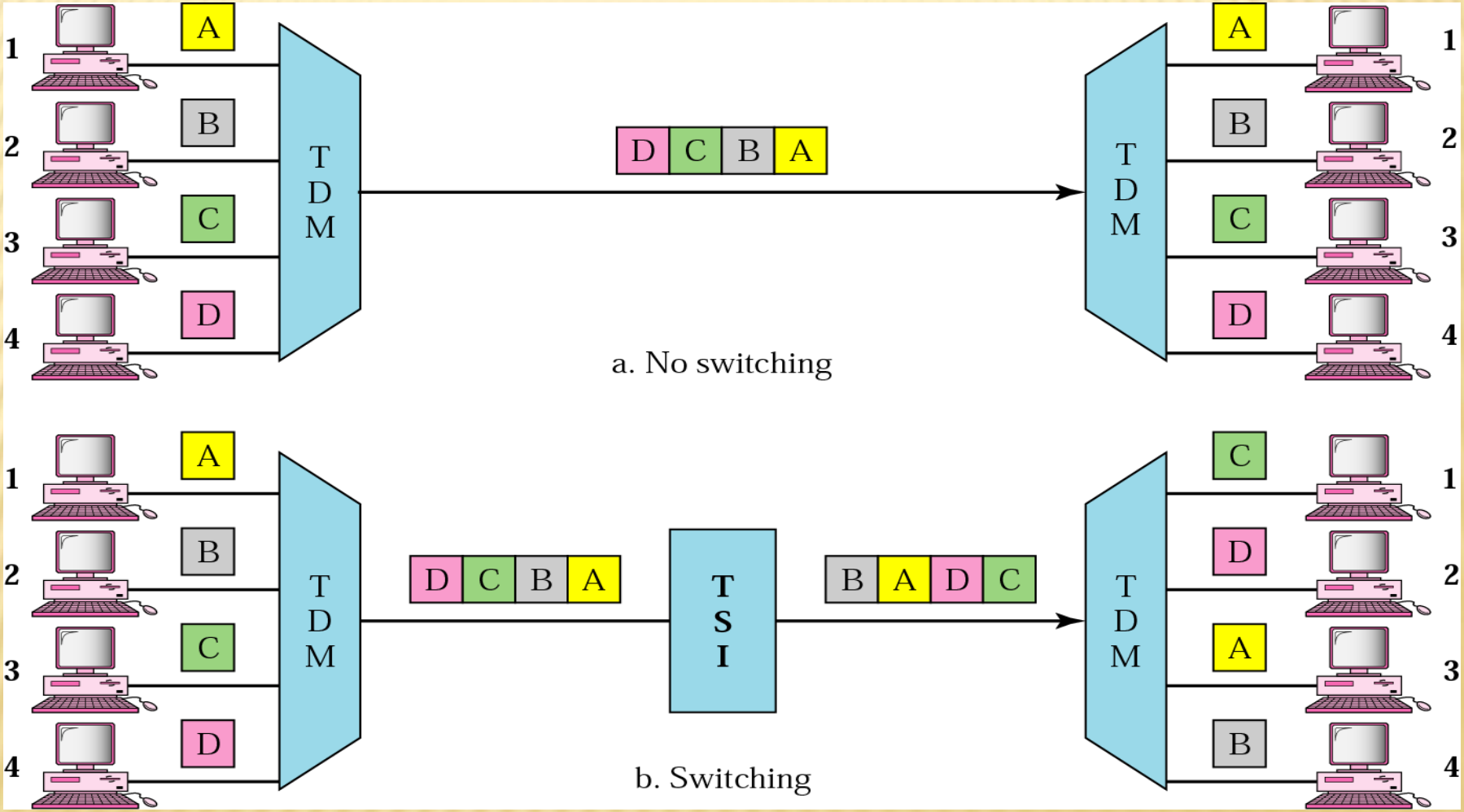
BROADBAND AND HIGH SPEED NETWORKS

2 Switching

TIME DIVISION SWITCHING

- **Time-division switching :** uses time-division multiplexing to achieve switching.
- Two methods used are:
  - Time-slot interchange (TSI) changes the order of the slots based on the desired connection.
  - Time Division Multiplexing (TDM) bus

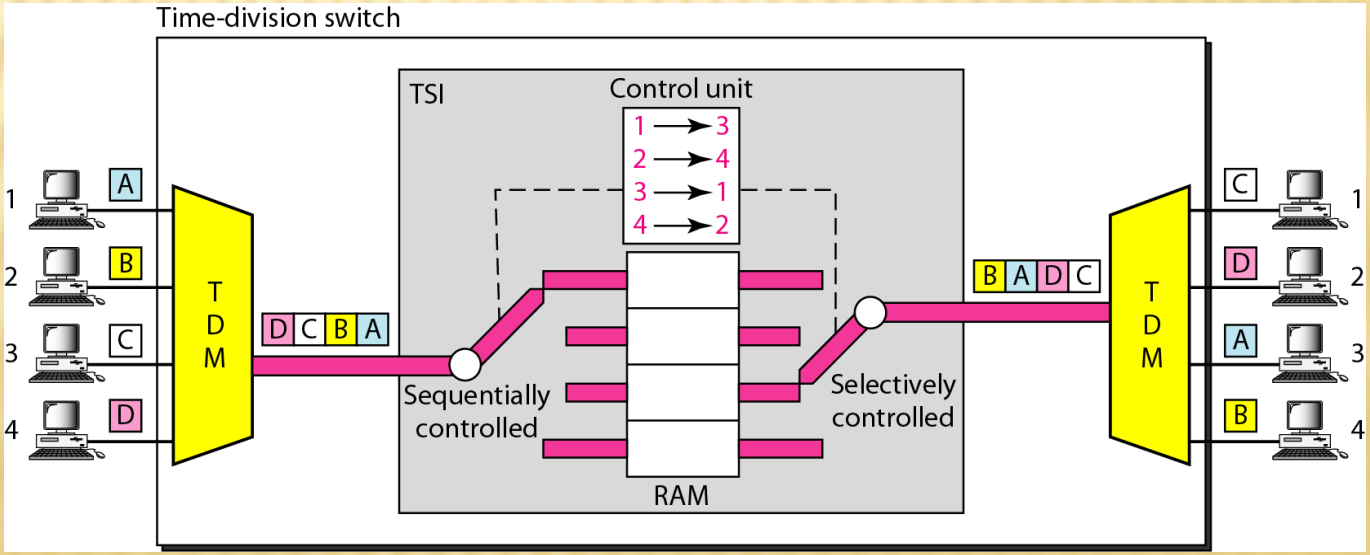
TIME-DIVISION MULTIPLEXING, WITHOUT AND WITH A TIME-SLOT INTERCHANGE



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

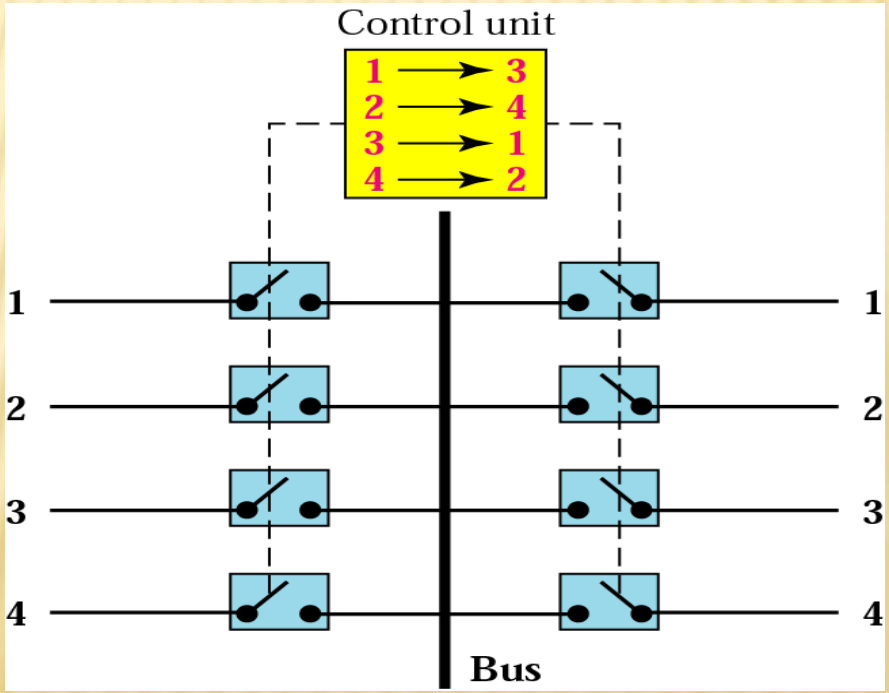
TIME-SLOT INTERCHANGE

- TSI consists of random access memory (RAM) with several memory locations. The size of each location is the same as the size of a single time slot.
- The number of locations is the same as the number of inputs.
- The RAM fills up with incoming data from time slots in the order received. Slots are then sent out in an order based on the decisions of a control unit.



TDM BUS

- Input and output lines are connected to a high-speed bus through input and output gates (microswitches)
- Each input gate is closed during one of the four slots.
- During the same time slot, only one output gate is also closed. This pair of gates allows a burst of data to be transferred from one specific input line to one specific output line using the bus.
- The control unit opens and closes the gates according to switching need.

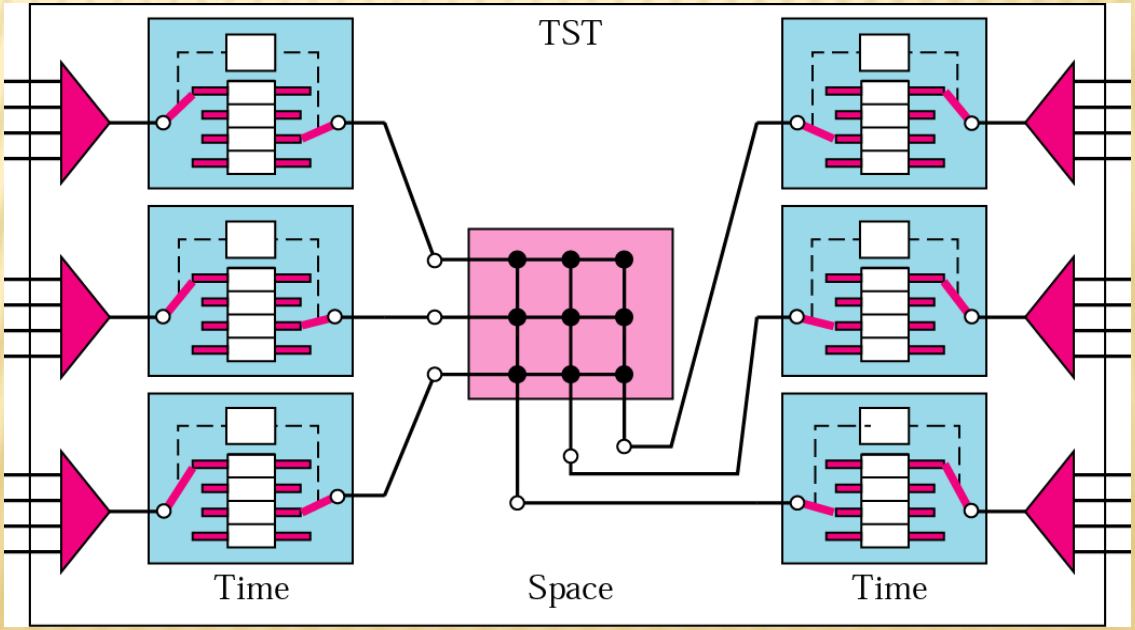


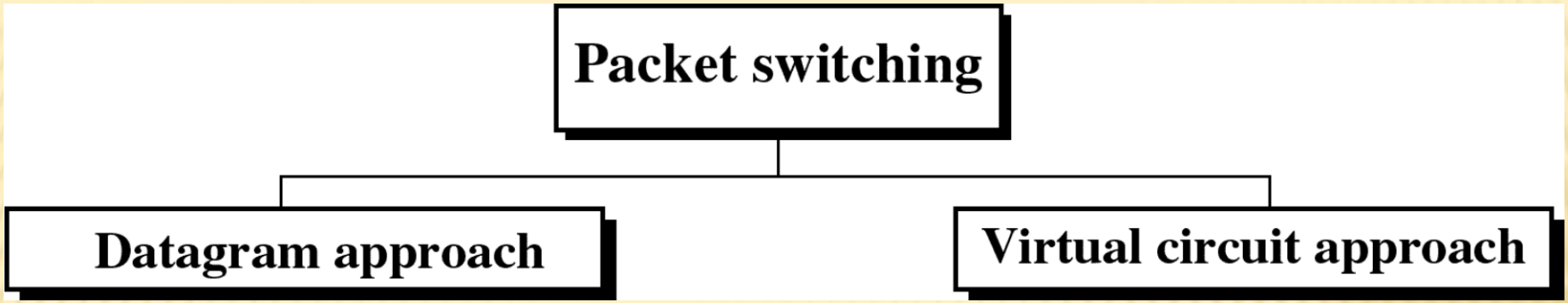
COMPARISON OF SDM AND TDM

- SDM
  - Advantage:
    - Instantaneous.
  - Disadvantage:
    - Number of cross points required.
- TDM
  - Advantage:
    - No cross points.
  - Disadvantage:
    - Processing delay.

TST SWITCH

- Combine Space division and time division switching.
- This results in switches that are optimized both physically (the number of crosspoints) and temporally (the amount of delay).
- Various types are: time-space-time (TST), time-space-space-time (TSST), space-time-time-space (STTS), etc.





TWO MAJOR PACKET SWITCHING MODES :

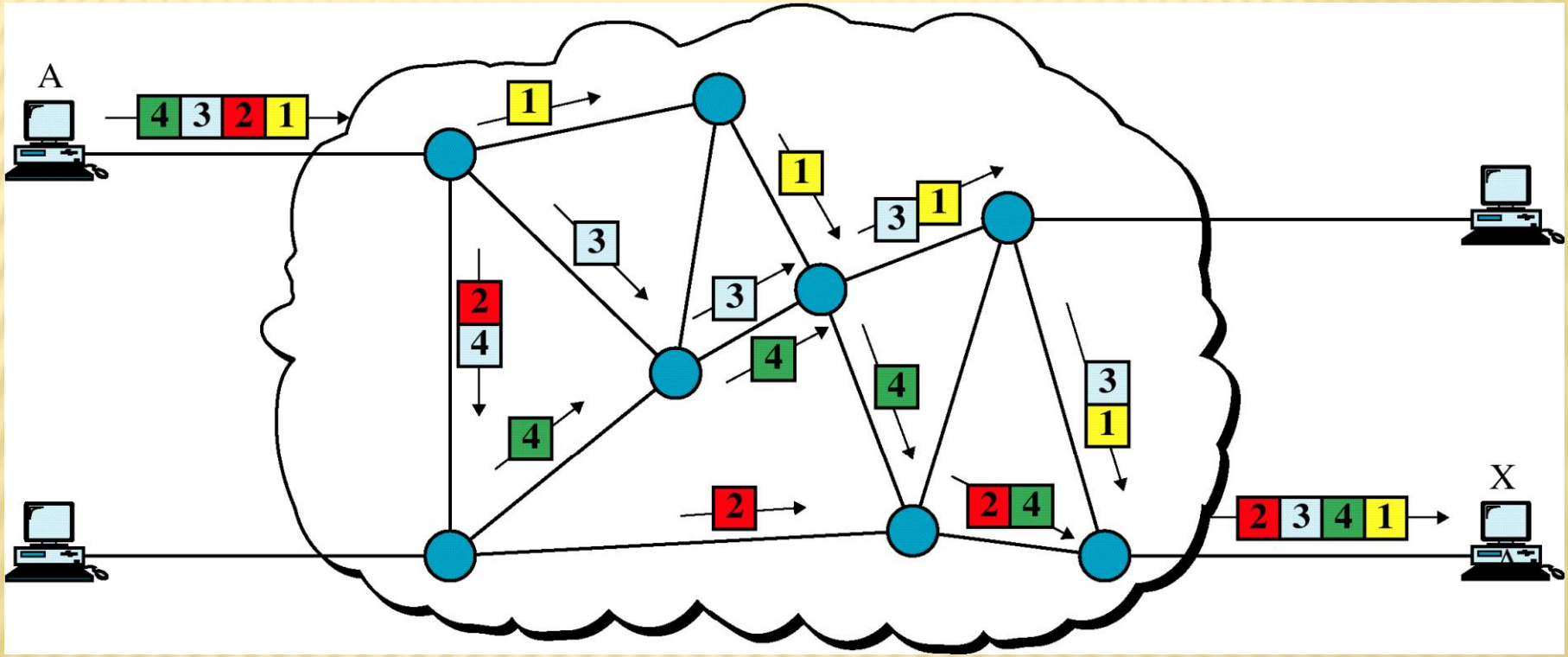
(1) connectionless packet switching, also known as datagram switching:

Each packet includes complete addressing or routing information. The packets are routed individually, sometimes resulting in different paths and out-of-order delivery.

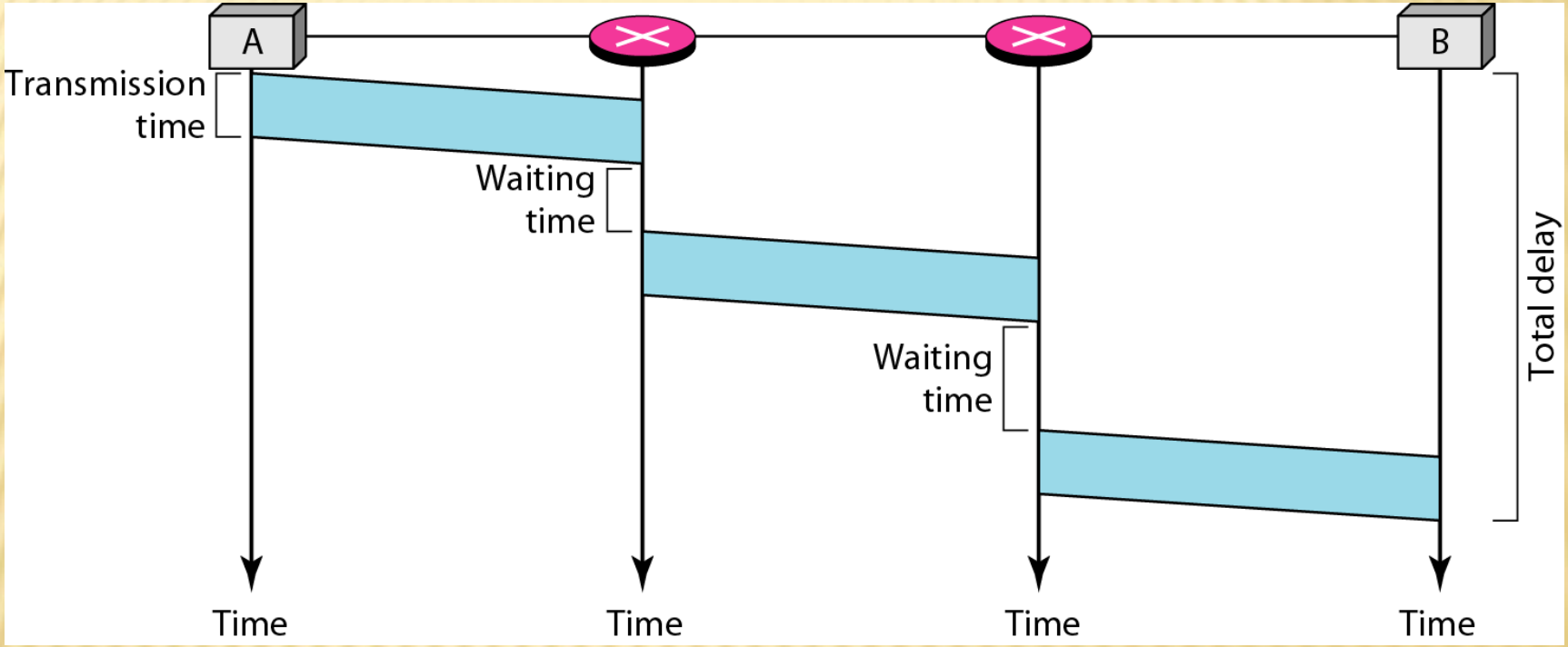
(2) connection-oriented packet switching, also known as virtual circuit switching

A connection is defined and pre allocated in each involved node during a connection phase before any packet is transferred. The packets include a connection identifier rather than address information, and are delivered in order.

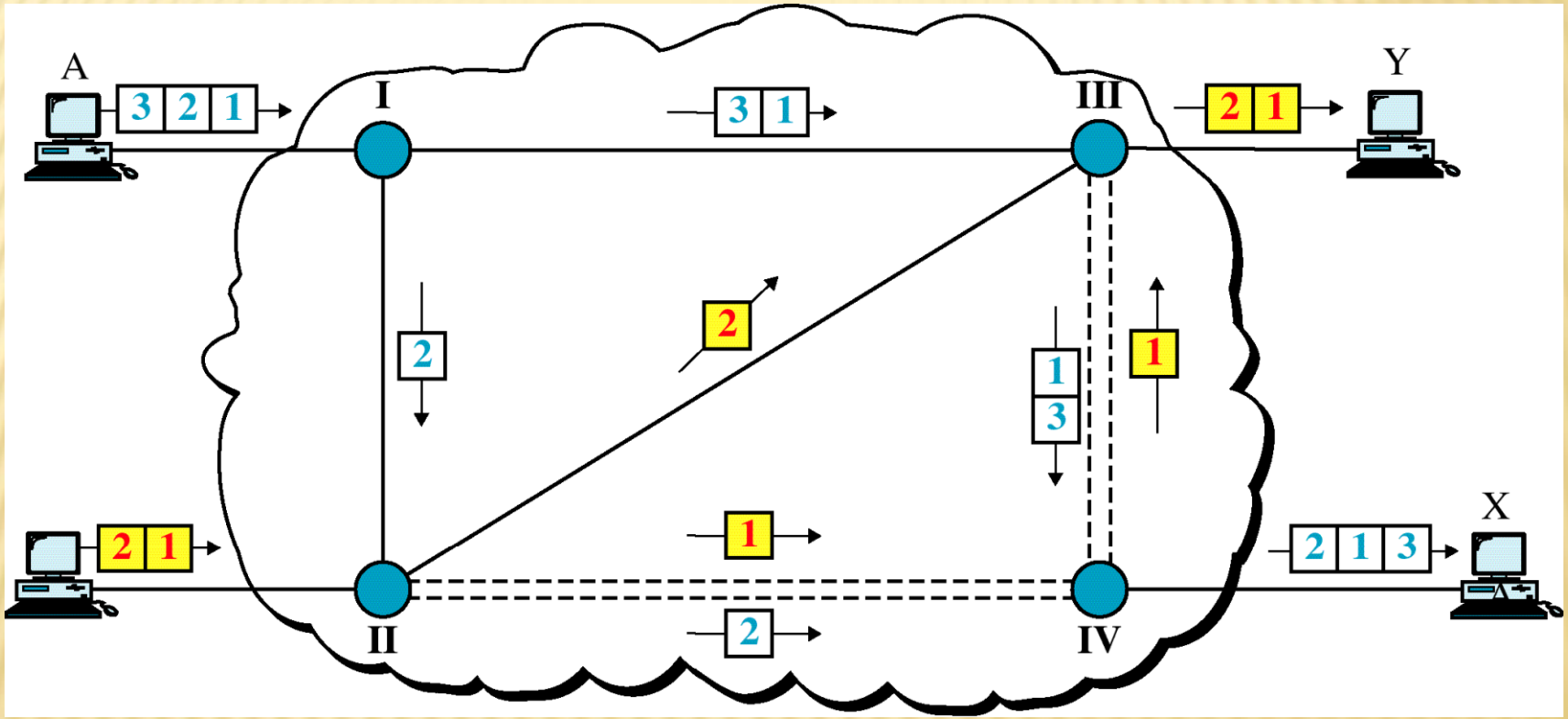
Datagram Approach



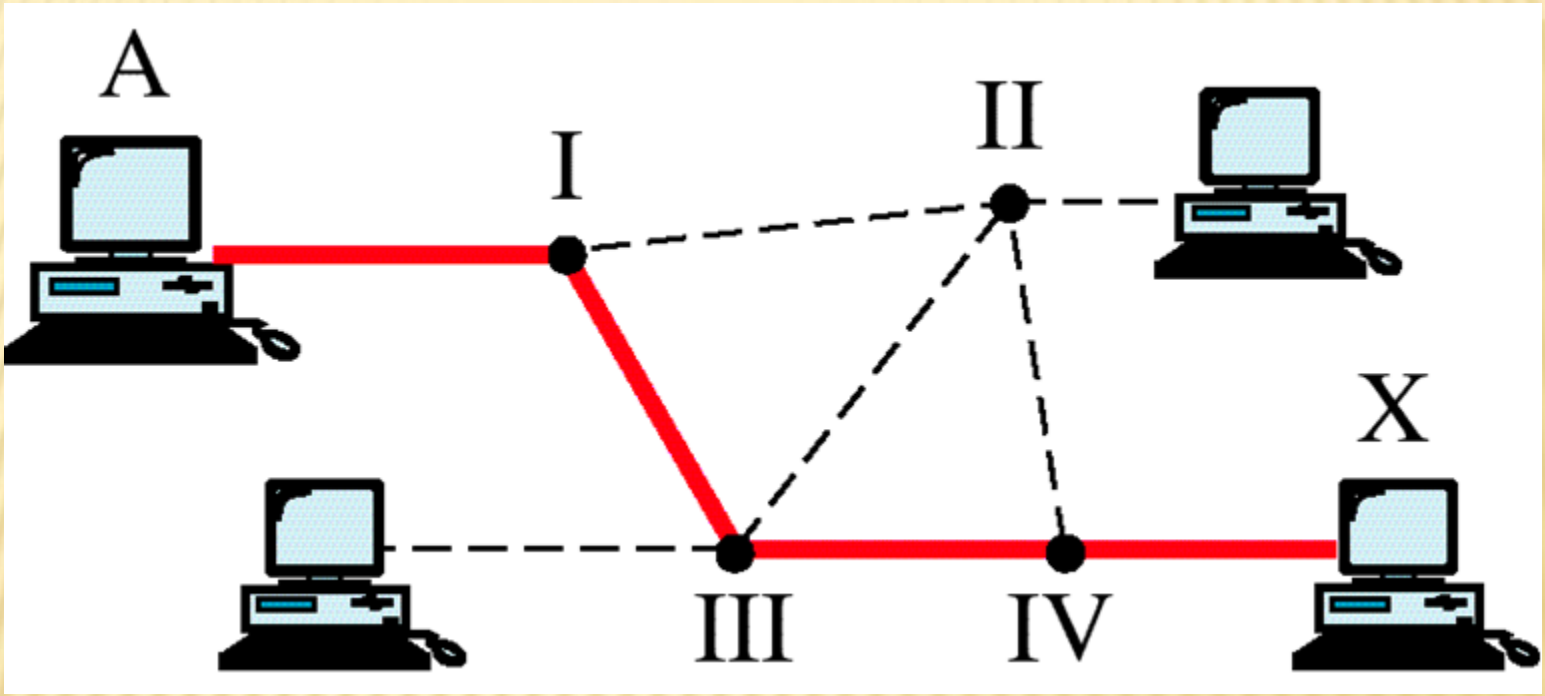
Delay in a datagram network



Datagram Approach and Multiple Channels

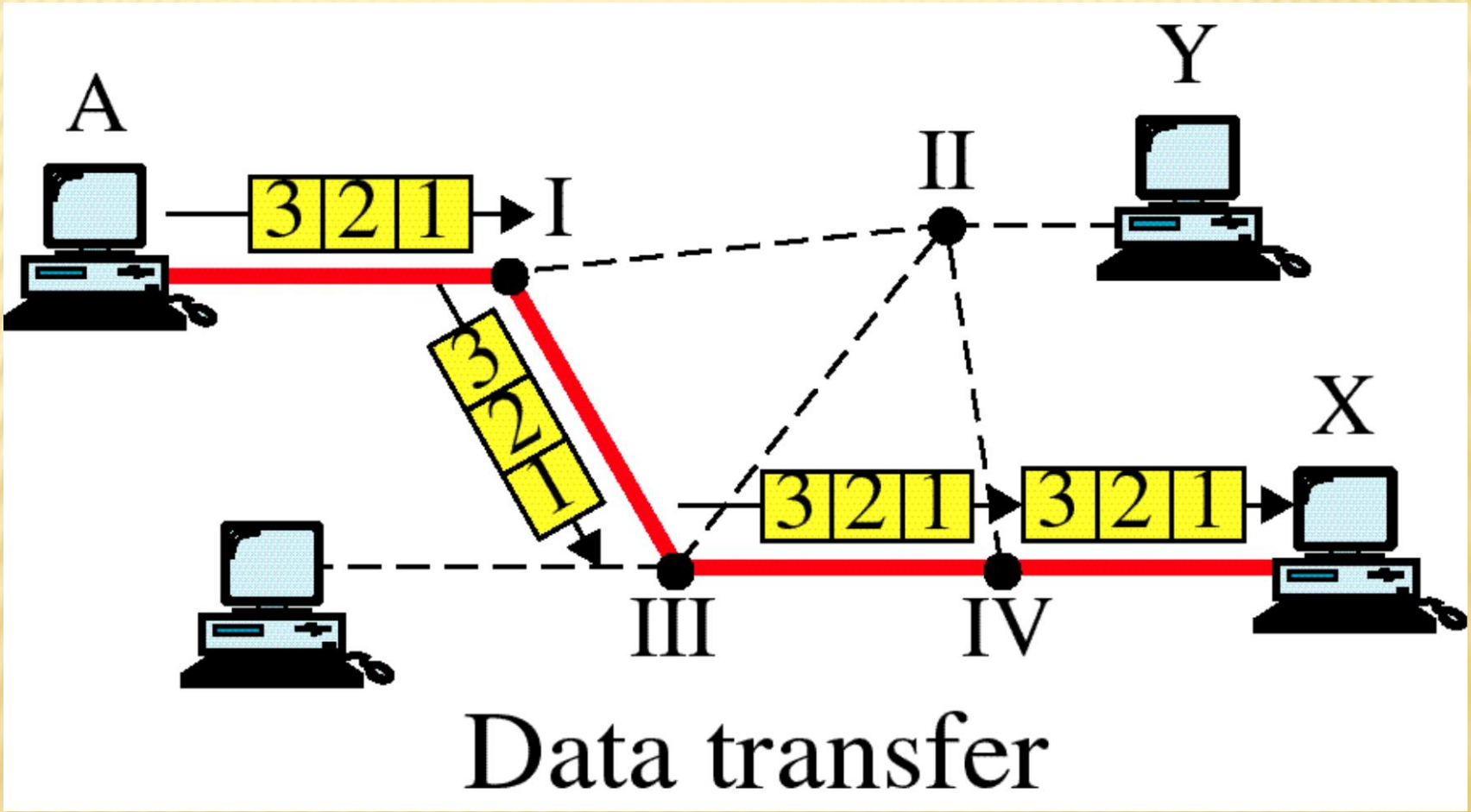


Switched Virtual Circuit

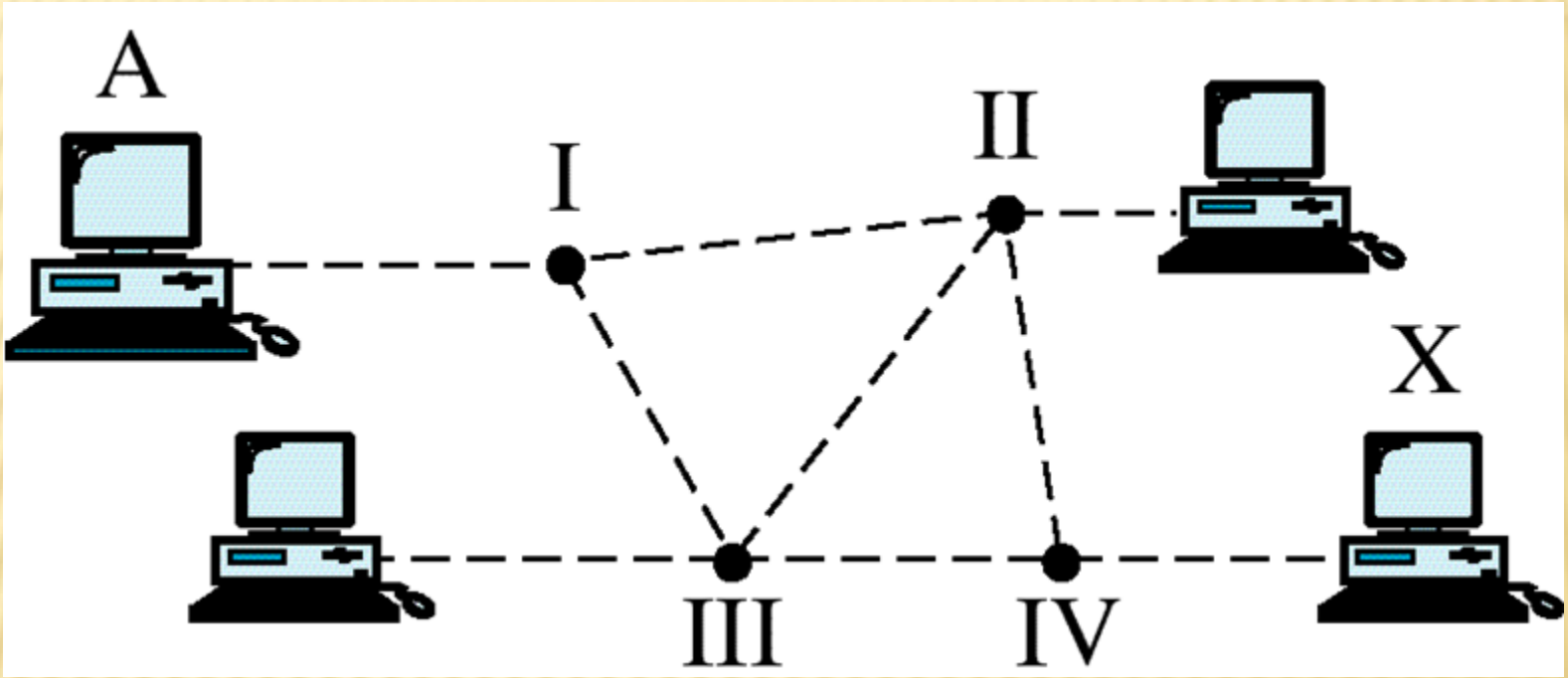


Connection Establishment

Switched Virtual Circuit

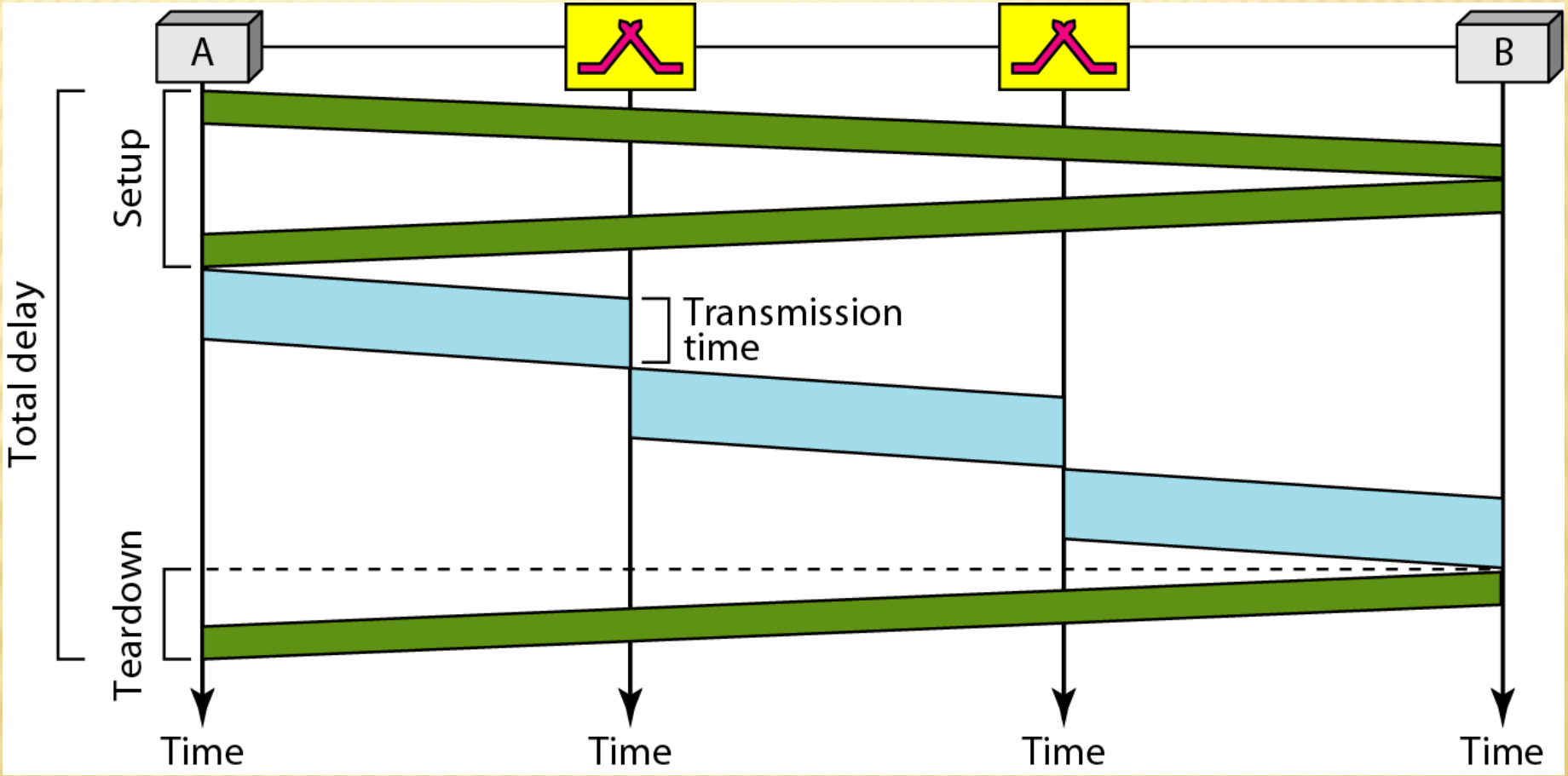


Switched Virtual Circuit

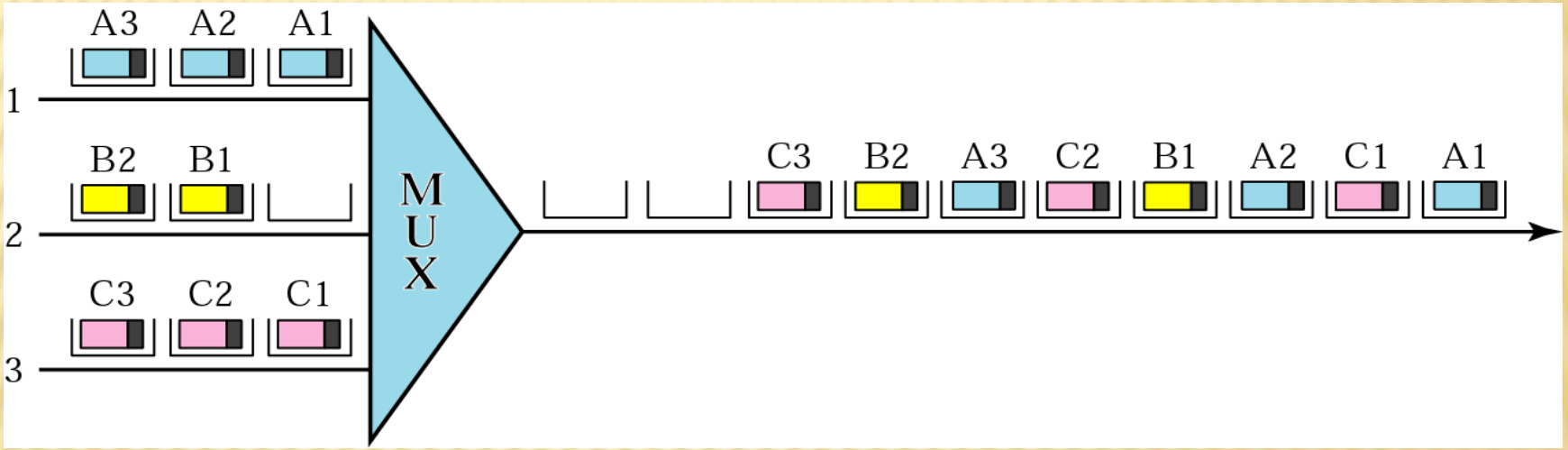


Connection release

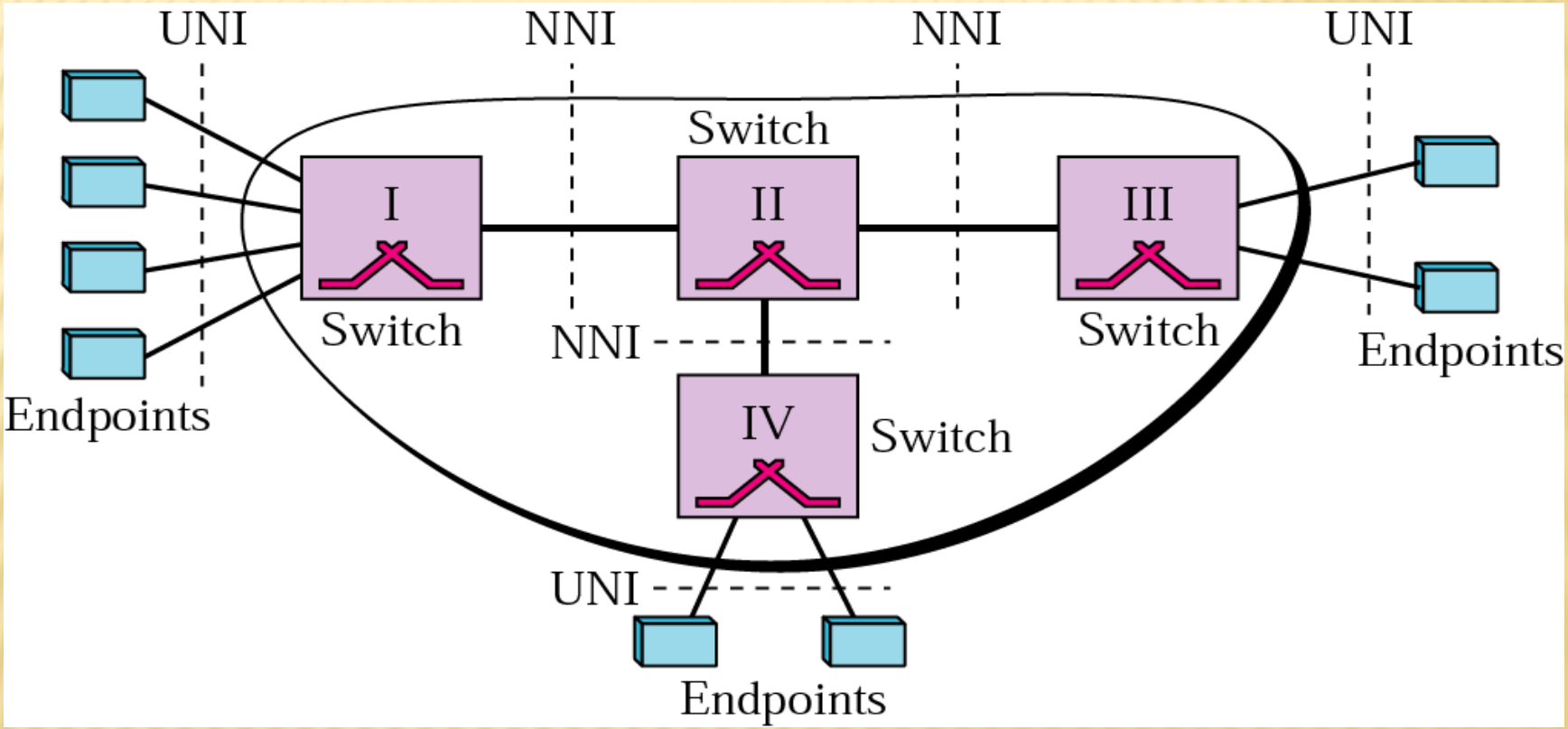
Delay in a virtual-circuit network



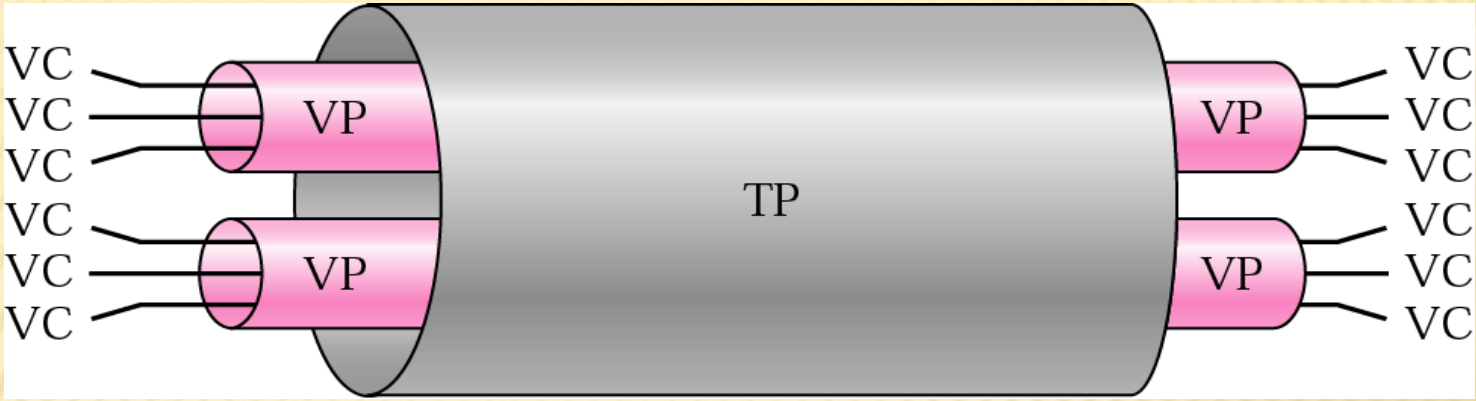
ATM multiplexing



Architecture of an ATM network

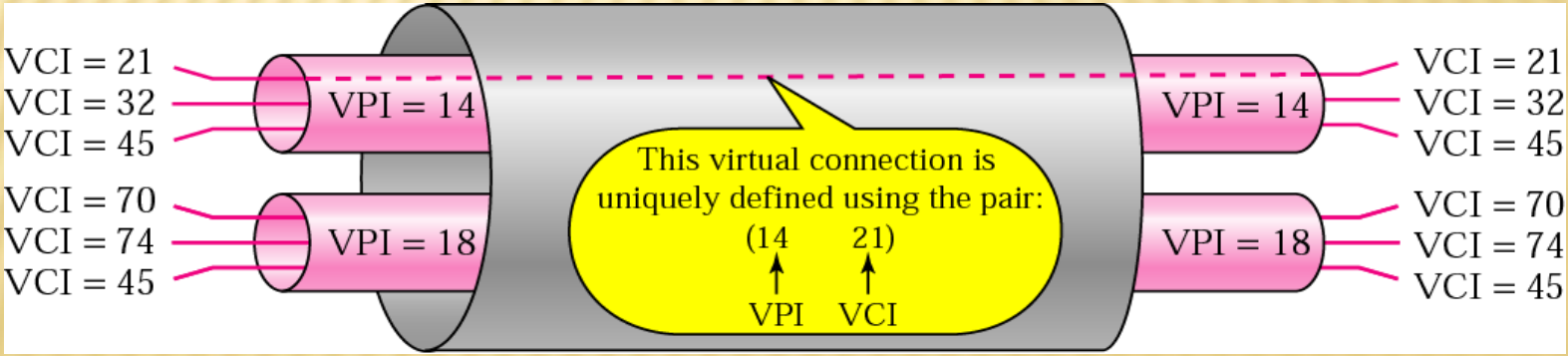


Terminal Path, Virtual Paths, and Virtual Circuits

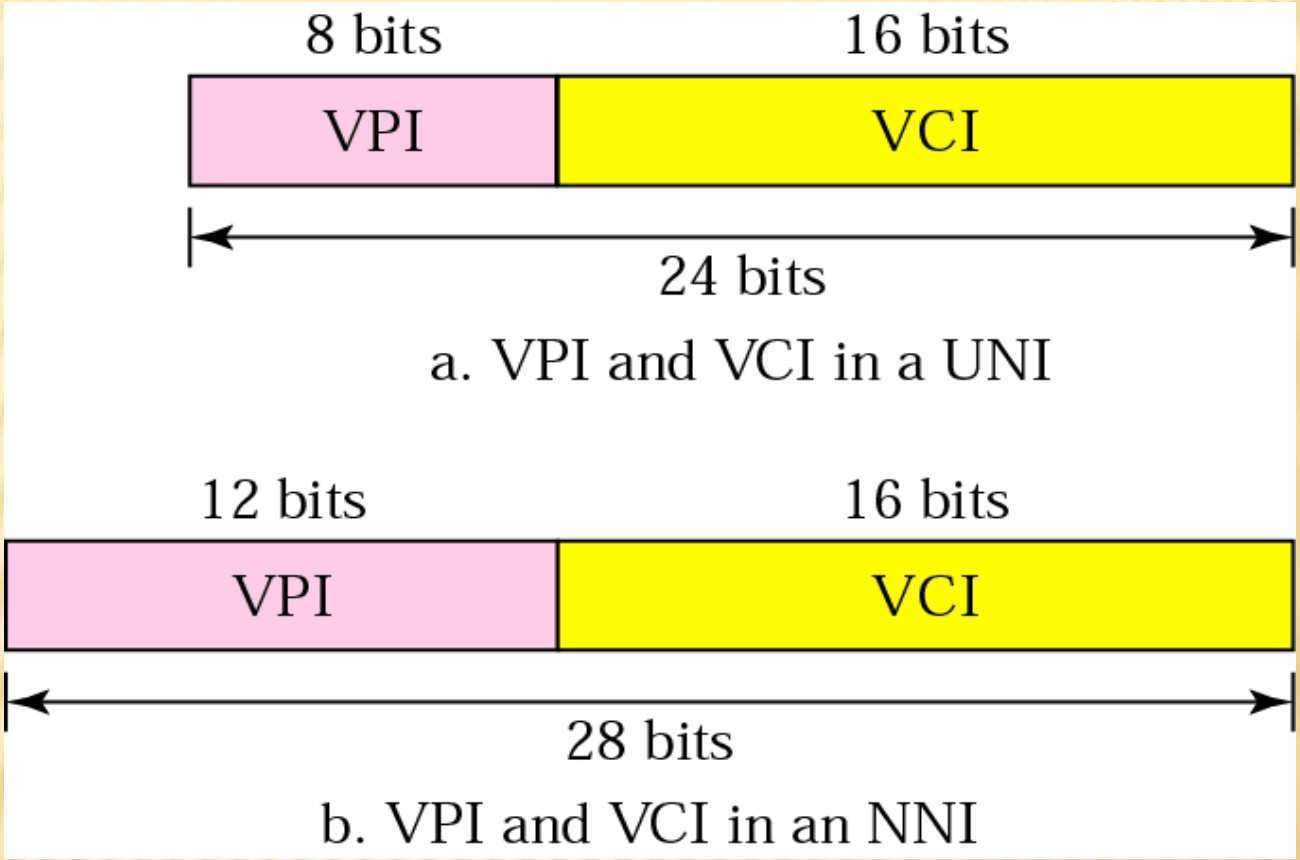


TP Terminal Path VP Virtual Path VC Virtual Circuit

A virtual connection is defined by a pair of numbers: VPI and VCI

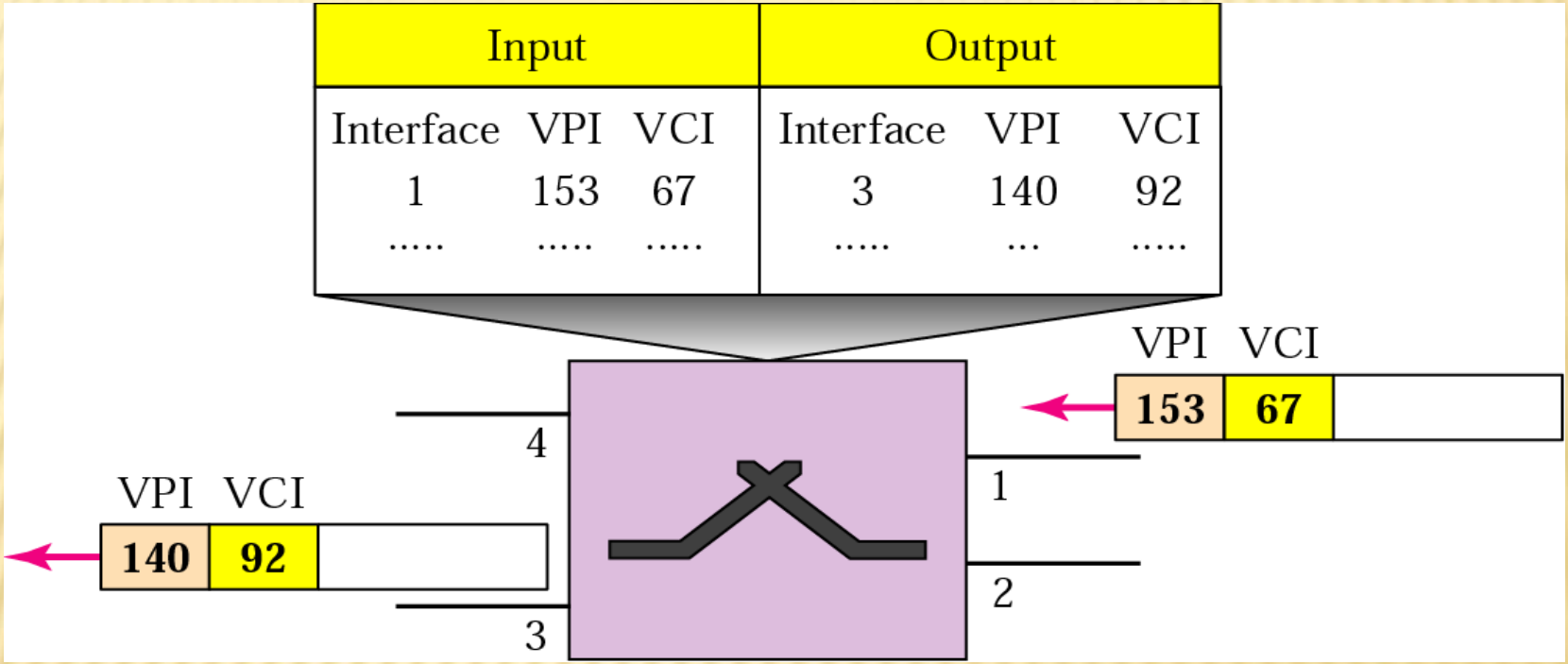


Virtual connection identifiers in UNIs and NNIs

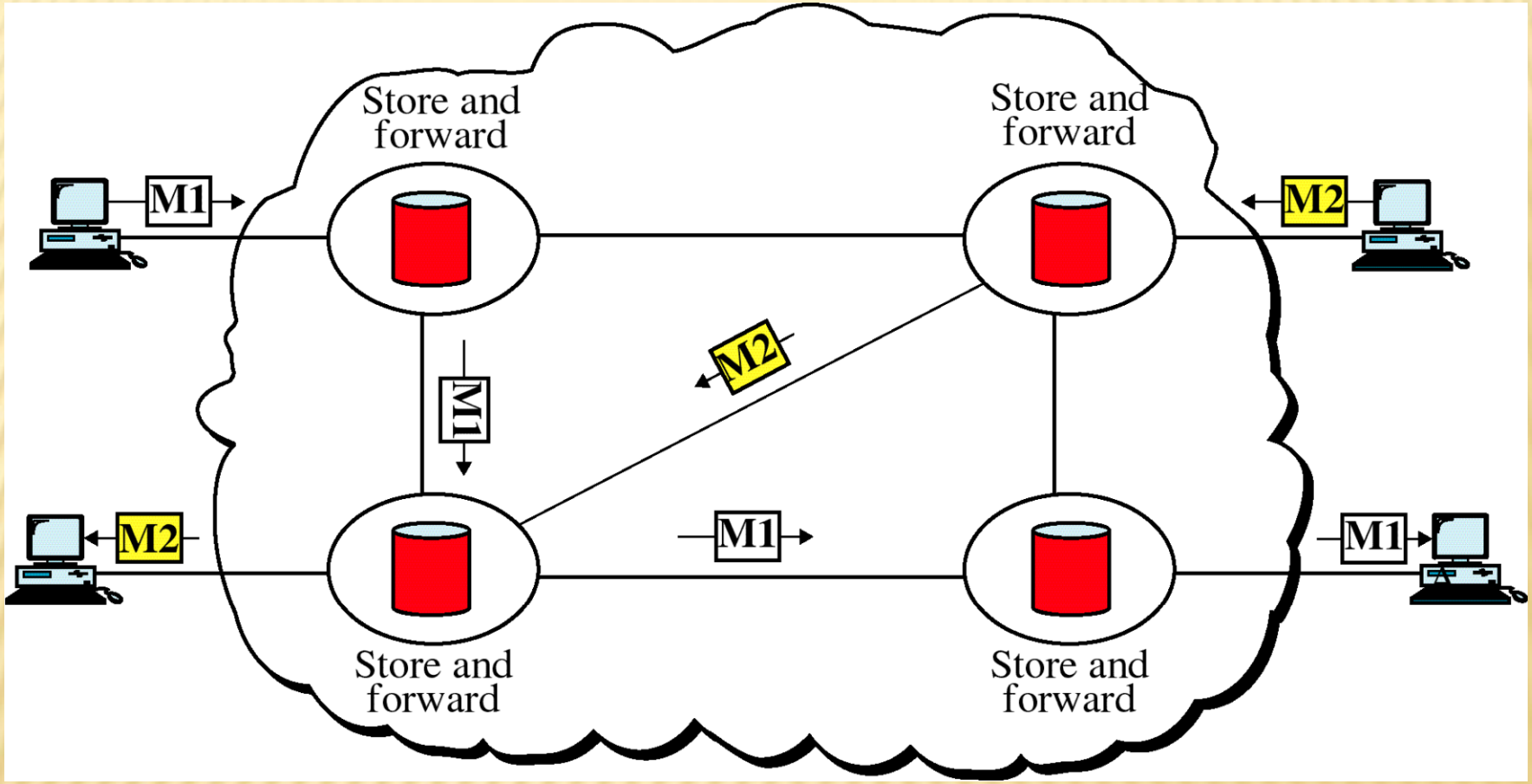


UNI **User-Network Interface**
NNI **Network-Network Interface**

Routing with a switch



Message Switching



Each message is treated as a separate entity and contains addressing information, and at each switch this information is read and the transfer path to the next switch is decided.