

# ATM

*Design Goals*

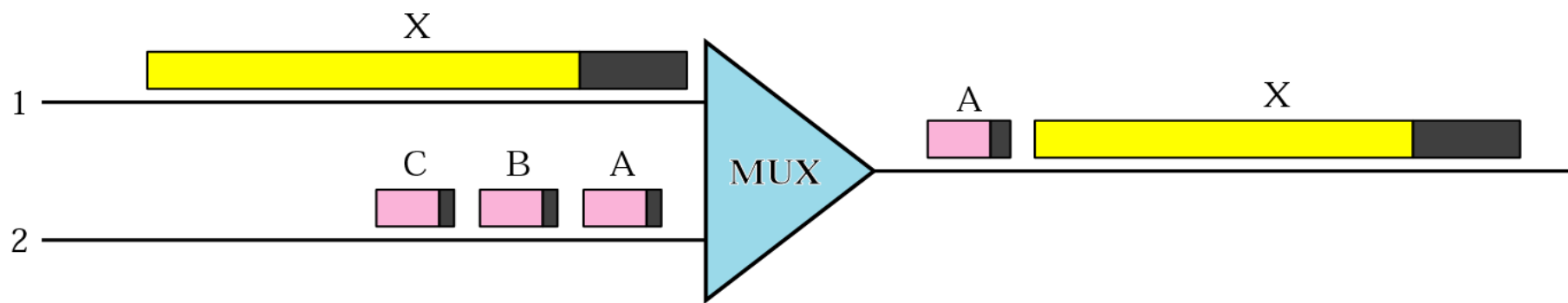
*Problems*

*Architecture*

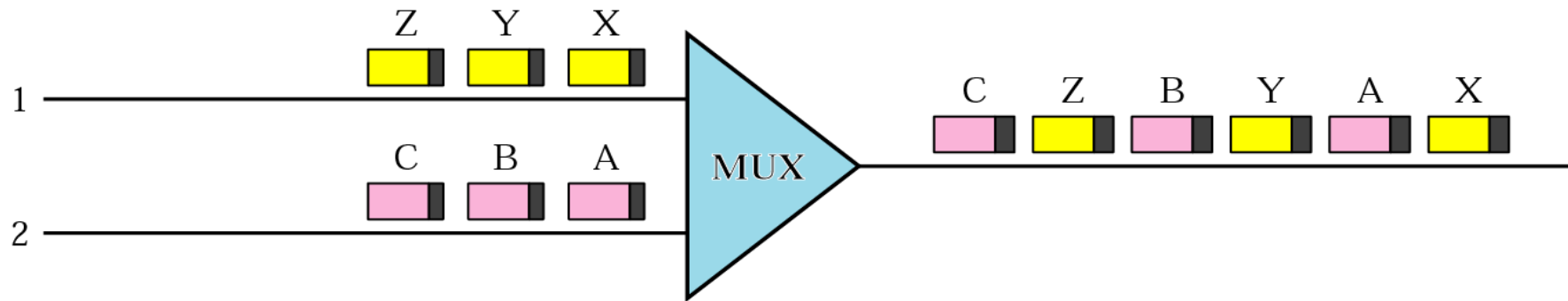
*Switching*

*Layers*

# Multiplexing using different frame sizes



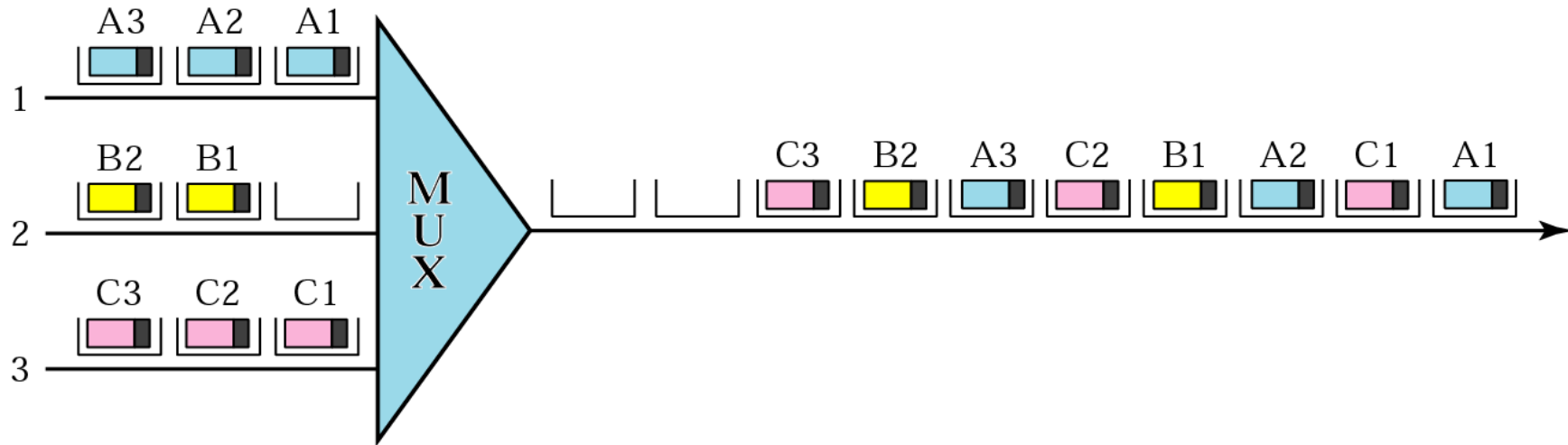
## Multiplexing using cells



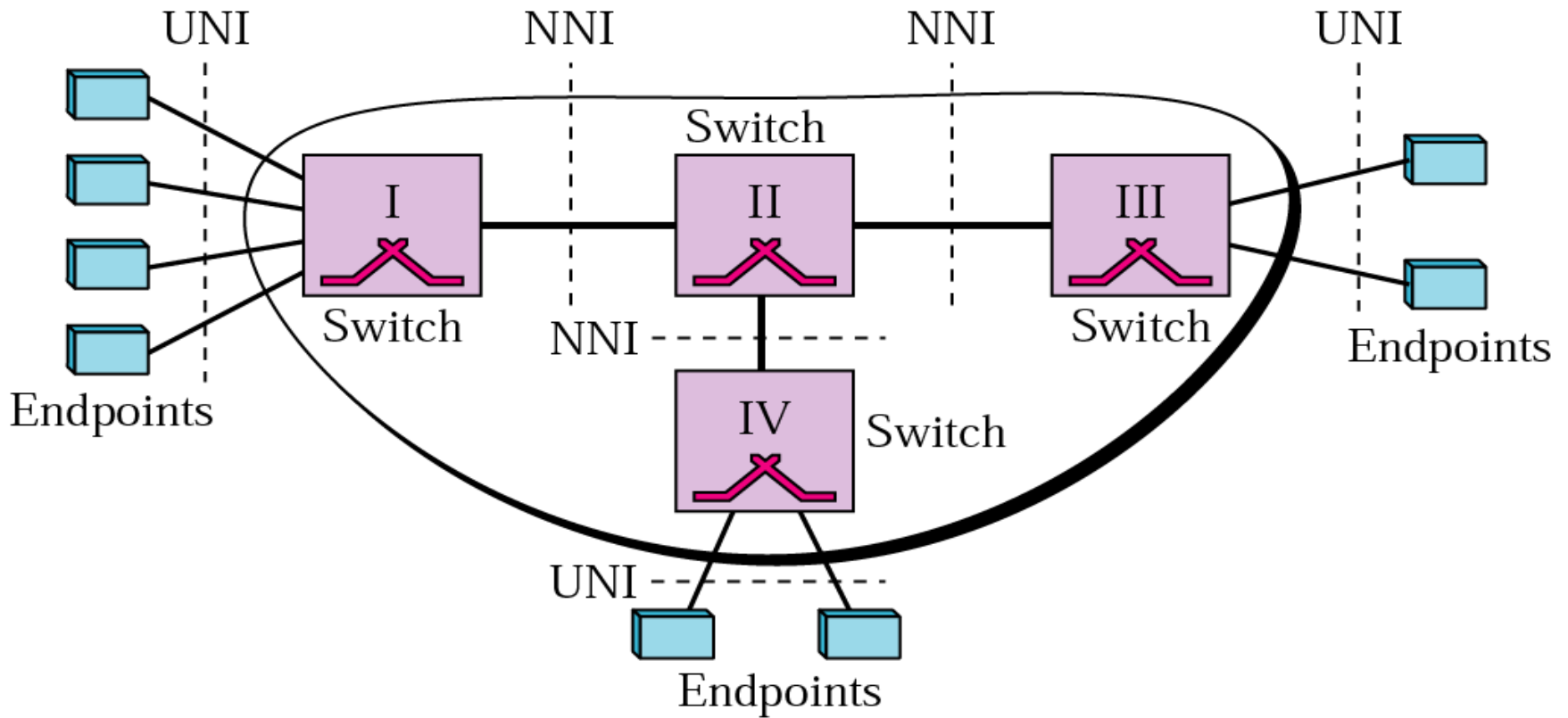
*A cell network uses the cell as the basic unit of data exchange.*

*A cell is defined as a small, fixed-sized block of information.*

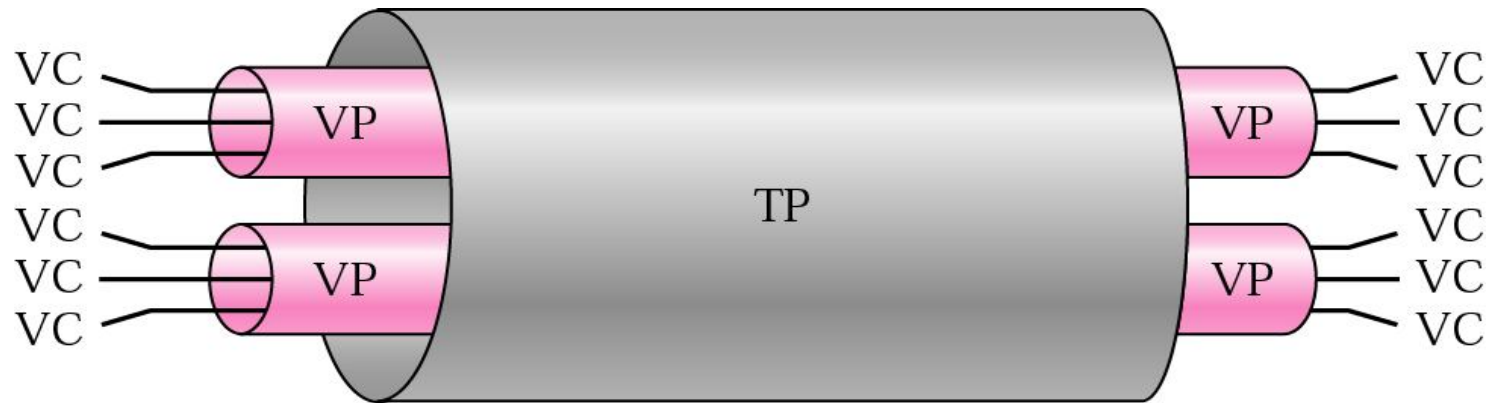
# ATM multiplexing



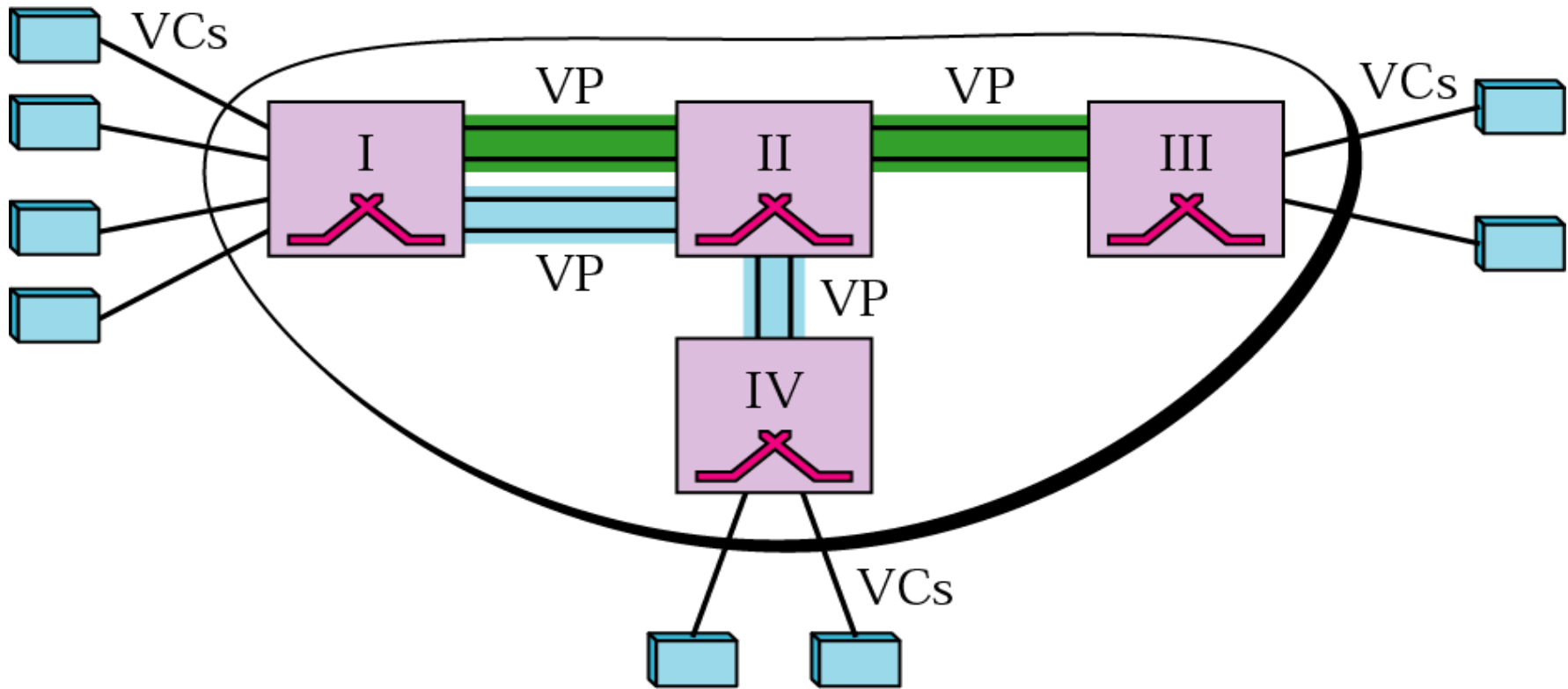
# Architecture of an ATM network



# TP, VPs, and VCs



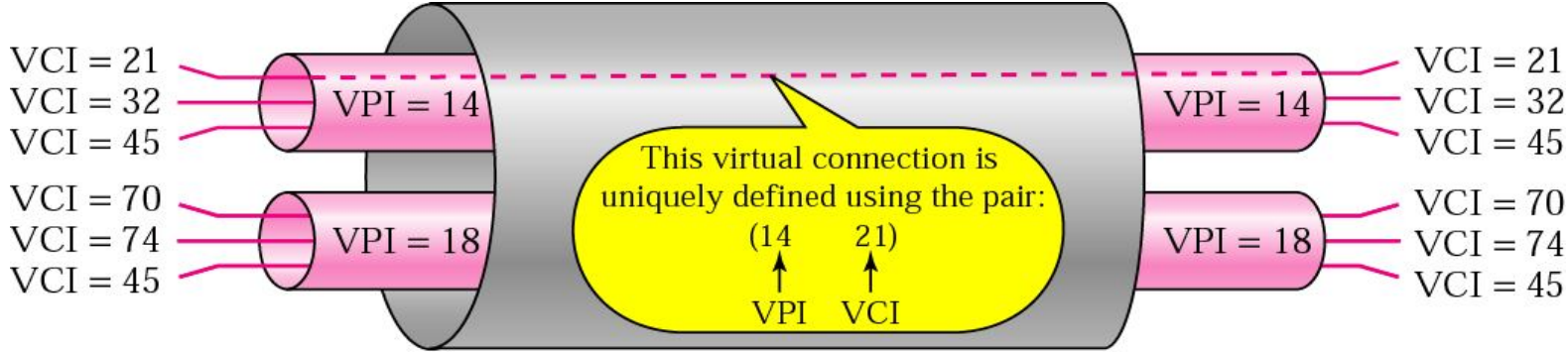
# Example of VPs and VCs



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

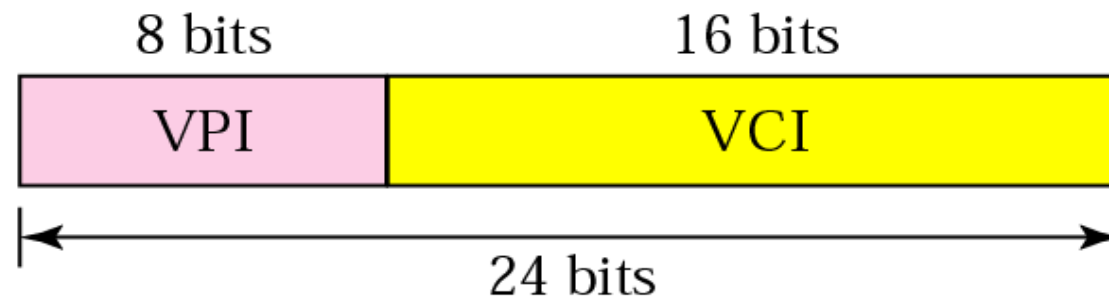


# Connection identifiers

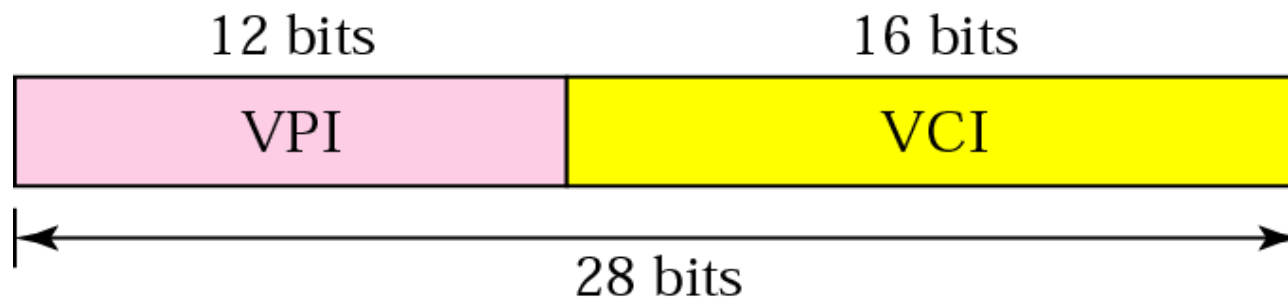




## Virtual connection identifiers in UNIs and NNIs



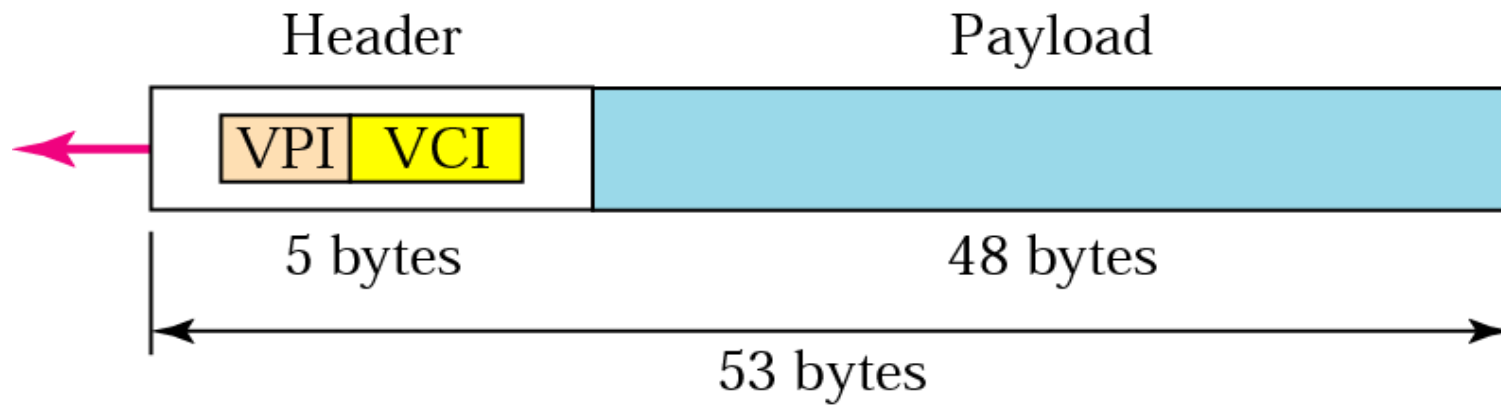
a. VPI and VCI in a UNI



b. VPI and VCI in an NNI

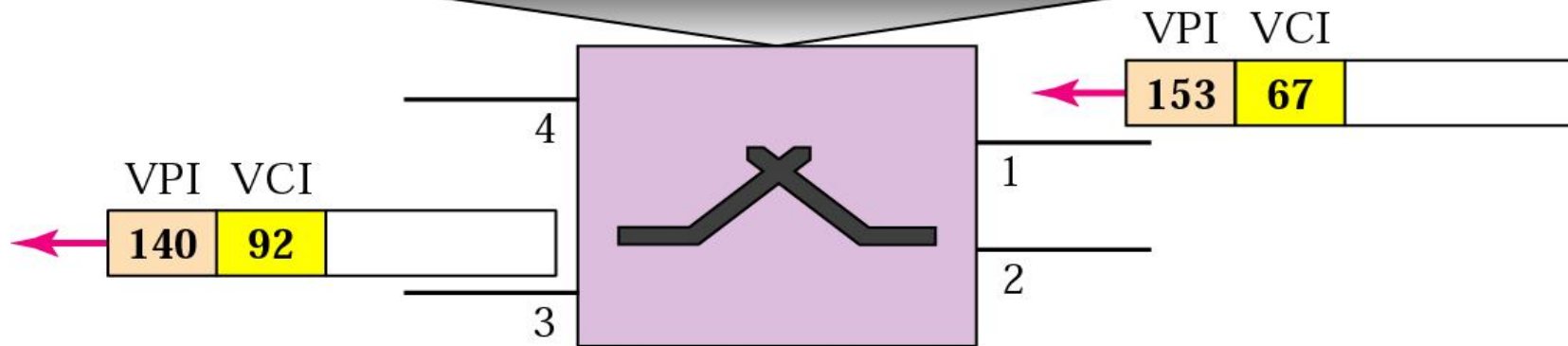


## An ATM cell



# Routing with a switch

Input			Output		
Interface	VPI	VCI	Interface	VPI	VCI
1	153	67	3	140	92
.....	.....	.....	.....	...	.....



## ATM layers

ATM supports different types of services via ATM Adaptation Layers (AAL).

Standardized AALs include AAL1, AAL2, and AAL5, and the rarely used AAL3 and AAL4.

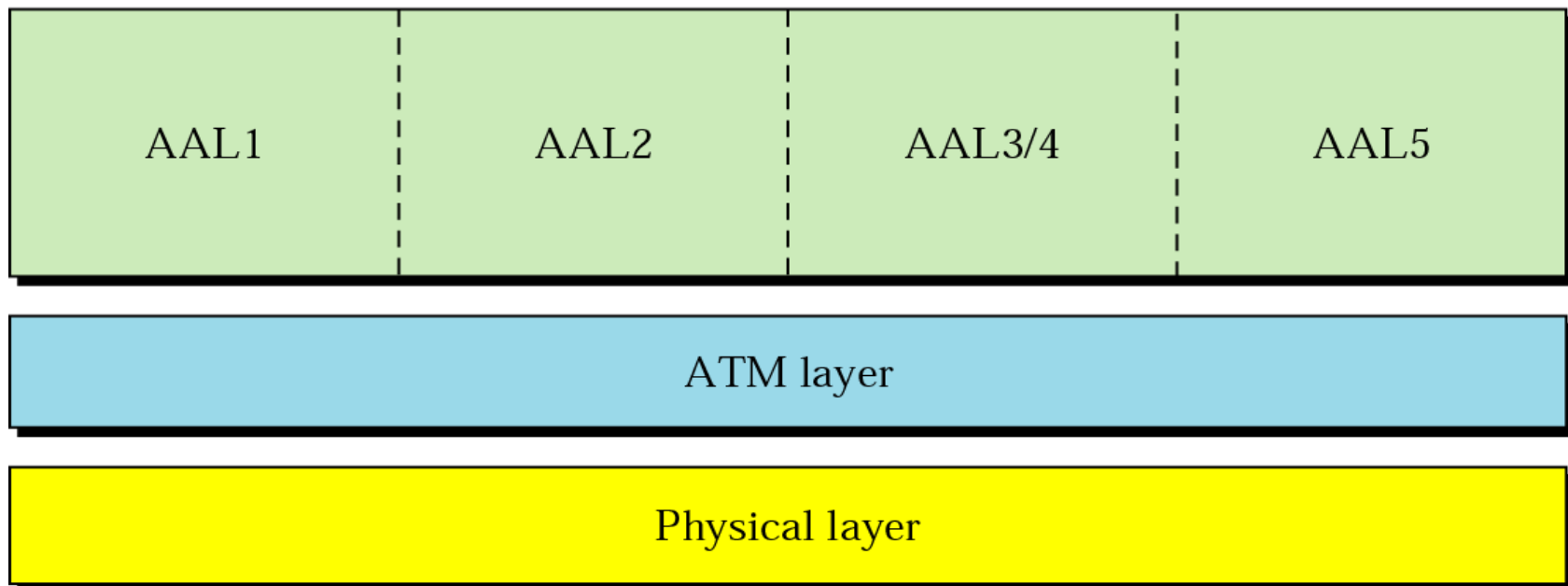
AAL1 is used for constant bit rate (CBR) services and circuit emulation.

AAL2 through AAL4 are used for variable bit rate (VBR) services

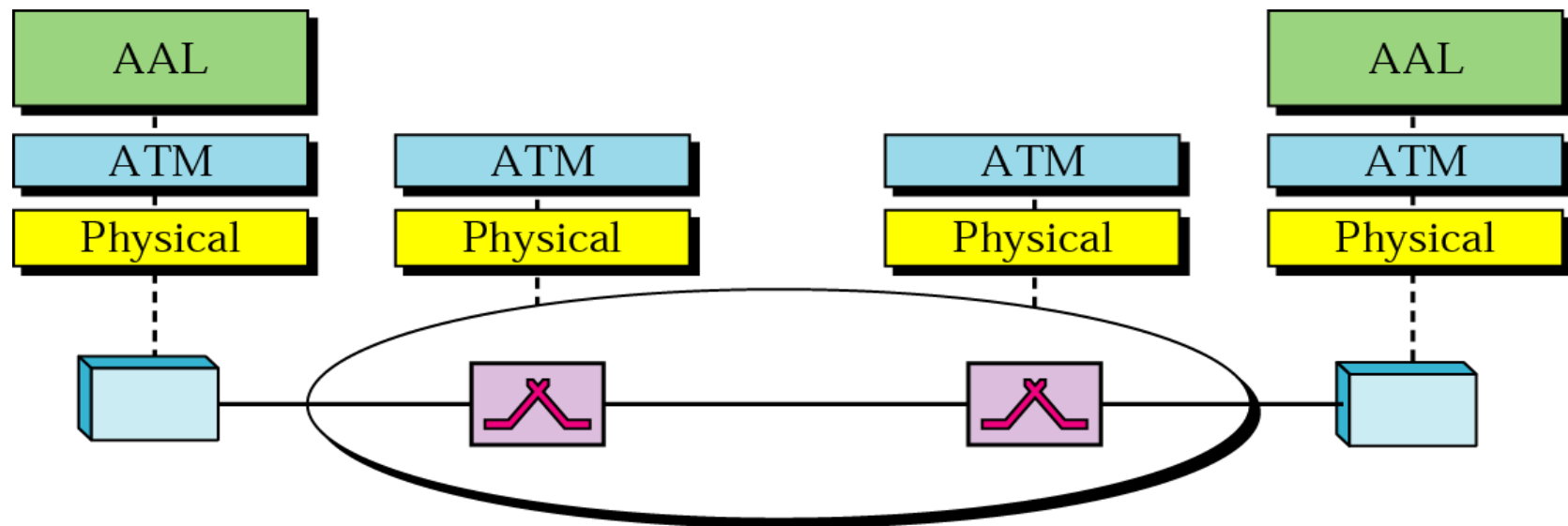
AAL5 for data.

Which AAL is in use for a given cell is not encoded in the cell. Instead, it is negotiated by or configured at the endpoints on a per-virtual-connection basis.

AAL layer



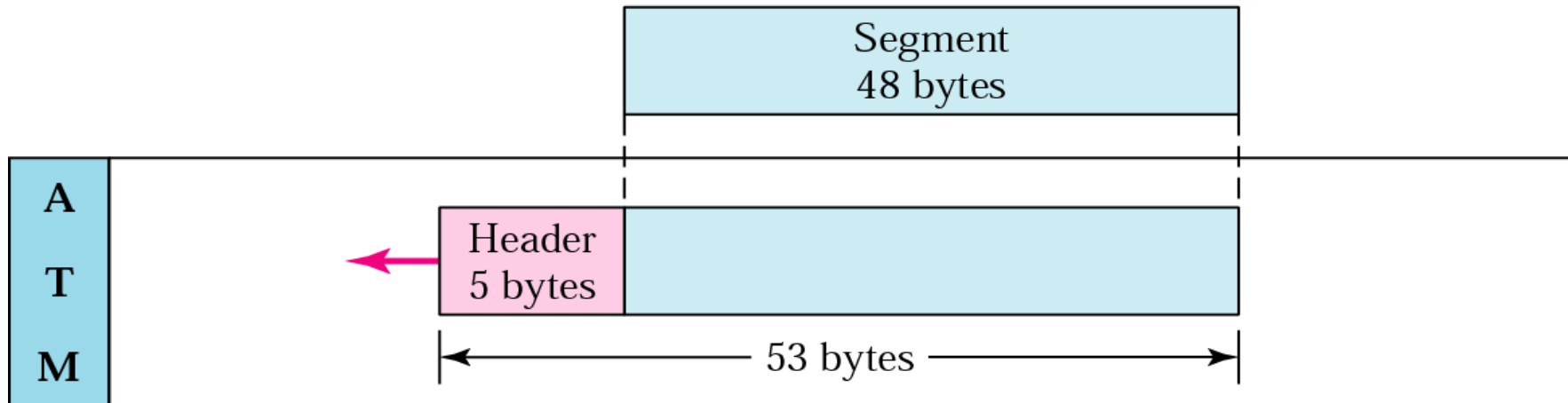
# ATM layers in endpoint devices and switches





# ATM layer

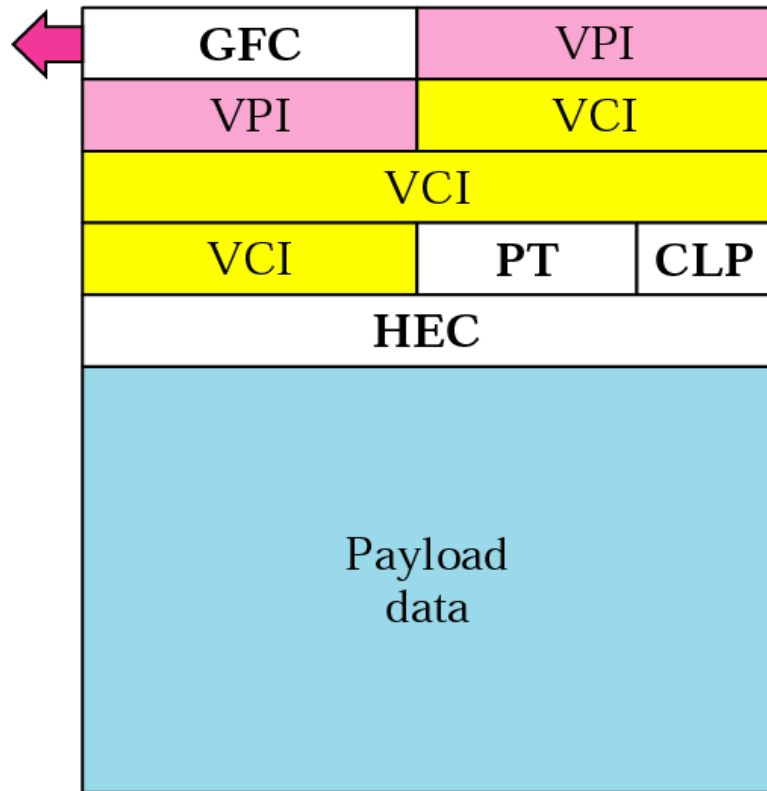
From AAL layer



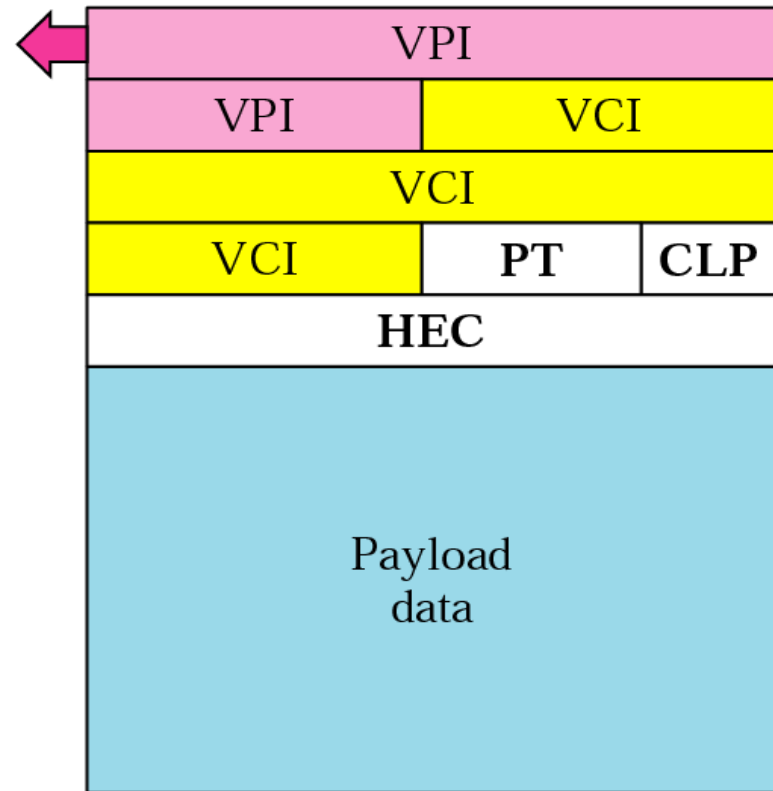
# ATM headers

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

PT: Payload type  
CLP: Cell loss priority  
HEC: Header error control



UNI Cell



NNI Cell



### Using cells and virtual circuits for traffic engineering

When an ATM circuit is set up each switch is informed of the traffic class of the connection.

ATM traffic contracts form part of the mechanism by which (QoS) is ensured. There are four basic types (and several variants) which each have a set of parameters describing the connection.

- CBR - Constant bit rate: a Peak Cell Rate (PCR) is specified, which is constant.
- VBR - Variable bit rate: an average cell rate is specified, which can peak at a certain level for a maximum interval before being problematic.
- ABR - Available bit rate: a minimum guaranteed rate is specified.
- UBR - Unspecified bit rate: traffic is allocated to all remaining transmission capacity.

VBR has real-time and non-real-time variants, and serves for "bursty" traffic. Non-real-time is usually abbreviated to vbr-nrt.

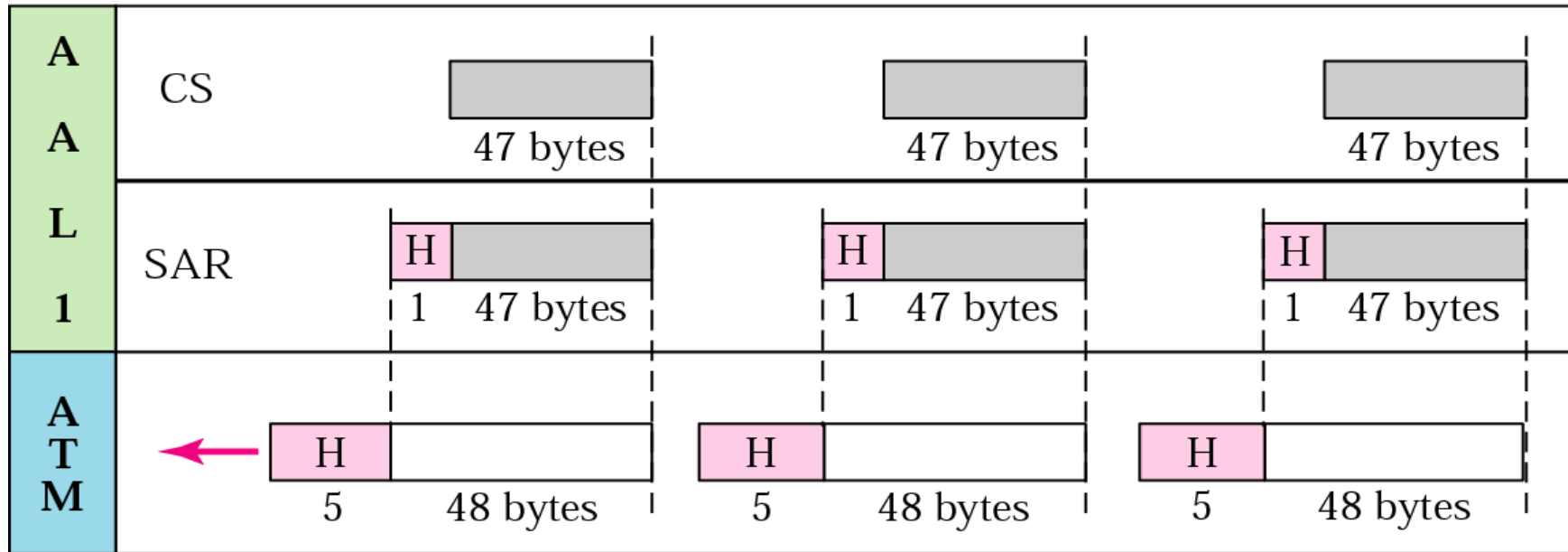
Most traffic classes also introduce the concept of Cell Delay Variation Tolerance (CDVT), which defines the "clumping" of cells in time.

To maintain traffic contracts, networks usually use a combination of queuing and marking of cells. "Policing" generally enforces traffic contracts.

# AAL1

Constant-bit-rate data from upper layer

.....1110010010001111 ..... 111110101010101 .....

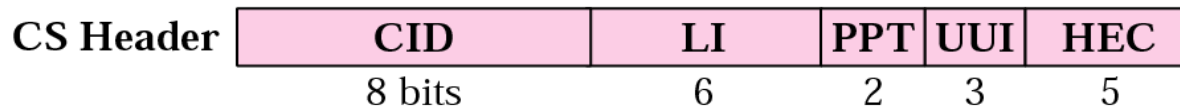
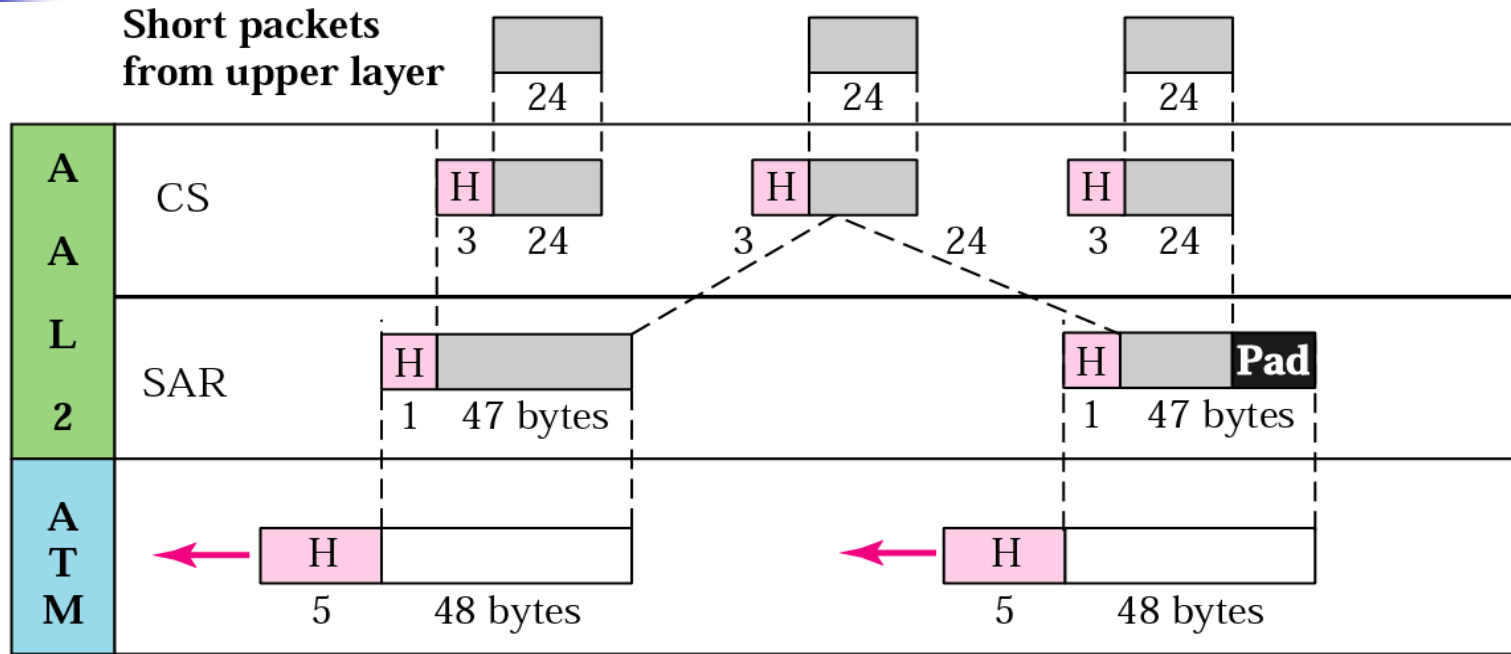


SN: Sequence number  
SNP: Sequence number protection

AAL1 is used for constant bit rate (CBR) services and circuit emulation.

Video and voice

# AAL2



CID: Channel identifier  
 LI: Length indicator  
 PPT: Packet payload type

UUI: User-to-user indication  
 HEC: Header error control  
 SF: Start field

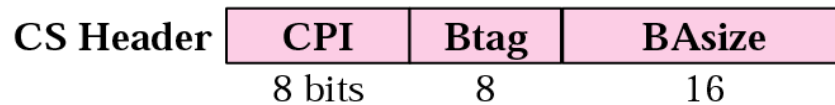
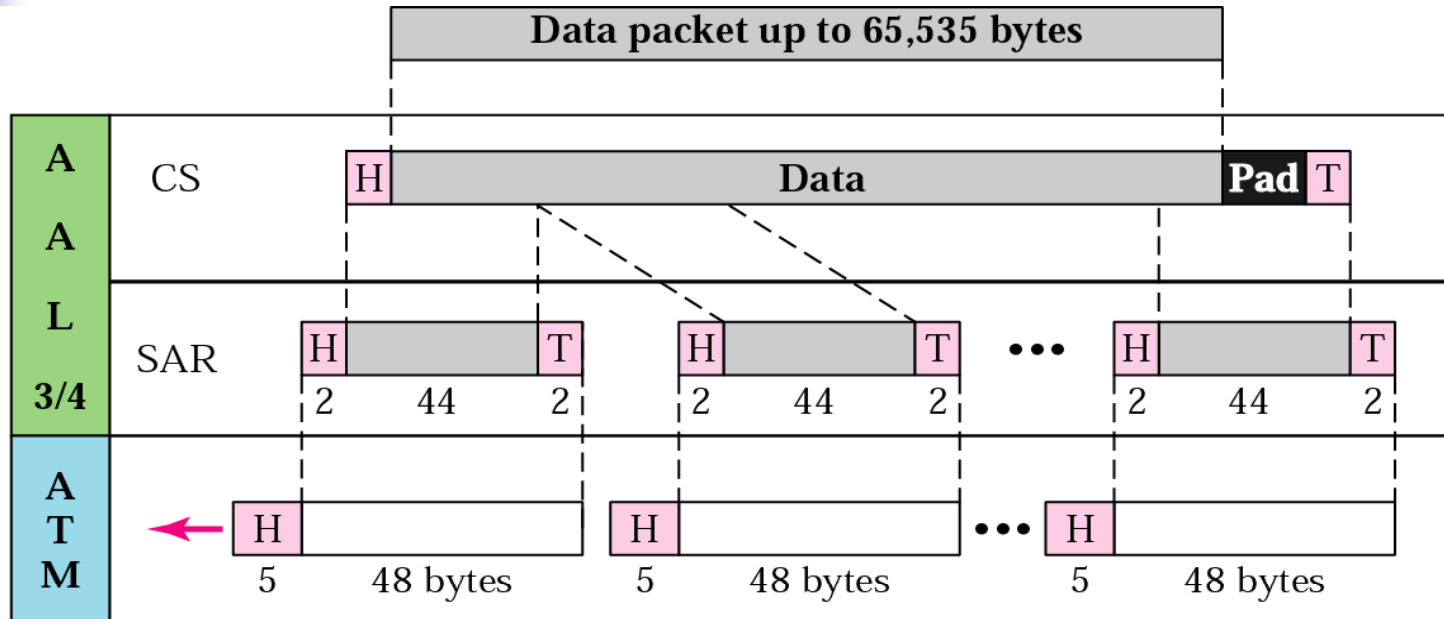
AAL2 are used for variable bit rate (VBR) services

Low bit rate traffic and short frame traffic as audio (compressed and uncompressed) video and fax.

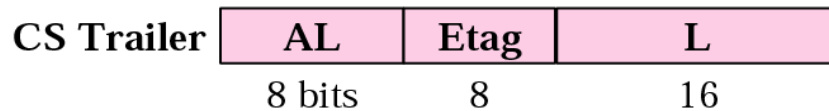
CS- Convergence sublayer

SAR – Segmentation and Reassembly sublayer

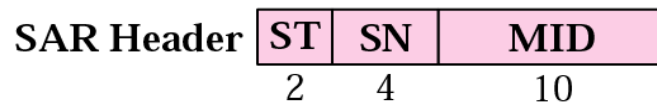
# AAL3/4



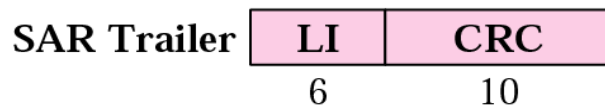
**CPI: Common part identifier**  
**Btag: Beginning tag**  
**BAsize: Buffer allocation size**



**AL: Alignment**  
**Etag: Ending tag**  
**L: Length**



**ST: Segment type**  
**SN: Sequence number**  
**MID: Multiplexing identifier**

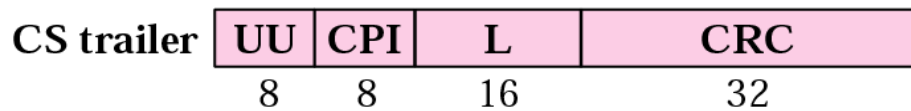
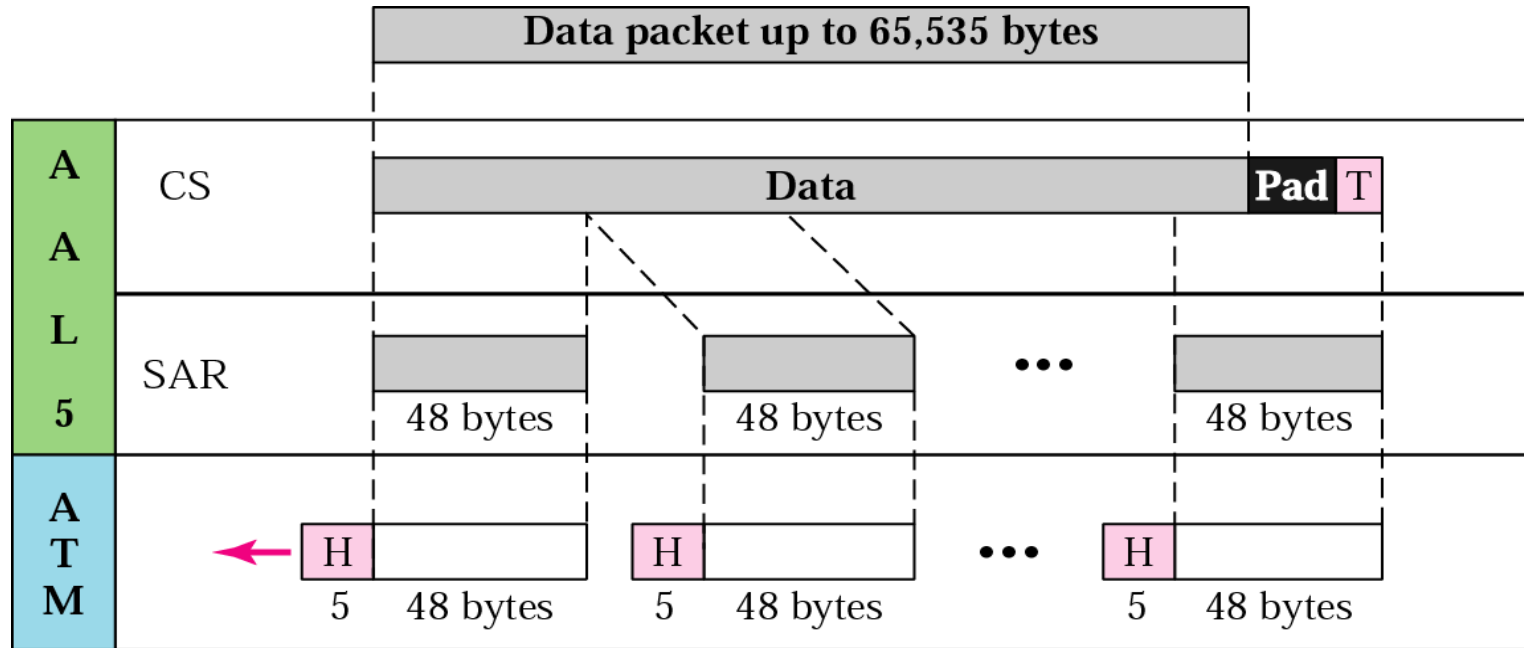


**LI: Length identifier**  
**CRC: Error detector**

**AAL3 support connection-oriented data services**

**AAL4 support connectionless services**

# AAL5



UU: Channel identifier  
 CPI: Common part identifier  
 L: Length  
 CRC: Error detector

**AAL5 the control functions are included in the upper layers**