

CN-Advanced L34

P2P Networking

Dr. Ram P Rustagi
rprustagi@ksit.edu.in
<http://www.rprustagi.com>
<https://www.youtube.com/rprustagi>

Acknowledgements

Chapter

Multimedia

Networking

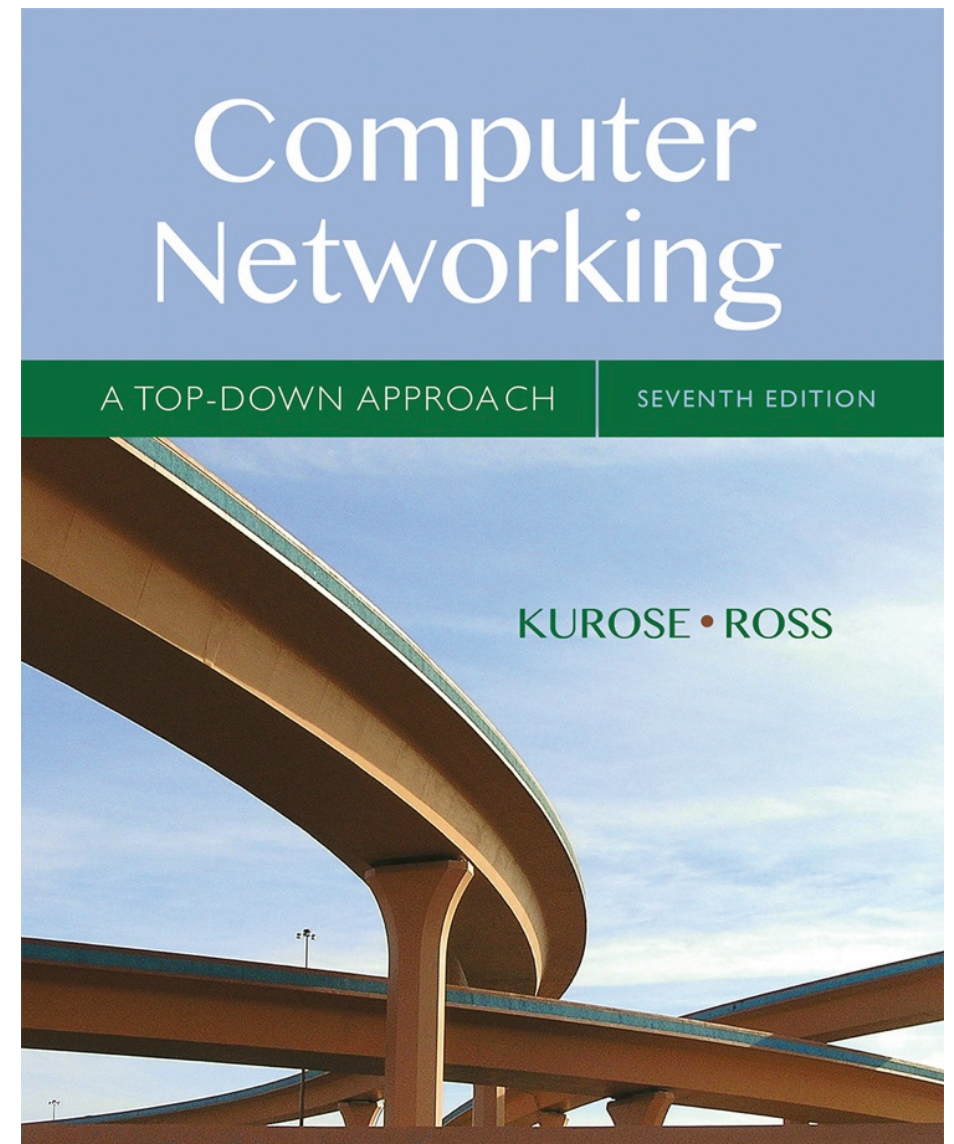
A note on the use of these Powerpoint slides:

We're making these slides freely available to all (faculty, students, readers). They're in PowerPoint form so you see the animations; and can add, modify, and delete slides (including this one) and slide content to suit your needs. They obviously represent a *lot* of work on our part. In return for use, we only ask the following:

- If you use these slides (e.g., in a class) that you mention their source (after all, we'd like people to use our book!)
- If you post any slides on a www site, that you note that they are adapted from (or perhaps identical to) our slides, and note our copyright of this material.

Thanks and enjoy! JFK/KWR

All material copyright 1996-2016
J.F Kurose and K.W. Ross, All Rights Reserved



Computer Networking: A Top Down Approach

7th edition

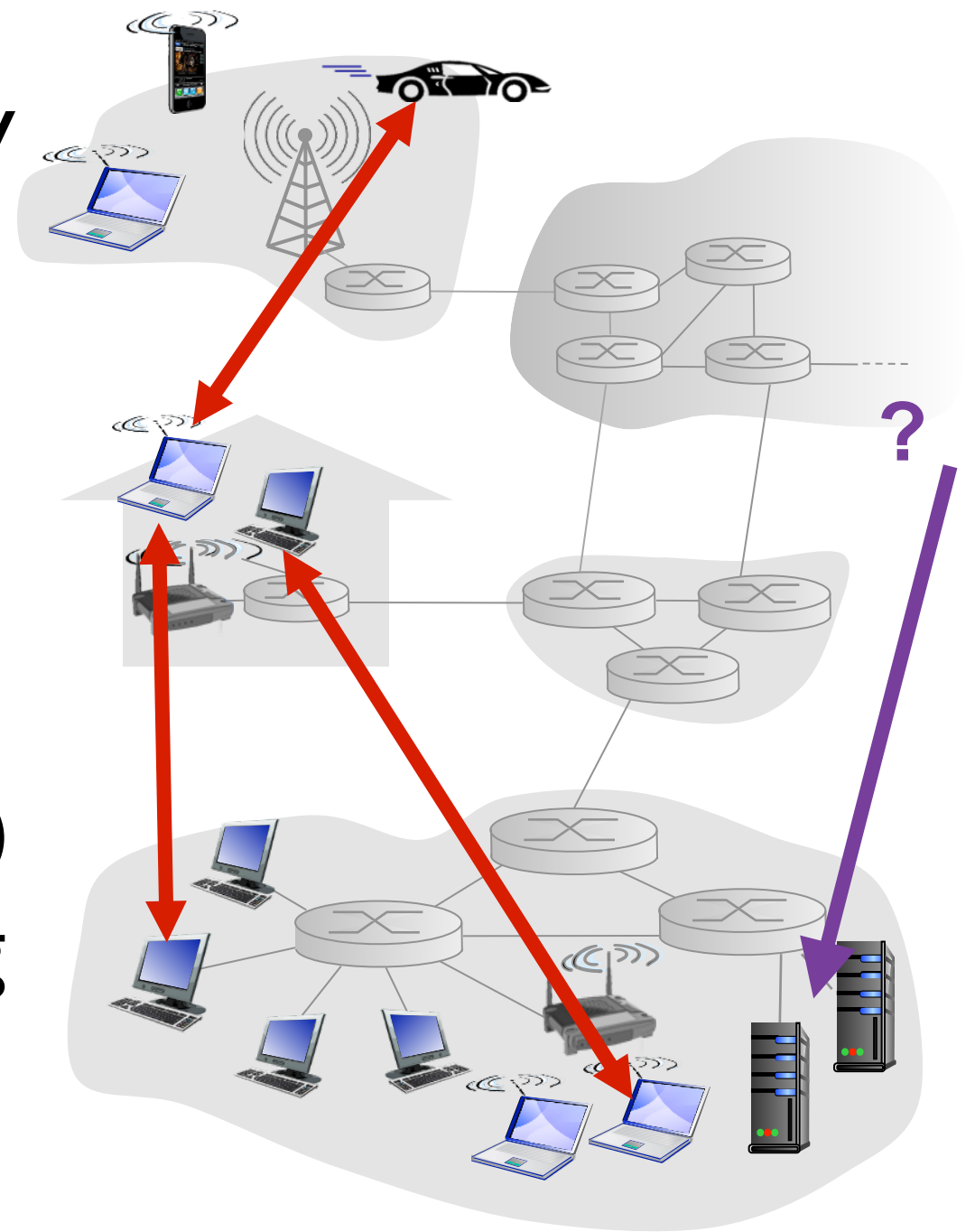
Jim Kurose, Keith Ross

Pearson/Addison Wesley

April 2016

Pure P2P architecture

- No always-on server
- Arbitrary end systems directly communicate
- Peers are intermittently connected and change IP addresses
- *examples:*
 - File distribution (BitTorrent)
 - Video onDemand Streaming (KanKan)
 - VoIP (Skype)

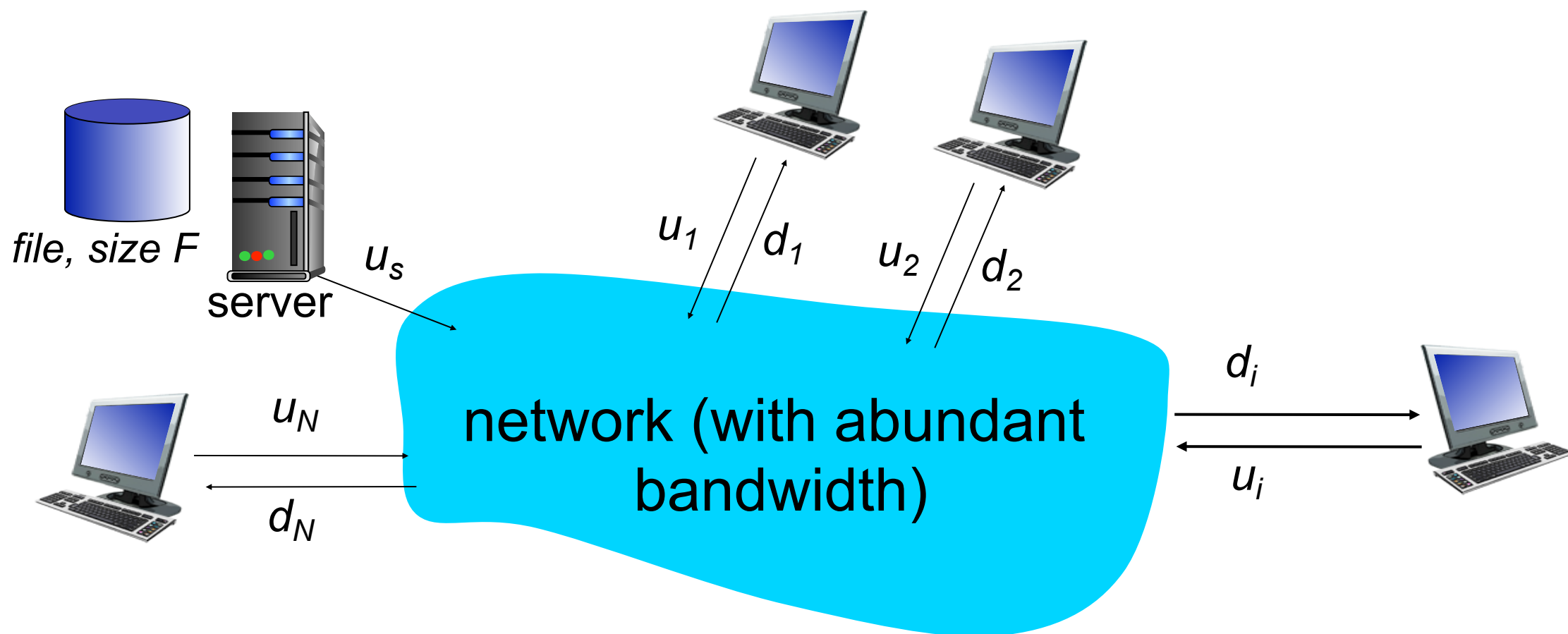


P2P Example :File download

Server has a file.

This file has to be distributed to all clients.

How would you approach?



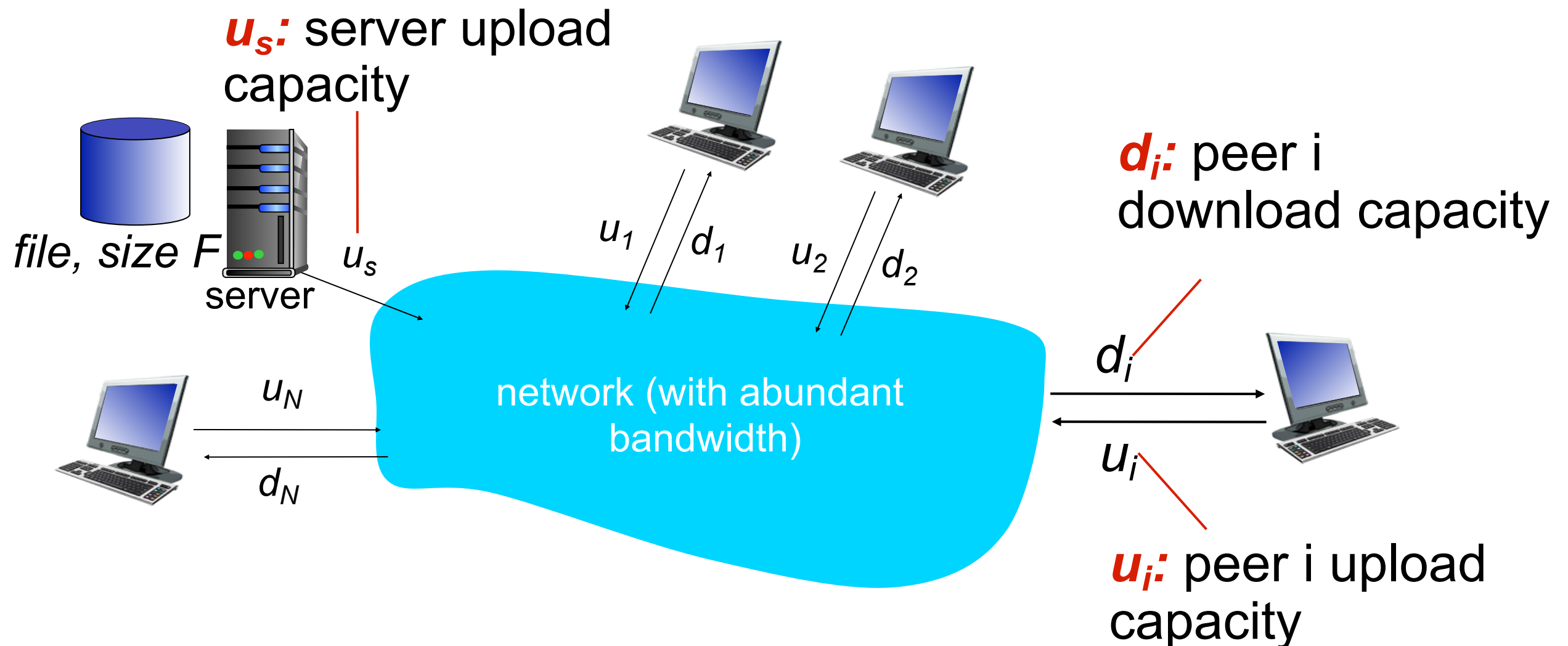
P2P Example: Client-Server Mode

- Case: File distribution among all peers
 - A server has file of size 100 Mbits.
 - The file is to be distributed among 100 peers.
 - Server upload rate is 10 Mbps.
 - Each peer has download rate of 10 Mbps, and
 - Upload rate of each peer is 1 Mbps.
- Questions (Distribution time)
 - Time taken in client server mode ?
 - Does time change when server upload speed is
 - 100Mbps? 10Gbps?
 - Time taken in P2P mode when no chunks are used?
 - Time taken in P2P mode when chunks are used
 - Full file as one chunk i.e. Chunks of 100 Mbits
 - Chunks of 10 Mbits
 - Chunks of 1 Mbits

File distribution: client-server vs P2P

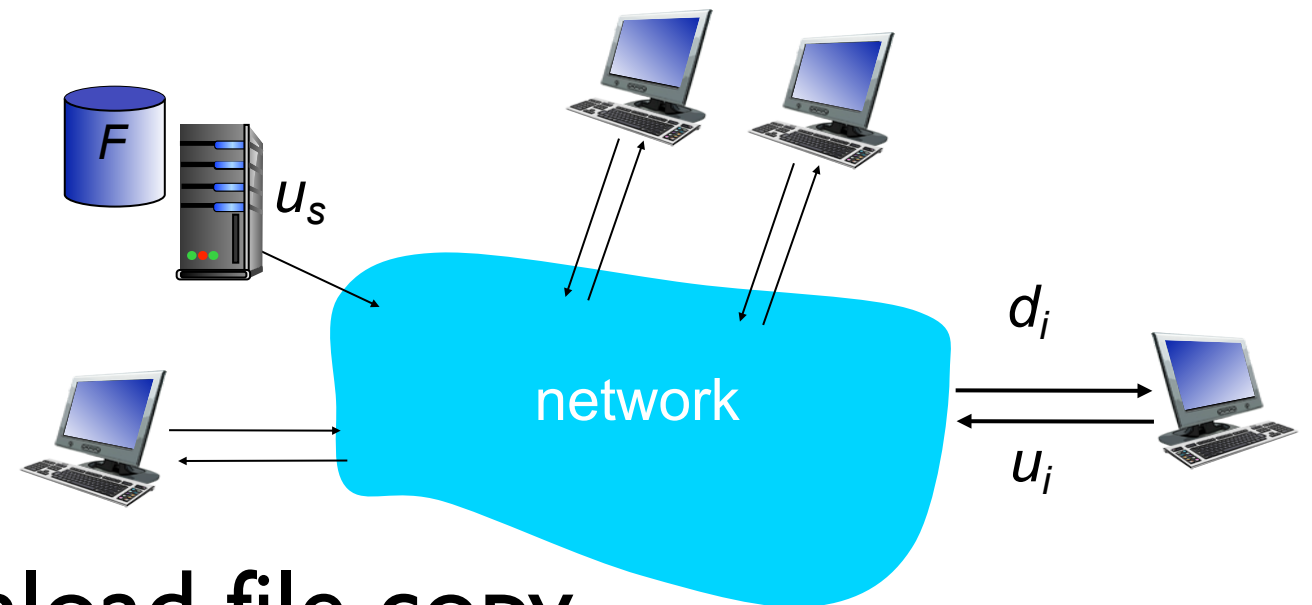
Question: How much time to distribute file (size F) from one server to N peers?

- Peer upload/download capacity is limited resource



File distribution time: client-server

- **server transmission:** must Sequentially send (upload) N file copies:
 - Time to send one copy: F/u_s
 - Time to send N copies: NF/u_s



- **client:** each client must download file copy
- d_{\min} = min client download rate
- Min client download time: F/d_{\min}

*time to distribute file F
to N clients using client-server approach*

$$D_{c-s} \geq \max\{NF/u_s, F/d_{\min}\}$$

increases linearly in N

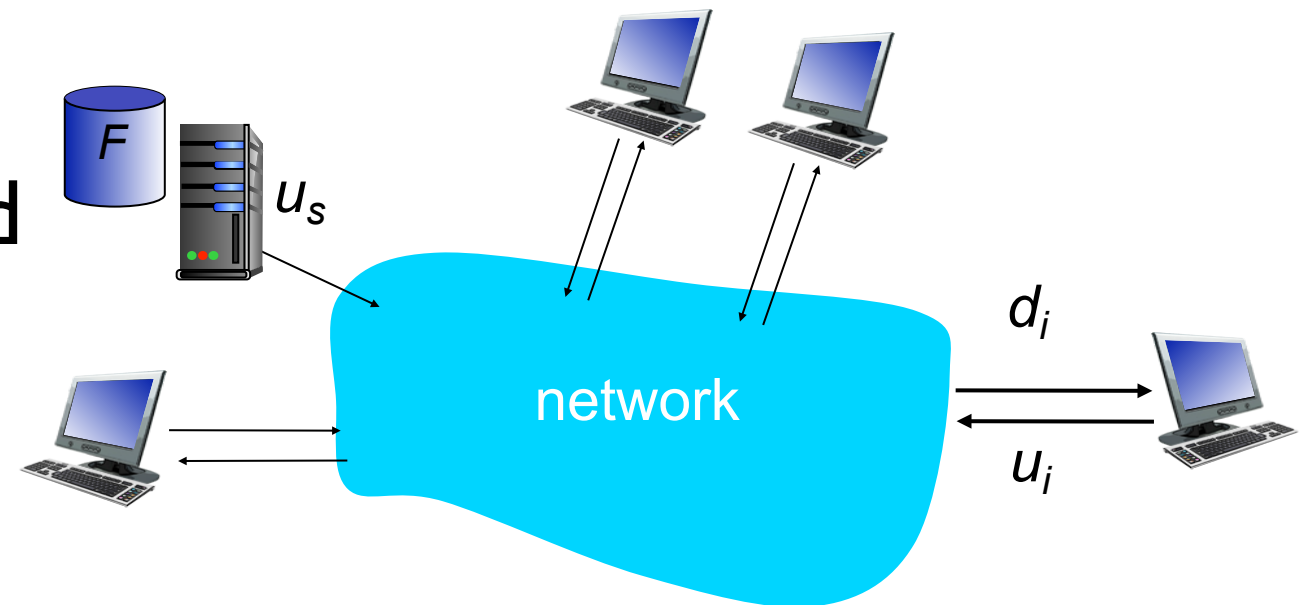
File distribution time: P2P

- **Server transmission:** must upload at least one copy

- Time to send one copy: F/u_s

- **Client:** each client must download file copy

- Min client download time: F/d_{\min}



- **Clients:** as aggregate must download NF bits
- Max upload rate (limiting max download rate) is $u_s + \sum u_i$

time to distribute F to N clients using P2P approach

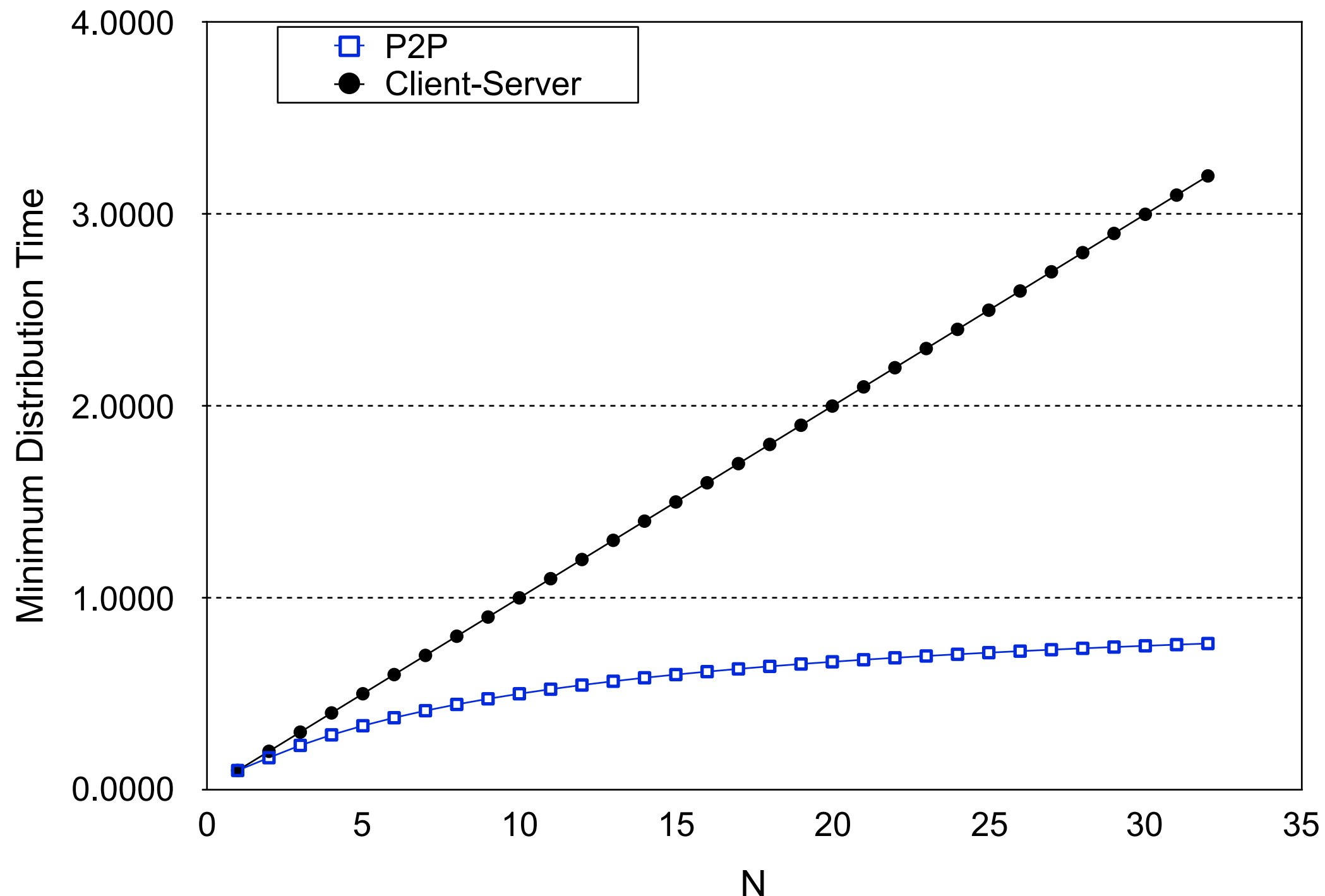
$$D_{P2P} \geq \max\{F/u_s, F/d_{\min}, NF/(u_s + \sum u_i)\}$$

increases linearly in N ...

... but so does this, as each peer brings service capacity

Client-server vs. P2P: example

client upload rate = u , $F/u = 1$ hour, $u_s = 10u$, $d_{\min} \geq u_s$
All peers have same download rate of u .



P2P Example

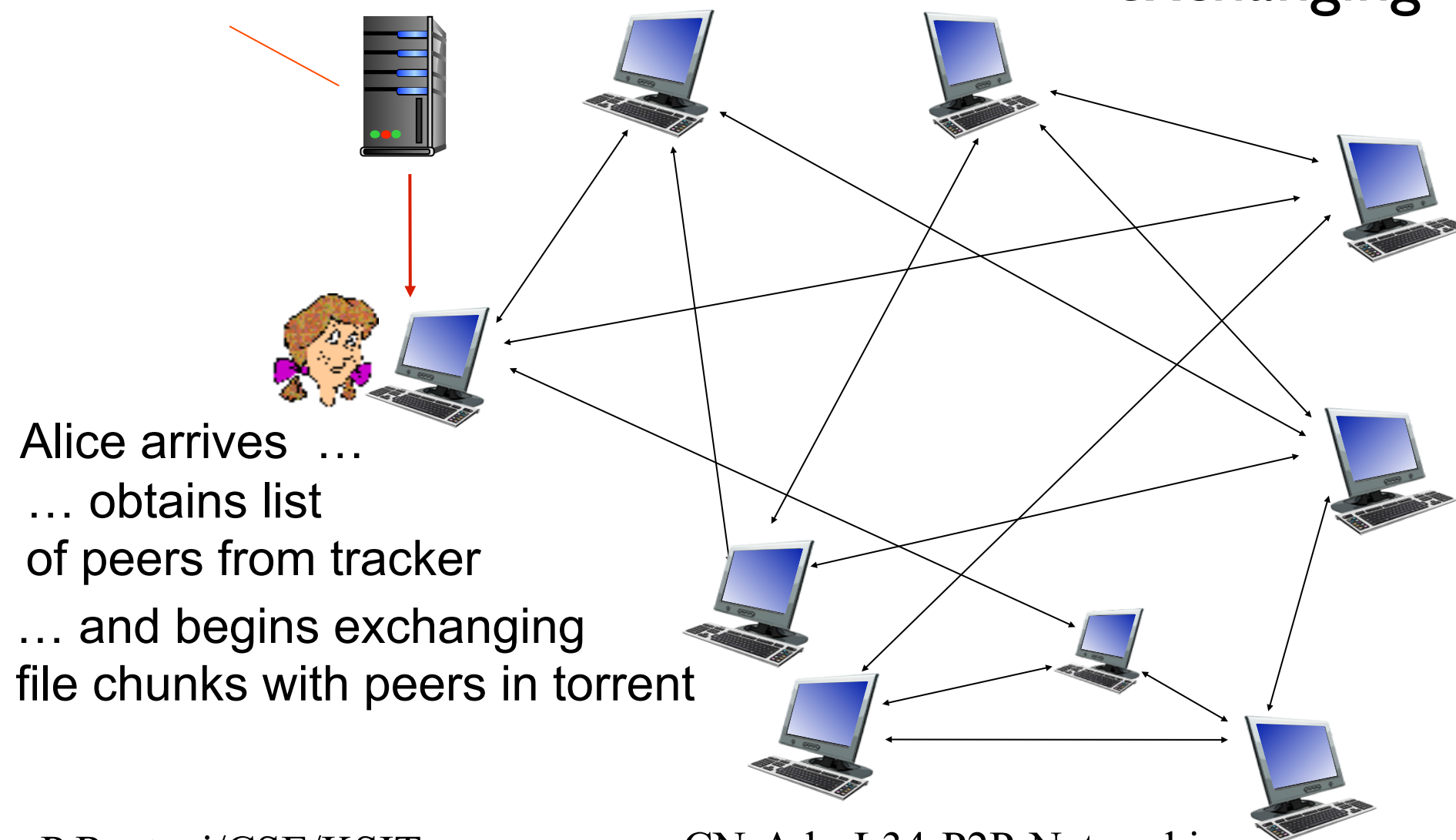
- Case: File distribution among all peers
 - A server has file of size 100 Mbits.
 - The file is to be distributed among 100 peers.
 - Server upload rate: 10 Mbps.
 - Each peer has download rate: 10 Mbps, upload rate: 1 Mbps
- Questions (Distribution time)
 - Time taken in client server mode ?
 - Time taken in P2P mode when no chunks are used?
 - Time taken in P2P mode when chunks are used
 - Full file as one chunk i.e. Chunks of 100 Mbits
 - a) Chunks of 10 Mbits, b) Chunks of 1 Mbits
 - Files
 - Ch02-P2P Distribution-FullFileAsChunk.xls
 - Ch02-P2P Distribution-10MbChunk.xls
 - Ch02-P2P Distribution-SmallChunk
- Animation:
 - <http://mg8.org/processing/bt.html>

P2P file distribution: BitTorrent

- file divided into 256Kb chunks
- peers in torrent send/receive file chunks

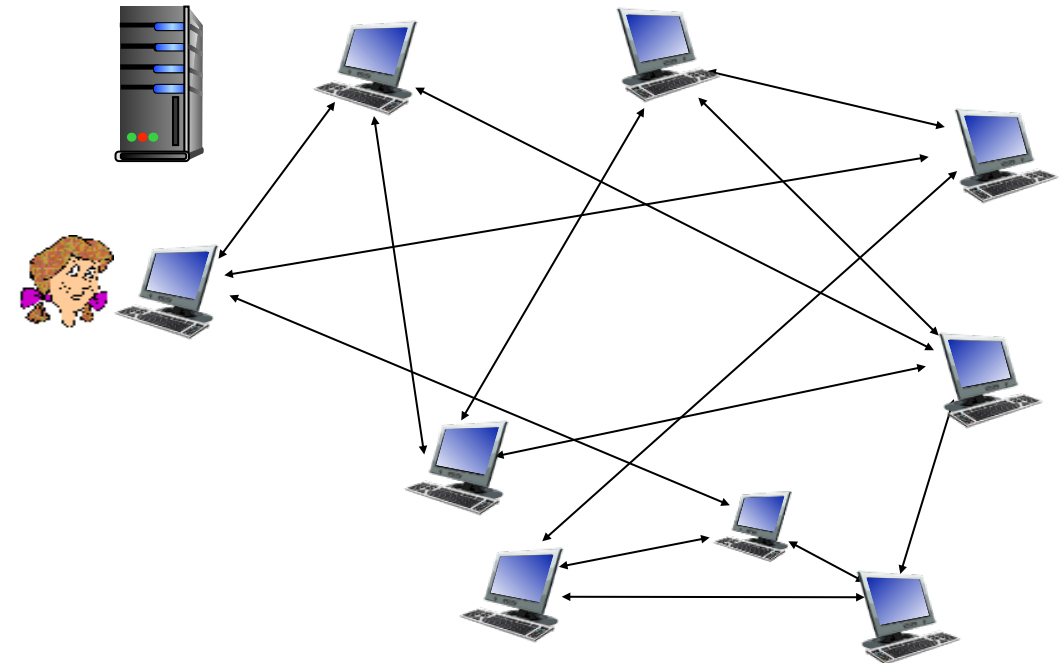
tracker: tracks peers participating in torrent

torrent: group of peers exchanging chunks of a file



P2P file distribution: BitTorrent

- peer joining torrent:
 - has no chunks, but will accumulate them over time from other peers
 - registers with tracker to get list of peers, connects to subset of peers (“neighbors”)
- while downloading, peer uploads chunks to other peers
- peer may change peers with whom it exchanges chunks
- **churn**: peers may come and go
- once peer has entire file, it may (selfishly) leave or (altruistically) remain in torrent

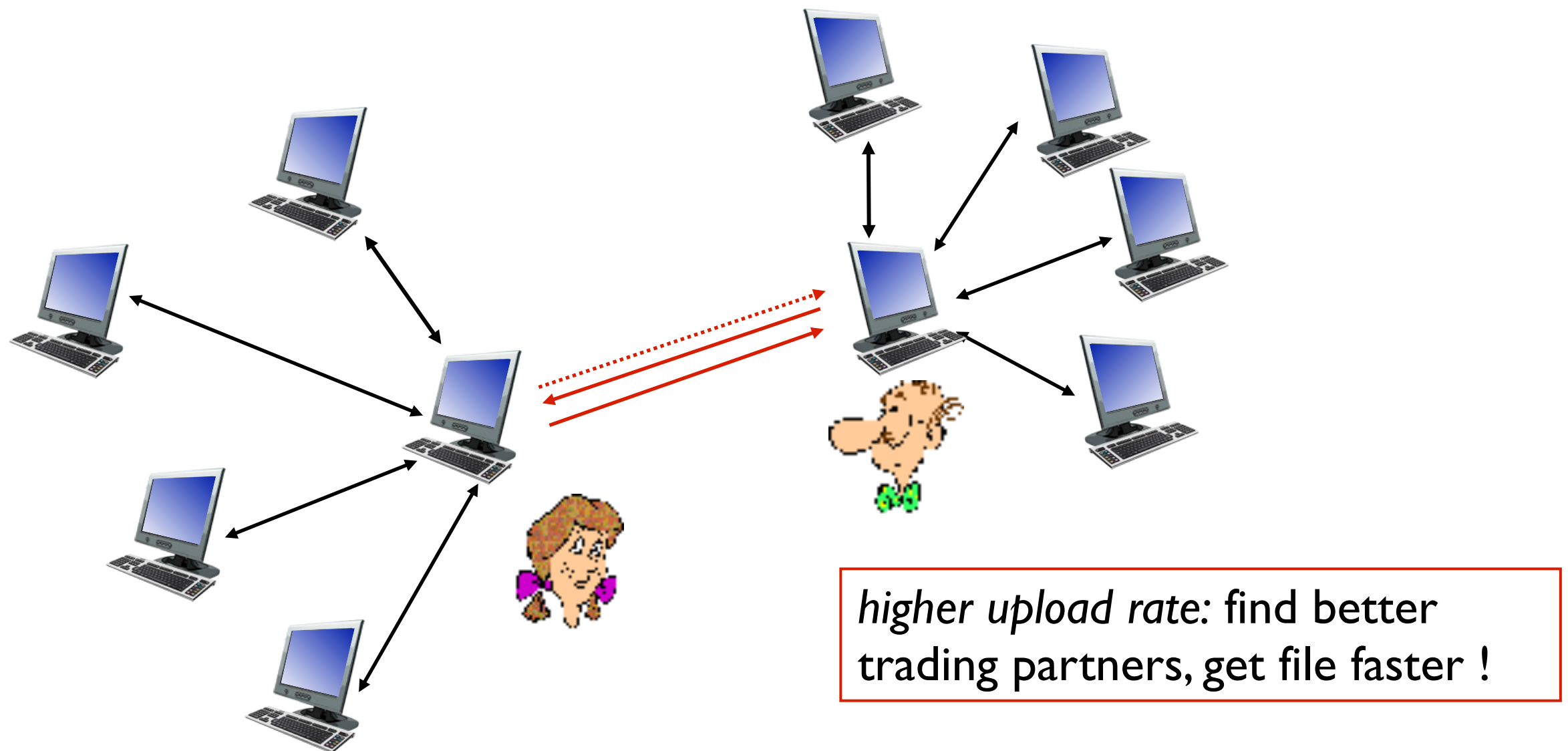


BitTorrent: requesting, sending file chunks

- *requesting chunks:*
- at any given time, different peers have different subsets of file chunks
- periodically, Alice asks each peer for list of chunks that they have
- Alice requests missing chunks from peers, **rarest first**
- *sending chunks: tit-for-tat*
- Alice sends chunks to those four peers currently sending her chunks *at highest rate*
- Called unchoked peers
- other peers are choked by Alice (do not receive chunks from her)
- re-evaluate top 4 every 10 secs
- every 30 secs: randomly select another peer, starts sending chunks
- “optimistically unchoke” this peer
- newly chosen peer may join top 4

BitTorrent: tit-for-tat

- (1) Alice “optimistically unchokes” Bob
- (2) Alice becomes one of Bob’s top-four providers; Bob reciprocates
- (3) Bob becomes one of Alice’s top-four providers



Summary

- P2P architecture
- File sharing (Download)
 - Client server approach
 - Peer to peer approach
- Bit Torrent implementation