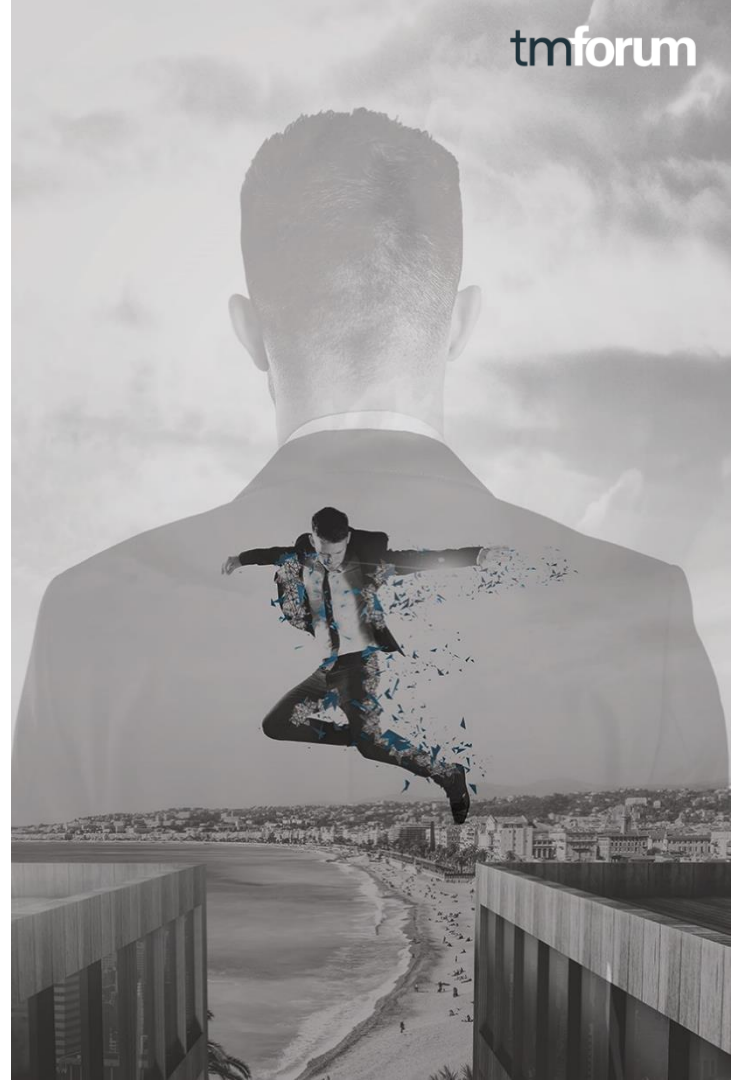


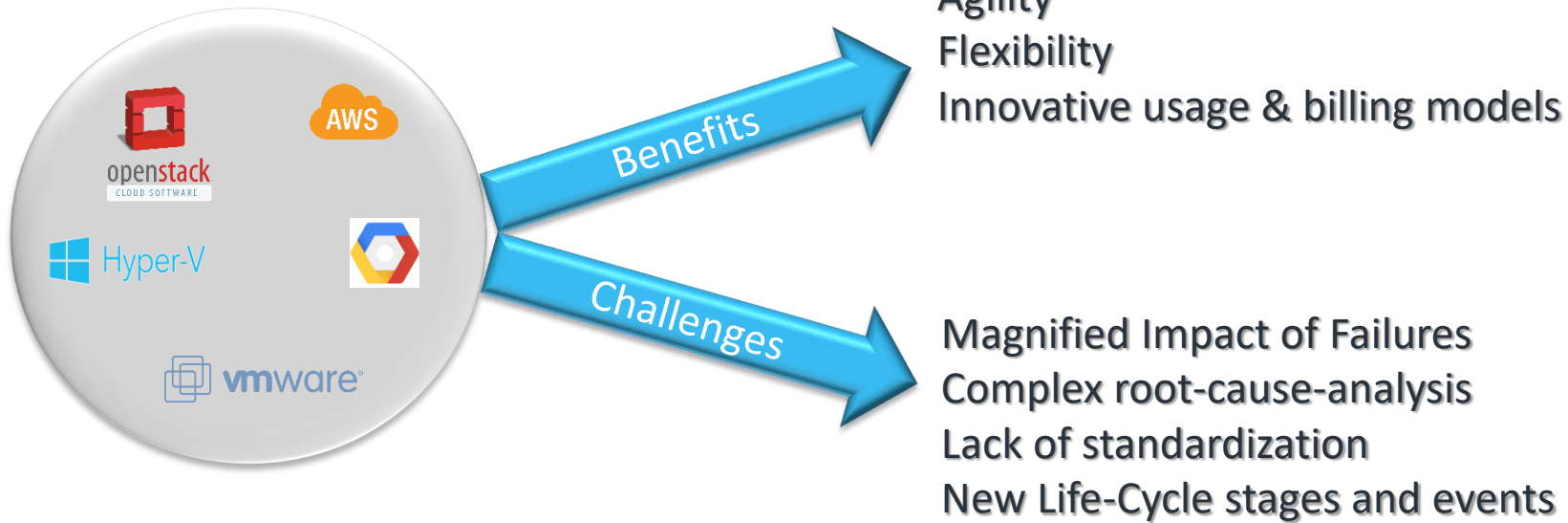


Golden Configuration Catalyst 2018

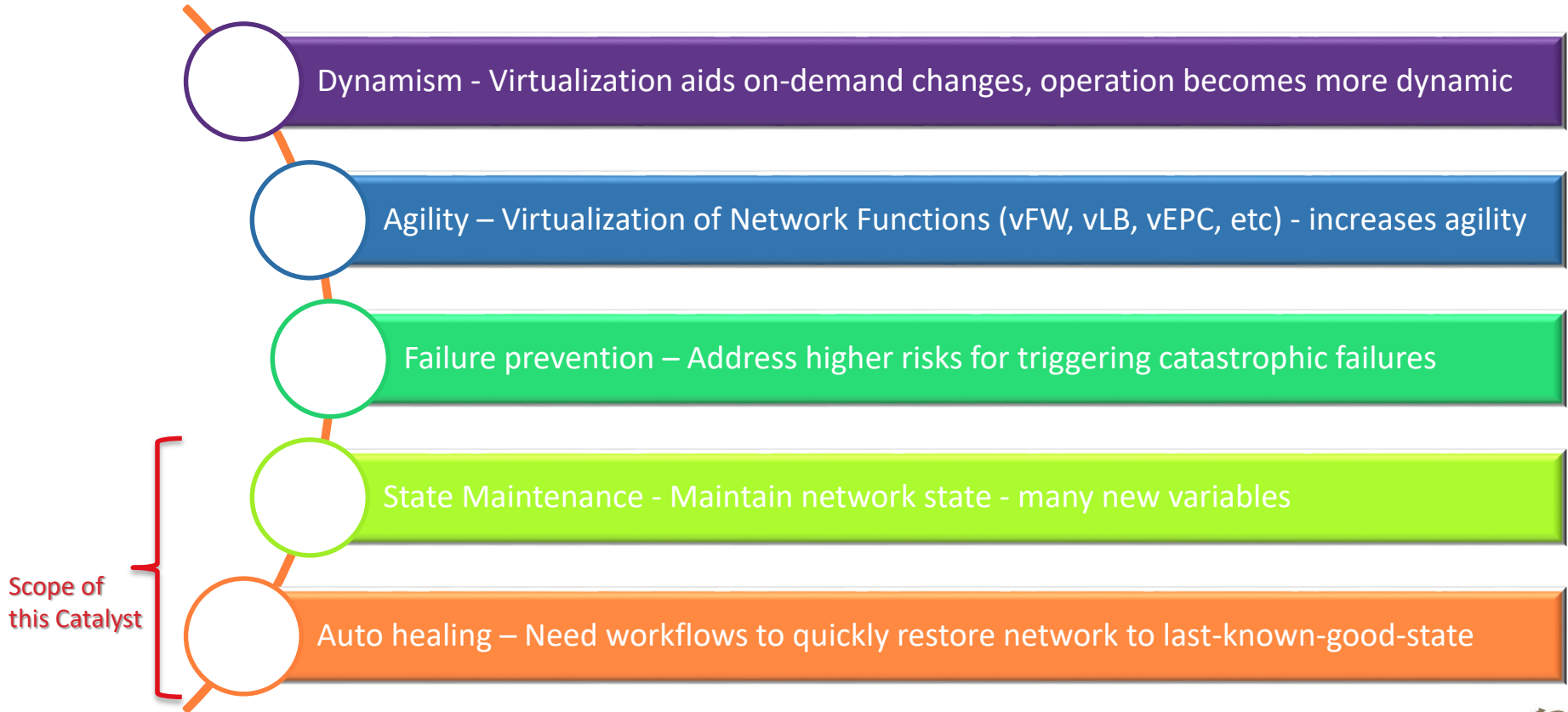
Verizon, Infosys, Nuviso Networks



Network Functions Virtualization



NFV Operational Characteristics



Scope of
this Catalyst

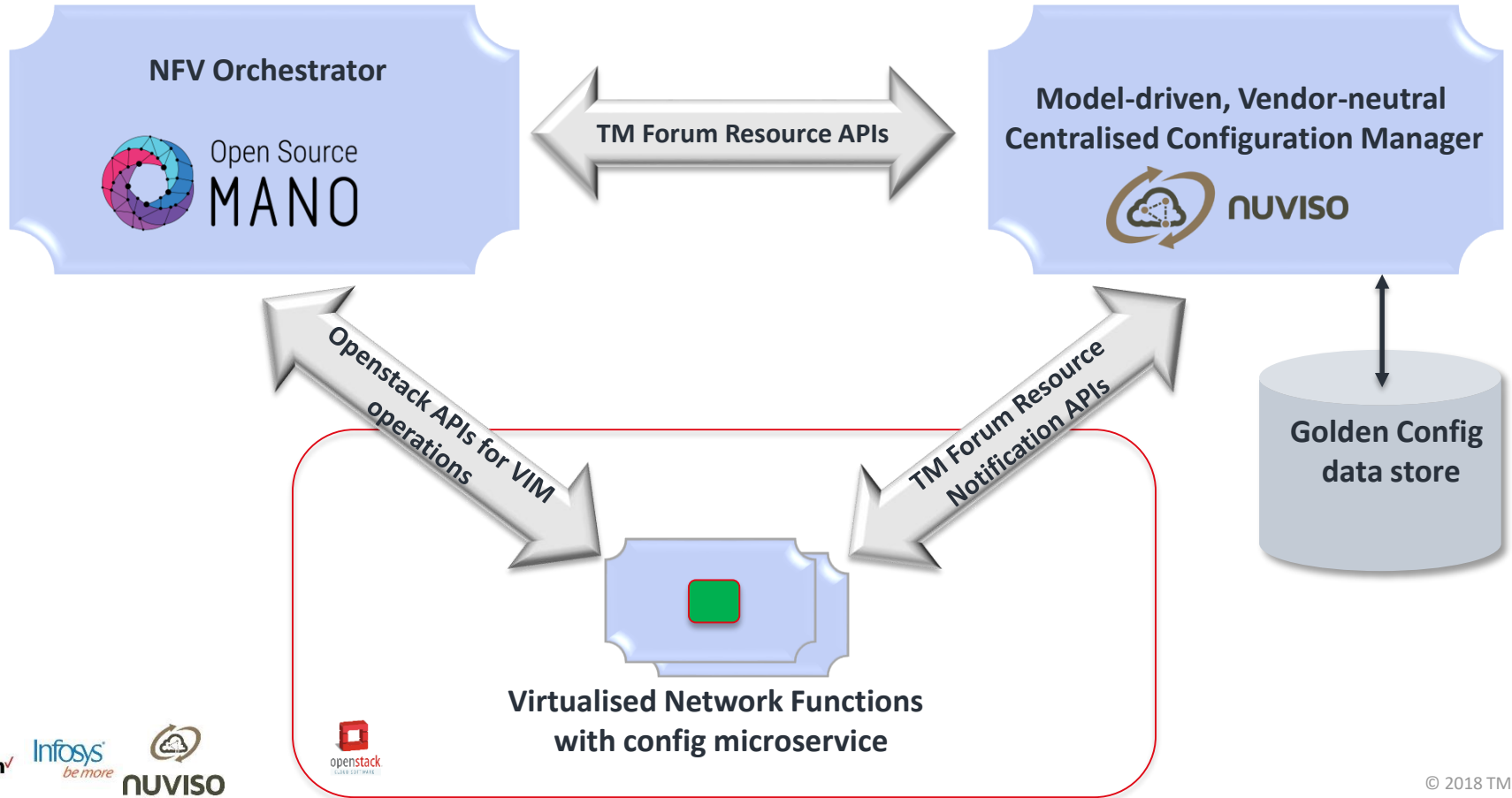
Problem Statement and Requirements

Operator Concerns	Expected Solution Capabilities
How do I configure a Network Service and baseline the config?	<ul style="list-style-type: none">• NFVO should support features to perform Day0, Day1 configuration• NFVO should invoke centralized config manager API to trigger Day2 config based on templates
How to enable near real time configuration change updates & re-baseline the config?	<ul style="list-style-type: none">• Change Notify Microservice within the VNF should notify the config changes to centralized configuration manager in near real time
How to auto-heal the network service with right & latest base lined configuration?	<ul style="list-style-type: none">• NFVO should re-instantiate the VNF and instruct config manager to restore baseline configuration

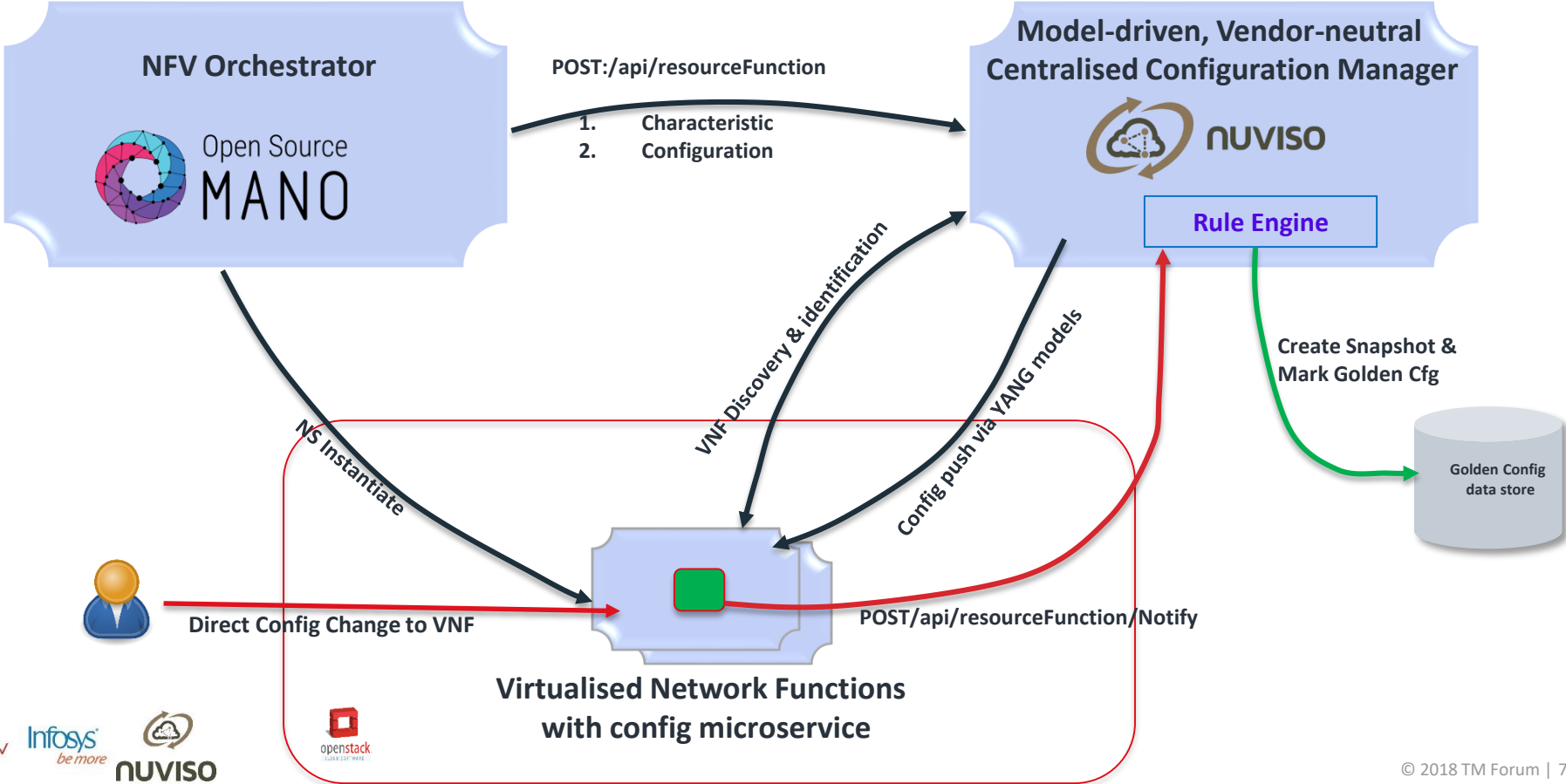
Key Drivers for the Catalyst

Key Driver	Catalyst Solution
Lack of standardization in the config management space	<ul style="list-style-type: none">• Use a Config Management Solution that is built on top of standards (TMF, IETF, OpenConfig)
Lack of scalability with centralized config management systems	<ul style="list-style-type: none">• Use a VNF based micro-service to report incremental config changes• Policy based rule-engine to take automated actions on config snapshots and golden config marking

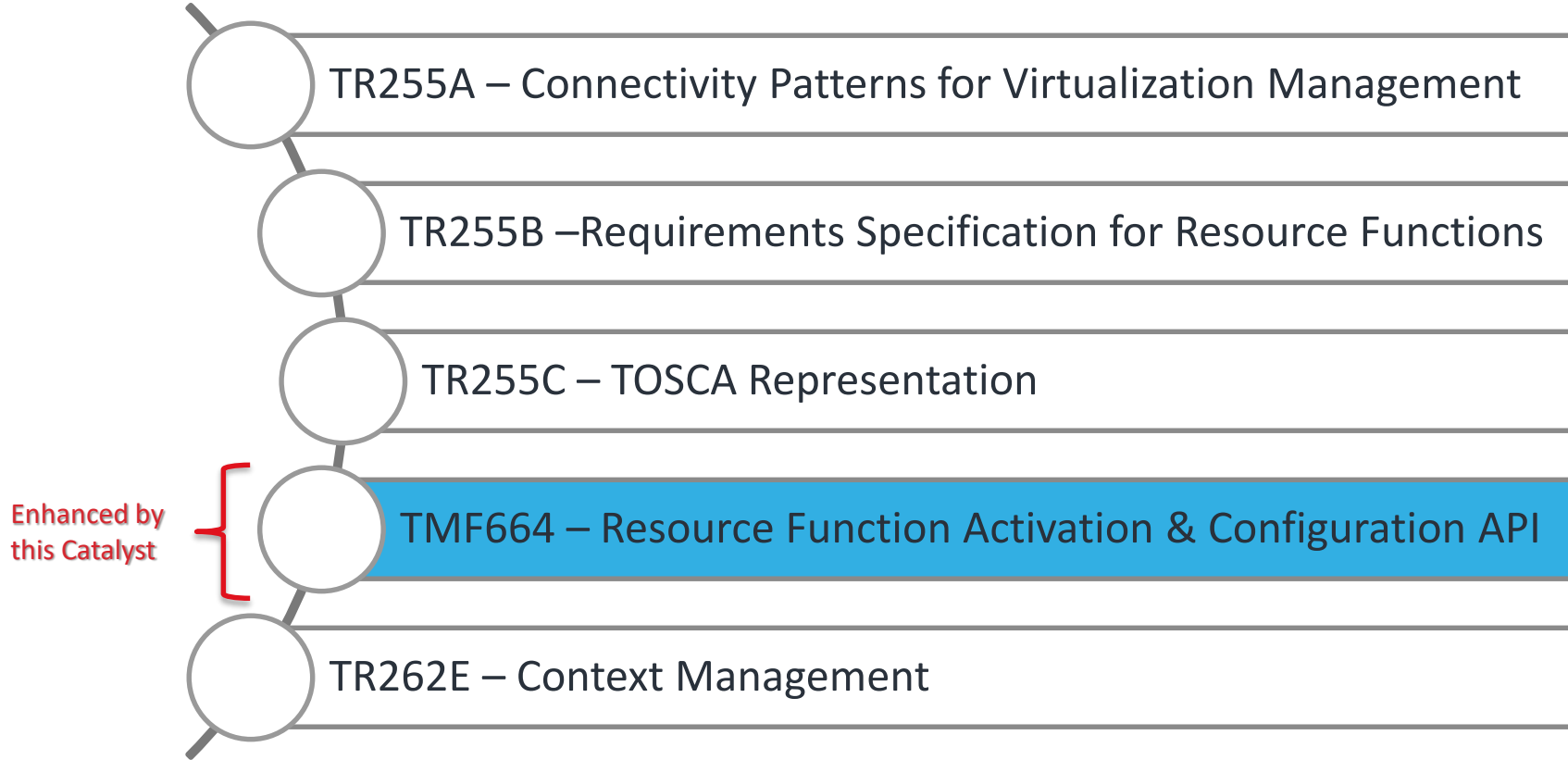
Golden Configuration – Key Building Blocks



Golden Configuration – Workflow



TMF Assets used/enhanced (TR255-TMF664)



APIs

TMF 664 Resource Configuration and Activation – R17.0.1

- ❑ **Resource Function APIs** (*/api/resourceFunction*) – *Trigger Centralized Config Manager for VNF discovery & pushing service level config.*

- ✓ **Proposed Enhancements to TMF 664 API:**
 1. API should support template based service configurations utilizing standard data models like YANG
 2. VNF identifier (resource-id) to be present in all the APIs so as to allow the VNF microservice to identify the resource function when notifying of changes. The same identifier used by other systems like the orchestrator

- ❑ **Resource Function Notification APIs** (*/api/resourceFunction/notify*) – *Trigger configuration changes notification to Centralized configuration Manager*

- ✓ **Proposed Enhancements to TMF 664 API:**
 1. Configuration deltas to be captured as a part of the notification APIs. Further work may include using a yang modelled abstraction of the data.
 2. Resource Function Notification APIs should have a provision to notify whether config changes applied by user on device should be considered as “Golden Config” or not. A Golden Config True/False field should be added in API
 3. Resource function API should have provision to suppress the notification updates so that user can decide whether to notify the changes or not

APIs (contd..)

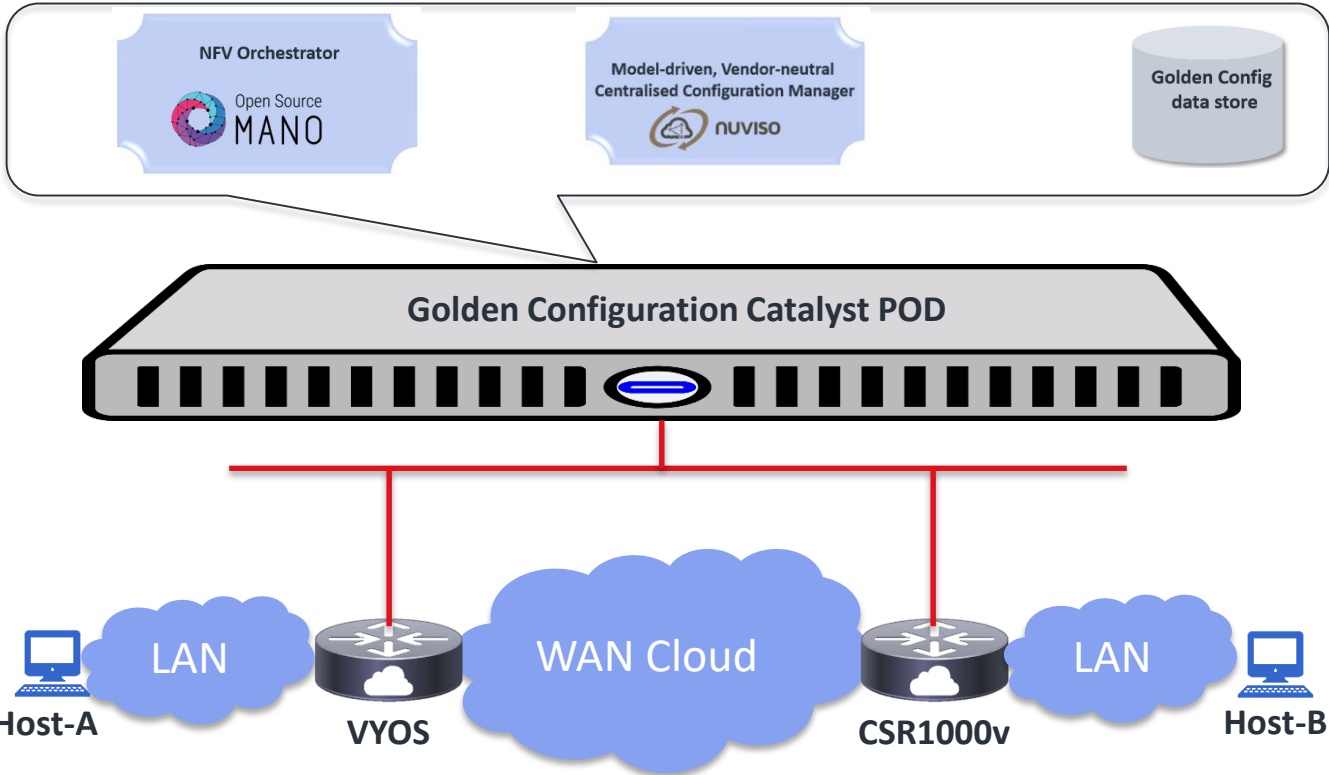
TMF 664 Resource Configuration and Activation – R17.0.1

❑ **Resource Function Heal APIs** (*/api/resourceFunction/heal*) – This API is used via Orchestrator to trigger service restoration lifecycle event to Centralized Configuration Manager to re-configure the VNF with stored golden config

✓ **Proposed Enhancements to TMF 664 API:**

1. VNF identifier (resource-id) to be present in all the APIs so as to allow the VNF microservice to identify the resource function when notifying of changes. The same identifier used by other systems like the orchestrator

POC Topology



- **Demo 1 - Service config & baseline the config in data store**
 - Instantiation of network service via OSM and push the day 0/day 1 configuration on VNFs
 - OSM to invoke TMF 664 API to push day 2 configuration on VNF via Config Manager (resource creation API)
 - End to end traffic flow between two hosts
 - Config Manager stores golden configuration backup of VNF
- **Demo 2 – Config change notify microservice**
 - Do manual configuration changes on VNF
 - Change notify microservice in VNF triggers configuration change notification API (TMF 664 resource change notification API)
 - Config Manager to save the latest configuration changes in config backup in data store
- **Demo 3 - Config restore during service outage scenario**
 - Induce the fault in network service
 - Trigger service restoration lifecycle event on OSM Orchestrator
 - OSM re-instantiates & restores Day 0/1 configuration
 - OSM Triggers Config Management API to restore last known golden configuration for the VNF (TMF 664 resource heal API)
 - Config manager restores configuration of VNF to activate end to end network service
 - Demo end to end traffic flow between two hosts

Service Topology View on NFV Orchestrator

The screenshot displays the NFV Orchestrator (MANO) Composer interface. The top navigation bar includes 'MANO', 'ACCOUNTS', 'CONFIG', 'LAUNCHPAD', and 'CATALOG'. The main workspace is titled 'COMPOSER' and shows a service topology for 'VPNSERVICE'. The topology consists of the following components and connections:

- MGMT_CLOUD** (Network Service) is connected to **VYOS_vnfd/1** (VNFD) and **CSR_VNFD/2** (VNFD).
- VYOS_vnfd/1** is connected to **HOSTA_LAN** (Network Service) and **WAN_CLOUD** (Network Service).
- CSR_VNFD/2** is connected to **WAN_CLOUD** (Network Service) and **HOSTB_LAN** (Network Service).
- VPNService** (Network Service) is highlighted with a yellow border.

The interface includes a left sidebar with 'DESCRIPTOR CATALOGS' and 'VPNSERVICE' selected. The top toolbar contains actions like 'UPDATE', 'CANCEL', 'YAML VIEWER', 'AUTO LAYOUT', 'ADD VLD', 'ADD VNFFG', and 'DELETE'. The right sidebar shows a metadata table for 'VPNSERVICE' and lists of 'VLD' and 'CONSTITUENT VNFD' items.

VPNService	NAME
Short Name	SHORT NAME
Vendor	VENDOR
Logo	LOGO
Description	DESCRIPTION
Version	VERSION

VLD 4 ITEMS + ADD

- MGMT_CLOUD [REMOVE]
- WAN_CLOUD [REMOVE]
- HOSTA_LAN [REMOVE]
- HOSTB_LAN [REMOVE]

CONSTITUENT VNFD 2 ITEMS + ADD

Drag a VNFD from the Catalog to add more.

- VYOS_vnfd/1 [REMOVE]
- CSR_VNFD/2 [REMOVE]

VNFFGD 0 ITEMS + ADD

Service Intents to Discover & Recover

The screenshot displays the 'LAUNCHPAD: VIEWPORT' interface. At the top, there is a navigation bar with 'MANO' (Open Source), 'ACCOUNTS', 'CONFIG', 'LAUNCHPAD', and 'CATALOG'. On the right side of the navigation bar are links for 'ABOUT', 'DEBUG', 'LOGGING', and 'LOGOUT'. Below the navigation bar, the main content area is titled 'LAUNCHPAD: VIEWPORT' and includes a 'VIEWPORT' section with a link to 'COMPUTE TOPOLOGY'. The main interface is divided into several sections: 'SELECT RECORD' showing 'VYOS_VNFD', 'VNF Data', 'Service Primitive', and 'VDU Console Links' tabs. A left sidebar lists three records: 'TMFORUMDEMO nsr', 'VYOS_VNFD vnfr' (highlighted with a dashed blue border), and 'CSR_VNFD vnfr'. The 'SERVICE-PRIMITIVES' section lists 'createresourcefunction', 'clearvnfconfig', and 'healresourcefunction'. A modal window is open for the 'healresourcefunction' primitive, showing a 'RESOURCEID *' field and a 'HEALRESOURCEFUNCTION' button. A '* required' label is next to the field. On the right, the 'JOB LIST' section shows three jobs: 'healresourcefunction ID: 3', 'clearvnfconfig ID: 2', and 'createresourcefunction ID: 1', each with a 'Show Parameters' link and a green status indicator.

Discovered VNFs on Config Manager

NUVISO *Interlude* Dashboard Topology Inventory Admin Manage system

3 Devices

Name	Serial #	Model	OS	Build	Plugin	IP	Port	State	Session	Transport	Last Heartbeat
vynos29	5EA032E2-6DF3-...	OpenStack Co...	VyOS - 1.1.8	1711111344-b4...	vynos	192.168.1.65	22	READY	CLI	SSH	May 4, 2018 3:59 PM
vynos100	BFF10319-F306-...	OpenStack Co...	VyOS - 1.1.8	1711111344-b4...	vynos	192.168.1.52	22	READY	CLI	SSH	May 8, 2018 7:36 PM
vynos09	562ADF1D-8DEA-...	OpenStack Co...	VyOS - 1.1.8	1711111344-b4...	vynos	192.168.1.51	22	READY	CLI	SSH	May 4, 2018 3:58 PM

Golden Config in Config Manager

Snapshot Type ▼

- Raw Output ▼
 - vyos100 ▼
 - show configuration comm... (highlighted)
 - vyos09 ◀
 - vyos29 ◀
- Feature ◀

5 Versions



#	Label	Device Name	Command	Date	Job Name	Run Id
5	Golden Config	vyos100	show configuration com...	May 9, 2018 3:16 PM		
4		vyos100	show configuration com...	May 8, 2018 9:58 PM		
3		vyos100	show configuration com...	May 8, 2018 7:48 PM		
2		vyos100	show configuration com...	May 8, 2018 7:24 PM		
1		vyos100	show configuration com...	May 8, 2018 7:19 PM	Inventory1848489926	1

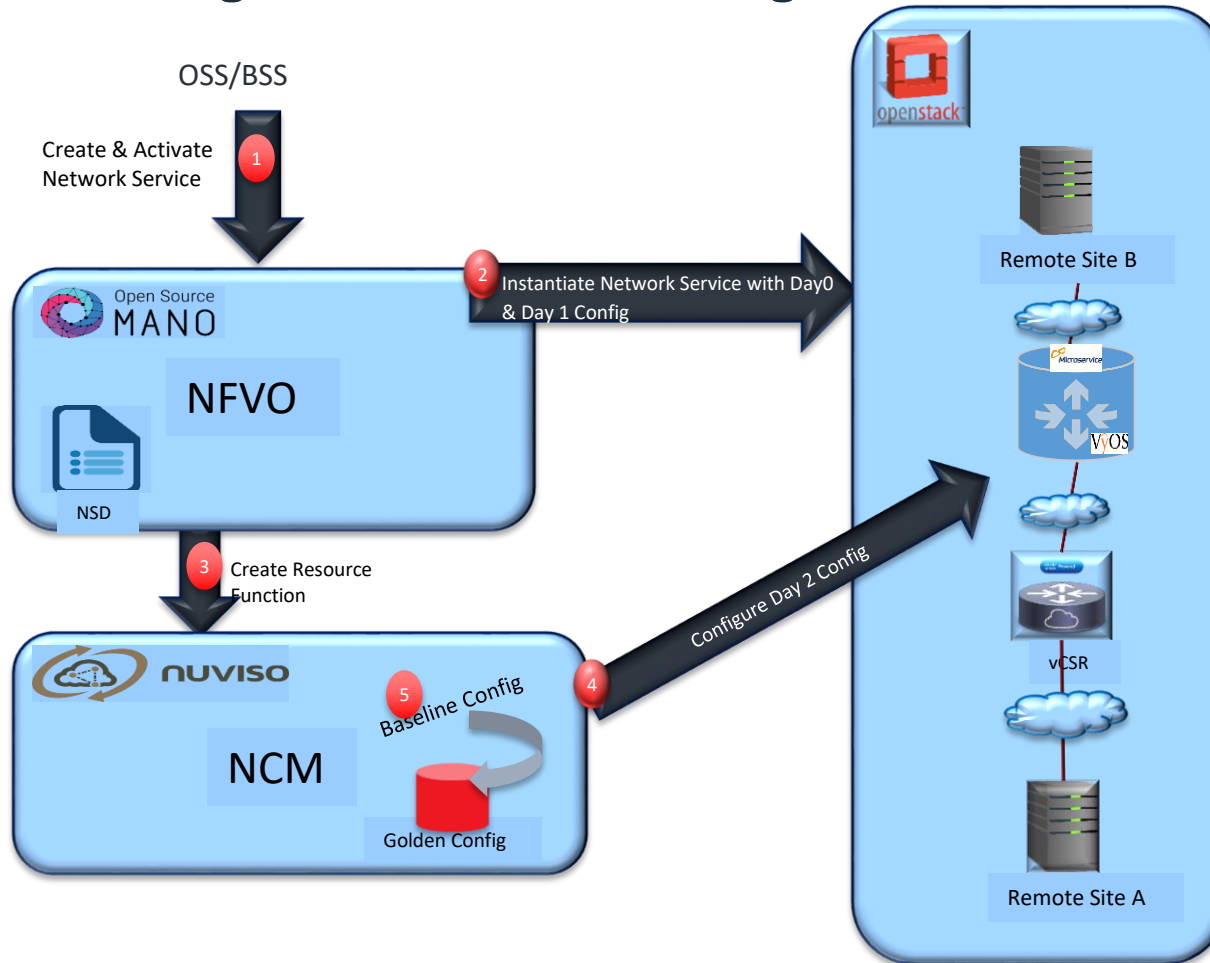
Config Delta triggered by Change Notify Microservice tmforum

The screenshot shows the NUVISO Interlude interface with a configuration delta comparison window. The window compares two snapshots of a device configuration, both created on 2018-05-09. The left snapshot is from 10:40:03.000Z and the right is from 16:28:03.000Z. The configuration is displayed in a table with 64 rows. Rows 59 through 63 are highlighted in red, indicating differences between the two snapshots.

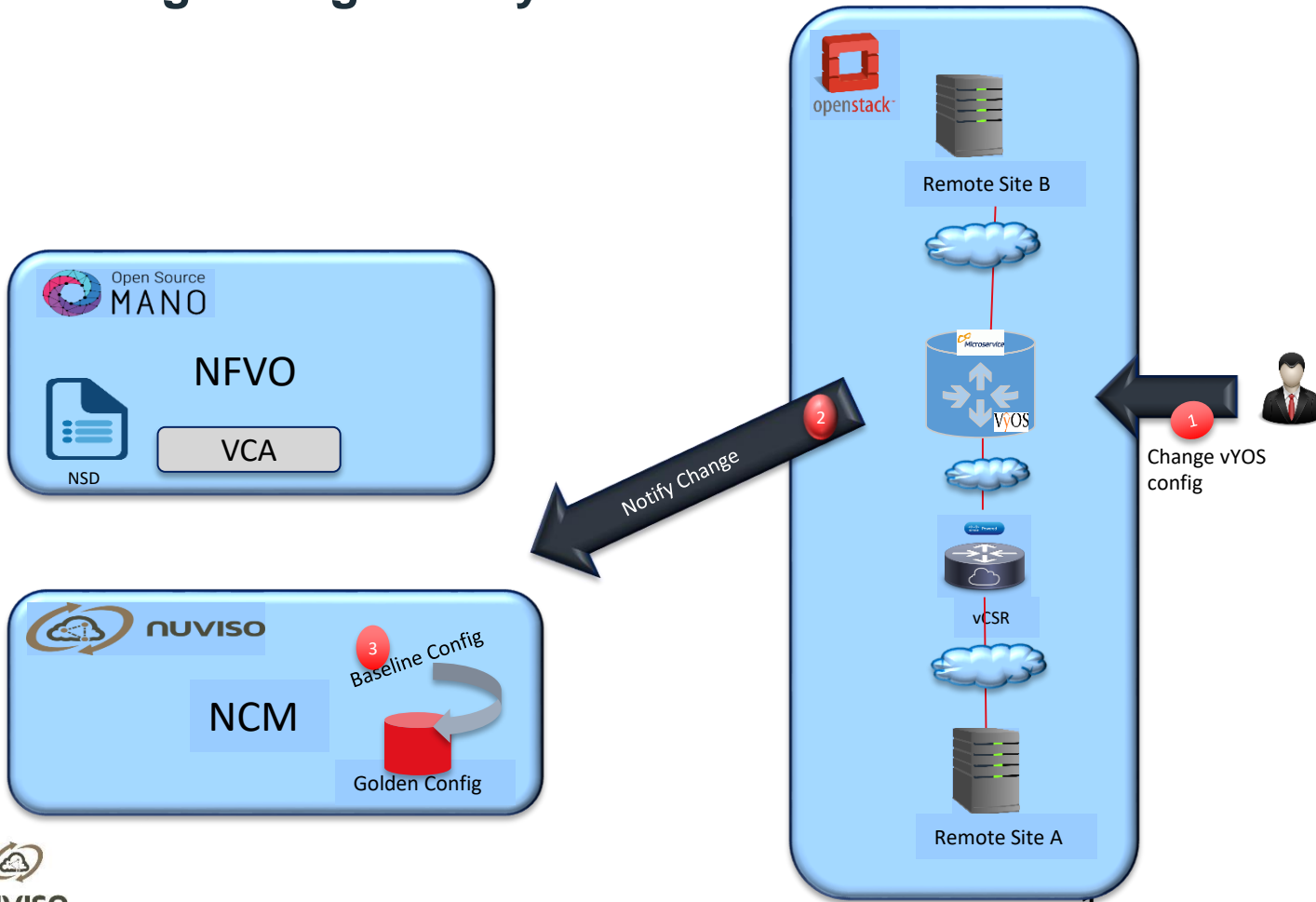
Line	Configuration	Line	Configuration
41	set system ntp server '0.pool.ntp.org'	41	set system ntp server '0.pool.ntp.org'
42	set system ntp server '1.pool.ntp.org'	42	set system ntp server '1.pool.ntp.org'
43	set system ntp server '2.pool.ntp.org'	43	set system ntp server '2.pool.ntp.org'
44	set system package auto-sync '1'	44	set system package auto-sync '1'
45	set system package repository community components 'main'	45	set system package repository community components 'main'
46	set system package repository community distribution 'helium'	46	set system package repository community distribution 'helium'
47	set system package repository community password ''	47	set system package repository community password ''
48	set system package repository community url 'http://packages.vyos.net/vyos'	48	set system package repository community url 'http://packages.vyos.net/vyos'
49	set system package repository community username ''	49	set system package repository community username ''
50	set system syslog global facility all level 'notice'	50	set system syslog global facility all level 'notice'
51	set system syslog global facility protocols level 'debug'	51	set system syslog global facility protocols level 'debug'
52	set system time-zone 'UTC'	52	set system time-zone 'UTC'
53	set interfaces ethernet eth0 description 'This interface is for Verizon'	53	set interfaces ethernet eth0 description 'This interface is for Verizon'
54	set interfaces ethernet eth0 mtu '1300'	54	set interfaces ethernet eth0 mtu '1300'
55	set interfaces ethernet eth1 mtu '1300'	55	set interfaces ethernet eth1 mtu '1300'
56	set interfaces ethernet eth2 mtu '1300'	56	set interfaces ethernet eth2 mtu '1300'
57	set interfaces ethernet eth1 offload-options tcp-segmentation 'off'	57	set interfaces ethernet eth1 offload-options tcp-segmentation 'off'
58	set interfaces ethernet eth2 offload-options tcp-segmentation 'off'	58	set interfaces ethernet eth2 offload-options tcp-segmentation 'off'
59	set interfaces ethernet eth1 duplex 'auto'		
60	set interfaces ethernet eth1 speed 'auto'		
61	set interfaces ethernet eth2 duplex 'auto'		
62	set interfaces ethernet eth2 speed 'auto'		
63	set 'policy'		
64		59	

Navigation: ← → Diffonly Cancel

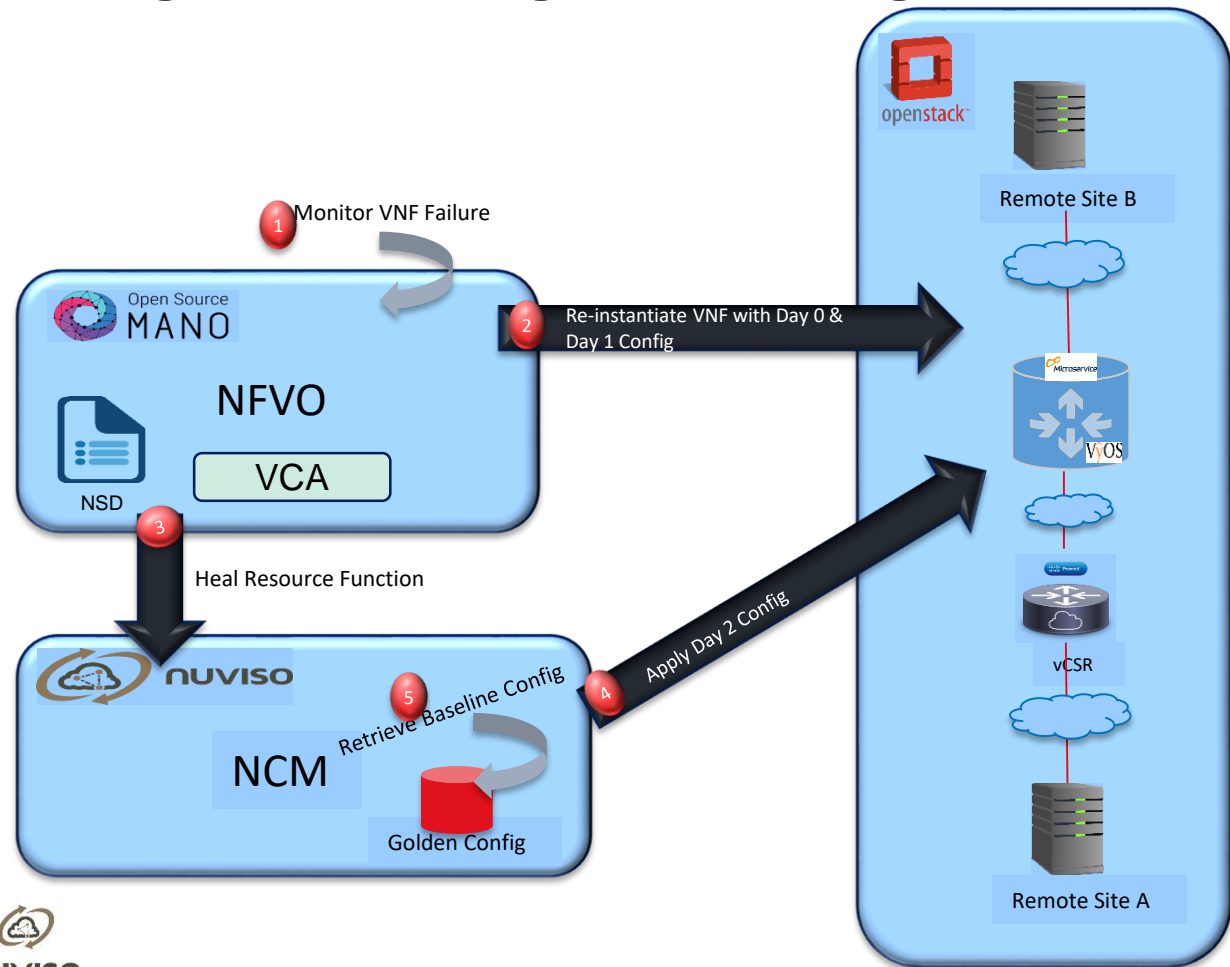
Demo 1 – Service config & baseline the config in data store



Demo 2 – Config Change Notify Microservice



Demo 3 – Config restore during service outage



Contributors

- **Champion** – Verizon Communications
- **System Integrator** – Infosys Limited
- **Configuration Management Solution** – Nuviso Networks

Thanks!

