



**JavaOne**<sup>SM</sup>  
Sun's 2001 Worldwide Java Developer Conference™

# JXTA Technology: A Peer-to-Peer Network Programming Environment

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# Goal of Presentation

- Learn about Project JXTA
  - what Project JXTA is
  - how JXTA technology works
  - why is it relevant to you
- Participate in JXTA technology development
  - where to start
  - how does the JXTA community work



# Learning Objectives

- As a result of this presentation, you will
  - understand the motivation of Project JXTA
  - see the benefit of peer-to-peer networking
  - feel the excitement of JXTA technology
  - decide to join the JXTA community



# Speaker's Qualifications

- Engineering Director of Project JXTA
- Principal Architect for JXTA technology
- Distinguished Engineer at Sun
- Extensive background in distributed computing (60 papers, 2 books, 1 PhD)



# Project JXTA: Technical Goal

Build a small, lightweight platform as the foundation of all peer-to-peer systems

jux·ta·pose

v. tr. jux·ta·posed, jux·ta·pos·ing, jux·ta·pos·es.

To place side by side, especially for comparison or contrast.

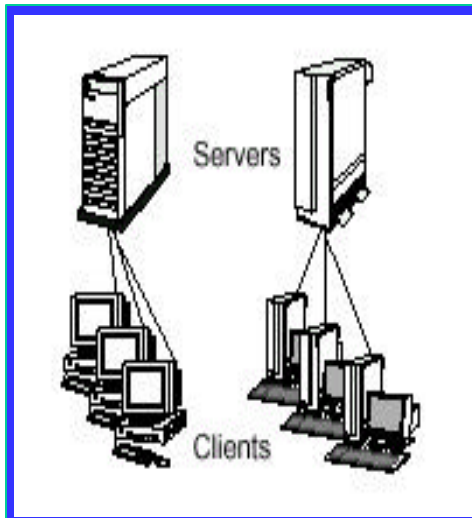


# Presentation Outline

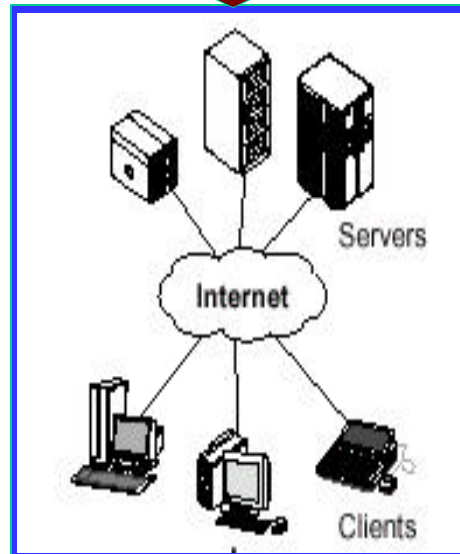
- Benefits of peer-to-peer networking
- Sun's interests in this space
- Overview of JXTA technology
- Examples of applications built using JXTA technology
- Roadmap for the near future
- Q&A



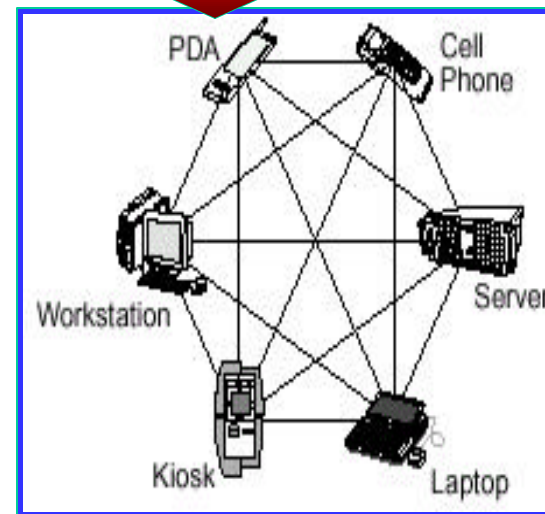
# Evolution of Computing



Client-server silos



Web-based computing



Peer-to-Peer



# Problems With Today's Paradigm

- Information
  - hard to find, impossible to catalog and index
- Bandwidth
  - hot links get hotter, cold ones stay cold
- Computing resources
  - heavily loaded nodes get overloaded, idle nodes remain idle





# Information Gathering

- The world produces two exabytes of information ( $2 \times 10^{18}$  bytes) every year
- The world publishes 300 terabytes of information ( $3 \times 10^{14}$  bytes) every year
- Google searches  $1.3 \times 10^9$  pages, total
- Data beyond web servers
- Transient information



# Bandwidth Utilization

- A single fiber's bandwidth has increased by a factor of  $10^6$ , doubling every 16 months, since 1975
- Traffic is still congested
  - more devices and people on the net
  - more volume of data to move around
  - same destinations (eBay, Yahoo, etc.)



# Computing Resources

- Moore's Law: processor speed doubles every 18 months
- Computing devices (server, PC, PDA, cell phone) are more powerful than ever
- Storage capacity has increased dramatically
- Computation still accumulates around data centers



# Benefits From Peer-to-Peer

- Theory
  - Dynamic discovery of information
  - Better utilization of bandwidth, processor, storage, and other resources
- Practice examples
  - Sharing browser cache over 100Mbps lines
  - Disk mirroring using spare capacity
  - Deep search beyond the web



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# Sun's Interest in Peer-to-Peer

- P2P is just an instance of the vision “The Network Is the Computer”
- Continued thought leadership
- Open, level competitive field
- Sun’s readiness for peer-to-peer
  - desktop software, workstations, iPlanet products, servers, storage, network appliances



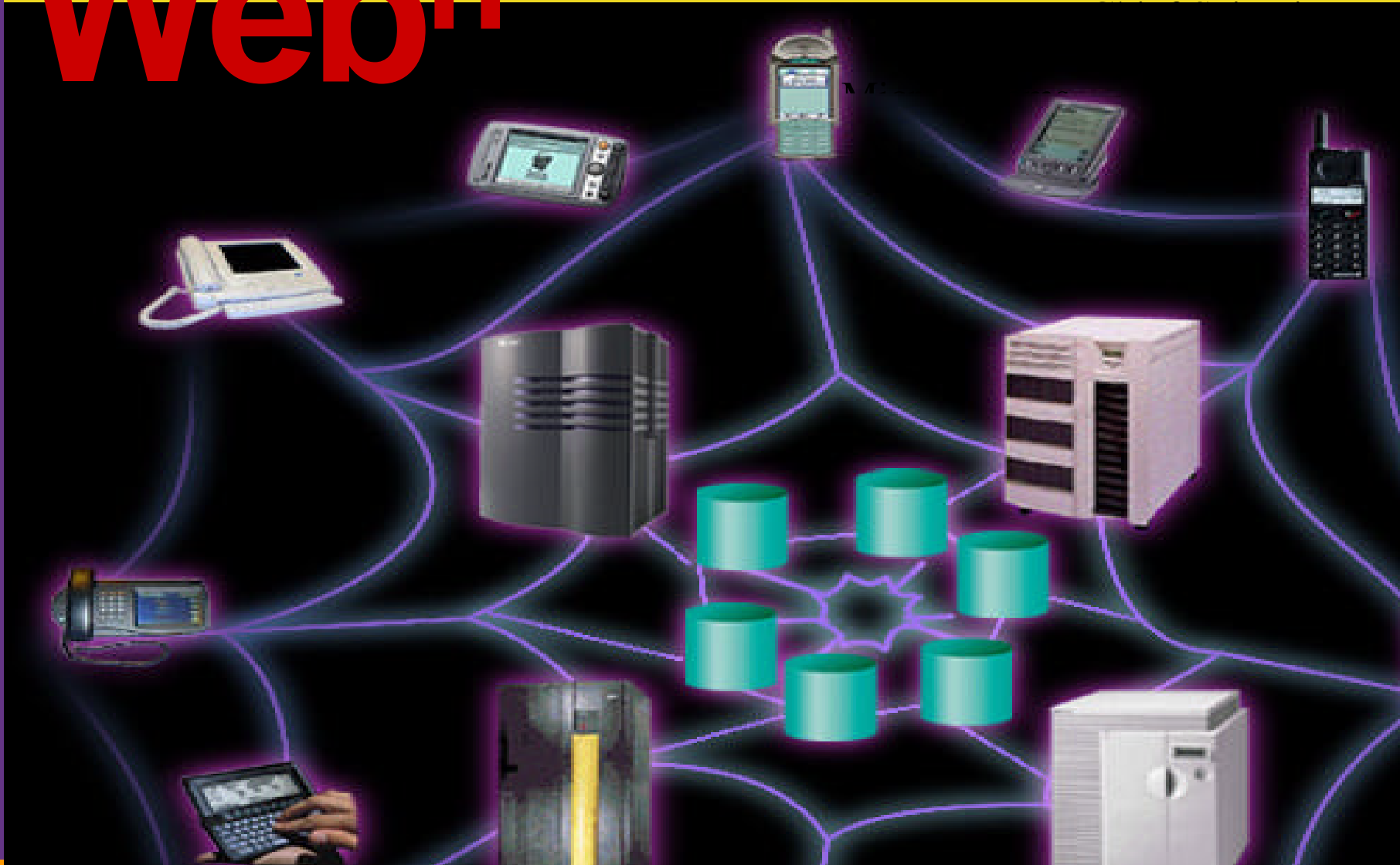
# From Scott McNealy, Sun's CEO

- “I’m a total believer that peer-to-peer is going to change the way we work and play.
- “It’s going to change the balance of power between consumers, service providers, and businesses.
- “It’s radical stuff. Will Sun be involved? You bet.”



# Project JXTA: Web<sup>n</sup>

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





# Sun's Approach to Project JXTA

- Sun
  - initiator, contributor, ...
- JXTA Advisory Council
  - guidance, early feedback, ...
- Open source community
  - adopter, innovator, evangelist, developer, ...
- The entire peer-to-peer industry
  - adopter, innovator, deployment, ...

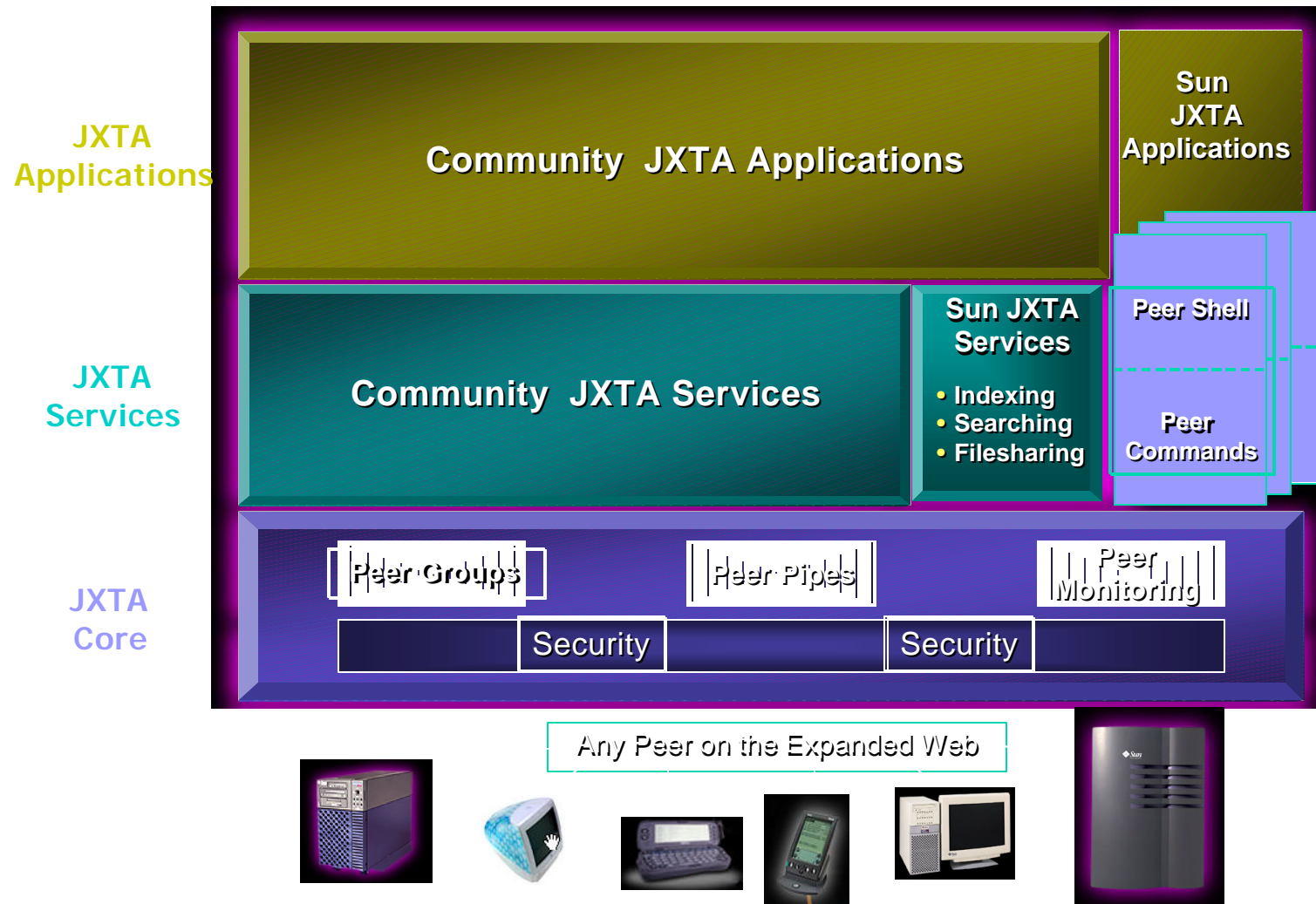


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# Peer-to-Peer Software Architecture



# Issues in Current Peer-to-Peer Systems Under Development

- Computing silos
  - non-interoperable, fragmented networks
- PC-to-PC
  - built-in dependencies on PC properties
- TCP/IP only
  - built-in dependency on IP-based transport
- Proprietary



# JXTA Technology Objectives

- Interoperability
  - across different peer-to-peer systems and communities
- Platform independence
  - programming languages, system platforms, and networking platforms
- Ubiquity
  - every device with a digital heartbeat



# JXTA Technology Concepts

- A set of protocols (akin to TCP/IP)
  - implementable in multiple programming languages (C/C++, Java, Perl, ...)
- Peers, peer groups, messages, pipes, content, services, advertisement
- Discovery, routing, security, monitoring, metering
- JXTA Shell



# Basic Concepts

- Peers and groups
  - any entity capable of the necessary protocols
- Advertisement
  - structured XML document
- Messaging
  - unreliable, asynchronous, uni-directional
- Pipe
  - virtual communication channel



# Initial JXTA Protocols

- Discovery protocol
  - find advertisements from other peers
- Resolver protocol
  - locate peers, groups, pipes, etc.
- Information protocol
  - query other peers' status





# Initial JXTA Protocols (Cont.)

- Membership protocol
  - obtain membership information, apply, receive, and update group membership,
- Pipe binding protocol
  - bind a pipe advertisement to an actual endpoint
- Routing protocol
  - find a route to reach a peer



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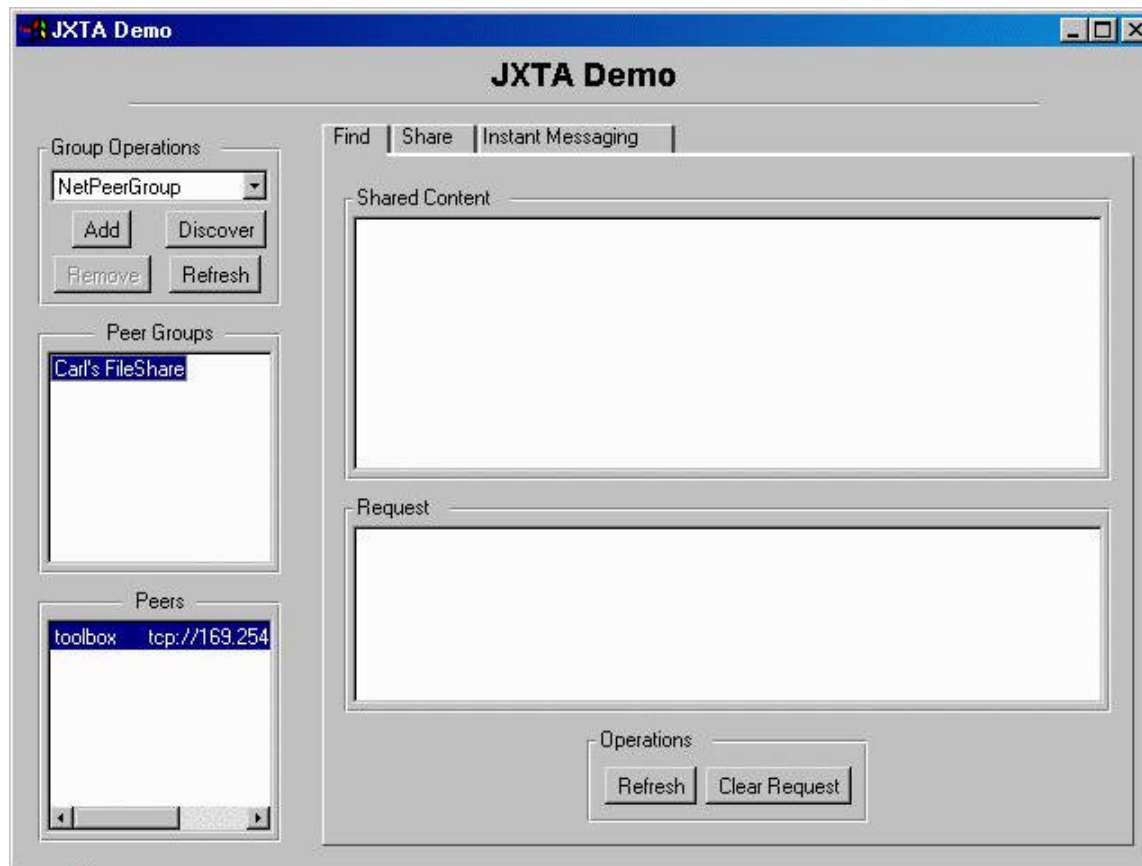


# JXTA Services and Applications

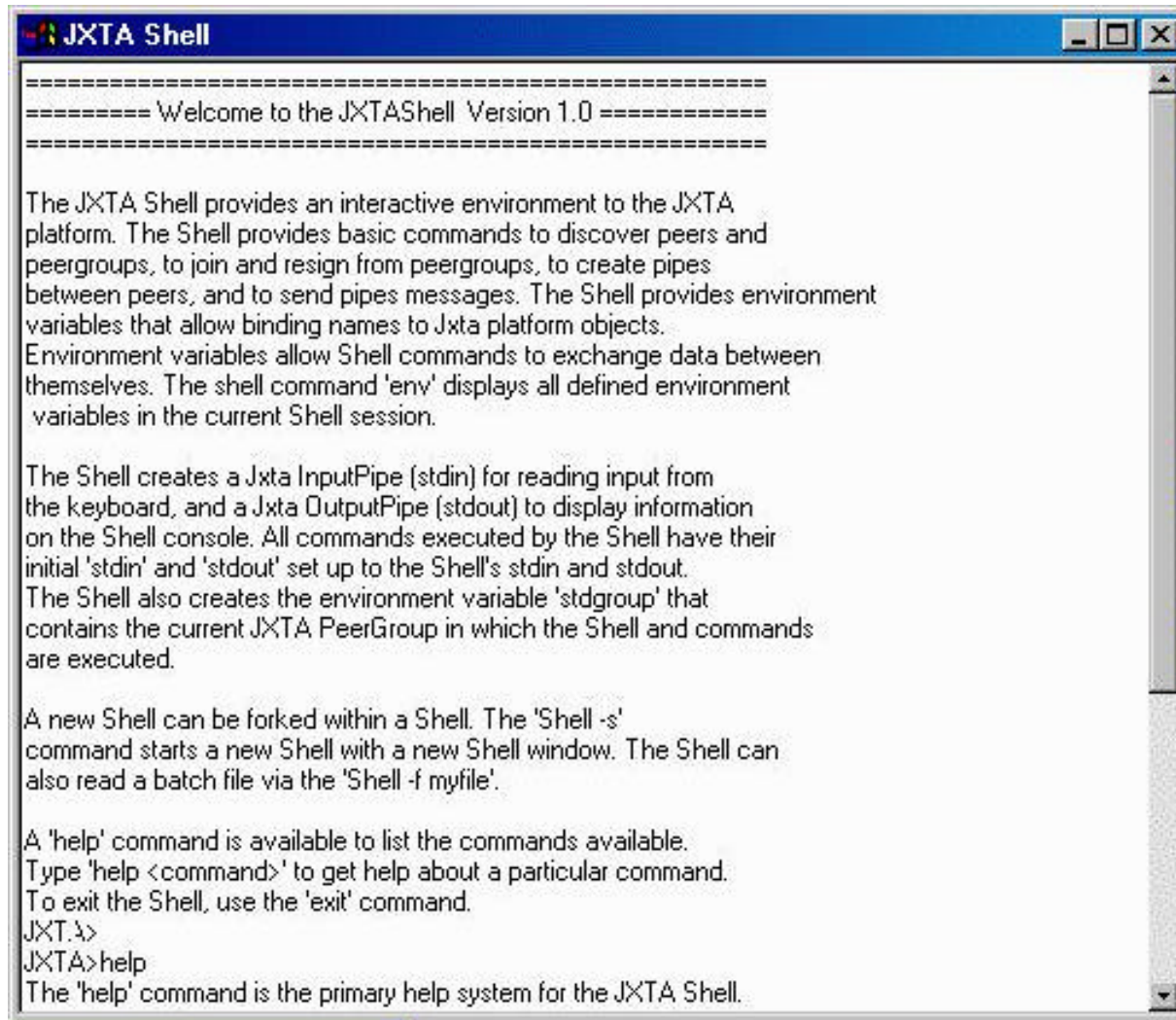
- Searching and indexing
- File sharing
- Distributed storage
- Peer-to-peer email
- Peer-to-peer DNS (Domain Name Service)
- JXTA Shell



# Instant P2P Demo



# JXTA Shell: A Screen Shot



```
JXTA Shell
=====
===== Welcome to the JXTAShell Version 1.0 =====
=====

The JXTA Shell provides an interactive environment to the JXTA
platform. The Shell provides basic commands to discover peers and
peergroups, to join and resign from peergroups, to create pipes
between peers, and to send pipes messages. The Shell provides environment
variables that allow binding names to Jxta platform objects.
Environment variables allow Shell commands to exchange data between
themselves. The shell command 'env' displays all defined environment
variables in the current Shell session.

The Shell creates a Jxta InputPipe (stdin) for reading input from
the keyboard, and a Jxta OutputPipe (stdout) to display information
on the Shell console. All commands executed by the Shell have their
initial 'stdin' and 'stdout' set up to the Shell's stdin and stdout.
The Shell also creates the environment variable 'stdgroup' that
contains the current JXTA PeerGroup in which the Shell and commands
are executed.

A new Shell can be forked within a Shell. The 'Shell -s'
command starts a new Shell with a new Shell window. The Shell can
also read a batch file via the 'Shell -f myfile'.

A 'help' command is available to list the commands available.
Type 'help <command>' to get help about a particular command.
To exit the Shell, use the 'exit' command.
JXT.1>
JXTA>help
The 'help' command is the primary help system for the JXTA Shell.
```



# JXTA Shell: Some Commands

- JXTA Shell models after the Unix Shell
- JXTA Shell executes within a network

```
JXTA> whoami
```

```
JXTA> peers
```

```
JXTA> groups | grep SUNW
```

```
JXTA> join SUNW
```

```
JXTA> peers | wc
```

```
JXTA> talk LiGong
```



# JXTA Shell: More Commands

```
JXTA> peerconfig
```

```
JXTA> peerinfo
```

```
JXTA> search
```

```
JXTA> cat >p1 myfile
```

```
JXTA> grep <p1 jxta
```

```
JXTA> grep <p1 unix
```

```
JXTA> cmd1 <> cmd2
```



iddle



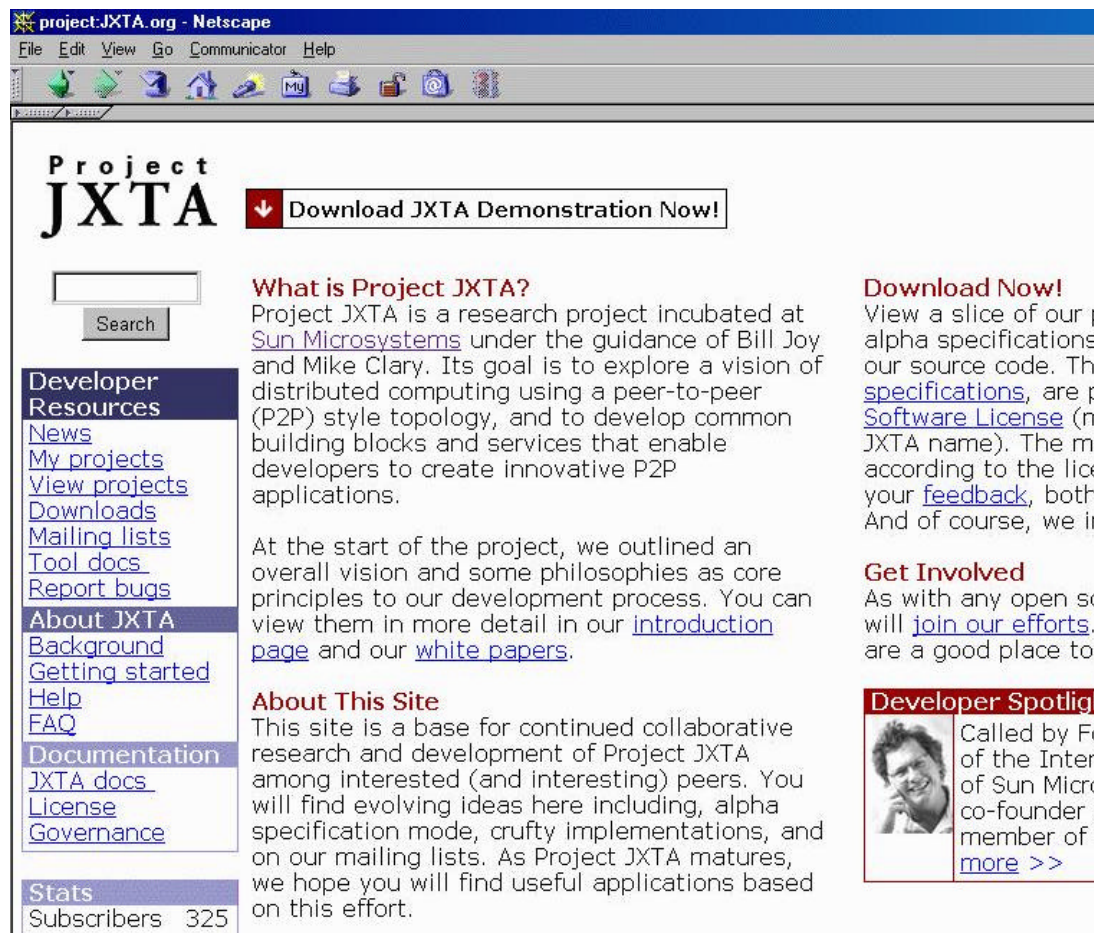


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# JXTA Community at jxta.org



The screenshot shows the Project JXTA website in a Netscape browser window. The browser's address bar displays "project.JXTA.org - Netscape". The website features a navigation menu on the left with links for "Developer Resources", "About JXTA", "Documentation", and "Stats". The main content area includes a search bar, a "Download JXTA Demonstration Now!" button, and sections titled "What is Project JXTA?", "Download Now!", "Get Involved", and "Developer Spotlight".

**Project JXTA**

[Download JXTA Demonstration Now!](#)

**Developer Resources**

- [News](#)
- [My projects](#)
- [View projects](#)
- [Downloads](#)
- [Mailing lists](#)
- [Tool docs](#)
- [Report bugs](#)

**About JXTA**

- [Background](#)
- [Getting started](#)
- [Help](#)
- [FAQ](#)

**Documentation**

- [JXTA docs](#)
- [License](#)
- [Governance](#)

**Stats**

Subscribers 325

**What is Project JXTA?**

Project JXTA is a research project incubated at [Sun Microsystems](#) under the guidance of Bill Joy and Mike Clary. Its goal is to explore a vision of distributed computing using a peer-to-peer (P2P) style topology, and to develop common building blocks and services that enable developers to create innovative P2P applications.

At the start of the project, we outlined an overall vision and some philosophies as core principles to our development process. You can view them in more detail in our [introduction page](#) and our [white papers](#).


**Download Now!**

View a slice of our alpha specifications or our source code. The [specifications](#), are per [Software License](#) (referred to as the JXTA name). The most important thing according to the license is your [feedback](#), both positive and negative. And of course, we're always looking for new members.

**Get Involved**

As with any open source project, we will [join our efforts](#). We're a good place to start.

**Developer Spotlight**

 Called by [Fred](#) of the Internet of Sun Microsystems co-founder and member of [more >>](#)



# Early JXTA Community



# JXTA Community Status

- 50,000 downloads in the first 5 weeks
- 14 new projects started
- 2000 plus developers registered
- tons of discussion email everyday



# JXTA Technology: The Near Future

- C/C++ and J2ME implementations
- Test-bed, especially for scaling
- Naming services, authentication services
- Solutions for firewalls and NAT
- Advanced discovery mechanisms
- Reliable and secure pipes
- Shell extensions



# Summary

- JXTA is a network programming platform
- JXTA is especially suitable for peer-to-peer
- JXTA is designed for interoperability, platform (language, OS, and transport) independence, and ubiquity
- JXTA is a set of protocols that enables higher-level services and applications
- JXTA community is at [jxta.org](http://jxta.org) - come join us!





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# Q&A

<http://jxta.org>

[discuss@jxta.org](mailto:discuss@jxta.org)

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