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TECHNICAL SPECIFICATION

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

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.

The interface Itf-N, defined in 3GPP TS 32.102 [2], is built up by a number of Integration Reference Points (IRPs) and a related Name Convention, which realise the functional capabilities over this interface. The basic structure of the IRPs is defined in 3GPP TS 32.150 [4].

The present document is part of a set that has been developed for converged management solutions.

The present document is part of a set that is used for management and orchestration of 5G networks and network slicing.

1 Scope

The present document specifies the Generic network resource information that can be communicated between an IRPAgent and an IRPManager for telecommunication network management purposes, including management of converged networks and networks that include virtualized network functions.

This document specifies the semantics of information object class attributes and relations visible across the reference point in a protocol and technology neutral way. It does not define their syntax and encoding.

This document supports the Federated Network Information Model (FNIM) concept described in [8] in that the relevant Information Object Class (IOC)s defined in this specification are directly or indirectly inherited from those specified in the Umbrella Information Model (UIM) of [9].

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 32.302: "Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Information Service (IS)".

[4] 3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and Definitions".

[5] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification"

[6] 3GPP TS 32.532: " Telecommunication management; Software Management Integration Reference Point (IRP); Information Service (IS)"

[7] ITU-T Recommendation X.710 (1991): "Common Management Information Service Definition for CCITT Applications".

[8] TS 32.107: "Telecommunication management; Fixed Mobile Convergence (FMC) Federated Network Information Model (FNIM)"

[9] TS 28.620: "Telecommunication management; Fixed Mobile Convergence (FMC) Federated Network Information Model (FNIM) Umbrella Information Model (UIM)"

[10] TS 32.156: "Telecommunication management; Fixed Mobile Convergence (FMC) Model Repertoire"

[11] 3GPP TS 32.111-2: "Telecommunication management; Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)".

[12] 3GPP TS 32.662: "Telecommunication management; Configuration Management (CM); Kernel CM Information Service (IS)".

[13] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".

[14]   3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".

[15]   ETSI GS NFV 003 V1.1.1: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[16]   ETSI GS NFV-IFA 008 v2.1.1: "Network Functions Virtualisation (NFV); Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification".

[17]   ETSI GS NFV-IFA 015 v2.1.2: "Network Functions Virtualisation (NFV); Management and Orchestration; Report on NFV Information Model".

[18]   ETSI ES 202 336-12 V1.1.1: "Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (power, cooling and building environment systems used in telecommunication networks); Part 12: ICT equipment power, energy and environmental parameters monitoring information model".

[19]   ITU-T Recommendation X.731: "Information technology - Open Systems Interconnection - Systems Management: State management function".

[20]   3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[21]   3GPP TS 28.625: "State Management Data Definition Integration Reference Point (IRP); Information Service (IS) ".

[22]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [22], 3GPP TS 32.101 [1], 3GPP TS 32.102 [2], 3GPP TS 32.150 [4] and 3GPP TS 32.600 [14] 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 [22], 3GPP TS 32.101 [1], 3GPP TS 32.102 [2], 3GPP TS 32.150 [4] and 3GPP TS 32.600 [14].

Association: In general it is used to model relationships between Managed Objects. Associations can be implemented in several ways, such as:

1) name bindings,

2) reference attributes, and

3) association objects.

This IRP stipulates that name containment associations shall be expressed through name bindings, but it does not stipulate the implementation for other types of associations as a general rule. These are specified as separate entities in the object models (UML diagrams). Currently however, all (non-containment) associations are modelled by means of reference attributes of the participating MOs.

Information Object Class (IOC): An IOC represents the management aspect of a network resource. It describes the information that can be passed/used in management interfaces. Their representations are technology agnostic software objects. IOC has attributes that represents the various properties of the class of objects. See the term "attribute" defined in [10]. Furthermore, IOC can support operations providing network management services invocable on demand for that class of objects. An IOC may support notifications that report event occurrences relevant for that class of objects. It is modelled using the stereotype "Class" in the UML meta-model. See TS 32.156 [10] for additional information on IOC.

Managed Object (MO): A MO is an instance of a Managed Object Class (MOC) representing the management aspects of a network resource. Its representation is a technology specific software object. It is sometimes called MO instance (MOI). The MOC is a class of such technology specific software objects. An MOC is the same as an IOC except that the former is defined in technology specific terms and the latter is defined in technology agnostic terms. MOCs are used/defined in SS level specifications. IOCs are used/defined in IS level specifications.

Management Information Base (MIB): A MIB is an instance of an NRM and has some values on the defined attributes and associations specific for that instance. In the context of the present document, an MIB consists of:

1) a Name space (describing the MO containment hierarchy in the MIB through Distinguished Names),

2) a number of Managed Objects with their attributes and

3) a number of Associations between these MOs. Also note that TMN (ITU-T Recommendation X.710 [7]) defines a concept of a Management Information Tree (also known as a Naming Tree) that corresponds to the name space (containment hierarchy) portion of this MIB definition. Figure 3.1 depicts the relationships between a Name space and a number of participating MOs (the shown association is of a non-containment type)
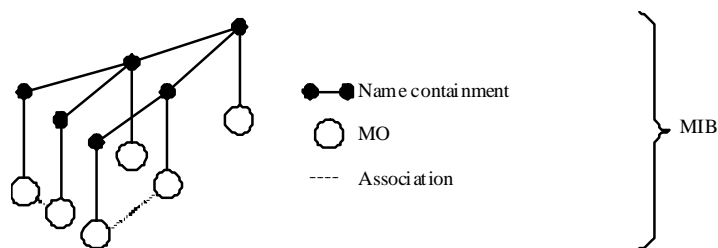
Figure 3.1: Relationships between a Name space and a number of participating MOs

Name space: A name space is a collection of names. The IRP name convention (see 3GPP TS 32.300 [13]) restricts the name space to a hierarchical containment structure, including its simplest form - the one-level, flat name space. All Managed Objects in a MIB shall be included in the corresponding name space and the MIB/name space shall only support a strict hierarchical containment structure (with one root object). A Managed Object that contains another is said to be the superior (parent); the contained Managed Object is referred to as the subordinate (child). The parent of all MOs in a single name space is called a Local Root. The ultimate parent of all MOs of all managed systems is called the Global Root.

Network resource: is a component of a NE, which can be identified as a discrete separate entity and is in an object-oriented environment for the purpose of management represented by an abstract entity called Information Object Class (IOC) instance.

Network Resource Model (NRM): A collection of IOCs, inclusive of their associations, attributes and operations, representing a set of network resources under management.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [22] 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 [22].

DN	Distinguished Name (see 3GPP TS 32.300 [13])
IOC	Information Object Class
MO	Managed Object
MOC	Managed Object Class
MOI	Managed Object Instance
NFVI	Network Functions Virtualisation Infrastructure (NFVI): Defined in ETSI GS NFV 003 [15].
RDN	Relative Distinguished Name (see 3GPP TS 32.300 [13])
SS	Solution Set

VNF   Virtualised Network Function

4   Model

4.1   Imported information entities and local labels

Label reference	Local label
3GPP TS 32.111-2 [11], notification, `notifyAckStateChanged`	`notifyAckStateChanged`
3GPP TS 32.662 [12], notification, `notifyAttributeValueChanged`	`notifyAttributeValueChanged`
3GPP TS 32.111-2 [11], notification, `notifyChangedAlarm`	`notifyChangedAlarm`
3GPP TS 32.111-2 [11], notification, `notifyClearedAlarm`	`notifyClearedAlarm`
3GPP TS 32.111-2 [11], notification, `notifyComments`	`notifyComments`
3GPP TS 32.111-2 [11], notification, `notifyNewAlarm`	`notifyNewAlarm`
3GPP TS 32.662 [12], notification, `notifyObjectCreation`	`notifyObjectCreation`
3GPP TS 32.662 [12], notification, `notifyObjectDeletion`	`notifyObjectDeletion`
3GPP TS 32.111-2 [11], notification, `notifyAlarmListRebuilt`	`notifyAlarmListRebuilt`
3GPP TS 32.111-2 [11], notification, `notifyPotentialFaultyAlarmList`	`notifyPotentialFaultyAlarmList`
3GPP TS 32.532 [6], notification, `notifyDownloadNESwStatusChanged`	`notifyDownloadNESwStatusChanged`
3GPP TS 32.532 [6], notification, `notifyInstallNESwStatusChanged`	`notifyInstallNESwStatusChanged`
3GPP TS 32.532 [6], notification, `notifyActivateNESwStatusChanged`	`notifyActivateNESwStatusChanged`
3GPP TS 28.620 [9], IOC, *Domain_*	*Domain_*
3GPP TS 28.620 [9], IOC, *ManagedElement_*	*ManagedElement_*
3GPP TS 28.620 [9], IOC, *Function_*	*Function_*
3GPP TS 28.620 [9], IOC, *ManagementSystem_*	*ManagementSystem_*
3GPP TS 28.620 [9], IOC, *TopologicalLink_*	*TopologicalLink_*
3GPP TS 28.620 [9], IOC, *Top_*	*Top_*

4.2   Class diagrams

4.2.1   Relationships

This clause depicts the set of classes (e.g. IOCs) that encapsulates the information relevant for this IRP. This clause provides the overview of the relationships of relevant classes in UML. Subsequent clauses provide more detailed specification of various aspects of these classes.

The following figure shows the containment/naming hierarchy and the associations of the classes defined in the present document. See Annex A of a class diagram that combines this figure with Figure 1 of [2], the class diagram of UIM.
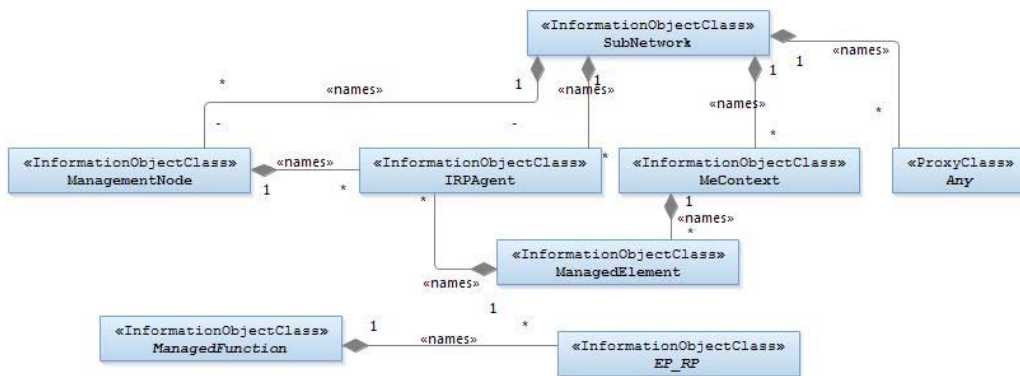
NOTE 1:   ManagedElement may be contained either
   - in a SubNetwork (since *SubNetwork* inherits from *Domain_* and *ManagedElement* inherits from *ManagedElement_*
   and *Domain_* name-contained *ManagedElement_* as observed in the figure of Annex A) or
   - in a MeContext instance as observed by the above figure or in the figure of Annex A.
   This either-or relation cannot be shown by using an {xor} constraint in the above figure.
   ManagedElement may also have no parent instance at all.
NOTE 2:   Each instance of the VsDataContainer shall only be contained under one IOC. The VsDataContainer can be contained under IOCs defined in other NRMs.
NOTE 3:   If the configuration contains several instances of SubNetwork, exactly one SubNetwork instance shall directly or indirectly contain all the other SubNetwork instances.
NOTE 4:   The SubNetwork instance not contained in any other instance of SubNetwork is referred to as "the root SubNetwork instance".
NOTE 5:   ManagementNode shall be contained in the root SubNetwork instance.
NOTE 6:   If contained in a SubNetwork instance, IRPAgent shall be contained in the root SubNetwork instance.
NOTE 7:   For a clarification on the choice of containment of the IRPAgent (since it has three possible parents), see the def. of IRPAgent.

Figure 4.2.1-1: Containment/Naming and Association NRM fragment

Each Managed Object is identified with a Distinguished Name (DN) according to 3GPP TS 32.300 [13] that expresses its containment hierarchy. As an example, the DN of a ManagedElement instance could have a format like:

SubNetwork=Sweden,MeContext =MEC-Gbg-1, ManagedElement=RNC-Gbg-1.
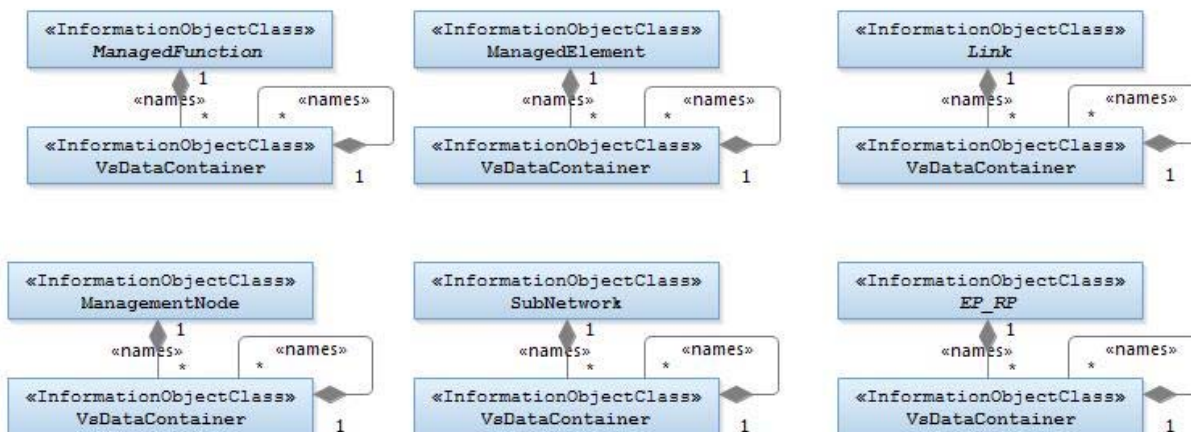
NOTE 8: Each instance of the `VsDataContainer` shall only be contained under one IOC. The `VsDataContainer` can be contained under IOCs defined in other NRMs by virtue of inheritance from the GENERIC NRM.

NOTE 9: The `VsDataContainer` is only used for the Bulk CM IRP.

Figure 4.2.1-2: `VsDataContainer` Containment/Naming and Association in GENERIC NRM diagram
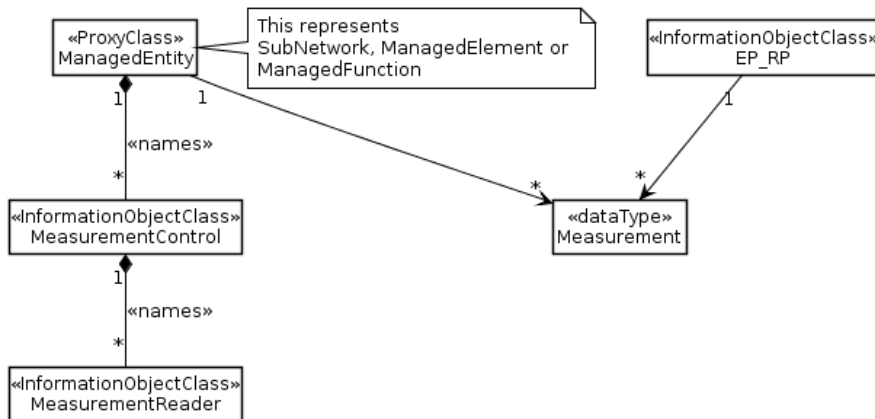
Figure 4.2.1-3: PM NRM fragment

4.2.2 Inheritance

This clause depicts the inheritance relationships.
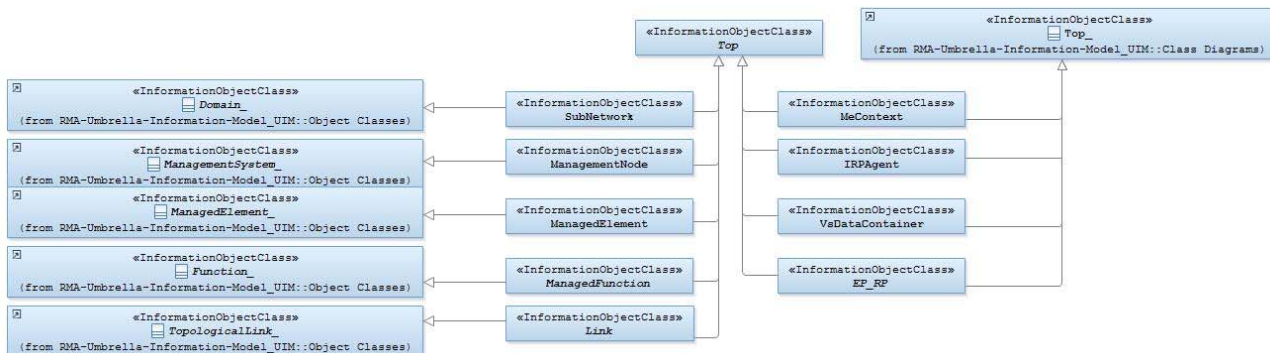
Figure 4.2.2-1: Inheritance Hierarchy NRM fragment
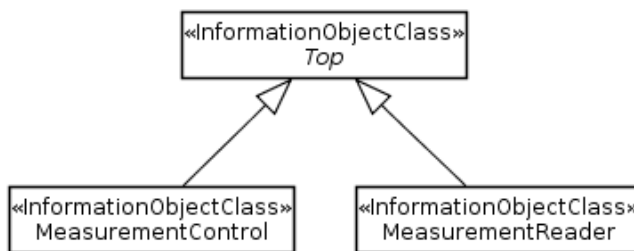
Figure 4.2.2-2: Inheritance PM NRM fragment

4.3 Class definitions

4.3.1 Any

4.3.1.1 Definition

This class represents the classes (e.g. IOC) that are not defined in this specification but are or will be defined in other IRP specification(s).

4.3.1.2 Attributes

None

4.3.1.3 Attribute constraints

None

4.3.1.4 Notifications

This class does not support any notification.

4.3.2 IRPAgent

4.3.2.1 Definition

This IOC represents the functionality of an IRPAgent. It shall be present. For a definition of IRPAgent, see 3GPP TS 32.102 [2].

The IRPAgent will be contained under an IOC as follows (only one of the options shall be used):

   1) ManagementNode, if the configuration contains a ManagementNode;

   2) SubNetwork, if the configuration contains a SubNetwork and no ManagementNode;

   3) ManagedElement, if the configuration contains no ManagementNode or SubNetwork.

4.3.2.2 Attributes

The IRPAgent IOC includes the attributes inherited from Top_ IOC (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
systemDN	M	MT	-F	-F	MT

4.3.2.3 Attribute constraints

None

4.3.2.4 Notifications

The common notifications defined in clause 4.5 are valid for this IOC, without exceptions or additions

4.3.3 ManagedElement

4.3.3.1 Definition

This IOC represents telecommunications equipment or TMN entities within the telecommunications network providing support and/or service to the subscriber.
An ME communicates with a manager (directly or indirectly) over one or more management interfaces for the purpose of being monitored and/or controlled. MEs may or may not additionally perform element management functionality.
An ME contains equipment that may or may not be geographically distributed. An ME is often referred to as a "Network Element".

A telecommunication equipment has software and hardware components. The IOC described above represents the case when the software component is designed to run on dedicated hardware component. In the case when the software is designed to run on ETSI NFV defined NFVI [15], the 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 ManagedElement IOC may be used to represent combined ME functionality (as indicated by the managedElementType attribute and the contained instances of different functional IOCs).

Single function ManagedElement IOC instances will have a 1..1 containment relationship to a function IOC instance (in this context a function IOC instance is an instance of an IOC derived from the ManagedFunction IOC). Multiple function ManagedElement instances will have a 1..N containment relationship to function IOC instances.

NOTE: For some specific functional IOCs a 1..N containment relationship is permitted. The specific functional entities are identified in the NRMs that define subclasses of ManagedFunction.

4.3.3.2 Attributes

The ManagedElement IOC includes the attributes inherited from ManagedElement_ IOC (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
vendorName	M	MT	F	F	MT
userDefinedState	M	MT	MT	F	MT
swVersion	M	MT	F	F	MT
priorityLabel	O	T	F	T	F
MeasurementsList	M	T	F	F	T

4.3.3.3 Attribute constraints

Name	Definition
dnPrefix (inherited) Support Qualifier	Condition: The ManagedElement instance is the local root instance of the MIB; otherwise, the attribute shall be absent or carry no information.

4.3.3.4 Notifications

The common notifications defined in clause 4.5 are valid for this IOC. In addition, the following set of notifications is also valid.

Name	Qualifier	Notes
notifyDownloadNESwStatusChanged	See Software Management IRP (3GPP TS 32.532 [6])	
notifyInstallNESwStatusChanged	See Software Management IRP (3GPP TS 32.532 [6])	
notifyActivateNESwStatusChanged	See Software Management IRP (3GPP TS 32.532 [6])	

4.3.4 *ManagedFunction*

4.3.4.1 Definition

This IOC is provided for sub-classing only. It provides attribute(s) that are common to functional IOCs. Note that a ManagedElement may contain several managed functions. The ManagedFunction may be extended in the future if more common characteristics to functional objects are identified.

This IOC can represent a telecommunication function either realized by software running on dedicated hardware or realized by software running on NFVI. Each ManagedFunction instance communicates with a manager (directly or indirectly) over one or more management interfaces exposed via its containing ME instance.

4.3.4.2 Attributes

The ManagedFunction IOC includes the attributes inherited from Function_IOC (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
vnfParametersList	CM	T	T	F	T
peeParametersList	CM	T	T	F	T
priorityLabel	O	T	F	T	F
measurementsList	M	T	F	F	T

4.3.4.3 Attribute constraints

Name	Definition
vnfParametersList Support Qualifier	Condition: The ManagedFunction instance is realized by one or more VNF instance(s). Otherwise this attribute shall be absent.
peeParametersList Support Qualifier	Condition:The control and monitoring of PEE parameters is supported by the ManagedFunction or sub-class instance.

4.3.4.4 Notifications

There is no notification defined.

4.3.5 ManagementNode

4.3.5.1 Definition

This IOC 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.

4.3.5.2 Attributes

The ManagementNode IOC includes the attributes inherited from ManagementSystem_ IOC (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
vendorName	M	T	F	F	T
userDefinedState	M	T	T	F	T
locationName	M	T	F	F	T
swVersion	M	T	F	F	T

4.3.5.3 Attribute constraints

None

4.3.5.4 Notifications

The common notifications defined in clause 4.5 are valid for this IOC, without exceptions or additions.

4.3.6 MeContext

4.3.6.1 Definition

This IOC is introduced for naming purposes. It may support creation of unique DNs in scenarios when some MEs have the same RDNs due to the fact that they have been manufacturer pre-configured.
If some MEs have the same RDNs (for the above mentioned reason) and they are contained in the same SubNetwork instance, some measure shall be taken in order to assure the global uniqueness of DNs for all IOC instances under those MEs. One way could be to set different dnPrefix for those NEs, but that would require either that:

   a) all LDNs or DNs are locally modified using the new dnPrefix for the upper portion of the DNs, or

   b) a mapping (translation) of the old LDNs or DNs to the new DNs every time they are used externally, e.g. in alarm notifications.

As both the two alternatives above may involve unacceptable drawbacks (as the old RDNs for the MEs then would have to be changed or mapped to new values), using MeContext offers a new alternative to resolve the DN creation. Using MeContext as part of the naming tree (and thus the DN) means that the dnPrefix, including a unique MeContext for each ME, may be directly concatenated with the LDNs, without any need to change or map the existing ME RDNs to new values.

MeContext have 0..N instances. It may exist even if no SubNetwork exists. Every instance of MeContext contains exactly one ManagedElement during steady-state operations.

4.3.6.2 Attributes

The MeContext IOC includes the attributes inherited from Top_ IOC (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
dnPrefix	CM	M	-	-	M

4.3.6.3 Attribute constraints

Name	Definition
dnPrefix Support Qualifier	Condition: The instance of MeContext is the local root instance of the MIB. Otherwise the attribute shall be absent or carry no information.

4.3.6.4   Notifications

The common notifications defined in clause 4.5 are valid for this IOC, without exceptions or additions.

4.3.7   SubNetwork

4.3.7.1   Definition

This IOC represents a set of managed entities.There may be zero or more instances of a SubNetwork. It shall be present if either a ManagementNode or multiple ManagedElements are present (i.e. ManagementNode and multiple ManagedElement instances shall have SubNetwork as parent).

The SubNetwork instance not contained in any other instance of SubNetwork is referred to as "the root SubNetwork instance".

4.3.7.2   Attributes

The SubNetwork IOC includes the attributes inherited from Domain_ IOC (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
setOfMcc	CM	T	F	F	T
priorityLabel	O	T	F	T	F
measurementsList	M	T	F	F	T

4.3.7.3   Attribute constraints

Name	Definition
dnPrefix (inherited) Support Qualifier	Condition: The instance of SubNetwork is the local root instance of the MIB. Otherwise the attribute shall be absent or carry no information.
setOfMcc Support Qualifier	Condition: There is more than one value in setOfMcc of the SubNetwork, otherwise the support is optional.

4.3.7.4   Notifications

The common notifications defined in clause 4.5 are valid for this IOC, without exceptions or additions

4.3.8   Top

4.3.8.1   Definition

This IOC is provided for sub-classing only. All information object classes defined in all TS that claim to be conformant to 32.102 [2] shall inherit from Top.

4.3.8.2   Attributes

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
objectClass	M	T	F	T	T
objectInstance	M	T	F	T	T

4.3.8.3   Attribute constraints

None

4.3.8.4   Notifications

There is no notification defined.

4.3.9   `VsDataContainer`

4.3.9.1   Definition

The `VsDataContainer` managed object is a container for vendor specific data. The number of instances of the `VsDataContainer` can differ from vendor to vendor. This IOC shall only be used by the Bulk CM IRP for all the NRMs.

4.3.9.2   Attributes

The VsDataContainer IOC includes the attributes inherited from Top_ IOC (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
vsDataType	M	T	F	F	O
vsData	M	T	O	F	O
vsDataFormatVersion	M	T	F	F	O

4.3.9.3   Attribute constraints

None

4.3.9.4   Notifications

Support for notification on the change of attribute value is vendor-specific.

4.3.10   *Link*

4.3.10.1   Definition

This IOC is provided for sub-classing only. This IOC represents a communication link or reference point between two network entities. The Link IOC does not indicate whether the represented communication link or reference point is a physical or logical entity.

For the subclasses of Link, the following rules apply:

1) The subclass names shall have the form "Link_<X>_<Y>", where <X> is a string that represents the IOC at one end of the association related to the particular Link subclass, and <Y> is a string that represents the IOC at the other end of the association. For the order of the two strings, <X> shall come alphabetically before <Y>.

2) In case <X> and <Y> are YyyFunction IOCs (inheriting from ManagedFunction and on first level below ManagedElement), the <X> and <Y> strings shall have the same form as the legal values of the `managedElementType` attribute (see clause 4.5.1), e.g. "Auc". Otherwise <X> and <Y> shall be the full IOC names.

Thus, two valid examples of Link subclass names would be: `Link_As_Cscf` and `Link_Mrfc_Mrfp`.

4.3.10.2   Attributes

The Link IOC includes the attributes inherited from TopologicalLink_ (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
userLabel	M	T	T	F	T
linkType	O	T	F	F	T
protocolVersion	O	T	F	F	T

4.3.10.3 Attribute constraints

Name	Definition
aEnd and zEnd (inherited from *TopologicalLink_*) Support Qualifier	Condition: The property multiplicity is 1.

4.3.10.4 Notifications

The common notifications defined in subclause 4.5 are valid for this IOC, without exceptions or additions

4.3.11 *EP_RP*

4.3.11.1 Definition

This IOC is provided for sub-classing only. This IOC represents an end point of a link used across a reference point between two network entities.

The detailed subclassed IOC, e.g. EP_X2, will be defined in E-UTRAN NRM IRP, by inheriting from this EP_RP.

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.

4.3.11.2 Attributes

The EP_RP IOC includes the attributes inherited from Top_ (defined in TS 28.620 [9]), attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute Name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
farEndEntity	O	T	-	-	T
userLabel	O	T	T	-	T
measurementsList	M	T	F	F	T

4.3.11.3 Attribute constraints

None

4.3.11.4 Notifications

This class does not support any notification.

4.3.12 MeasurementControl

4.3.12.1 Definition

This IOC captures the properties of the file-based and stream-based delivery methods.

The file-based delivery method has properties for the file location, the file reporting period and the file-based GP. The stream-based delivery method has properties for the stream target and the stream-based GP.

These properties are labelled as default (e.g. defaultFileBasedGP) in that they will be ignored in case the same properties captured in MeasurementReader are used.

Instance of this IOC shall not be created nor deleted by consumer. It shall be created and deleted by the producer.

Depending on particular deployment context and agreement between operator and vendor, the isWritable for all attributes could be 'F'.

4.3.12.2 Attributes

The MeasurementControl IOC includes attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
pMAdministrativeState	M	T	T	F	T
pMOperationalState	M	T	F	F	T
defaultFileBasedGP	M	T	T	F	F
defaultFileReportingPeriod	M	T	T	F	F
defaultFileLocation	M	T	T	F	F
streamBasedGP	O	T	T	F	F
defaultStreamTarget	O	T	T	F	F

4.3.12.3 Attribute constraints

None.

4.3.12.4 Notifications

The common notifications defined in clause 4.5 are valid for this IOC, without exceptions or additions

4.3.13 `MeasurementReader`

4.3.13.1 Definition

This IOC identifies the entity (derivatives of `ManagedFunction`) whose Measurements are required by consumer to be produced and captured. The types of Measurements required are identified by the attribute `measurementNames`.

This IOC captures the properties of the two delivery methods for delivering the Measurements.

The file-based delivery method has properties: `fileLocation`, `reportingPeriod` and `fileBasedGP`. The stream-based delivery method has properties: `streamTarget` and `streamBasedGP`.

The `MeasurementControl` also can capture the properties of the file-based and stream-based delivery methods.

If the `MeasurementReader` instance's file-based delivery method has valid properties, the file-based delivery method is used and the `MeasurementControl` instance's file-based delivery method is ignored

If the `MeasurementReader` instance's stream-based delivery method has valid properties, the stream-based delivery method is used and the `MeasurementControl` instance's stream-based delivery is ignored.

A file-based and stream-based delivery methods can be active at the same time for a `MeasurementReader` instance.

The activity of a `MeasurementReader` instance is independent of that of other `MeasurementReader` instances.

This IOC uses attributes managedObjectDNs or managedObjectDNsBasic to identify specific managed entities whose Measurements are required by consumer.

4.3.13.2 Attributes

The MeasurementReader IOC includes attributes inherited from Top IOC (defined in clause 4.3.8) and the following attributes:

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
measurementTypes	M	T	T	F	F
fileBasedGP	O	T	T	F	F
fileReportingPeriod	O	T	T	F	F
fileLocation	O	T	T	F	F
streamBasedGP	O	T	T	F	F
streamTarget	O	T	T	F	F
managedObjectDNsBasic	CM	T	T	F	F
managedObjectDNs	CM	T	T	F	F

4.3.13.3 Attribute constraints

Name	Definition
managedObjectDNsBasic, managedObjectDNs Support Qualifier	Condition: It shall be supported if the MeasurementReader is a subordinate of SubNetwork or NetworkSliceSubnet. If both attributes contain information, the information in managedObjectDNs is ignored.

4.3.13.4 Notifications

The common notifications defined in clause 4.5 are valid for this IOC, without exceptions or additions

4.3.14 Measurements <<dataType>>

4.3.14.1 Definition

This <<dataType>> captures the Measurement types supported by its associated IOC , i.e. ManagedFunction or ManagedElement or <EP_RP. It also captures the list of GPs supported, on per Measurement type. This <<dataType>> indicates a capability of the associated IOC and therefore its isWritable property is False and its isInvariant property is False (since vendor product upgrade can increase or decrease the number of supported Measurement types without the need to deleting the older-version instance and creating a newer-version instance.)

4.3.14.2 Attributes

Attribute name	Support Qualifier	isReadable	isWritable	isInvariant	isNotifyable
measurementTypeAndGPs	M	T	F	F	F

4.3.14.3 Attribute constraints

None

4.3.14.4 Notifications

Not applicable.

4.3.15 ManagedEntity <<ProxyClass>>

4.3.15.1 Definition

This represents an <<IOC>>SubNetwork, <<IOC>>ManagedElement or <<IOC>>ManagedFunction.

4.3.15.2 Attributes

See that defined in `<<IOC>>SubNetwork`, `<<IOC>>ManagedElement` or `<<IOC>>ManagedFunction`.

4.3.15.3 Attribute constraints

See that defined in `<<IOC>>SubNetwork`, `<<IOC>>ManagedElement` or `<<IOC>>ManagedFunction`.

4.3.15.4 Notifications

See respective IOCs.

4.4 Attribute definitions

4.4.1 Attribute properties

The following table defines the properties of attributes specified in the present document.

Attribute Name	Documentation and Allowed Values	Properties
farEndEntity	The value of this attribute shall be the Distinguished Name of the far end network entity to which the reference point is related. As an example, with EP_Iucs, if the instance of EP_Iucs is contained by one RncFunction instance, the farEndEntity is the Distinguished Name of the MscServerFunction instance to which this Iucs reference point is related. allowedValues: N/A	type: DN multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: False
linkType	This attribute defines the type of the link. allowedValues: Signalling, Bearer, OAM&P, Other or multiple combinations of this type.	type: String multiplicity: 0..* isOrdered: F isUnique: T defaultValue: No isNullable: False
locationName	The physical location of this entity (e.g. an address). allowedValues: N/A	type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: False
objectClass	An attribute which captures the name of the class from which the object instance is an occurrence of. allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False
objectInstance	An information which captures the Distinguished Name of any object. allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False

peeParamete rsList	This attribute contains the parameter list for the control and monitoring of power, energy and environmental parameters of `ManagedFunction` instance(s). This list contains the following parameters:	type: String multiplicity: 0..* isOrdered: N/A isUnique: True defaultValue: No default value isNullable: True
	- `siteIdentification`	
	- `siteLatitude` (optional)	
	- `siteLongitude` (optional)	
	- `siteDescription`	
	- `equipmentType`	
	- `environmentType`	
	- `powerInterface`	
	`siteIdentification`: The identification of the site where the `ManagedFunction` resides.	
	allowedValues: N/A	
	`siteLatitude`: The latitude of the site where the `ManagedFunction` instance resides, based on World Geodetic System (1984 version) global reference frame (WGS 84). Positive values correspond to the northern hemisphere. This attribute is optional in case of `BTSFunction` and `RNCFunction` instance(s).	
	allowedValues: -90.0000 to +90.0000	
	`siteLongitude`: The longitude of the site where the ManagedFunction instance resides, based on World Geodetic System (1984 version) global reference frame (WGS 84). Positive values correspond to degrees east of 0 degrees longitude. This attribute is optional in case of `BTSFunction` and `RNCFunction` instance(s).	
	allowedValues: -180.0000 to +180.0000	
	`siteDescription`: An operator defined description of the site where the ManagedFunction instance resides.	
	allowedValues: N/A	
	equipmentType: The type of equipment where the `managedFunction` instance resides.	
	allowedValues: see clause 4.4.1 of ETSI ES 202 336-12 [18].	
	`environmentType`: The type of environment where the managedFunction instance resides.	
	allowedValues: see clause 4.4.1 of ETSI ES 202 336-12 [18].	
	`powerInterface`: The type of power.	
	allowedValues: see clause 4.4.1 of ETSI ES 202 336-12 [18].	

Attribute Name	Documentation and Allowed Values	Properties

Attribute Name	Documentation and Allowed Values	Properties
priorityLabel	This is a label that consumer would assign a value on a concrete instance of the managed object. The management system takes the value of this attribute into account. The effect of this attribute value to the subject managed entity is not standardized	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False
protocolVersion	Versions(s) and additional descriptive information for the protocol(s) used for the associated communication link. Syntax and semantic is not specified. allowedValues: N/A	type: String multiplicity: * isOrdered: F isUnique: T defaultValue: no default value isNullable: False
setOfMcc	Set of Mobile Country Code (MCC). The MCC uniquely identifies the country of domicile of the mobile subscriber. MCC is part of the IMSI (TS 23.003 [5]) This list contains all the MCC values in subordinate object instances to this SubNetwork instance. allowedValues: See clause 2.3 of TS 23.003 [5] for MCC allocation principles.	type: Integer multiplicity: 1..* isOrdered: F isUnique: T defaultValue: No default value isNullable: False
swVersion	The software version of the ManagementNode or ManagedElement (this is used for determining which version of the vendor specific information is valid for the ManagementNode or ManagedElement). allowedValues: N/A	type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False
systemDN	The Distinguished Name (DN) of IRPAgent. Defined in 3GPP TS 32.300. allowedValues: N/A	type: DN multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False
userDefinedState	An operator defined state for operator specific usage. allowedValues: N/A	type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False
userLabel	A user-friendly (and user assignable) name of this object. allowedValues: N/A	type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
`vendorName`	The name of the vendor. allowedValues: N/A	type: String multiplicity: 0..1 isOrdered: N/A isUnique: N/A defaultValue: No default value isNullable: False

`vnfParamete rsList`	This attribute contains the parameter set of the VNF instance(s) corresponding to an NE. Each entry in the list contains:
	    - `vnfInstanceId`
	    - `vnfdId (optional)`
	    - `flavourId (optional)`
	    - `autoScalable`
	
	`vnfInstanceId`: VNF instance identifier (vnfInstanceId, see section 9.4.2 of [16] and section B2.4.2.1.2.3 of [17]).
	
	See Note 1.
	
	`vnfdId`: Identifier of the VNFD on which the VNF instance is based, see section 9.4.2 of [16]. This attribute is optional.
	Note: the value of this attribute is identical to that of the same attribute in clause 9.4.2 of ETSI GS NFV-IFA 008 [16].
	
	`flavourId`: Identifier of the VNF Deployment Flavour applied to this VNF instance, see section 9.4.3 of [16]. This attribute is optional.
	Note: the value of this attribute is identical to that of the same attribute in clause 9.4.3 of ETSI GS NFV-IFA 008 [16].
	
	`autoScalable`: Indicator of whether the auto-scaling of this VNF instance is enabled or disabled. The type is Boolean.
	
	See Note2.
	
	The presence of this attribute indicates that the `ManagedFunction` represented by the MOI is a virtualized function.
	
	See Note 3.
	
	allowedValues: N/A
	
	A string length of zero for vnfInstanceId means the VNF instance(s) corresponding to the MOI does not exist (e.g. has not been instantiated yet, has already been terminated).
		type: String
		multiplicity: *
		isOrdered: N/A
		isUnique: True
		defaultValue: None
		isNullable: True

`vsData`	Vendor specific attributes of the type `vsDataType`. The attribute definitions including constraints (value ranges, data types, etc.) are specified in a vendor specific data format file. allowedValues: --	type: -- multiplicity: -- isOrdered: -- isUnique: -- defaultValue: -- isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
vsDataForma tVersion	Name of the data format file, including version. allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: False
vsDataType	Type of vendor specific data contained by this instance, e.g. relation specific algorithm parameters, cell specific parameters for power control or re-selection or a timer. The type itself is also vendor specific. allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: False
pMAdministr ativeState	It indicates the administrative state of `MeasurementControl`. It describes the permission to use or prohibition against using the capability of `MeasurementControl`, imposed through the consumer of OAM services produced by `MeasurementControl`, The measurement report production would begin when `pMadministrativeState` is UNLOCKED and `pMoperationalState` is ENABLED. The meaning of these values is as defined in 3GPP TS 28.625 [21] and ITU-T X.731 [19]. allowedValues: LOCKED, SHUTTING DOWN, UNLOCKED.	type: ENUM multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: "LOCKED" isNullable: False
pMOperation alState	It indicates the operational state of `MeasurementControl`. It describes if the resource is physically installed and working. allowedValues: ENABLED, DISABLED. The meaning of these values is as defined in 3GPP TS 28.625 [21] and ITU-T X.731 [19].	type: ENUM multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No allowedValues: N/A isNullable: False
managedObje ctDNs	It identifies the managed entities whose Measurements are required to be produced. It identifies specific managed entities say X, Y, Z. They are called, X, Y and Z, the base. In case the base is `SubNetwork`, it identifies all, including the base, managed entities that are subordinates, in the sense of name-containment, of the base. The identified entities are called a collection. The presence of this IOC would mean Measurement types specified in attribute `MeasurementReader.measurementTypes`, are required to be produced if the member (of the collection) is capable of supporting the Measurement types. allowedValues: N/A	type: DN multiplicity: * isOrdered: N/A isUnique: True defaultValue: No isNullable: False

Attribute Name	Documentation and Allowed Values	Properties
managedObjectDNsBasic	It identifies the managed entities whose Measurements are required to be produced. It identifies specific managedentities (say X, Y, Z), it would mean Measurements type specified in `MeasurementReader.measurementTypes`, are required to be produced if X, Y, Z are capable of supporting the Measurement types. If `managedObjectDNs` of the same `MeasurementReader` instance has valid information, the information of this attribute is ignored. allowedValues: N/A	type: DN multiplicity: * isOrdered: N/A isUnique: True defaultValue: No isNullable: False
measurementsList	It specifies a list of Measurements (see clause 4.3.14) supported. A NULL value indicates there is no Measurements supported. allowedValues: N/A	type: Measurements multiplicity: * isOrdered: N/A isUnique: N/A defaultValue: None allowedValues: N/A isNullable: True
measurementTypes	It identifies one or more Measurement types. The Measurement type can be those specified in TS 28.552 [20], TS 32.404 [21] and can be those specified by other SDOs or can be vendor-specific. allowedValues: N/A	type: String multiplicity: * isOrdered: N/A isUnique: True defaultValue: No isNullable: False
measurementTypeAndGPs	It identifies the supported Measurement types and their supported GPs. This is a list of items. One item is composed of two parts: - One supported Measurement type; - One or more supported GPs (see Note 4). (A Measurement type cannot appear in more than one item.) For supported Measurement types, see "Documentation and Allowed Values" for measurementTypes. For supported GPs, see Note 4. allowedValues: N/A	type: String multiplicity: * isOrdered: False isUnique: True defaultValue: No isNullable: False
defaultFileBasedGP	This is a property of the file-based delivery method. See definition of `fileBasedGP`. This value is ignored in case the property captured in `MeasurementReader` is in use. GP unit is in minute.	Same as in `fileBasedGP`
defaultFileReportingPeriod	This is a property of the file-based delivery method. See definition of `fileReportingGP`. This value is ignored in case the property captured in `MeasurementReader` is in use.	Same as in `fileReportingPeriod`

Attribute Name	Documentation and Allowed Values	Properties
`defaultFileLocation`	This is a property of the file-based delivery method. See definition of `fileLocation`. This value is ignored in case the property captured in `MeasurementReader` is in use.	Same as in `fileLocation`
`defaultStreamBasedGP`	This is a property of the stream-based delivery method. See definition of `streamBasedGP`. This value is ignored in case the property captured in `MeasurementReader` is in use.	Same as in `streamBasedGP`
`defaultStreamTarget`	This is a property of the stream-based delivery method. See definition of `streamTarget`. This value is ignored in case the property captured in `MeasurementReader` is in use.	Same as in `streamTarget`
`fileBasedGP`	This defines the frequency of producing the measurement data. The measurement data would be produced immediately at the end of each `fileBasedGP`. A measurement report file contains multiple measurement data. GP unit is in minute. allowedValues: See Note 4.	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: False
`fileReportingPeriod`	This defines the frequency of producing the measurement report files, in `fileLocation`, that hold the measurement reports. allowedValues: Its value is a multiple of `fileBasedGP`.	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: False
`fileLocation`	This is used for the file-based delivery method. It is the path to a location on either the producer's file system or a URI to a network file location that is not part of the producer's file system. In case it points to a location on the producer's file system, it is a relative path based on a vendor-specified root directory for measurement files. The size of this `fileLocation` is decided by consumer and producer. The producer is expected to remove old files to make room for new files, when necessary. allowedValues: Not applicable.	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: True
`streamBasedGP`	It defines the frequency of producing and sending the Measurement to the `streamTargets`. allowedValues: See Note 4.	type: Integer multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: False
`streamTarget`	This identifies the target of the notification carrying the content of the measurement report. There are two delivery methods (i.e. file-based and stream-based) via which the consumer(s) can receive the Measurements. This attribute is used for the stream-based delivery method. allowedValues: N/A	type: String multiplicity: 1 isOrdered: N/A isUnique: N/A defaultValue: No isNullable: True

Attribute Name	Documentation and Allowed Values	Properties
	NOTE 1 : The value of this attribute is identical to that of the same attribute in clause 9.4.2 of ETSI GS NFV-IFA 008 [16].	
	NOTE 2: The value of this attribute is identical to that of the same attribute included in vnfConfigurableProperty in clause 9.4.2 of ETSI GS NFV-IFA 008 [16].	
	NOTE 3:The presence of the attribute vnfParametersList, whose vnfInstanceId with a string length of zero, in createMO operation can trigger the instantiation of the related VNF/VNFC instances.	
	NOTE 4: The GP defines the measurement data production rate. The supported rates are dependent on the capacity of the producer involved (e.g. the processing power of the producer, the complexity of the measurement type involved etc) and therefore, it cannot be standardized for all producers involved. The supported GPs reflects the agreement between producer and the consumer involved.	

4.4.2   Constraints

None

4.5   Common notifications

4.5.1   Alarm notifications

This clause presents a list of notifications, defined in [11], that IRPManager can receive. The notification header attribute objectClass/objectInstance, defined in [3], would capture the DN of an instance of an IOC defined in this IRP specification.

Name	Qualifier	Notes
notifyAckStateChanged	See Alarm IRP (3GPP TS 32.111-2 [11])	
notifyChangedAlarm	See Alarm IRP (3GPP TS 32.111-2 [11])	
notifyClearedAlarm	See Alarm IRP (3GPP TS 32.111-2 [11])	
notifyNewAlarm	See Alarm IRP (3GPP TS 32.111-2 [11])	
notifyComments	See Alarm IRP (3GPP TS 32.111-2 [11])	
notifyAlarmListRebuilt	See Alarm IRP (3GPP TS 32.111-2 [11])	
notifyPotentialFaultyAlarmList	See Alarm IRP (3GPP TS 32.111-2 [11])	

4.5.2 Configuration notifications

This clause presents a list of notifications, defined in [12], that IRPManager can receive. The notification header attribute objectClass/objectInstance, defined in [3], would capture the DN of an instance of an IOC defined in this IRP specification.

Name	Qualifier	Notes
notifyAttributeValueChange	O	
notifyObjectCreation	O	
notifyObjectDeletion	O	

Annex A (informative): Alternate class diagram

This class diagram combines the Figure 4.2.1-1 of this document with Figure 1 of [9], the class diagram of UIM.
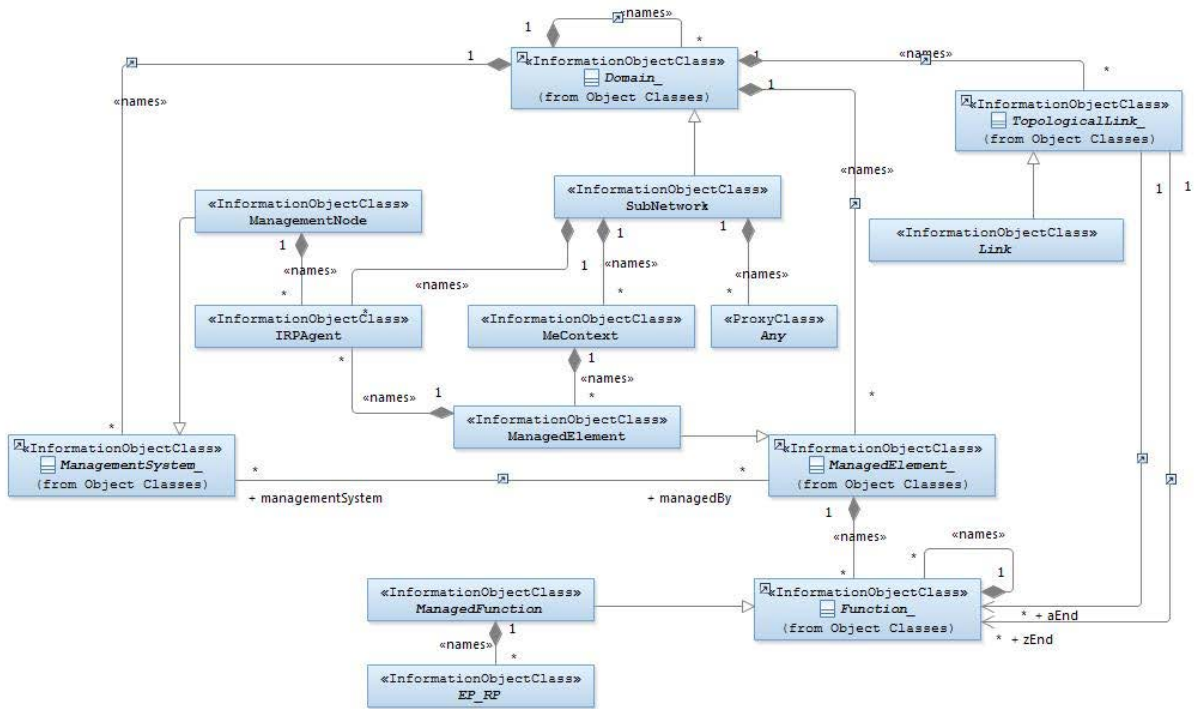

Figure A-1: Alternate class diagram

Annex B (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
2012-02					MCC update of TOC		11.0.0	11.0.1
2014-06	SA#64	SP-140332	001	-	Correction of reference		11.0.1	11.1.0
		SP-140358	002	-	Remove the feature support statements			
2014-09	SA#65				Upgrade to Rel-12		11.1.0	12.0.0
2015-12	SA#70	SP-150691	005	1	Add missing id attribute for 28.622		12.0.0	12.1.0
2016-01					Upgrade to Rel-13 (MCC)		12.1.0	13.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2016-12	SA#74	SP-160853	0010	-	A	Clarification on the need to show VsDataContainer self-containing itself several times	13.1.0
2017-03	SA#75	SP-170139	0012	2	A	Clarify notification triggered by VsDataContainer change	13.2.0
2017-03	SA#75	SP-170143	0015	1	B	Modify definitions of ME and MF to support virtualized network element	14.0.0
2017-03	SA#75	SP-170142	0016	3	B	Adding an attribute for ManagedFunction to support management of virtualized NE	14.0.0
2017-06	SA#76	SP-170510	0019	2	B	Add VNFInfo related attributes in IOC ManagedFunction	14.1.0
2018-01	SA#78	SP-170969	0021	-	F	Missing note in table of Attribute Properties	14.2.0
2018-03	SA#79	SP-180060	0022	-	B	Add new attribute peeParametersList to IOC ManagedFunction	15.0.0
2018-06	SA#80	SP-180421	0024	1	B	Remove references to Itf-N	15.1.0
2018-12	SA#82	SP-181156	0027	-	F	Add the missing NRM fragment supporting network performance management	15.2.0
2018-12	SA#82	SP-181042	0028	1	F	Replace MF with ManagedFunction	15.2.0
2018-12	SA#82	SP-181042	0029	1	F	Update NRM root IOCs to support slice priority	15.2.0
2019-09	SA#85	SP-190744	0034	3	F	Correct PMControl (Add report period attribute and disambiguate the delivery method attributes)	15.3.0
2019-09	SA#85	SP-190744	0035	1	F	Clarify optional configurable PM support	15.3.0
2019-09	SA#85	SP-190744	0037	2	F	Update class definition with inheritance information	15.3.0
2019-09	SA#85	SP-190744	0041	1	F	Correct definitions of granularity period	15.3.0
2019-09	SA#85	SP-190751	0045	-	F	Correct NR definition to avoid misalignment with RAN2 and add NRM definition	15.3.0
2019-09	SA#85					Correction of implementation of CR0043	15.3.1

History

Document history		
V15.1.0	June 2018	Publication
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