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**Residence Time Measurement in MPLS network
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Abstract

This document specifies G-ACh based Residence Time Measurement and how it can be used by time synchronization protocols being transported over MPLS domain.

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1. Introduction

Time synchronization protocols, Network Time Protocol version 4 (NTPv4) [[RFC5905](#)] and Precision Time Protocol (PTP) Version 2, a.k.a. IEEE-1588 v.2, can be used to synchronize clocks across network domain. In some scenarios calculation of time packet of time synchronization protocol spends within a node, called Resident Time, can improve accuracy of clock synchronization. This document defines new Generalized Associated Channel (G-ACh) that can be used in Multi-Protocol Label Switching (MPLS) network to measure Residence Time over Label Switched Path (LSP) or Pseudo-wire (PW). Transport of packets of a time synchronization protocol over MPLS domain is outside of scope of this document.

1.1. Conventions used in this document

1.1.1. Terminology

MPLS: Multi-Protocol Label Switching

ACH: Associated Channel

TTL: Time-to-Live

G-ACh: Generic Associated Channel

GAL: Generic Associated Channel Label

NTP: Network Time Protocol

PTP: Precision Time Protocol

PW: Pseudo-wire

LSP: Label Switched Path

OAM: Operations, Administration, and Maintenance

1.1.2. Requirements Language

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

2. Residence Time Measurement

Packet Loss and Delay Measurement for MPLS Networks [[RFC6374](#)] can be used to measure one-way or two-way end-to-end propagation delay over LSP or PW. But none of these metrics is useful for time synchronization across a network. For example, PTPv2 uses "residence time", time it takes for a PTPv2 packet to transit a node, not delay of propagation over a link connected to a port receiving the PTP event message.

3. G-ACh for Residence Time Measurement

[RFC 5586](#) [[RFC5586](#)] and [RFC 6423](#) [[RFC6423](#)] extended applicability of PW Associated Channel (ACH) [[RFC5085](#)] to LSPs. G-ACh presents mechanism to transport OAM and other control messages and trigger their processing by arbitrary transient LSRs through controlled use of Time-to-Live (TTL) value.

Packet format for Residence Time Measurement presented in Figure 1



Figure 1: G-ACh packet format for Residence Time Measurement

Version field is set to 0, as defined in [RFC 4385](#) [[RFC4385](#)]. Reserved field must be set to 0 on transmit and ignored at reception. Residence Time Measurement (RTM) G-ACh - value to be allocated by IANA. Scratch pad - 8 octets long field that can be used to accumulate residence time the packet spends traversing the node. Payload - optional field. May be used to transport a packet of time synchronization protocol.

4. Theory of Operation

An LSP ingress LSR, based on information collected through IGP extensions that are outside of scope of this document, select to use

use Residence Time Measurement G-ACh. The LSR then would use GAL and G-ACh header. The LSR will zero out Scratch Pad field and set TTL value so that TTL expiration will be at the next RTM capable downstream LSR.

Upon expiration of RTM packet an LSR would subtract local time value from the value in the Scratch Pad field and processes the packet according to label stack information. If the packet to be forwarded, the LSR will set TTL value so that the TTL expiration takes place at the next RTM-capable downstream LSR. The LSR adds local time value to the value in the Scratch Pad field as close to the start of packet transmission as possible.

LSP terminating LSR may use value accumulated in the Scratch Pad field as time correction as it represent sum of Residence Time of all traversed RTM capable LSR between end points of the LSP. For example, egress LSR may be PTP Boundary Clock synchronized to a Master Clock and as Slave Clock will use accumulated in the Scratch Pad Field value to update PTP's Correction Field.

5. IANA Considerations

IANA is requested to reserve a new G-ACh as follows:

Value	Description	Reference
X	Residence Time Measurement	This document

Table 1: New Residence Time Measurement

6. Security Considerations

Routers that support Residence Time Measurement are subject to the same security considerations as defined in [[RFC5586](#)] and [[RFC6423](#)].

7. Acknowledgements

TBD

8. References

8.1. Normative References

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8.2. Informative References

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