ulm university universität ulm

Lecture Computer Networks

Asynchronous Transfer Mode (ATM)

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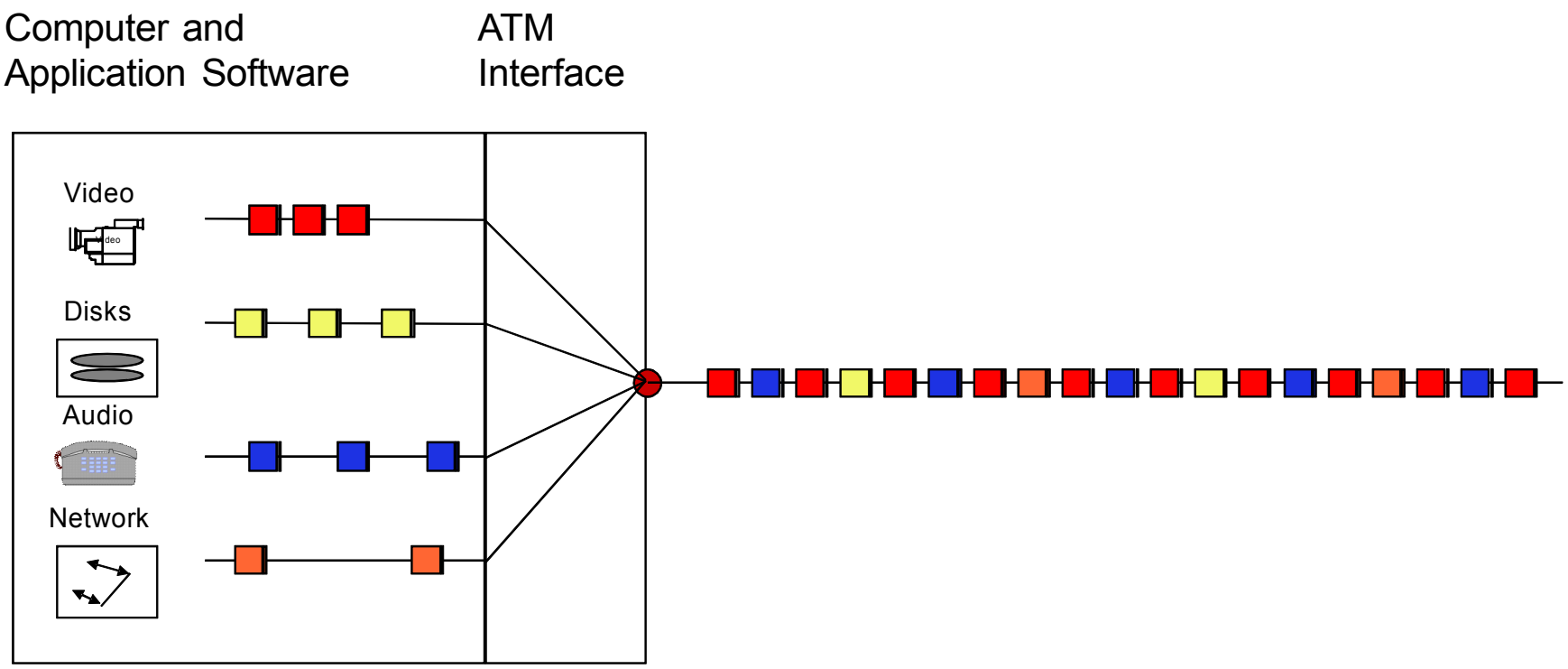
Institut für Organisation und Management von
Informationssystemen

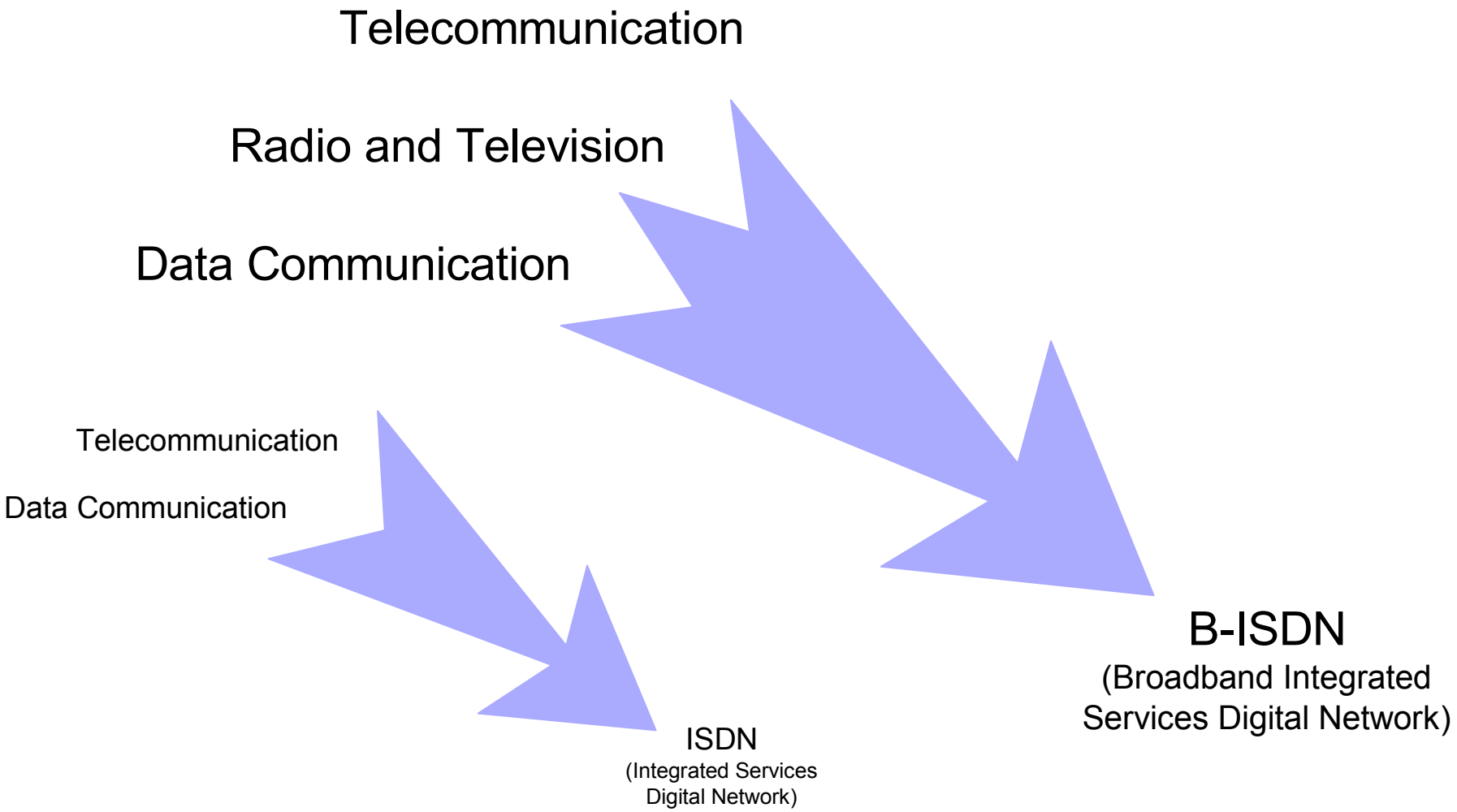
ATM – The Idea

- Provision of network capabilities for handling all current and future applications independently of their bandwidth requirements.
- The main goal was a unification of telecommunication with data communication.

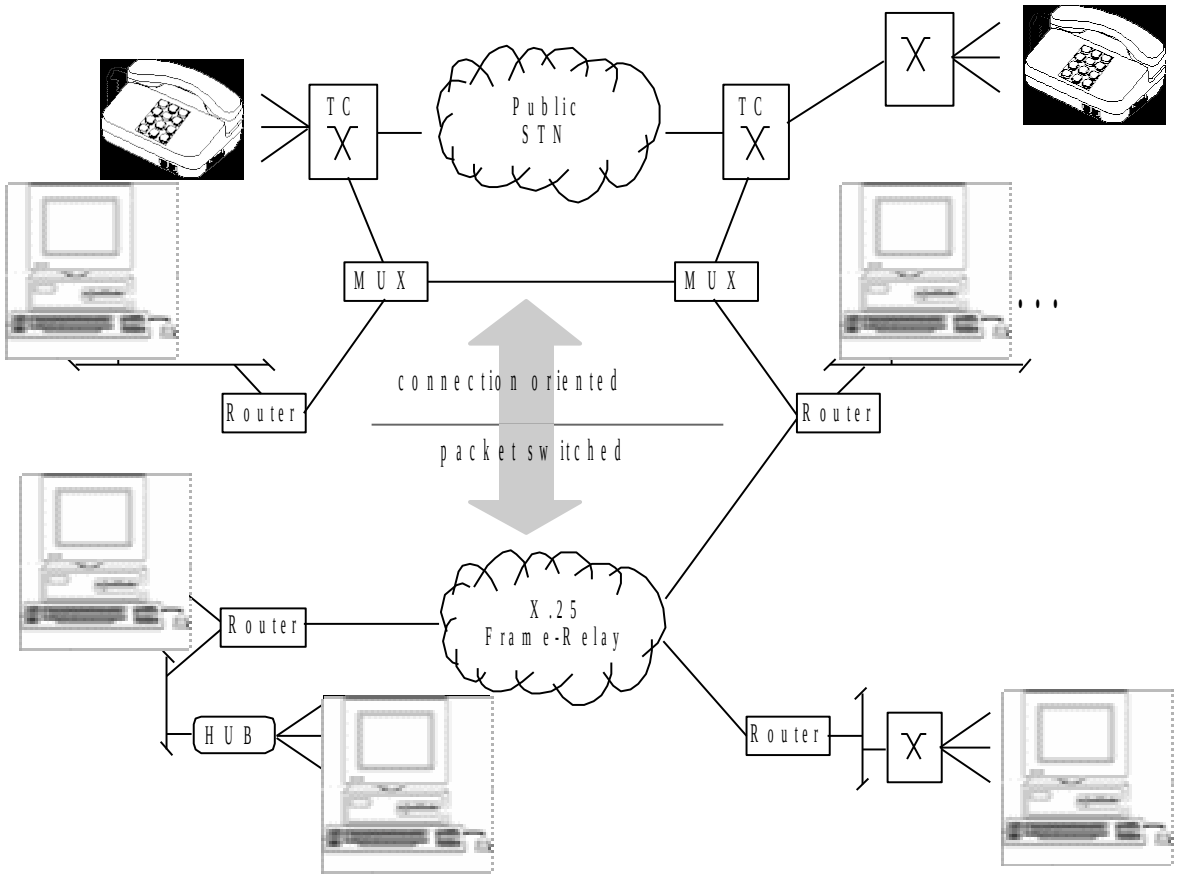
ATM – The Idea (II)



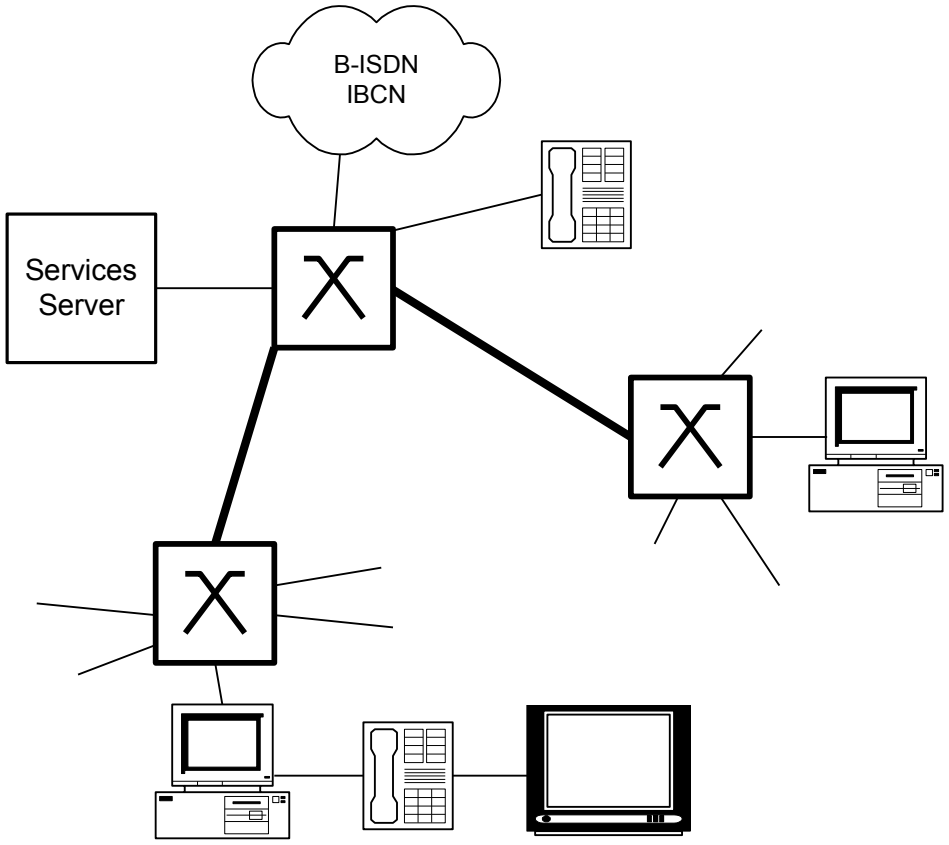
B-ISDN


Telecommunication
Radio and Television
Data Communication
Telecommunication
Data Communication
ISDN
(Integrated Services
Digital Network)
B-ISDN
(Broadband Integrated
Services Digital Network)

Todays Communication Infrastructure



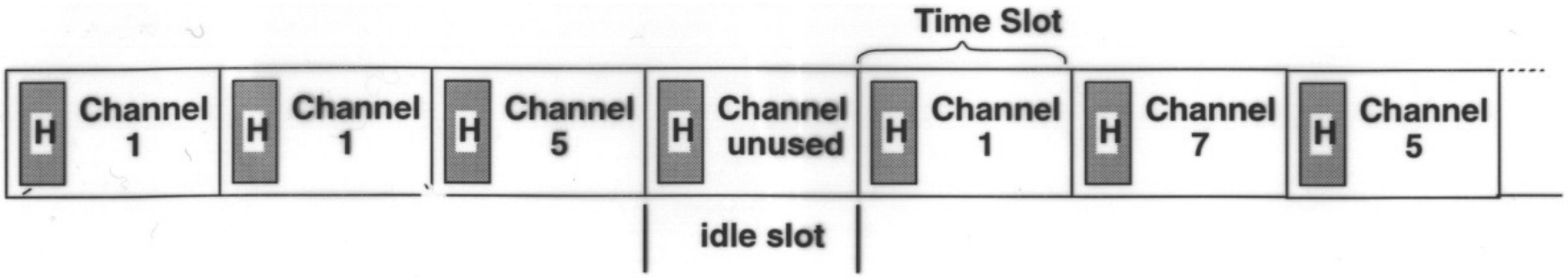
B-ISDN / ATM Infrastructure



Asynchronous Transfer Mode (ATM)

- Strategic B-ISDN direction since 1988
- Standards of ITU and the ATM Forum
- Technology
  - Fast packet switching
  - Variable bandwidth channel assignment
- ATM can handle different bit rates and traffic parameters with data rates 155.52 Mbps / 622.08 Mbps at UNI
- Transmission interface SONET / SDH up to 2.4 Gbps
- Culmination of all developments in circuit and packet switching over the past 20 years
- ATM-Forum founded in 1991

ATM II


Time Slot
H
Channel 1
H
Channel 1
H
Channel 5
H
Channel unused
H
Channel 1
H
Channel 7
H
Channel 5
idle slot

ATM Drafts

Packet switching

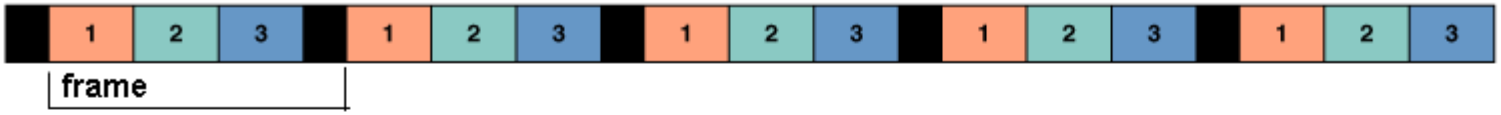
- no linkwise error protection
- connection-oriented
- small packet (cells) of fixed length

Time division multiplexing method

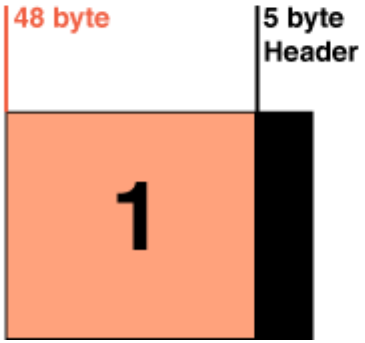
- time slot method
- time relations are not supported
- time slots are not marked by their position (asynchronous)

STM / ATM

STM (Synchrous Transfer Mode)

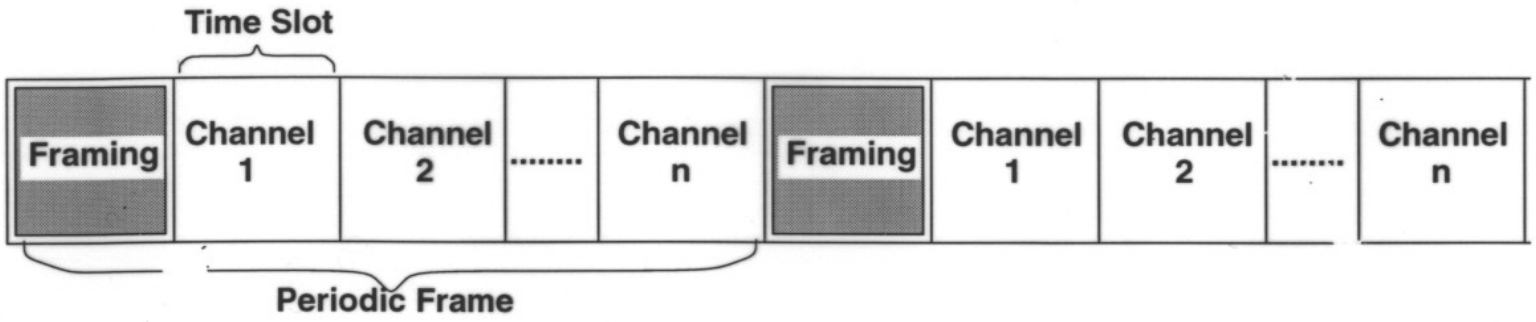


ATM (Asynchronous Transfer Mode)



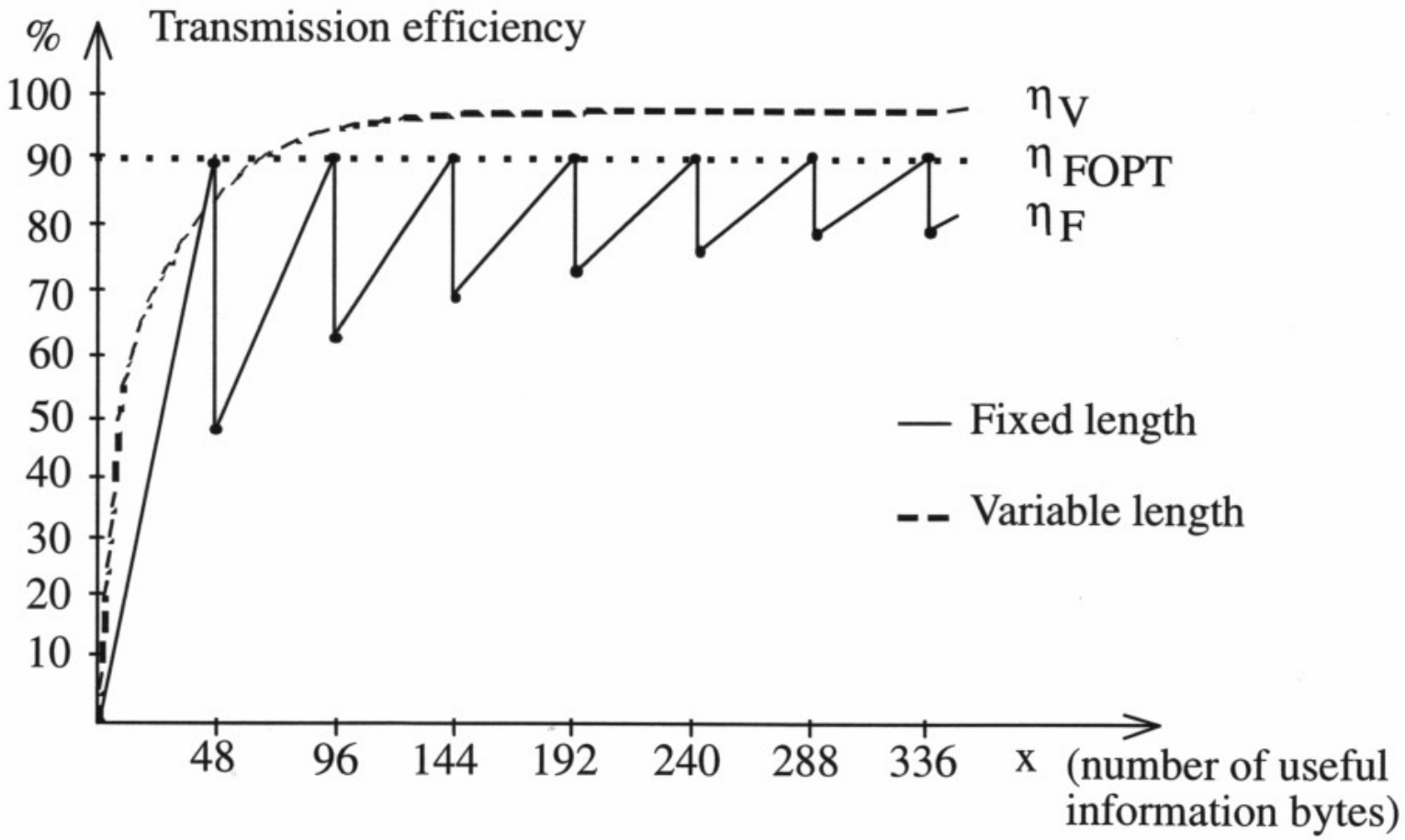
Synchronous Transfer Mode (STM)

- Based on time division multiplexing

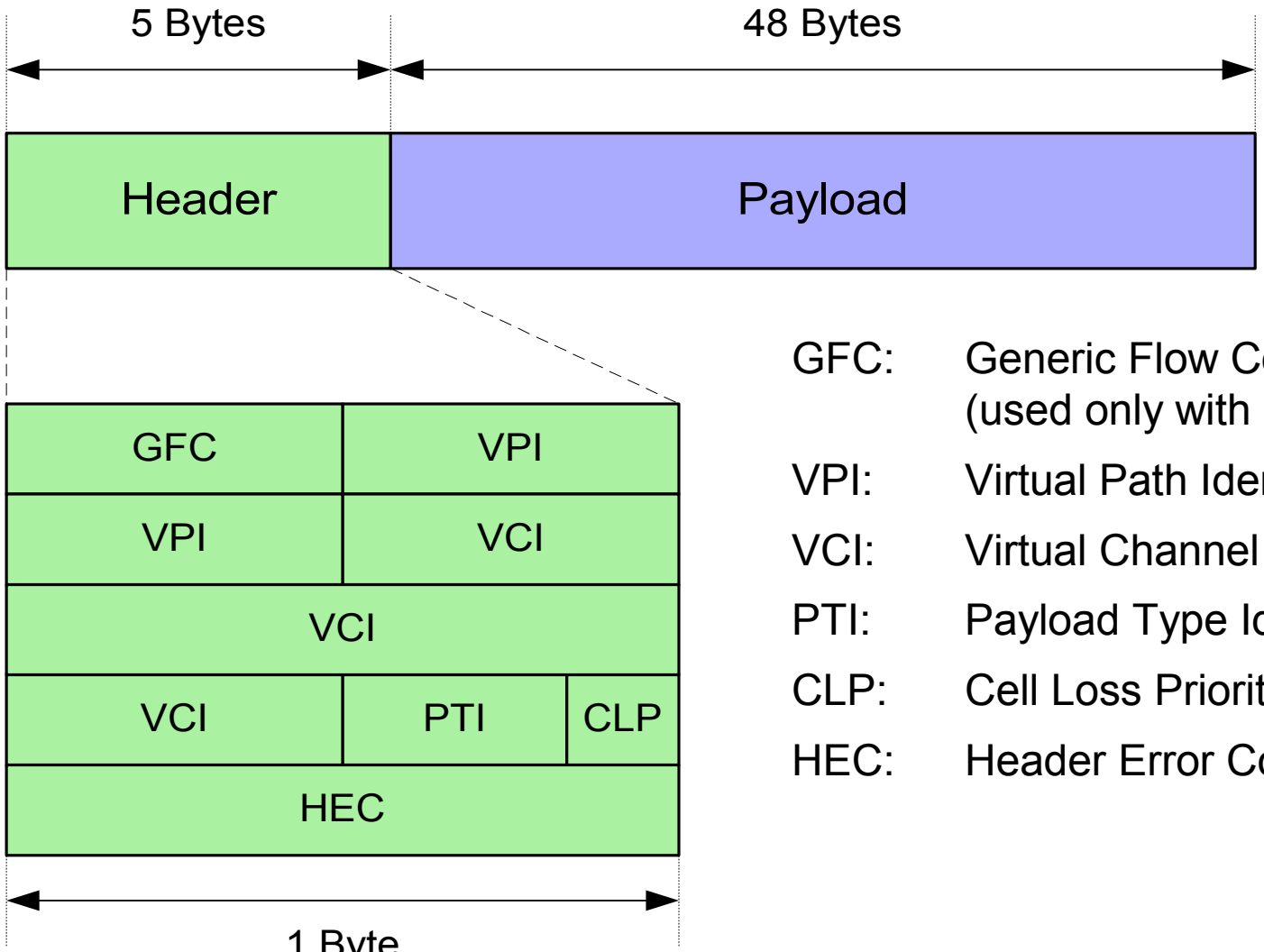


- Disadvantages
  - Fixed data rates
  - Fixed bandwidth for connection

ATM Transmission Efficiency



Cell Structure



GFC: Generic Flow Control (used only with UNI)

VPI: Virtual Path Identifier

VCI: Virtual Channel Identifier

PTI: Payload Type Identifier

CLP: Cell Loss Priority

HEC: Header Error Control

ATM Bandwidth

- NNI (network-network interface)
  155 Mb/s, 622 Mb/s, 2.4 Gb/s
- UNI (user-network interface)
  25 Mb/s ... 622 Mb/s
- bandwidth allocation for an application on demand

Modes of Connection

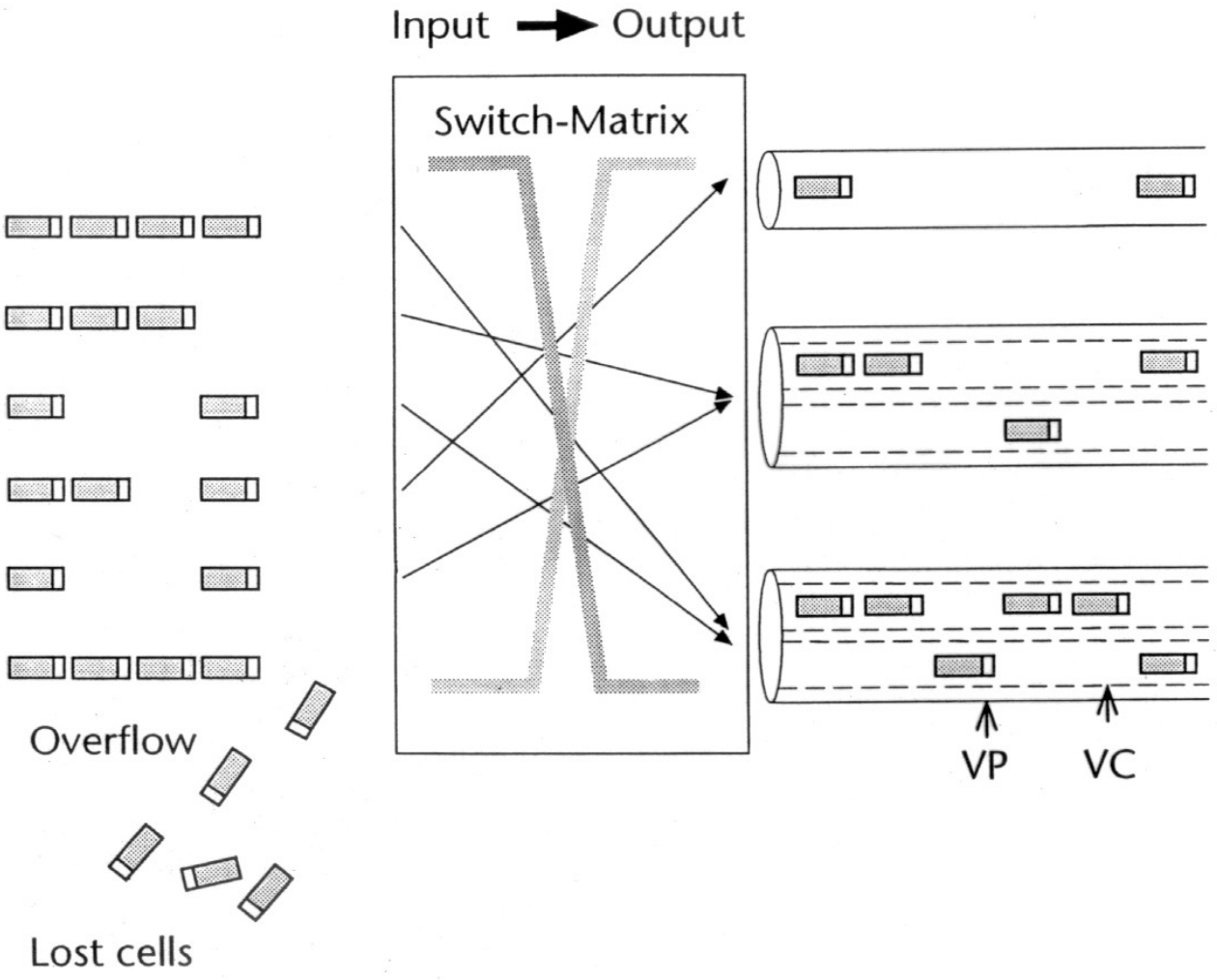
Permanent Virtual Circuit (PVC)

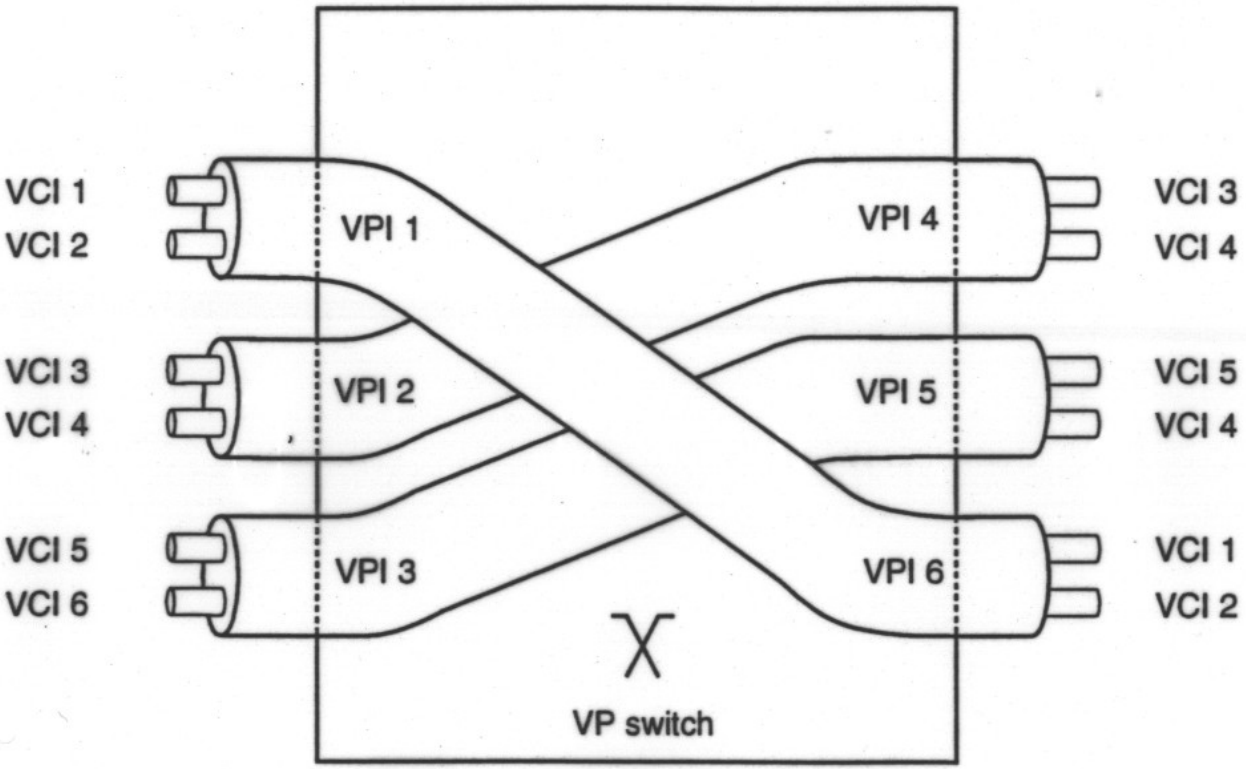
- VCI/VPI tables are created manually by administrator
- PVCs exist permanent, even when there is no data traffic

Switched Virtual Circuits (SVC)

- connections are established and closed dynamically by ATM signalling
- SVCs normally are closed when no data traffic occurs

ATM Switch Matrix





VCI Virtual channel identifier
VP Virtual path
VPI Virtual path identifier

ATM - Classes of Services I

	Class A	Class B	Class C	Class D
Time Reference	time-continuous		not time-continuous	
Bit rate	constant	variable		
Connection Mode	connection-oriented			connection-less
Services	Audio / Video	Audio / Video	Services for data	Services for data
Adaption Layer	AAL 1	AAL 2	AAL 5, AAL 3/4	

ATM - Classes of Services II

Class A

- Circuit emulation
- Intended for constant bitrate voice and video applications
- Timing relationship between source and destination

Class B

- Variable bit rate services
- Intended for isochronous voice and video traffic with variable bitrate information
- Timing relationship between connection endpoints (connection-oriented)

ATM - Classes of Services III

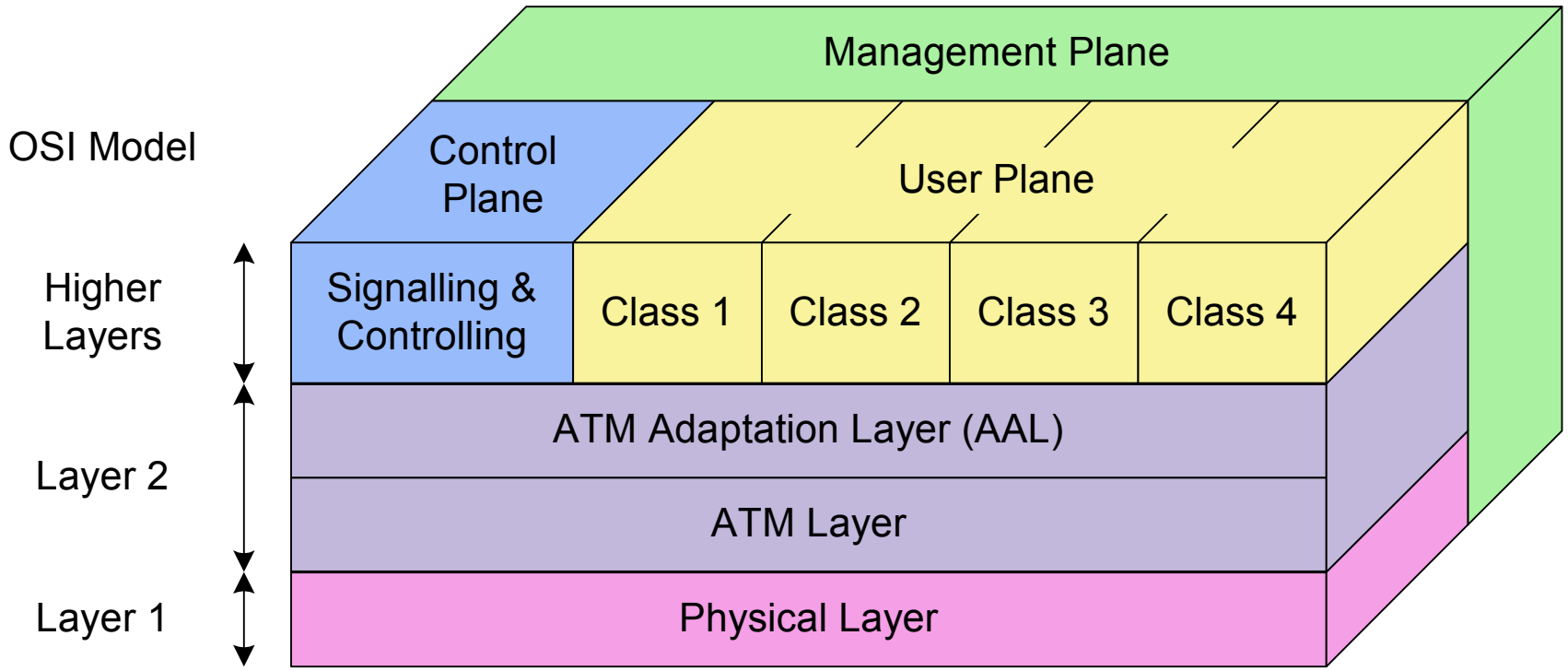
Class C

- Connection-oriented data transfer
- Intended for traditional data traffic as known e.g. in X.25
- “message mode”: transfer of single frames
- “streaming mode”: transport for multiple fixed length frames

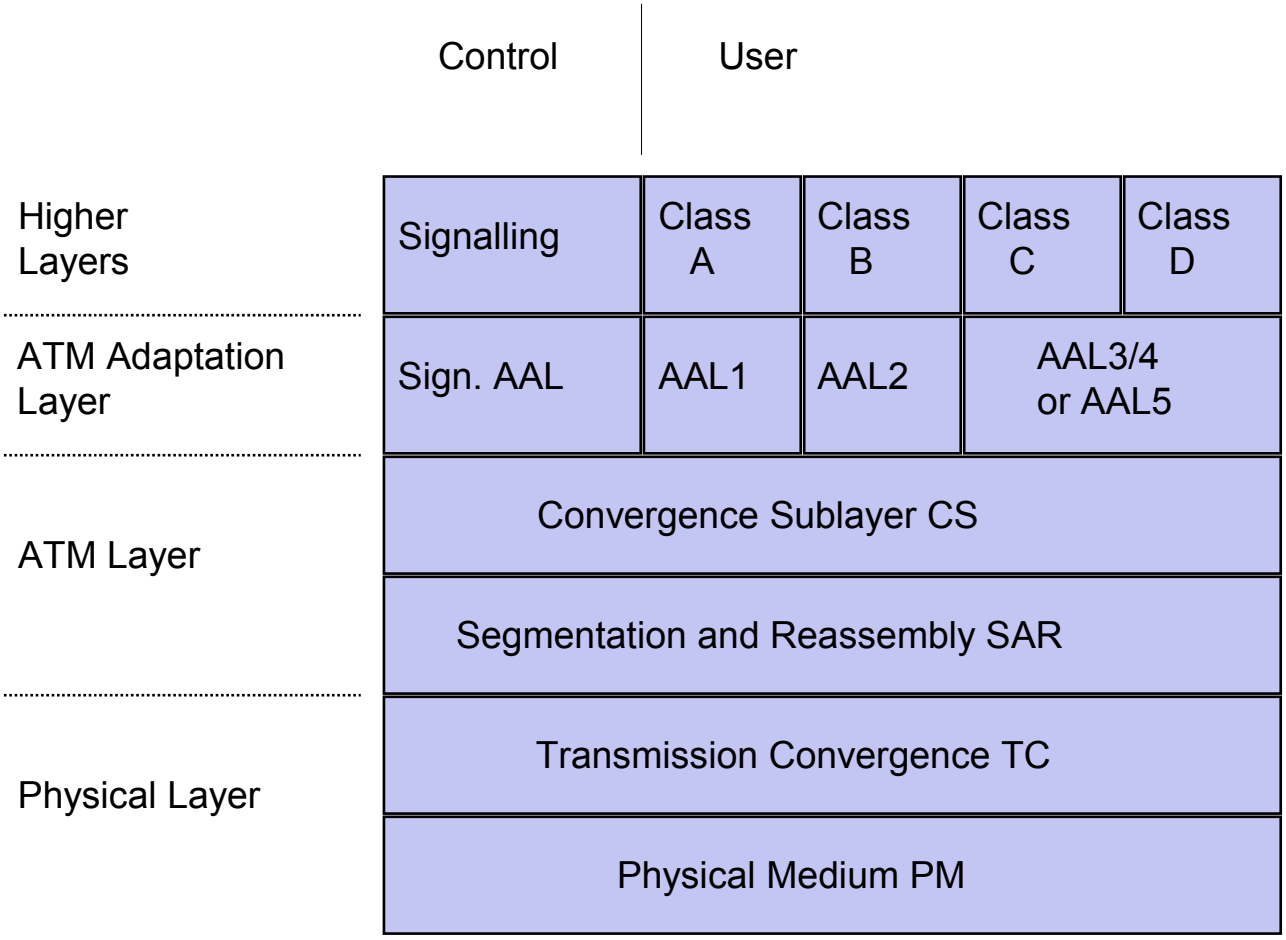
Class D

- Connectionless data transfer
- Intended to carry e.g. TCP/IP or LAN interconnection traffic

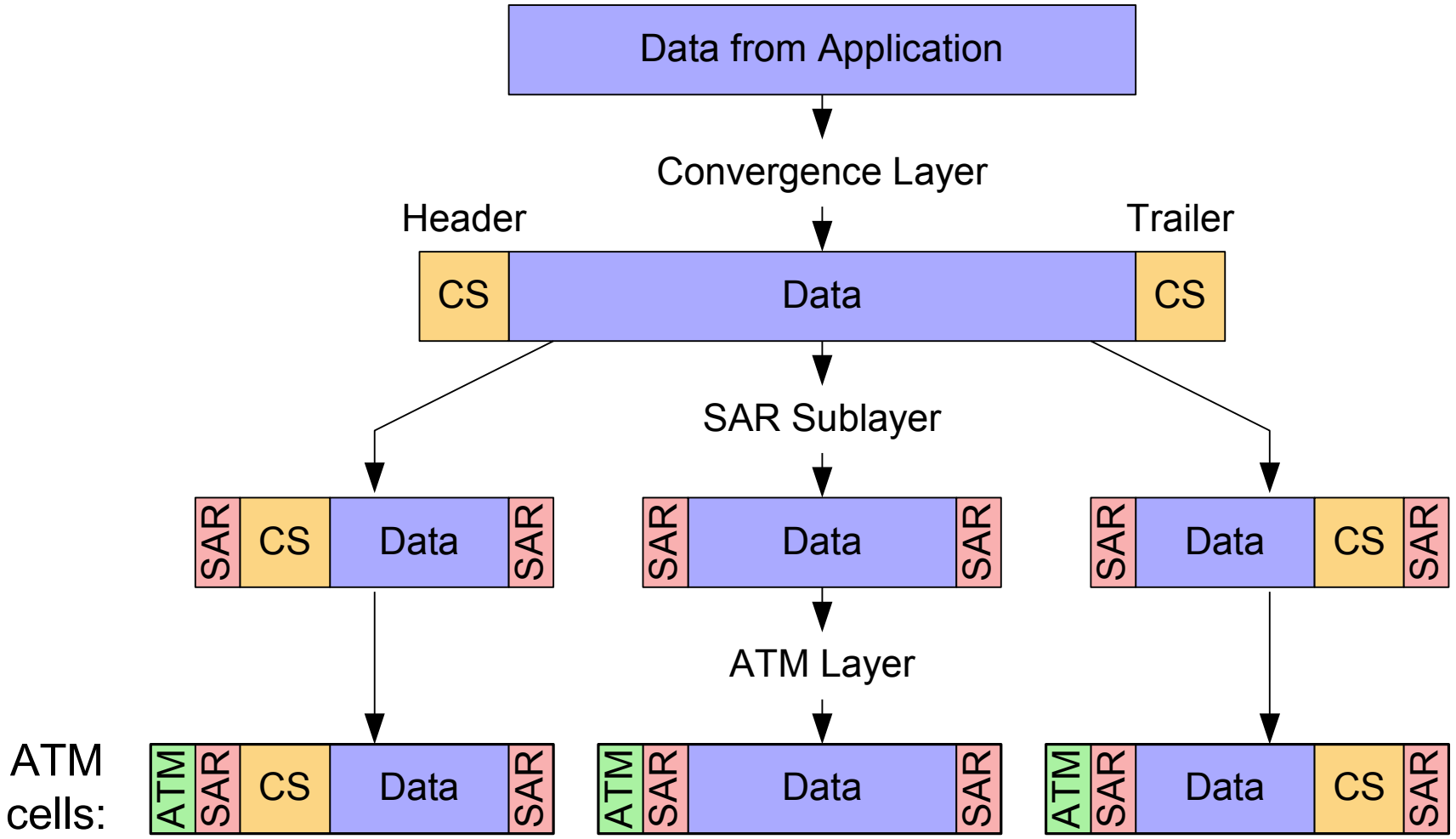
ATM Architecture



ATM Layers


Control
User
Higher Layers
Signalling
Class A
Class B
Class C
Class D
ATM Adaptation Layer
Sign. AAL
AAL1
AAL2
AAL3/4 or AAL5
ATM Layer
Convergence Sublayer CS
Segmentation and Reassembly SAR
Physical Layer
Transmission Convergence TC
Physical Medium PM

Encapsulation – the general scheme



(Not each adaption layer uses CS and SAR header and trailer)