

Computer Network Midterm 107-1

1. Consider a message that is to be sent from source to destination through 4 packet switches. Suppose each link is 3Mbps and the sum of each link's propagation, queuing, and processing delays is 10 msec. Suppose the message is segmented into 10000 packets, with each packet being 6000 bits long. How long (in second) does it take to move message from source to destination with message segmentation (12%) (要有中間過程的計算式或說明，以及最後答案)

Ans:

Time to send 1st packet from source host to first packet switch = $6000/3*10^6=2\text{msec}$. (4%)

Time at which 1st packet is received at the destination host = $(2+10) \text{ msec} * 5\text{hops} = 60 \text{ msec}$. (4%) After this, every 2msec one packet will be received; thus time at which last (10000th) packet is received = $60 \text{ msec} + 9999*2\text{msec} = 20.058 \text{ sec}$. (4%)

2. Assume you request a webpage consisting of one document and ten images. The document size is 5kbyte, all images have the same size of 50 kbytes, the download rate is 1Mbps, and the RTT is 200ms. How long does it take to obtain the whole webpage under the following conditions? Why? (要說明(a)(b)的動作與計算過程每個部分在算什麼值) (Assume no DNS name query is needed and the impact of the request line and the headers in the HTTP messages is negligible). (14% total)
- a. Nonpersistent HTTP with serial connections. (7%)
- b. Persistent HTTP with one connection. (7%)

Ans:

The total download time is:

- a. At most one object is sent over a TCP connection. (2%)

$$2 \cdot 200 \text{ ms} \left(\text{TCP handshaking} + \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for web page} \right) + \frac{8 \cdot 5 \cdot 10^3 \text{ bits}}{\frac{10^6 \text{ bits}}{\text{s}}} (\text{document transmission delay}) + 10 \cdot \left\{ 2 \cdot 200 \text{ ms} \left(\text{TCP handshaking} + \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for 1 object} \right) + \frac{8 \cdot 50 \cdot 10^3 \text{ bits}}{\frac{10^6 \text{ bits}}{\text{s}}} (\text{image transmission delay}) \right\} = 400 \text{ ms} + 40 \text{ ms} + 10 * (400 \text{ ms} + 400 \text{ ms}) = 8.44 \text{ sec} \text{ (1\% each, 5\% total)}$$

- b. Multiple objects can be sent over single TCP connection between client and server. The browser first waits to receive a HTTP response from the server before issuing a new HTTP request. (2%)

$$2 \cdot 200 \text{ ms} \left(\text{TCP handshaking} + \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for web page} \right) + \frac{8 \cdot 5 \cdot 10^3 \text{ bits}}{\frac{10^6 \text{ bits}}{\text{s}}} (\text{document transmission delay}) + 10 \cdot \left\{ 200 \text{ ms} \left(\text{HTTP} \frac{\text{request}}{\text{response}} \text{ for 1 object} \right) + \frac{8 \cdot 50 \cdot 10^3 \text{ bits}}{\frac{10^6 \text{ bits}}{\text{s}}} (\text{image transmission delay}) \right\} = 400 \text{ ms} + 40 \text{ ms} + 10 * (200 \text{ ms} + 400 \text{ ms}) = 6.44 \text{ sec. (1\% each, 5\% total)}$$

3. Describe two application architectures. (8%)

Ans: (a) client-server (2%)

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server:

always-on host, permanent IP address (1%)

clients:

communicate with server, do not communicate directly with each other

may be intermittently connected and have dynamic IP addresses (1%)

(b) peer-to-peer: (2%)

no always-on server (1%)

arbitrary end systems directly communicate

peers are intermittently connected and change IP addresses (1%)

4. Explain the following terms (a) bandwidth (2%) (b) IETF RFC (2%) (c) List two kinds of wireless access networks (4%) (d) How do loss occur in router buffers? (2%) (e) Network Throughput (2%) (f) Which two identifiers are used to identify a process? (2%) (g) Which program can provide delay measurement from source to router along end-end Internet path towards destination? (2%) (h) Why do we use the layered Internet protocol stack? (2%) (2% each, 18% total)

Ans: (a) bandwidth: link transmission rate (2%)

(b) IETF RFC: Internet standards (2%)

(c) wireless LANs and wider-area wireless access (4%)

(d) arriving packets dropped (loss) if no free buffers (2%)

(e) Network Throughput: rate (bits/time unit) at which bits transferred between sender/receiver (2%)

(f) Identifier includes both IP address and port numbers associated with process on host (2%)

(g) Traceroute (2%)

(h) Modularization eases maintenance, updating of system (2%)

5. (a) Web page consists of base HTML-file which includes several referenced objects. Which identifier is used to address each object? (2%)
- (b) This identifier consists of two parts. List them. (4%)
- (c) Describe operations of HTTP between client and server processes. (4%)
- (d) What is the HTTP server port (2%)
- (e) What is meant by a handshaking protocol? (2%)
- (f) Socket (4%) (18% total)

Ans:

a) by a URL (2%)

b) host name and path name (4%)

c) HTTP: hypertext transfer protocol

❖ *HTTP client*: browser that requests, receives, “displays” Web objects (2%)

❖ *HTTP server*: Web server sends objects in response to requests (2%)

d) Port 80 (2%)

e) A protocol uses handshaking if the two communicating entities first exchange control packets before sending data to each other. (2%)

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f) process sends/receives messages to/from its socket (4%)

6. An application-layer protocol defines four items. What are they? (8%)

Ans:

- (i) The types of messages exchanged (2%), for example, request messages and response Messages.
- (ii) The syntax of the various message types (2%), such as the fields in the message and how the fields are delineated.
- (iii) The semantics of the fields (2%), that is, the meaning of the information in the fields.
- (iv) Rules for determining when and how a process sends messages and responds to messages. (2%)

7. 答案請畫表格出來 (0.5%, 10%)

Application	Application layer protocol	Transport layer protocol	Data Loss	Elastic Bandwidth	Time Sensitive
File transfer	FTP	TCP	No	Yes	No
e-mail	SMTP	TCP	No	Yes	No
Web	HTTP	TCP	No	Yes	No
Real-time streaming multimedia	HTTP, RTP (都要寫)	TCP, UDP (都要寫)	Yes	No	Yes

8. Consider the figure below, where a client is sending an HTTP GET message to a web server, gaia.cs.umass.edu. Suppose the client-to-server HTTP GET message is the following: (12%)

GET /kurose_ross/interactive/hello.htm HTTP/1.0

Host: gaia.cs.umass.edu

Accept: text/plain, text/html, text/xml, image/png, image/jpeg, audio/vmf.wave, audio/basic, video/mpeg, video/wmv, application/, */**

Accept-Language: en-us, en-gb;q=0.6, en;q=0.1, fr, fr-ch, de, ar

If-Modified-Since: Mon, 13 Nov 2013 09:00:58 EST

User Agent: Mozilla/5.0 (Windows NT 6.1; WOW64; rv:10.0.2) Gecko/20100101 Firefox/10.0.2

Answer the following questions:

1. What tool can capture (“sniff”) messages being sent/received from/by your computer? (4%)
2. How to capture the HTTP GET message with this tool? (4%)
3. What is the name of the file that is being retrieved in this GET message? (2%)
4. What version of HTTP is the client running? (2%)

Ans:

1. The packet sniffer (Wireshark) (4%)
2. Run the tool first and then enter the URL in the browser. (4%)
3. The file being fetched is /kurose_ross/interactive/hello.htm (2%)
4. The client is running HTTP version 1.0. (2%)