CORBA
Common Object Request Broker Architecture

Based partially on Notes by D. Hollinger and Java Network Programming and Distributed Computing Chapter 12

Review of some benefits of Java RMI

- A network of heterogeneous machines is seen as a homogeneous network of Java virtual machines.
- Transparency of access to remote objects: remote method invocation looks like local method invocation, modulo exception handling.

CORBA

- The notion of having objects distributed across the network has been around for a while.
- The Object Management Group (OMG) was formed in 1989 to create a set of standards that would facilitate the development of distributed object-oriented applications.

Buzzword Warning

- CORBA is a rich source of acronyms and buzzwords.
- OMG is now the largest standards body that has ever existed (on this planet).
- First buzzword: *Middleware - software that hides the details of network programming from programmers, so they can worry about the application.* CORBA is middleware.

Important message from our sponsor

IDL does not provide a complete definition of OMA, nor does it facilitate the use of DII in conjunction with an ORB. Only with the aid of a BOA or alternative OAs as described in the RFPs and RFIs will it be possible to make use of any IIOP compliant system.

Object Management Group

- OMG creates specifications, not implementations.
- Some Key Specifications:
  - OMA: Object Management Architecture.
  - CORBA: Common Object Request Broker Architecture.

OMA Object Model

- Objects provide services.
- Clients makes a request to an object for a service.
- Client doesn’t need to know where the object is, or anything about how the object is implemented!
- Object interface must be known (public) - provides signature for each object method.

Object References

- Clients don't *have* objects, they just have object references.
- Object references can be persistent (saved for use later).

Accessing Remote Methods

- Clients can call remote methods in 2 ways:
  - Static Invocation: using stubs built at compile time.
  - Dynamic Invocation: actual method call is created on the fly. It is possible for a client to discover new objects at run time and access the object methods.

Interface Definition Language

- IDL is the language used to describe object interfaces, the same as Java interfaces in RMI.
- IDL is a declarative language, it only describes object interfaces.
- IDL is language neutral - there are mappings for many object oriented languages (C++, Smalltalk, Java).

Inheritance

- IDL supports interface inheritance
  - all operations are effectively virtual.
- IDL doesn’t say anything about implementation!

Interface Repository

- An IR provides persistent storage of IDL interface declarations.
- IR serves 2 purposes:
  - tool for programmers. Basically a database of object interfaces and inheritance hierarchy.
  - Support dynamic invocation interface (DII).

Object Adapters

- Object Adapters provide a layer between object method requests and the servers that service the requests. Functions include:
  - generation of object references
  - starting up the actual server program(s)
  - handling security

Basic Object Adapter

- Simplest object adapter, can support a number of different implementations:
  - one server that always is running
  - one program that can handle requests for multiple objects.
  - one program per object implementation.
  - one program for each object method.

Portable Object Adapter

- POA newer than BOA.
- Supports additional services:
  - Persistent objects.
  - Threads.

- So far there is no TOA, ZOA or OOA

Object Request Broker

- The ORB is an abstract entity that acts as the middleman in all remote method invocations.
- The ORB finds a server that can handle a method invocation, passes the request to the server, receives the response and forwards it to the client.
- The functions handled by an ORB are actually *implemented* in both client and server.

A Description of The ORB

http://www.omg.org/corba/whatiscorba.html

"The (ORB) is the middleware that establishes the client-server relationships between objects. Using an ORB, client can transparently invoke a method on a server object, which can be on the same machine or across a network."

A Picture from OMG

www.omg.org/gettingstarted/corbafaq.htm

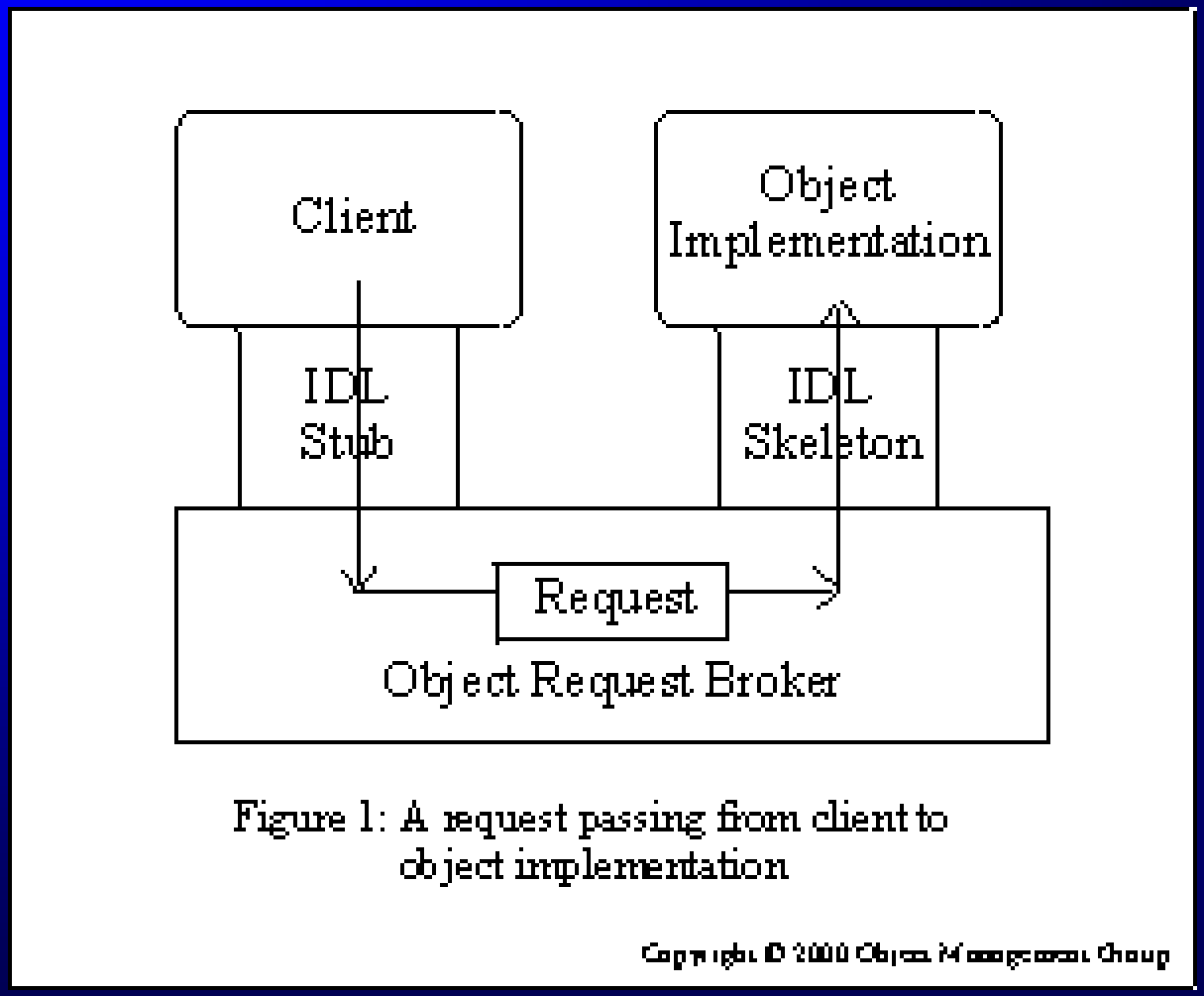


Figure 1: A request passing from client to object implementation

ORB Differences

- The Specification of the functionality of an ORB is not a complete implementation description.
- Many of the details are left up to the implementor.
- Every Vendor does things differently.
- You write code to work with a specific ORB.

Inter-ORB Protocol

- There is support for connecting ORBs.
- The most significant support is the Internet Inter-Orb Protocol (IIOP)
  - Specifies the details of communication (bridging) between ORBs.

Multiple ORB Picture

www.omg.org/gettingstarted/corbafaq.htm

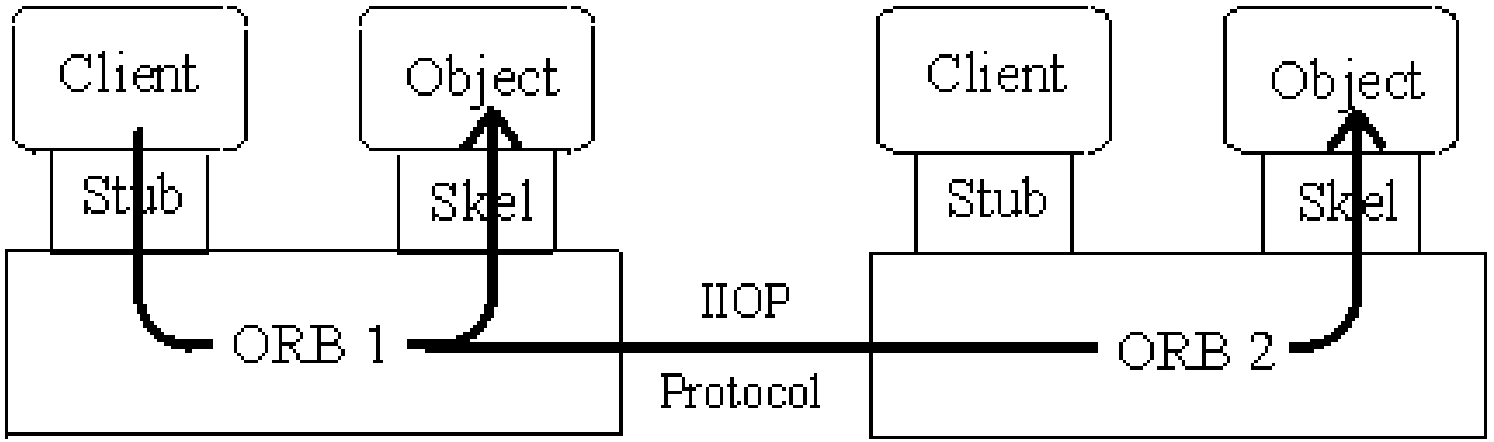


Figure 2: Interoperability uses ORB-to-ORB communication

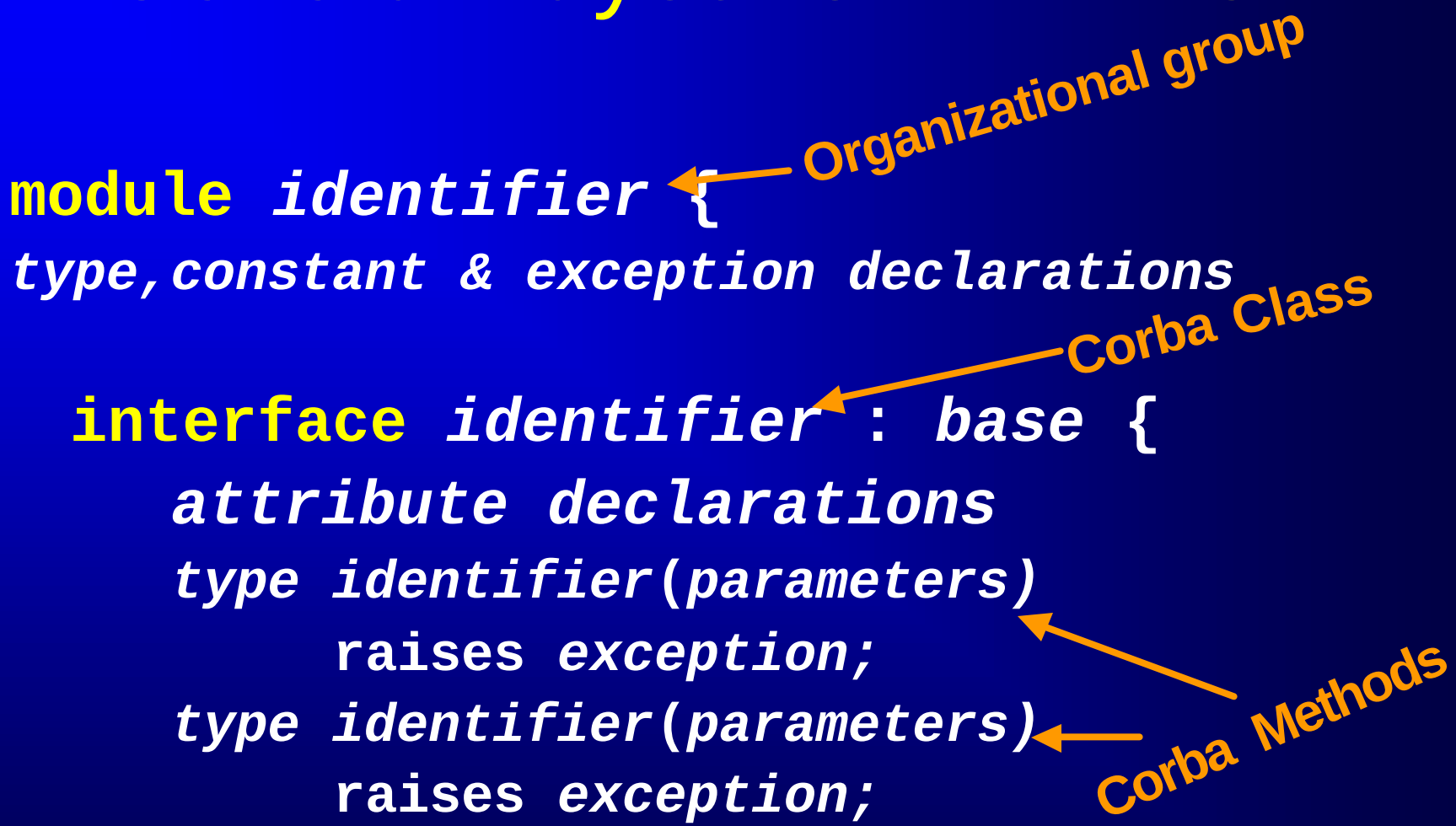
Call Semantics

(part of Corba Object Model - *1.2.8.5 Execution Semantics*)

"Two styles of execution semantics are defined by the object model:

- At-most-once: if an operation request returns successfully, it was performed exactly once; if it returns an exception indication, it was performed at-most-once.
- Best-effort: a best-effort operation is a request-only operation (i.e., it cannot return any results and the requester never synchronizes with the completion, if any, of the request)."

General Layout of IDL File




```
module identifier {
type,constant & exception declarations

  interface identifier : base {
     attribute declarations
     type identifier(parameters)
          raises exception;
     type identifier(parameters)
          raises exception;
     …
}
```

Sample IDL

(from Essential Dist. Object Survival Guide)

```
module MyAnimals {
   interface Dog:Pet,Animal {
       attribute integer age;
       exception NotInterested(string explanation);
       void Bark(in short how_long)
             raises(NotInterested);
       void Sit(in string where)
             raises(NotInterested);
   }
   interface Cat:Animal {
       void Eat();
   }
}
```

IDL for Bank Account Example

```
interface bank_account {
 exception overdrawn_exception {};
 void deposit(in float amount);
 void withdraw(in float amount)
     raises (overdrawn_exception);
 float balance();
};
```

Java Mapping to IDL Datatypes

- Void
- Boolean
- Char
- Byte
- Short
- Int
- Long
- Float
- Double
- java.lang.String

- void
- boolean
- wchar
- octet
- short
- long
- long long
- float
- double
- string / wstring

Parameter passing in IDL

- Parameters to a method can be declared of three different types:

`in`	Used for input only
`out`	Contents may be modified
`inout`	May be used for input and may also be modified

IDL Exception Handling

- It is still possible to define different exception types.
- However, there is no class hierarchy of exceptions like in Java.
- So, it is not possible to catch a related subset of possible exceptions within a single `catch(NetworkException ne)`.

A “feature”?

A Running Example: An Address Book Service

- Recording and looking up people by their names and emails.
- Language-neutral IDL interface definition
  - An `address_book_system` module with a single `address_book` interface.
- Servant, server, and client implementations in Java, using and extending code generated by `idlj –fall foo.idl` command.
- Example taken from:

  http://www.javacoffeebreak.com/articles/javaidl/javaidl.html