# EBU Seminar report
# From P2P to Broadcasting

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**As more and more broadcasters use the Internet to webcast their programmes, Peer-to-Peer (P2P) is becoming an interesting transport mechanism to convey these programmes to the general public, more efficiently than any traditional internet methods.**

**This article reports on the Seminar *From P2P to broadcasting* which was held at EBU headquarters in Geneva on 14 and 15 February 2006. It was jointly organized by the Technical and Training departments of the EBU, with the involvement of the Radio, Eurovision and Legal Departments.**

This EBU Seminar focused on the following topics:

- providing background knowledge of P2P technologies and examining the most relevant aspects of the P2P revolution;
- briefing broadcasters on how P2P networks could provide both linear and non-linear (on-demand) broadcast services for the audience at home;
- raising awareness on the main legal issues related to broadcasting law, copyright, piracy and digital rights management;
- helping broadcasters to understand what impact P2P may have on business, revenue and distribution models.

The seminar was very well attended: more than 100 participants were able to come, including representatives from 31 TV & Radio EBU Members and associate Members.

Some 20 high-profile speakers accepted, or even solicited, our invitation to speak. Among them were a number of P2P commercial service providers whose presence and competitive presentations were highly appreciated by the EBU broadcasters, who were able to develop an understanding of what is today a "hot" issue and to compare the P2P solutions on offer.

## P2P in a nutshell

Peer-to-Peer (P2P) is a distribution network which consists of individual users but appears as a single coherent system. P2P creates a “virtual software overlay” on the existing internet to enable collaboration and sharing of users' resources.

P2P does not require any special infrastructure or purposely-built networks. It capitalizes on the existing user-machine infrastructure but nevertheless requires a degree of willingness from the users to share their processing power and hard-disk capacity *(see Figs 1a & 1b)*.

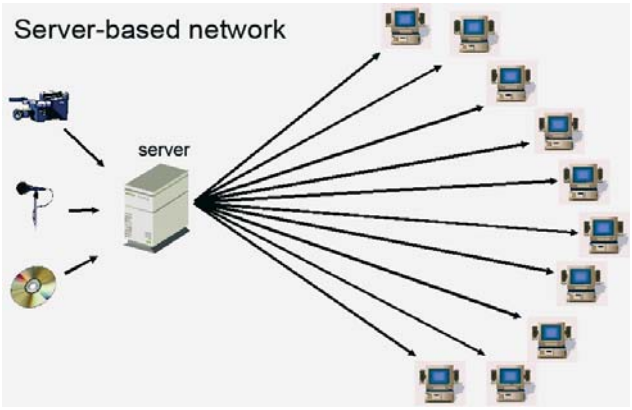


**Figure 1a**
**Server-based network** *(courtesy Abacast)*

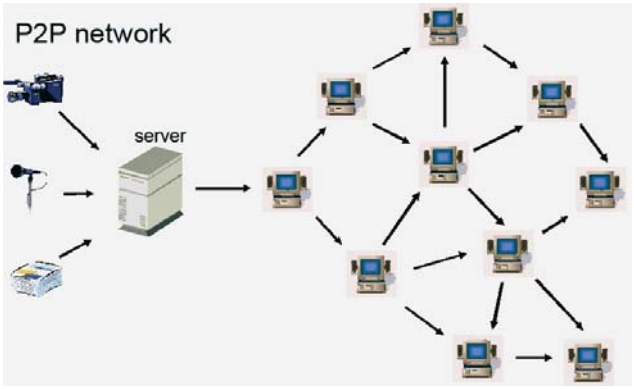


**Figure 1b**
**P2P server** *(courtesy Abacast)*

Over the last five years, P2P has become one of the most popular user applications on the Internet and is acknowledged as one of the key drivers for consumer broadband uptake. This popularity has positioned P2P as the dominant protocol on the Internet, representing between 60% and 80% of total traffic on the networks operated by Internet Service Providers (ISPs) (see *Fig. 2*).

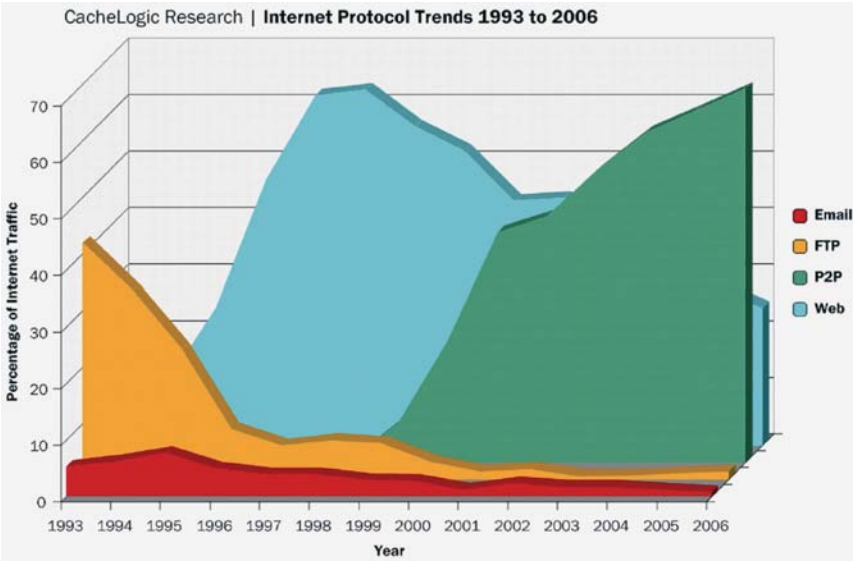


**Figure 2**
**Internet trends** *(courtesy CacheLogic)*

In recent years, P2P has been the subject of some hype ... but also controversy, which has led to mistrust and litigation involving the technology. P2P systems, such as Napster, Gnutella, Kazaa, Grokster and others have become synonymous with illegal file-sharing platforms, enabling the users to download songs, films and other content for free. Whilst all the legal problems have not yet been resolved, P2P has the potential to become an efficient, legally conformant and non-expensive means for delivering content to the general public.

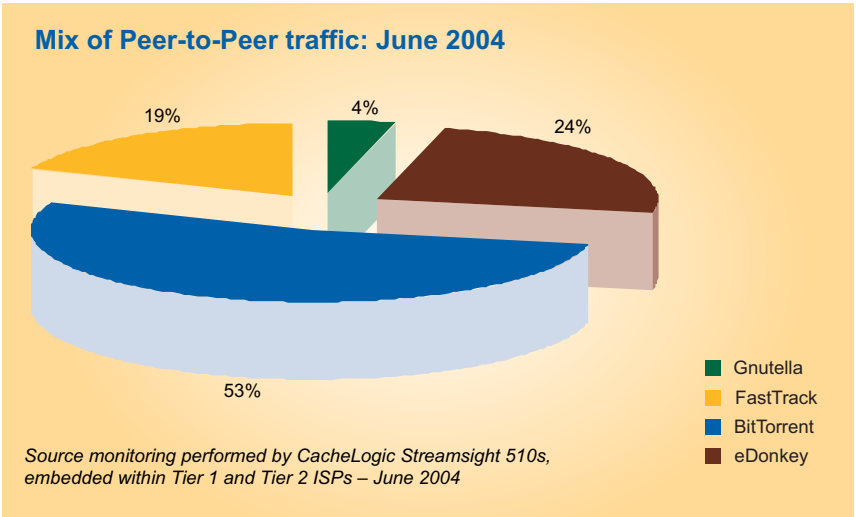


**Figure 3**
**P2P traffic** *(courtesy CacheLogic)*

P2P systems can be used for the distribution of either “linear” (i.e. real-time video or audio streaming) services and/or “non-linear” (on-demand) services (i.e. file downloading) over the Internet. P2P can also be used as a channel for networked Personal Video Recorders (PVRs).

*Fig. 3* shows what was the market share of the different P2P approaches in June 2004. BitTorrent is increasingly being

used for distributing legitimate content and takes more than half of all P2P traffic. According to a CacheLogic research study, P2P carries a mixture of audio (11%), video (61%) and other data traffic (about 28%). Almost half of all the traffic uses Microsoft Windows Media formats. Most of the audio files use the mp3 format (65%). eDonkey is still the most popular format for carrying video content.

Figures released in July 2004 by the Organization for Economic Cooperation and Development (OECD), based in Paris, suggest that file-sharers now swap more video and software content than music [1].

## Why does P2P matter to broadcasters

During the last decade the Internet has become a very useful broadcasting medium, particularly for on-demand services such as archive play-out. For live video and audio streaming, the Internet is largely uneconomic today – it is simply too expensive to provide streams to large audiences simultaneously. To this end, only a few broadcasters can afford to invest in large and expensive servers and networks. It is well known that the total bandwidth required, and thus the cost, increases proportionally to the size of the audience. As the number of streams increases, the broadcaster has to pay more, and is therefore penalised for his own success. In addition, investments in the streaming server infrastructure grow rapidly with the audience size. Large streaming server plants, capable of providing streaming services to several tens of simultaneous clients, may cost several hundred thousand euros.

Compared to conventional approaches, P2P networks require much less capital investment (as they comprise software overlaid on the existing telco network infrastructure) and much less maintenance. They offer more cost-efficient operation (transmission bandwidth savings), are more reliable (no single point of failure) and are more scalable and resistant to traffic peaks.

Thus, P2P may potentially reverse the traditional internet model. So far, broadcasters have typically had to pay more to distribute their more successful webcasts (“the more streams, the higher the cost”). From now on, the business model will radically change and will become: “the more streams, the better the system and the lower the cost (per stream)”.

Thanks to P2P networks, the costs borne by broadcasters will drop dramatically. The Internet may therefore become an interesting delivery mechanism, not only in relative terms (compared to other delivery technologies available on the Internet) but also in absolute terms (compared to cable, satellite and terrestrial channels).

At the recent Mix06 Conference in Las Vegas, Ashley Highfield, BBC Director of New Media and Technology, shared a vision of the future of television with Microsoft's Bill Gates and pointed out that the broadcast distribution costs are also falling. He said that the cost of delivering a television channel over the air is around £7 million a year using digital terrestrial television and around £700,000 over satellite. Using approaches such as multicast and peer-to-peer delivery over the Internet, the cost can fall to around £70,000 [2].

## Status of P2P technologies

Following several years of successful trials and experiments, P2P techologies have become mature, reliable and ready for commercial exploitation to provide cost-efficient webcast services over the Internet, both downloading and live streaming. This however does not mean that all technical, oper-

1. The New Scientist, 7th October 2004.
2. At the moment the BBC uses ***P2P*** (Kontiki) for downloading archive files, and ***multicasting*** for live media streaming. However, tests are being carried out to use P2P for both downloading and live streaming. Source: **http://informitv.com/articles/2006/03/21/billgatespreviews/**

ational and commercial issues have successfully been resolved. On the contrary, there are many open problems that will need further discussion and resolution.

The state-of-the-art P2P technologies presented at the EBU Seminar were as follows:

- ***Kontiki*** – a legitimate content (file) delivery mechanism used by AOL, Sky VoD, BBC iMP, OMN and NBC. It is now in its 5th generation and has reached a high degree of reliability for rich media delivery. It is fully scalable, DRM-protected, customizable and has a brandable user interface. While this report was being written, Kontiki was acquired by VeriSign, a broadband service provider in the USA, for $63 million.
- ***Octoshape*** – an advanced grid-based real-time P2P streaming system (which was the subject of an article in the July 2005 edition of the **Technical Review**). Peers monitor and probe each other to optimize the network flow, so there are no central-server bottlenecks. The traffic burden is spread evenly across the network, thus limiting the impact of peer loss. The efficiency of the system increases with the number of users. In cases of high packet loss, Octoshape simply injects more packets into the network. The system switches automatically between the different protocols as required (http, https, TCP, UDP) and thus guarantees availability. The user's own personal applications always have priority over Octoshape distribution of the stream, so that his/her normal computing activities are never compromised. The EBU has already tested the Octoshape system on the occasion of the *Prix Europa* opening concert in October 2005 and will further trial it during the *Eurovision Song Contest* in May 2006.
- ***Azureus & Aelitis*** – a very efficient P2P distribution platform for downloading files. It can achieve a bandwidth reduction factor of 400. The system is very popular – it typically serves a million downloads over any 3-day period.
- ***Rawflow*** – one of the leading P2P streaming networks. It is a tree-based proprietary technology which started in 2002. The system is mature and stable but is less bandwidth-efficient than grid-based systems.
- ***Abacast*** – a grid-based real-time streaming platform. It has now been in operation for six years and has achieved more than 35 million plug-in downloads. Its usage is extensive: over 8 million user-hours per month. Its efficiency is significant: 98% to 64% reduction in bandwidth. It allows clients to distribute and receive both full and partial streams to better utilize the available upstream bitrate. Each user is in constant contact with the Abacast server for real-time QoS (Quality of Service) monitoring. If the user needs upstream bandwidth for other purposes, this is given priority over Abacast distribution of the stream. The system is DRM compatible and can be customized.

In addition to the above systems, there are other commercial and open-source systems available on the market today such as PPLive, BitTorrent, Triber, etc.

The P2P clients can not only be downloaded to desk-top computers, they can also be embedded in consumer electronics (CE) equipment. Examples: Lamabox, Slingbox. Connected to a home LAN, these boxes can download music and videos from P2P networks.

## Potential threats perceived by broadcasters

P2P is potentially disruptive. It can destabilize traditional broadcast and communication business models and industries. As people watch less and less "normal" broadcast TV and use more and more interactive personalized P2P television, peer-to-peer can potentially cannibalize the broadcasters' "normal" businesses. In the P2P environment, surrounding trailers and advertisements are edited out of downloaded files. Consequently, TV marketing has a reduced impact on the P2P audience and webcasters suffer a loss in advertising revenue.

The biggest threat is that copyright is being infringed. Many TV and radio programmes may be obtained illegally. As an example of *de facto* destabilization of existing services, refer to Skype, which uses a P2P approach and provides very cheap fixed telephone communications worldwide.

There is some evidence that Skype (as well as other Internet phone companies) is causing severe damage to the commercial viability of traditional telecos.

P2P avoids intermediation between the source (broadcaster) and the user. Users can set up their own databases and become efficient P2P webcasters, thus potentially bypassing the established service providers.

## P2P business models

P2P represents an opportunity for a radically different business model to that known on the Internet today. For live webcast events, broadcasters pay ISPs in proportion to the number of streams, the bitrate and the duration of streaming services. Not surprisingly, the costs of live streaming are often high enough to discourage even enthusiastic broadcasters from embarking into streaming over the Internet. To illustrate this, for a large-scale event, a broadcaster may pay about one euro per stream per hour. Of course, many broadcasters, in particular the poorer ones, may not be interested in paying several tens of thousands of euros to stream the event live.

P2P can potentially emulate the traditional broadcast model which is characterized by zero incremental transmission costs, independence of the time of use and the media quality.

P2P technology providers can offer two kinds of licences: a technology licence and a hosting solution. In the former case, broadcasters operate their own P2P servers and host the P2P services by themselves. In the latter case, broadcasters send the source stream to a P2P provider who then performs the streaming services on their behalf.

Both options are under consideration and will be developed jointly by broadcasters and P2P providers.

## Some legal issues

The main question is how P2P networks could be set up for legal sharing. Several methods are being considered. For instance, one methodology would be to identify content using audio/video fingerprint/watermark technology and track all the content in a P2P network. Billing could be attached to tracked and shared files.

An example of the "Snocap" music distribution platform was given at the Seminar. Snocap allows those who own rights to music tracks to place them on P2P networks and retail them with DRM. Files in Snocap need to be registered, and fingerprints and usage rules are attached to them. A Snocap file-sharing scheme checks if a desired file is registered. If yes, downloading of a file is logged for billing. If it is not registered, the ISP decides whether or not the transfer is allowed.

## Conclusions

Broadcasters have no choice but to adopt P2P technology and adjust it to their needs. In so doing, broadcasters should coordinate their activities closely with Internet Service Providers (ISPs) and P2P service/technology providers.

Thanks to P2P, the Internet (both wired and wireless) may become not just a complementary delivery channel (as it is today), but indeed a primary channel for niche content and on-demand services.

Broadcasters should endeavour to develop high-quality legitimate, on-demand, on-line services in response to internet piracy. The development of legitimate services would be welcomed by rights-owners as well as audiences.

The EBU should study and trial the different P2P approaches from an interdisciplinary point of view involving technical, operational, commercial and legal implications. In this context, hands-on experience of large-scale events (such as the *Eurovision Song Contest*) is vital to check whether P2P really works in practice.

It will be necessary to identify an optimum balance between outsourcing P2P services and providing in-house solutions. Ideally, the EBU should adopt an open-source and standardized (non-proprietary) P2P network model and offer it to its Members free of charge.