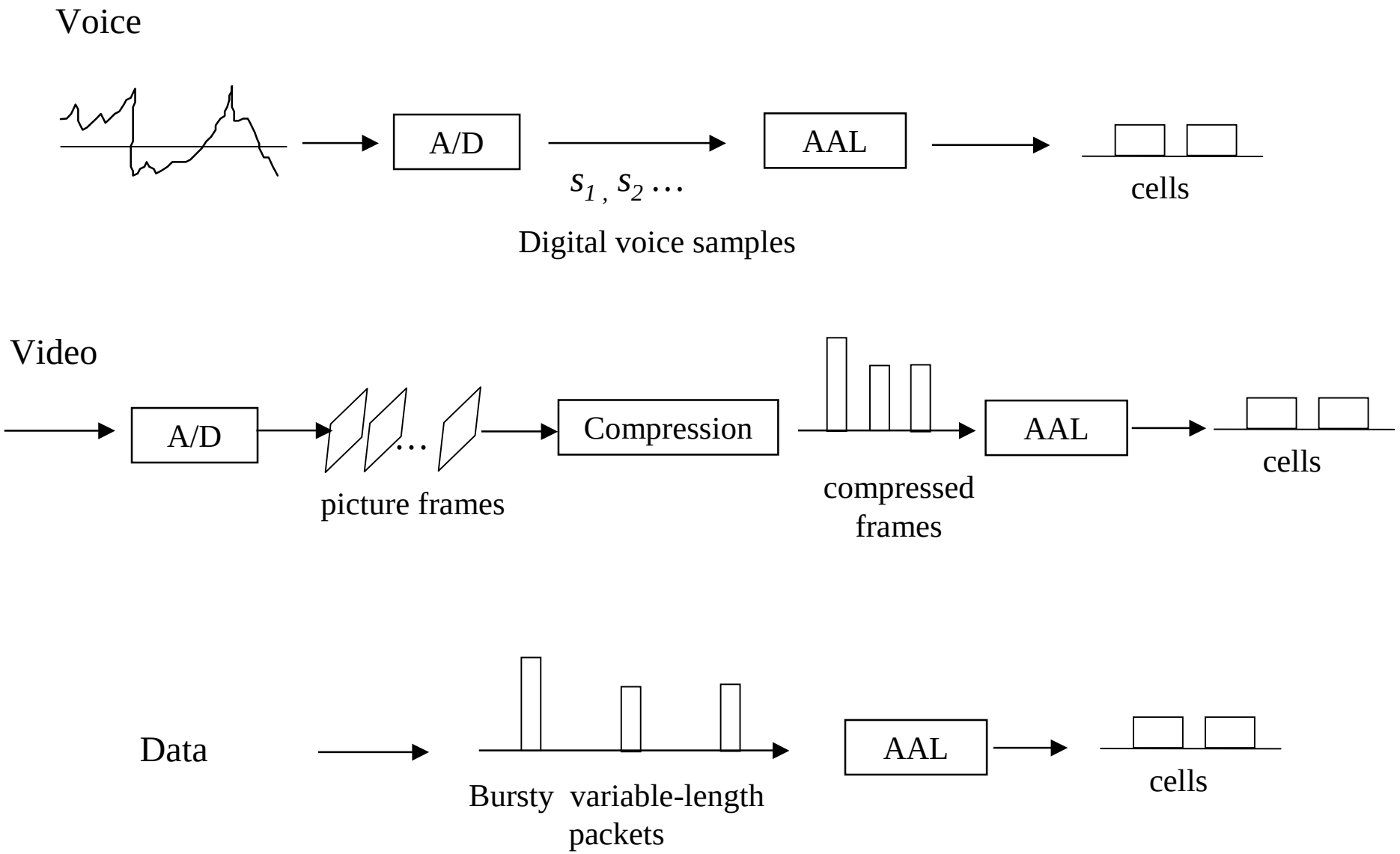
ATM

Asynchronous Transfer Mode



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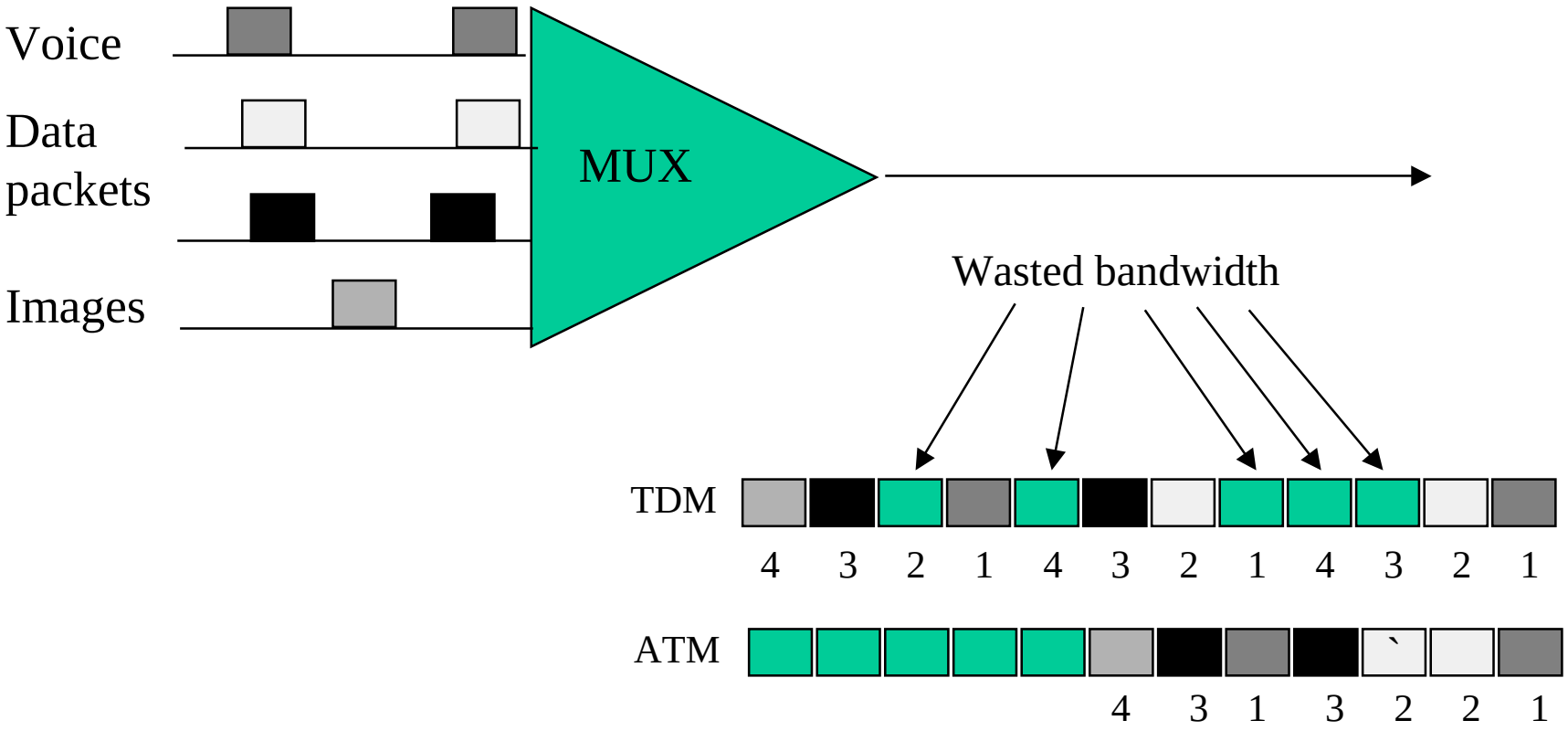
Asynchronous Transfer Mode (ATM)



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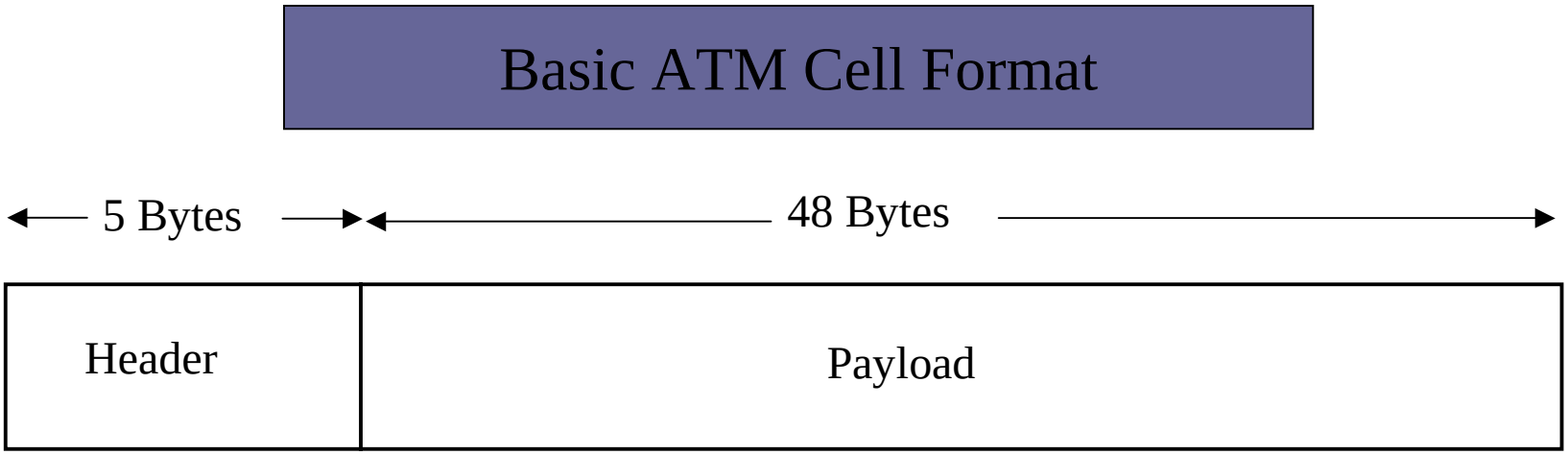
ATM

- ATM standard (defined by CCITT) is widely accepted by common carriers as mode of operation for communication – particularly BISDN.
- ATM is a form of cell switching using small fixed-sized packets.



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Assumptions for ATM Conceptual Model

1. ATM network will be organized as a hierarchy.

   User's equipment connects to networks via a UNI (User-Network Interface).

   Connections between provided networks are made through NNI (Network-Network Interface).

2. ATM will be *connection-oriented*.

   A connection (*a channel*) must be established before any cells are sent.

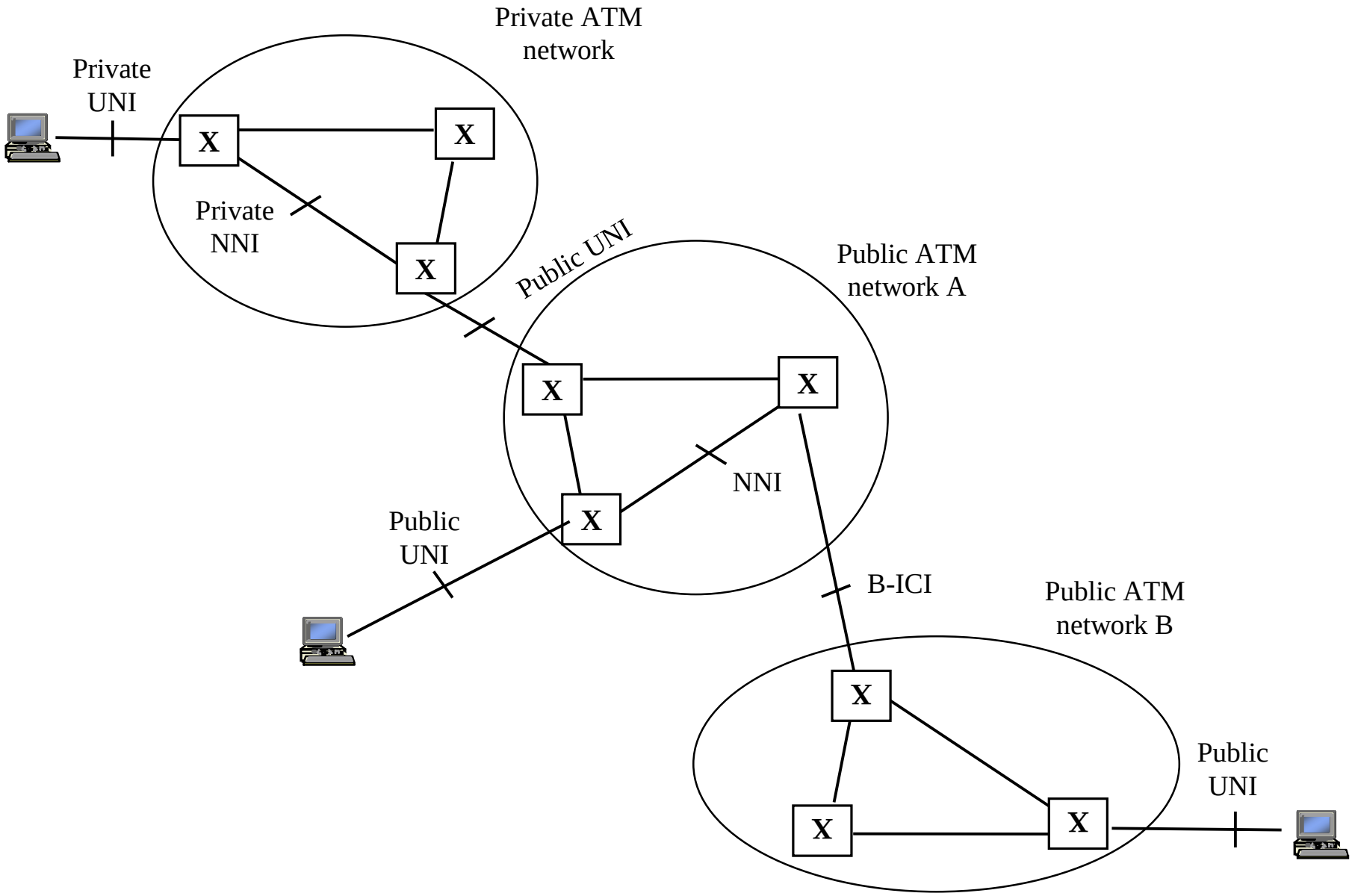
Assumptions for ATM Conceptual Model (cont.)

- two levels of ATM connections are defined:
  - virtual path connections
  - virtual channel connections

These are indicated by the two fields in the cell header:

virtual path identifier **VPI**

virtual channel identifier **VCI**



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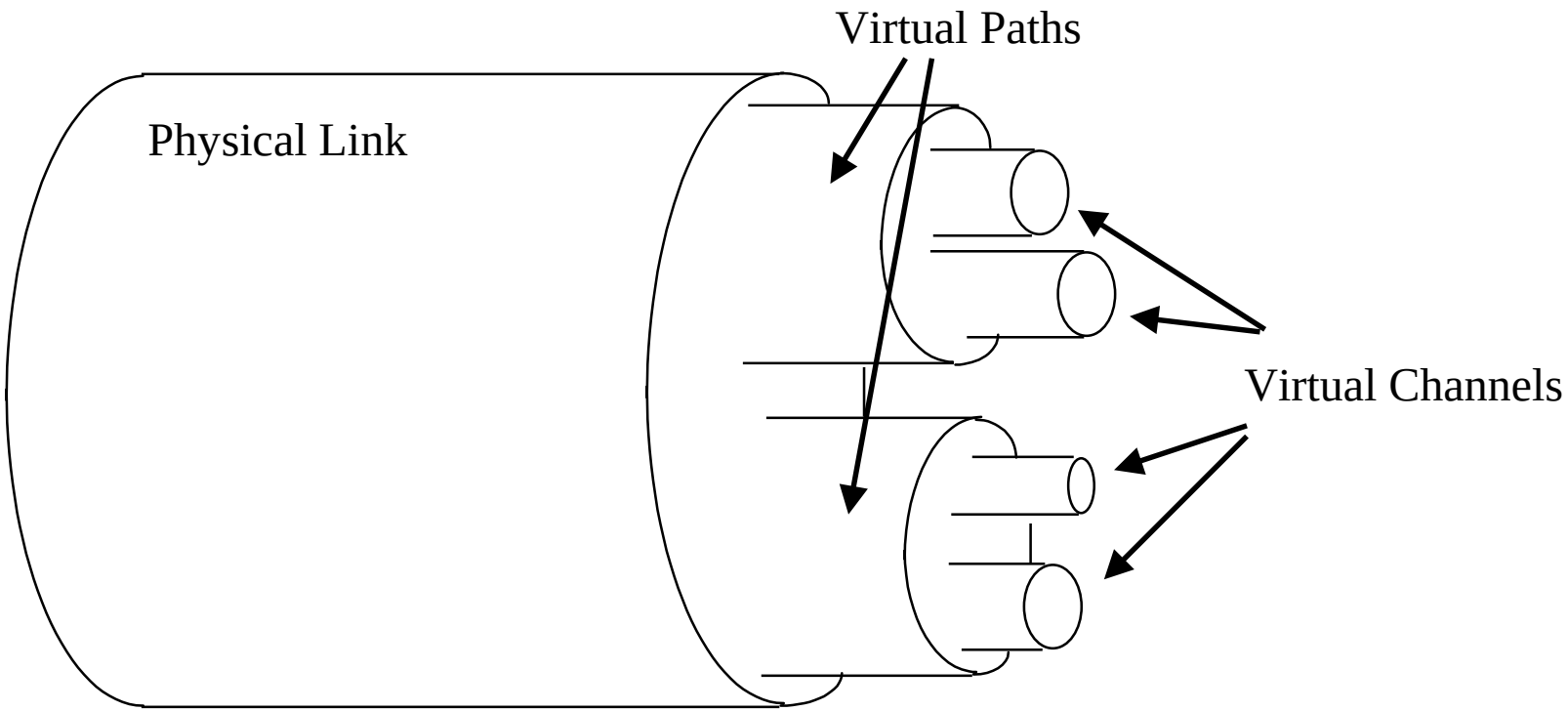
ATM Virtual Connections



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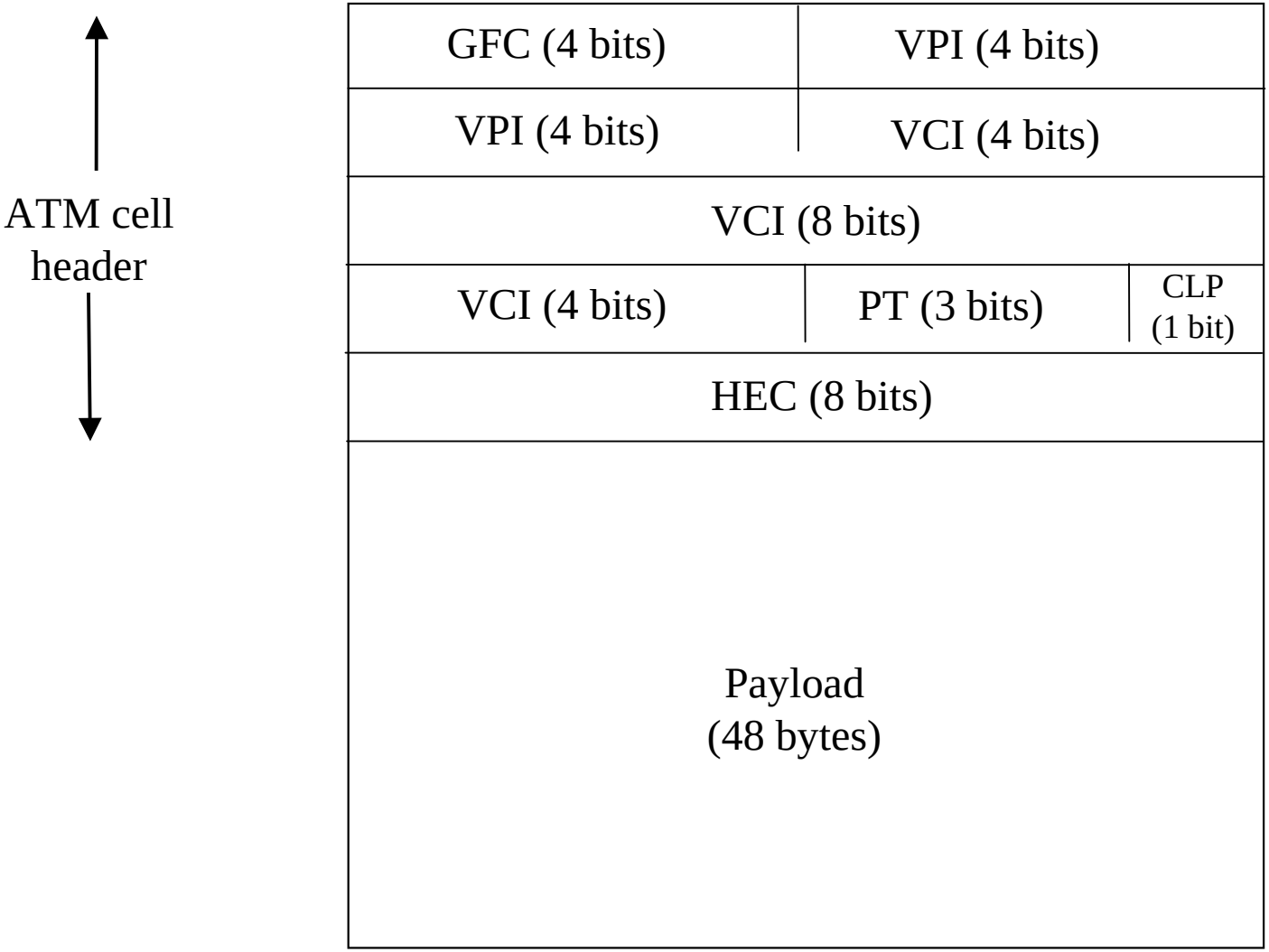
Assumptions for ATM Conceptual Model (cont.)

3. Vast majority of ATM networks will run on optical fiber networks with *extremely low error rates.*
4. ATM supports low cost attachments
   - This decision lead to a significant decision – to prohibit cell reordering in ATM networks.

   ➔ ATM switch design is more difficult.

UNI Cell Format



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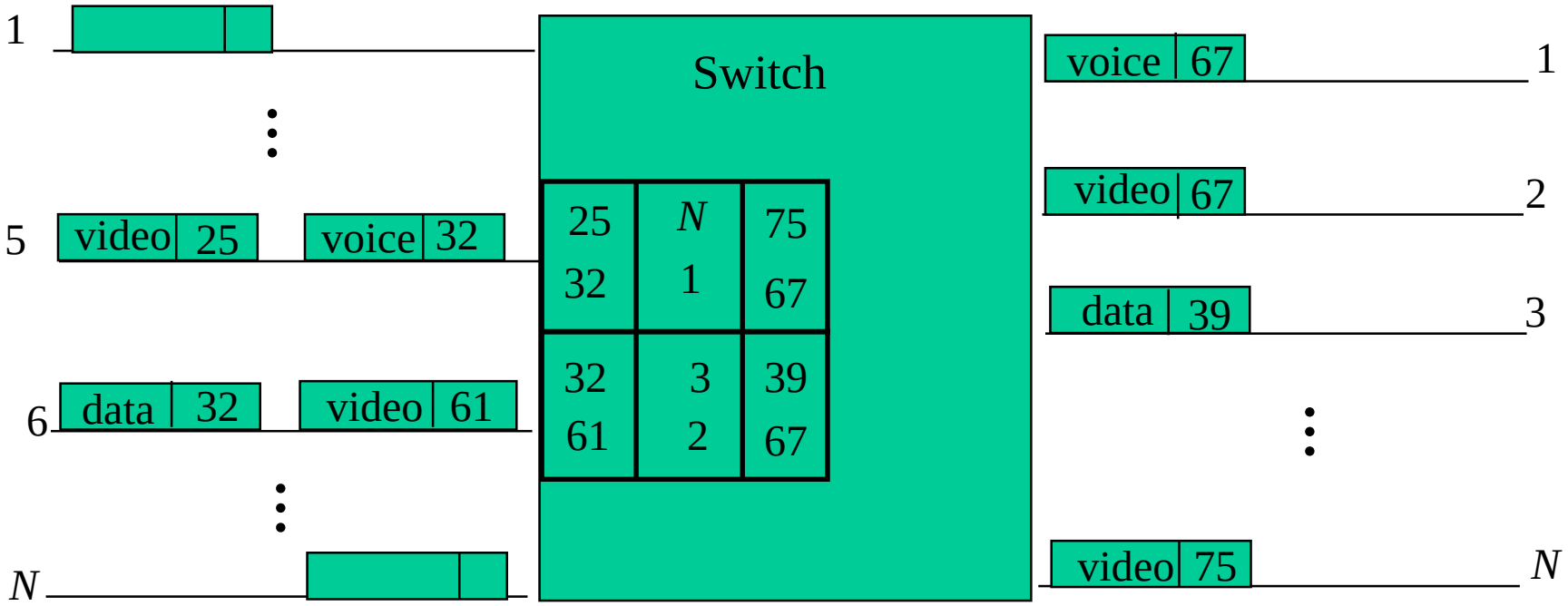
ATM Cell Switching



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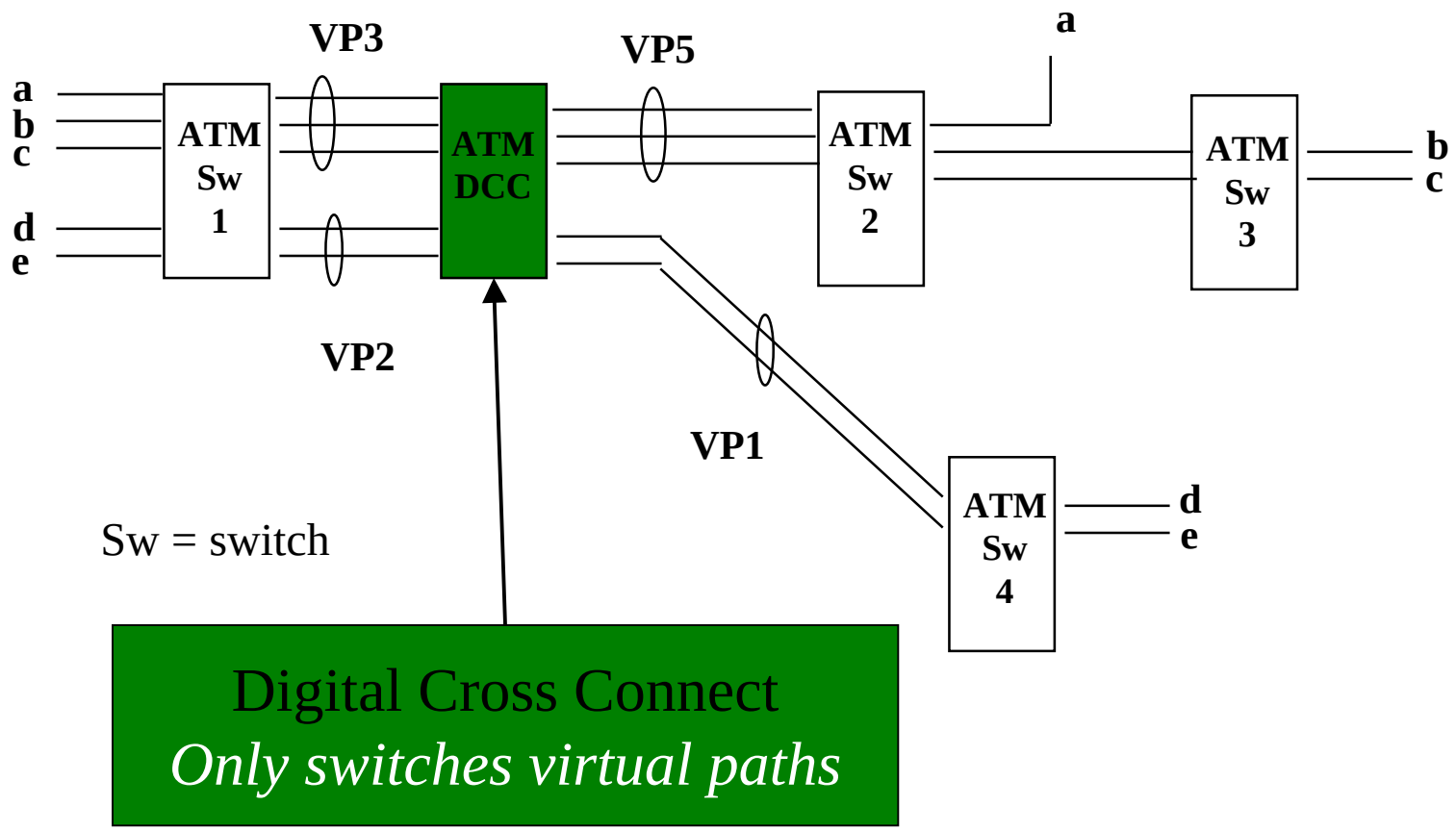

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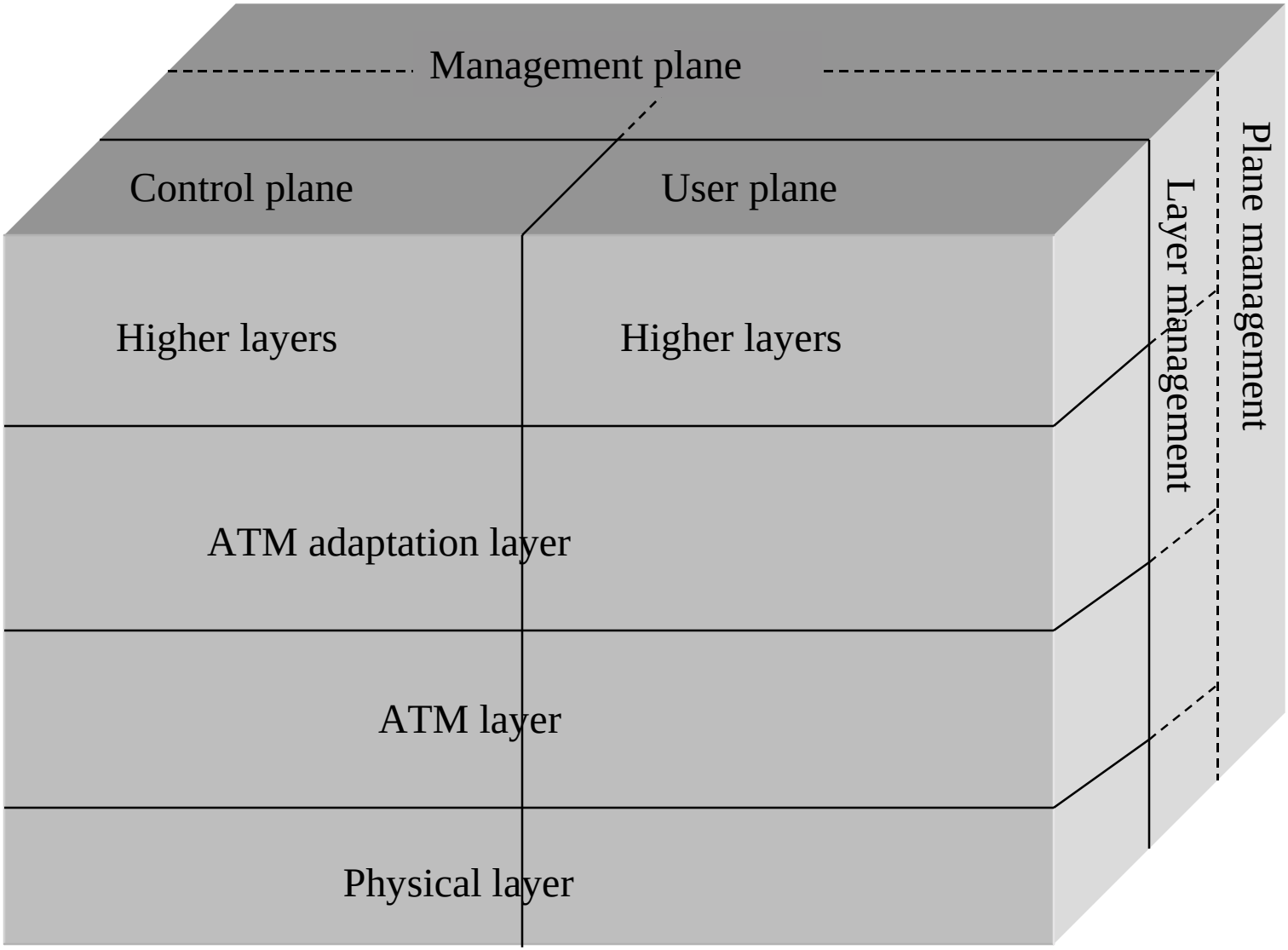
ATM Protocol Architecture

- ATM Adaptation Layer (AAL) – the protocol for packaging data into cells is collectively referred to as AAL.
- Must efficiently package higher level data such as voice samples, video frames and datagram packets into a series of cells.

Issue: *How many adaptation layers should there be?*



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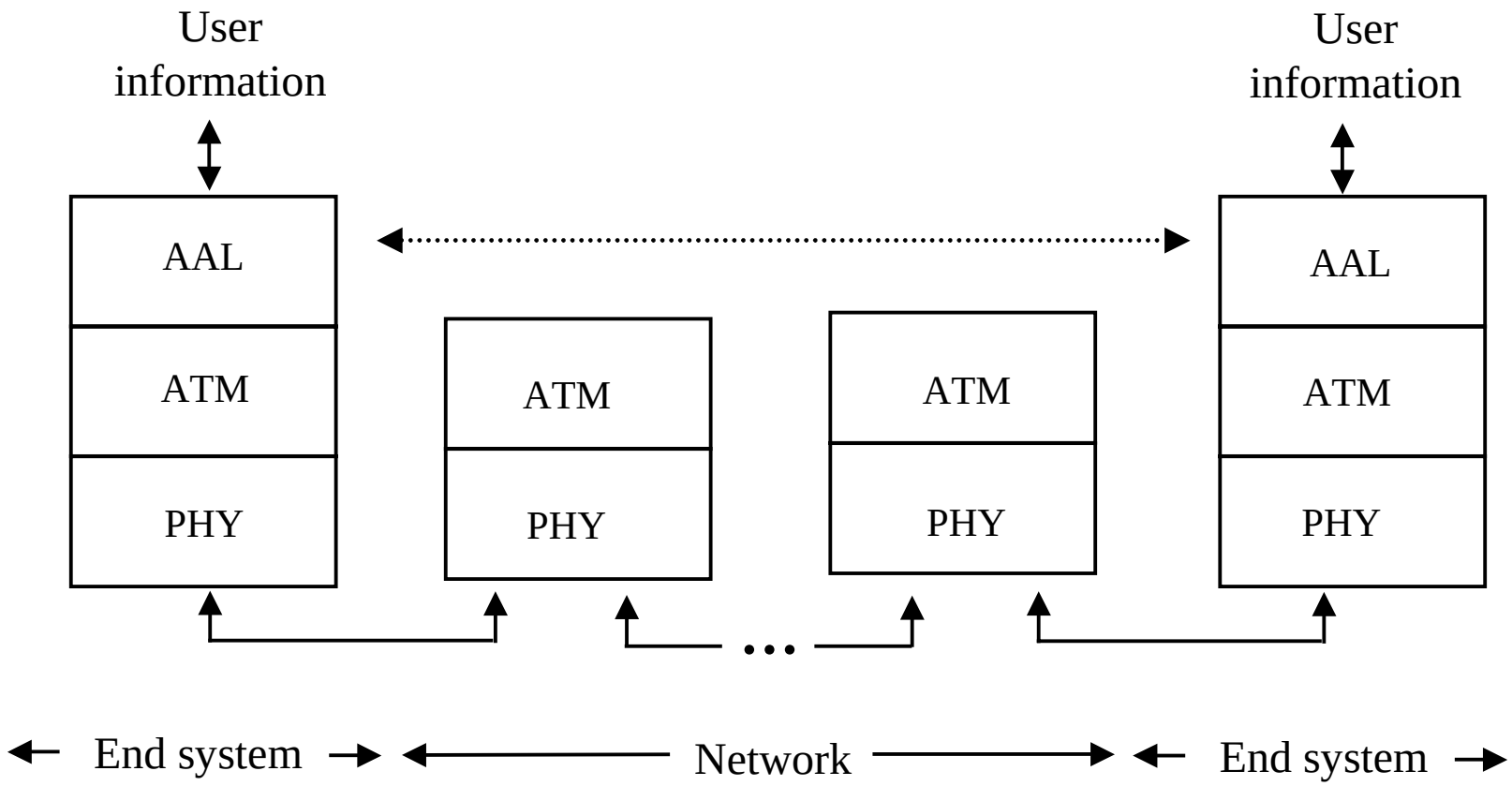

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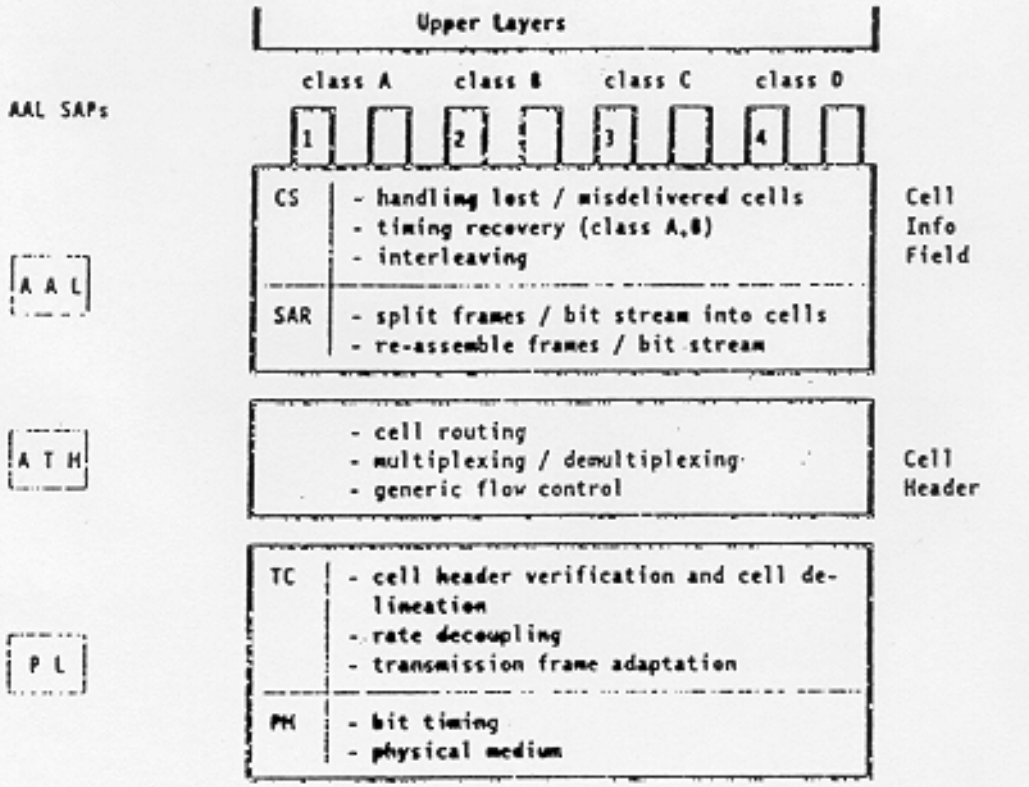
Original ATM Architecture

- CCITT envisioned four classes of applications (A-D) requiring four distinct adaptation layers (1-4) which would be *optimized* for an application class:

A. Constant bit-rate applications CBR
B. Variable bit-rate applications VBR
C. Connection-oriented data applications
D. Connectionless data application

ATM Architecture

- The AAL is further divided into:
  - The Convergence Sublayer (CS) – to manage flow of data to and from SAR sublayer.
  - The Segmentation and Reassembly Sublayer (SAR) – responsible for breaking data into cells at the sender and reassembling cells into larger data units at the receiver.



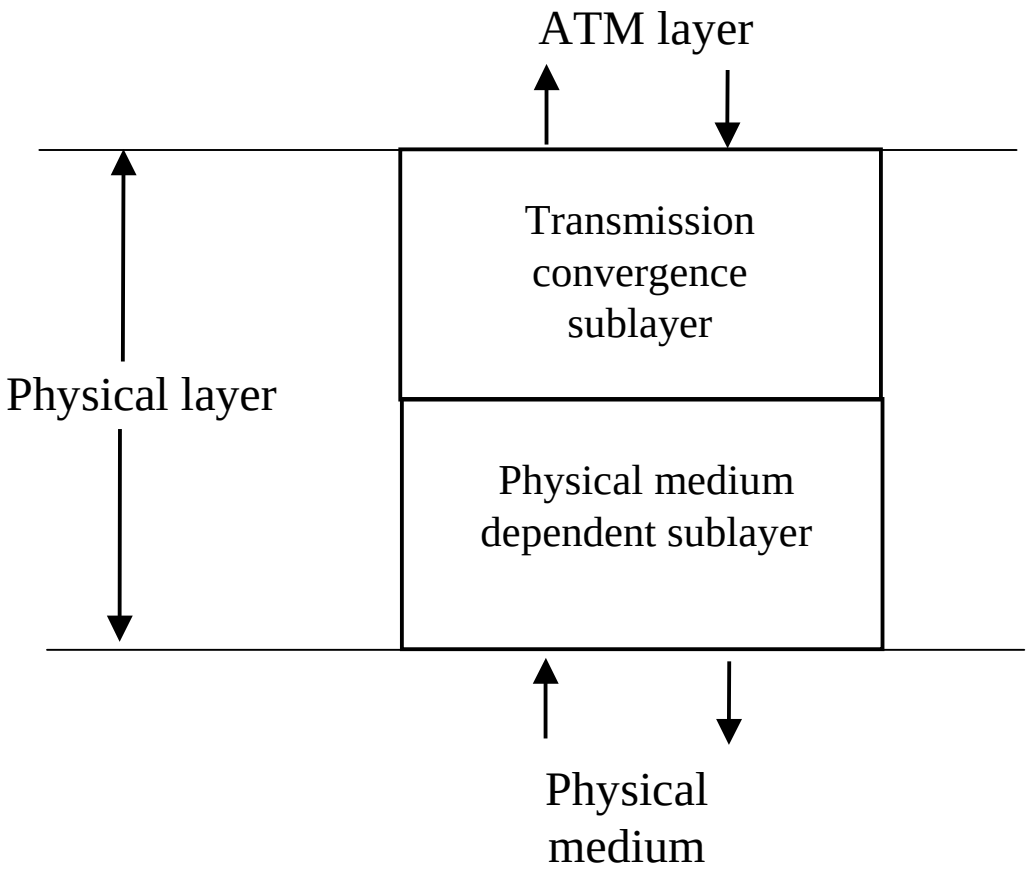
Abbreviations

AAL	ATH Adaptation Layer
SAR	Segmentation And Reassembly
CS	Convergence Sub-layer
PL	Physical Layer
TC	Transmission Convergence
PH	Physical Medium

SERVICE CLASSES for AAL

classe	type
A	Constant Bit Rate
B	Variable Bit Rate
C	Connection Oriented Data
D	Connectionless Data

I. Protocol Reference Model in the User Plane. See Section 4.1 for AAI SAP classes (A to D) and values (1 to 4).



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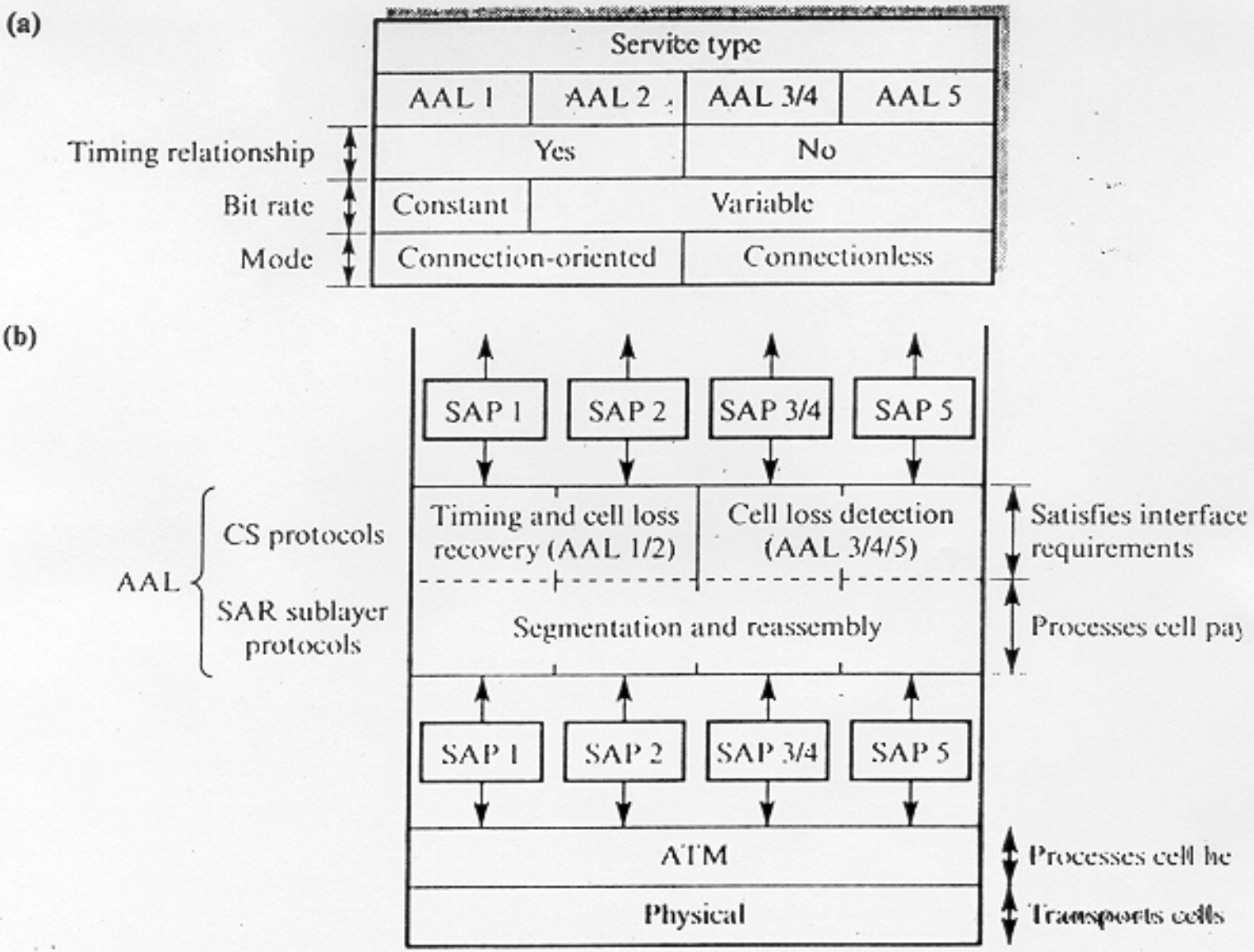
ATM Architecture {original}

- The AAL interface was initially defined as classes **A-D** with SAP (service access points) for **AAL1-4.**
- **AAL3** and **AAL4** were so similar that they were merged into **AAL3/4.**
- The data communications community concluded that **AAL3/4** *was not suitable* for data communications applications and they pushed for standardization of **AAL5 (also referred to as SEAL – the Simple and Efficient Adaptation Layer).**
- **AAL2 was not deployed.**


(a)
Service type
AAL 1
AAL 2
AAL 3/4
AAL 5
Timing relationship
Yes
No
Bit rate
Constant
Variable
Mode
Connection-oriented
Connectionless
(b)
SAP 1
SAP 2
SAP 3/4
SAP 5
AAL
CS protocols
SAR sublayer protocols
Timing and cell loss recovery (AAL 1/2)
Cell loss detection (AAL 3/4/5)
Segmentation and reassembly
Satisfies interface requirements
Processes cell pay
SAP 1
SAP 2
SAP 3/4
SAP 5
ATM
Physical
Processes cell he
Transports cells
CS = Convergence sublayer
SAR = Segmentation and reassembly

ATM Service Categories {revised}

Class	Description	Example
CBR	Constant Bit Rate	T1 circuit
RT-VBR	Real Time Variable Bit Rate	Real-time videoconferencing
NRT-VBR	Non-real-time Variable Bit Rate	Multimedia email
ABR	Available Bit Rate	Browsing the Web
UBR	Unspecified Bit Rate	Background file transfer

QoS, PVC, and SVC

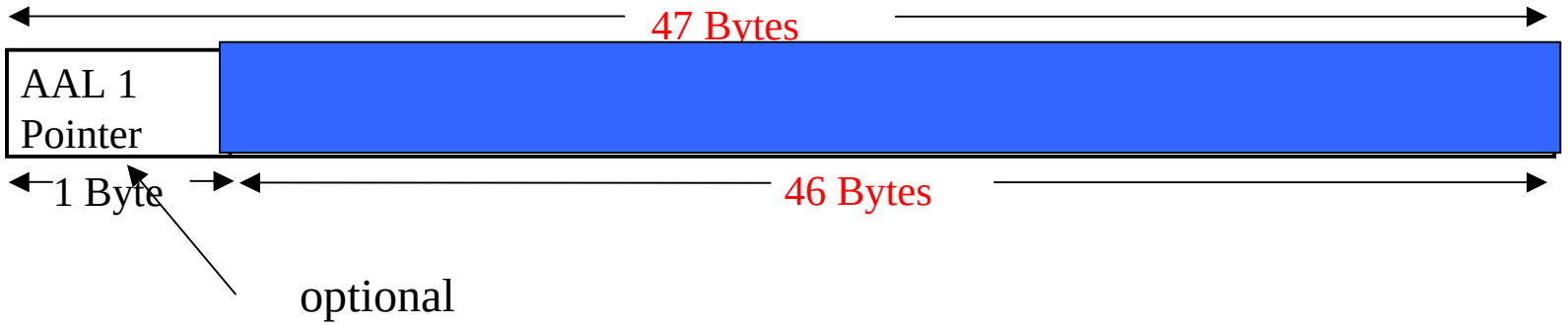
- Quality of Service requirements are handled at connection time and is viewed as part of *signaling*.
- ATM provides permanent virtual connections and switched virtual connections.
  - Permanent Virtual Connections (PVC)

    permanent connections set up *manually* by network manager
  - Switched Virtual Connections (SVC)

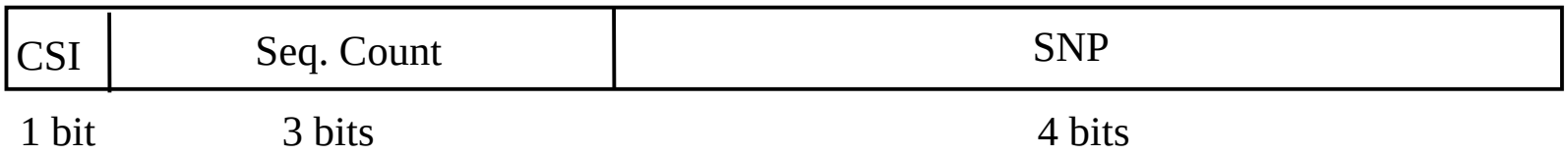
    set up and released *on demand* by the end user via signaling procedures.

AAL 1 Payload

(b) CS PDU with pointer in structured data transfer



(a) SAR PDU header



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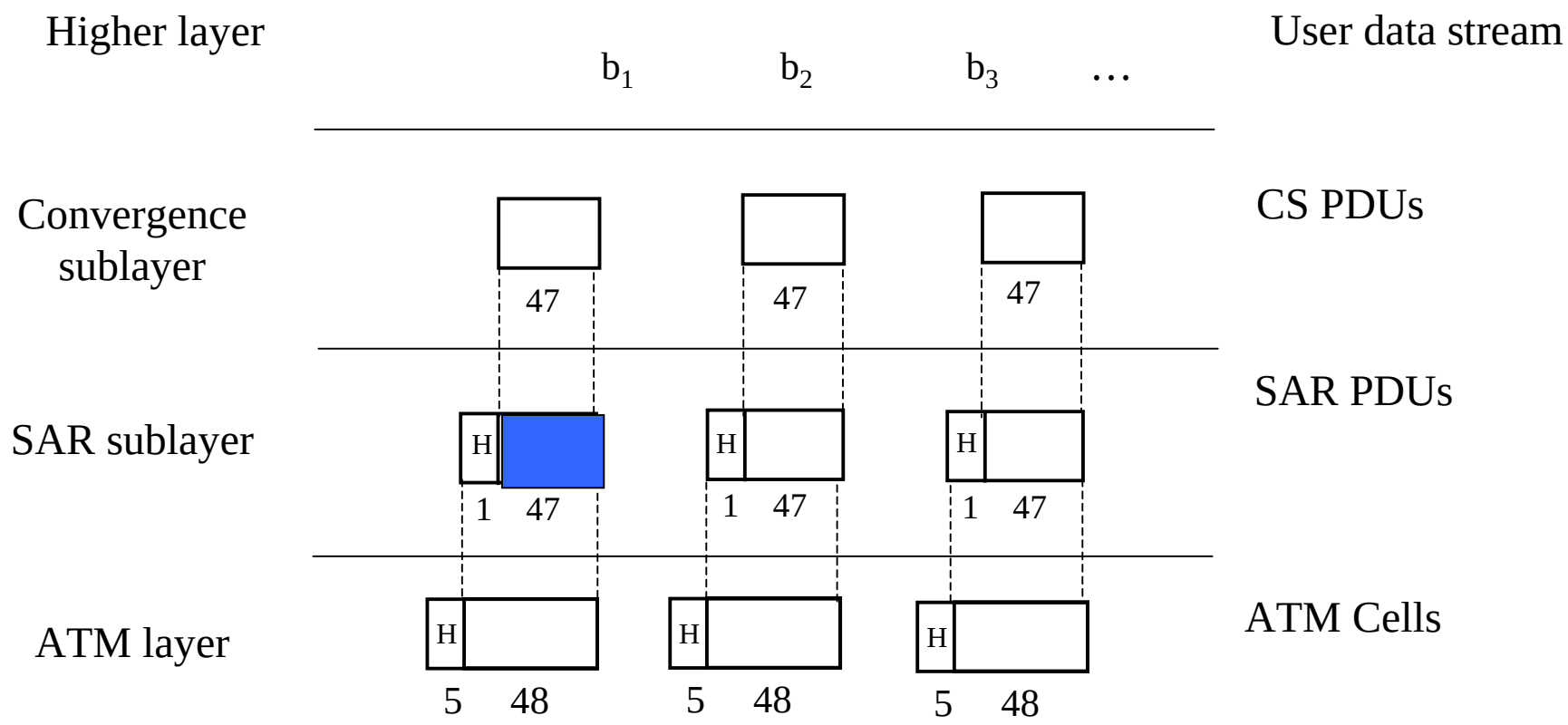
AAL 1



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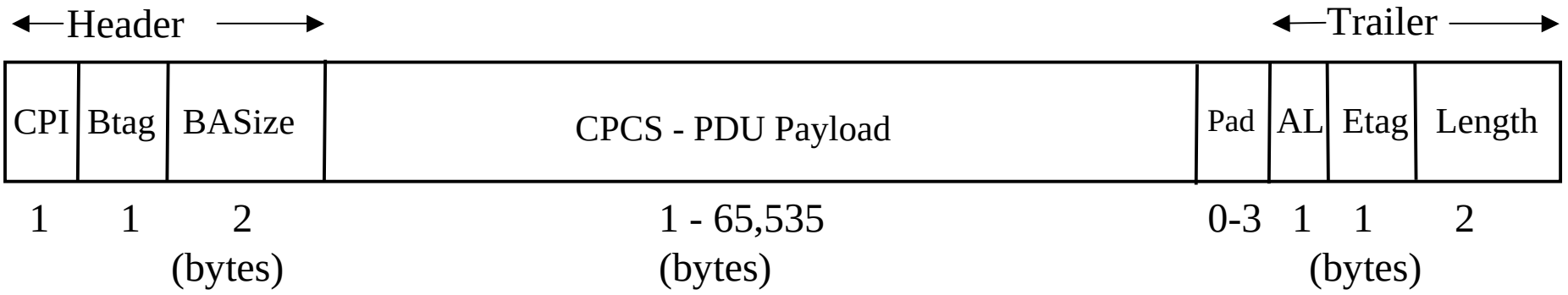
Leon-Garcia & Widjaja: *Communication Networks*

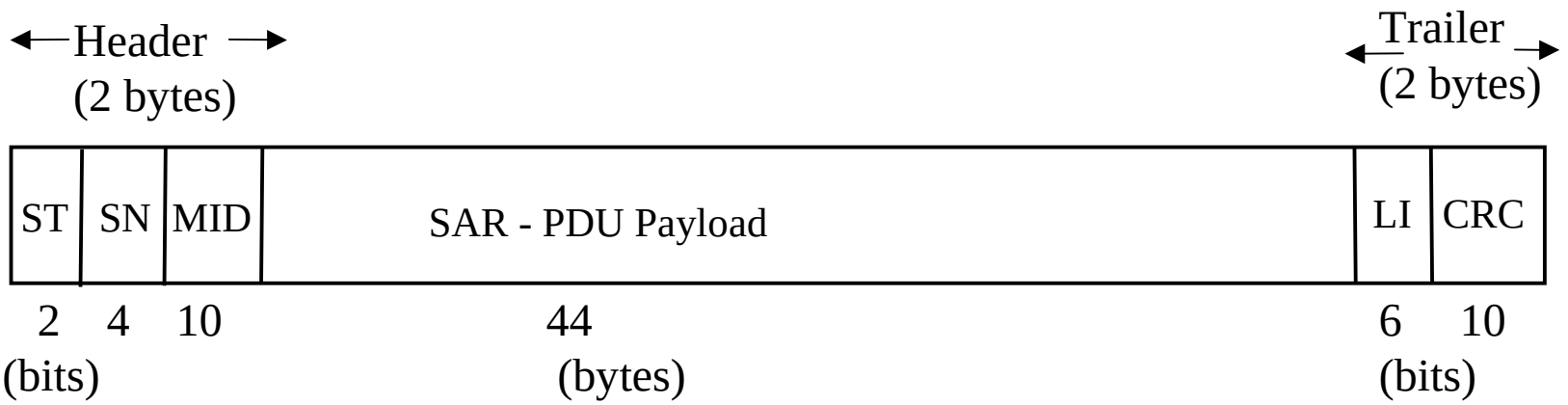
Figure 9.10

AAL 3/4
CS and SAR PDUs

(a) CPCS-PDU format



(b) SAR PDU format



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AAL 3/4

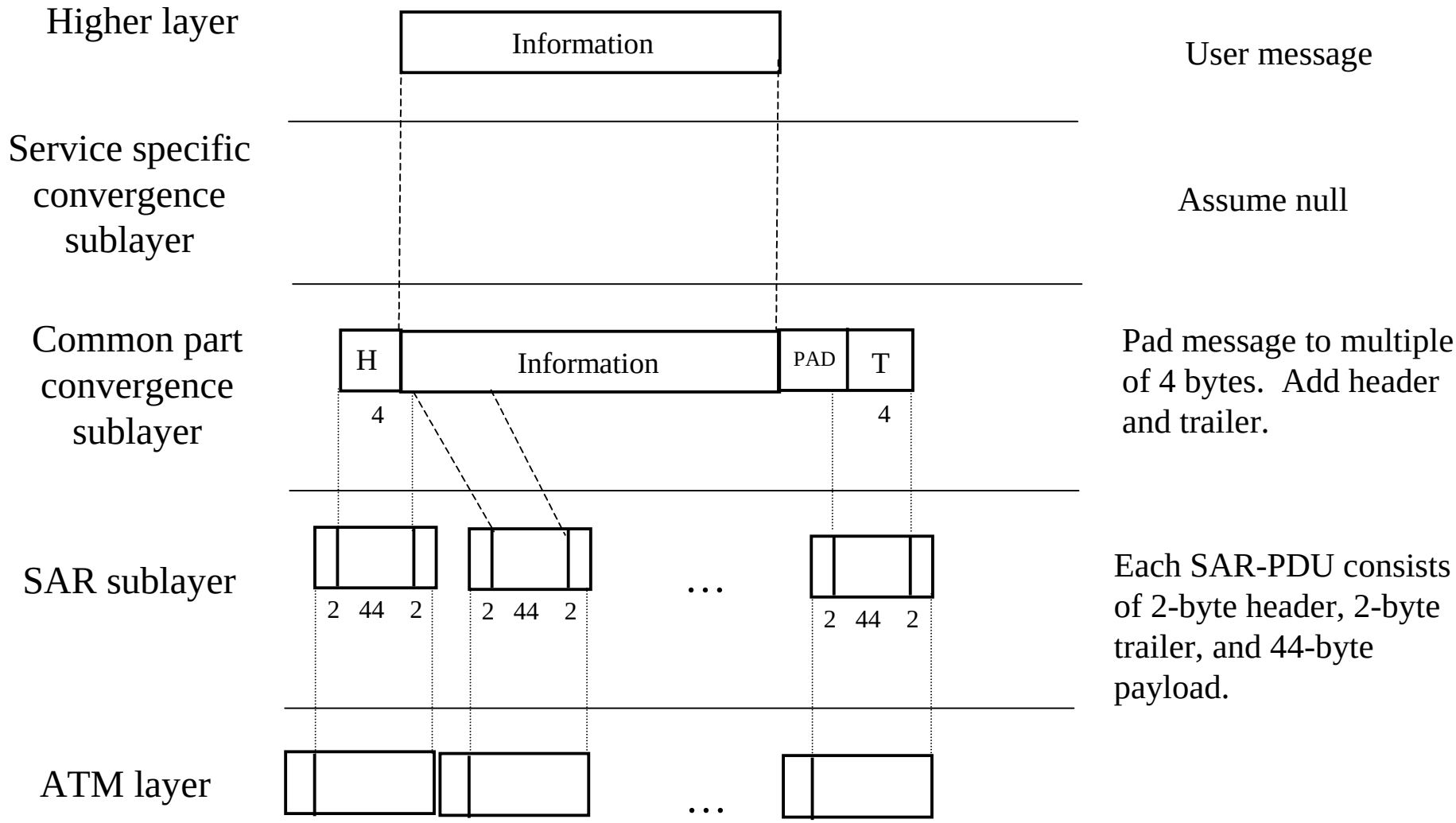

Figure 9.15

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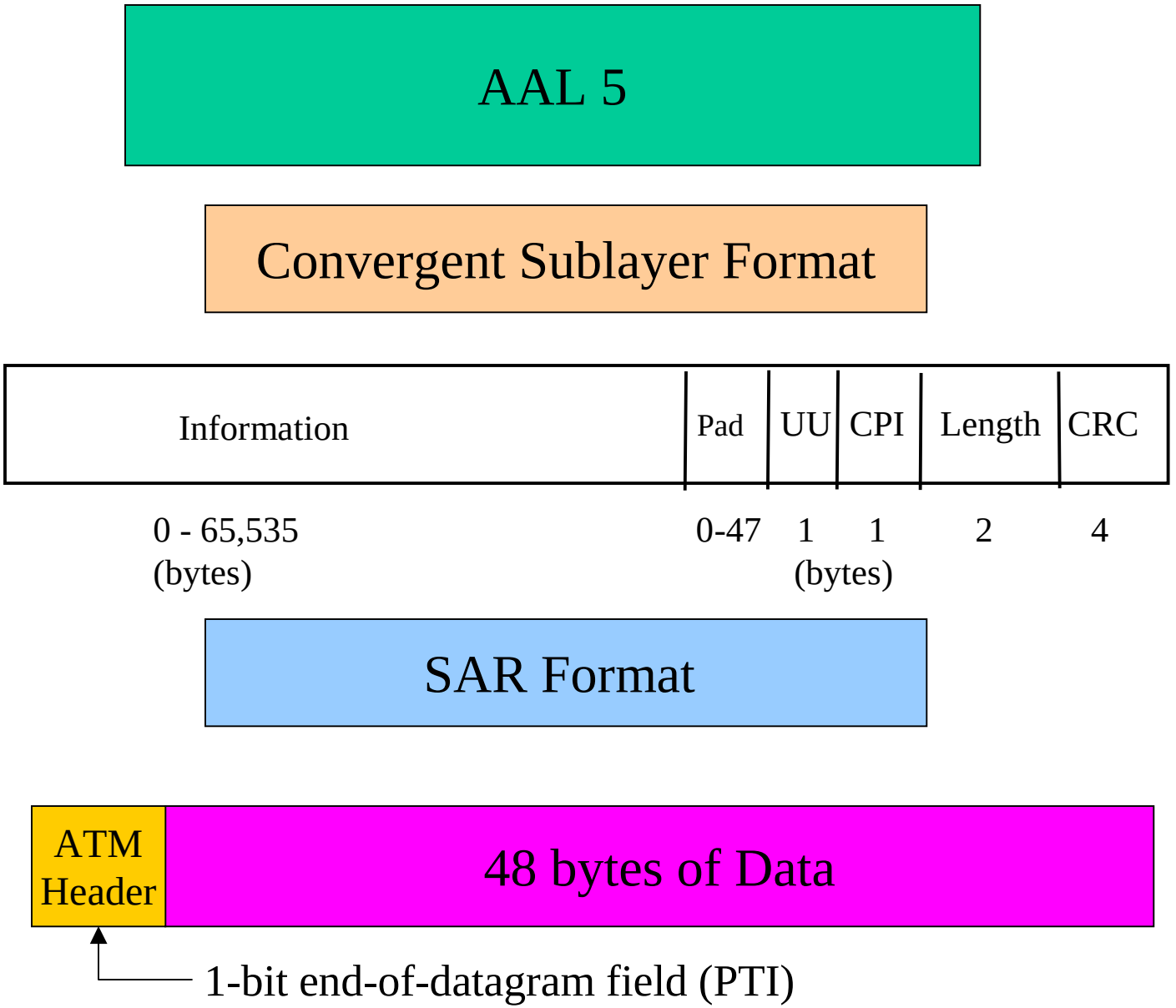

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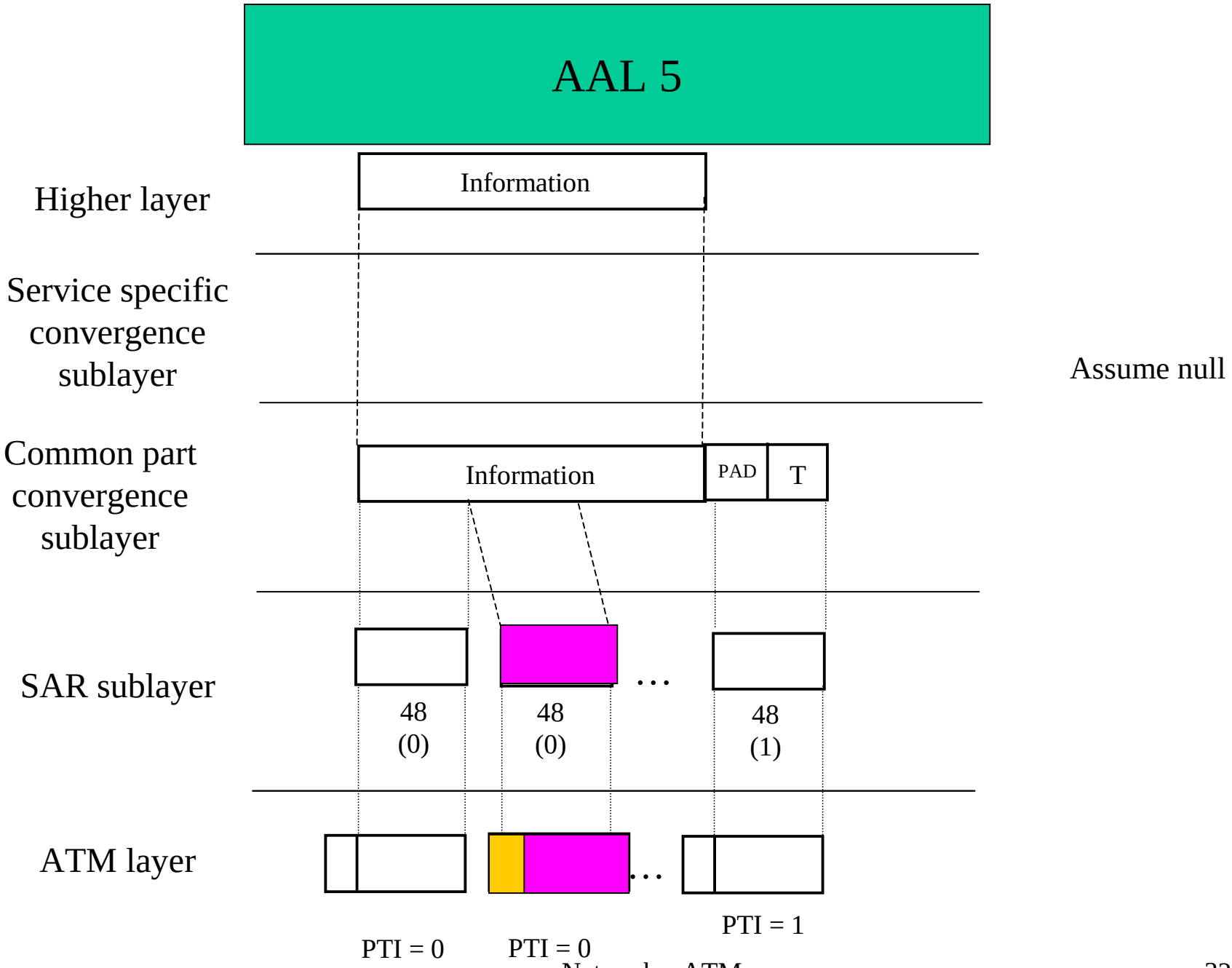

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