

NEWS TICKER

- 03/07/97 - “Hotline” is released
- 09/09/99 - “Napster” is released (at NorthEastern University)
- 04/04/00 - “Gnutella 0.56” is released
- 01/04/00 - “Napster” reaches 10 million downloads, but still has no revenue
- 01/05/00 - Cable internet provider threaten to discontinue contracts with users that use “Napster”
- 01/05/00 - Universal and Sony start to develop “Duet”, a “Napster” clone to be released 4/01
- 01/08/00 - AT&T start to develop “Publius”, a P2P network publishing system
- 03/08/00 - Intel, HP and IBM create the “P2P Working Group”
- 16/11/00 - Bertelsmann buys Napster; invests millions
- 08/12/00 - Sun says it is working on a Java Peer-to-Peer platform
- 18/01/01 - Microsoft initiates “Farsite” (“Federated, Available and Reliable Storage for an Incompletely Trusted Environment”) project

PEER-TO-PEER - CONTENT

- Background
 - History: P2P Networking
 - A P2P Definition
 - Merging technologies
- What is out there?
 - File Sharing
 - Distributed Computing
 - Instant Messaging
 - Collaboration
 - Web Services
- Summary
- Discussion
 - Will P2P remain?
 - Will P2P be a profitable business concept?

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P2P NETWORKING - "BACK TO THE FUTURE"

- Peer-to-Peer (P2P) has a specific meaning in many fields, e.g.
 - Literature (e.g. P2P review)
 - Psychology (e.g. counseling)
 - Education e.g. (peer groups)
- In computer science P2P used to describe
 - A small network without dedicated server
 - Files and peripherals are shared
 - Some access control
- What are then these P2P tools my younger sister talks about?
 - Isn't the internet just a peer-to-peer network (e.g. IP routing, ftp)?
 - Isn't the client/server metaphor just a matter of degree?
 - Is chatting and email also P2P?
 - > how precise can one define P2P in today's context?

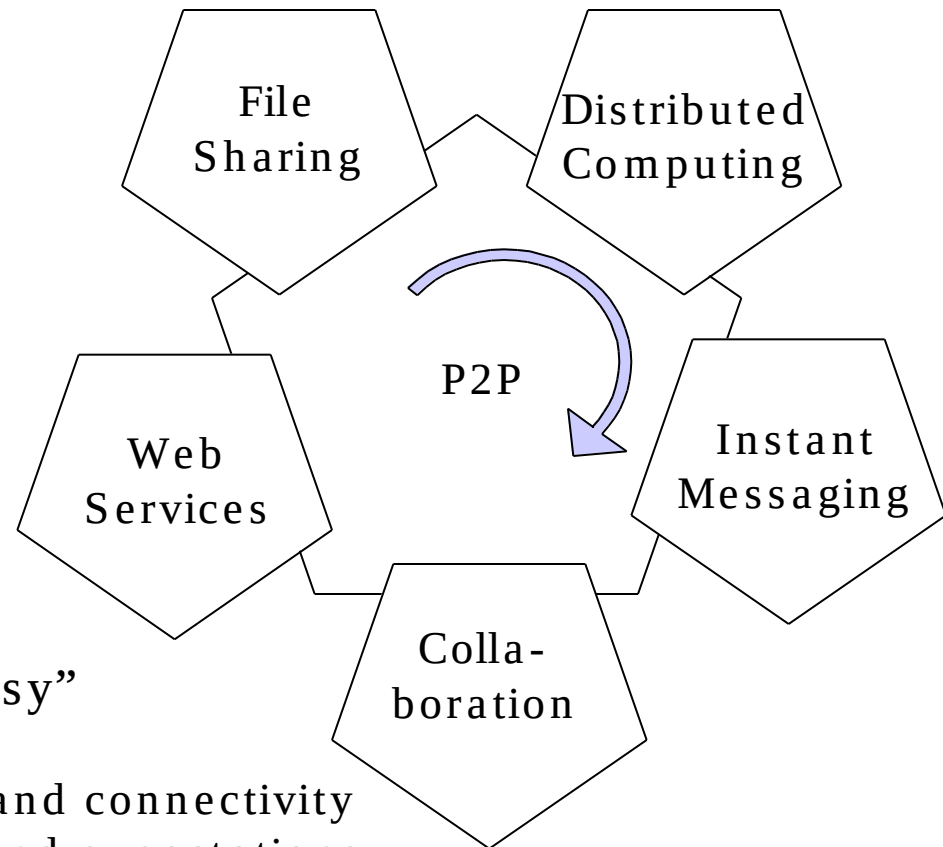


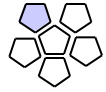
BACKGROUND - DEFINITION

- Definition (by Clay Shirky, The O'Reilly Network)
 - P2P is a class of applications that take advantage of remote resources (storage, cpu cycles, content, human presence, etc...) that are available at the edges of the Internet
 - Accessing these decentralized resources means operating in an environment of unstable connectivity and unpredictable IP addresses
- Criteria for a P2P application
 - 1) Does it treat variable connectivity and temporary network addresses as the norm? Does it operate outside the DNS system?
 - 2) Are the nodes more or less autonomous from a central server?
- P2P applications are thus not defined by technology or purpose
 - > Napster is a P2P application, because node addresses bypass the DNS system and because nodes manage the file transfer by themselves
 - -> Intel's "server P2P" is not a P2P application, because it assumes that the servers have fixed IP numbers
 - -> email is not a P2P application although it treats variable connectivity as the norm, because your address is not domain-name independent

BACKGROUND - TECHNOLOGIES & USE

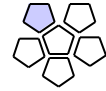
- Out of fashion many projects/product call themselves P2P
- Yet, there are many unique P2p applications emerging
- Although P2P started with file-sharing, today it is incorporating technologies/concepts from many areas
- General buzz: “Making it easy”
 - Self-organizing systems
 - Seamless communication and connectivity
 - Security: managing trust and expectations
 - Metadata Management (addressing and routing, service discovery)





- Description
 - File sharing (often music files or computer programs) among ad hoc user groups
 - There are no protocol standards for locating and addressing nodes or services
 - Products focus on effective caching, mirroring and searching of files to provide easier use
- P2P Relevance
 - The “classic” (Napster, Gnutella, etc.)
 - Part of almost all other P2P applications
- Remarks
 - Research projects aim to extend P2P towards a general “serverless file-system” and develop “cooperative storage models” for very large networks (> 100k PC, 10 PB data)
 - e.g. “Condor” (Univ. Wisconsin), “OceanStore” (UC Berkeley), “Farsite” (Microsoft)

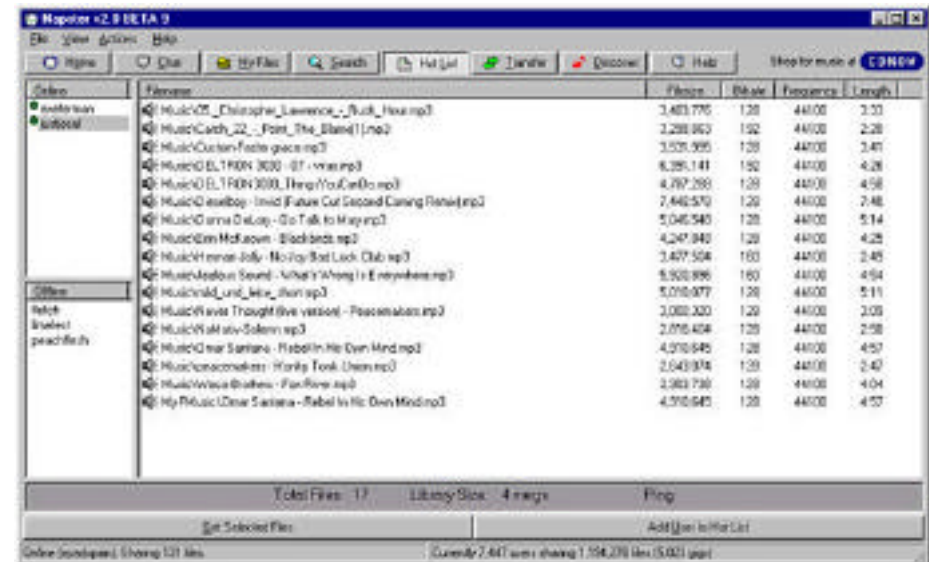
FILE SHARING - NAPSTER



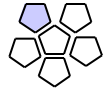
- Description
 - Developed in 09/99 by Shawn Fanning and Sean Parker; now part of Bertelsmann AG
 - MP3 sharing client based on centralized user directory server that connects peers
 - Some extra features like chat, local file management



- Client
 - www.napster.com // 2.0 beta
 - Mac/Windows
 - Now offers a link to buy CDs for downloaded file refs
 - Hopes to make money through advertisement
 - Might add a royalty system for each file transfer to make system legal



FILE SHARING - GNUTELLA - OVERVIEW



- Description

- Released in March 2000 by two students; file sharing protocol is an open protocol
- Is a technology, not a company!
- Many new programs are build around this protocol (e.g. BearShare, LimeWire, ToadNode, NewTella, MacTella, ..)
- Open, decentralized, P2P file search system
- Node IPs are passed on to other nodes
- No limit to what type of file (mp3, doc, jpg..)

www.gnutella.org
www.gnutella.com
www.gnutella.net

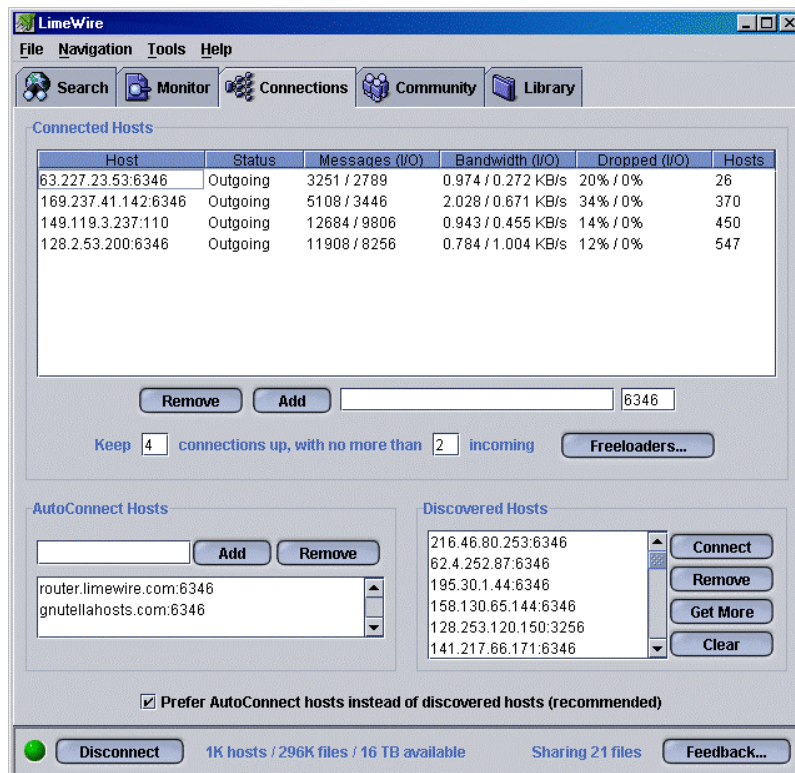
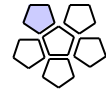
-> “it’s all okay”

- Software

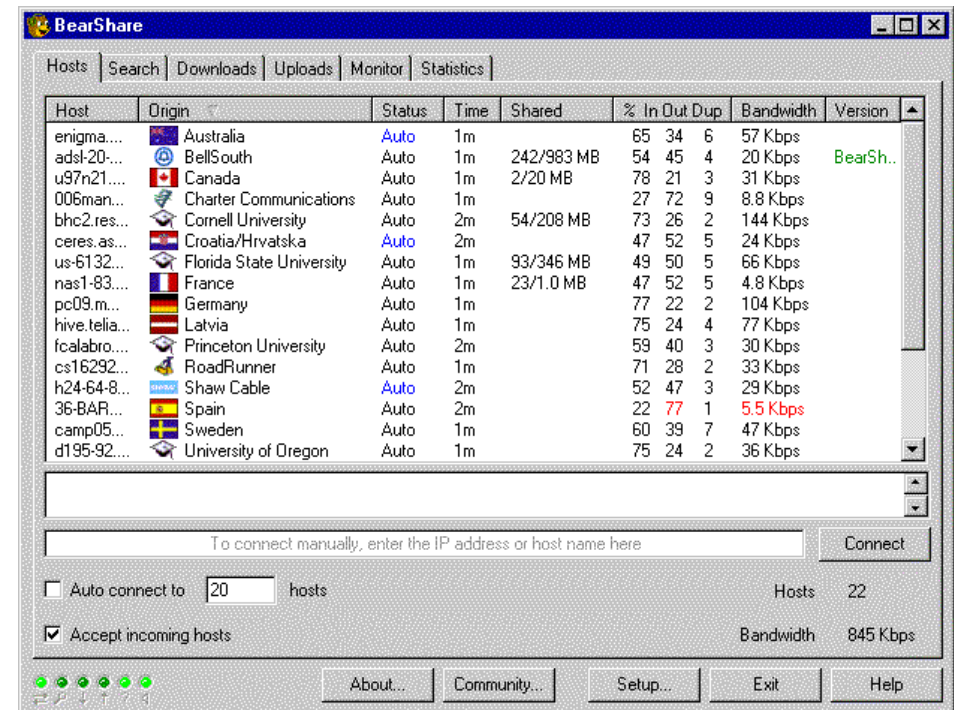
- Around 30 Win/mac/linux/java programs
- Some apps, some applets
- Add many features like chat, archive control, screensaver, background jobs, bots, etc.
- Good overview at dss.clip2.com

dss.clip2.com
gnutellang.wego.com
gnutellaDev.com
jnutella.org
infoanarchy.org

FILE SHARING - GNUTELLA - EXAMPLES

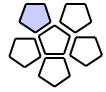


- LimeWire
 - Application, Mac/Win
 - Many features, comfortable



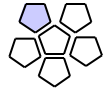
- BearShare
 - Application, Win
 - Many features, comfortable

FILE SHARING - GNUTELLA - PROTOCOL I

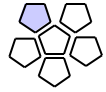


- Step 1: Determine who is on the network
 - Send ping packet to a host you know of
 - Host will forward ping to other hosts it knows of
 - Responses are returned from all reached hosts
- Step 2: Distributed searching
 - Send query to all known hosts
 - Hosts execute query locally, and forward query to other hosts
 - TTL (Time To Live) limits number of hops
- Step 3: Downloading
 - If successful, hosts return QueryHit packet along same route
 - QueryHit packets contain IP and GUID of that host
 - Then local client initiates direct http session
 - If http session is refused (e.g. because of a firewall), a Push packet prompts the remote node to reverse client/server roles
 - -> see animation

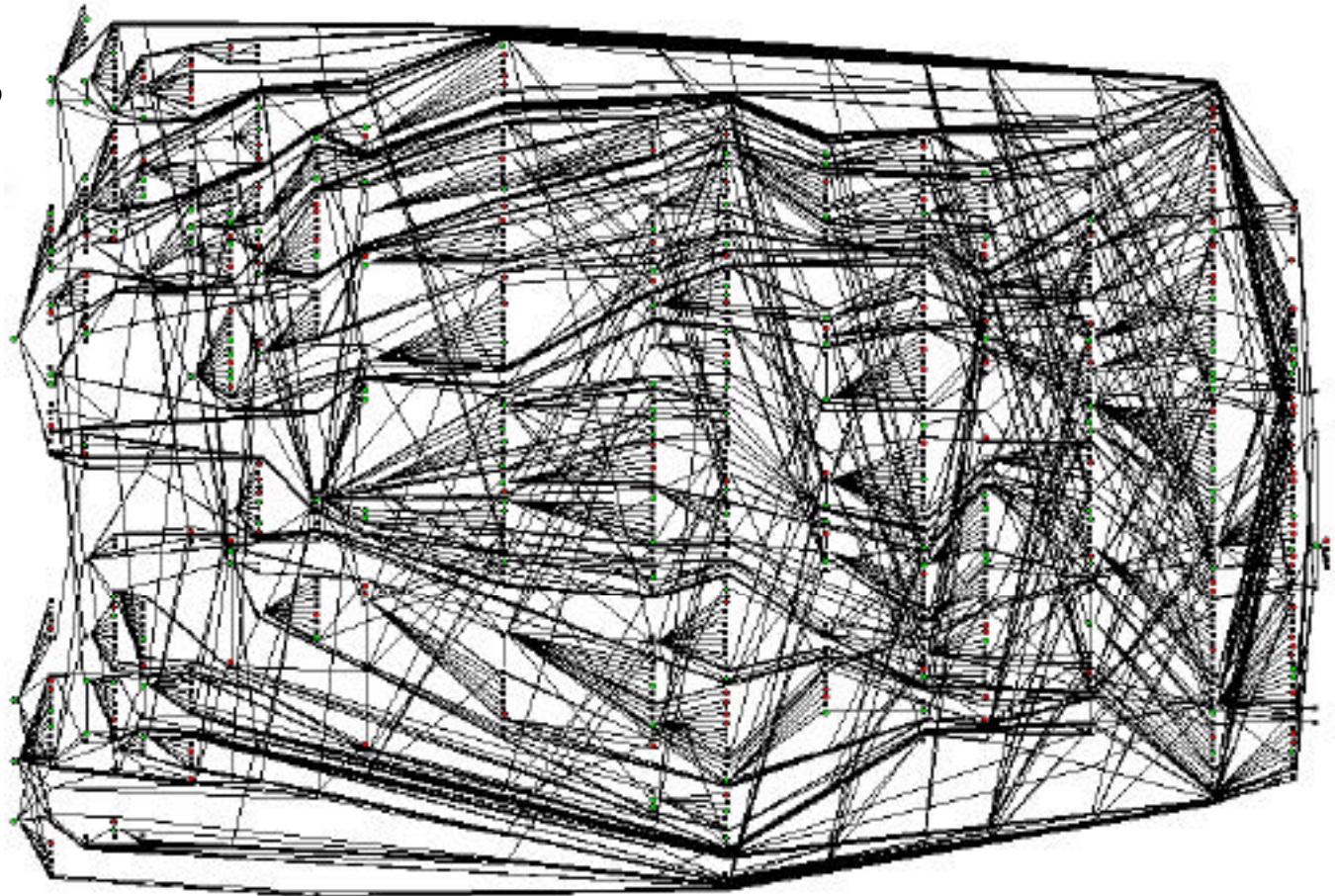
FILE SHARING - GNUTELLA - PROTOCOL II



FILE SHARING - GNUTELLA - LINK MAP

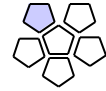


- 21/01/01 3:05
- 1949 Hosts
- 401.063 files
- 28.139 GB
- dss.clip2.com



- Partial map showing some nodes and their distributed queries

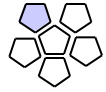
FILE SHARING - RUMOR



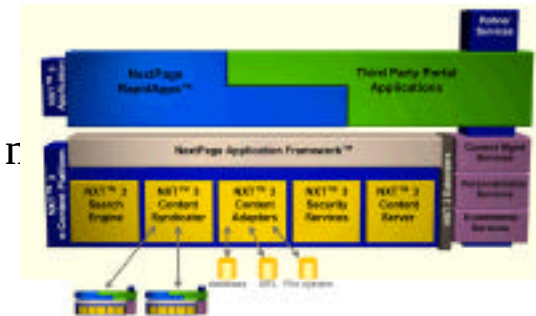
- Description (www.MyCIO.com)
 - Active file distribution service provider
 - Files propagate through P2P networks, in that component/clients (“Rumor”) query peers for more current versions of the files
 - Content might be virus definitions, software patches or firewall configuration files
- Finance
 - Subsidiary of utilities vendor Network Associates Inc. (e.g. McAfee VirusScan)
 - Revenue through remote control/config services
- Remarks
 - >30 employees
 - At least 100.000 users have downloaded (mostly unvoluntarily) the software
 - Also offers other services/programs, such as a web based virus check, etc.



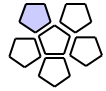
FILE SHARING - NEXTPAGE



- Description (www.nextpage.com)
 - P2P networking for file servers
 - Conduct context queries on files somewhere or linked servers through a web browser
 - > file sharing for enterprise customers
- Finance
 - Initial \$20 Mill by larger companies
 - Receives revenue from licence fees, consulting and transaction fees
 - Expects to become profitable by 3Q/01
 - Actually has a business plan
- Remarks
 - Competes with search engine providers like Inktomi and Oracle
 - 160 employees



FILE SHARING - FREENET

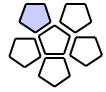


- Description (freenet.sourceforge.net)
 - Protocol for demand-based storing, caching and distributing information based on demand
 - The FreeNet clients form a distributed file system that moves files transparently
 - Through caching and lazy replication the system adapts to changing usage patterns
 - There are no tracable user/pc identification IDs, no broadcast searches or centralized indexes
 - Communication (e.g. queries) is PGP encrypted
 - As with Gnutella, queries are forwarded to all known peers, results send back the same route
- Remarks
 - Ian Clarke “*A Distributed Decentralized Information Storage and Retrieval System*”
 - A Java client has been implemented
 - Still primarily academic; <10 programmers



“Re-Wiring the Internet”

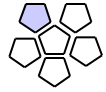
FILE SHARING - FLYCODE



- Description (www.flycode.com)
 - Distribution of video and photographs plus digital rights management
 - Aimed e.g at movie studios, television networks
 - Content (files) are sold together with ads, individually or as a subscription
- Finance
 - Initial \$2.5 Mill by known e-vestors
 - Expects revenue from advertisement, services and demographic information
- Remarks
 - Formerly AppleSoup; CEO= Napster founder
 - 35 employees



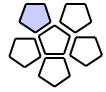
FILE SHARING - INFRASEARCH



- Description (www.gonesilent.com)
 - Dynamic file search engine with web frontend through provider server
 - Meant to index especially dynamic site content, e.g. databases (?)
 - One internet and one infranet version
 - Based on Gnutella code
- Finance
 - Initial \$5Mill e.g. by Marc Andreesson
 - Currently no revenue
- Remarks
 - CEO formerly developer of Gnutella
 - Got some press, but currently no software
 - Demo was described as slow
 - 15 employees



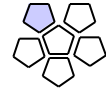
FILE SHARING - POINTERA



- Description (www.pointera.com)
 - Web based file sharing services for e.g. portals and e-commerce sites (“Sharing Engine”)
 - Similar to Napster in that queries return file urls and not web pages (any type of files)
 - Therefore no stale handles (updates 1/min)
- Finance
 - Initial \$10 Mill by individual investors
 - Expects revenue software sales, services and hosting fees
- Remarks
 - Java Applet
 - Demo at www.spinfrenzy.com
 - Query result size depends on number of concurrent users, therefore currently small
 - 10 employees

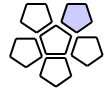


FILE SHARING - LIGHTSHARE



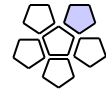
- Description (www.lightshare.com)
 - File-sharing in an e-commerce setting
 - Goods are stored locally and listed on central server that also monitors all completed transactions
 - Currently only electronic files
 - Targeted at digital content providers and software companies
- Finance
 - Initial \$2Mill by individual investors
 - Founded 1999 by Time Warner employee
 - Currently no revenue
- Remarks
 - Through central control piracy protection
 - Good press, but no product up to now
 - Why should users participate?



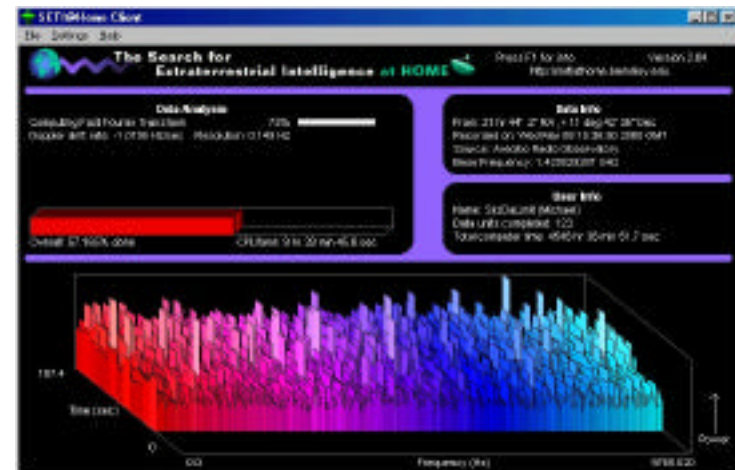


- Description
 - Large workloads are split into many small parts and distributed. Then the computing results are collected and merged.
 - Requires usually a central node of control
 - Used e.g. to crack encryption keys, search for extra-terrestrial life, etc.
- P2P Relevance
 - Used in applications that move away from simple file- to resource-sharing
 - Started out e.g. with “Indexing the Web”; now clients/tasks become more powerful and the development tools more generic
 - Has a P2P feel to it, as anybody’s PC can download the clients and start processing (seti@home, United Devices) at any time
 - In combination with a stronger collaboration aspect, some new applications start to emerge (e.g. MetaComputing)

COMPUTING - SETI@HOME



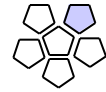
- Description
(setiathome.ssl.berkeley.edu)
 - Scientific, automatic and server based distributed data processing
 - Clients download and process radio astronomy data on their local PCs, then upload their results
 - Started in 1998 and claims to have more than 2 million unique users
- Remarks
 - Has become a “cult”
 - Many projects copy concept e.g. Golem@home, FightAids@home, mithral.com offers @home SDK



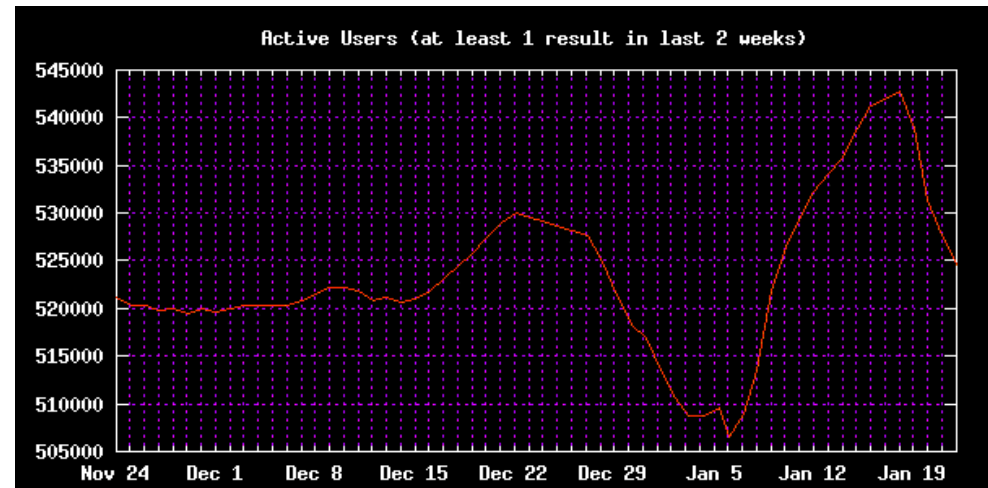
Seti@Home ScreenSaver



COMPUTING - SETI@HOME



Arecibo observatory/P.Rico

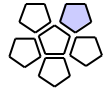


Active users over time

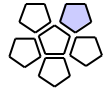
- Data propagation
 - 35 GB/d divided in 0.25 MB work units
 - Central server in Berkeley distributes and tracks units
 - Returned processing results 100byte

	Total	22 / 01 / 01
New Users	2713222	2408
Results received	276303573	544017
Total CPU Time	541015.91 years	1116.76 years
Tera FLOPS	7707	19.52
Avg. CPU time per work unit	17 hr 09 min	17 hr 58 min

COMPUTING - P2P WORKING GROUP

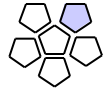


- Description (www.peer-to-peerwg.org)
 - Consortium to develop P2P standards
 - Targeted to unify P2P inter-operability, security, performance, management, privacy
 - So far one presentation at Intels developer conference August/00 -> with poor response
- Members
 - Open; \$5000/annum membership fee
 - 16 members (Intel, Fujitsu and smaller comp.)
 - 16 “supporting members” (e.g. HP, IBM)
- Remarks
 - Intel has been using centralized distributed computing (“NetBatch”, chip-design) on around 10.000 PCs since 1990
 - Wants to address the “fundamental issues” necessary to change dist./cluster computing to generate more revenue as manufacturer



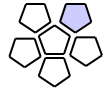
“The Grid OS”

- Description (www.appliedmeta.com)
 - P2P/distributed computing environment “Legion”
 - Resource sharing with failure detection, replication, distributed file system
 - Single, operating system independent name space (windows, unix, linux, some mainframe)
 - SDK for Java, Fortran, C++ and Corba
 - P2P through virtual -organizations and -work spaces where customers share data/applications (in dev.)
- Finance
 - At least 17 installations, some commercial
 - Founded 1998, private
- Remarks
 - Member of the “P2P -Working Group”
 - Java Monitor “Legion Live” -> >100 cpu’s working



- Description (www.2am.com)
 - P2P distributed computing to support content delivery (images, movies) and multiplayer games
 - “StreamingPeer” seeds content from central servers to broadband customers running the client. Peers will check other peers for new/relevant content
 - “2AMGames” uses peer -CPU, -disk and -network for (e.g. Poker) network games; displays ads
- Finance
 - At least 17 installations, some commercial
 - Generates revenue from 2AMGames advertisers
 - Founded 1998, private; quite professional
- Remarks
 - Member of the “P2P-Working Group”
 - Windows only (DirectX)
 - Java Monitor “Legion Live” -> >100 cpu’s working

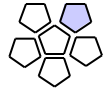




- Description (www.opencola.com)
 - Open-source software for P2P - and distributed computing using “AI” running on peer computers for better search results
 - “Smart Folders”: Lets users group local files into folders; these are broadcasted and “intelligently” matched with folders/files of other concurrent users; then the local folder fills up with “similar” files. Also searches Gnutella, Napster and other search sites.
 - “Swarmcast”: use customer pc to distribute files from content providers=“P2P -caching”
 - Targets sw developers, content providers
- Finance
 - Initial \$3 Mill by some e-vestors; 50 employees
 - Expects revenue from transaction fees paid by content providers
- Remarks
 - No downloads

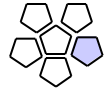


COMPUTING - KALEPA NETWORKS



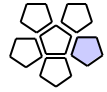
- Description (www.kelepa.com)
 - Software for P2P networking and distributed computing
 - Includes tools to manage dataflows among nodes
- Finance
 - Initial \$3 Mill by some individuals
 - Expects revenue first from licensing and later from transaction fees
- Remarks
 - Used to be search engine provider
 - No sw yet, seems to have a beta out there
 - Competes with companies like Interbind, Lotus Notes, Agile Software
 - 16 employees

TECHNOLOGIE - INSTANT MESSAGING

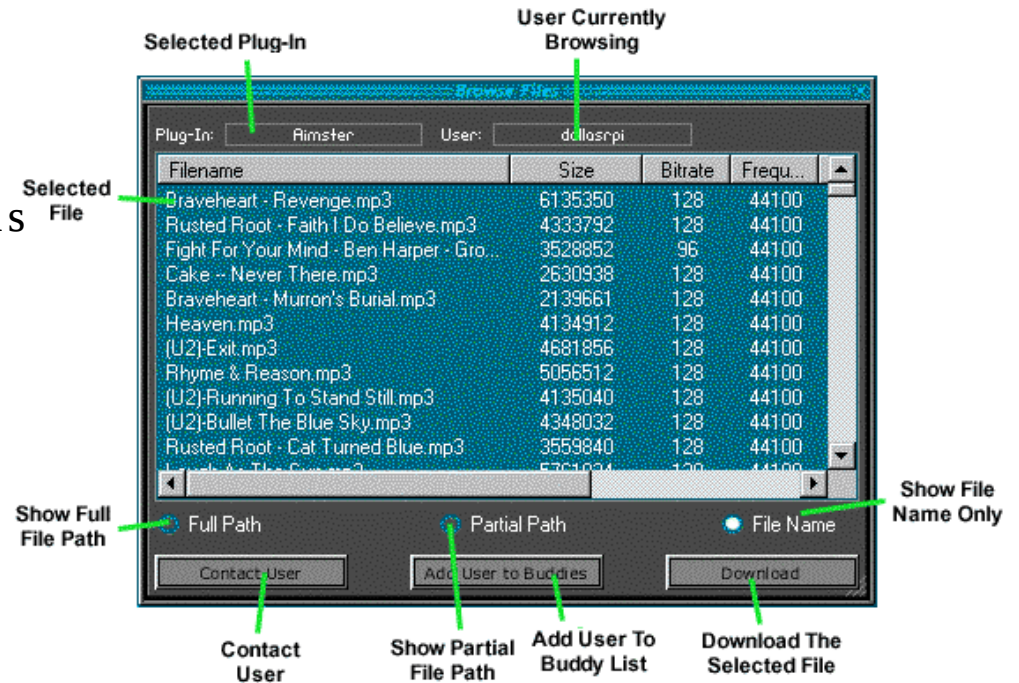


- Description
 - Chat and some filesharing among “buddies”
 - With many million users a very successful technologie
 - Used to be proprietary protocols (e.g. AIM) running over central server
 - Changing from a kid’s toy to a serious B2B/Intranet environment
- P2P Relevance
 - Is part of many P2P applications
 - P2P implementations shine through ease of use
 - They tend to be independent from the underlying protocol, operate decentralized, offer guaranteed anonymity and include extra features
- Remarks
 - Consumer success guaranteed
 - Direct economic value unclear

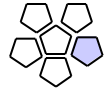
MESSAGING - AIMSTER



- Description (www.aimster.com)
 - Instant messenger for multiple systems (MSN, IRQ, AIM, and their own) and file sharing
 - queries also Gnutella space?
 - No limited to mp3
- Finance
 - Shareware
 - Supposedly 2 million downloads
- Remarks
 - Had lots of press
 - Windows only

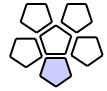


MESSAGING - JABBER



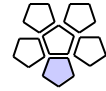
- Description (www.jabber.org)
 - Open source instant messaging application (AIM, MSN, IRQ, Yahoo)
 - Messages are in XML format
- Finance
 - www.jabber.com tries to sell their client to intranet business customers
 - Founded in 3/00; owned by WebbInteractive
 - Offers Oracle8i link for persistence, web administration and some admin services
- Remarks
 - > 20 Clients for all platforms (win/linux/mac/Java)
 - Jabber stands for (Oxford Dictionary): “chatter volubly and incoherently”
 - www.jabbercentral.org





- Description
 - Tools to work or play in ad hoc groups
 - Popular (and cheap) programs used to be limited to whiteboarding (e.g. Netmeeting)
 - Some transparent data/file exchange
- P2P Relevance
 - Always had a strong P2P aspect
 - Is now becoming the most business like fraction of the P2P market
 - P2P modifications of existing applications mainly try to deal with the temporary network structure and the “ease of use”
 - New applications tend to also integrate other P2P standard tools (e.g. chat)
- Remarks
 - Because of the long history, for B2B and intranets the most promising area

COLLABORATION - GROOVE NETWORKS

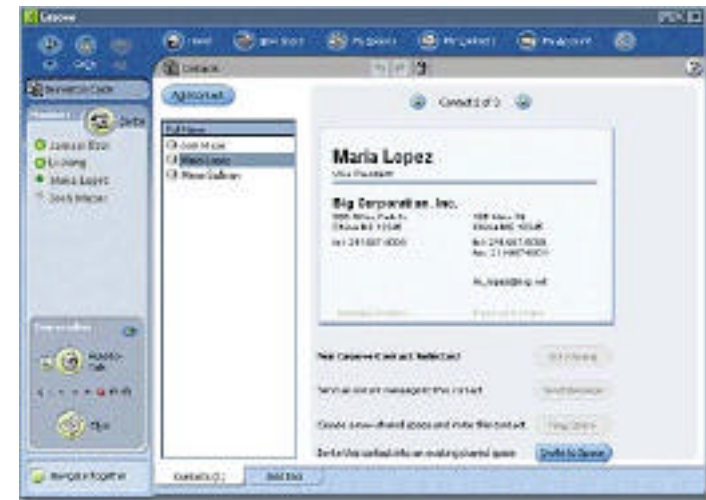
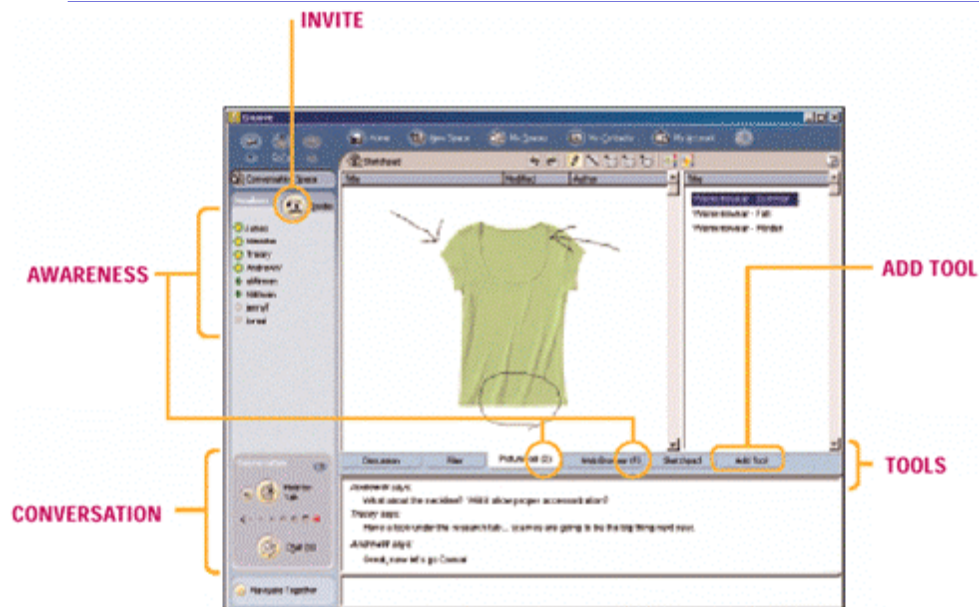
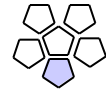


- Description (www.groovenetworks.com)
 - P2P client and a collaboration development framework aimed at customers and providers
 - The “Transceiver” client handles security, persistence, communication, etc.
 - Providers offer e.g. media content or processing services to ad hoc groups of Transceivers
 - API to integrate services/programs as “tools”
- Finance
 - Initial \$60 Mill; CEO Ray Ozzie (Lotus Notes)
 - Price for full Transceiver version around \$100
 - 60 employees
- Remarks
 - Check www.groove.net for tools (around 20)
 - Transceiver very easy to use
 - Developers are encouraged to integrate their COM applications using e.g. JavaScript



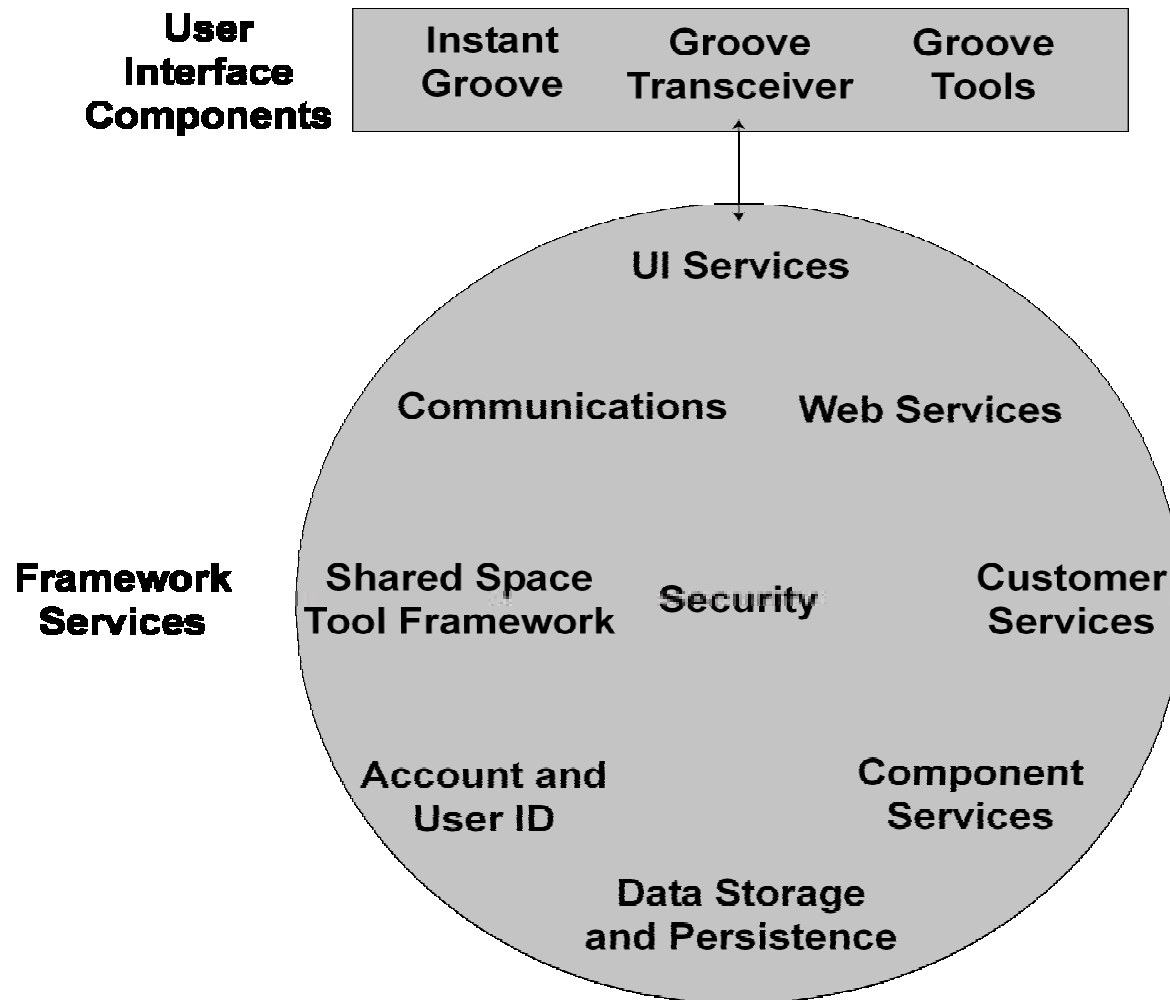
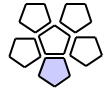
1. Download Transceiver
2. create account
3. create shared spaces
4. send email to friend
5. -> start working

COLLABORATION - GROOVE - CLIENT

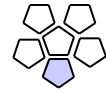


- “Transceiver” Architecture
 - Direct http communication (asynchronous) among peers using public key encryption; Online/offline -> store/forward mechanism
 - Based on MS COM (Component Object Model) -> MS bound
- Dynamic, context sensitive tools
 - Threaded discussions, chat, instant messaging, use whiteboard
 - Play games, play music and videos, live voice
 - Manage and share local files, browse web together,...

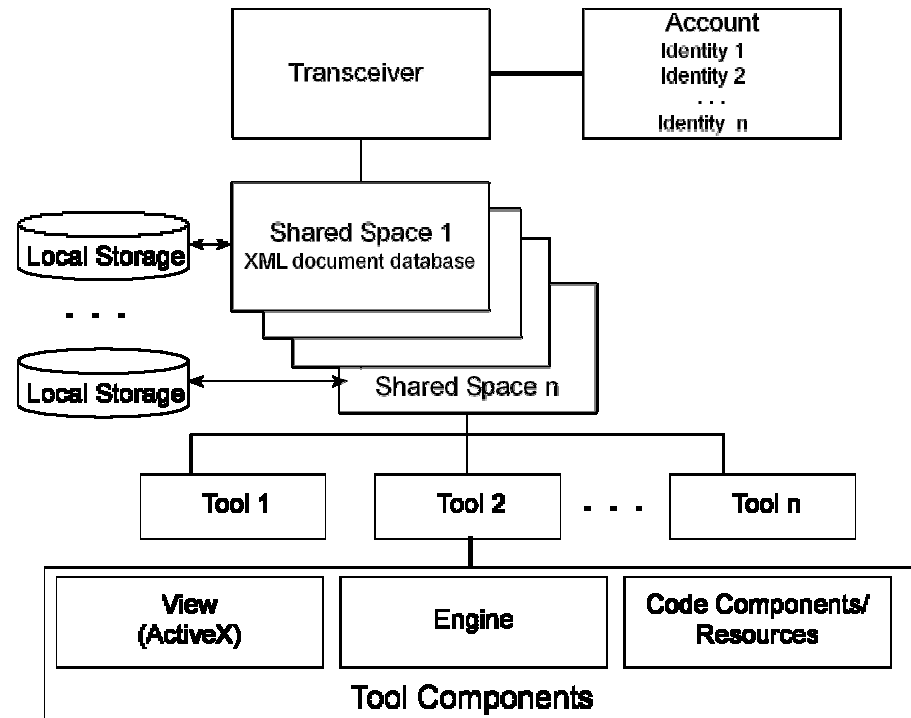
COLLABORATION - GROOVE - FRAMEWORK



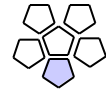
COLLABORATION - GROOVE - STORAGE



- Local storage
 - Completely in XML, encrypted, with links to referenced files (e.g dll)
 - New tools (COM) are integrated using XML templates (Layout and forms, connections, COM file references)
 - The current state is constantly recorded
 - > no save button
- Shared spaces
 - Each tool stores persistent data within its own file
 - A copy of the shared space is stored on each member's device
 - Tool property changes are disseminated to each member in group

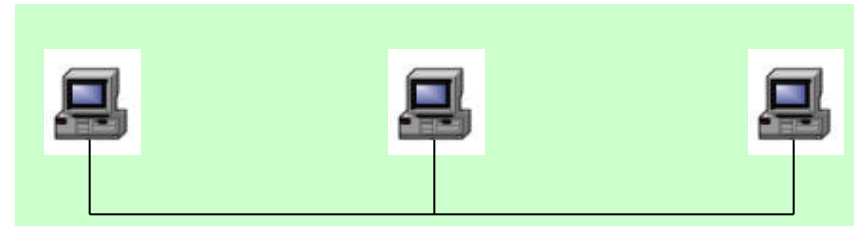


COLLABORATION - GROOVE - BOTS

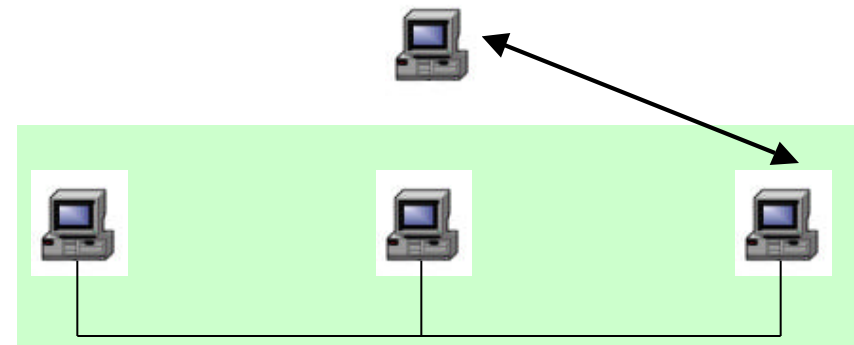


- API available to wrap your own application/datasource inside a “Connector”
- Are integrated into P2P shared spaces like any other peer
- Connectors choose between two modes of communication
 - One time (import/export)
 - Multiple time (publish/subscribe)
- Examples
 - Watch stock prices and send out instant messages when thresholds are reached
 - Mine discussion entries that match user profiles
 - Archive data stored in Groove off to an external repository

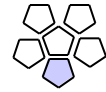
Peer-to-Peer network



Bot Integration



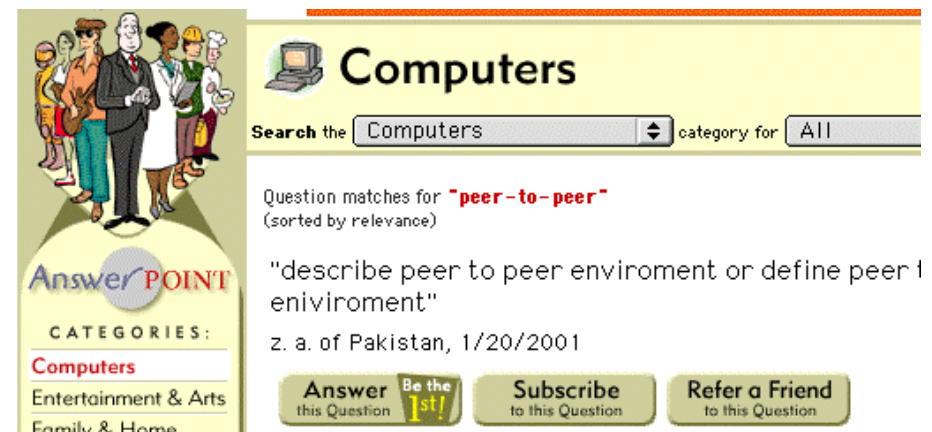
COLLABORATION - QUIQ



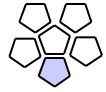
- Description (www.quiq.com)
 - Software for collecting, managing and distributing information
 - Hosts customer data on their own servers
 - Lets users search for information and post public comments on results
 - To end user, Quiq is similar to search engine combined with a message board

- Finance
 - Initial \$15 million (Cisco, SAP, BancBoston, etc.)
 - Expects revenue from licensing and hosting fees
 - 60 employees

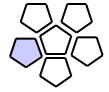
- Remarks
 - www.askjeeves.com is major customer



COLLABORATION - MOJO NATION



- Description (www.mojonation.net)
 - Collaboration software (“Broker”) to rent/offer cpu, disk and/or bandwidth from other peers
 - Peers pay “Mojo”s for rented resources
 - Distributed file system splits/reassembles files across multiple nodes in overlapping segments
 - Central server (seems to) accept all new content
 - Queries are propagated; new files split and uploaded to remote peers
- Finance
 - None, hoping for licensing
- Remarks
 - Currently rather boring
 - Might work though, as free-loading is impossible
 - Public c++ source runs on win/linux
 - You start with 1 million Mojo!



“The Writable Web”

- Description
 - Tools for content creation, management and web-publication
 - Started e.g. as simple browsers that allow you to change web pages (e.g. “Amaya” W3C) or complete web site management software (e.g. “Blogger”)
- Relevance for P2P
 - New clients add web server functionality, user identification, etc. and focus less on textual content (e.g. “Radio Userland”)
 - More of a whiteboarding than a file sharing aspect
 - Collaborative mechanisms are e.g. integrated by “WebDAV” (IETF)
- Remarks
 - For the most part http based

SUMMARY

- P2P has left its roots in file-sharing/simple networking
- P2P applications merge technologies/concepts from a number of different computer science areas
- P2P networks could be defined as an ad-hoc collections of largely autonomous nodes using a temporary address space
- P2P has become much more than a marketing hype
 - Millions of people use P2P applications today
 - Many university projects work on extending P2P
 - Many companies try to make money through P2P tools/services
 - Investors keep pouring millions of \$ into these companies
- -> but, will consumers drop P2P when the next fad comes along?
- -> but, how viable are P2P business plans?

DISCUSSION - IS P2P A COMMODITY?

- Pro - especially as a chat and file-sharing platform
 - Consumers have direct (cheap) access to information and people
 - In general, software utilization is easy and flexible
 - The user has a high degree of personal control and often anonymity
 - There will always be some cs-student to program the next Gnutella
- Contra - what about security?
 - Except on intranets, how can one trust other peers? Are these files changed in any way? Can I trust this party to route my payment?
 - Which resources do I make public? Can I be sure the client works?
 - How do I know my snazzy P2P client doesn't log my online banking?
- Contra - what about legal issues?
 - I can share pictures of my hamster, but can I digitize glossy magazines?
 - If I have no control over the content on my disk, am I responsible?
- Contra - what about motivation?
 - Sharing is cool, but what about all those free-loaders?

DISCUSSION - IS P2P READY FOR BUSINESS?

- Pro
 - Consumers (in general) “just” use a software. In principle, there is no difference between a web browser and a P2P client program
 - P2P applications make consumers forget about computer science
 - A small degree of central control/logging will take care of piracy
 - Freedom of speech is more important than copyright, decency, etc.
 - Intranet users have no choice
- Contra - Customer motivation (“sharing” versus “using”)
 - Why should a peer contribute resources for free?
 - What is a lasting motivation (Greed - e.g. mojos/transaction; coolness (seti@home); free content (theft?))?
- Contra - Practicality
 - Who gets paid and why? Will consumers trust some other pc enough to pay for service? What can you offer, that I cannot steal?
 - Will “serious” companies quit, if QoS without control is unpredictable?

SUMMARY - LINKS



- **Agents as Peers**
- [Infobot](#) [Sandia National Laboratories](#) [WebV2](#)
- **Collaboration**
- [Engenia Software, Inc.](#) [Everything](#) [eZ](#) [Groove Networks](#) [Ikimbo, Inc.](#) [Interbind](#) [WorldStreet](#)
- **Development Frameworks**
- [Biz2Peer Technologies](#) [Mithral Communications & Design Inc.](#) [WorldOS Corporation](#) [Zion Technologies](#)
- **Devices as Peers**
- [Bluetooth](#) [Brazil Project](#) [dHTTP \(Distributed HTTP\)](#) [Endeavors Technology, Inc.](#) [Jini](#)
- **Distributed Computation**
- [2AM](#) [Applied MetaComputing](#) [Centrata](#) [Datasynapse](#) [Distributed.net](#) [DistributedScience](#) [Entropia](#) [Parabon](#) [Computation](#) [Popular Power](#) [Porivo Technologies, Inc.](#) [SETI@home: The Search for Extraterrestrial Intelligence](#) [United Devices, Inc.: Individuals Accelerating Science](#)
- **Distributed Search Engines**
- [gonesilent.com \(aka InfraSearch\)](#) [grub.org](#) [OpenCOLA](#) [Plebio](#) [WebV2](#)

SUMMARY - LINKS



- **File-Sharing**
- [Bad Blue](#) [CuteMX.Com \(GlobalScape, Inc.\)](#) [File Navigator](#) [Freenet](#) [Gnutella](#) [Hotline Communications Ltd](#) [Jungle Monkey](#) [MangoSoft](#) [Mojo Nation](#) [Napster](#) [Ohaha](#) [OnSystems, Inc.](#) [OpenNap](#) [Pointera](#) [Publius](#) [Spinfrenzy.com](#) [The Free Haven Project](#)
- **Gaming**
- [2AM](#) [CenterSpan](#) [Proksim Software](#)
- **Internet Operating System**
- [Applied MetaComputing](#) [Globus](#) [ROKU](#) [Static](#)
- **Licensed Media Distribution**
- [eMikolo](#) [Flycode](#) [Kalepa Networks, Inc](#)
- **Messaging Frameworks**
- [Aimster](#) [BEEP](#) [BXXP](#) [CenterSpan](#) [IMPP](#) [Jabber](#)
- **Superdistribution**
- [2AM](#) [3Path](#) [Freenet](#) [vTrails](#)
- **The Writeable Web**
- [Amaya Web Editor/Browser](#) [Blogger](#) [Brazil Project](#) [Endeavors Technology, Inc.](#) [Everything](#) [Manila](#) [Radio Userland](#) [WebDAV](#) [Wiki Wiki Web](#)