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MPLS-TP: LABEL SWITCH PATH: CREATION AND MANAGEMENT

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ABSTRACT

MPLS Transport Profile (MPLS-TP) technology is gaining importance as it becomes a dominant solution for a converged transport network in recent years. This paper outlines how MPLS-TP methodology can be implemented in the real world scenario. A comprehensive study is carried out on MPLS recovery mechanisms for protecting and restoring traffic after failure occurrence. In this paper the requirements of designing an efficient and reliable MPLS-TP label switch paths and tunnel are well considered and also set concrete evaluating criteria. In this paper, a full comprehensive simulation environment is created for a conventional network and MPLS applied over that traditional network to evaluate the comparative performance of network traffic behavior. Finally, the results are evaluated and analyzed on different versions of network simulators.

KEYWORD: Label Switch Router(LSR),Label Switch Path(LSP), Network Element (NE), Bidirectional ForwardingDetection(BFD),Protectionpath

INTRODUCTION

A survivable transport network is a transport network that provides some ability to recover ongoing traffic disrupted by a network failure. Packet Transport Network (PTN) technologies, such as Carrier Ethernet and Multiprotocol Label Switching – Transport Profile (MPLS-TP), are rapidly gaining importance as they become the main solutions in the area of transport networks, which have traditionally been based on an Optical Transport Network (OTN). The boundaries between packet and circuit networks are disappearing as many traditional circuit-switched applications such as voice and video are now being carried over packet switched Multiprotocol Label Switching (MPLS) [1-2] or Ethernet networks. But, circuit network such as OTN is still required in order to transmit traffic to long distance remote node [3-4]. In today's world where businesses rely on transport networks, network survivability has always been an important factor in designing current and future networks. So, two-layer transport network survivability is an important research topic in terms of network resource usage. In two-layer transport networks such as MPLS-TP-over-OTN, a single protection mechanism could be provided at either layer. We can design the MPLS-TP layer as being the packet layer on top of the OTN layer. In this paper we consider the implementation details of label switch path and thus also propse the steps required to design MPLS-TP tunnel.

MULTI PROTOCOL LABEL SWITCHING TRANSPORT PROFILE (MPLS-TP)

MPLS Transport Profile (MPLS-TP), a joint ITU-IETF effort based on the mature MPLS packet technology, aims at supporting the capabilities and functionalities needed for packet transport network services and operations through combining the packet experience of MPLS with the operational experience of SONET/SDH[1]. There have been a lot of studies which focus on protection schemes and service adaptation in MPLS-TP networks. Two protection switching mechanisms are described[2], So far, few of them have been involved with multi-service edge-edge label transport and protection schemes.

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MPLS-TP Model

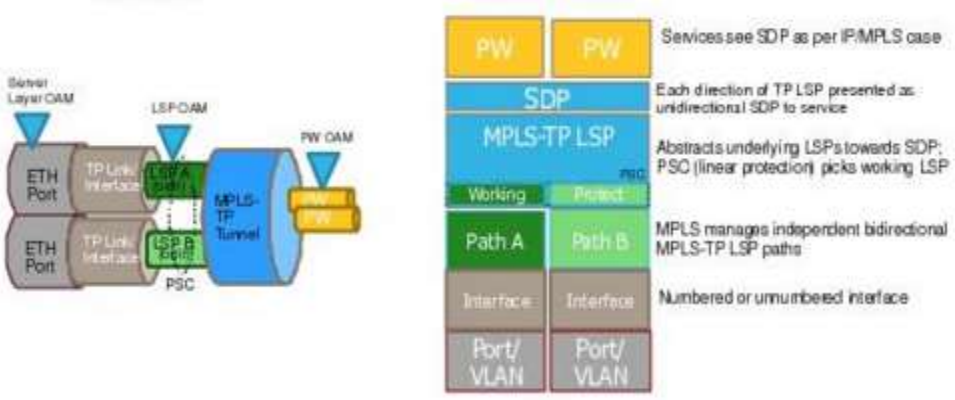

Figure 1: MPLS-TP Architecture

Figure 1 shows a high level functional model for MPLS-TP in SROS. LSP A (Path A) and LSP B (Path B) are the working and protect LSPs of an LSP tunnel. These are modelled as working and protect paths of an MPLS-TP LSP in SROS. MPLS-TP OAM runs in-band on each path. 1:1 linear protection coordinates the working and protect paths, using a protection switching coordination protocol (PSC) that runs in-band on each path over a Generic Associated Channel (G-ACh) on each path. Each path can use either an IP numbered, IP unnumbered, or MPLS-TP unnumbered (i.e. non-IP) interface[5]. Note that in SR OS, all MPLS-TP LSPs are bidirectional co-routed, as detailed in RFC5654. That is, the forward and backward directions follow the same route (in terms of links and nodes) across the network. Both directions are setup, monitored and protected as a single entity[2,5]. Therefore, both ingress and egress directions of the same LSP segment are associated at the LER and LSR and use the same interface (although this is not enforced by the system).

IMPLEMENTATION:

MPLS-TP technology works really well as a carrier grade transport technology. MPLS provides solution in service provider and mission critical networks today. MPLS finds its application in retail sector where constant use of point of sale devices requires transactional data to be carried rapidly to the processing datacenters[4]. Today many applications of MPLS are within the VPN (virtual private network).The device that makes MPLS so efficient is called label switching router (LSR). It is a combination of switch and router. In reality LSRs are classical IP routers which have been MPLS enhanced in a software upgrade. So previously in a pure IP network there exists lot of IP routers, here in the MPLS domain there exists lot of label switch routers. The special function of the LSR is when it is at the edge of the MPLS network , then it is called as edge LSR or precisely label edge router (LER)[2,3,5].The advantage of MPLS routing over normal IP packet routing is that the path across the network is established even before the packet starts its journey. For every forwarding equivalence class, a label switch path (LSP), a predictable route is established by the protocol that is running on the label switch router in the network[1,3]. The protocol that is used here is Resource Reservation Protocol–Traffic Engineering (RSVP-TE).

In an MPLS network a fixed label switch path called LSP is first set up between two end nodes called label edge routers and in the model of the diagram the path carries a pseudo wire from the input of one provider edge device to the output of the similar device at the far end.and any native data from the customer can be carried over this pseudo wire [2,5]. Each packet that arrives is simply given a label at the ingress and then it rapidly makes its way through the network being forwarded just according to its label. At each router its label is read and removed and is given a new one before being transmitted over the network and the job of reading and switching label is really quick as compared routing processes. MPLS-TP guarantees that the reverse pat is same as the forward path i.e, it provides deterministic congruent label switch paths[1,2].

The proposed system uses templates to provide ease of use for its users. By using templates users avoid having to add information into the system repetitively. An SQL database is also used to save all the values into the DB. The working and protection path together is known as tunnel. Before establishing a tunnel the user need to create LSP between different LSR. Then user need to enter the data such as minimum tunnel id, maximum tunnel id, tunnel name, description, author, select the LSP A end and Z end to create a tunnel in the network[2,4]. Thus the tunnel can be created though the templates, the user need not go to the labs to establish an MPLS-TP network in the system. The Graphical user interface is implemented using the Javascript, Dojo framework, Html, CSS languages. Once the user enters all the data in the template, the data is firstly in the user database. The data is then processed using java, spring and hibernate languages and this data is set up on the network elements using simple network adapter in the element management layer since the OTN (optical transport network) cannot directly interact with the network elements.

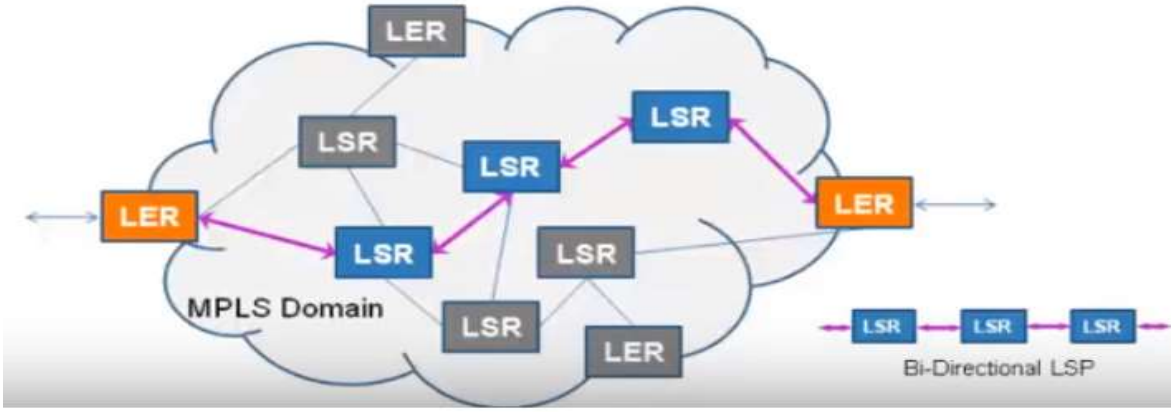

Figure 2: Bidirectional Label Switch Path

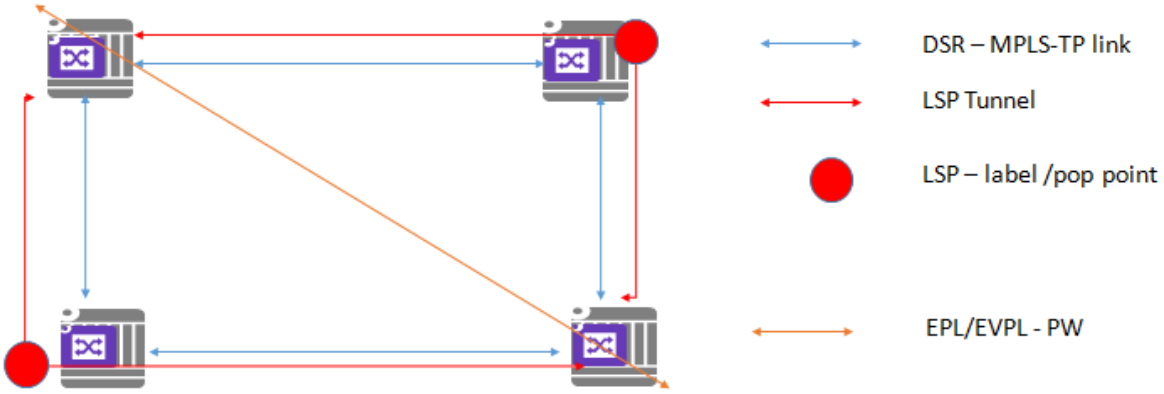

Figure 3: Topology view

RESULTS:

The above implementation has been tested with various scenarios of label switch path creation. A set of test cases have been implemented with different values of labels and number of label edge routers being used in each label switch paths. The network elements being used for the testing are KVM simulators and cloudSim simulators. Different release of network elements such 8.2, 8.3 and 8.4 have been part of the testing. It is found that older version to 8.2 do not support LSP deployment.

CONCLUSION:

A MPLS-TP network will not only be a cost effective data networking infrastructure, but also the most efficient technology for high performance network services with high level survivability. The protection features will construct one of the key technologies for a MPLS-TP network. This paper firstly describes the MPLS-TP features and then it details the implementation how LSP paths are created over the network even without the network administrator having to go the network site to configure the label switch path manually. However Further implementation, deployment, and operational experience are needed to mature MPLS-TP architecture.

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