Overlay OAM Design Team Report

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IETF-95 April, 2016

Motivation

- Existing work in NVO3, SFC and BIER WGs on OAM Framework, Requirements, and Solutions
- Look at the OAM “puzzle” holistically, prevent divergence
- E.g.:
    - Proposed adaptation, extension of existing OAM protocols (BFD in VXLAN)
    - Proposed new mechanism (Transcending Traceroute)
- Common OAM presentation and discussion at IETF-94

OOAM DT Charter

https://trac.tools.ietf.org/area/rtg/trac/wiki/RtgOoamDT

This Design Team is chartered to first produce a brief **gap analysis** and **requirements** document to focus its work on protocol extensions. This should be published by March 2016. With that basis, this Design Team is chartered to rapidly propose extensions to existing IETF OAM protocols such as those discussed in [RFC 7276] and new ones to support the requirements for OAM from NVO3, BIER, and SFC. The Design Team will produce an initial proposal by IETF 95. It is expected that the initial proposal will provide guidance to additional people who will be interested in working on the details and gaps.

The Design Team will consider the preliminary OAM requirements from NVO3, BIER, and SFC. The Design Team should align with the LIME WG's work on common YANG models of OAM.

Overlay OAM Requirements

draft-ooamdt-rtgwg-ooam-requirement-00

Structure

- Fault Management
  - Proactive FM
  - On-demand FM
- Performance Management
- Alarm Indication Signal (Suppression)
- Resiliency

Requirements

- OOAM independent from a transport layer
- Any node implicitly serves as MEP
- SDN-azation of Overlay OAM
- Proactive and on-demand OAM created equal
- Unidirectional Overlay OAM (CC and PM) optimization as services (multicast, SFC) are unidirectional
- OAM is about what is going in the transport layer and thus it must be in-band , i.e. fate sharing with data traffic
- Bi-directional OAM is important too, e.g. CC-CV and out-of-band Fault Management Signal

Fault Management

- Proactive
  - Continuity Check
  - Remote Defect Indication
  - Connectivity Verification
- On-demand
  - LoC defect localization
  - path tracing through overlay network
  - verification of mapping between overlay network and client layer services
  - ECMP discovery and verification
  - proxy ping/traceroute
- Fault Management Signals like Alarm Indication Signal to suppress client layer alarms when server layer fault detected
- Overlay network survivability may use protection switching and restoration

Performance Measurements

- Passive and Active Performance Measurement OAM are complimentary instruments in OOAM toolbox
  - One-way active and passive
  - Two-way active
- Support calculation of performance metrics:
  - packet delay
  - packet delay variation
  - packet loss
  - goodput (delivered throughput)

- Definition of Terms at: https://tools.ietf.org/html/rfc7276

Overlay OAM: Gap Analysis

draft-ooamdt-rtgwg-oam-gap-analysis-01

Gap Analysis Goals

- Today, we can ping/traceroute/BFD the underlay; that does not tell us much about the VNI/SFP/overlay.
- Two dimensions:
  1. Operators: Functionally adjacent to long-existing operational practice (format on the wire is less important)
  2. Implementers: Similar across different Encaps (reuse encodings?)

Gap Analysis Detail

- Done:
  - Identification of existing **OAM Protocols**
- To be Done:
  - Possible feature Gaps within each OAM protocol
  - Applicability of OAM Protocol to different Overlays
  - Encapsulation-specific requirements of OAM Protocol (extensions to the underlay encap)

Document Structure

Available OAM tools

Fault Management:

- proactive continuity check:
  - Bidirectional Forwarding Detection (BFD) for point-to-point as defined in [RFC5880], [RFC5882], [RFC5883], [RFC5884], [RFC5885], [RFC6428] and [RFC7726];
  - BFD for multipoint network as defined in [I-D.ietf-bfd-multipoint] and [I-D.ietf-bfd-multipoint-active-tail];
  - S-BFD as defined in [I-D.ietf-bfd-seamless-base] and [I-D.ietf-bfd-seamless-ip];
- on-demand continuity check and connectivity verification:
  - MPLS Echo Request/Reply, a.k.a. LSP Ping, as defined in [RFC4379] and its numerous extensions;
  - LSP Self-ping, as defined in [RFC7746];
  - [I-D.kumarzheng-bier-ping] is a good example of generic troubleshooting and defect localization tool that can be extended and suited for more specific requirements of the particular type of an overlay network.

Available OAM tools

Performance Measurement:

- packet loss and delay measurement in MPLS networks, as defined in [RFC6374] with ability to export measurement results for post-processing [I-D.ietf-mpls-rfc6374-udp-return-path];
- Two-Way Active Measurement Protocol (TWAMP), as defined in [RFC5357], [RFC6038], and [RFC7750];
- use of the Marking Method [I-D.tempia-ippm-p3m] that, if accordingly supported by the overlay layer, can behave as close as technically possible to a passive method to measure performance, e.g. [I-D.mirsky-bier-pmmm-oam].

Example 1:

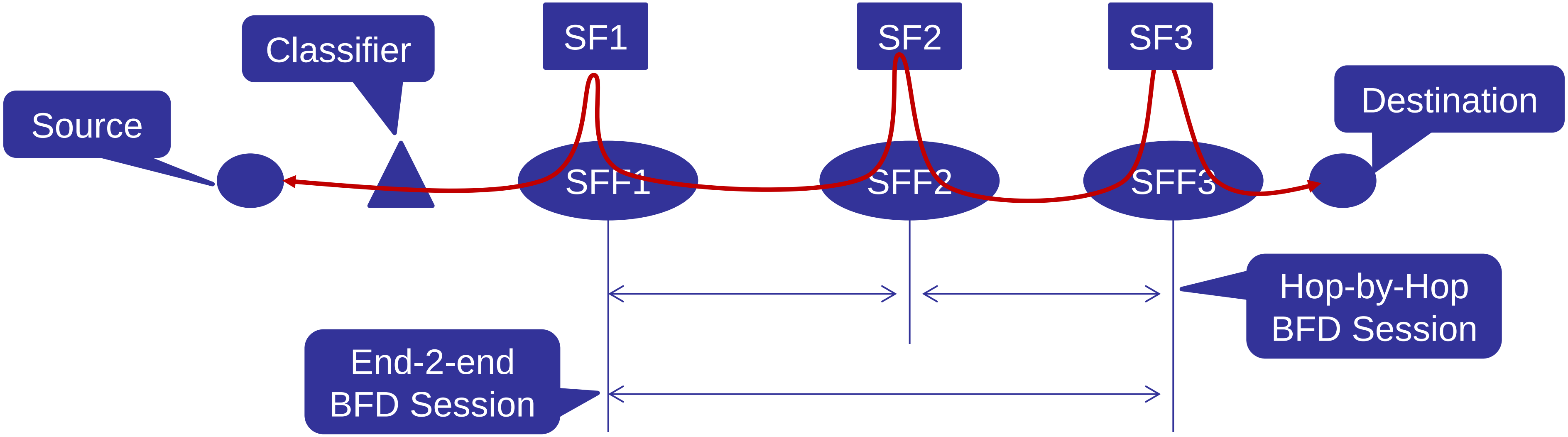
BFD for SFC

based on draft-ooamdt-rtgwg-gap-analysis-00

OAM for SFC Scope

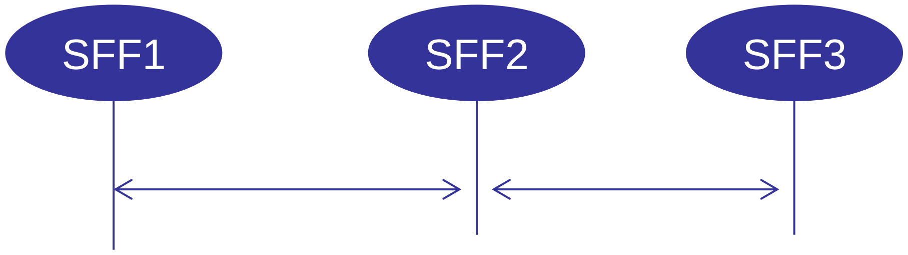
- Continuity Check on the SFP
- Verify that the SFF has the attachment point to talk to the SF
- Testing connectivity, **NOT** SF Functionality

Use Case



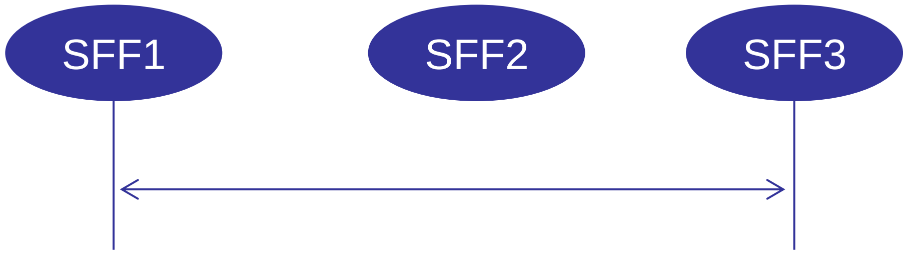
- Where to deploy the BFD sessions?
  - – Between SFFs (the major case)
    - Hop-by-hop BFD session (e.g., SFF1<->SFF2, SFF2<->SFF3)
    - End-2-end BFD session (e.g., SFF1<->SFF3)
  - – Other possibilities ?

Hop-by-hop Case



- An SFF should have capability to determine whether a packet should be delivered to an SF or terminated.
- Encapsulation dependent

End-2-End Case



- An SFF (e.g., SFF2) should have capability to determine whether a packet should be delivered to an SF or the next hop SFF.
- Encapsulation dependent

Control Plane

- BFD session bootstrapping
  - In-band signaling
  - Out-of-band channel
  - Centralized controller

Encapsulations

- BFD with IP/UDP encapsulation
  - Same as RFC5881 and 5884
  - The source/destination addresses and UDP port are derived from the IP/UDP header
- BFD without IP/UDP encapsulation
  - Add source and destination addresses field
  - UDP port is not necessary, the “Next Protocol” and/or “type” fields can be used to indicate a BFD packet
- BFD with embedded Src/Dst Info
  - Source and destination address are embedded in the BFD control packet
  - Similar to RFC6428, e.g., Source MEP ID TLV

Example 2:

SFC Trace

based on draft-ooamdt-rtgwg-gap-analysis-00

SFC Traceroute

```
sff_client.py --remote-sff-ip 10.0.1.41 --remote-sff-port 4789 --sfp-id 22 --sfp-index 255 --trace-req --num-trace-hops 3
```

```
Sending Trace packet to Service Path and Service Index: (22, 255)
Trace response...
Service-hop: 0. Service Type: dpi, Service Name: SF1, Address of Reporting SFF: ('10.0.1.41', 4789)
Service-hop: 1. Service Type: firewall, Service Name: SF4, Address of Reporting SFF: ('10.0.1.42', 4789)
Service-hop: 2. Service Type: napt44, Service Name: SF5, Address of Reporting SFF: ('10.0.1.43', 4789)
Trace end
```

In-band Telemetry Probe

(Yes, we need this too for)

What is this ?

- At some moment in time we would like to know the exact network state of the data path traffic
    - Example: ECMP next hop
    - Real time control feedback loop
        - Like ECN, XCP, RCP or utilization aware routing (CONGA)
    - Real time of network event detections
    - OAM
- We would like to get this info without control plan intervention.

How it works

- Traffic source (Application, NIC,TOR, etc.) will embed a request inside the data packet generate special probe packet
- Destination nodes, Sink, receive the instructions and possibly report the collected results of those instructions to an application or a controller
- Allowing the traffic Sink to monitor the exact state of the network
- The request and response have to be send over an Overlay network. Documented use-cases for some overlays already exist:
  - NSH
  - Geneve
  - Vxlan GPE

Telemetry Next steps

- Update the draft to cover following aspects of the gaps
  - Use Case
  - Control plane
  - Data plane/Encapsulations

Conclusion

- We need your review and comments!
- We are ready to start the protocol work –> What’s missing from the Requirements or Gap Analysis?