

Lecture 4

The Way Networks Work

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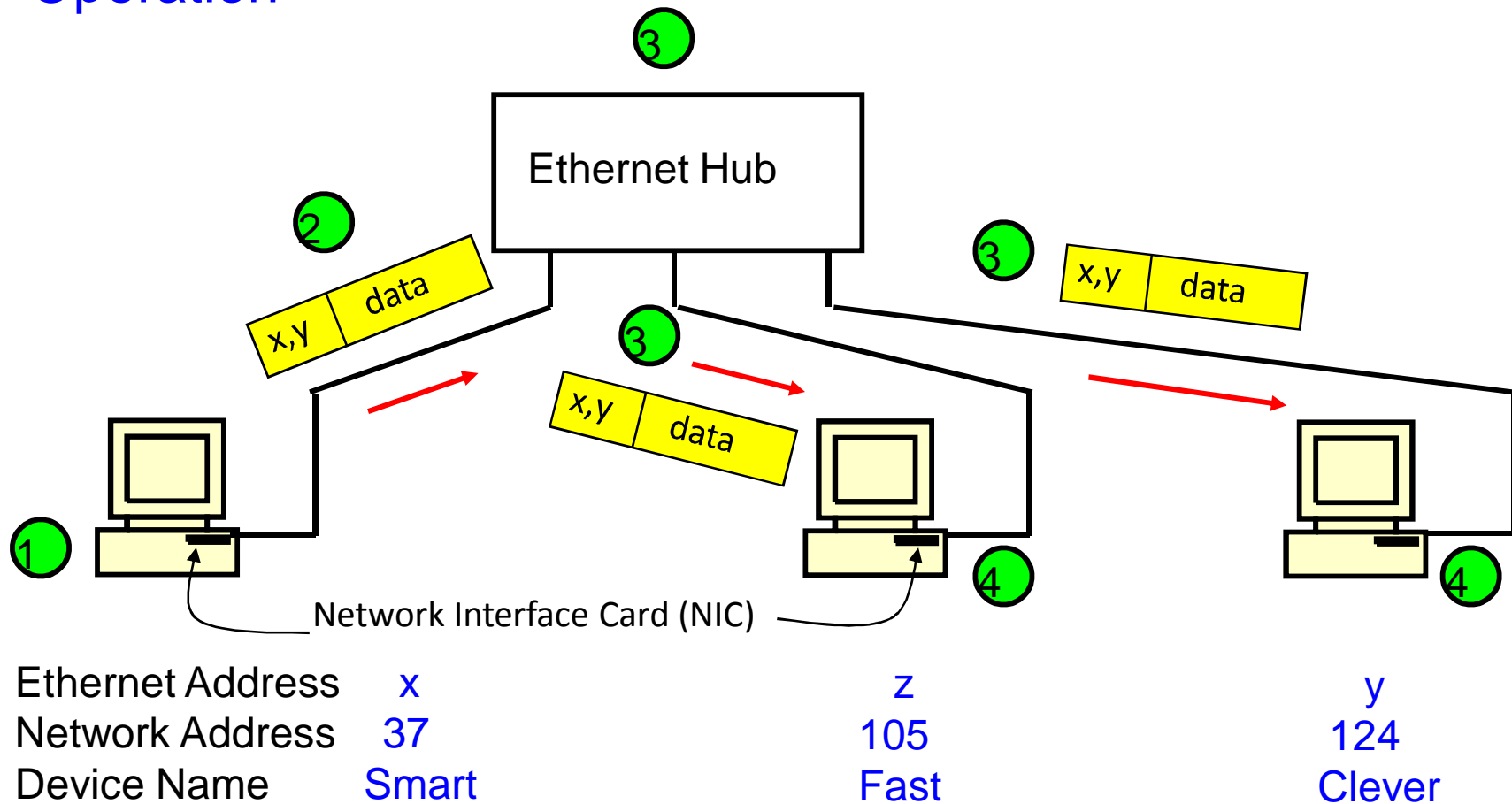
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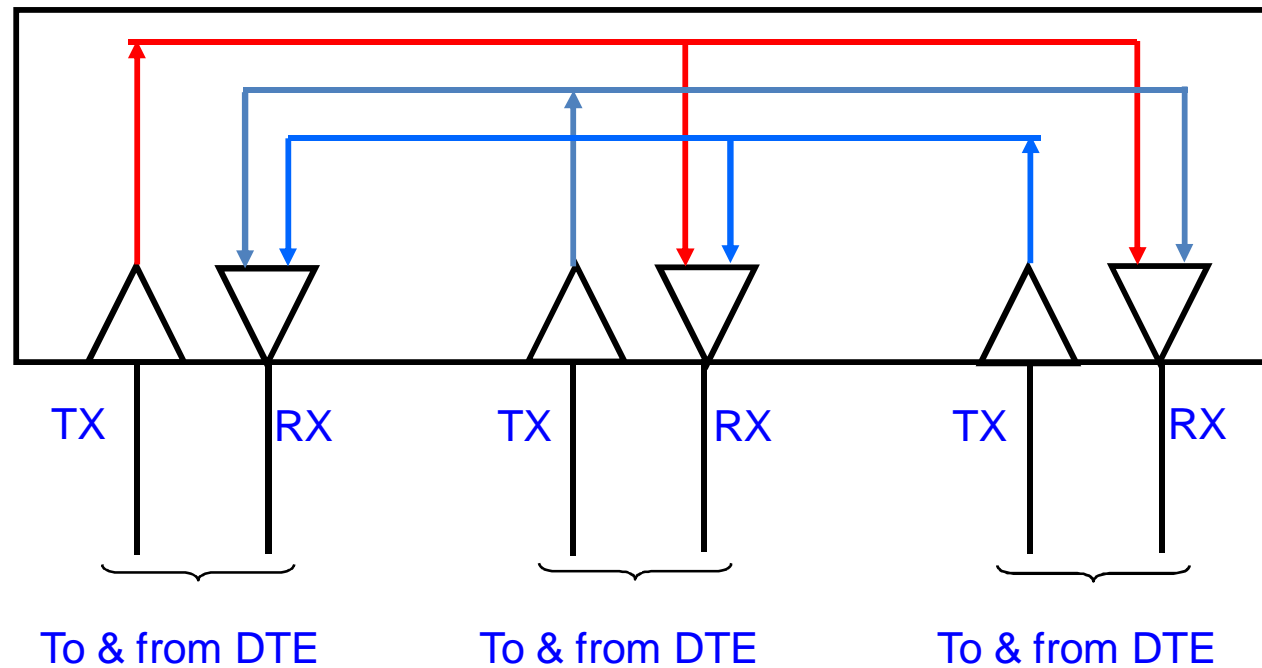
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Ethernet Hubs

Operation



Schematic diagram of Ethernet Hub (also called *Repeater*)



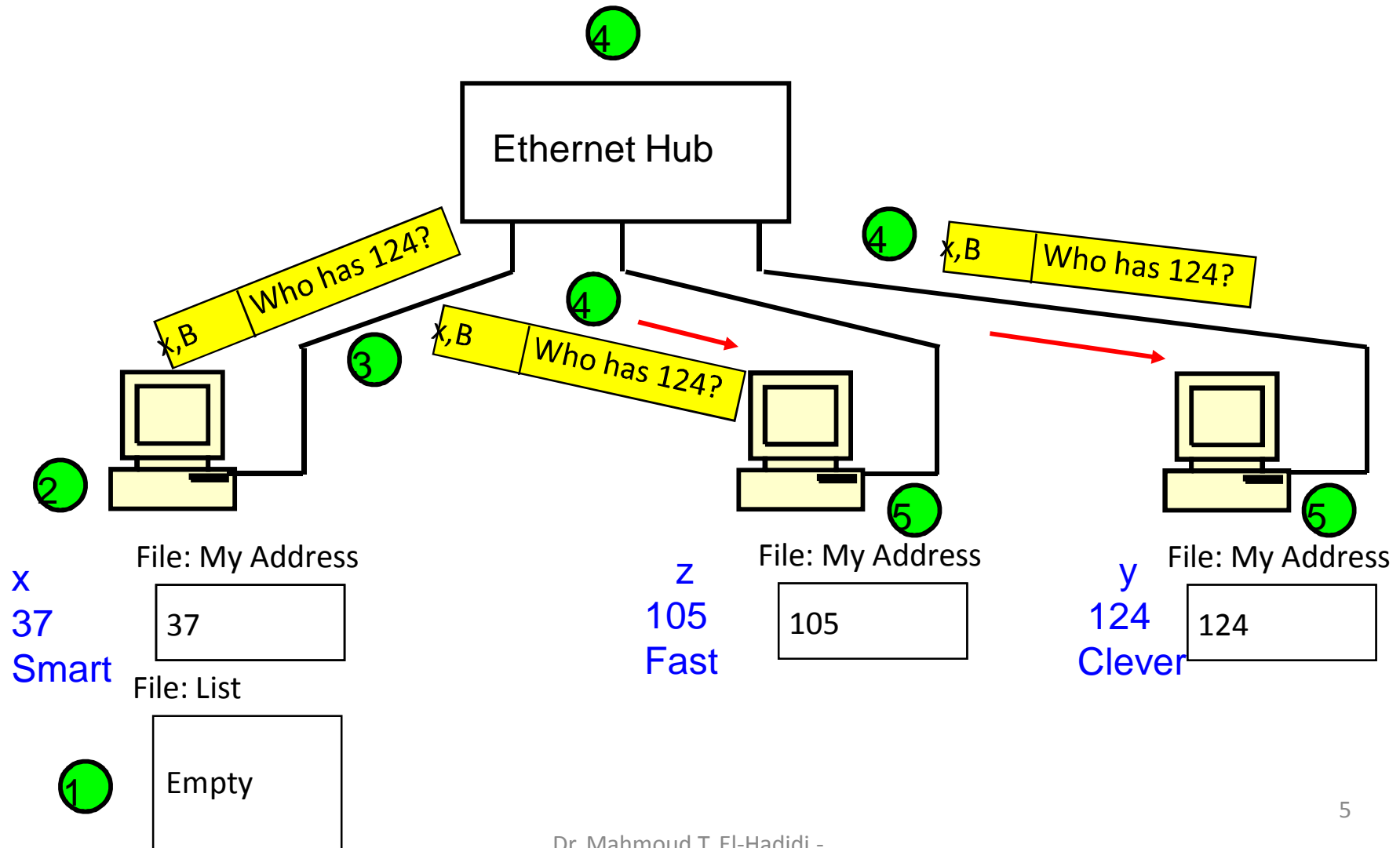
Collision and Access Control

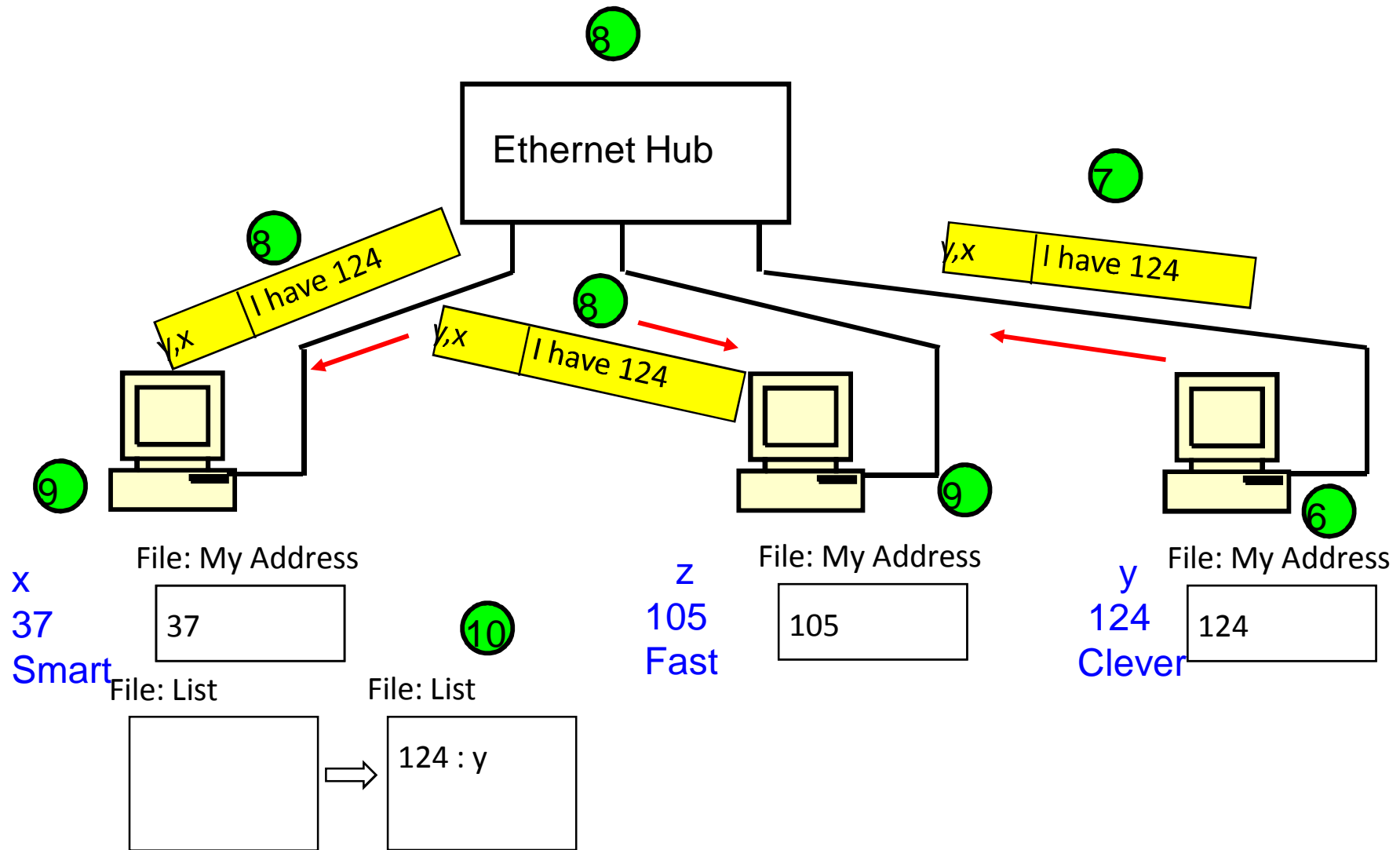
- ❑ Since PKT transmitted by a computer on its wires appears on all other wires of the hub, it is called “*Shared Ethernet*”
- ❑ It follows that if two computers start transmission simultaneously, the hub cannot repeat any of the corresponding two PKTs (because if it does, two PKTs will appear on these wires (called “*Collision*”).
- ❑ Hence, hub will instead issue a collision warning. On receiving this warning, all stations transmitting will immediately stop transmission. Each will then wait a “*Random Backoff*” time before attempting transmission again.
- ❑ Another rule, is that a station should listen to see if other station(s) is(are) currently transmitting. If so, it waits.

*Above access control procedure is called carrier sense multiple access with collision detection (*CSMA/CD*).*

Discovering Addresses : ARP and RARP

Q : If a PC wishes to transmit to another PC using Ethernet
How can it determine Ethernet Address of that PC ?





At the end of the above steps, computer 37 stores the Ethernet address of 124 (namely, y). It can then generate the Ethernet PKT.

Above procedure is called ***“Address Resolution Protocol”*** – ARP.

Remark

In some some devices (e.g. printers), there are NO harddisks. In this case, they cannot have “My-Address” file, or “List” file.

A server would then be used to maintain “List”. This is achieved by the device sending a message requesting network address from server, on booting. The server assigns a network address and keeps it on a list along with the Ethernet Address.

*Above procedure is called Reverse Address Resolution Protocol (**RARP**).*

Ethernet Switches

Why use an Ethernet Switch?

- ❑ In a shared Ethernet (Hub), # of computers that can be attached is limited due to performance limitation.

Solution :

Use switches.

- ❑ A shared Ethernet has a distance limitation.

Solution :

Use switches (if need to increase distance by few 100's meters)

Use routers (if need to increase distance by up to 1000's of kilometers)

What is a Switch ?

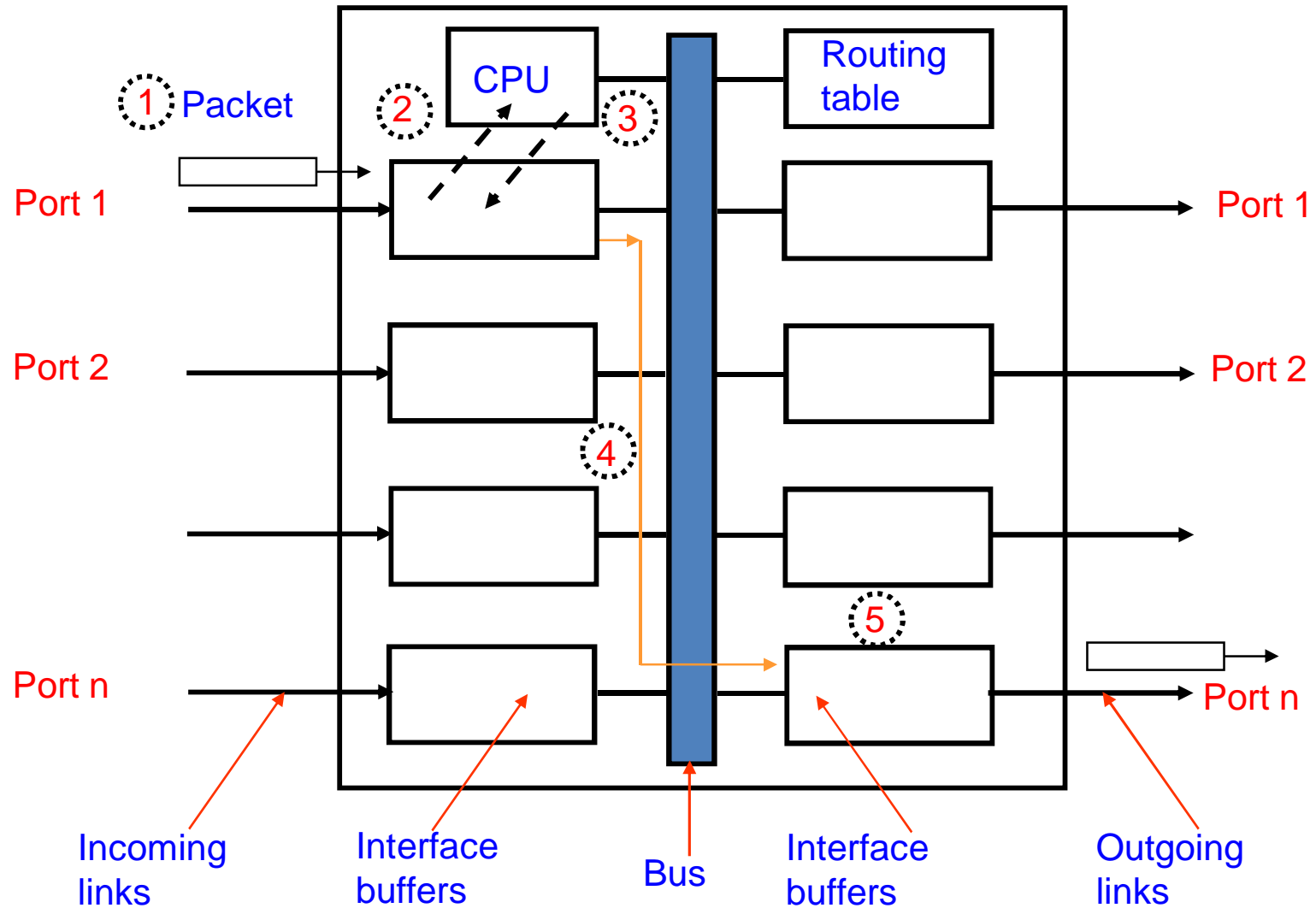
A device that attaches two or more Ethernet hubs, and can also attach directly to computers.

Switch Features

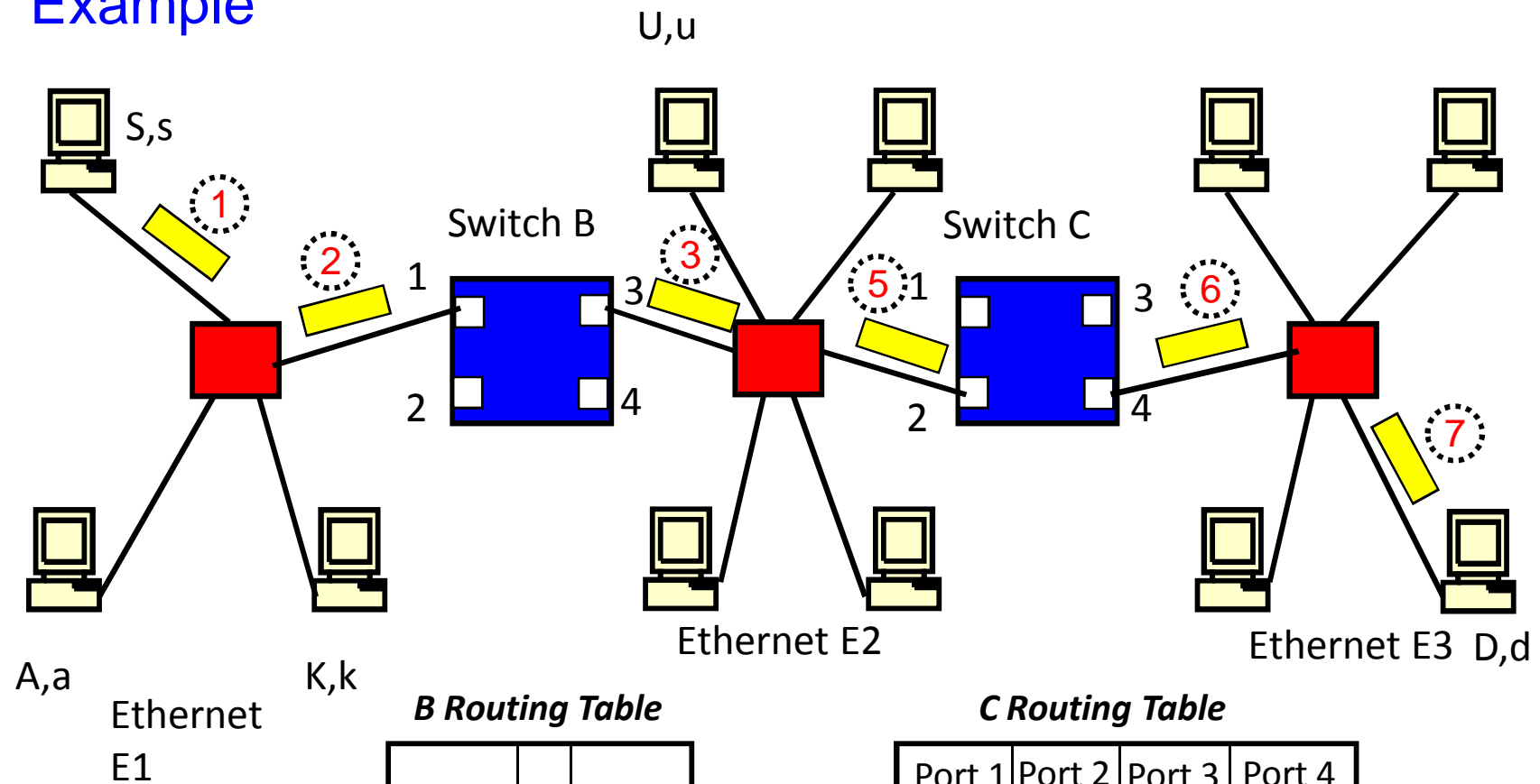
- ❑ Can transmit several PKTs - simultaneously - between two different input/output pairs.
- ❑ Can transmit and receive – simultaneously – on the same port connected to a computer (I.e. supports full-duplex operation).

Hence, a switch has higher throughput than a hub.

Operation



Example



B Routing Table

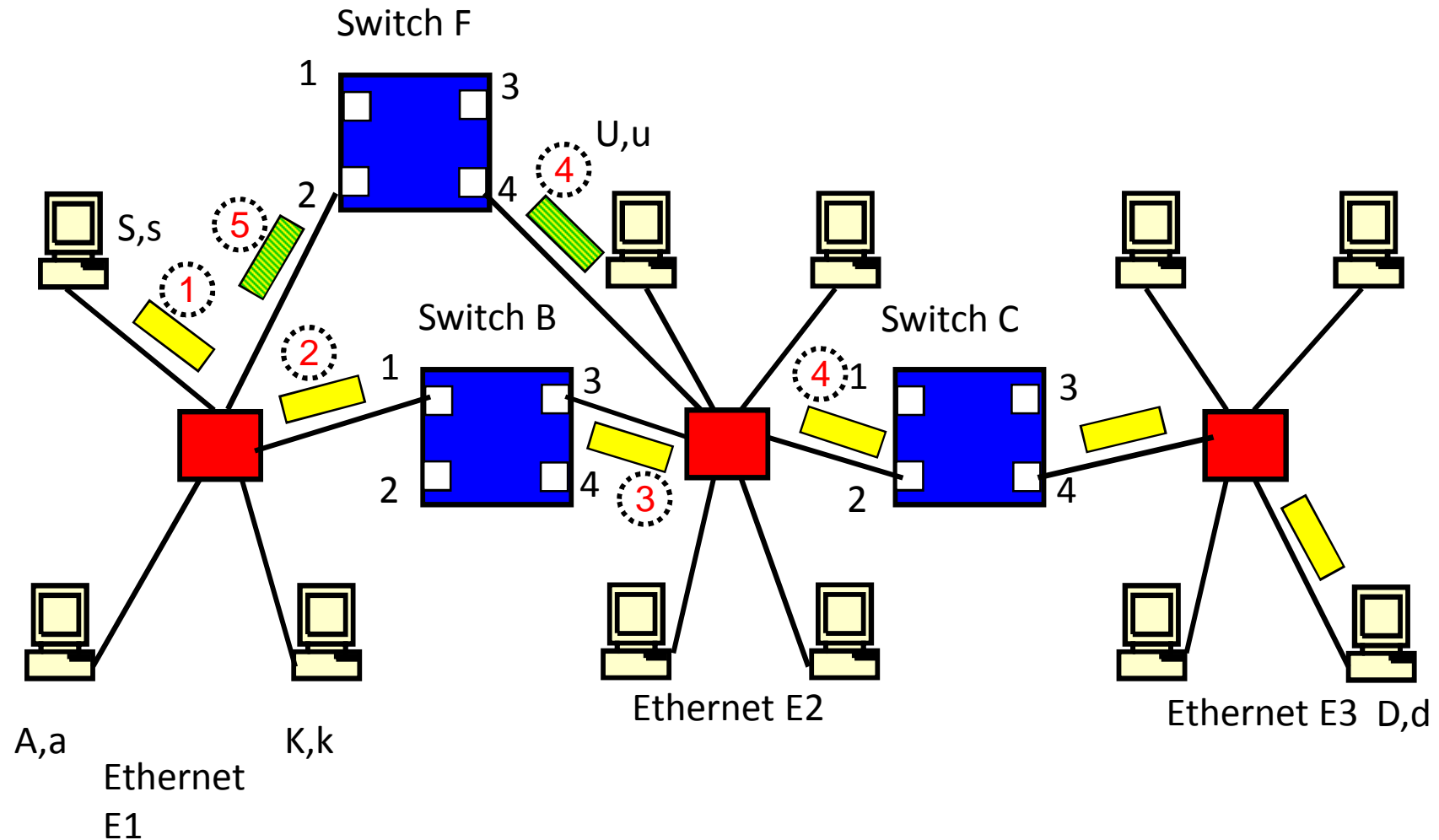
Port 1	Port 3
a : E1	u : E2
k : E1	
s : E1	

4

C Routing Table

Port 1	Port 2	Port 3	Port 4
	a : E1		d : E3
	k : E1		
	u : E2		
	s : E1		

What to do when a loop exists ?



One way to avoid packet circulation is (Spanning Tree Protocol-SPT) :

- Switches determine a spanning tree, which is a graph without loops that reaches all Ethernet.
- On forwarding pkts, only switches on the spanning tree can copy pkts.

