**CS 655: Computer Networks**

**Fall 2020**

**Sample Midterm Examination**

Please write clearly and neatly. Be precise in your answers – do not just re-iterate what you know about the topic. Clearly state any assumptions you make. The exam has 4questions over 5pages. Answer all questions.

**Problem 1 (Error Control)**

A 3000-km long, 1 Mbps link is used to transmit 1000-bitdata packets using the Selective Repeat protocol. If the speed of light in this link is 2 x10^5km/second, what is the minimum number of bits the sequence numbers should be? Assume no flow control, and negligible transmission and processing times for acknowledgments. Take 1M = 1000,000.

Sender window size:

SWS = RTT x bandwidth = 2 x 3000 km / ( 2 x 10^5 km/s) x 1 Mbps = 30000 bits

Number of packets: 30000 bits / 1000 bits = 30 packets

We need 30 x 2 = 60 packets or sequence numbers to make Selective Repeat protocol work well.

Thus, we need 6 bits of sequence numbers.

**Problem 2(Protocol Specification)**

**Problem 3 (HTTP Performance)**

Propagation delay = 300ms / 2 = 150ms

2 x RTP + O / R

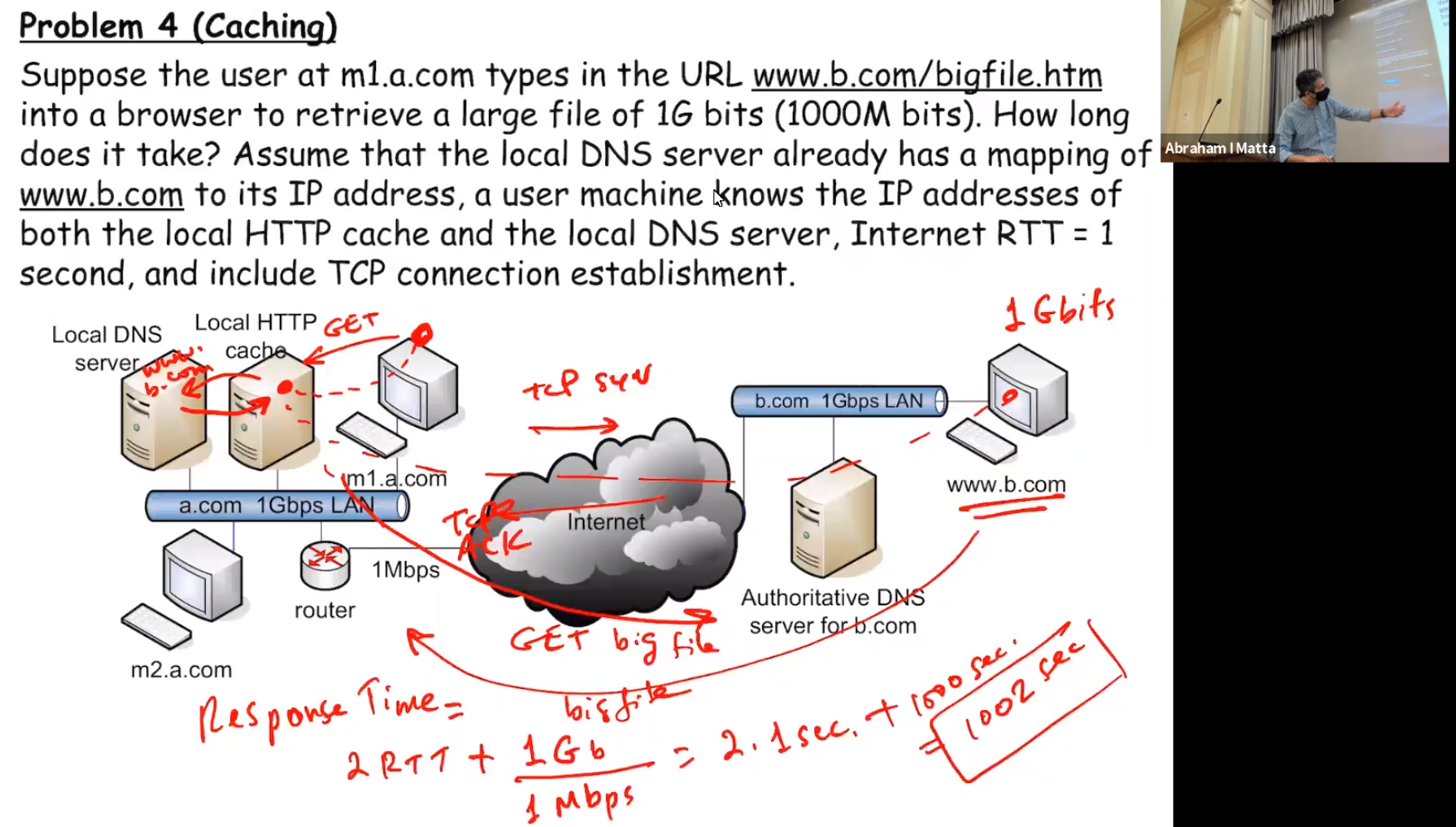
= 150ms + 150ms + 150ms + 150ms + (100 Kb / 100 Mbps) = 601ms to get the HTML file.

1 x RTP + O / R x 10

= 150ms + 150ms + (100 Kb / 100 Mbps) x 10 = 310ms to get the jpg files.

Response time = 2 x RTP + 1 x RTP + O / R x 10 = 3 x RTP + O / R x 11 = 911ms

**Problem 4 (Caching)**



1. 首先，host跟local HTTP cache发起get请求，

local http cache向local DNS server发起DNS查询并得到返回，

local http cache发现缓存没有，于是向[www.b.com发起TCP](http://www.b.com发起TCP) connection, 1.5个RTT，

文件传输时间为发送时延+传播时延+处理时延+排队时延，

发送时延取决于链路中的短板，1Gb / 1Mbps = 1000 s

传输时延为0.5个RTT,

Response time = 2RTT + 1000s = 1002 s

1. 1s 直接从local http cache获取。
2. Local http cache向local DNS server发起DNS query,

local DNS server向root DNS server发起请求再返回，1个RTT,

local DNS server向com DNS server发起请求再返回，1个RTT,

local DNS server向Authoritative DNS server发起请求再返回，1个RTT,

local DNS server把获知的IP address归还给local http cache.