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Training

ORB Engineering (Intro to ANSA)

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Abstract

The business problem addressed is...

The technical problem created by that business problem is ...

The solution being offered is....

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Briefing Note

Distribution:
Supersedes:
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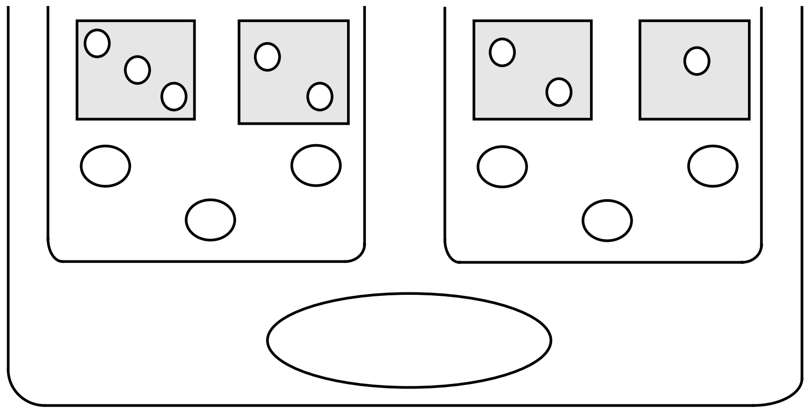
Object Request Broker (ORB) Infrastructure Engineering



In this session

- *Examine the roles of the elements of an ORB infrastructure*
- *Explain the various types of transparency mechanisms*
-

Engineering is concerned with trade-offs

- ***For example***
  - **flexibility versus performance**
  - **time versus space**
  - **... and many others**
- ***Using many of these trade-offs requires access to the ORB infrastructure***
  - **but some trade-offs can be done entirely within applications**

An application trade-off - object placement

- *Place objects in the same object implementation (process)*
  - for efficiency of communications
  - for efficiency by exploiting shared state
- *Place objects in different object implementations*
  - for robustness
  - for security
  - for flexibility of configuration
  - to avoid competing for same resources

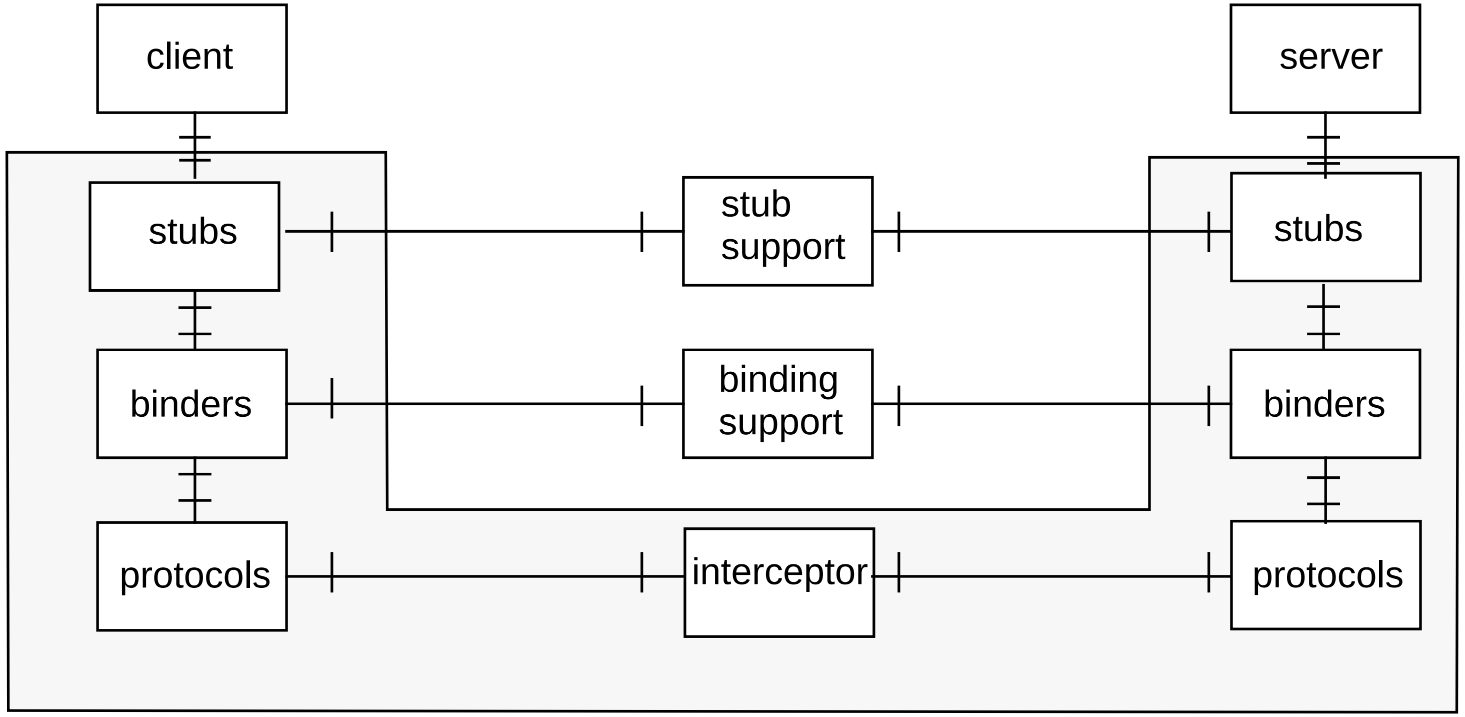
Object Implementations and Interfaces

- ***Objects in the same object implementation can still invoke each other's operations***
  - **you are not compelled to exploit shared state**
- ***Operations are invoked in the same way...***
  - **within a object implementation**
  - **between two object implementations on the same node**
  - **between two nodes**
- ***...the infrastructure should optimize communications between objects on the same node***

A general model for channels

- *Channels are communication paths between objects*
- *Channels may be:*
  - 1 to 1 (point-to-point)
  - 1 to many (point-to-multipoint: not yet supported by CORBA)
- *Channels may be*
  - operational
  - stream (not yet supported by CORBA)
- *Channels are layered*
  - built from *stubs*, *binders*, and *protocol objects*
  - there may be multiple protocols in a particular infrastructure...
  - ...layering hides the diversity from the application

Point-to-Point Client-Server Channel



Stubs, Binders, and Protocol Objects

- *Stubs provide data conversion*
  - for example, the GIOP CDR
- *Binders manage end-to-end integrity and quality-of-service*
- *Protocol objects provide communication*
- *... Most application developers will only be aware of stubs*
  - and even these will probably be generated automatically
- *Stubs should be independent of binders and protocols*

Stubs

- *Typically, there will be one stub per interface*
  - with separate code for each operation
- *Careful design of the stub code is necessary to avoid large amounts of code being generated*
- *Stubs marshal the invocation parameters in and out of a (linear) buffer*
- *Important optimizations include*
  - not copying the data more than once
  - using out-of-line marshalling (to share marshalling functions between stubs)
- *Stubs must be careful with garbage-collection*

Binding

- ***Binders establish end-to-end connections***
- ***Binding may be either implicit or explicit***
- ***Binding is usually implicit for operational interfaces***
  - **explicit binding may be helpful if you need precise control over resource allocation, and when allocation takes place**
- ***Binding is explicit for streams***

Objectives for the engineering infrastructure

- *Do not allocate resources that are never used*
- *Allocate resources as late as possible*
- *Share resources as much as possible*
- *Release resources as early as possible*
- *Match the distribution of resources to the scale of the demand*

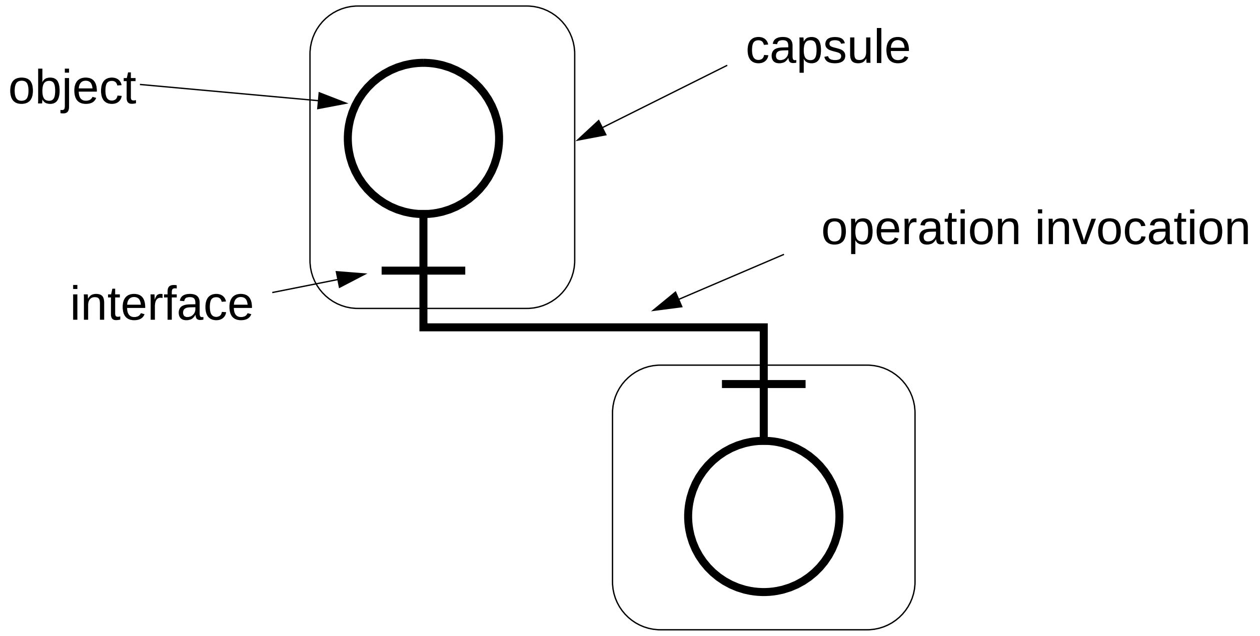
Quality-of-service considerations may constrain them

Transparencies - Simplifying distribution

- ***Remember that in a distributed system, traditional design assumptions must be reversed***
  - **for example, mobility: objects do not stay in one place, they can migrate**
- ***Must isolate the specification of transparencies from their design***

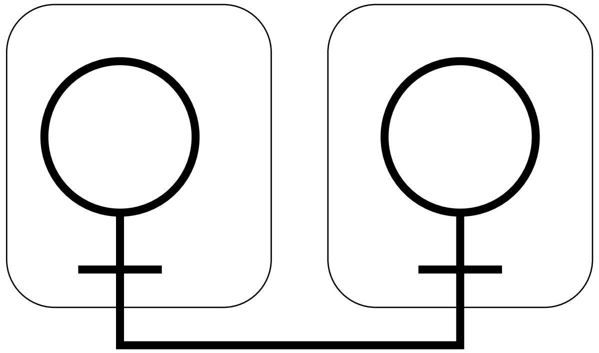
Transparency examples

- *In these examples the diagrams are slightly simplified*
- *This shows an object invoking an operation from another capsule*



Selective Transparency Engineering - Location

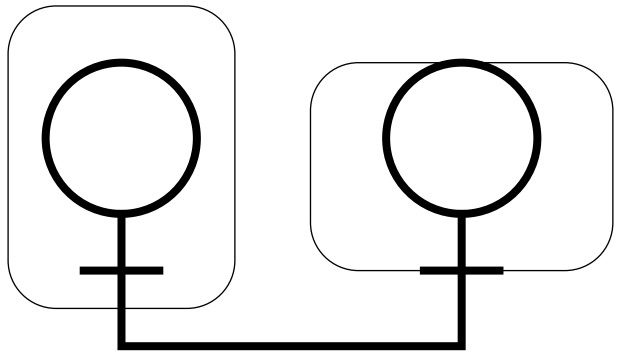
- *Location Transparency*
  - application need not know where object is to use it



  - objects may be in the same capsule, different capsules, or different nodes

Selective Transparency Engineering - Access

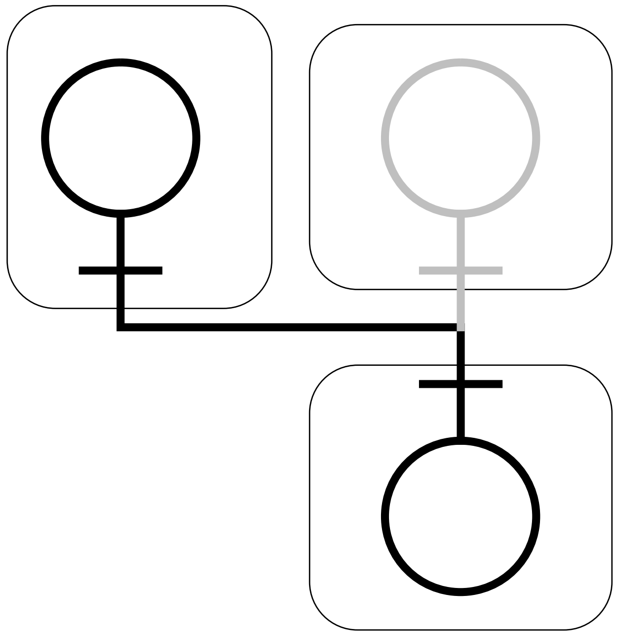
- ***Access Transparency***
  - application need not know the type of machine where the object is executing



  - objects may be in capsules on different operating systems, on different processor types (mainframe, workstation, or PC),...

Selective Transparency Engineering - Migration

- *Migration Transparency*
  - application need not know where the object has moved to

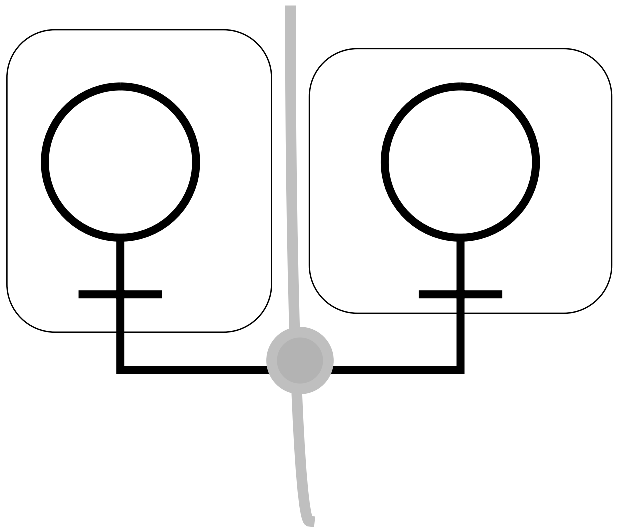


Migration Transparency

- ***Object migration needed:***
  - **when a node fails, and its capsules have to be moved to another node**
  - **for load-balancing between capsules**
- ***Like a stronger form of location transparency***
  - **relies on location transparency mechanism**

Selective Transparency Engineering - Federation

- ***Federation Transparency***
  - application need not know where administration boundaries are



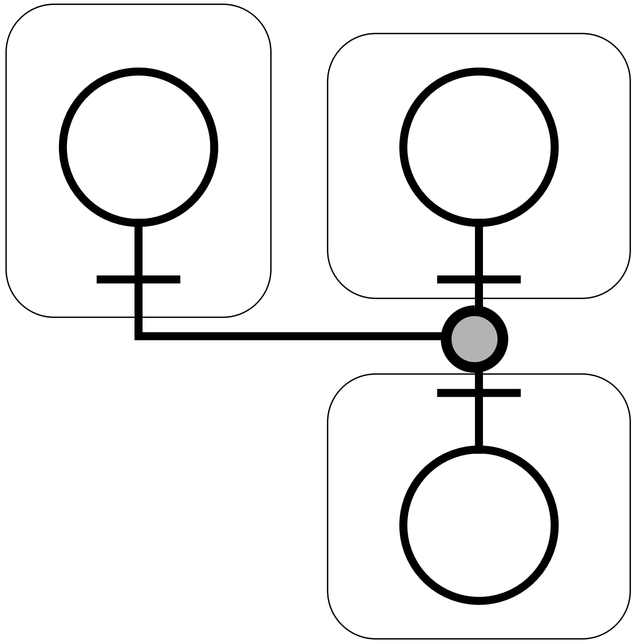
  - interception may happen at the boundary, but this is not visible to the application

Federation Transparency

- ***Federation is an Enterprise issue***
  - **there are many different kinds of federation boundaries: administration, organizational, contractual, and so on**
  - **constructing the transparency requires Enterprise knowledge**
- ***Federation is an ANSA research area***
  - **how it relates to trading**
  - **part of ANSA Phase III**

Selective Transparency Engineering - Replication

- *Replication Transparency*
  - application need not know how many copies



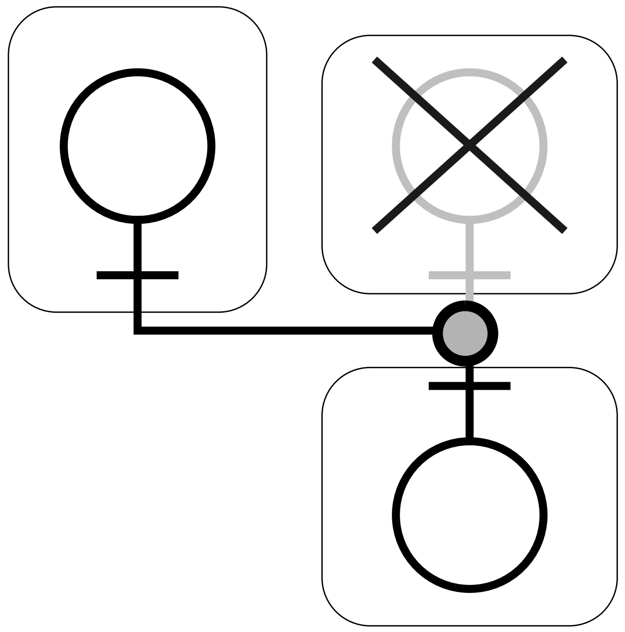
  - application only sees a single interface

Replication Transparency

- *Server objects are members of a group*
- *Replication transparency uses special mechanisms to make sure the group members are consistent*
  - for instance, it may use multi-point channels and special protocols
- *Implementing replication transparency efficiently is difficult*
  - it may need information from the application
  - it is under active research in the distributed systems community

Selective Transparency Engineering - Failure

- *Failure Transparency*
  - application need not know when an object fails

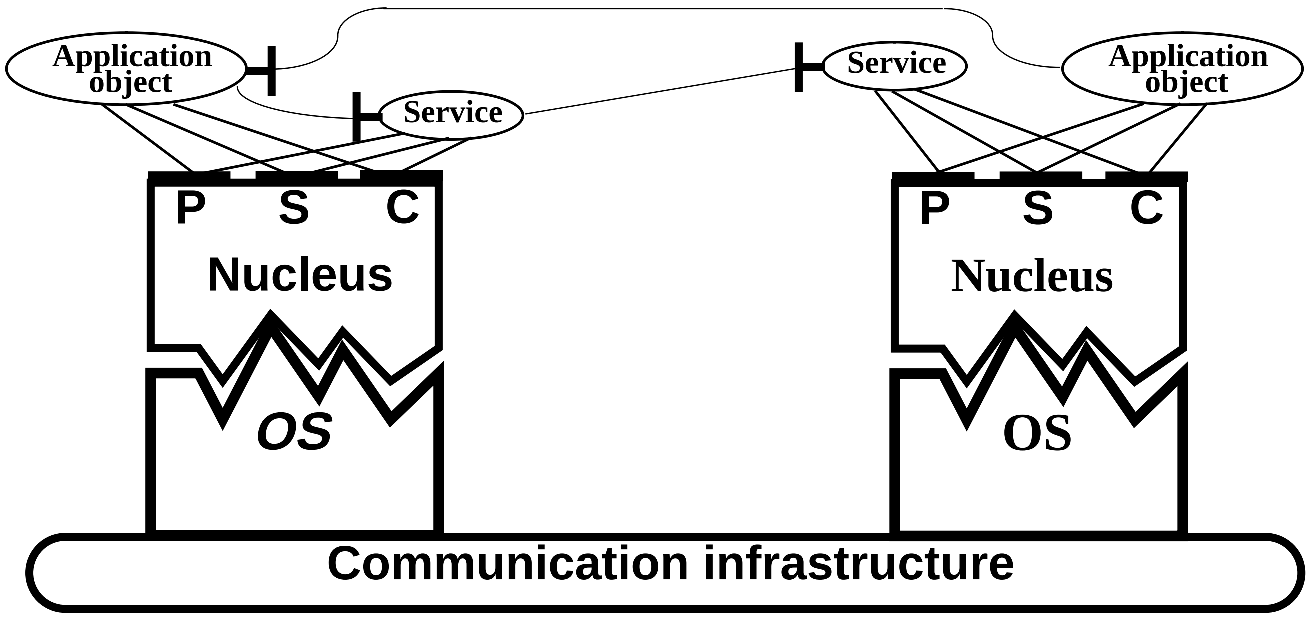


  - may use replication transparency to achieve this

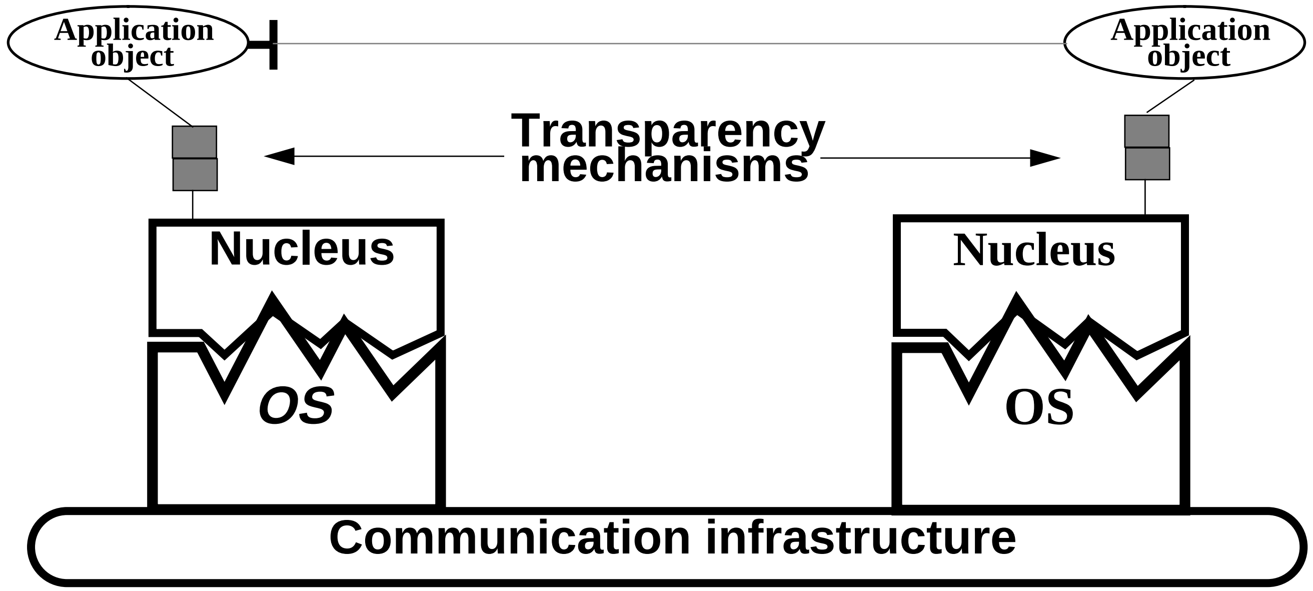
Other transparencies

- ***Security***
  - **application need not be aware of security policy**
- ***Concurrency***
  - **application need not be aware of other concurrent operations**
- ***Transaction***
  - **applications need not be aware of inconsistent states**
  -

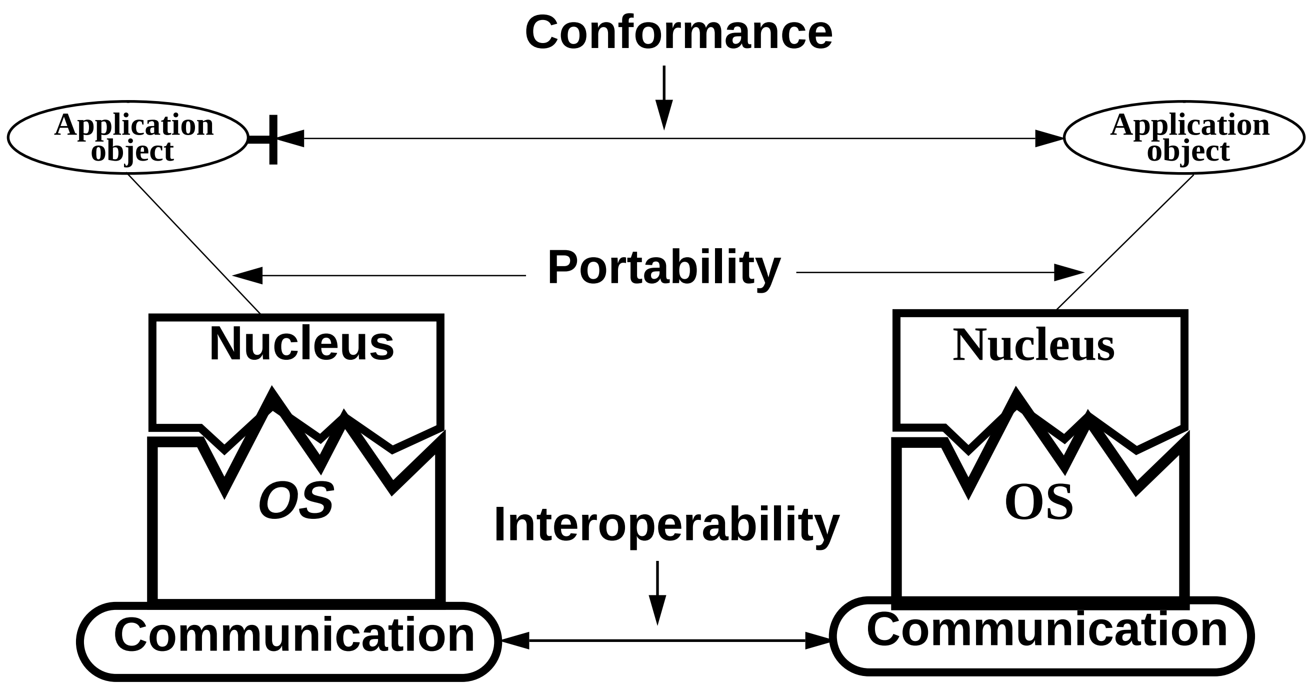
An engineering view of an ORB



ORBs and transparencies



Conformance, Portability and Interoperability



Summary

- *The ORB provides objects with the ability to communicate with each other*
- *Transparencies are aimed at hiding the complexity of distribution*
- *Application portability and interoperability are key issues for future systems*
- *To find out more: OMG CORBA, various ANSA/APM papers*