

## 5G Use Cases for R6 Frankfurt



- 5G Use Case Subcommittee
- ONAP Joint Subcommittee Face to Face (Sept 26-27, 2019) Antwerp

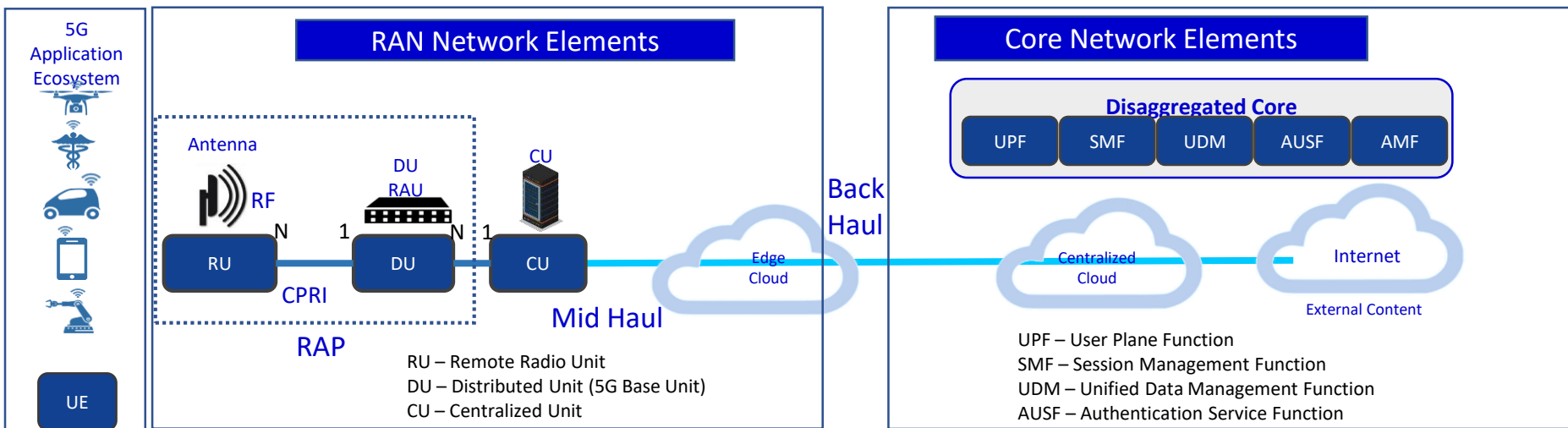
Benjamin Cheung, Vimal Begwani, and 5G Use Case Sub-committee

Sept 05, 2019 version 3

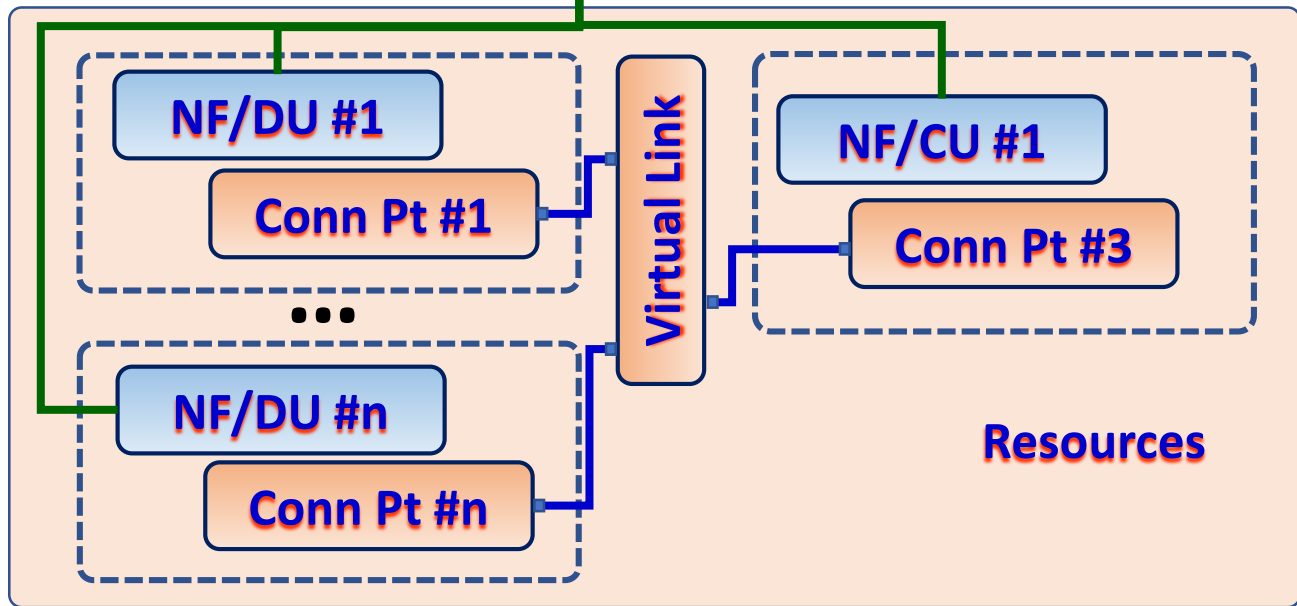
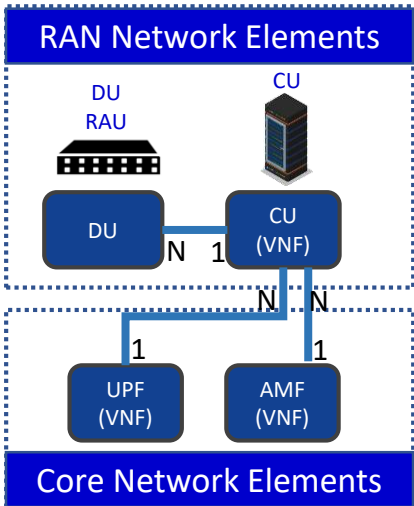
# R6 Frankfurt 5G USE CASE & PNF U/Cs SUMMARY

5G USE CASE	DESCRIPTION	Req vs U/C	5G Specific
<b>BULK PM</b>	Performance Measurements for 5G RAN Bulk Upload.	Requirements	General
<b>FM META DATA &amp; PM DICTIONARY</b>	Support for handling 5G FM Meta Data & support for PM Dictionary & PM Schema	Requirements	General
<b>OOF - SON (5G)</b>	Optimization and SON functions for 5G RAN. Self-optimization, Self-Healing, Self-configuration	Requirements	5G
<b>NETWORK SLICING (5G Use Case)</b>	Network Slicing defines Slices for 5G RAN systems. Network Slicing is a long-lead (multi-release) development.	E2E Use Case	5G
<b>5G SERVICE MODELING &amp; DEFINITION (5G)</b>	Defining and modeling a 5G Service (in Design Time) and associated Modeling (Platform Info & Data Model)	Requirements	5G
<b>RunTime DB (Data Persistency)</b>	A RunTime Database to handle data persistency needed by use cases and other run-time components. Storing LCM, OSS, Operational and configuration information.	Requirements	General
<b>Licensing Management</b>	Introduction of Licensing Management driven from MANO ETSI IFA034. Modeling and architecture work to lay the foundation for ONAP & Licensing handling	Requirements	General
<b>ORAN (3GPP) &amp; ONAP Harmonization</b>	Harmonizing ORAN (3GPP) O1/A1 interfaces with ONAP operation	Requirements	5G
<b>5G NRM (CM)</b>	5G Network Resource Model introducing Configuration Management (CM Notify/ Update) using RESTful (HTTPS) Interface (instead of NetConf).	Requirements	5G

# 5G SERVICE CREATION & MODELING in R6 Frankfurt



## 5G SERVICE



# 5G SERVICE CREATION & MODELING in R6 Frankfurt

This Use Case will introduce support for 5G Service creation and modeling

<https://wiki.onap.org/pages/viewpage.action?pageId=60888132>

R6 CANDIDATE ENHANCEMENTS	IMPACT
Modelling S/C	Evolution of Platform Info & Data model in support of 5G Service ETSI, 3GPP standards for modeling a service (might need alignment) Platform data/information model. A&AI schema (usable)
SDC	Support for creation of a 5G Service (E2E integration only)
Architecture	New Flows for 5G Services

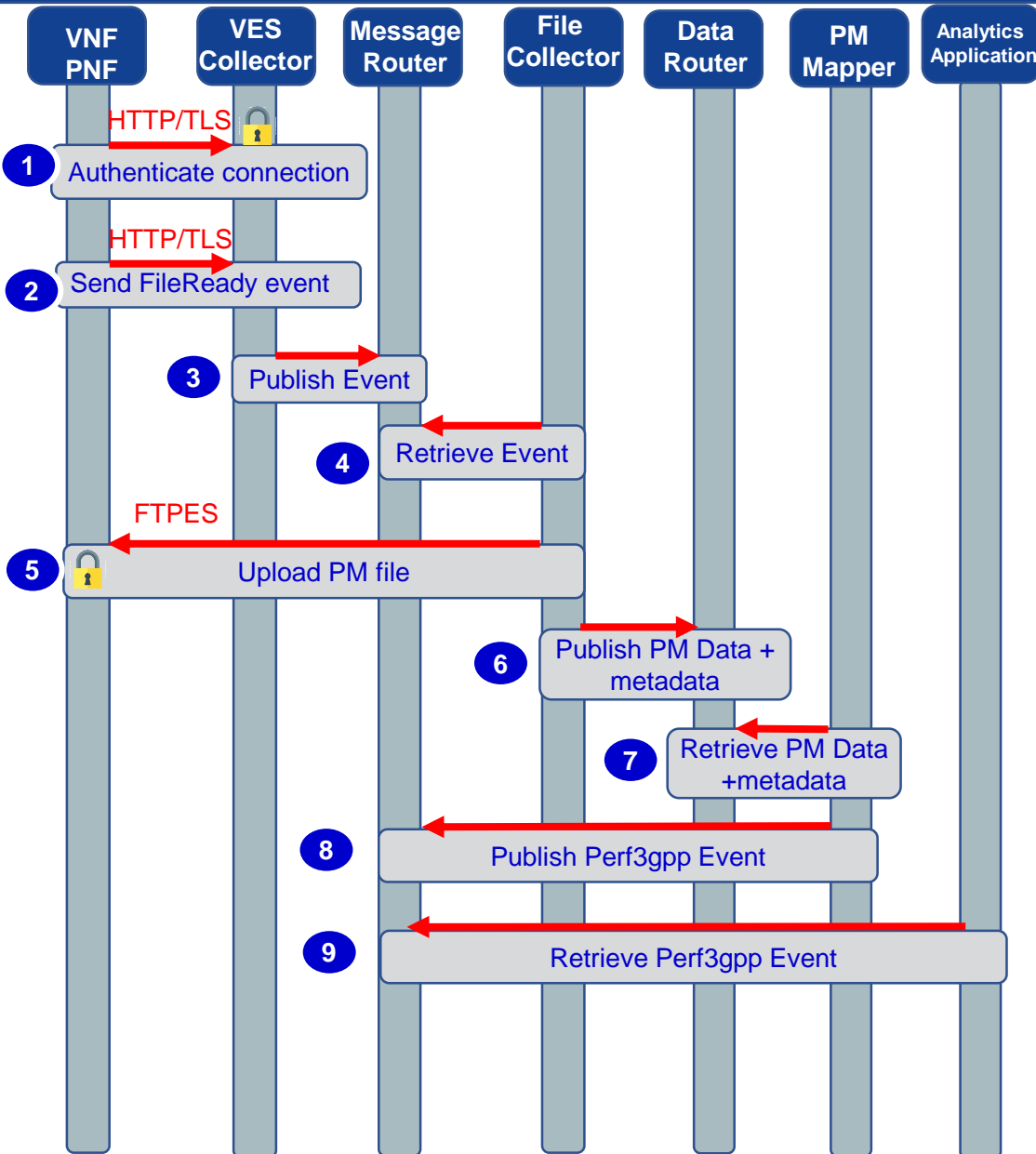
U/C DESCRIPTION

Wiki

R6 Frankfurt CANDIDATE ENHANCEMENTS

# Bulk PM (Perf3gpp Event Generation)

## Bulk PM File Upload and Perf3gpp Event Generation



## Bulk PM File Upload and Performance Event Generation

- 1 Network Function (NF) establishes a HTTP/TLS connection to the DCAE VES Collector.
- 2 NF sends FileReady notification Event to DCAE VES Collector. Event is encoded in JSON and sent via HTTP/TLS. HTTP/TLS connection is set up and torn down every time a FileReady notification event is sent.
- 3 DCAE VES Collector publishes the event to on DMaaP Message Router (MR).
- 4 DCAE File Collector retrieves the FileReady notification event from DMaaP MR.
- 5 File Collector uploads PM File from NF using a secure file transfer protocol; FTPES supported in Casablanca. NF authenticates the connection.
- 6 File Collector publishes PM Data to DMaaP Data Router (DR).
- 7 PM Mapper retrieves PM Data from DR and generates Perf3gpp events as configured by PM Mapper File.
- 8 PM Mapper publishes Perf3gpp events to MR.
- 9 Analytics Applications (AA) retrieve the Perf3gpp events of interest from MR. AA analyze the data to produce statistics and KPIs and optimization recommendations.

# Bulk PM for R6 Frankfurt

Support the following work items for Bulk PM for 5G xNFs:

1. UC1: Perf3gpp event creation by 3GPP PM Mapper from Bulk PM XML file
2. UC2: Closed Loop support using 3GPP PM data (stretch goal)
3. Additional Requirements: DFC robustness enhancements, DMaaP DR enhancements
4. Expand to include control plane performance data

<https://wiki.onap.org/pages/viewpage.action?pageId=40206494>

R6 CANDIDATE ENHANCEMENTS	DESCRIPTION
A&AI	Generate events for xNF instantiation and removal
CLAMP	CLAMP support for PNF control loops, CDS actor, Configuration policy.
DCAE	Addition of new PMSH Micro-service Updates to PM Mapper Micro-service
SDC	Ensure SDC support of policy types for PM control
Integration	E2E Test Case for New / Updates XNF simulation

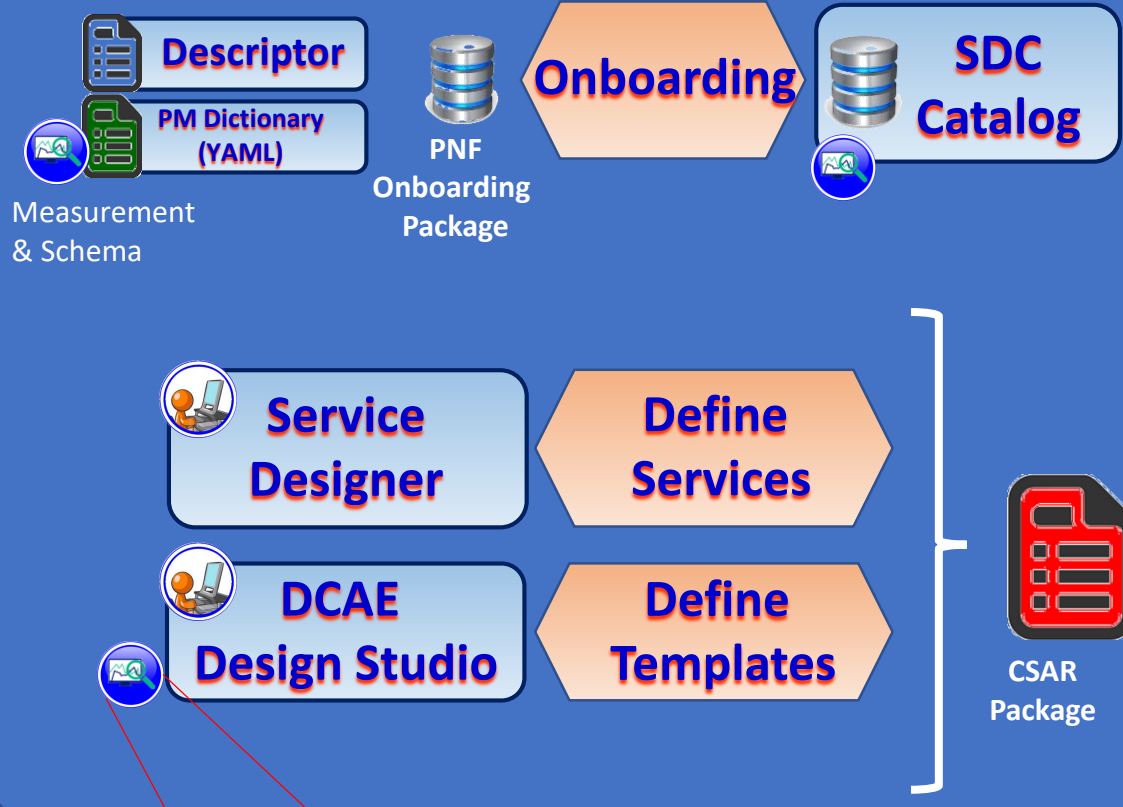
U/C DESCRIPTION

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R6 Frankfurt CANDIDATE ENHANCEMENTS

# PM DICTIONARY in R6 Frankfurt

## DESIGN-TIME (SDC)



El Alto (R5) Goal is to enhance the GUI and possibly show in other design time GUIs (e.g. Policy Designer, CLAMP, DCAE DS).

# PM DICTIONARY in R6 Frankfurt

Support the following work items for PM Dictionary for 5G xNFs:

1. Review and finalize VES Event Listener Specification v7.1 and VES Event Registration Specification v3.2 which contains the PM Dictionary format and content.
2. Onboard the PM Dictionary for an xNF as a PM Dictionary YAML file. Note: Onboarding of the PM Dictionary artifact is covered under the PNF Onboarding Use Case.
3. Display the PM Dictionary in a GUI to allow an ONAP User to create PM Mapper configuration files for Perf3gpp event generation.
4. Update VNF Requirements for PM Dictionary artifact.

<https://wiki.onap.org/pages/viewpage.action?pageId=40206485>

## R6 CANDIDATE ENHANCEMENTS

## IMPACT

VES Specifications

3GPP effort to align PM/FM with ONAP. Possible modification based on 3GPP outcome. Study done in 2019. Changes to make ONAP aligned. PM Measurements each with their own Yaml definition file. [File Ready VES event](#) may be updated.

GUI display of PM dictionary

Display the PM Dictionary in a GUI (either DCAE-DS or SDC-DS GUI) to allow an ONAP User to create PM Mapper configuration files for Perf3gpp event generation. PM Measurements each with their own Yaml definition file.

Extensions of the GUI to other Design time platforms

GUI (either DCAE-DS, Policy GUI and/or SDC GUI) to allow an ONAP User to create Policies for handling alarms

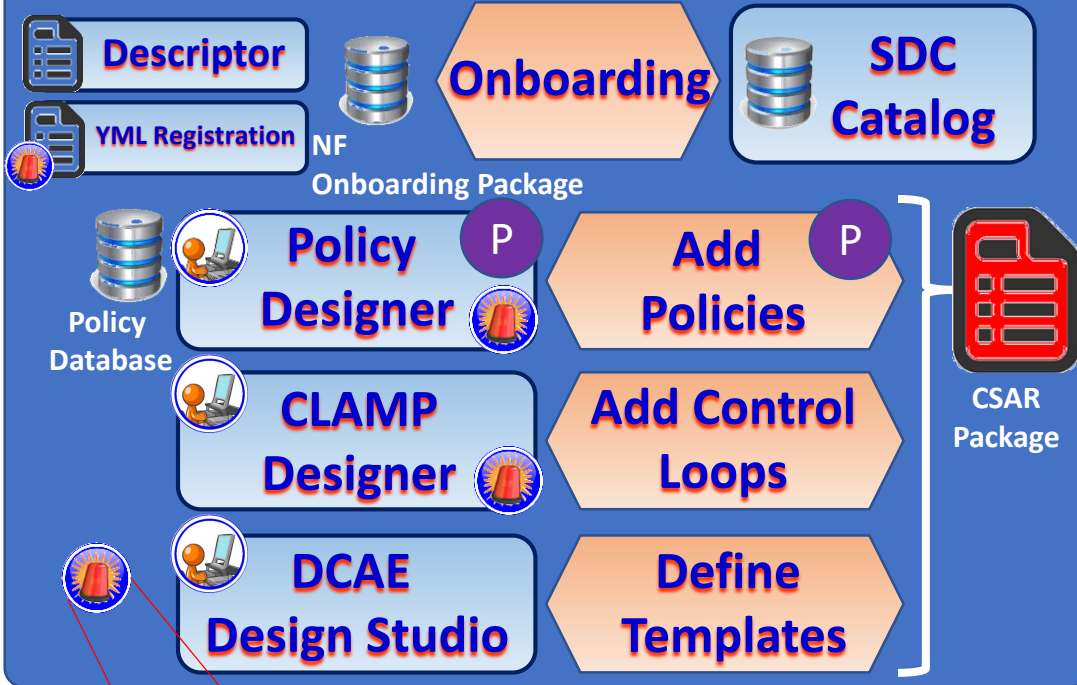
GUI Display functions (Search etc.)

Some basic (or more advanced) “functions” that a user can invoke, such as searching on fields or displaying filtered rows.



# FM META DATA in R6 Frankfurt

## DESIGN-TIME (SDC)



El Alto (R5) Goal is to enhance the GUI and possibly show in other design time GUIs (e.g. Policy Designer, CLAMP, DCAE DS).

# FM META DATA in R6 Frankfurt

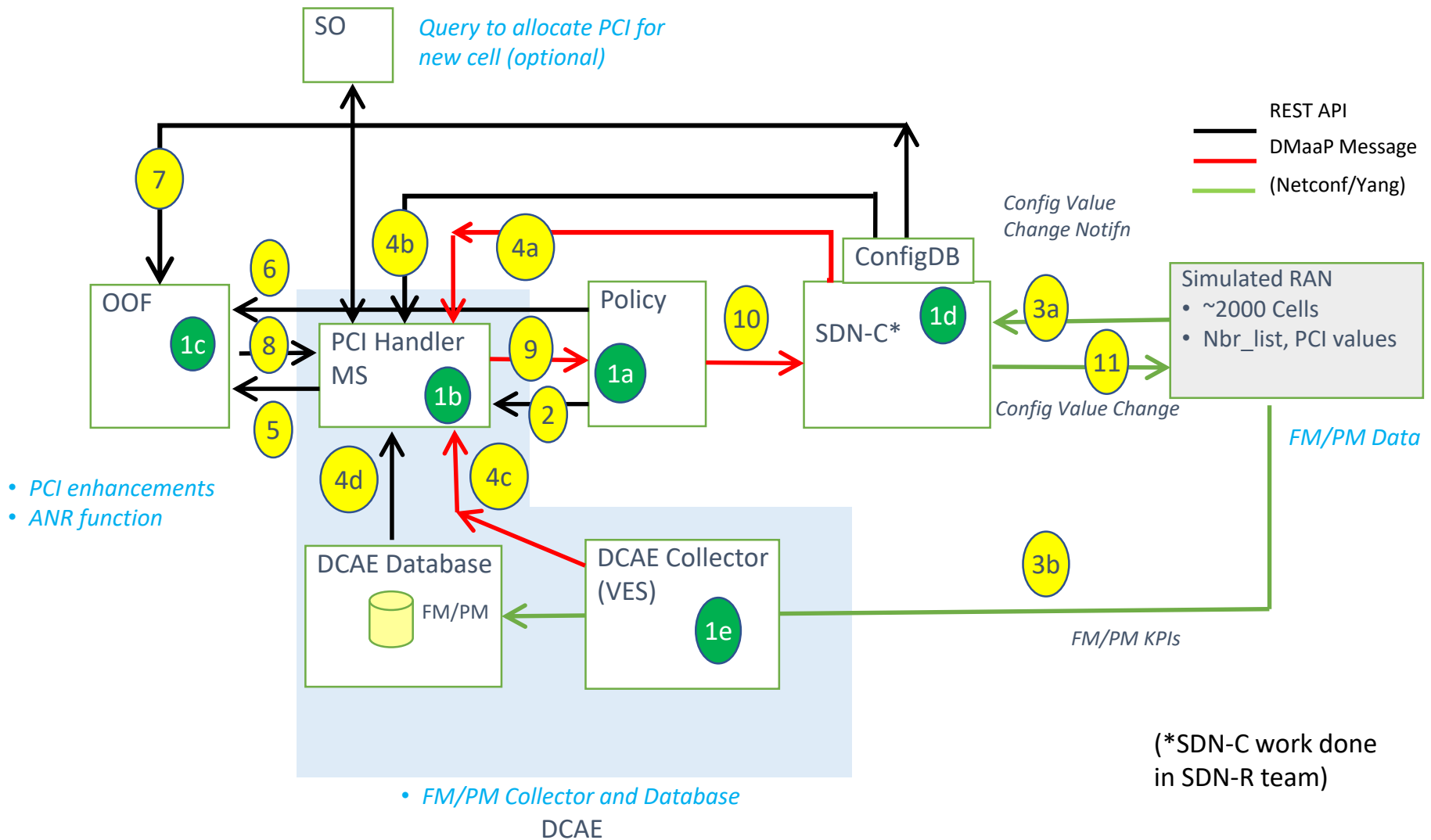
Support the following work items for FM Meta Data for 5G xNFs:

1. Review and finalize VES Event Listener Specification v7.1 and VES Event Registration Specification v3.2 which contains the FM metadata format and content.
2. Onboard the FM metadata for an xNF as part of the VES Event Registration YAML file. Note: Processing of the FM meta data is covered the PNF Pre-onboarding & onboarding Use Case
3. Display the FM metadata in a GUI to allow an ONAP User to create Policies for handling alarms.
4. Update VNF Requirements for FM metadata artifact.

<https://wiki.onap.org/pages/viewpage.action?pageId=40206485>

R6 CANDIDATE ENHANCEMENTS	IMPACT
VES Specifications	3GPP effort to align VES and 3GPP fault message. Additional fields defined. Updates to VES specification and would require updates & review. Creating a new <u><i>Fault3GPP VES Event</i></u> . DCAE Collector impact.
GUI Display of FM Meta Data Enhancements	Enhancements to Display the FM Meta data in a GUI. Column-by-field display (where the informational FM meta data fields are each on their own column). NOTE: New Fault3GPP Event may obviate need for changes to GUI. Possibly deferred to R7 Guilin
Extensions of the GUI to other Design time platforms	GUI (either DCAE-DS, Policy GUI and/or SDC GUI) to allow an ONAP User to create Policies for handling alarms
GUI Display functions (Search etc.)	Some basic (or more advanced) “functions” that a user can invoke, such as searching on fields or displaying filtered rows.

# OOF & SON in R6 Frankfurt



# OOF & SON in R6 Frankfurt

## Carry-over Items From Dublin:

Control Loop Co-ordination, New cell addition

## Enhancements:

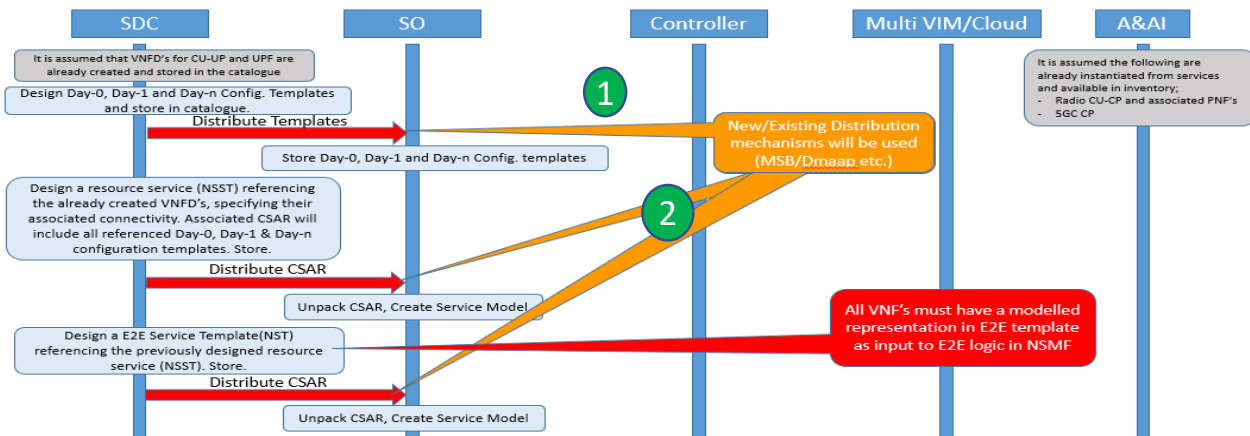
- 1) Include other ONAP modules, readiness for deployment
  - 1) PCI for new cell addition
  - 2) SDC – Service creation, CLAMP – Control Loop Deployment
- 2) Configuration Management with SDN-R
  - 1) Enhance yang model to align with O-RAN and 3GPP models
- 3) SON Functionality – enhance PCI, ANR, and add SON function
- 4) RAN Simulator – enhance and include in ONAP codebase

<https://wiki.onap.org/display/DW/OOF-PCI+Use+Case+-+Dublin+Release>

R6 CANDIDATE ENHANCEMENTS	IMPACT
OOF	Dynamic and static optimization, DMaaP interface
SDN-R	Enhance Yang model to align with 3GPP and O-RAN Configuration/Operational Database, Config History (e.g. to revert changes) RAN Simulator – enhance and include in ONAP codebase*
DCAE	Functionality enhancement to SON Handler MS
POLICY	Enhance the Policy functionality for Control Loop Coordination
AAI	Models & relationship between Config, Operational DB & AAI
SDC	SON service creation
CLAMP	Control Loop Deployment

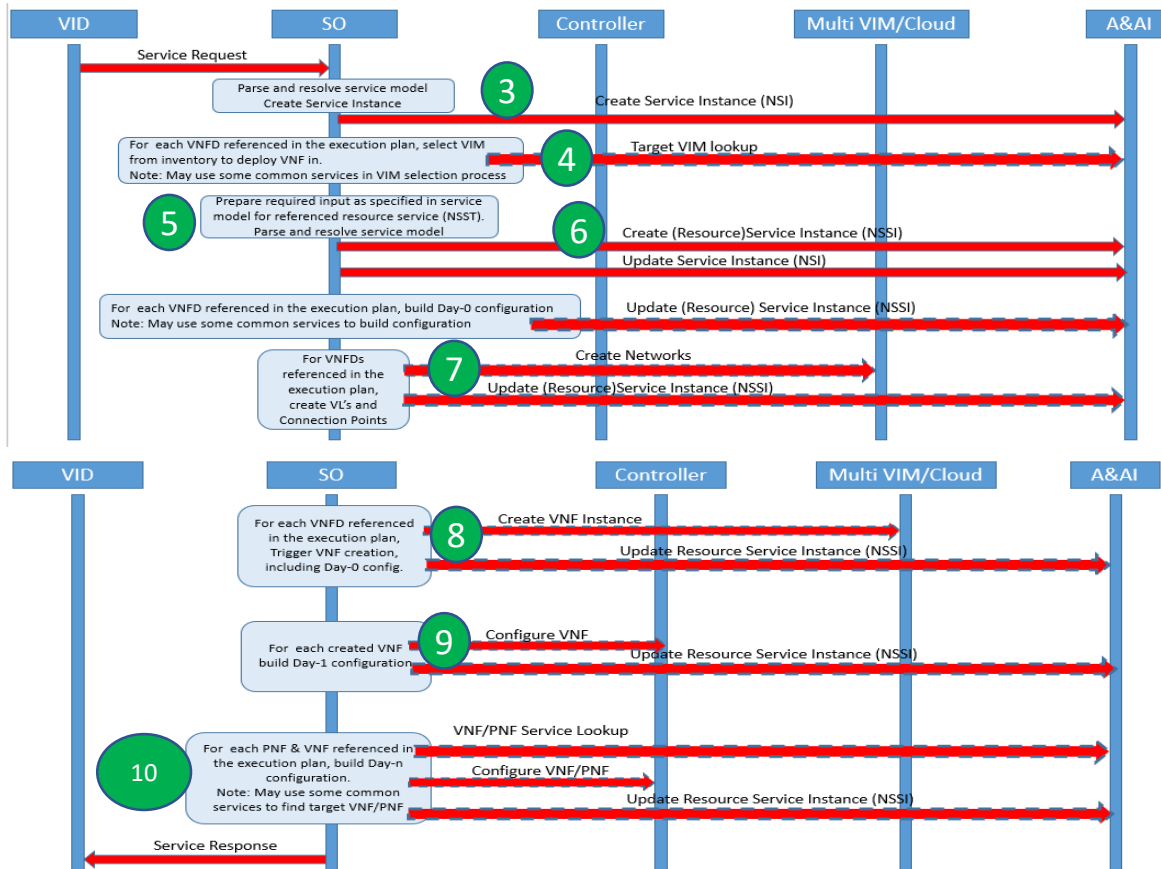
\* Need guidance re. location of RAN Simulator code. ONAP community can enhance and use as test resource)

# NETWORK SLICING in R6 Frankfurt



## Design Time

1. Configuration templates are designed and distributed.
2. Service templates are designed and distributed



## Run Time

3. Create E2E service instance
4. Determine VNF placement
5. Build required input for lower level service
6. Create resource service instance
7. Create networks
8. Instantiate VNF(s), applying Day-0 configuration
9. Configure instantiate VNF(s) with Day-1 configuration
10. Configure dependent PNF(s) &/ VNF(s) with Day-1 configuration

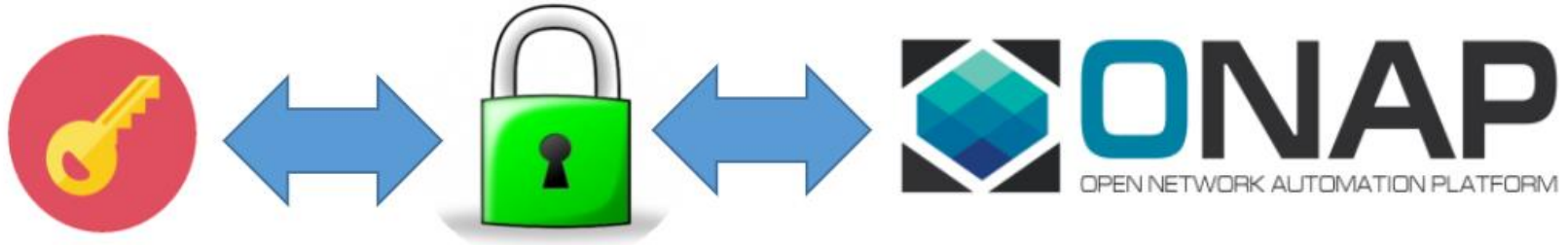
# NETWORK SLICING in R6 Frankfurt

..Based on identified Use Cases for NW Slicing in Dublin Release.  
First proposal outlines the scope of the identified use cases with ambition levels for each.  
[Use Case Scope and Ambition Levels](#)  
Following proposal focuses on flows for Use case 1, Ambition level 1.  
[Use Case 1 Ambition level 1](#)

<https://wiki.onap.org/pages/viewpage.action?pageId=38119661>

R6 CANDIDATE ENHANCEMENTS	DESCRIPTION
SDC	<ul style="list-style-type: none"><li>• Support the design and distribution of configuration templates</li><li>• Support the design of nested service templates (see <u><a href="#">ONAP Network Slice Modelling</a></u>)</li><li>• Support the distribution of service templates</li></ul>
SO	<ul style="list-style-type: none"><li>• Support orchestration of nested service templates</li><li>• Support integration with common functions for VNF placement decisions</li><li>• Support parameterization of configuration templates</li></ul>
A&AI	<ul style="list-style-type: none"><li>• Evolve model to support NW Slicing aspects</li></ul>
Controllers	<ul style="list-style-type: none"><li>• Support VNF Day-1 configuration</li><li>• Support VNF&amp;PNF Day-n configuration</li></ul>
VID	<ul style="list-style-type: none"><li>• Provide view of all available templates</li><li>• Provide means to trigger and monitor service instance creation and deletion</li><li>• Provide view of service instances and their dependencies</li></ul>
PoC	Network Slicing PoC to demonstrate something related to NS

# LICENSING MANAGEMENT in R6 Frankfurt



# LICENSING MANAGEMENT in R6 Frankfurt

## New Use Case

- 1) Start from 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. The use cases to start with include xNF onboarding, PNF introduction/ONAP PnP, VNF instantiation. Based on agreed use cases review relevant ONAP xNF requirements. No impacts to ONAP components foreseen in R6 Frankfurt, potentially minor update of ONAP architecture.

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

## R6 CANDIDATE ENHANCEMENTS

## IMPACT

Modeling

Modeling work to integrate changes already introduced from the modeling s/c for licensing with MANO ETSI IFA034 and architecture work from this use case

Architecture

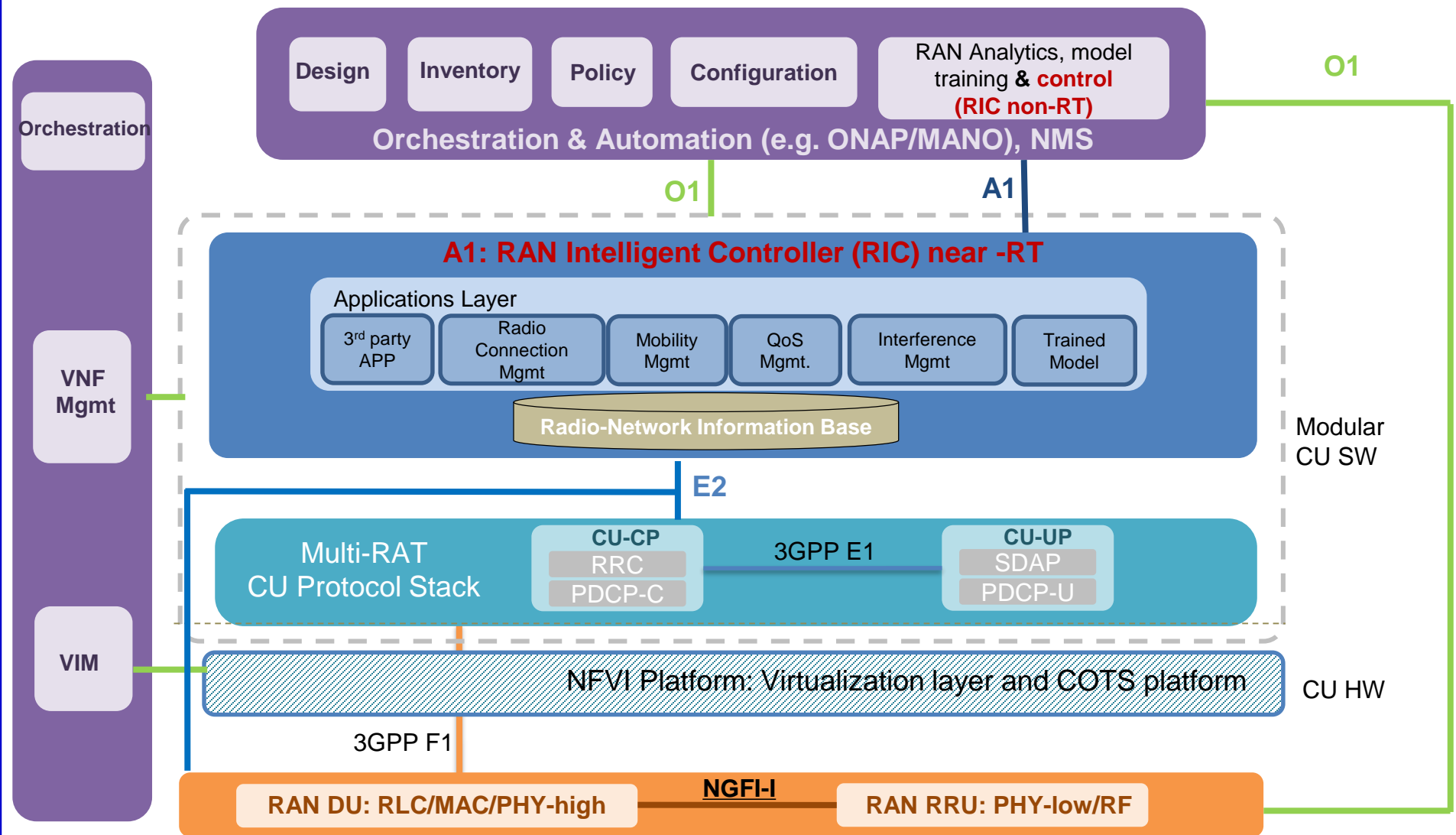
Define an architecture that supports simple or complex, vendor specific Commercial Licensing Models and Use Cases. Investigation of MANO ETSI IFA034 standards with what should be adopted by ONAP. Define the license management principles wrt the key UCs: xNF onboarding, PNF introduction / ONAP PnP, VNF instantiation

VNF-RQTS

Define appropriate new requirements in the VNF-Reqs project related to the new licensing management architecture



# MOBILITY STANDARDS HARMONIZATION in R6 Frankfurt



# MOBILITY STANDARDS HARMONIZATION in R6 Frankfurt

## New Use Case

Goal of this sub-project is to evolve and enhance ONAP Configuration Management and Fault & performance data collection to meet O-RAN specifications. O-RAN has defined two broad interface specifications for management 5G RAN elements (RU, DU, CU-UP, CU-CP, RAN Intelligent Controller [RIC]) called O1 and A1 interface. ONAP currently support O1 interface, but small enhancements might to required to fully comply with O-RAN specifications. A1 interface is between management framework (e.g. ONAP) and RAN Intelligent Controller (RIC). A1 provide intent based policies to RIC to optimize and manage RAN network performance.

<https://wiki.onap.org/display/DW/MOBILITY+STANDARDS+HARMONIZATION+WITH+ONAP>

## R6 CANDIDATE ENHANCEMENTS

## IMPACT

Provisioning Management

Three New CM VES notifications notifyMOICreation, notifyMOIDeletion, notifyMOIAttributeValueChange.

Fault Supervision

Align existing VES fault event or create new VES fault3gpp event to support harmonization work in TS 28.532.

Performance Assurance / File Management

Modify the changelIdentifier field name of the fileReady event to filetype indicating the type of file that is ready for upload

PNF Registration

ONAP modifications to support the addressing of MEs behind a NAT

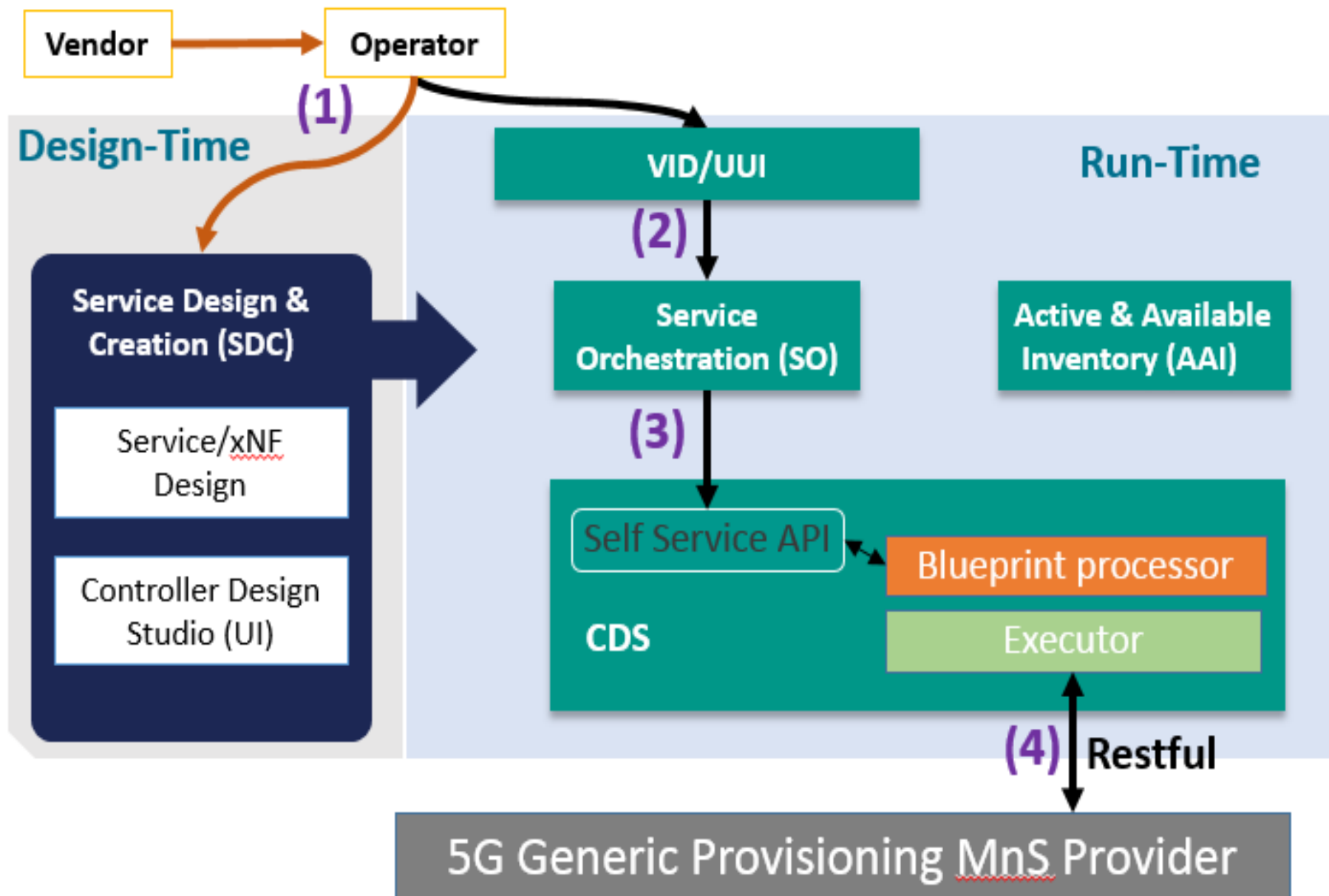
PNF S/W Management

Ensure O-RAN PNF S/W mgmt. can be support and define VES notifications

A1 Interface Introduction

A1 interface: Non-Real Time RIC and the Near Real Time RIC to transmit Policy and optimization information to the Near Real Time RIC and carry responses

# 5G Network Resource Model (NRM) in R6 Frankfurt



# 5G Network Resource Model (NRM) in R6 Frankfurt

## New Use Case

1) This use case introduces 5G NRM Configuration Management using a RESTful/HTTPS protocol (instead of NetConf).

<https://wiki.onap.org/display/DW/5G+Network+Resource+Model+%28NRM%29+Configuration+in+R6+Frankfurt>

## R6 CANDIDATE ENHANCEMENTS

## IMPACT

CDS

Add a new restful-executor in CDS blueprints processor  
Should be generic enough to support to **configure** any type and any number of NRM objects by restful createMOI operation in 3GPP

CDS

2. Provide CRUD operations on NRM objects via CDS  
Self-service API should support config-get, config-modify and config-delete actions

SO

3. 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

4. Support SO service/instance management API for NRM configuration  
Modify or Add additional SO NB APIs  
Define corresponding NRM IOCs in SO and BBs

# R6 Frankfurt General PNF Support U/C SUMMARY

5G USE CASE	DESCRIPTION	Req vs U/C	5G Specific
<b>PNF PRE-ONBOARDING &amp; ONBOARDING</b>	PNF Package delivery, Pre-onboarding and PNF Onboarding via SDC.	Requirements	General
<b>CONFIGURATION WITH NETCONF</b>	Enhancement to NETCONF support in ONAP supporting 5G and other use cases.	Requirements	General
<b>PNF PLUG AND PLAY</b>	PNF PnP enhancements, R3 Carry-overs, PRH (PNF Registration Handler) enhancements	E2E Use Case	General
<b>PNF S/W UPGRADE</b>	PNF Software upgrade to update the software on a PNF. Use of Ansible/NetConf direct to PNF.	Requirements	General

# PNF PRE-ONBOARDING/ONBOARDING U/C OVERVIEW

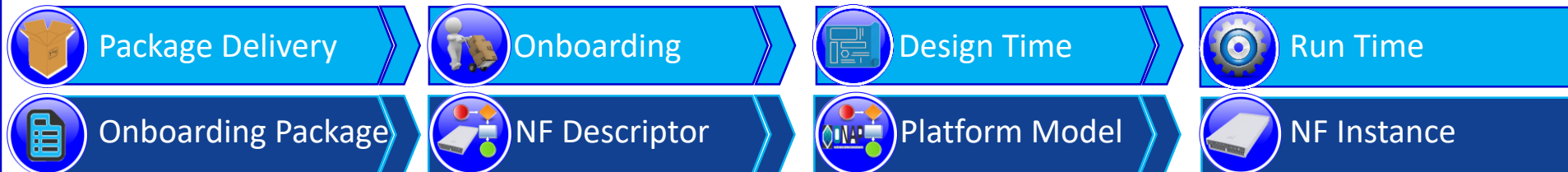
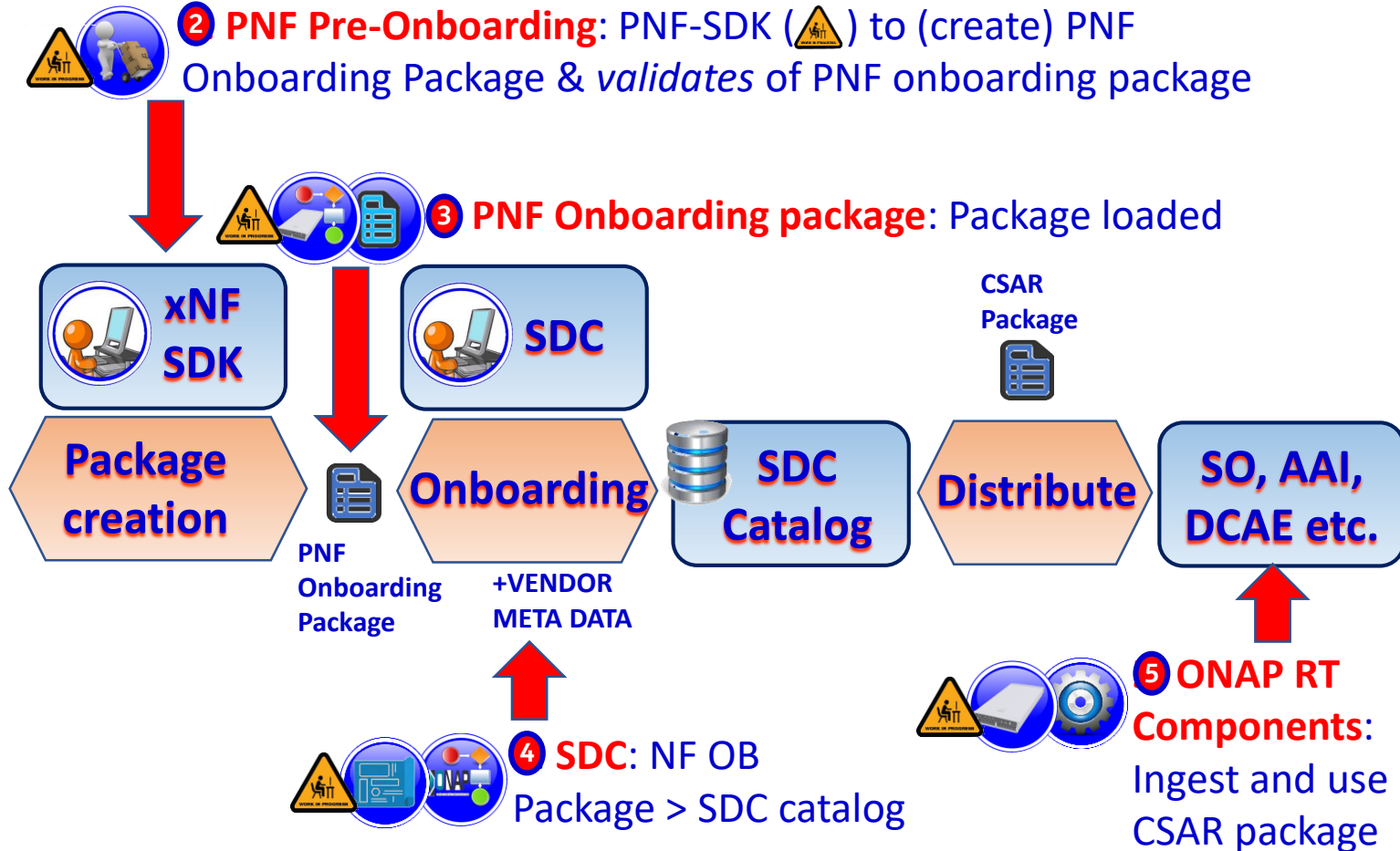
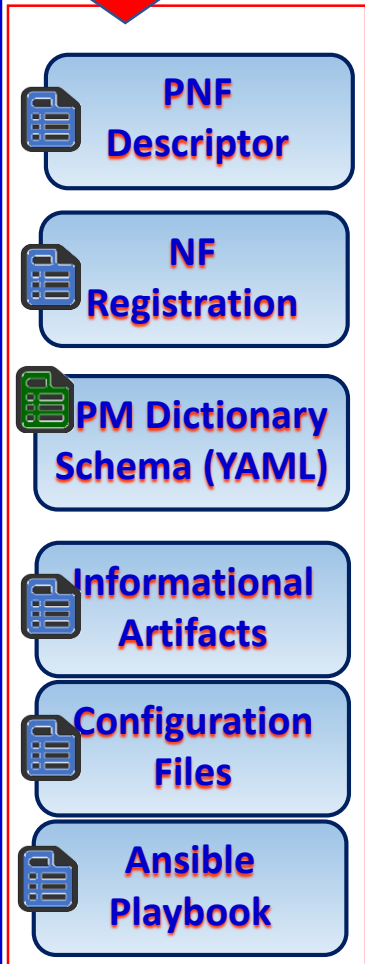
**1 PNF Package Delivery:** Vendor creates & delivers PNF Package with PNF artifacts

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

**3 PNF Onboarding package:** Package loaded

**4 SDC:** NF OB Package > SDC catalog

**5 ONAP RT Components:** Ingest and use CSAR package



# PNF PRE-ONBOARDING/ONBOARDING in R6 Frankfurt

This Use Case will introduce the support for PNF pre-onboarding (PNF Package, PNF descriptor support) and PNF onboarding (SDC, Design Time, PNF-SDK).

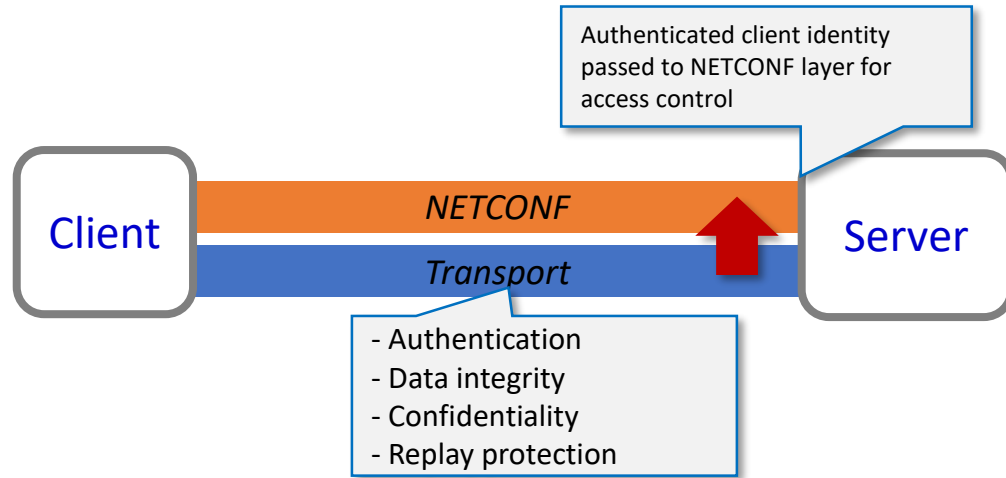
PNF Package delivery by vendor (during Pre-onboarding activities) and PNF Onboarding via SDC in Dublin.

<https://wiki.onap.org/pages/viewpage.action?pageId=45303641>

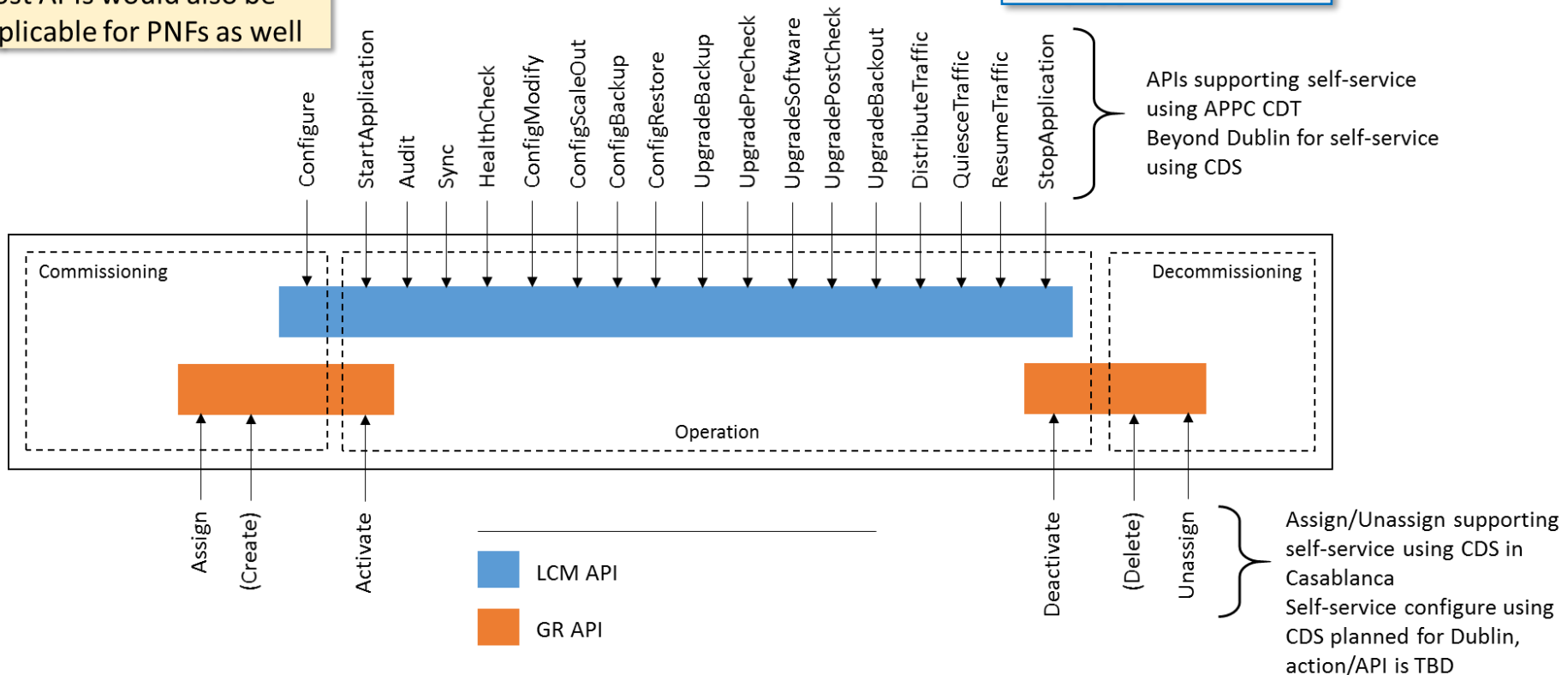
R6 CANDIDATE ENHANCEMENTS	IMPACT
Modelling	Definition of Platform Info & Data model continues
Resource Data Model	Onboarding PNFD to Platform PNFD mapping development & enhancement
VNF-SDK (PNF-SDK)	Package Validation enhancements notable Package security (option 2 per artifact), SOL004 alignment, License Model Check.
PNF Onboarding Package	Further carry-over development from R4/Dublin for PNF onboarding process.
VNF Onboarding	VNF onboarding, same procedure, same function, but testing/integration was not completed in R4/Dublin.
PNF VSP	SDC procedure to manually create a PNF VSP. (Carry-over from R4).

# CONFIGURATION WITH NETCONF in R6 Frankfurt

- NETCONF assumes that security is provided by the chosen transport protocol
- NETCONF over SSH (RFC6242) is mandatory but other options have also been standardized
  - NETCONF over TLS with mutual X.509 authentication (RFC7589)
- ONAP security sub-committee has recommended use of NETCONF over TLS: [Secure Communication to Network Functions](#)



Most APIs would also be applicable for PNFs as well





# CONFIGURATION WITH NETCONF in R6 Frankfurt

Proposed UC to focus on in Dublin for configuration with NETCONF:

Post-instantiation (triggered by SO), Including final configuration step (36/37) in the PNF PnP UC  
Configuration modification (e.g. triggered by Policy)

Specific requirements on NETCONF support in ONAP:

Officially support both PNFs and VNFs for north-bound controller APIs in the use cases

Support for NETCONF over TLS (RFC7589), Support for YANG 1.1 (RFC7950) modules in addition to YANG 1.0

<https://wiki.onap.org/display/DW/5G+-+Configuration+with+NETCONF>

R6 CANDIDATE ENHANCEMENTS	DESCRIPTION
A&AI	Addition of CMPv2 Client integration with certificate Management
SDN-C	Improve support for NetConf TLS Client certificates into ODL netconf-keystore
AAF	AAF support for NETCONF over TLS Client certificates into ODL netconf-keystore
Integration	Integration tests extended based on configuration with NetConf including client certificate deployment using AAF and external CA.
Improvements in Controller	Improvements in Controller to cover entire LCM API, architecture change to allow for U/C to use new capabilities. Used initially for upgrade, and improvements for other APIs/operations.

# PNF PLUG AND PLAY U/C Overview

Design Time

①



## PNF Modeling

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

②



## PNF Instance Declaration

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

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

Run-Time (Instances)

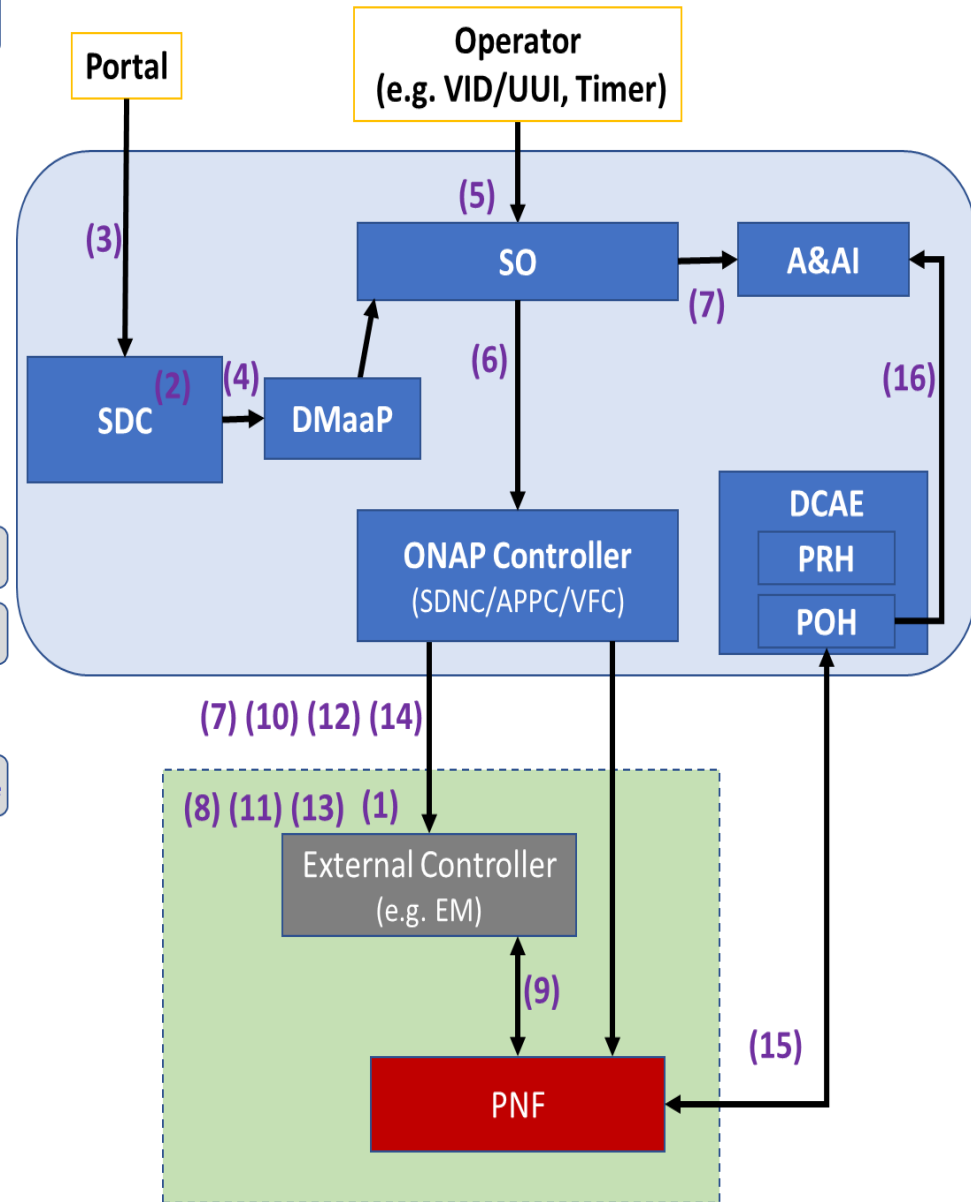
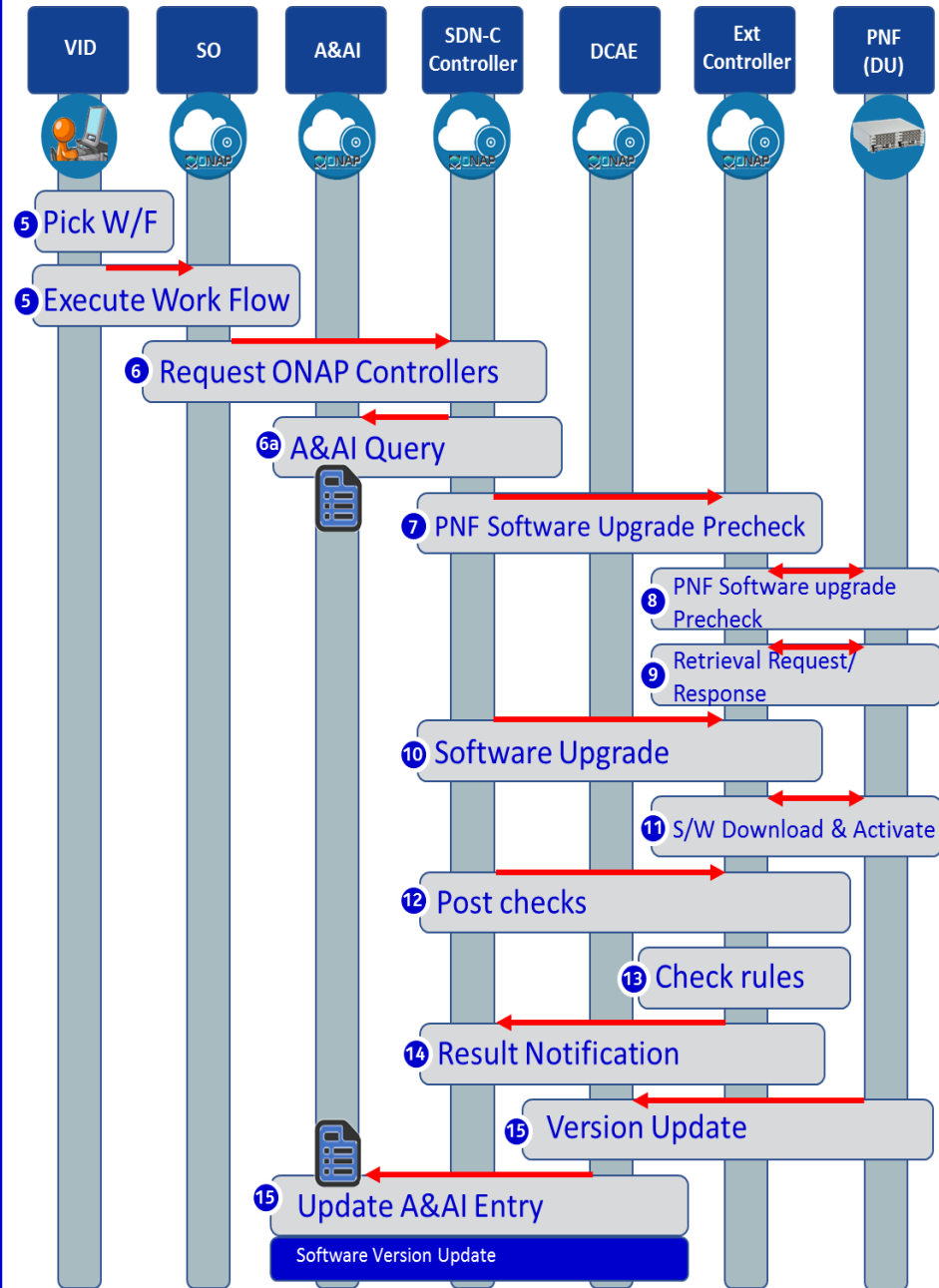
# PNF PLUG AND PLAY for R6 Frankfurt

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.

<https://wiki.onap.org/pages/viewpage.action?pageId=40206485>

R6 CANDIDATE ENHANCEMENTS	Description
Controller to NF Type Association	Association of Controller to NF Type, so that SO knows which controller to use for a particular NF instance
AAF	Security enrollment enhancements
Controller (VF-C, SDN-C/R)	Service configuration to PNF by controller ( <b>Step 37</b> ). SDN-C already supports DG & Ansible. NetConf introduction (separate U/C)
ESR	Association to External Controller (EMS/NMS). ESR Object
SO	Refactor PBMN workflow. Clean up work previously done in R4. Migrate existing workflows to existing building blocks.

# PNF S/W UPGRADE in R6 Frankfurt



# PNF S/W UPGRADE for R6 Frankfurt

PNF Software upgrade is one aspect of Software Management. The purpose is to modify the software running on the PNF. This could be used to update the PNF software to a newer or older version of software.

<https://wiki.onap.org/pages/viewpage.action?pageId=40206485>

## R6 CANDIDATE ENHANCEMENTS

## IMPACT

PNF Reporting its S/W version (NetConf)

PNF sends information regarding its Software Version directly to ONAP through a VES event. (possibly already covered with PNF Registration)

Support of NetConf & Yang models

PNF Software Upgrade using NetConf for direct ONAP to PNF communication.

Software Update Coverage Analysis

Find out what services, control loops, etc. are impacted during and post software update before the PNF software update

Post/Pre PNF SW Update Event Workflows

Deregistration, re-registration

VNF & PNF in-place software upgrade processes alignment

Unifying PNF and VNF entries in A&AI

VID support

Execute the E2E run-time software upgrade workflow.

3GPP Alignment

3GPP TS32.532 Automated/non-Automated S/W mgmt. API between manager & managed entity (south-bound of controller).