Computer Network Midterm 105-1

1. Consider a message that is to be sent from source to destination through 5 packet switches. Suppose each link is 2Mbps. Ignore propagation, queuing, and processing delays. Suppose the message is segmented into 20000 packets, with each packet being 3000 bits long. How long (in second) does it take to move message from source to destination with message segmentation (10%) (要有中間過程的計算式或說明，以及最後答案)

Ans:

a) Time to send 1st packet from source host to first packet switch = $\frac{3\times10^3}{2\times10^6}\text{sec} = 1.5\,m\text{sec}$. (3%)

Time at which 1st packet is received at the destination host = $1.5m\text{sec}\times 6\,hops = 9\,m\text{sec}$. (3%) After this, every 1.5msec one packet will be received; thus time at which last (20000th) packet is received = $9m\text{sec} + 19999 * 1.5m\text{sec} = 30.0075\text{sec}$. (4%)

2. (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) Why IP address of host does not suffice for identifying the process? (2%)? (14% 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) many processes can be running on same host (2%)

3. Describe the client-server and peer-to-peer application architectures. (12%)

Ans: (a) server:

always-on host, permanent IP address (2%)

clients:

communicate with server, do not communicate directly with each other (2%)

may be intermittently connected and have dynamic IP addresses (2%)

(b) peer-to-peer:

no always-on server (2%)

arbitrary end systems directly communicate or peers request service from other peers, provide service in return to other peers (2%)

peers are intermittently connected and change IP addresses (2%)

4. Classify Dial-up modem over telephone line, DSL over telephone line, Cable to HFC, 100 Mbps switched Ethernet, Wifi (802.11) and 3G and 4G as home access, enterprise access, or wide-area wireless access. (12%)

Ans: (配對要正確)

1. Dial-up modem over telephone line: home access; (2%)
2. DSL over telephone line: home or small office; (2%)
3. Cable to HFC: home; (2%)
4. 100 Mbps switched Ethernet: enterprise; (2%)

5. Wifi (802.11): home and enterprise: (2%)

6. 3G and 4G: wide-area wireless. (2%)

5. 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%)

6. List four broad classes of services that a transport protocol can provide (8%).

Ans:

a) Reliable data transfer or data integrity (2%)

b) A guarantee that a certain value for throughput will be maintained (2%)

c) A guarantee that data will be delivered within a specified amount of time (2%)

d) Security (2%)

7. Suppose within your web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that 2 DNS servers are visited before your host receives the IP address from DNS; visiting 1 of them incurs an RTT of D_1 per DNS and visiting each of remaining incurs an RTT of D_2. Further suppose that the web page associated with the link contains 5 very small objects on the same server. Suppose the HTTP is running and let RTT_0 denote the RTT between the local host and the server for each object. Assume zero transmission time of each object, (a) how they work? (b) how much time elapses from when the client clicks on the link until the client receives all the objects? (a) non-persistent HTTP with no parallel TCP connections? (b) persistent HTTP without pipelining? (c) Persistent HTTP with pipelining? ((說明每項的動作(2%)，並要說明每項動作的執行時間算式(4%)，不能只寫最後答案) (6% each, 18%)

Ans:

a) non-persistent HTTP with no parallel TCP connections:
   At most one object is sent over a TCP connection. *(2%)*
   The total time to get the IP address is 1*D*1 + 1*D*2. After this, 2RTT0 is required to set up each of the *5* TCP connections and to request and receive each HTTP object. Thus, the total response time is *1D*1 + 1*D*2 (1%) + 1 RTT_0 (TCP handshaking) + 1 RTT_0 (HTTP request/response for web page) (1%) +5* [1 RTT_0 (non-parallel TCP handshaking) +1 RTT_0 (HTTP request/response for 5 objects)] (1%) = *D*1 + *D*2 + 12 RTT0 (1%)

b) persistent HTTP without pipelining:
   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%)*
   *1D*1 + 1*D*2 (1%) + 1 RTT_0 (TCP handshaking) + 1 RTT_0 (HTTP request/response for web page) (1%) + 5* 1 RTT_0 (HTTP request/response for 5 objects) (1%) = *D*1 + *D*2 + 6 RTT0 (1%)

c) persistent HTTP with pipelining:
   The browser issues requests without waiting for response messages from the server. (*2%)*
   *1D*1 + 1*D*2 (1%) + 1 RTT_0 (TCP handshaking) + 1 RTT_0 (HTTP request/response for web page) (1%) + 1 RTT_0 (HTTP request/response for 5 objects) (1%) = *D*1 + *D*2 + 3 RTT0 (1%)

8. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of

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rates R1=250kbps, R2= 2Mbps, and R3=1Mbps. (要有計算式或說明，以及最後答案) (8% total)

a. Assume no other traffic in the network, what is the throughput for the file transfer? (2%)

b. Suppose the file is 8 million bytes. Dividing the file size by the throughput, roughly how long (in second) will it take to transfer the file to Host B? (2%)

c. Repeat (a) and (b), but now with R2 reduced to 100kbps. (2%) (2%)

Ans :

a) min{250kbps, 2Mbps, 1Mbps}=250kbps (2%)

b) $8*10^6*8/(250*10^3)$=256 seconds (2%)

c) min{250kbps, 100kbps, 1Mbps}=100kbps; (2%)

$8*10^6*8/(100*10^3)$=640 seconds (2%)

9. (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
Internet telephony	SIP, RTP, proprietary (任一個)	TCP or UDP （都要寫）	Yes	No	Yes