Architecture of the CORBA Component Model

CORBA 3.0

What is CORBA

CORBA (Common Request Broker Architecture) is a
distributed object-oriented client server platform.
It provides:

- An object oriented remote procedure call mechanism (RPC)
- Object Services (Naming, Trading)
- Language mappings
- Interoperability protocols
- Programming conventions and design patterns

CORBA replaces ad-hoc special mechanisms (e.g. socket communication) with an open, standardized and portable platform.

The Object Management Group (OMG)

- Founded 1989, Head-quarters in Framingham, MA
- 2004: 520 members
- CORBA: Common Request Broker Architecture
  - CORBA 1.0 (1991): Object Request Broker, IDL, C
  - CORBA 2.0 (1995): Interoperability, C++, ...
  - CORBA 3.0 (2002): Components, Scripting, Real-Time
  - Domain Specifications
- UML: Unified Modeling Language

OMG Task Forces

- Board of Directors, Architecture Board, Platform Technical Committee, Domain Technical Committee
- PTC Task Forces:
  - Object Request Broker/Object Services (orbos)
  - Analysis and Design (ad)
- DTC Task Forces:
  - Business Objects (bodtf)
  - Electronic Commerce (ec)
  - Finance
  - Health Care
  - Life Sciences Research
  - Manufacturing (mfg)
  - Telecommunications
  - Transportation
  - Utilities
- Special Interest Groups:
  - Benchmarking
  - Realtime
  - Japan
  - Security
  - Distributed Simulation
  - C4I
  - ...

What is Client-Server-Computing?

- A group of clients and servers cooperate in solving a problem
- Servers are passive participants, providing a service, and waiting for requests from clients
- Clients are active participants, requesting a service from the server.
- Clients and servers run (typically) as operating system processes on different computers
- Object-oriented client-server computing adds OO aspects: interfaces, messages, inheritance, polymorphism.

Advantages and disadvantages of CORBA

Advantages:

- Implementations based on vendor-independent and open standards, available on a multitude of hardware platforms, operating systems, and programming languages
- Disencumbers of the slavish tasks in distributed computing

Disadvantages:

- No reference implementation
- Defined by consensus and compromise
- Not perfect
- „can shoot yourself in the foot and blow the whole leg off“

Heterogeneity

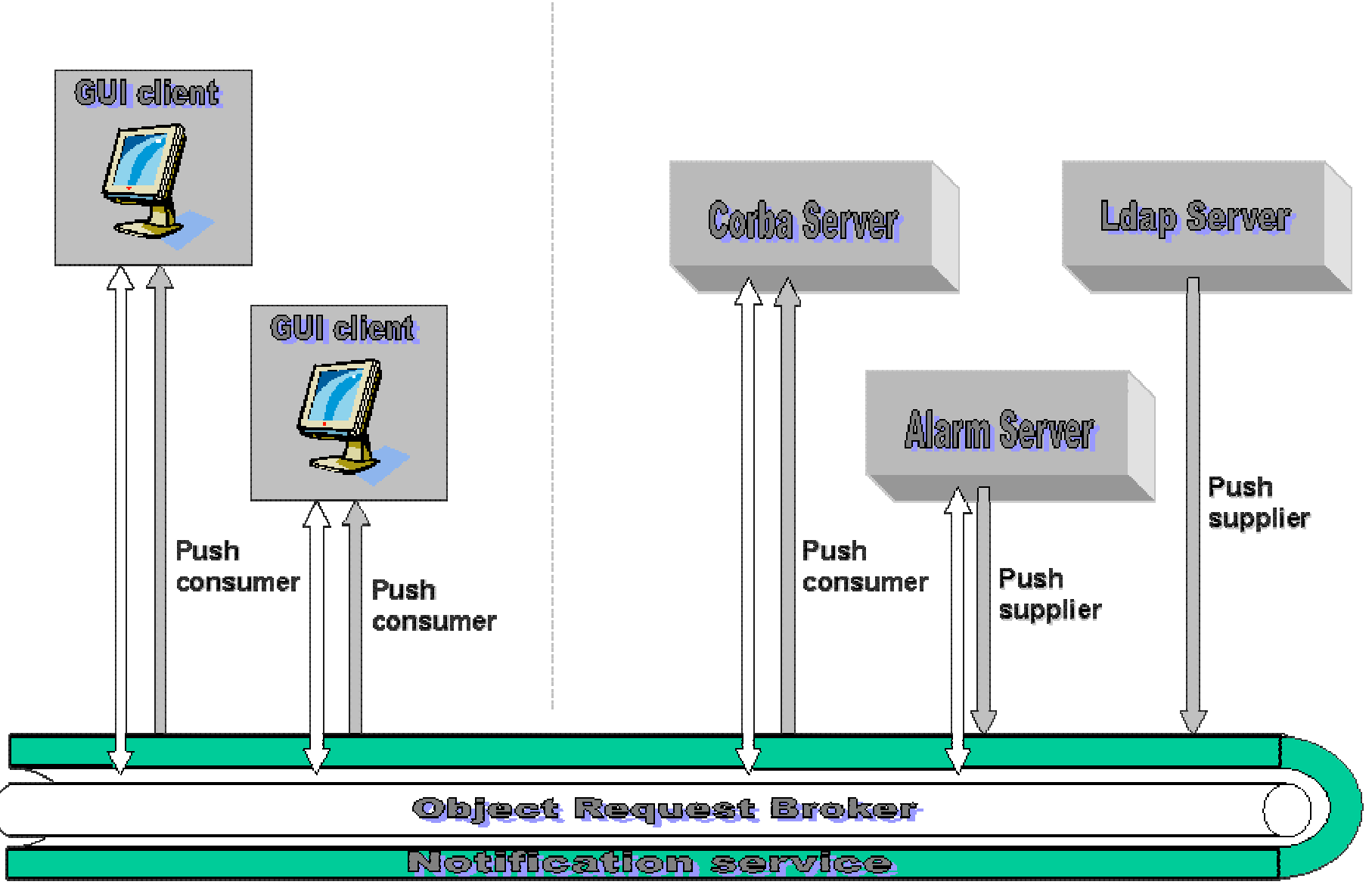
CORBA works for homogenous and heterogeneous environments. Characteristics of heterogeneous environments are:

- Language transparency
- Location transparency
- Service transparency
- Implementation transparency
- Architecture transparency
- Operating system transparency
- (Protocol transparency)
- (Transport transparency)

Examples (1)

Alcatel OmniVista

- Private Branch Exchange (PBX) Network Management
- Usage of the Notification Service
  - Distribution of alarms
  - Notification about changes in the LDAP repository

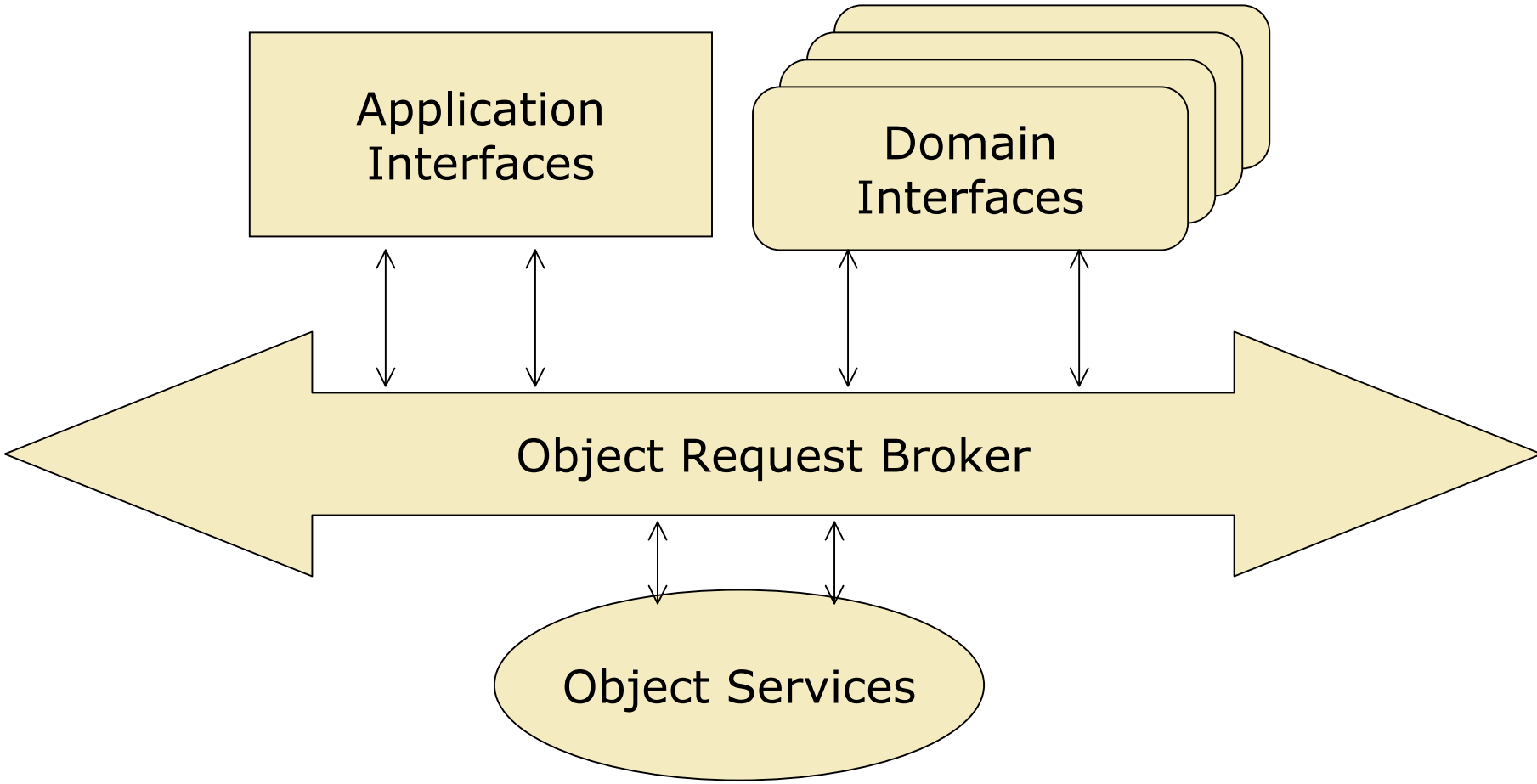

GUI client
GUI client
Corba Server
Ldap Server
Alarm Server
Push consumer
Push consumer
Push consumer
Push supplier
Push supplier
Object Request Broker
Notification service

Examples (2)

Nokia Intelligent Network

- Intelligent Network: special services, provided by network or customer
  - 0130/0180/0190
  - televoting
  - number portability
- Nokia: Service development using CORBA

Object Management Architecture (OMA)



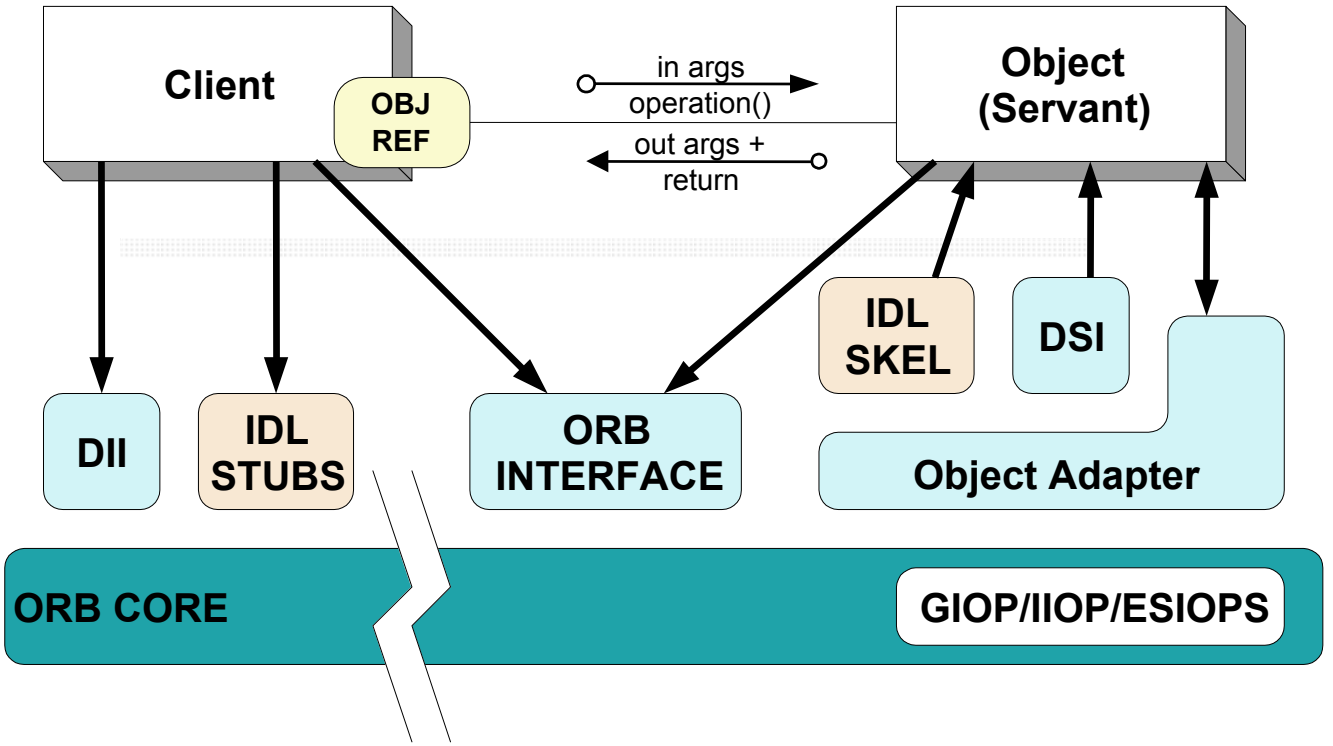
Objects

- Object: encapsulated entity with immutable specific identity, interacts only through well-specified interfaces
- CORBA object $\neq$ Java object (language-specific object)
  - A single Java object can implement multiple CORBA objects
  - A CORBA object can successively be implemented (incarnated) through multiple Java objects
  - Most simple case: one-to-one relationship between CORBA objects and Java objects (servants)

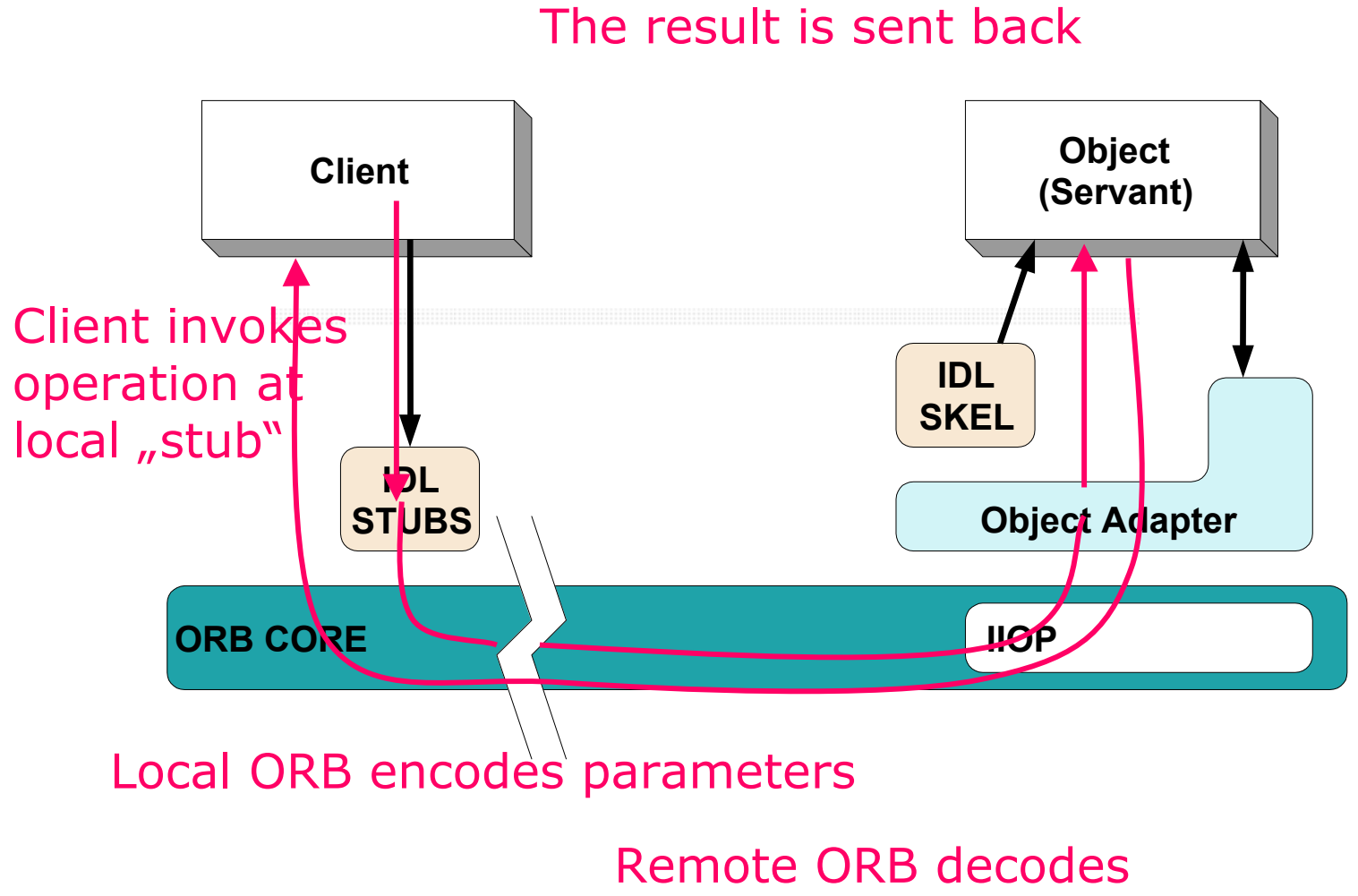
Interfaces

- Interface: Set of operations
  - Object services: Interfaces required in many applications independently from application domain
    - Horizontal services, infrastructure services
  - Domain interfaces: standardized interfaces for services specific to an application area
    - Vertical services
  - Application interfaces: specific for the application, not standardized
- Interfaces are defined using IDL (Interface Definition Language)

ORB: Object Request Broker



Method Call


The result is sent back
Client
Object
(Servant)
Client invokes
operation at
local „stub“
IDL
SKEL
IDL
STUBS
Object Adapter
ORB CORE
IIOP
Local ORB encodes parameters
Remote ORB decodes

Method call: Control flow

Client sends a request:

- Client ORB analyses object reference
- Connects to server if necessary
- Sends request: (target object, operation name, parameters)

ORB receives request:

- Activates server (if no server active)
- Activates target servant (if no servant active)
- Invokes method, waits for completion
- Sends reply (if required)

Method semantics:

- At-most-once: exception in case of error
- Best effort (*oneway*)

Interoperability

- CDR: Common Data Representation
- GIOP: General Inter-ORB Protocol
- IIOP: Internet Inter-ORB Protocol
- Alternative protocols:
  - ESIOP: Environment-specific Inter-ORB protocols
    - DCE-CIOP
  - SCCP (Signaling Control Part) IOP
  - Pluggable Protocols

Object references

- Every reference identifies exactly one object
- Different references may refer to the same object
- References may be „nil“
- References may become invalid (*dangle*): The object referred-to has already disappeared
- References are opaque
  - Note: „Interoperable Object References“ (IOR)
- References are strongly typed.
- References allow late binding.
- References may be persistent.

Object services

- Naming Service (CosNaming)
- Trader (CosTrading)
- Property Service (CosPropertyService)
- Event Service (CosEventComm, CosEventChannelAdmin)
- Notification Service (CosNotification)
- ...
- (Transactions)
- (Persistency) (PSS: Persistent State Service)