Topics to be covered

Topic	No of Weeks	Contact Hours
Introduction to Broadband Networks Characteristics of High-Speed Networks	1	4
Switching Crossbar Switches Multistage Interconnection Networks (MINs) Omega Networks Delta Networks ATM Switches The Batcher-Banyan Switches High Performance Switches	2	8

Switching

- **Circuit Switching**
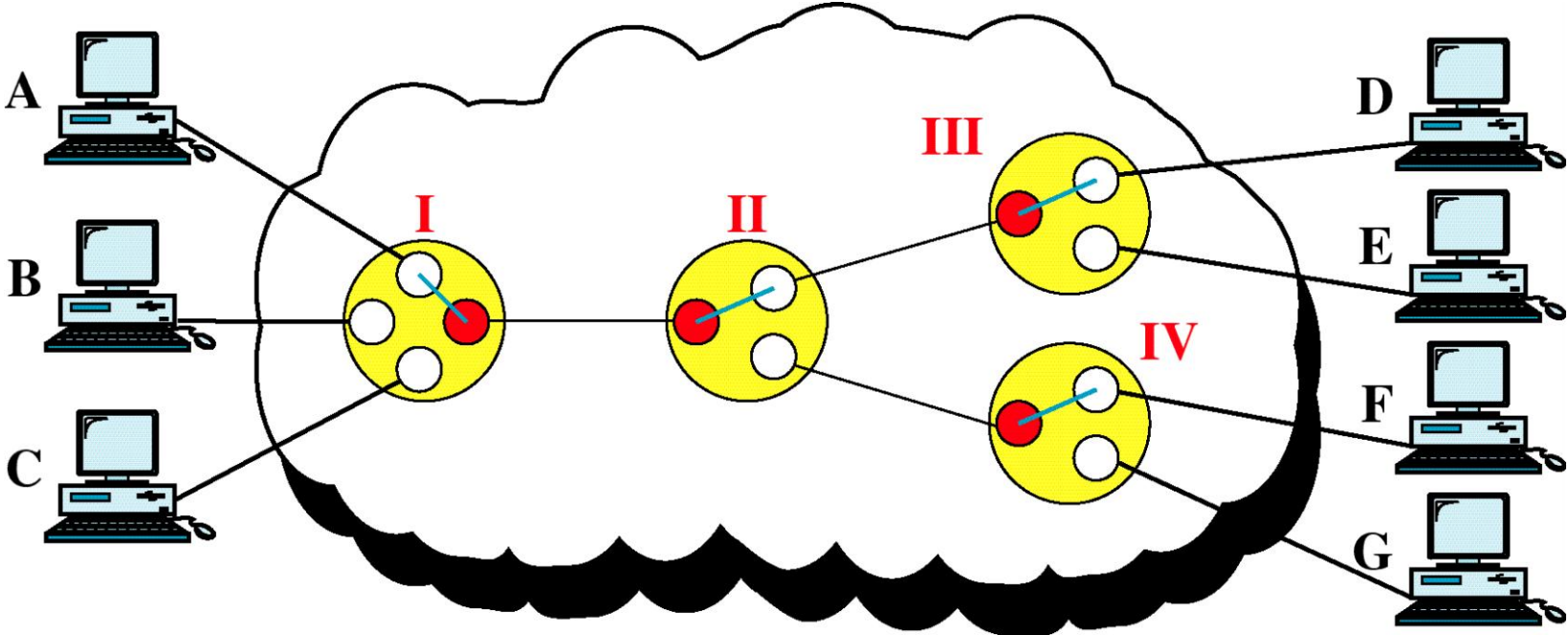- **Packet Switching**
- **Message Switching**

Switched Network
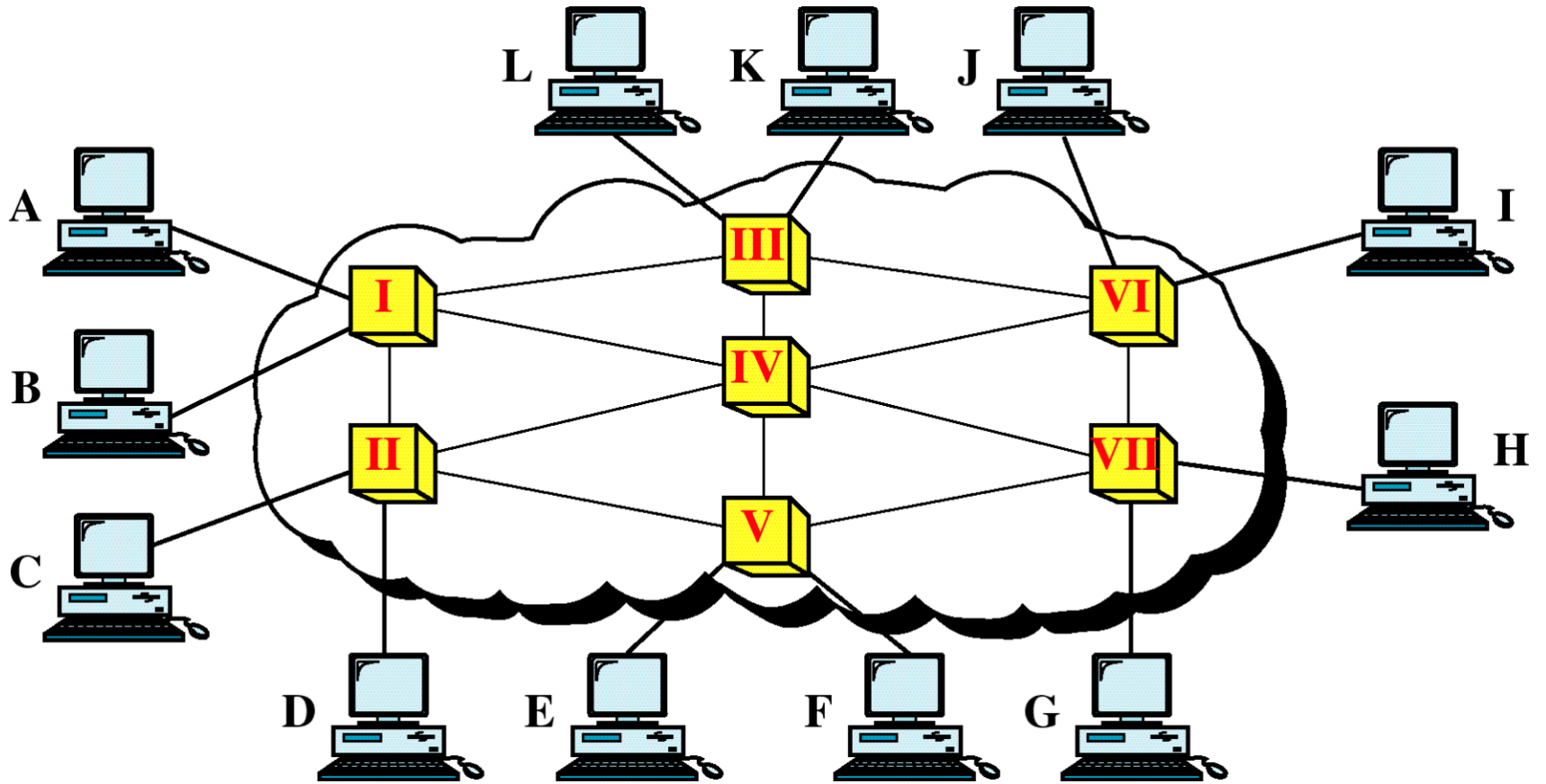
```
                    ┌─────────────────────┐
                    │  Switching methods  │
                    └─────────────────────┘
            ┌────────────────┼────────────────┐
 ┌───────────────────┐ ┌──────────────────┐ ┌────────────────────┐
 │ Circuit switching │ │ Packet switching │ │ Message switching  │
 └───────────────────┘ └──────────────────┘ └────────────────────┘
```

Circuit-Switched Network
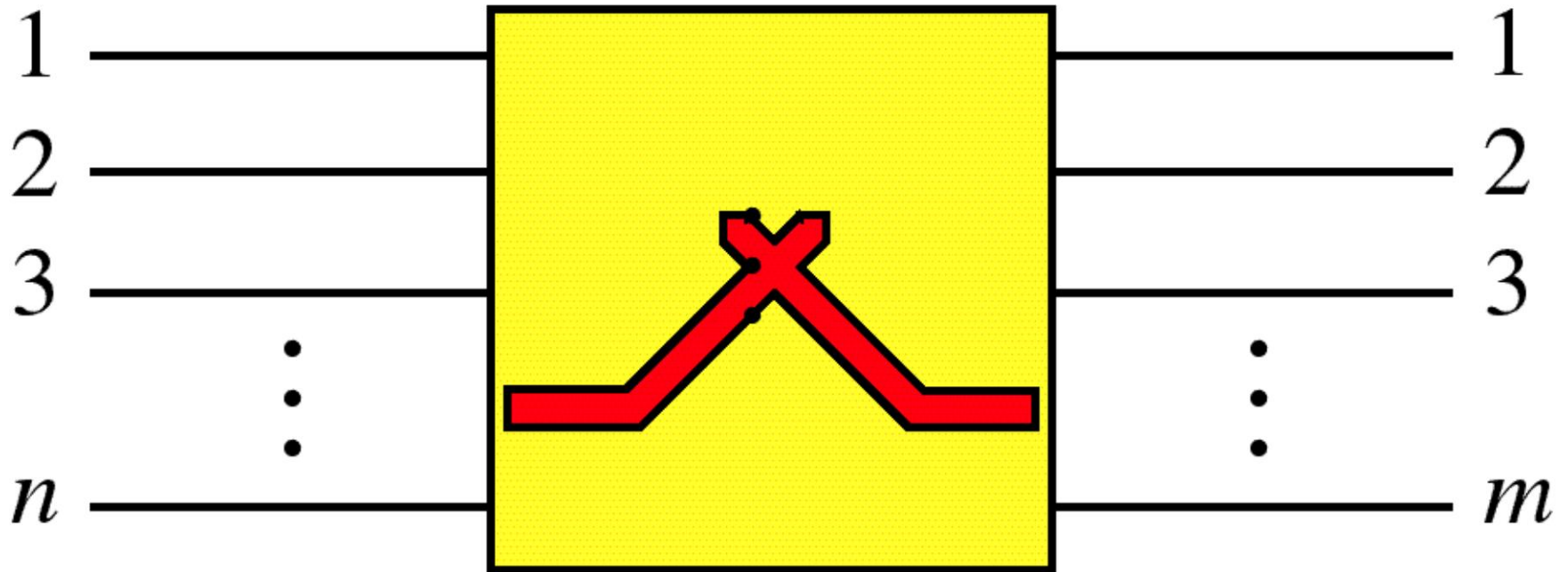
Switch

Folded Switch
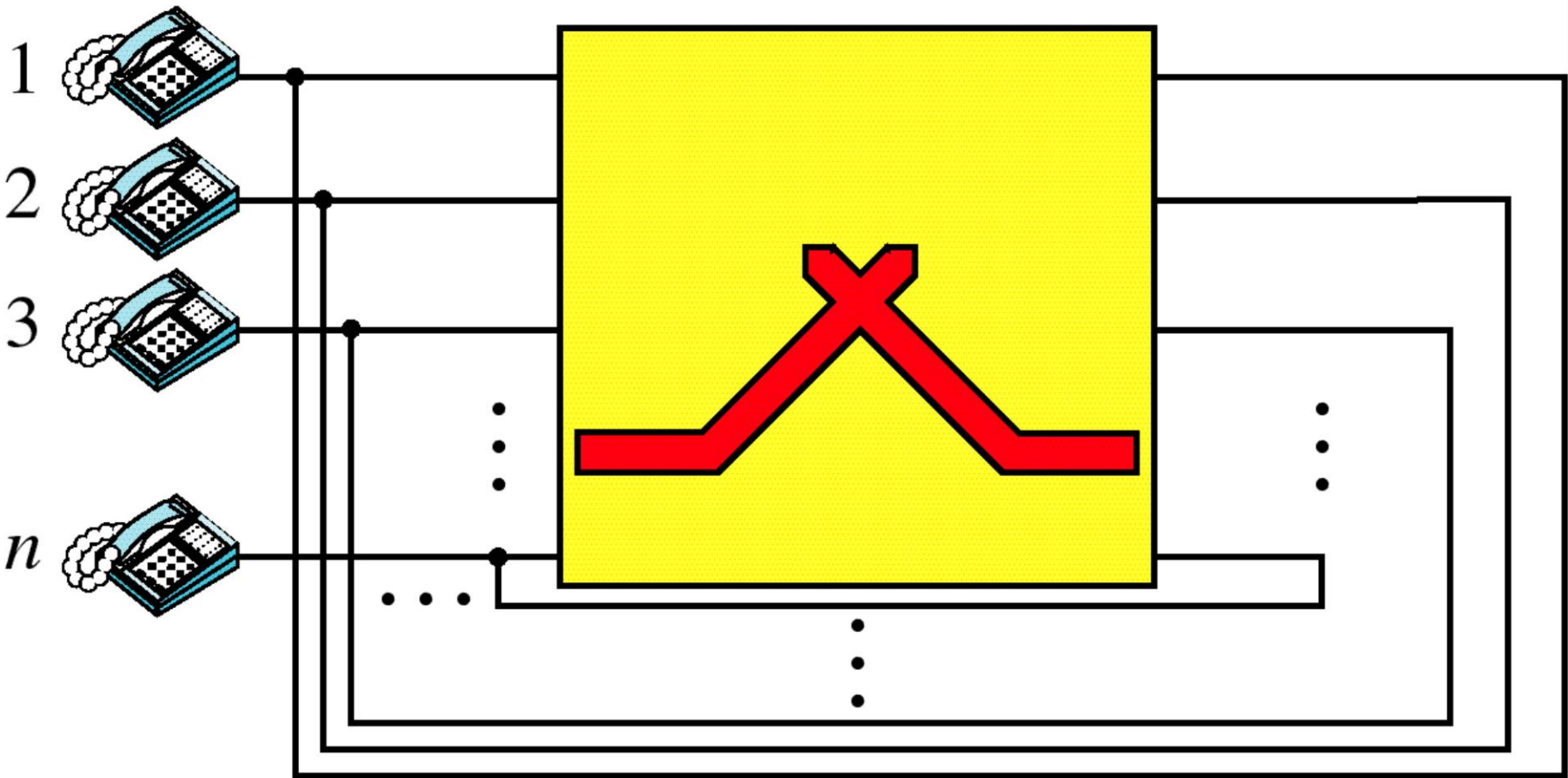
```
                    ┌──────────────────┐
                    │ Circuit switching │
                    └──────────────────┘
                              │
             ┌────────────────┴────────────────┐
             │                                 │
┌──────────────────────────┐      ┌──────────────────────────┐
│ Space-division switching │      │ Time-division switching  │
└──────────────────────────┘      └──────────────────────────┘
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Crossbar Switch

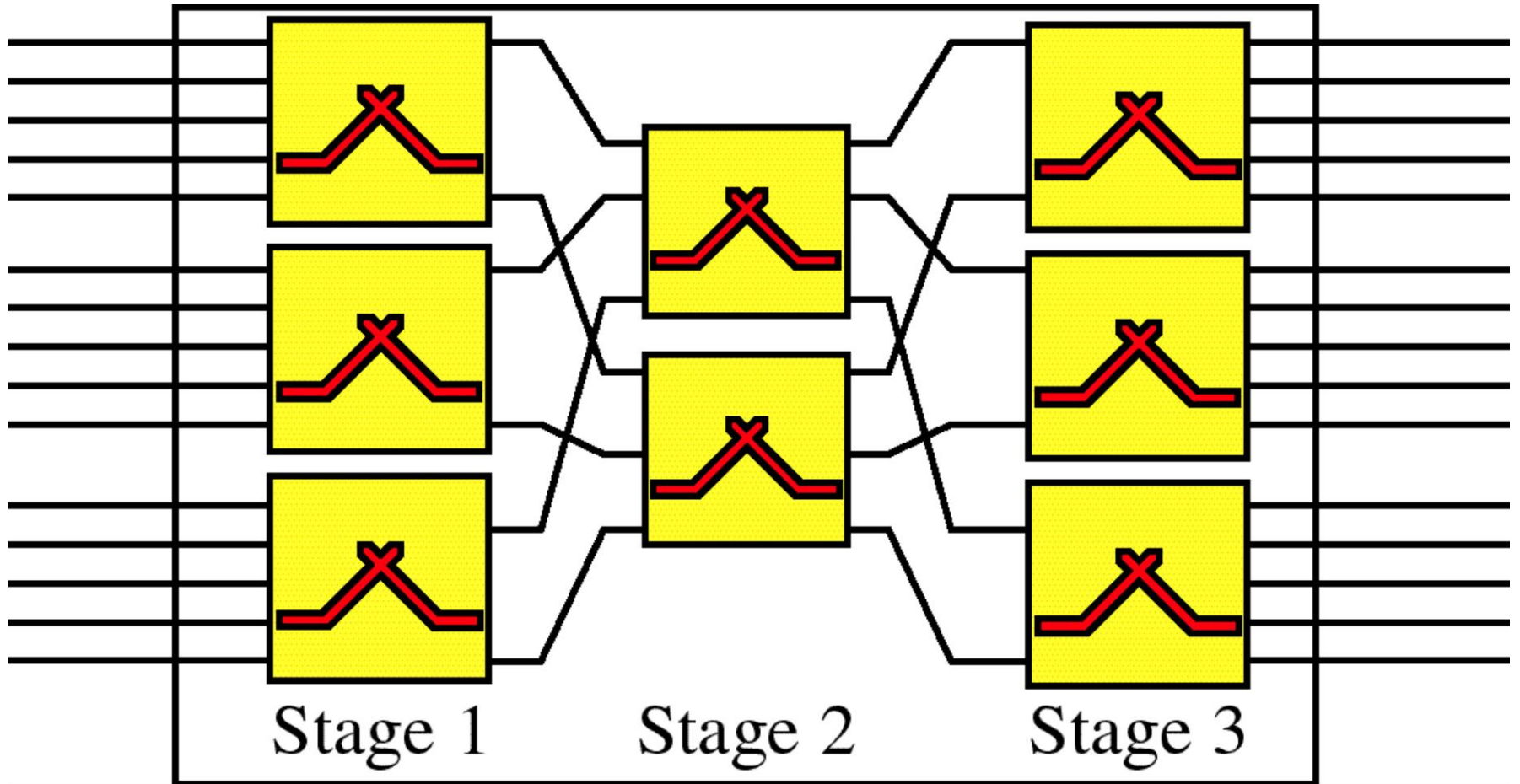*Crossbar switch with three inputs and four outputs*
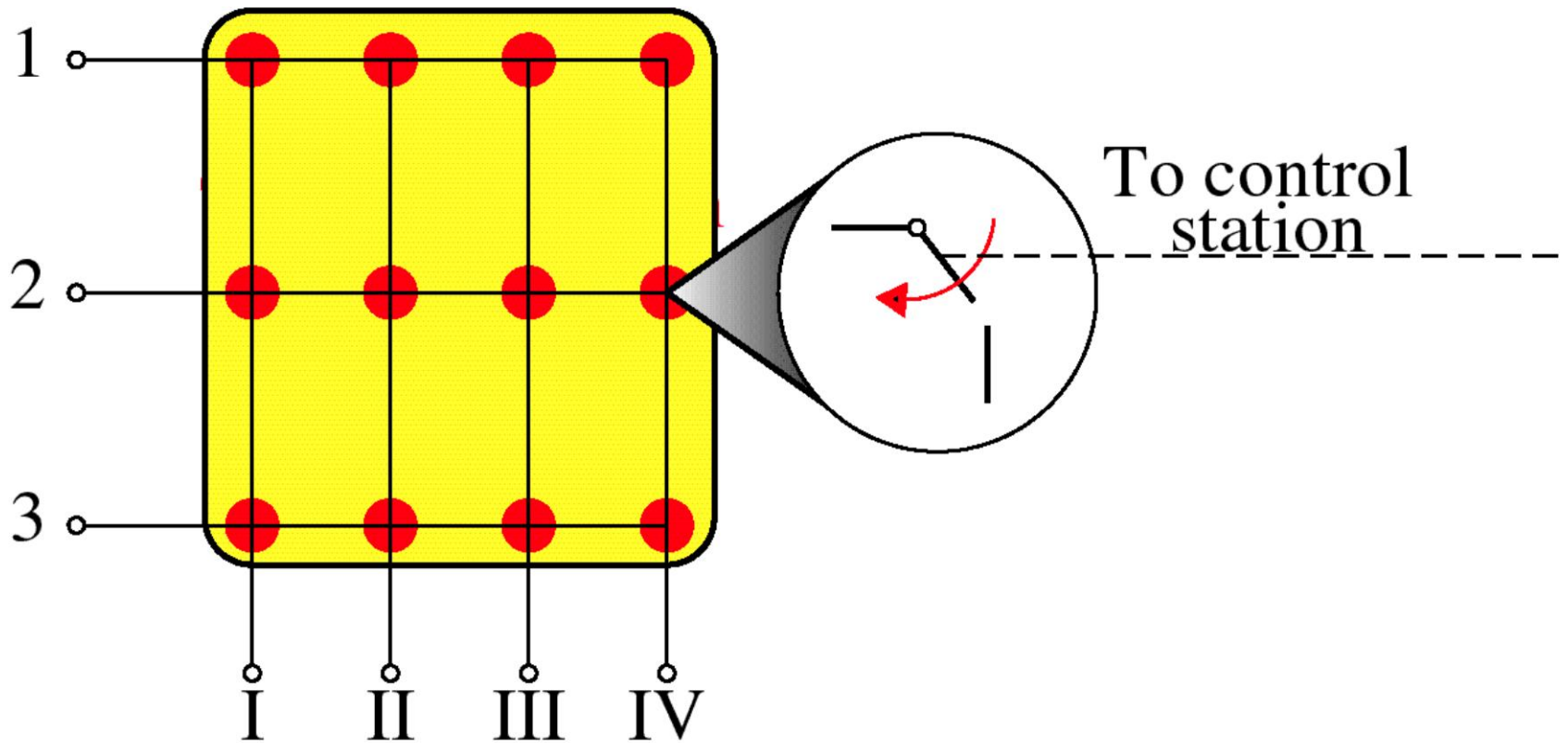
Multistage switch
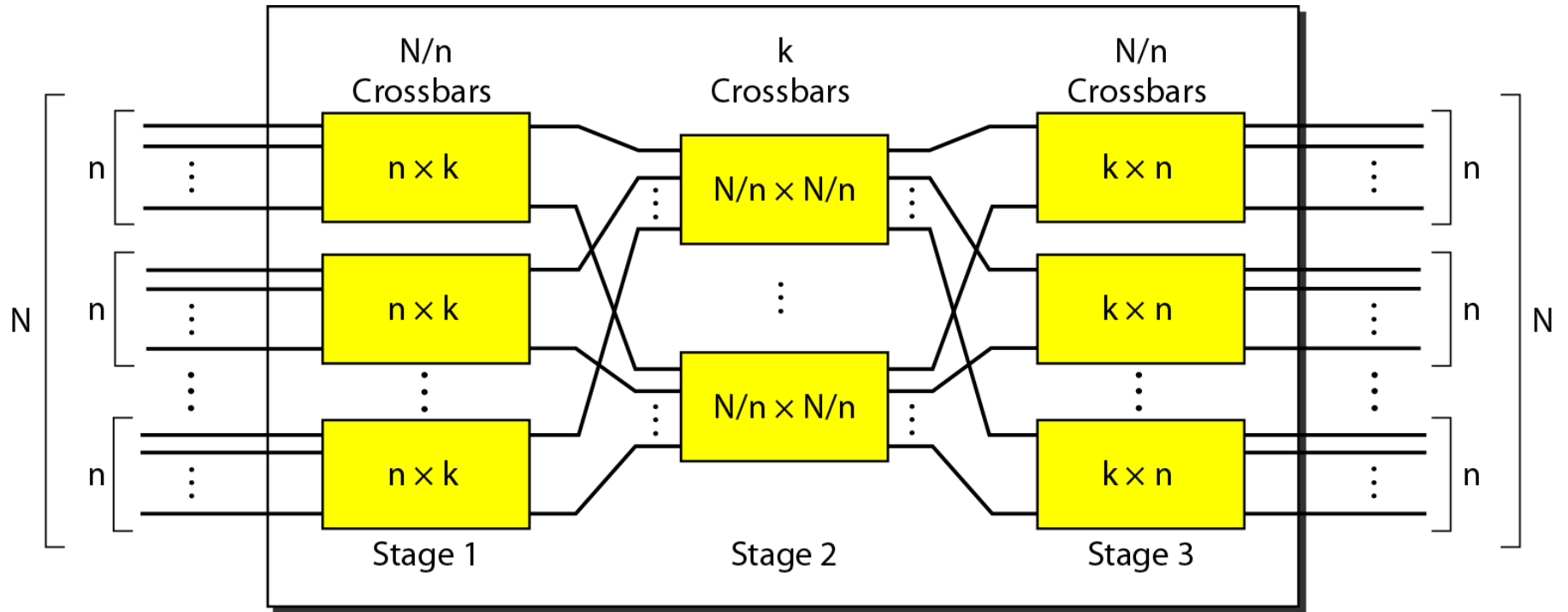
Multistage Switch
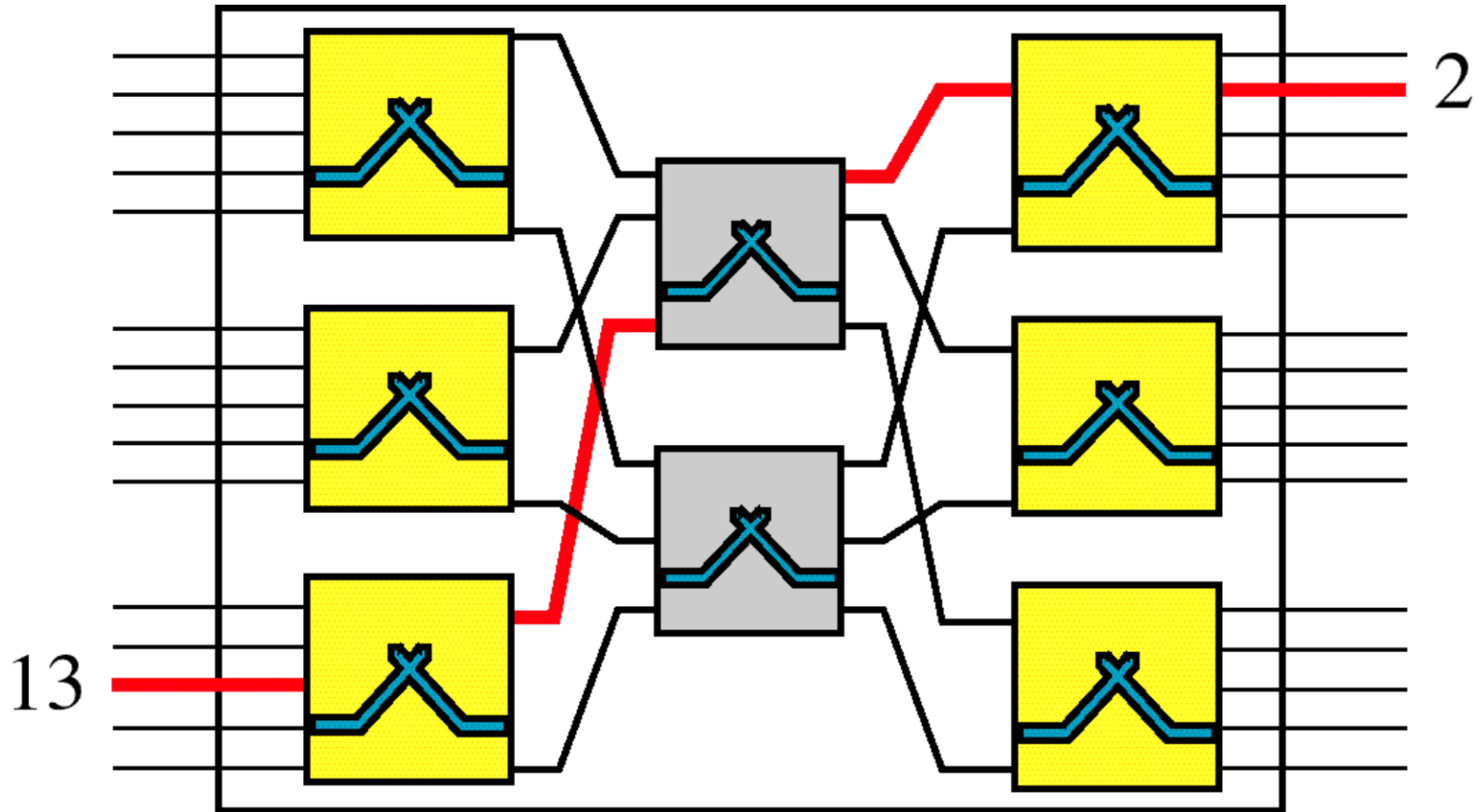

Stage 1   Stage 2   Stage 3
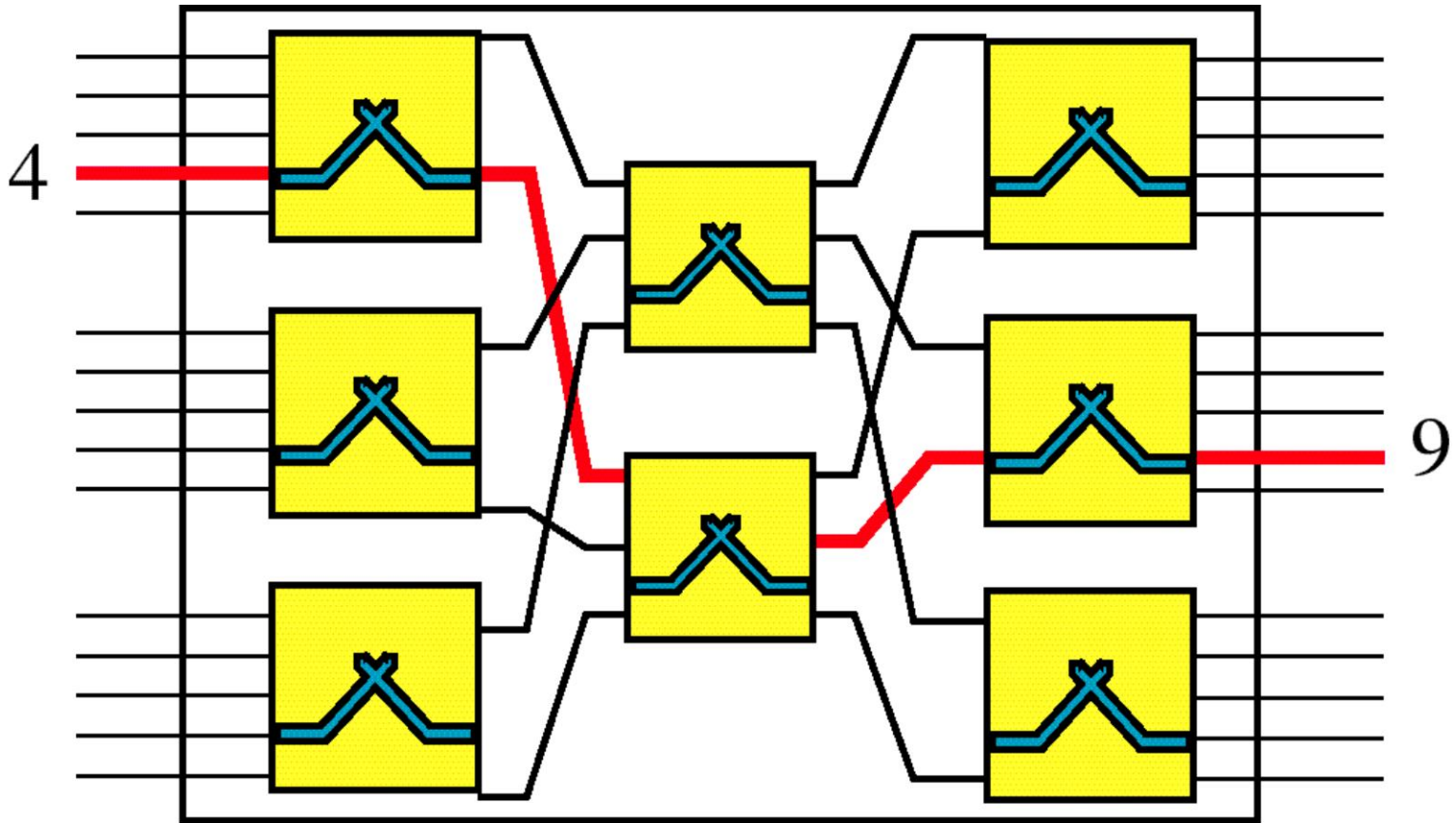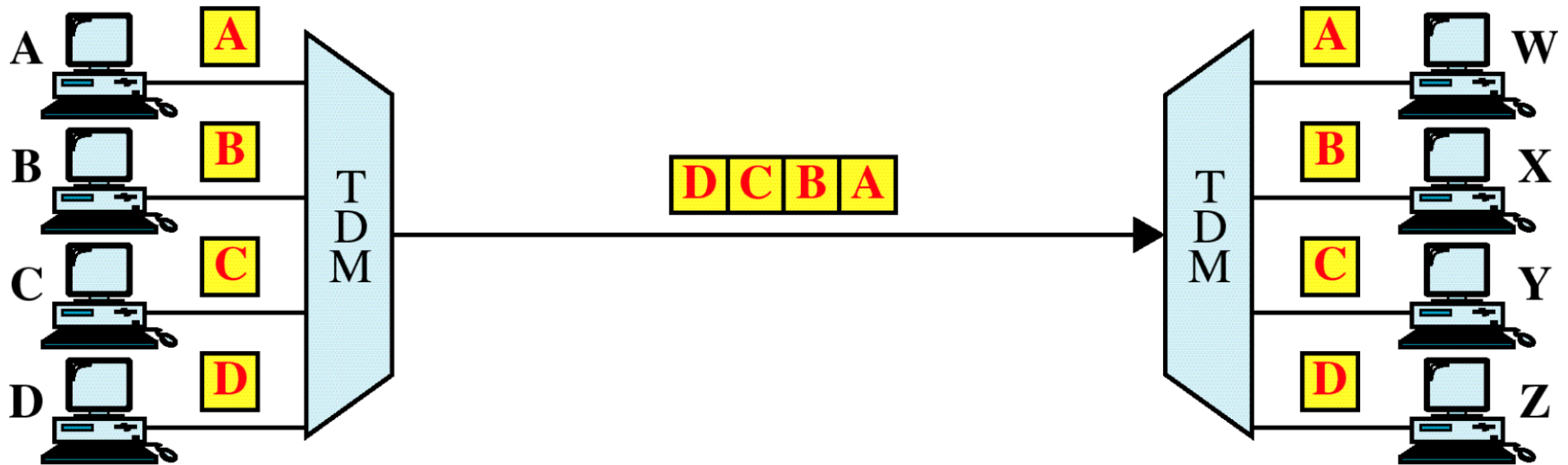
Switching Path

4 connected to 9

Switching Path
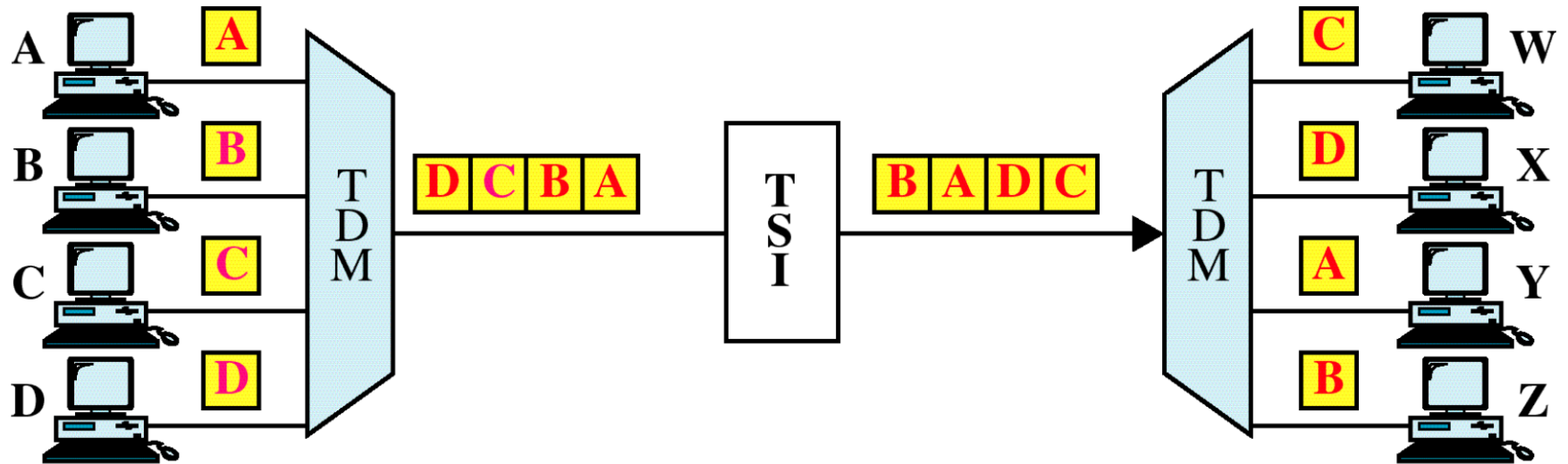

13 connected to 2

TDM without TSI

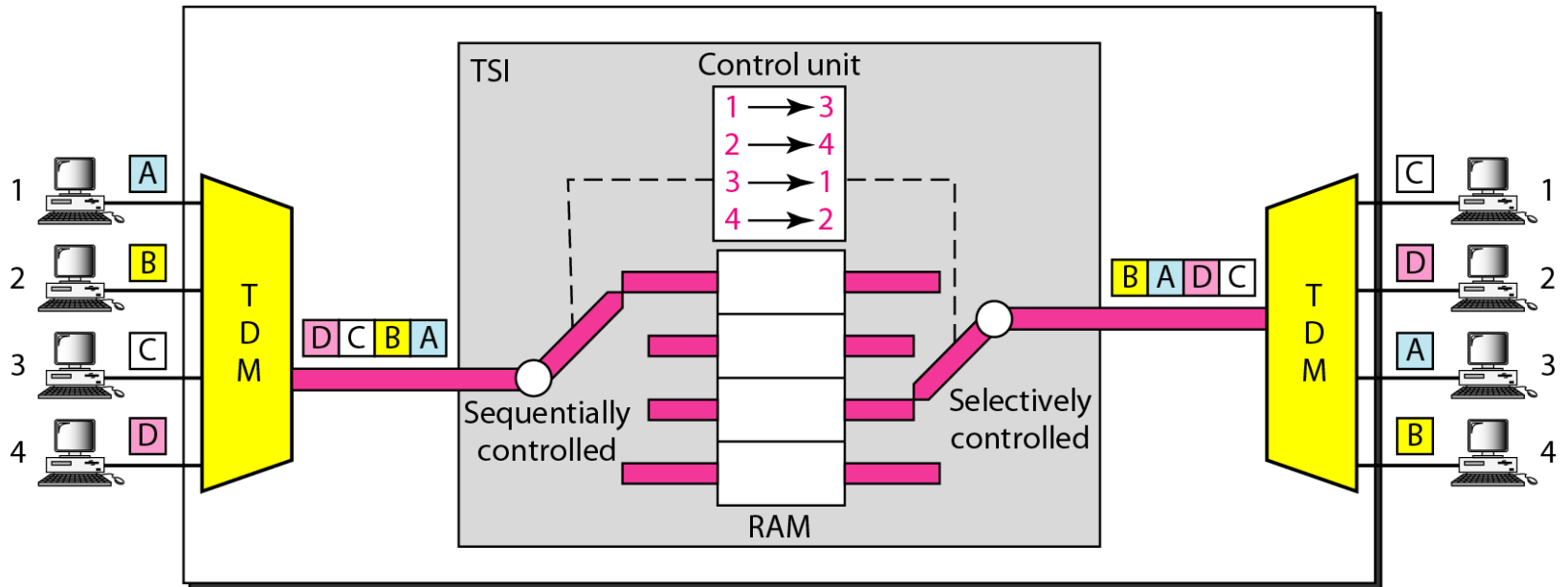TDM : Time-division Multiplexing
TSI : Time-Slot Interchange

No switching

TDM with TSI
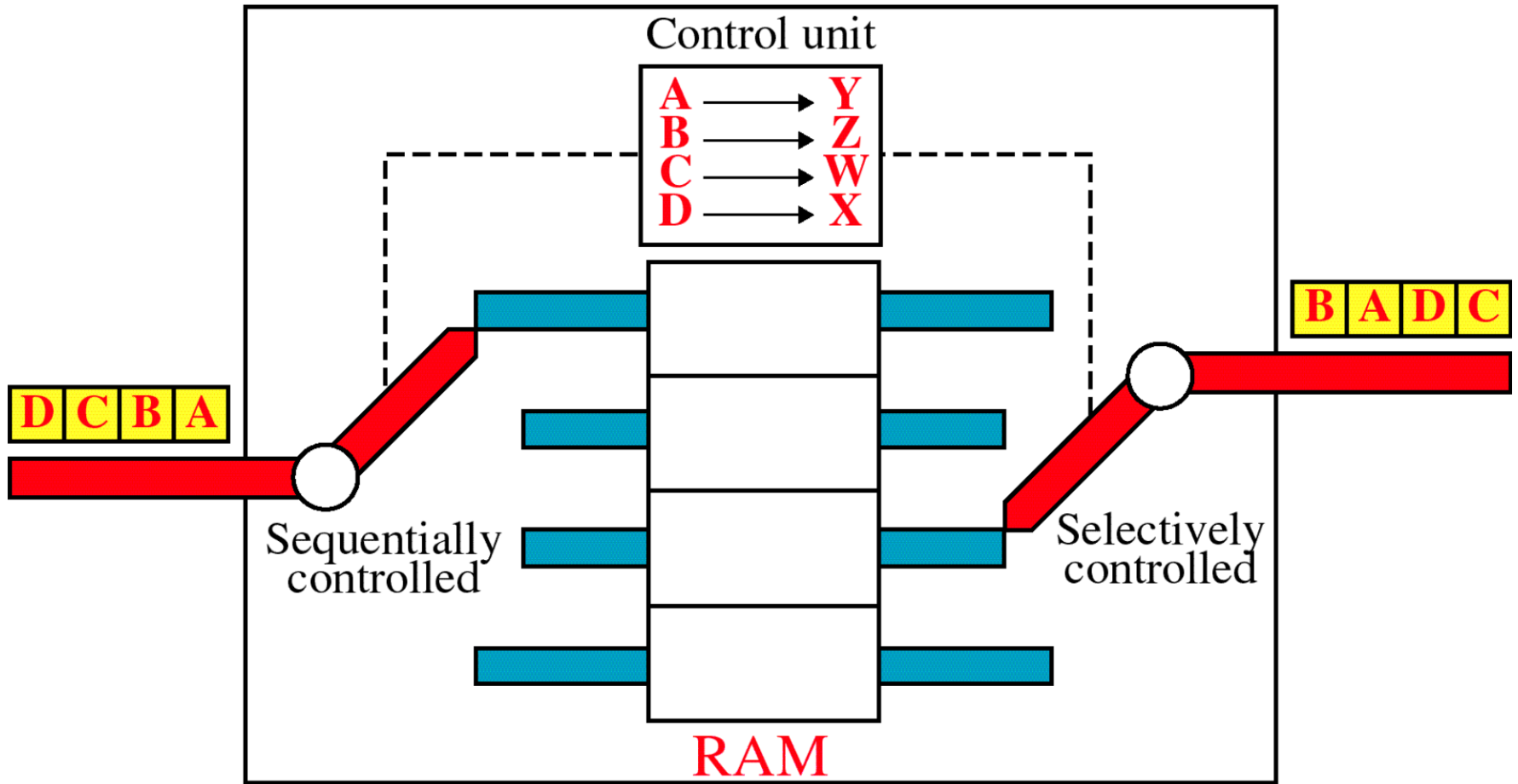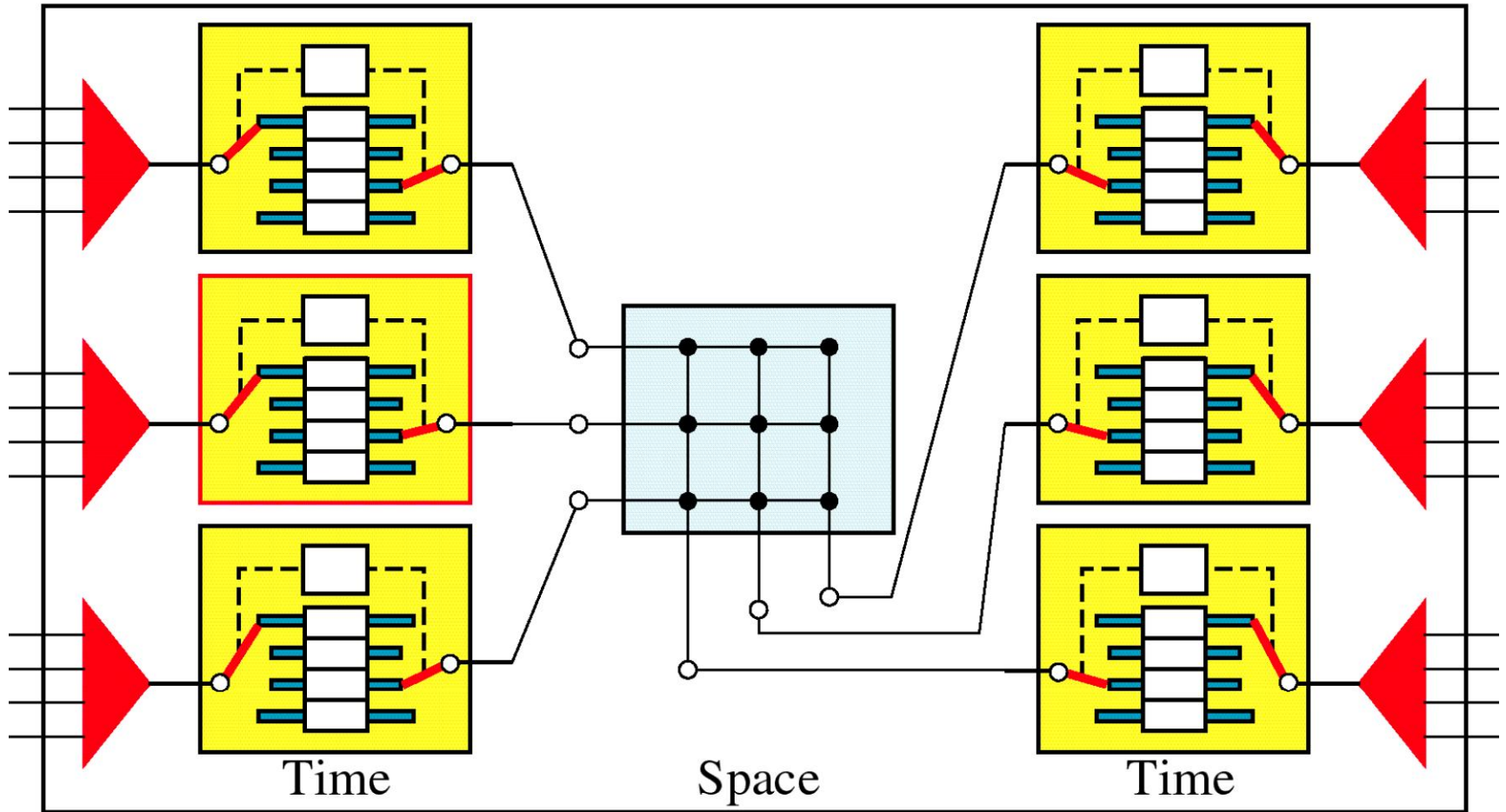

Switching

Time-division switch

TSI

Control unit

1 → 3
2 → 4
3 → 1
4 → 2

RAM

Sequentially controlled

Selectively controlled

Time-Slot Interchange

TST Switch

TST

```
                    ┌─────────────────────┐
                    │  Packet switching   │
                    └─────────────────────┘
                              │
              ┌───────────────┴───────────────┐
    ┌──────────────────────┐      ┌──────────────────────────┐
    │  Datagram approach   │      │ Virtual circuit approach │
    └──────────────────────┘      └──────────────────────────┘
```

Datagram Approach
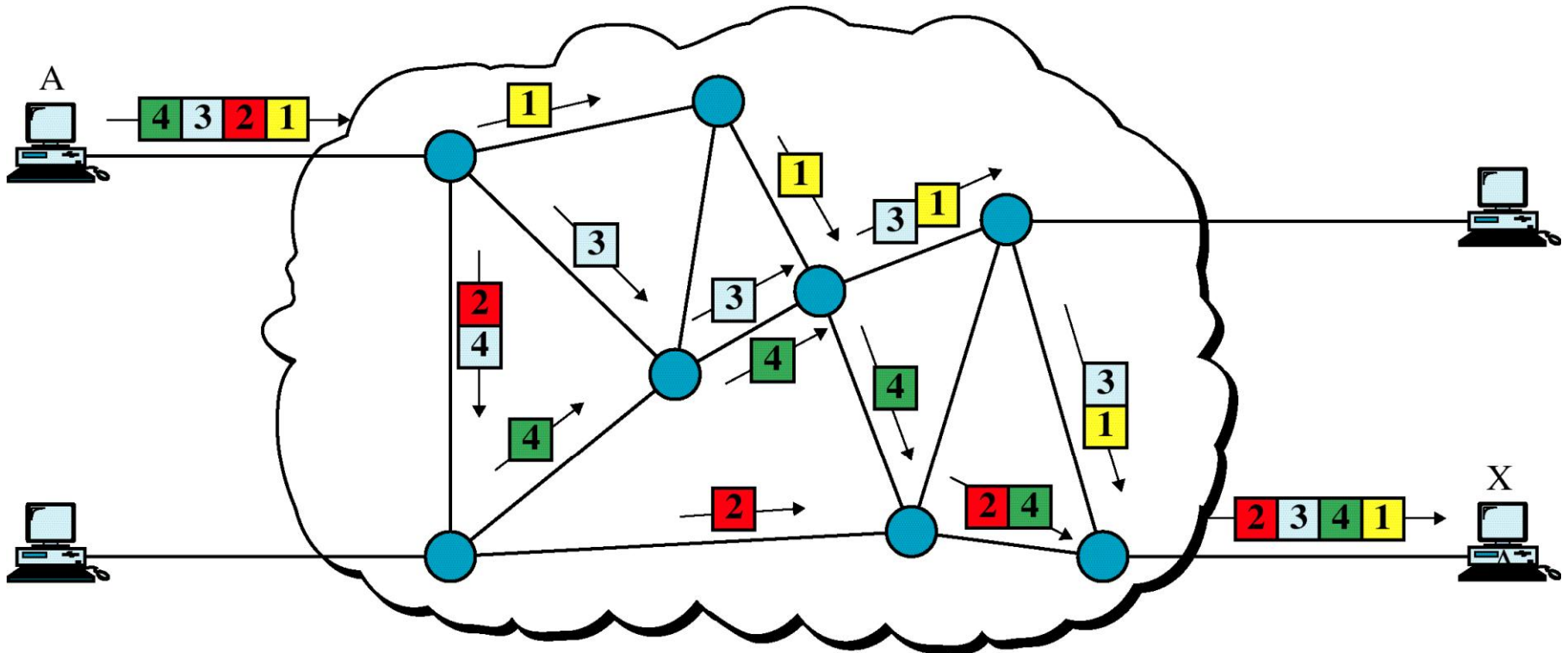
Delay in a datagram network

Transmission time

Waiting time

Waiting time

Total delay

A

B

Time

Time

Time
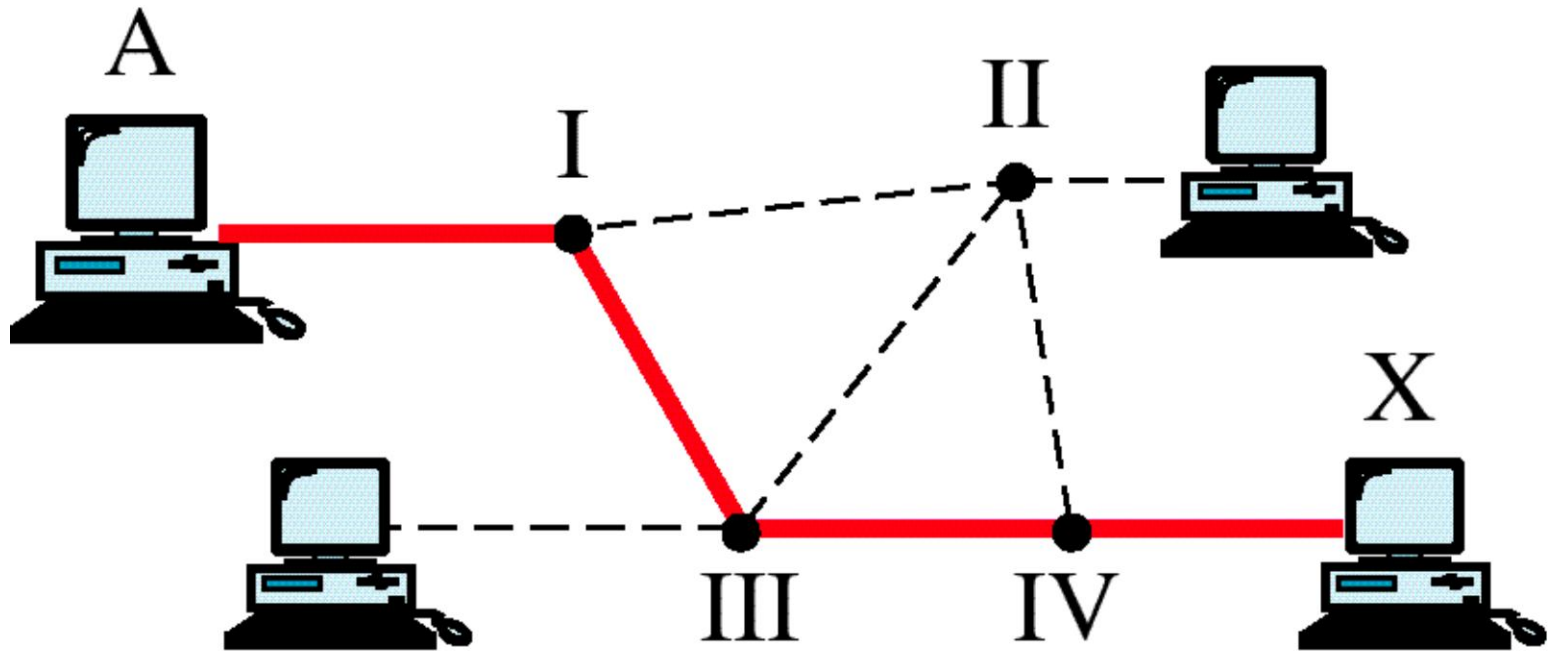
Time
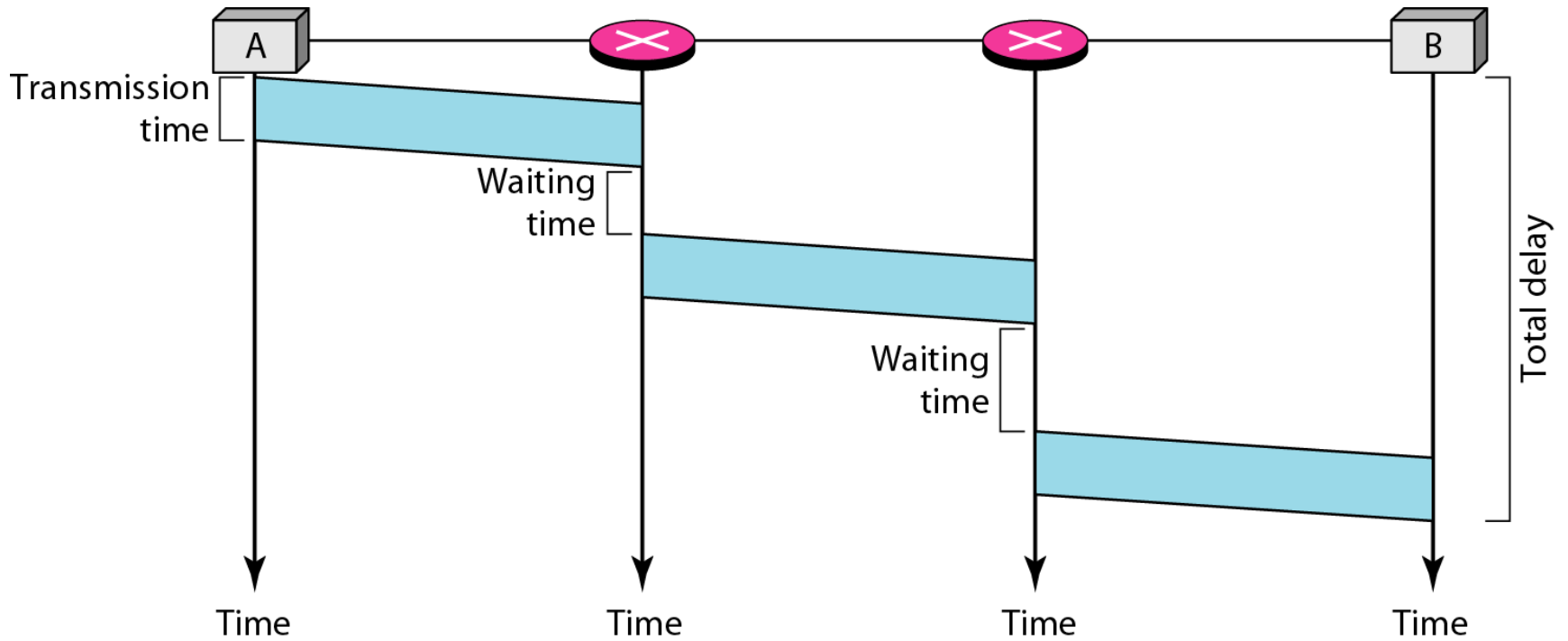
Datagram Approach, Multiple Channels
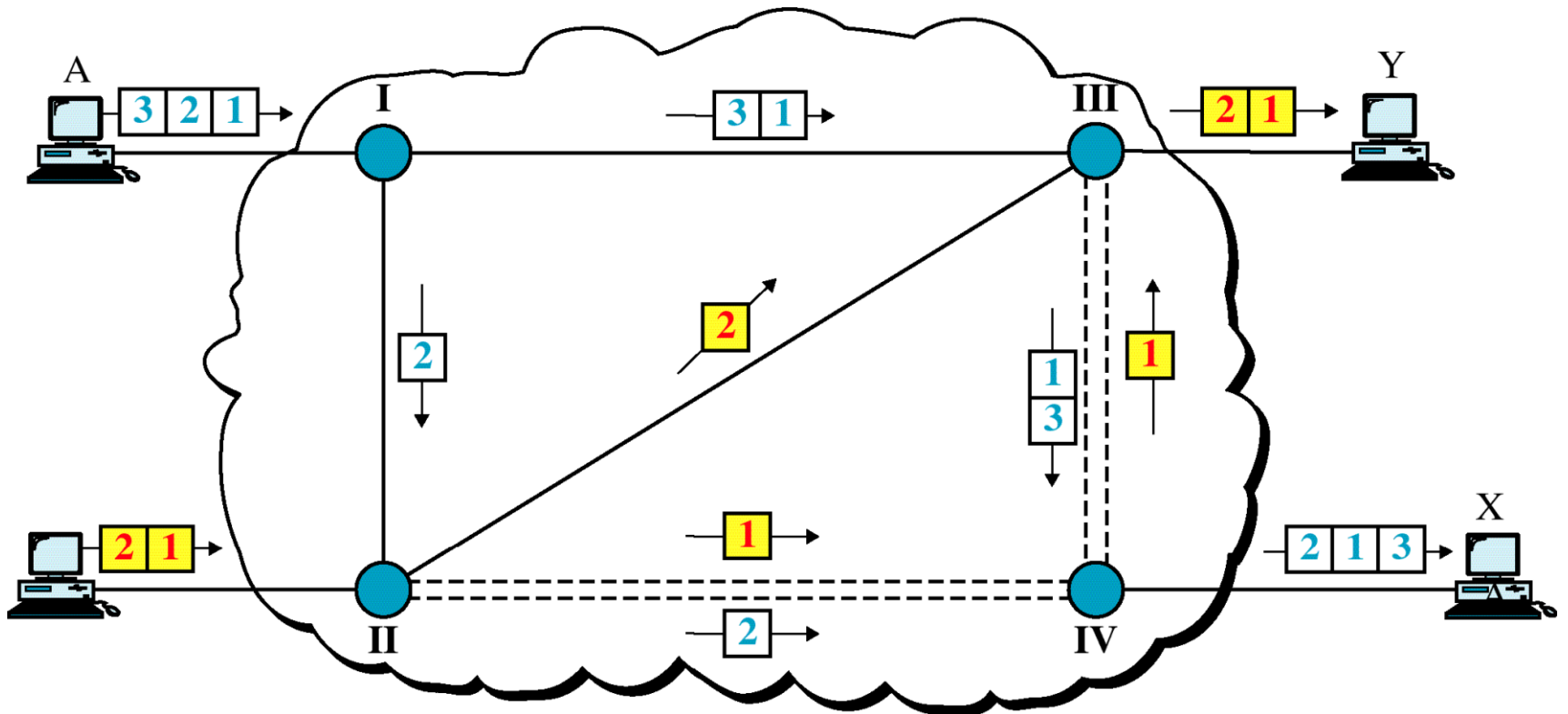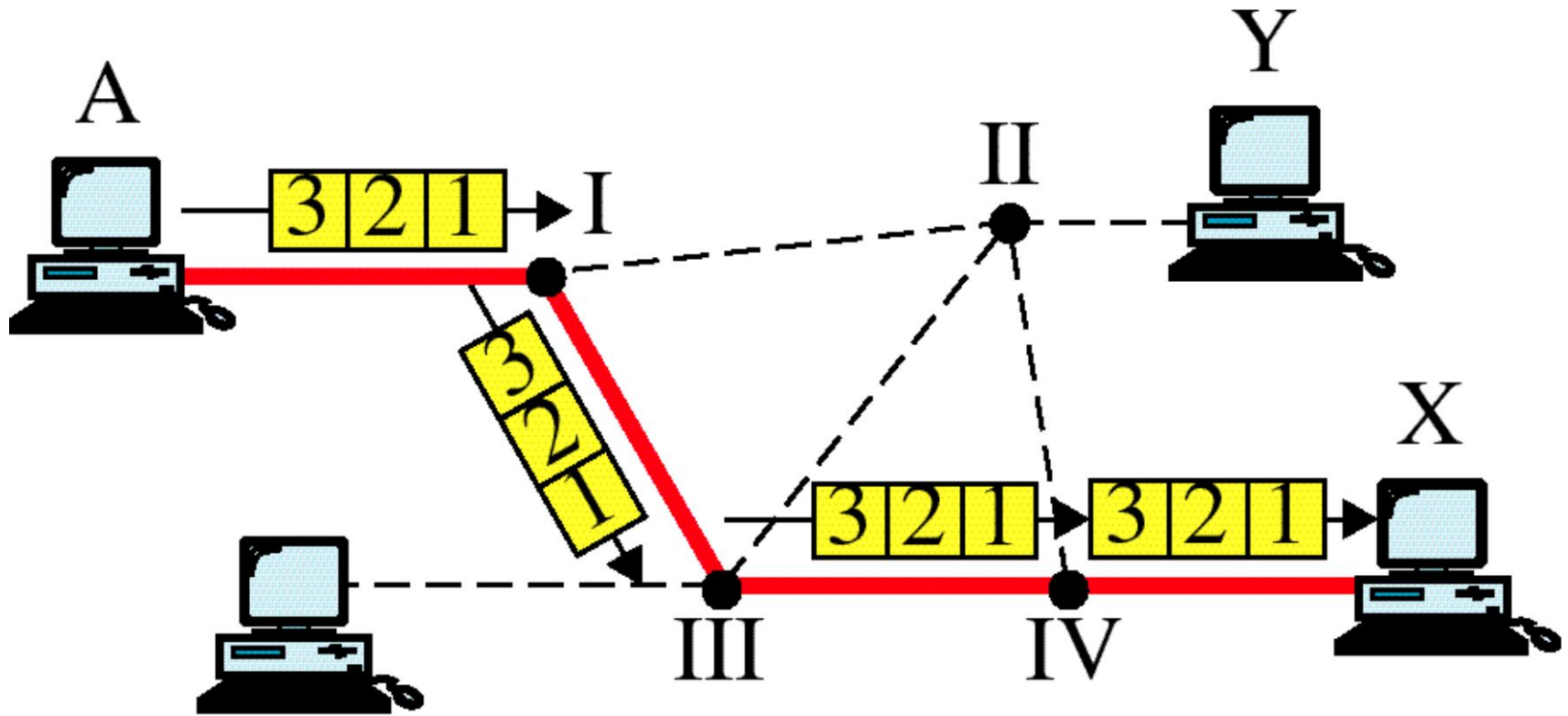
Switched Virtual Circuit
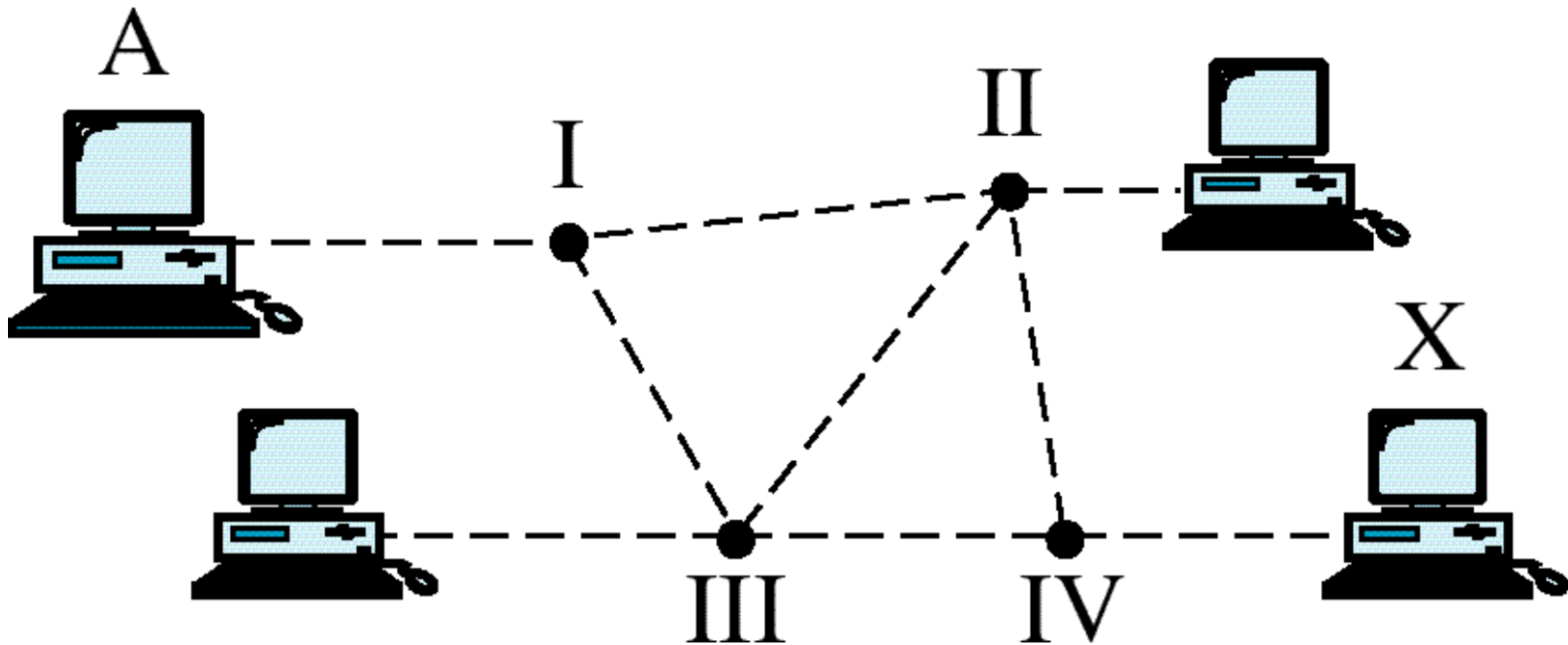

Connection establishment
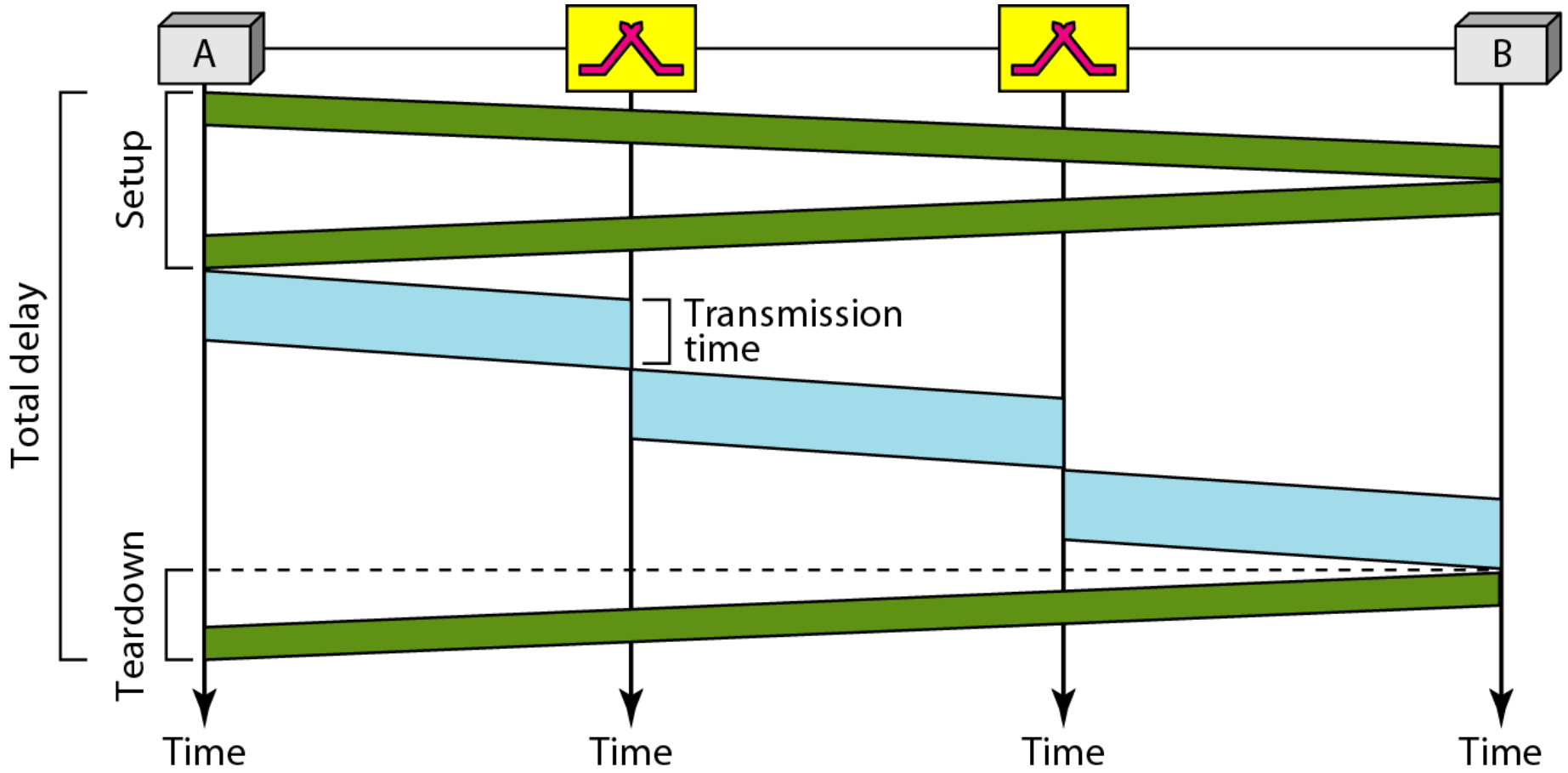
Switched Virtual Circuit

Data transfer

Switched Virtual Circuit

Connection release

Delay in a virtual-circuit network

Message Switching