National University

Of Computer & Emerging Sciences - Chiniot Faisalabad Campus

Computer Networks || Assignment # 2

Submission Guidelines

- The assignment should be **Handwritten.**
- Attempt all questions on A4 blank pages. Questions not done on A4blank pages will not be considered.
- Keep the questions in order. Not following the proper order will result in a marks deduction.
- **Plagiarism** will not be tolerated, either done from the internet or from anyclassmate and will lead to zero or negative marks in the assignment.
- Mention your **name**, **roll Number,** and **section** on the first page of yourassignment.
- No **late submissions** will be accepted.

Important Instruction

- Submit by hand before the deadline. Also, submit soft copy of assignment on Google Classroom

Question 1:

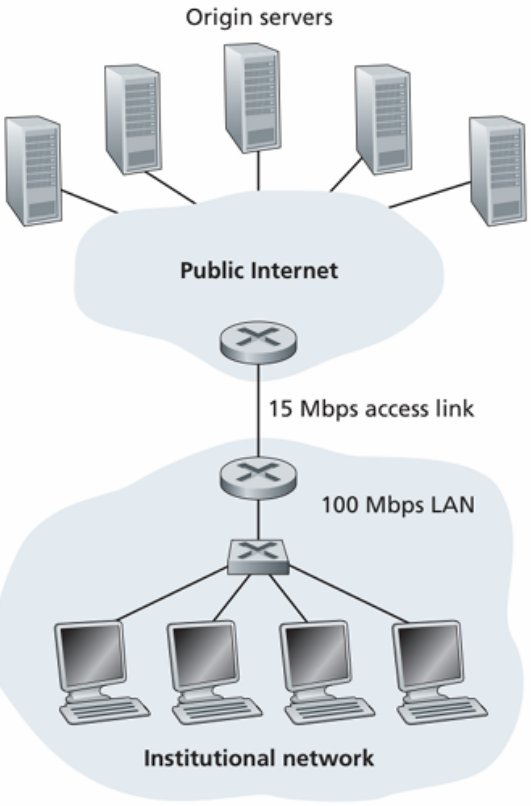

Figure 2.12 ♦ Bottleneck between an institutional network and the Internet

- Consider Figure 2.12, for which there is an institutional network connected to the Internet. Moreover, assume the access link has been upgraded to 54 Mbps, and the institutional LAN is upgraded to 10 Gbps. Suppose that the average object size is 1,600,000 bits and that the average

request rate from the institution's browsers to the original servers is 24 requests per second.

- Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is three seconds on average (see Section 2.2.5). Model the total average response time as the sum of the average access delay (that is, the delay from Internet router to institution router) and the average Internet delay. For the average access delay, use $\Delta/(1- \Delta b)$, where Δ is the average time required to send an object over the access link and b is the arrival rate of objects to the access link.
- Find the total average response time.
- Now suppose a cache is installed in the institutional LAN. Suppose the miss rate is 0.3. Find the total response time.

Question 2:

- Consider an overlay network with N active peers, with each pair of peers having an active TCP connection. Additionally, suppose that the TCP connections pass through a total of M routers. How many nodes and edges are there in the corresponding overlay network?
- How does SMTP mark the end of a message body? How about HTTP? Can HTTP use the same method as SMTP to mark the end of a message body? Explain.
- Consider sending over HTTP/2 a Web page that consists of one video file and three images. Suppose that the video clip is transported as 5000 frames, and each image captures four frames.
- If all the video frames are sent first without interleaving, how many "frame times" are needed until all images are sent?
- If frames are interleaved, how many frame times are needed until all three images are sent?

Question 3:

Consider distributing a file of F = 10 Gbits to N peers. The server has an upload rate of us = 1 Gbps, and each peer has a download rate of di = 200 Mbps and an upload rate of u. For N = 10, 100, and 1,000 and u =2Mbps, 10 Mbps, and 100 Mbps, prepare a table giving the minimum distribution time in seconds for each of the combinations of N and u for both client-server distribution and P2P distribution.

Question 4:

- Internet videos have multiple versions of the same video, at different rates suppose 300kbps, 1Mbps, and 3Mbps. Users watching the video over 3G with a smartphone might choose the 300kbps version.

- Users can decide the download version they want to watch as a result of their current available bandwidth, keeping in mind Higher the bit rate, the better the image quality and the better the overall user viewing experience.

- Explain with the help of numerical calculations why should this user use a 300kbps, not 1 or 3 Mbps video. (Considering how 3G networks have limited Bandwidth)

Question 5:

Consider distributing a file of F = 15 Gbits to N peers. The server has an upload rate of u_s = 30 Gbps, and each peer has a download rate of d_i = 2 Mbps and an upload rate of u. For N = 10, 100, and 1,000 and u = 300 Kbps, 700 Kbps, and 2 Mbps, prepare a table giving the minimum distribution time in seconds for each of the combinations of N and u for both
client-server distribution and P2P distribution.