

## 5G Use Cases for R4/Dublin



- 5G Use Case Subcommittee
- R4 Dublin Developer's Conference (January 9, 2019)

# R4 5G Use Case SUMMARY

5G USE CASE	DESCRIPTION	COMPANY SPONSORS	PTL COMMITMENT	5G / GENERAL
<b>BULK PM</b>	Performance Measurements 5G RAN Bulk Upload, Casablanca Carry-over items	AT&T, Ericsson, Nokia	In progress, Varies	General
<b>PNF PRE-ONBOARDING &amp; ONBOARDING</b>	PNF Package delivery, Pre-onboarding and PNF Onboarding via SDC in Dublin.	AT&T, Huawei, Ericsson, Nokia	In progress, Varies	General
<b>CONFIGURATION WITH NETCONF</b>	Enhancement to NETCONF support in ONAP supporting 5G and other use cases.	AT&T, Ericsson	In progress, Varies	General
<b>FM META DATA &amp; PM DICTIONARY</b>	Support for handling 5G FM Meta Data & support for PM Dictionary & PM Schema	AT&T, Ericsson, Nokia	In progress, Varies	General
<b>OOF &amp; PCI</b>	Optimization and PCI (SON) development. Casablanca Carry-over items	AT&T	In progress, Varies	5G Specific
<b>PNF Plug and Play</b>	PNF PnP enhancements, R3 Carry-overs, PRH (PNF Registration Handler) enhancements	AT&T, Huawei, Ericsson, Nokia	In progress, Varies	General
<b>PNF S/W UPGRADE</b>	PNF Software upgrade to update the software on a PNF, Casablanca Carry-over items	AT&T, Huawei, Ericsson	In progress, Varies	General
<b>NETWORK SLICING</b>	Advanced 5G functionality, for Network Slicing development and early steps in long-lead development.	AT&T, Amdocs, Ericsson	In progress, Varies	5G Specific/ Generic

# ONAP S/W modules impact Matrix

 Likely
 Possible

	SDC	VID/Portal	SO	AAI/ESR	Controllers	DCAE	OOF	Policy/CLAMP	DMaaP	AAF	VNF SDK	VNF Reqs & VES Spec
<b>PNF Pre-onboarding &amp; Onboarding</b>	Likely		Possible	Possible		Possible		Possible		Possible	Likely	Likely
<b>PNF Plug and Play</b>		Likely	Likely	Likely	Likely	Likely				Possible		
<b>PNF SW Upgrade</b>	Possible	Possible	Likely	Possible	Likely	Possible						
<b>Bulk PM</b>	Likely					Likely			Likely	Possible		Likely
<b>PM Dictionary</b>	Likely											Likely
<b>FM Meta Data</b>	Possible							Possible				Likely
<b>Configuration with NETCONF</b>		Possible	Likely		Likely			Possible		Possible		Likely
<b>OOF &amp; PCI</b>	Likely	Possible	Possible	Possible	Likely	Likely	Likely	Likely				
<b>Network Slicing</b>	Likely	Likely	Likely	Likely	Likely							

# PNF PRE-ONBOARDING/ONBOARDING U/C OVERVIEW

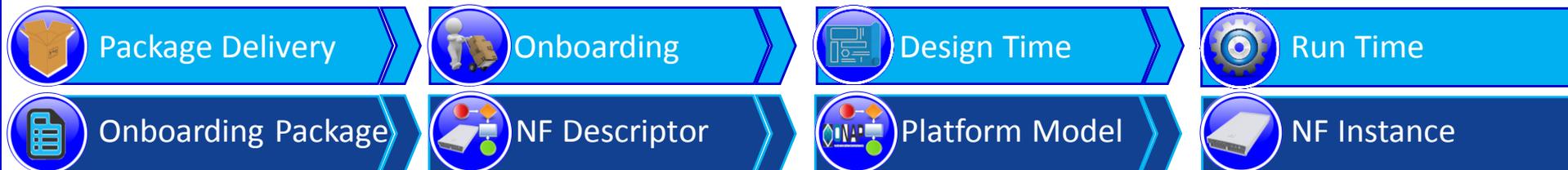
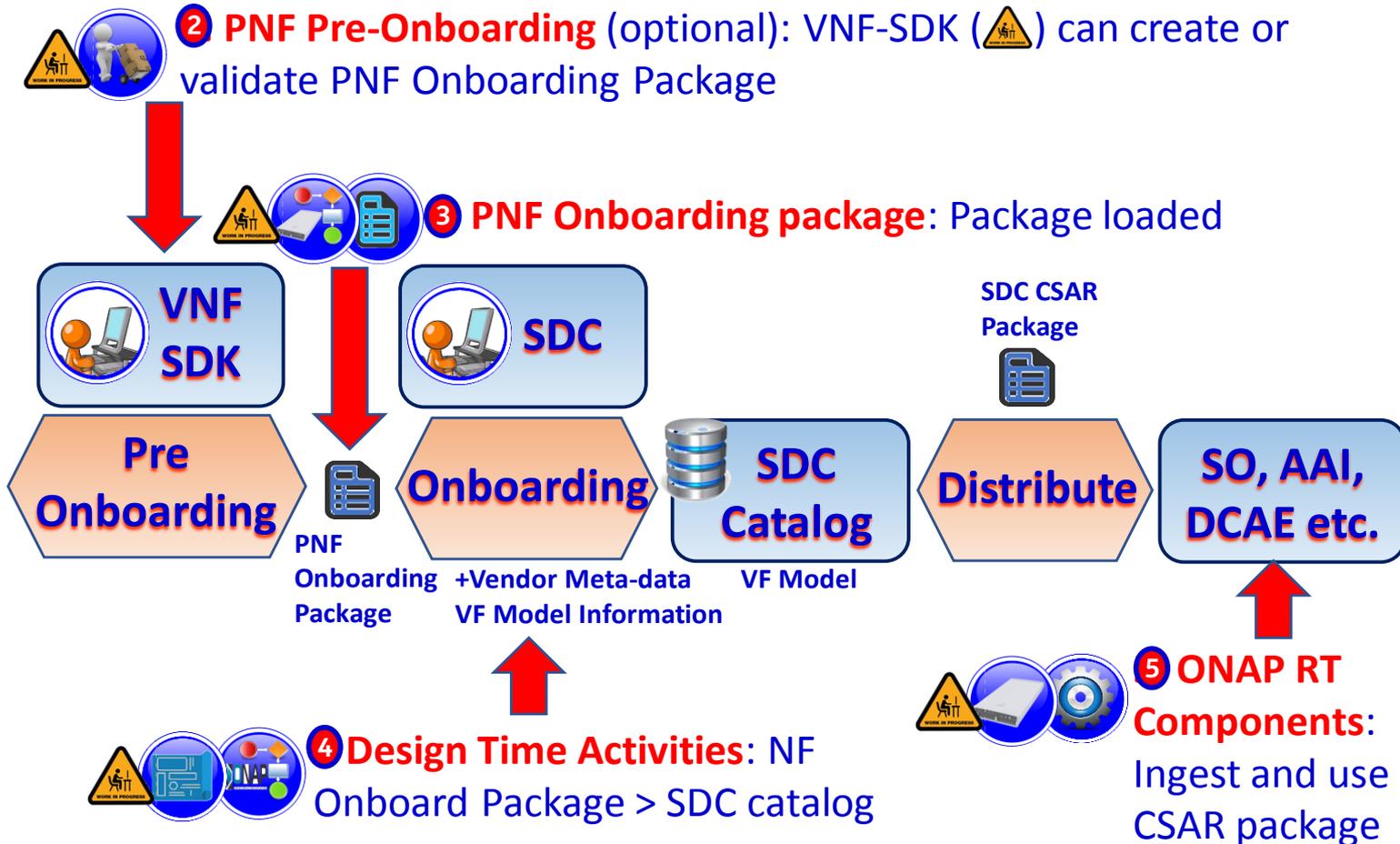
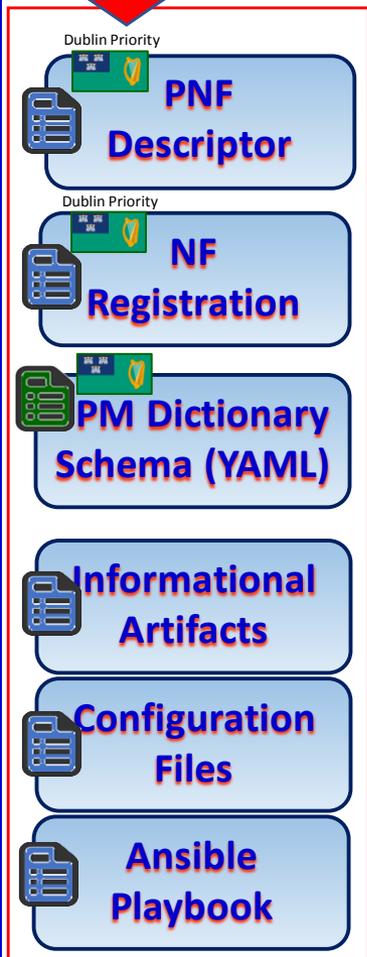
**1 PNF Package Delivery:** Vendor creates & delivers PNF Package with PNF artifacts

**2 PNF Pre-Onboarding** (optional): VNF-SDK (⚠️) can create or validate PNF Onboarding Package

**3 PNF Onboarding package:** Package loaded

**4 Design Time Activities:** NF Onboard Package > SDC catalog

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



# PNF PRE-ONBOARDING/ONBOARDING U/C IMPACTS

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>

RT COMPONENT	IMPACT	PTL
SDC	(1) PNF package format (2) Onboarding PNF package to internal PNF package mapping (3) Onboarding PNFD to internal PNFD mapping (4) Artifact management	Yes
Modelling	Definition of Platform Info & Data model	Yes
Resource Data Model	Onboarding PNFD to Platform PNFD mapping	PTL Notified
VNF-SDK	Update to VNF-SDK and (create), parse, validation, of PNF Onboarding Package	PTL Notified
SO, AAI, DCAE, Controller	Updates to RT components for proper ingestion of CSAR (Integration & Testing)	TBR (To be reviewed)
PNF Onboarding Package	Vendor provided PNF onboarding package w/ PNF Registration and PNF-Descriptor. And ETSI SOL 001-007 Alignment	N/A
VNF Requirements	PNF requirements (in the VNF requirements projects) for PNF onboarding. (1) NF requirements updated to cover PNF package, descriptor and artifacts (2) VNF requirements could be reviewed.	PTL Notified

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# 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 enhancements for R4 Dublin

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>

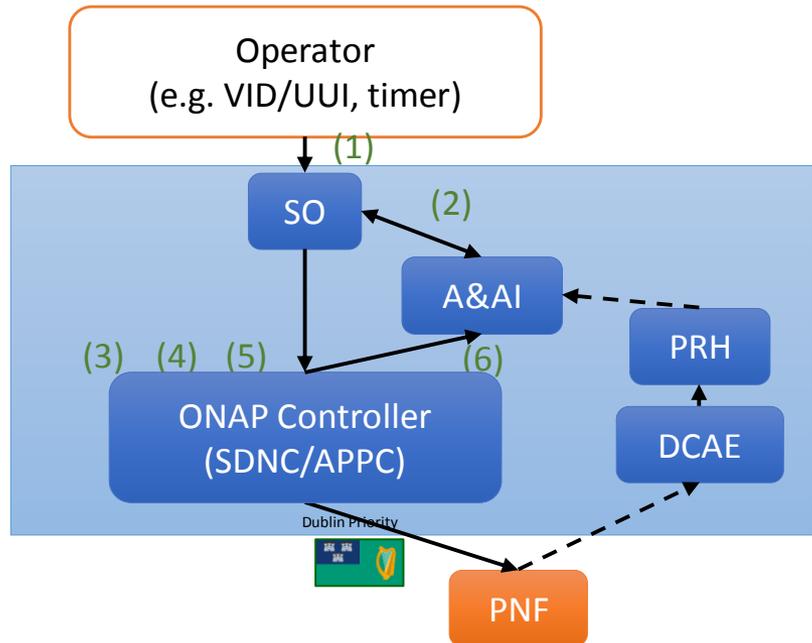
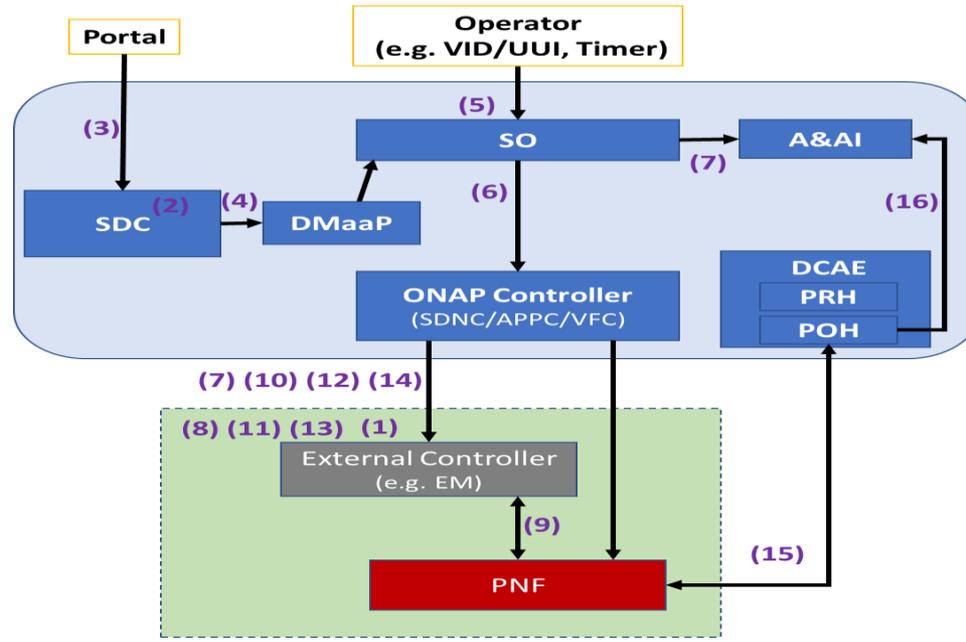
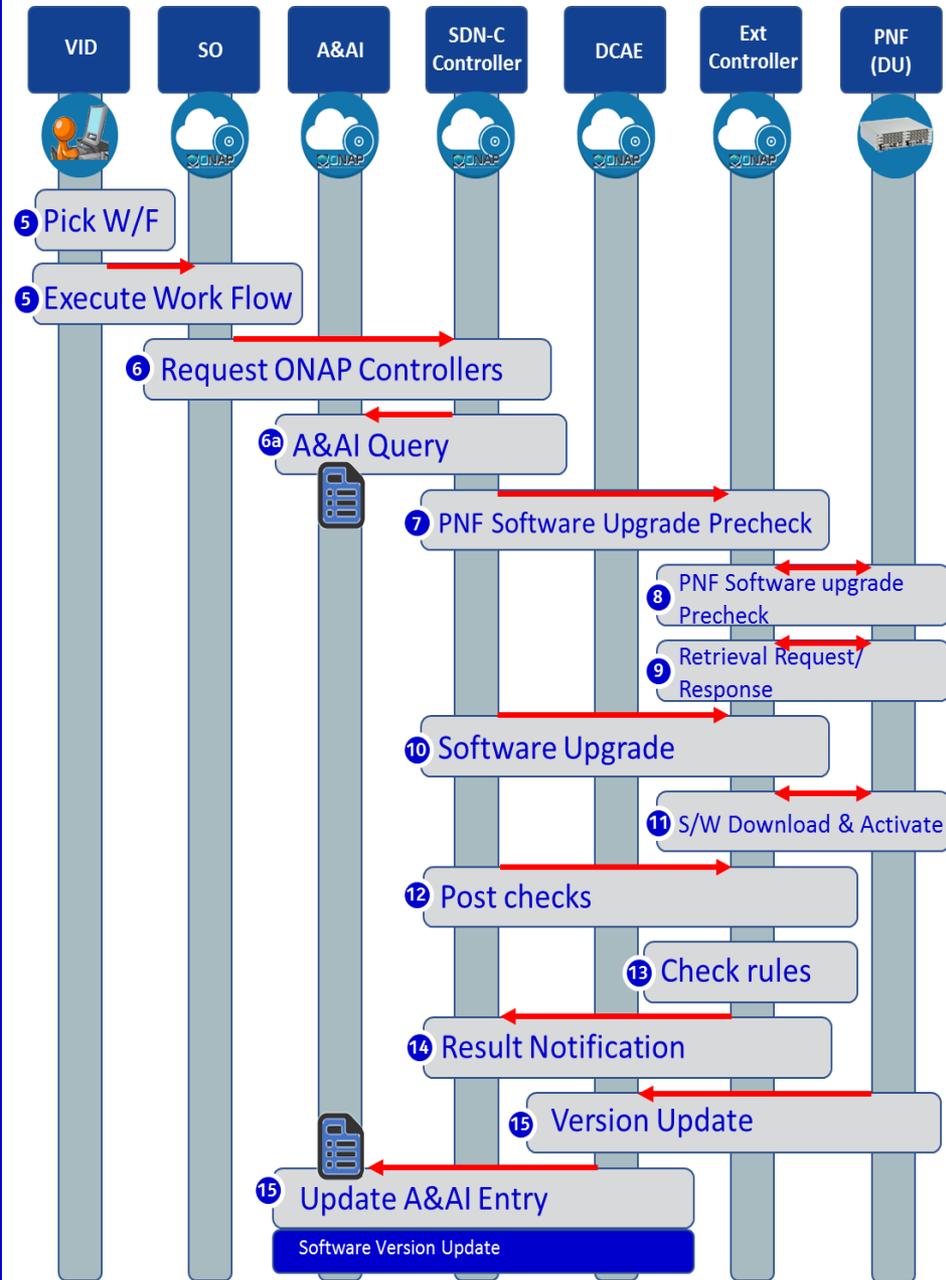
RT COMPONENT	IMPACT	PTL INVOLVEMENT
Controller to NF Type Association	Association of Controller to NF Type, so that SO knows which controller to use for a particular NF instance	PTL Notified
AAF, DCAE (Collectors)	Security enhancements to use Certificates & TLS	TBR
Controller (VF-C, SDN-C/R)	Service configuration to PNF by controller (Step 37). SDN-C already supports DG & Ansible. NetConf (q.v. U/C)	TBR
VID	VID enhancements for PNF PnP. Supporting Work Order. Supported with service specific applications.	TBR
A&AI	PNF Indexing using <i>pnf-id</i> (instead of <i>pnf-name</i> )	PTL Notified
SO	Support of SO for an already existing PNF (active) A&AI Entry	TBR
ESR	Association to External Controller (EMS/NMS).	TBR
PRH	Updates for A&AI adaptations & A&AI Entry < pnfRegistration	PTL Notified
PORTAL	Impact on Functional Menus	PTL Notified

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# PNF S/W Upgrade



# PNF S/W Upgrade for R4 Dublin

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>

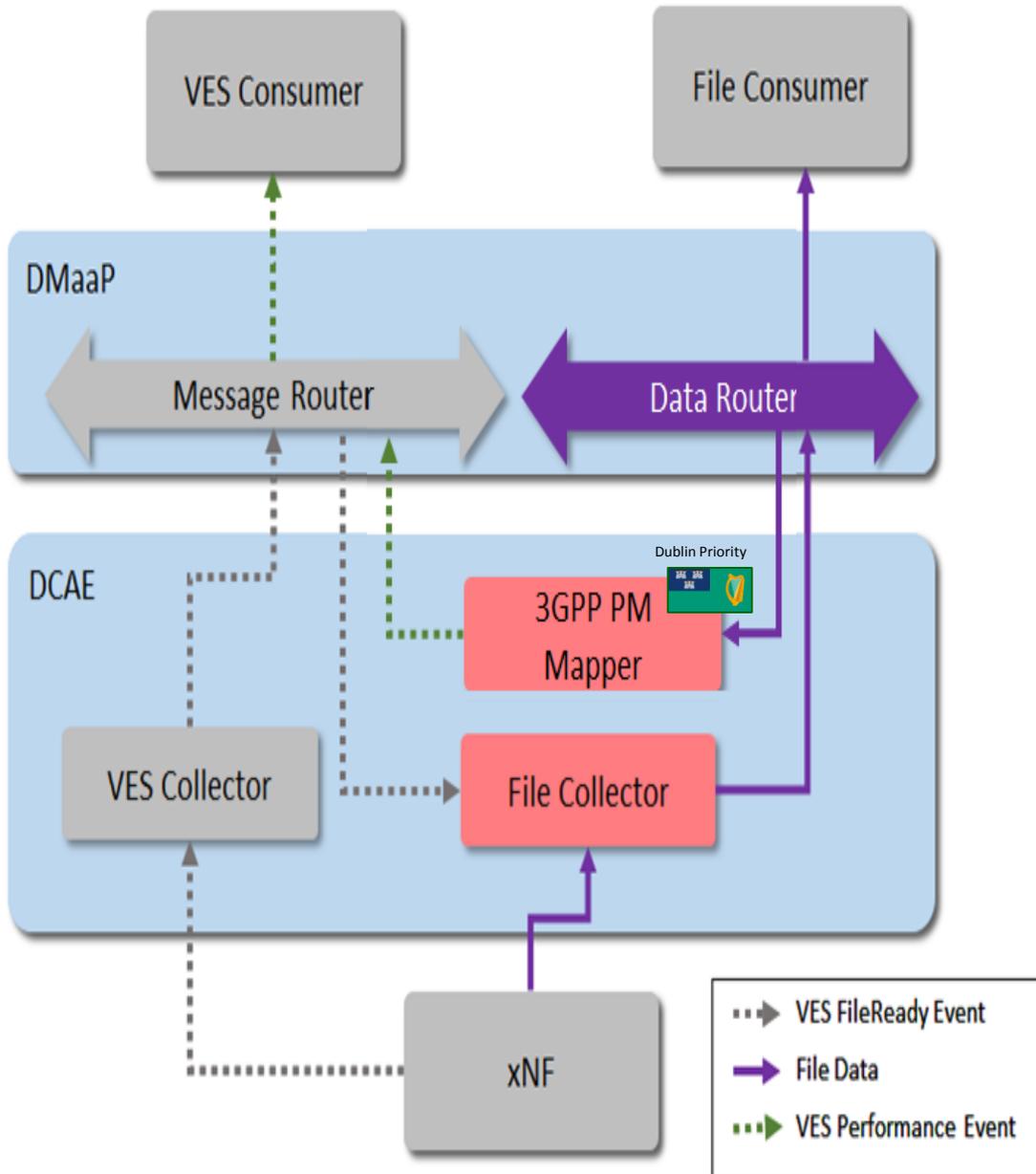
RT COMPONENT	IMPACT	PTL ?
PNF Reporting	PNF sends information regarding its Software Version directly to ONAP through a VES event.	TBR(to be reviewed)
Design Time Components	PNF software update workflow design, artifact onboarding upgrade rule list, utility of software version list.	TBR
PNF Package Update	A software update may require a change in the PNF Package before the software update or post update or both.	TBR
Software Update Coverage Analysis	Find out what services, control loops, etc. are impacted during and post software update before the PNF software update	TBR
Post/Pre PNF SW Update	Post/Pre PNF S/W updates - Deregistration, re-registration	TBR
VNF & PNF SW U/G alignment	Unifying PNF and VNF entries in A&AI	TBR
VID support	Execute the E2E run time software upgrade workflow.	TBR
Netconf Support	Use of Netconf for PNF S/W upgrade w/ Controllers to PNF	TBR
SO	Re-usable workflows and building blocks for PNF SW upgrade	TBR

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# BULK PM (Perf3gpp Event Generation) Overview



## R4/Dublin Enhancements:

1. New **3GPP PM Mapper** which will process 3GPP PM XML files to produce VES PM Events in perf3gpp domain.
2. Closed Loop support using 3GPP PM data
3. DCAE DFC Robustness and logging enhancements to existing components for improved Bulk PM handling in ONAP
4. DMaap DR (DCAE) enhanced handling of PM feeds (enhancements for DFC metadata; optional DR consumer specified feed compression handling; support for various deployments)

# Bulk PM Enhancements for Dublin R4

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

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

RT COMPONENT	IMPACT	PTL INVOLVEMENT
DCAE	U/C1: Perf3gpp event creation from PM XML file: implement 3GPP PM Mapper microservice, configure PM Mapper, subscribe to PM XML file and metadata from Data Router, generate Perf3gpp events, publish to Message Router	PTL Notified
DCAE, Policy, Controller	U/C2: Closed loop support using PM data: Analytics Applications subscribe to Perf3gpp event of interest or Bulk PM XML file, analyze the data, notify Policy of desired CM change, Policy triggers CM update to Controller. (Stretch Goal)	PTL Notified
Data File Collector (DFC)	DFC robustness enhancements: FileReady for all files on the node, DFC retry handling.	PTL Notified
DMaaP Data Router (DR)	DR enhanced handling of PM feeds: enhancements for DFC metadata, optional DR consumer specified feed encoding, high availability and scaling support.	PTL Notified
VNF Requirements	Updated FileReady requirement to add optional re-reporting	PTL Notified
SDC	Design Studio (DCAE-DS) support for Bulk PM	PTL Notified

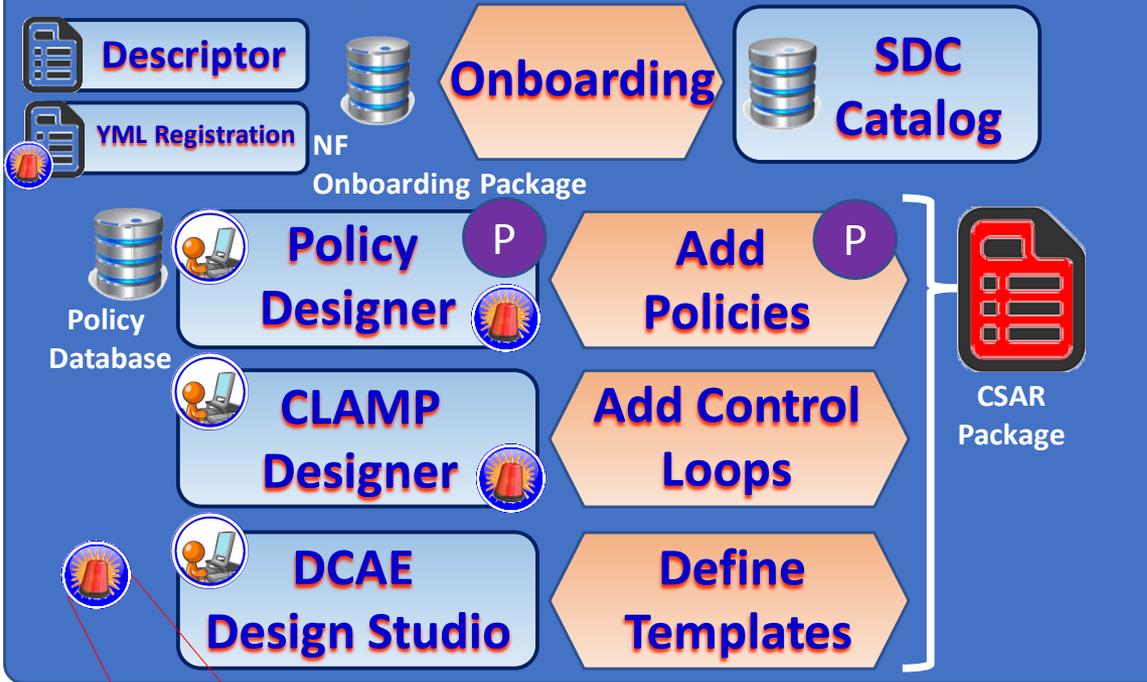
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# FM Meta Data

## DESIGN-TIME (SDC)



**Dublin (R4) Goal is to be able to view the onboarded FM Meta-Data (from the PNF onboarding package) in a GUI (either Policy Designer, CLAMP, DCAE DS).**

Dublin Priority



# FM Meta Data

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

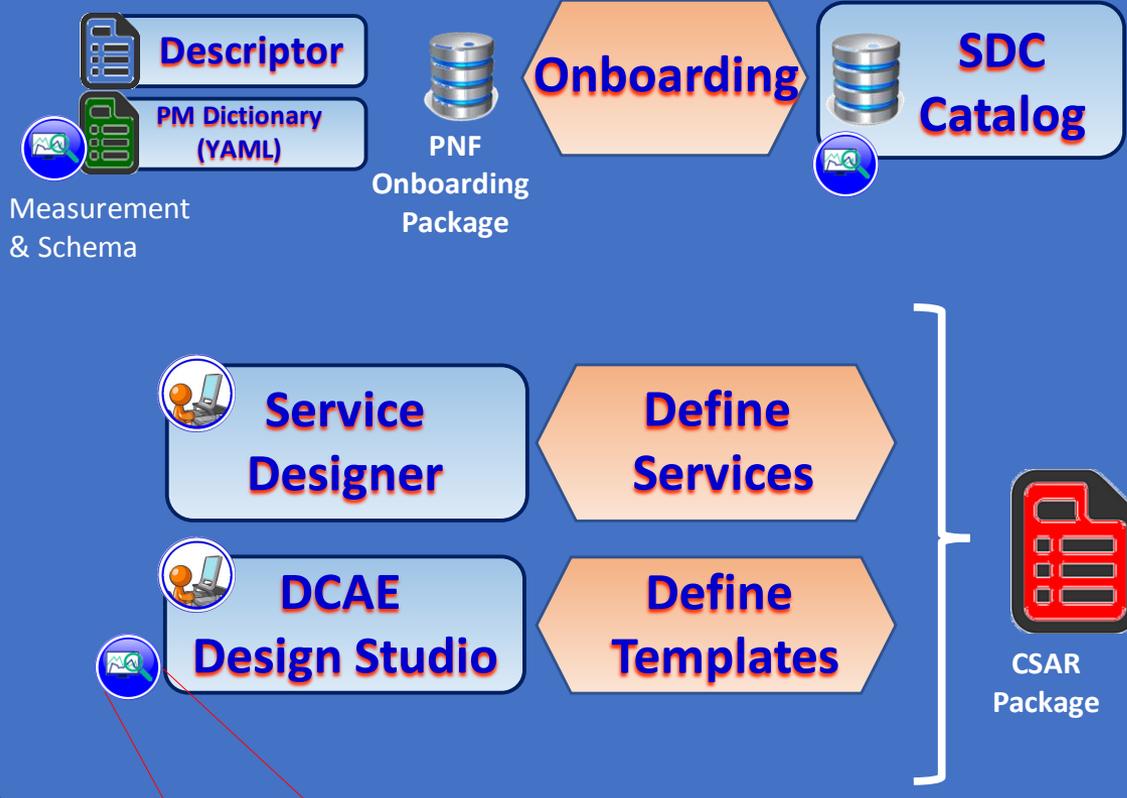
1. Review and finalize VES Event Listener Specification v7.1 and VES Event Registration Specification v3.2 which contains the FM metadata format and content.
2. Onboard the FM metadata for an xNF as part of the VES Event Registration YAML file. Note: Processing of the FM meta data is covered the PNF 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>

RT COMPONENT	IMPACT	PTL INVOLVEMENT
VES Specifications	Review and finalize VES Event Listener Specification v7.1 and VES Event Registration Specification v3.2	PTL Notified Updated VES Doc
GUI Display of FM Meta Data	Display the FM Meta data in a GUI (either DCAE-DS, Policy GUI and/or SDC GUI) to allow an ONAP User to create Policies for handling alarms	TBR (To be reviewed)
VNF Requirements	Update to VNF requirements for FM Dictionary metadata artifact creation	TBR

# PM Dictionary

## DESIGN-TIME (SDC)



**Dublin (R4) Goal is to be able to view the onboarded PM Dictionary (from the PNF onboarding package) in a GUI (either SDC Service Designer or DCAE-DS).**

Dublin Priority



# PM Dictionary

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

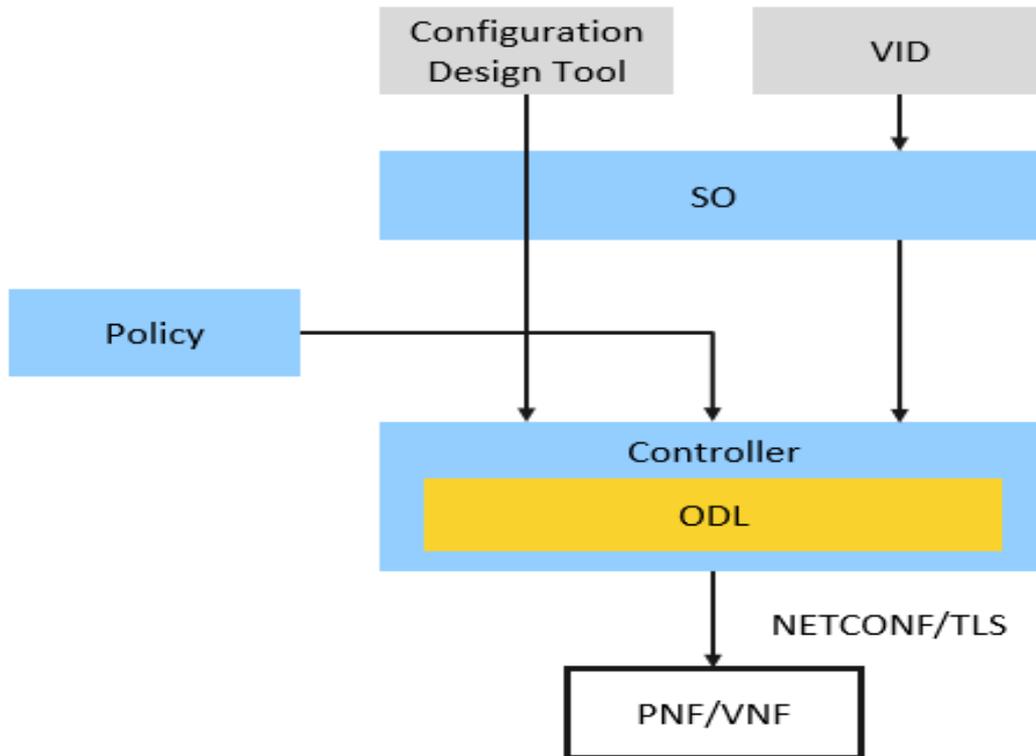
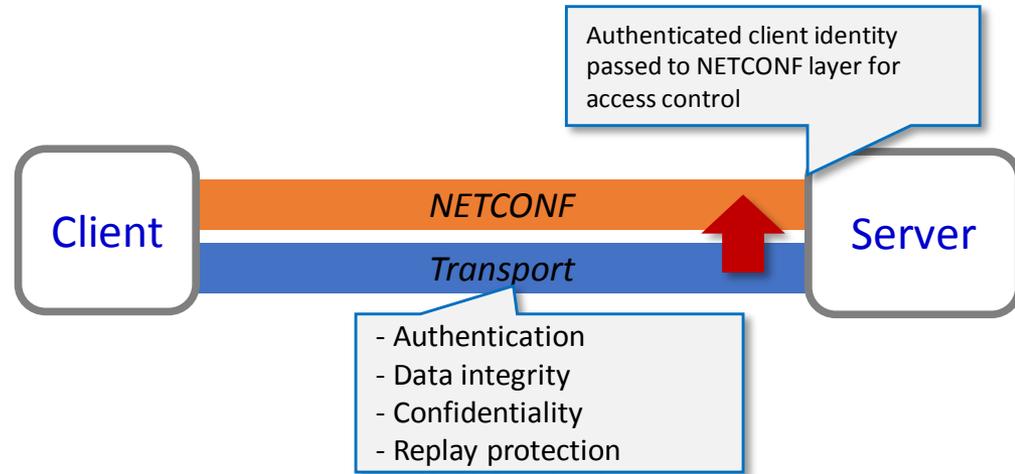
1. Review and finalize VES Event Listener Specification v7.1 and VES Event Registration Specification v3.2 which contains the PM Dictionary format and content.
2. Onboard the PM Dictionary for an xNF as a PM Dictionary YAML file. Note: Onboarding of the PM Dictionary artifact is covered under the PNF 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>

RT COMPONENT	IMPACT	PTL INVOLVEMENT
VES Specifications	Review and finalize VES Event Listener Specification v7.1 and VES Event Registration Specification v3.2	PTL Notified Updated VES Doc
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	TBR
VNF Requirements	Update to VNF requirements for PM Dictionary artifact creation	TBR

# Configuration with NetConf

- 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](#)



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  
(Stretch goal) 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

# Configuration with NetConf

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Post-instantiation (triggered by SO), Including final configuration step (36/37) in the PNF PnP UC

Configuration modification (e.g. triggered by Policy)

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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>

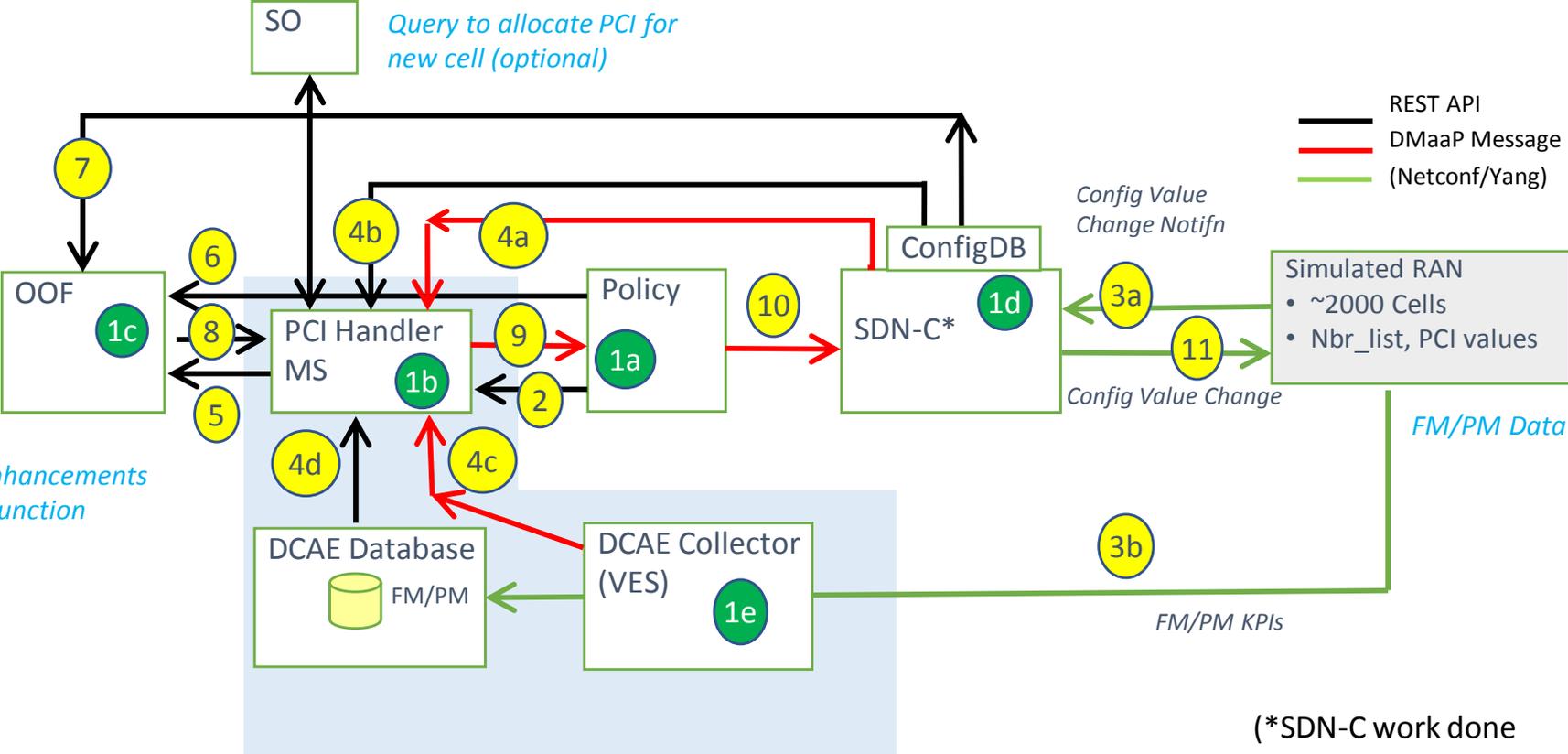
RT COMPONENT	IMPACT	PTL INVOLVEMENT
APPC, SDN-C, CCSDK	Enable NETCONF and TLS support in OpenDaylight Complete support for NETCONF configuration in the controller layer	PTL Notified
SO	Post instantiation configuration action	PTL Notified
VID	Trigger main workflow from GUI	PTL Notified
AAF (?)	Investigate AAF impact for NETCONF over TLS Also discuss in SECCOM meeting	TBR (to be reviewed)
Policy	Configuration change triggered by Policy (API, PNF as Target)	PTL Notified
VNF Requirements	Update applicable xNF requirements	PTL Notified

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# OOF & PCI



— REST API  
 — DMaaP Message  
 — (Netconf/Yang)

Simulated RAN  
 • ~2000 Cells  
 • Nbr\_list, PCI values

FM/PM Data

FM/PM KPIs

(\*SDN-C work done in SDN-R team)

• FM/PM Collector and Database

DCAE

- PCI enhancements
- ANR function

# OOF & PCI

## Carry-over Items From Casablanca:

Onboard PCI Handler MS to DCAE, and include in SDC Catalog

SDN-R use cases moved from Casablanca to Dublin

SDNC-430: Modify RAN informational model and yang model for RAN

SDNC-431: Implement config DB and REST API (SDN-R / OOF interface)

SDNC-432: Interfacing SDN-R with Policy

SDNC-432: Receive netconf notification from RAN, update configDB, and publish change on DMAaP

## Enhancements:

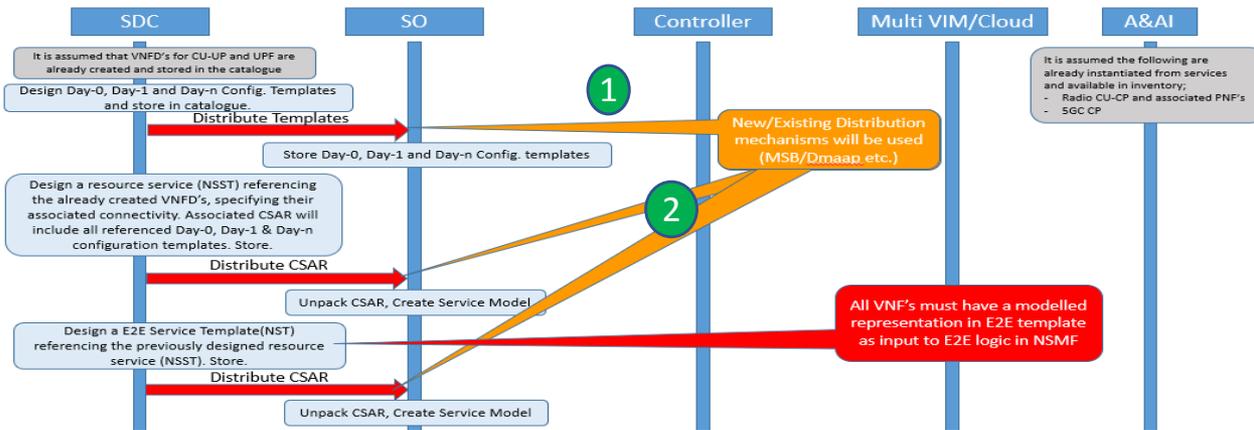
Common RAN Information Model, Configuration Management, Controller Enhancements, SON Coordination

Optimization for ANR (closely coupled with PCI)

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

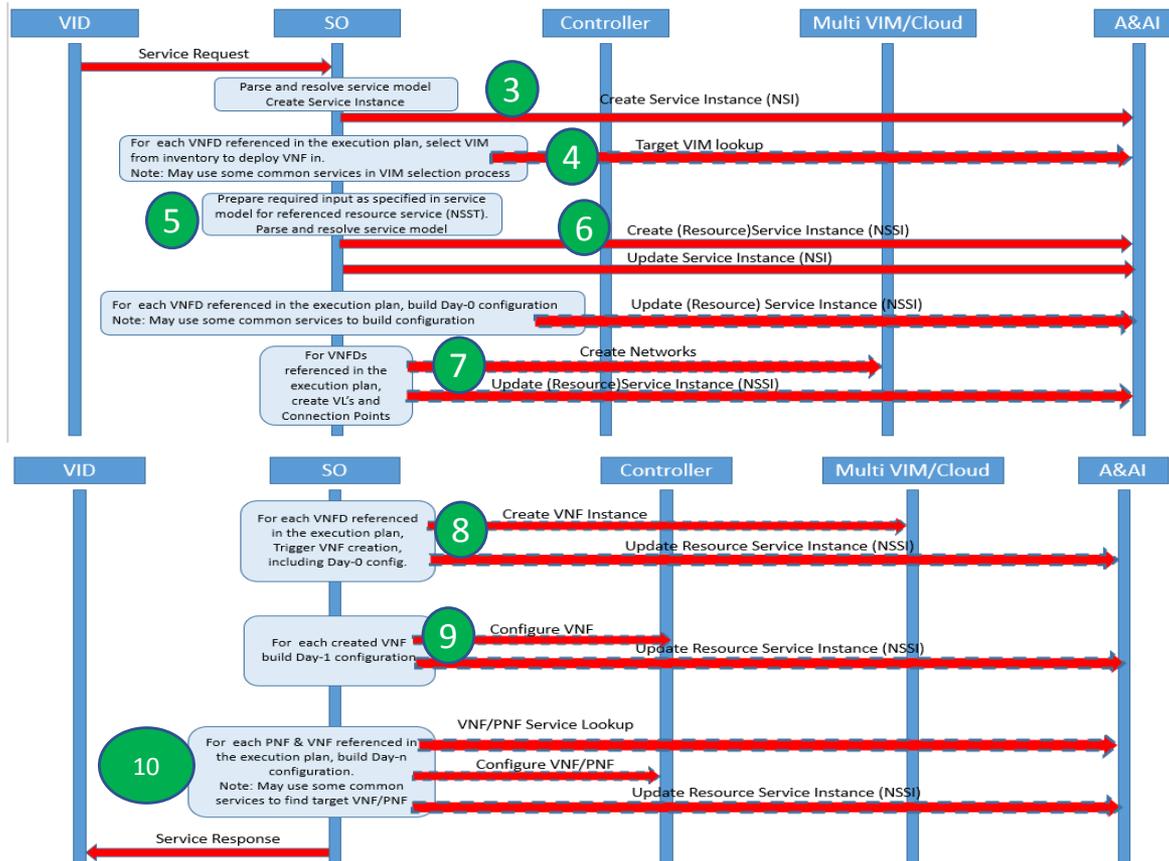
RT COMPONENT	IMPACT	PTL INVOLVEMENT
OOF	Add optimization objectives for PCI Optimization Add optimization for ANR (Automated Neighbor Relations) SON functionality (q.v. PCI SON)	PTL Notified
SDN-R	RAN Infomodel, Config DB, I/F SDN-R & Policy, Remove Netconf	PTL Notified
DCAE	Onboard PCI Handler MS to DCAE	TBR (To be reviewed)
POLICY	Enhance the Policy functionality for Control Loop Coordination (CLC); Implement 2 control loops for POC	PTL Notified
AAI	Models & relationship between Config, Operational DB & AAI	TBR (To be reviewed)
Informational Model	RAN Information Model; Target consensus among vendors for complete common RAN information model	TBR

# Network Slicing



## 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

..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>

RT COMPONENT	IMPACT	PTL INVOLVEMENT
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 <a href="#">ONAP Network Slice Modelling</a>)</li> <li>Support the distribution of service templates</li> </ul>	TBR
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>	TBR
A&AI	<ul style="list-style-type: none"> <li>Evolve model to support NW Slicing aspects</li> </ul>	TBR
Controllers	<ul style="list-style-type: none"> <li>Support VNF Day-1 configuration</li> <li>Support VNF&amp;PNF Day-n configuration</li> </ul>	TBR
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>	TBR

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# Controller Impacts and Questions

- Background
  - Several 5G sub-cases involve ONAP controllers and may require enhancements in R4/Dublin
  - There are also some questions since Casablanca about role of the different controllers
- Design-time
  - Need tool alignment: CDT -> CDS? When?
  - Blueprint format improvements: per service blueprints, PNF support, additional device protocols (e.g. NETCONF/TLS), follow API additions
- Controller personas and instances
  - Which personas will be defined in Dublin, how will clients like SO and Policy know which controller instance to use
- Controller (north-bound) APIs
  - Existing APIs (GR and LCM) don't recognize PNF as valid target
  - New model-driven "self-service API" also being added in Dublin (CCSDK)
  - Config DB API for PCI
  - Need to recommend APIs for some use cases: day 1/N configuration, Policy
- Implementation features
  - Configurable behavior (onboarded or self-service) supporting multiple protocols (Ansible and NETCONF), different vendors, VNFs and PNFs
  - Common NETCONF south-bound adapter supporting NETCONF/TLS, YANG 1.1
  - Configuration database
  - Operational database

Portal Project, "Data Layer"/Database Answer