ASYNCHRONOUS TRANSFER MODE (ATM)

Asynchronous transfer mode (ATM), also known as cell relay, is similar in concept to frame relay. Both frame relay and ATM take advantage of the reliability and fidelity of modern digital facilities to provide faster packet switching than X.25. ATM is even more streamlined than frame relay in its functionality, and can support data rates several orders of magnitude greater than frame relay.

The “asynchronous” in ATM means ATM devices do not send and receive information at fixed speeds or using a timer, but instead negotiate transmission speeds based on hardware and information flow reliability. The “transfer mode” in ATM refers to the fixed-size cell structure used for packaging information.

ATM transfers information in fixed-size units called cells. Each cell consists of 53 octets, or bytes as shown in Fig

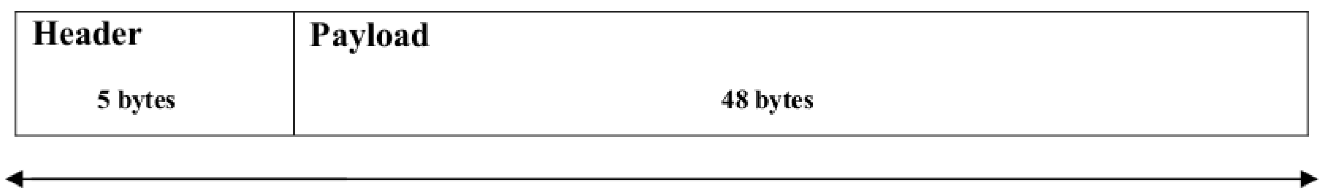
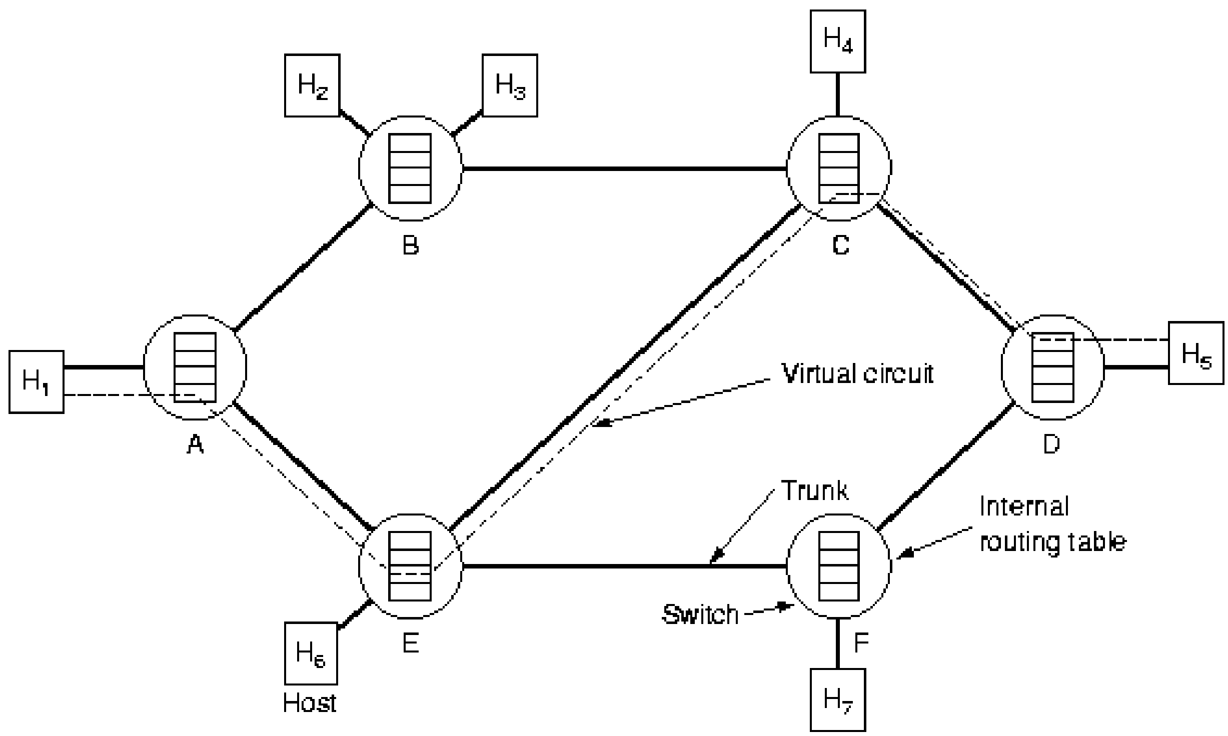


Fig:ATM cell Format

- Transmits all information in fixed size blocks called cells.
- Cells are transmitted asynchronously.
- The network is connection oriented.
- Each cell is 53 bytes long – 5 bytes header and 48 bytes payload.
- Making an ATM call requires first sending a message to set up a connection. Subsequently all cells follow the same path to the destination.

- ATM was envisioned as the technology for providing B-ISDN services.
- It can handle both constant rate traffic and variable-length traffic. Thus, it can carry multiple types of traffic with end-to-end quality of service.
- ATM is independent of transmission medium. It doesn't prescribe any particular rule.
- They may be sent on a wire or Fiber by themselves or they may be also packaged inside the payload of the other carrier system.
- Delivery of the system is not guaranteed but the order is.

When the virtual circuit is established, what really happens is that a route is chosen from source to destination. All the switches along the way make table entries for the virtual circuit and have the opportunity to reserve resources for the new circuit. The cells are sent from one switch to the next (stored and forwarded) until they reach the destination. When a cell comes along, the switch inspects its header to find out which virtual circuit it belongs to.



ATM Network Interfaces :
An ATM network consists of a set of ATM switches interconnected by point-to-point ATM links or interfaces. ATM switches support two primary types of interfaces: UNI and NNI as shown in Fig. Below. The **UNI (User-Network Interface)** connects ATM end systems (such as hosts and routers) to an ATM switch. The **NNI (Network-Network Interface)** connects two ATM switches. Depending on whether the switch is owned and located at the customer's premises or is publicly owned and operated by the telephone company, UNI and NNI can be further subdivided into public and private UNIs and NNIs. A private UNI connects an ATM endpoint and a private ATM switch. Its public counterpart connects an ATM endpoint or private switch to a public switch. A private NNI connects two ATM switches within the same private organization. A public one connects two ATM switches within the same public organization.

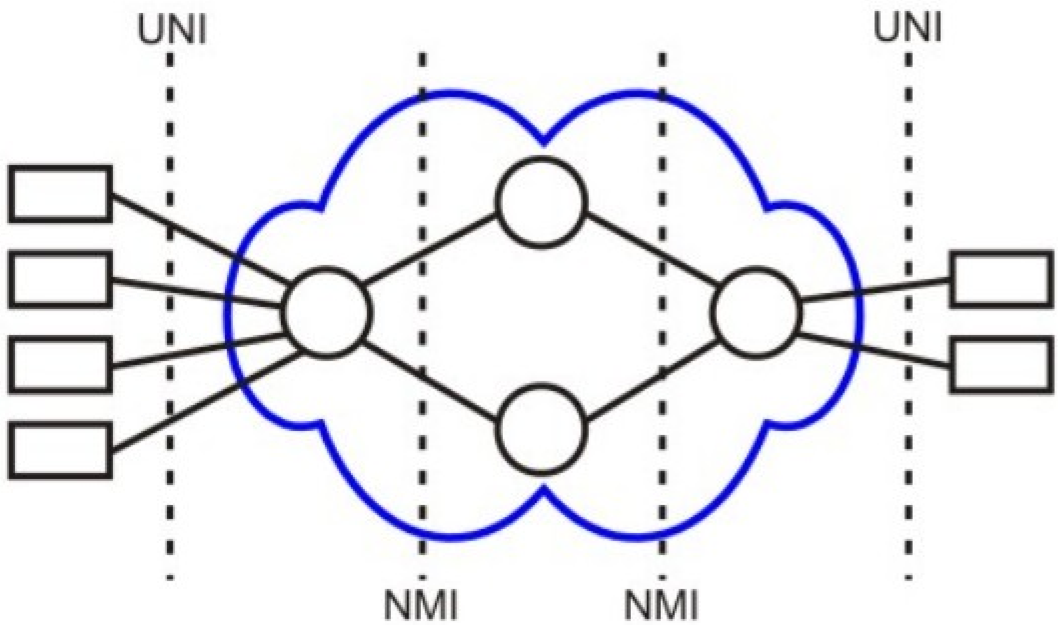


Fig:UNI and NNI interfaces of the ATM

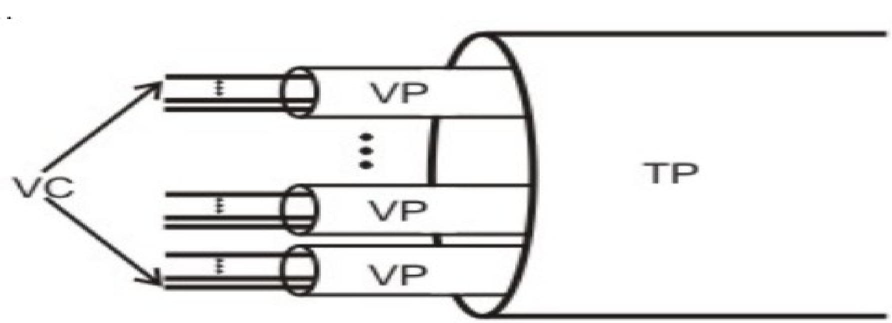
ATM Virtual Connections

ATM operates as a channel-based transport layer, using Virtual circuits (VCs). This is encompassed in the concept of the **Virtual Paths (VP)** and **Virtual Channels**. Every ATM cell has an 8- or 12-bit **Virtual Path Identifier (VPI)** and 16-bit **Virtual Channel Identifier (VCI)** pair defined in its header. Together, these identify the virtual circuit used by the connection. The length of the VPI varies according to whether the cell is sent on the user-network interface (on the edge of the network), or if it is sent on the network-network interface (inside the network).

As these cells traverse an ATM network, switching takes place by changing the VPI/VCI values (label swapping). Although the VPI/VCI values are not necessarily consistent from one end of the connection to the other, the concept of a circuit *is* consistent (unlike IP, where any given packet could get to its destination by a different route than the others).

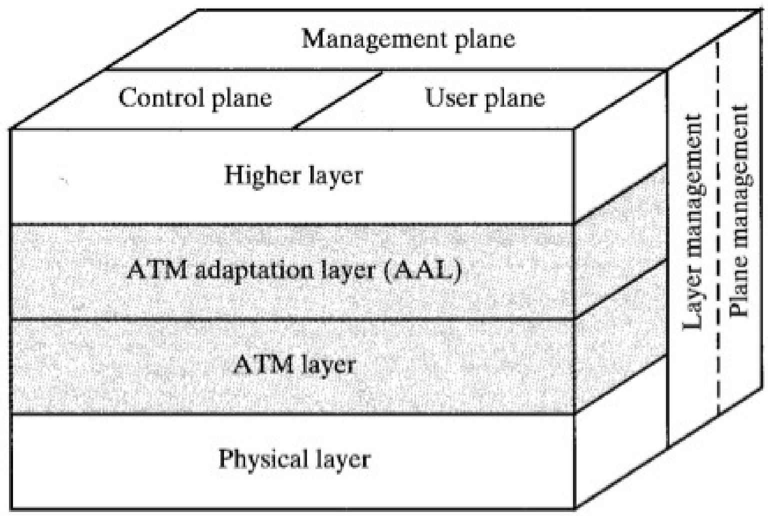
Another advantage of the use of virtual circuits comes with the ability to use them as a multiplexing layer, allowing different services (such as voice, Frame Relay, n* 64 channels, IP).

A virtual path connection (VPC) is a bundle of VCCs that have the same endpoints. Thus, all of the cells flowing over all of the VCCs in a single VPC are switched together



VC- Virtual Circuit
VP- Virtual Path
TP- Transmission Path

ATM Reference Model:
The protocol reference model makes reference to three separate planes:



User Plane. Provides for user information transfer, along with associated controls (e.g., flow control, error control).

Control Plane. Performs call control and connection control functions.

Management Plane. Includes plane management, which performs management functions related to a system as a whole and provides coordination between all the planes, and layer management, which performs management functions relating to resources and parameters residing in its protocol entities.

Physical layer—Analogous to the physical layer of the OSI reference model, the ATM physical layer manages the medium-dependent transmission.

ATM layer—Combined with the ATM adaptation layer, the ATM layer is roughly analogous to the data link layer of the OSI reference model. The ATM layer is responsible for the simultaneous sharing of virtual circuits over a physical link (cell multiplexing) and passing cells through the ATM network (cell relay). To do this, it uses the VPI and VCI information in the header of each ATM cell.

ATM adaptation layer (AAL)—Combined with the ATM layer, the AAL is roughly analogous to the data link layer of the OSI model. The AAL is responsible for isolating higher-layer protocols from the details of the ATM processes. The adaptation layer prepares user data for conversion into cells and segments the data into 48-byte cell payloads.

ATM Advantages:

- ATM supports voice, video and data allowing multimedia and mixed services over a single network.
- high evolution potential, works with existing, legacy technologies
- provides the best multiple service support
- supports delay close to that of dedicated services
- supports the broadest range of burstiness, delay tolerance and loss performance through the implementation of multiple QoS classes
- provides the capability to support both connection-oriented and connectionless traffic using AALs
- able to use all common physical transmission paths (such as DS1, SONET).
- cable can be twisted-pair, coaxial or fiber-optic
- ability to connect LAN to WAN
- legacy LAN emulation
- efficient bandwidth use by statistical multiplexing

- scalability
- higher aggregate bandwidth
- high speed Mbps and possibly Gbps

ATM disadvantages

- flexible to efficiency's expense, at present, for any one application it is usually possible to find a more optimized technology
- cost, although it will decrease with time
- new customer premises hardware and software are required
- competition from other technologies -100 Mbps FDDI, 100 Mbps Ethernet and fast ethernet

Source : http://dayaramb.files.wordpress.com/2011/03/computer-network-notes-pu.pdf