**3GPP TSG-CT4 Meeting #101-e *C4-205071***

**Online, , 3rd Nov 2020 - 13th Nov 2020**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **29.510** | **CR** | **0396** | **rev** | **-** | **Current version:** | **16.5.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **x** |

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| ***Title:*** | **Add a condition to trigger NF\_PROFILE\_CHANGE notification from NRF for any change in allowedxxx parameter** | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Cisco Systems | | | | | | | | | |
| ***Source to TSG:*** | CT4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | TEI16 | | | | |  | ***Date:*** | | | 2020-10-20 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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:*** | | To address the problem explained in the Discussion Paper C4-205076. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * A change of this allowedxxx attribute shall trigger a "NF\_PROFILE\_CHANGED" notification from NRF, only if conditionEvent in NotificationData is satisfied. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | If this is not addressed then this will result in a situation where a Consumer NF will continue to use services of Producer NF, even when it was prohibited to use its services. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | **6.1.6.2.2, 6.1.6.2.3, 5.2.2.6.2** | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **N** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* First Change \* \* \* \*

##### 5.2.2.6.2 Notification from NRF in the same PLMN

The operation is invoked by issuing a POST request to each callback URI of the different subscribed NF Instances.



Figure 5.2.2.6.2-1: Notification from NRF in the same PLMN

1. The NRF shall send a POST request to the callback URI.

For notifications of newly registered NF Instances, the request body shall include the data associated to the newly registered NF, and its services, according to the criteria indicated by the NF Service Consumer during the subscription operation. These data shall contain the NFInstanceID of the NF Instance, an indication of the event being notified ("registration"), and the new profile data (including, among others, the services offered by the NF Instance).

For notifications of changes of the profile of a NF Instance, the request body shall include the NFInstancceID of the NF Instance whose profile was changed, an indication of the event being notified ("profile change"), and the new profile data.

For notifications of deregistration of the NF Instance from NRF, the request body shall include the NFInstanceID of the deregistered NF Instance, and an indication of the event being notified ("deregistration").

When an NF Service Consumer subscribes to a set of NFs (using the different subscription conditions specified in clause 6.1.6.2.35), a change in the profile of the monitored NF Instance may result in such NF becoming a part of the NF set, or stops becoming a part of it (e.g., an NF Service Consumer subscribing to all NFs offering a given NF Service, and then, a certain NF Instance changes its profile by adding or removing an NF Service of its NF Profile); in such case, the NRF shall use the "NF\_PROFILE\_CHANGED" event type in the notification. Similarly, a change of the status (i.e. the "nfStatus" attribute of the NF Profile) shall result into the NRF to send notifications to subscribing NFs with event type set to "NF\_PROFILE\_CHANGED".

When an NF Service Consumer subscribes to a set of NFs, using the subscription conditions specified in clause 6.1.6.2.35, in case of a change of profile(s) of NFs potentially related to those subscription conditions, the NRF shall send notification to subscribing NF Service Consumer(s) to those NFs no longer matching the subscription conditions, and to subscribing NF Service Consumer(s) to NFs that start matching the subscription conditions. In that case, the NRF indicates in the notification data whether the notification is due to the NF Instance to newly start or stop matching the subscription condition (i.e. based on the presence of the "conditionEvent" attribute of the NotificationData).

The notification of changes of the profile may be done by the NRF either by sending the entire new NF Profile, or by indicating a number of "delta" changes (see clause 6.1.6.2.17) from an existing NF Profile that might have been previously received by the NF Service Consumer during an NFDiscovery search operation (see clause 5.3.2.2). If the NF Service Consumer receives "delta" changes related to an NF Service Instance (other than adding a new NF Service Instance) that had not been previously discovered, those changes shall be ignored by the NF Service Consumer, but any other "delta" changes related to NF Service Instances previously discovered or adding a new NF Service Instance shall be applied.

Change of authorization attributes (allowedNfTypes, allowedNfDomains, allowedNssais, allowedPlmns etc) shall trigger a "NF\_PROFILE\_CHANGED" notification from NRF, if the change of the NF Profile results in that the NF Instance starts or stops being authorized to be accessed by an NF having subscribed to be notified about NF profile changes. Otherwise change of authorization attributes shall not trigger notification.

\* \* \* Next Change \* \* \* \*

##### 6.1.6.2.2 Type: NFProfile

Table 6.1.6.2.2-1: Definition of type NFProfile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| nfInstanceId | NfInstanceId | M | 1 | Unique identity of the NF Instance. |
| nfType | NFType | M | 1 | Type of Network Function |
| nfStatus | NFStatus | M | 1 | Status of the NF Instance (NOTE 5) |
| nfInstanceName | string | O | 0..1 | Human readable name of the NF Instance |
| heartBeatTimer | integer | C | 0..1 | Time in seconds expected between 2 consecutive heart-beat messages from an NF Instance to the NRF.  It may be included in the registration request. When present in the request it shall contain the heartbeat time proposed by the NF service consumer.  It shall be included in responses from NRF to registration requests (PUT) or in NF profile updates (PUT or PATCH). If the proposed heartbeat time is acceptable by the NRF based on the local configuration, it shall use the same value as in the registration request; otherwise the NRF shall override the value using a preconfigured value. |
| plmnList | array(PlmnId) | C | 1..N | PLMN(s) of the Network Function (NOTE 7).  This IE shall be present if this information is available for the NF.  If not provided, PLMN ID(s) of the PLMN of the NRF are assumed for the NF. |
| snpnList | array(PlmnIdNid) | C | 1..N | SNPN(s) of the Network Function.  This IE shall be present if the NF pertains to one or more SNPNs. |
| sNssais | array(ExtSnssai) | O | 1..N | S-NSSAIs of the Network Function.  If not provided, and if the perPlmnSnssaiList attribute is not present, the NF can serve any S-NSSAI.  When present this IE represents the list of S-NSSAIs supported in all the PLMNs listed in the plmnList IE.  If the sNSSAIs attribute is provided in at least one NF Service, the S-NSSAIs supported by the NF Profile shall be the set or a superset of the S-NSSAIs of the NFService(s). |
| perPlmnSnssaiList | array(PlmnSnssai) | O | 1..N | This IE may be included when the list of S-NSSAIs supported by the NF for each PLMN it is supporting is different. When present, this IE shall include the S-NSSAIs supported by the Network Function for each PLMN supported by the Network Function. When present, this IE shall override sNssais IE. (NOTE 9)  If the perPlmnSnssaiList attribute is provided in at least one NF Service, the S-NSSAIs supported per PLMN in the NF Profile shall be the set or a superset of the perPlmnSnssaiList of the NFService(s). |
| nsiList | array(string) | O | 1..N | NSI identities of the Network Function.  If not provided, the NF can serve any NSI. |
| fqdn | Fqdn | C | 0..1 | FQDN of the Network Function (NOTE 1) (NOTE 2). For AMF, the FQDN registered with the NRF shall be that of the AMF Name (see 3GPP 23.003 [12] clause 28.3.2.5). |
| interPlmnFqdn | Fqdn | C | 0..1 | If the NF needs to be discoverable by other NFs in a different PLMN, then an FQDN that is used for inter-PLMN routing as specified in 3GPP 23.003 [12] shall be registered with the NRF (NOTE 8).  A change of this attribute shall result in triggering a "NF\_PROFILE\_CHANGED" notification from NRF towards subscribing NFs located in a different PLMN, but the new value shall be notified as a change of the "fqdn" attribute. |
| ipv4Addresses | array(Ipv4Addr) | C | 1..N | IPv4 address(es) of the Network Function (NOTE 1) (NOTE 2) |
| ipv6Addresses | array(Ipv6Addr) | C | 1..N | IPv6 address(es) of the Network Function (NOTE 1) (NOTE 2) |
| allowedPlmns | array(PlmnId) | O | 1..N | PLMNs allowed to access the NF instance.  If not provided, any PLMN is allowed to access the NF.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 16) |
| allowedSnpns | array(PlmnIdNid) | O | 1..N | SNPNs allowed to access the NF instance.  If this attribute is present in the NFService and in the NF profile, the attribute from the NFService shall prevail.  The absence of this attribute in both the NFService and in the NF profile indicates that no SNPN, other than the SNPN(s) registered in the snpnList attribute of the NF Profile, is allowed to access the service instance.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 16) |
| allowedNfTypes | array(NFType) | O | 1..N | Type of the NFs allowed to access the NF instance.  If not provided, any NF type is allowed to access the NF.  This attribute shall not be included in profile change notifications to subscribed NFs.(NOTE 16) |
| allowedNfDomains | array(string) | O | 1..N | Pattern (regular expression according to the ECMA-262 dialect [8]) representing the NF domain names within the PLMN of the NRF allowed to access the NF instance.  If not provided, any NF domain is allowed to access the NF.  This attribute shall not be included in profile change notifications to subscribed NFs.(NOTE 16) |
| allowedNssais | array(ExtSnssai) | O | 1..N | S-NSSAI of the allowed slices to access the NF instance.  If not provided, any slice is allowed to access the NF.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 16) |
| priority | integer | O | 0..1 | Priority (relative to other NFs of the same type) within the range 0 to 65535, to be used for NF selection; lower values indicate a higher priority. Priority may or may not be present in the nfServiceList parameters, xxxInfo parameters and in this attribute. Priority in the nfServiceList has precedence over the priority in this attribute, which has precedence over the priority in xxxInfo parameter. (NOTE 4).  The NRF may overwrite the received priority value when exposing an NFProfile with the Nnrf\_NFDiscovery service. |
| capacity | integer | O | 0..1 | Static capacity information within the range 0 to 65535, expressed as a weight relative to other NF instances of the same type; if capacity is also present in the nfServiceList parameters, those will have precedence over this value. (NOTE 4). |
| load | integer | O | 0..1 | Dynamic load information, within the range 0 to 100, indicates the current load percentage of the NF. |
| loadTimeStamp | DateTime | O | 0..1 | It indicates the point in time in which the latest load information (sent by the NF in the "load" attribute of the NF Profile) was generated at the NF Instance.  If the NF did not provide a timestamp, the NRF should set it to the instant when the NRF received the message where the NF provided the latest load information. |
| locality | string | O | 0..1 | Operator defined information about the location of the NF instance (e.g. geographic location, data center) (NOTE 3) |
| udrInfo | UdrInfo | O | 0..1 | Specific data for the UDR (ranges of SUPI, group ID …) |
| udrInfoList | map(UdrInfo) | O | 1..N | Multiple entries of UdrInfo. This attribute provides additional information to the udrInfo. udrInfoList may be present even if the udrInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| udmInfo | UdmInfo | O | 0..1 | Specific data for the UDM (ranges of SUPI, group ID…) |
| udmInfoList | map(UdmInfo) | O | 1..N | Multiple entries of UdmInfo. This attribute provides additional information to the udmInfo. udmInfoList may be present even if the udmInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| ausfInfo | AusfInfo | O | 0..1 | Specific data for the AUSF (ranges of SUPI, group ID…) |
| ausfInfoList | map(AusfInfo) | O | 1..N | Multiple entries of AusfInfo. This attribute provides additional information to the ausfInfo. ausfInfoList may be present even if the ausfInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| amfInfo | AmfInfo | O | 0..1 | Specific data for the AMF (AMF Set ID, …) |
| amfInfoList | map(AmfInfo) | O | 1..N | Multiple entries of AmfInfo. This attribute provides additional information to the amfInfo. amfInfoList may be present even if the amfInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| smfInfo | SmfInfo | O | 0..1 | Specific data for the SMF (DNN's, …).  (NOTE 12) |
| smfInfoList | map(SmfInfo) | O | 1..N | Multiple entries of SmfInfo. This attribute provides additional information to the smfInfo. smfInfoList may be present even if the smfInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters.  (NOTE 12) |
| upfInfo | UpfInfo | O | 0..1 | Specific data for the UPF (S-NSSAI, DNN, SMF serving area, interface…) |
| upfInfoList | map(UpfInfo) | O | 1..N | Multiple entries of UpfInfo. This attribute provides additional information to the upfInfo. upfInfoList may be present even if the upfInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| pcfInfo | PcfInfo | O | 0..1 | Specific data for the PCF |
| pcfInfoList | map(PcfInfo) | O | 1..N | Multiple entries of PcfInfo. This attribute provides additional information to the pcfInfo. pcfInfoList may be present even if the pcfInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| bsfInfo | BsfInfo | O | 0..1 | Specific data for the BSF |
| bsfInfoList | map(BsfInfo) | O | 1..N | Multiple entries of BsfInfo. This attribute provides additional information to the bsfInfo. bsfInfoList may be present even if the bsfInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| chfInfo | ChfInfo | O | 0..1 | Specific data for the CHF |
| chfInfoList | map(ChfInfo) | O | 1..N | Multiple entries of ChfInfo. This attribute provides additional information to the chfInfo. chfInfoList may be present even if the chfInfo is absent.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| nefInfo | NefInfo | O | 0..1 | Specific data for the NEF |
| nrfInfo | NrfInfo | O | 0..1 | Specific data for the NRF |
| udsfInfo | UdsfInfo | O | 0..1 | Specific data for the UDSF |
| udsfInfoList | map(UdsfInfo) | O | 1..N | Multiple entries of udsfInfo. This attribute provides additional information to the udsfInfo. udsfInfoExt may be present even if the udsfInfo is absent. |
| nwdafInfo | NwdafInfo | O | 0..1 | Specific data for the NWDAF. |
| pcscfInfoList | map(PcscfInfo) | O | 1..N | Specific data for the P-CSCF.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters.  (NOTE 11) |
| hssInfoList | map(HssInfo) | O | 1..N | Specific data for the HSS.  The key of the map shall be a (unique) valid JSON string per clause 7 of IETF RFC 8259 [22], with a maximum of 32 characters. |
| customInfo | object | O | 0..1 | Specific data for custom Network Functions |
| recoveryTime | DateTime | O | 0..1 | Timestamp when the NF was (re)started (NOTE 5) (NOTE 6) |
| nfServicePersistence | boolean | O | 0..1 | - true: If present, and set to true, it indicates that the different service instances of a same NF Service in this NF instance, supporting a same API version, are capable to persist their resource state in shared storage and therefore these resources are available after a new NF service instance supporting the same API version is selected by a NF Service Consumer (see 3GPP 23.527 [27]).  - false (default): Otherwise, it indicates that the NF Service Instances of a same NF Service are not capable to share resource state inside the NF Instance. |
| nfServices | array(NFService) | O | 1..N | List of NF Service Instances. It shall include the services produced by the NF that can be discovered by other NFs, if any. (NOTE 15)  This attribute is deprecated; the attribute "nfServiceList" should be used instead. |
| nfServiceList | map(NFService) | O | 1..N | Map of NF Service Instances, where the "serviceInstanceId" attribute of the NFService object shall be used as the key of the map. (NOTE 15)  It shall include the services produced by the NF that can be discovered by other NFs, if any. |
| nfProfileChangesSupportInd | boolean | O | 0..1 | NF Profile Changes Support Indicator.  See Annex B.  This IE may be present in the NFRegister or NFUpdate (NF Profile Complete Replacement) request and shall be absent in the response.  true: the NF Service Consumer supports receiving NF Profile Changes in the response.  false (default): the NF Service Consumer does not support receiving NF Profile Changes in the response.  Write-Only: true |
| nfProfileChangesInd | boolean | O | 0..1 | NF Profile Changes Indicator.  See Annex B.  This IE shall be absent in the request to the NRF and may be included by the NRF in NFRegister or NFUpdate (NF Profile Complete Replacement) response.  true: the NF Profile contains NF Profile changes.  false (default): complete NF Profile.  Read-Only: true |
| defaultNotificationSubscriptions | array(DefaultNotificationSubscription) | O | 1..N | Notification endpoints for different notification types.  (NOTE 10) |
| lmfInfo | LmfInfo | O | 0..1 | Specific data for the LMF |
| gmlcInfo | GmlcInfo | O | 0..1 | Specific data for the GMLC |
| nfSetIdList | array(NfSetId) | C | 1..N | NF Set ID defined in clause 28.12 of 3GPP TS 23.003 [12].  At most one NF Set ID shall be indicated per PLMN of the NF.  This information shall be present if available. |
| servingScope | array(string) | O | 1..N | The served area(s) of the NF instance.  The absence of this attribute does not imply that the NF instance can serve every area in the PLMN.  (NOTE 13) |
| lcHSupportInd | boolean | O | 0..1 | This IE indicates whether the NF supports Load Control based on LCI Header (see clause 6.3 of 3GPP TS 29.500 [4]).  - true: the NF supports the feature.  - false (default): the NF does not support the feature. |
| olcHSupportInd | boolean | O | 0..1 | This IE indicates whether the NF supports Overload Control based on OCI Header (see clause 6.4 of 3GPP TS 29.500 [4]).  - true: the NF supports the feature.  - false (default): the NF does not support the feature. |
| nfSetRecoveryTimeList | map(DateTime) | O | 1..N | Map of recovery time, where the key of the map is the *NfSetId* of NF Set(s) that the NF instance belongs to.  When present, the value of each entry of the map shall be the recovery time of the NF Set indicated by the key. |
| serviceSetRecoveryTimeList | map(DateTime) | O | 1..N | Map of recovery time, where the key of the map is the *NfServiceSetId* of the NF Service Set(s) configured in the NF instance.  When present, the value of each entry of the map shall be the recovery time of the NF Service Set indicated by the key. |
| scpDomains | array(string) | O | 1..N | When present, this IE shall carry the list of SCP domains the SCP belongs to, or the SCP domain the NF (other than SCP) belongs to.  (NOTE 14) |
| scpInfo | ScpInfo | O | 0..1 | Specific data for the SCP |
| NOTE 1: At least one of the addressing parameters (fqdn, ipv4address or ipv6adress) shall be included in the NF Profile. If the NF supports the NF services with "https" URI scheme (i.e use of TLS is mandatory), then the FQDN shall be provided in the NF Profile or the NF Service profile (see clause 6.1.6.2.3). See NOTE 1 of Table 6.1.6.2.3-1 for the use of these parameters. If multiple ipv4 addresses and/or ipv6 addresses are included in the NF Profile, the NF Service Consumer of the discovery service shall select one of these addresses randomly, unless operator defined local policy of IP address selection, in order to avoid overload for a specific ipv4 address and/or ipv6 address.  NOTE 2: If the type of Network Function is UPF, the addressing information is for the UPF N4 interface.  NOTE 3: A requester NF may use this information to select a NF instance (e.g. a NF instance preferably located in the same data center).  NOTE 4: The capacity and priority parameters, if present, are used for NF selection and load balancing. The priority and capacity attributes shall be used for NF selection in the same way that priority and weight are used for server selection as defined in IETF RFC 2782 [23].  NOTE 5: The NRF shall notify NFs subscribed to receiving notifications of changes of the NF profile, if the NF recoveryTime or the nfStatus is changed. See clause 6.2 of 3GPP 23.527 [27].  NOTE 6: A requester NF may consider that all the resources created in the NF before the NF recovery time have been lost. This may be used to detect a restart of a NF and to trigger appropriate actions, e.g. release local resources. See clause 6.2 of 3GPP 23.527 [27].  NOTE 7: A NF may register multiple PLMN IDs in its profile within a PLMN comprising multiple PLMN IDs. If so, all the attributes of the NF Profile shall apply to each PLMN ID registered in the plmnList. As an exception, attributes including a PLMN ID, e.g. IMSI-based SUPI ranges, TAIs and GUAMIs, are specific to one PLMN ID and the NF may register in its profile multiple occurrences of such attributes for different PLMN IDs (e.g. the UDM may register in its profile SUPI ranges for different PLMN IDs).  NOTE 8: Other NFs are in a different PLMN if they belong to none of the PLMN ID(s) configured for the PLMN of the NRF.  NOTE 9: This is for the use case where an NF (e.g. AMF) supports multiple PLMNs and the slices supported in each PLMN are different. See clause 9.2.6.2 of 3GPP TS 38.413 [29].  NOTE 10: If notification endpoints are present both in the profile of the NF instance (NFProfile) and in some of its NF Services (NFService) for a same notification type, the notification endpoint(s) of the NF Services shall be used for this notification type.  NOTE 11: The absence of the pcscfInfoList attribute in a P-CSCF profile indicates that the P-CSCF can be selected for any DNN and Access Type.  NOTE 12: The absence of both the smfInfo and smfInfoList attributes in an SMF profile indicates that the SMF can be selected for any S-NSSAI, DNN, TAI and access type.  NOTE 13: The servingScope attribute may indicate geographical areas, It may be used e.g. to discover and select NFs in centralized Data Centers that are expected to serve users located in specific region(s) or province(s). It may also be used to reduce the large configuration of TAIs in the NF instances.  NOTE 14: An NF (other than a SCP) can register at most one SCP domain in NF profile, i.e. the NF can belong to only one SCP domain. If an NF (other than a SCP) includes this information in its profile, this indicates that the services produced by this NF should be accessed preferably via an SCP from the SCP domain the NF belongs to.  NOTE 15: If the NF Service Consumer that issues an NF profile retrieval request indicates support for the "Service-Map" feature, the NRF shall return in the NF profile retrieval response the list of NF Service Instances in the "nfServiceList" map attribute. Otherwise, the NRF shall return the list of NF Service Instances in the "nfServices" array attribute.  NOTE X: A change of this attribute shall trigger a "NF\_PROFILE\_CHANGED" notification from NRF, if the change of the NF Profile results in that the NF Instance starts or stops being authorized to be accessed by an NF having subscribed to be notified about NF profile changes  . | | | | |

\* \* \* Next Change \* \* \* \*

##### 6.1.6.2.3 Type: NFService

Table 6.1.6.2.3-1: Definition of type NFService

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| serviceInstanceId | string | M | 1 | Unique ID of the service instance within a given NF Instance |
| serviceName | ServiceName | M | 1 | Name of the service instance (e.g. "nudm-sdm") |
| versions | array(NFServiceVersion) | M | 1..N | The API versions supported by the NF Service and if available, the corresponding retirement date of the NF Service.  The different array elements shall have distinct unique values for "apiVersionInUri", and consequently, the values of "apiFullVersion" shall have a unique first digit version number. |
| scheme | UriScheme | M | 1 | URI scheme (e.g. "http", "https") |
| nfServiceStatus | NFServiceStatus | M | 1 | Status of the NF Service Instance (NOTE 3) |
| fqdn | Fqdn | O | 0..1 | FQDN of the NF Service Instance (NOTE 1) (NOTE 8) |
| interPlmnFqdn | Fqdn | O | 0..1 | 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 as specified in 3GPP 23.003 [12] may be registered with the NRF (NOTE 1) (NOTE 6).  A change of this attribute shall result in triggering a "NF\_PROFILE\_CHANGED" notification from NRF towards subscribing NFs located in a different PLMN, but the new value shall be notified as a change of the "fqdn" attribute. |
| ipEndPoints | array(IpEndPoint) | O | 1..N | 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 (NOTE 1) (NOTE 7). |
| apiPrefix | string | O | 0..1 | Optional path segment(s) used to construct the {apiRoot} variable of the different API URIs, as described in 3GPP 29.501 [5], clause 4.4.1 |
| defaultNotificationSubscriptions | array(DefaultNotificationSubscription) | O | 1..N | Notification endpoints for different notification types. |
| allowedPlmns | array(PlmnId) | O | 1..N | PLMNs allowed to access the service instance (NOTE 5).  The absence of this attribute indicates that any PLMN is allowed to access the service instance.  When included, the allowedPlmns attribute needs not include the PLMN ID(s) registered in the plmnList attribute of the NF Profile, i.e. the PLMN ID(s) registered in the NF Profile shall be considered to be allowed to access the service instance.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 12) |
| allowedSnpns | array(PlmnIdNid) | O | 1..N | SNPNs allowed to access the service instance.  If this attribute is present in the NFService and in the NF profile, the attribute from the NFService shall prevail.  The absence of this attribute in both the NFService and in the NF profile indicates that no SNPN, other than the SNPN(s) registered in the snpnList attribute of the NF Profile, is allowed to access the service instance.  When included, the allowedSnpns attribute needs not include the PLMN ID/NID(s) registered in the snpnList attribute of the NF Profile, i.e. the SNPNs registered in the NF Profile shall be considered to be allowed to access the service instance.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 12) |
| allowedNfTypes | array(NFType) | O | 1..N | Type of the NFs allowed to access the service instance (NOTE 5).  The absence of this attribute indicates that any NF type is allowed to access the service instance.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 12) |
| allowedNfDomains | array(string) | O | 1..N | Pattern (regular expression according to the ECMA-262 dialect [8]) representing the NF domain names within the PLMN of the NRF allowed to access the service instance (NOTE 5).  The absence of this attribute indicates that any NF domain is allowed to access the service instance.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 12) |
| allowedNssais | array(ExtSnssai) | O | 1..N | S-NSSAI of the allowed slices to access the service instance (NOTE 5).  The absence of this attribute indicates that any slice is allowed to access the service instance.  This attribute shall not be included in profile change notifications to subscribed NFs. (NOTE 12) |
| allowedOperationsPerNfType | map(array(string)) | O | 1..N | Map of allowed operations on resources for each type of NF; the key of the map is the NF Type, and the value is an array of scopes.  The scopes shall be any of those defined in the API that defines the current service (identified by the "serviceName" attribute).  (NOTE 11) |
| allowedOperationsPerNfInstance | map(array(string)) | O | 1..N | Map of allowed operations on resources for a given NF Instance; the key of the map is the NF Instance Id, and the value is an array of scopes.  The scopes shall be any of those defined in the API that defines the current service (identified by the "serviceName" attribute).  (NOTE 11) |
| priority | integer | O | 0..1 | 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. (NOTE 2).  The NRF may overwrite the received priority value when exposing an NFProfile with the Nnrf\_NFDiscovery service. |
| capacity | integer | O | 0..1 | Static capacity information in the range of 0-65535, expressed as a weight relative to other services of the same type. (NOTE 2). |
| load | integer | O | 0..1 | Dynamic load information, ranged from 0 to 100, indicates the current load percentage of the NF Service. |
| loadTimeStamp | DateTime | O | 0..1 | It indicates the point in time in which the latest load information (sent by the NF in the "load" attribute of the NF Service) was generated at the NF Service Instance.  If the NF did not provide a timestamp, the NRF should set it to the instant when the NRF received the message where the NF provided the latest load information. |
| recoveryTime | DateTime | O | 0..1 | Timestamp when the NF service was (re)started (NOTE 3) (NOTE 4) |
| chfServiceInfo | ChfServiceInfo | O | 0..1 | Specific data for a CHF service instance |
| supportedFeatures | SupportedFeatures | O | 0..1 | Supported Features of the NF Service instance |
| nfServiceSetIdList | array(NfServiceSetId) | C | 1..N | NF Service Set ID (see clause 28.11 of 3GPP TS 23.003 [12])  At most one NF Service Set ID shall be indicated per PLMN of the NF.  This information shall be present if available. |
| sNssais | array(ExtSnssai) | O | 1..N | S-NSSAIs of the NF Service. This may be a subset of the S-NSSAIs supported by the NF (see sNssais attribute in NFProfile).  When present, this IE shall represent the list of S-NSSAIs supported by the NF Service in all the PLMNs listed in the plmnList IE and it shall prevail over the list of S-NSSAIs supported by the NF instance. |
| perPlmnSnssaiList | array(PlmnSnssai) | O | 1..N | S-NSSAIs of the NF Service per PLMN. This may be a subset of the S-NSSAIs supported per PLMN by the NF (see perPlmnSnssaiList attribute in NFProfile).  This IE may be included when the list of S-NSSAIs supported by the NF Service for each PLMN it is supporting is different. When present, this IE shall include the S-NSSAIs supported by the NF Service for each PLMN and it shall prevail over the list of S-NSSAIs supported per PLMN by the NF instance. When present, this IE shall override the sNssais IE. (NOTE 9) |
| vendorId | VendorId | O | 0..1 | Vendor ID of the NF Service instance, according to the IANA-assigned "SMI Network Management Private Enterprise Codes" [38]. |
| supportedVendorSpecificFeatures | map(array(VendorSpecificFeature)) | O | 1..N | Map of Vendor-Specific features, where the key of the map is the IANA-assigned "SMI Network Management Private Enterprise Codes" [38].  The value of each entry of the map shall be a list (array) of VendorSpecificFeature objects.  (NOTE 10) |
| oauth2Required | boolean | O | 0..1 | It indicates whether the NF Service Instance requires Oauth2-based authorization.  Absence of this IE means that the NF Service Producer has not provided any indication about its usage of Oauth2 for authorization. |
| NOTE 1: The NF Service Consumer will construct the API URIs of the service using:  - for intra-PLMN signalling: the FQDN and IP addresses related attributes present in the NF Service Profile, if any, otherwise the FQDN and IP addresses related attributes present in the NF Profile.  - for inter-PLMN signalling: the interPlmnFqdn present in the NF Service Profile, if any, otherwise the interPlmnFqdn present in the NF Profile.  See Table 6.2.6.2.4-1.  NOTE 2: The capacity and priority parameters, if present, are used for NF selection and load balancing. The priority and capacity attributes shall be used for NF selection in the same way that priority and weight are used for server selection as defined in IETF RFC 2782 [23].  NOTE 3: The NRF shall notify NFs subscribed to receiving notifications of changes of the NF profile, if the recoveryTime or the nfServiceStatus is changed. See clause 6.2 of 3GPP 23.527 [27].  NOTE 4: A requester NF subscribed to NF status changes may consider that all the resources created in the NF service before the NF service recovery time have been lost. This may be used to detect a restart of a NF service and to trigger appropriate actions, e.g. release local resources. See clause 6.2 of 3GPP 23.527 [27].  NOTE 5: If this attribute is present in the NFService and in the NF profile, the attribute from the NFService shall prevail. The absence of this attribute in the NFService and in the NFProfile indicates that there is no corresponding restriction to access the service instance. If this attribute is absent in the NF Service, but it is present in the NF Profile, the attribute from the NF Profile shall be applied.  NOTE 6: Other NFs are in a different PLMN if they belong to none of the PLMN ID(s) configured for the PLMN of the NRF.  NOTE 7: If multiple ipv4 addresses and/or ipv6 addresses are included in the NF Service, the NF Service Consumer of the discovery service shall select one of these addresses randomly, unless operator defined local policy of IP address selection, in order to avoid overload for a specific ipv4 address and/or ipv6 address.  NOTE 8: If the URI scheme registered for the NF service is "https" then FQDN shall be provided in the NF Service profile or in NF Profile (see clause 6.1.6.2.2).  NOTE 9: This is for the use case where an NF (e.g. AMF) supports multiple PLMNs and the slices supported in each PLMN are different. See clause 9.2.6.2 of 3GPP TS 38.413 [29].  NOTE 10: When present, this attribute allows the NF Service Consumer to determine which vendor-specific extensions are supported in a given NF Service Producer in order to include, or not, the vendor-specific attributes (see 3GPP TS 29.500 [4] clause 6.6.3) required for a given feature in subsequent service requests towards a certain service instance of the NF Service Producer.  NOTE 11: These attributes are used in order to determine whether a given resource/operation-level scope shall be granted to an NF Service Consumer that requested an Oauth2 access token with a specific scope; the NRF shall only grant such scope in the access token, if the scope is present in either "allowedOperationsPerNfType", for the specific NF type of the NF Service Consumer, or in "allowedOperationsPerNfInstance", for the specific instance ID of the NF Service Consumer.  NOTE X: A change of this attribute shall trigger a "NF\_PROFILE\_CHANGED" notification from NRF, if the change of the NF Profile results in that the NF Instance starts or stops being authorized to be accessed by an NF having subscribed to be notified about NF profile changes | | | | |

\* \* \* End of Changes \* \* \* \*