Benchmarking Methodology for MPLS Segment Routing

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Background

RFC5695 describes a methodology specific to the benchmarking of MPLS forwarding devices.

Segment Routing (SR), defined in RFC8402, leverages the source routing paradigm and can be applied to MPLS data plane (**SR-MPLS**)

- However, there is no standard method defined to compare and contrast the foundational SR-MPLS packet forwarding capabilities of network devices.
- This document aims to complement RFC5695 by defining the methodology for benchmarking SR-MPLS.
- It builds upon RFC2544, RFC5695 and RFC8402.

Changes from -01

New version which addressed the comments received at IETF 113:

- Revised Test Setup and Methodology
- Added new sections on Protocol Addresses, Trial Duration and Traffic Verification
- Included additional consideration on the relationship with RFC5695 and RFC2544
- Traffic Engineering and Services (VPNs) have been put out of the scope
- References to RFC9004 and ETSI GR-NFV-TST-007

Test Setup

The test setup is compliant with RFC2544 but augmented by the methodology specified in RFC5695 using many ports.

- It is needed to test the packet forwarding engine that may have different performance based on the number of ports served.
  - All ports served by a particular packet forwarding engine should be loaded in reverse proportion to the claimed oversubscription ratio.

- Tests SHOULD be done with bidirectional traffic that better reflects the real environment for SR-MPLS nodes.
  - It is OPTIONAL to choose non-equal proportion for upstream and downstream traffic for some specific aggregation nodes.

- SR may also be implemented as a software network function in an NFV Infrastructure and, in this case, additional considerations should be done.
  - RFC9004 updates the test procedures to measure the Back-to-Back Frames which are relevant in software-packet processing.
  - ETSI GR-NFV-TST-007 also describes test guidelines for NFV capabilities.

Label Distribution Support and Frame Formats and Sizes

It is RECOMMENDED that the DUT and test tool support at least one option for SID stack construction:

- IS-IS Extensions for Segment Routing (RFC8667)
- OSPF Extensions for Segment Routing (RFC8665)
- Segment Routing Prefix Segment Identifier Extensions for BGP (RFC8669)
- Segment Routing Policy Architecture (draft-ietf-spring-segment-routing-policy).

RFC5695 requires exactly a single entry in the MPLS label stack that is not enough to simulate typical SR SID list.

- It is RECOMMENDED that SR policy can be used for a stack with 2 SIDs.
- It is possible to test longer SID lists if there is an interest.

It is RECOMMENDED that the top SID on the list (outer label) should be an adjacency type to emulate TE scenarios.

The tests will use the Frame characteristics similarly to RFC5695, except the need for a bigger MTU to accommodate many MPLS labels.

- n*4 octets are added in the calculations to accommodate MPLS labels needed for respective tests

Reporting Format

- New parameters that MUST be added:
  - Port numbers involved in the tests and their respective oversubscription ratio.
  - Upstream/downstream traffic proportion (equal bidirectional or some other split).
  - SR-MPLS Forwarding Operations (PUSH/ NEXT/ CONTINUE).
  - Number of Segments considered in the MPLS Label Stack and the type of SIDs used (Global/Local).
  - SR Policy construction method (PCEP, BGP, manual configuration).
  - Type of the payload (IPv6/IPv4, UDP/TCP).

- Some parameters MAY be changed:
  - Label Distribution protocol and IGP are the same in the context of SR MPLS. Hence, it is called "label distribution".
  - Port media type may be reported only one time for all tests if only Ethernet media would be tested

SR-MPLS Forwarding Benchmarking Tests

RFC5695 defines tests (Throughput, Latency, Frame Loss, System Recovery, Reset) for **MPLS Label Push**, **MPLS Label Swap** and **MPLS Label POP**.

Similarly, for **SR-MPLS** three fundamental operations needs to be tested: **PUSH**, **NEXT** and **CONTINUE**

- The PUSH operation corresponds to the Label Push function.
  - It consists of pushing one or more MPLS labels on top of an incoming packet then sending it towards a particular next hop.
- The NEXT operation corresponds to the Label Pop function
  - It consists of removing the topmost label.
- The CONTINUE operation corresponds to the Label Swap function.
  - It consists of forwarding the packet on the outgoing interface based on the incoming label.

Therefore the procedure can be similar to RFC5695 with some extensions:

- Test SID list longer than 1 SID (2 are recommended, many are possible)
- Different Reporting Format.

Next Steps

BMWG may consider to adopt this missing piece to cover SR-MPLS

Welcome inputs, comments

Open to new coauthors, contributors

Thank you