

Forouzan

Chapter 18

Virtual-Circuit Networks: Frame Relay and ATM

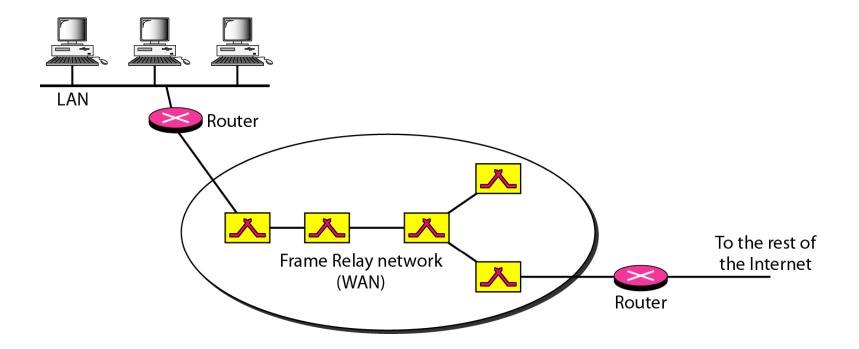
18-1 FRAME RELAY

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

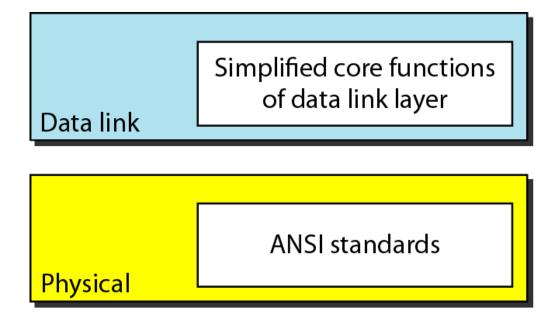




Note

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

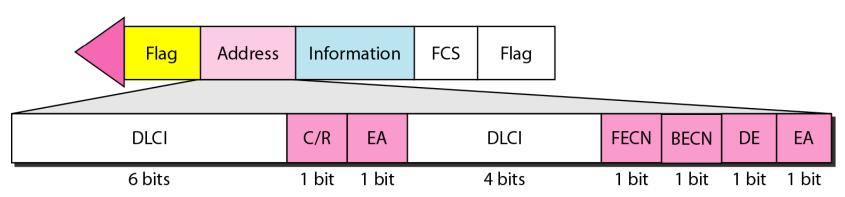
EA: Extended address

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

DLCI			C/R	EA = 0
DLCI	FECN	BECN	DE	EA = 1

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

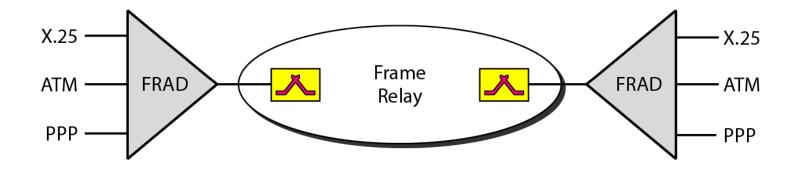
DLCI			C/R	EA = 0
DLCI	FECN	BECN	DE	EA = 0
DLCI			0	EA = 1

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

DLCI			C/R	EA = 0
DLCI	FECN	BECN	DE	EA = 0
	EA = 0			
DLCI			0	EA = 1

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

Figure 18.5 FRAD



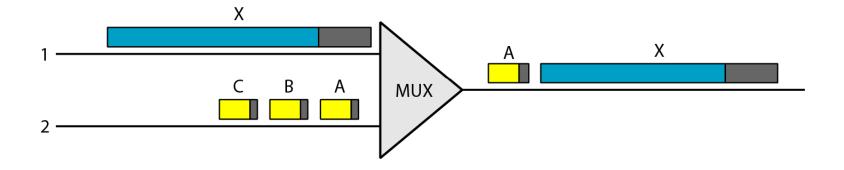
18-2 ATM

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

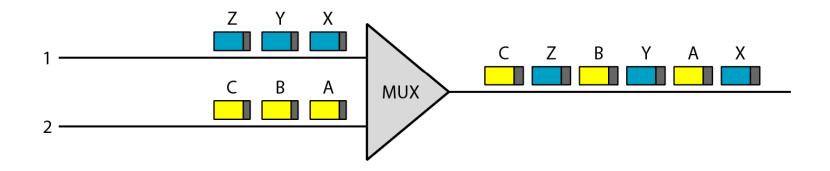


Figure 18.8 ATM multiplexing

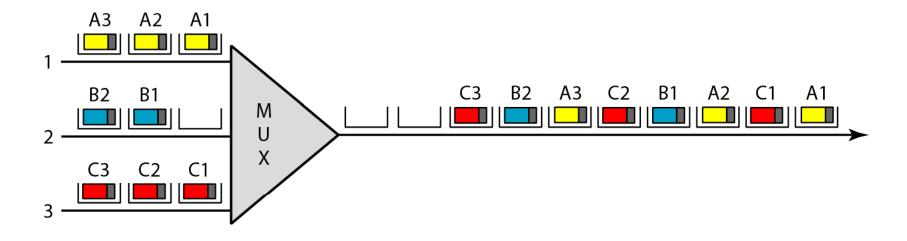


Figure 18.9 Architecture of an ATM network

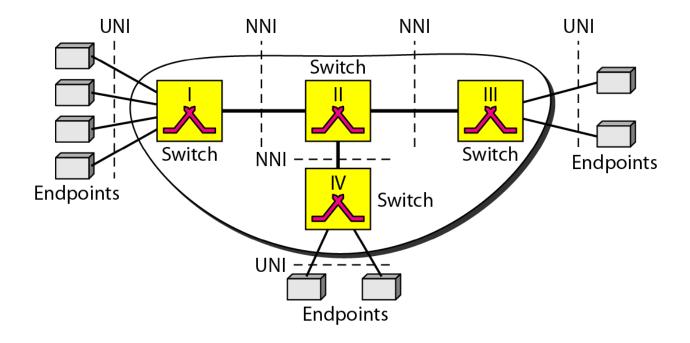


Figure 18.10 TP, VPs, and VCs

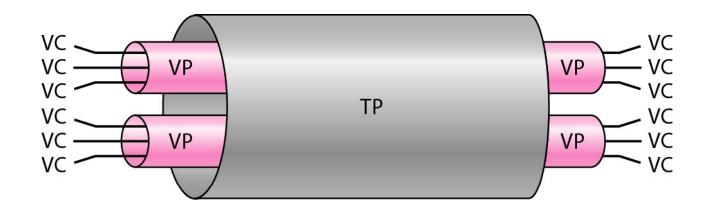
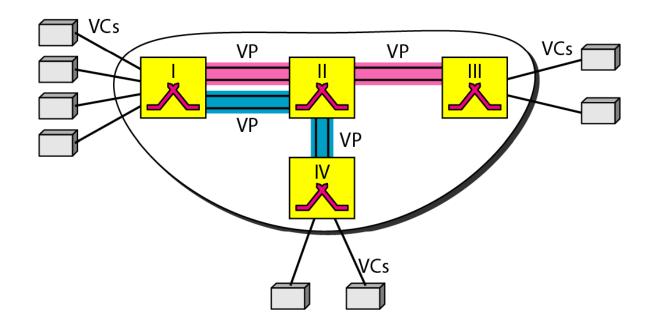


Figure 18.11 Example of VPs and VCs





Note

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

Figure 18.12 Connection identifiers

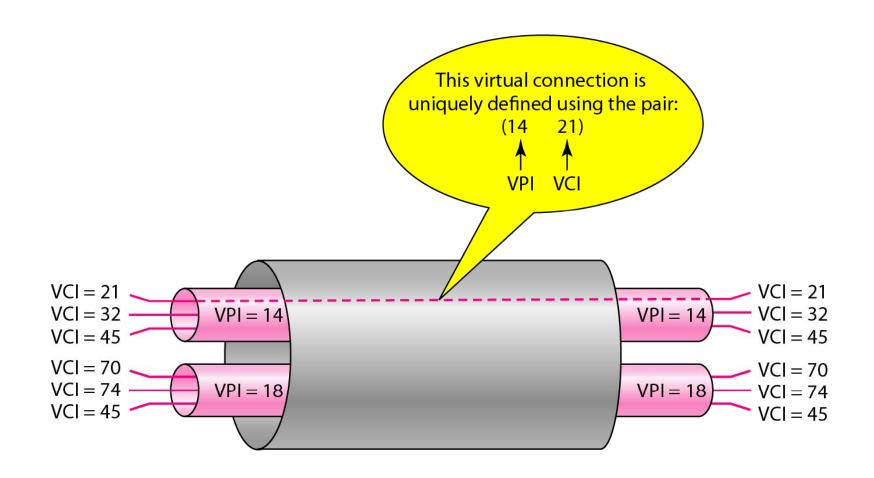
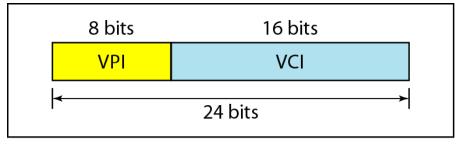


Figure 18.13 Virtual connection identifiers in UNIs and NNIs







b. VPI and VCI in an NNI

Figure 18.14 An ATM cell

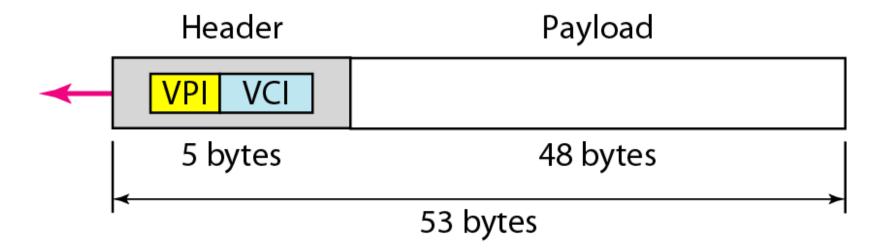


Figure 18.15 Routing with a switch

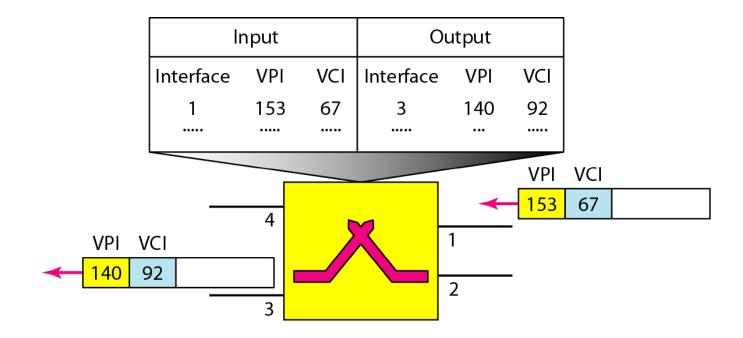


Figure 18.16 ATM layers

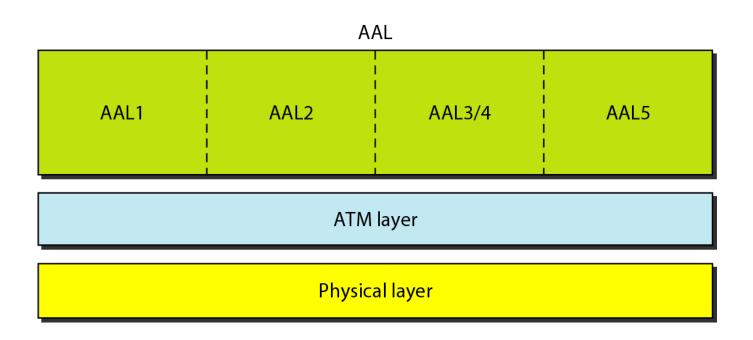


Figure 18.17 ATM layers in endpoint devices and switches

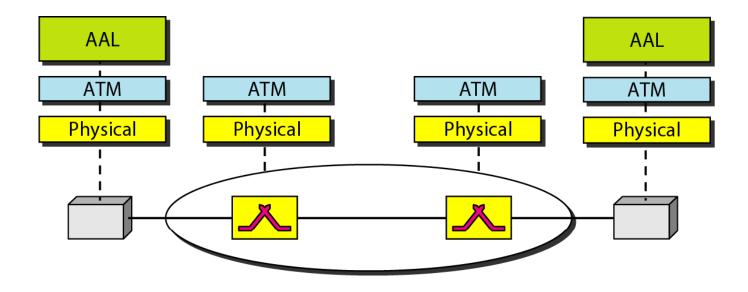


Figure 18.18 ATM layer

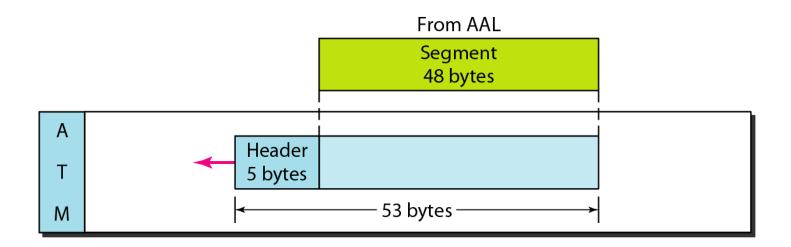


Figure 18.19 ATM headers

GFC: Generic flow control VPI: Virtual path identifier VCI: Virtual circuit identifier

PT: Payload type

CLP: Cell loss priority

HEC: Header error control

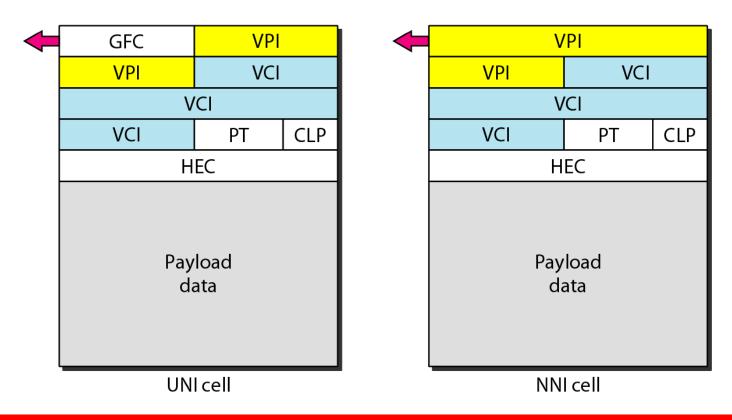
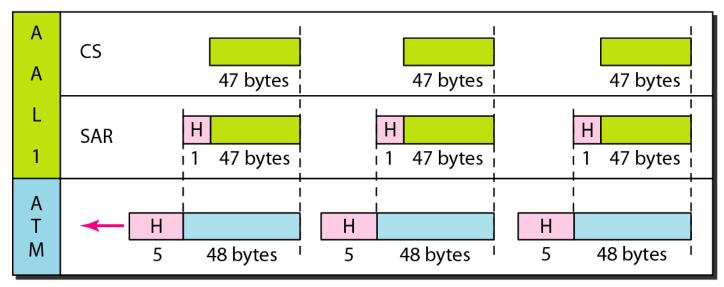


Figure 18.20 *AAL1*

Constant-bit-rate data from upper layer



SAR header SN SNP 4 bits 4 bits

SN: Sequence number

SNP: Sequence number protection

Figure 18.21 *AAL2*

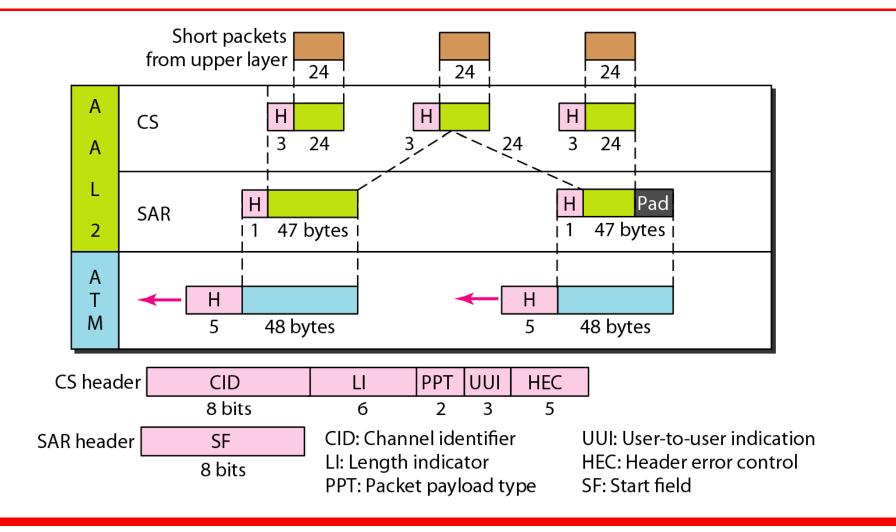


Figure 18.22 *AAL3/4*

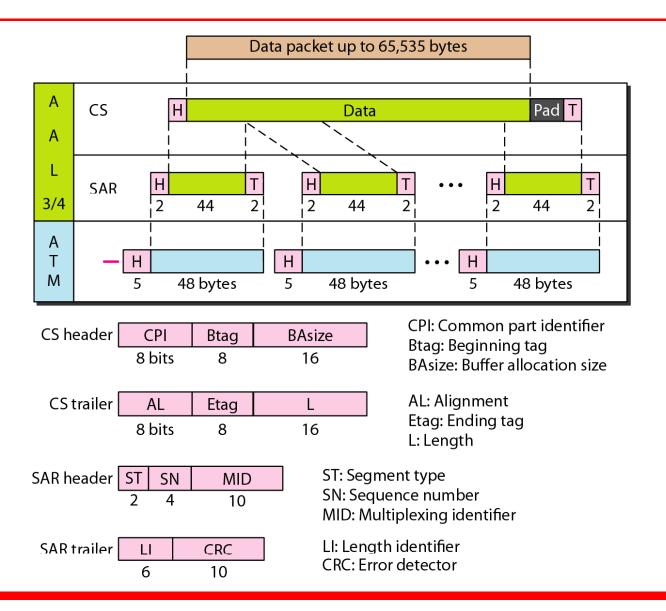
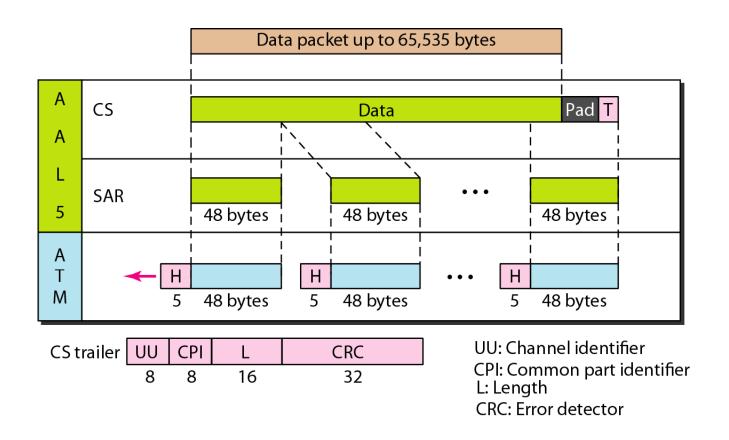


Figure 18.23 *AAL5*



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

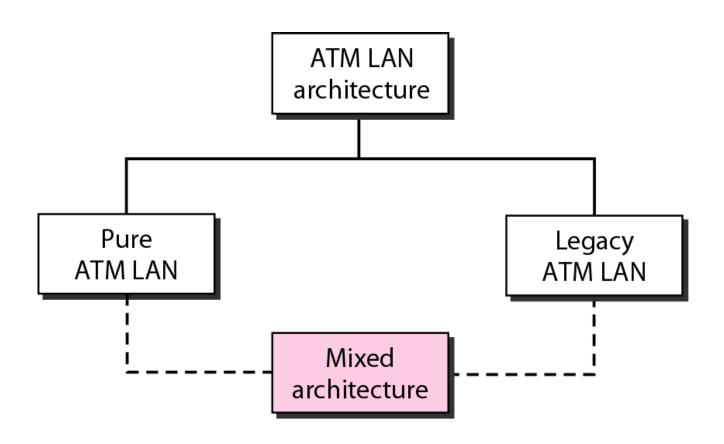


Figure 18.25 Pure ATM LAN

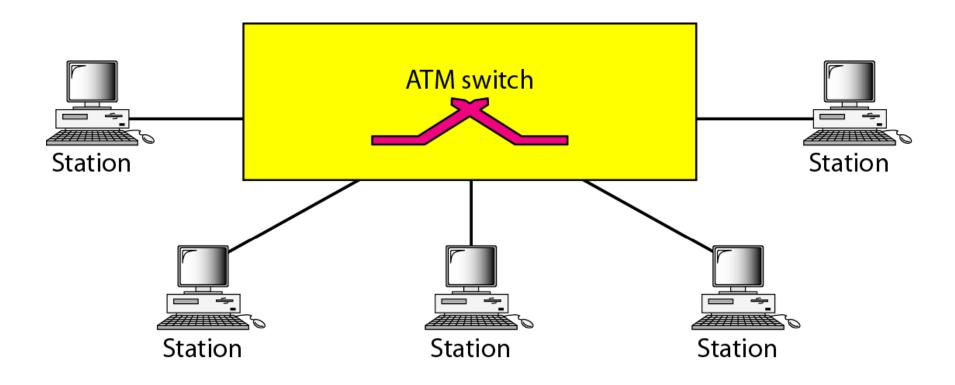


Figure 18.26 Legacy ATM LAN

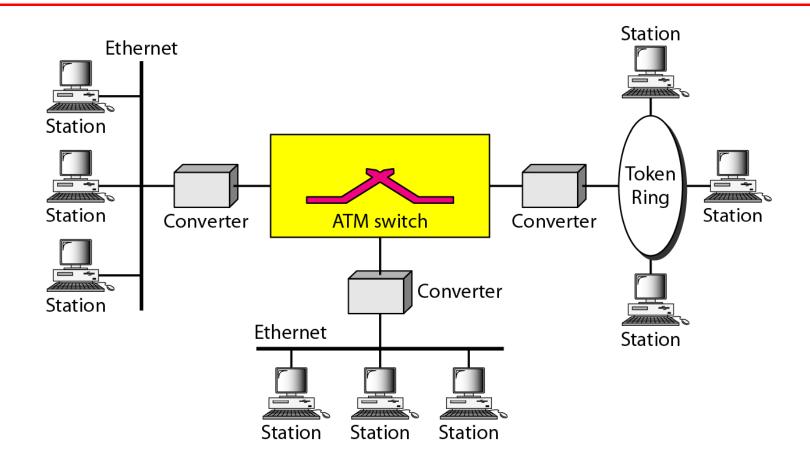


Figure 18.27 Mixed architecture ATM LAN

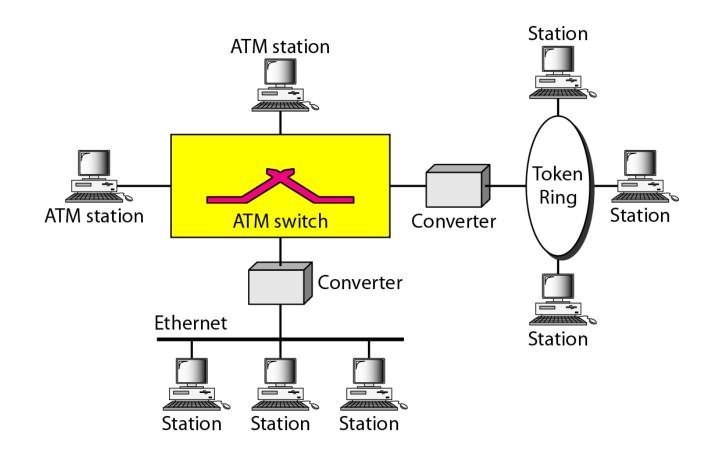


Figure 18.28 Client and servers in a LANE

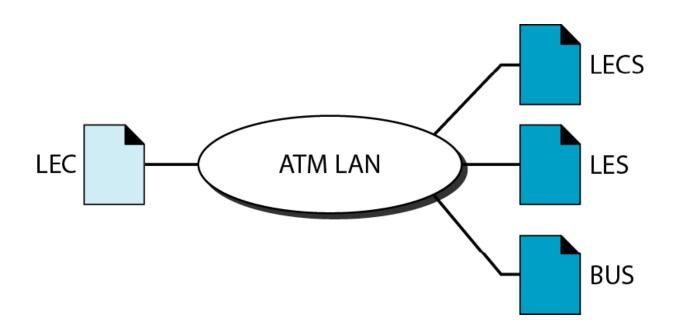


Figure 18.29 Client and servers in a LANE

