

An Introduction to ATM Technology

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Background

Asynchronous Transfer Mode (ATM) is a networking technology whose virtues continue to be debated in the industry. Some see ATM as a miracle solution that will facilitate a myriad of multimedia applications. Others see it as just another technology solution that will fail to fulfill its promise. Given the growing market acceptance of ATM technology, it is important that network administrators carefully evaluate its relative merits to determine if it is best suited to their business needs.

ATM is a packet switching technology that relays traffic through an address contained in the packet or cell. Packet switching technology has been around for about two decades having been introduced in the 70s. Examples of these technologies are X.25 and the original Arpanet. These packet switching technologies used variable-length packets to carry information from point to point. One of the problems associated with these technologies is latency, caused by the use of special timers to ensure that each packet contains the correct information.

In the case of WANs, telecommunications carriers set up a communication path by slicing up sections of a broadband circuit into a number of narrowband time slots which are then sold to customers. This narrowband of time slots and the monthly or yearly costs associated with it made this technology less desirable to the end user. The use of statistical (and synchronous) time division multiplexing services on the telecommunications networks of old had certain limitations. For the evolution and migration of these networks, it is important to remember that these network services came from the telephony world. In telephony, 4KHZ was used with digital time division multiplexing schemes. This resulted in 64kbps bandwidth time slots, and where larger chunks of bandwidth were needed the fixed slots were concatenated to form higher bandwidths. This fixed slot technology presented problems if a user wanted 256kbps for 1 hour, because the time slots would go unused for the rest of the day.

Advantages of ATM Technology

Although frame-relay and SMDS do provide bandwidth on demand, they fail to provide the scalability that ATM does. ATM allows for bandwidth on demand and provides each end user with as much bandwidth as is required. It derives its scalability from its use of a fixed cell. In early 1992 the industry adopted a fast packet or "Cell Relay" concept that uses a 53-byte fixed-length cell for transmitting data across both private and public networks, calling it ATM. ATM is defined in the general category of the B-ISDN standard as a transport and switching method which information does not occur periodically with some reference such as frame pattern. ATM is defined for the transport of a wide range of user information, including voice, data, video, and multimedia on any user to network interface (UNI). This flexibility makes it the networking tool of the 1990s and beyond. Some of the applications ATM lends itself to are:

- PBX to PBX tie line/trunks
- Host-host computer data links
- Video conferencing
- LAN to LAN bridged or routed traffic
- Multi-media networking services.

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These services can be combined over one virtual channel at aggregate speeds of 155Mbps and higher. As will be shown in the next section, the specifications for the ATM standard include the UNI and NNI. Even though PNNI has been released it will not be discussed in this paper.

Sorting Through ATM Standards

ATM standards are dictated from sources such as the International Telegraph and Telephone Consultative Committee Communications Standards Organization (CCITT), which provides communications standards for the International Telecommunications Union (ITU-T), American National Standards Institute (ANSI), and the ATM forum.

The CCITT standards (now known as ITU) are law in some European countries, but in most countries they are treated as recommendations. The ITU has recommended that ATM be used in worldwide broadband networks. The first standards were produced in the mid 1980s and provided a basic outline of the service. ATM was chosen as the transfer mode for BISDN in 1988, and an initial set of recommendations were agreed upon in 1990. The recommendations by the ITU specify ATM among the protocol suites at the lower layers of the OSI reference model. Most of the standards have already been specified by the ITU committee even though work continues in the area of signaling, call set-up definitions, and network management functions.

The BISDN reference model has been defined in ITU recommendation I.121 and defines multiple planes. The first is the User Plane (U-Plane), which provides the transfer of user application information. The second is the Control Plane (C-Plane), which deals with call set-up, breakdown, and other connection control. Third is the Management Plane (M-Plane), which provides management functions and the capability to exchange information between the U and C planes. This is all part of the User Network Interface standard (UNI V3.1).

The ATM standard is based on the B-ISDN reference model and is similar to the International Standards Organization (ISO) seven-layer Open Systems Interconnection (OSI) model. ANSI has subcommittees active in broadband network standards which define SONET rates and format specification (subcommittee T1X1). Subcommittee T1M1 defines the standard for operations, administration, and maintenance and provisioning. Physical media dependent sublayer (PMD) specifies physical medium and transmission (e.g., timing, line coding) characteristics, but not framing and overhead information. This is defined in ANSI T1E1.

Another contributor to the ATM standards is the ATM forum. The ATM forum is not a standards-based organization, but it does work closely with the standards organizations. Its members charter is to accelerate the acceptance of ATM products in local and wide area networks. The forum's UNI specification is what dictates how vendors design their products. It defines the interface between a router and a private ATM switch or between the private ATM switch and a public ATM switch. The forum is responsible for the LAN emulation specification (which isn't complete) and deals with running ATM in a LAN environment. It deals with LAN protocols such as TCP/IP and IPX. The forum is also working on using ATM on LANs and using LAN protocol standards such as SNMP for ATM network management.

The Implementation Impact of ATM

ATM technology will allow learning at levels from kindergarten through college to be taught through a variety of multi-media applications. Many schools today can't afford to support the large staffs they once did or to transport teachers from school to school to teach courses for classrooms with a small number of students. Classrooms could be linked together for real-time collaborative education with the instructor many miles away, or students in different locations around the world could share the same instructor for a particular course. This use of applications that use ATM technology can alone save a tremendous amount of money, and in turn can allow a better quality of education to the student.

ATM technology can also be used for the medical field. Today many hospitals don't have the funding to implement a high-speed technology that can transport MRIs across the country in minutes. But as costs continue to decrease for this technology, more and more hospitals will be implementing ATM. It will allow for doctors, who may be experts in particular fields, to view material hundreds or thousands of miles away that may help save a patient's life. Large databases of information will be made available to store data and laboratory findings that may save someone from doing duplicate research.

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In the commercial environment, companies spend a tremendous amount of money and time every year for the travel of their employees to attend meetings across town or across the country.
With the use of desktop conferencing via video or computer, meetings can be attended with less travel. Cost-efficient applications with a reliable transport will be key operatives here. Such conferencing will allow teams of engineers or businessmen to review plans together and share information as if they were in the same room.

Summary
While ATM technology may not be right for all enterprise networking requirements, it certainly has proven its benefits for a sufficient number of business applications to ensure its long-term viability. It is essential that network administrators carefully evaluate their business requirements and determine if ATM's attributes fit their needs.

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