3GPP TSG SA WG5 Meeting 136-e S5-212324

**Online, , 1st Mar 2021 - 9th Mar 2021**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **28.541** | **CR** | **<CR#>** | **rev** | **-** | **Current version:** | **17.1.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network | **X** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | YANG update | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson Hungary Ltd. | | | | | | | | | |
| ***Source to TSG:*** | S5 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | adNRM | | | | |  | ***Date:*** | | | 2021-03-10 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Adding YANG stage 3 for Slice management stage 2, Correcting YANG errors | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Add YANG stage 3 for the existing Slice management stage 2  Update YANG code to follow stage 2 definitions and correct earlier YANG compilation errors. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | YANG definition for slice management missing  YANG code does not compile and/or does not follow the stage 2 definitions | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | The CR is based on 211353, 212038, 212217 and 212289  Forge: <https://forge.3gpp.org/rep/sa5/MnS/commits/balazs-megacr-17-test> | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

***First change***

# 7 Solution Set (SS)

The present document defines the following NRM Solution Set definitions for NR and NG-RAN:

- XML based 3GPP NR and NG-RAN NRM Solution Set (Annex C).

- JSON based 3GPP NR and NG-RAN NRM Solution Set (Annex D).

- YANG based 3GPP NR and NG-RAN NRM Solution Set (Annex E).

The present document defines the following NRM Solution Set definitions for 5GC:

- XML based 3GPP 5GC NRM Solution Set (Annex F).

- JSON based 3GPP 5GC NRM Solution Set (Annex G).

- YANG based 3GPP 5GC NRM Solution Set (Annex H).

The present document defines the following NRM Solution Set definitions for network slice and network slice subnet:

- XML based 3GPP Network Slice NRM Solution Set (Annex I).

- JSON based 3GPP Network Slice NRM Solution Set (Annex J).

- YANG based 3GPP Network Slice NRM Solution Set (Annex N).

***Next change***

## E.5.2 module\_3gpp-nr-nrm-ep.yang

<CODE BEGINS>

module \_3gpp-nr-nrm-ep {

yang-version 1.1;

namespace "urn:3gpp:sa5:\_3gpp-nr-nrm-ep";

prefix "ep3gpp";

import \_3gpp-common-ep-rp { prefix eprp3gpp; }

import \_3gpp-common-managed-element { prefix me3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

import \_3gpp-nr-nrm-gnbcucpfunction { prefix gnbcucp3gpp; }

import \_3gpp-nr-nrm-gnbcuupfunction { prefix gnbcuup3gpp; }

import \_3gpp-nr-nrm-gnbdufunction { prefix gnbdu3gpp; }

organization "3GPP SA5";

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

description "Defines the YANG mapping of the NR related endpoint

Information Object Classes (IOCs) that are part of the NR Network

Resource Model (NRM).";

reference "3GPP TS 28.541 5G Network Resource Model (NRM)";

revision 2021-03-03 { reference CR-0435 ; }

revision 2021-02-17 { reference CR-0470; }

revision 2020-11-17 { reference CR-0410; }

revision 2020-03-02 { reference S5-201191; }

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

feature EPClassesUnderGNBCUCPFunction {

description "Endpoint classes shall be contained under GNBCUCPFunction";

}

feature EPClassesUnderGNBCUUPFunction {

description "Endpoint classes shall be contained under GNBCUUPFunction";

}

feature EPClassesUnderGNBDUFunction {

description "Endpoint classes shall be contained under GNBDUFunction";

}

grouping EP\_E1Grp {

description "Represents the EP\_E1 IOC.";

reference "3GPP TS 28.541, 3GPP TS 38.401";

uses eprp3gpp:EP\_Common;

}

grouping EP\_F1CGrp {

description "Represents the EP\_F1C IOC.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

uses eprp3gpp:EP\_Common;

}

grouping EP\_F1UGrp {

description "Represents the EP\_F1U IOC.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

uses eprp3gpp:EP\_Common;

}

grouping EP\_XnCGrp {

description "Represents the EP\_XnC IOC.";

reference "3GPP TS 28.541, 3GPP TS 38.420";

uses eprp3gpp:EP\_Common;

}

grouping EP\_XnUGrp {

description "Represents the EP\_XnU IOC.";

reference "3GPP TS 28.541, 3GPP TS 38.420";

uses eprp3gpp:EP\_Common;

}

grouping EP\_NgCGrp {

description "Represents the EP\_NgC IOC.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

uses eprp3gpp:EP\_Common;

}

grouping EP\_NgUGrp {

description "Represents the EP\_NgU IOC.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

uses eprp3gpp:EP\_Common;

}

grouping EP\_X2CGrp {

description "Represents the EP\_X2C IOC.";

reference "3GPP TS 28.541, 3GPP TS 36.423";

uses eprp3gpp:EP\_Common;

}

grouping EP\_X2UGrp {

description "Represents the EP\_X2U IOC.";

reference "3GPP TS 28.541, 3GPP TS 36.425";

uses eprp3gpp:EP\_Common;

}

grouping EP\_S1UGrp {

description "Represents the EP\_S1U IOC.";

reference "3GPP TS 28.541, 3GPP TS 36.410";

uses eprp3gpp:EP\_Common;

}

augment "/me3gpp:ManagedElement/gnbcucp3gpp:GNBCUCPFunction" {

if-feature EPClassesUnderGNBCUCPFunction;

list EP\_E1 {

description "Represents the local end point of the logical link,

supporting E1 interface between gNB-CU-CP and gNB-CU-UP.";

reference "3GPP TS 28.541, 3GPP TS 38.401";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_E1Grp;

}

}

list EP\_F1C {

description "Represents the local end point of the control plane

interface (F1-C) between the DU and CU or CU-CP.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_F1CGrp;

}

}

list EP\_NgC {

description "Represents the local end point of the control plane

interface (NG-C) between the gNB and NG-Core entity.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_NgCGrp;

}

}

list EP\_XnC {

description "Represents the local gNB node end point of the logical

link, supporting Xn application protocols, to a neighbour NG-RAN node

(including gNB and ng-eNB). The Xn Application PDUs are carried over

SCTP/IP/Data link layer/Physical layer stack.";

reference "3GPP TS 28.541, 3GPP TS 38.420 subclause 7";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_XnCGrp;

}

}

list EP\_X2C {

description "Represents the local end point of the logical link,

supporting X2-C application protocols used in EN-DC, to a neighbour

eNB or en-gNB node.";

reference "3GPP TS 28.541, 3GPP TS 36.423";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_X2CGrp;

}

}

}

augment "/me3gpp:ManagedElement/gnbcuup3gpp:GNBCUUPFunction" {

if-feature EPClassesUnderGNBCUUPFunction;

list EP\_E1 {

description "Represents the local end point of the logical link,

supporting E1 interface between gNB-CU-CP and gNB-CU-UP.";

reference "3GPP TS 28.541, 3GPP TS 38.401";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_E1Grp;

}

}

list EP\_F1U {

description "Represents the local end point of the user plane

interface (F1-U) between the DU and CU or CU-UP.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_F1UGrp;

}

}

list EP\_NgU {

description "Represents the local end point of the NG user plane

(NG-U) interface between the gNB and UPF.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_NgUGrp;

}

}

list EP\_XnU {

description "Represents the one end-point of a logical link supporting

the Xn user plane (Xn-U) interface. The Xn-U interface provides

non-guaranteed delivery of user plane PDUs between two NG-RAN nodes.";

reference "3GPP TS 28.541, 3GPP TS 38.420";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_XnUGrp;

}

}

list EP\_X2U {

description "Represents the local end-point of a logical link supporting

the X2 user plane (X2-U) interface used in EN-DC.";

reference "3GPP TS 28.541, 3GPP TS 36.425";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_X2UGrp;

}

}

list EP\_S1U {

description "Represents the local end point of the logical link,

supporting S1-U interface towards a S-GW node.";

reference "3GPP TS 28.541, 3GPP TS 36.410";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_S1UGrp;

}

}

}

augment "/me3gpp:ManagedElement/gnbdu3gpp:GNBDUFunction" {

if-feature EPClassesUnderGNBDUFunction;

list EP\_F1C {

description "Represents the local end point of the control plane

interface (F1-C) between the DU and CU or CU-CP.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_F1CGrp;

}

}

list EP\_F1U {

description "Represents the local end point of the user plane

interface (F1-U) between the DU and CU or CU-UP.";

reference "3GPP TS 28.541, 3GPP TS 38.470";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses EP\_F1UGrp;

}

}

}

}

<CODE ENDS>

***Next change***

## E.5.19 module \_3gpp-nr-nrm-nrcellcu.yang

<CODE BEGINS>

module \_3gpp-nr-nrm-nrcellcu {

yang-version 1.1;

namespace "urn:3gpp:sa5:\_3gpp-nr-nrm-nrcellcu";

prefix "nrcellcu3gpp";

import \_3gpp-common-yang-types { prefix types3gpp; }

import \_3gpp-common-managed-function { prefix mf3gpp; }

import \_3gpp-common-managed-element { prefix me3gpp; }

import \_3gpp-nr-nrm-gnbcucpfunction { prefix gnbcucp3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

import \_3gpp-5g-common-yang-types { prefix types5g3gpp; }

organization "3GPP SA5";

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

description "Defines the YANG mapping of the NRCellCU Information Object

Class (IOC) that is part of the NR Network Resource Model (NRM).";

reference "3GPP TS 28.541 5G Network Resource Model (NRM)";

revision 2021-01-25 { reference CR-0454 ; }

revision 2020-11-25 { reference CR-0386 ; }

revision 2020-11-05 { reference CR-0412 ; }

revision 2020-10-02 { reference CR-0384 ; }

revision 2020-05-08 { reference S5-203316 ; }

revision 2020-02-14 { reference S5-20XXXX ; }

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

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

feature DPCIConfigurationFunction {

description "Class representing Distributed SON or Domain-Centralized SON

function of PCI configuration feature";

}

feature DESManagementFunction {

description "Class representing Distributed SON or Domain-Centralized SON

Energy Saving feature";

}

feature DMROFunction {

description "Class representing D-SON function of MRO feature";

}

feature CESManagementFunction {

description "Class representing Cross Domain-Centralized SON Energy Saving

feature";

}

grouping NRCellCUGrp {

description "Represents the NRCellCU IOC.";

reference "3GPP TS 28.541";

uses mf3gpp:ManagedFunctionGrp;

leaf cellLocalId {

description "Identifies an NR cell of a gNB. Together with corresponding

gNB ID it forms the NR Cell Identifier (NCI).";

mandatory true;

type int32 { range "0..16383"; }

}

list pLMNInfoList {

description "The PLMNInfoList is a list of PLMNInfo data type. It defines

which PLMNs that can be served by the NR cell, and which S-NSSAIs that

can be supported by the NR cell for corresponding PLMN in case of

network slicing feature is supported.";

// Note: Whether the attribute pLMNId in the pLMNInfo can be writable

// depends on the implementation.

key "mcc mnc sd sst";

min-elements 1;

uses types5g3gpp:PLMNInfo;

}

leaf nRFrequencyRef {

description "Reference to corresponding NRFrequency instance.";

config false;

type types3gpp:DistinguishedName;

}

}

augment "/me3gpp:ManagedElement/gnbcucp3gpp:GNBCUCPFunction" {

list NRCellCU {

description "Represents the information required by CU that is

responsible for the management of inter-cell mobility and neighbour

relations via ANR.";

reference "3GPP TS 28.541";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses NRCellCUGrp;

}

uses mf3gpp:ManagedFunctionContainedClasses;

}

}

}

<CODE ENDS>

## E.5.20 module \_3gpp-nr-nrm-nrcelldu.yang

<CODE BEGINS>

module \_3gpp-nr-nrm-nrcelldu {

yang-version 1.1;

namespace "urn:3gpp:sa5:\_3gpp-nr-nrm-nrcelldu";

prefix "nrcelldu3gpp";

import \_3gpp-common-yang-types { prefix types3gpp; }

import \_3gpp-common-managed-function { prefix mf3gpp; }

import \_3gpp-common-managed-element { prefix me3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

import \_3gpp-nr-nrm-gnbdufunction { prefix gnbdu3gpp; }

import \_3gpp-nr-nrm-rrmpolicy { prefix nrrrmpolicy3gpp; }

import \_3gpp-5g-common-yang-types { prefix types5g3gpp; }

organization "3GPP SA5";

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

description "Defines the YANG mapping of the NRCellDU Information Object

Class (IOC) that is part of the NR Network Resource Model (NRM).";

reference "3GPP TS 28.541 5G Network Resource Model (NRM)";

revision 2021-01-25 { reference CR-0454 ; }

revision 2020-11-25 { reference CR-0386 ; }

revision 2020-11-05 { reference CR-0412 ; }

revision 2020-10-02 { reference CR-0384 ; }

revision 2020-05-08 { reference S5-203316 ; }

revision 2020-02-14 { reference S5-20XXXX ; }

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

revision 2019-09-03 { reference "Initial revision"; }

feature DRACHOptimizationFunction {

description "Class representing D-SON function of RACH optimization

feature";

}

feature CPCIConfigurationFunction {

description "Class representing Cross Domain-Centralized SON function of

PCI configuration feature";

}

grouping NRCellDUGrp {

description "Represents the NRCellDU IOC.";

reference "3GPP TS 28.541";

uses mf3gpp:ManagedFunctionGrp;

uses nrrrmpolicy3gpp:RRMPolicy\_Grp;

leaf cellLocalId {

description "Identifies an NR cell of a gNB. Together with the

corresponding gNB identifier in forms the NR Cell Identity (NCI).";

reference "NCI in 3GPP TS 38.300";

mandatory true;

type int32 { range "0..16383"; }

}

leaf operationalState {

description "Operational state of the NRCellDU instance. Indicates

whether the resource is installed and partially or fully operable

(ENABLED) or the resource is not installed or not operable

(DISABLED).";

config false;

type types3gpp:OperationalState;

}

leaf administrativeState {

description "Administrative state of the NRCellDU. Indicates the

permission to use or prohibition against using the cell, imposed

through the OAM services.";

type types3gpp:AdministrativeState;

default LOCKED;

}

leaf cellState {

description "Cell state of the NRCellDU instance. Indicates whether the

cell is not currently in use (IDLE), or currently in use but not

configured to carry traffic (INACTIVE), or currently in use and is

configured to carry traffic (ACTIVE).";

config false;

type types3gpp:CellState;

}

list pLMNInfoList {

description "The PLMNInfoList is a list of PLMNInfo data type. It

defines which PLMNs that can be served by the NR cell, and which

S-NSSAIs that can be supported by the NR cell for corresponding PLMN

in case of network slicing feature is supported. The plMNId of the

first entry of the list is the PLMNId used to construct the nCGI for

the NR cell.";

key "mcc mnc sd sst";

min-elements 1;

ordered-by user;

uses types5g3gpp:PLMNInfo;

}

leaf nRPCI {

description "The Physical Cell Identity (PCI) of the NR cell.";

reference "3GPP TS 36.211";

mandatory true;

type int32 { range "0..1007"; }

}

leaf nRTAC {

description "The common 5GS Tracking Area Code for the PLMNs.";

reference "3GPP TS 23.003, 3GPP TS 38.473";

type types3gpp:Tac;

}

leaf arfcnDL {

description "NR Absolute Radio Frequency Channel Number (NR-ARFCN) for

downlink.";

reference "3GPP TS 38.104";

mandatory true;

type int32;

}

leaf arfcnUL {

description "NR Absolute Radio Frequency Channel Number (NR-ARFCN) for

uplink.";

reference "3GPP TS 38.104";

type int32;

}

leaf arfcnSUL {

description "NR Absolute Radio Frequency Channel Number (NR-ARFCN) for

supplementary uplink.";

reference "3GPP TS 38.104";

type int32;

}

leaf bSChannelBwDL {

description "Base station channel bandwidth for downlink.";

reference "3GPP TS 38.104";

type int32;

units MHz;

}

leaf bSChannelBwUL {

description "Base station channel bandwidth for uplink.";

reference "3GPP TS 38.104";

type int32;

units MHz;

}

leaf bSChannelBwSUL {

description "Base station channel bandwidth for supplementary uplink.";

reference "3GPP TS 38.104";

type int32;

units MHz;

}

leaf ssbFrequency {

description "Indicates cell defining SSB frequency domain position.

Frequency (in terms of NR-ARFCN) of the cell defining SSB transmission.

The frequency identifies the position of resource element RE=#0

(subcarrier #0) of resource block RB#10 of the SS block. The frequency

must be positioned on the NR global frequency raster, as defined in

3GPP TS 38.101-1, and within bSChannelBwDL.";

mandatory true;

type int32 { range "0..3279165"; }

}

leaf ssbPeriodicity {

description "Indicates cell defined SSB periodicity. The SSB periodicity

is used for the rate matching purpose.";

mandatory true;

type int32 { range "5 | 10 | 20 | 40 | 80 | 160"; }

units "subframes (ms)";

}

leaf ssbSubCarrierSpacing {

description "Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz

(< 6 GHz), 120 kHz or 240 kHz (> 6 GHz) are applicable.";

reference "3GPP TS 38.211";

mandatory true;

type int32 { range "15 | 30 | 120 | 240"; }

units kHz;

}

leaf ssbOffset {

description "Indicates cell defining SSB time domain position. Defined

as the offset of the measurement window, in which to receive SS/PBCH

blocks, where allowed values depend on the ssbPeriodicity

(ssbOffset < ssbPeriodicity).";

mandatory true;

type int32 { range "0..159"; }

units "subframes (ms)";

}

leaf ssbDuration {

description "Duration of the measurement window in which to receive

SS/PBCH blocks.";

reference "3GPP TS 38.213";

mandatory true;

type int32 { range "1..5"; }

units "subframes (ms)";

}

leaf-list nRSectorCarrierRef {

description "Reference to corresponding NRSectorCarrier instance.";

min-elements 1;

type types3gpp:DistinguishedName;

}

leaf-list bWPRef {

description "Reference to corresponding BWP instance.";

type types3gpp:DistinguishedName;

}

leaf-list nRFrequencyRef {

description "Reference to corresponding NRFrequency instance.";

type types3gpp:DistinguishedName;

}

}

augment "/me3gpp:ManagedElement/gnbdu3gpp:GNBDUFunction" {

list NRCellDU {

description "Represents the information of a cell known by DU.";

reference "3GPP TS 28.541";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses NRCellDUGrp;

}

uses mf3gpp:ManagedFunctionContainedClasses;

}

}

}

<CODE ENDS>

## E.5.21 module \_3gpp-nr-nrm-nrcellrelation.yang

<CODE BEGINS>

module \_3gpp-nr-nrm-nrcellrelation {

yang-version 1.1;

namespace "urn:3gpp:sa5:\_3gpp-nr-nrm-nrcellrelation";

prefix "nrcellrel3gpp";

import \_3gpp-common-yang-types { prefix types3gpp; }

import \_3gpp-common-managed-function { prefix mf3gpp; }

import \_3gpp-common-managed-element { prefix me3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

import \_3gpp-nr-nrm-gnbcucpfunction { prefix gnbcucp3gpp; }

import \_3gpp-nr-nrm-nrcellcu { prefix nrcellcu3gpp; }

organization "3GPP SA5";

description "Defines the YANG mapping of the NRCellRelation Information

Object Class (IOC) that is part of the NR Network Resource Model (NRM).";

reference "3GPP TS 28.541 5G Network Resource Model (NRM)";

revision 2021-01-25 { reference CR-0454 ; }

revision 2020-06-03 { reference S5-202333 ; }

revision 2020-04-23 { reference CR0281 ; }

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

revision 2019-08-30 {

description "Initial revision";

}

typedef EnergySavingCoverage {

type enumeration {

enum FULL;

enum NO;

enum PARTIAL;

}

}

grouping NRCellRelationGrp {

description "Represents the NRCellRelation IOC.";

reference "3GPP TS 28.541";

leaf nRTCI {

description "Target NR Cell Identifier. It consists of NR Cell

Identifier (NCI) and Physical Cell Identifier of the target NR cell

(nRPCI).";

type uint64;

}

container cellIndividualOffset {

description "A set of offset values for the neighbour cell. Used when

UE is in connected mode. Defined for rsrpOffsetSSB, rsrqOffsetSSB,

sinrOffsetSSB, rsrpOffsetCSI-RS, rsrqOffsetCSI-RS and

sinrOffsetCSI-RS.";

reference "cellIndividualOffset in MeasObjectNR in 3GPP TS 38.331";

leaf rsrpOffsetSsb {

description "Offset value of rsrpOffsetSSB.";

default 0;

type types3gpp:QOffsetRange;

}

leaf rsrqOffsetSsb{

description "Offset value of rsrqOffsetSSB.";

default 0;

type types3gpp:QOffsetRange;

}

leaf sinrOffsetSsb {

description "Offset value of sinrOffsetSSB.";

default 0;

type types3gpp:QOffsetRange;

}

leaf rsrpOffsetCsiRs{

description "Offset value of rsrpOffsetCSI-RS.";

default 0;

type types3gpp:QOffsetRange;

}

leaf rsrqOffsetCsiRs {

description "Offset value of rsrqOffsetCSI-RS.";

default 0;

type types3gpp:QOffsetRange;

}

leaf sinrOffsetCsiRs {

description "Offset value of sinrOffsetCSI-RS.";

default 0;

type types3gpp:QOffsetRange;

}

}

leaf nRFreqRelationRef {

description "Reference to a corresponding NRFreqRelation instance.";

mandatory true;

type types3gpp:DistinguishedName;

}

leaf adjacentNRCellRef {

description "Reference to an adjacent NR cell (NRCellCU or

ExternalNRCellCU).";

mandatory true;

type types3gpp:DistinguishedName;

}

leaf isRemoveAllowed {

type boolean;

default true;

description "True if the ANR function in the node is allowed to remove this relation.";

}

leaf isHOAllowed {

type boolean;

default true;

description "True if handovers are allowed over this relation.";

}

leaf isESCoveredBy {

description "Indicates whether the adjacent cell

provides no, partial or full coverage for the parent cell

instance. Adjacent cells with this attribute equal to FULL are

recommended to be considered as candidate cells to take over the

coverage when the original cell is about to be changed to energy

saving state. All adjacent cells with this property equal

to PARTIAL are recommended to be considered as entirety of candidate

cells to take over the coverage when the original cell is about to be

changed to energy saving state.";

type EnergySavingCoverage;

}

}

augment /me3gpp:ManagedElement/gnbcucp3gpp:GNBCUCPFunction/nrcellcu3gpp:NRCellCU {

list NRCellRelation {

description "Represents a neighbour cell relation from a source cell

to a target cell, where the target cell is an NRCellCU or

ExternalNRCellCU instance.";

reference "3GPP TS 28.541";

key id;

uses top3gpp:Top\_Grp;

container attributes {

uses NRCellRelationGrp;

}

uses mf3gpp:ManagedFunctionContainedClasses;

}

}

}

<CODE ENDS>

***Next change***

E.5.30 module \_3gpp-nr-nrm-drachoptimizationfunction.yang

<CODE BEGINS>

module \_3gpp-nr-nrm-drachoptimizationfunction {

yang-version 1.1;

namespace "urn:3gpp:sa5:\_3gpp-nr-nrm-drachoptimizationfunction";

prefix "drachoptimizationfunction3gpp";

import \_3gpp-common-subnetwork { prefix subnet3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

import \_3gpp-common-managed-element { prefix me3gpp; }

import \_3gpp-nr-nrm-nrcelldu { prefix nrcelldu3gpp; }

import \_3gpp-nr-nrm-gnbdufunction { prefix gnbdu3gpp; }

organization "3GPP SA5";

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

description "Defines the YANG mapping of the DRACHOptimizationFunction Information Object Class

(IOC) that is part of the NR Network Resource Model (NRM).";

reference "3GPP TS 28.541 5G Network Resource Model (NRM)";

revision 2021-01-25 { reference CR-0454 ; }

revision 2020-10-02 { reference "CR-0384, CR-0382" ; }

revision 2020-05-08 { reference S5-203316; }

grouping DRACHOptimizationFunctionGrp {

description "Represents the DRACHOptimizationFunction IOC.";

reference "3GPP TS 28.541";

uses top3gpp:Top\_Grp;

list ueAccProbilityDist {

key targetProbability;

description "This is a list of target Access Probability (APn) for the RACH optimization function.";

leaf targetProbability {type TargetProbability;}

container attributes {

uses UeAccProbilityDistGrp;

}

}

list ueAccDelayProbilityDist {

key targetProbability;

description "This is a list of target Access Delay probability (ADP) for the RACH optimization function.";

leaf targetProbability {type TargetProbability;}

container attributes {

uses UeAccDelayProbilityDistGrp;

}

}

leaf drachOptimizationControl {

description "This attribute determines whether the RACH Optimization function is enabled or disabled.";

type boolean;

}

}

typedef TargetProbability {

type enumeration {

enum 25;

enum 50;

enum 75;

enum 90;

}

}

typedef Numberofpreamblessent {

type int32 { range "1..200"; }

units "1";

}

typedef Accessdelay {

type int32 { range "10..560"; }

units "1";

}

grouping UeAccProbilityDistGrp {

description "Represents the target Access Probability (APn) for the RACH optimization function.";

leaf targetProbability {

description "This attribute determines the target Probability.";

mandatory true;

type TargetProbability;

}

leaf numberofpreamblessent {

description "This attribute determines the number of preambles sent.";

mandatory true;

type Numberofpreamblessent;

}

}

grouping UeAccDelayProbilityDistGrp {

description "Represents the target Access Delay probability (ADP) for the RACH optimization function.";

leaf targetProbability {

description "This attribute determines the target Probability.";

mandatory true;

type TargetProbability;

}

leaf accessdelay {

description "This attribute determines the access delay.";

mandatory true;

type Accessdelay;

}

}

augment "/me3gpp:ManagedElement/gnbdu3gpp:GNBDUFunction/nrcelldu3gpp:NRCellDU" {

if-feature nrcelldu3gpp:DRACHOptimizationFunction;

uses DRACHOptimizationFunctionGrp;

}

augment "/me3gpp:ManagedElement/gnbdu3gpp:GNBDUFunction" {

if-feature gnbdu3gpp:DRACHOptimizationFunction;

uses DRACHOptimizationFunctionGrp;

}

augment "/me3gpp:ManagedElement" {

if-feature me3gpp:DRACHOptimizationFunction;

uses DRACHOptimizationFunctionGrp;

}

augment "/subnet3gpp:SubNetwork" {

if-feature nrcelldu3gpp:DRACHOptimizationFunction;

uses DRACHOptimizationFunctionGrp;

}

}

<CODE ENDS>

***Next change***

E.5.32 module \_3gpp-nr-nrm-dpciconfigurationfunction.yang

<CODE BEGINS>

module \_3gpp-nr-nrm-dpciconfigurationfunction {

yang-version 1.1;

namespace "urn:3gpp:sa5:\_3gpp-nr-nrm-dpciconfigurationfunction";

prefix "dpciconfigurationfunction3gpp";

import \_3gpp-common-subnetwork { prefix subnet3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

import \_3gpp-nr-nrm-nrcellcu { prefix nrcellcu3gpp; }

import \_3gpp-nr-nrm-gnbcucpfunction { prefix gnbcucp3gpp; }

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 DPCIConfigurationFunction Information Object Class

(IOC) that is part of the NR Network Resource Model (NRM).";

reference "3GPP TS 28.541 5G Network Resource Model (NRM)";

revision 2021-01-25 { reference CR-0454 ; }

revision 2020-11-25 { reference CR-0386 ; }

revision 2020-05-08 { reference S5-203316; }

grouping DPCIConfigurationFunctionGrp {

description "Represents the DPCICONFIGURATIONFunction IOC.";

reference "3GPP TS 28.541";

uses top3gpp:Top\_Grp;

list nRPciList {

key NRPci;

description "This holds a list of physical cell identities that can be assigned to the NR cells. This attribute shall be supported if D-SON PCI configuration or domain Centralized SON PCI configuration function is supported.";

leaf NRPci {type int32;}

container attributes {

uses NRPciListGrp;

}

}

leaf dPciConfigurationControl {

description " This attribute determines whether the Distributed SON or Domain-Centralized SON PCI configuration Function is enabled or disabled.";

type boolean;

}

}

grouping NRPciListGrp {

description "Represents the NR PCI list for the PCI configuration function.";

leaf NRPci {

description "This attribute determines the NR PCI.";

type int32 { range "0..1007"; }

units "1";

}

}

augment "/me3gpp:ManagedElement/gnbcucp3gpp:GNBCUCPFunction/nrcellcu3gpp:NRCellCU" {

if-feature nrcellcu3gpp:DPCIConfigurationFunction;

uses DPCIConfigurationFunctionGrp;

}

augment "/me3gpp:ManagedElement" {

if-feature me3gpp:DPCIConfigurationFunction;

uses DPCIConfigurationFunctionGrp;

}

augment "/subnet3gpp:SubNetwork" {

if-feature subnet3gpp:DPCIConfigurationFunction;

uses DPCIConfigurationFunctionGrp;

}

}

<CODE ENDS>

***Next change***

H.5.13 module \_3gpp-5gc-nrm-nfservice.yang

<CODE BEGINS>

module \_3gpp-5gc-nrm-nfservice {

yang-version 1.1;

namespace urn:3gpp:sa5:\_3gpp-5gc-nrm-nfservice;

prefix nfs3gpp;

import \_3gpp-common-yang-types { prefix types3gpp; }

import ietf-yang-types { prefix yang; }

import ietf-inet-types { prefix inet; }

import \_3gpp-5g-common-yang-types { prefix types5g3gpp; }

organization "3gpp SA5";

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

description "NF service class.";

reference "3GPP TS 29.510";

revision 2021-01-25 { reference CR-0454 ; }

revision 2020-11-05 { reference CR-0412 ; }

revision 2019-06-17 { reference "initial revision"; }

grouping NFServiceGrp {

description "Represents the NFService IOC";

leaf serviceInstanceID {

description

"Unique ID of the service instance within a given NF Instance.";

mandatory true;

type string;

}

leaf serviceName {

description "Name of the service instance (e.g. 'nudm-sdm').";

mandatory true;

type ServiceName;

}

list versions { //check in review if key is ok (unique)

description "API versions supported by the NF Service and if available,

the corresponding retirement date of the NF Service.";

min-elements 1;

key "apiVersionInUri apiFullVersion";

uses NFServiceVersion;

}

leaf scheme {

description "URI scheme (e.g. 'http', 'https').";

mandatory true;

type UriScheme;

}

leaf nfServiceStatus {

description "Status of the NF Service Instance.";

mandatory true;

type NFServiceStatus;

}

leaf fqdn {

description "FQDN of the NF Service Instance.";

//optional support

type inet:domain-name;

}

leaf interPlmnFqdn {

description "If the NF service needs to be discoverable by other NFs in a

different PLMN, then an FQDN that is used for inter PLMN routing.";

//optional support

type inet:domain-name;

}

list ipEndPoints {

description "IP address(es) and port information of the Network Function

(including IPv4 and/or IPv6 address)where the service is listening

for incoming service requests.";

//optional support

key idx;

leaf idx {

type string;

}

min-elements 1;

uses ipEndPoint;

}

leaf apiPrefix {

description "Optional path segment(s) used to construct the {apiRoot}

variable of the different API URIs.";

//optional support

type string;

}

list defaultNotificationSubscriptions {

description "Notification endpoints for different notification types.";

key notificationType;

//optional support

min-elements 1;

uses types3gpp:DefaultNotificationSubscription;

}

list allowedPlmns {

description "PLMNs allowed to access the service instance.

The absence of this attribute indicates that any PLMN is allowed to

access the service instance.";

min-elements 1;

//optional support

key "mcc mnc";

uses types3gpp:PLMNId;

}

leaf-list allowedNfTypes {

description "Type of the NFs allowed to access the service instance.

The absence of this attribute indicates that any NF type is allowed

to access the service instance.";

min-elements 1;

//optional support

type types3gpp:NfType;

}

leaf-list allowedNfDomains {

description "Pattern representing the NF domain names allowed to access the service instance.";

//optional support

min-elements 1;

type string;

}

list allowedNssais {

description "S-NSSAI of the allowed slices to access the service instance.

The absence of this attribute indicates that any slice is allowed to

access the service instance.";

min-elements 1;

//optional support

key "sd sst";

uses types5g3gpp:SNssai;

}

leaf priority {

description "Priority (relative to other services of the same type)

in the range of 0-65535, to be used for NF Service selection; lower

values indicate a higher priority.";

//optional support

type uint16;

}

leaf capacity {

description "Static capacity information in the range of 0-65535,

expressed as a weight relative to other services of the same type.";

//optional support

type uint16;

}

leaf load {

description "Dynamic load information, ranged from 0 to 100, indicates

the current load percentage of the NF Service.";

//optional support

type types3gpp:Load;

}

leaf recoveryTime {

description "Timestamp when the NF was (re)started.";

//optional support

type yang:date-and-time;

}

list chfServiceInfo { //is the key unique

description "Specific data for a CHF service instance.";

//optional support

max-elements 1;

key "primaryChfServiceInstance secondaryChfServiceInstance";

uses ChfServiceInfo;

}

leaf supportedFeatures {

description "Supported Features of the NF Service instance.";

//optional support

type SupportedFeatures;

}

}

typedef SupportedFeatures {

type string {

pattern '[A-Fa-f0-9]\*';

}

}

grouping ipEndPoint {

choice address {

leaf ipv4Address {

type inet:ipv4-address;

}

leaf ipv6Address {

type inet:ipv6-address;

}

leaf ipv6Prefix {

type inet:ipv6-prefix;

}

}

leaf transport {

type TransportProtocol;

}

leaf port {

type uint16;

}

}

typedef TransportProtocol {

type enumeration {

enum TCP;

enum STCP;

enum UDP;

}

}

grouping NFServiceVersion {

leaf apiVersionInUri {

mandatory true;

type string;

}

leaf apiFullVersion {

mandatory true;

type string;

}

leaf expiry {

//optional to support

type yang:date-and-time;

}

}

typedef ServiceName {

type enumeration {

enum NNRF\_NFM;

enum NNRF\_DISC;

enum NUDM\_SDM;

enum NUDM\_UECM;

enum NUDM\_UEAU;

enum NUDM\_EE;

enum NUDM\_PP;

enum NAMF\_COMM;

enum NAMF\_EVTS;

enum NAMF\_MT;

enum NAMF\_LOC;

enum NSMF\_PDUSESSION;

enum NSMF\_EVENT-EXPOSURE;

enum NAUSF\_AUTH;

enum NAUSF\_SORPROTECTION;

enum NNEF\_PFDMANAGEMENT;

enum NPCF\_AM-POLICY-CONTROL;

enum NPCF\_SMPOLICYCONTROL;

enum NPCF\_POLICYAUTHORIZATION;

enum NPCF\_BDTPOLICYCONTROL;

enum NPCF\_EVENTEXPOSURE;

enum NPCF\_UE\_POLICY\_CONTROL;

enum NSMSF\_SMS;

enum NNSSF\_NSSELECTION;

enum NNSSF\_NSSAIAVAILABILITY;

enum NUDR\_DR;

enum NLMF\_LOC;

enum N5G\_EIR\_EIC;

enum NBSF\_MANAGEMENT;

enum NCHF\_SPENDINGLIMITCONTROL;

enum NCHF\_CONVERGEDCHARGING;

enum NNWDAF\_EVENTSSUBSCRIPTION;

enum NNWDAF\_ANALYTICSINFO;

}

}

typedef UriScheme {

type enumeration {

enum HTTP;

enum HTTPS;

}

}

typedef NFServiceStatus {

type enumeration {

enum REGISTERED;

enum SUSPENDED;

enum UNDISCOVERABLE;

}

}

grouping ChfServiceInfo {

leaf primaryChfServiceInstance {

description "Shall be present if the CHF service instance serves as a

secondary CHF instance of another primary CHF service instance.";

//conditional to support

type string;

}

leaf secondaryChfServiceInstance {

description "Shall be present if the CHF service instance serves as a

primary CHF instance of another secondary CHF service instance.";

//conditional to support

type string;

}

}

}

<CODE ENDS>

***Next change***

Annex N (normative):  
YANG definition of the Slice NRM

N.1 General

This annex contains the YANG definitions for the Slice NRM in YANG format.

The Information Service (IS) of the Slice NRM is defined in clause 6.

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

# N.2 Modules

## N.2.1 module \_3gpp-ns-nrm-networkslice.yang

<CODE BEGINS>

module \_3gpp-ns-nrm-networkslice {

yang-version 1.1;

namespace urn:3gpp:sa5:\_3gpp-ns-nrm-networkslice;

prefix ns3gpp;

import \_3gpp-ns-nrm-networkslicesubnet { prefix nss3gpp; }

import \_3gpp-common-subnetwork { prefix subnet3gpp; }

import \_3gpp-common-yang-types { prefix types3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

include \_3gpp-ns-nrm-serviceprofile;

organization "3GPP SA5";

contact

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

description "A network slice instance in a 5G network.";

reference "3GPP TS 28.541

Management and orchestration;

5G Network Resource Model (NRM);

Information model definitions for network slice NRM (chapter 6)

";

revision 2020-02-19 {

description "Introduction of YANG definitions for network slice NRM";

reference "CR-0458";

}

grouping NetworkSliceGrp {

uses subnet3gpp:SubNetworkGrp; // Inherits from SubNetwork

leaf operationalState {

description "The operational state of the network slice instance.

It describes whether or not the resource is physically installed

and working.";

config false;

type types3gpp:OperationalState;

}

leaf administrativeState {

description "The administrative state of the network slice instance.

It describes the permission to use or prohibition against

using the instance, imposed through the OAM services.";

type types3gpp:AdministrativeState;

}

list serviceProfileList {

description "A list of service profiles supported by the network

slice instance.";

key serviceProfileId;

uses ServiceProfileGrp;

}

leaf networkSliceSubnetRef {

type leafref {

path /nss3gpp:NetworkSliceSubnet/nss3gpp:id;

}

description "The NetworkSliceSubnet that the NetworkSlice is

associated with.";

}

}

list NetworkSlice {

description "Represents the properties of a network slice instance in

a 5G network.";

key id;

container attributes {

uses NetworkSliceGrp;

}

uses top3gpp:Top\_Grp;

}

}

<CODE ENDS>

## N.2.2 module \_3gpp-ns-nrm-networkslicesubnet.yang

<CODE BEGINS>

module \_3gpp-ns-nrm-networkslicesubnet {

yang-version 1.1;

namespace urn:3gpp:sa5:\_3gpp-ns-nrm-networkslicesubnet;

prefix nss3gpp;

import \_3gpp-common-yang-types { prefix types3gpp; }

import \_3gpp-common-subnetwork { prefix subnet3gpp; }

import \_3gpp-common-measurements { prefix meas3gpp; }

import \_3gpp-common-top { prefix top3gpp; }

include \_3gpp-ns-nrm-sliceprofile;

organization "3GPP SA5";

contact

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

description "This IOC represents the properties of a network slice subnet

instance in a 5G network.";

reference "3GPP TS 28.541

Management and orchestration;

5G Network Resource Model (NRM);

Information model definitions for network slice NRM (chapter 6)

";

revision 2020-02-19 {

description "Introduction of YANG definitions for network slice NRM";

reference "CR-0458";

}

revision 2019-06-07 {

description "initial revision";

reference "Based on

3GPP TS 28.541 V15.X.XX";

}

feature MeasurementsUnderNetworkSliceSubnet {

description "The MeasurementSubtree shall be contained under

NetworkSliceSubnet.";

}

typedef ETSI-GS-NFV-Identifier {

type string;

reference "ETSI GS NFV-IFA 013";

}

grouping EPTransportGrp {

leaf ipAddress {

description "This parameter specifies the IP address assigned to a

logical transport interface/endpoint. It can be an IPv4 address

(See RFC 791) or an IPv6 address (See RFC 2373).";

mandatory true;

type string;

}

leaf logicInterfaceId {

description "This parameter specifies the identify of a logical

transport interface. It could be VLAN ID (See IEEE 802.1Q),

MPLS Tag or Segment ID.";

mandatory true;

type string;

}

leaf-list nextHopInfo {

description "This parameter is used to identify ingress transport

node. Each node can be identified by any of combination of IP

address of next-hop router of transport network, system name,

port name, IP management address of transport nodes.";

type string;

}

leaf-list qosProfile {

description "This parameter specifies reference to QoS Profile for

a logical transport interface. A QoS profile includes a set of

parameters which are locally provisioned on both sides of a logical

transport interface.";

type string;

}

leaf-list epApplicationRef {

description "This parameter specifies a list of application level

EPs associated with the logical transport interface.";

min-elements 1;

type types3gpp:DistinguishedName;

}

uses top3gpp:Top\_Grp;

}

grouping NsInfoGrp {

description "The NsInfo of the NS instance corresponding to the network

slice subnet instance.";

//suport condition: It shall be supported if the NSS instance is

//realized in the virtualized environment.

// Otherwise this attribute shall be absent.

reference "ETSI GS NFV-IFA 013 clause 8.3.3.2.2, which can be found at

https://www.etsi.org/deliver/etsi\_gs/NFV-IFA/001\_099/013

/03.04.01\_60/gs\_NFV-IFA013v030401p.pdf page 123-124";

leaf nSInstanceId {

description "Uniquely identifies the NS instance.";

config false;

type ETSI-GS-NFV-Identifier;

}

leaf nsName {

description "Human readable name of the NS instance.";

type string;

config false;

}

leaf description {

description "Human readable description of the NS instance.";

config false;

type string;

}

}

grouping NetworkSliceSubnetGrp {

uses subnet3gpp:SubNetworkGrp;

uses EPTransportGrp;

leaf operationalState {

description "The operational state of the network slice instance.

It describes whether or not the resource is physically installed

and working.";

mandatory true;

config false;

type types3gpp:OperationalState;

}

leaf administrativeState {

description "The administrative state of the network slice instance.

It describes the permission to use or prohibition against

using the instance, imposed through the OAM services.";

mandatory true;

type types3gpp:AdministrativeState;

}

list nsInfo {

description "This list represents the properties of network service

information corresponding to the network slice subnet instance.";

reference "ETSI GS NFV-IFA 013 clause 8.3.3.2.2";

config false;

key nSInstanceId;

max-elements 1;

uses NsInfoGrp;

}

list sliceProfileList {

description "List of SliceProfiles supported by the network slice

subnet instance";

key sliceProfileId;

uses SliceProfileGrp;

}

list managedFunctionRef {

description "The managed functions that the NetworkSliceSubnet is

associated with.";

key aggregatedManagedFunction;

leaf aggregatedManagedFunction {

type instance-identifier;

}

}

leaf-list networkSliceSubnetRef {

type leafref {

path /NetworkSliceSubnet/id;

}

description "Lists the NetworkSliceSubnet instances associated with

this NetworkSliceSubnet.";

}

}

list NetworkSliceSubnet {

description "Represents the properties of a network slice subnet

instance in a 5G network.";

key id;

container attributes {

uses NetworkSliceSubnetGrp;

leaf-list parents {

description "Reference to direct parent NetworkSliceSubnet

instances.

If NetworkSliceSubnets form a containment hierarchy this is

modeled using references between the child NetworkSliceSubnet

and the parent NetworkSliceSubnet.

This reference MUST NOT be present for the top level

NetworkSliceSubnet and MUST be present for other

NetworkSliceSubnets.";

type leafref {

path "/NetworkSliceSubnet/id";

}

}

leaf-list containedChildren {

description "Reference to all directly contained NetworkSliceSubnet

instances. If NetworkSliceSubnets form a containment hierarchy

this is modeled using references between the child

NetworkSliceSubnet and the parent NetworkSliceSubnet.";

type leafref {

path "/NetworkSliceSubnet/id";

}

}

}

uses top3gpp:Top\_Grp;

uses meas3gpp:MeasurementSubtree {

if-feature MeasurementsUnderNetworkSliceSubnet;

}

}

}

<CODE ENDS>

## N.2.3 module \_3gpp-ns-nrm-perfreq.yang

<CODE BEGINS>

module \_3gpp-ns-nrm-perfreq {

yang-version 1.1;

namespace urn:3gpp:sa5:\_3gpp-ns-nrm-perfreq;

prefix perf3gpp;

organization "3GPP SA5";

contact

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

description "The performance requirements for the NSI in terms of the

scenarios defined in the 3GPP TS 22.261, such as experienced data rate,

area traffic capacity (density) information of UE density.";

reference "3GPP TS 28.541

Management and orchestration;

5G Network Resource Model (NRM);

Information model definitions for network slice NRM (chapter 6)

";

revision 2020-02-19 {

description "Introduction of YANG definitions for network slice NRM";

reference "CR-0458";

}

typedef data-rate {

type uint32;

units kbits/s;

}

typedef integer-percentage {

type uint8 {

range 0..100;

}

units percent;

}

typedef reliability-string {

description "Mean time between failures.

E.g. '1 day', or '3 months'";

type string {

pattern "[0-9]+ (day|week|month|year)s?";

}

reference "3GPP TS 22.104 clause 5.2-5.5";

}

typedef message-size-string {

description "Message size in bytes.

E.g. '80', or '250-2000'";

type string {

pattern '[0-9]+(-[0-9]+)?';

}

units bytes;

reference "3GPP TS 22.104 clause 5.2-5.5";

}

typedef transfer-interval-string {

description "Transfer interval time. If multiple values are given,

the first value is the application requirement, the other values are

the requirement with multiple transmission of the same information

two or three times, respectively).

E.g. '40ms', or '0ms-5ms,0ms-2.5ms,0ms-1.7ms'";

type string {

pattern '[0-9]+(\.[0-9]+)?m?s-[0-9]+(\.[0-9]+)?m?s' +

'(,[0-9]+(\.[0-9]+)?m?s-[0-9]+(\.[0-9]+)?){0,2}';

}

reference "3GPP TS 22.104 clause 5.2-5.5";

}

typedef survival-time-string {

description "Survival time in milliseconds (ms) or in multiples of

the transfer interval (x). If multiple values are given,

the first value is the application requirement, the other values are

the requirement with multiple transmission of the same information

two or three times, respectively).

E.g. '12ms', or '0x,2x'";

type string {

pattern '[0-9]+(x|ms)(,[0-9]+(x|ms)){0,2}';

}

reference "3GPP TS 22.104 clause 5.2-5.5";

}

grouping PerfReqGrp {

//Stage2 issue: The perfReq object does not have any proper definition

// in 28.541 chapter 6.

//Stage2 issue: The text that exists on the perfReq mentions an sST

// element. There is potentially several sST elements in

// the SliceProfile/sNSSAIList which could be used as basis

// for deciding which perfReq elements are relevant.

// Operators can construct their own sST values. It is not

// clear which of the perfReq elements below would be

// relevant in such a case. Leaving all perfReq elements

// available in all use cases for now.

// eMBB leafs, SST = 1

leaf expDataRateDL {

description "User experienced data rate over downlink";

//TODO: add when 'somepath/sST = 1';

type data-rate;

reference "3GPP TS 22.261 clause 7.1, table 7.1-1";

}

leaf expDataRateUL {

description "User experienced data rate over uplink";

//TODO: add when 'somepath/sST = 1';

type data-rate;

reference "3GPP TS 22.261 clause 7.1, table 7.1-1";

}

leaf areaTrafficCapDL {

description "Area traffic capacity over downlink";

//TODO: add when 'somepath/sST = 1';

type data-rate;

units kbits/s/km2;

reference "3GPP TS 22.261 clause 7.1, table 7.1-1";

}

leaf areaTrafficCapUL {

description "Area traffic capacity over uplink";

//TODO: add when 'somepath/sST = 1';

type data-rate;

units kbits/s/km2;

reference "3GPP TS 22.261 clause 7.1, table 7.1-1";

}

leaf overallUserDensity {

description "Overall user density";

//TODO: add when 'somepath/sST = 1';

type uint32;

units users/km2;

reference "3GPP TS 22.261 clause 7.1, table 7.1-1";

}

leaf activityFactor {

description "Percentage value of the amount of simultaneous active

UEs to the total number of UEs where active means the UEs are

exchanging data with the network.";

//TODO: add when 'somepath/sST = 1';

type integer-percentage;

reference "3GPP TS 22.261 clause 7.1, table 7.1-1";

}

// uRLLC leafs, SST = 2

leaf cSAvailabilityTarget {

description "Reliability uptime target";

//TODO: add when 'somepath/sST = 2';

type decimal64 {

fraction-digits 6; // E.g. 99.999999

range 0..100;

}

reference "3GPP TS 22.104 clause 5.2-5.5";

}

leaf cSReliabilityMeanTime {

description "Mean time between failures";

//TODO: add when 'somepath/sST = 2';

type reliability-string;

}

leaf expDataRate {

description "User experienced data rate";

//TODO: add when 'somepath/sST = 2';

type data-rate;

reference "3GPP TS 22.104 clause 5.2-5.5";

}

leaf msgSizeByte {

description "PDU size";

//TODO: add when 'somepath/sST = 2';

type message-size-string;

}

leaf transferIntervalTarget {

description "Time difference between two consecutive transfers

of application data from an application via the service interface

to 3GPP system";

//TODO: add when 'somepath/sST = 2';

type transfer-interval-string;

}

leaf survivalTime {

description "The time that an application consuming a communication

service may continue without an anticipated message";

//TODO: add when 'somepath/sST = 2';

type survival-time-string;

}

}

}

<CODE ENDS>

## N.2.4 module \_3gpp-ns-nrm-serviceprofile.yang

<CODE BEGINS>

submodule \_3gpp-ns-nrm-serviceprofile {

yang-version 1.1;

belongs-to \_3gpp-ns-nrm-networkslice { prefix ns3gpp; }

import \_3gpp-common-yang-types { prefix types3gpp; }

import \_3gpp-5g-common-yang-types { prefix types5g3gpp; }

organization "3GPP SA5";

contact

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

description "A network slice instance in a 5G network.";

reference "3GPP TS 28.541

Management and orchestration;

5G Network Resource Model (NRM);

Information model definitions for network slice NRM (chapter 6)

";

revision 2020-02-19 {

description "Introduction of YANG definitions for network slice NRM";

reference "CR-0458";

}

revision 2019-06-23 {

description "Initial revision";

reference "3GPP TS 28.541 V15.X.XX";

}

typedef availability-percentage {

description "

Percentage value of the amount of time the end-to-end communication

service is delivered according to an agreed QoS, divided by the amount

of time the system is expected to deliver the end-to-end service

according to the specification in a specific area.";

reference "3GPP TS 22.261 3.1";

type decimal64 {

fraction-digits 4; // E.g. 99.9999

range 0..100;

}

}

typedef Category-enum {

type enumeration {

enum character;

enum scalability;

}

}

typedef Tagging-enum {

type enumeration {

enum performance;

enum function;

enum operation;

}

}

typedef Exposure-enum {

type enumeration {

enum API;

enum KPI;

}

}

typedef Support-enum {

type enumeration {

enum NOT\_SUPPORTED;

enum SUPPORTED;

}

}

grouping ServAttrComGrp {

leaf category {

description "This attribute specifies the category of a service

requirement/attribute of GST";

type Category-enum;

}

leaf-list tagging {

description "This attribute specifies the tagging of a service

requirement/attribute of GST in character category";

when "../category = 'character'";

type Tagging-enum;

}

leaf exposure {

description "This attribute specifies exposure mode of a service

requirement/attribute of GST";

type Exposure-enum;

}

}

typedef DeterminCommAvailability {

type Support-enum;

}

grouping DLThptGrp {

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf guaThpt {

description "This attribute describes the guaranteed data rate.";

type uint64;

units kbits/s;

}

leaf maxThpt {

description "This attribute describes the maximum data rate.";

type uint64;

units kbits/s;

}

}

typedef V2XMode-enum {

type enumeration {

enum NOT\_SUPPORTED;

enum SUPPORTED\_BY\_NR;

}

}

grouping ServiceProfileGrp {

leaf serviceProfileId {

description "Service profile identifier.";

type types3gpp:DistinguishedName;

}

list sNSSAIList {

description "The S-NSSAI list to be supported by the new NSI to be

created or the existing NSI to be re-used.";

min-elements 1;

key idx;

unique "sst sd";

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses types5g3gpp:SNssai;

}

list pLMNIdList {

description "List of PLMN IDs.";

min-elements 1;

key "mcc mnc";

ordered-by user;

uses types3gpp:PLMNId;

}

leaf maxNumberofUEs {

description "The maximum number of UEs that may simultaneously

access the network slice instance.";

mandatory true;

type uint64;

}

leaf-list coverageArea {

min-elements 1;

description "A list of TrackingAreas where the NSI can be selected.";

type types3gpp:Tac;

}

leaf latency {

description "The packet transmission latency (milliseconds) through

the RAN, CN, and TN part of 5G network, used to evaluate utilization

performance of the end-to-end network slice instance.";

reference "3GPP TS 28.554 clause 6.3.1";

mandatory true;

type uint16;

units milliseconds;

}

leaf uEMobilityLevel {

description "The mobility level of UE accessing the network slice

instance.";

reference "3GPP TS 22.261 clause 6.2.1";

type types3gpp:UeMobilityLevel;

}

leaf resourceSharingLevel {

description "Specifies whether the resources to be allocated to the

network slice instance may be shared with another network slice

instance(s).";

type types3gpp:ResourceSharingLevel;

}

//Stage2 issue: The sNSSAIList above specifies one or potentially

// several sST objects for the service profile.

// How do they relate?

leaf sST {

description "Specifies the slice/service type. See 3GPP TS 23.501

for defined values.";

mandatory true;

type uint32;

reference "3GPP TS 23.501 5.15.2.2";

}

leaf availability {

description "The availability requirement for a network slice

instance, expressed as a percentage.";

type availability-percentage;

}

list delayTolerance {

description "An attribute specifies the properties of service delivery

flexibility, especially for the vertical services that are not

chasing a high system performance.";

reference "TS 22.104 clause 4.3";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf support {

description "An attribute specifies whether or not the network

slice supports service delivery flexibility, especially for the

vertical services that are not chasing a high system performance.";

type Support-enum;

}

}

list deterministicComm {

//Stage2 issue: deterministicComm is not defined in 28.541 chapter 6,

// but I guess determinComm is meant

description "This list represents the properties of the deterministic

communication for periodic user traffic. Periodic traffic refers to the

type of traffic with periodic transmissions.";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf availability {

//Stage2 issue: Defined differently in 28.541 chapter 6, but XML

// uses DeterminCommAvailability

config false;

type DeterminCommAvailability;

}

leaf periodicityList {

//Stage2 issue: Not defined in 28.541 chapter 6. XML and YAML

// says "string".

type string;

}

}

list dLThptPerSlice {

description "This attribute defines achievable data rate of the

network slice in downlink that is available ubiquitously across

the coverage area of the slice";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses DLThptGrp;

}

list dLThptPerUE {

description "This attribute defines data rate supported by the network

slice per UE";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses DLThptGrp;

}

list uLThptPerSlic {

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

description "This attribute defines achievable data rate of the

network slice in uplink that is available ubiquitously across

the coverage area of the slice";

uses DLThptGrp;

}

list uLThptPerUE {

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

description "This attribute defines data rate supported by the

network slice per UE";

uses DLThptGrp;

}

list maxPktSize {

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

description "This parameter specifies the maximum packet size

supported by the network slice";

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf maxSize {

//Stage2 issue: Not defined in 28.541, guessing integer bytes

type uint32;

units bytes;

}

}

list maxNumberofPDUSessions {

description "Represents the maximum number of

concurrent PDU sessions supported by the network slice";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf nOofPDUSessions {

//Stage2 issue: Not defined in 28.541, guessing integer

type uint32;

}

}

list kPIMonitoring {

description "Represents performance monitoring";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf kPIList {

//Stage2 issue: Data format not specified, low interoperability

description "An attribute specifies the name list of KQIs and KPIs

available for performance monitoring";

type string;

}

}

list userMgmtOpen {

description "An attribute specifies whether or not the network slice

supports the capability for the NSC to manage their users or groups

of users’ network services and corresponding requirements.";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf support {

type Support-enum;

}

}

list v2XCommModels {

description "An attribute specifies whether or not the V2X

communication mode is supported by the network slice.";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf v2XMode {

type V2XMode-enum;

}

}

list termDensity {

description "An attribute specifies the overall user density over

the coverage area of the network slice";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf density {

type uint32;

units users/km2;

}

}

leaf activityFactor {

//Stage2 issue: This is modeled as writable/config true in 28.542,

// but that does not appear to match the description

description "An attribute specifies the percentage value of the

amount of simultaneous active UEs to the total number of UEs where

active means the UEs are exchanging data with the network";

reference "TS 22.261 Table 7.1-1";

type decimal64 {

fraction-digits 1;

}

}

leaf uESpeed {

//Stage2 issue: This is modeled as writable/config true in 28.542,

// but that does not appear to match the description

description "An attribute specifies the maximum speed (in km/hour)

supported by the network slice at which a defined QoS can be

achieved";

type uint32;

units km/h;

}

leaf jitter {

//Stage2 issue: This is modeled as writable/config true in 28.542,

// but that does not appear to match the description

description "An attribute specifies the deviation from the desired

value to the actual value when assessing time parameters";

reference "TS 22.104 clause C.4.1";

type uint32;

units microseconds;

}

leaf survivalTime {

description "An attribute specifies the time that an application

consuming a communication service may continue without an

anticipated message.";

reference "TS 22.104 clause 5";

type string;

}

leaf reliability {

description "An attribute specifies in the context of network layer

packet transmissions, percentage value of the amount of sent

network layer packets successfully delivered to a given system

entity within the time constraint required by the targeted service,

divided by the total number of sent network layer packets.";

reference "TS 22.261, TS 22.104";

type string;

}

leaf maxDLDataVolume {

//Stage2 issue: Not defined in 28.541. XML and YAML says "string"

type string;

}

leaf maxULDataVolume {

//Stage2 issue: Not defined in 28.541. XML and YAML says "string"

type string;

}

list nBIoT {

description "An attribute specifies whether NB-IoT is supported in

the RAN in the network slice";

config false;

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

list servAttrCom {

description "This list represents the common properties of service

requirement related attributes.";

reference "GSMA NG.116 corresponding to Attribute categories,

tagging and exposure";

key idx;

max-elements 1;

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses ServAttrComGrp;

}

leaf support {

description "An attribute specifies whether NB-IoT is supported

in the RAN in the network slice";

type Support-enum;

}

}

}

}

<CODE ENDS>

## N.2.5 module \_3gpp-ns-nrm-sliceprofile.yang

<CODE BEGINS>

submodule \_3gpp-ns-nrm-sliceprofile {

yang-version 1.1;

belongs-to \_3gpp-ns-nrm-networkslicesubnet { prefix nss3gpp; }

import \_3gpp-common-yang-types { prefix types3gpp; }

import \_3gpp-5g-common-yang-types { prefix types5g3gpp; }

import \_3gpp-ns-nrm-perfreq { prefix perf3gpp; }

organization "3GPP SA5";

contact

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

description "Represents the properties of network slice subnet related

requirement that should be supported by the network slice subnet

instance in a 5G network.";

reference "3GPP TS 28.541

Management and orchestration;

5G Network Resource Model (NRM);

Information model definitions for network slice NRM (chapter 6)

";

revision 2020-02-19 {

description "Introduction of YANG definitions for network slice NRM";

reference "CR-0458";

}

revision 2019-05-27 {

description "initial revision.";

reference "Based on

3GPP TS 28.541 V15.X.XX";

}

grouping SliceProfileGrp {

leaf sliceProfileId {

description "A unique identifier of the property of network slice

subnet related requirement should be supported by the network

slice subnet instance.";

type types3gpp:DistinguishedName;

}

list sNSSAIList {

description "List of S-NSSAIs the managed object is capable of

supporting. (Single Network Slice Selection Assistance Information)

An S-NSSAI has an SST (Slice/Service type) and an optional SD

(Slice Differentiator) field.";

key idx;

unique "sst sd";

leaf idx {

description "Synthetic index for the element.";

type uint32;

}

uses types5g3gpp:SNssai;

}

list pLMNIdList {

description "List of at most six entries of PLMN Identifiers, but at

least one (the primary PLMN Id). The PLMN Identifier is composed

of a Mobile Country Code (MCC) and a Mobile Network Code (MNC).";

min-elements 1;

max-elements 6;

key "mcc mnc";

ordered-by user;

uses types3gpp:PLMNId;

}

//Stage2 issue: The perfReq object does not have any proper definition

// in 28.541 chapter 6.

//Stage2 issue: The text that exists on the perfReq mentions an sST

// element. There is no sST element in SliceProfile which

// references perfReq, nor in perfReq itself. There are

// potentially several in the sNSSAIList. Should we take the

// union of those to control whivh perfReq elements are

// relevant? For now, making all perfReq elements available

// in all slice profiles.

list perfReq {

description "The performance requirements for the NSI in terms of the

scenarios defined in the 3GPP TS 22.261, such as experienced data

rate, area traffic capacity (density) information of UE density.";

key idx; //this list uses a grouping/choice and has no obvious key

leaf idx { type uint32; }

uses perf3gpp:PerfReqGrp;

}

leaf maxNumberofUEs {

description "Specifies the maximum number of UEs may simultaneously

access the network slice instance.";

//optional support

mandatory true;

type uint64;

}

leaf-list coverageAreaTAList {

description "A list of TrackingAreas where the NSI can be selected.";

//optional support

min-elements 1;

type types3gpp:Tac;

}

leaf latency {

description "The packet transmission latency (milliseconds) through

the RAN, CN, and TN part of 5G network, used to evaluate

utilization performance of the end-to-end network slice instance.";

reference "3GPP TS 28.554 clause 6.3.1";

//optional support

mandatory true;

type uint16;

units milliseconds;

}

leaf uEMobilityLevel {

description "The mobility level of UE accessing the network slice

instance.";

//optional support

type types3gpp:UeMobilityLevel;

}

leaf resourceSharingLevel {

description "Specifies whether the resources to be allocated to the

network slice subnet instance may be shared with another network

slice subnet instance(s).";

//optional support

type types3gpp:ResourceSharingLevel;

}

}

}

<CODE ENDS>

***End of changes***