



Peer-to-Peer Networks

02: Napster & Gnutella

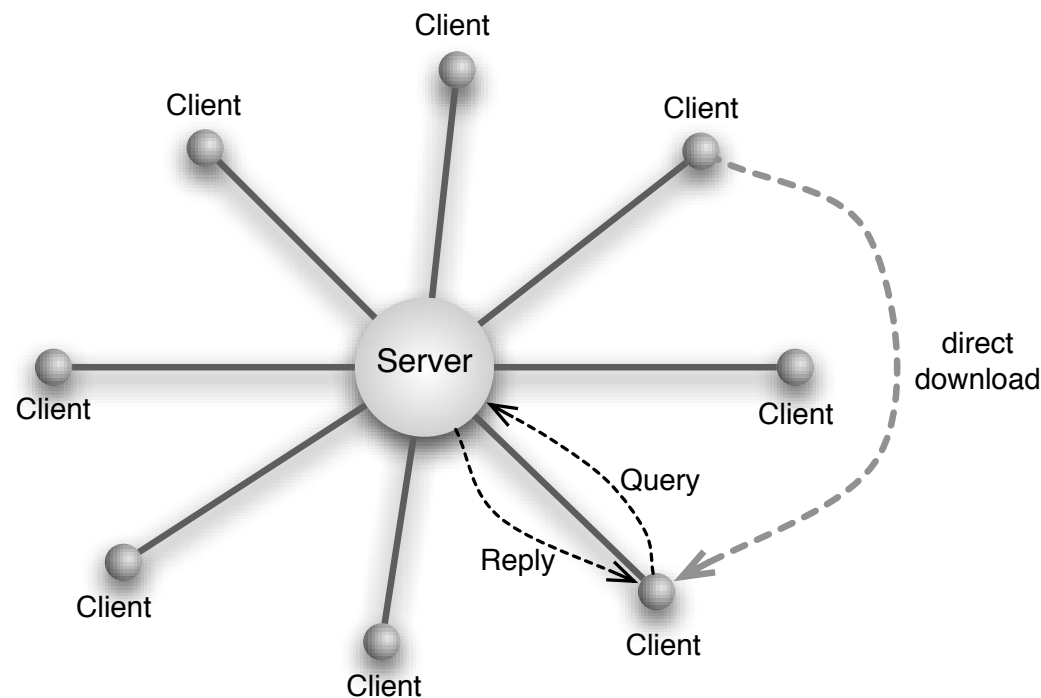
Christian Schindelhauer
Technical Faculty
Computer-Networks and Telematics
University of Freiburg

- Shawn (Napster) Fanning
 - published 1999 his beta version of the now legendary Napster P2P network
 - File-sharing-System
 - Used as mp3 distribution system
 - In autumn 1999 Napster has been called download of the year
- Copyright infringement lawsuit of the music industry in June 2000
- End of 2000: cooperation deal
 - between Fanning and Bertelsmann Ecommerce
- Since then Napster is a commercial file-sharing platform



How Did Napster Work?

- Client-Server
- Server stores
 - Index with meta-data
 - file name, date, etc
 - table of connections of participating clients
 - table of all files of participants
- Query
 - client queries file name
 - server looks up corresponding clients
 - server replies the owner of the file
 - querying client downloads the file from the file owning client



- Advantages

- Napster is simple
- Files can be found fast and effective

- Disadvantages

- Central structure eases censorship, hostile attacks and vulnerability against technical problems
 - e.g. denial of service (DOS) attack
- Napster does not scale
 - i.e. increasing number of participants implies a decline in performance
 - bandwidth and memory of the server is limited

- Conclusion

- Napster is not an acceptable P2P network solution
- Except the download part Napster is not a real P2P network

- Gnutella
 - was released in March 2000 by Justin Frankel and Tom Pepper from Nullsoft
 - Since 1999 Nullsoft is owned by AOL
- File-Sharing system
 - Same goal as Napster
 - But without any central structures

- Neighbor lists
 - Gnutella connects directly with other clients
 - the client software includes a list of usually online clients
 - the clients checks these clients until an active node has been found
- an active client publishes its neighbor list
 - the query (ping) is forwarded to other nodes
 - the answer (pong) is sent back
 - neighbor lists are extended and stored
 - the number of the forwarding is limited (typically: five)

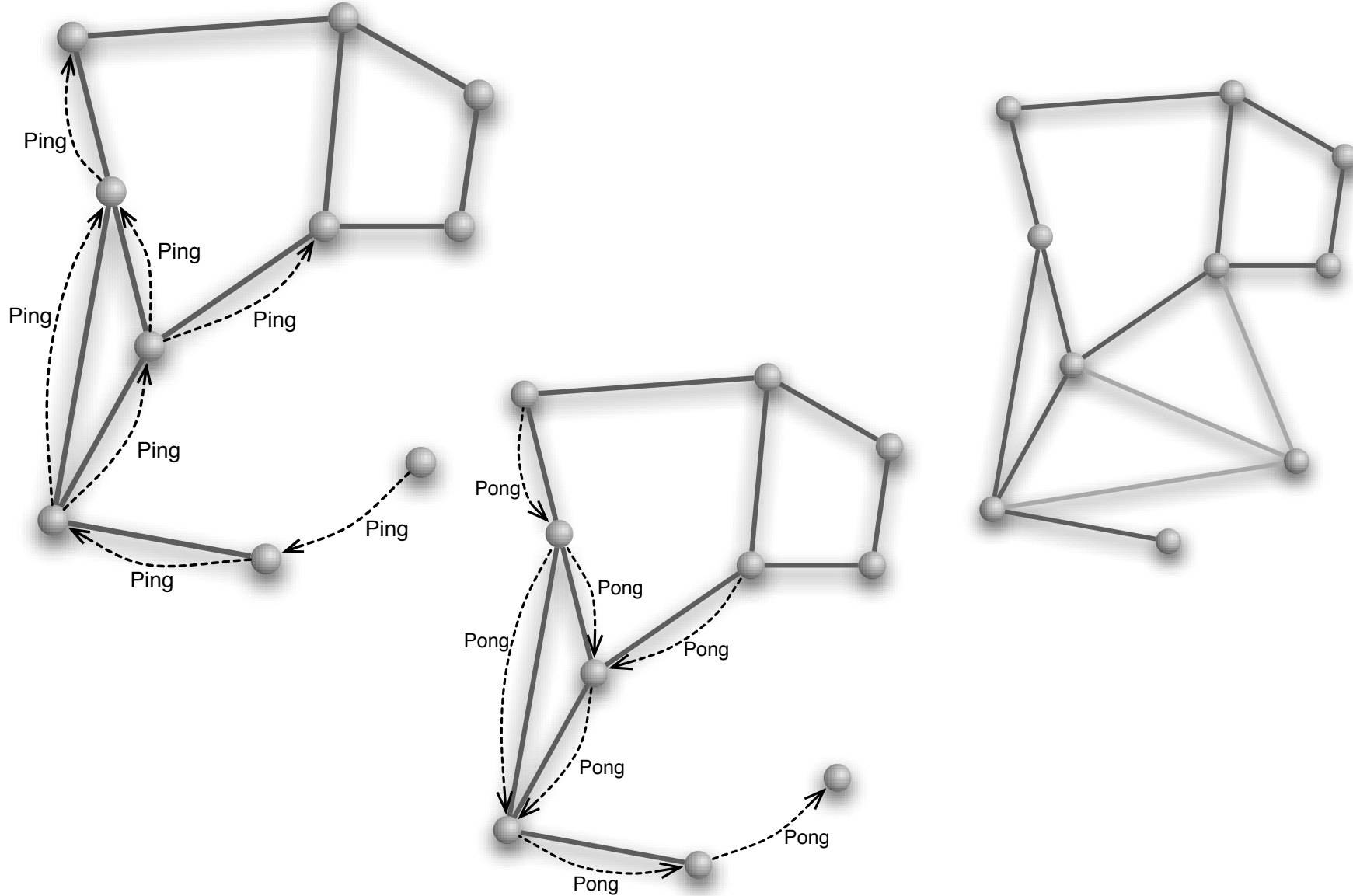
- Protokoll

- Ping

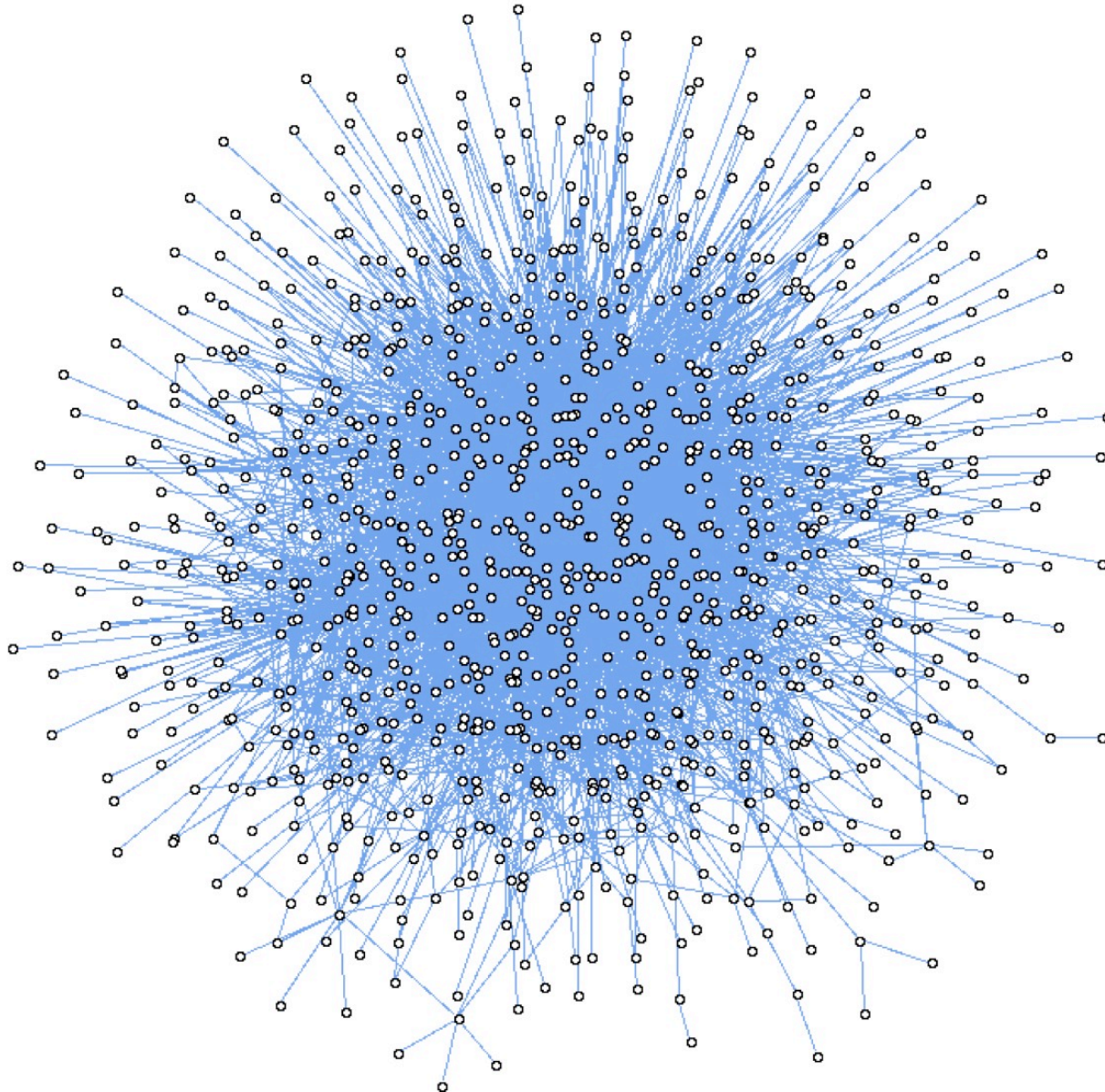
- participants query for neighbors
- are forwarded according for TTL steps (time to live)

- Pong

- answers Ping
- is forwarded backward on the query path
- reports IP and port adress (socket pair)
- number and size of available files



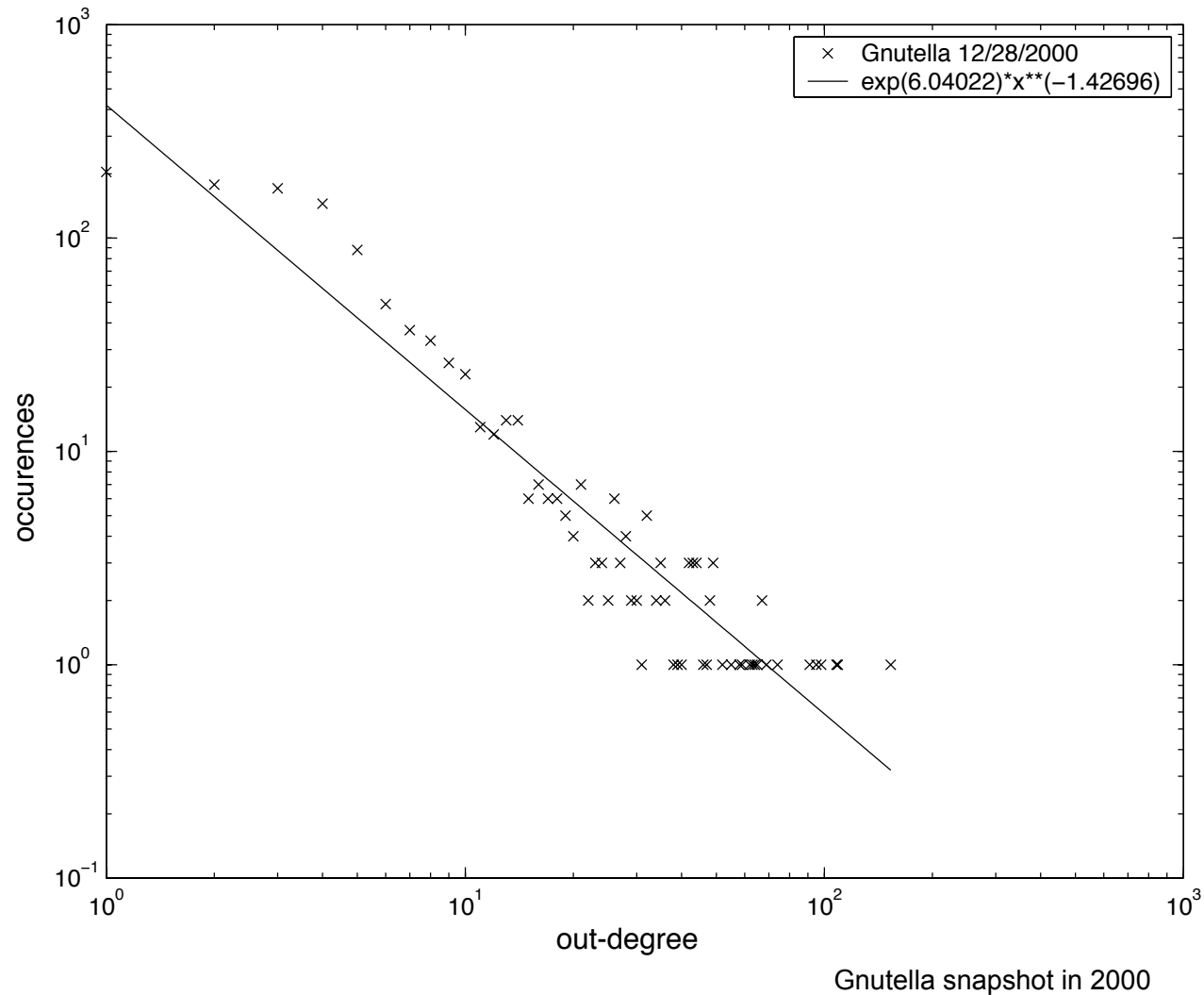
Gnutella — Graph Structure



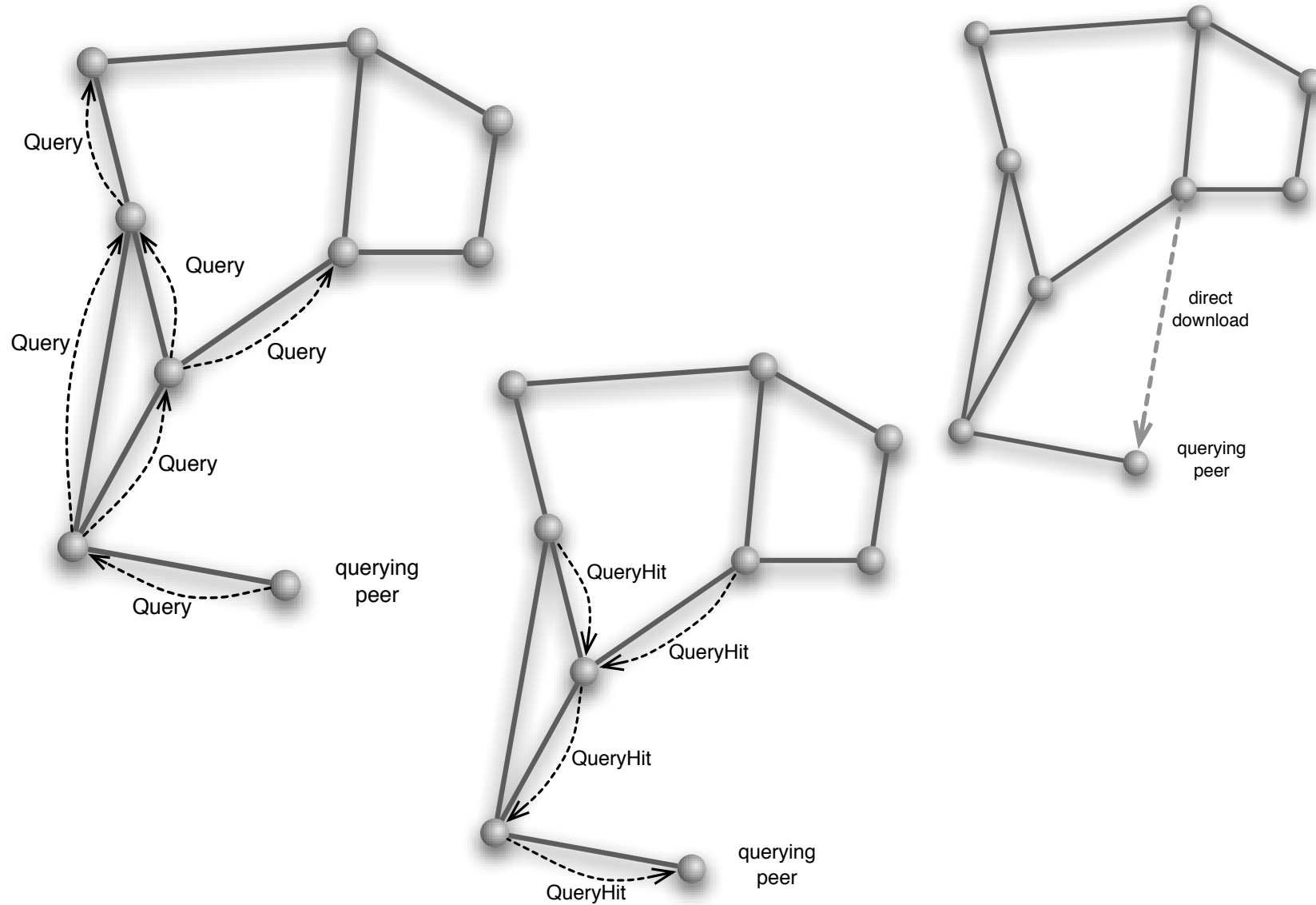
shot in 2000

■ Graph structure

- constructed by random process
- underlies power law
- without control

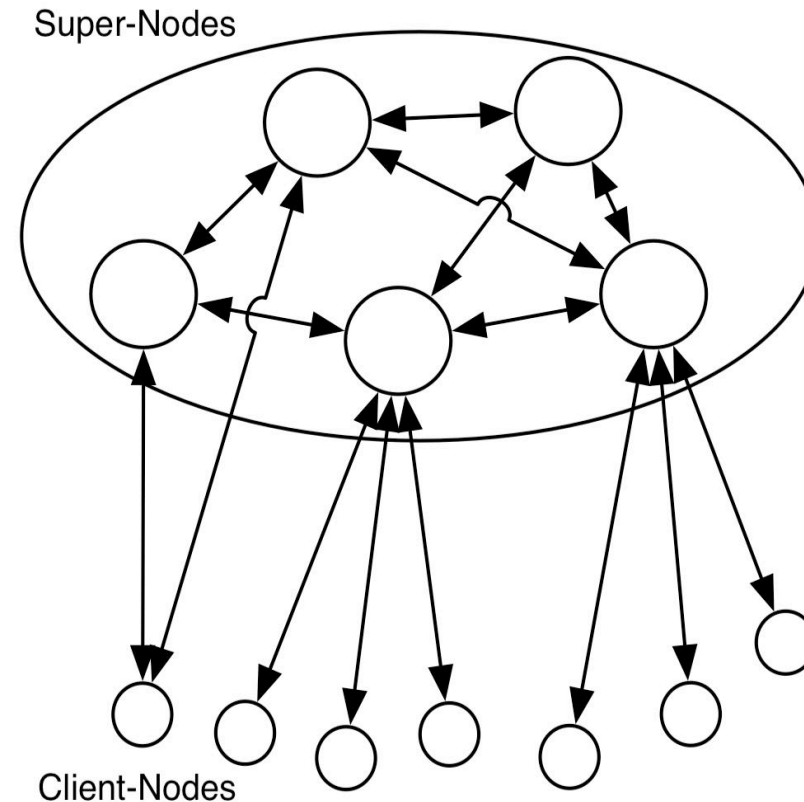


- File Query
 - are sent to all neighbors
 - Neighbors forward to all neighbors
 - until the maximum hop distance has been reached
 - TTL-entry (time to live)
- Protocol
 - Query
 - for file for at most TTL hops
 - Query-hits
 - answers on the path backwards
- If file has been found, then initiate direct download



- Advantages
 - distributed network structure
 - scalable network
- Disadvantages
 - bounded breadth depth search leads to implicit network partition
 - this reduces success probability
 - long paths, slow latency
- Suggested improvements
 - random walks instead broadcasting
 - passive replication of index information

- Hybrid Structure
 - high bandwidth node are elected as P2P-servers, aka. super-nodes
 - super-nodes are connected using the original Gnutella protocol
 - client nodes are connected only to super-nodes
- Used in
 - FastTrack
 - Gnutella 2
- Advantages
 - improved scalability
 - smaller latency
- Disadvantages
 - still unreliable and slow
 - peers decline to serve as super-nodes





Peer-to-Peer Networks

02: Napster & Gnutella

Christian Schindelhauer
Technical Faculty
Computer-Networks and Telematics
University of Freiburg