

E.6 The Naming Service

- Binding of object references to symbolic names (like the RMI registry)
- Hierarchical name space

1 IDL Interface

```
module CosNaming {  
  
    typedef string Istring;  
    struct NameComponent {  
        Istring id;  
        Istring kind;  
    };  
    typedef sequence <NameComponent> Name;  
  
    interface NamingContext {  
  
        void bind(in Name n, in Object obj) raises(NotFound,  
            CannotProceed, InvalidName, AlreadyBound);  
        void rebind(in Name n, in Object obj) raises(  
            NotFound, CannotProceed, InvalidName);  
    };  
};
```

1 IDL Interface

```

void bind_context(in Name n, in NamingContext nc)
    raises(NotFound, CannotProceed, InvalidName,
           AlreadyBound);
void rebind_context(in Name n, in NamingContext nc)
    raises(NotFound, CannotProceed, InvalidName);
void unbind(in Name n)
    raises(NotFound, CannotProceed, InvalidName);

Object resolve(in Name n)
    raises(NotFound, CannotProceed, InvalidName);

NamingContext new_context();
NamingContext bind_new_context(in Name n)
    raises(NotFound, AlreadyBound,
           CannotProceed, InvalidName);
void destroy() raises(NotEmpty);

void list( in unsigned long    how_many,
           out BindingList      bl,
           out BindingIterator bi);

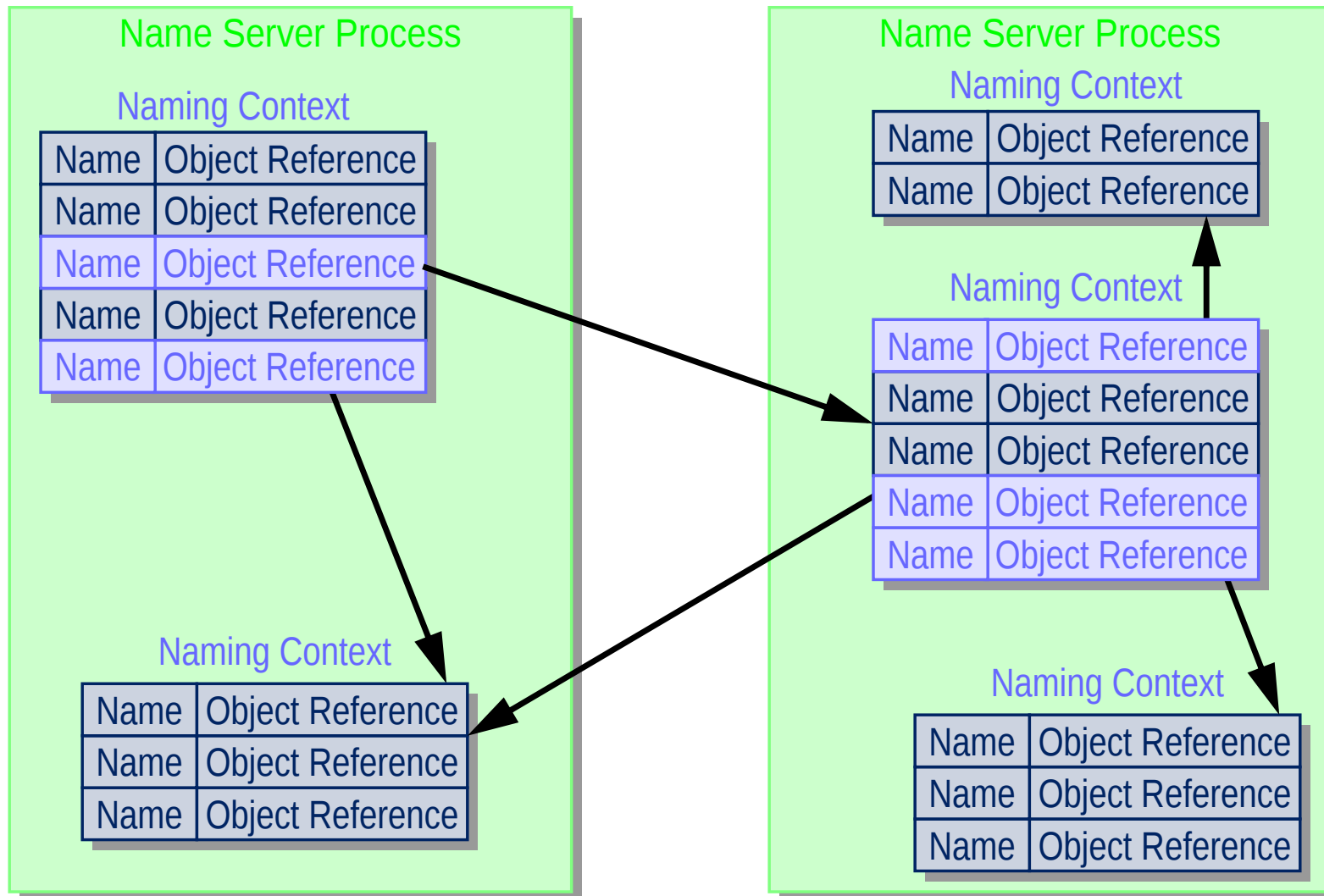
}; // end of interface NamingContext

}; // end of module CosNaming

```

2 Hierarchy of Naming Contexts

■ Naming Contexts in multiple name server processes



3 Getting the Root Naming Context

- ORB has the reference

```
org.omg.CORBA.Object o =
    orb.resolve_initial_references("NameService");
org.omg.CosNaming.NamingContext root_context =
    org.omg.CosNaming.NamingContextHelper.narrow( o );
```

- ORB gets Root Naming Context via command line parameter
 - ◆ Since Interoperable Naming Service (INS) Specification (November 2000)
 - ◆ ORB evaluates all parameters of the form **-ORB**<suffix> <value>
 - ◆ For initial references:

```
-ORBInitRef ObjectID=Reference
```

- ◆ Human readable object references:

```
corbaloc:Protocol:Host:Port/ObjectId
```

- ◆ Example:

```
-ORBInitRef NameService=corbaloc::fau40u.informatik.uni-erlangen.de:4711/NameService
```

4 Hello World Client With Naming Service

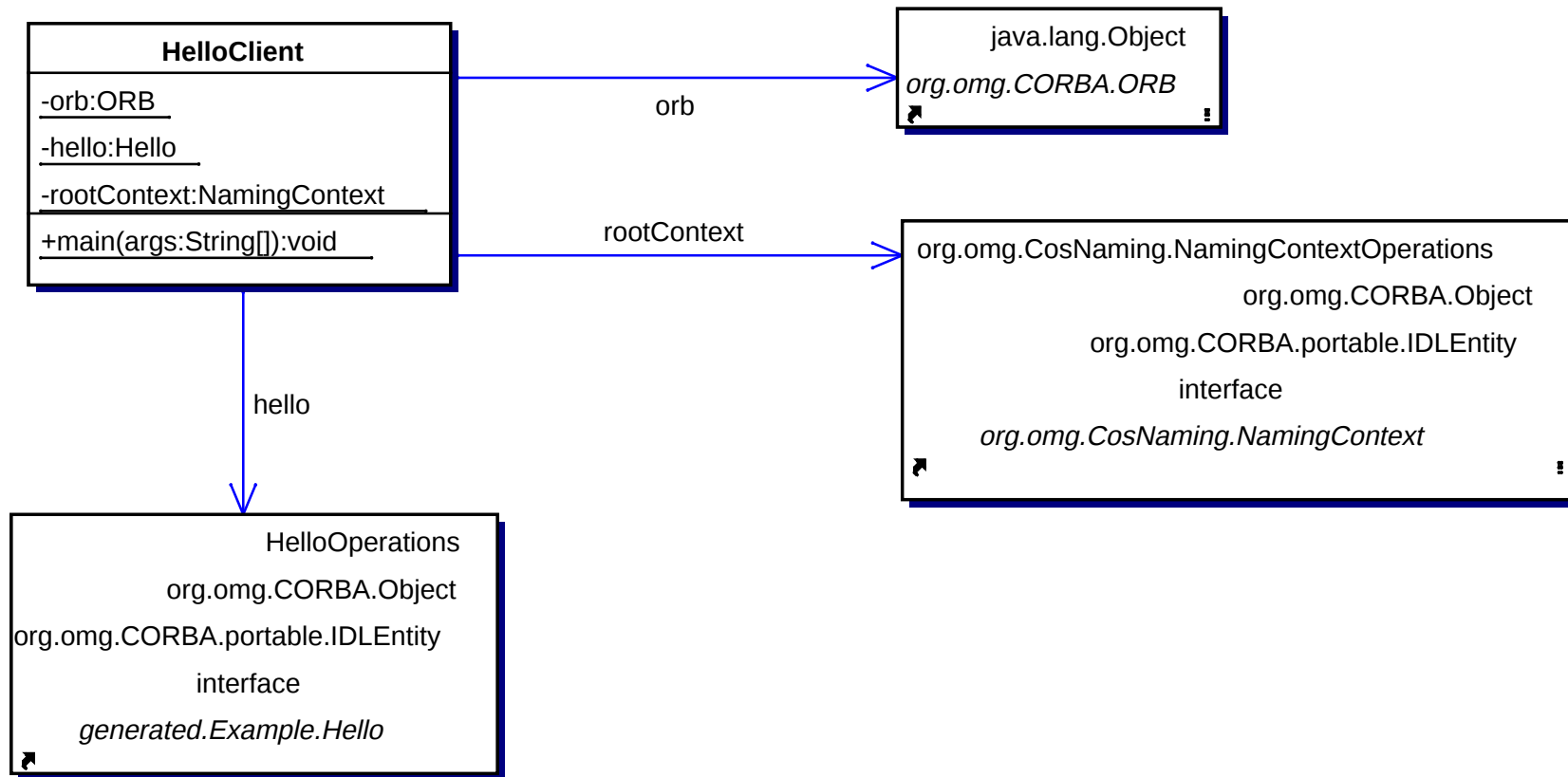
- Import additional package

```
import org.omg.CosNaming.*;
```

- Changes to client's main method

```
// Initialise ORB
ORB orb = ORB.init( args, null );
// Get Name Service reference
org.omg.CORBA.Object objRootContext =
    orb.resolve_initial_references("NameService");
// Narrow it to the NamingContext interface
NamingContext rootContext =
    NamingContextHelper.narrow( objRootContext );
// Create a name as an array of NameComponent objects
NameComponent name[] = new NameComponent[2];
name[0] = new NameComponent("pub", "");
name[1] = new NameComponent("Hello", "");
// Look the object up
org.omg.CORBA.Object o = rootContext.resolve(name);
// Narrow to the Hello interface
Hello h = HelloHelper.narrow( o );
```

4 Hello World Client With Naming Service



4 Hello World Client With Naming Service

- Go to the example directory

```
> cd /proj/i4oods/pub/hello_java_client_nameservice
```

- Compile

```
> /local/ORBacus-4.0.3/bin/jidl --package generated  
Hello.idl  
> /local/java-1.3/bin/javac -classpath /local/ORBacus-4.0.3/  
lib/OB.jar:/local/ORBacus-4.0.3/lib/OBNaming.jar:. client/  
HelloClient.java
```

- Run

```
> /local/java-1.3/bin/java -classpath /local/ORBacus-4.0.3/  
lib/OB.jar:/local/ORBacus-4.0.3/lib/OBNaming.jar:.  
-Dorg.omg.CORBA.ORBClass=com.ooc.CORBA.ORB  
-Dorg.omg.CORBA.ORBSingletonClass=com.ooc.CORBA.ORBSingleto  
n client>HelloClient -ORBInitRef  
NameService=corbaloc::fau.i40u.informatik.uni-  
erlangen.de:4711/NameService
```

5 Summary

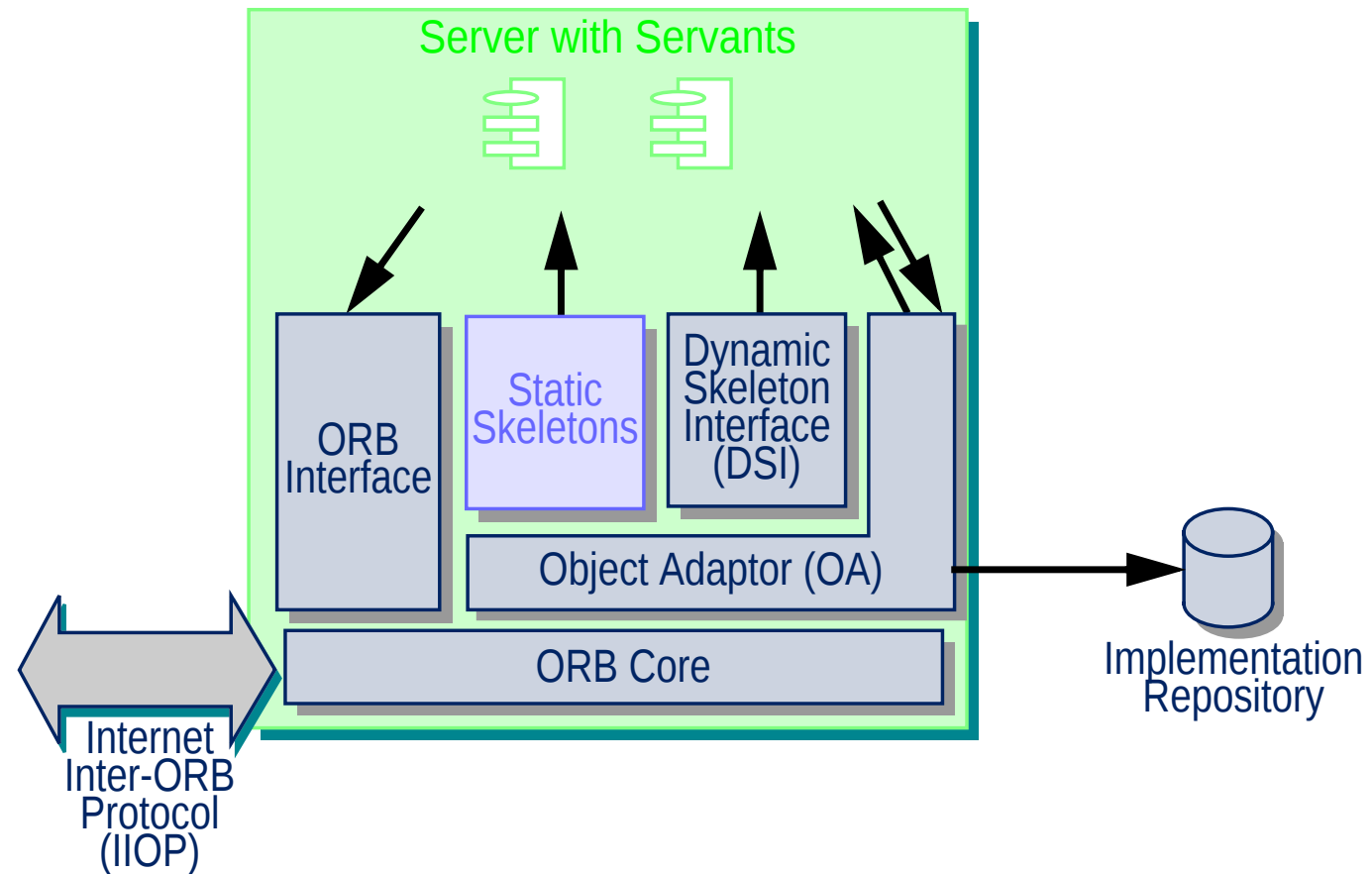
- Bind object references to names
- Naming Contexts are normal CORBA objects (IDL interface)
- Naming Contexts reside in Name Server processes
- Configuration of the Root Naming Context for an application via command line parameter

E.7 Implementing CORBA Objects

1 CORBA Objects revisited

- CORBA objects are accessed via object references
 - ◆ CORBA object conceptually exists when first reference was created
- Functionality of CORBA objects realised by servants
 - ◆ Servants written in a real programming language
 - ◆ Servant may not yet exist when CORBA object is invoked
 - ◆ At most one servant per CORBA object at each moment in time
 - ◆ But many different servants at different times

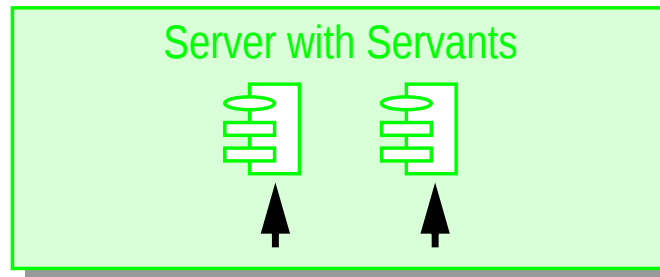
2 Server Architecture



3 The Server and Servants

■ Server

- ◆ Process that hosts implementations (Servants) of CORBA objects

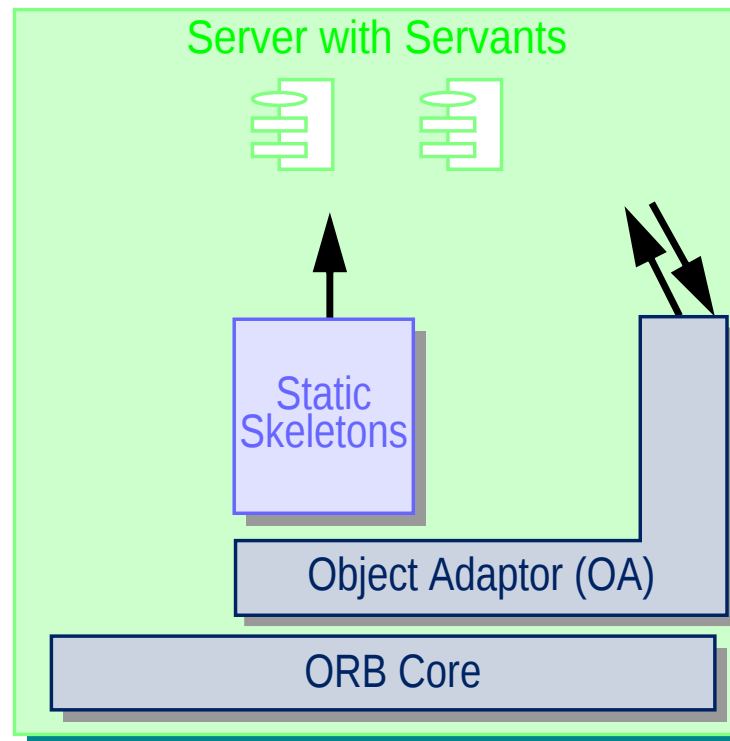


■ Servant

- ◆ Implementation of exactly one CORBA object
- ◆ In OO languages: a special object that implements the IDL interface
- ◆ In non-OO languages: a set of functions that implement the IDL interface and a data structure to identify the instance
- ◆ Many Servants per Server

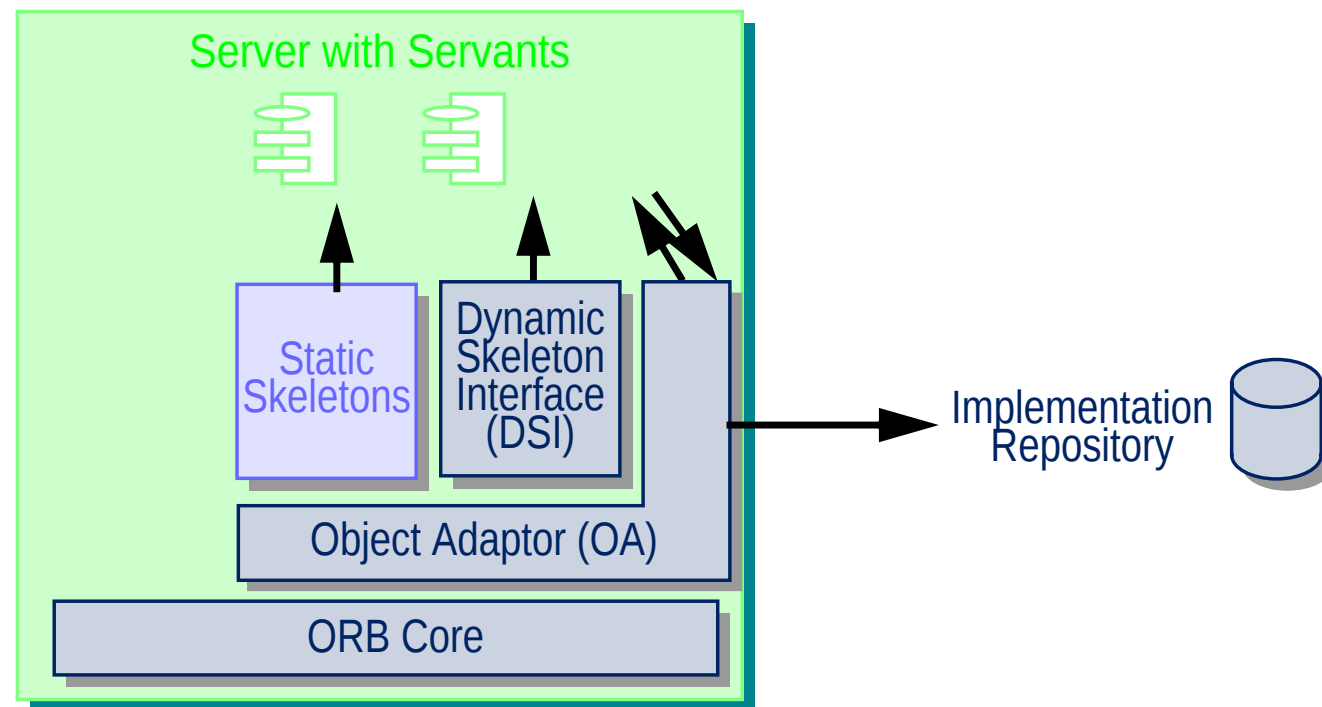
4 Static Skeletons

- Can also be created automatically from the IDL interface
- Demarshalling of invocation parameters, Call dispatching to Servant
- Marshalling of return values or exceptions from the invocation



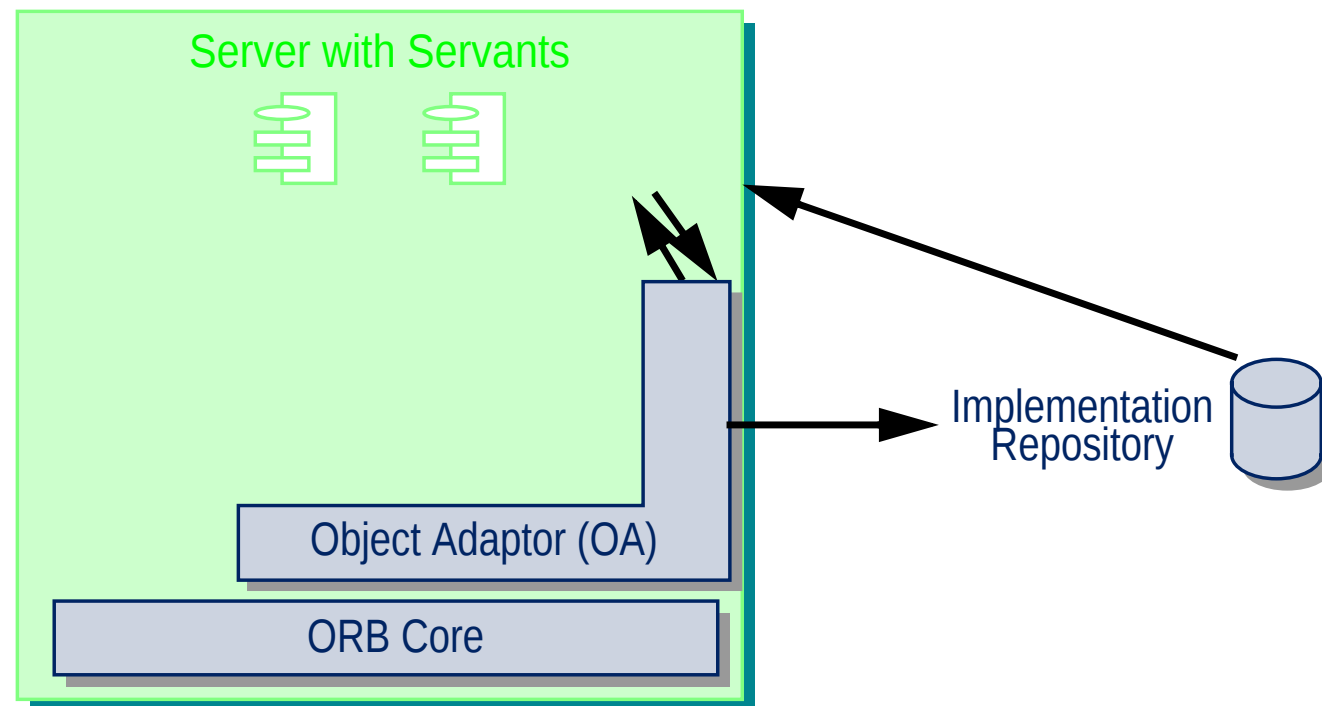
5 Object Adaptor

- Call dispatching from ORB Core to the Skeletons
- Creation and management of object references
- Dynamic activation of Servants
- up to CORBA 2.1: Basic Object Adaptor (BOA), now Portable OA (POA)



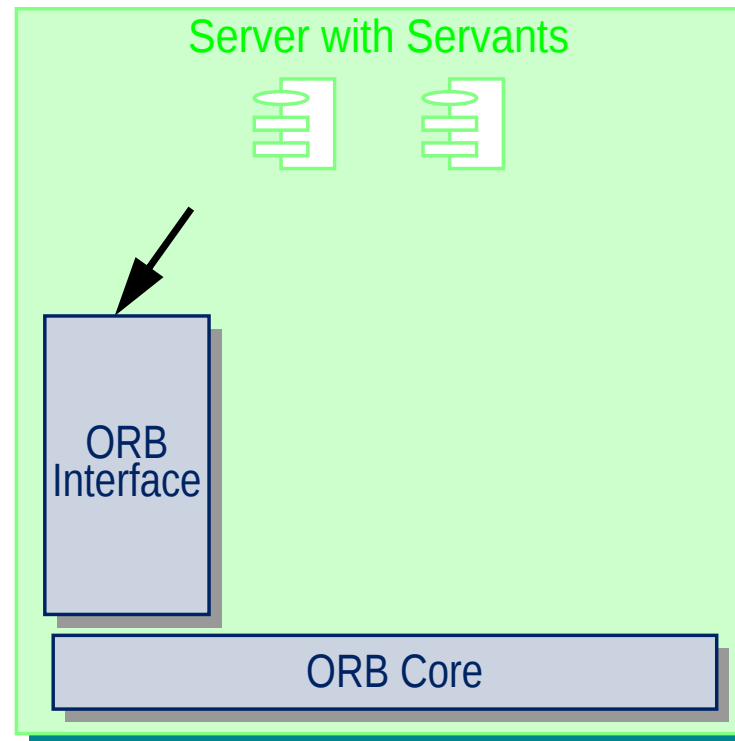
6 Implementation Repository

- Database for implementations of CORBA objects
 - ◆ Information about which object is implemented by which Servant
- Often combined with Location Forwarding Service
 - ◆ Dynamically starts Server processes
 - ◆ Forwards calls to Servants in dynamically started Servers



7 ORB Interface

- Export of initial object references (ORB, OAs, Naming Service, ...)
- Manipulation of object references (conversion into strings and back)



8 Server Summary

- Servants implement CORBA objects
- Server process hosts Servants
- Skeletons dispatch calls to Servants
- Object Adaptor manages Servant live cycle
- Implementation Repository contains information about active Servers and their Servants

E.8 Simple Java Server (POA)

- Using the Portable Object Adaptor
 - ◆ No need to use the POA interface for now
 - ◆ Use the so-called RootPOA
- Creating and Activating Servants

1 Servant

- Object that implements the functionality of a CORBA object
- Semantics for now:
 - ◆ Each creation of a Servant at the same time creates an associated CORBA object
 - ◆ After destruction of a Servant the associated CORBA object ceases to exist

- IDL:

```
module PortableServer {                                     // PIDL
    native Servant;
};
```

- Java Mapping into an abstract class:

```
package org.omg.PortableServer;

public abstract class Servant {
    ...
};
```

2 Skeleton

- Base class for your implementation

- IDL:

```
module module {
    interface name { ... };
};
```

- Java mapping into an abstract class *namePOA*:

```
package module;
public abstract class namePOA
    extends org.omg.PortableServer.Servant
    implements org.omg.CORBA.portable.InvokeHandler,
        nameOperations
{
    public org.omg.CORBA.portable.OutputStream _invoke(
        String op, org.omg.CORBA.portable.InputStream i,
        org.omg.CORBA.portable.ResponseHandler handler)
    { ... }
    public name _this( org.omg.CORBA.ORB orb ) { ... }
    ...
}
```

2 Skeleton

■ **OutputStream _invoke(String op, InputStream i, ...)**

- ◆ Unmarshals parameters from InputStream
- ◆ Dispatches call using Operation name **op**
- ◆ Marshals return values to OutputStream

■ **name _this(org.omg.CORBA.ORB orb)**

- ◆ Activates a new CORBA object
- ◆ Associates the servant with the new CORBA object
- ◆ Returns an object reference (i.e. local stub)
- ◆ Mechanism is also called *Implicit Activation*

■ Skeleton automatically generated by the IDL compiler

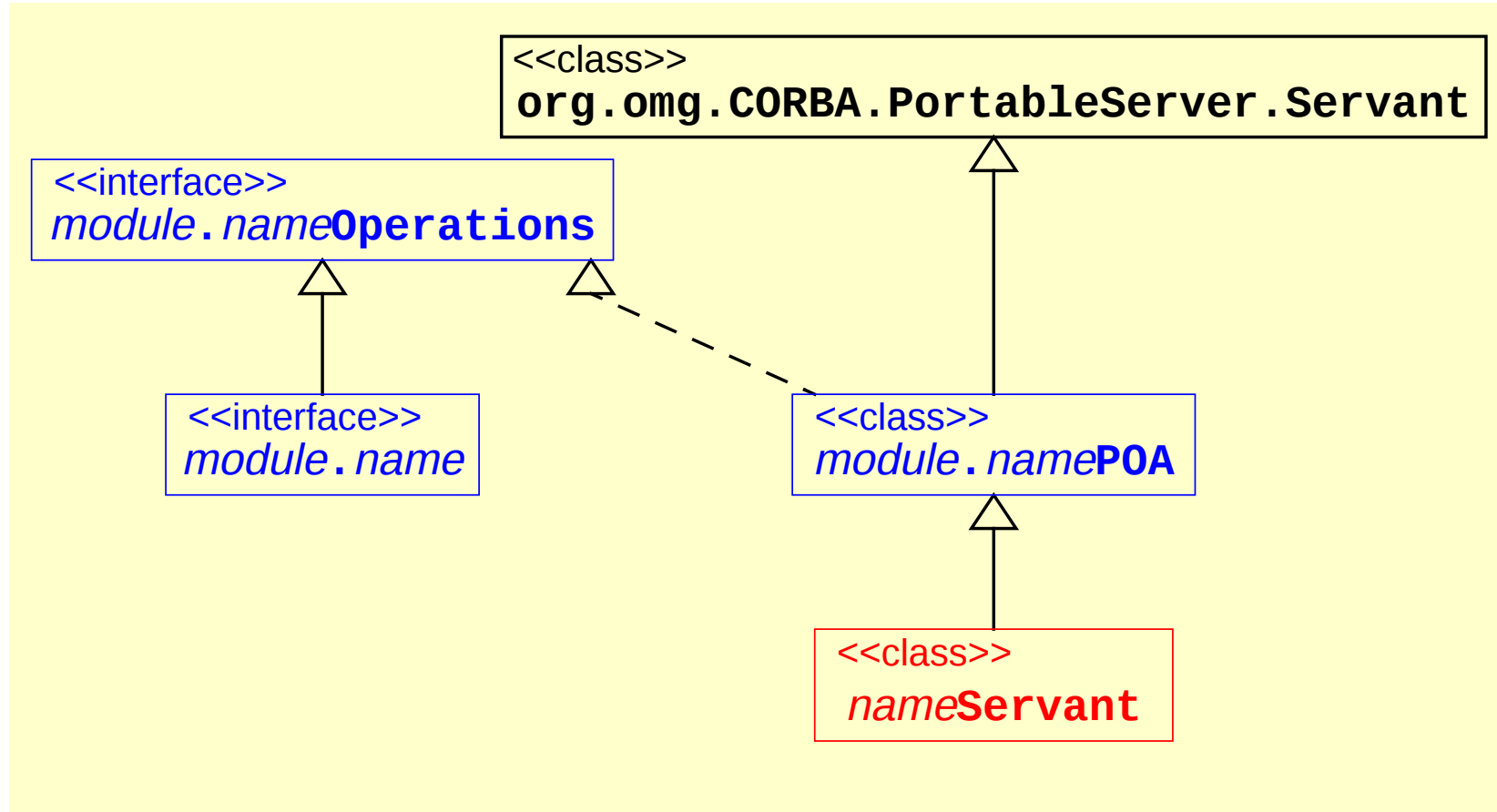
3 Your Servant

- Your implementation of the object's functionality
- Inherits from Skeleton class
- Naming convention: *nameServant*

```
public class nameServant extends module.namePOA {  
    Implementation of methods for attributes and operations  
}
```

4 Servant Implementation Hierarchy

- Class hierarchy for IDL interface *module::name*



4 Servant Implementation Hierarchy

■ Example: Generated interface and classes

```
public interface AccountOperations {
    public void withdraw( double amount )
        throws AccountPackage.Overdraft;
}

public interface Account extends org.omg.CORBA.Object,
    AccountOperations, ...
{
}

public abstract class AccountPOA
    extends org.omg.PortableServer.Servant
    implements AccountOperations, ...
{
    ...
}
```

■ Example: Your Servant

```
public class AccountServant extends AccountPOA {
    public void withdraw( double amount )
        throws AccountPackage.Overdraft {
        // Implementation of withdraw
    }
}
```

5 Missing Pieces

■ ORB initialization (see Client section)

■ POA activation

◆ Get reference to RootPOA via **resolve_initial_references**

```
org.omg.CORBA.Object o = orb.resolve_initial_references(
    "RootPOA" );
```

◆ Narrow to interface **org.omg.PortableServer.POA**

```
org.omg.PortableServer.POA poa =
    org.omg.PortableServer.POAHelper.narrow( o );
```

◆ Activate POA via **org.omg.PortableServer.POAManager**

```
poa.the_POAManager().activate();
```

■ ORB main loop

◆ Start processing requests via **run()** method in **org.omg.CORBA.ORB**

```
orb.run();
```

6 Hello World Server With Naming Service

■ IDL-Interface

```
// Hello.idl

module Example {
    interface Hello {
        string say( in string msg );
    };
};
```

6 Hello World Server With Naming Service

■ Servant implementation via inheritance

```
// server/HelloServant.java

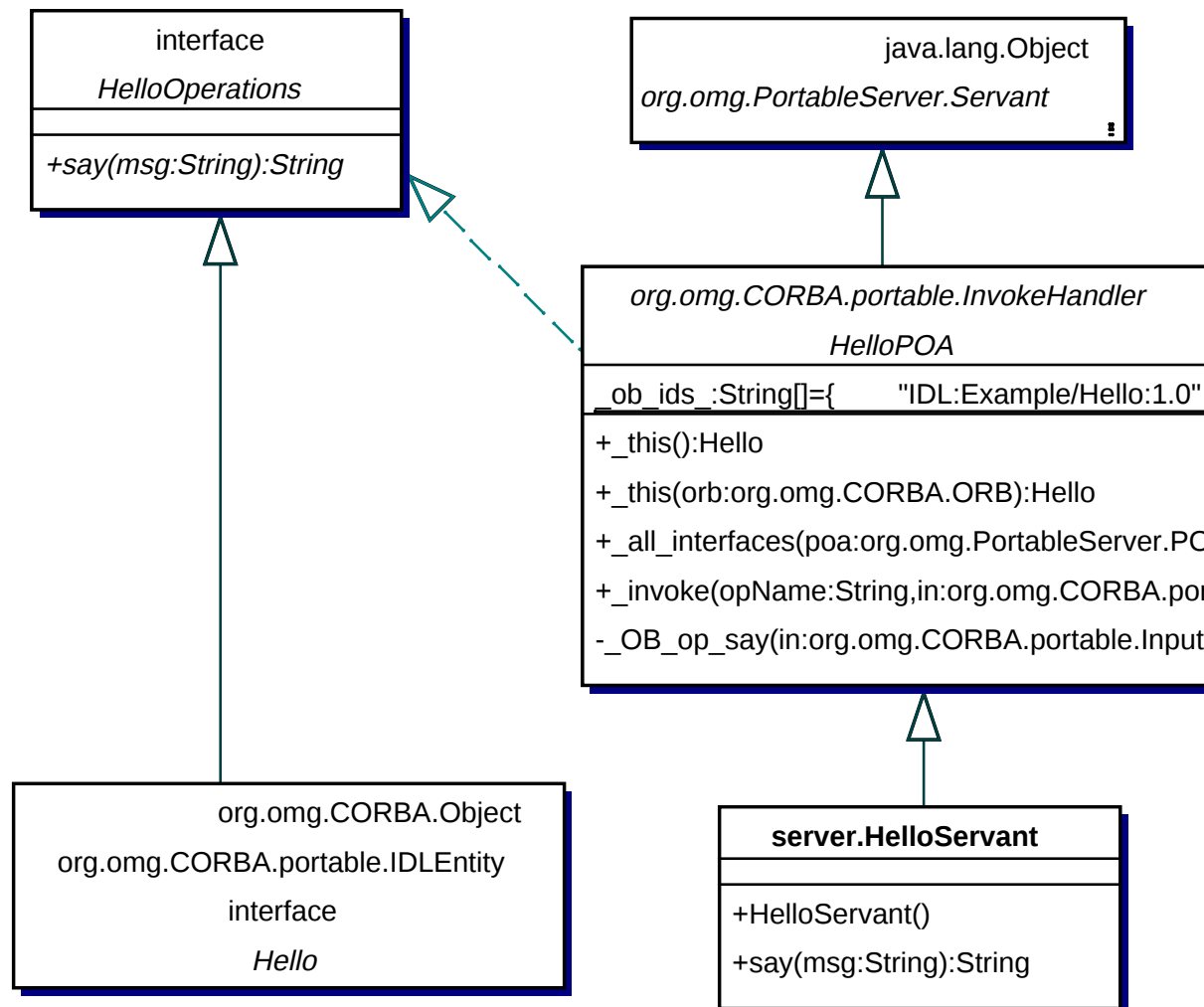
import generated.Example.*;

public class HelloServant extends HelloPOA {

    // Constructor
    public HelloServant() {
        super();
    }

    // Operation Example::Hello::say from IDL
    public String say( String msg ) {
        System.out.println( "say() called" );
        return "Hello" + msg;
    }
}
```

6 Hello World Server With Naming Service



6 Hello World Server With Naming Service

■ Server startup code

```
// server/HelloServer.java
import generated.Example.*;
import org.omg.CORBA.*;
import org.omg.CosNaming.*;
import org.omg.PortableServer.*;

public class HelloServer {
    public static void main( String[] args ) {
        try {
            // Initialize ORB
            ORB orb = ORB.init( args, null );

            // Get the RootPOA
            POA poa = POAHelper.narrow(
                orb.resolve_initial_references( "RootPOA" ) );
            // Activate the RootPOA
            poa.the_POAManager().activate();

            // Create the hello servant object
            HelloServant hServ = new HelloServant();
            // Activate the object
            Hello h = hServ._this( orb );
        }
    }
}
```

6 Hello World Server With Naming Service

■ Server startup code (cont.)

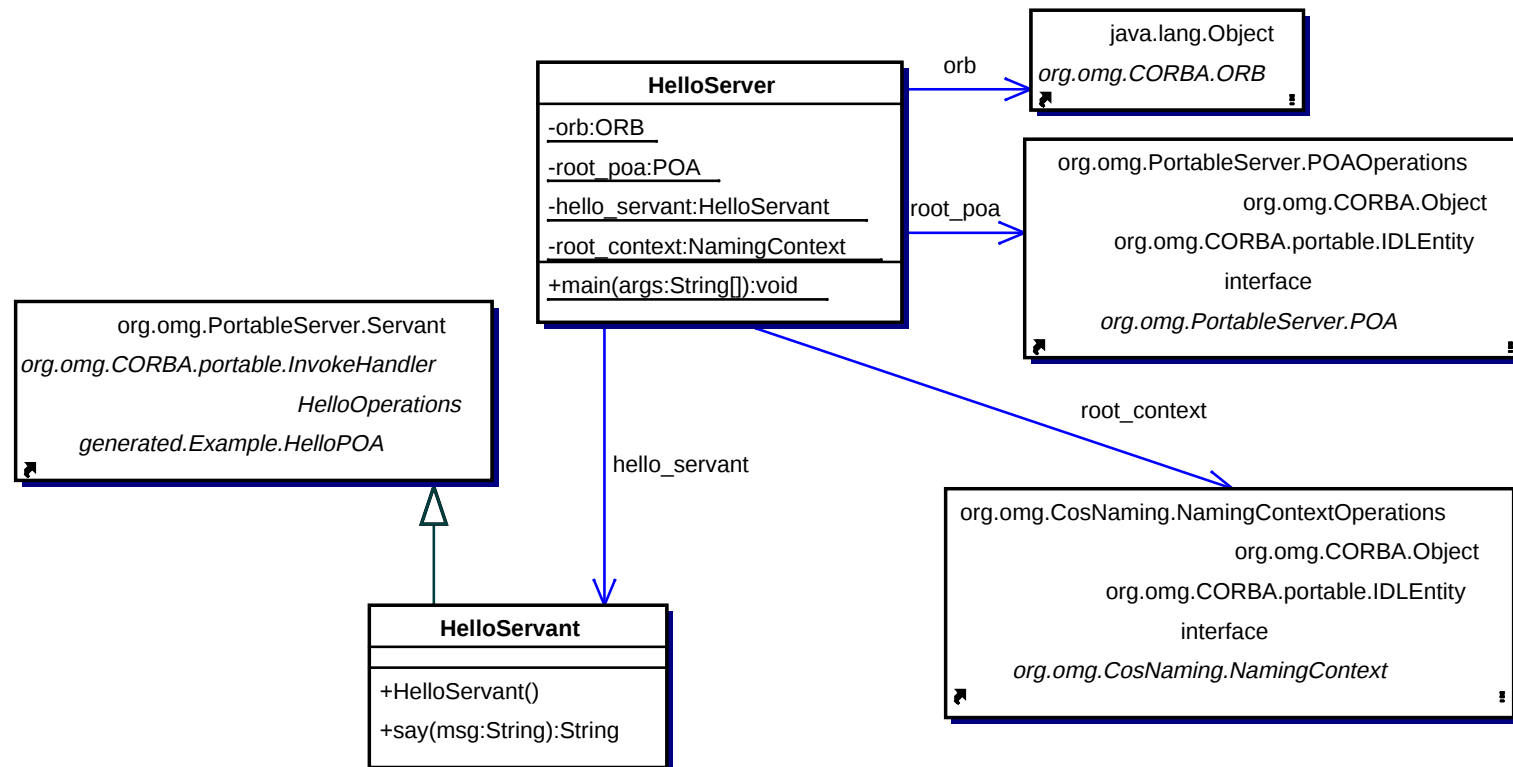
```

        // Get Name Service reference
        org.omg.CORBA.Object obj_root_context =
            orb.resolve_initial_references("NameService");
        // Narrow it to the NamingContext interface
        root_context = NamingContextHelper.narrow(
            obj_root_context );
        // Create a name as an array of NameComponents
        NameComponent name[] = new NameComponent[2];
        name[0] = new NameComponent("pub", "");
        name[1] = new NameComponent("Hello", "");
        // Register the Hello object
        root_context.rebind(name, hello);

        // Wait for requests
        System.out.println( "Hello server is ready" );
        orb.run();
    }
    catch(Throwable t) {
        t.printStackTrace();
    }
}

```

6 Hello World Server With Naming Service



6 Hello World Server With Naming Service

- Go to the example directory

```
> cd /proj/i4oods/pub/hello_java_server_nameservice
```

- Compile

```
> /local/ORBacus-4.0.3/bin/jidl --package generated
Hello.idl
> /local/java-1.3/bin/javac -classpath /local/ORBacus-4.0.3/
lib/OB.jar:/local/ORBacus-4.0.3/lib/OBNaming.jar:. server/
HelloServant.java server/HelloServer.java
```

- Run

```
> /local/java-1.3/bin/java -classpath /local/ORBacus-4.0.3/
lib/OB.jar:/local/ORBacus-4.0.3/lib/OBNaming.jar:.
-Dorg.omg.CORBA.ORBClass=com.ooc.CORBA.ORB
-Dorg.omg.CORBA.ORBSingletonClass=com.ooc.CORBA.ORBSingleto
n server>HelloServer -ORBInitRef
NameService=corbaloc::fau.i40u.informatik.uni-
erlangen.de:4711/NameService
```

7 Summary

- Initialize ORB
- Activate POA
- Instantiate Servant(s)
- Activate Servant(s)
- Register Servant(s) with Name Service
- Start ORB main loop