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# Data Transport Models over ATM

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**Abstract** Asynchronous Transfer Mode (ATM) is an asynchronous transfer technology designed to multiply the heterogeneous information on a common infrastructure such as: data, voice and video signals.

ATM was developed to meet the needs of Broadband Integrated Services Digital Network and designed to unify telecommunication and computer networks. It was designed for a network that must handle both traditional high-throughput data traffic e.g., file transfers, and real-time, low-latency content such as voice and video.

In this study, we explore the standard techniques used in data transport over ATM. In particular, we will examine the service interface definitions, the different layers of ISO model: network layer, data link layer and physical layer and ATM data methods. Secondly, we will explore the details of two models for Data transfer over ATM: the classic and LAN Emulation model. We will also examine recent routing standards between ATM switching nodes, data transport standards over ATM and broadcasting techniques of data over ATM.

**Keywords** ATM; LAN Emulation; Physical layers; network layer.

## Introduction

Due to the new technologies in the field of telecommunication, the future applications will require a constantly increasing bandwidth with a very heterogeneous traffic (voice, data and images). The ATM (Asynchronous Transfer Mode) guarantees the quality of service independently of the characteristics related to the carried and transported service for user.

This protocol was developed by all operators since 1982. It was standardized on three layers: physical, link and network layer.

ATM objectives are to support any type of communication (voice, video, data) on the same network, to provide the same service regardless of the network: LAN, WAN, MAN. It operates at very high speed (Bytes/s) and ensures quality of service to each user (such as bandwidth, latency, jitter, loss rate etc). The ATM technology uses standard existing physical layers: fiber optic, twisted pair and it has a convergence between telephone operators and IT.

## The main features of ATM

The ATM transfers a continuous stream of data with fixed-size including 5 bytes in header and 48 bytes of information. The network is connection oriented type; any packet is fragmented into 53-bytes. The small size enables to:

- Optimize transfer and insertion time of data,
- Do not waste space.

For example: On a regular oriented network, connection having a link of 240 byte / s, propagation delay of 240-byte through 2 switches is 2s which will be only 1.4s on ATM.

The network is designed to be in a proper and effective functioning manner. It means that messages or the packets are never retransmitted. The network must therefore have a low error rate. It allows new applications

- Phone: fixed latency (<400ms), low loss, constant bit rate.

- TV: high bandwidth (5Mb / s), fixed latency (<100ms), low error rates (<10-5), multicast.

In an ATM network, the User Network Interface (UNI) is the link of the network to the terminal equipment & Network Nodes Interface (NNI) is the relationship between Switches.

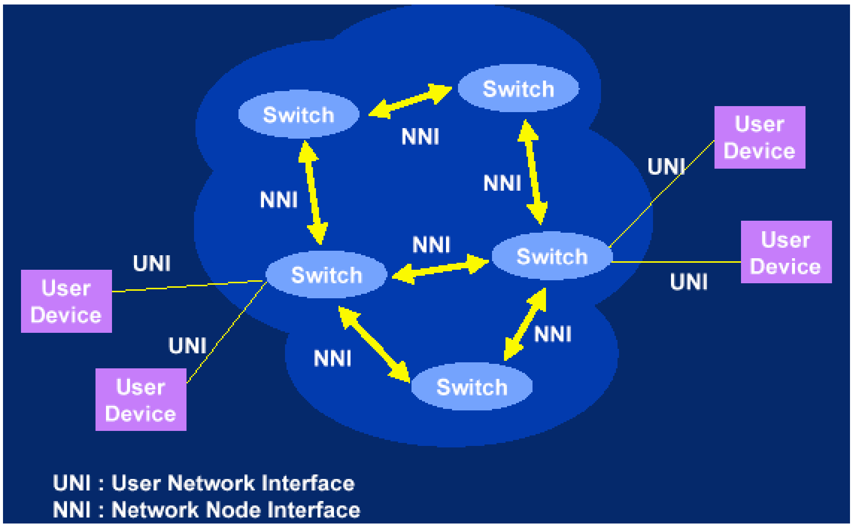


*Figure 1: ATM Network using UNI and NNI Interfaces*

The ATM model has three layers:

- Physical layer: adapting to transmission environment,
- ATM-layer: routing multiplexing and switching cells,
- Adaptation by type of information stream in the cell structure.

We followed the figure below (figure 1) related to ATM functioning for LAN Emulation.

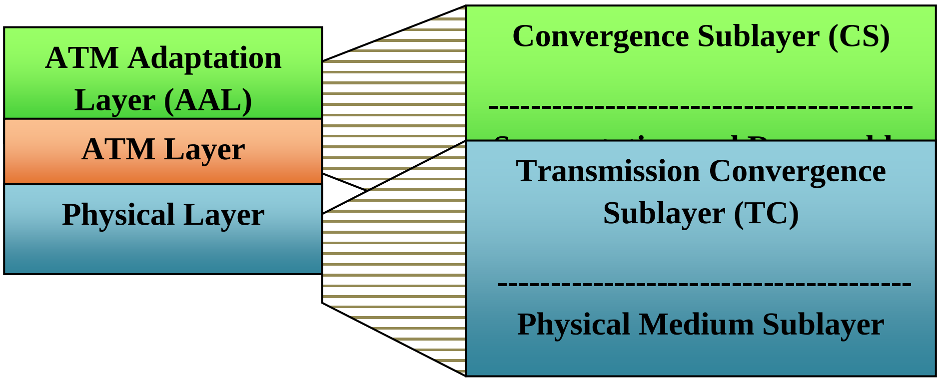


*Figure 2 : ATM functioning for LAN Emulation*

**Standardization**

ATM combines all actors in the ATM world: manufacturers, builders, operators, users. The IETF (Internet Engineering Task Force) has also taken a very active role in the standardization of interface layers between open systems protocols like TCP / IP and ATM.

**Reference Model**

Two main elements underlying the ATM architecture, such as the connected mode transmission through the establishment of virtual circuits, and the use of fixed-size cells as information transmission units.

Regarding the interfaces, we can distinguish the network interface board, known as the UNI (User-Network Interface) and inter-node switching known as the NNI (Network-Network Interface or Network-Node Interface). The NNI is available in public and private alternatives.

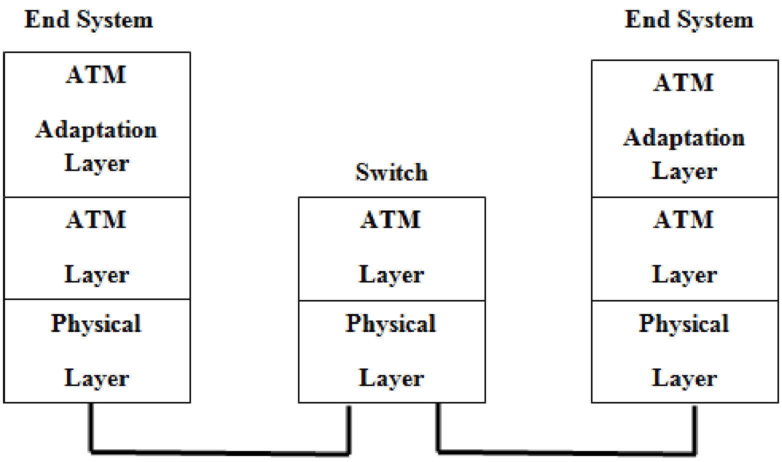


*Figure 3: ATM Reference Model*

**Basic layers**

**Physical layer**

ATM technology is implemented on multiple physical layers for electrical or optical fiber and for limited or extended distances. In local networks, we have the Synchronous Digital Hierarchy SDH which was standardized for transmission over optical fiber. There is also the standard 4B / 5B on optical fiber as well as standards for twisted pair cable (UTP) to 25Mbps, 51Mbps or 155Mbps.

**Adaptation layer**

There are two adaptation layers for transport of data over ATM : AAL3 / 4 and AAL5. Adaptation AAL3 / 4 is used in offline on data over ATM public services (SMDS / CBDS). The AAL5 adaptation is used in all other data applications over ATM including local area networks and Frame Relay (Frame Relay) over ATM. The layers AAL3 / 4 and AAL5 provide similar functionality in splitting (fragmentation) and reassembling data packets into ATM cells. Although AAL3 / 4 presents some strength aspects compared to AAL5 which is the most widely adaptation nowadays. This is due to its adoption in the local network which currently constitutes the most fertile network of ATM expansion.

**Signaling**

Establishing ATM virtual circuits is through the use of signaling protocols. Signaling protocols are standardized in the UNI interface but also more recently in the NNI interface. The adopted standards are derived from ISDN signaling standards. ATM signaling enables the dynamic establishment of ATM virtual circuits but also negotiating parameters associated with virtual circuit such as adaptation layer used, maximum packet size and quality of service desired by equipment…

**Broadcasting multicast over ATM**

In this part, we will explore the multicast broadcasting packets implementation methods over ATM: classic model and LAN Emulation Model.

**Classic model**

In the classic model, implementation is through spreading multicast servers. There are two proposals: the first is the use of multicast servers that are sent all data requiring broadcasting to a group of recipients.

The second is the use of an extension to the address servers (ARP Servers) enabling them to collect the list of recipients for each group address. Equipment wishing to send a broadcasted packet will ask the mailing address server MARS (Multicast Address Resolution Server) and receive a list of ATM addresses corresponding to all of the recipients of the data to distribute. Subsequently, the release of data will be by setting up individual virtual circuits to each destination, or by development of a multi-point virtual circuit ATM to those same destinations.

**LAN Emulation Model**

In the LAN Emulation model broadcasting is done by using servers BUS (Broadcast and Unknown Servers). This prevents network layers to know the implementation details of broadcasting, since these layers have the "illusion" of an Ethernet layer IEEE 802 or a Token Ring. The diffusion in this case is limited to the emulated LAN. The diffusion above the emulated LAN is done by broadcast packet routing techniques like PIM (Protocol-Independent Multicast) or DVMRP (Distance Vector Multicast Routing Protocol)... This is implemented on routers that are part of emulated local networks.

**Quality of Service**

UNI and NNI signaling used to convey through an ATM network of quality of service requests reaching the edges of the network. When the quality of service must be provided over a network including heterogeneous technologies (ATM, etc.), the RSVP (Resource ReSerVation Protocol) defines a global scheme QoS negotiation and independently of the sub-layer underlying.

**Conclusion**

ATM standards were created by telecoms. A huge work has been done to integrate as much as possible ATM technologies and existing conventions in telecommunications but ATM technology is too complex. Many telecoms have implemented large ATM networks and many DSL implementations using ATM but ATM failed to be widely used as a LAN technology because of its complexity.

Several efforts are in progress in the IETF and the ATM Forum on the various points of evolving standards which have been described above (Quality of Service, MPOA, new versions of LAN Emulation, etc.).

**References**


[1]. Anthony Alles (CISCO) " Contrary to common misconceptions, ATM is a very complex technology, perhaps the most complex ever developed by the networking industry " ; 1999, pp. 13-37

[2]. Christian Huitema (IAB - Directeur de recherche à l'INRIA) ; " ATM c'est vraiment X25 revu et corrigé pour paraître moderne. Ceux qui pronostiquent que demain ATM rasera gratis sont les mêmes qui annonçaient hier la conversion du monde entier à OSI " – 2003 , pp. 45-66.

[3]. Guy PUJOLLE, *Eyrolles* , LES RÉSEAUX, Guy PUJOLLE, *Eyrolles*. 2001, (pp. 105-139)

[4]. Jean-Louis MÉLIN, *Eyrolles*. PRATIQUE DES RÉSEAUX - ATM, 2006, (pp. 72-99)

[5]. Jean-David Olekhnovitch et Guillaume Desgeorge - Les réseaux locaux – Editions Micro Application, 2012(pp. 23-78)

[6]. http//www.linux-france.org/article/gvallee/atm/intro.html

[7]. https://fr.wikipedia.org/wiki/Asynchronous_Transfer_Mode

[8]. http://www.futura-sciences.com/magazines/high-tech/infos/dico/d/informatique-atm-1123/

[9]. [ILMI v4.0] ATM Forum, "Integrated Local Management Interface (ILMI) Specification," Version 4.0, af-ilmi- 0065.000, July 1996.

[10]. [PNNI v1.0] ATM Forum, "Private Network-Network Interface Specification version 1.0 (PNNI 1.0)," af-pnni- 0055.000, March 1996.

[11]. [SIG 4.0] ATM Forum, "ATM User-Network Interface (UNI) Signaling Specification Version 4.0," af-sig-0061.000, July 1996.

[12]. [RFC 2008] Implications of Various Address Allocation Policies for Internet Routing. Y. Rekhter, T. Li. October 1996.

[13]. [RFC 2050] Internet Registry IP Allocation Guidelines. K. Hubbard, M. Kosters, D. Conrad, D. Karrenberg, J.Postel. November 1996. (BEST CURRENT PRACTICE)