ONAP 5G & PNF Use Cases

- March 08, 2021
- ONAP Overview of Use Cases

Ben Cheung, Ph.D.

version 2

5G USE CASE SUMMARY

5G USE CASE	DESCRIPTION	Req vs U/C	5G Specific
BULK PM – PM control	PM data collection control provides a dynamic and efficient way to configure performance measurement collection on a selected subset of xNFs and complements the existing PM data collection and processing capabilities.	Requirements	General
OOF - SON PCI (5G)	Optimization and SON functions for 5G RAN. Self-optimization, Self-Healing, Self-configuration.	Requirements	5G
5G SERVICE MODELING & DEFINITION (5G)	Defining and modeling a 5G Service (in Design Time) and associated Modeling (Platform Info & Data Model).	Requirements	5G
CONFIGURATION & PERSISTENCY SERVICE	Configuration Persistency Service using internal Database for storing Network related data for use in LCM, OSS, Network, Operational applications.	Requirements	General
xNF LICENSING MANAGEMENT	Continue xNF License Management UC analysis for xNF onboarding, PNF introduction/ONAP PnP and VNF instantiation. Bring in new UCs like usage monitoring for the purpose of invoicing.	Requirements	General
ONAP/3GPP & ORAN Alignment	**Standards Defined Notifications over VES** Introducing the capability to receive, validate and process standards defined notifications encapsulated in VES events in ONAP. Also with A1 Adaptor extension.	Requirements	General
ONAP/ORAN Alignment - A1 adapter	A1 adapter: Enhancing the A1 adapter/interface capabilities in ONAP to manage A1 Policies, support multiple A1 targets in the RAN and multi-version A1 interface for different A1 targets, introduce secure TLS communication.	Requirements	General
E2E NETWORK SLICING (5G Use Case)	Network Slicing defines Slices for 5G RAN systems. Network Slicing is a long-lead (multi-release) development. (will be presented in its own lecture at the Virtual Face to Face)	E2E Use Case	5G
5G NRM (CM)	5G Network Resource Model introducing Configuration Management (CM Updates) using RESTful (HTTPS) Interface (instead of NetConf).	Requirements	5G

PNF USE CASE SUMMARY

5G USE CASE	DESCRIPTION	Req vs U/C
PNF PRE-ONBOARDING & ONBOARDING	PNF Package delivery, Pre-onboarding and PNF Onboarding via SDC.	Requirements
PNF PLUG AND PLAY	PNF PnP handles the PNF discovery and registration by ONAP during installation & commissioning. PRH (PNF Registration Handler) enhancements	E2E Use Case
xNF S/W UPGRADE	PNF Software upgrade to update the software on a PNF. Use of Ansible/NetConf direct to PNF.	Requirements
PNF - CMPv2	Certificate Management Protocol (Will be presented in its own Lecture at the Virtual Face to Face)	Requirements
IBN	Intent Based Networking	
VERTICAL INDUSTRY	Support for Vertical Industry Management.	

Use Case Realization Call

https://wiki.onap.org/display/DW/Use+Case+Realization+Meeting+Register+MoM

Use Case Realization Meeting Register MoM

Created by Benjamin Cheung, last modified on Feb 19, 2021

USE CASE REALIZATION

Use Case Realization Tasks, Activities

Description	File
Use Case Realization Tasks & Activities Presentation 📅 26 Jan 2021 PDF	UseCaseRealizationTasks_202101Ja26.pdf
PPTX	UseCaseRealizationTasks_202101Ja26.pptx

MEETING TIME

**TIME SLOT (USA): MONDAYS** Eastern EDT 9:00 AM (UTC-5) / Pacific PDT 06:00 AM (UTC-8)

TIME SLOT (WORLD): MONDAYS China 22:00 (PM) / CET (Central Europe UTC+1) 15:00

TIME SLOT (USA): THURSDAYS UTC/GMT 13:00 / Eastern EDT 8:00 AM (UTC-5) / Pacific PDT 05:00 AM (UTC-8)

TIME SLOT (WORLD): THURSDAYS China 20:00 (PM) / CET (Central Europe UTC+1) 13:00 / EET (East Europe UTC+2) 14:00 (PM)

Architecture Portal

https://safratech.net/onapdocs/action_page.php
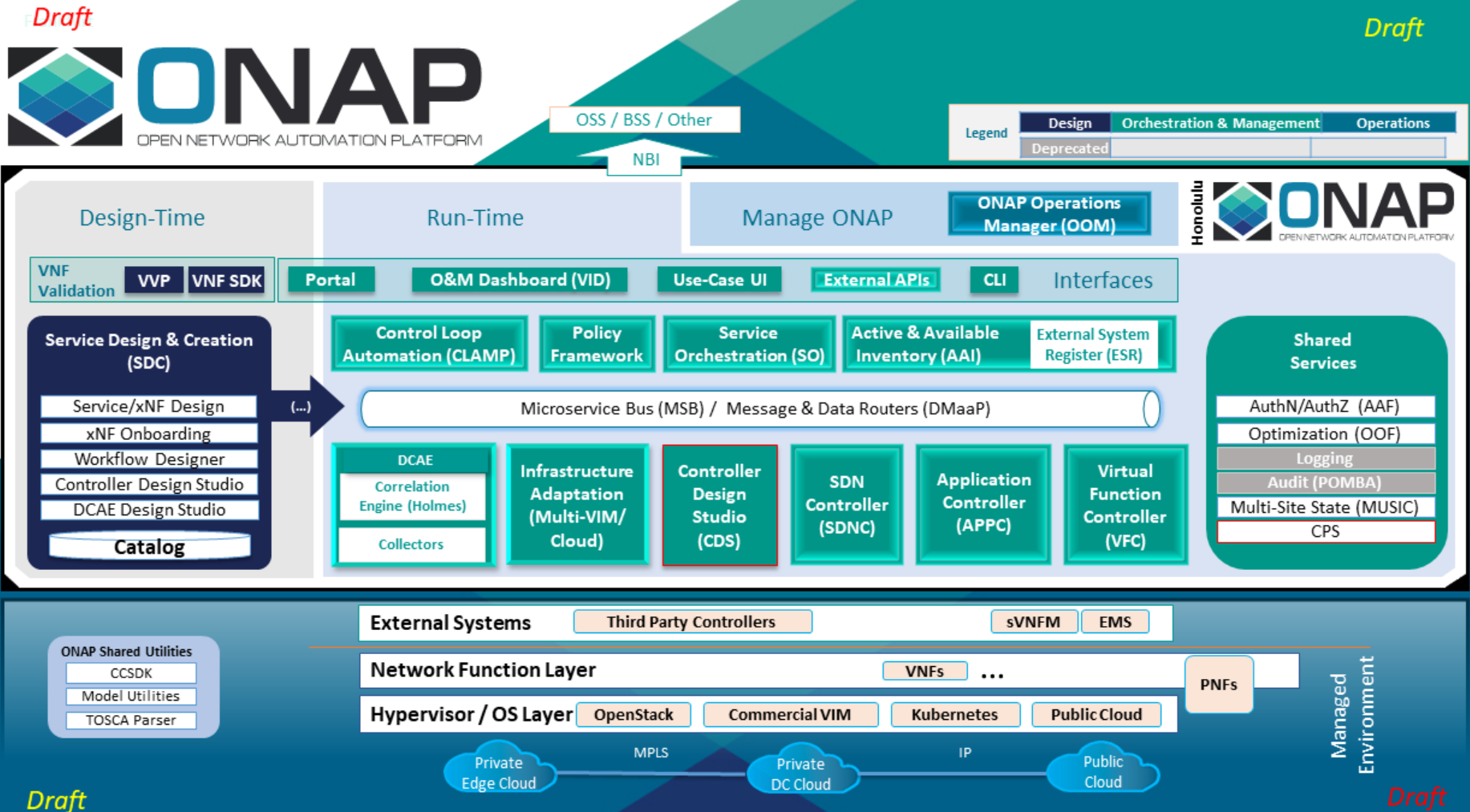
R8 Honolulu (Latest Release Feb 2021) Portal Page

https://wiki.onap.org/pages/viewpage.action?pageId=92996235

R8 Honolulu Use Cases & Requirements

Created by Benjamin Cheung, last modified on Feb 23, 2021

The following page describes the major use cases and key requirements targeted to the Honolulu Release

HISTORY OF USE CASE PORTAL PAGES

RELEASE	WIKI PAGE
R6 Frankfurt Release Use Case Portal	Release 6 (Frankfurt) proposed use cases and functional requirements
R7 Guilin Release Use Case Portal	Guilin (R7) - Use Cases (and Requirements in Use Cases)
Use Case Realization R6 Portal Page	Release 6 (Frankfurt) proposed use cases and functional requirements
Use Case Realization R6 Portal Page	Use Case Realization Meeting Register MoM

5G USE CASES & REQUIREMENTS IN R8 (HONOLULU)

5G Use Case Team (Monthly) Meeting Notes & recordings: 5G Use Case Team Meetings

5G Service Creation Use Case

5G Service Model & Creation – Overview

This Use Case will introduce support for 5G Service creation and modeling necessary to create a 5G service, and support an actual 5G PNF (Distributed Unit) in the field in order to have it come on-line and setup first call.

The objective is to be model driven as an objective. To consider how to incorporate Domain (RAN) specific information into the Platform Information Model

ARCHITECTURE REQUIREMENT IDENTITY – ROW 15

AR-0014-R7-052020 5G PNF SERVICE MODEL INTRODUCTION Benjamin Cheung 5G

BUSINESS DRIVERS

EXECUTIVE SUMMARY - **This requirement introduces platform information model enhancements to document new ISOMII experimental classes from 3GPP TS28.541, the 5G Network Resource Model (NRM).**

BUSINESS IMPACT - **The requirement, is a critical because it will serve to lay the ground-work for actually "turning on" a real 5G DU (PNF) that might be installed by a Vendor.**
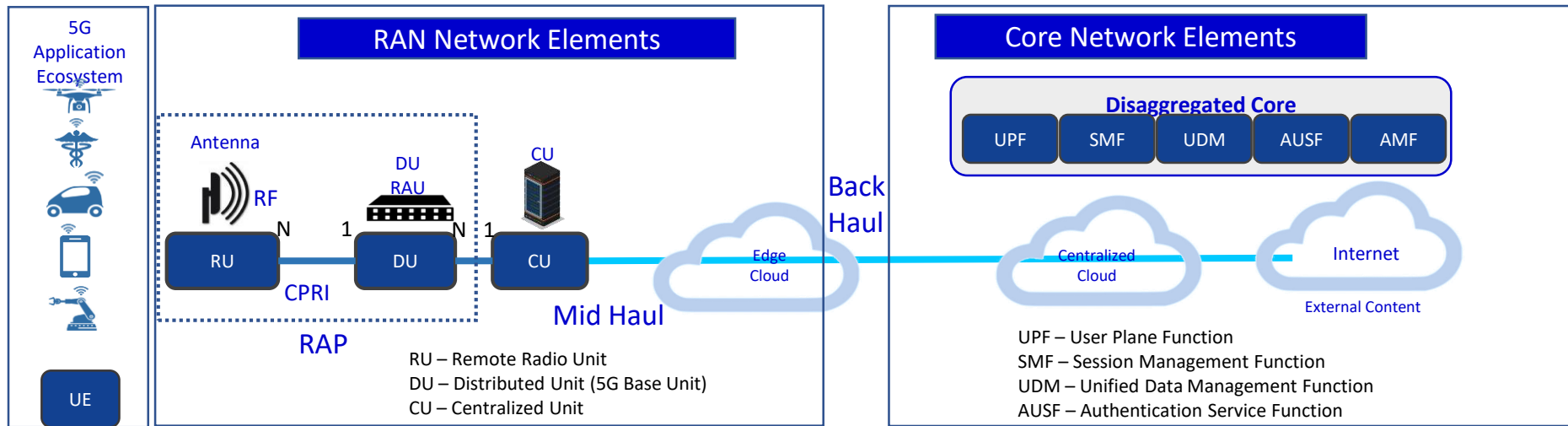
BUSINESS MARKETS - **This project applies to any domain (wireless, transport, optical, and wireline) that ONAP may manage.**

FUNDING/FINANCIAL IMPACTS - **Without the groundwork laid down for information model management of a 5G Service, operators will not be able to "turn on" a real live 5G network using "live" PNF resources. No Network. No Business. High OPEX impact.**
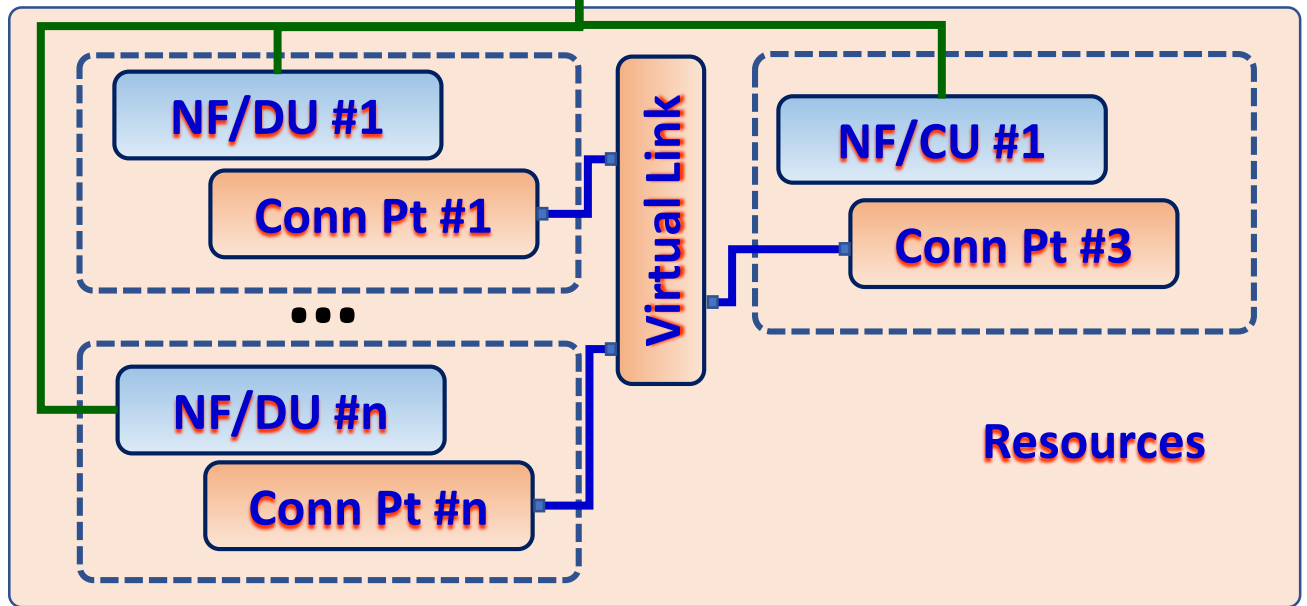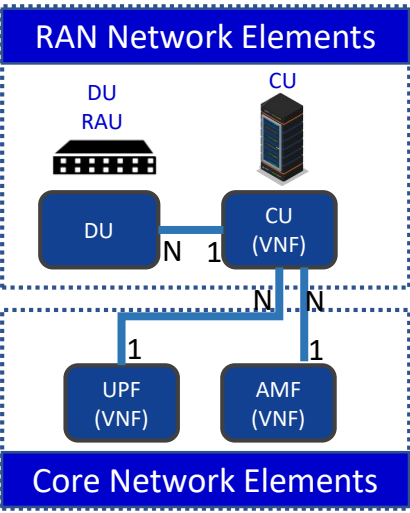
ORGANIZATION MGMT, SALES STRATEGIES - **There is no additional organizational management or sales strategies for this use case outside of a service providers "normal" ONAP deployment and its attendant organizational resources from a service provider.**

5G SERVICE CREATION & MODELING in

5G Application Ecosystem

UE

RAN Network Elements

Antenna
RF
RU
CPRI
N

DU
RAU
DU
1   N

CU
CU
1

RAP

Mid Haul

RU – Remote Radio Unit
DU – Distributed Unit (5G Base Unit)
CU – Centralized Unit

Core Network Elements

Disaggregated Core

| UPF | SMF | UDM | AUSF | AMF |

Back Haul

Edge Cloud

Centralized Cloud

Internet

External Content

UPF – User Plane Function
SMF – Session Management Function
UDM – Unified Data Management Function
AUSF – Authentication Service Function

RAN Network Elements

DU
RAU
DU
N   1

CU
CU (VNF)

N   N

1   1

UPF (VNF)

AMF (VNF)

Core Network Elements

5G SERVICE

NF/DU #1
Conn Pt #1

Virtual Link

NF/CU #1
Conn Pt #3

• • •
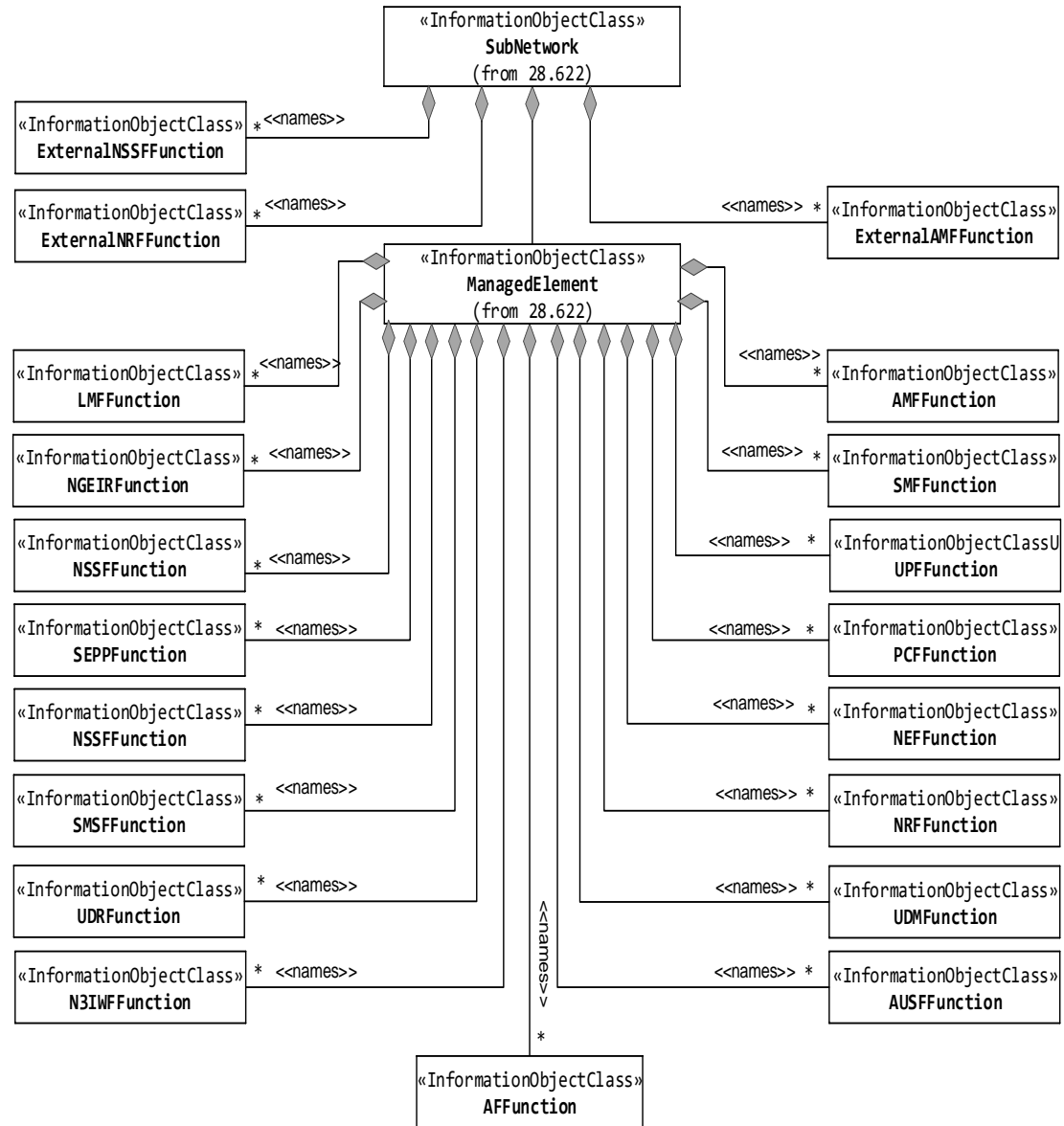
NF/DU #n
Conn Pt #n

Resources

5G Service Model & Creation – Overview

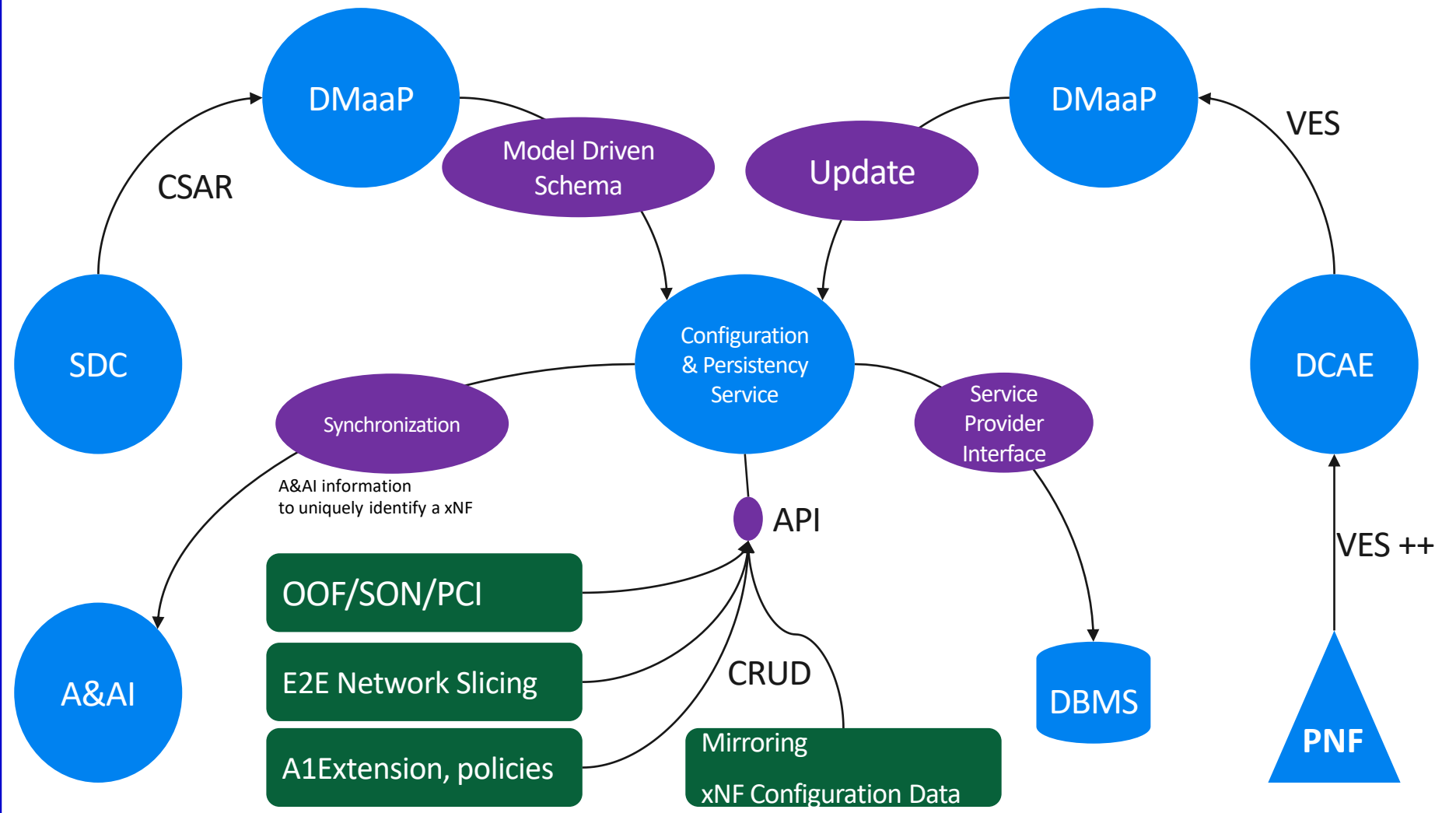## 3GPP TS 28.541 V15.4.0 (2019-09)

Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Management and orchestration;
5G Network Resource Model (NRM);
Stage 2 and stage 3
(Release 15)**

Model Driven C&PS PoC > Model Driven Configuration

5G SERVICE CREATION & MODELING

NEW COMPONENT CAPABILITIES

NEW COMPONENT CAPABILITIES	IMPACT DESCRIPTION
Modelling S/C	Evolution of Platform Info & Data model in support of 5G Service Service from 3GPP TS28.540 and TS28.541 5G NRM standards for modeling a service (might need alignment). Platform data/information model. To introduce one object from the 3GPP TS28.541. even if it is ISOMII Experimental (1) The objective is to be model driven as an objective. (2) To consider how to incorporate Domain (RAN) specific information into the Platform Information Model
	Modeling S/C suggests: maybe model the **"core" service model**; links-connectivity where we can hang tech-specific details off of. Perhaps borrow the ONF model (et al); Plug tech this into a common "core" model

5G SERVICE CREATION & MODELING

ExternalNRCellCU	NR NRM	nRPCI
NetworkSlice	Network Slice NRM	operationalState
NetworkSlice	Network Slice NRM	administrativeState
NetworkSlice	Network Slice NRM	serviceProfileList
NetworkSlice	Network Slice NRM	networkSliceSubnetRef
NetworkSliceSubnet	Network Slice NRM	operationalState
NetworkSliceSubnet	Network Slice NRM	administrativeState
NetworkSliceSubnet	Network Slice NRM	nsInfo
NetworkSliceSubnet	Network Slice NRM	sliceProfileList
NetworkSliceSubnet	Network Slice NRM	managedFunctionRef
NetworkSliceSubnet	Network Slice NRM	networkSliceSubnetRef
ServiceProfile	Network Slice NRM	serviceProfileId
ServiceProfile	Network Slice NRM	sNSSAIList
ServiceProfile	Network Slice NRM	pLMNIdList
ServiceProfile	Network Slice NRM	perfReq
ServiceProfile	Network Slice NRM	maxNumberofUEs
ServiceProfile	Network Slice NRM	coverageAreaTAList
ServiceProfile	Network Slice NRM	latency
ServiceProfile	Network Slice NRM	uEMobilityLevel
ServiceProfile	Network Slice NRM	resourceSharingLevel
ServiceProfile	Network Slice NRM	sST
ServiceProfile	Network Slice NRM	availability
SliceProfile	Network Slice NRM	sliceProfileId
SliceProfile	Network Slice NRM	sNSSAIList
SliceProfile	Network Slice NRM	pLMNIdList
SliceProfile	Network Slice NRM	perfReq
SliceProfile	Network Slice NRM	maxNumberofUEs
SliceProfile	Network Slice NRM	coverageAreaTAList
SliceProfile	Network Slice NRM	latency
SliceProfile	Network Slice NRM	uEMobilityLevel
SliceProfile	Network Slice NRM	resourceSharingLevel

INTERFACES & APIs

Interfaces	IMPACT
(None)	(None – Modeling work only)

Interfaces Impacts

API	IMPACT
(None)	(None – Modeling work only)

APIs Impacts

Bulk PM – PM Control Extensions

- PM Control/"PM Control plane" in ONAP has been introduced in Rel 6 to complete Bulk PM use case enabling configuration of PM jobs/subscriptions on xNFs.

- PM consumers can conveniently define PM subscriptions on (sub)network-level, thereby configuring PM on a set (small or large) of xNF instances in a single subscription. Different consumers to manage their own subscriptions, independently of each other

Bulk PM – PM Control

PM data collection control provides 5G network operators with a dynamic and more efficient way to configure performance measurement collection on a selected subset of PNFs/VNFs in the network and complements the existing PM data collection and processing capabilities in ONAP/DCAE. An initial version has been delivered in Rel 6 (5G / Bulk PM / PM Control - REQ-129). Planned enhancements for Rel 7 intend to further increase the capability and the dynamicity of this feature.
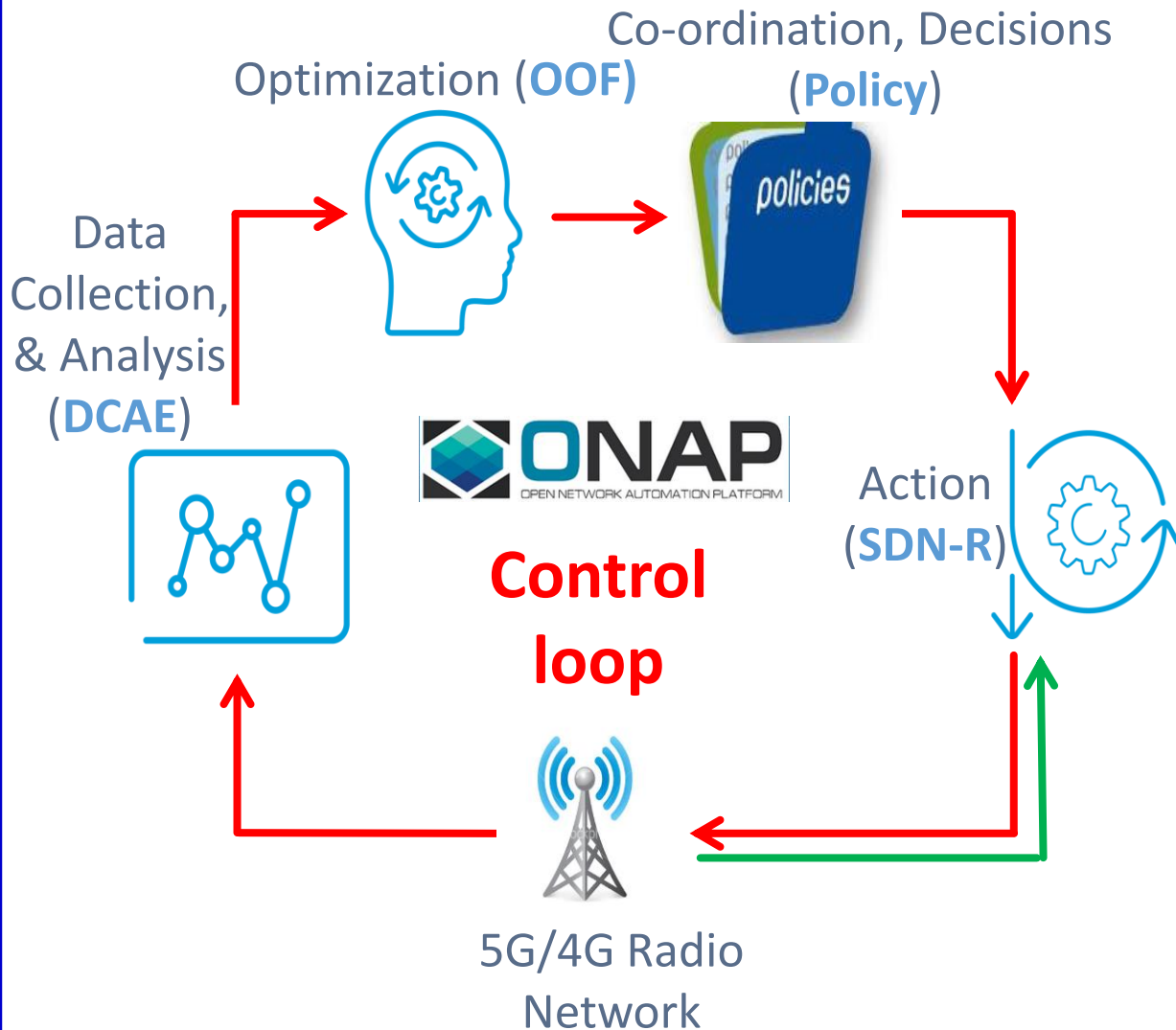Key Contacts: Michela Bevilacqua (Ericsson), Mark Scott (Ericsson)

Wiki

https://wiki.onap.org/pages/viewpage.action?pageId=84644982

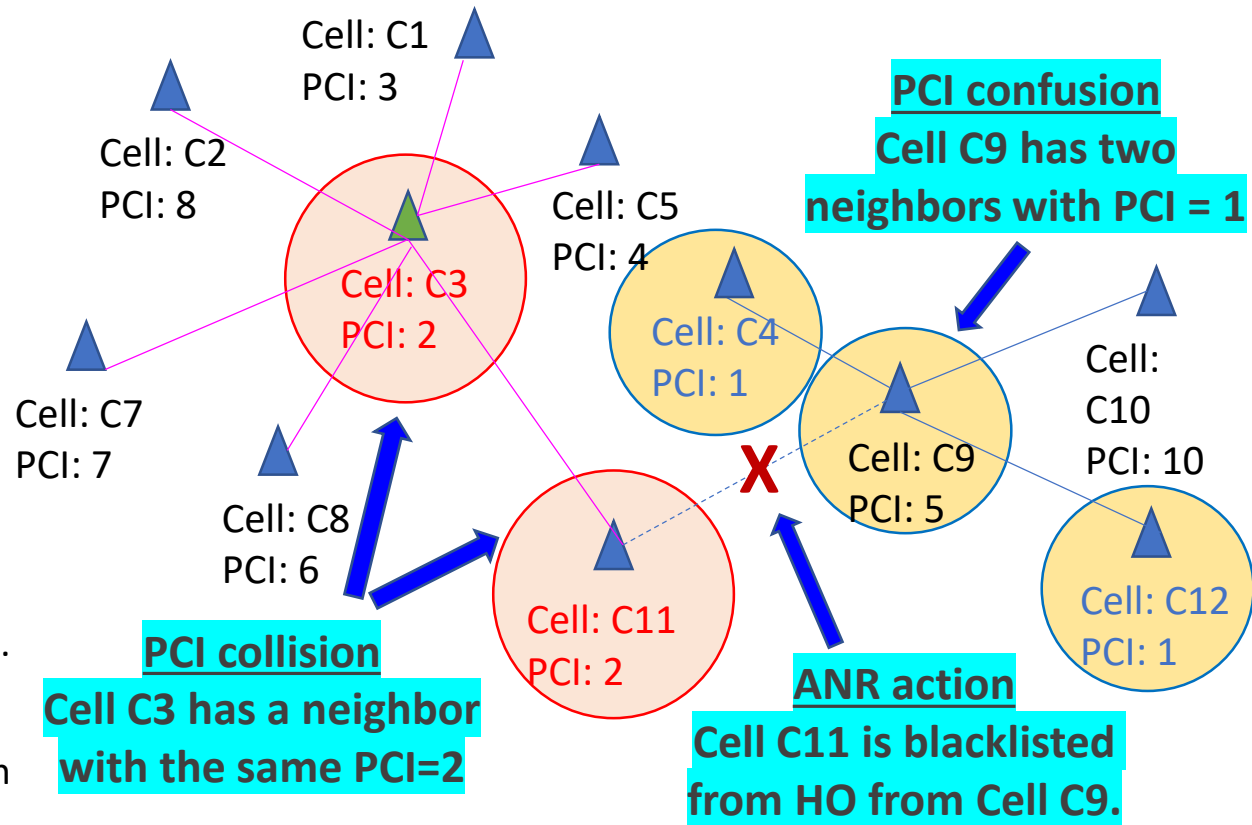| CANDIDATE ENHANCEMENTS	DESCRIPTION
DCAE	Improve usability of PMSH instantiation with CLAMP integration and enhanced Policy support. Support for additional A&AI parameters to allow more flexible filtering. Support dynamic modification of subscriptions. Error handling improvements and logging enhancement to comply with DCAE guidelines. Enable PMSH to support N subscriptions

CANDIDATE ENHANCEMENTS

OOF SON PCI Use Case

5G Self-Organizing Network using OOF

Optimization (**OOF**)

Co-ordination, Decisions (**Policy**)

Data Collection, & Analysis (**DCAE**)

Action (**SDN-R**)

Control loop

ONAP
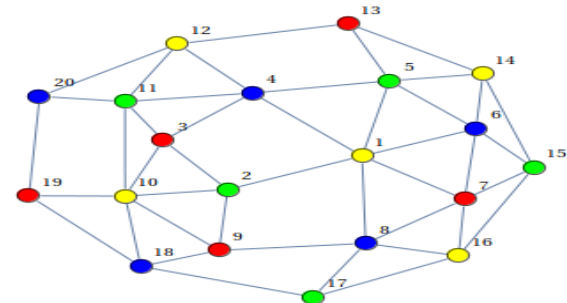OPEN NETWORK AUTOMATION PLATFORM

5G/4G Radio Network

- SON ⇔ Control Loop (CL)
- ONAP: Open-source platform, with basic open-source code
- Companies can use framework to add proprietary SON solutions
- OOF-PCI Casablanca –
  - First ONAP SON PCI use case
  - PoC Demo in Dec 2018
- OOF-PCI Dublin
  - Added SON function: ANR
  - More SON data flows: FM, PM
  - More ONAP code integration

5G Self-Organizing Network using OOF

- Physical cell ID (PCI) is a locally unique integer ID in 4G/5G
  - Used for handoff and physical layer design
  - PCI ranges: (LTE: 0-503, 5G: 0-1007)
- PCI optimization: Assign PCI values to avoid **PCI collision** and minimize **PCI confusion**
- Automated Neighbor Relations (ANR) builds & maintains neighbor relation tables in eNodeB and gNodeB
  - Distributed ANR in eNodeB, gNodeB
  - Centralized ANR optimizes neighbor tables based on global information
- PCI needs to be re-optimized if neighbor relationship changes, (e.g. during distributed ANR function in RAN)
- Centralized ONAP ANR optimization is best done jointly with PCI - blacklisting neighbors from HO based on HO metrics over a period of time

Cell: C1
PCI: 3

Cell: C2
PCI: 8

Cell: C5
PCI: 4

PCI confusion
Cell C9 has two neighbors with PCI = 1

Cell: C3
PCI: 2

Cell: C4
PCI: 1

Cell: C7
PCI: 7

Cell: C9
PCI: 5

Cell: C10
PCI: 10

Cell: C8
PCI: 6

Cell: C11
PCI: 2

Cell: C12
PCI: 1

PCI collision
Cell C3 has a neighbor with the same PCI=2

ANR action
Cell C11 is blacklisted from HO from Cell C9.

Graph Coloring Problem

5G Self-Organizing Network using OOF

U/C DESCRIPTION

SON (Self-Organizing Networks) functionality is an essential part of existing 4G mobility networks, and will be even more critical for 5G. SON enables automation to improve network performance and efficiency, improve user experience, and reduce operational expenses and complexity. The objective of the OOF-SON (new name for OOF-PCI) use case is to develop an ONAP-based SON platform using the ONAP Optimization Framework (OOF). We have taken a phased approach since SON is complex, and SON for 5G is still evolving. We started with the Physical Cell Identity (PCI) optimization SON use case in Casablanca, then added some centralized Automated Neighbor Relations (ANR) aspects in Dublin. For Frankfurt, we will address gaps such as PCI assignment during new cell addition, alignment with RAN inventory, etc., In addition, we aim to have enhancements such as: additional optimization functionality (e.g. include the use of AI/ML), use of control loop co-ordination in Policy, and alignment with industry trends for open interfaces and open models for the RAN interactions.

KEY CONTACTS: N.K. Shankar, Swami

Wiki

https://wiki.onap.org/display/DW/R7+OOF+SON+Use+Case

CANDIDATE ENHANCEMENTS

ENHANCEMENTS	IMPACT
OOF	• Optimization enhancements
SDN-R	• Enhance Yang model to align with 3GPP and O-RAN • Align with CPS interface • Receive Configuration Management (CM) notifications over VES
DCAE	• SON based on data/KPI analysis • CLC interaction • Machine Learning (ML) aspects in DCAE
POLICY	• Collaborate on CLC extensions (queueing, priority, …) • Enhancements to Frankfurt implementation related to SON Control loops
SO	• PNF onboarding & registration scenario, addition of new cell later to a PNF • Trigger OOF for assignment of PCI to a new cell
CPS (Configuration & Persistency Service)	• Data models/DB schema and APIs to be generated from yang models • Details of cells to be stored in CPS, along with reference to PNF in AAI • Modeling of RAN functions and objects
RAN-Simulators	• CM-Notify sending over VES, reporting of necessary PM/FM data

5G Self-Organizing Network using OOF

Category	Requirement	Content
Interoperability	O-RAN alignment (VES, O1 interface)	Receive Configuration Management (CM) notifications over VES (instead of netconf)
Functional	RAN Database (Runtime Config DB), including any new RAN models	1. Data models/DB schema & APIs to be generated from yang models 2. Details of cells to be stored with PNF reference in AAI 3. Modeling of RAN functions and objects
Platform	Control Loop Coordination (CLC) extensions	Collaborate on CLC extensions (queueing, priority, …)
Functional	SON function to evolve ONAP platform	1. SON based on data/KPI analysis 2. CLC interaction 3. Machine Learning (ML) aspects in DCAE
Functional	SON Lifecycle	Role of SO, SDC, CLAMP (for SON service/feature deployment) (stretch goal)
Interoperability	Real gNB interaction	Interaction with real gNB in lab (stretch goal)

5G Self-Organizing Network using OOF

| COMPONENT	IMPACT(S)
OOF	• Optimization enhancements • Impacts for ML-based SON (sub-component, interface from OSDF)
SDN-C (SDN-R)	• Enhance Yang model to align with 3GPP and O-RAN • Receive Configuration Management (CM) notifications over VES • Align with CPS interface
DCAE	• CLC interactions • Impacts due to enhancements in Policy related to Control Loops • Potential enhancements in case a new SON use case is considered for ML-based SON.
POLICY	• Collaborate on CLC extensions (queueing, priority, …) • Enhancements to Frankfurt implementation related to Control loops
CPS (Configuration & Persistency Service)	• Data models/DB schema and APIs to aligned to new yang models • Details of cells to be stored in CPS, along with reference to PNF in AAI • *Modeling of RAN functions and objects*
RAN-Sim (Simulators)	• Enhancements related to CM-Notify sending over VES, reporting of necessary PM/FM data for a new SON function

5G Self-Organizing Network using OOF
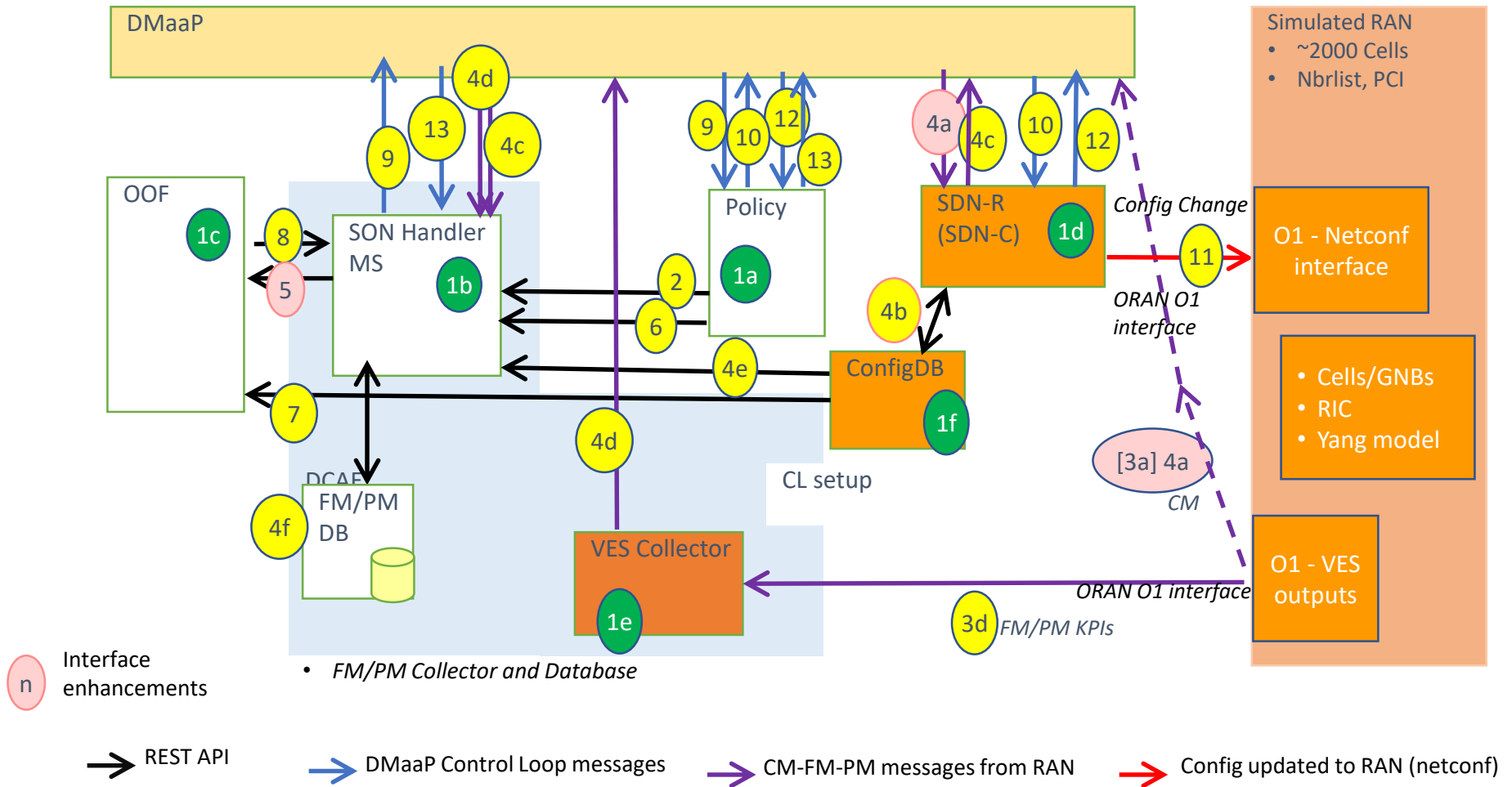
LICENSING MANAGEMENT

LICENSING MANAGEMENT
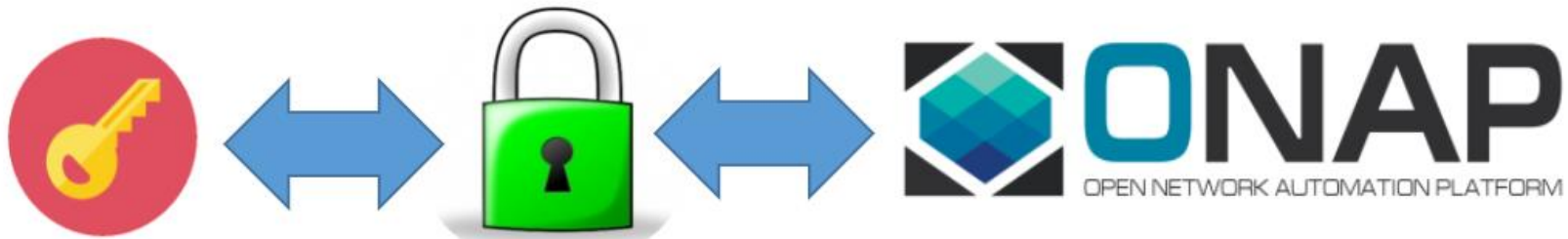
Executive Summary - Continue use case analysis for xNF License Management and derive any requirements to ONAP. The aim is for ONAP to support various types (simple, complex, vendor specific) commercial licensing models and use cases. These will be reflected as multiple, optional solutions for ONAP. The use cases we started with include xNF onboarding, PNF introduction/ONAP PnP, VNF instantiation. Further use cases to be analyzed, e.g. usage monitoring for the purpose of invoicing. Based on agreed use cases review relevant ONAP xNF requirements. Possible SW contributions, e.g. in SDC, as well as enhancement of ONAP architecture sequence diagrams.

Business Impact - xNF License Management is a critical business function. Agreed use cases should allow ONAP to flexibly support commercial licensing models.

Business Markets – The requirement applies to any domain (wireless, transport, optical, wireline) that ONAP will manage. It is not a market specific function.

Funding/Financial Impacts - The use case is fundamental for supporting efficiently business agreements between the operator and the vendor.

LICENSING MANAGEMENT in Design Time

Create a Licensing Model
- CREATE NEW VLM with a license Name, description
    - ADD ENTITLEMENT POOL : name
    - ADD LICENSE KEY GROUP (optional): name and universal type
    - ADD FEATURE GROUP: name, part number, manufacturer reference number, link a entitlement pools, link a license key group.
    - ADD LICENSE AGREEMENT: name, license term, link with one feature group

Create a VSP
- CREATE NEW VSP: name, a **license model**, and category. A VSP can be created from a vendor provided onboarding package or using SDC GUI
- Two xml files are added by SDC under Artifacts folder: vendor-license-model.xml and vf-license-model.xml.
- Modify the VSP, e.g. add additional artifacts (optional step)

Create a Resource
- Create a VNF / PNF from the VSP
- vendor-license-model.xml → Artifacts/Deployment/VENDOR_LICENSE
- vf-license-model.xml → Artifacts/Deployment/VF_LICENSE folder
- Modify the VSP, e.g. add additional artifacts (optional step)

Design a Network Service
- Create a service template
- Add at least one resource (VNF or PNF) into the service template
- Add additional artifacts, e.g. ECP, workflow. (optional step)

Testing

Approve

Distribution

LICENSING MANAGEMENT

Continue use case analysis for xNF License Management and derive any requirements to ONAP. The aim is for ONAP to support various types (simple, complex, vendor specific) commercial licensing models and use cases. These will be reflected as multiple, optional solutions for ONAP. The use cases we started with include xNF onboarding, PNF introduction/ONAP PnP, VNF instantiation. Further use cases to be analyzed, e.g. usage monitoring for the purpose of invoicing. Based on agreed use cases review relevant ONAP xNF requirements. Possible SW contributions, e.g. in SDC, as well as enhancement of ONAP architecture sequence diagrams.
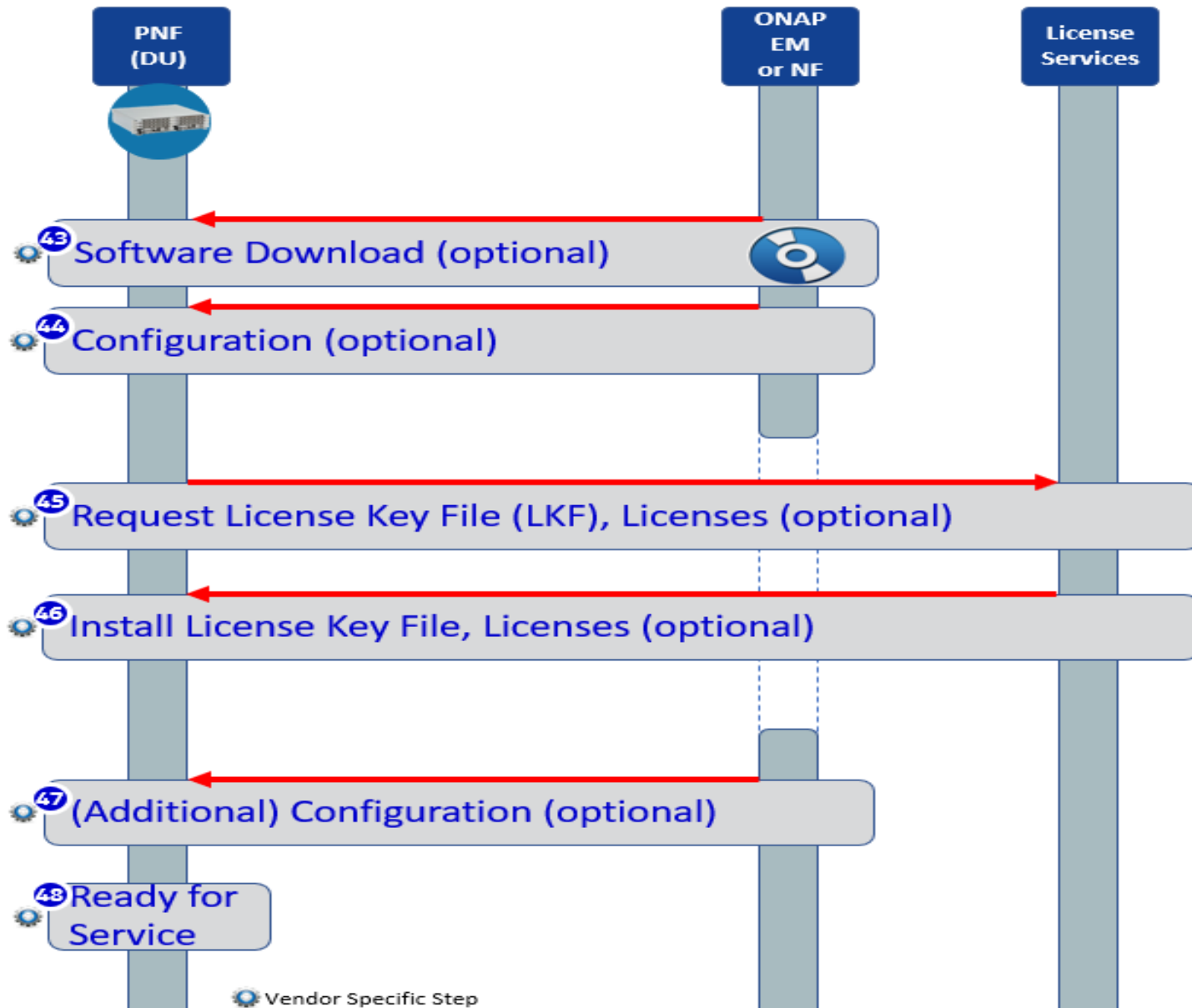
Key Contacts: Samuli Kuusela (Ericsson), Timo Perala (Nokia)

Wiki

https://wiki.onap.org/display/DW/LICENSING+MANAGEMENT

CANDIDATE ENHANCEMENTS

CANDIDATE ENHANCEMENTS	IMPACT
SDC	Review and Evaluate xNF Licensing Management enabling multiple optional solutions
Architecture	Define an architecture that support various types (simple, complex, vendor specific) of commercial licensing models and use cases. It will be reflected as multiple optional solutions for ONAP platform
VNF-RQTS	Review esisting and defining new requirements in the VNF-RQTS project related to the xNF Licensing Management architecture
Plug and Play	Introduce xNF Licensing Distribution in PnP Use case

PNF PLUG AND PLAY & Licensing Management

Stage 5: PNF Download & Activation (Vendor Specific)

PNF (DU)

ONAP EM or NF

License Services

43. Software Download (optional)

44. Configuration (optional)

45. Request License Key File (LKF), Licenses (optional)

46. Install License Key File, Licenses (optional)

47. (Additional) Configuration (optional)

48. Ready for Service

⚙ Vendor Specific Step

ONAP/3GPP & ORAN Alignment

Logical Architecture of O-RAN—ONAP as O-RAN compliant SMO

ONAP is concerned with O1, O2 and A1 interfaces ONLY.

Service Management and Orchestration Framework

Non-Real Time RIC

O1

O2

O1

A1 Adaptor

A1

REST based
#1 A1 Policies (cfg actions) (Spec avail) CRUD ops. Coordination f(n).
#2 Enrichment info / context from SMO to NRT RIC (TBW)
#3 AI & ML model mgmt. between SMO & NRT RIC (TBW)

Near-Real Time RAN Intelligent Controller (RIC)

E2

E2

O-eNB

E2

O-CU-CP

E1

O-CU-UP

X2-c

X2-u

NG-u

Xn-u

Xn-c

NG-c

Open Fronthaul M-Plane

E2

F1-c

F1-u

O-DU

Open Fronthaul CUS-Plane

Open Fronthaul M-Plane

O-RU

O-Cloud

ONAP/3GPP & ORAN Alignment

«Preliminary»
VesEvent

- «Preliminary» Fault
- «Preliminary» Heartbeat
- «Preliminary» Measurement
- «Preliminary» MobileFlow
- «Preliminary» Notification
- «Preliminary» Other

- «Preliminary» PnfRegistration
- «Preliminary» SipSignaling
- «Preliminary» StateChange
- «Preliminary» Syslog
- «Preliminary» ThresholdCrossingAlert
- «Preliminary» VoiceQuality
- «Preliminary» Perf3gpp

<<Preliminary>>
stndDefined

«Enumeration» «Preliminary» AlertAction
- SET
- CONT
- CLEAR

«Enumeration» «Preliminary» AlertType
- CARD_ANOMALY
- INTERFACE_ANOMALY
- ELEMENT_ANOMALY
- SERVICE_ANOMALY

«DataType» «Preliminary» ArrayofNamedHashMap
- «Preliminary» + arrayOfNamedHashmap: NamedHashMap [1..*]

«Enumeration» «Preliminary» EndpointDescription
- CALLER
- CALLEE

«Enumeration» «Preliminary» SyslogFacility
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23

«Enumeration» «Preliminary» Domain
- FAULT
- HEARTBEAT
- MEASUREMENT
- MOBILEFLOW
- NOTIFICATION
- OTHER
- PNFREGISTRATION
- SIPSIGNALING
- STATECHANGE
- SYSLOG
- THRESHOLDCROSSINGALERT
- VOICEQUALITY
- PERF3GPP
- STNDDEFINED

«Enumeration» «Preliminary» EventSeverity
- CRITICAL
- MAJOR
- MINOR
- WARNING
- NORMAL

«DataType» «Preliminary» HashMap
- «Preliminary» + hashmapEntry: KeyValuePair [*]

«DataType» «Preliminary» NamedHashMap
- «Preliminary» + name: String [1]
- «Preliminary» + hashMap: HashMap [1]

«DataType» «Preliminary» Key
- + keyName: String [1]
- + keyOrder: Integer [0..1]
- + keyValue: String [0..1]

«Enumeration» «Preliminary» NicAdminState
- IN_SERVICE
- OUT_OF_SERVICE

«Enumeration» «Preliminary» SyslogSev
- EMERGENCY
- ALERT
- CRITICAL
- ERROR
- WARNING
- NOTICE
- INFO
- DEBUG

«Enumeration» «Preliminary» NicOpsState
- IN_SERVICE
- OUT_OF_SERVICE

«Enumeration» «Preliminary» TCACriticality
- CRIT
- MAJ

«DataType» «Preliminary» ThresholdCrossingAlertCounter
- «Preliminary» + criticality: TCACriticality [1]
- «Preliminary» + hashMap: HashMap [1]
- «Preliminary» + thresholdCrossed: String [1]

«Enumeration» «Preliminary» VfStatus
- ACTIVE
- IDLE
- PREPARING_TO_TERMINATE
- READY_TO_TERMINATE
- REQUESTING_TERMINATION

«DataType» «Preliminary» SchemaObject
- «Preliminary» + objectInstances: SchemaObjectInstance [1..*]
- «Preliminary» + objectName: String [1]
- «Preliminary» + objectSchema: String [0..1]
- «Preliminary» + objectSchemaUrl: String [0..1]
- «Preliminary» + nfSubcribedObjectName: String [0..1]
- «Preliminary» + nfSubcriptionId: String [0..1]

«DataType» «Preliminary» SchemaObjectInstance
- «Preliminary» + schemaObject: SchemaObject [*]
- «Preliminary» + objectInstance: Object [0..1]
- «Preliminary» + objectInstanceEpochMicrosec: UnixEpoch [0..1]
- «Preliminary» + objectKeys: Key [*]

«DataType» «Preliminary» ArrayOfSchemaObject
- «Preliminary» + arrayOfSchemaObject: SchemaObject [1..*]

ONAP/3GPP & ORAN Alignment

EXECUTIVE SUMMARY -

-This contribution introduces a new domain in VES, stndDefined, which indicates that the event contains data that conforms to format/schema defined by a separate standards organization1. In addition we propose one new field in the VES Common Header to enable further classification of such events, e g to support routing of these events to appropriate DMaaP topics. An optional second stage validation is proposed in DCAE prior to acknowledging the event to enhance trouble shooting.

-It is proposed that the first application of this generic capability supports VES encapsulated 3GPP defined notifications as described in 28.532 version 16.3.0 Annex B (informative). The ORAN O1 specification also refers to VES-based 3GPP notifications for several management services, and in those cases is expected to further align with the approach and solution published in 3GPP in a future release.

BUSINESS IMPACT- The ability for service providers to deploy ONAP as the SMO in their O-RAN compliant network depends upon ONAP's ability to process VES encapsulated events as defined by 3GPP and ORAN in DCAE and route these events to appropriate DMaaP topics. This proposal, in , provides the necessary capability for ONAP to process and validate events that are defined using 3GPP schema for the data. The proposal is readily extensible for the support of additional events from 3GPP, ORAN or other standards organizations adding a high degree of flexibility to the ONAP platform.

BUSINESS MARKETS - This contribution applies to any Service Provider that wants to use ONAP as an O-RAN compliant SMO or to support 3GPP compliant interfaces and can be leveraged by Service Providers wishing to support events from network functions which are aligned with other standards organizations.

FUNDING/FINANCIAL IMPACTS -This contribution helps enable ONAP to be O-RAN and 3GPP compliant which should stimulate contributions from companies that are aligned with O-RAN and 3GPP. There is no new hardware to be procured and no new licenses.

ORGANIZATION MGMT, SALES STRATEGIES - This proposal does not affect sales strategies.

1) Standards organization is intended to be interpreted in a broader sense than SDO as defined by ITU, to cover also e.g. joint ventures like 3GPP and open industry fora like the O-RAN Alliance.

ONAP/3GPP & ORAN Alignment – *Standards Defined* Event in VES

U/C DESCRIPTION

Enhancements
1) Introduce the ability to receive and route events defined by a standards organization (3GPP, IETF etc.) encapsulated in a VES event to an appropriate DMaaP topic
2) Provide the optional capability to provide a second stage of validation within DCAE prior to the DCAE responding to the NF to validate the contents of the event against valid schema defined by the standards organization.
3) The first use case supported will be the processing of 3GPP defined notifications defined in TS 28.532 encapsulated in VES events

Wiki

https://wiki.onap.org/pages/viewpage.action?pageId=84640792

CANDIDATE ENHANCEMENTS

| CANDIDATE ENHANCEMENTS	IMPACT
Add a new domain in DCAE/VES Event Listener, to identify that the data carried in the event is defined by a standards organization. Add a field in the VES Common Header to further identify the routing path for the event.	Additional domain supported in the ENUM in DCAE. VES specification updates to document the new domain. To properly identify this event this enhancement would also introduce a new field in the VES Common Header to facilitate the proper routing of the event. The allowed content of this field would be specified by the standards organization that defined the notification and would not be part of the requirements in the VES specification. The VES specification would provide a reference to the document that contains the standardized information to be populated in that field.
Provide second stage validation of the data carried in the proposed stndDefinedFields structure of the event.	Introduce a schema broker in DCAE that will contain valid standards defined JSON schemas that can be used to validate the data in the standards defined event. Propose to extend existing DCAE CBS component to store valid, standards defined JSON schemas. Propose to extend existing DCAE components to allow for a second stage of validation.

Executive Summary - This requirement enhances the A1 adapter/interface capabilities provided in Rel 6 as part of 5G / ORAN & 3GPP Standards Harmonization requirement (REQ-38). O-RAN has defined A1 interface specification in the context of the management of 5G RAN elements to provide intent based policies for optimization of the RAN network performance. Planned enhancements for Rel 7 include additional support for managing A1 Policies, multiple A1 targets in the RAN, multi-version support for different A1 targets, and secure TLS communication.

Business Impact - Continuing the convergency between ONAP and ORAN initiated in Rel 6, A1 interface can be used by all service providers and avoid duplicate development effort.

Business Markets -Enhanced A1 capabilities, once developed, will be useable by any service provider deploying and using ONAP.

Funding/Financial Impacts - A1 interface provides a flexible way for the operator to manage wide area RAN network optimization, reducing capex investment needs.
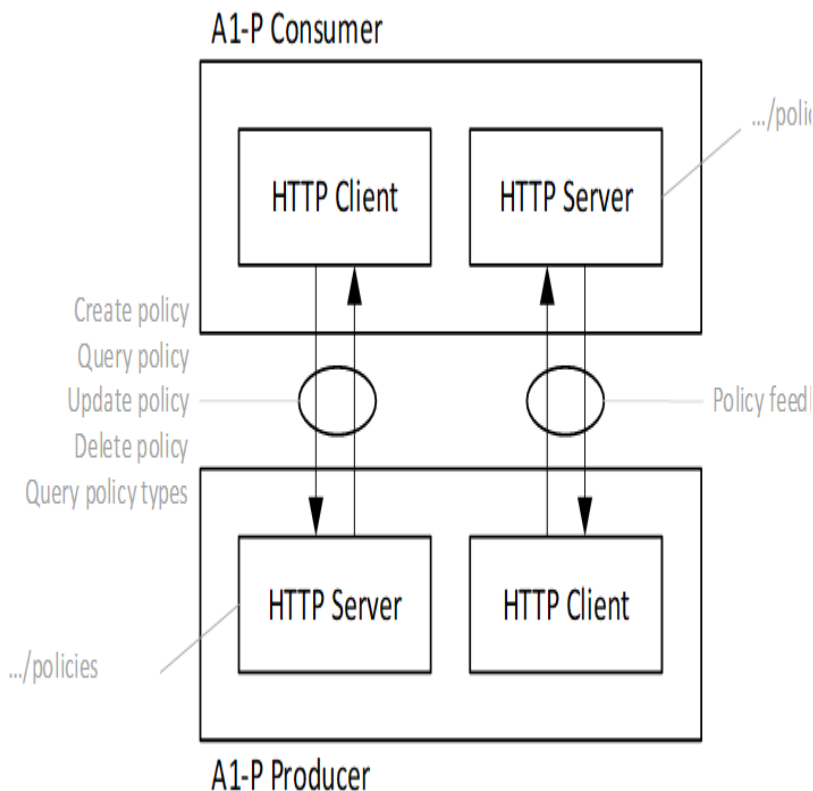
ONAP/3GPP & ORAN Alignment - A1 Adapter Extension

U/C DESCRIPTION

O-RAN has defined A1 interface specification in the context of the management of 5G RAN elements to provide intent based policies for optimization of the RAN network performance. This requirement enhances the A1 adapter/interface capabilities provided in Rel 6 as part of 5G/ORAN & 3GPP Standards Harmonization requirement (REQ-38) introducing in ONAP a function for manipulating, maintaining and managing A1 Polices in the RAN network as well as terminating A1 application protocol in ONAP.

Planned enhancements for Rel 7 include additional support for managing A1 Policies, multiple A1 targets in the RAN, multi-version support for different A1 targets, and secure TLS communication.

Key Contacts: Michela Bevilacqua (Ericsson), John Keeney (Ericsson)
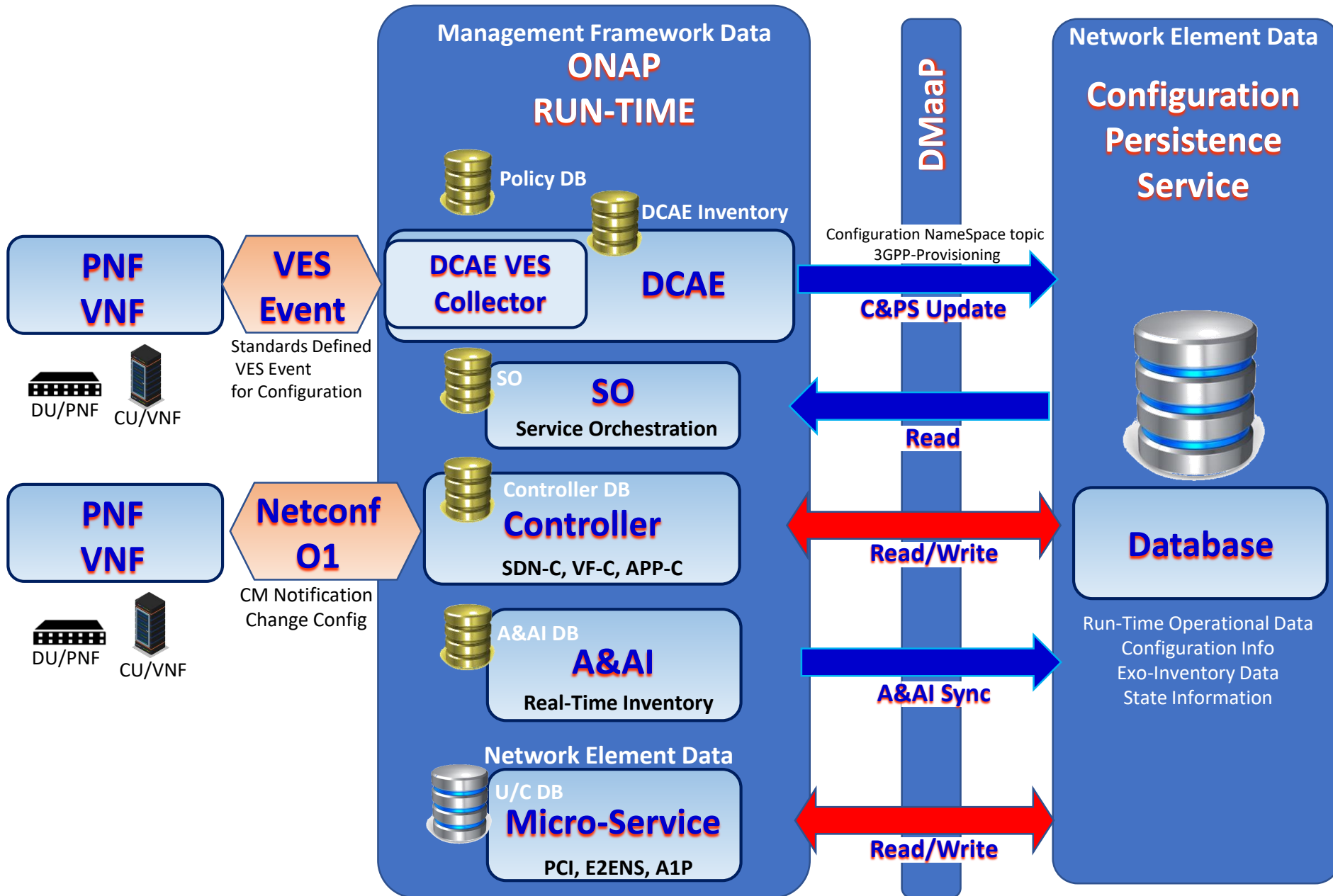
Wiki

TBD

CANDIDATE ENHANCEMENTS

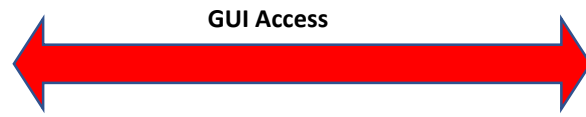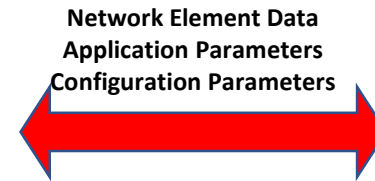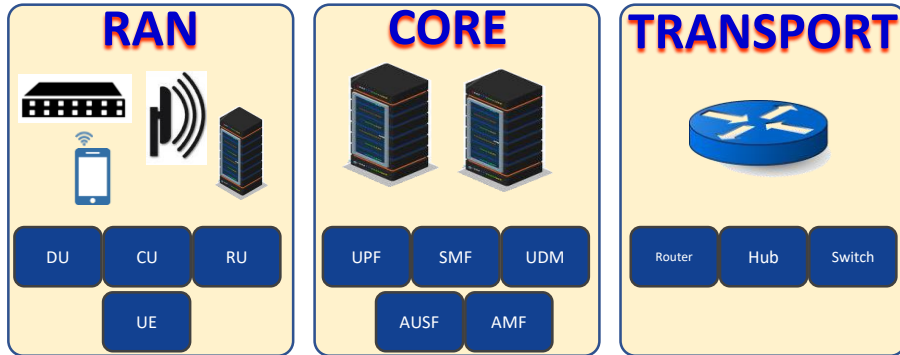| CANDIDATE ENHANCEMENTS	IMPACT
A1 Adaptor Extension	Take advantage of the A1 adapter evolution progress in OSC (converge adaptors) Manage A1 policies (Adding service to coordinate A1 policies) Enable the support of mulitple A1 targets and multiple versions (support support for multiple near-RT RICs). Multiple versions of A1 protocol (as the standards are rapidly evolving). Introduce a secure TLS communication and integrate certificate handling in line with ONAP CMPv2 solution. (A1 is a REST interface so want to add security). The use case is a "Convergence project"

CONFIGURATION PERSISTENC SERVICE (CPS)

CONFIGURATION PERSISTENCE SERVICE

Management Framework Data

ONAP RUN-TIME

Policy DB

DCAE Inventory

DCAE VES Collector **DCAE**

DMaaP

Network Element Data

Configuration Persistence Service

PNF VNF

VES Event

Standards Defined VES Event for Configuration

DU/PNF   CU/VNF

Configuration NameSpace topic
3GPP-Provisioning

C&PS Update

SO

SO
Service Orchestration

Read

PNF VNF

Netconf O1

CM Notification Change Config

DU/PNF   CU/VNF

Controller DB
Controller

SDN-C, VF-C, APP-C

Read/Write

Database

A&AI DB
A&AI

Real-Time Inventory

A&AI Sync

Run-Time Operational Data
Configuration Info
Exo-Inventory Data
State Information

Network Element Data

U/C DB
Micro-Service

PCI, E2ENS, A1P

Read/Write

CONFIGURATION & PERSISTENCY SERVICE

RAN

DU | CU | RU
UE

CORE

UPF | SMF | UDM
AUSF | AMF

TRANSPORT

Router | Hub | Switch

Network Element Data
Application Parameters
Configuration Parameters

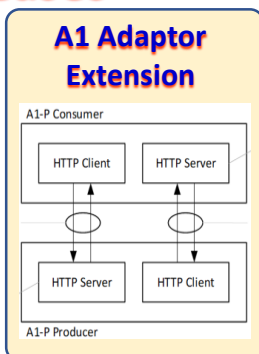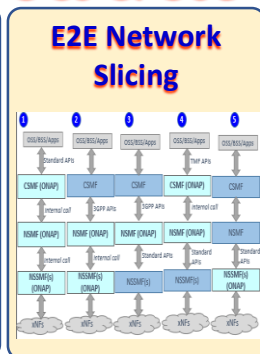## Network Element Data

Configuration & Persistency Service

NB Open API

GUI

GUI Access

Database

ONAP Micro-services, POCs & Use Cases
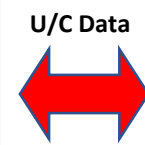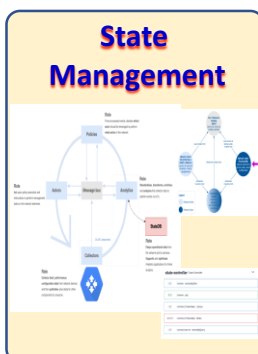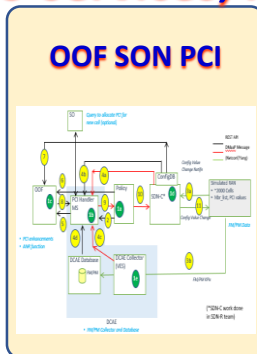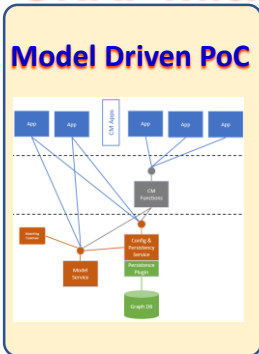
Model Driven PoC

OOF SON PCI

E2E Network Slicing

A1 Adaptor Extension

A1-P Consumer
HTTP Client | HTTP Server
HTTP Server | HTTP Client
A1-P Producer

State Management

U/C Data

Run-Time Operational Data
Configuration Info
Exo-Inventory Data
State Information

CONFIGURATION & PERSISTENCY SERVICE
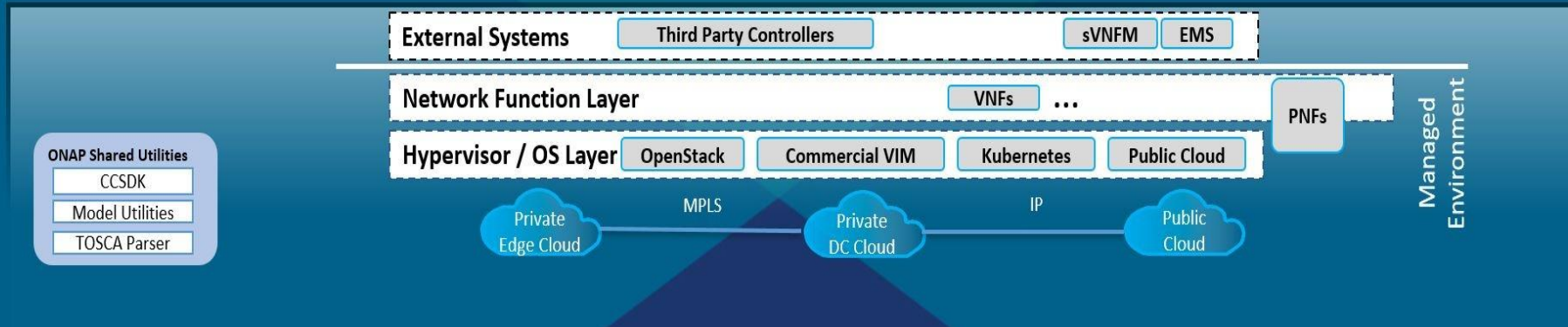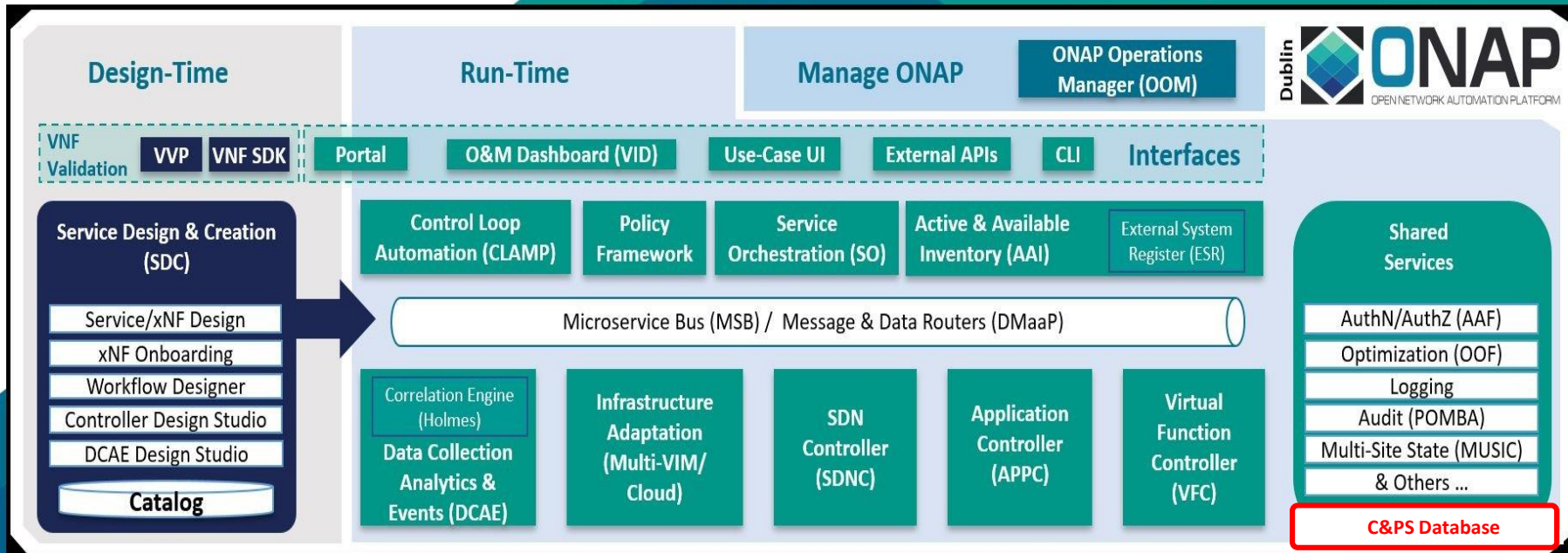
CONFIGURATION & PERSISTENCY SERVICE Overview

Configuration & Persistency Service (C&PS)

The Configuration & Persistency Service is a new platform component that is designed to serve as a data repository for Run-time data that needs to be persistent. As a stand-alone ONAP component, this project provides data layer services to other ONAP platform components and use cases that require persistent configuration or operational data. The R6 development will be enhanced as well.

REPOSITORY – The C&PS will store Network Element Configuration, State information, and Run Time data in its internal database.
DATA LAKE – The C&PS is designed to be a common services data layer for micro-services to access & store run time data.).

ARCHITECTURE REQUIREMENT IDENTITY – ROW 25

AR-0024-R7-052020 Run Time Configuration Database / Data Persistency Service Project Benjamin Cheung, Joanne Liu Rudel, Tony Finnerty xNF

EXECUTIVE SUMMARY - The RunTime Configuration Database / Data Persistency Service is a new platform component that is designed to serve as a data repository for Run-time data that needs to be persistent. As a stand-alone ONAP component, this project provides data layer services to other ONAP platform components and use cases that require persistent configuration or operational data. The R6 development will be enhanced as well.

BUSINESS IMPACT - The ability for service operators to visualize and manage data in a RAN network (PNFs, VNFs, and logical constructs) with ONAP is a critical business function because they are key Life Cycle Management (LCM) and OA&M operations. The project has business impacts to enhance the operation of data-handling within ONAP by providing efficient data layer services.

BUSINESS MARKETS - This project applies to any domain (wireless, transport, optical, and wireline) that ONAP may manage. It is not a market or geographical specific capability. It is expected that scaled ONAP installations such as Edge & Core ONAP deployments will also deploy the database across each installation.

FUNDING/FINANCIAL IMPACTS - This project represents a large potential Operating Expense (OPEX) savings for operators because of the ability to configure networks saving time and expenses.

ORGANIZATION MGMT, SALES STRATEGIES - There is no additional organizational management or sales strategies for this use case outside of a service providers "normal" ONAP deployment and its attendant organizational resources from a service provider.

CONFIGURATION & PERSISTENCY SERVICE in

NEW COMPONENT CAPABILITIES

NEW COMPONENT CAPABILITIES (CC-SDK R6 extension)	IMPACT DESCRIPTION
C&PS Database Development (New Development) [CC-SDK]	API Updates Interface to C&PS Database. Initial Database Setup / Database schema setup
Controller (SDN-C)	1. Yang model used C&PS (hosted by controller). 2. NetConf "path" - PNF through Netconf to update database.
DCAE (Dependency)	1. **Using** the 3GPP StndDefined VES Event* to send Configuration data 2. **Using** VES listener update/DCAE Pathway for 3GPP-Provisioning notification 3. **Using** DMaaP Development to publish on 3GPP-Provisioning NameSpace
Modeling	Design time support for dynamic database schema setup (run time)
A&AI (Dependency)	A&AI Element Sync (new/delete xNF, initial "getall") (**Using** A&AI) Query Retrieve & A&AI DMaaP Test only
VNF-REQ (Dependency)	(Dependency) VES requirements for VES updates.

*3GPP TS28.532 Annex B provides valid name spaces and details.

CONFIGURATION & PERSISTENCY SERVICE

Wiki

https://wiki.onap.org/pages/viewpage.action?pageId=81406119

NEW COMPONENT CAPABILITIES (**& Beyond**)	IMPACT DESCRIPTION
New C&PS Stand-alone Platform Component	Configuration & Persistency Service (CPS) would be its own Platform Component in Project proposal https://wiki.onap.org/pages/viewpage.action?pageId=71834216 New platform project – DMaaP listener, Absorb SDC Service CSAR Pkg (DMaaP) Database schema setup Objectives to support the Access & Support for initial Use Cases (see Roadmap slide)
Model Driven POC using C&PS	A Model Driven C&PS PoC to demonstrate C&PS functionality Then full project proposal in R8 Honolulu

NEW COMPONENT CAPABILITIES

*3GPP TS28.532 Annex B provides valid name spaces and details.
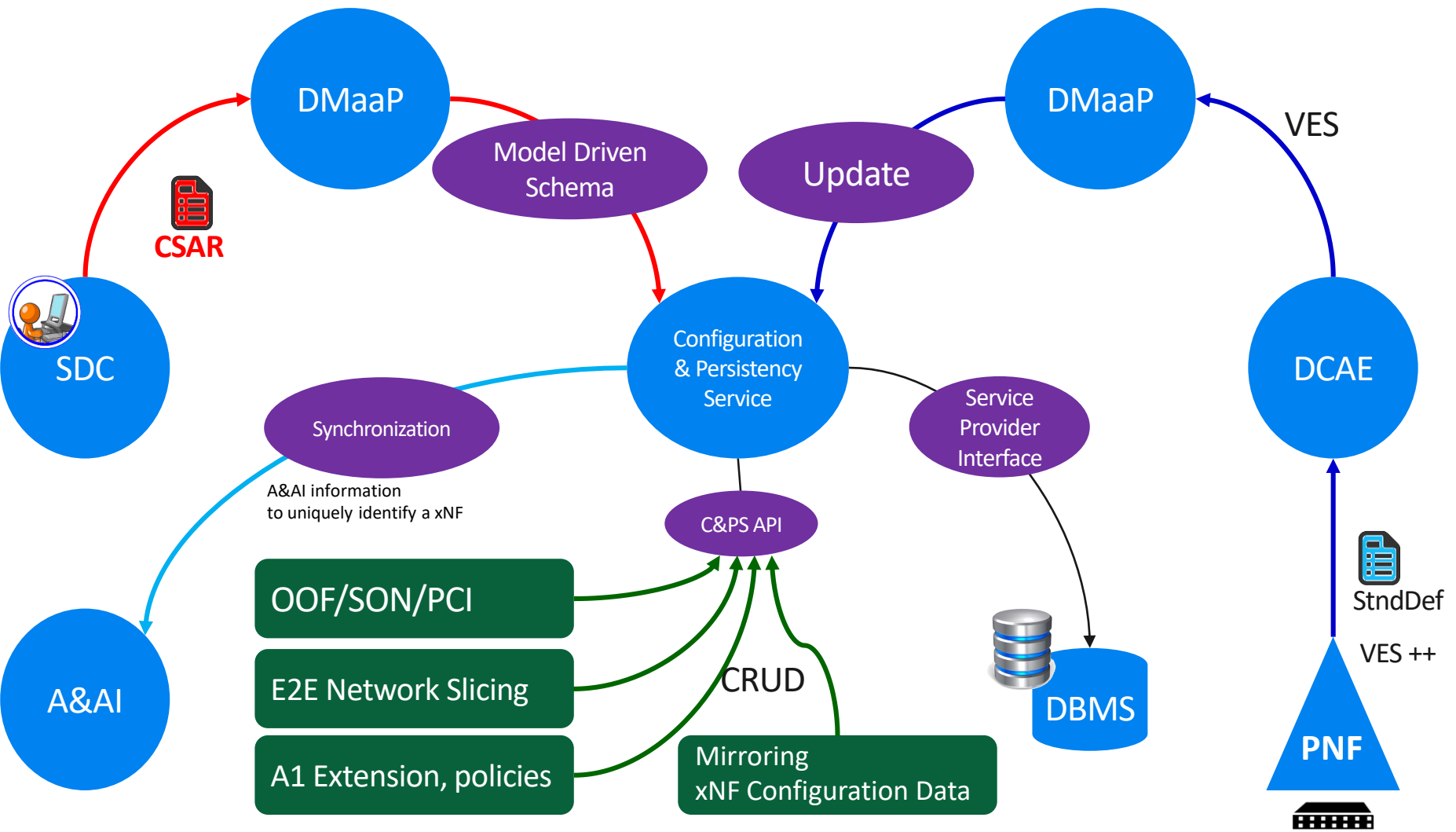
C&PS – INTERFACES & APIs

Interfaces Impacts

Interfaces	IMPACT
DCAE – VES Listener (Dependencies)	(USES Interface) this project DEPENDS on the 5G Harmonization work to develop the stndDefined VES 3GPP-Configuration (Namespace) Notification work
Controller (Dependencies)	(USES Interface) Controller Interfaces to receive Yang models (SDC) used by the project to setup database
A&AI (Dependencies)	(USES Interface) A&AI Interface to get new/delete xNF, initial "getall" Listening to A&AI updates on DMaaP

APIs Impacts

API	IMPACT

New API for C&PS (Stand-alone component)	**NEW API** for C&PS for uS to access C&PS internal databases
	NEW API to allow access to the data model
	   - Reflects Yang model to interpret data that is stored (constraints / Model driven)
	   - To Navigate data stored, based on Yang-model provided by NFs.
	   - C&PS to any entity to retrieve/store info to C&PS database

C&PS – MODELING IMPACTS

| Model	IMPACT
Platform Information Model	Data being consumed & used – is the design time yang model that in onboarded that will be used to setup the C&PS database.
Internal C&PS Model Work	Model-driven Common Foundation model – to "hang" tech specific information from. Common constructs API representation on C&PS API. Model -> Design time "Loading" from A&AI … needs to be modeled.

END TO END NETWORK SLICING

NETWORK SLICING

Objective: Demonstrate e2e slice design, creation, activation, deactivation and termination - including **RAN**, Core **and Transport** slice sub-nets. Demonstrate KPI monitoring, simple Closed Loop Control & Intelligent Slicing.

Lifecycle of a Network Slice Instance
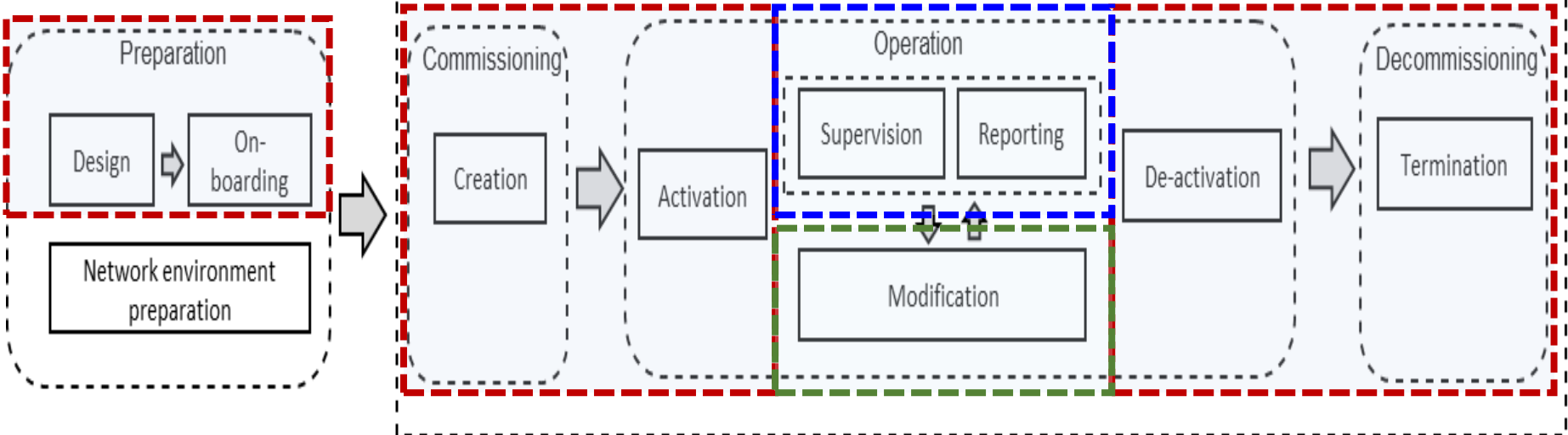
Ref.: 3GPP TS 28.530

Scope for Frankfurt (with enhancements)

Additional scope for (under discussion)

Initial steps in (under discussion)

- **Design and pre-provision**: Creation of necessary slice/slice sub-net templates.
- **Creation, activation, deactivation and termination** of NSI, including its constituent slice sub-nets (RAN, Core and Transport).

NETWORK SLICING

Network Slicing is looking to provide: (1) a full E2E Slicing solution involving RAN and Transport NSSMF, and connecting to external Core NSSMF. (2) KPI monitoring and Closed Loop Control (3) Intelligent Slicing (4) Standardized interfaces (5) Model enhancements, AAI schema updates 1:1 mapping between NSI and NSSI

Wiki

https://wiki.onap.org/display/DW/E2E+Network+Slicing+Use+Case+in+R7+

CANDIDATE ENHANCEMENTS

ENHANCEMENTS	DESCRIPTION
SDC	Enhance CST, NST, design of RAN, Transport NSSTs, KPI monitoring
UUI	Support of CSMF, NSMF, KPI monitoring, Time base service activation
EXT API	Support of standard interfaces for CSMF, NSMF and NSSMF
SO	NSSMF RAN/Transport subnets. Interface standardization, External Core NSSMF, CLC
OOF	NSI selection, NSSI selection, resource reallocation in RAN transport subnets, PM data
DCAE	Data lake, KPI data. uS KPI, Intelligent Slicing, VES enhance, Store AF data
Policy	Control loop enhancement, Config. Policies for OOF, SO, DCAE
SDN-C	NSSMF functionality for RAN & Transport, CLC functionality.
CDS	API mapping on SB interfaces
A&AI	Schema updates for network slicing, net modes for NSI, NSSI, RAN & transport slice inventory
C & P Service	RAN configuration data (cell level initial and network slicing related)

5G NETWORK RESOURCE MODEL (NRM)

5G Network Resource Model (NRM)
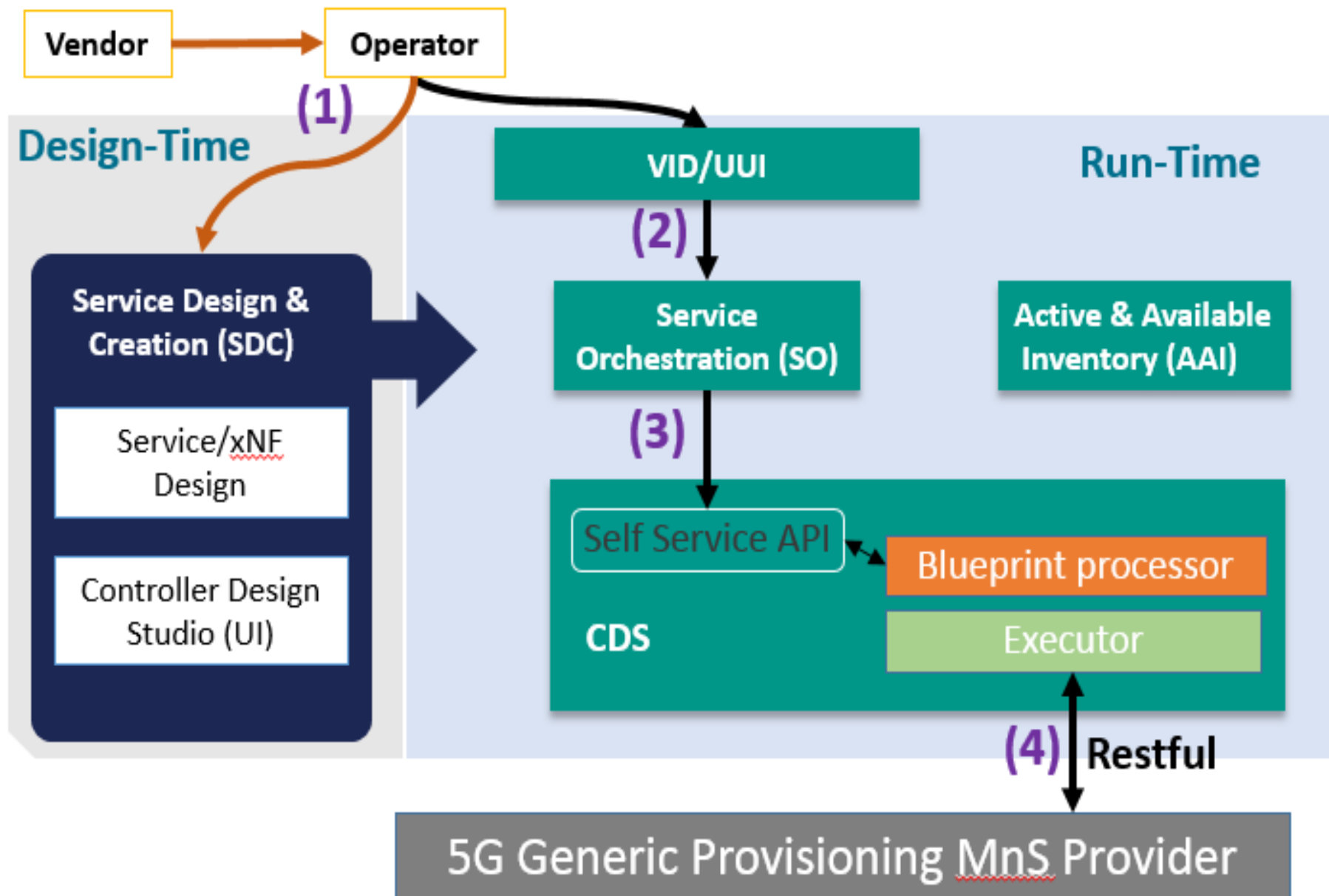
5G Network Resource Model (NRM)

New Use Case

1) This use case introduces 5G NRM Configuration Management using a RESTful/HTTPS protocol (instead of NetConf). Certainly some corresponding work need to be done in Integration, such as the provisioning MnS provider (Simulator) and documentation. Good news is we complete all implementation and test cases (tested via CLI, actually that is CDS self-service API).

Wiki

https://wiki.onap.org/display/DW/5G+Network+Resource+Model+%28NRM%29+Configuration+in+

CANDIDATE ENHANCEMENTS	IMPACT
SO	Add new NRM related data types, corresponding PNF packages and BPMN enhancements as well Use several NR NRM IOCs for demonstrations and enhance the PNFD model BPMN support for NRM configuration
SO	Support SO service/instance management API for NRM configuration Modify or Add additional SO NB APIs Define corresponding NRM IOCs in SO and BBs

PNF Support U/C SUMMARY

5G USE CASE	DESCRIPTION	Req vs U/C
PNF PRE-ONBOARDING & ONBOARDING	PNF Package delivery, Pre-onboarding and PNF Onboarding via SDC.	Requirements
PNF PLUG AND PLAY	PNF PnP handles the PNF discovery and registration by ONAP during installation & commissioning. PRH (PNF Registration Handler) enhancements	E2E Use Case
xNF S/W UPGRADE	PNF Software upgrade to update the software on a PNF. Use of Ansible/NetConf direct to PNF.	Requirements
CMPv2	Certificate Management Protocol (Will be presented in its own Lecture at the Virtual Face to Face)	Requirements

PNF PREONBOARDING / ONBOARDING

PNF PRE-ONBOARDING/ONBOARDING U/C OVERVIEW

① PNF Package Delivery: Vendor creates & delivers PNF Package with PNF artifacts

② PNF Pre-Onboarding: VNF-SDK (⚠) to (create) PNF Onboarding Package & *validates* of PNF onboarding package

③ PNF Onboarding package: Package loaded

Service CSAR Package

PNF Descriptor

NF Registration

PM Dictionary Schema (YAML)

Informational Artifacts

Configuration Files

Ansible Playbook

xNF SDK

Package creation

SDC

PNF Onboarding Package

Onboarding

+VENDOR META DATA

SDC Catalog

Distribute DMaaP

SO, AAI, DCAE etc.

④ SDC: NF OB Package > SDC catalog

⑤ ONAP RT Components: Ingest and use CSAR package

Package Delivery	Onboarding	Design Time	Run Time
Onboarding Package	NF Descriptor	Platform Model	NF Instance
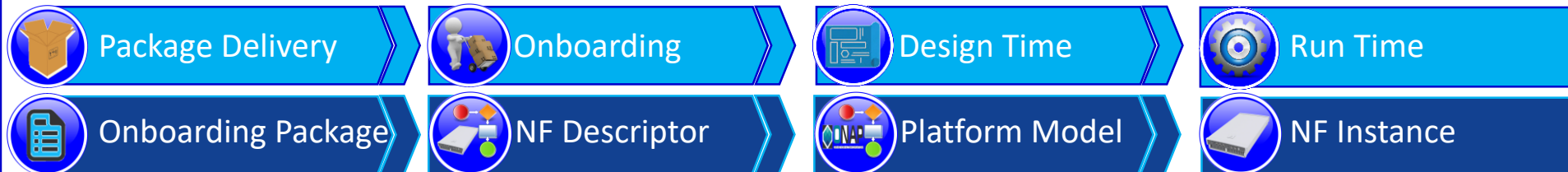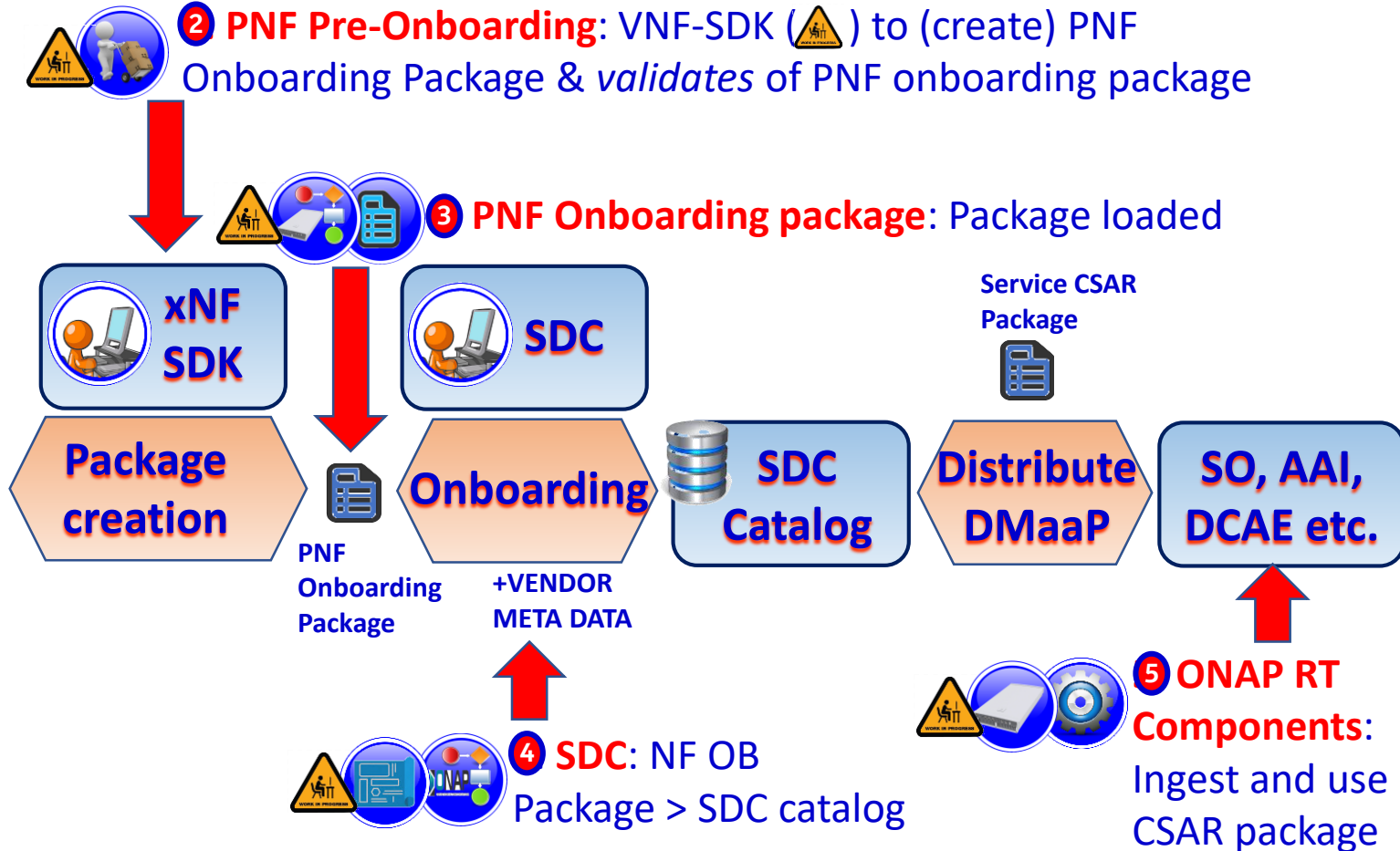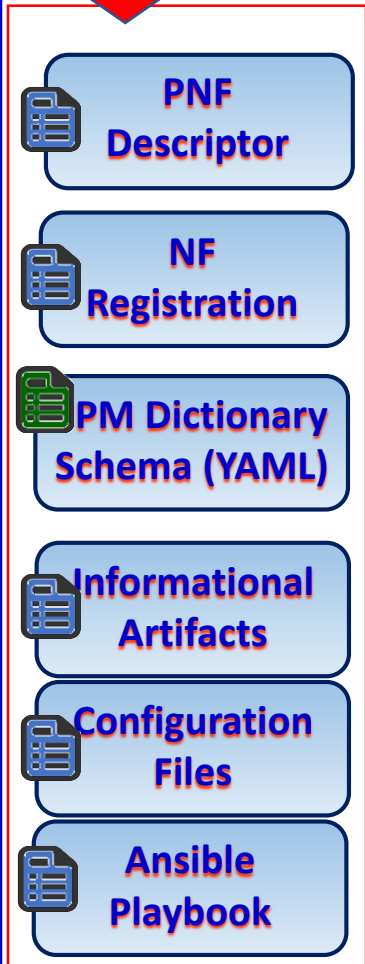
PNF PRE-ONBOARDING – Overview

This Use Case will introduce the support for PNF pre-onboarding (PNF Package, PNF descriptor support) and PNF onboarding (SDC, Design Time, PNF-SDK).
PNF Package delivery by vendor (during Pre-onboarding activities) and PNF Onboarding via SDC in Dublin.

ARCHITECTURE REQUIREMENT IDENTITY – ROW 19

AR-0018-R7-052020 release - functional requirements proposed list#R7PNFONBOARDING/PRE-ONBOARDINGVNF-SDKVALIDATION
Benjamin Cheung, Damian Nowak, Zu Qiang (Ericsson) xNF

EXECUTIVE SUMMARY - **This requirement enhances the PNF Pre-onboarding use case. This requirement introduces package security Option2 improvements on Signature per artifact on the Vendor delivered package as defined in ETSI NFV SOL004 v2.7.1. The validation of onboarded PM dictionary data based on schema information will be done. (What is added from existing functionality)?**

BUSINESS IMPACT - **The enhancement to Onboarding & Pre-onboarding is a critical business function because they are vital to design-time operation to properly onboard vendor packages.**

BUSINESS MARKETS - **This project applies to any domain (wireless, transport, optical, and wireline) that ONAP may manage.**

FUNDING/FINANCIAL IMPACTS - **The PNF Onboarding & Pre-onboarding use case has Operating Expense (OPEX) savings for operators because of the ability to saving time and expenses during installation and commissioning of PNF resources.**

ORGANIZATION MGMT, SALES STRATEGIES - **There is no additional organizational management or sales strategies for this use case outside of a service providers "normal" ONAP deployment and its attendant organizational resources from a service provider.**

ETSI GS NFV-SOL 004 V2.7.1 (2019-12)

GROUP SPECIFICATION

Network Functions Virtualisation (NFV) Release 2;
Protocols and Data Models;
VNF Package and PNFD Archive specification

5.2   VNF package manifest and certificate files

In option 1 (see clause 5.1) the manifest file provides the VNF package integrity and authenticity assurance. In this option the manifest contains the digests (hashes) for each individual file locally stored within the VNF package or referenced from it. Each file related entry of the manifest file includes the path or URI of the individual file, the hash algorithm and the generated digest. A consumer of the VNF package shall verify the digests in the manifest file by computing the actual digests and comparing them with the digests listed in the manifest file.

In option1 the VNF package authenticity is ensured by signing the manifest file with the VNF provider private key. The digital signature is stored in the manifest file itself (see clause 5.3). The VNF provider shall include an X.509 certificate [8] in the VNF Package. The certificate shall be either placed in a certificate file with extension .cert or, if the chosen signature format allows it, the certificate may be included in the signature container itself. The certificate provides the VNF provider public key.

In option 2 (see clause 5.1), the VNF package authenticity and integrity is ensured by signing the CSAR file with the VNF provider private key (option 2 in clause 5.1). The digital signature is stored in a separate file. The VNF provider shall also include an X.509 certificate. The certificate may be included in the signature itself if the signature format allows it or in a separate file. The signature and certificate files shall be siblings of the CSAR file, i.e. placed in the same folder in the parent archive. The signature file shall have an extension .cms and the same name as the CSAR file. Naming conventions for the certificate file are specified in clause 4.3.6.

In this alternative (option 2 in clause 5.1) it is not required to include digests (hashes) per each individual file or artefact in the manifest file. A consumer of the VNF package can verify the signature of the complete CSAR package with the VNF provider public key.

Table 5.2-1 summarizes the characteristics of the two possible options for integrity assurance.

Table 5.2-1: Options for VNF Package integrity assurance: summary of characteristics

Options	Digest per artifact	Signature per artefact	Support external artifacts	Signature as part of the manifest file	External Signature file for the whole CSAR	Certificate may be part of the signature	Certificate may be in a separate file
Option 1	Yes	Yes (mandatory)	Yes	Yes	No	Yes	Yes
Option 2	No	Yes (mandatory)	No	Yes	Yes	Yes	Yes

The X.509 certificate may contain one single signing certificate or a complete certificate chain. The root certificate that may be present in this X.509 certificate file shall not be used for validation purposes. Only trusted root certificate pre-installed in NFVO shall be used for validation (see clause 5.1).

PNF PRE-ONBOARDING/ONBOARDING

NEW COMPONENT CAPABILITIES

NEW COMPONENT CAPABILITIES	IMPACT DESCRIPTION
VNF-SDK (PNF-SDK)	**ETSI SOL004 alignment**: - Package Validation enhancements notable Package security (option 2 security on entire package) - Signatures Hashchecks per artifact (applicable for both Option 1 & 2) – in R4/R5/R6 signature Hashcheck may exist for option 1. - VNF-SDK adding Option 2

PNF PRE-ONBOARDING/ONBOARDING INTERFACES & APIs

Interfaces	IMPACT
(None)	(The work is entirely internal to VNF-SDK)

Interfaces Impacts

API	IMPACT
(None)	(The work is entirely internal to VNF-SDK)

APIs Impacts

PNF PRE-ONBOARDING/ONBOARDING MODELING IMPACTS

Modeling Impacts

Model	IMPACT
(None)	(None)

PNF PLUG AND PLAY

PNF PLUG AND PLAY U/C Overview

Design Time

① **PNF Modeling**
ONAP
OPEN NETWORK AUTOMATION PLATFORM

Resources Definition/Services Definition
SDC: PNF (physical element) Modeling
Distribution of types

Run-Time (Instances)

② **PNF Instance Declaration**
ONAP
OPEN NETWORK AUTOMATION PLATFORM

PNF Infrastructure Service Declaration
First part of PNF instantiation
PNF A&AI Entry created
⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒

③ **PNF Boot-strapping**

PNF Powers up and Boot-straps
PNF performs a "Plug and Play" procedure

Equipment vendor proprietary steps

④ **PNF Contacts ONAP**
ONAP
OPEN NETWORK AUTOMATION PLATFORM

PNF connects to ONAP via a Registration Event
PNF Registration Handler (PRH) processes the event

㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛

⑤ **PNF Activation**

Connection points configured
Second part of PNF service instantiation
PNF configured and ready to provide service
㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷

PNF PLUG AND PLAY – Overview

This Use Case will continue PNF Plug and Play development started in R3 Casablanca. Functionality that was started but not completed, and introduce some enhancements to improve Plug and Play operation.

ARCHITECTURE REQUIREMENT IDENTITY – ROW 17

AR-0016-R7-052020 R7PNFPLUG&PLAYBUILDINGBLOCK/WORK-FLOWMANAGEMENT Benjamin Cheung, Damian Nowak xNF

EXECUTIVE SUMMARY - This requirement will augment the work-flow to building block management within SO for Plug and Play operation. The continues the work started in R6. The description of the "base" work which will be enhanced is shown in the wiki: PNF PLUG and PLAY in R6 Frankfurt

BUSINESS IMPACT - The enhancement to Plug and Play operation in ONAP is a critical business function because they enhance installation and commissioning activities.

BUSINESS MARKETS - This project applies to any domain (wireless, transport, optical, and wireline) that ONAP may manage.

FUNDING/FINANCIAL IMPACTS - The plug and play project has Operating Expense (OPEX) savings for operators because of the ability to saving time and expenses during installation and commissioning and contributes towards ZTM (Zero touch management).

ORGANIZATION MGMT, SALES STRATEGIES - There is no additional organizational management or sales strategies for this use case outside of a service providers "normal" ONAP deployment and its attendant organizational resources from a service provider.

Proposed building blocks

Stage 5: PNF Download & Activation (Vendor Specific)

PNF (DU) — **ONAP EM or NF** — **License Services**

43. Software Download (optional)

44. Configuration (optional)

45. Request License Key File (LKF), Licenses (optional)

46. Install License Key File, Licenses (optional)

47. (Additional) Configuration (optional)

48. Ready for Service

⚙ Vendor Specific Step
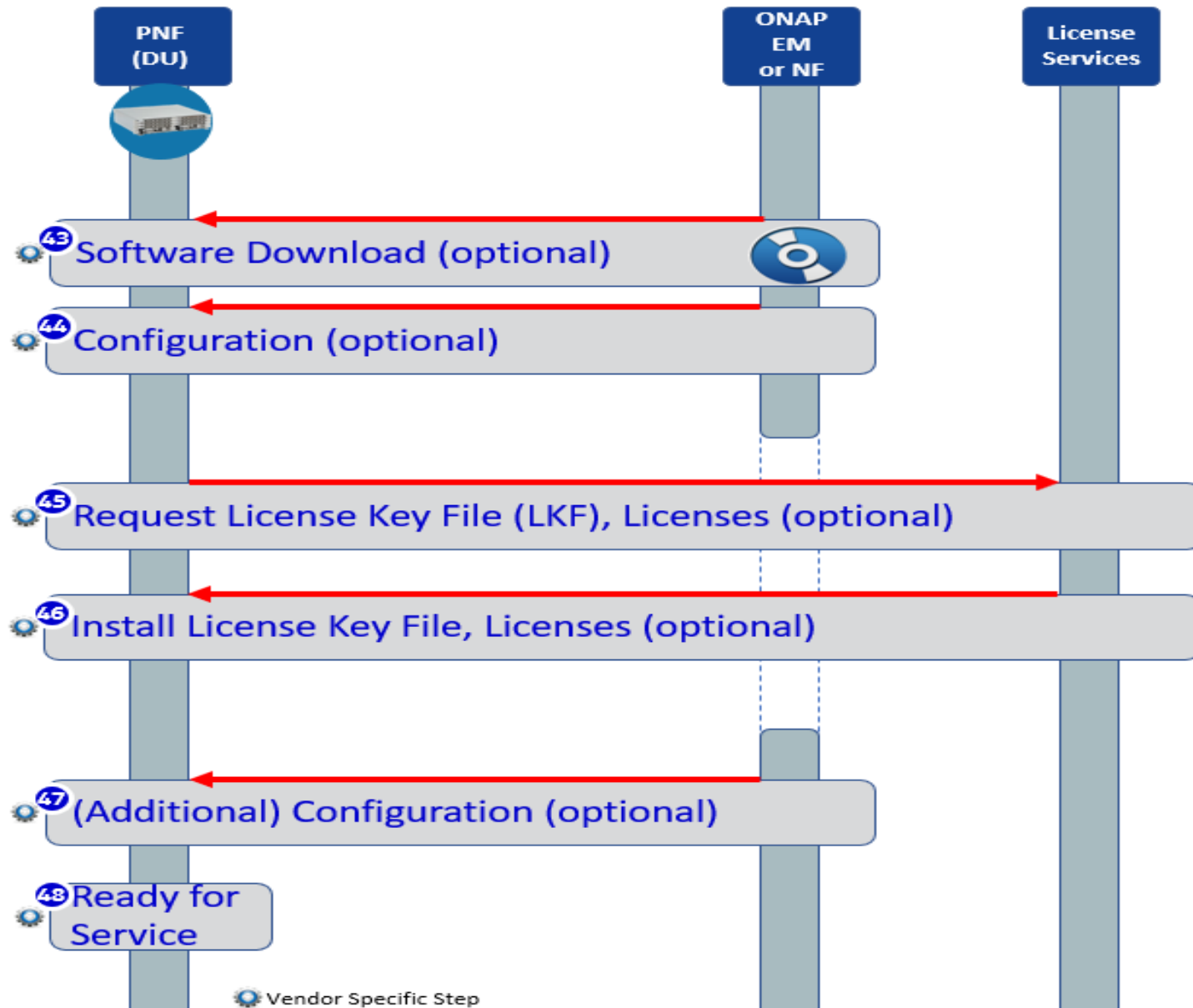
PNF PLUG AND PLAY for

NEW COMPONENT CAPABILITIES

NEW COMPONENT CAPABILITIES	DESCRIPTION
AAF / CMPv2 (Dependency)	(Dependent CMPv2 work) Security enrollment enhancements integration with DCAE. Code merging with OOM. Using CMPv2. R6 REQ-140 CMP client/server work done; Integration work (see later slides)
SO (Integration)	(Ericsson) Service configuration to PNF by controller (**Step 37**) NetConf. Impact to inventory (A&AI) BB based W/F connected to Configuration Steps to integrate & complete.
Licensing Management (Dependency)	(Dependency) Enhancements for requesting License Key File (LKF) & Licenses from License Service (message exchange) Flow still being defined by the Use Case team
AssignPNF BB – SO work	Done (Extended) PNF resource Model parameters
ControllerExecution BB – SO work	BB execution Framework, extended to understand PNFs. Preparing input object used for different BBs. Framework needs to take into PNFs. (Possible debug/work) (Testing & Integration Work). Environment where this is run Model parameters added, address the right CDS Blueprint.

PNF PLUG AND PLAY INTERFACES & APIs

Interfaces Impacts

Interfaces	IMPACT
AAF	(Dependency / Cross Interaction with CMPv2 work) – See CMPv2 Requirement
SO	(Integration work only) BB based W/F connected to Configuration Steps to integrate & complete.

APIs Impacts

API	IMPACT
SO	(Integration work) BB based W/F connected to Configuration Steps to integrate & complete.

PNF PLUG AND PLAY MODELING IMPACTS

Modeling Impacts

Model	IMPACT
(None)	(None)

PNF SOFTWARE UPGRADE

➢ Design time
- ➢ Updating the xNF resource template using vendor provided new onboarding package
- ➢ Updating and distributing the network service template with the updated resource template

➢ Run Time: executing a new service level workflow
- Upgrading a service instance and its resource instances based on the updated templates
- Updating the xNF schema (e.g. software version, artifacts) at xNF instance software upgrade completion
- Updating the network service schema at network service upgrade completion
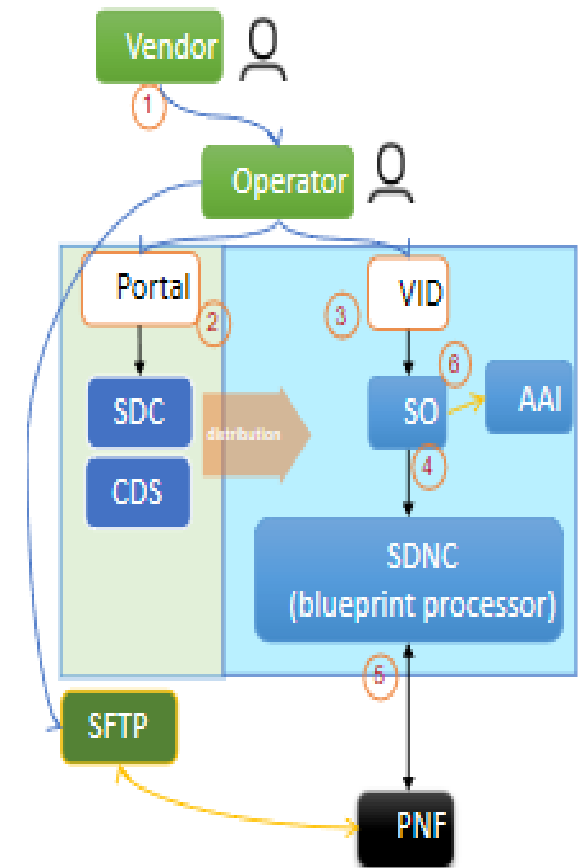
xNF S/W UPGRADE / with schema update

Support xNF Software Upgrade in association to schema update
A schema update in relation to a xNF software upgrades is a routine for network upgrade to support new xNF features, improve efficiency or increase xNF capacity on the field, and to eliminate bugs. This use case provides to ONAP an advantage in orchestrating and managing the Life Cycle of a Network Services in-line with business and service objectives
Key Contacts: Zu Qiang (Ericsson), Lukasz Rajewski (Orange), Ajay Mahimkar (AT&T), Chris Rapposelli-Manzo

Wiki

https://wiki.onap.org/pages/viewpage.action?pageId=81400388

CANDIDATE ENHANCEMENTS

CANDIDATE ENHANCEMENTS	IMPACT
SDC	Updating the xNF resource template from a vendor provided new onboarding package
SO	Introducing a new service level workflow • Upgrading a service instance and its resource instances based on the updated templates • Updating the xNF schema (e.g. software version, artifacts) at xNF instance software upgrade completion • Updating the network service schema at network service upgrade completion

CERTIFICATE MANAGEMENT PROTOCOL CMPv2

CERTIFICATE MANAGEMENT PROTOCOL (CMPv2)

Req Use Case - DESCRIPTION

The Certificate Management Protocol (CMP) is an Internet protocol used for obtaining X.509 digital certificates in a public key infrastructure (PKI). It is described in RFC 4210 and is one of two protocols so far to use the Certificate Request Message Format (CRMF), described in RFC 4211, with the other protocol being Certificate Management over CMS (CMC), described in RFC 5273. An obsolete version of CMP is described in RFC 2510, the respective CRMF version in RFC 2511. CMP messages are encoded in ASN.1, using the DER method and usually transported over HTTP. CMP (Certificate Management Protocol) Server & Client (completed in R6)

ARCHITECTURE REQUIREMENT IDENTITY – ROW 18

AR-0017-R7-052020 release - functional requirements proposed list#R7ONAPSECURITY-CMPv2SERVER/CLIENTINTEGRATION Benjamin Cheung, Pawel Baniewski, Hampus Tjäder xNF

BUSINESS DRIVERS

EXECUTIVE SUMMARY - This requirement improves ONAP Security with CMPv2. CMP is used by multiple operations including Plug and Play, and NetConf operation. In R6 CMPv2 Certificate Service and basic development was implemented. Integration with server & client to the certificate service will be completed. There are also two ONAP bordering clients to integrate with the certificate service with interfaces to (SDN-C = Done) and DCAE. DCAE interoperation with CMPv2. REQ-140

BUSINESS IMPACT - The enhancement to CMPv2 operation will improve security management within ONAP and affects multiple ONAP functions and use cases, including Plug and Play (PNF registration) and NetConf. As with all security functionality within ONAP, Security is a fundamental aspect of FCAPS, being the "S" for security management.

BUSINESS MARKETS - This project applies to any domain (wireless, transport, optical, and wireline) that ONAP may manage.
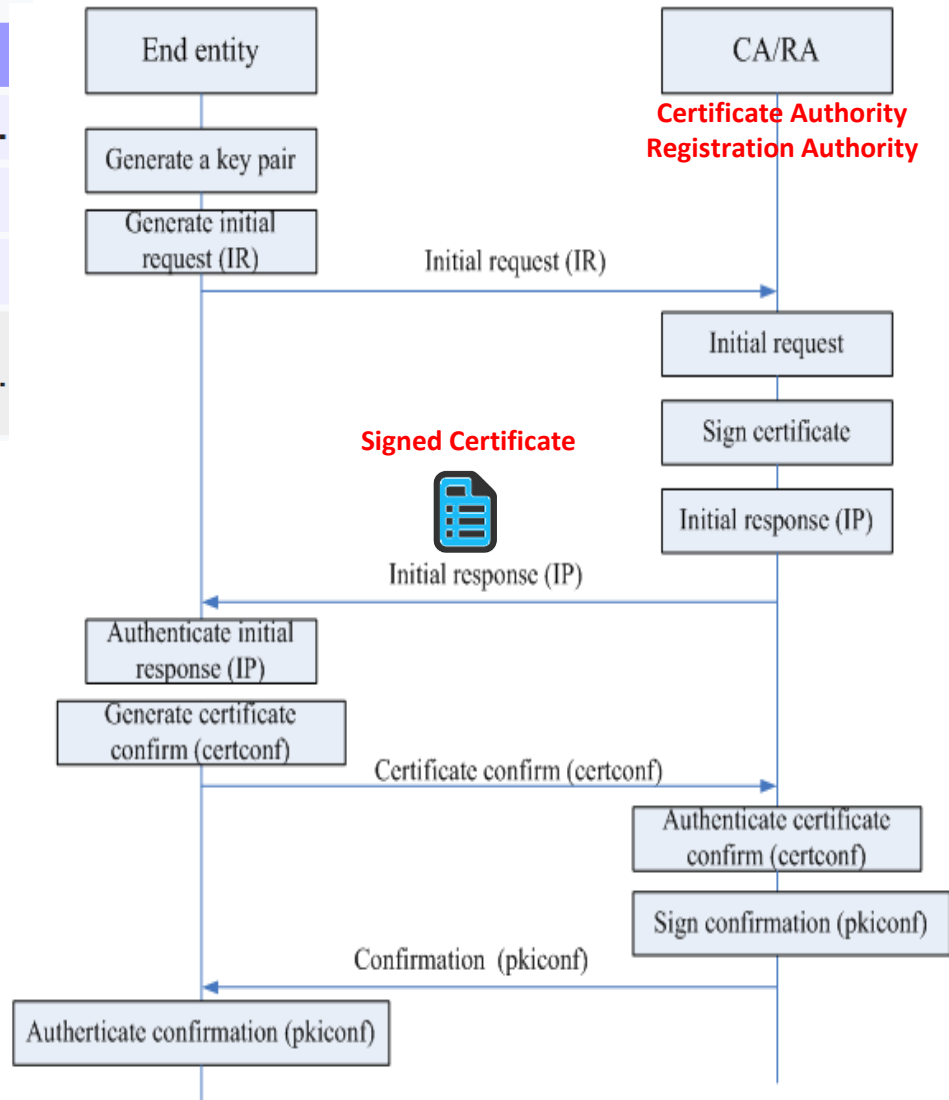
FUNDING/FINANCIAL IMPACTS - Potential OPEX savings with enhanced security to prevent breaches and prevent security compromises.

ORGANIZATION MGMT, SALES STRATEGIES - There is no additional organizational management or sales strategies for this use case outside of a service providers "normal" ONAP deployment and its attendant organizational resources from a service provider.

CERTIFICATE MANAGEMENT PROTOCOL (CMPv2)

CMP in the TCP/IP model:

application	CMP	CMP		
		HTTP	HTTPS	SMTP ...
transport	TCP			
Internet	IP (IPv4, IPv6)			
link	Ethernet	Token Bus	Token Ring	FDDI ...

End entity

Generate a key pair

Generate initial request (IR)

Initial request (IR)

CA/RA

Certificate Authority
Registration Authority

Initial request

Sign certificate

Signed Certificate

Initial response (IP)

Initial response (IP)

Authenticate initial response (IP)

Generate certificate confirm (certconf)

Certificate confirm (certconf)

Authenticate certificate confirm (certconf)

Sign confirmation (pkiconf)

Confirmation (pkiconf)

Authenticate confirmation (pkiconf)

CMP v2 for

NEW COMPONENT CAPABILITIES	IMPACT DESCRIPTION

DCAE CMP v2 enhancements	CMPv2 Client-Server was done is R6
	 (Nokia) Integration of bordering ONAP components – DCAE
	 Enhancements in certificate in CMPv2:
	     (a) **DCAE team requests output artifacts should be configurable** (P12, PEM)
	     (b) Certificate renewal (Best effort)
	
	 DCAE Micro-service onboarding & design (MOD) - Work Internal to DCAE. Component specifications modified to accommodate parameters to execute the client, with certificate details.
	 In DCAE changed deploying applications collectors, servers, analytics – understood by DCAE only, cloudify blueprint created and DMaaP configuration to deploy the service and connected w/ DMaaP topic. JSON/YAML internally to DCAE. Micro-service onboarding artifact. DCAE MOD. Cloudify Manager (Development)
	 Cloudify K8S plugin; blueprint generator (used by DCAE MOD)
	
	 Cert Service Client (Development).

CMP v2 integration/testing	(Ericsson) SDN-C Integration underway already in R6 (**may** have spill over in R7)

(left vertical label) NEW COMPONENT CAPABILITIES

INTENT BASED NETWORKING
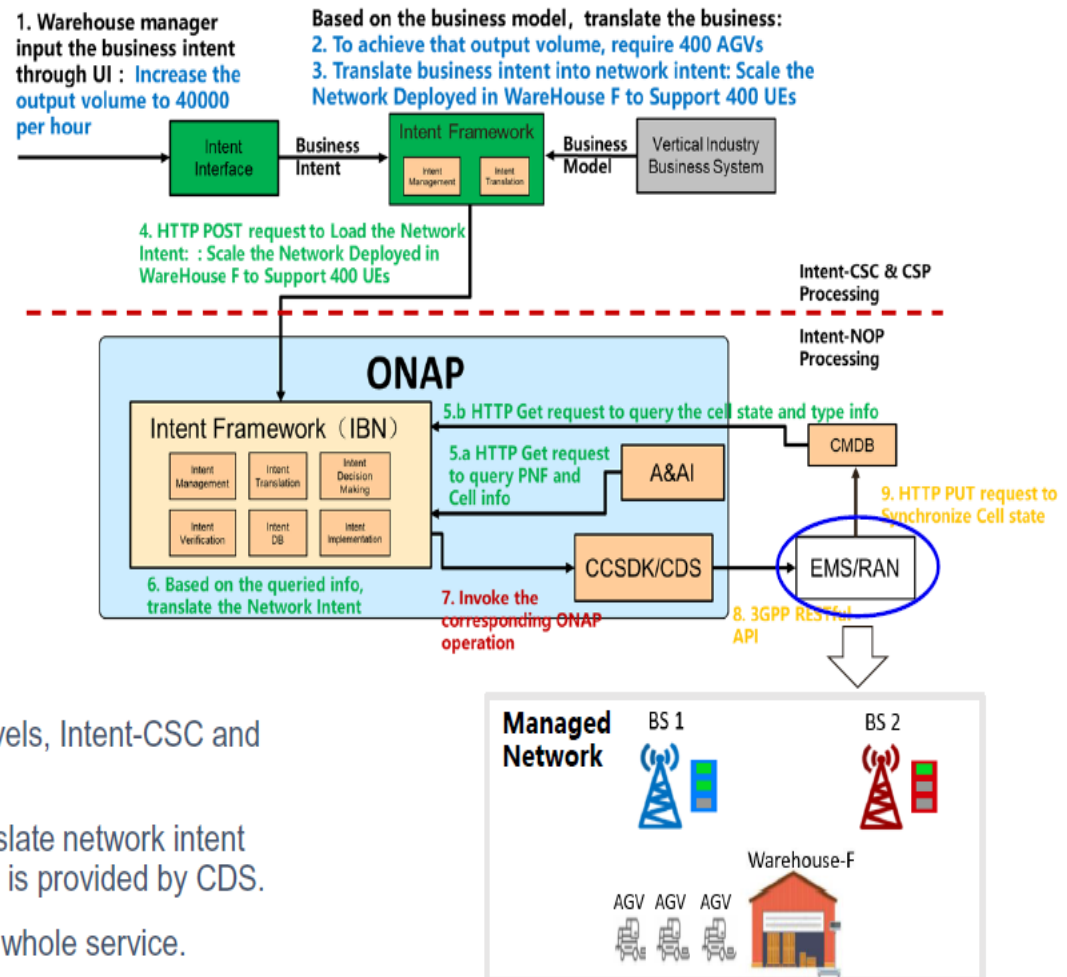
INTENT BASED NETWORKING

- Intent technology was first proposed into ONAP as a IBN POC in Guilin release.
- Guilin IBN PoC: A vertical industry use case (Smart Warehouse Management)

Assumptions/Pre-conditions:

1. Assisted business system provided business model, such as the capability of AGVs' output volume.

2. Network has been already deployed. Some network resources were configured. In this PoC, two base stations are deployed in Warehouse-F, and each base station had three cells. Two and one cell was activated there.

3. The capability of max UE connections of each cell was configured in CMDB.
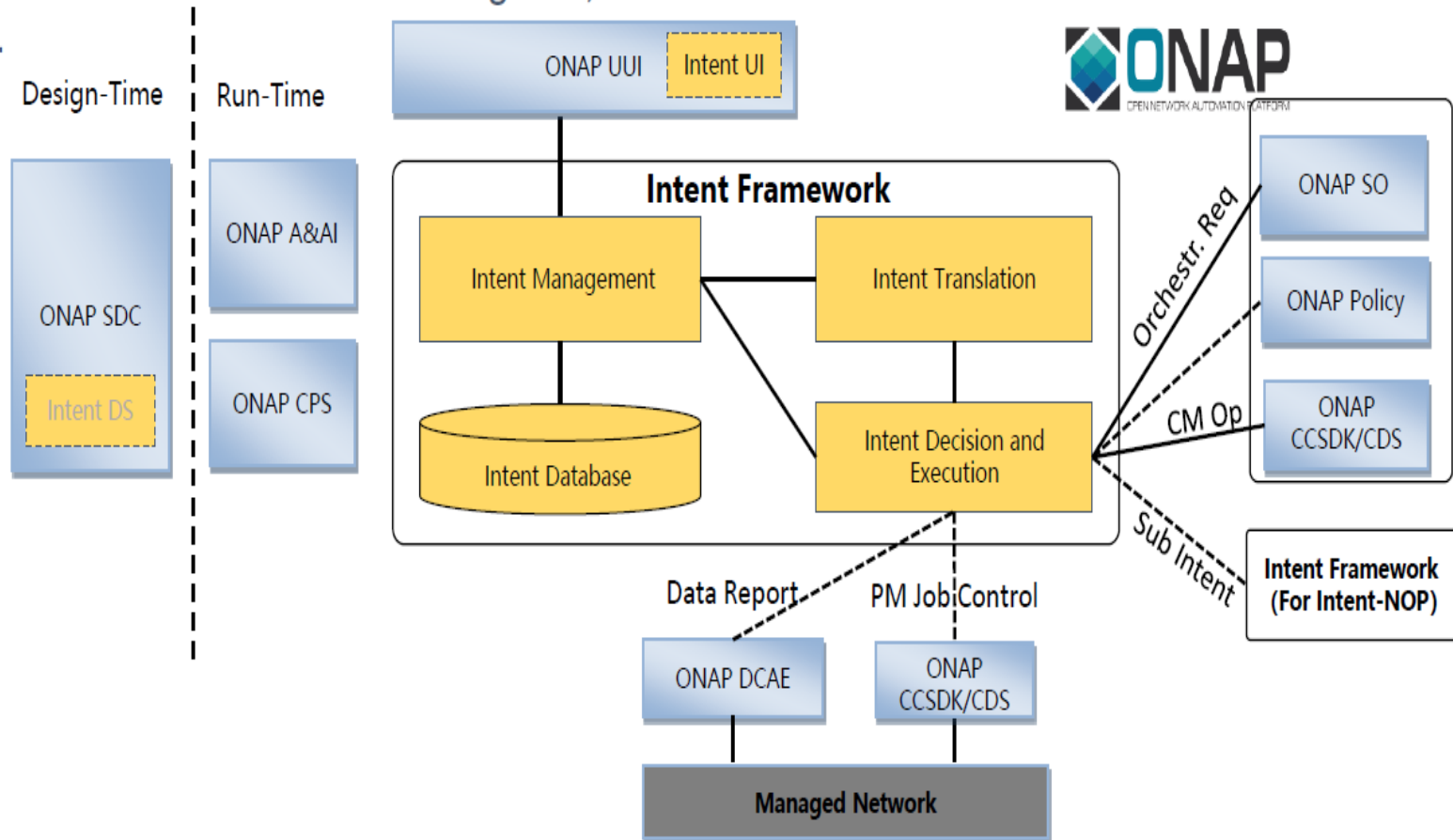
Guilin Intent PoC summary:

1. Framework can do intent management at different levels, Intent-CSC and Intent-CSP level.

2. During Intent-CSP processing, Intent framework translate network intent into the configuration management operations, which is provided by CDS.

3. Intent framework was a standalone component as a whole service.

- Intent framework is a system that helps to implement and operate networks that can improve network availability and agility.

- It takes a high-level business goal (intent) as input, converts it to the necessary network configurations and applies the network changes via network automation and/or network orchestration. Continuously monitoring the status of the network under control, the system validates in real time that the intent is being met, and can take corrective actions when desired intent is not met.

INTENT BASED NETWORKING

Intent Framework

| Intent Management | Intent Database | Intent Translation | Intent Decision and Execution |

ONAP UUI (Intent UI) | SO | AAI | Policy/OOF | CCSDK/CDS | Assisted System (Ext NSSMF/EM)

Intent: Allocate a network to satisfy the network consumer's intent

```
Ref: 3GPP TR 28.812
{
    "actionName": "NetworkProvisioning",
    "actionProperties":{
        "priority": 0,
        "type": "autoDeployment",
    }
    "objectName": "Area",
    "objectProperties":{
        "areaName": "Beijing ;X;X",
        "serviceProfile": {
            "maxUENumber": 1000,
            "ueDLThroughput": 200
        }
    }
}
```

1. Implement intent: POST /intents

2. Call intent translation

3. Lexical and grammatical analysis

4. Query intent knowledge

- Actions for Intent: enum(Create slice service, Instantiate service)
- Intent contexts: pnf id list, plmn id list, etc.

5. Call intent execution

6. (Opt) Query decision policy info

7. Make a decision

8a. If using network slice, send create slice service request
Create Slice: *POST /onap/so/infra/serviceInstantiation/v7/serviceInstances*, requestInputs={maxNumberUEs,dlThptPerUe,pLMNIdList}
Create slice response

8b. If not, send service instantiation request
Service instantiation (xNF Inst): *POST /onap/so/infra/serviceInstantiation/v7/serviceInstances*, requestInputs={nf-name}

or

8c. Notification (Failure: xNF Resource cannot satisfy or slice creation failure)

10. Notification (intent id, Intent execution complete)

9. (Optional) Query slice(NSI) info (creation/instantiation complete or not)

11. Query intent: GET /intents? Id={intent id}

12. Query DB

13. Intent instance info (id, state, cur operation)

Note: The MnS producer translates the intent from the MnS consumer to network deployment related requirements (e.g. using network slice or not, network topologies, etc.) and configurations.
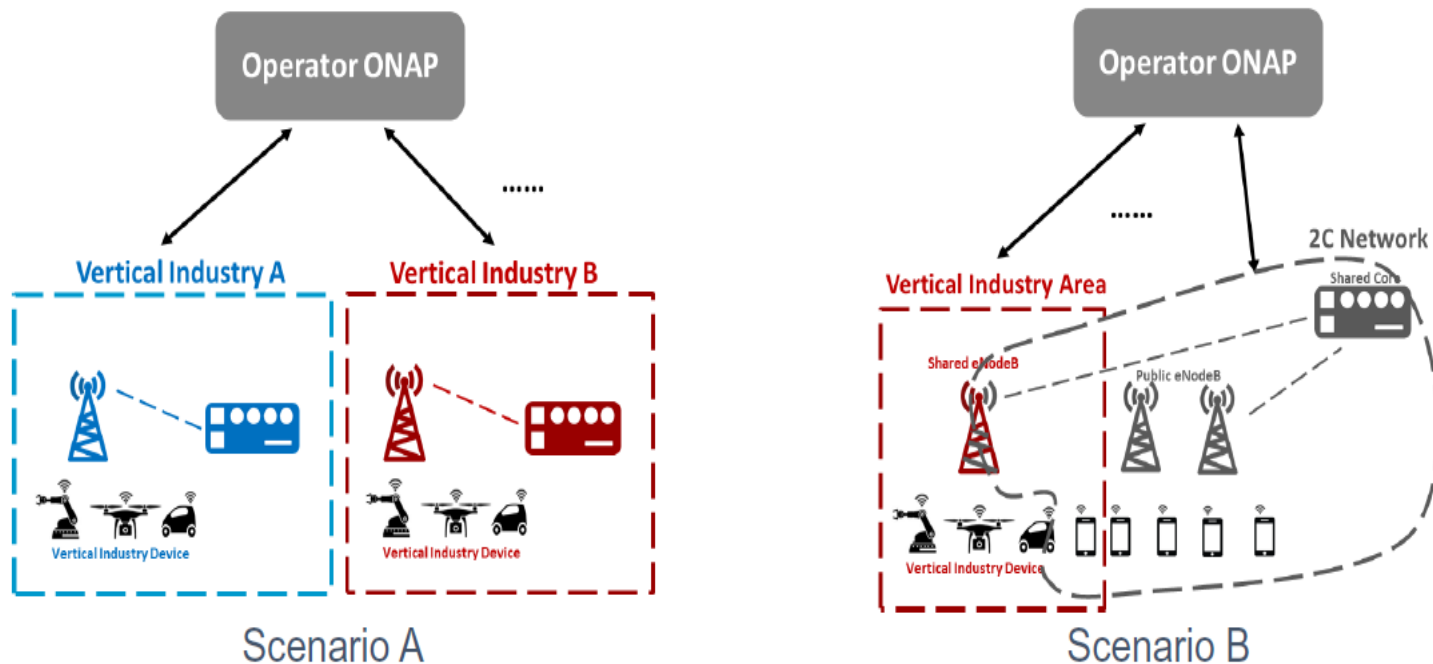
VERTICAL INDUSTRY SUPPORT

Wiki

https://wiki.onap.org/display/DW/Support+for+Vertical+Industry

- ONAP supporting for vertical industry has two typical scenarios:

  - Scenario A: One centralized operator ONAP only manages multiple vertical industry networks. Some medium/large-sized verticals may want operator to help them build separate vertical industry networks. Operator ONAP provides centralized O&M capabilities.

  - Scenario B: One centralized operator ONAP manages both vertical industry networks and traditional mobile networks. Some small/medium-sized verticals may rely on operators to deploy necessary network devices in their vertical area and share some network resource with operator network (2C Network). Operator ONAP needs capabilities to manage shared resources and provide O&M services for both.

Support for vertical industry scenario A in R8
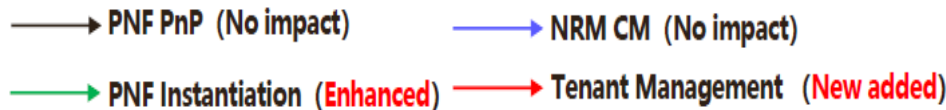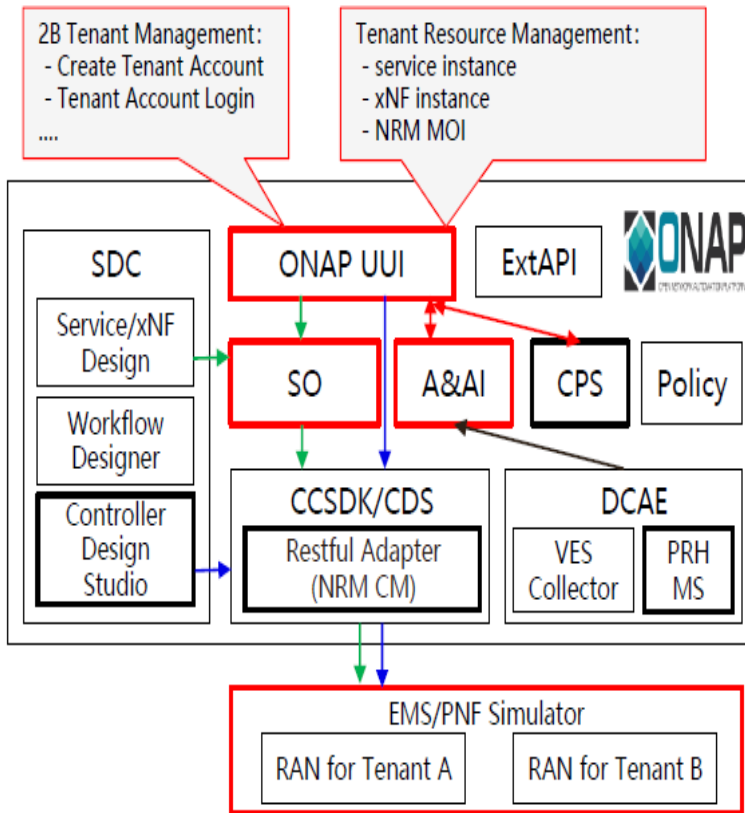
Pre-conditions:

- Create two tenant accounts for vertical industry A and vertical industry B.
- Design and publish Service/PNF/Workflow for vertical industry tenants.
- Design and publish corresponding CDS Blueprint.

Steps:

1. Two vertical industry tenants query the current resource instance separately (None).

2. Operator activate and complete PNF PnP/Instantiation for vertical industry tenant A. During the process, PNF1 will be associated to the tenant account of vertical industry A based on location info automatically.

3. Vertical industry tenant A query the current service/PNF instance (pnf-1).

4. Operator activate and complete PNF PnP/Instantiation for vertical industry tenant B. During the process, PNF2 will be associated to the tenant account of vertical industry B based on location info automatically.

5. Vertical industry tenant B query the current service/PNF instance (pnf-2).

6. Operator implement the NRM configuration for PNF1 and PNF2 (e.g. gNB Function & NRCell).

7. Vertical industry tenant A query the current gNB & Cell MOI info (gNB & Cell MOI info in pnf-1).

8. Vertical industry tenant B query the current gNB & Cell MOI info (gNB & Cell MOI info in pnf-2).