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**Universal Mobile Telecommunications System (UMTS);
LTE;
5G;
Telecommunication management;
Generic Network Resource Model (NRM)
Integration Reference Point (IRP);
Solution Set (SS) definitions
(3GPP TS 28.623 version 17.12.0 Release 17)**



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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 [4]. For deployment scenarios using the IRP framework the latest Rel-14 version of TS 28.623 is applicable.

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] Void
- [14] 3GPP TS 32.160: "Management and orchestration; Management Service Template".
- [15] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [16] IETF RFC 8528: "YANG Schema Mount".

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].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [15], 3GPP TS 32.600 [3] 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] and 3GPP TS 32.600 [3].

JSON	JavaScript Object Notation
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	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
supportedMonitoringGroups	supportedMonitoringGroups	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
tjMDTCollectionPeriodRrmNR	tjMDTCollectionPeriodRrmNR	tjMDTCollectionPeriodRrmNR-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
excessPacketDelayThresholds	excessPacketDelayThresholds	excessPacketDelayThresholds-Type

A.3 Solution Set (SS) 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;
    }
}
```

```

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

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

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

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 PMAAdministrativeStateType
    {
        LOCKED,
        SHUTTINGDOWN,
        UNLOCKED
    };
};

```



```
enum PMSOperationalStateType
{
    ENABLED,
    DISABLED
};

typedef MReferenceSet ManagedObjectDNSType;

typedef MReferenceSet ManagedObjectDNSType;

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 TS 28.622 [4].

The XML file formats are based on XML W3C REC-xml11-20060816 [8], W3C XML Schema Definition Language (XSD) 1.1 Part 1: Structures [10] W3C XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes [11] and W3C REC-xml-names-20060816 [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 (SS) 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"/>
    </sequence>
  </complexType>

```

```
<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"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

```

```

        <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:pMAAdministrativeStateType"/>
                                <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"/>
              </all>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
</element>

```

```

        <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>
        </sequence>
      </extension>
    </complexContent>
  </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 "TS28623_ComDefs.yaml"

```
<CODE BEGINS>
openapi: 3.0.1
info:
  title: Common Type Definitions
  version: 17.10.0
  description: >-
    OAS 3.0.1 specification of common type definitions in the Generic NRM
    Â© 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 28.623; Generic NRM; Common type definitions
  url: http://www.3gpp.org/ftp/Specs/archive/28_series/28.623/
paths: {}
components:
  schemas:

    Float:
      type: number
      format: float
    DateTime:
      type: string
      format: date-time
    Latitude:
      type: number
      format: float
      minimum: -90
      maximum: 90
    Longitude:
      type: number
      format: float
      minimum: -180
      maximum: 180

    Dn:
      type: string
```

```

DnList:
  type: array
  items:
    $ref: '#/components/schemas/Dn'

Mcc:
  type: string
  pattern: '^[0-9]{3}$'
Mnc:
  type: string
  pattern: '^[0-9]{2,3}$'
Nid:
  type: string
  pattern: '^[A-Fa-f0-9]{11}$'
PlmnId:
  type: object
  properties:
    mcc:
      $ref: '#/components/schemas/Mcc'
    mnc:
      $ref: '#/components/schemas/Mnc'
Tac:
  type: string
  pattern: '([A-Fa-f0-9]{4}$)|([A-Fa-f0-9]{6}$)'
UtraCellId:
  type: integer
EutraCellId:
  type: string
  pattern: '^[A-Fa-f0-9]{7}$'
NrCellId:
  type: string
  pattern: '^[A-Fa-f0-9]{9}$'
TimeWindow:
  type: object
  properties:
    startTime:
      $ref: '#/components/schemas/DateTime'
    endTime:
      $ref: '#/components/schemas/DateTime'
GeoCoordinate:
  type: object
  properties:
    latitude:
      $ref: '#/components/schemas/Latitude'
    longitude:
      $ref: '#/components/schemas/Longitude'
    altitude:
      $ref: '#/components/schemas/Float'
ConvexGeoPolygon:
  type: array
  items:
    $ref: '#/components/schemas/GeoCoordinate'
  minItems: 3
GeoArea:
  type: object
  properties:
    convexGeoPolygon:
      $ref: '#/components/schemas/ConvexGeoPolygon'
GeoAreaToCellMapping:
  type: object
  properties:
    geoArea:
      $ref: '#/components/schemas/GeoArea'
    associationThreshold:
      type: integer
AreaOfInterest:
  oneOf:
    - type: array
      items:
        $ref: '#/components/schemas/GeoAreaToCellMapping'
      minItems: 1
    - type: array
      items:
        $ref: 'TS28623_GenericNrm.yaml#/components/schemas/Tai'
    - type: array
      items:
        $ref: '#/components/schemas/NrCellId'
    - type: array

```

```

    items:
      $ref: '#/components/schemas/EutraCellId'
  - type: array
    items:
      $ref: '#/components/schemas/UtraCellId'

Fqdn:
  type: string
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])$'
  example: '198.51.100.1'
Ipv6Addr:
  type: string
  allOf:
    - pattern: '^((:|0?|([1-9a-f][0-9a-f]{0,3})))(0?|([1-9a-f][0-9a-f]{0,3}))(:|0?|([1-9a-f][0-9a-f]{0,3}))$'
    - pattern: '^((([:]+){7}([:]+))|((([:]+)*[:]+)?::(([:]+)*[:]+)?))$'
  example: '2001:db8:85a3::8a2e:370:7334'
Ipv6Prefix:
  type: string
  allOf:
    - pattern: '^((:|0?|([1-9a-f][0-9a-f]{0,3})))(0?|([1-9a-f][0-9a-f]{0,3}))(:|0?|([1-9a-f][0-9a-f]{0,3}))(\|/((0-9){2}|(1[0-1][0-9])|(12[0-8])))$'
    - pattern: '^((([:]+){7}([:]+))|((([:]+)*[:]+)?::(([:]+)*[:]+)?))(\|/.)$'
  example: '2001:db8:abcd:12::0/64'
IpAddr:
  oneOf:
    - $ref: '#/components/schemas/Ipv4Addr'
    - $ref: '#/components/schemas/Ipv6Addr'
    - $ref: '#/components/schemas/Ipv6Prefix'
HostAddr:
  # This definition will be deprecated, when all occurrences of HostAddr
  # are replaced by Host.
  oneOf:
    - $ref: '#/components/schemas/Ipv4Addr'
    - $ref: '#/components/schemas/Ipv6Addr'
    - $ref: '#/components/schemas/Fqdn'
Host:
  oneOf:
    - $ref: '#/components/schemas/IpAddr'
    - $ref: '#/components/schemas/Fqdn'
Uri:
  type: string

AdministrativeState:
  type: string
  enum:
    - LOCKED
    - UNLOCKED
OperationalState:
  type: string
  enum:
    - ENABLED
    - DISABLED
UsageState:
  type: string
  enum:
    - IDLE
    - ACTIVE
    - BUSY

AttributeNameValuePairSet:
  description: >-
  The key of this map is the attribute name, and the value the attribute value.
  type: object
  minProperties: 1
  additionalProperties:
    nullable: true
AttributeValueChangeSet:
  description: >-
  The first array item contains the attribute name value pairs with the new values,
  and the second array item the attribute name value pairs with the optional old values.
  type: array
  items:
    $ref: '#/components/schemas/AttributeNameValuePairSet'
  minItems: 1

```

```

    maxItems: 2

Filter:
  description: >-
    The filter format shall be compliant to XPath 1.0.
  type: string
SystemDN:
  type: string

NotificationId:
  type: integer
NotificationType:
  oneOf:
    - $ref: 'TS28532_FaultMnS.yaml#/components/schemas/AlarmNotificationTypes'
    - $ref: 'TS28532_ProvMnS.yaml#/components/schemas/CmNotificationTypes'
    - $ref: 'TS28532_PerfMnS.yaml#/components/schemas/PerfNotificationTypes'
    - $ref: 'TS28532_HeartbeatNtf.yaml#/components/schemas/HeartbeatNotificationTypes'
    - $ref: 'TS28532_FileDataReportingMnS.yaml#/components/schemas/FileNotificationTypes'
NotificationHeader:
  type: object
  properties:
    href:
      $ref: '#/components/schemas/Uri'
    notificationId:
      $ref: '#/components/schemas/NotificationId'
    notificationType:
      $ref: '#/components/schemas/NotificationType'
    eventTime:
      $ref: '#/components/schemas/DateTime'
    systemDN:
      $ref: '#/components/schemas/SystemDN'
  required:
    - href
    - notificationId
    - notificationType
    - eventTime
    - 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
<CODE ENDS>

```

C.4.3 OpenAPI document "TS28623_GenericNrm.yaml"

```

<CODE BEGINS>
openapi: 3.0.1
info:
  title: Generic NRM
  version: 17.11.0
  description: >-
    OAS 3.0.1 definition of the Generic NRM
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.
externalDocs:
  description: 3GPP TS 28.623; Generic NRM
  url: http://www.3gpp.org/ftp/Specs/archive/28_series/28.623/
paths: {}
components:
  schemas:

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

RegistrationState:
  type: string
  enum:
    - REGISTERED

```

```

- DEREGISTERED
VnfParameter:
  type: object
  properties:
    vnfInstanceId:
      type: string
    vnfId:
      type: string
    flavourId:
      type: string
    autoScalable:
      type: boolean
PeeParameter:
  type: object
  properties:
    siteIdentification:
      type: string
    siteDescription:
      type: string
    siteLatitude:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Latitude'
    siteLongitude:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Longitude'
    siteAltitude:
      type: number
      format: float
    equipmentType:
      type: string
    environmentType:
      type: string
    powerInterface:
      type: string
ThresholdInfo:
  type: object
  properties:
    performanceMetrics:
      type: array
      items:
        type: string
    thresholdDirection:
      type: string
      enum:
        - UP
        - DOWN
        - UP_AND_DOWN
    thresholdValue:
      oneOf:
        - type: integer
        - $ref: 'TS28623_ComDefs.yaml#/components/schemas/Float'
    hysteresis:
      oneOf:
        - type: integer
          minimum: 0
        - type: number
          format: float
          minimum: 0
Operation:
  type: object
  properties:
    name:
      type: string
    allowedNFTypes:
      $ref: '#/components/schemas/NFType'
    operationSemantics:
      $ref: '#/components/schemas/OperationSemantics'
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
OperationSemantics:
  type: string
  enum:
    - REQUEST_RESPONSE
    - SUBSCRIBE_NOTIFY
SAP:
  type: object
  properties:
    host:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/HostAddr'
    port:
      type: integer
NFServiceType:
  type: string
  enum:
    - Namf_Communication
    - Namf_EventExposure
    - Namf_MT
    - Namf_Location
    - Nsmf_PDUSession
    - Nsmf_EventExposure
    - Others
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
    reportingPeriods:
      type: array
      items:
        type: integer
        minimum: 1
ReportingCtrl:
  oneOf:
    - type: object
      properties:
        fileReportingPeriod:
          type: integer
    - type: object
      properties:
        fileReportingPeriod:
          type: integer
        notificationRecipientAddress:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
    - type: object
      properties:
        fileReportingPeriod:

```

```
    type: integer
    fileLocation:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
  - type: object
    properties:
      streamTarget:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
Scope:
  type: object
  properties:
    scopeType:
      type: string
      enum:
        - BASE_ONLY
        - BASE_ALL
        - BASE_NTH_LEVEL
        - BASE_SUBTREE
    scopeLevel:
      type: integer
ProcessMonitor:
  description: >-
    This data type is the "ProcessMonitor" data type without specialisations.
  type: object
  properties:
    jobId:
      type: string
    status:
      type: string
      enum:
        - NOT_STARTED
        - RUNNING
        - FINSHED
        - FAILED
        - PARTIALLY_FAILED
        - CANCELLING
        - CANCELLED
    progressPercentage:
      type: integer
      minimum: 0
      maximum: 100
    progressStateInfo:
      type: string
    resultStateInfo:
      type: string
    startTime:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
    endTime:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
    timer:
      type: integer
FileDownloadJobProcessMonitor:
  description: >-
    This data type is the "ProcessMonitor" data type with specialisations
    for usage in the "FileDownloadJob".
  type: object
  properties:
    jobId:
      type: string
    status:
      type: string
      enum:
        - NOT_STARTED
        - RUNNING
        - FINSHED
        - FAILED
        - CANCELLING
        - CANCELLED
    progressPercentage:
      type: integer
      minimum: 0
      maximum: 100
    progressStateInfo:
      type: string
    resultStateInfo:
      oneOf:
        - type: string
          enum:
            - NULL
```

```

    - UNKNOWN
    - NO_STORAGE
    - LOW_MEMROY
    - NO_CONNECTION_TO_REMOTE_SERVER
    - FILE_NOT_AVAILABLE
    - DNS_CANNOT_BE_RESOLVED
    - TIMER_EXPIRED
    - OTHER
  - type: string
  startTime:
    $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
  endTime:
    $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
  timer:
    type: integer
AreaScope:
  oneOf:
  - type: array
    items:
      $ref: '#/components/schemas/EutraCellId'
  - type: array
    items:
      $ref: '#/components/schemas/NrCellId'
  - type: array
    items:
      $ref: '#/components/schemas/Tac'
  - type: array
    items:
      $ref: '#/components/schemas/Tai'
Tai:
  type: object
  properties:
    mcc:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Mcc'
    mnc:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Mnc'
    tac:
      $ref: '#/components/schemas/Tac'
AreaConfig:
  type: object
  properties:
    freqInfo:
      $ref: '#/components/schemas/FreqInfo'
    pciList:
      type: array
      items:
        type: integer
FreqInfo:
  description: specifies the carrier frequency and bands used in a cell.
  type: object
  properties:
    arfcn:
      type: integer
    freqBands:
      type: array
      items:
        type: integer
MbsfnArea:
  type: object
  properties:
    mbsfnAreaId:
      type: integer
      minimum: 1
    earfcn:
      type: integer
      minimum: 1
Tac:
  type: string
  pattern: '([A-Fa-f0-9]{4}$)|([A-Fa-f0-9]{6}$)'
EutraCellId:
  type: string
  pattern: '^([A-Fa-f0-9]){7}$'
NrCellId:
  type: string
  pattern: '^([A-Fa-f0-9]){9}$'
IpAddr:
  oneOf:
  - $ref: 'TS28623_ComDefs.yaml#/components/schemas/Ipv4Addr'

```



```
- $ref: 'TS28623_ComDefs.yaml#/components/schemas/Ipv6Addr'
```

```
ManagementData:
  oneOf:
  - type: array
    items:
      type: string
      enum:
        - COVERAGE
        - CAPACITY
        - ENERGY_EFFICIENCY
        - MOBILITY
        - ACCESSIBILITY
  - type: array
    items:
      type: string
NodeFilter:
  type: object
  properties:
    areaOfInterest:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/AreaOfInterest'
    networkDomain:
      type: string
      enum:
        - CN
        - RAN
    cpUpType:
      type: string
      enum:
        - CP
        - UP
    sst:
      type: integer
```

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

```
jobType-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

listOfInterfaces-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
      - N70
      - N71
      - NU1
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
      - N16
      - N16a
      - N38
SMSFInterfaces:
  type: array
  items:
    type: string
    enum:
      - N20
      - N21
UDMInterfaces:
  type: array
  items:
    type: string
    enum:
      - N8
      - N10
      - N13
      - N21
      - NU1
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
```

listOfNETypes-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
    - AMF
    - PCF
    - SMF
    - UPF
    - AUSF
    - SMSF
    - HSS
    - UDM

pLMNTarget-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: 'TS28623_ComDefs.yaml#/components/schemas/Mcc'
    mnc:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Mnc'

listOfTraceMetrics:
  description: The trace metrics to be reported. See 3GPP TS 32.422 clause 10 for additional
details.
  type: array
  items:
    type: string

traceDepth-Type:
  description: Specifies how detailed information should be recorded in the Network Element. The
Trace Depth is a parameter 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

traceReference-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: 'TS28623_ComDefs.yaml#/components/schemas/Mcc'
    mnc:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Mnc'
    traceId:
      type: string

traceReportingFormat-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

traceTarget-Type:
type: object
description: Trace target conveying both the type and value of the target ID. For additional
details see 3GPP TS 32.422
properties:
  TargetIdType:
type: string
enum:
- IMSI
- IMEI
- IMEISV
- PUBLIC_ID
- UTRAN_CELL
- E-UTRAN_CELL
- NG-RAN_CELL
- eNB
- RNC
- gNB
- SUPI
  TargetIdValue:
type: string

triggeringEvents-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 details.
properties:
  MSC_SERVER:
type: array
items:
type: string
enum:
- MO_MT_CALLS
- MO_MT_SMS
- LU_IMSIattach_IMSIdetach
- HANDOVER
- SS
  SGSN:
type: array
items:
type: string
enum:
- PDPcontext
- MO_MT_SMS
- RAU_GPRSattach_GPRSdetach
- MBMScontext
  MGW:
type: array
items:
type: string
enum:
- CONTEXT
  GGSN:
type: array
items:
type: string
enum:
- PDPcontext
- MBMScontext
  IMS:
type: array
items:
type: string
enum:
- SIPsession_StandaloneTransaction
  BM_SC:
type: array
items:
type: string
enum:
- MBMSactivation
  MME:
type: array

```

```
items:
  type: string
  enum:
    - UEinitiatedPDNconnectivityRequest
    - ServiceRequest
    - InitialAttach_TAU_Detach
    - UEinitiatedPDNdisconnection
    - BearerActivationModificationDeletion
    - Handover
SGW:
  type: array
  items:
    type: string
    enum:
      - PDNconnectionCreation
      - PDNconnectionTermination
      - BearerActivationModificationDeletion
PGW:
  type: array
  items:
    type: string
    enum:
      - PDNconnectionCreation
      - PDNconnectionTermination
      - BearerActivationModificationDeletion
AMF:
  type: array
  items:
    type: string
    enum:
      - Registration
      - ServiceRequest
      - Handover
      - UEderegistration
      - NetworkDeregistration
      - UEMobilityFromEPC
      - UEMobilityToEPC
SMF:
  type: array
  items:
    type: string
    enum:
      - PDUsessionEstablishment
      - PDUsessionModification
      - PDUsessionRelease
      - PDUsessionUPactivationDeactivation
      - MobilityBtw3gppAndN3gppTo5GC
      - MobilityFromEpc
PCF:
  type: array
  items:
    type: string
    enum:
      - AMpolicy
      - Smpolicy
      - Authorization
      - BDTpolicy
UPF:
  type: array
  items:
    type: string
    enum:
      - N4Session
AUSF:
  type: array
  items:
    type: string
    enum:
      - UEauthentication
NEF:
  type: array
  items:
    type: string
    enum:
      - EventExposure
      - PFDmanagement
      - ParameterProvision
      - Trigger
```



```
NRF:
  type: array
  items:
    type: string
    enum:
      - NFmanagement
      - NFdiscovery
NSSF:
  type: array
  items:
    type: string
    enum:
      - NSSelection
      - NSSAI
SMSF:
  type: array
  items:
    type: string
    enum:
      - SMservice
UDM:
  type: array
  items:
    type: string
    enum:
      - UEcontext
      - SubscriberData
      - UEauthentication
      - EventExposure
```

anonymizationOfMDTData-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
```

beamLevelMeasurement-Type:
description: Determines whether beam level measurements shall be included in case of immediate MDT M1 measurement in NR. For additional details see 3GPP TS 32.422 clause 5.10.40.
type: boolean

collectionPeriodRRMLTE-Type:
description: See details in 3GPP TS 32.422 clause 5.10.20.

```
type: string
enum:
  - 100ms
  - 1000ms
  - 1024ms
  - 1280ms
  - 2048ms
  - 2560ms
  - 5120ms
  - 10000ms
  - 10240ms
  - 60000ms
```

collectionPeriodM6LTE-Type:
description: See details in 3GPP TS 32.422 clause 5.10.32.

```
type: string
enum:
  - 1024ms
  - 2048ms
  - 5120ms
  - 10240ms
```

collectionPeriodM7LTE-Type:
description: See details in 3GPP TS 32.422 clause 5.10.33.

```
type: integer
minimum: 1
maximum: 60
```

collectionPeriodRRMUMTS-Type:
description: See details in 3GPP TS 32.422 clause 5.10.21.

```
type: string
enum:
  - 100ms
```

- 250ms
- 500ms
- 1000ms
- 2000ms
- 3000ms
- 4000ms
- 6000ms

collectionPeriodRRMNR-Type:

description: See details in 3GPP TS 32.422 clause 5.10.30.

type: string

enum:

- 1024ms
- 2048ms
- 5120ms
- 10240ms
- 60000ms

collectionPeriodM6NR-Type:

description: See details in 3GPP TS 32.422 clause 5.10.34.

type: string

enum:

- 120ms
- 240ms
- 480ms
- 640ms
- 1024ms
- 2048ms
- 5120ms
- 10240ms
- 20480ms
- 40960ms
- 1min
- 6min
- 12min
- 30min

collectionPeriodM7NR-Type:

description: See details in 3GPP TS 32.422 clause 5.10.35.

type: integer

minimum: 1

maximum: 60

eventListForEventTriggeredMeasurement-Type:

description: See details in 3GPP TS 32.422 clause 5.10.28.

type: string

enum:

- OUT_OF_COVERAGE
- A2_EVENT

eventThreshold-Type:

description: See details in 3GPP TS 32.422 clause 5.10.7 (LTE/NR Event A2 RSRP, RSRQ, SINR), 5.10.13 (UMTS Event 1f) and 5.10.14 (UMTS Event 1i).

type: object

properties:

EventThresholdRSRP:

oneOf:

- type: integer
minimum: 0
maximum: 97
- type: integer
minimum: 0
maximum: 127

EventThresholdRSRQ:

oneOf:

- type: integer
minimum: 0
maximum: 34
- type: integer
minimum: 0
maximum: 127

EventThresholdSINR:

type: integer

minimum: 0

maximum: 127

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

listOfMeasurements-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
          - M1_EVENT_TRIGGERED
          - M8
          - M9

loggingDuration-Type:
  description: See details in 3GPP TS 32.422 clause 5.10.9.
  type: string
  enum:
    - 600s
    - 1200s
    - 2400s
    - 3600s
    - 5400s
    - 7200s

loggingInterval-Type:
```

```
description: See details in 3GPP TS 32.422 clause 5.10.8.
type: object
properties:
  UMTS:
    type: array
    items:
      type: string
      enum:
        - 1.28s
        - 2.56s
        - 5.12s
        - 10.24s
        - 20.48s
        - 30.72s
        - 40.96s
        - 61.44s
  LTE:
    type: array
    items:
      type: string
      enum:
        - 1.28s
        - 2.56s
        - 5.12s
        - 10.24s
        - 20.48s
        - 30.72s
        - 40.96s
        - 61.44s
  NR:
    type: array
    items:
      type: string
      enum:
        - 0.32s
        - 0.64s
        - 1.28s
        - 2.56s
        - 5.12s
        - 10.24s
        - 20.48s
        - 30.72s
        - 40.96s
        - 61.44s
        - INFINITY

eventThresholdL1-Type:
description: See details in 3GPP TS 32.422 clause 5.10.36.
type: object
properties:
  RSRP:
    type: integer
    minimum: 0
    maximum: 127
  RSRQ:
    type: integer
    minimum: 0
    maximum: 127

hysteresisL1-Type:
description: See details in 3GPP TS 32.422 clause 5.10.37.
type: integer
minimum: 0
maximum: 30

timeToTriggerL1-Type:
description: See details in 3GPP TS 32.422 clause 5.10.38.
type: string
enum:
  - 0ms
  - 40ms
  - 64ms
  - 80ms
  - 100ms
  - 128ms
  - 160ms
  - 256ms
  - 320ms
```

- 480ms
- 512ms
- 640ms
- 1024ms
- 1280ms
- 2560ms
- 5120ms

measurementPeriodLTE-Type:
description: See details in 3GPP TS 32.422 clause 5.10.23.
type: string
enum:

- 1024ms
- 2048ms
- 5120ms
- 10240ms
- 1min

measurementPeriodUMTS-Type:
description: See details in 3GPP TS 32.422 clause 5.10.22.
type: string
enum:

- 1000ms
- 2000ms
- 3000ms
- 4000ms
- 6000ms
- 8000ms
- 12000ms
- 16000ms
- 20000ms
- 24000ms
- 28000ms
- 32000ms
- 64000ms

measurementQuantity-Type:
description: See details in 3GPP TS 32.422 clause 5.10.15.
type: string
enum:

- CPICH_EcNo
- CPICH_RSCP
- PathLoss

eventThresholdUphUMTS-Type:
description: See details in 3GPP TS 32.422 clause 5.10.39.
type: integer
minimum: 0
maximum: 31

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

- type: object
- properties:
 - mcc:
 - \$ref: 'TS28623_ComDefs.yaml#/components/schemas/Mcc'
 - mnc:
 - \$ref: 'TS28623_ComDefs.yaml#/components/schemas/Mnc'

maxItems: 16

positioningMethod-Type:
description: See details in 3GPP TS 32.422 clause 5.10.19.
type: string
enum:

- GNSS
- E-CELL_ID

reportAmount-Type:
description: See details in 3GPP TS 32.422 clause 5.10.6.
type: string
enum:

- 1
- 2
- 4
- 8
- 16

- 32
- 64
- INFINITY

reportingTrigger-Type:

description: See details in 3GPP TS 32.422 clause 5.10.4.

type: array

items:

type: string

enum:

- PERIODICAL
- A2_FOR_LTE_NR
- 1F_FOR_UMTS
- 1I_FOR_UMTS_MCPS_TDD
- A2_TRIGGERED_PERIODIC_FOR_LTE_NR
- ALL_CONFIGURED_RRM_FOR_LTE_NR
- ALL_CONFIGURED_RRM_FOR_UMTS

reportInterval-Type:

description: See details in 3GPP TS 32.422 clause 5.10.5.

type: object

properties:

UMTS:

type: array

items:

type: string

enum:

- 250ms
- 500ms
- 1000ms
- 2000ms
- 3000ms
- 4000ms
- 6000ms
- 8000ms
- 12000ms
- 16000ms
- 20000ms
- 24000ms
- 28000ms
- 32000ms
- 64000ms

LTE:

type: array

items:

type: string

enum:

- 120ms
- 240ms
- 480ms
- 640ms
- 1024ms
- 2048ms
- 5120ms
- 10240ms
- 60000ms
- 360000ms
- 720000ms
- 1800000ms
- 3600000ms

NR:

type: array

items:

type: string

enum:

- 120ms
- 240ms
- 480ms
- 640ms
- 1024ms
- 2048ms
- 5120ms
- 10240ms
- 20480ms
- 40960ms
- 60000ms
- 360000ms
- 720000ms

```
- 1800000ms

reportType-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

sensorInformation-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

traceCollectionEntityId-Type:
  description: See details in 3GPP TS 32.422 clause 5.10.11. Only TCE Id value may be sent over
the air to the UE being configured for Logged MDT.
  type: integer

excessPacketDelayThreshold-Type:
  description: Excess Packet Delay Threshold for NR MDT. See details in 3GPP TS 32.422 clause
4.1.1 and 4.1.2.
  type: object
  properties:
    fiveQIValue:
      type: integer
    excessPacketDelayThresholdValue:
      type: string
      enum:
        - 0.25MS
        - 0.5MS
        - 1MS
        - 2MS
        - 4MS
        - 5MS
        - 10MS
        - 20MS
        - 30MS
        - 40MS
        - 50MS
        - 60MS
        - 70MS
        - 80MS
        - 90MS
        - 100MS
        - 150MS
        - 300MS
        - 500MS

excessPacketDelayThresholds-Type:
  description: Array of type excessPacketDelayThreshold-Type.
  type: array
  items:
    $ref: '#/components/schemas/excessPacketDelayThreshold-Type'
  minItems: 0
  maxItems: 255

#----- 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 occurrences of Top-Attr
# are replaced by Top.
  type: object
  properties:
    id:
      type: string
      nullable: true
    objectClass:
      type: string
    objectInstance:
```

```

    $ref: 'TS28623_ComDefs.yaml#/components/schemas/Dn'
  VsDataContainer:
    $ref: '#/components/schemas/VsDataContainer-Multiple'
  required:
  - id
Top:
  type: object
  properties:
    id:
      type: string
      nullable: true
    objectClass:
      type: string
    objectInstance:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Dn'
    VsDataContainer:
      $ref: '#/components/schemas/VsDataContainer-Multiple'
  required:
  - id

```

#----- 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:
      type: array
      items:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/Mcc'
    priorityLabel:
      type: integer
    supportedPerfMetricGroups:
      type: array
      items:
        $ref: '#/components/schemas/SupportedPerfMetricGroup'
    supportedTraceMetrics:
      type: array
      items:
        type: string
ManagedElement-Attr:
  type: object
  properties:
    dnPrefix:
      type: string
    managedElementTypeList:
      type: array
      items:
        type: string
    userLabel:
      type: string
    locationName:
      type: string
    managedBy:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/DnList'
    vendorName:
      type: string
    userDefinedState:
      type: string
    swVersion:
      type: string
    priorityLabel:
      type: integer
    supportedPerfMetricGroups:
      type: array
      items:
        $ref: '#/components/schemas/SupportedPerfMetricGroup'
    supportedTraceMetrics:
      type: array
      items:
        type: string
SubNetwork-nc0:

```



```

type: object
properties:
  ManagementNode:
    $ref: '#/components/schemas/ManagementNode-Multiple'
  MnsAgent:
    $ref: '#/components/schemas/MnsAgent-Multiple'
  MeContext:
    $ref: '#/components/schemas/MeContext-Multiple'
  PerfMetricJob:
    $ref: '#/components/schemas/PerfMetricJob-Multiple'
  ThresholdMonitor:
    $ref: '#/components/schemas/ThresholdMonitor-Multiple'
  TraceJob:
    $ref: '#/components/schemas/TraceJob-Multiple'
  ManagementDataCollection:
    $ref: '#/components/schemas/ManagementDataCollection-Multiple'
  NtfSubscriptionControl:
    $ref: '#/components/schemas/NtfSubscriptionControl-Multiple'
  AlarmList:
    $ref: '#/components/schemas/AlarmList-Single'
  FileDownloadJob:
    $ref: '#/components/schemas/FileDownloadJob-Multiple'
  Files:
    $ref: '#/components/schemas/Files-Multiple'
  MnsRegistry:
    $ref: '#/components/schemas/MnsRegistry-Single'
ManagedElement-nc0:
  type: object
  properties:
    MnsAgent:
      $ref: '#/components/schemas/MnsAgent-Multiple'
    PerfMetricJob:
      $ref: '#/components/schemas/PerfMetricJob-Multiple'
    ThresholdMonitor:
      $ref: '#/components/schemas/ThresholdMonitor-Multiple'
    TraceJob:
      $ref: '#/components/schemas/TraceJob-Multiple'
    NtfSubscriptionControl:
      $ref: '#/components/schemas/NtfSubscriptionControl-Multiple'
    AlarmList:
      $ref: '#/components/schemas/AlarmList-Single'
    FileDownloadJob:
      $ref: '#/components/schemas/FileDownloadJob-Multiple'
    Files:
      $ref: '#/components/schemas/Files-Multiple'

```

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

```

ManagedFunction-Attr:
  type: object
  properties:
    userLabel:
      type: string
    vnfParametersList:
      type: array
      items:
        $ref: '#/components/schemas/VnfParameter'
    peeParametersList:
      type: array
      items:
        $ref: '#/components/schemas/PeeParameter'
    priorityLabel:
      type: integer
    supportedPerfMetricGroups:
      type: array
      items:
        $ref: '#/components/schemas/SupportedPerfMetricGroup'
    supportedTraceMetrics:
      type: array
      items:
        type: string
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:
    jobType:
      $ref: '#/components/schemas/jobType-Type'
    listOfInterfaces:
      $ref: '#/components/schemas/listOfInterfaces-Type'
    listOfNETypes:
      $ref: '#/components/schemas/listOfNETypes-Type'
    pLMNTarget:
      $ref: '#/components/schemas/pLMNTarget-Type'
    listOfTraceMetrics:
      type: array
    traceReportingConsumerUri:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
    traceCollectionEntityIPAddress:
      $ref: '#/components/schemas/IpAddr'
    traceDepth:
      $ref: '#/components/schemas/traceDepth-Type'
    traceReference:
      $ref: '#/components/schemas/traceReference-Type'
    traceRecordingSessionReference:
      type: string
    jobId:
      type: string
    traceReportingFormat:
      $ref: '#/components/schemas/traceReportingFormat-Type'
    traceTarget:
      $ref: '#/components/schemas/traceTarget-Type'
    triggeringEvents:
      $ref: '#/components/schemas/triggeringEvents-Type'
    anonymizationOfMDTData:
      $ref: '#/components/schemas/anonymizationOfMDTData-Type'
    areaConfigurationForNeighCell:
      type: array
      items:
        $ref: '#/components/schemas/AreaConfig'
      maxItems: 32
    areaScope:
      type: array
      items:
        $ref: '#/components/schemas/AreaScope'
    beamLevelMeasurement:
      $ref: '#/components/schemas/beamLevelMeasurement-Type'
    collectionPeriodRRMLTE:
      $ref: '#/components/schemas/collectionPeriodRRMLTE-Type'
    collectionPeriodM6LTE:
      $ref: '#/components/schemas/collectionPeriodM6LTE-Type'
    collectionPeriodM7LTE:
      $ref: '#/components/schemas/collectionPeriodM7LTE-Type'
    collectionPeriodRRMUMTS:
      $ref: '#/components/schemas/collectionPeriodRRMUMTS-Type'
    collectionPeriodRRMNR:
      $ref: '#/components/schemas/collectionPeriodRRMNR-Type'
    collectionPeriodM6NR:
      $ref: '#/components/schemas/collectionPeriodM6NR-Type'
    collectionPeriodM7NR:
      $ref: '#/components/schemas/collectionPeriodM7NR-Type'
    eventListForEventTriggeredMeasurement:
      $ref: '#/components/schemas/eventListForEventTriggeredMeasurement-Type'
    eventThreshold:
      $ref: '#/components/schemas/eventThreshold-Type'
    listOfMeasurements:
      $ref: '#/components/schemas/listOfMeasurements-Type'
    loggingDuration:
      $ref: '#/components/schemas/loggingDuration-Type'
    loggingInterval:
      $ref: '#/components/schemas/loggingInterval-Type'
    eventThresholdL1:
      $ref: '#/components/schemas/eventThresholdL1-Type'
    hysteresisL1:
      $ref: '#/components/schemas/hysteresisL1-Type'
```

```

timeToTriggerL1:
  $ref: '#/components/schemas/timeToTriggerL1-Type'
mbsfnAreaList:
  type: array
  items:
    $ref: '#/components/schemas/MbsfnArea'
  maxItems: 8
measurementPeriodLTE:
  $ref: '#/components/schemas/measurementPeriodLTE-Type'
measurementPeriodUMTS:
  $ref: '#/components/schemas/measurementPeriodUMTS-Type'
measurementQuantity:
  $ref: '#/components/schemas/measurementQuantity-Type'
eventThresholdUphUMTS:
  $ref: '#/components/schemas/eventThresholdUphUMTS-Type'
pLMNList:
  $ref: '#/components/schemas/pLMNList-Type'
positioningMethod:
  $ref: '#/components/schemas/positioningMethod-Type'
reportAmount:
  $ref: '#/components/schemas/reportAmount-Type'
reportingTrigger:
  $ref: '#/components/schemas/reportingTrigger-Type'
reportInterval:
  $ref: '#/components/schemas/reportInterval-Type'
reportType:
  $ref: '#/components/schemas/reportType-Type'
sensorInformation:
  $ref: '#/components/schemas/sensorInformation-Type'
traceCollectionEntityId:
  $ref: '#/components/schemas/traceCollectionEntityId-Type'
excessPacketDelayThresholds:
  $ref: '#/components/schemas/excessPacketDelayThresholds-Type'

ManagedFunction-nc0:
  type: object
  properties:
    PerfMetricJob:
      $ref: '#/components/schemas/PerfMetricJob-Multiple'
    ThresholdMonitor:
      $ref: '#/components/schemas/ThresholdMonitor-Multiple'
    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'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            userLabel:
              type: string
            nFServiceType:
              $ref: '#/components/schemas/NFServiceType'
            SAP:
              $ref: '#/components/schemas/SAP'

```

```

    operations:
      type: array
      items:
        $ref: '#/components/schemas/Operation'
    administrativeState:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/AdministrativeState'
    operationalState:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/OperationalState'
    usageState:
      $ref: 'TS28623_ComDefs.yaml#/components/schemas/UsageState'
    registrationState:
      $ref: '#/components/schemas/RegistrationState'
ManagementNode-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            userLabel:
              type: string
            managedElements:
              $ref: 'TS28623_ComDefs.yaml#/components/schemas/DnList'
            vendorName:
              type: string
            userDefinedState:
              type: string
            locationName:
              type: string
            swVersion:
              type: string
        MnsAgent:
          $ref: '#/components/schemas/MnsAgent-Multiple'
MnsAgent-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            systemDN:
              $ref: 'TS28623_ComDefs.yaml#/components/schemas/Dn'
MeContext-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            dnPrefix:
              type: string
PerfMetricJob-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object
          properties:
            administrativeState:
              $ref: 'TS28623_ComDefs.yaml#/components/schemas/AdministrativeState'
            operationalState:
              $ref: 'TS28623_ComDefs.yaml#/components/schemas/OperationalState'
            jobId:
              type: string
            performanceMetrics:
              type: array
              items:
                type: string
            granularityPeriod:
              type: integer
              minimum: 1
            objectInstances:
              $ref: 'TS28623_ComDefs.yaml#/components/schemas/DnList'
            rootObjectInstances:

```

```

        $ref: 'TS28623_ComDefs.yaml#/components/schemas/DnList'
      reportingCtrl:
        $ref: '#/components/schemas/ReportingCtrl'
    Files:
      $ref: '#/components/schemas/Files-Multiple'
ThresholdMonitor-Single:
  allOf:
  - $ref: '#/components/schemas/Top'
  - type: object
    properties:
      attributes:
        type: object
      properties:
        administrativeState:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/AdministrativeState'
        operationalState:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/OperationalState'
        thresholdInfoList:
          type: array
          items:
            $ref: '#/components/schemas/ThresholdInfo'
        monitorGranularityPeriod:
          type: integer
          minimum: 1
        objectInstances:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/DnList'
        rootObjectInstances:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/DnList'
NtfSubscriptionControl-Single:
  allOf:
  - $ref: '#/components/schemas/Top'
  - type: object
    properties:
      attributes:
        type: object
      properties:
        notificationRecipientAddress:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
        notificationTypes:
          type: array
          items:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/NotificationType'
        scope:
          $ref: '#/components/schemas/Scope'
        notificationFilter:
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/Filter'
      HeartbeatControl:
        $ref: '#/components/schemas/HeartbeatControl-Single'
HeartbeatControl-Single:
  allOf:
  - $ref: '#/components/schemas/Top'
  - type: object
    properties:
      attributes:
        type: object
      properties:
        heartbeatNtfPeriod:
          type: integer
          minimum: 0
        triggerHeartbeatNtf:
          type: boolean
TraceJob-Single:
  allOf:
  - $ref: '#/components/schemas/Top'
  - type: object
    properties:
      attributes:
        $ref: '#/components/schemas/TraceJob-Attr'
      Files:
        $ref: '#/components/schemas/Files-Multiple'
ManagementDataCollection-Single:
  allOf:
  - $ref: '#/components/schemas/Top'
  - type: object
    properties:
      attributes:
        type: object
      properties:

```

```

managementData:
  $ref: '#/components/schemas/ManagementData'
targetNodeFilter:
  $ref: '#/components/schemas/NodeFilter'
collectionTimeWindow:
  $ref: 'TS28623_ComDefs.yaml#/components/schemas/TimeWindow'
reportingCtrl:
  $ref: '#/components/schemas/ReportingCtrl'
dataScope:
  type: string
  enum:
    - SNSSAI
    - 5QI
AlarmList-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object
        properties:
          administrativeState:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/AdministrativeState'
          operationalState:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/OperationalState'
          numOfAlarmRecords:
            type: integer
          lastModification:
            $ref: 'TS28623_ComDefs.yaml#/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: 'TS28532_FaultMnS.yaml#/components/schemas/AlarmRecord'
FileDownloadJob-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object
        properties:
          fileLocation:
            type: string
          notificationRecipientAddress:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
          cancelJob:
            type: string
            enum:
              - TRUE
              - FALSE
          jobMonitor:
            $ref: '#/components/schemas/FileDownloadJobProcessMonitor'
Files-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object
        properties:
          numberOfFiles:
            type: integer
          jobRef:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/Dn'
          jobId:
            type: string
          File:
            $ref: '#/components/schemas/File-Multiple'
File-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        attributes:
          type: object

```

```

    properties:
      fileLocation:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
      fileCompression:
        type: string
      fileSize:
        type: integer
      fileDataType:
        type: string
        enum:
          - PERFORMANCE
          - TRACE
          - ANALYTICS
          - PROPRIETARY
      fileFormat:
        type: string
      fileReadyTime:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
      fileExpirationTime:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/DateTime'
      fileContent:
        type: string
      jobRef:
        $ref: 'TS28623_ComDefs.yaml#/components/schemas/Dn'
      jobId:
        type: string
MnsRegistry-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        MnsInfo:
          $ref: '#/components/schemas/MnsInfo-Multiple'
MnsInfo-Single:
  allOf:
    - $ref: '#/components/schemas/Top'
    - type: object
      properties:
        mnsLabel:
          type: string
        mnsType:
          type: string
          enum:
            - ProvMnS
            - FaultSupervisionMnS
            - StreamingDataReportingMnS
            - FileDataReportingMnS
        mnsVersion:
          type: string
        mnsAddress:
          description: Resource URI as defined in the relevant Technical Specification
          $ref: 'TS28623_ComDefs.yaml#/components/schemas/Uri'
        mnsScope:
          description: >-
            List of the managed object instances that can be accessed using the MnS.
            If a complete SubNetwork can be accessed using the MnS, this attribute may
            contain the DN of the SubNetwork instead of the DNs of the individual managed
            entities within the SubNetwork.
          type: array
          items:
            $ref: 'TS28623_ComDefs.yaml#/components/schemas/Dn'

#----- Definition of YAML 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'
MnsAgent-Multiple:
  type: array

```

```

    items:
      $ref: '#/components/schemas/MnsAgent-Single'
MeContext-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/MeContext-Single'
PerfMetricJob-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/PerfMetricJob-Single'
ThresholdMonitor-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/ThresholdMonitor-Single'
TraceJob-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/TraceJob-Single'
ManagementDataCollection-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/ManagementDataCollection-Single'
NtfSubscriptionControl-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/NtfSubscriptionControl-Single'
FileDownloadJob-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/FileDownloadJob-Single'
Files-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/Files-Single'
File-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/File-Single'
MnsInfo-Multiple:
  type: array
  items:
    $ref: '#/components/schemas/MnsInfo-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/MnsAgent-Single'
    - $ref: '#/components/schemas/MeContext-Single'
    - $ref: '#/components/schemas/ManagedNFService-Single'
    - $ref: '#/components/schemas/PerfMetricJob-Single'
    - $ref: '#/components/schemas/ThresholdMonitor-Single'
    - $ref: '#/components/schemas/TraceJob-Single'
    - $ref: '#/components/schemas/ManagementDataCollection-Single'
    - $ref: '#/components/schemas/NtfSubscriptionControl-Single'
    - $ref: '#/components/schemas/HeartbeatControl-Single'
    - $ref: '#/components/schemas/AlarmList-Single'
    - $ref: '#/components/schemas/FileDownloadJob-Single'
    - $ref: '#/components/schemas/Files-Single'
    - $ref: '#/components/schemas/File-Single'
    - $ref: '#/components/schemas/MnsRegistry-Single'
    - $ref: '#/components/schemas/MnsInfo-Single'

```

<CODE ENDS>

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

```
<CODE BEGINS>
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.
  Copyright 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";
  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 2023-09-17 { reference CR-0270 ; }
  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;
  }
}
}
}
<CODE ENDS>

```

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

```

<CODE BEGINS>
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-subscription-control { prefix subscr3gpp; }
  import _3gpp-common-fm { prefix fm3gpp; }
  import _3gpp-common-trace { prefix trace3gpp; }
  import _3gpp-common-files { prefix files3gpp; }
  import _3gpp-5gc-nrm-configurable5qiset { prefix fiveqi3gpp; }
  import _3gpp-5gc-nrm-ecmconnectioninfo { prefix econn3gpp ; }

  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
    Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
    TTA, TTC). All rights reserved.";
  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 2024-01-29 { reference CR-0327 ; }
  revision 2023-11-05 { reference CR-0306 ; }
  revision 2023-09-17 { reference CR-0270 ; }
  revision 2022-07-26 { reference CR-0180 ; }
  revision 2021-01-16 { reference "CR-0120"; }
  revision 2020-08-06 { reference "CR-0102"; }
  revision 2020-08-03 { reference "CR-0095"; }
  revision 2020-06-08 { reference "CR-0092"; }
  revision 2020-05-12 { reference "CR0084"; }
  revision 2020-02-24 { reference "S5-201365"; }
  revision 2019-06-17 { reference " S5-203316"; }
  revision 2019-05-08 { reference "Initial revision"; }

  feature EcmConnectionInfoUnderManagedElement {
    description "The EcmConnectionInfo shall be contained under
    ManagedElement";
  }
}

```

```
feature Configurable5QISetUnderManagedElement {
  description "The Configurable5QISet shall be contained under
  ManagedElement";
}

feature FilesUnderManagedElement {
  description "Files shall be contained under ManagedElement";
}

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

feature SubscriptionControlUnderManagedElement {
  description "The SubscriptionControlSubtree shall be contained under
  ManagedElement";
}

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

feature TraceUnderManagedElement {
  description "The TraceSubtree shall be contained under ManagedElement";
}

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

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

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

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

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

feature CESManagementFunction {
  description "Class 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 Distinguished 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;

  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;
  }

  uses meas3gpp:SupportedPerfMetricGroupGrp;

  leaf-list supportedTraceMetrics {
```

```

type string;
config false;
description "List of trace metrics. When this attribute is contained in
a managed object it defines the trace metrics supported for this
object and all descendant objects.

Trace metrics include trace messages, MDT measurements
(Immediate MDT, Logged MDT, Logged MBSFN MDT), RLF and RCEF reports,
see TS 32.422. Trace metrics are identified with their metric
identifier. The metric identifier is constructed as defined
in clause 10 of TS 32.422.";
}
}

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 virtualization 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 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 ManagedElement 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 single 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
functionality (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 gNBDFunction";

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

uses meas3gpp:MeasurementSubtree {
if-feature MeasurementsUnderManagedElement;
}

uses subscr3gpp:SubscriptionControlSubtree {
if-feature SubscriptionControlUnderManagedElement;
}

uses fm3gpp:FmSubtree {
if-feature FmUnderManagedElement;
}

uses trace3gpp:TraceSubtree {
if-feature TraceUnderManagedElement;
}

uses files3gpp:FilesSubtree {
if-feature FilesUnderManagedElement;
}

```

```

    uses fiveqi3gpp:Configurable5QISetSubtree {
      if-feature Configurable5QISetUnderManagedElement;
    }

    uses econn3gpp:EcmConnectionInfoSubtree {
      if-feature EcmConnectionInfoUnderManagedElement;
    }
  }
}
<CODE ENDS>

```

D.2.3 module _3gpp-common-managed-function.yang

```

<CODE BEGINS>
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-yang-extensions { prefix yext3gpp; }
  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-measurements { prefix meas3gpp; }
  import _3gpp-common-trace { prefix trace3gpp; }

  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.
    Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
    TTA, TTC). All rights reserved.";
  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 2024-02-23 { reference CR-0347 ; }
  revision 2023-12-17 { reference CR-0327 ; }
  revision 2023-09-17 { reference CR-0270 ; }
  revision 2022-10-31 { reference CR-0195; }
  revision 2022-01-07 { reference "CR-0146"; }
  revision 2021-01-25 { reference "CR-0122"; }
  revision 2020-09-30 { reference "CR-bbbb"; }
  revision 2020-08-06 { reference "CR-0102"; }
  revision 2020-08-03 { reference "CR-0095"; }
  revision 2020-06-23 { reference "CR-085"; }
  revision 2020-06-08 { reference "CR-0092"; }
  revision 2019-11-21 { reference "S5-197275, S5-197735"; }
  revision 2019-10-28 { reference S5-193518 ; }
  revision 2019-06-18 { reference "Initial revision"; }

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

  feature TraceUnderManagedFunction {
    description "The TraceSubtree shall be contained under ManagedFunction";
  }

  grouping OperationGrp {
    description "This data type represents an Operation.";
    reference "3gpp TS 28.622";

    leaf name {
      type string;
      mandatory true;
      yext3gpp:notNotifyable;
      yext3gpp:inVariant;
    }
  }

  leaf-list allowedNFTypes {

```

```
    type string;
    min-elements 1;
    description "The type of the managed NF service instance
        The specific 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";
    yext3gpp:inVariant;
}

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 specific values allowed are described in clause 7.2 of TS 23.501";
        yext3gpp:notNotifiable;
        yext3gpp:inVariant;
    }

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

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

    leaf administrativeState {
        type types3gpp:BasicAdministrativeState;
        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;

  list vnfParametersList {
    key vnfInstanceId;
    description "Contains the parameter set of the VNF
    instance(s) corresponding to an NE.
    The presence of this list indicates that the ManagedFunction
    represented is realized by one or more VNF instance(s). Otherwise it
    shall be absent.
    The presence of a vnfParametersList entry, whose vnfInstanceId with a
    string length of zero, in createMO operation can trigger the
    instantiation of the related VNF/VNFC instances.";

    leaf vnfInstanceId {
      type string ;
      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";
  }
}

```



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

list peeParametersList {
  key idx;
  description "Contains the parameter set for the control
    and monitoring of power, energy and environmental parameters of
    ManagedFunction instance(s).";

  leaf idx { type uint32; }

  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
      for BTSFunction, RNCFUNCTION, GNBDUFunction and
      NRSectorCarrier 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
      for BTSFunction, RNCFUNCTION, GNBDUFunction and
      NRSectorCarrier
      instance(s).";
  }

  leaf siteAltitude {
    type decimal64 {
      fraction-digits 4;
    }
    description "The altitude of the site where the ManagedFunction
      instance resides, in the unit of meter. This attribute is
      optional for BTSFunction, RNCFUNCTION, GNBDUFunction and
      NRSectorCarrier 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 ;
    }

    uses trace3gpp:TraceSubtree {
        if-feature TraceUnderManagedFunction ;
    }
}
}
<CODE ENDS>

```

D.2.4 module _3gpp-common-measurements.yang

```

<CODE BEGINS>
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; }
    import _3gpp-common-yang-extensions { prefix yext3gpp; }
    import _3gpp-common-files { prefix files3gpp; }

    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
 Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC). All rights reserved.";

```

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 2024-02-23 { reference CR-0347; }
revision 2024-01-29 { reference "CR-0327"; }
revision 2023-11-17 { reference "CR-0298"; }
revision 2023-11-05 { reference CR-0306; }
revision 2023-09-17 { reference CR-0270 ; }
revision 2023-02-15 { reference "CR-0239"; }
revision 2022-11-03 { reference "CR-0193"; }
revision 2022-10-31 { reference CR-0195; }
revision 2021-07-22 { reference "CR-0137"; }
revision 2020-11-06 { reference "CR-0118"; }
revision 2020-09-04 { reference "CR-000107"; }
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 { reference " "; }

```

```

feature FilesUnderPerfMetricJob {
    description "Files shall be contained under PerfMetricJob";
}

```

```

grouping ThresholdInfoGrp {
    description "Defines a single threshold level.";
}

```

```

leaf-list performanceMetrics {
    type string;
    min-elements 1;
    description "List of performance metrics.
Performance metrics include measurements defined in TS 28.552 and KPIs
defined in TS 28.554 [28]. Performance metrics can also be specified
by other SDOs, or be vendor specific. Performance metrics are
identified with their names.

```

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 [28] the name is defined in the KPI definitions template as the component designated with e).

A name can also identify a vendor specific performance metric or a group of vendor specific performance metrics.";

```

}
leaf thresholdDirection {

```

```

type enumeration {
  enum UP;
  enum DOWN;
  enum UP_AND_DOWN;
}
must '. = "UP_AND_DOWN" or not(..hysteresis)' {
  error-message "In case a threshold with hysteresis is configured, the "
    +"threshold direction attribute shall be set to 'UP_AND_DOWN'.";
}
mandatory true;
description "Direction of a threshold indicating the direction for which
  a threshold crossing triggers a threshold.

When the threshold direction is configured to 'UP', the associated
threshold is triggered only when the performance metric value is going
up upon reaching or crossing the threshold value. The threshold is not
triggered, when the performance metric is going down upon reaching or
crossing the threshold value.

Vice versa, when the threshold direction is configured to 'DOWN', the
associated threshold is triggered only when the performance metric is
going down upon reaching or crossing the threshold value. The threshold
is not triggered, when the performance metric is going up upon reaching
or crossing the threshold value.

When the threshold direction is set to 'UP_AND_DOWN' the threshold is
active in both directions.

In case a threshold with hysteresis is configured, the threshold
direction attribute shall be set to 'UP_AND_DOWN'.";
}

leaf thresholdValue {
  type union {
    type int64;
    type decimal64 {
      fraction-digits 2;
    }
  }
  mandatory true;
  description "Value against which the monitored performance metric is
    compared at a threshold level in case the hysteresis is zero";
}

leaf hysteresis {
  type union {
    type uint64;
    type decimal64 {
      fraction-digits 2;
      range "0..max";
    }
  }
  must '. >= 0';
  description "Hysteresis of a threshold. If this attribute is present
    the monitored performance metric is not compared against the
    threshold value as specified by the thresholdValue attribute but
    against a high and low threshold value given by

    threshold-high = thresholdValue + hysteresis
    threshold-low = thresholdValue - hysteresis

When going up, the threshold is triggered when the performance metric
reaches or crosses the high threshold value. When going down, the
threshold is triggered when the performance metric reaches or crosses
the low threshold value.

A hysteresis may be present only when the monitored performance
metric is not of type counter that can go up only. If present
for a performance metric of type counter, it shall be ignored.";
}
}

grouping SupportedPerfMetricGroupGrp {
  list SupportedPerfMetricGroups {
    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 GNBDFunction.";

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 are identified by name.

  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).

  For non-3GPP specified measurements the name is defined
  elsewhere.";
}

leaf-list granularityPeriods {
  type uint32 {
    range 1..max ;
  }
  units seconds;
  description "Granularity periods supported for the associated
  measurement types. The period is defined in seconds.";
}

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;
}

leaf-list reportingPeriods {
  type uint32 {
    range 1..max ;
  }
  units seconds;
  description "Reporting periods supported for the associated
  measurement types. The period is defined in seconds.";
}
}
}

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

  leaf administrativeState {
    default UNLOCKED;
    type types3gpp:BasicAdministrativeState ;
    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 jobId {
    type string;
    description "Id for a PerfMetricJob job.";
    yext3gpp:inVariant;
  }
}

```

```
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 identified 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.";
}

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.";
}

uses types3gpp:ReportingCtrl {
  refine "reportingCtrl/file-based-reporting/fileReportingPeriod" {
    must '(number(..)*"60") mod number(../granularityPeriod) = "0"' {
      error-message
        "The time-period must be a multiple of the granularityPeriod.";
    }
  }
}

leaf _linkToFiles {
  type string;
  config false;
  mandatory true;
  yext3gpp:notNotifyable ;
  description "Link to a 'Files' object.";
  yext3gpp:inVariant;
}

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

  leaf administrativeState {
    default UNLOCKED;
    type types3gpp:BasicAdministrativeState ;
    description "Enables or disables the ThresholdMonitor.";
  }

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

```

list thresholdInfoList {
  key idx;
  min-elements 1;
  leaf idx { type uint32 ; }
  uses ThresholdInfoGrp;
  description "List of threshold info.";
}

leaf monitorGranularityPeriod {
  type uint32 {
    range "1..max";
  }
  units second;
  mandatory true;
  description "Granularity period used to monitor measurements for
  threshold crossings.";
}

leaf-list objectInstances {
  type types3gpp:DistinguishedName;
  yext3gpp:notNotifyable;
}

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.";
  yext3gpp:notNotifyable;
}
}

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.
  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 back to enabled.

  The jobId attribute can be used to associate metrics from multiple
  PerfMetricJob instances. The jobId can be included when reporting
  performance metrics to allow a MnS consumer to associate received
  metrics for the same purpose. For example, it is possible to configure
  the same jobId value for multiple PerfMetricJob instances required to
  produce the measurements for a specific KPI.

  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.

For file-based reporting, all performance metrics that are produced related to a `'PerfMetricJob'` instance for a reporting period shall be stored in a single reporting file.

When the administrative state is set to `'UNLOCKED'` after the creation of a `'PerfMetricJob'` the first granularity period shall start. When the administrative state is set to `'LOCKED'` or the operational state to `'DISABLED'`, the ongoing reporting period shall be aborted, for streaming the ongoing granularity period. When the administrative state is set back to `'UNLOCKED'` or the operational state to `'ENABLED'` a new reporting period shall start, in case of streaming a new granularity period.

Changes of all other configurable attributes shall take effect only at the beginning of the next reporting period, for streaming at the beginning of the next granularity period.

When the `'PerfMetricJob'` is deleted, the ongoing reporting period shall be aborted, for streaming the ongoing granularity period.

A `PerfMetricJob` creation request shall fail, when the requested performance metrics, the requested granularity period, the requested reporting 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 ;
}
uses files3gpp:FilesSubtree {
  if-feature FilesUnderPerfMetricJob;
}
}
```

```
list ThresholdMonitor {
  key id;
  description "Represents a threshold monitor for performance metrics.
  It can be contained by SubNetwork, ManagedElement, or ManagedFunction.
  A threshold monitor checks for threshold crossings of performance metric
  values and generates a notification when that happens.
```

The `ThresholdMonitor` is used only when NRM based threshold monitoring is supported.

To activate threshold monitoring, a MnS consumer needs to create a `ThresholdMonitor` instance on the MnS producer. For ultimate deactivation of threshold monitoring, the MnS consumer should delete the monitor to free up resources on the MnS producer.

For temporary suspension of threshold monitoring, the MnS consumer can manipulate the value of the administrative state attribute. The MnS producer may disable threshold monitoring as well, for example in

overload situations. This situation is indicated by the MnS producer with setting the operational state attribute to disabled. When monitoring is resumed the operational state is set again to enabled.

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

The optional 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.

Multiple thresholds can be defined for multiple performance metric sets in a single monitor using thresholdInfoList. The attribute monitorGranularityPeriod defines the granularity period to be applied. The value is a multiple of a supported granularity period for the measurements being monitored.

A threshold is defined using the attributes thresholdValue , thresholdDirection and hysteresis.

When hysteresis is absent or carries no information, a threshold is triggered when the thresholdValue is reached or crossed. When hysteresis is present, two threshold values are specified for the threshold as follows: A high threshold value equal to the threshold value plus the hysteresis value, and a low threshold value equal to the threshold value minus the hysteresis value. When the monitored performance metric increases, the threshold is triggered when the high threshold value is reached or crossed. When the monitored performance metric decreases, the threshold is triggered when the low threshold value is reached or crossed. The hysteresis ensures that the performance metric value can oscillate around a comparison value without triggering each time the threshold when the threshold value is crossed. Using the thresholdDirection attribute a threshold can be configured in such a manner that it is triggered only when the monitored performance metric is going up or down upon reaching or crossing the threshold.

A ThresholdMonitor creation request shall be rejected, if the performance metrics requested to be monitored, the requested granularity period, or the requested combination thereof is not supported by the MnS producer. A creation request may fail, when the performance metrics requested to be monitored are not produced by a PerfMetricJob.

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

A threshold crossing event detected by a 'ThresholdMonitor' shall trigger a 'notifyThresholdCrossing' notification. To subscribe to 'notifyThresholdCrossing' notifications the MnS consumer shall specify one or more 'ThresholdMonitor' instances in the subscription. All threshold crossings detected by the specified 'ThresholdMonitor' instances are sent as 'notifyThresholdCrossing' to subscribed MnS consumers (unless filtered out by the 'notificationFilter' attribute of 'NtfSubscriptionControl').";

```

uses top3gpp:Top_Grp ;
container attributes {
  uses ThresholdMonitorGrp ;
}
}
}
}
<CODE ENDS>

```

D.2.5 module _3gpp-common-subnetwork.yang

```

<CODE BEGINS>
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-subscription-control { prefix subscr3gpp; }
  import _3gpp-common-fm { prefix fm3gpp; }
  import _3gpp-common-trace { prefix trace3gpp; }
  import ietf-yang-schema-mount { prefix yangmnt; }
  import _3gpp-common-files { prefix files3gpp; }
  import _3gpp-5gc-nrm-configurable5qiset { prefix fiveqi3gpp; }
  import _3gpp-5gc-nrm-ecmconnectioninfo { prefix econn3gpp; }

  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
  Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";
  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 2024-01-29 { reference CR-0327 ; }
  revision 2023-11-05 { reference CR-0306 ; }
  revision 2023-09-17 { reference CR-0270 ; }
  revision 2022-07-26 { reference CR-0180 ; }
  revision 2021-01-16 { reference "CR-0120"; }
  revision 2020-08-06 { reference "CR-0102"; }
  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 {
    reference "Initial revision";
  }

  feature EcmConnectionInfoUnderSubNetwork {
    description "The EcmConnectionInfo shall be contained under
    Subnetwork";
  }

  feature Configurable5QISetUnderSubNetwork {
    description "The Configurable5QISet shall be contained under
    Subnetwork";
  }

  feature FilesUnderSubNetwork {
    description "Files shall be contained under Subnetwork";
  }
}

```

```
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";
}

feature SubscriptionControlUnderSubNetwork {
  description "The SubscriptionControlSubtree shall be contained under
  SubNetwork";
}

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

feature TraceUnderSubNetwork {
  description "The TraceSubtree shall be contained under SubNetwork";
}

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

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

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

feature DPCICongfigurationFunction {
  description "Class representing Distributed SON or Domain-Centralized SON
  function of PCI configuration feature. The DPCICongfigurationFunction shall
  be contained under SubNetwork.;"
}

feature CPCICongfigurationFunction {
  description "Class representing Cross Domain-Centralized SON function of PCI
  configuration feature. The CPCICongfigurationFunction shall be contained
  under SubNetwork.;"
}

feature CESManagementFunction {
  description "Class 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;

    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;
    }

    uses meas3gpp:SupportedPerfMetricGroupGrp;

    leaf-list supportedTraceMetrics {
      type string;
      config false;
      description "List of trace metrics. When this attribute is contained in
        a managed object it defines the trace metrics supported for this
        object and all descendant objects.

        Trace metrics include trace messages, MDT measurements
        (Immediate MDT, Logged MDT, Logged MBSFN MDT), RLF and RCEF reports,
        see TS 32.422. Trace metrics are identified with their metric
        identifier. The metric identifier is constructed as defined
        in clause 10 of TS 32.422.";
    }
  }
}

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 containing 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 subscr3gpp:SubscriptionControlSubtree {
  if-feature SubscriptionControlUnderSubNetwork;
}

uses fm3gpp:FmSubtree {
  if-feature FmUnderSubNetwork;
}

uses trace3gpp:TraceSubtree {
  if-feature TraceUnderSubNetwork;
}

uses files3gpp:FilesSubtree {
  if-feature FilesUnderSubNetwork;
}

uses fiveqi3gpp:Configurable5QISetSubtree {
  if-feature Configurable5QISetUnderSubNetwork;
}

uses econn3gpp:EcmConnectionInfoSubtree {
  if-feature EcmConnectionInfoUnderSubNetwork;
}

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

// augment external parts here
}
}
<CODE ENDS>

```

D.2.6 module _3gpp-common-top.yang

```

<CODE BEGINS>
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.
  Copyright 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";
  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 2023-09-17 { reference CR-0270 ; }
  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";
    }
  }
}

```

```
}
<CODE ENDS>
```

D.2.6a module _3gpp-common-subscription-control.yang

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

  import _3gpp-common-yang-extensions { prefix yext3gpp; }
  import _3gpp-common-top { prefix top3gpp; }

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

  description "Defines IOCs for subscription and heartbeat control.
    Copyright 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
    TTA, TTC). All rights reserved.";
  reference "3GPP TS 28.623
    Generic Network Resource Model (NRM)
    Integration Reference Point (IRP);
    Solution Set (SS) definitions
    3GPP TS 28.623";

  revision 2023-09-17 { reference CR-0270 ; }
  revision 2023-08-11 { reference "CR-0259"; }
  revision 2022-10-31 { reference CR-0195; }
  revision 2021-01-16 { reference "CR-0120"; }
  revision 2020-08-26 { reference "CR-0106"; }
  revision 2019-11-29 { 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.";

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

  leaf triggerHeartbeatNtf {
    type boolean;
    default false;
    description "Setting this attribute to 'true' triggers an immediate
    additional heartbeat notification emission. Setting the value to
    'false' has no observable result.

    The periodicity of notifyHeartbeat emission is not changed.

    After triggering the heartbeat the system SHALL set the value
    back to false.";
    yext3gpp:notNotifiable;
  }
}

grouping SubscriptionControlSubtree {
  description "Contains notification subscription 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 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 notifications are sent to the notificationRecipientAddress.

To receive notifications, a MnS consumer has to create NtfSubscriptionControl object instances 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 {
  description "MnS consumers (i.e. notification recipients) use heartbeat
  notifications to monitor the communication channels between themselves
  and MnS producers configured to emit notifications.
```

A HeartbeatControl instance allows controlling the emission of heartbeat notifications by MnS producers. The recipients of heartbeat notifications are specified by the notificationRecipientAddress attribute of the NtfSubscriptionControl instance containing the HeartbeatControl instance.

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 an instance does not trigger an emission of a heartbeat notification.

Once the instance is created, heartbeat notifications are emitted with a periodicity defined by the value of the heartbeatNtfPeriod attribute. No heartbeat notifications are emitted if the value is equal to zero. Setting a zero value to a non zero value, or a non zero value to a different non zero value, triggers an immediate heartbeat notification, that is the base for the new heartbeat period. Setting a non zero value to a zero value stops emitting heartbeats immediately; no final heartbeat notification is sent.

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.

Whether and when to emit heartbeat notifications is controlled by HeartbeatControl. Subscription for heartbeat is not supported via the NtfSubscriptionControl.";

```
max-elements 1;
key id;
uses top3gpp:Top_Grp;

container attributes {
  uses HeartbeatControlGrp;
}
}
```



```

}
}
<CODE ENDS>

```

D.2.7 module _3gpp-common-yang-extensions.yang

```

<CODE BEGINS>
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 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). 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 substataements 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 2023-09-17 { reference CR-0270 ; }
  revision 2022-10-31 { reference CR-0195; }
  revision 2019-06-23 { reference "Initial version"; }

  extension notNotifyable {
    description
      "Indicates that data change notifications shall not be sent
      for this attribute. If the extension is not present and other
      conditions are fulfilled data change notification should be sent.
      If a list or container already has the notNotifyable
      extension, that is also valid for all contained data nodes.

      The statement MUST only be a substatement of a leaf, leaf-list, list,
      container statement that is contained within the 'attributes'
      container of an IOC and that represents an attribute or sub-parts of
      an attribute .

      Zero or one notNotifyable statement is allowed per parent statement.
      NO substataements are allowed.

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

  extension inVariant {
    description

```

"Indicates that the value for the data node can only be set when the list data node representing the containing object(MOI) is created. The above statement in YANG terms means, that the value for the data node can only be set when the list entry that is the parent of the restricted node's ancestor container named 'attributes' is being created. To change the value after that, the mentioned list data node must be deleted and recreated with the restricted data node having the new value.

If a list or container already has the inVariant extension, that is also valid for all contained data nodes.

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 statement 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";

}

<CODE ENDS>

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

<CODE BEGINS>

```
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; }
  import _3gpp-common-yang-extensions { prefix yext3gpp; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";
  description "The model defines a YANG mapping of the top level
  information classes used for management of 5G networks and
  network slicing.
  Copyright 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";
```

```

reference "3GPP TS 28.623";

revision 2023-12-17 { reference CR-0327 ; }
revision 2023-11-05 { reference "CR-0306 CR-1130zz" ; }
revision 2023-09-17 { reference CR-0270 ; }
revision 2023-08-09 { reference CR-0265; }
revision 2023-05-09 { reference CR-0249; }
revision 2022-11-03 { reference "CR-0193"; }
revision 2022-10-31 { reference CR-0195; }
revision 2022-07-26 { reference CR-0180 ; }
revision 2022-02-09 { reference "CR-0144"; }
revision 2021-11-01 { reference "CR-0141"; }

revision 2021-09-30 {
  description "Added Longitude, Latitude, TenthOfDegrees, OnOff.";
  reference "CR-0138";
}

revision 2020-11-06 {
  description "Removed incorrect S-NSSAI definitions.";
  reference "CR-0118";
}

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 {
  reference "Initial version.";
}

typedef EnabledDisabled {
  type enumeration {
    enum DISABLED ;
    enum ENABLED ;
  }
}

grouping nameValuePair {
  leaf name { type string; }
  leaf value { type string; }
}

grouping ProcessMonitorGrp {
  description "Provides attributes to monitor the progress of processes
with specific purpose and limited lifetime running on MnS producers.
It may be used as data type for dedicated progress monitor attributes
when specifying the management representation of these processes.
The attributes in this clause are defined in a generic way.
For some attributes specialisations may be provided when specifying a
concrete process representation.

If a management operation on some IOCs triggers an associated
asynchronous process (whose progress shall be monitored), this should
also result in creating an attribute named 'processMonitor' (of type
'ProcessMonitor') in these IOC(s). The processMonitor attribute may be
accompanied by use-case specific additional data items.

The progress of the process is described by the 'status' and
'progressPercentage' attributes. Additional textual qualifications for
the 'status' attribute may be provided by the 'progressStateInfo' and
'resultStateInfo' attributes.

When the process is instantiated, the 'status' is set to 'NOT_RUNNING'
and the 'progressPercentage' to '0'. The MnS producer decides when to
start executing the process and to transition into the 'RUNNING' state.
This time is captured in the 'startTime' attribute. Alternatively, the

```

process may start to execute directly upon its instantiation. One alternative must be selected when using this data type.

During the 'RUNNING' state the 'progressPercentage' attribute may be repeatedly updated. The exact semantic of this attribute is subject to further specialisation. The 'progressInfo' attribute may be used to provide additional textual information in the 'NOT_RUNNING', 'CANCELLING' and 'RUNNING' states. Further specialisation of 'progressStateInfo' may be provided where this data type is used.

Upon successful completion of the process, the 'status' attribute is set to 'FINISHED', the 'progressPercentage' to 100%. The time is captured in the 'endTime' attribute. Additional textual information may be provided in the 'resultStateInfo' attribute. The type of 'resultStateInfo' in this data type definition is 'String'. Further specialisation of 'resultStateInfo' may be provided where this data type is used.

In case the process fails to complete successfully, the 'status' attribute is set to 'FAILED' or 'PARTIALLY_FAILED', the current value of 'progressPercentage' is frozen, and the time captured in 'endTime'. The 'resultStateInfo' specifies the reason for the failure. Specific failure reasons may be specified where the data type defined in this clause is used. The exact semantic of failure may be subject for further specialisation as well.

In case the process is cancelled, the 'status' attribute is first set to 'CANCELLING' and when the process is really cancelled then to 'CANCELLED'. The transition to 'CANCELLED' is captured in the 'endTime' attribute. The value of 'progressPercentage' is frozen. Additional textual information may be provided in the 'resultStateInfo' attribute.

The 'resultStateInfo' attribute is provided only for additional textual qualification of the states 'FINISHED', 'FAILED', 'PARTIALLY_FAILED' or 'CANCELLED'. It shall not be used for making the outcome, that the process may produce in case of success, available.

The process may have to be completed within a certain time after its creation, for example because required data may not be available any more after a certain time, or the process outcome is needed until a certain time and when not provided by this time is not needed any more. The time until the MnS producer automatically cancels the process is indicated by the 'timer' attribute."

```
leaf id {
  type string;
  mandatory true;
  description "Id of the process. It is unique within a single
    multivalue attribute of type ProcessMonitor.";
}

leaf status {
  type enumeration {
    enum NOT_STARTED ;
    enum RUNNING ;
    enum CANCELLING ;
    enum FINISHED ;
    enum FAILED ;
    enum PARTIALLY_FAILED ;
    enum CANCELLED ;
  }
  config false;
  default RUNNING;
  description "Represents the status of the associated process,
    whether it fails, succeeds etc.
    It does not represent the returned values of a successfully finished
    process. ";
}

leaf progressPercentage {
  type uint8 {
    range 0..100;
  }
  config false;
  description "Progress of the associated process as percentage";
}
```

```
leaf-list progressStateInfo {
  type string;
  config false;
  description "Additional textual qualification of the states
    'NOT_STARTED', 'CANCELLING' and 'RUNNING'.

    For specific processes, specific well-defined strings (e.g. string
    patterns or enums) may be defined as a specialisation.";
}

leaf resultStateInfo {
  type string;
  config false;
  description "Additional textual qualification of the states
    'FINISHED', 'FAILED', 'PARTIALLY_FAILED and 'CANCELLED'.
    For example, in the 'FAILED' or 'PARTIALLY_FAILED' state this
    attribute may be used to provide error reasons.

    This attribute shall not be used to make the outcome of the process
    available for retrieval, if any. For this purpose, dedicated
    attributes shall be specified when specifying the representation of
    a specific process.

    For specific processes, specific well-defined strings (e.g. string
    patterns or enums) may be defined as a specialisation.";
}

leaf startTime {
  type yang:date-and-time;
  config false;
  description "Start time of the associated process, i.e. the time when the
    status changed from 'NOT_STARTED' to 'RUNNING'.";
}

leaf endTime {
  type yang:date-and-time;
  config false;
  description "Date and time when status changed to 'SUCCESS', 'CANCELLED',
    'FAILED' or 'PARTIALLY_FAILED'.

    If the time is in the future, it is the estimated time
    the process will end.";
}

leaf timer {
  type uint32;
  units minutes;
  description "Time until the associated process is automatically cancelled.
    If set, the system decreases the timer with time. When it reaches zero
    the cancellation of the associated process is initiated by the
    MnS_Producer.
    If not set, there is no time limit for the process.

    Once the timer is set, the consumer can not change it anymore.
    If the consumer has not set the timer the MnS Producer may set it.";
  yext3gpp:notNotifyable;
}

typedef TenthOfDegrees {
  type uint16 {
    range 0..3600;
  }
  units "0.1 degrees";
  description "A single integral value corresponding to an angle in degrees
    between 0 and 360 with a resolution of 0.1 degrees.";
}

typedef Latitude {
  type decimal64 {
    fraction-digits 4;
    range "-90.0000..+90.0000";
  }
  description "Latitude values";
}

typedef Longitude {
  type decimal64 {
```

```
        fraction-digits 4;
        range "-180.0000..+180.0000";
    }
    description "Longitude values";
}

typedef Altitude {
    type decimal64 {
        fraction-digits 6;
    }
    units "meters";
    description
        "Height from a reference 0 value.";
}

grouping GeographicalCoordinates {
    description "This datatype represents the geographical coordinates";
    reference "#GPP TS 28.558 clause 6.3.8";

    leaf latitude {
        type Latitude;
        mandatory true;
    }

    leaf longitude {
        type Longitude;
        mandatory true;
    }

    leaf altitude {
        type Altitude;
    }
}

typedef OnOff {
    type enumeration {
        enum ON;
        enum OFF;
    }
}

// grouping ManagedNFProfile will be removed as it is
// being moved to _3gpp-5gc-nrm-nfprofile
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 " ;
        yext3gpp:inVariant;
    }

    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 Ugrinfo, Config=false for UgmInfo 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 SAPGrp {
    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 38.413 clause 9.3.3.5";
}

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 BasicAdministrativeState {
  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.";
    }
}

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 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";
}

grouping GeoCoordinateGrp {
    description "Geographical location on earth";
    leaf latitude {
```

```
    type decimal64 {
      fraction-digits 4;
      range -90..90 ;
    }
    mandatory true;
    description "Latitude based on World Geodetic System (1984 version)
    global reference frame (WGS 84). Positive values correspond to the
    northern hemisphere.";
  }

  leaf longitude {
    type decimal64 {
      fraction-digits 4;
      range -180..180 ;
    }
    mandatory true;
    description "Longitude based on World Geodetic System (1984 version)
    global reference frame (WGS 84). Positive values correspond to
    degrees east of 0 degrees longitude.";
  }

  leaf altitude {
    type decimal64 {
      fraction-digits 4;
    }
    units meters;
    description "It is the vertical distance between the point of interest
    from the mean sea level measured in metres.";
  }
}

grouping GeoAreaGrp {
  description "This data type defines a geographical area.
  The geo-area is defined using a convex polygon in the attribute
  'convexGeoPolygon'.";

  list convexGeoPolygon {
    description "Specifies the geographical area with a convex polygon.
    The convex polygon is specified by its corners.";
    key "latitude longitude";
    min-elements 3;
    ordered-by user;

    uses GeoCoordinateGrp;
  }
}

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;
  }
}
```



```

    leaf LocalDNAttributeType { type string { // NameOfClassWithIdAttribute |
NamesOfClassAndNamingAttribute RDNSeparator is a single , no space or \R allowed
    // NameOfClassWithIdAttribute|NamesOfClassAndNamingAttribute
    pattern '[A-Z][^,+=<>#;\\\"\\r\\n*.*]|([A-Z][^,+=<>#;\\\"\\r\\n*.*]\\. [a-z][^,+=<>#;\\\"\\r\\n*.*])*';
    } }

    leaf RegularAttributeValue { type string { // ( AttributeValueChar - SpaceChar ) , [ {
AttributeValueChar } , ( AttributeValueChar - SpaceChar ) ]
    pattern '([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-9]{2}))((([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-
9]{2})))*([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-9]{2})))?' ;
    } }

    leaf NamesOfClassAndNamingAttribute { type string { // ClassName ,
ClassNamingAttributeSeparator , NamingAttributeName
    // pattern: ClassName\.NamingAttributeName
    pattern '[A-Z][^,+=<>#;\\\"\\r\\n*.*]\\. [a-z][^,+=<>#;\\\"\\r\\n*.*]*' ;
    } }

    leaf restrictiveClassName { type string { //
    pattern '[a-zA-Z][a-zA-Z0-9-]*' ;
    } }

    leaf ClassName { type string { // CapitalLetterChar , { LocalDNAttributeTypeChar }
    pattern '[A-Z][^,+=<>#;\\\"\\r\\n*.*]*' ;
    } }

    leaf NamingAttributeName { type string { // SmallLetterChar , { LocalDNAttributeTypeChar }
    pattern '[a-z][^,+=<>#;\\\"\\r\\n*.*]*' ;
    } }

*/
typedef DistinguishedName {
    type string {
        pattern '[A-Z][^,+=<>#;\\\"\\r\\n*.*]*=([^\s,+=<>#;\\\"\\r\\n* ]|'
        + '([a-fA-F0-9]{2}))((([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-9]{2}))*'
        + '([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-9]{2})))?'
        + '(, [A-Z][^,+=<>#;\\\"\\r\\n*.*]*=([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-9]{2})))'
        + '([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-9]{2}))*'
        + '([^\s,+=<>#;\\\"\\r\\n* ]|([a-fA-F0-9]{2})))?' ;
    }
    description "Represents the 3GPP standard for DistinguishedName.

    Limitations:
    - RDNSeparator: don't allow SpaceChar or CarriageReturnChar
    - NullDN: Disallow nullDN that is the same as not providing a DN
    - NamesOfClassAndNamingAttribute format not allowed
      (eg. ManagedElement.mykey=345436)";
    reference "3GPP TS 32.300";
}

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;
}

grouping ReportingCtrl {
    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, on condition that an appropriate subscription
        is in place, inform the MnS consumer about the availability of new
        files and the file location using the notifyFileReady notification.
        In case the preparation of a file fails, 'notifyFilePreparationError'
        shall be sent instead.

        - When the 'fileReportingPeriod' and 'notificationRecipientAddress'

```


D.2.9 module _3gpp-common-fm.yang

```
<CODE BEGINS>
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; }
  import _3gpp-common-yang-extensions { prefix yext3gpp; }

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

  description "Defines a Fault Management model
  Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";

  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 2024-02-23 { reference CR-0347; }
  revision 2023-09-17 { reference CR-0270; }
  revision 2023-05-09 { reference CR-0249; }
  revision 2022-10-31 { reference CR-0195; }
  revision 2021-08-08 { reference "CR-0132"; }
  revision 2021-06-02 { reference "CR-0130"; }
  revision 2020-06-03 { reference "CR-0091"; }
  revision 2020-02-24 { reference "S5-201365"; }

  feature AcknowledgeByConsumer {
    description "Indicates whether alarm acknowledgement by the consumer is
    supported.";
  }

  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_VIOLATION {
        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 severities";
}

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 ACKNOWLEDEDED.";

    leaf alarmId {
        type string;
        mandatory true;
        description "Identifies the alarmRecord";
        yext3gpp:notNotifiable;
    }

    leaf objectInstance {
        type types3gpp:DistinguishedName;
        config false ;
        mandatory true;
        yext3gpp:notNotifiable;
        yext3gpp:inVariant;
    }

    leaf notificationId {
        type int32;
        config false ;
        mandatory true;
        description "The Id of the last notification updating the AlarmRecord.";
        yext3gpp:notNotifiable;
    }

    leaf alarmRaisedTime {
        type yang:date-and-time ;
        mandatory true;
        config false ;
        yext3gpp:notNotifiable;
    }

    leaf alarmChangedTime {
        type yang:date-and-time ;
        config false ;
        description "not applicable if related alarm has not changed";
        yext3gpp:notNotifiable;
    }

    leaf alarmClearedTime {

```

```
    type yang:date-and-time ;
    config false ;
    description "not applicable if related alarm was not cleared";
    yext3gpp:notNotifyable;
  }

  leaf alarmType {
    type eventType;
    config false ;
    mandatory true;
    description "General category for the alarm.";
    yext3gpp:notNotifyable;
    yext3gpp:inVariant;
  }

  leaf probableCause {
    type union {
      type int32;
      type string;
    }
    config false ;
    mandatory true;
    yext3gpp:notNotifyable;
    yext3gpp:inVariant;
  }

  leaf specificProblem {
    type union {
      type int32;
      type string;
    }
    config false ;
    reference "ITU-T Recommendation X.733 clause 8.1.2.2.";
    yext3gpp:notNotifyable;
    yext3gpp:inVariant;
  }

  leaf perceivedSeverity {
    type severity-level;
    mandatory true;
    description "This is Writable only if producer supports consumer
    to set perceivedSeverity to CLEARED";
    yext3gpp:notNotifyable;
  }

  leaf backedUpStatus {
    type boolean;
    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.";
    yext3gpp:notNotifyable;
  }

  leaf backUpObject {
    type types3gpp:DistinguishedName;
    config false ;
    description "Backup object of the alarmed object as defined in
    ITU-T Rec. X. 733";
    yext3gpp:notNotifyable;
  }

  leaf trendIndication {
    type enumeration {
      enum MORE_SEVERE;
      enum NO_CHANGE;
      enum LESS_SEVERE;
    }
    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.";
    yext3gpp:notNotifyable;
  }

  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.";
    }

    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.";
    }
  }

  list thresholdInfo {
    config false ;
    yext3gpp:notNotifyable;
    description "Indicates the crossed threshold";
    uses ThresholdInfoGrp;
  }

  list stateChangeDefinition {
    key attributeName;
    config false ;
    description "Indicates MO attribute value changes associated with the
      alarm for state attributes of the monitored entity (state transitions).
      The change is reported with the name of the state attribute, the new
      value and an optional old value.
      See definition in ITU-T Recommendation X.733 [4] clause 8.1.2.10.";
    yext3gpp:notNotifyable;

    leaf attributeName {
      type string;
    }

    anydata newValue {
      mandatory true;
      description "The new value of the attribute. The content of this data
        node shall be in accordance with the data model for the attribute.";
    }

    anydata oldValue{
      description "The old value of the attribute. The content of this data
        node shall be in accordance with the data model for the attribute.";
    }
  }

  list monitoredAttributes {
    key attributeName;
    config false ;
    yext3gpp:notNotifyable;
    description "Attributes of the monitored entity and their
      values at the time the alarm occurred that are of interest for the
      alarm report.";
    reference "ITU-T Recommendation X.733 clause 8.1.2.11.";
  }
}
```

```
leaf attributeName {
  type string;
}

anydata value {
  mandatory true;
  description "The value of the attribute. The content of this data
  node shall be in accordance with the data model for the attribute.";
}

leaf proposedRepairActions {
  type string;
  config false ;
  description "Indicates proposed repair actions. See definition in
  ITU-T Recommendation X.733 clause 8.1.2.12.";
  yext3gpp:notNotifyable;
}

leaf additionalText {
  type string;
  config false ;
  yext3gpp:notNotifyable;
}

list additionalInformation {
  key name;
  config false ;
  yext3gpp:notNotifyable;
  description "Vendor specific alarm information in the alarm.";
  uses types3gpp:nameValuePair;
}

leaf rootCauseIndicator {
  type boolean;
  default false;
  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.";
  yext3gpp:notNotifyable;
}

leaf ackTime {
  if-feature AcknowledgeByConsumer;
  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.";
  yext3gpp:notNotifyable;
}

leaf ackUserId {
  if-feature AcknowledgeByConsumer;
  type string;
  description "It identifies the last user who has changed the
  Acknowledgement State.";
  yext3gpp:notNotifyable;
}

leaf ackSystemId {
  if-feature AcknowledgeByConsumer;
  type string;
  description "It identifies the system (Management System) that last
  changed the ackState of an alarm, i.e. acknowledged or unacknowledged
  the alarm.";
  yext3gpp:notNotifyable;
}

leaf ackState {
  if-feature AcknowledgeByConsumer;
  type enumeration {
    enum ACKNOWLEDGED {
      description "The alarm has been acknowledged.";
    }
    enum UNACKNOWLEDGED {
```

```

        description "The alarm has unacknowledged or the alarm has never
            been acknowledged.";
    }
}
yext3gpp:notNotifyable;
}

leaf clearUserId {
    type string;
    description "Carries the identity of the user who invokes the
        clearAlarms operation.";
    yext3gpp:notNotifyable;
}

leaf clearSystemId {
    type string;
    yext3gpp:notNotifyable;
}

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.";
    yext3gpp:notNotifyable;
}

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.";
    yext3gpp:notNotifyable;
}

leaf securityAlarmDetector {
    type string;
    config false ;
    yext3gpp:notNotifyable;
}

list correlatedNotifications {
    key sourceObjectInstance;
    description "List of correlated notifications";

    leaf sourceObjectInstance {
        type types3gpp:DistinguishedName;
    }

    leaf-list notificationId {
        type int32;
        min-elements 1;
    }
}

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

    leaf administrativeState {
        type types3gpp:BasicAdministrativeState ;
        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";
  yext3gpp:notNotifyable;
}

leaf lastModification {
  type yang:date-and-time ;
  config false;
  description "The last time when an alarm record was modified";
  yext3gpp:notNotifyable;
}

list alarmRecords {
  key alarmId;
  description "List of alarmRecords";
  yext3gpp:notNotifyable;
  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 ;
    }
  }
}
}
<CODE ENDS>

```

D.2.10 module _3gpp-common-trace.yang

```

<CODE BEGINS>
module _3gpp-common-trace {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-trace";
  prefix "trace3gpp";

  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-yang-types {prefix types3gpp; }
  import _3gpp-common-yang-extensions { prefix yext3gpp; }
  import ietf-inet-types { prefix inet; }
  import _3gpp-common-files { prefix files3gpp; }

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

  description "Trace handling
  Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,

```

```

    TTA, TTC). All rights reserved.";

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 2024-08-09 { reference "CR-0419" ; }
revision 2024-05-13 { reference "CR-0360" ; }
revision 2024-04-05 { reference "CR-0341" ; }
revision 2023-11-05 { reference "CR-0293 CR-0301" ; }
revision 2023-09-17 { reference CR-0270 ; }
revision 2023-07-25 { reference CR00252; }
revision 2023-02-17 { reference "CR-0232"; }
revision 2023-02-15 { reference "CR-0236"; }
revision 2022-04-27 { reference "CR-0159"; }
revision 2021-10-18 { reference "CR-0139"; }
revision 2021-07-22 { reference "CR-0137"; }
revision 2021-01-25 { reference "CR-0122"; }
revision 2020-11-16 { reference "CR-0117"; }
revision 2020-08-06 { reference "CR-0102"; }

feature FilesUnderTraceJob {
  description "Files shall be contained under TraceJob";
}

grouping TraceReference {
  leaf mcc {
    mandatory true;
    type types3gpp:Mcc;
  }
  leaf mnc {
    mandatory true;
    type types3gpp:Mnc;
  }
  leaf traceId {
    mandatory true;
    type int64;
  }
}

grouping AreaScopeGrp {
  description "Represents the AreaScope dataType.
  This <<dataType>> defines the area scope of MDT.
  The Area Scope parameter in LTE and NR is either:
  - list of Cells, identified by E-UTRAN-CGI or NG-RAN CGI.
  Maximum 32 CGI can be defined.
  - list of Tracking Area, identified by TAC.
  Maximum of 8 TAC can be defined.
  - list of Tracking Area Identity, identified by TAC with
  associated plmn-Identity perTAC-List containing the
  PLMN identity for each TAC. Maximum of 8 TAI can be defined.";

  choice AreaScopeChoice {
    leaf-list eutraCellIdList {
      type string;
      min-elements 1;
      max-elements 32;
      description "List of E-UTRAN cells identified by E-UTRAN-CGI";
    }

    leaf-list nrCellIdList {
      type string;
      min-elements 1;
      max-elements 32;
      description "List of NR cells identified by NG-RAN CGI";
    }

    leaf-list tacList {
      type types3gpp:Tac;
      min-elements 1;
      max-elements 8;
      description "Tracking Area Code list";
    }
  }
}

```

```

    }

    list taiList {
      description "Tracking Area Identity list";
      key idx;
      min-elements 1;
      max-elements 8;
      leaf idx { type string; }
      uses types3gpp:TaiGrp;
    }
  }
}

grouping TraceJobGrp {
  leaf jobType {
    type enumeration {
      enum IMMEDIATE_MDT_ONLY;
      enum LOGGED_MDT_ONLY;
      enum TRACE_ONLY;
      enum IMMEDIATE_MDT_AND_TRACE;
      enum RLF_REPORT_ONLY;
      enum RCEF_REPORT_ONLY;
      enum LOGGED_MBSFN_MDT;
    }
    default TRACE_ONLY;
    description "Specifies the MDT mode and it specifies also whether the
      TraceJob represents only MDT, Logged MBSFN MDT, Trace or a combined
      Trace and MDT job. The attribute is applicable for Trace, MDT, RCEF and
      RLF reporting.";
    reference "Clause 5.9a of 3GPP TS 32.422 for additional details on the
      allowed values.";
  }
}

list listOfInterfaces {
  key idx;
  must 'count(MSCServerInterfaces)+count(MGWInterfaces)+count(RNCInterfaces)'
    '+count(SGSNInterfaces)+count(GGSNInterfaces)+count(S-CSCFInterfaces)'
    '+count(P-CSCFInterfaces)+count(I-CSCFInterfaces)+count(MRFCInterfaces)'
    '+count(MGCFInterfaces)+count(IBCInterfaces)+count(E-CSCFInterfaces)'
    '+count(BGCFInterfaces)+count(ASInterfaces)+count(HSSInterfaces)'
    '+count(EIRInterfaces)+count(BM-SCInterfaces)+count(MMEInterfaces)'
    '+count(SGWInterfaces)+count(PDN_GWInterfaces)+count(eNBInterfaces)'
    '+count(en-gNBInterfaces)+count(AMFInterfaces)+count(AUSFInterfaces)'
    '+count(NEFInterfaces)+count(NRFInterfaces)+count(NSSFInterfaces)'
    '+count(PCFInterfaces)+count(SMFInterfaces)+count(SMSFInterfaces)'
    '+count(UDMInterfaces)+count(UPFInterfaces)+count(ng-eNBInterfaces)'
    '+count(gNB-CU-CPInterfaces)+count(gNB-CU-UPInterfaces)'
    '+count(gNB-DUInterfaces)';

  description "Specifies the interfaces that need to be traced in the given
    ManagedEntityFunction.The attribute is applicable only for Trace. In
    case this attribute is not used, it carries a null semantic.";
  reference "Clause 5.5 of 3GPP TS 32.422 for additional details on the
    allowed values.";

  leaf idx { type uint32 ; }

  leaf-list MSCServerInterfaces {
    type enumeration {
      enum A ;
      enum Iu-CS ;
      enum Mc ;
      enum MAP-G ;
      enum MAP-B ;
      enum MAP-E ;
      enum MAP-F ;
      enum MAP-D ;
      enum MAP-C ;
      enum CAP ;
    }
  }

  leaf-list MGWInterfaces {
    type enumeration {
      enum Mc ;
      enum Nb-UP ;
      enum Iu-UP ;
    }
  }
}

```



```
}
leaf-list RNCInterfaces {
  type enumeration {
    enum Iu-CS ;
    enum Iu-PS ;
    enum Iur ;
    enum Iub ;
    enum Uu ;
  }
}
leaf-list SGSNInterfaces {
  type enumeration {
    enum Gb ;
    enum Iu-PS ;
    enum Gn ;
    enum MAP-Gr ;
    enum MAP-Gd ;
    enum MAP-Gf ;
    enum Ge ;
    enum Gs ;
    enum S6d ;
    enum S4 ;
    enum S3 ;
    enum S13 ;
  }
}
leaf-list GGSNInterfaces {
  type enumeration {
    enum Gn ;
    enum Gi ;
    enum Gmb ;
  }
}
leaf-list S-CSCFInterfaces {
  type enumeration {
    enum Mw ;
    enum Mg ;
    enum Mr ;
    enum Mi ;
  }
}
leaf-list P-CSCFInterfaces {
  type enumeration {
    enum Gm ;
    enum Mw ;
  }
}
leaf-list I-CSCFInterfaces {
  type enumeration {
    enum Cx ;
    enum Dx ;
    enum Mg ;
    enum Mw ;
  }
}
leaf-list MRFCInterfaces {
  type enumeration {
    enum Mp ;
    enum Mr ;
  }
}
leaf-list MGCFInterfaces {
  type enumeration {
    enum Mg ;
    enum Mj ;
    enum Mn ;
  }
}
leaf-list IBCFInterfaces {
  type enumeration {
    enum Ix ;
    enum Mx ;
  }
}
leaf-list E-CSCFInterfaces {
  type enumeration {
    enum Mw ;
    enum Ml ;
  }
}
```

```
        enum Mm ;
        enum Mi-Mg ;
    }
}
leaf-list BGCFInterfaces {
    type enumeration {
        enum Mi ;
        enum Mj ;
        enum Mk ;
    }
}
leaf-list ASInterfaces {
    type enumeration {
        enum Dh ;
        enum Sh ;
        enum ISC ;
        enum Ut ;
    }
}
leaf-list HSSInterfaces {
    type enumeration {
        enum MAP-C ;
        enum MAP-D ;
        enum Gc ;
        enum Gr ;
        enum Cx ;
        enum S6d ;
        enum S6a ;
        enum Sh ;
    }
}
leaf-list EIRInterfaces {
    type enumeration {
        enum MAP-F ;
        enum S13 ;
        enum MAP-Gf ;
    }
}
leaf-list BM-SCInterfaces {
    type enumeration {
        enum Gmb ;
    }
}
leaf-list MMEInterfaces {
    type enumeration {
        enum S1-MME ;
        enum S3 ;
        enum S6a ;
        enum S10 ;
        enum S11 ;
        enum S13 ;
    }
}
leaf-list SGWInterfaces {
    type enumeration {
        enum S4 ;
        enum S5 ;
        enum S8 ;
        enum S11 ;
        enum Gxc ;
    }
}
leaf-list PDN_GWInterfaces {
    type enumeration {
        enum S2a ;
        enum S2b ;
        enum S2c ;
        enum S5 ;
        enum S6b ;
        enum Gx ;
        enum S8 ;
        enum SGi ;
    }
}
leaf-list eNBInterfaces {
    type enumeration {
        enum S1-MME ;
        enum X2 ;
    }
}
```

```
    }  
  }  
  leaf-list en-gNBInterfaces {  
    type enumeration {  
      enum S1-MME ;  
      enum X2 ;  
      enum Uu ;  
      enum F1-C ;  
      enum E1 ;  
    }  
  }  
  leaf-list AMFInterfaces {  
    type enumeration {  
      enum N1 ;  
      enum N2 ;  
      enum N8 ;  
      enum N11 ;  
      enum N12 ;  
      enum N14 ;  
      enum N15 ;  
      enum N20 ;  
      enum N22 ;  
      enum N26 ;  
    }  
  }  
  leaf-list AUSFInterfaces {  
    type enumeration {  
      enum N12 ;  
      enum N13 ;  
    }  
  }  
  leaf-list NEFInterfaces {  
    type enumeration {  
      enum N29 ;  
      enum N30 ;  
      enum N33 ;  
    }  
  }  
  leaf-list NRFInterfaces {  
    type enumeration {  
      enum N27 ;  
    }  
  }  
  leaf-list NSSFInterfaces {  
    type enumeration {  
      enum N22 ;  
      enum N31 ;  
    }  
  }  
  leaf-list PCFInterfaces {  
    type enumeration {  
      enum N5 ;  
      enum N7 ;  
      enum N15 ;  
    }  
  }  
  leaf-list SMFInterfaces {  
    type enumeration {  
      enum N4 ;  
      enum N7 ;  
      enum N10 ;  
      enum N11 ;  
      enum S5-C ;  
      enum N38 ;  
      enum N16 ;  
      enum N16a ;  
    }  
  }  
  leaf-list SMSFInterfaces {  
    type enumeration {  
      enum N20 ;  
      enum N21 ;  
    }  
  }  
  leaf-list UDMInterfaces {  
    type enumeration {  
      enum N8 ;  
      enum N10 ;  
    }  
  }  
}
```

```

        enum N13 ;
        enum N21 ;
    }
}
leaf-list UPFInterfaces {
    type enumeration {
        enum N4 ;
    }
}
leaf-list ng-eNBInterfaces {
    type enumeration {
        enum NG-C ;
        enum Xn-C ;
        enum Uu ;
    }
}
leaf-list gNB-CU-CPInterfaces {
    type enumeration {
        enum NG-C ;
        enum Xn-C ;
        enum Uu ;
        enum F1-C ;
        enum E1 ;
        enum X2-C ;
    }
}
leaf-list gNB-CU-UPInterfaces {
    type enumeration {
        enum E1 ;
    }
}
leaf-list gNB-DUInterfaces {
    type enumeration {
        enum F1-C ;
    }
}
}
}

leaf-list listOfNETypes {
    type enumeration {
        enum MSC_SERVER;
        enum SGSN;
        enum MGW;
        enum GGSN;
        enum RNC;
        enum BM_SC;
        enum MME;
        enum SGW;
        enum PGW;
        enum ENB;
        enum EN_GNB;
        enum GNB_CU_CP;
        enum GNB_CU_UP;
        enum GNB_DU;
    }
    description "Specifies in which type of ManagedFunction the trace should
        be activated. The attribute is applicable only for Trace with
        Signalling Based Trace activation. In case this attribute is not used,
        it carries a null semantic";
    reference "Clause 5.4 of 3GPP TS 32.422 for additional details on the
        allowed values";
}

list pLMNTarget {
    key "mcc mnc";
    description "Specifies which PLMN that the subscriber of the session to
        be recorded uses as selected PLMN. PLMN Target might differ from the
        PLMN specified in the Trace Reference";
    reference "Clause 5.9b of 3GPP TS 32.422";

    uses types3gpp:PLMNId;
}

leaf-list listOfTraceMetrics {
    when '../jobType = "TRACE_ONLY"
        + ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
    type string;
    description "Specifies the metrics to be reported.";
}

```

```

    reference "Clause 10 of 3GPP TS 32.422";
  }

  leaf traceReportingConsumerUri {
    when '../traceReportingFormat = "STREAMING"';
    type inet:uri;
    description "URI of the Streaming Trace data reporting MnS consumer
      (a.k.a. streaming target).
      This attribute shall be present if file based trace data reporting is
      supported and traceReportingFormat set to 'file based' or when
      jobType is set to Logged MDT or Logged MBSFN MDT.";
    reference "Clause 5.9 of 3GPP TS 32.422";
  }

  leaf traceCollectionEntityIPAddress {
    when '../traceReportingFormat = "FILE_BASED" or '
      + '../jobType = "LOGGED_MDT_ONLY" or ../jobType = "LOGGED_MBSFN_MDT"';
    type union {
      type inet:uri;
      type inet:ip-address;
    }
    mandatory true;
    description "Specifies the address of the Trace Collection Entity when
      the attribute traceReportingFormat is configured for the file-based
      reporting. The attribute is applicable for both Trace and MDT.";
    reference "Clause 5.9 of 3GPP TS 32.422";
  }

  leaf traceDepth {
    when '../jobType = "TRACE_ONLY"
      + ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
    type enumeration {
      enum MINIMUM;
      enum MEDIUM;
      enum MAXIMUM;
      enum VENDORMINIMUM;
      enum VENDORMEDIUM;
      enum VENDORMAXIMUM;
    }
    default MAXIMUM;
    description "Specifies how detailed information should be recorded in the
      Network Element. The Trace Depth is a parameter 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.
      The attribute is applicable only for Trace, otherwise it carries a null
      semantic.";
    reference "Clause 5.3 of 3GPP TS 32.422";
  }

  list traceReference {
    uses TraceReference;
    key "mcc mnc traceId";
    max-elements 1;
    description "A globally unique identifier, which uniquely identifies the
      Trace Session that is created by the TraceJob.
      In case of shared network, it is the MCC and MNC of the Participating
      Operator that request the trace session that shall be provided.
      The attribute is applicable for both Trace and MDT.";
  }

  leaf jobId {
    type string;
    description "Identifier of a TraceJob";
    yext3gpp:inVariant;
  }

  leaf traceReportingFormat {
    type enumeration {
      enum FILE_BASED;
      enum STREAMING;
    }
    default FILE_BASED;
    description "Specifies the trace reporting format - streaming trace
      reporting or file-based trace reporting";
    reference "3GPP TS 32.422 clause 5.11";
  }

  list traceTarget {
    key "targetIdType targetIdValue";
  }

```

```

max-elements 1;

leaf targetIdType {
  type enumeration {
    enum IMSI;
    enum IMEI;
    enum IMEISV;
    enum PUBLIC_ID;
    enum UTRAN_CELL;
    enum E_UTRAN_CELL;
    enum NG_RAN_CELL;
    enum ENB;
    enum RNC;
    enum GNB;
    enum SUPI;
  }
}

leaf targetIdValue {
  type string;
}

description "Specifies the target object of the Trace and MDT. The
attribute is applicable for both Trace and MDT. This attribute
includes the ID type of the target as an enumeration and the ID value.

The traceTarget shall be public ID in case of a Management Based
Activation is done to an ScscfFunction. The traceTarget shall be
cell only in case of the UTRAN cell traffic trace function.

The traceTarget shall be E-UtranCell only in case of E-UTRAN cell
traffic trace function.The traceTarget shall be either IMSI or
IMEI(SV) if the Trace Session is activated to any of the following
ManagedEntity(ies):
- HssFunction
- MscServerFunction
- SgsnFunction
- GgsnFunction
- BmscFunction
- RncFunction
- MmeFunction

The traceTarget shall be IMSI if the Trace Session is activated to a
ManagedEntity playing a role of ServinGWFunction.

In case of signaling based Trace/MDT, the traceTarget attribute shall
be able to carry (IMSI or IMEI(SV) or SUPI), the MDTAreaScope attribute
shall be able to carry a list of (cell or E-UtranCell or NRCellDU or
TA/LA/RA).

In case of management based Immediate MDT, the traceTarget attribute
shall be null value, the MDTAreaScope attribute shall carry a list of
(Utrancell or E-UtranCell or NRCellDU).

In case of management based Logged MDT, the traceTarget attribute
shall carry an eNBs or a RNC or gNBs. The Logged MDT should be initiated
on the specified eNB or RNC or gNB in traceTarget. The MDTAreaScope
attribute shall carry a list of (Utrancell or E-UtranCell or NRCellDU or
TA/LA/RA).

In case of RLF reporting, or RCEF reporting, the traceTarget
attribute shall be null value, the MDTAreaScope attribute shall carry
one or list of eNBs/gNBs";
reference "3GPP TS 32.422";
}

leaf triggeringEvents {
  when '../jobType = "TRACE_ONLY" or ' +
    '../jobType = "IMMEDIATE_MDT_AND_TRACE"';
  type string ;
  mandatory true;
  description "Specifies the triggering event parameter of the trace session.
The attribute is applicable only for Trace. In case this attribute is
not used, it carries a null semantic.";
reference "Clause 5.1 of 3GPP TS 32.422";
}

```

```

leaf MDTAnonymizationOfData {
  when ../areaScope ;
  type enumeration {
    enum NO_IDENTITY;
    enum TAC_OF_IMEI;
  }
  default NO_IDENTITY;
  description "Specifies level of MDT anonymization.";
  reference "3GPP TS 32.422 clause 5.10.12.";
}

list MDTAreaConfigurationForNeighCell {
  when '../jobType = "LOGGED_MDT_ONLY"';
  key "idx";
  min-elements 1;
  leaf idx { type uint32 ; }

  description "It specifies the area for which UE is requested to perform
  measurement logging for neighbour cells which have list of frequencies.
  If it is not configured, the UE shall perform measurement logging for
  all the neighbour cells.

  Applicable only to NR Logged MDT.";
  reference "3GPP TS 32.422 clause 5.10.26.";

  leaf frequency {
    type string;
  }

  leaf cell {
    type string;
  }
}

list areaScope {
  description "specifies MDT area scope when activates an MDT job.

  For RLF and RCEF reporting it specifies the eNB or list of eNBs where the
  RLF or RCEF reports should be collected.

  List of cells/TA/LA/RA for signaling based MDT or management based Logged
  MDT.

  List of cells for management based Immediate MDT.

  Cell, TA, LA, RA are mutually exclusive.

  One or list of eNBs for RLF and RCEF reporting";
  reference "Clause 5.10.2 of 3GPP TS 32.422";

  key idx;
  leaf idx {type string; }
  uses AreaScopeGrp;
}

leaf MDTCollectionPeriodRrmLte {
  when '../jobType = "IMMEDIATE_MDT_ONLY"'
  + ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
  type uint32 {
    range "250|500|1000|2000|3000|4000|6000|8000|12000|16000|20000|"
    +"24000|28000|32000|64000";
  }
  units milliseconds;
  description "Specifies the collection period for collecting RRM configured
  measurement samples for M2, M3 in LTE. The attribute is applicable only
  for Immediate MDT. In case this attribute is not used, it carries a
  null semantic.";
  reference "Clause 5.10.20 of 3GPP TS 32.422";
}

leaf MDTCollectionPeriodM6Lte {
  when '../jobType = "IMMEDIATE_MDT_ONLY"'
  + ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
  type uint32 {
    range "1024|2048|5120|10240";
  }
}

```

```

units milliseconds;
description "Specifies the collection period for the Packet Delay
measurement (M6) for MDT taken by the eNB. The attribute is applicable
only for Immediate MDT. In case this attribute is not used,
it carries a null semantic.";
reference "Clause 5.10.32 of TS 32.422 ";
}

leaf MDTCollectionPeriodM7Lte {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type uint16 {
range 1..60 ;
}
description "It specifies the collection period for the Data Volume (M6)
and Throughput measurements (M7) for UMTS MDT taken by RNC. The
attribute is applicable only for Immediate MDT. In case this attribute
is not used, it carries a null semantic.";
reference "Clause 5.10.22 of TS 32.422 .";
}

leaf MDTCollectionPeriodRrmUmts {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type uint32 {
range "1024|1280|2048|2560|5120|"
+"10240|60000";
}
units milliseconds;
description "Specifies the collection period for collecting RRM configured
measurement samples for M3, M4, M5 in UMTS. The attribute is applicable
only for Immediate MDT. In case this attribute is not used, it carries
a null semantic";
reference "Clause 5.10.21 of 3GPP TS 32.422";
}

leaf MDTCollectionPeriodRrmNR {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type uint32 {
range "1024|2048|5120|10240|60000";
}
units milliseconds;
description "Specifies the collection period for collecting RRM
configured measurement samples for M4, M5 in NR. The attribute is
applicable only for Immediate MDT. In case this attribute is not
used, it carries a null semantic.";
reference "Clause 5.10.30 of 3GPP TS 32.422";
}

leaf MDTCollectionPeriodM6NR {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type enumeration {
enum 120ms;
enum 240ms;
enum 480ms;
enum 640ms;
enum 1024ms;
enum 2048ms;
enum 5120ms;
enum 10240ms;
enum 20480ms;
enum 40960ms;
enum 1min;
enum 6min;
enum 12min;
enum 30min;
}
description "It specifies the collection period for the Packet Delay
measurement (M6) for NR MDT taken by the gNB. The attribute is
applicable only for Immediate MDT. In case this attribute is not used,
it carries a null semantic.";
reference "clause 5.10.34 of TS 32.422";
}

leaf MDTCollectionPeriodM7NR {
when '../jobType = "IMMEDIATE_MDT_ONLY"'

```



```

+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE";
type uint32 {
  range "1..60";
}
description "It specifies the collection period for the Packet Loss Rate
  measurement (M7) for NR MDT taken by the gNB. The attribute is
  applicable only for Immediate MDT. In case this attribute is not used,
  it carries a null semantic.";
reference "clause 5.10.35 of TS 32.422";
}

leaf MDTEventListForTriggeredMeasurement {
  when '../jobType = "LOGGED_MDT_ONLY";
  type enumeration {
    enum OUT_OF_COVERAGE ;
    enum A2_EVENT ;
  }
  mandatory true;
  description "Specifies event types for event triggered measurement in the
    case of logged NR MDT. Each trace session may configure at most one
    event. The UE shall perform logging of measurements only upon certain
    condition being fulfilled:
    - Out of coverage.
    - A2 event.";
  reference "Clause 5.10.28 of 3GPP TS 32.422";
}

leaf MDTEventThreshold {
  type int64;
  description "Specifies the threshold which should trigger the reporting
    in case A2 event reporting in LTE or 1F/1l event in UMTS. The attribute
    is applicable only for Immediate MDT and when reportingTrigger is
    configured for A2 event in LTE or 1F event or 1l event in UMTS. In
    case this attribute is not used, it carries a null semantic.";
  reference "Clauses 5.10.7 and 5.10.7a of 3GPP TS 32.422";
}

leaf MDTListOfMeasurements {
  when '../jobType = "IMMEDIATE_MDT_ONLY";
  type int64;
  mandatory true;
  description "It specifies the UE measurements that shall be collected in
    an Immediate MDT job. The attribute is applicable only for Immediate MDT.
    In case this attribute is not used, it carries a null semantic.";
  reference "3GPP TS 32.422 clause 5.10.3";
}

leaf MDTLoggingDuration {
  when '../jobType = "LOGGED_MDT_ONLY" or'
  + ' ../jobType = "LOGGED_MBSFN_MDT";
  type uint32 {
    range "600|1200|2400|3600|5400|7200";
  }
  units seconds;
  mandatory true;
  description "Specifies how long the MDT configuration is valid at the
    UE in case of Logged MDT. The attribute is applicable only for
    Logged MDT and Logged MBSFN MDT. In case this attribute is not used, it
    carries a null semantic.";
  reference "5.10.9 of 3GPP TS 32.422";
}

leaf MDTLoggingInterval {
  when '../jobType = "LOGGED_MDT_ONLY" or'
  + ' ../jobType = "LOGGED_MBSFN_MDT";
  type uint32 {
    range "1280|2560|5120|10240|20480|"
    +"30720|40960|61440";
  }
  units milliseconds;
  mandatory true;
  description "Specifies the periodicty for Logged MDT. The attribute is
    applicable only for Logged MDT and Logged MBSFN MDT. In case this
    attribute is not used, it carries a null semantic";
  reference "5.10.8 of 3GPP TS 32.422";
}

leaf MDTLoggingEventThreshold {

```

```

when '../jobType = "LOGGED_MDT_ONLY" or '
+ '../jobType = "LOGGED_MBSFN_MDT"';
type uint32 {
  range "0..127";
}
description "It specifies the threshold which should trigger
the reporting in case of event based reporting of logged NR MDT.
The attribute is applicable only for Logged MDT and when MDTReportType
is configured for event triggered reporting and when
MDTEventListForTriggeredMeasurement is configured for L1 event.
In case this attribute is not used, it carries a null semantic.";
reference "clause 5.10.36 of TS 32.422";
}

leaf MDLoggedHysteresis {
when '../jobType = "LOGGED_MDT_ONLY" or '
+ '../jobType = "LOGGED_MBSFN_MDT"';
type uint32 {
  range "0..30";
}
description "It specifies the hysteresis used within the entry and leave
condition of the L1 event based reporting of logged NR MDT.
The attribute is applicable only for Logged MDT, when MDTReportType
is configured for event triggered reporting and when
MDTEventListForTriggeredMeasurement is configured for L1 event.
In case this attribute is not used, it carries a null semantic.";
reference "clause 5.10.37 of TS 32.422";
}

leaf MDLoggedTimeToTrigger {
when '../jobType = "LOGGED_MDT_ONLY" or '
+ '../jobType = "LOGGED_MBSFN_MDT"';
type int32 ;
description "It specifies the threshold which should trigger
the reporting in case of event based reporting of logged NR MDT.
The attribute is applicable only for Logged MDT, when MDTReportType
is configured for event triggered reporting and when
MDTEventListForTriggeredMeasurement is configured for L1 event.
In case this attribute is not used, it carries a null semantic.";
reference "clauses 5.10.38 of TS 32.422";
}

leaf-list MDTMBSFNAreaList {
when '../jobType = "LOGGED_MBSFN_MDT"';
type string;
min-elements 1;
max-elements 8;
description "The MBSFN Area consists of a MBSFN Area ID and Carrier
Frequency (EARFCN). The target MBSFN area List can have up to 8 entries.
This parameter is applicable only if the job type is Logged MBSFN MDT.";
reference "5.10.25 of 3GPP TS 32.422";
}

leaf MDMeasurementPeriodLTE {
when '../jobType = "IMMEDIATE_MDT_ONLY"
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type uint32 {
  range "1024|1280|2048|2560|5120|"
+ "10240|60000";
}
units milliseconds;
mandatory true;
description "It specifies the measurement period for the Data Volume and
Scheduled IP throughput measurements for MDT taken by the eNB.
The attribute is applicable only for Immediate MDT. In case this
attribute is not used, it carries a null semantic.";
reference "Clause 5.10.23 of 3GPP TS 32.422";
}

leaf MDMeasurementPeriodUMTS {
when '../jobType = "IMMEDIATE_MDT_ONLY"
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type uint32 {
  range "250|500|1000|2000|3000|4000|6000|8000|12000|16000|20000|"
+ "24000|28000|32000|64000";
}
units milliseconds;
mandatory true;

```

```

description "It specifies the measurement period for the Data Volume and
Throughput measurements for MDT taken by RNC.
The attribute is applicable only for Immediate MDT. In case this
attribute is not used, it carries a null semantic.";
reference "Clause 5.10.22 of 3GPP TS 32.422";
}

leaf MDTMeasurementQuantity {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type uint64 ;
mandatory true;
description "It specifies the measurements that are collected in an MDT
job for a UMTS MDT configured for event triggered reporting.";
reference "Clause 5.10.15 of 3GPP TS 32.422";
}

leaf MDTM4ThresholdUmts {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type uint16 {
range 0..31 ;
}
description "It specifies the threshold which should trigger
the reporting in case of event-triggered periodic reporting for M4
(UE power headroom measurement) in UMTS. In case this attribute is
not used, it carries a null semantic.";
reference "3GPP TS 32.422 clause 5.10.A";
}

list MDTPLMList {
when '../jobType = "LOGGED_MDT_ONLY"';
key "mcc mnc";
uses types3gpp:PLMNId;
min-elements 1;
max-elements 16;
description "It indicates the PLMNs where measurement collection, status
indication and log reporting is allowed.";
reference "Clause 5.10.24 of 3GPP TS 32.422";
}

leaf MDTPositioningMethod {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' or ../jobType = "IMMEDIATE_MDT_AND_TRACE"';
type enumeration {
enum GNSS;
enum E_CELL_ID;
}
mandatory true;
description "It specifies what positioning method should be used in the
MDT job.";
reference "Clause 5.10.19 of 3GPP TS 32.422";
}

leaf MDTReportAmount {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' and ../MDTReportingTrigger = "PERIODICAL"';
type union {
type uint32 {
range "1|4|8|16|32|64" ;
}
type enumeration {
enum INFINITY;
}
}
mandatory true;
description "It specifies the number of measurement reports that shall be
taken for periodic reporting while the UE is in connected.
The attribute is applicable only for Immediate MDT and when
MDTReportingTrigger is configured for periodical measurements. In
case this attribute is not used, it carries a null semantic.";
reference "Clause 5.10.6 of 3GPP TS 32.422";
}

leaf MDTReportingTrigger {
when '../jobType = "IMMEDIATE_MDT_ONLY"';
type enumeration {
enum PERIODICAL;
}
}

```

```

    enum A2_FOR_LTE;
    enum 1F_FOR_UMTS;
    enum 1I_FOR_UMTS_MCPS_TDD;
    enum A2_TRIGGERED_PERIODIC_FOR_LTE;
    enum ALL_CONFIGURED_RRM_FOR_LTE;
    enum ALL_CONFIGURED_RRM_FOR_UMTS;
}
description "It specifies whether periodic or event based measurements
should be collected.
The attribute is applicable only for Immediate MDT and when the
MDTListOfMeasurements is configured for M1 (for both UMTS and LTE)
or M2 (only for UMTS). In case this attribute is not used, it carries
a null semantic.";
reference "Clause 5.10.4 of 3GPP TS 32.422";
}

leaf MDTReportInterval {
when '../jobType = "IMMEDIATE_MDT_ONLY"'
+ ' and ../MDTReportingTrigger = "PERIODICAL"';
type uint32 {
range "120|240|250|480|500|640|1000|1024|2000|2048|3000|4000|"
+"5120|6000|8000|10240|12000|16000|20000|"
+"24000|28000|32000|60000|64000|"
+"360000|720000|1800000|3600000";
}
units milliseconds;
mandatory true;
description "It specifies the interval between the periodical measurements
that shall be taken when the UE is in connected mode.
The attribute is applicable only for Immediate MDT and when
MDTReportingTrigger is configured for periodical measurements. In case
this attribute is not used, it carries a null semantic.";
reference "5.10.5 of 3GPP TS 32.422";
}

leaf MDTReportType {
when '../jobType = "LOGGED_MDT_ONLY"';
type enumeration {
enum PERIODICAL;
enum EVENT_TRIGGERED;
}
mandatory true;
description "It specifies report type for logged NR MDT";
reference "Clause 5.10.27 of 3GPP TS 32.422";
}

leaf MDTSensorInformation {
type bits {
bit BAROMETRIC_PRESSURE;
bit UE_SPEED;
bit UE_ORIENTATION;
}
default "";
description "It specifies which sensor information shall be included in
logged NR MDT and immediate NR MDT measurement if they are available.
The following sensor measurement can be included or excluded for
the UE.";
reference "Clause 5.10.29 of 3GPP TS 32.422";
}

leaf MDTTraceCollectionEntityID {
when '../jobType = "LOGGED_MDT_ONLY" or '
+ '../jobType = "LOGGED_MBSFN_MDT"';
type uint8;
mandatory true;
description "It specifies the TCE Id which is sent to the UE in
Logged MDT.";
reference "Clause 5.10.11 of 3GPP TS 32.422";
}
}

grouping TraceSubtree {
description "Contains classes that manage Tracing.
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!";

```
list TraceJob {
  description "Represents the Trace Control and Configuration parameters of a
  particular Trace Job (see TS 32.421 and TS 32.422 for details).
  It can be name-contained by SubNetwork, ManagedElement, ManagedFunction
  or NetworkSliceSubnet.
```

To activate Trace Jobs, a MnS consumer has to create TraceJob object instances on the MnS producer. A MnS consumer can activate a Trace Job for another MnS consumer since it is not required the value of traceCollectionEntityAddress or streamingTraceConsumerUri to be his own.

When a MnS consumer wishes to deactivate a Trace Job, the MnS consumer shall delete the corresponding TraceJob instance.

For details of management Trace Job activation/deactivation see clause 4.1.1.1.2 of TS 32.422.

The attribute traceReference specifies a globally unique ID and identifies a Trace session. One Trace Session may be activated to multiple Network Elements. The traceReference is populated by the consumer that makes the request for a Trace Session.

The attribute tjJobType specifies the kind of data to collect. Dependent on the selected type various parameters shall be available. The attributes tjJobType, tjTraceReference, tjTraceCollectionEntityAddress and tjTraceReportingFormat are mandatory for all job types. If streaming reporting is selected for tjTraceReportingFormat, tjStreamingTraceConsumerURI shall be present additionally. The attribute tjPLMNTarget shall be present if trace activation method is management based.

For the different job types the attributes are differentiated as follows:

- In case of TRACE_ONLY additionally the following attributes shall be available: listOfNeTypes, traceDepth, traceTarget and triggeringEvent.

For this case the optional attribute listOfInterfaces allows to specify the interfaces to be recorded.

- In case of IMMEDIATE_MDT_ONLY additionally the following attributes shall be available:
 - traceTarget
 - MDTAnonymizationOfData,
 - MDTListOfMeasurements,
 - MDTCollectionPeriodRrmUmts (conditional for M3, M4 and M5 in UMTS),
 - MDTMeasurementPeriodUMTS (conditional for M6 and M7 in UMTS),
 - MDTCollectionPeriodRrmLte (conditional for M2 and M3 in LTE),
 - MDTMeasurementPeriodLTE (conditional for M4 and M5 in LTE),
 - MDTCollectionPeriodM6Lte (conditional for M6 in LTE),
 - MDTCollectionPeriodM7Lte (conditional for M7 in LTE),
 - MDTCollectionPeriodRrmNR (conditional for M4 and M5 in NR),
 - MDTCollectionPeriodM6NR (conditional for M6 in NR),
 - MDTCollectionPeriodM7NR (conditional for M7 in NR),
 - MDTReportInterval (conditional for M1 in LTE or NR and M1/M2 in UMTS),
 - MDTReportAmount (conditional for M1 in LTE or NR and M1/M2 in UMTS),
 - MDTReportingTrigger (conditional for M1 in LTE or NR and M1/M2 in UMTS),
 - MDTEventThreshold (conditional for A2 event reporting or A2 event triggered periodic reporting),
 - MDTMeasurementQuantity (conditional for 1F event reporting).

For this case the optional attribute MDTAreaScope allows to specify the area in terms of cells or Tracking Area/Routing Area/Location area where the MDT data collection shall take place and the optional attributes MDTPositioningMethod, MDTSensorInformation allow to specify the positioning methods to use or the sensor information to include.

- In case of IMMEDIATE_MDT_AND_TRACE both additional attributes of TRACE_ONLY and IMMEDIATE_MDT_ONLY shall apply.

- In case of LOGGED_MDT_ONLY additionally the following attributes

shall be available: traceTarget, MDTAnonymizationOfData, MDTTraceCollectionEntityID, MDTLoggingInterval, MDTLoggingDuration, MDTReportType, MDTEventListForTriggeredMeasurements.

For this case the optional attribute MDTAreaScope allows to specify the area in terms of cells or Tracking Area/Routing Area/Location area where the MDT data collection shall take place, the optional attribute MDTPLMNList allows to specify the PLMNs where measurement collection, status indication and log reporting is allowed, the optional attribute MDTAreaConfigurationForNeighCell allows to specify the area for which UE is requested to perform measurements logging for neighbour cells which have list of frequencies and the optional attribute MDTSensorInformation allows to specify the sensor information to include.

- In case of RLF_REPORT_ONLY and RCEF_REPORT_ONLY additionally the attribute traceTarget shall be available, the optional attribute MDTAreaScope allows to specify the eNB or list of eNBs or gNB or list of gNBs where the reports should be collected.

- In case of LOGGED_MBSFN_MDT additionally the following attributes shall be available: MDTAnonymizationOfData, MDTLoggingInterval, MDTLoggingDuration, MDTMBSFNAreaList.

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

```

key id;
uses top3gpp:Top_Grp ;
container attributes {
    uses TraceJobGrp ;
}
uses files3gpp:FilesSubtree {
    if-feature FilesUnderTraceJob;
}
}
}
}
}
}
<CODE ENDS>

```

D.2.11 module _3gpp-common-mnsregistry.yang

```

<CODE BEGINS>
module _3gpp-common-mnsregistry {
    yang-version 1.1;
    namespace "urn:3gpp:sa5:_3gpp-common-mnsregistry";
    prefix "mnsregist3gpp";

    import _3gpp-common-subnetwork { prefix subnet3gpp; }
    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 the YANG mapping of the MNSRegistry Information Object
        Class (IOC) that is part of the Generic Network Resource Model (NRM).
        Copyright 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
        TTA, TTC). All rights reserved.";
    reference "3GPP TS 28.623 Generic Network Resource Model (NRM)";

    revision 2023-09-29 { reference CR0277; }
    revision 2023-09-17 { reference CR0270; }
    revision 2023-09-09 { reference CR0242; }
    revision 2023-07-25 { reference CR00252; }
    revision 2021-11-23 { reference "S5-216090"; }
    revision 2021-10-18 { reference "S5-215263"; }
    revision 2021-08-29 { reference "Initial revision, S5-214388"; }

    grouping MnsInfoGrp {
        description "Represents the MnsInfo IOC.";
        leaf mnsLabel {
            description "Human-readable name of management service.";
            mandatory true;
            type string;
        }
    }
}

```

```

    }

    leaf mnsType {
      description "Type of management service.";
      type enumeration {
        enum ProvMnS;
        enum FaultSupervisionMnS;
        enum StreamingDataReportingMnS;
        enum FileDataReportingMnS;
      }
    }

    leaf mnsVersion {
      description "Version of management service.";
      type string;
    }

    leaf mnsAddress {
      description "Addressing information for Management Service operations.";
      mandatory true;
      type string;
    }

    leaf-list mnsScope {
      description "List of the managed object instances that can be accessed
        using the MnS. If a complete SubNetwork can be accessed using the MnS,
        this attribute may contain the DN of the SubNetwork instead of the
        DNs of the individual managed entities within the SubNetwork. If a
        complete ManagedElement can be accessed using the MnS, this attribute
        may contain the DN of the ManagedElement instead of the DNs of the
        individual managed entities within the ManagedElement.";
      min-elements 1;
      type types3gpp:DistinguishedName;
    }
  }

  augment "/subnet3gpp:SubNetwork" {
    list MNSRegistry {
      description "Represents the MNSRegistry IOC.
        The IOC is instantiated by the system.";
      uses top3gpp:Top_Grp;
      key id;
      max-elements 1;

      list MnsInfo {
        description "This IOC represents an available Management Service (MnS)
          and provides the data required to support its discovery.
          It is name-contained by MnsRegistry.

          This specification does not specify how 'MnsInfo' objects are
          created and maintained.

          This information is used by the consumer to discover the producers
          of specific Management Services and to derive the addresses of the
          Management Service.

          Attributes mnsLabel, mnsType, and mnsVersion are used to describe
          the Management Service.

          Attribute mnsAddress is used to provide addressing information for
          the Management Service operations.

          Attribute mnsScope is used to provide information about the
          management scope of the Management Service. The management scope is
          defined as the set of managed object instances that can be accessed
          using the Management Service.";

        key id;
        uses top3gpp:Top_Grp;
        container attributes {
          uses MnsInfoGrp;
        }
      }
    }
  }
}
<CODE ENDS>

```

D.2.12 Void

D.2.13 module _3gpp-common-filemanagement.yang

```

<CODE BEGINS>
module _3gpp-common-filemanagement {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-filemanagement";
  prefix "filemgmt3gpp";

  import _3gpp-common-subnetwork { prefix subnet3gpp; }
  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-yang-types { prefix types3gpp; }
  import _3gpp-common-yang-extensions { prefix yext3gpp; }
  import _3gpp-common-managed-element { prefix me3gpp; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";
  description "Defines the YANG mapping of the FileDownloadJob Information Object
  Class (IOC) that is part of the Generic Network Resource Model (NRM).
  Copyright 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";
  reference "3GPP TS 28.623 Generic Network Resource Model (NRM)";

  revision 2023-12-17 { reference CR-0327 ; }
  revision 2023-09-17 { reference CR-0270 ; }
  revision 2022-10-31 { reference CR-0195; }
  revision 2022-02-10 { reference "Initial revision, S5-221757"; }

  grouping FileDownloadProcessMonitor {
    description "Provides specialisations of the ProcessMonitor datatype.";
    uses types3gpp:ProcessMonitorGrp {
      refine resultStateInfo {
        description "If status is FAILED resultStateInfo will be one of
        the following or empty.";
        must './status != "FAILED"
        or . = "UNKNOWN"
        or . = "NO_STORAGE"
        or . = "LOW_MEMORY"
        or . = "NO_CONNECTION_TO_REMOTE_SERVER"
        or . = "FILE_NOT_AVAILABLE"
        or . = "DNS_CANNOT_BE_RESOLVED"
        or . = "TIMER_EXPIRED"
        or . = "OTHER"
        or . = "NULL" ';
      }
      refine status {
        description "Status must not be 'PARTIALLY_FAILED'.";
        must '. != "PARTIALLY_FAILED" ';
      }
    }
  }

  grouping FileDownloadJobGrp {
    description "Represents the FileDownloadJob IOC.";
    reference "3GPP TS 28.622";
    uses top3gpp:Top_Grp;

    leaf fileLocation {
      description "Provides the location of a file.
      allowedValues: File URI (See RFC 8089)";
      mandatory true;
      type string;
      yext3gpp:notNotifyable;
      yext3gpp:inVariant;
    }

    leaf notificationRecipientAddress {
      description "Address of the notification recipient.";
      type string;
      yext3gpp:notNotifyable;
      yext3gpp:inVariant;
    }
  }
}

```



```

leaf cancelJob {
  description "Setting this attribute to TRUE cancels the file download job.
  As specified in the definition of ProcessMonitor, cancellation is
  possible in the NOT_STARTED and RUNNING state. Setting the attribute
  to FALSE has no observable result.";
  type boolean;
  mandatory true;
}

list jobMonitor {
  key "id";
  description "Provides monitoring for the file download job.";
  uses FileDownloadProcessMonitor;
}

grouping FileDownloadJobSubtree {
  description "Helps augmenting FileDownloadJob into multiple places.";
  list FileDownloadJob {
    description "Specifies the FileDownloadJob IOC, see 3GPP TS 28.622.";
    key "id";
    uses top3gpp:Top_Grp;
    container attributes {
      uses FileDownloadJobGrp;
    }
  }
}

augment "/subnet3gpp:SubNetwork" {
  uses FileDownloadJobSubtree;
}

augment "/me3gpp:ManagedElement" {
  uses FileDownloadJobSubtree;
}
}
<CODE ENDS>

```

D.2.14 module _3gpp-common-managementdatacollection.yang

```

<CODE BEGINS>
module _3gpp-common-managementdatacollection {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-managementdatacollection";
  prefix "mgtdatcol3gpp";

  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-yang-types {prefix types3gpp; }
  import _3gpp-common-yang-extensions { prefix yext3gpp; }
  //import ietf-inet-types { prefix inet; }
  import ietf-yang-types { prefix yang; }
  import _3gpp-common-subnetwork { prefix subnet3gpp; }

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

  description "Handling management data collection
  Copyright 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";

  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 2023-12-17 { reference CR-0327 ; }
  revision 2023-11-17 { reference "CR-0298" ; }
  revision 2023-09-17 { reference CR-0270 ; }
  revision 2022-11-03 { reference "CR-0193" ; }

  grouping GeoAreaToCellMappingGrp {

```

```

description "Represents the GeoAreaToCellMapping data type.

The mapping of the geographical area to cells is performed at
instantiation of the IOC.";

list geoArea {
  description "It specifies the geographical area using the coordinates of
the corners of a convex polygon.";
  key idx;
  max-elements 1;
  leaf idx {
    type string;
  }
  uses types3gpp:GeoAreaGrp;
}

leaf associationThreshold {
  type uint8 {
    range 1..100;
  }
  units percent;
  yext3gpp:inVariant;
  description "It specifies the threshold of coverage area in
percentage whether a cell belongs to the geographical area or not.

If this attribute is absent, the location of the base station
antenna determines whether a cell belongs to the geographical
area or not.";
}
}

grouping AreaOfInterestGrp {
  description "It specifies a location(s) from where the management data
shall be collected.";

  choice AreaOfInterestChoice {

    list geoAreaToCellMapping {
      description "Contains a geographical area and an association threshold.
The geo-area is defined as a convex polygon using the attribute
'geoArea'.

This data type contains a geographical area and an association
threshold. The geo-area is defined as a convex polygon using the
attribute 'geoArea'.

The MnS producer shall map the geographical area to cells. There are
two evaluation criteria whether a cell belongs to a geographical area
or not. If attribute 'associationThreshold' is absent, the location
of the base station antenna determines the belonging. If attribute
'associationThreshold' is configured, the coverage area is considered.
The attribute 'associationThreshold' determines the lower boundary of
the coverage ratio. For example, if the 'associationThreshold' is
configured to 60%, a cell shall be considered as included in the
geographical area if at least 60% of the coverage area of that
cell overlaps with the specified geographical area.

The mapping of the geographical area to cells is performed at
instantiation of the IOC.";
      key idx;
      leaf idx { type string; }
      uses GeoAreaToCellMappingGrp;
    }

    list tailList {
      description "Tracking Area Identity list";
      key idx;
      max-elements 8;
      leaf idx { type string; }
      uses types3gpp:TaiGrp;
    }

    leaf-list nrCellIdList {
      type string;
      max-elements 32;
      description "List of NR cells identified by NG-RAN CGI";
    }
  }
}

```

```

leaf-list eutraCellIdList {
  type string;
  max-elements 32;
  description "List of E-UTRAN cells identified by E-UTRAN-CGI";
}

leaf-list utraCellIdList {
  type string;
  max-elements 32;
  description "List of UTRAN cells identified by UTRAN CGI";
}
}
}

grouping NodeFilterGrp {
  description "This data type defines several selection criteria for the
  target node(s) i.e., the node(s) producing the requested management data.

  The attribute 'areaOfInterest' determines the location for which the
  management data is collected. The system translates the area into the
  target managed objects. The location is either configured by a list of
  TAI, a list of cells (identified either by NG-RAN CGI,
  E-UTRAN CGI or UTRAN CGI) or by a geographical area. The geographical
  area will be mapped to the cells providing coverage for this area.
  The cell coverage status at the time of the request is used for the
  mapping. Managed objects providing service to these cells are
  considered as target managed objects. Furthermore, an object which name
  contains or is associated to a managed object providing service to the
  considered cell, is considered as target managed object as well.

  The attribute 'networkDomain' is used to select a particular domain
  (e.g. RAN, CN) for which the management data is collected. The system
  translates this information into the target managed objects. Managed
  objects from this selected particular domain (e.g RAN, CN) are
  considered as target managed objects. Furthermore, an object which name
  contains or is associated to a managed object of that domain, is
  considered as target managed object as well.

  The attribute 'cpUpType' is used to select the traffic type (CP, UP) for
  which the management data is collected. The system translates this
  information into the target managed objects. Managed objects catering
  particular traffic type (CP, UP) are considered as target managed objects.
  Furthermore, an object which name contains or is associated to a managed
  object of that traffic type, shall be considered as target managed
  object as well.

  The attribute 'sst' is used to select the SST (Slice/Service Type)
  for which the management data is collected. The system translates this
  information into the target managed objects. Managed objects related to
  particular SST will be considered as target managed objects.

  If it is not possible to select the target node(s) (based on a
  particular selection criteria) deterministically, the selection criteria
  should not be used.";

  list areaOfInterest {
    key idx;
    leaf idx {
      type string;
    }
    uses AreaOfInterestGrp;
    description "It specifies a location(s) from where the management data
    shall be collected.";
  }

  leaf networkDomain {
    type enumeration {
      enum CN;
      enum RAN;
    }
    description "It specifies the network domain of the target node. This
    will also result in collecting appropriate management data from the
    nodes belonging to the specified domain.";
  }

  leaf cpUpType {
    type enumeration {
      enum CP;
    }
  }
}

```

```

    enum UP;
  }
  description "It specifies the traffic type of the target node. This will
  also result in collecting appropriate management data from the nodes
  handling the specified traffic (e.g AMF for CP and UPF for UP).";
}

leaf sst {
  type uint8; // TS 28.003 clause 28.4.
  description "It specifies the slice service type (SST) of which the slice
  subnet should be targeted. Please refer to 3GPP TS 23.501: 'System
  Architecture for the 5G System'";
}
}

typedef mgtDataCategoryType {
  type enumeration {
    enum COVERAGE;
    enum CAPACITY;
    enum ENERGY_EFFICIENCY;
    enum MOBILITY;
    enum ACCESSIBILITY;
  }
  description "";
}

grouping TimeWindowGrp {
  leaf startTime {
    type yang:date-and-time;
    yext3gpp:inVariant;
  }
  leaf endTime {
    type yang:date-and-time;
    yext3gpp:inVariant;
  }
}

grouping ManagementDataCollectionGrp {
  choice managementData {
    case mgtDataCategory {
      leaf-list mgtDataCategory {
        type mgtDataCategoryType;
        yext3gpp:inVariant;
        description "This attributes defines the type of management data that
        are requested.

        Allowed values for data category are COVERAGE, CAPACITY,
        ENERGY_EFFICIENCY, MOBILITY, ACCESSIBILITY. The data categories
        will map to certain measurement families defined in TS 28.552, see
        below. In addition to the below mappings, MnS producer may map the
        provided categories to any additional proprietary management data,
        as appropriate.

        - The COVERAGE category will map to measurement families of MR
        (measurements related to Measurement Report) and L1M (measurements
        related to Layer 1 Measurement).

        - The CAPACITY category will map to measurement family RRU
        (measurements related to Radio Resource Utilization).

        - The ENERGY_EFFICIENCY category will map to measurement family PEE
        (measurements related to Power, Energy and Environment).

        - The MOBILITY category will map to measurement family MM
        (measurements related to Mobility Management).

        - The ACCESSIBILITY category will map to measurement family CE
        (measurements related to Connection Establishment).";
      }
    }
  }
  case mgtDataName {
    leaf-list mgtDataName {
      type string;
      yext3gpp:inVariant;
      description "A list of management data identified by name.
      The list may include metrics or set of metrics defined
      in TS 28.552, TS 28.554 and TS 32.422."
    }
  }
}

```

For performance 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 according to the KPI definitions template as the component designated with a).

For trace metrics (including trace messages, MDT measurements (Immediate MDT, Logged MDT, Logged MBSFN MDT), RLF and RCEF reports) defined in TS 32.422, the name (metric identifier) is defined in clause 10 of TS 32.422.;"

```

    }
  }
  mandatory true;
}

list targetNodeFilter {
  key idx;
  yext3gpp:inVariant;
  leaf idx {
    type string;
  }
  description "Set of information to target the Object Instance to collect
  the measurements from.";
  uses NodeFilterGrp;
}

list collectionTimeWindow {
  key "startTime endTime";
  yext3gpp:inVariant;
  max-elements 1;
  description "Collection time window for which the management data
  should be reported.";
  uses TimeWindowGrp;
}

list reportingCtrl {
  key idx;
  yext3gpp:inVariant;
  leaf idx {
    type string;
  }
  min-elements 1;
  max-elements 1;
  uses types3gpp:ReportingCtrl;
  description "Selecting the reporting method and defining associated
  control parameters.";
}

leaf dataScope {
  yext3gpp:inVariant;
  type enumeration {
    enum SNSSAI;
    enum 5QI;
  }
  description "It specifies whether the required data is reported per
  S-NSSAI or per 5QI.";
}
}

augment /subnet3gpp:SubNetwork {
  list ManagementDataCollection {
    key id;
    uses top3gpp:Top_Grp ;
    container attributes {
      uses ManagementDataCollectionGrp;
    }
  }
  description "This IOC represents a management data collection request
  job. The requested data could be of kind Trace, MDT (Minimization
  of Drive Test), RLF (Radio Link Failure) report, RCEF (RRC Connection
  Establishment Failure) report, PM (performance measurements), KPI
  (end-to-end key performance indicators) or a combination of these.

```

The attribute 'managementData' defines the management data which shall be reported. This may either include a list of data categories or a list of management data identified with their name. For further details see TS 28.622 clause 4.3.50. The 'targetNodeFilter' attribute can be used to target object instance(s) producing the required management data. It is assumed that the consumer may not have detailed knowledge of the network and hence may not identify the exact object instance producing the required management data. In this case consumer can request management data, specified by 3GPP, produced by certain network function(s) based on a particular location, the domain (CN or RAN) of the object instances, and the handled traffic (CP or UP) of the object instances.

To activate the production of the requested data, a MnS consumer has to create a 'ManagementDataCollection' object instance on the MnS producer.

The MnS producer will derive multiple jobs ('PerfMetricJob', 'TraceJob') from a single 'ManagementDataCollection' job for collecting the required management data. Once it receives the measurement from multiple sources, it consolidates the data into a set of management data for reporting.

The attribute 'collectionTimeWindow' specifies the time window for which the management data should be reported.

The attribute 'reportingCtrl' specifies the method and associated control parameters for reporting the produced management data 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.

The attribute 'dataScope' configures, whether the management data should be reported per S-NSSAI or per 5QI, if applicable.";

```

    }
  }
}
<CODE ENDS>

```

D.2.15 module _3gpp-common-files.yang

```

<CODE BEGINS>
module _3gpp-common-files {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-files";
  prefix "files3gpp";

  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-yang-types { prefix types3gpp; }
  import _3gpp-common-yang-extensions { prefix yext3gpp; }
  import ietf-yang-types { prefix yang; }
  import ietf-inet-types { prefix inet; }

  organization "3GPP SA5";
  contact "https://www.3gpp.org/DynaReport/TSG-WG--S5--officials.htm?Itemid=464";
  description "Defines the YANG mapping of File retrieval NRM fragment
    including the IOCs File and Files.
    Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
    TTA, TTC). All rights reserved.";
  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 2024-05-11 { reference CR-0361 ; }
  revision 2023-09-17 { reference CR-0270 ; }
  revision 2022-09-28 { reference CR-0191; }

  grouping FileGrp {

```

```
description "Represents the File IOC.";

leaf fileLocation {
  type inet:uri ;
  mandatory true;
  yext3gpp:notNotifyable ;
  yext3gpp:inVariant ;
  description "Location of the file incl. the file transfer protocol,
    and the file name for the case the file content cannot be retrieved
    by reading the 'fileContent' attribute.

    The allowed file transfer protocols are:
    - sftp
    - ftpes
    - https

    Examples:
    'sftp://companyA.com/datastore/fileName.xml',
    'https://companyA.com/ManagedElement=1/Files=1/File=1'
    ";
}

leaf fileCompression {
  type string ;
  mandatory true;
  yext3gpp:notNotifyable ;
  yext3gpp:inVariant ;
  description "Name of the algorithm used for compressing the file.
    An empty or absent 'fileCompression' parameter indicates the file is
    not compressed. The MnS producer selects the compression algorithm.
    It is encouraged to use popular algorithms such as GZIP.";
}

leaf fileSize {
  type uint64 ;
  mandatory true;
  units bytes;
  yext3gpp:notNotifyable ;
  yext3gpp:inVariant ;
  description "Size of the file";
}

leaf fileDataType {
  type enumeration {
    enum PERFORMANCE {
      description "The value 'PERFORMANCE' refers to measurements and KPIs";
    }
    enum TRACE;
    enum ANALYTICS;
    enum PROPRIETARY;
  }
  mandatory true;
  yext3gpp:notNotifyable ;
  yext3gpp:inVariant ;
  description "Type of the management data stored in the file.";
}

leaf fileFormat {
  type string ;
  mandatory true;
  yext3gpp:notNotifyable ;
  yext3gpp:inVariant ;
  description "Identifier of the XML or ASN.1 schema (incl. its version)
    used to produce the file content.";
}

leaf fileReadyTime {
  type yang:date-and-time ;
  mandatory true;
  yext3gpp:notNotifyable ;
  yext3gpp:inVariant ;
  description "Date and time, when the file was closed (the last time)
    and made available on the MnS producer.
    The file content will not be changed anymore.";
}

leaf fileExpirationTime {
  type yang:date-and-time ;
}
```

```

    mandatory true;
    yext3gpp:notNotifyable ;
    yext3gpp:inVariant ;
    description "Date and time after which the file may be deleted.";
  }

  leaf fileContent {
    type string ; // String is very restrictive
    mandatory true;
    yext3gpp:notNotifyable ;
    yext3gpp:inVariant ;
    description "File content";
  }

  leaf-list jobRef {
    type types3gpp:DistinguishedName ;
    yext3gpp:notNotifyable ;
    yext3gpp:inVariant ;
    description "Object instance of the 'PerfMetricJob' or 'TraceJob'
      that produced the file.";
  }

  leaf jobId {
    type string ;
    yext3gpp:notNotifyable ;
    yext3gpp:inVariant ;
    description "Identifier of a PerfMetricJob job or a TraceJob.";
  }
}

grouping FilesGrp {
  description "Represents the Files IOC.";
  leaf numberOfFiles {
    type uint64 ;
    yext3gpp:notNotifyable ;
    description "Number of files in a file collection.";
  }

  leaf-list jobRef {
    type types3gpp:DistinguishedName ;
    yext3gpp:notNotifyable ;
    yext3gpp:inVariant ;
    description "Object instance of the 'PerfMetricJob' or 'TraceJob'
      that produced the file.";
  }

  leaf jobId {
    type string ;
    yext3gpp:notNotifyable ;
    yext3gpp:inVariant ;
    description "Identifier of a PerfMetricJob job or a TraceJob.";
  }
}

grouping FilesSubtree {
  description "Contains classes of the File retrieval NRM fragment.
    Should be used in classes (or classes inheriting from)
    - SubNnetwork
    - ManagedElement
    - PerfMetricJob
    - TraceJob

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

  list Files {
    description "This IOC represents a collection of files. It can be
      name-contained by 'SubNetwork', 'ManagedElement', 'PerfMetricJob' or
      'TraceJob'. The 'Files' object name-contains 'File' objects, that
      represent the files of the collection. File collections allow to
      structure related files under a common root.

      Instances of 'Files' are created by MnS producers. They shall be
      created at latest when the first file of the collection becomes
      available for retrieval by MnS consumers.

      The attributes of 'Files' represent properties of the file collection
      and not properties of individual files.
    
```


When the file retrieval NRM fragment is used together with a data collection job ('PerfMetricJob' or 'TraceJob') the following provisions shall apply:

- The 'Files' object shall be created at the same time as the object representing the data collection job.
- The attributes 'jobRef' and 'jobId' shall be supported and present in a 'Files' instance. They shall identify the job that the files in the file collection relate to.
- A 'Files' instance shall contain files related to one and only one job.
- The files produced by one job shall be contained in one and only one 'Files' instance.
- The job object shall support an attribute with a link to the created 'Files' instance ('_linkToFiles').
- The attribute '_linkToFiles' shall be returned in the job creation response, if the stage 3 protocol supports returning attributes in an object creation response.
- The MnS producer decides where to name-contain the 'Files' instance related to a job.

The attribute '_linkToFiles' allows a MnS consumer to create simple and targeted subscriptions for 'notifyFileReady', and 'notifyFilePreparationError', or 'notifyMOICreation', 'notifyMOIChanges' and 'notifyFilePreparationError' related to 'File' instances created or deleted under the 'Files' instance of a specific job. The subscription needs to scope simply objects one level below the 'Files' object.

In addition, the attribute '_linkToFiles' allows for simple deployments not relying on notifications for reporting the availability of new files, where the MnS consumer polls regularly for new files under 'Files.';

```
key id;
config false;
uses top3gpp:Top_Grp ;
container attributes {
  uses FilesGrp ;
}
```

```
list File {
  description "Represents a file. It is name-contained by 'Files'.
```

When a file becomes available on a MnS producer for retrieval by a MnS consumer, the MnS producer shall create a 'File' instance representing that file.

The time of creation shall be captured by the MnS producer in the 'fileReadyTime' attribute. The MnS producer shall keep the file at least until the time specified by 'fileExpirationTime'. After that time the MnS producer may delete the 'File' instance. The 'fileExpirationTime' is determined by the MnS producer based on considerations such as available storage space or file retention policies.

The attributes 'fileSize', 'fileCompression', 'fileDataType' and 'fileFormat' describe the file properties.

The 'fileLocation' attribute indicates the address where the file can be retrieved. The address includes the file transfer protocol (schema). Allowed file transfer protocols are 'sftp', 'ftpes' and 'https'.

The value of 'fileLocation' can be identical to or different from the address of the 'File' instance. The attribute 'fileContent' is provided for retrieving the actual file content. When identifying in the Read request a 'File' instance and specifying only the 'fileContent' attribute be returned, then only the file content shall be returned in the response. Note, as usual, multiple attributes can be specified to be returned, so that the file content together with some or all file meta data attributes can be returned in response to a single request.

In case the 'fileLocation' specifies a location different than the 'File' object location, then the attribute 'fileContent' cannot be used for retrieving the file content. For example, the 'File' object location may be given by

```
'https://companyA.com/ManagedElement=1/Files=1/File=1'
```



```

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

description "Defines ManagementNode IOCs
  Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";
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 2024-01-29 { reference CR-0327 ; }

grouping ManagementSystem_Grp {
  description "Represents the ManagementSystem_ IOC.";

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

  leaf-list managedElements {
    type types3gpp:DistinguishedName;
    config false;
    description "Contains a list of the DN(s) of the related subclasses of
      ManagedElement_ instance(s).";
  }
}

grouping ManagementNodeGrp {
  uses ManagementSystem_Grp;

  leaf vendorName {
    type string;
    config false;
  }

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

  leaf locationName {
    type string;
    config false;
    description "The physical location of this entity (e.g. an address).";
  }

  leaf swVersion {
    type string;
    config false;
  }
}

augment /subnet3gpp:SubNetwork {
  list ManagementNode {
    description "Represents a telecommunications management system (EM) within
      the TMN that contains functionality for managing a number of
      ManagedElements (MEs). The management system communicates with the MEs
      directly or indirectly over one or more interfaces for the purpose
      of monitoring and/or controlling these MEs.

      This class has similar characteristics as the ManagedElement. The
      main difference between these two classes is that the ManagementNode
      has a special association to the managed elements that it is
      responsible for managing.";

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

```

```

    }
  }
}

```

<CODE ENDS>

D.2.17 module _3gpp-common-mnsagent.yang

```

<CODE BEGINS>
module _3gpp-common-mnsagent {
  yang-version 1.1;
  namespace urn:3gpp:sa5:_3gpp-common-mnsagent;
  prefix "magent3gpp";

  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-yang-types { prefix types3gpp ; }
  import _3gpp-common-managed-element { prefix me3gpp ; }
  import _3gpp-common-subnetwork { prefix subnet3gpp ; }
  import _3gpp-common-management-node { prefix mngmtnode3gpp ; }

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

  description "Defines MnsAgent IOCs
    Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
    TTA, TTC). All rights reserved.";
  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 2024-01-29 { reference CR-0327 ; }

  feature MnsAgentUnderManagedElement {
    description "MnsAgent shall be contained under ManagedElement.";
  }

  feature MnsAgentUnderSubNetwork {
    description "MnsAgent shall be contained under SubNetwork.";
  }

  feature MnsAgentUnderManagementNode {
    description "MnsAgent shall be contained under ManagementNode.";
  }

  grouping MnsAgentGrp {
    description "Represents the MnsAgentGrp IOC.";

    leaf systemDN {
      type types3gpp:DistinguishedName;
      config false;
      description "Distinguished Name (DN) of a IRPAgent or a MnsAgent.";
    }
  }

  grouping MnsAgentSubtree {
    list MnsAgent {
      description "The MnsAgent represents the MnS producers, incl. the
        supporting hardware and software, available for a certain management
        scope that is related to the object name-containing the MnS Agent.
        The MnsAgent can be name-contained under an IOC as follows:
        1) ManagementNode;
        2) SubNetwork, if the SubNetwork does not contain a ManagementNode;
        3) ManagedElement, if it is the root element.
        In case the MnsAgent is name-contained under a ManagementNode, the
        management scope is the complete management scope of the

```

```

ManagementNode or a subset thereof.
In case the MnsAgent is name-contained under a SubNetwork, the
management scope is the complete SubNetwork or a subset thereof.
In case the MnsAgent is name-contained under a ManagedElement, the
management scope is the complete ManagedElement or a subset thereof.";
key id;
uses top3gpp:Top_Grp;
container attributes {
  uses MnsAgentGrp;
}
}
}

augment /me3gpp:ManagedElement {
  if-feature MnsAgentUnderManagedElement;
  uses MnsAgentSubtree;
}
augment /subnet3gpp:SubNetwork {
  if-feature MnsAgentUnderSubNetwork;
  uses MnsAgentSubtree;
}
augment /subnet3gpp:SubNetwork/mgmtnode3gpp:ManagementNode {
  if-feature MnsAgentUnderManagementNode;
  uses MnsAgentSubtree;
}
}
}

<CODE ENDS>

```

D.2.18 module _3gpp-common-mecontext.yang

```

<CODE BEGINS>
module _3gpp-common-mecontext {
  yang-version 1.1;
  namespace "urn:3gpp:sa5:_3gpp-common-mecontext";
  prefix "mectx3gpp";

  import _3gpp-common-yang-types { prefix types3gpp; }
  import _3gpp-common-top { prefix top3gpp; }
  import _3gpp-common-subnetwork { prefix subnet3gpp; }
  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 MeContext which will be augmented by other IOCs
  Copyright 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI,
  TTA, TTC). All rights reserved.";
  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 2024-07-17 { reference "CR-0381 CR-0382 CR-0383"; }

  grouping MeContextGrp {
    description "Represents the MeContext IOC.";

    leaf dnPrefix {
      type types3gpp:DistinguishedName;
      config false;
      description "It carries the DN Prefix information or no information.
      The instance of MeContext is the local root instance of the MIB.
      Otherwise the attribute shall be absent or carry no information.";
      reference "Annex C of 32.300 ";
    }
  }

  augment "/subnet3gpp:SubNetwork" {
    list Mecontext {
      description "This IOC is introduced for naming purposes. It may support

```


Annex E (normative): YANG/Netconf-based solution set

E.1 Common data types

Data types in YANG have the same name as in stage 2 also considering the mapping rule in TS 32.160 [14] clause 6.2.16.1. There are some data types that do not conform to this rule because the data type was defined by an external organisation (e.g. IETF) or pre-existing YANG definitions exist. Table E.1-1 lists the mapping for these exceptions.

Table E.1-1: Mapping of common data types

Stage-2 Type Name	YANG type	Description
FullTime	yang:time-with-zone-offset	Defined in ietf-yang-types.yang
Float	Decimal64	Defined in RFC 7950
DnList	types3gpp:DistinguishedName	A list or leaf-list of type types3gpp:DistinguishedName Defined in _3gpp-common-yang-types.yang
Fqdn	inet:host-name	Defined in ietf-inet-types.yang
Ipv4Addr	inet:ipv4-address	Defined in ietf-inet-types.yang
Ipv6Addr	inet:ipv6-address	Defined in ietf-inet-types.yang
Ipv6Prefix	inet:ipv6-prefix	Defined in ietf-inet-types.yang
Uri	inet:uri	Defined in ietf-inet-types.yang

Annex F (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
2020-09	SA#89e	SP-200729	0095	-	F	Correction of YANG errors	16.5.0
2020-09	SA#89e	SP-200727	0101	1	A	Clean-up definitions and references	16.5.0
2020-09	SA#89e	SP-200729	0102	-	B	YANG SS for Trace Control	16.5.0
2020-09	SA#89e	SP-200724	0103	-	F	Add missing definitions to comDefs.yaml (OpenAPI definitions)	16.5.0
2020-09	SA#89e	SP-200724	0104	-	F	Correct various smaller errors (e.g. validation errors) in genericNRM.yaml (OpenAPI definitions)	16.5.0
2020-09	SA#89e	SP-200729	0105	1	F	Correct ThresholdMonitor definition (OpenAPI definitions)	16.5.0
2020-09	SA#89e	SP-200729	0106	-	F	Update HeartbeatControl YANG definition	16.5.0
2020-09	SA#89e	SP-200729	0107	-	F	Update ThresholdMonitor YANG definition	16.5.0
2020-12	SA#90e	SP-201057	0108	-	F	Correction of NRM YANG errors	16.6.0
2020-12	SA#90e	SP-201063	0109	1	F	Add new MDT specific parameter collection period for NR aligning with 28.622 for stage 3	16.6.0
2020-12	SA#90e	SP-201057	0110	-	F	Remove thresholdLevel attribute from ThresholdMonitor (OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201050	0111	1	F	Correct and add types in comDefs.yaml (OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201050	0112	1	F	Use comDefs.yaml instead of local definitions in genericNrm.yaml (OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201057	0113	1	F	Update attribute perfMetricJobGroupld.	16.6.0
2020-12	SA#90e	SP-201057	0114	-	F	Remove value handling from the granularityPeriod description	16.6.0
2020-12	SA#90e	SP-201088	0115	-	F	Correct and add types in comDefs.yaml (OpenAPI definition)	16.6.0
2020-12	SA#90e	SP-201063	0117	-	F	Correct trace target parameter for trace control in stage 3	16.6.0
2020-12	SA#90e	SP-201089	0118	1	F	Remove incorrect S-NSSAI definition from YANG SS	16.6.0
2021-03	SA#91e	SP-210146	0121	-	F	Fix compilation errors	16.7.0
2021-03	SA#91e	SP-210153	0125	-	F	YANG compilation error and missing stage 2 corrections	16.7.0
2021-06	SA#92e	SP-210406	0119	2	F	Replace legacy IRPagent with MnsAgent (OpenAPI definition)	16.8.0
2021-06	SA#92e	SP-210397	0127	1	F	Correction of Trace/MDT related parameters (OpenAPI definition)	16.8.0
2021-06	SA#92e	SP-210397	0128	1	F	Align Trace/MDT related parameters to TS 32.422 (OpenAPI definition)	16.8.0
2021-06	SA#92e	SP-210406	0129	1	F	Clean up regarding common data types (OpenAPI definition)	16.8.0
2021-06	SA#92e	SP-210411	0130	-	F	Correct definition of additionalInformation (YANG)	16.8.0

2021-09	SA#93e	SP-210886	0131	1	F	Replace local data type definition for notificationFilter by common filter definition	16.9.0
2021-09	SA#93e	SP-210886	0132	1	F	Correct data type of notificationId (YANG definitions)	16.9.0
2021-09	SA#93e	SP-210886	0133	1	F	Clarify resource id is required and nullable (OpenAPI definitions)	16.9.0
2021-09	SA#93e	SP-210865	0134	-	F	Correction and clarification of reporting in TraceJob (stage3)	16.9.0
2021-09	SA#93e	SP-210865	0135	-	F	Adaptation and cleanup of Trace/MDT related parameters (stage3)	16.9.0
2021-09	SA#93e	SP-210871	0136	-	F	YANG updates to correct YANG merging problems	16.9.0
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