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Benchmarking Methodology for Service Function Chain Performance
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Abstract

Service Function Chain is the ordered set of service functions such as firewall, Deep Packet Inspection(DPI), virtualized Evolved Packet Core (vEPC), and etc,. Operators make chains with several service functions depending on the service which they have to provide. The chain needs to be evaluated to measure the SLA. This draft describes the benchmarking methodologies for Service Function Chain(SFC) performance and the affecting factors to SFC performance.

Requirements Language

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 RFC 2119 [RFC2119].

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on May 4, 2017.

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1. Introduction

Service Function Chain is the ordered set of service functions such as firewall, Deep Packet Inspection(DPI), virtualized Evolved Packet Core (vEPC), and etc,. The service functions include virtualized network functions and physical network functions. As the network infrastructure become virtualized, operators make chains with several service functions depending on the service which they have to provide. The chain needs to be evaluated to measure the SLA.

This draft describes the benchmarking methodologies for Service Function Chain(SFC) performance and the influential factors to SFC performance.

2. Definition of Terms

The detail explanations of each term are in [RFC 7665]

SF Service Function

SFC Service Function Chain

SFF Service Function Forwarder

CLA Classifier

PNF Physical Network Function

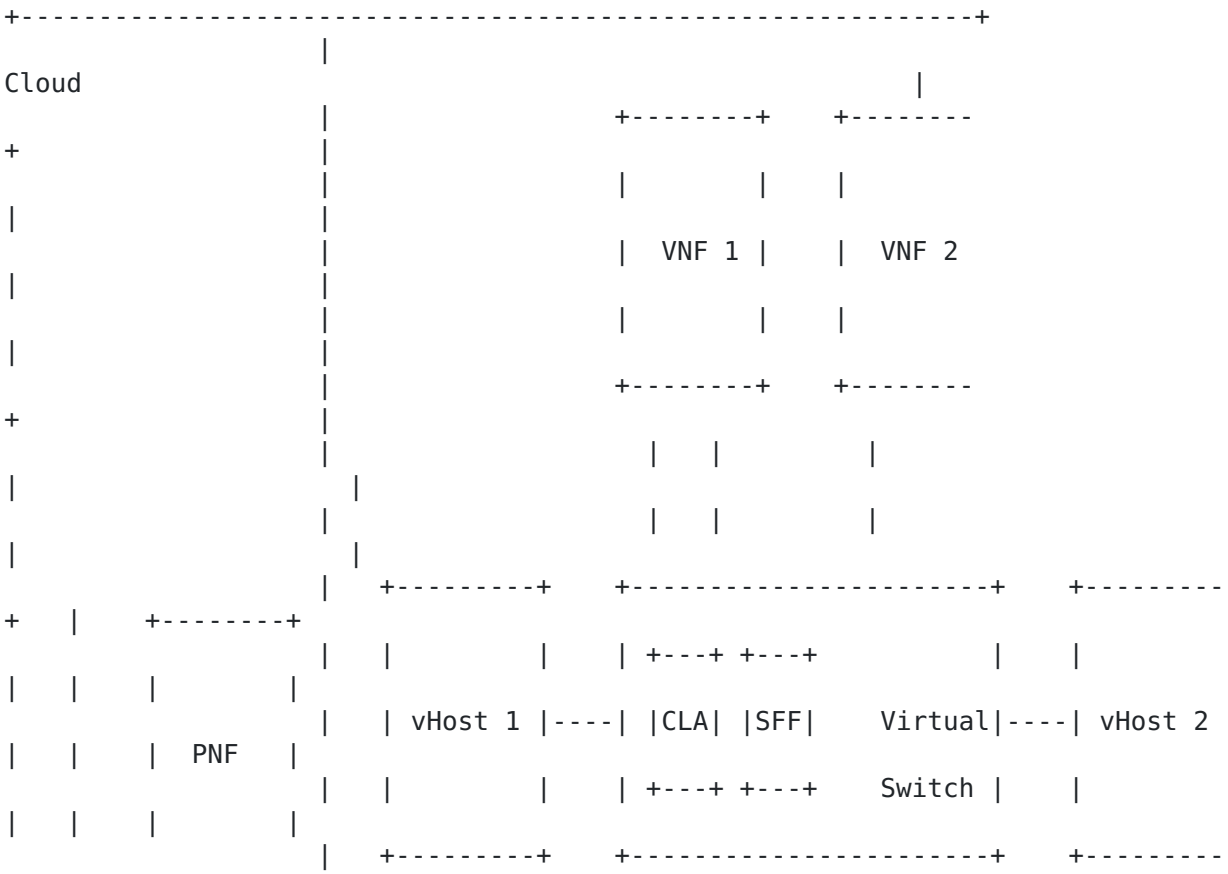
VNF Virtualized Network Function

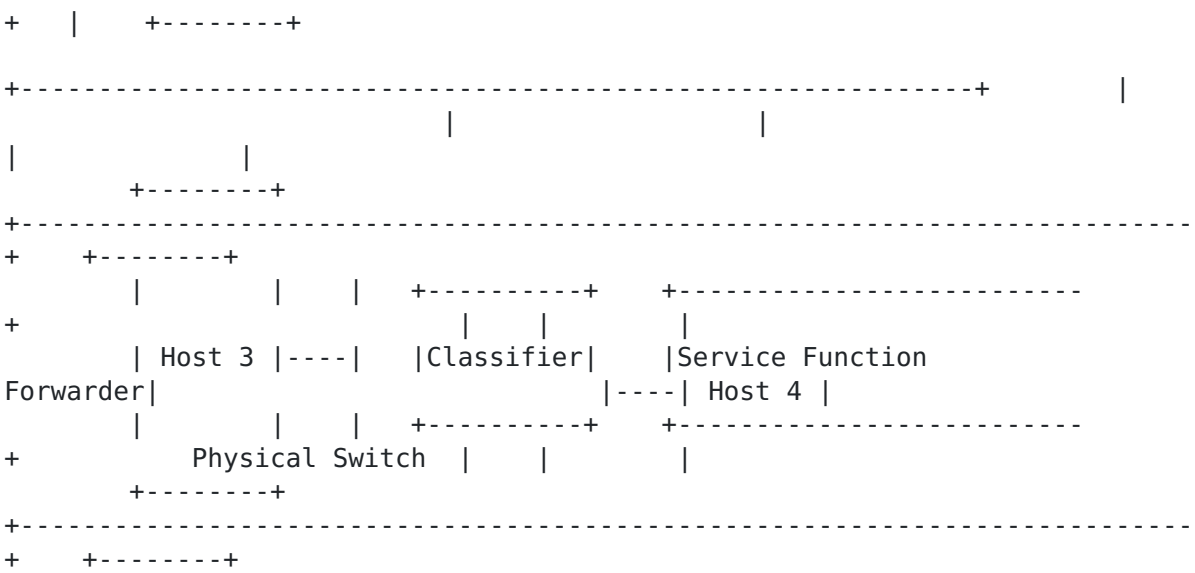
NSH Network Service Header

3. Test Setup

This section discusses test topology and the test traffic

3.1. Test Topology




| Host 3 |
Classifier
Service Function Forwarder
Host 4
Physical Switch

3.2. Test Traffic

There are two types of traffic. One is External traffic and the other is Internal traffic.

- Internal Traffic :
  - The traffic flows inside the cloud. A source host and a destination host are inside the same cloud and the SFC is also made in the cloud. Therefore, the SFC does not contain a SF outside the cloud(PNF). (e.g. SFC : vHost1 -> VNF1 -> VNF2 -> vHost2)
- External Traffic :
  - The traffic flows outside the cloud. A source host or destination host can be exists outside the cloud. Therefore, the SFC can contain a SF outside the cloud(PNF) (e.g. SFC : Host3 -> VNF1 -> VNF2 -> PNF-> Host4)

The frame sizes of the test traffic SHOULD be multiple sizes as recommended in RFC2544.

4. Benchmarking Test

4.1. Connectivity

Objective :

The connectivity of each part of SFC and the end to end SFC it self. This test demonstrates the SFC works properly.

Procedure:

1. Send the test traffic from source host to destination host
2. Check each SF and links between the SFs
3. Check the test traffic from the source host and the destination host.
4. Among SFs, the test traffic SHOULD flows only selected SF from the source host to the destination host.

4.2. Performance

4.2.1. E2E Latency

Objective :

This test demonstrates how much time the SFC takes to flow traffic from the source host to the desination host. Latency is the key of some services such as video streaming.

Procedure:

1. Check the connectivity of the SFC

2. Send the test traffic from source host to destination host

3. Check the test traffic from the source host and the destination host.

Measurement:

E2E Latency Time = TL

Average E2E Latency :

$$\frac{TL1 + TL2 + \ldots TLn}{\text{Total Test Iterations}}$$

4.2.2. E2E Packet Loss Rate

Objective :

This test demonstrates how many packets are loss depending on the frame sizes or parallel SFCs

Procedure:

1. Check the connectivity of the SFC

2. Make the conflict circumstances with differenct frame sizes and other SFCs

3. Send the test traffic from source host to destination host.

4. Check the test traffic from the source host and the destination host.

Measurement:

E2E Packet Loss Rate = PLR

Average Packet Loss Rate :

$$\frac{PLR1 + PLR2 + ...PLRn}{\text{Total Test Iterations}}$$

4.2.3. E2E Bandwidth

Objective :

This test demonstrates how much bandwidth the SFC can support. To find out the bandwidth of SFC is enough for particular sevices such as bandwidth-intensive services.

Procedure:

1. Check the connectivity of the SFC

2. Send the test traffic from source host to destination host.

3. Check the test traffic from the source host and the destination host has no packet loss.

4. Record the E2E Bandwidth.

Measurement:

E2E Bandwidth = BW

Average E2E Bandwidth :

$$\frac{BW1 + BW2 + ...BWn}{\text{Total Test Iterations}}$$

5. Factors affecting the SFC Performance

This section describes factors affecting the SFC performance.

- SFC awareness
  - * - Depending on the awareness of SFC encapsulation,NSH, the SFC performance is different. When SFC uses NSH, it takes time to check the NSH of every packet.

- Composition of SFC
  - the number of SFs in the SFC affects the SFC performance because of the trasition overhead.
- Operation of SF
  - The operations of SF can affect to the SFC performance, such as DPI and UTM.
  - When the SF has multi functions, the traffic takes time to pass through the SF.
- Types of SF; PNF or VNF
  - It is hard to assure the network performance of VNF because it is on the virtual machine(VM); VNF is affected from the CPU of physical machine(PM).
  - VNF is also affected from the number of flow rules in the virtual switch.

6. Security Considerations

TBD.

7. IANA Considerations

No IANA Action is requested at this time.

8. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

[RFC2544] Bradner, S. and J. McQuaid, "Benchmarking Methodology for Network Interconnect Devices", RFC 2544, DOI 10.17487/RFC2544, March 1999, <http://www.rfc-editor.org/info/rfc2544>.

[RFC7665] Halpern, J., Ed. and C. Pignataro, Ed., "Service Function Chaining (SFC) Architecture", RFC 7665, DOI 10.17487/RFC7665, October 2015, <http://www.rfc-editor.org/info/rfc7665>.

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