Computer Networks
Lesson 2

The Application Layer

Problems

Departamento de
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Problem 1: True or False?

a) A user requests a web page consisting of text and 3 references to images. To get that page, the client sends a request message and receives four reply messages.

b) Two different web pages (www.mit.edu/research.html and www.mit.edu/students.html) can be sent over the same persistent connection.

c) With non-persistent connections between a browser and a source server, a single TCP segment can carry two different HTTP request messages.

d) The "Date:" header line of the HTTP response message indicates when the object was last modified.

e) HTTP response messages never include an empty message body.

Problem 2: Application-Transport

An HTTP client wants to retrieve a web document that is located at a given URL. Initially, the IP address of the HTTP server is unknown.

What application-layer and transport-layer protocols, in addition to HTTP, are required in this scenario?

Problem 3: HTTP Client Headers

The following ASCII string was captured when the browser was sending an HTTP GET message.

NOTE: The width of the lines in the box is 60 characters

```
GET /cs453/index.html HTTP/1.1←↓Host: gaia.cs.umass.edu←↓Use
r-Agent: Mozilla/5.0 (Windows;U; Windows NT 5.1; en-US; rv:1
.7.2) Gecko/20040804 Netscape/7.2 (ax)←↓Accept: ext/xml, app
lication/xml, application/xhtml+xml, text/html;q=0.9, text/p
lain;q=0.8, image/png, */*;q=0.5←↓Accept-Language: en-us,en;
q=0.5←↓Accept-Encoding: zip,deflate←↓Accept-Charset: ISO-885
9-1,utf-8;q=0.7,*;q=0.7←↓Keep-Alive: 300←↓Connection: keep-a
live←↓←↓
```

NOTE: ← is a carriage return and ↓ is an end of line.

Answer the following questions, indicating in which part of the HTTP GET message the answer to the question is located:

a) What is the URL of the requested document?

b) What version of HTTP is running in the browser?

c) Does the browser request a persistent connection or not?

d) What is the IP address of the host running the browser?

e) What type of browser sends the message? Why is it necessary to indicate the type of browser in the message?

f) How many bytes does the HTTP_PDU sent by the customer occupy?

g) How many bytes of HTTP_UD carries?

Problem 4: HTTP Server Headers

The following string shows the response returned by the Web server to the message from the previous problem.

NOTE: The width of the lines in the box is 60 characters

```
HTTP/1.1 200 OK←↓Date: Tue, 07 Mar 2008 12:39:45 GMT←↓Server
: Apache/2.0.52 (Fedora)←↓Last-modified: Sat, 10 Dec 2005 18
:27:46 GMT←↓ETag: "526c3-f22-a88a4c80"←↓Accept-Ranges: bytes
←↓Content-Length: 3874←↓Keep-Alive: timeout=max=100←↓Connect
ion: keep-alive←↓Content-Type: text/html; charset=ISO-8859-1
←↓←↓<!doctype html public "-//w3c//dtd html 4.0 transitional
//en">←↓<html>←↓<head>←↓<meta name="GENERATOR" content="Mozi
lla/4.79 [en] (Windows NT 5.0; U) Netscape]">←↓<title>←↓</he
ad>←↓... Here I would follow the rest of the HTML document...
```

NOTE: ← is a carriage return and ↓ is an end of line.

Answer the following questions, indicating where in the HTTP response message is the answer to the question:

a) Has the server found the document? At what point is the answer provided with the doc.?

b) When was the document last modified?

c) How many bytes does the returned document contain?

d) What are the first 5 bytes of the returned document?

e) How many bytes of HTTP_UD carries?

f) How many bytes does the HTTP_PDU sent by the server has?

Problem 5: Transfer time (I)

Suppose your browser clicks on a link to a web page. The IP address corresponding to the associated URL is not cached on your local host, so a DNS lookup is required.

Assume that the round trip time (RTT) of the dns server query is RTT_{dns}

Also assume that the web page associated with the link is a small HTML file (which is a negligible transmission time) and that it does not contain references to other objects.

Let RTT^0 be the RTT time between the local host and the web server.

How long does it take for the customer to click the link until they receive the object?

Problem 6: Transfer time (II)

Continuing with problem 5, assume that the HTML base file references 8 very small objects that are on the same server.

Disregarding the transmission times, to load the entire web page, how much time elapses if it is used...

a) …Non-persistent HTTP without parallel TCP connections?

b) …Non-persistent HTTP with 5 parallel connections?

c) …1 single persistent HTTP connection?