# Centralised and Decentralised Peer-to-Peer(P2P) network

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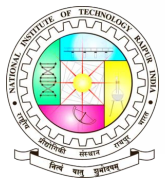
# Outline

- What is P2P Network
- Working of P2P Network
- A Centralised P2P Network
- Working of Centralised P2P Network
    - Explaining with an Example : Napster
- Working of Decentralised P2P Network
    - Explaining with an Example : Bittorrent
- Difference between Centralised and Decentralise P2P Network

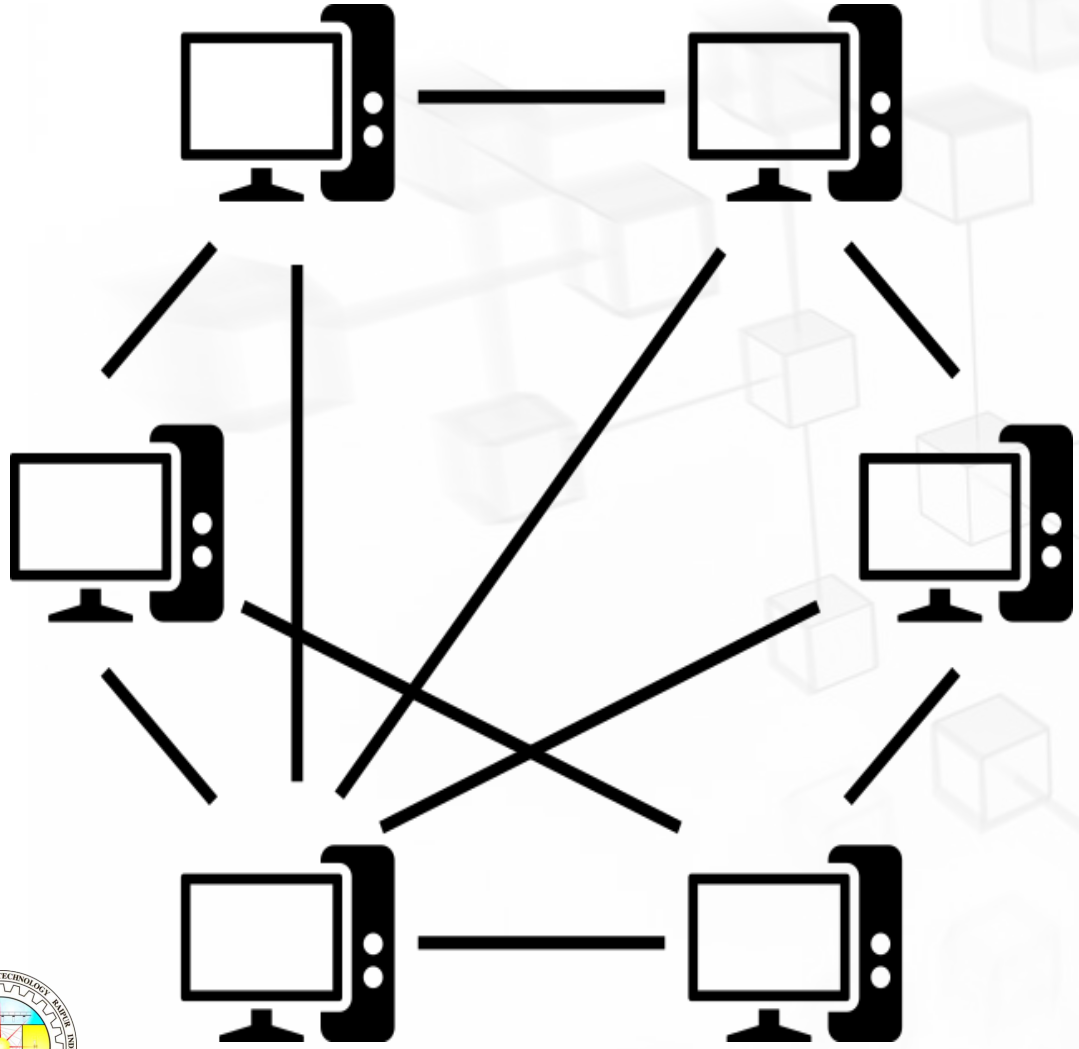
# Peer-to-Peer network

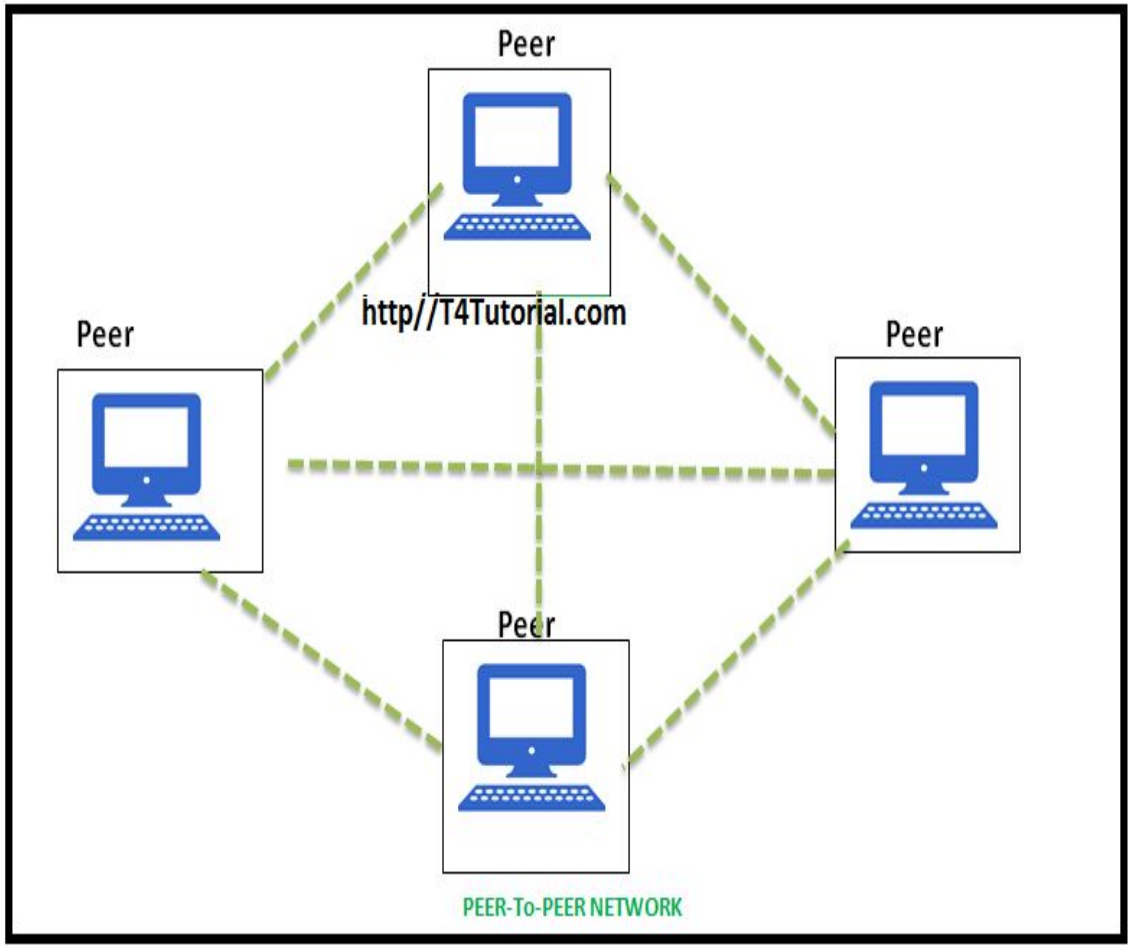
- A peer-to-peer network is a network created whenever two or more devices (usually a computer) are connected and share the resources.
- In this, each node acts as a server and thus there is no central server to the network. This allows the sharing of a huge amount of data.
- The tasks are equally divided amongst the nodes. Each node connected in the network, shares an equal workload.
- If any node get affected or compromised, it dose note affect to whole network.



***Node:** a device that connected through internet and can share file and messages over the network.

# Peer-to-Peer network



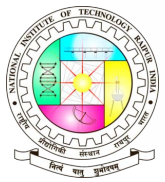


# Peer-to-Peer network

- A P2P network can be an ad hoc connection—a couple of computers connected via a Universal Serial Bus to transfer files.

- A P2P network also can be a permanent infrastructure that links a half-dozen computers in a small office over copper wires.

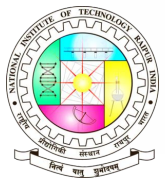
- A P2P network can be a network on a much grander scale in which special protocols and applications set up direct relationships among users over the Internet.



# Peer-to-Peer network

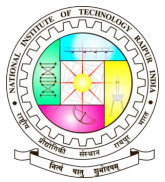
- Based on the network architecture P2P having following two types.

1. **Unstructured networks:**
   - An unstructured peer-to-peer network is one where the links in the network are established randomly.
   - Such networks are easy to construct as any new peer that would like to join and contribute to the network.
   - Can join the network by copying the existing links of another section and then forming and spreading its own links.



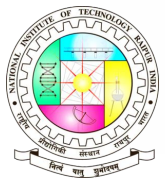
# Peer-to-Peer network

2. **Structured networks:**
   - The structured networks allow each peer to look after a specific section of the content over the network.
   - These networks assign a specific value to each content and peer in the network which is then followed by a common protocol.
   - These protocol determines which section is responsible for which part of the content.
   - Whenever someone reaches out to a peer to search for content,
   - The network uses the common protocol to determine the section responsible for data transfer and direct the search query towards the peer responsible for it.



# Working of P2P Network

- Every node is responsible for the storing file and proper backup at their own.
- As every system act as client server model, any node can download or upload files based on the request.
- Devices usually run both server and client software in a peer-to-peer network and can also make the resources available to other users on the network.
- Suppose you are node of P2P network and want to download a file (act as client), when you search that specific file it checked all the connected peers and gives the number of the same.
- When you start downloading the file, then that is transfer from that peers to your system. And when the file downloaded your system you can also be a server for same file to other computer.



# Applications of P2P Network

- File sharing: BitTorrent
- Decentralised storage system: IPFS
- Instant messaging: **Signal**
- Collaborative Community: Telegram
- IP Telephony: Ozeki VOIP
- Blockchain: Bitcoin

Telegram



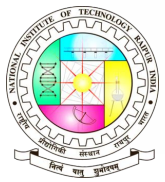
# Merit and Demerits of P2P Network

**Advantages of P2P Network :**

- Network is easy to maintain because each node is independent of each other.
- Since each node acts as a server, therefore the cost of the central server is saved.
- Adding, deleting and repairing nodes in this network is easy.

**Disadvantages of P2P Network :**

- Because of no central server, data is always vulnerable to get lost because of no backup.
- It becomes difficult to secure the complete network because each node is independent.



**तकनीकी नवाचार** | **डिजिटल-नेट बैंकिंग से एक कदम आगे**

# मेटावर्स की दस्तक

# बैंक के कामकाज निपटाएगा आपका आभासी अवतार

## जेपी मोर्गन चेज, एचएसबीसी, कुकमिन बैंक, यूनियन बैंक ऑफ इंडिया ने खोले सेंटर

## गेमिंग, ब्लॉक चेन व आर्टिफिशियल इंटेलीजेंस तकनीक का मिलाजुला रूप

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**मुंबई.** संचार क्षेत्र में क्रांति के बाद बैंकिंग सेवा लोगों की अंगुलियों पर है। बिजली-पानी सहित तमाम जरूरी सेवाओं और शापिंग बिलों का भुगतान पलक झपकते मोबाइल से कर लेते हैं। जब चाहें तब बैंक खाते से फंड ट्रांसफर कर सकते हैं। जिस काम के लिए घंटों लगते थे, वही अब मिनटों में घर-दफ्तर या दुकान में बैठे-बैठे हो जाता है। डिजिटल बैंकिंग सेवा के बीच बैंक अब मेटावर्स की ओर बढ़ रहे हैं। यह नेट बैंकिंग से एक कदम आगे की तकनीक है। गेमिंग, क्रिप्टो करेंसी लेन-देन में इस्तेमाल होने वाली ब्लॉक चेन तकनीक व आर्टिफिशियल इंटेलीजेंस के मेल से बनी मेटावर्स प्रौद्योगिकी बिल्कुल अलग अनुभव प्रदान करेगी। खाता धारक घर बैठे रहेंगे, उनका वर्चुअल अवतार बैंक जाकर जरूरी काम निपटा लेगा। दुनिया में बैंकिंग मेटावर्स अभी शुरुआती चरण में है। बहुराष्ट्रीय बैंक जेपी मोर्गन व एचएसबीसी व दक्षिण कोरिया के कुकमिन बैंक व भारत के यूनियन बैंक ऑफ इंडिया (यूबीआई) ने इसकी शुरुआत कर दी है। **शेष @ पेज 7**

### कैसे काम करती है तकनीक

**कस्टमर** को वर्चुअल रियल्टी (वीआर) हेडसेट या डेस्कटॉप का इस्तेमाल करना होगा। बैंक की वेबसाइट पर लॉगिन कर मेटा पिन-पासवर्ड लेना होगा। पिन इंटर के बाद बैंक का मेटावर्स लाउंज खुलेगा। इसमें ग्राहक के अवतार को प्रवेश मिलेगा, जो वहां मौजूद मैनेजर के अवतार या रोबो एडवाइजर्स से जानकारी लेगा। ग्राहक भी सीधे सवाल पूछ सकते हैं। जवाब रोबो एडवाइजर-रिलेशनशिप मैनजर का अवतार देगा।

### गहरे होंगे रिश्ते, बढ़ेगा भरोसा

डिजिटल सेवा प्रदाता किया (एआई) ने हाल ही में कियावर्स नामक मेटावर्स लांच किया। किया के मुख्य कार्यकारी अधिकारी राजेश मिर्जनकर ने कहा कि समावेशी डिजिटल बैंकिंग अन्य लोगों पर आश्रित है। इसमें मानवीय स्पर्श नहीं है। इससे ग्राहकों और बैंक के बीच रिश्ते प्रगाढ़ होंगे। एक-दूसरे में भरोसा बढ़ेगा।

### भविष्य की बैंकिंग

यूबीआई के मुख्य तकनीकी अधिकारी (सीटीओ) ने बताया कि सुरक्षा कारणों से मेटावर्स में लेन-देन की सुविधा नहीं है। गाइडलाइन का इंतजार है। भरोसेमंद तकनीक के बाद आभासी दुनिया में वास्तविक लेन-देन शुरू होगा। पेशेवर इसे भविष्य की बैंकिंग बता रहे हैं।

### क्या है मेटावर्स

मेटावर्स के नींव में ब्लॉकचेन टेक्नोलॉजी है। यह एक तरह की इमर्सिव वर्चुअल दुनिया है। ग्राहक का डिजिटल अवतार बैंक जाएगा और वर्चुअल मैनेजर से जानकारी लेगा। पूरा विवरण ग्राहक को डिजिटल फॉर्मेट में मिलेगा। वास्तव में यह 3-डी गेम जैसा है।

# Centralised P2P Network

- **Centralized P2P Network:** A network configuration where participants must communicate with a central authority to communicate with one another. Since all participants must go through a single centralized source, the loss of that source would prevent all participants from communicating.

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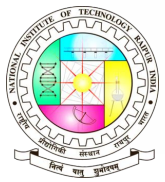
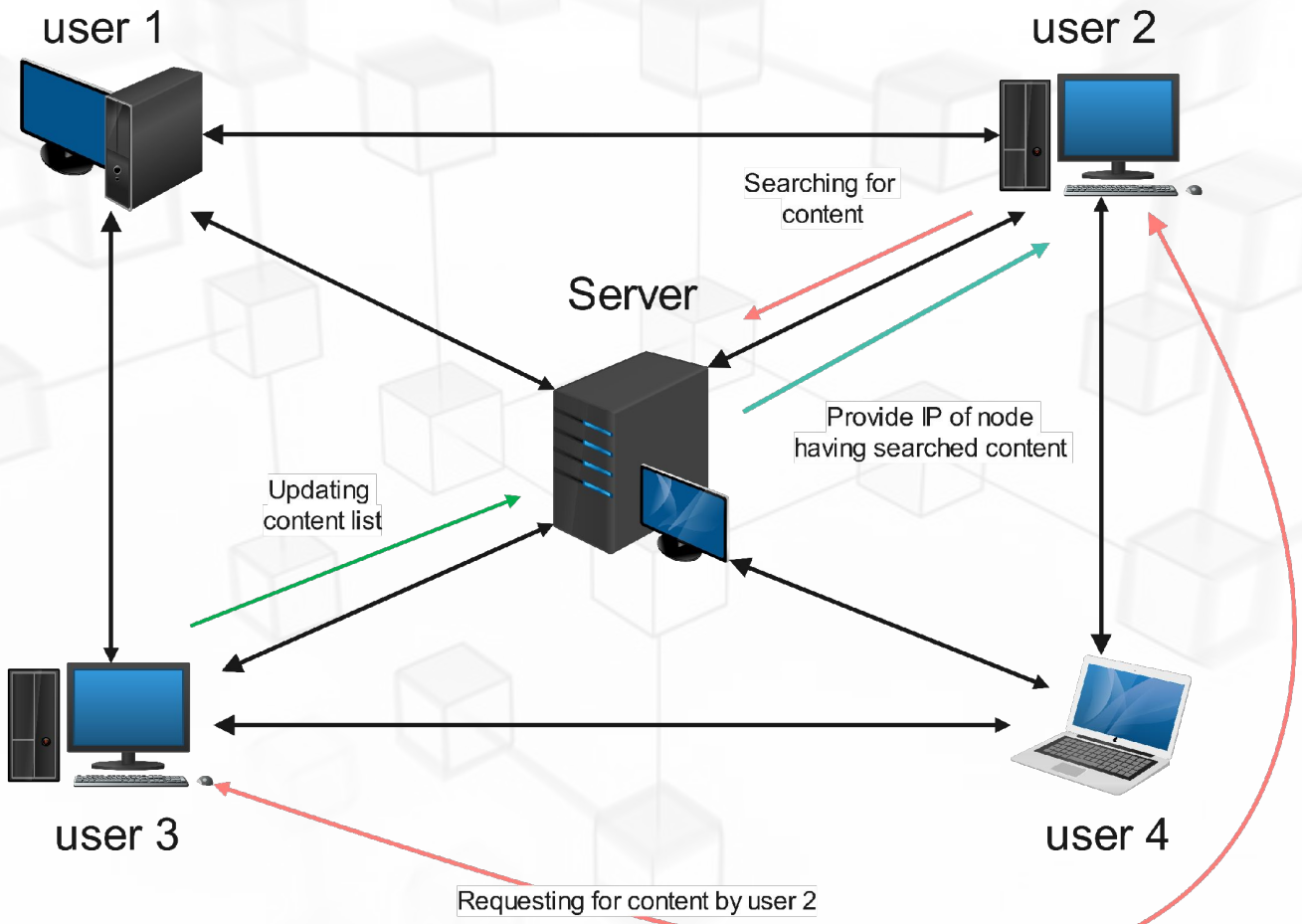
**OR**

- **Centralized P2P networks** relay on services of servers for **indexing and finding content.** In which files were distributed on peers but file lookup relay on server after resource is located, request is made and reply is process between peers.

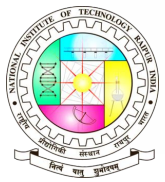


# Centralised P2P Network



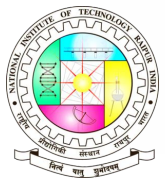
# Centralised P2P Network

- **Properties of centralized P2P network**
  - Client server architecture.
  - Having central server to manage indexing and providing interface to search content easily.
  - Because of the centralized server it is easy to manage the connected nodes.
  - Searching of content is very fast as all the content list is present on single central server.
  - Less space required, because in this only list of content is present on the server and files are present at connected node.
  - Connected node can trade content directly, after finding the IP of node where content is stored.

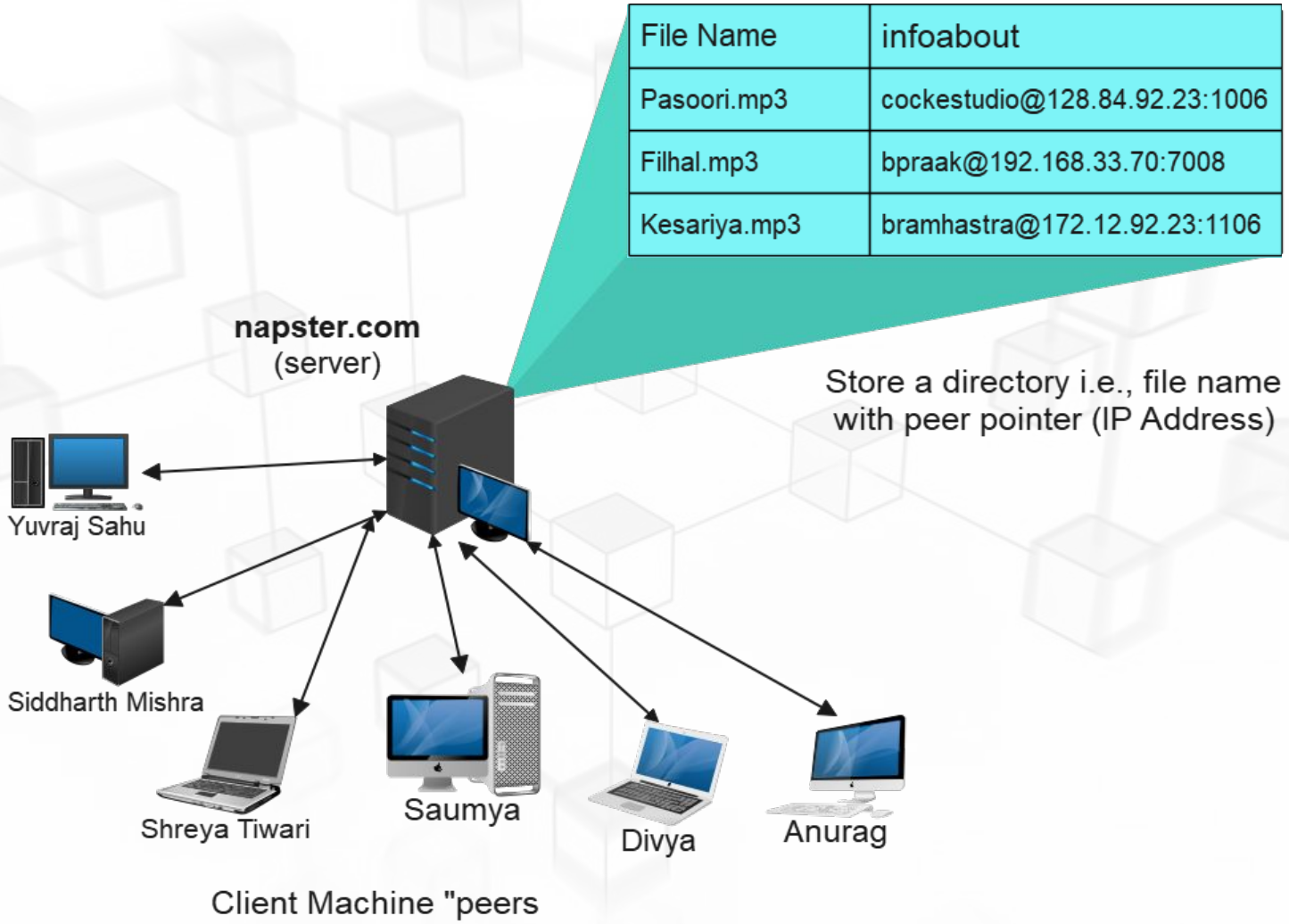


# Working of Centralised P2P Network

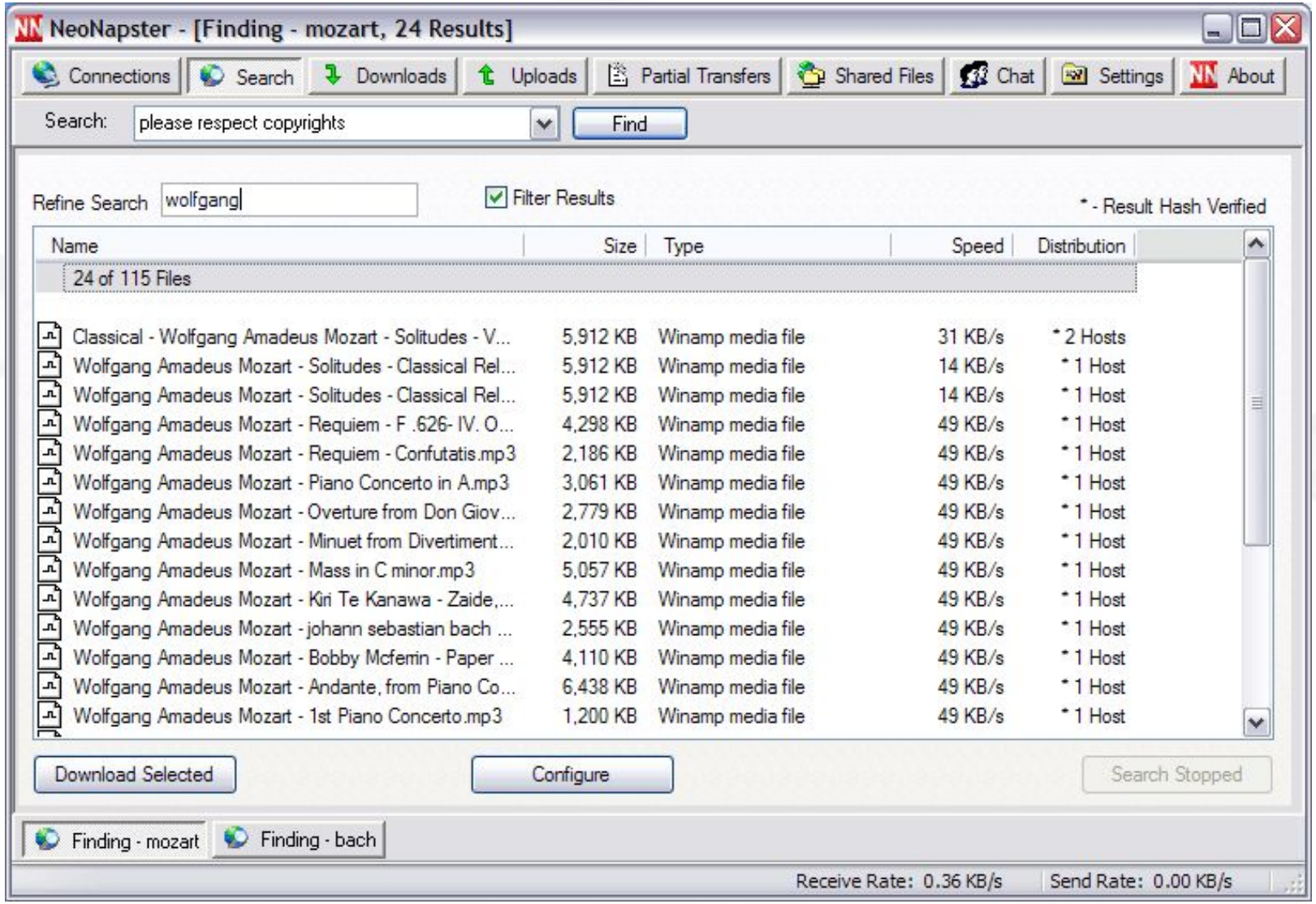
- Explaining with an Example : **Napster**
  - Developed by Shawn and releases for online music service.
  - This is the 1st generation peer-to-peer protocal.
  - It is an online music trading website where user can trade their music collection online without any taxation.
  - To use this service user only have to install napster client and having a shared directory.



# Napster Structure

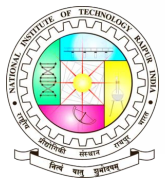


# Napster utility application for windows



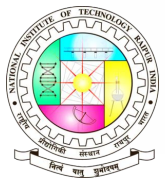
# Flow of action in napster

- Client
  - Connect to a Napster server.
  - Upload list of music files that you want to share
  - Server maintains list of <filename, ip_address, portnum> tuples.
  - Example < Passori.mp3, 128.84.92.23:1006>
  - **Server never stores any files, only store lookup table.**



# Flow of action in napster

- **Client**
- Search
  - Send keywords to the server by writing that in **search box** of napster utility application.
  - Server searches its list with the keywords that you provided
  - Server returns a list of hosts having that file as - **<ip_address, portnum>** tuples - to client
  - Client pings each host node from the list to find best transfer rates.
  - Client fetches file from **best host having high transfer rate**.



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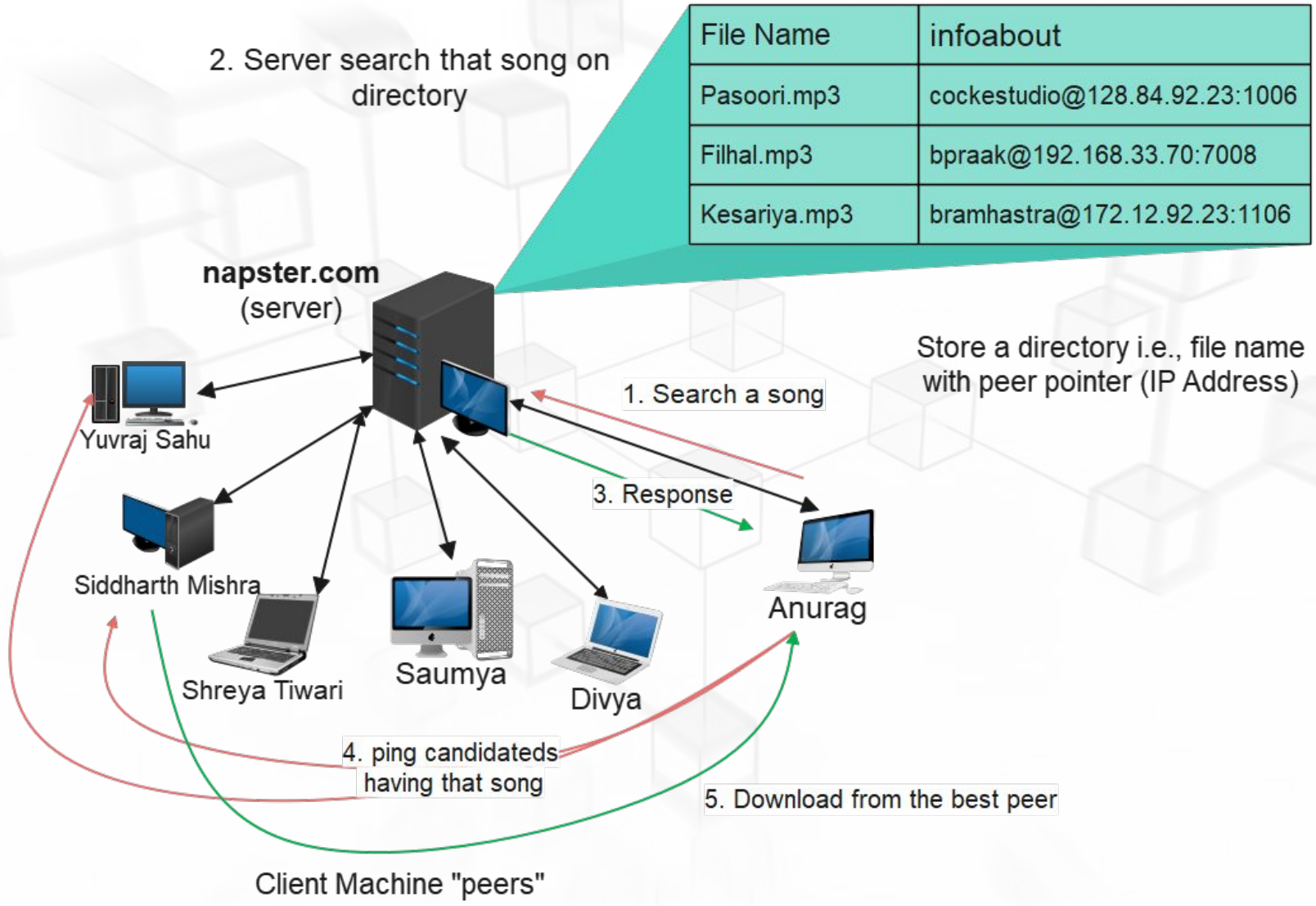
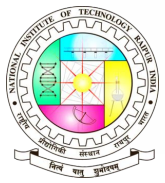


# Advantages and disadvantages of napster

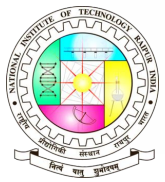
- **Advantages**
  - Hard for clients to lie – cannot give fake details such as IP addresses.
  - Central site has all the control.
  - Central site knows the details of every single transfer.
- **Disadvantages**
  - Millions of people were freely sharing copyrighted songs.
  - Free internet provided by institutions or organizations was being abused.



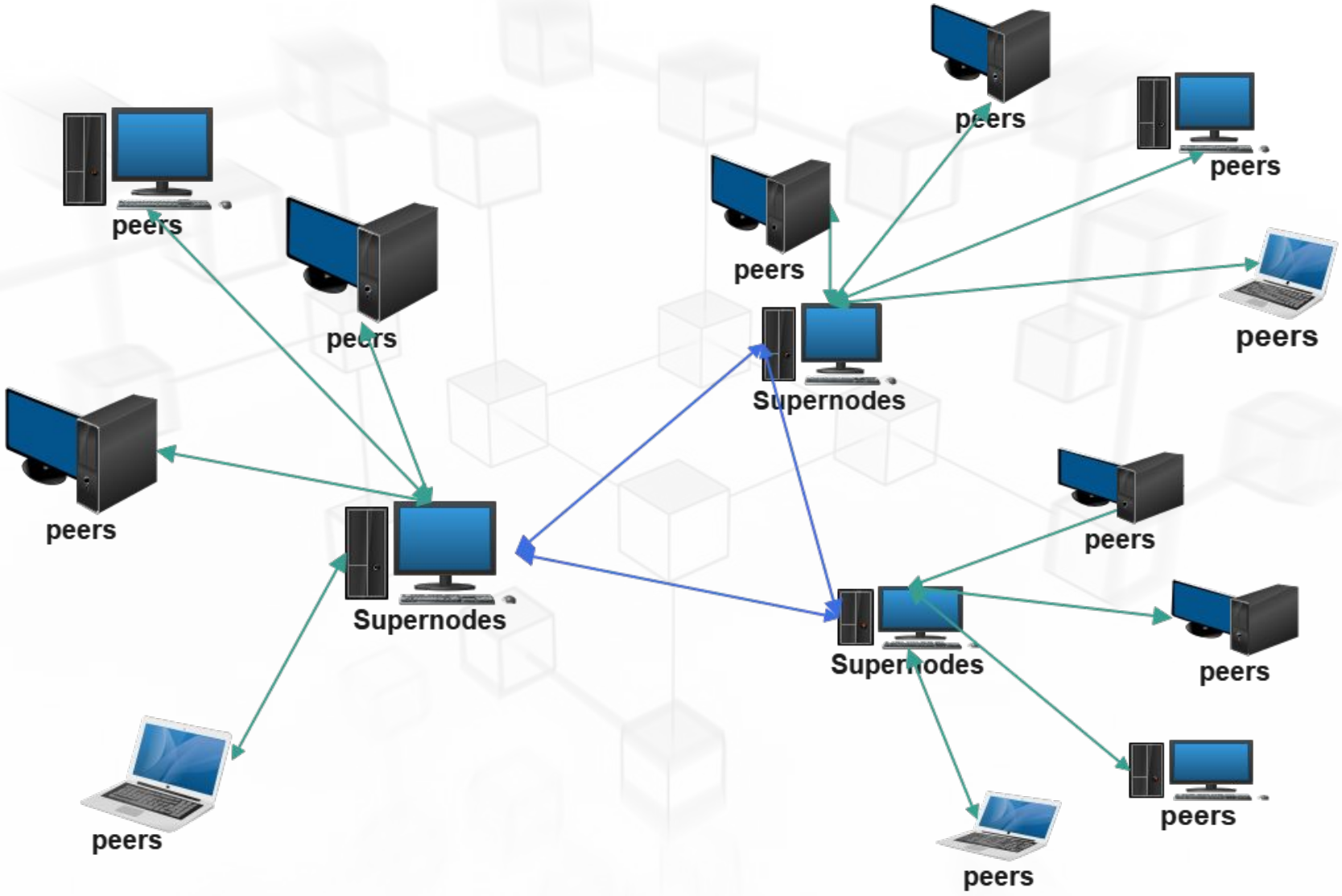
# Decentralised P2P Network

- A network configuration having more than one centralized servers where participants can communicate to other peer using these servers. There no centralized server authority. As all participants can directly communicate with each other using decentralized servers, if any server goes off line or corrupted then it will not effect the whole network.

- A network configuration where, some node behave like central server that contain and maintain lookup files for other connected peer to it. This nodes are known as **supernode** and there is no centralized server. Participants of the network can directly communicate using this super nodes

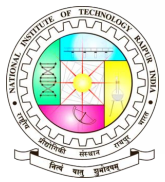


# Decentralized P2P Network



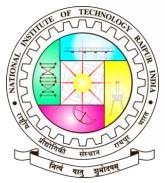
# An Example of Decentralized P2P Network

- An Example of Decentralized P2P Network: **BitTorrent**
  - P2P(Peer To Peer) file transfer protocol
  - Transfer of large files such as movies, music collections, softwares……
  - Files are shared by many users(peers)
  - Active participation of all users who are connected to the network
  - BitTorrent is developed by the Bram Cohen in 2001.



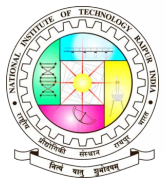
# Working of BitTorrent

- To share the data using BitTorrent we must have:-
  - Tracker server.
  - A file with .'torrent' extension.
  - Complete copy of the file being shared by the connected peers.
  - Torrent file contains data which is essential for the protocol to function-
    - File length/ Size of file
    - File name
    - Information about the trackers
  - When we open . 'torrent' file in client, it will connect to the peers(seeders) and start downloading.



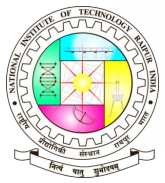
# Some terminologies of BitTorrent

- **Torrent**
  - This refers to the small metadata file you receive from the web server (the one that ends in **.torrent**). Metadata means, the file contains information about the data you want to download, not the data itself.
- **Peer**
  - A peer is another computer on the internet that you connect to and transfer data. Generally a peer does not have the complete file.
- **Seed**
  - A computer that has a complete copy of a certain torrent. Once a client downloads a file completely, he can continue to upload the file which is called as **seeding.** This is a good practice in the BitTorrent world since it allows other users to have the file easily.

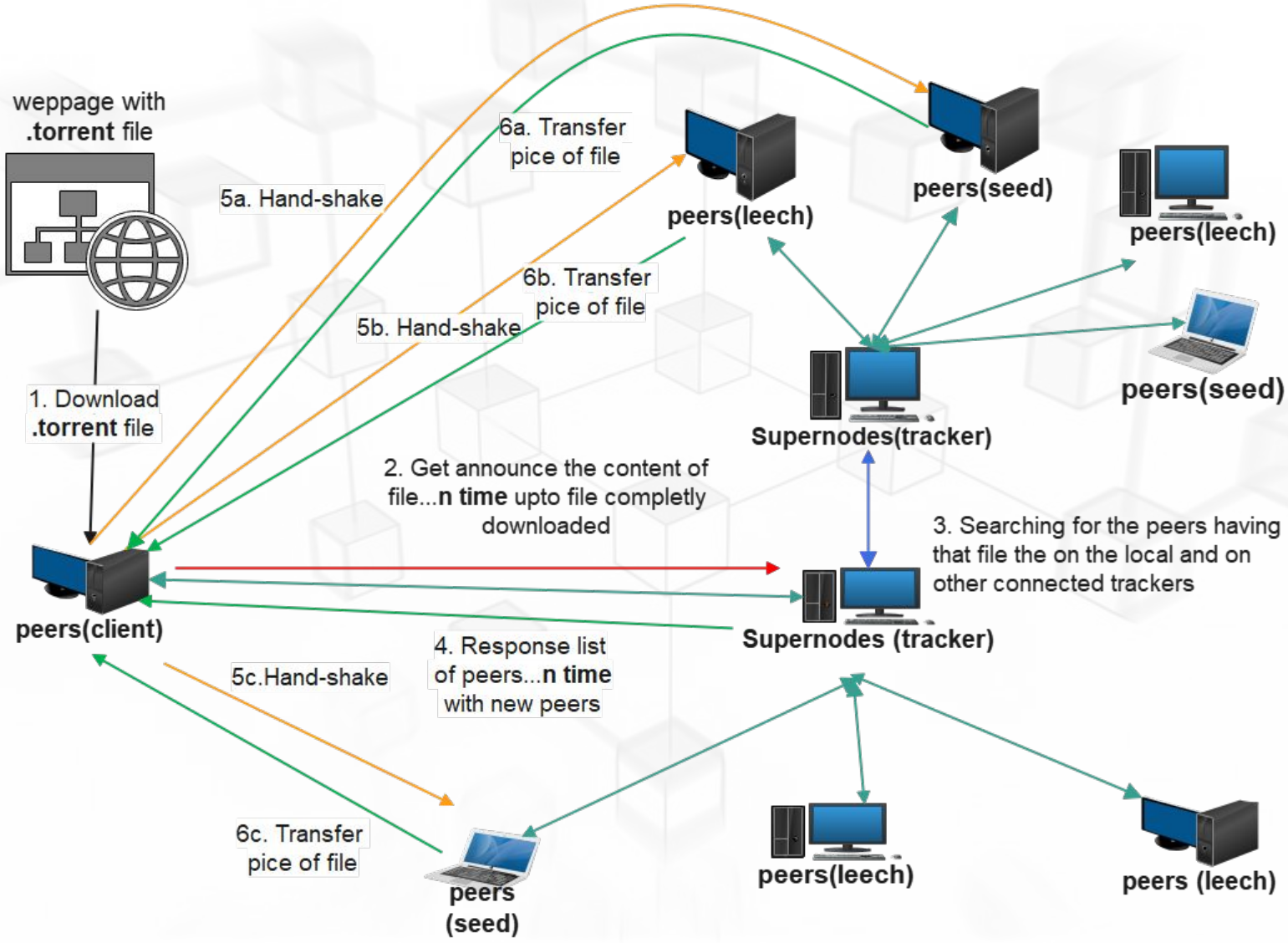


# Some terminologies of BitTorrent

- **Tracker**
  - A server on the Internet that acts to coordinate the action of BitTorrent clients. The clients are in constant touch with this server to know about the peers in the swarm.
- **Leecher**
  - They are similar to peers in that they won't have the complete file. But the main difference between the two is that a leech will not upload once the file is downloaded.
- **Swarm**
  - The group of machines that are collectively connected for a particular file.

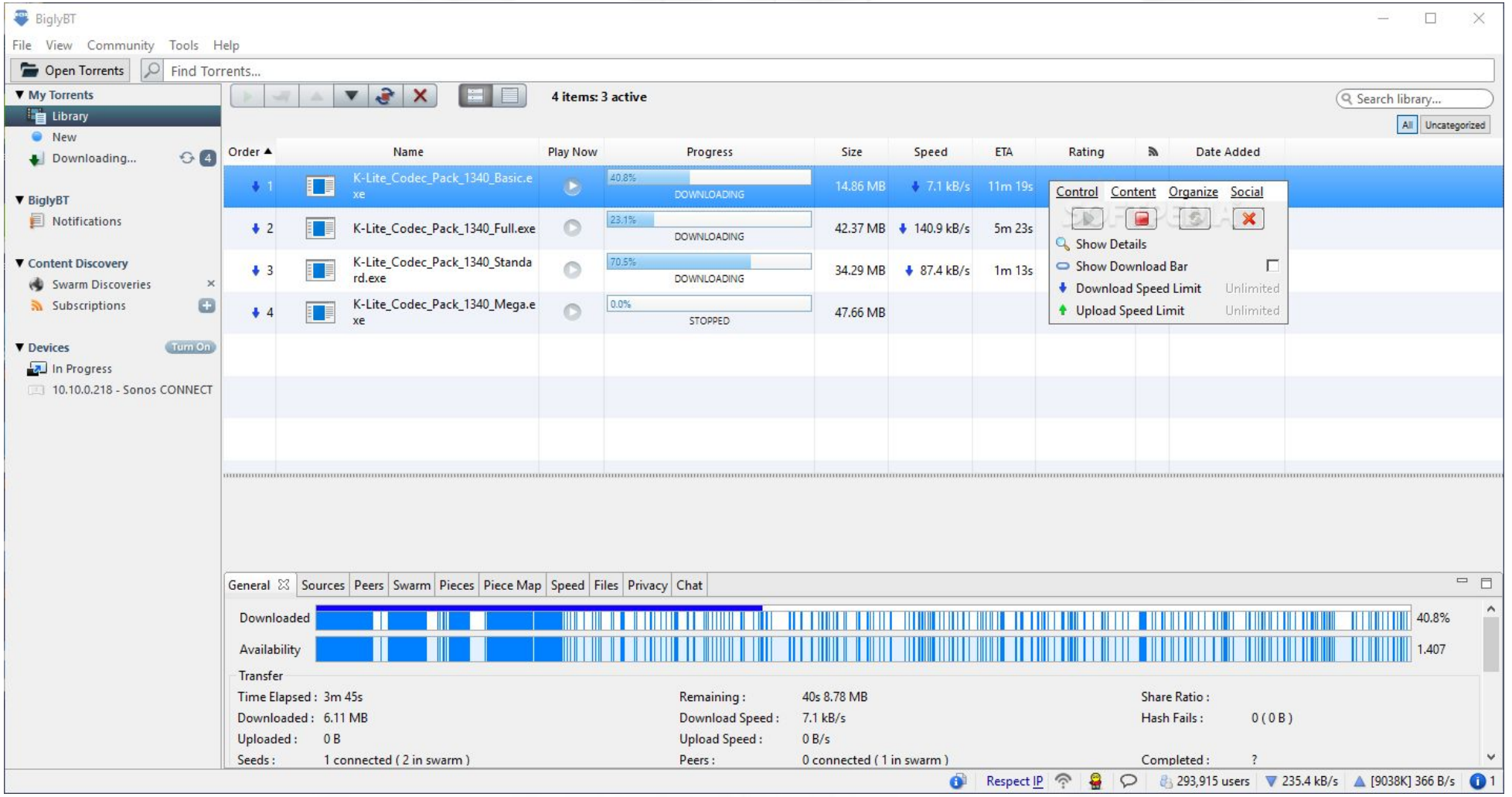


# An Example of Decentralized P2P Network



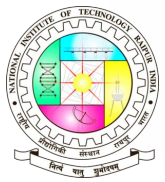
# Downloading with BitTorrent

- A BitTorrent client application



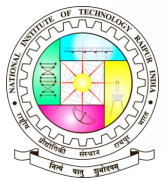
# Downloading with BitTorrent

- For that first you have installed a torrent client such as Transmission, µTorrent on your system.
- Then download the **.torrent** file of desired movie or song, from any webpage or from the torrent search engine.
- Then add this **.torrent** file into the torrent client application installed on your system.
- After adding **.torrent** file, client application is announcing the metadata of the file to the trackers.
- Trackers find the list of the peer having the complete file mentioned in metadata and provide this list to client.



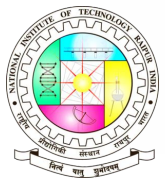
# Downloading with BitTorrent

- After getting list of the peers client connect to them and start downloading a piece of lie from each peers.
- Lastly when all pieces are completely downloaded, then merge it in a single file.
- Each time when user pause and resume the downloading, application is announcing the metadata of the file to the trackers again.
- Every time getting new list of peer.



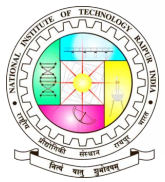
# Advantages of BitTorrent

1. No centralized server present, if any server gosse down that it will not affect the whole network.
2. If one download source is not active, you can rely on other sources to complete the download.
3. Even if you suddenly are disconnected from the Internet or your PC shuts down/restarts, you will be able to complete the download once you're back online. No need to restart from scratch.
4. Users with slow Internet speeds can download a file faster in torrents, than using the 'traditional' download process.
5. Files are easy to find and download.



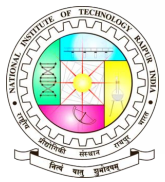
# Disadvantages of BitTorrent

1. If the file you are after has no ‘seeds’, you will not be able to download it.
2. The fact you are downloading and uploading at the same time may take its all on your bandwidth.
3. Everybody downloading the torrent file you are leeching or seeding can see your public IP address.
4. That includes your ISP or digital copyright groups.
5. To protect your privacy while using torrents, simply use VPN. More on that below.



# Difference between Centralized and Decentralized peer to peer network

| S.No. | Centralized | Decentralized |
|---|---|---|
| 1. | Having one centralized server for communication between the peers | Having multiple decentralized servers for communication between the peers |
| 2. | The peers are controlled by the centralized server for indexing the filename and IP addresses | The peers are controlled by the decentralized multiple servers for indexing the metadata of the file. |
| 3. | If the centralized server is down then the whole network is affected. | If any server is down, it dose not affect the whole network. |
| 4. | The Ip address is known by the centralized server and the peer only. | The Ip address is known by the multiple servers and also to the connected peers. |
| 5. | If any peer is compromised by any attacker then the whole network is compromised, because it leads to centralized server. | If any peer is compromised by any attacker then only that peer and connected server will affected and the other part of network is running normal. |



# Difference between Centralised and Decentralise P2P Network

| S.No. | Centralized | Decentralized |
|---|---|---|
| 6 | Its implementation is taking less cost because of having single server. | Its implementation is taking huge cost because of having multiple servers. |
| 7 | The communication process is slower because of short path to create communication between source to client peers. | The communication process is faster because of going through multiple path to create communication between source to client peers. |
| 8 | Scalability issues to connect more peer as centralized server is having limited size of storage. | No Scalability issues to connect more peer as it's having multiple servers and can add more when it required. |
| 9. | Load on the network is very high because of every peers are have to go through the centralized server for further communication. | Load on the network is normal because of any peers have to go through the only server connected to it, for further communication. |
| 10 | Example: Napster | Example: BitTorrent, Kaza, Grouckster. |