

CS 4316/5313: Computer Networks

Homework 1

(24 pts)

1. Suppose end system A wants to send a large file to end system B. At a very high level, describe how end system A creates packets from the file. When one of these packets arrives to a router, what information in the packet does the router use to determine the link onto which the packet is forwarded? Why is packet switching in the Internet analogous to driving from one city to another and asking directions along the way?
2. What advantage does a circuit-switched network have over a packet-switched network? What advantages does TDM have over FDM in a circuit-switched network?
3. Consider sending a packet from a source host to a destination host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are constant and which are variable?
4. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates $R_1 = 500$ kbps, $R_2 = 2$ Mbps, and $R_3 = 1$ Mbps.
 - a. Assuming no other traffic in the network, what is the throughput for the file transfer?
 - b. Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?
 - c. Repeat (a) and (b), but now with R_2 reduced to 100 kbps.
5. How can websites keep track of users? Do they always need to use cookies? List five nonproprietary Internet applications and the application-layer protocols that they use.
6. Describe how Web caching can reduce the delay in receiving a requested object. Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?
7. Assume you open a browser and enter *http://yourbusiness.com/about.html* in the address bar. What happens until the webpage is displayed? Provide details about the protocol(s) used and a high-level description of the messages exchanged.
8. Consider the following string of ASCII characters that were captured by Wireshark when the browser sent an HTTP GET message (i.e., this is the actual content of an HTTP GET message). The characters `<cr><lf>` are carriage return and line-feed characters (that is, the italicized character string `<cr>` in the text below represents the single carriage-return character that was contained at that point in the HTTP header). Answer the following questions, indicating where in the HTTP GET message below you find the answer.

```
GET /cs453/index.html HTTP/1.1<cr><lf>Host: gai a.cs.umass.edu<cr><lf>User-Agent: Mozilla/5.0 ( Windows;U; Windows NT 5.1; en-US; rv:1.7.2) Gec ko/20040804 Netscape/7.2
```

(ax) <cr><lf>Accept:ex t/xml, application/xml, application/xhtml+xml, text /html;q=0.9,
text/plain;q=0.8,image/png, */*;q=0.5.
<cr><lf>Accept-Language: en-us,en;q=0.5<cr><lf>Accept- Encoding:
zip,deflate<cr><lf>Accept-Charset: ISO -8859-1,utf-8;q=0.7, *,*;q=0.7<cr><lf>Keep-Alive:
300<cr> <lf>Connection:keep-alive<cr><lf><cr><lf>

- a. What is the URL of the document requested by the browser?
- b. What version of HTTP is the browser running?
- c. What is the IP address of the host on which the browser is running?
- d. What type of browser initiates this message? Why is the browser type needed in an HTTP request message?