Virtual Private Wire Service (VPWS)

Enabling Ethernet Services

VPWS (Virtual Private Wire Service) is the simplest form for enabling Ethernet services over MPLS. It is also known as ETHoMPLS (Ethernet over MPLS), or VLL (Virtual Leased Line).

VPWS comprises point-to-point LSPs that carry Ethernet PWs (pseudowires) between LERs (Label Edge Routers). These LERs or PEs (Provider Equipment) in Carrier Ethernet terminology provide the UNI-N functionality. In such a case, the CEN (Carrier Ethernet Network) provides Ethernet services to CEs (Customer Equipment) attached to the PEs.

In other deployments, the network is a CEN where some external interfaces are ENNIs. In such a case, the PW is between the ENNI-N and a UNI-N or between two ENNI-Ns.

The objective is to create virtual connections between PEs with pseudowires and to transport the Ethernet services over these pseudowires.

The entire Ethernet frame (excluding FCS) is carried over the MPLS PW. Therefore, no MAC learning is required.

Pseudowires and Labels

Forwarding of Ethernet frames within the MPLS network is performed using MPLS labels. The setting of the labels and path selection is outside the scope of this explanation.

Multiple PWs can be carried over a single LSP, and each PW can be configured to carry either one CoS (Class of Service) or multiple CoSs. Up to a maximum of 8 CoSs can be carried over a given PW.

The figure on the right illustrates how a C-Tag frame sent from the CE is encapsulated over MPLS PW.

The tunnel label (LSP label) is a 20-bit field, yielding 1 million unique labels over a link. Each LSP can carry one or more EVCs (Ethernet Virtual Connection) or OVC (Operator Virtual Connection). Since an EVC or an OVC can be mapped to a single PW or to multiple PWs, theoretically 1 million EVCs and/or OVCs can be carried over a single LSP. This implies that an almost unlimited number of Carrier Ethernet services can be implemented over a single VPWS.

CoS

The MPLS network has a 3-bit CoS ID identifier called the EXP bits (also known as the Traffic Class field in later RFCs). The EXP bits are used for CoS ID and color forwarding where applicable.

Up to eight CoSs can be delivered over MPLS LSPs. However, assuming that some CoSs need to also denote color, the effective number is five CoSs. MPLS networks can support the 3-CoS model of MEF 23.

The ingress LER can tunnel almost any frame over a PW, with the exception of PAUSE frames. It can support CE-VLAN ID and CE-VLAN CoS preservation. Interworking with customer spanning tree is also specified. This means that EPL and EVPL services can be provided over VPWS with transparent handling of L2CPs.

Multicast replication is not part of this transport technology since it is point-to-point. In the event that multipoint/multicast replication support is required, VPLS can be used (see next section).

Resiliency
Resiliency is provided by MPLS LSP and MPLS PW redundancy. This can be based on G.8031 linear protection or MPLS FRR. Both of these techniques can provide sub-50 msec protection. These resiliency capabilities can be configured to provide transparent resiliency to the Ethernet service layer. This is as a result of the fact that the protection mechanism changes the path between the two PEs transparently to the Ethernet layer.

## Carrier Ethernet Services

Support for the various Ethernet services is summarized in the table at right.

**Example**

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<th>Description</th>
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<tr>
<td>Ethernet Trunk</td>
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![Carrier Ethernet Services Diagram](image)