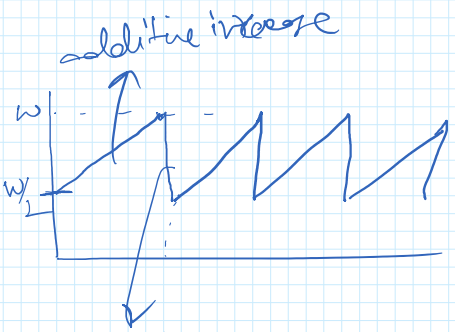
Lecture 17

20 October 2021 16:59

- Recap
  - TCP throughput
  - TCP fairness
  - N/w introduction
    - VC
    - Datagram
    - Forwarding / Routing
- Forwarding table
- Router architecture
  - switching types
    - I/P port Queuing
    - O/P port Queue
- IP Datagram Structure
- IP addressing terminology → subnet etc.

Recap

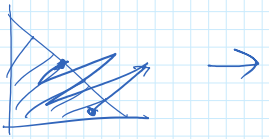
TCP throughput



(AIMD)

$\frac{3W}{4}$

TCP Fairness



N/w layer

- Forwarding
- Routing
- VC Vs Datagram
  - Fixed path
  - VC1 → o/p 1
    2 →

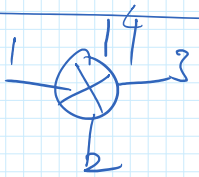
32 bit

Forwarding table

IP v4 32 bit

I/P	o/p Link #
000000 to 001111	1

2^6 entries



192.168.1.1 → 4

6 entries

000000 to 001111 → 1

010000 to 011111 → 2

100000 to 101111 → 3

110000 to 111111 → 4

⇒

Prefix

00**** → 1

01**** → 2

10**** → 3

11**** → 4

Another Ex

000000 to 011111 → 1

100000 to 100011 → 2

100100 to 111111 → 3

0***** → 1

1000** → 2

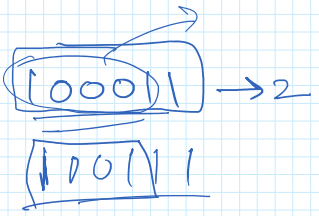
1001** → 3

1010** → 3

1011** → 3

1***** → 3 except 1000** → 2

"Longest Prefix match"



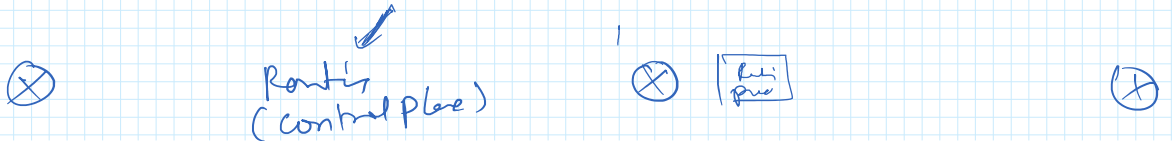
I.P.

0 → 1 ✓

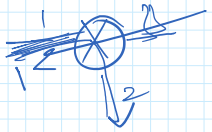
1000 → 2 ✓

→ 3 ✓

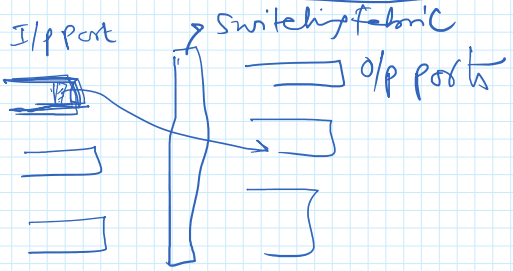
Router architecture



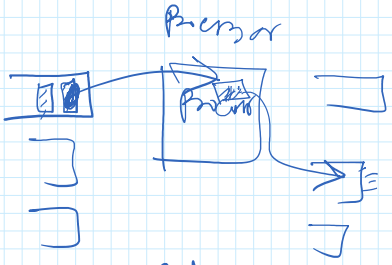
Routing (control plane)



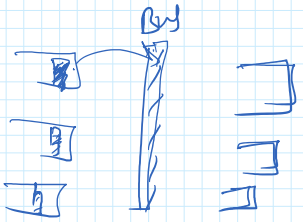
Forwarding (Data plane)



① Memory/CPU



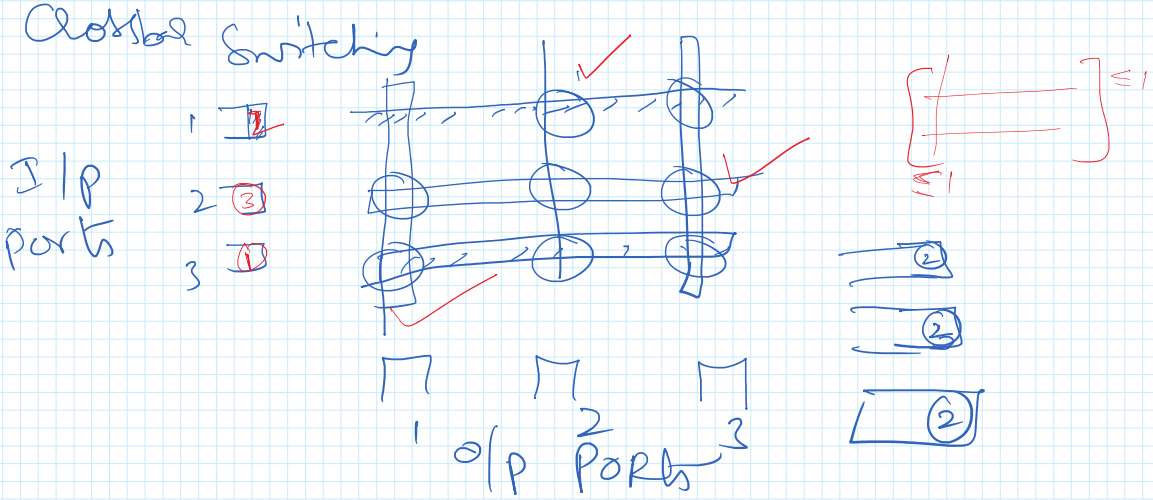
②



→ Small header

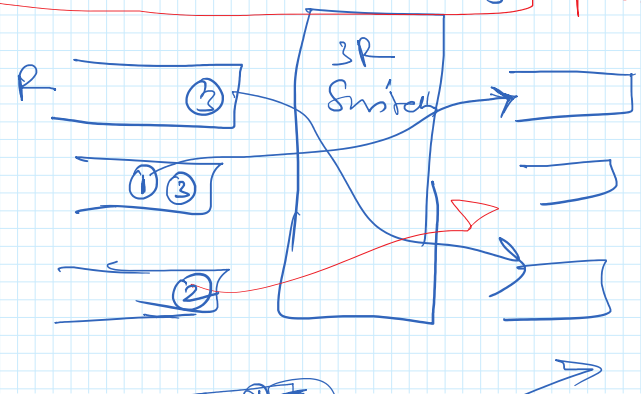
→ If header matches,

③ Crossbar Switching

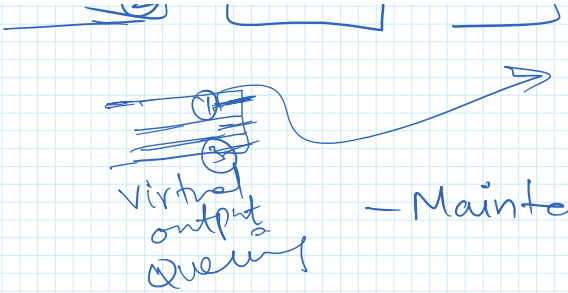


- Two i/p ports cannot send to the same o/p Port at a given time

Head-of-line Blocking Problem



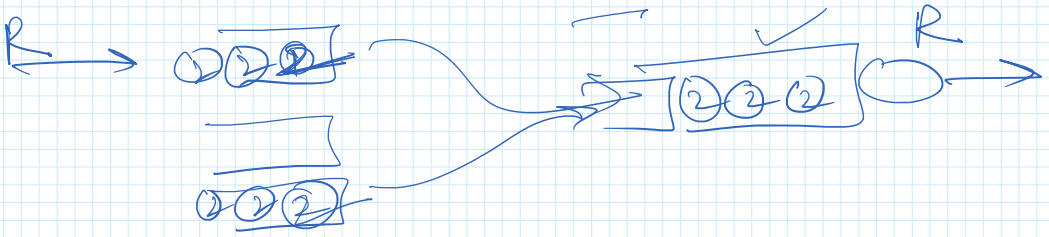
Packet Switching algorithms



– Maintain seperate queue for each output Port at the i/p Port.

Book "R. Srikant" → Read theoritical aspects.

O/p Queuing

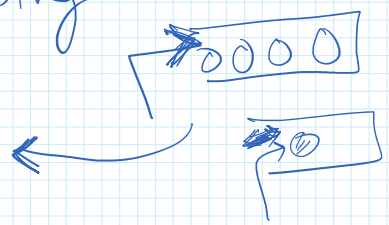


I/p queuing : linerate >> Switching rate

Switchingrate ≈ N linerate

How much Buffer size ??

Dropping



Drop-tail

RED → Random Early Detection

$Q < q_{min}$ → no drop

$q_{min} < Q < q_{max}$ → drop w.p. 1/2

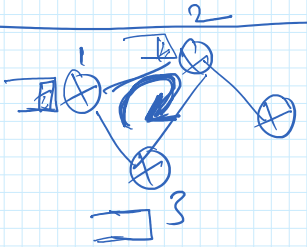
$Q > q_{max}$ (q_{max} = 70% of Cap) → always drop

IP Datagram

TTL : Time to live

So

S → D

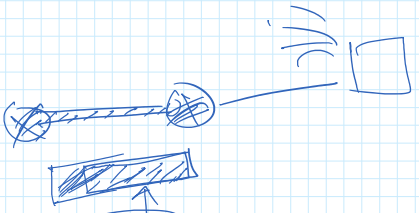


S → D
50 hops

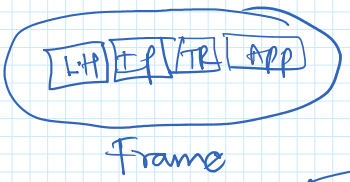
50 → 49 → 48

3

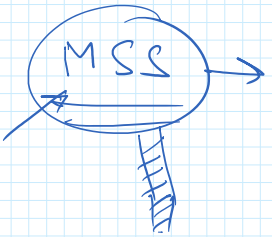
— Fragmentation



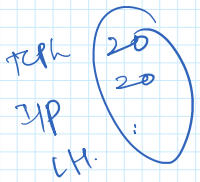
max. link-layer size = MTU = Max. transmissible unit



Frame

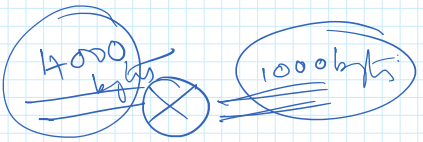


MTU



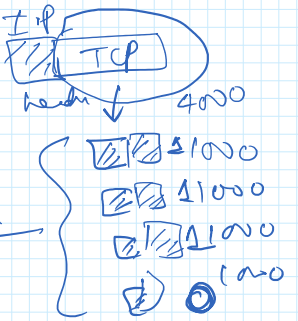
MSS + 3 headers (TCP, IP, link layer) < MTU

Path



— Fragmentation (IP)

IP - separate



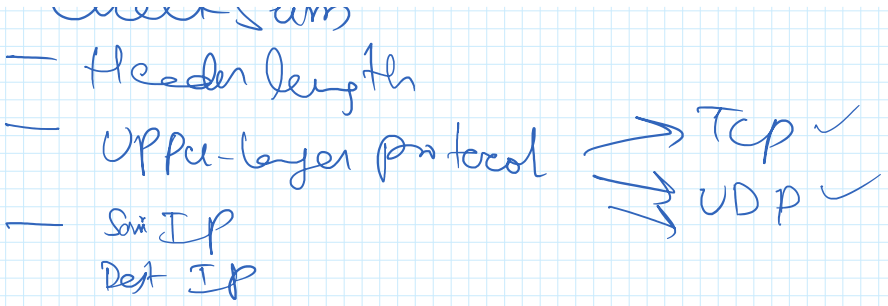
— Fragmentation related headers

→ Identification ✓ 16 bit

→ Flag ✓ 1 for all fragments except last fragment = 0

→ offset ✓ = 0 (1st fragment)
= 1000 (2nd frag)
= 2000 (3rd frag)
= 3000 (4th fragment)

— version number.
— checksum
— Header length


— Header length
— Upper-layer protocol
TCP
UDP
— Src IP
Dest IP