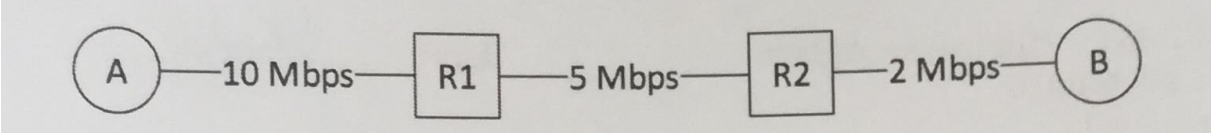
Suppose users share a 10 Mbps link. Also suppose each user transmits continuously at 1 Mbps when transmitting, but each user transmits only 20 percent of the time.

a. When circuit switching is used, how many users can be supported?
b. For the remainder of this problem, suppose packet switching is used. Why will there be essentially no queuing delay before the link if 10 or fewer users transmit at the same time? Why will there be a queuing delay if 15 users transmit at the same time?
c. Find the probability that a given user is transmitting.
d. Suppose now there are 30 users. Find the probability that at any given time, 12 users are transmitting simultaneously. Find the fraction of time during which the queue grows.
e. Find the probability that there are 21 or more users transmitting simultaneously.

i) Consider a connection where the distance between the receiver and the transmitter is 500 km. Calculate the round-trip time(RTT) for this connection assuming that the propagation speed is 2x10^5 km/s. Neglect the processing and queue delay. [Alıcıyla verici arasındaki mesafenin 500 km olduğu bir bağlantı düşünün. Bu bağlantı için gidiş-geliş gecikmesini yayılım hızını 2x10^5 km/s kabul ederek hesaplayınız. İşleme ve kuyruk gecikmelerini ihmal ediniz.]

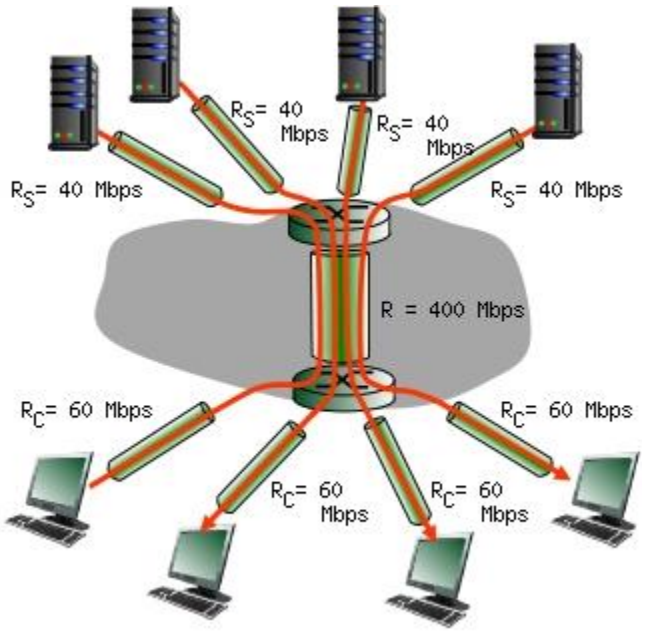
ii) We want to transfer 10^4 byte file using the connection mentioned above. Assume that each segment has a 40 byte header and maximum segment size is 1250 byte including header. Calculate how many segments are needed at least to transfer this file and find the time it takes to transmit each segment on a 10 Mbps connection. [Yukarıdaki bağlantıyı 10^4 Byte büyüklüğündeki bir dosyayı transfer etmede kullanıyoruz. Her segmentin başında 40 Byte'lık bir başlık kısmı olduğunu ve segmentin bu başlık dahil maksimum büyüklüğünün 1250 Byte olduğunu varsayın. Bu dosyayı transfer etmek için en az kaç tane segment gerektiğini hesaplayın ve 10 Mbps hızındaki bir bağlantıda her segmentin iletimi için geçen zamanı bulun.]



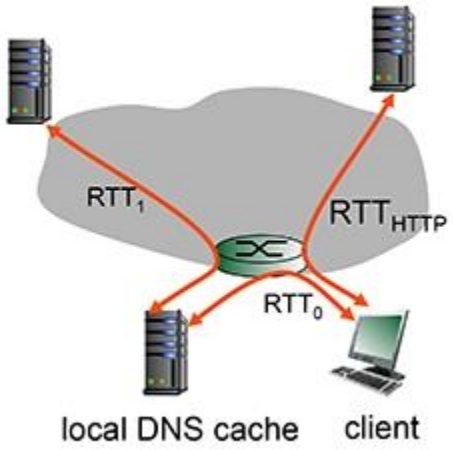
Assume that there are three connection that connects A and B and pass through R1 and R2 routers. The distance of each link is 600 km and propagation speed is 2x10^5. The transmission speed of each link is given in above Figure. We want to transfer four packets from A to B using packet switching. Each packet begins to be transferred to B at 0, 5, 10 and 15 ms, respectively. The size of packets is 1250 byte. Neglect the processing and queuing delay. Calculate the time it takes to transfer these four packets. [A ve B birimlerini bağlayan R1 ve R2 yönlendiricilerinden geçen 3 tane link olduğunu varsayalım. Her linkin uzunluğu 600 km olsun ve yayılım hızını 2x10^5 km/s olarak kabul edelim. Her linkin iletim hızı şekil üzerinde verilmiştir. A'dan B'ye 4 tane paketi paket anahtarlama yoluyla gönderiyoruz. Bu dört paketin iletimleri 0, 5, 10 ve 15 ms'lerde başlamaktadır. Her paketin uzunluğu 1250 Byte'dır. İşleme ve kuyruk gecikmelerini ihmal ediniz. Bu dosyayı A'dan B'ye göndermek için gereken süreyi hesaplayınız.]

Consider the scenario shown below, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 400 Mbps. The four links from the servers to the shared link have a transmission capacity of R_S = 40 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of R_C = 60 Mbps per second. You might want to review Figure 1.20 in the text before answering the following questions:

1. What is the maximum achievable end-end throughput (in Mbps) for each of four client-to-server pairs, assuming that the middle link is fair-shared (i.e., divides its transmission rate equally among the four pairs)?
2. Which link is the bottleneck link for each session?
3. Assuming that the senders are sending at the maximum rate possible, what are the link utilizations for the sender links (R_S), client links (R_C), and the middle link (R)?



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 two DNS servers are visited before your host receives the IP address from DNS. The first DNS server visited is the local DNS cache, with an RTT delay of $RTT_0 = 3$ msecs. The second DNS server contacted has an RTT of 50 msecs. Initially, let's suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Suppose the RTT between the local host and the Web server containing the object is $RTT_{HTTP} = 59$ msecs.



1. Assuming zero transmission time for the HTML object, how much time elapses from when the client clicks on the link until the client receives the object?
2. Now suppose the HTML object references 8 very small objects on the same web server. Neglecting transmission times, how much time elapses from when the client clicks on the link until the base object and all 8 additional objects are received from web server at the client, assuming non-persistent HTTP and no parallel TCP connections?
3. Repeat 2. above but assume that the client is configured to support a maximum of 5 parallel TCP connections, with non-persistent HTTP.
4. Repeat 2. above but assume that the client is configured to support a maximum of 5 parallel TCP connections, with persistent HTTP.
5. What do you notice about the overall delays (taking into account both DNS and HTTP delays) that you computed in cases 2., 3. and 4. above?

You own a company named mydream. The following table gives the DNS records for mydream.

Name	Type	Value	TTL	Priority
mydream.com	A	178.198.17.118	86400 seconds	
asi.mydream.com	A	178.198.11.9	86400	10
asi.mydream.com	A	178.198.11.10	86400	1
myns.mydream.com	A	178.198.1.101	86400	
gediz.mydream.com	A	178.198.15.225	86400	
mydream.com	NS	myns.mydream.com	86400	
mydream.com	NS	myser.myorg.org	86400	
mydream.com	MX	gediz.mydream.com	86400	
www.mydream.com	CNAME	asi.mydream.com	86400	

i. If you type **http://www.mydream.com** into your web browser, to which IP address does your browser connect?

ii. If you send an e-mail to **ali@mydream.com**, to which IP address does your e-mail get delivered?

iii. What is the IP address for **the authoritative name server** for mydream?

iv. The TTL field for all the records are chosen as 86400 seconds (1 day). What might be a possible disadvantage of choosing a much longer TTL value, e.g., 1 month?

v. What might be a possible disadvantage of choosing a much shorter TTL value, e.g., 1 minute?

vi. Suppose that you want to change the IP address of mydreams's web server. What actions should you take before implementing the IP address change in the DNS records contained in mydream's authoritative name server so that your customers will have no interruptions in reaching your web server at its new IP address?