

## Computer Network Midterm 108-1

1. Describe detailed operations of HTTP cookie, web caching and conditional GET. (6\*3=18%) (說明其用處，並畫圖加解釋每步驟)
2. Describe FTP operations (8%). Which port does the FTP client contact with the FTP server? (2%) (10% total)
3. What are the major differences between SMTP and POP3? (4%) Draw a figure to show the mail-sending flow and all necessary modules among two end users. (6%) (10% total)
4. Classify Dial-up modem over telephone line, DSL over telephone line, Cable to HFC, 100 Mbps switched Ethernet, Wi-Fi (802.11) and 3G and 4G as home access, enterprise access, or wide-area wireless access. (12%)
5. For the encapsulation/decapsulation processes of the Internet protocol stack, (a) what are the first layers, the second layers, the third layers to perform? (6% , 分 encapsulation process 與 decapsulation process 兩部分) (b) Besides, you have to write the name of data unit of upper four layer. (寫出最上面四層資料單位的專有名稱) (4%) (10% total)
6. Assume you request a webpage consisting of one document and 6 images. The document size is 1kbyte, all images have the same size of 10 kbytes, the download rate is 2Mbps, and the RTT is 300ms. How long in second (秒為單位) does it take to obtain the whole webpage under the following conditions? Why? (要說明(a)(b)(c)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). (18% total)
  - a. Nonpersistent HTTP with serial connections. (說明 2%, 計算過程與結果 4%)
  - b. Persistent HTTP with one connection.
  - c. Persistent HTTP with pipelining
7. (a) Compare the circuit switching and packet switching on resource usage, performance, and call setup. (6%) (b) Draw two figures to explain two circuit switching techniques. (4%) (10% total)
8. (a) What is the process? (2%)  
(b) What are the Client process and Server process? (4%)  
(c) Does IP address of host on which process runs suffice for identifying the process? (2%) Why? (2%)  
(d) Which identifier is used to identify a process? (2%) (12% total)

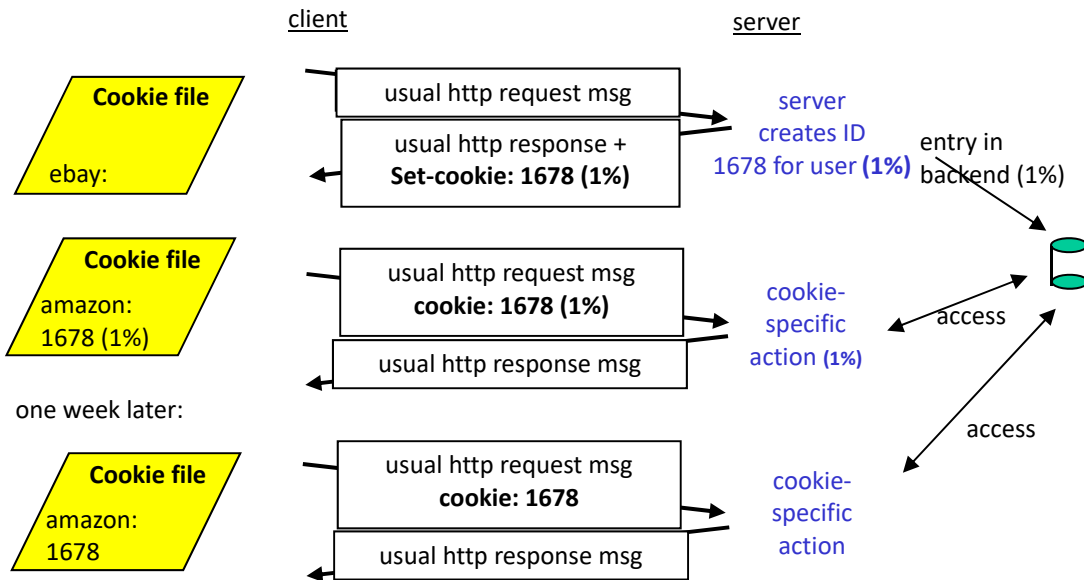
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1. Describe detailed operations of HTTP cookie, web caching and conditional GET. (6\*3=18%) (說明其用處，並畫圖加解釋每步驟)

Ans:

☐ cookie:

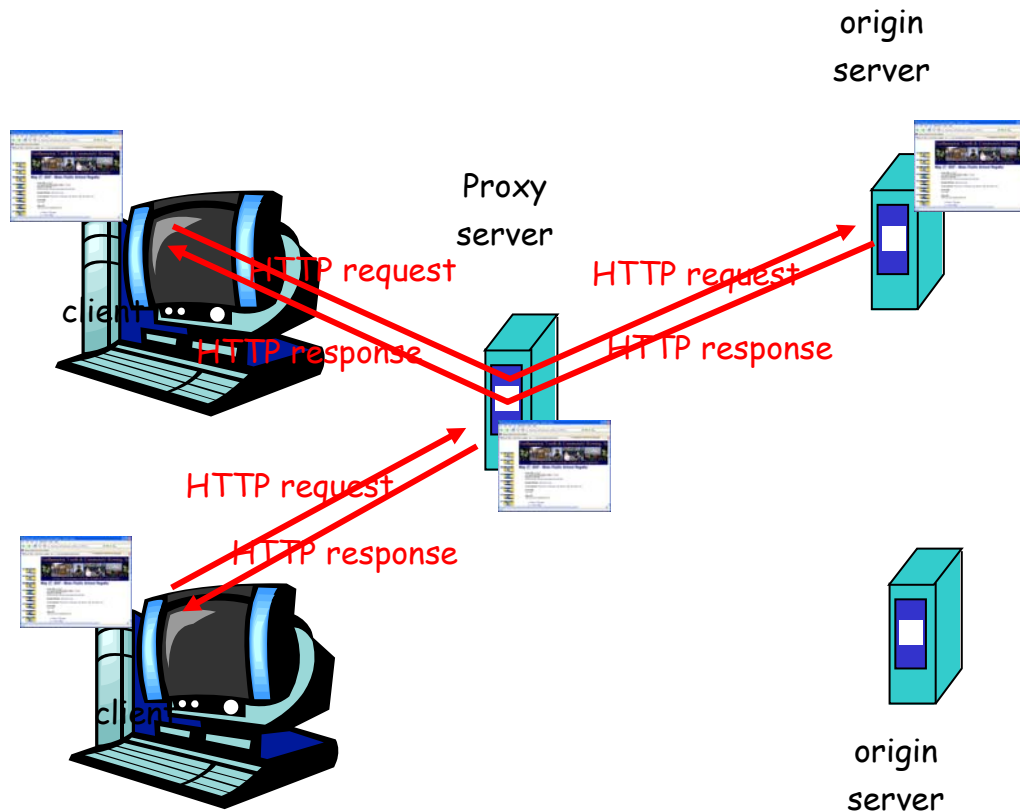
when a user visits a specific web site for first time and initial HTTP requests arrives at site, site creates a unique ID and creates an entry in backend database for recording user states of this ID.  
=> keep client's states (cookie-specific action)!



☐ web caching:

- user sets browser: Web accesses via cache
- browser sends all HTTP requests to cache (2%)
  - if object in cache
    - cache returns object (2%)
  - else
    - cache requests object from origin server, then returns object to client (2%)

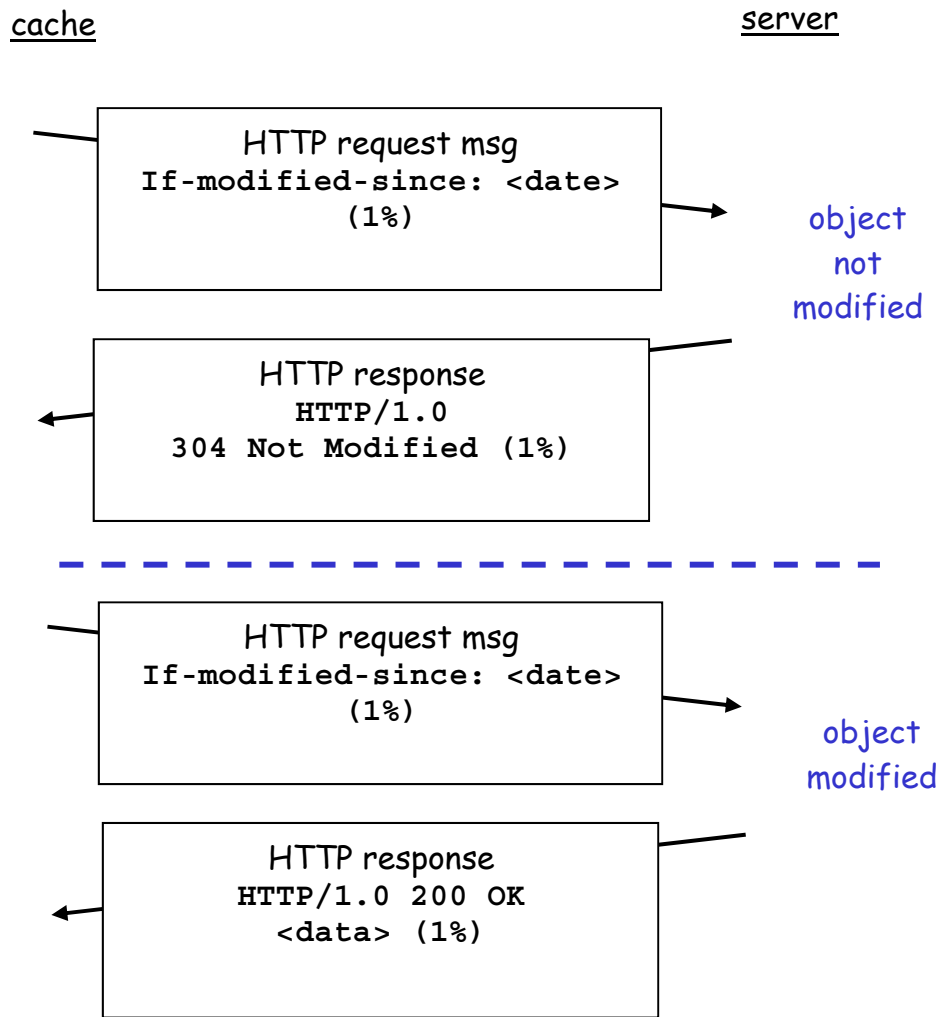
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### conditional GET (6%)

- Conditional GET: don't send object if cache has up-to-date cached version (1%) => reduce traffic loads (delays) on network links! (1%)
  - cache: specify date of cached copy in HTTP request (1%)
    - If-modified-since: <date>** (1%)
  - server: response contains no object if cached copy is up-to-date: (1%)
    - HTTP/1.0 304 Not Modified** (1%)

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2. Describe FTP operations (8%). Which port does the FTP client contact with the FTP server? (2%) (10% total)

Ans:

- FTP client contacts FTP server at port 21, specifying TCP as transport protocol (4%)
- Client obtains authorization and sends commands over control connection (2%)
- When server receives a command for a file transfer, the server opens a TCP data connection to client. (2%) After transferring one file, server closes connection. (2%)

3. What are the major differences between SMTP and POP3? (4%) Draw a figure to show the mail-sending flow and all necessary modules among two end users. (6%) (10% total)

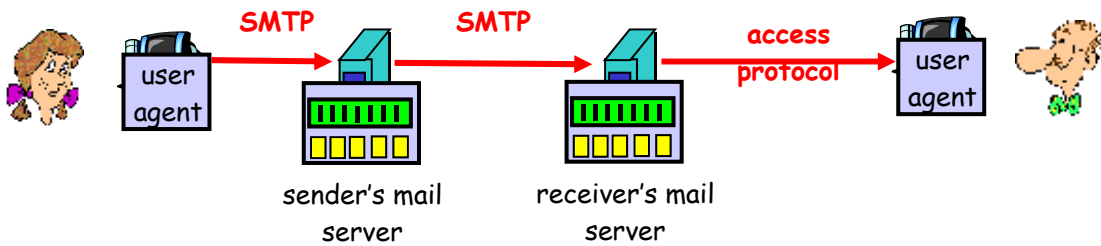
Ans:

POP: Mail access protocol: retrieval from server (説明 2%)

SMTP:

- direct transfer between mail servers to send email messages (説明 2%)

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(1% each, 6% total)

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. For the encapsulation/decapsulation processes of the Internet protocol stack, (a) what are the first layers, the second layers, the third layers to perform? (6% , 分 encapsulation process 與 decapsulation process 兩部分) (b) Besides, you have to write the name of data unit of upper four layer. (寫出最上面四層資料單位的專有名稱) (4%) (10% total)

Ans:

- (a)  
Source encapsulation process: application layer -> transport layer -> network layer  
Destination decapsulation process: physical layer -> link layer -> network layer 各 1% , 共 6%

- (b)  
application layer: message  
transport layer: segment  
network layer: datagram  
link layer: frame  
各 1% , 共 4%

6. Assume you request a webpage consisting of one document and 6 images. The document size is 1kbyte, all images have the same size of 10 kbytes, the download rate is 2Mbps, and the RTT is 300ms. How long in second (秒為單位) does it take to obtain the whole webpage under the following conditions? Why? (要說明(a)(b)(c)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). (18% total)
- a. Nonpersistent HTTP with serial connections. (說明 2%, 計算過程與結果 4%)
  - b. Persistent HTTP with one connection.
  - c. Persistent HTTP with pipelining

Ans:

The total download time is:

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

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$2 \cdot 300 \text{ ms} \left( \text{TCP handshaking} + \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for web page} \right) +$

$$\frac{8 \cdot 10^3 \text{ bits}}{\frac{2 \cdot 10^6 \text{ bits}}{s}} \text{ (document transmission delay)} + 6 \cdot \left\{ 2 \cdot 300 \text{ ms} \left( \text{TCP handshaking} + \right. \right. \\ \left. \left. \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for 1 object} \right) + \frac{8 \cdot 10^3 \text{ bits}}{\frac{2 \cdot 10^6 \text{ bits}}{s}} \text{ (image transmission delay)} \right\} = 600 \text{ ms} + 4 \text{ ms} + 6 \cdot \\ (600 \text{ ms} + 40 \text{ ms})(2\%) = 4.444 \text{ sec (2\%)} \text{ (4\% total)}$$

- 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%)

$2 \cdot 300 \text{ ms} \left( \text{TCP handshaking} + \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for web page} \right) +$

$$\frac{8 \cdot 10^3 \text{ bits}}{\frac{2 \cdot 10^6 \text{ bits}}{s}} \text{ (document transmission delay)} + 6 \cdot \left\{ 300 \text{ ms} \left( \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for 1 object} \right) + \right. \\ \left. \frac{8 \cdot 10^3 \text{ bits}}{\frac{2 \cdot 10^6 \text{ bits}}{s}} \text{ (image transmission delay)} \right\} = 600 \text{ ms} + 4 \text{ ms} + 6 \cdot (300 \text{ ms} + 40 \text{ ms})(2\%) = \\ 2.644 \text{ sec (2\%)} \text{ (4\% total)}$$

- c. persistent HTTP with pipelining:

The browser issues requests as soon as it has a need to do so, without waiting for response messages from the server. (2%)

$2 \cdot 300 \text{ ms} \left( \text{TCP handshaking} + \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for web page} \right) +$

$$\frac{8 \cdot 10^3 \text{ bits}}{\frac{2 \cdot 10^6 \text{ bits}}{s}} \text{ (document transmission delay)} + 300 \text{ ms} \left( \text{HTTP} \frac{\text{request}}{\text{response}} \text{ for 6 objects} \right) + 6 \cdot \\ \left\{ \frac{8 \cdot 10^3 \text{ bits}}{\frac{2 \cdot 10^6 \text{ bits}}{s}} \text{ (image transmission delay)} \right\} = 600 \text{ ms} + 4 \text{ ms} + 300 \text{ ms} + 6 \cdot 40 \text{ ms (2\%)} = \\ 1.144 \text{ sec (2\%)} \text{ (4\% total)}$$

7. (a) Compare the circuit switching and packet switching on resource usage, performance, and call setup. (6%) (b) Draw two figures to explain two circuit switching techniques. (4%) (10% total)

Ans:

- (a) Circuit-switching: (1% each, total 6%)

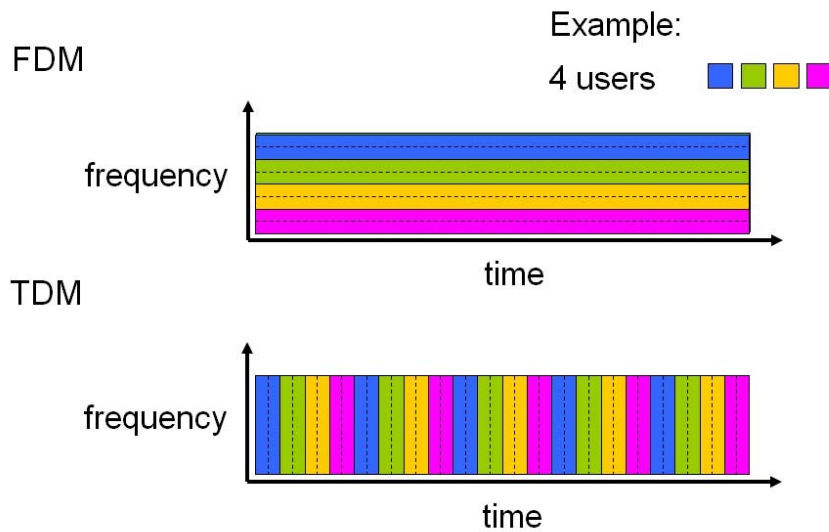
- i. end-end resources reserved for "call", like link bandwidth, switch capacity. dedicated resources: no sharing
- ii. circuit-like (guaranteed) performance
- iii. call setup required

Packet-switching:

- i. each end-end data stream divided into *packets*. User A, B packets *share* network resources as *needed*
- ii. resource contention may degrade performance.
- iii. no call setup required

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(b) Draw two figures to explain two circuit switching techniques. (4%)



8. (a) What is the process? (2%)  
(b) What are the Client process and Server process? (4%)  
(c) Does IP address of host on which process runs suffice for identifying the process? (2%) Why? (2%)  
(d) Which identifier is used to identify a process? (2%) (12% total)

Ans:

- (a) A program running within a host (2%)  
(b) Client process: process that initiates communication (2%)  
Server process: process that waits to be contacted (2%)  
(c) No (2%), many processes can be running on same host (2%)  
(d) Identifier includes both IP address and port numbers associated with process on host (2%)