What is ATM?

Introduction into the concepts of Asynchronous Transfer Mode technology.

A Nextep Broadband White Paper
October 2001

Broadband Networks Group

INTRODUCTION

Asynchronous Transfer Mode (ATM) is a technology developed specifically for allowing multiple diverse services with wildly differing service requirements to be carried over a single network efficiently and effectively.

By using the unique qualities of ATM, Nextep is able to meet the diverse demands of their customers. Customers requiring multiple services are able to specify the quality levels for each service and receive those over a single DSL connection just as multiple customers with differing requirements can be effectively serviced using the common ATM backbone network.

HISTORY

Before the 1980's there were two basic types of telecommunications networks: The Voice network and the Data network. Each was optimally designed to meet the requirements of their particular application.

For a high quality voice network latency and jitter are the fundamental requirements. The human ear is very sensitive to phase variation (jitter) and the human psyche intolerant of long delay. Interestingly, voice information is highly redundant and loss of data does not seriously impact upon the perceived quality of the call.

Data, on the other hand, is typically unconcerned with the time taken to send the information and variation in this time makes no difference to the quality. Lost data heavily impacts upon the quality of the network.

In the early 1980's, the International Telecommunications Union (then the CCITT) proposed a unified telecommunications network capable of simultaneously supporting a wide range of applications, including voice and data, over a wide range of data rates. This proposal was a logical extension to their Integrated Services Digital Network (ISDN) model called the Broadband Integrated Services Digital Network (B-ISDN). Asynchronous Time Division Multiplexing, also known as Asynchronous Transfer Mode (ATM) was developed as the technology best suited to meeting the diverse requirements of the unified network.

ASYNCHRONOUS TRANSFER MODE

Asynchronous Transfer Mode is a packet-switched, connection-oriented network protocol using short (53byte) fixed sized packets known as cells. Sending data in packets allows multiple applications to simultaneously access the network resource. By allowing the packets to be sent asynchronously, the network does not have to allocate fixed time-slots to individual applications. This means that the network only needs to carry the actual data traffic and can effectively re-use quiet periods in one application to service a busy period in another. This statistical treatment of the traffic load is termed statistical multiplexing and this feature is one of the major advantages of ATM.

The choice of 53 bytes for the packet size is a compromise between the voice requirements of low latency and jitter, suited to smaller packets, and the demands of payload efficiency best served by larger packets.

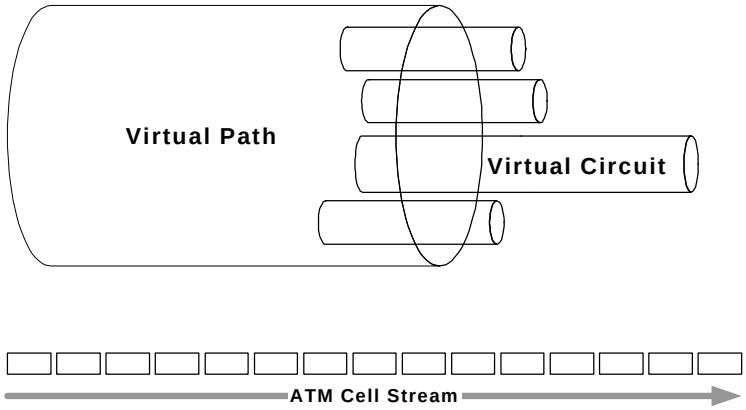
VIRTUAL CIRCUITS, VIRTUAL PATHS

ATM was designed to be connection oriented for several reasons. The first reason is that for a network to guarantee a good quality of service it needs to be able to do two things. It needs to be able to monitor the demands on the network in terms of expected volumes and destinations of traffic and it needs to be able to prevent applications from using the network when the additional traffic will adversely affect the performance of the existing applications. This process is known as connection admission control and is akin to the telephone network checking whether there are enough physical circuits to carry your telephone call before making the connection. If there are insufficient resources, the telephone network will signal “busy” to the caller and the ATM network will reject the connection application.

The second reason for using connection orientation is one of efficiency. By pre-establishing connections, individual packets need only be labeled with locally significant identification. This reduces the size of the header information in each packet. For comparison, the entire ATM cell header consists of 40 bits. The

packet header for an IP packet, which uses globally significant identification,[1] takes up 512 bits.

There are two types of connections recognized in an ATM network. The fundamental type of connection is a virtual circuit. This virtual circuit carries data from a single application between the end-points of the ATM network. The second type of connection is an aggregation of multiple virtual circuits known as a virtual path. The virtual path uses only the most significant bits of the connection identifier while the virtual circuit uses all of the connection identifier bits. The advantage of this hierarchical arrangement is that groups of virtual circuits can be treated as a single bundle for traffic management and switching reasons.



TRAFFIC CLASSES

Whenever an application wishes to establish a connection, it needs to negotiate with the network for the specific service that the application desires. The ATM network recognizes a small number of fundamental types of service (traffic classes) designed to meet the wide variety of application requirements. Within each service type there are a range of parameters that can be specified to further define the service. The ATM network either rejects the connection request or contracts to provide a sufficiently high quality connection to meet the needs of the application. The application accepts that if it exceeds the parameters requested during the negotiation with the network that the network may provide a degraded service.

[1] Source and destination addresses.

The three fundamental traffic classes in ATM are:

Constant Bit Rate (CBR)

This service provides a fixed bandwidth (Peak Cell Rate) with minimum latency and jitter. It is suitable for high quality voice calls and near real time applications where the bandwidth requirements are fixed and known.

Variable Bit Rate (VBR)

This service provides an average bandwidth (Sustainable Cell Rate) but allows the application to send bursts at higher rates (up to the Peak Cell Rate), provided the bursts are shorter than a negotiated maximum length (the Maximum Burst Size).

This service is suited to applications such as variable bit rate video (MPEG2). There are two sub-types of Variable Bit Rate, depending upon the latency requirements.

VBR-RT

Real Time Variable Bit Rate provides smaller buffers but more bandwidth for a reduced latency and jitter. This is suitable for video conferencing applications.

VBR-NRT

Non-Real-Time Variable Bit Rate provides larger buffers and reduced bandwidth for a high latency and jitter service that matches the requirements for sustainable data transfers such as aggregate corporate data or video on demand.

Unspecified Bit Rate (UBR)

This service is a best effort service akin to an IP network. No bandwidth is allocated to this service and no buffer space is guaranteed. This service makes use of any spare resources to fill the network. It is best suited to IP traffic that is capable of self regulation, such as that implemented by TCP.

Service classes are being continually developed. Other service classes with more specific application include:

Available Bit Rate (ABR)

This uses network feedback to limit the transmission rate of the source. It has great theoretical interest but is not particularly practical for the majority of networks.

ATM Block Transfer (ABT)

This provides a guaranteed buffer size with feedback to indicate when the next block can be transferred. It is an alternative to the available bit rate service, better suited to data applications.

Guaranteed Frame Rate (GFR)

This is a type of UBR where a minimum data rate is guaranteed.

ATM WITH DSL

When developing recommendations for the deployment of DSL technologies, the DSL Forum recommended ATM as the network layer protocol. The reasons for this parallel the original reasons for developing ATM in the first place. Namely, that ATM allows multiple services to be efficiently carried over a common network infrastructure while maintaining different qualities of service for each service.

For the operator, this means that they can statistically multiplex customers for carriage over the core network, reducing costs while maintaining the quality of service required by the customer.

For the customer, this means that they can receive both high and low quality services over the same DSL line at lower cost than equivalent services using older technologies. Examples of mixing high and low qualities of service would be a combination of voice telephony and Internet access. In this example, the voice is served with a high priority and low latency CBR service, while the Internet access is served using UBR on a best-effort basis.

NEXTEP ATM BASED SERVICE

Nextep provides standards based ATM over DSL services. We offer flexible products based upon the type of service required and amount of statistical multiplexing gain that the customer requires. Customer's services are offered using virtual circuits. These circuits are bundled into virtual paths for carriage across the ATM backbone network depending upon the negotiated service level.

By using the unique qualities of ATM, Nextep is able to meet the diverse demands of customers. Customers requiring multiples services are able to specify the quality levels for each service and receive those over a single DSL connection just as multiple customers with differing requirements can be effectively serviced using the common ATM backbone network. Service levels are kept high and costs kept low, resulting in a win-win relationship for Nextep and the customer.

CONTRIBUTING COMPANIES

For over a year, two of Australia's leaders in DSL technology have worked together to perfect a cost-effective high speed broadband service for small and medium enterprises (SMEs).

The result is a new business enterprise, Nextep Broadband, bringing together the expertise of NEC Australia and xDSL Limited.

NEC Australia

NEC Australia has more than 7 years experience with broadband deployments in Australia, New Zealand, Spain, Venezuela, Japan and Hong Kong, and is the DSL Global Design Centre for NEC Corporation.

NEC's DSL-based system is a standards-based, fully managed, multi-service access platform designed for carrier and enterprise applications. System interoperability has been tested and confirmed with more than 20 major CPE vendors and a range of backend server, switch and transmission equipment.

xDSL Limited

xDSL Limited was established in 1999 to explore the commercialisation of DSL as a broadband technology in Australia. Its major shareholders include ASX-listed Sirocco Resources N.L., the RMB Ventures group and AIB investments.

xDSL has a 26.7% interest in VOD Pty Limited, a joint venture with the Sirocco group and Civic Video. VOD is currently deploying video-on-demand over the TransACT network in Canberra.

xDSL has considerable experience in deploying content and other broadband services in commercial environments. The success of xDSL is due in large measure to its highly focused and skilled team assembled from a broad mix of backgrounds and disciplines.

"What is ATM" 221-003-BS-085-1-0 Rev 1.0
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