King Fahd University of Petroleum and Minerals
College of Computer Sciences and Engineering
Department of Computer Engineering

COE 344 – Computer Networks (T152)

Homework # 02 (*due date & time: Sunday 21/02/2016 during class period*)

Late homework submission will NOT be accepted

***** Show all your work. No credit will be given if work is not shown! *****

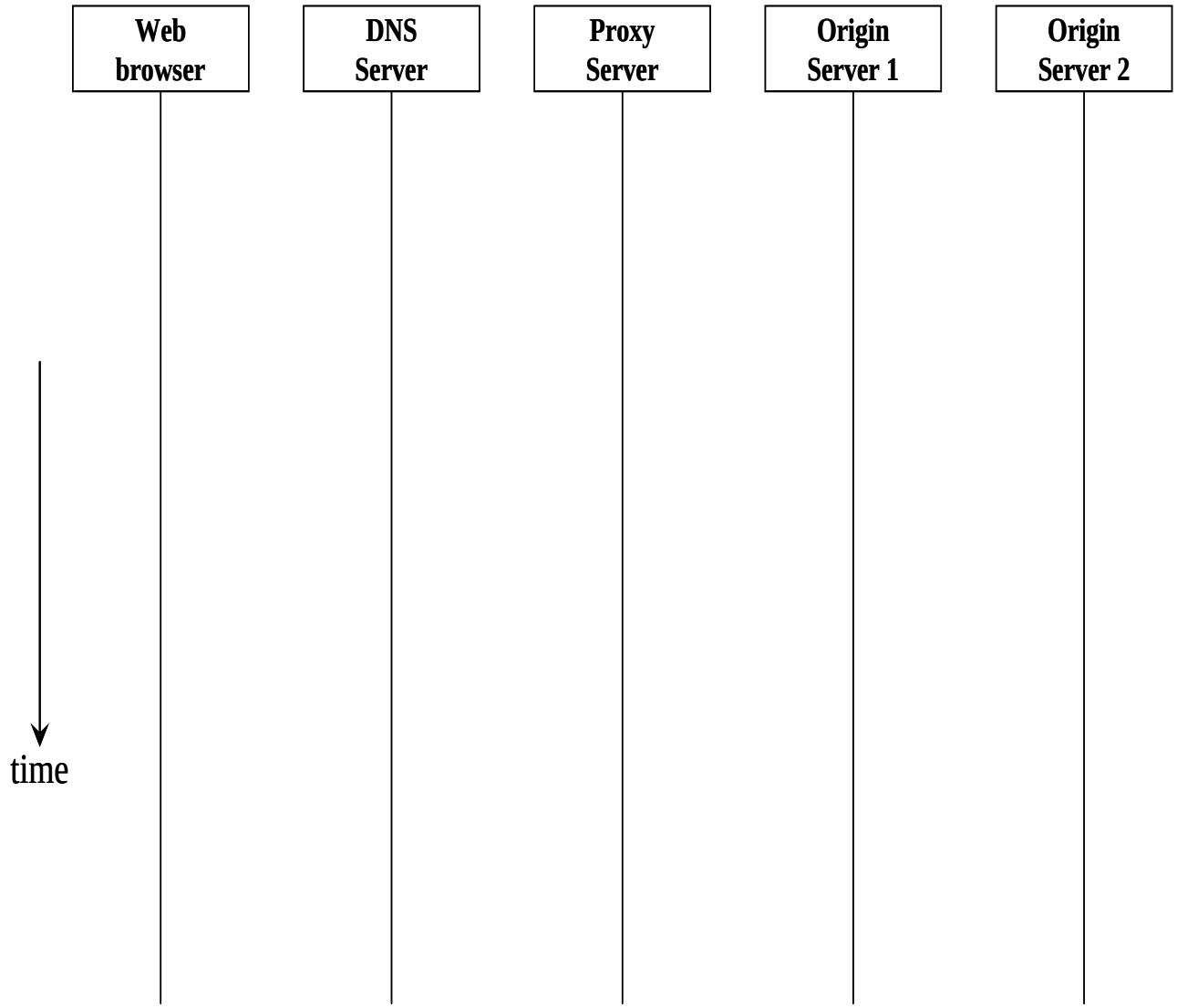
Problem # 1 (40 points): Suppose within your Web browser you click on a link to obtain a web page. Suppose that the IP address for the associated URL is not cached in your local host, so that a DNS look-up is necessary to obtain the IP address. Suppose that two (2) DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT_1 and RTT_2. Further suppose that the Web page associated with the link contains exactly one object; the base HTML file. Let RTT_0 denote the RTT between the local host and the server containing the object. Assuming t_{trans} transmission time of the base HTML file, find:

a. **(8 points)** The amount of time that elapses from when the client clicks on the link until the client receives the base HTML file.
b. Suppose the base HTML file indexes four (4) more objects. The first and the second indexed objects reside on the same server hosting the base HTML file. The third and the fourth indexed objects reside on a *different* server than the server hosting the base HTML file, and the IP address of such a server is already cached in your local host. Assume that RTT_0 denotes the RTT between the local host and each server containing an object. Using the same assumptions used in part (a) for the base HTML file, and assuming the transmission time for each indexed object is t_{trans}, find the total amount of time that elapses from when the client clicks on the link until the client receives all objects with:
    i. **(8 points)** nonpersistent HTTP with no parallel TCP connections
    ii. **(8 points)** nonpersistent HTTP with parallel TCP connections (assume that parallel TCP connections **cannot** be made to different servers at the same time)
    iii. **(8 points)** persistent HTTP without pipelining
    iv. **(8 points)** persistent HTTP with pipelining

Problem # 2 (60 points; 20 points each):

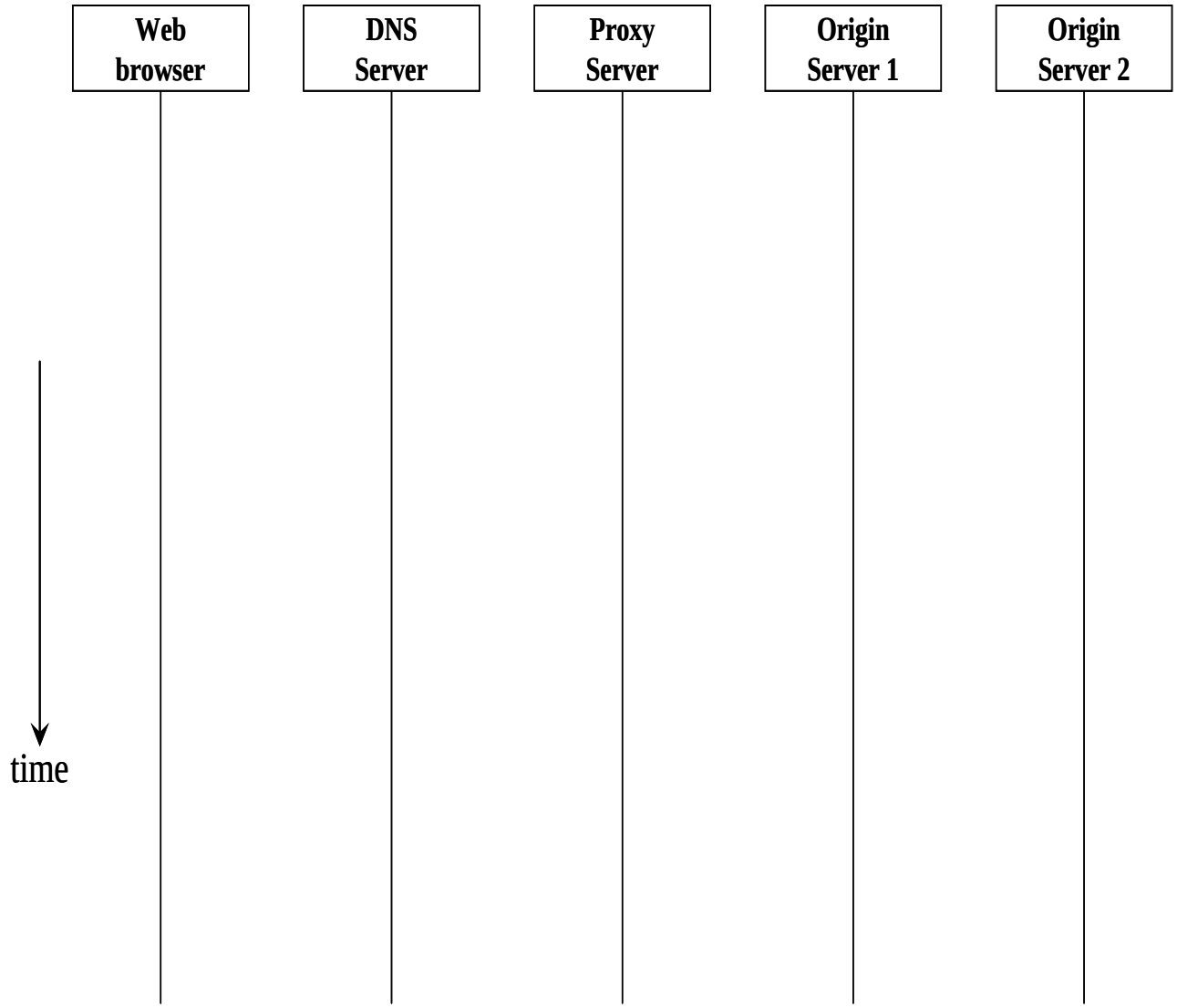
1. Suppose within your Web browser you submit a URL to obtain a web page. Assume the following:
   a. The local proxy server is used, and currently has no established TCP connections.
   b. The IP address of the server hosting the requested web page is not known to the Web browser.
   c. The base HTML file indexes two (2) objects. Both objects do not reside on the same server that hosts the requested web page.
   d. The IP address of the server holding the indexed objects is already known to the Web browser.
   e. The base HTML file and the indexed objects have never been cached by the local proxy server.
   f. Persistent HTTP with pipelining is used.

Utilizing the following diagram, use labeled arrows to show the complete sequence of messages from the moment your Web browser requests the web page until the indexed objects in the base HTML file are received by your Web browser.
(note that the names of possible message that can be used are *TCP connect. request*, *TCP connect. granted*, *HTTP request*, *HTTP response*, *DNS query*, *DNS reply*)



2. Suppose within your Web browser you submit a URL to obtain a web page. Assume the following:
   a. The base HTML file indexes two (2) objects. The first object resides on the same server that hosts the requested web page, while the second object does not reside on the same server that hosts the requested web page.
   b. The local proxy server is used, and currently has no established TCP connections.
   c. The base HTML file is already cached at the local proxy and is up-to-date.
   d. The two indexed objects are already cached at the local proxy but stale. However, the IP addresses of the two servers hosting the two objects are cached by the proxy.
   e. Persistent HTTP without pipelining is used.

Utilizing the following diagram, use labeled arrows to show the complete sequence of messages from the moment your Web browser requests the web page until the indexed objects in the base HTML file are received by your Web browser.
(note that the names of possible message that can be used are *TCP connect. request*, *TCP connect. granted*, *HTTP request*, *HTTP response*, *DNS query*, *DNS reply*)



3. Suppose within your Web browser you submit a URL to obtain a web page. Assume the following:
   a. The base HTML file indexes two (2) objects. Both objects reside on the same server that hosts the requested web page.
   b. The local proxy server is used, and currently has no established TCP connections.
   c. The base HTML file and the two indexed objects are already cached at the local proxy but stale. The IP address of the server hosting the base HTML file and the two objects is not cached by the proxy.
   d. Persistent HTTP with pipelining is used.

Utilizing the following diagram, use labeled arrows to show the complete sequence of messages from the moment your Web browser requests the web page until the indexed objects in the base HTML file are received by your Web browser.
(note that the names of possible message that can be used are *TCP connect. request*, *TCP connect. granted*, *HTTP request*, *HTTP response*, *DNS query*, *DNS reply*)