Virtualised service assurance management in vGi-LAN

1 NFV ISG PoC Proposal

1.1 PoC Team Members

- PoC Project Name: Virtualized service assurance management in vGi-LAN

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1.2 PoC Project Goals

The purpose of this PoC is to demonstrate deterministic service chain provisioning and re-routing in a virtualized multi-site Gi-LAN environment through intelligent granular resource sharing across multiple NFVI-PoP's. It will be demonstrated how this can be achieved by providing the NFV provisioning layers with network-wide visibility of Gi-LAN VNF health status and inter-Gi-LAN WAN performance metrics via vSAM (Virtualised Service Assurance Manager). The vSAM is analogous to the TRAM (Test Results Analysis Module) which is a new component currently being proposed for active monitoring and failure detection in NFVREL004.

The vSAM will provide platform and NFVI-PoP interconnect network performance metrics to the NFVO to inform intelligent decisions on adaptation of VNF chaining across multiple Gi-LAN sites.

Whilst vGi-LAN is the use-case we will demonstrate first for vSAM, it should be noted that the vSAM concept is de-coupled from the NFV application and may be equally used for other scenarios such as vHome, vCPE, C-RAN, vEPC etc.

It can be assumed that this PoC may be carried out over several phases. In phase 1 we will not demonstrate any performance capability and will implement pre-established service chains. Furthermore a full-scale VIM will not be used in phase 1 but rather there will be scripted instantiation of VM's and configuration of virtual networks using the same commands as a typical VIM such as OpenStack. A lightweight application will be implemented to provide NFVI KPI's (key performance indicators) via the Libvirt API as would typically be provided by a VIM telemetry feature. In the second phase a VIM such as OpenStack may be integrated into the PoC for virtual infrastructure orchestration and telemetry.

The PoC has the following goals:

- PoC Project Goal #1: Demonstrate implementation of a TRAM (Test Results Analysis Module) as described in NFVREL004 where NFVI-PoP interconnect performance metrics are gathered from VTA's (vProbes) and provided to the service chaining application in correlation with NFVI performance metrics to enable it to make an intelligent decision as regards placement of service chains on vGi-LAN resources across multiple sites. This can be seen as an alternative to NFV Use Case #5 (Figure 14) whereby instead of VNF relocation upon failure, the service chaining controller steers the traffic onto the remote resource.

1.3 PoC Demonstration

Venue for the demonstration of the PoC: NFV Work Congress, DoubleTree Hilton, San Jose, USA, April 19-22, 2016.

1.4 Publication

The PoC results will be documented in a whitepaper and made available to ETSI members and the general public during May, 2016.

1.5 PoC Project Timeline

- What is the PoC start date? May, 2015
- (First) Demonstration target date April, 2016 (NFV World Congress)
- PoC Report target date May 2016
- When is the PoC considered completed? May 2016

2 NFV PoC Technical Details

2.1 PoC Overview

Currently Gi-LAN resources are not shared between sites, and Gi-LANs are heavily overbuilt to cater for failure and overload scenarios. Load-balancing within Gi-LAN service chains can help scale individual service nodes and provide fault tolerance in the event of failures. In this POC we will monitor performance metrics of Gi-LAN VNFs and also performance of interconnects between Gi-LAN sites. The POC will demonstrate that during failures or peak periods orchestration of service chaining can make more optimal use of resources between sites (aka NFVI-PoPs). Such capabilities allow network operators to leverage multiple sites in the delivery of their Gi-LAN services, thus addressing Service Provider OpEx concerns via sophisticated and dynamic service chaining and CapEx concerns via intelligent resource sharing.

Study items for active monitoring of VNFs, NFVI and network services are currently being identified in the NFVREL Work Group. In work item NFVREL004 "Active Monitoring and Failure Detection in NFV Environments", three new components are currently suggested for the purpose of active monitoring; Test Controller (TC), Test Results Analysis Module (TRAM) and Virtual Test Agent (VTA), see Figure 2. In this PoC the vSAM performs the role of the TC and TRAM and a vProbe is used as a VTA to monitor performance between Gi-LAN sites using standard measurement protocols specified in NFVREL004 such as TWAMP and Y.1731.

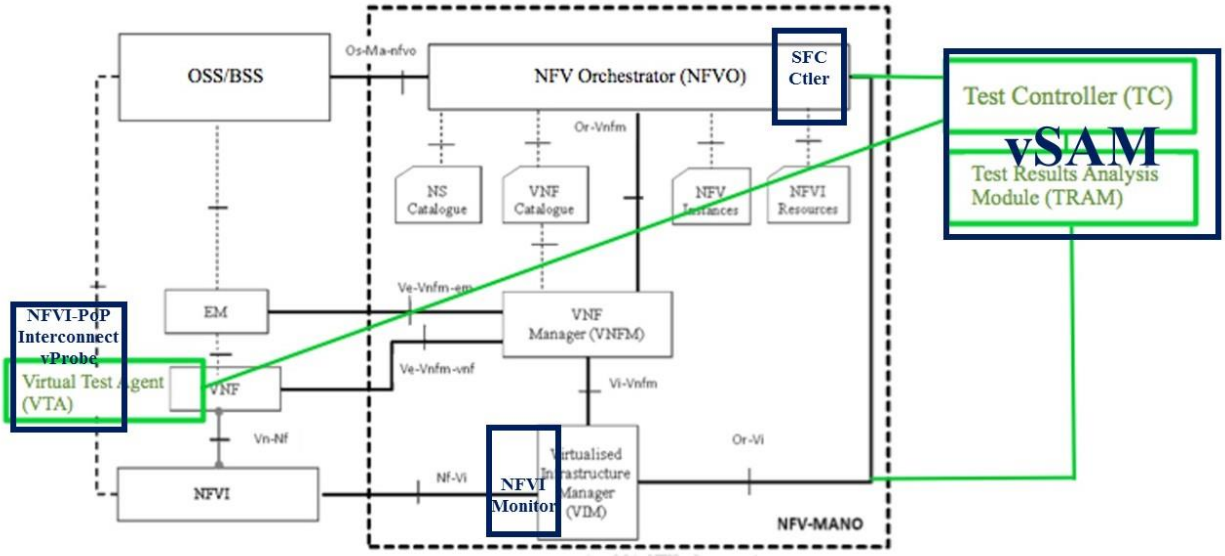

Figure 1. Alignment of POC with new components as suggested in NFV REL WG (TC, TRAM, VTA)

This PoC will use two service chains, one for voice traffic and one for video traffic. The vSAM will utilize vProbes (aka VTA's) to monitor the performance of NFVI-PoP interconnect links and an NFVI Monitor application to monitor resource-usage by VNF's. The SFC controller will adapt VNF service-chains based on resource availability across multiple NFVI-PoP's.

Figure 2 below shows the high level architecture of each Gi-LAN NFVI-PoP. For the purpose of this PoC, three inter-connected Gi-LAN sites are simulated.

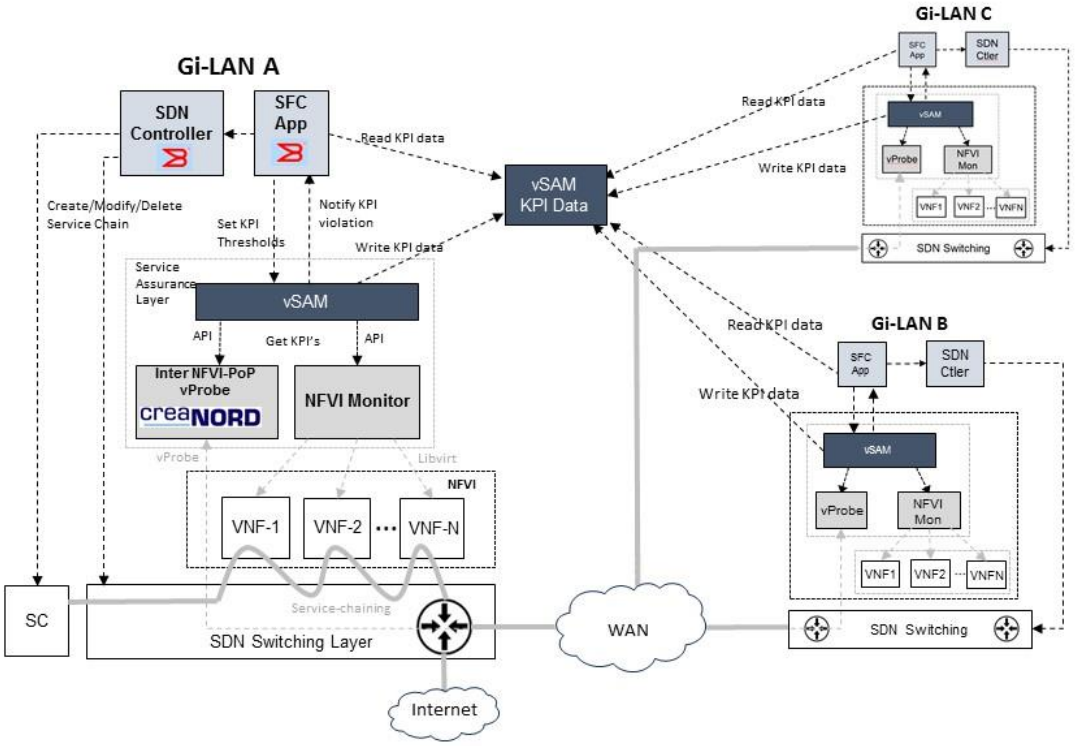

Figure 2. PoC architecture diagram

The vSAM component will be developed as an open service assurance manager for NFV. A northbound API will be developed to allow provisioning of platform and network underlay KPI Monitors by the NFVO (SFC orchestration function) and for notification of KPI violations towards the NFVO (SFC). In the southbound direction vSAM collects performance metrics from KPI monitors such as the NFVI resource-usage monitor and NFVI-PoP interconnect performance monitor.

In this POC the Brocade Service Chaining application will perform the service-chaining orchestration function within the NFVO. A basic NFVI resource usage monitor will be developed for the purpose of the PoC which is based on the collectd application for platform metrics collection, and with a Libvirt API plugin to gather resource-usage metrics for VNF's. The Creanord vProbe will be used to monitor the performance of NFVI-PoP interconnects. The vSAM gathers and collates KPI data and compares in real time to KPI threshold values that may be provisioned at service instantiation. In case of some threshold violation the SFC application is alerted to perform a service chaining adaptation at address the KPI violation and maintain service integrity.

vSAM may potentially support any number of pluggable KPI monitors to gather service assurance metrics from the NFV platform and the network underlay.

2.2 PoC Scenarios

Describe the high level scenario(s) that will be demonstrated. Where applicable, provide a network diagram(s):

The following scenarios are illustrated in this PoC:

- Scenario 1 - E2E video and voice services provided through Gi-LAN VNF service-chaining
- Scenario 2 - automatic adaptation of service chains to alleviate VNF overload condition
- Scenario 3- automatic adaptation of service chains to WAN underlay overload condition

Scenario 1 – E2E service with Gi-LAN Service Chaining

E2E service with Gi-LAN VNF Service Chaining will be verified in this scenario. UE may access video steaming or voice services through the Gi-LAN service chains in which all Gi-LAN elements (NAT, VO, SBC, CDN and FW) are virtualized. Below is shown how video traffic is detected and service-chained in Gi-LAN.

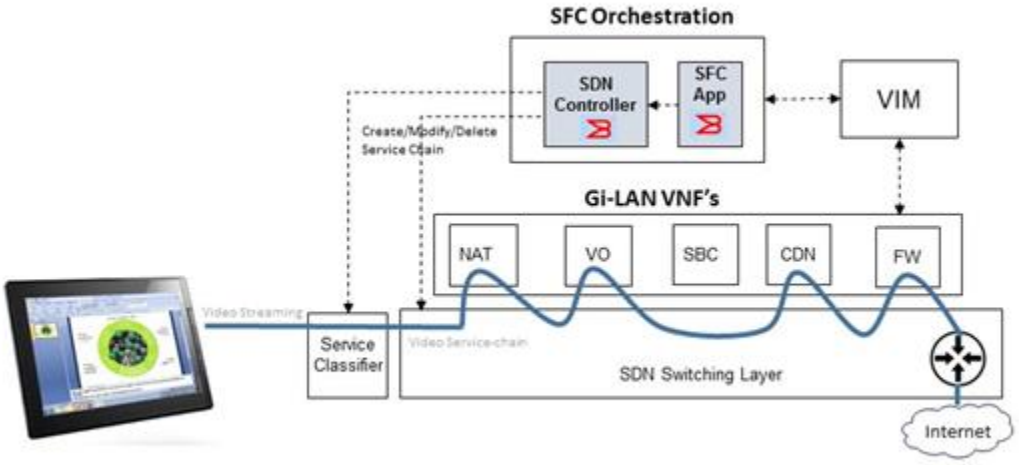

Figure 3. Gi-LAN service-chaining for video streaming request from UE

Scenario 2 – automatic adaptation of service chains to alleviate VNF overload conditions

Automatic adaptation of Gi-LAN VNF Service Chaining to address a VNF resource-usage violation will be verified in this scenario. UE will access a video steaming service provided by a service chain. vSAM detects CPU overload in the local CDN VNF and alerts the SFC orchestration layer to re-direct the service chain to use the CDN VNF on Gi-LAN B.

It will be demonstrated how a video steaming session may continue uninterrupted and a caption overlay on the screen will be used to indicate that the CDN delivering video has switched to another site.

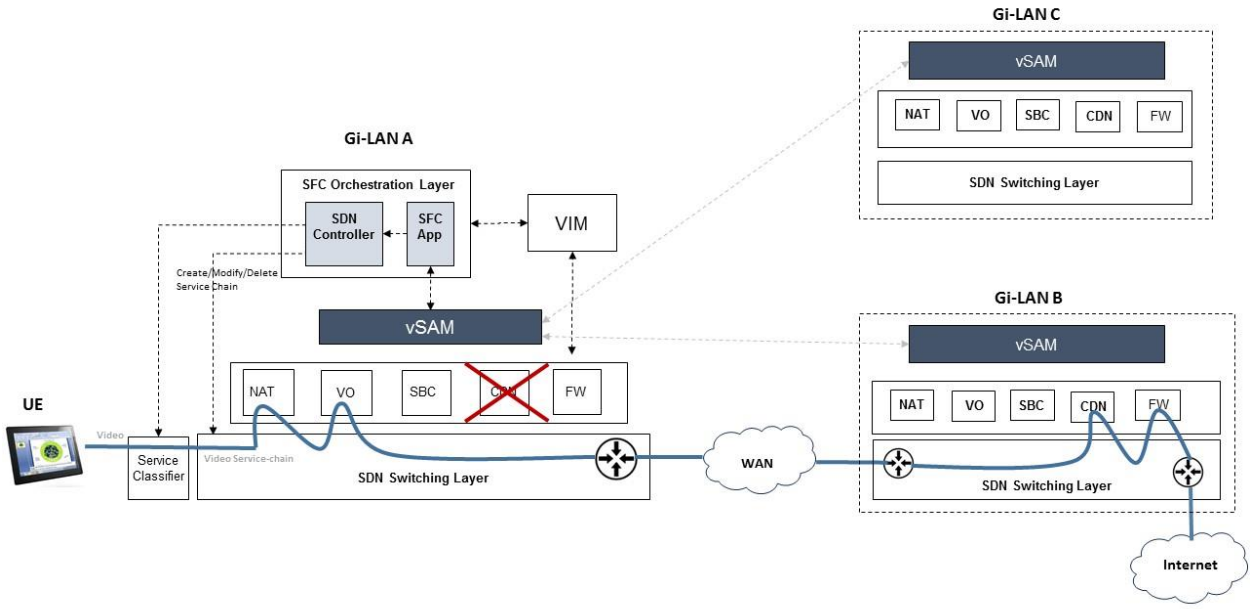

Figure 4. Gi-LAN service-chaining adaptation for Video service-chain

A GUI representation of the VNF service-chaining across three Gi-LAN sites will be purpose built for this PoC. This will show the status of service chains and allow us to demonstrate several use-cases by allowing impairments to be injected into VNF's and the NFVI-PoP interconnect links by pointing at the item to be impaired on the GUI screen. The example below illustrates how a voice service chain is re-directed due to a CPU overload in an SBC.

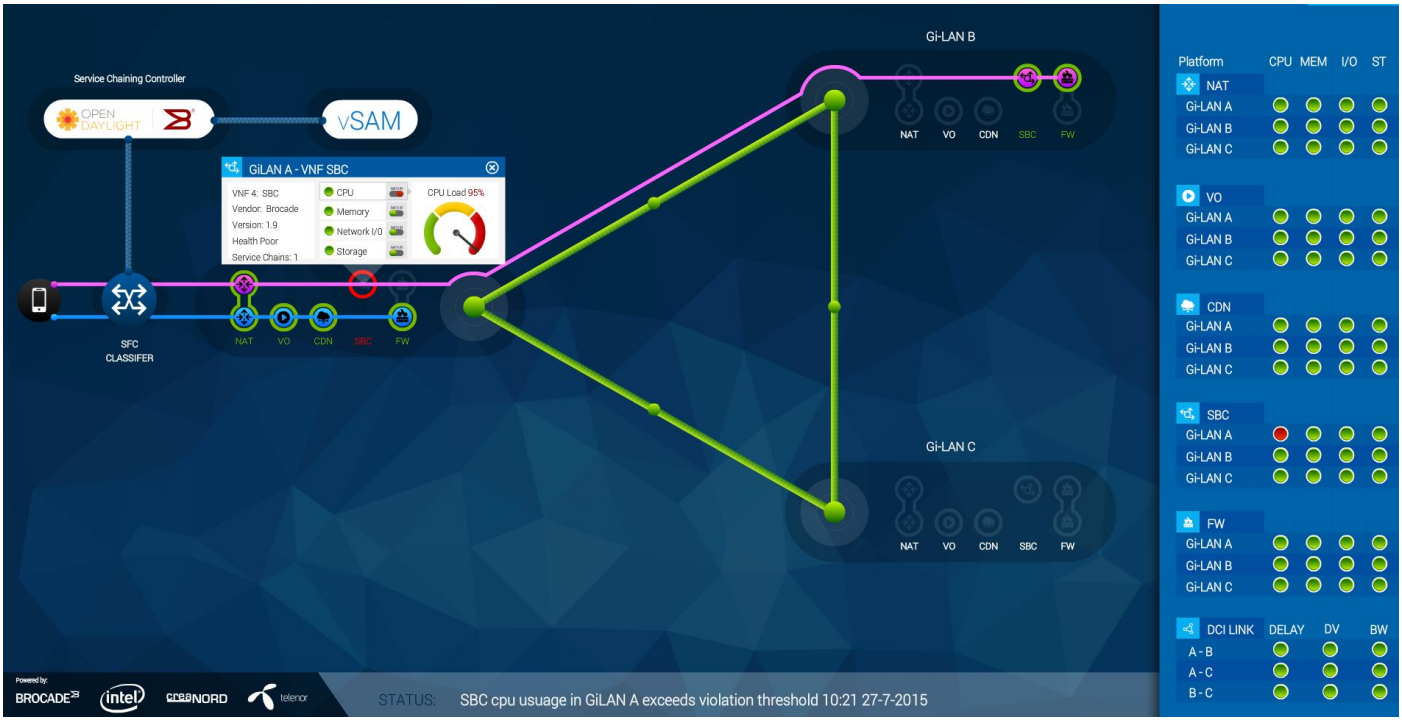

Figure 5. GUI to illustrate Gi-LAN service-chaining adaptation for VNF overload condition

Scenario 3 – automatic adaptation of service chains to alleviate WAN underlay overload conditions

Similarly to scenario 2, the vSAM can alert the SFC orchestration layer when a WAN underlay KPI for a service-chain spanning 2 NFVI-PoP's exceeds a configurable threshold value. This may be a bandwidth, delay, delay variation or packet loss KPI over a configurable duration.

Upon receipt of the KPI violation alert, the SFC orchestration layer checks with vSAM for the real-time state of WAN underlay and VNF resource-usage KPI's and moves the service chain to a more appropriate WAN link if one exists, thus maintaining service integrity as per scenario 2.

Below is an illustration of this scenario using the GUI which was described in the previous section. Here an impairment is injected into a WAN underlay which is being used by a voice service-chain. This causes the SFC orchestration layer to re-route the service chain to use the NFVI-PoP interconnect link to Gi-LAN C, thus enabling a more appropriate WAN underlay to be utilized.

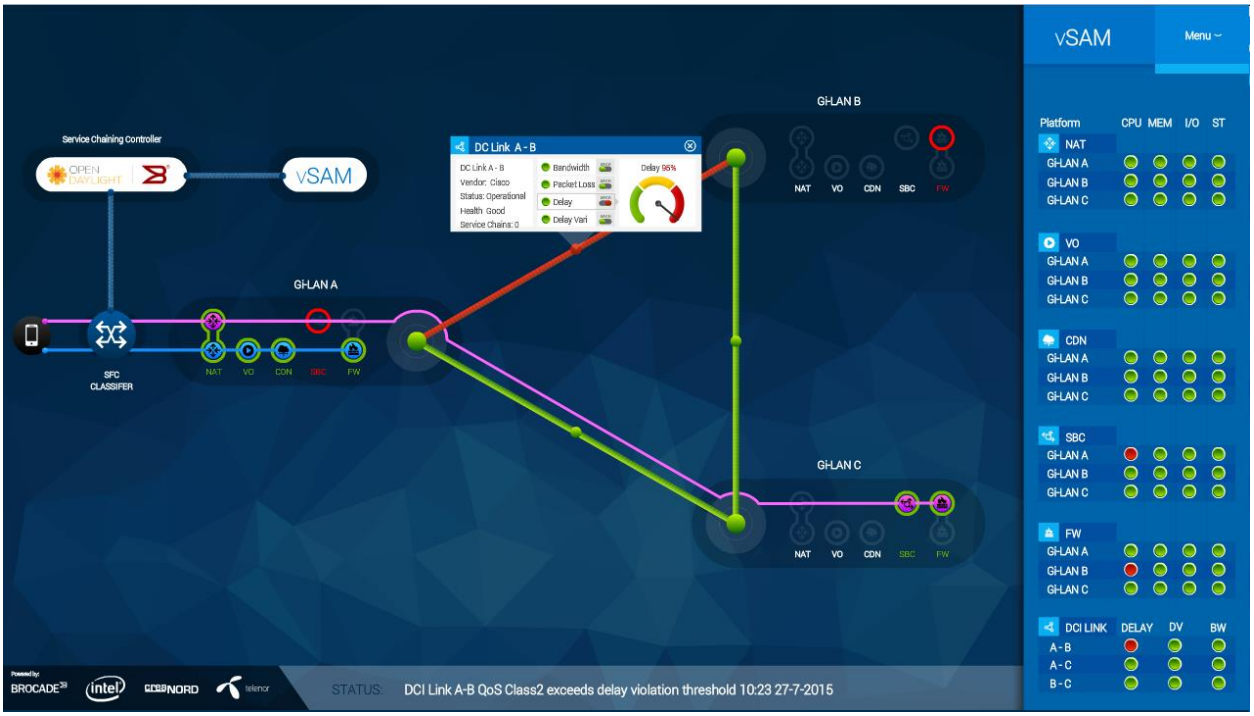

Figure 6. GUI illustrating Gi-LAN service-chaining adaptation for WAN underlay overload condition

2.3 Mapping to NFV ISG Work

The following describes how this PoC relates to NFV ISG work.

	Use Case	Requirement	E2E Arch	Comments
Scenario 1	UC#4: VNF Forwarding Graphs (GS NFV 001 V1.1.1)	GS NFV 004, Chapter 5.1, General Requirements [Gen.1]	NFVO (SFC) VIM, NFVI VNF's	This scenario shows placement of service chains across multiple Gi-LAN NFVI-PoPs
Scenario 2	UC #5 (GS NFV 001 V1.1.1)	GS NFV 004 [Res.1] [Cont.2]	NFVO (SFC) VIM, NFVI VNF's	This scenario shows how topology can be re-configured dynamically in response to VNF overload or failure.
Scenario 3	UC #5 (GS NFV 001 V1.1.1	GS NFV 004 [Res.1] [Cont.2]	NFVO (SFC) VIM, NFVI VNF's	This scenario shows how topology can be re-configured dynamically in response to NFVI-PoP interconnect WAN undelay overload or failure.

2.4 PoC Success Criteria

Successfully demonstrate deterministic adaptation of service chains during periods of overload and failure in Gi-LAN VNF's and Gi-LAN NFVI-PoP interconnect WAN underlays.

2.5 Expected PoC Contribution

List of contributions towards specific NFV ISG WIs expected to result from the PoC Project:

- PoC Project Contribution #1: we expect this PoC to influence the NFV REL004 WI as it is concerned with active monitoring of VNFs and service chains and associated recovery and have submitted a contribution to to NFV REL004 version 0.1.4 (November 2015). This includes the combination of platform and network service assurance into a middleware function to inform the SDN control plane. Examples are provided in section 7.7 - Active Monitoring of Service Chains.