International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 |June 2021 www.irjet.net p-ISSN: 2395-0072

Peer to Peer Networks: A Bit Torrent Case Study

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Abstract – *A Peer to Peer(P2P) application is a software where the clients communicate over a network with each other directly. This P2P has both client and the server for file sharing. Scalability and Reliability are the main characteristics of P2P networks.P2P enables the large number of computer system to provide the access to data and other resources. Bit torrent is a file distribution system which enables for the faster download of the larger files and reduces the load on the hos machine. In Bit Torrent the files are split into chunks which has a fixed size.*

Key Words: **Peer to peer, Bit torrent, Client, Server, Networks, Files, Architecture.**

1. INTRODUCTION

In Peer to peer, there is minimal or no reliance on always on servers. Instead of servers they are connected intermittently by the hosts called peers and they communicate with each other directly. There are no algorithmic or technical limitations of how large the system is which is known as Scalability.Eg: the complexity of the system should be constant in spite of the number of nodes in the particular system. They are reliable because if there is malfunction in any given nodes the whole system is not affected.

Many files shared between the clients do not have any authorization of the owner which makes it illegal to transfer. The bandwidth which P2P applications consume more bandwidth which has led to network delay for the other users. The systems which work on Peer to peer applications are vulnerable to data leaks as important information can be transferred easily over a network which cannot be tracked. P2P systems are scalable because of the availability of resources to grow with the number of users.P2P system enables the large number of systems to provide access to the data and resources that they collectively store and manage. Bit torrent is a P2P file distribution system which enables the faster downloads of huge files and reduces the load on the system. A node of chunks of a file in parallel from different nodes which enables the faster download speed. It is the collection of peers which are participating in the distribution of particular file. Once a peer has acquired the file it may leave the application or remain in it and continue to upload chunks to other peers. The size of chunk files is 256byte when downloaded.

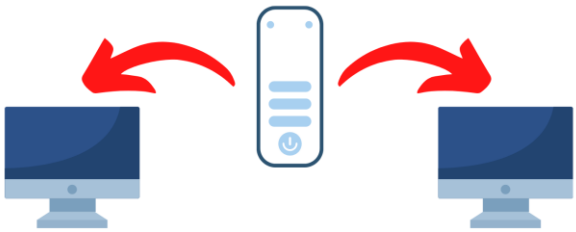

Fig 1.1

Fig1.1 explains the client server approach to download

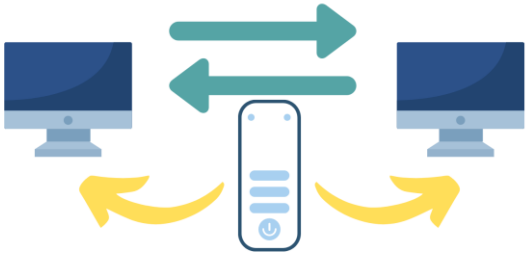

Fig 1.2

Fig1.2 shows the bit torrent approach which splits the file and send parts to peers and lets the missing part get downloaded from each other.

2. LITERATURE SURVEY

The most common method used to transfer files on the internet is the client-server method. One server sends the entire file to each client that requests it, that is how FTP and HTTP works. The main advantage of this is it is easy to set up and files are always available to the client. Peer to peer networks has evolved in recent years due to ongoing battle with the entertainment industry. This is not a new concept despite many beliefs but it is the simplest forms. Bit torrent is a distributed peer to peer system which is a potential landscape for the entertainment broadcast industry and file distribution. It uses Tit-for-tat model for more efficiency as it can comply with various mechanisms and algorithms to ensure there is no variations in the network. In the original implementation it uses a torrent file a tracker which is centralized and associated swarm of peers. Then there is bit torrent approach where the files are split and made to transfer.

3. EVOLUTION OF P2P NETWORK

Peer to see network or P2P network could be a network between computers through local area network or net. Peer could be a laptop connected within the P2P network. The shopper could be a system that gets the info from another laptop and also the laptop that stores the info and resource is termed as servers.

In 1979, the P2P network was introduced within the sort of the USENET that was the system that allowed users to post the messages and news on-line that is analogous to today's on-line forums and blog posts. The only distinction between USENET is that it failed to operate below a central server.
In 1999, the web has gone though and this is often once NAPSTER came into existence that allowed users to transfer and share music. It got finished off as a result of it had been ill-gotten.

After twenty years P2P remains the foremost in style technology for sharing files from one user to a different user below each ill-gotten and legal circumstances.

4. HISTORY OF BIT TORRENT

Bit torrent is the most popular peer to peer application ever. Surveys shows that 35%-40% of internet traffic is accounted by Bit Torrent.in the end of 90s Brahm Cohin went bankrupt and decided to develop something on his own. The idea was to store the files safe by splitting it into pieces in many locations. The idea was inspired by his last job. In 2001, he released the beta version followed by the full version in 2004.He wanted people to download movies and other files quickly. Bit torrent is free and open source software which can be used by any people around the world.

Why Bit torrent?

- Unlike other peer to peer downloading methods, bit torrent is a protocol that offloads some of the file tracking work to the central server.
- Another difference is that it uses tit-for-tat principle

5. CHARACTERISTICS OF BIT TORRENT

Here we are discussing about the characteristics of the bit torrent:

- Peer selection is a process of selecting peers which are willing to share files to the current peers
- The process of selecting peers based on the download speed is **Tit for Tat.**
- Choking/Unchoking is the mechanism used to control peer selection as the goal is to get good TCP performance and free riders.
- **Optimistic Choking:** The client uses some part of its available bandwidth for transferring data to random peers. The main goal of this is to avoid the problem of bootstrapping with the tit for tat process and make sure that new peers can join.
- **Piece selection:** The main goal is supporting the High piece diversity of local Rarest first for piece selection. There will be BITFIELD messages after a handshake with peers, then HAVE messages for the downloaded pieces.
- **End Game Mode:** To avoid delays the last blocks requests protocol from all the peers and send cancel message for the blocks which has been downloaded to avoid unwanted transmission when to start the end game mode which is not detailed in the specification.

6. ARCHITECTURE

6.1 Peer to peer Architecture

Unlike client server structure, peer to peer structure encompass decentralized network of peers as nodes which plays the operations of each client and servers with comparable duties and capabilities. In data centers there is a minimum dependence on dedicated servers. P2P network influences direct communication between the pairs of irregularly connected hosts named peers. These peers consist of super peers and edge peers. P2P circulates uniform workload amongst its peers which results in consumption of resources within the network with none centralized server. It's not essential for all peers to have the same amount of resources. For example, super peers can come up with more than they consume with mass resources and edge peers only consume and without donating to the compilation of the operations performed by the network. To help nodes to communicate with each other and manage the network, this architecture has a central tracking server present on the top. These peers aren't owned via way of means of service providers, they're computers and laptops operated via way of means of users even as residing in homes, universities and offices. P2P is appropriate for small place vicinity as PC's act as unbiased workstations and can keep data in its hardisk. Many of today's maximum famous and traffic in depth programs are primarily based on peer to peer architecture.

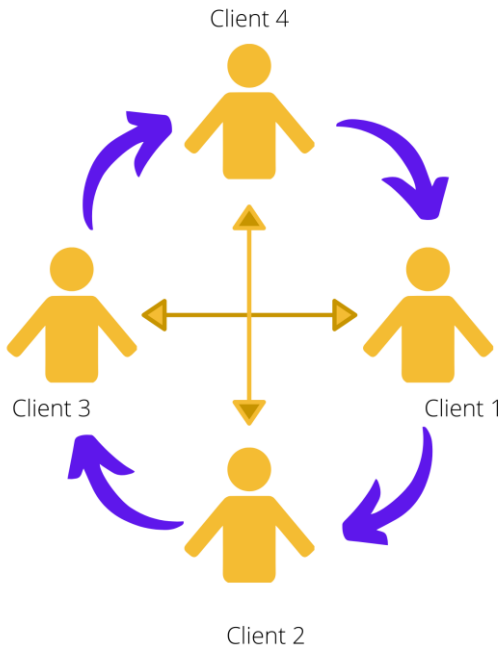

Fig 1.3 Architecture of P2P

6.1.1 Setting up of peer to peer network

In this section, we will discuss hardware requirements, adding network adapter, adding protocol stack configuring the network, sharing local resources, connection with other computers.

Hardware Requirements:

- It calls for a couple of laptop with network adapters for every respectively
- If user has 10base-t adapters with Only two computers, then direct connection is carried through crossover cable.
- More than two computers then direct communique is viable through the usage of 10base-t hub.

Adding network adapters:

- Install the NIC card in the open bay (slot 1 is recommended) Note- computer must be in off mode.
- Run the computer and open the control panel.
- Click on upload new hardware and press next button then select either yes in case you need to go looking for adapter or no to manually input adapter. Click on next.
- To set-up a driver for NIC card use driver diskette then reboot if requested.

Add protocols stack:

- Select protocol stack which user needs to apply in their local network. Use NetBEUI or IPX to access it without the internet. Use TCP/IP and assign a duplicate IP address for local lan to get entry with the internet.
- Open Control Panel and double click on network icon
- If the user desires NetBEUI, spotlight it and remove IPX or vise-versa, to feature TCP/IP click on add.
- Click on protocol, then on Microsoft and then on TCP/IP.

Configuring the network:

- Each computer should have a unique name under the control panel.
- Workgroup name should be the same for all computer systems.
- If TCP/IP is established earlier then select a different IP address with identical subnet mask.
- Click on file and print sharing button to check if user desires to share files or printers

Sharing local resources:

- Enable the user computer to share files and printers. Open network icon in control panel. Click on file and print sharing button. Click on options which are to be enabled then click on OK.
- To share local resource Open explorer and right click on the directory that must be shared and choose sharing. Enter share name. Choose if read, complete or relies upon password. Type and agree upon the password.
- Repeat similar steps for the printer.

To connect with any other computer's shared aid, click on network neighborhood

To configure the printer as a shared device earlier than attaching to any other computer follow the below steps:

- Click on start, choose settings, printers and click on add printer. Click on next button.
- Click on network printer and next button.
- Browse the network to understand about the hosts of another printer that user desires to connect to.
- Choose a printer that is connected to any other computer then click finish.
- The computer for which the printer is hooked up is booted and activated on the network for sharing purposes.

6.2 Bit Torrent architecture

This is hybrid network which is combination of both client-server and peer to peer architecture. Following

are the entities that a Bit Torrent consists of Tracker (centralized server), static meta info file (Torrent file), end-user downloads(leecher), and original download(seed)

- Tracker's role is to help peers to search another peer. It has many sessions which every individual session keeps track of all active peers in specific torrent. The peers requests trackers to respond with list of neighboring peer that it can connect to. It does not participate in distribution of work load. Some of its characteristics encompass bandwidth which at lesser range.
- Static meta info/torrent is created by free program. File contains session of content that is distributed. It includes files that is a part of current torrent and Bencoding which consists nested lists and dictionaries. These files are then coded with two keys announce and info. Announce contains URL of tracker, where info maps to dictionaries like names, pieces, piece length, either length or files key.
- Name is to download the file. These downloaded files are split into pieces. It maps to SHA 1 hash value of each piece. The number of bytes of each piece is computed by piece length. Length shows the file length in bytes whereas files, if it's a dictionary then key maps to list and includes length and path. Whereas path gives the sub-directory names.
- After this it joins the peer network. A free space is allocated for file which is sent from torrent file. This is necessary because peers refuse to download pieces of file as bit torrent application assembles pieces in order when received. Leecher acts as both client and server and seeder plays role of only servers. The files are distributed among peers using a technique of swarming, peers have an advantage that it can download multiple pieces at same time and can upload to same or different peers from location of downloaded file.

7. WORKING OF BIT TORRENT

- Peers in a torrent download equal-length chunks of the record from one another, with an ordinary chew length of 256 Kbytes.
- First peer may not have any chunks while it joins a torrent because it accumulates chunks over time. While it downloads chunks it additionally uploads chunks to different friends.
- Each torrent has an infrastructure node referred to as a tracker.
- When a peer joins a torrent it registers itself as a tracker and informs the tracker that it's miles nonetheless there with inside the torrent. In this manner the tracker continues music of the friends which can be collaborating with inside the torrent.
- When a brand new peer joins the torrent, the tracker randomly selects a subset of friends (name it as 50) from the collaborating friends and sends the ones 50 friends to a brand new peer.
- After processing those lists a new peer tries to set up the TCP reference to all of the friends. The peer which establishes TCP connection is referred to as "Neighboring friends".
- After a while those friends can also additionally depart and others can also additionally set up the TCP connection.
- Peers will ask everyone in their neighboring friends for the listing of chunks they have.
- If there are N distinctive neighbours it's going to acquire N lists of chunks.
- With this peer will problem the request which it does now no longer have presently over TCP connection.
- Deciding which chunks to request it uses a unique technique called rarest first
- In deciding which chunks to request, peer uses a way known as rarest 1st. The concept is to confirm, from among the chunks peer doesn't have, the chunks that square measure the rarest among its neighbors so request those rarest chunks 1st.
- During this manner, the rarest chunks get more quickly decentralized, reaching to equalize the numbers of copies of every chunk within the torrent.
- To decide which requests peer responds to, Bit Torrent makes use of an ingenious mercantilism formula.
- The simple plan is that peer gives precedence to the friends that location unit currently hobby information to it on the very excellent charge. Specifically, for each of its friends, peer frequently measures the charge at which it gets bits and determines the 4 friends that location unit feeding bits on the maximum charge. Peer then reciprocates with the aid of inflicting chunks to the identical 4 friends. Every ten seconds, the peer recalculates the charges and probably modifies the set of four friends.
- In Bit Torrent can't, those 4 friends' location units aforesaid to be unchoked. significantly, every thirty seconds, peer conjointly selects one more neighbor randomly and sends it chunks. In Bit Torrent can't, this random elite peer is alleged to be optimistically unchoked.
- The random neighbor preference conjointly allows new friends to set off chunks, so they may have something to trade. The incentive mechanism for mercantilism certainly delineated is usually spoken as tit-for-tat.

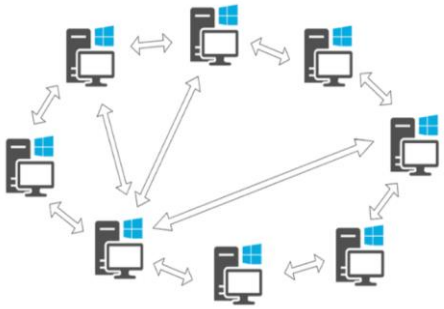

Fig 1.4: Working of Bit Torrent

8. NETWORK TOPOLOGY

Under this topic, we are briefing about the types of peer to peer network.

Pure peer to peer- also called as fully peer to peer network. It does not have any centralized dedicated server hence all peers equally work. Gnutella protocol capable to search and locate all files is an example.

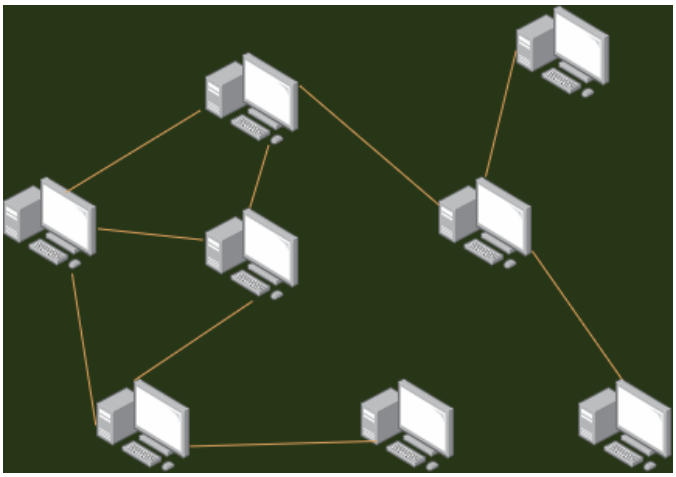

Fig 1.5: Pure P2P

Unstructured peer to peer- To connect with each other every device is given an easy task. Network may face difficulties in searching rare contents. Churn rate (number of user joining and releasing of network) is higher.

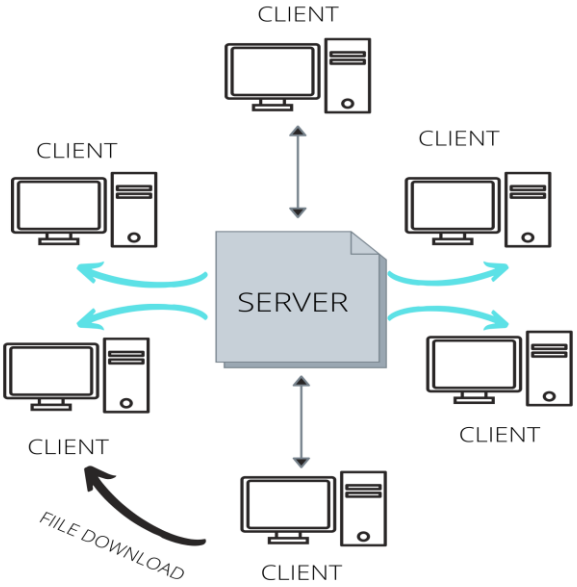

Fig 1.6: Unstructured P2P

Structured peer to peer- Complicated network setup but allows user to access for finding rare content over network it has less churn rate.

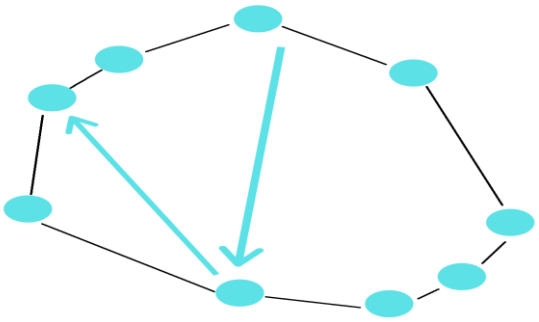

Fig 1.7: Structured P2P

Hybrid peer to peer- It works similar to client server network. They also contain centralized peer which takes all responsibilities for host management of all available resources.

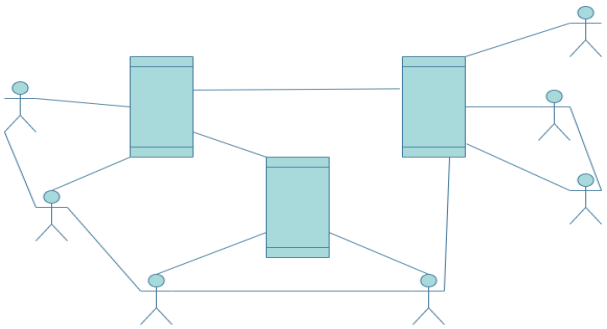

Fig 1.8: Hybrid P2P

9. APPLICATIONS

- Within the presence of a lot of active peers it becomes easier for brand new peers to change the integrity of the network to attach to the other peers. These applications embody file sharing, instant electronic messaging, auditory communication, collaboration and high performance computing.
- P2P network works best once employment is distributed in little chunks amongst its peers that may be recollected. So because of this distribution the workload is reduced from individual peer and active peers are exaggerated. In file sharing, peer will transfer several chunks of the file from totally different peers at the same time once a file is broken down.
- Thus P2P design results and operates at its best when it has lot active peers in active network. Napster, BitTorrent, skype, bitcoin, gnutella, kazaa, lime wire are some samples of this network.
- Bit Torrent is employed in uTorrent(windows), deluge (all platforms), transmission, rTorrent. It uses common and trending file sharing protocol

10. ADVANTAGES AND DISADVANTGAES

ADVANTAGES

- Economical and uses offered resources as central servers as absent.
- Cost effective since they ordinarily do not need important server infrastructure and server bandwidth.
- Less probabilities of failure unless the network is extremely little.
- Flexible to alter its peers; Loss of 1 peer can have borderline results on the entire network.
- Adaptable and survive attacks.
- Self-scalability; in P2P file sharing applications though every peer generates workload by requesting files, every peer conjointly adds service capability to the system by distributing files to different peers.

DISADVANTAGES

- Security- it is a significant challenge due to its extremely distributed and open nature. If a single peer is affected by the virus and uploads chunks, then it might damage several different receiving peers.
- Access Permissions- it might be tough if it's sharing confidential files with a higher quantity of peers.
- Leechers- These consume resources shared by any other peer who acts as edge peer; it can be led to facilitate illegal activities.
- ISP friendly- most of them are dimensioned for asymmetrical information measure usage that's for way more downstream than upstream traffic. This causes important stress on ISP's.Future P2P applications have to be designed in order that they're friendly.
- Incentives- The success conjointly depends on convincing users to volunteer bandwidth, storage and computation resources to the application that is the challenge of the look.

13. CONCLUSION

In this paper we've got defined the features, architecture, Working of Peer to see networks with the idea of Bit Torrent. Bit torrent is a document distribution device which permits for the quicker download of the bigger documents and decreases the burden at the host machine. Peer to peer is a software which interacts with the users directly.

In this manner we've amassed fundamental facts of peer to peer and its applications in order that it's far beneficial for the novices to apprehend networking concepts.

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