

Problem 1

For each of the three schemes, the time required for DNS look-up, and thus obtaining the IP address of the URL is same. Looking up k DNS-servers in a sequential manner causes a delay of $k \times \text{RTT}_{\text{dns}}$, which is a part of the response time. The rest of the response time arises due to the connection and object request from the client (i.e., laptop) to the server and varies according to the protocol and requesting scheme. The following table gives the breakdown of the rest of the response time for the three given scenarios:

Protocol and scheme	TCP connection	WEB page arrival	Image arrival	Total
(a) Non-persistent HTTP no parallel TCP connection	RTT_{WEB}	RTT_{WEB}	$3(\text{RTT}_{\text{WEB}} + \text{RTT}_{\text{WEB}})$	$8 \text{ RTT}_{\text{WEB}}$
(b) Non-persistent HTTP with parallel TCP connection	RTT_{WEB}	RTT_{WEB}	$\text{RTT}_{\text{WEB}} + \text{RTT}_{\text{WEB}}$	$4 \text{ RTT}_{\text{WEB}}$
(c) Persistent HTTP with pipelining	RTT_{WEB}	RTT_{WEB}	RTT_{WEB}	$3 \text{ RTT}_{\text{WEB}}$

Thus the total response times for the three cases are:

- (a) $k \times \text{RTT}_{\text{dns}} + 8 \text{ RTT}_{\text{WEB}} = 1900 \text{ msec.}$
- (b) $k \times \text{RTT}_{\text{dns}} + 4 \text{ RTT}_{\text{WEB}} = 1100 \text{ msec.}$
- (c) $k \times \text{RTT}_{\text{dns}} + 3 \text{ RTT}_{\text{WEB}} = 900 \text{ msec.}$