**BitTorrent**

BitTorrent may be popularly known as a method of piracy, but it isn’t just for pirates. BitTorrent is a protocol that enables fast downloading of large files using minimum Internet bandwidth. It costs nothing to use and includes no spyware or pop-up advertising.

Unlike other download methods, BitTorrent maximizes transfer speed by gathering pieces of the file you want and downloading these pieces from people who already have them. This process makes popular and very large files, such as videos and television programs, download much faster than is possible with other protocols.

**Traditional Client-Server Downloading**

To understand how BitTorrent works and why it is different from other file-serving methods, let's examine what happens when you download a file from a Web site. It works something like this:

* You open a Web page and click a link to download a file to your computer.
* The Web browser software on your computer (the client) tells the server (a central computer that holds the Web page and the file you want to download) to transfer a copy of the file to your computer.
* The transfer is handled by a protocol (a set of rules), such as FTP (File Transfer Protocol) or HTTP (HyperText Transfer Protocol).

The transfer speed is affected by a number of variables, including the type of protocol, the amount of traffic on the server and the number of other computers that are downloading the file. If the file is both large and popular, the demands on the server are great, and the download will be slow.

**Peer-to-peer file sharing**

Peer-to-peer file sharing is different from traditional file downloading. In peer-to-peer sharing, you use a software program (rather than your Web browser) to locate computers that have the file you want. Because these are ordinary computers like yours, as opposed to servers, they are called peers. The process works like this:

* You run peer-to-peer file-sharing software on your computer and send out a request for the file you want to download.
* To locate the file, the software queries other computers that are connected to the Internet and running the file-sharing software.
* When the software finds a computer that has the file you want on its hard drive, the download begins.
* Others using the file-sharing software can obtain files they want from your computer's hard drive.

The file-transfer load is distributed between the computers exchanging files, but file searches and transfers from your computer to others can cause bottlenecks. Some people download files and immediately disconnect without allowing others to obtain files from their system, which is called leeching. This limits the number of computers the software can search for the requested file.

**How BitTorrent Works**

Unlike some other peer-to-peer downloading methods, BitTorrent is a protocol that offloads some of the file tracking work to a special server that keeps track of the connected computers (called tracker). Another difference is that it uses a principal called tit-for-tat. This means that in order to receive files, you have to give them. This solves the problem of leeching – one of developer Bram Cohen's primary goals. With BitTorrent, the more files you share with others, the faster your downloads are. Finally, to make better use of available Internet bandwidth (the pipeline for data transmission), BitTorrent downloads different pieces of the file you want simultaneously from multiple computers.

Here's how it works:

* You open a Web page and click on a link for the file you want.
* BitTorrent client software communicates with a tracker to find other computers running BitTorrent that have the complete file (seed computers) and those with a portion of the file (peers that are usually in the process of downloading the file).
* The tracker identifies the swarm, which is the connected computers that have all of or a portion of the file and are in the process of sending or receiving it.
* The tracker helps the client software trade pieces of the file you want with other computers in the swarm. Your computer receives multiple pieces of the file simultaneously.
* If you continue to run the BitTorrent client software after your download is complete, others can receive .torrent files from your computer;

Downloading pieces of the file at the same time helps solve a common problem with other peer-to-peer download methods: Peers upload at a much slower rate than they download. By downloading multiple pieces at the same time, the overall speed is greatly improved. The more computers involved in the swarm, the faster the file transfer occurs because there are more sources of each piece of the file. For this reason, BitTorrent is especially useful for large, popular files.

**Seeders**

Users that remain connected to a BitTorrent swarm even after they’ve downloaded the complete file, contributing more of their upload bandwidth so other people can continue to download the file, are referred to as “seeders”. For a torrent to be downloadable, one seeder – who has a complete copy of all the files in the torrent – must initially join the swarm so other users can download the data. If a torrent has no seeders, it won’t be possible to download – no connected user has the complete file.

BitTorrent clients reward other clients who upload, preferring to send data to clients who contribute more upload bandwidth rather than sending data to clients who upload at a very slow speed. This speeds up download times for the swarm as a whole and rewards users who contribute more upload bandwidth.

**Trackerless Torrents**

In recent times, a decentralized “trackerless” torrent system allows BitTorrent clients to communicate among each other without the need for any central servers. BitTorrent clients use distributed hash table (DHT) technology for this, with each BitTorrent client functioning as a DHT node. When you add a torrent using a “magnet link”, the DHT node contacts nearby nodes and those other nodes contact other nodes until they locate the information about the torrent.

As the DHT protocol specification says, “In effect, each peer becomes a tracker.” This means that BitTorrent clients no longer need a central server managing a swarm. Instead, BitTorrent becomes a fully decentralized peer-to-peer file transfer system.

DHT can also work alongside traditional trackers. For example, a torrent can use both DHT and a traditional tracker, which will provide redundancy in case the tracker fails.

**BitTorrent Isn’t Just For Piracy**

BitTorrent isn’t synonymous with piracy. Blizzard uses a custom BitTorrent client to distribute updates for its games. This helps speed up downloads for everyone by allowing people to share their upload bandwidth with others, leveraging unused bandwidth towards faster downloads for everyone. Of course, it also saves Blizzard money on their bandwidth bills.

People can use BitTorrent to distribute large files to significant numbers of people without paying for the web hosting bandwidth. A free film, music album, or game could be hosted on BitTorrent, allowing an easy, free method of distribution where the people downloading the file also help distribute it. WikiLeaks distributed data via BitTorrent, taking a significant load off their servers. Linux distributions use BitTorrent to help distribute their ISO disc images.

BitTorrent, Inc. – a company responsible for developing BitTorrent as a protocol, who also purchased and develop the popular µTorrent torrent client – is developing a variety of applications that use the BitTorrent protocol for new things via their BitTorrent Labs project. Labs experiments include a syncing application that securely synchronizes files between several computers by transferring the files directly via BitTorrent, and a BitTorrent Live experiment that uses the BitTorrent protocol to help broadcast live, streaming video, leveraging the power of BitTorrent to stream live video to large numbers of people without the current bandwidth requirements.