JXTA and Grid Update

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JXTA™ Vision

Everybody and everything connected to the Network

- Network of People, Places, Things
- A complex network computing problem
- Enable edge computing
Evolution of Distributed Computing Driven by Protocols

- TCP/IP
- HTTP
- JXTA
- Client-Server
- Web-based
- Peer-to-Peer
What is JXTA?

- An open network programming platform for peer-to-peer (P2P) computing
  - A set of protocols (XML-based)
    - Works with any language, OS, network, and service models
  - A virtual network overlay
  - A set of mechanisms, not policies
  - An Open Source project: www.jxta.org
Open Source Model

- **www.jxta.org**
  - All source, projects, docs, examples on-line
- **Apache style software license**
  - No barriers to getting started
  - No royalties, no fees, no registration
- **Meritocracy**
  - The more you've done, the more you can do
JXTA Virtual Network (Virtual Sockets)

Physical Network

Virtual Network

Virtual Mapping

TCP/IP

Firewall

HTTP

NAT

Peer

Peer

Peer

Peer

Peer

Peer

Peer

Peer

Peer
Peer Groups (Application level's VPNs)

Virtual Network

Physical Network

Virtual Mapping

Peer Groups (Application level's VPNs)
Why Use Peer Groups?

• Create secure and protected domains
• Scope peer operations
  – Discovery, search, communications
• Provide a “group” identity
  – Group peers sharing a common interest
• Enable monitoring and auditing
A Network of Virtual P2P Networks
Virtual Socket

- Support the transfer of virtually any objects
  - Binary, code, data, metadata, etc.
- Virtual communication channels
  - Binding at runtime
  - May connect peers that do not have direct physical links
  - Can be bound to more than one peer endpoint
  - Migrate as peers roam within the JXTA network
Communication Primitives

• **Point-to-Point**
  - Connects exactly two peer endpoints together

• **Propagate**
  - Connects one output pipe to multiple input pipes
  - Within logical domain scope

Additional pipe types can be created from the core types.
Discovery

• Asynchronous mechanism for publishing and discovering resources (CPU, network, service, etc.)
• All resources in JXTA represented as advertisements
  – Language-neutral XML documents
  – Peers cache, publish, and exchange advertisements
  – Each advertisement published with a lifetime (time-to-live)
• P2P discovery network (across subnet, LAN, WAN, Firewall, Nat)
JXTA End-to-End Security

- Transport Layer Security (TLS)
- Peer certificates
- Multiple certificate authority policy (centralized, decentralized)
- Domain certificate chains
- Enable Web of Trust (reputation)
Transport Layer Security (TLS)
JXTA and Web Services

- Web Services define a platform-independent environment to create, access and deploy services on the network
- JXTA extends Web Services
  - Provide virtual network support: NAT and Firewall traversals, location independence (soap.jxta.org)
  - Application level's domain scoping
  - Internet scale service discovery
  - Services failover and availability (domain service signatures)
JXTA and Jini

- Jini is a service technology, JXTA is a network technology
- JXTA expands Jini
  - Deploy Jini services over the Internet
  - Dynamic discovery of lookup service
  - Domain scoping
  - Secure transports
- Jeri provider: Jini running over JXTA
Sun Related JXTA Grid Projects

- JXTA in Sun Grid Engine
  - Dynamic discovery of resource to join a grid
- JXTABoot in VSP Products
  - Embed JXTA into boot firmware
  - Provision OS image to VSP server
  - Sun Control Station self-discovery
Sun Related JXTA Grid Projects

- Sun Grid Engine MDE Group
- JNGI (jngi.jxta.org) is a framework that users can use to submit jobs.
  - Jobs are split and distributed among several peers.
  - JXTA peer groups helps us to localize communication, which in turn improves scaling.
  - JXTA Peergroups provide redundancy within peer groups, we ensure that failures do not affect job completion.
**JXTA within GGF**

- NaraBrokering (Pervasive Computing Labs – University of Indiana - G. Fox and al.)
  - provide a messaging/brokering infrastructure for linking multiple grid infrastructures

![Diagram of JXTA and Grid Update]
JXTA within GGF

- Triana (Cardiff University)
  - Distribute collections of computing units among a set of distributed computers
GEMSS: Maxillo-facial Surgery Simulation
Applications

• **User Interface Integration (direct plugin)**
  - Used GriPhyN to represent work-flow
  - GEO 600 - interface with GEO++ monitoring system

• **GEMSS:**
  - Application Work-flow
  - choreographing web services

• **Galaxy Formation**
  - Galaxy formation group at Cardiff for visualization

• **GEO 600 Signal Processing**
  - Quick Look data analysis
    - GEO 600 - rigorous unit testing (over 200 signal processing units)
  - Data mining
  - Coalescing Binary Code - will compare against MPI code
    - Uses 50+ Triana units to simulate the search
    - Full search complete ...
JXTA within GGF

- **JuxMem** (INRIA - IRISA)
  - Large scale persistent and coherent Data Grids

Peer-to-peer model

Client/server model
Compute Power Market

CPM Peer Group

Market Resource Agent <A>

Market Resource Agent <B>

Market <U>

Market Resource Broker <X>

Market Resource Broker <Y>

Market <K>

Contract with X

Request

Contract with B

Result
JXTA Sample Applications --
Momentum 1.0 by InView Software
JXTA Sample Applications – VistaPortal
JXTA Sample Applications - Java IDE by Internet Access Methods
Project JXTA Community

WWW.JXTA.ORG

- 2,500,000+ downloads
- 100+ projects
- 18,000 members
- Active discussion groups
- Community actively contributing and integrating technology.
Report Card

- JXTA Protocol: B+
  - The protocol has been made much leaner and efficient since its earlier versions.
  - The API does need additional capability for real-time voice and video transmission.
  - Security is there for encryption, but no identity capability. The protocol is stable with little likelihood of changes.
  - Additions to the protocol should not affect compatibility.
Report Card

• JXTA Java API: B.
  – Much simpler, faster, and greater stability.
  – Addition of simpler configuration has helped greatly for end-user adoption.
  – Still has a few quirks and many parts are needlessly complex but core functionality is easily used.
  – Stability of the API signatures is fairly stable and we should only see additions.
Report Card

• JXTA Adoption: C.
  – Related to components and utilities because most developers like constrained environments.

• JXTA Developer Education: C-.
  – We need a lot of work here. Primarily to educate developers and companies on how different P2P is from client server solutions.

• P2P Patterns: B-.
  – This is how we design develop applications. The patterns are there, but not well known and only a few cases represented by large installations. This area is wide open because we have only scratched the surface.
Report Card

- JXTA utilities and application components: D.
  - We have a few libraries, but there needs to be a larger group of components to add to applications taking advantage of P2P with little understanding of P2P or JXTA.
  - Examples are chat, identity management, file sharing, whiteboard (controlling a common electronic workspace), searching, database apps, data synchronization, and monitoring.
Summary

• JXTA Open-source P2P Platform
  – Stable API
  – Quarterly release train

• Leverage on-going GGF works on JXTA

• JXTA opportunities within HPTC
  – Network infrastructure to build massive Internet scale grids
  – Ad hoc resource discovering and resource binding
  – Domain scoping
  – Failover and load balancing domain via domain service signature.
Thank you

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