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Role of Asynchronous Transfer Method (ATM) on Corporate

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Abstract: This study aims to explain the unfamiliar term of "Asynchronous Transfer Mode" and its benefits in company. It is safe to say that companies nowadays depends on technology. And one of it is the asynchronous transfer mode that is a "special" network. This ATM is like a tool to boost the internet speed. But ATM can only be used to boost the internet speed if connected to some kind of signals like frame relay or SONET. ATM is also service-independent. All services (data, pictures, sound, etc) can be transmitted through ATM by setting some types of ATM Adaptation Layer (AAL). AAL. AAL changes the original format of information into the ATM format, so that the information can be trasmitted. ATM works by dismembering, then recombining the varying types of information (voice, video, data, etc) in a 53-byte cell format through the same physical channel. That kind of process named statistical multiplexing. In short, ATM is a double-layered technology, that can be used by anyone, and also is a public network as well as internet, with a neatly managed addressing system that every device in a network can has a unique identity. ATM has such benefits as supporting services for all types of applications currently available and application developments in the future, providing very high utilization of network resources, reducing switching complexity, and so on. With that kind of benefits, ATM is a very useful tools for companies.

Keywords: Asynchronous transfer mode, company technologies, ATM layers.

INTRODUCTION

It is known that communication technology is a general thing nowadays. In every aspect, people use the communication technology. With the existence of communication technology, we are able to reach people all over the world. And for that to be happened, the system receives messages from the sender, then translates it into signals that can be read by the system. After that, the system sends the translated messages to receiver's system and then translates it again from signals into real messages that can be read by user.

These days, communication technology often be considered as a unity with information that later is called information and communication technology. And among the system, there is a thing called asynchronous transfer method (ATM). This ATM is like a tool to boost the internet speed. But ATM can only be used to boost the internet speed if connected to some kind of signals like frame relay or SONET.

Further about the ATM, this technology is a double-layered technology that actually can be used by everyone. This technology has a neatly organized IP address so that every device on this network could have a unique identity.

This paper reviews how ATM works inside the network and can be useful for users, especially on corporate.

1. LITERATURE REVIEW

Asynchronous is a digital technology that deals with fixed time intervals coordinated by a clock, as data is transmitted one byte or character at a time. The word 'asynchronous' in ATM means that the data transfer is carried out asynchronously, which means the sender and the receiver, respectively, is not necessarily seemed to have the same or synchronized time. Asynchronous transfer mode (ATM) is a network technology platform and communication infrastructure that can be used by telecommunications networks for digital transmission. Each cell is 53 bytes long consisting of a 5-byte header and a 48-byte payload.

Unlike other more common data link technologies, say, Ethernet, ATM does not involve routing. ATM uses fixed-sized cells instead of cells with varying lengths. There are two characteristics offered by ATM to fix the speed level of data transfer. The first characteristic compares the communicated packets with protocols for telephone systems. And the second one is increasing the speed.

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ATM is service independent. All services (data, pictures, sound, etc) can be transmitted through ATM by setting some types of ATM Adaptation Layer (AAL). AAL. AAL changes the original format of information into the ATM format, so that the information can be trasmitted. ATM can be implemented on networks in three ways, sorted from the easiest to the most difficult are Native ATM APIs, Classical IP and Address Resolution Protocol and LANE Native ATM APIs. Classical IP is limited only for network with TCP/IP protocol, while LANE could use any kind of protocol. LANE allows existing applications and protocols to operate without changes when ATM is applied. It means that company does not have to ditch the existing application or network infrastructur. Consequently, there are so many companies in USA using ATM system.

ATM works by dismembering, then recombining the varying types of information (voice, video, data, etc) in a 53-byte cell format through the same physical channel. That kind of process named statistical multiplexing.

Through that method, information from the user is transmitted among other information using an information packet addressed to the ATM cell of 53 bytes consisting of 48 bytes containing information and 5 bytes of headers. The cells are identified by labeling the header of each cell and transmitted according to a pre-arranged sequence.

In short, ATM is a double-layered technology, that can be used by anyone, and also is a public network as well as internet, with a neatly managed addressing system that every device in a network can has a unique identity.

Here are some characteristics of ATM:
1. They do not use error protection and flow control on the *link to link basic*; Error protection can be ignored because of these times, the links on network have a very high quality that control of error can be done enough by end-to-end.
2. ATM operates on connection oriented mode; Before information trasnferred from terminal to network, a setup logical / virtual connection phase should be done to provide the necessary resource. If the available resources are insufficient, then connection from terminal is canceled.
3. Reduction of header function; If header functions are limited, the implementation of header processing in ATM's node can be way too easier and simpler and can be done at the very high speed (150 Mbps - 2,5 Gbps) and also this will cause low processing delay and queuing delay.
4. ATM protocol layer; ATM layer is the layer for connecting to protocol. Physical layer involves spesification of transmision media and signal-coding-scheme.
5. Length of the filed information in one cell is relatively small; It is done to reduce the internal buffer size in switching node, and also delimit queuing delay happened on that buffer.

2. METHODS

On this section, we will provide more detailed informations about ATM. ATM's network is formed by ATM switches and ATM endpoints. ATM switches are responsible for transiting cells through the ATM network. ATM switches also have responsibility for several things: 1). Receiving cells from ATM endpoints or other ATM switches; 2). Reading and updating the header information of the cells and switching it into the destination.

Not only ATM switches have the responsibilities, but also ATM endpoints. ATM endpoints is tasked to be an adapter for the ATM network, such as workstations, router, LAN switch, video CODEC, Digital Service Unit (DSU).

Data blocks with various sizes transmitted by user from the highest layer will be sent back to the AAL (ATM Adaption Layer), which in this process, headers, trailer, padding octets, and CRC (Cyclic Redundancy Check) bits depend on certain condition on each data block.

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Next, each data block will be divided into several smaller data blocks which then will be revealed to 53 octet cells in the ATM layer. This data will be sent to the desired destination.

Protocol reference model involves three different levels:
- User level: Available for transfer of information between users, together with related controls.
- Control level: Display functions of call control and connection control.
- Management level: Display management functions related to the whole system.

3. RESULT AND DISCUSSION

4.1. Results

In ATM networks, all information is formatted into fixed-sized cells consisting of 48 bytes (8 bits per byte) in the form of payloads and 5 bytes in the form of headers. Fixed cell size ensures that the quality of the data, whether voice or video, is not affected by the data frame or packet length. These headers are structured for high speed switching efficiency.

The ATM layer is a layer above the physical layer which has characteristics that are independent of the physical media used.

a) The ATM network is a connection-oriented network. To make an ATM call requires sending a message first to set up a connection. After that, all subsequent cells follow the same trajectory to reach the destination machine after all messages have been sent then the connection is disconnected. To achieve high transfer speeds, an ATM network uses special hardware and software techniques, namely:
b) An ATM network has one or more high-speed switches, which are connected to computer hosts or other ATM switches.
c) ATM uses optical fiber for connections, including connection from the host computer to the ATM switch, which provides a higher transfer rate than copper cable. Usually the connection between the host computer and the ATM switch is between 100-155 Mbps.
d) The lowest layer of the ATM network uses fixed-size frames called cells. Because each cell is the same length, the ATM switch hardware can process cells quickly.

ATM is able to handle all types of communication traffic (voice, data, image, video, high-speed voice, multimedia and so on) in one channel and at high speed). ATM can be used in Local Area Network and Wide Area Network (WAN). In LAN construction, the use of ATM can save costs because Users who will connect themselves to the LAN ATM system can use adapters to provide transmission speed according to the bandwidth they need.

ATM have the following benefits:

1) Support services for all types of applications currently available and application developments in the future.
2) Provides very high utilization of network resources.
3) Reduced switching complexity.
4) Reduces processing time on intermediate nodes and supports ultra-high-speed transmission.
5) Reducing the required buffer size at intermediate nodes to avoid delays and complexity of buffer settings.
6) Ensure the performance required by the current application and its development in the future.

ATM has 3 layers:
1) Physical Layer:

The physical layer is concerned with the physical medium, namely: voltage, bit timing and other similar problems and involves the specification of the transmission medium and the signal coding scheme. Data rate at Physical Layer: 25.6 MBps to 622.08 MBps. The physical layer is divided into 2 (two) sub layers, namely: PMD (Physical Medium Dependent) and TC (Transmission Convergence). PMD is an interface for the transmission media (cable, radio gel etc.) The PMD sublayer transfers the bits of information and handles the timing of the corresponding bits.

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TC's job is to convert the bit stream into a cell stream for the ATM layer. The TC sublayer is responsible for handling all the problems related to marking the start and end of cells in the bit stream . When cells are transmitted, the TC sublayer sends them a string of bits to the PMD layer and the TC sublayer gets a pure stream of incoming bits from the PMD layer. The physical layer of the ATM protocol is a mixture of the physical layer and the data link layer of the ATM protocol.

2) ATM Layer:

ATM Layer is used for various forms of services and data transfer capabilities (determining the transmission of data in a certain packet size). When viewed from the OSI protocol, the ATM layer performs the tasks performed by the data link layer and the network layer in the OSI protocol.

The OSI data link layer is concerned with the formation of frames and transfer protocols between two machines on the same physical cable (or optical fiber). The data link layer protocol is a single-hop protocol. These protocols are not concerned with end-to-end connections because there can be no switching and routing at the data link layer. The network layer is the layer that connects sources to destinations, so this layer involves switching and routing (that is, it is multihop).

The ATM layer functions to move cells from source to destination and involves routing algorithms and protocols found in ATM switches. The ATM layer is also concerned with global addressing

The ATM layer performs the following main functions:

- Cell multiplexing/demultiplexing, in the direction of sending cells from individual VP (Virtual Path) and VC (Virtual Channel) will be multiplexed to produce a cell stream. On the receiving side, the cell demultiplexing function will separate the received cell stream into individual cell flows to the related VP and VC.
- Translation of VPI and VCI. The translation of VPI (VP Identifier) and VCI is done at the ATM switching node. In the VP node the value of the VPI field for each incoming cell will be translated to the new VPI value for the outgoing cell. On the VC switch, both the VPI and VCI values will be translated to the new VPI and VCI values.
- Generating / splitting the cell header, this function is applied to the termination points of the ATM layer. In the sending direction, the information field received from AAL is added to the ATM cell header (except the HEC field) and the VPI and VCI values from the cell header can be obtained by translating the SAP (Service Access Point) identifier. In the receive direction, the header cell split function will separate the header cells, and only the information fields are passed to AAL.
- Generic Flow Control (GFC). The GFC function is only used on BISDN UNI (User Network Interface) only. GFC is used to support control of ATM traffic flow in one customer network and can be used to reduce overload conditions on UNI. GFC information is superimposed in the assigned and unassigned cells.

3) ATM Adaptation Layer (AAL):

AAL maps information from the Higher layer into ATM cells to be transported throughout the network and vice versa collects information from ATM cells to send to the Higher Layer

AAL is divided into 2 (two) sub layers, namely SAR (Segmentation and Reassembly) and CS (Convergence), the lower sub layer breaks down packets into cells on the transmission side and recombines them at the destination. The upper sub-layer enables the ATM system to offer other forms of service for various applications (e.g. file transfer, video, on-demand requests for different requirements for error handling, timing etc.)

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Besides consisting of the three layers above, this reference model also consists of 3 planes, namely:
• User Plane (U-Plane) which has a function to transmit information from users transparently.
• Control Plane (C-Plane) is in charge of sending the necessary information to control connections from the user plane (establishing/disconnecting a connection, monitoring the characteristics of a connection, etc.)
• The Management Plane (M-Plane).

ATM Losses:
1. Costs are still relatively high
2. Higher complexity: Complex mechanisms to achieve QoS (Quality of Service)
3. Overhead cell header (5 bytes per cell)

4.2. DISCUSSION

ATMs are needed in business because there are several developments in business needs, including:

- Changes in operations from centralized to distributed
- The existence of a distributed processing & client server paradigm
- LAN/MAN/WAN interconnection requirements
- Significant increase in inter-LAN traffic
- Bandwidth on demand

With the ATM, there is a network that can be used to carry all types of traffic and connections between networks.

4. CONCLUSION

Asynchronous transfer mode; when the speed of the I/O device is slower than that of the microprocessor, many companies prefer the asynchronous transfer mode. As the speeds of both the devices differ, the I/O device's internal timing is entirely independent of the microprocessor. Because of that, they are termed to be '*asynchronous*' from each other. The term '*asynchronous*' itself means "at irregular intervals".

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