

Internet Protocols EBU5403

The Transport Layer Part 2

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	Week 1	Week 2	Week 3	Week 4
Telecom	Adnan Kiani	Michael Chai		
E-Commerce	Richard Clegg	Michael Chai	Richard Clegg	

No need for photos

- ALL THESE SLIDES WILL BE ON QMPLUS (at the end of next week).
- There is no need to photograph the slides.

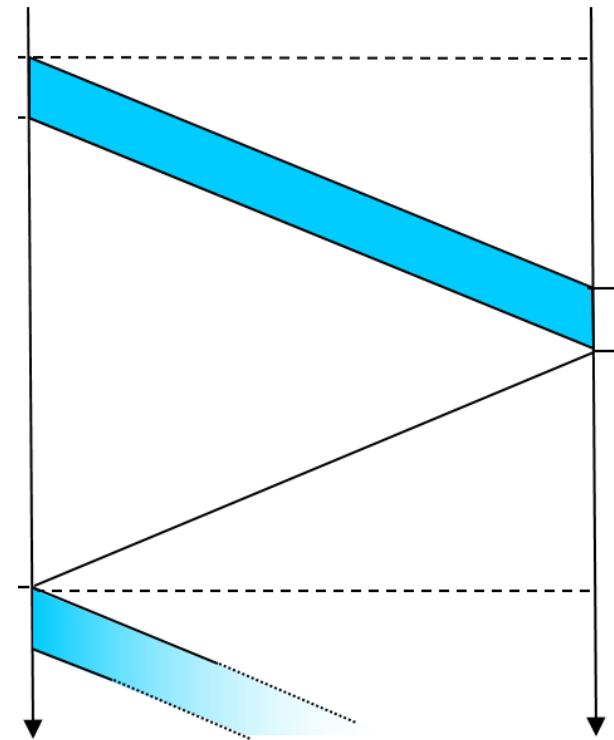


Welcome to the IP week 2 quiz

- Start with two easy questions from week 1 material.
- Then we move on to four questions about IP addresses and subnets.

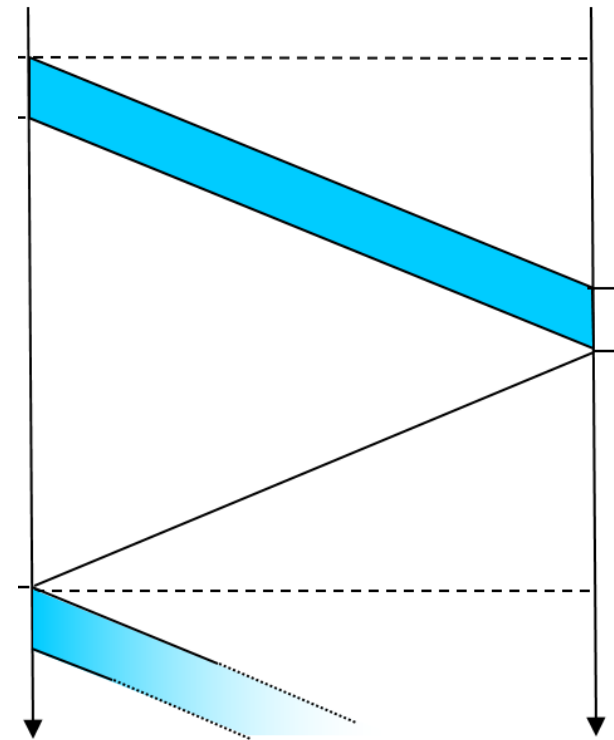
Revision Quiz Week 2: Q1

- Define link utilisation:
 - A. The time it takes between the sender finishing sending and the sender getting an ACK from the receiver.
 - B. The time it takes to send a packet.
 - C. The proportion of the time that the link is used for sending data.
 - D. The proportion of the time that the link is empty.



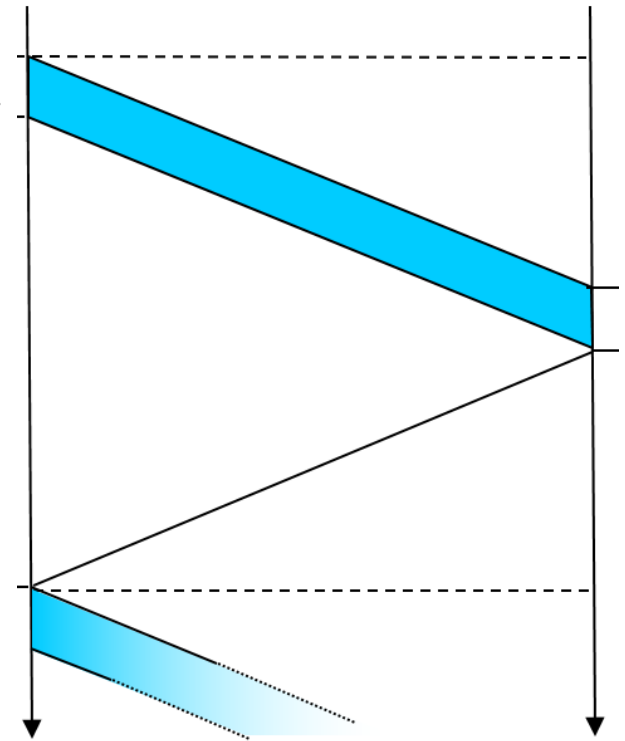
Revision Quiz Week 2: Q1

- Define link utilisation:
 - A. The time it takes between the sender finishing sending and the sender getting an ACK from the receiver. (This is RTT).
 - B. The time it takes to send a packet. (This is transmission delay)
 - C. The proportion of the time that the link is used for sending data.**
 - D. The proportion of the time that the link is empty. (This is $1 - \text{utilisation}$).



Revision Quiz Week 2: Q2

- Consider data transmission in rdt 3.0. Packets of length 1500 bits are sent over a link which is 100Mb/s. The delay is 1ms.
- What is the utilisation (approx):
 - A. 0.00744
 - B. 0.00515
 - C. 0.00015
 - D. 1.5



Revision Quiz Week 2: Q2

- Consider data transmission in rdt 3.0. Packets of length 1500 bits are sent over a link which is 100Mb/s. The delay is 1ms.

- What is the utilisation (approx):

A. 0.00744

B. 0.00515

C. 0.00015

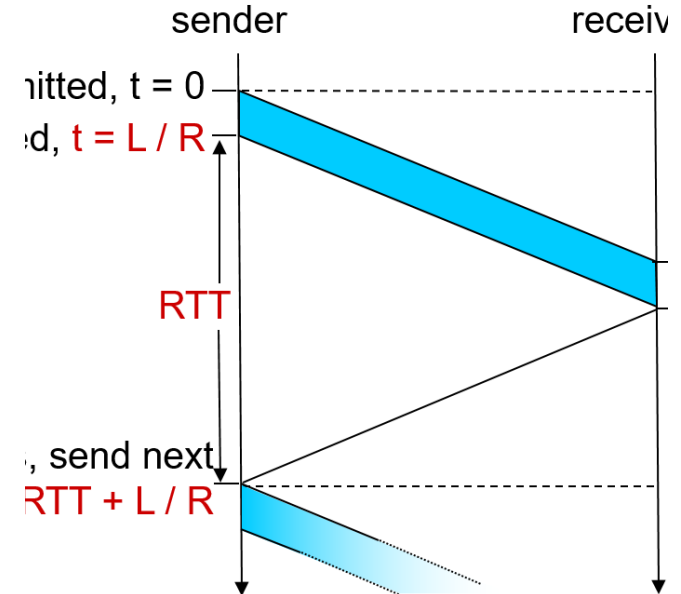
D. 1.5

$L = 1500 \text{ bits}$ $R = 100,000,000 \text{ bits/sec}$

$L/R = 0.000015 \text{ seconds}$

$RTT = 0.002 \text{ seconds}$

$U = (L/R) / (L/R + RTT) = 0.00015 / 0.002015 = 0.00744..$



Subnets and / notation (revision)

- An IPv4 address is 32 bits separated into 4 blocks of 8 bits.
- Every network interface needs an IP address. (Routers may have many).
- We could write an address in decimal or binary
 - 127.0.0.1
 - 11111111.00000000.00000000.00000001
 - Each number is 8 binary bits.
- The left part of this IPv4 address represents the “network” (group of interfaces).
- The right part represents the “host” the specific interface within that network.

Subnets and / notation (revision)

- Example 129.66.24.5/27

Host part 5 bits

Network part (27 bits – because it is /27) (32 bits – 27 bits)

10000001.01000010.00011000.00000101

Network address is the address with all the host bits set to zero – address like any other but represents the network.

10000001.01000010.00011000.00000000

Network address: 129.66.24.0/27

The network address is also the first usable IP address in the block

Broadcast address (sends to everyone) is the address with all the host bits set to one.

10000001.01000010.00011000.00011111

Broadcast address: 129.66.24.31/27

Subnets and / notation (revision)

- Example 129.66.24.5/27

Host part 5 bits

Network part (27 bits – because it is /27) (32 bits – 27 bits)

10000001.01000010.00011000.00000101

Hosts can be given any IP address with any combination of bits in the host part EXCEPT for the broadcast address.

10000001.01000010.00011000.00000000

Earliest network address: 29.66.24.0/27

10000001.01000010.00011000.00011110

Latest network address: 29.66.24.30/27

Address range from 29.66.24.0-29.66.24.30

Creating a subnetwork

- If we want to split a network into subnetworks the first question is how big must that subnetwork be?
- Subnetwork sizes must be powers of 2 e.g. 2, 4, 8, 16, 32...
- (Strictly speaking one of these addresses is the broadcast address).
- So if we need 390 hosts then we must create a subnet of size 512 – enough room for 511 hosts and 1 broadcast address.
- 512 is 2^9 = so we need 9 host bits. The network is a /23 (32 bits in IP address – 9 bits for host = 23 bits)
- NOTE: In the real world you might want to leave room in case the subnetwork got more hosts later.

Revision Quiz Week 2: Q3

- What IP addresses are in the same range as 192.168.28.67/27
 - A. 192.168.28.64-192.168.28.95
 - B. 192.168.28.0-192.168.28.255
 - C. 192.168.0.0-192.168.255.255
 - D. 192.16.28.64-192.168.28.127

Revision Quiz Week 2: Q3

- What IP addresses are in the same range as 192.168.28.67/27
 - A. 192.168.28.64-192.168.28.95**
 - B. 192.168.28.0-192.168.28.255
 - C. 192.168.0.0-192.168.255.255
 - D. 192.16.28.64-192.168.28.127
- /24 takes up the first three bytes so we know that the addresses are 192.168.28.x
- 67 in binary is 01000011 – the first three (red) bits are the (fixed) **network** part. The blue bits are the **host part**.
- Therefore the first network address is 01000000 and the last is 01011111 these correspond to 64 and 95.
- Note that 192.168.28.95 is the broadcast address.
- The broadcast address is the address with the leftmost **red bits (network address)** fixes and the rightmost **blue bits (host address)** all set to 1.

Revision Quiz Week 2: Q4

- What is the broadcast address for the IP address 192.124.123.54/22
 - A. 192.124.123.255
 - B. 192.124.122.255
 - C. 192.124.123.0
 - D. 192.124.128.0

Revision Quiz Week 2: Q4

- What is the broadcast address for the IP address 192.124.122.54/22
 - A. 192.124.123.255**
 - B. 192.124.122.255
 - C. 192.124.123.0
 - D. 192.124.128.0

The broadcast address is the FINAL address in the subnet – the address with the same first 22 bits but the other ten bits set to 1.

We know that 16 is the first two bytes so the broadcast address begins 192.124.x.x

22-16 is 6 the first 6 bits of the byte 3 are the network part.

122 in binary is 01111010 setting the host part to 1s giving 01111011 which is 123.

For the fourth byte it must all be 1s and we know that 11111111 is 255 so the broadcast address is 192.124.123.255

Revision Quiz Week 2: Q5

- What is the first IP address in the range containing the host 211.222.202.26/29
 - A. 211.222.202.0
 - B. 211.222.0.0
 - C. 211.222.202.24
 - D. 211.222.202.16

Revision Quiz Week 2: Q5

- What is the first IP address in the range containing the host 211.222.202.26/29
 - A. 211.222.202.0
 - B. 211.222.0.0
 - C. 211.222.202.24**
 - D. 211.222.202.16

For a /29 we know that the first three bytes are fixed (/24 is first three bytes) so the address must be 211.222.202.x

The next 5 bytes are the network address with 3 for the host address.

26 is 00011010 where red is the network part.

First number in this range is 00011000 which is 24.

Hence the first IP address is 211.222.202.24

Revision Quiz Week 2: Q6

- You need to assign a server the last valid host address on the subnet 172.19.144.0/20. What IP address would you assign?
- A. 172.19.144.255
 - B. 172.19.144.254
 - C. 172.19.159.254
 - D. 172.19.159.255

Revision Quiz Week 2: Q6

- You need to assign a server the last valid host address on the subnet 172.19.144.0/20. What IP address would you assign?

A. 172.19.144.255

B. 172.19.144.254

C. 172.19.159.254

D. 172.19.159.255

- /20 means the first two bytes are fixed so the address is 172.19.x.x
- The first two bytes are 16 bits. $20 - 16 = 4$ bits of the third byte are the network address.
- 144 is 10010000 the last address in the /20 is 10011111 which is 159.
- The last usable address is 172.19.159.254 (remember 172.19.159.255 is broadcast address).

Revision Quiz Week 2: Q7

- You have been given a network 144.123.4.0/24. You want to break it into subnetworks. The first subnetwork contains 43 hosts. The second contains 20 hosts. What is the host range for the second subnetwork.
 - A. 144.123.4.32/26
 - B. 144.123.4.64/26
 - C. 144.123.4.32/27
 - D. 144.123.4.64/27

Revision Quiz Week 2: Q7

- You have been given a network 144.123.4.0/24. You want to break it into subnetworks. The first subnetwork contains 43 hosts. The second contains 20 hosts. What is the host range for the second subnetwork.
- A. 144.123.4.32/26
- B. 144.123.4.64/26
- C. 144.123.4.32/27
- D. 144.123.4.64/27**

Revision Quiz Week 2: Q7

- You have been given a network 144.123.4.0/24. You want to break it into the most efficient subnetworks. The first subnetwork contains 43 hosts. The second contains 20 hosts. What is the network address (with /) for the second subnetwork.

43 hosts – require room for 64 IP addresses. 64 is 2^6 or 6 bits for host. Hence $32 - 6 = 26$ bits for network.

Network is /26. The network address is 144.123.4.0/26.

It starts at 144.32.4.0 and finishes at 144.32.4.63.

Last byte is 00100000 (network red)(host blue)

Second network must have room for 32 hosts. $32 = 2^5$ or 5 bits. Network is /27. The network address is 144.123.4.64/27

01000000 (network red)(host blue)

Thanks for doing this class

- Good luck! See you next month.