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Training

EPFL Course September 95: Architecture for ODP, Part 2

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Abstract

This presentation is based on APM.1330.02 “ANSAwise - Trading and Federation”.

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Briefing Note

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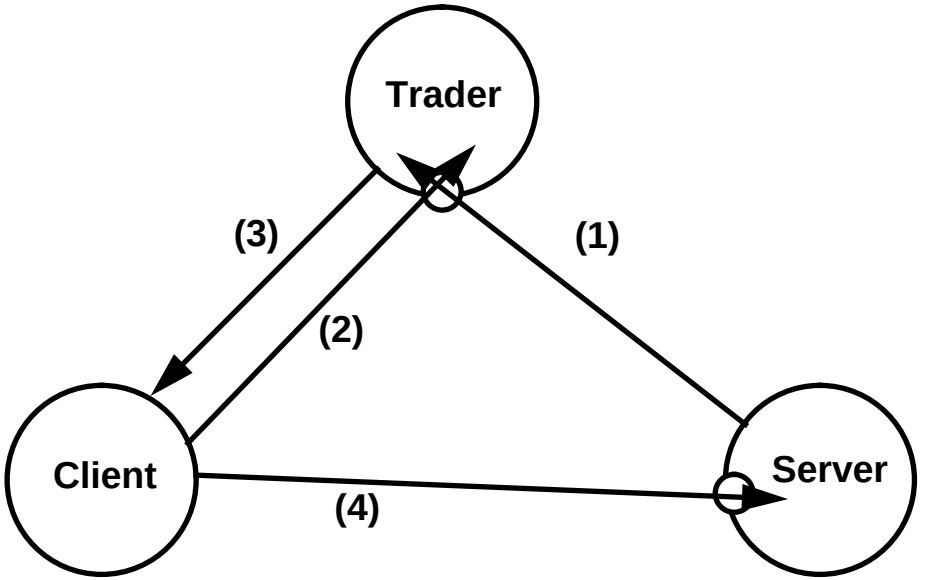
ODP Architecture II: Trading and Federation

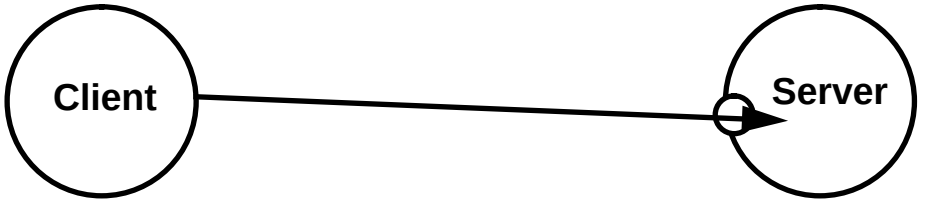


In this session

- *Explain the purpose of trading in a distributed system*
  - the roles of client, server, and trader
- *Show a simple form of trading in action*
- *Explain the significance of federation*
- *Explain federated trading*

Client and Server are Roles, not Types of Machine

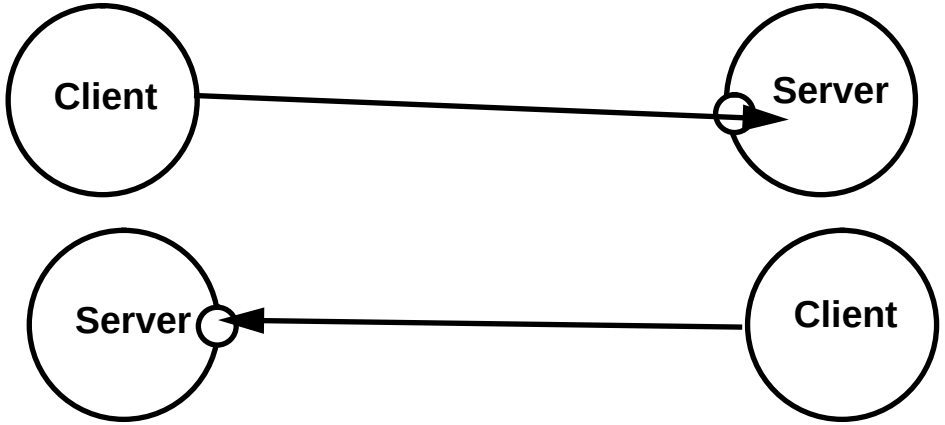
- *We use the terms client and server in a particular sense...*
- *... Client and Server are roles in a specific interaction between objects*

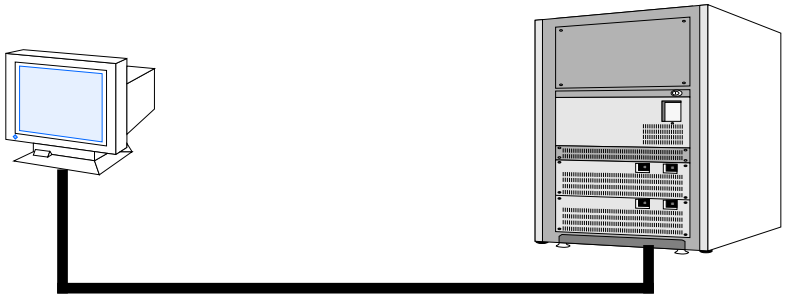


- *Nothing is implied about the technology that supports them*
  - the client could be a mainframe...
  - ...the server could be a PC
  - ... they could both be on the same Unix machine
- *Technology is not part of the Computational Model*

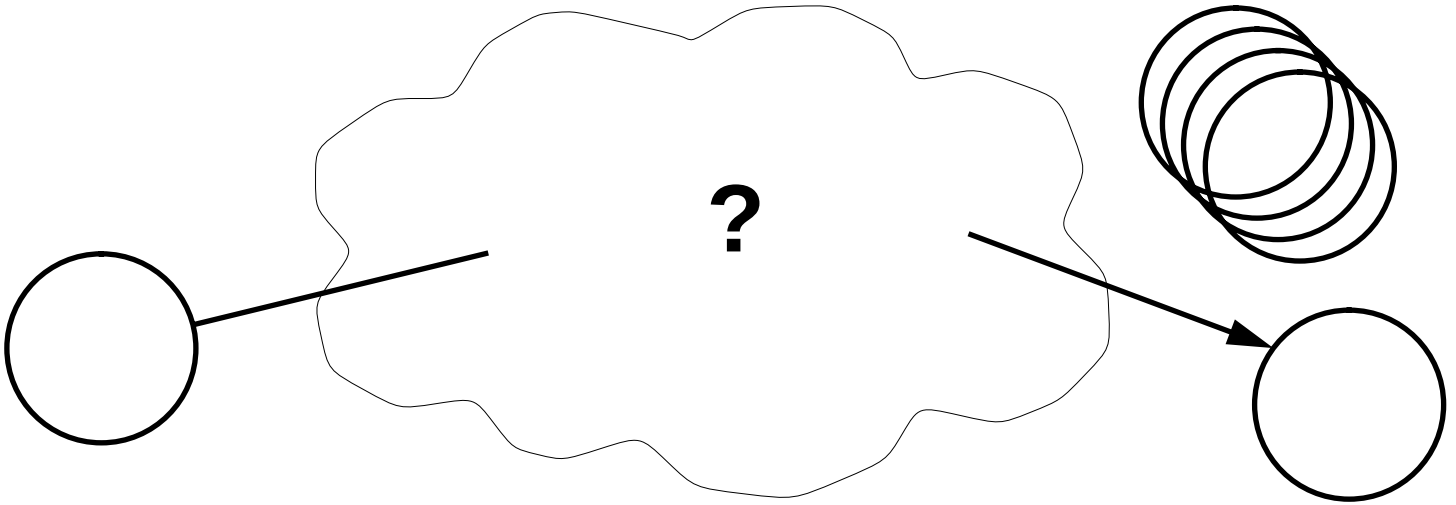
Client and Server Roles

- ***The roles are determined by the objects themselves***





The need for Trading



- ***How can clients find servers that provide the services that they need?***
  - **in the future, there will be millions of interconnected servers around the world**
  - **clients will come and go dynamically**
  - **servers will come and go dynamically**

Stating service requirements

- *There are two potential ways to identify something*
  - by naming it (as in a “white pages” telephone directory)
  - by describing it (as in a “yellow pages” telephone directory)
- *These functions are sometimes combined in a directory service*
  - but they are logically separate, just as real telephone directories are
- *CORBA has separate Naming and Trading services*

Naming is not enough

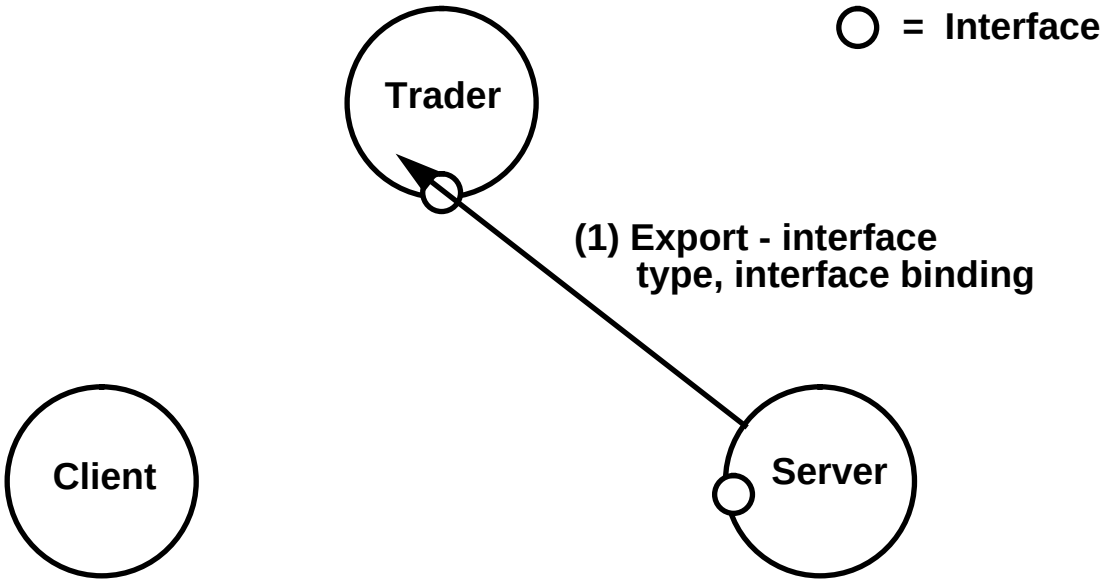
- ***Trading is necessary***
  - **we cannot rely on clients being able to name servers...**
  - **....the server may not even exist when the client was created**
- ***Trading works by matching descriptions provided by clients and servers***

Trading - Basic needs

- ***Server must state what it provides***
  - **it must export a service offer**
- ***Client must state what it requires***
  - **it must import a service offer**
- ***Trading must find a service offer that matches the request***
  - **there may be many such offers...**
  - **...there may be none**

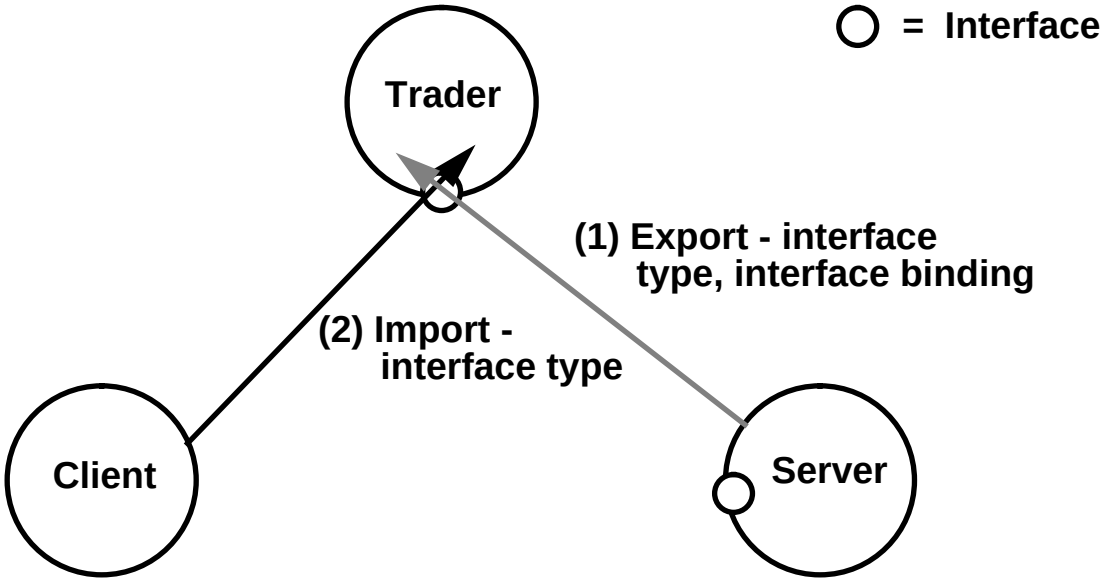
Steps in Trading - (1)

- *(1) Server exports a service offer to the Trader*



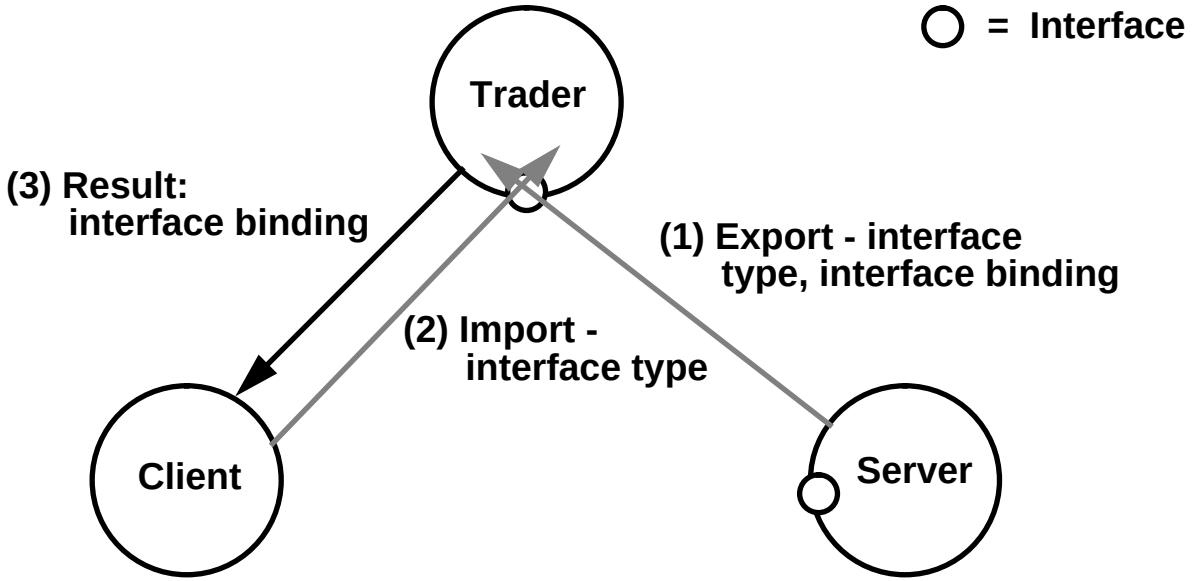
Steps in Trading - (2)

- *(2) Client requests a service offer from the Trader*



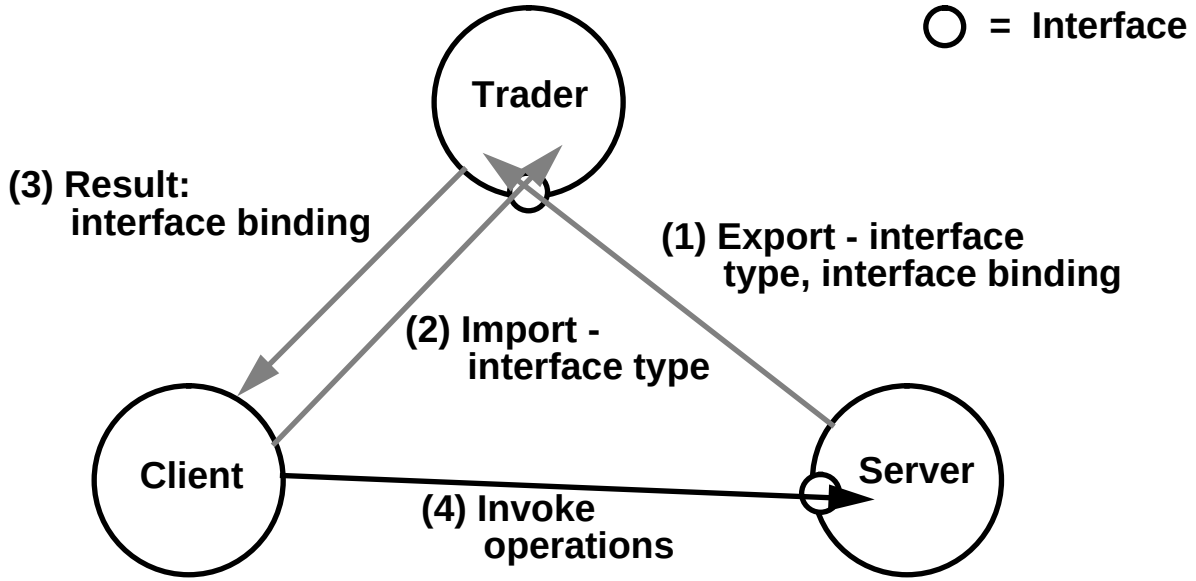
Steps in Trading - (3)

- *(3) Trader returns a matching service offer to the client*
  - it returns the interface binding given by the server



Steps in Trading - (4)

- *(4) Client uses interface binding to invoke the server's operations*
  - Trader takes no further part in the interaction
  - an interface binding from the Trader is invoked just like any other



Matching requests with offers - type conformance

- ***How does Trading decide whether a client request matches a server offer?***
  - **it uses the interface *type conformance* concept from the Computational Model**
- ***If the client request and server offer interface types do not conform, they are incompatible, and cannot match***

Other matching criteria

- *Type conformance is not sufficient*
  - who owns the service?
  - what will it cost to use?
  - where is the service, and can it be reached?
- *These criteria are known as properties*
  - (name, value) pairs
- *Preference criteria sort matching offers into order*
- *Scope criteria control where to look for offers*

Using properties

- ***Property name/value pairs are specified when offer is exported***
- ***Clients importing services may specify:***
  - **Acceptable property constraints, for example**

```
(PaperSize=='A4')
```

  - **Selection of offer with maximum (or minimum) value of a property**
- ***Arbitrary combinations of constraints may be specified in the form of a logical expression, for example***

```
(Node == 'basilisk') and (Price <= 200)
```

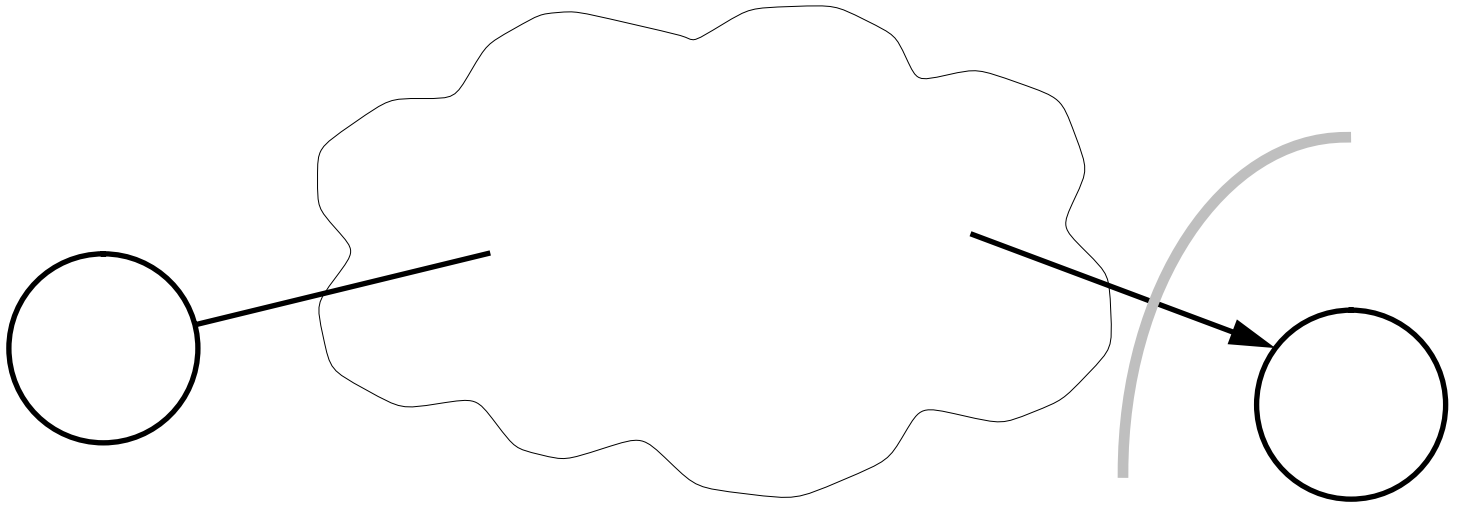
Trading in large distributed systems

- ***Because there will be millions of servers in the world:***
  - **there will be many Traders providing the Trading service**
  - **... Traders must be interconnected**
  - **... the Trading service must itself be distributed for scalability**
  - **... and cannot be centralized**
  - **this is called *federated trading***
- ***And also because organizations will wish to control their own Traders:***
  - **to determine who sees which services**

The need for federation

- ***Organizations want to offer electronic services to other organizations***
  - **services provided by applications in the usual way...**
  - **...services provided by distributed objects**
- ***Organizations want to make money***
  - **to *sell* services provided by distributed objects**
- ***Organizations need to keep control of their objects***
  - **control over their security, for instance**

Federation is concerned with boundaries



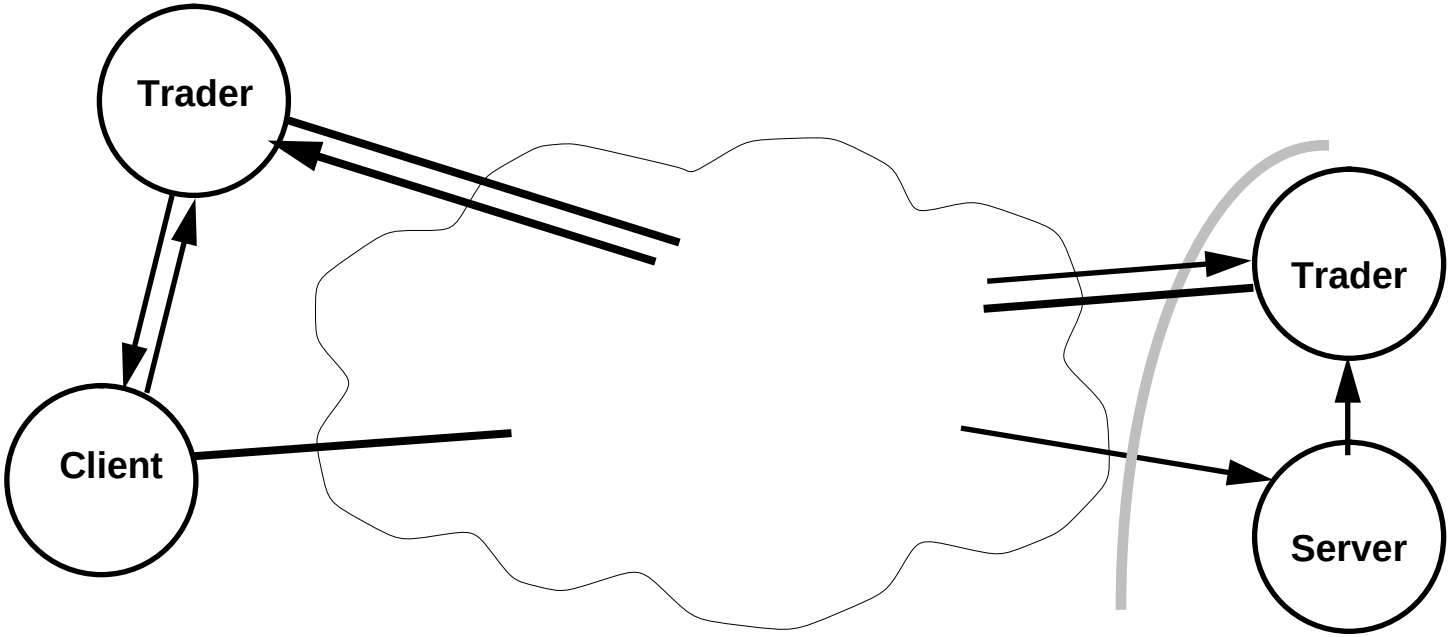
- *Controls can be enforced naturally at boundaries*
- *Distributed objects are ideal*
  - their encapsulation provides a boundary

Kinds of boundaries

- *There may be many kinds of boundaries*
  - Administrative
  - Judicial
  - Political
  - Technological
- *Openness entails bridging boundaries (in a controlled manner)*
  - not abolishing them
- *But we want these boundaries to be transparent to applications*

Federated Trading

- ***The traders are federated, but the client and server need not be aware of the boundary***



Different policies for different organizations

- ***Federation raises policy issues including***
  - **Authority**
  - **Billing**
  - **Security**
- ***Organizations that sell electronic services must be able to enforce their policies***
  - **they cannot rely on trust**

Federated Trading

- ***Distributed objects in the Computational Model already satisfy most of the needs of federation...***
- ***... but there are new issues***
  - **federation of naming contexts**
  - **technology boundaries**
  - **security**
- ***These issues affect all services, including the trading service itself***

Implementing Traders

- ***Traders can be implemented in several ways***
  - **as small, self-contained objects: optimized for locality and speed**
  - **as databases: optimized for large numbers of offers, and sophisticated query facilities**
  - **integrated with the naming service: optimized to share the federation facilities of the naming service**
- ***Whichever implementation is chosen, traders can be federated***
- ***The research community has used all these implementations and proved the scalability of traders***

Standards in Trading

- ***Standards work has been carried out in ISO/IEC using the ODP Reference Model***
  - **issued as DIS 13235 (ODP Trading Function)**
  - **Annex A includes a CORBA IDL Specification**
- ***OMG CORBAservices COSS RFP 5 is for a Trader of exactly this kind***

Summary

- ***Trading is necessary to support large distributed systems***
  - **it is the activity of choosing a service offer that matches the service requirement**
- ***The Trading service (trader) is provided just as any other service***
- ***A trader manages a database of service offers and matches requirements to offers***
  - **this matching is done on the basis of type conformance**
- ***Once a trader has introduced a server to a client, it plays no further part in the interaction***

Trading and Federation - more information

- *For a general discussion of trading and federation, see The ANSA Model for Trading and Federation (paper: AR.005.00; ftp: APM.1005)*
- *For naming issues, see The ANSA Naming Model (paper: AR.003.01; ftp: APM.1003)*
- *For security issues, see A Framework for Federating Secure Systems (paper: AR.008.00; ftp: APM.1008)*
- *For a discussion of Quality of Service issues in multimedia applications, see Integrating Multimedia into the ANSA Architecture (paper: TR.028.00; ftp: not yet released)*

Trading - Extra questions

- ***If Trading is a service, how does a client find the Trading service to start with?***
  - **Yes, there has to be a way to bootstrap the client. This can be done by building a Trader interface-reference into the infrastructure, by broadcasting, or some other special means. This is really an Engineering issue**
- ***How does Trading understand what the service offers mean?***
  - **It doesn't need to. It just needs to decide whether they match service requests**

Advanced trading - negotiation

- ***The 4-step approach described earlier will satisfy many needs, but not all...***
  - **...if several offers match, which one should be chosen?**
- ***Different offers may have a different quality-of-service, or cost***
  - **This will require more sophisticated patterns of *negotiation*...**
  - **... for trade-offs between quality and cost**
  - **... involving another service, a *negotiation service***
  - **the Trading service is neither accountable nor responsible for the quality of service described in service offers**

Advanced trading - different lifecycle epochs

- *The description so far implies that trading happens at run-time*
  - this is typical
- *Does it make sense for trading to happen at earlier epochs during the service development lifecycle?*
  - at application link time?
  - at application compile time?
  - at design time?
  - at specification time?

Advanced trading - compile/link time epoch

- *At compile/link time, special tools could be used...*
  - to test that a set of services could trade successfully
  - to determine an optimum set of bindings within this set
  - to replace the trading operations by this set of bindings
- *... to optimize a group of closely-related services*

Advanced trading - design/specification epoch

- ***Applications and service designers need to know what services already exist***
  - **to avoid re-inventing the wheel**
- ***This information is already available in the trading service***
  - **intelligent browsing tools can aid the designer**

Advanced trading - new service wanted...

- *Suppose the designer does not find the service they require...*
  - ...but they do not want to implement the service themselves
- *They can simply place a service request for this non-existent service*
  - ...like a Service Wanted advertisement
- *A special service can intercept this request*
  - and create a dummy service

Use of MatchMaking Service