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Definition of P2MP PW TLV for LSP-Ping Mechanisms  
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## Abstract

LSP-Ping is a widely deployed Operation, Administration, and Maintenance (OAM) mechanism in MPLS networks. This document describes a mechanism to verify connectivity of Point-to-Multipoint (P2MP) Pseudowires (PW) using LSP Ping.

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P2MP PW LSP Ping

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## [1.](#) Introduction

A Point-to-Multipoint (P2MP) Pseudowire (PW) emulates the essential attributes of a unidirectional P2MP Telecommunications service such as P2MP ATM over PSN. Requirements for P2MP PW are described in [[RFC7338](#)]. P2MP PWs are carried over P2MP MPLS LSP. The Procedures for P2MP PW signaling using BGP are described in [[RFC7117](#)] and LDP for single segment P2MP PWs are described in [[I-D.ietf-pwe3-p2mp-pw](#)]. Many P2MP PWs can share the same P2MP MPLS LSP and this arrangement is called Aggregate P-tree. The aggregate P2MP trees require an upstream assigned label so that on the tail of the P2MP LSP, the traffic can be associated with a VPN or a VPLS instance. When a P2MP MPLS LSP carries only one VPN or VPLS service instance, the arrangement is called Inclusive P-Tree. For Inclusive P-Trees, P2MP MPLS LSP label itself can uniquely identify the VPN or VPLS service being carried over P2MP MPLS LSP. The P2MP MPLS LSP can also be used in Selective P-Tree arrangement for carrying multicast traffic. In a Selective P-Tree arrangement, traffic to each multicast group in a VPN or VPLS instance is carried by a separate unique P-tree. In Aggregate Selective P-tree arrangement, traffic to a set of multicast groups from different VPN or VPLS instances is carried over a same shared P-tree.

The P2MP MPLS LSP are setup either using P2MP RSVP-TE [[RFC4875](#)] or Multipoint LDP (mDLP) [[RFC6388](#)]. Mechanisms for fault detection and isolation for data plane failures for P2MP MPLS LSPs are specified in

[[RFC6425](#)]. This document describes a mechanism to detect data plane failures for P2MP PW carried over P2MP MPLS LSPs.

This document defines a new P2MP Pseudowire sub-TLV for Target FEC Stack for P2MP PW. The P2MP Pseudowire sub-TLV is added in Target FEC Stack TLV by the originator of the Echo Request to inform the receiver at P2MP MPLS LSP tail, of the P2MP PW being tested.

Multi-segment Pseudowires support is out of scope of this document at present and may be included in future.

## [2.](#) Specification of Requirements

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

## [3.](#) Terminology

ATM: Asynchronous Transfer Mode

LSR: Label Switching Router

MPLS-OAM: MPLS Operations, Administration and Maintenance

P2MP-PW: Point-to-Multipoint PseudoWire

PW: PseudoWire

TLV: Type Length Value

## [4.](#) Identifying a P2MP PW

This document introduces a new LSP Ping Target FEC Stack sub-TLV, P2MP Pseudowire sub-TLV, to identify the P2MP PW under test at the P2MP LSP Tail/Bud node.

#### 4.1. P2MP Pseudowire Sub-TLV

The P2MP Pseudowire sub-TLV has the format shown in Figure 1. This TLV is included in the echo request sent over P2MP PW by the originator of request.

The Attachment Group Identifier (AGI) in P2MP Pseudowire Sub-TLV as described in [Section 3.4.2 in \[RFC4446\]](#), identifies the VPLS instance. The Originating Router's IP address is the IPv4 or IPv6 address of the P2MP PW root.

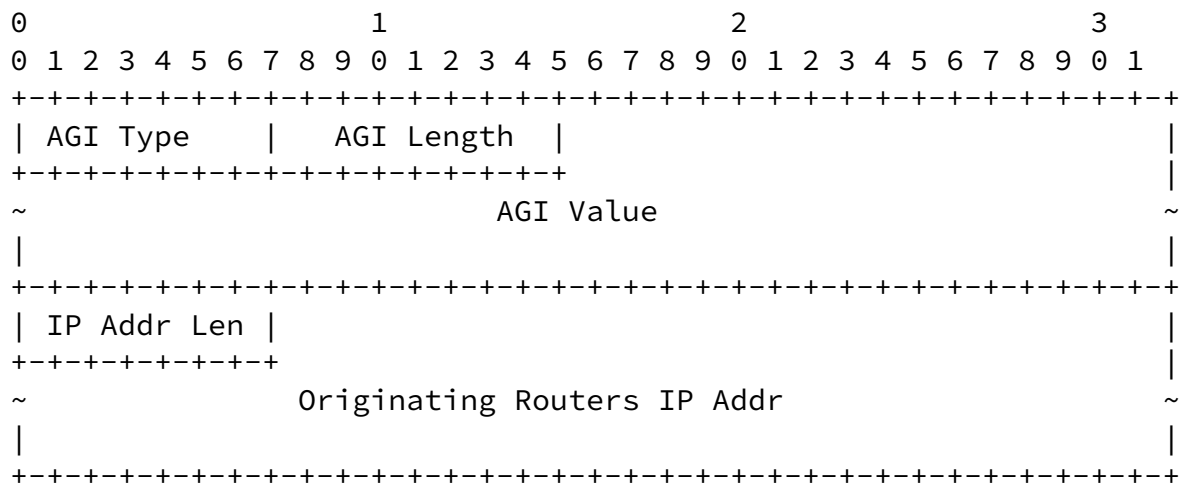


Figure 1: P2MP Pseudowire sub-TLV format

For Inclusive and Selective P2MP MPLS P-trees, the echo request is sent using the P2MP MPLS LSP label.

For Aggregate Inclusive and Aggregate Selective P-trees, the echo request is sent using a label stack of [P2MP MPLS P-tree label, upstream assigned P2MP PW label]. The P2MP MPLS P-tree label is the outer label and upstream assigned P2MP PW label is inner label.

#### 5. Encapsulation of OAM Ping Packets

The LSP Ping Echo request IPv4/UDP packets will be encapsulated with the MPLS label stack as described in previous sections, followed by the GAL Label [\[RFC6426\]](#). The GAL label will be followed by the ACH

with the Pseudowire Associated Channel Type 16 bit value in the ACH set to IPv4 indicating that the carried packet is an IPv4 packet.

## 6. Operations

In this section, we explain the operation of the LSP Ping over P2MP PW. Figure 2 shows a P2MP PW PW1 setup from T-PE1 to remote PEs (T-PE2, T-PE3 and T-PE4). The transport LSP associated with the P2MP PW1 can be MLDP P2MP MPLS LSP or P2MP TE tunnel.

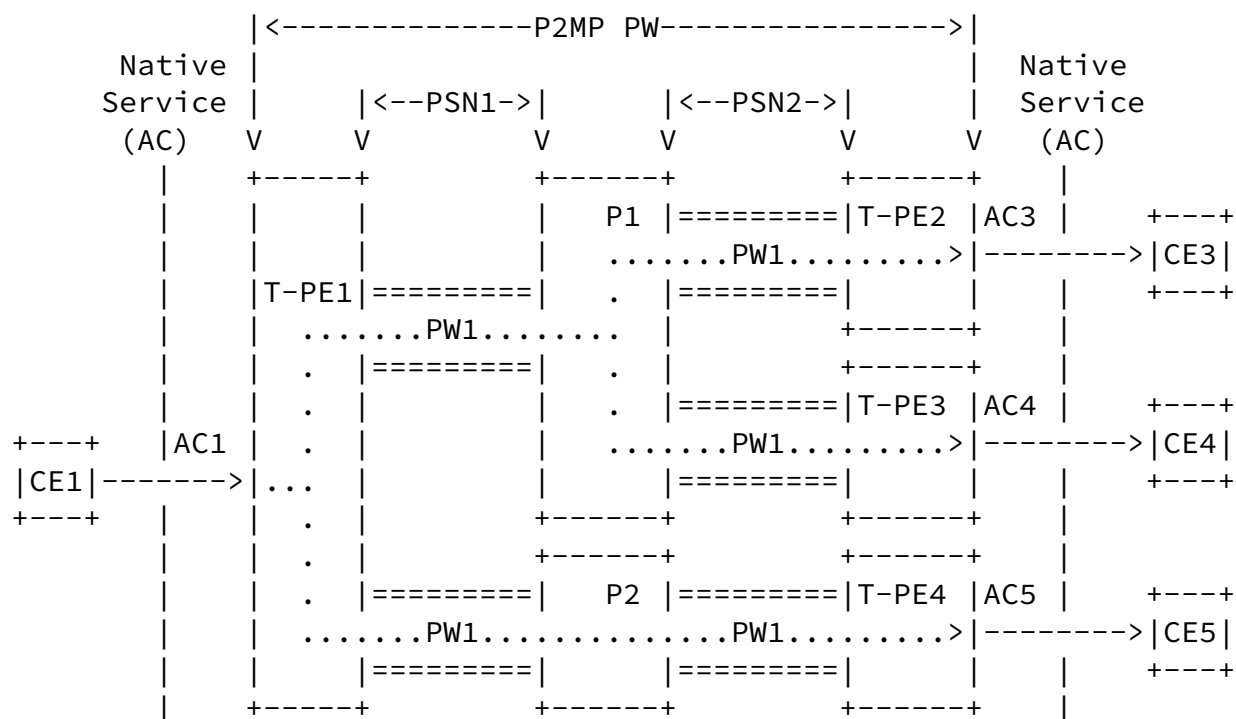


Figure 2: P2MP PW

When an operator wants to perform a connectivity check for the P2MP PW1, the operator initiate a LSP-Ping request with the Target FEC Stack TLV containing P2MP Pseudowire sub-TLV in the echo request packet. For an Inclusive P2MP P-tree arrangement, the echo request packet is sent over the P2MP MPLS LSP with {P2MP P-tree label, GAL} MPLS label stack and IP ACH Channel header. For an Aggregate Inclusive P-tree arrangement, the echo request packet is sent over the P2MP MPLS LSP with {P2MP P-tree label, P2MP PW upstream assigned label, GAL} MPLS label stack and IP ACH Channel header. The intermediate P router will do swap and replication based on the MPLS LSP label. Once the echo request packet reaches remote terminating PEs, T-PEs will use the GAL label and the IP ACH Channel header to determine that the packet is IPv4 OAM Packet. The T-PEs will process the packet and perform checks for the P2MP Pseudowire sub-TLV present in the Target FEC Stack TLV as described in [Section 4.4 in \[RFC4379\]](#) and respond according to [\[RFC4379\]](#) processing rules.

## [7.](#) Controlling Echo Responses

The procedures described in [\[RFC6425\]](#) for preventing congestion of Echo Responses (Echo Jitter TLV) and limiting the echo reply to a single egress node (Node Address P2MP Responder Identifier TLV) can be applied to P2MP PW LSP Ping.

## [8.](#) Security Considerations

The proposal introduced in this document does not introduce any new security considerations beyond that already apply to [\[RFC6425\]](#).

## [9.](#) IANA Considerations

This document defines a new sub-TLV type to be included in Target FEC Stack TLV (TLV Type 1) [\[RFC4379\]](#) in LSP Ping.

IANA is requested to assign a sub-TLV type value to the following sub-TLV from the "Multiprotocol Label Switching (MPLS) Label Switched Paths (LSPs) Parameters - TLVs" registry, "TLVs and sub-TLVs" sub-registry:

- o P2MP Pseudowire sub-TLV

## 10. Acknowledgments

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