Computer Networks Midterm (100/11)

1. Is HFC transmission rate dedicated or shared among users? (3%) Are collisions possible in a downstream HFC channel? Why or why not? (3%)

Ans:

HFC bandwidth is shared among the users. (3%)

On the downstream channel, all packets emanate from a single source, namely, the head end. Thus, there are no collisions in the downstream channel. (3%)

2. Why is it said that packet switching employs statistical multiplexing? (3%) Contrast statistical multiplexing with the multiplexing that takes place in TDM. (3%)

Ans:

In a packet switched network, the packets from different sources flowing on a link do not follow any fixed, pre-defined pattern. (3%)

In TDM circuit switching, each host gets the same slot in a revolving TDM frame. (3%)

3. Which layer in the Internet protocol stack does a router process? (3%) Which layer does a host process? (3%)

Ans:

Routers process layers 1 through 3. (3%)

Hosts process all five layers. (3%)

4. List four broad classes of services that a transport protocol can provide (8%). For each of the service classes, indicate if either UDP or TCP (or both) provides such a service. (4%)

Ans:

a) Reliable data transfer (2%)

TCP provides a reliable byte-stream between client (1%) and server but UDP does not.

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

Neither (1%)

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

Neither (1%)

d) Security (2%)

Neither (1%)

5. Describe how web caching can reduce the delay in receiving a requested object. (4%) Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? (2%) Why? (2%)

Ans:

- Web caching can bring the desired content “closer” to the user, perhaps to the same LAN to which the user’s host is connected. (4%)
- Web caching can reduce the delay for all objects (2%), even objects that are not cached, since caching reduces the traffic on links. (2%)

6. Consider the following string of ASCII characters that were captured by Ethereal when the browser sent

an HTTP GET message.

(a) What is the URL of the document requested by the browser? Why?

(b) What version of HTTP is the browser running? Why?

(c) Does the browser request a non-persistent or persistent connection? Why? (3% each, 9% total)

```
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) The document request was http://gaia.cs.umass.edu/cs453/index.html. The Host : field indicates the server's name and /cs453/index.html indicates the file name.

b) The browser is running HTTP version 1.1,as indicated just before hte first <cr><lf> pair.

c) The browser is requesting a persistent connection, as indicated by the Connection: keep-alive.

7. 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 (2%)

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

8. 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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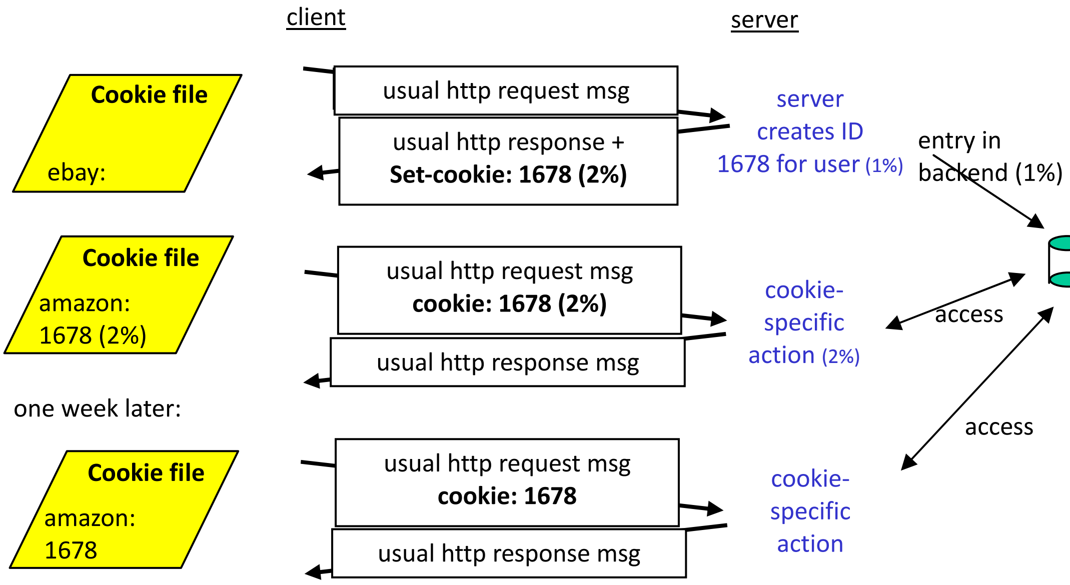


- web caching:
  - user sets browser: Web accesses via cache (2%)
  - browser sends all HTTP requests to cache (2%)

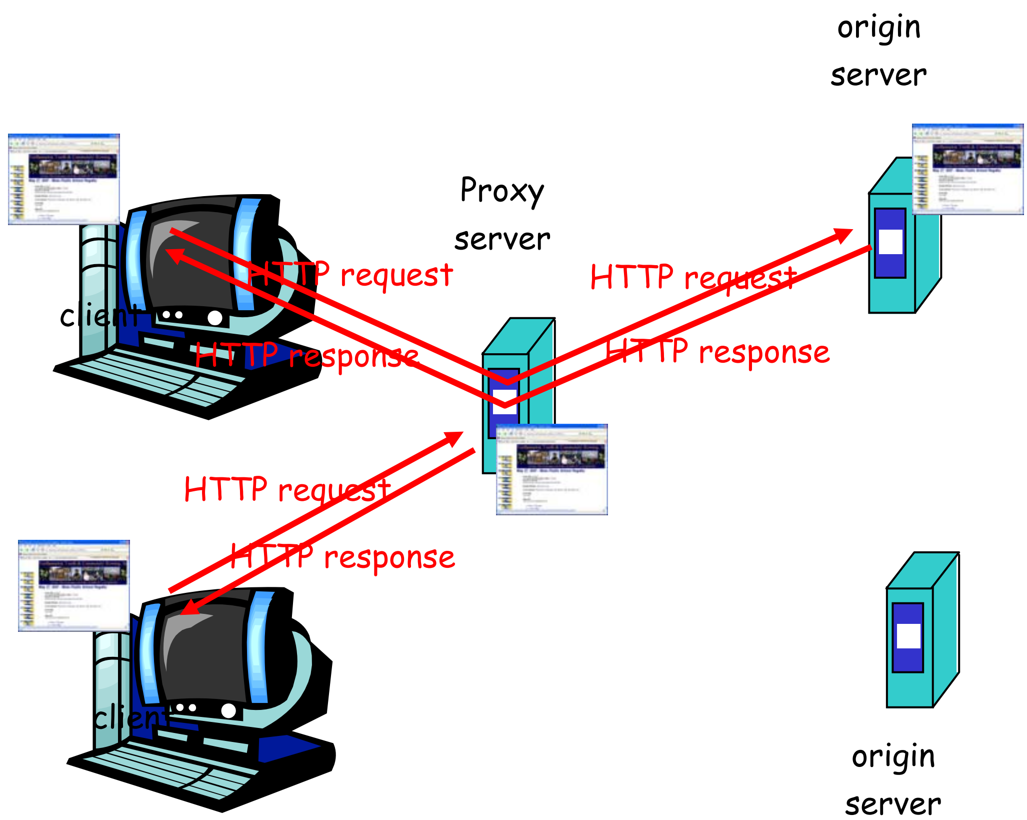
    if object in cache

      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%)



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9. Consider a packet of length 1000 bytes which begins at end system A, travels over one link to a packet switch, and travels from the packet switch over a second link to a destination end system. Suppose the propagation speed on both links is $2.5*10^8$m/s, the transmission rates of both links is 1Mbps, the packet switch processing delay is 1msec, the length of the first link is 4000km, and the length of the last link is 1000km. What is the end-to-end delay? (畫出過程的時間圖，並說明如何計算每部分的時間，10% total)

Ans: 10% total

The first end system requires L/R_1 to transmit the packet onto the first link; the packet propagates over the first link in d_1/s_1; the packet switch adds a processing delay of d_{proc}; after receiving the entire packet, the packet switch requires L/R_2 to transmit the packet onto the second link; the packet propagates over the second link in d_2/s_2. Adding these five delays gives

$$d_{end\text{-}end} = L/R_1 + L/R_2 + d_1/s_1 + d_2/s_2 + d_{proc}$$

To answer the second question, we simply plug the values into the equation to get 8 + 8 + 16 + 4 + 1 = 37 msec.

10. Suppose you click a hyperlink (http://www.ncue.edu.tw) to obtain a Web page. The IP address for the associated URL is cached in your local host, so a DNS lookup is not necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT_1,…, RTT_n. Further suppose the HTML file references five very small objects on the same server. Assuming RTT_0 denotes the round trip time between your host and the server containing the object. Assuming zero transmission time of the object, how much time elapses with (a) nonpersistent HTTP with no parallel TCP connections, (b) persistent HTTP without pipelining, (c) persistent HTTP with pipelining, from when the client clicks on the link until the client receives the Web page and the five objects? (說明每項的動作，畫出過程的時間圖，並解釋如何計算時間，12%)

Ans:

Once the IP address is known, RTT_O elapses to set up the TCP connection and another RTT_O elapses to request and receive the Web object.

(a) nonpersistent HTTP without parallel TCP connections:

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

[1 RTT_0 (TCP handshaking) + 1 RTT_0 (HTTP request/response)]* 6 objects (1 Web page + 5 objects) = 12 RTT_0 (2%)

(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%)*

1 RTT_0 (TCP handshaking) + 1 RTT_0 (HTTP request/response) * 6 objects = 7 RTT_0 (2%)

(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%)*

1 RTT_0 (TCP handshaking) + 1 RTT_0 (HTTP request/response for web page) + 1 RTT_0 (HTTP request/response for 5 objects) = <u>3 RTT_0</u> (2%)

12% total