CORBA Components

Components 1.1 RTF

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Preface

About This Document

Under the terms of the collaboration between OMG and The Open Group, this document is a candidate for adoption by The Open Group, as an Open Group Technical Standard. The collaboration between OMG and The Open Group ensures joint review and cohesive support for emerging object-based specifications.

Object Management Group

The Object Management Group, Inc. (OMG) is an international organization supported by over 600 members, including information system vendors, software developers and users. Founded in 1989, the OMG promotes the theory and practice of object-oriented technology in software development. The organization's charter includes the establishment of industry guidelines and object management specifications to provide a common framework for application development. Primary goals are the reusability, portability, and interoperability of object-based software in distributed, heterogeneous environments. Conformance to these specifications will make it possible to develop a heterogeneous applications environment across all major hardware platforms and operating systems.

OMG’s objectives are to foster the growth of object technology and influence its direction by establishing the Object Management Architecture (OMA). The OMA provides the conceptual infrastructure upon which all OMG specifications are based. More information is available at http://www.omg.org/.

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The Open Group, a vendor and technology-neutral consortium, is committed to delivering greater business efficiency by bringing together buyers and suppliers of information technology to lower the time, cost, and risks associated with integrating new technology across the enterprise.
The mission of The Open Group is to drive the creation of boundaryless information flow achieved by:

- Working with customers to capture, understand and address current and emerging requirements, establish policies, and share best practices;
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The Open Group has over 15 years experience in developing and operating certification programs and has extensive experience developing and facilitating industry adoption of test suites used to validate conformance to an open standard or specification. The Open Group portfolio of test suites includes tests for CORBA, the Single UNIX Specification, CDE, Motif, Linux, LDAP, POSIX.1, POSIX.2, POSIX Realtime, Sockets, UNIX, XPG4, XNFS, XTI, and X11. The Open Group test tools are essential for proper development and maintenance of standards-based products, ensuring conformance of products to industry-standard APIs, applications portability, and interoperability. In-depth testing identifies defects at the earliest possible point in the development cycle, saving costs in development and quality assurance.


**Intended Audience**

The architecture and specifications described in this manual are aimed at software designers and developers who want to produce applications that comply with OMG standards for the Object Request Broker (ORB). The benefit of compliance is, in general, to be able to produce interoperable applications that are based on distributed, interoperating objects. As defined by the Object Management Group (OMG) in the *Object Management Architecture Guide*, the ORB provides the mechanisms by which objects transparently make requests and receive responses. Hence, the ORB provides interoperability between applications on different machines in heterogeneous distributed environments and seamlessly interconnects multiple object systems.

**Context of CORBA**

The key to understanding the structure of the CORBA architecture is the Reference Model, which consists of the following components:

- **Object Request Broker**, which enables objects to transparently make and receive requests and responses in a distributed environment. It is the foundation for building applications from distributed objects and for interoperability between applications in hetero- and homogeneous environments. The architecture and specifications of the Object Request Broker are described in this manual.
**Object Services**, a collection of services (interfaces and objects) that support basic functions for using and implementing objects. Services are necessary to construct any distributed application and are always independent of application domains. For example, the Life Cycle Service defines conventions for creating, deleting, copying, and moving objects; it does not dictate how the objects are implemented in an application. Specifications for Object Services are contained in *CORBA services: Common Object Services Specification*.

**Common Facilities**, a collection of services that many applications may share, but which are not as fundamental as the Object Services. For instance, a system management or electronic mail facility could be classified as a common facility. Information about Common Facilities will be contained in *CORBA facilities: Common Facilities Architecture*.

**Application Objects**, which are products of a single vendor on in-house development group that controls their interfaces. Application Objects correspond to the traditional notion of applications, so they are not standardized by OMG. Instead, Application Objects constitute the uppermost layer of the Reference Model.

The Object Request Broker, then, is the core of the Reference Model. It is like a telephone exchange, providing the basic mechanism for making and receiving calls. Combined with the Object Services, it ensures meaningful communication between CORBA-compliant applications.

### Associated Documents

The CORBA documentation set includes the following books:

- **Object Management Architecture Guide** defines the OMG's technical objectives and terminology and describes the conceptual models upon which OMG standards are based. It also provides information about the policies and procedures of OMG, such as how standards are proposed, evaluated, and accepted.

- **CORBA: Common Object Request Broker Architecture and Specification** contains the architecture and specifications for the Object Request Broker.

- **CORBA services: Common Object Services Specification** contains specifications for the Object Services.

- **CORBA facilities: Common Facilities Architecture** contains the architecture for Common Facilities.

OMG collects information for each book in the documentation set by issuing Requests for Information, Requests for Proposals, and Requests for Comment and, with its membership, evaluating the responses. Specifications are adopted as standards only when representatives of the OMG membership accept them as such by vote.

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Definition of CORBA Compliance

The minimum required for a CORBA-compliant system is adherence to the specifications in CORBA Core and one mapping. Each additional language mapping is a separate, optional compliance point. Optional means users are not required to implement these points if they are unnecessary at their site, but if implemented, they must adhere to the CORBA specifications to be called CORBA-compliant. For instance, if a vendor supports C++, their ORB must comply with the OMG IDL to C++ binding specified in the C++ Language Mapping Specification.

Interoperability and Interworking are separate compliance points. For detailed information about Interworking compliance, refer to CORBA Core, the Interworking Architecture chapter, OCompliance to COM/CORBA Interworking.

Typographical Conventions

The type styles shown below are used in this document to distinguish programming statements from ordinary English. However, these conventions are not used in tables or section headings where no distinction is necessary.

**Helvetica bold** - OMG Interface Definition Language (OMG IDL) and syntax elements.

**Courier bold** - Programming language elements.

*Helvetica* - Exceptions

Terms that appear in *italics* are defined in the glossary. Italic text also represents the name of a document, specification, or other publication.

Acknowledgements

The following companies submitted and/or supported parts of this specification:

- **Computational Physics, Inc.**
- **Laboratoire d’Informatique Fondamentale de Lille**
Component Model

Note D This specification is based on the Adopted CORBA Components Specification (formal/2002-06-65). Text in Red is from the Components 1.1 RTF interim report (ptc/2002-08-02).

This chapter describes the semantics of the CORBA Component Model (CCM) and the conformance requirements for vendors.

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1.1 Component Model

Component is a basic meta-type in CORBA. The component meta-type is an extension and specialization of the object meta-type. Component types are specified in IDL and represented in the Interface Repository. A component is denoted by a component reference, which is represented by an object reference. Correspondingly, a component definition is a specialization and extension of an interface definition.

A component type is a specific, named collection of features that can be described by an IDL component definition or a corresponding structure in an Interface Repository. Although the current specification does not attempt to provide mechanisms to support formal semantic descriptions associated with component definitions, they are designed to be associated with a single well-defined set of behaviors. Although there may be several realizations of the component type for different run-time environments (e.g., OS/hardware platforms, languages, etc.), they should all behave consistently. As an abstraction in a type system, a component type is instantiated to create concrete entities (instances) with state and identity.

A component type encapsulates its internal representation and implementation. Although the component specification includes standard frameworks for component implementation, these frameworks, and any assumptions that they might entail, are completely hidden from clients of the component.

1.1.1 Component Levels

There are two levels of components: basic and extended. Both are managed by component homes, but they differ in the capabilities they can offer. Basic components essentially provide a simple mechanism to Ocomponentize O a regular CORBA object. Extended components, on the other hand, provide a richer set of functionality.

A basic component is very similar in functionality to an EJB as defined in the Enterprise JavaBeans 1.1 specification. This allows much easier mapping and integration at this level.

1.1.2 Ports

Components support a variety of surface features through which clients and other elements of an application environment may interact with a component. These surface features are called ports. The component model supports four basic kinds of ports:

>Facets, which are distinct named interfaces provided by the component for client interaction.
**Receptacles**, which are named connection points that describe the component’s ability to use a reference supplied by some external agent.

**Event sources**, which are named connection points that emit events of a specified type to one or more interested event consumers, or to an event channel.

**Event sinks**, which are named connection points into which events of a specified type may be pushed.

**Attributes**, which are named values exposed through accessor and mutator operations. Attributes are primarily intended to be used for component configuration, although they may be used in a variety of other ways.

Basic components are not allowed to offer facets, receptacles, event sources and sinks. They may only offer attributes.

Extended components may offer any type of port.

### 1.1.3 Components and Facets

A component can provide multiple object references, called *facets*, which are capable of supporting distinct (i.e., unrelated by inheritance) IDL interfaces. The component has a single distinguished reference whose interface conforms to the component definition. This reference supports an interface, called the component’s *equivalent interface*, that manifests the component’s surface features to clients. The equivalent interface allows clients to navigate among the component’s facets, and to connect to the component’s ports.

Basic components cannot support facets, therefore attempts to navigate to other facets will always fail. The equivalent interface of a basic component is the only object available with which a client may interact.

The other interfaces provided by the component are referred to as *facets*. Figure 1-1 illustrates the relationship between the component and its facets.
The relationship between the component and its facets is characterized by the following observations:

- The implementations of the facet interfaces are encapsulated by the component, and considered to be "parts" of the component. The internal structure of a component is opaque to clients.

- Clients can navigate from any facet to the component equivalent interface, and can obtain any facet from the component equivalent interface.

- Clients can reliably determine whether any two references belong to the same component instance.

- The life cycle of a facet is bounded by the life cycle of its owning component.

### 1.1.4 Component Identity

A component instance is identified primarily by its component reference, and secondarily by its set of facet references (if any). The component model provides operations to determine whether two references belong to the same component instance, and (as mentioned above) operations to navigate among a component's references. The definition of a component's component instance is ultimately up to the
component implementor, in that they may provide a customized implementation of this operation. However, a component framework shall provide standard implementations that constitute de facto definitions of ÒsamenessÓ when they are employed.

Components may also be associated with primary key values by a component home. Primary keys are data values exposed to the component’s clients that may be used in the context of a component home to identify component instances and obtain references for them. Primary keys are not features of components themselves; the association between a component instance and a particular primary key value is maintained by the home that manages the component.

1.1.5 Component Homes

A component home is meta-type that acts as a manager for instances of a specified component type. Component home interfaces provide operations to manage component life cycles, and optionally, to manage associations between component instances and primary key values. A component home may be thought of as a manager for the extent of a type (within the scope of a container). A home must be declared for every component declaration.

Component types are defined in isolation, independent of home types. A home definition, however, must specify exactly one component type that it manages. Multiple different home types can manage the same component type, though they cannot manage the same set of component instances.

At execution time, a component instance is managed by a single home object of a particular type. The operations on the home are roughly equivalent to static or class methods in object-oriented programming languages.

1.2 Component Definition

A component definition in IDL implicitly defines an interface that supports the features defined in the component definition body. It extends the concept of an interface definition to support features that are not supported in interfaces. Component definitions also differ from interface definitions in that they support only single inheritance from other component types.

The IDL grammar for components may be found in CORBA Core, OMG IDL Syntax and Semantics chapter.
1.3 Component Declaration

1.3.1 Basic Components

Basic components cannot avail themselves of certain features in the model. In particular, they cannot inherit from other components, nor can they provide or use interfaces, or make any event declarations. A basic component is declared using a restricted version of a `<component_dcl>`. See CORBA Core, OMG IDL Syntax and Semantics chapter, Section 3.17.1, ªComponentÔ for the syntax.

To avoid ambiguity between basic and extended definitions, any component declaration that matches the following pattern is a basic component:

```
"component" <identifier> [ <supported_interface_spec> ]
"{" { <attr_dcl> ";" }* "}"
```

Ideally the syntax should explicitly represent these rules. However this can only be achieved by introducing a new keyword to distinguish between basic and extended components. It was felt that an extra keyword would cause problems in the future, as the distinction between basic and extended components gets blurred. This blurring may occur due to future development of both the CORBA Component Model and the Enterprise JavaBeans specifications.

1.3.2 Equivalent IDL

The client mappings; that is, mappings of the externally-visible component features for component declarations are described in terms of equivalent IDL.

As described above, the component meta-type is a specialization of the interface meta-type. Each component definition has a corresponding equivalent interface. In programming language mappings, components are denoted by object references that support the equivalent interface implied by the component definition.

Since basic components are essentially a profile, no specific rules are defined for them.

1.3.2.1 Simple declaration

For a component declaration with the following form:

```
component component_name { ... };
```

the equivalent interface shall have the following form:

```
interface component_name
  : Components::CCMObject { É };
```

1.3.2.2 Supported interfaces

For a component declaration with the following form:
component <component_name>
supports <interface_name_1>, <interface_name_2> { ... };

the equivalent interface shall have the following form:

    interface <component_name>
        : Components::CCMObject,
        <interface_name_1>, <interface_name_2> { È }
    ;

Supported interfaces are described in detail in Section 1.4.5, "Supported interfaces," on page 1-13.

1.3.2.3 Inheritance

For a component declaration with the following form:

component <component_name> : <base_name> { ... };

the equivalent interface shall have the following form:

    interface <component_name> : <base_name> { È } 

1.3.2.4 Inheritance and supported interfaces

For a component declaration with the following form:

component <component_name> : <base_name>
supports <interface_name_1>, <interface_name_2> { ... };

the equivalent interface shall have the following form:

    interface <component_name>
        : <base_name>, <interface_name_1>, <interface_name_2> { È };

1.3.3 Component Body

A component forms a naming scope, nested within the scope in which the component is declared.

Declarations for facets, receptacles, event sources, event sinks and attributes all map onto operations on the component's equivalent interface. These declarations and their meanings are described in detail below.
1.4 Facets and Navigation

A component type may provide several independent interfaces to its clients in the form of facets. Facets are intended to be the primary vehicle through which a component exposes its functional application behavior to clients during normal execution. A component may exhibit zero or more facets.

1.4.1 Equivalent IDL

Facet declarations imply operations on the component interface that provide access to the provided interfaces by their names. A facet declaration of the following form:

```
provides <interface_type> <name>;
```

results in the following operation defined on the equivalent interface:

```
@interface_type provide_<name>();
```

The mechanisms for navigating among a component’s facets are described in Section 1.4.3, Ordinary, on page 1-9. The relationships between the component identity and the facet references, and assumptions regarding facet references, are described in Section 1.4.4, Ordinary, on page 1-12. The implementation of navigation operations are provided by the component implementation framework in generated code; the user-provided implementation of a component type is not responsible for navigation operations. The responsibilities of the component servant framework for supporting navigation operations are described in detail in the OMG CIDL Syntax and Semantics chapter.

1.4.2 Semantics of Facet References

Clients of a component instance can obtain a reference to a facet by invoking the `provide_<name>` operation on the equivalent interface corresponding to the `provides` declaration in the component definition. The component implementation is responsible for guaranteeing the following behaviors:

- In general, a component instance shall be prepared to return object references for facets throughout the instance’s life cycle. A component implementation may, as part of its advertised behavior, return a nil object reference as the result of a `provide_<name>` operation.

- An object reference returned by a `provide_<name>` operation shall support the interface associated with the corresponding `provides` declaration in the component definition. Specifically, when the `_Is_a` operation is invoked on the object reference with the `RepositoryId` of the provided interface type, the result shall be `TRUE`, and legal operations of the facet interface shall be able to be invoked on the object reference. If the type specified in the `provides` declaration is `Object`, then there are no constraints on the interface types supported by the reference.

  A facet reference provided by a component may support additional interfaces, such as interfaces derived from the declared type, as long as the stated contract is satisfied.
Facet references must behave properly with respect to component identity and navigation, as defined in Section 1.4.4, OProvided References and Component Identity, O on page 1-12 and Section 1.4.3, ONavigation, O on page 1-9.

1.4.3 Navigation

Navigation among a component’s facets may be accomplished in the following ways:

- A client may navigate from any facet reference to the component that provides the reference via CORBA::Object::get_component.
- A client may navigate from the component interface to any facet using the generated provide_<name> operations on the equivalent interface.
- A client may navigate from the component interface to any facet using the generic provide_facet operation on the Navigation interface (inherited by all component interfaces through Components::CCMObject). Other operations on the Navigation interface (i.e., get_all_facets and get_named_facets) return multiple references, and can also be used for navigation. When using generic navigation operations on Navigation, facets are identified by string values that contain their declared names.
- A client may navigate from a facet interface that derives from the Navigation interface directly to any other facet on the same component, using provide_facet, get_all_facets, and get_named_facets.
- For components, such as basic components, that do not provide interfaces, only the generic navigation operations are available on the equivalent interface. The behavior of these operations, where there are no facets to navigate to, is defined below.

The detailed descriptions of these mechanisms follow.

1.4.3.1 get_component()

module CORBA { 
    interface Object { // PIDL
        ...
        Object get_component ( );
    };
};

If the target object reference is itself a component reference (i.e., it denotes the component itself), the get_component operation returns the same reference (or another equivalent reference). If the target object reference is a facet reference, the get_component operation returns an object reference for the component. If the target reference is neither a component reference nor a provided reference, get_component returns a nil reference.
Implementation of `get_component`

As with other operations on `CORBA::Object`, `get_component` is implemented as a request to the target object. Following the pattern of other `CORBA::Object` operations (i.e., `_interface`, `_is_a`, and `_non_existent`) the operation name in GIOP request corresponding to `get_component` shall be `O_component`. An implementation of `get_component` is a required element of the CORBA core, even if the ORB does not provide an implementation of CORBA components. Thus component vendors that are not also ORB vendors can rely on the availability of this capability in a compliant ORB.

1.4.3.2 Component-specific provide operations

The `provide_<name>` operation implicitly defined by a `provides` declaration can be invoked to obtain a reference to the facet.

1.4.3.3 Navigation interface on the component

As described in Section 1.3, ÔComponent Declaration,Ó on page 1-6 all component interfaces implicitly inherit directly or indirectly from `CCMObject`, which inherits from `Components::Navigation`. The definition of the `Components::Navigation` interface is as follows:

```plaintext
module Components {
    typedef string FeatureName;
    typedef sequence<FeatureName> NameList;

    valuetype PortDescription {
        public FeatureName name;
        public CORBA::RepositoryId type_id;
    };

    valuetype FacetDescription : PortDescription {
        public Object facet_ref;
    };
    typedef sequence<FacetDescription> FacetDescriptions;

    exception InvalidName { };

    interface Navigation {
        Object provide_facet (in FeatureName name)
            raises (InvalidName);

        FacetDescriptions get_all_facets();
    }
```
FacetDescriptions get_named_facets (in NameList names) 
  raises (InvalidName);

  boolean same_component (in Object object_ref);
};

This interface provides generic navigation capabilities. It is inherited by all component interfaces, and may be optionally inherited by any interface that is explicitly designed to be a facet interface for a component. The descriptions of Navigation operations follow.

provide_facet
The provide_facet operation returns a reference to the facet denoted by the name parameter. The value of the name parameter must be identical to the name specified in the provides declaration. The valid names are defined by inherited closure of the actual type of the component; that is, the names of facets of the component type and all of its inherited component types. If the value of the name parameter does not correspond to one of the component\'s facets, the InvalidName exception shall be raised. A component that does not provide any facets (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the InvalidName exception.

get_all_facets
The get_all_facets operation returns a sequence of value objects, each of which contains the RepositoryId of the facet interface and name of the facet, along with a reference to the facet. The sequence shall contain descriptions and references for all of the facets in the component\'s inheritance hierarchy. The order in which these values occur in the sequence is not specified. A component that does not provide any facets (e.g., a basic component) shall return a sequence of length zero.

get_named_facets
The get_named_facets operation returns a sequence of described references (identical to the sequence returned by get_all_facets), containing descriptions and references for the facets denoted by the names parameter. If any name in the names parameter is not a valid name for a provided interface on the component, the operation raises the InvalidName exception. The order of values in the returned sequence is not specified. A component that does not provide any facets (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the InvalidName exception.

The same_component operation on Navigation is described in Section 1.4.4, Provided References and Component Identity, on page 1-12.
1.4.3.4 Navigation interface on facet interfaces

Any interface that is designed to be used as a facet interface on a component may optionally inherit from the Navigation interface. When the navigation operations (i.e., provide_facet, get_all_facets, and get_named_facets) are invoked on the facet reference, the operations shall return the same results as if they had been invoked on the component interface that provided the target facet. The skeletons generated by the Component Implementation Framework shall provide implementations of these operations that will delegate to the component interface.

This option allows navigation from one facet to another to be performed in a single request, rather than a pair of requests (to get the component reference and navigate from there to the desired facet).

To illustrate, consider the following component definition:

```
module example {
  interface foo : Components::Navigation { ... };
  interface bar { ... };
  component baz session {
    provides foo a;
    provides bar b;
  };
}
```

A client could navigate from a to b as follows:

```
foo myFoo;
// assume myFoo holds a reference to a foo provided by a baz
baz myBaz = bazHelper.narrow(myFoo.get_component());
bar myBar = myBaz.provide_b();
```

Or, it could navigate directly:

```
foo myFoo;
// assume myFoo holds a reference to a foo provided by a baz
bar myBar =
  barHelper.narrow(myFoo.provide_interface(ObO));
```

1.4.4 Provided References and Component Identity

The same_component operation on the Navigation interface allows clients to determine reliably whether two references belong to the same component instance, that is, whether the references are facets of or directly denote the same component instance. The component implementation is ultimately responsible for determining what the Øsame component instanceØ means. The skeletons generated by the Component Implementation Framework shall provide an implementation of same_component.
where Òsame instanceÓ is defined in terms of opaque identity values supplied by the component implementation or the container in the container context. User-supplied implementations can provide different semantics.

If a facet interface inherits the Navigation interface, then the same_component operation on the provided interface shall give the same results as the same_component operation on the component interface that owns the provided interface. The skeletons generated by the Component Implementation Framework shall provide an implementation of same_component for facets that inherit the Navigation interface.

### 1.4.5 Supported interfaces

A component definition may optionally support one or more interfaces, or in the case of extended components, inherit from a component that supports one or more interfaces. When a component definition header includes a supports clause as follows:

```
component <component_name> supports <interface_name> { ... };
```

the equivalent interface inherits both CCMObject and any supported interfaces, as follows:

```
interface <component_name>
  : Components::CCMObject, <interface_name> { È };
```

The component implementation shall supply implementations of operations defined on supported interfaces. Clients shall be able to widen a reference of the componentÕs equivalent interface type to the type of any of the supported interfaces. Clients shall also be able to narrow a reference of type CCMObject to the type of any of the componentÕs supported interfaces.

*For example, given the following IDL:*

```idl
module M {
  interface I {
    void op();
  };
  component A supports I {
    provides I foo;
  };
  home AManger manages A { };
};
```

*The AManger interface shall be derived from KeylessCCMHome, supporting the create_component operation, which returns a reference of type CCMObject. This reference shall be able to be narrowed directly from CCMObject to I:*

```java
// java
...
M.AManager aHome = ...; // get A’s home
org.omg.Components.CCMObject myComp =
aHome.create_component();
```
M.I myI = M.IHelper.narrow(myComp);  
// must succeed

For example, given the following IDL:

module M{
  interface I {
    void op();
  };
  component A supports I {
    provides I foo;
  };
  component B : A { ... };
  home BHome manages B {}; 
};

The equivalent IDL is:

module M {
  interface I {
    void op();
  };
  interface A : 
    org.omg.Components.CCMObject, I { ... };
  interface B : A { ... };
};

which allows the following usage:

M.BHome bHome = ... // get B’s home
M.B myB = bHome.create();
myB.op();  // I’s operations are supported
// directly on B’s interface

The supports mechanism provides programming convenience for lightweight components that only need to implement a single operational interface. A client can invoke operations from the supported interface directly on the component reference, without narrowing or navigation:

M.A myA = aHome.create();
myA.op();

as opposed to

M.A myA = aHome.create();
M.I myI = myA.provide_foo();
myI.op();

or, assuming that the client has AÔs home, but doesnôt statically know about AÔs interface or home interface:

org.omg.Components.KeylessCCMHome genericHome = ... // get A’s home;
org.omg.Components.CCMObject myComp =
genericHome.create_component();

M.I myI = M.IHelper.narrow(myComp);
myI.op();
as opposed to

    org.omg.CORBA.Object obj =
    myComp.provide_interface("foo");
    M.I myI = M.IHelper.narrow(obj);
    myI.op();

This mechanism allows component-unaware clients to receive a reference
to a component (passed as type CORBA::Object) and use the supported
interface.

1.5 Receptacles

A component definition can describe the ability to accept object references upon which
the component may invoke operations. When a component accepts an object reference
in this manner, the relationship between the component and the referent object is called
a connection; they are said to be connected. The conceptual point of connection is
called a receptacle. A receptacle is an abstraction that is concretely manifested on a
component as a set of operations for establishing and managing connections. A
component may exhibit zero or more receptacles.

Receptacles are intended as a mechanical device for expressing a wide
variety of relationships that may exist at higher levels of abstraction. As
such, receptacles have no inherent higher-order semantics, such as implying
ownership, or that certain operations will be transient across connec-
tions.

1.5.1 Equivalent IDL

A uses declaration of the following form:

uses <interface_type> <receptacle_name>;

results in the following equivalent operations defined in the component interface:

    void connect_<receptacle_name> ( in <interface_type> conxn ) raises ( Components::AlreadyConnected,
    Components::InvalidConnection );

    <interface_type> disconnect_<receptacle_name> ( )
    raises ( Components::NoConnection );

    <interface_type> get_connection_<receptacle_name> ( );

A uses declaration of the following form:

uses multiple <interface_type> <receptacle_name>;

results in the following equivalent operations defined in the component interface:

    struct <receptacle_name>Connection {
    <interface_type> objref;
    Components::Cookie ck;
    };

sequence <<receptacle_name>Connection> <receptacle_name>Connections;

Component::Cookie
    connect_<receptacle_name> ( in <interface_type> connection ) raises ( Component::ExceededConnectionLimit, Component::InvalidConnection );

<interface_type> disconnect_<receptacle_name> ( in Component::Cookie ck)
    raises ( Component::InvalidConnection );

<receptacle_name>Connections get_connections_<receptacle_name> ();

1.5.2 Behavior

1.5.2.1 Connect operations

Operations of the form connect_<receptacle_name> are implemented in part by the component implementor, and in part by generated code in the component servant framework. The responsibilities of the component implementation and servant framework for implementing connect operations are described in detail in Chapter 1 - OMG CIDL Syntax and Semantics. The receptacle holds a copy of the object reference passed as a parameter. The component may invoke operations on this reference according to its design. How and when the component invokes operations on the reference is entirely the prerogative of the component implementation. The receptacle shall hold a copy of the reference until it is explicitly disconnected.

Simplex receptacles

If a receptacle’s uses declaration does not include the optional multiple keyword, then only a single connection to the receptacle may exist at a given time. If a client invokes a connect operation when a connection already exists, the connection operation shall raise the AlreadyConnected exception.

The component implementation may refuse to accept the connection for arbitrary reasons. If it does so, the connection operation shall raise the InvalidConnection exception.

Multiplex receptacles

If a receptacle’s uses declaration includes the optional multiple keyword, then multiple connections to the receptacle may exist simultaneously. The component implementation may choose to establish a limit on the number of simultaneous connections allowed. If an invocation of a connect operation attempts to exceed this limit, the operation shall raise the ExceededConnectionLimit exception.
The component implementation may refuse to accept the connection for arbitrary reasons. If it does so, the connection operation shall raise the InvalidConnection exception.

Connect operations for multiplex receptacles return values of type Components::Cookie. Cookie values are used to identify the connection for subsequent disconnect operations. Cookie values are generated by the receptacle implementation (the responsibility of the supplier of the component-enabled ORB, not the component implementor). Likewise, cookie equivalence is determined by the implementation of the receptacle implementation.

The client invoking connection operations is responsible for retaining cookie values and properly associating them with connected object references, if the client needs to subsequently disconnect specific references. Cookie values must be unique within the scope of the receptacle that created them. If a cookie value is passed to a disconnect operation on a different receptacle than that which created it, results are undefined.

Cookie values are described in detail in Section 1.5.2.4, ÔCookie type,Ô on page 1-18.Ô

Cookie values are required because object references cannot be reliably tested for equivalence.

1.5.2.2 Disconnect operations

Operations of the form disconnect_receptacle_name terminate the relationship between the component and the connected object reference.

Simplex receptacles

If a connection exists, the disconnect operation will return the connected object reference. If no connection exists, the operation shall raise a NoConnection exception.

Multiplex receptacles

The disconnect_receptacle_name operation of a multiplex receptacle takes a parameter of type Components::Cookie. The ck parameter must be a value previously returned by the connect_receptacle_name operation on the same receptacle. It is the responsibility of the client to associate cookies with object references they connect and disconnect. If the cookie value is not recognized by the receptacle implementation as being associated with an existing connection, the disconnect_receptacle_name operation shall raise an InvalidConnection exception.
1.5.2.3 get_connection and get_connections operations

Simplex receptacles

Simplex receptacles have operations named get\_connection\_receptacle\_name. If the receptacle is currently connected, this operation returns the connected object reference. If there is no current connection, the operation returns a nil object reference.

Multiplex receptacles

Multiplex receptacles have operations named get\_connections\_receptacle\_name. This operation returns a sequence of structures, where each structure contains a connected object reference and its associated cookie value. The sequence contains a description of all of the connections that exist at the time of the invocation. If there are no connections, the sequence length will be zero.

1.5.2.4 Cookie type

The Cookie valuetype is defined by the following IDL:

```idl
module Components {
  valuetype Cookie {
    private CORBA::OctetSeq cookieValue;
  };
}
```

Cookie values are created by multiplex receptacles, and are used to correlate a connect operation with a disconnect operation on multiplex receptacles.

Implementations of component-enabled ORBs may employ value type derived from Cookie, but any derived cookie types shall be truncatable to Cookie, and the information preserved in the cookieValue octet sequence shall be sufficient for the receptacle implementation to identify the cookie and its associated connected reference.

1.5.3 Receptacles Interface

The Receptacles interface provides generic operations for connecting to a component\'s receptacles. The CCMObject interface is derived from Receptacles. For components, such as basic components, that do not use interfaces, only the generic receptacles operations are available on the equivalent interface. The default behavior in such cases is defined below.

The Receptacles interfaces is defined by the following IDL:

```idl
module Components {
  valuetype ConnectionDescription {
    public Cookie ck;
    public Object objref;
  };
}
```
typedef sequence<ConnectionDescription> ConnectionDescriptions;

valuetype ReceptacleDescription : PortDescription
{
    public boolean is_multiple;
    public ConnectionDescriptions connections;
};
typedef sequence<ReceptacleDescription> ReceptacleDescriptions;

exception ExceededConnectionLimit { };
exception CookieRequired { };

interface Receptacles {
  Cookie connect ( in FeatureName name, in Object connection )
  raises (
    InvalidName,
    InvalidConnection,
    AlreadyConnected,
    ExceededConnectionLimit);

  void-Object disconnect ( in FeatureName name,
                           in Cookie ck) raises ( 
    InvalidName,
    InvalidConnection,
    CookieRequired,
    NoConnection);

  ConnectionDescriptions get_connections ( in FeatureName name) raises (InvalidName);

  ReceptacleDescriptions get_all_receptacles ();

  ReceptacleDescriptions get_named_receptacles ( 
    in NameList names) raises(InvalidName);
};

connect

The connect operation connects the object reference specified by the connection parameter to the receptacle specified by the name parameter on the target component. If the specified receptacle is a multiplex receptacle, the operation returns a cookie.
value that can be used subsequently to disconnect the object reference. If the receptacle is a simplex receptacle, the return value is a nil. The following exceptions may be raised:

- If the name parameter does not specify a valid receptacle name, then the InvalidName exception is raised.
- If the receptacle is a simplex receptacle and it is already connected, then the AlreadyConnected exception is raised.
- If the object reference in the connection parameter does not support the interface declared in the receptacleOs uses statement, the InvalidConnection exception is raised.
- If the receptacle is a multiplex receptacle and the implementation-defined limit to the number of connections is exceeded, the ExceededConnectionLimit exception is raised.
- A component that does not have any receptacles (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the InvalidName exception.

disconnect

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If the receptacle identified by the name parameter is a simplex receptacle, the operation will disassociate any object reference currently connected to the receptacle. The cookie value in the ck parameter is ignored. If the receptacle identified by the name parameter is a multiplex receptacle, the disconnect operation disassociates the object reference associated with the cookie value (i.e., the object reference that was connected by the operation that created the cookie value) from the receptacle. In both cases, the disconnect operation returns the previously connected object reference. The following exceptions may be raised:

- If the name parameter does not specify a valid receptacle name, then the InvalidName exception is raised.
- If the receptacle is a simplex receptacle there is no current connection, then the NoConnection exception is raised.
- If the receptacle is a multiplex receptacle and the cookie value in the ck parameter does not denote an existing connection on the receptacle, the InvalidConnection exception is raised.
- If the receptacle is a multiplex receptacle and a null value is specified in the ck parameter, the CookieRequired exception is raised.
- A component that does not have any receptacles (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the InvalidName exception.
get_connections

The get_connections operation returns a sequence of ConnectionDescription structs. Each struct contains an object reference connected to the receptacle named in the name parameter, and a cookie value that denotes the connection. If the name parameter does not specify a valid receptacle name, then the InvalidName exception is raised. A component that does not have any receptacles (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the InvalidName exception.

get_all_receptacles

The get_all_receptacles operation returns information about all receptacle ports in the component's inheritance hierarchy as a sequence of ReceptacleDescription values. The order in which these values occur in the sequence is not specified. For components that do not have any receptacles (e.g., a basic component), this operation returns a sequence of length zero.

get_named_receptacles

The get_named_receptacles operation returns information about all receptacle ports denoted by the names parameter as a sequence of ReceptacleDescription values. The order in which these values occur in the sequence is not specified. If any name in the names parameter is not a valid name for a receptacle in the component's inheritance hierarchy, the operation raises the InvalidName exception. A component that does not provide any receptacles (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the InvalidName exception.

1.6 Events

The CORBA component model supports a publish/subscribe event model. The event model for CORBA components is designed to be compatible with CORBA notification, as defined in OMG document telecom/98-11-01. The interfaces exposed by the component event model provide a simple programming interface whose semantics can be mapped onto a subset of CORBA notification semantics.

1.6.1 Event types

IDL contains event type declarations, which are a restricted form of value type declarations. They are for the use in the CORBA Component event model.

Since the underlying implementation of the component event mechanism provided by the container is CORBA notification, event values shall be inserted into instances of the any type. The resulting any values shall be inserted into a CORBA notification structured event. The mapping between a component event and a notification event is implemented by the container.
1.6.1.1 Equivalent IDL

For the declaration of event types of the following form:

```
module <module_name> {
    valuetyep A { <A_state_members> };
    eventtype B : A { <B_state_members> };
    eventtype C : B { <C_state_members> };
}
```

The following equivalent IDL is implied:

```
module <module_name> {
    valuetyep A { <A_state_members> };
    valuetyep B : A, ::Components::EventBase { <B_state_members> }
    interface BConsumer : ::Components::EventConsumerBase {
        void push_B (in B the_b);
    }
    valuetyep C : B { <C_state_members> }
    interface CConsumer : BConsumer {
        void push_C (in C the_c);
    }
}
```

As shown above the first event type in the inheritance chain introduces the inheritance from `Components::EventBase` into the inheritance chain for the equivalent value types. The same rule applies for the equivalent consumer interfaces and `Components::EventConsumerBase`. Consumer interfaces are in the same inheritance relation as the event types, where they origin.

1.6.1.2 EventBase

The module `Components` contains the following abstract value type definition:

```
module Components {
    abstract valuetyep EventBase { };
}
```

It serves as base type for value types derived via the Equivalent IDL mapping for event types.
To ensure proper transmission of value type events, this specification makes the following clarifications to the semantics of value types when inserted into an\texttt{ys}:

When an\texttt{y} containing a value type is received as a parameter in an ORB-mediated operation, the value contained in the\texttt{y} shall be preserved, regardless of whether the receiving execution context is capable of constructing the value (in its original form or a truncated form), or not. If the receiving context attempts to extract the value, the extraction may fail, or the extracted value may be truncated. The value contained in the\texttt{y} shall remain unchanged, and shall retain its integrity if the\texttt{y} is passed as a parameter to another execution context.

1.6.2 EventConsumer Interface

The component event model is a push model. The basic mechanics of this push model are defined by consumer interfaces. Event sources hold references to consumer interfaces and invoke various forms of push operations to send events.

Component event sources hold references to consumer interfaces and push to them. Component event sinks provide consumer references, into which other entities (e.g., channels, clients, other component event sources) push events.

Event consumer interfaces are derived from the\texttt{Components::EventConsumerBase} interface, which is defined as follows:

\begin{verbatim}
module Components {
    exception BadEventType {
        CORBA::RepositoryId expected_event_type;
    }
    interface EventConsumerBase {
        void push_event(in EventBase evt) raises (BadEventType);
    }
}
\end{verbatim}

Type-specific event consumer interfaces are derived from the\texttt{EventConsumerBase} interface. Event source and sink declarations in component definitions cause type-specific consumer interfaces to be generated for the event types used in the declarations.

The\texttt{push_event} operation pushes the event denoted by the\texttt{evt} parameter to the consumer. The consumer may choose to constrain the type of event it accepts. If the actual type of the\texttt{evt} parameter is not acceptable to the consumer, the\texttt{BadEventType} exception shall be raised. The\texttt{expected_event_type} member of the exception contains the\texttt{RepositoryId} of the type expected by the consumer.

Note that this exception can only be raised by the consumer upon whose reference the\texttt{push_event} operation was invoked. The consumer may be a proxy for an event or notification channel with an arbitrary number of subscribers. If any of those subscribers raise any exceptions, they will not be propagated back to the original event source (i.e., the component).
1.6.3 Event Service Provided by Container

Container implementations provide event services to components and their clients. Component implementations obtain event services from the container during initialization, and mediate client access to those event services. The container implementation is free to provide any mechanism that supports the required semantics. The container is responsible for configuring the mechanism and determining the specific quality of service and routing policies to be employed when delivering events.

1.6.4 Event Sources—Publishers and Emitters

An event source embodies the potential for the component to generate events of a specified type, and provides mechanisms for associating consumers with sources.

There are two categories of event sources, emitters and publishers. Both are implemented using event channels supplied by the container. An emitter can be connected to at most one proxy provider by the container. A publisher can be connected through the channel to an arbitrary number of consumers, who are said to subscribe to the publisher event source. A component may exhibit zero or more emitters and publishers.

A publisher event source has the following characteristics:

- The equivalent operations for publishers allow multiple subscribers (i.e., consumers) to connect to the same source simultaneously.
- Subscriptions to a publisher are delegated to an event channel supplied by the container at run time. The component is guaranteed to be the only source publishing to that event channel.

An emitter event source has the following characteristics:

- The equivalent operations for emitters allow only one consumer to be connected to the emitter at a time.
- The events pushed from an emitter are delegated to an event channel supplied by the container at run time. Other event sources, however, may use the same channel. Events pushed from an emitter are then pushed by the container into the consumer interface supplied as a parameter to the connect_<source> operation.

In general, emitters are not intended to be exposed to clients. Rather, they are intended to be used for configuration purposes. It is expected that emitters will be connected at the time of component initialization and configuration to consumer interfaces that are proxies for event channels that may be shared between arbitrary clients, components and other system elements.

In contrast, publishers are intended to provide clients with direct access to a particular event stream being generated by the component (embodied by the publisher event source). It is our intent that clients subscribe directly to the publisher source.
1.6.5 Publisher

1.6.5.1 Equivalent IDL

For an event source declaration of the following form:

```plaintext
module <module_name> {  
  component <component_name> {  
    publishes <event_type> <source_name>;  
  };  
};
```

The following equivalent IDL is implied:

```plaintext
module <module_name> {  
  module <component_name>EventConsumers {  
    interface <event_type>Consumer;  
  };  

  interface <component_name>: Components::CCMObject {  
    Components::Cookie subscribe_<source_name> (  
      in <component_name>EventConsumers::<event_type>Consumer consumer  
    ) raises (Components::ExceededConnectionLimit);  

    <component_name>EventConsumers::<event_type>Consumer unsubscribe_<source_name> (in Components::Cookie ck)  
    raises (Components::InvalidConnection));
  };  

  module <component_name>EventConsumers {  
    interface <event_type>Consumer : Components::EventConsumerBase {  
      void push (in <event_type>evt);  
    };  
  };

  module <module_name> {  
    interface <component_name>: Components::CCMObject {  
      Components::Cookie subscribe_<source_name> (  
        in <event_type>Consumer consumer  
      ) raises (Components::ExceededConnectionLimit);  

      <event_type>Consumer unsubscribe_<source_name> (  
        in Components::Cookie ck  
      ) raises (Components::InvalidConnection);
    };  
  }
```

Note D Removed by the Components December 2000 FTF (see ptc/01-11-03, page 61-241).
1.6.5.2 Event publisher operations

subscribe_<source_name>

The subscribe_<source_name> operation connects the consumer parameter to an event channel provided to the component implementation by the container. The component shall be the only publisher to that channel. If the implementation of the component or the channel place an arbitrary limit on the number of subscriptions that can be supported simultaneously, and the invocation of the subscribe operation would cause that limit to be exceeded, the operation raises the ExceededConnectionLimit exception. The Cookie value returned by the operation identifies the subscription formed by the association of the subscriber with the publisher event source. This value can be used subsequently in an invocation of unsubscribe_<source_name> to disassociate the subscriber from the publisher.

unsubscribe_<source_name>

The unsubscribe_<source_name> operation destroys the subscription identified by the ck parameter value, returning the reference to the subscriber. If the ck parameter value does not identify an existing subscription to the publisher event source, the operation shall raise an InvalidConnection exception.

1.6.6 Emitters

1.6.6.1 Equivalent IDL

For an event source declaration of the following form:

```
module <module_name> {
    component <component_name> { emits <event_type> <source_name>; };
};
```

The following equivalent IDL is implied:

```
module <module_name> {
    module <component_name> EventConsumers; 
    interface <event_type>Consumer;
};
```
consumer_.raises (Components::AlreadyConnected);

<component_name>EventConsumers::<event_type>Consumer:
disconnect_<source_name>();
    raises (Components::NoConnection);
};

module <component_name>EventConsumers {
    interface <event_type>Consumer:
        Components::EventConsumerBase {
            void push (in <event_type>evt);
        }
};

module <module_name> {
    interface <component_name> : Components::CCMOBJECT {
        void connect_<source_name> (in <event_type>Consumer consumer)
            raises (Components::AlreadyConnected);

        <event_type>Consumer disconnect_<source_name>()
            raises (Components::NoConnection);
    }
};

1.6.6.2 Event emitter operations

connect_<source_name>

The connect_<source_name> operation connects the event consumer denoted by the consumer parameter to the event emitter. If the emitter is already connected to a consumer, the operation shall raise the AlreadyConnected exception.

disconnect_<source_name>

The disconnect_<source_name> operation destroys any existing connection by disassociating the consumer from the emitter. The reference to the previously connected consumer is returned. If there was no existing connection, the operation raises the NoConnection exception.

The following observations and constraints apply to the equivalent IDL for event source declarations:

The need for a typed event consumer interface requires the definition of a module scope to guarantee that the interface name for the event subscriber is unique. The module (whose name is formed by appending the string ÒEventConsumersÓ to the component type name) is defined in the same scope as the componentÓs equivalent interface. The module is opened before the equivalent interface definition to provide forward declarations for consumer interfaces. It is re-opened after the equivalent interface definition to define the consumer interfaces.
The name of a consumer interface is formed by appending the string "Consumer" to the name of the event type. One consumer interface type is implied for each unique event type used in event source and event sink declarations in the component definition.

1.6.7 Event Sinks

An event sink embodies the potential for the component to receive events of a specified type. An event sink is, in essence, a special-purpose facet whose type is an event consumer. External entities, such as clients or configuration services, can obtain the reference for the consumer interface associated with the sink.

Unlike event sources, event sinks do not distinguish between connection and subscription. The consumer interface may be associated with an arbitrary number of event sources, unbeknownst to the component that supplies the event sink. The component event model provides no inherent mechanism for the component to control which events sources may be pushing to its sinks. By exporting an event sink, the component is, in effect, declaring its willingness to accept events pushed from arbitrary sources. A component may exhibit zero or more consumers.

*If a component implementation needs control over which sources can push to a particular sink it owns, the sink should not be exposed as a port on the component. Rather, the component implementation can create a consumer internally and explicitly connect or subscribe it to sources.*

1.6.7.1 Equivalent IDL

For an event sink declaration of the following form:

```
module <module_name> {
  component <component_name> {
    consumes <event_type> <sink_name>;
  };
}
```

The following equivalent IDL is implied:

```
module <module_name> {
  module <component_name>EventConsumers {
    interface <event_type>Consumer;
  };
  interface <component_name>::Component::CCMObject {
    <component_name>EventConsumers::<event_type>Consumer
      get_consumer_<sink_name>();
  };
```

**Note D** Removed by the Components December 2000 FTF (see ptc/01-11-03, page 61-245).
1.6.7.2 Event sink operations

The `get_consumer_<sink_name>` operation returns a reference that supports the consumer interface specific to the declared event type.

1.6.8 Events interface

The `Events` interface provides generic access to event sources and sinks on a component. `CCMOObject` is derived from `Events`. For components, such as basic components, that do not declare participation in events, only the generic `Events` operations are available on the equivalent interface. The default behavior in such cases is described below.

The `Events` interface is described as follows:

```cpp
module Components {
    exception InvalidName { }; exception InvalidConnection { }; exception AlreadyConnected { }; exception NoConnection { };

    valuetype ConsumerDescription : PortDescription {
        public EventConsumerBase consumer;
    }; typedef sequence<ConsumerDescription> ConsumerDescriptions;

    valuetype EmitterDescription : PortDescription {
        public EventConsumerBase consumer;
    }; typedef sequence<EmitterDescription> EmitterDescriptions;

    valuetype SubscriberDescription {
```
public Cookie ck;
    public EventConsumerBase consumer;
};
typedef sequence<SubscriberDescription> SubscriberDescriptions;

valuetype PublisherDescription : PortDescription
{
    public SubscriberDescriptions consumers;
};
typedef sequence<PublisherDescription> PublisherDescriptions;

interface Events {
    EventConsumerBase get_consumer (in FeatureName sink_name)
    raises (InvalidName);
    Cookie subscribe (in FeatureName publisher_name,
        in EventConsumerBase subscriber)
    raises (InvalidName, InvalidConnection,
        ExceededConnectionLimit);

    void unsubscribe (in FeatureName publisher_name,
        in Cookie ck)
    raises (InvalidName, InvalidConnection);
    void connect_consumer (in FeatureName emitter_name,
        in EventConsumerBase consumer)
    raises (InvalidName, AlreadyConnected,
        InvalidConnection);
    EventConsumerBase disconnect_consumer (in FeatureName source_name)
    raises (InvalidName, NoConnection);
    ConsumerDescriptions get_all_consumers ();
    ConsumerDescriptions get_named_consumers (in NameList names)
    raises (InvalidName);
    EmitterDescriptions get_all_emitters ();
    EmitterDescriptions get_named_emitters (in NameList names)
    raises (InvalidName);
    PublisherDescriptions get_all_publishers ();
    PublisherDescriptions get_named_publishers (in NameList names)
    raises (InvalidName);
};

get_consumer

The get_consumer operation returns the EventConsumerBase interface for the sink specified by the sink_name parameter. If the sink_name parameter does not specify a valid event sink on the component, the operation raises the InvalidName
exception. A component that does not have any sinks (e.g., a basic component) will have no valid sink_name parameter to this operation and thus shall always raise the InvalidName exception.

**subscribe**

The subscribe operation associates the subscriber denoted by the subscriber parameter with the event source specified by the publisher_name parameter. If the publisher_name parameter does not specify a valid event publisher on the component, the operation raises the InvalidName exception. The cookie return value can be used to unsubscribe from the source. A component that does not have any event sources (e.g., a basic component) will have no valid publisher_name parameter to this operation and thus shall always raise the InvalidName exception. If the object reference in the subscriber parameter does not support the consumer interface of the eventtype declared in the publishes statement, the InvalidConnection exception is raised. If the implementation-defined limit to the number of subscribers is exceeded, the ExceededConnectionLimit exception is raised.

**unsubscribe**

Note D Issue 4983

The unsubscribe operation disassociates the subscriber associated with ck parameter with the event source specified by the publisher_name parameter, and returns the reference to the subscriber. If the publisher_name parameter does not specify a valid event source on the component, the operation raises the InvalidName exception. If the ck parameter does not identify a current subscription on the source, the operation raises the InvalidConnection exception. A component that does not have any event sources (e.g., a basic component) will have no valid publisher_name parameter to this operation and thus shall always raise the InvalidName exception.

**connect_consumer**

The connect_consumer operation associates the consumer denoted by the consumer parameter with the event source specified by the emitter_name parameter. If the emitter_name parameter does not specify a valid event emitter on the component, the operation raises the InvalidName exception. If a consumer is already connected to the emitter, the operation raises the AlreadyConnected exception. If the object reference in the consumer parameter does not support the consumer interface of the eventtype declared in the emits statement, the InvalidConnection exception is raised. The cookie return value can be used to disconnect from the source. A component that does not have any event sources (e.g., a basic component) will have no valid emitter_name parameter to this operation and thus shall always raise the InvalidName exception.
disconnect_consumer

The **disconnect_consumer** operation disassociates the currently connected consumer from the event source specified by the **emitter_name** parameter, returning a reference to the disconnected consumer. If the **emitter_name** parameter does not specify a valid event source on the component, the operation raises the **InvalidName** exception. If there is no consumer connected to the emitter, the operation raises the **NoConnection** exception. A component that does not have any event sources (e.g., a basic component) will have no valid **emitter_name** parameter to this operation and thus shall always raise the **InvalidName** exception.

get_all_consumers

The **get_all_consumers** operation returns information about all consumer ports in the component's inheritance hierarchy as a sequence of **ConsumerDescription** values. The order in which these values occur in the sequence is not specified. For components that do not consume any events (e.g., a basic component), this operation returns a sequence of length zero.

get_named_consumers

The **get_named_consumers** operation returns information about all consumer ports denoted by the **names** parameter as a sequence of **ConsumerDescription** values. The order in which these values occur in the sequence is not specified. If any name in the **names** parameter is not a valid name for an event sink in the component's inheritance hierarchy, the operation raises the **InvalidName** exception. A component that does not provide any consumers (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the **InvalidName** exception.

get_all_emitters

The **get_all_emitters** operation returns information about all emitter ports in the component's inheritance hierarchy as a sequence of **EmitterDescription** values. The order in which these values occur in the sequence is not specified. For components that do not emit any events (e.g., a basic component), this operation returns a sequence of length zero.

get_named_emitters

The **get_named_emitters** operation returns information about all emitter ports denoted by the **names** parameter as a sequence of **EmitterDescription** values. The order in which these values occur in the sequence is not specified. If any name in the **names** parameter is not a valid name for an emitter port in the component's inheritance hierarchy, the operation raises the **InvalidName** exception. A component that does not provide any emitters (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the **InvalidName** exception.
get_all_publishers

The get_all_publishers operation returns information about all publisher ports in the component’s inheritance hierarchy as a sequence of PublisherDescription values. The order in which these values occur in the sequence is not specified. For components that do not publish any events (e.g., a basic component), this operation returns a sequence of length zero.

get_named_publishers

The get_named_publishers operation returns information about all publisher ports denoted by the names parameter as a sequence of PublisherDescription values. The order in which these values occur in the sequence is not specified. If any name in the names parameter is not a valid name for a publisher port in the component’s inheritance hierarchy, the operation raises the InvalidName exception. A component that does not provide any publishers (e.g., a basic component) will have no valid name parameter to this operation and thus shall always raise the InvalidName exception.

1.7 Homes

An IDL specification may include home definitions. A home definition describes an interface for managing instances of a specified component type. The salient characteristics of a home definition are as follows:

¥ A home definition implicitly defines an equivalent interface, which can be described in terms of IDL.

¥ The presence of a primary key specification in a home definition causes home’s equivalent interface to contain a set of implicitly defined operations whose signatures are determined by the types of the primary key and the managed component. These operations are specified in Section 1.7.1.2, “Home definitions with primary keys,” on page 1-34.

1.7.1 Equivalent Interfaces

Every home definition implicitly defines a set of operations whose names are the same for all homes, but whose signatures are specific to the component type managed by the home and, if present, the primary key type specified by the home.

Because the same operation names are used for these operations on different homes, the implicit operations cannot be inherited. The specification for home equivalent interfaces accommodates this constraint. A home definition results in the definition of three interfaces, called the explicit interface, the implicit interface, and the equivalent interface. The name of the explicit interface has the form <home_name>Explicit, where <home_name> is the declared name of the home definition. Similarly, the name of the implicit interface has the form <home_name>Implicit, and the name of the equivalent interface is simply the name of the home definition, with the form <home_name>. All of the operations defined explicitly on the home (including explicitly-defined factory and finder operations) are represented on the explicit
interface. The operations that are implicitly defined by the home definition are exported by the implicit interface. The equivalent interface inherits both the explicit and implicit interfaces, forming the interface presented to programmer using the home.

The same names are used for implicit operations in order to provide clients with a simple, uniform view of the basic life cycle operations—creation, finding, and destruction. The signatures differ to make the operations specific to the storage type (and, if present, primary key) associated with the home. These two goals—uniformity and type safety—are admittedly conflicting, and the resulting complexity of equivalent home interfaces reflects this conflict. Note that this complexity manifests itself in generated interfaces and their inheritance relationships; the model seen by the client programmer is relatively simple.

1.7.1.1 Home definitions with no primary key

Given a home definition of the following form:

```cpp
definition
  <home_name> manages <component_type> {
    <explicit_operations>
  };
```

The resulting explicit, implicit, and equivalent local interfaces have the following forms:

```cpp
interface <home_name>:Explicit : Components::CCMHome {
  <equivalent_explicit_operations>
};

interface <home_name>:Implicit : Components::KeylessCCMHome {
  <component_type> create() raises(CreateFailure);
};

interface <home_name>:<home_name>:Explicit, <home_name>:Implicit {};
```

where `<equivalent_explicit_operations>` are the operations defined in the home declaration ( `<explicit_operations>` ), with factory and finder operations transformed to their equivalent operations, as described in Section 1.7.3, Explicit Operations in Home Definitions, on page 1.37.

create

This operation creates a new component instance of the type managed by the home. The `CreateFailure` exception is raised if any application errors are encountered in home creation.

1.7.1.2 Home definitions with primary keys

Given a home of the following form:

```cpp
definition
  <home_name> manages <component_type> primarykey <key_type> {
    <explicit_operations>
  };
```
The resulting explicit, implicit, and equivalent interfaces have the following forms:

```plaintext
interface <home_name>Explicit : Components::CCMHome {
    <equivalent_explicit_operations>
};

interface <home_name>Implicit {
    <component_type> create (in <key_type> key)
    raises (Components::CreateFailure, Components::DuplicateKeyValue, Components::InvalidKey);

    <component_type> find_by_primary_key (in <key_type> key)
    raises (Components::FinderFailure, Components::UnknownKeyValue, Components::InvalidKey);

    void remove (in <key_type> key)
    raises (Components::RemoveFailure, Components::UnknownKeyValue, Components::InvalidKey);

    <key_type> get_primary_key (in <component_type> comp);
};

interface <home_name> : <home_name>Explicit, <home_name>Implicit { }
```

where `<equivalent_explicit_operations>` are the operations defined in the home declaration `<explicit_operations>`, with factory and finder operations transformed to their equivalent operations, as described in Section 1.7.3, “Explicit Operations in Home Definitions,” on page 1-37.

create

This operation creates a new component associated with the specified primary key value, returning a reference to the component. If the specified key value is already associated with an existing component managed by the storage home, the operation raises an `DuplicateKeyValue` exception. If the key value was not a well-formed, legal value, the operation shall raise the `InvalidKey` exception. All other error conditions may raise the `CreateFailure` exception.

find_by_primary_key

This operation returns a reference to the component identified by the primary key value. If the key value does not identify an existing component managed by the home, an `UnknownKeyValue` exception is raised. If the key value was not a well-formed, legal value, the operation shall raise the `InvalidKey` exception. All other error conditions may raise the `FinderFailure` exception.
remove

This operation removes the component identified by the specified key value. Subsequent requests to any of the component's facets shall raise an OBJECT_NOT_EXIST system exception. If the specified key value does not identify an existing component managed by the home, the operation shall raise an UnknownKeyVal exception. If the key value was not a well-formed, legal value, the operation shall raise the InvalidKey exception. All other error conditions may raise the RemoveFailure exception.

1.7.1.3 Supported interfaces

A home definition may optionally support one or more interfaces. When a home definition header includes a supports clause as follows:

home <home_name> supports <interface_name>
    manages <component_type> {
        <explicit_operations>
    };

The resulting explicit interface inherits both CCMHome and any supported interfaces, as follows:

interface <home_name>Explicit : Components::CCMHome,
    <interface_name> {
        <equivalent_explicit_operations>
    };

The home implementation shall supply implementations of operations defined on supported interfaces. Clients shall be able to widen a reference of the home's resulting explicit or equivalent interface type to the type of any of the supported interfaces. Clients shall also be able to narrow a reference of type CCMHome to the type of any of the home's supported interfaces.

1.7.2 Primary Key Declarations

Primary key values shall uniquely identify component instances within the scope of the home that manages them. Two component instances cannot exist on the same home with the same primary key value.

Different home types that manage the same component type may specify different primary key types. Consequently, a primary key type is not inherently related to the component type, and vice versa. A home definition determines the association between a component type and a primary key type. The home implementation is responsible for maintaining the association between specific primary key values and specific component identities.

Note that this discussion pertains to component definitions as abstractions. A particular implementation of a component type may be cognizant of, and dependent upon, the primary keys associated with its instances. Such dependencies, however, are not exposed on the surface of the component.
type. A particular implementation of a component type may be designed to be manageable by different home interfaces with different primary keys, or it may be inextricably bound to a particular home definition. Generally, an implementation of a component type and the implementation of its associated home are inter-dependent, although this is not absolutely necessary.

1.7.2.1 Primary key type constraints

Primary key and types are subject to the following constraints:

- A primary key type must be a value type derived from `Components::PrimaryKeyBase`.
- A primary key type must be a concrete type with at least one public state member.
- A primary key type may not contain private state members.
- A primary key type may not contain any members whose type is a CORBA interface reference type, including references for interfaces, abstract interfaces, and local interfaces.
- These constraints apply recursively to the types of all of the members; that is, members that are structs, unions, value types, sequences or arrays may not contain interface reference types. If the type of a member is a value type or contains a value type, it must meet all of the above constraints.

1.7.2.2 PrimaryKeyBase

The base type for all primary keys is the abstract value type `Components::PrimaryKeyBase`. The definition of `PrimaryKeyBase` is as follows:

```
module Components {
    abstract valuetype PrimaryKeyBase { };
};
```

1.7.3 Explicit Operations in Home Definitions

A home body may include zero or more operation declarations, where the operation may be a factory operation, a finder operation, or a normal operation or attribute.

1.7.3.1 Factory operations

A factory operation is denoted by the `factory` keyword. A factory operation has a corresponding equivalent operation on the home's explicit interface. Given a factory declaration of the following form:

```
home <home_name> manages <component_type> {
    factory <factory_operation_name> (<parameters>)
    raises (<exceptions>);
};
```
The equivalent operation on the explicit interface is as follows:

```cpp
<component_type> <factory_operation_name> ( <parameters> )
raises (Components::CreateFailure, <exceptions> );
```

A factory operation is required to support creation semantics; that is, the reference returned by the operation shall identify a component that did not exist prior to the operation's invocation. Factory operations are required to raise `CreateFailure` and may raise other exceptions.

### 1.7.3.2 Finder operations

A finder operation is denoted by the `finder` keyword. A finder operation has a corresponding equivalent operation on the home's explicit interface. Given a finder declaration of the following form:

```cpp
home <home_name> manages <component_type> {
    finder <finder_operation_name> ( <parameters> ) raises ( <exceptions> );
};
```

The equivalent operation on the explicit interface is as follows:

```cpp
<component_type> <finder_operation_name> ( <parameters> )
raises (Components::FinderFailure, <exceptions> );
```

A finder operation shall support the following semantics. The reference returned by the operation shall identify a previously-existing component managed by the home. The operation implementation determines which component's reference to return based on the values of the operation's parameters. Finder operations are required to raise `FinderFailure` and may raise other exceptions.

### 1.7.3.3 Miscellaneous exports

All of the exports, other than factory and finder operations, that appear in a home definition are duplicated exactly on the home's explicit interface.

### 1.7.4 Home inheritance

Given a derived home definition of the following form:

```cpp
home <home_name> : <base_home_name> manages <component_type> {
    <explicit_operations>
};
```

The resulting explicit interface has the following form:

```cpp
interface <home_name>Explicit : <base_home_name>Explicit {
    <equivalent_explicit_operations>
};
```

Given a derived home definition supporting one or more interfaces, as follows:
home <home_name> : <base_home_name>
supports <interface_name>
manages <component_type> { 
  <explicit_operations>
};

The resulting explicit interface has the following form:

interface <home_name>Explicit : <base_home_name>Explicit,
<interface_name> { 
  <equivalent_explicit_operations>
};

where <equivalent_explicit_operations> are the operations defined in the home declaration (<explicit_operations>), with factory and finder operations transformed to their equivalent operations, as described in Section 1.7.3, Explicit Operations in Home Definitions, on page 1-37. The forms of the implicit and equivalent interfaces are identical to the corresponding forms for non-derived storage homes, determined by the presence or absence of a primary key specification.

A home definition with no primary key specification constitutes a pair \((H, T)\) where \(H\) is the home type and \(T\) is the managed component type. If the home definition includes a primary key specification, it constitutes a triple \((H, T, K)\), where \(H\) and \(T\) are as previous and \(K\) is the type of the primary key. Given a home definition \((H_0, T_0)\) or \((H_0, T_0, K)\), where \(K\) is a primary key type specified on \(H_0\), such that \(H_0\) is derived from \(H\), then \(T_0\) must be identical to \(T\) or derived (directly or indirectly) from \(T\).

Given a base home definition with a primary key \((H, T, K)\), and a derived home definition with no primary key \((H_0, T_0)\), such that \(H_0\) is derived from \(H\), then the definition of \(H_0\) implicitly includes a primary key specification of type \(K\), becoming \((H_0, T_0, K)\). The implicit interface for \(H_0\) shall have the form specified for an implicit interface of a home with primary key \(K\) and component type \(T_0\).

Given a base home definition \((H, T, K)\), noting that \(K\) may have been explicitly declared in the definition of \(H\), or inherited from a base home type, and a home definition \((H_0, T_0, K_0)\) such that \(H_0\) is derived from \(H\), then \(T_0\) must be identical to or derived from \(T\) and \(K_0\) must be identical to or derived from \(K\).

Note the following observations regarding these constraints and the structure of inherited equivalent interfaces:

- If a home definition does not specify a primary key directly in its header, but it is derived from a home definition that does specify a primary key, the derived home inherits the association with that primary key type, precisely as if it had explicitly specified that type in its header. This inheritance is transitive. For the purposes of the following discussion, home definitions that inherit a primary key type are considered to have specified that primary key type, even though it did not explicitly appear in the definition header.

- Operations on CCMHome are inherited by all home equivalent interfaces. These operations apply equally to homes with and without primary keys.
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Operations on KeylessCCMHome are inherited by all homes that do not specify primary keys.

Implicitly-defined operations (i.e., that appear on the implicit interface) are only visible to the equivalent interface for the specific home type that implies their definitions. Implicitly-defined operations on a base home type are not inherited by a derived home type. Note that the implicit operations for a derived home may be identical in form to the corresponding operations on the base type, but they are defined in a different name scope.

Explicitly-defined operations (i.e., that appear on the explicit interface) are inherited by derived home types.

1.7.5 Semantics of Home Operations

Operations in home interfaces fall into two categories:

- Operations that are defined by the component model. Default implementations of these operations must, in some cases, be supplied by the component-enabled ORB product, without requiring user programming or intervention. Implementations of these operations must have predictable, uniform behaviors. Hence, the required semantics for these operations are specified in detail. For convenience, we will refer to these operations as orthodox operations.

- Operations that are defined by the user. The semantics of these operations are defined by the user-supplied implementation. Few assumptions can be made regarding the behavior of such operations. For convenience, we will refer to these operations as heterodox operations.

Orthodox operations include the following:

- Operations defined on CCMHome and KeylessCCMHome.
- Operations that appear on the implicit interface for any home.

Heterodox operations include the following:

- Operations that appear in the body of the home definition, including factory operations, finder operations, and normal IDL operations and attributes.

1.7.5.1 Orthodox operations

Because of the inheritance structure described in Section 1.7.4, ÔHome inheritance,Ô on page 1-38 problems relating to polymorphism in orthodox operations are limited. For the purposes of determining key uniqueness and mapping key values to components in orthodox operations, equality of value types (given the constraints on primary key types specified in Section 1.7.2.1, ÔPrimary key type constraints,Ô on page 1-37) are defined as follows:

- Only the state of the primary key type specified in the home definition (which is also the actual parameter type in operations using primary keys) shall be used for the purposes of determining equality. If the type of the actual parameter to the operation is more derived than the formal type, the behavior of the underlying implementation of the operation shall be as if the value were truncated to the formal
type before comparison. This applies to all value types that may be contained in the
closure of the membership graph of the actual parameter value; that is, if the type of
a member of the actual parameter value is a value type, only the state that
constitutes the member's declared type is compared for equality.

Two values are equal if their types are precisely equivalent and the values of all of
their public state members are equal. This applies recursively to members that are
value types.

If the values being compared constitute a graph of values, the two values are equal
only if the graphs are isomorphic.

Union members are equal if both the discriminator values and the values of the
union member denoted by the discriminator are precisely equal.

Members that are sequences or arrays are considered equal if all of their members
are precisely equal, where order is significant.

1.7.5.2 Heterodox operations

Polymorphism in heterodox operations is somewhat more problematic, as they are
inherited by homes that may specify more-derived component and primary key types.
Assume a home definition \((H, T; K)\), with an explicit factory operation \(f\) that takes a
parameter of type \(K\), and a home definition \((H\tilde{O}, T\tilde{O}, K\tilde{O})\), such that \(H\tilde{O}\) is derived from
\(H, T\tilde{O}\) is derived from \(T\), and \(K\tilde{O}\) is derived from \(K\). The operation \(f\) (whose
parameter type is \(K\)) is inherited by equivalent interface for \(H\tilde{O}\). It may be the intended
behavior of the designer that the actual type of the parameter to invocations of \(f\) on \(H\tilde{O}\)
should be \(K\tilde{O}\), exploiting the polymorphism implied by inheritance of \(K\) by \(K\tilde{O}\).
Alternatively, it may be the intended behavior of the designer that actual parameter
values of either \(K\) or \(K\tilde{O}\) are legitimate, and the implementation of the operation
determines what the appropriate semantics of operation are with respect to key
equality.

This specification does not attempt to define semantics for polymorphic equality.
Instead, we define the behavior of operations on home that depend on primary key
values in terms of abstract tests for equality that are provided by the implementation of
the heterodox operations.

Implementations of heterodox operations, including implementations of key value
comparison for equality, are user-supplied. This specification imposes the following
constraints on the tests for equality of value types used as keys in heterodox
operations:

For any two actual key values A and B, the comparison results must be the same for
all invocations of all operations on the home.

The comparison behavior must meet the general definition of equivalence; that is, it
must be symmetric, reflexive, and transitive.

1.7.6 CCMHome Interface

The definition of the CCMHome interface is as follows:
module Components {

typedef unsigned long FailureReason;

exception CreateFailure { FailureReason reason; };

exception FinderFailure { FailureReason reason; };

exception RemoveFailure { FailureReason reason; };

exception DuplicateKeyValue { };

exception InvalidKey { };

exception UnknownKeyValue { };

interface CCMHome {
    CORBA::IOR get_component_def();
    CORBA::IOR get_home_def();
    void remove_component ( in CCMObject comp)
        raises (RemoveFailure);
};

get_component_def

The get_component_def operation returns an object reference that supports the
CORBA::ComponentIR::ComponentDef interface, describing the component type
associated with the home object. In strongly typed languages, the IRObj ect
returned must be narrowed to CORBA::ComponentIR::ComponentDef before use.

get_home_def

The get_home_def operation returns an object reference that supports the
CORBA::ComponentIR::HomeDef interface describing the home type. In strongly
typed languages, the IRObj ect returned must be narrowed to
CORBA::ComponentIR::HomeDef before use.

remove_component

The remove_component operation causes the component denoted by the reference
to cease to exist. Subsequent invocations on the reference will cause an
OBJECT _ NOT _ EXIST system exception to be raised. If the component denoted by
the parameter does not exist in the container associated with target home object,
remove_component raises a BAD _ PARAM system exception. All other
application errors raise the RemoveFailure exception.
**Note** This specification does not define explicitly what the **FailureReason** values are for the **CreateFailure**, **FinderFailure**, and **RemoveFailure** exceptions. These values are currently vendor specific and will be standardized once consensus among vendors will be established.

### 1.7.7 KeylessCCMHome Interface

The definition of the **KeylessCCMHome** interface is as follows:

```idl
module Components {
  interface KeylessCCMHome {
    CCMObject create_component() raises (CreateFailure);
  };
}

create_component
```

The **create_component** operation creates a new instance of the component type associated with the home object. A home implementation may choose to disable the parameter-less **create_component** operation, in which case it shall raise a **NO_IMPLEMENT** system exception. All other failures raise the **CreateFailure** exception.

### 1.8 Home Finders

The **HomeFinder** interface is, conceptually, a greatly simplified analog of the **CosLifeCycle::FactoryFinder** interface. Clients can use the **HomeFinder** interface to obtain homes for particular component types, of particularly home types, or homes that are bound to specific names in a naming service.

A reference that supports the **HomeFinder** interface may be obtained from the ORB pseudo-object by invoking **CORBA::ORB::resolve_initial_references**, with the parameter value **"ComponentHomeFinder"**. This requires the following enhancement to the **ORB** interface definition:

```idl
module CORBA {
  interface ORB {
    Object resolve_initial_references (in ObjectId identifier)
      raises (InvalidName);
  };
}
```

The **HomeFinder** interface is defined by the following IDL:

```idl
module Components {
  exception HomeNotFound { }

  interface HomeFinder {
```
CCMHome find_home_by_component_type (
    in CORBA::RepositoryId comp_repId) raises (HomeNotFound);

CCMHome find_home_by_home_type (in CORBA::RepositoryId home_repId) raises (HomeNotFound);

CCMHome find_home_by_name (in string home_name) raises (HomeNotFound);
}


cpp

find_home_by_component_type

The find_home_by_component_type operation returns a reference, which supports the interface of a home object that manages the component type specified by the comp_repId parameter. This parameter contains the repository identifier of the component type required. If there are no homes that manage the specified component type currently registered, the operation shall raise the HomeNotFound exception.

Little is guaranteed about the home interface returned by this operation. If the definition of the returned home specified a primary key, there is no generic factory operation available on any standard interface (i.e. pre-defined, as opposed to generated type-specific interface) supported by the home. The only generic factory operation that is potentially available is Components::KeylessCCMHome::create_component. The client must first attempt to narrow the CCMHome reference returned by the find_home_by_component_type to KeylessCCMHome. Otherwise, the client must have specific out-of-band knowledge regarding the home interface that may be returned, or the client must be sophisticated enough to obtain the HomeDef for the home and use the DII to discover and invoke a create operation on a type-specific interface supported by the home.

find_home_by_home_type

The find_home_by_home_type operation returns a reference that supports the interface of the type specified by the repository identifier in the home_repId parameter. If there are no homes of this type currently registered, the operation shall raise the HomeNotFound exception.

The current LifeCycle find_factories operation returns a sequence of factories to the client requiring the client to choose the one that will create the instance. Based on the experience of the submitters, CORBA components defines operations which allows the server to choose the ÒbestÓ home for the client request based on its knowledge of workload, etc.

Since the operation returns a reference to CCMHome, it must be narrowed to the specific home type before it can be used.

find_home_by_name

The find_home_by_name operation returns a home reference bound to the name specified in the home_name parameter. This parameter is expected to contain a name in the format described in the Naming Service specification (formal/01-02-65), section
2.4, ÔStringified Names.Ó The implementation of this operation may be delegated directly to an implementation of CORBA naming, but it is not required. The semantics of the implementation are considerably less constrained, being defined as follows:

The implementation is free to maintain multiple bindings for a given name, and to return any reference bound to the name.

It is generally expected that implementations that do not choose to use CORBA naming will do so for reasons of scalability and flexibility, in order for example, to provide a home which is logically more Ôlocalô to the home finder (and thus, the client).

The clientôs expectations regarding the returned reference, other than that it supports the CCMHome interface, are not guaranteed or otherwise mediated by the home. The fact that certain names may be expected to provide certain home types or qualities of implementation are outside the scope of this specification.

This is no different than any application of naming services in general. Applications that require clients to be more discriminating are free to use the Trader service, or any other similar mechanism that allows query or negotiation to select an appropriate home. This mechanism is intentionally kept simple.

If the specified name does not map onto a home object registered with the finder, the operation shall raise the HomeNotFound exception.

1.9 Component Configuration

The CORBA component model provides mechanisms to support the concept of component configurability.

Experience has proven that building re-usable components involves making difficult trade-offs between providing well-defined, reasonably-scoped functionality, and providing enough flexibility and generality to be useful (or re-useful) across a variety of possible applications. Packaging assumptions of the component architecture preclude customizing a componentôs behavior by directly altering its implementation or (in most cases) by deriving specialized sub-types. Instead, the model focuses on extension and customization through delegation (e.g., via dependencies expressed with uses declarations) and configuration. Our assumption is that generalized components will typically provide a set of optional behaviors or modalities that can be selected and adjusted for a specific application.

The configuration framework is designed to provide the following capabilities:

The ability to define attributes on the component type that are used to establish a component instanceôs configuration. Component attributes are intended to be used during a component instanceôs initialization to establish its fundamental behavioral properties. Although the component model does not constrain the visibility or use of attributes defined on the component, it is generally assumed that they will not be of interest to the same clients that will use the component after it is configured. Rather, it is intended for use by component factories or by deployment tools in the process of instantiating an assembly of components.
The ability to define a configuration in an environment other than the deployment environment (e.g., an assembly tool), and store that configuration in a component package or assembly package to be used subsequently in deployment.

The ability to define such a configuration without having to instantiate the component type itself.

The ability to associate a pre-defined configuration with a component factory, such that component instances created by that factory will be initialized with the associated configuration.

Support for visual, interactive configuration tools to define configurations. Specifically, the framework allows component implementors to provide a configuration manager associated with the component implementation. The configuration manager interface provides descriptive information to interactive users, constrains configuration options, and performs validity checks on proposed configurations.

The CORBA component model allows a distinction to be made between interface features that are used primarily for configuration, and interface features that are used primarily by application clients during normal application operation. This distinction, however, is not precise, and enforcement of the distinction is largely the responsibility of the component implementor.

It is the intent of this specification (and a strong recommendation to component implementors and users) that operational interfaces should be either provided interfaces or supported interfaces. Features on the component interface itself, other than provided interfaces, (i.e., receptacles, event sources and sinks) are generally intended to be used for configuration, although there is no structural mechanism for limiting the visibility of the features on a component interface. A mechanism is provided for defining configuration and operational phases in a component's life cycle, and for disabling certain interfaces during each phase.

The distinction between configuration and operational interfaces is often hard to make in practice. For example, we expect that operational clients of a component will want to receive events generated by a component. On the other hand, some applications will want to establish a fixed set of event source and sink connections as part of the overall application structure, and will want to prevent clients from changing those connections. Likewise, the responsibility for configuration may be hard to assign in some applications the client that creates and configures a component may be the same client that will use it operationally. For this reason, the CORBA component model provides general guidelines and optional mechanisms that may be employed to characterize configuration operations, but does not attempt to define a strict separation of configuration and operational behaviors.

1.9.1 Exclusive Configuration and Operational Life Cycle Phases

A component implementation may be designed to implement an explicit configuration phase of its life cycle, enforcing serialization of configuration and functional operation. If this is the case, the component life cycle is divided into two mutually exclusive phases, the configuration phase and the operational phase.
The `configuration_complete` operation (inherited from Components::CCMObject) is invoked by the agent effecting the configuration to signal the completion of the configuration phase. The `InvalidConfiguration` exception is raised if the state of the component configuration state at the time `configuration_complete` is invoked does not constitute an acceptable configuration state. It is possible that configuration may be a multi-step process, and that the validity of the configuration may not be determined until the configuration process is complete. The `configuration_complete` operation should not return to the caller until either 1) the configuration is deemed invalid, in which case the `InvalidConfiguration` exception is raised, or 2) the component instance has performed whatever work is necessary to consolidate the final configuration and is prepared to accept requests from arbitrary application clients.

In general, component implementations should defer as much consolidation and integration of configuration state as possible until `configuration_complete` is invoked. In practice, configuring a highly-connected distributed object assembly has proven very difficult, primarily because of subtle ordering dependencies that are difficult to discover and enforce. If possible, a component implementation should not be sensitive to the ordering of operations (interface connections, configuration state changes, etc.) during configuration. This is one of the primary reasons for the definition of `configuration_complete`.

### 1.9.1.1 Enforcing exclusion of configuration and operation

The implementation of a component may choose to disable changes to the configuration after `configuration_complete` is invoked, or to disable invocations of operations on provided interfaces until `configuration_complete` is invoked. If an implementation chooses to do either (or both), an attempt to invoke a disabled operation should raise a `BAD_INV_ORDER` system exception.

Alternatively, a component implementation may choose not to distinguish between configuration phase and deployment phase. In this case, invocation of `configuration_complete` will have no effect.

The component implementation framework provides standard mechanisms to support disabling operations during configuration or operation. Certain operations are implemented by the component implementation framework (see Chapter 3 - CCM Implementation Framework) and may not be disabled.

### 1.10 Configuration with Attributes

A component's configuration is established primarily through its attributes. An `attribute configuration` is defined to be a description of a set of invocations on a component's attribute set methods, with specified values as parameters.

There are a variety of possible approaches to attribute configuration at run time, depending on the design of the component implementation and the needs of the application and deployment environments. The CORBA component model defines a set of basic mechanisms to support attribute configuration. These mechanisms can be deployed in a number of ways in a component implementation or application.
1.10.1 Attribute Configurators

A configurator is an object that encapsulates a specific attribute configuration that can be reproduced on many instances of a component type. A configurator may invoke any operations on a component that are enabled during its configuration phase. In general, a configurator is intended to invoke attribute set operations on the target component.

1.10.1.1 The Configurator interface

The following interface is supported by all configurators:

```plaintext
module Components {
    exception WrongComponentType { };

    interface Configurator {
        void configure (in CCMObject comp)
        raises (WrongComponentType);}
    }
}
```

configure

The `configure` operation establishes its encapsulated configuration on the target component. If the target component is not of the type expected by the configurator, the `configure` operation shall raise the `WrongComponentType` exception.

1.10.1.2 The StandardConfigurator interface

The `StandardConfigurator` has the following definition:

```plaintext
module Components {

    valuetype ConfigValue {
        public FeatureName name;
        public any value;
    }

typedef sequence<ConfigValue> ConfigValues;

    interface StandardConfigurator : Configurator {
        void set_configuration (in ConfigValues descr);
    }
}
```

The `StandardConfigurator` interface supports the ability to provide the configurator with a set of values defining an attribute configuration.
set_configuration

The **set_configuration** operation accepts a parameter containing a sequence of **ConfigValue** instances, where each **ConfigValue** contains the name of an attribute and a value for that attribute, in the form of an **any**. The **name** member of the **ConfigValue** type contains the unqualified name of the attribute as declared in the component definition IDL. After a configuration has been provided with **set_configuration**, subsequent invocations of **configure** will establish the configuration on the target component by invoking the set operations on the attributes named in the value set, using the corresponding values provided in the **anys**. Invocations on attribute set methods will be made in the order in which the values occur in the sequence.

1.10.2 Factory-based Configuration

Factory operations on home objects may participate in the configuration process in a variety of ways.

- **A** a factory operation may be explicitly implemented to establish a particular configuration.
- **A** a factory operation may apply a configurator to newly-created component instances. The configurator may be supplied by an agent responsible for deploying a component implementation or a component assembly.
- **A** a factory operation may apply an attribute configuration (in the form of a **Components::ConfigValues** sequence) to newly-created instances. The attribute configuration may be supplied to the home object by an agent responsible for deploying a component implementation or a component assembly.
- **A** a factory operation may be explicitly implemented to invoke **configuration_complete** on newly-created component instances, or to leave component instances open for further configuration by clients.
- **A** a factory operation may be directed by an agent responsible for deploying a component implementation or assembly to invoke **configuration_complete** on newly-created instances, or to leave them open for further configuration by clients.

If no attribute configuration is applied by a factory or by a client, the state established by the component implementation's instance initialization mechanism (e.g., the component servant constructor) constitutes the default configuration.

1.10.2.1 HomeConfiguration interface

The implementation of a component type's home object may optionally support the **HomeConfiguration** interface. The **HomeConfiguration** interface is derived from **Components::CCMHome**. In general, the **HomeConfiguration** interface is intended for use by an agent deploying a component implementation into a container, or an agent deploying an assembly.
The **HomeConfiguration** interface allows the caller to provide a **Configurator** object and/or a set of configuration values that will be applied to instances created by factory operations on the home object. It also allows the caller to cause the home object's factory operations to invoke **configuration_complete** on newly-created instances, or to leave them open for further configuration.

The **HomeConfiguration** allows the caller to disable further use of the **HomeConfiguration** interface on the home object.

The **Configurator** interface and the **HomeConfiguration** interface are designed to promote greater re-use, by allowing a component implementor to offer a wide range of behavioral variations in a component implementation. As stated previously, the CORBA component specification is intended to enable assembling applications from pre-built, off-the-shelf component implementations. An expected part of the assembly process is the customization (read: configuration) of a component implementation, to select from among available behaviors the behaviors suited to the application being assembled. We anticipate that assemblies will need to define configurations for specific component instances in the assembly, but also that they will need to define configurations for a deployed component type, i.e., all of the instances of a component type managed by a particular home object.

The **HomeConfiguration** interface is defined by the following IDL:

```idl
module Components {

    interface HomeConfiguration : CCMHome {
        void set_configurator (in Configurator cfg);
        void set_configuration_values (in ConfigValues config);
        void complete_component_configuration (in boolean b);
        void disable_home_configuration();
    }
};
```

**set_configurator**

This operation establishes a configurator object for the target home object. Factory operations on the home object will apply this configurator to newly-created instances.

**set_configuration_values**

This operation establishes an attribute configuration for the target home object, as an instance of **Components::ConfigValues**. Factory operations on the home object will apply this configurator to newly-created instances.

**complete_component_configuration**

This operation determines whether factory operations on the target home object will invoke **configuration_complete** on newly-created instances. If the value of the boolean parameter is **TRUE**, factory operations will invoke
configuration_complete on component instances after applying any required configurator or configuration values to the instance. If the parameter is FALSE, configuration_complete will not be invoked.

disable_home_configuration

This operation serves the same function with respect to the home object that the configuration_complete operation serves for components. This operation disables further use of operations on the HomeConfiguration interface of the target home object. If a client attempts to invoke HomeConfiguration operations, the request will raise a BAD_INV_ORDER system exception. This operation may also be interpreted by the implementation of the home as demarcation between its own configuration and operational phases, in which case the home implementation may disable operations and attributes on the home interface.

If a home object is supplied with both a configurator and a set of configuration values, the order in which set_configurator and set_configuration_values are invoked determines the order in which the configurator and configuration values will be applied to component instances. If set_configurator is invoked before set_configuration_values, the configurator will be applied before the configuration values, and vice-versa.

The component implementation framework defines default implementations of factory operations that are automatically generated. These generated implementations will behave as specified here. Component implementors are free to replace the default factory implementations with customized implementations. If a customized home implementation chooses to support the HomeConfiguration interface, then the factory operation implementations must behave as specified, with respect to component configuration.

1.11 Component Inheritance

The mechanics of component inheritance are defined by the inheritance relationships of the equivalent IDL component interfaces. The following rules apply to component inheritance:

- All interfaces for non-derived component types are derived from CCMObject.
- If a component type directly supports one or more IDL interfaces, the component interface is derived from both CCMObject and the supported interfaces.
- A derived component type may not directly support an interface.
- The interface for a derived component type is derived from the interface of its base component type.
- A component type may have at most one base component type.
- The features of a component that are expressed directly on the component interface are inherited as defined by IDL interface inheritance. These include:
  - operations implied by provides statements
  - operations implied by uses statements
Y operations implied by `emits` statements
Y operations implied by `publishes` statements
Y operations implied by `consumes` statements
Y attributes

**Figure 1-2** Component inheritance and related interface inheritance

### 1.11.1 CCMObject Interface

The `CCMObject` interface is defined by the following IDL:

```idl
module Components {
  valuetype ComponentPortDescription {
    public FacetDescriptions facets;
    public ReceptacleDescriptions receptacles;
  }
}
```
public ConsumerDescriptions consumers;
public EmitterDescriptions emitters;
public PublisherDescriptions publishers;
}

exception NoKeyAvailable { }

interface CCMObject : Navigation, Receptacles, Events {
  CORBA::iROBJECT get_component_def ();
  CCMHome get_ccm_home();
  PrimaryKeyBase get_primary_key() raises (NoKeyAvailable);
  void configuration_complete() raises (InvalidConfiguration);
  void remove() raises (RemoveFailure);
  ComponentPortDescription get_all_ports ();
};

get_component_def

This operation returns an IROBJECT reference to the component definition in the Interface Repository. The interface repository representation of a component is defined in the Interface Repository Metamodel chapter. In strongly typed languages, the IROBJECT returned must be narrowed to CORBA::ComponentIR::ComponentDef before use.

get_ccm_home

This operation returns a CCMHome reference to the home that manages this component.

get_primary_key

This operation is equivalent to the same operation on the component's home interface. It returns a primary key value if the component is being managed by a home which defines a primary key. Otherwise, the NoKeyAvailable exception shall be raised.

configuration_complete

This operation is called by a configurator to indicate that the initial component configuration has completed. If the component determines that it is not sufficiently configured to allow normal client access, it raises the InvalidConfiguration exception. The component configuration process is described in Section 1.9, "Component Configuration," on page 1-45.

remove

This operation is used to delete a component. Application failures during remove may raise the RemoveFailure exception.
get_all_ports

The get_all_ports operation returns a value of type ComponentPortDescription containing information about all facets, receptacles, event sinks, emitted events and published events in the component's inheritance hierarchy. The order in which the information occurs in these sequences is not specified. If a component does not offer a port of any type, the associated sequence will have length zero.

1.12 Conformance Requirements

This section identifies the conformance points required for compliant implementations of the CORBA Component model.

The following conformance points are defined:

1. A CORBA COS vendor shall provide the relevant changes to the Lifecycle, Transaction, and Security Services identified in the following Section 1.12.2, "Changes to Object Services," on page 1-55.

2. A CORBA ORB vendor need not provide implementations of Components aside from the changes made to the Core to support components. Conversely a CORBA Component vendor need not be a CORBA ORB vendor.

3. A CORBA Component vendor shall provide a conforming implementation of the Basic Level of CORBA Components.

4. A CORBA Component vendor may provide a conforming implementation of the Extended Level of CORBA Components.

5. To be conformant at the Basic level a non-Java product shall implement (at a minimum) the following:

   - the IDL extensions and generation rules to support the client and server side component model for basic level components.
   - CIDL. The multiple segment feature of CIDL (Section 2.12, "Segment Definition," on page 2-10) need not be supported for basic components.
   - a container for hosting basic level CORBA components.
   - the XML deployment descriptors and associated zip files for basic components in the format defined in Section 6.1, "Introduction," on page 6-1.

   Such implementations shall work on a CORBA ORB as defined in #1 above.

6. To be conformant at the Basic level a Java product shall implement (at a minimum):

   - EJB 1.1, including support for the EJB 1.1 XML DTD.
   - the java to IDL mapping, also known as RMI/IIOP.
   - EJB to IDL mapping as defined in Section 5.3.2, "Translation of CORBA Component requests into EJB requests," on page 5-9.

   Such implementations shall work in a CORBA interoperable environment, including interoperable support for IIOP, CORBA transactions and CORBA security.
7. To be conformant at the extended level, a product shall implement (at a minimum) the requirements needed to achieve Basic PLUS:
   - IDL extensions to support the client and server side component model for extended level components.
   - A container for hosting extended level CORBA components.
   - The XML deployment descriptors and associated zip files for basic and enhanced level components in the format defined in Section 6.1, “Introduction,” on page 6-1.

Such implementations shall work on a CORBA ORB as defined in #1 above.

8. A CORBA Component vendor may optionally support EJB clients interacting with CORBA Components, by implementing the IDL to EJB mapping as defined in Section 5.4.2, “Translation of EJB requests into CORBA Component Requests,” on page 5-17.

9. This specification includes extensions to IDL, in the form of new keywords and grammar. Although a CORBA ORB vendor need not be a CORBA Component vendor, and vice-versa, it is important to maintain IDL as a single language. To this end, all compliant products of any conformance points above shall be able to parse any valid IDL definitions. However, it is permitted to raise errors, or to ignore, those parts of the grammar that relate to another conformance point.

Conforming implementations as defined above may also implement any additional features of this specification not required by the above conformance points.

1.12.1 A Note on Tools

Component implementations are expected to be supported by tools. It is not possible to define conformance points for tools, since a particular tool may only support part of the component development and deployment life-cycle. Hence a suite of tools may be needed. The Component architecture contains a number of definitions that are relevant to tools, including zip files and XML formats, as well as IDL interfaces for customization and installation. Although it cannot be enforced, tools are expected to conform to the relevant areas with which they are dealing. For example, a tool that generates implementations for a particular platform is expected to generate XML according to the <implementation> clauses in the DTD (defined in CORBA Core, the Interface Repository chapter).

1.12.2 Changes to Object Services

1.12.2.1 Life Cycle Service

To support the factory design pattern for creating a component instance and to allow the server, rather than a client, to select from a group of functionally equivalent factories based on load or other server-side visible criteria, the following operation is added to the FactoryFinder interface of the CosLifeCycle module:

```java
module CosLifeCycle {
```
interface FactoryFinder {
    Factory find_factory (in Key factory_key) raises (noFactory);
};

The parameters of the above operation are as defined by CosLifeCycle with the following clarifications:

- The `factory_key` parameter is a name conforming to the Interoperable Naming Specification (orbos/98-10-11) for stringified names.
- The `factory_key` parameter is used as an input to the `find_home_by_name` operation on `Components::HomeFinder`.
- The default factory operation on the home is used to obtain a reference which can be narrowed to the `CosLifeCycle::GenericFactory` type.

### 1.12.2.2 Transaction Service

The following CORBA transaction service interface is changed to a local interface:

- `CosTransactions::Current`

### 1.12.2.3 Security Service

The following CORBA Security interfaces are changed to local interfaces:

- `SecurityLevel1::Current`
- `SecurityLevel2::PrincipalAuthenticator`
- `SecurityLevel2::Credentials`
- `SecurityLevel2::ReceivedCredentials`
- `SecurityLevel2::AuditChannel`
- `SecurityLevel2::AuditDecision`
- `SecurityLevel2::AccessDecision`
- `SecurityLevel2::QOPPolicy`
- `SecurityLevel2::MechanismPolicy`
- `SecurityLevel2::InvocationCredentialsPolicy`
- `SecurityLevel2::EstablishTrustPolicy`
- `SecurityLevel2::DelegationDirectivePolicy`
- `SecurityLevel2::Current`
- `SecurityReplacable::Vault`
- `SecurityReplacable::SecurityContext`
- `SecurityReplacable::ClientSecurityContext`
- `SecurityReplacable::ServerSecurityContext`
OMG CIDL Syntax and Semantics

This chapter describes OMG Component Implementation Definition Language (CIDL) semantics and gives the syntax for OMG CIDL grammatical constructs.

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<tr>
<td>ÓOMG CIDL SpecificationÓ</td>
<td>2-5</td>
</tr>
<tr>
<td>ÓComposition DefinitionÓ</td>
<td>2-6</td>
</tr>
<tr>
<td>ÓCatalog Usage DeclarationÓ</td>
<td>2-7</td>
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<tr>
<td>ÓHome Executor DefinitionÓ</td>
<td>2-8</td>
</tr>
<tr>
<td>ÓHome Implementation DeclarationÓ</td>
<td>2-9</td>
</tr>
<tr>
<td>ÓStorage Home BindingÓ</td>
<td>2-9</td>
</tr>
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<td>ÓHome Persistence DeclarationÓ</td>
<td>2-10</td>
</tr>
<tr>
<td>ÓExecutor DefinitionÓ</td>
<td>2-10</td>
</tr>
</tbody>
</table>

Note D Text in Red is from the Components 1.1 RTF interim report (ptc/2002-08-02).
2.1 Overview

The OMG Component Implementation Definition Language (CIDL) is a language used to describe the structure and state of component implementations. Component-enable ORB products generate implementation skeletons from CIDL definitions. Component builders extend these skeletons to create complete implementations.

OMG CIDL obeys the same lexical rules as OMG Persistent State Definition Language (PSDL) and OMG IDL, although new keywords are introduced to support concepts specific to component implementation descriptions.

The description of OMG CIDL’s lexical conventions is presented in Section 2.2, "Lexical Conventions," on page 2-3. A description of OMG IDL preprocessing is presented in CORBA Core, IDL Syntax and Semantics chapter, Preprocessing section. The scope rules for identifiers in an OMG IDL specification are described in CORBA Core, IDL Syntax and Semantics chapter, CORBA Module section.

The OMG CIDL grammar is an extension of a combination of the OMG PSDL and OMG IDL grammars, with new constructs to define component implementations. OMG CIDL is a declarative language. The grammar is presented in Section 2.3, "OMG CIDL Grammar," on page 2-3.

A source file containing specifications written in OMG CIDL must have a .cdl extension.

The description of OMG CIDL grammar uses the same syntax notation that is used to describe OMG IDL in CORBA Core, IDL Syntax and Semantics chapter. For reference, Table 2-1 lists the symbols used in this format and their meaning.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>::=</td>
<td>Is defined to be</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;text&gt;</td>
<td>Nonterminal</td>
</tr>
</tbody>
</table>
2.2 Lexical Conventions

This section presents the lexical conventions of OMG CIDL. In general OMG CIDL uses the same lexical conventions as OMG PSDL and OMG IDL. It does use additional keywords as described below.

2.2.1 Keywords

**Note D Issue 5499**

The identifiers listed in Table 2-2 are reserved for use as keywords in CIDL, and may not be used otherwise in CIDL, unless escaped with a leading underscore. These are in addition to the ones defined by PSDL and IDL, which may also not be used otherwise in CIDL, unless escaped with a leading underscore.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ÆtextÈ</td>
<td>Literal</td>
</tr>
<tr>
<td>*</td>
<td>The preceding syntactic unit can be repeated zero or more times</td>
</tr>
<tr>
<td>+</td>
<td>The preceding syntactic unit can be repeated one or more times</td>
</tr>
<tr>
<td>{}</td>
<td>The enclosed syntactic units are grouped as a single syntactic unit</td>
</tr>
<tr>
<td>[]</td>
<td>The enclosed syntactic unit is optional/ may occur zero or one time</td>
</tr>
</tbody>
</table>

Table 2-2 Keywords

<table>
<thead>
<tr>
<th>String</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>bindsTo</td>
<td>delegatesTo</td>
</tr>
<tr>
<td>catalog</td>
<td>entity</td>
</tr>
<tr>
<td>composition</td>
<td>executor</td>
</tr>
</tbody>
</table>

2.3 OMG CIDL Grammar

The CIDL grammar is a combination of the PSDL and IDL grammars plus the following productions:

**Note D Issues 5498, 5499, and 5500**

(1) \(<\text{idl\_specification}> := <\text{import}>* <\text{idl\_definition}>+

(2) \(<\text{idl\_definition}> := <\text{type\_dcl}> \text{O;O}
   <\text{const\_dcl}> \text{O;O}
   <\text{except\_dcl}> \text{O;O}
   <\text{interface}> \text{O;O}
   <\text{idl\_module}> \text{O;O}
   <\text{storage\_home}> \text{O;O}
   <\text{abstract\_storagehome}> \text{O;O}
   <\text{storage\_type}> \text{O;O}
   <\text{abstract\_storage\_type}> \text{O;O}
(17) \( \langle \text{segment_member} \rangle ::= \langle \text{segment_persistence_dcl} \rangle \; \text{O;O} \)
| \( \langle \text{facet_dcl} \rangle \; \text{O;O} \)
(18)\( \langle \text{segment_persistence_dcl} \rangle ::= \text{OstoredOnO} \)
| \( \langle \text{abstract_storage_home_name} \rangle \; \text{O;O} \)
(19) \( \langle \text{facet_dcl} \rangle ::= \text{OprovidesO facetO} \langle \text{identifier} \rangle \)
| \( \{ \text{O,O} \langle \text{identifier} \rangle \}^* \)
(20)\( \langle \text{feature_delegation_spec} \rangle ::= \text{OdelegatesToO OstorageO} \)
| \( \langle \text{feature_delegation_list} \rangle \)
(21) \( \langle \text{feature_delegation_list} \rangle ::= \text{O(O} \langle \text{feature_delegation} \rangle \{ \text{O,O} \)
| \( \langle \text{feature_delegation} \rangle \}^* \text{O}O \)
(22) \( \langle \text{feature_delegation} \rangle ::= \langle \text{feature_name} \rangle \text{O;O} \)
| \( \langle \text{storage_member_name} \rangle \)
(23) \( \langle \text{feature_name} \rangle ::= \langle \text{identifier} \rangle \)
(24)\( \langle \text{storage_member_name} \rangle ::= \langle \text{identifier} \rangle \)
(25)\( \langle \text{abstract_storage_home_delegation_spec} \rangle ::= \text{OdelegatesToO OabstractO} \)
| \( \text{OstoragehomeO} \langle \text{delegation_list} \rangle \text{O;O} \)
(26)\( \langle \text{executor_delegation_spec} \rangle ::= \text{OdelegatesToO OexecutorO} \)
| \( \langle \text{delegation_list} \rangle \text{O;O} \)
(27) \( \langle \text{delegation_list} \rangle ::= \text{O(O} \langle \text{delegation} \rangle \{ \text{O,O} \langle \text{delegation} \rangle \}^* \text{O})O \)
(28) \( \langle \text{delegation} \rangle ::= \langle \text{operation_name} \rangle \{ \text{O,O} \langle \text{operation_name} \rangle \} \]
(29) \( \langle \text{operation_name} \rangle ::= \langle \text{identifier} \rangle \)
(30) \( \langle \text{abstract_spec} \rangle ::= \text{OabstractO} \langle \text{operation_list} \rangle \text{O;O} \)
(31) \( \langle \text{operation_list} \rangle ::= \text{O(O} \langle \text{operation_name} \rangle \}
| \( \text{O,O} \langle \text{operation_name} \rangle \}^* \text{O})O \)
(32) \( \langle \text{proxy_home_def} \rangle ::= \text{OproxyO OhomeO} \langle \text{identifier} \rangle \)
| \( \text{O(O} \langle \text{proxy_home_member} \rangle + \text{O})O \text{O;O} \)
(33) \( \langle \text{proxy_home_member} \rangle ::= \langle \text{home_delegation_spec} \rangle \text{O;O} \)
| \( \langle \text{abstract_spec} \rangle \)
(34) \( \langle \text{home_delegation_spec} \rangle ::= \text{OdelegatesToO OhomeO} \langle \text{delegation_list} \rangle \)

2.4 OMG CIDL Specification

A CIDL specification is like a PSDL and IDL specification that could also contain composition definitions. The syntax is:

\[ \langle \text{import} \rangle^* \langle \text{cidl_definition} \rangle^+ \]

2.4.1 CIDL Specification

(1) \( \langle \text{cidl_specification} \rangle ::= \langle \text{import} \rangle^* \langle \text{cidl_definition} \rangle^+ \)
(2) \( \langle \text{cidl_definition} \rangle ::= \langle \text{type_dcl} \rangle \text{O;O} \)
| \( \langle \text{const_dcl} \rangle \text{O;O} \)
| \( \langle \text{except_dcl} \rangle \text{O;O} \)
| \( \langle \text{interface} \rangle \text{O;O} \)
| \( \langle \text{cidl_module} \rangle \text{O;O} \)
| \( \langle \text{storage_home} \rangle \text{O;O} \)
| \( \langle \text{abstract_storagehome} \rangle \text{O;O} \)
| \( \langle \text{storagetype} \rangle \text{O;O} \)
2.5 Composition Definition

The syntax for composition definitions is as follows:

\[(3) \text{<cidl\_module> ::= } \text{module}\text{<identifier> }\text{O(}\text{O<cidl\_definition>+}\text{O)O}}\]

\[(4) \text{<composition> ::= } \text{composition}\text{<category> <identifier> }\text{O(}\text{O<composition\_body> }\text{O)O}}\]

\[(5) \text{<category> ::= } \text{entity}\text{O}\text{<process> }\text{O<service> }\text{O<session>}\]

\[(6) \text{<composition\_body> ::= } \text{[<catalog\_use\_decl>] <home\_executor\_def> [<proxy\_home\_def>]}\]

A composition definition is a named scope that contains elements that constitute the composition. The elements of a composition definitions are as follows:

- The keyword `composition`.
- The specification of the life cycle category, one of the keywords `service`, `session`, `process`, or `entity`. Subsequent definitions and declarations in the composition must be consistent with the declared category, as defined in Section 2.5.1, ÔLife Cycle Category and Constraints,Ô on page 2-6.
- An identifier that names the composition in the enclosing module scope.
- The composition body.

The composition body consists of the following elements:

- an optional catalog usage declaration.
- a mandatory home executor definition, and
- an optional proxy home definition.
2.5.1 Life Cycle Category and Constraints

Certain composition configurations are only valid for certain life cycle categories. The Container Programming Model chapter describes the life cycle-related constraints from the perspective of the container. These constraints map onto corresponding constraints in component and composition definitions. The following lists define the CIDL constructs that are either mandatory or invalid for the designated life cycle category.

Note that these constraints supersede the conditionality of constructs based on CIDL syntax. If a construct is described below as mandatory for the category in question, it is mandatory regardless of its syntactic properties. All of the constructs described as invalid for a particular category are, of necessity, syntactically optional.

<table>
<thead>
<tr>
<th>Service and Session</th>
<th>Mandatory</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abstract storage home bound to home executor: 
<abstract_storage_home_binding> in home executor body.

Component home implemented by home executor specifies a primary key.

Component home implemented by home executor specifies explicit finder operations.

Segmented executor: <segment_def> in executor body.

### Table 2-4 Constraints for process components

<table>
<thead>
<tr>
<th>Process</th>
<th>Mandatory</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Component home implemented by home executor specifies a primary key.

### Table 2-5 Constraints for entity components

<table>
<thead>
<tr>
<th>Entity</th>
<th>Mandatory</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Component home implemented by home executor specifies a primary key.

Note D Issue 5499

### 2.6 Catalog Usage Declaration

The syntax for a catalog usage declaration is as follows:
A catalog usage declaration consists of the following elements:

- the keywords `uses` and `catalog`, and
- a block containing one or more catalog label declarations.

A catalog label declaration consists of the following elements:

- a scoped name denoting a previously defined catalog, and
- an identifier that denotes a putative catalog of the specified type within the scope of the composition.

A catalog usage declaration identifies catalog types that are used by the composition and assigns them labels that are used within the scope of the composition to refer to a putative catalog of the specified type. A catalog usage declaration also causes the CIF to generate implementation of the following behaviors.

During the activation of a home executor, the CIF-generated activate implementation on the home executor shall obtain the `CosPersistentState::CatalogBase` interface from the component context, and invoke `get_catalog` on it, requesting a catalog of each type specified in the catalog usage declaration. The catalogs are requested by their repository ID values. The home shall maintain references to the specified catalogs, and make them available to the executors.

### 2.7 Home Executor Definition

The syntax for a home executor definition is as follows:

```
(7)  <home_executor_def> ::= ÔhomeÔ ÔexecutorÔ <identifier>
                                 Ô(Ô <home_executor_body> Ô)Ô Ô;Ô
(8)  <home_executor_body> ::= <home_impl_dcl>
                          [ <abstract_storage_home_binding> ]
                          [ <stored_onhome_persistence_dcl> ]
                          <executor_def>
                          [ <abstract_storage_home_delegation_spec> ]
                          [ <executor_delegation_spec> ]
                          [ <abstract_spec> ]
```

A home executor definition consists of the following elements:

- the keywords `home` and `executor`,
- an identifier that names the home executor definition within the scope of the composition, and
- a home executor body.
The home executor body consists of the following elements:

- A home implementation declaration.
- An optional abstract storage home binding, specifying the storage home upon which the components managed by the home are stored.
- An optional home persistence declaration, identifying an abstract storage home upon which the state of the home executor itself is to be stored.
- An executor definition, describing the component executor managed by the home executor.
- An optional delegation specification describing the mapping of home operations to storage home operations.
- An optional delegation specification describing the mapping of home factory operations to the operations on the component executor.
- An optional abstract specification, declaring operations on the home executor that are to be left unimplemented, overriding default generated implementations.

The <identifier> in the header of the home executor definition is used as the basis for the name of the skeleton artifact generated by the CIF. The specific forms of the executors are defined in language mappings. The general requirements for language mappings of home executors are defined in Section 2.7, Home Executor Definition, on page 2-8.

2.8 Home Implementation Declaration

The syntax of a home implementation declaration is as follows:

Note D Issue 5498

(9) \[ \text{<impl_dcl> ::= \text{\#implements\, <home_type_name> \;}} \]
(10) \[ \text{<home_type_name> ::= \text{<scoped_name>}} \]

The home implementation declaration consists of the following elements:

- the keyword implements, and
- a scoped name denoting a component home imported from IDL.

The home implementation declaration specifies the component home that is to be implemented by the home executor being defined. The generated skeleton must support the home equivalent interface, as defined in Section 1.7.1, Equivalent Interfaces, on page 1-33. Implementations of orthodox home operations are generated if the life cycle category of the composition is either entity or process and the home executor specifies an abstract storage home binding, or if the life cycle category of the executor is either session or service.

The detailed semantics of generated implementations are described in Section 2.8, Home Implementation Declaration, on page 2-9.
2.9 Storage Home Binding

The syntax for a storage home binding is as follows:

\[
\text{abstract\_storage\_home\_binding} ::= \text{bindsTo} \text{abstract\_storage\_home\_name} \text{;}\]

\[
\text{abstract\_storage\_home\_name} ::= \text{catalog\_label} \text{;} \text{abstract\_storage\_home\_label} \]

An abstract storage home binding declaration consists of the following elements:

- the keyword `bindsTo`, and
- an abstract storage home name.

**Note:** Issues 5498, 5499, and 5500

**Note:** Issue 5499

An abstract storage home name consists of a catalog label, a period separator, and a storage home label. The catalog label must denote a catalog previously declared in the catalog usage declaration in the current composition definition. The storage home label must denote a storage home declared as a member of the catalog type associated with the catalog label.

2.10 Home Persistence Declaration

The syntax for a home persistence declaration is as follows:

\[
\text{home\_persistence\_dcl} ::= \text{storedOn} \text{abstract\_storage\_home\_name} \text{;}\]

A home persistence declaration consists of the following elements:

- the keyword `storedOn`, and
- an abstract storage home name.

A home persistence declaration establishes that the home executor is itself persistent, and that its persistent state is managed by the container. The abstract storage type of the specified abstract storage home constitutes the state of the component home. The specific responsibilities of generated home executors related to home persistence are described in Section 2.9, ÖStorage Home Binding,Ö on page 2-9.

2.11 Executor Definition

The syntax for an executor definition is as follows:
An executor definition has the following elements:

¥ the keyword `manages`.

¥ and identifier that names the component executor being defined, and

¥ an executor body, containing one or more members enclosed in braces.

An executor member is either a *segment definition* or a *feature delegation specification*, as defined below.

The identifier in the executor definition forms the basis of the name of the programming artifact generated as the executor skeleton. The details of executor structure and responsibilities are defined in Section 2.7, “Home Executor Definition,” on page 2-8, and in CIDL language mappings.

### 2.12 Segment Definition

The syntax for a segment definition is as follows:

A segment definition consists of the following elements:

¥ the keyword `segment`,

¥ an identifier that names the segment in the scope of the executor definition, and

¥ one or more segment members enclosed in braces.

A segment member is either a *segment persistence declaration*, or a *facet declaration*, as described below.

If a segment definition occurs in an executor definition, the corresponding executor is said to be a segmented executor. If no segment definition occurs in an executor definition, the executor is said to be monolithic.

A separate skeleton is generated by the CIF for each segment of a segmented executor. Segments are independently activated. Each segment is assigned a segment identifier, which as a numeric value of type short, by the CIF implementation. The segment
identifier is interpreted internally by the generated implementation during activation. Segment identifiers are also used in component identities, as described in Section 4.4.3.1, "Component Identifiers," on page 4-38. There is no canonical mechanism for assigning segment identifier values (other than the component segment), as the values of segment identifiers does not affect portability or interoperability.

All executors have a distinguished segment, the component segment, that supports the component facet (i.e., the facet supporting the component equivalent interface). The segment identifier value of the component segment is always zero. If a component does not explicitly declare segments, the monolithic executor is still considered in some contexts to be the component segment executor.

The details of segment structure and implementation responsibilities are described in Section 2.12, "Segment Definition," on page 2-10.

### 2.13 Segment Persistence Declaration

The syntax for a segment persistence declaration is as follows:

```
(18)<segment_persistence_dcl>::= "stored On"
                        
                        <abstract_storage_home_name> "{","identifier"> "";
```

A segment persistence declaration has the following elements:
- The keyword `storedOn`, and
- An abstract storage home name.

A segment persistence declaration specifies the abstract storage home upon which the state of the segment will be stored. The abstract storage type of the storage home constitutes the state of the segment.

The detailed structure of segments, and implementation responsibilities with respect to segment persistence are described in Section 2.13, "Segment Persistence Declaration," on page 2-11.

### 2.14 Facet Declaration

The syntax for a facet declaration is as follows:

```
(19) <facet_dcl> ::= "provides" "facet" <identifier>
                     { "","identifier"> }*
```

A facet declaration has the following elements:
- The keywords `provides` and `facet`.
One or more identifiers separated by commas, where each identifier denotes a facet defined by the component type implemented by the composition (i.e., the component type managed by the home that is implemented by the home executor defined in the composition).

A facet declaration associates one or more component facets with the segment. The generated segment executor will provide the specified facets. A facet name may only appear in a single segment definition. Facets that are not explicitly declared in a segment definition are provided by the component segment.

The detailed structure of segments, and implementation responsibilities with respect to providing facets are described in Section 2.14, ÔFacet Declaration,Ô on page 2-12.

### 2.15 Feature Delegation Specification

The syntax for a feature delegation specification is as follows:

Note D Issue 5498

(20)<feature_delegation_spec> ::= ÔdelegatesToÓ ÔstorageÓ
                            <feature_delegation_list>

(21) <feature_delegation_list> ::= ÔÔ <feature_delegation> { Ô,Ô <feature_delegation> } ÔÔ

(22) <feature_delegation> ::= <feature_name> Ô:Ô <storage_member_name>

(23) <feature_name> ::= <identifier>

(24)<storage_member_name> ::= <identifier>

A feature delegation specification has the following elements:

¥ the keywords delegatesTo, abstract and storgatpe, and

¥ a list of feature delegation specifications, enclosed in parentheses and separated by commas.

A feature delegation specification consists of the following elements:

¥ An identifier that denotes a stateful feature of the component implemented by the composition.

¥ A colon.

¥ An identifier that denotes a member of the abstract storage type of the abstract storage home specified in the abstract storage home binding in the home executor definition.

A feature delegation specification defines an association between a stateful feature of the component being implemented and a member of the abstract storage type that incarnates the component (or the component segment). The component executor skeleton generated by the CIF will provide implementations of feature management operations that store the featureÕs state in the specified storage member. Stateful features include attributes, receptacles, and event sources.

The following constraints regarding feature delegation must be observed:
Feature delegation specifications may only occur in an executor definition when the
home executor specified an abstract storage home binding.

The type of the storage member specified in a feature delegation must be
compatible with the type of the feature. Compatibility, for the purposes of feature
delegation is defined in Table 2-6.

Table 2-6 Type compatibility for feature delegation purposes

<table>
<thead>
<tr>
<th>Feature</th>
<th>Storage member type</th>
</tr>
</thead>
<tbody>
<tr>
<td>attribute</td>
<td>Must be identical to feature for all types except</td>
</tr>
<tr>
<td></td>
<td>object reference and valuetype; for object reference</td>
</tr>
<tr>
<td></td>
<td>and valuetype storage member must be of identical</td>
</tr>
<tr>
<td></td>
<td>type or base type (direct or indirect).</td>
</tr>
<tr>
<td>receptacle (simplex)</td>
<td>Must be identical to feature type or base interface</td>
</tr>
<tr>
<td></td>
<td>(direct or indirect) of feature type.</td>
</tr>
<tr>
<td>receptacle (multiplex)</td>
<td>Sequence of type compatible with receptacle type as</td>
</tr>
<tr>
<td></td>
<td>defined above.</td>
</tr>
<tr>
<td>emitter event source</td>
<td>Must be identical to feature type or base interface</td>
</tr>
<tr>
<td></td>
<td>(direct or indirect) of feature type.</td>
</tr>
<tr>
<td>publisher event source</td>
<td>long*</td>
</tr>
</tbody>
</table>

* The persistent state maintained internally by the component is the ChannelId of the
notification channel created by the container.

2.16 Abstract Storage Home Delegation Specification

The syntax for a storage home delegation specification is as follows:

```
Note D Issue 5498

(25) <abstract_storage_home_delegation_spec>::= ÔdelegatesToÔ ÔabstractÔ
                ÔstoragehomeÕ <delegation_list> Ô;Õ
(27)     <delegation_list> ::= Ô(Ô Ô<delegation> { ÔÔ Ô<delegation> }Ô)Õ
(28)     <delegation> ::= <operation_name> [ ÔÔ Ôoperation_nameÕ ]
(29)     <operation_name> ::= <identifier>
```

An abstract storage home delegation specification has the following elements:

- The keywords delegatesTo, abstract, and storagehome.
- A list of delegation specifications enclosed in parentheses and separated by
  commas.

A delegation specification has the following elements:

- An identifier that denotes an operation on the home equivalent interface
  supported by the home executor.
An optional delegation target, consisting of a colon, followed by identifier that
denotes an operation on the abstract storage home to which the home is bound
(i.e., the abstract storage home specified in the abstract storage home binding).

An abstract storage home delegation specification associates an operation on the home
interface with an operation on the abstract storage home interface. The CIF shall
generate an implementation of the specified home operation that delegates to the
specified abstract storage home operation.

If the optional delegation target is omitted, the home operation is assumed to be
delegated to an operation on the abstract storage home with the same name. If no such
operation exists on the abstract storage home, the specification is not legal.

The signature of the abstract storage home operation must be compatible with the
abstract storage home. Signature compatibility, from the perspective of abstract storage
home delegation, has the following definition:

- If the home operation is an explicit factory operation, the abstract storage home
  operation must be an explicit factory operation.

- If the home operation is not a factory, the return type of the home operation must be
  identical to the return type of the abstract storage home operation, except when the
  return type is an object reference type or a value type. If the return type of the home
  operation is an object reference type or a value type, the return type of the storage
  home operation must be identical to, or more derived than, the return type of the
  home operation.

- For each exception explicitly raised by the storage home operation, an identical
  exception must appear in the raises clause of the home operation. The inverse is
  not true - the home operation may raise exceptions not raised by the abstract storage
  home operation.

- The number of parameters in the parameter lists of the home operation and the
  abstract storage home operation must be equal. Each parameter in the abstract
  storage home operation must be compatible with the parameter in the same position
  in the signature of the home operation, where compatibility is defined as follows:

  - If the parameter in the home operation is neither an object reference type nor a
    value type, the type of the corresponding parameter in the abstract storage home
    operation must be identical.

  - If the parameter type in the home operation is an object reference and the
    parameter is an in parameter, the corresponding parameter in the abstract storage
    home operation must be identical to, or a base type (direct or indirect) of, the
    parameter in the home operation.

  - If the parameter type in the home operation is an object reference and the
    parameter is an out parameter, the corresponding parameter in the abstract
    storage home operation must be identical to, or more derived than, the parameter
    in the home operation.

  - If the parameter type in the home operation is an object reference and the
    parameter is an inout parameter, the corresponding parameter in the abstract
    storage home operation must be identical to the parameter in the home operation.
The following additional constraints and rules apply to abstract storage home delegation:

¥ An operation on the home interface may delegate to at most one operation on the abstract storage home interface.

¥ An operation on the abstract storage home interface may be the target of at most one delegation from the home interface.

¥ Implicitly defined operations on the home (i.e., orthodox operations) delegate by default to cognate operations on the abstract storage home, as described by Section 1.7.5.1, ÔOrthodox operations,Ô on page 1-40. These default delegations may be over-ridden by explicit delegations. If an operation on the abstract storage home that is normally the default target of a delegation appears as the target of an explicit delegation, then the home operation that normally would have delegated to that target by default shall have no generated implementation (unless one is explicitly defined).

The detailed semantics and implementation responsibilities of delegated abstract storage home operations are described in Section 2.16, ÔAbstract Storage Home Delegation Specification,Ô on page 2-13.

2.17 Executor Delegation Specification

The syntax for an executor delegation specification has the following form:

```
(26)<executor_delegation_spec> ::= ÔdelegatesToÔ ÔexecutorÔ
<delegation_list> Ô;Ô
```

An executor delegation specification consists of the following elements:

¥ the keywords delegatesTo and executor, and

¥ a delegation list, identical structurally to the delegation list of the abstract storage home delegation specification.

An executor delegation specification defines an operation on the component executor, to which the specified home operation will be delegated. The following constraints apply to executor delegation specifications:

¥ Only factory operations may be delegated to the executor, including explicitly declared factories and implicit create operations.

¥ If no delegation target is explicitly specified, the operation defined on the executor shall have the same name as the delegating home operation.

¥ The signature of the defined operation on the executor shall be identical to the signature of the home operation, with the exception that the return type of the executor operation shall be void if the home does not specify a primary key, or the return type shall be the type of the primary key if the home specifies a primary key.
The CIF shall generate an implementation of the home operation that delegates to the defined operation on the executor. The detailed semantics and implementation responsibilities are described in Section 2.17, "Executor Delegation Specification," on page 2-15.

2.18 Abstract Spec Declaration

The syntax for an abstract spec has the following form:

<table>
<thead>
<tr>
<th>Note D Issue 5498</th>
</tr>
</thead>
<tbody>
<tr>
<td>(30) <code>&lt;abstract_spec&gt;</code> ::= &quot;abstract&quot; <code>&lt;operation_list&gt;</code> ;</td>
</tr>
<tr>
<td>(31) <code>&lt;operation_list&gt;</code> ::= ( <code>&lt;operation_name&gt;</code> , <code>&lt;operation_name&gt;</code> )* ;</td>
</tr>
</tbody>
</table>

2.19 Proxy Home Declaration

The syntax for a proxy home declaration has the following form:

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(32) <code>&lt;proxy_home_def&gt;</code> ::= &quot;proxy&quot; <code>&lt;home_def&gt;</code> <code>&lt;home_member&gt;</code> <code>&lt;abstract_spec&gt;</code></td>
</tr>
<tr>
<td>(33) <code>&lt;proxy_home_member&gt;</code> ::= <code>&lt;home_delegation_spec&gt;</code> <code>&lt;abstract_spec&gt;</code></td>
</tr>
<tr>
<td>(34) <code>&lt;home_delegation_spec&gt;</code> ::= &quot;delegatesTo&quot; <code>&lt;home_def&gt;</code> <code>&lt;delegation_list&gt;</code></td>
</tr>
</tbody>
</table>
This chapter describes the semantics of the CORBA Component Model Implementation Framework.

Contents

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3.1 Introduction

The Component Implementation Framework (CIF) defines the programming model for constructing component implementations. Implementations of components and component homes are described in CIDL. See the ÒOMG CIDL Syntax and Semantics” chapter for the definition and syntax. The CIF uses CIDL descriptions to generate programming skeletons that automate many of the basic behaviors of components, including navigation, identity inquiries, activation, state management, lifecycle management, and so on.
3.2 Component Implementation Framework (CIF) Architecture

As a programming abstraction, the CIF is designed to be compatible with the existing POA framework, but also to insulate programmers from its complexity. In particular, the CIF can be implemented using the existing POA framework, but it does not directly expose any elements of that framework.

3.2.1 Component Implementation Definition Language (CIDL)

The focal point of the CIF is Component Implementation Definition Language (CIDL), a declarative language for describing the structure and state of component implementations. Component-enabled ORB products generate implementation skeletons from CIDL definitions. Component builders extend these skeletons to create complete implementations.

3.2.2 Component persistence and behavior

CIDL is a superset of the Persistent State Definition Language, defined in the Persistent State Service specification (document orbos/99-07-07).

A CIDL implementation definition may optionally associate an abstract storage type with the component implementation, such that the abstract storage type defines the form of the internal state encapsulated by the component. When a component implementation declares an associated abstract storage type in this manner, the CIF and the run-time container environment cooperate to manage the persistence of the component state automatically.

This chapter addresses the elements of the CIF that pertain to the implementation of a component's behavior.

3.2.3 Implementing a CORBA Component

The remainder of Section 3.2 provides an overview of the concepts involved in building component implementations. It is intended to provide a high-level description that will serve as a framework for understanding the more formal descriptions that follow in subsequent sections. While the information in this section is normative (with the exception of italicized, indented rationale), it is not intended to be a complete or precise specification of the CIF, or all of the possible design options from which a component implementor may choose.

3.2.4 Behavioral elements: Executors

We coin the term *executor* to indicate the programming artifact that supplies the behavior of a component or a component home. In general, the terms *executor* or *component executor* refer to the artifact that implements the component type, and the term *home executor* refers to the artifact that implements the component home.

*We chose to use the word executor rather than servant to avoid confusion with POA servants. POA servants, while conceptually similar to executors,*
are significantly different in detail, and map to different types in programming languages. Executor is pronounced with the accent on the second syllable (e.g., ZEK-oo-tor).

We have tried to avoid terminology that is specific to object-oriented programming languages, such as class, base class, derive, and so on, in an attempt to be precise and acknowledge that the CIF framework may be mapped to procedural programming languages. Hence, we typically use the word artifact or programming artifact to denote what may conveniently be thought of as a class, and likewise, the term skeleton to denote a generated abstract base class that is extended to form a complete implementation class. We hope this is not overly distracting to the reader.

3.2.5 Unit of implementation: Composition

An implementation of a component comprises a potentially complex set of artifacts that must exhibit specific relationships and behaviors in order to provide a proper implementation. The CIDL description of a component implementation is actually a description of this aggregate entity, of which the component itself may be a relatively small part. In order to enable more concise discussion, we coin the term composition to denote both the set of artifacts that constitute the unit of component implementation, and the definition itself. Composition is the CIDL meta-type that corresponds to an implementation definition.

A composition definition specifies the following elements:

**Component home**

A composition definition specifies a component home type, imported from IDL. The specification of a component home implicitly identifies the component type for which the composition provides an implementation (i.e., the component type managed by the home, as specified in the IDL home definition).

**Abstract Storage home binding**

A composition optionally specifies an abstract storage home to which the component home is bound. The specification of an abstract storage home binding implicitly identifies the abstract storage type that incarnates the component. The relationship between a home and the component it manages is isomorphic to the relationship between an abstract storage home and the abstract storage type it manages. When a home binds to an abstract storage home, the component managed by the home is implicitly bound to the abstract storage type of this abstract storage home.

**Home executor**

A composition definition specifies a home executor definition. The name of the home executor definition is used as the name of the programming artifact (e.g., the class) generated by the CIF as the skeleton for the home executor. The contents of the home executor definition describe the relationships between the home executor and other elements of the composition, determining the characteristics of the generated home executor skeleton.
Component executor

A composition specifies an executor definition. The name of the executor definition is used as the name of the programming artifact generated by the CIF as the skeleton of the component executor. The body of the executor definition optionally specifies executor segments, which are physical partitions of the executor, encapsulating independent state and capable of being independently activated. Segments are described in Section 3.2.9.1, ÔSegmented executors,Ô on page 3-27. The executor body may also specify a mapping, or delegation, of certain component features (e.g., attributes) to storage members.

Delegation specification

A composition may optionally provide a specification of home operation delegation. This specification maps operations defined on the component home to isomorphic operations on either the abstract storage home or the component executor. The CIF uses this description to generate implementations of operations on the home executor, and to generate operation declarations on the component executor.

Proxy home

A composition may optionally specify a proxy home. The CIF supports the ability to define proxy home implementations, which are not required to be collocated with the container that executes the component implementation managed by the home. In some configurations, proxy homes can provide implementations of home operations without contacting the container that executes the actual home and component implementation. Support for proxy homes is intended to increase the scalability of the CORBA Component Model. The use of proxy homes is completely transparent to component clients and, to a great extent, transparent to component implementations. Proxy home behavior is described in Section 3.2.10.1, ÔProxy home delegation,Ô on page 3-36.

3.2.6 Composition structure

A composition binds all of the previously-described elements together, and requires that the relationships between the bound entities define a consistent whole.

Note that a component home type necessarily implies a component type; that is, the managed component type specified in the home definition. Likewise, an abstract storage home implies an abstract storage type. It is unnecessary, therefore, for a composition to explicitly specify a component type or an abstract storage type. They are implicitly determined by the specification of a home and abstract storage home.

It may seem odd that the center of focus for compositions is the home rather than the component, but this works out to be reasonably intuitive in practice. The home is the primary point of contact for a client, and the homeÔôs interface and behavior have a major influence on the interaction between the client and the component.

A composition definition specifies a name that identifies the composition within the enclosing module scope, and which constitutes the name of a scope within which the contents of the composition are contained. The essential parts of a composition definition are the following:
The name of the composition.

The life cycle category of the component implementation, either service, session, process, or entity, as defined in Section 4.1.4, Component Categories, on page 4-5.

The home type being implemented (which implicitly identifies the component type being implemented).

The name of the home executor to be generated.

The name of the component executor skeleton to be generated.

A composition definition has the following essential form:

```plaintext
composition <category> <composition_name> {
    home executor <home_executor_name> {
        implements <home_type>;
        manages <executor_name>;
    };
};
```

where `<composition_name>` is the name of the composition, `<category>` identifies the life cycle category supported by the composition, `<home_executor_name>` is the name assigned to the generated home executor skeleton, `<home_type>` is the name of a component home type imported from IDL, and `<executor_name>` is the name assigned to the generated component executor skeleton.

This is a schematic representation of the minimal form of a composition, which specifies no state management. The structure of the composition specified by this schematic is illustrated in Figure 3-1. Note that the component type itself is not explicitly specified. It is unambiguously implied by the specification of the home type, as is the relationship between the executor and the component (i.e., that the executor implements the component).
General disclaimer and abdication of responsibility with regards to programming examples:

Before presenting programming examples, it should be noted that all examples are non-normative illustrations. In particular, the implementations provided in the examples of code that is to be generated by the CIF are merely schematic representations of the intended behaviors: they are by no means indicative of the actual content of a real implementation (e.g., they generally don’t include exception handling, testing for validity, etc.).

Although the grammar for CIDL has not been presented yet, a simple example will help illustrate the concepts described in the previous sections. Assume the following IDL component and home definitions:

```
// Example 1
// USER-SPECIFIED IDL
//
module LooneyToons {
  interface Bird {
    void fly (in long how_long);
  };
  interface Cat {
    void eat (in Bird lunch);
  };
  component Toon {
```

Figure 3-1  Minimal composition structure and relationships
provides Bird tweety;
provides Cat sylvester;

};

home ToonTown manages Toon {};

};

The following example shows a minimal CIDL definition that describes an implementation binding for those IDL definitions:

-----------------------------------------------------------------------------------------------

// Example 1
//@ USER-SPECIFIED CIDL
//@
import ::LooneyToons;

module MerryMelodies {

    // this is the composition:

    composition session ToonImpl {
        home executor ToonTownImpl {
            implements LooneyToons::ToonTown;
            manages ToonSessionImpl;
        }
    }

};

In this example, ToonImpl is the name of the composition. It defines the name of the generated home executor to be ToonTownImpl, which implemented the ToonTown home interface imported from IDL. The home executor definition also specified the name of the component executor, ToonSessionImpl, which is managed by the home executor. Note that the component type (Toon) is not explicitly named; it is implied by the specification of the home ToonTown, which is known to manage the component type Toon. Thus, the declaration (manages ToonSessionImpl) implicitly defines the component executor ToonSessionImpl to be the implementation of the component type Toon.

This CIDL specification would cause the generation of the following artifacts:

✓ The skeleton for the component executor ToonSessionImpl
✓ The complete implementation of the home executor ToonTownImpl

We provide the following brief sketches of generated implementation skeletons in Java to help illustrate the programming model for component implementations.

Java <interface>Operations interfaces for all of the IDL interfaces are generated, precisely as currently specified by the current Java IDL language mapping:
---

// Example 1
//
// GENERATED FROM IDL SPECIFICATION:
//
package LooneyToons;

import org.omg.Components./*;

public interface BirdOperations {
    public void fly (long how_long);
}

public interface CatOperations {
    void eat(LooneyToons.Bird lunch);
}

public interface ToonOperations
extends CCMObjectOperations {
    LooneyToons.Bird provide_tweety();
    LooneyToons.Cat provide_sylvestor();
}

public interface ToonTownExplicitOperations
extends CCMHomeOperations {
}

public interface ToonTownImplicitOperations
extends KeylessCCMHomeOperations {
    Toon create();
}

public interface ToonTownOperations extends
ToonTownExplicitOperations,
ToonTownExplicitOperations {
---

The ToonImpl executor skeleton class has the following form:
---

// Example 1
//
// GENERATED FROM CIDL SPECIFICATION:
//
package MerryMelodies;
import LooneyToons;
import org.omg.Components./*;

abstract public class ToonSessionImpl
implements ToonOperations, SessionComponent,
ExecutorSegmentBase {

    // Generated implementations of operations
    // inherited from SessionComponent and
    // ExecutorSegmentBase are omitted here.
    //
protected ToonSessionImpl()
{
    // generated implementation ...
}

// The following operations must be implemented
// by the component developer:

abstract public BirdOperations
    _get_facet_tweety();
abstract public CatOperations
    _get_facet_sylvestrer();

The generated executor abstract base class ToonSessionImpl implements all of the operations inherited by ToonOperations, including operations on CCMObject and its base interfaces. It also implements all of the operations inherited through SessionComponent, which are internal operations invoked by the container and the internals of the home implementation to manage executor instance lifecycle.

A complete implementation of the home executor ToonTownImpl is generated from the CIDL specification:

public class ToonTownImpl
    implements LooneyToons,ToonTownOperations,
    HomeExecutorBase, CCMHome
{
    // Implementations of operations inherited
    // from ExecutorBase and CCMHome
    // are omitted here.
    //
    // ToonHomeImpl also provides implementations
    // of operations inherited from the component
    // home interface ToonTown

    CCMObject create_component()
    {
        return create();
    }

    void remove_component(CCMObject comp)
    {
    }

    Toon create()
    {
}
The user-provided executor implementation must supply the following:

- Implementations of the operations _get_tweety and _get_sylvesters, which must return implementations of the BirdOperations and CatOperations interfaces
- said implementations of the behaviors of the facets tweety and sylvestere respectively

The following example shows one possible implementation strategy:

```java
// Example 1
// PROVIDED BY COMPONENT PROGRAMMER:
// import LooneyToons.*;
import MerryMelodies.*;

public class myToonImpl extends ToonSessionImpl implements BirdOperations, CatOperations {

    protected long timeFlown;
    protected Bird lastBirdEaten;

    public myToonImpl() {
        super();
        timeFlown = 0;
        lastBirdEaten = nil;
    }

    public void fly (long how_long) {
        timeFlown += how_long;
    }

    public void eat (Bird lunch) {
        lastBirdEaten = lunch;
    }

    public BirdOperations _get_facet_tweety() {
        return (BirdOperations) this;
    }

    public CatOperations _get_facet_sylvesters() {
        return (CatOperations) this;
    }
}
```

This simple example implements all of the facets directly on the executor. This is not the only option; the programming objects that implement BirdOperations and CatOperations could be constructed separately and managed by the executor class.

The final bit of implementation that the component programmer must pro-
vide is an extension of the home executor that acts as a component executor factory, by implementing the `create_executor_segment` method. This class must also provide an implementation of a static method called `create_home_executor` that returns a new instance of the home executor (as an `ExecutorSegmentBase`). This static method acts as an entry point for the entire composition.

---

```java
// Example 1

// PROVIDED BY COMPONENT PROGRAMMER:
//
import LooneyToons.*;
import MerryMelodies.*;

public class myToonTownImpl extends ToonTownImpl {
    protected myToonTownImpl() { super(); }

    ExecutorSegmentBase create_executor_segment (int segid) {
        return new myToonImpl();
    }

    public static ExecutorSegmentBase create_home_executor() {
        return new myToonTownImpl();
    }
}
```

---

Note that these last two classes constitute the entirety of the code that must be supplied by the programmer. The implementations of operations for navigation, executor activation, object reference creation and management, and other mechanical functions are either generated or supplied by the container.

---

### 3.2.7 Compositions with Managed Storage

A composition definition may also contain a variety of optional specifications, most of which are related to state management. These include the following elements:

---

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- One or more catalogs that provide the storage homes to the composition implementation. Each specified catalog is assigned an alias, or label, that identifies the catalog within the context of the composition.
- An abstract storage home type to which the component home is bound (this implicitly identifies the abstract storage type to which the component itself is bound).
- The life cycle category of the composition must be either `entity` or `process` to support managed storage.
When state management is added to a composition definition, the definition takes the following general form, expressed as a schematic:

```plaintext
composition <category> <composition_name> {
    usesCatalog {
        <catalog_type> <catalog_label>;
    }
    homeExecutor <home_executor_name> {
        implements <home_type>;
        bindsTo <catalog_label>abstract_storage_home>;
        manages <executor_name>;
    }
}
```

where the additional elements are as follows: `<catalog_type>` identifies the type of a catalog previously defined in PSDL, `<catalog_label>` is an alias by which the catalog can be identified in the composition definition, and `<catalog_label>abstract_storage_home>` denotes a particular abstract storage home provided by the catalog.

The structure of the resulting composition and the relationships between the elements is illustrated in Figure 3-2.
In many cases, it is expected that an abstract storage home will be intentionally designed to support a particular component home.

### 3.2.8 Relationship between Home Executor and Abstract Storage Home

When a composition specifies managed storage, the relationship between the home executor and the abstract storage home to which the home executor binds determines many of the characteristics of the implementation, including what implementation...
elements may be generated and how they will behave. This section provides an overview of the basic concepts involved in home implementations and their relationships to abstract storage homes.

In general, operations on a home interface provide life cycle management. As described in Section 1.7, “Homes,” on page 1-32, when a home definition does not specify a primary key, the resulting equivalent home interface has the following operations:

- A generic `create_component` operation inherited from `KeylessCCMHome`,
- A `remove_component` operation inherited from `CCMHome`, and
- An implicitly-defined type-specific parameter-less `create` operation.

When a home definition specifies a primary key, the resulting equivalent home interface has the following operations:

- A `remove_component` operation inherited from `CCMHome`,
- An implicitly-defined type-specific `create` operation with a primary key parameter,
- An implicitly-defined type-specific `remove` operation with a primary key parameter, and
- An implicitly-defined type-specific `find_by_primary_key` operation.

### 3.2.8.1 Primary Key Binding

A component home can define its primary key as a valuetype with a number of public data members, whereas abstract storage home defines keys as lists of attributes. A composition can only bind a component home with a primary key to an abstract storage home that defines a key on a state member whose type is this valuetype. If there is more than one key satisfying this condition, the first key is used.

For example:

```plaintext
valuetype SSN {
    public string social_security_number;
};

abstract storgagetype Person {
    readonly state SSN social_security_number;
    state string name;
    state string address;
};

abstract storagehome PersonStore of Person {
    key social_security_number;
};
```

A home with primary key SSN can be bound to `PersonStore`. The key `social_security_number` is called the matching key.
3.2.8.2 *Implicit delegation of home operations*

When a composition specifies managed storage, finder operations can be implemented in terms of finder operations on the abstract storage home to which the home executor is bound.

<table>
<thead>
<tr>
<th>home operation</th>
<th>abstract storagehome operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>component find_by_primary_key (key)</td>
<td>ref&lt;X&gt; find_ref_by_matching_key_name (matching_key)</td>
</tr>
</tbody>
</table>

- The `find_by_primary_key` operation uses the `find_ref_by_matching_key_name` operation on the abstract storage home. The returned storage reference is used to create an object reference for the component and returned to the invoking client.
- Destruction operations delegate to `destroy_object` operations on the reference.

The validity of these implementation semantics are predicated on the following assumptions:

- The initial state of the storage object created by the storage home constitutes a valid initial state for the component.
- All of the persistent state of the component is defined on (or reachable from) the storage object whose PID is associated with the component instance.
- The executor is monolithic, not segmented. Home operations can also be delegated to abstract storage homes when the executor is segmented, but the process is slightly more complex, and is discussed in full in Section 3.2.9.1, ÔSegmented executors,Ô on page 3-27.

If these assumptions do not hold (in particular, either of the first two), the component implementor can provide custom implementations of one or more home operations to accommodate the implementation requirements.

```idl
// Example 2

// USER-SPECIFIED IDL

module LooneyToons { // IDL

    ... identical to previous example, except for the addition of the primary key:

    valuetype EpisodeName : Components::PrimaryKeyBase {
```
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The CIDL now defines an abstract storage type, and an abstract storage home, and a catalog. The composition binds:

---

// Example 2
// // USER-SPECIFIED CIDL
// import ::LooneyToons;

module MerryMelodies {

  abstract storagetype ToonState {
    state LooneyToons::EpisodeName episode_name;
    state string name;
    state unsigned long time_flown;
    state LooneyToons::Bird last_bird_eaten;
  };

  abstract storagehome ToonStateHome of ToonState {
    key episode_name;
    factory create(episode_name);
  };

  catalog ToonCatalog {
    provides ToonStateHome TSHome;
  };

  // this is the composition:

  composition entity ToonImpl {
    uses catalog (ToonCatalog store:);
    home executor ToonTownImpl {
      implements LooneyToons::ToonTown;
      bindsTo store.TSHomeToonStateHome;
      manages ToonEntityImpl;
    };
  };

---

In this example, the composition binds the component home ToonTown to the abstract storage home ToonStateHome, and thus, implicitly binds the component type Toon to the abstract storage type ToonState. Note that the primary key (if any) in the home must match a key in the abstract stor-
As will be seen later in the CIDL grammar specification, the keyword entity in the implementation binding declaration specifies a particular lifecycle model for the resulting implementation.

This CIDL specification would cause the generation of the following programming objects:

- The skeleton for the component executor `ToonEntityImpl`.
- The implementation of the home executor `ToonTownImpl`.
- The incarnation interface for the abstract storage type `ToonState`.

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- The interface for the abstract storage home `ToonStateHome`.
- The interface for the catalog `ToonCatalog`.

Note that the complete implementation of the home executor may not be able to be generated in some cases, e.g., when no abstract storage type is declared or when user-defined operations with arbitrary signatures appear on the component home definition.

Note also that the implementations of the storage-related interfaces `ToonState` and `ToonStateHome` are not necessarily provided by the same product that generates the component implementation skeletons. The CIF is specifically designed to decouple the executor implementation from the storage implementation, so that these capabilities may be provided by different products. A component-enabled ORB product is only required to generate the programming interfaces for the abstract storage type and homes through which the executor implementation will interact with one or more storage mechanisms. The implementations of these interfaces may be supplied separately, perhaps deferred until run-time.

The interfaces generated from the IDL are identical, with the exception of the addition of the primary key:

```
// Example 2
// GENERATED FROM IDL SPECIFICATION:
//
package LooneyToons;

import org.omg.Components.);

... same as previous except for the following:

public interface ToonTownImplicitOperations {
    Toon create(LooneyToons.EpisodeName key)
        throws DuplicateKey, InvalidKey;
    Toon find_by_primary_key
        (LooneyToons.EpisodeName key)
        throws UnknownKey, InvalidKey;
    void remove(LooneyToons.EpisodeName key)
        throws UnknownKey, InvalidKey;
```
LooneyToons.EpisodeName
    get_primary_key(Toon comp);
}

public interface ToonTownOperations extends
ToonTownExplicitOperations,
ToonTownExplicitOperations {}

The abstract storage type ToonState results in the generation of the follow-
ing incarnation interfaces:

// Example 2
//
// GENERATED FROM CIDL SPECIFICATION:
//
package MerryMelodies;
import org.omg.CosPersistentState.*;
import LooneyToons.*;

public interface ToonState extends StorageObject {
    public string name();
    public void name (String val);
    public long time_flown();
    public void time_flown (long val);
    public Bird last_bird_eaten();
    public void last_bird_eaten (Bird val);
}

The storage home ToonStateHome results in the generation of the follow-
ing interface:

// Example 2
//
// GENERATED FROM CIDL SPECIFICATION:
//

// no explicit operations
public interface ToonStateHome
    extends StorageHomeBase {

    public ToonState
        find_by_episode_name (EpisodeName k);

    public ToonStateRef
        find_ref_by_episode_name (EpisodeName k);
    }

The ToonImpl executor skeleton class has the following form:

// Example 2
abstract public class ToonImpl
implements LooneyToons.ToonOperations,
ExecutorSegmentBase, PersistentComponent
{
    // Generated implementations of operations
    // inherited from CCMObject and
    // ExecutorSegmentBase and PersistentComponent
    // are omitted here.
    //
    // ToonImpl also provides implementations of
    // operations inherited from ToonState, that
    // delegate to a separate incarnation object:
    protected ToonStateIncarnation _state;
    protected ToonImpl() { _state = null; }
    public void set_incarntion (ToonState state) {
        _state = state;
    }
    // The following operations must be implemented
    // by the component developer:
    abstract public BirdOperations
        _get_facet_tweety();
    abstract public CatOperations
        _get_facet_sylvester();
}

An implementation of the home executor ToonHomeImpl is generated from the CIDL specification:

// Example 2
//
public class ToonTownImpl
implements LooneyToons.ToonTownOperations,
PersistentComponent, ExecutorSegmentBase
{
    // Implementations of operations inherited
    // from PersistentComponent and
    // ExecutorSegmentBase
    // are omitted here.
ToonHomeImpl also provides implementations of operations inherited from the component home interface ToonTown, that delegate designated operations on the storage home //

values set during initialization // and activation:
protected Entity2Context _origin;
protected ToonStateHome _storageHome;
...

Toon create(EpisodeName key)
{
    // create a storage object with the key
    ToonState new_state = _storageHome.create(key);
    // REVISIT - Bernard Normier 7/27/1999
    // don’t know how to complete this method
}

Toon find(EpisodeName key)
{
    ToonStateRef ref =
        _storageHome.find_ref_by_episode_name(key);
    // create reference from ref
    // and return, same as above...
}

// and so on...

The user-provided executor uses the storage accessor and mutators on the incarnation:

Example 2

Provided by Component Programmer:
import LooneyToons.*;
import MerryMelodies.*;

public class myToonImpl extends ToonImpl implements BirdOperations, CatOperations {

    public myToonImpl() { super(); }

    //void fly (long how_long) {
    //    _state.timeFlown =
    //        ( _state.timeFlown + how_long);
    //}
void eat (Bird lunch) {
    _state.last_bird_eaten(lunch);
}

BirdOperations get_facet_tweety() {
    return (BirdOperations) this;
}

CatOperations get_facet_sylvester() {
    return (CatOperations) this;
}

3.2.8.3 Explicit delegation of home operations

The previous section described the default home executor implementation generated by
the CIF. Default delegation can only be implemented for home operations or the home
base interfaces, and implicitly-defined home operations (i.e., orthodox home
operations). The syntax for home definitions permits explicitly-defined factory
operations, finder operations, and operations with arbitrary signatures to be declared on
the home. The CIF makes no assumptions about the semantics of these operations (i.e.,
the heterodox operations), other than the assumptions that factory operations return
references for newly-created components, and finder operations return references for
existing components that were indirectly identified by the parameters of the finder
operation. Implementations of these operations are not generated by default. CIDL
does, however, allow the component implementor to specify explicitly how heterodox
home operations are implemented. A CIDL home executor definition may optionally
include the declarations illustrated in the following schematic CIDL example:

    composition <category> <composition_name> {
        ... // assume storage management specified
        home executor <home_executor_name> {
            delegatesTo abstract storagehome ( 
                <home_op_0> : <storage_home_op_0>, 
                <home_op_1> : <storage_home_op_1>, ... 
            );
            delegatesTo executor( 
                <home_op_2> : <executor_op_2>, ... 
            );
            abstract(<home_op_3>, <home_op_4>, ...);
        }
    }

Delegation to abstract storage home

The delegatesTo abstract storagehome declaration specifies a sequence of
operation mappings, where each operation mapping specifies the name of an operation
on the home, and the name of an operation on the storage home. The signatures of the
operations must be compatible, as defined in Section 1.7.4, OHome inheritance, O on
Based on this declaration, the CIF generates implementations of the home operations on the home executor that delegate to the specified operations on the abstract storage home.

**Delegation to executor**

The `delegatesTo executor` declaration specifies a sequence of operation mappings, similar to the `delegatesTo abstract storagehome` declaration. The name on the left hand side of the mapping (i.e., to the left of the colon, Ó:Ó) must denote an explicitly-declared factory operation on the home, or the identifier Ócreate.Ó denoting the implicitly-declared factory operation. The right hand side of each mapping specifies the name of an abstract operation that will be generated on the component executor. The component implementor provides the implementation of the executor operation, and the CIF provides an implementation of the operation on the home executor that delegates to the executor.

The delegation of home operations to executors is problematic, since home operations (other than factories) have no target component. For this reason, only factory operations may be delegated to the component executor. The CIF implements this delegation by defining an additional facet on the component executor, called a *factory facet*. A factory facet is only exposed to the home executor; clients cannot navigate to the factory facet, and the factory facet is not exposed in component meta-data, or described in the `FacetDescription` values returned from `Navigation::get_all_facets`.

The implementation of the factory operation on the home executor that delegates to the component executor must first create an object reference that denotes the factory facet. The home operation then invokes the mapped factory operation on the object reference, causing the activation of the component and ensuring that the execution of the operation on the component occurs in a proper invocation context.

If the factory operation being delegated is any operation other than the orthodox `create` operation, and the home definition includes a primary key specification, the operation generated on the factory facet of the component executor returns a value of the specified primary key type. The delegating operation on the home executor associates the primary key value returned from the component executor with the storage object (i.e., the storage objectÔs PID) created to incarnate the component instance.

*The use of PID values to create object references obviates the need to have two versions of a create method on the executor, as is the case in EJB with create and postCreate methods. An appropriate calling context can be created before the factory operation is invoked on the executor.*

These precise semantics of and requirements for factory operations delegated to the executor are described in detail in Section 1.7.3.1, ÔFactory operations,Ô on page 1-37.
Suppressing generated implementation

The **abstract** specification overrides the generation of implementations for orthodox home operations. The name of any explicitly-defined operation on the home may be specified in the operation list of the abstract declaration. The CIF will not implement the specified operations, instead leaving unimplemented abstract operation declarations (on whatever appropriate equivalent exists for the particular language mapping).

The following example extends the previous example to illustrate delegation of home operations to the abstract storage home and the executor. The example highlights differences from the previous, and does not repeat elements that are identical:

```idl
// Example 3  // USER-SPECIFIED IDL
module LooneyToons {   // IDL

... identical to previous example, except for the home:

home ToonTown manages Toon primarykey EpisodeName {
    factory createToon(
        in string name, in long num, in Bird brief);
    void arbitrary_operation();
};
```

---

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The CIDL now defines abstract storage types, **and abstract storage homes** and a **catalog**. The composition binds:

```idl
// Example 3  // USER-SPECIFIED CIDL
import ::LooneyToons;

module MerryMelodies {

... identical to the previous example, except for:

abstract storagehome ToonStateHome of ToonState
{
    key episode_name;
    factory create();
    void do_something();
};

composition entity ToonImpl {
    uses catalog {ToonCatalog store:};
}
In this example, the \texttt{arbitrary\_operation} on the home interface \texttt{ToonTown} is delegated to the storage home operation \texttt{do\_something}. Note that the operations have identical signatures. The \texttt{createToon} factory operation is delegated to an operation of the same name on the executor. This delegation causes the implicit definition of a factory facet on the component with the following interface:

\begin{verbatim}
interface ToonImplFactoryFacet {
    EpisodeName createToon(
        in string name, in long num, in Bird bref);
};
\end{verbatim}

This interface is not part of the public interface of the component; its use is restricted to the home executor. In fact, the IDL need not be generated. All of the code that uses the factory facet is either generated by the CIF, or derived from CIF-generated skeletons, so the CIF can simply generate language mappings for the interface without actually providing any IDL for it. Note also that only a subset of the normal language mapping artifacts are required, including (in the case of Java) the abstract Operations interface, the POA tie class to be used internally by the executor, and a local stub to allow the home executor to make a delegating invocation. There is no need to generate a remote stub, as the facet is never exposed outside of the container.

The abstract storage home \texttt{ToonStateHome} interface has the added \texttt{do\_something} operation on the explicit interface:

\begin{verbatim}
// Example 3
// // GENERATED FROM CIDL SPECIFICATION:
// public interface ToonStateHome
extends StorageHomeBase {
    public void do\_something();
    // ...
}
\end{verbatim}

The \texttt{ToonImpl} executor skeleton class supports an additional facet (the factory facet), which is returned by the \texttt{\_get\_factory\_facet} operation:
// Example 3
//
// GENERATED FROM CIDL SPECIFICATION:
//
package MerryMelodies;
import LooneyToons;

abstract public class ToonImpl
    implements LooneyToons.ToonOperations,
    ExecutorSegmentBase, PersistentComponent {
    ... same as previous
    // The following operations must be implemented
    // by the component developer:

    abstract public ToonImplFactoryFacetOperations
        _get_factory_facet();
    abstract public BirdOperations
        _get_facet_tweety();
    abstract public CatOperations
        _get_facet_sylvester();
}

The CIF generates implementations of the delegated operations on the
home executor:

// Example 3
//
// GENERATED FROM CIDL SPECIFICATION:
//
package MerryMelodies;
import LooneyToons;

public class ToonTownImpl
    implements LooneyToons.ToonTownOperations,
    CCMHome, ExecutorSegmentBase

    // values set during initialization
    // and activation:
    protected ToonStateHome _storageHome;
    protected Entity2Context _origin;
    ... 

    Toon createToon(
        String name, long num, Bird bref)
    {
        ToonState new_state=
            _storageHome.create();
        // etc.
    }

    void arbitrary_operation()
    {
        _storageHome.do_something();
    }
The user-provide executor must implement the factory facet and operation:

---

// Example 3
// // PROVIDED BY COMPONENT PROGRAMMER:
// import LooneyToons.*;
import MerryMelodies.*;

public class myToonImpl extends ToonImpl
implements BirdOperations, CatOperations, 
ToonImplFactoryFacetOperations{
...
...

    EpisodeName
createToon(String name, long num, Bird bref) {
        // presumably, the main reason for doing
        // this kind of delegation is to initialize
        // state in the context of the component:
        how_long(num); 
        last_bird_eaten(bref);
        EpisodeNameDefaultFactory _keyFactory
        = new EpisodeNameDefaultFactory();
        return _keyFactory.create(name);
    }

    ToonImplFactoryFacetOperations
    _get_factory_facet() {
        return 
        (ToonImplFactoryFacetOperations) this;
    }
...

---

3.2.9 Executor Definition

The home executor definition must include an executor definition. An executor
definition specifies the following characteristics of the component executor:

📅 The name of the executor, which is used as the name of the generated executor
skeleton.

📅 Optionally, one or more distinct segments, or physical partitions of the executor.
Each segment encapsulates independent state and is capable of being independently
activated. Each segment also provides at least one facet.
Optionally, the generation of operation implementations that manage the state of stateful component features (i.e., receptacles, attributes, and event sources) as members of the component incarnation.

A delegation declaration that describes a correspondence between stateful component features and members of the abstract storage type that incarnates the component. The CIF uses this declaration to generate implementations of the feature-specific operations (e.g., `connect_` and `disconnect_` operations for receptacles, accessors, and mutators for attributes) that store the state associated with each specified feature in the storage member indicated on the right hand side of the delegation.

### 3.2.9.1 Segmented executors

A component executor may be *monolithic* or *segmented*. A monolithic executor is, from the container's perspective, a single artifact. A segmented executor is a set of physically distinct artifacts. Each segment may have a separate abstract state declaration. Each segment must provide at least one facet defined on the component definition. The life cycle category of the composition must be *entity* or *process* if the executor specifies segmentation.

The primary purpose for defining segmented executors is to allow requests on a subset of the component's facets to be serviced without requiring the entire component to be activated. Segments are independently activated. When the container receives a request whose target is a facet of a segmented executor, the container activates only the segment that provides the required facet.

The following schema CIDL illustrates the declaration of a segmented executor:

```plaintext
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composition <category> <composition_name> { ...
  home executor <home_executor_name> { ...
    // assume storage management specified ...
    manages <executor_name> { ...
      segment <segment_name>0 { ...
        storedOn <catalog_label.abstract_storage_home>; ...
        provides ( <facet_name>0 , <facet_name>1 , ... ); ...
      } ...
      segment <segment_name>1 { ... } ... ...
    } ...
  } ...
}
```

The abstract storage home specified in the segment's `storedOn` declaration implicitly specifies the abstract storage type that incarnates the segment. The home executor will use this abstract storage home to create and manage instances of the segment state (i.e., incarnations). If the component home specifies a primary key, then all of the abstract
storage homes associated with executor segments must specify a matching key. The facets specified in the segment’s `provides` declaration are implemented on the segment.

A segmented executor has a distinguished segment associated with the component. The component segment is implicitly declared, and supplies all of the facets not provided by separate segments, as well as all other component features and supported interfaces.

Figure 3-3, and Figure 3-4, illustrate the structure of monolithic and segmented executors, and the relationships between facets, storage objects, and segments. These figures also illustrate the identity information that is embedded in component and facet object references. Component identity information is described in more detail in Section 1.1.4, “Component Identity,” on page 1-4.

![Diagram](image-url)

*Figure 3-3 Monolithic executor and reference information structure*
The details of the structure and behavior of segments and requirements for their implementation are specified in Section 3.2.9.1, "Segmented executors," on page 3-27.

The following example extends the previous example 2 to illustrate segmented executors. The example highlights differences from the previous, and does not repeat elements that are identical:

```
//
// USER-SPECIFIED IDL
//
```

Figure 3-4  Segmented executor and reference information structure
module LooneyToons {  // IDL
  ...  identical to previous example 2
};

-------------------------------------------------------------------------------------------------------------------

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The CIDL now defines abstract storage types; and abstract storage homes; and a catalog. The composition binds:

-------------------------------------------------------------------------------------------------------------------

//
// USER-SPECIFIED CIDL
//
import ::LooneyToons;

module MerryMelodies {
  ...
  identical to example 2 except for new storage, storage home and executor definitions

  abstract storagetype ToonState {
    state LooneyToons::EpisodeName episode_name;
    state string name;
    state LooneyToons::Bird last_bird_eaten;
  };

  abstract storagehome ToonStateHome of ToonState {
    key episode_name;
  };

  abstract storagetype BirdSegState {
    state unsigned long time_flown;
  };

  abstract storagehome BirdSegStateHome of BirdSegState {
    key episode_name;
  };

  catalog ToonCatalog {
    provides ToonStateHome TSHome;
    provides BirdSegStateHome BSSHHome;
  };

  composition entity ToonImpl {
    uses Catalog::ToonCatalog store;
  }

  home executor ToonTownImpl {
    implements LooneyToons::ToonTown;
    bindsTo store::TSHome ToonStateHome;
    manages ToonEntityImpl {
      segment BirdSegment {
        storedOn store::BSSHHome BirdSegStateHome;
        provides (tweety);
      }
    }
  }

-------------------------------------------------------------------------------------------------------------------
The storage home `BirdSegStateHome` `BSSHome` on the `ToonCatalog` catalog is bound to the segment `BirdSegment`, which implicitly binds the segment executor for `BirdSegment` to the abstract storage type `BirdSegState`. This segment provides the facet `tweety`, leaving the remaining facet (sylvestre) on the component segment.

The mappings of the CIDL abstract storage types and abstract storage homes and the catalog are not presented, as they are not affected by the segmentation.

The generated component executor base class `ToonImpl` is also not presented, as the changes are trivial. The facet accessor `_get_facet_tweety` is no longer present on the component executor. There are other internal changes that are not visible to the component implementor. The executor for the new `BirdSegment` has the following form:

```
package MerryMelodies;
import LooneyToons;

abstract public class BirdSegment
    implements ExecutorSegmentBase, PersistentComponent
{
    // Generated implementations of operations
    // inherited from CCMObject and
    // ExecutorSegmentBase and PersistentComponent
    // are omitted here.

    protected BirdSegState _state;
    protected BirdSegment() { _state = null; }

    public void set_incarnation (BirdSegState state) {
        _state = state;
    }

    // The following operations must be implemented
    // by the component developer:

    abstract public BirdOperations
        _get_facet_tweety();
    }
```
Note that the BirdSegment executor does not implement any IDL interface directly, as does the component segment. It is remotely accessible only through a provided facet.

A generated implementation of the home executor ToonHomeImpl is considerably different from the previous example 2. The create method must create references for all of the segments and construct a ComponentId with the proper information:

```java
package MerryMelodies;
import LooneyToons;

public class ToonTownImpl implements LooneyToons.ToonTownOperations,
CCMHome, ExecutorSegmentBase
{
    // Implementations of operations inherited
    // from CCMHome and ExecutorSegmentBase
    // are omitted here.
    //
    // ToonHomeImpl also provides implementations
    // of operations inherited from the component
    // home interface ToonTown, that delegate
    // designated operations on the storage home
    //
    // values set during initialization
    // and activation:
    protected Entity2Context _origin;
    protected ToonStateHome _toonStorageHome;
    protected BirdSegStateHome _birdStorageHome;
    ...

    Toon create(EpisodeName key)
    {
        ToonState new_toon =
            _toonStorageHome.create(key);
        // etc.
    }
```

There are now two segment executors to implement:

```java
//
// PROVIDED BY COMPONENT PROGRAMMER:
//
import LooneyToons.*;
import MerryMelodies.*;

public class myToonImpl extends ToonImpl
```
implements CatOperations {
    public myToonImpl() { super(); }

    void fly (long how_long) {
        _state.timeFlown
        (_state.timeFlown() + how_long);
    }
    void eat (Bird lunch) {
        _state.last_bird_eaten(lunch);
    }
    BirdOperations get_facet_tweety() {
        return (BirdOperations) this;
    }
    CatOperations get_facet_sylvestor() {
        return (CatOperations) this;
    }
}
}

public class myBirdSegImpl extends BirdSegment
    implements BirdOperations {
    public myBirdSegImpl() { super(); }

    void fly (long how_long) {
        _state.timeFlown
        (_state.timeFlown() + how_long);
    }

    BirdOperations get_facet_tweety() {
        return (BirdOperations) this;
    }
}

The programmer must also supply a different implementation of the
create_executor_segment operation on the home executor, that uses the
segment ID value to determine which executor to create.

--------------------------------------------------------------------------------

// Example 4
//
// PROVIDED BY COMPONENT PROGRAMMER:
//
import LooneyToons.*;
import MerryMelodies.*;

public class myToonTownImpl extends ToonTownImpl {
    protected myToonTownImpl() { super(); }

    ExecutorSegmentBase
    create_executor_segment (int segid) {
        // case discriminator values are constants
3.2.9.2 Delegation of feature state

An executor may also optionally declare a correspondence between stateful component features (which include receptacles, attributes, and event sources) and members of the abstract storage type that incarnates the component (or the distinguished component segment, in the case of a segmented executor). The CIF uses this declaration to generate implementations of the feature-specific operations (e.g., connect_ and disconnect_ operations for receptacles, accessors, and mutators for attributes) that store the state associated with each specified feature in the storage member indicated on the right hand side of the delegation. The following schematic CIDL illustrates a feature delegation:

```
composition <category> <composition_name> {
    ...
    home executor <home_executor_name> {
        ...
        manages <executor_name> {
            delegatesTo abstract storagetype {
                <feature_name0>: <storage_member_name0>,
                <feature_name1>: <storage_member_name1>, ...
            }
        }
    }
}
```

The type of the storage member must be compatible with the type associated with the feature, as defined in the Component Model chapter. In the case of attributes, the CIF-generated implementations of accessors and mutators retrieve and store the attribute value in the specified storage member. The executor programming model allows implementors to intercept invocations of the generated accessor and mutator invocations and replace or extend their behaviors. In the case of receptacles and event sources, the implementations of the connect_<receptacle_name>, disconnect_<receptacle_name>, connect_<source_name>, disconnect_<source_name>, subscribe_<source_name>, and unsubscribe_<source_name> operations store the connected object references in the specified members of the storage object that incarnates the component.
This mechanism is only particularly useful if the connected object references are persistent references, capable of causing server and object activation if necessary.

3.2.10 Proxy Homes

A composition definition may include a <proxy home> declaration. A proxy home implements the component home interface specified by the composition definition, but the implementation is not required to be collocated with the container where the components managed by the home are activated.

Proxy homes are, in essence, remote projections of the actual home implementation, which is always collocated with the executing component implementation. A proxy home may be able to implement some subset (or potentially, all) of the operations defined on the component home without contacting the actual home implementation. Operations that cannot be locally implemented by the proxy home are delegated to the actual home. The run-time implementation of the CIF (including the supporting infrastructure of the container and the home finder) is responsible for maintaining the associations between proxy homes and the actual home they represent. The container provides an interface for registering proxy homes, described in Section 4.4.1.3, on page 4-35.

Proxy homes offer the capacity for considerably increased scalability over collocated homes, particularly when the home operations can be implemented locally by the proxy home implementation. The following schematic CIDL illustrates a proxy home definition:

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```
composition <category> <composition_name> { 
  ... 
  home executor <home_executor_name> { 
    implements <home_type>; 
    bindsTo <catalog_label>abstract_storage_home>; 
    ... 
  };
  proxy home <proxy_executor_name> { 
    delegatesTo home ( <home_op0>, <home_op1>, ... ); 
    abstract ( <home_op2>, <home_op3>, ... ); 
  };

The <proxy_executor_name> is used as the name of the generated skeleton artifact for the proxy home executor. The proxy home declaration implicitly acquires the characteristics of the actual home, as declared in the home executor definition (which must precede the proxy home definition in the composition scope). In particular, the proxy home implements the same home, and binds to the same abstract storage home.
```
The operation delegations specified in the actual home executor definition are also acquired by the proxy home, but certain delegations are transformed according to rules specified in Section 3.2.10.1, ÒProxy home delegation,Ó on page 3-36.

3.2.10.1 Proxy home delegation

For proxy homes in compositions that specify managed state, the CIF assumes that the proxy home has connectivity to the same persistent store as the actual home. Based on this assumption, the default implementations of orthodox operations on the proxy home executor are delegated directly to the storage home, precisely as they are in the actual home executor. In general, other operations are delegated to the actual home, by default, although the specific rules for determining the implementation of proxy home operations are somewhat more involved, and are described completely in Section 3.2.3, ÒImplementing a CORBA Component,Ó on page 3-2.

3.2.11 Component Object References

The CIF defines an information model for component object references. This information model is encapsulated within the object_key field of an IOP profile, or an equivalent field in other profiles. The information model is an abstraction; no standard encoding within an object_key is specified. It is the responsibility of the container and the underlying ORB to encode this information for insertion into object references and to extract this information from the object_key in incoming requests, decode it, and use it to activate the appropriate component or segment and dispatch the request to the proper facet.

The Entity2Context interface, described in Section 4.4.3.7, ÒThe Entity2Context Interface,Ó on page 4-43 is used by the component implementation to provide this information to the container, with which the container creates the object references for the component and its facets. The ComponentId interface encapsulates the component reference information. Examples 2, 3, and 4 in the previous sections illustrate the use of the Entity2Context and ComponentId interfaces to create object references. Figure 3-3, and Figure 3-4, illustrate the structure of the information encapsulated in ComponentId, and its relationship to executor structure.

3.2.11.1 Facet identifiers

The CIF implementation allocates numeric identifiers to facets. The facet ID values are interpreted by generated code in the component implementation, so the assignment of values does not need to be uniformly specified; a given CIF implementation's choice of facet ID values does not affect portability or interoperability.

3.2.11.2 Segment identifiers

The CIF implementation must also allocate numeric identifiers to segments. Similar to facet IDs, segment IDs are also interpreted by the component implementation, so no uniform allocation mechanism is specified. The implementation of create_executor_segment (on the home executor implementation) provided by the component implementor must interpret segment ID values in order to create and return
the appropriate segment executor. The generated implementations of segment executor skeletons define symbolic constants to assist the component implementor in this mapping.

3.2.11.3 State identifiers

State identifier is an abstraction that generalizes different representations of state identifiers, the primary of which is the **pid** of the CORBA persistent state service. The generic representation of a state identifier is **StateldValue**, an abstract valuetype from which specific, concrete state identity types are derived. Implementations of the concrete sub-types are responsible for converting their representations to byte sequences and back again.

3.2.11.4 Monolithic reference information

Monolithic references contain a facet identifier and a single state identifier. The facet identifier denotes the target facet of the reference (or, of requests made on the reference). The state identifier is interpreted by the component implementation and used to retrieve the component’s state. In the case of automatically managed state, the CIF-generated implementation interprets the state identifier as a **pid**, using it to incarnate the component’s storage object.

*Note that navigation from one facet’s reference to another consists of merely replacing the target facet identifier with the facet identifier of the desired facet. This can be accomplished without activating the component.*

3.2.11.5 Segmented reference information

The reference information for segmented executors consists of the following:

- a target facet identifier
- a target segment identifier
- a sequence of segment descriptors, each of which contains:
  - the segment identifier of the segment being described
  - the state identifier for the segment

The target facet identifier denotes the target of requests made on the reference, and the target segment identifier denotes the segment on which that facet is implemented. The sequence of segment descriptors contains one element for each segment, including the component segment. This sequence is invariant for all references to a given component, over the lifetime of the component.

*In the case of segmented executors, navigation is accomplished by replacing the facet and segment identifiers.*
3.2.11.6 Component identity

The state identifier of the component segment (or the single state identifier in the case of monolithic executors) is interpreted as the unique identity of the component, within the scope of the home to which it belongs. Equivalence of component identity is defined as equivalence of state identifier values of the component segment.

3.3 Language Mapping

3.3.1 Overview

This part describes the language mapping for CORBA Components and defines interfaces that are used to implement components and homes. The language mapping, like the mapping for the client side, is based on equivalent IDL. For components and homes, local interfaces are defined. The user then implements these local interfaces using existing language mapping rules.

There are two strategies for implementing a component, coined monolithic and locator. In the monolithic strategy, the user implements all attributes, supported interfaces, and event consumers in a single executor interface. In the locator strategy, the user implements a locator, and the container uses this locator to retrieve references to executors for each port of a component. The decision which strategy is being used is made by the home, which can return a reference to either the monolithic or to the locator.

It is expected that the monolithic strategy is more simple to use and that it is sufficient for most use cases, while the locator strategy gives the user even more control over the life cycle of each executor.

Interfaces are designated internal or callback. Callback interfaces are implemented by the user and called by the container, while internal interfaces are provided by the container.

Some callback interfaces may be optionally implemented by the user. In order to optionally implement an interface, the user must define an interface, in IDL, that inherits both the base interface and the optional interface. For example, to inherit the optional SessionSynchronization interface in the implementation of a Bank component, the user would declare a new local interface, as shown below.

```
local interface MyBank :
    Components::SessionSynchronization,
    CCM_Bank { };
```

Optional interfaces are used by services that require the component’s cooperation (and therefore callback hooks). To determine whether an implementation supports an optional interface, the container narrows the object reference to that interface.

Internal interfaces are used by the container and various services to provide runtime information to the component. The component accesses internal interfaces through the context reference that it acquires through the `set_session_context` operation.
Details about existing internal and callback interfaces can be found in the *Container Programming Model* chapter. Some of those interfaces are forward-referenced in this section.

### 3.3.2 Common Interfaces

*EnterpriseComponent* is an empty callback interface that serves as common base for all component implementations, whether monolithic or locator-based.

```java
module Components {
    local interface EnterpriseComponent {};
}
```

**Note** The *EnterpriseComponent* interface is also defined in the *Container Programming Model* chapter.

The *ExecutorLocator* interface is a callback interface that is used for the locator implementation strategy.

```java
module Components {
    local interface ExecutorLocator : EnterpriseComponent {
        Object obtain_executor (in string name)
            raises (CCMException);
        void release_executor (in Object exc)
            raises (CCMException);
        void configuration_complete()
            raises (InvalidConfiguration);
    }
}
```

If a home, in creating a component, returns an *ExecutorLocator*, the container will invoke its *obtain_executor* operation prior to each invocation to retrieve the implementation for a port. The port name, given in the *name* parameter, is the same as used in the componentOs interface description in IDL, or the componentOs name for the *main* executor. The *obtain_executor* operation returns a local object reference of the expected type, as detailed below. The *CCMException* exception may be raised in case of a system error that prohibits locating the requested executor.

The *release_executor* operation is called by the container once the current invocation on an executor that was obtained through the *obtain_executor* operation has finished. The locator can thus release any resources that were acquired as part of the *obtain_executor* operation.

The *configuration_complete* operation is called to propagate the *configuration_complete* operation on the *CCMObject* interface to the component implementation.
Implementations of the **ExecutorLocator** interface for a service or session component must implement the **Components::SessionComponent** interface. Implementations of the **ExecutorLocator** interface for a process or entity component must implement the **Components::EntityComponent** interface.

**Note** *Object* is used as the return type of the **obtain_executor** operation, because there is yet no IDL type for the common base of all local objects. Since local objects inherit from *Object*, this is not a problem.

The **HomeExecutorBase** interface is a common base for all home implementations.

```plaintext
module Components {
    local interface HomeExecutorBase {
    }
};
```

### 3.3.3 Mapping Rules

This section defines equivalent interfaces that are generated for each interface, eventtype, component, and home.

#### 3.3.3.1 Interfaces

For each non-abstract and non-local interface, a local **facet executor** interface is generated. This facet executor interface has the same name as the original interface with a **CCM_** prefix, and inherits the original interface. So for an interface of name `<interface name>`, the facet executor interface has the following form:

```plaintext
local interface CCM_<interface name> : <interface name> {
    }
```

If a component provides an interface as a facet, the user implements the facet executor interface rather than the original interface in order to achieve a local implementation.

**Note** A container implementation may choose to limit generation of facet executor interfaces to only those interfaces that are actually used as a facet.

#### 3.3.3.2 Eventtypes

For each eventtype, a local **consumer executor** interface is generated. For an eventtype `<eventtype name>`, a local interface with the same name, but with a **CCM_** prefix and a postfix of **Consumer** is generated. This interface has a single **push** operation with no result, and the eventtype as a single **in** parameter:

```plaintext
local interface CCM_<eventtype name>Consumer {
    void push (in <eventtype name> ev);
}
```
3.3.3.3 Components

A component maps to three local interfaces; two of them are callback interfaces, and one is an internal interface. The monolithic executor callback interface is for use in monolithic implementations, the main executor callback interface is for use in locator-based implementations. Both callback interfaces inherit the component’s base and supported interfaces. They also both expose the component’s attributes.

In addition, the monolithic executor callback interface also contains operations for acquiring references to facets, and for consuming events - in the locator approach, these jobs are mediated by the locator.

An internal context interface is defined for each component. It is implemented by the container and handed to the component as session or entity context. The context interface contains component-specific runtime information (e.g., for pushing events into event source ports).

Component Main Executor Interface

The main executor callback interface as used by the locator approach is defined by the following rules:

1. For each component `<component name>`, a local main executor interface with the same name as the component, but with a prefix of `OCCM_O` and a postfix of `O_E` is defined.
2. The main executor interface contains all attributes declared by the component.
3. If the component has a base component with a name of `<base name>`, the main executor interface inherits `CCM_<base name>_Executor`. If the component does not have a base, the main executor interface inherits `Components::EnterpriseComponent`.
4. If the component has supported interfaces, they are inherited by the main executor interface.

If the container desires to acquire a reference to the main executor, it calls the `obtain_executor` operation of the `ExecutorLocator` with the name parameter set to `<component name>`.

Component Monolithic Executor Interface

The monolithic executor callback interface is defined by the following rules:

1. For each component `<component name>`, a local monolithic executor interface with the same name as the component and a prefix of `OCCM_O` is defined.
2. The monolithic executor interface contains all attributes declared by the component.
3. If the component has a base component with a name of `<base name>`, the monolithic executor interface inherits `CCM_<base name>`. If the component does not have a base, the monolithic executor interface inherits `Components::EnterpriseComponent`.
4. If the component has supported interfaces, they are inherited by the monolithic interface.

5. Additional operations are added to the monolithic interface for facets and event sinks.

6. Above rules can be satisfied by inheriting the main executor interface and adding operations for facets and event sinks. This is an optional design choice by the container implementation.

In a service and session component, the user may optionally inherit the
Components::SessionComponent interface in the implementation of a monolithic executor in order to be notified by the container of activation and passivation. In a process or entity component, the user may optionally inherit the
Components::EntityComponent interface in the implementation of a monolithic executor.

**Component Context Interface**

The context internal interface is defined by the following rules:

1. For each component `<component name>`, a local context interface with the same name as the component, but with a prefix of OCCM_ and a postfix of _Context is defined.

2. If the component has a base component with a name of `<base name>`, the context interface inherits CCM_<base name>_Context. If the component does not have a base, the context interface inherits Components::CCMContext.

3. Additional operations are added to the context interface for receptacles and event sources.

The container will implement an interface that inherits both the above context interface and either Components::SessionContext or Components::EntityContext, depending on the type of the component. The component implementation can narrow the Components::SessionContext or Components::EntityContext reference that it receives to the above component-specific context interface.

### 3.3.3.4 Example

For the following component declaration in IDL,

```idl
interface Hello {
    void sayHello ();
};

component HelloWorld supports Hello {
    attribute string message;
};
```

the following local interfaces are generated:
local interface CCM_Hello : Hello
{
}

local interface CCM_HelloWorld_Executor :
   Components::EnterpriseComponent, Hello
{
   attribute string message;
};

local interface CCM_HelloWorld :
   Components::EnterpriseComponent, Hello
{
   attribute string message;
};

local interface CCM_HelloWorld_Context :
   Components::CCMContext
{
};

Read on for further contents of these interfaces.

3.3.3.5 Ports

This section defines equivalent operations that are added to either of the three interfaces for each port definition.

Facets

For each facet, an equivalent operation is defined in the monolithic executor interface. For a facet of name <name> and type <type>, an operation with the same name as the facet but with a ÒgetÓ prefix is generated. This operation has an empty parameter list and a reference of the interfaceÕs facet executor type as return value:

CCM_<type> get_<name> ();

Users may optionally implement facet interfaces directly in the monolithic executor implementation by declaring a new local interface that inherits both the monolithic executor interface and the facet executor, and by then returning a reference to itself in the implementation of the above operation. Example:
// IDL
cOMPONENT MyComponent {
   provides MyInterface MyFacet;
};

// User IDL
local interface MyComponentImpl :
   CCM_MyComponent, CCM_MyMyInterface
{};

// C++
CCM_MyInterface_ptr
MyComponent_Impl::get_MyFacet ()
{
   return CCM_MyInterface::_duplicate (this);
}

If the locator strategy is used, the container calls the obtain_executor operation on
the ExecutorLocator with the name parameter set to <name> in order to acquire a
reference to the facet executor that matches this facet port.

Receptacles
For each receptacle, an equivalent operation is defined in the context interface. The
signature of this operation depends on whether the receptacle is simplex or multiplex.

For a simplex receptacle of name <name> and type <type>, an operation of the same
name as the receptacle but with a get_connection Ô prefix is generated. The
operation has an empty parameter list, and an object reference of the interfaceÔs type
as return value:

<type> get_connection_<name> ();

If there is no connection, this operation returns a nil reference.

For a multiplex receptacle of name <name> and type <type>, an operation of the same
name as the receptacle but with a get_connections Ô prefix is generated. The
operation has an empty parameter list and a sequence of type
<name>Connections as return value (this type is defined by the client-side
equivalent IDL):

<name>Connections get_connections_<name> ();

Publisher and Emitter
For each publisher and emitter port, an equivalent operation is defined in the context
interface. For a publisher or emitter port of name <name> and type <type>, an
operation of the same name as the port but with a push Ô prefix is generated. This
operation has no return value and a single in parameter containing the event.

void push_<name> (in <type> ev);
The component may call this operation in order to push an event to the consumer (for emitter ports) or to all subscribers (for publisher ports). The container is responsible for delivering the event.

**Consumer**

For each consumer port, an equivalent operation is defined in the monolithic executor interface. For a consumer port of name `<name>` and type `<type>`, an operation of the same name as the port but with a `push_` prefix is generated. This operation has no return value and a single `in` parameter containing the event.

```c
void push_<name> (in <type> ev);
```

For component implementations that use the monolithic strategy, the container invokes this operation whenever a client sends an event to this sink.

For component implementations that use the locator strategy, the container calls the `obtain_executors` operation on the `ExecutorLocator` with the name parameter set to `<name>` in order to acquire a reference to an implementation of the `EventExecutor` consumer executor interface.

### 3.3.3.6 Home

For each home, three callback interfaces are generated, similar in structure to the interfaces defined on the client side. The three interfaces are named the *Implicit*, *Explicit*, and *Main* home executor.

**Home Explicit Executor Interface**

The *home explicit executor* callback interface is defined by the following rules:

1. For each home `<home name>`, a local *explicit executor* interface with the same name as the home, but with a prefix of `CCM_` and a postfix of `Explicit` is defined.

2. The explicit executor interface contains all attributes and operations declared by the home.

3. If the home has a base with a name of `<base name>`, the explicit executor interface inherits `CCM_<base name>Explicit`. If the home does not have a base, the explicit executor interface inherits `Components::HomeExecutorBase`.

4. If the home has supported interfaces, they are inherited by the explicit executor interface.

5. Additional operations are added to the explicit executor interface for factories and finders, see below.

**Home Implicit Executor Interface**

The contents of the *home implicit executor* callback interface depend on whether the home is keyless or keyed.
**Implicit Executor Interface for Keyless Homes**

For a keyless home `<home name>`, a local implicit executor interface with the same name as the home, but with a prefix of `CCM_` and a postfix of `Implicit` is defined. This interface contains a single `create` operation with the following signature:

```cpp
local interface CCM_<home name>Implicit {
    Components::EnterpriseComponent create ()
    raises (Components::CCMException);
};
```

The container calls the implicit `create` operation in order to create a new component instance. The operation can return either a reference to a monolithic executor or to an `ExecutorLocator`. In the former case, the container assumes that the monolithic strategy is used, otherwise it will use the locator strategy. The implementation may raise the `CCMException` exception in order to indicate a system-level error.

---

**Note D Issue 5340**

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**Implicit Executor Interface for Explicitly or Implicitly Keyed Homes**

For a keyed home `<home name>` with a key of `<key type>` or a keyless home `<home name>` that derives from a keyed home with a key of `<key type>`, a local implicit executor interface with the same name as the home, but with a prefix of `CCM_` and a postfix of `Implicit` is defined. This interface contains the following operations:

```cpp
local interface CCM_<home name>Implicit {
    Components::EnterpriseComponent
        create (in <key type> key)
        raises (Components::CCMException);
    Components::EnterpriseComponent
        find_by_primary_key (in <key type> key)
        raises (Components::CCMException);
    void remove (in <key_type> key)
        raises (Components::CCMException);
};
```

The container calls the `create` operation in order to create a new component associated with the specified primary key value. The operation can return either a reference to a monolithic executor or to an `ExecutorLocator`. In the former case, the container assumes that the monolithic strategy is used, otherwise it will use the locator strategy. The operation may raise the `CCMException` exception to indicate a system-level error.

The container calls the `find_by_primary_key` operation in order to find an existing component associated with the specified primary key value. The operation shall return the same reference to a monolithic executor or to an `ExecutorLocator` as it was previously returned from a `create` operation. The operation may raise the `CCMException` exception to indicate a system-level error.
The container calls the **remove** operation in order to remove the component identified by the specified primary key value. The operation may raise the **CCMException** exception to indicate a system-level error.

**Home Main Executor Interface**

For each home `<home name>`, a local *main executor* interface with the same name as the home and a prefix of *CCM_* is defined. The main executor interface inherits both the implicit and explicit executor interfaces, as shown below.

```plaintext
local interface CCM_<home name> : 
    CCM_<home name>Explicit,
    CCM_<home name>Implicit 
{
};
```

The main executor interface does not have any other contents.

In the implementation of a home main executor for a service and session component, the user may optionally inherit the **Components::SessionComponent** interface in order to be notified by the container of activation and passivation. In the implementation of a home main executor for a process or entity component, the user may optionally inherit the **Components::EntityComponent** interface.

**Factories**

For each factory in the home, an operation is defined in the explicit home executor interface. This operation has the same parameter list as the factory and the return type **EnterpriseComponent**. As with the home’s **create** operation, factories can return either a reference to a monolithic executor or to an **ExecutorLocator**.

Factories are assumed to return a new component instance.

**Finders**

For each finder in the home, an operation is defined in the explicit home executor interface. This operation has the same parameter list as the finder and the return type **EnterpriseComponent**. As with the home’s **create** operation, finders can return either a reference to a monolithic executor or to an **ExecutorLocator**.

Finders may return existing or new component instances. If a finder decides to return an existing component instance, it shall return the same reference to a monolithic executor or to an **ExecutorLocator** as it was previously returned from a factory or from the **create** operation.
**Entry Points**

Some programming languages require the existence of user-provided entry points, or Home Factories. These entry points are not part of the language mapping; they are dealt with in the Packaging and Deployment chapter.

Home Factories, if required by a language mapping, shall return a reference to an instance of the home's main executor interface.

**Example**

The following example shows a Bank home that manages an Account component.

```
  home Bank manages Account {
    factory open (in string name);
    void close (in string name);
  };
```

In this example, the following equivalent interfaces would be generated.

```
  local interface CCM_BankExplicit :
    Components::HomeExecutorBase {
      Components::EnterpriseComponent open (in string name);
      void close (in string name);
    };
```

```
  local interface CCM_BankImplicit :
    {
      Components::EnterpriseComponent create ()
      raises (Components::CCMException);
    };
```

```
  local interface CCM_Bank :
    CCM_BankExplicit,
    CCM_BankImplicit
    {
    };
```

The user would then implement the CCM_Bank interface and eventually provide an entry point that creates a CCM_Bank instance.
The Container Programming Model

Note D Text in Red is from the Components 1.1 RTF interim report (ptc/2002-08-02).

This chapter describes the CORBA component container programming model.

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The container is the server’s runtime environment for a CORBA component implementation. This environment is implemented by a deployment platform such as an application server or a development platform like an IDE. A deployment platform typically provides a robust execution environment designed to support very large numbers of simultaneous users. A development platform would provide enough of a runtime to permit customization of CORBA components prior to deployment but perhaps support a limited number of concurrent users. From the point of view of the CORBA component implementation, such differences are qualities of service characteristics and have no effect on the set of interfaces the component implementor can rely on. This chapter is organized as follows:
Section 4.1 - "Introduction" introduces the programming model and defines the elements that comprise it.

The container programming model is an API framework designed to simplify the task of building a CORBA application. Although the framework does not exclude the component developer from using any function currently defined in CORBA, it is intended to be complete enough in itself to support a broad spectrum of applications.

Section 4.2 - "The Server Programming Environment" describes the programming model the component implementor is to follow.

The programming model identifies the architectural choices which must be made to develop a CORBA component which can be deployed in a container.

Section 4.3 - "Server Programming Interfaces - Basic Components" describes the interfaces seen by the component developer.

These interfaces constitute the contract between the container provider and the component implementor. Together with the client programming interfaces defined in the Component Model chapter, which can be used by servers as well as clients, they define the server programmer's API.

Section 4.5 - "The Client Programming Model" describes the client view of a CORBA component.

The client programming model has been described previously (see the Component Model chapter). This section describes the specific use of CORBA required by a client, which is NOT itself a CORBA component, to use a CORBA component written to the server programming model described in Section 4.3, "Server Programming Interfaces - Basic Components," on page 4-21.

4.1 Introduction

The container programming model is made up of several elements:

- The external API types define the interfaces available to a component client.
- The container API type defines the API framework used by the component developer.
- The CORBA usage model defines the interactions between the container and the rest of CORBA (including the POA, the ORB, and the CORBA services).
- The component category is the combination of the container API type (i.e., the server view) and the external API types (i.e., the client view).
The overall architecture is depicted in Figure 4-1.

The external API types are defined by the component IDL including the home specification. These interfaces are righteous CORBA objects and are stored in the Interface Repository for client use.

The container API type is a framework made up of internal interfaces and callback interfaces used by the component developer. These are defined using the new local interface declaration in IDL for specifying locality-constrained interfaces. The container API type is selected using CIDL, which describes component implementations.

*The EJB session bean and entity bean can be viewed as two examples of container API type since they offer different sets of framework APIs to the EJB programmer. However, each of them also implies a client view (i.e., the external API types). EJB does not define a term for the two framework API sets it supports.*

The CORBA usage model is controlled by policies that specify distinct interaction patterns with the POA and a set of CORBA services. These are defined by CIDL, augmented using XML, and used by the container factory to create a POA when the container is created.
The component category is a specific combination of external API types and container API type used to implement an application with the CORBA component technology.

4.1 External API Types

The external API types of a component are the contract between the component developer and the component client. We distinguish between two forms of external API types: the home interface and the application interfaces.

These are analogous to the EJBHome and EJBOBJECT interfaces of Enterprise JavaBeans.

Home interfaces support operations that allow the client to obtain references to one of the application interfaces the component implements. From the client’s perspective, two design patterns are supported - factories for creating new objects and finders for existing objects. These patterns are distinguished by the presence of a primarykey parameter in the home IDL declaration.

¥ A home interface with a primarykey declaration supports finders and its client is a keyfull client.
¥ A home interface without a primarykey declaration does not support finders and its client is a keyless client. All home types support factory operations.

4.1.2 Container API Type

The container API type defines an API framework; that is, the contract between a specific component and its container. This specification defines two base types that define the common APIs and a set of derived types that provide additional function. The session container API type defines a framework for components using transient object references. The entity container API type defines a framework for components using persistent object references.

4.1.3 CORBA Usage Model

A CORBA usage model specifies the required interaction pattern between the container, the POA, and the CORBA services. We define three CORBA usage models as part of this specification. Since all support the same set of CORBA services, they are distinguished only by their interaction with the POA.

¥ stateless - which uses transient object references in conjunction with a POA servant that can support any ObjectID.
¥ conversational - which uses transient references in conjunction with a POA servant that is dedicated to a specific ObjectID.
¥ durable - which uses persistent references in conjunction with a POA servant that is dedicated to a specific ObjectID.

It should be obvious that the fourth possibility (persistent references with a POA servant that can support any ObjectID) makes no sense and is therefore not included.
4.1.4 Component Categories

The component categories are defined as the valid combinations of external API types, container API type, and CORBA usage model. Table 4-1 summarizes the categories and identifies their EJB equivalent.

<table>
<thead>
<tr>
<th>CORBA Usage Model</th>
<th>Container API Type</th>
<th>Primary Key</th>
<th>Component Categories</th>
<th>EJB Bean Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>stateless</td>
<td>session</td>
<td>No</td>
<td>Service</td>
<td>-</td>
</tr>
<tr>
<td>conversational</td>
<td>session</td>
<td>No</td>
<td>Session</td>
<td>Session</td>
</tr>
<tr>
<td>durable</td>
<td>entity</td>
<td>No</td>
<td>Process</td>
<td>-</td>
</tr>
<tr>
<td>durable</td>
<td>entity</td>
<td>Yes</td>
<td>Entity</td>
<td>Entity</td>
</tr>
</tbody>
</table>

4.2 The Server Programming Environment

The component container provides interfaces to the component. These interfaces support access to CORBA services (transactions, security, notification, and persistence) and to other elements of the component model. This section describes the features of the container that are selected by the deployment descriptor packaged with the component implementation. These features comprise the design decisions to be made in developing a CORBA component. Details of the interfaces provided by the container are provided in Section 4.3, ©Server Programming Interfaces - Basic Components,© on page 4-21.

4.2.1 Component Containers

Containers provide the run-time execution environment for CORBA components. A container is a framework for integrating transactions, security, events, and persistence into a component’s behavior at runtime. A container provides the following functions for its component:

- All component instances are created and managed at runtime by its container.
- Containers provide a standard set of services to a component, enabling the same component to be hosted by different container implementations.

Components and homes are deployed into containers with the aid of container specific tools. These tools generate additional programming language and metadata artifacts needed by the container. The tools provide the following services:

- Editing the configuration metadata,
- Editing the deployment metadata, and
- Generating the implementations needed by the containers to support the component.

The container framework defines two forms of interfaces:
**Internal interfaces** - These are locality-constrained interfaces defined as local interface types, which provide container functions to the CORBA component.

*These are similar to the EJBCONTEXT interface in Enterprise JavaBeans.*

**Callback interfaces** - These are also local interface types invoked by the container and implemented by a CORBA component.

*These interfaces provide functions analogous to the SessionBean and EntityBean interfaces defined by Enterprise JavaBeans.*

This architecture is depicted in Figure 4-1 on page 4-3.

We define a small set of **container API types** to support a broad spectrum of component behavior with their associated internal and callback interfaces as part of this specification. These container API types are defined using local interfaces.

Additional component behavior is controlled by policies specified in the deployment descriptor. This specification defines policies that support POA interactions (CORBA usage model), servant lifetime management, transactions, security, events, and persistence. See the Packaging and Deployment chapter, specifically Section 6.3, OSoftware Package Descriptor, for details of how container policies are specified.

CORBA containers are designed to be used as Enterprise JavaBeans containers. This allows a CORBA infrastructure to be the foundation of EJB, enabling a more robust implementation of the EJB specification. To support enterprise Beans natively within a CORBA container, the container must support the API frameworks defined by the EJB specification. This architecture is defined in the Integrating with Enterprise JavaBeans chapter of this specification.

### 4.2.2 CORBA Usage Model

The **CORBA Component Specification** defines a set of CORBA usage models that create either **TRANSIENT** or **PERSISTENT** object references and use either a 1:1 or 1:N mapping of **Servant** to **Object Id**. These CORBA usage models are summarized in Table 4-2. A given component implementation shall support one and only one CORBA usage model.

<table>
<thead>
<tr>
<th>CORBA Usage Model</th>
<th>Object Reference</th>
<th>Servant:OID Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>stateless</td>
<td>TRANSIENT</td>
<td>1:N</td>
</tr>
<tr>
<td>conversational</td>
<td>TRANSIENT</td>
<td>1:1</td>
</tr>
<tr>
<td>durable</td>
<td>PERSISTENT</td>
<td>1:1</td>
</tr>
<tr>
<td>(Invalid)</td>
<td>PERSISTENT</td>
<td>1:N</td>
</tr>
</tbody>
</table>

A CORBA usage model is specified using CIDL and is used to either create or select a component container at deployment time.
4.2.2.1 Component References

**TRANSIENT** objects support only the factory design pattern. They are created by operations on the home interface defined in the component declaration.

**PERSISTENT** objects support either the factory design pattern or the finder design pattern, depending on the component category. **PERSISTENT** objects support self-managed or container-managed persistence. **PERSISTENT** objects can be used with the CORBA persistent state service or any user-defined persistence mechanism. When the CORBA persistent state service is used, servant management is aligned with the **PersistentId** defined by the CORBA persistent state service and the container supports the transformation of an **ObjectId** to and from a **PersistentId**. A **PersistentId** provides a persistent handle for a class of objects whose permanent state resides in a persistent store (e.g., a database).

Home references are exported for client use by registering them with a HomeFinder which the client subsequently interrogates or by binding them to the CORBA naming service in the form of externally visible names.

EJB clients find references to EJBHome using JNDI, the Java API for Cos-Naming. Placing home references is CosNaming supports both the CORBA component client and the EJB client programming models.

4.2.2.2 Servant to Objectld Mapping

Component implementations may use either the 1:1 or 1:N mapping of Servant to **Objectld** with **TRANSIENT** references (stateless and conversational CORBA usage model, respectively) but may use only the 1:1 mapping with **PERSISTENT** references.

- A 1:N mapping allows a Servant to be shared among all requests for the same interface and therefore requires the object to be stateless (i.e., it has no identity).
- A 1:1 mapping binds a Servant to a specific **Objectld** for an explicit servant lifetime policy (see Section 4.2.5, OServant Lifetime Management, on page 4-8) and therefore is stateful.

4.2.2.3 Threading Considerations

CORBA components support two threading models: serialize and multithread. A threading policy of serialize means that the component implementation is not thread safe and the container will prevent multiple threads from entering the component simultaneously. A threading policy of multithread means that the component is capable of mediating access to its state without container assistance and multiple threads will be allowed to enter the component simultaneously. Threading policy is specified in CIDL.

A threading policy of serialize is required to support an enterprise Bean since they are defined to be single-threaded.
4.2.3 Component Factories

A home is a component factory, responsible for creating instances of all interfaces exported by a component. Factory operations are defined on the home interface using the factory declaration. A default factory is automatically defined whose implementation may be generated by tools using the information provided in the component IDL. Specialized factories; for example, factories that accept user-defined input arguments must be implemented by the component developer. Factory operations are typically invoked by clients but may also be invoked as part of the implementation of the component. A CORBA component implementation can locate its home interface using an interface provided by the container.

4.2.4 Component Activation

CORBA components rely on the automatic activation features of the POA to tailor the behavior of the components using information present in the componentÖs deployment descriptor. Once references have been exported, clients make operation requests on the exported references. These requests are then routed by the ORB to the POA that created the reference and then the component container. This enables the container to control activation and passivation for components, apply policies defined in the componentÖs descriptor, and invoke callback interfaces on the component as necessary.

4.2.5 Servant Lifetime Management

Servants are programming language objects that the POA uses to dispatch operation requests based on the ObjectId contained in the object key. The server programming model for CORBA components includes facilities to efficiently manage the memory associated with these programming objects. To implement this sophisticated memory management scheme, the server programmer makes several design choices:

¥ The container API type must be chosen.
¥ The CORBA usage model must be chosen.
¥ A servant lifetime policy is selected. CORBA components support four servant lifetime policies (method, transaction, component, and container).
¥ The designer is required to implement the callback interface associated with his choice.

The servant lifetime policies are defined as follows:

method

The method servant lifetime policy causes the container to activate the component on every operation request and to passivate the component when that operation has completed. This limits memory consumption to the duration of an operation request but incurs the cost of activation and passivation most frequently.
The *transaction* servant lifetime policy causes the container to activate the component on the first operation request within a transaction and leave it active until the transaction completes and which point the component will be passivated. Memory remains allocated for the duration of the transaction.

The *component* servant lifetime policy causes the container to activate the component on the first operation request and leave it active until the component implementation requests it to be passivated. After the operation that requests the passivation completes, the component will be passivated by the container. Memory remains allocated until explicit application request.

The *container* servant lifetime policy causes the container to activate the component on the first operation request and leave it active until the container determines it needs to be passivated. After the current operation completes, the component will be passivated by the container. Memory remains allocated until the container decides to reclaim it.

Table 4-3 shows the relationship between the CORBA usage model, the container API type, and the servant lifetime policies.

<table>
<thead>
<tr>
<th>CORBA Usage Model</th>
<th>Container API Type</th>
<th>Valid Servant Lifetime Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>stateless</td>
<td>session</td>
<td>method</td>
</tr>
<tr>
<td>conversational</td>
<td>session</td>
<td>method, transaction, component, container</td>
</tr>
<tr>
<td>durable</td>
<td>entity</td>
<td>method, transaction, component, container</td>
</tr>
</tbody>
</table>

Servant lifetime policies may be defined for each segment within a component.

### 4.2.6 Transactions

CORBA components may support either *self-managed transactions* (SMT) or *container-managed transactions* (CMT). A component using self-managed transactions will not have transaction policies defined with its deployment descriptor and is responsible for transaction demarcation using either the container’s *UserTransaction* interface or the CORBA transaction service. A component using
container-managed transactions defines transaction policies in its associated descriptor. The selection of container-managed transactions vs. self-managed transactions is a component-level specification.

When container-managed transactions are selected, additional transaction policies are defined in the component’s deployment descriptor. The container uses these descriptions to make the proper calls to the CORBA transaction service. The transaction policy defined in the component’s deployment descriptor is applied by the container prior to invoking the operation. Differing transaction policy declarations can be made for operations on any of the component’s ports as well as for the component’s home interface.

Table 4-4 summarizes the effects of the various transaction policy declarations and the presence or absence of a client transaction on the transaction that is used to invoke the requested operation on the component.

<table>
<thead>
<tr>
<th>Transaction Attribute</th>
<th>Client Transaction</th>
<th>Component’s Transaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOT_SUPPORTED</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>-</td>
</tr>
<tr>
<td>REQUIRED</td>
<td>-</td>
<td>T2</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>T1</td>
</tr>
<tr>
<td>SUPPORTS</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>T1</td>
</tr>
<tr>
<td>REQUIRES_NEW</td>
<td>-</td>
<td>T2</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
</tr>
<tr>
<td>MANDATORY</td>
<td>-</td>
<td>EXC (TRANSACTION_REQUIRED)</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>T1</td>
</tr>
<tr>
<td>NEVER</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>EXC (INVALID_TRANSACTION)</td>
</tr>
</tbody>
</table>

This component does not support transactions. If the client does not provide a current transaction, the operation is invoked immediately. If the client provides a current transaction, it is suspended (CosTransactions::Current::suspend) before the operation is invoked and resumed (CosTransactions::Current::resume) when the operation completes.
required
This component requires a current transaction to execute successfully. If one is supplied by the client, it is used to invoke the operation. If one is not provided by the client, the container starts a transaction (\texttt{CosTransactions::Current::begin}) before invoking the operation and attempts to commit the transaction (\texttt{CosTransactions::Current::commit}) when the operation completes.

supports
This component will support transactions if one is available. If one is provided by the client, it is used to invoke the operation. If one is not provided by the client, the operation is invoked outside the scope of a transaction.

requires\_new
This component requires its own transaction to execute successfully. If no transaction is provided by the client, the container starts one (\texttt{CosTransactions::Current::begin}) before invoking the operation and tries to commit it (\texttt{CosTransactions::Current::commit}) when the operation completes. If a transaction is provided by the client, it is first suspended (\texttt{CosTransactions::Current::suspend}), a new transaction is started (\texttt{CosTransactions::Current::begin}), the operation invoked, the component\'s transaction attempts to commit (\texttt{CosTransactions::Current::commit}), and the client\'s transaction is resumed (\texttt{CosTransactions::Current::resume}).

mandatory
The component requires that the client be in a current transaction before this operation is invoked. If the client is in a current transaction, it is used to invoke the operation. If not, the TRANSACTION\_REQUIRED exception shall be raised.

never
This component requires that the client not be in a current transaction to execute successfully. If no current transaction exists, the operation is invoked. If a current transaction exists, the INVALID\_TRANSACTION exception shall be raised.

4.2.7 Security
Security policy is applied consistently to all categories of components. The container relies on CORBA security to consume the security policy declarations from the deployment descriptor and to check the active credentials for invoking operations. The security policy remains in effect until changed by a subsequent invocation on a different component having a different policy.
Access permissions are defined by the deployment descriptor associated with the component. The granularity of permissions must be aligned by the deployer with a set of rights recognized by the installed CORBA security mechanism since it will be used to check permissions at operation invocation time. Access permissions can be defined for any of the component’s ports as well as the component’s home interface.

**Note D** The security model used by EJB and being adopted by CORBA components requires the secure transportation of security credentials between systems. Today that is only possible if SECOIF is used as the CORBA transport.

### 4.2.8 Events

CORBA components use a simple subset of the CORBA notification service to emit and consume events. The subset can be characterized by the following attributes:

- Events are represented as **valuetypes** to the component implementor and the component client.
- The event data structure is mapped to an **any** in the body of a structured event presented to and received from CORBA notification.
- The fixed portion of the structured event is added to the event data structure by the container on sending and removed from the event data structure when receiving.
- Components support two forms of event generation using the push model:
  - A component may be an exclusive supplier of a given type of event.
  - A component may supply events to a shared channel that other CORBA notification users are also utilizing.
- A CORBA component consumes both forms of events using the push model.
- Events have transaction and security policies associated with the component’s event ports as defined in the deployment descriptor.
- All channel management is implemented by the container, not the component.
- Filters are set administratively by the container, not the component.

Because events can be emitted and consumed by clients as well as component implementations, operations for emitting and consuming events are generated from the specifications in component IDL. The container is responsible for mapping these operations to the CORBA notification service to provide a robust event distribution network.

#### 4.2.8.1 Transaction Policies for Events

Transaction policies are defined for component event ports, which include both events being generated and events being consumed. The possible values are as follows:
normal

A normal event policy indicates the event should be generated or consumed outside the scope of a transaction. If a current transaction is active, it is suspended before sending the event or invoking the operation on the proxy object provided by the component.

default

A default event policy indicates the event should be generated or consumed regardless of whether a current transaction exists. If a current transaction is active, the operation is transactional. If not, it is non-transactional.

transaction

A transaction event policy indicates the event should be generated or consumed within the scope of a transaction. If a current transaction is not active, a new one is initiated before sending the event or invoking the operation on the proxy object provided by the component. The new transaction is committed as soon as the operation is complete.

Transaction policy declarations can be defined in the deployment descriptor for each event port defined by the component.

4.2.8.2 Security Policies for Events

CORBA components permits access control policies based on roles to be associated with the generation and consumption of events. This is accomplished by associating ACLs with the component ports used to emit/publish and consume events and using CORBA security to restrict access. These policies provide access control based on role for both event generation and consumption.

4.2.9 Persistence

The entity container API type supports the use of a persistence mechanism for making component state durable; for example, storing it in a persistent store like a database. The entity container API type defines two forms of persistence support:

- container-managed persistence (CMP) - the component developer simply defines the state that is to be made persistent and the container (in conjunction with generated code) automatically saves and restores state as required.

  Container-managed persistence is selected by defining the abstract state associated with a component segment using the state declaration language of the CORBA persistent state service and connecting that state declaration to a component segment using CIDL.

- self-managed persistence (SMP) - the component developer assumes the responsibility for saving and restoring state when requested to do so by the container.
Self-managed persistence is selected via CIDL declaration and triggered by the container invoking the callback interfaces (which the component must implement) defined later in this chapter (Section 4.3, ÖServer Programming Interfaces - Basic Components,Ó on page 4-21).

Table 4-5 summarizes the choices and their required responsibilities.

<table>
<thead>
<tr>
<th>Persistence Support</th>
<th>Persistence Mechanism</th>
<th>Responsibility</th>
<th>Persistence Classes</th>
<th>Callback Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Managed</td>
<td>CORBA</td>
<td>Container</td>
<td>Generated Code</td>
<td>Generated Code</td>
</tr>
<tr>
<td>Container Managed</td>
<td>User</td>
<td>Container</td>
<td>Component implements</td>
<td>Generated Code</td>
</tr>
<tr>
<td>Self-managed</td>
<td>CORBA</td>
<td>Component</td>
<td>Generated Code</td>
<td>Component implements</td>
</tr>
<tr>
<td>Self-managed</td>
<td>User</td>
<td>Component</td>
<td>Component implements</td>
<td>Component implements</td>
</tr>
</tbody>
</table>

Container-managed vs. self-managed persistence is selected via the deployment descriptor for each segment of the component.

### 4.2.9.1 Container-managed Persistence

Container-managed persistence may be accomplished using the CORBA persistent state service or any user-defined persistence mechanism. When the CORBA persistent state service is used, the container manages all interactions with the persistence provider and the component developer need not use the persistence interfaces offered by the container. With container-managed persistence using the CORBA persistent state service, it is possible to provide automatic code generation for the storage factories, finders, and some callback operations.

If container-managed persistence is to be accomplished with a user-defined persistence mechanism, the component developer must implement the various persistence classes defined in the persistence framework.

Container-managed persistence is selected using CIDL and tailored using XML at deployment time to specify connections to specific persistence providers and persistent stores.

### 4.2.9.2 Self-managed Persistence

Self-managed persistence is also supported by the entity container API type. Like container-managed persistence, the component developer has two choices: to use the CORBA persistent state service or some user-defined persistence mechanism. But since no declarations are available to support code generation, the component
developer is responsible for implementing both the callback interfaces and the persistence classes. The container supports access to a component persistence abstraction provided by the CORBA persistent state service, which hides many of the details of the underlying persistence mechanism from the component developer.

Self-managed persistence is selected using CIDL and tailored using XML at deployment time to specify connections to specific persistence providers and persistent stores.

4.2.10 Application Operation Invocation

The application operations of a component can be specified on both the component’s supported interfaces and the provided interfaces. These operations are normal CORBA object invocations.

Application operations may raise exceptions, both application exceptions (i.e., those defined as part of the IDL interface definition) and system exceptions (those that are not). Exceptions defined as part of the IDL interfaces defined for a component (that includes both provided interfaces and supported interfaces) are raised back to the client directly and do not affect the current transaction. All other exceptions raised by the application are intercepted by the container which then raises the TRANSACTION_ROLLED_BACK exception to the client, if a transaction is active. Otherwise they are reported back to the client directly.

4.2.11 Component Implementations

A component implementation consists of one or more executors. Each executor describes the implementation characteristics of a particular component segment. The session container API type consists of a single executor with a single segment that is activated in response to an operation request on any component facet. The entity container API type can be made up of multiple segments, each of which is associated with a different abstract state declaration. Each segment is independently activated when an operation request on a facet associated with that segment is received.

4.2.12 Component Levels

The CORBA component specification defines two levels of component function that can be used by component developers and supported by CORBA container providers:

- **basic** - The basic CORBA component supports a single interface (or multiple interfaces related by inheritance) and does not define any ports (provided interfaces or event source/sinks). The implementation of a basic component may use transaction, security, and simple persistence (i.e., a single segment) and relies on its container to manage the construction of CORBA object references.

  The basic component is functionally equivalent to the EJB 1.1 Component Architecture.
**extended** - The extended component is a basic component with multiple ports (supported interfaces, provided interfaces and/or event source/sinks). The implementation of the extended component may use all basic function, advanced persistence (multiple segments) plus the event model and participates in the construction of component object references.

The component interfaces defined in this specification have been structured into functional modules corresponding to the two levels of components defined above.

Basic container APIs are defined in Section 4.3, ÔServer Programming Interfaces - Basic Components,Ô on page 4-21.

Extended container APIs are defined in Section 4.4, ÔServer Programming Interfaces - Extended Components,Ô on page 4-33.

Partitioning the component function into two discrete packages permits the EJB 1.1 APIs to be used to implement basic CORBA components in Java. It also supports the construction of CORBA components in any supported CORBA language that can be accessed by EJB clients. This is described further in the ÔIntegrating with Enterprise JavaBeans” chapter.

### 4.2.13 Component Categories

As indicated in Section 4.1.4, ÔComponent Categories,Ô on page 4-5, this specification defines four component categories whose behavior is specified by the two container API types. Additionally we reserve a component category to describe the empty container (i.e., a container API type that does not use one of the API frameworks defined in this specification). The four component categories are described briefly in the following sections. The component categories are independent of the component levels defined in Section 4.2.12, ÔComponent Levels,Ô on page 4-15.

#### 4.2.13.1 The Service Component

The service component is a CORBA component with the following properties:

- **no state**
- **no identity**
- **behavior**

The lifespan of a service component is equivalent to the lifetime of a single operation request (i.e., *method*) so it is useful for functions such as command objects that have no duration beyond the lifetime of a single client interaction with them. A service component can also be compared to a traditional TP monitor program like a Tuxedo service or a CICS transaction. A service component provides a simple way of wrapping existing procedural applications.

*A service component is equivalent to a stateless EJB session bean.*

Table 4-6 summarizes the characteristics of a service component as seen by the server programmer.
Because of its absence of state, any programming language servant can service any `ObjectID`, enabling such servants to be managed as a pool or dynamically created as required, depending on usage patterns. Because a service component has no identity, `ObjectIDs` can be managed by the POA, not the component implementor, and the client sees only the factory design pattern.

The service component can use either container-managed or self-managed transactions.

### 4.2.13.2 The Session Component

The `session` component is a CORBA component with the following properties:

- transient state
- identity (which is not persistent)
- behavior

The lifespan of a `session` component is specified using the servant lifetime policies defined in Section 4.2.5, `OServant Lifetime Management`, on page 4-8. A session component (with a `transaction` lifetime policy) is similar to an MTS component and
is useful for modeling things like iterators, which require transient state for the lifetime of a client interaction but no persistent store. A session component is equivalent to the stateful session bean found in EJB.

Table 4-7 summarizes the characteristics of a session component as seen by the server programmer.

Table 4-7  Session Component Design Characteristics

<table>
<thead>
<tr>
<th>Design Characteristic</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Interfaces</td>
<td>As defined in the component IDL</td>
</tr>
<tr>
<td>Internal Interfaces</td>
<td>Base Set plus</td>
</tr>
<tr>
<td></td>
<td>SessionContext (basic)</td>
</tr>
<tr>
<td></td>
<td>Session2Context (extended)</td>
</tr>
<tr>
<td>Callback Interfaces</td>
<td>SessionComponent plus (optionally)</td>
</tr>
<tr>
<td></td>
<td>SessionSynchronization</td>
</tr>
<tr>
<td>CORBA usage model</td>
<td>conversational</td>
</tr>
<tr>
<td>Client Design Pattern</td>
<td>Factory</td>
</tr>
<tr>
<td>External API Types</td>
<td>keyless</td>
</tr>
<tr>
<td>Persistence</td>
<td>No</td>
</tr>
<tr>
<td>Servant Lifetime Policy</td>
<td>Any</td>
</tr>
<tr>
<td>Transactions</td>
<td>May use, but not included in current transaction</td>
</tr>
<tr>
<td>Events</td>
<td>Transactional or Non-transactional</td>
</tr>
<tr>
<td>Executor</td>
<td>Single segment with a single servant and no managed storage</td>
</tr>
</tbody>
</table>

A programming language servant is allocated to an Objectld for the duration of the servant lifetime policy specified. At that point, the servant can be returned to a pool and re-used for a different Objectld. Alternatively, servants may be dynamically created as required, depending on usage patterns. Because a session component has no persistent identity, Objectlds can be managed by the container, however extended components may choose to participate in creating references if desired, and the client sees only the factory design pattern.

The session component shall use either container-managed or self-managed transactions.

4.2.13.3  The Process Component

The process component is a CORBA component with the following properties:

- Persistent state, which is not visible to the client and is managed by the process component implementation or the container.
Persistent identity, which is managed by the process component and can be made visible to the client only through user-defined operations.

Behavior, which may be transactional.

The process component is intended to model objects that represent business processes (e.g., applying for a loan, creating an order, etc.) rather than entities (e.g., customers, accounts, etc.). The major difference between process components and entity components is that the process component does not expose its persistent identity to the client (except through user-defined operations).

Table 4-8 summarizes the characteristics of process component as seen by the server programmer.

Table 4-8  Process Component Design Characteristics

<table>
<thead>
<tr>
<th>Design Characteristic</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Interfaces</td>
<td>As defined in component IDL</td>
</tr>
<tr>
<td>Internal Interfaces</td>
<td>Base set plus EntityContext (basic) Entity2Context (extended)</td>
</tr>
<tr>
<td>Callback Interfaces</td>
<td>EntityComponent</td>
</tr>
<tr>
<td>CORBA usage model</td>
<td>durable</td>
</tr>
<tr>
<td>Client Design Pattern</td>
<td>Factory</td>
</tr>
<tr>
<td>External API Types</td>
<td>keyless</td>
</tr>
<tr>
<td>Persistence</td>
<td>Self-managed with or without PSS or Container-managed with or without PSS</td>
</tr>
<tr>
<td>Servant Lifetime Policy</td>
<td>Any</td>
</tr>
<tr>
<td>Transactions</td>
<td>May use, and can be included in current transaction</td>
</tr>
<tr>
<td>Events</td>
<td>Non-transactional or transactional events</td>
</tr>
<tr>
<td>Executor</td>
<td>Multiple segments with associated managed storage</td>
</tr>
</tbody>
</table>

A process component may have transactional behavior. The container will interact with the CORBA transaction service to participate in the commit process. The process component shall use container-managed transactions. This is identical to the EJB restriction for Entity Beans.

The process component can use container-managed or self-managed persistence using either the CORBA persistent state service or a user-defined persistence mechanism. The implications of the various choices are described in Section 4.2.9, ÒPersistenceÓ on page 4-13. The entity container uses callback interfaces, which enable the process component’s implementation to retrieve and save state data at activation and passivation respectively.
4.2.13.4 The Entity Component

The entity component is a CORBA component with the following properties:

- Persistent state, which is visible to the client and is managed by the entity component implementation or the container.
- Identity, which is architecturally visible to its clients through a primarykey declaration.
- Behavior, which may be transactional.

As a fundamental part of the architecture, entity components expose their persistent state to the client as a result of declaring a primarykey value on their home declaration. The entity component may be used to implement the entity bean in EJB.

Table 4-9 summarizes the characteristics of entity component as seen by the server programmer:

Table 4-9  Entity Component Design Characteristics

<table>
<thead>
<tr>
<th>Design Characteristic</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Interfaces</td>
<td>As defined in the component IDL</td>
</tr>
<tr>
<td>Internal Interfaces</td>
<td>Base set plus EntityContext (basic) Entity2Context (extended)</td>
</tr>
<tr>
<td>Callback Interfaces</td>
<td>EntityComponent</td>
</tr>
<tr>
<td>CORBA usage model</td>
<td>durable</td>
</tr>
<tr>
<td>Client Design Pattern</td>
<td>Factory or Finder</td>
</tr>
<tr>
<td>External API Types</td>
<td>keyfull</td>
</tr>
<tr>
<td>Persistence</td>
<td>Self-managed with or without PSS or Container-managed with or without PSS</td>
</tr>
<tr>
<td>Servant Lifetime Policy</td>
<td>Any</td>
</tr>
<tr>
<td>Transactions</td>
<td>May use, and can be included in current transaction</td>
</tr>
<tr>
<td>Events</td>
<td>Non-transactional or transactional events</td>
</tr>
<tr>
<td>Executor</td>
<td>Multiple segments with associated managed storage</td>
</tr>
</tbody>
</table>

The entity component shall use container-managed transactions. The container shall interact with the CORBA transaction service to participate in the commit process. This is identical to the EJB restriction for Entity Beans.

The entity component can use container-managed or self-managed persistence using either the CORBA persistent state service or a user-defined persistence mechanism. The implications of the various choices are described in Section 4.2.9, ÖPersistence,Ö
on page 4-13. The entity container uses callback interfaces that enable the entity component's implementation to retrieve and save state data at activation and passivation, respectively.

### 4.3 Server Programming Interfaces - Basic Components

This section defines the local interfaces used and provided by the component developer for basic components. These interfaces are then grouped as follows:

- Interfaces common to both container API types.
- Interfaces supported by the session container API type only.
- Interfaces supported by the entity container API type only.

Unless otherwise indicated, all of these interfaces are defined within the `Components` module.

#### 4.3.1 Component Interfaces

All components deal with three sets of interfaces:

- **Internal** interfaces that are used by the component developer and provided by the container to assist in the implementation of the component's behavior.
- **External** interfaces that are used by the client and implemented by the component developer.
- **Callback** interfaces that are used by the container and implemented by the component, either in generated code or directly, in order for the component to be deployed in the container.

A container API type defines a base set of internal interfaces which the component developers use in their implementation. These interfaces are then augmented by others that are unique to the component category being developed.

- **CCMContext** - serves as a bootstrap and provides access to the other internal interfaces including access to the runtime services implemented by the container. Each container API type has its own specialization of `CCMContext`, which we refer to as a context.
- **UserTransaction** - wraps the demarcation subset of the CORBA transaction service required by the application developer.
- **EnterpriseComponent** - the base class that all callback interfaces derive from.
  
  All components implement a callback interface that is determined by the component category. It serves the same role as EnterpriseBean in EJB.

When a component instance is instantiated in a container, it is passed a reference to its context, a local interface used to invoke services. For basic components, these services include transactions and security. The component uses this reference to invoke operations required by the implementation at runtime beyond what is specified in its deployment descriptor.
4.3.2 Interfaces Common to both Container API Types

This section describes the interfaces and operations provided by both container API types to support all categories of CORBA components.

4.3.2.1 The CCMContext Interface

The CCMContext is an internal interface that provides a component instance with access to the common container-provided runtime services applicable to both container API types. It serves as a "bootstrap" to the various services the container provides for the component.

The CCMContext provides the component access to the various services provided by the container. It enables the component to simply obtain all the references it may require to implement its behavior.

typedef SecurityLevel2::Credentials Principal;  exception IllegalState { };

local interface CCMContext {
    Principal get_caller_principal();
    CCMHome get_CCM_home();
    boolean get_rollback_only() raises (IllegalState);
    Transaction::UserTransaction get_user_transaction() raises (IllegalState);
    boolean is_caller_in_role (in string role);
    void set_rollback_only() raises (IllegalState);
};

get_caller_principal

The get_caller_principal operation obtains the CORBA security credentials in effect for the caller. Security on the server is primarily controlled by the security policy in the deployment descriptor for this component. The component may use this operation to determine the credentials associated with the current client invocation.

get_CCM_home

The get_CCM_home operation is used to obtain a reference to the home interface. The home is the interface that supports factory and finder operations for the component and is defined by the home declaration in component IDL.

get_rollback_only

The get_rollback_only operation is used by a component to test if the current transaction has been marked for rollback. The get_rollback_only operation returns TRUE if the transaction has been marked for rollback, otherwise it returns FALSE. If no transaction is active, the IllegalState exception shall be raised. When get_rollback_only is issued by a component, it results in a
CosTransaction::Current::get_status being issued to the CORBA transaction service and the status value returned being tested for the MARKED_ROLLBACK state.

get_user_transaction

The get_user_transaction operation is used to access the Transaction::UserTransaction interface. The UserTransaction interface is used to implement self-managed transactions. The IllegalState exception shall be raised if this component is using container-managed transactions.

is_caller_in_role

The is_caller_in_role operation is used by the CORBA component to compare the current credentials to the credentials defined by the role parameter. If they match, TRUE is returned. If not, FALSE is returned.

set rollback_only

The set rollback_only operation is used by a component to mark an existing transaction for abnormal termination. If no transaction is active, the IllegalState exception shall be raised. When set rollback_only is issued by a component, it results in a CosTransaction::Current::rollback_only being issued to the CORBA transaction service. The rules for the use of this operation are equivalent to the rules of its corresponding CORBA transaction service operation.

4.3.2.2 The Home Interface

A home is an external interface that supports factory and finder operations for the component. These operations are generated from the home IDL declaration (see Section 1.7, ‘Homes’ on page 1-32). The context supports an operation (get_CCM_home) to obtain a reference to the component's home interface.

4.3.2.3 The UserTransaction Interface

A CORBA component may use either container-managed or self-managed transactions, depending on the component category. With container-managed transactions, the component implementation relies on the transaction policy declarations packaged with the deployment descriptor and contains no transaction APIs in its implementation code.

This is identical to container-managed transactions in EJB or the default processing of an MTS component.

A component specifying self-managed transactions may use the CORBA transaction service directly to manipulate the current transaction or it may choose to use a simpler API, defined by this specification, which exposes only those transaction demarcation functions needed by the component implementation.
Manipulation of the current transaction shall be consistent between the client, the transaction policy specified in the deployment descriptor, and the component implementation.

For example, if the client or the container starts a transaction, the component may not end it (commit or rollback). The rules to be used are defined by the CORBA transaction service.

If the component uses the CosTransactions::Current interface, all operations defined for Current may be used as defined by the CORBA transaction service with the following exceptions:

- The Control object returned by suspend may only be used with resume.
- Operations on Control are not supported with CORBA components and may raise the NO_IMPLEMENT system exception.

The Control interface in the CORBA transaction service supports accessors to the Coordinator and Terminator interfaces. The Coordinator is used to build object versions of XA resource managers. The Terminator is used to allow a transaction to be ended by someone other than the originator. Since neither function is within the scope of the demarcation subset of CORBA transactions used with CORBA components, we allow CORBA transaction services implementations used with CORBA components to raise the NO_IMPLEMENT exception. This provides the same level of function as the bean-managed transaction policy in Enterprise JavaBeans.

The UserTransaction is an internal interface implemented by the container and is defined within its own module, Transaction, within the Components module (Components::Transaction). Because the UserTransaction is a wrapper over CosTransactions::Current, it is thread specific. The UserTransaction exposes a simple demarcation subset of the CORBA transaction service to the component. The context supports an operation (get_user_transaction) to obtain a reference to the UserTransaction interface. The UserTransaction interface is defined by the following IDL.

typedef sequence<octet> TranToken;
exception NoTransaction { };
exception NotSupported { };
exception SystemError { };
exception RollbackError { };
exception HeuristicMixed { };
exception HeuristicRollback { };
exception Security { };
exception InvalidToken { };

enum Status {
    ACTIVE,
    MARKED_ROLLBACK,
    PREPARED,
    COMMITTED,
    ROLLED_BACK,
}
local interface UserTransaction {
    void begin () raises (NotSupportedException, SystemError);
    void commit () raises (RollbackError, NoTransaction,
                         HeuristicMixed, HeuristicRollback,
                         Security, SystemError);
    void rollback () raises (NoTransaction, Security, SystemError);
    void set_rollback_only () raises (NoTransaction, SystemError);
    Status get_status() raises (SystemError);
    void set_timeout (in long to) raises (SystemError);
    TranToken suspend () raises (NoTransaction, SystemError);
    void resume (in TranToken txtoken)
        raises (InvalidToken, SystemError);
};

begin

The begin operation is used by a component to start a new transaction and associate it
with the current thread. When begin is issued by a component, it results in a
CosTransaction::Current::begin with report_heuristics set to TRUE being
issued to the CORBA transaction service. The rules for the use of this operation are
equivalent to the rules of its corresponding CORBA transaction service operation. The
NotSupportedException exception is returned if it is received from the CORBA transaction
service. Since nested transactions are not supported by CORBA component containers,
this indicates an attempt to start a new transaction when an existing transaction is
active. All other exceptions are converted to the SystemError exception.

commit

The commit operation is used by a component to terminate an existing transaction
normally. When commit is issued by a component, it results in a
CosTransaction::Current::commit being issued to the CORBA transaction service.
The rules for the use of this operation are equivalent to the rules of its corresponding
CORBA transaction service operation. If no transaction is active, the NoTransaction
exception shall be raised. If the TRANSACTION_ROLLEDBACK system
exception is returned, it is converted to the RollbackError exception. The
CosTransaction::HeuristicMixed and CosTransaction::HeuristicRollback
exceptions are reported as the HeuristicMixed and HeuristicRollback exceptions
respectively. The NO_PERMISSION system exception is converted to the
Security exception. All other exceptions are converted to the SystemError
exception.
rollback

The rollback operation is used by a component to terminate an existing transaction abnormally. When rollback is issued by a component, it results in a CosTransaction::Current::rollback being issued to the CORBA transaction service. The rules for the use of this operation are equivalent to the rules of its corresponding CORBA transaction service operation. If no transaction is active, the NoTransaction exception shall be raised. The NO_PERMISSION system exception is converted to the Security exception. All other exceptions are converted to the SystemError exception.

set_rollback_only

The set_rollback_only operation is used by a component to mark an existing transaction for abnormal termination. When set_rollback_only is issued by a component, it results in a CosTransaction::Current::rollback_only being issued to the CORBA transaction service. The rules for the use of this operation are equivalent to the rules of its corresponding CORBA transaction service operation. If no transaction is active, the NoTransaction exception shall be raised. All other exceptions shall be converted to the SystemError exception.

get_status

The get_status operation is used by a component to determine the status of the current transaction. If no transaction is active, it returns the NoTransaction status value. Otherwise it returns the state of the current transaction. When get_status is issued by a component, it results in a CosTransaction::Current::get_status being issued to the CORBA transaction service. The status values returned by this operation are equivalent to the status values of its corresponding CORBA transaction service operation. All exceptions shall be converted to the SystemError exception.

set_timeout

The set_timeout operation is used by a component to associate a time-out value with the current transaction. The timeout value (to) is specified in seconds. When set_timeout is issued by a component, it results in a CosTransaction::Current::set_timeout being issued to the CORBA transaction service. The rules for the use of this operation are equivalent to the rules of its corresponding CORBA transaction service operation. All exceptions are converted to the SystemError exception.

suspend

The suspend operation is used by a component to disconnect an existing transaction from the current thread. The suspend operation returns a TranToken, which can only be used in a subsequent resume operation. When suspend is issued by a component, it results in a CosTransaction::Current::suspend being issued to the CORBA transaction service. The rules for the use of this operation are more restrictive than the rules of its corresponding CORBA transaction service operation:
Only one transaction may be suspended.
The suspended transaction is the only transaction that may be resumed.

If no transaction is active, the NoTransaction exception shall be raised. All other exceptions are converted to the SystemError exception.

resume

The resume operation is used by a component to reconnect a transaction previously suspended to the current thread. The TranToken identifies the suspended transaction that is to be resumed. If the transaction identified by TranToken has not been suspended, the InvalidToken exception shall be raised. When resume is issued by a component, it results in a CosTransaction::Current::resume being issued to the CORBA transaction service. The rules for the use of this operation are more restrictive than the rules of its corresponding CORBA transaction service operation since the single suspended transaction is the only transaction that may be resumed. All other exceptions are converted to the SystemError exception.

The UserTransaction interface is equivalent to the UserTransaction interface (javax.transaction.UserTransaction) in EJB with the addition of the suspend and resume operations.

4.3.2.4 The EnterpriseComponent Interface

All CORBA components must implement an interface derived from the EnterpriseComponent interface to be housed in a component container. EnterpriseComponent is a callback interface that defines no operations.

4.3.3 Interfaces Supported by the Session Container API Type

This section describes the interfaces supported by the session container API type. This includes both internal interfaces provided by the container and callback interfaces, which must be implemented by components deployed in this container API type.

4.3.3.1 The SessionContext Interface

The SessionContext is an internal interface that provides a component instance with access to the container-provided runtime services. It serves as a bootstrap to the various services the container provides for the component. The SessionContext enables the component to simply obtain all the references it may require to implement its behavior.

    exception IllegalState { }

    local interface SessionContext : CCMContext {
        Object get_CCM_object() raises (IllegalState);
    }
get_CCM_object

The get_CCM_object operation is used to get the reference used to invoke the component. For basic components, this will always be the component reference. For extended components, this will be a specific facet reference. If this operation is issued outside of the scope of a callback operation, the IllegalStateException exception is returned.

4.3.3.2 The SessionComponent Interface

The SessionComponent is a callback interface implemented by a session CORBA component. It provides operations for disassociating a context with the component and to manage servant lifetimes for a session component.

enum CCMExceptionReason {
  SYSTEM_ERROR,
  CREATE_ERROR,
  REMOVE_ERROR,
  DUPLICATE_KEY,
  FIND_ERROR,
  OBJECT_NOT_FOUND,
  NO_SUCH_ENTITY;
}

exception CCMException (CCMExceptionReason reason;);

local interface SessionComponent : EnterpriseComponent {
  void set_session_context (in SessionContext ctx)
    raises (CCMException);
  void ccm_activate() raises (CCMException);
  void ccm_passivate() raises (CCMException);
  void ccm_remove () raises (CCMException);
}

set_session_context

The set_session_context operation is used to set the SessionContext of the component. The container calls this operation after a component instance has been created. This operation is called outside the scope of an active transaction. The component may raise the CCMException with the SYSTEM_ERROR minor code to indicate a failure caused by a system level error.

ccm_activate

The ccm_activate operation is called by the container to notify a session component that it has been made active. The component instance should perform any initialization required prior to operation invocation. The component may raise the CCMException with the SYSTEM_ERROR minor code to indicate a failure caused by a system level error.
ccm_passivate

The `ccm_passivate` operation is called by the container to notify a session component that it has been made inactive. The component instance should release any resources it acquired at activation time. The component may raise the `CCMException` with the `SYSTEM_ERROR` minor code to indicate a failure caused by a system level error.

ccm_remove

The `ccm_remove` operation is called by the container when the servant is about to be destroyed. It informs the component that it is about to be destroyed. The component may raise the `CCMException` with the `SYSTEM_ERROR` minor code to indicate a failure caused by a system level error.

4.3.3.3 The Session Synchronization Interface

The `SessionSynchronization` interface is a callback interface that may optionally be implemented by the session component. It permits the component to be notified of transaction boundaries by its container.

```c
exception CCMException (CCMExceptionReason reason);

local interface SessionSynchronization {
    void after_begin () raises (CCMException);
    void before_completion () raises (CCMException);
    void after_completion (in boolean committed) raises (CCMException);
};
```

after_begin

The `after_begin` operation is called by the container to notify a session component that a new transaction has started, and that the subsequent operations will be invoked in the context of the transaction. The component may raise the `CCMException` with the `SYSTEM_ERROR` minor code to indicate a failure caused by a system level error.

before_completion

The `before_completion` operation is called by the container just prior to the start of the two-phase commit protocol. The container implements the `CosTransactions::Synchronization` interface of the CORBA transaction service and invokes the `before_completion` operation on the component before starting its own processing. The component may raise the `CCMException` with the `SYSTEM_ERROR` minor code to indicate a failure caused by a system level error.
after_completion

The after_completion operation is called by the container after the completion of the two-phase commit protocol. If the transaction has committed, the committed value is set to TRUE. If the transaction has been rolled back, the committed value is set to FALSE. The container implements the CosTransactions::Synchronization interface of the CORBA transaction service and invokes the after_completion operation on the component after completing its own processing. The component may raise the CCMEexception with the SYSTEM_ERROR minor code to indicate a failure caused by a system level error.

4.3.4 Interfaces Supported by the Entity Container API Type

This section describes the interfaces supported by the entity container API type. This includes both internal interfaces provided by the container and callback interfaces that must be implemented by components deployed in this container API type.

4.3.4.1 The EntityContext Interface

The EntityContext is an internal interface that provides a component instance with access to the container-provided runtime services. It serves as a ObootsrapO to the various services the container provides for the component.

The EntityContext enables the component to simply obtain all the references it may require to implement its behavior.

    exception IllegalState { }

    local interface EntityContext : CCMContext {
        Object get_CCM_object () raises (IllegalState);
        PrimaryKeyBase get_primary_key () raises (IllegalState);
    }

get_CCM_object

The get_CCM_object operation is used to obtain the reference used to invoke the component. For basic components, this will always be the component reference. For extended components, this will be a specific facet reference. If this operation is issued outside of the scope of a callback operation, the IllegalState exception is returned.

get_primary_key

The get_primary_key operation is used by an entity component to access the primary key value declared for this componentÔs home. This operation is equivalent to issuing the same operation on the componentÔs home interface. If this operation is issued outside of the scope of a callback operation, the IllegalState exception is returned.
4.3.4.2 The EntityComponent Interface

The EntityComponent is a callback interface implemented by both process and entity components. It contains operations to manage the persistent state of the component.

Note D As currently defined, any operation request will cause the container to activate the component segment, if required. Since the component reference is well-structured, we could consider the possibility of trapping navigation operations prior to activation and executing them without actually activating the component (or we could leave that to clever implementations).

```java
exception CCMException {CCMExceptionReason reason;};

local interface EntityComponent : EnterpriseComponent {
    void set_entity_context (in EntityContext ctx)
        raises (CCMException);
    void unset_entity_context () raises (CCMException);
    void ccm_activate () raises (CCMException);
    void ccm_load () raises (CCMException);
    void ccm_store () raises (CCMException);
    void ccm_passivate () raises (CCMException);
    void ccm_remove () raises (CCMException);
};

set_entity_context

The set_entity_context operation is used to set the EntityContext of the component. The container calls this operation after a component instance has been created. This operation is called outside the scope of an active transaction. The component may raise the CCMException with the SYSTEM_ERROR minor code to indicate a failure caused by a system level error.

unset_entity_context

The unset_entity_context operation is used to remove the EntityContext of the component. The container calls this operation just before a component instance is destroyed. This operation is called outside the scope of an active transaction. The component may raise the CCMException with the SYSTEM_ERROR minor code to indicate a failure caused by a system level error.

ccm_activate

The ccm_activate operation is called by the container to notify the component that it has been made active. For most CORBA component implementations, no action is required. The component instance should perform any initialization (other than establishing its state) required prior to operation invocation. This operation is called
within an unspecified transaction context. The component may raise the 
CCMException with the SYSTEM_ERROR minor code to indicate a failure caused 
by a system level error.

**ccm_load**

The `ccm_load` operation is called by the container to instruct the component to 
synchronize its state by loading it from its underlying persistent store. When container-
managed persistence is implemented using the CORBA persistent state service, this 
operation can be implemented in generated code. If self-managed persistence is being 
used, the component is responsible for locating its state in a persistent store. This 
operation executes within the scope of the current transaction. The component may 
raise the CCMException with the SYSTEM_ERROR minor code to indicate a 
failure caused by a system level error.

**ccm_store**

The `ccm_store` operation is called by the container to instruct the component to 
synchronize its state by saving it in its underlying persistent store. When container-
managed persistence is implemented using the CORBA persistent state service, this 
operation can be implemented in generated code. If self-managed persistence is being 
used, the component is responsible for saving its state in the persistent store. This 
operation executes within the scope of the current transaction. The component may 
raise the CCMException with the SYSTEM_ERROR minor code to indicate a 
failure caused by a system level error.

**ccm_passivate**

The `ccm_passivate` operation is called by the container to notify the component that 
it has been made inactive. For most CORBA component implementations, no action is 
required. The component instance should perform any termination processing (other 
than saving its state) required prior to being passivated. This operation is called within 
an unspecified transaction context. The component may raise the CCMException 
with the SYSTEM_ERROR minor code to indicate a failure caused by a system level error.

**ccm_remove**

The `ccm_remove` operation is called by the container when the servant is about to be 
destroyed. It informs the component that it is about to be destroyed. This operation is 
always called outside the scope of a transaction. The component raises the 
CCMException with the REMOVE_ERROR minor code if it does not allow the 
destruction of the component. The component may raise the CCMException with the 
SYSTEM_ERROR minor code to indicate a failure caused by a system level error.

*The EntityComponent interface is equivalent to the EntityBean interface 
in Enterprise JavaBeans. Container-managed persistence with the CORBA 
persistent state service supports automatic code generation for ccm_load 
and ccm_store. For self-managed persistence, the component implementor 
provides the ccm_load and ccm_store methods. Since both process and*
entity components have persistent state and container-managed persistence, the same callback interfaces can be used.

4.4 Server Programming Interfaces - Extended Components

This section defines the local interfaces used and provided by the component developer for extended components. These interfaces are grouped as in Section 4.3, ÔServer Programming Interfaces - Basic Components,Ô on page 4-21. Unless otherwise indicated, all of these interfaces are defined within the Components module. Extended components add interfaces in the following areas:

- **CCM2Context** - adds functions unique to extended components.
  
  Each container API type has its own specialization of CCM2Context that we refer to as a context. The context for extended components adds accessors to persistence services and supports operations for managing servant lifetime policy, and creating and managing object references in conjunction with the POA.

- **Componentld** - encapsulates a component identifier, which is an abstract information model used to locate the componentOs state.

  Only the entity container API type supports the Componentld interface.

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**Note D** Removed by the Components December 2000 FTF (see ptc/01-11-02 issue 3937 and ptc/01-11-03 page 62-358).

- **Event** - offers the subset of the CORBA Notification service supported by CORBA components.

4.4.1 Interfaces Common to both Container API Types

This section describes the interfaces and operations provided for extended components by both container API types to support all categories of CORBA components.

4.4.1.1 The CCM2Context Interface

The CCM2Context is an internal interface that extends the CCMContext interface to provide the extended component instance with access to additional container-provided runtime services applicable to both container API types. These services include advanced persistence using the CORBA Persistent State service, and runtime management of component references and servants using the POA. The CCM2Context is defined by the following IDL:

```idl
typedef CosPersistentState::CatalogBase CatalogBase;
typedef CosPersistentState::Typeld Typeld;

exception PolicyMismatch { };
```
exception PersistenceNotAvailable { }

local interface CCM2Context : CCMContext {
    HomeRegistration get_home_registration();
}


EventNotification::Event get_event();
void req_passivate () raises (PolicyMismatch);

CatalogBase get_persistence (in TypelId catalog_type_id)
    raises (PersistenceNotAvailable);
}

get_home_registration

The get_home_registration operation is used to obtain a reference to the HomeRegistration interface. The HomeRegistration is used to register component homes so they may be located by the HomeFinder.

req_passivate

The req_passivate operation is used by the component to inform the container that it wishes to be passivated when its current operation completes. To be valid, the component must have a servant lifetime policy of component or container. If not, the PolicyMismatch exception shall be raised.

get_persistence

The get_persistence operation provides the component access to a persistence framework provided by an implementation of the CORBA Persistence State service. It returns a CosPersistentState::CatalogBase, which serves as an index to the available storage homes. The CatalogBase is identified by its CosPersistentState::TypelId catalog_type_id. If the CatalogBase identified by catalog_type_id is not available on this container, the PersistenceNotAvailable exception shall be raised.

4.4.1.2 The HomeRegistration Interface

The HomeRegistration is an internal interface that may be used by the CORBA component to register its home so it can be located by a HomeFinder.

The HomeRegistration interface allows a component implementation to advertise a home instance that can be used to satisfy a client's find_home request. It may also be used by an administrator to do the same thing. It is likely that the combination of HomeRegistration and HomeFinder interfaces will work within the domain of a single container provider unless multiple implementations use other shareable directory mechanisms (e.g., an LDAP global directory). Federating HomeFinders is a similar problem to federating CORBA security domains and we defer to the security people
for an architecture for such federation rather than attempting to specify
such an architecture in this specification.

The HomeRegistration interface is defined by the following IDL:

```idl
local interface HomeRegistration {
  void register_home ( in CCMHome home_ref,
                      in string home_name);
  void unregister_home (in CCMHome home_ref);
};
```

**register_home**

The `register_home` operation is used to register a component home with the
HomeFinder so it can be located by a component client. The `home_ref` parameter
identifies the home being registered and can be used to obtain both the
`CORBA::ComponentRI::ComponentDef (CCMHome::get_component_def)`
and the `CORBA::InterfaceDef (CORBA::Object::get_interface_def)` to support
both `HomeFinder::find_home_by_component_type` and
`HomeFinder::find_home_by_home_type`. The `home_name` parameter identifies
an Interoperable Naming Service (INS) name that can be used as input to the
`HomeFinder::find_home_by_name` operation. If the `home_name` parameter is
NULL, no name is associated with this home so this home cannot be retrieved by
name.

**unregister_home**

The `unregister_home` operation is used to remove a component home from the
HomeFinder. Once `unregister_home` completes, a client will never be returned a
reference to the home specified as being unregistered. The `home_ref` parameter
identifies the home being unregistered.

### 4.4.1.3 The ProxyHomeRegistration Interface

Because CORBA components exploit the dynamic activation features of the POA, it is
possible for some component types to provide a home that is not collocated with the
component instances it creates. This permits load balancing criteria to be applied in
selecting the actual server and POA where this instance will be created. The
ProxyHomeRegistration is an internal interface, derived from
HomeRegistration, which can be used by the CORBA component to register a
remote home (i.e., one that is not collocated with the component) so it can be returned
by a HomeFinder. The ProxyHomeRegistration interface is defined by the
following IDL:

```idl
exception UnknownActualHome { };
exception ProxyHomeNotSupported { };

local interface ProxyHomeRegistration : HomeRegistration {
  void register_proxy_home (}
```
register_proxy_home

The register_proxy_home operation is used to register a component home, not collocated with the instances that it can create, with the HomeFinder so the proxy home can be used by component clients. The rhome parameter identifies the proxy home being registered. The ahome parameter identifies the actual home that the rhome is associated with. If the actual home specified by ahome is not known, the UnknownActualHome exception shall be raised. If this component does not support proxy homes, the ProxyHomeNotSupported exception shall be raised. Support for proxy homes is a component implementation option.

Note D Removed by the Components December 2000 FTF (see ptc/01-11-02 issue 3937 and ptc/01-11-03).

4.4.1.4 The Event Interface

typedef CosNotification::EventHeader EventHeader;
typtedef CosNotifyChannelAdmin::ChannelId Channel;

exception ChannelUnavailable {};
exception InvalidSubscription {};
exception InvalidName {};
exception InvalidChannel {};

local interface LocalCookie {
    boolean same_as (in LocalCookie cookie);
};
local interface Event {
    EventConsumerBase create_channel
        (out Channel chid)
        raises (ChannelUnavailable);

    LocalCookie subscribe {
        in EventConsumerBase ecb,
        in Channel chid)raises (ChannelUnavailable);

    void unsubscribe (in LocalCookie cookie)
        raises (InvalidSubscription);

    EventConsumerBase obtain_channel {
        in string supp_name,
        in EventHeader hdr)raises (InvalidName);

    void listen (in EventConsumerBase ecb,
        in string csrm_name)raises (InvalidName);

    void push (in EventBase evt);

    void destroy_channel (in Channel chid)raises (InvalidChannel);
};
EJB does not have an event API yet, but one is under development. The Java 2 Platform, Enterprise Edition (J2EE) does however have a messaging API (JMS) that supports publish/subscribe. This is an area that will need to be harmonized with EJB in the future.

4.4.2 Interfaces Supported by the Session Container API Type

This section describes the interfaces supported for extended components by the session container API type. This includes both internal interfaces provided by the container and callback interfaces, which must be implemented by components deployed in this container API type.

4.4.2.1 The Session2Context Interface

The Session2Context is an internal interface that extends the SessionContext to provide a component instance with access to additional container-provided runtime services for the session container API type. It adds the ability to create references for components deployed in a session container API type. The Session2Context is defined by the following IDL:

```idl
enum BadComponentReferenceReason {
    NON_LOCAL_REFERENCE,
    NON_COMPONENT_REFERENCE,
    WRONG_CONTAINER
};

exception BadComponentReference {
    BadComponentReferenceReason reason;
};
exception IllegalState {
}

local interface Session2Context : SessionContext, CCM2Context {
    Object create_ref (in CORBA::RepositoryId repid);
    Object create_ref_from_oid (in PortableServer::ObjectId oid,
                                in CORBA::OctetSeq oid,
                                in CORBA::RepositoryId repid);
    PortableServer::ObjectId CORBA::OctetSeq get_oid_from_ref (in Object objref)
                              raises (IllegalState, BadComponentReference);
};

create_ref
```

The `create_ref` operation is used to create a reference to be exported to clients to invoke operations. The `repid` parameter identifies the `RepositoryId` associated with the interface for which a reference is being created. Invocations on the new object
reference are delivered to the appropriate segment of the component that invokes this operation. The RepositoryId must match the RepositoryId of the component itself, one of its bases, one of its supported interfaces, or one of its facets.

create_ref_from_oid

The create_ref_from_oid operation is used to create a reference to be exported to clients that includes information provided by the component which it can use on subsequent operation requests. The oid parameter identifies the ObjectSeq to be encapsulated in the reference and the report parameter identifies the RepositoryId associated with the interface for which a reference is being created.

get_oid_from_ref

The get_oid_from_ref operation is used by the component to extract the oid encapsulated in the reference. The objref parameter specifies the reference that contains the oid. This operation must be called within an operation invocation. If not, the IllegalStateException exception shall be raised. If the reference was not created by this container, the BadComponentReference with the WRONG_CONTAINER minor code is raised.

4.4.3 Interfaces Supported by the Entity Container API Type

This section describes the interfaces provided for extended components by the entity container API type. This includes both internal interfaces provided by the container and callback interfaces, which must be implemented by components deployed in this container API type.

4.4.3.1 Component Identifiers

The ComponentId interface is an internal interface provided by the entity container API type through which the component implementation and the container exchange identity information, referred to as component identifiers. The ComponentId interface encapsulates a component identifier, which is an abstract information model. The ComponentId interface is used in the following ways:

- Component implementations (usually home executor implementations) create component identifiers to describe new components, and to create object references that encapsulate the provided description. The Entity2Context interface acts as a factory for component identifiers and as the factory for object references.

- The container encodes the information encapsulated by the component identifier in the object identifier value it uses internally to create the object reference on the encapsulated POA. The encoding is not specified, since a container's choice of encoding does not affect interoperability or portability.

- While dispatching an incoming request, the container extracts and decodes the component identifier from the Objectid. The extracted component identifier is made available to the component executor through the context before the request is dispatched to the component.
When the container invokes `ccm_load` in the component executor, the implementation of `ccm_load` uses the contents of the component identifier to locate and incarnate the required component state.

In the following discussions, component identifiers and component object references are sometimes used as though the terms were synonymous. Since there is a one-to-one relationship between a component identifier and an object reference created from the component identifier, this discussion occasionally uses the term `component reference` to mean `the component reference created from the component identifier in question`, for the sake of brevity.

The `ComponentId` interface does not explicitly specify the state representation it encapsulates. The abstract state is implied by the interface and reflects the structure of the executor it describes (see the CCM Implementation Framework chapter for a complete discussion of executor structure).

A component identifier encapsulates the following information:

- A `facet identifier` value denoting the target facet of the component reference.
- A `segment identifier` value denoting the target segment of the component reference (i.e., the segment that supports the target facet).
- A sequence of `segment descriptors`.

A segment descriptor includes the following:

- A segment identifier denotes the segment being described, and
- A `state identifier` value that denotes the persistent state of the segment in some storage mechanism.

A monolithic executor is represented as a degenerate case of the generalized component identifier, where the target segment identifier is set to zero and the sequence of segment descriptors contains a single element, whose segment identifier is zero and whose state identifier denotes the persistent state of the component's single segment.

The facet identifier value zero is reserved to denote the component facet; that is, the facet that supports the component equivalent interface. The segment identifier value zero is reserved to denote the segment that supports the component facet. For monolithic executors, the segment identifier values is always zero.

State identifier is an abstraction that generalizes a variety of possible state identity schemes. This specification provides a mechanism for describing state identifiers that can be extended by component implementors, allowing customization for storage mechanisms that do not support the standard persistence interfaces.

The `ComponentId` local interface and supporting constructs are defined by the following IDL:

```idl
typedef short SegmentId;
const SegmentId COMPONENT_SEGMENT = 0;

typedef short FacetId;
const FacetId COMPONENT_FACET = 0;
```
typedef sequence<octet> IdData;
typedef CosPersistentState::Pid PersistentId;

extception InvalidStateIdData {};

typedef short StatIdType;
const StatIdType PERSISTENT_ID = 0;

abstract valuetyple StatIdValue {
    StatIdType get_sid_type();
    IdData get_sid_data();
};

local interface StatIdFactory {
    StatIdValue create (in IdData data) raises (InvalidStateIdData);
};

valuetyple PersistentIdValue : StatIdValue {
    private PersistentId pid;
    PersistentId get_pid();
    factory init (in PersistentId pid);
};

valuetyple SegmentDescr {
    private StatIdValue sid;
    private SegmentId seg;
    StatIdValue get_sid();
    SegmentId get_seg_id();
    factory init (in StatIdValue sid, in SegmentId seg);
};

typedef sequence<SegmentDescr> SegmentDescrSeq;

local interface ComponentId {
    FacetId get_target_facet();
    SegmentId get_target_segment();
    StatIdValue get_target_state_id (in StatIdFactory sid_factory)
        raises (InvalidStateIdData);
    StatIdValue get_segment_state_id (in SegmentId seg,
        in StatIdFactory sid_factory)
        raises (InvalidStateIdData);
    ComponentId create_with_new_target (in FacetId new_target_facet,
        in SegmentId new_target_segment);
    SegmentDescrSeq get_segment_descrs (in StatIdFactory sid_factory)
        raises (InvalidStateIdData);
};
4.4.3.2 StateIdValue abstract valuetype

The StateIdValue type is the base valuetype for concrete, storage-specific state identity values. The container interacts with state identities completely in terms of this interface. A single pre-defined concrete value type derived from StateIdValue is provided for PersistentId state identities. Component implementors, or suppliers of storage mechanisms that do not support the CORBA component persistence model can provide their own state identity types by deriving from StateIdValue and implementing the required behaviors properly.

get_sid_type

The get_sid_type operation returns a discriminator (physically, a short) that identifies the type of the state identity encapsulated by the StateIdValue. This specification defines the value zero (0) to denote a Components::Extended::PersistentId state identifier.

get_sid_data

The get_sid_data operation returns the encapsulated state identity expressed in a canonical form, as a sequence of octets. The implementation of the derived concrete value type is responsible for converting its encapsulated data into this form, and for supplying a factory that can construct an instance of the concrete type from an IdData value (a sequence of octets).

4.4.3.3 StateIdFactory Interface

StateIdFactory is the abstract base interface for factories of state identity values derived from StateIdValue. An implementation of StateIdFactory must be supplied with the implementation of a concrete state identity type. If the IdData octet sequence provided in the data parameter cannot be decoded to create a proper instance of the expected state identity concrete type, the operation raises an InvalidStateIdData exception.

create

The create operation constructs an instance of a concrete state identifier from the octet sequence parameter. This operation performs the inverse of the transformation performed by the get_sid_data.

4.4.3.4 PersistentIdValue valuetype

The PersistentIdValue type is a specialization of StateIdValue that encapsulates a PersistentId value for inclusion in a component identifier.

get_pid

The get_pid operation returns the PersistentId value encapsulated by the value type.
**init**

The initializer for `PersistentIdValue` creates an instance of the valuetype that encapsulates the `PersistentId` value passed as a parameter.

**get_sid_value**

The implementation of `get_sid_value` for `PersistentIdValue` performs no transformation on the encapsulated `PersistentId` value. The sequence of octets returned by `get_sid_value` is identical to the encapsulated `PersistentId` value.

4.4.3.5 **SegmentDescr valuetype**

The `SegmentDescr` type describes an executor segment, encapsulating a segment identifier and a state identifier. A component identifier for a segmented executor encapsulates a sequence of `SegmentDescr` instances.

**get_sid**

The `get_sid` operation returns the state identity value of the segment being described.

**get_seg_id**

The `get_seg_id` operation returns the segment identifier of the segment being described.

**init**

This initializer sets the value of the encapsulated segment identifier and state identifier to the values of the respective parameters.

4.4.3.6 **ComponentId Interface**

The `ComponentId` interface encapsulates a complete component identity. Instances of `ComponentId` can only be created by the `Entity2Context` interface, which is supplied by the container, or by duplicating an existing component identifier with a new target value, with `ComponentId::create_with_new_target`. Instances of `ComponentId` are also provided by the `EntityContext` interface in the context of a CORBA invocation. The value of the component identifier provided by the `Entity2Context` shall be identical to the component identifier value used to create the object reference on which the invocation was made. The `ComponentId` interface is a read-only interface. Once a component identifier is constructed by the `create_component_id` operation or constructed internally and provided through the `Entity2Context` interface, the value of the component identifier cannot be altered.
get_target_facet

The get_target_facet operation returns the facet identifier of the facet, which is the target of the component reference; that is, the target of requests made on the component reference.

get_target_segment

The get_target_segment operation returns the segment identifier of the target segment; that is, the segments that provides the target facet.

get_target_state_id

The get_target_state_id operation returns the state identifier of the target segment. The StateIdFactory specified in the sid_factory parameter is used by the implementation of get_target_state_id to construct the proper state identifier from the octet sequence encapsulated by the component identifier. If the state identifier of the target segment is a PersistentIdValue, the sid_factory parameter may be nil. Container implementations shall provide a default implementation of StateIdFactory to be used when the encapsulated state identifier value is a PersistentIdValue. If provided (or default) factory cannot construct a correct state identifier of the expected type from the undecoded octet sequence encapsulated by the component identifier, the operation raises an InvalidStateIdData exception.

get_segment_state_id

The get_segment_state_id operation returns the state identifier of the segment specified by the seg parameter. The semantics are otherwise identical to get_target_state_id, with respect to the meaning and use of the sid_factory parameter.

get_segment_descrs

The get_segment_descrs operation returns a sequence containing all of the segment descriptors encapsulated by the component identifier. The sequence is a copy of the encapsulated sequence. The state identifier factory in the sid_factory parameter (or the default) is used by the implementation of get_segment_descrs to construct state identifiers of the appropriate concrete subtype of StateIdValue. If provided (or default) factory cannot construct a correct state identifier of the expected type from the undecoded octet sequence encapsulated by the component identifier, the operation raises an InvalidStateIdData exception.

create_with_new_target

The create_with_new_target operation creates a new component identifier that is identical to the target component identifier, except that the target facet and target segment values are replaced with the values of the new_target_facet and new_target_segment parameters, respectively.

This operation is intended primarily to be used in implementing navigation.
4.4.3.7 The Entity2Context Interface

The Entity2Context is an internal interface that extends the EntityContext interface to provide the extended component with access to additional container-provided runtime services for managing object references and advanced persistence. Object references for components deployed in an entity container API type can choose to use the CORBA Persistent State service or some user defined persistence mechanism. The ComponentId interface (defined in Section 4.4.3.6, ComponentId Interface, page 4-42) encapsulates this distinction when a reference is to be used. The Entity2Context is defined by the following IDL.

```idl
exception BadComponentReference {
    BadComponentReferenceReason reason; }
exception IllegalState { }

local interface Entity2Context : EntityContext, CCM2Context {
    ComponentId get_component_id ()
        raises (IllegalState);
    ComponentId create_component_id (  
        in FacetId target_facet,
        in SegmentId target_segment,
        in SegmentDescrSeq seq_descrs);
    ComponentId create_monolithic_component_id (  
        in FacetId target_facet,
        in StateIdValue sid);
    Object create_ref_from_cid (  
        in CORBA::RepositoryIdId rapid,
        in ComponentId cid);
    ComponentId get_cid_from_ref (  
        in Object objref) raises (BadComponentReference);
}
```

**get_component_id**

The get_component_id operation is used to obtain a reference to the ComponentId interface. The ComponentId interface encapsulates a persistence identifier that can be used to access the component's persistence state. If this operation is issued outside of the scope of a callback operation, the IllegalState exception is returned.

**create_component_id**

The create_component_id operation creates a component identifier value, initializing it with the values specified in the parameters. The target_facet parameter contains the facet identifier of the target facet, the target_segment parameter contains the segment identifier of the target segment, and the seq_descrs parameter contains a sequence of segment descriptors describing all of the segments that constitute the component executor.
create_monolithic_component_id

The create_monolithic_component_id operation provides a simplified signature for creating a component identifier value for monolithic executors, which have a single segment. The target_facet parameter contains the facet identifier of the target facet, and the sid parameter contains the state identifier for the single executor segment. The target segment identifier encapsulated by the component identifier is set to zero, and the sequence of segment descriptors encapsulated by the component identifier has a single element, initialized with segment identifier value zero, and state identifier value specified by the sid parameter.

create_ref_from_cid

The create_ref_from_cid operation is used by a component factory to create an object reference that can be exported to clients. The cid parameter specifies the ComponentId value to be placed in the object reference and made available (using the get_component_id operation on the context) when the EntityComponent callback operations are invoked. The rapid parameter identifies the RepositoryId associated with the interface for which a reference is being created.

get_cid_from_ref

The get_cid_from_ref operation is used by a persistent component to retrieve the ComponentId encapsulated in the reference (objref). The ComponentId interface supports operations to locate the state in some persistent store. The BadComponentReference exception can be raised if the input reference is not local (NON_LOCAL_REFERENCE), not a component reference (NON_COMPONENT_REFERENCE), or created by some other container (WRONG_CONTAINER).

The ComponentId structure is dependent on the home implementation and the container, in particular, its implementation of the Entity2Context interface. It is likely that a ComponentId created by one container will not be understandable by another; hence the possibility of the WRONG_CONTAINER exception.

4.5 The Client Programming Model

This section describes the architecture of the component programming model as seen by the client programmer. The client programming model as defined by IDL extensions has been described previously (see the Component Model chapter). This section focuses on the use of standard CORBA by the client who wishes to communicate with a CORBA component implemented in a Component Server. It enables a CORBA client, which is not itself a CORBA component, to communicate with a CORBA component.

The client interacts with a CORBA component through two forms of external interfaces - a home interface and one or more application interfaces. Home interfaces support operations that allow the client to obtain references to an application interface which the component implements.
From the client's perspective, the home supports two design patterns - factories for creating new objects and finders for existing objects. These are distinguished by the presence of a primarykey parameter in the home IDL.

- If a primarykey is defined, the home supports both factories and finders and the client may use both.
- If a primarykey is not defined, the home supports only the factory design pattern and the client must create new instances.

Two forms of clients are supported by the CORBA component model:

- Component-aware clients - These clients know they are making requests against a component (as opposed to an ordinary CORBA object) and can therefore avail themselves of unique component function; for example, navigation among multiple interfaces and component type factories.
- Component-unaware clients - These clients do not know that the interface they are making requests against is implemented by a CORBA component so they can only invoke functions supported by an ordinary CORBA object; for example, looking up a name in a Naming or Trader service, searching for a particular type of factory using a factory finder, etc.

### 4.5.1 Component-aware Clients

Clients that are defined using the IDL extensions in the Component Model chapter are referred to as component-aware clients. Such clients can avail themselves of the unique features of CORBA components that are not supported by ordinary CORBA objects. The interaction between these clients and a CORBA component are outlined in the following sections. A component-aware client interacts with a component through one or more CORBA interfaces:

- The equivalent interface implied by the component IDL declaration.
- Zero or more supported interfaces declared on the component specification.
- Zero or more interfaces defined by the provides clauses in the component definition.
- The home interface that supports factory and finder operations.

Furthermore a component-aware client locates those interfaces using the Components::HomeFinder or a naming service. The starting point for client interactions with the component is the resolve_initial_references operation on CORBA::ORB that provides the initial set of object references.

#### 4.5.1.1 Initial References

Initial references for all services used by a component client are obtained using the CORBA::ORB::resolve_initial_references operation. This operation currently supports the following references required by a component client:

- Name Service (ONamespaceServiceO)
Transaction Current (\texttt{TransactionCurrent})

Security Current (\texttt{SecurityCurrent})

Notification Service (\texttt{NotificationService})

Interface Repository (\texttt{InterfaceRepository}) for DII clients

Home Finder (\texttt{ComponentHomeFinder})

The client uses ComponentHomeFinder (defined in Section 1.8, \texttt{Home Finders}, on page 1-42) to obtain a reference to the \texttt{HomeFinder} interface.

\textbf{4.5.1.2 Factory Design Pattern}

For factory operations, the client invokes a \texttt{create} operation on the home. Default create operations are defined for each category of CORBA components for which code can be automatically generated. These operations return an object of type \texttt{CORBA::Component} that must be narrowed to the specific type. Alternatively, the component designer may specify custom factories as part of the \texttt{component} definition to define a type-specific signature for the \texttt{create} operation. Because these operations are defined in IDL, operation names can be chosen by the component designer. All that is required is that the operations return an object of the appropriate type.

A client using the factory design pattern uses the \texttt{HomeFinder} to locate the component factory (\texttt{CCMHome}) by interface type. The \texttt{HomeFinder} returns a type-specific factory reference, which can then be used to create new instances of the component interface. Once created, the client makes operation requests on the reference representing the interface. This is illustrated by the following code fragment:

\begin{verbatim}
// Resolve HomeFinder
org.omg.CORBA.Object objref =
  orb.resolve_initial_references("ComponentHomeFinder");

ComponentHomeFinder ff =
  ComponentHomeFinderHelper.narrow(objref);

org.omg.CORBA.Object of =
  ff.find_home_by_type(AHomeHelper.id());

AHome F = AHomeHelper.narrow (of);
org.omg.Components.ComponentBase AInst = F.create();
A Areal = AHelper.narrow (AInst);

// Invoke Application Operation
answer = A.foo(input);
\end{verbatim}
4.5.1.3 Finder Design Pattern

A component-aware client wishing to use an existing component instance (rather than create a new instance) uses a finder operation. Finders are supported for entity components only. ClientOs may use the HomeFinder as described in Section 1.8, ÔHome Finders,Ô on page 1-42 to locate the componentOs home or they may use CORBA naming to look up a specific instance of the home by symbolic name.

A client using the finder design pattern uses the CosNaming::NamingContext interface to look up a symbolic name. The naming service returns an object reference of the type previously bound. The client then makes operation requests on the reference representing the interface. This is illustrated by the following code fragment:

```java
org.omg.CORBA.Object objref =
    orb.resolve_initial_references("NamingService");

NamingContext ncRef = NamingContextHelper.narrow(objref);

// Resolve the Object Reference in Naming
NameComponent nc = new NameComponent("A",""),
NameComponent path[] = { nc };
A aRef = AHelper.narrow(ncRef.resolve(path));

// Invoke Application Narrow Operation
answer = A.foo(input);
```

4.5.1.4 Transactions

A component-aware client may optionally define the boundaries of the transaction to be used with CORBA components. If so, it uses the CORBA transaction service to ensure that the active transaction is associated with subsequent operations on the CORBA component.

The client obtains a reference to CosTransactions::Current by using the CORBA::ORB::resolve_initial_references operation specifying an ObjectID of OTransactionCurrentO. This permits the client to define the boundaries of the transaction; that is, how many operations will be invoked within the scope of the clientOs transaction. All operations defined for Current may be used as defined by the CORBA Transaction service with the following exceptions:

- The Control object returned by get_control and suspend may only be used with resume.
- Operations on Control may raise the NO_IMPLEMENT exception with CORBA components.

The Control interface in the CORBA transaction service supports accessor to the Coordinator and Terminator interfaces. The Coordinator is used to build object versions of XA resource managers. The Terminator is used to allow a transaction to be ended by someone other than the originator. Since neither function is within the scope of the demarcation subset of CORBA transactions used with CORBA components, we allow CORBA
The following code fragment shows a typical usage:

```java
org.omg.CORBA.Object objref =
orb.resolve_initial_references("TransactionCurrent");

Current txRef = CurrentHelper.narrow(objRef);
txRef.begin();
// Invoke Application Operation
answer = A.foo(input);
txRef.commit();
```

### 4.5.1.5 Security

A component-aware client uses the existing CORBA security mechanism to manage security for a CORBA component. There are two scenarios possible:

- **Use of SSL for establishing client credentials**
  
  CORBA security today does not define a standard API for clients to use with SSL to set the credentials that will be used to authorize subsequent requests. The credentials must be set in a way that is proprietary to the client ORB.

- **Use of SECIOP by the client ORB.**
  
  In this case, CORBA security does define an API and it must be used by the client to establish the credentials to be used to authorize subsequent requests.

Security processing for CORBA components uses a subset of CORBA security. For SECIOP, the client sets the credentials to be used with subsequent operations on the component by using operations on the `SecurityLevel2::PrincipalAuthenticator`. The client obtains a reference to `SecurityLevel2::PrincipalAuthenticator` by using the `CORBA::ORB::resolve_initial_references` operation specifying an `ObjectID` of `SecurityCurrent`. This permits the client to access the `PrincipalAuthenticator` interface to associate security credentials with subsequent operations. The following code fragment shows a typical usage:

```java
org.omg.CORBA.Object objref =
orb.resolve_initial_references("SecurityCurrent");

org.omg.SecurityLevel2.PrincipalAuthenticator secRef =
org.omg.SecurityLevel2.PrincipalAuthenticatorHelper.narrow
(objRef);

secRef.authenticate(...);
// Invoke Application Operation
answer = A.foo(input);
```
4.5.1.6 Events

Component-aware clients wishing to emit or consume events use the component APIs defined in the Component Model chapter. Alternatively, they may use CORBA notification directly and conform to the subset supported by CORBA components (see Section 4.5.2.6, ÒEvents,Ó on page 4-51 for details).

4.5.2 Component-unaware Clients

CORBA components can also be used by clients who are unaware that they are making requests against a component. Such clients can see only a single interface (the supported interface of a component) and do not support navigation.

4.5.2.1 Initial References

Component-unaware clients obtain initial references using existing CORBA mechanisms, viz. CORBA::ORB::resolve_initial_references. It is unlikely, however, that this mechanism would be used to obtain a reference to the HomeFinder.

4.5.2.2 Factory Design Pattern

The factory design pattern can be used by component-unaware clients only if the supported interface has application operations defined. This permits existing CORBA objects to be easily converted to CORBA components, transparently to their existing clients. The following techniques can be used:

- The reference to a factory finder (typically the CosLifeCycle::FactoryFinder) can be stored in the Naming or Trader service and looked up by the client before creating the instance.
- A reference to the home interface can be obtained from the Naming service.
- The reference to the home interface can be obtained from a Trader service.
- After locating a factory finder, the factory can be located using the existing find_factories operation or by using the new find_factory operation on the CosLifeCycle::FactoryFinder interface.

The current CosLifeCycle find_factories operation returns a sequence of factories to the client requiring the client to choose the one which will create the instance. To allow the server (i.e., the FactoryFinder) to make the selection, we also add a new find_factory operation to CosLifeCycle which allows the server to choose the ÒbestÓ factory for the client request based on its knowledge of workload, etc.

A FactoryFinder will return an Object. A component-unaware client may expect to narrow this to CosLifeCycle::GenericFactory and use the generic create operation. For this reason, we allow the default creation operation on home to return a GenericFactory interface. This is fully described in Section 1.7, ÒHomes,Ó on page 1-32.
A stringified object reference can be retrieved from a file known by the component-unaware client.

Once a reference to the home has been obtained, the client can create component instances and make operation requests on the component. Each component exports at least one IDL interface. A supported interface must be used by the client to invoke the component's application operations. Provided interfaces cannot be located using the factory design pattern.

### 4.5.2.3 Finder Design Pattern

A component-unaware client can use CORBA naming to locate an existing entity component. Unlike the factory design pattern, the name to be looked up by the client can be either a supported interface or any of the provided interfaces. The following techniques can be used:

- A symbolic name associated with the component's home can be looked up in a Naming service to make an invocation of the finder operations.
- Alternatively, the reference to the home interface can be obtained from a Trader service.
- The finder operation can be invoked on the entity component to return a reference to the client.

### 4.5.2.4 Transactions

This is the same as component-aware clients (See Section 4.5.1.4, "Transactions," on page 4-48). However, the possibility of the NO_IMPLEMENT exception being raised for operations on Control may have a more serious impact, since the component-unaware client may not be expecting that to happen.

### 4.5.2.5 Security

This is the same as component-aware clients (See Section 4.5.1.5, "Security," on page 4-49).

### 4.5.2.6 Events

Component-unaware clients wishing to emit or consume events must use the equivalent CORBA notification interfaces and stay within the subset supported by CORBA components (see Section 4.2.8, "Events," on page 4-12 for details). This is illustrated by the following code fragment:
org.omg.CORBA.Object objref =
orb.resolve_initial_references("NotificationService");

org.omg.CosNotifyChannelAdmin.EventChannelFactory evfRef =
org.omg.EventChannelFactoryHelper.narrow(objRef);

// Create an Event Channel
org.omg.CosNotifyChannelAdmin.EventChannel evcRef =
evfRef.create_channel(...);

// Obtain a SupplierAdmin
org.omg.CosNotifyChannelAdmin.SupplierAdmin publisher =
evcRef.new_for_suppliers (...);

// And a ConsumerProxy
org.omg.CosNotifyComm.ProxyConsumer proxy =
publisher.obtain_notification_push_consumer (...);

// Publish a structured event
proxy.push_structured_event(...);
Integrating with Enterprise JavaBeans

This chapter describes the integration of CORBA components with Enterprise JavaBeans.

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5.1 Introduction

This chapter describes how an Enterprise JavaBeans (EJB) component can be used by CORBA clients, including CORBA components. The EJB will have a CORBA component style remote interface that is described by CORBA IDL (including the component extensions).
This chapter also describes how a CORBA component can be used by a Java client, including an Enterprise JavaBeans component. The CORBA component will have an EJB style remote interface that is defined following the Enterprise JavaBeans specification.

The concepts in this chapter follow in the same prescription for interworking as laid out in the Common Object Request Broker Architecture (CORBA) specification, Interworking Architecture chapter where it is discussed as follows:

How interworking can be practically achieved is illustrated in an Interworking Model, shown in Figure 5-1. It shows how an object in Object System B can be mapped and represented to a client in Object System A. From now on, this will be called a B/A mapping. For example, mapping a CORBA Component Model object to be visible to an EJB client is a CCM/EJB mapping.

On the left is a client in object system A, that wants to send a request to a target object in system B, on the right. We refer to the entire conceptual entity that provides the mapping as a bridge. The goal is to map and deliver any request from the client transparently to the target.

To do so, we first provide an object in system A called a View. The View is an object in system A that presents the identity and interface of the target in system B mapped to the vernacular of system A, and is described as an A View of a B target. The View exposes an interface, called the View Interface, which is isomorphic to the target’s interface in system B. The methods of the View Interface convert requests from system A clients into requests on the target’s interface in system B. The View is a component of the bridge. A bridge may be composed of many Views.

The bridge maps interface and identify forms between different object systems. Conceptually, the bridge holds a reference in B for the target (although this is not physically required). The bridge must provide a point of rendezvous between A and B,
and may be implemented using any mechanism that permits communication between the two systems (IPC, RPC, network, shared memory, and so forth) sufficient to preserve all relevant object semantics.

The client treats the View as though it is the real object in system A, and makes the request in the vernacular request form of system A. The request is translated into the vernacular of object system B, and delivered to the target object. The net effect is that a request made on an interface in A is transparently delivered to the intended instance in B.

The Interworking Model works in either direction. For example, if system A is EJB, and system B is CCM, then the View is called the EJB View of the CCM target. The EJB View presents the targetOs interface to the EJB client. Similarly if system A is CCM and system B is EJB, then the View is called the CCM View of the EJB target. The CCM View presents the targetOs interface to the CCM client.

5.2 Enterprise JavaBeans Compatibility Objectives and Requirements

The objective is to allow the creation of distributed applications that mix CORBA components running in CORBA component servers with EJB components running in an EJB technology-based server. This objective allows a developer to create an application by reusing existing components of either kind.

This requires development time and runtime translations between the CORBA component and EJB domains provided by mediated bridges. It also requires that:

- A CORBA component view for an EJB comply with the EJB to CORBA mapping specification. In particular, this requires that:
  - An EJB definition be mapped to a CORBA component definition following the Java Language to IDL mapping plus the extensions to that mapping that are specified in this chapter.
  - Value objects of one kind (e.g., Keys for EJB) have counterpart value objects of the other kind.
  - CORBA components accessible via CosNaming have their EJB views accessible via JNDI, and vice versa.

- An EJB view for a CORBA component comply with the EJB specification.

An application is to be built using both EJB and CORBA components deployed in their respective containers. At component development time, EJB components are originally defined in Java and CORBA components are originally defined in IDL. When applications are assembled using both, the application assembly environment will most commonly dictate which model these components must present to developers. During application assembly, developers construct clients (which themselves may be components) that make use of components in the way most natural to the particular environment. Thus in a CORBA environment clients will expect to make use of both
the CCM model and the EJB model as CORBA components, and in an EJB environment, clients will expect to make use of both kinds as enterprise beans. All four combinations of clients and components are illustrated in Figure 5-2.

![Diagram](image)

**Figure 5-2** Interoperation in a mixed environment

In this scenario, components of one kind are made accessible to clients of another by way of two mechanisms: generation of bindings at development time and method translation at runtime. Thus, the containers provide an EJB view of a CORBA component and a CCM view of an EJB.

For application developers in a CORBA environment, EJBs specified in Java are mapped to CORBA IDL for use by CCM clients, and at runtime client calls on CCM methods are translated by a bridge into EJB methods. In effect, the EJBs are CORBA components.

For application developers in an EJB environment, CORBA components specified in IDL are mapped to Java interfaces for use by EJB clients, and at runtime client calls on EJB methods are translated by a bridge into CCM methods. In effect, the CORBA components are EJBs.

### 5.3 CORBA Component Views for EJBs

This kind of view allows a CORBA client -- either a CORBA component or any piece of code that uses CORBA, and either component-aware or not -- to access an EJB as a CORBA component. To do this, two things are needed:
1. A mapping of the definition of the existing EJB into the definition of a CORBA component. This mapping takes an EJB’s RMI remote interface and home interface and produces an equivalent CORBA component definition.

2. A translation, at run-time, of CORBA component requests performed by a CORBA client into EJB requests. This translation can be performed in terms of either straight delegation, or as an interpretation of a CORBA client request in terms of EJB requests.

5.3.1 Mapping of EJB to Component IDL definitions

An EJB definition includes the following EJB interfaces:

- EJB home interface - This interface extends the pre-defined EJBHome interface.
- EJB remote interface - This interface extends the pre-defined EJBOBJECT interface.

Thus, for the purposes of this chapter, at least these EJB interfaces must be mapped into IDL in order to obtain a CORBA component definition of a view that a CORBA client can use to make requests on an existing EJB. An EJB home interface definition maps into a CORBA component’s home definition, whose implied IDL inherits from CCMHome. This means that EJBHome is mapped into CCMHome. Likewise, an EJB remote interface definition maps into a basic CORBA component definition, whose implied IDL inherits from CCMObject. This means that EJBOBJECT is mapped into CCMObject.

In addition, EJBHome and EJBOBJECT make use of the following pre-defined EJB interfaces:

- HomeHandle
- Handle
- EJBMetaData

Handles are an EJB concept that has no direct counterpart in CORBA components. Thus, HomeHandle and Handle are not directly mapped into equivalent IDL.

Notice that although Interoperable Object References (IORs) and the ORB provided operations that manipulate them (string_to_object and object_to_string) are conceptually similar to Handles, there are enough differences between IORs and Handles to preclude a mapping from Handles to IORs.

Meta data is available to a CORBA client but not in the same form as that provided by EJBMetaData. Given that an EJB maps into a CORBA component, whose definition produces the meta data that a CORBA client expects, mapping EJBMetaData into equivalent IDL is not required.

5.3.1.1 Java Language to IDL Mapping

The reader is assumed to be familiar with the specification for the Java to IDL mapping, whose major aspects are repeated here for convenience.
A Java interface is an RMI/IDL remote interface if it at least extends `java.rmi.Remote` and all of its methods throw `java.rmi.RemoteException`.

- get- and set- name pattern names are translated to IDL attributes.
- IDL generated methods have only `in` parameters (but these can include object references to remote objects, allowing reference semantics normally obtained by using parameters of type `java.rmi.Remote`).
- Java objects that inherit from `java.io.Serializable` or `java.io.Externalizable` are mapped to a CORBA valuetype. All object types appearing in RMI remotable interfaces must inherit from these interfaces or from `java.rmi.Remote`. EJB Key and Handle types must inherit from `java.io.Serializable`.
  - However, the mapping does NOT require that methods on such objects or constructors be mapped to corresponding IDL operations on `valuetypes` and `init` specifications. The developer is expected to select those methods that should be mapped to IDL operations, and the method signatures must meet the requirements of the mapping.
- Objects that inherit from `java.io.Externalizable` or that implement `writeObject` are understood to perform custom marshalling and the corresponding custom marshellers must be created for the CORBA valuetype.
- Arrays are mapped to ÒboxedÓ CORBA `valuetypes` containing sequences because Java arrays are dynamic.
- Java exceptions are subclassable; IDL exceptions are not. Consequently a name pattern is used to map to IDL exceptions. The Java exception object is mapped to a CORBA valuetype. The CORBA valuetype has an inheritance hierarchy like that of the corresponding Java exception object.
- Some additional programming is required to define Java classes (including EJB implementations) that are accessible via RMI/IIOP. This is to account for the fact that IIOP does not support distributed garbage collection.

### 5.3.1.2 EJB to IDL mapping

In general, the CORBA component that results from mapping an EJB will support an interface that is the Java to IDL map of the Remote interface of the EJB. The mapping rules are as follows.

**Mapping the Remote Interface**

- An EJB’s remote interface maps to a definition of a basic CORBA component that supports the default interface. The form of the CORBA component definition is `component XXX supports XXXDefault`.
- An EJB’s remote interface declaration is used to create a `supports` declaration and the corresponding IDL for the primary interface of the CORBA component that the EJB maps to. The identifier of this supported interface on the component is...
XXXDefault, where XXX is the name of the EJB remote interface. This generated interface is referred to as the Default interface of the component that the given EJB maps to.

Each operation on the Remote interface is mapped under Java to IDL to an equivalent operation on the XXXDefault interface.

Each pair of getXXX and setXXX methods in the EJB remote interface will be mapped to IDL attributes in the component definition itself. Any exceptions thrown by a getXXX method is mapped to an exception in the getraises clause of the mapped IDL attribute. Likewise, any exception thrown by a setXXX method is mapped to an exception in the setraises clause of the mapped IDL attribute. The actual definitions of the exceptions thrown are mapped following the Java to IDL rules.

Mapping the Home Interface

An EJBÖs home interface maps to a definition of a CORBA component home. The form of the CORBA component home definition is home YYY manages XXX, where YYY is the name of the EJB home interface. Mapping an EJB home into a CORBA component home requires the existence of meta data that links the EJB home to the EJB that it hosts. These meta data are obtained from the EJBÖs deployment descriptor. Thus XXX is the name of the EJB that the EJB home hosts, as it is given in the EJB deployment descriptor.

The EJB home methods called create are mapped into home factory declarations in IDL. The actual names of each of the factory operations are produced following the rules for mapping Java names to IDL names in the Java to IDL specification. The Java parameters of the operation are mapped to their corresponding IDL types and names as defined by Java to IDL.

An EJB Primary Key class is mapped to a CORBA valuetype using the mapping rules in Java to IDL. This valuetype will be declared in the IDL for the CORBA component home as the primary key valuetype for the component. The key valuetype will inherit from Components::PrimaryKeyBase. If an EJB home uses a primary key, then the form of the CORBA component home definition is home YYY manages XXX primarykey KKK, where KKK is the name of the valuetype that the EJB primary key class maps to.

The EJB home operation named findByPrimaryKey is mapped into the find_by_primary_key( in <key-type> key ) operation on the componentÖs implicit home interface.

Finder and Creator EJB operations that return an RMI style object reference are mapped into Component IDL operations that return a CORBA Component Object Reference to XXX.

EJB home operations prefixed find whose return type is the type of the EJB hosted by the EJB home are mapped into component home finder operations in IDL. The actual names of each of the finder operations are produced following the rules for mapping Java names to IDL names in the Java to IDL specification. The Java parameters of the operation are mapped to their corresponding IDL types and names as defined by Java to IDL.
Finder EJB operations that return a Java Enumeration are mapped into CORBA component operations that return a value of type `Enumeration`. This value type is declared as:

```java
module Components {
    abstract valuetype Enumeration {
        boolean has_more_elements();
        CCMObject next_element();
    };
}
```

*The Enumeration interface is just the RMI/IIOP image of the Java Enumeration class as defined in the JDK 1.1.6+. Sun has said that they intend to replace this with the JDK 1.2 (Java 2.0) Collections in a future version of the EJB specification. Subsequent to such a specification being issued, the CORBA components specification will be updated to correspond.*

A concrete specialization of this abstract value type must be provided. This specialization has the form:

```java
module Components {
    typedef sequence<CCMObject> CCMObjectSeq;
    valuetype DefaultEnumeration : Enumeration {
        private CCMObjectSeq objects;
    };
}
```

Any implementation of `DefaultEnumeration`, in any language, must provide implementations for the two `Enumeration` methods. Any client ORB that supports the interoperable bridge has to provide an implementation that knows how to read `DefaultEnumeration` from the wire and to use that information to provide a local implementation of these two methods. Any EJB container that supports the CCM-EJB bridge has to provide an implementation that knows how to construct itself from a `java.util Enumeration` and then write itself to the wire as a `DefaultEnumeration`.

In order for an EJB home definition that defines `findByPrimaryKey` to be successfully mapped onto a CORBA component home definition, it must define a `create` method that takes the primary key of the hosted EJB as its sole argument and returns an instance of the hosted EJB. This create method is mapped to `create( in <key-type> key )` on the CORBA component implicit home interface.

**Mapping standard exceptions**

The EJB exceptions `FinderException`, `CreateException`, `DuplicateKeyException`, and `RemoveException` thrown by methods to find, create, and remove an EJB are always mapped to the CCM exceptions `Components::FinderFailure`, `Components::CreateFailure`, `Components::DuplicateKeyValue` and `Components::RemoveFailure`, respectively.
### 5.3.2 Translation of CORBA Component requests into EJB requests

A CORBA client that uses a CORBA component view on an EJB expects to be able to perform CORBA component requests on such a view. These requests need to be translated into EJB requests at run-time. This translation can be performed at the client-side, server-side, or a combination of the two. Table 5-1 lists the CORBA component operations that a CORBA client can perform requests on by interface, and it lists the corresponding EJB methods that these requests translate into, also by interface.

#### Table 5-1 Translation of CCM operation requests into EJB method requests

<table>
<thead>
<tr>
<th>CCM Interface</th>
<th>Operation called by client</th>
<th>EJB interface</th>
<th>Method invoked by bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCMHome</td>
<td>ComponentDef get_component_def ();</td>
<td>EJBHome</td>
<td>EJBMetaData getEJBMetaData () throws RemoteException;</td>
</tr>
<tr>
<td></td>
<td>CORBA::IObject get_home_def ();</td>
<td></td>
<td>EJBMetaData getEJBMetaData() throws RemoteException;</td>
</tr>
<tr>
<td></td>
<td>void remove_component ( in CCMObject comp ) raises (RemoveFailure);</td>
<td></td>
<td>void remove ( Handle handle ) throws RemoveException, RemoteException;</td>
</tr>
<tr>
<td>&lt;home-name&gt;Explicit</td>
<td>&lt;name&gt; createXXX ( &lt;arg-list&gt; ) raises (CreateFailure, DuplicateKeyValue, InvalidKey);</td>
<td>&lt;home-name&gt;</td>
<td>&lt;name&gt; create ( &lt;arg-list&gt; ) throws CreateException, DuplicateKeyException;</td>
</tr>
<tr>
<td></td>
<td>&lt;name&gt; findXXX ( &lt;arg-list&gt; ) raises (FinderFailure, &lt;exceptions&gt;);</td>
<td></td>
<td>&lt;name&gt; findXXX ( &lt;arg-list&gt; ) throws &lt;exceptions&gt;;</td>
</tr>
<tr>
<td>&lt;home-name&gt;Implicit</td>
<td>&lt;name&gt; create ( in &lt;key-type&gt; key ) raises (CreateFailure, DuplicateKeyValue, InvalidKey);</td>
<td>&lt;name&gt; create ( Object primaryKey ) throws CreateException, DuplicateKeyException;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;name&gt; find_by_primary_key ( in &lt;key-type&gt; key ) raises (FinderFailure, UnknownKeyValue, InvalidKey);</td>
<td></td>
<td>&lt;name&gt; findByPrimaryKey ( &lt;key-type&gt; key ) throws FinderException, ObjectNotFoundException;</td>
</tr>
<tr>
<td></td>
<td>void remove ( in &lt;key-type&gt; key ) raises (RemoveFailure, UnknownKeyValue, InvalidKey);</td>
<td>EJBHome</td>
<td>void remove ( Object primaryKey ) throws RemoveException, RemoteException;</td>
</tr>
<tr>
<td></td>
<td>&lt;key_type&gt; get_primary_key ( in &lt;name&gt; comp );</td>
<td>EJBObject</td>
<td>Object getPrimaryKey () throws RemoteException;</td>
</tr>
<tr>
<td>CCMObject</td>
<td>ComponentDef get_component_def ();</td>
<td>EJBHome</td>
<td>EJBMetaData getEJBMetaData () throws RemoteException;</td>
</tr>
<tr>
<td></td>
<td>CCMHome get_ccm_home ();</td>
<td>EJBObject</td>
<td>EJBHome getEJBHome() throws RemoteException;</td>
</tr>
</tbody>
</table>
Notice that a CORBA client may use operations on object references such as `string_to_object` and `object_to_string` that may be considered as analogous to EJB `Handle` methods. However, these operations are not seen by the bridge since they are performed on the ORB and thus no translation for these operations on the part of the bridge is required.

The following restrictions apply:

- **create (in `<key_type>` key)** on the component implicit home interface can only be validly invoked by a CORBA client if the underlying EJB home declares the `findByPrimaryKey` operation.
- **remove (in `<key_type>` key)** on the component implicit home interface can only be validly invoked by a CORBA client if the underlying EJB home declares the `findByPrimaryKey` operation.
- **get_primary_key** on the component implicit home and on `CCMObject` can only be validly invoked by a CORBA client if the underlying EJB home declares the `findByPrimaryKey` operation.
- **configuration_complete** on `CCMObject` is not translated by the bridge, a request on this operation by a CORBA client raises the `NO_IMPLEMENT` exception.

### 5.3.3 Interoperability of the View

As stated in Section 5.3.2, ÔTranslation of CORBA Component requests into EJB requestsÔ on page 5-9, translation of CORBA Component requests into EJB requests can happen at either the client-side, the server-side, or a combination of the two.
However, in order to provide interoperability of implementations of CORBA component views of EJBs, a minimal number of translation points must be performed and they must be performed at an explicitly defined location: either the client-side or the server-side. For the implementation of a CORBA component view of an EJB, and for an EJB home interface, the translation points are as follows.

**Translation of specific method names**

The following methods shall translate their names as indicated.

*Table 5-2  Translation of specific method names*

<table>
<thead>
<tr>
<th>CCM Interface</th>
<th>Method name</th>
<th>EJB Interface</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCMHome</td>
<td>get_component_def</td>
<td>EJBHome</td>
<td>getEJBMetaData</td>
</tr>
<tr>
<td></td>
<td>remove_component</td>
<td></td>
<td>remove</td>
</tr>
<tr>
<td>&lt;name&gt;Implicit</td>
<td>find_by_primary_key</td>
<td>&lt;name&gt;</td>
<td>findByPrimaryKey</td>
</tr>
<tr>
<td></td>
<td>remove</td>
<td></td>
<td>remove__java_lang_Object</td>
</tr>
<tr>
<td></td>
<td>create</td>
<td></td>
<td>create__java_lang_Object</td>
</tr>
<tr>
<td></td>
<td>get_primary_key</td>
<td>EJBObject</td>
<td>getPrimaryKey</td>
</tr>
<tr>
<td>CCMObject</td>
<td>get_ccm_home</td>
<td>EJBObject</td>
<td>getEJBHome</td>
</tr>
<tr>
<td></td>
<td>get_primary_key</td>
<td></td>
<td>getPrimaryKey</td>
</tr>
</tbody>
</table>

**Handling of standard exceptions**

The following exceptions, caught by the indicated methods, shall be translated as indicated before raising them to their CORBA clients.

*Table 5-3  Handling of standard exceptions*

<table>
<thead>
<tr>
<th>CCM Interface</th>
<th>Method name</th>
<th>Exception caught</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCMHome</td>
<td>get_component_def</td>
<td>RemoteException</td>
<td>CORBA::UNKNOWN</td>
</tr>
<tr>
<td></td>
<td>remove_component</td>
<td>RemoveException</td>
<td>Components::RemoveFailure CORBA::UNKNOWN</td>
</tr>
<tr>
<td>&lt;name&gt;Implicit</td>
<td>create</td>
<td>DuplicateKeyException CreateException</td>
<td>Components::DuplicateKeyValue Components::CreateFailure</td>
</tr>
<tr>
<td></td>
<td>find_by_primary_key</td>
<td>ObjectNotFoundException FinderException</td>
<td>Components::UnknownKeyValue Components::FinderFailure</td>
</tr>
<tr>
<td></td>
<td>remove</td>
<td>RemoveException</td>
<td>Components::RemoveFailure CORBA::UNKNOWN</td>
</tr>
<tr>
<td></td>
<td>get_primary_key</td>
<td>RemoteException</td>
<td>CORBA::UNKNOWN</td>
</tr>
<tr>
<td>CCMObject</td>
<td>get_ccm_home</td>
<td>RemoteException</td>
<td>CORBA::UNKNOWN</td>
</tr>
<tr>
<td></td>
<td>get_primary_key</td>
<td>RemoteException</td>
<td>CORBA::UNKNOWN</td>
</tr>
</tbody>
</table>
### Handling of standard exceptions

<table>
<thead>
<tr>
<th>CCM Interface</th>
<th>Method name</th>
<th>Exception caught</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>remove</td>
<td>RemoveException</td>
<td>Components::RemoveFailure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RemoteException</td>
<td>CORBA::UNKNOWN</td>
</tr>
</tbody>
</table>

Note: `RemoteException` is translated into `CORBA::UNKNOWN` system exception according to rules defined in formal/01-06-07, section 1.4.7.

### Handling of a primary key parameter

The methods `create`, `find_by_primary_key` and `remove`, defined by `<home>Implicit` shall translate the primary key value they get as input parameter to a `CORBA::Any` equivalent. Likewise, the method `get_primary_key` defined by `<home>Implicit` shall translate the `CORBA::Any` value of the primary key it gets as a result from its request into an equivalent primary key value type before returning it.

The method `get_primary_key`, defined by `CCMObject`, shall translate the `CORBA::Any` value of the primary key it gets as a result from its request into an equivalent `Components::PrimaryKeyBase` value type before returning it.

### 5.3.4 CORBA Component view Example

In this section we show a simple EJB together with the corresponding Component IDL. Note that the EJB deployment metadata is needed to generate the IDL; this is because the metadata binds together the Remote interface and the Home interface.

Below are the remote interfaces of the EJB.

```java
package example;

class CustInfo implements java.io.Serializable
{
    public int custNo;
    public String custName;
    public String custAddr;
};

class CustBal implements java.io.Serializable
{
    public int custNo;
    public float acctBal;
};
```
interface CustomerInquiry extends javax.ejb.EJBObject
{
    CustInfo get CustInfo(int iCustNo)
        throws java.rmi.RemoteException;
    CustBal get CustBal(int iCustNo)
        throws java.rmi.RemoteException;
};

interface CustomerInquiryHome extends javax.ejb.EJBHome
{
    CustomerInquiry create()
        throws java.rmi.RemoteException;
};

Below are the contents of the descriptor classes as they might be expressed in an equivalent XML document.

<ejb-jar>
  <session>
    <description/>
    <ejb-name> CustomerInquiry </ejb-name>
    <home> example.CustomerInquiryHome </home>
    <remote> example.CustomerInquiry </remote>
    <ejb-class> example.CustomerInquiryBean </ejb-class>
    <session-type> Stateful </session-type>
  </session>
</ejb-jar>

The EJB is a session bean, and in this case, its `create` operation requires no parameters. The two operations take a key value and return values to the caller. The EJB implementation will use JDBC to retrieve the information to be returned by the operations on the `CustomerInquiry` EJB.

The serializable value classes are translated by RMI/IIOP into CORBA concrete `valuetypes` as follows:

valuetype CustInfo {
    public long custNo;
    public ::CORBA::WStringValue custName;
    public ::CORBA::WStringValue custAddr;
};

valuetype CustBal {
    public long custNo;
    public float custBal;
};
The information in the deployment descriptor and the home and remote interface declarations is introspected and used to generate the following IDL:

```idl
interface CustomerInquiryDefault {
    CustInfo getCustInfo(in long iCustNo);
    CustBal getCustBal(in long iCustNo);
};

component CustomerInquiry supports CustomerInquiryDefault {};

home CustomerInquiryHome manages CustomerInquiry {
    factory create();
};
```

### 5.4 EJB Views for CORBA Components

This kind of view allows a Java client -- either an EJB or any other piece of Java code -- to access a CORBA component as an EJB. To do this, two things are needed:

- A mapping of the Component IDL definition of a CORBA component into an EJB definition. This mapping only considers that portion of the Component IDL language that has a counterpart in the EJB specification language and it ignores the rest. Notice that ÒThe home and remote interfaces of the enterprise bean's client view are defined as Java RMI interfaces. This allows the Container to implement the home and remote interfaces as distributed objects.Ó One implication of this is that the signatures on methods on an EJB's remote interface can only include parameters with in semantics. That is, out and inout semantics for parameters is not allowed. As a consequence, the out and inout qualifiers for parameters in IDL interface method definitions are not included in the portion of Component IDL that can be mapped to an EJB definition.

Note however that a Java client does not have to use an EJB view in order to access a CCM. Any Java client can access a CCM directly via its IDL interface using a standard Java ORB, such as the one built into the JDK. This provides full access to all aspects of the CCM. Since the EJB view is derived using the IDL to Java mapping rules, the Java IDL interface is identical to the EJB view for all business operations. The only differences are in the operations mentioned in Table 5-4 on page 5-18 have slightly different names and signatures.

- A translation, at run-time, of EJB requests performed by a Java client into CORBA component requests.

#### 5.4.1 Mapping of Component IDL to Enterprise JavaBeans Specifications

The portion of the Component extensions to the IDL language that can be mapped to the EJB specification language is denoted by the following subset of the Component extensions to IDL grammar:

```idl
<component_dcl> ::= <component_header> O(Ô <component_body> Ô)Ô
```
<component_header> ::= ÖcomponentÖ <identifier> [ 
    <supported_interface_spec> ]

<supported_interface_spec> ::= ÖsupportsÖ <scoped_name> { Ö,Ö 
    <scoped_name> }*

<component_body> ::= <component_export>*

<component_export> ::= <attr_dcl> Ö;Ö

<attr_dcl> ::= <readonly_attr_spec> | <attr_spec>

<readonly_attr_spec> ::= ÖreadonlyÖ ÖattributeÖ <param_type_spec> 
    <readonly_attr_declarator>

<readonly_attr_declarator> ::= <simple_declarator> <raises_expr> | 
    <simple_declarator> { Ö,Ö <simple_declarator> }*

<attr_spec> ::= ÖattributeÖ <param_type_spec> <attr_declarator>

<attr_declarator> ::= <simple_declarator> <attr_raises_expr> | 
    <simple_declarator> { Ö,Ö <simple_declarator> }*

<attr_raises_expr> ::= <get_excep_expr> [ <set_excep_expr> ] | 
    <set_excep_expr>

<get_excep_expr> ::= ÖgetraisesÖ <exception_list>

<set_excep_expr> ::= ÖsetraisesÖ <exception_list>

<exception_list> ::= Ö(Ö <scoped_name> { Ö,Ö <scoped_name> } · Ö)Ö

<home_dcl> ::= <home_header> <home_body>

<home_header> ::= ÖhomeÖ <identifier> ÖmanagesÖ <scoped_name> [ 
    <primary_key_spec> ]

<primary_key_spec> ::= ÖprimarykeyÖ <scoped_name>

<home_body> ::= Ö(Ö <home_export>* Ö)Ö

<home_export> ::= <factory_dcl> Ö;Ö | <finder_dcl> Ö;Ö

<factory_dcl> ::= ÖfactoryÖ <identifier> Ö(Ö [ <init_param_decls> ] Ö)Ö [ 
    <raises_expr> ]

<finder_dcl> ::= ÖfinderÖ <identifier> Ö(Ö [ <init_param_decls> ] Ö)Ö [ 
    <raises_expr> ]
The rules for mapping a CORBA component definition into an EJB definition are defined in the following sections. Where appropriate, these rules rely on the standard IDL to Java mapping.

**Mapping the component definition**

- A basic CORBA component definition is mapped to an EJB remote interface definition.
- The name of the EJB remote interface is the name of the basic CORBA component in the Component IDL definition.
- For each operation defined in each interface that the CORBA component supports, a method definition will be included in the EJB remote interface that the CORBA component maps to. That is, the EJB to which the basic CORBA component maps defines all the supported operations defined by the basic CORBA component.
- The signatures of the CORBA component operations are mapped to signatures of EJB remote interface methods following the IDL to Java mapping rules. Only signatures whose parameters have an in qualifier are allowed. Signatures that include parameters with out or inout qualifiers shall be signaled as an error.
- For each attribute XXX that the CORBA component defines, the corresponding EJB remote interface defines a pair of getXXX and setXXX methods, where XXX is the name of the given attribute. If the attribute definition includes a getraises exception clause, then the corresponding getXXX method definition in the EJB remote interface will include a throws exception clause. Likewise, if the attribute definition includes a setraises exception clause, then the corresponding setXXX method definition in the EJB remote interface will include a throws exception clause.
- Exceptions raised by CORBA component definition operations and attributes are mapped to exceptions thrown by EJB method definitions using the standard IDL to Java mapping rules.

**Mapping the Component Home definition**

- A CORBA component’s home definition is mapped to an EJB home’s remote interface definition. That is a definition of the form home XXX manages YYY [primarykey KKK] is mapped to an EJB home interface with name xxx.
- The methods defined by the EJB home remote interface include the implicit as well as the explicit methods of the CORBA component’s home definition.
- Implicit CORBA component home operations are mapped to EJB home remote interface methods as follows:
  ```java
  <component_type> create (in <key_type> key) raises (Components::CreateFailure, Components::DuplicateKeyValue, Components::InvalidKey); maps to <component_type> create (<key_type> key) throws DuplicateKeyException, CreateException.
  ```
¥ `<component_type> find_by_primary_key (in <key_type> key)` raises (Components::FinderFailure, Components::UnknownKeyValue, Components::InvalidKey); maps to `<component_type> findByPrimaryKey( <key_type> key )` throws ObjectNotFoundException, FinderException.

¥ void remove (in <key_type> key) raises (Components::RemoveFailure, Components::UnknownKeyValue, Components::InvalidKey); maps to the remove by key method defined in EJBHome.

¥ `<key_type> get_primary_key (in <component_type> comp)` has no counterpart in an EJB home definition. Given that EJBObj already defines getPrimaryKey, it is not necessary to map get_primary_key on the implicit home to an EJB home operation.

¥ Explicit CORBA component basic home operations are mapped to EJB home remote interface methods as follows:

¥ A `factory` operation maps to an overloaded `create` method with the corresponding arguments and exceptions.

¥ A `finder` operation maps to a `find<identifier>` method with the corresponding arguments and exceptions, where `<identifier>` is the name of the `finder` operation.

¥ The signatures of `factory` and `finder` operations are mapped to signatures of EJB home interface methods following the IDL to Java mapping rules.

¥ A `valuetype` that is used to define the primary key of a CORBA component home is mapped to a Java class under the rules of the standard IDL to Java mapping. In addition, such a Java class is defined to extend `java.io.Serializable`.

### Mapping standard exceptions

The CCM exceptions `Components::FinderFailure, Components::CreateFailure, Components::DuplicateKeyValue` and `Components::RemoveFailure` raised by methods to find, create and remove a CORBA component are always mapped to the EJB exceptions `FinderException, CreateException, DuplicateKeyException` and `RemoveException`, respectively.

#### 5.4.2 Translation of EJB requests into CORBA Component Requests

A Java client that uses an EJB view on a CORBA component expects to be able to perform EJB requests on such a view. These requests need to be translated into CORBA component requests at run-time. This translation can be performed at the client-side, the server-side, or a combination of the two. Table 5-4 lists the EJB
methods that a Java client can perform requests on by interface, and it lists the corresponding CORBA component operations that these requests translate into, also by interface.

**Table 5-4** Translation of EJB method requests into CCM operation requests

<table>
<thead>
<tr>
<th>EJB Interface</th>
<th>Method called by client</th>
<th>CCM interface</th>
<th>Operation called by bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>EJBHome</td>
<td>EJBMetaData getEJBMetadata () throws RemoteException;</td>
<td>CCMHome</td>
<td>Translation performed by bridge does not call a CCM standard operation</td>
</tr>
<tr>
<td></td>
<td>void remove (Handle handle) throws RemoveException, RemoteException;</td>
<td></td>
<td>void remove_component (in CCMObject comp) raises (RemoveFailure);</td>
</tr>
<tr>
<td></td>
<td>void remove (Object primaryKey) throws RemoveException, RemoteException;</td>
<td>&lt;home-name&gt;Implicit</td>
<td>void remove (in &lt;key-type&gt; key) raises (RemoveFailure, UnknownKeyValue, InvalidKey);</td>
</tr>
<tr>
<td></td>
<td>HomeHandle getHomeHandle () throws RemoteException;</td>
<td></td>
<td>Translation performed by bridge does not call a CCM standard operation</td>
</tr>
<tr>
<td>&lt;name&gt;</td>
<td>&lt;name&gt; create (&lt;arg-list&gt;) throws CreateException, DuplicateKeyException;</td>
<td>&lt;home-name&gt;Explicit</td>
<td>&lt;name&gt; createXXX (&lt;arg-list&gt;) raises (CreateFailure, DuplicateKeyValue, InvalidKey);</td>
</tr>
<tr>
<td></td>
<td>&lt;name&gt; findByXXX (&lt;arg-list&gt;) throws &lt;exceptions&gt;;</td>
<td></td>
<td>&lt;name&gt; findXXX (&lt;arg-list&gt;) raises (FinderFailure, &lt;exceptions&gt;);</td>
</tr>
<tr>
<td></td>
<td>&lt;name&gt; findByPrimaryKey (&lt;key-type&gt; key) throws FinderException, ObjectNotFoundException;</td>
<td>&lt;home-name&gt;Implicit</td>
<td>&lt;name&gt; find_by_primary_key (&lt;key-type&gt; key) raises (FinderFailure, UnknownKeyValue, InvalidKey);</td>
</tr>
<tr>
<td>EJBOBJECT</td>
<td>EJBHome getEJBHome () throws RemoteException;</td>
<td>CCMObject</td>
<td>CCMHome get_ccm_home ();</td>
</tr>
<tr>
<td></td>
<td>Object getPrimaryKey () throws RemoteException;</td>
<td></td>
<td>PrimaryKeyBase getKey ();</td>
</tr>
<tr>
<td></td>
<td>void remove () throws RemoveException, RemoteException;</td>
<td></td>
<td>void remove () raises (RemoveFailure);</td>
</tr>
<tr>
<td></td>
<td>boolean isIdentical (EJBOBJECT object) throws RemoteException;</td>
<td>CORBA::Object</td>
<td>boolean is_equivalent ();</td>
</tr>
<tr>
<td></td>
<td>Handle getHandle () throws RemoteException;</td>
<td></td>
<td>Translation performed by bridge does not call a CCM standard operation</td>
</tr>
<tr>
<td>&lt;name&gt;</td>
<td>&lt;res-type&gt; &lt;operation&gt; (&lt;arg-list&gt;) throws &lt;exceptions&gt;;</td>
<td>&lt;name&gt;</td>
<td>&lt;res-type&gt; &lt;operation&gt; (&lt;arg-list&gt;) raises (&lt;exceptions&gt;);</td>
</tr>
<tr>
<td></td>
<td>&lt;res-type&gt; getXXX () throws &lt;exceptions&gt;;</td>
<td></td>
<td>&lt;res-type&gt; get XXX () raises (&lt;exceptions&gt;);</td>
</tr>
<tr>
<td></td>
<td>void setXXX (&lt;arg-list&gt;) throws &lt;exceptions&gt;;</td>
<td></td>
<td>&lt;res-type&gt; set_XXX () raises (&lt;exceptions&gt;);</td>
</tr>
</tbody>
</table>
In addition, the EJB programming model allows a Java client to:

- Locate EJB homes and distinguished EJB objects via JNDI.
- Demarcate transactions via a UserTransaction object, after locating this object via JNDI.

These requests are translated into similar requests provided by the CORBA component programming model, as follows:

- Location of home and EJB objects requires the definition of a mapping of JNDI to the COSNaming service. It also requires the mapping of a COSNaming name space into a JNDI name space.
- Transaction demarcation requires the definition of a mapping of JTA to the CORBA transaction service. It also requires that a JNDI name space location be populated with an object that implements UserTransaction and that maps to the corresponding CORBA transaction service object.

### 5.4.3 Interoperability of the View

As stated in Section 5.4.2, Translation of EJB requests into CORBA Component Requests, on page 5-17 can happen at either the client-side, the server-side, or a combination of the two.

However, in order to provide interoperability of implementations of EJB views of CORBA components, a minimal number of translation points must be performed and they must be performed at an explicitly defined location: either the client-side or the server-side. For the implementation of an EJB view of a CORBA component, and for a CCM interface, the translation points are:
**Translation of specific method names**

The following methods shall translate their names as indicated.

**Table 5-5  Translation of specific method names**

<table>
<thead>
<tr>
<th>EJB Interface</th>
<th>Method name</th>
<th>CCM Interface</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EJBHome</td>
<td>remove</td>
<td>CCMHome</td>
<td>remove_component</td>
</tr>
<tr>
<td>&lt;name&gt;</td>
<td>findByPrimaryKey</td>
<td>&lt;name&gt;Implicit</td>
<td>find_by_primary_key</td>
</tr>
<tr>
<td></td>
<td>remove__java_lang_Object</td>
<td></td>
<td>remove</td>
</tr>
<tr>
<td></td>
<td>create__java_lang_Object</td>
<td></td>
<td>create</td>
</tr>
<tr>
<td>EJBOBJECT</td>
<td>getEJBHome</td>
<td>CCMObject</td>
<td>get_ccm_home</td>
</tr>
<tr>
<td></td>
<td>getPrimaryKey</td>
<td></td>
<td>get_primary_key</td>
</tr>
<tr>
<td></td>
<td>isIdentical</td>
<td>CORBA::Object</td>
<td>is_equivalent</td>
</tr>
</tbody>
</table>

**Handling of standard exceptions**

The following exceptions, caught by the indicated methods, shall be translated as indicated before raising them to their EJB clients.

**Table 5-6  Handling of standard exceptions**

<table>
<thead>
<tr>
<th>EJB Interface</th>
<th>Method name</th>
<th>Exception caught</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EJBHome</td>
<td>remove</td>
<td>Components::RemoveFailure</td>
<td>RemoveException</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CORBA system exceptions</td>
<td>RemoteException</td>
</tr>
<tr>
<td></td>
<td>remove__java_lang_Object</td>
<td>Components::RemoveFailure</td>
<td>RemoveException</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CORBA system exceptions</td>
<td>RemoteException</td>
</tr>
<tr>
<td>&lt;name&gt;</td>
<td>create</td>
<td>Components::CreateFailure</td>
<td>CreateException</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Components::DuplicateKeyValue</td>
<td>DuplicateKeyException</td>
</tr>
<tr>
<td></td>
<td>findByPrimaryKey</td>
<td>Components::UnknownKeyValue</td>
<td>ObjectNotFoundException</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Components::FinderFailure</td>
<td>FinderException</td>
</tr>
<tr>
<td>EJBOBJECT</td>
<td>getEJBHome</td>
<td>CORBA system exceptions</td>
<td>RemoteException</td>
</tr>
<tr>
<td></td>
<td>getPrimaryKey</td>
<td>CORBA system exceptions</td>
<td>RemoteException</td>
</tr>
<tr>
<td></td>
<td>remove</td>
<td>Components::RemoveFailure</td>
<td>RemoveException</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CORBA system exceptions</td>
<td>RemoteException</td>
</tr>
<tr>
<td></td>
<td>isIdentical</td>
<td>CORBA system exceptions</td>
<td>RemoteException</td>
</tr>
</tbody>
</table>

**Note** CORBA system exceptions are translated into **RemoteException** according to rules defined in formal/01-06-07, section 1.4.8.
Handling of a primary key parameter

The methods create and findByPrimaryKey, defined by <name>, and remove__java_lang_Object, defined by EJBHome, shall translate the primary key valuetype they get as input parameter to a CORBA::Any equivalent.

The method getPrimaryKey, defined by EJBOBJECT, shall translate the CORBA::Any value of the primary key it gets as a result from its request into an equivalent Java Object valuetype before returning it.

5.4.4 Example

We show a simple CORBA component definition and its corresponding EJB mapping. The basic CORBA component Account is defined in terms of a regular IDL interface AccountOps. The home AccountHome is defined to manage Account and to use a primary key.

```idl
interface AccountOps {
    void debit( in double amt ) raises (NotEnoughFunds);
    void credit( in double amt );
};
```

```java
component Account supports AccountOps {
    readonly attribute double balance;
};
```

```java
valuetype AccountKey {
    public long acctNo;
};
```

```java
home AccountHome manages Account primarykey AccountKey {
    finder largeAccount( double threshold );
};
```

The following EJB definition is derived from the definition of Account and its home.

```java
public interface Account extends javax.ejb.EJBObject {
    public void debit( double amount )
        throws NotEnoughFunds, java.rmi.RemoteException;
    public void credit( double amount )
        throws java.rmi.RemoteException;
    public double getBalance() throws java.rmi.RemoteException;
};
```

```java
public class AccountKey implements java.io.Serializable {
    public long acctNo;
    public AccountKey( long k ) { acctNo = k; }
};
```
public interface AccountHome extends javax.ejb.EJBHome {
    public Account create(AccountKey key)
        throws DuplicateKeyException, CreateException,
                java.rmi.RemoteException;
    public Account findByPrimaryKey(Account key)
        throws ObjectNotFoundException, FinderException,
                java.rmi.RemoteException;
    public Account findByLargeAccount(double threshold)
        throws java.rmi.RemoteException;
}

5.5 Compliance with the Interoperability of Integration Views

As stated in Section 5.3.3, “Interoperability of the View,” on page 5-10 and
Section 5.4.3, “Interoperability of the View,” on page 5-19, request translations must
happen at an explicitly defined location: either the client-side or the server side.

Rather than mandate one location arbitrarily, a number of levels of compliance with
the interoperability of integration views are defined. Vendors shall clearly state what
level of interoperability is supported by their implementations. These levels are:

- **NONE**: Integration view implementations that comply with this level actually
  perform no request translations. These implementations can still interoperate with
  other implementations that understand non-translated requests (e.g.,
  implementations compliant with levels SERVER-SIDE and FULL).
- **CLIENT-SIDE**: Translation occurs either in the address space of a client stub or in
  a separate address space downstream from the client stub but before the resulting
  GIOP request gets sent to the server.
- **SERVER-SIDE**: Translation occurs either in the address space of a server skeleton
  or in a separate address space upstream from the server skeleton but after the GIOP
  request has been received from the client. The presence of a server-side view must
  not prevent native (i.e., non-translated) access to the component.
- **FULL**: Integration view implementations that comply with this level comply with
  both the CLIENT-SIDE and SERVER-SIDE levels. Note that a stand-alone bridge
  in a separate address space complies at this level since it is both upstream of the
  client (SERVER-SIDE) and downstream of the server (CLIENT-SIDE).
- **FULL**: Integration view implementations that comply with this level comply with
  both the CLIENT and the SERVER levels.

Table 5-7 illustrates the possible combinations of level compliance that are implied by
the previous definitions. Rows in the table denote implementations compliant with a
given level that send a request. Columns denote implementations compliant with a
given level that receive a request. So, for example, a SERVER-SIDE implementation
cannot interoperate with a CLIENT-SIDE implementation because the SERVER-
SIDE implementation does not translate on send and the CLIENT-SIDE
implementation does not translate on receive.
Table 5-7  Compliance with the Interoperability of Integration Views

<table>
<thead>
<tr>
<th></th>
<th>NONE</th>
<th>CLIENT-SIDE</th>
<th>SERVER-SIDE</th>
<th>FULL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>CLIENT-SIDE</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>SERVER-SIDE</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>FULL</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

5.6  Comparing CCM and EJB

The following series of tables summarized the component APIs for Enterprise Java Beans (EJB 1.1) and Basic CORBA Components. The tables are organized as follows:

1. The home interfaces that define the remote access protocols for creating or finding EJBs or CORBA components (Section 5.6.1, The Home Interfaces, on page 5-23).

2. The component interfaces that define the remote access protocols for invoking business operations on EJBs or CORBA components (Section 5.6.2, The Component Interfaces, on page 5-25).

3. The callback interfaces that the CORBA component or EJB programmer must implement (Section 5.6.3, The Callback Interfaces, on page 5-26).

4. The Context interfaces that provide the component developer access to container-provided services (Section 5.6.4, The Context Interfaces, on page 5-28).

5. The Transaction interface that supports bean-managed or component-managed transactions (Section 5.6.5, The Transaction Interfaces, on page 5-29).

6. The metadata interfaces that support access to component metadata (Section 5.6.6, The Metadata Interfaces, on page 5-30).

5.6.1  The Home Interfaces

Table 5-8 compares the home interfaces and operations that make up the EJB and CORBA component models. In EJB, the EJBHome object is created by the EJB container provider's tools and provides implementations for methods of the base class and delegates factory or finder methods on a derived class (<name>Home) to similarly named methods on the bean itself (<name>Bean).

In the CORBA component model, homes are defined as righteous CORBA objects and the associated factory or finder methods are generated as operations on the home and the component developer implements these directly so the container need not provide delegation support. The component developer may not even need to provide implementations for the default factory and finder operations if sufficient information is provided with the component's definition.
For CORBA clients to use EJB implementations, the container provider must externalize **EJBJhome** to the CORBA client as a CORBA component home. This is accomplished by extensions to the Java to IDL mapping defined in Chapter 8. For EJB clients to access CORBA component homes, the container provider must create an **EJBJhome** object that serves as a bridge between equivalent operations on **EJBJhome** and the CORBA component home. This bridge is also described in Chapter 8.

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>javax.ejb</td>
<td>Components</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>EJBJhome extends java.rmi.Remote</td>
<td>CCMHome</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public EJBJmetaData get EJBJmetaData () throws java.rmi.RemoteException</td>
<td>ComponentDef get_component_def ();</td>
<td>CORBA IR supports more metadata</td>
</tr>
<tr>
<td></td>
<td>public HomeHandle getHomeHandle() throws java.rmi.RemoteException</td>
<td></td>
<td>CORBA::object_to_string provides same function</td>
</tr>
<tr>
<td></td>
<td>public void remove (HomeHandle handle) throws java.rmi.RemoteException, RemoveException</td>
<td>void remove_component (in CCMObject component) raises (CMEException);</td>
<td>CORBA references instead of handles REMOVE_ERROR is minor code</td>
</tr>
<tr>
<td></td>
<td>public void remove (java.lang.Object primaryKey) throws java.rmi.RemoteException, RemoveException</td>
<td></td>
<td>similar operation is defined on &lt;home&gt;Implicit for Homes with primarykey</td>
</tr>
<tr>
<td>Interface</td>
<td>HomeHandle extends java.io.Serializable</td>
<td></td>
<td>CORBA reference used for handle</td>
</tr>
<tr>
<td></td>
<td>public EJBJhome getEJBJhome() throws java.rmi.RemoteException</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module</td>
<td>&lt;session-name&gt;</td>
<td>&lt;session-home&gt;</td>
<td>CORBA::string_to_object</td>
</tr>
<tr>
<td>Interface</td>
<td>&lt;session&gt;home extends EJBJhome</td>
<td>&lt;session-home&gt;::CCMHome, &lt;session-home&gt;Implicit, &lt;session-home&gt;Explicit</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public &lt;session-name&gt;Remote create (&lt;arg-type&gt; &lt;arg-list&gt;) throws CreateException</td>
<td>&lt;session-component&gt; create ();</td>
<td>Generated operation Inherited from &lt;home&gt;Implicit</td>
</tr>
<tr>
<td>Module</td>
<td>&lt;entity-name&gt;</td>
<td>&lt;entity-home&gt;</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>&lt;entity&gt;home extends EJBJhome</td>
<td>&lt;entity-home&gt;::CCMHome, &lt;entity-home&gt;Implicit, &lt;entity-home&gt;Explicit</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-8 Comparing the home interfaces of EJB and CORBA components
5.6.2 The Component Interfaces

Table 5-9 compares the component interfaces and operations that make up the EJB and CORBA component models. In EJB, the EJBObject object is created by the EJB container provider’s tools and provides implementations for methods of the base class and delegates business methods to a derived class (<name>Remote).

In the basic CORBA component model, components are defined as righteous CORBA objects and the associated business methods are defined as operations on a supported interface and the component developer implements these directly so the container need not provided delegation support.

For CORBA clients to use EJB implementations, the container provider must externalize EJBObject to the CORBA client as a CORBA component. This is accomplished by extensions to the Java to IDL mapping defined in Chapter 8. For EJB clients to access CORBA components, the container provider must create an EJBObject implementation that serves as a bridge between business methods on EJBObject and the basic CORBA component’s supported interface. This bridge is also described in Chapter 8.

Table 5-9 Comparing the remote interfaces of EJB and CORBA components
### Table 5-10 Comparing the remote interfaces of EJB and CORBA components

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation (continued)</td>
<td>public void remove (Handle handle) throws java.rmi.RemoteException, RemoveException</td>
<td>void remove() raises (CCMException); CORBA references instead of handles; REMOVE_ERROR is minor code</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public Handle getHandle() throws java.rmi.RemoteException</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public boolean isIdentical (EJBOBJECT obj) throws java.rmi.RemoteException</td>
<td>boolean is_equivalent( in Object obj);</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>Handle extends java.io.Serializable</td>
<td>CORBA reference used for handle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public EJBOBJECT getEJBOBJECT() throws java.rmi.RemoteException</td>
<td>CORBA::string_to_object</td>
<td></td>
</tr>
<tr>
<td>Module</td>
<td>&lt;session-bean&gt;</td>
<td>&lt;session-component&gt;</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>&lt;session&gt;Remote extends EJBOBJECT</td>
<td>&lt;session&gt;::CCMObject</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;res-type&gt; &lt;operation&gt; (</td>
<td>&lt;res-type&gt; &lt;operation&gt;(</td>
<td>business methods</td>
</tr>
<tr>
<td></td>
<td>&lt;arg-type&gt; &lt;arg-list&gt;) throws &lt;exceptions&gt;</td>
<td>in &lt;arg-type&gt; &lt;arg-list) raises &lt;exceptions&gt;;</td>
<td></td>
</tr>
<tr>
<td>Module</td>
<td>&lt;entity-bean&gt;</td>
<td>&lt;entity-component&gt;</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>&lt;entity&gt;Remote extends EJBOBJECT</td>
<td>&lt;entity&gt;::CCMObject</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;res-type&gt; &lt;operation&gt; (</td>
<td>&lt;res-type&gt; &lt;operation&gt;(</td>
<td>business methods</td>
</tr>
<tr>
<td></td>
<td>&lt;arg-type&gt; &lt;arg-list&gt;) throws &lt;exceptions&gt;</td>
<td>in &lt;arg-type&gt; &lt;arg-list) raises &lt;exceptions&gt;;</td>
<td></td>
</tr>
</tbody>
</table>

### 5.6.3 The Callback Interfaces

Table 5-10 summarizes the callback interfaces the EJB programmer or basic CORBA component programmer must implement. The EJB interfaces are specified as Java interfaces in accordance with the EJB 1.1 specification dated June 28, 1999. The CCM interfaces are specified in IDL as defined in this specification.

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>javax.ejb</td>
<td>Components::Basic</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>EnterpriseBean</td>
<td>EnterpriseComponent</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>SessionBean extends EnterpriseBean</td>
<td>SessionComponent::EnterpriseComponent</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public void setSessionContext (SessionContext ctx) throws EJBEJException</td>
<td>void set_session_context( in SessionContext ctx) raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void ejbActivate () throws EJBEJException</td>
<td>void ccm_activate () raises (CCMException);</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5-10 Comparing EJB and CCM Callback Interfaces

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>public void ejbPassivate ()</td>
<td>void ccm_passivate ()</td>
<td></td>
</tr>
<tr>
<td>(continued)</td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void ejbRemove ()</td>
<td>void ccm_remove ()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public void ejbCreate (</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;Arg-type&gt; &lt;arg-list&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws CreateException, EJBEexception</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>&lt;name&gt;Bean extends SessionBean</td>
<td></td>
<td>Home operations are not delegated in CCM.</td>
</tr>
<tr>
<td>Operation</td>
<td>public void afterBegin ()</td>
<td>void after_begin ()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void beforeCompletion()</td>
<td>void before_completion ()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void afterCompletion (</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>boolean committed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>SessionSynchronization</td>
<td>SessionSynchronization</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public void setEntityContext (</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EntityContext ctx)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void unsetEntityContext ()</td>
<td>void unset_entity_context ()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void ejbActivate ()</td>
<td>void ccm_activate ()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void ejbLoad ()</td>
<td>void ccm_load ()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void ejbStore ()</td>
<td>void ccm_store()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void ejbPassivate ()</td>
<td>void ccm_passivate ()</td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws EJBEexception</td>
<td>raises (CCMException);</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>REMOVE_ERROR is a minor code</td>
</tr>
<tr>
<td>Interface</td>
<td>&lt;name&gt;Bean extends EntityBean</td>
<td></td>
<td>Home operations are not delegated in CCM.</td>
</tr>
<tr>
<td>Operation</td>
<td>public &lt;key-type&gt; ejbcreate (</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;Arg-type&gt; &lt;arg-list&gt;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>throws CreateException, DuplicateKeyException, EJBEexception</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Implemented on home, CREATE_ERROR and DUPLICATE_KEY are minor codes</td>
</tr>
</tbody>
</table>

**Note:** The entries in the table are hypothetical and for demonstration purposes. The actual implementation details and exceptions may differ based on the specific EJB and CCM implementations.
5.6.4 The Context Interfaces

The context interfaces summarized in Table 5-11 provide accessors to services provided by the component container. They are used by the component developer when these services are required.

Table 5-10 Comparing EJB and CCM Callback Interfaces

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>javax.ejb</td>
<td>Components::Basic</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>EJBCallback</td>
<td>CCMContext</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public java.security.Principal getCallerPrincipal()</td>
<td>Principal get_caller_principal();</td>
<td></td>
</tr>
<tr>
<td></td>
<td>get EJBHome getEJBHome()</td>
<td>CCMHome get_ccm_home();</td>
<td></td>
</tr>
<tr>
<td></td>
<td>getRollbackOnly() throws java.lang.IllegalState</td>
<td>boolean get_rollback_only() raises (IllegalState);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>getUserTransaction() throws java.lang.IllegalState</td>
<td>Transaction::UserTransaction get_user_transaction () raises (IllegalState);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>isCallerInRole (java.lang.String (roleName))</td>
<td>boolean is_caller_in_role (in string role);</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>SessionContext extends EJBCallback</td>
<td>SessionContext::CCMContext</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>get EJBObject() throws java.lang.IllegalState</td>
<td>CORBA::Object get_CCM_Object() raises (IllegalState);</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-11 Comparing the EJB and CCM Context Interfaces

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>javax.ejb</td>
<td>Components::Basic</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>EJBCallback</td>
<td>CCMContext</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public java.security.Principal getCallerPrincipal()</td>
<td>Principal get_caller_principal();</td>
<td></td>
</tr>
<tr>
<td></td>
<td>get EJBHome getEJBHome()</td>
<td>CCMHome get_ccm_home();</td>
<td></td>
</tr>
<tr>
<td></td>
<td>getRollbackOnly() throws java.lang.IllegalState</td>
<td>boolean get_rollback_only() raises (IllegalState);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>getUserTransaction() throws java.lang.IllegalState</td>
<td>Transaction::UserTransaction get_user_transaction () raises (IllegalState);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>isCallerInRole (java.lang.String (roleName))</td>
<td>boolean is_caller_in_role (in string role);</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>SessionContext extends EJBCallback</td>
<td>SessionContext::CCMContext</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>get EJBObject() throws java.lang.IllegalState</td>
<td>CORBA::Object get_CCM_Object() raises (IllegalState);</td>
<td></td>
</tr>
</tbody>
</table>

this will be the component reference
5.6.5 The Transaction Interfaces

Table 5-12 summarizes the transaction interfaces provided for bean-managed or component-managed transactions. Both EJB and CCM provide an accessor function in the context to obtain a reference to a transaction service. The transaction service supported for EJB is JTA, a subset of JTS which is equivalent to the CORBA transaction service (OTS). The transaction service supported for CORBA components is implemented by the component container as a wrapper over the CORBA transaction service. Components::Transaction is functionally equivalent to JTA (which is not a distinct compliance level for OTS) with the addition of suspend and resume.

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>javax.transaction</td>
<td>Components::Transaction</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>UserTransaction</td>
<td>UserTransaction</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>public void begin() throwsNotSupportedException, SecurityException</td>
<td>void begin() raises (NotSupportedException, SystemException);</td>
<td>SystemException to avoid confusion with System Exception</td>
</tr>
<tr>
<td></td>
<td>public void rollback() throws java.security.SecurityException, java.lang.IllegalArgumentException, SystemException</td>
<td>void rollback() raises (Security, IllegalState, SystemError);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public void setRollbackOnly() throws SystemException</td>
<td>void set_rollback_only() raises (SystemError);</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public int getStatus() throws SystemException;</td>
<td>Status getStatus() raises (SystemError);</td>
<td></td>
</tr>
</tbody>
</table>
5.6.6 The Metadata Interfaces

The EJB component model supports a limited set of metadata through the 
**EJBMetaData** interface. The CORBA component model extends the CORBA interface repository to add component-unique metadata for components. This metadata is in addition to the metadata currently provided by the IR. When EJB clients access CORBA components, the container provider must provide an implementation of **EJBMetaData**, which supports the necessary metadata from the Interface Repository or the component descriptors. This is described further in Chapter 8. When CORBA clients access EJB implementations, the Interface Repository is already populated for the **EJBHome** and **EJBObject** interfaces, enabling client requests to be satisfied. Table 5-13 compares the metadata supported by EJB and CORBA Components.

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>javax.ejb</td>
<td>IR</td>
<td></td>
</tr>
<tr>
<td>Interface</td>
<td>EJBMetaData</td>
<td>ComponentDef</td>
<td></td>
</tr>
<tr>
<td></td>
<td>public EJBHome getEJBHome()</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public java.lang.Class getHomeInterfaceClass()</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public java.lang.Class getRemoteInterfaceClass()</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public java.lang.Class getPrimaryKeyClass()</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public boolean isSession()</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>public boolean isStatelessSession()</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 5-12** Comparing the EJB Transaction service (JTA) with CORBA component transactions

<table>
<thead>
<tr>
<th>Construct</th>
<th>EJB Form</th>
<th>CCM Form</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>public void setTimeout (int seconds) throws SystemException</td>
<td>void set_transaction_timeout(int long to) raises (SystemError);</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TranToken suspend() raises (NoTransaction, SystemError);</td>
<td>CCM supports suspend/resume which JTA does not</td>
<td></td>
<td></td>
</tr>
<tr>
<td>void resume(in TranToken) raises (invalidToken, SystemError);</td>
<td>CCM supports suspend/resume which JTA does not</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Packaging and Deployment

Note D Text in Red is from the Components 1.1 RTF interim report (ptc/2002-08-02).

This chapter describes the CORBA component packaging and deployment model.

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</tr>
<tr>
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<td>6-68</td>
</tr>
</tbody>
</table>

6.1 Introduction

Component implementations may be packaged and deployed.
A CORBA Component package maintains one or more implementations of a component. It may be installed on a computer or grouped together with other components to form an assembly. A component assembly is a group of interconnected components represented by an assembly package.

A package, in general, consists of one or more descriptors and a set of files. The descriptors describe the characteristics of the package and point to its various files. The files that make up a package, including the descriptor, may be grouped together in an archive file or stored separately. When stored separately, the descriptor contains pointers to the location of each file.

The component package is a specialization of a general software package. The software packaging scheme, described here, could be used to package arbitrary software entities. In fact it was initially inspired by the Open Software Description (OSD) note to the W3C. OSD is an XML vocabulary for describing software packages and their dependencies. We have extended OSD slightly, without loss of generality, to support component packaging.

A component package may be deployed alone, as is, or it may be included in a component assembly package and deployed as part of the assembly along with the other components of the assembly.

A component assembly is a set of interrelated components and component homes represented by an assembly package. A component assembly package consists of a set of component packages and an assembly descriptor. The assembly descriptor specifies the components that make up the assembly, partitioning constraints, and connections. Connections are between interface ports, represented by provides and uses features and between event ports, represented by emits, produces, and consumes features.

Component and assembly packages are provided as input to a deployment tool.

A deployment tool deploys individual components and assemblies of components to an installation site, usually a set of hosts on a network. The user of the deployment tool guides in determining where each component should be installed. Components within an assembly may be installed on a single machine or scattered across a network.

Based on an assembly descriptor and user input, the deployment tool installs and activates component homes and instances; it configures component properties and connects components together via interface and event ports, as indicated in the assembly descriptor.

### 6.2 Component Packaging

A software package is represented by a descriptor and a set of files. The descriptor and associated files are grouped together in a ZIP archive file. The software package could be used to describe arbitrary software packages.

In relation to CORBA Components, software packages are used to package a CORBA Component implementation.
6.3 Software Package Descriptor

The contents of a software package are described by a software package descriptor. The descriptor consists of general information about the software followed by one or more sections describing implementations of that software. An XML vocabulary is used to describe component software packages. The descriptor file has a .csd extension. CSD stands for CORBA Software Descriptor. When used in an archive, the CSD file for the archive is placed in a top level directory called Meta-inf.

The structure and intent of the descriptor can be better understood by looking at an example.

6.3.1 A softpkg Descriptor Example

```xml
<softpkg name="Bank" version="1,0,1,0">
    <pkgtype>CORBA Component</pkgtype>
    <title>Bank</title>
    <author>
        <company>Acme Component Corp.</company>
        <webpage href="http://www.acmecomponent.com"/>
    </author>
    <description>Yet another bank example</description>
    <license href="http://www.acmecomponent.com/license.html"/>
</softpkg>
```

---

**Note D Issue 5091**

```xml
<idl id="IDL:M1/Bank:1.0" homeid="IDL:M1/BankHome:1.0">
    <link href="ftp://x/y/Bank.idl"/>
</idl>
```

```xml
<propertyfile><fileinarchive name="bankprops.cpf"/></propertyfile>
```

```xml
<implementation id=ÓDCE:700dc518-0110-11ce-ac8f-0800090b5d3eÓ>
    <os name="WinNT" version="4,0,0,0"/>
    <os name="Win95"/>
    <processor name="x86"/>
    <compiler name="MyFavoriteCompiler"/>
    <programminglanguage name="C++"/>

    <dependency type=ÓORBÓ>
        <name>ExORB</name>
    </dependency>

    <descriptor type=ÓCORBAComponentÓ>
        <fileinarchive name="processcontainer.ccd"/>
    </descriptor>

    <code type=ÓDLLÓ>
        <fileinarchive name="bank.dll"/>
    </entrypoint>createBankHome</entrypoint>
</code>
```
6.3.2 The Software Package Descriptor XML Elements

This section describes the XML elements that make up a software package descriptor. The section is organized starting with the root element of the package descriptor document, `softpkg`, followed by all subordinate elements, in alphabetical order. The complete `softpkg` DTD may be found in the softpkg.dtd in Section 7.1, Ôsoftpkg.dtd,Ó on page 7-1.

Note D An effective strategy for studying an XML DTD is to recursively navigate from the root element, which in this case is `softpkg`, to each child element.

6.3.2.1 The `softpkg` Root Element

The `softpkg` element is the root element of the document. As well, it is a child element of `dependency`. It contains a set of general child elements that describe the software package. This is followed by one or more implementation specifications.

A `softpkg` archive may contain multiple implementations of a component. This allows the component implementor to provide specialized implementations for different operating systems, compilers, or ORBs, or to provide different programming language implementations of the component. Each implementation is represented in the `softpkg` descriptor as a distinct implementation element.
Note D Issue 5584

<!ATTLIST softpkg
  name ID #REQUIRED
  version CDATA #OPTIONAL #IMPLIED >

The attributes are as follows:

name

Uniquely identifies the package within the package.

version

Specifies the version of the component. The format of the version string is numerical major and minor version numbers separated by commas (e.g., 01,0,0,0).

6.3.2.2 The author Element

The author element is used to identify the author of the softpkg. It may contain name, company, and webpage child elements.

<!ELEMENT author
  ( name
    | company
    | webpage
  )* >

6.3.2.3 The code Element

The code element points to a file in the archive that implements the component. This could be, for example, a DLL, a .so, or a .class file. The fileinarchive child element is used to indicate the code file within the archive. codebase and link are used to point to code files outside of any archive. The optional entrypoint child element is used to specify an entry point to the code. The optional usage element is used to describe how to use (i.e., invoke, the code).

<!ELEMENT code
  ( ( codebase
      | fileinarchive
      | link
    )
    , entrypoint?
    , usage?
  ) >
The `type` attribute specifies the type of code. The types `DL DLL`, `Executable`, and `Java Class` shall be recognized as valid types.

6.3.2.4 The `codebase` Element

The `codebase` element is used to specify a resource. If the resource is not available in the local environment, then a link specifies where it may be obtained. `codebase` has an `EMPTY` content model.

```
<!ELEMENT codebase EMPTY >
<!ATTLIST codebase
  filename CDATA #IMPLIED
  %simple-link-attributes; >
```

codebase has two attributes: `name` - the name of the resource, and `href`--as defined in `simple-link-attributes`--the link.

6.3.2.5 The `company` Element

The `company` element, an optional child element of `author`, specifies the company that created the `softpkg`. It contains string data.

```
<!ELEMENT company ( #PCDATA ) >
```

6.3.2.6 The `compiler` Element

The optional `compiler` element specifies the compiler used to create an implementation. `compiler` has an empty content model.

```
<!ELEMENT compiler EMPTY >
<!ATTLIST compiler
  name   CDATA #REQUIRED
  version CDATA #IMPLIED >
```

The required attribute `name`, specifies the name of the compiler and the optional `version`, the version of the compiler. The version is specified in a `Ow,x,y,z` format.

6.3.2.7 The `dependency` Element

The `dependency` element is used to specify environmental or other dependencies. The type of dependency is specified by the `type` attribute. The `dependency` element is a child element of both the `softpkg` element and `implementation` elements. When used...
as a child of `softpkg`, it specifies general dependencies applicable to all implementations. When used as a child of `implementation`, it specifies implementation specific dependencies.

```xml
<!ELEMENT dependency ( softpkgref | codebase | fileinarchive | localfile | name | valuetypefactory )>
<!ATTLIST dependency
type CDATA #IMPLIED
action (assert | install) "assert">
```

The `type` attribute specifies the type of the resource required. The types ÖDLL, ÖExecutable, Ö and ÖJava ClassÖ shall be recognized as valid types.

When `action` is set to `assert`, the installation process must verify that the dependency exists in the environment. If `action` is set to `install`, the installation process must install the dependency if it does not already exist.

### 6.3.2.8 The description Element

The `description` element contains a string description. It is used to describe its parent element. It contains string content.

```xml
<!ELEMENT description ( #PCDATA )>
```

### 6.3.2.9 The descriptor Element

The `descriptor` element is used to refer to descriptor files associated with a `softpkg` or `implementation`. In a CORBA Component `softpkg`, it is used to point to the CORBA Component descriptor.

```xml
<!ELEMENT descriptor ( link | fileinarchive )>
<!ATTLIST descriptor
type CDATA #IMPLIED>
```

The `type` attribute is the type of the descriptor.

---

**Note D** With respect to the CORBA Component model, a `type` of ÖCORBA ComponentÖ is used to indicate a CORBA component descriptor (described in Section 6.4.4, ÖCORBA Component Descriptor ExampleÖ on page 6-18).
6.3.10 The entrypoint Element

The entrypoint element specifies the entry point to a software package. See Section 6.9.8, OComponent Entry Points (Component Home Factories), on page 6-81 for information on CORBA component entry points.

<!ELEMENT entrypoint ( #PCDATA )>

6.3.11 The extension Element

The extension element is used to add experimental or vendor specific elements to the softpkg DTD. The content model of the extension element is PCDATA, meaning that it can have character data or markup.

An effort has been made to make the extension element an optional child element of all non-trivial elements. Processors may ignore extension elements that they do not recognize.

<!ELEMENT extension ( #PCDATA )>
<!ATTLIST extension
    class CDATA #REQUIRED
    origin CDATA #REQUIRED
    id ID #IMPLIED
    extra CDATA #IMPLIED
    html-form CDATA #IMPLIED>

The attributes of the extension element are as follows:

class

Used to distinguish this extension element usage. A processing application identifies extension elements that it understands by examining an extension element’s class and origin attributes.

origin

An origin attribute is required to identify the party responsible for the extension; for example, an ORB vendor.

id

An optional ID attribute that must be unique in the file.

extra

An extra attribute that may be used however the originator wishes.

html-form

The html-form element is used for formatting. The content will be formatted per the html element type indicated (e.g., Õ<em>Ó).
6.3.12 The fileinarchive Element

The fileinarchive element is used to specify a file in the same archive as the descriptor. The optional link element may be used to point to an external archive, in which case the file will be looked for in that file.

```xml
<!ELEMENT fileinarchive
       ( link? )>
<!ATTLIST fileinarchive
          name CDATA #REQUIRED >
```

The name attribute specifies the name or path of the element in the archive.

6.3.13 The humanlanguage Element

The humanlanguage element specifies a spoken language. humanlanguage has an EMPTY content model.

```xml
<!ELEMENT humanlanguage EMPTY >
<!ATTLIST humanlanguage
          name CDATA #REQUIRED >
```

The human language name is specified in the name attribute.

6.3.14 The idl Element

---

**Note D Issue 5091**

The idl element points to a file or repository containing an idl IDL definitions. If a component and its home are defined in different files or repositories, then the idl element refers to the file or repository where the home is defined.

```xml
<!ELEMENT idl
       ( link
           | fileinarchive
           | repository
       )>
<!ATTLIST idl
          id CDATA #REQUIRED
          homeid CDATA #REQUIRED >
```

The id attribute is a repository Id that uniquely identifies the IDL equivalent interface for the software component. The homeid attribute is a repository Id that uniquely identifies the IDL equivalent interface for the home of the software component.
6.3.2.15 The implementation Element

The implementation element contains descriptive information about a particular implementation of the software represented by the softpkg descriptor. An implementation is described by platform dependencies, descriptors, dependencies, code filename, entry points, and other characteristics.

```xml
<!ELEMENT implementation (
  description |
  code |
  compiler |
  dependency |
  descriptor |
  extension |
  programminglanguage |
  humanlanguage |
  os |
  propertyfile |
  processor |
  runtime |
)*)>
<!ATTLIST implementation
  id ID #IMPLIED
  variation CDATA #IMPLIED>
```

The id attribute is a DCE UUID that uniquely identifies the implementation.

The variation attribute is used to indicate a variation from a normal implementation. The interpretation of the variation attribute depends on user of the softpkg.

**Note** The only valid variation string defined by the CORBA Component model is "ProxyHome". The ProxyHome variation indicates that the component implementation contains a proxy home only, not a full component implementation.

6.3.2.16 The implref Element

The implref element is used to refer to an implementation within a softpkg.

```xml
<!ELEMENT implref EMPTY>
<!ATTLIST implref
  idref CDATA #REQUIRED>
```

The idref attribute refers to a unique implementation element id in the softpkg descriptor.
6.3.2.17 **The license Element**

The *license* child element of *softpkg* is used to point to the text of a usage license. The license is pointed to by an *href* attribute. The *license* element may have arbitrary string content.

```xml
<!ELEMENT license ( #PCDATA ) >
<!ATTLIST license
  %simple-link-attributes; >
```

6.3.2.18 **The link Element**

The *link* element is used to specify a generic link. The *href* attribute indicates the link. The element can have string content.

```xml
<!ELEMENT link ( #PCDATA ) >
<!ATTLIST link
  %simple-link-attributes; >
```

6.3.2.19 **The localfile Element**

The *localfile* element is used to specify a file that is expected to be found in the local environment.

```xml
<!ELEMENT localfile EMPTY >
<!ATTLIST localfile
  name CDATA #REQUIRED >
```

The name of the file is specified in the *name* attribute.

6.3.2.20 **The name Element**

The *name* element is an optional child element of both the *author* and *dependency* elements. When used as a child of *author*, it specifies the name of the author. When used as a child of *dependency*, it specifies the expected value of the dependency. It has string content.

```xml
<!ELEMENT name ( #PCDATA ) >
```

6.3.2.21 **The os Element**

The *os* element is used to specify a particular operating system that the implementation will work with. This can be specified multiple times if the implementation will work on more than one *os*.

```xml
<!ELEMENT os EMPTY >
<!ATTLIST os
  name CDATA #REQUIRED
  version CDATA #IMPLIED>
```
The **name** attribute specifies the name of the operating system.

The **version** attribute specifies the version of the **os** in \( \text{\textasciitilde}w,x,y,z\) format.

Legal values include:

- AIX
- BSDi
- VMS
- DigitalUnix
- DOS
- HPBLS
- HPUX
- IRIX
- Linix
- MacOS
- OS/2
- AS/400
- MVS
- SCO CMW
- SCO ODT
- Solaris
- SunOS
- UnixWare
- VxWorks
- Win95
- WinNT

### 6.3.2.22 The pkgtype Element

The **pkgtype** element is used to identify the type of software that the **softpkg** represents. This specification reserves package types **CORBA Component** and **CORBA Interface Impl** for the packaging of CORBA component and interface implementations.

```
<!ELEMENT pkgtype (#PCDATA )>
<!ATTLIST pkgtype
   version CDATA #IMPLIED >
```

The optional **version** attribute specifies a version of the package type.
6.3.2.23 The processor Element

The processor element indicates the type of processor that the implementation must run on, if there is any such constraint.

<!ELEMENT processor EMPTY >
<!ATTLIST processor
   name CDATA #REQUIRED >

The name of the processor is indicated in the name attribute.

Legal values include:
- x86
- mips
- alpha
- ppc
- sparc
- 680x0
- vax
- AS/400
- S/390

6.3.2.24 The programminglanguageElement

The programminglanguage element specifies the type of the component implementation. programminglanguage has an empty content model. programminglanguage is a child element of implementation.

<!ELEMENT programminglanguage EMPTY>
<!ATTLIST programminglanguage
   name CDATA #REQUIRED
   version CDATA #IMPLIED >

The required programminglanguage name and optional version attributes specify the programming language used to implement the component.

6.3.2.25 The propertyfile Element

The propertyfile element is used to refer to a property file associated with the softpkg or implementation.

A property file of a particular type, defined at the top level of the descriptor, may be overridden by implementation specific property files of that type, defined in an implementation element.

<!ELEMENT propertyfile>
The type attribute, distinguishes a property file from other types of property files. If there is only one type of property file, or if the type of property file is implicit given a context, then the type is not required.

6.3.2.26 The repository Element

The repository element is a child element of the idl element used to point to a repository, such as the interface repository.

```xml
<!ELEMENT repository (ins | objref | link)>
<!ATTLIST repository type CDATA #IMPLIED>
```

The type attribute specifies the type of repository. Currently, the only predefined value for type is "CORBA Interface Repository".

6.3.2.27 The runtime Element

The runtime element specifies a runtime required by a component implementation. An example of a runtime is a Java VM.

```xml
<!ELEMENT runtime EMPTY >
<!ATTLIST runtime name CDATA #REQUIRED
version CDATA #IMPLIED>
```

The name and version of the runtime are specified in the name and version attributes. The version is specified in "w,x,y,z" format.

6.3.2.28 The simple-link-attributes Entity

The simple-link-attributes entity is used to specify link attributes. The default link form is a simple link.

```xml
<!ENTITY % simple-link-attributes "
xmllink CDATA "FIXED 'SIMPLE'
href CDATA "REQUIRED">
">
```
The user of an element that uses these link attributes will likely only need to be concerned with the `href` attribute. However the user may specify other attributes if desired.

**Note** In the context of CORBA Components, the `href` attribute may be used to specify INS format names.

To demonstrate the usage of an element that employs the `simple-link-attributes` entity, consider the following element definition:

```xml
<!ELEMENT exampleelement EMPTY >
<!ATTLIST exampleelement
  %simple-link-attributes; >
```

This could be used as follows:

```xml
<exampleelement href="http://www.abc.com/xyz"/>
```

### 6.3.2.29 The softpkg Element

This is the root element of the descriptor. See Section 6.3.2.1, "The softpkg Root Element" on page 6-4.

### 6.3.2.30 The softpkgref Element

The `softpkgref` element refers to an external softpkg. The file is referenced by a `fileinarchive` element or a `link`. An optional `implref` element refers to a particular implementation within the softpkg descriptor.

```xml
<!ELEMENT softpkgref ( ( fileinarchive | link ) , implref? ) >
```

### 6.3.2.31 The title Element

The `title` element is used to specify the friendly, or tool name of the `softpkg`. The title element contains string data.

```xml
<!ELEMENT title ( #PCDATA ) >
```

### 6.3.2.32 The usage Element

The `usage` element contains a string usage description.

```xml
<!ELEMENT usage ( #PCDATA ) >
```
6.3.2.33 The valuetypefactory Element

The `valuetypefactory` element contains information needed to register and utilize a valuetype factory. The `valuetypefactory` element is a child element of the `dependency` element.

```xml
<!ELEMENT valuetypefactory (
  codebase | fileinarchive | link
)>
<!ATTLIST valuetypefactory
  rapid CDATA #REQUIRED
  valueentrypoint CDATA #IMPLIED
  factoryentrypoint CDATA #IMPLIED>
```

The `rapid` attribute specifies the repository id of the valuetype created by the valuetype factory. The `factoryentrypoint` attribute specifies an operation or function that can be used to create an instance of a valuetype factory associated to the repository id given by `rapid`. The `valueentrypoint` attribute specifies an operation or function that can be used to create an instance of a valuetype using a factory instance created with `factoryentrypoint`.

6.3.2.34 The webpage Element

The `webpage` element, an optional child element of `author`, specifies a web page associated with the author.

```xml
<!ELEMENT webpage ( #PCDATA )>
<!ATTLIST webpage
  %simple-link-attributes;>
```

6.4 CORBA Component Descriptor

The CORBA Component descriptor describes a component. It is referred to by a `<descriptor type="CORBAComponent">` element in a softpkg descriptor describing a CORBA component. The CORBA Component descriptor specifies component characteristics, used at design and deployment time. A component descriptor file has a recommended `.ccd` extension, standing for CORBA Component Descriptor.

The component descriptor is generated by a CIDL compiler. This is convenient as the CIDL compiler has much of the necessary information at hand. However, the compiler doesn't have all of the information required. The user, likely with the help of a packaging tool, will have to modify the generated descriptor. This could be done manually, but it is more likely to be done with the help of a packaging tool.

The component descriptor is described using an XML vocabulary. The complete XML DTD for the descriptor is in the `XML DTDs` chapter. This section discusses each element of the descriptor in detail.
6.4.1 Component Feature Description

The component descriptor provides information that a design tool may use to display information about a component. This includes information about the interfaces that the component supports and its ports.

Note D For the purpose of component packaging and deployment we will use the term ports to collectively describe the interfaces that a component uses and provides and the events that it emits, publishes, and consumes. In addition, provides and uses ports will be called interface ports, and emits, publishes, and consumes ports will be termed event ports.

The component descriptor describes the structure of a component with respect to supported interfaces, inherited components, and uses and provides ports. The component is described by a componentfeatures element, which describes inherited components, supported interfaces, used and provided interfaces, and emitted, published and consumed events. If the component inherits from other components, then the features of that component are described in a separate componentfeatures element and referenced by the inheritscomponent. The primary componentfeatures element of the descriptor is indicated by the repositoryid element of the component descriptor.

Each interface supported or provided by a component is described by an interface element. Interface elements are referenced by the repository id of the interface. An interface has a name and a repository id, and may inherit from other interfaces. The inheritance relationship is represented by the inheritsinterface element.

This information allows a tool to display the features of a component and to connect components together based on those features. For example, a component that uses interface X could be connected to another component that provides interface X, based on information in each component's descriptor.

6.4.2 Deployment Information

At deployment time, the component descriptor is used to determine the type of container in which the component needs to be installed and to provide information about the component to the container.

The componentkind element tells the creator of the container what kind of container to create. A componentkind can be either session, service, process, or entity.

The transaction element indicates the transactional characteristic of the component.

The eventpolicy is used to indicate the quality of service of event ports.

The threading element indicates how the container should dispatch operations on the component instance. If threading is set to multithread, then the component is ready to accept multiple threads of control within a single instance. The component takes responsibility for protecting its internal state. If threading is set to serialize, then the container will serialize all calls to a single instance. Note that although the
component will not need to protect instance state, the container may employ other threads to invoke other instances of the component type, thus the component must protect any static or class data.

The configurationcomplete element tells the deployment agent whether the component expects for configuration_complete to be called after its properties have been set and its ports configured to their initial state (e.g., as described by a component assembly descriptor).

The segments element provides the container with information necessary to map segment tags to segment names, segment tags to facet tags, and segment tags to abstract storage home types. The facettag element references a provides interface element described elsewhere in the descriptor. The provides element maps facet tags to provided interface names. A container uses the information provided by these elements to construct data structures mapping segment tags to segment names, facet tags to facet names, and segment tags to facet tags. Note that a segment tag can map to more than 1 facet tag.

6.4.3 CIDL Compiler Responsibilities

A CIDL compiler is responsible for generating an initial component descriptor. This initial descriptor is vendor specific and may be manipulated directly by the user or using vendor supplied tools.

6.4.4 CORBA Component Descriptor Example

```xml
<?xml version="1.0"?>
<!DOCTYPE corbacomponent SYSTEM "corbacomponent.dtd">
<corbacomponent>
  <corbaversion>3.0</corbaversion>
  <componentrepid repid="IDL:BookStore:1.0"/>
  <homerepid repid="IDL:BookStoreHome:1.0"/>
  <componentkind>
    <entity>
      <servant lifetime="processcontainer"/>
    </entity>
  </componentkind>
  <security rightsfamily="corba"/>
  <threading policy="multithread"/>
  <configurationcomplete set="true"/>
  <segment name="bookseg" segmenttag="1">
    <segmentmember facettag="1"/>
    <segmentmember facettag="2"/>
    <containermanagedpersistence>
      <storagehome id="PSDL:BookHome:1.0"/>
    </containermanagedpersistence>
  </segment>
</corbacomponent>
```

Note D Issue 5492
<pssimplemplementation id="ACME-PSS" />

**Note D  Issue 5499**

```xml
<catalog-type="PSDL:BookCatalog:1.0" />
<accessmode mode="READ_ONLY" />
<psstransaction policy="TRANSACTIONAL">
  <psstransactionisolationlevel level="SERIALIZABLE" />
</psstransaction>
<params>
  <param name="x" value="1" />
</params>
</containermanagedpersistence>

<homefeatures name="BookStoreHome" repid="IDL:BookStoreHome:1.0">
  <operationpolicies>
    <operation name="*">
      <transaction use="never" />
    </operation>
  </operationpolicies>
</homefeatures>

<componentfeatures name="BookStore" repid="IDL:BookStore:1.0">
  <inheritscomponent repid="IDL:Acme/Store:1.0" />
  <ports>
    <provides
      providesname="book_search"
      repid="IDL:BookSearch:1.0"
      facettag="1">
      <operationname="getByAuthor">
        <requiredrights>
          <right name="get" />
        </requiredrights>
      </operation>
      <operationname="getByTitle">
        <requiredrights>
          <right name="get" />
        </requiredrights>
      </operation>
      <operationname="getByISBN">
        <requiredrights>
          <right name="get" />
        </requiredrights>
      </operation>
    </provides>
    <provides
      providesname="shopping_cart"
repid="IDL:CartFactory:1.0"
facettag="2" />
<uses
usesname="ups_rates"
repid="IDL:ShippingRates:1.0" />
<uses
usesname="fedex_rates"
repid="IDL:ShippingRates:1.0" />
<emits
emitsname="low_stock"
eventtype="StockRecord">
<eventpolicy policy="normal" />
</emits>
<publishes
publishesname="offer_alert"
eventtype="SpecialOffer">
<eventpolicy policy="normal" />
</publishes>
</ports>
</componentfeatures>

<componentfeatures name="Store" repid="IDL:Acme/Store">
<supportsinterface repid="IDL:Acme/GeneralStore">
<operationpolicies>
<operation name="*">
<transaction use="required" />
</operation>
</operationpolicies>
</supportsinterface>
<ports>
<provides
providesname="admin"
repid="IDL:Acme/StoreAdmin:1.0"
facettag="3" />
</ports>
</componentfeatures>

@interface name="BookSearch" repid="IDL:BookSearch:1.0">
<inheritsinterface repid="IDL:SearchEngine:1.0" />
</interface>
@interface name="SearchEngine" repid="IDL:SearchEngine:1.0"/>
@interface name="CartFactory" repid="IDL:CartFactory:1.0"/>
@interface name="ShippingRates" repid="IDL:ShippingRates:1.0"/>
@interface name="StoreAdmin" repid="IDL:Acme/StoreAdmin:1.0">
<operationpolicies>
<operation name="*">
<transaction use="required" />
<requiredrights>
(right name="manage")
(right name="set")
</requiredrights>
</operationpolicies>
6.4.5 The CORBA Component Descriptor XML Elements

This section describes the XML elements that make up a component descriptor. The section is organized starting with the root element of the component descriptor document, `corbacomponent`, followed by all subordinate elements, in alphabetical order. The complete CORBA component descriptor DTD may be found in Section 7.2, `corbacomponent.dtd`, on page 7-5.

6.4.5.1 The `corbacomponent` Root Element

The `corbacomponent` element is the root element of the CORBA component descriptor.

```xml
```

These elements must be provided in the order presented.

- `corbaversion` tells which version of CORBA the component is assuming.
- `componentrepid` is the interface repository id of the component. It also refers to a `componentfeatures` element later in the descriptor.
- `homerepid` is the interface repository id of the home. It also refers to a `homefeatures` element later in the descriptor.
componentkind describes properties of the component that will determine what kind of container the component must reside in.

interop specifies interoperation information (e.g., with EJB).

transaction determines transaction policies for the entire component. This policy is optional and may be overridden on individual facets or supported interfaces.

security specifies CORBA security rights family for the component.

threadingpolicy determines whether calls to the component will be serialized or not.

configurationcomplete is set if the component expects for configuration_complete to be called on the component after all of its properties have been set and its ports have been connected.

extendedpoapolicy is used to set a POA policy for the component beyond the base POA policies. For example, firewall policies.

repository provides a reference to a repository, such as the interface repository.

segment describes a segment including its name, tag, member facets, and storage home type.

homefeatures describes the structure of the component's homes.

componentproperties specifies the default component properties file.

homeproperties specifies the default home properties file.

componentfeatures describes inherited components, supported interfaces, uses and provides ports, and emits, publish, and consumes ports of the component. If the primary component inherits from other components, those components are described in separate componentfeature elements.

interface describes the simple name and repository id of an interface and points to inherited interfaces. Between the componentfeatures and interface elements, one can navigate all of the interfaces that a component uses, provides, supports, and inherits.

extension may be used by a user or vendor to provide proprietary information in the component descriptor.

These are the top-level elements of the document. These descriptor elements are described in terms of attributes and other elements. The remainder of this section will describe the top-level and child elements in detail.

Elements are presented in alphabetical order so that they will be easy to locate.

See Section 7.2, Ôcorbacomponent.dtd,Ô on page 7-5 for the full text of the component descriptor DTD.

6.4.5.2 The accessmode Element

Child element of containermanagedpersistence.
The `accessmode` element identifies whether the persistent state may be read and written or only read.

```xml
<!ELEMENT accessmode EMPTY>
<!ATTLIST accessmode
    mode (READ_ONLY|READ_WRITE) #REQUIRED >
```

The `mode` attribute identifies the access mode.

---

### 6.4.5.3 The `catalog` Element

Child element of `containermanagedpersistence`.

The `catalog` element identifies the catalog to be used in loading and storing persistent state.

```xml
<!ELEMENT catalog EMPTY>
<!ATTLIST catalog
type CDATA #REQUIRED >
```

The `type` attribute identifies the type of catalog.

---

### 6.4.5.4 The `componentfeatures` Element

Child element of `corbacomponent`.

The `componentfeatures` element is used to describe a component with respect to the components that it inherits from, the interfaces that the component supports, and its provides, uses, emits, publish, and consumes ports. A component also has the features that it inherits from other components. In addition, supported interfaces may inherit from other interfaces. By following the inheritance chain, a graph is formed from the primary component to a set of ports, supported interfaces, and other components. The root component in this graph is identified by the `repositoryid` child element of `corbacomponent`.

---

**Note D Issue 5493**

The information obtained by traversing the `componentfeatures` graph may be displayed by graphical tools. But more importantly, it allows component assembly tools to decide which ports on a component are capable of connecting to ports on other components.

```xml
<!ELEMENT componentfeatures
    ( inheritscomponent?, supportsinterface* )
```
The name attribute is the non-qualified name of the component.

The repid attribute is the fully qualified repository id of the component. repid is also used to refer to this component from elsewhere in the descriptor (for example, from the inheritscomponent element).

6.4.5.5 The componentkind Element
Child element of corbaComponent.

The componentkind element defines the component category. For more information on these categories, see Section 4.1.4, ÔComponent Categories,Ô on page 4-5.

6.4.5.6 The componentproperties Element
The componentproperties element specifies a default component property file. The format of the property file is described in Section 6.8, ÔProperty File Descriptor,Ô on page 6-62.

6.4.5.7 The componentrepid Element
Child element of corbaComponent.

componentrepid identifies the repository id of the component described by this descriptor. The repository id also serves to point to the primary componentfeatures element for this component within the descriptor, so as to distinguish it from inherited components.
repid CDATA #IMPLIED >

repid is the fully qualified repository id of the component.

6.4.5.8 The configurationcomplete Element

Child element of corbacomponent.

The configurationcomplete attribute is used to set whether configuration_complete should be called on the component after it has been fully configured.

<!ELEMENT configurationcomplete EMPTY >
<!ATTLIST configurationcomplete
   set ( true | false ) #REQUIRED >

6.4.5.9 The consumes Element

Child element of ports.

A consumes port specifies an event that the component expects to receive. At deployment or creation time, the component will be connected via a channel to other components or entities that emit the event. The eventpolicy allows the transaction policy of the event port to be specified.

<!ELEMENT consumes
   ( eventpolicy
      , extension* ) >
<!ATTLIST consumes
   consumesname CDATA #REQUIRED
   eventtype CDATA #REQUIRED >

consumesname

The consumesname attribute identifies the name associated with the consumes statement in idl.

eventtype

The eventtype attribute identifies the repository id of the event that the component expects to consume.

6.4.5.10 The containermanagedpersistence Element

Child element of segment.

A containermanagedpersistence element specifies attributes required by the container to manage the componentÕs persistent state using a PSS.

storagehome indicates the type of abstract storage home.
**psimplemplementation** identifies a particular PSS implementation to be used, if not specified, then the default PSS is used, as determined by the container implementation.

---

**Note D Issue 5499**

**catalog** specifies the catalog type.

**accessmode** specifies the access mode--read only or read-write.

**psstransactionpolicy** specifies whether transactions are to be used or not and, if so, the isolation level.

**params** is used to specify vendor specific parameters.

---

```xml
<!ELEMENT containermanagedpersistence (storagehome, pssimplemplementation?)
   (catalog?, accessmode, psstransactionpolicy, params?)>
```

**6.4.5.11 The corbacomponent Element**

The root element of this CORBA Component descriptor. See Section 6.4.5.1, ÔThe corbacomponent Root Element,Ô on page 6-21.

**6.4.5.12 The corbaversion Element**

Child element of corbacomponent.

The corbaversion is used to identify the version of CORBA that the component implementation is assuming. The version is represented by a major and minor number separated by a O.O. For example, Ô<corbaversion>3.0</corbaversion>O.

```xml
<!ELEMENT corbaversion (#PCDATA)>
```

**6.4.5.13 The description Element**

See Section 6.3.2.8, ÔThe description Element,Ô on page 6-7.

**6.4.5.14 The emits Element**

Child element of ports.
An emits port specifies an event that the component generates. At deployment or creation time, the component will be connected to a channel in which it can be connected to consuming components. The eventpolicy allows the transaction policy of the event port to be specified.

```xml
<!ELEMENT emits (eventpolicy, extension*)>
<!ATTLIST emits
    emitsname CDATA #REQUIRED
    eventtype CDATA #REQUIRED>
```

The emitsname attribute identifies the name associated with the emits statement in idl. The eventtype attribute identifies the repository id of the emitted events.

### 6.4.5.15 The entity Element

Child element of componentkind.

The entity component kind is described in Section 4.2.1, ÖComponent Containers,Ö on page 4-5.

```xml
<!ELEMENT entity (servant)>
```

### 6.4.5.16 The eventpolicy Element

**Note Đ Issue 5494**

Child element of corba, component, consumes, emits, publishes.

Event policies define the quality of service associated with the event ports of the component. The possible values are defined in Section 4.2.8, ÖEvents,Ö on page 4-12.

```xml
<!ELEMENT eventpolicy EMPTY>
<!ATTLIST eventpolicy
    policy (normal | default | transaction) #IMPLIED>
```

### 6.4.5.17 The extendedpoapolicy Element

Child element of corba.

The extendedpoapolicy element is a name-value pair used to specify POA policies beyond the base set of policies. It is for new policies, such as firewall, or future POA policies yet to be defined. The extendedpoapolicy element must not be used to specify any of the base POA policies. A set of POA policies is predefined for each component.
category, except for the unclassified category. Only the unclassified component type is flexible with respect to base POA policies; these are set using the poapolicies child element of the unclassified element.

```xml
<!ELEMENT extendedpoapolicy EMPTY>
<!ATTLIST extendedpoapolicy
  name CDATA #REQUIRED
  value CDATA #REQUIRED >
```

The name attribute is the name of the poa policy as defined in the specification where it originated.

The value attribute is a valid attribute for the policy as defined in the specification where it originated.

### 6.4.5.18 The extension Element

Child element of corbacomponent, componentfeatures, homefeatures.

See Section 6.3.2.11, ØThe extension Element,Ø on page 6-8.

### 6.4.5.19 The fileinarchive Element

See Section 6.3.2.12, ØThe fileinarchive Element,Ø on page 6-9.

### 6.4.5.20 The homefeatures Element

Child element of corbacomponent.

The homefeatures element is used to describe a component home with respect to the homes that it inherits from and the operationpolicies of its interface.

```xml
<!ELEMENT homefeatures
  ( inheritshome?,
    , operationpolicies?,
    , extension* ) >
<!ATTLIST homefeatures
  name CDATA #REQUIRED
  repid CDATA #REQUIRED >
```

The name attribute is the non-qualified name of the home.

The repid attribute is the fully qualified repository id of the home. repid is also used to refer to this component from elsewhere in the descriptor, for example from the inheritshome element.

### 6.4.5.21 The homeproperties Element

The homeproperties element specifies a default home property file. The format of the property file is described in Section 6.8, ØProperty File Descriptor,Ø on page 6-62.
6.4.5.22 The homerepid Element
Child element of corbacomponent.

homerepid identifies the repository id of the home of the component described by this descriptor. The home repository id also serves to point to the primary homefeatures element for the home within the descriptor, so as to distinguish it from inherited homes.

<!ELEMENT homerepid EMPTY >
<!ATTLIST homerepid      repid CDATA #IMPLIED >

repid is the fully qualified repository id of the component.

6.4.5.23 The inheritscomponent Element
Child element of componentfeatures.

The inheritscomponent element specifies an inherited component.

<!ELEMENT inheritscomponent EMPTY>  
<!ATTLIST inheritscomponent      repid CDATA #REQUIRED>  

The repid identifies is the repository id of the inherited component. It also serves to refer to the componentfeatures element of the inherited component elsewhere in the descriptor.

6.4.5.24 The inheritshome Element
Child element of homefeatures.

The inheritshome element specifies an inherited home.

<!ELEMENT inheritshome EMPTY>  
<!ATTLIST inheritshome      repid CDATA #REQUIRED>  

The repid identifies is the repository id of the inherited home. It also serves to refer to the homefeatures element of the inherited home elsewhere in the descriptor.

6.4.5.25 The inheritsinterface Element
Child element of interface.
The `inheritsinterface` element is used to specify interface inheritance. This allows, for example, for a derivation chain to be followed from a supported or provided interface up to but excluding the `Object` interface.

```xml
<!ELEMENT inheritsinterface EMPTY>
<!ATTLIST inheritsinterface
   repid CDATA #REQUIRED>
```

The `repid` identifies is the repository id of the inherited interface. It is used to refer to the interface element of the inherited interface elsewhere in the descriptor.

### 6.4.5.26 The `ins` Element

Child element of `repository`.

The `ins` element is used to specify an interoperable naming service name.

```xml
<!ELEMENT ins EMPTY>
<!ATTLIST ins
   name CDATA #REQUIRED >
```

`name` is the INS name.

### 6.4.5.27 The `interface` Element

Child element of `corbacomponent`.

Specifies an interface that the component, either directly or through inheritance, provides, uses, or supports. The `operationpolicies` child element specifies default transaction policies and required security rights for uses of the interface.

```xml
<!ELEMENT interface
   ( inheritsinterface*,
       operationpolicies? ) >
<!ATTLIST interface
   name CDATA #REQUIRED
   repid CDATA #REQUIRED >
```

The `name` attribute is the non-qualified name of the interface.

The `repid` attribute is the fully qualified repository id of the interface. `repid` is also used to refer to this interface from elsewhere in the descriptor, for example from the `inheritsinterface` element.

### 6.4.5.28 The `interop` Element

Child element of `corbacomponent`.

The `interop` element is used to specify whether this component interoperates with another component type by acting as a view for that type or having a view of that type.
6.4.5.29 The link Element

See Section 6.3.2.18, "The link Element," on page 6-11.

6.4.5.30 The objref Element

Child element of repository.

The objref element is used to specify a stringified object reference.

6.4.5.31 The operation Element

Child element of operationpolicies.

The operation element is used to specify transaction and required security rights for a particular operation (or group of operations if name=Ó*Ó).

6.4.5.32 The operationpolicies Element

Child element of componentfeatures, homefeatures, interface, provides, and supportsinterface.
The **operationpolicies** element is used to specify a set of operation policies. It consists of a list of operation child elements that each may specify security or transaction policies of an operation or set of operations.

The scope of the **operationpolicies** element depends upon where it is specified. As a child of **componentfeatures** it specifies the policies for the component operations, such as the operations effecting facets, receptacles, and event ports. When used as a child of **homefeatures** it specifies the policies of the home interface operations. As a child of **interface** it specifies the operation policies for all uses of the particular interface. Operation policies set in a **supportsinterface** or **provides** element specify operation policies for a particular use of an interface. Note that operation policies set in **supportsinterface** or **provides** element supersede policies set in an **interface** element.

```
<!ELEMENT operationpolicies
 ( operation+ )>
```

### 6.4.5.33 The param Element

Child element of **params**.

The **param** element is used to specify a name-value pair.

```
<!ELEMENT param EMPTY >
<!ATTLIST param
 name CDATA #REQUIRED
 value CDATA #REQUIRED >
```

The **name** attribute specifies the name.

The **value** attribute specifies the value.

### 6.4.5.34 The params Element

Child element of **containermanagedpersistence**.

The **params** element is used to specify a set of one or more name-value pairs.

```
<!ELEMENT params (param+) >
```

### 6.4.5.35 The poapolicies Element

Child element of **unclassified**.

The **poapolicies** element is used to identify POA creation parameters for an empty container in which an **unclassified** category component will reside.

```
<!ELEMENT poapolicies EMPTY>
<!ATTLIST poapolicies
 thread (ORB_CTRL_MODEL | SINGLE_THREAD_SAFE ) #REQUIRED
 lifespan (TRANSIENT | PERSISTENT ) #REQUIRED
 iduniqueness (UNIQUE_ID | MULTIPLE_ID) #REQUIRED
```
id assignment (USER_ID | SYSTEM_ID) #REQUIRED
servant retention (RETAIN | NON RETAIN) #REQUIRED
request processing (USE_ACTIVE_OBJECT_MAP_ONLY | USE_DEFAULT_SERVANT | USE_SERVANT_MANAGER) #REQUIRED
implicit activation (IMPLICIT_ACTIVATION | NON_IMPLICIT_ACTIVATION) #REQUIRED >

The poapolicies attributes are as defined in the base POA specification.

**Note D** Not all combinations of POA policies are valid. A good component packaging tool will not permit the user to specify invalid POA policy combinations. If however, an invalid combination of policies is used to configure the empty container, the container/POA should throw an exception.

### 6.4.5.36 The ports Element

Child element of componentfeatures.

The ports element describes what interfaces a component provides and uses, and what events it emits, publishes, and consumes. Any number of uses, provides, emits, publishes, and consumes elements can be specified in any order.

```xml
<!ELEMENT ports
  ( uses
    | provides
    | emits
    | publishes
    | consumes
  )* >
```

### 6.4.5.37 The process Element

Child element of componentkind.

The process component kind is described in Section 4.1.4, Component Categories, on page 4-5.

```xml
<!ELEMENT process
  ( servant ) >
```

### 6.4.5.38 The provides Element

Child element of ports.

The provides element specifies an interface that is provided by the component.
The optional operationpolicies child element allows transaction policies and required rights to be specified for the provided interface. The policies specified here override any policies specified in the interface element, as identified by the repid.

```xml
<!ELEMENT provides
   ( operationpolicies?
   , extension* ) >
<!ATTLIST provides
   providesname CDATA #REQUIRED
   repid     CDATA #REQUIRED
   facettag  CDATA #REQUIRED >
```

The providesname is the name given to the provides port in IDL.

The repid is the fully qualified repository id of the component. It is also used to reference an interface element elsewhere in the descriptor.

The facettag is the tag for the facet. This attribute is used in combination with the segmentmember element, defined in Section 6.4.5.48, “The segmentmember Element,” on page 6-37, to associate a facet with a segment.

6.4.5.39 The pssimplementation Element

Child element of containermanagedpersistence.

The pssimplementation element identifies a particular vendor’s PSS implementation.

```xml
<!ELEMENT pssimplementation EMPTY>
<!ATTLIST pssimplementation
   id CDATA #REQUIRED >
```

The id attribute identifies the particular PSS implementation.

6.4.5.40 psstransaction Element

Child element of containermanagedpersistence.

The psstransaction element is used to specify the PSS transactional policies associated with the entity or process component.

```xml
<!ELEMENT psstransaction (psstransactionisolationlevel? ) >
<!ATTLIST psstransaction
   policy (TRANSACTIONAL|NON_TRANSACTIONAL) #REQUIRED >
```

6.4.5.41 psstransactionisolationlevel Element

Child element of psstransaction.

The psstransactionisolationlevel element is used to specify the transaction isolation level when persistent store access is transactional.
The level attribute identifies one of four isolation levels.

6.4.5.42 The publishes Element

Child element of ports.

A publishes port specifies an event that the component publishes. At deployment or creation time, the component will be connected to a channel by which it can be connected to consuming components. The eventpolicy allows the transaction policy of the event port to be specified.

The publishesname attribute identifies the name associated with the emits statement in idl.

The event_type attribute identifies the repository id of the published events.

6.4.5.43 The repository Element

Child element of corbacomponent.

The repository element is used to point to a repository, such as the interface repository.

The type attribute specifies the type of repository. Currently, the only predefined value for type is CORBA Interface Repository.

6.4.5.44 The requiredrights Element

Child element of operation and security.
The `requiredrights` element specifies a list of required rights. When used as a child of `operation`, the rights specified must belong to a rights family specified in the `security` element. When used as a child of `security` the list of rights specify the available rights in the rights family.

```xml
<!ELEMENT requiredrights
 ( right* ) >
```

### 6.4.5.45 The right Element

Child element of `requiredrights`.

The `right` element specifies a particular required right. The right must be a member of the rights family specified by the security element.

```xml
<!ELEMENT right
 ( description? ) >
<!ATTLIST right
 name CDATA #REQUIRED >
```

The `name` attribute is the name of the required right.

### 6.4.5.46 The security Element

Child element of `corbacomponent`.

The `security` element is an optional child element of `corbacomponent`; it is required whenever rights are assigned to component operations within the descriptor. It specifies the rights family assumed when defining component operation rights and the rights combinator required for interpretation of multiple required rights. The optional `requiredrights` element may be used to document the rights available in the rights family.

```xml
<!ELEMENT security
 ( requiredrights? ) >
<!ATTLIST security
 rightsfamily CDATA #REQUIRED
 rightscombinator ( secallrights | secanyrights ) #REQUIRED >
```

The `rightsfamily` attribute defines the rights family (for example, the ŒCORBAÓ rights family). The `rightscombinator` enumeration attribute defines the possible rights combinator describing the interpretation of multiple rights as defined by the CORBA Security Service.

### 6.4.5.47 The segment Element

Child element of `corbacomponent`. 
The segment element describes a component segment. It consists of a list of one or more segmentmember child elements, indicating the facets that the segment supports, and a containermanagedpersistence element indicating that the persistent state of the segment is managed by the container. If the containermanagedpersistence element is not present, then the persistent state, if any, is managed by the component. Note that the containermanagedpersistence element is only employed for entity and process components.

```xml
<!ELEMENT segment
  ( segmentmember+, containermanagedpersistence?, extension* ) >
<!ATTLIST segment
  name CDATA #REQUIRED
  segmenttag CDATA #REQUIRED >
```

name is the name of the segment.
segmenttag is the segment's tag.

### 6.4.5.48 The segmentmember Element

Child element of segment.

The segmentmember element specifies a facet that is a member of a segment.

```xml
<!ELEMENT segmentmember EMPTY>
<!ATTLIST segmentmember
  facettag CDATA #REQUIRED >
```

The facettag attribute indicates the member facet's tag. It corresponds to a provided interface with the same facet tag elsewhere in the descriptor. (See the provides tag element in Section 6.4.5.38, the provides Element, on page 6-33.)

### 6.4.5.49 The servant Element

Child element of entity, process, session.

Servant lifetime policies control the lifetime of the servant that implements a component's operations and provide an aid to efficiently manage storage of components within a server process. Servant lifetime policies are fixed for service components. Servant lifetime policies must be specified for session, process, and entity components and are implemented by the component using APIs provided by the container.

```xml
<!ELEMENT servant EMPTY >
<!ATTLIST servant
  lifetime (component|method|transaction|container) #REQUIRED >
```
The possible values are defined in Section 4.2.5, ÖServant Lifetime Management,Ó on page 4-8.

6.4.5.50 The service Element

Child element of componentkind.

Specifies that the component is of the service category. The service component kind is described in Section 4.2.13.1, ÖThe Service Component,Ó on page 4-16.

<!ELEMENT service EMPTY >

6.4.5.51 The session Element

Child element of componentkind.

Specifies that the component is of the session category. The session component category is described in Section 4.2.13.2, ÖThe Session Component,Ó on page 4-17.

<!ELEMENT session ( servant ) >

6.4.5.52 The storagehome Element

Child element of segment.

The storagehome element specifies an abstract storage home type.

<!ELEMENT storagehome EMPTY>
<!ATTLIST storagehome
  id CDATA #REQUIRED >

The id attribute specifies the repository id of the abstract storage home.

6.4.5.53 The simple-link-attributes Entity

See Section 6.3.2.28, ÖThe simple-link-attributes Entity,Ó on page 6-14.

6.4.5.54 The supportsinterface Element

Child element of componentfeatures.

The supportsinterface element identifies an interface that the component supports, as defined in IDL.

The optional operationpolicies child element allows transaction policies and required rights to be specified for the supported interface. The policies specified here override any policies specified in the interface element, as identified by the repid.

<!ELEMENT supportsinterface>
The **repid** is the fully qualified repository id of the component. It is also used to reference an interface element elsewhere in the descriptor.

### 6.4.5.55 The threading Element

Child element of `corbacomponent`.

The **threading** element determines the threading policy of the container in which it is placed.

```xml
<!ELEMENT threading EMPTY>
<!ATTLIST threading
  policy (serialize | multithread ) #REQUIRED >
```

Setting **policy** to **serialize** means that the container will serialize calls to the container. Setting **policy** to **multithread** means that multiple threads of control can be active in the component at one time.

### 6.4.5.56 The transaction Element

Child element of `corbacomponent`.

The **transaction** element controls the way transactions are managed by the container for this component. Seven possible values can be selected by the component developer to provide maximum flexibility.

```xml
<!ELEMENT transaction EMPTY >
<!ATTLIST transaction
  use (self-managed|not-supported|required|supports|required-new|mandatory|never) #REQUIRED >
```

If the transaction **use** attribute is set to **self-managed**, then it is assumed that the component will manage transactions on its own. Other **use** values indicate that transactions are to be managed by the container; the meaning of these values are defined in the container chapter, Section 4.2.6, "Transactions," on page 4-9.

### 6.4.5.57 The unclassified Element

Child element of `componentkind`.

The **unclassified** element identifies that the component is of the unclassified sort. See Section 4.2.1, "OComponent Containers," on page 4-5 for more information on the unclassified component category.

```xml
<!ELEMENT unclassified>
```
6.4.5.58 The uses Element

Child element of ports.

The uses element specifies an interface that is used by the component, as specified in a component IDL uses declaration.

```xml
<!ELEMENT uses ( extension* )>
<!ATTLIST uses
  usename CDATA #REQUIRED
  repid   CDATA #REQUIRED >
```

The usename is the name given to the uses port in IDL.

The repid is the fully qualified repository id of the component. It is also used to reference an interface element elsewhere in the descriptor.

6.5 Component Assembly Packaging

A component package is the vehicle for deploying a single component implementation. A component assembly package is the vehicle for deploying a set of interrelated component implementations. It is a template or pattern for instantiating a set of components and introducing them to each other.

An assembly package consists of a descriptor and a set of component packages and property files. These files may be packaged together in an archive file or distributed. When distributed, the descriptor represents the package and holds links to its associated files.

The component assembly descriptor describes which components make up the assembly, how those components are partitioned, and how they are connected to each other. A component assembly descriptor is the recipe for deploying a set of interconnected components.

An assembly is normally created visually within a design tool; however, it is possible to create assemblies using more primitive tools.

**Note D** An assembly specifies an initial configuration. The actual connected graph of components may evolve beyond that initial configuration. The assembly does not address the evolution of this graph.

6.6 Component Assembly File

The component assembly archive file is a ZIP file containing a component assembly descriptor, a set of component archive files, and, if necessary, a set of component property files. The component assembly archive file has a .aarO extension.
6.7 Component Assembly Descriptor

A component assembly descriptor is specified using an XML vocabulary. Each component assembly package must contain a single descriptor file. Component descriptors have a .cad extension (Component Assembly Descriptor).

The assembly descriptor describes a component assembly. It consists of elements describing the components used in the assembly, connection information, and partitioning information.

A component instantiation is always relative to a home. A deployed home is called a home Òplacement.Ó

Component instantiations are connected by their provides and uses interfaces, or by their emits, publishes, and consumes events. If one component provides an interface of a particular type and another component uses an interface of that type, then we can pass the reference of the provided interface to the component that uses it, in effect connecting the two components. In the same way, we connect two components where one emits or publishes an event that the other consumes.

Sets of component instances may be partitioned. Components may be free or partitioned to a generic set of hosts and processes. This is really a process of conveying that specific components are to be collocated within a single process or host. Free components, components that are not used in a collocation may be deployed in any manner at deployment time.

When used in an archive, the CAD file for the archive is placed in a top level directory called Òmeta-inf.Ó

6.7.1 Component Assembly Descriptor Example

The following example illustrates how to write a component assembly descriptor. For further information, see the element descriptions that follow and the XML DTDs in Chapter 7.

```xml
<!DOCTYPE componentassembly SYSTEM "componentassembly.dtd">

<componentassembly id="ZZZ123">
  <description>Example assembly</description>
  <componentfiles>
    <componentfile id="A">
      <fileinarchive name="ca.csd"/>
    </componentfile>
    <componentfile id="B">
      <fileinarchive name="cb.csd"/>
    </componentfile>
    <componentfile id="C">
      <fileinarchive name="cc.csd">
        <link href="ftp://www.xyz.com/car/cc.car"/>
      </fileinarchive>
    </componentfile>
  </componentfiles>
</componentassembly>
```
<componentfile id="D">
  <fileinarchive name="cd.csd"/>
</componentfile>

<componentfile id="E">
  <fileinarchive name="ce.csd"/>
</componentfile>

<componentfile id="F">
  <fileinarchive name="cf.csd"/>
</componentfile>
</componentfiles>

<partitioning>

<homeplacement id="AaHome">
  <componentfileref idref="A"/>
  <componentinstantiation id="Aa"/>
</homeplacement>

<processcollocation cardinality="*">
  <usagename>Example process collocation</usagename>
  <impltype language="C++"/>
  <homeplacement id="BbHome">
    <componentfileref idref="B"/>
    <componentinstantiation id="Bb"/>
  </homeplacement>
  <homeplacement id="CcHome">
    <componentfileref idref="C"/>
    <componentinstantiation id="Cc"/>
  </homeplacement>
</processcollocation>

<hostcollocation cardinality="1">
  <usagename>Example host collocation</usagename>
  <processcollocation cardinality="*">
    <homeplacement id="DdHome">
      <componentfileref idref="D"/>
      <componentinstantiation id="Dd"/>
    </homeplacement>
    <homeplacement id="EdHome">
      <componentfileref idref="E"/>
      <componentinstantiation id="Ee"/>
    </homeplacement>
    <homeplacement id="FfHome">
      <componentfileref idref="F"/>
      <componentinstantiation id="Ff"/>
    </homeplacement>
  </processcollocation>
  <homeplacement id="AaaHome">
    <usagename>Example home for A components</usagename>
  </homeplacement>
</hostcollocation>
<componentfileref idref="A"/>
<componentimplref idref="an A impl"/>
<homeproperties>
  <fileinarchive name="AHomeProperties.cpf"/>
</homeproperties>
<componentproperties>
  <fileinarchive name="defaultAProperties.cpf"/>
</componentproperties>
<registerwithhomefinder name="AaHome"/>

<componentinstantiation id="Aaa">
  <usagename>Example component instantiation</usagename>
  <componentproperties>
    <fileinarchive name="AaaProperties.cpf"/>
  </componentproperties>
  <registercomponent>
    <registerwithnaming name="sink"/>
  </registercomponent>
</componentinstantiation>

<registerwithtrader>
  <traderexport>
    <traderservicetypename>
aTraderServiceTypeName
</traderservicetypename>
    <traderproperties>
      <traderproperty>
        <traderpropertyname>ppm</traderpropertyname>
        <traderpropertyvalue>10</traderpropertyvalue>
      </traderproperty>
      <traderproperty>
        <traderpropertyname>weight</traderpropertyname>
        <traderpropertyvalue>333</traderpropertyvalue>
      </traderproperty>
    </traderproperties>
  </traderexport>
</registerwithtrader>
</partitioning>

<connections>
  <connectinterface>
    <usesport>
      <usesidentifier>abc</usesidentifier>
      <componentinstantiationref idref="Aa"/>
    </usesport>
    <providesport>
      <providesidentifier>abc</providesidentifier>
    </providesport>
  </connectinterface>
</connections>
6.7.2 Component Assembly Descriptor XML Elements

This section describes the XML elements that make up a component assembly descriptor. The section is organized starting with the root element of the descriptor document, `componentassembly`, followed by all subordinate elements, in alphabetical order. The complete component assembly DTD may be found in Section 7.4, "componentassembly.dtd", on page 7-13.

6.7.2.1 The componentassembly Root Element

The `componentassembly` element is the root element of the component assembly descriptor. The `description` element is text describing the assembly. The `componentfiles` element lists the component files that are used in the assembly, the `partitioning` element describes how homes and components are to be deployed. The `connections` element describes how deployed components and homes are to be connected. The `extension` element can be used to add proprietary or experimental elements to the component assembly document.

```
<componentassembly
( description?
, componentfiles
, partitioning
, connections?
, extension*
 ) >
```

The `id` attribute is a DCE UUID that uniquely identifies the assembly. The `derivedfrom` attribute is used to point to an assembly from which this assembly was derived. The `derivedfrom` attribute contains the id of the source assembly.

```xml
<componentinstantiationref idref="Bb"/>
</providesport>
</connectinterface>
<connectevent>
  <consumesport>
    <consumesidentifier>pqr</consumesidentifier>
    <componentinstantiationref idref="Aaa"/>
  </consumesport>
  <emitsport>
    <emitsidentifier>mno</emitsidentifier>
    <componentinstantiationref idref="Ee"/>
  </emitsport>
</connectevent>
</connections>
```
### Note D

The `derivedfrom` attribute is for a deployment tool that wants to create a copy of an assembly descriptor and archive to describe an actual deployment; it maintains the relationship between the ÒcloneÓ and the original. The new assembly descriptor would have the destination addresses for each placement and collocation defined; and collocations with non-ordinal cardinality in the original assembly would be copied to one or more collocations, with singular cardinality, in the derived assembly. The new archive file might prune constituent component archive files to contain single implementations to facilitate copying component implementations to target deployment hosts.

---

#### 6.7.2.2 The codebase Element

See Section 6.3.2.4, ÔThe codebase Element,Ó on page 6-6.

#### 6.7.2.3 The componentfile Element

The `componentfile` element refers to a component software descriptor containing information regarding a component and home implementation. `componentfile` elements are referenced by `homeplacement` elements.

`componentfile` contains either a `fileinarchive`, `link`, or `codebase` element.

```xml
<!ELEMENT componentfile ( fileinarchive | codebase | link )>
<!ATTLIST componentfile id ID #REQUIRED type CDATA #IMPLIED >
```

The `id` attribute must uniquely identify the `componentfile` element within the descriptor.

The optional `type` attribute specifies the type of component file. If unspecified, then the file is assumed to be CORBA component. An example use of the type attribute would be to specify an EJB component file, where `type=ÓEJB 1.1Ó`.

#### 6.7.2.4 The componentfileref Element

The `componentfileref` element refers to a particular `componentfile` element in the `componentfiles` block.

```xml
<!ELEMENT componentfileref EMPTY >
<!ATTLIST componentfileref idref CDATA #REQUIRED >
```

The `idref` attribute corresponds to a unique `componentfile id` attribute.
6.7.2.5 The componentfiles Element

The componentfiles element is used to list all of the component files that are used in the assembly. At least one component file must be specified.

Each component file is uniquely identified for reference elsewhere in the descriptor. Multiple component instances may refer to a single component file.

```xml
<!ELEMENT componentfiles
     ( componentfile+ )>
```

6.7.2.6 The componentimplref Element

The componentimplref element is used to refer to a particular implementation in a component file.

```xml
<!ELEMENT componentimplref EMPTY>
<!ATTLIST componentimplref
   idref CDATA #REQUIRED>
```

The idref attribute refers to a unique implementation element id in the component descriptor. The componentimplref is optional if there is only one implementation in the component file. Or it may be set at deployment time depending on the type of platform that the component is deployed to.

6.7.2.7 The componentinstantiation Element

The componentinstantiation element describes a particular instantiation of a component relative to a home placement. The componentinstantiation element is a direct child of the homenulement element.

The usagename child element is used to specify a name for the placement, possibly for display in a tool. The componentproperties element refers to a property file associated with this instantiation. It is used to configure the component once it is created and after the home sets initial property values (as specified in the homeplacement componentproperties element). The registercomponent element instructs the installation process to register the component or its provided interfaces with a naming service or trader.

```xml
<!ELEMENT componentinstantiation
     ( usagename?,
       componentproperties?,
       registercomponent?,
       extension*)>
<!ATTLIST componentinstantiation
   id    ID   #REQUIRED>
```
The id attribute is a unique identifier within the assembly descriptor for the component. The id is used to refer to the component instance in the connect block.

6.7.2.8 The componentinstantiationref Element

The componentinstantiationref element refers to a particular componentinstantiation element in the assembly descriptor.

<!ELEMENT componentinstantiationref EMPTY >
<!ATTLIST componentinstantiationref
idref CDATA #REQUIRED >

The idref attribute corresponds to a unique componentinstantiation id attribute.

6.7.2.9 The componentproperties Element

The componentproperties element specifies a property file for a home. If the component file has a default property file in the component package, the component property file overrides the default. The property file may be specified by either a fileinarchive or a codebase child element. The format of the property file is described in Section 6.8, ÔProperty File Descriptor,Ô on page 6-62.

When the componentproperties element is specified as part of a homeplacement element, then the properties are used to configure each component created through that home. When componentproperties is specified as part of a componentinstantiation element, the properties are used to configure that single instantiation. If component properties are set on both a homeplacement and an associated componentinstantiation, then the component will be configured first by the homeplacement component properties and then by the componentinstantiation component properties.

<!ELEMENT componentproperties
  ( fileinarchive
    | codebase
  ) >

6.7.2.10 The componentsupportedinterface Element

Specifies a component with a supports interface that can satisfy an interface connection to a uses port within a connectinterface element. The component is identified by a componentinstantiationref or a findby element. The componentinstantiationref identifies a component within the assembly. The findby element points to an existing component that can be found within a naming service or trader, or using a stringified object reference.

<!ELEMENT componentsupportedinterface
  ( componentinstantiationref
    | findby
  ) >
6.7.2.11 The connectevent Element

The `connectevent` element is used in the `connections` element to specify a connection from a `consumes` port, of one component, or an existing interface to an `emits` or `publishes` port of another component.

The `consumesport` element identifies a component and associated consumes port. The `emitsport` element identifies a component associated emits port. The `publishesport` element identifies a component and associated `publishesport`.

```xml
<!ELEMENT connectevent
  ( (consumesport
      | existinginterface
    )
    , (emitsport
        | publishesport
      )
  )>
<!ATTLIST connectevent
  id ID #IMPLIED>
```

The `id` attribute is a unique identifier within the assembly descriptor. It is not required or used elsewhere in the assembly descriptor; however, someone (or a tool) might want to use it to refer to a particular `connectevent` element.

6.7.2.12 The connecthomes Element

The `connecthomes` element is used to specify a connection between a `proxyhome` and another home.

The `proxyhome` element refers to the proxy home. The `destinationhome` element refers to the home to which the proxy home will be connected. The destination home can be either another proxy home or an actual home.

```xml
<!ELEMENT connecthomes
  ( proxyhome
    , destinationhome
  )>
<!ATTLIST connecthomes
  id ID #IMPLIED>
```

The `id` attribute is a unique identifier within the assembly descriptor. It is not required or used elsewhere in the assembly descriptor; however, someone (or a tool) might want to use it to refer to a particular `connecthomes` element.
6.7.2.13 The connectinterface Element

The connectinterface element is used to connect a component’s uses port to an interface. The interface may be a provided or supported interface of another component, it may be an existing interface (other than those provided by components in the assembly), or it may be a home interface.

The usesport element identifies the component and port where the connection is to be made. The providesport element identifies a component and provides port. The componentsupportedinterface element identifies a component that has a supported interface that will satisfy the uses port. The existinginterface element identifies a way to find an existing interface that will satisfy the uses. The homeinterface element identifies a homeinterface that the uses port requires.

<!ELEMENT connectinterface (
  usesport ,
   ( providesport
     | componentsupportedinterface
     | existinginterface
     | homeinterface
   )
)>

<!ATTLIST connectinterface
  id ID #IMPLIED >

The id attribute is a unique identifier within the assembly descriptor. It is not required or used elsewhere in the assembly descriptor; however, someone (or a tool) might want to use it to refer to a particular connectinterface element.

6.7.2.14 The connections Element

The connections element is used to satisfy component uses and consumes dependencies and to connect homes. The connectinterface element is used to connect component uses ports to interfaces. The connectevent element is used to connect a components consumes port to event producers. The connecthomes element is used to connect a proxy home to another home.

<!ELEMENT connections
  ( connectinterface
   | connectevent
   | connecthomes
   | extension
  )* >

Note D If a componentinstantiation involved in a connection has a cardinality greater than 1, or if it is part of a process or host collocation with a cardinality greater than 1, then multiple connections will be realized from or to each instance of the component. That is, the connection will be made for each instantiation of the component.
6.7.2.15 The consumesidentifier Element

A child element of consumingcomponent, consumesidentifier identifies which consumes ÔportÔ on the component is to participate in the relationship. The type of the consumes event must match the type of the connected emits or publishes event.

<!ELEMENT consumesidentifier ( #PCDATA ) >

6.7.2.16 The consumesport Element

Specifies the event-consuming side of an event connection relationship. The consumesidentifier child element identifies the particular consumes port. The component with this consumes port is identified by a componentinstantiationref or a findby element. The componentinstantiationref identifies a component within the assembly. The findby element points to an existing component that can be found within a naming service or trader, or using a stringified object reference.

<!ELEMENT consumesport ( consumesidentifier , ( componentinstantiationref | findby ) ) >

6.7.2.17 The description Element

The description element contains a string description. It is used to describe its parent element. It contains string content.

<!ELEMENT description ( #PCDATA ) >

6.7.2.18 The destination Element

The destination element is used to record where a homeplacement, executableplacement, hostcollocation, or processcollocation is to be (or has been) deployed. The format of the destination string is determined by a particular deployment tool.

<!ELEMENT destination ( #PCDATA ) >

6.7.2.19 The destinationhome Element

Identifies a home to be connected to by a proxy home. The home is identified by a homeplacementref or a findby element. The homeplacementref identifies a home within the assembly. The findby element points to an existing home that can be found within a home finder, naming service, or trader, or using a stringified object reference.

<!ELEMENT destinationhome
( homeplacementref
 | findby
 ) >

6.7.2.20 The emitsidentifier Element

The emitsidentifier identifies an emits ÒportÓ on a component. The identifier corresponds to an emits identifier specified in IDL.

<!ELEMENT emitsidentifier ( #PCDATA ) >

6.7.2.21 The emitsport Element

Specifies the event-emitting side of an event connection relationship. The emitsidentifier child element identifies the particular emits port. The component with this emits port is identified by a componentinstantiationref or a findby element. The componentinstantiationref identifies a component within the assembly. The findby element points to an existing component that can be found within a naming service or trader, or using a stringified object reference.

<!ELEMENT emitsport
 ( emitsidentifier
 , ( componentinstantiationref
 | findby
 )
 ) >

6.7.2.22 The executableplacement Element

This executableplacement element describes a deployment of an executable. The executableplacement element may be a direct child of the partitioning element, which states that it has no collocation constraints; or it may be a child element of the hostcollocation element.

The usagename child element is used to specify a name for the placement, possibly for use in a tool. The componentfileref element specifies the component file. The componentimplref element refers to a specific implementation in the softpkg descriptor. Note that the implementation referred to by componentimplref must have a code type of ÔExecutableÕ. The invocation element specifies any arguments with which the executable should be invoked. The destination element is used to record where the executableplacement is to be deployed.

<!ELEMENT executableplacement
 ( usagename?
 , componentfileref
 , componentimplref?
 , invocation?
 , destination?
 , extension*
The id attribute is a unique identifier within the assembly descriptor for the executableplacement.

The cardinality attribute specifies how many instantiations of this executable may be deployed. Possible values for cardinality are a specific number, a Õ+Ó to specify 1 or more, or a Õ*Ó to specify 0 or more. The default cardinality is Õ1.Ó

6.7.2.23 The existinginterface Element

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Specifies an interface that can satisfy an interface connection to a uses port within a connectinterface element, or to an emits or publishes port within a connectevent element. The findby element points to an existing interface that can be found within a naming service or trader, or using a stringified object reference.

<!ELEMENT existinginterface
     ( findby )>

6.7.2.24 The extension Element

See Section 6.3.2.11, ÔThe extension Element,Ó on page 6-8.

6.7.2.25 The fileinarchive Element

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See Section 6.3.2.11, ÔThe extension Element,Ó on page 6-8.

See Section 6.3.2.12, ÔThe fileinarchive Element,Ó on page 6-9.

6.7.2.26 The findby Element

The findby element is used to resolve a connection between two components. It tells the installation agent how to locate a party, usually a component, interface, or home involved in the relationship. In the simplest case, the installer will know where the item is because it was the one responsible for installing it. But if the item to be located already exists in the installation environment, the installer must know how to find it. It could locate a component in a naming service, in a trader, a home finder, or by a stringified object reference. The purpose of the findby element is to provide such information.
The **namingservice** element specifies a naming service name. The **stringifiedobjectref** element is a stringified IOR for the item. The **traderquery** is a query for locating the item in a trader. The **homefinder** is a name to look up a home in a home finder.

```xml
<!ELEMENT findby
  ( namingservice
   | stringifiedobjectref
   | traderquery
   | homefinder
   | extension
  )>
```

### 6.7.2.27 The homefinder Element

The **homefinder** element is used to indicate a home finder name for a home.

```xml
<!ELEMENT homefinder EMPTY >
<!ATTLIST homefinder
  name CDATA #REQUIRED >
```

The **name** attribute specifies the name of the home as registered with the home finder. Home finders are defined in Section 1.8, ÔHome Finders,Ô on page 1-42.

### 6.7.2.28 The homeinterface Element

Specifies a home with an interface that can satisfy an interface connection to a **uses** port within a **partitioning** element. The home is identified by a **homeplacementref** or a **findby** element. The **homeplacementref** identifies a home within the assembly. The **findby** element points to an existing home that can be found within a home finder, a naming service or trader, or using a stringified object reference.

```xml
<!ELEMENT homeinterface
  ( homeplacementref
   | findby
  )>
```

### 6.7.2.29 The homeplacement Element

This **homeplacement** element describes a particular deployment of a component home. The **homeplacement** element may be a direct child of the **partitioning** element which states that it has no collocation constraints; or it may be a child element of the **hostcollocation** or **processcollocation** elements that states specific host or process collocation constraints.

The **usagename** child element is used to specify a name for the placement, possibly for use in a tool. The **componentfileref** element specifies the component file. The **componentimplref** element refers to a specific implementation in the component file.
The **homeproperties** element refers to a state file associated with the home placement; it is used to configure the home after it is created. The **componentproperties** element refers to a property file used to configure all components created through the home. The **registerwithhomefinder** element instructs the installation process to register the home with the home finder. The **registerwithnaming** element instructs the installation process to register the home with a naming service. The **registerwithtrader** element instructs the installation process to register the home with a trader service. The **componentinstantiation** element instructs the installation agent to create a component using this home. The **destination** element is used to record where the **homeplacement** is to be deployed, if designated.

```xml
<!ELEMENT homeplacement (
  usagename?,
  componentfileref,
  componentimplref?,
  homeproperties?,
  componentproperties?,
  registerwithhomefinder*,
  registerwithnaming*,
  registerwithtrader*,
  componentinstantiation*,
  destination?,
  extension*)>
<!ATTLIST homeplacement
  id ID #REQUIRED
  cardinality CDATA "1" >
```

The **id** attribute is a unique identifier within the assembly descriptor for the **homeplacement**. The **id** is used to refer to the home in the connect block.

The **cardinality** attribute specifies how many instantiations of this component may be deployed. Possible values for cardinality are a specific number, a Ò+Ó to specify 1 or more, or a Ò*Ó to specify 0 or more. The default cardinality is Ò1.Ó

Note that if the **cardinality** is greater than 1 and there are any connections to this **homeplacement**, then connections will be made to each instance of the deployed home.

### 6.7.2.30 The **homeplacementref** Element

The **homeplacementref** element refers to a particular **homeplacement** element in the assembly descriptor.

```xml
<!ELEMENT homeplacementref EMPTY >
<!ATTLIST homeplacementref
  idref CDATA #REQUIRED >
```

The **idref** attribute corresponds to a unique **homeplacement** id attribute.
6.7.2.31 The homeproperties Element

The homeproperties element specifies a property file for a home. The properties are used to configure the home when it is created. The property file may be specified by either a fileinarchive or a codebase child element. The format of the property file is described in Section 6.8, Property File Descriptor, on page 6-62.

```xml
<!ELEMENT homeproperties
   ( fileinarchive
       | codebase
   )>
```

6.7.2.32 The hostcollocation Element

A hostcollocation specifies a group of component instances that are to be deployed together to a single host. The child elements are an optional usagename, an optional impltype, and a list of processcollocation, homeplacement, and executableplacement elements. If impltype is specified, then each of the component instances must have implementations supporting the implementation type. If impltype is not specified, then at deployment time each of the collocated components must have implementations supporting the target deployment platform.

```xml
<!ELEMENT hostcollocation
   ( usagename?
       , impltype?
       , ( homeplacement
           | executableplacement
           | processcollocation
           | extension
       )+)
   , destination?
 )>
<!ATTLIST hostcollocation
   id ID #IMPLIED
   cardinality CDATA "1" >
```

The id attribute uniquely identifies this host collocation in the component assembly file. The cardinality attribute specifies how many instances of this host collocation may be deployed. Possible values for cardinality are a specific number, a 0+0 to specify 1 or more, or a 0*0 to specify 0 or more. The default cardinality is 01.0

Note that if the cardinality is greater than 1, and there are connections to components within the hostcollocation, then connections will be made to the corresponding components or component homes within each instance of the collocation.

6.7.2.33 The impltype Element

Placeholder for future version.
6.7.2.34 The invocation Element

The invocation element is used to specify invocation arguments for an executable placement.

<!ELEMENT invocation EMPTY >
<!ATTLIST invocation
  args CDATA  #REQUIRED >

The args attribute is a string containing the arguments to be used in invoking the executable. Note that args is just the arguments to the executable, it does not include the executable name.

6.7.2.35 The link Element

See Section 6.3.2.18, ÔThe link Element,Ó on page 6-11.

6.7.2.36 The namingservice Element

The naming service element is used to indicate that a component or interface should be found using a naming service.

<!ELEMENT namingservice EMPTY >
<!ATTLIST namingservice
  name CDATA  #REQUIRED >

The name attribute specifies the naming service name to look up.

6.7.2.37 The partitioning Element

Component partitioning specifies a deployment pattern of homes and components to generic processes and hosts. The pattern is expressed via collocation constraints.

A particular usage of a component is always relative to a component home. Uses of component homes are recognized in the assembly as home placements. A home placement, and component instantiations relative to that home, may be collocated with other home placements and component instantiations in a process. Processes and home placements may be collocated within a logical host. A home placement that is not part of a process or host collocation may be deployed without constraint.

An executable placement is the placement of a particular executable. It may be partitioned without constraint or as part of a host collocation.

Within a partitioning element, homeplacement, executableplacement, and collocation constraints are specified. The homeplacement child element specifies a freely deployable home. The executableplacement element specifies a freely deployable executable. The processcollocation and hostcollocation child elements are used to group homeplacement together into deployable units.
A `homeplacement` may be declared as part of a host or process collocation or by itself. The actual host and process will be determined at deployment time. Home placements, executable placements, process collocations, and host collocations all have an associated cardinality. The default cardinality is Ô1.Ô An ordinal cardinality of 1 or greater mandates that the deployable unit must be instantiated that many times, cardinality of Ô+Ô indicates 1 or more, and Ô*Ô indicates zero or more.

```
<!ELEMENT partitioning
  ( homeplacement
   | executableplacement
   | processcollocation
   | hostcollocation
   | extension
  )* >
```

### 6.7.2.38 The processcollocation Element

The `processcollocation` element specifies a group of home and associated component instantiations that are to be deployed together to a single process. The child elements are an optional `usagename`, an optional `impltype`, and a list of `homeplacement` elements. If `impltype` is specified, then each of the component instances must have implementations supporting the implementation type. If `impltype` is not specified, then at deployment time each of the collocated components have implementations supporting the target deployment platform.

#### Note D Issue 5496

```
<!ELEMENT processcollocation
  ( usagename?,
    impltype?,
    ( homeplacement
      | extension
    )+,
    destination?
  ) >
<!ATTLIST processcollocation
  id     ID  #IMPLIED
  cardinality  CDATA "1" >
```

The `id` attribute uniquely identifies this process collocation in the component assembly file. The `cardinality` attribute specifies how many instances of this process collocation may be deployed. Possible values for `cardinality` are a specific number, a Ô+Ô to specify 1 or more, or a Ô*Ô to specify 0 or more. The default cardinality is Ô1.Ô

Note that if the `cardinality` is greater than 1, and there are connections to components and homes within the `processcollocation`, then connections will be made to corresponding components or component homes within each instance of the collocation.
6.7.2.39 The providesidentifier Element

The providesidentifier identifies a provides ÒportÓ on a component. The identifier corresponds to a provides identifier specified in component IDL.

```
<!ELEMENT providesidentifier ( #PCDATA ) >
```

6.7.2.40 The providesport Element

Specifies the interface providing side of an interface connection relationship. The providesidentifier child element identifies the particular provides port. The component with this provides port is identified by a componentinstantiationref or a findby element. The componentinstantiationref identifies a component within the assembly. The findby element points to an existing component that can be found within a naming service or trader, or using a stringified object reference.

```
<!ELEMENT providesport
    ( providesidentifier
      , ( componentinstantiationref
            | findby
      )
    )>
```

Note Ð Issue 5497

6.7.2.41 The proxyhome Element

Identifies a proxy home that is to be connected to another home. The home is identified by a homeplacementref or a findby element. The homeplacementref identifies a home within the assembly. The findby element points to an existing home that can be found within a home finder, naming service, or trader, or using a stringified object reference.

```
<!ELEMENT remoteproxyhome
    ( homeplacementref
      | findby
    ) >
```

6.7.2.42 The publishesidentifier Element

The publishesidentifier identifies a publishes ÒportÓ on a component. The identifier corresponds to the identifier specified in IDL for the publishes port.

```
<!ELEMENT publishesidentifier ( #PCDATA ) >
```
6.7.2.43 The publishesport Element

Specifies the event-publishes side of an event connection relationship. The
publishesidentifier child element identifies the particular publishes port. The
component with this publishes port is identified by a componentinstantiationref or a
findby element. The componentinstantiationref identifies a component within the
assembly. The findby element points to an existing component that can be found
within a naming service or trader, or using a stringified object reference.

<!ELEMENT publishesport
   ( publishesidentifier
      , ( componentinstantiationref
          | findby
       )
   )>

6.7.2.44 The registercomponent Element

Note D Issue 5092

The registercomponent element is used to specify that a component, a provided
interface, or an published event consumer interface should be registered with a naming
service or trader.

If an emitsidentifier, providesidentifier, or publishesconsumeridentifier is specified,
then that element is registered. If none of the above are specified, then it is implied that
the component itself is to be registered.

Registration may be through a naming service or trader. The registerwithnaming
element specifies a naming service registration and registerwithtrader specifies a
trader registration. The interface, event, or component registration may be registered
with both a naming service and a trader, multiple times. At least one registration must
take place.

<!ELEMENT registercomponent
   ( ( emitsidentifier
      - providesidentifier
      - publishesconsumeridentifier
     )?
   , ( registerwithnaming
      | registerwithtrader
   )+ )>

6.7.2.45 The registerwithhomefinder Element

The registerwithhomefinder element tells the installer to register a component home
with the home finder.
6.7.2.46 The registerwithnaming Element

The registerwithnaming element tells the installer to register a component instance or home with a naming service after it is created.

<!ELEMENT registerwithnaming EMPTY >
<!ATTLIST registerwithnaming
   name CDATA #REQUIRED >

The name attribute is the naming service name. If the name is not specified, it will be determined at deployment time, possibly with interaction with the user.

6.7.2.47 The registerwithtrader Element

The registerwithtrader element tells the installer to register a component instance or home with a trader after it is created.

<!ELEMENT registerwithtrader EMPTY >
<!ATTLIST registerwithtrader
   tradername CDATA #IMPLIED >

Note D Issue 5497

6.7.2.48 The proxyhome Element

Identifies a proxy home that is to be connected to another home. The home is identified by a homeplacementref or a findby element. The homeplacementref identifies a home within the assembly. The findby element points to an existing home that can be found within a home finder, naming service, or trader, or using a stringified object reference.

<!ELEMENT remotehome
   (homeplacementref|
    findby)>

Note D Issue 5092
6.7.2.49 **The stringifiedobjectref Element**

The `stringifiedobjectref` element is used to locate a component by its object reference.

```xml
<!ELEMENT stringifiedobjectref ( #PCDATA )>
```

6.7.2.50 **Trader elements**

The trader elements are used to register a home, component or interface with a trader and to find a home, component, or interface using a trader query. The trader elements closely parallel trader functionality in name and purpose.

```xml
<!ELEMENT traderconstraint ( #PCDATA )>

<!ELEMENT traderexport
    ( traderservicetype, traderproperties )>

<!ELEMENT traderpolicy
    ( traderpolicyname, traderpolicyvalue )>

<!ELEMENT traderpolicyname ( #PCDATA )>

<!ELEMENT traderpolicyvalue ( #PCDATA )>

<!ELEMENT traderpreference ( #PCDATA )>

<!ELEMENT traderproperties
    ( traderproperty+ )>

<!ELEMENT traderproperty
    ( traderpropertypname, traderpropertyvalue )>

<!ELEMENT traderpropertypname ( #PCDATA )>

<!ELEMENT traderpropertyvalue ( #PCDATA )>

<!ELEMENT traderquery
    ( traderservicetype, traderconstraint, traderpreference?, traderpolicy*, traderspecifiedprop* )>
```
<!ELEMENT traderservicetypename ( #PCDATA ) >

<!ELEMENT traderspecifiedprop ( #PCDATA ) >

**Note D** Refer to the OMG Trading Object Service specification (formal/00-06-27) for additional information.

### 6.7.2.51 The usagename Element

A user defined ÔfriendlyÓ name.

<!ELEMENT usagename ( #PCDATA ) >

### 6.7.2.52 The usesidentifier Element

A child element of usesport, usesidentifier identifies which uses ÒportÓ on the component is to participate in the relationship. The type of the using interface must match the type of the connected provides interface.

<!ELEMENT usesidentifier ( #PCDATA ) >

### 6.7.2.53 The usesport Element

Specifies the interface using side of an interface connection relationship. The usesidentifier child element identifies the particular uses port. The component with this uses port is identified by a componentinstantiationref or a findby element. The componentinstantiationref identifies a component within the assembly. The findby element points to an existing component that can be found within a naming service or trader, or using a stringified object reference.

```xml
<!ELEMENT usesport
  ( usesidentifier
    , ( componentinstantiationref
      | findby
    )
  )>
```

### 6.8 Property File Descriptor

The property file details component or home attribute settings. Properties are described using an XML vocabulary described below. The property file is used at deployment time to configure a home or component instance. A configurator uses the property file to determine how to set component and component home property attributes.

The property file may be edited using a text editor or with the help of a GUI tool. A packaged component may be shipped with a set of default properties that may be altered by the end user.
The suggested file extension for property files is .cpf (Component Property File).

6.8.1 Property File Example

The following property descriptor example has 3 properties: bufferSize, niceGuys, and sanityTestTime.

The bufferSize parameter is a long type; the niceGuys property is a sequence of strings; and the sanityTestTime property is a structure of type timestruct, containing 3 shorts.

```
<properties>
  <simple name="bufSize" type="long">
    <description>Size of Whizitron input buffer</description>
    <value>4096</value>
    <defaultValue>256</defaultValue>
  </simple>
  <sequence name="niceGuys" type="sequence<string>">
    <simple type="string">David</simple>
    <simple type="string">Ed</simple>
    <simple type="string">Garrett</simple>
    <simple type="string">Jeff</simple>
    <simple type="string">Jim</simple>
    <simple type="string">Martin</simple>
    <simple type="string">Patrick</simple>
  </sequence>
  <struct name="sanityTestTime" type="timestruct">
    <description>Time to start daily sanity check</description>
    <simple name="hour" type="short">24</simple>
    <simple name="minute" type="short">0</simple>
    <simple name="second" type="short">0</simple>
  </struct>
</properties>
```

The properties document has 4 major elements: simple, sequence, struct, and valuetype. The simple element describes a single primitive idl type. The sequence element corresponds to an IDL sequence, the struct element corresponds to an IDL struct, and the valuetype element corresponds to an IDL valuetype.

Note D If the user of the property file does not have static information about the types specified in the property file, then it will likely need to construct the type into a DynAny.
6.8.2 Property File XML Elements

This section describes the XML elements that make up a properties file. The section is organized starting with the root element of the properties document, `properties`, followed by all subordinate elements, in alphabetical order. The complete properties file DTD may be found in Section 7.3, Ôproperties.dtd,Ô on page 7-11.

6.8.2.1 The properties Root Element

The `properties` element is the root element of the properties document. It contains an optional description and any combination of `simple`, `sequence`, `struct`, and `valuetype` elements.

```xml
<!ELEMENT properties (description?, (simple | sequence | struct | valuetype)*)>
```

6.8.2.2 The choice Element

```xml
<!ELEMENT choice (#PCDATA)>
```

The `choice` element is used to specify a valid simple property value.

6.8.2.3 The choices Element

```xml
<!ELEMENT choices (choice | range) >
```

The `choices` element is a list of one or more choice or range elements.

6.8.2.4 The defaultvalue Element

```xml
<!ELEMENT defaultvalue (#PCDATA)>
```

The `defaultvalue` element is used to specify a default simple property value.

6.8.2.5 The description Element

```xml
<!ELEMENT description (#PCDATA)>
```

The `description` element is used to provide a description of its enclosing element.
6.8.2.6 The properties Element

The root element of the properties file. See Section 6.8.2.1, ÒThe properties Root Element,Ó on page 6-64.

6.8.2.7 The range Element

<!ELEMENT range (value, value) >

The range element is a set of two value elements that define a specific range of valid simple property values. The order of the range limits; that is, (min, max) or (max, min) is not implied.

6.8.2.8 The simple Element

The simple element is used to specify an attribute value of a primitive type. simple contains a mandatory value element, and optional description, choices, and defaultvalue elements.

The value element is used to specify the value of the simple type. If the value element is empty, the value is deemed unspecified. If the value is unspecified, and there is a defaultvalue defined, then the default value will be used.

The description, choices and defaultvalue child elements may be used to provide guidance to the end user in deciding how to set the attributes.

<!ELEMENT simple >
  ( description?,
  value,
  choices?,
  defaultvalue? )>

Note D Issue 5429

<!ATTLIST simple
  name CDATA #IMPLIED
  type ( boolean | char | double | float | short | long | objref | octet
  | short ) | string | ulong | ushort | longlong

The name attribute specifies the name of the attribute as it appears in IDL. The name attribute is required, except when the property is used in a sequence.

The type attribute specifies the type of the corresponding attribute. Property types are either an IDL primitive data type, or an objref.

**Note** The objref is in its stringified form in the property element. The stringified object reference is converted into a proper object reference before being assigned to its corresponding attribute.

### 6.8.2.9 The sequence Element

The sequence element is used to represent a sequence of similar types. It may be a sequence of simple types, a sequence of structs, a sequence of valuetypes, or a sequence of sequences. The order of the sequence elements in the property file is preserved in the constructed sequence. An optional description may be used to describe the sequence property.

```xml
<!ELEMENT sequence
  ( description?,
    ( simple* |
      struct* |
      sequence* |
      valuetype* )
  )>

<!ATTLIST sequence
  name CDATA #IMPLIED
  type CDATA #REQUIRED >
```

The name attribute specifies the name of the sequence as it appears in IDL. The name attribute is required, except when the sequence property is used in another sequence.
type

The `type` attribute specifies the type of the corresponding IDL sequence. The type of each element in the sequence must match the sequence type.

6.8.2.10 The struct Element

The `struct` element corresponds to an IDL structure. It may be composed of simple properties, sequences, structs, or other valuetypes.

```
<!ELEMENT struct
  ( description?,
    ( simple
      | sequence
      | struct
      | valuetype
    )* )>
```

Example:

```
<!ATTLIST struct
  name CDATA #IMPLIED
  type CDATA #REQUIRED >
```

name

The `name` attribute specifies the name of the struct attribute as it appears in IDL. The name attribute is required, except when the structure property is used in a sequence.

type

The `type` attribute specifies the type of the corresponding IDL struct.

6.8.2.11 The value Element

The `value` element is used to specify a simple value.

```
<!ELEMENT value ( #PCDATA ) >
```

6.8.2.12 The valuetype Element

The `valuetype` element is used to specify an IDL valuetype. It may be composed of simple properties, sequences, structs, or other valuetypes.

```
<!ELEMENT valuetype
  ( description?,
    ( simple
      | sequence
      | struct
      | valuetype
    )* )>
```
name

The name attribute specifies the name of the valuetype attribute as it appears in IDL. The name attribute is required, except when the valuetype property is used in a sequence.

type

The type attribute specifies the repository id of the corresponding IDL valuetype.

primarykey

The primarykey attribute indicates whether or not the valuetype property provides the state information for an entity component primary key with a repository id given by the type attribute.

6.9 Component Deployment

Components, component homes, and component assemblies are deployed on target hosts in a network using a deployment tool provided by an ORB or tool vendor.

The aim of deployment is to install and Ôhook-upÕ a logical component topology to a physical computing environment. The component topology is specified by an assembly package, or in the degenerate case, an individual component package.

The basic steps in the deployment process are:

1. Identify on which hosts the components are to be installed. This information will most likely come from an interaction between tool and user. Components are deployed either singly or together with other components as part of a process or host collocation.

2. Install component implementations on each platform where corresponding component instances are to be deployed. If a component implementation, uniquely identified by a UUID, is already installed on a host, then it does not have to be installed again.

3. Instantiate component homes and components on particular hosts. The mapping for doing so was determined in step 1.

4. Connect components as specified in the assembly descriptor’s connect blocks.
A stand-alone component package may be deployed as well as assembly packages. In that case, step 4 does not apply. Unless otherwise noted, all interfaces defined in the subsequent sections are in the Deployment module, which is imbedded within the Components module.

6.9.1 Participants in Deployment

The deployment of a component or component assembly is carried out by a deployment application in conjunction with a set of helper objects. The helper objects include component repositories, assembly and component factories, an object representing an assembly itself, and a container.

The following class diagram and scenario represents a deployment architecture.

Note D Removed by the Components December 2000 FTF (see ptc/01-11-03, page 69-542).

Note D Of the interfaces described below, only ComponentInstallation, AssemblyFactory, and Assembly are required by this specification; the other interfaces are included for illustrative purposes and to support an end-to-end scenario.
6.9.1.1 Deployment Architecture

![Deployment Architecture Diagram]

Figure 6-1  Deployment Architecture

6.9.1.2 Packages and Locations

References are made above and below to assembly and component packages and their location with some degree of intentional ambiguity to allow for future interpretations of a package and its location. At a minimum a package can be interpreted as a package descriptor or an archive that contains a package descriptor as described in Section 6.1, Introduction, on page 6-1. A location can be interpreted as a URI or absolute path to a package or other file.

6.9.1.3 Deployment Scenario

The steps in deploying and activating a component assembly could unfold as follows.
1. The deployment application has a conversation with the user to determine where each component or collocation is to be placed. Information about where components are to be located is recorded in a copy of the component assembly descriptor. This marked-up assembly descriptor will be used later by the Assembly object to direct the creation and connectivity of the assembly.

2. Next the component implementations are installed on the platforms where they are expected to be used. The deployment application calls install on the ComponentInstallation object, passing the component implementation id and a string denoting the location of the component package. If the component has not already been installed on the target platform, then the ComponentInstallation object retrieves the component package and optionally makes it available in the local environment (component implementations and other needed files can be retrieved Ôjust in timeÕ by a ComponentInstallation object if configured to do so).

3. The deployment application then creates an Assembly object. Assembly objects coordinate the creation and destruction of component assemblies. Each Assembly object represents an assembly instantiation. Assembly objects are created by calling an AssemblyFactory object on the host where the assembly object is to be created. The AssemblyFactory is passed a string denoting the location of an assembly package. If necessary, the AssemblyFactory brings the assembly package into the local environment and makes its location known to the Assembly object.

4. The assembly object uses the assembly package as a recipe for creating the assembly. The assembly package specifies which components and component homes to create, where they are to be located, what components are to be collocated with each other, and what components are to be connected with each other. Based on this information the Assembly object creates each component home and component and “hooks-up” the assembly.

5. In creating a component, the Assembly object must create a component server, create a container within the server, install a home object within the container, and then use the home to create the component. This work is accomplished with the help of a set of objects on each host. These are ServerActivator, ComponentServer, Container, and the CCMHome.

6. The Assembly object first calls the ServerActivator on the target host to create a component server. There is one instance of the ServerActivator object on each host where components could be installed. The Assembly object creates the component server by calling the create_component_server operation on the ServerActivator object. This operation creates an empty server process and returns a reference to the ComponentServer object of the newly created process.

7. A ComponentServer object is used by the Assembly object to create containers within the server. A container is created when the Assembly object calls create_container on the ComponentServer object, passing in a list of container configuration values. The create_container operation returns a reference to the Container interface of the newly created container.
8. The **Assembly** object uses the **Container** interface to install the component homes into the container. This is accomplished by calling **install_home** on the **Container** object. The **install_home** operation takes a component **id** parameter and returns a reference to the home interface.

9. In order to create the home, the **Container** must load the DLL, shared object file, or .class file into the container process. To locate the component implementation, the container calls the **get_implementation** operation of the **ComponentInstallation** object. It passes in the **id** of the component implementation and is returned the location of the component implementation. The container then loads the implementation DLL, shared object file, or .class file that can be used to instantiate a home object. The home object reference is then returned to the **Assembly** object.

10. The **Assembly** object uses the component’s home object to create a component instance. If the component category is **service**, **session**, or **process** an instance is created by calling **create_component** on the home reference. If the component category is **entity**, then a component instance is created by calling **create** on the home reference and passing in an instance of a value type derived from **Components::PrimaryKeyBase**. The primary key value type instance can be created using information supplied in a component property file. Both the **create** operation and the **create_component** return a **CCMObject** object reference.

11. If applicable, a configurator is applied to the component.

12. Once all of the components are installed, the **Assembly** object connects components in the assembly based on the information in the connect blocks of the assembly descriptor. It does so by calling the receptacle and event connection operations on the **CCMObject** references.

13. Following the successful consummation of each connection in the assembly, the **Assembly** object may call **configuration_complete** on each object in the assembly to signal that all of its configuration values have been set and all initial connections have been fixed.

---

**Note** The operation **configuration_complete** should be called on components according to their interconnection dependencies. For instance, an active (containing a thread) component should not start before all the components connected to via its connection ports start, else the active component could use other components that have not yet started (i.e., on which **configuration_complete** has not yet been called). If circular dependencies exist between connected components then no assumption can be made as to the “best” order that the **configuration_complete** operation should called on dependent components.
6.9.1.4 Configuration

Several operations defined below include argument parameters of type `ConfigValues` (described in Section 1.10.1.2, ÔThe StandardConfigurator interface,Ô on page 1-48). These configuration parameters are name value pairs that are used to pass configuration information in a standard way. Default configuration value names, if specified, are provided below with the corresponding operation that uses them. Operations that accept a `ConfigValues` parameter may raise an `InvalidConfiguration` exception if a configuration value passed by a calling procedure is invalid or unexpected. The relevant types and default list of reasons for invalid configuration name value pairs follow:

```c
typedef FailureReason InvalidConfigurationReason;

const InvalidConfigurationReason UnknownConfigValueName = 0;
const InvalidConfigurationReason InvalidConfigValueType = 1;
const InvalidConfigurationReason ConfigValueRequired = 2;
const InvalidConfigurationReason ConfigValueNotExpected = 3;

exception InvalidConfiguration
{
    InvalidConfigurationReason reason;
    FeatureName name;
};
```

The `reason` field of the `InvalidConfiguration` exception could take the following `InvalidConfigurationReason` values:

- `UnknownConfigValueName` if the name of a configuration value is unknown by the called operation.
- `InvalidConfigValueType` if the configuration value is known but the type of the value is incorrect.
- `ConfigValueRequired` if the caller did not pass in a required configuration value.
- `ConfigValueNotExpected` if the configuration value is correct but not expected in the context of the called operation.

**Note** This specification does not exhaustively define what the configuration values are (i.e., some of these may be specific to an ORB vendor). To provide deployment interoperability a future RFP should be submitted to standardize the configuration values once consensus among vendors will be established.

6.9.2 ComponentInstallation Interface

The `ComponentInstallation` object is used to install, query, and remove component implementations on a single platform. There is at most one `ComponentInstallation` object per host.
It is intended that this interface be general enough to encompass a wide range of underlying implementations, as the `ComponentInstallation` interface may be implemented on top of a vendor specific implementation repository.

Note that it is entirely possible for `ComponentInstallation` objects to forego physical installation of component packages and to delay actual location of and use of component implementations until needed by a container; that is, when a container calls the `get_implementation` operation of `ComponentInstallation`). This delayed location and use of implementations can reduce allocation of ÔlocalÔ physical storage and enable the use of distributed or remote implementation repositories or acquisition of implementations from services such as the Naming Service and Trader Service.

```java
typedef string UUID;
typedef string Location;

exception UnknownImplId { };
exception InvalidLocation { };
exception InstallationFailure { FailureReason reason; };

interface ComponentInstallation {
  void install(in UUID implUUID,
               in Location component_loc)
    raises (InvalidLocation, InstallationFailure);
  void replace(in UUID implUUID,
               in Location component_loc)
    raises (InvalidLocation, InstallationFailure);
  void remove(in UUID implUUID)
    raises (UnknownImplId, RemoveFailure);
  Location get_implementation(in UUID implUUID)
    raises(UnknownImplId, InstallationFailure);
};
```

**install**

The `install` operation installs a component on the particular host on which the `ComponentInstallation` object resides. The `component_loc` parameter points to the location of the component package. The `implUUID` refers to a particular implementation within the component package. The operation raises an `InvalidLocation` exception if the `component_loc` parameter does not denote a valid package location. The operation raises an `InstallationFailure` exception if the package denoted by the `component_loc` parameter could not be properly installed on the host on which the `ComponentInstallation` object resides.

**replace**

The `replace` operation replaces a component package previously installed. The `component_loc` parameter points to the location of a component package. The `implUUID` refers to a particular implementation within the component package. The operation raises an `InvalidLocation` exception if the `component_loc` parameter does
not denote a valid package location. The operation raises an **InstallationFailure**
exception if the package denoted by the `component_loc` parameter could not be
properly installed on the host on which the `ComponentInstallation` object resides.

**remove**

The **remove** operation removes a previously installed component package. The
`implUUID` refers to the particular implementation within the component package. The
operation raises an **UnknownImplId** exception if the `id` denoted by the `implUUID`
parameter does not correspond to a previously installed component package. The
operation raises a **RemoveFailure** exception if the installed component package that
 corresponds to the `id` denoted by the `implUUID` parameter could not be removed for
any internal reasons.

**get_implementation**

The **get_implementation** operation returns the location of a component
implementation. The `implUUID` refers to a particular implementation within a
component package. The operation raises an **UnknownImplId** exception if the `id`
denoted by the `implUUID` parameter does not correspond to a previously installed
component package. The operation raises an **InstallationFailure** exception if a
component package corresponding to the `id` denoted by the `implUUID` parameter does
not exist or cannot be accessed in order to retrieve a component implementation.

### 6.9.3 AssemblyFactory Interface

The **AssemblyFactory** interface is used to create **Assembly** objects. A single
**AssemblyFactory** object must be present on each host where **Assembly** objects are
to be created. At least one **AssemblyFactory** object must be present on a deployment
domain.

---

**Note D** Removed by the Components December 2000 FTF (see ptc/01-11-03, page 69-548).

```java
exception InvalidLocation {}; exception InvalidAssembly { };
```

**Note D** Issue 5577

```java
interface AssemblyFactory {
   Cookie create _assembly (in Location assembly _loc)
   raises (InvalidLocation, CreateFailure);
   Assembly lookup (in Cookie c)
   raises (InvalidAssembly);
   void destroy (in Cookie c)
   raises (InvalidAssembly, RemoveFailure);}
```

---
create\_assembly

The create\_assembly operation creates an Assembly object on the host on which the AssemblyFactory is located. It takes a string denoting the location of an assembly package and returns a Cookie that may be used to reference the assembly later on. The Cookie is the same as specified in Section 1.5.2.4, Cookie type, on page 1-18 of this document. The operation raises an InvalidLocation exception if the assembly package could not be found. The operation raises a CreateFailure exception if an Assembly object could not be created for internal reasons such as insufficient resources.

lookup

The lookup operation takes a Cookie and returns an object reference to an Assembly object. The operation raises an InvalidAssembly exception if the Cookie does not refer to an existing assembly that was previously created by this AssemblyFactory.

destroy

The destroy operation destroys the assembly referenced by a Cookie. If the assembly is active it will first tear down the assembly. The operation raises an InvalidAssembly exception if the Cookie does not reference an existing assembly that was previously created by this AssemblyFactory. The operation raises a RemoveFailure exception if the Assembly was not properly and completely removed for any internal reasons.

6.9.4 Assembly Interface

The Assembly interface represents an assembly instantiation. It is used to build up and tear down component assemblies. Building the assembly up means instantiating all of the components in the assembly and creating connections between them as specified in the assembly descriptor. Tearing the assembly down means removing all connections and destroying the components, homes, and containers, and component servers created by the assembly.

    enum AssemblyState { INACTIVE, INSERVICE };

    interface Assembly {
        void build() raises (CreateFailure);
        void tear\_down() raises (RemoveFailure);
        AssemblyState get\_state();
    };

build

The build operation creates required component servers, creates required containers, installs required component homes, instantiates components, configures and interconnects them according to the assembly descriptor. If the build fails, then the
build operation is responsible for cleaning up any pieces of the assembly that were created. The operation raises a `CreateFailure` exception if an assembly could not be built for internal reasons such as insufficient resources.

**tear_down**

The `tear_down` operation removes all connections between components and destroys all components, homes, containers, and component servers that were created by the `build` operation. The operation raises a `RemoveFailure` exception if the assembly could not be removed properly and completely for any internal reasons.

**get_state**

The `get_state` operation returns whether the assembly is active or inactive. An assembly will be inactive before it is built, while it is being built, when it is being torn down, and after it has been torn down. It will be active after it is successfully built and before it is torn down.

### 6.9.5 `ServerActivator` interface

The `ServerActivator` interface represents a singleton object that resides on each host and acts as a factory for `ComponentServer` objects. A `ServerActivator` object is used by an `Assembly` to create a `ComponentServer` object that is then used by the `Assembly` to create `Container` objects.

```
typedef sequence<
ComponentServer>
ComponentServers;

interface ServerActivator {

  ComponentServer create_component_server(
    in ConfigValues config)
  raises(CreateFailure, InvalidConfiguration);

  void remove_component_server(in ComponentServer server)
  raises(RemoveFailure);

  ComponentServers get_component_servers();
};
```

**create_component_server**

The `create_component_server` operation creates a `ComponentServer` object on the host on which the `ServerActivator` is located. The `config` parameter represents a sequence of `ConfigValue` objects that provide name value pairs used to configure the new `ComponentServer` such as the required ORB and programming language. The operation raises an `InvalidConfiguration` exception if the configuration values are not valid. The operation raises a `CreateFailure` exception if a component server could not be created for internal reasons such as insufficient resources.
remove_component_server

The **remove_component_server** operation removes a component server and all containers, homes, and components created in this component server. The **server** parameter points to the specific component server that should be removed. The operation raises a **BAD_PARAM** system exception if the **server** parameter was not created by this **ServerActivator**. The operation raises a **RemoveFailure** exception if the component server or any of its containers could not be removed for any internal reasons.

**get_component_servers**

The **get_component_servers** operation returns a sequence of all **ComponentServer** objects created by this **ServerActivator**.

### 6.9.6 ComponentServer interface

The **ComponentServer** acts as a singleton factory for the creation of **Container** objects and is used by an **Assembly** object during the deployment process.

```c
typedef sequence<Container> Containers;

interface ComponentServer {
    readonly attribute ConfigValues configuration;
    ServerActivator get_server_activator();
    Container create_container(in ConfigValues config)
        raises (CreateFailure, InvalidConfiguration);
    void remove_container(in Container cref) raises (RemoveFailure);
    Containers get_containers();
    void remove() raises (RemoveFailure);
};
```

**configuration**

Accessing the **configuration** attribute returns the sequence of **ConfigValue** objects passed in to the **create_component_server** operation at the **ComponentServer** creation.

**get_server_activator**

The **get_server_activator** operation returns a reference to the **ServerActivator** object that has created this **ComponentServer**.

**create_container**

The **create_container** operation creates a new **Container** object within the component server process. The **config** parameter represents a sequence of **ConfigValue** objects that provide name value pairs used to configure the new
Container. The operation raises an InvalidConfiguration exception if the configuration values are not valid. The operation raises a CreateFailure exception if a container could not be created for internal reasons such as insufficient resources.

remove_container

The remove_container operation removes a previously created container and all homes and components that were created in the container. The cref parameter refers to the container that should be removed. The operation raises a BAD_PARAM system exception if the cref parameter was not created by this ComponentServer. The operation raises a RemoveFailure exception if the container or any of its homes could not be removed for any internal reasons.

get_containers

The get_containers operation returns a sequence of all Container objects created by this ComponentServer.

remove

The remove operation removes the component server and all containers, homes, and components that were created in the component server. The operation raises a RemoveFailure exception if the component server or any of its containers could not be removed for any internal reasons.

6.9.7 Container interface

The Container interface represents a server-side framework built on the ORB, the Portable Object Adaptor (POA), and a set of CORBA services, which provides the runtime environment for multiple component homes and component instances. The following constraints apply:

- Each container has an associated container API type, which describes its interaction with the component, and an associated CORBA usage model, which describes its interaction with the POA, the ORB, and a set of CORBA services,

- Each container supports a single container API type and manages a specific component category. Multiple home instances of the same component category can be deployed in the same container.

module Components {
    typedef sequence<CCMHome> CCMHomes;
};

exception ImplEntryPointNotFound {};

interface Container {
    readonly attribute ConfigValues configuration;
    ComponentServer get_component_server();
    CCMHome install_home(in UUID id,
in string entrypt,
in ConfigValues config)
raises (UnknownImplId,
ImplEntryPointNotFound,
InstallationFailure,
InvalidConfiguration);
void remove_home(in CCMHome href) raises (RemoveFailure);
CCMHomes get_homes();
void remove() raises (RemoveFailure);
}

configuration

Accessing the configuration attribute returns the sequence of ConfigValue objects
passed in to the create_container operation at the Container creation.

get_component_server

The get_component_server operation returns a reference to the
ComponentServer object that created this Container.

install_home

The install_home operation installs and returns a new CCMHome object. The id and
entrypt parameters are used by the container to locate an implementation file and
instantiate a new home object. The config parameter represents a sequence of
ConfigValue objects that provide name value pairs used to configure the installation
of the new home instance; for example, provide persistency source, transaction, and
security policies that must be applied to the home and its components. The operation
raises an UnknownImplId exception if the id parameter does not correspond to any
component packages installed using the ComponentInstallation object. The
operation raises an ImplEntryPointNotFound exception if the entrypt parameter
cannot be found in the implementation returned from ComponentInstallation. The
operation raises an InstallationFailure exception if the home could not be installed
in the container for internal reasons such as insufficient resources or inadequate
implementation for this container; for example, installing a C++ home implementation
in a Java container. The operation raises an InvalidConfiguration exception if the
config parameter does not contain valid configuration name value pairs.

remove_home

The remove_home operation removes a home from the container and all components
that were created by this home. The operation raises a BAD_PARAM system
exception if the href parameter was not created by this container. The operation raises
a RemoveFailure exception if the home or any of its components could not be
removed from the container for any internal reasons.
get_homes

The `get_homes` operation returns a sequence of all `CCMHome` objects created by this `Container`.

remove

The `remove` operation removes the container and all homes and components created in the container. The operation raises a `RemoveFailure` exception if the container or any of its homes could not be removed for any internal reasons.

6.9.8 Component Entry Points (Component Home Factories)

Each component package contains a component implementation. A component implementation is a dynamically loadable module such as a DLL, a shared library, or a Java `.class` file. The component implementation file contains the code for the component implementation and its associated home implementation.

To load a component into a container, the home for the component must first be created. The home is then used to create component instances. The component’s home is created by calling a well-known entry point in the component implementation file.

The entry point is an operation or function whose existence and signature is common across all component implementation files. This generic entry point function allows a container to create a component home without requiring specific knowledge of that home or its associated component implementation.

Entry points are programming language specific. Depending on the language, it is either a function or static method. The signature and semantics of the operation are specified for Java and C++.

In general, the entry point function takes no arguments and returns a pointer or reference to a `HomeExecutorBase`.

**Entry Points in Java**

In Java, the entry point is the name of a class and static method that may be invoked to create a servant, which implements the component home. The method must have the following signature:

```java
public static HomeExecutorBase foo();
```

For instance, if one wrote the following code for the entry point:
package bigbank.corbacomponents.Account;
public class AccountHomeFactory {
    public static HomeExecutorBase create() {
        return new AccountHomeImpl();
    }
}

Then the string representing the entry point string would be
bigbank.corbacomponents.Account.AccountHomeFactory.create

**Entry Points in C++**

In C++, the entry point is the symbol in a shared library or DLL that should be invoked
to return the **HomeExecutorBase** for the component’s home implementation.

The entry point should have **OC** linkage (i.e., no name-mangling) and have the
following signature:

```
HomeExecutorBase* (*)( *) ();
```

So for example:

```
extern "C" {
    HomeExecutorBase* createAccountHome() {
        return new AccountHomeImpl();
    }
};
```

In this case, the entry point would simply be **createAccountHome**.Ö
XML DTDs

Note D Text in Red is from the Components 1.1 RTF interim report (ptc/2002-08-02).

This chapter contains the definitions of the XML DTDs used by the CORBA Components.

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7.1 sofpkg.dtd

<!-- DTD for sofpkg. Used to describe CORBA Component implementations. The root element is <softpkg>. Elements are listed alphabetically. -->

<!-- Simple xml link attributes based on W3C WD-xlink-19980303. May change when XLL is finalized -->

<!ENTITY % simple-link-attributes "
xml:link CDATA #FIXED 'SIMPLE'
href CDATA #REQUIRED"
<!ELEMENT author 
 ( name 
   | company 
   | webpage 
 )* >

<!ELEMENT code 
 ( ( codebase 
   | fileinarchive 
   | link 
   ) 
   , entrypoint? 
   , usage? 
 ) >

<!ATTLIST code
 type CDATA #IMPLIED >

<!-- If file not available locally, then download via codebase link -->

<!ELEMENT codebase EMPTY >
<!ATTLIST codebase
 filename CDATA #IMPLIED
 %simple-link-attributes; >

<!ELEMENT compiler EMPTY >
<!ATTLIST compiler
 name CDATA #REQUIRED
 version CDATA #IMPLIED >

<!ELEMENT company ( #PCDATA ) >

<!ELEMENT dependency
 ( softpkgref 
   | codebase 
   | fileinarchive 
   | localfile 
   | name 
   | valuuetypefactory 
 ) >

<!ATTLIST dependency
 type CDATA #IMPLIED
 action (assert | install) "assert" >

<!ELEMENT description ( #PCDATA ) >

<!ELEMENT descriptor
 ( link 
   | fileinarchive 
   ) >

<!ATTLIST descriptor
 type CDATA #IMPLIED >

<!ELEMENT entrypoint ( #PCDATA ) >

<!-- The "extension" element is used for vendor-specific extensions -->

<!ELEMENT extension ( #PCDATA ) >
<!ATTLIST extension
class CDATA #REQUIRED
origin CDATA #REQUIRED
id ID #IMPLIED
extra CDATA #IMPLIED
html-form CDATA #IMPLIED>

<!-- The "fileinarchive" element is used to specify a file in the archive.
If the file is in another archive then link is used to point to the archive in which the file may be found.
-->

<!ELEMENT fileinarchive
( link? )>
<!ATTLIST fileinarchive
name CDATA #REQUIRED>

<!ELEMENT idl
( link
  | fileinarchive
  | repository
)>

**Note D Issue 5091**

<!ATTLIST idl
id CDATA #REQUIRED
homeid CDATA #REQUIRED>

<!ELEMENT implementation
( description
  | code
  | compiler
  | dependency
  | descriptor
  | extension
  | programminglanguage
  | humanlanguage
  | os
  | propertyfile
  | processor
  | runtime
)*>

<!ATTLIST implementation
id ID #IMPLIED
variation CDATA #IMPLIED>

<!ELEMENT implref EMPTY>
<!ATTLIST implref
idref CDATA #REQUIRED>

**Note D Issue 5584**

<!ELEMENT ins EMPTY>
<!ATTLIST ins
  name CDATA #REQUIRED >

<!ELEMENT humanlanguage EMPTY >
<!ATTLIST humanlanguage
  name CDATA #REQUIRED >

<!ELEMENT license ( #PCDATA ) >
<!ATTLIST license
  %simple-link-attributes; >

<!ELEMENT link ( #PCDATA ) >
<!ATTLIST link
  %simple-link-attributes; >

<!-- A file that should be available in the local environment -->
<!ELEMENT localfile EMPTY >
<!ATTLIST localfile
  name CDATA #REQUIRED >

<!ELEMENT name ( #PCDATA ) >

---

**Note D Issue 5584**

<!ELEMENT objref EMPTY>
<!ATTLIST objref
  string CDATA #REQUIRED >

<!ELEMENT os EMPTY >
<!ATTLIST os
  name CDATA #REQUIRED
  version CDATA #IMPLIED>

<!ELEMENT pkgtype ( #PCDATA ) >
<!ATTLIST pkgtype
  version CDATA #IMPLIED >

<!ELEMENT processor EMPTY >
<!ATTLIST processor
  name CDATA #REQUIRED >

<!ELEMENT programminglanguage EMPTY>
<!ATTLIST programminglanguage
  name CDATA #REQUIRED
  version CDATA #IMPLIED >

<!ELEMENT propertyfile
  ( fileinarchive
    | link ) >
<!ATTLIST propertyfile
  type CDATA #IMPLIED >

<!ELEMENT repository
  ( ins
| objref  |
| link   |

`<!ATTLIST repository`  
`type CDATA #IMPLIED>`

`<!ELEMENT runtime EMPTY>`

`<!ATTLIST runtime`  
`name CDATA #REQUIRED`  
`version CDATA #IMPLIED>`

`<!ELEMENT softpkg`  
`( title`  
`| pkgtype`  
`| author`  
`| description?`  
`| license`  
`| idl`  
`| propertyfile`  
`| dependency`  
`| descriptor`  
`| implementation`  
`| extension`) * >`

`<!ATTLIST softpkg`  
`name ID #REQUIRED`  
`version CDATA #IMPLIED>`

`<!ELEMENT softpkgref`  
`( ( fileinarchive`  
`| link`  
`) , implefref?`  
`) >`

`<!ELEMENT title ( #PCDATA )>`

`<!ELEMENT usage ( #PCDATA )>`

`<!ELEMENT valuetypefactory`  
`( codebase`  
`| fileinarchive`  
`| link`) >`

`<!ATTLIST valuetypefactory`  
`repid CDATA #REQUIRED`  
`valueentrypoint CDATA #IMPLIED`  
`factoryentrypoint CDATA #IMPLIED>`

`<!ELEMENT webpage ( #PCDATA )>`

`<!ATTLIST webpage`  
`%simple-link-attributes; >`
7.2 corbacomponent.dtd

    <!-- DTD for CORBA Component Descriptor. The root element is
     <corbacomponent>. Elements are listed alphabetically.    -->

    <!-- Simple xml link attributes based on W3C WD-xlink-19980303.
     May change when XLL is finalized. -->
    <!ENTITY % simple-link-attributes "
     xml:link       CDATA                #FIXED 'SIMPLE'
     href           CDATA                #REQUIRED
    ">

    <!ELEMENT accessmode EMPTY>
    <!ATTLIST accessmode
     mode (READ_ONLY|READ_WRITE) #REQUIRED >

--- Note D Issue 5499 ---

    <!ELEMENT catalog EMPTY>
    <!ATTLIST catalog
     type CDATA #REQUIRED >

    <!ELEMENT componentfeatures
     ( inheritscomponent?,
     , supportsinterface*,
     , ports,
     , operationpolicies?,
     , extension*) >
    <!ATTLIST componentfeatures
     name CDATA #REQUIRED
     repid CDATA #REQUIRED >

    <!ELEMENT componentkind
     ( service
     | session
     | process
     | entity
     | unclassified
     ) >

    <!ELEMENT componentproperties
     ( fileinarchive
     ) >

    <!ELEMENT componentrepid EMPTY>
    <!ATTLIST componentrepid
     repid CDATA #IMPLIED >

--- Note D Issue 5499 ---

    <!ELEMENT containermanagedpersistence


```xml
( storagehome
 , pssimplemation?
 , catalog?
 , accessmode
 , psstranaction
 , params?
 ) >

<!ELEMENT configurationcomplete EMPTY >
<!ATTLIST configurationcomplete
     set ( true | false ) #REQUIRED >

<!ELEMENT consumes
 ( eventpolicy
 , extension* ) >
<!ATTLIST consumes
 consumesname CDATA #REQUIRED
 eventtype CDATA #REQUIRED >

<!ELEMENT corbacomponent
 ( corbaversion
 , componentrepid
 , homerepid
 , componentkind
 , interop?
 , transaction?
 , security?
 , threading
 , configurationcomplete
 , extendedpoapolicy*
 , repository?
 , segment*
 , componentproperties?
 , homeproperties?
 , homefeatures+
 , componentfeartures+
 , interface*
 , extension*
 ) >

<!ELEMENT corbaversion (#PCDATA) >

<!ELEMENT description ( #PCDATA ) >

<!ELEMENT emits
 ( eventpolicy
 , extension* ) >
<!ATTLIST emits
 emisname CDATA #REQUIRED
 eventtype CDATA #REQUIRED >

<!ELEMENT entity
 ( servant ) >

<!ELEMENT eventpolicy EMPTY>
```
<!ATTLIST eventpolicy
   policy ( normal | default | transaction ) #IMPLIED>

<!ELEMENT extendedpoapolicy EMPTY>
<!ATTLIST extendedpoapolicy
   name CDATA #REQUIRED
   value CDATA #REQUIRED >

<!-- The "extension" element is used for vendor-specific extensions -->
<!ELEMENT extension (#PCDATA) >
<!ATTLIST extension
   class CDATA #REQUIRED
   origin CDATA #REQUIRED
   id ID #IMPLIED
   extra CDATA #IMPLIED
   html-form CDATA #IMPLIED >

<!-- The "fileinarchive" element is used to specify a file in the archive.
   If the file is in another archive then link is used to point to the archive in which the file may be found. -->
<!ELEMENT fileinarchive
   ( link? ) >
<!ATTLIST fileinarchive
   name CDATA #REQUIRED >

<!ELEMENT homefeatures
   ( inheritshome?, operationpolicies?, extension* ) >
<!ATTLIST homefeatures
   name CDATA #REQUIRED
   repid CDATA #REQUIRED >

<!ELEMENT homeproperties
   ( fileinarchive ) >

<!ELEMENT homerepid EMPTY >
<!ATTLIST homerepid
   repid CDATA #IMPLIED >

<!ELEMENT inheritscomponent EMPTY>
<!ATTLIST inheritscomponent
   repid CDATA #REQUIRED>

<!ELEMENT inheritshome EMPTY>
<!ATTLIST inheritshome
   repid CDATA #REQUIRED>

<!ELEMENT inheritsinterface EMPTY>
<!ATTLIST inheritsinterface
   repid CDATA #REQUIRED>
<!ELEMENT ins EMPTY>
<!ATTLIST ins
  name CDATA #REQUIRED >

<!ELEMENT interface
  ( inheritsinterface*, operationpolicies? ) >
<!ATTLIST interface
  name CDATA #REQUIRED
  repid CDATA #REQUIRED >

<!ELEMENT interop EMPTY>
<!ATTLIST interop
  type CDATA #REQUIRED
  direction ( hasview | isview ) #REQUIRED
  descriptor CDATA #REQUIRED >

<!ELEMENT link ( #PCDATA )>
<!ATTLIST link
  %simple-link-attributes; >

<!ELEMENT objref EMPTY>
<!ATTLIST objref
  string CDATA #REQUIRED >

<!ELEMENT operation
  ( transaction?, requiredrights? ) >
<!ATTLIST operation
  name CDATA #REQUIRED >
<!!-- an operation name of "*" specifies all operations in the current
scope -->

<!ELEMENT operationpolicies
  ( operation+ ) >

<!ELEMENT param EMPTY >
<!ATTLIST param
  name CDATA #REQUIRED
  value CDATA #REQUIRED >

<!ELEMENT params ( param+ ) >

<!ELEMENT poapolicies EMPTY>
<!ATTLIST poapolicies
  thread ( ORB_CTRL_MODEL | SINGLE_THREAD_SAFE ) #REQUIRED
  lifespan ( TRANSIENT | PERSISTENT ) #REQUIRED
  iduniqueness ( UNIQUE_ID | MULTIPLE_ID ) #REQUIRED
  idassignment ( USER_ID | SYSTEM_ID ) #REQUIRED
  servantretention ( RETAIN | NON RETAIN ) #REQUIRED
  requestprocessing ( USE_ACTIVE_OBJECT_MAP_ONLY
                      | USE_DEFAULT_SERVANT
                      | USE_SERVANT_MANAGER ) #REQUIRED
  implicitactivation ( IMPLICIT_ACTIVATION
                      | NON IMPLICIT_ACTIVATION ) #REQUIRED >
<!ELEMENT ports
  ( uses
     | provides
     | emits
     | publishes
     | consumes
  )* >

<!ELEMENT process
  ( servant ) >

<!ELEMENT provides
  ( operationpolicies?
    , extension* ) >

<!ATTLIST provides
  providesname CDATA #REQUIRED
  repid CDATA #REQUIRED
  facettag CDATA #REQUIRED >

<!ELEMENT pssimplementation EMPTY>
<!ATTLIST pssimplementation
  id CDATA #REQUIRED >

<!ELEMENT pstransaction (pstransactionisolationlevel?) >
<!ATTLIST pstransaction
  policy (TRANSACTIONAL|NON_TRANSACTIONAL) #REQUIRED >

<!ELEMENT pstransactionisolationlevel EMPTY>
<!ATTLIST pstransactionisolationlevel
  level (READ_UNCOMMITTED|READ_COMMITTED|REPEATABLE_READ|SERIALIZABLE)
  #REQUIRED >

<!ELEMENT publishes
  ( eventpolicy
    , extension* ) >

<!ATTLIST publishes
  publishesname CDATA #REQUIRED
  eventtype CDATA #REQUIRED >

<!ELEMENT repository
  ( ins
    | objref
    | link
  ) >

<!ATTLIST repository
  type CDATA #IMPLIED >

<!ELEMENT requiredrights
  ( right* ) >

<!ELEMENT right
  ( description? ) >

<!ATTLIST right
  name CDATA #REQUIRED >
<!ELEMENT security (requiredrights? ) >
<!ATTLIST security
  rightsfamily CDATA #REQUIRED
  rightscombinator (secallrights | secanyrights) #REQUIRED >

<!ELEMENT segment (segmentmember+,
  containermanagedpersistence?,
  extension* ) >
<!ATTLIST segment
  name CDATA #REQUIRED
  segmenttag CDATA #REQUIRED >

<!ELEMENT segmentmember EMPTY>
<!ATTLIST segmentmember
  facettag CDATA #REQUIRED >

<!ELEMENT servant EMPTY >
<!ATTLIST servant
  lifetime (component|method|transaction|container) #REQUIRED >

<!ELEMENT service EMPTY >
<!ELEMENT session ( servant ) >

<!ELEMENT storagehome EMPTY>
<!ATTLIST storagehome
  id CDATA #REQUIRED >

<!ELEMENT supportsinterface (operationpolicies?,
  extension* ) >
<!ATTLIST supportsinterface
  rapid CDATA #REQUIRED >

<!ELEMENT threading EMPTY>
<!ATTLIST threading
  policy ( serialize | multithread ) #REQUIRED >

<!ELEMENT transaction EMPTY >
<!ATTLIST transaction
  use (self-managed|not-supported|required|supports|required-new|mandatory|never) #REQUIRED >

<!ELEMENT unclassified ( poapolicies ) >
<!ELEMENT uses ( extension* ) >
<!ATTLIST uses
  usesname CDATA #REQUIRED
  rapid CDATA #REQUIRED >
7.3 properties.dtd

```xml
<!-- DTD for CORBA Component property file. The root element is <properties>. Elements are listed alphabetically. -->

<!ELEMENT choice ( #PCDATA ) >
<!ELEMENT choices ( choice | range )+ >
<!ELEMENT defaultValue ( #PCDATA ) >
<!ELEMENT description ( #PCDATA ) >
<!ELEMENT value ( #PCDATA ) >

<!ELEMENT properties
    ( description?
    , ( simple
        | sequence
        | struct
        | valuetype
    )* ) >

<!ELEMENT range (value, value) >

<!ELEMENT simple
    ( description?
    , value
    , choices?
    , defaultValue?
    ) >
```

---

Note D Issue 5429

```xml
<!ATTLIST simple
    name CDATA #IMPLIED
type ( boolean
        | char
        | double
        | float
        | short
        | long
        | objref
        | octet
        | short
        | string
        | ulong
        | ushort
        | longlong
        | ulonglong
        | longdouble
        | wchar
        | wstring
        ) >
```
7.4 componentassembly.dtd

<!-- DTD for Component Assembly Descriptor. The root element is <componentassembly>. Elements are listed alphabetically. -->

<!-- Simple xml link attributes based on W3C WD-xlink-19980303. May change slightly when XLL is finalized. -->

<!ENTITY % simple-link-attributes "
  xml:link       CDATA                #FIXED 'SIMPLE'
  href           CDATA                #REQUIRED " >
<!-- If file not available locally, then download via codebase link -->
<!ELEMENT codebase EMPTY >
<!ATTLIST codebase
  filename CDATA #IMPLIED
  %simple-link-attributes; >

<!ELEMENT componentassembly
  ( description?,
    componentfiles
    , partitioning
    , connections?,
    extension* ) >
<!ATTLIST componentassembly
  id ID #REQUIRED
derivedfrom CDATA #IMPLIED >

<!ELEMENT componentfile
  ( fileinarchive |
    codebase |
    link ) >
<!ATTLIST componentfile
  id ID #REQUIRED
type CDATA #IMPLIED >

<!ELEMENT componentfileref EMPTY >
<!ATTLIST componentfileref
  idref CDATA #REQUIRED >

<!ELEMENT componentfiles
  ( componentfile+ ) >

<!ELEMENT componentimplref EMPTY >
<!ATTLIST componentimplref
  idref CDATA #REQUIRED >

<!ELEMENT componentinstantiation
  ( usagename?,
    componentproperties?
    , registercomponent*,
    extension* ) >
<!ATTLIST componentinstantiation
  id ID #REQUIRED >

<!ELEMENT componentinstantiationref EMPTY >
<!ATTLIST componentinstantiationref
  idref CDATA #REQUIRED >

<!ELEMENT componentproperties
  ( fileinarchive |
    codebase ) >
<!ELEMENT componentSupportedInterface
    ( componentInstantiationRef
      | findby )>

Note D Issue 5093

<!ELEMENT connectEvent
    ( ( consumesPort
      | existingInterface )
    , ( emitsPort
      | publishesPort )
    ) >

<!ATTLIST connectEvent
    id ID #IMPLIED >

<!ELEMENT connectHomes
    ( proxyHome
      , destinationHome )

<!ATTLIST connectHomes
    id ID #IMPLIED >

<!ELEMENT connectInterface
    ( usesPort
      , ( providesPort
        | componentSupportedInterface
        | existingInterface
        | homeInterface )
    ) >

<!ATTLIST connectInterface
    id ID #IMPLIED >

<!ELEMENT connections
    ( connectInterface
      | connectEvent
      | connectHomes
      | extension
    )* >

<!ELEMENT consumesIdentifier ( #PCDATA ) >

<!ELEMENT consumesPort
    ( consumesIdentifier
      , ( componentInstantiationRef
        | findby )
    ) >

<!ELEMENT description ( #PCDATA ) >
<!ELEMENT destination ( #PCDATA )>

<!ELEMENT destinationhome
 ( homeplacementref
  | findby
 )>

<!ELEMENT emitsidentifier ( #PCDATA )>

<!ELEMENT emitsport
 ( emitsidentifier
   , ( componentinstantiationref
       | findby
     )
 )>

<!ELEMENT executableplacement
 ( usagename?
   , componentfileref
   , componentimplref?
   , invocation?
   , destination?
   , extension*
 )>

<!ATTLIST executableplacement
 id ID #REQUIRED
 cardinality CDATA "1" >

<!ELEMENT existinginterface
 ( findby )>

!-- The "extension" element is used for vendor-specific extensions -->
<!ELEMENT extension ( #PCDATA )>
<!ATTLIST extension
 class CDATA #REQUIRED
 origin CDATA #REQUIRED
 id ID #IMPLIED
 extra CDATA #IMPLIED
 html-form CDATA #IMPLIED >

!-- The "fileinarchive" element is used to specify a file in the archive.
 If the file is independent of an archive then link is used to point
to
 the archive in which the file may be found.
-->
<!ELEMENT fileinarchive
 ( link? )>
<!ATTLIST fileinarchive
 name CDATA #REQUIRED >

<!ELEMENT findby
 ( namingservice
<ELEMENT homefinder EMPTY>
<ATTLIST homefinder
  name CDATA #REQUIRED>

<ELEMENT homeinterface
  ( homeplacementref
    | findby
  )>

<ELEMENT homeplacement
  ( usagename?
    , componentfileref
    , componentimplref?
    , homeproperties?
    , componentproperties?
    , registerwithhomefinder*
    , registerwithnaming*
    , registerwithtrader*
    , componentinstantiation*
    , destination?
    , extension*
  )> 

<ATTLIST homeplacement
  id ID #REQUIRED
  cardinality CDATA "1" >

<ELEMENT homeplacementref EMPTY>
<ATTLIST homeplacementref
  idref CDATA #REQUIRED>

<ELEMENT homeproperties
  ( fileinarchive
    | codebase
  )>

<ELEMENT hostcollocation
  ( usagename?
    , impltype?
    , ( homeplacement
      | executableplacement
      | processcollocation
      | extension
    )+
    , destination?
  )>

<ATTLIST hostcollocation
  id ID #IMPLIED
  cardinality CDATA "1" >
<!ELEMENT impltype EMPTY >
<!ATTLIST impltype
  language CDATA #REQUIRED
  version CDATA #IMPLIED >

<!ELEMENT invocation EMPTY >
<!ATTLIST invocation
  args CDATA #REQUIRED >

<!ELEMENT link ( #PCDATA ) >
<!ATTLIST link
  %simple-link-attributes; >

<!ELEMENT namingservice EMPTY >
<!ATTLIST namingservice
  name CDATA #REQUIRED >

<!ELEMENT partitioning
  ( homeplacement
    | executableplacement
    | processcollocation
    | hostcollocation
    | extension
  )* >

<!ELEMENT processcollocation
  ( usagename?
    , impltype?
    , ( homeplacement
      | extension
    )*+ 
    , destination?
  )>
<!ATTLIST processcollocation
  id   ID   #IMPLIED
  cardinality CDATA "1" >

<!ELEMENT providesidentifier ( #PCDATA ) >

<!ELEMENT providesport
  ( providesidentifier
    , ( componentinstantiationref
      | findby
    )
  )>

---

**Note D Issue 5497**

<!ELEMENT proxyhome
  ( homeplacementref
    | findby
  )>

<!ELEMENT publishesidentifier ( #PCDATA ) >
<!ELEMENT publishesport
   ( publishesidentifier
   , ( componentinstantiationref
       | findby
   )
   )>

Note D Issue 5092

<!ELEMENT registercomponent
   ( ( emitsidentifier
       | providesidentifier
       | publishesconsumesidentifier
   )?
   , ( registerwithnaming
       | registerwithtrader
   )+
   )>

<!ELEMENT registerwithhomefinder EMPTY >
<!ATTLIST registerwithhomefinder
   name CDATA #REQUIRED >

<!ELEMENT registerwithnaming EMPTY >
<!ATTLIST registerwithnaming
   name CDATA #IMPLIED >

<!ELEMENT registerwithtrader
   ( traderpropertiesexport )>
<!ATTLIST registerwithtrader
   tradername CDATA #IMPLIED >
<!-- DEVNOTE: is tradername necessary? -->
<!-- DEVNOTE: Should trader properties be specified in component file? And in assembly file? -->

Note D Issue 5497

<!ELEMENT proxyhome
   ( homeplacementref
   , findby
   )>

<!ELEMENT stringifiedobjectref ( #PCDATA ) >

<!ELEMENT traderconstraint ( #PCDATA ) >

<!ELEMENT traderexport
   ( traderservicetypename
   , traderproperties
   )>

<!ELEMENT traderpolicy>
( traderpolicyname 
  , traderpolicyvalue 
  ) >

<!ELEMENT traderpolicyname ( #PCDATA ) >
<!ELEMENT traderpolicyvalue ( #PCDATA ) >
<!ELEMENT traderpreference ( #PCDATA ) >
<!ELEMENT traderproperties
  ( traderproperty+ ) >

<!ELEMENT traderproperty
  ( traderpropertyname 
    , traderpropertyvalue 
  ) >

<!ELEMENT traderpropertyname ( #PCDATA ) >
<!ELEMENT traderpropertyvalue ( #PCDATA ) >

<!ELEMENT traderquery
  ( traderservicetypename 
    , traderconstraint
    , traderpreference?
    , traderpolicy*
    , traderspecifiedprop*
  ) >

<!ELEMENT traderservicetypename ( #PCDATA ) >
<!ELEMENT traderspecifiedprop ( #PCDATA ) >
<!ELEMENT usagename ( #PCDATA ) >
<!ELEMENT usesidentifier ( #PCDATA ) >

<!ELEMENT usesport
  ( usesidentifier
    , ( componentinstantiationref
      | findby
    )
  ) >
Interface Repository Metamodel

Note D Text in Red is from the Components 1.1 RTF interim report (ptc/2002-08-02).

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8.1 Introduction

The first goal of the MOF-compliant metamodel is to express the extensions to IDL defined by the CORBA Component Model. Since these extensions are derived from the previously-existing IDL base, it is not possible to define a MOF-compliant metamodel for the extensions without defining a MOF-compliant metamodel for the IDL base.

Thus, the first MOF Package defined, entitled BaseIDL, is a MOF-compliant description of the pre-existing CORBA Interface Repository, while the second Package, entitled ComponentIDL, expresses the Component Model extensions. As shown by the following package diagram (Figure 8-1), the ComponentIDL Package is dependent upon the BaseIDL Package.
8.1.1 BaseIDL Package

The base CORBA Interface Repository (IR) is described in the Common Object Request Broker Architecture (CORBA) in the form of CORBA IDL. Because the MOF is more expressive than IDL, a range of legitimate MOF-compliant metamodels are equivalent to this IDL. For instance, multi-valued attributes and references expressed in IDL could be ordered or unordered, allow an instance to be contained in the collection only once or more than once. Further, specific multiplicity constraints could be specified; for example:

- Can the sequence be empty?
- Is there an upper bound?

As can be seen from an examination of the portion of the metamodel contained in the BaseIDL Package, many such questions are resolved via the more precise expression that the MOF enables.

8.1.1.1 A Structural Comparison of the BaseIDL Package with the Existing IR

Although the structure of the MOF-compliant CORBA IR is very similar to the existing CORBA IR, the submitters have taken this opportunity to do some streamlining.

In the existing CORBA IR, elements that are "typed," such as constants, attributes, etc., hold an attribute of type IDLType. However, the same IDLType can be the type for many elements, so an attribute (with its composition semantics) is not appropriate. Instead, the MOF-compliant IR specifies the abstract Typed metaclass, and an Association between Typed and IDLType. This change eliminates the need for repeating the type attribute, which returns a TypeCode, in 6 different metaclasses.
In the existing CORBA IR, StructField, Parameter, and UnionField are datatypes (structs). The MOF-compliant IR specifies them as full-blown metaclasses so that they can participate as derivations of the Typed metaclass.

The MOF-compliant IR does not have to represent a repository since MOF-based servers inherently have such a construct. Thus, the MOF-compliant IR has no Repository metaclass and it specifies Container as a sub(metaclass of Contained, simplifying the hierarchy.

The existing IR's IRObject provides a def_kind readonly attribute. This information would be redundant in a MOF server, which inherently carries information describing the type of a metaobject. Thus, there is no IRObject metaclass in the MOF-compliant IR. However, it can be derived for a CORBA IR layer.

In the existing IR, UnionDef, StructDef, ExceptionDef, and OperationDef inherit from Container. Since they each contain only a single type of object, it makes less sense for them to have a reference to a collection of Contained metaobjects. Instead, in the MOF-compliant IR they each hold their set of fields or parameters as attributes.

As a simplification the two-stated enums AttributeMode and OperationMode have been eliminated. Attributes typed as AttributeMode or OperationMode have been turned into boolean-typed attributes.

Basic CRUD operations for creating, reading, updating, and deleting metaobjects are generally not included in the metamodel, since these are generated automatically by the MOF-IDL mapping, which takes a MOF-compliant metamodel as input and deterministically derives the IDL for representing the metamodel in a repository.

The existing IR duplicates many of the interfaces representing basic IR elements with structs representing the same elements. This duplication supports the ability to get a large collection of information required by a DII client without requiring the client to subsequently make repeated, possibly remote requests to objects in order to process the collection of information. Since the DII is optimized for the existing IR, this specification assumes that an IR layer will continue to service DII clients and thus does not attempt to provide this functionality in the MOF-compliant IR.

Figure 8-2 shows all of the metaclasses and relationships defined in the BaseIDL Package.
Figure 8-2  BaseDL Package—All Elements
8.1.1.2 Typing

As mentioned earlier in this chapter (Section 8.1.1.1, OA Structural Comparison of the BaseIDL Package with the Existing IR, on page 8-2), the two critical elements of the BaseIDL Package supporting the typing of IR entities are the Typed and IDLType metaclasses. A Typed element references an IDLType, which has an attribute of type TypeCode.

Figure 8-3 IDL Typing
8.1.1.3 Containment

Many elements in the metamodel descend from Container or Contained, in keeping with the structure of the original CORBA Interface Repository. As mentioned in the previous section, the metamodel also derives Container from Contained so that an element that is logically a container and at the same time is defined in another container does not have to inherit directly from both Container and Contained. However, this change requires that a constraint be written such that ModuleDef and only ModuleDef does not have to be defined in a Container. This constraint is included in the next section on containment constraints. Figure 8-4 expresses the containment hierarchy.
8.1.1.4 Containment Constraints

The Association between Container and Contained is named Contains. Contains is very general and is inherited by sub(meta)classes of Container and Contained. Unless further constrained, Contains would allow any Container to directly contain any Contained element. For example, a ModuleDef could contain an OperationDef and a ValueDef could contain an InterfaceDef. Clearly, the Contains Association must be constrained.

Figure 8-5 and Figure 8-6 express the containment constraints formally via the OMGÔs Object Constraint Language (OCL). They also supplement the formal expressions with English natural language equivalents.
**Constraints in English**

1. A ConstantDef must be defined in a Container

**Constraints in OCL**

1. { definedIn().notEmpty }  

2. A TypeDefDef must be defined in a Container

**Constraints in OCL**

2. { definedIn().notEmpty }  

3. An AttributeDef can be defined within an InterfaceDef or within a ValueDef

**Constraints in OCL**

3. { definedIn().oclIsKindOf(InterfaceDef) or definedIn().oclIsKindOf(ValueDef) }  

4. An OperationDef must be defined within an InterfaceDef or within a ValueDef

**Constraints in OCL**

4. { definedIn().oclIsKindOf(InterfaceDef) or definedIn().oclIsKindOf(ValueDef) }  

5. A ValueMemberDef must be defined within a ValueDef

**Constraints in OCL**

5. { definedIn().oclIsTypeof(ValueDef) }  

6. An ExceptionDef must be defined in a Container

**Constraints in OCL**

6. { definedIn().notEmpty }  

**Constraints in English**

[1] A ConstantDef must be defined in a Container

**Constraints in OCL**

[1] { definedIn().notEmpty }  

[2] A TypeDefDef must be defined in a Container

**Constraints in OCL**

[2] { definedIn().notEmpty }  

[3] An AttributeDef can be defined within an InterfaceDef or within a ValueDef

**Constraints in OCL**

[3] { definedIn().oclIsKindOf(InterfaceDef) or definedIn().oclIsKindOf(ValueDef) }  

[4] An OperationDef must be defined within an InterfaceDef or within a ValueDef

**Constraints in OCL**

[4] { definedIn().oclIsKindOf(InterfaceDef) or definedIn().oclIsKindOf(ValueDef) }  

[5] A ValueMemberDef must be defined within a ValueDef

**Constraints in OCL**

[5] { definedIn().oclIsTypeof(ValueDef) }  

[6] An ExceptionDef must be defined in a Container

**Constraints in OCL**

[6] { definedIn().notEmpty }  

---

Figure 8-5  Containment Constraints--Subclasses of Contained
**Constraints in English**

[7] If ModuleDef is defined in a Container, this Container must be another ModuleDef

**Constraints in OCL**

[7] \( \text{definedIn}.\text{notEmpty} \implies (\text{definedIn}.\text{ooclIsKindOf(ModuleDef)} \land \text{definedIn} \not= \text{self}) \)
### 8.1.1.5 Typedef and Type Derivations

Figure 8-7 expresses the hierarchy of derivatives of Typedef and Typed.
8.1.1.6 Exceptions

Figure 8-8 shows the formal definition of the ExceptionDef metaclass. Note the inclusion of the newly-defined (in this specification) ability for attribute accessors and mutators to raise user-defined exceptions.
8.1.1.7 Value Types

CORBA 2.3 provided a model for types of objects that can be passed by value. The Objects By Value specification expanded the grammar of IDL and the structure of the Interface Repository to accommodate value types. Figure 8-9 focuses on the definition of value types in the MOF-compliant IR metamodel.

**Figure 8-9 Value Types**
8.1.1.8 Naming

Figure 8-10 focuses on the aspects of the metamodel that concern naming.

```
**Constraints in English**
[14] Contained elements have unique names within their Container

**Constraints in OCL**
[14] { contents->forAll (c0, c1 | c0 <> c1 implies c0.identifier <> c1.identifier) }
```

Figure 8-10 Naming

8.1.1.9 Operations

As mentioned earlier in this chapter (Section 8.1.1.1, „A Structural Comparison of the BaseIDL Package with the Existing IR„ on page 8-2), the metamodel generally does not declare CRUD operations for the metaclasses, due to the fact that the MOF automatically generates such operations based on the structural metamodel. However, a few convenience operations are defined on the Container metaclass, as illustrated by Figure 8-11.
8.1.2 ComponentIDL Package

8.1.2.1 Overview

The following UML class diagram describes a metamodel representing the extensions to IDL defined by the CORBA Component Model. Just as these extensions are dependent on the base IDL defined in the CORBA Core, so is this metamodel dependent on a metamodel representing the base IDL.
Figure 8-12 ComponentIDL Package - Main Diagram
8.1.2.2 Containers and Contained Elements

The following UML class diagram (Figure 8-13) describes the derivation of the metamodel elements from the BaseIDL Container and Contained elements:

![UML Class Diagram]

Figure 8-13 Containment Hierarchy

Each of the subtypes of Contained shown in Figure 8-13 can only be defined within certain subtypes of Container. Figure 8-14 formally specifies these constraints via the OMGÖs Object Constraint Language (OCL), and supplements the OCL by expressing the constraints in natural language for the benefit of readers who are not familiar with OCL.
Figure 8-14 Constraints on Containment of Elements Defined In ComponentDef

An instance of ComponentDef describes a CORBA component in an abstract manner. The definition contains a description of all features of a component that are visible from the outside. More precise, it defines all interfaces including interfaces that are implicit or used for event communication. In detail, the features of component that are visible to the outside are:

- The component equivalent interface, containing all implicit operations, operations and attributes that are inherited by a component (also from supported interfaces), and attributes defined inside the component.
The facets of a component; that is, all interfaces that are provided by the component to the outside.

The receptacles of a component; that is, all interfaces that are used by a component.

The events, which a component can emit, publish, or consume.

If a component is going to be implemented, all these features must be handled by the component implementation. To provide a common basis for defining the related implementation definitions (as part of CIF) the abstract metaclass ComponentFeature is defined. The metaclasses ComponentDef, ProvidesDef, UsesDef, and EventPortDef are defined as subclasses of the metaclass ComponentFeature.

![ComponentFeature diagram](image)

Figure 8-15

All of ComponentDef's composition Associations shown in the main diagram (Figure 8-12 on page 8-15) are derived from the BaseIDL metamodel's Contains Association between Container andContained. As shown by Figure 8-13 on page 8-16, ComponentDef inherits that Association from InterfaceDef, which inherits it from Container.

The following class diagram (Figure 8-16 on page 8-20) details these derived Associations. A O/O prefix in an Association name denotes that the Association is derived, and sets the MOF's OisDerived property for the Association. The constraints for each of the derived Associations are expressed in the OMG's Object Constraint Language and declare how the Associations are derived from the Contains Association.

The "<implicit>" stereotype is a standard UML stereotype that designates the Association as conceptual rather than manifest. An "<implicit>" Association is ignored when generating IDL for the metamodel via the MOF-IDL mapping. It is also ignored when deriving the XML DTD for the metamodel via the MOF-XML mapping specified by the XMI specification. The Contains association is sufficient for generating the accessor methods in the IDL allowing the containments to be traversed. If these Associations were not marked as "<implicit>", then additional accessor methods would be generated to do the more focused traversals that they conceptualize. In the judgement of the submitters the generation of these additional accessor methods would expand the footprint of the IDL interfaces more than is warranted, given that the containments can be traversed by the single inherited Contains Association.
The fact that these <<implicit>> Associations are ignored when generating the IDL for the metamodel does not mean that they have no bearing on the contents of a repository. The ÔreflectiveÔ interfaces that all MOF metaobjects inherit have an operation called metaObject that returns a metaobject. This metaobject is part of the metamodel rather than part of a model; in other words, it is actually a meta-metaobject that is part of the description of the metamodel. The definitions of the <<implicit>> Associations in which a metaobject participates would be available via this meta-metaobject. The multiplicity constraints of these Associations would be available as well. Thus, for example, the fact that a ComponentDef aggregates zero or more UsesDef metaobjects is discoverable through such meta-metaobjects and thus serves as a formal constraint on the Contains Association from which the aggregation is derived.

Furthermore, when the state of the metamodel is streamed in conformance with the DTD for the MOF meta-metamodel, the state that specifies the <<implicit>> Associations are part of the stream. The DTD for the MOF meta-metamodel is contained in the XMI specification. XML streams conforming to that DTD and which contain the state of the IR metamodel are included in Section 8.3, ÔMOF DTDs and IDL for the Interface Repository Metamodel,Ô on page 8-27.
Figure 8-16  Implicit Derived Containments with ComponentDef as the Composite

*HomeDef*'s composition Associations also are derived from the *Contains* Association. As shown in Figure 8-13 on page 8-16, *HomeDef* descends from *Container*. All of the components of its composition Associations descend from *Contained*. As with the derived Associations in which *ComponentDef* plays the composite role, the derived Associations in which *HomeDef* plays the composite role are marked as *<implicit>*, to prevent excess IDL generation. Figure 8-17 formally defines the constraints that define the semantics of the derivations.
8.1.2.3 ValueDef Constraints EventsDef

The ValueDef metaclass, which is part of the BaseIDL Package, participates in a number of Associations defined by the ComponentIDL Package. The emits, publishes, and consumes declarations that are part of the component model IDL extensions all reference a ValueDef. Furthermore, the primaryKey declaration within home declarations references a ValueDef. However, the IDL type of the ValueDef is constrained, as explained in the Component Model chapter.

Figure 8-18 expresses the ValueDef constraints formally. Note that it uses an OCL technique of defining a side-effect free operation to support recursion, which is required to traverse the transitive closure of a ValueDef’s inheritance hierarchy.

The Component IDL metamodel is changed to introduce the new metatype `eventtype`. This metatype is introduced as a metaclass EventDef, which is a specialization of ValueDef. Inheritance for instances of EventDef is allowed from instances of ValueDef and EventDef; however, instances of ValueDef are not allowed to inherit from instances of EventDef.

![Diagram of ValueDef Constraints EventsDef](image-url)
The former metaclass `EventDef` as contained in the metamodel for `ComponentIDL` in orbos/99-07-02 is renamed to `EventData`. The Association between `EventData` and `ValueDef` is removed. Instead, there is a similar Association defined between `EventData` and `EventDef`. The metamodel for Component IDL is shown in Figure 8-12 on page 8-15.

### 8.1.2.4 Additional Type and Inheritance Constraints

Figure 8-19 and Figure 8-20 define additional constraints on the `ComponentDef`, `HomeDef`, `FactoryDef`, and `FinderDef` metaclasses.

**Constraints in English**
- [19] A `ComponentDef` C may be derived from at most one base.
- [20] Furthermore, that one base must be a `ComponentDef`.
- [21] A `ComponentDef` may not define operations.
- [22] A supported `InterfaceDef` must not be one of the derived forms of `InterfaceDef` (i.e. a `ComponentDef` or a `HomeDef`).

**Constraints in OCL**
- [19] `base->size <= 1`
- [20] `base->notEmpty() implies (base->forAll(oclType = ComponentDef))`
- [21] `contents->forAll(oclType = OperationDef)`
- [22] `supports->forAll(oclTypeDef(oclInterfaceDef))`

**Constraints in English**
- [18] The return type must be the same as the type of the component that the `FinderDef` home manages.

**Constraints in OCL**
- [18] `type = home.manages.type`

**Constraints in English**
- [23] A `HomeDef` may be derived from at most one base.
- [24] Furthermore, that one base must be a `HomeDef`.

**Constraints in OCL**
- [23] `base->size <= 1`
- [24] `base->notEmpty() implies (base->forAll(oclType = HomeDef))`
Note D Removed by the Components December 2000 FTF (see ptc/01-11-03, page 70-601).

Figure 8-20 Primary Key Constraints
8.1.2.5 Constraints on Basic Components

The CORBA Component Model defines the notion of basic components. The ComponentDef metaclass has an attribute named isBasic. The fact that a component is basic can actually be computed from the component declaration--if the component
observes certain constraints, it is basic. Thus, strictly speaking, the \textit{isBasic} attribute is not necessary. However, the attribute greatly simplifies the process of determining whether a component definition is basic.

Given the circumstances, it would seem appropriate to define the \textit{isBasic} attribute as a derived one. In the MOF and UML, \textit{isDerived} is an attribute of \textit{Attribute} that indicates that the information can be computed from other information in the model. However, the XMI standard specifies that the state of derived attributes is not deposited in XMI/XML streams representing models. Thus, if the \textit{isBasic} attribute were marked as derived, the state of the attribute would not appear in XMI streams representing CORBA-based object models. The submitters have therefore decided not to mark the \textit{isBasic} attribute of \textit{ComponentDef} as derived.

The constraints on basic components are modeled formally as shown in Figure 8-22.
8.2 Conformance Criteria

This chapter identifies the conformance points required for compliant implementations of the interface repository metamodel architecture.
8.2.1 Conformance Points

In the previous section, the MOF metamodel of the Interface Repository is defined. The following section defines the XMI format for the exchange of Interface Repository metadata and the IDL for a MOF-compliant Interface Repository. Support for the generation and consumption of the XMI metadata and for the MOF-compliant IDL is optional.

8.3 MOF DTDs and IDL for the Interface Repository Metamodel

The XMI DTDs and IDL for the Interface Repository metamodel are presented in this section. The DTDs are generated by applying the MOF-XML mapping defined by the XMI specification to the MOF-compliant metamodel described in Section 8.1, “Introduction,” on page 8-1. The IDL is generated by applying the MOF-IDL mapping defined in the MOF specification to the metamodels and was validated using the IDL compilers.

The IDL requires the inclusion of the reflective interfaces defined in ad/99-07-03 as part of the MOF 1.3 specification.

8.3.1 XMI DTD

```xml
<!ELEMENT XMI (XMI.header?, XMI.content?, XMI.difference*, XMI.extensions*)>
<!ATTLIST XMI
    xmi.version CDATA #FIXED "1.1"
    timestamp CDATA #IMPLIED
    verified (true|false) #IMPLIED>
```
function as a simple XLink as well as refer to model
-->
constructs within the same XMI file.
->

ENTRY % XMI.link.att

'href CDATA #IMPLIED xmi.idref IDREF #IMPLIED
xml:link
CDATA #IMPLIED xlink:inline (true|false) #IMPLIED
xlink:actuate (show|user) #IMPLIED xlink:content-
role
CDATA #IMPLIED xlink:title CDATA #IMPLIED xlink:show
(emb|replace|new) #IMPLIED xlink:behavior CDATA
#IMPLIED'

ENTRY % XMI.model ANY>
\attlist XMI.model %XMI.link.att;
xml.name CDATA #REQUIRED
xml.version CDATA #IMPLIED>

ENTRY % XMI.metamodel ANY>
\attlist XMI.metamodel %XMI.link.att;
xml.name CDATA #REQUIRED
xml.version CDATA #IMPLIED>

ENTRY % XMI.metametamodel ANY>
\attlist XMI.metametamodel %XMI.link.att;
xml.name CDATA #REQUIRED
xml.version CDATA #IMPLIED>
<!-- transferred data -->
<!--

<!ELEMENT XMI.metamodel ANY>
<!ATTLIST XMI.metamodel %XMI.link.att;
 xml.name CDATA #REQUIRED
 xml.version CDATA #IMPLIED>

<!--

<!ELEMENT XMI.import ANY>
<!ATTLIST XMI.import %XMI.link.att;
 xml.name CDATA #REQUIRED
 xml.version CDATA #IMPLIED>

<!--

<!ELEMENT XMI.content ANY>

<!--

<!ELEMENT XMI.extensions ANY>
<!ATTLIST XMI.extensions
 xml.extender CDATA #REQUIRED>
<ELEMENT XMI.extension ANY>
<!ATTLIST XMI.extension %XMI.element.att; %XMI.link.att;
    xml.extender CDATA #REQUIRED
    xml.extenderID CDATA #IMPLIED>

<!ELEMENT XMI.difference (XMI.difference | XMI.delete | XMI.add | XMI.replace)>
<!ATTLIST XMI.difference %XMI.element.att; %XMI.link.att;>

<!ELEMENT XMI.delete EMPTY>
<!ATTLIST XMI.delete %XMI.element.att; %XMI.link.att;>

<!ELEMENT XMI.add EMPTY>
<!ATTLIST XMI.add %XMI.element.att; %XMI.link.att;>
<!ELEMENT XMI.add ANY>
<!ATTLIST XMI.add %XMI.element.att; %XMI.link.att;
    xmi.position CDATA "-1">

<!--
>
<!-- XMI.replace represents the replacement of a model construct
-->
<!-- with another model construct in a base model
-->
<!--
>
<!ELEMENT XMI.replace ANY>
<!ATTLIST XMI.replace %XMI.element.att; %XMI.link.att;
    xmi.position CDATA "-1">

<!--
>
<!-- XMI.reference may be used to refer to data types not defined
in -->
<!-- the metamodel
<!--
>
<!ELEMENT XMI.reference ANY>
<!ATTLIST XMI.reference %XMI.link.att;>

<!--
>
<!-- This section contains the declaration of XML elements
-->
<!-- representing data types
-->
<!--
>
<!ELEMENT XMI.TypeDefinitions ANY>
<!ELEMENT XMI.field ANY>
<!ELEMENT XMI.seqItem ANY>
<!ELEMENT XMI.octetStream (#PCDATA)>
<!ELEMENT XMI.unionDiscrim ANY>

<!ELEMENT XMI.enum EMPTY>
<!ATTLIST XMI.enum xml.value CDATA #REQUIRED>
<!ELEMENT XMI.any ANY>
<!ATTLIST XMI.any %XMI.link.att;
    xml.type CDATA #IMPLIED
    xml.name CDATA #IMPLIED>

<!ELEMENT XMI.CorbaTypeCode (XMI.CorbaTcAlias|XMI.CorbaTcStruct |
    XMI.CorbaTcSequence|XMI.CorbaTcArray|XMI.CorbaTcEnum |
    XMI.CorbaTcUnion|XMI.CorbaTcException|XMI.CorbaTcString |
    XMI.CorbaTcWstring|XMI.CorbaTcShort|XMI.CorbaTcLong |
    XMI.CorbaTcUshort |XMI.CorbaTcUlong |XMI.CorbaTcFloat |
    XMI.CorbaTcDouble |XMI.CorbaTcBoolean |XMI.CorbaTcChar |
    XMI.CorbaTcWchar |XMI.CorbaTcOctet |XMI.CorbaTcAny |

XMI.CorbaTcTypeCode|XMI.CorbaTcPrincipal|XMI.CorbaTcNull |
XMI.CorbaTcVoid|XMI.CorbaTcLongLong|XMI.CorbaTcULongLong |
    XMI.CorbaTcObjRef |XMI.CorbaTcLongDouble)>
<!ATTLIST XMI.CorbaTypeCode %XMI.element.att;>

<!ELEMENT XMI.CorbaTcAlias (XMI.CorbaTypeCode)>
<!ATTLIST XMI.CorbaTcAlias
    xml.tcName CDATA #REQUIRED
    xml.tcid CDATA #IMPLIED>

<!ELEMENT XMI.CorbaTcStruct (XMI.CorbaTcField)>
<!ATTLIST XMI.CorbaTcStruct
    xml.tcName CDATA #REQUIRED
    xml.tcid CDATA #IMPLIED>

<!ELEMENT XMI.CorbaTcField (XMI.CorbaTypeCode)>
<!ATTLIST XMI.CorbaTcField
    xml.tcName CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcSequence
(XMI.CorbaTypeCode|XMI.CorbaRecursiveType)>
<!ATTLIST XMI.CorbaTcSequence
    xml.tcLength CDATA #REQUIRED>

<!ELEMENT XMI.CorbaRecursiveType EMPTY>
<!ATTLIST XMI.CorbaRecursiveType
    xml.offset CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcArray (XMI.CorbaTypeCode)>
<!ATTLIST XMI.CorbaTcArray
    xml.tcLength CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcObjRef EMPTY>
<!ATTLIST XMI.CorbaTcObjRef
    xml.tcName CDATA #REQUIRED
    xml.tcid CDATA #IMPLIED>

<!ELEMENT XMI.CorbaTcEnum (XMI.CorbaTcEnumLabel)>
<!ATTLIST XMI.CorbaTcEnum
    xml.tcName CDATA #REQUIRED
    xml.tcid CDATA #IMPLIED>
<!ELEMENT XMI.CorbaTcEnumLabel EMPTY>
<!ATTLIST XMI.CorbaTcEnumLabel
  xmi.tcName CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcUnionMbr (XMI.CorbaTypeCode, XMI.any)>  
<!ATTLIST XMI.CorbaTcUnionMbr
  xmi.tcName CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcUnion (XMI.CorbaTypeCode, XMI.CorbaTcUnionMbr*)> 
<!ATTLIST XMI.CorbaTcUnion
  xmi.tcName CDATA #REQUIRED
  xmi.tcId CDATA #IMPLIED>

<!ELEMENT XMI.CorbaTcExcept (XMI.CorbaTcField)*> 
<!ATTLIST XMI.CorbaTcExcept
  xmi.tcId CDATA #IMPLIED>

<!ELEMENT XMI.CorbaTcString EMPTY> 
<!ATTLIST XMI.CorbaTcString
  xmi.tcLength CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcWstring EMPTY>  
<!ATTLIST XMI.CorbaTcWstring
  xmi.tcLength CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcFixed EMPTY> 
<!ATTLIST XMI.CorbaTcFixed
  xmi.tcDigits CDATA #REQUIRED
  xmi.tcScale CDATA #REQUIRED>

<!ELEMENT XMI.CorbaTcShort EMPTY> 
<!ELEMENT XMI.CorbaTcLong EMPTY>

<!ELEMENT XMI.CorbaTcUshort EMPTY> 
<!ELEMENT XMI.CorbaTcUlong EMPTY>

<!ELEMENT XMI.CorbaTcFloat EMPTY> 
<!ELEMENT XMI.CorbaTcDouble EMPTY> 
<!ELEMENT XMI.CorbaTcBoolean EMPTY> 
<!ELEMENT XMI.CorbaTcChar EMPTY> 
<!ELEMENT XMI.CorbaTcWchar EMPTY> 
<!ELEMENT XMI.CorbaTcOctet EMPTY> 
<!ELEMENT XMI.CorbaTcAny EMPTY>

<!ELEMENT XMI.CorbaTcTypeCode EMPTY> 
<!ELEMENT XMI.CorbaTcPrincipal EMPTY>

<!ELEMENT XMI.CorbaTcNull EMPTY> 
<!ELEMENT XMI.CorbaTvoid EMPTY> 
<!ELEMENT XMI.CorbaTcLongLong EMPTY> 
<!ELEMENT XMI.CorbaTcUlongLong EMPTY> 
<!ELEMENT XMI.CorbaTcLongDouble EMPTY> 

<!ATTLIST XMI xmlns:BaseIDL CDATA #IMPLIED>
<!--

> <!-- METAMODEL PACKAGE: BaseIDL -->

<!--

> <!-- METAMODEL CLASS: BaseIDL.Typed -->

<!--

> <!--

<!ELEMENT BaseIDL::Typed.idlType (BaseIDL::IDLType) -->

<!ENTITY % BaseIDL::TypedFeatures 'XMI.extension | BaseIDL::Typed.idlType'>

<!ENTITY % BaseIDL::TypedAttys '%XMI.element.att; %XMI.link.att; idlType IDREFS #IMPLIED'>

<!ELEMENT BaseIDL::Typed (%BaseIDL::TypedFeatures;) -->

<!ATTLIST BaseIDL::Typed %BaseIDL::TypedAttys;>
<!--

>  

<!--

<!-- METAMODEL CLASS: BaseIDL.ParameterDef

-->  

<!--

<!ELEMENT BaseIDL:ParameterDef.identifier (#PCDATA|XMI.reference)>

<!ELEMENT BaseIDL:ParameterDef.direction EMPTY>

<!ATTLIST BaseIDL:ParameterDef.direction xml.value %BaseIDL:ParameterMode; #REQUIRED>

<!ENTITY % BaseIDL:ParameterDefFeatures '%BaseIDL:TypedFeatures; | BaseIDL:ParameterDef.identifier | BaseIDL:ParameterDef.direction'>

<!ENTITY % BaseIDL:ParameterDefAtts '%BaseIDL:TypedAtts; identifier CDATA #IMPLIED
direction %BaseIDL:ParameterMode; #IMPLIED'>

<!ELEMENT BaseIDL:ParameterDef (%BaseIDL:ParameterDefFeatures;)*>

<!ATTLIST BaseIDL:ParameterDef %BaseIDL:ParameterDefAtts;>

<!--

>  

<!-- METAMODEL CLASS: BaseIDL.Contained

-->  

<!--

<!ELEMENT BaseIDL:Contained.definedIn (BaseIDL:Container)*>

<!ELEMENT BaseIDL:Contained.identifier (#PCDATA|XMI.reference)>

<!ELEMENT BaseIDL:Contained.repositoryId (#PCDATA|XMI.reference)>

<!ELEMENT BaseIDL:Contained.version (#PCDATA|XMI.reference)>

<!ENTITY % BaseIDL:ContainedFeatures 'XMI.extension | BaseIDL:Contained.definedIn | BaseIDL:Contained.identifier | BaseIDL:Contained.repositoryId | BaseIDL:Contained.version'>
<!ENTITY % BaseIDL:ContainedAtts 'XMI.element.att; XMI.link.att;_definedIn IDREFS #IMPLIED_identifier CDATA #IMPLIED_repositoryId CDATA #IMPLIED_version CDATA #IMPLIED'>

<!ELEMENT BaseIDL:Contained (%BaseIDL:ContainedFeatures;)*>

<!ATTLIST BaseIDL:Contained %BaseIDL:ContainedAtts;>

<!ENTITY % BaseIDL:ConstantDef 'BaseIDL:ConstantDefFeatures; |
   BaseIDL:Contained | BaseIDL:ConstantDef | BaseIDL:TypedDef | BaseIDL:TypeDef | BaseIDL:StructDef | BaseIDL:UnionDef | BaseIDL:EnumDef | BaseIDL:AliasDef'>

<!ELEMENT BaseIDL:ConstantDef (%BaseIDL:ConstantDefFeatures;)*>

<!ATTLIST BaseIDL:ConstantDef %BaseIDL:ConstantDefAtts;>

<!ENTITY % BaseIDL:Container 'BaseIDL:Contained | BaseIDL:ConstantDef | BaseIDL:TypedDef | BaseIDL:TypeDef | BaseIDL:StructDef | BaseIDL:UnionDef | BaseIDL:EnumDef | BaseIDL:AliasDef'>

<!ELEMENT BaseIDL:Container.contents (BaseIDL:Contained| BaseIDL:ConstantDef|BaseIDL:TypedDef|BaseIDL:TypeDef|BaseIDL:StructDef| BaseIDL:UnionDef|BaseIDL:EnumDef|BaseIDL:AliasDef|
BaseIDL:ValueBoxDef|BaseIDL:Container|BaseIDL:ModuleDef|
BaseIDL:InterfaceDef|ComponentIDL:ComponentDef|ComponentIDL:HomeDef|
BaseIDL:ValueDef|ComponentIDL:EventDef|CIF:ComponentImplDef|
CIF:HomeImplDef|BaseIDL:ValueMemberDef|
BaseIDL:OperationDef|ComponentIDL:FactoryDef|ComponentIDL:FinderDef|
BaseIDL:ExceptionDef|BaseIDL:AttributeDef|
CIF:ArtifactDef|CIF:SegmentDef|ComponentIDL:ProvidesDef|
ComponentIDL:UsesDef|ComponentIDL:EventPortDef|ComponentIDL:EmitsDef|
ComponentIDL:ConsumesDef|ComponentIDL:PublishesDef)*>
<!ENTITY % BaseIDL:ContainerFeatures '
BaseIDL:Container.contents'; |
<!ENTITY % BaseIDL:ContainerAtts '
ComponentIDL:ContainerAtts;'
<!ELEMENT BaseIDL:Container (%BaseIDL:ContainerFeatures;)*
<!ATTLIST BaseIDL:Container %BaseIDL:ContainerAtts;
<!---
---

>  

<!--- METAMODEL CLASS: BaseIDL.ModuleDef
---

>  

<!---
---

<!ELEMENT BaseIDL:ModuleDef.prefix (#PCDATA|XMI.reference)>
<!ENTITY % BaseIDL:ModuleDefFeatures '
BaseIDL:ModuleDef.prefix'; |
<!ENTITY % BaseIDL:ModuleDefAtts '
prefix CDATA #IMPLIED'>
<!ELEMENT BaseIDL:ModuleDef (%BaseIDL:ModuleDefFeatures;)*
<!ATTLIST BaseIDL:ModuleDef %BaseIDL:ModuleDefAtts;
<!---
---

>  

<!--- METAMODEL CLASS: BaseIDL.IDLType
---

>  

<!---
<!ENTITY % BaseIDL:IDLTypeFeatures 'XMI.extension'>
<!ENTITY % BaseIDL:IDLTypeAtts '%XMI.element.att; %XMI.link.att;'>
<!ELEMENT BaseIDL:IDLType (%BaseIDL:IDLTypeFeatures;)*>
<!ATTLIST BaseIDL:IDLType %BaseIDL:IDLTypeAtts;>

<!ENTITY % BaseIDL:TypedefDefFeatures '%BaseIDL:IDLTypeFeatures; |
  BaseIDL:Contained.definedIn |
  BaseIDL:Contained.identifier |
  BaseIDL:Contained.repositoryId |
  BaseIDL:Contained.version'>
<!ENTITY % BaseIDL:TypedefDefAtts '%BaseIDL:IDLTypeAtts;
  definedIn IDREFS #IMPLIED
  identifier CDATA #IMPLIED
  repositoryId CDATA #IMPLIED
  version CDATA #IMPLIED'>
<!ELEMENT BaseIDL:TypedefDef (%BaseIDL:TypedefDefFeatures;)*>
<!ATTLIST BaseIDL:TypedefDef %BaseIDL:TypedefDefAtts;>

<!ENTITY % BaseIDL:InterfaceDef 'BaseIDL:IDLType |
  BaseIDL:IDLTypeFeatures |
  BaseIDL:IDLTypeAtts |
  BaseIDL:IDLTypeDefFeatures |
  BaseIDL:IDLTypeDefAtts'>
<!ELEMENT BaseIDL:InterfaceDef (%BaseIDL:IDLType; |
  %BaseIDL:IDLTypeFeatures; |
  %BaseIDL:IDLTypeAtts; |
  %BaseIDL:IDLTypeDefFeatures; |
  %BaseIDL:IDLTypeDefAtts;)*>
<!ATTLIST BaseIDL:InterfaceDef.isAbstract EMPTY>
<!ATTLIST BaseIDL:InterfaceDef.isAbstract xmi.value (true|false) #REQUIRED>
<!ELEMENT BaseIDL:InterfaceDef.isLocal EMPTY>
<!ATTLIST BaseIDL:InterfaceDef.isLocal xmi.value (true|false) #REQUIRED>
<!ENTITY % BaseIDL:InterfaceDefFeatures "%BaseIDL:IDLTypeFeatures; |
  BaseIDL:Contained.definedIn | BaseIDL:Contained.identifier | BaseIDL:Contained.repositoryId | BaseIDL:Contained.version | BaseIDL:Container.contents | BaseIDL:InterfaceDef.base | BaseIDL:InterfaceDef.isAbstract | BaseIDL:InterfaceDef.isLocal">
<!ENTITY % BaseIDL:InterfaceDefAtts "%BaseIDL:IDLTypeAtts; 
definedIn IDREFS #IMPLIED 
identifier CDATA #IMPLIED 
repositoryId CDATA #IMPLIED 
version CDATA #IMPLIED 
base IDREFS #IMPLIED 
isAbstract (true|false) #IMPLIED 
isLocal (true|false) #IMPLIED'">
<!ELEMENT BaseIDL:InterfaceDef (%BaseIDL:InterfaceDefFeatures;)*>
<!ATTLIST BaseIDL:InterfaceDef %BaseIDL:InterfaceDefAtts;>
<!-- BaseIDL:InterfaceDef %BaseIDL:InterfaceDefAtts; -->
<!ELEMENT BaseIDL:Field (%BaseIDL:FieldFeatures;)*>
<!ENTITY % BaseIDL:FieldFeatures "%BaseIDL:TypedFeatures; |
  BaseIDL:Field.identifier">
<!ENTITY % BaseIDL:FieldAtts "%BaseIDL:TypedAtts; 
identifier CDATA #IMPLIED'">
<!ELEMENT BaseIDL:Field (%BaseIDL:FieldFeatures;)*>
<!ATTLIST BaseIDL:Field %BaseIDL:FieldAtts;>
<!--

> <!--
<!-- METAMODEL CLASS: BaseIDL.StructDef
--> <!--
<!--

<!--ELEMENT BaseIDL:StructDef.members (BaseIDL:Field)*
<!--ENTITY % BaseIDL:StructDefFeatures ' %BaseIDL:TypedefDefFeatures; | BaseIDL:StructDef.members'
<!--ENTITY % BaseIDL:StructDefAtts ' %BaseIDL:TypedefDefAtts; '>
<!--ELEMENT BaseIDL:StructDef (%BaseIDL:StructDefFeatures;)*
<!--ATTLIST BaseIDL:StructDef %BaseIDL:StructDefAtts;

<!--

> <!--
<!-- METAMODEL CLASS: BaseIDL.UnionDef
--> <!--
<!--

<!--ELEMENT BaseIDL:UnionDef.discriminatorType (BaseIDL:IDLType)*
<!--ELEMENT BaseIDL:UnionDef.unionMembers (BaseIDL:UnionField)*
<!--ENTITY % BaseIDL:UnionDefFeatures ' %BaseIDL:TypedefDefFeatures; | BaseIDL:UnionDef.discriminatorType | BaseIDL:UnionDef.unionMembers'
<!--ENTITY % BaseIDL:UnionDefAtts ' %BaseIDL:TypedefDefAtts; discriminatorType IDREFS #IMPLIED'
<!--ELEMENT BaseIDL:UnionDef (%BaseIDL:UnionDefFeatures;)*
<!--ATTLIST BaseIDL:UnionDef %BaseIDL:UnionDefAtts;

<!--

> <!--
<!-- METAMODEL CLASS: BaseIDL.EnumDef
--> -->
<!ELEMENT BaseIDL:EnumDef.members (#PCDATA|XMI.reference)>

<!ENTITY % BaseIDL:EnumDefFeatures '%BaseIDL:TypedefTypeDefFeatures;  
  BaseIDL:EnumDef.members'>

<!ENTITY % BaseIDL:EnumDefAtts '%BaseIDL:TypedefTypeDefAtts;  
  members CDATA #IMPLIED'>

<!ELEMENT BaseIDL:EnumDef (%BaseIDL:EnumDefFeatures;)*>

<!ATTLIST BaseIDL:EnumDef %BaseIDL:EnumDefAtts;>

<!ELEMENT BaseIDL:AliasDef (#PCDATA|XMI.reference)>

<!ENTITY % BaseIDL:AliasDefFeatures '%BaseIDL:TypedefTypeDefFeatures;  
  BaseIDL:Typedef.idlType'>

<!ENTITY % BaseIDL:AliasDefAtts '%BaseIDL:TypedefTypeDefAtts;  
  idlType IDREFS #IMPLIED'>

<!ELEMENT BaseIDL:AliasDef (%BaseIDL:AliasDefFeatures;)*>

<!ATTLIST BaseIDL:AliasDef %BaseIDL:AliasDefAtts;>

<!ELEMENT BaseIDL:StringDef.bound (#PCDATA|XMI.reference)>

<!ENTITY % BaseIDL:StringDefFeatures '%BaseIDL:IDLTypeFeatures;  
  BaseIDL:StringDef.bound'>

<!ENTITY % BaseIDL:StringDefAtts '%BaseIDL:IDLTypeAtts;
bound CDATA #IMPLIED'>

<!ELEMENT BaseIDL:StringDef (%BaseIDL:TypeDefFeatures;)*>
<!ATTLIST BaseIDL:StringDef %BaseIDL:TypeDefatts;>
<!--
>  
<!-- METAMODEL CLASS: BaseIDL.WStringDef
-->  
<!--
>  
<!ELEMENT BaseIDL:WStringDef.bound (#PCDATA|XMI.reference)*>
<!ENTITY % BaseIDL:WStringDefFeatures '%BaseIDL:IDLTypeFeatures; | BaseIDL:WStringDef.bound'>
<!ENTITY % BaseIDL:WStringDefatts '%BaseIDL:IDLTypeatts;
  bound CDATA #IMPLIED'>
<!ELEMENT BaseIDL:WStringDef (%BaseIDL:WStringDefFeatures;)*>
<!ATTLIST BaseIDL:WStringDef %BaseIDL:WStringDefatts;>
<!--
>  
<!-- METAMODEL CLASS: BaseIDL.FixedDef
-->  
<!--
>  
<!ELEMENT BaseIDL:FixedDef.digits (#PCDATA|XMI.reference)>  
<!ELEMENT BaseIDL:FixedDef.scale (#PCDATA|XMI.reference)>  
<!ENTITY % BaseIDL:FixedDefFeatures '%BaseIDL:IDLTypeFeatures; | BaseIDL:FixedDef.digits | BaseIDL:FixedDef.scale'>
<!ENTITY % BaseIDL:FixedDefatts '%BaseIDL:IDLTypeatts;
digits CDATA #IMPLIED
  scale CDATA #IMPLIED'>
<!ELEMENT BaseIDL:FixedDef (%BaseIDL:FixedDefFeatures;)*>
<!ATTLIST BaseIDL:FixedDef %BaseIDL:FixedDefatts;>
<!--

-->  

<!-- METAMODEL CLASS: BaseIDL.SequenceDef
-->  

<!--


<!ELEMENT BaseIDL:SequenceDef.bound (#PCDATA|XMI.reference)*>

<!ENTITY % BaseIDL:SequenceDefFeatures "%BaseIDL:TypedFeatures; | BaseIDL:SequenceDef.bound'">

<!ENTITY % BaseIDL:SequenceDefAtts "%BaseIDL:TypedAtts;
  bound CDATA #IMPLIED'">

<!ELEMENT BaseIDL:SequenceDef (%BaseIDL:SequenceDefFeatures;)*>

<!ATTLIST BaseIDL:SequenceDef %BaseIDL:SequenceDefAtts;>

<!--

-->  

<!--

-->  

<!-- METAMODEL CLASS: BaseIDL.ArrayDef
-->  

<!--


<!ELEMENT BaseIDL:ArrayDef.bound (#PCDATA|XMI.reference)*>

<!ENTITY % BaseIDL:ArrayDefFeatures "%BaseIDL:TypedFeatures; | BaseIDL:ArrayDef.bound'">

<!ENTITY % BaseIDL:ArrayDefAtts "%BaseIDL:TypedAtts;
  bound CDATA #IMPLIED'">

<!ELEMENT BaseIDL:ArrayDef (%BaseIDL:ArrayDefFeatures;)*>

<!ATTLIST BaseIDL:ArrayDef %BaseIDL:ArrayDefAtts;>

<!--

-->  

<!--

-->  

<!-- METAMODEL CLASS: BaseIDL.PrimitiveDef
-->  

<!--

-->
<!ELEMENT BaseIDL:PrimitiveDef.kind EMPTY>
<!ATTLIST BaseIDL:PrimitiveDef.kind xmi.value %BaseIDL:PrimitiveKind; #REQUIRED>
<!ENTITY % BaseIDL:PrimitiveDefFeatures '%BaseIDL:IDLTypeFeatures;
  BaseIDL:PrimitiveDef.kind'>
<!ENTITY % BaseIDL:PrimitiveDefAtts '%BaseIDL:IDLTypeAtts;
  kind %BaseIDL:PrimitiveKind; #IMPLIED'>
<!ELEMENT BaseIDL:PrimitiveDef (%BaseIDL:PrimitiveDefFeatures;)>*
<!ATTLIST BaseIDL:PrimitiveDef %BaseIDL:PrimitiveDefAtts;>

<!--
>
<!--
<!-- METAMODEL CLASS: BaseIDL.UnionField
-->
<!--
<!--
>
<!ELEMENT BaseIDL:UnionField.identifier (#PCDATA|XMI.reference)*>
<!ELEMENT BaseIDL:UnionField.label (XMI.any)>
<!ENTITY % BaseIDL:UnionFieldFeatures '%BaseIDL:TypedFeatures;
  BaseIDL:UnionField.identifier | BaseIDL:UnionField.label'>
<!ENTITY % BaseIDL:UnionFieldAtts '%BaseIDL:TypedAtts;
  identifier CDATA #IMPLIED'>
<!ELEMENT BaseIDL:UnionField (%BaseIDL:UnionFieldFeatures;)>*
<!ATTLIST BaseIDL:UnionField %BaseIDL:UnionFieldAtts;>

<!--
>
<!--
<!-- METAMODEL CLASS: BaseIDL.ValueMemberDef
-->
<!--

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<!-- -->

<!ELEMENT BaseIDL:ValueMemberDef.isPublicMember EMPTY>

<!ATTLIST BaseIDL:ValueMemberDef.isPublicMember xml.value (true|false) #REQUIRED>

<!ENTITY % BaseIDL:ValueMemberDefFeatures '%BaseIDL:TypedFeatures;
| BaseIDL:Contained.cursorDefinedIn |
BaseIDL:Contained.identifier |
BaseIDL:Contained.repositoryId |
BaseIDL:Contained.version |
BaseIDL:ValueMemberDef.isPublicMember'>

<!ENTITY % BaseIDL:ValueMemberDefAtts '%BaseIDL:TypedAtts;
definedIn IDREFS #IMPLIED
identifier CDATA #IMPLIED
repositoryId CDATA #IMPLIED
version CDATA #IMPLIED
isPublicMember (true|false) #IMPLIED'>

<!ELEMENT BaseIDL:ValueMemberDef (%BaseIDL:ValueMemberDefFeatures;)>  

<!ATTLIST BaseIDL:ValueMemberDef %BaseIDL:ValueMemberDefAtts;>

<!-- -->

<!-- METAMODEL CLASS: BaseIDL.ValueDef -->

<!-- -->

<!-- -->

<!ELEMENT BaseIDL:ValueDef.interfaceDef (BaseIDL:InterfaceDef)="/">

<!ELEMENT BaseIDL:ValueDef.base (BaseIDL:ValueDef)="/">

<!ELEMENT BaseIDL:ValueDef.abstractBase (BaseIDL:ValueDef)="/">

<!ELEMENT BaseIDL:ValueDef.isAbstract EMPTY>

<!ATTLIST BaseIDL:ValueDef.isAbstract xmi.value (true|false) #REQUIRED>

<!ELEMENT BaseIDL:ValueDef.isCustom EMPTY>

<!ATTLIST BaseIDL:ValueDef.isCustom xmi.value (true|false) #REQUIRED>
<!ELEMENT BaseIDL:ExceptionDef (BaseIDL:ExceptionDef)>
<!ELEMENT BaseIDL:isOneWay EMPTY>
<!ATTLIST BaseIDL:isOneWay xmi.value (true|false) #REQUIRED>
<!ELEMENT BaseIDL:parameters (BaseIDL:ParameterDef)>
<!ELEMENT BaseIDL:contexts (#PCDATA|XMI.reference)>
<!ENTITY % BaseIDL:OperationDefFeatures '%BaseIDL:TypedFeatures; |
  BaseIDL:Contained.defIn |
  BaseIDL:Contained.identifier |
  BaseIDL:Contained.repositoryId |
  BaseIDL:Contained.version |
  BaseIDL:OperationDef.exceptionDef |
  BaseIDL:OperationDef.isOneWay |
  BaseIDL:OperationDef.parameters |
  BaseIDL:OperationDef.contexts'>
<!ENTITY % BaseIDL:OperationDefAtts '%BaseIDL:TypedAtts; |
  definedIn IDREFS #IMPLIED |
  identifier CDATA #IMPLIED |
  repositoryId CDATA #IMPLIED |
  version CDATA #IMPLIED |
  exceptionDef IDREFS #IMPLIED |
  isOneWay (true|false) #IMPLIED |
  contexts CDATA #IMPLIED'>
<!ELEMENT BaseIDL:OperationDef (%BaseIDL:OperationDefFeatures;)>  
<!ATTLIST BaseIDL:OperationDef %BaseIDL:OperationDefAtts;>
<!--
-->
<!-- METAMODEL CLASS: BaseIDL.ExceptionDef
--> 
<!--
--> 
<!ELEMENT BaseIDL:ExceptionDef.typeCode (XMI.CorbaTypeCode)>
<!ELEMENT BaseIDL:ExceptionDef.members (BaseIDL:Field)>
<!ENTITY % BaseIDL:ExceptionDefFeatures '%BaseIDL:ContainedFeatures; | BaseIDL:ExceptionDef.typeCode | BaseIDL:ExceptionDef.members'>

<!ENTITY % BaseIDL:ExceptionDefAtts '%BaseIDL:ContainedAtts;'>

<!ELEMENT BaseIDL:ExceptionDef (%BaseIDL:ExceptionDefFeatures;)*>

<!ATTLIST BaseIDL:ExceptionDef %BaseIDL:ExceptionDefAtts;>

<!ELEMENT BaseIDL:AttributeDef.setException (BaseIDL:ExceptionDef)*>

<!ELEMENT BaseIDL:AttributeDef.getException (BaseIDL:ExceptionDef)*>

<!ELEMENT BaseIDL:AttributeDef.isReadOnly EMPTY>

<!ATTLIST BaseIDL:AttributeDef.isReadOnly xmi.value (true|false) #REQUIRED>

<!ENTITY % BaseIDL:AttributeDefFeatures '%BaseIDL:TypedFeatures; | BaseIDL:ContaineddefinedIn | BaseIDL:Contained.identifier | BaseIDL:Contained.repositoryId | BaseIDL:Contained.version | BaseIDL:AttributeDef.setException | BaseIDL:AttributeDef.getException | BaseIDL:AttributeDef.isReadOnly'>

<!ENTITY % BaseIDL:AttributeDefAtts '%BaseIDL:TypedAtts; definedIn IDREFS #IMPLIED identifier CDATA #IMPLIED repositoryId CDATA #IMPLIED version CDATA #IMPLIED setException IDREFS #IMPLIED getException IDREFS #IMPLIED isReadOnly (true|false) #IMPLIED'>

<!ELEMENT BaseIDL:AttributeDef (%BaseIDL:AttributeDefFeatures;)*>

<!ATTLIST BaseIDL:AttributeDef %BaseIDL:AttributeDefAtts;>
<!--
>
<!--
METAMODEL PACKAGE: CIF
>
<!--

<!ENTITY % CIF:ComponentCategory
'(PROCESS|SESSION|ENTITY|SERVICE)'>

<!--
>
<!--
METAMODEL CLASS: CIF:ArtifactDef
>
<!--

<!ENTITY % CIF:ArtifactDefFeatures '(%BaseIDL:ContainedFeatures;')>
<!ENTITY % CIF:ArtifactDefAtts '(%BaseIDL:ContainedAtts;')>
<!ELEMENT CIF:ArtifactDef (%CIF:ArtifactDefFeatures;)*>
<!ATTLIST CIF:ArtifactDef %CIF:ArtifactDefAtts;>

<!--
>
<!--
METAMODEL CLASS: CIF:SegmentDef
>
<!--

<!ELEMENT CIF:SegmentDef.artifact (CIF:ArtifactDef)*>
<!ELEMENT CIF:SegmentDef.features (ComponentIDL:ComponentFeature)>
<!ELEMENT CIF:SegmentDef.policies (CIF:Policy)*>
<!ELEMENT CIF:SegmentDef.isSerialized EMPTY>
<!ATTLIST CIF:SegmentDef.isSerialized xmi.value {true|false} #REQUIRED>
<!ENTITY % CIF:SegmentDefFeatures '%BaseIDL:ContainedFeatures; |
  CIF:SegmentDef.artifact | CIF:SegmentDef.features | CIF:SegmentDef.policies |
  CIF:SegmentDef.isSerialized'>

<!ENTITY % CIF:SegmentDefAtts '%BaseIDL:ContainedAtts;
  artifact IDREFS #IMPLIED
  features IDREFS #IMPLIED
  policies IDREFS #IMPLIED
  isSerialized (true|false) #IMPLIED'>

<!ELEMENT CIF:SegmentDef (%CIF:SegmentDefFeatures;)*>

<!ATTLIST CIF:SegmentDef %CIF:SegmentDefAtts;>

<--

> 
<--
<-- METAMODEL CLASS: CIF:ComponentImplDef
--> 
<--
<--

>

<!ELEMENT CIF:ComponentImplDef.component
  (ComponentIDL:ComponentDef)'>

<!ELEMENT CIF:ComponentImplDef.category EMPTY>

<!ATTLIST CIF:ComponentImplDef.category xmi.value
  %CIF:ComponentCategory; #REQUIRED>

<!ENTITY % CIF:ComponentImplDefFeatures '%BaseIDL:ContainerFeatures; |
  CIF:ComponentImplDef.component | CIF:ComponentImplDef.category'>

<!ENTITY % CIF:ComponentImplDefAtts '%BaseIDL:ContainerAtts;
  component IDREFS #IMPLIED
category %CIF:ComponentCategory; #IMPLIED'>

<!ELEMENT CIF:ComponentImplDef (%CIF:ComponentImplDefFeatures;)*>

<!ATTLIST CIF:ComponentImplDef %CIF:ComponentImplDefAtts;>

<--

> 
<--
<-- METAMODEL CLASS: CIF:Policy
-->
<!ENTITY % CIF:PolicyFeatures 'XMI.extension'>
<!ENTITY % CIF:PolicyAtts '%XMI.element.att; %XMI.link.att;'>
<!ELEMENT CIF:Policy (%CIF:PolicyFeatures;)*>
<!ATTLIST CIF:Policy %CIF:PolicyAtts;>

<!--

>  
<!-- METAMODEL CLASS: CIF:HomeImplDef
 -->
<!--
<!ELEMENT CIF:HomeImplDef.home (ComponentIDL:HomeDef)*>
<!ELEMENT CIF:HomeImplDef.component_impl (CIF:ComponentImplDef)*>
<!ENTITY % CIF:HomeImplDefFeatures '%BaseIDL:ContainerFeatures; | CIF:HomeImplDef.home | CIF:HomeImplDef.component_impl'>
<!ENTITY % CIF:HomeImplDefAtts '%BaseIDL:ContainerAtts; home IDREFS #IMPLIED component_impl IDREFS #IMPLIED'>
<!ELEMENT CIF:HomeImplDef (%CIF:HomeImplDefFeatures;)*>
<!ATTLIST CIF:HomeImplDef %CIF:HomeImplDefAtts;>

<!--

>  
<!-- METAMODEL PACKAGE: ComponentIDL
 -->
<!--
<!--
<!--
<!--

!-->

<!ELEMENT ComponentIDL:ProvidesDef.provides
(BaseIDL:InterfaceDef)>

<!ENTITY % ComponentIDL:ProvidesDefFeatures
'BaseIDL:ContainedFeatures;
   ComponentIDL:ProvidesDef.provides'>

<!ENTITY % ComponentIDL:ProvidesDefAtts
'BaseIDL:ContainedAtts;
   provides IDREFS #IMPLIED'>

<!ELEMENT ComponentIDL:ProvidesDef
(%ComponentIDL:ProvidesDefFeatures;)>

<!ATTLIST ComponentIDL:ProvidesDef %ComponentIDL:ProvidesDefAtts;>

<!--

!-->

<!ELEMENT ComponentIDL:HomeDef.component
(ComponentIDL:ComponentDef)>

<!ELEMENT ComponentIDL:HomeDef.primary_key
(BaseIDL:ValueDef)>

<!ELEMENT ComponentIDL:HomeDef.supports
(BaseIDL:InterfaceDef)>

<!ENTITY % ComponentIDL:HomeDefFeatures
'InterfaceDefFeatures;
   component IDREFS #IMPLIED
   primary_key IDREFS #IMPLIED
   supports IDREFS #IMPLIED'>

<!ENTITY % ComponentIDL:HomeDefAtts
'InterfaceDefAtts;
   component IDREFS #IMPLIED
   primary_key IDREFS #IMPLIED
   supports IDREFS #IMPLIED'>

<!ELEMENT ComponentIDL:HomeDef
(%ComponentIDL:HomeDefFeatures;)>

<!ATTLIST ComponentIDL:HomeDef %ComponentIDL:HomeDefAtts;>

<!--

-->
<!--
<!-- METAMODEL CLASS: ComponentIDL:FactoryDef
-->
<!--
<!--

> 

<!ENTITY % ComponentIDL:FactoryDefFeatures
'BaseIDL:OperationDefFeatures;'>

<!ENTITY % ComponentIDL:FactoryDefAtts
'BaseIDL:OperationDefAtts;'>

<!ELEMENT ComponentIDL:FactoryDef
( %ComponentIDL:FactoryDefFeatures;)*>

<!ATTLIST ComponentIDL:FactoryDef %ComponentIDL:FactoryDefAtts;>

<!--
-->

> 

<!--
<!-- METAMODEL CLASS: ComponentIDL:FinderDef
-->
<!--
<!--

> 

<!ENTITY % ComponentIDL:FinderDefFeatures
'BaseIDL:OperationDefFeatures;'>

<!ENTITY % ComponentIDL:FinderDefAtts 'BaseIDL:OperationDefAtts;'>

<!ELEMENT ComponentIDL:FinderDef
( %ComponentIDL:FinderDefFeatures; )>*

<!ATTLIST ComponentIDL:FinderDef %ComponentIDL:FinderDefAtts;>

<!--
-->

> 

<!--
<!-- METAMODEL CLASS: ComponentIDL:EventPortDef
-->
<!--
<!--

> 

<!ELEMENT ComponentIDL:EventPortDef.type (ComponentIDL:EventDef)*>

<!ENTITY % ComponentIDL:EventPortDefFeatures
'BaseIDL:ContainedFeatures; |
ComponentIDL:EventPortDef.type'>

<!ENTITY % ComponentIDL:EventPortDefAtts '%BaseIDL:ContainedAtts;
type IDREFS #IMPLIED'>

<!ELEMENT ComponentIDL:EventPortDef (%ComponentIDL:EventPortDefFeatures;)*>

<!ATTLIST ComponentIDL:EventPortDef %ComponentIDL:EventPortDefAtts;>

<!--
>  
<!--
<!-- METAMODEL CLASS: ComponentIDL:EmitsDef
-->
<!--
<!--
<!--

>  
<!ENTITY % ComponentIDL:EmitsDefFeatures '%ComponentIDL:EventPortDefFeatures;'>

<!ENTITY % ComponentIDL:EmitsDefAtts '%ComponentIDL:EventPortDefAtts;'>

<!ELEMENT ComponentIDL:EmitsDef (%ComponentIDL:EmitsDefFeatures;)*>

<!ATTLIST ComponentIDL:EmitsDef %ComponentIDL:EmitsDefAtts;>

<!--
>  
<!--
<!-- METAMODEL CLASS: ComponentIDL:ConsumesDef
-->
<!--
<!--
<!--

>  
<!ENTITY % ComponentIDL:ConsumesDefFeatures '%ComponentIDL:EventPortDefFeatures;'>

<!ENTITY % ComponentIDL:ConsumesDefAtts '%ComponentIDL:EventPortDefAtts;'>

<!ELEMENT ComponentIDL:ConsumesDef (%ComponentIDL:ConsumesDefFeatures;)*>

<!ATTLIST ComponentIDL:ConsumesDef %ComponentIDL:ConsumesDefAtts;>
<!--

>  

<!--

<!-- METAMODEL CLASS: ComponentIDL:UsesDef
-->

<!--

<!ELEMENT ComponentIDL:UsesDef.uses (BaseIDL:InterfaceDef)*>

<!ELEMENT ComponentIDL:UsesDef.multiple EMPTY>

<!ATTLIST ComponentIDL:UsesDef.multiple xmi.value (true|false) #REQUIRED>

<!ENTITY % ComponentIDL:UsesDefFeatures "%BaseIDL:ContainedFeatures; |
  ComponentIDL:UsesDef.uses |
  ComponentIDL:UsesDef.multiple'>

<!ENTITY % ComponentIDL:UsesDefAtts "%BaseIDL:ContainedAtts;
  uses IDREFS #IMPLIED
  multiple (true|false) #IMPLIED'>

<!ELEMENT ComponentIDL:UsesDef (%ComponentIDL:UsesDefFeatures;)*>

<!ATTLIST ComponentIDL:UsesDef %ComponentIDL:UsesDefAtts;>

<!--

>

<!--

<!-- METAMODEL CLASS: ComponentIDL:PublishesDef
-->

<!--

>  

<!ENTITY % ComponentIDL:PublishesDefFeatures "%ComponentIDL:EventPortDefFeatures;">

<!ENTITY % ComponentIDL:PublishesDefAtts "%ComponentIDL:EventPortDefAtts;">

<!ELEMENT ComponentIDL:PublishesDef (%ComponentIDL:PublishesDefFeatures;)*>

<!ATTLIST ComponentIDL:PublishesDef %ComponentIDL:PublishesDefAtts;>
<!--
-->
<!--
-->
<!-- METAMODEL CLASS: ComponentIDL:EventDef
-->
<!--
-->
<!--
->
<! ENTITY % ComponentIDL:EventDefFeatures '%BaseIDL:ValueDefFeatures;'>
<! ENTITY % ComponentIDL:EventDefAtts '%BaseIDL:ValueDefAtts;'>
<! ELEMENT ComponentIDL:EventDef (%ComponentIDL:EventDefFeatures;)*>
<! ATTLIST ComponentIDL:EventDef %ComponentIDL:EventDefAtts;>
8.3.2 IDL for the BaseIDL Package

```IDL
#pragma prefix "ccm.omg.org"
#include "Reflective.idl"

module BaseIDL {
    interface TypedClass;
    interface Typed;
    typedef sequence<Typed> TypedSet;
    interface ParameterDefClass;
    interface ParameterDef;
    typedef sequence<ParameterDef> ParameterDefSet;
    interface ContainedClass;
    interface Contained;
    typedef sequence<Contained> ContainedSet;
    interface ConstantDefClass;
    interface ConstantDef;
    typedef sequence<ConstantDef> ConstantDefSet;
    interface ContainerClass;
    interface Container;
    typedef sequence<Container> ContainerSet;
    interface ModuleDefClass;
    interface ModuleDef;
    typedef sequence<ModuleDef> ModuleDefSet;
    interface IDLTypeClass;
    interface IDLType;
    typedef sequence<IDLType> IDLTypeSet;
    interface TypedDefClass;
    interface TypedDef;
    typedef sequence<TypedDef> TypedDefSet;
    interface InterfaceDefClass;
    interface InterfaceDef;
    typedef sequence<InterfaceDef> InterfaceDefSet;
    interface FieldClass;
    interface Field;
    typedef sequence<Field> FieldSet;
    interface StructDefClass;
    interface StructDef;
    typedef sequence<StructDef> StructDefSet;
    interface UnionDefClass;
    interface UnionDef;
    typedef sequence<UnionDef> UnionDefSet;
    interface EnumDefClass;
    interface EnumDef;
    typedef sequence<EnumDef> EnumDefSet;
    interface AliasDefClass;
    interface AliasDef;
    typedef sequence<AliasDef> AliasDefSet;
    interface StringDefClass;
}
interface StringDef;
typedef sequence<StringDef> StringDefSet;
interface WstringDefClass;
interface WstringDef;
typedef sequence<WstringDef> WstringDefSet;
interface FixedDefClass;
interface FixedDef;
typedef sequence<FixedDef> FixedDefSet;
interface SequenceDefClass;
interface SequenceDef;
typedef sequence<SequenceDef> SequenceDefSet;
interface ArrayDefClass;
interface ArrayDef;
typedef sequence<ArrayDef> ArrayDefSet;
interface PrimitiveDefClass;
interface PrimitiveDef;
typedef sequence<PrimitiveDef> PrimitiveDefSet;
interface UnionFieldClass;
interface UnionField;
typedef sequence<UnionField> UnionFieldSet;
interface ValueMemberDefClass;
interface ValueMemberDef;
typedef sequence<ValueMemberDef> ValueMemberDefSet;
interface ValueDefClass;
interface ValueDef;
typedef sequence<ValueDef> ValueDefSet;
interface VBoxDefClass;
interface VBoxDef;
typedef sequence<VBoxDef> VBoxDefSet;
interface OperationDefClass;
interface OperationDef;
typedef sequence<OperationDef> OperationDefSet;
interface ExceptionDefClass;
interface ExceptionDef;
typedef sequence.ExceptionDef> ExceptionDefSet;
interface AttributeDefClass;
interface AttributeDef;
typedef sequence<AttributeDef> AttributeDefSet;
interface BaseIDLPackage;
enum PrimitiveKind {PK_NULL, PK_VOID, PK_SHORT, PK_LONG,
PK_USHORT, PK ULONG, PK_FLOAT, PK_DOUBLE, PK_BOOLEAN,
PK_CHAR, PK OCTET, PK_ANY, PKONGLONG, PK WSTRING,
PK TYPECODE, PK WCHAR, PK PRINCIPAL, PK STRING,
PK ULONG, PK OBREF, PKONGLONG};
enum ParameterMode {PARAM_IN, PARAM_OUT, PARAM_INOUT};
enum DefinitionKind {DK NONE, DK ALL, DK ATTRIBUTE,
DK CONSTANT, DK EXCEPTION, DK INTERFACE, DK MODULE,
DK OPERATION, DK_TYPEDEF, DK_ALIAS, DK_STRUCT, DK UNION,
DK FIXED, DK ENUM, DK PRIMITIVE, DK STRING, DK SEQUENCE,
DK WSTRING, DK_ARRAY, DK REPOSITORY};
interface TypedClass : Reflective::RefObject
{
    readonly attribute TypedSet all_of_type_typed;
};

interface Typed : TypedClass
{
    IDLType idl_type ()
        raises (Reflective::MofError);
    void set_idl_type (in IDLType new_value)
        raises (Reflective::MofError);
}; // end of interface Typed

interface ParameterDefClass : TypedClass
{
    readonly attribute ParameterDefSet all_of_type_parameter_def;
    readonly attribute ParameterDefSet all_of_class_parameter_def;
    ParameterDef create_parameter_def (in string identifier,
                                          in ParameterMode direction)
        raises (Reflective::MofError);
};

interface ParameterDef : ParameterDefClass, Typed
{
    string identifier ()
        raises (Reflective::MofError);
    void set_identifier (in string new_value)
        raises (Reflective::MofError);
    ParameterMode direction ()
        raises (Reflective::MofError);
    void set_direction (in ParameterMode new_value)
        raises (Reflective::MofError);
}; // end of interface ParameterDef

interface ContainedClass : Reflective::RefObject
{
    readonly attribute ContainedSet all_of_type_contained;
};

interface Contained : ContainedClass
{
    Container defined_in ()
        raises (Reflective::NotSet, Reflective::MofError);
    void set_defined_in (in Container new_value)
        raises (Reflective::MofError);
    void unset_defined_in ()
        raises (Reflective::MofError);
    string identifier ()
        raises (Reflective::MofError);
    void set_identifier (in string new_value)
interface ConstantDefClass : TypedClass, ContainedClass
{
    readonly attribute ConstantDefSet all_of_type_constant_def;
    readonly attribute ConstantDefSet all_of_class_constant_def;
    ConstantDef create_constant_def (in string identifier,
        in string repository_id,
        in string version,
        in any const_value)
        raises (Reflective::MofError);
};

interface ConstantDef : ConstantDefClass, Typed, Contained
{
    any const_value ()
        raises (Reflective::MofError);
    void set_const_value (in any new_value)
        raises (Reflective::MofError);
}; // end of interface ConstantDef

interface ContainerClass : ContainedClass
{
    readonly attribute ContainerSet all_of_type_container;
}

interface Container : ContainerClass, Contained
{
    ContainedSet contents ()
        raises (Reflective::MofError);
    void set_contents (in ContainedSet new_value)
        raises (Reflective::MofError);
    void unset_contents ()
        raises (Reflective::MofError);
    void add_contents (in Contained new_element)
        raises (Reflective::MofError);
    void modify_contents (in Contained old_element,
        in Contained new_element)
raises (Reflective::NotFoundException, Reflective::MofError);
void remove_contents (in Contained old_element)
  raises (Reflective::NotFoundException, Reflective::MofError);
Contained lookup_name(
  in string search_name,
  in long levels_to_search,
  in DefinitionKind limit_to_type,
  in boolean exclude_inherited)
  raises (Reflective::MofError);
Contained lookup(
  in string search_name)
  raises (Reflective::MofError);
Contained get_filtered_contents(
  in DefinitionKind limit_to_type,
  in boolean include_inherited)
  raises (Reflective::MofError);
}; // end of interface Container

interface ModuleDefClass : ContainerClass
{
  readonly attribute ModuleDefSet all_of_type_module_def;
  readonly attribute ModuleDefSet all_of_class_module_def;
  ModuleDef create_module_def(
    in string identifier,
    in string repository_id,
    in string version,
    in string prefix)
    raises (Reflective::MofError);
}

interface ModuleDef : ModuleDefClass, Container
{
  string prefix ()
    raises (Reflective::MofError);
  void set_prefix (in string new_value)
    raises (Reflective::MofError);
}; // end of interface ModuleDef

interface IDLTypeClass : Reflective::RefObject
{
  readonly attribute IDLTypeSet all_of_type_idltype;
};

interface IDLType : IDLTypeClass
{
  CORBA::TypeCode type_code ()
    raises (Reflective::MofError);
}; // end of interface IDLType

interface typedefClass : IDLTypeClass, ContainedClass
{
readonly attribute TypedefDefSet all_of_type_typedef_def;

interface TypedefDef : TypedefDefClass, IDLType, Contained
{
}; // end of interface TypedefDef

interface InterfaceDefClass : IDLTypeClass, ContainerClass
{
    readonly attribute InterfaceDefSet all_of_type_interface_def;
    readonly attribute InterfaceDefSet all_of_class_interface_def;
    InterfaceDef create_interface_def (in string identifier,
     in string repository_id,
     in string version,
     in boolean is_abstract,
     in boolean is_local)
     raises (Reflective::MofError);
};

interface InterfaceDef : InterfaceDefClass, IDLType, Container
{
    InterfaceDefSet base ()
     raises (Reflective::MofError);
    void set_base (in InterfaceDefSet new_value)
     raises (Reflective::MofError);
    void unset_base ()
     raises (Reflective::MofError);
    void add_base (in InterfaceDef new_element)
     raises (Reflective::MofError);
    void modify_base (in InterfaceDef old_element,
     in InterfaceDef new_element)
     raises (Reflective::NotFoundException, Reflective::MofError);
    void remove_base (in InterfaceDef old_element)
     raises (Reflective::NotFoundException, Reflective::MofError);
    boolean is_abstract ()
     raises (Reflective::MofError);
    void set_is_abstract (in boolean new_value)
     raises (Reflective::MofError);
    boolean is_local ()
     raises (Reflective::MofError);
    void set_is_local (in boolean new_value)
     raises (Reflective::MofError);
}; // end of interface InterfaceDef

interface FieldClass : TypedClass
{
    readonly attribute FieldSet all_of_type_field;
    readonly attribute FieldSet all_of_class_field;
    Field create_field (}
in string identifier)
    raises (Reflective::MofError);
};

interface Field : FieldClass, Typed
{
    string identifier ()
    raises (Reflective::MofError);
    void set_identifier (in string new_value)
    raises (Reflective::MofError);
}; // end of interface Field

interface StructDefClass : TypedefDefClass
{
    readonly attribute StructDefSet all_of_type_struct_def;
    readonly attribute StructDefSet all_of_class_struct_def;
    StructDef create_struct_def (in string identifier,
    in string repository_id,
    in string version,
    in Field members)
    raises (Reflective::MofError);
};

interface StructDef : StructDefClass, TypedefDef
{
    Field members ()
    raises (Reflective::MofError);
    void set_members (in Field new_value)
    raises (Reflective::MofError);
}; // end of interface StructDef

interface UnionDefClass : TypedefDefClass
{
    readonly attribute UnionDefSet all_of_type_union_def;
    readonly attribute UnionDefSet all_of_class_union_def;
    UnionDef create_union_def (in string identifier,
    in string repository_id,
    in string version,
    in UnionField union_members)
    raises (Reflective::MofError);
};

interface UnionDef : UnionDefClass, TypedefDef
{
    IDLType discriminator_type ()
    raises (Reflective::MofError);
    void set_discriminator_type (in IDLType new_value)
    raises (Reflective::MofError);
    UnionField union_members ()

raises (Reflective::MofError);
void set_union_members (in UnionField new_value)
raises (Reflective::MofError);
}; // end of interface UnionDef

interface EnumDefClass : TypedefDefClass
{
  readonly attribute EnumDefSet all_of_type_enum_def;
  readonly attribute EnumDefSet all_of_class_enum_def;
  EnumDef create_enum_def (
      in string identifier,
      in string repository_id,
      in string version,
      in string members)
  raises (Reflective::MofError);
};

interface EnumDef : EnumDefClass, TypedefDef
{
  string members ()
  raises (Reflective::MofError);
  void set_members (in string new_value)
  raises (Reflective::MofError);
}; // end of interface EnumDef

interface AliasDefClass : TypedefDefClass, TypedClass
{
  readonly attribute AliasDefSet all_of_type_alias_def;
  readonly attribute AliasDefSet all_of_class_alias_def;
  AliasDef create_alias_def (
      in string identifier,
      in string repository_id,
      in string version)
  raises (Reflective::MofError);
};

interface AliasDef : AliasDefClass, TypedefDef, Typed
{
}; // end of interface AliasDef

interface StringDefClass : IDLTypeClass
{
  readonly attribute StringDefSet all_of_type_string_def;
  readonly attribute StringDefSet all_of_class_string_def;
  StringDef create_string_def (
      in unsigned long bound)
  raises (Reflective::MofError);
};

interface StringDef : StringDefClass, IDLType
{
unsigned long bound ()
    raises (Reflective::MofError);
void set_bound (in unsigned long new_value)
    raises (Reflective::MofError);
}; // end of interface StringDef

interface WstringDefClass : IDLTypeClass
{
    readonly attribute WstringDefSet all_of_type_wstring_def;
    readonly attribute WstringDefSet all_of_class_wstring_def;
    WstringDef create_wstring_def (in unsigned long bound)
    raises (Reflective::MofError);
};

interface WstringDef : WstringDefClass, IDLType
{
    unsigned long bound ()
        raises (Reflective::MofError);
    void set_bound (in unsigned long new_value)
        raises (Reflective::MofError);
}; // end of interface WstringDef

interface FixedDefClass : IDLTypeClass
{
    readonly attribute FixedDefSet all_of_type_fixed_def;
    readonly attribute FixedDefSet all_of_class_fixed_def;
    FixedDef create_fixed_def (in unsigned short digits,
                              in short scale)
    raises (Reflective::MofError);
};

interface FixedDef : FixedDefClass, IDLType
{
    unsigned short digits ()
        raises (Reflective::MofError);
    void set_digits (in unsigned short new_value)
        raises (Reflective::MofError);
    short scale ()
        raises (Reflective::MofError);
    void set_scale (in short new_value)
        raises (Reflective::MofError);
}; // end of interface FixedDef

interface SequenceDefClass : TypedClass, IDLTypeClass
{
    readonly attribute SequenceDefSet all_of_type_sequence_def;
    readonly attribute SequenceDefSet all_of_class_sequence_def;
    SequenceDef create_sequence_def (in unsigned long bound)
raises (Reflective::MofError);

};

interface SequenceDef : SequenceDefClass, Typed, IDLType
{
    unsigned long bound ()
        raises (Reflective::MofError);
    void set_bound (in unsigned long new_value)
        raises (Reflective::MofError);
}; // end of interface SequenceDef

interface ArrayDefClass : TypedClass, IDLTypeClass
{
    readonly attribute ArrayDefSet all_of_type_array_def;
    readonly attribute ArrayDefSet all_of_class_array_def;
    ArrayDef create_array_def (in unsigned long bound)
        raises (Reflective::MofError);
};

interface ArrayDef : ArrayDefClass, Typed, IDLType
{
    unsigned long bound ()
        raises (Reflective::MofError);
    void set_bound (in unsigned long new_value)
        raises (Reflective::MofError);
}; // end of interface ArrayDef

interface PrimitiveDefClass : IDLTypeClass
{
    readonly attribute PrimitiveDefSet all_of_typePrimitive_def;
    readonly attribute PrimitiveDefSet all_of_classPrimitive_def;
    PrimitiveDef createPrimitive_def (in PrimitiveKind kind)
        raises (Reflective::MofError);
};

interface PrimitiveDef : PrimitiveDefClass, IDLType
{
    PrimitiveKind kind ()
        raises (Reflective::MofError);
    void set_kind (in PrimitiveKind new_value)
        raises (Reflective::MofError);
}; // end of interface PrimitiveDef

interface UnionFieldClass : TypedClass
{
    readonly attribute UnionFieldSet all_of_type_union_field;
    readonly attribute UnionFieldSet all_of_class_union_field;
    UnionField create_union_field (in string identifier,
in any label)
    raises (Reflective::MofError);
};

interface UnionField : UnionFieldClass, Typed
{
    string identifier ()
        raises (Reflective::MofError);
    void set_identifier (in string new_value)
        raises (Reflective::MofError);
    any label ()
        raises (Reflective::MofError);
    void set_label (in any new_value)
        raises (Reflective::MofError);
}; // end of interface UnionField

interface ValueMemberDefClass : TypedClass, ContainedClass
{
    readonly attribute ValueMemberDefSet all_of_type_value_member_def;
    readonly attribute ValueMemberDefSet all_of_class_value_member_def;
    ValueMemberDef create_value_member_def (in string identifier,
                                            in string repository_id,
                                            in string version,
                                            in boolean is_public_member)
        raises (Reflective::MofError);
};

interface ValueMemberDef : ValueMemberDefClass, Typed, Contained
{
    boolean is_public_member ()
        raises (Reflective::MofError);
    void set_is_public_member (in boolean new_value)
        raises (Reflective::MofError);
}; // end of interface ValueMemberDef

interface ValueDefClass : ContainerClass, IDLTypeClass
{
    readonly attribute ValueDefSet all_of_type_value_def;
    readonly attribute ValueDefSet all_of_class_value_def;
    ValueDef create_value_def (in string identifier,
                                in string repository_id,
                                in string version,
                                in boolean is_abstract,
                                in boolean is_custom,
                                in boolean is_truncatable)
        raises (Reflective::MofError);
};

interface ValueDef : ValueDefClass, Container, IDLType
{ InterfaceDef interface_def ()
    raises (Reflective::NotSet, Reflective::MofError);
void set_interface_def (in InterfaceDef new_value)
    raises (Reflective::MofError);
void unset_interface_def ()
    raises (Reflective::MofError);
ValueDef base ()
    raises (Reflective::NotSet, Reflective::MofError);
void set_base (in ValueDef new_value)
    raises (Reflective::MofError);
void unset_base ()
    raises (Reflective::MofError);
ValueDefSet abstract_base ()
    raises (Reflective::MofError);
void set_abstract_base (in ValueDefSet new_value)
    raises (Reflective::MofError);
void unset_abstract_base ()
    raises (Reflective::MofError);
void add_abstract_base (in ValueDef new_element)
    raises (Reflective::MofError);
void modify_abstract_base (in ValueDef old_element,
    in ValueDef new_element)
    raises (Reflective::NotFound, Reflective::MofError);
void remove_abstract_base (in ValueDef old_element)
    raises (Reflective::NotFound, Reflective::MofError);
boolean is_abstract ()
    raises (Reflective::MofError);
void set_is_abstract (in boolean new_value)
    raises (Reflective::MofError);
boolean is_custom ()
    raises (Reflective::MofError);
void set_is_custom (in boolean new_value)
    raises (Reflective::MofError);
boolean is_truncatable ()
    raises (Reflective::MofError);
void set_is_truncatable (in boolean new_value)
    raises (Reflective::MofError);
}; // end of interface ValueDef

interface ValueBoxDefClass : TypedefDefClass
{ readonly attribute ValueBoxDefSet all_of_type_value_box_def;
readonly attribute ValueBoxDefSet all_of_class_value_box_def;
ValueBoxDef create_value_box_def (in string identifier,
    in string repository_id,
    in string version)
    raises (Reflective::MofError);
};
interface ValueBoxDef : ValueBoxDefClass, TypedefDef
{
}; // end of interface ValueBoxDef

interface OperationDefClass : TypedClass, ContainedClass
{
    readonly attribute OperationDefSet all_of_type_operation_def;
    readonly attribute OperationDefSet all_of_class_operation_def;
    OperationDef create_operation_def (in string identifier,
                                        in string repository_id,
                                        in string version,
                                        in boolean is_oneway,
                                        in ParameterDef parameters,
                                        in string contexts)
        raises (Reflective::MofError);
}

interface OperationDef : OperationDefClass, Typed, Contained
{
    ExceptionDefSet exception_def ()
        raises (Reflective::MofError);
    void set_exception_def (in ExceptionDefSet new_value)
        raises (Reflective::MofError);
    void unset_exception_def ()
        raises (Reflective::MofError);
    void add_exception_def (in ExceptionDef new_element)
        raises (Reflective::MofError);
    void modify_exception_def (in ExceptionDef old_element,
                               in ExceptionDef new_element)
        raises (Reflective::NotFoundException, Reflective::MofError);
    void remove_exception_def (in ExceptionDef old_element)
        raises (Reflective::NotFoundException, Reflective::MofError);
    boolean is_oneway ()
        raises (Reflective::MofError);
    void set_is_oneway (in boolean new_value)
        raises (Reflective::MofError);
    ParameterDef parameters ()
        raises (Reflective::MofError);
    void set_parameters (in ParameterDef new_value)
        raises (Reflective::MofError);
    string contexts ()
        raises (Reflective::MofError);
    void set_contexts (in string new_value)
        raises (Reflective::MofError);
}; // end of interface OperationDef

interface ExceptionDefClass : ContainedClass
{
readonly attribute ExceptionDefSet all_of_type_exception_def;
readonly attribute ExceptionDefSet all_of_class_exception_def;
ExceptionDef create_exception_def (
  in string identifier,
  in string repository_id,
  in string version,
  in CORBA::TypeCode type_code,
  in Field members)
  raises (Reflective::MofError);
};

interface ExceptionDef : ExceptionDefClass, Contained {
  CORBA::TypeCode type_code ()
    raises (Reflective::MofError);
  Field members ()
    raises (Reflective::MofError);
  void set_members (in Field new_value)
    raises (Reflective::MofError);
}; // end of interface ExceptionDef

interface AttributeDefClass : TypedClass, ContainedClass {
  readonly attribute AttributeDefSet all_of_type_attribute_def;
  readonly attribute AttributeDefSet all_of_class_attribute_def;
  AttributeDef create_attribute_def (
    in string identifier,
    in string repository_id,
    in string version,
    in boolean is_readonly)
  raises (Reflective::MofError);
};

interface AttributeDef : AttributeDefClass, Typed, Contained {
  ExceptionDefSet set_exception ()
    raises (Reflective::MofError);
  void set_set_exception (in ExceptionDefSet new_value)
    raises (Reflective::MofError);
  void unset_set_exception ()
    raises (Reflective::MofError);
  void add_set_exception (in ExceptionDef new_element)
    raises (Reflective::MofError);
  void modify_set_exception (in ExceptionDef old_element,
    in ExceptionDef new_element)
    raises (Reflective::NotFound, Reflective::MofError);
  void remove_set_exception (in ExceptionDef old_element)
    raises (Reflective::NotFound, Reflective::MofError);
  ExceptionDefSet get_exception ()
    raises (Reflective::MofError);
void set_get_exception (in ExceptionDefSet new_value)
  raises (Reflective::MofError);
void unset_get_exception ()
  raises (Reflective::MofError);
void add_get_exception (in ExceptionDef new_element)
  raises (Reflective::MofError);
void modify_get_exception (in ExceptionDef old_element,
  in ExceptionDef new_element)
  raises (Reflective::NotFound, Reflective::MofError);
void remove_get_exception (in ExceptionDef old_element)
  raises (Reflective::NotFound, Reflective::MofError);
boolean is_readonly ()
  raises (Reflective::MofError);
void set_is_readonly (in boolean new_value)
  raises (Reflective::MofError);
};  // end of interface AttributeDef

struct InterfaceDerivedFromLink
{
  InterfaceDef base;
  InterfaceDef derived;
};
typedef sequence<InterfaceDerivedFromLink> InterfaceDerivedFromLink-Set;

interface InterfaceDerivedFrom : Reflective::RefAssociation
{
  InterfaceDerivedFromLinkSet all_interface Derived_from_links()
    raises (Reflective::MofError);
  boolean exists (in InterfaceDef base,
    in InterfaceDef derived)
    raises (Reflective::MofError);
  InterfaceDefSet base (in InterfaceDef derived)
    raises (Reflective::MofError);
  void add (in InterfaceDef base,
    in InterfaceDef derived)
    raises (Reflective::MofError);
  void modify_base (in InterfaceDef base,
    in InterfaceDef derived,
    in InterfaceDef new_base)
    raises (Reflective::NotFound, Reflective::MofError);
  void remove (in InterfaceDef base,
    in InterfaceDef derived)
    raises (Reflective::NotFound, Reflective::MofError);
};  // end of interface InterfaceDerivedFrom
struct DiscriminatedByLink
{
    IDLType discriminator_type;
    UnionDef union_def;
};
typedef sequence<DiscriminatedByLink> DiscriminatedByLinkSet;

interface DiscriminatedBy : Reflective::RefAssociation
{
    DiscriminatedByLinkSet all_discriminated_by_links()
        raises (Reflective::MofError);
    boolean exists (in IDLType discriminator_type,
                    in UnionDef union_def)
        raises (Reflective::MofError);
    IDLType discriminator_type (in UnionDef union_def)
        raises (Reflective::MofError);
    void add (in IDLType discriminator_type,
              in UnionDef union_def)
        raises (Reflective::MofError);
    void modify_discriminator_type (in IDLType discriminator_type,
                                     in UnionDef union_def,
                                     in IDLType new_discriminator_type)
        raises (Reflective::NotFound, Reflective::MofError);
    void remove (in IDLType discriminator_type,
                 in UnionDef union_def)
        raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface DiscriminatedBy

struct TypedByLink
{
    IDLType idl_type;
    BaseIDL::Typed typed;
};
typedef sequence<TypedByLink> TypedByLinkSet;

interface TypedBy : Reflective::RefAssociation
{
    TypedByLinkSet all_typed_by_links()
        raises (Reflective::MofError);
    boolean exists (in IDLType idl_type,
                    in BaseIDL::Typed typed)
        raises (Reflective::MofError);
    IDLType idl_type (in BaseIDL::Typed typed)
        raises (Reflective::MofError);
    void add (in IDLType idl_type,
in BaseIDL::Typed typed)
raises (Reflective::MofError);
void modify_idl_type (  
in IDLType idl_type,  
in BaseIDL::Typed typed,  
in IDLType new_idl_type)
raises (Reflective::NotFound, Reflective::MofError);
void remove (  
in IDLType idl_type,  
in BaseIDL::Typed typed)
raises (Reflective::NotFound, Reflective::MofError);
} // end of interface TypedBy

struct SupportsLink
{
   InterfaceDef interface_def;
   ValueDef value_def;
};
typedef sequence<SupportsLink> SupportsLinkSet;

interface Supports : Reflective::RefAssociation
{
   SupportsLinkSet all_supports_links()  
   raises (Reflective::MofError);
   boolean exists (  
in InterfaceDef interface_def,  
in ValueDef value_def)  
   raises (Reflective::MofError);
   InterfaceDef interface_def (in ValueDef value_def)  
   raises (Reflective::MofError);
   void add (  
in InterfaceDef interface_def,  
in ValueDef value_def)  
   raises (Reflective::MofError);
   void modify_interface_def (  
in InterfaceDef interface_def,  
in ValueDef value_def,  
in InterfaceDef new_interface_def)  
   raises (Reflective::NotFound, Reflective::MofError);
   void remove (  
in InterfaceDef interface_def,  
in ValueDef value_def)  
   raises (Reflective::NotFound, Reflective::MofError);
} // end of interface Supports

struct ValueDerivedFromLink
{
   ValueDef base;
   ValueDef derived;
};
typedef sequence<ValueDerivedFromLink> ValueDerivedFromLinkSet;
interface ValueDerivedFrom : Reflective::RefAssociation
{
    ValueDerivedFromLinkSet all_value_derived_from_links()
    raises (Reflective::MofError);
    boolean exists (in ValueDef base,
    in ValueDef derived)
    raises (Reflective::MofError);
    ValueDef base (in ValueDef derived)
    raises (Reflective::MofError);
    void add (in ValueDef base,
    in ValueDef derived)
    raises (Reflective::MofError);
    void modify_base (in ValueDef base,
    in ValueDef derived,
    in ValueDef new_base)
    raises (Reflective::NotFound, Reflective::MofError);
    void remove (in ValueDef base,
    in ValueDef derived)
    raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface ValueDerivedFrom

struct AbstractDerivedFromLink
{
    ValueDef abstract Derived;
    ValueDef abstract Base;
};
typedef sequence<AbstractDerivedFromLink> AbstractDerivedFromLinkSet;

interface AbstractDerivedFrom : Reflective::RefAssociation
{
    AbstractDerivedFromLinkSet all_abstract Derived_from_links()
    raises (Reflective::MofError);
    boolean exists (in ValueDef abstract Derived,
    in ValueDef abstract Base)
    raises (Reflective::MofError);
    ValueDefSet abstract Base (in ValueDef abstract Derived)
    raises (Reflective::MofError);
    void add (in ValueDef abstract Derived,
    in ValueDef abstract Base)
    raises (Reflective::MofError);
    void modify_abstract Base (in ValueDef abstract Derived,
    in ValueDef abstract Base,
in ValueDef new_abstract_base)
  raises (Reflective::NotFound, Reflective::MofError);
void remove (  
in ValueDef abstract-derived,
  in ValueDef abstract_base)
  raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface AbstractDerivedFrom

struct SetRaisesLink  
{
  ExceptionDef set_exception;
  AttributeDef set_attribute;
};
typedef sequence<Set RaisesLink> SetRaisesLinkSet;

interface SetRaise : Reflective::RefAssociation  
{
  SetRaisesLinkSet all_set_raises_links()
  raises (Reflective::MofError);
  boolean exists (   
in ExceptionDef set_exception,
   in AttributeDef set_attribute)
  raises (Reflective::MofError);
  ExceptionDefSet set_exception (in AttributeDef set_attribute)
  raises (Reflective::MofError);
  void add (    
in ExceptionDef set_exception,
  in AttributeDef set_attribute)
  raises (Reflective::MofError);
  void modify_set_exception (    
in ExceptionDef set_exception,
  in AttributeDef set_attribute,
  in ExceptionDef new_set_exception)
  raises (Reflective::NotFound, Reflective::MofError);
  void remove (   
in ExceptionDef set_exception,
  in AttributeDef set_attribute)
  raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface SetRaise

struct CanRaiseLink  
{  
  ExceptionDef exception_def;
  OperationDef operation_def;
};
typedef sequence<CanRaiseLink> CanRaiseLinkSet;

interface CanRaise : Reflective::RefAssociation  
{
  CanRaiseLinkSet all_can_raise_links()
  raises (Reflective::MofError);
boolean exists (  
    in ExceptionDef exception_def,  
    in OperationDef operation_def)  
  raises (Reflective::MofError);  
ExceptionDefSet exception_def (in OperationDef operation_def)  
  raises (Reflective::MofError);  
void add (  
    in ExceptionDef exception_def,  
    in OperationDef operation_def)  
  raises (Reflective::MofError);  
void modify_exception_def (  
    in ExceptionDef exception_def,  
    in OperationDef operation_def,  
    in ExceptionDef new_exception_def)  
  raises (Reflective::NotFound, Reflective::MofError);  
void remove (  
    in ExceptionDef exception_def,  
    in OperationDef operation_def)  
  raises (Reflective::NotFound, Reflective::MofError);  
}; // end of interface CanRaise

struct GetRaisesLink
{
    ExceptionDef get_exception;
    AttributeDef get_attribute;
};
typedef sequence<Get RaisesLink> Get RaisesLink Set;

interface Get Raises : Reflective::RefAssociation 
{
    Get RaisesLink Set all_get_raises_links()  
      raises (Reflective::MofError);  
boolean exists (  
    in ExceptionDef get_exception,  
    in AttributeDef get_attribute)  
  raises (Reflective::MofError);  
ExceptionDefSet get_exception (in AttributeDef get_attribute)  
  raises (Reflective::MofError);  
void add (  
    in ExceptionDef get_exception,  
    in AttributeDef get_attribute)  
  raises (Reflective::MofError);  
void modify_get_exception (  
    in ExceptionDef get_exception,  
    in AttributeDef get_attribute,  
    in ExceptionDef new_get_exception)  
  raises (Reflective::NotFound, Reflective::MofError);  
void remove (  
    in ExceptionDef get_exception,  
    in AttributeDef get_attribute)  
  raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface GetRaises

struct ContainsLink
{
    Container defined_in;
    Contained contents;
};
typedef sequence<ContainsLink> ContainsLinkSet;

interface Contains : Reflective::RefAssociation
{
    ContainsLinkSet all_contains_links()
        raises (Reflective::MofError);
    boolean exists (in Container defined_in,
                    in Contained contents)
        raises (Reflective::MofError);
    Container defined_in (in Contained contents)
        raises (Reflective::MofError);
    ContainedSet contents (in Container defined_in)
        raises (Reflective::MofError);
    void add (in Container defined_in,
              in Contained contents)
        raises (Reflective::MofError);
    void modify_defined_in (in Container defined_in,
                             in Contained contents,
                             in Container new_defined_in)
        raises (Reflective::NotFound, Reflective::MofError);
    void modify_contents (in Container defined_in,
                          in Contained contents,
                          in Contained new_contents)
        raises (Reflective::NotFound, Reflective::MofError);
    void remove (in Container defined_in,
                 in Contained contents)
        raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface Contains

interface BaselIDLPackageFactory
{
    BaselIDLPackage create_base_idl_package ()
        raises (Reflective::MofError);
};

interface BaselIDLPackage : Reflective::RefPackage
{
    readonly attribute TypedClass typed_ref;
    readonly attribute ParameterDefClass parameter_def_ref;
8.3.3 IDL for the ComponentIDL Package

```idl
#pragma prefix "ccm.omg.org"
#include "BaseIDL.idl"

module ComponentIDL
{
    interface ComponentFeatureClass;
    interface ComponentFeature;
    typedef sequence<ComponentFeature> ComponentFeatureSet;
    interface ComponentDefClass;

```
interface ComponentDef;
typedef sequence<ComponentDef> ComponentDefSet;
interface ProvidesDefClass;
interface ProvidesDef;
typedef sequence<ProvidesDef> ProvidesDefSet;
interface HomeDefClass;
interface HomeDef;
typedef sequence<HomeDef> HomeDefSet;
interface FactoryDefClass;
interface FactoryDef;
typedef sequence<FactoryDef> FactoryDefSet;
interface FinderDefClass;
interface FinderDef;
typedef sequence<FinderDef> FinderDefSet;
interface EventPortDefClass;
interface EventPortDef;
typedef sequence<EventPortDef> EventPortDefSet;
interface EmitsDefClass;
interface EmitsDef;
typedef sequence<EmitsDef> EmitsDefSet;
interface ConsumesDefClass;
interface ConsumesDef;
typedef sequence<ConsumesDef> ConsumesDefSet;
interface UsesDefClass;
interface UsesDef;
typedef sequence<UsesDef> UsesDefSet;
interface PublishesDefClass;
interface PublishesDef;
typedef sequence<PublishesDef> PublishesDefSet;
interface EventDefClass;
interface EventDef;
typedef sequence<EventDef> EventDefSet;
interface ComponentIDLPackage;

interface ComponentFeatureClass : Reflective::RefObject
{
    readonly attribute ComponentFeatureSet all_of_type_component_feature;
};

interface ComponentFeature : ComponentFeatureClass
{
}; // end of interface ComponentFeature

interface ComponentDefClass : BaseIDL::InterfaceDefClass, ComponentFeatureClass
{
    readonly attribute ComponentDefSet all_of_type_component_def;
    readonly attribute ComponentDefSet all_of_class_component_def;
    ComponentDef create_component_def (in string identifier,
in string repository_id,
in string version,
in boolean is_abstract,
in boolean is_local)
  raises (Reflective::MofError);
};

interface ComponentDef : ComponentDefClass, BaseIDL::InterfaceDef,
ComponentFeature
{
  ProvidesDefSet facet ()
  raises (Reflective::MofError);
  void set_facet (in ProvidesDefSet new_value)
  raises (Reflective::MofError);
  void unset_facet ()
  raises (Reflective::MofError);
  void add_facet (in ProvidesDef new_element)
  raises (Reflective::MofError);
  void modify_facet (  
in ProvidesDef old_element,
in ProvidesDef new_element)
  raises (Reflective::NotFound, Reflective::MofError);
  void remove_facet (in ProvidesDef old_element)
  raises (Reflective::NotFound, Reflective::MofError);
  EmitsDefSet emits ()
  raises (Reflective::MofError);
  void set_emits (in EmitsDefSet new_value)
  raises (Reflective::MofError);
  void unset_emits ()
  raises (Reflective::MofError);
  void add_emits (in EmitsDef new_element)
  raises (Reflective::MofError);
  void modify_emits (  
in EmitsDef old_element,
in EmitsDef new_element)
  raises (Reflective::NotFound, Reflective::MofError);
  void remove_emits (in EmitsDef old_element)
  raises (Reflective::NotFound, Reflective::MofError);
  ConsumesDefSet consumes ()
  raises (Reflective::MofError);
  void set_consumes (in ConsumesDefSet new_value)
  raises (Reflective::MofError);
  void unset_consumes ()
  raises (Reflective::MofError);
  void add_consumes (in ConsumesDef new_element)
  raises (Reflective::MofError);
  void modify_consumes (  
in ConsumesDef old_element,
in ConsumesDef new_element)
  raises (Reflective::NotFound, Reflective::MofError);
  void remove_consumes (in ConsumesDef old_element)
raises (Reflective::NotFound, Reflective::MofError);
UsesDefSet receptacle ()
raises (Reflective::MofError);
void set_receptacle (in UsesDefSet new_value)
raises (Reflective::MofError);
void unset_receptacle ()
raises (Reflective::MofError);
void add_receptacle (in UsesDef new_element)
raises (Reflective::MofError);
void modify_receptacle (  
in UsesDef old_element,
in UsesDef new_element)
raises (Reflective::NotFound, Reflective::MofError);
void remove_receptacle (in UsesDef old_element)
raises (Reflective::NotFound, Reflective::MofError);
BaseIDL::InterfaceDefSet supports ()
raises (Reflective::MofError);
void set_supports (in BaseIDL::InterfaceDefSet new_value)
raises (Reflective::MofError);
void unset_supports ()
raises (Reflective::MofError);
void add_supports (in BaseIDL::InterfaceDef new_element)
raises (Reflective::MofError);
void modify_supports (  
in BaseIDL::InterfaceDef old_element,
in BaseIDL::InterfaceDef new_element)
raises (Reflective::NotFound, Reflective::MofError);
void remove_supports (in BaseIDL::InterfaceDef old_element)
raises (Reflective::NotFound, Reflective::MofError);
PublishesDefSet publishes ()
raises (Reflective::MofError);
void set-publishes (in PublishesDefSet new_value)
raises (Reflective::MofError);
void unset_publishes ()
raises (Reflective::MofError);
void add_publishes (in PublishesDef new_element)
raises (Reflective::MofError);
void modify_publishes (  
in PublishesDef old_element,
in PublishesDef new_element)
raises (Reflective::NotFound, Reflective::MofError);
void remove_publishes (in PublishesDef old_element)
raises (Reflective::NotFound, Reflective::MofError);
}); // end of interface ComponentDef

interface ProvidesDefClass : BaseIDL::ContainedClass, ComponentFeatureClass
{
  readonly attribute ProvidesDefSet all_of_type_provides_def;
  readonly attribute ProvidesDefSet all_of_class_provides_def;
  ProvidesDef create_provides_def (  

in string identifier,
in string repository_id,
in string version)
  raises (Reflective::MofError);
};

interface ProvidesDef : ProvidesDefClass, BasILD::Contained, ComponentFeature
{
  BasILD::InterfaceDef provides ()
  raises (Reflective::MofError);
  void set_provides (in BasILD::InterfaceDef new_value)
  raises (Reflective::MofError);
  ComponentDef component ()
  raises (Reflective::MofError);
  void set_component (in ComponentDef new_value)
  raises (Reflective::MofError);
};  // end of interface ProvidesDef

interface HomeDefClass : BasILD::InterfaceDefClass
{
  readonly attribute HomeDefSet all_of_type_home_def;
  readonly attribute HomeDefSet all_of_class_home_def;
  HomeDef create_home_def (in string identifier,
in string repository_id,
in string version,
in boolean is_abstract,
in boolean is_local)
  raises (Reflective::MofError);
};

interface HomeDef : HomeDefClass, BasILD::InterfaceDef
{
  FinderDefSet finder ()
  raises (Reflective::MofError);
  void set_finder (in FinderDefSet new_value)
  raises (Reflective::MofError);
  void unset_finder ()
  raises (Reflective::MofError);
  void add_finder (in FinderDef new_element)
  raises (Reflective::MofError);
  void modify_finder (in FinderDef old_element,
in FinderDef new_element)
  raises (Reflective::NotFound, Reflective::MofError);
  void remove_finder (in FinderDef old_element)
  raises (Reflective::NotFound, Reflective::MofError);
  ComponentDef component ()
  raises (Reflective::MofError);
  void set_component (in ComponentDef new_value)
raises (Reflective::MofError);
FactoryDefSet factory ();
raises (Reflective::MofError);
void set_factory (in FactoryDefSet new_value)
raises (Reflective::MofError);
void unset_factory ()
raises (Reflective::MofError);
void add_factory (in FactoryDef new_element)
raises (Reflective::MofError);
void modify_factory (
  in FactoryDef old_element,
  in FactoryDef new_element)
raises (Reflective::NotFound, Reflective::MofError);
void remove_factory (in FactoryDef old_element)
raises (Reflective::NotFound, Reflective::MofError);
BaseIDL::ValueDef primary_key ()
raises (Reflective::NotSet, Reflective::MofError);
void set_primary_key (in BaseIDL::ValueDef new_value)
raises (Reflective::MofError);
void unset_primary_key ()
raises (Reflective::MofError);
BaseIDL::InterfaceDefSet supports ()
raises (Reflective::MofError);
void set_supports (in BaseIDL::InterfaceDefSet new_value)
raises (Reflective::MofError);
void unset_supports ()
raises (Reflective::MofError);
void add_supports (in BaseIDL::InterfaceDef new_element)
raises (Reflective::MofError);
void modify_supports (
  in BaseIDL::InterfaceDef old_element,
  in BaseIDL::InterfaceDef new_element)
raises (Reflective::NotFound, Reflective::MofError);
void remove_supports (in BaseIDL::InterfaceDef old_element)
raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface HomeDef

interface FactoryDefClass : BaseIDL::OperationDefClass
{
  readonly attribute FactoryDefSet all_of_type_factory_def;
  readonly attribute FactoryDefSet all_of_class_factory_def;
FactoryDef create_factory_def (
  in string identifier,
  in string repository_id,
  in string version,
  in boolean is_oneway,
  in BaseIDL::ParameterDef parameters,
  in string contexts)
raises (Reflective::MofError);
};
interface FactoryDef : FactoryDefClass, BaseIDL::OperationDef
{
    HomeDef home ()
    raises (Reflective::MofError);
    void set_home (in HomeDef new_value)
    raises (Reflective::MofError);
}; // end of interface FactoryDef

interface FinderDefClass : BaseIDL::OperationDefClass
{
    readonly attribute FinderDefSet all_of_type_finder_def;
    readonly attribute FinderDefSet all_of_class_finder_def;
    FinderDef create_finder_def (in string identifier,
    in string repository_id, 
    in string version,
    in boolean is_oneway, 
    in BaseIDL::ParameterDef parameters,  
    in string contexts)
    raises (Reflective::MofError);
};

interface FinderDef : FinderDefClass, BaseIDL::OperationDef
{
    HomeDef home ()
    raises (Reflective::MofError);
    void set_home (in HomeDef new_value)
    raises (Reflective::MofError);
}; // end of interface FinderDef

interface EventPortDefClass : BaseIDL::ContainedClass, ComponentFeatureClass
{
    readonly attribute EventPortDefSet all_of_type_event_port_def;
};

interface EventPortDef : EventPortDefClass, BaseIDL::Contained, ComponentFeature
{
    EventDef type ()
    raises (Reflective::MofError);
    void set_type (in EventDef new_value)
    raises (Reflective::MofError);
}; // end of interface EventPortDef

interface EmitsDefClass : EventPortDefClass, ComponentFeatureClass
{
    readonly attribute EmitsDefSet all_of_type_emits_def;
    readonly attribute EmitsDefSet all_of_class_emits_def;
    EmitsDef create_emits_def (in string identifier,
interface EmitsDef : EmitsDefClass, EventPortDef, ComponentFeature
{
    ComponentDef component()
    raises (Reflective::MofError);
    void set_component (in ComponentDef new_value)
    raises (Reflective::MofError);
} // end of interface EmitsDef

interface ConsumesDefClass : EventPortDefClass, ComponentFeature-Class
{
    readonly attribute ConsumesDefSet all_of_type_consumes_def;
    readonly attribute ConsumesDefSet all_of_class_consumes_def;
    ConsumesDef create_consumes_def(
        in string identifier,
        in string repository_id,
        in string version)
    raises (Reflective::MofError);
};

interface ConsumesDef : ConsumesDefClass, EventPortDef, ComponentFeature
{
    ComponentDef component()
    raises (Reflective::MofError);
    void set_component (in ComponentDef new_value)
    raises (Reflective::MofError);
} // end of interface ConsumesDef

interface UsesDefClass : BaseIDL::ContainedClass, ComponentFeature-Class
{
    readonly attribute UsesDefSet all_of_type_uses_def;
    readonly attribute UsesDefSet all_of_class_uses_def;
    UsesDef create_uses_def(
        in string identifier,
        in string repository_id,
        in string version,
        in boolean multiple)
    raises (Reflective::MofError);
};

interface UsesDef : UsesDefClass, BaseIDL::Contained, ComponentFeature
{
    ComponentDef component()
raises (Reflective::MofError);
void set_component (in ComponentDef new_value)
raises (Reflective::MofError);
BaseIDL::InterfaceDef uses ()
raises (Reflective::MofError);
void set_uses (in BaseIDL::InterfaceDef new_value)
raises (Reflective::MofError);
boolean multiple ()
raises (Reflective::MofError);
void set_multiple (in boolean new_value)
raises (Reflective::MofError);
}; // end of interface UsesDef

interface PublishesDefClass : EventPortDefClass, ComponentFeature-Class
{
  readonly attribute PublishesDefSet all_of_type_publishes_def;
  readonly attribute PublishesDefSet all_of_class_publishes_def;
  PublishesDef create_publishes_def (in string identifier,
    in string repository_id,
    in string version)
  raises (Reflective::MofError);
};

interface PublishesDef : PublishesDefClass, EventPortDef, Component-Feature
{
  ComponentDef component ()
  raises (Reflective::MofError);
  void set_component (in ComponentDef new_value)
  raises (Reflective::MofError);
}; // end of interface PublishesDef

interface EventDefClass : BaseIDL::ValueDefClass
{
  readonly attribute EventDefSet all_of_type_event_def;
  readonly attribute EventDefSet all_of_class_event_def;
  EventDef create_event_def (in string identifier,
    in string repository_id,
    in string version,
    in boolean is_abstract,
    in boolean is_custom,
    in boolean is_truncatable)
  raises (Reflective::MofError);
};

interface EventDef : EventDefClass, BaseIDL::ValueDef
{
}; // end of interface EventDef
struct ProvidesInterfaceLink {
    BaseIDL::InterfaceDef provides;
    ProvidesDef provides_def;
};
typedef sequence<ProvidesInterfaceLink> ProvidesInterfaceLinkSet;

interface ProvidesInterface : Reflective::RefAssociation {
    ProvidesInterfaceLinkSet all_provides_interface_links()
        raises (Reflective::MofError);
    boolean exists (    
        in BaseIDL::InterfaceDef provides,
        in ProvidesDef provides_def)
        raises (Reflective::MofError);
    BaseIDL::InterfaceDef provides (in ProvidesDef provides_def)
        raises (Reflective::MofError);
    void add (    
        in BaseIDL::InterfaceDef provides,
        in ProvidesDef provides_def)
        raises (Reflective::MofError);
    void modify_provides (    
        in BaseIDL::InterfaceDef provides,
        in ProvidesDef provides_def,
        in BaseIDL::InterfaceDef new_provides)
        raises (Reflective::NotFound, Reflective::MofError);
    void remove (    
        in BaseIDL::InterfaceDef provides,
        in ProvidesDef provides_def)
        raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface ProvidesInterface

struct ComponentFacetLink {
    ComponentDef component;
    ProvidesDef facet;
};
typedef sequence<ComponentFacetLink> ComponentFacetLinkSet;

interface ComponentFacet : Reflective::RefAssociation {
    ComponentFacetLinkSet all_component_facet_links()
        raises (Reflective::MofError);
    boolean exists (    
        in ComponentDef component,
        in ProvidesDef facet)
        raises (Reflective::MofError);
    ComponentDef component (in ProvidesDef facet)
        raises (Reflective::MofError);
    ProvidesDefSet facet (in ComponentDef component)
raises (Reflective::MofError);
void add (  
in ComponentDef component,
in ProvidesDef facet)
raises (Reflective::MofError);
void modify_component (  
in ComponentDef component,
in ProvidesDef facet,
in ComponentDef new_component)
raises (Reflective::NotFoundException, Reflective::MofError);
void modify_facet (  
in ComponentDef component,
in ProvidesDef facet,
in ProvidesDef new_facet)
raises (Reflective::NotFoundException, Reflective::MofError);
void remove (  
in ComponentDef component,
in ProvidesDef facet)
raises (Reflective::NotFoundException, Reflective::MofError);
}; // end of interface ComponentFacet

struct HomeFinderLink  
{
    HomeDef home;
    FinderDef finder;
};
typedef sequence<HomeFinderLink> HomeFinderLinkSet;

interface HomeFinder : Reflective::RefAssociation  
{
    HomeFinderLinkSet all_home_finder_links()  
        raises (Reflective::MofError);
    boolean exists (  
in HomeDef home,
in FinderDef finder)
        raises (Reflective::MofError);
    HomeDef home (in FinderDef finder)
        raises (Reflective::MofError);
    FinderDefSet finder (in HomeDef home)
        raises (Reflective::MofError);
    void add (  
in HomeDef home,
in FinderDef finder)
        raises (Reflective::MofError);
    void modify_home ()  
in HomeDef home,
in FinderDef finder,
in HomeDef new_home)
        raises (Reflective::NotFoundException, Reflective::MofError);
    void modify_finder (  
in HomeDef home,
in FinderDef finder,
in FinderDef new_finder)
raises (Reflective::NotFound, Reflective::MofError);
void remove (  
in HomeDef home,
in FinderDef finder)
raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface HomeFinder

struct ComponentEmitsLink
{
  ComponentDef component;
  EmitsDef emits;
};
typedef sequence<ComponentEmitsLink> ComponentEmitsLinkSet;

interface ComponentEmits : Reflective::RefAssociation
{
  ComponentEmitsLinkSet all_component_emits_links()
  raises (Reflective::MofError);
  boolean exists (  
in ComponentDef component,
in EmitsDef emits)
  raises (Reflective::MofError);
  ComponentDef component (in EmitsDef emits)
  raises (Reflective::MofError);
  EmitsDefSet emits (in ComponentDef component)
  raises (Reflective::MofError);
  void add (  
in ComponentDef component,
in EmitsDef emits)
  raises (Reflective::MofError);
  void modify_component (  
in ComponentDef component,
in EmitsDef emits,
in ComponentDef new_component)
  raises (Reflective::MofError);
  void modify_emits (  
in ComponentDef component,
in EmitsDef emits,
in EmitsDef new_emits)
  raises (Reflective::MofError);
  void remove (  
in ComponentDef component,
in EmitsDef emits)
  raises (Reflective::MofError);
}; // end of interface ComponentEmits

struct ComponentConsumeSLink
{
  ComponentDef component;
ConsumesDef consumes;
}
typedef sequence<
ComponentConsumesLink>
ComponentConsumesLinkSet;

interface ComponentConsumes : Reflective::RefAssociation
{
    ComponentConsumesLinkSet
    all_component_consumes_links()
    raises (Reflective::MofError);
    boolean exists ( in ComponentDef component,
    in ConsumesDef consumes)
    raises (Reflective::MofError);

    ComponentDef component (in ConsumesDef consumes)
    raises (Reflective::MofError);

    ConsumesDefSet
    consumes (in ComponentDef component)
    raises (Reflective::MofError);

    void add ( in ComponentDef component,
    in ConsumesDef consumes)
    raises (Reflective::MofError);

    void modify_component ( in ComponentDef component,
    in ConsumesDef consumes,
    in ComponentDef new_component)
    raises (Reflective::NotFound, Reflective::MofError);

    void modify_consumes ( in ComponentDef component,
    in ConsumesDef consumes,
    in ConsumesDef new_consumes)
    raises (Reflective::NotFound, Reflective::MofError);

    void remove ( in ComponentDef component,
    in ConsumesDef consumes)
    raises (Reflective::NotFound, Reflective::MofError);
}
}; // end of interface ComponentConsumes

struct ComponentReceptacleLink
{
    ComponentDef component;
    UsesDef receptacle;
};
typedef sequence<
ComponentReceptacleLink>
ComponentReceptacleLinkSet;

interface ComponentReceptacle : Reflective::RefAssociation
{
    ComponentReceptacleLinkSet
    all_component_receptacle_links()
    raises (Reflective::MofError);
    boolean exists ( in ComponentDef component,
}
in UsesDef receptacle)
raises (Reflective::MofError);
ComponentDef component (in UsesDef receptacle)
 raises (Reflective::MofError);
UsesDefSet receptacle (in ComponentDef component)
 raises (Reflective::MofError);
void add (  
in ComponentDef component,  
in UsesDef receptacle)
raises (Reflective::MofError);
void modify_component (  
in ComponentDef component,  
in UsesDef receptacle,  
in ComponentDef new_component)
 raises (Reflective::NotFound, Reflective::MofError);
void modify_receptacle (  
in ComponentDef component,  
in UsesDef receptacle,  
in UsesDef new_receptacle)
 raises (Reflective::NotFound, Reflective::MofError);
void remove (  
in ComponentDef component,  
in UsesDef receptacle)
 raises (Reflective::NotFound, Reflective::MofError);
} ; // end of interface ComponentReceptacle

struct UsesInterfaceLink
{
  BaseIDL::InterfaceDef uses;
  UsesDef uses_def;
};
typedef sequence<UsesInterfaceLink> UsesInterfaceLinkSet;

interface UsesInterface : Reflective::RefAssociation
{
  UsesInterfaceLinkSet all_uses_interface_links()  
  raises (Reflective::MofError);
  boolean exists (  
in BaseIDL::InterfaceDef uses,
  in UsesDef uses_def)  
  raises (Reflective::MofError);
BaseIDL::InterfaceDef uses (in UsesDef uses_def)
 raises (Reflective::MofError);
void add (  
in BaseIDL::InterfaceDef uses,
  in UsesDef uses_def)
 raises (Reflective::MofError);
void modify_uses (  
in BaseIDL::InterfaceDef uses,
  in UsesDef uses_def,  
in BaseIDL::InterfaceDef new_uses)
raises (Reflective::NotFoundError, Reflective::MofError);
void remove (  
in BaseIDL::InterfaceDef uses,
in UsesDef uses_def)
  raises (Reflective::NotFoundError, Reflective::MofError);
}; // end of interface UsesDefInterface

struct ComponentHomeLink
{
  ComponentDef component;
  HomeDef home;
};
typedef sequence<ComponentHomeLink> ComponentHomeLinkSet;

interface ComponentHome : Reflective::RefAssociation
{
  ComponentHomeLinkSet all_component_home_links()  
    raises (Reflective::MofError);
  boolean exists (  
in ComponentDef component,
in HomeDef home)
    raises (Reflective::MofError);
  ComponentDef component (in HomeDef home)
    raises (Reflective::MofError);
  void add (  
in ComponentDef component,
in HomeDef home)
    raises (Reflective::MofError);
  void modify_component (  
in ComponentDef component,
in HomeDef home,
in ComponentDef new_component)
    raises (Reflective::NotFoundError, Reflective::MofError);
  void remove (  
in ComponentDef component,
in HomeDef home)
    raises (Reflective::NotFoundError, Reflective::MofError);
}; // end of interface ComponentHome

struct ComponentSupportsLink
{
  BaseIDL::InterfaceDef supports;
  ComponentDef components;
};
typedef sequence<ComponentSupportsLink> ComponentSupportsLinkSet;

interface ComponentSupports : Reflective::RefAssociation
{
  ComponentSupportsLinkSet all_component_supports_links()  
    raises (Reflective::MofError);
boolean exists (  
in BaseIDL::InterfaceDef supports,  
in ComponentDef components)  
raises (Reflective::MofError);  
BaseIDL::InterfaceDefSet supports (in ComponentDef components)  
raises (Reflective::MofError);  
void add (  
in BaseIDL::InterfaceDef supports,  
in ComponentDef components)  
raises (Reflective::MofError);  
void modify_supports (  
in BaseIDL::InterfaceDef supports,  
in ComponentDef components,  
in BaseIDL::InterfaceDef new supports)  
raises (Reflective::NotFoundException, Reflective::MofError);  
void remove (  
in BaseIDL::InterfaceDef supports,  
in ComponentDef components)  
raises (Reflective::NotFoundException, Reflective::MofError);  
}; // end of interface ComponentSupports

struct HomeFactoryLink  
{  
  HomeDef home;  
  FactoryDef factory;  
};
typedef sequence<HomeFactoryLink> HomeFactoryLinkSet;

interface HomeFactory : Reflective::RefAssociation  
{
  HomeFactoryLinkSet all_home_factory_links()  
  raises (Reflective::MofError);  
  boolean exists (  
in HomeDef home,  
in FactoryDef factory)  
  raises (Reflective::MofError);  
  HomeDef home (in FactoryDef factory)  
  raises (Reflective::MofError);  
  FactoryDefSet factory (in HomeDef home)  
  raises (Reflective::MofError);  
  void add (  
in HomeDef home,  
in FactoryDef factory)  
  raises (Reflective::MofError);  
  void modify_home (  
in HomeDef home,  
in FactoryDef factory,  
in HomeDef new_home)  
  raises (Reflective::NotFoundException, Reflective::MofError);  
  void modify_factory (  
in HomeDef home,
in FactoryDef factory,
in FactoryDef new_factory
raises (Reflective::NotFoundException, Reflective::MofError);
void remove (in HomeDef home,
in FactoryDef factory)
  raises (Reflective::NotFoundException, Reflective::MofError);
}; // end of interface HomeFactory

struct ComponentPublishesLink
{
  ComponentDef component;
  PublishesDef publishes;
};
typedef sequence<
  ComponentPublishesLink>
  ComponentPublishesLinkSet;

interface ComponentPublishes : Reflective::RefAssociation
{
  ComponentPublishesLinkSet all_component_publishes_links()
    raises (Reflective::MofError);
  boolean exists (in ComponentDef component,
in PublishesDef publishes)
    raises (Reflective::MofError);
  ComponentDef component (in PublishesDef publishes)
    raises (Reflective::MofError);
  PublishesDefSet publishes (in ComponentDef component)
    raises (Reflective::MofError);
  void add (in ComponentDef component,
in PublishesDef publishes)
    raises (Reflective::MofError);
  void modify_component (in ComponentDef component,
in PublishesDef publishes,
in ComponentDef new_component)
    raises (Reflective::NotFoundException, Reflective::MofError);
  void modify_publishes (in ComponentDef component,
in PublishesDef publishes,
in PublishesDef new_publishes)
    raises (Reflective::NotFoundException, Reflective::MofError);
  void remove (in ComponentDef component,
in PublishesDef publishes)
    raises (Reflective::NotFoundException, Reflective::MofError);
}; // end of interface ComponentPublishes

struct EventTypeLink
{

EventDef type;
   EventPortDef event;
};
typedef sequence<EventTypeLink> EventTypeLinkSet;

interface EventType : Reflective::RefAssociation
{
   EventTypeLinkSet all_event_type_links()
      raises (Reflective::MofError);
   boolean exists ( 
      in EventDef type,
      in EventPortDef event)
      raises (Reflective::MofError);
   EventDef type (in EventPortDef event)
      raises (Reflective::MofError);
   void add ( 
      in EventDef type,
      in EventPortDef event)
      raises (Reflective::MofError);
   void modify_type ( 
      in EventDef type,
      in EventPortDef event,
      in EventDef new_type)
      raises (Reflective::NotFound, Reflective::MofError);
   void remove ( 
      in EventDef type,
      in EventPortDef event)
      raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface EventType

struct APrimaryKeyHomeLink
{
   BasIDL::ValueDef primary_key;
   HomeDef home;
};
typedef sequence<APrimaryKeyHomeLink> APrimaryKeyHomeLinkSet;

interface APrimaryKeyHome : Reflective::RefAssociation
{
   APrimaryKeyHomeLinkSet all_a_primary_key_home_links()
      raises (Reflective::MofError);
   boolean exists ( 
      in BasIDL::ValueDef primary_key,
      in HomeDef home)
      raises (Reflective::MofError);
   BasIDL::ValueDef primary_key (in HomeDef home)
      raises (Reflective::MofError);
   void add ( 
      in BasIDL::ValueDef primary_key,
      in HomeDef home)
      raises (Reflective::MofError);
void modify_primary_key (  
  in BaseIDL::ValueDef primary_key,  
  in HomeDef home,  
  in BaseIDL::ValueDef new_primary_key)  
raises (Reflective::NotFound, Reflective::MofError);  
void remove (  
  in BaseIDL::ValueDef primary_key,  
  in HomeDef home)  
raises (Reflective::NotFound, Reflective::MofError);  
}; // end of interface APrimaryKeyHome

struct ASupportsHomeDefLink  
{
  BaseIDL::InterfaceDef supports;
  HomeDef home_def;
};
typedef sequence<ASupportsHomeDefLink> ASupportsHomeDefLinkSet;

interface ASupportsHomeDef : Reflective::RefAssociation  
{
  ASupportsHomeDefLinkSet all_a_supports_home_def_links()  
  raises (Reflective::MofError);  
boolean exists (  
  in BaseIDL::InterfaceDef supports,  
  in HomeDef home_def)  
raises (Reflective::MofError);  
BaseIDL::InterfaceDefSet supports (in HomeDef home_def)  
raises (Reflective::MofError);  
void add (  
  in BaseIDL::InterfaceDef supports,  
  in HomeDef home_def)  
raises (Reflective::MofError);  
void modify_supports (  
  in BaseIDL::InterfaceDef supports,  
  in HomeDef home_def,  
  in BaseIDL::InterfaceDef new_supports)  
raises (Reflective::NotFound, Reflective::MofError);  
void remove (  
  in BaseIDL::InterfaceDef supports,  
  in HomeDef home_def)  
raises (Reflective::NotFound, Reflective::MofError);  
}; // end of interface ASupportsHomeDef

interface ComponentIDLPackageFactory  
{
  ComponentIDLPackage create_component_idl_package ()  
  raises (Reflective::MofError);  
};

interface ComponentIDLPackage : Reflective::RefPackage  
{
readonly attribute ComponentFeatureClass component_feature_ref;
readonly attribute ComponentDefClass component_def_ref;
readonly attribute ProvidesDefClass provides_def_ref;
readonly attribute HomeDefClass home_def_ref;
readonly attribute FactoryDefClass factory_def_ref;
readonly attribute FinderDefClass finder_def_ref;
readonly attribute EventPortDefClass event_port_def_ref;
readonly attribute EmitsDefClass emits_def_ref;
readonly attribute ConsumesDefClass consumes_def_ref;
readonly attribute UsesDefClass uses_def_ref;
readonly attribute PublishesDefClass publishes_def_ref;
readonly attribute EventDefClass event_def_ref;
readonly attribute ProvidesInterface provides_interface_ref;
readonly attribute ComponentFacet component_facet_ref;
readonly attribute HomeFinder home_finder_ref;
readonly attribute ComponentEmits component_emits_ref;
readonly attribute ComponentConsumes component_consumes_ref;
readonly attribute ComponentReceptacle component_receptacle_ref;
readonly attribute UsesInterface uses_interface_ref;
readonly attribute ComponentHome component_home_ref;
readonly attribute ComponentSupports component_supports_ref;
readonly attribute HomeFactory home_factory_ref;
readonly attribute ComponentPublishes component_publishes_ref;
readonly attribute EventType event_type_ref;
readonly attribute APrimaryKeyHome a_primary_key_home_ref;
readonly attribute ASupportsHomeDef a_supports_home_def_ref;
});
}; // end of module ComponentIDL
CIF Metamodel

Note D Text in Red is from the Components 1.1 RTF interim report (ptc/2002-08-02).

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9.1 CIF Package

In addition to the packages BaseIDL and ComponentIDL, a new package CIF is introduced that contains the metamodel for the Component Implementation Framework. This package obviously depends on the ComponentIDL package since its main purpose is to enable the modeling of implementations for components specified using the ComponentIDL definitions. This situation is depicted in the following diagram:
9.2 **Classes and Associations**

The CIF metamodel defines additional metaclasses and associations. An overview on these is to be seen in Figure 9-2. Their meaning is explained in the following.
This meta class is used to model an implementation definition for a given component definition. It specifies an association to ComponentDef to allow instances to point exactly to the component the instance is going to implement. A ComponentImplDef always has exactly one ComponentDef associated while each ComponentDef might be implemented by different ComponentImplDefs.

ComponentImplDef is specified as being a Container, by doing so, instances are able to contain other definitions. The only definitions that are allowed to be contained by a ComponentImplDef are instances of SegmentDef.

Currently, there is no inheritance specification for instances of ComponentImplDef.
**SegmentDef**

Instances of SegmentDef are used to model a segmented implementation structure for a component implementation. This means that the behavior for each component feature can be provided by a separate segment of the component implementation (most likely a separate programming language class in the code generated by the CIF tools) if necessary. It is also possible to specify that a segment provides the behavior for a number of component features including the extreme that only one segment implements all component features.

Instances of SegmentDef are always contained in instances of ComponentImplDef and therefore are derived from Contained. SegmentDef has an association to ComponentFeature so that instances can point to all features of a component which the segment is going to implement. SegmentDef has in addition an association to ArtifactDef, which are models of programming language constructs (classes) used to actually implement the behavior for component features. There is always exactly one artifact for each segment. However, artefacts may be shared between component implementations whereas segments cannot. That’s why the distinction between artefacts and segments has been modeled in the CIF.

The attribute isSerialized is used to indicate that the access to segment is required to be serialized or not.

**ArtifactDef**

ArtifactDef is used to model abstractions from programming language constructs like classes. Instances from ArtifactDef in a model represent the elements that provide the behavior for features of a component. Since these can be shared across component implementations the distinctions between artefacts and segments have been made in the metamodel.

ArtifactDef is a specialization of the metaclass Contained, which means that artefacts are identifiable and contained in other definitions. The only allowed Container for ArtifactDef is ModuleDef.

**Policy**

Segment definitions modeled as instances of the metaclass SegmentDef may contain a set of policies that have to be applied to realizations of the segment in the implementation code. These policies include for example activation policies for the artifact associated to a segment. The complete set of required policies is not known yet and the metamodel is designed to be flexible. Policy is introduced as an abstract metaclass and concrete policies are expected to be defined as specializations of that class. SegmentDef aggregates a set of policies.

The metamodel for component implementations is shown in Figure 9-3.
ComponentCategory

<Enumeration>

PROCESS
SESSION
ENTITY
SERVICE

ComponentImplDef

category : ComponentCategory

ComponentDef
(from ComponentIDL)

0..n
+component

implements

ComponentFeature
(from ComponentIDL)

+features

1..n
implemented_by

SegmentDef

+artifact

1

ArtifactDef

+policiess

0..n

Policy

Specifi cation of Policies

Specifi cation of State

Figure 9-3 Metamodel for component implementations

HomeImplDef

Home interfaces have to be implemented and their implementation is not part of a component implementation. However, for a home implementation it has to be specified, which component implementation the home implementation manages. For that reason, the CIF metamodel contains a metaclass HomeImplDef. Each instance of HomeImplDef in a model implements exactly one instance of HomeDef. This relation is modeled by the association implements between both metaclasses. HomeImplDef inherits from the abstract metaclass Container. This is to allow a home implementation to be identifiable within a model and to contain other model elements. (For the time being, no such elements have been identified). Each home implementation manages
exactly one component implementation, this relation is modeled by the association manages. It is required, that for each instance x of HomeImplDef the instance of ComponentDef, which is associated to the instance of HomeDef associated to x is the same instance as the instance of ComponentDef associated to the instance of ComponentImplDef which is associated to x.

![Diagram](image)

**Figure 9-4 Metamodel for home implementations**

### 9.3 Conformance Criteria

This section identifies the conformance points required for compliant implementations of the Component Implementation Framework (CIF) metamodel architecture.

#### 9.3.1 Conformance Points

In the previous section, the MOF metamodel of the Component Implementation Framework (CIF) was defined. The following section defines the XMI format for the exchange of CIF metadata and the IDL for a MOF-compliant CIF repository. Support for the generation and consumption of the XMI metadata and for the MOF-compliant IDL is optional.
9.4 **MOF DTDs and IDL for the CIF Metamodel**

The XMI DTDs and IDL for the Interface Repository metamodel are presented in this section. The DTDs are generated by applying the MOF-XML mapping defined by the XMI specification to the MOF-compliant metamodel described in Section 9.1, "CIF Package," on page 9-1. The IDL is generated by applying the MOF-IDL mapping defined in the MOF specification to the metamodels and was validated using the IDL compilers.

The IDL requires the inclusion of the reflective interfaces defined in ad/99-07-03 as part of the MOF 1.3 specification.

### 9.4.1 XMI DTD

See Section 8.3.1, "XMI DTD," on page 8-27.
9.4.2 IDL for the CIF Package

```idl
#pragma prefix "ccm.omg.org"
#include "ComponentIDL.idl"

module CIF {
    interface ArtifactDefClass;
    interface ArtifactDef;
    typedef sequence<ArtifactDef> ArtifactDefSet;
    interface SegmentDefClass;
    interface SegmentDef;
    typedef sequence<SegmentDef> SegmentDefSet;
    interface ComponentImplDefClass;
    interface ComponentImplDef;
    typedef sequence<ComponentImplDef> ComponentImplDefSet;
    interface PolicyClass;
    interface Policy;
    typedef sequence<Policy> PolicySet;
    interface HomeImplDefClass;
    interface HomeImplDef;
    typedef sequence<HomeImplDef> HomeImplDefSet;
    interface CIFPackage;
    enum ComponentCategory {PROCESS, SESSION, ENTITY, SERVICE};

    interface ArtifactDefClass : BaseIDL::ContainedClass {
        readonly attribute ArtifactDefSet all_of_type_artifact_def;
        readonly attribute ArtifactDefSet all_of_class_artifact_def;
        ArtifactDef create_artifact_def (in string identifier,
                                          in string repository_id,
                                          in string version)
            raises (Reflective::MofError);
    };

    interface ArtifactDef : ArtifactDefClass, BaseIDL::Contained {
    } // end of interface ArtifactDef

    interface SegmentDefClass : BaseIDL::ContainedClass {
        readonly attribute SegmentDefSet all_of_type_segment_def;
        readonly attribute SegmentDefSet all_of_class_segment_def;
        SegmentDef create_segment_def (in string identifier,
                                         in string repository_id,
                                         in string version,
                                         in boolean is_serialized)
            raises (Reflective::MofError);
    }
```
interface SegmentDef : SegmentDefClass, BaseIDL::Contained
{
    ArtifactDef artifact ()
    raises (Reflective::MofError);
    void set_artifact (in ArtifactDef new_value)
    raises (Reflective::MofError);
    ComponentIDL::ComponentFeatureSet features ()
    raises (Reflective::MofError);
    void set_features (in ComponentIDL::ComponentFeatureSet new_value)
    raises (Reflective::MofError);
    void add_features (in ComponentIDL::ComponentFeature new_element)
    raises (Reflective::MofError);
    void modify_features (in ComponentIDL::ComponentFeature old_element,
    in ComponentIDL::ComponentFeature new_element)
    raises (Reflective::NotFound, Reflective::MofError);
    void remove_features (in ComponentIDL::ComponentFeature old_element)
    raises (Reflective::NotFound, Reflective::MofError);
    PolicySet policies ()
    raises (Reflective::MofError);
    void set_policies (in PolicySet new_value)
    raises (Reflective::MofError);
    void unset_policies ()
    raises (Reflective::MofError);
    void add_policies (in Policy new_element)
    raises (Reflective::MofError);
    void modify_policies (in Policy old_element,
    in Policy new_element)
    raises (Reflective::NotFound, Reflective::MofError);
    void remove_policies (in Policy old_element)
    raises (Reflective::NotFound, Reflective::MofError);
    boolean is_serialized ()
    raises (Reflective::MofError);
    void set_is_serialized (in boolean new_value)
    raises (Reflective::MofError);
}; // end of interface SegmentDef

interface ComponentImplDefClass : BaseIDL::ContainerClass
{
    readonly attribute ComponentImplDefSet
    all_of_type_component_impl_def;
    readonly attribute ComponentImplDefSet
    all_of_class_component_impl_def;
    ComponentImplDef create_component_impl_def (in string identifier,
    in string repository_id,
    in string version,
in ComponentCategory category)
raises (Reflective::MofError);
};

interface ComponentImplDef : ComponentImplDefClass, BaselDL::Container
{
  ComponentIDL::ComponentDef component ()
    raises (Reflective::MofError);
  void set_component (in ComponentIDL::ComponentDef new_value)
    raises (Reflective::MofError);
  SegmentDefSet segments ()
    raises (Reflective::MofError);
  void set_segments (in SegmentDefSet new_value)
    raises (Reflective::MofError);
  void add_segments (in SegmentDef new_element)
    raises (Reflective::MofError);
  void modify_segments (in SegmentDef old_element,
                        in SegmentDef new_element)
    raises (Reflective::NotFoundException, Reflective::MofError);
  void remove_segments (in SegmentDef old_element)
    raises (Reflective::NotFoundException, Reflective::MofError);
  ComponentCategory category ()
    raises (Reflective::MofError);
  void set_category (in ComponentCategory new_value)
    raises (Reflective::MofError);
}; // end of interface ComponentImplDef

interface PolicyClass : Reflective::RefObject
{
  readonly attribute PolicySet all_of_type_policy;
};

interface Policy : PolicyClass
{
}; // end of interface Policy

interface HomImplDefClass : BaselDL::ContainerClass
{
  readonly attribute HomImplDefSet all_of_type_home_impl_def;
  readonly attribute HomImplDefSet all_of_class_home_impl_def;
  HomImplDef create_home_impl_def (in string identifier,
                                    in string repository_id,
                                    in string version)
    raises (Reflective::MofError);
};

interface HomImplDef : HomImplDefClass, BaselDL::Container
ComponentIDL::HomeDef home ()
  raises (Reflective::MofError);
void set_home (in ComponentIDL::HomeDef new_value)
  raises (Reflective::MofError);
ComponentImplDef component_impl ()
  raises (Reflective::MofError);
void set_component_impl (in ComponentImplDef new_value)
  raises (Reflective::MofError);
}; // end of interface HomeImplDef

struct AArtifactSegmentDefLink
{
  ArtifactDef artifact;
  SegmentDef segment_def;
};
typedef sequence<AArtifactSegmentDefLink> AArtifactSegmentDefLinkSet;

interface AArtifactSegmentDef : Reflective::RefAssociation
{
  AArtifactSegmentDefLinkSet all_a_artifact_segment_def_links()
    raises (Reflective::MofError);
  boolean exists (in ArtifactDef artifact,
                  in SegmentDef segment_def)
    raises (Reflective::MofError);
  ArtifactDef artifact (in SegmentDef segment_def)
    raises (Reflective::MofError);
  void add (in ArtifactDef artifact,
            in SegmentDef segment_def)
    raises (Reflective::MofError);
  void modify_artifact (in ArtifactDef artifact,
                        in SegmentDef segment_def,
                        in ArtifactDef new_artifact)
    raises (Reflective::NotFound, Reflective::MofError);
  void remove (in ArtifactDef artifact,
               in SegmentDef segment_def)
    raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface AArtifactSegmentDef

struct SegmentsLink
{
  SegmentDef segments;
  ComponentImplDef component_impl_def;
};
typedef sequence<SegmentsLink> SegmentsLinkSet;

interface Segments : Reflective::RefAssociation
{  
  SegmentsLinkSet all_segments_links()  
  raises (Reflective::MofError);  
  
  boolean exists (  
    in SegmentDef segments,  
    in ComponentImplDef component_impl_def)  
  raises (Reflective::MofError);  
  
  SegmentDefSet segments (in ComponentImplDef component_impl_def)  
  raises (Reflective::MofError);  
  
  void add (  
    in SegmentDef segments,  
    in ComponentImplDef component_impl_def)  
  raises (Reflective::MofError);  
  
  void modify_segments (  
    in SegmentDef segments,  
    in ComponentImplDef component_impl_def,  
    in SegmentDef new_segments)  
  raises (Reflective::NotFound, Reflective::MofError);  
  
  void remove (  
    in SegmentDef segments,  
    in ComponentImplDef component_impl_def)  
  raises (Reflective::NotFound, Reflective::MofError);  
}; // end of interface Segments

struct ImplementedByLink
{  
  ComponentIDL::ComponentFeature features;  
  SegmentDef segment_def;  
};

typedef sequence<ImplementedByLink> ImplementedByLinkSet;

interface ImplementedBy : Reflective::RefAssociation
{  
  ImplementedByLinkSet all_implemented_by_links()  
  raises (Reflective::MofError);  
  
  boolean exists (  
    in ComponentIDL::ComponentFeature features,  
    in SegmentDef segment_def)  
  raises (Reflective::MofError);  
  
  ComponentIDL::ComponentFeatureSet features (in SegmentDef segment_def)  
  raises (Reflective::MofError);  
  
  void add (  
    in ComponentIDL::ComponentFeature features,  
    in SegmentDef segment_def)  
  raises (Reflective::MofError);  
  
  void modify_features (  
    in ComponentIDL::ComponentFeature features,  
    in SegmentDef segment_def,  
    in ComponentIDL::ComponentFeature new_features)  
  raises (Reflective::NotFound, Reflective::MofError);  
}
void remove (  
    in ComponentIDL::ComponentFeature features,  
    in SegmentDef segment_def)  
raises (Reflective::NotFound, Reflective::MofError);  
}; // end of interface ImplementedBy

struct PoliciesLink  
{  
    Policy policies;  
    SegmentDef segment_def;  
};
typedef sequence<PoliciesLink> PoliciesLinkSet;

interface Policies : Reflective::RefAssociation  
{  
    PoliciesLinkSet all_policies_links()  
    raises (Reflective::MofError);  
    boolean exists (  
        in Policy policies,  
        in SegmentDef segment_def)  
    raises (Reflective::MofError);  
    PolicySet policies (in SegmentDef segment_def)  
    raises (Reflective::MofError);  
    void add (  
        in Policy policies,  
        in SegmentDef segment_def)  
    raises (Reflective::MofError);  
    void modify_policies (  
        in Policy policies,  
        in SegmentDef segment_def,  
        in Policy new_policies)  
    raises (Reflective::NotFound, Reflective::MofError);  
    void remove (  
        in Policy policies,  
        in SegmentDef segment_def)  
    raises (Reflective::NotFound, Reflective::MofError);  
}; // end of interface Policies

struct ManagesLink  
{  
    ComponentImplDef component_impl;  
    HomeImplDef home_impl;  
};
typedef sequence<ManagesLink> ManagesLinkSet;

interface Manages : Reflective::RefAssociation  
{  
    ManagesLinkSet all_manages_links()  
    raises (Reflective::MofError);  
    boolean exists (  
        in ComponentImplDef component_impl,
in HomeImplDef home_impl)
  raises (Reflective::MofError);
ComponentImplDef component_impl (in HomeImplDef home_impl)
  raises (Reflective::MofError);
void add (  
in ComponentImplDef component_impl,  
in HomeImplDef home_impl)
  raises (Reflective::MofError);
void modify_component_impl (  
in ComponentImplDef component_impl,  
in HomeImplDef home_impl,  
in ComponentImplDef new_component_impl)
  raises (Reflective::NotFound, Reflective::MofError);
void remove (  
in ComponentImplDef component_impl,  
in HomeImplDef home_impl)
  raises (Reflective::NotFound, Reflective::MofError);
}; // end of interface Manages

interface CIFPackageFactory
{
  CIFPackage create_cif_package ()
  raises (Reflective::MofError);
};

interface CIFPackage : Reflective::RefPackage
{
  readonly attribute ArtifactDefClass artifact_def_ref;  
  readonly attribute SegmentDefClass segment_def_ref;  
  readonly attribute ComponentImplDefClass component_impl_def_ref;  
  readonly attribute PolicyClass policy_ref;  
  readonly attribute HomemImplDefClass home_impl_def_ref;  
  readonly attribute ArtifactSegmentDef a_artifact_segment_def_ref;  
  readonly attribute Segments segments_ref;  
  readonly attribute ImplementedBy implemented_by_ref;  
  readonly attribute Policies policies_ref;  
  readonly attribute Manages manages_ref;
}; // end of module CIF
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