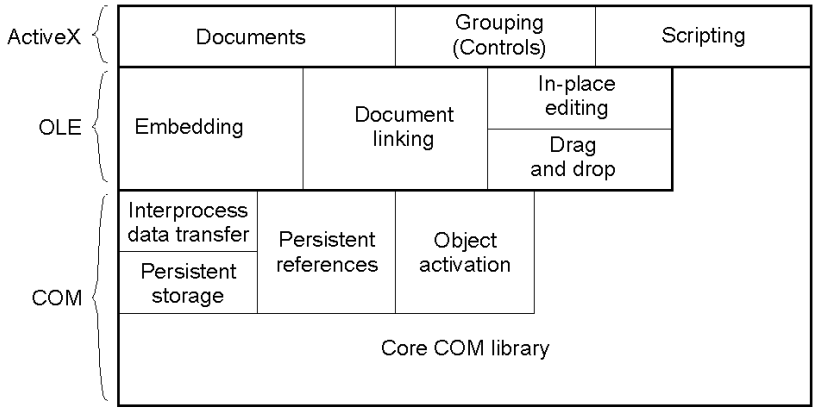
Today: More Case Studies

- DCOM
- Jini

DCOM

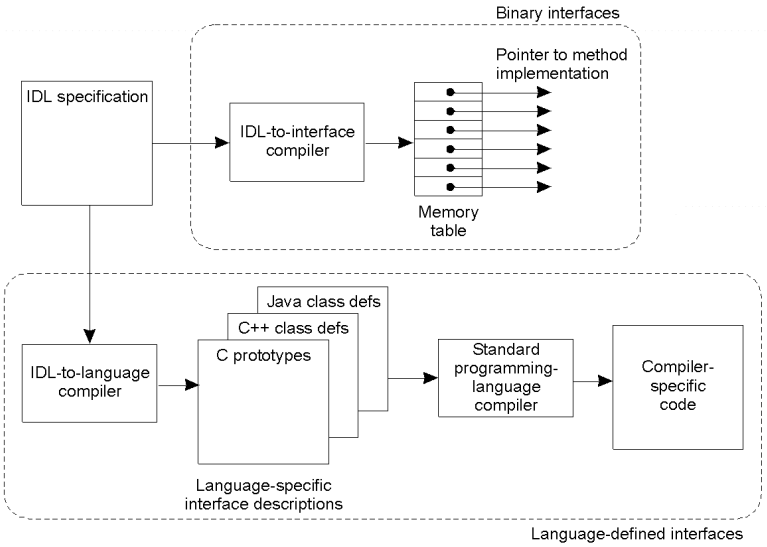
- Distributed Component Object Model
  - Microsoft's object model (middleware)



DCOM: History

- Successor to COM
  - Developed to support compound documents
    - Word document with excel spreadsheets and images
- Object linking and embedding (OLE)
  - Initial version: message passing to pass information between parts
  - Soon replaced by a more flexible layer: COM
- ActiveX: OLE plus new features
  - No good consensus on what exactly does ActiveX contain
  - Loosely: groups capabilities within applications to support scripting, grouping of objects.
- DCOM: all of the above, but across machines

Object Model



- The difference between language-defined and binary interfaces.

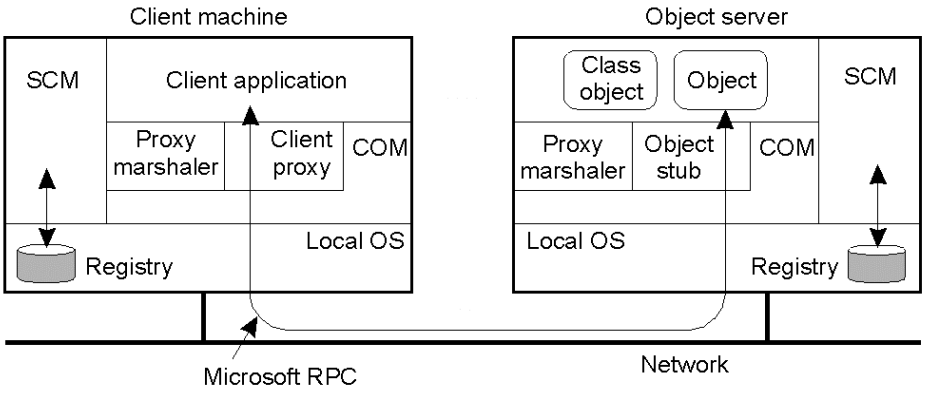
DCOM Object Model

- DCOM: uses remote object model
- Supports only binary interfaces
  - Table of pointers to methods
  - Uses Microsoft IDL

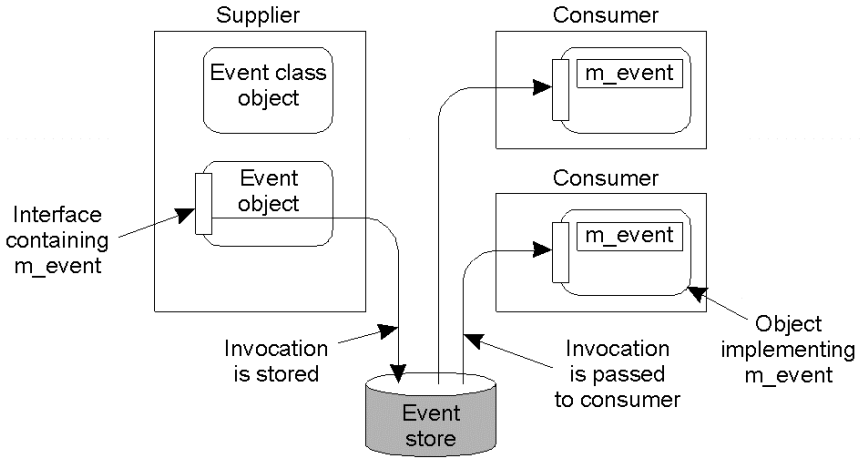
- Unlike CORBA, all objects are transient
  - Delete an object with refcount == 0
- Like CORBA, DCOM supports dynamic object invocation

Type Library and Registry

- The overall architecture of DCOM.
  - Type library == CORBA interface repository
  - Service control manager == CORBA implmentation repository

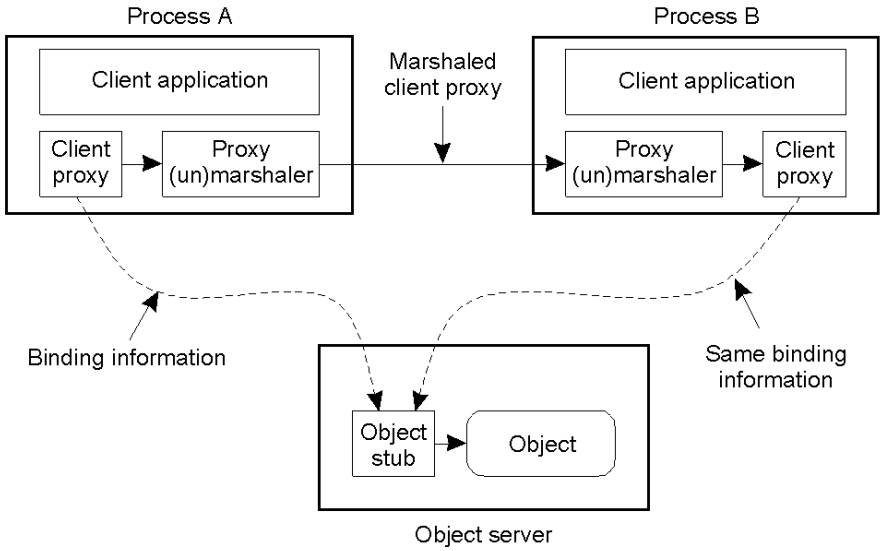


Events and Messaging



- Event processing in DCOM: publish/subscribe paradigm
- Persistent asynchronous communication: MSFT Message Queuing

Clients



- Passing an object reference in DCOM with custom marshaling.

Monikers: Persistent Objects

Step	Performer	Description
1	Client	Calls BindMoniker at moniker
2	Moniker	Looks up associated CLSID and instructs SCM to create object
3	SCM	Loads class object
4	Class object	Creates object and returns interface pointer to moniker
5	Moniker	Instructs object to load previously stored state
6	Object	Loads its state from file
7	Moniker	Returns interface pointer of object to client

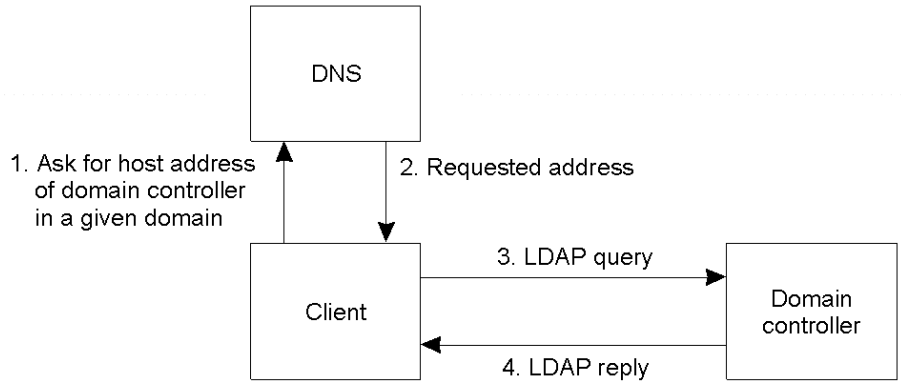
- By default, DCOM objects are transient
- Persistent objects implemented using monikers (reference stored on disk)
  - Has all information to recreate the object at a later time

Monikers (2)

Moniker type	Description
File moniker	Reference to an object constructed from a file
URL moniker	Reference to an object constructed from a URL
Class moniker	Reference to a class object
Composite moniker	Reference to a composition of monikers
Item moniker	Reference to a moniker in a composition
Pointer moniker	Reference to an object in a remote process

- DCOM-defined moniker types.

Naming: Active Directory



- The general organization of Active Directory
  - Implemented using LDAP
  - Distr. System partitioned into domains (uses domain controllers)
  - Each domain controller has a DNS name
  - DC registered as LDAP services in DNS

Distributed Coordination

- Motivation
  - Next generation of systems will be inherently distributed
  - Main problem: techniques to coordinate various components
    - Emphasis on coordination of activities between components

Introduction to Coordination Models

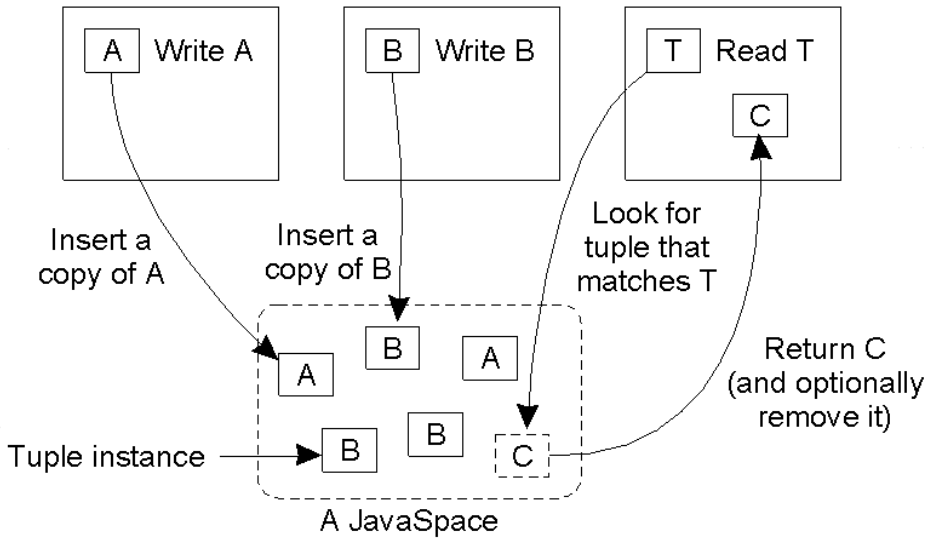
- Key idea: separation of computation from coordination
- A taxonomy of coordination models
  - Direct coordination
  - Mailbox coordination
  - Meeting-oriented coordination (publish/subscribe)
  - Generative (shared tuple space)

Referential \ Temporal	Coupled	Uncoupled
Coupled	Direct	Mailbox
Uncoupled	Meeting oriented	Generative communication

Jini Case Study

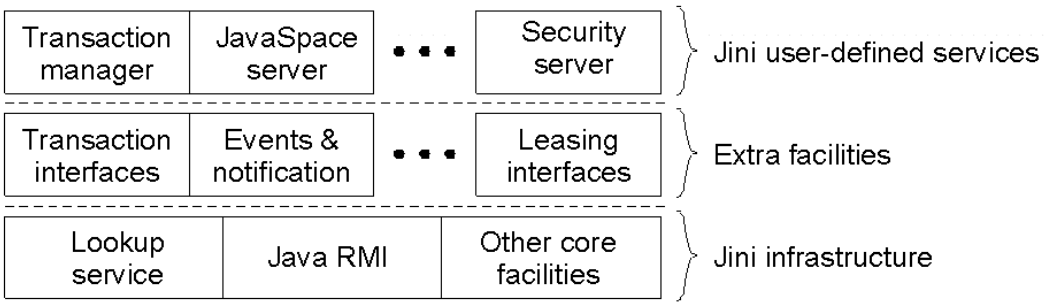
- Coordination system based on Java
  - Clients can *discover* new services as they become available
  - Example: "intelligent toaster"
  - Distributed event and notification system
- Coordination model
  - Uses JavaSpaces: a shared dataspace that stores tuples
    - Each tuple points to a Java object

Overview of Jini



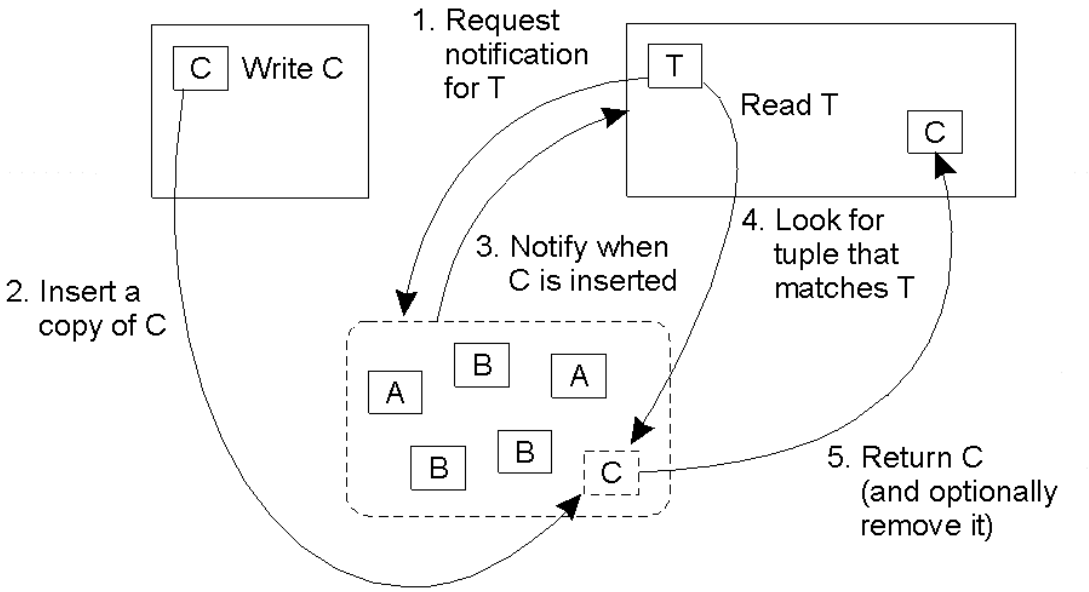
- The general organization of a JavaSpace in Jini.

Architecture



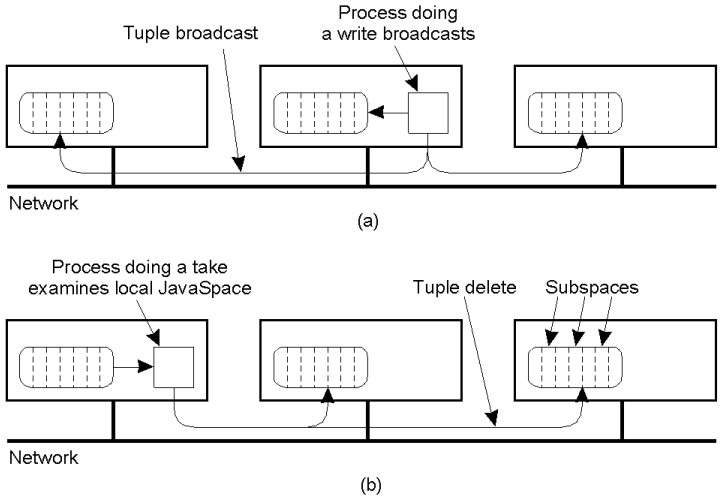
- The layered architecture of a Jini System.

Communication Events



- Using events in combination with a JavaSpace

Processes (1)

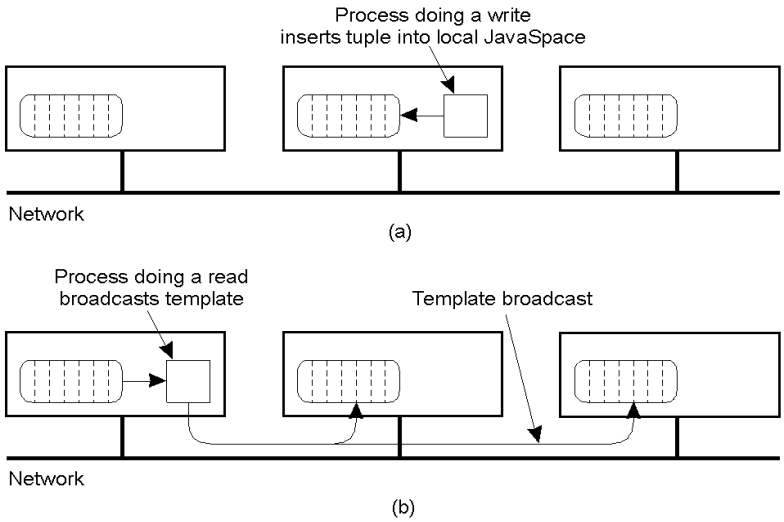


- A JavaSpace can be replicated on all machines. The dotted lines show the partitioning of the JavaSpace into subspaces.

a) Tuples are broadcast on WRITE

b) READs are local, but the removing of an instance when calling TAKE must be broadcast

Processes (2)



- Unreplicated JavaSpace.

a) A WRITE is done locally.

b) A READ or TAKE requires the template tuple to be broadcast in order to find a tuple instance

The Jini Lookup Service (1)

Field	Description
ServiceID	The identifier of the service associated with this item.
Service	A (possibly remote) reference to the object implementing the service.
AttributeSets	A set of tuples describing the service.

- The organization of a service item.

The Jini Lookup Service (2)

Tuple Type	Attributes
ServiceInfo	Name, manufacturer, vendor, version, model, serial number
Location	Floor, room, building
Address	Street, organization, organizational unit, locality, state or province, postal code, country

- Examples of predefined tuples for service items.