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Contents

Foreword

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Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

28.621 Generic Network Resource Model (NRM) Integration Reference Point (IRP); Requirements.

28.622 Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS).

28.623 Generic Network Resource Model (NRM) Integration Reference Point (IRP); Solution Set (SS) definitions.

1 Scope

The TS 28.62x-series (Generic Network Resources IRP) define an Integration Reference Point (IRP) through which an "IRPAgent" (typically an Element Manager or Network Element) can communicate Network Management related information to one or several "IRPManagers" (typically Network Managers).

This TS-family specifies a generic Network Resource Model, NRM (also referred to as a Management Information Model - MIM) with definitions of Information Object Classes (IOCs) and Managed Object Classes (MOCs).

The present document specifies the Solution Set definition for the Generic NRM IRP.

The Solution Set definition is related to 3GPP TS 28.622 V16.1.X [4].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".

[2] 3GPP TS 32.102: "Telecommunication management; Architecture".

[3] 3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".

[4] 3GPP TS 28.622: “Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)”.

[5] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".

[6] Void

[7] 3GPP TS 32.616: "Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP); Solution Set (SS) definitions".

[8] W3C REC-xml11-20060816: "Extensible Markup Language (XML) 1.1 (Second Edition)".

[9] Void.

[10] W3C XML Schema Definition Language (XSD) 1.1 Part 1: Structures.

[11] W3C XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes.

[12] W3C REC-xml-names-20060816: "Namespaces in XML 1.1 (Second Edition)".

[13] 3GPP TS 32.158: "Management and orchestration; Design rules for REpresentational State Transfer (REST) Solution Sets (SS) ".

[14] 3GPP TS 32.160: "Management and orchestration; Management Service Template".

[15] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [15], 3GPP TS 32.101 [1], 3GPP TS 32.102 [2], 3GPP TS 32.600 [3], 3GPP TS 28.622 [4] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [15] and 3GPP TS 32.101 [1], 3GPP TS 32.102 [2] and 3GPP TS 32.600 [3] and 3GPP TS 28.622 [4].

XML file: file containing an XML document

XML document: composed of the succession of an optional XML declaration followed by a root XML element

NOTE: See [8]; in the scope of the present document.

XML declaration: it specifies the version of XML being used

NOTE: See [8].

XML element: has a type, is identified by a name, may have a set of XML attribute specifications and is either composed of the succession of an XML start-tag followed by the XML content of the XML element followed by an XML end-tag, or composed simply of an XML empty-element tag; each XML element may contain other XML elements

NOTE: See [8].

empty XML element: having an empty XML content; an empty XML element still possibly has a set of XML attribute specifications; an empty XML element is either composed of the succession of an XML start-tag directly followed by an XML end-tag, or composed simply of an XML empty-element tag

NOTE: See [8].

XML content (of an XML element): empty if the XML element is simply composed of an XML empty-element tag; otherwise the part, possibly empty, of the XML element between its XML start-tag and its XML end-tag

XML start-tag: the beginning of a non-empty XML element is marked by an XML start-tag containing the name and the set of XML attribute specifications of the XML element

NOTE: See [8].

XML end-tag: the end of a non-empty XML element is marked by an XML end-tag containing the name of the XML element

NOTE: See [8].

XML empty-element tag: composed simply of an empty-element tag containing the name and the set of XML attribute specifications of the XML element.

NOTE: See [8].

XML attribute specification: has a name and a value

NOTE: See [8].

DTD: defines structure and content constraints to be respected by an XML document to be valid with regard to this DTD

NOTE: See [8].

XML schema: more powerful than a DTD, an XML schema defines structure and content constraints to be respected by an XML document to conform with this XML schema; through the use of XML namespaces several XML schemas can be used together by a single XML document; an XML schema is itself also an XML document that shall conform with the XML schema for XML schemas

NOTE: See [10] and [11].

XML namespace: enables qualifying element and attribute names used in XML documents by associating them with namespaces identified by different XML schemas

NOTE: See [12], in the scope of the present document.

XML complex type: defined in an XML schema; cannot be directly used in an XML document; can be the concrete type or the derivation base type for an XML element type or for another XML complex type; ultimately defines constraints for an XML element on its XML attribute specifications and/or its XML content

NOTE: See [10] and [11].

XML element type: declared by an XML schema; can be directly used in an XML document; as the concrete type of an XML element, directly or indirectly defines constraints on its XML attribute specifications and/or its XML content; can also be the concrete type or the derivation base type for another XML element type

NOTE: See [10] and [11].

For additional terms and definitions please refer to 3GPP TS 32.101 [1], 3GPP TS 32.102 [2], 3GPP TS 32.600 [3] and 3GPP TS 28.622 [4].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [15] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [15].

CM	Configuration Management
DN	Distinguished Name
DTD	Document Type Definition
JSON	JavaScript Object Notation
MO	Managed Object
MOC	Managed Object Class
SS	Solution Set

4 Solution Set (SS) definitions

This specification defines the following 3GPP Generic NRM IRP Solution Set Definitions:

- 3GPP Generic NRM IRP CORBA SS (Annex A).
- 3GPP Generic NRM IRP XML Definitions (Annex B).
- 3GPP Generic NRM IRP JSON Definitions (Annex C).
- 3GPP Generic NRM IRP YANG Definitions (Annex D).

Annex A (normative): CORBA Solution Set

A.0 General

This annex contains the CORBA Solution Set for the IRP whose semantics is specified in Generic NRM IRP: Information Service (3GPP TS 28.622 [4]).

A.1 Architectural features

The overall architectural feature of Generic Network Resources IRP is specified in 3GPP TS 28.622 [4].
This clause specifies features that are specific to the CORBA SS.

A.1.1 Syntax for Distinguished Names

The syntax of a Distinguished Name is defined in 3GPP TS 32.300 [5].

A.1.2 Rules for NRM extensions

A.1.2.0 Introduction

This clause discusses how the models and IDL definitions provided in the present document can be extended for a particular implementation and still remain compliant with 3GPP SA5's specifications.

A.1.2.1 Allowed extensions

Vendor-specific MOCs may be supported. The vendor-specific MOCs may support new types of attributes.
The 3GPP SA5-specified notifications may be issued referring to the vendor-specific MOCs and vendor-specific attributes. New MOCs shall be distinguishable from 3GPP SA5 MOCs by name. 3GPP SA5-specified and vendor-specific attributes may be used in vendor-specific MOCs. Vendor-specific attribute names shall be distinguishable from existing attribute names.

NRM MOCs may be subclassed. Subclassed MOCs shall maintain the specified behaviour of the 3GPP SA5's superior classes. They may add vendor-specific behaviour with vendor-specific attributes. When subclassing, naming attributes cannot be changed. The subclassed MOC shall support all attributes of its superior class. Vendor-specific attributes cannot be added to 3GPP SA5 NRM MOCs without subclassing.

When subclassing, the 3GPP SA5-specified containment rules and their specified cardinality shall still be followed. As an example, ManagementNode (or its subclasses) shall be contained under SubNetwork (or its subclasses).

Managed Object Instances may be instantiated as CORBA objects. This requires that the MOCs be represented in IDL. 3GPP SA5's NRM MOCs are not currently specified in IDL, but may be specified in IDL for instantiation or subclassing purposes. However, management information models should not require that IRPManagers access the instantiated managed objects other than through supported methods in the present document.

Extension rules related to notifications (Notification categories, Event Types, Extended Event Types etc.) are for further study.

A.1.2.2 Extensions not allowed

The IDL specifications in the present document cannot be edited or altered. Any additional IDL specifications shall be specified in separate IDL files.

IDL interfaces (note: not MOCs) specified in the present document may not be subclassed or extended. New interfaces may be defined with vendor-specific methods.

A.2 Mapping

A.2.1 General mapping

Attributes modelling associations as defined in the NRM (here also called "reference attributes") are in this SS mapped to attributes. The names of the reference attributes in the NRM are mapped to the corresponding attribute names in the MOC. When the cardinality for an association is 0..1 or 1..1 the datatype for the reference attribute is defined as an MOReference. The value of an MO reference contains the distinguished name of the associated MO. When the cardinality for an association allows more than one referred MO, the reference attribute will be of type MOReferenceSet, which contains a sequence of MO references.

A.2.2 Information Object Class (IOC) mapping

This Solution Set supports reference attributes for relations other than containment relations between objects. Reference attributes are therefore introduced in each MOC where needed.

A.2.2.1 IOC SubNetwork

Mapping from NRM IOC SubNetwork attributes to SS equivalent MOC SubNetwork attributes

IS Attributes	SS Attributes	SS Type
id	id	string
dnPrefix	dnPrefix	string
userLabel	userLabel	string
userDefinedNetworkType	userDefinedNetworkType	string
setOfMcc	setOfMcc	GenericNetworkResourcesIRPSystem::AttributeTypes::StringSet

A.2.2.2 IOC ManagedElement

Mapping from NRM IOC ManagedElement attributes and association roles to SS equivalent MOC ManagedElement attributes

IS Attributes	SS Attributes	SS Type
id	id	string
dnPrefix	dnPrefix	string
userLabel	userLabel	string
locationName	locationName	string
vendorName	vendorName	string
userDefinedState	userDefinedState	string
managedElementType	managedElementType	GenericNetworkResourcesIRPSystem::AttributeTypes::StringSet
managedBy	managedBy	GenericNetworkResourcesIRPSystem::AttributeTypes::MOReferenceSet
swVersion	swVersion	string

A.2.2.3 IOC MeContext

Mapping from NRM IOC MeContext attributes to SS equivalent MOC MeContext attributes

IS Attributes	SS Attributes	SS Type
id	id	string
dnPrefix	dnPrefix	string

A.2.2.4 IOC ManagementNode

Mapping from NRM IOC ManagementNode attributes and association roles to SS equivalent MOC ManagementNode attributes

IS Attributes	SS Attributes	SS Type
id	id	string
userLabel	userLabel	string
locationName	locationName	string
vendorName	vendorName	string
userDefinedState	userDefinedState	string
managedElements	managedElements	GenericNetworkResourcesIRPSystem::AttributeTypes::MOReferenceSet
swVersion	swVersion	string

A.2.2.5 IOC VsDataContainer

Mapping from NRM IOC VsDataContainer attributes and association roles to SS equivalent MOC VsDataContainer attributes

IS Attributes	SS Attributes	SS Type
id	id	string
vsDataType	vsDataType	string
vsData	vsData	any
vsDataFormatVersion	vsDataFormatVersion	string

A.2.2.6 IOC ManagedFunction

Mapping from NRM IOC ManagedFunction attributes and association roles to SS equivalent MOC ManagedFunction attributes

IS Attributes	SS Attributes	SS Type
id	id	string
peeParametersList	peeParametersList	GenericNetworkResourcesIRPSystem::AttributeTypes::PEEParametersListType
userLabel	userLabel	string
vnfParametersList	vnfParametersList	GenericNetworkResourcesIRPSystem::AttributeTypes::VNFParametersListType

A.2.2.7 IOC IRPAgent

Mapping from NRM IOC IRPAgent attributes to SS equivalent MOC IRPAgent attributes

IS Attributes	SS Attributes	SS Type
id	id	string
systemDN	systemDN	string

A.2.2.8 IOC Top

Mapping from NRM IOC Top attributes to SS equivalent attributes in all MOCs

IS Attributes	SS Attributes	SS Type
objectClass	CLASS	string
objectInstance	No direct mapping	

A.2.2.9 IOC Link

Mapping from NRM IOC Link attributes to SS equivalent MOC IRPAgent attributes

IS Attributes	SS Attributes	SS Type
id	id	string
userLabel (see note 2)	userLabel	string
aEnd	aEnd	GenericNetworkResourcesIRPSystem::AttributeTypes::MOReference
zEnd	zEnd	GenericNetworkResourcesIRPSystem::AttributeTypes::MOReference
linkType	linkType	LinkTypeType
protocolName	protocolName	string
protocolVersion	protocolVersion	string

NOTE 1: Void.

NOTE 2: Void.

A.2.2.10 IOC EP_RP

Mapping from NRM IOC EP_RP attributes to SS equivalent MOC EP_RP attributes

IS Attributes	SS Attributes	SS Type
id	id	string
userLabel	userLabel	string
farEndEntity	farEndEntity	GenericNetworkResourcesIRPSystem::AttributeTypes::MOReference

A.2.2.11 IOC ThresholdMonitoringCapability

Mapping from NRM IOC ThresholdMonitoringCapability attributes to SS equivalent MOC ThresholdMonitoringCapability attributes

IS Attributes	SS Attributes	SS Type
supportedMonitoringGPs	supportedMonitoringGPs	GenericNetworkResourcesIRPSystem::AttributeTypes::LongSet

A.2.2.12 IOC ThresholdMonitor

Mapping from NRM IOC ThresholdMonitor attributes to SS equivalent MOC ThresholdMonitor attributes

IS Attributes	SS Attributes	SS Type
thresholdInfoList	thresholdInfoList	GenericNetworkResourcesIRPSystem::AttributeTypes::ThresholdInfoListType
monitoringGP	monitoringGP	long
monitoringNotifTarget	monitoringNotifTarget	string
monitoredIOCName	monitoredIOCName	string
monitoredObjectDNs	monitoredObjectDNs	GenericNetworkResourcesIRPSystem::AttributeTypes::DNListType

A.2.2.13 IOC TraceJob

Mapping from NRM IOC TraceJob attributes to SS equivalent MOC TraceJob attributes

IS Attributes	SS Attributes	SS Type
tjJobType	tjJobType	tjJobType-Type
tjListOfInterfaces	tjListOfInterfaces	tjListOfInterfaces-Type
tjListOfNeTypes	tjListOfNeTypes	tjListOfNeTypes-Type
tjPLMNTarget	tjPLMNTarget	tjPLMNTarget-Type
tjStreamingTraceConsumerURI	tjTraceConsumer	StreamingTraceConsumerURI-Type
tjTraceCollectionEntityAddress	tjTraceConsumer	TraceCollectionEntityAddress-Type
tjTraceDepth	tjTraceDepth	tjTraceDepth-Type
tjTraceReference	tjTraceReference	tjTraceReference-Type
tjTraceReportingFormat	tjTraceReportingFormat	tjTraceReportingFormat-Type
tjTraceTarget	tjTraceTarget	tjTraceTarget-Type
tjTriggeringEvent	tjTriggeringEvent	tjTriggeringEvent-Type
tjMDTAnonymizationOfData	tjMDTAnonymizationOfData	tjMDTAnonymizationOfData-Type
tjMDTAreaConfigurationForNeighCell	tjMDTAreaConfigurationForNeighCell	tjMDTAreaConfigurationForNeighCell-Type
tjMDTAreaScope	tjMDTAreaScope	tjMDTAreaScope-Type
tjMDTCollectionPeriodRrmLte	tjMDTCollectionPeriodRrmLte	tjMDTCollectionPeriodRrmLte-Type
tjMDTCollectionPeriodRrmUmts	tjMDTCollectionPeriodRrmUmts	tjMDTCollectionPeriodRrmUmts-Type
tjMDTEventListForTriggeredMeasurement	tjMDTEventListForTriggeredMeasurement	tjMDTEventListForTriggeredMeasurement-Type
tjMDTEventThreshold	tjMDTEventThreshold	tjMDTEventThreshold-Type
tjMDTListOfMeasurements	tjMDTListOfMeasurements	tjMDTListOfMeasurements-Type
tjMDTLoggingDuration	tjMDTLoggingDuration	tjMDTLoggingDuration-Type
tjMDTLoggingInterval	tjMDTLoggingInterval	tjMDTLoggingInterval-Type
tjMDTMBSFNAreaList	tjMDTMBSFNAreaList	tjMDTMBSFNAreaList-Type
tjMDTMeasurementPeriodLTE	tjMDTMeasurementPeriodLTE	tjMDTMeasurementPeriodLTE-Type
tjMDTMeasurementPeriodUMTS	tjMDTMeasurementPeriodUMTS	tjMDTMeasurementPeriodUMTS-Type
tjMDTMeasurementQuantity	tjMDTMeasurementQuantity	tjMDTMeasurementQuantity-Type
tjMDTPLMList	tjMDTPLMList	tjMDTPLMList-Type
tjMDTPositioningMethod	tjMDTPositioningMethod	tjMDTPositioningMethod-Type
tjMDTReportAmount	tjMDTReportAmount	tjMDTReportAmount-Type
tjMDTReportingTrigger	tjMDTReportingTrigger	tjMDTReportingTrigger-Type
tjMDTReportInterval	tjMDTReportInterval	tjMDTReportInterval-Type
tjMDTReportType	tjMDTReportType	tjMDTReportType-Type
tjMDTSensorInformation	tjMDTSensorInformation	tjMDTSensorInformation-Type
tjMDTTraceCollectionEntityID	tjMDTTraceCollectionEntityID	tjMDTTraceCollectionEntityID-Type

A.3 Solution Set definitions

A.3.1 IDL definition structure

Clause A.3.2 defines the types which are used by the Generic NRM IRP.

Clause A.3.3 defines the MO classes for the Generic NRM IRP.

A.3.2 IDL specification "GenericNetworkResourcesIRPSystem.idl"

```
//File: GenericNetworkResourcesIRPSystem.idl
#ifndef _GENERIC_NETWORK_RESOURCES_IRP_SYSTEM_IDL_
#define _GENERIC_NETWORK_RESOURCES_IRP_SYSTEM_IDL_

// This statement must appear after all include statements
#pragma prefix "3gppsa5.org"

module GenericNetworkResourcesIRPSystem
{
   /**
    * The format of Distinguished Name (DN) is specified in "Name Convention
    * for Managed Objects (3GPP TS 32.300 [5])".
    */
   typedef string DN;

   /**
    *  This module adds datatype definitions for types
    *  used in the NRM which are not basic datatypes defined
    *  already in CORBA.
    */
   module AttributeTypes
   {
      /**
       * An MO reference refers to an MO instance.
       * "otherMO" contains the distinguished name of the referred MO.
       * A conceptual "null" reference (meaning no MO is referenced)
       * is represented as an empty string ("").
       *
       */
      struct MOReference
      {
         DN otherMO;
      };

      /**
       * MOReferenceSet represents a set of MO references.
       * This type is used to hold 0..n MO references.
       * A referred MO is not allowed to be repeated (therefore
       * it is denoted as a "Set")
       */
      typedef sequence<MOReference> MOReferenceSet;

      /**
       *  A set of strings.
       */
      typedef sequence<string> StringSet;

      /**
       *  A set of long.
       */
      typedef sequence<long> LongSet;
      /*
       * The LinkListSet represents the Link_X_Y objects (or subclasses of
       * Link_X_Y objects) that have a relationship with this object instance.
       * Each Link_X_Y object models interface(s) between objects of class X and
       * Y. The object containing this attribute must either be a class of type X,
       * Y, XFunction, YFunction or a subclass of one of those classes. The
       * LinkListSet may be empty, or there may be no instances for a particular
       * Link_X_Y class name.
       */
      typedef MOReferenceSet LinkListSet;
```

```
    /**
     * VNFParameters includes several attributes of a VNF instance.
     * The detailed definition of the attributes, see clause 4.4.1 of [4].
     */
    struct VNFParameters
    {
       string vnfInstanceId;
       string vnfdId;
       string flavourId;
       boolean autoScalable;
    };

    /**
     * VNFParametersListType represents a list of VNFParameters.
     * The detailed definition of vnfParametersListType, see clause 4.4.1 of [4].
     */
    typedef sequence<VNFParameters> VNFParametersListType;
    struct PEEParameters
    {
       string siteIdentification;
       float siteLatitude;
       float siteLongitude;
       string siteDescription;
       string equipmentType;
       string environmentType;
       string powerInterface;
    };

    /**
     * PEEParametersListType represents a list of PEEParameters.
     * The detailed definition of PEEParametersListType, see clause 4.4.1 of [4].
     */
    typedef sequence<PEEParameters> PEEParametersListType;

    typedef any ThresholdValueType;
    enum Direction {INCREASING, DECREASING};
    union HysteresisType switch(boolean)
    {
        case TRUE: long long_value;
        case FALSE: float float_value;
    };
    struct ThresholdPackElement
    {
       ThresholdValueType thresholdValue;
       short thresholdLevel;
       HysteresisType hysteresis;
    };
    typedef sequence<ThresholdPackElement> ThresholdPackType;
    struct ThresholdInfo
    {
       string measurementType;
       Direction direction_;
       ThresholdPackType thresholdPack;
    };
    typedef sequence<ThresholdInfo> ThresholdInfoListType;

};


    /**
     *  This module adds datatype definitions for PM Control
     */
    module PMControlTypes
    {
       Struct Measurements
       {
          measurementTypes StringSet,
          gPs LongSet
       };
       typedef sequence <Measurements> Measurements;

    enum PMAdministrativeStateType
    {
       LOCKED,
       SHUTTINGDOWN,
       UNLOCKED
    };
```

```
      enum PMOperationalStateType
      {
         ENABLED,
         DISABLED
      };

      typedef MOReferenceSet ManagedObjectDNsType;

      typedef MOReferenceSet ManagedObjectDNsBasicType;

      typedef integer DefaultFileBasedGPType;
      typedef integer DefaultFileReportPeriodType;
      typedef string DefaultFileLocationType;
      typedef integer DefaultStreamBasedGPType;
      typedef string DefaultStreamTargetType;

      typedef integer FileBasedGPType;
      typedef integer FileReportingPeriodType;
      typedef string FileLocationType;
      typedef integer StreamBasedGPType;
      typedef string StreamTargetType;

      };

};

#endif // _GENERIC_NETWORK_RESOURCES_IRP_SYSTEM_IDL_
```

A.3.3 IDL specification "GenericNetworkResourcesNRMDefs.idl"

```
//File: GenericNetworkResourcesNRMDefs.idl
#ifndef _GENERIC_NETWORK_RESOURCES_NRM_DEFS_IDL_
#define _GENERIC_NETWORK_RESOURCES_NRM_DEFS_IDL_
// This statement must appear after all include statements
#pragma prefix "3gppsa5.org"
/**
 * This module defines constants for each MO class name and
 * the attribute names for each defined MO class.
 */
module GenericNetworkResourcesNRMDefs
{
      /**
       *  Definitions for MO class Top
       */
      interface Top
      {
         // Attribute Names
         //
         const string CLASS = "Top";
      };
      /**
       *  Definitions for MO class SubNetwork
       */
      interface SubNetwork : Top
      {
         const string CLASS = "SubNetwork";
         // Attribute Names
         //
         const string id = "id";
         const string dnPrefix = "dnPrefix";
         const string userLabel = "userLabel";
         const string userDefinedNetworkType = "userDefinedNetworkType";
         const string setOfMcc = "setOfMcc";
      };

      /**
       *  Definitions for MO class ManagedElement
       */
      interface ManagedElement : Top
      {
         const string CLASS = "ManagedElement";
         // Attribute Names
         //
         const string id = "id";
         const string dnPrefix = "dnPrefix";
         const string managedElementType = "managedElementType";
         const string userLabel = "userLabel";
         const string vendorName = "vendorName";
         const string userDefinedState ="userDefinedState";
         const string locationName ="locationName";
         const string managedBy = "managedBy";
         const string swVersion = "swVersion";
      };

      /**
       *  Definitions for MO class MeContext
       */
      interface MeContext : Top
      {
         const string CLASS = "MeContext";
         // Attribute Names
         //
         const string id = "id";
         const string dnPrefix = "dnPrefix";
      };
      /**
       *  Definitions for MO class ManagementNode
       */
      interface ManagementNode : Top
      {
         const string CLASS = "ManagementNode";

         // Attribute Names
         //
         const string id = "id";
```

```
   const string userLabel = "userLabel";
   const string vendorName = "vendorName";
   const string userDefinedState = "userDefinedState";
   const string locationName = "locationName";
   const string managedElements = "managedElements";
   const string swVersion = "swVersion";
};

/**
 *  Definitions for abstract MO class ManagedFunction
 *
 */
interface ManagedFunction : Top
{
   const string CLASS = "ManagedFunction";
   // Attribute Names
   //
   const string id = "id";
   const string peeParametersList = "peeParametersList";
   const string userLabel = "userLabel";
   const string vnfParametersList = "vnfParametersList";
};

/**
 *  Definitions for MO class IRPAgent
 */
interface IRPAgent : Top
{
   const string CLASS = "IRPAgent";
   // Attribute Names
   //
   const string id = "id";
   const string systemDN = "systemDN";
};
/**
 *  Definitions for abstract MO class Link
 *  This inherits from ManagedFunction
 *  The attributes aEnd and zEnd are populated with the DNs
 *  of the entities associated via the link class.
 *  The aEnd takes the DN of the 1st entity in alphabetical order,
 *  the zEnd takes the 2nd entity in alphabetical order of the class
 *  names.
 */
interface Link : ManagedFunction
{
   const string CLASS = "Link";
   // Attribute Names
   //
   const string aEnd = "aEnd";
   const string zEnd = "zEnd";
   const string linkType = "linkType";
   const string protocolName = "protocolName";
   const string protocolVersion = "protocolVersion";
};
/**
 *  Definitions for MO class VsDataContainer
 */
interface VsDataContainer : Top
{
   const string CLASS = "VsDataContainer";
   // Attribute Names
   //
   const string id = "id";
   const string vsDataType = "vsDataType";
   const string vsData = "vsData";
   const string vsDataFormatVersion = "vsDataFormatVersion";
};
/**
 *  Definitions for abstract MO class EP_RP
 */
interface EP_RP : Top
{
   const string CLASS = "EP_RP";
   // Attribute Names
   //
   const string farEndEntity = "farEndEntity";
   const string id = "id";
   const string userLabel = "userLabel";
```

```
      };

      /**
       *  Definitions for MO class ThresholdMonitoringCapability
       */
      interface ThresholdMonitoringCapability : Top
      {
         const string CLASS = "ThresholdMonitoringCapability";
         // Attribute Names
         //
         const string supportedMonitoringGPs = "supportedMonitoringGPs";
      };

      /**
       *  Definitions for MO class ThresholdMonitor
       */
      interface ThresholdMonitor : Top
      {
         const string CLASS = "ThresholdMonitor";
         // Attribute Names
         //
         const string thresholdInfoList = "thresholdInfoList";
         const string monitoringGP = "monitoringGP";
         const string monitoringNotifTarget = "monitoringNotifTarget";
         const string monitoredIOCName = "monitoredIOCName";
         const string monitoredObjectDNs = "monitoredObjectDNs";
      };

      /**
       *  This module adds datatypes definitions for the Link Class
       *  These attributes are not the basic datatypes already defined
       */
      module LinkAttributeTypes
      {
         enum LinkType
         {
            SIGNALLING,
            BEARER,
            OAM_AND_P,
            OTHER
         };
         typedef sequence <LinkType> LinkTypeType;
      };
};
#endif // _GENERIC_NETWORK_RESOURCES_NRM_DEFS_IDL_
```

Annex B (normative): XML Definitions

B.0 General

This annex contains the XML Definitions for the Generic NRM IRP as it applies to Itf-N, in accordance with Generic NRM IRP IS definitions [4].

The XML file formats are based on XML [8], XML Schema [10] [11] and XML Namespace [12] standards.

B.1 Architectural features

B.1.0 Introduction

The overall architectural feature of Generic Network Resources IRP is specified in 3GPP TS 28.622 [4].

This clause specifies features that are specific to the Schema definitions.

B.1.1 Syntax for Distinguished Names

The syntax of a Distinguished Name is defined in 3GPP TS 32.300 [5].

B.2 Mapping

B.2.1 General mapping

An IOC maps to an XML element of the same name as the IOC's name in the IS. An IOC attribute maps to a sub-element of the corresponding IOC's XML element, and the name of this sub-element is the same as the attribute's name in the IS.

B.2.2 Information Object Class (IOC) mapping

The mapping is not present in the current version of this specification.

B.3 Solution Set definitions

B.3.1 XML definition structure

The overall description of the file format of configuration data XML files is provided by 3GPP TS 28.616 [7].

Annex B.3.3 of the present document defines the NRM-specific XML schema `genericNrm.xsd` for the Generic Network Resources IRP NRM defined in 3GPP TS 28.622 [4].

XML schema `genericNrm.xsd` explicitly declares NRM-specific XML element types for the related NRM.

The definition of those NRM-specific XML element types complies with the generic mapping rules defined in 3GPP TS 28.616 [7], with the following exception: as defined in 3GPP TS 28.616 [7], the `vsData` XML element type has an empty XML content.

Additionally, XML schema `genericNrm.xsd` also provides the following global XML declarations and definitions:

- XML complex type `NrmClass`: derivation base type (see [8], [10] and [11]) for all NRM class associated XML element types (see 3GPP TS 28.616 [7]);
- XML element type `vsData`: derivation base type (see [8], [10] and [11]) for all vendor-specific XML element types (see 3GPP TS 28.616 [7]);
- XML element type `SubNetworkOptionallyContainedNrmClass`: substitution group head (see [8], [10] and [11]) for all XML element types associated to further NRM classes optionally contained under `SubNetwork` NRM class;
- XML element type `ManagedElementOptionallyContainedNrmClass`: substitution group head (see [8], [10] and [11]) for all XML element types associated to further NRM classes optionally contained under `ManagedElement` NRM class.

B.3.2 Graphical Representation

The graphical representation is not present in the current version of this specification.

B.3.3 XML schema "genericNrm.xsd"

```
<?xml version="1.1" encoding="UTF-8"?>

<!--
  3GPP TS 28.623 Generic Network Resources IRP
  Bulk CM Configuration data file NRM-specific XML schema
  genericNrm.xsd
-->

<schema
  targetNamespace="http://www.3gpp.org/ftp/specs/archive/28_series/28.623#genericNrm"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified"
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:xn="http://www.3gpp.org/ftp/specs/archive/28_series/28.623#genericNrm"
  xmlns:sp="http://www.3gpp.org/ftp/specs/archive/28_series/28.629#sonPolicyNrm"
>
<import namespace="http://www.3gpp.org/ftp/specs/archive/28_series/28.629#sonPolicyNrm"/>
  <!-- Base XML type for all NRM class associated XML elements -->

  <complexType name="NrmClass">
    <attribute name="id" type="string" use="required"/>
    <attribute name="modifier" use="optional">
      <simpleType>
        <restriction base="string">
          <enumeration value="create"/>
          <enumeration value="delete"/>
          <enumeration value="update"/>
        </restriction>
      </simpleType>
    </attribute>
  </complexType>

  <!-- Generic Network Resources IRP NRM attribute related XML types -->

  <simpleType name="dn">
    <restriction base="string">
      <maxLength value="400"/>
    </restriction>
  </simpleType>

  <complexType name="dnList">
    <sequence minOccurs="0" maxOccurs="unbounded">
      <element name="dn" type="xn:dn"/>
    </sequence>
  </complexType>

  <simpleType name="linkType">
    <list>
      <simpleType>
        <restriction base="string">
          <enumeration value="Signalling"/>
          <enumeration value="Bearer"/>
          <enumeration value="OAM_AND_P"/>
          <enumeration value="Other"/>
        </restriction>
      </simpleType>
    </list>
  </simpleType>

  <complexType name="linkListType">
    <sequence minOccurs="0" maxOccurs="unbounded">
      <element name="dn" type="xn:dn"/>
    </sequence>
  </complexType>

   <complexType name="managedElementTypeListType">
    <sequence minOccurs="0" maxOccurs="unbounded">
      <element name="managedElementType" type="string"/>
    </sequence>
  </complexType>

  <complexType name="vnfParametersListType">
    <sequence minOccurs="1" maxOccurs="unbounded">
      <element name="vnfInstanceId" type="string"/>
      <element name="vnfdId" type="string" minOccurs="0"/>
```

```
    <element name="flavourId" type="string" minOccurs="0"/>
    <element name="autoScalable" type="boolean"/>
  </sequence>
</complexType>

<simpleType name="latitude">
  <restriction base="decimal">
    <fractionDigits value="4"/>
    <minInclusive value="-90.0000"/>
    <maxInclusive value="90.0000"/>
  </restriction>
</simpleType>

<simpleType name="longitude">
  <restriction base="decimal">
    <fractionDigits value="4"/>
    <minInclusive value="-180.0000"/>
    <maxInclusive value="180.0000"/>
  </restriction>
</simpleType>


<complexType name="peeParametersListType">
  <sequence minOccurs="1" maxOccurs="unbounded">
    <element name="siteIdentification" type="string"/>
    <element name="siteLatitude" type="xn:latitude" minOccurs="0"/>
    <element name="siteLongitude" type="xn:longitude" minOccurs="0"/>
    <element name="siteDescription" type="string"/>
    <element name="equipmentType" type="string"/>
    <element name="environmentType" type="string"/>
    <element name="powerInterface" type="string"/>
  </sequence>
</complexType>

<simpleType name="pMAdministrativeStateType">
  <restriction base="string">
    <enumeration value="LOCKED"/>
    <enumeration value="SHUTTINGDOWN"/>
    <enumeration value="UNLOCKED"/>
  </restriction>
</simpleType>

<simpleType name="pMOperationalStateType">
  <restriction base="string">
    <enumeration value="ENABLED"/>
    <enumeration value="DISABLED"/>
  </restriction>
</simpleType>

<simpleType name="nFServiceType">
  <restriction base="string">
    <enumeration value="Namf_Communication"/>
    <enumeration value="Namf_EventExposure"/>
    <enumeration value="Namf_MT"/>
    <enumeration value="Namf_Location"/>
    <enumeration value="Nsmf_PDUSession"/>
    <enumeration value="Nsmf_EventExposure"/>
    <enumeration value="others"/>
  </restriction>
</simpleType>

<simpleType name="usageStateType">
  <restriction base="string">
    <enumeration value="IDEL"/>
    <enumeration value="ACTIVE"/>
    <enumeration value="BUSY"/>
  </restriction>
</simpleType>

<simpleType name="registrationStateType">
  <restriction base="string">
    <enumeration value="LOCKED"/>
    <enumeration value="SHUTTING_DOWN"/>
    <enumeration value="UNLOCKED"/>
  </restriction>
</simpleType>

  <simpleType name="NFType">
```

```
    <restriction base="string">
      <enumeration value="NRF"/>
      <enumeration value="UDM"/>
      <enumeration value="AMF"/>
      <enumeration value="SMF"/>
      <enumeration value="AUSF"/>
      <enumeration value="NEF"/>
      <enumeration value="PCF"/>
      <enumeration value="SMSF"/>
      <enumeration value="NSSF"/>
      <enumeration value="UDR"/>
      <enumeration value="GMLC"/>
      <enumeration value="5G EIR"/>
      <enumeration value="SEPP"/>
      <enumeration value="UPF"/>
      <enumeration value="N3IWF"/>
      <enumeration value="AF"/>
      <enumeration value="UDSF"/>
      <enumeration value="DN"/>
    </restriction>
  </simpleType>

  <simpleType name="operationSemanticsType">
    <restriction base="string">
      <enumeration value="REQUEST_RESPONSE"/>
      <enumeration value="SUBSCRIBE_NOTIFY"/>
    </restriction>
  </simpleType>

  <complexType name="SAP">
    <sequence>
      <element name="host" type="xn:hostType"/>
      <element name="port" type="integer"/>
    </sequence>
  </complexType>

  <complexType name="hostType">
    <sequence>
    <element name="ipv4Address" type="string"/>
    <element name="ipv6Address" type="string"/>
    <element name="fqdn" type="string"/>
    </sequence>
  </complexType>

  <complexType name="operationsList">
    <sequence>
      <element name="operation" type="xn:operationType" minOccurs="1" maxOccurs="unbounded"/>
    </sequence>
  </complexType>

  <complexType name="operationType">
    <sequence>
      <element name="name" type="string"/>
      <element name="allowedNFTypes" type="xn:NFType"/>
      <element name="operationSemantics" type="xn:operationSemanticsType"/>
    </sequence>
  </complexType>

  <complexType name="MeasurementTypeList">
    <sequence minOccurs="1" maxOccurs="unbounded">
      <element name="measurementType" type="string"/>
    </sequence>
  </complexType>

  <complexType name="GPList">
    <sequence minOccurs="1" maxOccurs="unbounded">
      <element name="gP" type="integer"/>
    </sequence>
  </complexType>

  <complexType name="Measurements">
    <sequence>
      <element name="measurementTypes" type="xn:MeasurementTypeList"/>
      <element name="GPs" type="xn:GPList"/>
    </sequence>
  </complexType>

  <complexType name="MeasurementsList">
```

```
    <sequence>
      <element name="measurements" type="xn:Measurements" minOccurs="1" maxOccurs="unbounded"/>
    </sequence>
  </complexType>


  <complexType name="GPListType">
    <sequence minOccurs="1" maxOccurs="unbounded">
      <element name="GP" type="integer"/>
    </sequence>
  </complexType>

  <complexType name="KPINameList">
    <sequence minOccurs="1" maxOccurs="unbounded">
      <element name="kPIName" type="string"/>
    </sequence>
  </complexType>

  <complexType name="KPIs">
    <sequence>
      <element name="kPITypes" type="xn:KPINameList"/>
      <element name="GPs" type="xn:GPList"/>
    </sequence>
  </complexType>

  <complexType name="KPIsList">
    <sequence>
      <element name="kPIs" type="xn:KPIs" minOccurs="1" maxOccurs="unbounded"/>
    </sequence>
  </complexType>


  <simpleType name="directionType">
    <list>
      <simpleType>
        <restriction base="string">
          <enumeration value="increasing"/>
          <enumeration value="decreasing"/>
        </restriction>
      </simpleType>
    </list>
  </simpleType>

  <complexType name="thrsholdPackType">
    <sequence minOccurs="1" maxOccurs="unbounded">
      <element name="thresholdPackElement" type="xn:thresholdPackElementType"/>
    </sequence>
  </complexType>

  <complexType name="thresholdPackElementType">
    <all>
      <element name="thresholdValue" type="string"/>
      <element name="thresholdLevel" type="integer"/>
      <element name="hysteresis" type="decimal" minOccurs="0"/>
    </all>
  </complexType>

  <complexType name="thresholdInfoType">
    <all>
      <element name="measurementType" type="string"/>
      <element name="direction" type=" xn:directionType"/>
      <element name="thresholdPack" type=" xn:thrsholdPackType"/>
    </all>
  </complexType>

  <complexType name="thresholdInfoListType">
    <sequence minOccurs="1" maxOccurs="unbounded">
      <element name="ThresholdInfoElement" type="xn:thresholdInfoType"/>
    </sequence>
  </complexType>

  <simpleType name="ScopeType">
    <restriction base="string">
      <enumeration value="BASE_ONLY"/>
      <enumeration value="BASE_ALL"/>
      <enumeration value="BASE_NTH_LEVEL"/>
      <enumeration value="BASE_SUBTREE"/>
    </restriction>
```

```
  </simpleType>

  <complexType name="Scope">
    <sequence>
      <element name="scopeType" type="xn:ScopeType"/>
      <element name="scopeLevel" type="integer" minOccurs="0"/>
    </sequence>
  </complexType>


 <!-- Generic Network Resources IRP NRM class associated XML elements -->

  <element name="SubNetwork">
    <complexType>
      <complexContent>
        <extension base="xn:NrmClass">
          <sequence>
            <element name="attributes" minOccurs="0">
              <complexType>
                <all>
                  <element name="dnPrefix" minOccurs="0"/>
                  <element name="userLabel"/>
                  <element name="userDefinedNetworkType"/>
                  <element name="setOfMcc" minOccurs="0"/>
                  <element name="priority" type="integer" minOccurs="0"/>
                  <element name="measurementsList" type="xn:MeasurementsList" minOccurs="0"/>
                  <element name="kPIsList" type="xn:KPIsList" minOccurs="0"/>
                </all>
              </complexType>
            </element>
            <choice minOccurs="0" maxOccurs="unbounded">
              <element ref="xn:SubNetwork"/>
              <element ref="xn:ManagedElement"/>
              <element ref="xn:MeContext"/>
              <element ref="xn:ManagementNode"/>
              <element ref="xn:IRPAgent"/>
              <element ref="xn:SubNetworkOptionallyContainedNrmClass"/>
              <element ref="xn:VsDataContainer"/>
              <element ref="xn:ThresholdMonitoringCapability"/>
              <element ref="xn:ThresholdMonitor"/>
              <element ref="xn:MeasurementControl"/>
              <element ref="xn:NtfSubscriptionControl"/>
            </choice>
            <choice minOccurs="0" maxOccurs="1">
              <element ref="sp:ESPolicies"/>
            </choice>
          </sequence>
        </extension>
      </complexContent>
    </complexType>
  </element>

  <element name="ManagedElement">
    <complexType>
      <complexContent>
        <extension base="xn:NrmClass">
          <sequence>
            <element name="attributes" minOccurs="0">
              <complexType>
                <all>
                  <element name="dnPrefix"/>
                  <element name="managedElementTypeList" type="xn:managedElementTypeListType"
minOccurs="0"/>
                  <element name="userLabel"/>
                  <element name="vendorName"/>
                  <element name="userDefinedState"/>
                  <element name="locationName"/>
                  <element name="swVersion"/>
                  <element name="managedBy" type="xn:dnList" minOccurs="0"/>
                  <element name="priority" type="integer" minOccurs="0"/>
                  <element name="measurementsList" type="xn:MeasurementsList" minOccurs="0"/>
                </all>
              </complexType>
            </element>
            <choice minOccurs="0" maxOccurs="unbounded">
              <element ref="xn:IRPAgent"/>
              <element ref="xn:ManagedElementOptionallyContainedNrmClass"/>
              <element ref="xn:VsDataContainer"/>
```

```
            <element ref="xn:ThresholdMonitoringCapability"/>
            <element ref="xn:ThresholdMonitor"/>
            <element ref="xn:MeasurementControl"/>
            <element ref="xn:NtfSubscriptionControl"/>
          </choice>

        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="ManagedFunction">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="userLabel" type="string"/>
                <element name="vnfParametersList" type="xn:vnfParametersListType"/>
                <element name="peeParametersList" type="xn:peeParametersListType"/>
                <element name="priority" type="integer" minOccurs="0"/>
                <element name="measurementsList" type="xn:MeasurementsList" minOccurs="0"/>
              </all>
            </complexType>
          </element>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="xn:VsDataContainer"/>
            <element ref="xn:EP_RP"/>
            <element ref="xn:ThresholdMonitoringCapability"/>
            <element ref="xn:ThresholdMonitor"/>
            <element ref="xn:MeasurementControl"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="ManagedNFService">
    <complexType>
      <complexContent>
        <extension base="xn:NrmClass">
          <sequence>
            <element name="attributes" minOccurs="0">
              <complexType>
                <all>
                  <element name="userLabel" type="string"/>
                  <element name="nFServiceType" type="xn:nFServiceType"/>
                  <element name="AdministrativeState" type="xn:pMAdministrativeStateType"/>
                  <element name="OperationalState" type="xn:pMOperationalStateType"/>
                  <element name="usageState" type="xn:usageStateType"/>
                  <element name="registrationState" type="xn:registrationStateType"/>
                  <element name="sAP" type="xn:SAP" minOccurs="0"/>
                   <element name="operations" type="xn:operationsList" minOccurs="0"/>
                </all>
              </complexType>
            </element>
            <choice minOccurs="0" maxOccurs="unbounded">
              <element ref="xn:VsDataContainer"/>
              <element ref="xn:ThresholdMonitoringCapability"/>
              <element ref="xn:ThresholdMonitor"/>
            </choice>
          </sequence>
        </extension>
      </complexContent>
    </complexType>
  </element>

  <element name="MeContext">
    <complexType>
      <complexContent>
        <extension base="xn:NrmClass">
          <sequence>
            <element name="attributes" minOccurs="0">
              <complexType>
```

```
              <all>
               <element name="dnPrefix" minOccurs="0"/>
              </all>
            </complexType>
          </element>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="xn:ManagedElement"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="ManagementNode">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="userLabel"/>
                <element name="vendorName"/>
                <element name="locationName"/>
                <element name="managedElements" type="xn:dnList" minOccurs="0"/>
                <element name="swVersion"/>
                <element name="userDefinedState"/>
              </all>
            </complexType>
          </element>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="xn:IRPAgent"/>
            <element ref="xn:VsDataContainer"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="MeasurementControl">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="pMAdministrativeState" type="xn:pMAdministrativeStateType"/>
                <element name="pMOperationalState" type="xn:pMOperationalStateType"/>
                <element name="defaultFileBasedGP" type="integer"/>
                <element name="defaultFileReportingPeriod" type="integer"/>
                <element name="defaultFileLocation" type="string"/>
                <element name="defaultStreamBasedGP" type="integer"/>
                <element name="defaultStreamTarget" type="string"/>
              </all>
            </complexType>
          </element>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="xn:MeasurementReader"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="MeasurementReader">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="measurementTypes"/>
                <element name="fileBasedGP" type="integer" minOccurs="0"/>
```

```
                <element name="fileReportingPeriod" type="integer" minOccurs="0"/>
                <element name="fileLocation" type="string" minOccurs="0"/>
                <element name="streamBasedGP" type="integer" minOccurs="0"/>
                <element name="streamTarget" type="string" minOccurs="0"/>
                <element name="managedObjectDNsBasic" type="xn:dnList" minOccurs="0"/>
                <element name="managedObjectDNs" type="xn:dnList" minOccurs="0"/>
              </all>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="IRPAgent">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element ref="xn:systemDN" minOccurs="0"/>
              </all>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="EP_RP">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="farEndEntity" type="xn:dn" minOccurs="0"/>
                <element name="userLabel" type="string" minOccurs="0"/>
                  <element name="measurementsList" type="xn:MeasurementsList" minOccurs="0"/>
              </all>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="VsDataContainer">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="vsDataType"/>
                <element name="vsDataFormatVersion"/>
                <element ref="xn:vsData"/>
              </all>
            </complexType>
          </element>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="xn:VsDataContainer"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="ThresholdMonitoringCapability">
  <complexType>
```

```
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
               <element name="supportedMonitoringGPs" type="xn:GPListType"/>
              </all>
            </complexType>
          </element>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="xn:ThresholdMonitoringCapabilityOptionallyContainedNrmClass"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="HeartbeatControl">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="heartbeatNtfPeriod" type="integer"/>
                <element name="triggerHeartbeatNtf" type="boolean"/>
              </all>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="ThresholdMonitor">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
               <element name="thresholdInfoList" type="xn:thresholdInfoListType"/>
               <element name="monitoringGP" type="integer"/>
               <element name="monitoringNotifTarget" type="string"/>
               <element name="monitoredIOCName" type="string"/>
               <element name="monitoredObjectDNs" type="xn:dnList"/>
              </all>
            </complexType>
          </element>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="xn:ThresholdMonitorOptionallyContainedNrmClass"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

<element name="NtfSubscriptionControl">
  <complexType>
    <complexContent>
      <extension base="xn:NrmClass">
        <sequence>
          <element name="attributes" minOccurs="0">
            <complexType>
              <all>
                <element name="notificationRecipientAddress" type="string"/>
                <element name="notificationTypes" type="string" minOccurs="0" />
                <element name="scope" type="xn:Scope"/>
                <element name="notificationFilter" type="string" minOccurs="0" />
              </all>
            </complexType>
          </element>
```

```
            <choice minOccurs="0" maxOccurs="1">
              <element ref="xn:HeartbeatControl"/>
            </choice>
          </sequence>
        </extension>
      </complexContent>
    </complexType>
  </element>

  <!--
    IRPAgent IOC attributes
  -->

  <element name="systemDN" type="xn:dn"/>

  <!--
    VsDataContainer NRM class vsData attribute associated empty XML element
  -->

  <complexType name="vsData"/>
  <element name="vsData" type="xn:vsData"/>

  <!--
    Abstract head XML element for all XML elements associated to further
    NRM classes optionally contained under SubNetwork NRM class
  -->

  <element
    name="SubNetworkOptionallyContainedNrmClass"
    type="xn:NrmClass"
    abstract="true"
  />

  <!--
    Abstract head XML element for all XML elements associated to further
    NRM classes optionally contained under ManagedElement NRM class
  -->

  <element
    name="ManagedElementOptionallyContainedNrmClass"
    type="xn:NrmClass"
    abstract="true"
  />

  <!--
    Abstract head XML element for all XML elements associated to further
    NRM classes optionally contained under ThresholdMonitoringCapability NRM class
  -->

  <element
    name="ThresholdMonitoringCapabilityOptionallyContainedNrmClass"
    type="xn:NrmClass"
    abstract="true"
  />

  <!--
    Abstract head XML element for all XML elements associated to further
    NRM classes optionally contained under ThresholdMonitor NRM class
  -->

  <element
    name="ThresholdMonitorOptionallyContainedNrmClass"
    type="xn:NrmClass"
    abstract="true"
  />


</schema>
```

Annex C (normative): OpenAPI definitions

C.1 General

This annex contains the OpenAPI definition of the Generic NRM in YAML format.

The Information Service (IS) of the Generic NRM is defined in 3GPP TS 28.622 [4].

Mapping rules to produce the OpenAPI definition based on the IS are defined in 3GPP TS 32.160 [14].

C.2 Void

C.3 Void

C.4 Solution Set (SS) definitions

C.4.1 Void

C.4.2 Void

C.4.2a OpenAPI document "comDefs.yaml"

```
openapi: 3.0.1
info:
  title: Common Type Definitions
  version: 16.3.0
  description: >-
    OAS 3.0.1 specification of common type definitions in the Generic NRM
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 28.623 V16.3.0; Generic NRM, Common Type Definitions
  url: http://www.3gpp.org/ftp/Specs/archive/28_series/28.623/
paths: {}
components:
  schemas:

    Long:
      type: string
      format: long
    Float:
      type: string
      format: float
    DateTime:
      type: string
      format: date-Time

    Dn:
      type: string
    Uri:
      type: string

    AttributeNameValuePairSet:
      type: object
      minProperties: 1
    AttributeValueChangeSet:
      description: >-
```

```
        The key in this map is the attribute name. The value of each key is an array.
        When only one item is present in the array, it carries the new attribute
        value. If two items are present, then the first item carries the old value
        and the second item the new value. The items can be of any type including null.
      type: object
      additionalProperties:
        type: array
        minItems: 1
        maxItems: 2
        items:
          nullable: true

    Filter:
      type: string
    SystemDN:
      type: string

    NotificationId:
      type: integer
    NotificationHeader:
      description: >-
        Header used for all notifications types
      type: object
      required:
        - uri
        - notificationId
        - notificationType
        - eventTime
        - systemDn
      properties:
        uri:
          $ref: '#/components/schemas/Uri'
        notificationId:
          $ref: '#/components/schemas/NotificationId'
        notificationType:
          oneOf:
            - $ref: 'faultMnS.yaml#/components/schemas/AlarmNotificationTypes'
            #- $ref: 'provMnS.yaml#/components/schemas/CmNotificationTypes'
            # more to be added
        eventTime:
          $ref: '#/components/schemas/DateTime'
        systemDN:
          $ref: '#/components/schemas/SystemDN'

    ErrorResponse:
      description: >-
        Default schema for the response message body in case the request
        is not successful.
      type: object
      properties:
        error:
          type: object
          properties:
            errorInfo:
              type: string
```

C.4.3 OpenAPI document "genericNrm.yaml"

```
openapi: 3.0.1
info:
  title: Generic NRM
  version: 16.4.0
  description: >-
    OAS 3.0.1 specification of the Generic NRM
    © 2020, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 28.623 V16.4.0; Generic NRM
  url: http://www.3gpp.org/ftp/Specs/archive/28_series/28.623/
paths: {}
components:
  schemas:

#-------- Definition of types---------------------------------------------------

    DateTime:
      type: string
```

```
    format: date-time
  Dn:
    type: string
    maxLength: 400
  DnList:
    type: array
    items:
      $ref: '#/components/schemas/Dn'
  Mcc:
    type: string
    pattern: '^[0-9]{3}$'
  Mnc:
    type: string
    pattern: '^[0-9]{2,3}$'
  AdministrativeState:
    type: string
    enum:
      - LOCKED
      - UNLOCKED
  OperationalState:
    type: string
    enum:
      - ENABLED
      - DISABLED
  UsageState:
    type: string
    enum:
      - IDEL
      - ACTIVE
      - BUSY
  RegistrationState:
    type: string
    enum:
      - REGISTERED
      - DEREGISTERED
  SetOfMcc:
    type: array
    items:
      $ref: '#/components/schemas/Mcc'
  ManagedElementType:
    type: string
  ManagedElementTypeList:
    type: array
    items:
      $ref: '#/components/schemas/ManagedElementType'
  VnfParameter:
    type: object
    properties:
      vnfInstanceId:
        type: string
      vnfdId:
        type: string
      flavourId:
        type: string
      autoScalable:
        type: boolean
  VnfParametersList:
    type: array
    items:
      $ref: '#/components/schemas/VnfParameter'
  SiteLatitude:
    type: number
    format: float
    minimum: -90
    maximum: 90
  SiteLongitude:
    type: number
    format: float
    minimum: -180
    maximum: 180
  PeeParameter:
    type: object
    properties:
      siteIdentification:
        type: string
      siteDescription:
        type: string
      siteLatitude:
```

```
        $ref: '#/components/schemas/SiteLatitude'
      siteLongitude:
        $ref: '#/components/schemas/SiteLongitude'
      equipmentType:
        type: string
      environmentType:
        type: string
      powerInterface:
        type: string
PeeParametersList:
  type: array
  items:
    $ref: '#/components/schemas/PeeParameter'
MonitoringGPList:
  type: array
  items:
    type: integer
ThresholdInfoList:
  type: array
  items:
    $ref: '#/components/schemas/ThresholdInfo'
ThresholdInfo:
  type: object
  properties:
    measurementType:
      type: string
    direction:
      $ref: '#/components/schemas/Direction'
    thresholdPack:
      $ref: '#/components/schemas/ThresholdPack'
Direction:
  enum:
    - Increasing
    - Decreasing
ThresholdPack:
  type: array
  items:
    $ref: '#/components/schemas/ThresholdPackElement'
ThresholdPackElement:
  type: object
  properties:
    thresholdLevel:
      type: integer
    thresholdValue:
      type: number
    hysteresis:
      type: number
Operation:
  type: object
  properties:
    name:
      type: string
    allowedNFTypes:
      $ref: '#/components/schemas/NFType'
    operationSemantics:
      $ref: '#/components/schemas/OperationSemantics'
OperationList:
  type: array
  items:
    $ref: '#/components/schemas/Operation'
NFType:
  type: string
  description: ' NF name defined in TS 23.501'
  enum:
    - NRF
    - UDM
    - AMF
    - SMF
    - AUSF
    - NEF
    - PCF
    - SMSF
    - NSSF
    - UDR
    - LMF
    - GMLC
    - 5G_EIR
    - SEPP
```

```
        - UPF
        - N3IWF
        - AF
        - UDSF
        - DN
    Fqdn:
      type: string
    OperationSemantics:
      type: string
      enum:
        - REQUEST_RESPONSE
        - SUBSCRIBE_NOTIFY
    SAP:
      type: object
      properties:
        host:
          $ref: '#/components/schemas/HostAddr'
        port:
          type: integer
    NFServiceType:
      type: string
      enum:
        - Namf_Communication
        - Namf_EventExposure
        - Namf_MT
        - Namf_Location
        - Nsmf_PDUSession
        - Nsmf_EventExposure
        - Others
    HostAddr:
      oneOf:
        - $ref: '#/components/schemas/Ipv4Addr'
        - $ref: '#/components/schemas/Ipv6Addr'
        - $ref: '#/components/schemas/Fqdn'
    Ipv4Addr:
      type: string
      pattern: '^(([0-9]|[1-9][0-9]|1[0-9][0-9]|2[0-4][0-9]|25[0-5])\.){3}([0-9]|[1-9][0-9]|1[0-
9][0-9]|2[0-4][0-9]|25[0-5])$'
      example: '198.51.100.1'
    Ipv4AddrRm:
      type: string
      pattern: '^(([0-9]|[1-9][0-9]|1[0-9][0-9]|2[0-4][0-9]|25[0-5])\.){3}([0-9]|[1-9][0-9]|1[0-
9][0-9]|2[0-4][0-9]|25[0-5])$'
      example: '198.51.100.1'
      nullable: true
    Ipv6Addr:
      type: string
      allOf:
        - pattern: '^((:|(0?|([1-9a-f][0-9a-f]{0,3})):)((0?|([1-9a-f][0-9a-
f]{0,3})):){0,6}(:|(0?|([1-9a-f][0-9a-f]{0,3})))$'
        - pattern: '^((([^:]+:){7}([^:]+))|((([^:]+:)*[^:]+)?::(([^:]+:)*[^:]+)?))$'
      example: '2001:db8:85a3::8a2e:370:7334'
    Ipv6AddrRm:
      type: string
      allOf:
        - pattern: '^((:|(0?|([1-9a-f][0-9a-f]{0,3})):)((0?|([1-9a-f][0-9a-
f]{0,3})):){0,6}(:|(0?|([1-9a-f][0-9a-f]{0,3})))$'
        - pattern: '^((([^:]+:){7}([^:]+))|((([^:]+:)*[^:]+)?::(([^:]+:)*[^:]+)?))$'
      example: '2001:db8:85a3::8a2e:370:7334'
      nullable: true
    Ipv6Prefix:
      type: string
      allOf:
        - pattern: '^((:|(0?|([1-9a-f][0-9a-f]{0,3})):)((0?|([1-9a-f][0-9a-
f]{0,3})):){0,6}(:|(0?|([1-9a-f][0-9a-f]{0,3})))(\/(([0-9])|([0-9]{2})|(1[0-1][0-9])|(12[0-8])))$'
        - pattern: '^((([^:]+:){7}([^:]+))|((([^:]+:)*[^:]+)?::(([^:]+:)*[^:]+)?))(\/.+)$'
      example: '2001:db8:abcd:12::0/64'
    Uri:
      type: string
    TransportProtocol:
      anyOf:
        - type: string
          enum:
            - TCP
        - type: string
    SupportedPerfMetricGroup:
      type: object
      properties:
```

```
        performanceMetrics:
          type: array
          items:
            type: string
        granularityPeriods:
          type: array
          items:
            type: integer
            minimum: 1
        reportingMethods:
          type: array
          items:
            type: string
            enum:
             - FILE_BASED_LOC_SET_BY_PRODUCER
             - FILE_BASED_LOC_SET_BY_CONSUMER
             - STREAM_BASED
    ReportingCtrl:
      oneOf:
        - type: object
          properties:
            fileReportingPeriod:
              type: integer
        - type: object
          properties:
            fileReportingPeriod:
              type: integer
            fileLocation:
              $ref: '#/components/schemas/Uri'
        - type: object
          properties:
            streamTarget:
              $ref: '#/components/schemas/Uri'
    Scope:
      type: object
      properties:
        scopeType:
          type: string
          enum:
            - BASE_ONLY
            - BASE_ALL
            - BASE_NTH_LEVEL
            - BASE_SUBTREE
        scopeLevel:
          type: integer
    NotificationType:
      type: string
      enum:
        - notifyMOICreation
        - notifyMOIDeletion
        - notifyMOIAttributeValueChanges
        - notifyEvent
        - notifyNewAlarm
        - notifyChangedAlarm
        - notifyAckStateChanged
        - notifyComments
        - notifyCorrelatedNotificationChanged
        - notifyChangedAlarmGeneral
        - notifyAlarmListRebuilt
        - notifyPotentialFaultyAlarmList
        - notifyFileReady
        - notifyFilePreparationError
        - notifyThresholdCrossing
    NotificationTypes:
      type: array
      items:
        $ref: '#/components/schemas/NotificationType'

#-------- Definition of types used in Trace control NRM fragment------------------

    tjJobType-Type:
      type: string
      description: Specifies whether the TraceJob represents only MDT, Logged MBSFN MDT, Trace or a
combined Trace and MDT job. Applicable for Trace, MDT, RCEF and RLF reporting. See 3GPP TS 32.422
clause 5.9a for additional details.
      enum:
        - IMMEDIATE_MDT_ONLY
        - LOGGED_MDT_ONLY
```

```
        - TRACE_ONLY
        - IMMEDIATE_MDT AND TRACE
        - RLF_REPORT_ONLY
        - RCEF_REPORT_ONLY
        - LOGGED_MBSFN_MDT

    tjListOfInterfaces-Type:
      description: The interfaces to be recorded in the Network Element. See 3GPP TS 32.422 clause
5.5 for additional details.
      type: object
      properties:
        MSCServerInterfaces:
          type: array
          items:
            type: string
            enum:
              - A
              - Iu-CS
              - Mc
              - MAP-G
              - MAP-B
              - MAP-E
              - MAP-F
              - MAP-D
              - MAP-C
              - CAP
        MGWInterfaces:
          type: array
          items:
            type: string
            enum:
              - Mc
              - Nb-UP
              - Iu-UP
        RNCInterfaces:
          type: array
          items:
            type: string
            enum:
              - Iu-CS
              - Iu-PS
              - Iur
              - Iub
              - Uu
        SGSNInterfaces:
          type: array
          items:
            type: string
            enum:
              - Gb
              - Iu-PS
              - Gn
              - MAP-Gr
              - MAP-Gd
              - MAP-Gf
              - Ge
              - Gs
              - S6d
              - S4
              - S3
              - S13
        GGSNInterfaces:
          type: array
          items:
            type: string
            enum:
              - Gn
              - Gi
              - Gmb
        S-CSCFInterfaces:
          type: array
          items:
            type: string
            enum:
              - Mw
              - Mg
              - Mr
              - Mi
```

```
        P-CSCFInterfaces:
          type: array
          items:
            type: string
            enum:
              - Gm
              - Mw
        I-CSCFInterfaces:
          type: array
          items:
            type: string
            enum:
              - Cx
              - Dx
              - Mg
              - Mw
        MRFCInterfaces:
          type: array
          items:
            type: string
            enum:
              - Mp
              - Mr
        MGCFInterfaces:
          type: array
          items:
            type: string
            enum:
              - Mg
              - Mj
              - Mn
        IBCFInterfaces:
          type: array
          items:
            type: string
            enum:
              - Ix
              - Mx
        E-CSCFInterfaces:
          type: array
          items:
            type: string
            enum:
              - Mw
              - Ml
              - Mm
              - Mi/Mg
        BGCFInterfaces:
          type: array
          items:
            type: string
            enum:
              - Mi
              - Mj
              - Mk
        ASInterfaces:
          type: array
          items:
            type: string
            enum:
              - Dh
              - Sh
              - ISC
              - Ut
        HSSInterfaces:
          type: array
          items:
            type: string
            enum:
              - MAP-C
              - MAP-D
              - Gc
              - Gr
              - Cx
              - S6d
              - S6a
              - Sh
        EIRInterfaces:
```

```
      type: array
      items:
        type: string
        enum:
          - MAP-F
          - S13
          - MAP-Gf
    BM-SCInterfaces:
      type: array
      items:
        type: string
        enum:
          - Gmb
    MMEInterfaces:
      type: array
      items:
        type: string
        enum:
          - S1-MME
          - S3
          - S6a
          - S10
          - S11
          - S13
    SGWInterfaces:
      type: array
      items:
        type: string
        enum:
          - S4
          - S5
          - S8
          - S11
          - Gxc
    PDN_GWInterfaces:
      type: array
      items:
        type: string
        enum:
          - S2a
          - S2b
          - S2c
          - S5
          - S6b
          - Gx
          - S8
          - SGi
    eNBInterfaces:
      type: array
      items:
        type: string
        enum:
          - S1-MME
          - X2
    en-gNBInterfaces:
      type: array
      items:
        type: string
        enum:
          - S1-MME
          - X2
          - Uu
          - F1-C
          - E1
    AMFInterfaces:
      type: array
      items:
        type: string
        enum:
          - N1
          - N2
          - N8
          - N11
          - N12
          - N14
          - N15
          - N20
          - N22
```

```
      - N26
AUSFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N12
      - N13
NEFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N29
      - N30
      - N33
NRFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N27
NSSFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N22
      - N31
PCFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N5
      - N7
      - N15
SMFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N4
      - N7
      - N10
      - N11
      - S5-C
SMSFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N20
      - N21
UDMInterfaces:
  type: array
  items:
    type: string
    enum:
      - N8
      - N10
      - N13
      - N21
UPFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N4
ng-eNBInterfaces:
  type: array
  items:
    type: string
    enum:
      - NG-C
      - Xn-C
      - Uu
gNB-CU-CPInterfaces:
```

```
          type: array
          items:
            type: string
            enum:
              - NG-C
              - Xn-C
              - Uu
              - F1-C
              - E1
              - X2-C
        gNB-CU-UPInterfaces:
          type: array
          items:
            type: string
            enum:
              - E1
        gNB-DUInterfaces:
          type: array
          items:
            type: string
            enum:
              - F1-C

    tjListOfNeTypes-Type:
      description: The Network Element types where Trace Session activation is needed. See 3GPP TS
32.422 clause 5.4 for additional details.
      type: array
      items:
        type: string
        enum:
          - MSC_SERVER
          - SGSN
          - MGW
          - GGSN
          - RNC
          - BM_SC
          - MME
          - SGW
          - PGW
          - ENB
          - EN_GNB
          - GNB_CU_CP
          - GNB_CU_UP
          - GNB_DU

    tjPLMNTaget-Type:
      type: object
      description: The PLMN for which sessions shall be selected in the Trace Session in case of
management based activation when several PLMNs are supported in the RAN (this means that shared
cells and not shared cells are allowed for the specified PLMN. Note that the PLMN Target might
differ from the PLMN specified in the Trace Reference, as that specifies the PLMN that is containing
the management system requesting the Trace Session from the NE. See 3GPP TS 32.422 clause 5.9b for
additional details.
      properties:
        mcc:
          $ref: '#/components/schemas/Mcc'
        mnc:
          $ref: '#/components/schemas/Mnc'
      required:
        - mcc
        - mnc

    tjStreamingTraceConsumerURI-Type:
      type: string
      description: The URI of the Trace Reporting MnS consumer (see 3GPP TS 28.532) to which the
Trace records shall be sent. See 3GPP TS 32.422 clause 5.9 for additional details.
      format: uri

    tjTraceCollectionEntityAddress-Type:
      description: The IP address to which the Trace records shall be transferred. See 3GPP TS
32.422 clause 5.9 for additional details.
      oneOf:
        - $ref: '#/components/schemas/Ipv4Addr'
        - $ref: '#/components/schemas/Ipv6Addr'

    tjTraceDepth-Type:
```

```
      description: Specifies how detailed information should be recorded in the Network Element. The
Trace Depth is a paremeter for Trace Session level, i.e., the Trace Depth is the same for all of the
NEs to be traced in the same Trace Session. See 3GPP TS 32.422 clause 5.3 for additional details.
      type: string
      enum:
        - MINIMUM
        - MEDIUM
        - MAXIMUM
        - VENDORMINIMUM
        - VENDORMEDIUM
        - VENDORMAXIMUM

    tjTraceReference-Type:
      type: object
      description: The Trace Reference parameter shall be globally unique, therefore the Trace
Reference shall compose as follows - MCC+MNC+Trace ID, where the MCC and MNC are coming with the
Trace activation request from the management system to identify one PLMN containing the management
system, and Trace ID is a 3 byte Octet String. See 3GPP TS 32.422 clause 5.6 for additional details.
      properties:
        mcc:
          $ref: '#/components/schemas/Mcc'
        mnc:
          $ref: '#/components/schemas/Mnc'
        traceId:
          type: integer
      required:
        - mcc
        - mnc
        - traceId

    tjTraceReportingFormat-Type:
      type: string
      description: Specifies whether file-based or streaming reporting shall be used for this Trace
Session. See 3GPP TS 32.422 clause 5.11 for additional details.
      enum:
        - FILE-BASED
        - STREAMING

    tjTraceTarget-Type:
      type: string
      description: Type of trace target. For additional details see 3GPP TS 32.422.
      enum:
        - IMSI
        - IMEI
        - IMEISV
        - PUBLIC_ID
        - UTRAN_CELL
        - E-UTRAN_CELL
        - NG-RAN_CELL
        - eNB
        - RNC
        - gNB

    tjTriggeringEvent-Type:
      type: object
      description: Specifies when to start a Trace Recording Session and which message shall be
recorded first, when to stop a Trace Recording Session and which message shall be recorded last
respectively. See 3GPP TS 32.422 clause 5.1 for additional detials.
      properties:
        NetworkElement:
          type: string
          enum:
            - MSC_SERVER
            - SGSN
            - MGW
            - GGSN
            - BM_SC
            - MME
            - SGW
            - PGW
            - AMF
            - SMF
            - PCF
            - UPF
        EventBitmap:
          type: integer
      required:
        - NetworkElement
```

```
        - EventBitmap

    tjMDTAnonymizationOfData-Type:
      description: Specifies level of MDT anonymization. For additional details see 3GPP TS 32.422
clause 5.10.12.
      type: string
      enum:
        - NO_IDENTITY
        - TAC_OF_IMEI

    tjMDTAreaConfigurationForNeighCell-Type:
      description: Used for logged NR MDT and defines the area for which UE is requested to perform
measurement logging for neighbour cells which have list of frequencies. For additional details see
3GPP TS 32.422 clause 5.10.26.
      type: array
      items:
        type: object
        properties:
          frequency:
            type: string
          cell:
            type: string

    tjMDTAreaScope-Type:
      description: defines the area in terms or Cells or Tracking Area/Routing Area/Location Area
where the MDT data collection shall take place. For additional details see 3GPP TS 32.422 clause
5.10.2.
      allOf:
        - $ref: '#/components/schemas/DnList'

    tjMDTCollectionPeriodRrmLte-Type:
      description: See details in 3GPP TS 32.422 clause 5.10.20.
      type: string
      enum:
        - 250ms
        - 500ms
        - 1000ms
        - 2000ms
        - 3000ms
        - 4000ms
        - 6000ms
        - 8000ms
        - 12000ms
        - 16000ms
        - 20000ms
        - 24000ms
        - 28000ms
        - 32000ms
        - 64000ms

    tjMDTCollectionPeriodRrmUmts-Type:
      description: See details in 3GPP TS 32.422 clause 5.10.21.
      type: string
      enum:
        - 1024ms
        - 1280ms
        - 2048ms
        - 2560ms
        - 5120ms
        - 10240ms
        - 1min

    tjMDTEventListForTriggeredMeasurement-Type:
      description: See details in 3GPP TS 32.422 clause 5.10.28.
      type: string
      enum:
        - OUT_OF_COVERAGE
        - A2_EVENT

    tjMDTEventThreshold-Type:
      description: See details in 3GPP TS 32.422 clause 5.10.7, 5.10.7a, 5.10.13 and 5.10.14.
      type: object
      properties:
        EventThresholdRSRP:
          type: integer
          minimum: 0
          maximum: 97
        EventThresholdRSRQ:
```

```
        type: integer
        minimum: 0
        maximum: 34
      EventThreshold1F:
        type: object
        properties:
          CPICH_RSCP:
            type: integer
            minimum: -120
            maximum: 25
          CPICH_EcNo:
            type: integer
            minimum: -24
            maximum: 0
          PathLoss:
            type: integer
            minimum: 30
            maximum: 165
      EventThreshold1I:
        type: integer
        minimum: -120
        maximum: 25

  tjMDTListOfMeasurements-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.3 for details.
    type: object
    properties:
      UMTS:
        type: array
        items:
          type: string
          enum:
            - M1
            - M2
            - M3
            - M4
            - M5
            - M6_DL
            - M6_UL
            - M7_DL
            - M7_UL
      LTE:
        type: array
        items:
          type: string
          enum:
            - M1
            - M2
            - M3
            - M4
            - M5
            - M1_EVENT_TRIGGERED
            - M6
            - M7
            - M8
            - M9
      NR:
        type: array
        items:
          type: string
          enum:
            - M1
            - M2
            - M3
            - M4
            - M5
            - M6
            - M7
            - M8
            - M9

  tjMDTLoggingDuration-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.9.
    type: string
    enum:
      - 600s
      - 1200s
      - 2400s
```

```
      - 3600s
      - 5400s
      - 7200s

  tjMDTLoggingInterval-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.8.
    type: string
    enum:
      - 1.28s
      - 2.56s
      - 5.12s
      - 10.24s
      - 20.48s
      - 30.72s
      - 40.96s
      - 61.44s

  tjMDTMBSFNAreaList-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.25.
    type: array
    items:
      type: object
      properties:
        mbsfnAreaId:
          type: integer
          minimum: 1
        earfcn:
          type: integer
          minimum: 1
      required:
        - mbsfnAreaId
        - earfcn

  tjMDTMeasurementPeriodLTE-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.23.
    type: string
    enum:
      - 1024ms
      - 1280ms
      - 2048ms
      - 2560ms
      - 5120ms
      - 10240ms
      - 1min

  tjMDTMeasurementPeriodUMTS-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.22.
    type: string
    enum:
      - 250ms
      - 500ms
      - 1000ms
      - 2000ms
      - 3000ms
      - 4000ms
      - 6000ms
      - 8000ms
      - 12000ms
      - 16000ms
      - 20000ms
      - 24000ms
      - 28000ms
      - 32000ms
      - 64000ms

  tjMDTMeasurementQuantity-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.15.
    type: string
    enum:
      - CPICH_EcNo
      - CPICH_RSCP
      - PathLoss

  tjMDTPLMList-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.24.
    type: array
    items:
      type: object
```

```
      properties:
        mcc:
          $ref: '#/components/schemas/Mcc'
        mnc:
          $ref: '#/components/schemas/Mnc'
      required:
        - mcc
        - mnc
    maxItems: 16

  tjMDTPositioningMethod-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.19.
    type: string
    enum:
      - GNSS
      - E-CELL_ID

  tjMDTReportAmount-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.6.
    type: string
    enum:
      - 1
      - 2
      - 4
      - 8
      - 16
      - 32
      - 64
      - INFINITY

  tjMDTReportingTrigger-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.4.
    type: array
    items:
      type: string
      enum:
        - PERIODICAL
        - A2_FOR_LTE
        - 1F_FOR_UMTS
        - 1I_FOR_UMTS_MCPS_TDD
        - A2_TRIGGERED_PERIODIC_FOR_LTE
        - ALL_CONFIGURED_RRM_FOR_LTE
        - ALL_CONFIGURED_RRM_FOR_UMTS

  tjMDTReportInterval-Type:
    description: See details in 3GPP TS 32.422 clause 5.10.5.
    type: string
    enum:
      - 250ms
      - 500ms
      - 1000ms
      - 2000ms
      - 3000ms
      - 4000ms
      - 6000ms
      - 8000ms
      - 12000ms
      - 16000ms
      - 20000ms
      - 24000ms
      - 28000ms
      - 32000ms
      - 64000ms
      - 120ms
      - 240ms
      - 480ms
      - 640ms
      - 1024ms
      - 2048ms
      - 5120ms
      - 10240ms
      - 60000ms
      - 360000ms
      - 720000ms
      - 1800000ms
      - 3600000ms

  tjMDTReportType-Type:
```

```
      description: Report type for logged NR MDT. See details in 3GPP TS 32.422 clause 5.10.27.
      type: string
      enum:
        - PERIODICAL
        - EVENT_TRIGGERED

    tjMDTSensorInformation-Type:
      description: See details in 3GPP TS 32.422 clause 5.10.29.
      type: array
      items:
        type: string
        enum:
          - BAROMETRIC_PRESSURE
          - UE_SPEED
          - UE_ORIENTATION

    tjMDTTraceCollectionEntityID-Type:
      description: See details in 3GPP TS 32.422 clause 5.10.11. Only tceID value may be sent over
the air to the UE being configured for Logged MDT.
      type: object
      properties:
        tceID:
          type: integer
        tcePLMN:
          type: object
          properties:
            mcc:
              $ref: '#/components/schemas/Mcc'
            mnc:
              $ref: '#/components/schemas/Mnc'
          required:
            - mcc
            - mnc
        tceAddress:
          oneOf:
            - $ref: '#/components/schemas/tjTraceCollectionEntityAddress-Type'
            - $ref: '#/components/schemas/tjStreamingTraceConsumerURI-Type'
      required:
        - tceID
        - tcePLMN
        - tceAddress


#-------- end of Definition of types used in Trace control NRM fragment ----------


#-------- Definition of abstract IOC Top ----------------------------------------

    Top-Attr:
      #  This definition will be deprecated, when all occurances of Top-Attr
      #  are replaced by Top.
      type: object
      properties:
        id:
          type: string
        VsDataContainer:
          $ref: '#/components/schemas/VsDataContainer-Multiple'
    Top:
      type: object
      properties:
        id:
          type: string
        VsDataContainer:
          $ref: '#/components/schemas/VsDataContainer-Multiple'

#-------- Definition of IOCs with new name-containments defined in other TS ------

    SubNetwork-Attr:
      type: object
      properties:
        dnPrefix:
          type: string
        userLabel:
          type: string
        userDefinedNetworkType:
          type: string
        setOfMcc:
          $ref: '#/components/schemas/SetOfMcc'
```

```
        priorityLabel:
          type: integer
        supportedPerfMetricGroups:
          type: array
          items:
            $ref: '#/components/schemas/SupportedPerfMetricGroup'
    ManagedElement-Attr:
      type: object
      properties:
        dnPrefix:
          type: string
        managedElementTypeList:
          $ref: '#/components/schemas/ManagedElementTypeList'
        userLabel:
          type: string
        locationName:
          type: string
        managedBy:
          $ref: '#/components/schemas/DnList'
        vendorName:
          type: string
        userDefinedState:
          type: string
        swVersion:
          type: string
        priorityLabel:
          type: integer
        supportedPerfMetricGroups:
          type: array
          items:
            $ref: '#/components/schemas/SupportedPerfMetricGroup'

    SubNetwork-ncO:
      type: object
      properties:
        ManagementNode:
          $ref: '#/components/schemas/ManagementNode-Multiple'
        MeContext:
          $ref: '#/components/schemas/MeContext-Multiple'
        PerfMetricJob:
          $ref: '#/components/schemas/PerfMetricJob-Multiple'
        ThresholdMonitor:
          $ref: '#/components/schemas/ThresholdMonitor-Multiple'
        ThresholdMonitoringCapability:
          $ref: '#/components/schemas/ThresholdMonitoringCapability-Single'
        NtfSubscriptionControl:
          $ref: '#/components/schemas/NtfSubscriptionControl-Multiple'
        TraceJob:
          $ref: '#/components/schemas/TraceJob-Multiple'
        AlarmList:
          $ref: '#/components/schemas/AlarmList-Single'
    ManagedElement-ncO:
      type: object
      properties:
        PerfMetricJob:
          $ref: '#/components/schemas/PerfMetricJob-Multiple'
        ThresholdMonitor:
          $ref: '#/components/schemas/ThresholdMonitor-Multiple'
        ThresholdMonitoringCapability:
          $ref: '#/components/schemas/ThresholdMonitoringCapability-Single'
        NtfSubscriptionControl:
          $ref: '#/components/schemas/NtfSubscriptionControl-Multiple'
        TraceJob:
          $ref: '#/components/schemas/TraceJob-Multiple'
        AlarmList:
          $ref: '#/components/schemas/AlarmList-Single'

#-------- Definition of abstract IOCs -----------------------------------------

    ManagedFunction-Attr:
      type: object
      properties:
        userLabel:
          type: string
        vnfParametersList:
          $ref: '#/components/schemas/VnfParametersList'
        peeParametersList:
          $ref: '#/components/schemas/PeeParametersList'
```

```
      priorityLabel:
        type: integer
      supportedPerfMetricGroups:
        type: array
        items:
          $ref: '#/components/schemas/SupportedPerfMetricGroup'
  EP_RP-Attr:
    type: object
    properties:
      userLabel:
        type: string
      farEndEntity:
        type: string
      supportedPerfMetricGroups:
        type: array
        items:
          $ref: '#/components/schemas/SupportedPerfMetricGroup'

  TraceJob-Attr:
    type: object
    description: abstract class used as a container of all TraceJob attributes
    properties:
      tjJobType:
        $ref: '#/components/schemas/tjJobType-Type'
      tjListOfInterfaces:
        $ref: '#/components/schemas/tjListOfInterfaces-Type'
      tjListOfNeTypes:
        $ref: '#/components/schemas/tjListOfNeTypes-Type'
      tjPLMNTarget:
        $ref: '#/components/schemas/tjPLMNTaget-Type'
      tjTraceConsumer:
        oneOf:
          - $ref: '#/components/schemas/tjStreamingTraceConsumerURI-Type'
          - $ref: '#/components/schemas/tjTraceCollectionEntityAddress-Type'
      tjTraceDepth:
        $ref: '#/components/schemas/tjTraceDepth-Type'
      tjTraceReference:
        $ref: '#/components/schemas/tjTraceReference-Type'
      tjTraceReportingFormat:
        $ref: '#/components/schemas/tjTraceReportingFormat-Type'
      tjTraceTarget:
        $ref: '#/components/schemas/tjTraceTarget-Type'
      tjTriggeringEvent:
        $ref: '#/components/schemas/tjTriggeringEvent-Type'
      tjMDTAnonymizationOfData:
        $ref: '#/components/schemas/tjMDTAnonymizationOfData-Type'
      tjMDTAreaConfigurationForNeighCell:
        $ref: '#/components/schemas/tjMDTAreaConfigurationForNeighCell-Type'
      tjMDTAreaScope:
        $ref: '#/components/schemas/tjMDTAreaScope-Type'
      tjMDTCollectionPeriodRrmLte:
        $ref: '#/components/schemas/tjMDTCollectionPeriodRrmLte-Type'
      tjMDTCollectionPeriodRrmUmts:
        $ref: '#/components/schemas/tjMDTCollectionPeriodRrmUmts-Type'
      tjMDTEventListForTriggeredMeasurement:
        $ref: '#/components/schemas/tjMDTEventListForTriggeredMeasurement-Type'
      tjMDTEventThreshold:
        $ref: '#/components/schemas/tjMDTEventThreshold-Type'
      tjMDTListOfMeasurements:
        $ref: '#/components/schemas/tjMDTListOfMeasurements-Type'
      tjMDTLoggingDuration:
        $ref: '#/components/schemas/tjMDTLoggingDuration-Type'
      tjMDTLoggingInterval:
        $ref: '#/components/schemas/tjMDTLoggingInterval-Type'
      tjMDTMBSFNAreaList:
        $ref: '#/components/schemas/tjMDTMBSFNAreaList-Type'
      tjMDTMeasurementPeriodLTE:
        $ref: '#/components/schemas/tjMDTMeasurementPeriodLTE-Type'
      tjMDTMeasurementPeriodUMTS:
        $ref: '#/components/schemas/tjMDTMeasurementPeriodUMTS-Type'
      tjMDTMeasurementQuantity:
        $ref: '#/components/schemas/tjMDTMeasurementQuantity-Type'
      tjMDTPLMList:
        $ref: '#/components/schemas/tjMDTPLMList-Type'
      tjMDTPositioningMethod:
        $ref: '#/components/schemas/tjMDTPositioningMethod-Type'
      tjMDTReportAmount:
        $ref: '#/components/schemas/tjMDTReportAmount-Type'
```

```
        tjMDTReportingTrigger:
          $ref: '#/components/schemas/tjMDTReportingTrigger-Type'
        tjMDTReportInterval:
          $ref: '#/components/schemas/tjMDTReportInterval-Type'
        tjMDTReportType:
          $ref: '#/components/schemas/tjMDTReportType-Type'
        tjMDTSensorInformation:
          $ref: '#/components/schemas/tjMDTSensorInformation-Type'
        tjMDTTraceCollectionEntityID:
          $ref: '#/components/schemas/tjMDTTraceCollectionEntityID-Type'
      required:
        - tjJobType
        - tjTraceReference
        - tjTraceConsumer
        - tjTraceReportingFormat
        - tjTraceTarget

    ManagedFunction-ncO:
      type: object
      properties:
        MeasurementControl:
          $ref: '#/components/schemas/MeasurementControl-Multiple'
        ThresholdMonitor:
          $ref: '#/components/schemas/ThresholdMonitor-Multiple'
        ThresholdMonitoringCapability:
          $ref: '#/components/schemas/ThresholdMonitoringCapability-Single'
        ManagedNFService:
          $ref: '#/components/schemas/ManagedNFService-Multiple'
        TraceJob:
          $ref: '#/components/schemas/TraceJob-Multiple'

#-------- Definition of concrete IOCs -----------------------------------------

    VsDataContainer-Single:
      type: object
      properties:
        id:
          type: string
        attributes:
          type: object
          properties:
            vsDataType:
              type: string
            vsDataFormatVersion:
              type: string
            vsData:
              nullable: true
        VsDataContainer:
          $ref: '#/components/schemas/VsDataContainer-Multiple'
    ManagedNFService-Single:
      allOf:
        - $ref: '#/components/schemas/Top-Attr'
        - type: object
          properties:
            attributes:
              type: object
              properties:
                userLabel:
                  type: string
                nFServiceType:
                  $ref: '#/components/schemas/NFServiceType'
                sAP:
                  $ref: '#/components/schemas/SAP'
                operations:
                  $ref: '#/components/schemas/OperationList'
                administrativeState:
                  $ref: '#/components/schemas/AdministrativeState'
                operationalState:
                  $ref: '#/components/schemas/OperationalState'
                usageState:
                  $ref: '#/components/schemas/UsageState'
                registrationState:
                  $ref: '#/components/schemas/RegistrationState'
    ManagementNode-Single:
      allOf:
        - $ref: '#/components/schemas/Top-Attr'
        - type: object
          properties:
```

```
        attributes:
          type: object
          properties:
            userLabel:
              type: string
            managedElements:
              $ref: '#/components/schemas/DnList'
            vendorName:
              type: string
            userDefinedState:
              type: string
            locationName:
              type: string
            swVersion:
              type: string
MeContext-Single:
  allOf:
    - $ref: '#/components/schemas/Top-Attr'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            dnPrefix:
              type: string
PerfMetricJob-Single:
  allOf:
    - $ref: '#/components/schemas/Top-Attr'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            administrativeState:
              $ref: '#/components/schemas/AdministrativeState'
            operationalState:
              $ref: '#/components/schemas/OperationalState'
            perfMetricJobGroupId:
              type: string
            performanceMetrics:
              type: array
              items:
                type: string
            granularityPeriod:
              type: integer
              minimum: 1
            objectInstances:
              $ref: '#/components/schemas/DnList'
            rootObjectInstances:
              $ref: '#/components/schemas/DnList'
            reportingCtrl:
              $ref: '#/components/schemas/ReportingCtrl'
ThresholdMonitoringCapability-Single:
  allOf:
    - $ref: '#/components/schemas/Top-Attr'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            supportedMonitoringGPs:
              $ref: '#/components/schemas/MonitoringGPList'
ThresholdMonitor-Single:
  allOf:
    - $ref: '#/components/schemas/Top-Attr'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            thresholdInfoList:
              $ref: '#/components/schemas/ThresholdInfoList'
            monitoringGP:
              type: integer
            monitoringNotifTarget:
              type: string
            monitoredIOCName:
              type: string
```

```
              monitoredObjectDNs:
                $ref: '#/components/schemas/DnList'
    NtfSubscriptionControl-Single:
      allOf:
        - $ref: '#/components/schemas/Top-Attr'
        - type: object
          properties:
            attributes:
              type: object
              properties:
                notificationRecipientAddress:
                  $ref: '#/components/schemas/Uri'
                notificationTypes:
                  $ref: '#/components/schemas/NotificationTypes'
                scope:
                  $ref: '#/components/schemas/Scope'
                notificationFilter:
                  type: string
            HeartbeatControl:
              $ref: '#/components/schemas/HeartbeatControl-Single'
    HeartbeatControl-Single:
      allOf:
        - $ref: '#/components/schemas/Top-Attr'
        - type: object
          properties:
            attributes:
              type: object
              properties:
                heartbeatNtfPeriod:
                  type: integer
                triggerHeartbeatNtf:
                  type: boolean
    TraceJob-Single:
      allOf:
        - $ref: '#/components/schemas/Top-Attr'
        - type: object
          properties:
            attributes:
              $ref: '#/components/schemas/TraceJob-Attr'

    AlarmList-Single:
      allOf:
        - $ref: '#/components/schemas/Top-Attr'
        - type: object
          properties:
            attributes:
              type: object
              properties:
                administrativeState:
                  $ref: '#/components/schemas/AdministrativeState'
                operationalState:
                  $ref: '#/components/schemas/OperationalState'
                numOfAlarmRecords:
                  type: integer
                lastModification:
                  $ref: '#/components/schemas/DateTime'
                alarmRecords:
                  description: >-
                     This resource represents a map of alarm records.
                     The alarmIds are used as keys in the map.
                  type: object
                  additionalProperties:
                    $ref: 'faultMnS.yaml#/components/schemas/AlarmRecord'

#-------- Definition of JSON arrays for name-contained IOCs ----------------------

    VsDataContainer-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/VsDataContainer-Single'
    ManagedNFService-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/ManagedNFService-Single'
    ManagementNode-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/ManagementNode-Single'
```

```
    MeContext-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/MeContext-Single'
    PerfMetricJob-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/MetricProdJob-Single'
    ThresholdMonitor-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/ThresholdMonitor-Single'
    NtfSubscriptionControl-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/NtfSubscriptionControl-Single'
    TraceJob-Multiple:
      type: array
      items:
        $ref: '#/components/schemas/TraceJob-Single'

#-------- Definitions in TS 28.623 for TS 28.532 ---------------------------------

    resources-genericNrm:
      oneOf:

       - $ref: '#/components/schemas/VsDataContainer-Single'

       - $ref: '#/components/schemas/ManagementNode-Single'
       - $ref: '#/components/schemas/MeContext-Single'

       - $ref: '#/components/schemas/ManagedNFService-Single'

       - $ref: '#/components/schemas/PerfMetricJob-Single'

       - $ref: '#/components/schemas/ThresholdMonitoringCapability-Single'
       - $ref: '#/components/schemas/ThresholdMonitor-Single'

       - $ref: '#/components/schemas/NtfSubscriptionControl-Single'
       - $ref: '#/components/schemas/HeartbeatControl-Single'
       - $ref: '#/components/schemas/TraceJob-Single'

       - $ref: '#/components/schemas/AlarmList-Single'
```

Annex D (normative): YANG definitions

D.1 General

This annex contains the YANG definitions for the Generic NRM.

D.2 Modules

D.2.1 module _3gpp-common-ep-rp.yang

```
module _3gpp-common-ep-rp {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-ep-rp";
  prefix "eprp3gpp";

  import _3gpp-common-yang-types { prefix types3gpp ; }
  import ietf-inet-types { prefix inet; }
  import _3gpp-common-measurements { prefix meas3gpp; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";
  description "Common/basic class/grouping to be inherited/reused.
    This IOC represents an end point of a link used across a reference
    point between two network entities.";
  reference
    "3GPP TS 28.622
    Generic Network Resource Model (NRM)
    Integration Reference Point (IRP);
    Information Service (IS)

    3GPP TS 28.620
    Umbrella Information Model (UIM)";

  revision 2020-06-08 { reference "CR-0092"; }

  revision 2019-06-17 {
    description "Initial revision";
  }

  grouping EP_RPGrp {
    description "Abstract class, represents an end point of a link used
      across a reference point between two network entities.

      For naming the subclasses of EP_RP, the following rules shall apply:
      - The name of the subclassed IOC shall have the form 'EP_<rp>',
      where <rp> is a string that represents the name of the reference point.
      Thus, two valid examples of EP_RP subclassed IOC names would be:
      EP_S1 and EP_X2.";

    leaf userLabel {
        type string;
        description "A user-friendly (and user assignable) name of this object.";
    }

    leaf farEndEntity {
      config false;
      type types3gpp:DistinguishedName;
    }
  }

  grouping EP_Common {
    uses EP_RPGrp;
    uses meas3gpp:SupportedPerfMetricGroupGrp;
    list localAddress {
      description "Local IP address and VLAN ID.";
      key "ipAddress vlanId";
```

```
      min-elements 1;
      max-elements 1;
      uses types3gpp:AddressWithVlan;
    }

    leaf remoteAddress {
      description "Remote IP address.";
      mandatory true;
      type inet:ip-address;
    }
  }
}
```

D.2.2 module _3gpp-common-managed-element.yang

```
module _3gpp-common-managed-element {
  yang-version 1.1;
  namespace urn:3gpp:sa5:_3gpp-common-managed-element;
  prefix "me3gpp";

  import _3gpp-common-yang-types { prefix types3gpp ; }
  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-measurements { prefix meas3gpp; }
  import _3gpp-common-fm { prefix fm3gpp; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";
  description "Defines ManagedElement which will be augmented
      by other IOCs";
  reference "3GPP TS 28.623
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Solution Set (SS) definitions

      3GPP TS 28.622
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Information Service (IS)

      3GPP TS 28.620
      Umbrella Information Model (UIM)";

  revision 2020-06-08 { reference "CR-0092"; }

  revision 2020-05-12 {
    reference "CR0084";
  }
  revision 2020-02-24 {
    reference "S5-201365";
  }
   revision 2019-06-17 {
      revision 2020-05-08 {
    reference " S5-203316";
  }

 description "Initial revision";
   }

  feature MeasurementsUnderManagedElement {
    description "The MeasurementSubtree shall be contained under ManagedElement";
  }

  feature FmUnderManagedElement {
    description "The FmSubtree shall be contained under ManagedElement";
  }

  feature DESManagementFunction {
    description "Classs representing Distributed SON or Domain-Centralized SON Energy Saving
feature. The DESManagementFunction shall be contained under ManagedElement.";
  }

  feature DMROFunction {
    description "Classs representing D-SON function of MRO feature. The DMROFunction shall be
contained under ManagedElement.";
  }
```

```
  feature DRACHOptimizationFunction {
    description "Classs representing D-SON function of RACH optimization feature. The
DRACHOptimizationFunction shall be contained under ManagedElement.";
  }

  feature DPCIConfigurationFunction {
    description "Classs representing Distributed SON or Domain-Centralized SON function of PCI
configuration feature. The DPCIConfigurationFunction shall be contained under ManagedElement.";
  }

  feature CPCIConfigurationFunction {
    description "Classs representing Cross Domain-Centralized SON function of PCI configuration
feature. The CPCIConfigurationFunction shall be contained under ManagedElement.";
  }

  feature CESManagementFunction {
    description "Classs representing Cross Domain-Centralized SON Energy Saving feature. The
CESManagementFunction shall be contained under ManagedElement.";
  }

  grouping ManagedElement_Grp {
    description "Abstract class representing telecommunications resources.
      An ME communicates with a manager (directly or indirectly) for the
      purpose of being monitored and/or controlled. MEs may perform element
      management functionality.
      An ME (and its contained Function_(s)) may or may not be geographically
      distributed. An ME (and its contained Function_(s)) is often referred
      to as a Network Element";

    leaf dnPrefix {
      description "Provides naming context that allows the Managed
        Elements to be partitioned into logical domains.
        A Distingushed Name(DN) is defined by 3GPP TS 32.300,
        which splits the DN into a DN Prefix and Local DN";
      type types3gpp:DistinguishedName;
    }

    leaf userLabel {
      description "A user-friendly (and user assignable) name of this object.";
      type string;
    }

    leaf locationName {
      description "The physical location (e.g. an address) of an entity
        represented by a (derivative of) ManagedElement_. It may contain no
        information to support the case where the derivative of
        ManagedElement_ needs to represent a distributed multi-location NE.";
      config false;
      type string;
    }

    leaf-list managedBy {
      description "Relates to the role played by ManagementSystem_ in the
        between ManagedSystem_ and ManagedElement_. This attribute contains
        a list of the DN(s) of the related subclasses of
        ManagementSystem_ instance(s).";

      config false;
      type types3gpp:DistinguishedName;
    }

    leaf-list managedElementTypeList {
      description "The type of functionality provided by the ManagedElement.
        It may represent one ME functionality or a combination of
        more than one functionality.
        1) The allowed values of this attribute are the names of the IOC(s)
        that are (a) derived/subclassed from ManagedFunction and (b) directly
        name-contained by ManagedElement IOC (on the first level below
        ManagedElement), but with the string 'Function' excluded.
        2) If a ManagedElement contains multiple instances of a ManagedFunction
        this attribute will not contain repeated values.
        3) The capitalisation (usage of upper/lower case) of characters in this
        attribute is insignificant.  Thus, the NodeB should be case insensitive
        when reading these values.
        4) Two examples of allowed values are:
        -  NodeB;
        -  HLR, VLR.";
```

```
    config false;
    min-elements 1;
    type string;
  }
}

grouping ManagedElementGrp {
  description "Represents telecommunications equipment or
    TMN entities within the telecommunications network providing support
    and/or service to the subscriber.";

  uses ManagedElement_Grp;
  uses meas3gpp:SupportedPerfMetricGroupGrp {
    if-feature MeasurementsUnderManagedElement ;
  }

  leaf vendorName {
    config false;
    type string;
  }

  leaf userDefinedState {
    type string;
    description "An operator defined state for operator specific usage";
  }

  leaf swVersion {
    config false;
    type string;
  }

  leaf priorityLabel {
    type uint32;
    mandatory true;
  }
}

list ManagedElement {
  description "Represents telecommunications equipment or
    TMN entities within the telecommunications network providing support
    and/or service to the subscriber.
    An ManagedElement IOC is used to represent a  Network Element defined
    in TS 32.101 including virtualizeation or non-virtualization scenario.
    An ManagedElement instance is used for communicating with a manager (directly or indirectly)
    over one or more management interfaces for the purpose of being monitored and/or
    controlled. ManagedElement may or may not additionally perform element management
    functionality.
    An ManagedElement contains equipment that may or may not be geographically
    distributed.
    A telecommunication equipment has software and hardware components.
    The ManagedElement IOC described above represents following two case:
    - In the case when the  when the software component
    is designed to run on dedicated hardware component, the ManagedElement IOC
    description includes both software and hardware components.
    - In the case when the Software is designed to run on ETSI NFV defined NFVI [15], the
    ManagedElement
    IOC description would exclude the NFVI component supporting the above
    mentioned subject software. A ManagedElement may be contained in either a SubNetwork or in a
    MeContext instance. A single ManagedElement may also
    exist stand-alone with no parent at all.
    The relation of ManagedElement IOC and ManagedFunction IOC can be described as following:
     - A ManaagedElement instance may have 1..1 containment relationship to a ManagedFunction
     instance. In this case, the ManagedElement IOC may be used to represent a NE with signgle
     functionality. For example, a ManagedElement is used to represent the 3GPP defined RNC
     node;
     - A ManagedElement instance may have 1..N containment relationship to multiple
     ManagedFunction IOC instances. In this case, the ManagedElement IOC may be used to represent
      a NE with combined ManagedFunction funcationality (as indicated by the managedElementType
      attribute and the contained
     instances of different ManagedFunction IOCs).For example, a
     ManagedElement is used to represent the combined functionality of 3GPP defined
    gNBCUCPFuntion,gNBCUUPFunction and gNBDUFunction";

  key id;
  uses top3gpp:Top_Grp;
  container attributes {
    uses ManagedElementGrp;
  }
```

```
    uses meas3gpp:MeasurementSubtree {
      if-feature MeasurementsUnderManagedElement ;
    }

    uses fm3gpp:FmSubtree {
      if-feature FmUnderManagedElement ;
    }
  }
}
```

D.2.3 module _3gpp-common-managed-functionyang

```
module _3gpp-common-managed-function {
  yang-version 1.1;
  namespace urn:3gpp:sa5:_3gpp-common-managed-function;
  prefix mf3gpp;

  import _3gpp-common-yang-types { prefix types3gpp; }
  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-measurements { prefix meas3gpp; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";
  description "The module defines a base class/grouping for major 3GPP functions.";
  reference
    "3GPP TS 28.622
    Generic Network Resource Model (NRM)
    Integration Reference Point (IRP);
    Information Service (IS)

    3GPP TS 28.620
    Umbrella Information Model (UIM)";

  revision 2020-06-08 { reference "CR-0092"; }

  revision 2020-06-23 {
    reference "CR-085";
  }
  revision 2019-11-21 {
    reference "S5-197275, S5-197735";
  }

  revision 2019-10-28 {
    reference S5-193518 ;
  }

  revision 2019-06-18 {
    description "Initial revision";
  }

  feature MeasurementsUnderManagedFunction {
    description "The MeasurementSubtree shall be contained under ManageElement";
  }

  grouping Operation {
    reference "3gpp TS 28.622";

    leaf name {
      type string;
      mandatory true;
    }

    leaf-list allowedNFTypes {
      type string;
      min-elements 1;
      description "The type of the managed NF service instance
        The specifc values allowed are described in TS 23.501";
    }

    leaf operationSemantics {
      type enumeration {
        enum REQUEST_RESPONSE;
        enum SUBSCRIBE_NOTIFY;
```

```
    }
    config false;
    mandatory true;
    description "Semantics type of the operation.";
    reference "3GPP TS 23.502";
  }
}

grouping ManagedNFServiceGrp {
  description "A ManagedNFService represents a Network Function (NF) service.";
  reference "Clause 7 of 3GPP TS 23.501.";

  leaf userLabel {
      type string;
      description "A user-friendly (and user assignable) name of this object.";
  }

  leaf nFServiceType {
    config false;
    mandatory true;
    type string;
    description "The type of the managed NF service instance
      The specifc values allowed are described in clause 7.2 of TS 23.501";
  }

  list sAP {
    key "host port";
    min-elements 1;
    max-elements 1;
    description "The service access point of the managed NF service instance";
    uses types3gpp:SAP;
  }

  list operations {
    key name;
    min-elements 1;
    uses Operation ;
    description "Set of operations supported by the managed NF
      service instance";
  }

  leaf administrativeState  {
    type types3gpp:AdministrativeState;
    mandatory true;
    description "Permission to use or prohibition against using the instance";
  }

  leaf operationalState  {
    type types3gpp:OperationalState;
    config false;
    mandatory true;
    description "Describes whether the resource is installed and working";
  }

  leaf usageState {
    type types3gpp:usageState ;
    config false;
    mandatory true;
    description "Describes whether the resource is actively in use at a
      specific instant, and if so, whether or not it has spare
      capacity for additional users.";
  }

  leaf registrationState {
    type enumeration {
      enum REGISTERED;
      enum DEREGISTERED;
    }
    config false;
  }
}

grouping Function_Grp {
  description "A base grouping for 3GPP functions.";

  leaf userLabel {
      type string;
      description "A user-friendly (and user assignable) name of this object.";
```

```
    }
  }

  grouping ManagedFunctionGrp {
    description "Abstract root class to be inherited/reused by classes
      representing 3GPP functions.

      Anywhere this grouping is used by classes inheriting from ManagedFunction
      the list representing the inheriting class needs to include all
      contained classes of ManagedFunction too. Contained classes are
      either
      - augmented into the Function class or
      - shall be included in the list representing the inheriting class
      using the grouping  ManagedFunctionContainedClasses:
        1) EP_RP solved using augment
        2) uses mf3gpp:ManagedFunctionContainedClasses;
      ";

    uses Function_Grp;

    container vnfParametersList {
      description "Contains the parameter set of the VNF
        instance(s) corresponding to an NE.";
      presence "The presence of this container indicates that the ManagedFunction
        represented is realized by one or more VNF instance(s). Otherwise it
        shall be absent.";

      leaf vnfInstanceId {
        type string ;
        mandatory true;
        description "VNF instance identifier";
        reference "ETSI GS NFV-IFA 008 v2.1.1:
          Network Functions Virtualisation (NFV); Management and Orchestration;
          Ve-Vnfm reference point - Interface and Information Model Specification
          section 9.4.2

          ETSI GS NFV-IFA 015 v2.1.2: Network Functions Virtualisation (NFV);
          Management and Orchestration; Report on NFV Information Model
          section B2.4.2.1.2.3";
      }

      leaf vnfdId {
        type string ;
        description "Identifier of the VNFD on which the VNF instance is based.
          The absence of the leaf or a string length of zero for vnfInstanceId
          means the VNF instance(s) does not exist (e.g. has not been
          instantiated yet, has already been terminated).";
        reference "ETSI GS NFV-IFA 008 v2.1.1:
          Network Functions Virtualisation (NFV); Management and Orchestration;
          Ve-Vnfm reference point - Interface and Information Model Specification
          section 9.4.2";
      }

      leaf flavourId {
        type string ;
        description "Identifier of the VNF Deployment Flavour applied to this
          VNF instance.";
        reference "ETSI GS NFV-IFA 008 v2.1.1:
          Network Functions Virtualisation (NFV); Management and Orchestration;
          Ve-Vnfm reference point - Interface and Information Model Specification
          section 9.4.3";
      }

      leaf autoScalable                         {
        type boolean ;
        mandatory true;
        description "Indicator of whether the auto-scaling of this
          VNF instance is enabled or disabled.";
      }
    }

    container peeParametersList {
      description "Contains the parameter set for the control
        and monitoring of power, energy and environmental parameters of
        ManagedFunction instance(s).";
      presence "Present supported if the control and monitoring of PEE
        parameters is supported by the ManagedFunction or sub-class instance.";
```

```
      leaf siteIdentification {
        type string;
        mandatory true;
        description "The identification of the site where the
          ManagedFunction resides.";
      }

      leaf siteLatitude {
        type decimal64 {
          fraction-digits 4;
          range "-90.0000..+90.0000";
        }
        description "The latitude of the site where the ManagedFunction
          instance resides, based on World Geodetic System (1984 version)
          global reference frame (WGS 84). Positive values correspond to
          the northern hemisphere. This attribute is optional in case of
          BTSFunction and RNCFunction instance(s).";
      }

      leaf siteLongitude {
        type decimal64 {
          fraction-digits 4;
          range "-180.0000..+180.0000";
        }
        description "The longitude of the site where the ManagedFunction
          instance resides, based on World Geodetic System (1984 version)
          global reference frame (WGS 84). Positive values correspond to
          degrees east of 0 degrees longitude. This attribute is optional in
          case of BTSFunction and RNCFunction instance(s).";
      }

      leaf siteDescription {
        type string;
        mandatory true;
        description "An operator defined description of the site where
          the ManagedFunction instance resides.";
      }

      leaf equipmentType {
        type string;
        mandatory true;
        description "The type of equipment where the managedFunction
          instance resides.";
        reference "clause 4.4.1 of ETSI ES 202 336-12";
      }

      leaf environmentType {
        type string;
        mandatory true;
        description "The type of environment where the managedFunction
          instance resides.";
        reference "clause 4.4.1 of ETSI ES 202 336-12";
      }

      leaf powerInterface {
        type string;
        mandatory true;
        description "The type of power.";
        reference "clause 4.4.1 of ETSI ES 202 336-12";
      }
    }

    leaf priorityLabel {
      mandatory true;
      type uint32;
    }
    uses meas3gpp:SupportedPerfMetricGroupGrp;
  }

  grouping ManagedFunctionContainedClasses {
    description "A grouping used to containe classes (lists) contained by
      the abstract IOC ManagedFunction";
    list ManagedNFService {
      description "Represents a Network Function (NF)";
      reference "3GPP TS 23.501";
      key id;
      uses top3gpp:Top_Grp;
      container attributes {
```

```
        uses ManagedNFServiceGrp;
      }
    }

    uses meas3gpp:MeasurementSubtree {
      if-feature MeasurementsUnderManagedFunction ;

  }
}
```

D.2.4 module _3gpp-common-measurements.yang

```
module _3gpp-common-measurements {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-measurements";
  prefix "meas3gpp";

  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-yang-types { prefix types3gpp; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";

  description "Defines Measurement and KPI related groupings
    Any list/class intending to use this should include 2 or 3 uses statements
    controlled by a feature:

    A)
+++     feature MeasurementsUnderMyClass {
+++       description 'Indicates whether measurements and/or KPIs are supported
+++       for this class.';
+++     }

    B) include the attribute measurementsList and/or kPIsList indicating the
      supported measurment and KPI types and GPs. Note that for classes
      inheriting from ManagedFunction, EP_RP or SubNetwork these attributes are
      already inherited, so there is no need to include them once more. E.g.

+++     grouping MyClassGrp {
+++        uses meas3gpp:SupportedPerfMetricGroup;
+++     }

    C) include the class PerfmetricJob to control the measurements/KPIs. E.g.

        list MyClass {
          container attributes {
            uses MyClassGrp;
          }
+++       uses meas3gpp:MeasurementSubtree {
+++         if-feature MeasurementsUnderMyClass ;
+++       }
        }

    Measurements can be contained under ManagedElement, SubNetwork, or
    any list representing a class inheriting from Subnetwork or
    ManagedFunction. Note: KPIs will only be supported under SubNetwork";

  reference "3GPP TS 28.623
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Solution Set (SS) definitions

      3GPP TS 28.622
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Information Service (IS)";

  revision 2020-06-08 { reference "CR-0092"; }
  revision 2020-05-31 { reference "CR-0084"; }
  revision 2020-03-11 { reference "S5-201581, SP-200229"; }

  revision 2019-11-21 {
    reference "S5-197275, S5-197735";
  }
```

```
  revision 2019-10-28 {
    reference "S5-193516";
  }

  revision 2019-06-17 {
  }

  grouping SupportedPerfMetricGroupGrp {

    list SupportedPerfMetricGroup {
      config false;
      description "Captures a group of supported performance metrics and
        associated parameters related to their production and reporting.
        A SupportedPerfMetricGroup attribute which is part of an MOI may
        define performanceMetrics for any MOI under the subtree contained
        under that MOI, e.g. SupportedPerfMetricGroup on a ManagedElement
        can specify supported metrics for contained ManagedFunctions
        like a GNBDUFunction.";

      leaf-list performanceMetrics {
        type string;
        min-elements 1;
        description "Performance metrics include measurements defined in
          TS 28.552 and KPIs defined in TS 28.554. Performance metrics can
          also be those specified by other SDOs or vendor specific metrics.
          Performance metrics are identfied with their names. A name can also
          identify a vendor specific group of performance metrics.

          For measurements defined in TS 28.552 the name is constructed as
          follows:
          - 'family.measurementName.subcounter' for measurement types with
          subcounters
          - 'family.measurementName' for measurement types without subcounters
          - 'family' for measurement families

          For KPIs defined in TS 28.554 the name is defined in the KPI
          definitions template as the component designated with e).";
      }

      leaf-list granularityPeriods {
        type uint32 {
          range 1..max ;
        }
        units seconds;
        min-elements 1;
      }

      leaf-list reportingMethods {
        type enumeration {
          enum FILE_BASED_LOC_SET_BY_PRODUCER;
          enum FILE_BASED_LOC_SET_BY_CONSUMER;
          enum STREAM_BASED;
        }
        min-elements 1;
      }
    }
  }

  grouping PerfMetricJobGrp {
    description "Represents the attributtes of the IOC PerfMetricJob";

    leaf administrativeState {
      default UNLOCKED;
      type types3gpp:AdministrativeState ;
      description "Enable or disables production of the metrics";
    }

    leaf operationalState {
      config false;
      mandatory true;
      type types3gpp:OperationalState ;
      description "Indicates whether the PerfMetricJob is working.";
    }

    leaf perfMetricJobGroupId {
      type string;
      description "Identifies members of a PerfMetricJob group. For the
        stream based reporting method this reference shall be present.";
```

```
    }

    leaf-list performanceMetrics {
      type string;
      min-elements 1;
      description "Performance metrics include measurements defined in
        TS 28.552 and KPIs defined in TS 28.554. Performance metrics can
        also be those specified by other SDOs or vendor specific metrics.
        Performance metrics are identfied with their names. A name can also
        identify a vendor specific group of performance metrics.

        For measurements defined in TS 28.552 the name is constructed as
        follows:
        - 'family.measurementName.subcounter' for measurement types with
        subcounters
        - 'family.measurementName' for measurement types without subcounters
        - 'family' for measurement families

        For KPIs defined in TS 28.554 the name is defined in the KPI
        definitions template as the component designated with e).";
    }

    leaf granularityPeriod {
      type uint32 {
        range 1..max ;
      }
      units seconds;
      mandatory true;
      description "Granularity period used to produce measurements. The value
        must be one of the supported granularity periods for the metric.

        For measurements of type counter this is the period at which samples
        of the internal counter value, that is incremented with every event
        occurance, are taken.

        For measurements of type gauge, this is period, over which the mean
        value of the measured variable is calculated. The mean value is
        then taken as sample.";
    }

    leaf-list objectInstances {
      type types3gpp:DistinguishedName;
    }

    leaf-list rootObjectInstances {
      type types3gpp:DistinguishedName;
      description "Each object instance designates the root of a subtree that
      contains the root object and all descendant objects.";
    }

    choice reportingCtrl {
      mandatory true;
      description "This choice defines the method for reporting collected
        performance metrics to MnS consumers as well as the parameters for
        configuring the reporting function. It is a choice between the control
        parameter required for the reporting methods, whose presence selects
        the reporting method as follows:
        - When only the fileReportingPeriod attribute is present, the MnS
        producer shall store files on the MnS producer at a location selected
        by the MnS producer and inform the MnS consumer about the availability
        of new files and the file location using the notifyFileReady
        notification.
        - When only the fileReportingPeriod and fileLocation attributes are
        present, the MnS producer shall store the files on the MnS consumer at
        the location specified by fileLocation. No notification is emitted by
        the MnS producer.
        - When only the streamTarget attribute is present, the MnS producer
        shall stream the data to the location specified by streamTarget.

        For the file-based reporting methods the fileReportingPeriod attribute
        specifies the time window during which collected measurements are stored
        into the same file before the file is closed and a new file is opened.";

      case file-based-reporting {
        leaf fileReportingPeriod {
          type uint32 {
            range 1..max;
          }
```

```
        units minutes";
        must '(number(.)*"60") mod number(../granularityPeriod) = "0"' {
          error-message
            "The time-period must be a multiple of the granularityPeriod.";
        }
        mandatory true;
        description "For the file-based reporting method this is the time
          window during which collected measurements are stored into the same
          file before the file is closed and a new file is opened.
          The time-period must be a multiple of the granularityPeriod.

          Applicable when the file-based reporting method is supported";
      }

      leaf fileLocation {
        type string ;
        description "Applicable and must be present when the file-based
          reporting method is supported, and the files are stored on the MnS
          consumer.";
      }
    }
    case stream-based-reporting {
      leaf streamTarget {
        type string;
        mandatory true;
        description "Applicable when stream-based reporting method is
          supported.";
      }
    }
  }
}


grouping ThresholdMonitoringCapabilityGrp {
  description "Represents the capability of threshold monitoring(s)
    allowed to be created by ThresholdMonitor to monitor some or all
    of the measurements identified by SupportedPerfMetricGroup.";

  leaf-list supportedMonitoringGPs {
    type uint32;
    units second;
    config false;
    min-elements 1;
    description "The monitoring granularity periods supported by the
      producer for the monitored entities.";
  }
}

grouping ThresholdMonitorGrp {
    description "A threshold monitor that is created by the consumer for
      the monitored entities whose measurements are required by consumer
      to monitor.";

  list thresholdInfoList {
    key idx;
    leaf idx { type uint32 ; }

    leaf measurementType {
      type string;
      mandatory true;
      description "Shall be in one of the following form:
        - 'family.measurementName.subcounter' for monitoring the
        measurement types with subcounters defined.
        - 'family.measurementName' for monitoring the measurement
        types without subcounters defined.";
    }

    leaf direction {
      type enumeration {
        enum INCREASING;
        enum DECREASING;
      }
      mandatory true;
      description "
        - If it is 'INCREASING', the threshold crossing
        notification is triggered when the measurement value
        equals or exceeds a thresholdValue.
        - If it is 'DECREASING', the threshold crossing notification is
```

```
        triggered when the measurement value equals or below a
        thresholdValue.";
    }

    list thresholdPack {
      key idx;
      min-elements 1;
      leaf idx { type uint32 ; }

      leaf  thresholdLevel {
        type int64;
        mandatory true;
        description "";
      }

      leaf thresholdValue {
        type int64;
        mandatory true;
        description "";
      }

      leaf threshold-low  {
        type int64;
        description "The values threshold-low and threshold-high must
          be present or absent together.
          The measurementType value is allowed to oscillate between
          threshold-low and threshold-highwithout triggering the
          threshold crossing notification.";
      }

      leaf threshold-high  {
        when '../threshold-low';
        type int64;
        mandatory true;
        description "The values threshold-low and threshold-high must
          be present or absent together.
          The measurementType value is allowed to oscillate between
          threshold-low and threshold-highwithout triggering the
          threshold crossing notification.";
      }
    }
  }

  leaf monitoringGP  {
    type uint32;
    units second;
    mandatory true;
    description "Monitoring granularity period";
  }

  leaf monitoringNotifTarget {
    type string;
    description "Identifies the target of the notifications when the
      monitored measurement crosses or reaches the threshold set by the
      subject threshold monitor.";
  }

  leaf monitoredIOCName  {
    type string;
    mandatory true;
    description "Specifies the name of list(s) representing one object
      class for which the threshold monitor is created.
      When this attribute is effective, the threshold monitor is created
      for all list nodes/entries with the specified name in the containment
      tree whose top (tree) node is the list entry containing the subject
      ThresholdMonitor list-entry containing this leaf.
      This leaf is effective when the monitoredObjectDNs contained by
      the same ThresholdMonitor list entry is empty.

      AllowedValues: The IOC names defined in the NRMs specifications.";
  }

  leaf-list monitoredObjectDNs {
    type types3gpp:DistinguishedName;
    description "Specifies the object instance(s) for threshold monitoring.
      The attribute monitoredIOCName contained by the same
      ThresholdMonitor entry has no effect unless this leaf-list empty.";
  }
```

```
  }

  grouping MeasurementSubtree {
    description "Contains classes that define measurements.
      Should be used in all  classes (or classes inheriting from)
      - SubNnetwork
      - ManagedElement
      - ManagedFunction

      If a YANG module wants to augment these classes/list/groupings they must
      augment all user classes!

      If a class uses this grouping in its list it shall also use the
      grouping SupportedPerfMetricGroupGrp to add SupportedPerfMetricGroup as
      an attribute to its grouping";

    list PerfMetricJob {
      description "This IOC represents a performance metric production job. It
        can be name-contained by SubNetwork, ManagedElement, or ManagedFunction.

        To activate the production of the specified performance metrics, a MnS
        consumer needs to create a PerfMetricJob instance on the MnS producer
        and ensure that the adminState is sUNLOCKED>.
        For ultimate deactivation of metric production, the MnS consumer should
        delete the job to free up resources on the MnS producer.

        For temporary suspension of metric production, the MnS consumer can
        manipulate the value of the administrative state attribute. The MnS
        producer may disable metric production as well, for example in overload
        situations. This situation is indicated by the MnS producer with setting
        the operational state attribute to disabled. When production is resumed
        the operational state is set again to enabled.

        The perfMetricJobGroupId is a common reference across all members of a
        PerfMetricJob group. A group contains related PerfMetricJob instances.

        The attribute performanceMetrics defines the performance metrics to be
        produced and the attribute granularityPeriod defines the granularity
        period to be applied.

        All object instances below and including the instance name-containing
        the PerfMetricJob (base object instance) are scoped for performance
        metric production. Performance metrics are produced only on those object
        instances whose object class matches the object class associated to the
        performance metrics to be produced.

        The attributes objectInstances and rootObjectInstances allow to restrict
        the scope. When the attribute objectInstances is present, only the object
        instances identified by this attribute are scoped. When the attribute
        rootObjectInstances is present, then the subtrees whose root objects are
        identified by this attribute are scoped. Both attributes may be present
        at the same time meaning the total scope is equal to the sum of both
        scopes. Object instances may be scoped by both the objectInstances and
        rootObjectInstances attributes. This shall not be considered as an error
        by the MnS producer.

        When the performance metric requires performance metric production on
        multiple managed objects, which is for example the case for KPIs, the
        MnS consumer needs to ensure all required objects are scoped. Otherwise
        a PerfMetricJob creation request shall fail.

        The attribute reportingCtrl specifies the method and associated control
        parameters for reporting the produced measurements to MnS consumers.
        Three methods are available: file-based reporting with selection of the
        file location by the MnS producer, file-based reporting with selection
        of the file location by the MnS consumer and stream-based reporting.

        A PerfMetricJob creation request shall fail, when the requested
        performance metrics, the requested granularity period, the requested
        repoting method, or the requested combination thereof is not supported
        by the MnS producer.

        Creation and deletion of PerfMetricJob instances by MnS consumers is
        optional; when not supported, PerfMetricJob instances may be created and
        deleted by the system or be pre-installed.";

      key id;
      uses top3gpp:Top_Grp ;
```

```
      container attributes {
        uses PerfMetricJobGrp ;
      }
    }


    list ThresholdMonitoringCapability {
      key id;
      max-elements 1;
      description "Represents the capability of threshold monitoring(s)
        allowed to be created by ThresholdMonitor to monitor some or all
        of the measurements identified by supportedMeasurementsGPs.

        This list entry instance represents the capability of the
        threshold monitor(s) allowed to be created for the measurements of
        the (tree) nodes of a containment tree whose top (tree) node is
        the list-entry instance containing the ThresholdMonitoringCapability
        instance.

        In case one entry (say A) is contained by a tree node (say X), and
        a similar list entry named ThresholdMonitoringCapability  (say B) is
        contained by a subordinate tree node (of tree node X), the entry
        (B) contained by the subordinate tree node (Y) prevail.";

      uses top3gpp:Top_Grp ;
      container attributes {
        uses ThresholdMonitoringCapabilityGrp ;
      }
    }

    list ThresholdMonitor {
      key id;
      description "A threshold monitor that is created by the consumer for
        the monitored entities whose measurements are required by consumer
        to monitor. The monitored entities are identified by the attribute
        monitoredObjectDNs.

        The creation request for this list entry may be rejected, if
        the measurements to be monitered are being collected
        (e.g., by a measurement job or NRM configurations) with a GP different
        from the monitoringGP; or the measurements to be monitered are not
        being collected.

        In case one entry (say A) is contained by a tree node (say X), and
        a similar list entry named ThresholdMonitor (say B) is
        contained by a subordinate tree node (of tree node X),
        when these two instances have overlaps the entry (B)
        contained by the subordinate tree node (Y) will prevail for the
        overlapped parts.";

      uses top3gpp:Top_Grp ;
      container attributes {
        uses ThresholdMonitorGrp ;
      }
    }
  }
}
```

D.2.5 module _3gpp-common-subnetwork.yang

```
module _3gpp-common-subnetwork {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-subnetwork";
  prefix "subnet3gpp";

  import _3gpp-common-yang-types { prefix types3gpp; }
  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-measurements { prefix meas3gpp; }
  import _3gpp-common-fm { prefix fm3gpp; }
  import ietf-yang-schema-mount { prefix yangmnt; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";

  description "Defines basic SubNetwork which will be augmented by other IOCs";
  reference "3GPP TS 28.623
```

```
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Solution Set (SS) definitions

      3GPP TS 28.622
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Information Service (IS)

      3GPP TS 28.620
      Umbrella Information Model (UIM)";

  revision 2020-06-08 { reference "CR-0092"; }
  revision 2020-05-08 {
    reference "S5-203316";
  }


  revision 2020-03-11 {
    description "Added KPIs and corrections";
    reference "S5-201365, S5-201581, SP-200229";
  }

  revision 2020-02-24 {
    reference "S5-201365";
  }

  revision 2019-06-17 {
    description "Initial revision";
  }

  feature ExternalsUnderSubNetwork {

    description "Classes representing external entities like EUtranFrequency,
      ExternalGNBCUCPFunction, ExternalENBFunction
      are contained under a Subnetwork list/class.";
  }

  feature MeasurementsUnderSubNetwork {
    description "The MeasurementSubtree shall be contained under SubNetwork
      indicating the support of Measurements and/or KPIs";
  }

  feature FmUnderSubNetwork {
    description "The FmSubtree shall be contained under SubNetwork";
  }

  feature DESManagementFunction {
    description "Classs representing Distributed SON or Domain-Centralized SON Energy Saving
feature. The DESManagementFunction shall be contained under subnetwork.";
  }

  feature DMROFunction {
    description "Classs representing D-SON function of MRO feature. The DMROFunction shall be
contained under subnetwork.";
  }

  feature DRACHOptimizationFunction {
    description "Classs representing D-SON function of RACH optimization feature. The
DRACHOptimizationFunction shall be contained under subnetwork.";
  }

  feature DPCIConfigurationFunction {
    description "Classs representing Distributed SON or Domain-Centralized SON function of PCI
configuration feature. The DPCIConfigurationFunction shall be contained under subnetwork.";
  }

  feature CPCIConfigurationFunction {
    description "Classs representing Cross Domain-Centralized SON function of PCI configuration
feature. The CPCIConfigurationFunction shall be contained under subnetwork.";
  }

  feature CESManagementFunction {
    description "Classs representing Cross Domain-Centralized SON Energy Saving feature. The
CESManagementFunction shall be contained under subnetwork.";
  }

  grouping Domain_Grp {
```

```
    description "A domain is a partition of instances of managed entities
      such that :
      -  the group represents a topological structure which describes the
      potential for connectivity
      -  Subject to common administration
      -  With common characteristics";

    leaf dnPrefix {
      type types3gpp:DistinguishedName;
      reference "Annex C of 32.300 ";
    }

    leaf userLabel {
        type string;
        description "A user-friendly (and user assignable) name of this object.";
    }

    leaf userDefinedNetworkType {
      type string;
      description "Textual information indicating network type, e.g. 'UTRAN'.";
    }
  }

  grouping SubNetworkGrp {
    uses Domain_Grp;
    uses meas3gpp:SupportedPerfMetricGroupGrp;


    leaf-list setOfMcc {
      description "Set of Mobile Country Code (MCC).
        The MCC uniquely identifies the country of domicile
        of the mobile subscriber. MCC is part of the IMSI (3GPP TS 23.003)

        This list contains all the MCC values in subordinate object
        instances to this SubNetwork instance.

        See clause 2.3 of 3GPP TS 23.003 for MCC allocation principles.

        It shall be supported if there is more than one value in setOfMcc
        of the SubNetwork. Otherwise the support is optional.";
      type types3gpp:Mcc;
    }

    leaf priorityLabel {
      mandatory true;
      type uint32;
    }

  }

  list SubNetwork {
    key id;
    description "Represents a set of managed entities";

    uses top3gpp:Top_Grp;
    container attributes {
      uses SubNetworkGrp;
      leaf-list parents {
        description "Reference to all containg SubNetwork instances
          in strict order from the root subnetwork down to the immediate
          parent subnetwork.
          If subnetworks form a containment hierarchy this is
          modeled using references between the child SubNetwork and the parent
          SubNetworks.
          This reference MUST NOT be present for the top level SubNetwork and
          MUST be present for other SubNetworks.";
        type leafref {
          path "../../../SubNetwork/id";
        }
      }

      leaf-list containedChildren{
        description "Reference to all directly contained SubNetwork instances.
          If subnetworks form a containment hierarchy this is
          modeled using references between the child SubNetwork and the parent
          SubNetwork.";
        type leafref {
          path "../../../SubNetwork/id";
```

```
        }
      }
    }

    uses meas3gpp:MeasurementSubtree {
      if-feature MeasurementsUnderSubNetwork ;
    }

    uses fm3gpp:FmSubtree {
      if-feature FmUnderSubNetwork ;
    }

    yangmnt:mount-point children-of-SubNetwork {
      description "Mountpoint for ManagedElement";
      reference "RFC8528 YANG Schema Mount";
    }

    // augment external parts here
  }
}
```

D.2.6 module _3gpp-common-top@2019-06-17.yang

```
module _3gpp-common-top {
  yang-version 1.1;

  namespace urn:3gpp:sa5:_3gpp-common-top;
  prefix top3gpp;

  organization "3gpp SA5";
  description "The model defines a YANG mapping of the top level
    information classes used for management of 5G networks and
    network slicing.";
  reference
    "3GPP TS 28.622
    Generic Network Resource Model (NRM)
    Integration Reference Point (IRP);
    Information Service (IS)

    3GPP TS 28.620
    Umbrella Information Model (UIM)";

  revision 2019-06-17 {
    description "Initial revision";
  }

  grouping Top_Grp {
    description "Abstract class supplying a naming attribute";
    reference "3GPP TS 28.620";

    leaf id {
      type string;
      description "Key leaf (namingAttribute) for a class/list.
        Should be used as a key leaf for lists representing
        stage 2 classes.";
      reference "3GPP TS 32.300 Name convention for managed objects";
    }
  }
}
```

D.2.6a module _3gpp-common-subscription-control@2019-11-29.yang

```
module _3gpp-common-subscription-control {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-subscription-control";
  prefix "subscr3gpp";

  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-subnetwork { prefix subnet3gpp; }
  import _3gpp-common-managed-element { prefix me3gpp; }
```

```
  organization "3GPP SA5";

  description "Defines IOCs for subscription and heartbeat control.";
  reference "3GPP TS 28.623
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Solution Set (SS) definitions
      3GPP TS 28.623";

  revision 2019-11-29 {
    description "Initial revision";
    reference "S5-197648 S5-197647 S5-197829 S5-197828";
  }

  grouping NtfSubscriptionControlGrp {
    description "Attributes of a specific notification subscription";

    leaf notificationRecipientAddress {
      type string;
      mandatory true;
    }

    leaf-list notificationTypes {
      type string;
      description "Defines the types of notifications that are candidates
        for being forwarded to the notification recipient.
        If the notificationFilter attribute is not supported or not present
        all candidate notifications types are forwarded to the notification;
        discriminated by notificationFilter attribute.";
    }

    list scope {
      key "scopeType";
      min-elements 1;
      max-elements 1;
      description "Describes which object instances are selected with
        respect to a base object instance.";

      leaf scopeType {
        type enumeration {
          enum BASE_ONLY;
          enum BASE_ALL;
          enum BASE_NTH_LEVEL;
          enum BASE_SUBTREE;
        }
        description "If the optional scopeLevel parameter is not supported
          or absent, allowed values of scopeType are BASE_ONLY and BASE_ALL.

          The value BASE_ONLY indicates only the base object is selected.
          The value BASE_ALL indicates the base object and all of its
          subordinate objects (incl. the leaf objects) are selected.

          If the scopeLevel parameter is supported and present, allowed
          values of scopeType are BASE_ALL, BASE_ONLY, BASE_NTH_LEVEL
          and BASE_SUBTREE.

          The value BASE_NTH_LEVEL indicates all objects on the level,
          which is specified by the scopeLevel parameter, below the base
          object are selected. The base object is at scopeLevel zero.
          The value BASE_SUBTREE indicates the base object and all of its
          subordinate objects down to and including the objects on the level,
          which is specified by the scopeLevel parameter, are selected.
          The base object is at scopeLevel zero.";
      }

      leaf scopeLevel {
        when '../scopeType = "BASE_NTH_LEVEL" or ../scopeType = "BASE_SUBTREE"';
        type uint16;
        mandatory true;
        description "See description of scopeType.";
      }
    }

    leaf notificationFilter {
      type string;
      description "Defines a filter to be applied to candidate notifications
        identified by the notificationTypes attribute.
        If notificationFilter is present, only notifications that pass the
```

```
      filter criteria are forwarded to the notification recipient; all other
      notifications are discarded.
      The filter can be applied to any field of a notification.";
  }
}

grouping HeartbeatControlGrp {
  description "Attributes of HeartbeatControl. Note the triggerHeartbeatNtf attribute
   has no mapping in the present release.";

  leaf heartbeatNtfPeriod {
    type uint32 ;
    mandatory true;
    units minute;
    description "Specifies the periodicity of heartbeat notification emission.
      The value of zero has the special meaning of stopping the heartbeat
      notification emission.";
  }
}

grouping NtfSubscriptionControlWrapper {
  list NtfSubscriptionControl {
    description "A NtfSubscriptionControl instance represents the
      notification subscription of a particular notification recipient.
      The scope attribute is used to select managed object instances.
      The base object instance of the scope is the object instance
      name-containing the NtfSubscriptionControl instance.
      The notifications related to the selected managed object instances
      are candidates to be sent to the address specified by the
      notificationRecipientAddress attribute.
      The notificationType attribute and notificationFilter attribute
      allow MnS consumers to exercise control over which candidate
      notifications are sent to the notificationRecipientAddress.
      If the notificationType attribute is supported and present, its
      value identifies the
      types of notifications that are candidate to be sent to the
      notificationRecipientAddress. If the notificationType attribute is
      not supported or not present, all types of notifications are
      candidate to be sent to notificationRecipientAddress.
      If supported, the notificationFilter attribute defines a filter that
      is applied to the set of candidate notifications. Only candidate
      notifications that pass the filter criteria are sent to the
      notificationRecipientAddress. If the notificationFilter attribute is
      not supported all candidate notificatios are sent to the
      notificationRecipientAddress.
      To receive notifications, a MnS consumer has to create
      NtfSubscriptionControl object instancess on the MnS producer.
      A MnS consumer can create a subscription for another MnS consumer
      since it is not required the notificationRecipientAddress be his own
      address.
      When a MnS consumer does not wish to receive notifications any more
      the MnS consumer shall delete the corresponding NtfSubscriptionControl
      instance.
      Creation and deletion of NtfSubscriptionControl instances by MnS
      consumers is optional; when not supported, the NtfSubscriptionControl
      instances may be created and deleted by the system or be pre-installed.";

    key id;
    uses top3gpp:Top_Grp;
    container attributes {
      uses NtfSubscriptionControlGrp;
    }

    list HeartbeatControl {
      min-elements 1;
      max-elements 1;
      description "MnS consumers (i.e. notification recipients) use heartbeat
        notifications to monitor the communication channels between them and
        data reporting MnS producers emitting notifications such as
        notifyNewAlarm and notifyFileReady.
        A HeartbeatControl instance allows controlling the emission of
        heartbeat notifications by MnS producers. The recipients of heartbeat
        notifications are not specified by an attribute of the Heartbeat
        instance, but by an attribute of the IOC name-containing the
        HeartbeatControl IOC.
        Note that the MnS consumer managing the HeartbeatControl instance
        and the MnS consumer receiving the heartbeat notifications may not be
        the same.
```

```
          As a pre-condition for the emission of heartbeat notifications, a
          HeartbeatControl instance needs to be created. Creation of an
          instance with an initial non-zero value of the heartbeatNtfPeriod
          attribute triggers an immediate heartbeat notification emission.
          Creation of an instance with an initial zero value of the
          heartbeatPeriod attribute does not trigger an emission of a
          heartbeat notification. Deletion of this instance does not trigger
          an emission of a heartbeat notification.
          Creation and deletion of HeartbeatControl instances by MnS Consumers
          is optional; when not supported, the HeartbeatControl instances may
          be created and deleted by the system or be pre-installed.
";
        key id;
        uses top3gpp:Top_Grp;

        container attributes {
          uses HeartbeatControlGrp;
        }
      }
    }
  }

  augment /subnet3gpp:SubNetwork {
    uses NtfSubscriptionControlWrapper;
  }

  augment /me3gpp:ManagedElement {
    uses NtfSubscriptionControlWrapper;
  }
}
```

D.2.7 module _3gpp-common-yang-extensions@2019-06-23.yang

```
module _3gpp-common-yang-extensions {
  yang-version 1.1;
  namespace urn:3gpp:sa5:_3gpp-common-yang-extensions ;
  prefix yext3gpp ;

  organization "3GPP SA5";
  description "The module defines YANG extensions needed
    3GPP YANG modeling.

    Copyright (c) 2019 3GPP. All rights reserved.

    Extensions MUST be defined with the following structure in the
    description statement:
        - What is this statement.
        - Newline,
        - This statement can be a substatement of the xxx statements with
        cardinality x..y.
        - This statement can have the following substatements with
        cardinality x..y.
        - Newline
        - Is changing this statement an editorial, BC(backwards compatible)
        or NBC(non-BC) change?
        - Newline.
        - The argument its meaning and type. Preferably use YANG types and
          constraints to define the argument's type.

    Any extension statement can be added with a
    deviation/deviate add statement. In this case the restriction about
    the parent statement of the extension SHALL be evaluated based on the
    target of the deviation statement.

    Support for this module does not mean that a YANG server implements
    support for each of these extensions.
    Implementers of each specific module using an extensions MUST check
    if the server implements support for the used extension.
    Note: modules use many extensions which individual
    implementations MAY or MAY NOT support.
    If support for an extension is missing the extension statement needs
    individual handling or it SHOULD be removed from the module using
    the extension e.g. with a deviation.
          ";
```

```
  revision "2019-06-23" {
    description "Initial version";
  }

  extension inVariant {
    description
      "Indicates that the value for the data node can only be set when its
      parent data node is being created. To change the value after that, the
      parent data node must be deleted and recreated with the data node
      having the new value.

      It is unnecessary to use and MUST NOT be used for key leafs.

      The statement MUST only be a substatement of a leaf, leaf-list, list
      statements that is config=true.
      Zero or one inVariant statement is allowed per parent statement.
      NO substatements are allowed.

      Adding this statement is an NBC change, removing it is BC.";
  }

  extension initial-value {
    description "Specifies a value that the system will set for a leaf
      leaf-list if a value is not specified for it when its parent list
      or container is created. The value has no effect in any other
      modification e.g. changing or removing the value.

      The description statement of the parent statement SHOULD contain
      the label 'Initial-value: ' followed by the text from the argument.

      The statement MUST only be a substatement of a leaf or leaf-list.
      The statement MUST NOT be present if the leaf or the leaf-list
      has a default statement or the type used for the data node
      has a default value.
      The statement MUST NOT be used for config=false data or in an
      action, rpc or notification.
      Zero or one initial-value statements are allowed for a leaf parent
      statement. Zero or more initial-value statements are allowed for a
      leaf-list parent statement. If the leaf-list is ordered-by user, the
      initial values are stored in the order they appear in the YANG definition.
      NO substatements are allowed.

      Always consider using a YANG-default statement instead.

      Modification of the initial-value is a non-backwards-compatible change.

      The argument specifies a single initial value for a leaf or leaf-list.
      The value MUST be part of the valuespace of the leaf/leaf-list.
      It follows the same rules as the argument of the default statement.";

    argument "initial-value";
  }
}
```

D.2.8 module _3gpp-common-yang-types@.yang

```
module _3gpp-common-yang-types {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-yang-types";
  prefix "types3gpp";

  import ietf-inet-types { prefix inet; }
  import ietf-yang-types { prefix yang; }

  organization "3GPP SA5";
  description "The model defines a YANG mapping of the top level
    information classes used for management of 5G networks and
    network slicing.";
  reference "3GPP TS 28.541";

  revision 2020-03-10 {
    description "Removed faulty when statements.";
    reference “SP-200229”;
  }
```

```
  revision 2019-10-25 {
    description "Added ManagedNFProfile.";
    reference "S5-194457";
  }

  revision 2019-10-16 {
    description "Added SAP and usageState.";
    reference "S5-193518";
  }

  revision 2019-06-23 {
    description "Initial version.";
  }

  grouping ManagedNFProfile {
    description "Defines profile for managed NF";
    reference "3GPP TS 23.501";

    leaf idx { type uint32 ; }

    leaf nfInstanceID {
      config false;
      mandatory true;
      type yang:uuid ;
      description "This parameter defines profile for managed NF.
        The format of the NF Instance ID shall be a
        Universally Unique Identifier (UUID) version 4,
        as described in IETF RFC 4122 " ;
    }

    leaf-list nfType {
      config false;
      min-elements 1;
      type NfType;
      description "Type of the Network Function" ;
    }

    leaf hostAddr {
      mandatory true;
      type inet:host ;
      description "Host address of a NF";
    }

    leaf authzInfo {
      type string ;
      description "This parameter defines NF Specific Service authorization
        information. It shall include the NF type (s) and NF realms/origins
        allowed to consume NF Service(s) of NF Service Producer.";
      reference "See TS 23.501" ;
    }

    leaf location {
      type string ;
      description "Information about the location of the NF instance
        (e.g. geographic location, data center) defined by operator";
      reference "TS 29.510" ;
    }

    leaf capacity {
      mandatory true;
      type uint16 ;
      description "This parameter defines static capacity information
        in the range of 0-65535, expressed as a weight relative to other
        NF instances of the same type; if capacity is also present in the
        nfServiceList parameters, those will have precedence over this value.";
      reference "TS 29.510" ;
    }

    leaf nFSrvGroupId {
      type string ;
      description "This parameter defines identity of the group that is
        served by the NF instance.
        May be config false or true depending on the ManagedFunction.
        Config=true for Udrinfo. Config=false for UdmInfo and AusfInfo.
        Shall be present if ../nfType = UDM or AUSF or UDR. ";
      reference "TS 29.510" ;
    }
```

```
    leaf-list supportedDataSetIds {
      type enumeration {
        enum SUBSCRIPTION;
        enum POLICY;
        enum EXPOSURE;
        enum APPLICATION;
      }
      description "List of supported data sets in the UDR instance.
        May be present if ../nfType = UDR";
      reference "TS 29.510" ;
    }

    leaf-list smfServingAreas {
      type string ;
      description "Defines the SMF service area(s) the UPF can serve.
        Shall be present if ../nfType = UPF";
      reference "TS 29.510" ;
    }

    leaf priority {
      type uint16;
      description "This parameter defines Priority (relative to other NFs
        of the same type) in the range of 0-65535, to be used for NF selection;
        lower values indicate a higher priority. If priority is also present
        in the nfServiceList parameters, those will have precedence over
        this value. Shall be present if ../nfType = AMF ";
      reference "TS 29.510" ;
    }
  }

  typedef usageState {
    type enumeration {
      enum IDLE;
      enum ACTIVE;
      enum BUSY;
    }
    description "It describes whether or not the resource is actively in
      use at a specific instant, and if so, whether or not it has spare
      capacity for additional users at that instant. The value is READ-ONLY.";
    reference "ITU T Recommendation X.731";
  }

  grouping SAP {
    leaf host {
      type inet:host;
      mandatory true;
    }
    leaf port {
      type inet:port-number;
      mandatory true;
    }
    description "Service access point.";
    reference "TS 28.622";
  }

  typedef Mcc {
    description "The mobile country code consists of three decimal digits,
      The first digit of the mobile country code identifies the geographic
      region (the digits 1 and 8 are not used):";
    type string {
      pattern '[02-79][0-9][0-9]';
    }
    reference "3GPP TS 23.003 subclause 2.2 and 12.1";
  }

  typedef Mnc {
    description "The mobile network code consists of two or three
      decimal digits (for example: MNC of 001 is not the same as MNC of 01)";
    type string {
      pattern '[0-9][0-9][0-9]|[0-9][0-9]';
    }
    reference "3GPP TS 23.003 subclause 2.2 and 12.1";
  }

  grouping PLMNId {
    leaf mcc {
      mandatory true;
      type Mcc;
```

```
    }
    leaf mnc {
      mandatory true;
      type Mnc;
    }
    reference "TS 23.658";
  }

  typedef Nci {
    description "NR Cell Identity. The NCI shall be of fixed length of 36 bits
      and shall be coded using full hexadecimal representation.
      The exact coding of the NCI is the responsibility of each PLMN operator";
    reference "TS 23.003";
    type union {
      type string {
        length 36;
        pattern '[01]+';
      }
      type string {
        length 9;
        pattern '[a-fA-F0-9]*';
      }
    }
  }

  typedef OperationalState {
    reference "3GPP TS 28.625 and ITU-T X.731";
    type enumeration {
      enum DISABLED {
        value 0;
        description "The resource is totally inoperable.";
      }

      enum ENABLED {
        value 1;
        description "The resource is partially or fully operable.";
      }

    }
  }

  typedef AdministrativeState {
    reference "3GPP TS 28.625 and ITU-T X.731";
    type enumeration {
      enum LOCKED {
        value 0;
        description "The resource is administratively prohibited from performing
                 services for its users.";
      }

      enum UNLOCKED {
        value 1;
        description "The resource is administratively permitted to perform
          services for its users. This is independent of its inherent
          operability.";
      }

      enum SHUTTINGDOWN {
        value 2;
        description "Use of the resource is administratively permitted to
          existing instances of use only. While the system remains in
          the shutting down state the manager or the managed element
          may at any time cause the resource to transition to the
          locked state.";
      }
    }
  }

  typedef AvailabilityStatus {
      type enumeration {
          enum IN_TEST;
          enum FAILED;
          enum POWER_OFF;
          enum OFF_LINE;
          enum OFF_DUTY;
          enum DEPENDENCY;
          enum DEGRADED;
          enum NOT_INSTALLED;
```

```
        enum LOG_FULL;
     }
}

typedef CellState {
    type enumeration {
      enum IDLE;
      enum INACTIVE;
      enum ACTIVE;
   }
}

typedef SNssai {
  type union {
    type Sst;
   //optional support
    type Sd;
  }
  description "Single Network Slice Selection Assistance Information.";
  reference "TS 23.501 clause 5.15.2";
}

typedef Sst {
  type uint8;
}

typedef Sd {
  type string{
    length 6;
    pattern '[a-fA-F0-9]*';
  }
}

typedef Nrpci {
  type uint32;
  description "Physical Cell Identity (PCI) of the NR cell.";
  reference "TS 36.211 subclause 6.11";
}

typedef Tac {
  type int32 {
    range 0..16777215 ;
  }
  description "Tracking Area Code";
  reference "TS 23.003 clause 19.4.2.3";
}

typedef AmfRegionId {
  type union {
    type uint8 ;
    type string {
      length 8;
      pattern '[01]*';
    }
  }
  reference "clause 2.10.1 of 3GPP TS 23.003";
}

typedef AmfSetId {
  type union {
    type uint16 {
      range '0..1023';
    }
    type string {
      length 8;
      pattern '[01]*';
    }
  }
  reference "clause 2.10.1 of 3GPP TS 23.003";
}

typedef AmfPointer {
  type union {
    type uint8 {
      range '0..63';
    }
    type string {
      length 6;
```

```
        pattern '[01]*';
      }
    }
    reference "clause 2.10.1 of 3GPP TS 23.003";
  }

  grouping AmfIdentifier {
    leaf amfRegionId {
      type AmfRegionId;
    }
    leaf amfSetId {
      type AmfSetId;
    }
    leaf amfPointer {
      type AmfPointer;
    }
    description "The AMFI is constructed from an AMF Region ID,
      an AMF Set ID and an AMF Pointer.
      The AMF Region ID identifies the region,
      the AMF Set ID uniquely identifies the AMF Set within the AMF Region, and
      the AMF Pointer uniquely identifies the AMF within the AMF Set. ";
  }

// type definitions especially for core NFs

  typedef NfType {
    type enumeration {
      enum NRF;
      enum UDM;
      enum AMF;
      enum SMF;
      enum AUSF;
      enum NEF;
      enum PCF;
      enum SMSF;
      enum NSSF;
      enum UDR;
      enum LMF;
      enum GMLC;
      enum 5G_EIR;
      enum SEPP;
      enum UPF;
      enum N3IWF;
      enum AF;
      enum UDSF;
      enum BSF;
      enum CHF;
    }
  }

  typedef NotificationType {
    type enumeration {
      enum N1_MESSAGES;
      enum N2_INFORMATION;
      enum LOCATION_NOTIFICATION;
    }
  }

  typedef Load {
    description "Latest known load information of the NF, percentage ";
    type uint8 {
      range 0..100;
    }
  }

  typedef N1MessageClass {
    type enumeration {
      enum 5GMM;
      enum SM;
      enum LPP;
      enum SMS;
    }
  }

  typedef N2InformationClass {
    type enumeration {
      enum SM;
      enum NRPPA;
```

```
    enum PWS;
    enum PWS_BCAL;
    enum PWS_RF;
  }
}

grouping DefaultNotificationSubscription {

  leaf notificationType {
    type NotificationType;
  }

  leaf callbackUri {
    type inet:uri;
  }

  leaf n1MessageClass {
    type N1MessageClass;
  }

  leaf n2InformationClass {
    type N2InformationClass;
  }
}

grouping Ipv4AddressRange {
leaf start {
  type inet:ipv4-address;
  }
leaf end {
  type inet:ipv4-address;
  }
}

grouping Ipv6PrefixRange {
leaf start {
  type inet:ipv6-prefix;
  }
leaf end {
  type inet:ipv6-prefix;
  }
}

typedef NsiId {
  type string;
}

typedef UeMobilityLevel {
  type enumeration {
    enum STATIONARY;
    enum NOMADIC;
    enum RESTRICTED_MOBILITY;
    enum FULLY_MOBILITY;
  }
}

typedef ResourceSharingLevel {
    type enumeration {
      enum SHARED;
      enum NOT_SHARED;
    }
}

typedef TxDirection {
    type enumeration {
      enum DL;
      enum UL;
      enum DL_AND_UL;
    }
}

grouping AddressWithVlan {
  leaf ipAddress {
    type inet:ip-address;
  }
  leaf vlanId {
     type uint16;
  }
```

```
  }

  typedef DistinguishedName {    // TODO is this equivalent to TS 32.300 ?
    type string {
      pattern '([a-zA-Z][a-zA-Z0-9-]*=(\\( |#|\\|>|<|;|"|\+|,|[a-fA-F0-9]{2})|[^\\><;"+,# ])'
        + '((\\( |#|\\|>|<|;|"|\+|,|[a-fA-F0-9]{2})|[^\\><;"+,])*'
        + '(\\( |#|\\|>|<|;|"|\+|,|[a-fA-F0-9]{2})|[^\\><;"+, ]))?'
        + '[,\+])*[a-zA-Z][a-zA-Z0-9-]*=(\\( |#|\\|>|<|;|"|\+|,|[a-fA-F0-9]{2})|[^\\><;"+,# ])'
        + '((\\( |#|\\|>|<|;|"|\+|,|[a-fA-F0-9]{2})'
        + '|[^\\><;"+,])*(\\( |#|\\|>|<|;|"|\+|,|[a-fA-F0-9]{2})|[^\\><;"+, ]))?';
    }
    description "Represents the international standard for the representation
      of Distinguished Name (RFC 4512).
      The format of the DistinguishedName REGEX is:
      {AttributeType = AttributeValue}

      AttributeType consists of alphanumeric and hyphen (OIDs not allowed).
      All other characters are restricted.
      The Attribute value cannot contain control characters or the
        following characters : \\ > < ; \" + , (Comma) and White space
      The Attribute value can contain the following characters if they
        are excaped : \\ > < ; \" + , (Comma) and White space
      The Attribute value can contain control characters if its an escaped
        double digit hex number.
        Examples could be
          UID=nobody@example.com,DC=example,DC=com
            CN=John Smith,OU=Sales,O=ACME Limited,L=Moab,ST=Utah,C=US";
    reference  "RFC 4512 Lightweight Directory Access Protocol (LDAP):
                    Directory Information Models";
  } // recheck regexp it doesn't handle posix [:cntrl:]

  typedef QOffsetRange  {
    type int8 {
      range "-24 | -22 | -20 | -18 | -16 | -14 | -12 | -10 | -8 | -6 | " +
        " -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | " +
        " 12 | 14 | 16 | 18 | 20 | 22 | 24";
    }
    units dB;
  }
}
```

D.2.9 module _3gpp-common-fm.yang

```
module _3gpp-common-fm {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-fm";
  prefix "fm3gpp";

  import ietf-yang-types { prefix yang; }
  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-yang-types { prefix types3gpp; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";

  description "Defines a Fault Management model";

  reference "3GPP TS 28.623
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Solution Set (SS) definitions

      3GPP TS 28.622
      Generic Network Resource Model (NRM)
      Integration Reference Point (IRP);
      Information Service (IS)";

  revision 2020-06-03 { reference "CR-0091"; }
  revision 2020-02-24 {
    reference "S5-201365";
  }

    typedef eventType {
        type enumeration {
            enum COMMUNICATIONS_ALARM {
                value 2;
```

```
            }

            enum QUALITY_OF_SERVICE_ALARM {
                value 3;
            }

            enum PROCESSING_ERROR_ALARM {
                value 4;
            }

            enum EQUIPMENT_ALARM {
                value 5;
            }

            enum ENVIRONMENTAL_ALARM {
                value 6;
            }

            enum INTEGRITY_VIOLATION {
                value 7;
            }

            enum OPERATIONAL_VIOLATION {
                value 8;
            }

            enum PHYSICAL_VIOLATIONu {
                value 9;
            }

            enum SECURITY_SERVICE_OR_MECHANISM_VIOLATION {
                value 10;
            }

            enum TIME_DOMAIN_VIOLATION {
                value 11;
            }
        }

        description "General category for the alarm.";
    }

    typedef severity-level {
        type enumeration {
            enum CRITICAL { value 3; }
            enum MAJOR { value 4; }
            enum MINOR { value 5; }
            enum WARNING { value 6; }
            enum INDETERMINATE { value 7; }
            enum CLEARED { value 8; }
        }

        description "The possible alarm serverities.
            Aligned with ERICSSON-ALARM-MIB.";
    }

  grouping AlarmRecordGrp {
    description "Contains alarm information of an alarmed object instance.
      A new record is created in the alarm list when an alarmed object
      instance generates an alarm and no alarm record exists with the same
      values for objectInstance, alarmType, probableCause and specificProblem.
      When a new record is created the MnS producer creates an alarmId, that
      unambiguously identifies an alarm record in the AlarmList.

      Alarm records are maintained only for active alarms. Inactive alarms are
      automatically deleted by the MnS producer from the AlarmList.
      Active alarms are alarms whose
      a)    perceivedSeverity is not CLEARED, or whose
      b)    perceivedSeverity is CLEARED and its ackState is not ACKNOWLEDED.";

      leaf alarmId {
        type string;
        mandatory true;
        description "Identifies the alarmRecord";
      }

      leaf objectInstance {
        type string;
```

```
    config false ;
    mandatory true;
  }

  leaf notificationId {
    type string;
    config false ;
    mandatory true;
  }

  leaf alarmRaisedTime {
    type yang:date-and-time ;
    config false ;
  }

  leaf alarmChangedTime {
    type yang:date-and-time ;
    config false ;
    description "not applicable if related alarm has not changed";
  }

  leaf alarmClearedTime {
    type yang:date-and-time ;
    config false ;
    description "not applicable if related alarm was not cleared";
  }

  leaf alarmType {
    type eventType;
    config false ;
    description "General category for the alarm.";
  }

  leaf probableCause {
    type string;
    config false ;
  }

  leaf specificProblem {
    type string;
    config false ;
    reference "ITU-T Recommendation X.733 clause 8.1.2.2.";
  }

  leaf perceivedSeverity {
    type severity-level;
    description "This is Writable only if producer supports consumer
      to set perceivedSeverity to CLEARED";
  }

  leaf backedUpStatus {
    type string;
    config false ;
    description "Indicates if an object (the MonitoredEntity) has a back
      up. See definition in ITU-T Recommendation X.733 clause 8.1.2.4.";
  }

  leaf backUpObject {
    type string;
    config false ;
  }

  leaf trendIndication {
    type string;
    config false ;
    description "Indicates if some observed condition is getting better,
      worse, or not changing. ";
    reference "ITU-T Recommendation X.733 clause 8.1.2.6.";
  }

  grouping ThresholdPackGrp {
    leaf thresholdLevel {
      type string;
    }
    leaf thresholdValue {
      type string;
    }
    leaf hysteresis {
```

```
    type string;
    description "The hysteresis has a threshold high and a threshold
      low value that are different from the threshold value.
      A hysteresis, therefore, defines the threshold-high and
      threshold-low levels within which the measurementType value is
      allowed to oscillate without triggering the threshold crossing
      notification.";
  }
}

grouping ThresholdInfoGrp {
  leaf measurementType {
    type string;
    mandatory true;
  }

  leaf direction {
    type enumeration {
      enum INCREASING;
      enum DECREASING;
    }
    mandatory true;
    description "
      If it is 'Increasing', the threshold crossing notification is
      triggered when the measurement value equals or exceeds a
      thresholdValue.

      If it is 'Decreasing', the threshold crossing notification is
      triggered when the measurement value equals or below a
      thresholdValue.";
  }

  uses ThresholdPackGrp;
}

list thresholdInfo {
  config false ;
  uses ThresholdInfoGrp;
}

leaf stateChangeDefinition {
  type string;
  config false ;
  description "Indicates MO attribute value changes. See definition
    in ITU-T Recommendation X.733 clause 8.1.2.11.";
}

leaf monitoredAttributes {
  type string;
  config false ;
  description "Indicates MO attributes whose value changes are being
  monitored. See definition in ITU-T Recommendation X.733 clause 8.1.2.11.";
}

leaf proposedRepairActions {
  type string;
  config false ;
  description "Indicates proposed repair actions. See definition in
    ITU-T Recommendation X.733 clause 8.1.2.12.";
}

leaf additionalText {
  type string;
  config false ;
}

leaf additionalInformation {
  type string;
  config false ;
}

leaf rootCauseIndicator {
  type enumeration {
    enum YES;
    enum NO;
  }
  config false ;
  description "It indicates that this AlarmInformation is the root cause
```

```
        of the events captured by the notifications whose identifiers are in
        the related CorrelatedNotification instances.";
    }

    leaf ackTime  {
      type yang:date-and-time ;
      config false ;
      description "It identifies the time when the alarm has been
        acknowledged or unacknowledged the last time, i.e. it registers the
        time when ackState changes.";
    }

    leaf ackUserId  {
      type string;
      description "It identifies the last user who has changed the
        Acknowledgement State.";
    }

    leaf ackSystemId  {
      type string;
      description "It identifies the system (Management System) that last
        changed the ackState of an alarm, i.e. acknowledged or unacknowledged
        the alarm.";
    }

    leaf ackState  {
      type enumeration {
        enum ACKNOWLEDGED {
          description "The alarm has been acknowledged.";
        }
        enum UNACKNOWLEDGED {
          description "The alarm has unacknowledged or the alarm has never
            been acknowledged.";
        }
      }
    }

    leaf clearUserId {
      type string;
      description "Carries the identity of the user who invokes the
        clearAlarms operation.";
    }

    leaf clearSystemId {
      type string;
    }

    leaf serviceUser {
      type string;
      config false ;
      description "It identifies the service-user whose request for service
        provided by the serviceProvider led to the generation of the
        security alarm.";
    }

    leaf serviceProvider {
      type string;
      config false ;
      description "It identifies the service-provider whose service is
        requested by the serviceUser and the service request provokes the
        generation of the security alarm.";
    }

    leaf securityAlarmDetector {
      type string;
      config false ;
    }
}

grouping AlarmListGrp {
  description "Represents the AlarmList IOC.";

  leaf administrativeState {
    type types3gpp:AdministrativeState ;
    default LOCKED;
    description "When set to UNLOCKED, the alarm list is updated.
      When the set to LOCKED, the existing alarm records are not
      updated, and new alarm records are not added to the alarm list.";
```

```
    }

    leaf operationalState {
      type types3gpp:OperationalState ;
      default DISABLED;
      config false;
      description "The producer sets this attribute to ENABLED, indicating
        that it has the resource and ability to record alarm in AlarmList
        else, it sets the attribute to DISABLED.";
    }

    leaf numOfAlarmRecords {
      type uint32 ;
      config false;
      mandatory true;
      description "The number of alarm records in the AlarmList";
    }

    leaf lastModification {
      type yang:date-and-time ;
      config false;
      description "The last time when an alarm record was modified";
    }

    list alarmRecords {
      key alarmId;
      description "List of alarmRecords";
      uses AlarmRecordGrp;
    }
  }

  grouping FmSubtree {
    description "Contains FM related classes.
      Should be used in all classes (or classes inheriting from)
      - SubNetwork
      - ManagedElement

      If some YAM wants to augment these classes/list/groupings they must
      augment all user classes!";

    list AlarmList {
      key id;
      max-elements 1;
      description "The AlarmList represents the capability to store and manage
        alarm records. The management scope of an AlarmList is defined by all
        descendant objects of the base managed object, which is the object
        name-containing the AlarmList, and the base object itself.

        AlarmList instances are created by the system or are pre-installed.
        They cannot be created nor deleted by MnS consumers.

        When the alarm list is locked or disabled, the existing alarm records
        are not updated, and new alarm records are not added to the alarm list";


      uses top3gpp:Top_Grp ;
      container attributes {
        uses AlarmListGrp ;
      }
    }
  }

}
```

D.3 Void

Annex E (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2012-12					New version after approval	2.0.0	11.0.0
2013-06	SA#60	SP-130304	002	2	Correction of XML schema	11.0.0	11.1.0
2014-06	SA#64	SP-140332	003	1	upgrade XSD	11.1.0	11.2.0
		SP-140358	004	-	remove the feature support statements		
2014-09	SA#65	SP-140560	005	-	Update the link from Solution Set to Information Service due to the end of Release 12	11.2.0	12.0.0
2015-12	SA#70	SP-150691	006	1	Add missing id attribute	12.0.0	12.1.0
2016-01					Upgrade to Rel-13 (MCC)	12.1.0	13.0.0
2016-03	SA#71	SP-160031	010	1	Make the XML schema well formed	13.0.0	13.1.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2016-06	SA#72	SP-160407	0011	-	F	Update the link from IRP Solution Set to IRP Information Service	13.2.0
2017-03	SA#75	-	-	-		Promotion to Release 14 without technical change	14.0.0
2017-06	SA#76	SP-170510	0015	2	B	Modifications to align with IS to support Configuration Management for mobile networks that include virtualized network functions	14.1.0
2018-03	SA#79	SP-180060	0016	1	B	Add attribute peeParametersList to Solution Set definitions	15.0.0
2018-12	SA#82	SP-181042	0018	1	F	Update NRM root IOCs Solution Set to support priority	15.1.0
2019-03	SA#83	SP-190121	0020	1	F	Update Generic NRM Solution Set to support JSON	15.2.0
2019-06	SA#84	SP-190371	0021	-	B	Add IOCs for threshold monitoring control	16.0.0
2019-09	SA#85	SP-190745	0026	1	F	generate JSON definition for generic NRM based on new style guideline	16.1.0
2019-09	SA#85	SP-190744	0027	-	A	Add IDL XML YANG solutions	16.1.0
2019-09	SA#85	SP-190751	0029	-	A	Correct references and remove not need abbreviations	16.1.0
2019-12	SA#86	SP-191166	0031	1	F	Correct XML solution set for generic NRM	16.2.0
2019-12	SA#86	SP-191166	0035	-	B	Updates to YANG SS	16.2.0
2019-12	SA#86	SP-191173	0037	1	A	Add the definition of attribute measurementsList	16.2.0
2019-12	SA#86	SP-191166	0039	-	B	Add heartbeat control NRM fragment - Stage 3	16.2.0
2019-12	SA#86	SP-191166	0040	-	B	Add notification subscription control NRM fragment - Stage 3	16.2.0
2020-03	SA#87E	SP-200163	0041	2	B	Add configurable KPI control NRM	16.3.0
2020-03	SA#87E	SP-200163	0042	-	B	Add configurable FM - YANG Solution	16.3.0
2020-03	SA#87E	SP-200230	0043	1	F	Add OpenAPI definitions required by the ProvMnS	16.3.0
2020-03	SA#87E	SP-200169	0045		F	Correct errors in yang solution set	16.3.0
2020-03	SA#87E					Correction in the implementation of CR0041	16.3.1
2020-03	SA#87E					Correction of implementation	16.3.2
2020-07	SA#88E	SP-200490	0046	2	B	Add OpenAPI definitions for the FM control fragment	16.4.0
2020-07	SA#88E	SP-200489	0047	-	F	Correct OpenAPI definition for notificationTypes	16.4.0
2020-07	SA#88E	SP-200483	0079	2	B	Add trace control NRM fragment stage 3	16.4.0
2020-07	SA#88E	SP-200484	0080	-	D	Fix inconsistent formatting	16.4.0
2020-07	SA#88E	SP-200493	0081	-	B	Stage3 add the NRM fragment for SON management	16.4.0
2020-07	SA#88E	SP-200485	0082	-	F	Update the definition of SNssai	16.4.0
2020-07	SA#88E	SP-200490	0084	-	F	Update ManagedElement YANG moduel	16.4.0
2020-07	SA#88E	SP-200596	0085	1	F	Update Nrm YANG	16.4.0
2020-07	SA#88E	SP-200490	0087	2	F	Update PM control fragment (OpenAPI definitions)	16.4.0
2020-07	SA#88E	SP-200490	0088	-	F	Clarify usage of the VsDataContainer (OpenAPI definitions)	16.4.0
2020-07	SA#88E	SP-200490	0089	-	F	Add common data definitions (OpenAPI definitions)	16.4.0
2020-07	SA#88E	SP-200490	0091	-	F	Update FM control fragment (YANG definitions)	16.4.0
2020-07	SA#88E	SP-200490	0092	-	F	Update PM Control fragment (YANG definitions)	16.4.0
2020-07	SA#88E	SP-200490	0093	1	F	Correct genericNRM definition in XML solution	16.4.0

History

Document history		
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