CORBA-III

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Cpt. S 464/564 Lecture

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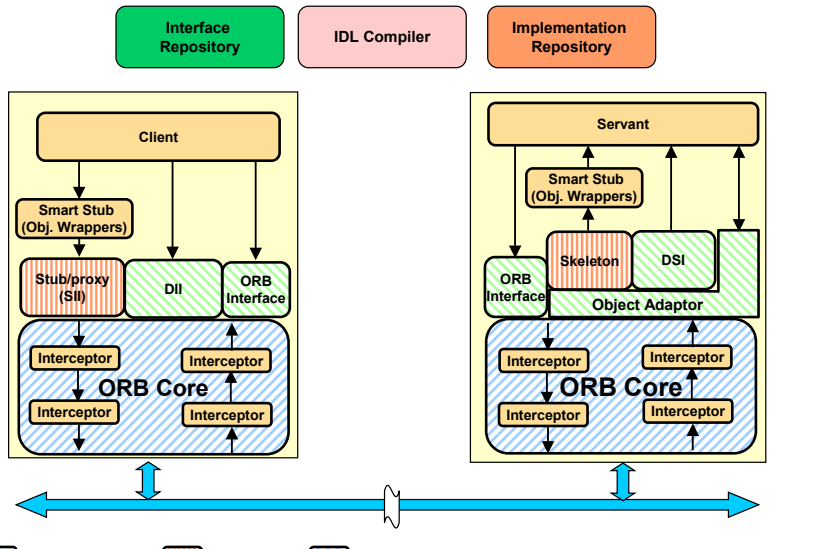
Outline

- Interceptors
- Smart Stubs ("Object Wrappers" in VisiBroker terminology)
- CORBA Interoperability and GIOP

CORBA Components and System Hooks



(This slide adapted from FTCS-29 Tutorial by Shalini Yajnik of Lucent Technologies)

Interceptors

- Used to plug in additional behavior into the ORB
  - Security
  - Transactions
  - Logging/tracing
- Interceptors give you a callback to your object, which implements a predefined interface
- Two kinds of interceptors
  - Client interceptors: on the client side
  - Server interceptors: on the server side

Kinds of Interceptors

- Q: what might each be used for?
- Client interceptors
  - BindInterceptor: called before and after a bind call goes over the network
  - ClientRequestInterceptor: called before a request goes on the net, and after a reply comes back
- Server interceptors
  - POALifeCycleInterceptor: called every time a POA is created
  - ActiveObjectLifeCycleInterceptor: called whenever an object is added to an Active Object Map
  - ServerRequestInterceptor: called when a request arrives at a server and the reply is being processed
  - IORCreationInterceptor: called whenever a POA creates an object reference
- ServiceResolverInterceptor: used to install a user service that you can dynamically load

Example #1: BindInterceptor Interface

```
public interface BindInterceptor {
    public IORValue bind(IORValue ior, org.omg.CORBA.object target,
                         boolean rebind, Closure closure);
    public IORValue bind_failed(IORValue ior,
                         org.omg.CORBA.object target, Closure closure);
    public void bind_succeeded(IORValue ior,
                         org.omg.CORBA.object target,  int Index,
                         InterceptorManagerControl control,
                         Closure closure);
    public void exception_occurred(IORValue ior,
                         org.omg.CORBA.object target,
                         org.omg.CORBA.Environment env,
                         Closure closure);
}
```


Example #2: ClientRequestInterceptor

```
public interface ClientRequestInterceptor {
    public void preinvoke_premarshal(org.omg.CORBA.Object target,
        String operation, ServiceContectListHolder service_context_holder,
        Closure closure);
    public void preinvoke_postmarshal(org.omg.CORBA.Object target,
        OutputStream payload, Closure closure);
    public void postinvoke(org.omg.CORBA.Object target,
        ServiceContext[] service_contexts,
        org.omg.CORBA.Environment env, Closure closure);
    public void exception_occurred(org.omg.CORBA.Object target,
        org.omg.CORBA.Environment env, Closure closure);
}
```


Final Notes on Interceptors

- We will use interceptors in Project #5….
- But lecture CORBA-IV will have to give more details on how to use… they involve implementing and registering factories and then interceptors
- For more info, see chapter in PROG and REF

Outline

- Interceptors
- **Smart Stubs ("Object Wrappers" in VisiBroker terminology)**
- CORBA Interoperability and GIOP

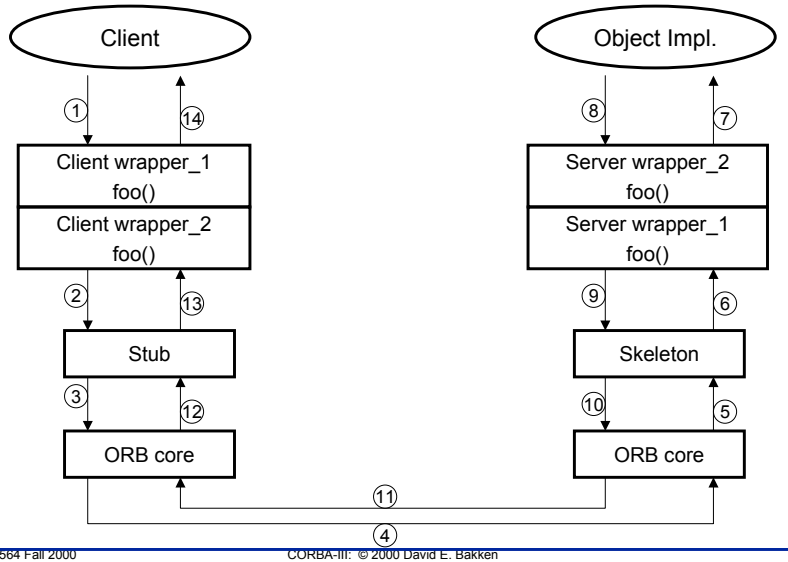
Object Wrappers in VisiBroker

- Object wrappers are a layer above the stub/proxy
- Can be used to implement
  - Logging/tracing
  - Caching (return a value quickly, without going over the network)
  - Timings
- Can be installed on
  - Client side
  - Server side
  - Both
- Can have multiple wrappers installed
- Note: if you stringify a reference to an object for which object wrappers are installed, these will not automatically be installed in another process…
- For more info, see chapter in PROG and REF

Kinds of Object Wrappers

- Typed object wrappers
  - Receives parameters that are passed to stub
  - Can return control to caller without invoking the next wrapper, or the stub, or the remote object
  - Will not be invoked for all operation requests for all objects
- Un-typed object wrappers
  - Does not receive parameters that are passed to stub
  - Can not return control to caller without invoking the next wrapper, or the stub, or the remote object
  - Will be invoked for all operation requests for all objects
- Typed object wrappers are good for
  - Caching
  - Object-specific adaptations
- Un-typed object wrappers are good for
  - Logging/tracing
  - Timing

Typed Wrappers and Chaining, calling foo()



Steps in Creating Typed Object Wrappers

1. Decide which interfaces you want to create a typed object wrapper for
2. Generate wrapper code by using the –obj_wrapper flag to the IDL compiler
3. Derive your typed object wrapper class from the class named <interface_name>ObjectWrapper, which was generated by the IDL compiler, then implement its methods
4. Modify your application to register the typed object wrapper

Sample Typed Object Wrapper

```
package BankWrappers;

public class CachingAccountObjectWrapper extends Bank.AccountObjectWrapper {
   private boolean _initialized = false;
   private float _balance;
   public float balance() {
    System.out.println("+ CachingAccountObjectWrapper: Before calling balance: ");
    try {
       if ( !_initialized ) {
          _balance = super.balance();
          _initialized = true;
        } else {
          System.out.println("+ CachingAccountObjectWrapper: Returning Cached value");
        }
       return _balance;
    }
    finally {
       System.out.println("+ CachingAccountObjectWrapper: After  calling balance:");
   }
  }
```


Registering a Typed Object Wrapper

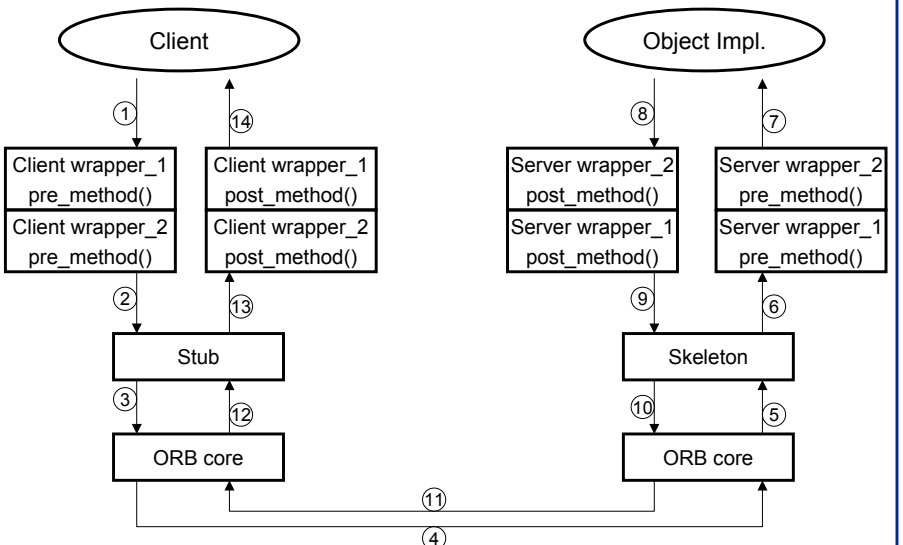
```
public class TypedClient {

  public static void main(String[] args) throws Exception {
    // Initialize the ORB.
    org.omg.CORBA.ORB orb = org.omg.CORBA.ORB.init(args,null);
    doMain (orb, args);
  }

  public static void doMain(org.omg.CORBA.ORB orb, String[] args) {
     // Add a typed object wrapper for Account objects
     Bank.AccountHelper.addClientObjectWrapperClass(orb,
           BankWrappers.CachingAccountObjectWrapper.class);
     // Locate an account manager.
     Bank.AccountManager manager =
        Bank.AccountManagerHelper.bind(orb, "BankManager");

    // use args[0] as the account name, or a default.
   ....
```


Un-typed Wrappers and Chaining



Steps in Using Un-typed Object Wrappers

(For Java; C++ similar)

1. Figure out which interfaces you want to use untyped wrappers with
2. Generate the code using the –obj_wrapper flag to the IDL compiler
3. Create an implementation for your un-typed object wrapper factory, which derives from UntypedObjectWrapperFactory class (in Java)
   - Has method create, called whenever
     - Client binds to an object
     - (Client?) invokes a method on an object
4. Create an implementation for your un-typed object wrapper, which derives from UntypedObjectWrapperClass
5. Modify client or server application to access the appropriate type of ChaiUntypedObjectWrapperFactory.
6. Modify your application to create your un-typed object wrapper factory
7. Use the ChainUntypedObjectWrapperFactory's add method to add your factory to the chain

Creating an Un-typed object wrapper factory

```
package UtilityObjectWrappers;

import com.inprise.vbroker.interceptor.*;

public class TimingUntypedObjectWrapperFactory implements
   UntypedObjectWrapperFactory {
   public UntypedObjectWrapper create(org.omg.CORBA.Object target,
         Location loc)
   {
         return new TimingUntypedObjectWrapper();
   }

}
```


Implementing an un-typed object wrapper

```
package UtilityObjectWrappers;
import com.inprise.vbroker.interceptor.*;

public class TimingUntypedObjectWrapper implements UntypedObjectWrapper {

 private long time;

 public void pre_method(String operation, org.omg.CORBA.Object target, Closure closure) {
   System.out.println("Timing: "
      + ((com.inprise.vbroker.CORBA.Object) target)._object_name() + "->" + operation + "()");
   time = System.currentTimeMillis();
 }
 public void post_method(String operation,  org.omg.CORBA.Object target,
                  org.omg.CORBA.Environment env,  Closure closure) {
   long diff = System.currentTimeMillis() - time;
   System.out.println("Timing: Time for call \t"
      + ((com.inprise.vbroker.CORBA.Object) target)._object_name()
      + "->" + operation + "() = " + diff + " ms.");
 }

}
```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- Interceptors
- Smart Stubs ("Object Wrappers" in VisiBroker terminology)
- **CORBA Interoperability and GIOP**

General Interoperability Protocol (GIOP)

Abstract protocol to allow for interoperability between different vendors' ORBs. To do this, it defines:

- Interoperable Object Reference (IOR) format (see CORBA-II).
- Inter-ORB message formats

1. 1. `Request`: from client, sending an invocation. Contains
   - `GIOP.MessageHeader`
   - `GIOP.RequestHeader`
   - `GIOP.RequestBody`
- 2. `Reply`: from server, responding to Request.
- 3. `CancelRequest`: from client, telling it to ignore a Request already sent.
- 4. `LocateRequest`: from client, to find out if a server can service a particular request, or if it has a forwarding IOR to the actual server implementation.
- 5. `LocateReply`: from server, in response to `LocateRequest`.
- 6. `CloseConnection`: from server, indicating it is closing the connection.
- 7. `MessageError`: by both…

- Wire protocol (data transfer syntax): Common Data Representation (CDR). A coding for all IDL types, structured types, exceptions, object references. Covers coding into an octet stream, alignment boundaries, how to indicate byte ordering used.

Example of GIOP Format

```
module GIOP {
    enum MsgType {Request, Reply, CancelRequest, LocateRequest,
          LocateReply, CloseConnection, MessageError};
    struct MessageHeader {
          char magic[4];
          Version GIOP_version;
          octet byte_order;
          octet message_type;
          unsigned long message_size;
    };
    struct RequestHeader {
          IIOP::ServiceContextList service_context;
          unsigned long request_id;
          boolean response_requested;
          sequence<octet> object_key;
          string operation;
          Principal requesting_principal;
    }
    …
```


GIOP Transport Layer Assumptions

- Connection-oriented
  - I.e., transport management deals with opening and closing and using connections
- Connections are like
  - Two roles
    - Clients: open connections to servers
    - Servers: listen for connections
  - Clients and servers may only send a subset of the message types
  - Can be closed in an orderly fashion, or abortive close (both clearly defined)

IIOP

- IIOP is simply GIOP (an abstract protocol, remember) implemented over TCP/IP
- Must be implemented by every ORB
  - Gives a universal way for ORBs to communication
  - A given ORB may implement different transports underneath GIOP, also
- CommunicationID = {IP address, port}