Trading Services for Distributed Enterprise Communications

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Presentation Agenda

• Enterprise Systems Technology Classifications
• Naming, Directory, and Trading Services in a Nutshell
• CORBA as a Trading Service
• Microsoft Active Directory Services
• Jini as a Trading Service
  – Jini Component Architecture
  – Jini Programming Model
  – Jini Infrastructure
  – Jini Class Architecture and Development Process
  – Jini Service Example
  – From the Logical Infrastructure to a Physical Solution
  – Physical Solution Implementation Steps
• Conclusions
Enterprise Systems Technology Classifications

- User Interfacing
  - AWT, Swing, JMF, JavaBeans
- Distributed Communications Enabling
  - TCP/IP, HTTP, CORBA, RMI/IIOP, COM+
- Services for Distributed Communications
  - JNDI, CORBA Trading, JINI, Activation, JMS, JavaMail, JTA, JTS, etc.
- Systems Assurance
  - Security, Reliability, Availability, Maintainability, Safety
- Data Enabling
  - JDBC, RDBMs, ODBMSs
- Web Enabling
  - HTML, XML, Applets, Servlets, JSPs
- Applications Enabling
  - EJB, EAI

Services for Distributed Communications

- Naming
  - DNS, JNDI
- Directory
  - NIS, NDS, LDAP, Microsoft Active Directory
- Trading
  - CORBA Trading Service, JINI
- Activation
  - CORBA LifeCycle Service, Java Activation Framework
- Messaging
  - JMS, JavaMail, CORBA Event Service, CORBA Messaging Service, CORBA Notification Service
- Transaction
  - CORBA OTS, JTS, JTA
Naming Service

- Provides the ability to bind names to objects, and lookup objects by names (~ telephone white pages)
e.g., COSNaming, DNS, LDAP, NIS, JNDI

Directory Service

- Provides a way to manage the storage and distribution of shared information (~ telephone yellow pages)
e.g., NIS, NDS, LDAP, Microsoft Active Directory
Trading Service
- Provide a framework for objects to identify themselves in a distributed system
- Provides facilities for looking up and discovering other services
- Provides services to remote objects
  - e.g., CORBA Trading, Jini, Microsoft Active Directory

CORBA as a Trading Service
- Provides a sophisticated directory service in which the directory objects contain:
  - Attributes and service type information on distributed objects
  - Distributed objects Handles
- APIs: Admin, Link, Lookup, Proxy Register

Microsoft Active Directory Service (ADS)
- Maintains user, security, and network resource information used on a Windows 2000 network
- DCOM components can store their activation and connection information in the ADS
- COM objects can be exposed as APIs to ADS
Introducing Jini as a Trading Service

- What is Jini Technology?
- Who Developed Jini?
- What are the Claimed Benefits?
- What are the Limitations?
- What is the Jini system architecture?

Jini Technology Architecture

- Jini provides “underware” (not middleware)
- Jini helps services, clients, and users find other services (via lookup, registration, and leasing services)
What is Jini Technology?

- Jini provides an infrastructure to federate services in a distributed system
- Enable spontaneous networking
- Simplify delivery of network services
- Simplify access to network services
- Jini provides a programming model for reliable, secure distributed services
- Jini provides several basic services

Who Developed Jini?

- Jim Waldo (CORBA, RMI, JavaSpaces)
- Bill Joy (BSD Unix, SunOS)
- Ken Arnold (JavaSpaces)
- Ann Wollrath (Java RMI)
- Bob Sheifler (X Window System)
What are the Claimed Benefits?

- Makes using a network more like using a phone
- Allows software and hardware components to more easily provide network services
- Makes adding and managing network services easier

What are the Limitations?

- Intended for workgroups of 2-100 nodes/services
- Implies some agreement regarding trust, identity and policy within a single Jini federation
- Requires Java, 48KB of memory
- Licensing (SCSL new licensing model)
- …
### Key Concepts

- Services
- Discovery and Lookup
- Extended RMI
- Distributed Security
- Leasing
- Transactions
- Distributed Events

### Services

- Services may be added or withdrawn from a Jini federation at any time
- Jini provides mechanisms for service registration, lookup, and use
- Services communicate by using a service protocol (i.e., a set of Java interfaces)
- Set of services is open-ended
Discovery and Lookup

- Lookup service provides mapping:
  - Interfaces to objects
- Hierarchical lookup:
  - Lookup service may include entry for other lookup services
- Discovery is registering a new service with a lookup service (Jini federation discovers service)

Extended RMI

- Communication among services uses Java RMI
- Extended with leases
- RMI provides
  - Activation
  - Distributed garbage collection
  - Multicast
  - Replication
Distributed Security

- Principal: entity on behalf of which a service is accessed
- Access control list: associates access privileges with each object implementing a service

Leasing

- A lease is a grant of access over a time period
- Negotiated as part of service protocol (~CORBA licensing service role)
- If lease expires without renewal, user and provider can free associated resource
- Leases handle client and network failures, removal of services, …
- Exclusive lease says service cannot be shared
Transactions

- A series of operations may be wrapped in a transaction
- Insure changes made atomically: all or none
- Jini transaction interfaces supply service protocol for a two-phase commit

Distributed Events

- Jini supports distributed events (~ CORBA events)
- Objects register interest in other object’s events
- Notifications delivered to interested objects
Java + Jini

- **Base Java**
  - Infrastructure:
    - Java VM, RMI, Java Security Model
  - Programming Model:
    - Java APIs, Java Beans, etc.
  - Services:
    - JNDI, EJBs, JTS, etc.

- **Java + Jini**
  - Infrastructure:
    - Extended RMI, Discovery, Distributed Security, Lookup
  - Programming Model:
    - Leasing, Transactions, Distributed Events
  - Services:
    - JavaSpaces, Two-Phase Commit Manager

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**Discovery Protocol**

- Service Joins a Jini Lookup Service
  - Provider uses multicast to locate Lookup service
  - Registers Interfaces
  - Loads Proxy object into Lookup Service
Lookup Protocol

- Client looks up service when needed
- Looks up by Java type, attributes
- Copy of proxy moved to client
- Uses proxy to invoke services

Client / Service Interaction

- Client uses service through proxy
- Proxy might be complete service object or RMI stub
- Or mixture of local/remote methods
- Service protocol may be private to sender
Jini Component Architecture

- Logical Component Architecture
  - Storage, JavaSpaces, Printing, TM
  - Jini Discovery, Join, and Lookup
  - Java 2 platform (RMI, security, networking)
- Physical Component Architecture
  - JSTK JavaSpaces Starter Kit
  - Jini Starter Kit
    - Jini Software Kit (JSK) - com.sun.jini.*
    - Jini Extended Platform (JXP) - net.jini.*
    - Jini Core Platform (JCP) - net.jini.core.*
  - J2SE

Jini Programming Model

- Distributed Events API
  - Interface extending the JavaBeans event model
- Distributed Leasing
  - Interfaces to obtain leases for use of distributed resources
- Distributed Transactions
Jini Infrastructure

- Service Discovery
- Jini Community Joining
  - Services provide service items (meta-data attribute information, and proxy object)
- Jini Lookup Services
  - Clients fill out a service template
  - Clients receive a set of service matches
  - Clients can extract the service proxy item to start using the service

Jini Tools and Configuration

- JSK: Jini System Software Starter Kit
  - JCP (jni-core.jar), JXP (jni-ext.jar), JSK (subset included in sun-util.jar)
  - JSK provides a lookup service with the codename “reggie”
  - JSK also provides a transaction management service with the codename “mahalo”
- Sun provides a Jini service called JavaSpaces used to store and retrieve Java objects in a distributed network (codename is “outrigger”)
Jini Class Architecture and Development Process

- Server side
  - Jini service implementation
  - Jini service proxy
  - Connectivity needed to a back-end device or process
- Client side
  - Discover a lookup service
  - Create a Jini service template
  - Look up a Jini service
  - Handle Jini Service Lookup Matches
  - Use the Jini Service

Jini Service Examples

- Jini[TM] Technology Starter Kit (starter kit) and the Jini Technology Core Platform Compatibility Kit (TCK) are available to download under the Sun Community Source License v 3.0/Jini Technology Specific Attachment v 1.0 (SCSL3/Jini TSA v 1.0) program
- Sample applications are provided with the Starter Kit
Conclusions

- CORBA Trading Service provides support for associating distributed CORBA object references in a directory service
- CORBA Trading Service is a somewhat complicated framework to use
- ADS provides a directory service implementation and standard interfaces for COM/DCOM applications
- ADS is platform dependent
- Jini adds support for dynamic discovery of lookup services by servers and clients
- Jini’s API is simple
- Configuring Jini’s runtime infrastructure can be somewhat tedious.

Links to more information

- Jini home
- Jini FAQs
- Jini white papers
- Jini specs
- Jini licensing