Asynchronous Transfer Mode (ATM)

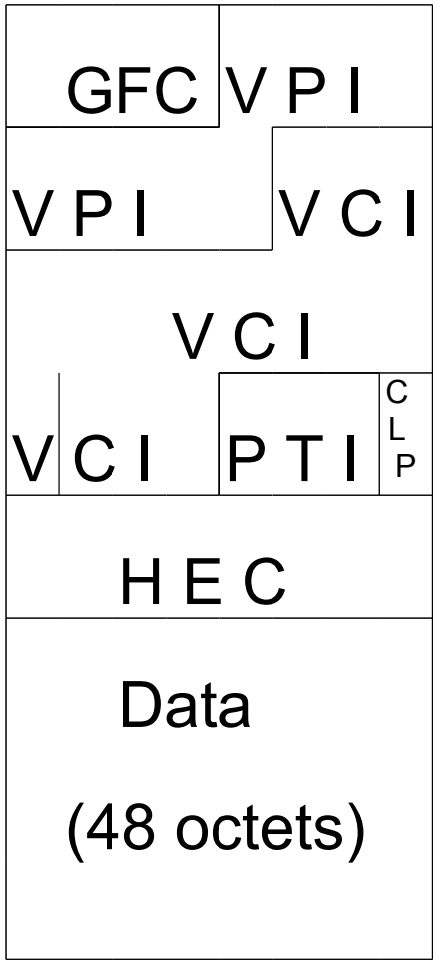
"Ordinary" message formats are inefficient or difficult to handle because –

- It may be difficult to decide on length (count, delimiters, etc)
- Checksumming all messages at all levels is expensive
- Small urgent messages may be delayed behind large unimportant ones
- Header and message delimiters waste space

Therefore

use small packets of constant size and minimum overhead (no delimiters or counts and minimal checksum)

ATM cell format



GFC = Generic Flow Control (4 bits)

VPI = Virtual Path Identifier (8 bits)

VCI = Virtual Channel Identifier (16 bits)

PTI = Payload Type Indicator (3 bits), CLP = Cell Loss Priority 1 bit)

HEC = Header Error Control (8 bits)

Data or Payload

Always fixed at 48 octets

Cell fields

- GFC Generic Flow Control – allows user to specify flow control
- VPI Virtual Path Identifier – part of the Virtual Circuit Identifier; allows several VCIs to be "bundled" together and routed as a unit
- VCI Virtual Channel Identifier – part of Virtual Circuit Identifier
- PTI Payload Type – 4 system functions and 4 user functions.
- CLP Cell Loss Priority – marks cell for preferential discard in event of congestion
- HEC Header Error Control – CRC checksum over 5 header octets, using polynomial $x^8 + x^2 + x + 1$, gives error detection and some error correction.
- Payload Always 48 octets.

User PTI (Payload Type Indicator)

Three bits — 0 *x y*

first bit is always 0 (signifies user)

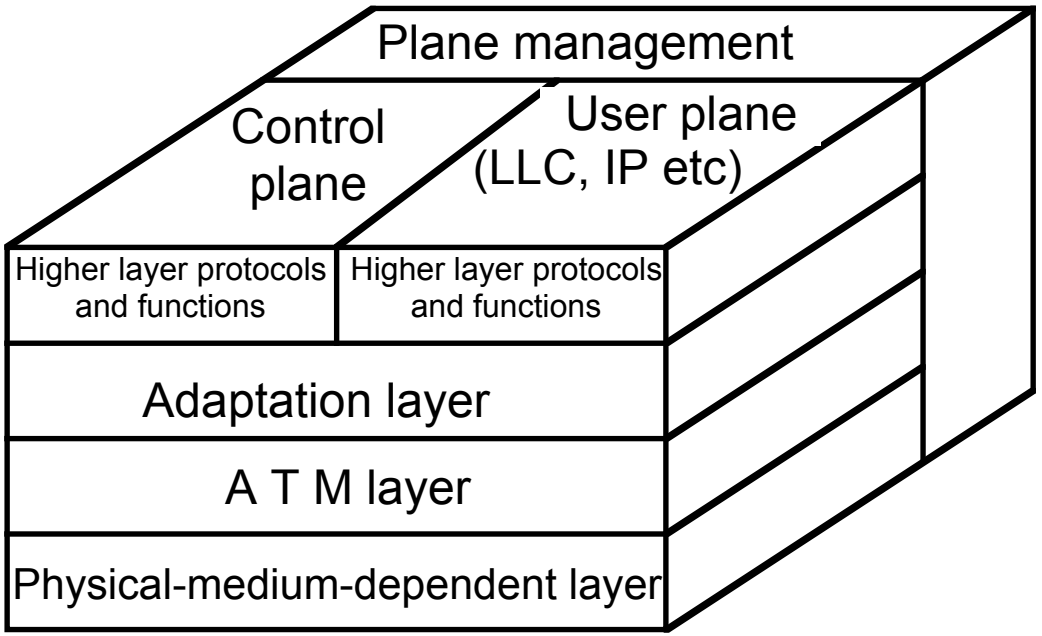
x, initially 0, set to 1 if congestion is encountered

y available for user indication

- ATM is like a Virtual Circuit. The type of connection is negotiated at call establishment and the AAL (Adaptation Layer – see later) and other attributes are associated with the Virtual Circuit.
- ATM is meant to provide all types of service – computer data, time-critical voice and video, constant and variable bit rate. … …

ATM Layering

- ATM can be a full Virtual Circuit-based network provider
- It often looks like a Physical/MAC layer, providing transport for IP etc



B-ISDN asynchronous transfer mode (ATM) protocol model

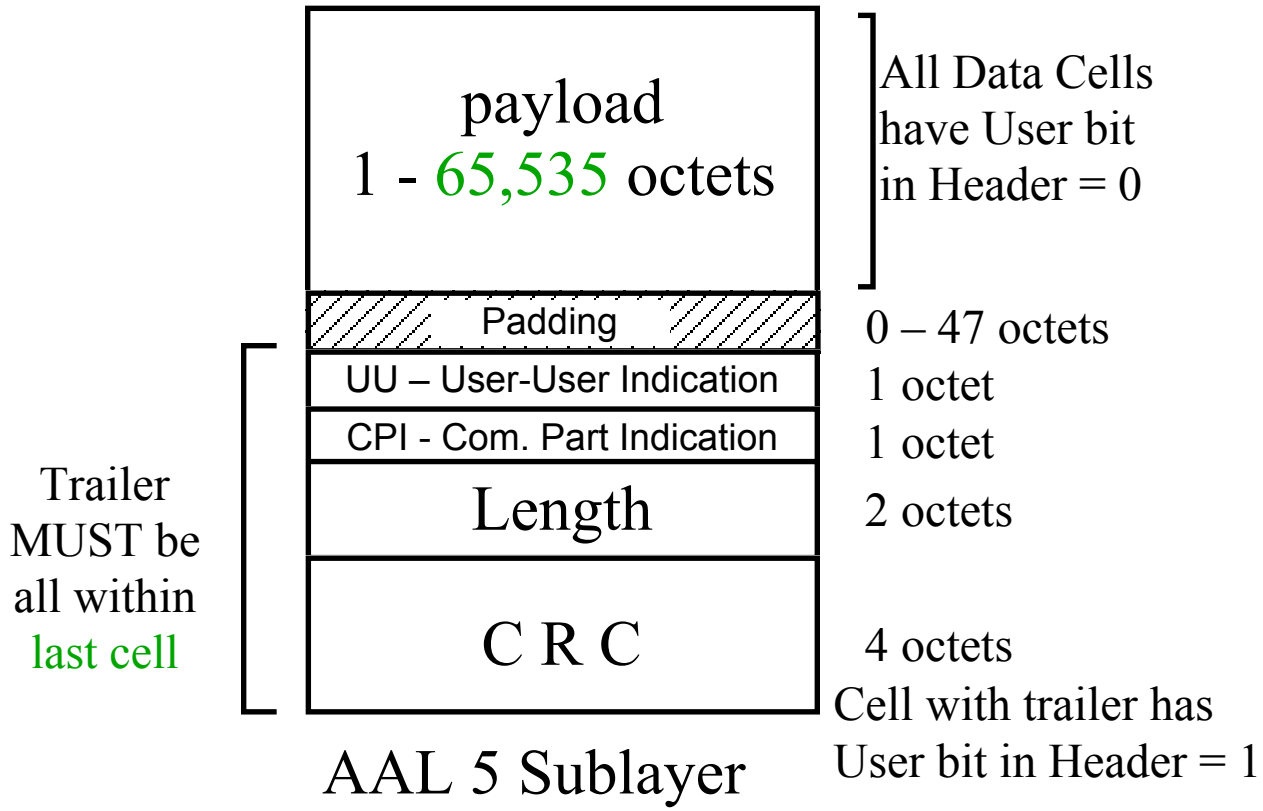
ATM Adaptation Layers

These provide combinations of constant or variable bit rate and connection or connectionless operation. Most are complex; we just look at AAL5.

AAL type	Bit rate	Connection mode	Other features	Uses
1	constant (CBR)	Connection oriented	Segmentation, cell loss & misdelivery, time-critical	fixed bit-rate simulation
2	variable (VBR)	Connection oriented	Segmentation, cell loss & misdelivery, time-critical	Video and audio
3	variable (VBR)	Connection oriented	bursty data services	Computer data transfer
4	variable (VBR)	Connectionless	bursty data services	Computer data transfer
5	variable (VBR)	either	"best effort", detection but not recovery	Computer data transfer

AAL5 (ATM Adaptation Layer 5)

AAL5 provides a simple data transfer, with no multiplexing and minimum overhead.



- Data, up to 65,535 octets, is split into 48-octet cell payloads and each cell is sent with no other identification apart from its VPI/VCI.
- All first cells have a user indication bit = 0 in the header.
- The final cell has a user indication bit = 1 and 8 octets aligned at the end of the cell.
  - 2 octets available for system and user communication
  - 2 octets of count of the valid data octets
  - 4 octets of CRC, similar to IEEE 802.3
- The final cell may contain padding, between the end of the data and the trailer. The padding length is computed from the number of cells and the length octet, allowing for the 8 octet trailer.