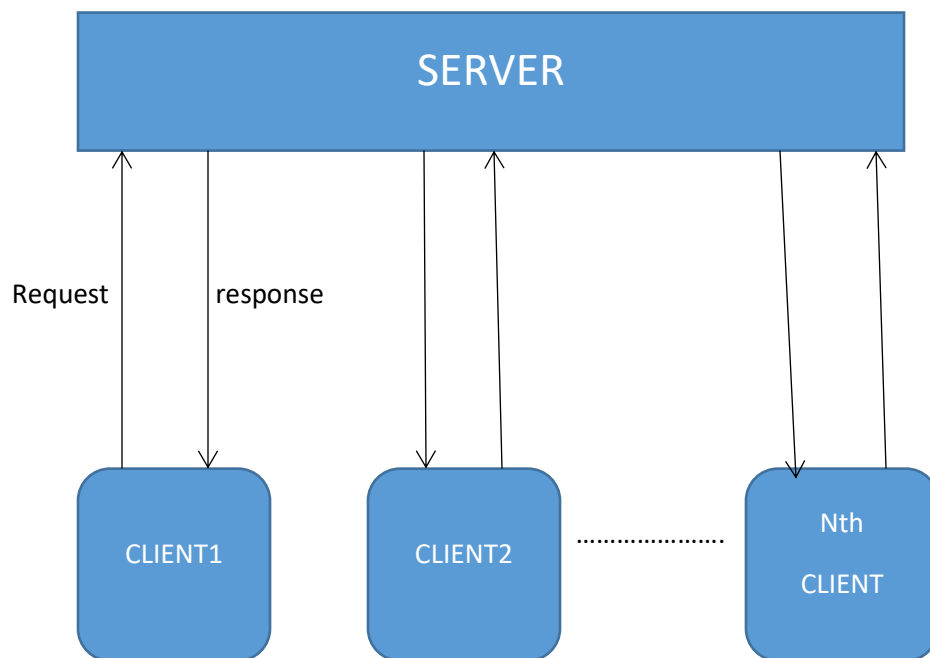


## UNIT 8

### CLIENT – SERVER ARCHITECTURE:

*In this network architecture,*

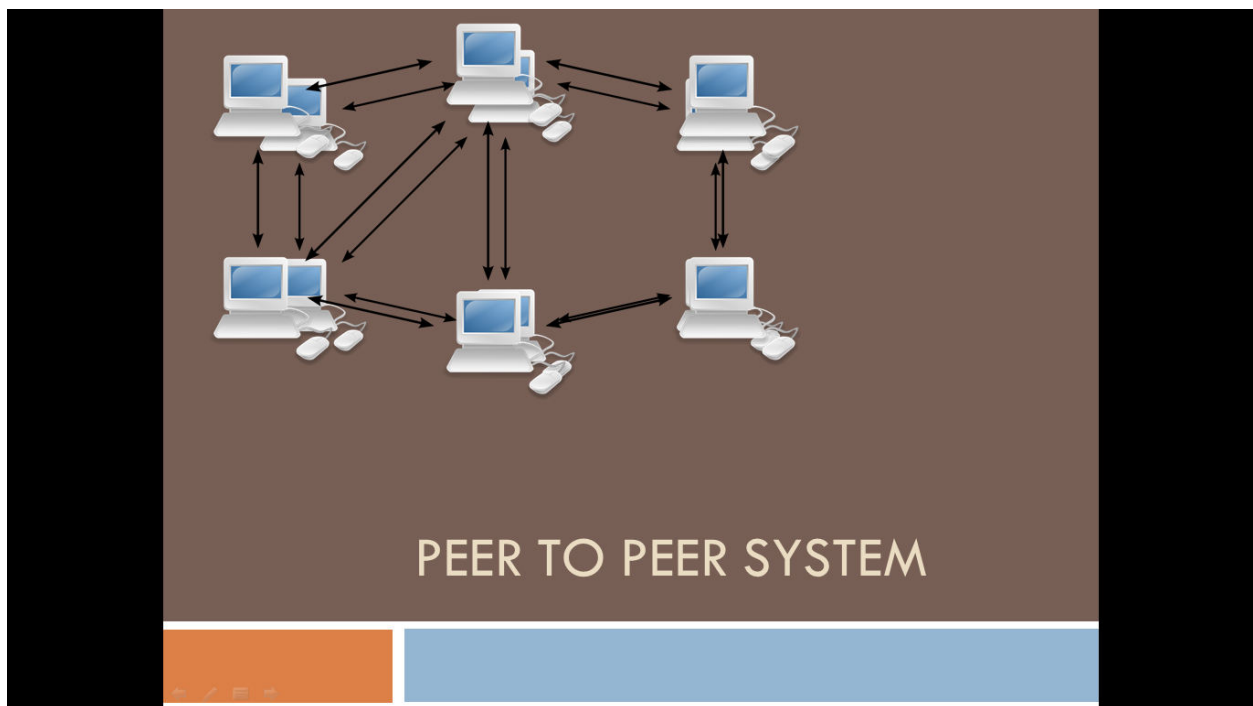
- ✓ A node can either act as a client or a server.
- ✓ A client node is the one who send request for some resources to server.
- ✓ A server is a powerful node which processes the client requests.



## PEER TO PEER ARCHITECTURE:

*In this network architecture,*

- ✓ There is no central server to manage the request/response activity.
- ✓ Each node can act both as a client and a server.
- ✓ The nodes discover and communicate with each other to share the resources required.



### **P2P advantage:**

Distributed resources.

No central server dependency.

Load balancing.

### **P2P disadvantage**

Search time is higher

Network complexity

**P2P Application;**

- File sharing
- Peer to peer communication
- Collaborative environments

**Client/Server Vs. Peer to Peer architecture:**

<b>CLIENT/SERVER</b>	<b>PEER to PEER</b>
A node can either be client or a server.	Every node can act both as a client and a server.
Central server administration exist.	No central server exist.
Only server can donate the resources.	Every node can donate and consume resources.
Ex. Users viewing webpages in google.	Ex. Skype communication
Less fault tolerant	High fault tolerant.

## HISTORY AND EXAMPLES OF P2P SHARING:

### Short History of P2P Networking Protocols

- 1999: Napster
- 2000: Gnutella, eDonkey
- 2001: Kazaa
- 2002: eMule, BitTorrent
- 2003: Skype
- 2004: Coolstreaming, GridMedia, PPLive
- 2004~: TVKoo, TVAnts, PPStream, SopCast, ...

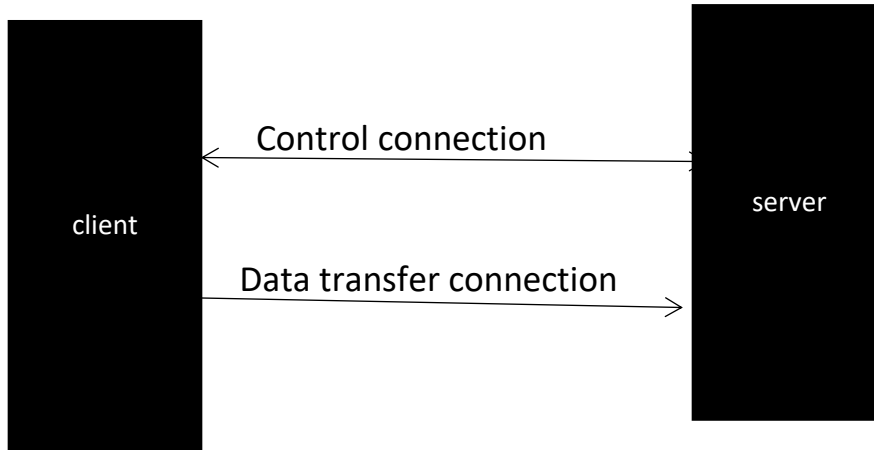
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### File Transfer Protocol (FTP)

File Transfer Protocol (FTP) is the standard mechanism provided by *TCP/IP* for copying a file from one host to another. FTP differs from other client/server applications in that it establishes two connections between the hosts. One connection is used for data transfer, the other for control information (commands and responses).

FTP uses the services of TCP. It needs two TCP connections. The well-known port 21 is used for the

control connection and the well-known port 20 for the data connection.



## Napster: Overview

- Centralized Database:
  - **Join**: on startup, client contacts central server
  - **Publish**: reports list of files to central server
  - **Search**: query the server => return someone that stores the requested file
  - **Fetch**: get the file directly from peer

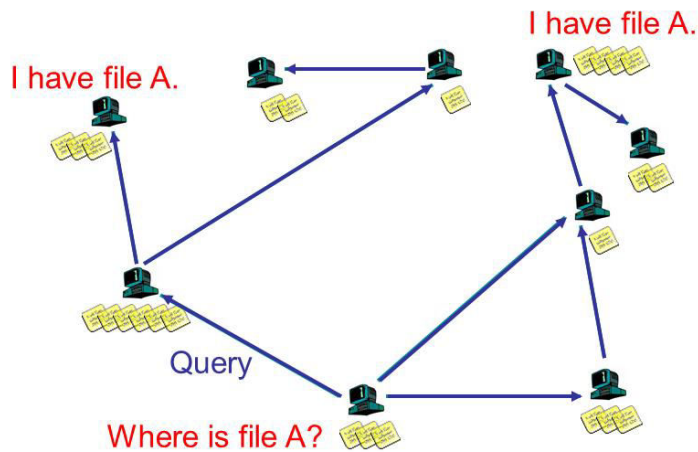
## Gnutella: Overview

- Query Flooding:
  - **Join**: on startup, client contacts a few other nodes; these become its “neighbors”
  - **Publish**: no need
  - **Search**: ask neighbors, who ask their neighbors, and so on... when/if found, reply to sender.
    - TTL limits propagation!!
  - **Fetch**: get the file directly from peer

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## Gnutella: Search



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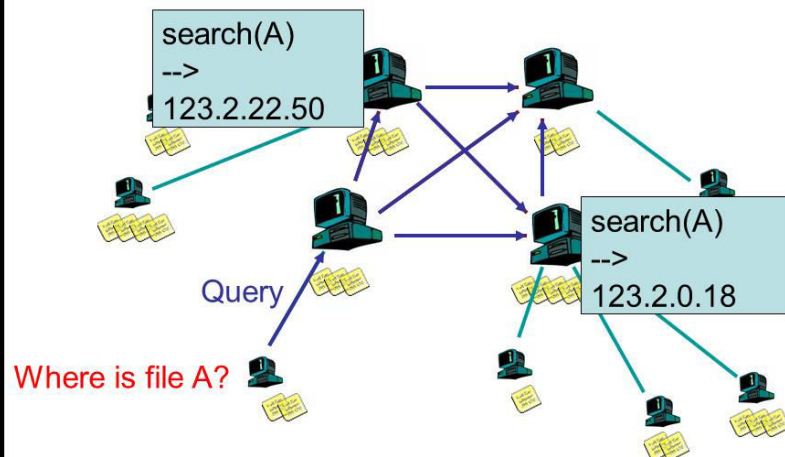


## KaZaA: Overview

- “Smart” Query Flooding:
  - **Join**: on startup, client contacts a “supernode” ... may at some point become one itself
  - **Publish**: send list of files to supernode
  - **Search**: send query to supernode, supernodes flood query amongst themselves.
  - **Fetch**: get the file directly from peer(s); can fetch simultaneously from multiple peers

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## KaZaA: File Search



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## What is IRC?

- Internet Relay Chat is one of the most popular and most interactive services on the Internet.
- Using an IRC client (program) you can exchange text messages interactively with other people all over the world.

## What is IRC?

- Benefits
  - Allows chat and file sharing
  - Companies can avoid fees from long distance and conference calls
- Drawbacks
  - Consumes bandwidth
  - Means of spreading worms
  - Susceptible to flooding
  - Can be embedded in trojans and act as a hostile server unnoticed

## Usage

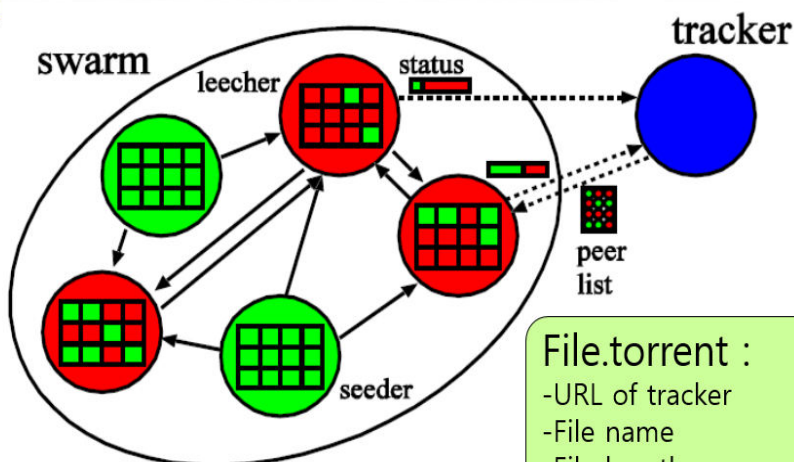
- Users connect to a public IRC server
- Join channels
- Chat with other users
- Share files through DCC connections

# BitTorrent: Overview

- Swarming:
  - **Join**: contact centralized “tracker” server, get a list of peers.
  - **Publish**: Run a tracker server.
  - **Search**: Out-of-band. E.g., use Google to find a tracker for the file you want.
  - **Fetch**: Download chunks of the file from your peers. Upload chunks you have to them.
- Big differences from Napster:
  - Chunk based downloading (sound familiar? :)
  - “few large files” focus
  - Anti-freeloading mechanisms

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## BitTorrent : Overview



Seeder – peer having entire file  
 Leecher – peer downloading file

### File.torrent :

- URL of tracker
- File name
- File length
- Chunk length
- Checksum for each chunk (SHA1 hash)



## BitTorrent : Pros/Cons

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- Pros
  - Proficient in utilizing partially downloaded files
  - Encourages diversity through “rarest-first”
    - Extends lifetime of swarm
  - Works well for “hot content”
- Cons
  - Assumes all interested peers active at same time; performance deteriorates if swarm “cools off”
  - Even worse: no trackers for obscure content

## Skype Architecture

- Like its file sharing predecessor KaZaa, Skype is an overlay peer-to-peer network.
- There are two types of nodes in this overlay network, **ordinary hosts** and **super nodes (SN)**.
- An **ordinary host** is a **Skype application** that can be used to place voice calls and send text messages.
- A **super node** is an **ordinary host's end-point** on the Skype network. **Any node with a public IP address** having **sufficient CPU, memory, and network bandwidth** is a candidate to become a super node.

## Skype Architecture (contd.)

- An **ordinary host must connect** to a **super node** and **must register** itself with the **Skype login server** for a successful login.
- The Skype login server is an important entity in the Skype network. User names and passwords are stored at the login server.
- User authentication at login is also done at this server.
- This server also ensures that Skype login names are unique across the Skype name space.

### DNS:

**Domain Name System** helps to resolve the host name to an address. It uses a hierarchical naming scheme and distributed database of IP addresses and associated names.

## Domain Name System Architecture

The Domain name system comprises of **Domain Names, Domain Name Space, Name Server** that have been described below:

### Domain Names

Domain Name is a symbolic string associated with an IP address. There are several domain names available; some of them are generic such as **com, edu, gov, net** etc, while some country level domain names such as **au, in, za, us** etc.

The following table shows the **Generic** Top-Level Domain names:

Domain Name	Meaning
Com	Commercial business

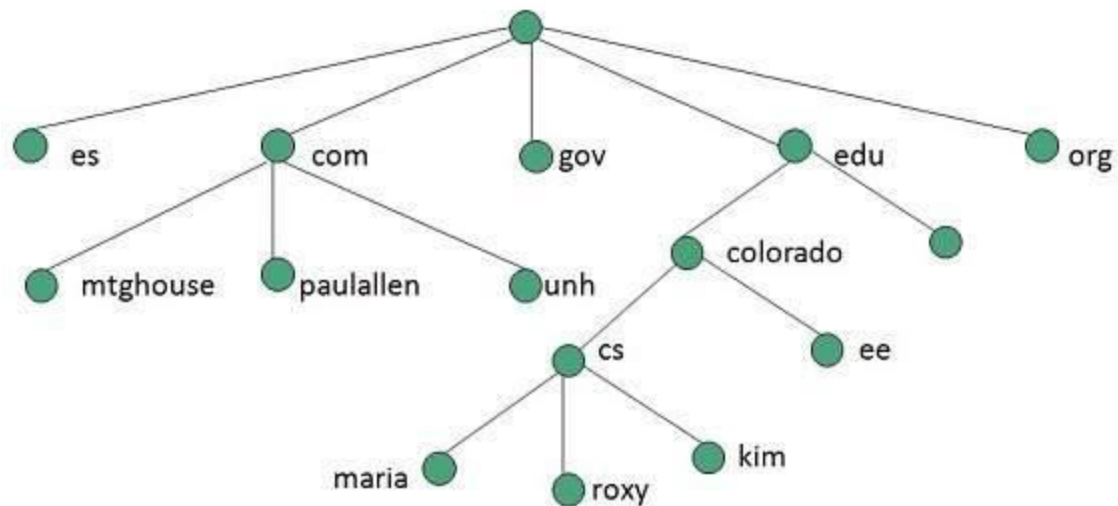
Edu	Education
Gov	U.S. government agency
Int	International entity
Mil	U.S. military
Net	Networking organization
Org	Non profit organization

The following table shows the **Country top-level** domain names:

Domain Name	Meaning
au	Australia
in	India
cl	Chile
fr	France
us	United States
za	South Africa

## Domain Name Space

The domain name space refers a hierarchy in the internet naming structure. This hierarchy has multiple levels (from 0 to 127), with a root at the top. The following diagram shows the domain name space hierarchy:



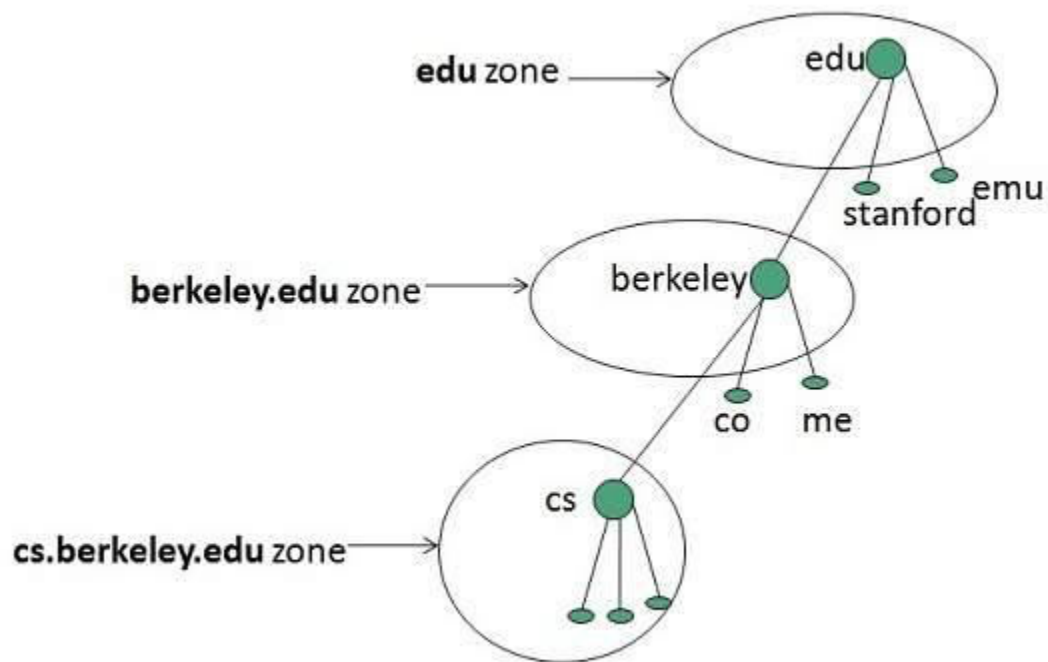
## Name Server

Name server contains the DNS database. This database comprises of various names and their corresponding IP addresses

- The entire name space is divided into the zones

## Zones

Zone is collection of nodes (sub domains) under the main domain. The server maintains a database called zone file for every zone.



### **TYPES OF NAME SERVERS**

Following are the three categories of Name Servers that manages the entire Domain Name System:

1. Root Server
2. Primary Server
3. Secondary Server

#### ROOT SERVER

Root Server is the top level server which consists of the entire DNS tree.

#### PRIMARY SERVERS

Primary Server stores a file about its zone.

#### SECONDARY SERVER

Secondary Server transfers complete information about a zone from another server which may be primary or secondary server.

## DNS Working

DNS translates the domain name into IP address automatically. Following steps will take you through the steps included in domain resolution process:

- When we type **www.tutorialspoint.com** into the browser, it asks the local DNS Server for its IP address.
- When the local DNS does not find the IP address of requested domain name, it forwards the request to the root DNS server and again enquires about IP address of it.
- The root DNS server replies with delegation that **I do not know the IP address of www.tutorialspoint.com but know the IP address of DNS Server.**
- The local DNS server then asks the com DNS Server the same question.
- The **com** DNS Server replies the same that it does not know the IP address of www.tutorialspont.com but knows the address of tutorialspoint.com.
- Then the local DNS asks the tutorialspoint.com DNS server the same question.
- Then tutorialspoint.com DNS server replies with IP address of www.tutorialspoint.com.
- Now, the local DNS sends the IP address of www.tutorialspoint.com to the computer that sends the request.

## What is Usenet?

- Computers communicate articles through protocols



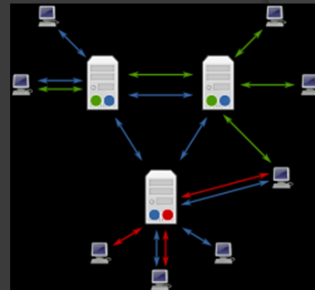
## Articles

- Must include a header and body
- Similar to email
- Rules for distribution



## Article Distribution

- Any message contributed gets sent out and copied to all servers
- The articles are distributed to every Usenet server (180,000 as of 1994)
- Assigned to a newsgroup



Wikipedia.org

## Newsgroups

- comp.\***: computer-related discussions
- humanities.\***: Fine arts, literature, and philosophy
- misc.\***: Miscellaneous topics
- news.\***: Discussions and announcements about news (meaning Usenet, not current events)
- rec.\***: Recreation and entertainment
- sci.\***: Science related discussions
- soc.\***: Social discussions
- talk.\***: Talk about various controversial topics



Wikipedia.org

**P2P discovery fall into three major categories:**

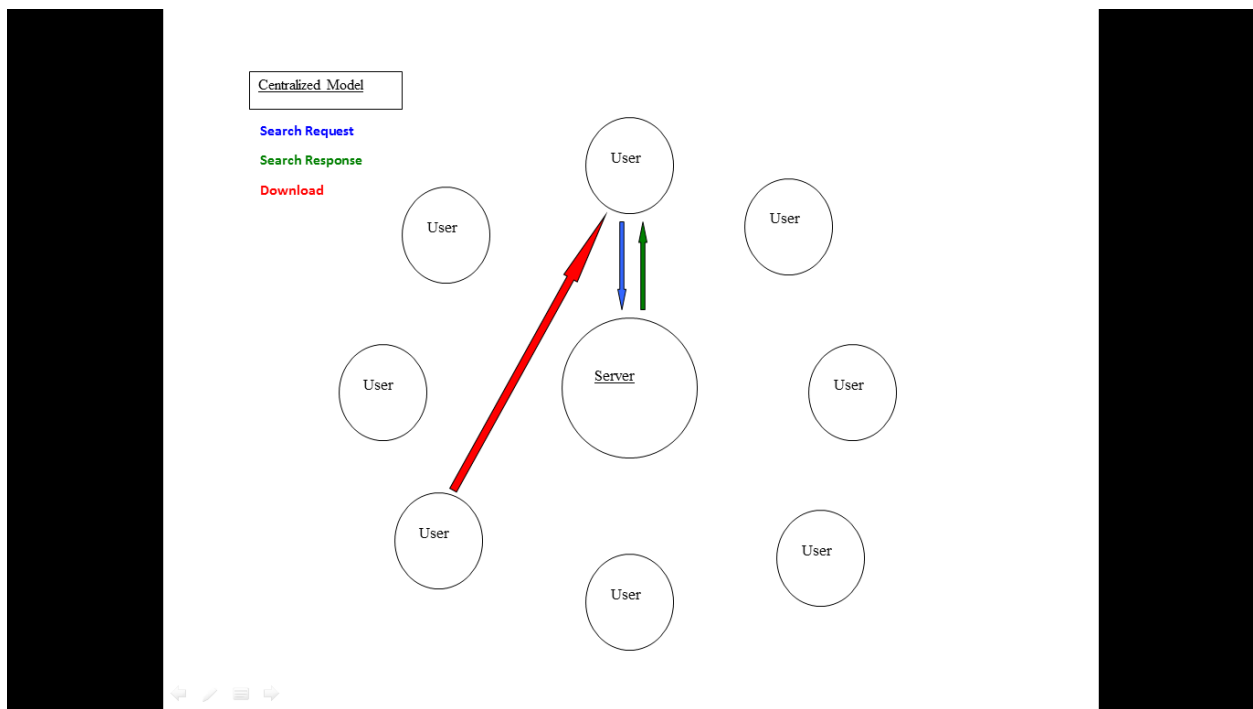
**(i) centralized (eg. Napster)**

**(ii) decentralized (eg. Gnutella)**

**(iii) hierarchical**

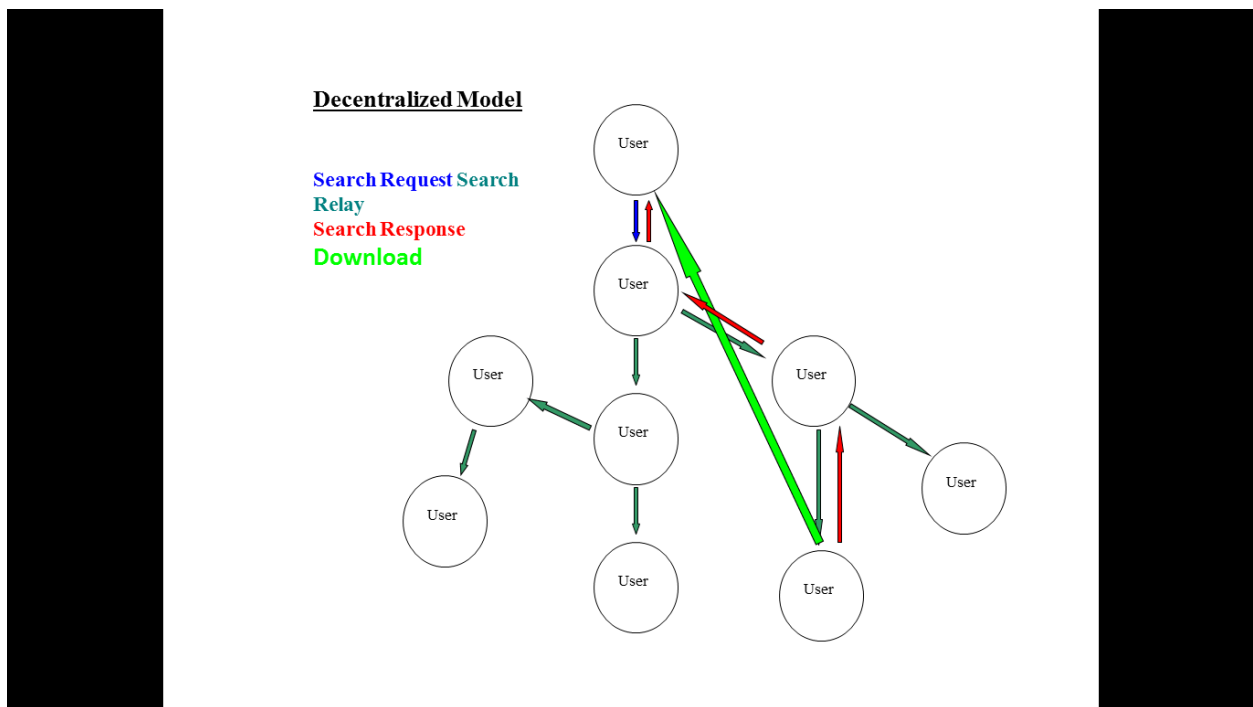
### Centralized System

In a centralized system a server maintains directories of what is stored in each peer computer. The central server directs the connections between peers. Thus, while the connection is made directly from peer to peer, a server is still necessary



## Decentralized System

With a decentralized program each peer connects directly to other peers without being directed by a server. These connections are repeated making the resulting network, in theory, infinitely large. In reality this size of a network is constrained by the number of layers of computers a message has to travel through.



## HIERARCHICAL(eg. Kazaa)

Hierarchical P2P network: As its name shows, hierarchical P2P network utilizes multiple, usually equal to or larger than two, levels of hierarchy. Participants of hierarchical P2P network are divided into different roles, for example, super-peer and peer, based on their capabilities and reliability. Generally, the network topology of each level can be

different, for example, the upper level can be structured P2P network, while the lower level can be unstructured P2P network.

## **GOSSIP BASED BROADCAST:**

- Choose a gossip target node, uniformly at random, and send it the message.
- Upon receiving a message for the first time, a node repeats this process: by selecting  $t$  gossip targets at random and forwarding the message to them.
- If a node receives the same message twice - it simply discards the message.

**Fan-out:** This is the number of nodes that are selected as gossip targets.

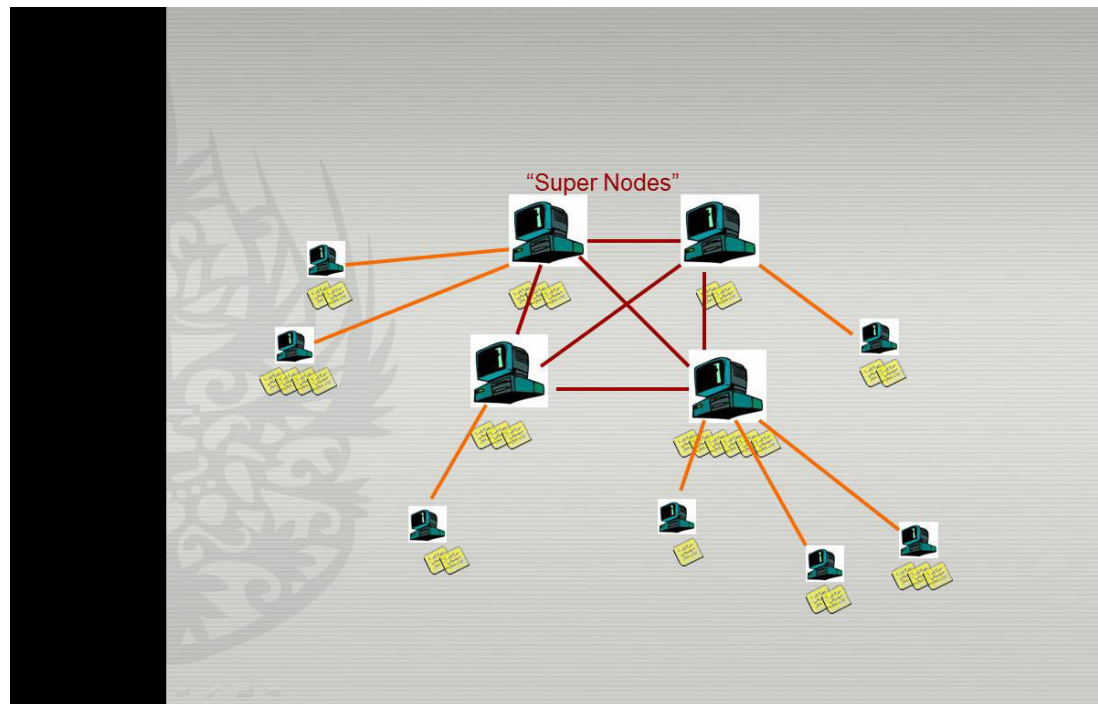
**Maximum rounds:** This is the maximum number of times a given gossip message is retransmitted by nodes.

### Drawbacks of gossip:

- More faults,
- Higher redundancy
- lower system throughput

## SUPER PEER

- ✓ The nodes that have more bandwidth and is most available are designated as a superpeer or supernode.
- ✓ Superpeer acts as a local index server.
- ✓ Superpeers communicate with each other for queries .
- ✓ Each superpeer can manage 100 to 150 children node.
- ✓ One superpeer (supernode) connects to 30 or 50 other supernodes.



## P2P OPERATION

Every client participating in a P2P network application must be able to perform the following operations

able to **discover** other clients.

able to **connect to** other clients.

able to **communicate** with other clients.

**The discovery problem** has two obvious solutions. You can either keep a list of the clients on the server so clients can obtain this list and contact other clients (known as *peers*), or you can use an infrastructure (for example PNRP) that enables clients to find each other directly. Most file-sharing systems use the “list on a server” solution by using servers known as *trackers*. Also, in file-sharing systems any client may act as a server by declaring that it has a file available and registering it with a tracker. In fact, a pure P2P network needs no servers at all, just peers.

**The connection problem** is a more subtle one, and concerns the overall structure of the networks used by a P2P application. If you have one group of clients, all of which can communicate with one another, the topology of the connections between these clients can become extremely complex. You can often improve performance by having more than one group of clients, each of which consists of connections between clients in that group, but not to clients in other groups. If you can make these groups locale-based you will get an additional performance boost, because clients can communicate with each other with fewer hops between networked computers.

**Communication** is perhaps a problem of lesser importance, because communication protocols such as TCP/IP are well established and can be reused here.

Discovery, connection, and communication are central to any P2P implementation.

## P2P INFRASTRUCTURE

P2P infrastructure includes the following

- Peer Name Resolution protocol (PNRP)
- People Near Me Server

**The Peer Name Resolution Protocol (PNRP)**, is used to publish and resolve peer addresses. It is one of the underlying technologies that you use to resolve peer

addresses. PNRP enables a client to register an endpoint (known as a *peer name*) that is automatically circulated among peers in a cloud. This peer name is encapsulated in a PNRP ID. A peer that discovers the PNRP ID is able to use PNRP to resolve it to the actual peer name, and can then communicate directly with the associated client

## PNRP IDs

PNRP IDs are 256-bit identifiers. The low-order 128 bits are used to uniquely identify a particular peer, and the high-order 128 bits identify a peer name.

The PNRP service on a peer is responsible for maintaining a list of PNRP IDs, including the ones that it publishes as well as a cached list of those it has obtained by PNRP service instances elsewhere in the cloud. When a peer attempts to resolve a PNRP ID, the PNRP service either uses a cached copy of the endpoint to resolve the peer that published the PNRP or it asks its neighbors if they can resolve it. Eventually a connection to the publishing peer is made and the PNRP service can resolve the PNRP ID.

## PNRP Clouds

Two types of clouds are available to the PNRP service

**Link local** —These clouds consist of the computers attached to a local network.

**Global** —This cloud consists of computers connected to the Internet by default.

Clouds may be in one of the following states:

**Active** —If the state of a cloud is active, you can use it to publish and resolve peer names.

**Alone** —If the peer you are querying the cloud from is not connected to any other peers, it will have a state of alone.

**No Net** —If the peer is not connected to a network, the cloud state may change from active to no net.

**Virtual** —If a cloud connection has been inactive for more than 15 minutes it may enter the virtual state.

## People Near Me.

The People Near Me service is an implementation of the discovery stage, and enables you to locate peers that are signed in to the Windows People Near Me service in your local area. You may have come across this service because it is built into Vista and Windows 7, and is used in the Windows Meeting Space application, which you can use for sharing applications among peers. You can configure this service through the Change People Near Me settings control panel item (you can navigate to this quickly by typing “people” in the Start menu search box). This control panel item displays the dialog box. After you have signed in, the service is available to any application that is built to use the PNM service.