

1. **(Modified from KR, Chapter 2, P7)** Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address.

Suppose that n DNS servers are visited before your host receives the IP address from DNS; visiting them incurs an RTT of D_{DNS} per DNS server.

Further suppose that the Web page associated with the link contains m very small objects. Suppose the HTTP running is non-persistent and non-parallel. Let D_{Web} denote the RTT between the local host and the server of each object.

Assuming zero transmission time of each object, how much time elapses from when the client clicks on the link until the client receives all the objects?

2. **(Modified from KR, Chapter 2, P8)** Referring to the previous question, suppose that three DNS servers are visited. Further, the HTML file references five very small objects on the same server.

Neglecting transmission time, how much time elapses with:

- (a) Non-persistent HTTP with no parallel TCP connections?
 - (b) Non-persistent HTTP with the browser configured for five parallel connections?
 - (c) Persistent HTTP with pipelining?
3. Suppose a malicious party can intercept your HTTP GET requests (but not necessary your HTTP responses) and have access to your cookie. Explain how this could lead to undesirable circumstances.
 4. Suppose a malicious party can insert fake DNS records into DNS servers. Suggest three different ways how this can be abused.