Computer Networks Principles

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Open book — Be concise and justify your answers

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Please, no picture of handwritten notes, send me a clean pdf, or a simple text message.

Duration: 2h

1 IP and Routing

We consider a network with the following routing tables in machines A, B, C and D.

A:

dest.	next hop
10.1/16	link 1
0/0	10.1.1.2

B:

dest.	next hop
10.1/16	link 1
10.2/16	link 2
0/0	1.2.3.4
10.3.0/24	10.2.0.4

C:

dest.	next hop
10.3.0/24	link 1
10.2/16	link 2
0/0	10.2.0.2

D:

dest.	next hop
10.2/16	link 1
0/0	10.2.0.2

All interfaces are Ethernet.

1.1) Is the order of the entries important in the routing tables?

1.2) Make a schema of the network topology.

- Specify the network addresses when you know them;
- Place the IP addresses that you could learn from the routing tables;
- Attribute arbitrary (and appropriate) IP addresses to all other entities (make it apparent which are the ones you chose);
- We suppose that the MAC address of A is a0:a0:a0:11:11:11 and that all other Ethernet interfaces are numbered similarly. Specify all MAC addresses.

1.3) We send a packet from D to 10.3.0.12 (tell me first where you assume this machine is?). What path will the IP packet follow? Along the way, what IP addresses does the packet bear? What MAC addresses?

1.4) Make the time diagram of a ping between A and 10.3.0.12, assuming all machines have empty caches.

2 TCP

I just received two TCP packets back to back:

`IP src: 1.1.1.1 dst: 2.2.2.2 tot. length: 540 TCP src prt: 8080 dst prt: 52345 seq:12 ack:25 [data: 500B]`

`IP src: 1.1.1.1 dst: 2.2.2.2 tot. length: 540 TCP src prt: 8080 dst prt: 52345 seq:1012 ack:25 [data: 500B]`

2.1) What will be the values in the blank fields of the packet below, sent in response?
`IP src: [ ] dst: [ ] tot. length: 40 TCP src prt: [ ] dst prt: [ ] seq: [] ack:[ ] [data: 0B]`

2.2) What will happen next if I keep receiving data segments?

2.3) Suppose that I keep receiving data and the application on my computer does not execute any `read()`. Does the sender keep receiving ACKs? Does the application on the sender side eventually notice anything?

3 Performance

We consider a TCP data transfer and we assume that the congestion window is 2 MSS (2 fully filled 1500B IP packets). Let's consider that the congestion window does not change (maybe it is blocked by the buffer size at the receiver?). . We assume that there is 1 intermediate router and 2 switches between the sender and the receiver. The first link is 10 Mb/s, all others are 100Mb/s.s

3.1) Draw a time diagram of the exchange (assuming that there is no delayed ACK, in case you are wondering)

3.2) How long will it take to send 10 full segments? (we neglect all link layer overhead, propagation delays, switching delays…)

3.3) How long would it take with a congestion window of 3 MSS?