

## ***Why peer-to-peer is efficient***

When a user wishes to download a file from a website, they submit a HTTP GET request. This request for the file uses a single TCP socket, and communicates with a single server which transfers the entire file. By contrast, a P2P protocol creates TCP connections with multiple hosts and makes many small data requests to each. The P2P client then combines the chunks to recreate the file. A single file host will usually have limited upload capacity, but connecting to many servers simultaneously allows for higher file transfers, and disperses the costs associated with data transfers amongst many peers. Moreover, a client mid-way through downloading the file also acts as a server, hosting the bits to others which they have already downloaded. These differences from traditional HTTP GET requests allow for lower costs and higher redundancy since many people are sharing the files.

## ***Fault Tolerance***

The Internet evolved from the Arpanet, which, by design, was created to link the valuable computer assets possessed by various DARPA research sites by creating a physically decentralized computer network. By following the Internet's historical design, peer-to-peer technologies can be utilized for fault tolerant decentralized logical networks. These logical networks can and could support any type of data, such as Internet DNS information, scientific information, or large distributed and redundant information databases. The internationally, and potentially universally, distributed nature of these peer-to-peer logical networks can enable critical data to survive natural and human disasters. Peer-to-peer networks represent a valuable technological tool for the preservation of human knowledge.

## ***BitTorrent***

BitTorrent is one of the most popular peer-to-peer file sharing protocols used on the Internet and it accounts for a significant amount of traffic on the Internet.

## **Film**

- The creator of BitTorrent, Bram Cohen has set up deals with major content providers and now [offers Hollywood movies for purchase or rental](#), distributed via BitTorrent.
- Movies that have [entered the public domain are available over BitTorrent](#). Because they are no longer profitable, there is little business incentive to pay for bandwidth hosting costs. BitTorrent allows these films to reach audiences.
- The world's first “open movie”, [Elephants Dream](#) was simultaneously released on the web and over [BitTorrent](#). The group's follow up film, [Big Buck Bunny](#) is also being distributed via [BitTorrent](#).
- A documentary about file sharing, [Steal This Film](#) has chosen BitTorrent as its distribution mechanism.
- [Ourmedia.org](#), the Open Media Directory, offers free and legal public domain movies through BitTorrent

## Video

Many so-called “new media” content publishers on the Internet have chosen BitTorrent as their distribution mechanism to save costs:

- On the [Revision3 Internet Television Network](#) users can view 16 different shows straight from the website. But to offload some of their bandwidth costs, Revision3 has set up their own BitTorrent tracker, and viewers can subscribe to a show's RSS feed and automatically download new shows via BitTorrent.

## Music & Audio

- Trent Reznor's Nine Inch Nails have offered free downloads of their last few albums. For the higher quality (i.e., larger file sized) versions of the tracks, Reznor has chosen to use BitTorrent to distribute his music. In a text file distributed with the album [Ghotos I](#), Reznor states “*Now that we're no longer constrained by a record label, we've decided to personally upload Ghotos I, the first of the four volumes, to various torrent sites, because we believe BitTorrent is a revolutionary digital distribution method, and we believe in finding ways to utilize new technologies instead of fighting them...*” He has also released via [BitTorrent the original Garageband files](#) for fans to mix and create new content.
- [Subpop Records](#) has [made some of its artists' content available](#) for free on BitTorrent, including *The Shins*, *The Postal Service*, *Flight of the Conchords*, *Constantines*, *Hot Hot Heat*, and *David Cross*.
- Indie rock label Saddle Creek has distributed an [exclusive-to-BitTorrent free sampler](#) over, as well as singles from their popular artists such as *Bright Eyes*, *Mayday*, and *Cursive*.
- Music sharing portal [Jamendo](#) offers a “free, legal and unlimited” music from over 5500 artists via BitTorrent.
- Public domain audiobooks from [LibriVox.org](#) available at [legaltorrents.com](#)

## Television

- The CBC offered an episode of its television show [Canada's Next Great Prime Minister via BitTorrent](#). The torrent file was hosted on [Mininova.org](#), one of the largest BitTorrent portals in the world. The full-resolution version has been downloaded over 10,000 times, and over 4,700 users have downloaded a smaller file tailored for portable video players.

## Computer Applications

- [Miro](#)'s tagline is “Turn your computer into an Internet TV” and it accomplishes this as a Bittorrent client. Focusing on the “video podcasting” market, Miro employs RSS (Really Simple Syndication) technology to keep users up-to-date on their favourite video casts.
- Much like Miro, [Vuze](#) is a media hub which compartmentalizes content into “channels” much like traditional television broadcasting. BitTorrent makes it possible for Vuze to offer [high quality HD content](#). Without distributing the bandwidth requests amongst its peer users, Vuze would be unable to offer these large files (typically exceeding one gigabyte).
- Software developer Konami has elected to build BitTorrent technology into their upcoming

Playstation 3 title [\*Metal Gear Solid\*](#). When the game requires updates, users have the option of downloading through P2P, or HTTP. Beta testers of the game [report that the BitTorrent option delivered their patch quicker](#).

- [Blizzard](#), the company behind famous PC game franchises like Diablo, Starcraft, and Warcraft have implemented a software update scheme which relies on BitTorrent technology. The “[Blizzard Downloader](#)” is a combination HTTP and BitTorrent client which polls Blizzard's HTTP servers for smaller updates, but harnesses the community's superior bandwidth capacity for larger updates. Their most popular game, *World of Warcraft* has [approximately 10 million subscribers](#) and using Bittorrent enables Blizzard's servers to avoid being 'flash flooded' by update requests when they issue a patch.
- Various versions of the Linux operating system, called “distributions”, and their updates are commonly downloaded via BitTorrent. For example, one of the most popular distributions, Ubuntu offers [torrent files from their website](#). An independent host, Mininova, records that the latest Ubuntu torrent file has been [downloaded over 12,000](#) times just from that website alone.

## **File Sharing**

### **Tribler**

[Tribler](#), developed at the Delft University of Technology and the Vrije Universiteit Amsterdam, is an open source social interactive Peer-to-Peer client with integrated search engine, video and audio player.

## **Private File Sharing**

### **Pando**

[Pando](#) is a personal P2P program, much like BitTorrent but geared toward those looking for a simple and secure means of file transfer. Users may email, IM, or post to their website a .pando file. When the intended recipient downloads the .pando file, the Pando software contacts an secure Pando server (much like the “tracker” in the BitTorrent system) and allows the sender to initiate [a direct P2P transfer to the recipient](#).

## **Peercasting**

Like broadcasting, peercasting is a method of streaming content to consumers. But it differs from traditional broadcasting because the consumers of peercasted content are simultaneously broadcasters.

- [The Peer Distributed Transfer Protocol \(PDTP\)](#) specification is a peer-to-peer system that provides streaming downloads of content which originates from a central server. These files are shared amongst the peer network which allows the aggregate bandwidth capacity of the network to grow naturally with the number of clients connected. DistribuStream, a joint venture between the [University of Colorado Department of Computer Science](#) and [Medioh!](#) has implemented PDTP into an application which allows anyone to “set up a lo cost on-demand streaming media server”.
- P2PTV is another form of peer-to-peer streaming but is more focused on the re-broadcasting of traditional media content. Popular examples of this technology include [Sopcast](#), [TVU Player](#), [CoolStreaming](#), [Zattoo](#) and [IT-Koo](#).

## Freecast

[Freecast](#) is a peer-to-peer streaming audio broadcasting program. Typically, residential Internet connections have a much lower upload capacity than download capacity. Thus, it was impossible in the past for residential users to broadcast personal audio streams (such as talk-radio, or music) to more than one user at a time.

Freecast relies on P2P to allow these users to stream their broadcast to a much, much larger audience. The [software's collaborative approach](#) to sharing the bandwidth requirements of streaming audio provides a way for "small organizations to diffuse over Internet radio broadcasting, musical events, etc. without a financial and technical dependency with a web host.

## Content Distribution

### Babelgum

[Babelgum](#) is similar to Joost, but uses a proprietary P2P protocol with an encrypted data stream to prevent piracy. This free service only airs professionally produced content but will cater to independent producers. Babelgum will offer Independents compensation for uploading their content, and promise a world-wide audience with a safe and efficient content delivery scheme. Like Joost, Babelgum is supported by advertising.

### Blinkx BBTv

[Blinkx BBTv](#) fuses TV and other video from the web using "hybrid peer-to-peer streaming [which] enables [content providers] to disperse the burden of content delivery [through the blinkx network and peer-to-peer distribution](#)". As the content gains in popularity, the audience base becomes large enough to sustain the bandwidth requests on its own, thereby reducing overall distribution costs of penny-pinching content owners.

### BBC iPlayer

Last December BBC launched a content distribution service through their website, a P2P client, and cable television. The [iPlayer download service](#) relies on peer-to-peer technology designed by [Kontiki](#) which allows the distribution of massive video files to be enjoyed without significant delays. Users can download and keep content for up to seven days, and have access to an electronic program guide to schedule automatic downloads. [Statistics from April 2008](#) show that an average of 1.4 million people per week used the iPlayer, making 21 million requests for program downloads.

- [Sky Anytime](#) and [4oD](#) both offer a similar video-on-demand service using the same Kontiki peer-to-peer technology.

### GridNetworks

GridNetworks aims to combine the traditional notion of content delivery networks (CDNs), like [Akami](#), with P2P technology. Grid is openly courting cable networks to use its content delivery infrastructure, and embed their proprietary P2P protocol into "[network devices, set-top boxes and even consumer devices](#)." The company says this "[GridCasting managed Interent television service](#)" can be offered at a fraction of the cost of traditional content delivery networks, and will allow higher quality video (HD) to be enjoyed by consumers.

## Jaman

[Jamen](#) distributes international independent movies. Using its Jaman Player, the user downloads the movies through their "Jaman Cascade Network". The "Jaman Cascade Network" provides pieces of the movie via their server and via P2P. Some films are free, some are available for a small cost. By utilizing P2P technology, [Jayman claims](#) this is how they can provide some of the content for free or low cost.

## Joost

[Joost](#) distributes TV and other video shows for free over the web using P2P and has [major contracts](#) with Viacom (which includes MTV, BET, and Paramount Pictures), Fox, Warner Music, Indianapolis Speedway Productions, Ministry of Sound TV, Aardman Animation, Warner Music, CBS, CNN, Sony Pictures, and even has signed a deal to redistribute NHL content such as the 2007 Stanley Cup Finals. Joost is an advertising supported business.

## LiveStation

[LiveStation](#) runs on peer-to-peer software originally created by Microsoft in its Cambridge, UK location. The free service delivers live TV and radio news as it happens from reputable world-wide sources. It works by splitting a video stream into many parts which are distributed amongst the peer cloud. Similar to other P2P content delivery services, the Livestation Player reduces the need for a central server and slashes operating costs.

## Mashboxx

While currently unreleased, [Mashboxx](#) promises to be the first peer-to-peer software authorized by major record labels, Sony BMG Music, and EMI Music. The Mashboxx software is a P2P client which allows users to search existing P2P networks for audio tracks. To appease the record labels, the results are filtered through a digital catalogue fingerprinted by SNOCAP. Users then have the ability to download and play a full-length song up to five times, or purchase it.

Chairman and CEO of EMI Music North America and Vice Chairman of EMI Music world wide had [this to say about P2P technology](#): "Legal peer-to-peer services which offer consumers a great user experience and which compensate creators appropriately are good for music fans, good for artists, and good for the digital music market as a whole," said David Munns, Chairman and CEO of EMI Music North America and Vice Chairman of EMI Music worldwide"

## Open Media Network

[Open Media Network](#) hosts content from educational, community, and non-profit organization. The software aims to offer socially-conscious programming through an easy TV Guide experience. They specialize in content which is not well distributed by traditional media outlets, for example, audio and video from non-profit organizations.

The software, OMN's Secure Grid Network (P2P) uses the popular Kontiki delivery system as used by BBC's iPlayer.

## **Pando Networks**

In addition to Pando's [personal P2P software](#), Pando Networks offers [Pando Publisher](#) for companies who wish to stream full-screen HD content, accelerate downloadable media, or reduce bandwidth bills “by up to 90%”. Their “Pando Content Delivery Suite” offers companies all they need to publish, distribute, track, and monetize their content.

Similar to GridCasting, Pando's [Media Booster](#) is a client installed on user's computers which runs in the background and leverages the user's bandwidth. “The more viewers a video has, the faster and more cost effectively it can be delivered”. [NBC is currently working with Pando Networks](#) in a beta project on a platform to deliver its “true” 720 HD video downloads to customers.

## **RedSwoosh**

[Red Swoosh](#) is a networking client owned by the popular Content Delivery Network, [Akami Technologies](#). Red Swoosh is a peercasting tool that is offered as a browser plugin. The software relies on a proprietary peer-to-peer protocol which allows servers to offload their bandwidth demands to the consumers of their content.

## **Reeltime Rentals**

[ReelTime Rentals](#) is a low cost TV and movie content distribution company providing the most efficient, secure and economic delivery of high bit-rate content, P2P powered by [GridNetworks](#).

## **Tribler Video Streaming**

[This software](#) uses Peer-2-Peer technology for streaming live video feeds across the Internet to millions of users. The University developers are currently involved in the European Union's 19M€ R&D project into P2P-Next.

## ***Privacy Protection***

### **Tor**

Tor is an application that shields its user's identities by sending their traffic through a network of relays set up by volunteers around the world. In other words “it prevents somebody watching your Internet connection from learning what sites you visit, and it prevents the sites you visit from learning your physical location.” Tor is used by everyday ordinary Internet users who wish to avoid advertiser's [behavioural targeting](#), citizen journalists in countries without safe access to media, law enforcement setting up anonymous tip lines, activists, and whistleblowers.

To accomplish this, the Tor network relies on people to volunteer their Internet connection as a “relay”. These relays send user's content privately to other volunteer relays with the aim of obfuscating the user's location or identity. Those who volunteer their Internet connection as a relay are committing to allowing a certain level of bandwidth usage flow through their pipe ([20KB/sec minimum](#)).

## ***Real-time communication***

### **Skype**

Skype, the popular VoIP application does not run the traditional client-server model. Rather, Skype is entirely decentralized and distributed to each Skype user's connection. This has allowed Skype to start up business without investing in complex and costly infrastructure to support their over [240 million users](#).

### ***Adobe Flash Player***

The next version of Flash Player (version 10) will include the Real Time Media Flow Protocol (RTMFP) which [enables peer-to-peer communication](#). This implementation relies on an Adobe server which maintains a list of peers, much like a BitTorrent tracker. The technology will allow end users to stream microphone or webcam media to other Flash Player clients when connected as peers.

## ***Web Search Engines***

### **YaCy**

[YaCy](#) is a peer-to-peer search engine and web crawler. Users install the software and become a “YaCy-peer”, volunteering their computer to independently crawl through the web, analyzing and indexing websites into a database shared by all Yacy peers. [More than 400 million websites have been indexed](#) by YaCy. There is no central server; the database is shared and upheld by the YaCy peers.

There are a few distinct advantages of a decentralized peer-to-peer search engine: since there is no central server or company who owns the service, the search results cannot be censored, and no incentives to prioritize results based on prospective contracts or advertising dollars.

### **FAROO**

[FAROO](#) offers a similar P2P search product to YaCy, but also has “distributed ranking” which lists the websites according to anonymized usage statistics of the websites visited by users of FAROO. This democratic method of ranking avoids so-called “search engine optimization” techniques that firms use to game popular search engines like Google in hopes of moving their site higher up on the list of search results.

FAROO states that “[t]he searcher becomes a part of FAROO. All users connect their computers to a huge collective search engine. Whose architecture is decentralized like the Internet itself.” FAROO was one of the [2007 TechCrunch40](#): “[Forty of the hottest new startups](#) from around the world will announce and demo their products over a two day period at TechCrunch40. And they don't pay a cent to do this. They will be selected to participate based on merit alone”. TechCrunch40 was set up to help start-ups find funding to launch their product.

## **Government**

### **European Union offers 14M€ grant for 14 P2P research**

The European Union will pay 14M€ to [P2P-Next](#), which is a 4-year technical trial of a content delivery platform for new media which would run on a wide range of consumer devices. Their mandate is to develop an “open source, efficient, trusted, personalized, user-centric, and participatory television plus media delivery mechanism with social and collaborative connotation using the emerging Peer-to-Peer (P2P) paradigm, which takes into account the existing EU legal framework.” P2P-Next is gathering of industrial partners, media content providers, and universities, which include the BBC, Delft University of Technology, the European Broadcasting Union, Lancaster University, Markenfilm, Pioneer and the VTT technical Research Centre of Finland.

The conglomerate aims, *inter alia*, to help P2P shed it's dubious reputation as an illegal file sharing mechanism, claiming that “today [P2P] is considered by many as an efficient, reliable, and low cost mechanism for distributing any media file or live stream...[b]roadcasters and content providers consider P2P as a future-proof, universal, and ubiquitous two-way (interactive) distribution mechanism.”

## **Business**

### **Collanos Workplace**

[Colonos Workplace](#) is a cross-platform P2P system for collaborative teams to work on projects and transmit their work amongst their work group. This P2P based product fills the gap for small and medium size businesses who don't have the IT budget for the elaborate collaborative software found in larger businesses.

Currently released in Beta phase, is its open source integrated VOIP technology, so team members can talk in real time, conduct conference calls and to communicate through its integrated multiplatform, multiprotocol instant messaging features while collaborating on work projects.