Q1. 180.110.10.50 → 200.18.30.22

a. Destination address in case of indirect routing will be the mobile node's permanent address. It will be 180.110.10.50.

Source address will be mobile node's permanent address : 180.110.10.50

b. In case of direct routing, dest address of a data packet will be mobile node's COA as the correspondent will contact with home agent and gets in COA. — 200.18.30.22.

The Source address will also be 200.18.30.22

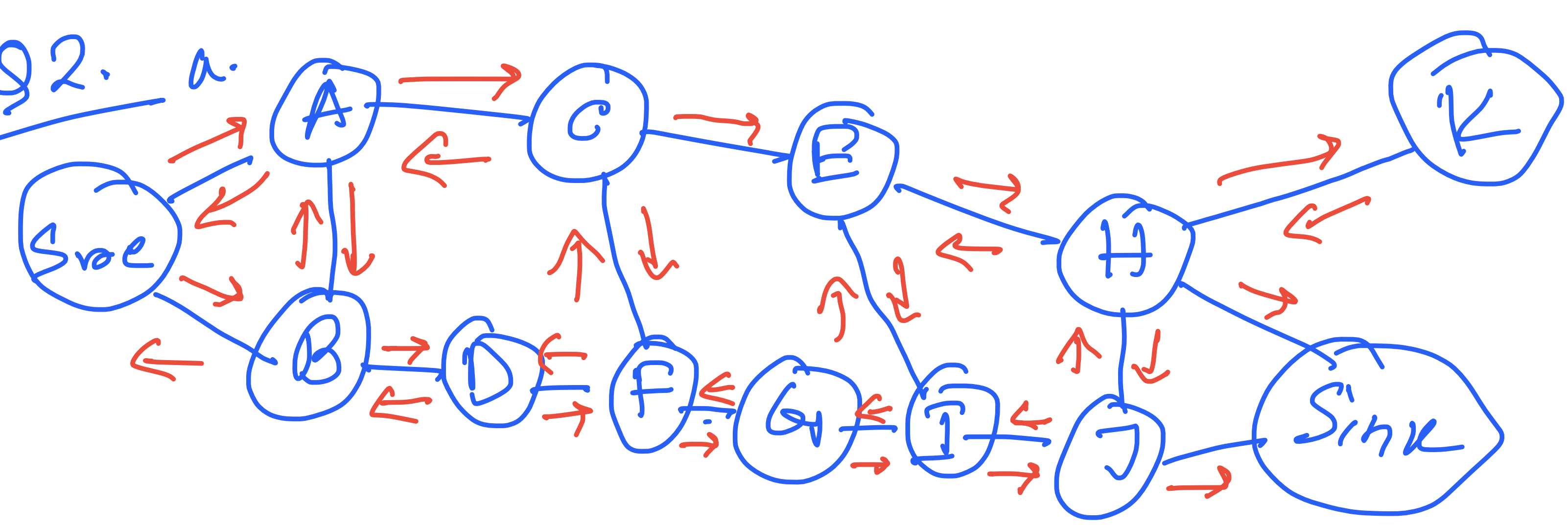
c. In this case, as the mobile node is in correspondent node's network, direct routing is more efficient. In case of indirect, the packets will go to home agent then again to correspondent's network, will have to travel extra hops that is why direct is more efficient.

d. firewall stops any packets whose source / dest address does not belong to correspondent's network.

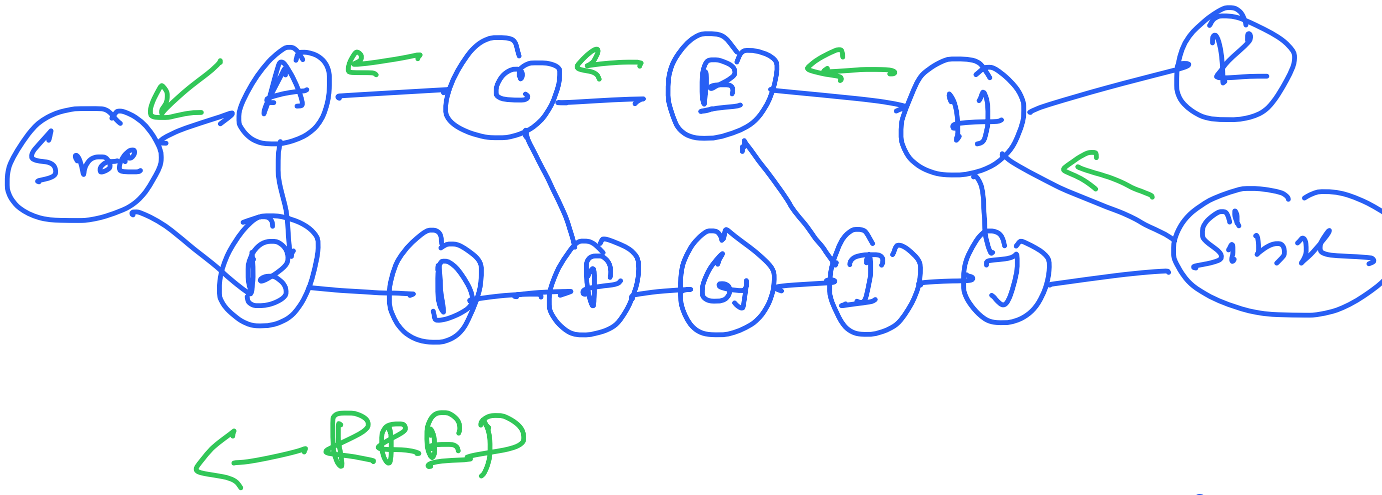
Neither direct routing / indirect routing will be impacted by this. As, for indirect, the packets will go to home network from that home agent sends to foreign agent with COA address only. Then mobile node sends with PA but directly to correspondent. Since this is internal not incoming / outgoing firewall wont cause a problem.

For direct routing, the packets from directly between corr. & mobile in the same network so no problem is caused.

Q2. a.



→ RREQ



b. Routing table entry B, C, D, G, J, E

Every node that receives RREQ from Src. sets up reverse path routing table entry pointing to Src.

Similarly, every node that receives RREP sets up routing table entry pointing to dest on the forward path

B

Dest	Next hop	Seq. No.
Src	Src	S_1

C

Dest	Next hop	Seq No.
Src	A	S_1
Sink	E	S_2

D

Dest	Next hop	Seq No.
Src	B	S_1

G

Dest	Next hop	Seq. No.
Src	F	S_1

J

Dest	Next hop	Seq No.
Src	H	S_1

E

Dest	Next hop	Seq. No.
Src	C	S_1
Sink	H	S_2

Assuming S_1 Seq. no. generated by Src
S_2 " " Sink.

Note that a node who was not in RREP path, will not have entry for Sink.
Similarly a node , receives RREQ from whichever path earliest will put Routing table entry accordingly.

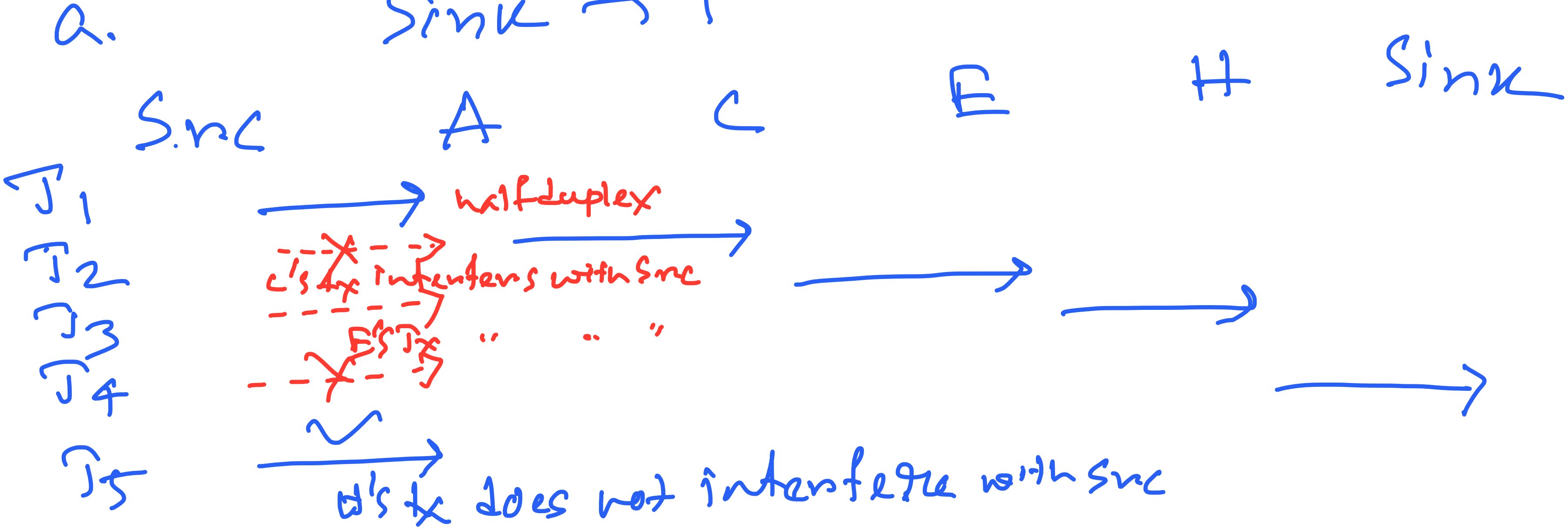
d. Best route

Src – A – C – E – H – Sink

Q3.

Src → 2
A → 2
C → 3
E → 4
H → 2
Sink → 1

a.



Thus, effective data rate $= \frac{R}{4}$

b.

Timeslot 1	Timeslot 2
Src → A (ch1)	A → C (ch1)
C → E (ch2)	E → H (ch2)
H → Sink (ch1)	

Thus, effective data rate $= \frac{R}{2}$

4.

In the PIP protocol, the Teardown message is sent by the source only not by the sink.

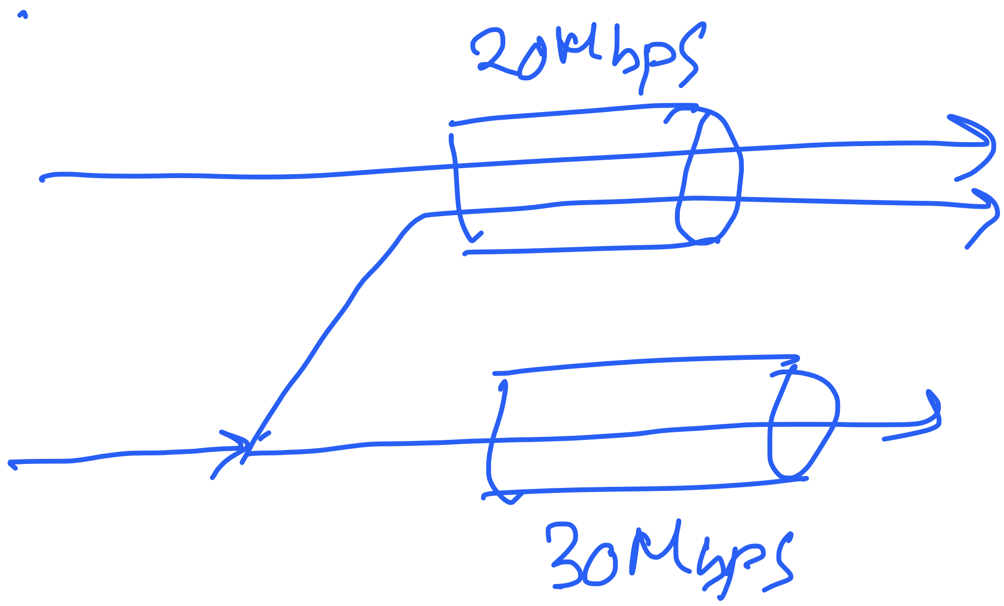
When the src determines that all packets have been acknowledged, sends a Teardown message. After forwarding Teardown message, nodes switch from SMC to UIC mode. If Src. sends the Teardown message and even if the link between two nodes is 100% loss even then there is no inconsistency between Src & Sink, as Src sends Teardown only when it knows all packets have been received successfully.

5. We can't use data sequence numbers as it is because two issues

① Since the latency characteristics on two links would be different, there will be reordering of packets

② Each path will continuous holes in the sequence numbers, this will upset some middleboxes & they won't allow such packets to flow.

6.



a. MPTCP + EWTCP congestion control.
with EWTCP each link will be shared evenly between subflows that use it

Thus, on the 20Mbps path
regular TCP would get - 10Mbps

one subflow gets - 10Mbps

The other subflow is not shared with anyone, hence gets = 30Mbps

Thus, regular tcp gets - 10Mbps

MPTCP gets - 10+30

= 40Mbps

b. For coupled congestion control, it is fair to regular tcp & utilizes paths efficiently to put more traffic on less congested paths.

Thus, it will utilize 30Mbps link fully & push more traffic there & very less traffic on the 20Mbps link.

Thus, regular tcp gets ~ 20Mbps

MPTCP gets ~ 30Mbps

Q7. b & c.

Q8.

a. SampleRate

Starts with 54 → Samples 10th pkt at 48 as lossless Tx < Current avg

moves to 48 as avg with 48 < 54

at 48 samples at 36 & 54 as 36 lossless Tx < Current avg.

moves to 36 as avg with 36 < 48

10th packet it samples at 24, 48, 54

24 as lossless Tx < Current avg.

it does not move to 24 as its avg > 36's avg.

So, SampleRate stays at 36 & keeps sampling at 24, 48 & 54.

SampleYaRa →

54 → Samples 10th pkt at 48 & lossless Tx < Current avg

moves to 48 as avg at 48 < avg at 54 & diff time < threshold

at 48 → does not sample at 36 as diff > threshold

So, SampleYara will stay at 48 & will keep sampling at 54

b. SampleRate

54 → 48 lossless < avg.

moves to 48 as avg < 54's avg

at 48 samples at 54, 36

moves to 36 as avg < 48's avg

does not sample at 24 as lossless > crossed avg

So, SampleRate will stay at 36 & keeps sampling at 48, 54.

SampleYara

54

↓

48

↓

36

Stays at 36 & keeps sampling at 48, 54