Peer-to-Peer Networking and Perspective

Peer-to-peer networking is a technology that enables direct exchange of data between personal computers. It became famous with Napster, a program dedicated to the exchange of MP3 (music) files, but was actually already in use as early as 1997 in instant messaging services like ICQ. The increasing number of residential always-on broadband access PCs acts now as a key enabler for this technology and also makes it a threat for the whole communication service industry.

The CTO Office supports the Swisscom CTO (Chief Technology Officer) by tracking technological developments and trends. It provides an expert view of the impact of new technologies on Swisscom and supports the CT-internal planning and management of Exploration Programmes. The CTO Office also runs an outpost in Silicon Valley to closely monitor new developments in the Internet industry and to establish business relationships with attractive Internet startups.
With its Exploration Programmes, Corporate Technology is exploring telecommunication technologies and new service possibilities with a long-term view of 2–5 years. Further, the expertise built up in the course of this activity enables active support of business innovation projects.

Tens of millions of people all over the world have downloaded Napster client software. It facilitates exchange of music files between individuals free of charge. Alarmed by the success of Napster, the Recording Industry

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Association of America wants the courts to shut down Napster. But whatever is decided on Napster, P2P (Peer-to-Peer) technology is here to stay.

Napster is technology driven, and the technology is called P2P. It allows communication between Internet appliances on equal level, rather than in a client/server relationship. Therefore it fits perfectly to some communities shaping the evolution of the Internet, while the business models of classical Telco's poorly fit to P2P.

The Gartner Group assumes that "by 2002, more than half of global Internet users will regularly sign on to at least two P2P Internet applications" [4], while Forrester forecasts that "by 2004, 33% of the online population will use P2P services" [3]. As we can expect to see more P2P services being deployed, their impact on Swisscom has to be understood on different levels: on the network design, service development, customer ownership, and on the business model.
The following is a short analysis of the current P2P trends first observed by the CT outpost in Silicon Valley [1] and some related implications to be considered on the above-mentioned technological and business levels.

The Principle of P2P Architecture

There are basically 2 different designs of P2P architecture in use today, one with and the other without central servers (also called "pure P2P"). It is crucial to see the difference between those two designs in order to understand their impact on the business models. As shown below, the P2P with a central server design offers new opportunities, while the pure P2P design literally destroys business. The most promising approach to prevent pure P2P is to foster the P2P with a central server.

P2P with a Central Server

It uses central servers for member registration and as a storage for the lists of files offered for sharing. The files themselves are not stored centrally, but remain on the users' PCs. When user A wants to get some data like a song for example, he asks the server. The server then searches its central database and finds that user B has this data. Now the server informs user A that user B has the data, and user A grabs the data directly from user B's hard disk. This concept, as illustrated by fig. 1, allows to keep control and customer relationship at the server side, while nearly 100% of the investment (storage infrastructure and content) is contributed by the individual users.
In this category one can find Napster and its clones like JNapster, FileNavigator, au-
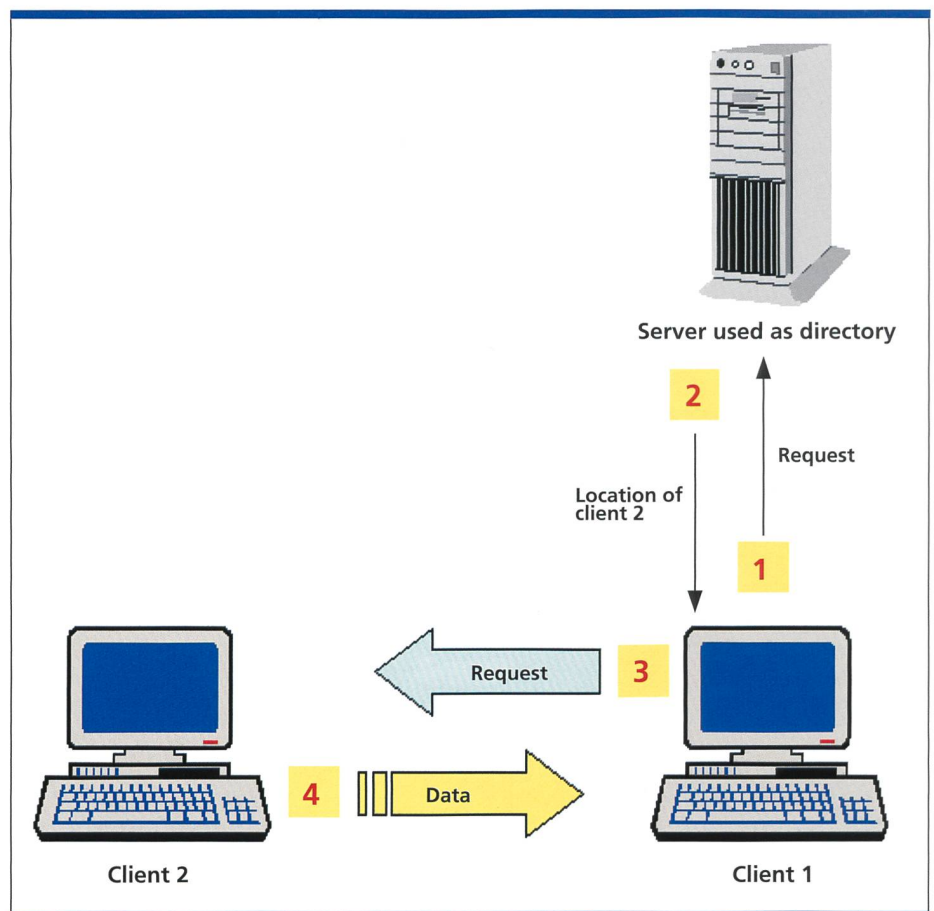

Fig. 1. The Peer-to-Peer model with a central server (like Napster): The server keeps a list of all registered users currently online, and a list of all files offered for sharing by the members. A member makes a request to the server and gets the location of the file he is looking for. Then he sends a request to the specified location and gets the requested file.

dioGnome, NapAmp, Napigator, Mac-Star, Macster, Rapster, Gtk-Napster, … Clearly this concept is an interesting business model for a broad range of applications, including e.g. making better use of idle hard disks and processing power of networked corporate PCs.

Pure P2P

Driven by the prosecution of Napster, a completely serverless design was developed. A PC running such an application advertises its existence to known PCs running the same application, which forward it to PCs they know, etc. Each PC sends its address to the originator of the advertisement. By this, each PC soon knows a large number of other PCs currently connected and running the same application. Requests for file sharing are later propagated through this ad-hoc network. This P2P architecture is fully decentralised, eliminating any control and ownership, as illustrated by figure 2. While this kind of architecture may be appealing to end users, it is a disaster for commercial service providers, as there is no business model in sight.

In this category one finds Gnutella and its variants like Gnut, UMX, Hagelslag, Mactella, Aimster, Bodetella, furi, Gnewtella, MyTella, Toadnode, … Applications of that type are not only threatening business, but also law enforcement, as it is impossible to shut them down. Fortunately for service providers, there is also a disadvantage in pure P2P for end users: the performance of this architecture is inherently inferior to that of P2P with a central server.

P2P versus Client/Server

P2P architecture, as opposed to client/server architecture as shown in fig. 3, avoids sending traffic through central nodes, thus using network resources more efficiently, resulting in better performance experienced by the user. But both architectures will continue to exist in parallel, as they are not competing, but complementary.

P2P is the superior architecture, whenever data is exchanged between equal partners. On the other hand, client/server architecture is used when "customers" pull data from "providers". Obviously, real-time communication services are of the "exchange-between-equal-partner" type, and will therefore be handled with P2P architecture. But directory services – crucial to start real-time
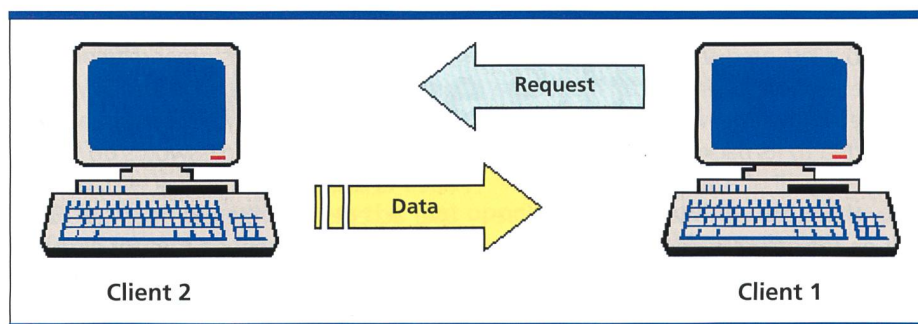

Fig. 2. Pure Peer-to-Peer (like Gnutella): Client 1 first installs a special application. Then he has to know at least one more client running the same application. The first step is to know where and which kind of files are offered for sharing. So client 1 sends a request to other clients to get their own lists of clients and files. The next step is to send a request to a targeted client 2 and get the data from client 2.
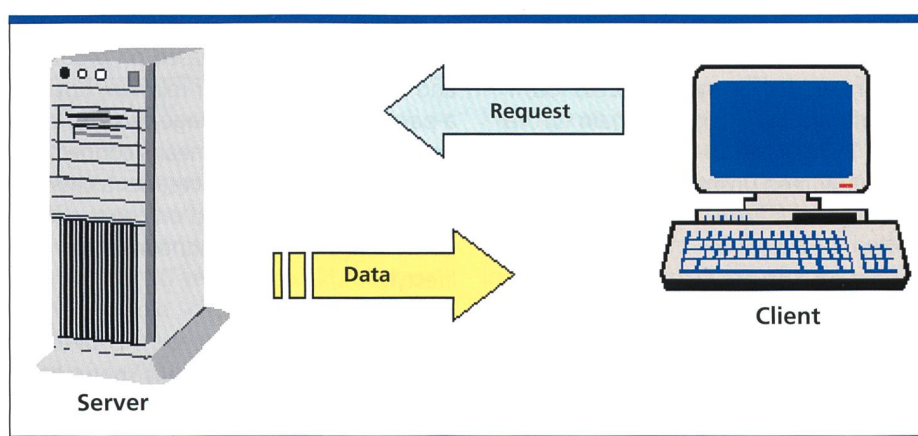

Fig. 3. The Client/Server model: a server stores the information and delivers it after a user request.

communications – are of the client/server type. And the non real-time unified messaging is of the client/server/client type.

P2P Applications

Different kinds of applications already handle the P2P technology, like e.g. instant messaging, online chat, workgroup collaboration, file sharing and distributed computing.

Communication Extension

Instant messaging allows customers to chat directly with each other without going through a central server. This concept has been extended to support the exchange of files. Companies like Aimster, Jabber, Groove Networks provide to this form of communication service.

Distributed Computing

Today, most PCs use only a small fraction of their processing power. Distributed computing takes this opportunity by spreading a computer problem across a large number of unused PCs and thus combining their processing power. This

can be seen in projects like SETI, which conducts scientific research on life in the universe (www.seti-inst.edu), or GIMPS, which is an organised search for Mersenne prime numbers (www.mersenne.org/prime.htm).

Internet Searching

Popular internet activities like searching, combined with the P2P technology, are looked at as new business opportunities. Startup companies like openCola start to set up a network of PCs that share search engine results and bookmarks.

The Impact on Swisscom

The fact that parts of communication services will be implemented in P2P architecture has radical impact on our business on a variety of different levels.

Impact on Network Design

The bulk traffic from communication services will run on the "logical edge" of the network, i.e. between individual customers, rather than between customers and known server farms. This will create

a more evenly distributed traffic pattern, but also a less predictable one. While today the network operator can make sure that well-known heavy traffic servers are connected to its backbone, in the future any PC may all of a sudden become a heavy traffic server. Today's networks are built on the assumption that heavy traffic is mostly downstream, whereas P2P technology generates heavy downstream and upstream traffic from users.

A first guess on how to cope with the phenomena of changed traffic patterns is that one might want to increase the level of network meshing. Already clear today is the increasing need of broadband on all levels of the network (fibre to the home is likely to be needed much earlier than anticipated) and the increasing demand for always-on access for millions of personal devices. To gain further share, Telco's have to promote features like guaranteed upstream bandwidth for P2P personal information sharing.

Impact on Service Development

Once the network enables P2P and always-on connected devices, we will see a wealth of P2P services developed by individuals all over the world. Instead of competing with those masses of smart developers, agreements could be entered with them, as those developers can be very willing to partner with Telco's. Indeed, they mostly lack the resources to bring their services to the market fast enough. By opening up telecommunication platforms for this new breed of service developers and building communities of interest, customers can get best-of-breed services. Moreover, portal sites should serve as directories of P2P services and help consumers to locate other P2P PCs supporting a same client software. As always when negotiating partnerships, the culture of the partners has to be understood. In the case of this new breed of service developers, it is the smart, young, high-tech, positive, ambitious start-up culture. To successfully go for partnerships, excellent peers in Swisscom are needed, working in innovation and service development, being able to bridge the gap between those two company cultures.

Impact on Customer Ownership

The Internet makes it very easy for customers to do "cherry-picking" and put together a set of best-of-breed services. Those services are typically offered for free in exchange for customer information, resulting in a customer relationship on the granularity of individual services. This situation is surely not favourable for the user (how many passwords do you need to access all your services?), but the user accepts it, as there is no single company innovative enough to offer him a similar set of services. But the situation is not favourable for the service developer, either. His core business is software. He accepts because he needs an audience to run his business model.

Obviously, there is an opportunity for an intermediary who establishes relationships to service providers, as well as to consumers. Swisscom may focus on this opportunity to build up long-lasting customer ownership, not based on products and a provider/customer relation, but on a partnership and an image such as: connected with Swisscom means connected with best-of-breed services, i.e. a customer relationship based on connectivity, in the sense of being connected to a lifestyle.

Conclusions

The Napster trial dramatically shows how a technology has driven the music industry into a need for changing its business model, and that it was too late in understanding this.

The communication service industry has to take into account the P2P technology. Only those Telco's that understand the developments and take the challenge to modify their business models will get the benefits of the P2P networking technology.

Outlook

In its Peer-to-Peer Networking Project (P2P) – which forms part of the Exploration Programme "Broadband Communication Opportunities" – CT is examining the implications of the P2P approach for Swisscom more closely. The aim of the project is to seek technology- and business-oriented answers to the following questions: How can Swisscom respond to changes in traffic profiles, in particular in the network access area? How can Swisscom portals and other server services stand their ground against

CTO Office (Swisscom-internal link only):
http://cto.swissptt.ch

CT Outpost USA (Swisscom-internal link only):
http://ctep.swissptt.ch/cto/outpost

Napster:
http://www.napster.com

Gnutella:
http://www.gnutella.wego.com

Groove Networks:
http://www.groove.net

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Résumé

La technologie P2P (littéralement point-à-point) diffère du modèle client-serveur utilisé par internet, par le fait qu'elle permet l'échange de données entre ordinateurs sans passer par un serveur central. Les applications utilisant cette technologie sont par exemple la messagerie instantannée, l'aire commune de communication ou les calculs distribués. Afin de tenir compte de cette technologie qui prend de plus en plus d'ampleur, les opérateurs de télécommunication vont devoir modifier, du moins en partie, la conception de leurs activités commerciales.

P2P solutions? What new services will be feasible thanks to P2P and how should they be designed so that they are profitable? Is it possible, using technical or even economic measures, to prevent or even promote such services via Swisscom networks? The results of the P2P project will be published in a later Comtec issue. [6]

Abbreviations
P2P:	Peer to Peer
ICQ:	say "I seek you"
CPU:	Central Processing Unit

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« WAP the Pitfalls »

WAP, for most operators, was the first opportunity to provide content to their customers and subscribers. This represented and still represents a golden opportunity to begin measuring the success of particular types of content, their usage and, most importantly, their value to individual subscribers and customers.

This would enable operators to begin the process of building the more complex content services, which they will no doubt wish to provide – profitably – to their customers and subscribers. To date however, there is little

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evidence to suggest that all but the most cursory measurement has taken place. How many operators could tell you, whether the 50 year-old stockbroker, or the 15 year-old school girl use the stock quotation service or horoscope reading more often? If they can't, they won't be able to put a value on the service. Consequently they will not be able to identify how much can be charged for the service.

WAP is all about Convenience
We have heard some operators actively talk about the revolution in commerce which WAP will bring, with subscribers booking their holidays using WAP devices. However, as this is the most expensive purchase that the average individual makes each year, we do not believe WAP users will suddenly stop getting holiday brochures, visiting travel agents and the web, to use a WAP phone to book their holidays. It is simply not the way that people will use WAP devices. WAP is all about convenience – checking a bank balance, buying a cinema ticket, checking e-mail, or booking into a flight. These are all services, which can be made considerably more convenient using a WAP device while on the move. When operators find trading partners, with whom they can build effective convenience based services which will contribute positively to the endless struggle for the "Work/Life Balance" of subscribers, they will see a marked increase in the use of these services. Until then, it will remain an interesting oddity.

Customer Centric
When it comes to the next generation of content services produced for GPRS and ultimately 3G, the operators are going to have to carry out a great deal of market research to identify exactly the kind of services that their customers and subscribers will actually use. They may even have to run pilot services with groups of test customers and services, to determine how effective and convenient some services actually are. Once this has been done the operators will have a far better indication as to the range of services that can be provided, profitably, to their subscribers and customers.
The key to the whole content services market will lie in being customer centric. Internet banking has not taken off because it is any better than branch banking. It has taken off because it is considerably more convenient than losing an hour at lunchtime to stand in a queue at the branch and transfer money from one account to the other. On the Internet, it takes only minutes and can be done any time. As mentioned earlier in this article, individuals are constantly trying to create an effective balance between life and work – a difficult challenge to say the least. Those operators, which provide services which can contribute positively to the work/life balance of an individual, will create competitive advantage by doing so. [1]

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