# 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 <br> **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 NRM information in PNF package for onboarding (such as non-mano artifacts) and BPMN enhancements. [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.
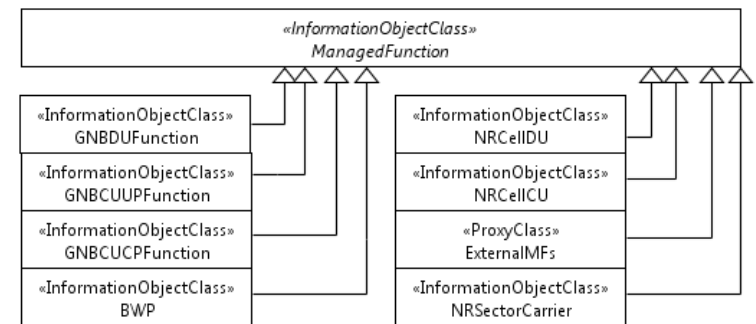  - LTE: IRP mechanism

- **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.
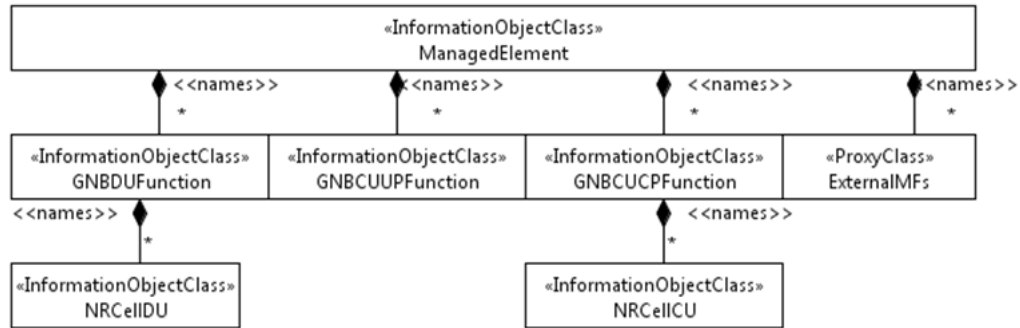  - 5G: Service-based management

- **Network Resource Model (NRM)** [8]:
  - Information model definitions for **NR NRM**, 5GC NRM, network slice NRM
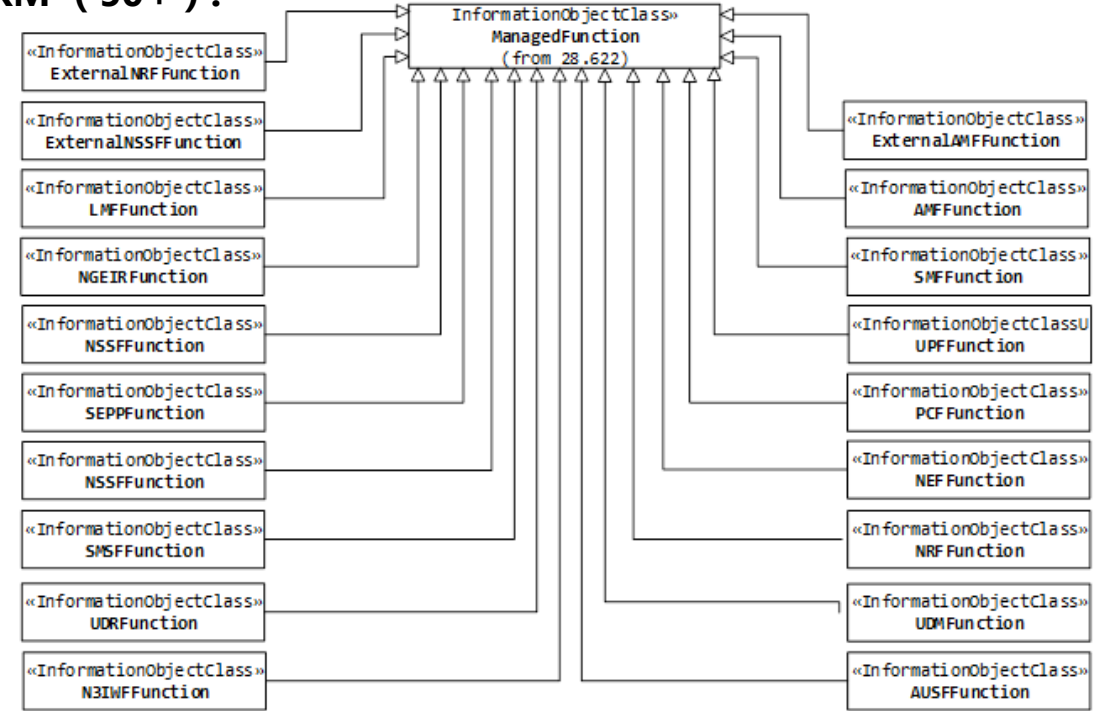
Inheritance Hierarchy for NR NRM
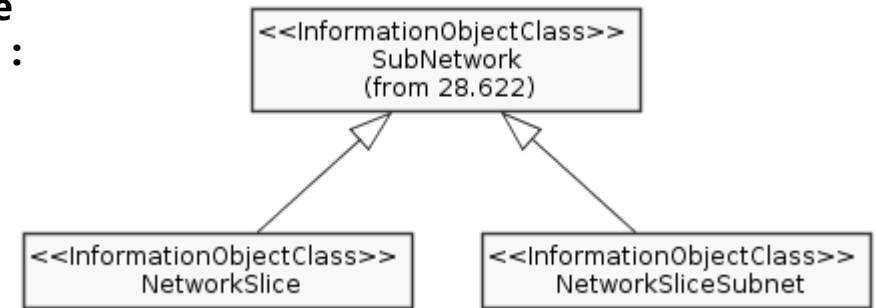
# NRM IOCs Example [8,TS 28.541]

**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
- 4.3.3 GNBCUUPFunction
- 4.3.4 NRCellCU
- 4.3.5 NRCellDU
- 4.3.6 NRSectorCarrier
- 4.3.7 BWP
- 4.3.8 EP_E1
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- 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
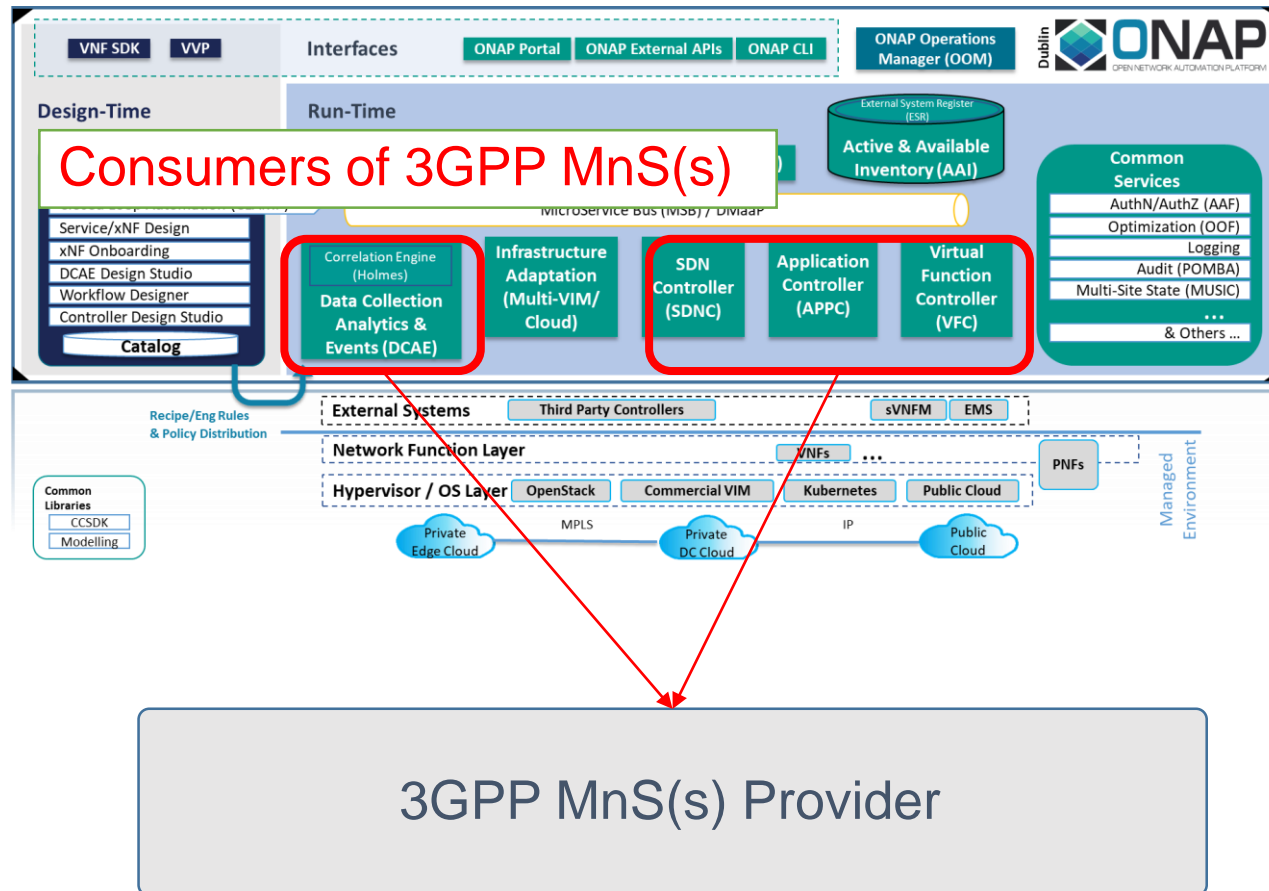- 4.3.19 ExternalGNBCUUPFunction

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# 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**

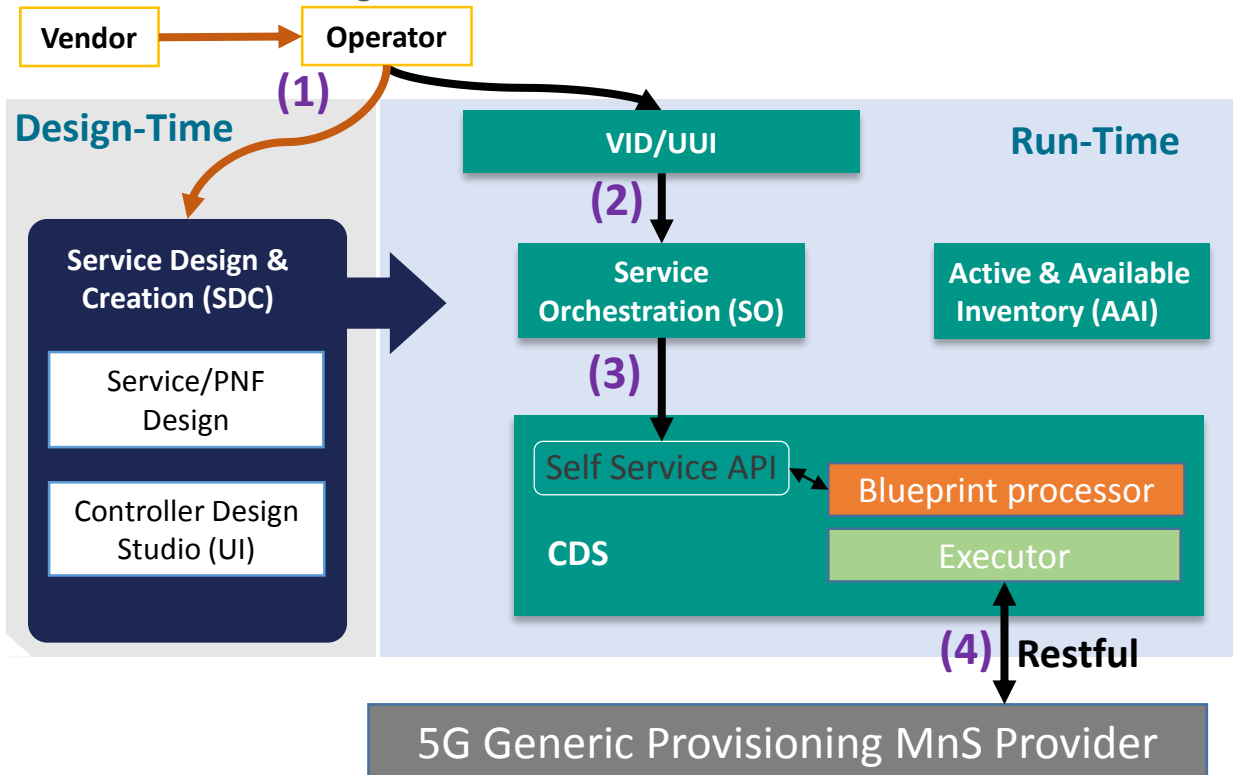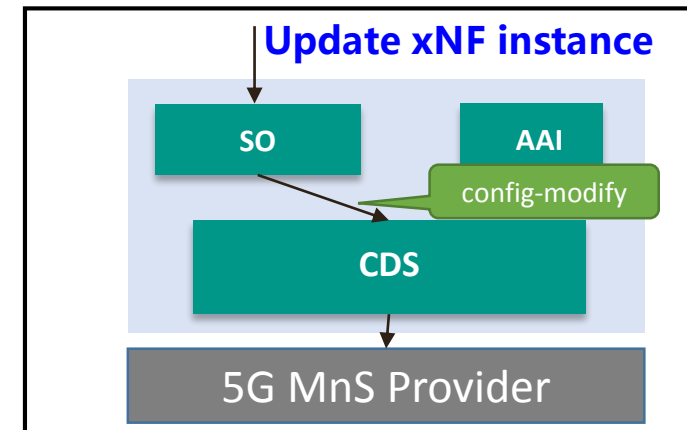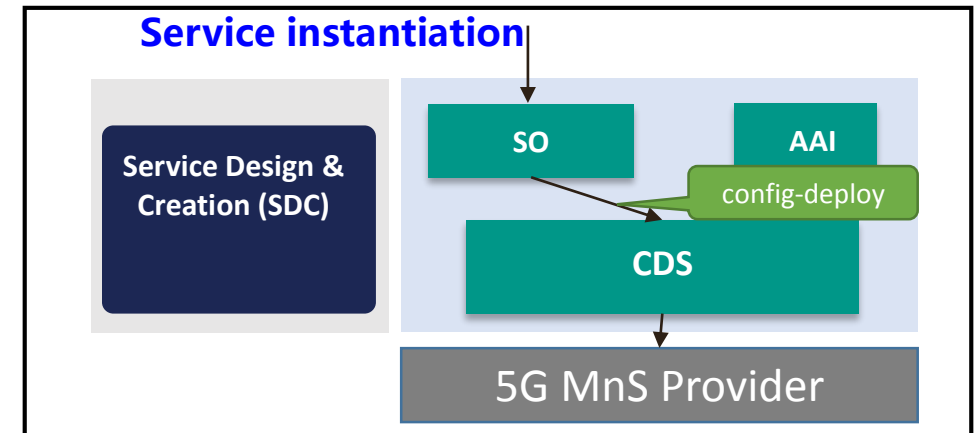| IS operation | HTTP Method | Resource URI | Qualifier |
|---|---|---|---|
| createMOI | PUT | /{className}/{id} | M |
| getMOIAttributes | GET | /{className}/{id} | M |
| modifyMOIAttributes | PATCH | /{className}/{id} | M |
| deleteMOI | DELETE | /{className}/{id} | M |

# 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
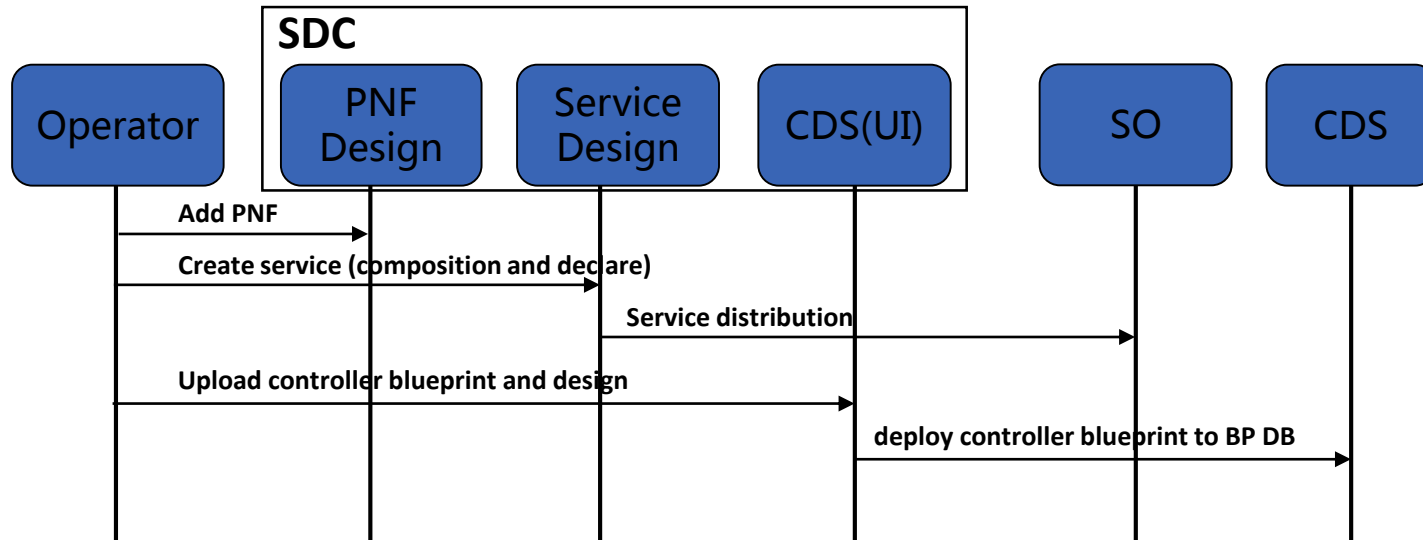    - Resolve the huge number of IOCs adaptively during the NRM configuration

- When to Use this UC
    - Day0: PNP (Post-instantiation)
    - DayX: CM maintenance, e.g. MO CRUD operations
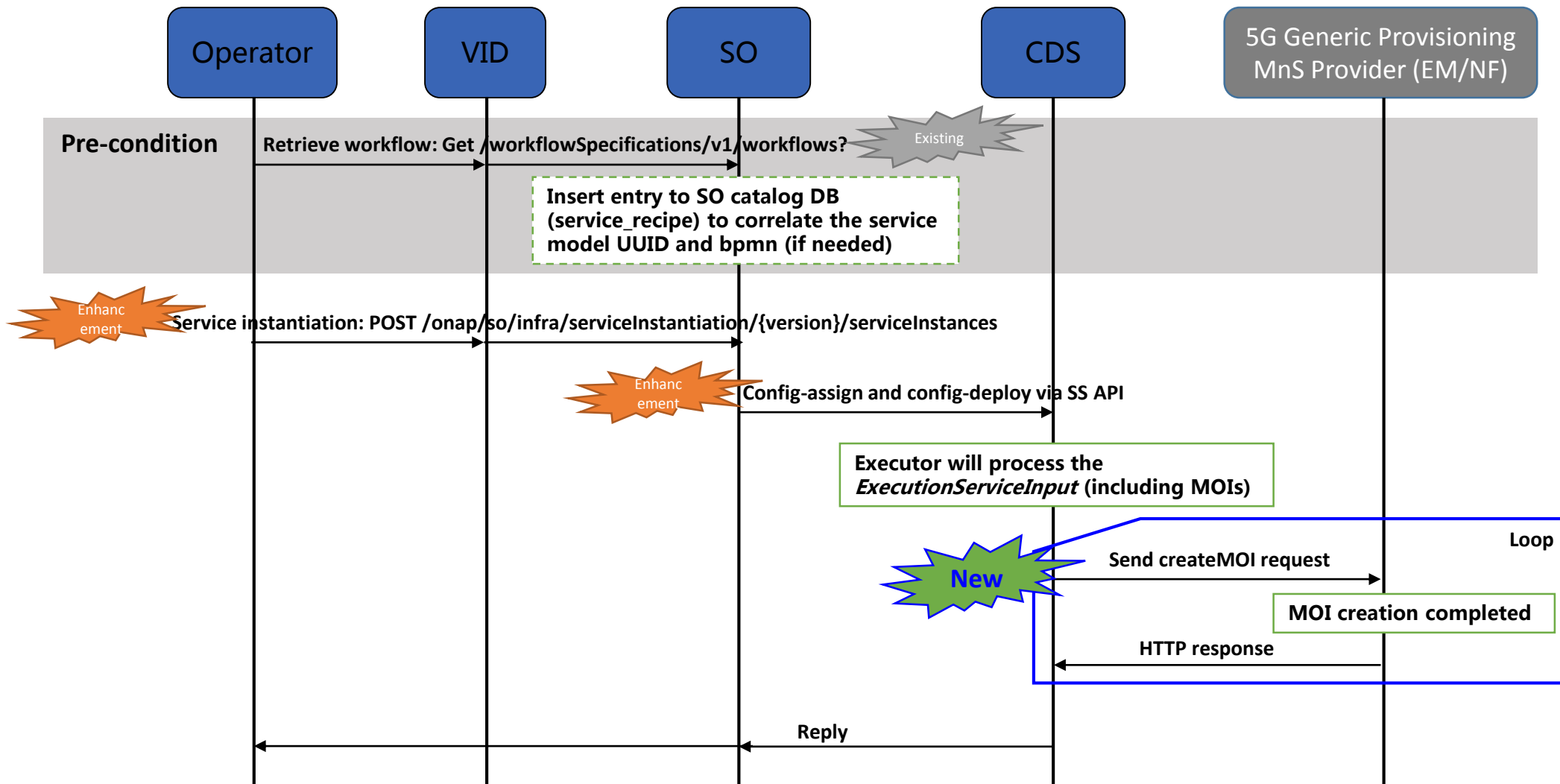
# Whole procedure: Design time

- Take NRM configuration with PNP as example



- PNF Modeling and Service Modeling
  - During PNF Pre-onboarding and onboarding, add NRM as template to the PNF Package
  - 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)

# Whole procedure: Runtime



**Operator** | **VID** | **SO** | **CDS** | **5G Generic Provisioning MnS Provider (EM/NF)**

**Pre-condition**

Retrieve workflow: Get /workflowSpecifications/v1/workflows?    *Existing*

Insert entry to SO catalog DB (service_recipe) to correlate the service model UUID and bpmn (if needed)

*Enhancement*    Service instantiation: POST /onap/so/infra/serviceInstantiation/{version}/serviceInstances

*Enhancement*    Config-assign and config-deploy via SS API

Executor will process the *ExecutionServiceInput* (including MOIs)

**New**

**Loop**

Send createMOI request

MOI creation completed

HTTP response

Reply

Service instantiation: VID—(restful api)-->SO—(self-service api)—>CDS—(restful api)—>MnS Provider

# Other procedures

- In addition to MO creation, the new executor, e.g. RestfulComponentExecutor, should support:
  - get MO instance
  - modify MOI attribute(s)
  - delete MOI
- Consider SO NB API, it needs service instance id, pnf instance id, MOI DN