5G NRM (Network Resource Model) Configuration

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Outline

- 5G NRM Configuration use case (Target in R6)
  - Background
  - High-level architecture, when and how to trigger this UC
  - Whole procedure of 5G NRM Configuration (design and runtime)

- Modeling (SDC) Requirements

LFN DDF link:
https://wiki.lfnetworking.org/display/LN/2019+June+Event+Topic+Proposals#id-2019JuneEventTopicProposals-5GProvisioningmanagementservicetoNRM

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

Reference List

ID	Reference
1	TS 32.602 Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP); Information Service (IS)
2	TS 32.662 Telecommunication management; Configuration Management (CM); Kernel CM Information Service (IS)
3	TS 32.658 Telecommunication management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)
4	TS 28.530 Management and orchestration; Concepts, use cases and requirements
5	TS 28.531 Management and orchestration; Provisioning
6	**TS 28.532 Management and orchestration; Generic management services**
7	TS 28.533 Management and orchestration; Architecture framework
8	TS 28.540 Management and orchestration; 5G Network Resource Model (NRM); Stage 1 **TS 28.541 Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3**
9	TR 28.890 Management and orchestration; Study on integration of Open Network Automation Platform (ONAP) and 3GPP management for 5G networks

Background

- Motivation
  - Started from Beijing, PNF (especially RAN) PnP was proposed in ONAP 5G UC. However, PNF PnP UC becomes more generic for all kinds of PNF instances.
  - On the other side, 'pnf ready' after current PNF PnP allows ONAP to only get the PNF instances. This UC will show how to make the PNF (focus on RAN side) 'alive' from perspective of demonstration. More much work need to do in real product environment.

- Goals of the use case in Frankfurt (R6): **5G NRM CM with RESTful/HTTPS protocol**.
  - 1. Add a new restful-executor in CDS blueprints processor. [CDS]
  - 2. Provide CRUD operations on NRM objects via CDS. [CDS]
  - 3. Add new NRM related data types, corresponding PNF packages and BPMN enhancements as well. Use a subset of NR NRM IOCs for demonstrations and enhance the PNFD model. [Modeling/SDC]
  - 4. Support SO service/instance management API for NRM configuration. [SO]

Concepts

- **Configuration Management (CM)** [1]:
  - in general, provides the operator with the ability to assure correct and effective operation of the 3G network as it evolves.
  - CM actions have the objective to control and monitor the actual configuration on the Network Elements (NEs) and Network Resources (NRs), and they may be initiated by the operator or by functions in the Operations Systems (OSs) or NEs.
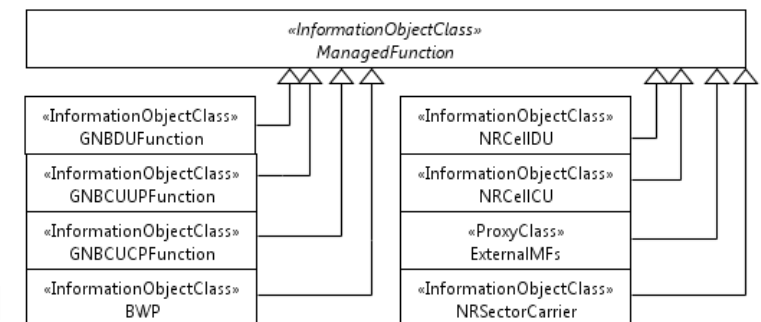 - LTE: IRP mechanism

- **Management service (MnS)** [7] :
  - Offers management capabilities. These management capabilities are accessed by management service consumers via standardized service interface composed of individually specified management service components.
  - **Generic provisioning management service**, Performance assurance specific MnSs, etc.
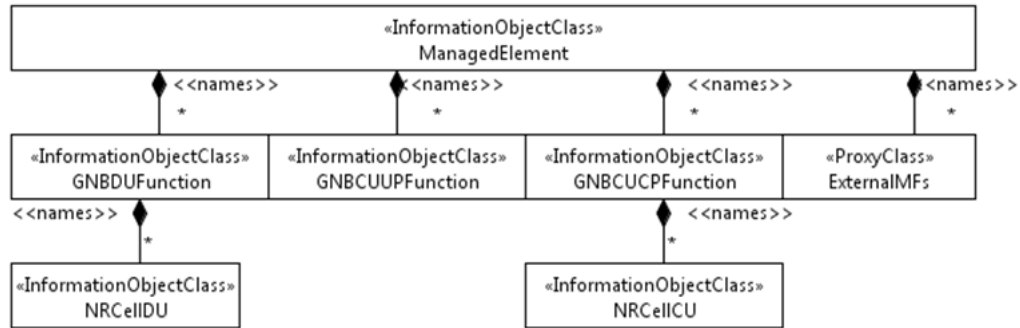 - 5G: Service-based management

- **Network Resource Model (NRM)** [8]:
  - Information model definitions for **NR NRM**, 5GC NRM, network slice NRM


Inheritance Hierarchy for NR NRM

# NRM IOCs Example [8,TS 28.541]

NR NRM（30+）:

4.3.1 GNBDUFunction	4.3.20 ExternalGNBDUFunction
4.3.2 GNBCUCPFunction	4.3.21 ExternalUPFFunction
4.3.3 GNBCUUPFunction	4.3.22 ExternalAMFFunction
4.3.4 NRCellCU	4.3.23 ExternalMFs <<ProxyClass>>
4.3.5 NRCellDU	4.3.24 ENBFunction <<ProxyClass>>
4.3.6 NRSectorCarrier	4.3.25 GNBCUCPFunction <<ProxyClass>>
4.3.7 BWP	4.3.26 GNBCUUPFunction <<ProxyClass>>
4.3.8 EP_E1	4.3.27 GNBDUFunction <<ProxyClass>>
4.3.9 EP_XnU	4.3.28 ServingGWFFunction <<ProxyClass>>
4.3.10 EP_NgC	4.3.29 UPFFunction <<ProxyClass>>
4.3.11 EP_NgU	4.3.30 AMFFunction <<ProxyClass>>
4.3.12 EP_F1C	4.3.31 Void4.3.32 NRCellRelation
4.3.13 EP_F1U	4.3.33 NRFreqRelation
4.3.14 EP_S1U	4.3.34 EutranFreqRelation
4.3.15 EP_X2C	4.3.35 ExternalNRCellCU
4.3.16 EP_X2U	4.3.36 RRMPolicyRatio2 <<dataType>>
4.3.17 EP_XnC	4.3.37 S-NSSAI <<dataType>>
4.3.18 ExternalGNBCUCPFunction	
4.3.19 ExternalGNBCUUPFunction	

5GC NRM（50+）:
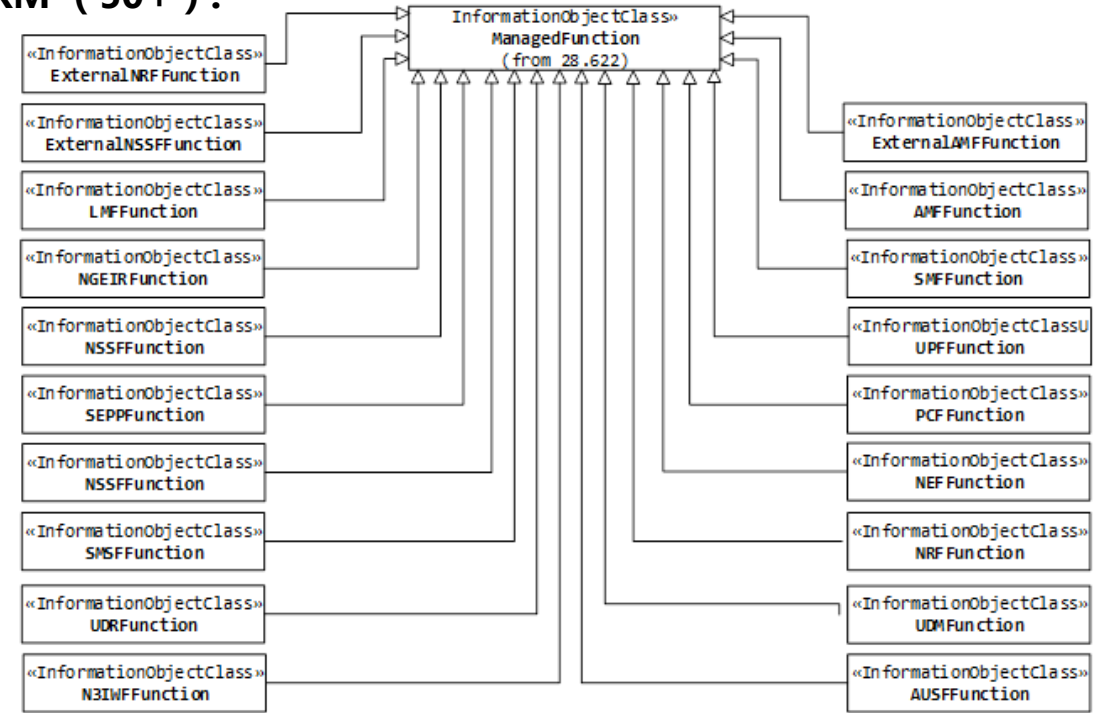
network slice NRM（<10）:
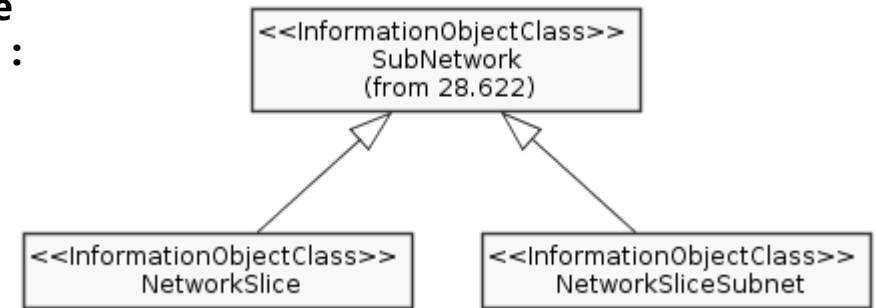
IOC Scope of the UC in R6

- In R6, the UC will focus on NR NRM and start from the simplified set of IOCs in TS 28.541(version 16.1.0). Note that, 30+ IOCs were given for NR NRM.

- Three deployment scenarios are provided for the representation of gNB and en-gNB. The UC will start from 'non-split' one.

Deployment scenario focus

IOC focus

GNBDUFunction

Role	Req	End point requirement for 3-split deployment scenario	End point requirement for 2-split deployment scenario	End point requirement for Non-split deployment scenario
gNB		`<<IOC>>EP_F1C,` `<<IOC>>EP_F1U`	`<<IOC>>EP_F1C,` `<<IOC>>EP_F1U`	None.

GNBCUCPFunction

Role	Req	End point requirement for 3-split deployment scenario	End point requirement for 2-split deployment scenario	End point requirement for Non-split deployment scenario
gNB		`<<IOC>>EP_XnC,` `<<IOC>>EP_NgC,` `<<IOC>>EP_F1C,` `<<IOC>>EP_E1.`	`<<IOC>>EP_XnC,` `<<IOC>>EP_NgC,` `<<IOC>>EP_F1C` `<<IOC>>EP_F1U.`	`<<IOC>>EP_XnC,` `<<IOC>>EP_NgC.`

GNBCUUPFunction

Role	Req	End point requirement for 3-split deployment scenario	End point requirement for 2-split deployment scenario	End point requirement for Non-split deployment scenario
gNB		`<<IOC>>EP_XnU,` `<<IOC>>EP_NgU,` `<<IOC>>EP_F1U,` `<<IOC>>EP_E1.`	`<<IOC>>EP_XnU,` `<<IOC>>EP_NgU,` `<<IOC>>EP_F1U.`	`<<IOC>>EP_XnU,` `<<IOC>>EP_NgU.`

4.3.1 GNBDUFunction
4.3.2 GNBCUCPFunction
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4.3.4 NRCellCU
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4.3.9 EP_XnU
4.3.10 EP_NgC
4.3.11 EP_NgU
4.3.12 EP_F1C
4.3.13 EP_F1U
4.3.14 EP_S1U
4.3.15 EP_X2C
4.3.16 EP_X2U
4.3.17 EP_XnC
4.3.18 ExternalGNBCUCPFunction
4.3.19 ExternalGNBCUUPFunction

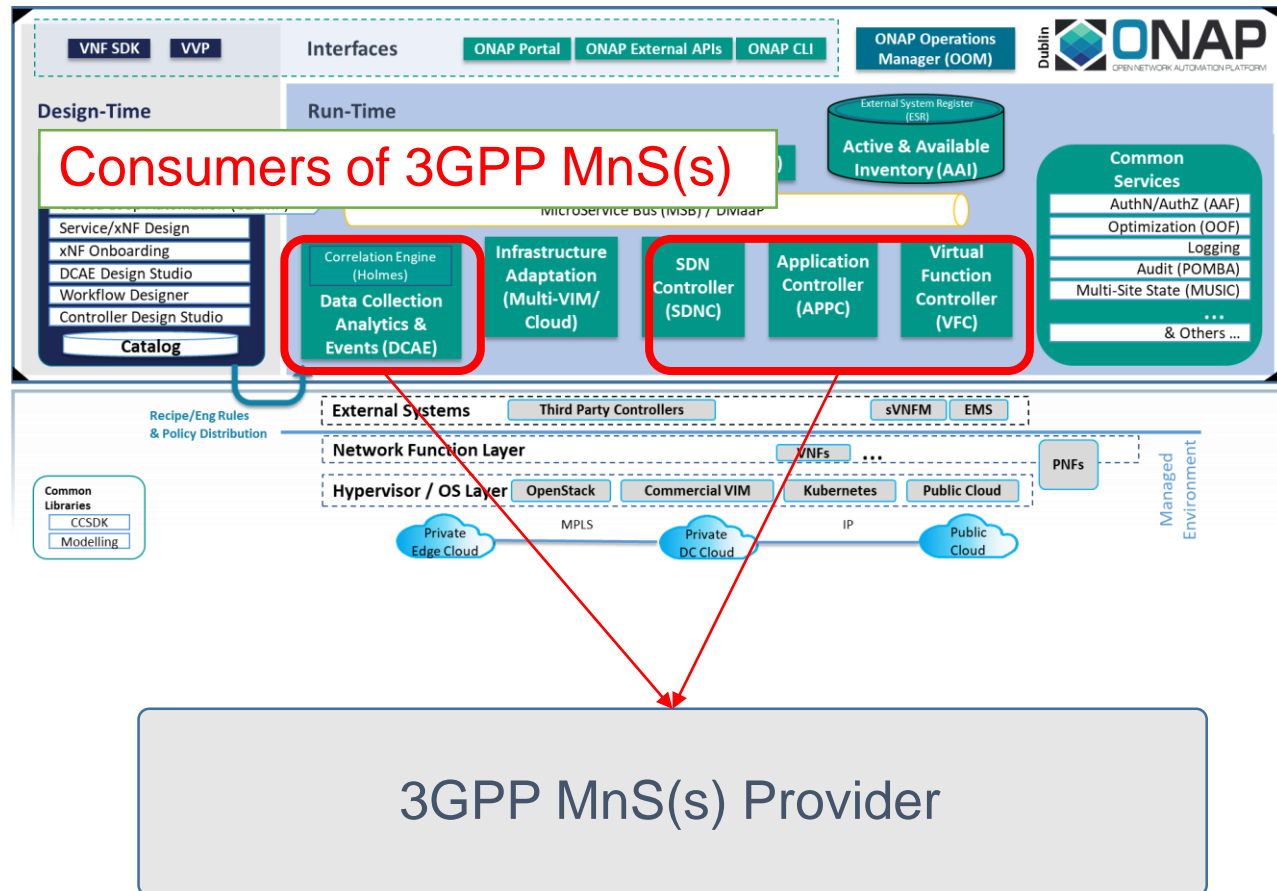# Generic provisioning management service: RESTFul Solution

Consumers of 3GPP MnS(s)

3GPP MnS(s) Provider

Ref: TR 28.890 [9]

In TS 28.532 [6], operations of Generic provisioning MnS:

IS operation	Description
createMOI	create a Managed Object instance in the MIB maintained by the createMOI operation service provider.
getMOIAttributes	the retrieval of management information (Managed Object attribute names and values) from the MIB maintained
modifyMOIAttributes	modification of one or more Managed Object instances
deleteMOI	deletion of one or more Managed Object instances
subscribe	establish subscription to receive network events via notifications, under the filter constraint specified in this operation.
unSubscribe	cancel one subscription made with a consumerReference by providing the corresponding subscriptionId or all subscriptions made with the same consumerReference by leaving the subscriptionId parameter absent.

RESTful HTTP-based solution set of provisioning

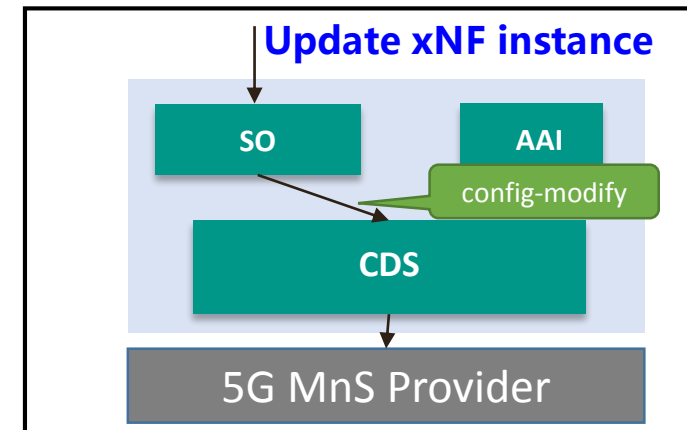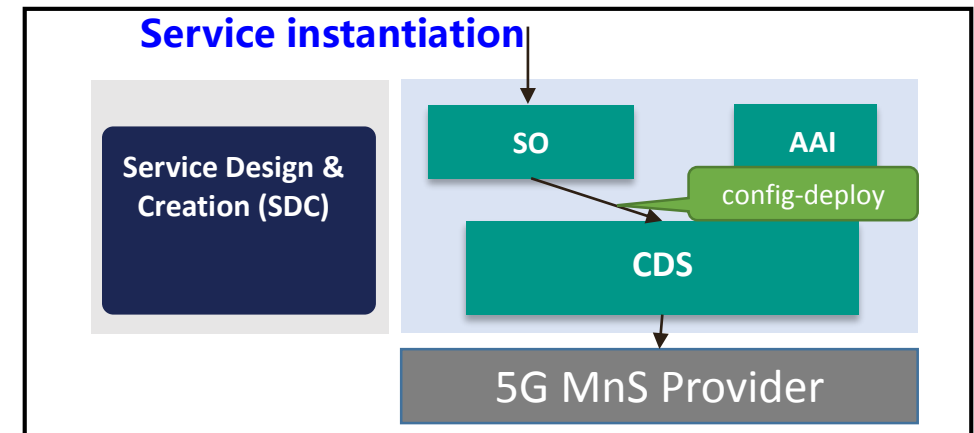| IS operation	HTTP Method	Resource URI	Qualifier
createMOI	PUT	/{className}/{id}	M
getMOIAttributes	GET	/{className}/{id}	M
modifyMOIAttributes	PATCH	/{className}/{id}	M
deleteMOI	DELETE	/{className}/{id}	M

High-level design of 5G NRM Configuration

- The goal of the UC is integration of ONAP with 3GPP management for 5G networks on NRM configuration management:
  - Support service-based management
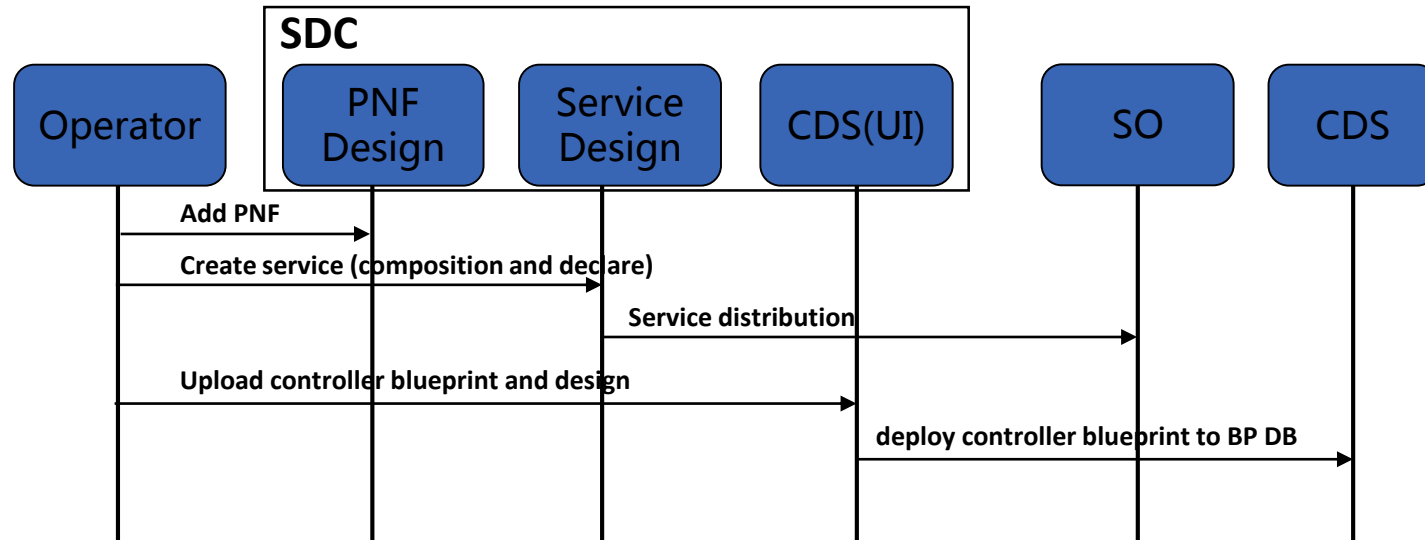 - Resolve the huge number of IOCs adaptively during the NRM configuration
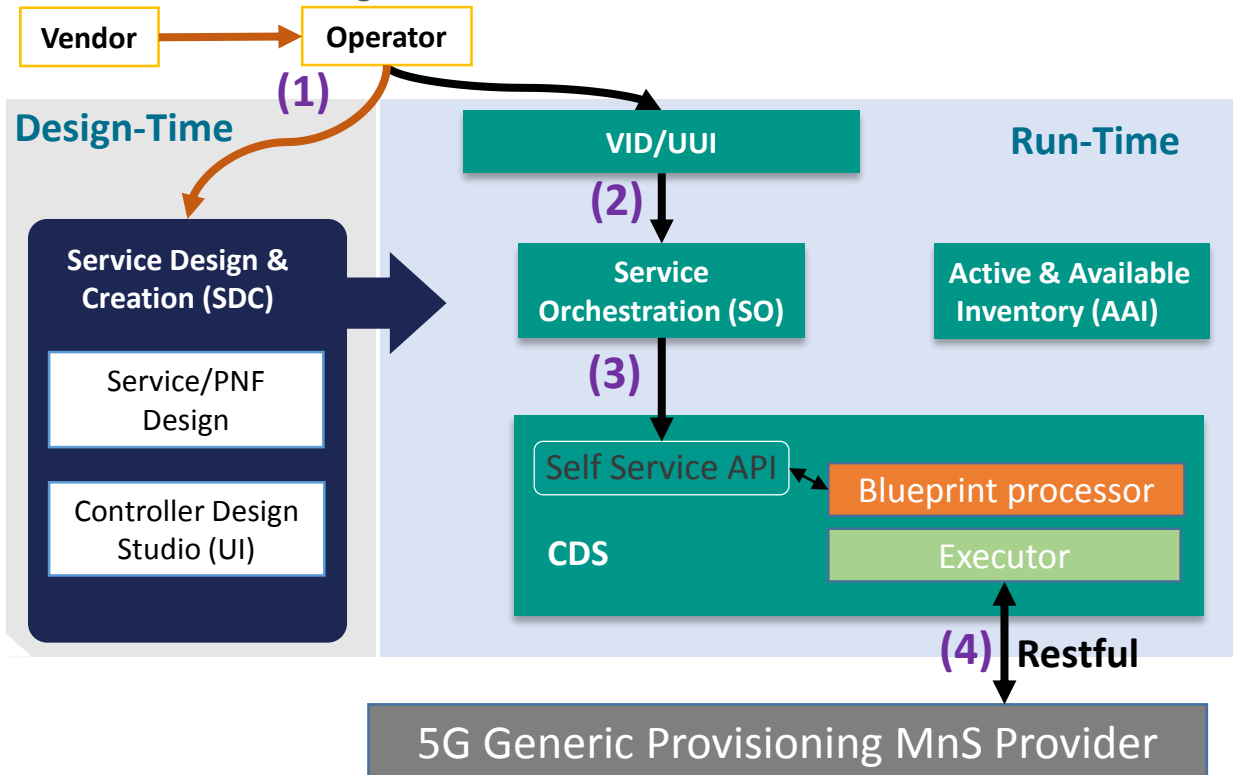
- When to Use this UC
  - Day0: PNP (Post-instantiation)
  - DayX: CM maintenance, e.g. MO CRUD operations

Whole procedure: Design time

- Take NRM configuration with PNP as example

- PNF Modeling and Service Modeling
  - During PNF modeling, add additional NRM to the PNF resource model
  - During Service modeling, 'declare' MO you want and its attributes
- BPMN enhancements (also can customize a separate BPMN)
  - Add NRM configuration activity during *ConfigurePnfResource* subprocess
- Design and upload the cba via CDS UI
  - Re-use or override the restful component function (which should be in cbp ms repo in R6)

```
data_types:
  tosca.datatypes.nrm3gpp.nr.PLMNId:
  ## Ref 3GPP 28.659:

  tosca.datatypes.nrm3gpp.nr.GNBDUFunction:
  ## Ref 3GPP 28.541 NR NRM:
    derived_from: tosca.datatypes.Root
    description: Represents the logical function DU of gNB or en-gNB.
    properties:
      gNBId:
        type: integer
        description: It identifies a gNB within a PLMN.
        required: true
      gNBDUId:
        type: integer
        description: It uniquely identifies the DU at least within a gNB.
        required: true
      gNBIdLength:
        type: integer
        description: This indicates the number of bits for encoding the gNB ID.
        required: true
        constraints:
          - in_range: [ 22, 32 ]
      gNBDUName:
        type: string
        description: It identifies the Distributed Entity of a NR node.
        required: false
      pLMNId:
        type: tosca.datatypes.nrm3gpp.nr.PLMNId
        description: It specifies the PLMN identifier to be used as part of the
        required: true
```

```
node_types:
  tosca.nodes.3gpp.nr.NonSplitGNB:    # Non-split deployment sce
    derived_from: tosca.nodes.nfv.PNF
    properties:
      ##############################################
      ## NR NRM ##
      ##############################################
      gNBDUFunction:
        type: tosca.datatypes.nrm3gpp.nr.GNBDUFunction:
        required: true
      gNBCUCPFunction:
        type: tosca.datatypes.nrm3gpp.nr.GNBCUCPFunction:
        required: true
      gNBCUUPFunction:
        type: tosca.datatypes.nrm3gpp.nr.GNBCUUPFunction:
        required: true
```

Whole procedure: Runtime
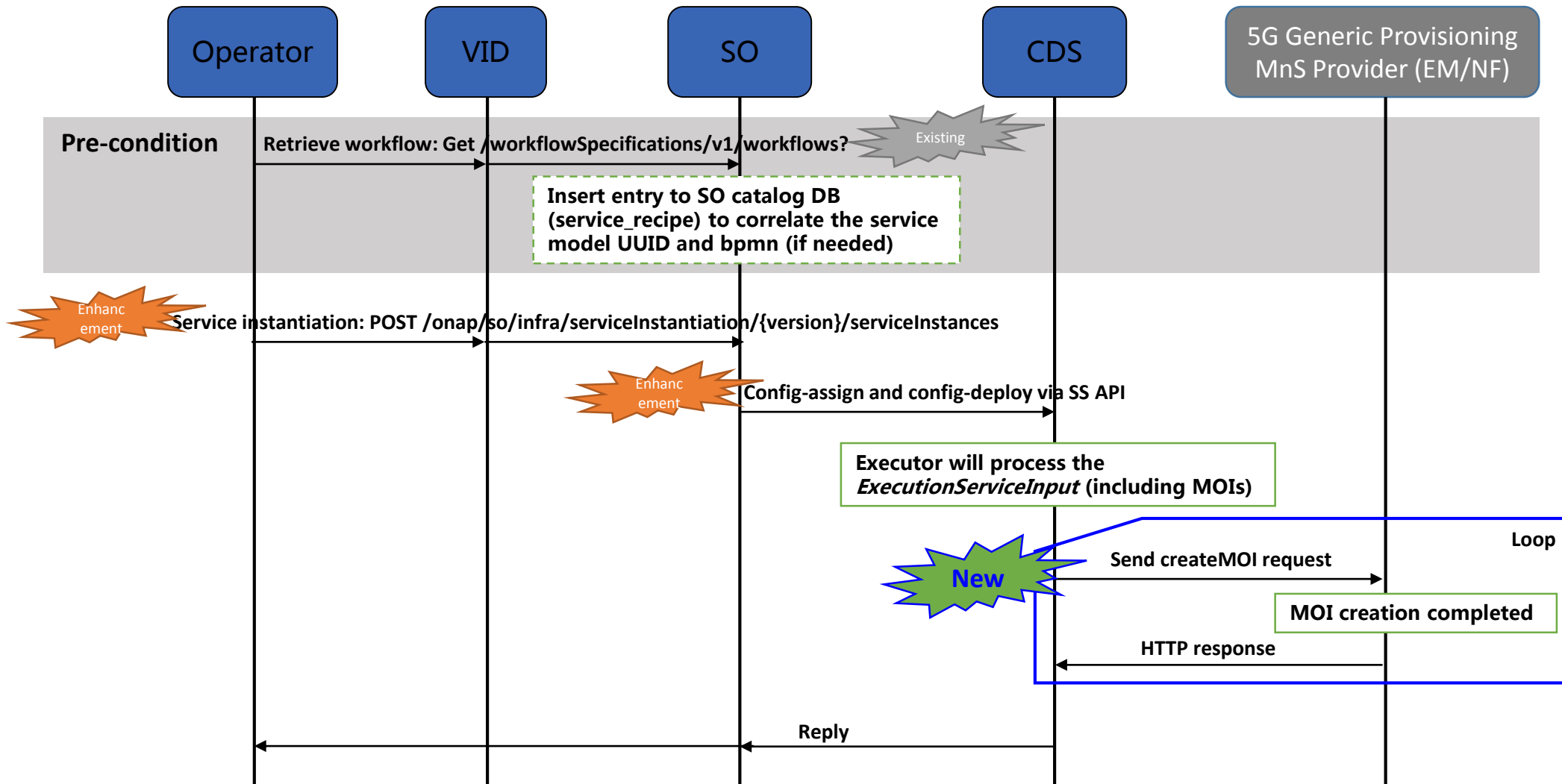
Service instantiation: VID—(restful api)-->SO—(self-service api)—>CDS—(restful api)—>MnS Provider
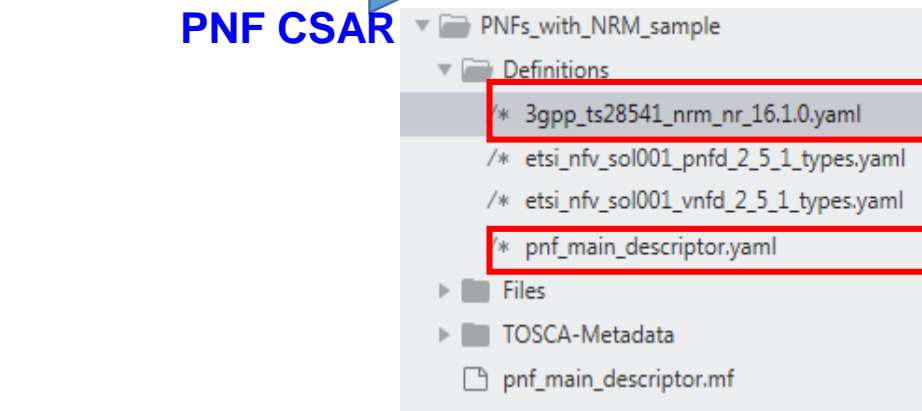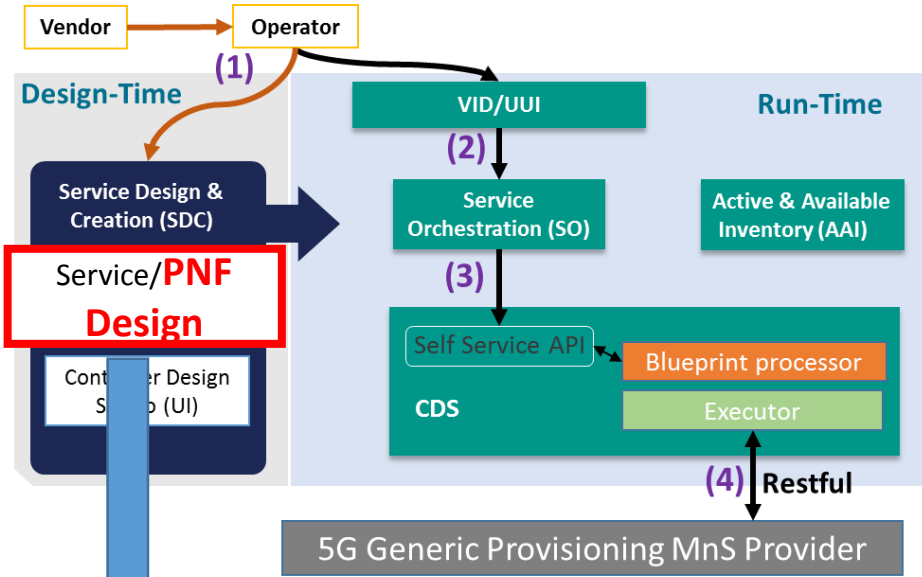
Modeling Requirements in Frankfurt (R6)

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Modeling Requirements

- 1. Define data types of a subset of NR NRM IOCs, which are aligned with 3GPP TS 28.541
  - GNBDUFunction
  - GNBCUCPFunction
  - GNBCUUPFunction
  - EP_XnC
  - EP_NgC
  - EP_XnU
  - EP_NgU
  - PLMNId
- 2. Add one user defined node type, a pnf with NRM attributes (c.f. SDC-2520 for user defined node type for VNF)
  - E.g. NonSplitGNB
- 3. Define topology template with above node type

Modeling Details