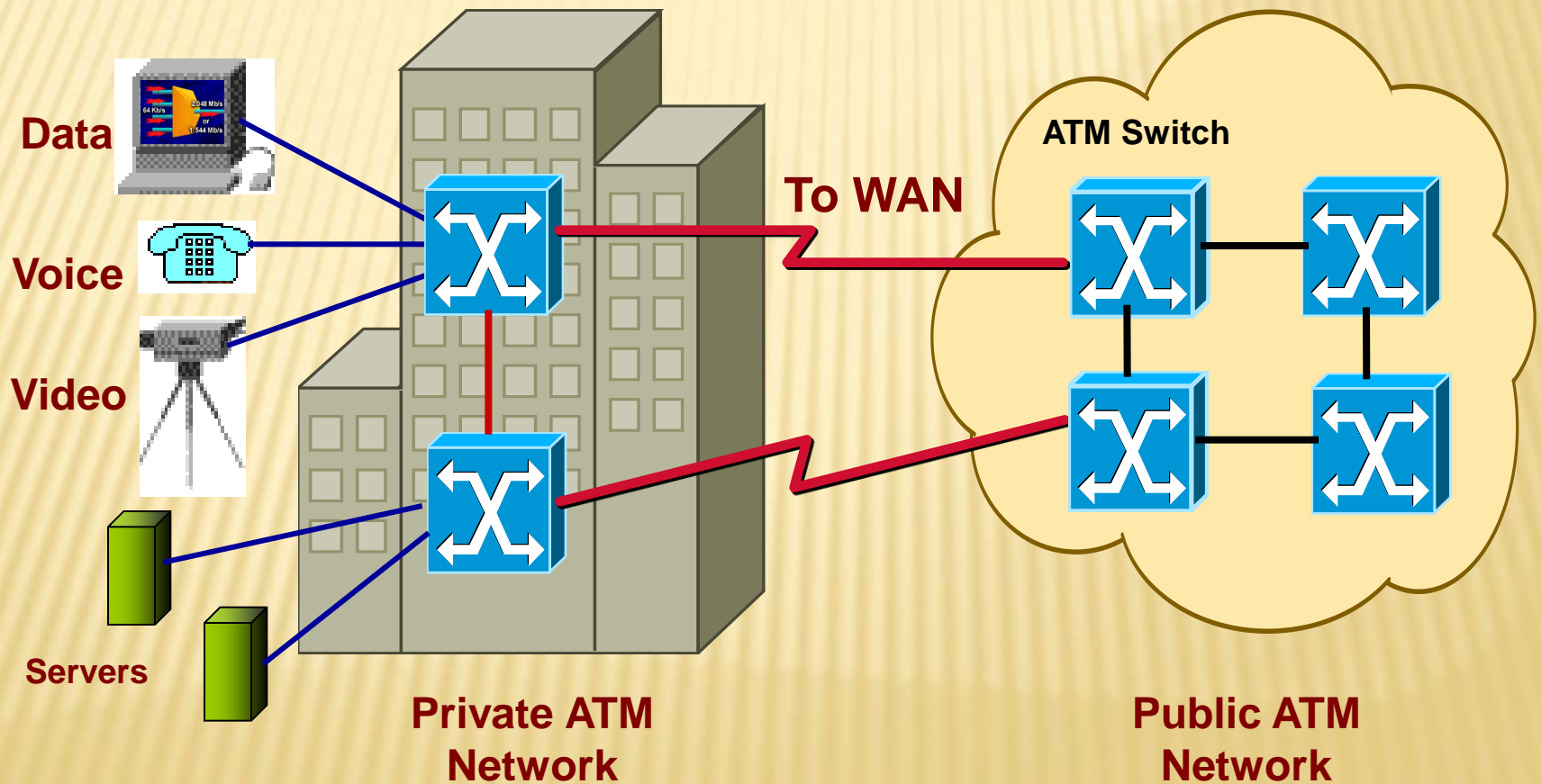


BROADBAND AND HIGH SPEED NETWORKS

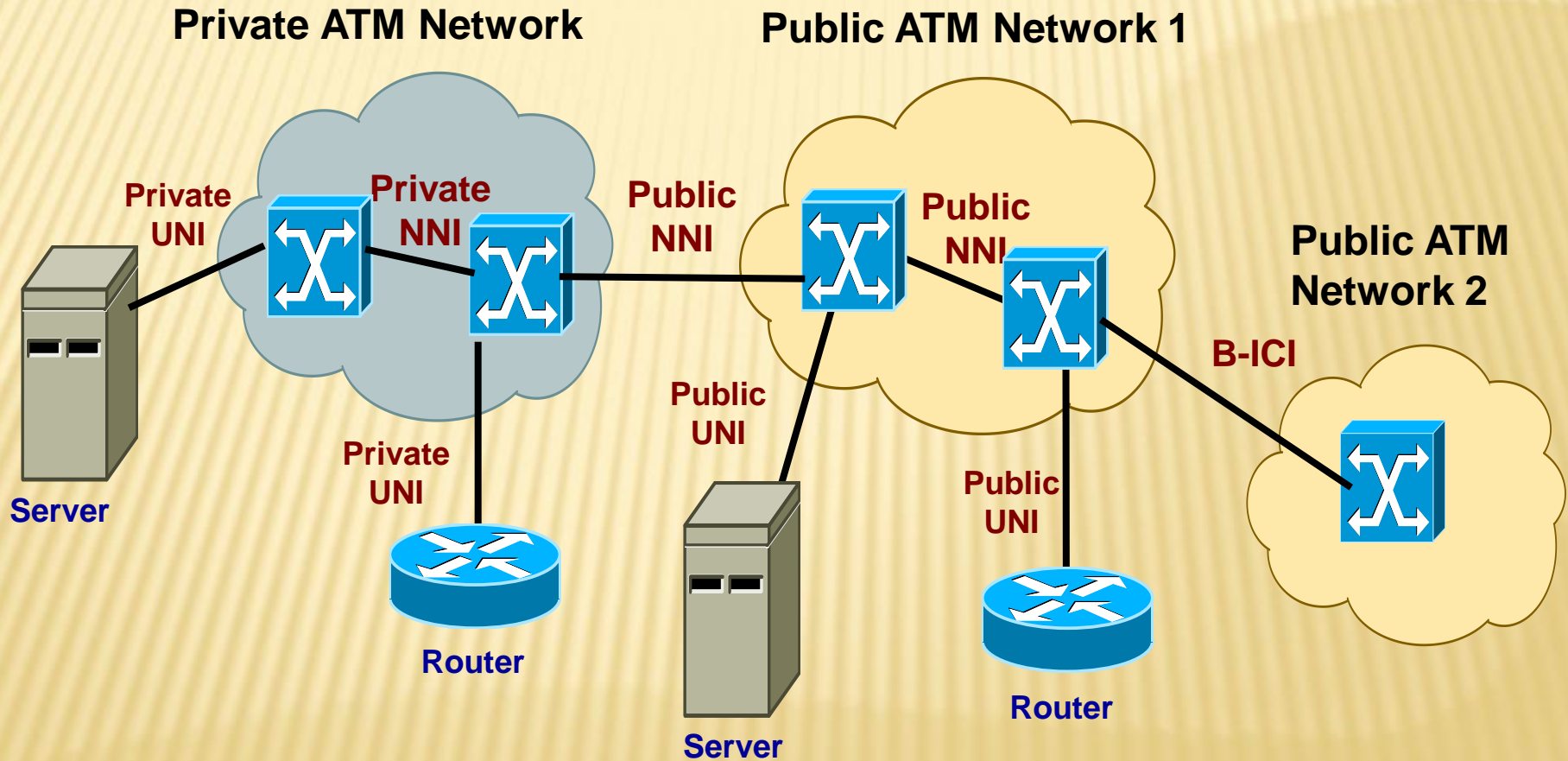
6

Asynchronous Transfer Mode (ATM)

ASYNCHRONOUS TRANSFER MODE (ATM)



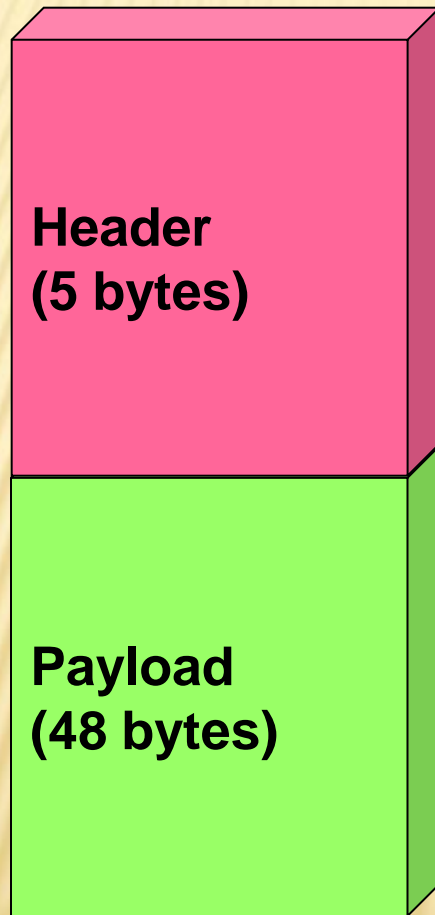
ATM NETWORK INTERFACES



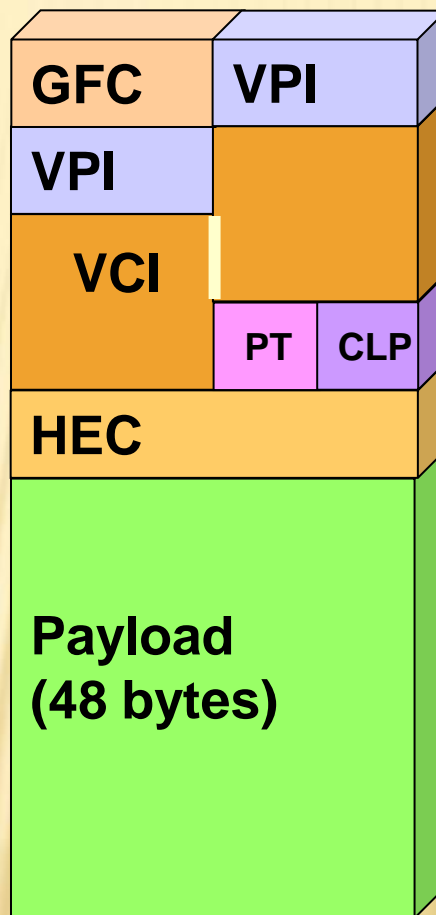
ATM CELL HEADER FORMAT

- ❑ An ATM cell header can be one of two formats:
 - ❑ UNI
 - ❑ NNI
- ❑ **UNI header** is used for communication between ATM endpoints and ATM switches in private ATM networks.
- ❑ **NNI header** is used for communication between ATM switches.
- ❑ Unlike the UNI, the NNI header does not include the **Generic Flow Control (GFC) field**. Additionally, the NNI header has a **Virtual Path Identifier (VPI) field** that occupies the first 12 bits, allowing for larger trunks between public ATM switches.

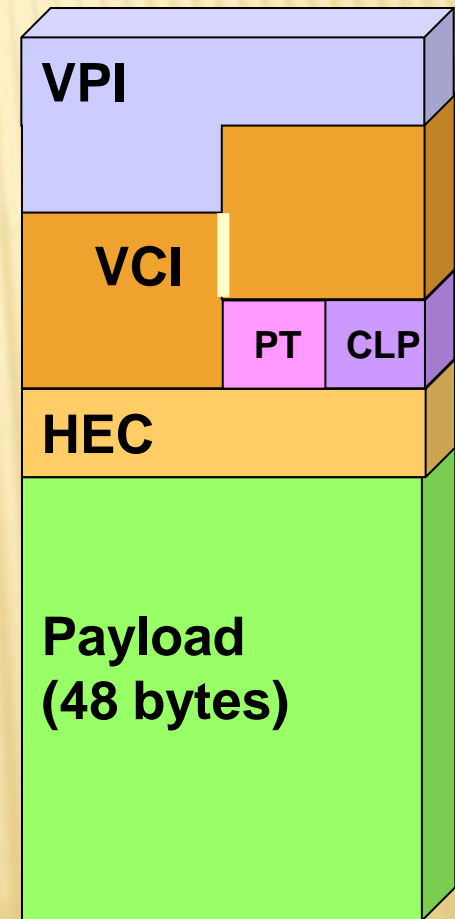
ATM CELL HEADER FORMAT



ATM Cell



ATM UNI Cell



ATM NNI Cell

ATM CELL HEADER FORMAT

- ❑ **Generic Flow Control (GFC) :** It is present only in cells between a host and a network. The purpose of this field was originally conceived as *flow control* or *priority*. However, this field is typically not used and is set to its default value of 0 (binary 0000).
- ❑ **Virtual Path Identifier (VPI) :** It is an integer number selecting particular virtual path.
- ❑ **Virtual Channel Identifier (VCI) :** It is an integer number selecting particular virtual circuit within the chosen virtual path.
 - ❑ Since the *VPI* field has 8 bits (at the UNI) and the *VCI* field has 16 bits, theoretically, a host could have up to 256 VC bundles, each containing up to 65,536 virtual circuits. Actually, some *VCI* are reserved for control functions.
 - ❑ *VPI/VCI*, identifies the next destination of a cell as it passes through a series of ATM switches on the way to its destination.
- ❑ **Payload Type (PT) :** Indicates in the *first bit* whether the cell contains user data or control data. If the cell contains user data, the bit is set to 0. If it contains control data, it is set to 1. The *second bit* indicates congestion (0 = no congestion, 1 = congestion), and the *third bit* has an open purpose.

ATM CELL HEADER FORMAT

Payload Type	Meaning
000	User data cell, no congestion, cell type 0
001	User data cell, no congestion, cell type 1
010	User data cell, congestion experienced, cell type 0
011	User data cell, congestion experienced, cell type 1
100	Maintenance information between adjacent switches
101	Maintenance information between source and destination switches
110	Resource Management cell (used for ABR congestion control)
111	Reserve for future function

ATM CELL HEADER FORMAT

- ❑ **Cell Loss Priority (CLP)** : Indicates whether the cell should be discarded if it encounters extreme congestion as it moves through the network. **If the CLP bit equals 1, the cell should be discarded in preference to cells with the CLP bit equal to 0.**
 - ❑ The CLP bit can be set by the host to differentiate between high priority traffic and low priority traffic.
 - ❑ If congestion occurs and cells must be discarded, **switches discard cells with CLP set to 1.**
- ❑ **Header Error Control (HEC)** : Calculates checksum only on the first 4 bytes of the header. It does not check the payload.
 - ❑ **HEC** can correct all single bit error in these 4 bytes, and can detect about 90% of all multi-bit errors. thereby preserving the cell rather than discarding it.

ATM SERVICES

- ❑ The available ATM services are:

 - *Permanent virtual circuits (PVC)*

 - *Switched virtual circuits (SVC)*

- ❑ **PVC** allows direct connectivity between sites [similar to a leased line].

 - ❑ **Advantages** : PVC guarantees availability of a connection and does not require call setup procedures between switches.

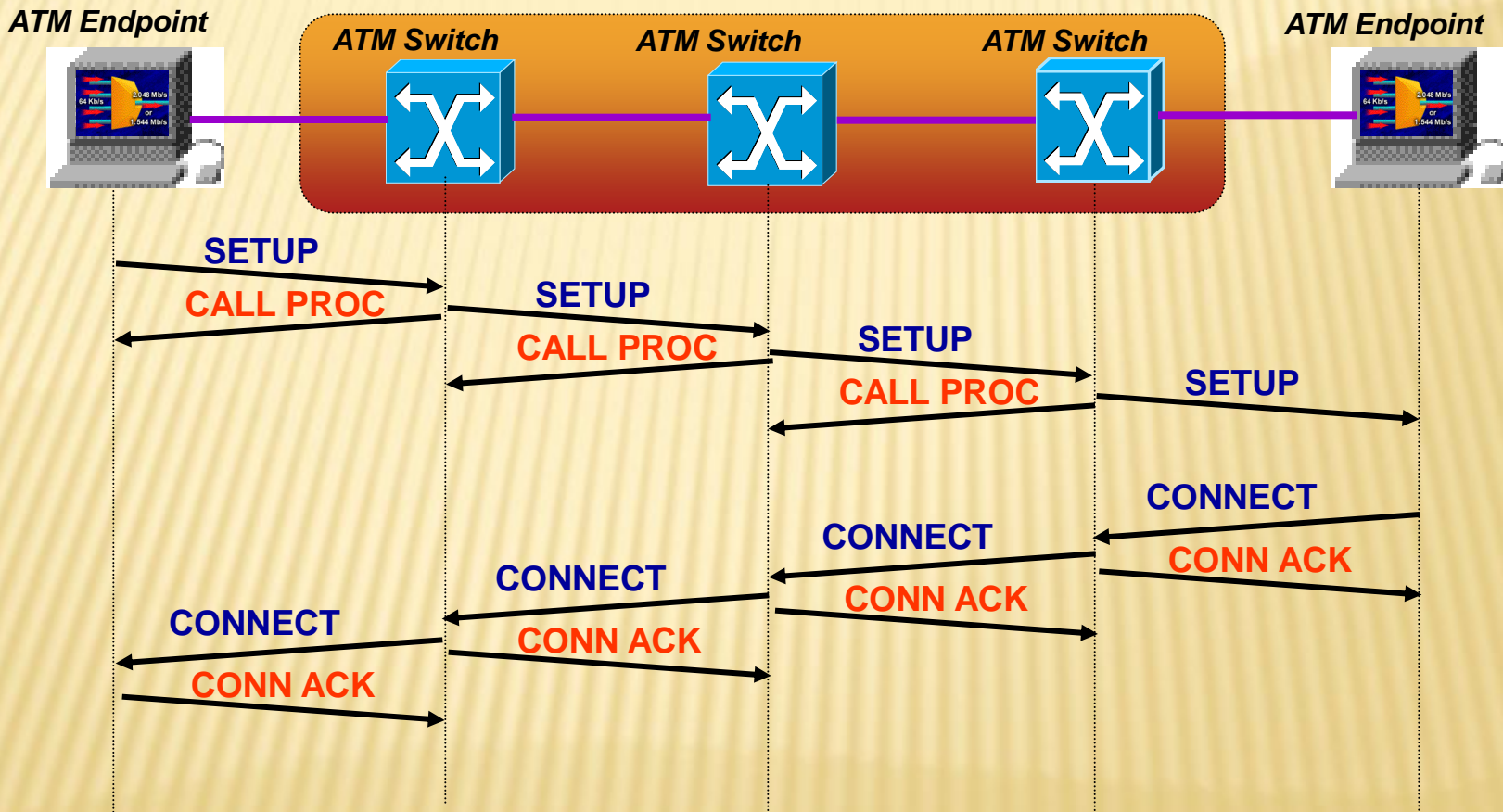
 - ❑ **Disadvantages** : Static connectivity and manual setup. Each piece of equipment between the source and the destination must be manually provisioned for the PVC.

- ❑ **SVC** is created and released dynamically and remains in use only as long as data is being transferred [similar to a telephone call]. Dynamic call control requires a signaling protocol between the ATM endpoint and the ATM switch.

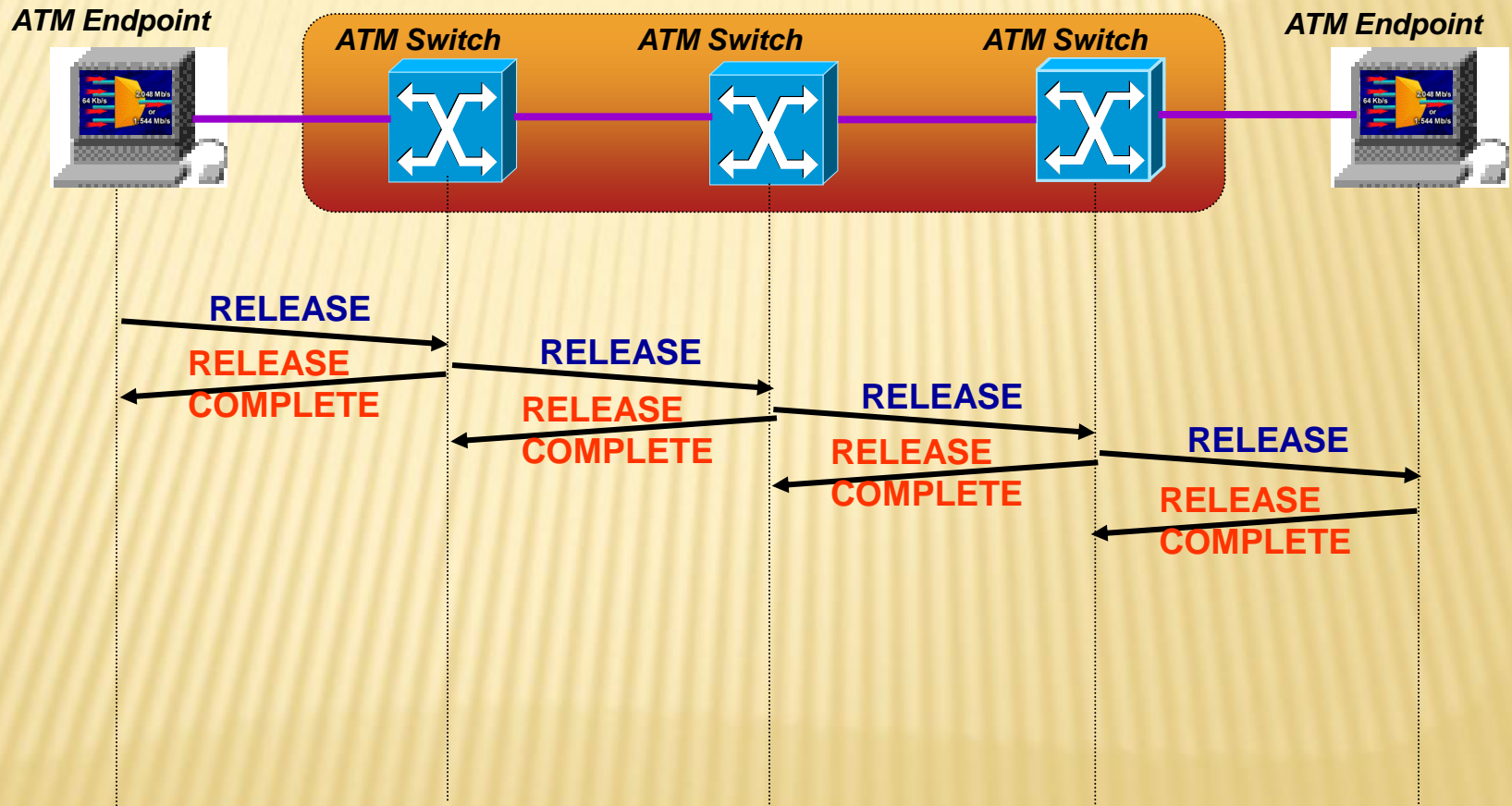
 - ❑ **Advantages** : Connection flexibility and call setup that can be handled automatically by a networking device.

 - ❑ **Disadvantages** : The extra time and overhead required to set up the connection.

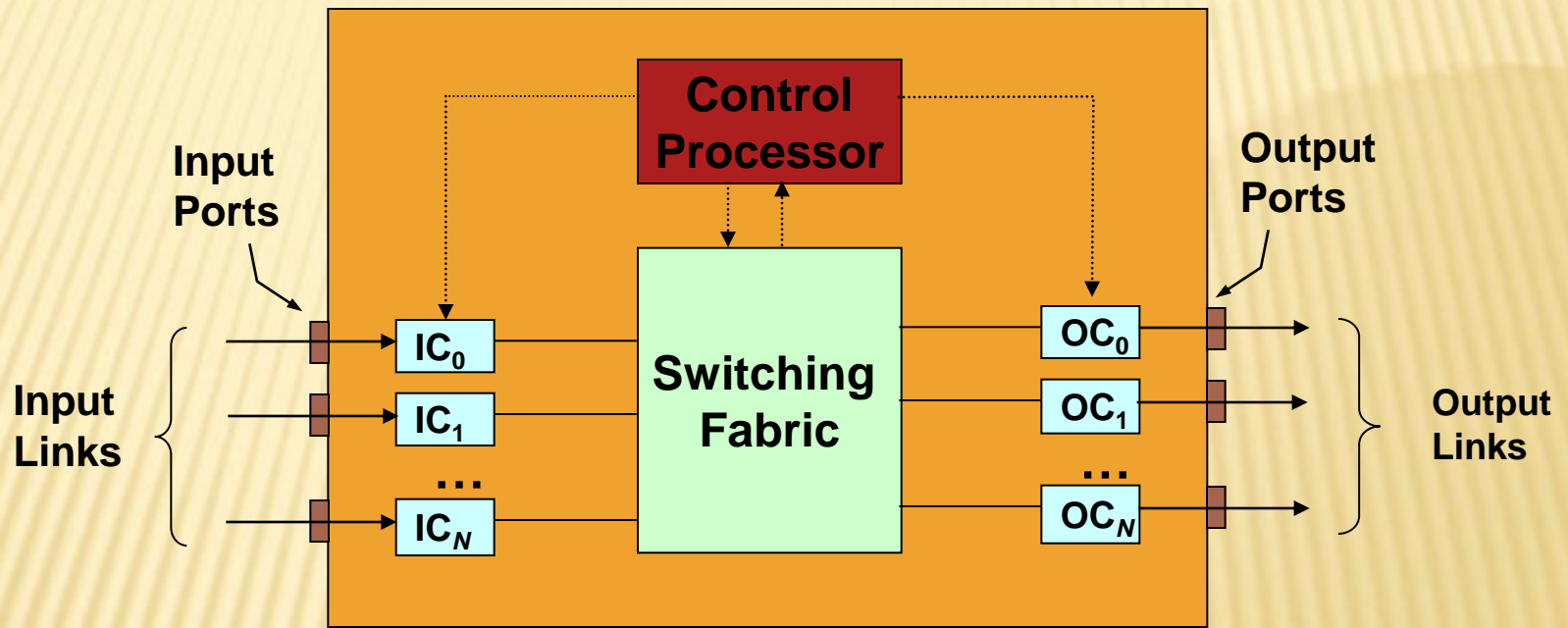
SVC [Q.2931] CONNECTION



SVC [Q.2931] TERMINATION



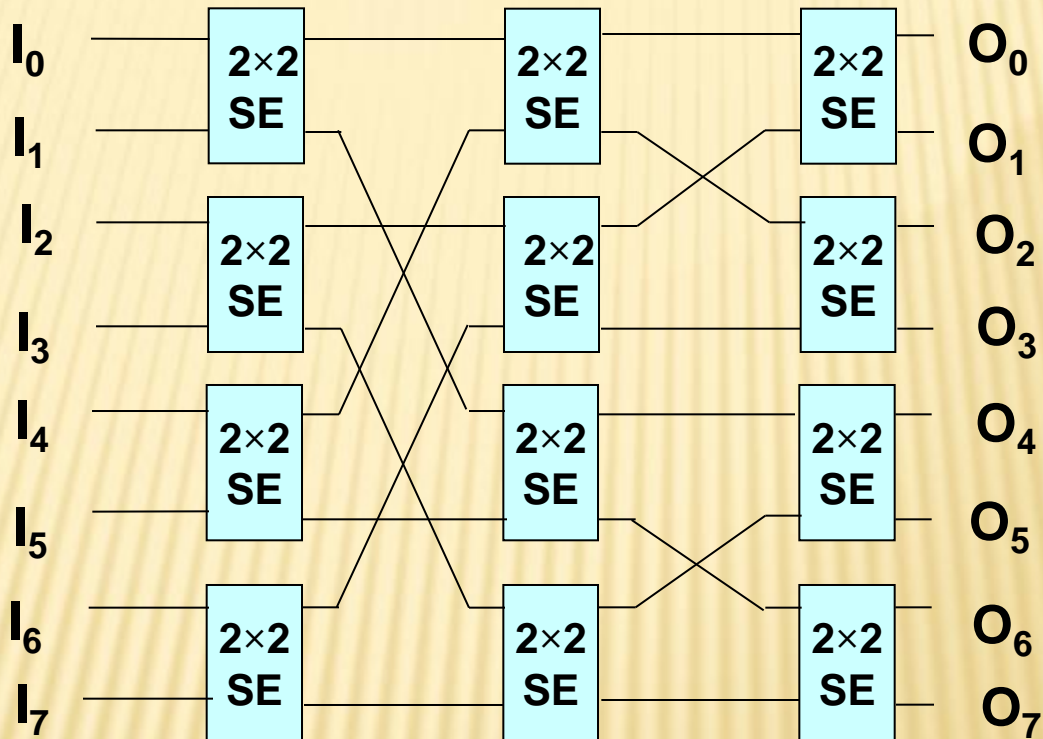
ATM SWITCHES



IC = Input Controller

OC = Output Controller

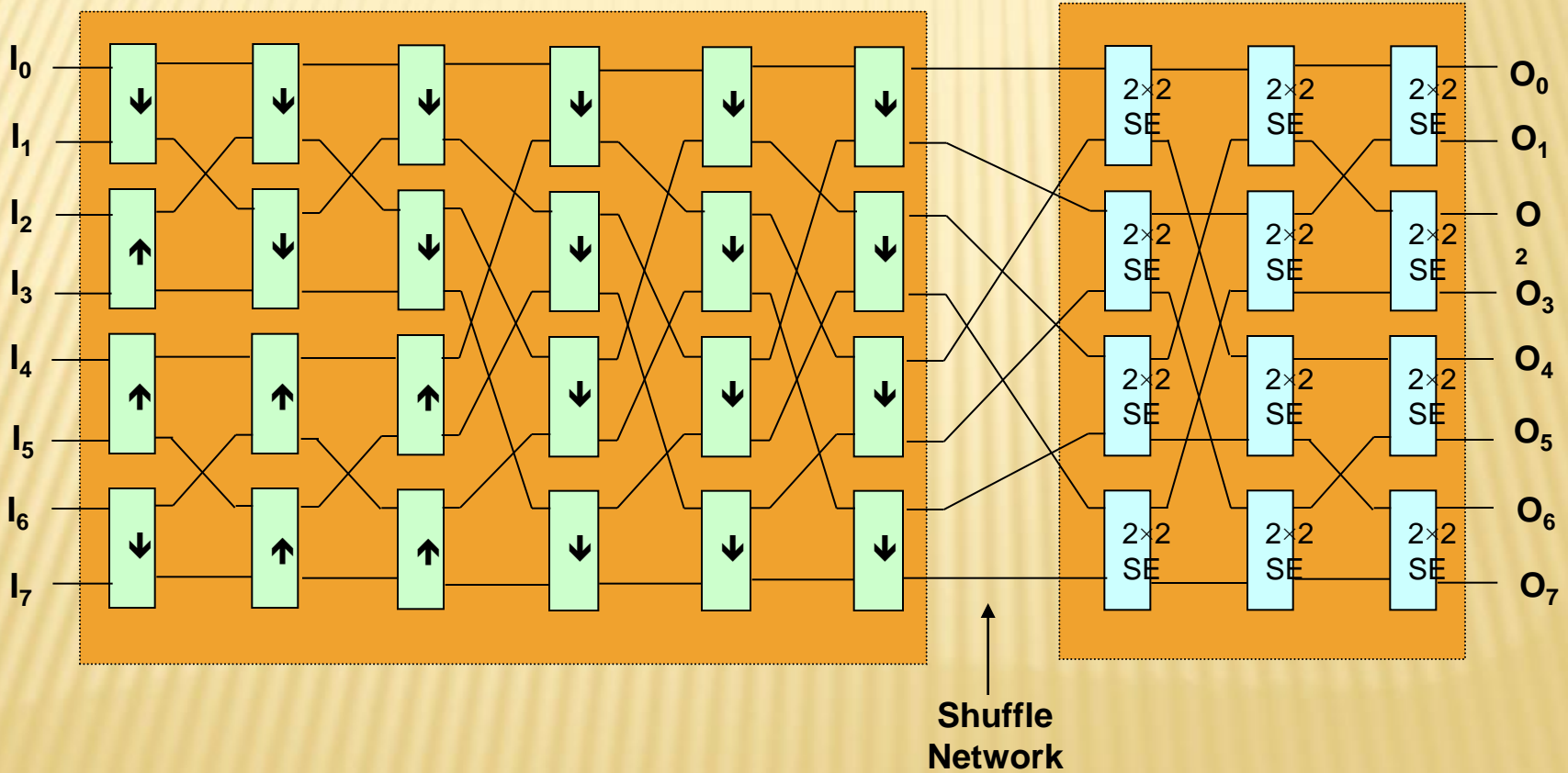
ATM SWITCHES – THE BANYAN SWITCH



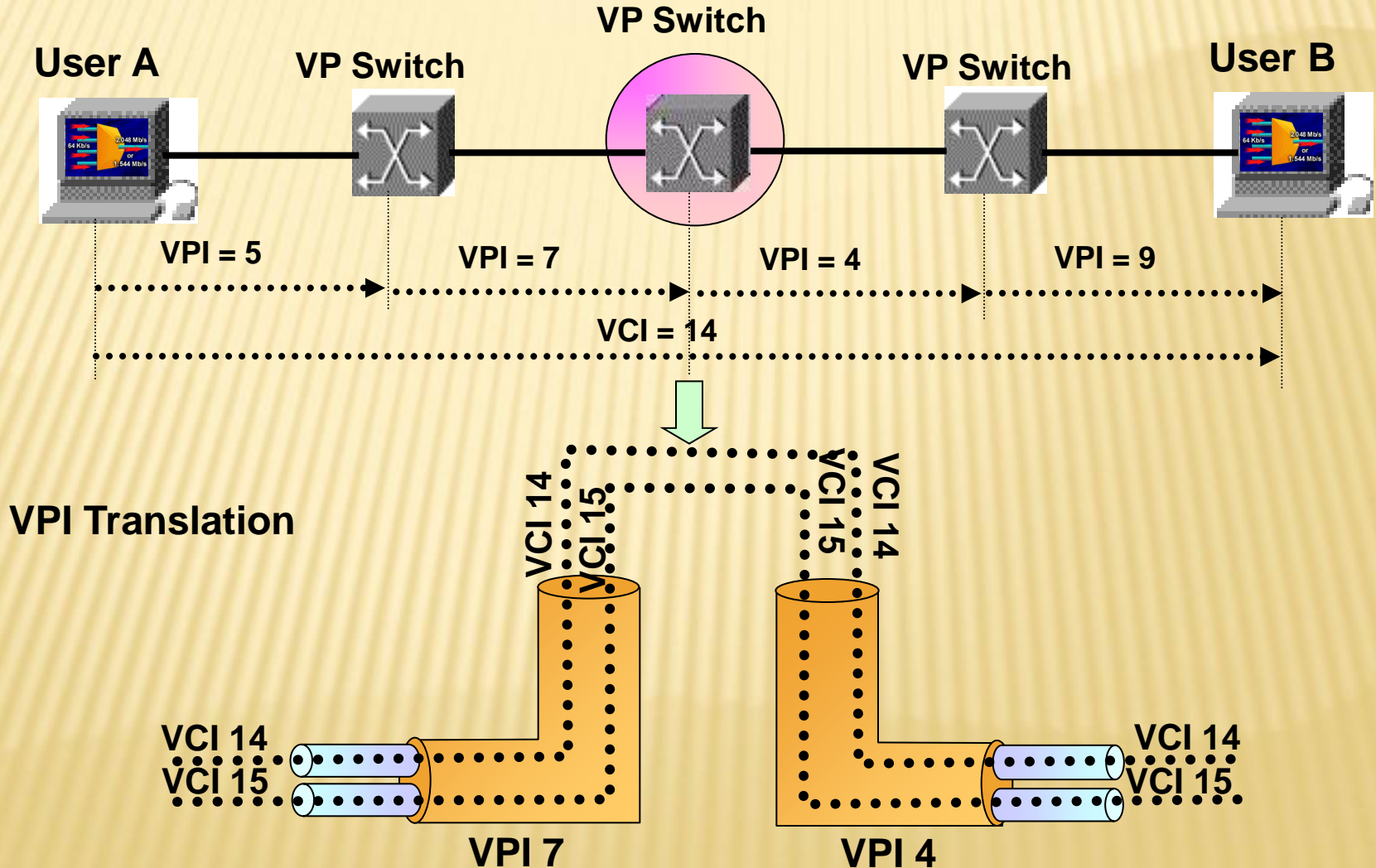
ATM SWITCHES – THE BATCHER-BANYAN SWITCH

Batcher Switch

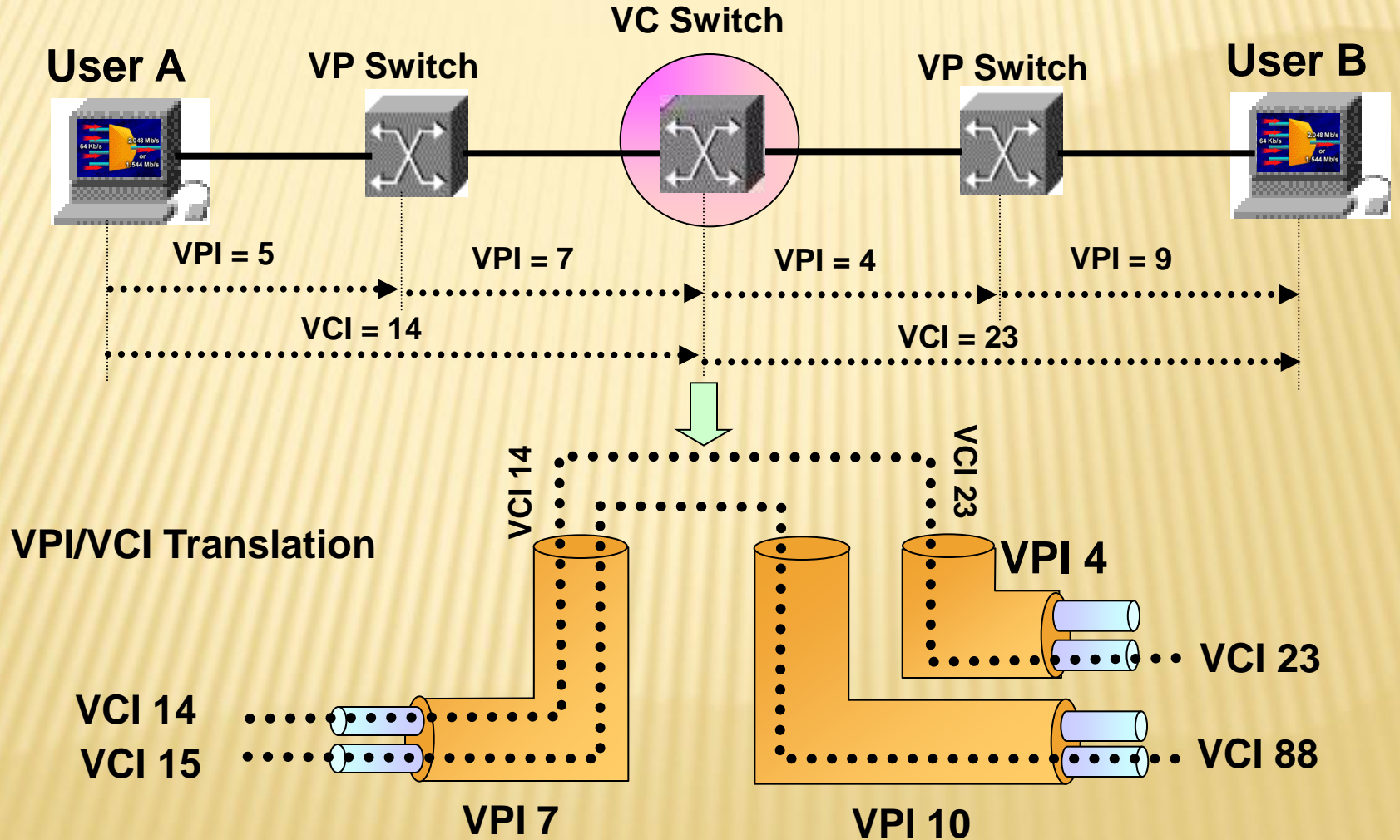
Banyan Switch



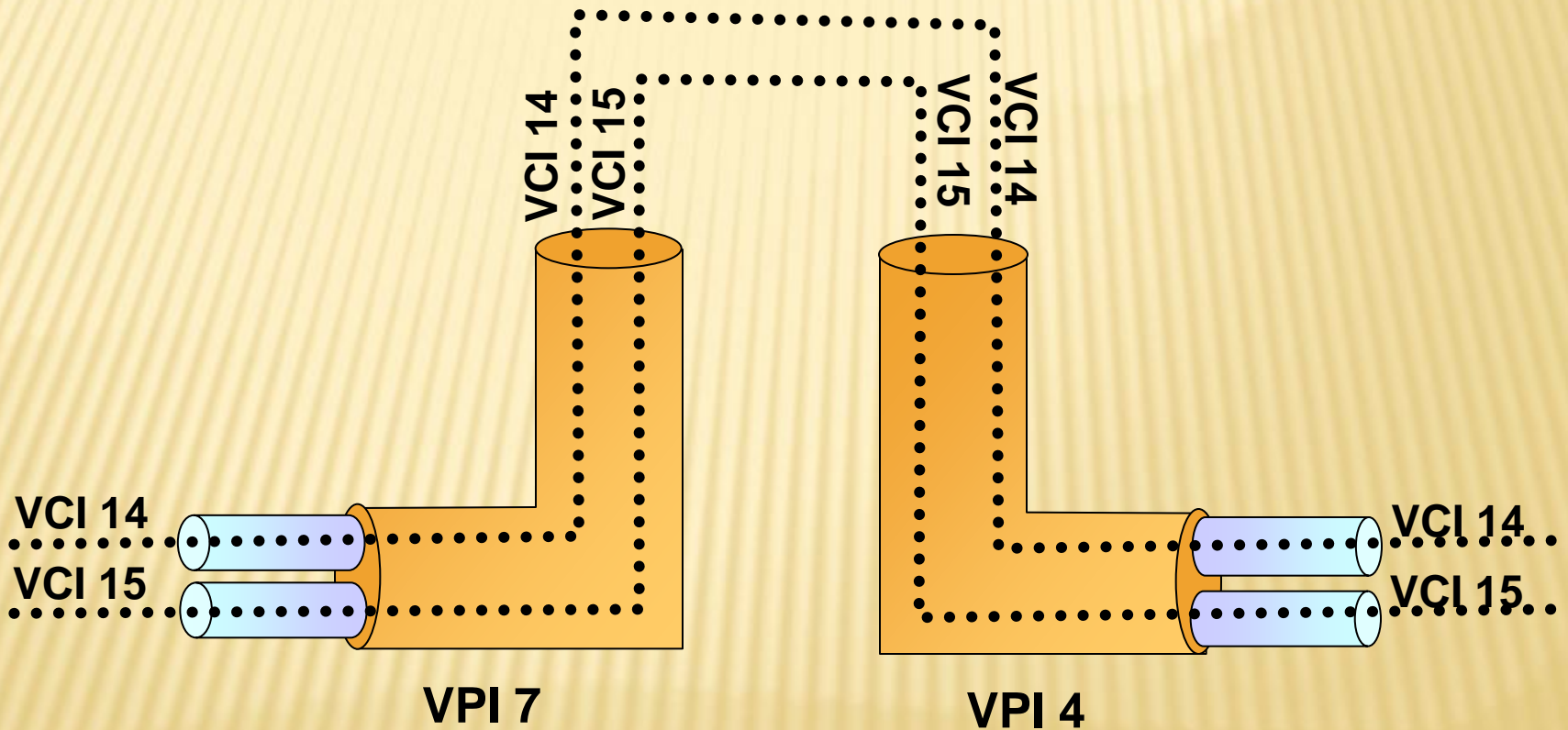
ATM SWITCHES



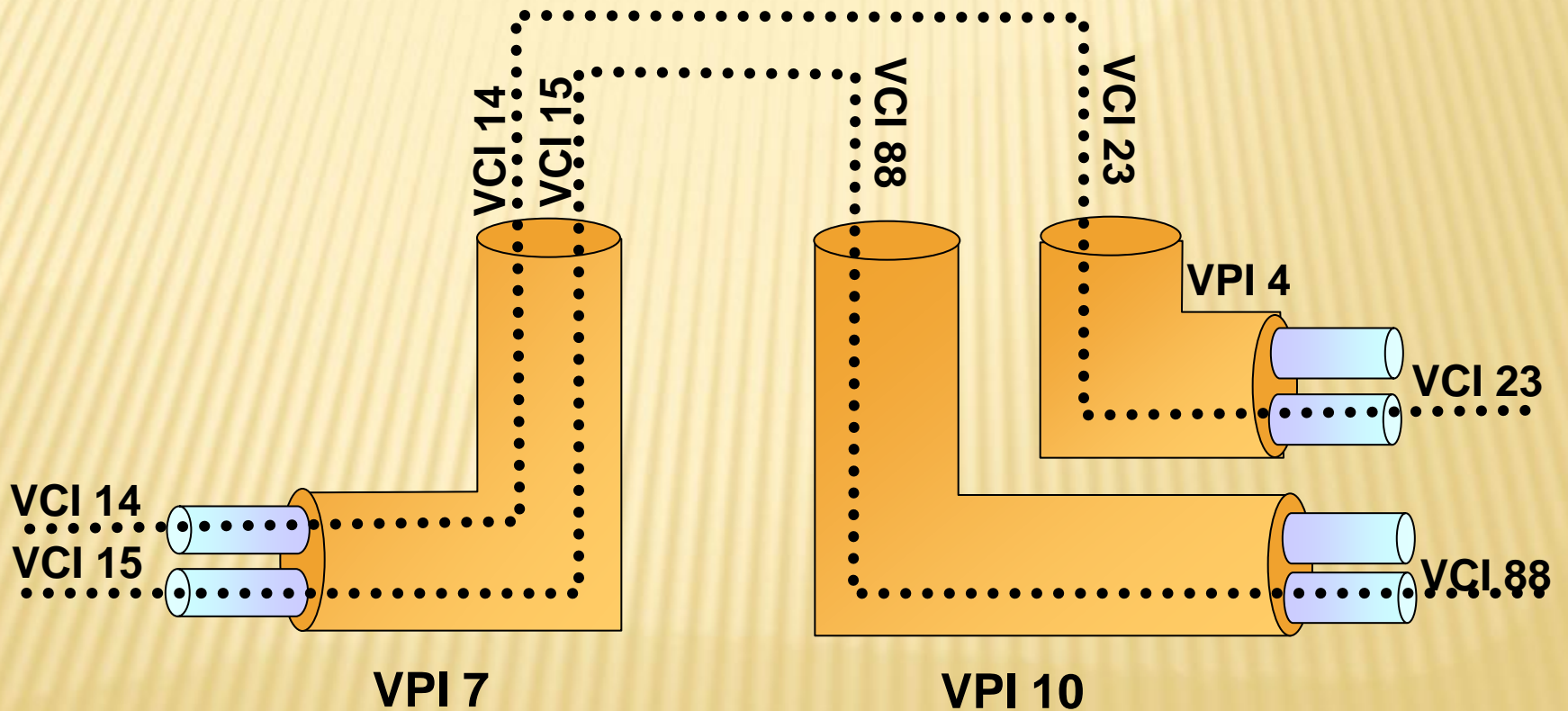
ATM SWITCHES



ATM SWITCHES: VPI TRANSLATION



ATM SWITCHES: VPI/VCI TRANSLATION



ATM SWITCHING OPERATIONS

- ❑ The *basic operation* of an ATM switch is straightforward:
 - ❑ The cell is received across a link on a known *VCI* or *VPI* value.
 - ❑ The switch looks up the connection value in a *local translation table* to determine the outgoing port (or ports) of the connection and the new *VPI/VCI* value of the connection on that link.
 - ❑ The switch then retransmits the cell on that outgoing link with the appropriate connection identifiers.
 - ❑ Because all *VCIs* and *VPIs* have *only local significance* across a particular link, these values are remapped, as necessary, at each switch.