Data Communications and Networking Fourth Edition

Forouzan

Chapter 18

Virtual-Circuit Networks: Frame Relay and ATM

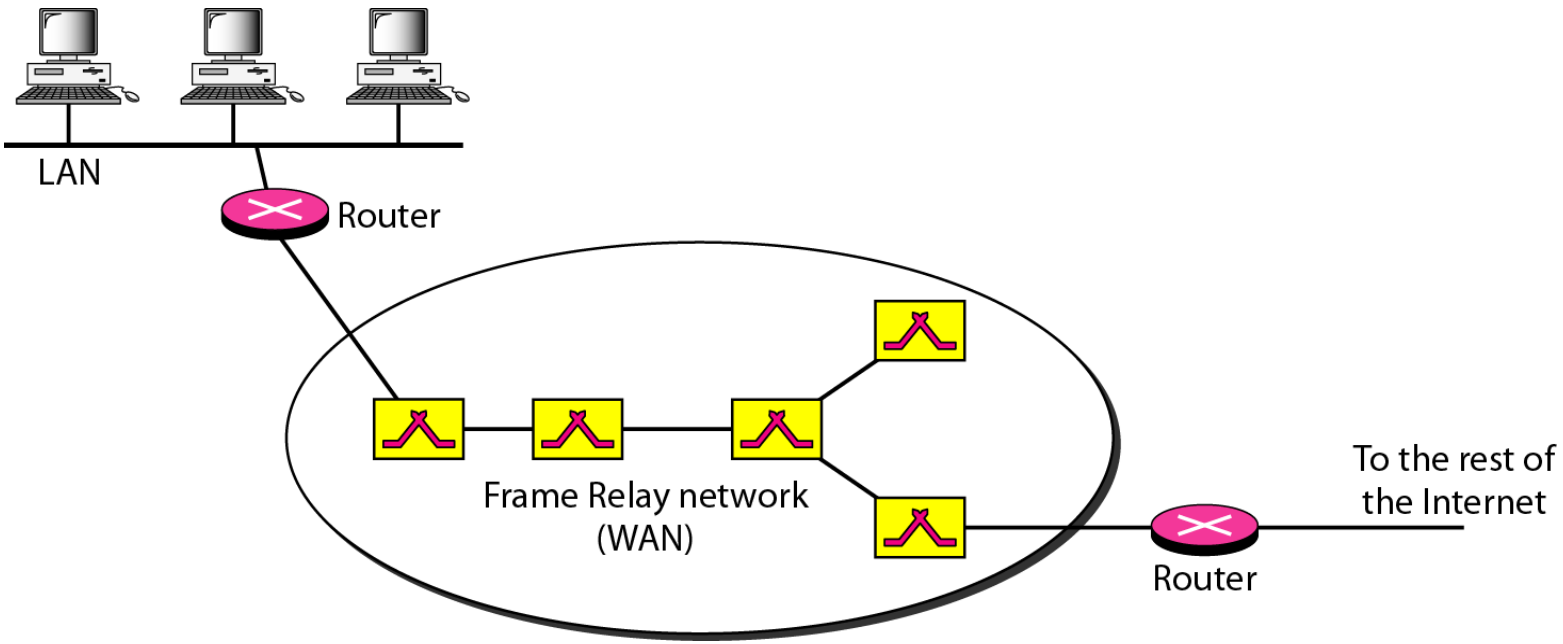
18-1 FRAME RELAY

Frame Relay is a virtual-circuit wide-area network that was designed in response to demands for a new type of WAN in the late 1980s and early 1990s.

Topics discussed in this section:

Architecture
Frame Relay Layers
Extended Address
FRADs
VOFR
LMI

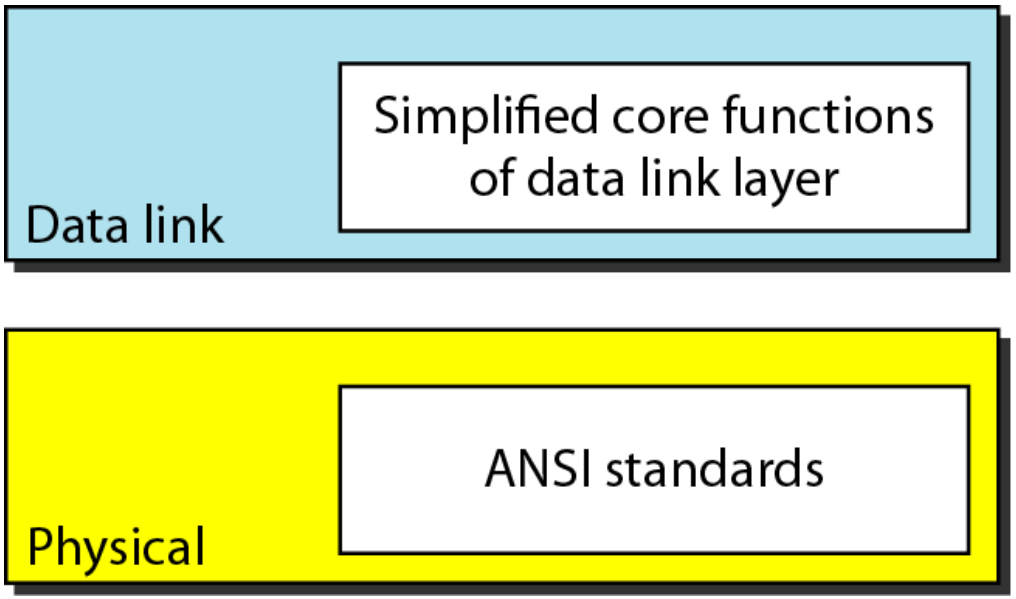
Figure 18.1 *Frame Relay network*



Note

VCIs in Frame Relay are called DLCIs.

Figure 18.2 *Frame Relay layers*



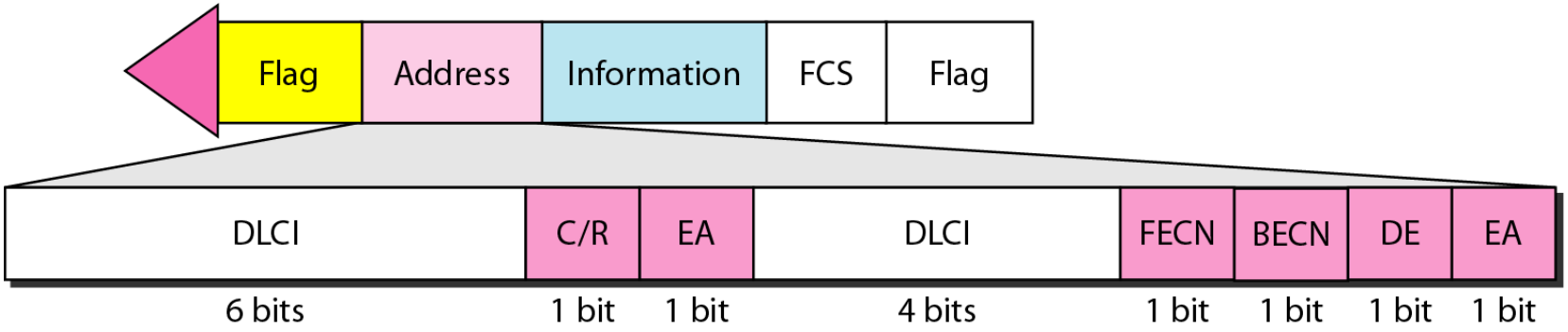
Note

Frame Relay operates only at the physical and data link layers.

Figure 18.3 *Frame Relay frame*

C/R: Command/response
EA: Extended address
FECN: Forward explicit congestion notification

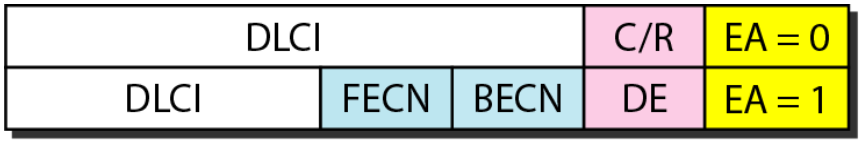
BECN: Backward explicit congestion notification
DE: Discard eligibility
DLCI: Data link connection identifier



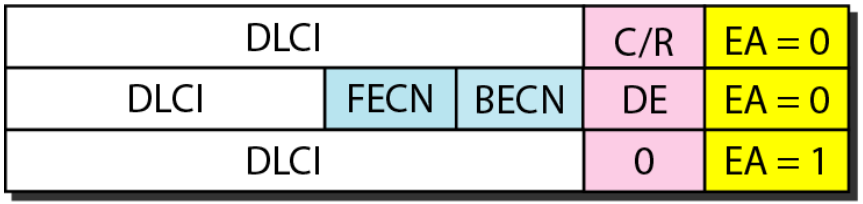
Note

Frame Relay does not provide flow or error control; they must be provided by the upper-layer protocols.

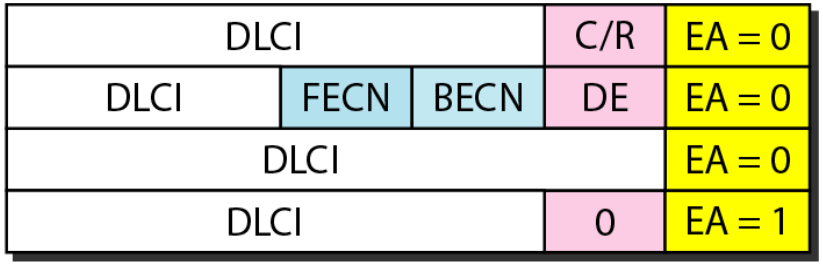
Figure 18.4 *Three address formats*



a. Two-byte address (10-bit DLCI)

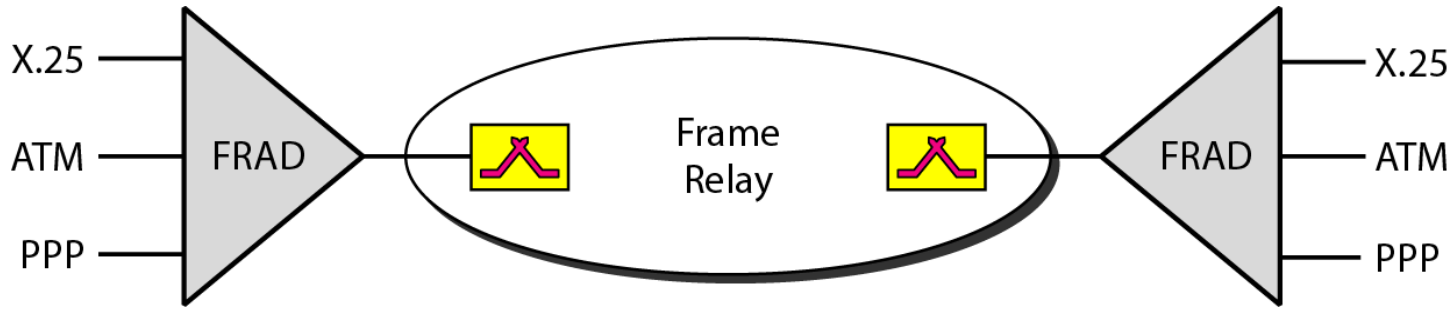


b. Three-byte address (16-bit DLCI)



c. Four-byte address (23-bit DLCI)

Figure 18.5 *FRAD*



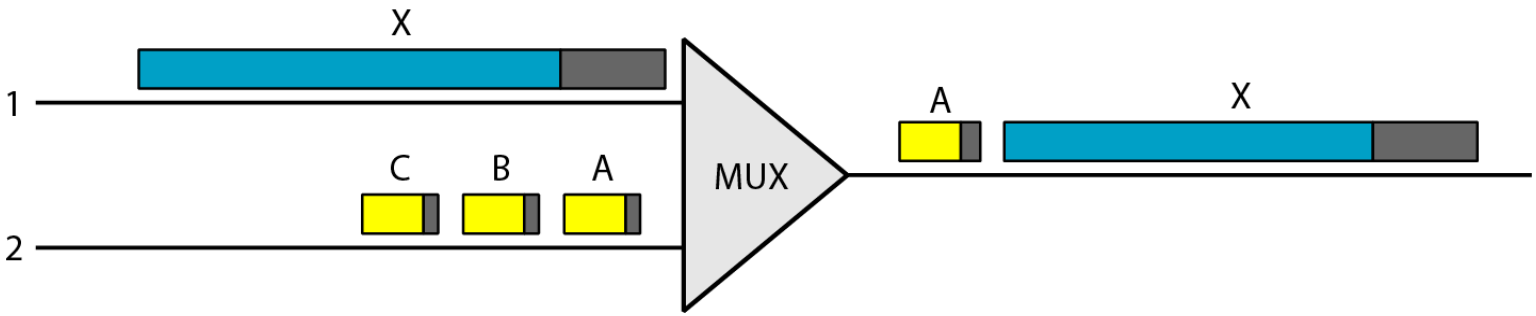
18-2 ATM

Asynchronous Transfer Mode (ATM) is the cell relay protocol designed by the ATM Forum and adopted by the ITU-T.

Topics discussed in this section:

Design Goals
Problems
Architecture
Switching
ATM Layers

Figure 18.6 *Multiplexing using different frame sizes*



Note

A cell network uses the cell as the basic unit of data exchange.
A cell is defined as a small, fixed-size block of information.

Figure 18.7 *Multiplexing using cells*

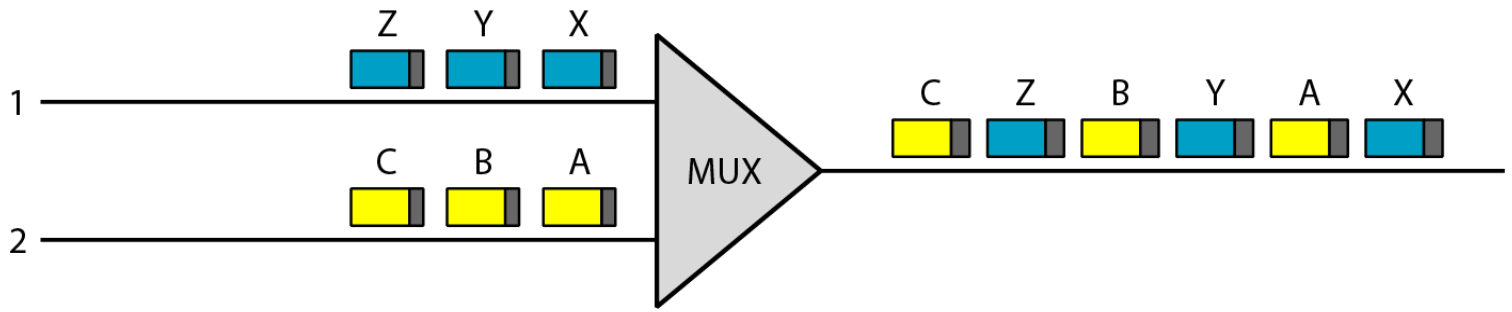


Figure 18.8 *ATM multiplexing*

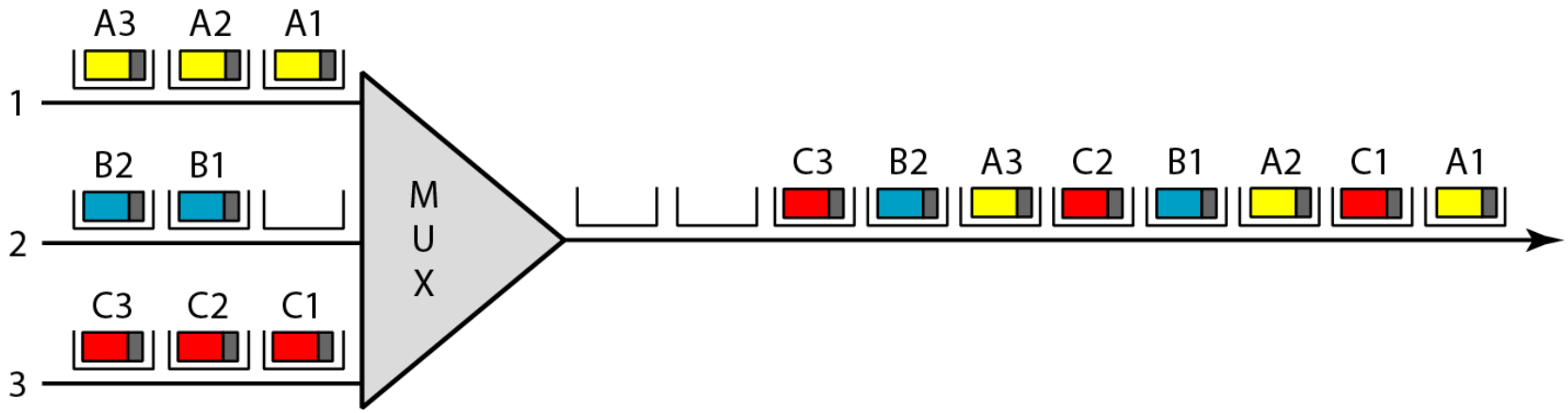


Figure 18.9 *Architecture of an ATM network*

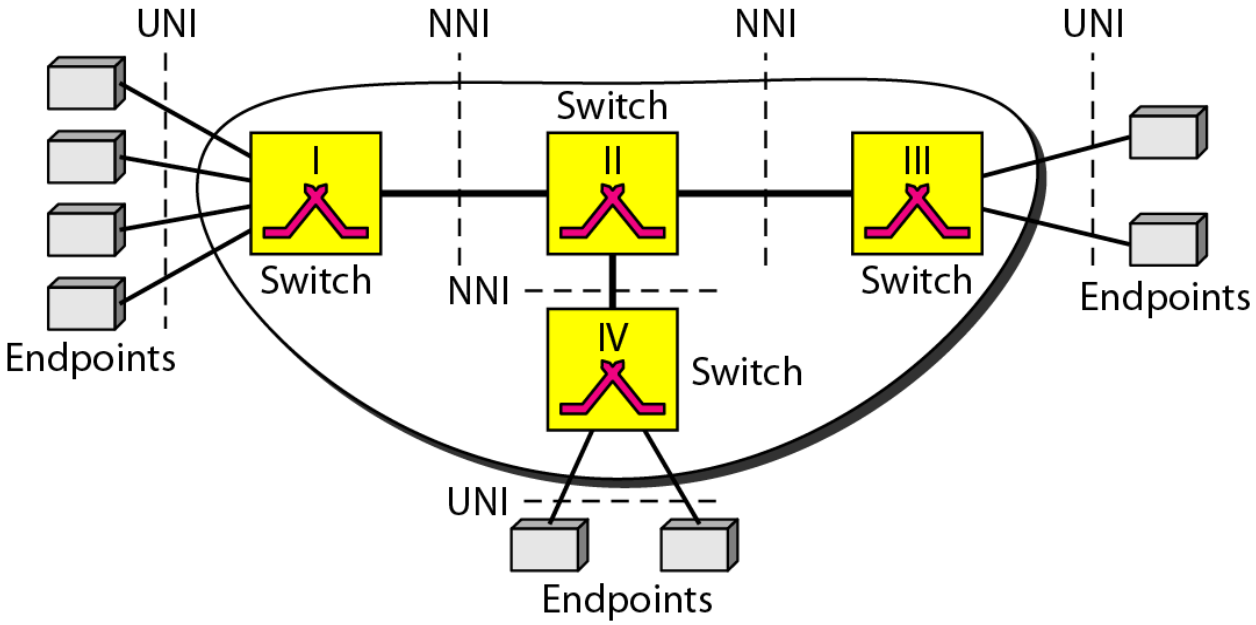


Figure 18.10 *TP, VPs, and VCs*

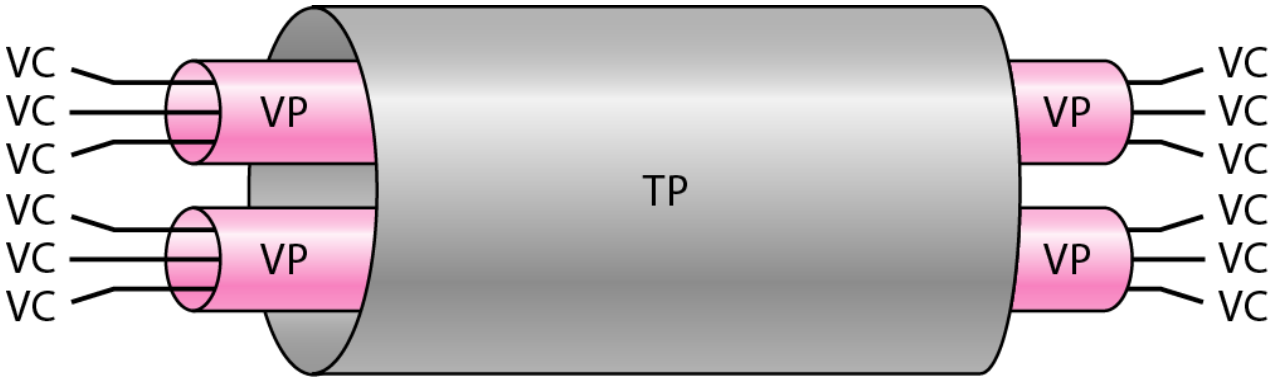
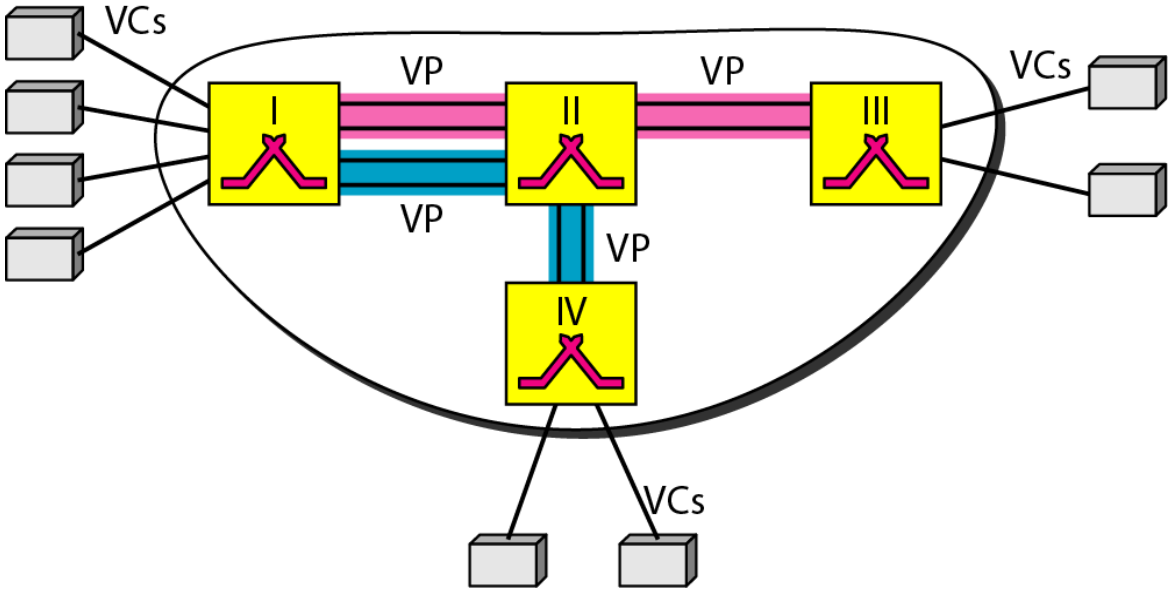


Figure 18.11 *Example of VPs and VCs*



Note

Note that a virtual connection is defined by a pair of numbers: the VPI and the VCI.

Figure 18.12 *Connection identifiers*

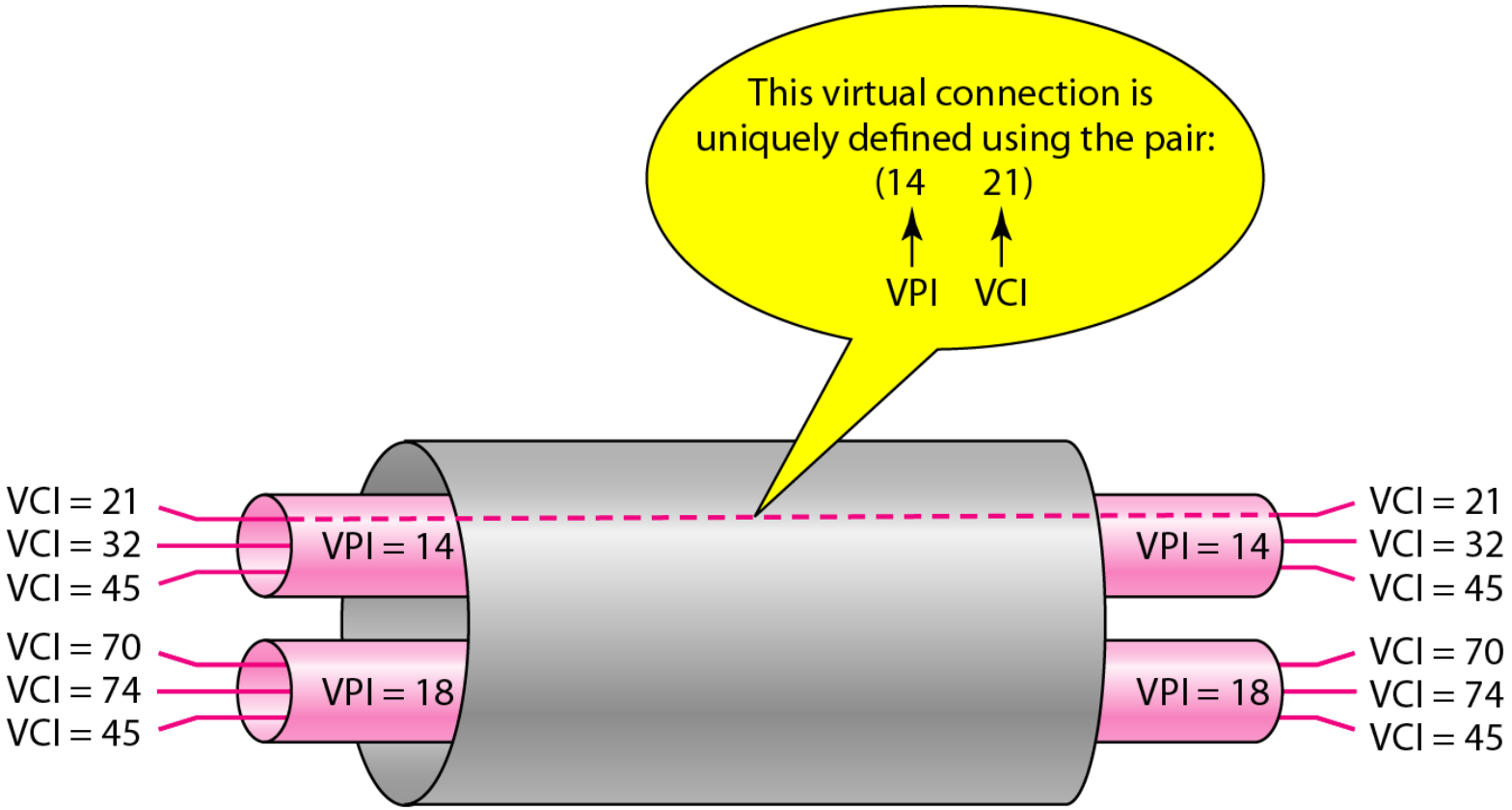
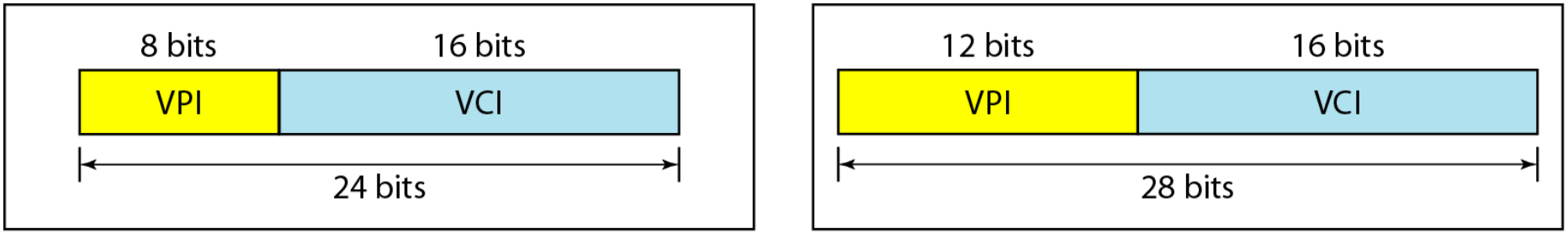


Figure 18.13 *Virtual connection identifiers in UNIs and NNIs*



a. VPI and VCI in a UNI

b. VPI and VCI in an NNI

Figure 18.14 *An ATM cell*

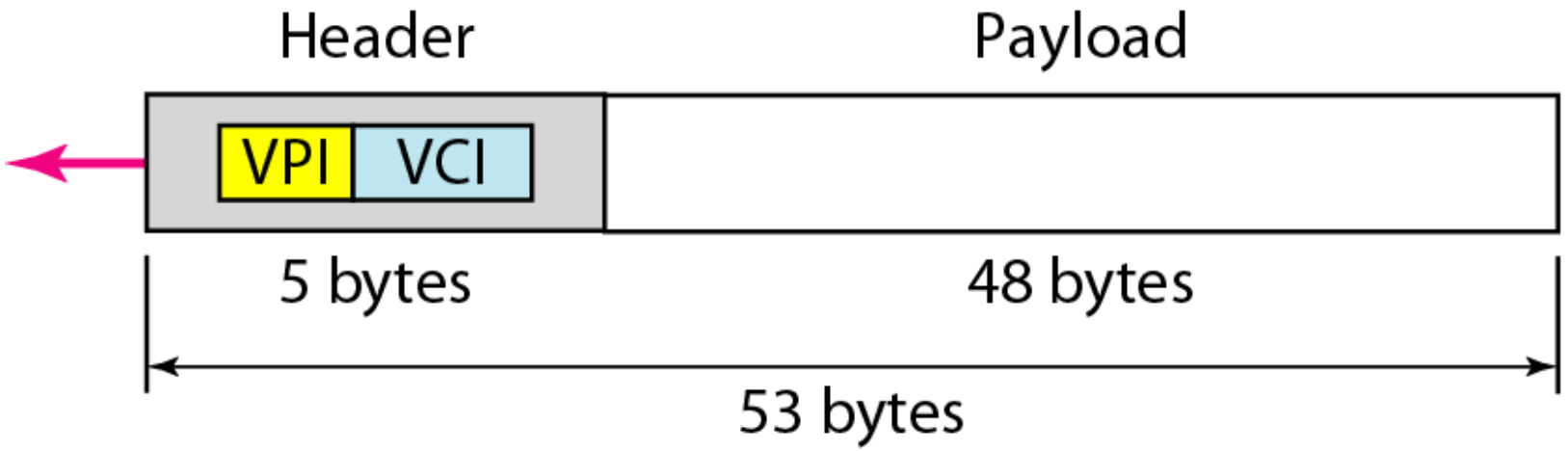


Figure 18.15 *Routing with a switch*

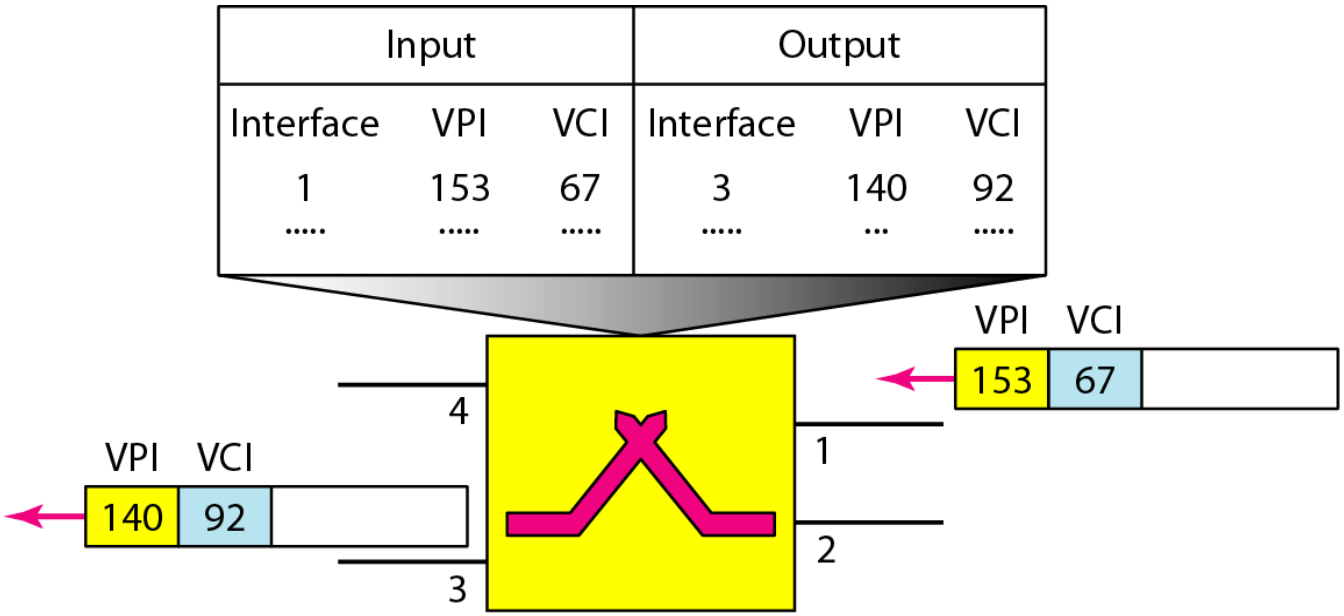


Figure 18.16 *ATM layers*

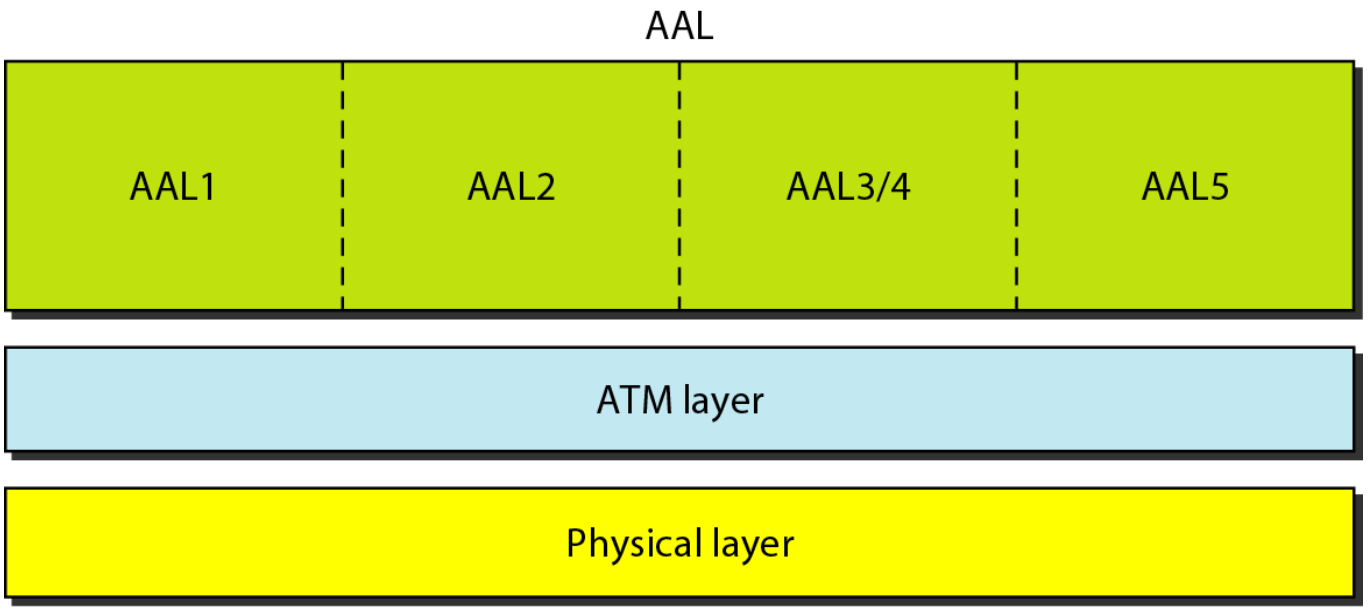


Figure 18.17 *ATM layers in endpoint devices and switches*

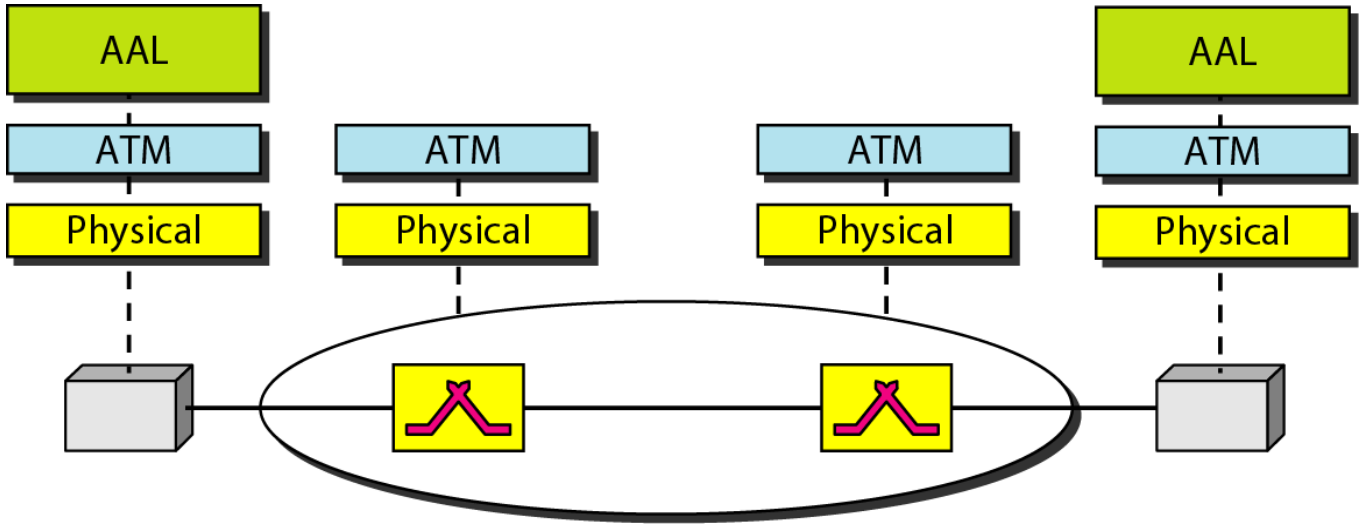


Figure 18.18 *ATM layer*

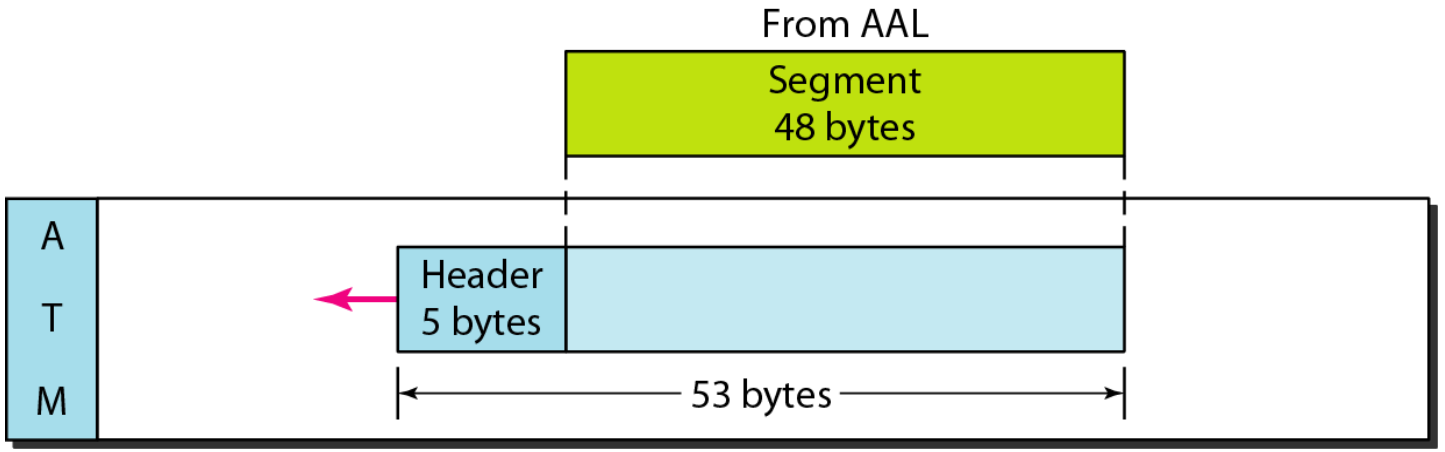


Figure 18.19 *ATM headers*

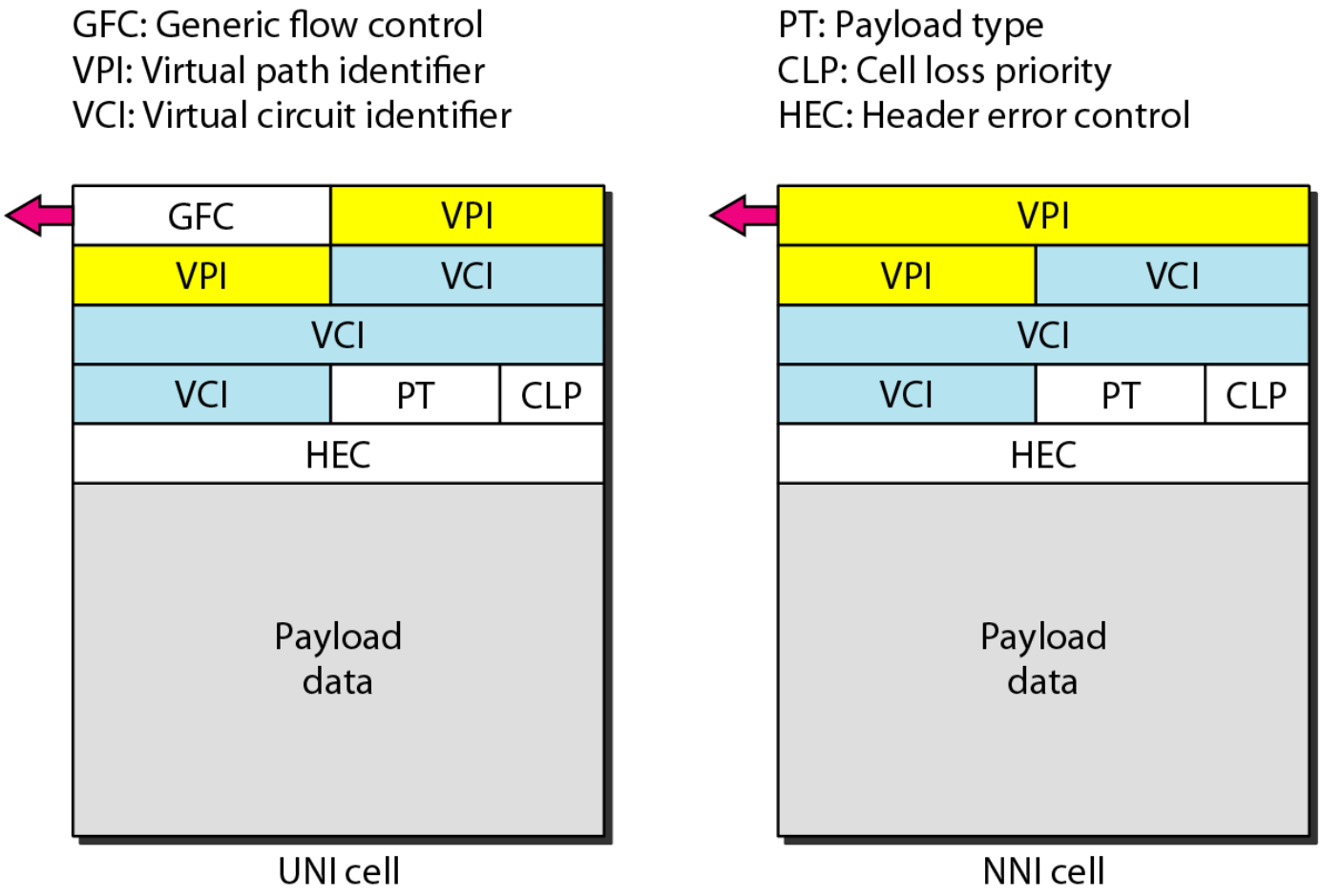


Figure 18.20 *AAL1*

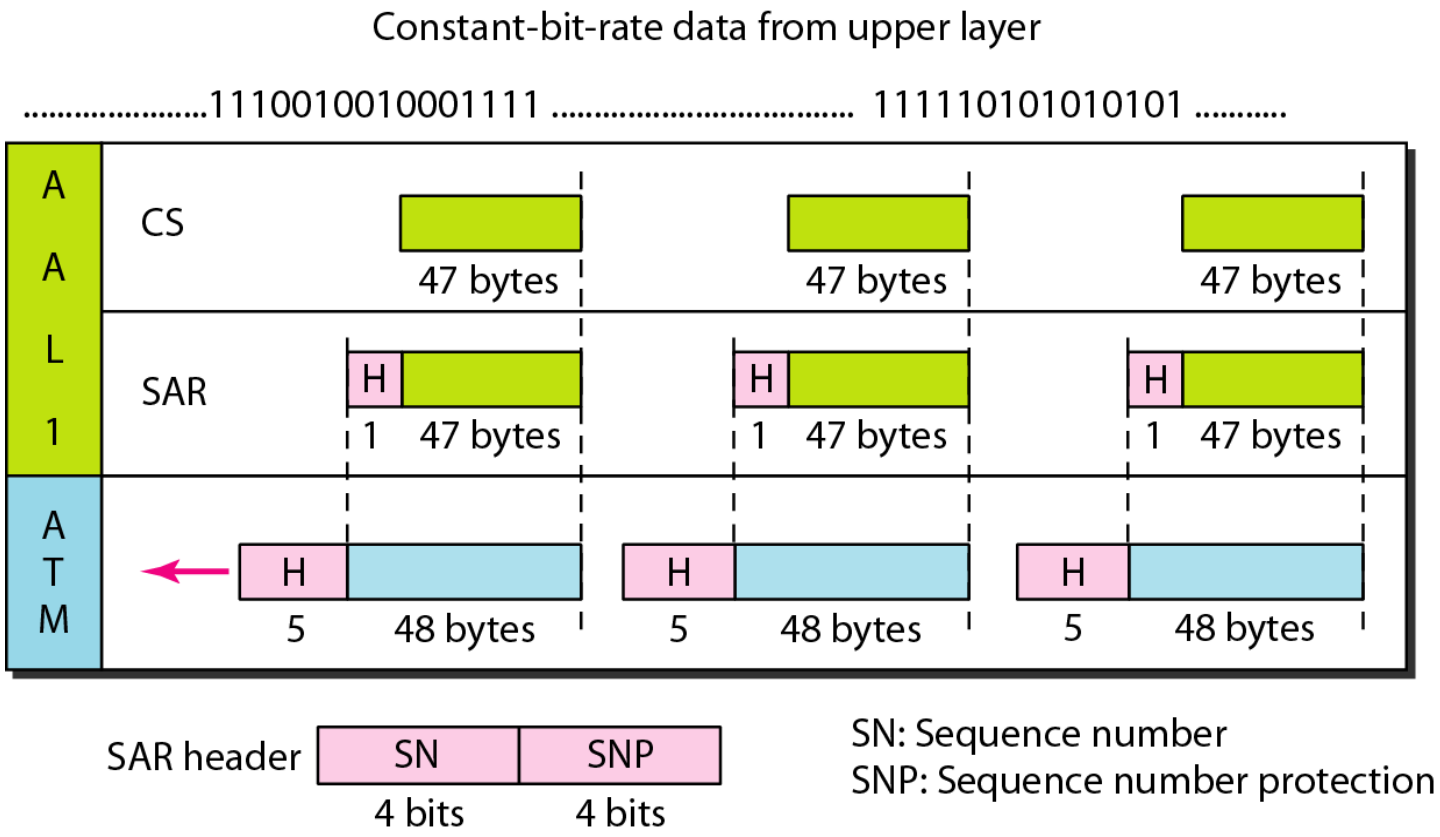


Figure 18.21 *AAL2*

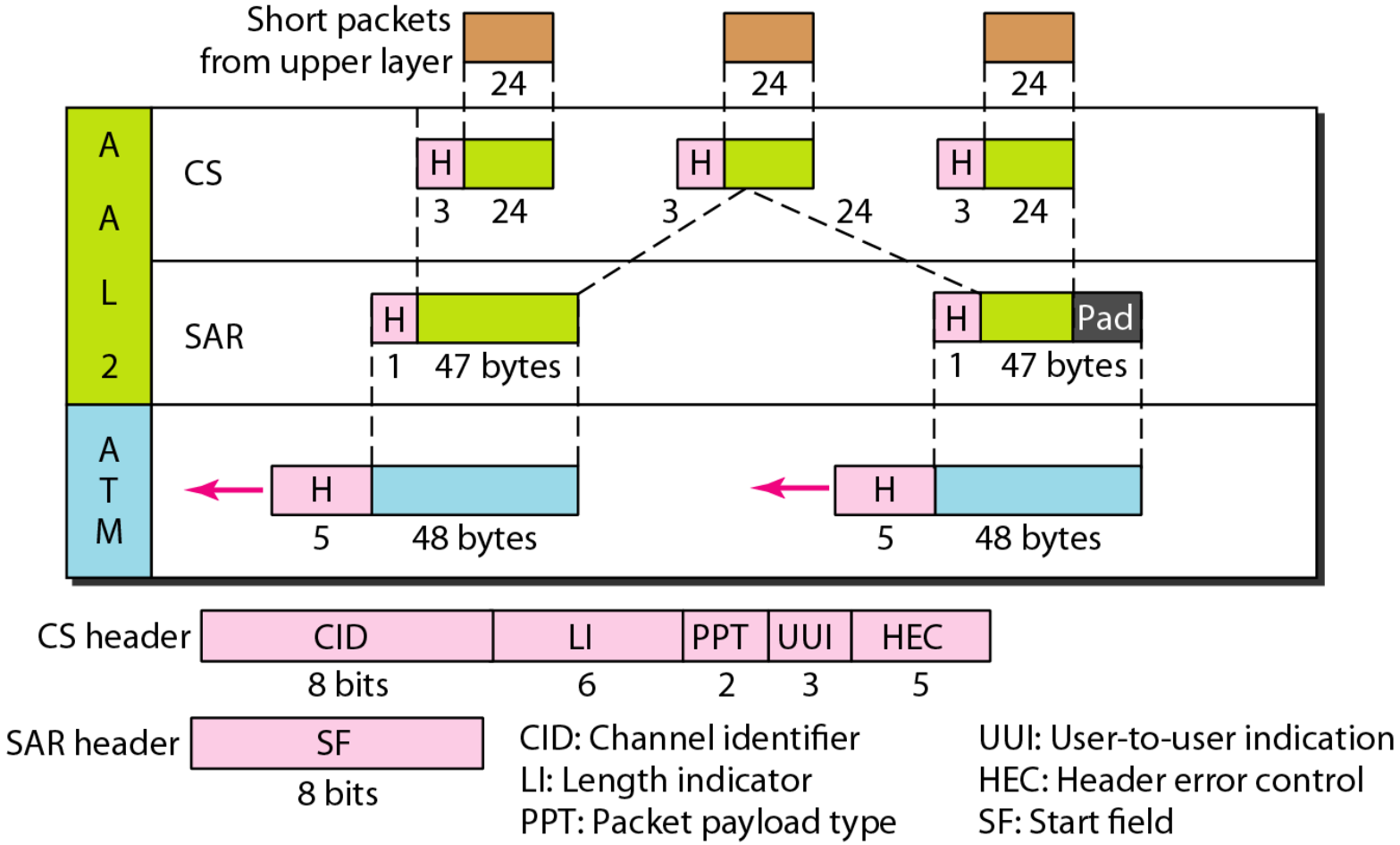


Figure 18.22 *AAL3/4*

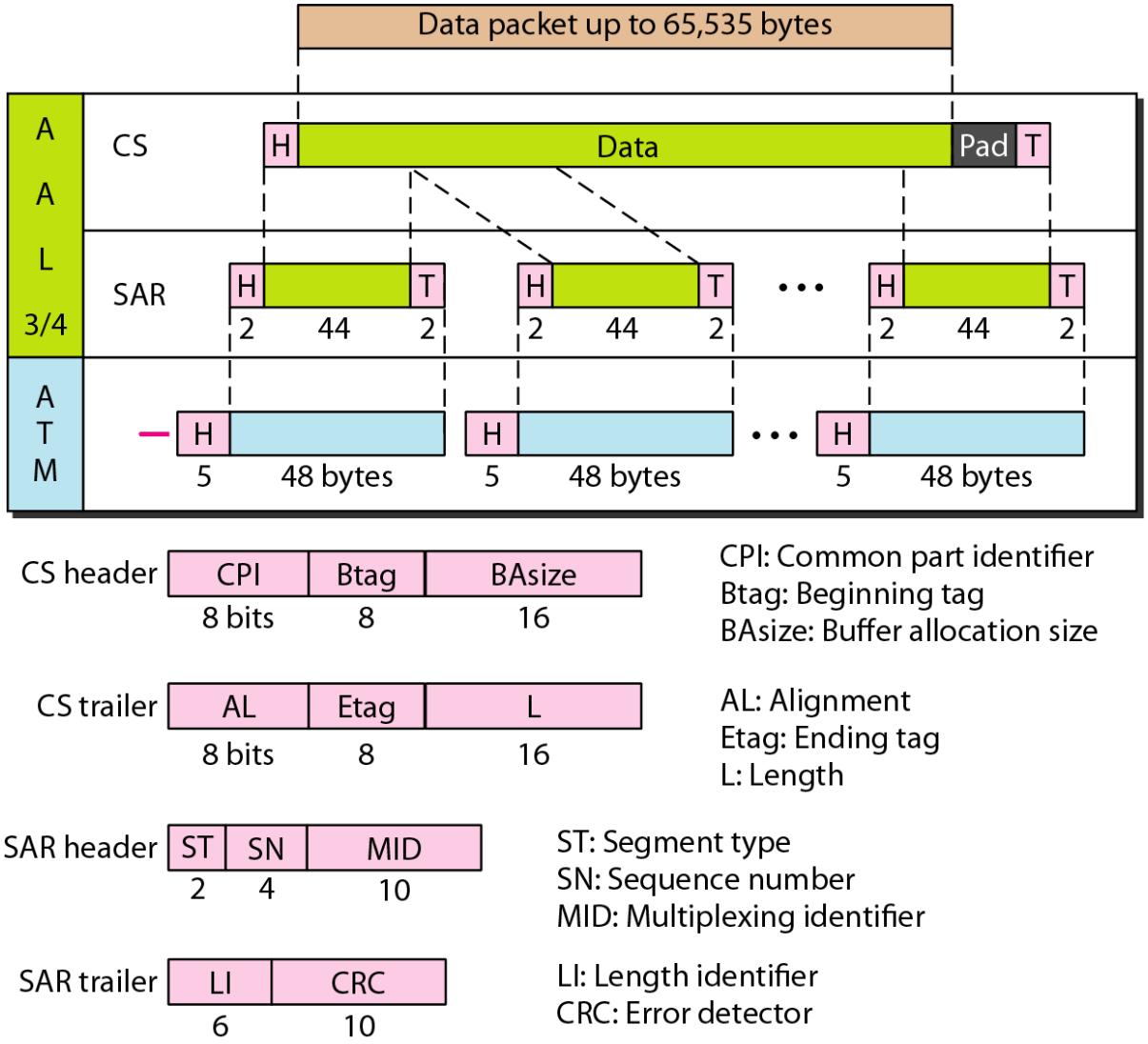
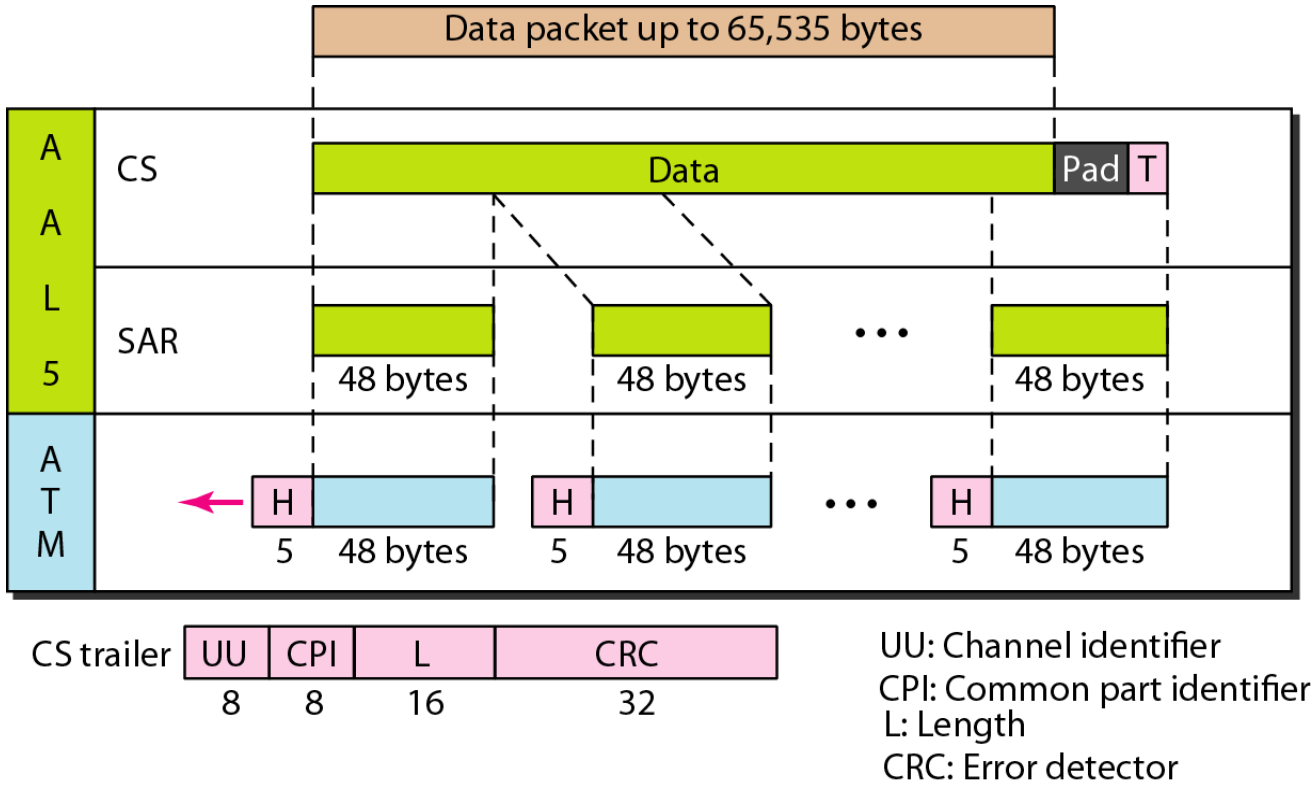


Figure 18.23 *AAL5*



18-3 ATM LANs

ATM is mainly a wide-area network (WAN ATM); however, the technology can be adapted to local-area networks (ATM LANs). The high data rate of the technology has attracted the attention of designers who are looking for greater and greater speeds in LANs.

Topics discussed in this section:

ATM LAN Architecture
LAN Emulation (LANE)
Client/Server Model
Mixed Architecture with Client/Server

Figure 18.24 *ATM LANs*

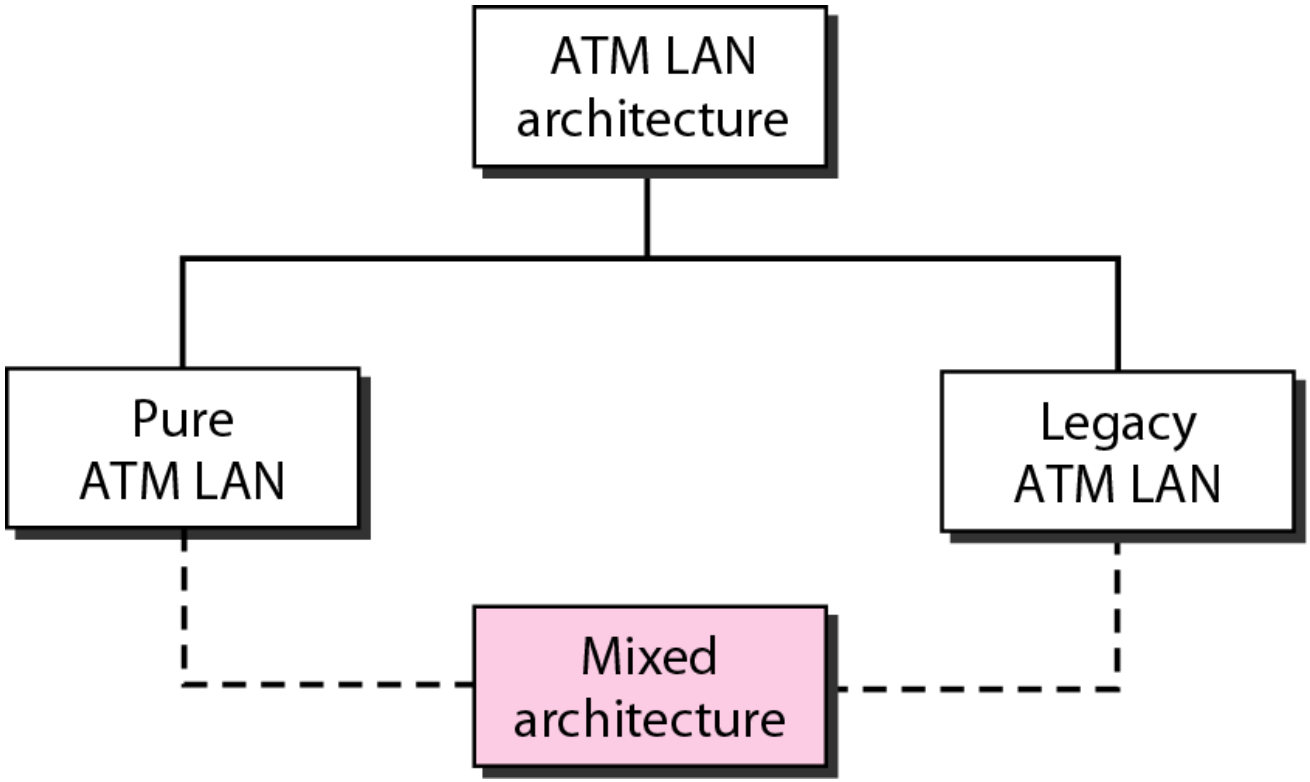


Figure 18.25 *Pure ATM LAN*

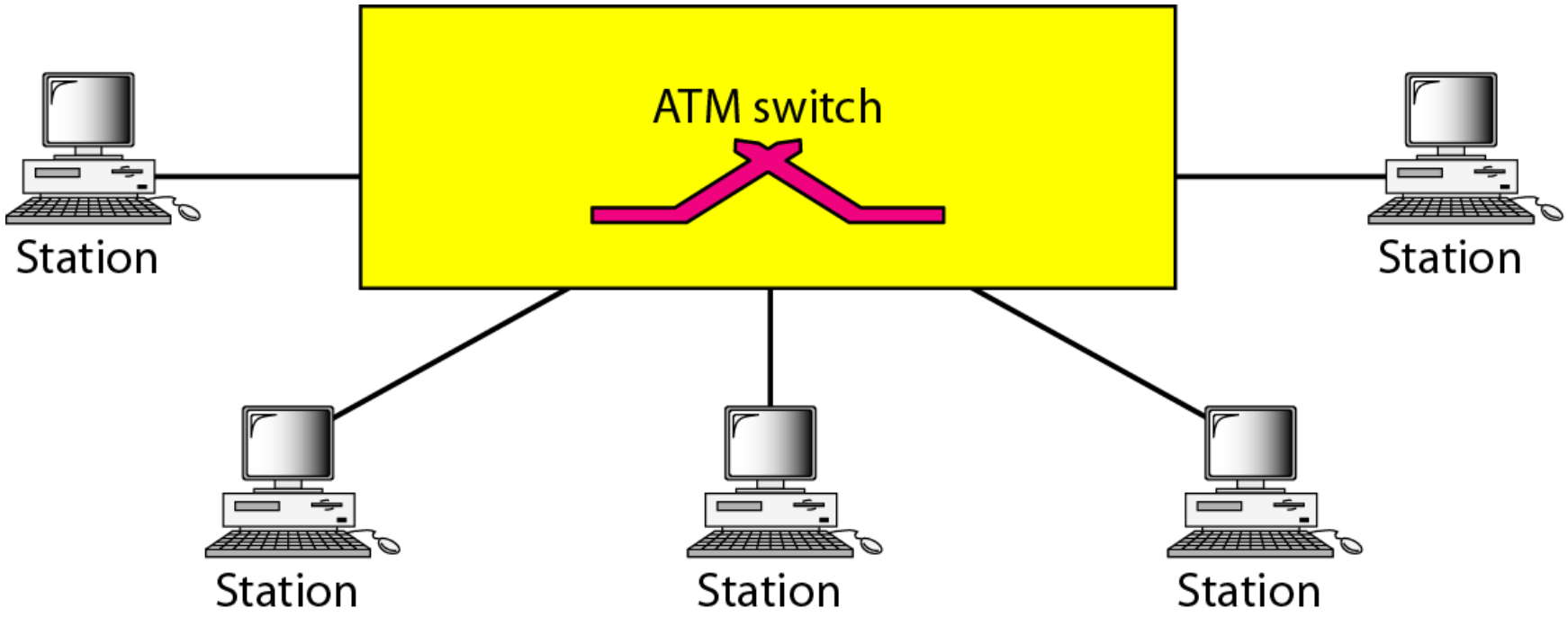


Figure 18.26 *Legacy ATM LAN*

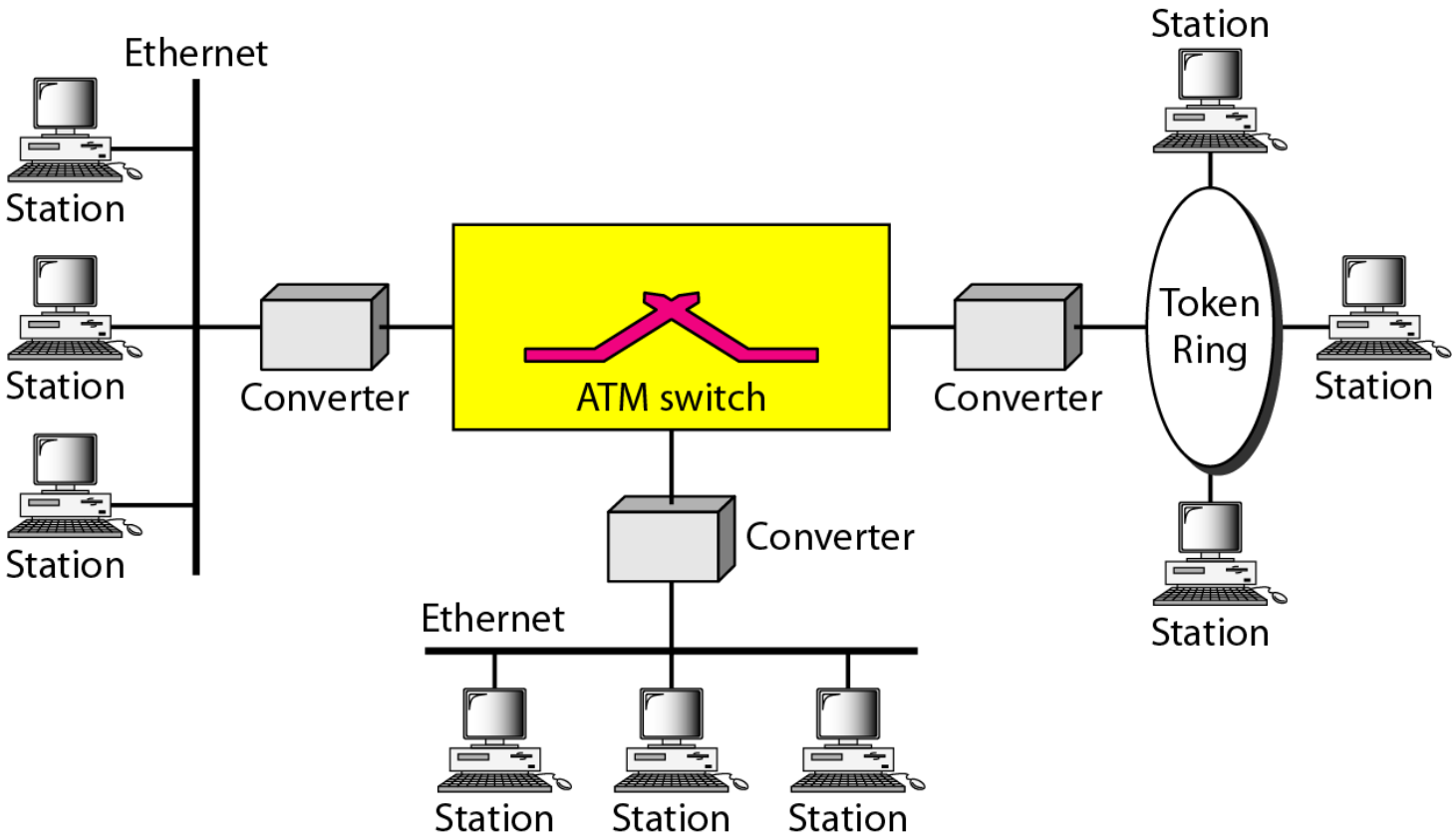


Figure 18.27 *Mixed architecture ATM LAN*

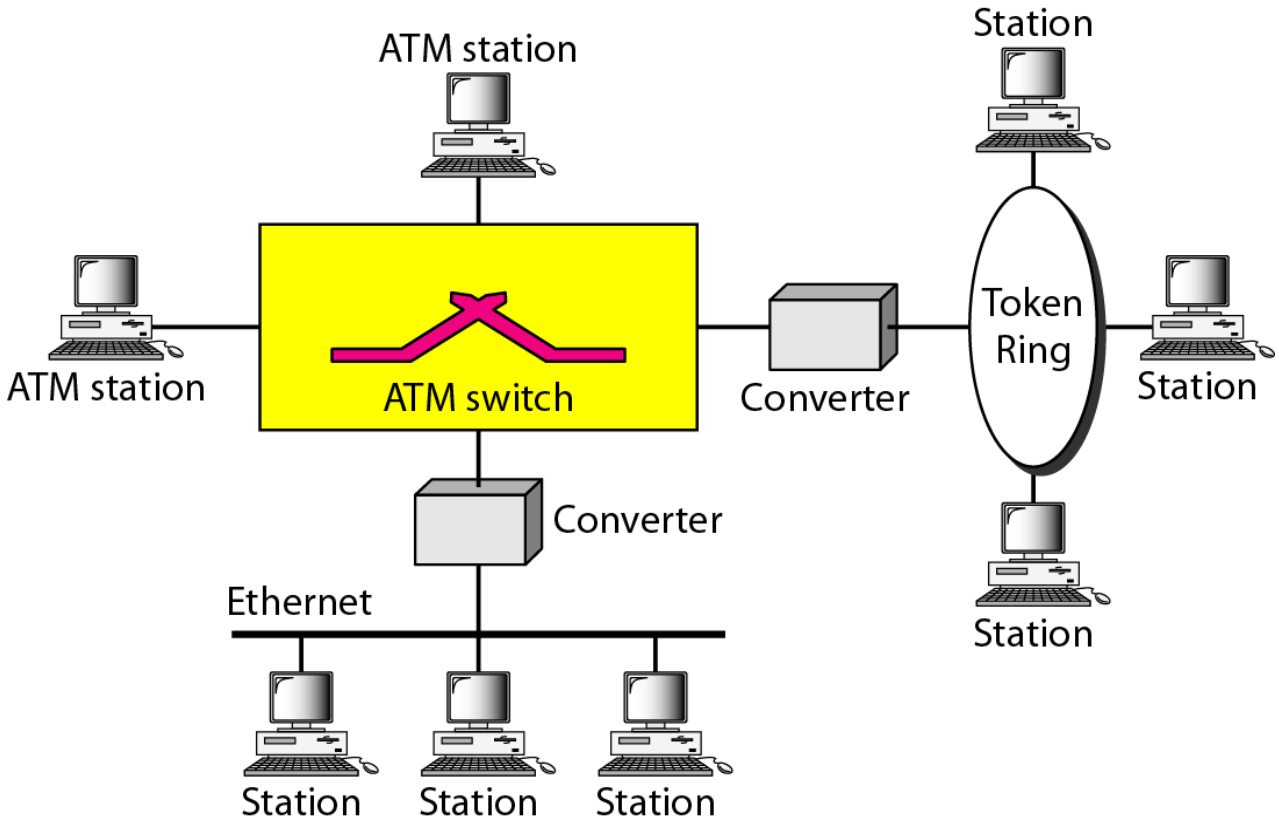


Figure 18.28 *Client and servers in a LANE*

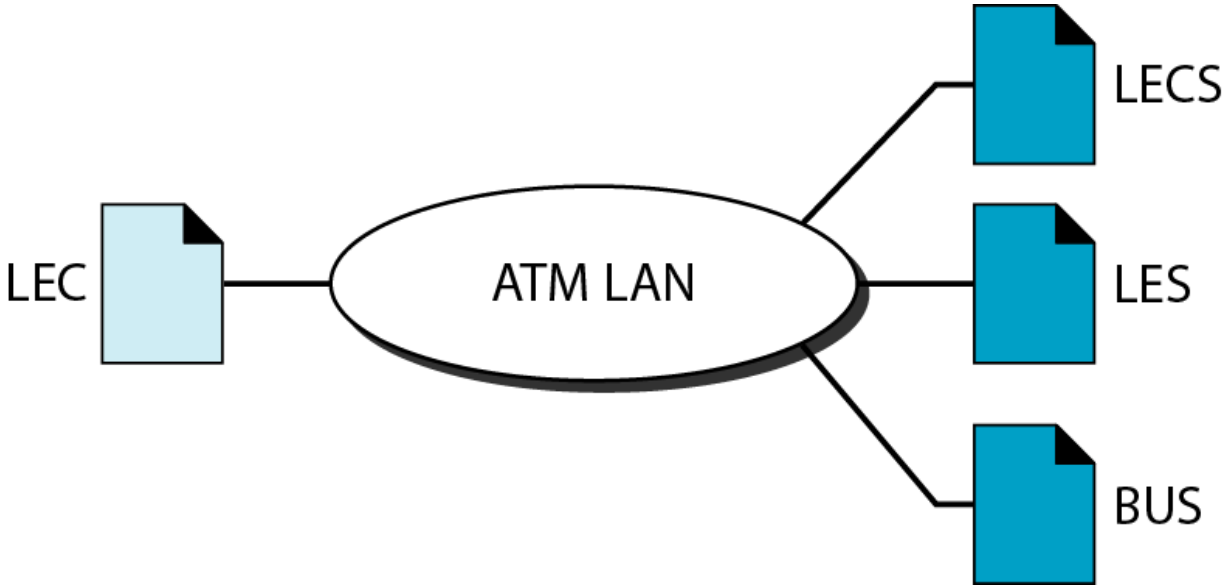


Figure 18.29 *Client and servers in a LANE*