

同儕系統—從個體計算到總體計算

# Peer-to-peer Systems: Macro-computing with Micro-computers

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## Outline

- P2P Applications in Action
  - KaZaA, SETI@home, PlanetLab
- Defining P2P
- Peering and Searching in P2P Systems
  - Napster, Gnutella, Freenet, KaZaA
- Summary
  - Implications, Resources and Links

## Most Popular Titles in Windows

This Week	Titles	Last Week	Weeks On Chart	Downloads This Week	Total Downloads
1	<b>Kazaa Media Desktop</b>	1	62	3,341,658	247,784,738
2	<i>ICQ Lite</i>	2	39	502,242	22,274,706
3	<i>AOL Instant Messenger (AIM)</i>	4	39	487,807	14,806,084
4	<b>iMesh</b>	3	167	423,180	53,064,693
5	WinZip	5	351	340,661	98,885,930
6	<i>ICQ Pro 2003a beta</i>	6	302	331,395	231,418,448
7	Spybot - Search & Destroy	9	19	200,197	1,677,149
8	Ad-aware	7	33	193,321	17,890,549
9	<b>Morpheus</b>	8	114	155,017	113,014,928
10	<i>MSN Messenger</i>	10	2	139,833	324,664

Taiwan: EzPeer, Kuro, eDonkey, ... *download.com, Week Ending July 6*

*P2P Applications in Action*

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## Example of P2P File Sharing: KaZaA

*As of July 2003*

Users Online	3,824,411
Total Number of MP3 Files	294,468,383
Total Size of Movies Files	894,435
Total Number of Files Shared	2,936,033,461
Total Size of Shared Files	8,283,375GB

- Employees in 77% of surveyed companies had at least one installation of file-swapping software (AssetMetrix, July 16, 2003)
- Today more KaZaA traffic than Web traffic!

*P2P Applications in Action*

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## Example of Computing-Power Sharing: SETI@home

A scientific experiment that uses Internet-connected computers to analyze radio telescope data in the Search for Extraterrestrial Intelligence (SETI)

<http://setiathome.ssl.berkeley.edu/>

SETIatTaiwan@groups.msn.com

(Not real Peer-to-Peer)

Last updated: Mon Jul 21 2003 UTC	Total	Last 24 Hours
Users	4591332	1787 (new)
Results received	963,646,331	1,449,085
Total CPU time	1545634.1 years	1524.6 years
Avg CPU time per work unit	14 hr 03 m 01.9 s	9 hr 13 m 00.4 s

*P2P Applications in Action*

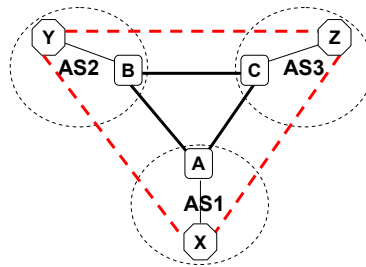
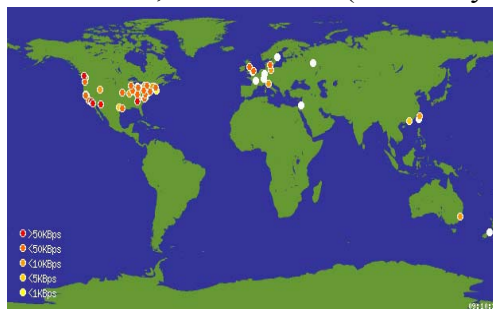
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## Example of Host Sharing: PlanetLab

An open testbed for developing, deploying, and accessing planetary-scale services

<http://www.planet-lab.org/>

163 Nodes, 68 Networks (As of July 2003)



*P2P Applications in Action*

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## Definition of P2P

“Peer-to-Peer (P2P) is a way of structuring distributed applications such that the individual nodes have symmetric roles. Rather than being divided into clients and servers each with quite distinct roles, in P2P applications a node may act as both a client and a server.”

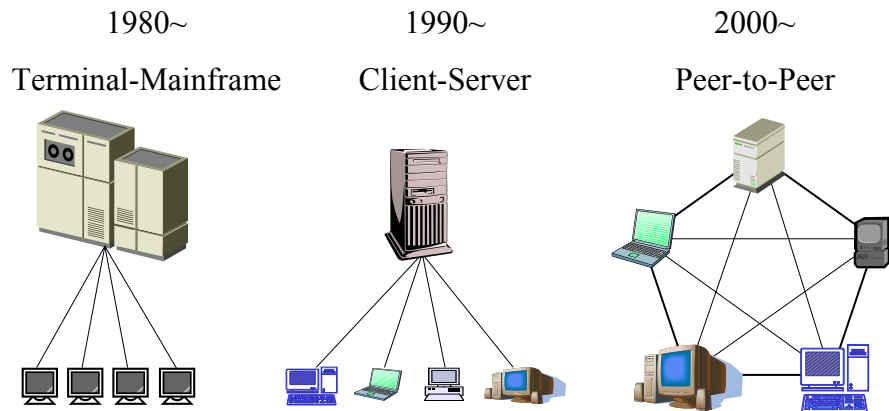
*Excerpt from the Charter of Peer-to-Peer Research Group,  
IETF/IRTF, June 24, 2003*

Client, Server and Relay

*Defining P2P*

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## Paradigm Shift of Computing Environment



*Defining P2P*

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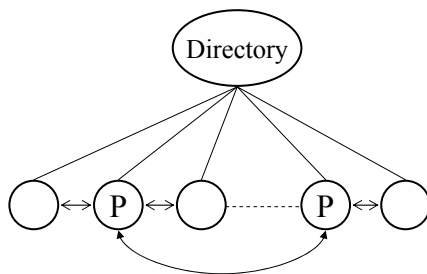
# P2P Applications

- P2P File Sharing
  - Napster, FreeNet, Gnutella, KaZaA, eDonkey, EZPeer, Kuro
- P2P Communication
  - Instant Messaging, News
- P2P Computation
  - SET@home
- P2P Gaming
  - Magnetar Games
- Distributed Hash Tables and Their Applications
  - Chord/CFS, Tapestry/OceanStore, Pastry/PAST, CAN
- P2P Overlay Networking
  - RON, PDF, Detour, LRR
- Overlay Testbed
  - PlanetLab, NetBed/EmuLab

*Defining P2P*

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## Example of Centralized P2P Systems: Napster

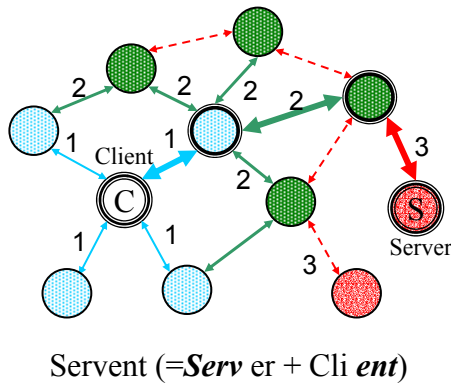


- Announced in January 1999 by Shawn Fanning for sharing MP3 files and pulled plug in July 2001
- Centralized server for search, direct file transfer among peer nodes
- Proprietary client-server protocol and client-client protocol
- Relying on the user to choose a 'best' source
- Disruptive, proof of concepts

*Peering and Searching*

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## Examples of Decentralized P2P Systems: Gnutella

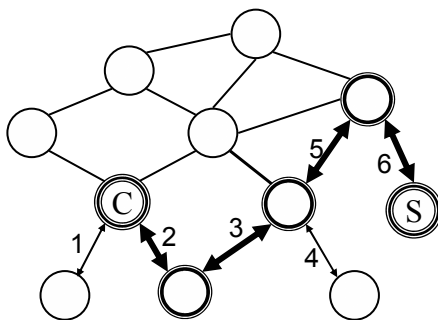


- Open source
- 3/14/2000: Released by NullSoft/AOL, almost immediately withdrawn, and became open source
- Message flooding: serverless, decentralized search by message broadcast, direct file transfer using HTTP
- Limited-scope query

Peering and Searching

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## Examples of Decentralized P2P Systems: Freenet

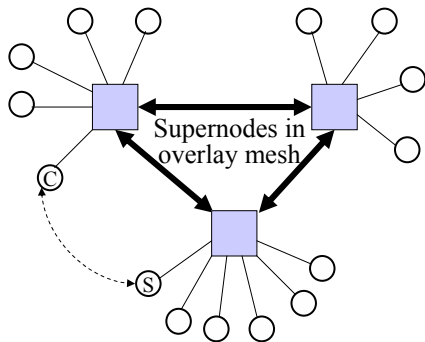


- Ian Clarke, Scotland
- Distributed depth-first search, Exhaustive search
- File hash key, lexicographically closest match
- Store-and-forward file transfer
- Anonymity
- Open source

Peering and Searching

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## Example of Hybrid P2P Systems: FastTrack / KaZaA



*Peering and Searching*

- Proprietary software developed by FastTrack in Amsterdam and licensed to many companies
- Summer 2001, Sharman networks, founded in Vanuatu, acquires FastTrack
- Hierarchical supernodes (Ultra-peers)
- Dedicated authentication server and supernode list server
- From user's perspective, it's like Google.
- Encrypted files and control data transported using HTTP
- Parallel download
- Automatically switch to new server

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## Implications of P2P

- Beyond Open Source
  - content, computing resource, network bandwidth
- Beyond Sharing
  - collaboration, collusion, distributed defenses and attacks, etc.
- Beyond Personal Computer
  - Worldwide Computer, Cyber-infrastructure
- Beyond Computer Science
  - Economics, sociology
- Toward Open Social Networks
  - Autonomous, cooperative peers
  - Fairness: free-riding problem
  - Reputation, trust and anonymity
  - Security and privacy

*Summary*

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## P2P Resources

- O'Reilly P2P Portal  
<http://openp2p.com/>
- Gnutelliums: directory of Gnutella clients  
<http://www.gnutelladev.com/>
- IRTF Peer-to-peer Research Group  
<http://www.irtf.org/charters/p2prg.html>
- p2p-hackers : peer-to-peer development  
<http://zgp.org/mailman/listinfo/p2p-hackers>
- the\_gdf : Gnutella Developer Forum  
[http://groups.yahoo.com/group/the\\_gdf/](http://groups.yahoo.com/group/the_gdf/)

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## P2POpen Systems and Research Projects

- Freenet: The free network project  
<http://freenet.sourceforge.net/>
- FreeHaven: A system for distributed, anonymous, persistent data storage  
<http://www.freehaven.net/>
- eMule: A filesharing client based on eDonkey2000 network  
<http://www.emule-project.net/>
- OCN: Open Content Network for distributing open source and public domain content  
<http://open-content.net/>
- Sun JXTA Project  
<http://www.jxta.org/>
- PAST/Pastry: A substrate for peer-to-peer applications  
<http://research.microsoft.com/~antr/Pastry/>
- OceanStore/Tapestry: Providing Global-Scale Persistent Data  
<http://oceanstore.cs.berkeley.edu/>
- CFS/Chord: Scalable, robust distributed systems  
<http://www.pdos.lcs.mit.edu/chord/>
- RON: Resilient Overlay Networks  
<http://nms.lcs.mit.edu/ron/>

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