Peer to Peer Applications: KaZaA

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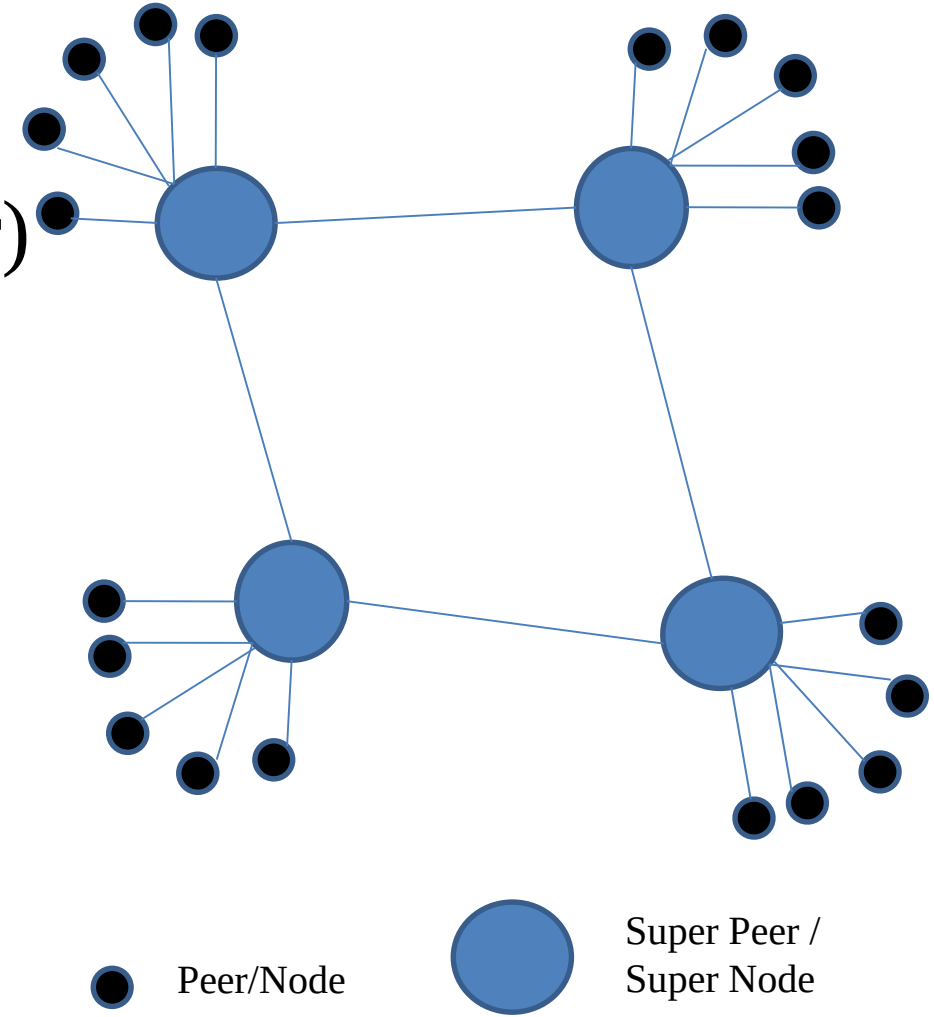
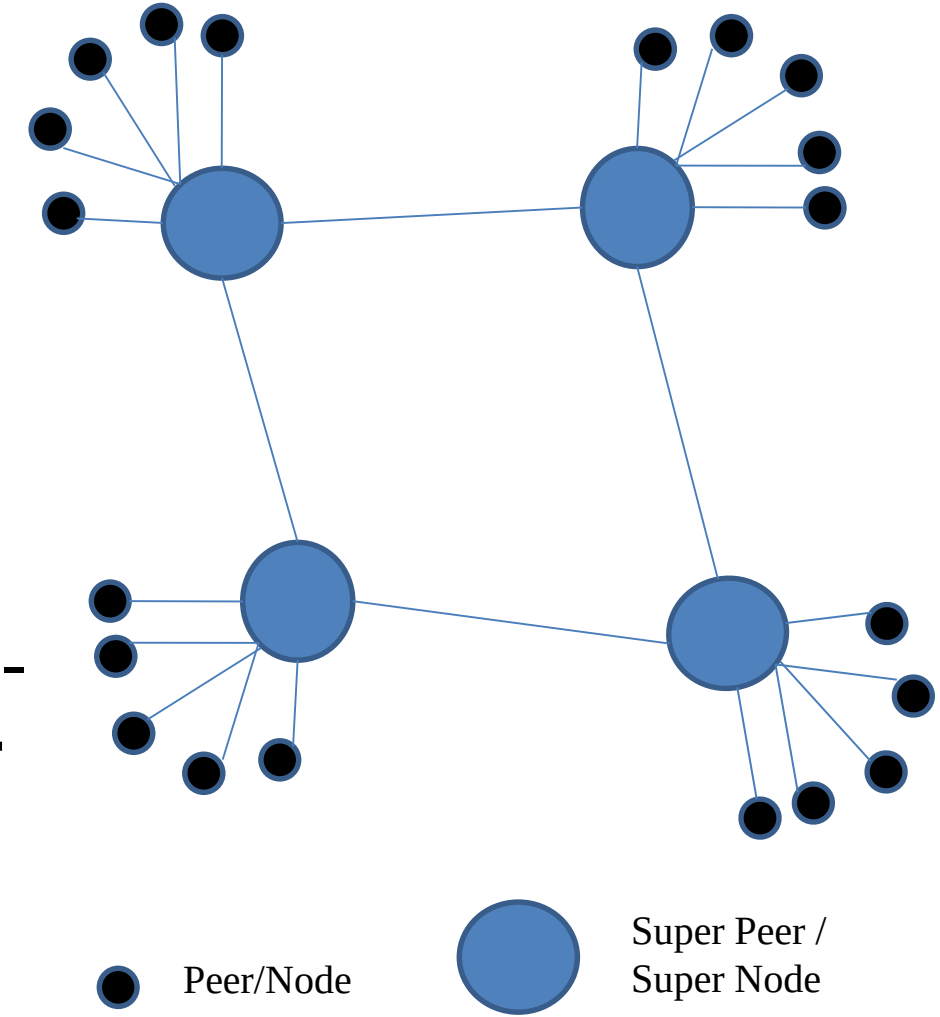
KaZaA

- Cross between Napster and Gnutella
  - Napster (centralized): efficient search but single point of failure
  - Gnutella (distributed): inefficient search based on flooding but robust against failure
    - All peers are treated equal → peers with limited resources can deteriorate overall performance
- Basic idea: Leverage heterogeneity of peers (assign more responsibility to peers with better resources –> super nodes/peers) and impose a hierarchy

- Super node acts as a central server to a subset of clients (like in Napster)
  - Search is efficient
  - A node may become super-node at some point based on its capabilities and how long its been on
  - A supernode serves about 100-150 nodes



- Super-nodes form a distributed network (like in Gnutella)
  - Many super-peers share load and provide robustness
  - A supernode has about 30-50 connections with other supernodes



Node Join

- Some supernodes hardcoded in downloaded software
- New peer contacts (hardcoded) supernodes one by one till it finds an operational supernode
- New peer obtains a more up-to-date list (200 entries) from the (hardcoded) supernode, contacts supernodes (in list) and connects to one who replies to it
- Supernodes typically are mostly ON, but in case it goes down, node chooses another supernode in list

Publish

- Node informs supernode of the list of files it wishes to share
- For each file, it uploads the following metadata
  - File name
  - File size
  - File hash (helps determine identical copies and permits parallel downloads)
  - File descriptors: used during keyword search

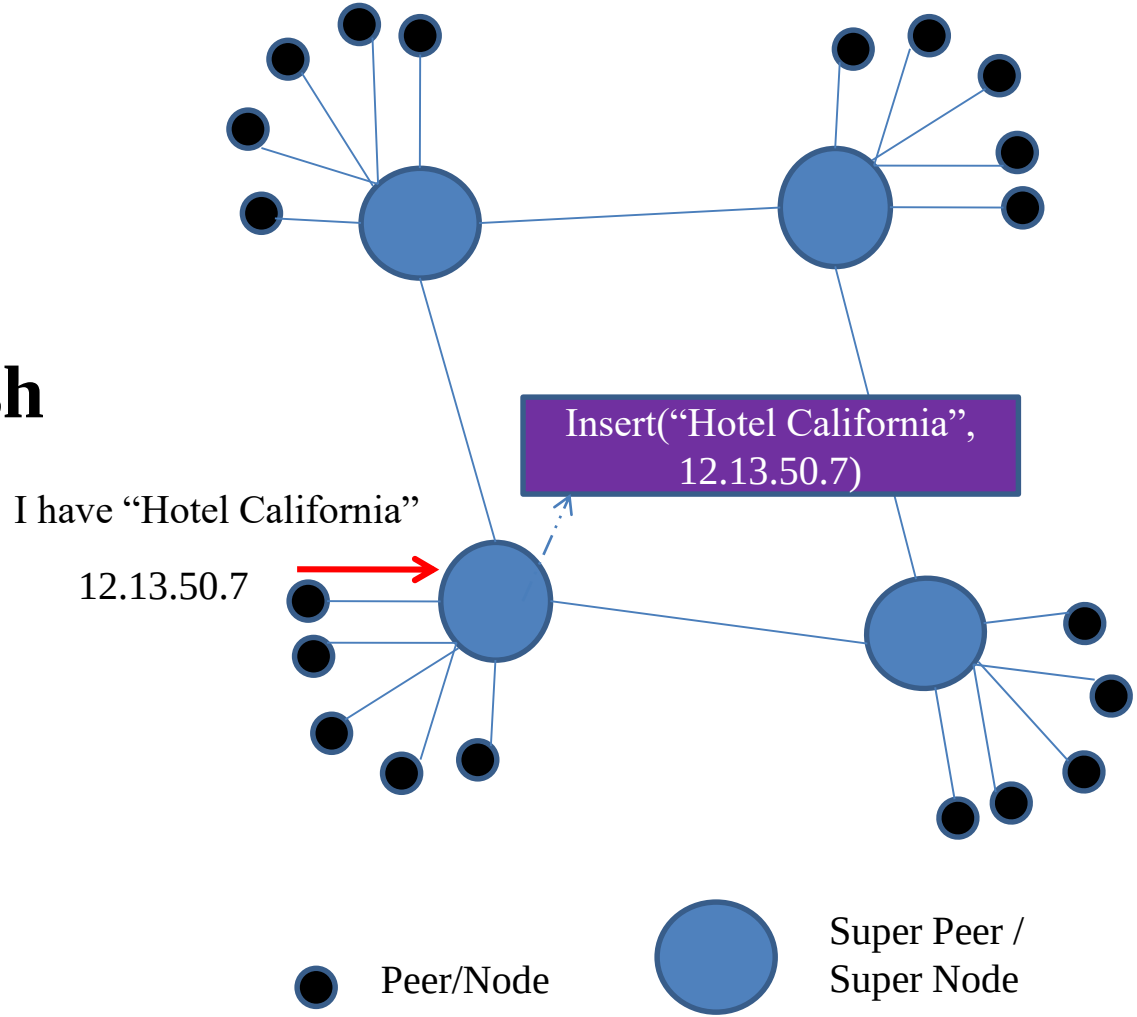
Search

- Node first queries the supernode; if x matches found done.
- Else, supernode forwards query to subset of supernodes (limited scope flooding in incremental steps) till a total of x matches found
- Supernode responds to node with matches
  - Each match returns metadata and IP address of peer with file

Fetch

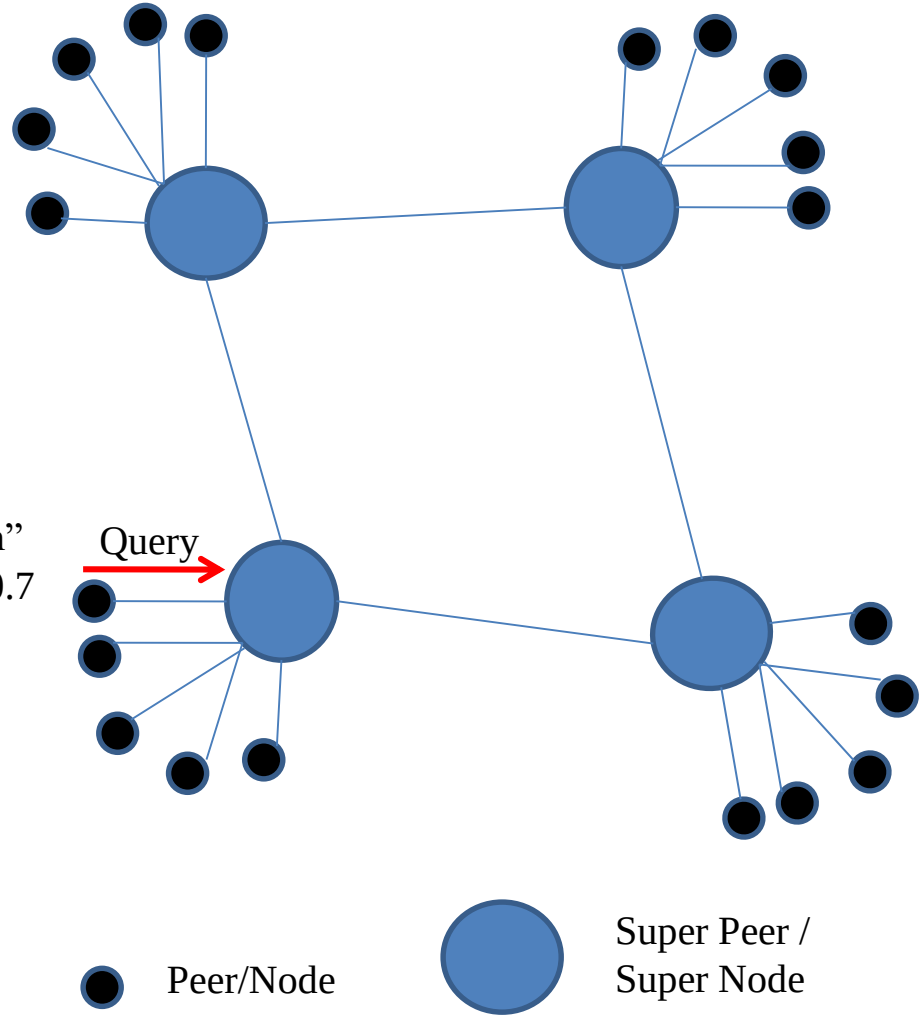
- Get file directly from peer(s)
- Parallel downloads permitted via HTTP byte-range header
  - Identical copies determined by file hash
  - HTTP byte-range header used to request different portions of the file from different nodes

Publish


Insert(“Hotel California”, 12.13.50.7)
I have “Hotel California”
12.13.50.7
Peer/Node
Super Peer / Super Node

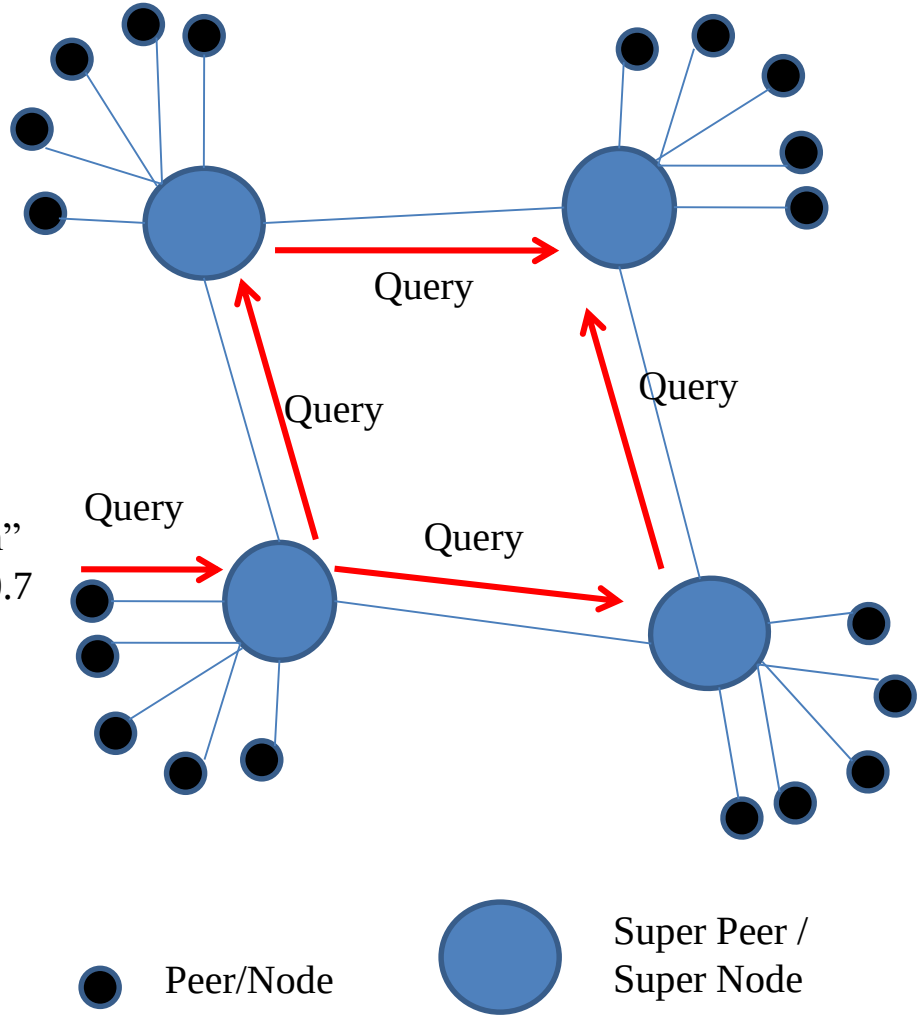
Search

I want “Stairway to Heaven”
12.13.50.7



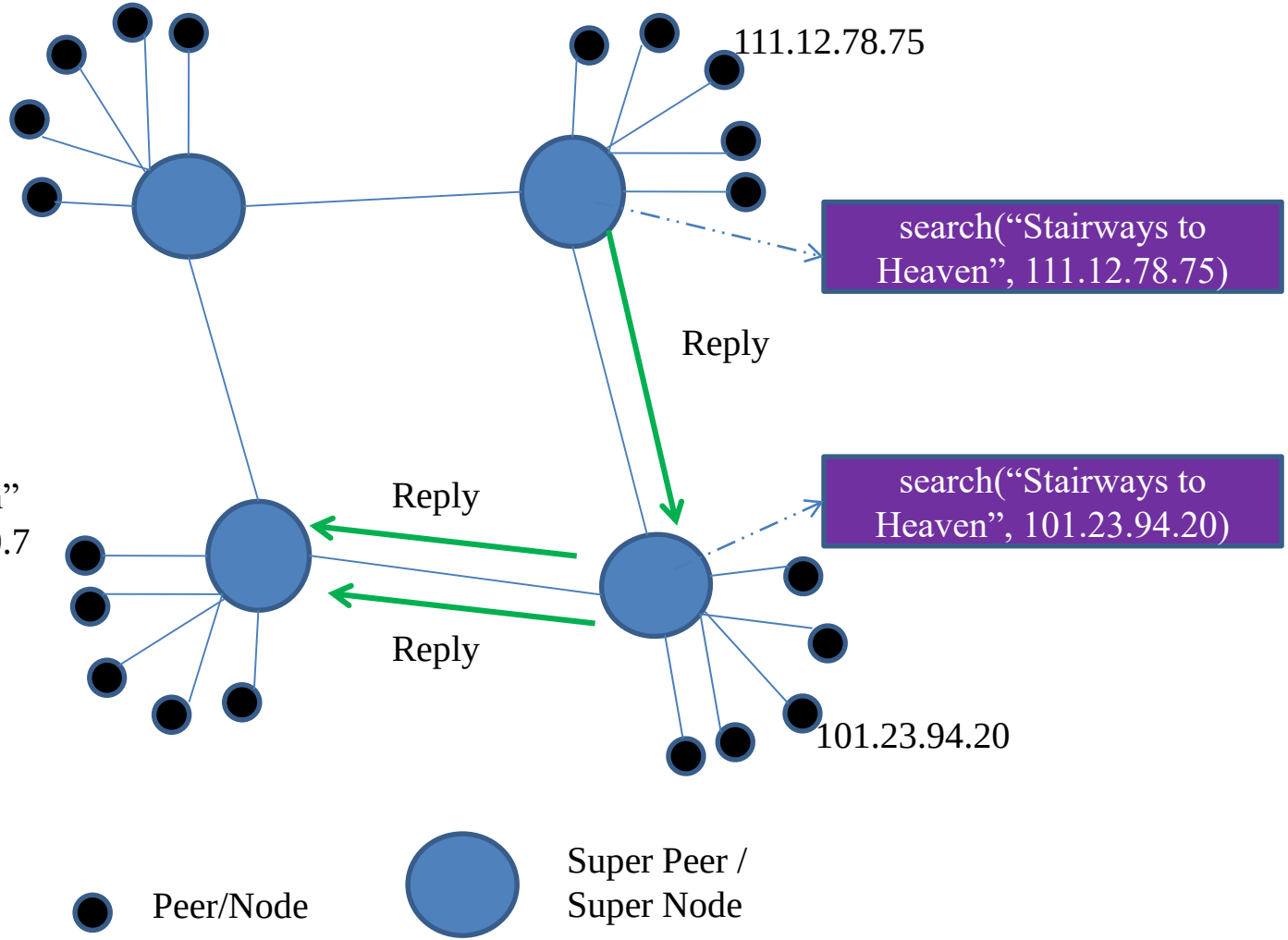
Search

I want “Stairway to Heaven”
12.13.50.7



Search

I want “Stairway to Heaven”
12.13.50.7



Discussion

Pros:

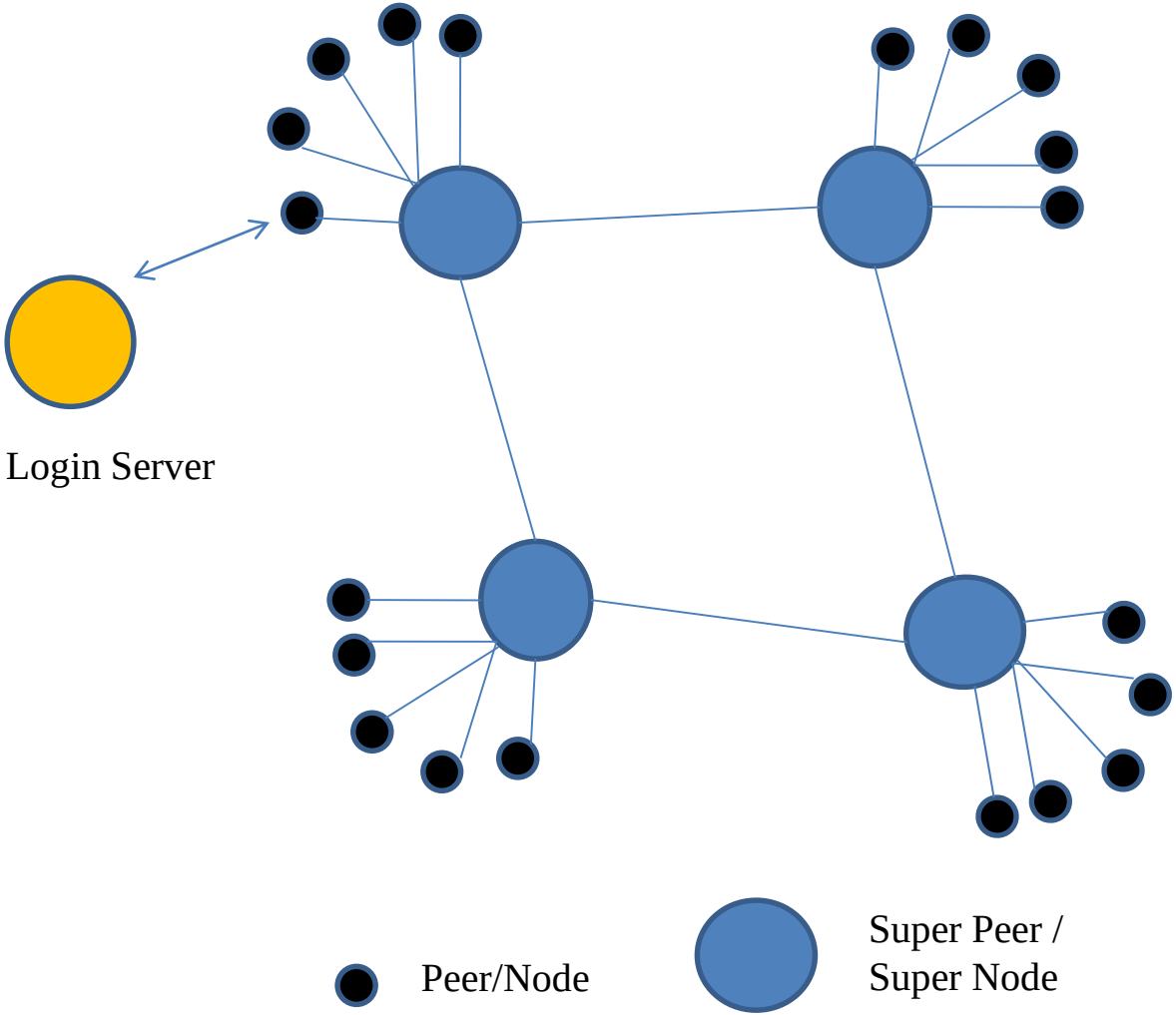
- Improves scalability and search efficiency by leveraging node heterogeneity

Cons:

- No guarantees on search time
- No mechanism to tackle freeloading

Skype

- Provides video/voice chat/calls from computers/mobile devices to other devices including telephones via Internet
- Same developers as KaZaA; similar architecture as KaZaA
  - Supports a few additional servers: login (for authentication), skypeout, skypein (for interfacing with PSTN)
- Provides excellent NAT and firewall traversal mechanisms


Login Server
Peer/Node
Super Peer /
Super Node

Summary

- KaZaA a cross between Napster and Gnutella
- Leverages heterogeneity of nodes and imposes a hierarchy in the overlay network
  - Supernodes form a distributed network and act as a central server to a subset of clients/peers
  - Improves scalability and searchability
- Popular IP telephony service Skype is P2P based whose working is very similar to KaZaA