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① Ch4: P2 :-

a). No; using a shared bus, we can only transmit one packet at a time. with this conclusion, we can forward 2 different output ports. through the switch fabric at an instant. with shared bus.

b). No; forwarding 2 packets with switch fabric at an instant is not acheivable via memory since if the destination ports were different and we can only have one memory operation either to read/write at once using shared system bus.

c). No; with the use of Crossbar too would not be possible to sent 2 at a time as the packets would need to be sent over the output bus.

② Ch4: P4 :-

Least # of slots to transfer packets from input → output ports ⇒ 3.

Scheduling :-

Slot 1: Sending X → top of Input Queue.
Y → middle input Queue.

Slot 2:-

x → middle of input Queue.

Y → bottom of input Queue

Slot 3:-

Send z → input Queue.

→ Maximum # of slots ⇒ 3. In the worst case scenario, we might end up having 4 timeslots when the 1st datagra -m in the bottom input Queue and with an assumption of an non-empty queue is never idle, as first slot has x in top; y in middle and in second slot it has y at the bottom.

③ Ch4: P8 :-

⇒ Subnets with prefix 223.1.17.0/24 are mentioned below.

① 223.1.17.0/26

② 223.1.17.128/25

③ 223.1.17.192/28.

④ Ch4: P12 :-

a) Following the Constraints and addresses allocated from 214.97.254/23 and possible assignments are.

Subnet A — 214.97.225/24 ⇒ 256

B — [214.97.254.0/25 ⇒ 214.97.254.0/29] ⇒ 120

C — 214.97.254.128/25 ⇒ 128

D — 214.97.254.0/31 ⇒ 2

E — 214.97.254.2/31 ⇒ 2

F — 214.97.254.4/30 ⇒ 4 #

b)

Assumptions:-

→ No datagrams have routes interfaces as final destinations.

→ 'D' as upper-right, E – Bottom, f – upper-left interior Subnets

Router 1:-

Longest prefix match.			Interface
11 01 0110	011 00001	11111111	Subnet A
11 01 0110	011 00001	11111111 00000000	Subnet B
11 01 0110	011 00001	11111111 00000001	Subnet F.

Router 2:-

Longest prefix match:-				Interface
11 01 0110	011 00001	11111111	00000000	Subnet D.
11 01 0110	011 00001	11111110	0	Subnet B
11 01 0110	011 00001	1111 1110	0000001	Subnet E.

Router 3:-

Longest prefix match:-				Interface
11 01 0110	011 00001	11111111	00000001	Subnet - F
11 01 0110	011 00001	11111110	00000001	Subnet E
11 01 0110	011 00001	11111110	1	Subnet C.

⑥ Ch4-P18:-

→ ND; we cannot establish a Tcp connection with Bernard from Arnold and cannot come up with any such procen. without app-specific NATting.

→ A direct TCP connection has to be established between Arnold/Bob that must start a connection for others.

→ If neither of them cannot make that happen when they are behind NAT which eventually drops SYNC packets from WAN.

⑤ Ch14:-

Length of datagram = 2400 bytes

IP header = 20bytes

MTU = 700 bytes

Identification # stamped = 422

# of fragment generated ⇒ $\left\{\frac{\text{datagram Length} - \text{Ip Header Length}}{\text{MTU} - \text{Ip header}}\right\}$

$\Rightarrow \left(\frac{2400-20}{700-20}\right)$

# of fragments generated $\Rightarrow \frac{2380}{680} \Rightarrow 3.5 \cong 4$ #.

fragment #	Datafield (Bytes)	Identification #	fragmentation affect	flag.
1	700 − 20 ⇒ 680	422	0	1
2	700 − 20 ⇒ 680	422	85	1
3	700 − 20 ⇒ 680	422	170	1
4	2380 − 3(680) ⇒ 340	422	255	0

(7)

Ans

Network	Next Hop	Network in Binary.
C4.50.0.0/12	A	1100 0100 0001 0000 0000 0000 0000 0000
C4.50.10.0/20	B	1100 0100 0101 1100 0001 0000 0000 0000
C4.60.0.0/12	C	1100 0100 0110 0000 0000 0000 0000 0000
80.0.0.0/1	E	1000 0000 0000 0000 0000 0000 0000 0000
40.0.0.0/2	F	0100 0000 0000 0000 0000 0000 0000 0000
0.0.0.0/2	G	0000 0000 0000 0000 0000 0000 0000 0000

a). C4.5E.13.87

Binary ⇒ 1100 0100 0101 0001 0011 1000 0111

Matching ⇒ 1100 0101 1110 0001 0000 0000 0000

the 20 bits

⇒ C4.5E.10.0 ; (B) will be next hop.

b). C4.5E.22.09

Binary ⇒ 1100 0100 0101 1110 0010 0010 0000 1001

Matching ⇒ 1100 0100 0101 0000 0000 0000 0000 0000
the 20 bits

⇒ C4.50.0.0 (A) ; will be our next hop.

c) C3.41.80.02

Binay ⇒ 1100 0011 0100 0001 1000 0000 0000 0000

Matching ⇒ 1000 0000 0000 0000 0000 0000 0000 0000
1 bit

⇒ 80.0.0.0 (E) ; will be our next hop

d) 5E.43.91.12

Binary ⇒ 0101 1111 0100 0011 1001 0001 0001 0000

Matching ⇒ 0100 0000 0000 0000 0000 0000 0000 0000
2 bits

⇒ 40.0.0.0 (F) ; will be our next hop.

e) C4.60.31.2E

Binary ⇒ 1100 0100 0011 0110 0011 0001 0010

comparing ⇒ 1100 0100 0110 0000 0000 0000 0000
with 3rd
address

⇒ C4.60.0.0 (C) ; will be our next hop.

f). C4.6B.31.2F

Binary ⇒ 1100 0100 0011 0101 1001 1001 0010 1110

Matching ⇒ 1100 0100 0110 1000 0000 0000 0000 0000

If bits

⇒ C4.68.0.0 (D); will be our next hop.

*B:-

a)

Shared memory routers:-

→ with the assumption of there are many line cards throughput in this model and is limited by memory.

Bit rate ⇒ 200 MHz * 32 bits

⇒ 6.4 Gbps.

→ We need to place/allocated twice the memory needed one for memory and other for line card.

Bit rate ⇒ $\frac{6.4}{2}$ Gbps

⇒ 3.2 Gbps.

→ Packet has to be written/read from memory once.

Memory throughput ⇒ 32 bits / 10^{-8} sec ⇒ 3.2 Gbps.

b) Bus backplane routers:-

⇒ Consider there may be many line cards, bus is the painpoint for this design. Every packet has to be put onto bus only once.

throughput ⇒ 6.4 Gbps.

& Bus back plane

C). Switched back plane Routers:-

→ Considering 'N' cards, a Cross bar is thought of and no limitation on throughput of Routers.

throughput at each line card ⇒ 3.2 Gbps

Actual throughput at each line card ⇒ 25 %. (Throug

⇒ (3.2 x 25 %) Gb

⇒ 800 Mbps.

* Total throughput for N cards ⇒ N(800) Mbps #.