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**Chapter 2 Application Layer**

**Homework 2**

1. Consider the bottlenecked network in Figure 2.12 in the text with the access speed of 15 Mbps on the access link and 100 Mbps on the LAN. Suppose that the average object size is 100,000 bytes (convert to bits) and that the average request rate from the institution’s browsers to the origin servers is 15 requests per second. Also suppose that the average amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is 3 seconds (See Sec 2.2.5 in text). Model the total average response time as the sum of the average access delay (from Internet Router to Institution Router) and the average Internet delay. Assume ***d*** = average time required to send an object over the access link and ***a*** = the arrival rate of objects to the access link. Compute ***d*** /(1 – (***d*** \* ***a***))

***Access delay = 800000 / 15000000 = 0.053 sec***

***a = 15/sec***

***d\*a = 0.79999***

***0.79999 / 1 – 0.7999 = 0.26493***

1. Find the total average response time

LAN delay::= 800000/100000000 = 0.008 sec

Access delay::= 800000/15000000 = 0.053 sec

Internet delay::­­­­= 3 sec

Avg response time = LAN delay + Access delay + Internet delay = 3.061

Total average response time = 15 \* 3.061 = 45sec

1. Now suppose a cache is installed in the institutional LAN. Suppose the miss rate is 0.45. Find the total response time.

**15 (.55 (0.008) + .45 (3.061) ) 20.72775 sec**