# ATM AND MULTIPROTOCOL NETWORKING pdf

## 1: MultiProtocol Label Switching (MPLS) - Providers and Solutions

*Two top networking experts describe the ATM protocol and architecture as they relate to carrying existing computer network protocols,and help you integrate ATM in a multiprotocol internetwork. Emphasis on corporate implementation helps you fully exploit ATM in real-life corporate settings.*

Multiprotocol over ATM ATM Devices and the Network Environment ATM is a cell-switching and multiplexing technology that combines the benefits of circuit switching guaranteed capacity and constant transmission delay with those of packet switching flexibility and efficiency for intermittent traffic. It provides scalable bandwidth from a few megabits per second Mbps to many gigabits per second Gbps. Because of its asynchronous nature, ATM is more efficient than synchronous technologies, such as time-division multiplexing TDM. With TDM, each user is assigned to a time slot, and no other station can send in that time slot. If a station has much data to send, it can send only when its time slot comes up, even if all other time slots are empty. However, if a station has nothing to transmit when its time slot comes up, the time slot is sent empty and is wasted. Because ATM is asynchronous, time slots are available on demand with information identifying the source of the transmission contained in the header of each ATM cell. Each cell consists of 53 octets, or bytes. The first 5 bytes contain cell-header information, and the remaining 48 contain the payload user information. Small, fixed-length cells are well suited to transferring voice and video traffic because such traffic is intolerant of delays that result from having to wait for a large data packet to download, among other things. Figure below illustrates the basic format of an ATM cell. The job of an ATM switch is well defined: It then reads and updates the cell header information and quickly switches the cell to an output interface toward its destination. ATM switches support two primary types of interfaces: Its public counterpart connects an ATM endpoint or private switch to a public switch. A public one connects two ATM switches within the same public organization. An additional specification, the broadband intercarrier interface B-ICI , connects two public switches from different service providers. Figure below illustrates the ATM interface specifications for private and public networks. The following descriptions summarize the ATM cell header fields illustrated in the above figure: This field is typically not used and is set to its default value of 0 binary  Payload Type PT â€” Indicates in the first bit whether the cell contains user data or control data. If the cell contains user data, the bit is set to 0. If it contains control data, it is set to 1. Cell Loss Priority CLP â€” Indicates whether the cell should be discarded if it encounters extreme congestion as it moves through the network. HEC can correct a single bit error in these bytes, thereby preserving the cell rather than discarding it. PVC allows direct connectivity between sites. In this way, a PVC is similar to a leased line. Among its advantages, PVC guarantees availability of a connection and does not require call setup procedures between switches. Disadvantages of PVCs include static connectivity and manual setup. Each piece of equipment between the source and the destination must be manually provisioned for the PVC. Furthermore, no network resiliency is available with PVC. An SVC is created and released dynamically and remains in use only as long as data is being transferred. In this sense, it is similar to a telephone call. The advantages of SVCs include connection flexibility and call setup that can be handled automatically by a networking device. Disadvantages include the extra time and overhead required to set up the connection. A virtual channel is roughly equivalent to a virtual circuit. Two types of ATM connections exist: A virtual path is a bundle of virtual channels, all of which are switched transparently across the ATM network based on the common VPI. All VPIs and VCIs, however, have only local significance across a particular link and are remapped, as appropriate, at each switch. A transmission path is the physical media that transports virtual channels and virtual paths. Figure below illustrates how VCs concatenate to create VPs, which, in turn, traverse the media or transmission path. The switch then retransmits the cell on that outgoing link with the appropriate connection identifiers. Because all VCIs and VPIs have only local significance across a particular link, these values are remapped, as necessary, at each switch. ATM functionality corresponds to the physical layer and part of the data link layer of the OSI reference model. The ATM reference model is composed of the following planes, which span all layers: Control â€” This plane is responsible for generating and managing signaling requests. User â€” This plane is

responsible for managing the transfer of data. Management â€" This plane contains two components: Layer management manages layer-specific functions, such as the detection of failures and protocol problems. Plane management manages and coordinates functions related to the complete system. Physical layer â€" Analogous to the physical layer of the OSI reference model, the ATM physical layer manages the medium-dependent transmission. The ATM layer is responsible for the simultaneous sharing of virtual circuits over a physical link cell multiplexing and passing cells through the ATM network cell relay. The adaptation layer prepares user data for conversion into cells and segments the data into byte cell payloads. Figure below illustrates the ATM reference model: Cells are converted into a bitstream, the transmission and receipt of bits on the physical medium are controlled, ATM cell boundaries are tracked, and cells are packaged into the appropriate types of frames for the physical medium. The ATM physical layer is divided into two parts: The PMD sublayer provides two key functions. First, it synchronizes transmission and reception by sending and receiving a continuous flow of bits with associated timing information. Second, it specifies the physical media for the physical medium used, including connector types and cable. The TC sublayer has four functions: The cell delineation function maintains ATM cell boundaries, allowing devices to locate cells within a stream of bits. HEC sequence generation and verification generates and checks the header error control code to ensure valid data. Cell-rate decoupling maintains synchronization and inserts or suppresses idle unassigned ATM cells to adapt the rate of valid ATM cells to the payload capacity of the transmission system. Transmission frame adaptation packages ATM cells into frames acceptable to the particular physical layer implementation. Circuit-emulation service also accommodates the attachment of equipment currently using leased lines to an ATM backbone network. AAL1 requires timing synchronization between the source and the destination. The AAL1 process prepares a cell for transmission in three steps. First, synchronous samples for example, 1 byte of data at a sampling rate of microseconds are inserted into the Payload field. Third, the remainder of the Payload field is filled with enough single bytes to equal 48 bytes. Figure below illustrates how AAL1 prepares a cell for transmission. This is called variable bit rate VBR traffic. This typically includes services characterized as packetized voice or video that do not have a constant data transmission speed but that do have requirements similar to constant bit rate services. The AAL2 process uses 44 bytes of the cell payload for user data and reserves 4 bytes of the payload to support the AAL2 processes. Type fields identify whether a cell is the beginning, continuation, or end of a message. Sequence number fields identify the order in which cells should be reassembled. The Multiplexing Identifier field determines which cells from different traffic sources are interleaved on the same virtual circuit connection VCC so that the correct cells are reassembled at the destination. AAL5 prepares a cell for transmission in three steps. First, the CS sublayer appends a variable-length pad and an 8-byte trailer to a frame. This allows the AAL5 receiving process to detect bit errors, lost cells, or cells that are out of sequence. For all cells except the last, a bit in the Payload Type PT field is set to 0 to indicate that the cell is not the last cell in a series that represents a single frame. For the last cell, the bit in the PT field is set to 1. It decided on the subnetwork or overlay model of addressing, in which the ATM layer is responsible for mapping network layer addresses to ATM addresses. Therefore, it requires an entirely new addressing scheme and routing protocol. The AFI identifies the type and format of the IDI, which, in turn, identifies the address allocation and administrative authority. The DSP contains actual routing information. Devices attached to the switch inherit the prefix value from the switch as part of their NSAP address. The prefix is used by switches to support ATM routing. Each device attached to the switch must have a unique ESI value. The last byte, called the selector SEL byte, identifies the intended process within the device that the connection targets. ICD codes identify particular international organizations. Figure below illustrates the three formats of ATM addresses used for private networks. AFI â€" Identifies the type and format of the address E. DCC â€" Identifies particular countries. The ATM Forum combined these fields to support a flexible, multilevel addressing hierarchy for prefix-based routing protocols. Selector SEL â€" Is used for local multiplexing within end stations and has no network significance. ICD â€" Identifies particular international organizations. Point-to-point connects two ATM end systems and can be unidirectional one-way communication or bidirectional two-way communication. Point-to-multipoint connects a single-source end system known as the root node to multiple destination end systems known as leaves. Such connections are

unidirectional only.

# ATM AND MULTIPROTOCOL NETWORKING pdf

## 2: Asynchronous Transfer Mode Switching - DocWiki

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Devices attached to the switch inherit the prefix value from the switch as part of their NSAP address. The prefix is used by switches to support ATM routing. Each device attached to the switch must have a unique ESI value. The last byte, called the selector SEL byte, identifies the intended process within the device that the connection targets. ICD codes identify particular international organizations. AFI - Identifies the type and format of the address E. DCC - Identifies particular countries. The ATM Forum combined these fields to support a flexible, multilevel addressing hierarchy for prefix-based routing protocols. Selector SEL - Is used for local multiplexing within end stations and has no network significance. ICD - Identifies particular international organizations. Point-to-point connects two ATM end systems and can be unidirectional one-way communication or bidirectional two-way communication. Point-to-multipoint connects a single-source end system known as the root node to multiple destination end systems known as leaves. Such connections are unidirectional only. Root nodes can transmit to leaves, but leaves cannot transmit to the root or to each other on the same connection. Cell replication is done within the ATM network by the ATM switches where the connection splits into two or more branches. It would be desirable in ATM networks to have bidirectional multipoint-to-multipoint connections. Such connections are

analogous to the broadcasting or multicasting capabilities of shared-media LANs, such as Ethernet and Token Ring. A broadcasting capability is easy to implement in shared-media LANs, where all nodes on a single LAN segment must process all packets sent on that segment.

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## 3: Multiprotocol over ATM Building State of the Art ATM Intranets Utilizing RSVP | eBay

*Multiprotocol Label Switching (MPLS) is a type of data-carrying technique for high-performance telecommunications networks. MPLS directs data from one network node to FORE SYSTEMS FORERUNNER ATM USER MANUAL Pdf Download.*

As mentioned above, when MPLS was conceived, label lookup and label switching were faster than a routing table or RIB Routing Information Base lookup because they could take place directly within the switched fabric and avoid having to use the OS. In the case of Ethernet frames this is done through the use of EtherType values 0x and 0x, for unicast and multicast connections respectively. This is a type of router located in the middle of an MPLS network. It is responsible for switching the labels used to route packets. When an LSR receives a packet, it uses the label included in the packet header as an index to determine the next hop on the label-switched path LSP and a corresponding label for the packet from a lookup table. The old label is then removed from the header and replaced with the new label before the packet is routed forward. Alternatively, under penultimate hop popping this function may instead be performed by the LSR directly connected to the LER. Devices that function only as transit routers are similarly called P Provider routers. Label-switched paths[ edit ] Label-switched paths LSPs are established by the network operator for a variety of purposes, such as to create network-based IP virtual private networks or to route traffic along specified paths through the network. The packet is then passed on to the next hop router for this tunnel. Routers can have prebuilt lookup tables that tell them which kind of operation to do based on the topmost label of the incoming packet so they can process the packet very quickly. In a swap operation the label is swapped with a new label, and the packet is forwarded along the path associated with the new label. In a push operation a new label is pushed on top of the existing label, effectively "encapsulating" the packet in another layer of MPLS. This allows hierarchical routing of MPLS packets. In a pop operation the label is removed from the packet, which may reveal an inner label below. This process is called "decapsulation". If the popped label was the last on the label stack, the packet "leaves" the MPLS tunnel. Indeed, transit routers typically need only to examine the topmost label on the stack. The forwarding of the packet is done based on the contents of the labels, which allows "protocol-independent packet forwarding" that does not need to look at a protocol-dependent routing table and avoids the expensive IP longest prefix match at each hop. At the egress router, when the last label has been popped, only the payload remains. This can be an IP packet, or any of a number of other kinds of payload packet. An MPLS transit router has no such requirement. Usually by default with only one label in the stack, accordingly to the MPLS specification , the last label is popped off at the penultimate hop the hop before the egress router. This is called penultimate hop popping PHP. This may be interesting in cases where the egress router has lots of packets leaving MPLS tunnels, and thus spends inordinate amounts of CPU time on this. By using PHP, transit routers connected directly to this egress router effectively offload it, by popping the last label themselves. This optimisation is no longer that useful like for initial rationales for MPLS â€" easier operations for the routers. Some specific label values have been notably reserved [16] [17] for this use: The path is set up based on criteria in the FEC. The path begins at a label edge router LER , which makes a decision on which label to prefix to a packet, based on the appropriate FEC. The last router in the path removes the label from the packet and forwards the packet based on the header of its next layer, for example IPv4. The router which first prefixes the MPLS header to a packet is called an ingress router. The last router in an LSP, which pops the label from the packet, is called an egress router. Routers in between, which need only swap labels, are called transit routers or label switch routers LSRs. Since bidirectional communication is typically desired, the aforementioned dynamic signaling protocols can set up an LSP in the other direction to compensate for this. When protection is considered, LSPs could be categorized as primary working , secondary backup and tertiary LSP of last resort. If one wants to carry two different types of traffic between the same two routers, with different treatment by the core routers for each type, one has to establish a separate MPLS path for each type of traffic. The paths an LSR knows can be defined using explicit hop-by-hop configuration, or are dynamically routed by the constrained shortest path first CSPF algorithm, or are

configured as a loose route that avoids a particular IP address or that is partly explicit and partly dynamic. In a pure IP network, the shortest path to a destination is chosen even when the path becomes congested. In addition to the constraint of RSVP bandwidth, users can also define their own constraints by specifying link attributes and special requirements for tunnels to route or not to route over links with certain attributes. MPLS local protection fast reroute [ edit ] Main article: MPLS local protection In the event of a network element failure when recovery mechanisms are employed at the IP layer, restoration may take several seconds which may be unacceptable for real-time applications such as VoIP. Frame Relay[ edit ] Frame Relay aimed to make more efficient use of existing physical resources, which allow for the underprovisioning of data services by telecommunications companies telcos to their customers, as clients were unlikely to be utilizing a data service percent of the time. In more recent years, Frame Relay has acquired a bad reputation in some markets because of excessive bandwidth overbooking by these telcos. In both technologies, connections are signaled between endpoints, connection state is maintained at each node in the path, and encapsulation techniques are used to carry data across the connection. Private Network-to-Network Interface for ATM there still remain significant differences in the behavior of the technologies. The most significant difference is in the transport and encapsulation methods. Packets must be segmented, transported and re-assembled over an ATM network using an adaptation layer, which adds significant complexity and overhead to the data stream. MPLS, on the other hand, simply adds a label to the head of each packet and transmits it on the network. Differences exist, as well, in the nature of the connections. Establishing two-way communications between endpoints requires a pair of LSPs to be established. Because 2 LSPs are required for connectivity, data flowing in the forward direction may use a different path from data flowing in the reverse direction. MPLS can stack multiple labels to form tunnels within tunnels. Modern routers are able to support both MPLS and IP natively across a common interface allowing network operators great flexibility in network design and operation. It is deployed to connect as few as two facilities to very large deployments. Evolution[ edit ] MPLS has been originally proposed to allow high performance traffic forwarding and traffic engineering in IP networks. The major goal of MPLS development was the increase of routing speed. These also provide services such as service provider layer 2 and layer 3 VPNs. L2TPv3 has been suggested as a competitor, but has not reached any wider success. An organisation has an office in each city. The organisation requires connectivity between these two offices. To connect the offices to the PoPs, a connection via the local loop will be commissioned for each office. In this way, an NPLC is delivered.

## 4: What is Multiprotocol Over ATM (MPOA)? - Definition from Techopedia

*Multiprotocol Label Switching (MPLS) is a type of data-carrying technique for high-performance telecommunications networks. MPLS directs data from one network node to the next based on short path labels rather than long network addresses, avoiding complex lookups in a routing table.*

At this location, the Layer 3 header is mapped to a fixed-length label. At each router across the network, only the label need be examined in the incoming cell or packet in order to send the cell or packet on its way across the network. At the other end of the network, an edge LSR swaps the label out for the appropriate header data linked to that label. A key result of this arrangement is that forwarding decisions based on some or all of these different sources of information can be achieved by means of a single table lookup from a fixed-length label. For this reason, label switching makes it feasible for routers and switches to make forwarding decisions based on multiple destination addresses. Label switching integrates switching and routing functions, combining the reachability information provided by the router function with the traffic engineering benefits achieved by the optimizing capabilities of switches. IP VPN services are an invaluable development in provider networks, giving enterprise customers a service that meets their needs for private, connectionless delivery of IP services. Furthermore, Cisco supports all the standards relevant to carrier-class IP services: When integrated with ATM switches, label switching uses switch hardware optimized to take advantage of the fixed length of ATM cells and to switch the cells at high speeds. Support of all these services on a common platform provides operational cost savings and simplifies provisioning for multiservice providers. These MPLS benefits are analyzed in greater detail in the following list: But a number of problems exist with this approach, all arising from the fact that the PVC links between routers are overlaid on the ATM network. This makes the ATM network structure invisible to the routers. A single ATM link failure could make several router-to-router links fail, creating problems with large amounts of routing update traffic and subsequent processing. See the next section for details. This might lead to inefficient routing in the ATM network. Support of these services entails much time and work in the standards bodies and implementation; the resulting mapping between IP features and ATM features is often approximate. VPN services are an important way to provide enterprises with private IP networks within their infrastructures. Additionally, you can isolate Internet routing tables from service provider network cores. This separation of interior routes from full Internet routes also provides better fault isolation and improved stability. Traffic engineering lets you shift the traffic load from overutilized portions of the network to underutilized portions, according to traffic destination, traffic type, traffic load, time of day, and so on.

# ATM AND MULTIPROTOCOL NETWORKING pdf

## 5: Multiprotocol Label Switching - Wikipedia

*Certify and Increase Opportunity. Be Govt. Certified Network Support Professional ATM Asynchronous Transfer Mode Asynchronous Transfer Mode (ATM) is an International Telecommunication Union-Telecommunications Standards Section (ITU-T) standard for cell relay wherein information for multiple service types, such as voice, video, or data, is conveyed in small, fixed-size cells.*

Often referred to as "Layer 2. MPLS is part of the family of packet-switched networks. It was designed primarily to provide a unified data-carrying service for Circuit-based as well as Circuit-switching clients. Both the clients offer a datagram service model. Labels are assigned to the data packets in an MPLS network. Based on the label contents, packet-forwarding decisions are made, without necessitating examination of the data packets. Through this feature, end-to-end circuits may be created using any protocol over any type of transport medium. It also does not require multiple data link layer networks to gratify different traffic types. In MPLS technology, a specific path is set up for a given sequence of data packets. These packets are identified by the packet label, thereby saving the time that a router takes to search the address where the packet should next be forwarded. The major benefits of MPLS networks include: It can support pre-provisioned routes that are virtual circuits known as "Label-Switched Paths LSPs ," across the network. Provision for backing up multiple service categories containing different forwarding and drop priorities, is also available with this technology. Multiprotocol label switching addresses common networking problems such as scalability, speed, Quality of Service QoS , and traffic engineering, and provides them a viable and effective solution. Owing to its versatility, MPLS has emerged as a solution capable of meeting bandwidth and other service requirements for IP-based networks. Considering the positive points and shortcomings of ATM, MPLS technologies were designed to provide more leverage to network engineers and to be deployed flexibly. The marketplace is constantly being replaced with new technologies and technology devices. MPLS came to the forefront when there was a requirement for a protocol that needs less overhead and at the same time provides connection oriented-services for frames of variable length. Technology such as ATM and frame relay has been replaced in many areas by MPLS technology, which combines many options to satisfy the technology requirements of clientele. Concurrently, Multiprotocol label switching technology continues to maintain the traffic engineering and bandwidth control, which was popularized by ATM and frame relay in large-scale networks. Migration to MPLS technology is beneficial especially since the benefits of traffic management are important. Performance level increases and so does reliability. It is mainly used for forwarding Ethernet traffic and IP datagrams. It is based on the service provider, to secure overlay VPN solutions. Although there are many advantages in using MPLS technology, there are yet a few hassles. Multiprotocol label switching was primarily designed for allowing routers to decide and forward IP packets based on label contents instead of the complex route lookup mechanism that is based on the destination IP address. As technology advanced, it became possible for Layer 3 switches, which are ASIC-based routers, to execute route lookups at adequate speed for supporting most interface types. Also the management issues are quite complex as MPLS networks rely solely on the routing protocols to transport data accurately. Any technology snag in routing and forwarding will result in data loss and redirection of data packets in some cases. In order to resolve the complexities that are encountered due to various technologies, it is essential to use advanced technology solutions that provide efficient alternatives. The technology marketplace offers a wide array of technology products and enhanced solutions that support such technology. Customers can use a VPN at the customer premise with a managed VPN service as a back up to a frame relay or private line.

## 6: Multiprotocol Label Switching Networks > A Network Administrator's View of Multiservice Networks

*This text is intended for network professionals who are integrating ATM into networks running on such protocols as TCP/IP, SNA and APPN in order to enhance transmission of data, video and sound -.*

# ATM AND MULTIPROTOCOL NETWORKING pdf

## 7: ATM Asynchronous Transfer Mode - Tutorial

*Multiprotocol over ATM (MPOA) facilitates local area network (LAN) data exchange through an asynchronous transfer mode (ATM) backbone. MPOA is an ATM Forum specification standardized as RFC*

## 8: What is Asynchronous Transfer Mode (ATM)? - Definition from Techopedia

*Asynchronous transfer mode (ATM) is a switching technique used by telecommunication networks that uses asynchronous time-division multiplexing to encode data into small, fixed-sized cells. This is different from Ethernet or internet, which use variable packet sizes for data or frames.*

## 9: Introduction to Multiprotocol Label Switching > Voice, IP, and ATM MPLS Features

*MPLS explained Multi-protocol label switching is a way to insure reliable connections for real-time applications, but it's expensive, leading enterprises to consider SD-WAN as a way to limit its use.*

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