

5G Service Modeling & 5G Service Creation



- R6 Frankfurt Use Cases

5G Basics & 5G RAN



3GPP Release 15, IMT-2020 = 5G



eMBB (enhanced Mobile Broadband)



Media Anywhere
Broadband Experience
Everywhere Anytime
Virtual and Augmented Reality

Remote Surgery
and Examination



Factory Automation
Remote Device Control



Smart Automated
Vehicle Control



Smart
Infrastructure
Smart City



Internet of Things (IoT)
Geographically spread devices

**URLLC (Ultra Reliable Low
Latency Communications)**

**mMTC (massive Machine Type
Communications)**



Smart



Connected



Collaborate



Access



Interactive

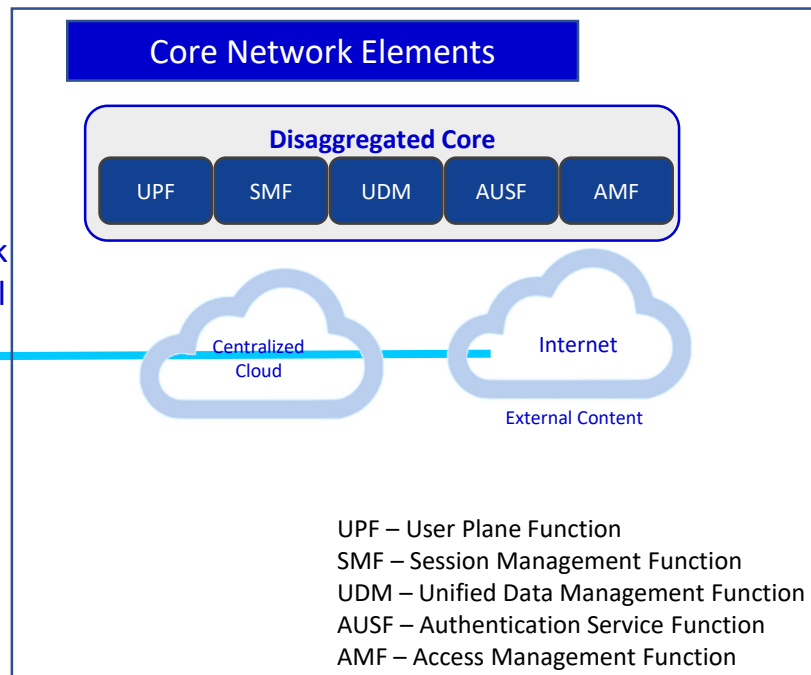
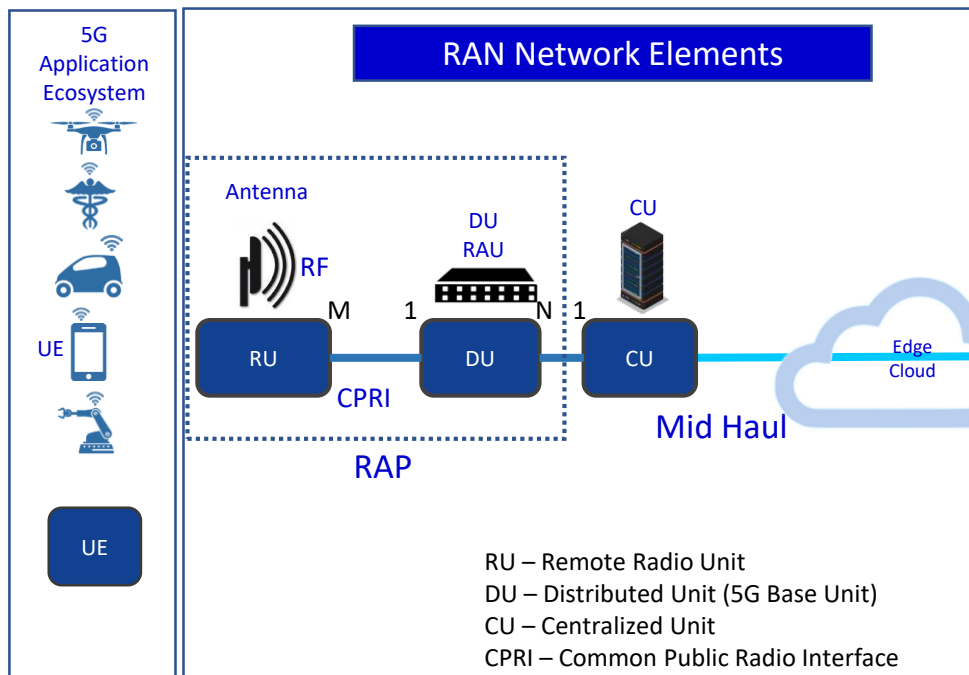


Aware

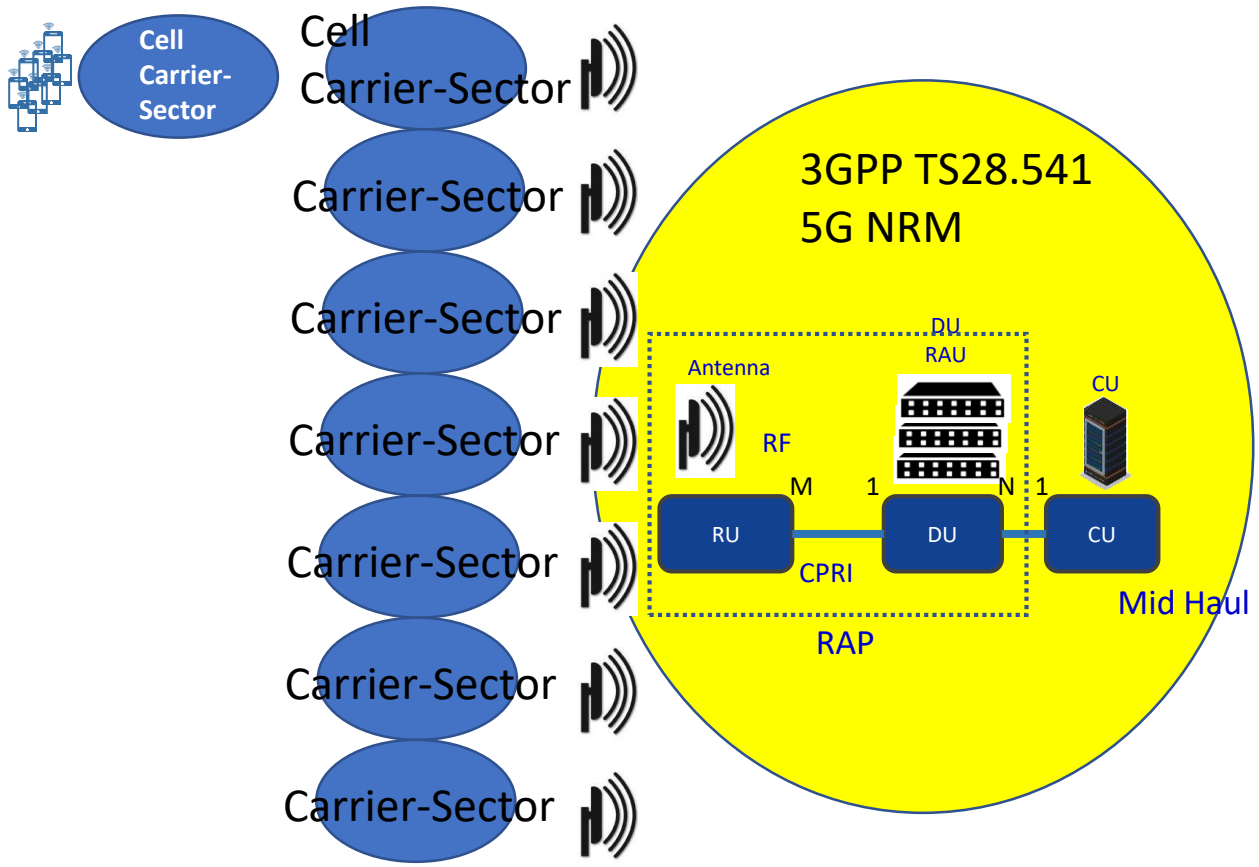
5G RAN Wireless Network



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



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



GROUPINGS

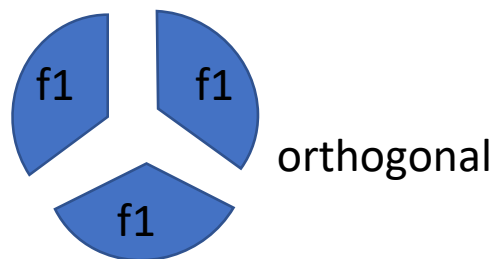
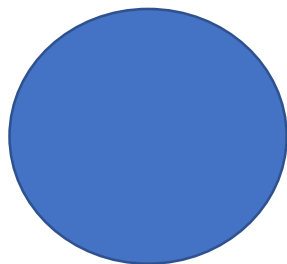
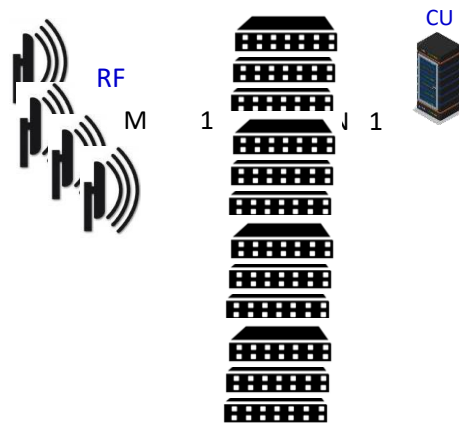
Kevin
 What parameters are common to many functions
 Super-class w/ common things and sub-class to particular functions
 Configurations & groupings.

Different Domains

Are there common constructs we can use across domains.
 Optical Fixed Wireless = same Information
 Data Models domain focused?

Fred
 RAN management – see it/ performing/ control
 Performance, 28.541 as anchor
 Model for gNB.
 Look at other 3GPP documents to capture common for functions
 Categorized to lifecycle management; instant. Rtconfig, ...
 Orchestration / Performance FCAPS. LCM

Fred F.
Bob Pape
Chris Skowronek
Chuyi Guo
Jacqueline Beaulac
Marek Kukulski
S. Ricci
Yaoguang Wang
Andy Mayer
Kevin Skaggs



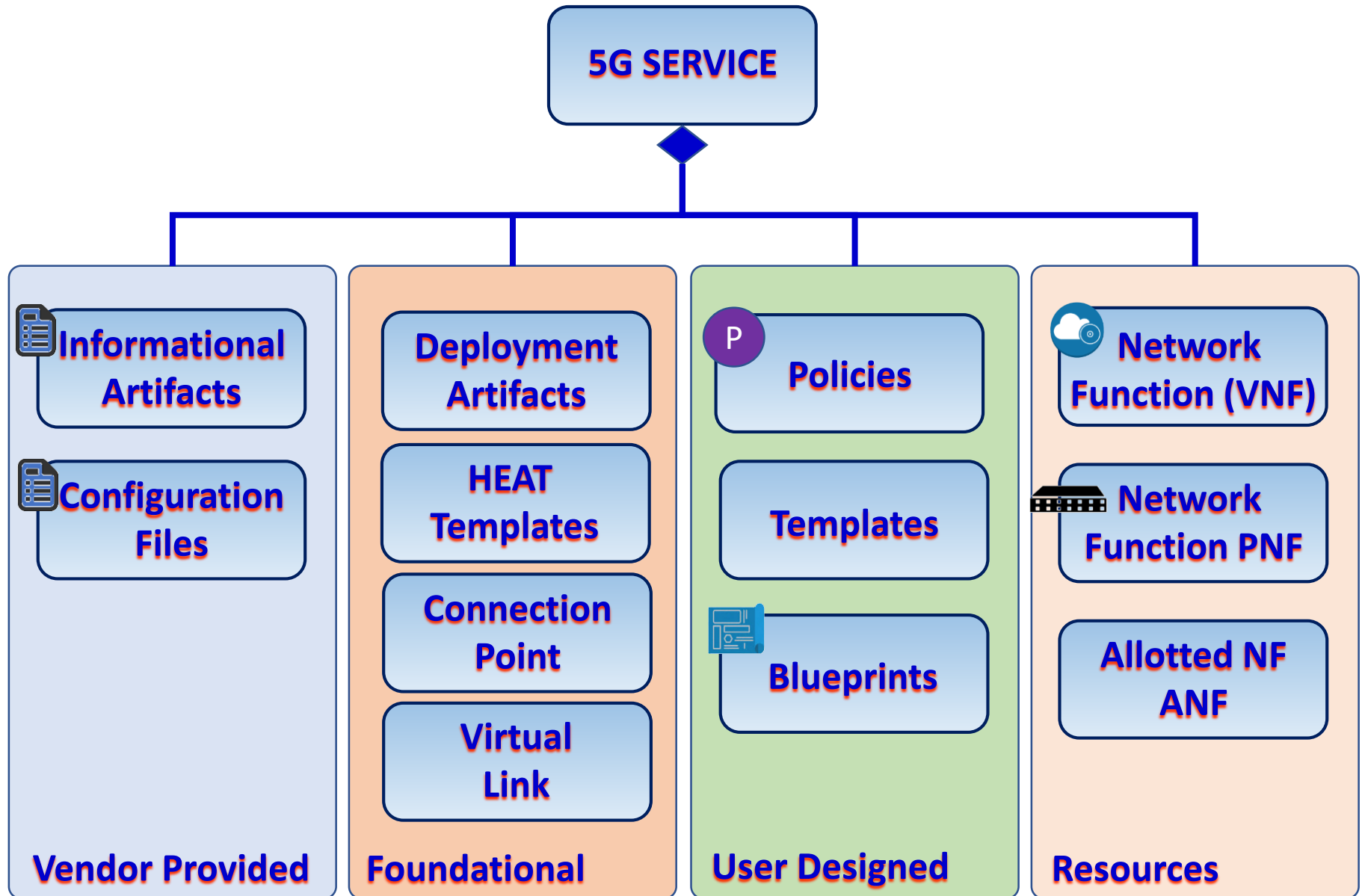


5G Service Modeling & 5G Service Creation



Benjamin Cheung, PhD

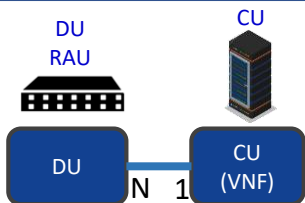
R7: Modeling a 5G Service



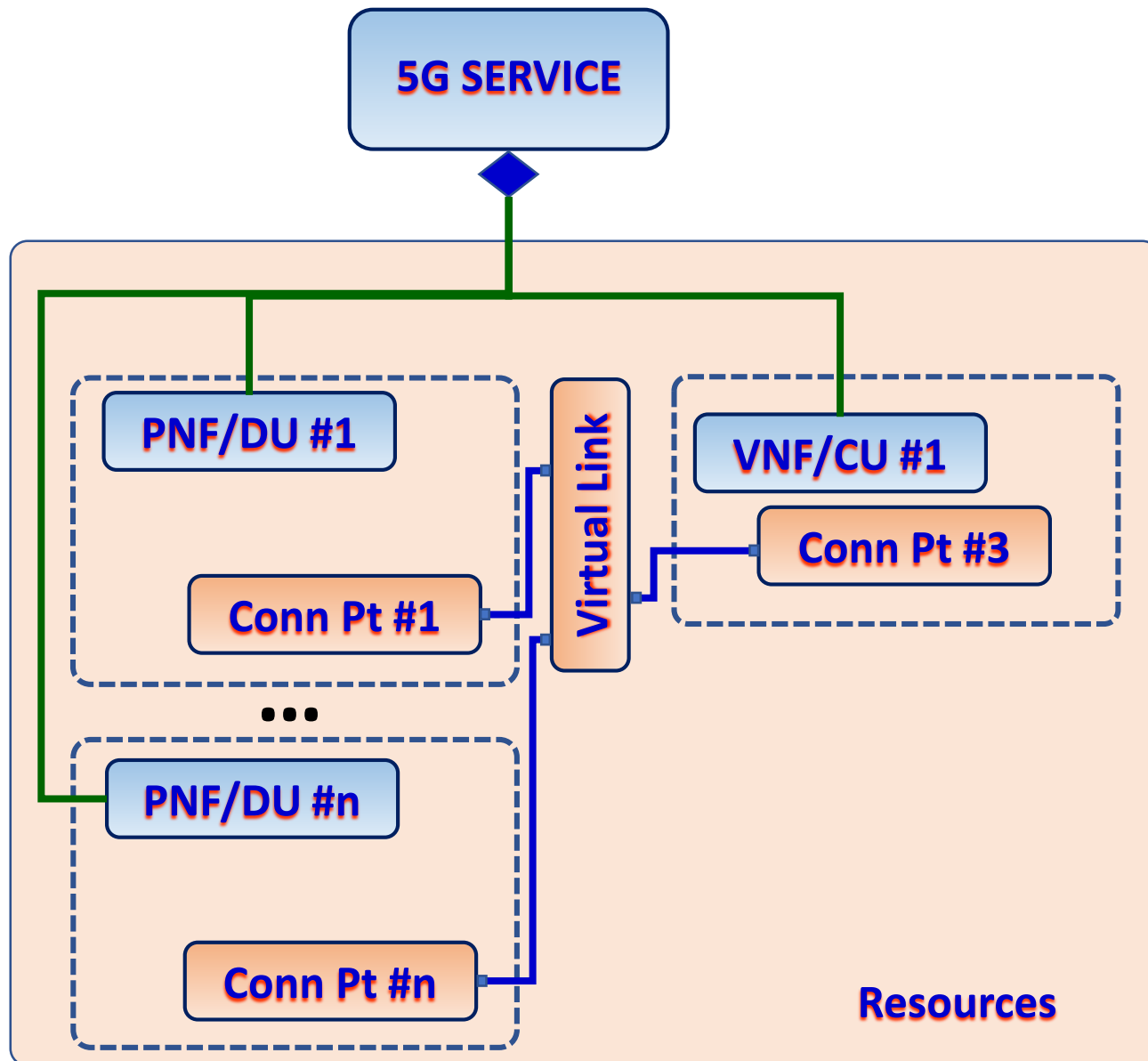
R4: 5G Base Station (gNodeB)



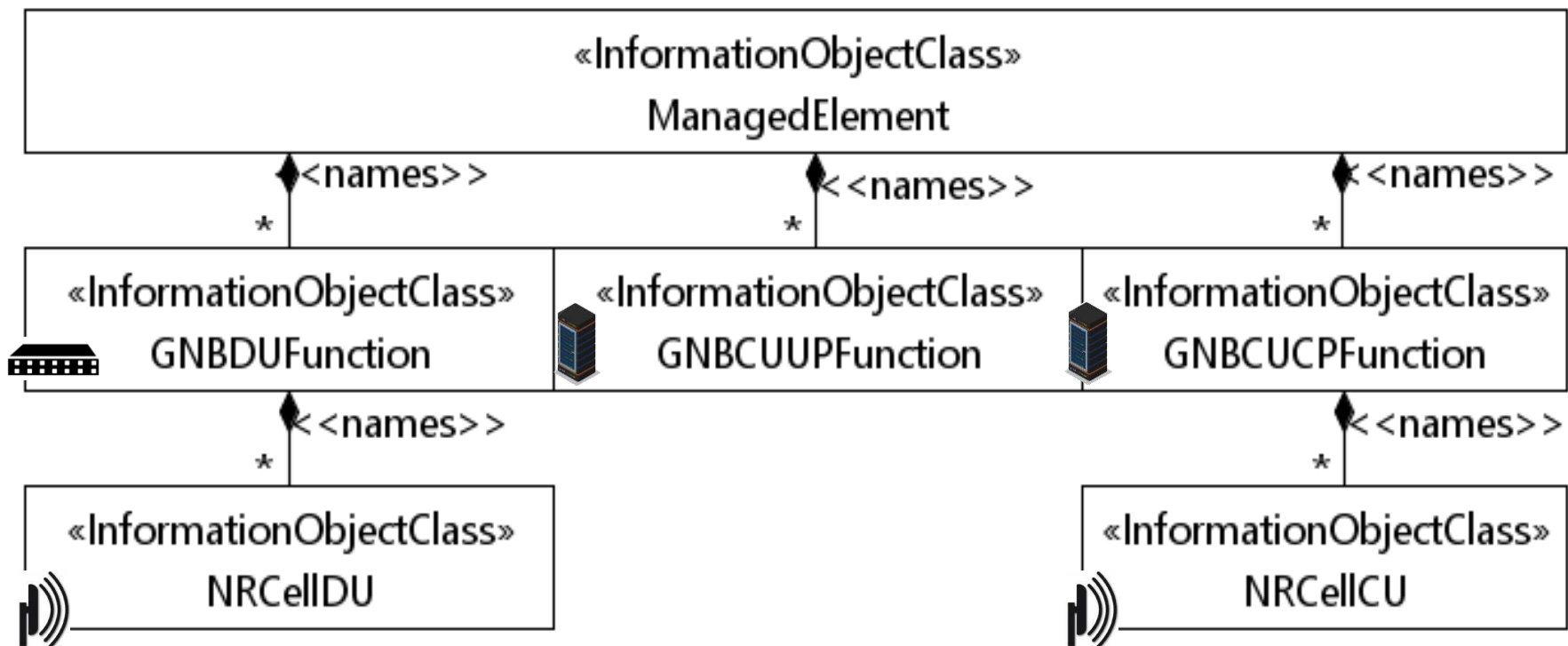
RAN Network Elements



Core Network Elements

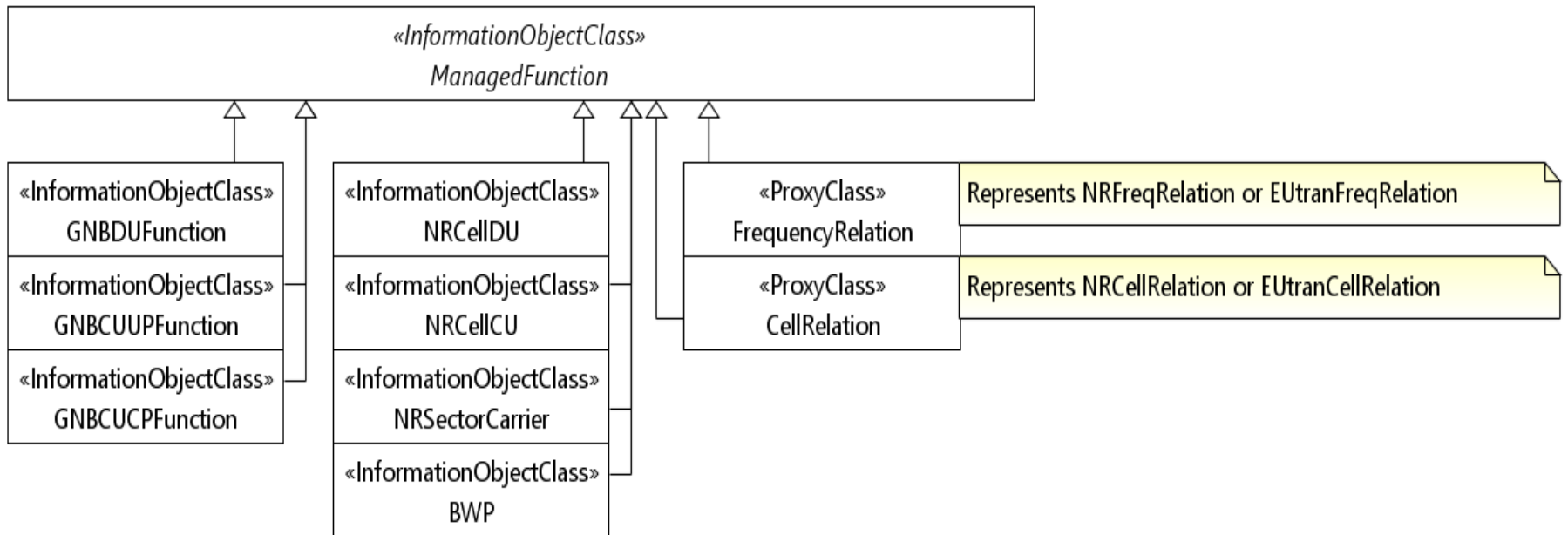
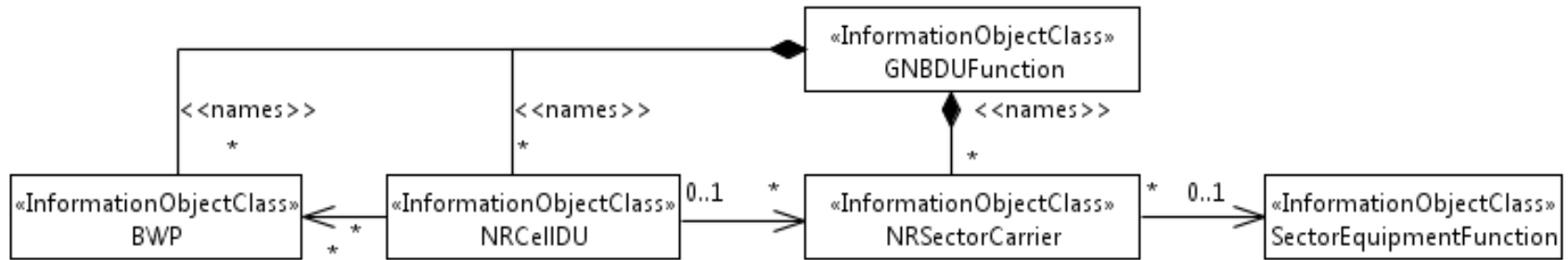


3GPP TS28.541/TS28.622 Model*



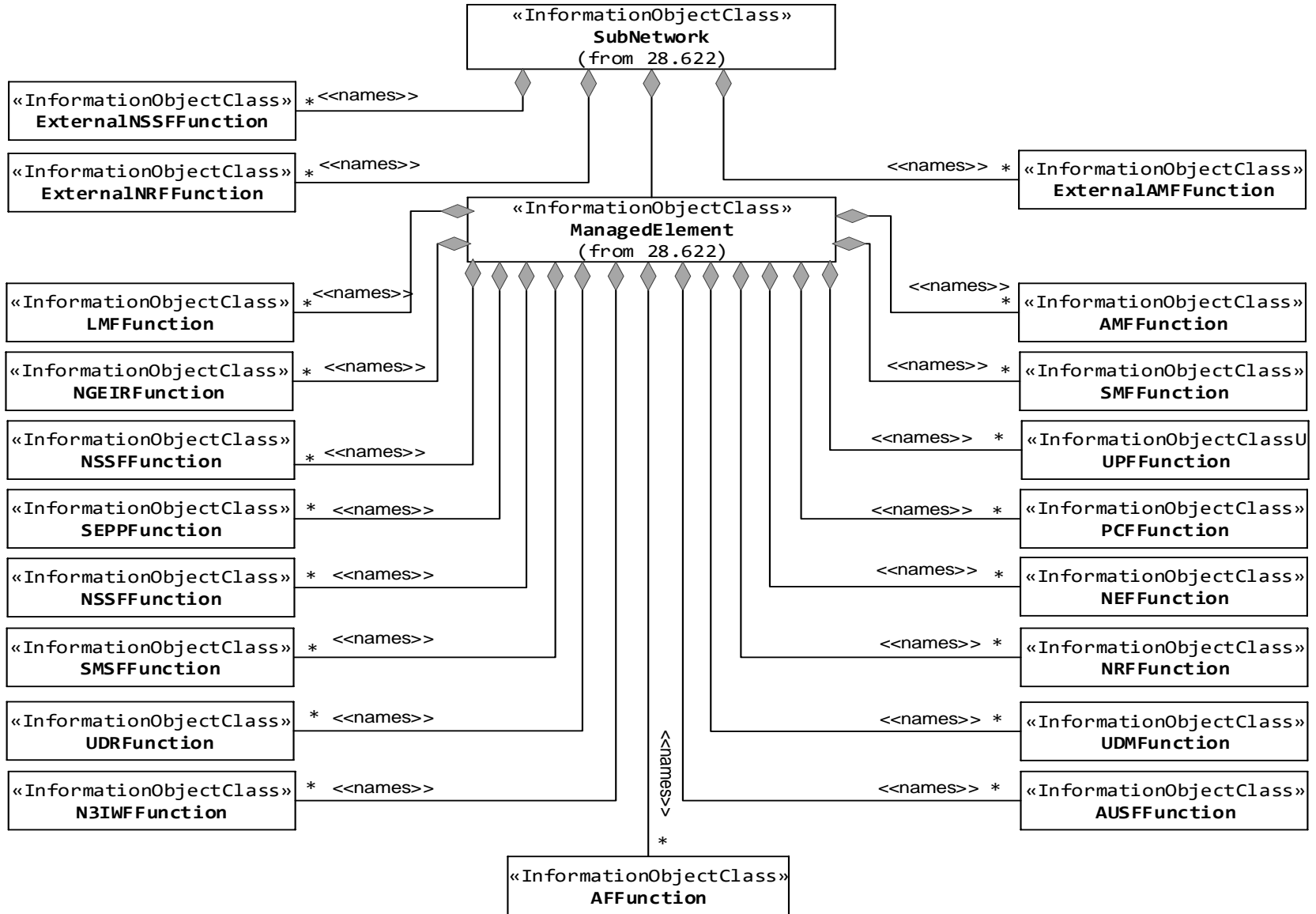
*Generic Information Model

3GPP TS28.541 5GNRM/TS28.622 Model

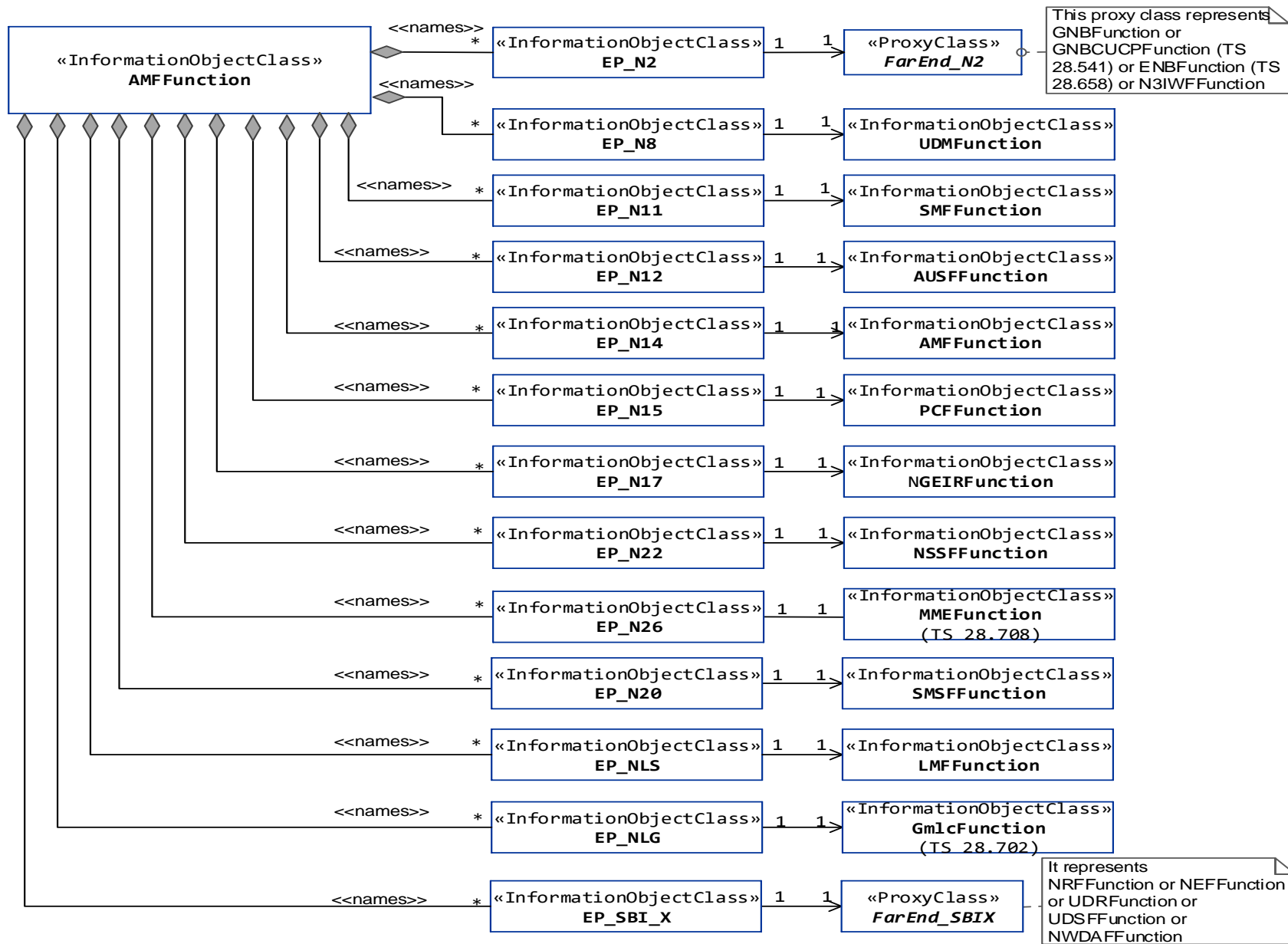


ETSI Alignment R7+ U/C will introduce a CNF version of the gNB DU

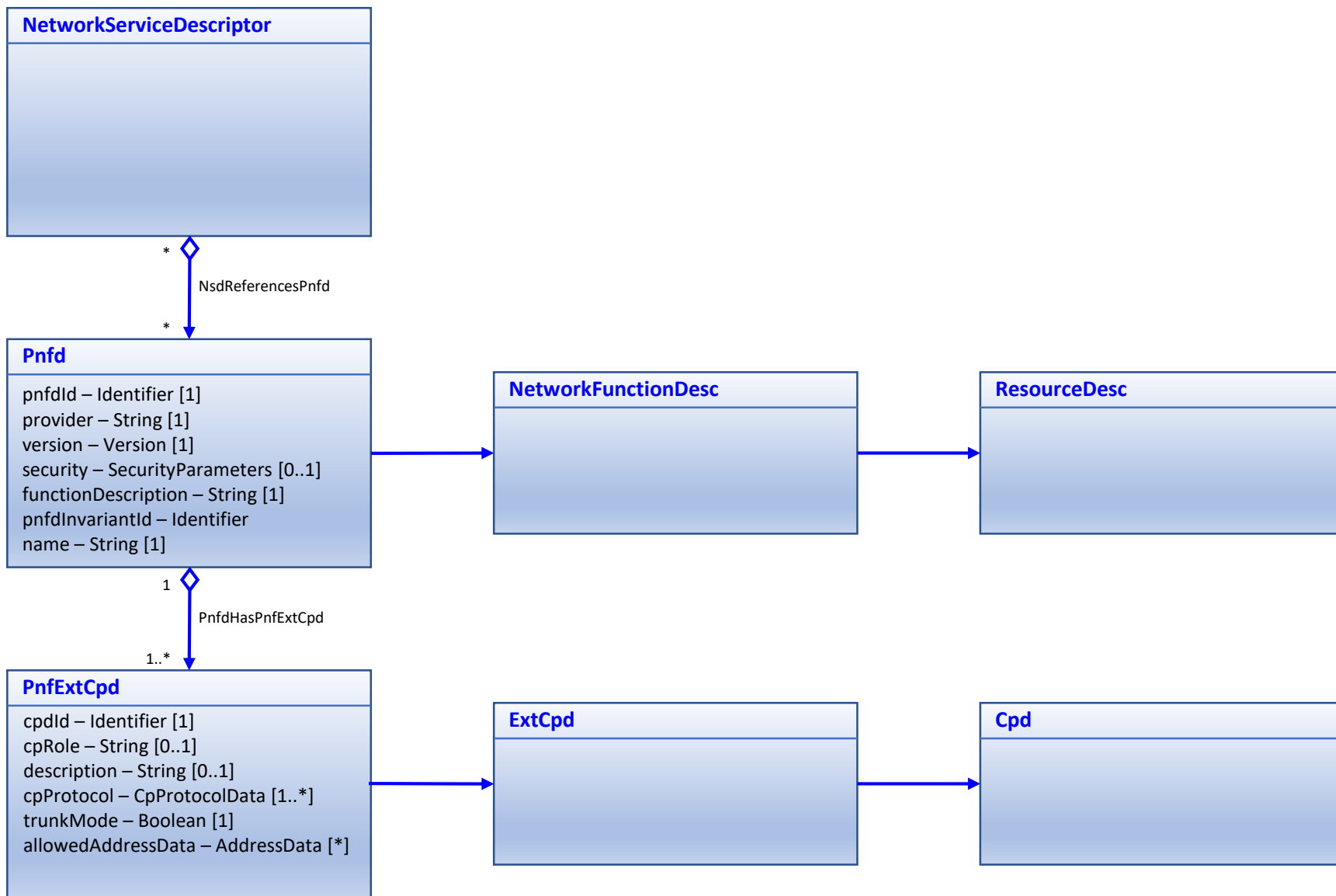
3GPP TS28.541 Model (Transport)



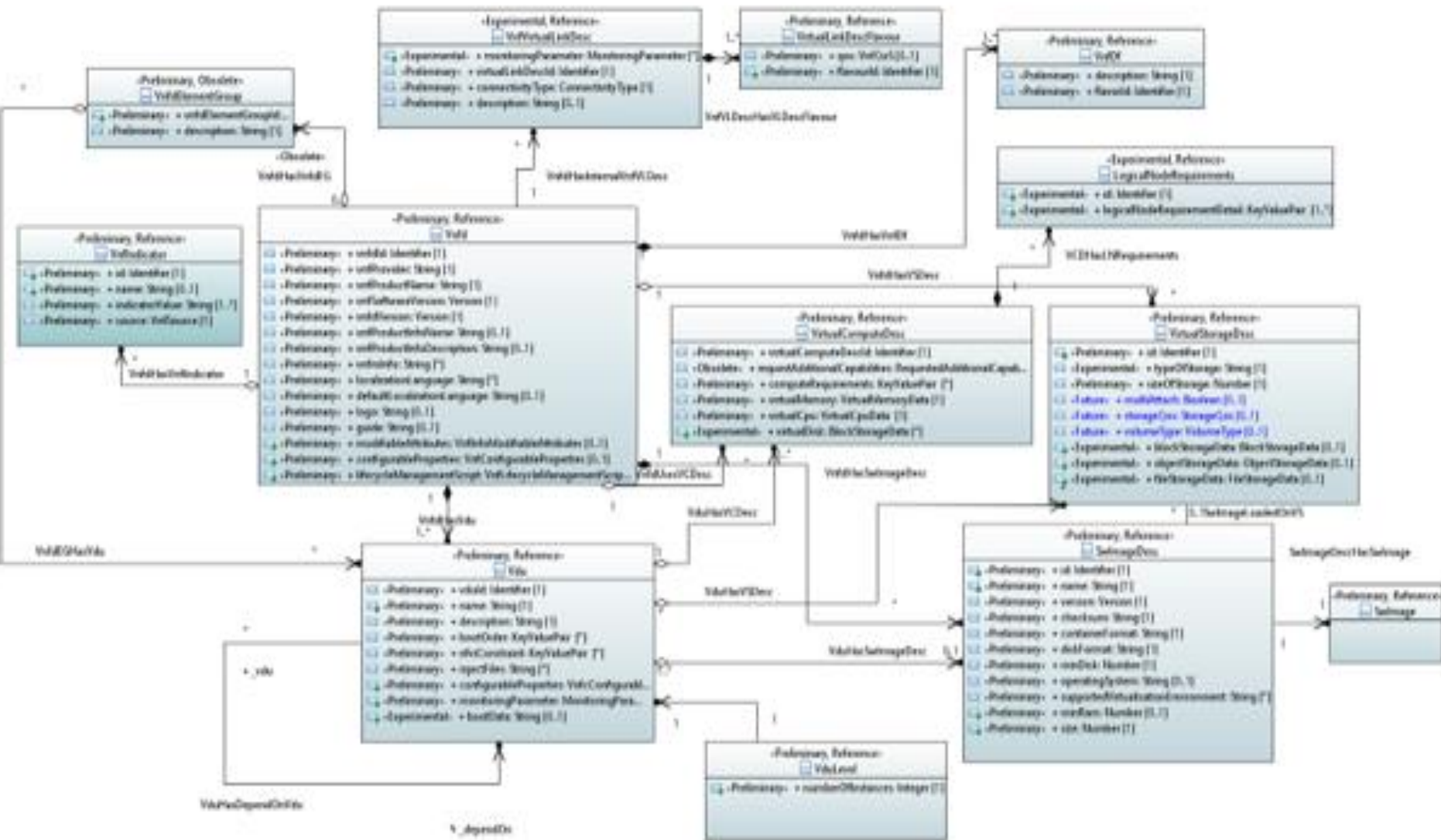
3GPP TS28.541 Model



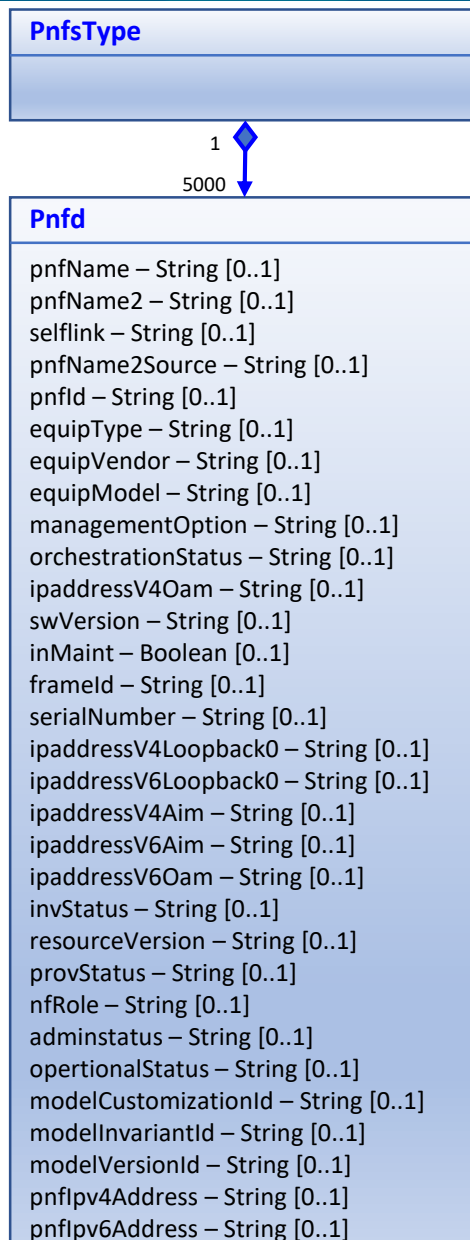
PNF Descriptor Model



VNFD Model



PNF A&AI Model



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





Some IOC of TS 28.622 are derived from IOCs in TS 28.620 (Federation Umbrella Information Module)

BR,
Jing

From: Andrianov, Anatoly (Nokia - US/Naperville)

Sent: Friday, November 22, 2019 8:29 AM

To: Cheung, Ben (Nokia - US/Murray Hill) <ben.cheung@nokia.com>

Cc: Ping, Jing (NSB - CN/Chengdu) <jing.ping@nokia-sbell.com>; Andrianov, Anatoly (Nokia - US/Naperville) <anatoly.andrianov@nokia.com>

Subject: RE: 5G Configuration / Resource Model

Hi Ben,

Yes, 5G NRM is in TS 28.541. For complete 5G picture you also need to look at TS 28.622 (generic NRM) and TS 28.632 (inventory NRM). There are several NRMs for LTE... for 5G we tried to consolidate all necessary information in one place, but as you may see (28.622 and 28.632) it's not the case now.

-Anatoly

P.S.: I'm CC-ing Jing – she is the rapporteur of 5G NRM

Sources



ONAP
OPEN NETWORK AUTOMATION PLATFORM

- A&AI Schema
- SDC AID
- ONAP Platform Information Model
- Complex Object Place object

ORAN WGx

3GPP TS28.501

3GPP Inventory

3GPP TS32.106

ITUT X.731 Op/Admin

3GPP Operational

Civic Address/GeoLoc

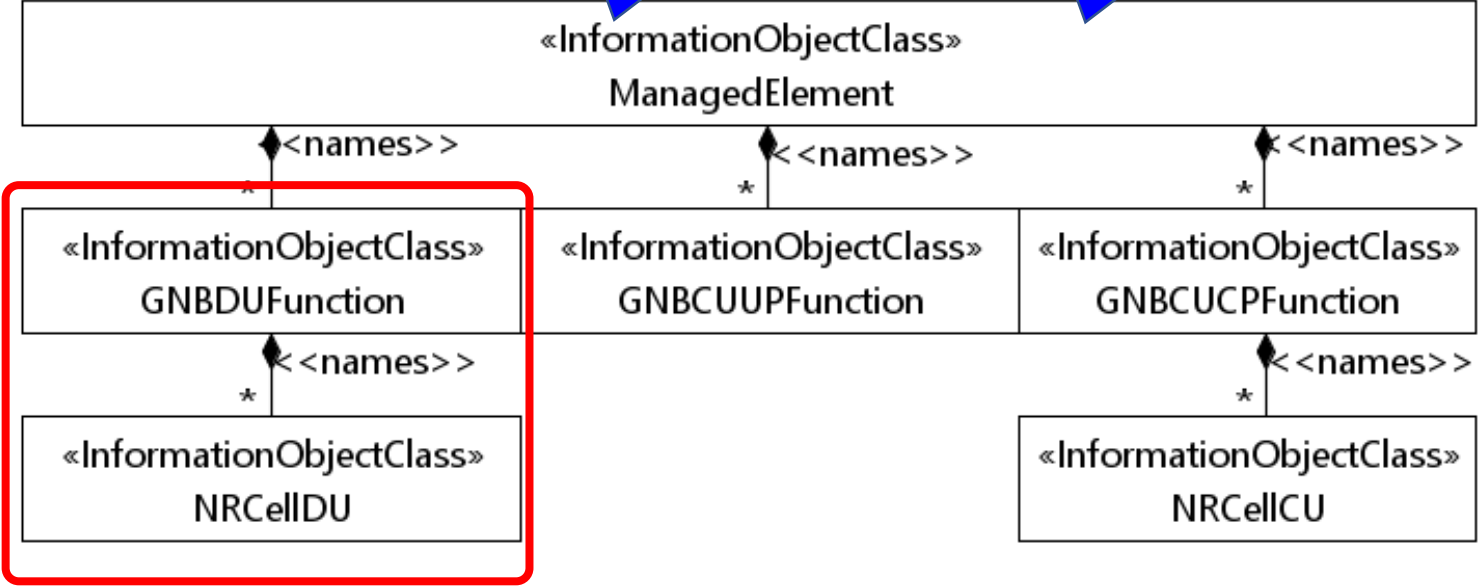
- TMF GB922 Location (Place)
- RFC 6225 Geo Location
- ETSI SOL 001 Civic Address

5G NRM

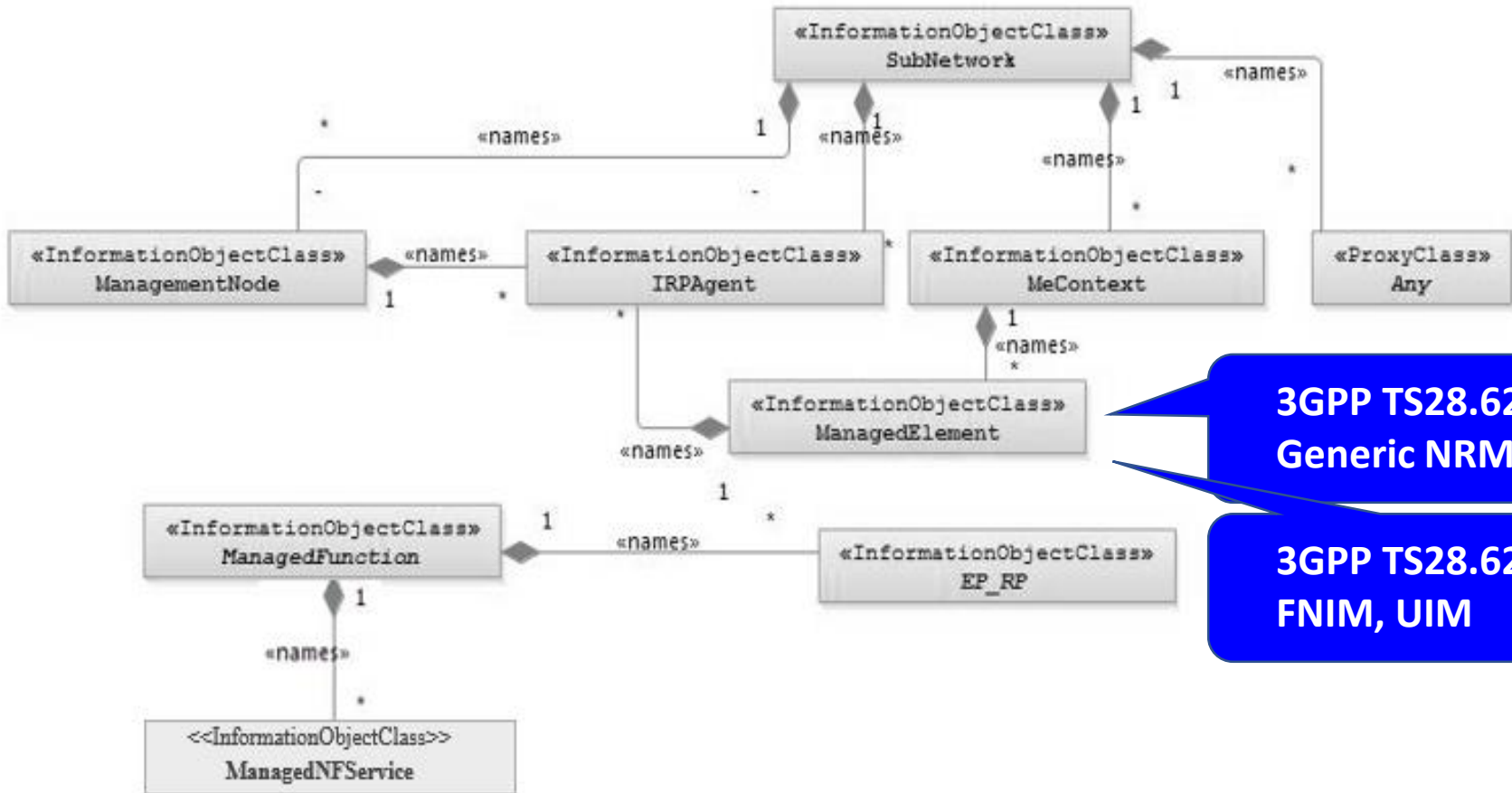
- 3GPP TS28.620 FNIM UIM
- 3GPP TS28.540 5G NRM
- 3GPP TS28.622 Generic NRM
- 3GPP TS28.541 5G NRM

**3GPP TS28.622
Generic NRM**

**3GPP TS28.620
FNIM, UIM**



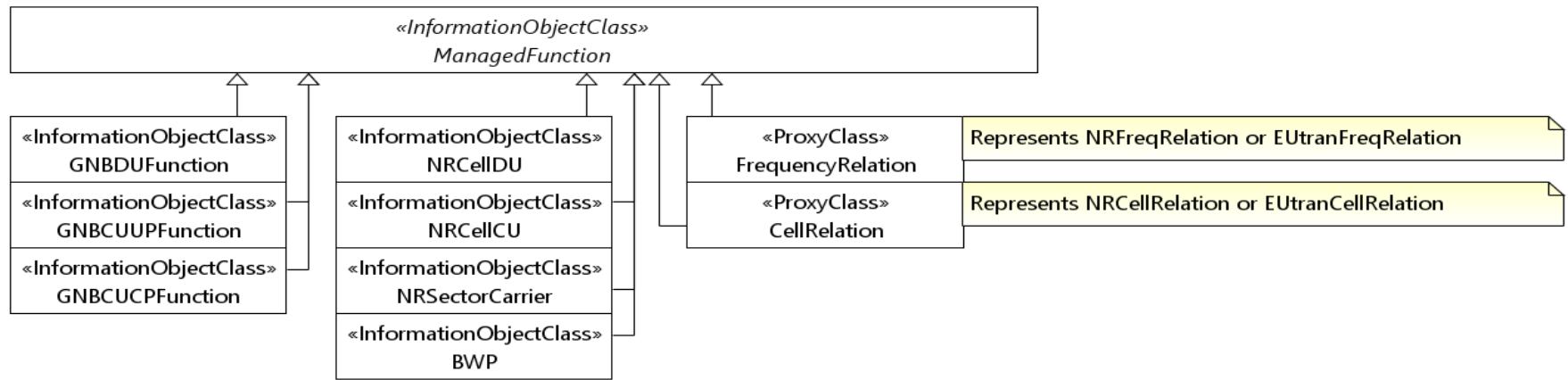
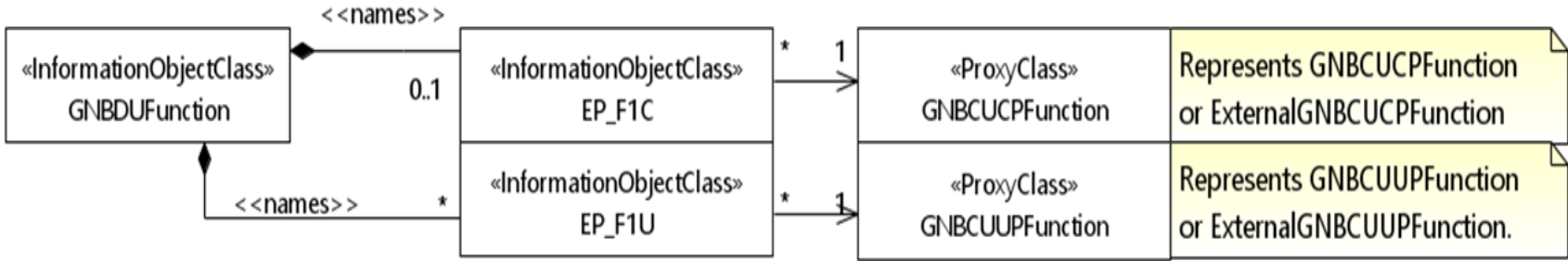
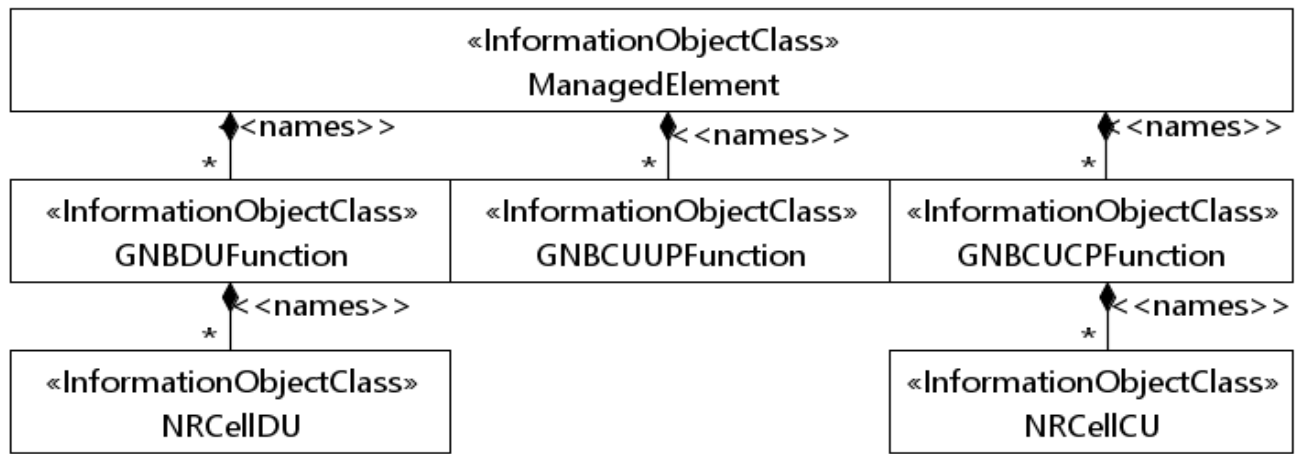
* Federated Network Information Model (FNIM) , Umbrella Information Model (UIM)



**3GPP TS28.622
Generic NRM**

**3GPP TS28.620
FNIM, UIM**

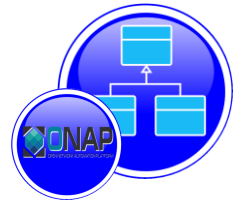
3GPP DU Models from TS28.541, 620, 622



Enhance Platform Information Model



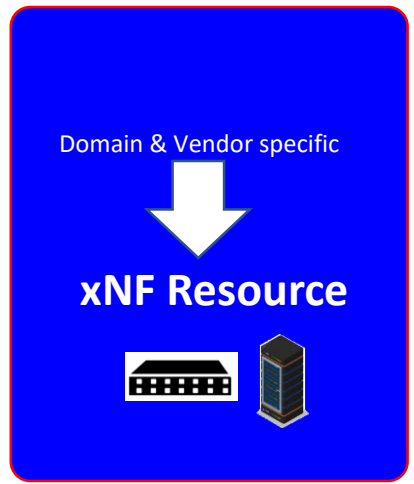
- 3GPP TS28.540 5G NRM
- 3GPP TS28.541 5G NRM
- 3GPP TS28.620 FNIM UIM
- TS28.622 Generic NRM



Platform Information Model ++



**5G NRM
Generic NRM**



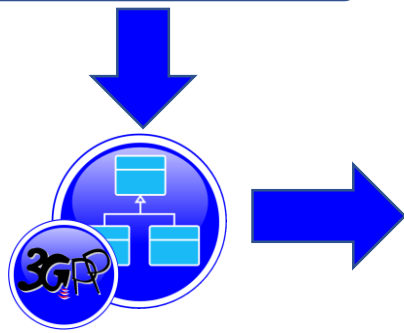
C&PS Database

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



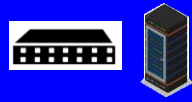
Optical ISOMII


DESIGN TIME 




Generic Application Model
+ Domain & Vendor specific

xNF Resource





RUN TIME 

SDN-C (etc)



PNF#106



C&PS Database



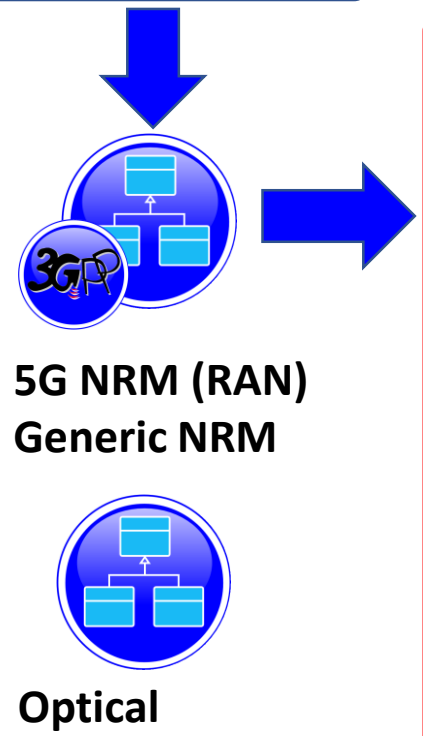
Platform Information Model

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)



DESIGN TIME

Generic 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


C&PS Database

PNF#106

↑ StndDef VES

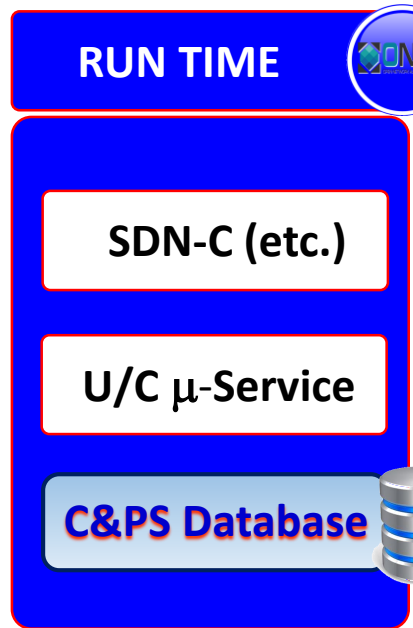
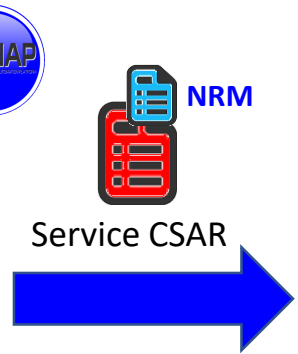
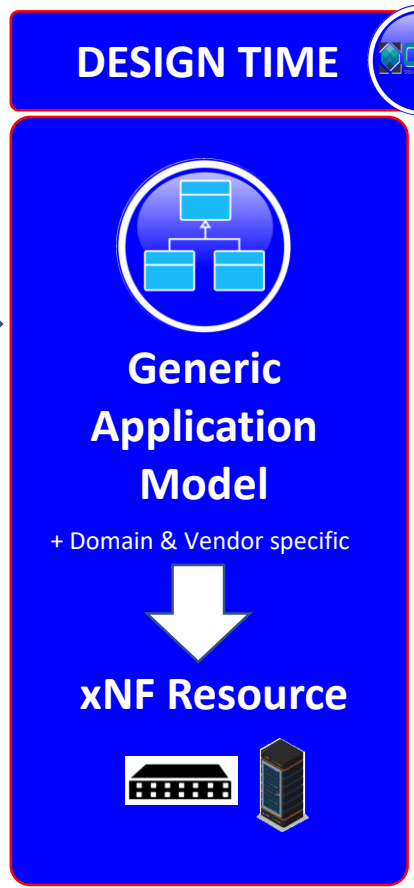
Generic Application Model / Hybrid – R7



 **NRM . (Yang/Ansible) Artifact**
 Vendor Onboarded CSAR

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


Network Slice (Class)
 serviceProfileList (Attribute)
 networkSlideSubnetRef




C&PS Record
 xNF instance
 (looks at) NRM arti



 

Platform Information Model++
 (optional if needed)



PNF#106 

StdDef VES



5G NRM
Generic NRM

Optical

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)

(one possible location) 5GNRM.Ansible

(one possible location) 5GNRM.Yang

- Images
- Deployment
- Scripts
- Tests
- ChangeLog.txt
- MainServiceTemplate.cert
- License_term.txt

- Configuration
- Yang_module
- Measurements
- Events
- ...

yang-module.yang

pm-dictionary.yaml

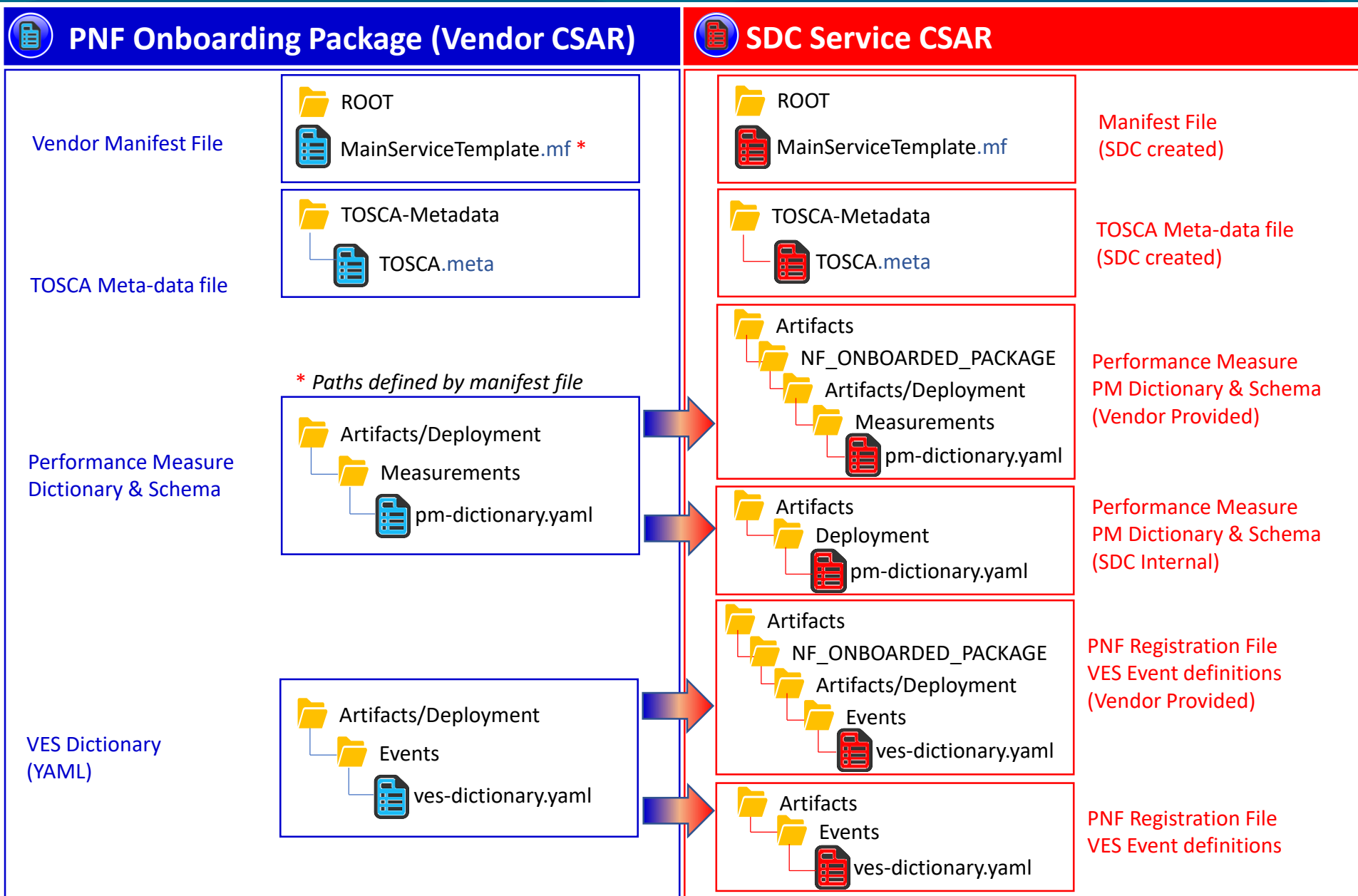
- Install.csh
- ...

ves-dictionary.yaml

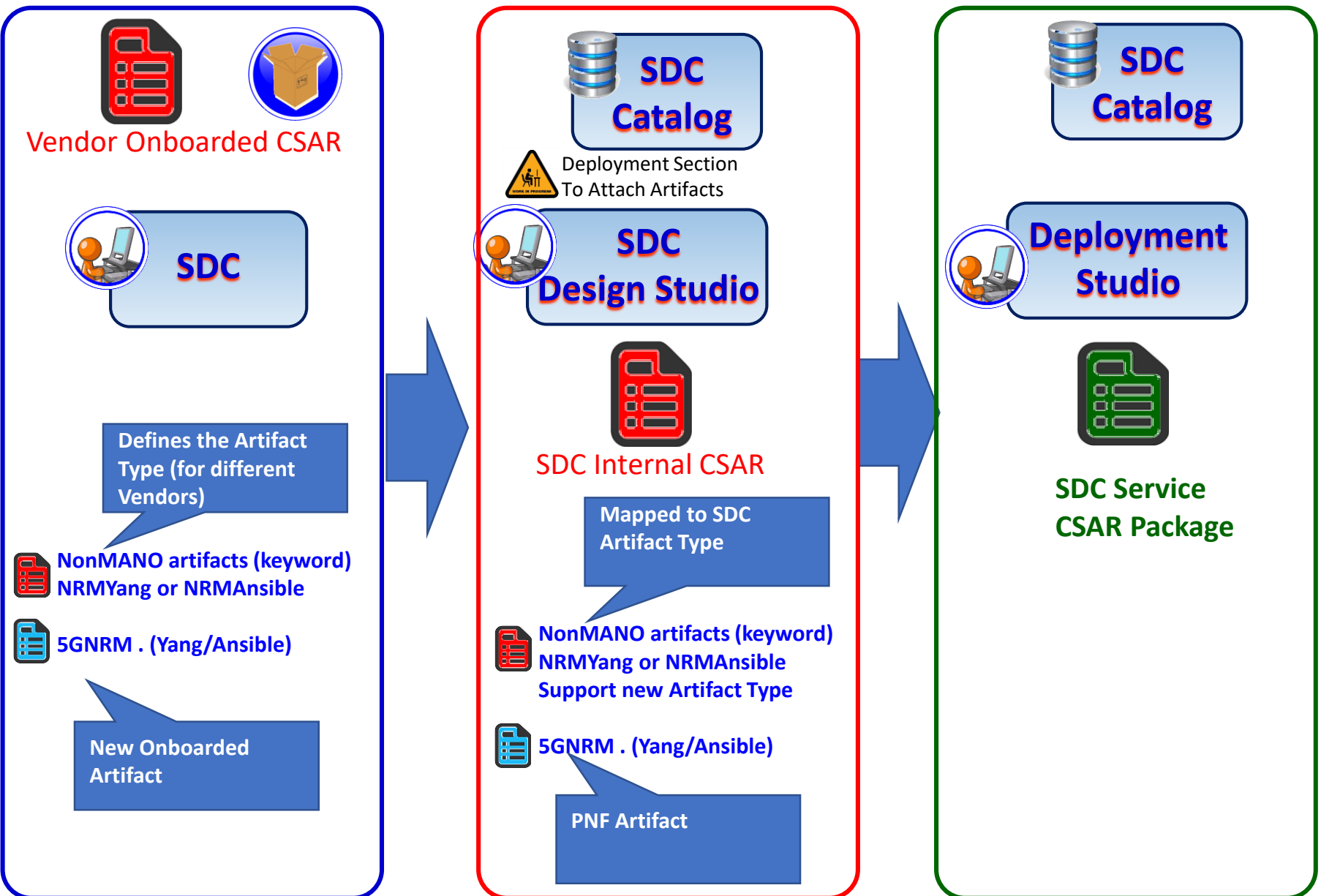
metadata:

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

Onboarded Package to SDC Internal Mapping



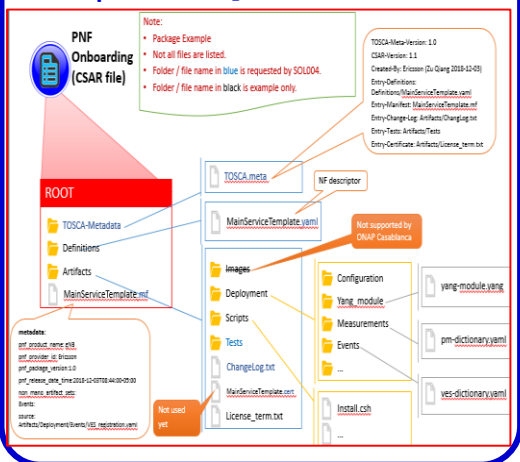
PNF PACKAGES



PNF PACKAGES

VNF SDK

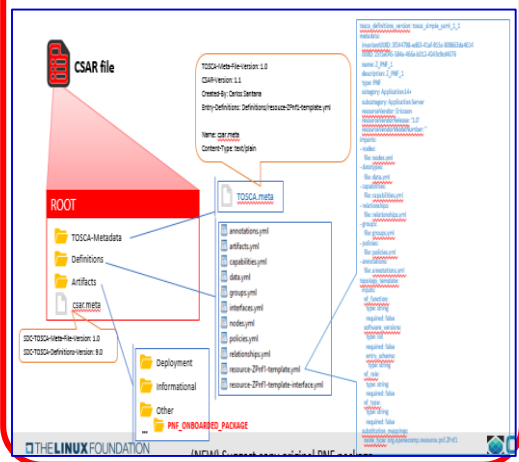
PNF Package (Vendor onboarded)
VSP [vendor s/w product]



SDC Catalog

SDC Design Studio

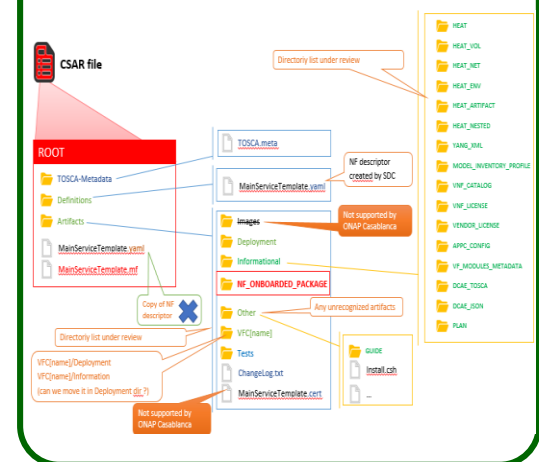
SDC Internal CSAR PNF Package

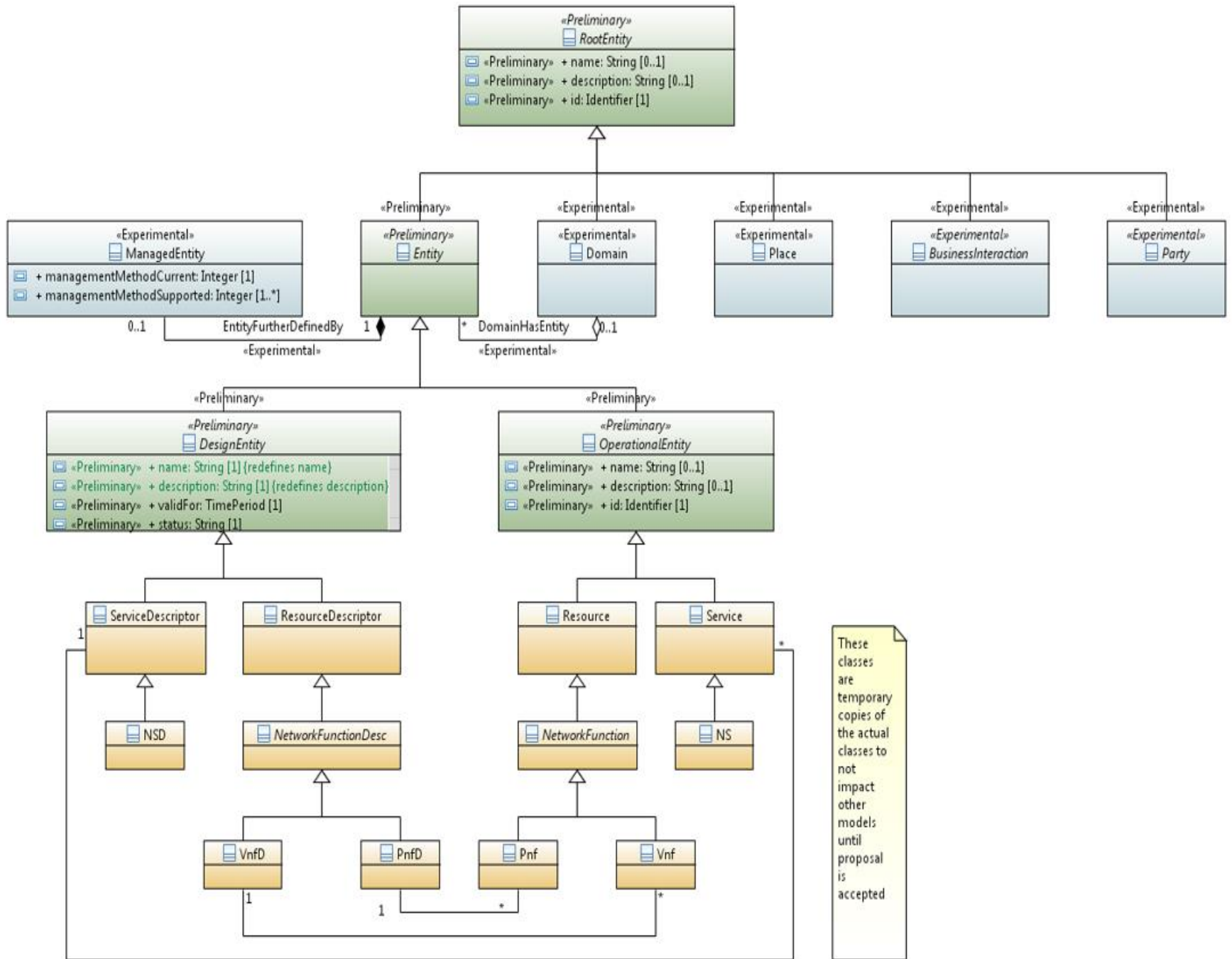


SDC Catalog

Deployment Studio

SDC Service CSAR Package





These classes are temporary copies of the actual classes to not impact other models until proposal is accepted

(Zu) Use case driven, in current use cases, use SDN-C

For node configuration, C&PS stores the config data

Need to understand the application model, no other run-time component

Needs this model, so it would be nice to **NOT** significantly change the PlfrmInfoModel

The 3GPP model is well-defined, doesn't make sense for ONAP to redefine it.

CNF/VNF (Fred) the generic APP-C using CDS as the modeling approach would fit this model well. Intended to

Encompass application model, and deal w/ configuration manipulation of application model > turn into

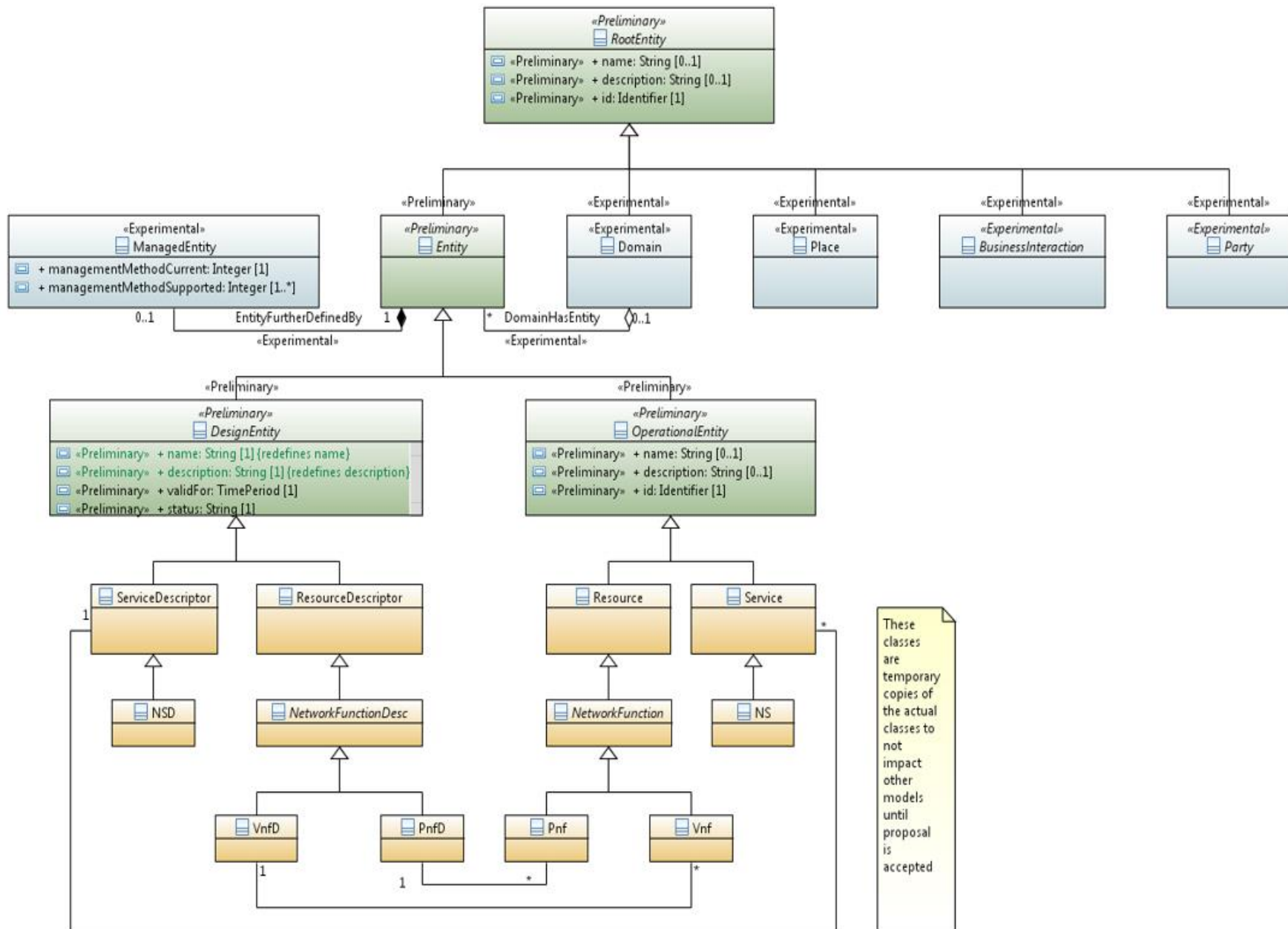
Specific implementations. CDS & APP-C . xNF consideration. General abstraction problem

Unification strategy to join SDN-C and APP-C into one entity. Yuriy for CDS.

CDS – GUI – define the (3GPP model) model that you can import; enable you to input the model and instance specific configuration to talk to each instance. Define models for manip application data. Define a model (importing the 3GPP model) and have the manipulation svc to implement the configuration associated w/ the xNF.

ACTION ITEM: PNF resource instantiated by ONAP. The issue of non-unification. Could interact w/ PNF. Yuriy.




(Andy) Maybe we introduce “core” sub-model to the Platform information that might accompany the G-A-M solution. Creating a “hybrid” solution, where the G-A-M serves the MAIN data model for xNFs, and this adjunct model maybe a way to SUPPLEMENT the P.I.M. w/ information that G-A-M solution falls short on, (1) isolates the changes thus there is not a big change to the P.I.M. (2) covers all the bases, “management level” that G-A-M 100% sufficient.

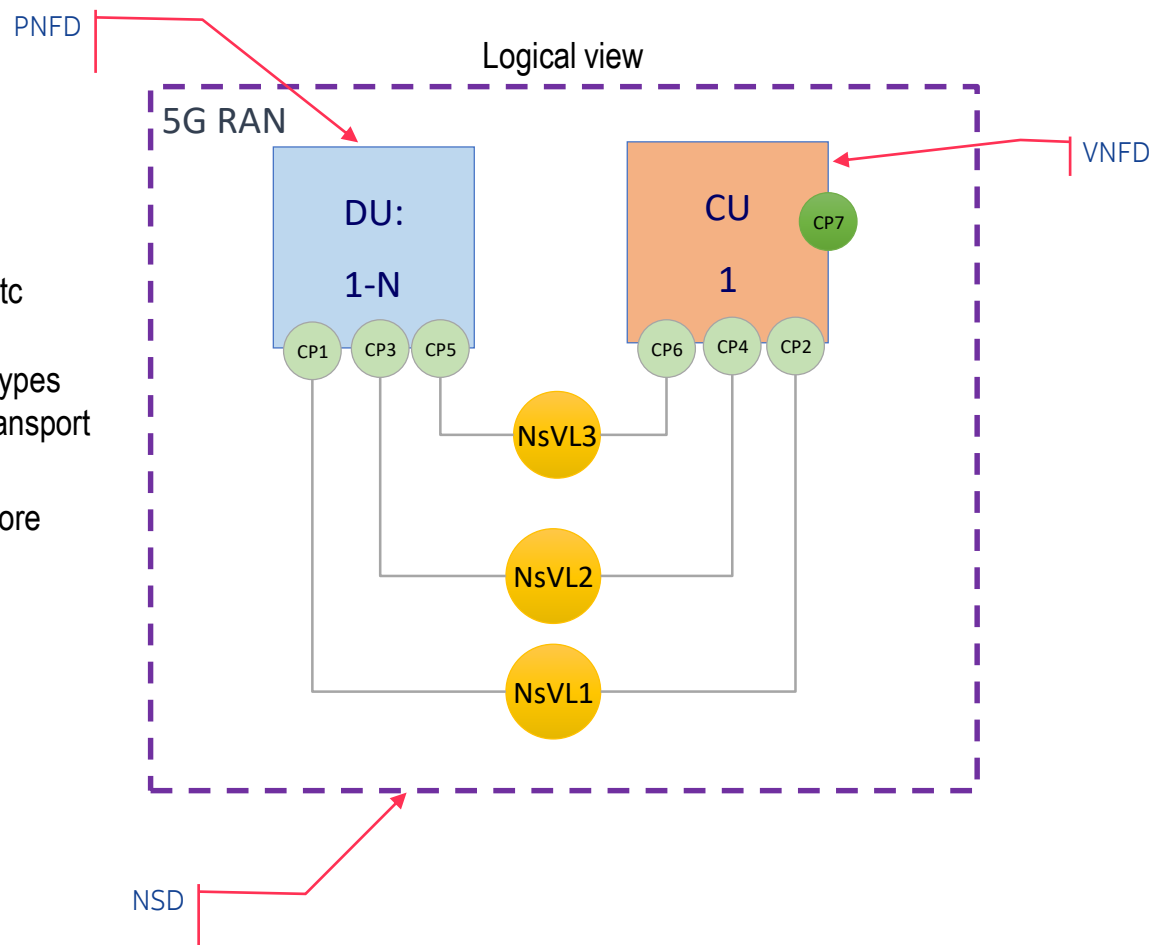


These classes are temporary copies of the actual classes to not impact other models until proposal is accepted

PNFD Model



-  CP1 CP1 to CP6: Ext connection points (e.g. Control plane, data plane, management, etc)
-  NsVL1 NsVirtual link for each type of connection types
Note: These VL may also can represent transport network technologies used.
-  ECP7 CP7: Ext connection point(s) for network core elements.



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)



Cell Management, Cell object, Cell Configuration



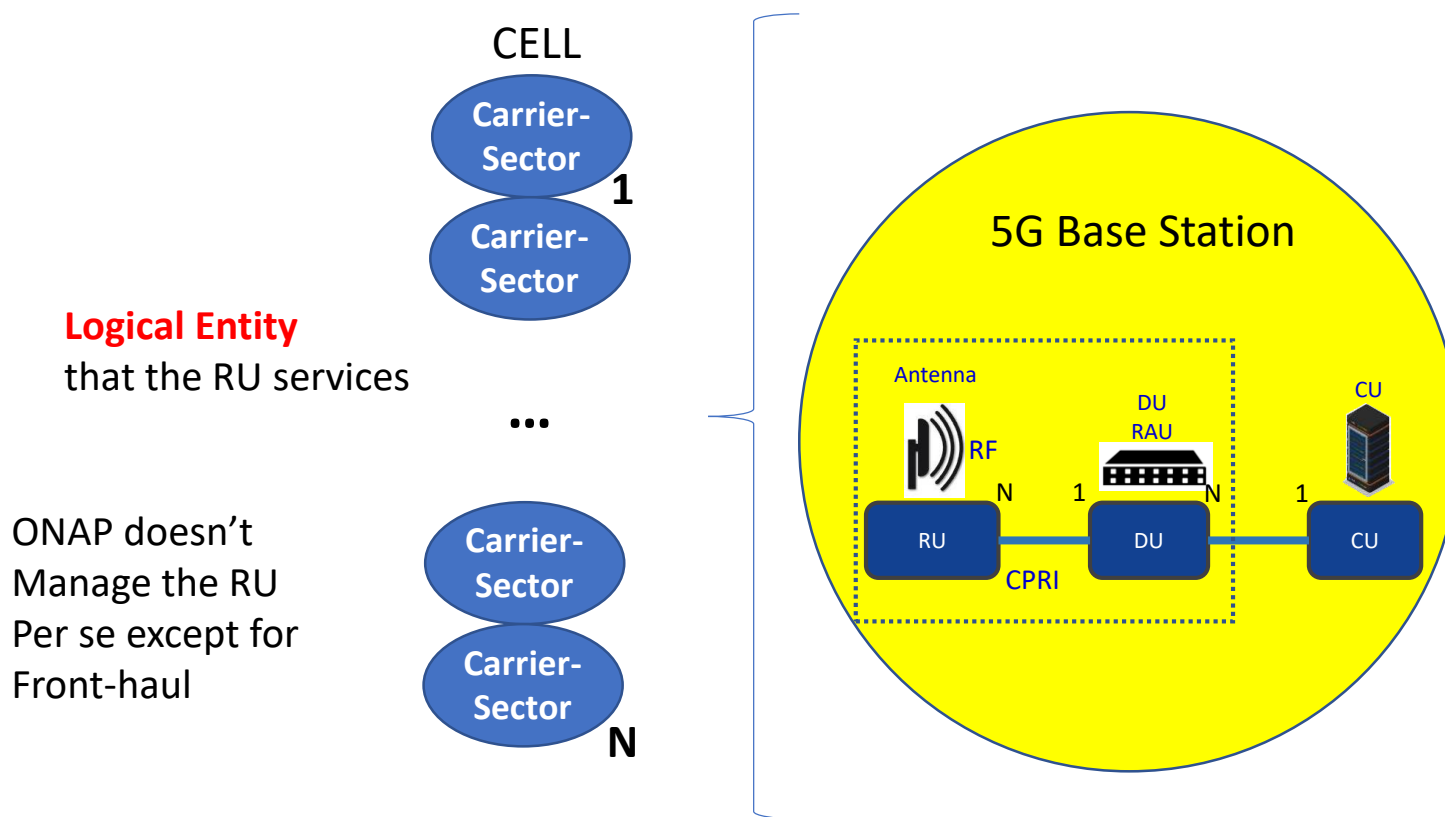
Benjamin Cheung, PhD

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/>





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 **OOB/SON/PCI** What use cases are Using it – OOB/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 C&PS 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 C&PS database entry. The DU informs ONAP that a Cell is added/deleted, then C&PS updates database accordingly. ONAP management level to add/delete would be a configuration update.

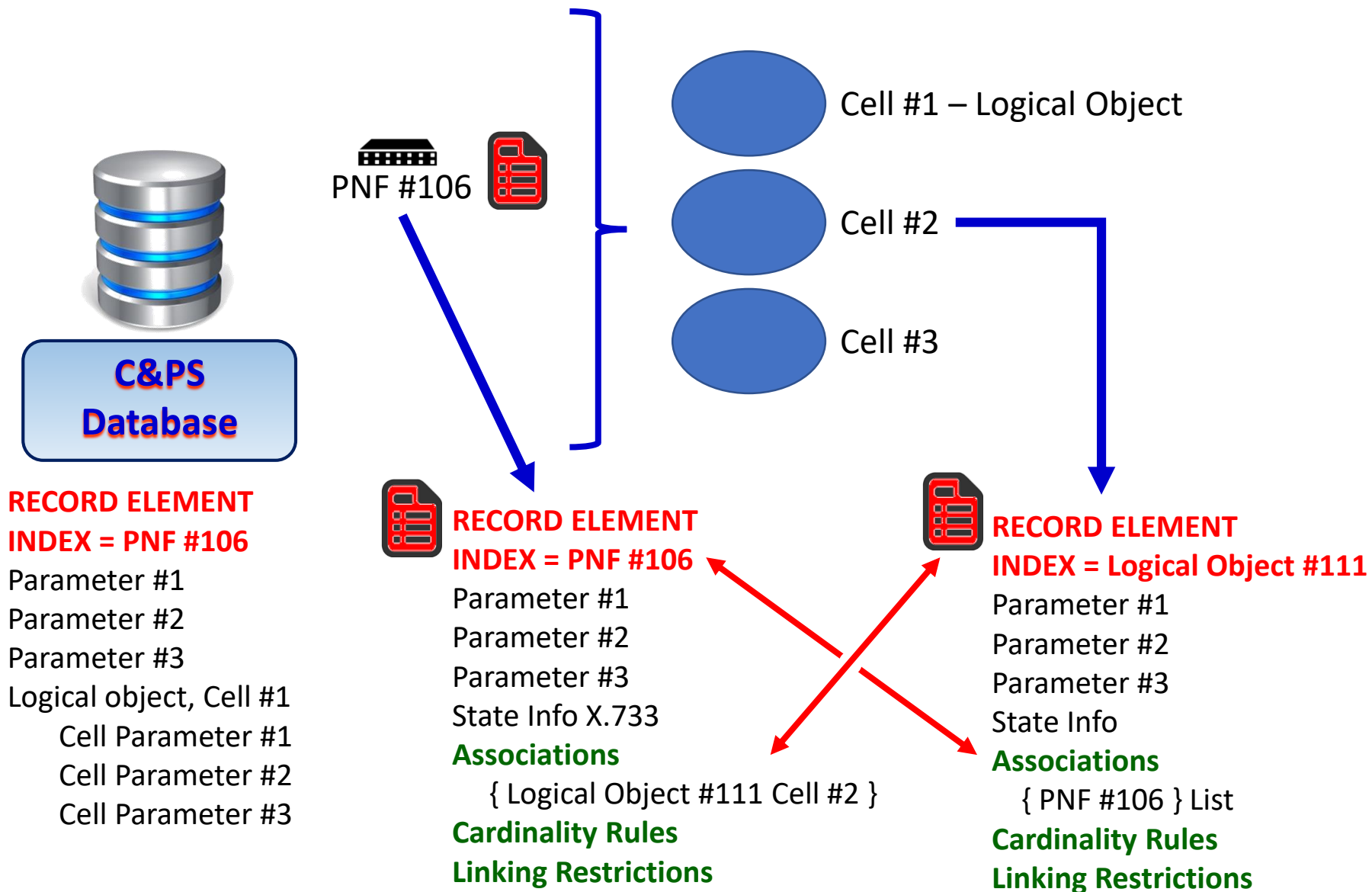
4 **MODELING** - How would it Model it? (Info Model). A DU is a MOC. A Cell is a Logical object. -> No modeling is needed.

INFORMATION ABOUT CELL

1 **PERFORMANCE MANAGEMENT** - 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).

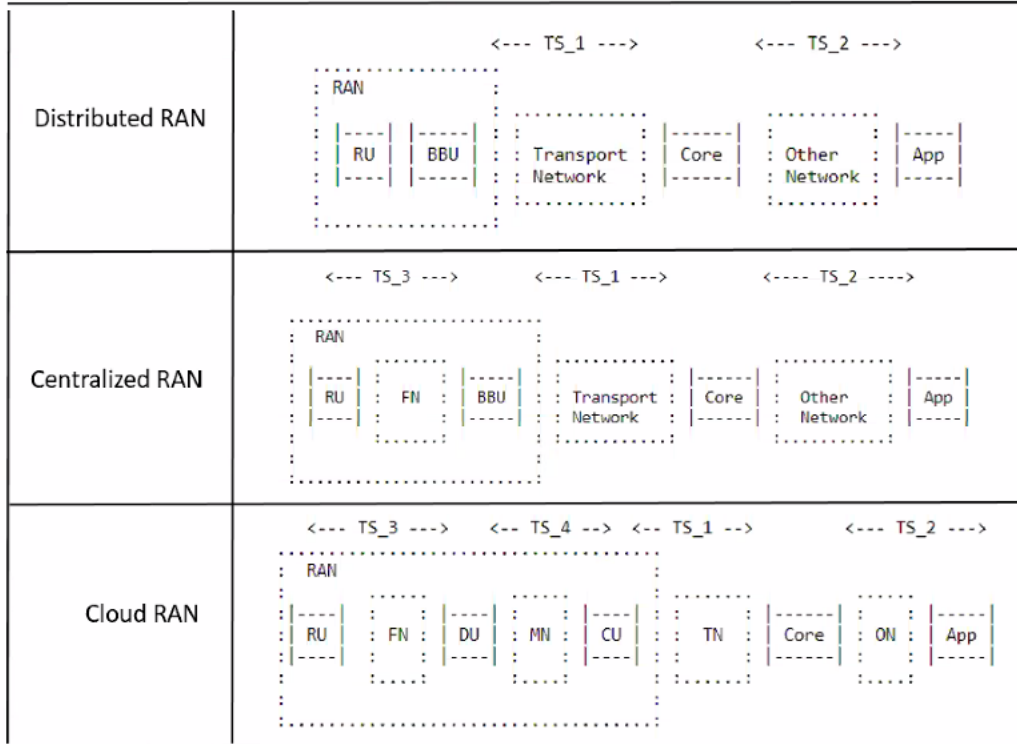
2 **CONFIGURATION MGMT** - Cell configuration info - Cell related information stored in C&PS.; Cell – A cell is a logical object. CDS. Cell related information is use case specific (PCI and E2ENS). (1) define, (2) store, (3) loop back to the xNF.

C&PS Database (Run-Time View)



Appendix





- An E2E Network Slice may consists of a set of TS instances, depending on the scenarios. Each TS instance defines the connectivity between two 5G domains. For example, TS_1 defines backhaul connectivity; TS_2, CORE to APP; TS_3, Fronthaul; TS_4, Midhaul.
- One TS consists of a set of networks (connectivity graphs). Each network has its own SLA. See next slide.
- One TS model for all TS instances in all scenarios.
- TSCi defines the TS model. And TSCi is the interface of the TN MD. It follows that the consumers of the TN MD could be E2E MD and/or RAN MD, depending on the scenarios. The TN MD does not care who the consumer is.



TS: Transport Slice
 RS: RAN Slice
 CS: Core Slice
 FN: Fronthaul network
 MN: Midhaul network
 TN: Transport network
 ON: Other network