A Review on Asynchronous Transfer Mode Networks

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Abstract: For many applications, audio is now conveyed digitally. Video applications are following fast, particularly for video on demand. These digital streams require constant-rate digital channels between the source and destination, but a great number of all networks being planned today are based on the packet switched Asynchronous Transfer Mode (ATM) technology. This paper serves as an introduction to ATM, with emphasis on its ability to carry fixed rate channels, and describes the approach of the Cambridge Digital Interactive Television Trial, where Video and Audio on demand are transported to the Home over ATM.


I. INTRODUCTION

Asynchronous Transfer Mode (ATM) is, according to the ATM Forum, “a telecommunications concept defined by ANSI and ITU standards for carriage of a complete range of user traffic, including voice, data, and video signals” ATM was developed to meet the needs of the Broadband Integrated Services Digital Network, as defined in the late 1980s 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. The reference model for ATM approximately maps to the three lowest layers of the ISO-OSI reference model: network layer, data link layer, and physical layer. ATM is a core protocol used over the SDH backbone of the public switched telephone network (PSTN) and Integrated Services Digital Network (ISDN), but its use is declining in favour of all IP. ATM provides functionality that is similar to both circuit switching and packet switching networks: ATM uses asynchronous time-division multiplexing, and encodes data into small, fixed-sized packets (ISO-OSI frames) called cells.

II. HISTORY OF ATM

Early 80’s: Research on Fast Packets.
Mid 80’s: B-ISDN Study Group formed.
1986 ATM approach chosen for B-ISDN.
June 1989: 48+5 chosen (64+4 vs 32+4).
1993: UNIVERSITY V3.

III. STRUCTURE OF AN ATM CELL

An ATM cell consists of a 5-byte header and a 48-byte payload. The payload size of 48 bytes was chosen as described above. ATM defines two different cell formats: UNI (User-Network Interface) and NNI (Network-Network Interface). Most ATM links use UNI cell format.
GFC = Generic Flow Control (4 bits) (default: 4-zero bits)
VPI = Virtual path identifier (8 bits UNI, or 12 bits NNI)
VCI = Virtual channel identifier (16 bits)
PT = Payload Type (3 bits)
PT bit 3 (ms bit): Network management cell. If 0, user data cell and the following apply:
PT bit 2: Explicit forward congestion indication (EFCI): 1 = Network congestion experienced
PT bit 1 (ls bit): ATM user-to-user (AAU) bit. Used by AAL5 to indicate packet boundaries.
CLP = Cell Loss Priority (1-bit)
HEC = Header error control (8-bit CRC, polynomial = X^8 + X^2 + X + 1)

ATM uses the PT field to designate various special kinds of cells for operations, administration and management (OAM) purposes, and to delineate packet boundaries in some ATM adaptation layers (AAL). ATM traffic contracts form part of the mechanism by which "quality of service" is ensured. There are four basic types (and several variants) which each have a 4 / 2 – datagrams set of parameters describing the connection.

1. CBR - Constant bit rate: a Peak Cell Rate (PCR) is specified, which is constant.
2. VBR - Variable bit rate: an average or Sustainable Cell Rate (SCR) is specified, which can peak at a certain level, a PCR, for a maximum interval before being problematic.
3. ABR - Available bit rate: a minimum guaranteed rate is specified.
4. UBR - Unspecified bit rate: traffic is allocated to all remaining transmission capacity.

VBR has real-time and non-real-time variants, and serves for “bursty” traffic. Non-real-time is sometimes abbreviated to vbr-rt. Most traffic classes also introduce the concept of Cell Delay Variation Tolerance (CDVT), which defines the “clumping” of cells in time.

VII. DEPLOYMENT

ATM became popular with telephone companies and many computer makers in the 1990s. However, even by the end of the decade, the better price/performance of Internet Protocol-based products was competing with ATM technology for integrating real-time and bursty network traffic. Companies such as FORE Systems focused on ATM products, while other large vendors such as Cisco Systems provided ATM as an option. After the burst of the dot-com bubble, some still predicted that “ATM is going to dominate”. However, in 2005 the ATM Forum, which had been the trade organization promoting the technology, merged with groups promoting other technologies, and eventually became the BroadbandForum.

VII. WIRELESS ATM OR MOBILE ATM

Wireless ATM, or Mobile ATM, consists of an ATM core network with a wireless access network. ATM cells are transmitted from base stations to mobile terminals. Mobility functions are performed at an ATM switch in the core network, known as “crossover switch”, which is similar to the MSC (mobile switching center) of GSM Networks. The advantage of Wireless ATM is its high bandwidth and high speed handoffs done at Layer.

In the early 1990s, Bell Labs and NEC Research Labs worked actively in this field. Andy Hopper from Cambridge University Computer Laboratory also worked in this area. There was a Wireless ATM Forum formed to standardize the technology behind Wireless ATM Networks. The forum was supported by several telecommunication companies, including NEC, Fujitsu, AT&T, etc. Mobile ATM aimed to provide high speed multimedia communications technology, capable of delivering broadband mobile communications beyond that of GSM and WLANs.

IX. BENEFITS OF ATM

- It is very High-speed communication compared with others.
- It is basically a connection-oriented service network which is similar to our traditional telephony.
- Hardware-based switching.
• A single, universal, interoperable network transport.
• ATM is only a single network connection that can reliably mix voice, video, and data.
• Flexible and efficient allocation of network bandwidth.

CONCLUSION
ATM was developed to provide a data network for any type of application, regardless of its bandwidth requirements. Due to its complexity, and the advances made in competing technologies, it has not lived up to the original expectations of its creators, and has not gained possible that gigabit Ethernet will supplant ATM as the technology of choice in new WAN implementations.

References