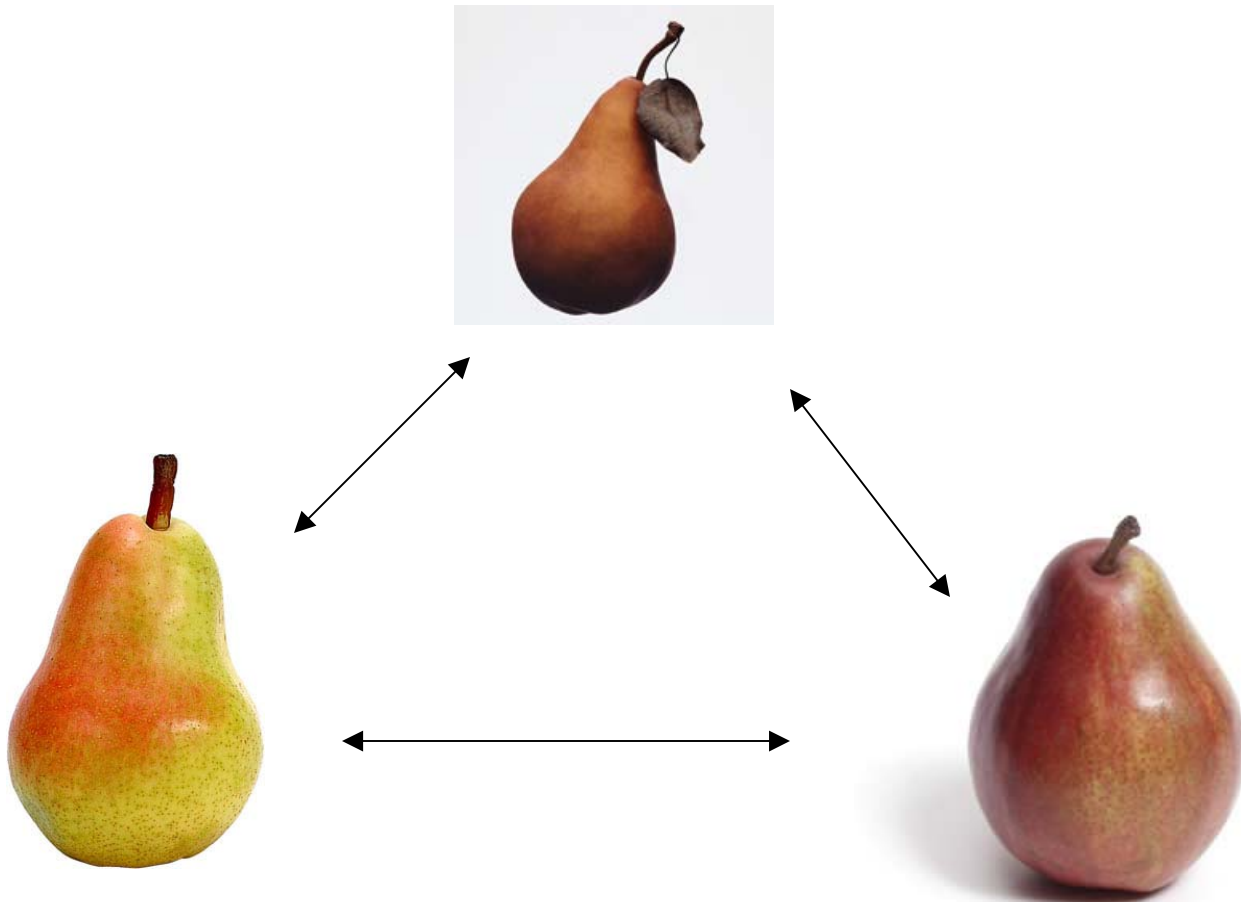


Peer to Peer Networks



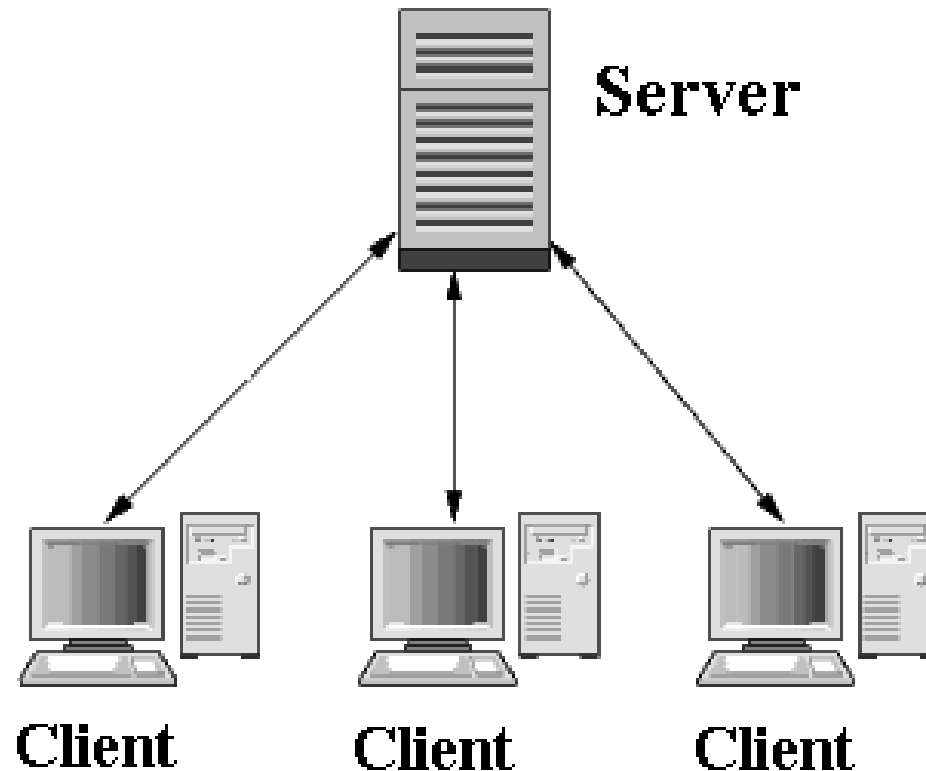
Common P2P Examples

- Napster
- Morpheus
- Gnutella
- Freenet
- BitTorrent
- Skype

Uses of P2P

- File sharing
- Instant messaging
- Voice communication
- Collaboration
- Backup
- Sensor nets
- Distributed computing
- Defence

Client-Server Architecture



Information Flow in Client-Server Architecture

Client (Active Entity):

- Sends requests to the server

- Waits for reply

Server (Passive Entity):

- Waits for requests

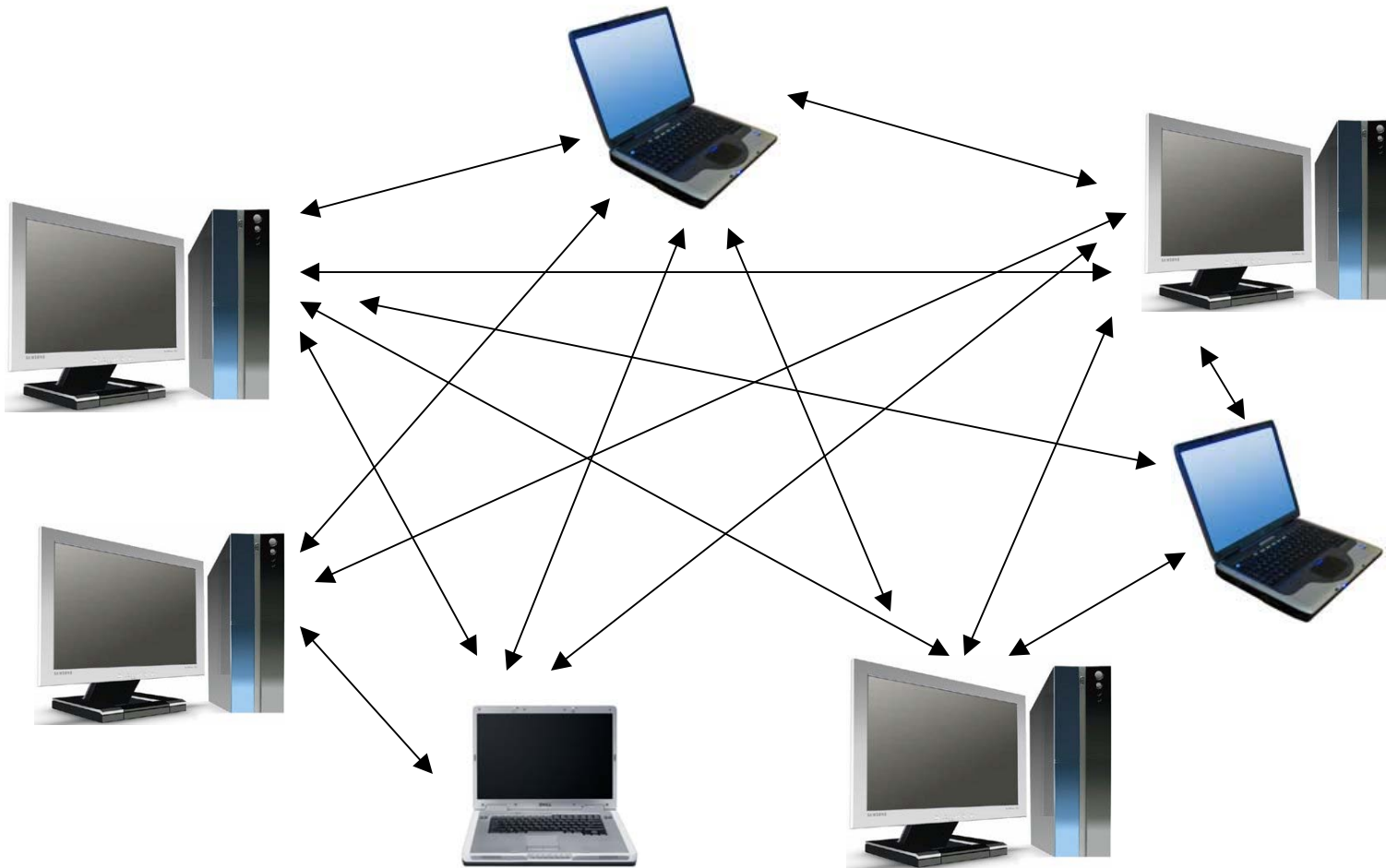
- On request sends reply(ies)

As more clients are added, the demand on the server increases

A Few Examples

- Web (HTTP) servers
- FTP Servers
- Print servers
- File servers
- Database servers

Pure P2P Architecture



P2P vs. Client-Server

Pure P2P:

No central server

For certain requests any peer can function as a client or as a server

The information is not located in a central location but is distributed among all peers

A peer may need to communicate with multiple peers to locate a piece of information

As more peers are added, both demand and capacity of the network increases

Major technical challenges of P2P

- Finding peers on the network
- Storing and Locating information on the network
- Maintaining stable, fully accessible network
- Supporting secure communication

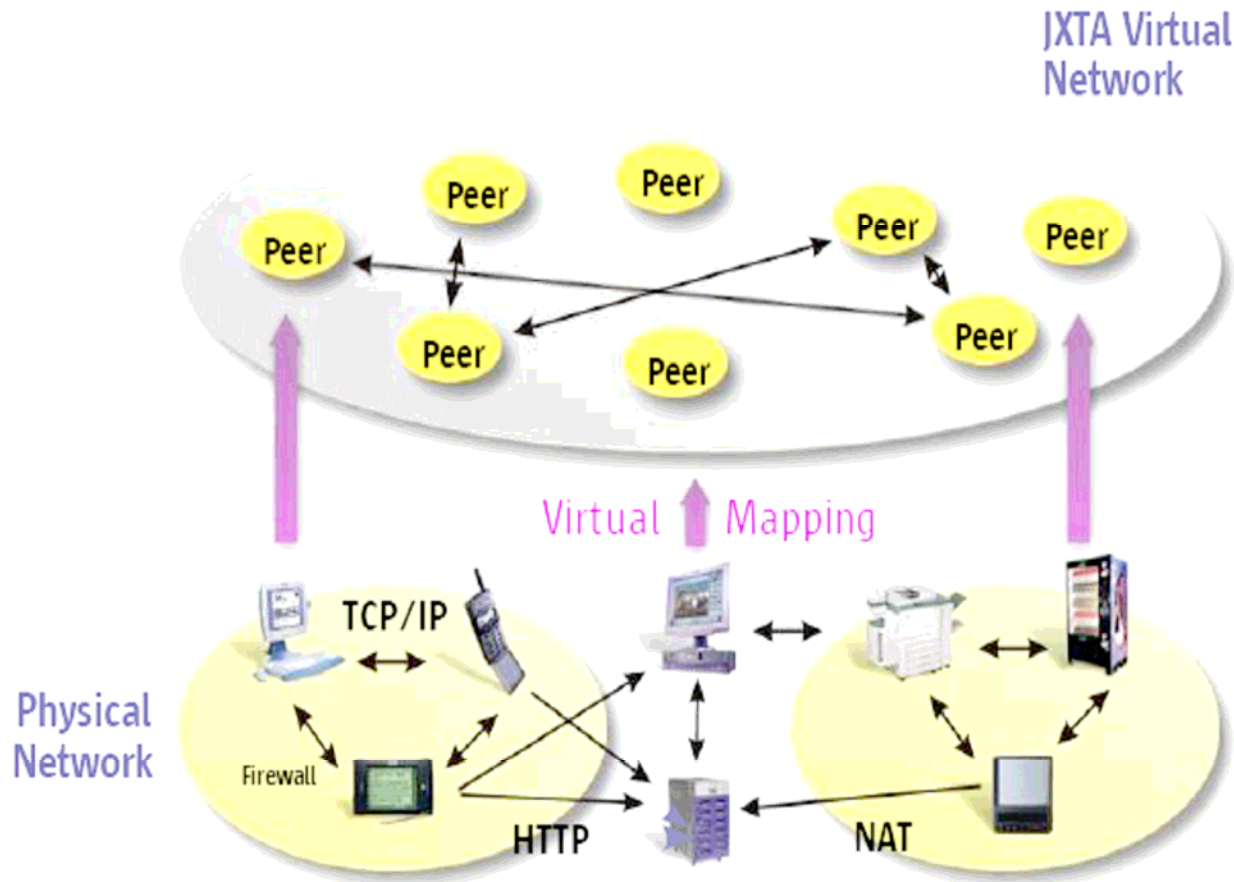
JXTA As an Example of P2P

What is JXTA?

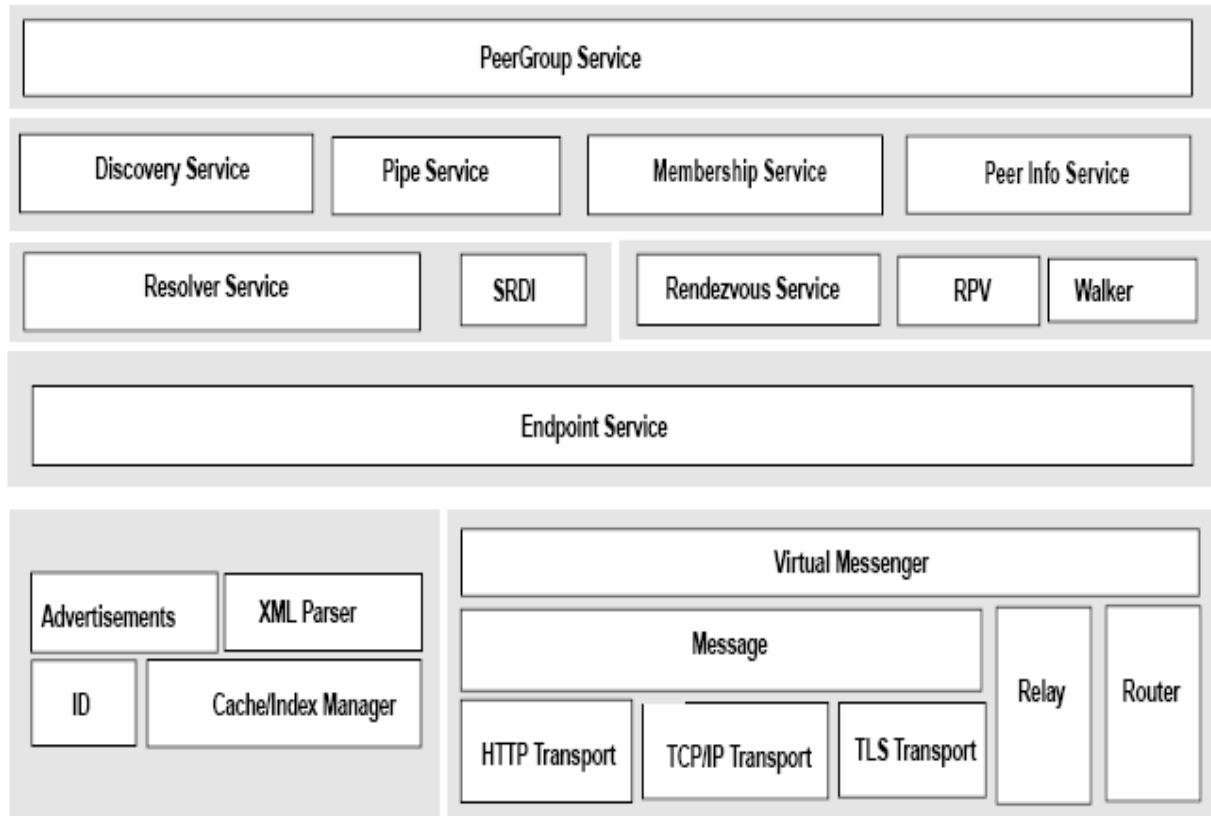
Set of open protocols for collaboration in P2P manner.

An open source P2P architecture started and supported by SUN Microsystems.

JXTA, High Level Picture



JXTA, Low Level Picture



Edge peers and Super peers

Peers on the network may have different number of computing resources available to them: High-End Desktop vs. Cell Phone.

Peers with more resources may take upon themselves to provide certain services to other peers. Such peers are called **Super Peers**.

Peers which do not provide any global services are called **Edge Peers**.

How do peers distinguish each other

Each peer has a “unique” identifier called peer id. The id is randomly generated so that the chance of generating two identical ids is extremely low.

`uuid-59616261646162614E50472050325033816021CBBE15434AAF3B827A0B80417203`

Why not use some physical property of the peer such as the Peer's Name, IP address, MAC address, etc.

Advertisements

How does a peer locate information or other peers on the network?

Anything locatable on the network has an advertisement including peers, pipes, rdvs, any other entities or resources

```
<?xml version="1.0"?>
<!DOCTYPE jxta:PA>
<jxta:PA xmlns:jxta="http://jxta.org">
  <PID>urn:jxta:uuid-59616261646162614E50472050325033816021CBBE15434AAF3B827A0B80417203</PID>
  <GID>urn:jxta:jxta-NetGroup</GID>
  <Name>JXTA Edge Peer</Name>
  <Desc>COMP102 Peer</Desc>
</jxta:PA>
```

Rendezvous Super-Peers

Serves as a library of advertisement for edge peers

Does not store the advertisements themselves but only the indices

An edge peer can ask a rendezvous for all advertisements matching a certain restriction, for example advertisements of all peers with description equal to “COMP102 Peer”

Rendezvous will search its index and find all advertisements matching the restriction

It will then ask the peers who own the advertisements to forward the actual advertisements to the requestor

Rendezvous – Propagating

What if a rendezvous receives a search request but does not know where the advertisement is located?

To handle this situation each rendezvous maintains a list of other rendezvous on the network and will propagate the search to them.

Rendezvous organize themselves into sub-networks in order to store and share advertisement indices

Unicast Pipes

How do two peers communicate with one another, send messages, files, etc?

Unicast Pipes are used to send any kind of information between two peers

- Each pipe has an advertisement
- One peers needs to open a pipe and create an advertisement
- The other needs for find the advertisement and start sending the information through the pipe
- The information can only flow in one direction

Multicast Pipe

Like a unicast pipe but more than one peer can listen to the information going through the pipe

How all this works together

Edge peer



A

Rendezvous peer



B

Edge peer



C

Edge peer



D

What are the steps for the following to happen:

Peer A wants to find who is online

Peer B want to send a file to peer C

Peer D wants to give a lecture to peers A and B

Peer C wants to find out all about peer E

Lots more to talk about

There are a lot more important details behind JXTA:

Communicating through firewalls

Establishing a secure channel between peers

Creating peer groups

Insuring network stability with unreliable peers



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