Peer-to-Peer Systems

Reference: George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012

Peer-to-Peer Systems

- Peer-to-Peer Systems
  - Where data and computational resources are contributed by many hosts
  - Objective to balance network traffic and reduce the load on the primary host
  - Management requires knowledge of all hosts, their accessibility, (distance in number of hops), availability and performance.
  - They exploit existing naming, routing, data replication and security techniques in new ways.

Peer-to-Peer Systems

- Goal of Peer-to-Peer Systems
  - Sharing data and resources on a very large scale
  - ‘Applications that exploit resources available at the edges of the Internet – storage, cycles, content, human presence’ (Shirky 2000)
  - Uses data and computing resources available in the personal computers and workstations

Peer-to-Peer Systems

- Goal of Peer-to-Peer Systems
  - Load balancing: Get rid of central servers, less load on one node in the network.
  - Fault Tolerance: No single point of failure, if the server goes down the network can still carry on.
  - Efficient use of resources: There are often lots of wasted resources on network (spare file space, spare computation power ....).
  - In P2P systems it is very easy for clients to participate.

Peer-to-Peer Systems

- Characteristics of Peer-to-Peer Systems
  - Each computer contributes resources
  - All the nodes have the same functional capabilities and responsibilities
  - No centrally-administered system
  - Offers a limited degree of anonymity
  - Algorithm for placing and accessing the data
    - Balance workload, ensure availability
    - Without adding undue overhead

Peer-to-Peer Systems

- Evolution of Peer-to-Peer Systems
  - Napster – download music, return address
  - Freenet, Gnutella, Kazaa and BitTorrent
    - More sophisticated – greater scalability, anonymity and fault tolerance
  - Pastry, Tapestry, CAN, Chord, Kademlia
    - Peer-to-peer middleware

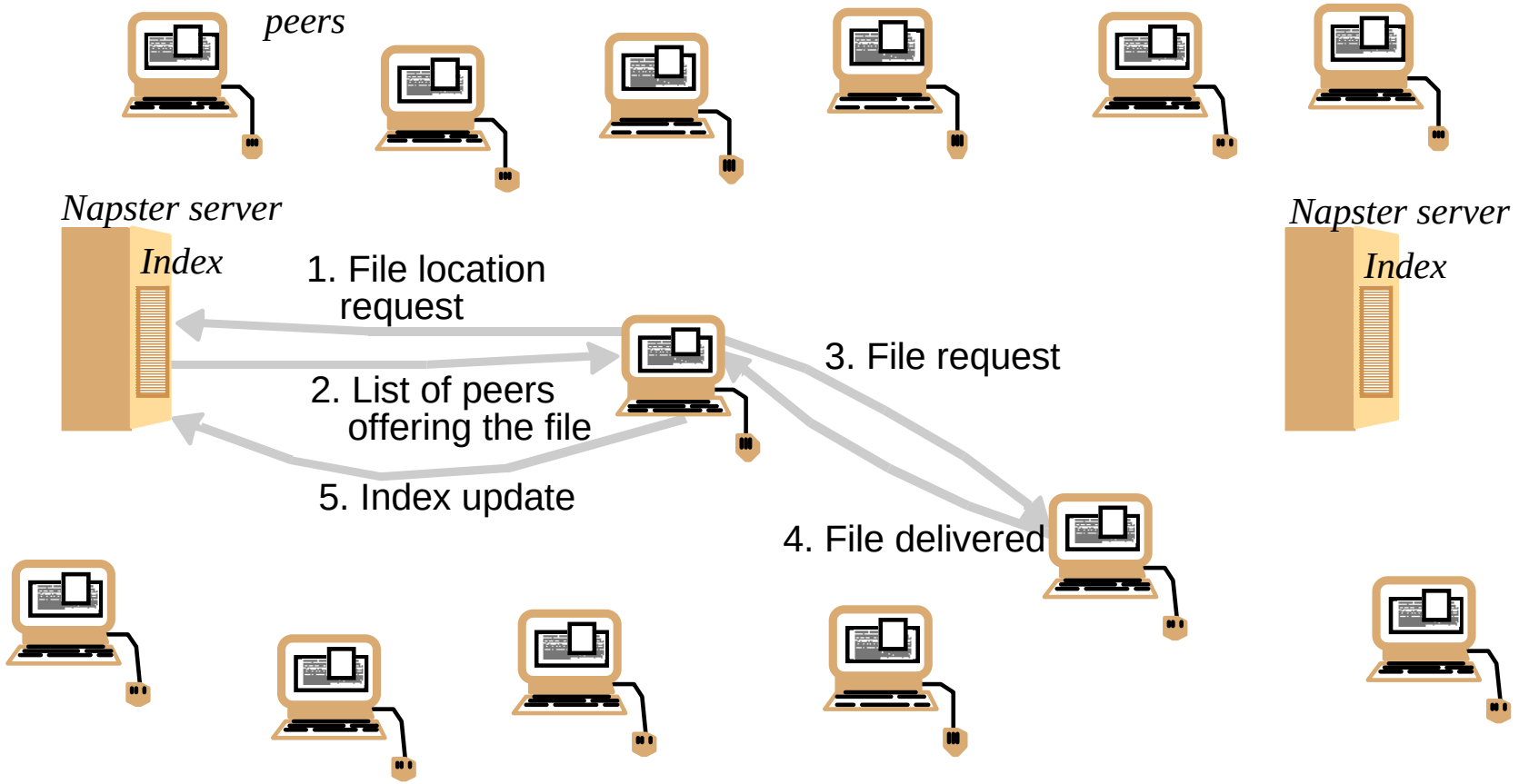
Peer-to-Peer Systems

- Evolution (Continued)
  - Immutable Files, (music, video)
  - GUIDs (Globally Unique Identifiers)
  - Middleware to provide better routing algorithms, react to outages
  - Evolve to mutable files
  - Application within one company's intranet

Napster and its Legacy

- Napster
  - Provided a means for users to share music files – primarily MP3s
  - Launched 1999 – several million users
  - Not fully peer-to-peer since it used central servers to maintain lists of connected systems and the files they provided, while actual transactions were conducted directly between machines
  - Proved feasibility of a service using hardware and data owned by ordinary Internet users

Napster and its Legacy



Examples to be continued in another Lecture Material

Napster

Bit-torrent