5G Service Modeling & 5G Service Creation

- Architecture Sub-committee Review

Benjamin Cheung, PhD

December 08, 2020 version 6

ARCHITECTURE SUB-COMMITTEE PRESENTATION

3GPP Release 15, IMT-2020 = 5G

eMBB (enhanced Mobile Broadband)

Media Anywhere

Broadband Experience Everywhere Anytime
Virtual and Augmented Reality

Remote Surgery and Examination

Smart Infrastructure
Smart City

5G USE CASES

Factory Automation
Remote Device Control

Smart Automated Vehicle Control

Internet of Things (IoT)
Geographically spread devices

URLLC (Ultra Reliable Low Latency Communications)

mMTC (massive Machine Type Communications)
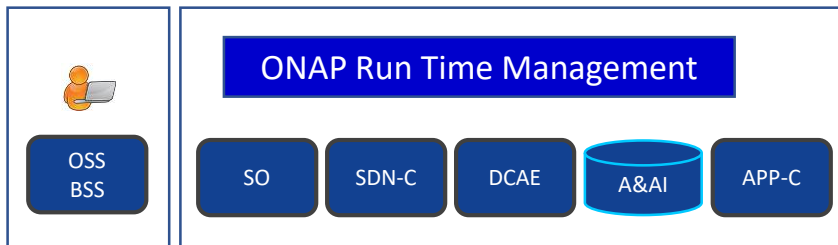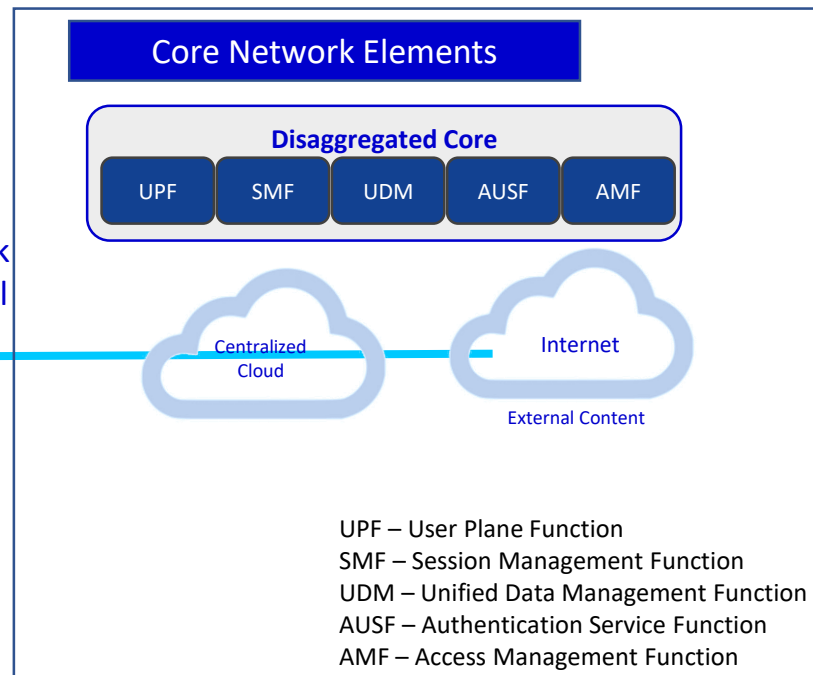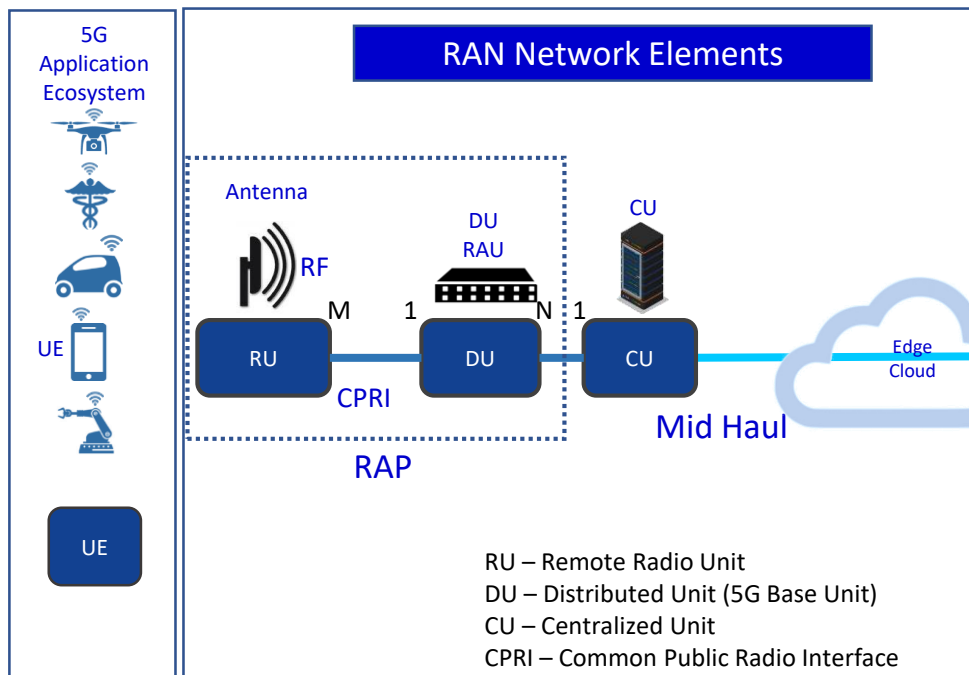
- Smart
- Connected
- Collaborate
- Access
- Interactive
- Aware

THE **LINUX** FOUNDATION

ONAP

5G RAN Wireless Network

ONAP Run Time Management
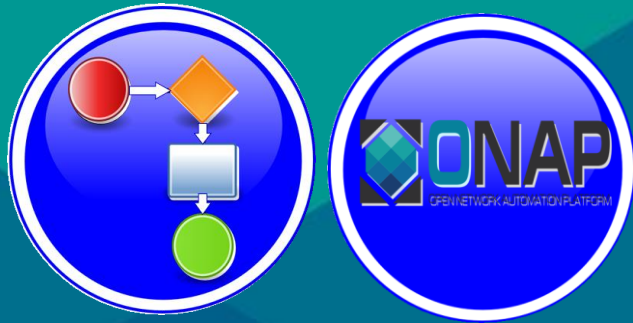
OSS BSS

| SO | SDN-C | DCAE | A&AI | APP-C |

SO – Service Orchestrator
SDN-C – Service Design Network Controller
DCA&E – Data Collection Analytics & Events
A&AI – Available & Active Inventory
APP-C – Application Control

RAN Network Elements

5G Application Ecosystem

UE

Antenna

RF

DU RAU

CU

RU — M — 1 — DU — N — 1 — CU

CPRI

RAP

Mid Haul

Edge Cloud

Back Haul

RU – Remote Radio Unit
DU – Distributed Unit (5G Base Unit)
CU – Centralized Unit
CPRI – Common Public Radio Interface

Core Network Elements

Disaggregated Core

| UPF | SMF | UDM | AUSF | AMF |

Centralized Cloud

Internet

External Content

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

5G Service Modeling & 5G Service Creation

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5G SERVICE

Vendor Provided

- Informational Artifacts
- Configuration Files

Foundational

- Deployment Artifacts
- HEAT Templates
- Connection Point
- Virtual Link

User Designed

- Policies
- Templates
- Blueprints

Resources

- Network Function (VNF)
- Network Function PNF
- Allotted NF ANF
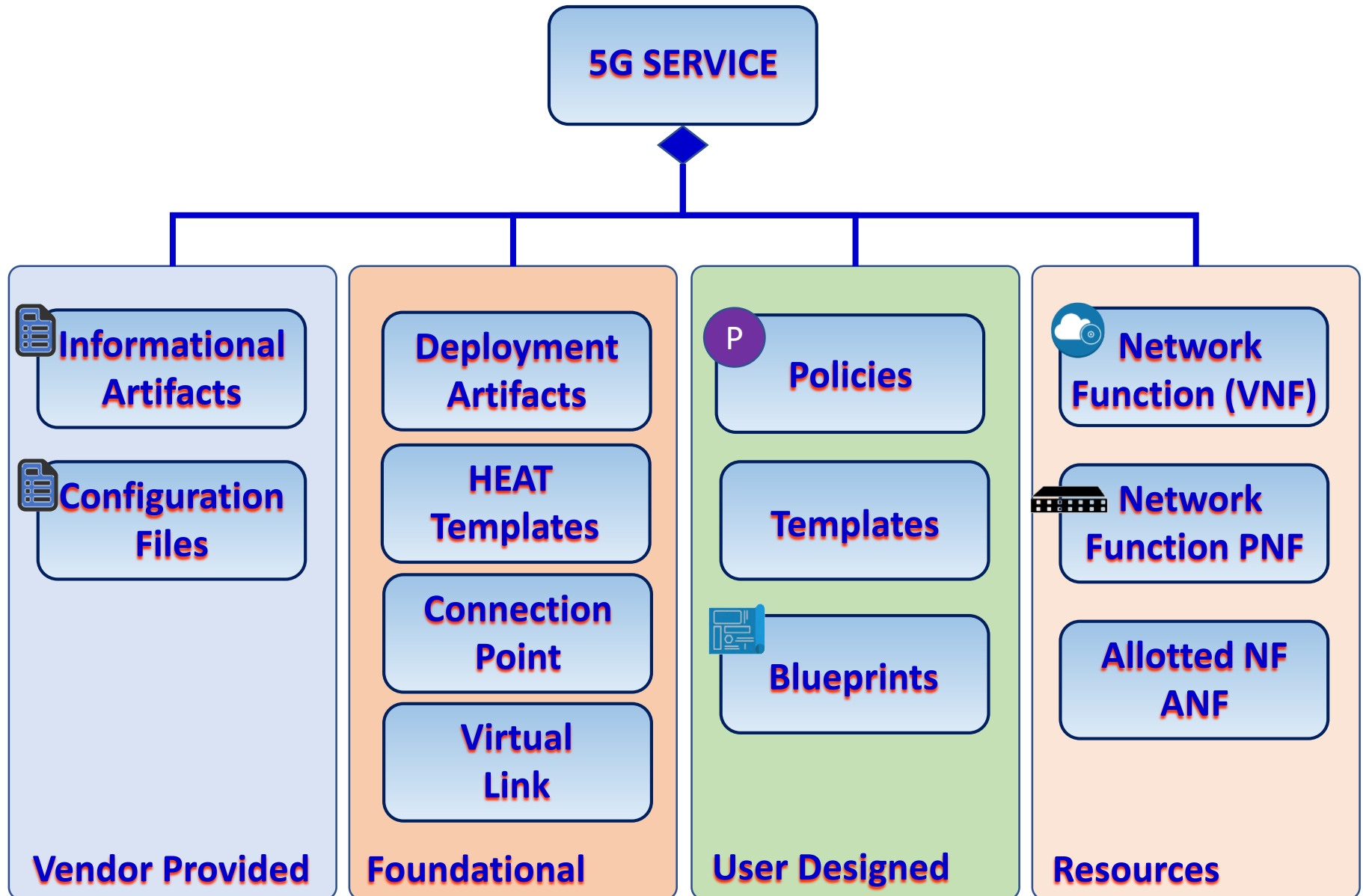
R8: 5G Service Modeling

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.
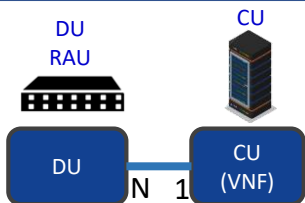
FUNDING/FINANCIAL IMPACTS - Without the groundwork laid down for information model management of a 5G Service, operators will not be able to "turn on" a real live 5G network using "live" PNF resources. No Network. No Business. High OPEX impact.

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.

R4: 5G Base Station (gNodeB)

RAN Network Elements
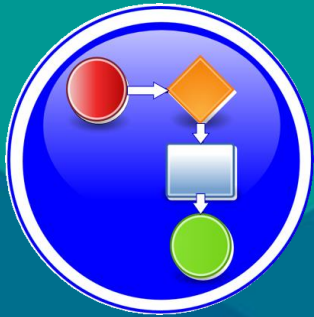
DU
RAU

CU

DU — N   1 — CU (VNF)

N   N

1   1

UPF (VNF)   AMF (VNF)

Core Network Elements

5G SERVICE

PNF/DU #1

Conn Pt #1

Virtual Link

VNF/CU #1

Conn Pt #3

● ● ●

PNF/DU #n

Conn Pt #n

Resources
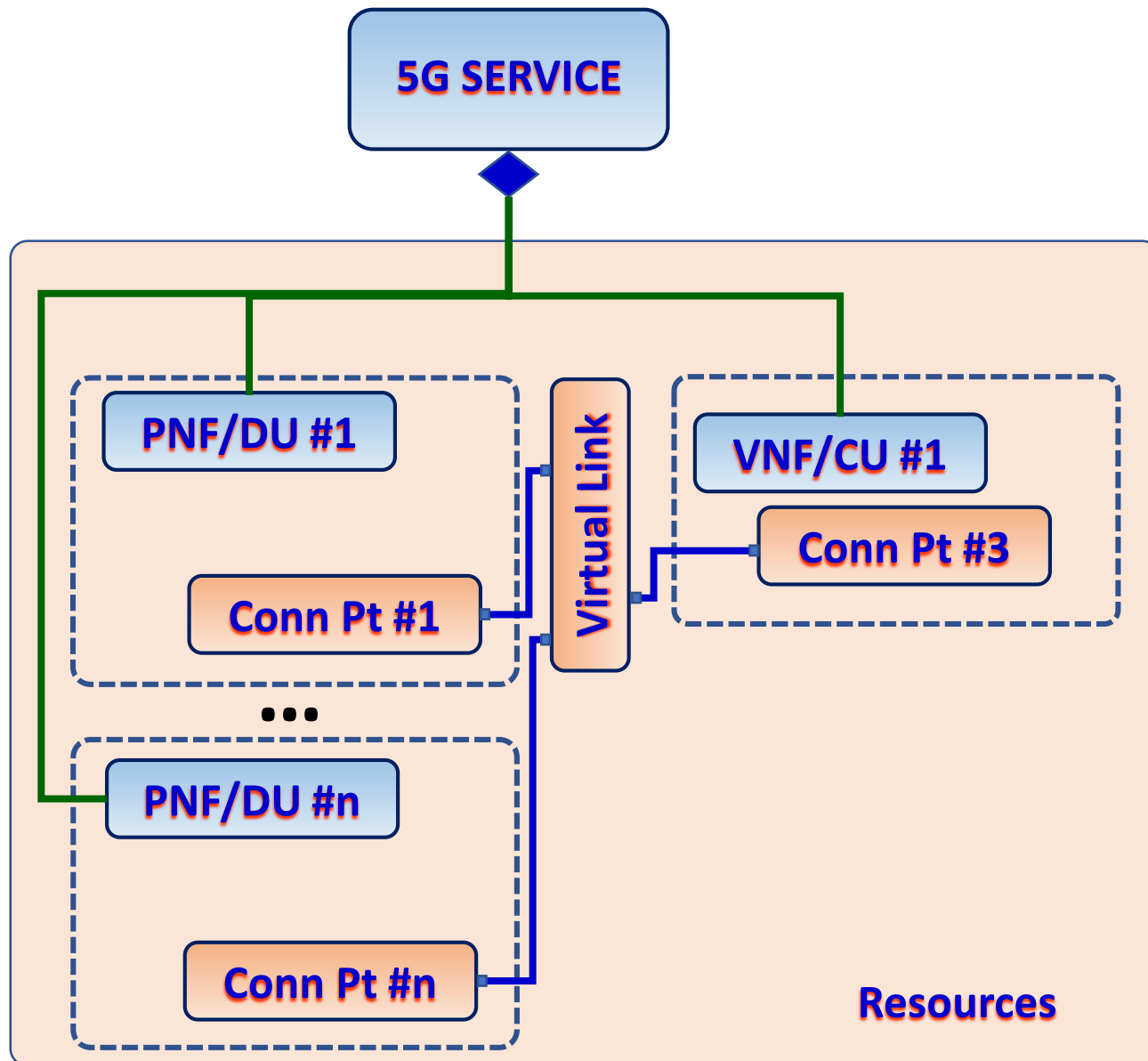
Sources

5G Standards

- **3GPP TS28.501**
- **3GPP Inventory**
- **3GPP TS32.106**
- **3GPP Operational**

5G NRM

- **3GPP TS28.620 FNIM UIM**
- **3GPP TS28.540 5G NRM**
- **3GPP TS28.622 Generic NRM**
- **3GPP TS28.541 5G NRM**

ONAP
OPEN NETWORK AUTOMATION PLATFORM

- **A&AI Schema**
- **Platform Swaggers API, Data Models**
- **SDC AID**
- **ONAP Platform Information Model**

- **ITUT X.731 Op/Admin**
- **ORAN WGx**

Sources

SA5 5G Spec structure

5G Management Concept
28.530 (stage1)

Service based management Architecture
28.533 (stage1)

Provision
28.531
(Stage1+2+3)

Fault Supervision
28.545
(Stage1+2+3)

Performance Assurance
28.550
(Stage1+2+3)

5G Energy Efficency
28.310
(stage1+2+3)

Generic service
(Heart beat)
28.532(stage1)

5G SON
28.313
(stage1+2+3)

Close-loop SLS
28.535(stage1)

Trace
32.421
(stage1)

Intent-driven
28.312
(stage1+2+3)

Close-loop SLS
28.536(stage2+3)

Trace
32.422
(stage2+3)

Generic Operations
28.532 (stage2+3)

5G NRM
28.540(stage1)
28.541(stage2+3)

5G measurements
28.552 (PM)
28.554 (KPI)

Generic NRM & Controls
28.621 (stage1)
28.622 (stage2)
28.623 (stage3)

Inventory
28.631(stage1)
28.632(stage2)
28.633(stage3)

Legend
→ Reference
☐ generic
☐ 5G specific

Index of all 3GPP specifications is https://www.3gpp.org/specifications/specification-numbering
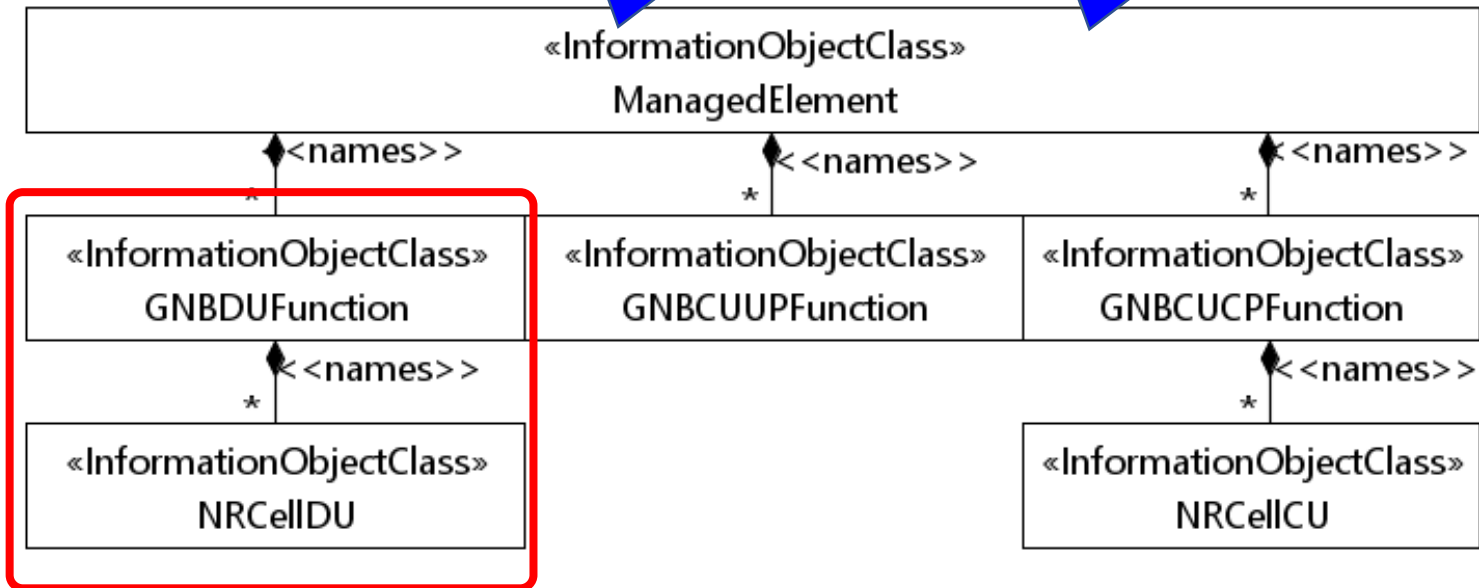OAM specifications are either 28.xxx series or 32.xxx series.
Many of the legacy 32.xxx have been replaced by the newer versions in 28.xxx space.
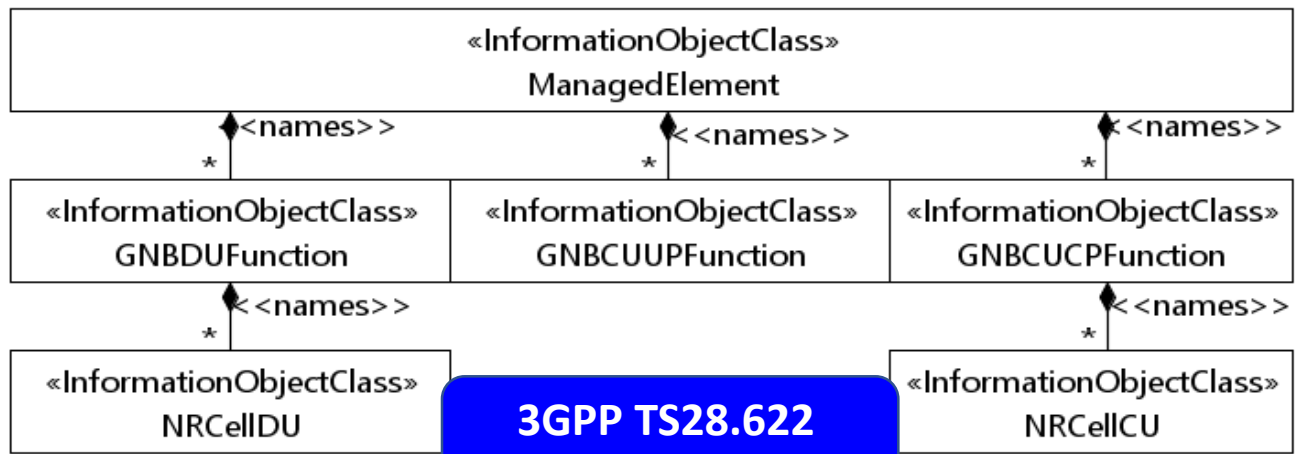An overview "map" of 5G OAM specifications is in the S5-197548

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3GPP DU Models from TS28.541, 620, 622

* Federated Network Information Model (FNIM) , Umbrella Information Model (UIM)

3GPP TS28.622
Generic NRM

3GPP TS28.620
FNIM, UIM

ONAP Platform Information Model

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PNF A&AI Model

PnfsType

1

5000

Pnfd

pnfName – String [0..1]

pnfName2 – String [0..1]

selflink – String [0..1]

pnfName2Source – String [0..1]

pnfId – String [0..1]

equipType – String [0..1]

equipVendor – String [0..1]

equipModel – String [0..1]

managementOption – String [0..1]

orchestrationStatus – String [0..1]

ipaddressV4Oam – String [0..1]

swVersion – String [0..1]

inMaint – Boolean [0..1]

frameId – String [0..1]

serialNumber – String [0..1]

ipaddressV4Loopback0 – String [0..1]

ipaddressV6Loopback0 – String [0..1]

ipaddressV4Aim – String [0..1]

ipaddressV6Aim – String [0..1]

ipaddressV6Oam – String [0..1]

invStatus – String [0..1]

resourceVersion – String [0..1]

provStatus – String [0..1]

nfRole – String [0..1]

adminstatus – String [0..1]

opertionalStatus – String [0..1]

modelCustomizationId – String [0..1]

modelInvariantId – String [0..1]

modelVersionId – String [0..1]

pnfIpv4Address – String [0..1]

pnfIpv6Address – String [0..1]

https://wiki.onap.org/display/DW/Example%3A+PNF+in+AAI

CPS Information Model Design R7

«Preliminary»
DesignEntity

- «Preliminary» + validFor: TimePeriod [0..1]
- «Preliminary» + status: String [1]
- «Preliminary» + name: String [1]
- «Preliminary» + description: String [1]
- «Preliminary» + id: Identifier [1]

«Preliminary»
OperationalEntity

- «Preliminary» + name: String [0..1]
- «Preliminary» + description: String [0..1]
- «Preliminary» + id: Identifier [1]

«Experimental»

1=Take Model "As Is"

0= Optional

«Preliminary»
ResourceDesc

«Preliminary»
ResourceInstance

«Experimental»

«Experimental»
ResourceDescHasResourceAppModel

«Experimental»
ResourceInstanceHasAppData

0..1

0..1

«Experimental»
ResourceAppModel

«Experimental»
ResInstAppDataDescribedByResAppModel

«Experimental»
ResourceInstanceAppData

1
+_resourceappmodel

*

«Experimental»
YangModelSet

- «Experimental» + yangModules: YangModuleIdentifier [1..*]

«DataType»
«Experimental, Reference»
YangModuleIdentifier
{reference=IETF RFC7950 }

- «OpenModelAttribute, Reference» + namespace: String [1]
- «OpenModelAttribute, Reference» + yangVersion: String [1]
- «OpenModelAttribute, Reference» + moduleName: String [1]
  + Revision: String [1]

*For more information see IETF RFC7950

Dec 3, 2020 – Notes from U/C R

YANG MODEL REVISIONS

Revision of Yang model may be needed

Revision & namespace is used in CPS to uniquely identify a yang module

Namespace is globally unique

Dataspace CPS concept

Resource that a package is using.

Onboarding new versions of a package for use of EXISTING xnfs.

Upgrade that brings along the new artifacts assoc w/ the new version.

Using existing SDC distr. Mechanisms.

Support multiple versions of the same yang module.

Parameters that USED to be Mandatory / optional and changes its category (and vice versa). How would CPS know?

ACTION: (JB) + Model Revision of ONAP model contribution.

xNF DESCRIPTOR

(Fred O.) In the ETSI PNFD/VNFD, the configurable elements can be described in the configurable_properties section of the P/VNF Descriptor. Would we be able to support that as an alternative way to supply the model for CPS? Not directly in the ONAP model. In ETSI NF upgrade scenario, the NF descriptor has upgrade sections the would describe the NF configuration differences. Dynamically extracted as instantiating an xNF based on the package. Is the CPS model dynamically created based on the xNF package? A 5G NRM model + vendor info. (Tony) CPS is agnostic to data it stores. Whoever wants to store data can provide CPS with a Yang model w/ the structure & validate on its behalf. Could probably describe the entire CM model, the intent for day0 configuration. Extract properties in yang model > CPS > Store data. Controllers that talk to the network.

BACKWARD COMPATIBILITY & DATA MIGRATION

(tony) From CPS perspective different model, the VNF ID would be the same, ensure models for later version are backward compatible to migrate data. How to handle wi/ CPS project, if not delete & recreate. How to enforce this? Or is there a "**bit**" that indicates backward compatibility. A CPS process would look at? CPS-core or CPS-xNF-proxy. (Jacqueline) convention in the version?. (toine) it is just Date/timestamp & 3GPP-SA-reference-date. (tony) new model revision? We'll delete & resync. Master data, the xNF is the master. CPS might or might not be seen as the master. How is this configured? (JB) if we are supporting both cases , need to define behavior for each case when new models are introduced.

Data not pure instance data. Meta-Data describe behavior want CPS in how it represents native network data. Golden templates/configurations. Anchors/Data space (CPS concepts) meta-data of CPS.

Only interested in data/constraints. METADATA not needed for validation the ODL Yang parser may not expose it. Ownership & Registry. To identify unique modules wi/ CPS (internal).
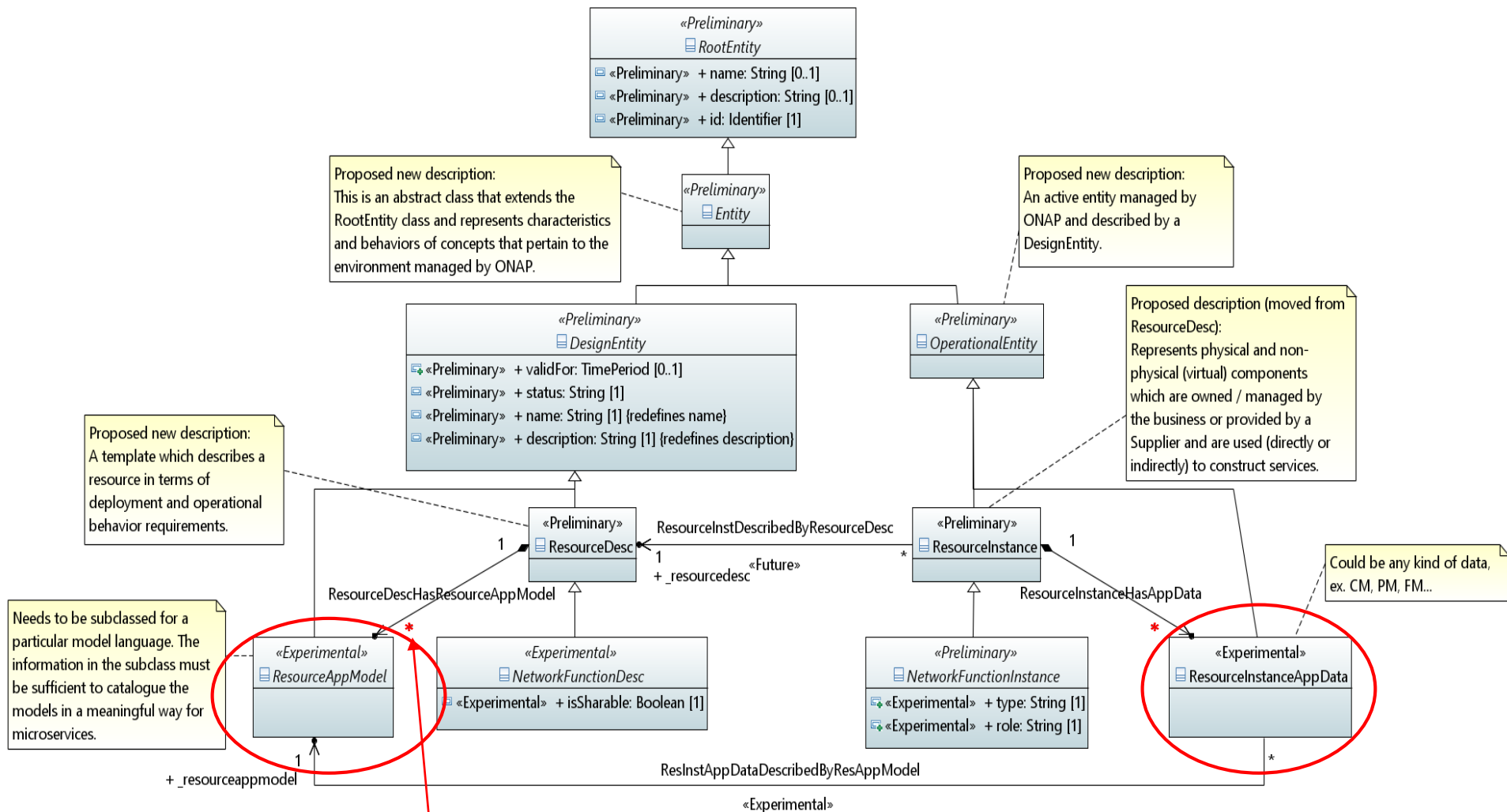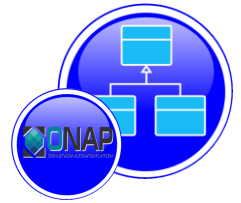
Enhance Platform Information Model

3GPP TS28.540 5G NRM

3GPP TS28.541 5G NRM

3GPP TS28.620 FNIM UIM

TS28.622 Generic NRM

Platform Information Model ++
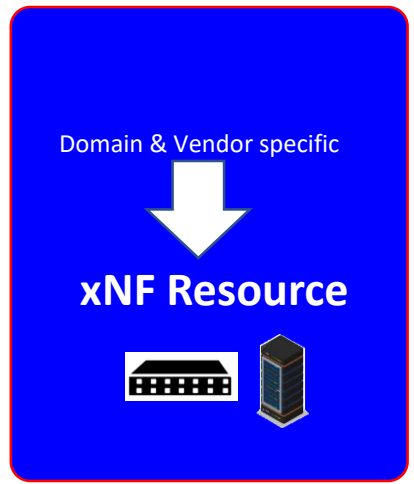
5G NRM Generic NRM

DESIGN TIME

Domain & Vendor specific

xNF Resource

Service CSAR

RUN TIME

SDN-C (etc)

CPS Database
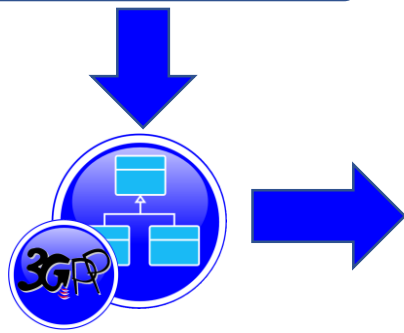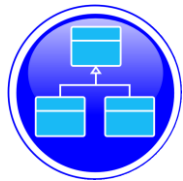
Cell Carrier-Sector

Generic Application Model

3GPP TS28.540 5G NRM

3GPP TS28.541 5G NRM

3GPP TS28.620 FNIM UIM

TS28.622 Generic NRM

5G NRM
Generic NRM

Optical ISOMII

DESIGN TIME

Application Model

+ Domain & Vendor specific

xNF Resource

Service CSAR

Platform Information Model

RUN TIME

SDN-C (etc)

PNF#106

CPS Database

Generic Application Model / Hybrid

3GPP TS28.540 5G NRM

3GPP TS28.541 5G NRM

3GPP TS28.620 FNIM UIM

TS28.622 Generic NRM

Define new artifact type, Design time & Run time
Uses that type to retrieve info from 5G NRM artifact
Framework is there, minor impact to code.
M#1 SDC (onboarding) CBA read yang model from onboarding package
M#2 CDS (manually load NRM into CBA)

5G NRM (RAN) Generic NRM

Optical

DESIGN TIME

Application Model

+ Domain & Vendor specific

Pointer to Application Model

xNF Resource

PNFd (descriptors) Connectionpts
PNF Parameters
Application Parms in Artifacts

Service CSAR

Platform Information Model++

(Minor)
connections

RUN TIME

SDN-C (etc.)

U/C μ-Service

CPS Database

StndDef VES

PNF#106
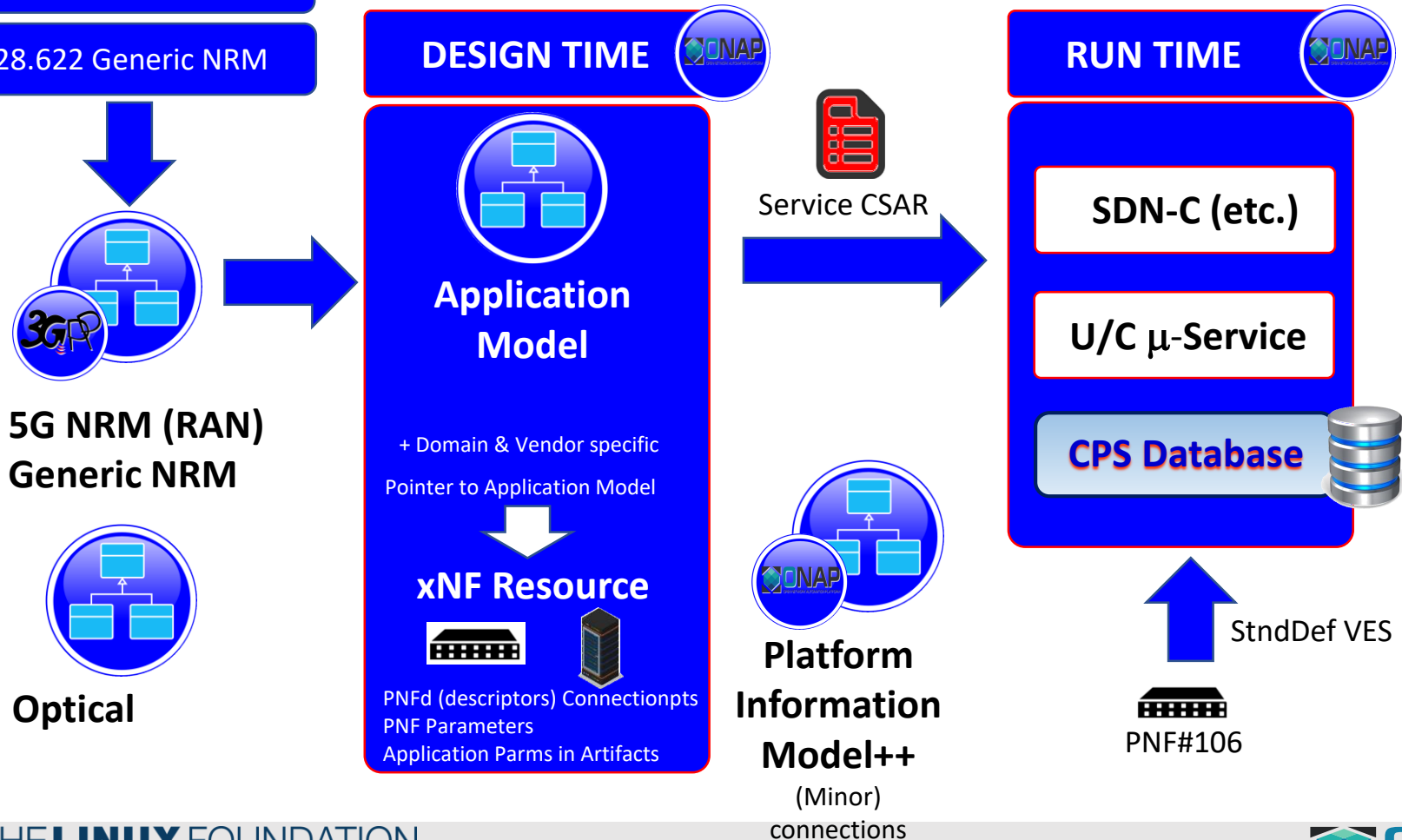
Generic Application Model / Hybrid – R8

NRM . (Yang/Ansible) Artifact

Vendor Onboarded CSAR

Network Slice (Class)

serviceProfileList (Attribute)
networkSlideSubnetRef

DESIGN TIME ONAP

NRM

RUN TIME ONAP

5G NRM
Generic NRM

Application Model

+ Domain & Vendor specific

Service CSAR

SDN-C (etc.)

U/C μ-Service

CPS Record
xNF instance
(looks at) NRM arti

NRM

CPS Database

PNF#106

xNF Resource

PNF#106

Optical Model

Platform Information Model++

(optional if needed)

StndDef VES

PNF#106

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ONAP

Generic Application Model / Hybrid – R8

Vendor #1

Vendor Onboarded CSAR

NRM Artifact

5G NRM

Vendor #2

Vendor Onboarded CSAR

NRM Artifact

5G NRM

DESIGN TIME ONAP

Application Model

+ Domain & Vendor specific

xNF Resource

PNF#106

NRM

Service CSAR

ONAP

Platform Information Model++

(optional if needed)

RUN TIME ONAP

SDN-C (etc.)

U/C μ-Service

CPS Database

NRM

PNF#106

CPS Record
xNF instance
NRM artifact

StndDef VES

PNF#106

Generic Application Model / Hybrid – R8

RUN TIME

ONAP

SDN-C (etc.)

U/C μ-Service

CPS Database

CPS Record
xNF instance
(looks at) NRM artifact

NRM

PNF#106

StndDef VES

PNF#106

Service Instantiation

What kind of xNF Resource do I have?

Do I have a NRM Artifact for it?

CPS Data R/W

What kind of xNF Resource do I have?
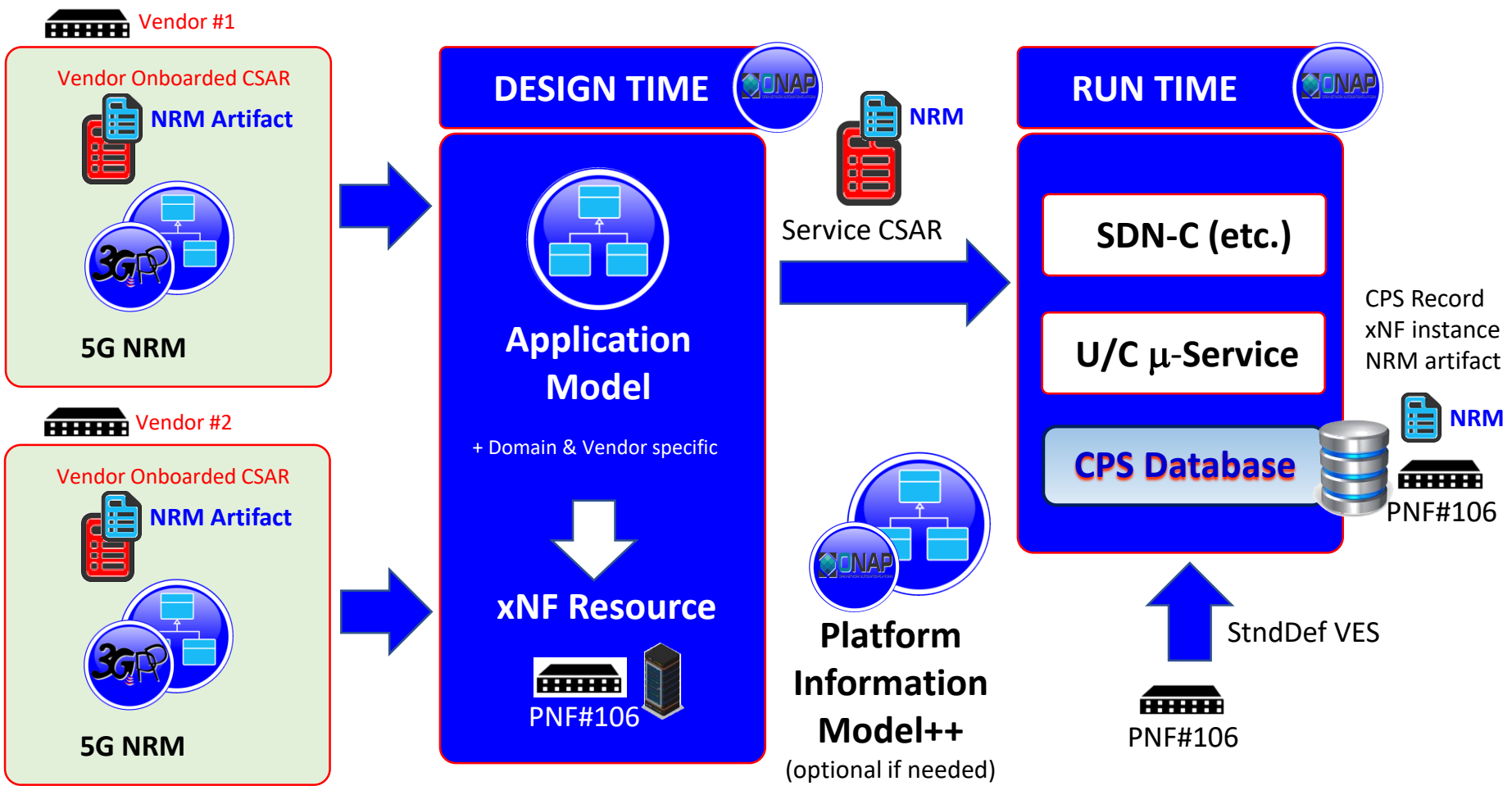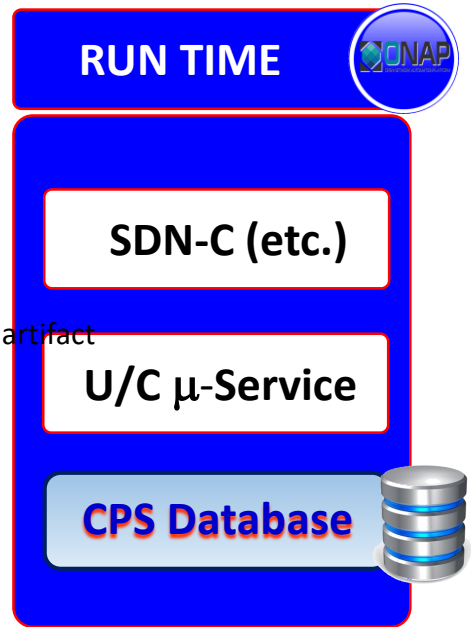
DOMAIN Bit "I'm 5G NRM compatible"

Do I have this kind of data for it? Can I understand it?
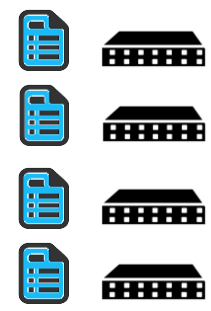
M-S interested in particular kinds of xNFs
Kind of data in xNF
Can I identify a model associated w/ the xNF
That the mS process.
How to tag models that are incorporated useful in a catalog to make a decision point to decide if a model is useful to it.
How to automatically set the Domain Bit/Flag
* Meaningful classification – defining a classification of the model & filling it. / Meta-Model Cladistic Topology Model (Meta-Categorization)
* Model & resource descriptor link.

ONAP
OPEN NETWORK AUTOMATION PLATFORM

ONAP RUN TIME Registry Service & CPS

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PROBLEM STATEMENT:

Sharing Data / Hard coding / Co-management-ownership

Why Sharing

CONTEXT:

Data Discoverable at Run-Time

SOLUTION:

Solution – Coordination / Race

Registry Service Flow

U/C μ-Service A

U/C μ-Service B

7 μ–Service-B REQUESTS permission from μ–Service-A for data & instance access

8 μ–Service A grants permission to data xNF instances, and security token

1 Model Update & Definition for ElecMechTilt (Yang)

2 Register: Model Metadata (e.g. Antenna, RAN, 3GPP) Model Keywords

5 Query Registry for Antenna Metadata Micro-Services

6 Registry Returns a *list* of Micro-Services = { μSvc A }

9 RO/RW Security Token for xNF #106 ElecMechTilt data

10 CPS returns ElecMechTilt for xNF#106 = 50º

REST Endpoint: Register

REST Endpoint: Query

Registry Service

CPS Database

Record

4 Sets Value for xNF #106 ElecMechTilt = 50º

CPS Listener

xNF#106

ElecMchTilt = 50

3 xNF#106 sends StndDef VES event setting ElecMechTilt = 50º

PNF#106 StndDef VES ElecMchTilt = 50

WELCOME TO
HONOLULU
WELCOME TO

DU/PNF   CU/VNF

ONAP RUN-TIME

DMaaP

Config & Persist Service

1

PNF VNF → **VES Event** → **DCAE VES Collector**

DCAE Inventory

DCAE

Analytics

Configuration NameSpace topic
3GPP-Provisioning

CPS Update

TOPIC = Standards Defined
VES Event
for Configuration

The PNF has a parameter update to report. The update originates from the PNF and is reported through a Standards Defined VES event with a configuration NameSpace (3GPP-Provisioning)

Standards Defined VES Event is received by the *DCAE VES Collector*. DCAE publishes the VES Event onto the DMaaP Bus.

In R8+: CPS as a stand-alone component, subscribes to the DMaaP Topic and gets the DMaaP event from the DMaaP bus to update the internal database. The VES event has a Configuration namespace topic, 3GPP-Provisioning

CPS Database

Run-Time Operational Data
Configuration Info
Exo-Inventory Data
RT Logical & Physical Connections

3GPP Mapper (DCAE)
Map stndDef VES event
onto existing VES event

UNDER CONSTRUCTION

CPS Roadmap & R6-R8 Plan

Configuration Persistence Service (CPS) Roadmap –

R6 Frankfurt → R7 Guilin → R8 Honolulu →

June 5, 2020 | **December, 2020** | **June 2021**

CPS 1.0
R6 CPS
- CC-SDK/SDN-C solution
- Evolution of "ConfigDB"

Supporting R6 Use Cases:
- SON/OOF/PCI U/C

CPS 1.1
R6 CPS Extensions
- Evolution of CC-SDK/SDN-C solution REQ322

Supporting R7 Use Cases:
- SON/OOF/PCI U/C
- 5G E2E Network Slicing
- A1 Policy extension (Ericsson)

Model-Driven PoC
- Write "base" CPS
- Write NE *Data*
- Read NE Data
- Access Control

State Management PoC
- State Management PoC (BellCA) self-contained

CPS 2.0
R8 CPS stand-alone project proposal
- Deprecate CPS 1.0 & 1.1
- Project proposals TSC/Architecture S/C
- Setup Project Repo

CPS FUNCTIONALITY:
- Data Recovery
- Model Adaption (Dynamic Schema)

Legend:
RED text is CC-SDK/SDN-C solution
BLUE text is the PoC & stand-alone project

Onboarding

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PNF Onboarding Package (CSAR)

PNF Onboarding (CSAR file)

Note:
- Package Example
- Not all files are listed.
- Folder / file name in blue is requested by SOL004.
- Folder / file name in black is example only.

TOSCA-Meta-Version: 1.0
CSAR-Version: 1.1
Created-By: Ericsson (Zu Qiang 2018-12-03)
Entry-Definitions:
Definitions/MainServiceTemplate.yaml
Entry-Manifest: MainServiceTemplate.mf
Entry-Change-Log: Artifacts/ChangLog.txt
Entry-Tests: Artifacts/Tests
Entry-Certificate: Artifacts/License_term.txt

ROOT

📁 TOSCA-Metadata
📁 Definitions
📁 Artifacts
📄 MainServiceTemplate.mf

📄 TOSCA.meta

NF descriptor

📄 MainServiceTemplate.yaml

NonMANO artifacts (keyword)
NRMYang or NRMAnsible
5GNRM . (Yang/ansible)

📁 Images
📁 Deployment
📁 Scripts
📁 Tests
📄 ChangeLog.txt
📄 MainServiceTemplate.cert
📄 License_term.txt

(one possible location)
NRM.Ansible

📁 Configuration
📁 Yang_module
📁 Measurements
📁 Events
📁 ...

(one possible location)
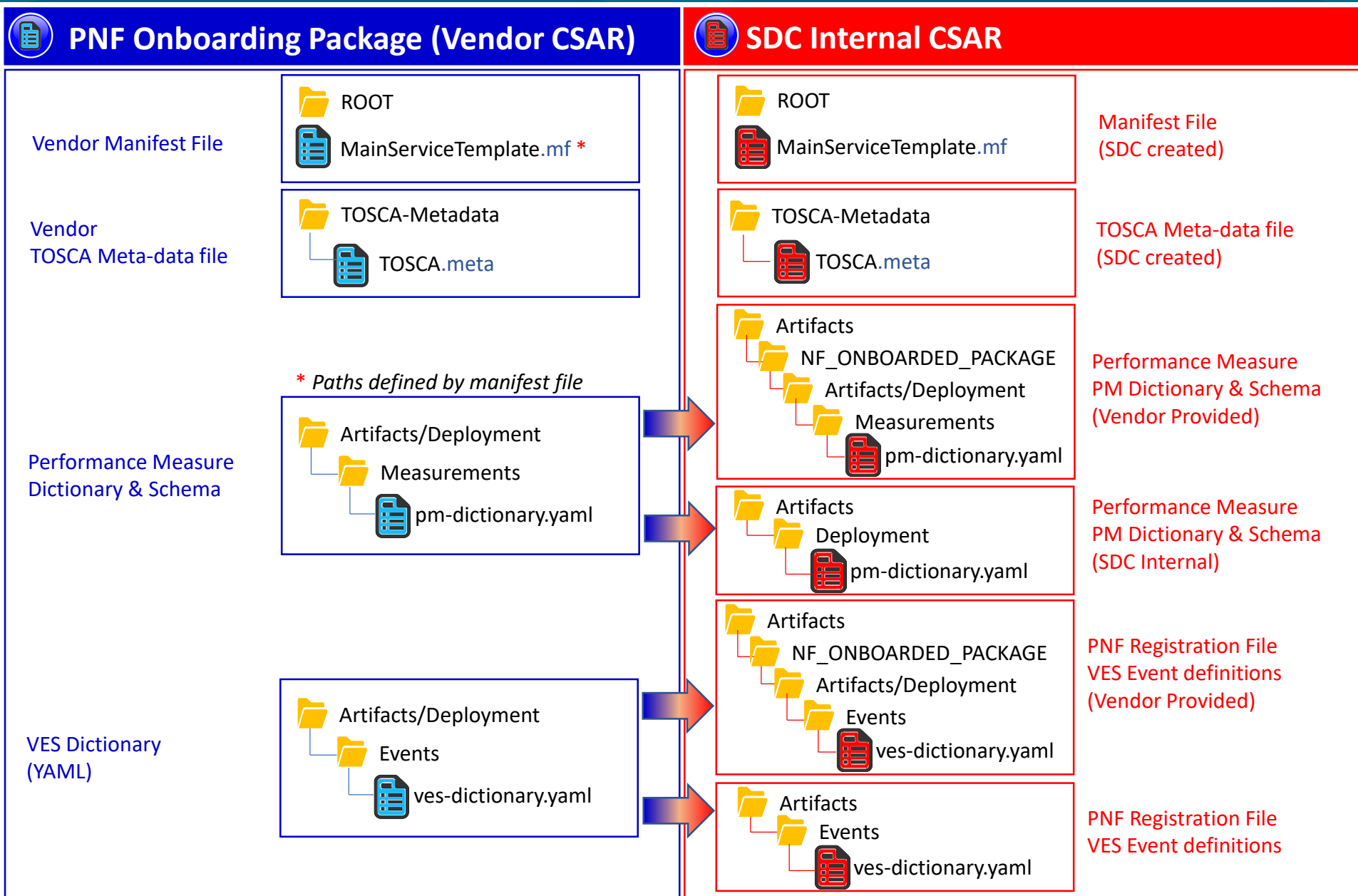**NRM.Yang**

📄 yang-module.yang

📄 pm-dictionary.yaml

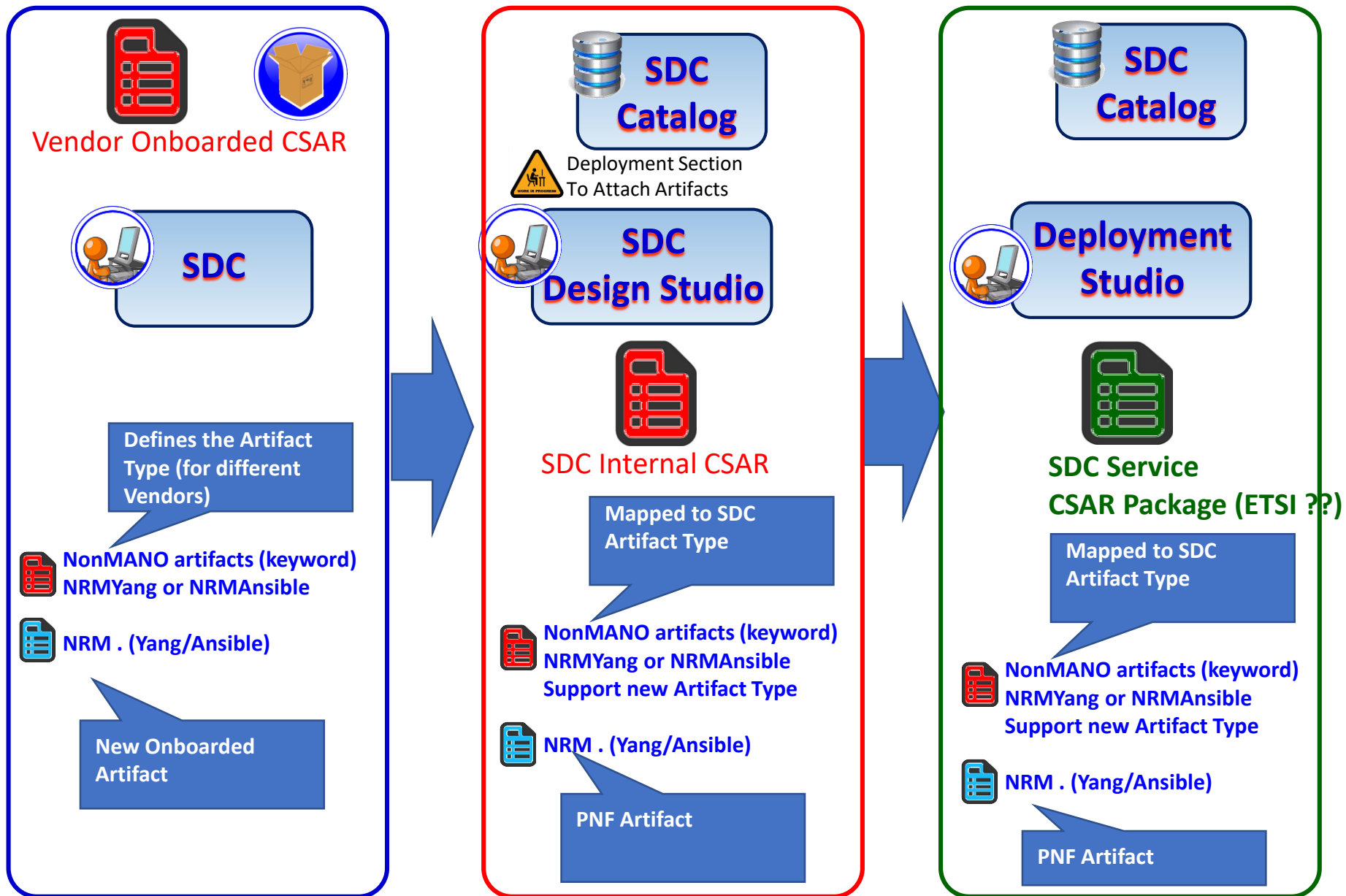📄 ves-dictionary.yaml

📄 Install.csh
📄 ...

metadata:
pnf_product_name: gNB
pnf_provider_id: Ericsson
pnf_package_version:1.0
pnf_release_date_time:2018-12-03T08:44:00-05:00
non_mano_artifact_sets:
Events:
source:
Artifacts/Deployment/Events/VES_registration.yaml

el
edicated NONMano artifact keyword

ONAP

Onboarded Package to SDC Internal Mapping

PNF Onboarding Package (Vendor CSAR)

Vendor Manifest File

📁 ROOT
📄 MainServiceTemplate.mf *

Vendor TOSCA Meta-data file

📁 TOSCA-Metadata
📄 TOSCA.meta

Paths defined by manifest file

Performance Measure Dictionary & Schema

📁 Artifacts/Deployment
📁 Measurements
📄 pm-dictionary.yaml

VES Dictionary (YAML)

📁 Artifacts/Deployment
📁 Events
📄 ves-dictionary.yaml

SDC Internal CSAR

📁 ROOT
📄 MainServiceTemplate.mf

Manifest File (SDC created)

📁 TOSCA-Metadata
📄 TOSCA.meta

TOSCA Meta-data file (SDC created)

📁 Artifacts
📁 NF_ONBOARDED_PACKAGE
📁 Artifacts/Deployment
📁 Measurements
📄 pm-dictionary.yaml

Performance Measure PM Dictionary & Schema (Vendor Provided)

📁 Artifacts
📁 Deployment
📄 pm-dictionary.yaml

Performance Measure PM Dictionary & Schema (SDC Internal)

📁 Artifacts
📁 NF_ONBOARDED_PACKAGE
📁 Artifacts/Deployment
📁 Events
📄 ves-dictionary.yaml

PNF Registration File VES Event definitions (Vendor Provided)

📁 Artifacts
📁 Events
📄 ves-dictionary.yaml

PNF Registration File VES Event definitions

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VNF/PNF PACKAGES

Vendor Onboarded CSAR

SDC

Defines the Artifact Type (for different Vendors)

NonMANO artifacts (keyword) NRMYang or NRMAnsible

NRM . (Yang/Ansible)

New Onboarded Artifact

SDC Catalog

Deployment Section To Attach Artifacts

SDC Design Studio

SDC Internal CSAR

Mapped to SDC Artifact Type

NonMANO arifacts (keyword) NRMYang or NRMAnsible Support new Artifact Type

NRM . (Yang/Ansible)

PNF Artifact
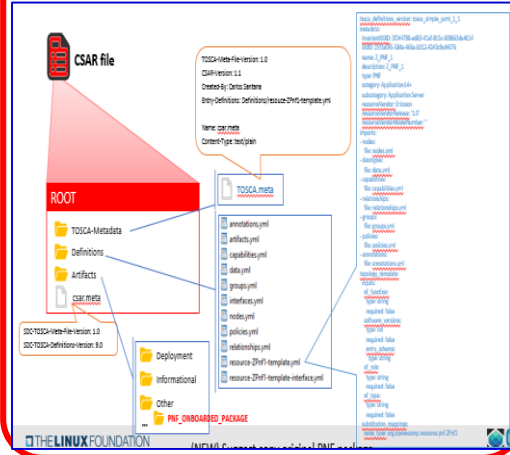
SDC Catalog

Deployment Studio

SDC Service CSAR Package (ETSI ??)

Mapped to SDC Artifact Type

NonMANO artifacts (keyword) NRMYang or NRMAnsible Support new Artifact Type

NRM . (Yang/Ansible)

PNF Artifact

PNF PACKAGES
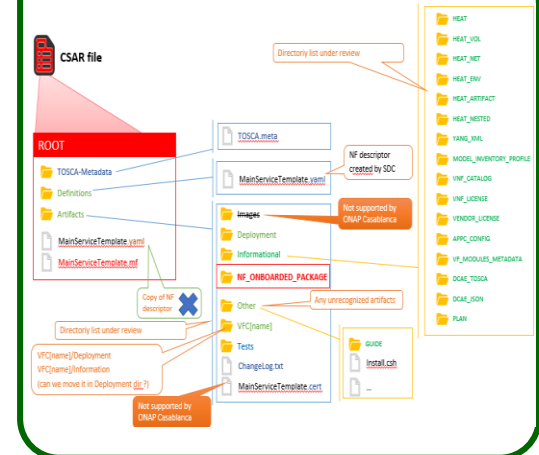
PNFD Model

CP1 to CP6: Ext connection points (e.g. Control plane, data plane, management, etc

NsVirtual link for each type of connection types Note: These VL may also can represent transport network technologies used.

CP7: Ext connection point(s) for network core elements.

Logical view

5G RAN

PNFD

DU:
1-N

CU
1

CP7

CP1 CP3 CP5

CP6 CP4 CP2

VNFD

NsVL3

NsVL2

NsVL1

NSD

CP1

NsVL1

ECP7
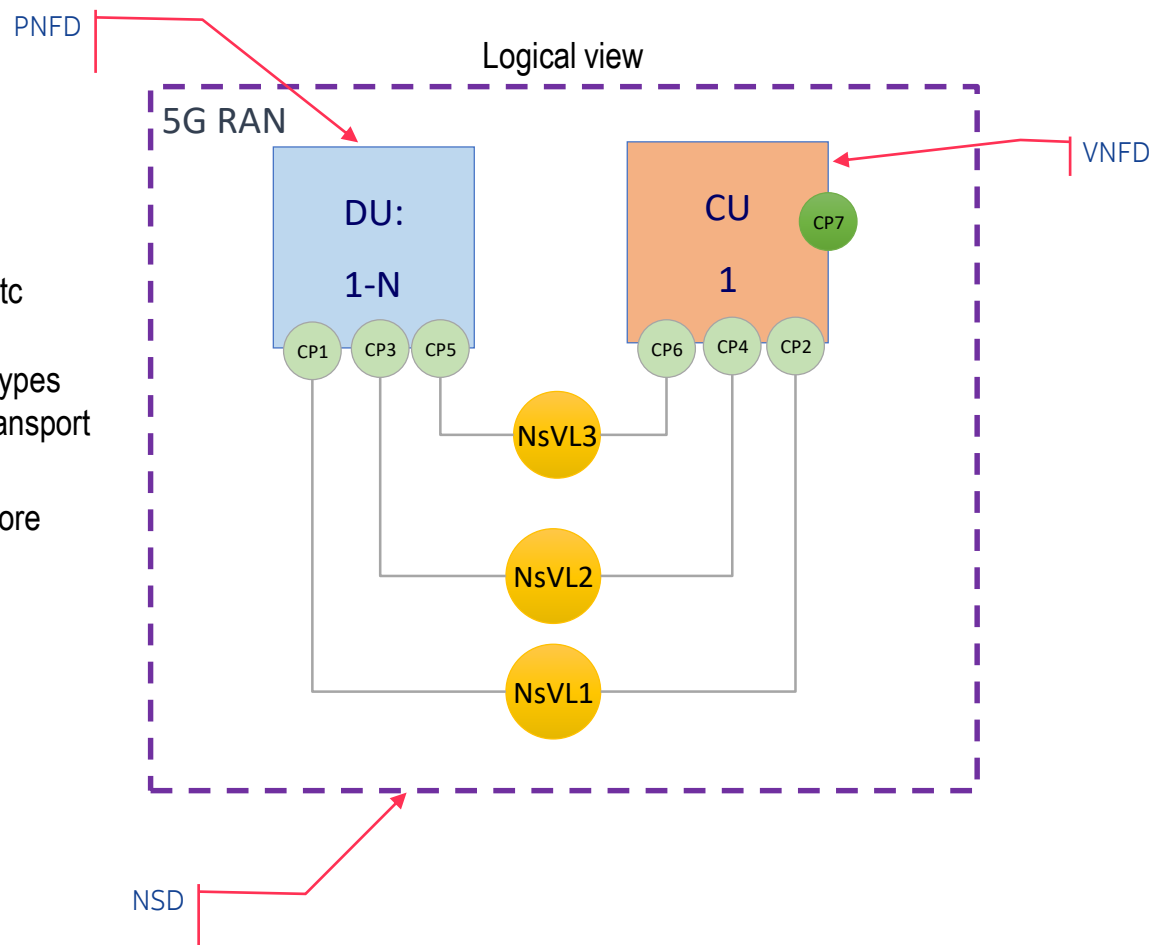
Example: TOSCA Service Template

```
tosca_definitions_version: tosca_simple_yaml_1_2
description: 5G RAN simple example
imports:
  - etsi_nfv_sol001_nsd_2_6_1_types.yaml
node_types:
  tosca.5gexample_NS:
    derived_from: tosca.nodes.nfv.NS
    properties:
      descriptor_id:
      flavour_id:
topology_template:
  substitution_mappings:
    node_type: tosca.5gexample_NS
    requirements:
       virtual_link: [ CU, virtual_link_XYZ ] # the External connection point of CU
  node_templates:
    my_5gservice:
      type: tosca.5gexample_NS
      properties:
      interfaces:
        Nslcm:
    CU:
      type: tosca.nodes.nfv.5Gexample_VNF1 # this type is described in another service template
      properties:
        flavour_id: simple
        vnf_profile:
      requirements:
        - virtual_link_1: NsVirtualLink_1
        - virtual_link_2: NsVirtualLink_2
        - virtual_link_3: NsVirtualLink_3
    DU_1_to_N:
      type: tosca.nodes.pnf.5gexample_DU # the description of this type is described in another service template
      properties:
      requirements:
        - virtual_link_1: NsVirtualLink_1
        - virtual_link_2: NsVirtualLink_2
        - virtual_link_3: NsVirtualLink_3
        - dependency: CU

    NsVirtualLink_1:  #
      type: tosca.nodes.nfv.NsVirtualLink
      properties:
        connectivity_type:
        vl_profile:
NsVirtualLink_2:  #
      type: tosca.nodes.nfv.NsVirtualLink
    NsVirtualLink_3:  #
      type: tosca.nodes.nfv.NsVirtualLink
# omitted here for brevity
```

Creating a 5G Service

Need to create a 5G service in R6

- Currently individual services can be created using VNFs and PNFs
- Modeling of 5G NFs is work ongoing in Platform (Internal) Info Modeling Committee
- Architecture sub-committee needs to approve modeling committee proposal before requirements can go to SDC
- SDC needs to receive requirements so service models can be created
- Schedule in R6 M0 (Sept 5 2019).
- 5G Use Case Proposed for R6.
- "Target" 5G Service. Multiple options. 3GPP options 2/7/8. Based on U/C.

Creating a 5G Service

- Config DB (MariaDB) used by PCI-H-MS (step 4b) and OOF (step 7)

- Query API (swagger JSON spec) exposed to other ONAP modules

- cellId needs to be globally unique (assumed eCGI) and align with ONAP YANG model, ORAN, 3GPP

- pnf-name/pnf-id indicates netconf server to be used for interactions regarding cells

- 'ho' property added to support ANR use case

Cell (Object)

Attribute	Format
networkId	string
cellId	string
pciValue	uint64
nbrList	list of cellId
lastModifiedTS	timestamp
pnf-id	string

Cell_Nbr_Info (Object)

Attribute	Format
cellId	String
target_cell_id	String
ho	BIT(1)

Place location & Geolocation Information

Benjamin Cheung, PhD

Civic Address/GeoLoc

TMF GB922 Location (Place)

RFC 6225 Geo Location

ETSI SOL 001 Civic Address

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Complex Object Place object

"Place" object in Platform Information Model

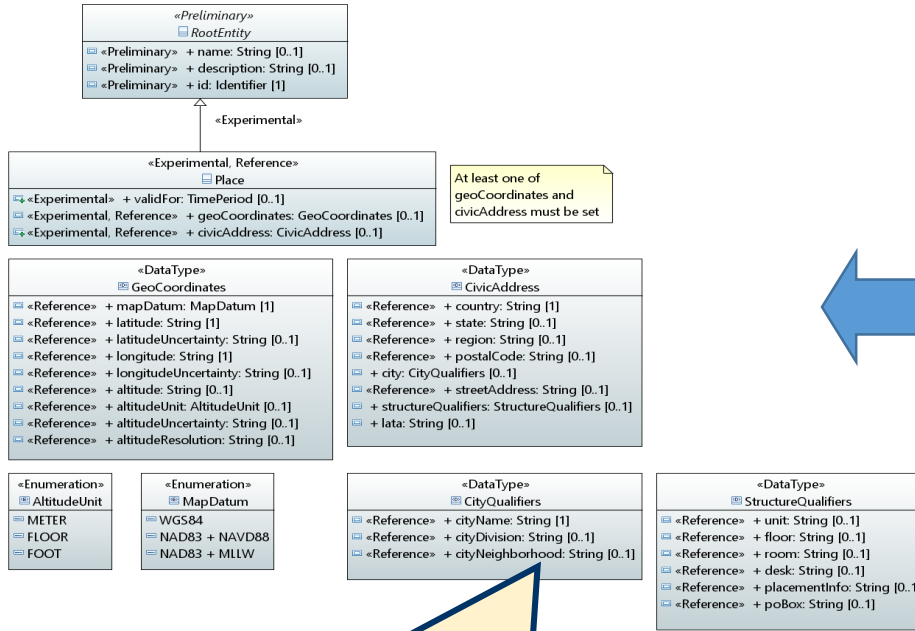| ATTRIBUTE	DESCRIPTION	EXAMPLE	TYPE	NOTES
physical-location-id	Unique identifier for physical location, e.g., CLLI (Location ID)	clli Code	String	
data-center-code	Data center code which can be an alternate way to identify a complex	example-data-center-code-val-6667	String	(Data Center centric - may need adaptation for PNF)
complex-name	Gamma complex name for LCP instance.	clli2	String	(ibid)
identity-url	URL of the keystone identity service	example-identity-url-val-28399	String	(ibid)
resource-version	Used for optimistic concurrency. Must be empty on create, valid on update and delete.		String	
physical-location-type	Type, e.g., central office, data center.	example-physical-location-type-val-28399	String	
street address	A string describing the street address of the place.	example-street1-val-28399	Map	Tag Value Array (Name/Value) = (1) "Street value #1=String" ; (2)"Street value #2=String"
city	The name of the metropolitan area, city, township, borough, district, or ward. The Map has with further specific city sub-divisions such as: division, borough, district, ward, chou, neighborhood, block, street group	example-city-val-28399	Map	Map of City (City, Township, Parish) City Division (Borough, District, Ward, Chou) Neighborhood (Block, Street groups)
state	The name of the state, province	example-state-val-28399	String	
postal-code	The string for the postal code or zip code	example-postal-code-val-28399	String	
country	The name of the country	example-country-val-28399	String	
region	The name of the region	example-region-val-28399	String	
additional qualifiers	These are additional descriptive qualifiers (general string) that may be concatenated information representing the structure qualifiers. This is a map, a tag value array of pre-defined qualifier fields including: unit, floor, room, desk	Tag Value Array	Map	
latitude	Latitude in binary geodetic form. A 34-bit fixed-point value consisting of 9 bits of integer and 25 bits of fraction. From RFC6225 (Optional)	example-latitude-val-28399	String	
longitude	Longitude in binary geodetic form. A 34-bit fixed-point value consisting of 9 bits of integer and 25 bits of fraction. From RFC6225 (Optional)	example-longitude-val-28399	String	
elevation	A 30-bit value defined by the Altitude Type field. From RFC6225 (Optional)	example-elevation-val-28399	String	
location-name	the location name (CANDIDATE)		String	
lata	Local Access Transport Area (1920s) (CANDIDATE)	example-lata-val-28399	String	
ctag-pools	CE VLAN IDs		Array	#/definitions/ctag-pool
relationship-list			Object	#/definitions/relationship
Latitude Uncertainty	(Candidates from RFC6225)	When the Ver field = 1, this field represents latitude uncertainty. Uncertainty = 2 ^ (21 - x). x = 21 - ceil(log2(uncertainty))	String	
Longitude Uncertainty	(Candidates from RFC6225)	When the Ver field = 1, this field represents longitude uncertainty. Uncertainty = 2 ^ (21 - x). x = 21 - ceil(log2(uncertainty))	String	
Altitude Uncertainty	(Candidates from RFC6225)	When the Ver field = 1, this field represents altitude uncertainty.	String	
Altitude Type	(Candidates from RFC6225)	(1) Altitude in Meters, (2) Altitude in Floors.	String	
Altitute Resolution	(Candidates from RFC6225)	value encodes the number of high-order altitude bits that should be considered valid	String	
Map Datum	(Candidates from RFC6225)	The Map Datum used for the coordinates given in this option: WGS84, NAD83 + NAVD88, NAD83 + MLLW.	String	
Geographic Geometry	TMForum GB922	Modeling sub-team has considered and discussed inclusion of (surfaces, multi-points, and shapes) and concluded that for now, there are immediate use cases that would need this.	Object	

Place Model in Platform Information Model
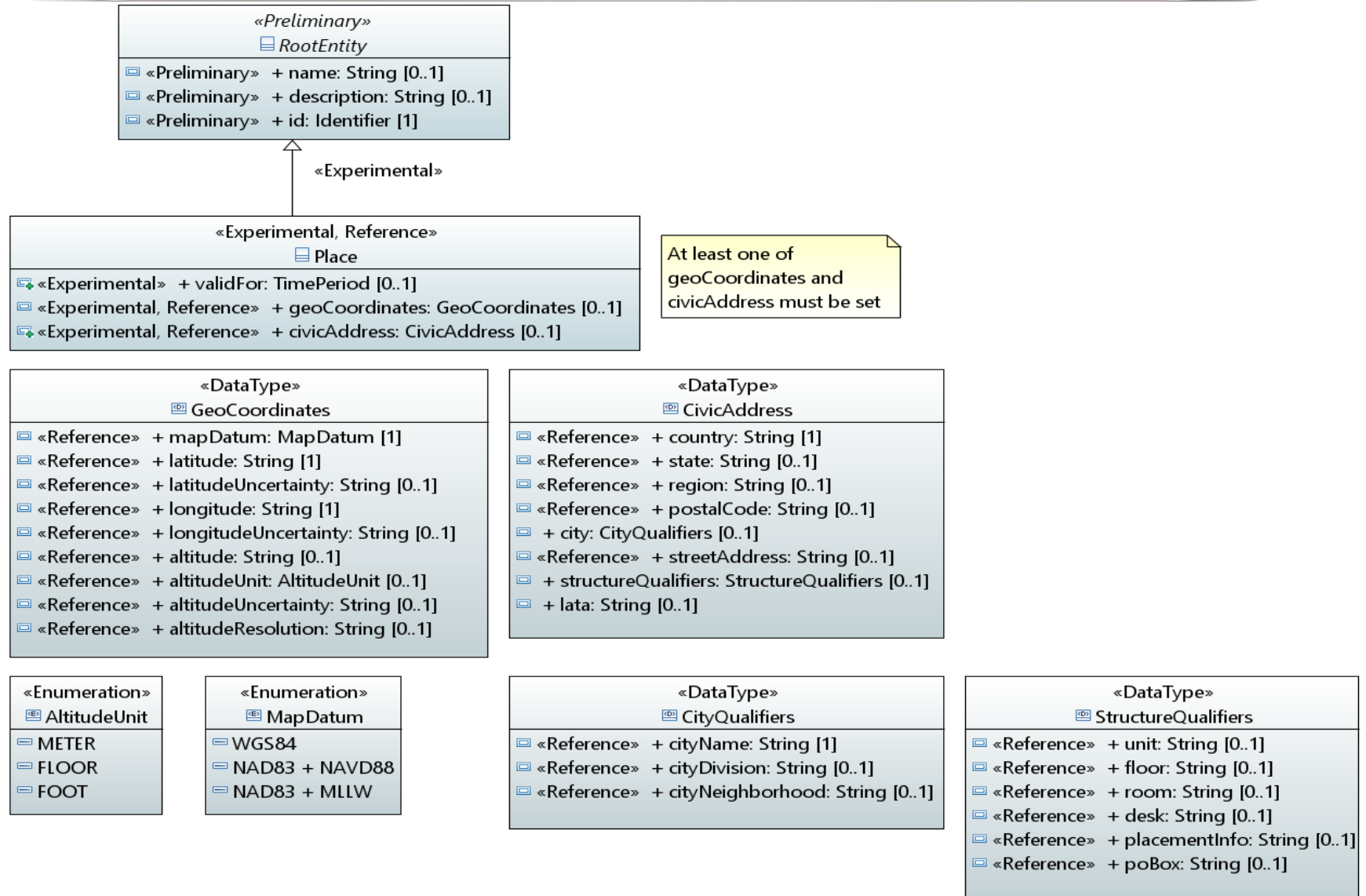
Place Model in Platform Information Model

ONAP INFO-MODEL: PLACE OBJECT

«Preliminary»
RootEntity
- «Preliminary» + name: String [0..1]
- «Preliminary» + description: String [0..1]
- «Preliminary» + id: Identifier [1]

«Experimental»

«Experimental, Reference»
Place
- «Experimental» + validFor: TimePeriod [0..1]
- «Experimental, Reference» + geoCoordinates: GeoCoordinates [0..1]
- «Experimental, Reference» + civicAddress: CivicAddress [0..1]

At least one of geoCoordinates and civicAddress must be set

«DataType»
GeoCoordinates
- «Reference» + mapDatum: MapDatum [1]
- «Reference» + latitude: String [1]
- «Reference» + latitudeUncertainty: String [0..1]
- «Reference» + longitude: String [1]
- «Reference» + longitudeUncertainty: String [0..1]
- «Reference» + altitude: String [0..1]
- «Reference» + altitudeUnit: AltitudeUnit [0..1]
- «Reference» + altitudeUncertainty: String [0..1]
- «Reference» + altitudeResolution: String [0..1]

«DataType»
CivicAddress
- «Reference» + country: String [1]
- «Reference» + state: String [0..1]
- «Reference» + region: String [0..1]
- «Reference» + postalCode: String [0..1]
- + city: CityQualifiers [0..1]
- «Reference» + streetAddress: String [0..1]
- + structureQualifiers: StructureQualifiers [0..1]
- + lata: String [0..1]

«Enumeration»
AltitudeUnit
- METER
- FLOOR
- FOOT

«Enumeration»
MapDatum
- WGS84
- NAD83 + NAVD88
- NAD83 + MLLW

«DataType»
CityQualifiers
- «Reference» + cityName: String [1]
- «Reference» + cityDivision: String [0..1]
- «Reference» + cityNeighborhood: String [0..1]

«DataType»
StructureQualifiers
- «Reference» + unit: String [0..1]
- «Reference» + floor: String [0..1]
- «Reference» + room: String [0..1]
- «Reference» + desk: String [0..1]
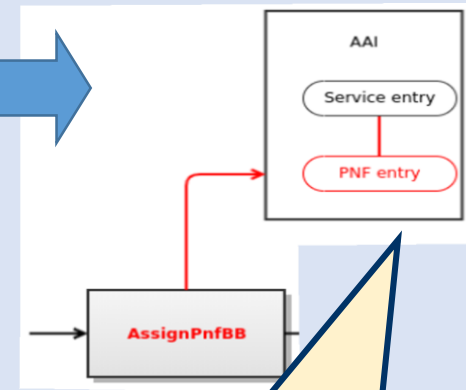- «Reference» + placementInfo: String [0..1]
- «Reference» + poBox: String [0..1]

SO BB Execution

During Plug and Play, the SO Building Block will instantiate a PNF A&AI entry which associated with a PLACE Object.

AAI
- Service entry
- PNF entry

AssignPnfBB

In R6 & R7, the Place Object platform information model was developed & approved (???) to be STUDIED

In R8, during the AssignPnfBB, SO needs to associate the PNF AAI entry with a Place object (???) to be STUDIED

In R8, a study will be done to figure out how to use this; no code will necessarily be done.
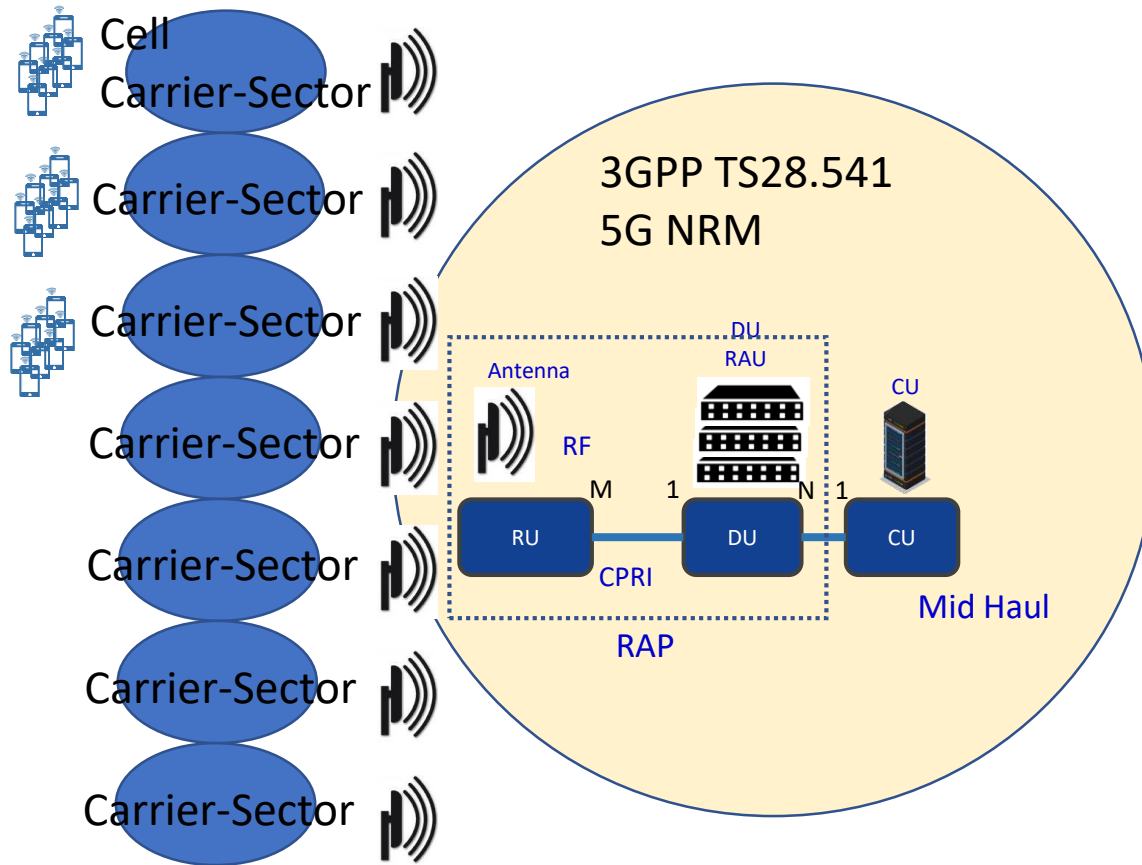
Cell Management, Cell object, Cell Configuration
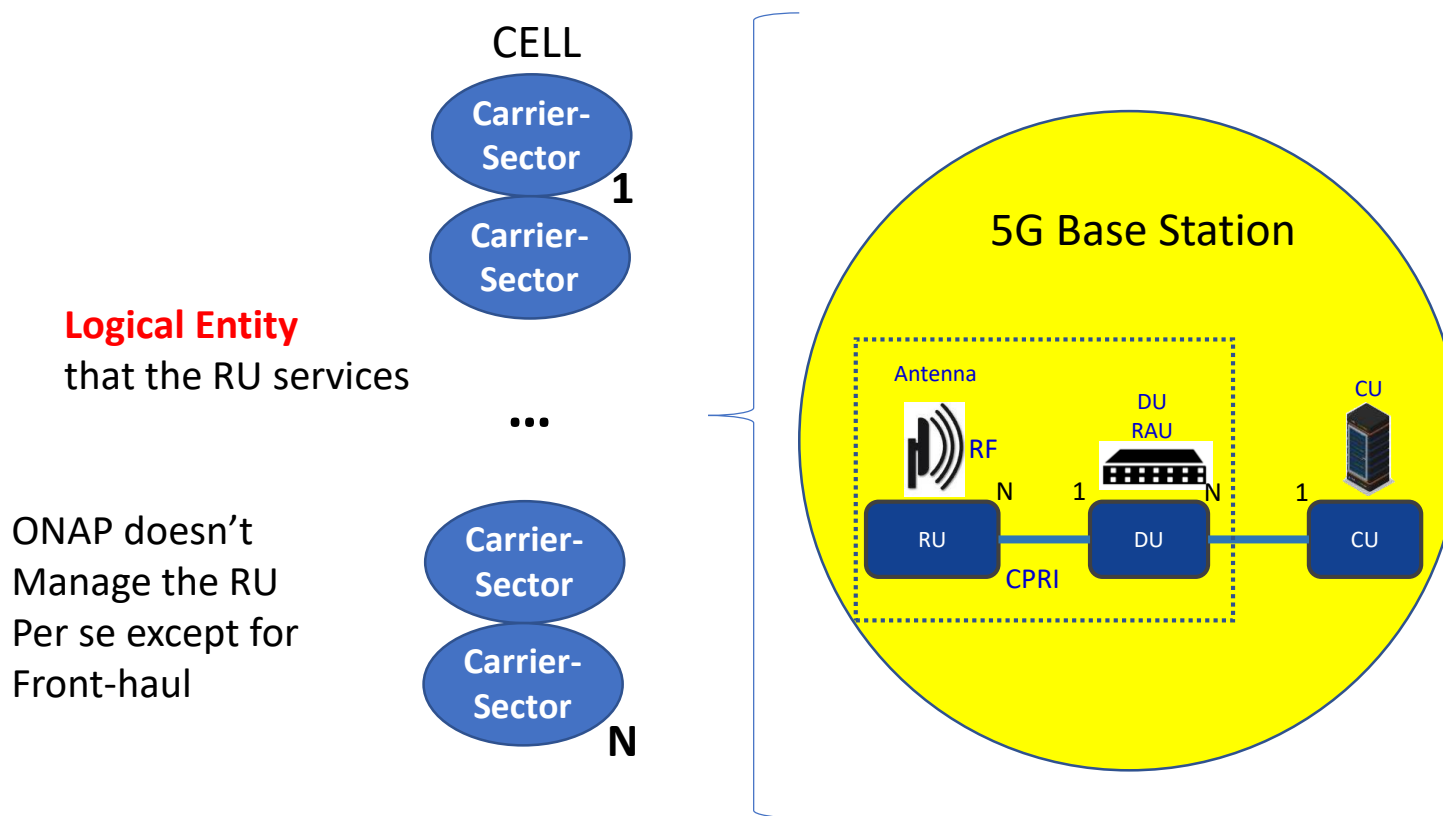
Benjamin Cheung, PhD

Cell Definition

DEFINITION: Cell in wireless communication technologies, the geographical region that is covered by a transmission facility. The term «cell» is most often used in reference to cellular phone technology, but it can also be used in reference to the coverage areas for transmission of cordless telephones, satellite transmissions, wireless local area networks (LANs), packet radio, and paging technologies.

https://networkencyclopedia.com/cell-in-wireless-communication/

CELL

Carrier-Sector

1

Carrier-Sector

Logical Entity
that the RU services

...

ONAP doesn't
Manage the RU
Per se except for
Front-haul

Carrier-Sector

Carrier-Sector

N

5G Base Station

Antenna

DU
RAU

CU

RF

RU

N

1

DU

N

1

CU

CPRI

Cell Management

VISIBILITY / EXISTENCE OF CELL

1 **USE CASES** –

      1a **E2E Network Slicing -** Slicing – xNFs involved in a slice (TA/RA), where is the "slice" stored? NSI in A&AI. Alloted NF (ANF). Slice Service.

      1b **OOF/SON/PCI** What use cases are Using it – OOF/SON/PCI which needs to store some cell info, KPI HO success rate. CellID. What Attributes to update. Key Identifiers. Neighbor Lists.

2 **EXISTENCE** - does ONAP need to know of existence of Cell? What does it need to know about a Cell?

MANAGEMENT OF CELL

1 **LIFE CYCLE** - Life Cycle of a Cell (FCAPS); OA&M interface at ONAP (no interface) **all the information related to a cell is reported/retrieved from the DU**. -> ONAP command "xyz Cell" (add/del/ onboard). ONAP would not "manage" a cell at all; it would manage a DU -> rather information for a cell (adds/deletes) are covered by the CPS database solution.

2 **FUNCTION** - What would it do with a Cell

3 **ADD/DELETE** - For add/delete Cell case -> the corresponding activity in ONAP is to add/delete CPS database entry. The DU informs ONAP that a Cell is added/deleted, then CPS updates database accordingly. ONAP management level to add/delete would be a configuration update.
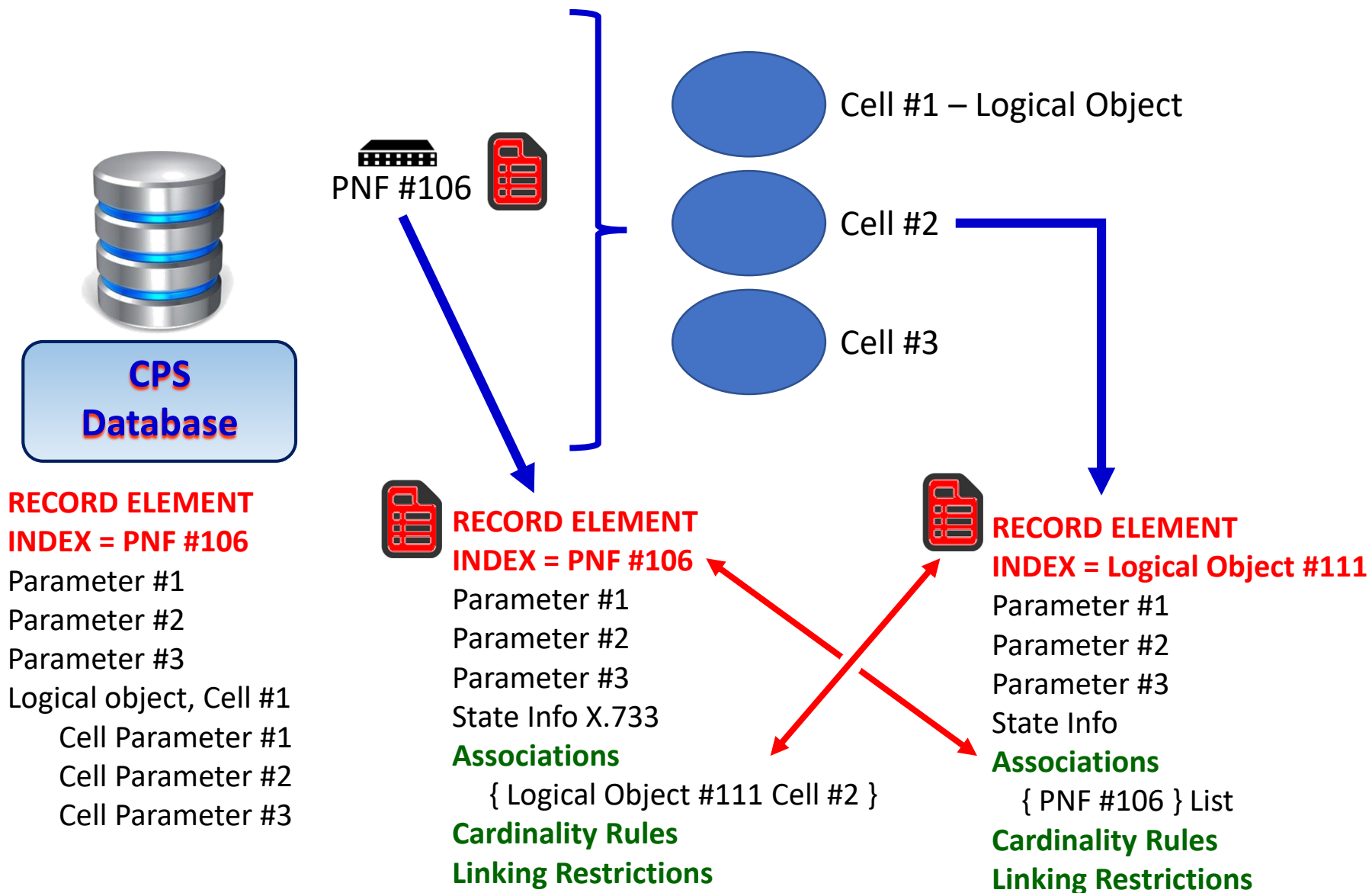
4 **MODELING** - How would it Model it? (Info Model). A DU is a MOC. A Cell is a Logical object. -> No modeling is needed.

INFORMATION ABOUT CELL

1 **PERFORMANCE MANAGMENT** - Cell specific KPIs, PM generated & reported from **DU**. COUNTERS collected & reported by the **DU**. KPI derived from counters. ONAP doesn't need to interact with a RU/Cell w.r.t. PM (Counters & KPI).

2 **CONFIGURATION MGMT** - Cell configuration info - Cell related information stored in CPS.; Cell – A cell is a logical object. CDS. Cell related information is use case specific (PCI and E2ENS). (1) define, (2) store, (3) loop back to the xNF.

CPS Database (Run-Time View)

CPS Database

PNF #106

Cell #1 – Logical Object

Cell #2

Cell #3

RECORD ELEMENT
INDEX = PNF #106
Parameter #1
Parameter #2
Parameter #3
Logical object, Cell #1
    Cell Parameter #1
    Cell Parameter #2
    Cell Parameter #3

RECORD ELEMENT
INDEX = PNF #106
Parameter #1
Parameter #2
Parameter #3
State Info X.733
Associations
    { Logical Object #111 Cell #2 }
Cardinality Rules
Linking Restrictions

RECORD ELEMENT
INDEX = Logical Object #111
Parameter #1
Parameter #2
Parameter #3
State Info
Associations
    { PNF #106 } List
Cardinality Rules
Linking Restrictions

![ONAP - Open Network Automation Platform logo]

Questions?

Benjamin Cheung, PhD

Appendix

Benjamin Cheung, PhD

VNFD Model

ACTIONS: <u>SDC team</u> – S/W change support **new nonMANO artifact type**
ACTION: Jacqueline mapping from onboarded NRM to the CPS Record
(modeling Subcommittee). Gen. Application Modeling defined.
ACTION: new nonMANO artifact types (defined in Modeling SubCommittee)
ACTION: <u>CPS team</u> to describe solution
ACTION: <u>VNF-SDK</u> to validate
ACTION: <u>VNF-REQTS</u>

Associated classes in RT
Sv attributed yang model w/ svc descriptor
Related connection/end points. Subsvcs.
Follow similar structure for a svc descriptor & components
Instead of massive yang model, associate specific resources
Vendor onboarded CSAR
Yang artifacts assoc. w/ resource > PNFd

Yuriy – we already had this in R6

CPS DB > NRM > define record > xNF
mSvcs > OOFSONPCI > records / NRM

Discussion Sept 17, 2020 at 5G Svc Modeling Call

Q (Xin): mS standing? – Run Time components
Q a framework, specific to use cases? Life time of the mS? "xNF proxy in the CPS project"
Safeguarding system from exposure of data
Q "services of CPS (andy) – exposing data in DB that you would not otherwise be able to see.
A: rather like clients, or like a bank, CPS has money, but doesn't have any itself.

Q (Shankar / PCI) – the notion of mS having a model & notifying a registry service, if two mS have a shared interest and a WAY to exchange info is good. So CPS knows who needs what and they can keep in touch of the other. Model changes happen, flexible schema, model. / if completely distributed what handles conflict resolution? "A says I really need to update this, but "B" I'm using it now". Design-time activity.
A: (Tony) that is a distributed model, ONAP knows, so you can interrogate the ONAP S/W.
A decentralized model. For each piece of info there is only one owner, the upgrade of the model will always be with that owner. For deprecation of older schemas, the owner will be aware that it has 5 users. Has been granting access.
Coupling – need to understand the coupling; another S/W didn't realize that they were using your data. Could end up with corruption.
Q: Cross-team coordination needed. Ownership of the model is maintenance load. Class mS model. By exposing a shared data model & shared data the I/F is extended. Like the JSON schema in the REST endpoint. A change to I/F is an impact, to change model = change the I/Fs. TSC highlighted by introducing a data lake run the risk of undermining the activities of cohesiveness of ONAP platform as a system. Models have to be owned by ONAP S/W; apps or platform components. A decentralized view of what info should be shared & LCMed. Important to have the data lake the ability to share data.

Q: new S/W? API between mS A & B. A: could be co-owners of data; registry S/W.

Q: (Chuyi) Each time the PNF will give the info stored in the CPS DB, the VES event; mSA is like a container which lists PNF info/types mSB is like the requirements role when the req comes from mSB if I can reuse/check the status of the current PNF resources can query mSA can judge what resources can fulfill mSB's needs.
NSSI / ORAN stored in CPSDB, Query CPS and get subnet capabilities to compose NSSI & usage of resources.

Motivation / Ownership

Modeling Sept 14, 2020
Responsibility to set keywords
Deciding in a model can be used as a keyword
Platform activity; or owning mS ; on onboarding ; inherit to model

"fixed dictionary" , "manual entries", "automatic dynamic collected from model"

Metadata info in the model?

Example of Keywords / Metadata:

Metro-A

5G 3GPP RAN (this model has "base" 5G NRM data) -> 3GPP TS32.540/541
ISOMII (Optical model)
Wireless / Transport / Wireline
Area-A, B, City-xyz
Types of Hardware (Antenna, Base station, Core)
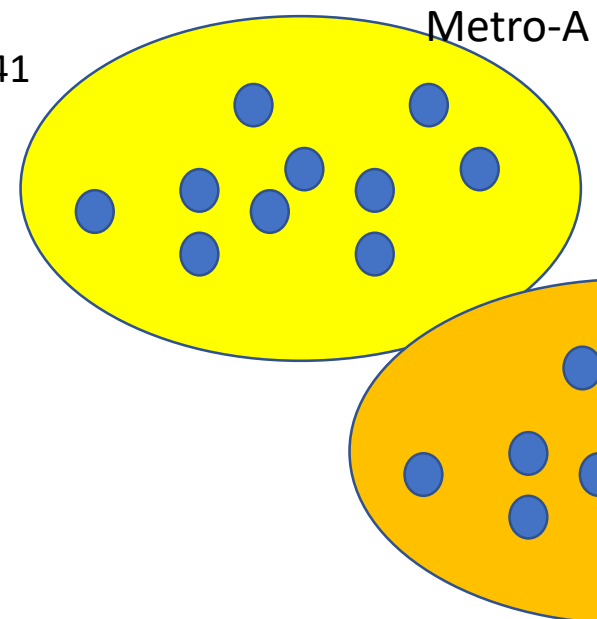
Analytics mS
OOF SON PCI – cells (PCI)
E2E Network Slicing – wireless (RAN), Core [Domain]
KPI Performance Measurement Analysis – (domain, PM/KPI)

Meta-data Model -> Meta-data repository -> Rules for keywords/ taxonomy ->
Topical or model imported -> Governance (strings agreed between parties / I/F)
Federated governance -> Socialize (open source projects & standards)

Domain	Wireless RAN	optical	CORE	transport
Standards	3GPP 5G NRM			
Components	Antenna Base Stations			
Services				

DISCUSSION Friday Sept 4 & Friday Sept 11 CPS Team Call

M-S#1 SDC>CSAR > creates CPSDB records "owner" (Mirror svc) gets model in raw form. mS#1 Hua mS#2 Er mS#3 nok

mS#4 "analytics"/"correlation" … across domains/ across multiple vendors installations … needs to ASK for access from mS#1,mS#2, mS#3 … wants to traverse the data lake. Code will be coupled to different models. READ ONLY

Mechanism / **Registration component** "I am x" and I have models that relate to "a", "b", "c"
I am publishing the model
mS can **Query the Registry** – and can ask for access.
mS#1 Ericsson RAN -> body of RAN related PNF records -> "owns them"
  -> register function -> publish ownership -> I've created these records, they are of this type, if you want access talk to me.

mS#5 BT (service provider's mS) -> certain kinds of data … -> **query/crawl/search the registry** -> "all RAN record" -> mS#1
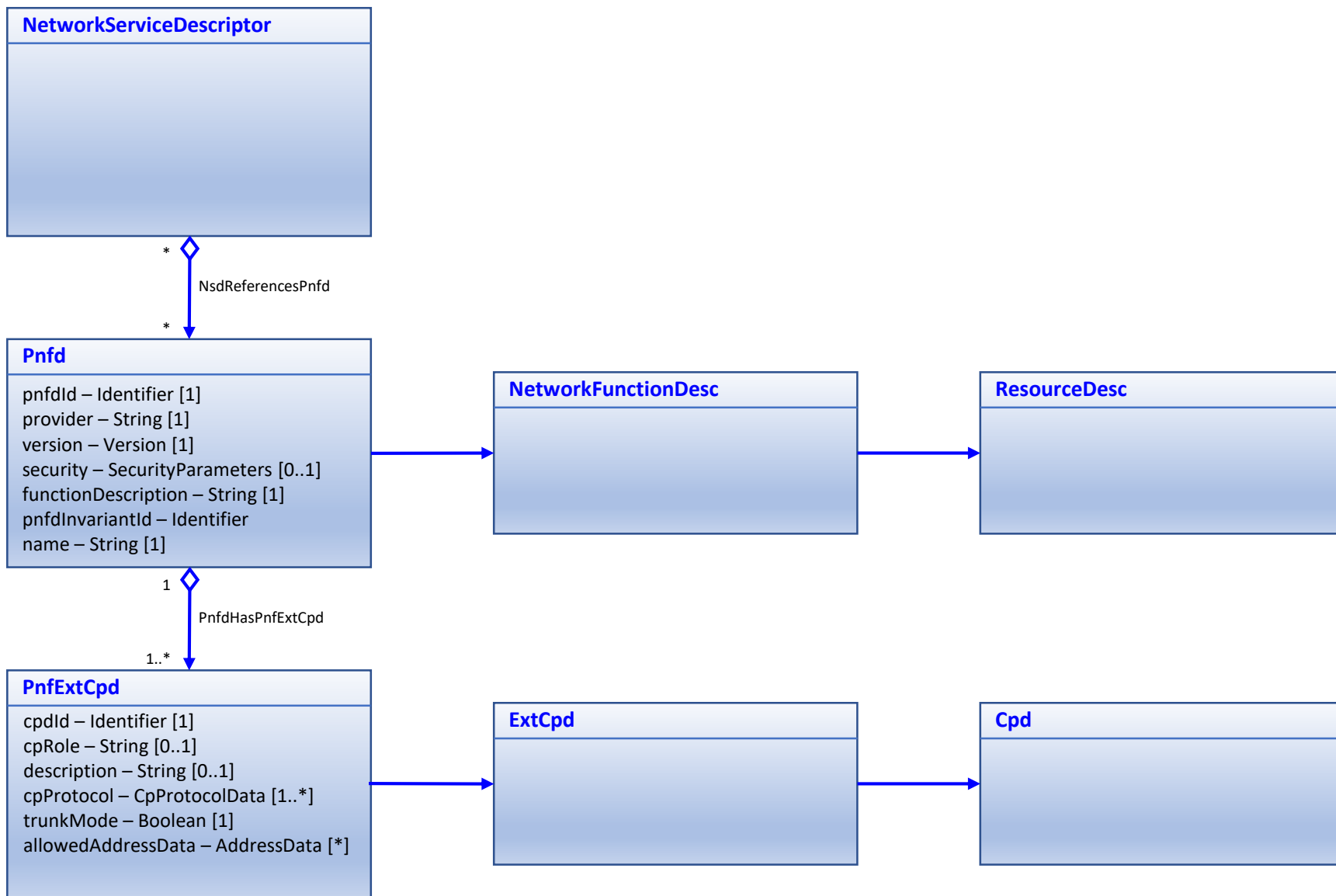Once mS#5 has been given access, mS#1 grants access to mS#5 access to the data.
mS#5 "release access" done using the data.

When you request reg users, anyone who wants access needs to call the reg
Expose the reg, grant all read requests.

PNF Descriptor Model

NetworkServiceDescriptor

* ◇
NsdReferencesPnfd
*

Pnfd

pnfdId – Identifier [1]
provider – String [1]
version – Version [1]
security – SecurityParameters [0..1]
functionDescription – String [1]
pnfdInvariantId – Identifier
name – String [1]

NetworkFunctionDesc

ResourceDesc

1 ◇
PnfdHasPnfExtCpd
1..*

PnfExtCpd

cpdId – Identifier [1]
cpRole – String [0..1]
description – String [0..1]
cpProtocol – CpProtocolData [1..*]
trunkMode – Boolean [1]
allowedAddressData – AddressData [*]

ExtCpd

Cpd

THE **LINUX** FOUNDATION

ONAP

Brief Project Overview (brief as it should be known)
(Referenced to existing documentations is highly encouraged for the purpose of keeping this document up to date)

New component capabilities for Guilin, i.e. the functional enhancements, if applicable

New or modified interfaces

If they are modified, are they backwards compatible?

Interface naming (point to an example)

Consumed API from other platform projects (A&AI, DCAE, SO)

Published API

Reference to the interfaces.
(Reference to the the swagger.json file(s) whenever possible)
What are the system limits?

.
Involved use cases, architectural capabilities or functional requirements.

Listing of new or impacted models used by the project (for information only).
•Identify any High Level Information Model Requirements.   See: ONAP R7 Modeling High Level Requirements
        •Models based on information exchanges from Use Cases
        •Models documenting existing implementations
        •Forward looking models that may be implemented in future releases
•Describe how exposed APIs are mapped to information models
(list all the relevant Jira tickets)

Any other details that are specific to this functional enhancement or UseCase.

Testing/Integration

- The most basic procedure for installing Eclipse Papyrus consists in installing the Eclipse Modeling Package for your own platform.
- Then, you have to use the discovery interface ("Help" > "Install New Software" > "Modeling") and select Papyrus for UML.
- You may install the latest release of Eclipse Papyrus by following the instructions below "Update sites".

Update Sites

Eclipse provides facilities for adding new software to the platform or updating software in the system. In all cases, the site location (i.e. the Web URL or the archived Update Site provided above) is the only required item to update or install a software within Eclipse.

Nightly Update Sites

Latest Release Update Site

Previous Releases Update Sites

CLICK ON THIS

Other resources

Previous Releases Update Sites

Eclipse Papyrus 2020-03 (4.7.X)

- https://download.eclipse.org/modeling/mdt/papyrus/updates/releases/2020-03

Eclipse Papyrus 2019-12 (4.6.X)

- https://archive.eclipse.org/modeling/mdt/papyrus/updates/releases/2019-12

Eclipse Papyrus 2019-09 (4.5.X)

- https://archive.eclipse.org/modeling/mdt/papyrus/updates/releases/2019-09

MATCH YOUR VERSIONS

Eclipse Papyrus 2019-06 (4.4.X)

- https://archive.eclipse.org/modeling/mdt/papyrus/updates/releases/2019-06

Eclipse Papyrus 2019-03 (4.3.X)

- https://archive.eclipse.org/modeling/mdt/papyrus/updates/releases/2019-03

Eclipse Papyrus 2018-12 (4.2.X)

- https://archive.eclipse.org/modeling/mdt/papyrus/updates/releases/2018-12

Eclipse Papyrus 2018-09 (4.1.X)

- https://archive.eclipse.org/modeling/mdt/papyrus/updates/releases/2018-09

Eclipse Papyrus Photon (4.0.0)

- https://archive.eclipse.org/modeling/mdt/papyrus/updates/releases/photon