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Peer-to-Peer Networking

Some Technical and Social Aspects of Unlimited Resource Sharing

Peer-to-peer was the buzzword of the year 2000 thanks to the enormous popularity of Napster, the music swapping application. Napster was the fastest growing application in the history of Internet. Avalanche was started by Shawn Fanning, alias Napster, 18 years old student. He was listening to his colleagues complaining how hard it is to find digitalized music on the Internet. Fanning proposed a simple solution: 'Why don't you guys just share what you have already found?' It took him two months of intensive programming to complete an early version of Napster client application and Unix server that keeps a dynamic database of connected users and their shared resource.

Napster created a global musical library in which it was possible to search for any kind of music. Sometimes Napster was the only way to find music that was not accessible in any other way, because it is sold out, for instance.

Napster created a virtual library almost without any investment, utilizing user's resources, their home computers!

In a very short time Napster created friends and enemies. Napster community was growing quickly. Last time I bothered to look there was the impressive number of 40.000.000 clients. But in the same time it had acquired a lot of bad publicity and was associated with breaking the copyright laws and stealing intellectual property. Is music swapping actually sharing or stealing? Recording industry obviously thinks it is stealing, although there are signs that Napster actually boosted their sales! When Napster was forced to filter the traffic and exclude some songs, sales dropped during the first half of 2001! Obviously, easy access to information is generating growth! Recording industry must quickly improve their outdated business model!

'Peer-to-peer is the next great thing for the Internet' said Lawrence Lessig, from Stanford Law School, author of the book about the cyber law. Is it coincidence that a lawyer is interested in P2P? But he is not the only one with great expectations.

Napster is just one example of movement that was slowly maturing for a long time. Quick surfing will discover a string of P2P projects on the Web. We'll mention just some of them and you can follow links to find out more interesting details.

Gnutella was generally considered to be the next great thing after Napster. It allows sharing of all kinds of files, not only music. There is no central server, clients are searching for each other and exchanging information that they have gathered.

Morpheus has in the meantime become the most used appliance for downloading music.

SETI@home is project of Berkeley University. They are recording signals from space and search for patterns that would indicate the existence extraterrestrial intelligence. The input of data is too large for their computers, so they created a screen saver that we can download for free. When our computers are idle, the screen saver will connect with SETI@home server, download a small chunk of data and perform all the necessary computations. It usually takes a week to finish this task, and then the results are forwarded to Berkeley. In this way we are giving processor time to project, creating a global network for distributed computing.

People Power is the similar project; people are donating computer time to help research project that is looking for a better flu vaccine.

Publius is trying to eliminate any kind of censorship imposed on information and offers anonymity to publishers. Information is encrypted and spread over several servers.

Some people think that the most interesting application of P2P technology will be in the Business-to-Business area. Microsoft is jumping on that wagon, by announcing their .Net project.

In the absence of any P2P standards, each application is inventing its own protocol. To resolve that situation, SUN Microsystems is proposing an open standard and development library based on Java that will make

production of new P2P applications easier, and in the same time allow some degree of necessary monitoring.

P2P is actually not a brand new concept. If we look back in history, most of us were already acquainted with the term peer-to-peer from the time of small office networks, like Windows for Workgroups, or Lantastic. But actually the early Internet was also peer-to-peer network. It was connecting five US universities, and all computers on that network were of equal importance.

Usenet, with us from 1979, is an early example of decentralized service. New discussion groups are opened on the basis of democratic procedure, it is usually enough that a group of people demands it. There is also a collection of anarchic newsgroups, their names begin with alt, alternative. Anyone can open alt.* newsgroup, without asking for permission.

As Internet was spreading and growing in numbers, it was increasingly hard to maintain it as a peer-to-peer network. Vertical, hierarchical services were introduced to make life easier. Domain Name Service, a distributed database for mapping names to numeric addresses is a good example. Internet evolved towards a client/server architecture and at the same time became more and more commercialized. It is interesting to notice that client/server fits perfectly in commercial environment. Commercial companies run servers, and clients are seen as potential customers, or consumers.

But Internet is still basically horizontally structured. Client/server organization is considered to be some kind of episode, and now it is time for the Internet to come back to its roots. The growth of PC's has the decisive role in that process. PC's have more and more processing power and disk space, and their connections are faster and faster. They are ready to perform new roles and to change the way we use the Network.

If we try to define what we have discovered about P2P concept, we can extract some common points. All P2P projects are using decentralization to avoid control. But this is not a dogma, since some degree of centralization improves performance. They avoid using DNS service, and try to connect computers that have temporary IP addresses. In that way they give strength and autonomy to the nodes on the edge of Internet. Users own the necessary hardware, not by governments or commercial companies. And they all strive to bring new services that respond to users needs, simple, low-tech applications that require zero administration.

If there is political mission behind P2P movement, it can be simply put in few simple ideas. Avoid any kind of censorship, governmental or commercial, give users anonymity, create a network that is free not only of control, but of physical limitations. P2P is introducing democratic networking, by allowing us to create our virtual LAN's over the Internet infrastructure.

But commercialized Internet has many obstacles that stand in the way of connecting computers. Firewalls are filtering and restricting traffic. Sometimes we cannot reach the computer that is publishing information directly. Instead proxy servers give us information. Computers on the edges do not have fixed IP addresses, and move all the time. Network Address Translation is a technique that is hiding computers behind firewalls, giving them private, non-routable addresses. All the traffic is then routed through controlled computers that log and filter the traffic.

P2P is offering some solutions. It is using protocol centric addressing, instead of machine centric, by mapping usernames to their temporary, provisional numeric addresses.

Who knows maybe in some foreseeable future we shall use our browsers to access shared P2P resources, by typing URL that will look something like this: [napster://BadBlueBoy](#).

Http is a good example of technology that is using some form of P2P. Hyperlinks are P2P, they link pages without any physical limits. But it is still a client server technology, and desktop users were offered only client application, a web browser. People demanded that they should be able to publish information on their computers without having to pay to some ISP to keep their pages on public servers. Microsoft responded and later versions of Windows offered Personal Web Server. Unix users have more power, since it is only matter of installation and configuration to turn client to a server.

Another step towards a two way Web is a SOAP protocol that enables different applications to share data in a standardized way. Metadata included in content are used to denote what is the type of content and to improve searchability.

Development towards P2P has already brought some social consequences. It is increasing our freedom of expression by allowing easy creation of ad-hoc interest groups that can freely exchange

information and ideas. Maybe we should say People-to-People instead of Peer-to-Peer!

But we all live in a society. If we try to avoid some unnecessary restrictions, it doesn't mean that we can be absolutely free and without any obligations to other people. P2P should therefore not promote antisocial behavior. There will be need to develop some ways to build trust, to authenticate users, and to keep record of previous use, or reputation of users. But how can we do it without implementing control and censorship? And can we trust the people that control us? The final question is: do we really think that information should be free, or it must be copyrighted, protected, restricted? Free information is promoting development and growth, there is no doubt about it.

At the end of this short presentation, too short to reach definite conclusions about something that is still in the early phase of development, let us try again to make some points about P2P paradigma. They are from the book *Peer-to-Peer, Harnessing the Benefits of a Disruptive Technology*, published recently by O'Reilly.

- Client is server
- Network is the computer
 - Distributed calculations, file sharing
- Tolerate unreliability
 - Users can come and go as they wish
- Tolerate redundancy
 - It compensates for unreliability
- Tolerate asymmetry
 - Free riders are OK
- Follow the users
 - Listen to their needs, offer simple solutions.
- Information wants to be free!
 - Slogan of Free Software Foundation

References:

Peer-to-Peer, Harnessing the Benefits of a Disruptive Technology
Edited by Andy Oram
O'Reilly 2001
ISBN 0-596-00110-X

www.openp2p.com

O'Reilly site dedicated to P2P technology and Web Services conference, news, interviews, links.