

ATM (Asynchronous Transfer Mode)

ATM as defined in CCITT Blue Books is "a multiplexing technique in which a transmission capability is organized in undedicated slots filled with cells with respect to each application's instantaneous real need".

ATM is a cell-switching and multiplexing technology that combines the benefits of circuit switching (guaranteed capacity and constant transmission delay) with those of packet switching (flexibility and efficiency for intermittent traffic).

ATM technology enables information to be transported from place to place in these "undedicated slots filled with cells" as opposed to

the older technology with "permanent allocation of channels/bandwidth."

The information that is transported can be Voice, Data or Video. It can be used for multimedia, video conferencing etc.

What does the word Asynchronous in ATM mean? The terms synchronous and asynchronous, as applied to transfer modes, refer to the scheme of multiplexing. Multiplexing means mixing traffic from many sources together on the same physical network path. In a synchronous transfer mode, each source is assigned a fixed bandwidth based on position: a frequency band in FDM or a time slot in TDM. ATM is not based on position in the data stream at all; a header identifies whose traffic it is and where it goes.

An ATM network is not service-dependent; it works well for voice, video and data. It is not inflexible; as

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bandwidth requirements for video decrease, the ATM networks can easily adjust. For example the blue VCR "idle screen" where there is no information being sent; the ATM network will immediately use the unused bandwidth for something else. Resources assigned for now to a voice connection can be used later for data traffic - ATM is very efficient.

Cell streams from various sources are multiplexed on **the same ATM link**. These cells may represent voice, video or data.

Another very important point to note is that ATM uses switches as nodes, not routers. In an ATM network, the network nodes (switches) switch ATM cells.

Services Offered by ATM & their properties:

Connectionless Vs Connection-oriented: Connectionless services are those in which the receiver does not have to be contacted in some way prior to communication. Information is merely packaged and sent as it is made available to the sender. Connection-oriented services require the establish-

Telephone	CONN-OR	Delay Variation Sensitive	Low BW	CBR
Data	CONN LESS Or CONN-OR	Delay Variation Insensitive	Low/High BW	VBR
Cable TV	CONN-LESS	Delay Variation Sensitive	High BW	CBR
Video Conf.	CONN-OR	Delay Variation Sensitive	Low/High BW	CBR And VBR

ment of a "connection" between sender and receiver.

Delay Variation Sensitivity deals with the issue of how long data may be delayed within the network. The variation

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sensitivity of the receiver is an indication of how much this

delay can vary (from 10 to 20 milliseconds for instance) before the receiver will think there is something wrong.

Bandwidth just refers to the required bit rate of the service, which is highly dependent on whether some bit compression coding is used or not.

Some services are always sending bits at a constant rate: constant-bit-rate (CBR) services. Some send bits in bursts: variable-bit-rate (VBR) services. Some networks offer the possibility of multiple quality of service (QOS) parameters that users may want at various times. **The Challenge of ATM is to make one physical network for all previous networks and services and be immune to changes in service demands in the future.**

ATM Devices: An ATM network is made up of the following two main types of components:

? ATM switch

? ATM endpoint

ATM Switch: An ATM switch is responsible for cell transit through an ATM network.

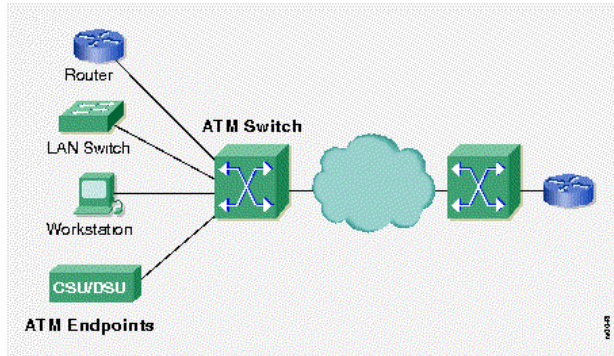
The job of an ATM switch is well-defined:

1. Accept the incoming cell from an ATM endpoint or another ATM switch.
2. Read and update the cell header information.
3. Quickly switch the cell to an output interface toward its destination.

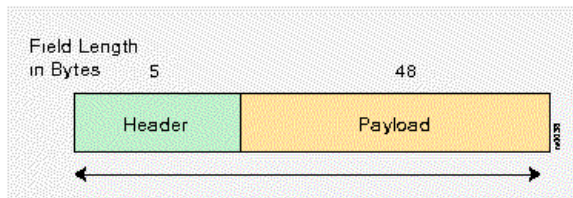
ATM Endpoint: An ATM endpoint (or endsystem) contains an ATM network interface adapter. Examples of ATM endpoints are workstations, routers, data service units (DSUs), LAN switches, and video coder-decoder (CODEC).

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The following figure shows an ATM network made up of ATM switches and ATM endpoints:



The ATM Cell: All ATM networking is based on the cell as the unit of data exchange. A cell is defined as a fixed-length block of information. Previous networks all used a simple stream of 0s and 1s that were organized into different structures depending on the service and networks. The organization is



still done with ATM networks, but at the endpoints of the network. At the physical (bit) level, everything is sent and received as cells: a fixed-sized packet of bits.

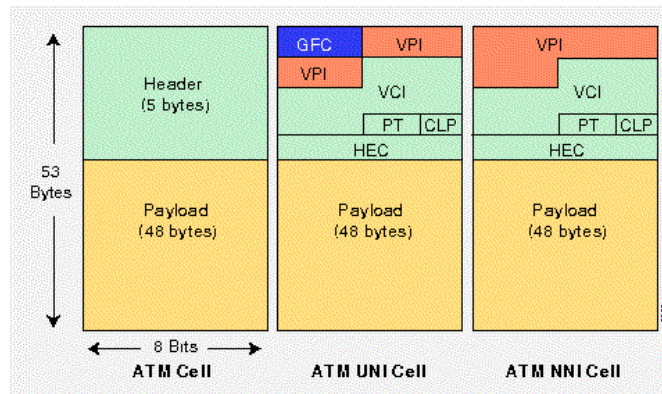
ATM Cell Header Format: An ATM cell header can be one of two formats:

User-network interface (UNI) header: The UNI header is used for communication between ATM endpoints and ATM switches in private ATM networks.

Network-node interface (NNI) header: The NNI header is used for communication between ATM

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switches. The figure below shows the basic ATM cell format, the ATM UNI cell header format, and the ATM NNI cell header format:



Comparison of NNI and UNI Header Formats: The NNI header does not include the Generic Flow Control (GFC) field. Additionally, this header has a Virtual Path Identifier (VPI) field that occupies the first 12 bits allowing for

larger trunks between public ATM switches.

ATM Cell Header Fields

Generic Flow Control (GFC) Can be used to provide local functions, such as identifying multiple stations that share a single ATM interface. This field is typically not used (and is set to its default value).

Virtual Path Identifier (VPI) Used in conjunction with the VCI to identify the next destination of a cell as it passes through a series of ATM switches on its way to its destination. The VPI is 8 bits long

Virtual Channel Identifier (VCI) Used in conjunction with the VPI to identify the next destination of a cell as it passes through a series of ATM switches on its way to its destination.

The VCI field identifies dynamically allocated connections, and the VPI field identifies statically allocated connections.

Payload Type (PT) The first bit indicates whether the cell contains user data or control data. If the cell contains user

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data, the second bit indicates congestion, and the third bit indicates whether the cell is the last in a series of cells.

Congestion Loss Priority (CLP) Indicates whether the cell should be discarded if it encounters extreme congestion as it moves through the network. If the CLP bit equals 1, the cell should be discarded in preference to cells with the CLP bit equal to zero.

Header Error Control (HEC) Checksum is calculated only on the header itself. If more than one bit error in a cell header is detected, the receiver will discard the entire cell. The information contained in the cell payload need to be retransmitted in case of an error.

What is Virtual Path & Virtual Channel? ATM connections are of two types:

- ? Virtual paths, identified by virtual path identifiers (VPIs)
- ? Virtual Channels, identified by the combination

of a VPI and a virtual channel identifier (VCI).



A virtual path is a bundle of virtual channels, all of which are switched transparently across the ATM network on the basis of the common VPI. All VCI and VPI, however, have only local significance across a particular link, and are remapped, as appropriate, at each switch. A transmission path is a bundle of VPs.

HCL