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Networks Security and data transmission using Multi-protocol Label Switching (MPLS) technology

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ABSTRACT:

Considered the MPLS network is the future for all the needs and applications of networks and most efficient .With the development of companies and organizations to keep pace with the ever-changing business climate, companies' networking needs are becoming more dynamic. Their networks must be able to transfer sophisticated applications quickly and efficiently while minimizing costs. MPLS is a technology that can be very beneficial to companies and this paper outlines what MPLS is, the benefits that MPLS delivers and how MPLS can satisfy companies -networking requirements. But the problem is when they went all the companies and service providers to the Internet Protocol IP, it has become important to find a more efficient way approve of this type of approach, MPLS simplifies the network infrastructure by allowing the improvement of multiple technologies and applications such as voice, video and data. MPLS provides enhanced security & high availability through the below-mentioned theories & analysis we can see that the MPLS is faster than traditional routing technique. If we can improve hardware facilities and software platform by real-time routers then we can notice the significant difference. This is indicated by the work paper from improving the performance of data transfer to ensure confidentiality and speed of transfer.

Keywords: MPLS, IP, TE, ATM, QOS

1- Introduction:

The core components of a network play key role as fares overall network performance is concerned and it has nothing to do with end systems. The technology used for routing can also make significant difference. Currently, we have three main technologies for routing used in network cores: IP, ATM and MPLS based routing. IP is the oldest and highly used in network cores, a lot has been done, and still research is going on it for further improvement. In order to enhance IP performance, various modifications to the routing techniques were proposed. [1] Recently, as Internet and its services grow rapidly, a new switching mechanism, Multi-protocol Label Switching (MPLS), has been introduced by IETF. [2] MPLS by overlying IP and simplifying backbone of wide-area IP networks is a high-speed technology. [3] It substitutes conventional packet forwarding within a network, or a part of network, with a faster operation of label look-up and switching. [4] The use of one Unified Network Infrastructure, Means use of the network and one uniform, and this is the benefit of a great advantage, especially for service providers, there is no need to launch multiple services or several networks both Frame-Relay or ATM with each individually, network is the MPLS able to provide the service and upload any type or any service. The purpose of this paper is to summarize the benefits and applications of protocols Label Switching (MPLS) in companies or institutions networks. This paper also describes the implication in solving the end-to-end from core of the data center and the edge of the corporate network. That using Traffic Engineering (TE) along with QoS in MPLS network decreases the jitter, packet delay variation and end-to-end packet delay compared to using IP network for voice traffic. The application of nodal tensor method for solving the problem of routing in MPLS-TE network with additional directions of traffic transmission is proposed. An additional direction of traffic routing has been selected by the criterion of minimum time of packets delivery in order to ensure balanced load and reliability of a network.

2- Benefits of MPLS:

The various notable benefits or advantages of MPLS are given as:

(a) Speed

(b)Optimal Traffic Flow

(c)Traffic Engineering (TE)

(d)Quality-of-Service (QoS)

(e)Overlapping Address Pools

(f) Better IP over ATM Integration. [5]

Though the MPLS targeted primarily to service providers in the past, a growing number of companies carried out a deployment of MPLS and / or VPLS in their networks. Because of how to build MPLS technology, it brings many potential benefits to service providers, as well as companies. One of the main interests of MPLS is that separates the redirection mechanisms of basic services and related data. MPLS supports multiple applications including, Unicast and multicast IP routing, MPLS minimizes the overhead refer to basic routers, MPLS can support referral protocols is IP, The benefit in the end is unified or converged network to support all service categories.

An MPLS-enabled network simplifies the overall network infrastructure with the rapprochement multiple technologies. Institutions and companies can eliminate multiple, complex overlay networks and are able to the transfer of a variety of new applications over the network using voice, video and data. Facilitation of network greatly reduces capital and operating costs. As applications concentrate onto one network, the Company network operator must ensure that all users have the same user experience regardless of whether they are located in a branch office or in corporate headquarters. MPLS supports Quality of Service (QoS), the ability to allocate priorities for different applications in the network, thereby allocating the needed network bandwidth at the appropriate time.

3- MPLS and security:

IP/MPLS VPN helps improve application performance across your network with a private, point-to-multipoint network design between multiple locations, even to a third party data center or cloud platform IP/MPLS VPN offers high capacity multi-point connectivity that's cost effective, reliable and flexible. Delivered using Multi-Protocol Label Switching (MPLS) technology, our IP/MPLS VPN offers high levels of security, network infrastructure, and network management and operational levels (Figure1).[6]

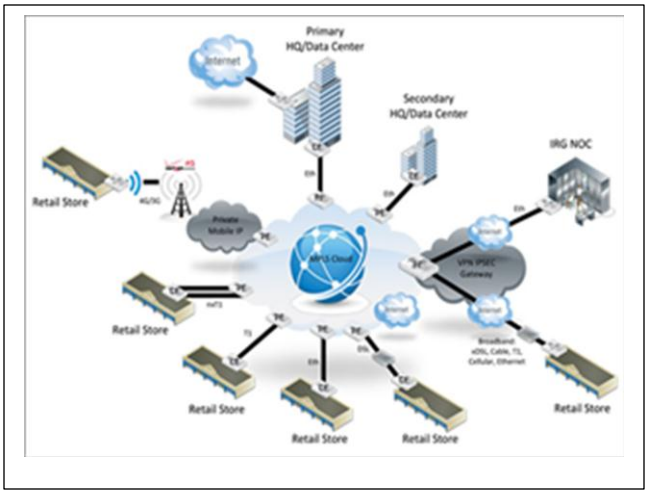

Figure 1: IP / MPLS VPN

Believes networks MPLS VPN the same level of safety provided by the VPN networks with contact wave (such as ATM, Frame Relay). Packets coming from the VPN are not considered to another VPN automatically. Provide security when the edge of the provider network, sure that packets receiving of the customer placed in the VPN correct in network, VPN traffic kept separate. With MPLS VPN technology, the company has a viable stand by to the purchasing and provisioning of multiple links and circuits. With a single physical network for multiple Of its divisions, enterprises can logically separate these entities and in doing so Can ensure security for the

mission-critical data from different entities. MPLS VPNs allow for a shared set of network resources to

be shared all around entire business without sacrificing security. For example, a common data center can be leveraged all around business, without requiring complex overlay formation that some other technologies would dictate.

4- MPLS TECHNOLOGY:

Multiprotocol label switching (MPLS) is an addition to the existing Internet Protocol (IP) architecture. By adding new capabilities to the IP architecture, MPLS enables support of new features and applications. In MPLS short fixed-length, labels are assigned to packets at the edge of the MPLS domain and these pre assigned labels are used rather than the original packet headers to forward packets on pre-routed paths through the MPLS network [7].

MPLS technology can provide additional services to its customers through service providers expand the scope of its work and its offerings and exercise more control over their growing networks by using its traffic engineering capabilities, MPLS is a switching technology used to get packets from one place to another through a series of hops. MPLS technology supports business needs to explore other possibilities in growth and expansion. Using an MPLS network connection you can easily add, remove and connect new sites and remote workers.

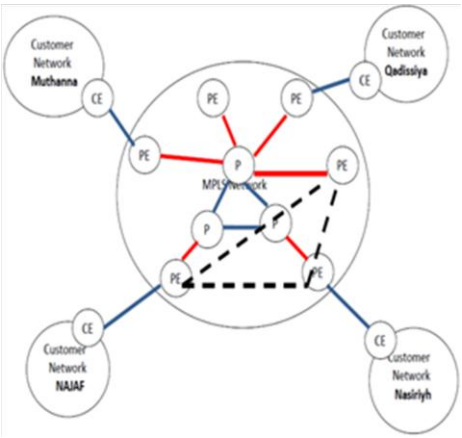

Figure 2: MPLS TECHNOLOGY

- **Customer Edge (CE) router:** The routers connecting individual customer sites to the service provider network.

- **Provider Edge (PE) router:** The service provider devices to which the CE routers are directly connected.

- **Provider (P) router:** The service provider devices used for forwarding data in the IP backbone. The provider router is not directly connected to any customer edge router.

4-1-Scalability and high availability:

Currently providers of MPLS VPN and VPLS services face some serious scalability concerns; for instance, PE devices provide a limited amount of memory for storage of MAC addresses and IP

prefixes of numerous customers. Besides, running control functions (such as MP-BGP for MPLS VPN and maintaining full mesh of pseudo wires among PEs for VPLS) puts a heavy load on PE devices, especially when the number of PE devices increase according to growth of services. Although there has been some attempts to solve the scalability problems of MPLS VPN and VPLS services so far [8][9][10].MPLS specifically designed for expansion solutions, and enable hundreds and even thousands of VPN via the same network. Network designers can reduce the number of hops between network points, which translates directly to increased response time and improved application performance. MPLS-based networks also improve recovery from problems with a variety of mechanisms. Data centers and other key locations can be linked to multiple redundant ways to the core MPLS network. Remote sites can be quickly and easily reconnect to backup locations if necessary, and applications can be forwarded on any links fails or network connections in real time. It provides network-based technology MPLS- increase the availability of high, which is crucial to the success of the business of the enterprise.

4-2- Traffic Engineering (TE):

The Internet is a collection of nodes and links with the purpose of delivering IP datagrams from a source host to a destination host. The source does not, in general, care how the data is delivered so long as it arrives in a timely and reliable way. The routing protocols are based on shortest path first, in which each datagram are routed on the shortest path between the source and the destination [11]. This means that traffic engineering must provide the possibility to steer traffic through the network on paths different from the preferred path, which the least-cost path is provided by IP routing. It believes in the ability to prepare a single track or several specific paths will be followed by movement across the network. As well as the ability to believe in the preparation of the advantages of the performance of the class movement. This feature improves the use of the service offering of the tracks used. Because the protocols directing shortest path Send traffic via the shortest route without taking into account other factors such as the requirements of network usage and traffic using (TE), can Network operators redistribute the flow of packets to achieve a more balanced distribution of cross-links. It allows forcing traffic to flow through specific paths to take advantage of most of the existing network capacity.

And the same time be easier to secure a fixed customer service levels. Provide (MPLS) the network mega-events, which is the most effective way to apply (TE) Orientation (MPLS TE) traffic flows across the network by organizing the resources needed by a particular flow with the actual capacity and planned the topology. way Guidance those specified feed traffic network routing towards the path or more and prevent choking is expected, enabling the restoration of a link failure or a node.

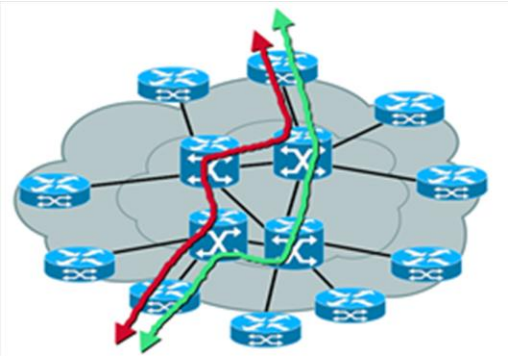

Figure 3: Traffic Engineering

4-2-1- Characteristics

High performance
Low overhead
End-to-end connectivity

4-2-2- Applications

Constraint-based routing
Fast reroute
Guaranteed bandwidth
Frame/ATM transport
Control plane for ATM
and OXCs

5- Quality of Service:

Using quality of service (mpls) can for Service providers secure multiple classes of service with a strong guarantee for (Qos) For network clients VPN.MPLS The QoS It is an essential component of Offer MPLS. There is no need for MPLS To secure QoS In the network (IP) Because those options exist in MPLS. The network (MPLS) Provide quality service, which provides a more secured network from (IP). You can use the class MPLS apply the advantages of the quality of service for ATM Allowing providers to secure the audio and video high reliability of service in addition to the conventional data transfer. Such benefits will be required dramatically as companies began switching

to voice over technology (VoIP: Voice over IP) IP. As well as many multimedia applications, it has been introduced to the Internet.

(MPLS) Supports the advantages of the quality of the service following:

1- **Classification and mark the package:** allows Classification the packet dividing the traffic to several levels of priority or classes of service, to give priority to indicators.

2- **Congestion avoidance:** Believes avoid congestion by random discovery algorithm WRED (Weighted Random Early Detection) possibility on network interfaces to secure the port administration.

3- **Congestion management:** When it becomes the network port crowded, it is necessary to use the stacking techniques to make sure that the occupation of critical applications traffic priority on non-critical applications.

4- **Improve the movement:** It can result in traffic control and to improve the traffic entering the network. Easy to portray the movement flowing at a rate specified by using the ports. While surveillance identifies a specific rate.

6- MPLS data network setup:

MPLS is a scalable, protocol-independent transport. In an MPLS network, data packets are assigned labels. Packet-forwarding decisions are made solely on the contents of this label, without the need to examine the packet itself (Figure 4,5)[12].

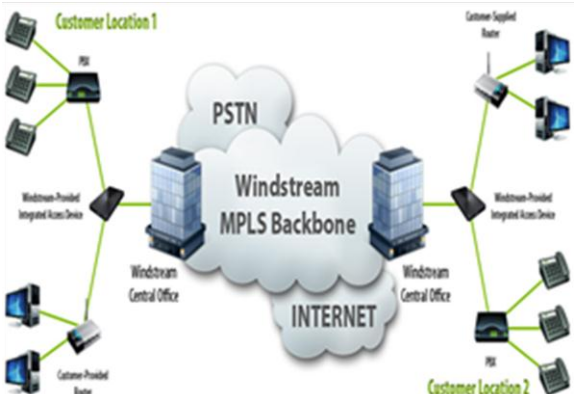

Figure 4: network setup

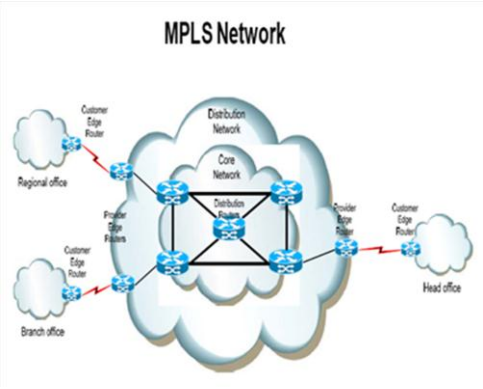

Figure 5: MPLS network

Companies or departments that use MPLS technology, However if the MPLS goes down, the connection to a remote location is lost. This process describes how the Device Manager based on the status of the Internet uplinks, and will illustrate the complete flow of traffic when the VPN is properly enabled and functioning.

7-1- Benefits:

- Reduces network management expenses.

- MPLS offers greater security and a lot of companies need this kind of security, which need

enhanced privacy and security for their network needs.

- Priority Use Dedicated to improving the performance of the network.

- Easy to add sites, change bandwidth and budget for network growth.

- MPLS networks achieve greater Quality of Service for their customers. Quality of Service

(QoS) means exactly that – you can expect a higher standard of service such as reliability, speed, and voice quality. This is for a few reasons, one already mentioned above.

- Ensure data transmission speed and security between multiple locations.

- The speed of performing lookups for destinations and routing is much faster than the

IP table lookups non-MPLS routers have to perform.

- MPLS networks are also able to restore interrupted connections at a faster speed than typical

networks. Obviously, this is a benefit.

7-2- MPLS Applications:

MPLS addresses today's network backbone requirements adequately by giving a models based arrangement that accomplishes the following:

- The maximum benefit is unified or converged network to support all service categories.

- MPLS is a crucial additional capacity for IP networks; solve the problems for which no other solutions are known.

- MPLS enters the big architectural change in IP networks.

- Improves packet-forwarding performance in the network

- MPLS enhances and simplifies pack conversion through routers using Layer-2switching paradigms.

- MPLS is simple which allows for easy implementation.

- MPLS increases reticulation command to it enables routing by switching at wireline speeds.

- Bolsters QoS and CoS for service differentiation

- MPLS utilizes activity traffic-engineered path setup and accomplishes benefit level assurances.

- MPLS consolidates arrangements for constraint-based and explicit path setup.

- Bolsters network scalability

- Coordinates IP and ATM in the system

- MPLS supply a bridge between access IP and core ATM.

- MPLS can reuse existing router /ATM switch equipment, adequately joining the two divergent systems.

- Builds interoperable networks

- MPLS is a principles based arrangement that accomplishes cooperative synergy amongst IP and ATM systems.

- MPLS helps build scalable VPNs with traffic-engineering capability.

8- Conclusion:

MPLS is a technology that is greatly valuable to company. MPLS streamlines the network infrastructure by allowing the consolidation of multiple technologies and applications such as voice, video and data. MPLS provides enhanced security, scalability and high. MPLS is speedier than traditional routing technique. MPLS bolster covering IP addresses. Providing QoS and activity building abilities in the web is extremely fundamental. for this reason, the present web must be upgraded with new advances, such as MPLS.MPLS will assume a key part in future specialist organizations and bearers IP backbone and facilitate the development of new services such as real-time applications in the internet.

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امنية الشبكات ونقل البيانات باستخدام تقنية MPLS

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المستخلص :

تعتبر تقنية **MPLS** هي المستقبل لجميع احتياجات ومتطلبات الشبكات وأكثرها كفاءة. مع تطور الشركات والمؤسسات لمواكبة مناخ الأعمال المتغيرة باستمرار، واحتياجات الربط الشبكي للشركات أصبحت أكثر ديناميكية. يجب أن تكون شبكاتهم قادرة على نقل التطبيقات المتطورة بسرعة وكفاءة مع التقليل من التكاليف. **MPLS** هي التكنولوجيا التي يمكن أن تكون مفيدة جدا للشركات وتحدد هذه الورقة ما هو **MPLS**، والفوائد التي **MPLS** وكيفية **MPLS** التي يمكن أن تلبي احتياجات الشركات لمتطلباتها. ولكن المشكلة هي عندما ذهبوا جميع الشركات ومزودي الخدمة الى بروتوكول الإنترنت(**IP**)، أصبح من المهم ايجاد وسيلة أكثر كفاءة لكي يوافقون على هذا النوع من النهج،**MPLS** يبسط البنية التحتية للشبكة عن طريق السماح لتحسين التكنولوجيات والتطبيقات المتعددة مثل الصوت والفيديو والبيانات. **MPLS** يتيح تعزيز الأمن وتوافر عالية من خلال النظريات المذكورة أدناه، والتحليل يمكننا أن نرى أن **MPLS** أسرع من تقنية التوجيه التقليدية. إذا يمكننا تحسين مرافق الأجهزة ومنصة برمجيات من قبل أجهزة التوجيه في الوقت الحقيقي ثم يمكننا أن نلاحظ الفرق الكبير. وهذا ما تشير اليه ورقة العمل من تحسين اداء نقل البيانات لضمان سريتها وسرعة نقلها.