Computer Networks Midterm II (100/11)

1. The text below shows the reply sent from the server in response to the HTTP GET message in 8.
   (a) Was the server able to successfully find the document or not?
   (b) When was the document last modified?
   (c) How many bytes are there in the document being returned? (3% each, 9% total)

```
HTTP/1.1 200 OK<cr><lf>Date: Tue, 07 Mar 2006
12:39:45GMT<cr><lf>Server: Apache/2.0.52 (Fedora)
<cr><lf>Last-Modified: Sat, 10 Dec2005 18:27:46
GMT<cr><lf>ETag: "526c3-f22-a88a4c80"<cr><lf>Accept-
Ranges: bytes<cr><lf>Content-Length: 3874<cr><lf>
Keep-Alive: timeout=max=100<cr><lf>Connection:
Keep-Alive<cr><lf>Content-Type: text/html; charset=
ISO-8859-1<cr><lf><cr><lf><!doctype html public "-
//w3c//dtd html 4.0 transitional//en"><lf><html><lf>
<head><lf>  <meta http-equiv="Content-Type"
content="text/html; charset=iso-8859-1"><lf> <meta
name="GENERATOR" content="Mozilla/4.79 [en] (Windows NT
5.0; U) Netscape]"><lf>  <title>CMPSCI 453 / 591 /
NTU-ST550A Spring 2005 homepage</title><lf></head><lf>
```

Ans: (2% each)

a) The status code of 200 and the phrase OK indicate that the server was able to locate the document successfully. The reply was provided on Tuesday, 07 Mar 2006 12:39:45 Greenwich Mean Time.

b) The document index.html was last modified on Saturday 10 Dec 2005 18:27:46 GMT.

c) There are 3874 bytes in the document being returned.

2. (a) What is the process? (2%)
   (e) What are the Client process and Server process? (4%)
   (f) Does IP address of host on which process runs suffice for identifying the process? Why? (2%)
   (g) Which two identifiers are used to identify a process? (4%) (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, many processes can be running on same host (2%)
(d) Identifier includes both IP address and port numbers associated with process on host (4%)

3. Explain Internet protocol stack (1% each layer's name, 1% each layer's functions, 10% total)

Ans: application: supporting network applications
transport: host-host data transfer
network: routing of datagrams from source to destination
link: data transfer between neighboring network elements

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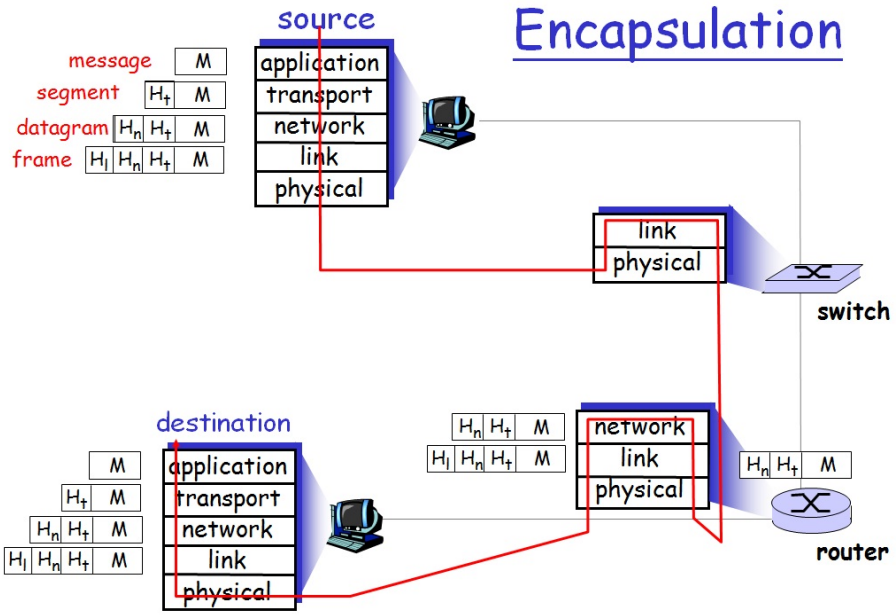
physical: bits “on the wire” (1% each layer’s name, 1% each layer’s functions, 10% total)

application
transport
network
link
physical

4. Draw a figure to explain the encapsulation/decapulation processes of the Internet protocol stack. (4%) Besides, you have to write the name of data unit of each layer. (寫出每層資料單位的專有名稱) (8%)

Ans:



資料單位名稱 2%, 共 8%，source/destination 的 encapsulation/decapulation 過程各 2%，共 12%

5. Consider a message that is $6*10^6$ bits long that is to be sent from source to destination through three packet switch. Suppose each link is 1Mbps. Ignore propagation, queuing, and processing delays.
   (a) How long does it take to move the message from source to destination without message segmentation? (4%)
   (b) Suppose the message is segmented into 6000 packets, with each packet being 1000 bits long. How long does it take to move message from source to destination with message segmentation (6%)
   (c) Translate this problem into Chinese (用中文翻譯整個題目 4%，包含 a,b 兩部分各 3%). (20% total)

Ans:

a) Time to send message from source host to first packet switch = $\frac{6\times10^6}{1\times10^6}\text{sec} = 6\text{sec}$. With store-and-forward switching, the total time to move message from source host to destination host = $6\text{sec}\times 4\ hops = 24\text{sec}$ (4%)

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

Time at which 2nd packet is received at the first switch = time at which 1st packet is received at the second switch = $2\times1\,m\text{sec} = 2\,m\text{sec}$

Time at which 1st packet is received at the destination host = $1\,m\text{sec}\times4\,hops = 4\,m\text{sec}$. After this, every 1msec one packet will be received; thus time at which last (6000^{th}) packet is received = $4m\text{sec} + 5999*1m\text{sec} = 6.003\text{sec}$. (4%)

c) Consider a message that is $6*10^6$ bits long that is to be sent from source to destination through two packet switch. Suppose each link is 1Mbps. Ignore propagation, queuing, and processing delays.

⇨ 考慮一個 $6*10^6$ 位元長的訊息要從來源端經過兩個封包交換器送到目的端的情況。假設每個鍊結(link)是 1Mbps 的傳輸速率，忽略傳播、排隊(queuing)與處理的延遲時間。4%

(a) How long does it take to move the message from source to destination without message segmentation?

⇨ 不使用訊息分割，需要花費多少時間將此訊息從來源端送到目的端？(3%)

(b) Suppose the message is segmented into 6000 packets, with each packet being 1000 bits long. How long does it take to move message from source to destination with message segmentation (6%)

⇨ 假設此訊息分割成 6000 個封包，每個封包長度是 1000 位元。使用訊息分割，需要花費多少時間將此訊息從來源端送到目的端？(3%)

6. What are network protocol, throughput and packet loss? (3%, 2%, 3%, 8% total) (8% total)

- Protocol: protocols define format, order of msgs sent and received among network entities, and actions taken on msg transmission, receipt (3%)
- throughput: rate (bits/time unit) at which bits transferred between sender/receiver (2%)
- Packet loss: queue (aka buffer) preceding link in buffer has finite capacity (3%)
  packet arriving to full queue dropped (aka lost)

7. Describe detailed operations of cookie and web caching. (20%)（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)! (2%)

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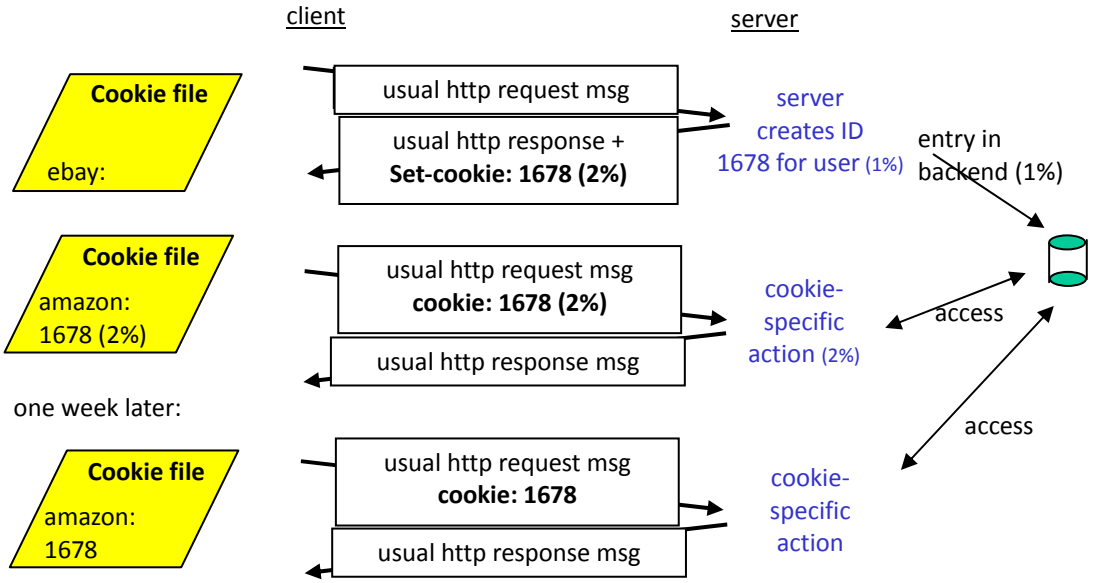


- web caching:
  - user sets browser: Web accesses via cache (2%)
  - browser sends all HTTP requests to cache (2%)

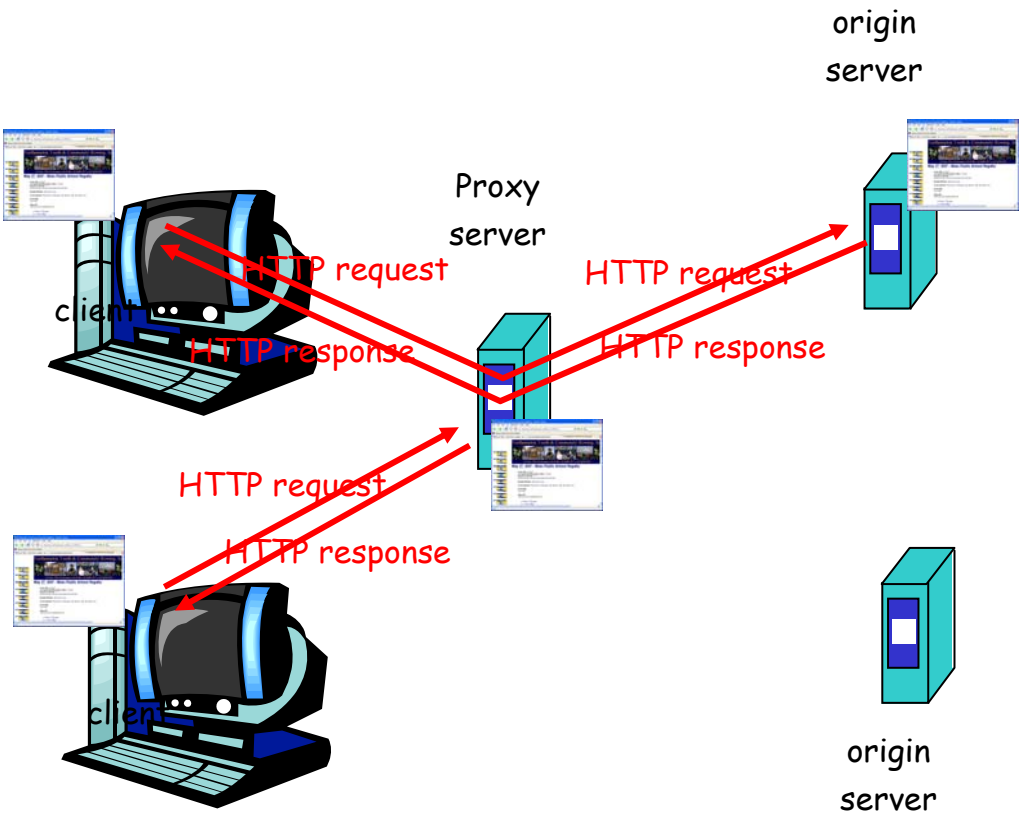
    if object in cache

    cache returns object (2%)

    else

    cache requests object from origin server, then returns object to client (2%)

    => reduce response time for client request and traffic on an institution's access link. (2%)



8. Explain operations of (a) nonpersistent HTTP with no parallel TCP connections, (b) persistent HTTP without pipelining, (c) persistent HTTP with pipelining (9%)

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Ans:

(a) nonpersistent HTTP without parallel TCP connections:

At most one object is sent over a TCP connection. *(3%)*

(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. *(3%)*

(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. (*3%)*