Lecture 6

The Way Networks Work (continued)

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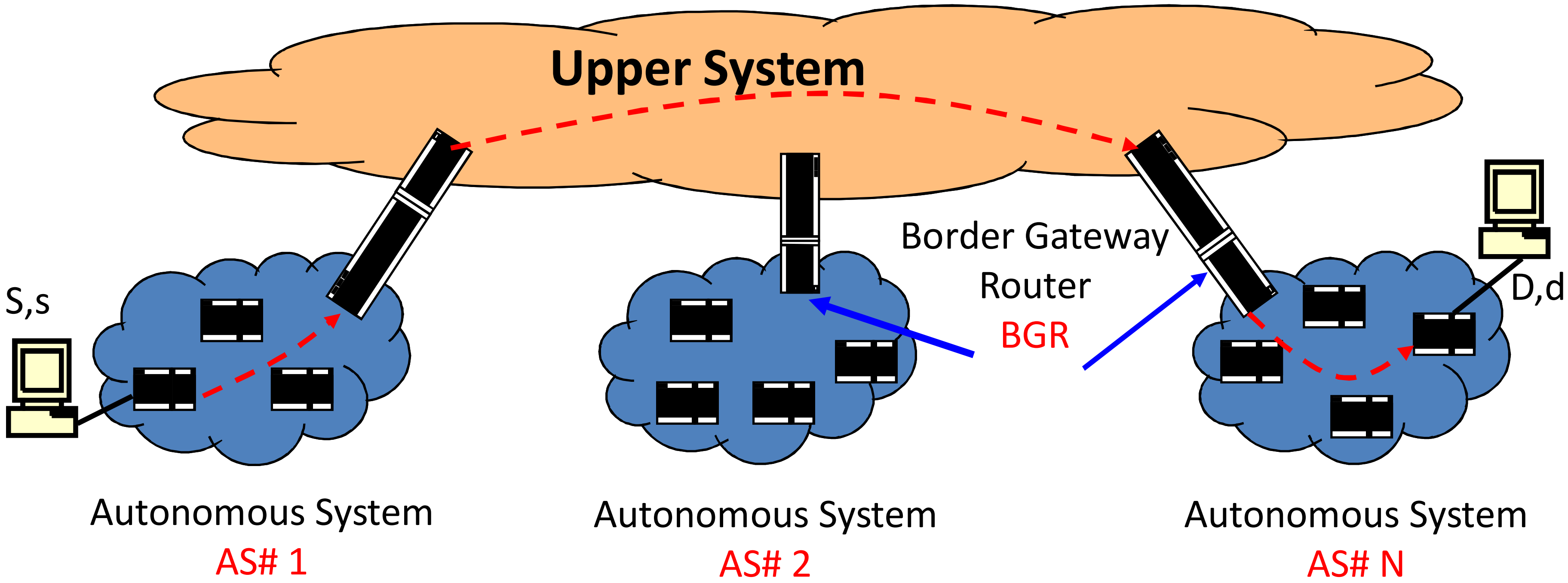
Guaranteeing delivery & regulating flow of packets (Answer to Q3)

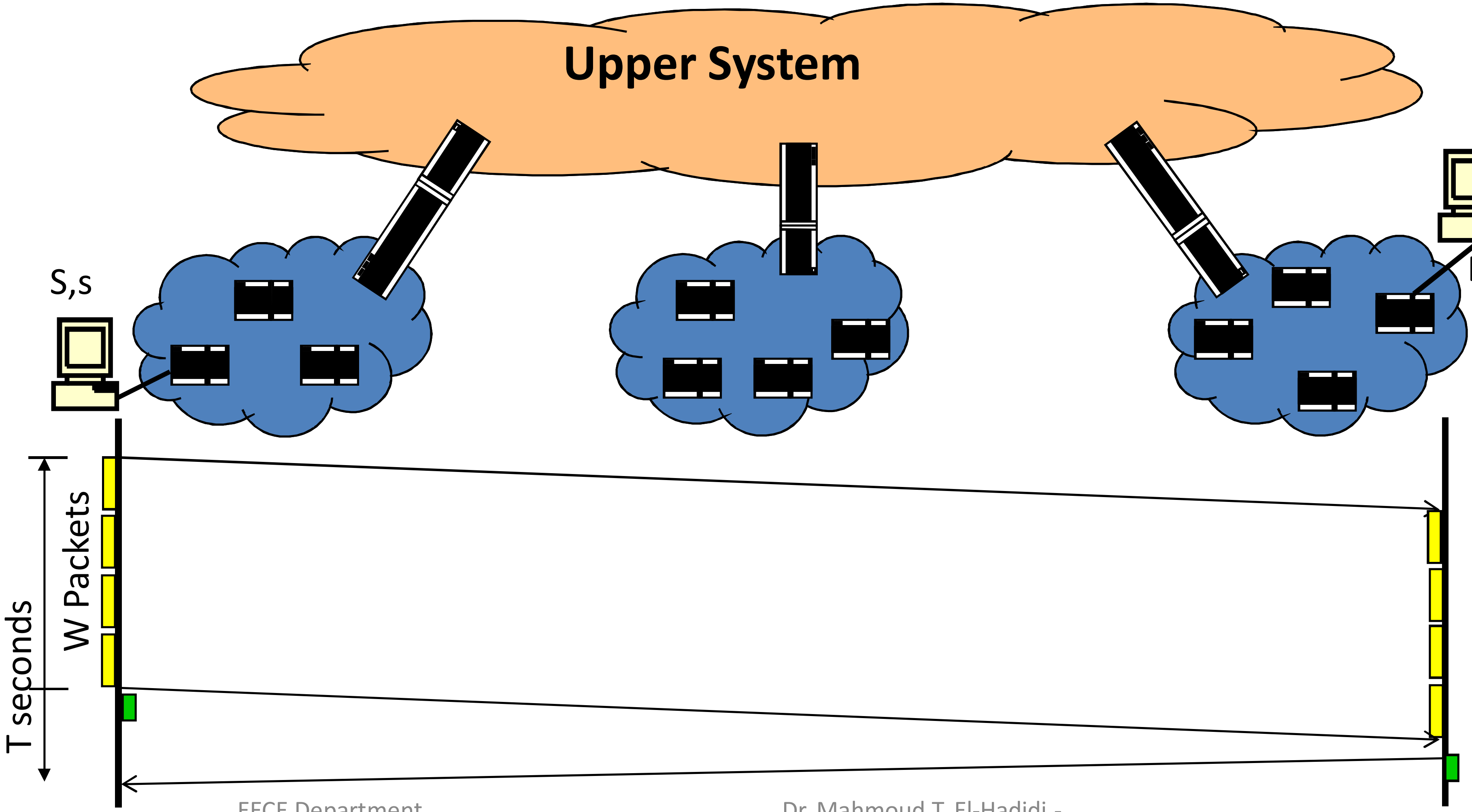


Having determined the route from S to D, it is required to ensure :

- messages are delivered correctly
- flow of messages is regulated to avoid overflow

Guaranteeing delivery & regulating flow of packets (Answer to Q3 - Continued)

An end-to-end protocol – called Transmission Control Protocol (TCP) – is used :



Guaranteeing delivery & regulating flow of packets (Answer to Q3 - Continued)

- Pkts are sent in groups (W pkts/group)
- An ACK pkt is sent to confirm safe delivery of pkts (from one end to another)
- If ACK is not received (within Timeout), pkts are sent again.

Error Control

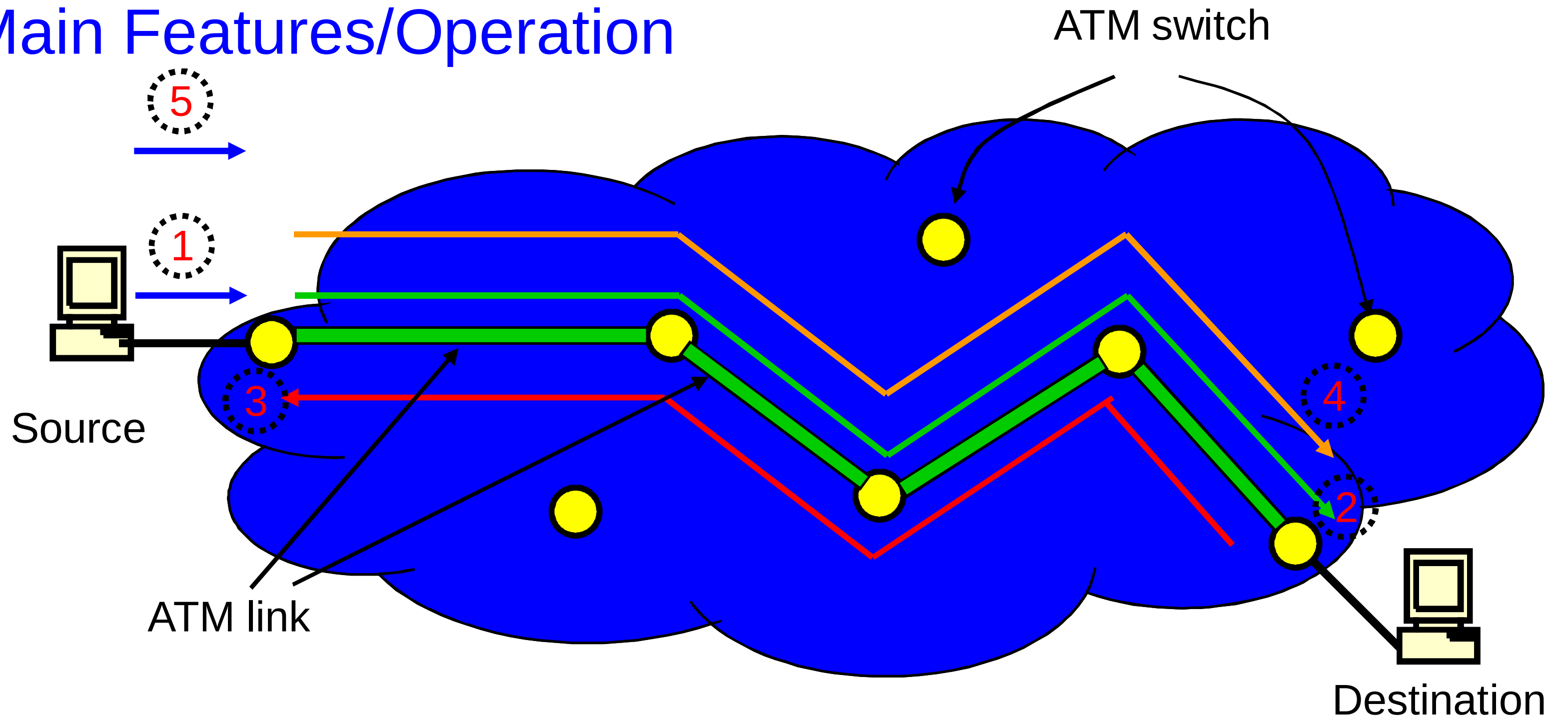
- Time req'd to send W pkts is recorded (= T seconds, say)
- Ratio W/T is calculated.
- If W/T is small, throughput is small and indicates high traffic in NW. To reduce traffic, W is reduced.

Flow Control

Transmission Control

Asynchronous Transfer Mode - ATM

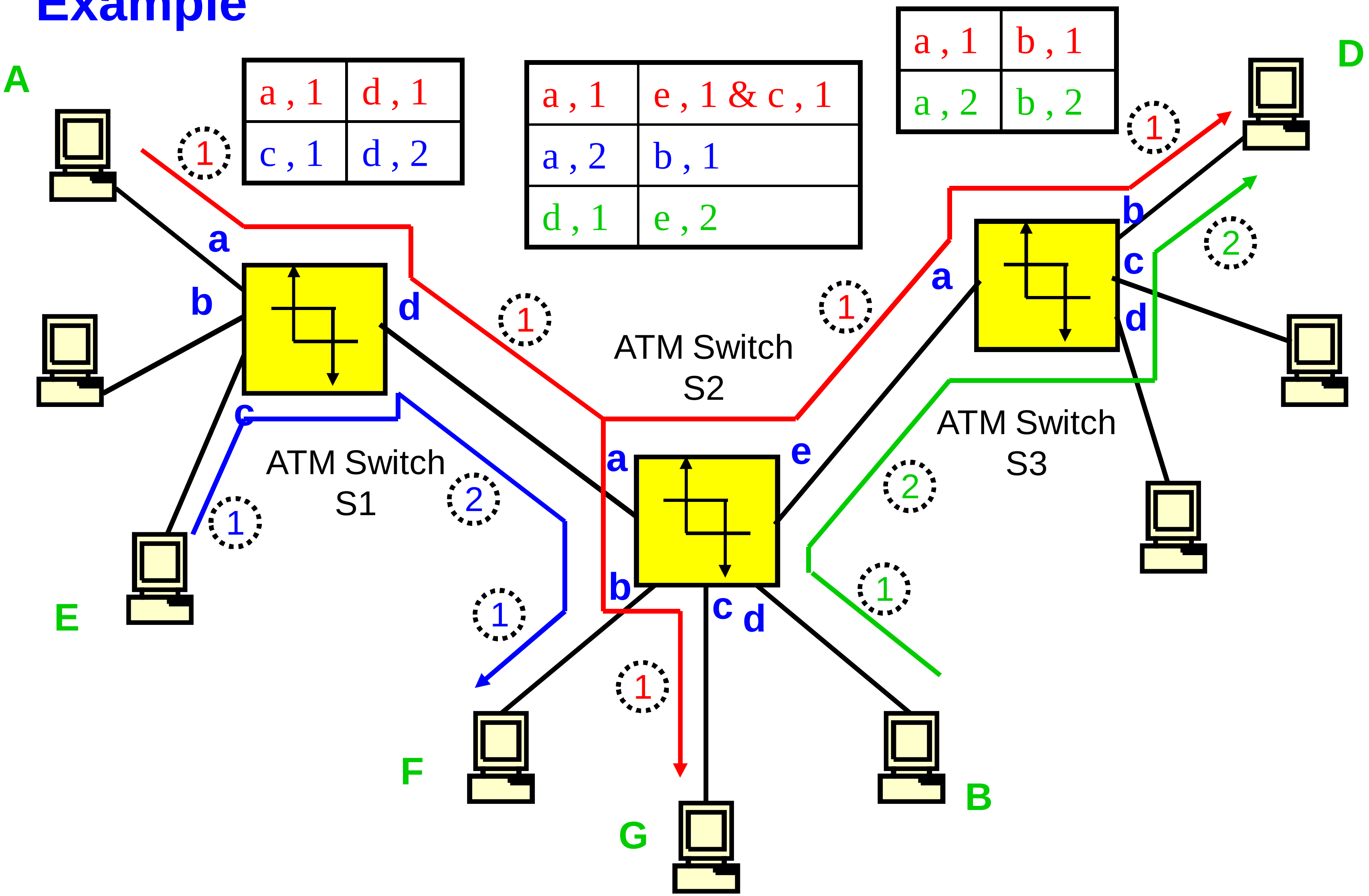
Main Features/Operation



For Source to send information to Destination :

- Source informs NW of its request (Step 1)
- NW establishes a connection bet. Source and Destination (Steps 2, 3)
- Source sends information to Destination over established path (Step 4)
- Source informs NW that transfer is completed (Step 5)

Example



a , 1	d , 1
c , 1	d , 2

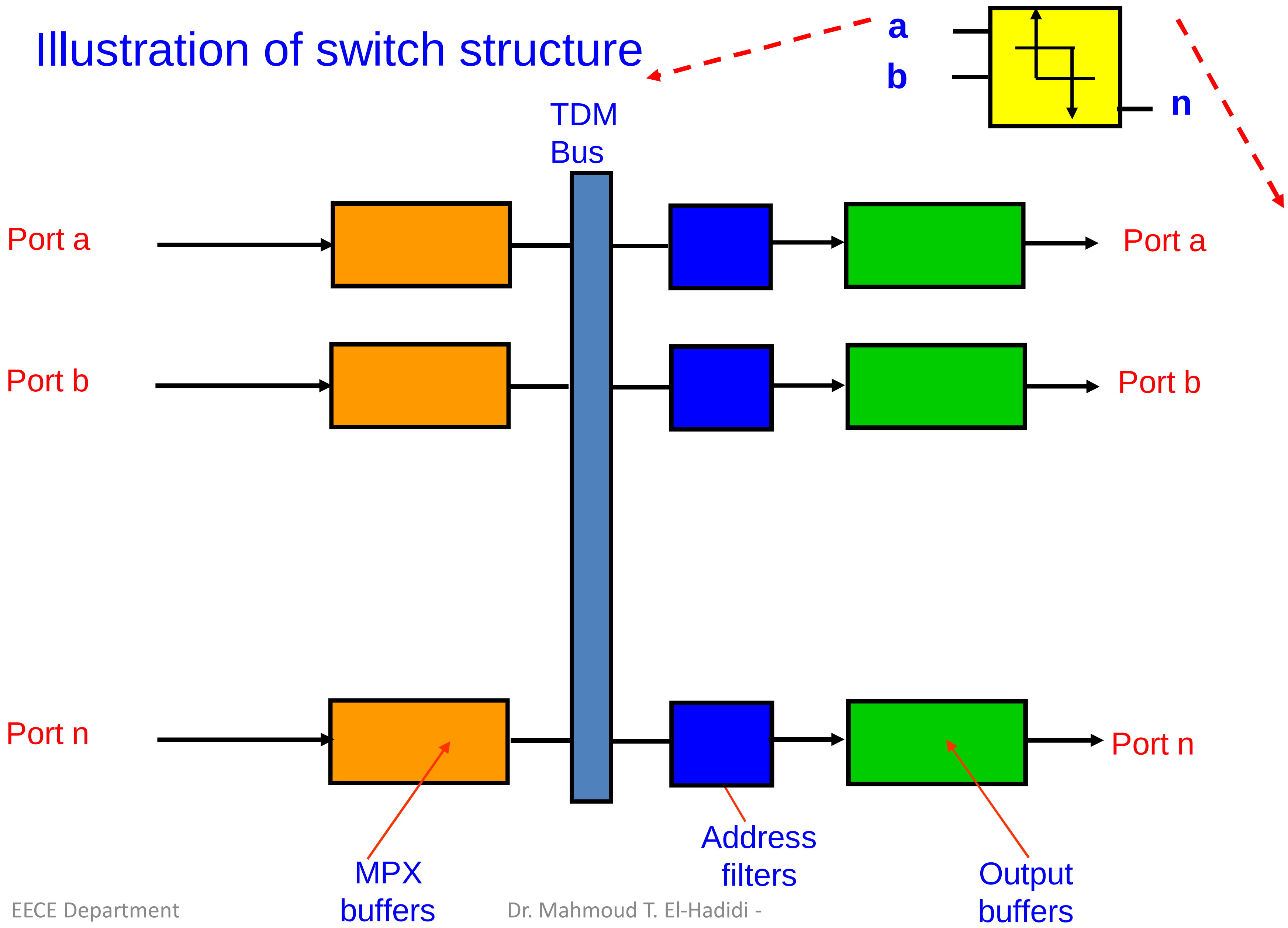
a , 1	e , 1 & c , 1
a , 2	b , 1
d , 1	e , 2

a , 1	b , 1
a , 2	b , 2

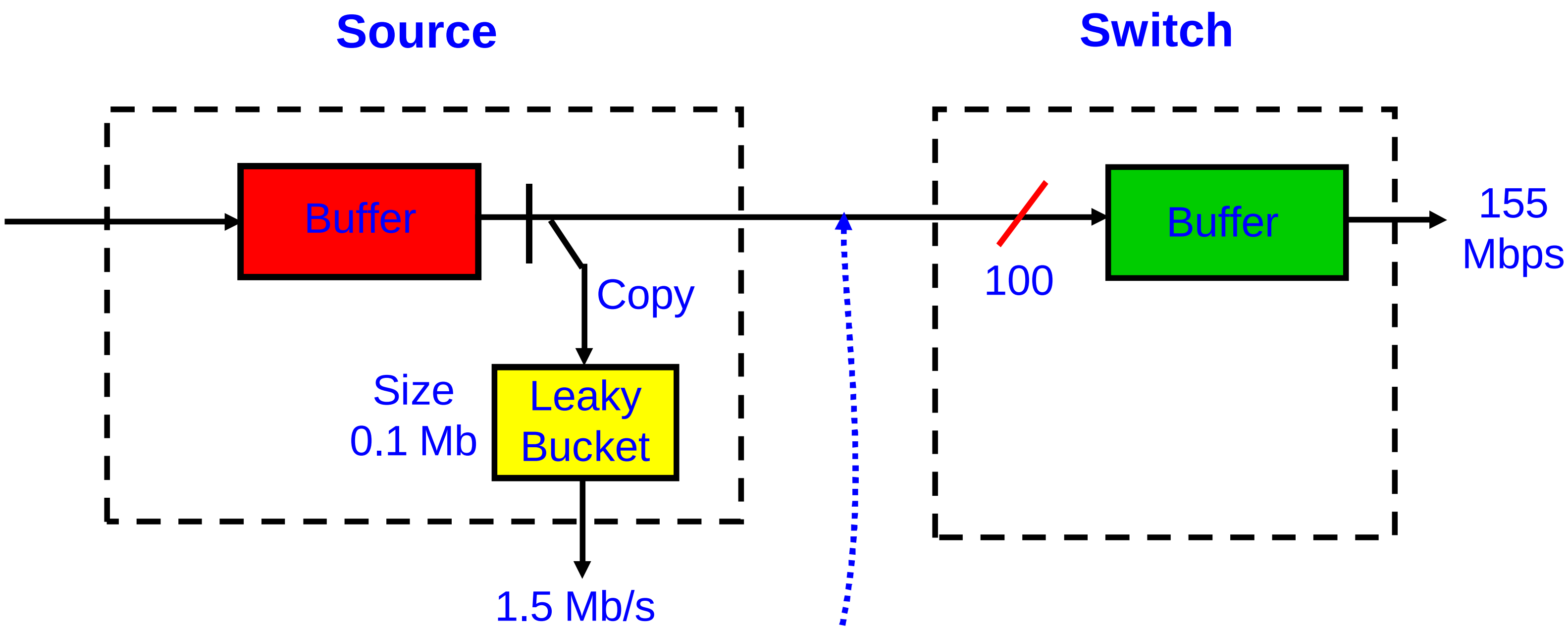
Connections are established in the order :

A ↔ D , G then E ↔ F then B ↔ D

Illustration of switch structure



Control of QoS : Leaky Bucket



Consider a switch serving 100 connections going to same O/P port.

- Source transmits only if bucket is not full
- Bucket receives whatever bits source sends. It leaks at rate 1.5 Mbps

Clearly, use of leaky bucket results in O/P of source :

- not to exceed burst size of 0.1 Mb
- not to exceed bit rate of 1.5 Mbps

∴ O/P of source over any time period "t" is constrained < $0.1 + 1.5\,t$

Next, by using an output buffer of size 10 Mb at switch :

- Switch can handle 100 connections without any source loosing data due to simultaneous bursts.
 (if ALL sources had a burst of size 0.1 Mb)

And, by using an O/P link of bit rate 155 Mbps :

- Switch can handle 100 connections without any source loosing data at steady state
 (if ALL sources had an average rate of 1.5 Mbps)

- No bit will experience delay more than 10/155 $\cong$ 65 msec

Error Control

Delay Control

Quality of Service
QoS