

spring
Internet-Draft
Intended status: Informational
Expires: April 20, 2014

R. Geib, Ed.
Deutsche Telekom
October 17, 2013

**Use case for a scalable and topology aware MPLS data plane monitoring
system
draft-geib-spring-oam-usecase-00**

Abstract

This document describes features and a use case of a path monitoring system. Segment based routing enables a scalable and simple method to monitor data plane liveness of the complete set of paths belonging to a single domain.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on April 20, 2014.

Copyright Notice

Copyright (c) 2013 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	3
2.	A topology aware MPLS path monitoring system	4
3.	Applying SR to monitor LDP paths	5
4.	PMS monitoring of different Segment ID types	6
5.	IANA Considerations	6
6.	Security Considerations	6
7.	References	6
7.1.	Normative References	6
7.2.	Informative References	7
	Author's Address	7

1. Introduction

Paths looping packets through a network are not desirable for network and user data routing. The ability to execute arbitrary path combinations within a domain offers several benefits for network monitoring. A single monitoring device is able to monitor the complete set of a domains forwarding paths with OAM packets never leaving data plane. This requires topology awareness as well as a suitable security architecture. Topology awareness is an essential part of link state IGPs. Adding MPLS topology awareness to an IGP speaking device hence enables a simple and scalable data plane monitoring mechanism.

The design of such a monitoring system should ensure that OAM packets never leave the domain they are supposed to monitor. Topology and network state awareness are useful, careful address-selection may be another one.

MPLS OAM offers flexible features to recognise and execute data paths of an MPLS domain. By utilising the ECMP related tool set of [RFC 4379](#) [[RFC4379](#)], a segment based routing LSP monitoring system may:

- o easily detect ECMP functionality and properties of paths at data level.
- o construct monitoring packets executing desired paths also if ECMP is present.
- o limit the MPLS label stack of an OAM packet to a minimum of 3 labels.

IPv6 related ECMP path detection and execution for OAM purposes is less powerful than that offered by MPLS OAM. This document is focussed on MPLS path monitoring.

The MPLS path monitoring system described by this document can be realised with pre-Segment based Routing (SR) technology. Making monitoring system aware of a domains complete MPLS topology from utilising stale MPLS label information, IGP must be monitored and MPLS topology must be timely aligned with IGP topology. Obviously, enhancing IGPs to exchange of MPLS topology information significantly simplifies and stabilises such an MPLS path monitoring system. In addition to IGP extensions, also [RFC 4379](#) may have to be extended to support detection of SR routed paths.

Note that the MPLS path monitoring system may be a specialised system residing at a single interface of the domain to be monitored. As long as measurement packets return to this or another well specified

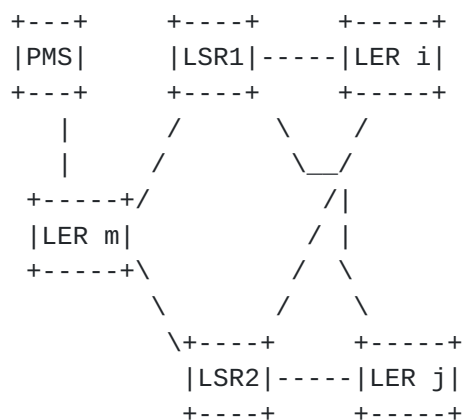
interface, the MPLS monitoring system is the single entity pushing monitoring packet label stacks. Concerns about router label stack pushing capabilities don't apply in this case.

2. A topology aware MPLS path monitoring system

A MPLS path monitoring system (PMS) which is able to learn all labeled paths of a domain is able to build a measurement packet which executes an arbitrary chain of paths. Such a monitoring system is aware of the MPLS topology. The task is to check liveness of the MPLS transport path between LER i and LER j. The PMS may do so by sending packets carrying the following minimum address information:

- o Top Label: connected LSRs path to LER i.
- o Next Label: LER i's path to LER j.
- o Next Label or address: Data plane measurement destination at LER j (this could be a label or an IP address)

Note that the label stack could as well address MPLS node after MPLS node passed by the measurement packet on it's path from PMS to the packets destination or any address stack between this maximum and the above minimum address information. Further, the destination could be the PSM itself. This is shown in figure.



Example of a PMS based LSP dataplane liveness measurement

Figure 1

For the sake of simplicity, let's assume a global Node-Segment ID label space (meaning the value of a label never changes during a label swap). Let's assign the following Node SIDs to the nodes of

the figure: PMS = 10, LER i = 20, LER j = 30.

The aim is to check liveness of the path LER i to LER j. The PMS does this by creating a measurement packet with the following label stack (top to bottom): 20 - 30 - 10.

LER m forwards the packet received from the PMS to LSR1. Assuming Pen-ultimate Hop Popping to be deployed, LSR1 pops the top label and forwards the packet to LER i. There the top label has a value 30 and LER i forwards it to LER j. This will be done transmitting the packet via LSR1 or LSR2. The LSR will again pop the top label. LER j will forward the packet now carrying the top label 10 to the PMS (and it will pass a LSR and LER m).

A few observations on the example:

- o The path PMS to LER i must be stable and it must be detectable.
- o If ECMP is deployed, it may be desired to measure along both possible paths, a packet may use between LER i and LER j. This may be done by using MPLS OAM coded measurement packets with suitable IP destination addresses.
- o The path LER j to PMS to must be stable and it must be detectable.

To ensure reliable results, the PMS should be aware of any changes in IGP or MPLS topology.

Determining a path to be executed prior to a measurement may also be done by setting up a label including all node SIDs along that path (if LER1 has Node SID 40 in the example and it should be passed between LER i and LER j, the label stack is 20 - 40 - 30 - 10).

Obviously, the PMS is able to check and monitor data plane liveness of all LSPs in the domain. The PMS may be a router, but could also be dedicated monitoring system. If measurement system reliability is an issue, more than a single PMS may be connected to the MPLS domain.

Monitoring an MPLS domain by a PMS based on SR offers the option of monitoring complete MPLS domains with little effort and very excellent scalability.

3. Applying SR to monitor LDP paths

A SR based PMS connected to a MPLS domain consisting of LER and LSR supporting SR and LDP in parallel in all nodes may use SR paths to transmit packets to and from start and end points of LDP paths to be

monitored. In the above example, the label stack top to bottom may be as follows, when sent by the PMS:

- o Top: SR based Node-SID of LER i at LER m.
- o Next: LDP label identifying the path to LER j at LER i.
- o Bottom: SR based Node-SID identifying the path to the PMS at LER j

While the mixed operation shown here still requires the PMS to be aware of the LER LDP-MPLS topology, the PMS may learn the SR MPLS topology by IGP and use this information.

4. PMS monitoring of different Segment ID types

MPLS SR topology awareness should allow the SID to monitor liveness of most types of SIDs (this may not be recommendable if a SID identifies an inter domain interface).

To match control plane information with data plane information, [RFC4379](#) should be enhanced to allow collection of data relevant to check all relevant types of Segment IDs.

5. IANA Considerations

This memo includes no request to IANA.

6. Security Considerations

As mentioned in the introduction, a PMS monitoring packet should never leave the domain where it originated. It therefore should never use stale MPLS or IGP routing information. Further, assigning different label ranges for different purposes may be useful. A well known global service level range may be excluded for utilisation within PMS measurement packets. These ideas shouldn't start a discussion. They rather should point out, that such a discussion is required when SR based OAM mechanisms like a SR are standardised.

7. References

7.1. Normative References

- [RFC4379] Kompella, K. and G. Swallow, "Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures", [RFC 4379](#),

February 2006.

[min_ref] authSurName, authInitials., "Minimal Reference", 2006.

7.2. Informative References

[ID.sr-architecture]
IETF, "Segment Routing Architecture", IETF, [https://
datatracker.ietf.org/doc/
draft-filsfils-rtgwg-segment-routing/](https://datatracker.ietf.org/doc/draft-filsfils-rtgwg-segment-routing/), 2013.

Author's Address

Ruediger Geib (editor)
Deutsche Telekom
Heinrich Hertz Str. 3-7
Darmstadt, 64295
Germany

Phone: +49 6151 5812747
Email: Ruediger.Geib@telekom.de