University of Tokyo Java Class
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JXTA P2P Coding

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Goal of Presentation

- Learn about project JXTA technology
- What is project JXTA technology?
- What problems does project JXTA technology address
- Get an update on project JXTA technology
- How can you participate in project JXTA technology

Learning Objectives

- Understand project JXTA technology
  - See the benefits of Peer-to-Peer computing
  - Get an update on the latest project JXTA technology
- Feel the momentum behind project JXTA technology

Project JXTA Technology Technical Goal

Build a generic, secure, peer-to-peer virtual network as the foundation for the next generation of internet applications

jux.ta.pose
v.tr. jux.ta.posed, jux.ta.posing, jux.ta.pos.es
To place side by side, especially for comparison or contrast

Presentation Outline

- Benefits of Peer-to-Peer networking
- What is project JXTA Technology
- Project JXTA technology momentum
- Project JXTA network abstractions
- Project JXTA technology implementations update
- How to participate in project JXTA technology

"Project JXTA will expand the accessibility of the Web and the depth of the content that's available."

— Bill Joy

Why Peer-to-Peer Computing

- Build complex behaviors by juxtaposing elementary ones
- Massive scalability
- Resilience
- Maximize localize peer interactions
- Self-organized network domains
- Decentralized and ad hoc resource discovery
- Increase performance as more peers participate
- Edge computing
- Share infrastructure cost

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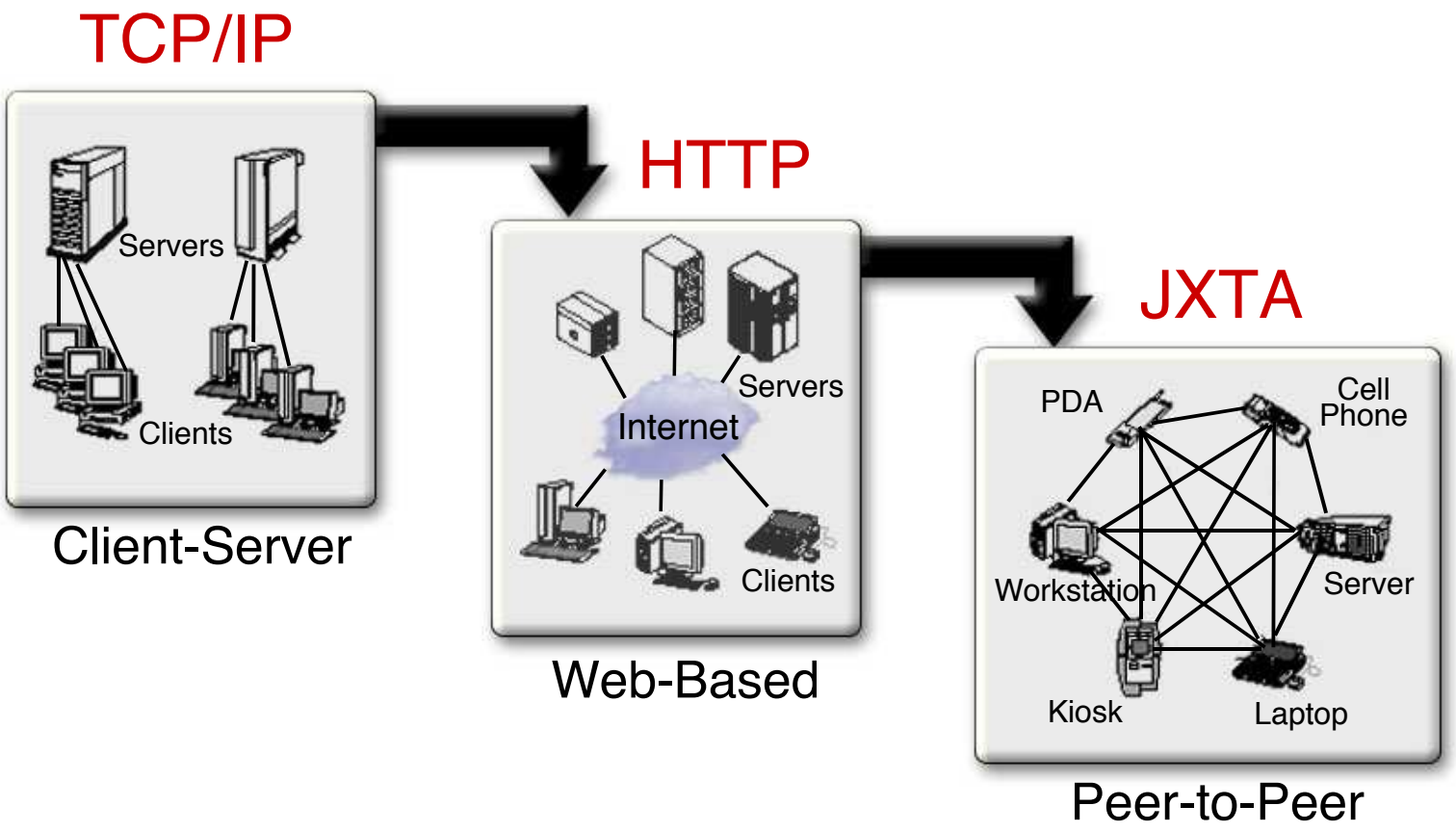
Network Organization Is Driven by Internet "Core" Protocols

Define the minimum required network semantic (network DNA)



What Is Project JXTA ?

- An open set of XML protocols for developing peer-to-peer applications
  - Focus on network organization and connectivity
  - Service agnostic technology (Web services, ORB, etc.)
  - A virtual network overlay
  - Defines mechanisms, not policies
  - Open source project: www.jxta.org

Project JXTA Technology Objectives

- Interoperability
  - Across different P2P systems and communities
- Platform independence
  - Programming languages, system platforms, and networking platforms
- Ubiquity
  - Every device with a digital heartbeat
- Security and Monitoring
  - For commercial and enterprise deployment

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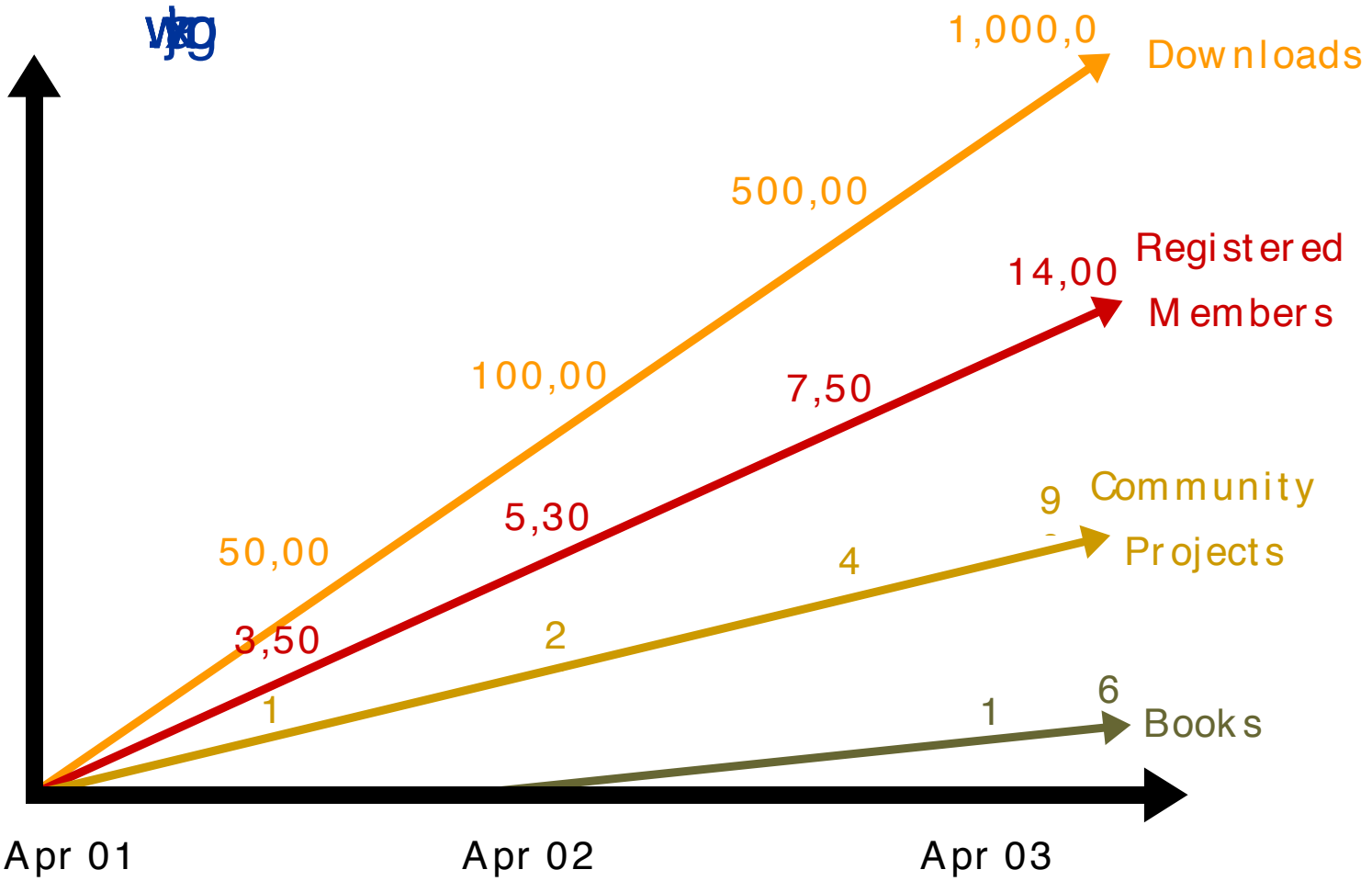
JXTA Technology Momentum



JXTA Technology Samples Applications

Project JXTA Technology: Shell

JXTA Shell modeled after the Unix Shell

Interactive commands executed within the JXTA network

JXTA> whoami

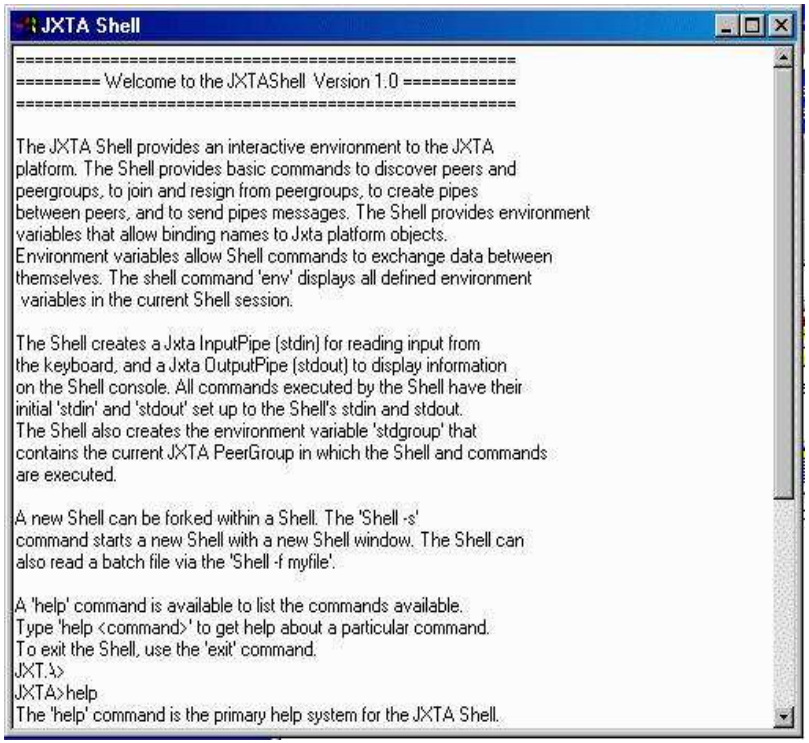
JXTA> peers

JXTA> groups I grep SUNW

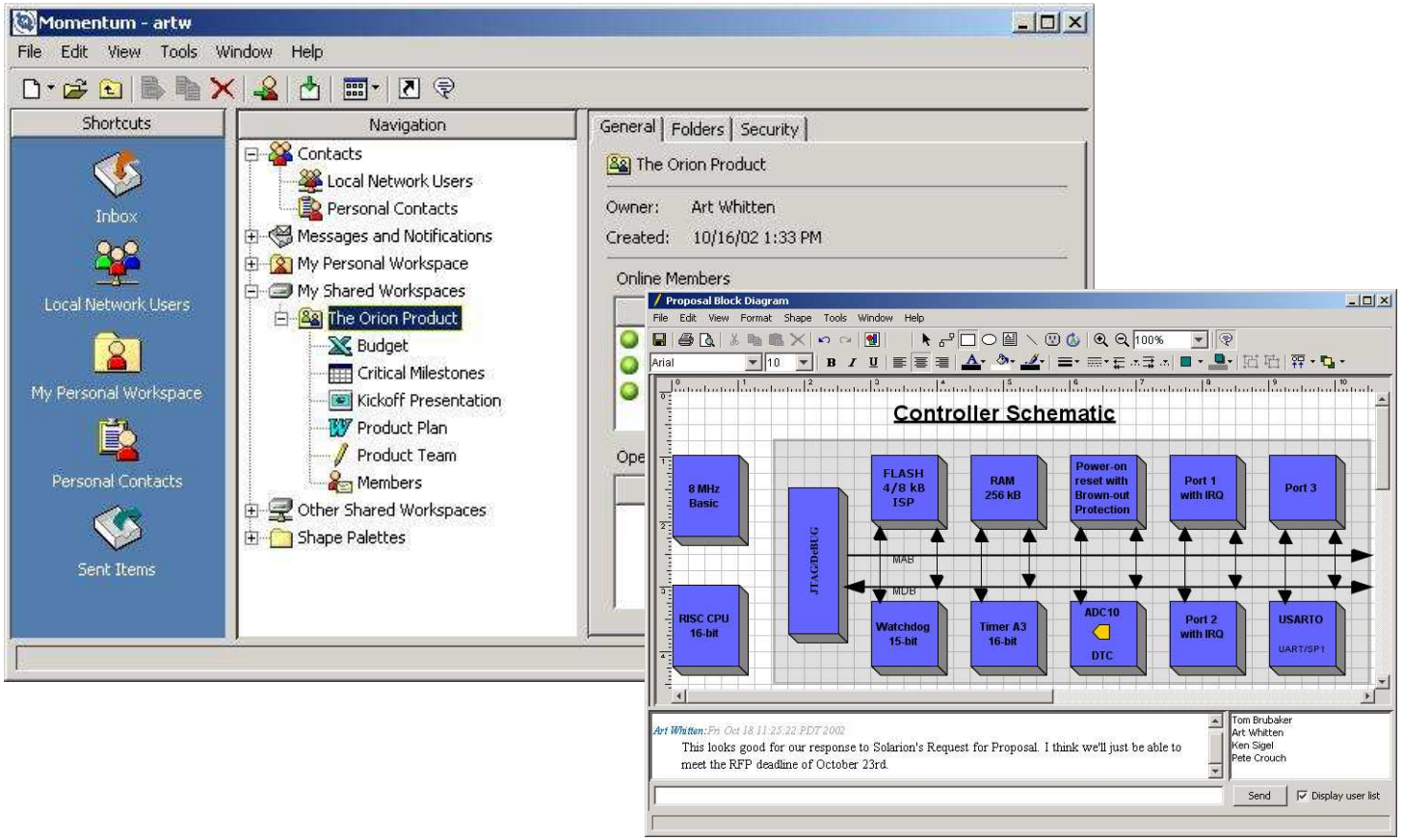
JXTA> join SUNW

JXTA> peers I wc

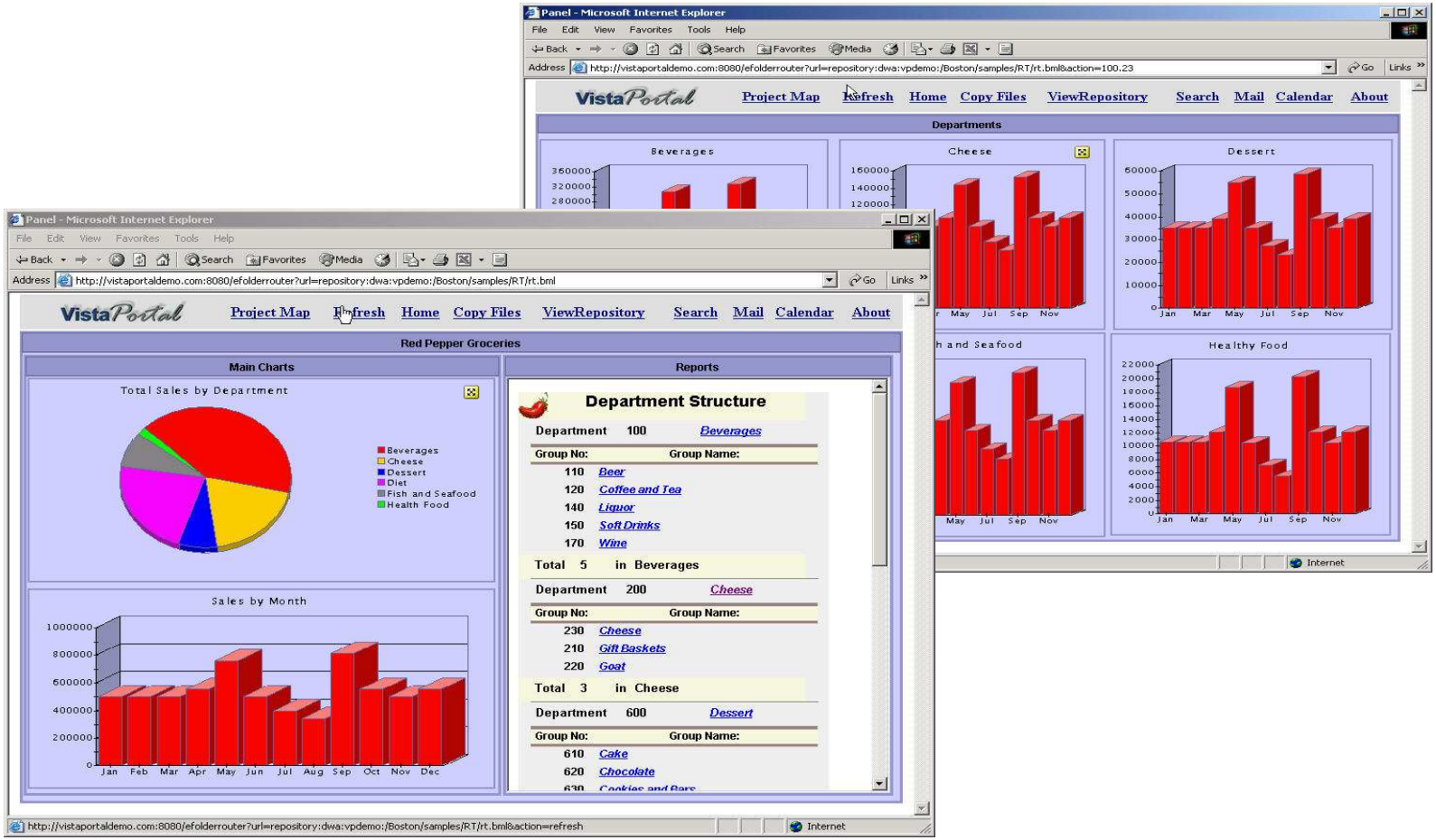
JXTA> talk tra



JXTA Commercial Applications



JXTA Commercial Applications

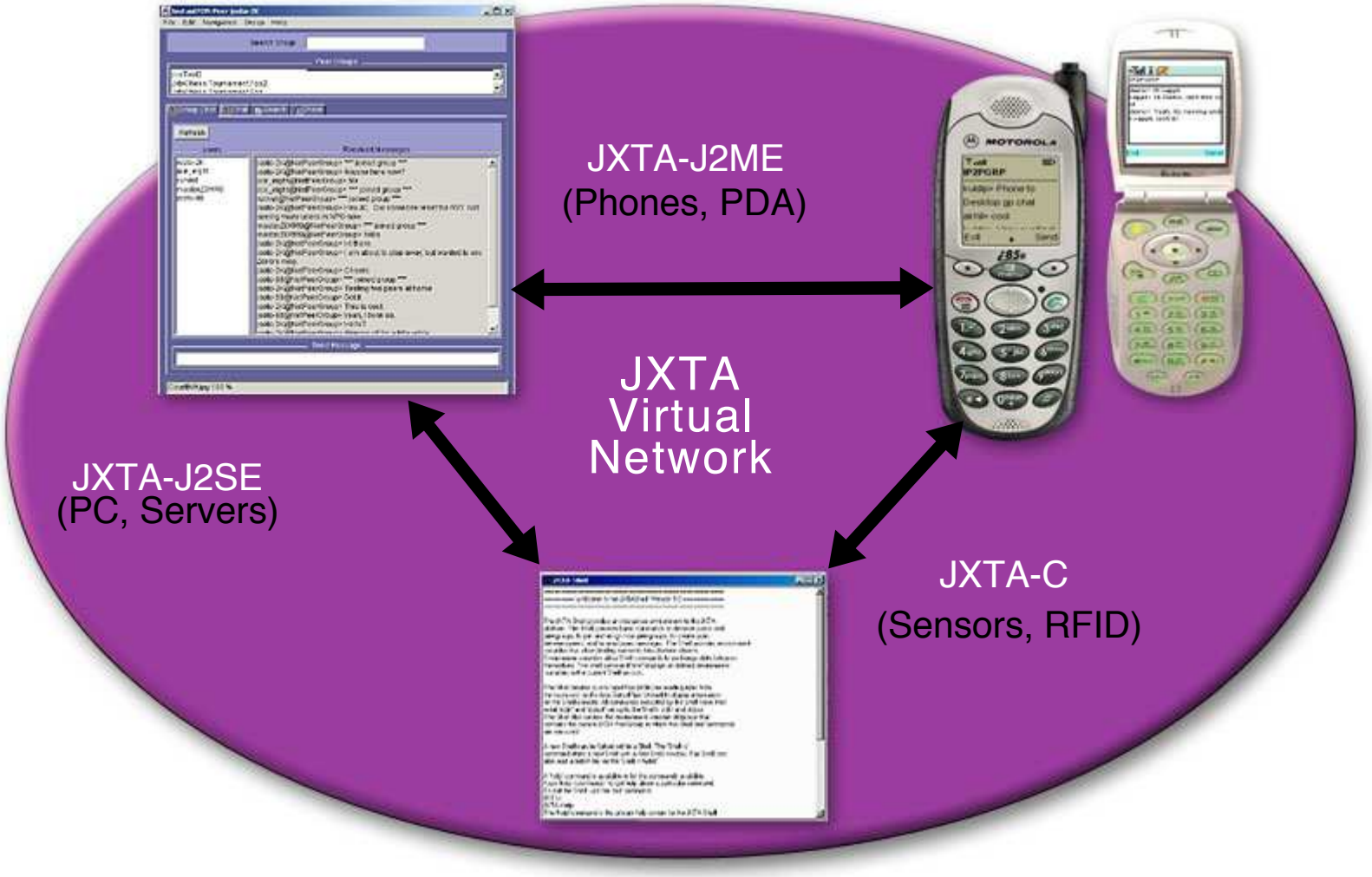


JXTA on J2ME™ Wireless Devices

P2P Messaging
Group and 1:1

P2P
Collaboration

Everything Connected to the Network!



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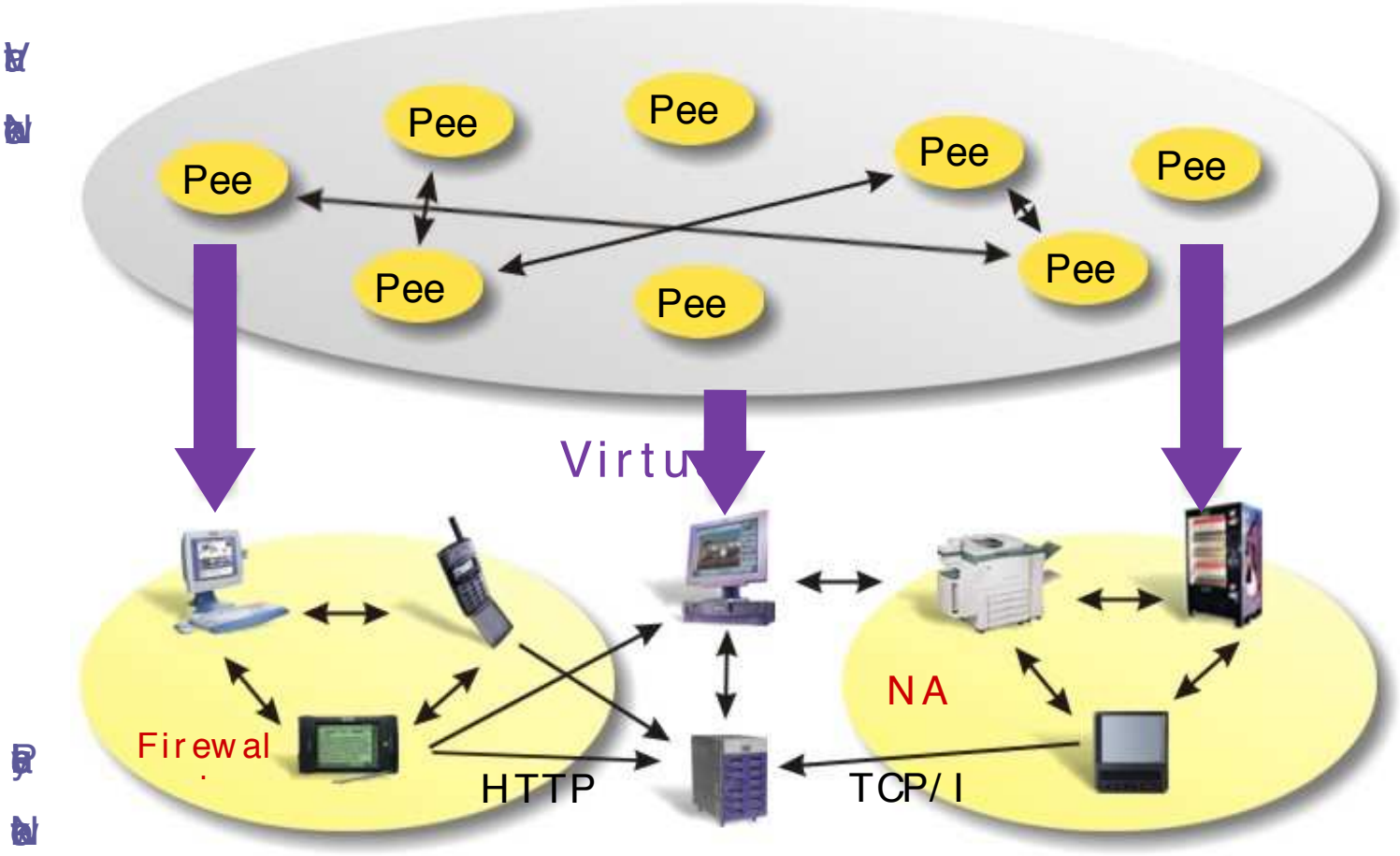
JXTA Virtual Network Abstractions

- Virtual addressing (dynamic mapping between virtual and physical network)
- Advertisements as platform-neutral (XML) network resource descriptors
- Decentralized resource discovery (rendezvous network)
- Ad doc peergroups (virtual secure domains)
- Pipes (virtual communication channels)

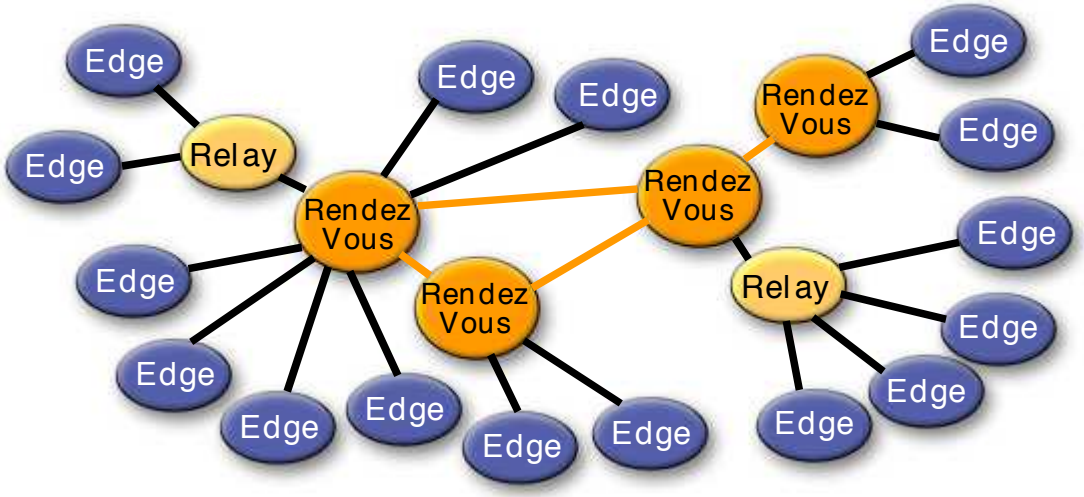
JXTA Virtual Network



JXTA Advertisements

- Language-neutral meta-data resource descriptors
- Can be used to describe virtually anything (data, code, classes, JIT code, Web service, java object, etc.)
- Developers can create their own advertisements
- Peers publish, cache and discover advertisements
- Every advertisement is assigned a lifetime (self-healing resource presence)

Not All Peers Are Equals

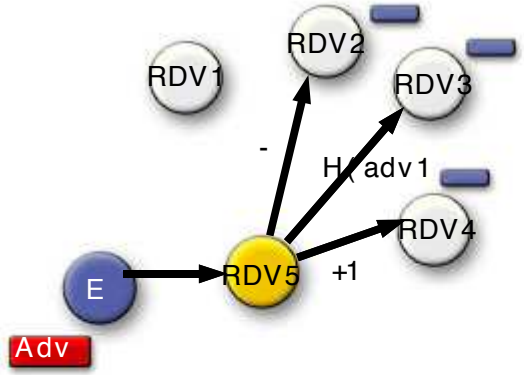


- Edge Peer
  - Publish, discover share resources and communicate)
- Relay Peer (connectivity network)
  - Store and forward messages across NAT and Firewall domains
  - Virtual router (logical multicast)
  - Landmark routing access point
- Rendezvous Peer (advertisement discovery network)
  - Index edge peer advertisements
  - Route discovery queries

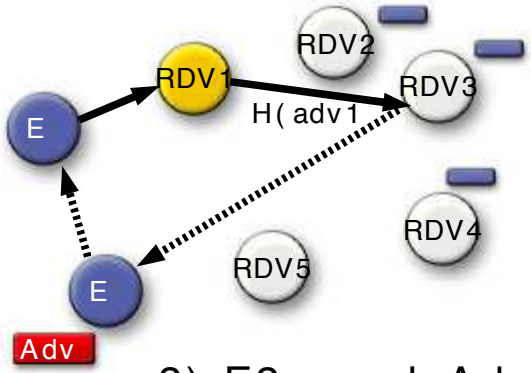
Decentralized RendezVous Discovery

- Route queries within RDV network (no centralized registry mandated)
- Loosely-consistent Distributed Hash Table (DHT) to index advertisements (log(n))
- Replicate indeces in the proximity of the target RDV
- Rendezvous walkers to garbage collect inconsistent indeces
- Provide a default RDV walker policy, but walkers are pluggable!
- Ad doc RDV network organization and failover

RendezVous Network Discovery

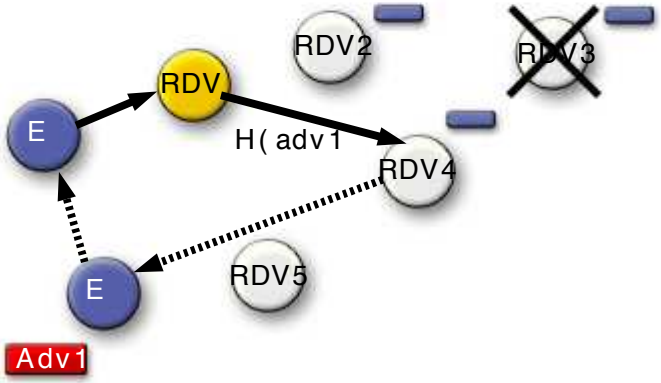


1) E1 publish



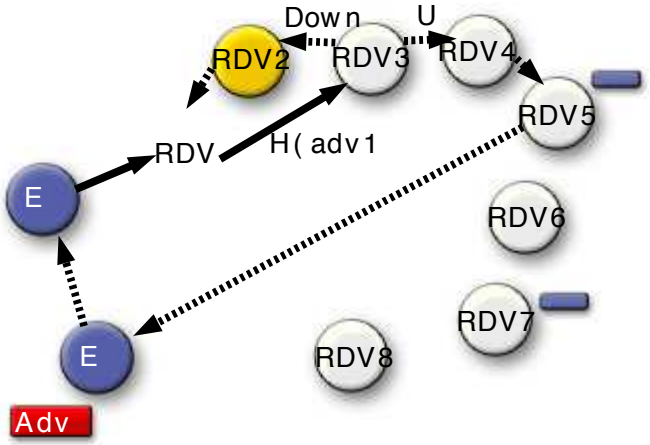
2) E2 search Adv1

(Consistent RDV view)



3) E2 search Adv1

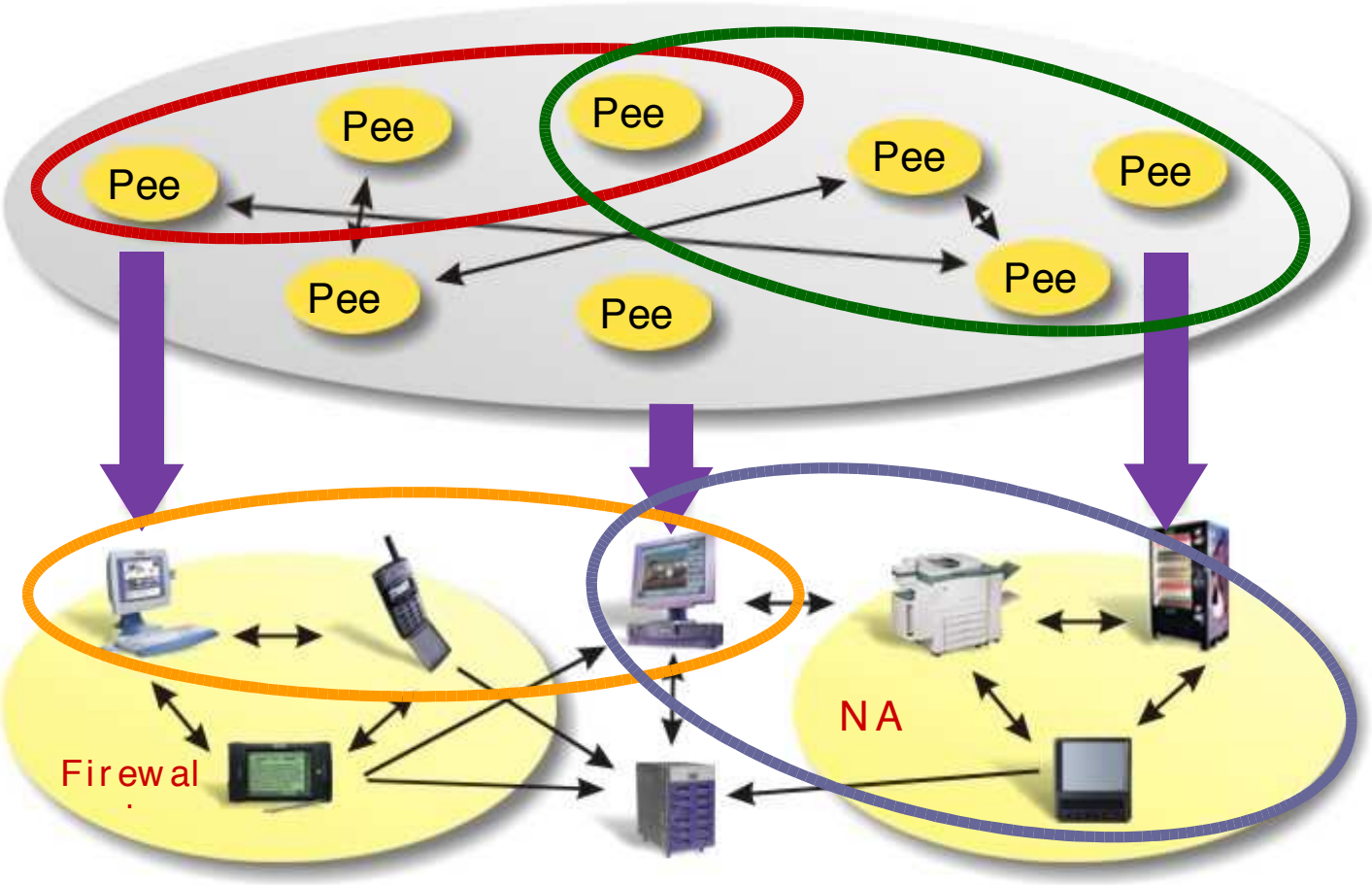
(Shift (+1 -1) RDV



4) E2 search Adv1

(Limited-Range Walker)

Virtual PeerGroup Domains



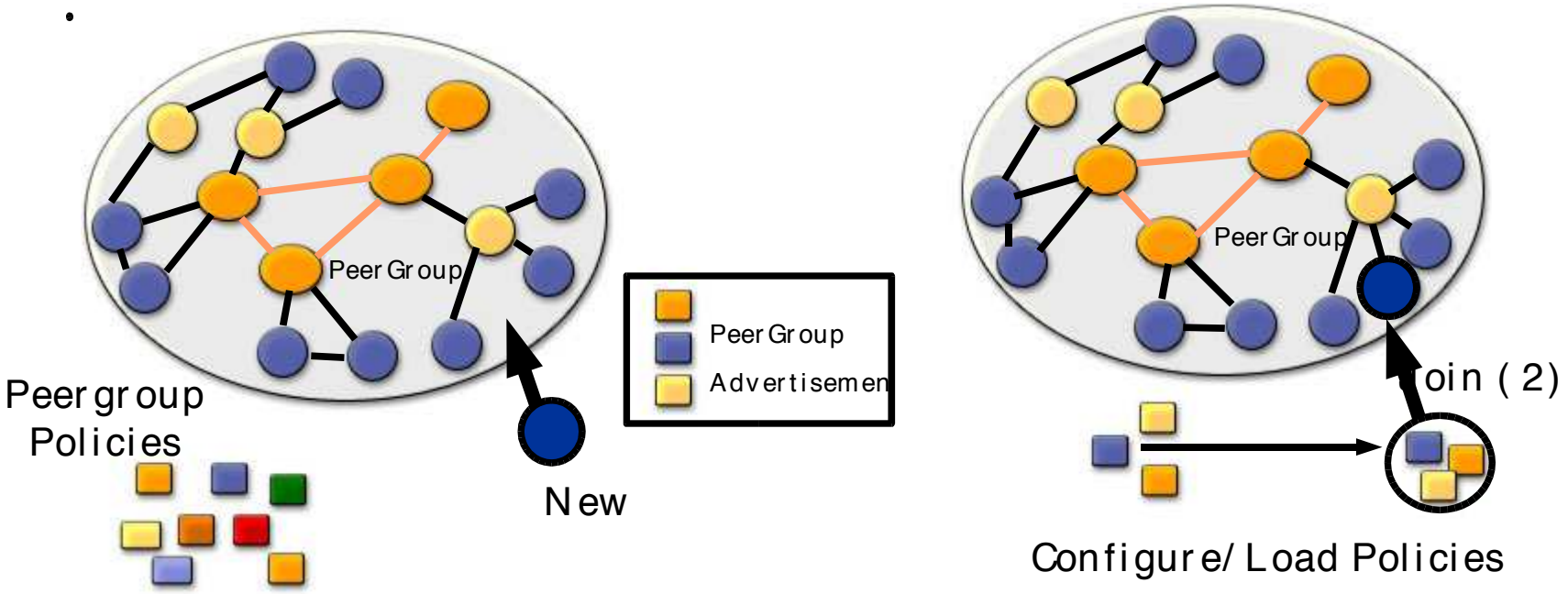
Peergroups

- Define by developers, NOT ONLY by network administrators
- Enable self-organization of peers
- Pluggable membership and access control policy
- Create secure and protected domains (virtual firewalls)
- Scope peer interactions (discovery)
- Create an identity for peers sharing a “common” interest (baseball, storage or cpu-sharing peer groups)

Pipes

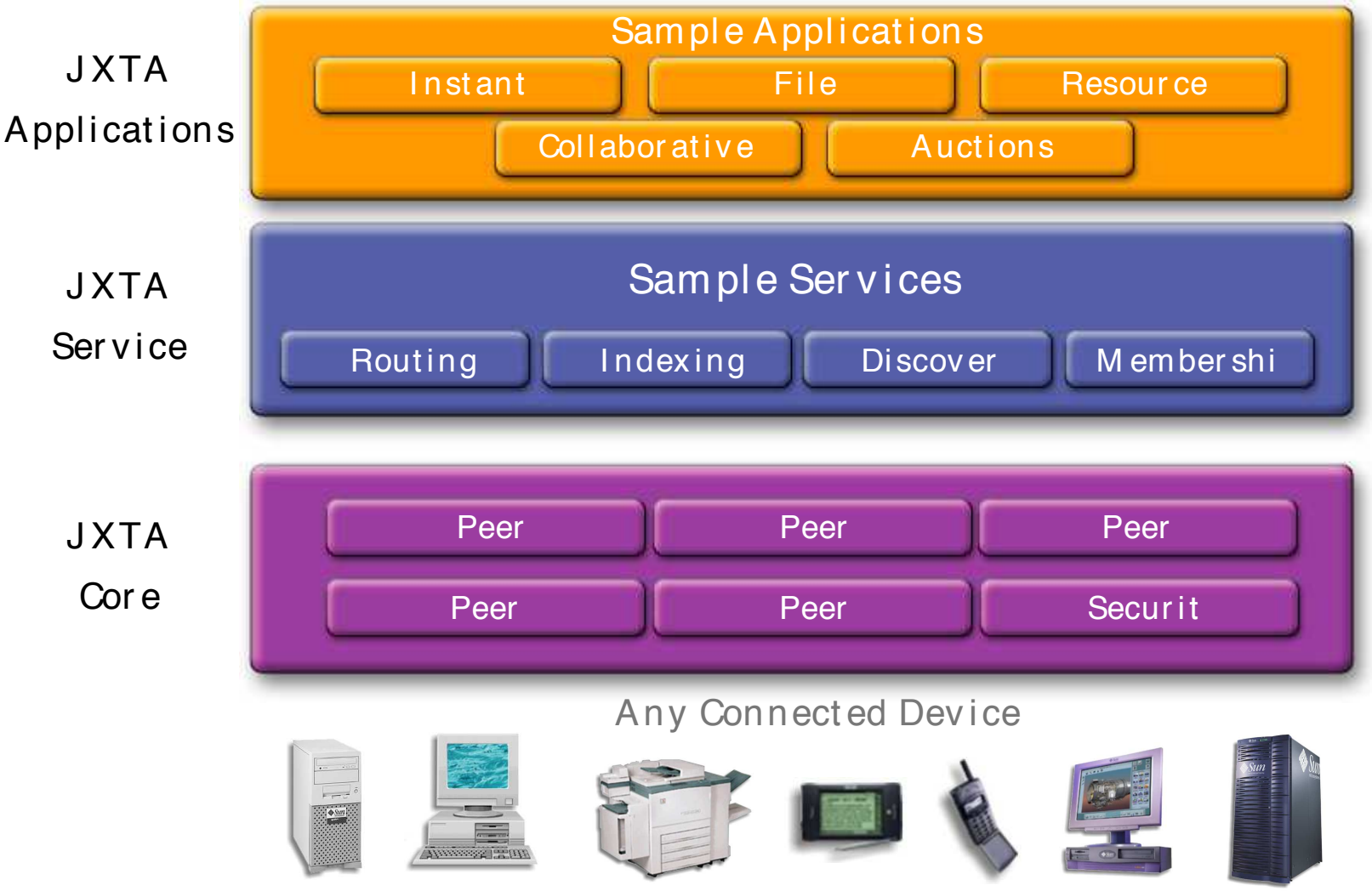
- Virtual communication channels (traverse NAT and firewall)
- Dynamic binding of pipe ends
- Can be used to transfer virtually anything (data, code, binary, XML, etc.)
- Core pipe services
  - Unicast (asynchronous and uni-directional)
  - Propagate (virtual multicast within peergroup)
- Can be extended (reliable and secure pipes)

Peergroups Enable Network Diversity



- Peergroup policies (membership, routing, searching, indexing, etc.)
- Policy represented by advertisements (Module advertisements)
- Loadable policies (mutation and learning)

JXTA Software Architecture



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JXTA Implementations Status

- J2SE™ Reference Implementation
  - Full implementation of JXTA 1.0-2.0 protocols
  - Edge, relay and rendezvous functionality
  - APIs and functionality frozen since Nov'02
  - Just released JXTA 2.1 for JavaOne!
    - New metering and monitoring framework
    - Reliable JXTA socket
    - New Bi-directional pipes
    - Access peergroup service
    - Relay and rendezvous dynamic failover

JXTA Implementations Status (2)

- JXTA for J2ME™ technology
  - Edge Peer JXTA 2.0 functionality only
  - MIDP—1.0 compliant
- JXTA-C
  - Edge Peer JXTA 1.0 functionality only
  - Runs on Linux, Solaris™ OE, and Windows
- Community effort
  - Python, Perl
  - .Net

What's in It for Developers?

- Open Source Code and License friendly!
- Community of Open Source Developers
- Opportunity to "Steer the Boat"
- A "pluggable" infrastructure that provide a foundation for P2P applications
- Quick time to market for new products and services

Looking Ahead

- Better performance and scalability
- Continue improving Quality
  - Distributed Testing Framework (www.jdf.org)
- Security
  - crypto ID
  - advertisement signing
  - QoS pipes
- Better integration with Web services (JXTA socket, JXTA-SOAP, JXTA-RPC)
- Specification standardization through public organization (IRTF)

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JXTA Community (www.jxta.org)

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Please join our efforts!

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Sun Microsystems, Inc.

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We make the net work.