A Review Paper on MPLS L3 VPNs Architecture
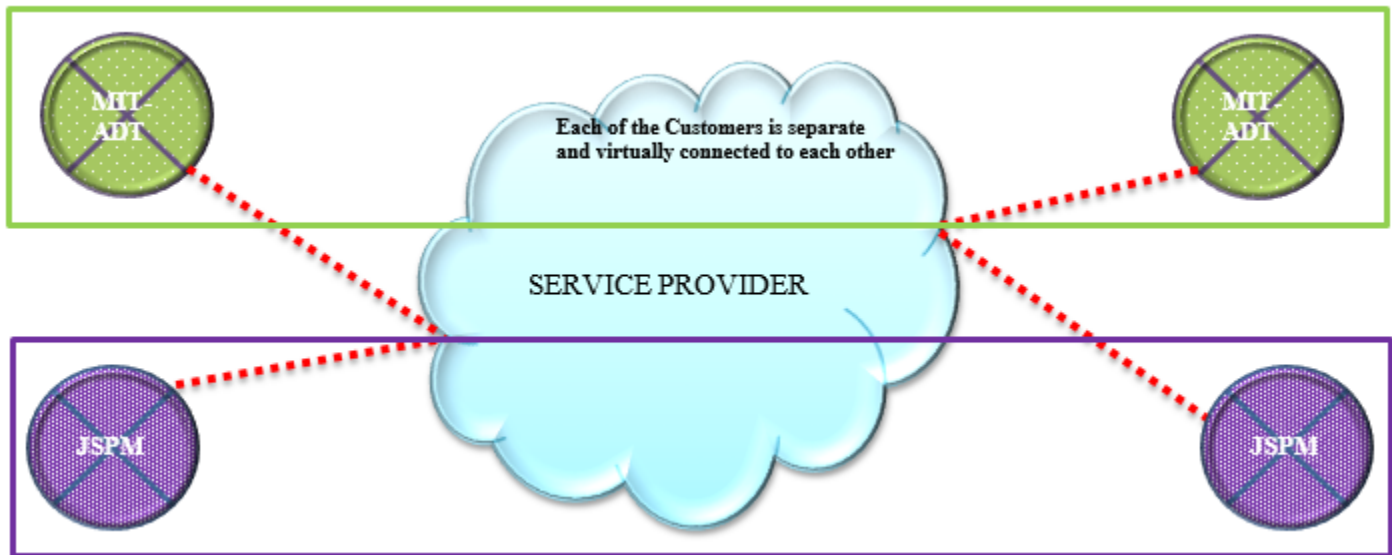
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Abstract- The Virtual Networks that are private from every other customer/Client/ Site to Site has Virtual Private Network (VPN) that's a reason the VPN refers to the Layer 3 VPNs. MPLS enabled application like Layer 3 VPN. MPLS Application is not about IPsec and cryptography but a VPN with Layer 3 VPN & MPLS Services. Virtually it's all about separating a set of network from another set of network. It's separated from each of the customer's network which is a private domain, for e.g. MIT ADT and JSPM are two different customers for a services provider, in which MIT-ADT is private network from JSPM's network. Mostly it has been used by service provider in the past, but it has become a trend for the big and even small organizations to go for MPLS L3 VPN. As it is a cost effective, well known for speed, Label switching at Layer 2.5, and good for security.

I. INTRODUCTION

The functions of routing, forwarding & switching with MPLS L3 VPN will provide virtual network to multiple customer with a physical connection. MPLS is basically used by the server provider to provide the services to multiple customers. Let's understand further: {1} Forwarding IP traffic with the help of labels insists of L3 IP addressing. {2}Label generated locally by the router to every destination of the network. {3} Routing decision on the basis of IPV4- Control Plane Protocol vs. MPLS - Label Distribution Protocol {4} MPLS been a boom in traffic forwarding mechanism. In [14-24], various techniques are explored to understand the system overall performance and reviewed the quality of service parameters.

1.1} Forwarding using Labels

In IPv4 network IP forwarding works with the help of IP address which is being advertises by routing protocol (OSPF, ISIS or some other IGP). IP network would consider its routing table to make the forwarding decision and Network portion has two components i.e. network portion and host address portion. Based on routing table which is chased Cisco Express Forwarding (CEF) it will make a forwarding decision and its forward the packet to destination by re-encapsulating the Layer 2 information. Every time the packet goes to the next hop it will look into the destination IP address and will decide where the packet does forwarded. Every time the packet reaches the next hop, it will make the forwarding decision by re-encapsulating Layer 2 information, but the source and destination IP address will remain unchanged on every next hop till it reaches to the destination.
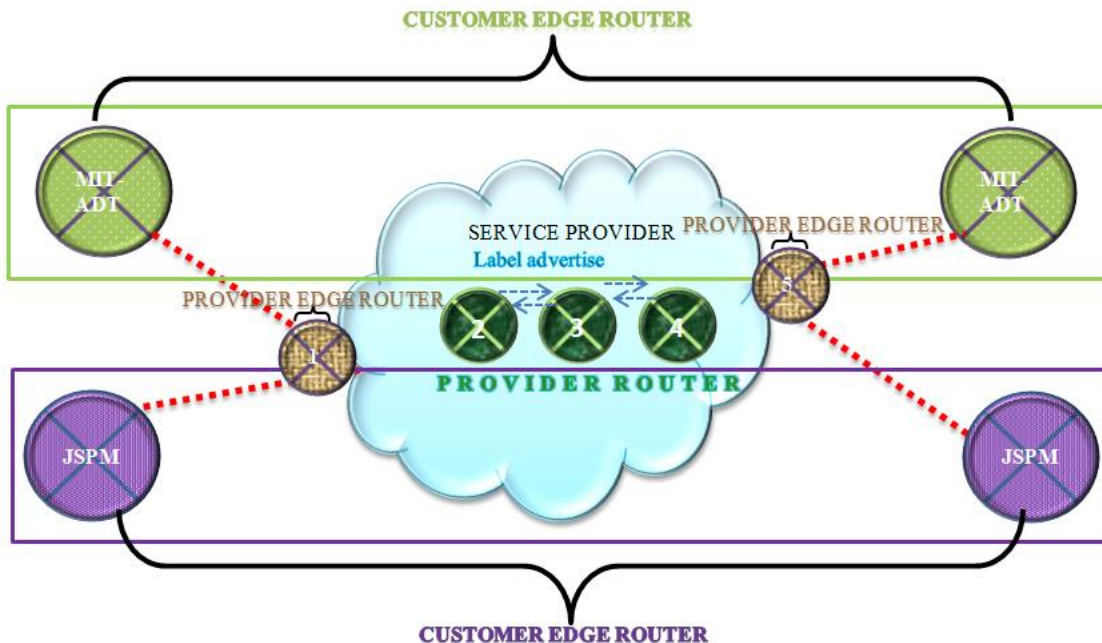
In IPv4 routing above process happens for every single packet every time, which would be affected if its millions packets. To overcome such process situation we have MPLS where forwarding packet will be based on label instead of layer 3 lookup of IP address.

1.2} Label Position in router

MPLS labels are locally generated by the router for each and every single network it has in their IP routing table. Router builds a Label forwarding information for every single network in

the IP routing. Labels are actually a numbers which could be any possible number associated to the particular destination of the network.

Router will not only generate a local label to a particular destination in the network, but will also advertise those generated local labels.

1.3} Control Plane Protocol vs. Label Distribution Protocol

Control plane protocol (OSPF, EIGRP, RIP) train the network to reach destination of the network in IPv4 network, similar way in MPLS Network we have label Distribution Protocol (LDP). MPLS is injected between the Network layer and Data Link layer also known as layer 2.5 of the TCP/IP model.

While the packet travels from source host to destination host it will impose a label and at every hop it will change the label as per the local forwarding information base (FIB) table to reach to the destination. In all this process it will not look at the layer 3 of TCP/IP OSI Model, it will just de-encapsulate the layer 2 information and according to the label it will forward the packet to next hop or swap the label as per the remote label associated to the destination network. Label distribution protocol (LDP) plays an important role while forwarding the packet in MPLS L3 VPN. And finally before reaching to the destination, it will remove the label and forward the plain IPv4 packet to the Destination host.

1.4} Benefits of MPLS VPN

Label switching is much faster than Layer 3 lookup. MPLS VPN is develop and popular for his speed, label switching and label forwarding in which IPv4 and IPv6 traffic can flows simultaneously on the same physical network, because it never look into the layer 3 information, Traffic engineering for quality of services.

MPLS VPN refers to the private and separate portion for each of the network.

1. VPNs – Private and Separate Network by using Tunnel

By using the method of tunnel, service provider make a connection from one end point to another end point by creating a VPN connection for the various Branches, it's providing virtual and secure connection to the network.

2.1} Lets understand tunnel formation in Layer 2 and Layer 3

Tunnel formation- Layer 2	Tunnel formation- Layer 3
Tunnel formation between the end points of the network that carry through data link layer in VPN	Tunnel formation between the end points of the network formed with the help of IP address

MPLS VPN connection Step

As we discuss early MPLS VPN works on the basis of label forwarding. In terms of creating a virtual and separate network that will make virtual connection between two points. There are few basic requirements that need to fulfill. A routing protocol should be enabled and configured properly at the provider edge router to make the MPLS VPN connection to work.

MPLS forwards the packet with the help of label, where routing protocol in MPLS VPN is a backbone for the flow of the traffic.

Label distribution protocol builds the LDP neighbor ship between the routers, which will then exchange their local label information with each other for each and every network. All the information will be cached which will include mac address, source and destination IP address etc. Whenever there is time to forward the packet it will simply swap the label with the next HOP or POP the label at destination host.

MPLS provide one & one connection between multiple sites. To keep all the traffic separate from each of the customer/ network. MPLS VPN has to make sure that it has to be significant different from each of the customer/ network.

In MPLS L3 VPN there is routing protocol runs between the customer edge and provider edge router. As the customer and

provider edge router are in peer and sharing the routing information with each other and the method is routing protocol. And further each customer is divided by the virtual routing and forwarding (VRF). For each customer there is unique VRF, router distinguisher and route target. With all these information, it's called as VPN route or more specify VPN V4 route or IPv4 VPN route.

II. Transport Mechanism

There is transport mechanism that does the work to deliver the VPNv4 route which is known as Multiprotocol BGP (MBGP). As MBGP carries multiple IPv4 route for that purpose its Multi BGP.

III. Traffic Engineering in MPLS L3 VPN

Traffic engineering would take us to more details about prioritizes different route, differently do get prioritizes treatment that's call QOS. We will do this by using traffic engineering to force those forms of traffic into the Label Switch Path.

IV. Conclusion

Software Defined Network is one of the results we could achieve as automatic. In the fast moving world where our goal is to achieve the faster technology with cost effective. Security is also a big concern for every other organization. MPLS VPN is the combination of the entire flavor that we could actually achieve with an end to end connection to the virtual and private network.

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