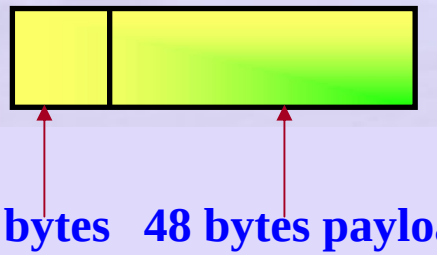
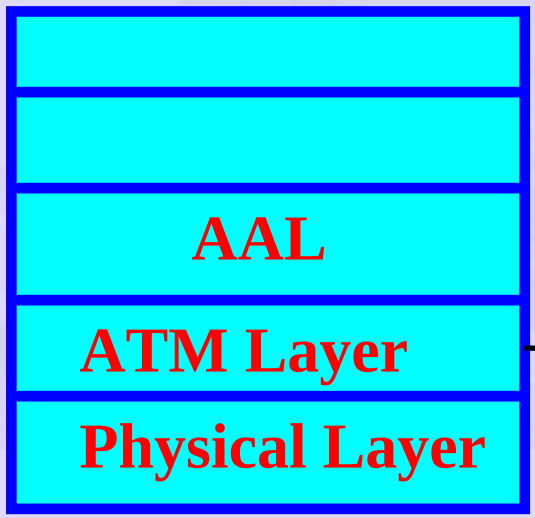
ATM – Asynchronous Transfer Mode

- No master clock
- Virtual circuits
- Cell based – Cell switching
- Fixed size cells 53 bytes



Handles both constant, variable rate traffic

ATM in a LAN

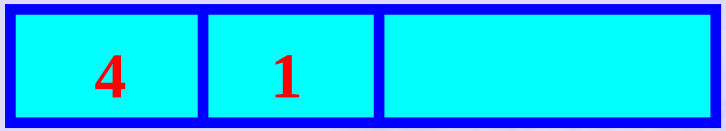


Layout of cells and what header field means.
establish and release VCs

DLL --ATM

- ATM –
  - order of cells maintained
  - some cells dropped
  - connection oriented
- First call: setup connection subsequently all follow same path
- In ATM – only HEC
  - higher layers to take care of rest

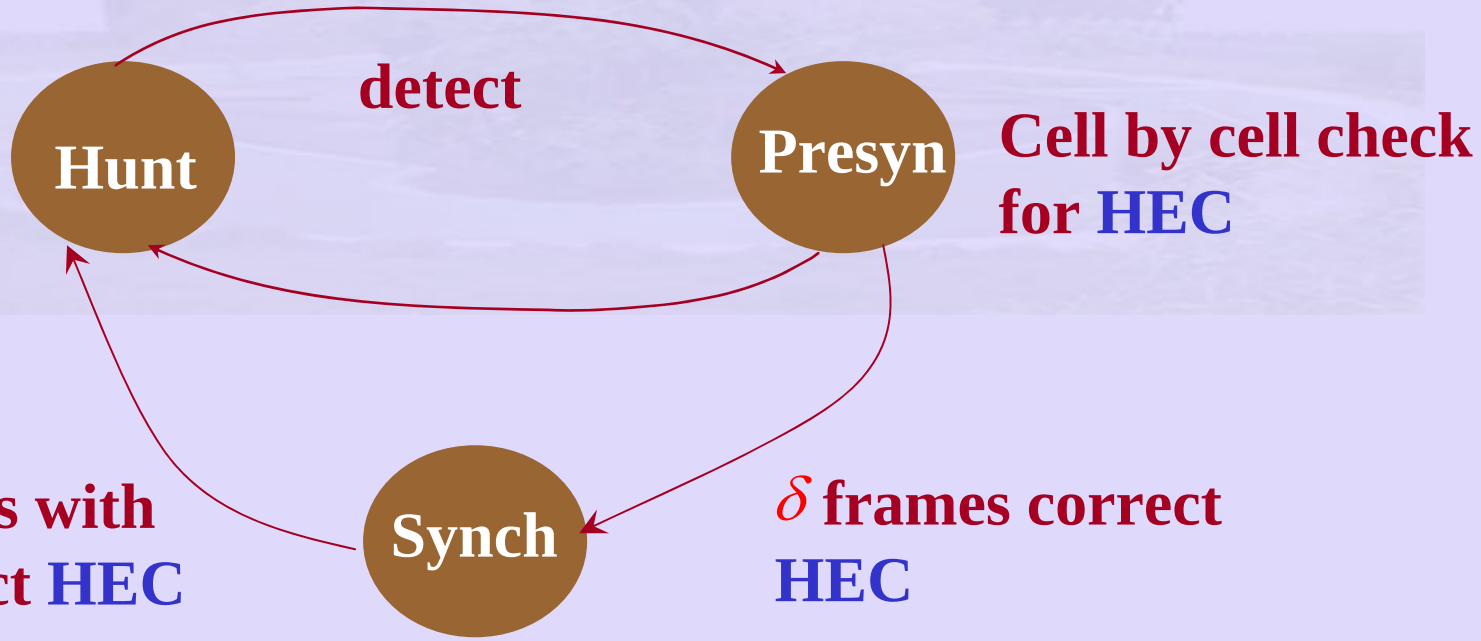
Error Checking in ATM



header

1 byte checksum

Bit by bit check – correct HEC



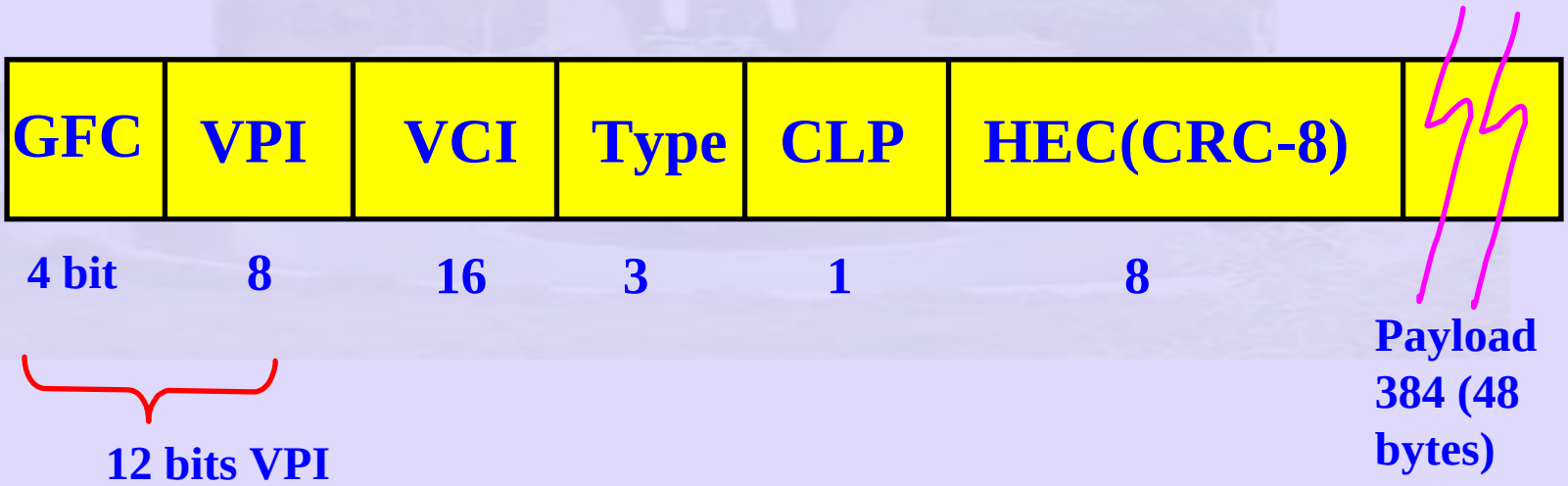
Cell Switching in ATM

- high speed switching technology
  - embraced by the telephone NW
  - connection oriented packet switched technology
  - use signalling for connection setup
  - allocate resources at the switches along the circuit

Fixed Cell Size in ATM

- 53 bytes (48 byte payload + 5 byte header)
  - facilitate hardware switchin
  - all packets same length
  - large number switch in parallel possible.
  - Queues – tied only until packet transmission
  - Queues tend to be smaller – packet buffereds

ATM Cell Format



ATM Cell Format

- GFC – generic flow control
  - means to arbitrate access to a link on a shared medium to
- ATM connection.
  - VPI: Virtual Path ID
  - VCI: Virtual Circuit ID
  - VPI + VCI together identify a VC uniquely

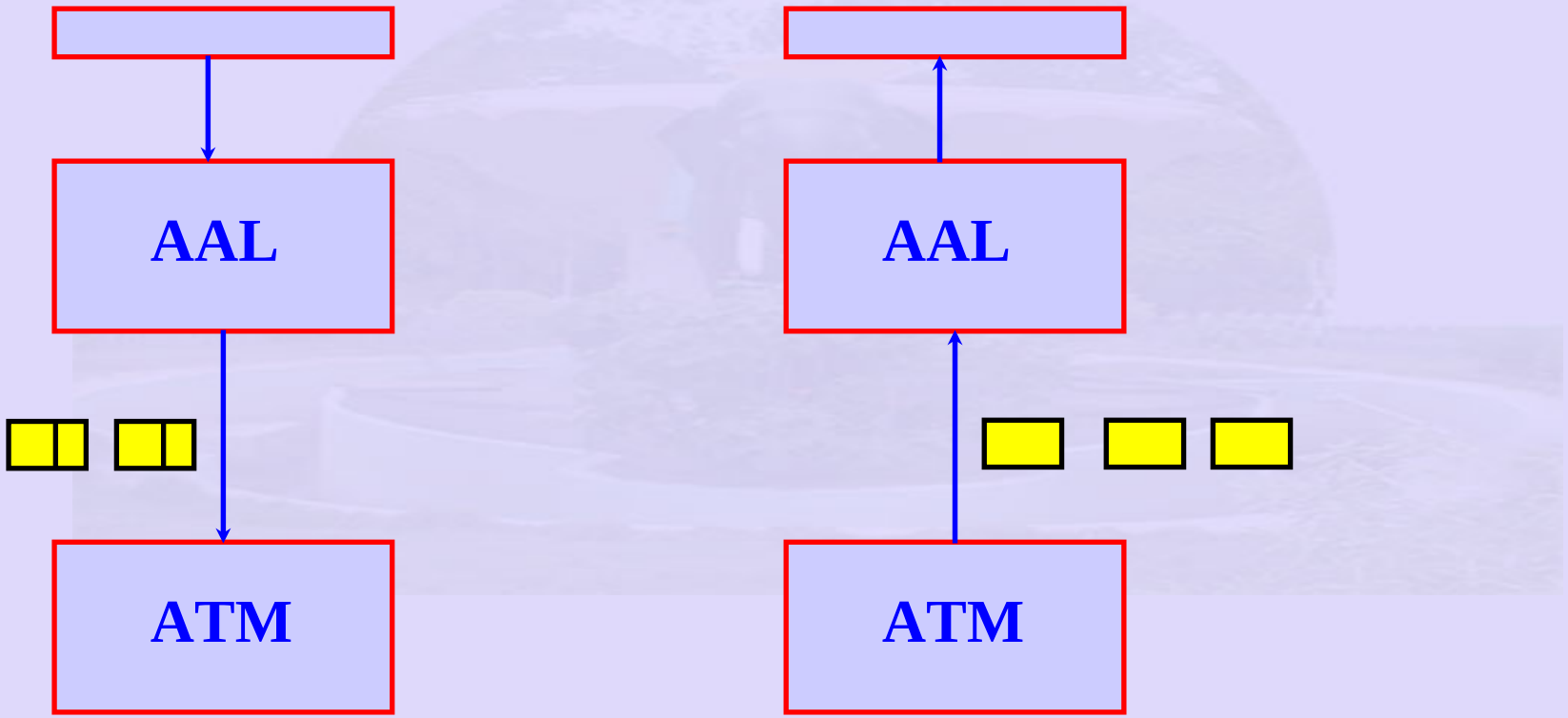
ATM Cell Format

- Type: 3 bits
  - First bit
    - 4 of them first bit set
      - management function
    - First bit clear
      - user data
  - 2nd bit – EFCI (Explicit Forward Congestion Indication – set by a congested switch)
  - 3rd bit – primarily along with AAL for segmenting and reassembling purpose.

ATM Cell Format

- CLP – Cell Loss Priority
  - user NE may set it to indicate that packet may be dropped
    - Overload
    - a cell dropped may not cause significant change in video data.

ATM Adaptation Layer



ATM Adaptation Convergence Sublayer (CS-PDU)

- support fragment high level message into low level packets.
- Transmit low level packets
- Reassemble packets
- fragmentation and reassembling (segmentation and reassembling in ATM)

Different types of AALs

- 1, 2 – support voice / video application
  - applications require guaranteed bit rate.
- 3, 4 – support packet data running over ATM
- 3 – connection oriented packet services (X25)
- 4 – connectionless packet services (IP)
- AAL 3/4 : Support both connectionless and connection oriented
- AAL5 – overcome Shortcomings of AAL 3/4
- 1, 2, 3/4, 5 – four AALs in existence

AAL3/4

- support fragmentation and reassemble for variable length
- packet transported across ATM Network.
- a new layer introduced and a new PDU.
  - CS -PDU – encapsulates a variable length PDU and prior to segmenting them.
  - CS-PDU then segmented into ATM cells.

CS-PDU Format

CPI – Common Part Indicator (Version of CS – PDU format only version 0 defined)

Btag – Beginning tag – to match

Etag – End tag – prevent loss of cell of one PDU merged with lost beginning of next PDU

BAsize – Buffer size for reassembling (not actual size since sender may not know actual size of PDU at transmission time of header.

Pad – 3 bytes – multiples of 3
Pad user data is multiple of 3 bytes.

AAL 3/4 Cell Format

Additional – header & trailer in each cell
CS-PDU segmented into 44-byte chunks
AAL3/4 header+trailer makes it 48 bytes
Becomes payload of ATM Cell

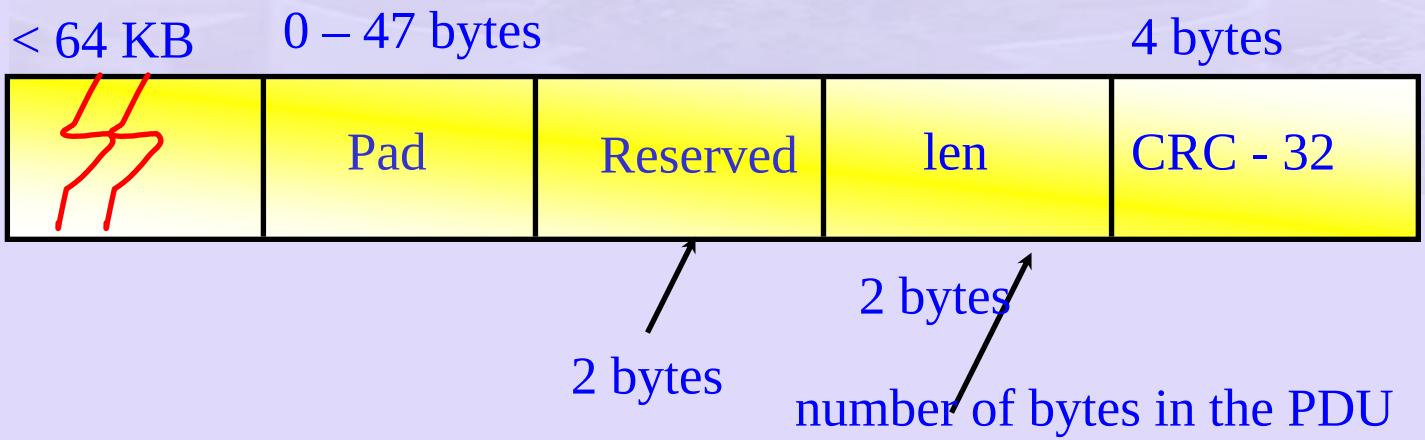
Type Field

Value	Name	Meaning
10	BOM	Beginning of message
00	COM	End of Message
11	SSM	Single Segment Message

MID – support multiplexing of several PDUs

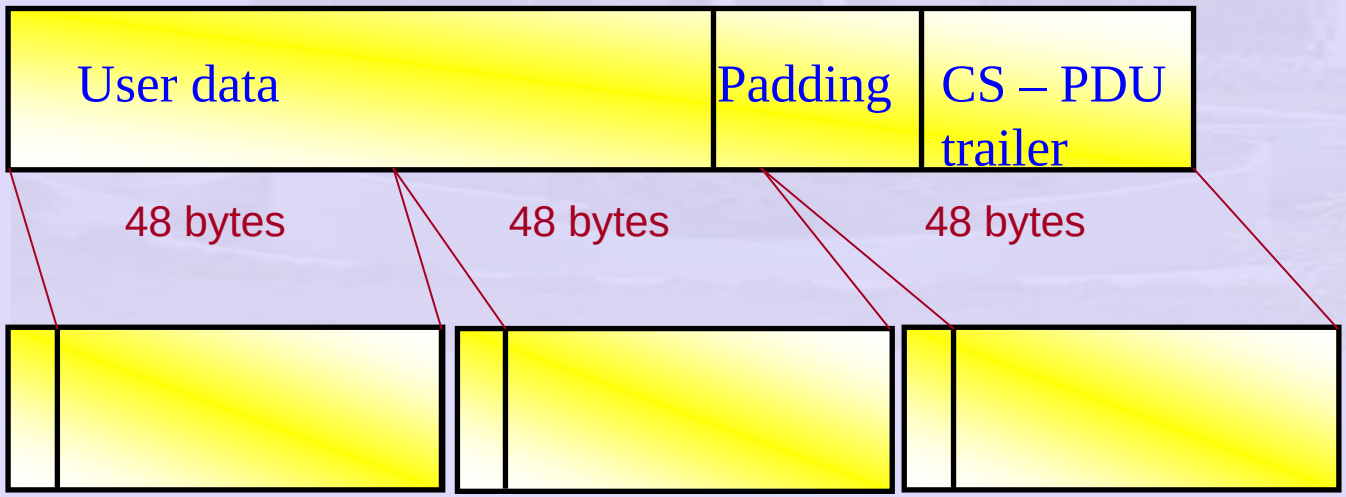
Encapsulation and segmentation for AAL5

- AAL 3/4 overhead 9 bits/cell
- ATM AAL5 packet format
  - Reduces overhead



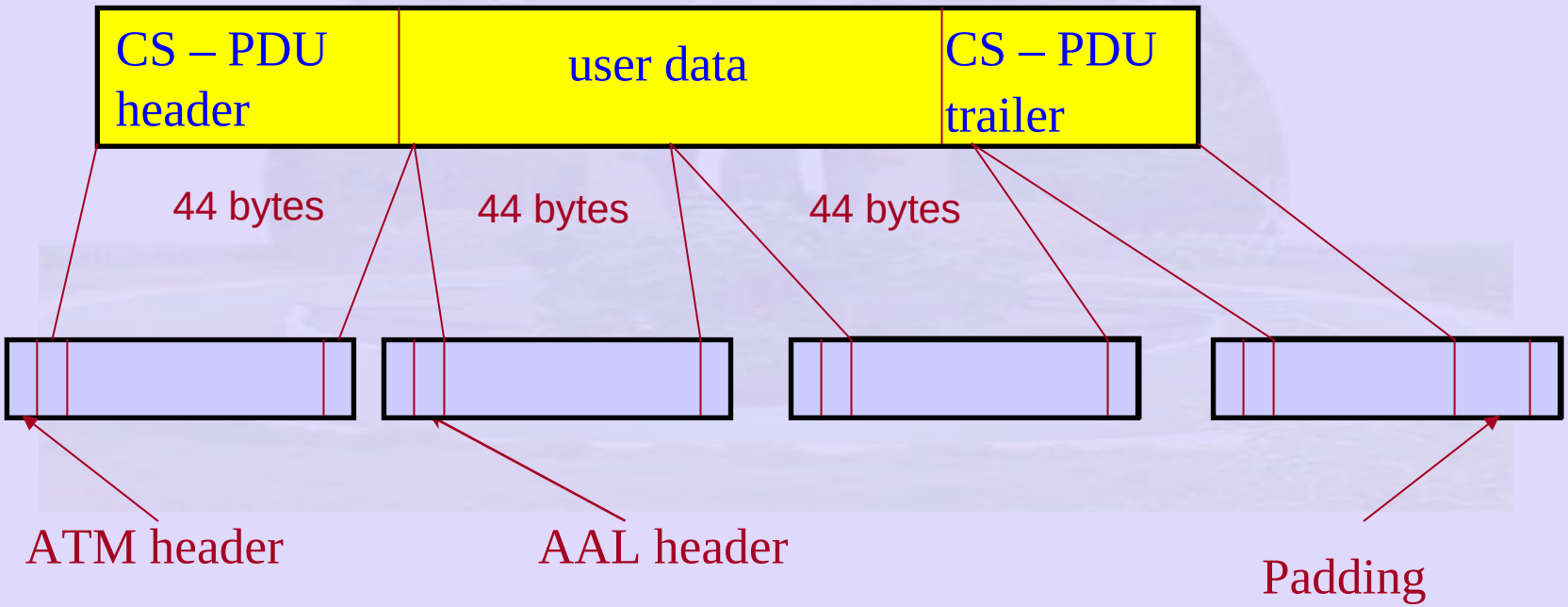
Encapsulation and segmentation in AAL5

- Overheard – 2bit type in AAL3/4 replaced by 1bit – indicates last cell of PDU



does not support MID

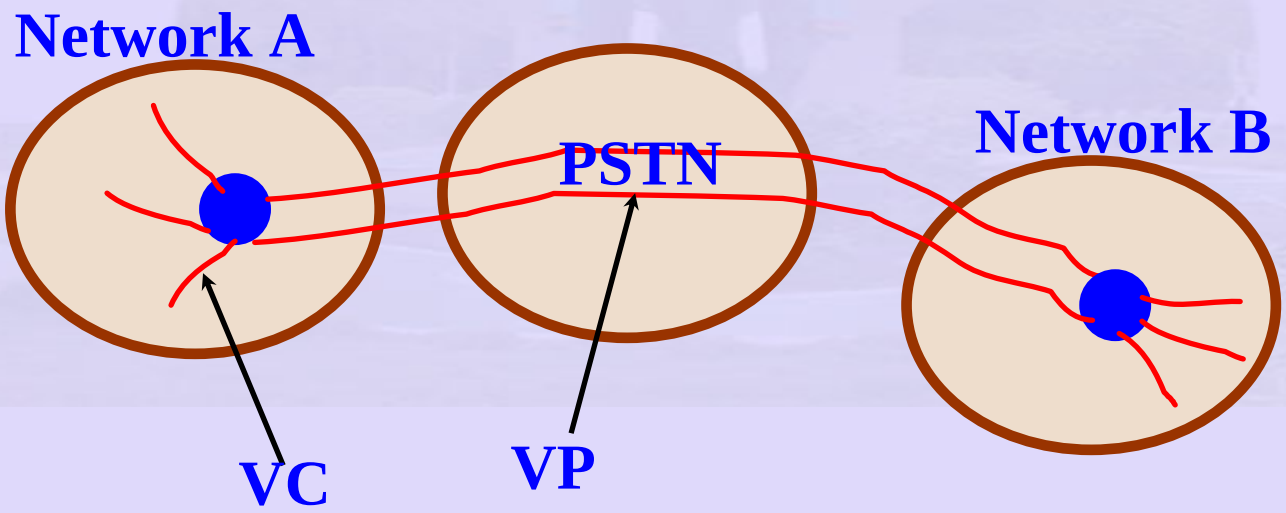
Encapsulation and Segmentation for AAL3/4



Virtual Path

- Multiple VCs through same path.
- PSTN uses only VP to switch.
- Receiving Network uses both VP & VC to switch
- VP: Bundle of VCs
  - advantage:1000s of VCs across public NW, switches in public NW think it is only one connection

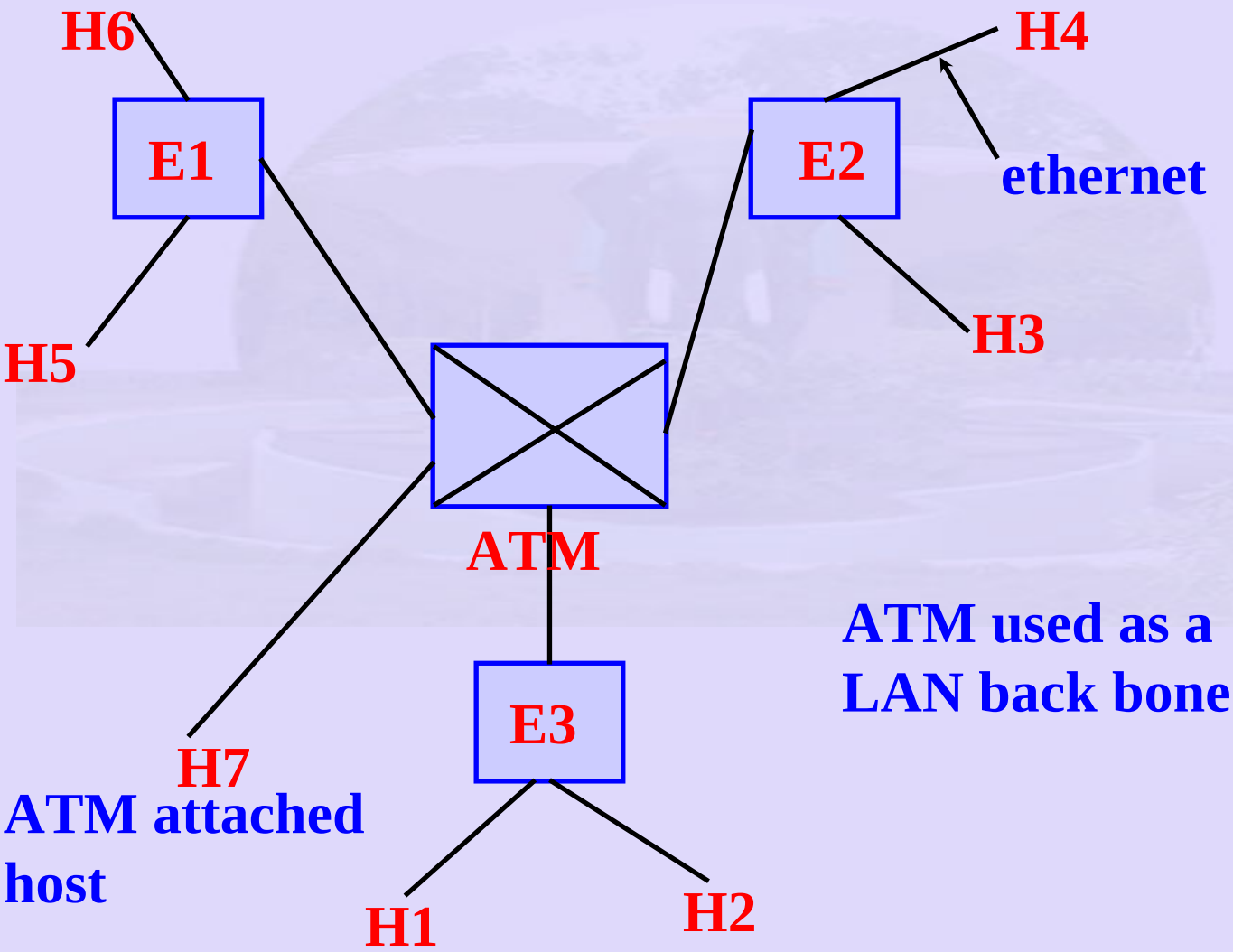
Virtual Path



Physical Layer for ATM

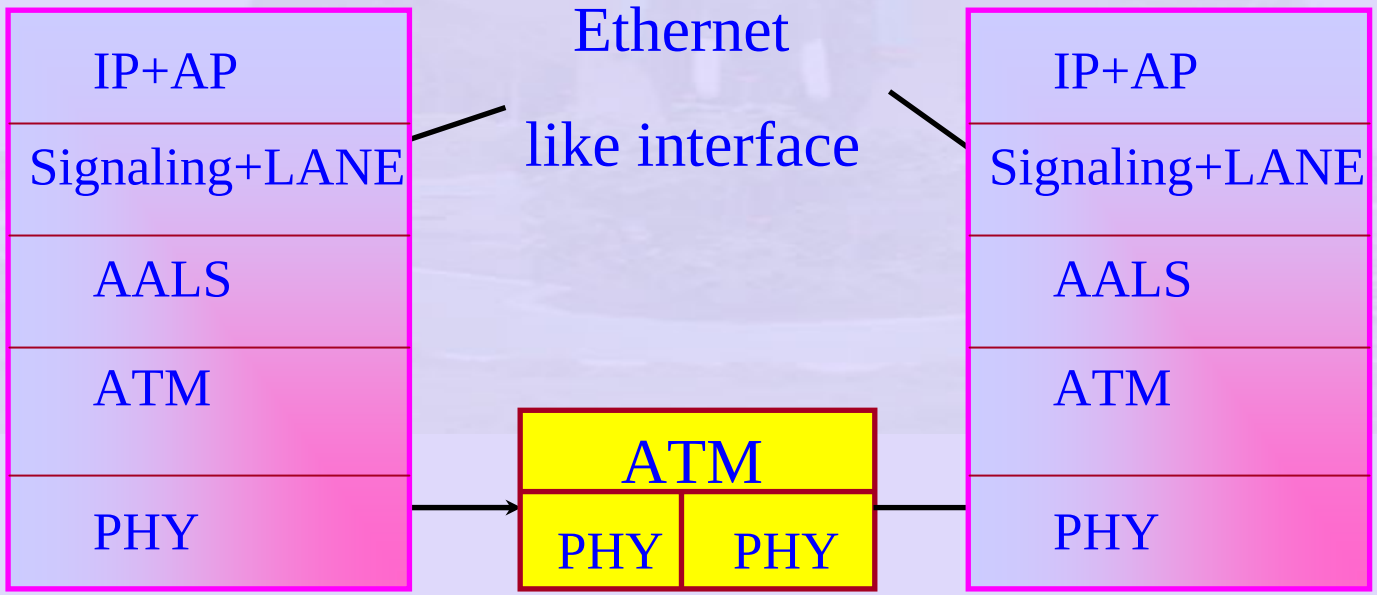
- Can run over different physical media
- HEC for header error control
- ATM for Fibre, wireless also being defined

ATM – Best Suited for the backbone Network

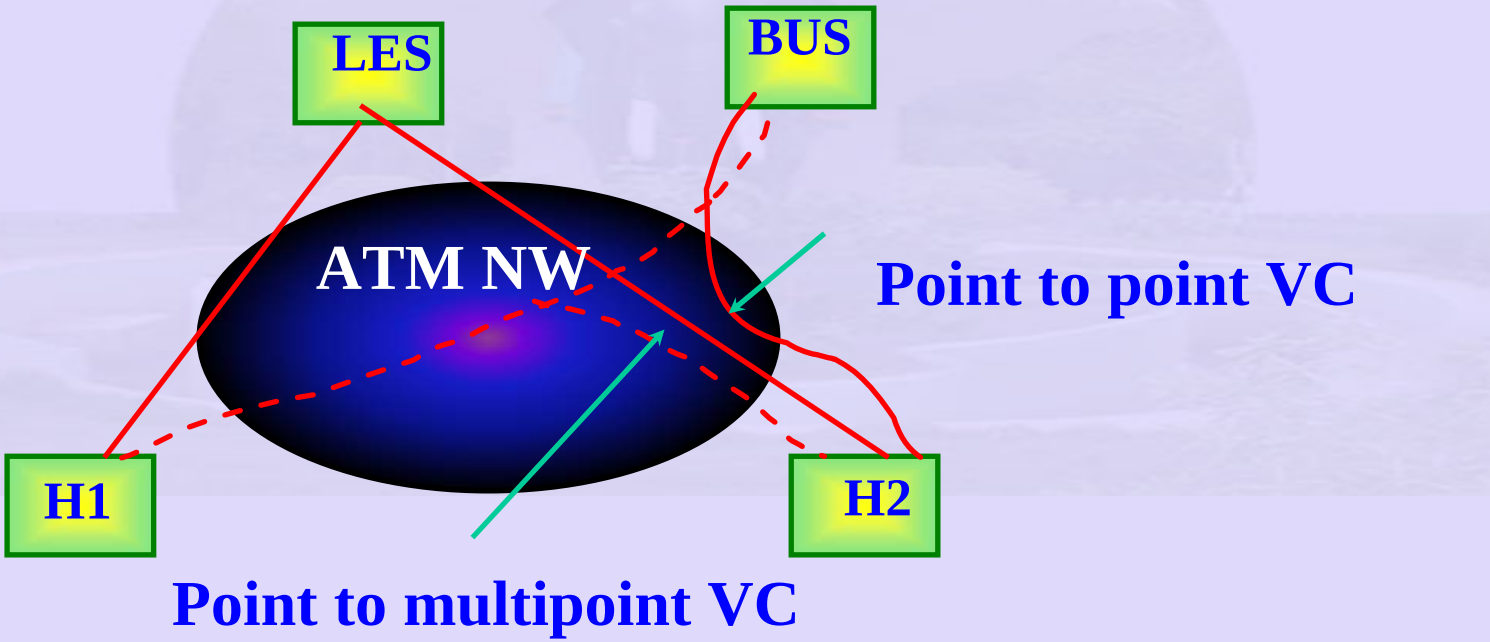


ATM in a LAN

- LAN Emulation - LANE



ATM Network



ATM Network

- LECS (LAN emulation Configuration Server):
  - enables a newly attached or rebooted LEC (LAN emulation client)
- Hosts find LECS
  - permanent VC – or prior knowledge of the LECS ATM address
  - setup VC
  - LECS tells what kind of LANE, address of LES

ATM Network

- LECs sets up connection to LES
- LEC registers its address with LES (MAC + ATM)
- LES – gives ATM address of BUS
- BUS – maintains single point to multipoint VC that connects to all registered clients.
- LEC – has ATM address of BUS
  - signals for connection to BUS
  - Now LEC connected to transfer data!
- BUS – used for multicast packets
- Unicast packets -new attached host does not know VC

ATM Network

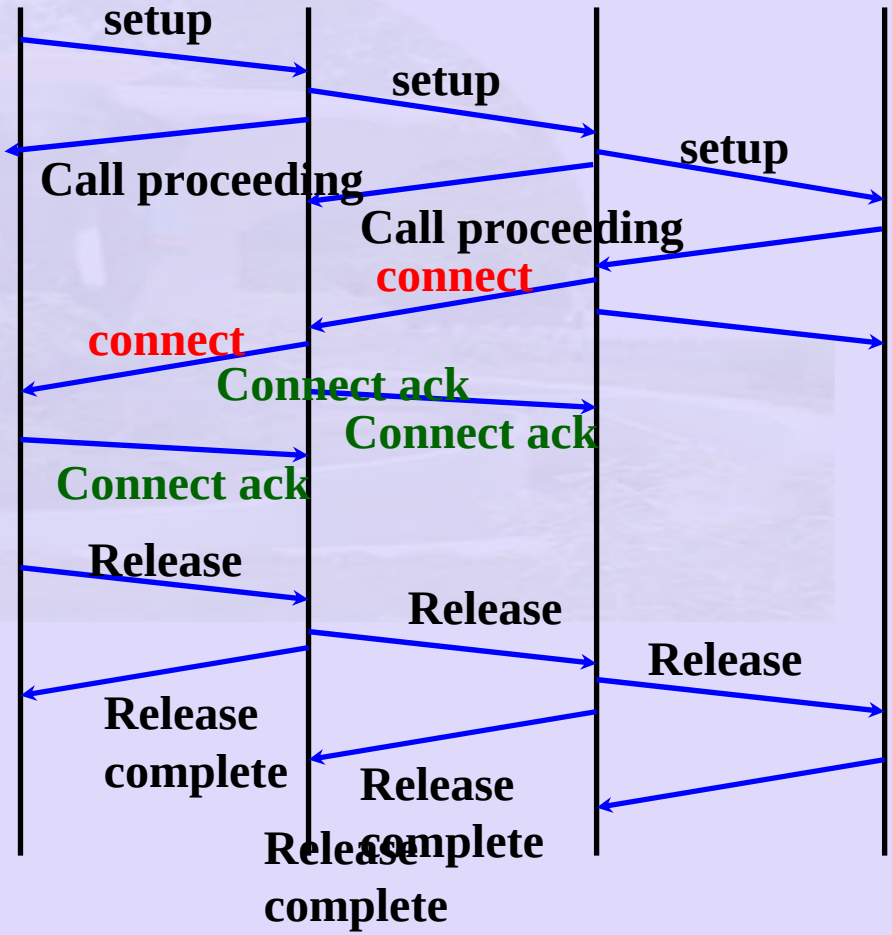
- Host performs:
  - send packet to BUS – to transfer packets using point to multipoint VC
  - address resolve request to LES – MAC address correspond to which ATM address?
  - Once address resolved
    - signal for VC to use to forward subsequent frames.
  - BUS used – to minimise delay – LES +VC
  - LANE – also supports reordering of out of order packets
  - too many VCs → host should dispose VCs not in use

ATM Call Setup

Switches

Permanent virtual circuit

Call setup for connection



ATM (contd.)

Two level hierarchy:

VP and VCs

A bundle of VCs

Reroute entire VP