**3GPP TSG-CT WG4 Meeting #96eC4-200862**

**E-Meeting, 17th – 28th February 2020**

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| --- |
| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **29.510** | **CR** | **0312** | **rev** | **1** | **Current version:** | **16.2.0** |  |
|  |
| *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** |

|  |
| --- |
|  |
| ***Title:***  | LMF selection |
|  |  |
| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** | CT4 |
|  |  |
| ***Work item code:*** | 5G\_eLCS |  | ***Date:*** | 2020-02-12 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***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 canbe 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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | For LMF selection, LMF ID is used to select a LMF, and if a LMF ID is unusual, some factors may be used to select a LMF, these factors are listed in clause 5.1 of TS 23.273, see as bellows:*The following factors may be considered during the LMF selection:**- Requested Quality of Service information, e.g.:**- LCS accuracy,**- Response time (latency),*LMF ID*- Access Type (3GPP /N3GPP).**NOTE: Location methods may differ depending on the Access Type, e.g. in case of WLAN Access Location determination may just correspond to retrieval of IP addressing information from the N3IWF/TNGF; As another example, for Wireline access, Location determination may just correspond to retrieval of geo coordinates corresponding to a Line Id.**- RAT type (i.e. 5G NR or eLTE) and/or the serving AN node (i.e. gNB or NG-eNB) of the target UE.**- RAN configuration information.**- LMF capabilities.**- LMF load.**- LMF location.**- Indication of either a single event report or multiple event reports.**- Duration of event reporting.**- Network slicing information, e.g. S-NSSAI and/or NSI ID* *RAT type.*Selecting LMF according to LMF ID, or based on factors Access Type, RAT Type, serving AN node type should be supported for alignment with stage 2. |
|  |  |
| ***Summary of change:*** | 1.Add LMF ID, the Locaiton Quality of Service, list of Access Type, list of serving AN node type, list of RAT type which LMF can serve in LmfInfo.2.Add the Locaiton Quality of Service, Access Type, serving AN node type, RAT type which are needed to support as query paramters in Get method of NFDiscovery Service. |
|  |  |
| ***Consequences if not approved:*** | Stage 2 solution won't be implemented. |
|  |  |
| ***Clauses affected:*** | 6.1.6.1, 6.1.6.2.46, 6.1.6.3.x(new), 6.2.3.2.3.1, 6.2.9, A.2, A.3 |
|  |  |
|  | **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:*** | This CR will introduce backward compatible new features in the OpenAPI specification files of TS29510\_Nnrf\_NFDiscovery.yaml, TS29510\_Nnrf\_NFManagement.yaml. |
|  |  |
| ***This CR's revision history:*** | Rev:1.Move Location QoS as a factor of registration and discovery LMF.2. Add AnNodeType in Table 6.2.6.1-2: Nnrf\_NFDiscovery re-used Data Types |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*The start of changes\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 6.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.1.6.1-1 specifies the data types defined for the Nnrf service based interface protocol.

Table 6.1.6.1-1: Nnrf\_NFManagement specific Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Clause defined | Description |
| NFProfile | 6.1.6.2.2 |  |
| NFService | 6.1.6.2.3 |  |
| DefaultNotificationSubscription | 6.1.6.2.4 | Data structure for specifying the notifications the NF service subscribes by default along with callback URI. |
| IpEndPoint | 6.1.6.2.5 |  |
| UdrInfo | 6.1.6.2.6 |  |
| UdmInfo | 6.1.6.2.7 |  |
| AusfInfo | 6.1.6.2.8 |  |
| SupiRange | 6.1.6.2.9 |  |
| IdentityRange | 6.1.6.2.10 |  |
| AmfInfo | 6.1.6.2.11 |  |
| SmfInfo | 6.1.6.2.12 |  |
| UpfInfo | 6.1.6.2.13 | Information related to UPF |
| SnssaiUpfInfoItem | 6.1.6.2.14 |  |
| DnnUpfInfoItem | 6.1.6.2.15 |  |
| SubscriptionData | 6.1.6.2.16 |  |
| NotificationData | 6.1.6.2.17 |  |
| NFServiceVersion | 6.1.6.2.19 | Contains the version details of an NF service. |
| PcfInfo | 6.1.6.2.20 |  |
| BsfInfo | 6.1.6.2.21 |  |
| Ipv4AddressRange | 6.1.6.2.22 |  |
| Ipv6PrefixRange | 6.1.6.2.23 |  |
| InterfaceUpfInfoItem | 6.1.6.2.24 |  |
| UriList | 6.1.6.2.25 |  |
| N2InterfaceAmfInfo | 6.1.6.2.26 | AMF N2 interface information |
| TaiRange | 6.1.6.2.27 |  |
| TacRange | 6.1.6.2.28 |  |
| SnssaiSmfInfoItem | 6.1.6.2.29 |  |
| DnnSmfInfoItem | 6.1.6.2.30 |  |
| NrfInfo | 6.1.6.2.31 |  |
| ChfInfo | 6.1.6.2.32 |  |
| ChfServiceInfo | 6.1.6.2.33 |  |
| PlmnRange | 6.1.6.2.34 |  |
| SubscrCond | 6.1.6.2.35 |  |
| NfInstanceIdCond | 6.1.6.2.36 |  |
| NfTypeCond | 6.1.6.2.37 |  |
| ServiceNameCond | 6.1.6.2.38 |  |
| AmfCond | 6.1.6.2.39 |  |
| GuamiListCond | 6.1.6.2.40 |  |
| NetworkSliceCond | 6.1.6.2.41 |  |
| NfGroupCond | 6.1.6.2.42 |  |
| NotifCondition | 6.1.6.2.43 |  |
| PlmnSnssai | 6.1.6.2.44 |  |
| NwdafInfo | 6.1.6.2.45 |  |
| LmfInfo | 6.1.6.2.46 |  |
| GmlcInfo | 6.1.6.2.47 |  |
| NefInfo | 6.1.6.2.48 |  |
| PfdData | 6.1.6.2.49 |  |
| AfEventExposureData | 6.1.6.2.50 |  |
| WAgfInfo | 6.1.6.2.51 |  |
| TngfInfo | 6.1.6.2.52 |  |
| PcscfInfo | 6.1.6.2.53 |  |
| NfSetCond | 6.1.6.2.54 |  |
| NfServiceSetCond | 6.1.6.2.55 |  |
| NfInfo | 6.1.6.2.56 |  |
| HssInfo | 6.1.6.2.57 |  |
| ImsiRange | 6.1.6.2.58 |  |
| InternalGroupIdRange | 6.1.6.2.59 |  |
| Fqdn | 6.1.6.3.2 |  |
| NefId | 6.1.6.3.2 |  |
| NFType | 6.1.6.3.3 |  |
| NotificationType | 6.1.6.3.4 |  |
| TransportProtocol | 6.1.6.3.5 |  |
| NotificationEventType | 6.1.6.3.6 |  |
| NFStatus | 6.1.6.3.7 |  |
| DataSetId | 6.1.6.3.8 |  |
| UPInterfaceType | 6.1.6.3.9 |  |
| ServiceName | 6.1.6.3.11 |  |
| NFServiceStatus | 6.1.6.3.12 |  |

Table 6.1.6.1-2 specifies data types re-used by the Nnrf service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nnrf service based interface.

Table 6.1.6.1-2: Nnrf\_NFManagement re-used Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Comments |
| N1MessageClass | 3GPP 29.518 [6] | The N1 message type |
| N2InformationClass | 3GPP 29.518 [6] | The N2 information type |
| IPv4Addr | 3GPP TS 29.571 [7] |  |
| IPv6Addr | 3GPP TS 29.571 [7] |  |
| IPv6Prefix | 3GPP TS 29.571 [7] |  |
| Uri | 3GPP TS 29.571 [7] |  |
| Dnn | 3GPP TS 29.571 [7] |  |
| SupportedFeatures | 3GPP TS 29.571 [7] |  |
| Snssai | 3GPP TS 29.571 [7] |  |
| PlmnId | 3GPP TS 29.571 [7] |  |
| Guami | 3GPP TS 29.571 [7] |  |
| Tai | 3GPP TS 29.571 [7] |  |
| NfInstanceId | 3GPP TS 29.571 [7] |  |
| LinksValueSchema | 3GPP TS 29.571 [7] | 3GPP Hypermedia link |
| UriScheme | 3GPP TS 29.571 [7] |  |
| AmfName | 3GPP TS 29.571 [7] |  |
| DateTime | 3GPP TS 29.571 [7] |  |
| Dnai | 3GPP TS 29.571 [7] |  |
| ChangeItem | 3GPP TS 29.571 [7] |  |
| DiameterIdentity | 3GPP TS 29.571 [7] |  |
| AccessType | 3GPP TS 29.571 [7] |  |
| NfGroupId | 3GPP TS 29.571 [7] | Network Function Group Id |
| AmfRegionId | 3GPP TS 29.571 [7] |  |
| AmfSetId | 3GPP TS 29.571 [7] |  |
| PduSessionType | 3GPP TS 29.571 [7] |  |
| AtsssCapability | 3GPP TS 29.571 [7] | Capability to support procedures related to Access Traffic Steering, Switching, Splitting. |
| Nid | 3GPP TS 29.571 [7] |  |
| PlmnIdNid | 3GPP TS 29.571 [7] |  |
| NfSetId | 3GPP TS 29.571 [7] | NF Set ID (see clause 28.10 of 3GPP TS 23.003 [12]) |
| NfServiceSetId | 3GPP TS 29.571 [7] | NF Service Set ID (see clause 28.11 of 3GPP TS 23.003 [12]) |
| GroupId | 3GPP TS 29.571 [7] | Internal Group Identifier |
| RatType | 3GPP TS 29.571 [7] | RAT Type |
| EventId | 3GPP TS 29.520 [32] | Defined in Nnwdaf\_AnalyticsInfo API. |
| NwdafEvent | 3GPP TS 29.520 [32] | Defined in Nnwdaf\_EventsSubscription API. |
| ExternalClientType | 3GPP TS 29.572 [33] |  |
| LMFIdentification | 3GPP TS 29.572 [33] | LMF Identification |
| AfEvent | 3GPP TS 29.517 [35] | Defined in Naf\_EventExposure API |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

##### 6.1.6.2.46 Type: LmfInfo

Table 6.1.6.2.46-1: Definition of type LmfInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| servingClientTypes | array(ExternalClientType) | C | 1..N | This IE shall be present if the LMF is dedicated to serve the listed external client type(s), e.g. emergency client. The NRF should only include this LMF instance to NF discovery with "client-type" query parameter indicating one of the external client types in the list.Absence of this IE means the LMF is not dedicated to serve specific client types. |
| lmfId | LMFIdentification | C | 0..1 | When present, this ID shall indicate the LMF identification. |
| servingAccessTypes | array(AccessType) | C | 1..N | If included, this IE shall contain the access type (i.e. 3GPP\_ACCESS and/or NON\_3GPP\_ACCESS) supported by the LMF.If not included, it shall be assumed that all access types are supported. |
| servingAnNodeTypes | array(AnNodeType) | C | 1..N | If included, this IE shall contain the AN node type (i.e. gNB or NG-eNB) supported by the LMF.If not included, it shall be assumed that all AN node types are supported. |
| servingRatTypes | array(RatType) | C | 1..N | If included, this IE shall contain the RAT type (e.g. 5G NR or eLTE) supported by the LMF.If not included, it shall be assumed that all RAT types are supported. |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

##### 6.1.6.3.x Enumeration: AnNodeType

Table 6.1.6.3.x-1: Enumeration AnNodeType

|  |  |
| --- | --- |
| Enumeration value | Description |
| "GNB" | gNB |
| "NG\_ENB" | NG-eNB |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#### 6.2.6.1 General

This clause specifies the application data model supported by the API.

Table 6.2.6.1-1 specifies the data types defined for the Nnrf service based interface protocol.

Table 6.2.6.1-1: Nnrf\_NFDiscovery specific Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Clause defined | Description |
| SearchResult | 6.2.6.2.2 |  |
| NFProfile | 6.2.6.2.3 |  |
| NFService | 6.2.6.2.4 |  |
| StoredSearchResult | 6.2.6.2.5 |  |
| PreferredSearch | 6.2.6.2.6 |  |

Table 6.2.6.1-2 specifies data types re-used by the Nnrf service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nnrf service based interface.

Table 6.2.6.1-2: Nnrf\_NFDiscovery re-used Data Types

|  |  |  |
| --- | --- | --- |
| Data type | Reference | Comments |
| Snssai | 3GPP TS 29.571 [7] |  |
| PlmnId | 3GPP TS 29.571 [7] |  |
| Dnn | 3GPP TS 29.571 [7] |  |
| Tai | 3GPP TS 29.571 [7] |  |
| SupportedFeatures | 3GPP TS 29.571 [7] |  |
| NfInstanceId | 3GPP TS 29.571 [7] |  |
| Uri | 3GPP TS 29.571 [7] |  |
| Gpsi | 3GPP TS 29.571 [7] |  |
| GroupId | 3GPP TS 29.571 [7] |  |
| Guami | 3GPP TS 29.571 [7] |  |
| IPv4Addr | 3GPP TS 29.571 [7] |  |
| IPv6Addr | 3GPP TS 29.571 [7] |  |
| UriScheme | 3GPP TS 29.571 [7] |  |
| Dnai | 3GPP TS 29.571 [7] |  |
| NfGroupId | 3GPP TS 29.571 [7] | Identifier of a NF Group |
| PduSessionType | 3GPP TS 29.571 [7] |  |
| AtsssCapability | 3GPP TS 29.571 [7] |  |
| PlmnIdNid | 3GPP TS 29.571 [7] |  |
| NfSetId | 3GPP TS 29.571 [7] |  |
| NfServiceSetId | 3GPP TS 29.571 [7] |  |
| EventId | 3GPP TS 29.520 [32] | Defined in Nnwdaf\_AnalyticsInfo API. |
| NwdafEvent | 3GPP TS 29.520 [32] | Defined in Nnwdaf\_EventsSubscription API. |
| ExtGroupId | 3GPP TS 29.503 [36] |  |
| DefaultNotificationSubscription | 3GPP TS 29.510 | See clause 6.1.6.2.4 |
| IPEndPoint | 3GPP TS 29.510 | See clause 6.1.6.2.5 |
| NFType | 3GPP TS 29.510 | See clause 6.1.6.3.3 |
| UdrInfo | 3GPP TS 29.510 | See clause 6.1.6.2.6 |
| UdmInfo | 3GPP TS 29.510 | See clause 6.1.6.2.7 |
| AusfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.8 |
| SupiRange | 3GPP TS 29.510 | See clause 6.1.6.2.9 |
| AmfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.11 |
| SmfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.12 |
| UpfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.13 |
| PcfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.20 |
| BsfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.21 |
| ChfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.32 |
| ChfServiceInfo | 3GPP TS 29.510 | See clause 6.1.6.2.33 |
| NFServiceVersion | 3GPP TS 29.510 | See clause 6.1.6.2.19 |
| PlmnSnssai | 3GPP TS 29.510 | See clause 6.1.6.2.44 |
| NwdafInfo | 3GPP TS 29.510 | See clause 6.1.6.2.45 |
| NFStatus | 3GPP TS 29.510 | See clause 6.1.6.3.7 |
| DataSetId | 3GPP TS 29.510 | See clause 6.1.6.3.8 |
| ServiceName | 3GPP TS 29.510 | See clause 6.1.6.3.11 |
| NFServiceStatus | 3GPP TS 29.510 | See clause 6.1.6.3.12 |
| LmfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.46 |
| GmlcInfo | 3GPP TS 29.510 | See clause 6.1.6.2.47 |
| NefInfo | 3GPP TS 29.510 | See clause 6.1.6.2.48 |
| PfdData | 3GPP TS 29.510 | See clause 6.1.6.2.49 |
| AfEventExposureData | 3GPP TS 29.510 | See clause 6.1.6.2.50 |
| PcscfInfo | 3GPP TS 29.510 | See clause 6.1.6.2.53 |
| HssInfo | 3GPP TS 29.510 | See clause 6.1.6.2.57 |
| ImsiRange | 3GPP TS 29.510 | See clause 6.1.6.2.58 |
| NefId | 3GPP TS 29.510 | See clause 6.1.6.3.2 |
| AnNodeType | 3GPP TS 29.510 | See clause 6.1.6.3.x |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

###### 6.2.3.2.3.1 GET

This operation retrieves a list of NF Instances, and their offered services, currently registered in the NRF, satisfying a number of filter criteria, such as those NF Instances offering a certain service name, or those NF Instances of a given NF type (e.g., AMF).

Table 6.2.3.2.3.1-1: URI query parameters supported by the GET method on this resource

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Data type | P | Cardinality | Description | Applicability |
| target-nf-type | NFType | M | 1 | This IE shall contain the NF type of the NF Service Producer being discovered. |  |
| requester-nf-type | NFType | M | 1 | This IE shall contain the NF type of the NF Service Consumer that is invoking the Nnrf\_NFDiscovery service. |  |
| requester-nf-instance-id | NfInstanceId | O  | 0..1 | If included, this IE shall contain the NF instance id of the NF service consumer.  | Query-Params-Ext2 |
| service-names | array(ServiceName) | O | 1..N | If included, this IE shall contain an array of service names for which the NRF is queried to provide the list of NF profiles. The NRF shall return the NF profiles that have at least one NF service matching the NF service names in this list. The NF service names returned by the NRF shall be an interclause of the NF service names requested and the NF service names registered in the NF profile.If not included, the NRF shall return all the NF service names registered in the NF profile. |  |
| requester-nf-instance-fqdn | Fqdn | O | 0..1 | If included, this IE shall contain the FQDN of the NF Service Consumer that is invoking the Nnrf\_NFDiscovery service.The NRF shall use this to return only those NF profiles that include at least one NF service containing an entry in the "allowedNfDomains" list (see clause 6.1.6.2.3) that matches the domain of the requester NF. |  |
| target-plmn-list | array(PlmnId) | C | 1..N | This IE shall be included when NF services in a different PLMN, or NF services of specific PLMN ID(s) in a same PLMN comprising multiple PLMN IDs, need to be discovered. When included, this IE shall contain the PLMN ID of the target NF. If more than one PLMN ID is included, NFs from any PLMN ID present in the list matches the query parameter.For inter-PLMN service discovery, at most 1 PLMN ID shall be included in the list; it shall be included in the service discovery from the NF in the source PLMN sent to the NRF in the same PLMN, while it may be absent in the service discovery request sent from the source NRF to the target NRF. In such case, if the NRF receives more than 1 PLMN ID, it shall only consider the first element of the array, and ignore the rest. |  |
| requester-plmn-list | array(PlmnId) | C | 1..N | This IE shall be included when NF services in a different PLMN need to be discovered. When included, this IE shall contain the PLMN ID(s) of the requester NF. |  |
| target-nf-instance-id | NfInstanceId | O | 0..1 | Identity of the NF instance being discovered. |  |
| target-nf-fqdn | Fqdn | O | 0..1 | FQDN of the target NF instance being discovered. |  |
| hnrf-uri | Uri | C | 0..1 | If included, this IE shall contain the API URI of the NFDiscovery Service (see clause 6.2.1) of the home NRF. It shall be included if the NF Service Consumer has previously received such API URI to be used for service discovery (e.g., from the NSSF in the home PLMN). |  |
| snssais | array(Snssai) | O | 1..N | If included, this IE shall contain the list of S-NSSAIs that are served by the NF Instances being discovered. The NRF shall return those NF profiles of NF Instances that have at least one of the S-NSSAIs in this list. The S-NSSAIs included in the NF profiles of NF Instances returned by the NRF shall be an interclause of the S-NSSAIs requested and the S-NSSAIs supported by those NF Instances. (NOTE 10). |  |
| requester-snssais | array(Snssai) | O | 1..N | If included, this IE shall contain the list of S-NSSAI of the requester NF. The NRF shall use this to return only those NF profiles of NF Instances allowing to be discovered from the slice(s) identified by this IE, according to the "allowedNssais" list in the NF Profile and NF Service (see clause 6.1.6.2.2 and 6.1.6.2.3). |  |
| plmn-specific-snssai-list | array(PlmnSnssai) | O | 1..N | If included, this IE shall contain the list of S-NSSAI that are served by the NF service being discovered for the corresponding PLMN provided. The NRF shall use this to identify the NF services that have registered their support for the S-NSSAIs for the corresponding PLMN given. The NRF shall return the NF profiles that have at least one per PLMN S-NSSAI entry matching the PLMN specific S-NSSAIs provided in this list. The per PLMN list of S-NSSAIs included in the NF profile returned by the NRF shall be an interclause of the list requested and the list registered in the NF profile. (NOTE 10). |  |
| nsi-list | array(string) | O | 1..N | If included, this IE shall contain the list of NSI IDs that are served by the services being discovered. |  |
| dnn | Dnn | O | 0..1 | If included, this IE shall contain the DNN for which NF services serving that DNN is discovered. DNN may be included if the target NF type is e.g. "BSF", "SMF", "PCF", "PCSCF" or "UPF".If the Snssai(s) are also included, the NF services serving the DNN shall be available in the network slice(s) identified by the Snssai(s). |  |
| smf-serving-area | string | O | 0..1 | If included, this IE shall contain the serving area of the SMF. It may be included if the target NF type is "UPF". |  |
| tai | Tai | O | 0..1 | Tracking Area Identity. |  |
| amf-region-id | AmfRegionId | O | 0..1 | AMF Region Identity. |  |
| amf-set-id | AmfSetId | O | 0..1 | AMF Set Identity. |  |
| guami | Guami | O | 0..1 | Guami used to search for an appropriate AMF.(NOTE 1) |  |
| supi | Supi | O | 0..1 | If included, this IE shall contain the SUPI of the requester UE to search for an appropriate NF. SUPI may be included if the target NF type is e.g. "PCF", "CHF", "AUSF", "UDM" or "UDR". |  |
| ue-ipv4-address | Ipv4Addr | O | 0..1 | The IPv4 address of the UE for which a BSF needs to be discovered. |  |
| ip-domain | string | O | 0..1 | The IPv4 address domain of the UE for which a BSF needs to be discovered. |  |
| ue-ipv6-prefix | Ipv6Prefix | O | 0..1 | The IPv6 prefix of the UE for which a BSF needs to be discovered. |  |
| pgw-ind | boolean | O | 0..1 | When present, this IE indicates whether a combined SMF/PGW-C or a standalone SMF needs to be discovered.true: A combined SMF/PGW-C is requested to be discovered;false: A standalone SMF is requested to be discovered.(See NOTE 2) |  |
| pgw | Fqdn | O | 0..1 | If included, this IE shall contain the PGW FQDN which is received by the AMF from the MME to find the combined SMF/PGW. |  |
| gpsi | Gpsi | O | 0..1 | If included, this IE shall contain the GPSI of the requester UE to search for an appropriate NF. GPSI may be included if the target NF type is "CHF", "PCF", "UDM" or "UDR". |  |
| external-group-identity | ExtGroupId | O | 0..1 | If included, this IE shall contain the external group identifier of the requester UE to search for an appropriate NF. This may be included if the target NF type is "UDM" or "UDR". |  |
| pfd-data | PfdData | O | 0..1 | When present, this IE shall contain the application identifiers and/or application function identifiers in PFD management. This may be included if the target NF type is "NEF". | Query-Params-Ext2 |
| data-set | DataSetId | O | 0..1 | Indicates the data set to be supported by the NF to be discovered. May be included if the target NF type is "UDR". |  |
| routing-indicator | string | O | 0..1 | Routing Indicator information that allows to route network signalling with SUCI (see 3GPP 23.003 [12]) to an AUSF and UDM instance capable to serve the subscriber. May be included if the target NF type is "AUSF" or "UDM". |  |
| group-id-list | array(NfGroupId) | O | 1..N | Identity of the group(s) of the NFs of the target NF type to be discovered. May be included if the target NF type is "UDR", "UDM", "HSS", "PCF" or "AUSF". |  |
| dnai-list | array(Dnai) | O | 1..N | If included, this IE shall contain the Data network access identifiers. It may be included if the target NF type is "UPF". |  |
| upf-iwk-eps-ind | boolean | O | 0..1 | When present, this IE indicates whether a UPF supporting interworking with EPS needs to be discovered.true: A UPF supporting interworking with EPS is requested to be discovered;false: A UPF not supporting interworking with EPS is requested to be discovered.(NOTE 3) |  |
| chf-supported-plmn | PlmnId | O | 0..1 | If included, this IE shall contain the PLMN ID that a CHF supports (i.e., in the PlmnRange of ChfInfo attribute in the NFProfile). This IE may be included when the target NF type is "CHF". |  |
| preferred-locality | string | O | 0..1 | Preferred target NF location (e.g. geographic location, data center).When present, the NRF shall prefer NF profiles with a locality attribute that matches the preferred-locality.The NRF may return additional NFs in the response not matching the preferred target NF location, e.g. if no NF profile is found matching the preferred target NF location.The NRF should set a lower priority for any additional NFs on the response not matching the preferred target NF location than those matching the preferred target NF location.(NOTE 6) |  |
| access-type | AccessType | C | 0..1 | If included, this IE shall contain the Access type which is required to be supported by the target Network Function (i.e. SMF, LMF). |  |
| supported-features | SupportedFeatures | O | 0..1 | List of features required to be supported by the target Network Function.This IE may be present only if the service-names attribute is present and if it contains a single service-name, or if the target Network Function does not support any service. It shall be ignored by the NRF otherwise.(NOTE 4) |  |
| required-features | array(SupportedFeatures) | O | 1..N | List of features required to be supported by the target Network Function, as defined by the supportedFeatures attribute in NFService (see clauses 6.1.6.2.3 and 6.2.6.2.4).This IE may be present only if the service-names attribute is present.When present, the required-features attribute shall contain as many entries as the number of entries in the service-names attribute. The nth entry in the required-features attribute shall correspond to the nth entry in the service-names attribute. An entry corresponding to a service for which no specific feature is required shall be encoded as "0". | Query-Params-Ext1 |
| complex-query | ComplexQuery | O | 0..1 | This query parameter is used to override the default logical relationship of query parameters. | Complex-Query |
| limit | integer | O | 0..1 | Maximum number of NFProfiles to be returned in the response.  | Query-Params-Ext1 |
| max-payload-size | integer | O | 0..1 | Maximum payload size (before compression, if any) of the response, expressed in kilo octets.When present, the NRF shall limit the number of NF profiles returned in the response such as to not exceed the maximum payload size indicated in the request.Default = 124. Maximum = 2000 (i.e. 2 Mo). | Query-Params-Ext1 |
| pdu-session-types | array(PduSessionType) | O | 1..N | List of the PDU session type (s) requested to be supported by the target Network Function (i.e UPF). | Query-Params-Ext1 |
| event-id-list | array(EventId) | O | 1..N | If present, this attribute shall contain the list of events requested to be supported by the Nnwdaf AnalyticsInfo Service, the NRF shall return NF which support all the requested events. | Query-Param-Analytics |
| nwdaf-event-list | array(NwdafEvent) | O | 1..N | If present, this attribute shall contain the list of events requested to be supported by the Nnwdaf\_EventsSubscription service, the NRF shall return NF which support all the requested events. | Query-Param-Analytics |
| atsss-capability | AtsssCapability | O | 0..1 | When present, this IE indicates the ATSSS capability of the target UPF needs to be supported. | MAPDU |
| upf-ue-ip-addr-ind | boolean | O | 0..1 | When present, this IE indicates whether a UPF supporting allocating UE IP addresses/prefixes needs to be discovered.true: a UPF supporting UE IP addresses/prefixes allocation is requested to be discovered;false: a UPF not supporting UE IP addresses/prefixes allocation is requested to be discovered. | Query-Params-Ext2 |
| client-type | ExternalClientType | O | 0..1 | When present, this IE indicates that NF(s) dedicatedly serving the specified Client Type needs to be discovered. This IE may be included when target NF Type is "LMF" and "GMLC".If no NF profile is found dedicately serving the requested client type, the NRF may return NF(s) not dedicatedly serving the request client type in the response. | Query-Params-Ext2 |
| lmf-id | LMFIdentification | O | 0..1 | When present, this IE shall contain LMF identification to be discovered.This may be included if the target NF type is "LMF". | Query-Params-Ext2 |
| an-node-type | AnNodeType | O | 0..1 | If included, this IE shall contain the AN Node type which is required to be supported by the target Network Function (i.e. LMF). | Query-Params-Ext2 |
| rat-type | RatType | O | 0..1 | If included, this IE shall contain the RAT type which is required to be supported by the target Network Function (i.e. LMF). | Query-Params-Ext2 |
| target-snpn | PlmnIdNid | C | 0..1 | This IE shall be included when NF services of a specific SNPN need to be discovered. When included, this IE shall contain the PLMN ID and NID of the target NF.  | Query-Params-Ext2 |
| af-ee-data | AfEventExposureData | O | 0..1 | When present, this shall contain the application events, and optionally application function identifiers, application identifiers of the AF(s). This may be included if the target NF type is "NEF". | Query-Params-Ext2 |
| w-agf-info | WAgfInfo | O | 0..1 | If included, this IE shall contain the W-AGF identifiers of N3 terminations which is received by the SMF to find the combined W-AGF/UPF. | Query-Params-Ext2 |
| tngf-info | TngfInfo | O | 0..1 | If included, this IE shall contain the TNGF identifiers of N3 terminations which is received by the SMF to find the combined TNGF/UPF. | Query-Params-Ext2 |
| target-nf-set-id | NfSetId | O | 0..1 | When present, this IE shall contain the target NF Set ID (as defined in clause 28.10 of 3GPP TS 23.003 [12]) of the NF instances being discovered. | Query-Params-Ext2 |
| target-nf-service-set-id | NfServiceSetId | O | 0..1 | When present, this IE shall contain the target NF Service Set ID (as defined in clause 28.11 of 3GPP TS 23.003 [12]) of the NF service instances being discovered. | Query-Params-Ext2 |
| preferred-tai | Tai | O | 0..1 | When present, the NRF shall prefer NF profiles that can serve the TAI, or the NRF shall return NF profiles not matching the TAI if no NF profile is found matching the TAI.(NOTE 5) | Query-Params-Ext2 |
| nef-id | NefId | O | 0..1 | When present, this IE shall contain the NEF ID of the NEF to be discovered. This may be included if the target NF type is "NEF". (NOTE 7) | Query-Params-Ext2 |
| preferred-nf-instances | array(NfInstanceId) | O | 1..N | When present, this IE shall contain a list of preferred candidate NF instance IDs. (NOTE 8) | Query-Params-Ext2 |
| notification-type | NotificationType | O | 0..1 | If included, this IE shall contain the notification type of default notification subscriptions that shall be registered in the NFProfile or NFService of the NF Instances being discovered. The NF profiles returned by the NRF shall contain all the registered default notification subscriptions, including the one corresponding to the notification-type parameter.(NOTE 9) | Query-Params-Ext2 |
| serving-scope | array(string) | O | 1..N | If present, this attribute shall contain the list of areas that can be served by the NF instances to be discovered. The NRF shall return NF profiles of NFs which can serve all the areas requested in this query parameter. | Query-Params-Ext2 |
| imsi | string | O | 0..1 | If included, this IE shall contain the IMSI of the requester UE to search for an appropriate NF. IMSI may be included if the target NF type is "HSS".pattern: "[0-9]{5,15}" | Query-Params-Ext2 |
| internal-group-identity | GroupId | O | 0..1 | If included, this IE shall contain the internal group identifier of the UE to search for an appropriate NF. This may be included if the target NF type is "UDM"  | Query-Params-Ext2 |
| preferred-api-versions | map(string) | O | 1..N | When present, this IE indicates the preferred API version of the services that are supported by the target NF instances. The key of the map is the ServiceName (see clause 6.1.6.3.11) for which the preferred API version is indicated. Each element carries the API Version Indication for the service indicated by the key. An API Version Indication is a string formatted as {operator}+{API Version}. The following operators shall be supported:"=" match a version equals to the version value indicated.">" match any version greater than the version value indicated">=" match any version greater than or equal to the version value indicated"<" match any version less than the version value indicated"<=" match any version less than or equal to the version value indicated"^" match any version compatible with the version indicated, i.e. any version with the same major version as the version indicated.Precedence between versions is identified by comparing the Major, Minor, and Patch version fields numerically, from left to right.If no operator or an unknown operator is provided in API Version Indication, "=" operator is applied. Example of API Version Indication:Case1: "=1.2.4.operator-ext" or "1.2.4.operator-ext" means matching the service with API version "1.2.4.operator-ext"Case2: ">1.2.4" means matching the service with API versions greater than "1.2.4"Case3: "^2.3.0" or "^2" means matching the service with all API versions with major version "2". | Query-Params-Ext2 |
| NOTE 1: If this parameter is present and no AMF supporting the requested GUAMI is available due to AMF Failure or planned AMF removal, the NRF shall return in the response AMF instances acting as a backup for AMF failure or planned AMF removal respectively for this GUAMI (see clause 6.1.6.2.11). The NRF can detect if an AMF has failed, using the Heartbeat procedure. The NRF will receive a de-registration request from an AMF performing a planned removal.NOTE 2: If the combined SMF/PGW-C is requested to be discovered, the NRF shall return in the response the SMF instances registered with the SmfInfo containing pgwFqdn.NOTE 3: If a UPF supporting interworking with EPS is requested to be discovered, the NRF shall return in the response the UPF instances registered with the upfInfo containing iwkEpsInd set to true.NOTE 4: This attribute has a different semantic than what is defined in clause 6.6.2 of 3GPP TS 29.500 [4], i.e. it is not used to signal optional features of the Nnrf\_NFDiscovery Service API supported by the requester NF.NOTE 5: The AMF may perform the SMF discovery based on the dnn, snssais and preferred-tai during a PDU session establishment procedure, and the NRF shall return the SMF profiles matching all if possible, or the SMF profiles only matching dnn and snssais. If the SMF profiles only matching dnn and snssais are returned, the AMF shall insert an I-SMF. An SMF may also perform a UPF discovery using this parameter.NOTE 6: The SMF may select the P-CSCF close to the UPF by setting the preferred-locality to the value of the locality of the UPF.NOTE 7: During EPS to 5GS idle mobility procedure, the NF service consumer (i.e. SMF) discovers the anchor NEF for NIDD using the SCEF ID received from EPS as the value of the NEF ID, as specified in clause 4.11.1.3.3 of 3GPP TS 23.502 [3].NOTE 8: The service consumer may include a list of preferred-nf-instance-ids in the query. If so, the NRF shall first check if the NF profiles of the preferred NF instances match the other query parameters, and if so, then the NRF shall return the corresponding NF profiles; otherwise, the NRF shall return a list of candidate NF profiles matching the query parameters other than the preferred-nf-instance-ids. For example, the target AMF may set this query parameter to the SMF Instance ID and I-SMF Instance ID during an inter AMF mobility procedure to select an I-SMF.NOTE 9: This parameter may be used by the SCP (with other query parameters) to discover and select a NF service consumer with a default notification subscription supporting the notication type of a notification request (see clause 6.10.3.x of 3GPP TS 29.500 [4]).NOTE 10: An S-NSSAI value used in discovery request query parameters shall be considered as matching the S-NSAAI value in the NF Profile of a given NF Instance if both the SST and SD components are identical (i.e. an S-NSSAI value where SD is absent, shall not be considered as matching an S-NSSAI where SD is present, regardless if SST is equal in both).NOTE x: NRF shall return the Network Functions that can support equal and higher location QoS level. |

The default logical relationship among the query parameters is logical "AND", i.e. all the provided query parameters shall be matched, with the exception of the "preferred-locality" or the "preferred-nf-instances" query (see Table 6.2.3.2.3.1-1).

The NRF may support the Complex query expression as defined in 3GPP TS 29.501 [5] for the NF Discovery service. If the "complexQuery" query parameter is included, then the logical relationship among the query parameters contained in "complexQuery" query parameter is as defined in 3GPP TS 29.571 [7].

A NRF not supporting Complex query expression shall reject a NF service discovery request including a complexQuery parameter, with a ProblemDetails IE including the cause attribute set to INVALID\_QUERY\_PARAM and the invalidParams attribute indicating the complexQuery parameter.

This method shall support the request data structures specified in table 6.1.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.3.2.3.1-3.

Table 6.2.3.2.3.1-2: Data structures supported by the GET Request Body on this resource

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | P | Cardinality | Description |
| n/a |  |  |  |

Table 6.2.3.2.3.1-3: Data structures supported by the GET Response Body on this resource

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data type | P | Cardinality | Responsecodes | Description |
| SearchResult | M | 1 | 200 OK | The response body contains the result of the search over the list of registered NF Instances. |
| n/a |  |  | 307 Temporary Redirect | The response shall be used when the intermediate NRF redirects the service discovery request.The NRF shall include in this response a Location header field containing a URI pointing to the resource located on the redirect target NRF. |
| ProblemDetails | M | 1 | 400 Bad Request | The response body contains the error reason of the request message.If the query parameter used to match the authorization parameter is required but not provided in the NF discovery request, the "cause" attribute shall be set to "MANDATORY\_QUERY\_PARAM\_MISSING", and the missing query parameter shall be indicated. |
| ProblemDetails | M | 1 | 403 Forbidden | This response shall be returned if the NF Service Consumer is not allowed to discover the NF Service(s) being queried. |
| ProblemDetails | M | 1 | 404 Not Found | This response shall be returned if the requested resource URI is not found in the server.It may also be sent in hierarchical NRF deployments when the NRF needs to forward/redirect the request to another NRF but lacks information in the request to do so; similarly, the NRF shall return this response code when it is received from the upstream NRF. |
| ProblemDetails | M | 1 | 500 Internal Server Error | The response body contains the error reason of the request message. |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 6.2.9 Features supported by the NFDiscovery service

The syntax of the supportedFeatures attribute is defined in clause 5.2.2 of 3GPP TS 29.571 [7].

The following features are defined for the Nnrf\_NFDiscovery service.

Table 6.2.9-1: Features of supportedFeatures attribute used by Nnrf\_NFDiscovery service

|  |  |  |
| --- | --- | --- |
| Feature Number | Feature | Description |
| 1 | Complex-Query | Support of Complex Query expression (see clause 6.2.3.2.3.1)  |
| 2 | Query-Params-Ext1 | Support of the following query parameters:- limit- max-payload-size- required-features- pdu-session-types |
| 3 | Query-Param-Analytics  | Support of the query parameters for Analytics identifier:- event-id-list- nwdaf-event-list |
| 4 | MAPDU | This feature indicates whether the NRF supports selection of UPF with ATSSS capability. |
| 5 | Query-Params-Ext2 | Support of the following query parameters:- requester-nf-instance-id- upf-ue-ip-addr-ind- pfd-data- target-snpn- af-ee-data- w-agf-info- tngf-info- target-nf-set-id- target-nf-service-set-id- preferred-tai- nef-id- preferred-nf-instances- notification-type- serving-scope- internal-group-identity- preferred-api-versions- lmf-id- an-node-type- rat-type |
| Feature number: The order number of the feature within the supportedFeatures attribute (starting with 1).Feature: A short name that can be used to refer to the bit and to the feature.Description: A clear textual description of the feature. |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

## A.2 Nnrf\_NFManagement API

openapi: 3.0.0

***(… text not shown for clarity …)***

 LmfInfo:

 type: object

 properties:

 servingClientTypes:

 type: array

 items:

 $ref: 'TS29572\_Nlmf\_Location.yaml#/components/schemas/ExternalClientType'

 minItems: 1

 lmfId:

 $ref: 'TS29572\_Nlmf\_Location.yamll#/components/schemas/LMFIdentification'

 servingAccessTypes:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/AccessType'

 minItems: 1

 servingAnNodeTypes:

 type: array

 items:

 $ref: '#/components/schemas/AnNodeType'

 minItems: 1

 servingRatTypes:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/RatType'

 minItems: 1

 AnNodeType:

 anyOf:

 - type: string

 enum:

 - GNB

 - NG\_ENB

 - type: string

***(… text not shown for clarity …)***

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Next change\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

## A.3 Nnrf\_NFDiscovery API

openapi: 3.0.0

***(… text not shown for clarity …)***

paths:

 /nf-instances:

 get:

 summary: Search a collection of NF Instances

 operationId: SearchNFInstances

 tags:

 - NF Instances (Store)

 parameters:

 - name: target-nf-type

 in: query

 description: Type of the target NF

 required: true

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/NFType'

 - name: requester-nf-type

 in: query

 description: Type of the requester NF

 required: true

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/NFType'

 - name: requester-nf-instance-id

 in: query

 description: NfInstanceId of the requester NF

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfInstanceId'

 - name: service-names

 in: query

 description: Names of the services offered by the NF

 schema:

 type: array

 items:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/ServiceName'

 minItems: 1

 uniqueItems: true

 style: form

 explode: false

 - name: requester-nf-instance-fqdn

 in: query

 description: FQDN of the requester NF

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/Fqdn'

 - name: target-plmn-list

 in: query

 description: Id of the PLMN of the target NF

 content:

 application/json:

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/PlmnId'

 minItems: 1

 - name: requester-plmn-list

 in: query

 description: Id of the PLMN where the NF issuing the Discovery request is located

 content:

 application/json:

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/PlmnId'

 minItems: 1

 - name: target-nf-instance-id

 in: query

 description: Identity of the NF instance being discovered

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfInstanceId'

 - name: target-nf-fqdn

 in: query

 description: FQDN of the NF instance being discovered

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/Fqdn'

 - name: hnrf-uri

 in: query

 description: Uri of the home NRF

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Uri'

 - name: snssais

 in: query

 description: Slice info of the target NF

 content:

 application/json:

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Snssai'

 minItems: 1

 - name: requester-snssais

 in: query

 description: Slice info of the requester NF

 content:

 application/json:

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Snssai'

 minItems: 1

 - name: plmn-specific-snssai-list

 in: query

 description: PLMN specific Slice info of the target NF

 content:

 application/json:

 schema:

 type: array

 items:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/PlmnSnssai'

 minItems: 1

 - name: dnn

 in: query

 description: Dnn supported by the BSF, SMF or UPF

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Dnn'

 - name: nsi-list

 in: query

 description: NSI IDs that are served by the services being discovered

 schema:

 type: array

 items:

 type: string

 minItems: 1

 style: form

 explode: false

 - name: smf-serving-area

 in: query

 schema:

 type: string

 - name: tai

 in: query

 description: Tracking Area Identity

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Tai'

 - name: amf-region-id

 in: query

 description: AMF Region Identity

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/AmfRegionId'

 - name: amf-set-id

 in: query

 description: AMF Set Identity

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/AmfSetId'

 - name: guami

 in: query

 description: Guami used to search for an appropriate AMF

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Guami'

 - name: supi

 in: query

 description: SUPI of the user

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Supi'

 - name: ue-ipv4-address

 in: query

 description: IPv4 address of the UE

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Ipv4Addr'

 - name: ip-domain

 in: query

 description: IP domain of the UE, which supported by BSF

 schema:

 type: string

 - name: ue-ipv6-prefix

 in: query

 description: IPv6 prefix of the UE

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Ipv6Prefix'

 - name: pgw-ind

 in: query

 description: Combined PGW-C and SMF or a standalone SMF

 schema:

 type: boolean

 - name: pgw

 in: query

 description: PGW FQDN of a combined PGW-C and SMF

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/Fqdn'

 - name: gpsi

 in: query

 description: GPSI of the user

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Gpsi'

 - name: external-group-identity

 in: query

 description: external group identifier of the user

 schema:

 $ref: 'TS29503\_Nudm\_SDM.yaml#/components/schemas/ExtGroupId'

 - name: internal-group-identity

 in: query

 description: internal group identifier of the user

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/GroupId'

 - name: pfd-data

 in: query

 description: PFD data

 content:

 application/json:

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/PfdData'

 - name: data-set

 in: query

 description: data set supported by the NF

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/DataSetId'

 - name: routing-indicator

 in: query

 description: routing indicator in SUCI

 schema:

 type: string

 pattern: '^[0-9]{1,4}$'

 - name: group-id-list

 in: query

 description: Group IDs of the NFs being discovered

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfGroupId'

 minItems: 1

 style: form

 explode: false

 - name: dnai-list

 in: query

 description: Data network access identifiers of the NFs being discovered

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Dnai'

 minItems: 1

 style: form

 explode: false

 - name: pdu-session-types

 in: query

 description: list of PDU Session Type required to be supported by the target NF

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/PduSessionType'

 minItems: 1

 style: form

 explode: false

 - name: event-id-list

 in: query

 description: Analytics event(s) requested to be supported by the Nnwdaf\_AnalyticsInfo service

 schema:

 type: array

 items:

 $ref: 'TS29520\_Nnwdaf\_AnalyticsInfo.yaml#/components/schemas/EventId'

 minItems: 1

 style: form

 explode: false

 - name: nwdaf-event-list

 in: query

 description: Analytics event(s) requested to be supported by the Nnwdaf\_EventsSubscription service.

 schema:

 type: array

 items:

 $ref: 'TS29520\_Nnwdaf\_EventsSubscription.yaml#/components/schemas/NwdafEvent'

 minItems: 1

 style: form

 explode: false

 - name: supported-features

 in: query

 description: Features required to be supported by the target NF

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

 - name: upf-iwk-eps-ind

 in: query

 description: UPF supporting interworking with EPS or not

 schema:

 type: boolean

 - name: chf-supported-plmn

 in: query

 description: PLMN ID supported by a CHF

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/PlmnId'

 - name: preferred-locality

 in: query

 description: preferred target NF location

 schema:

 type: string

 - name: access-type

 in: query

 description: AccessType supported by the target NF

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/AccessType'

 - name: limit

 in: query

 description: Maximum number of NFProfiles to return in the response

 required: false

 schema:

 type: integer

 minimum: 1

 - name: required-features

 in: query

 description: Features required to be supported by the target NF

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/SupportedFeatures'

 minItems: 1

 style: form

 explode: false

 - name: complex-query

 in: query

 description: the complex query condition expression

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/ComplexQuery'

 - name: max-payload-size

 in: query

 description: Maximum payload size of the response expressed in kilo octets

 required: false

 schema:

 type: integer

 maximum: 2000

 default: 124

 - name: atsss-capability

 in: query

 description: ATSSS Capability

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/AtsssCapability'

 - name: upf-ue-ip-addr-ind

 in: query

 description: UPF supporting allocating UE IP addresses/prefixes

 schema:

 type: boolean

 - name: client-type

 in: query

 description: Requested client type served by the NF

 content:

 application/json:

 schema:

 $ref: 'TS29572\_Nlmf\_Location.yaml#/components/schemas/ExternalClientType'

 - name: lmf-id

 in: query

 description: LMF identification to be discovered

 content:

 application/json:

 schema:

 $ref: 'TS29572\_Nlmf\_Location.yaml#/components/schemas/LMFIdentification'

 - name: an-node-type

 in: query

 description: Requested AN node type served by the NF

 content:

 application/json:

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/AnNodeType'

 - name: rat-type

 in: query

 description: Requested RAT type served by the NF

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/RatType'

 - name: preferred-tai

 in: query

 description: preferred Tracking Area Identity

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/Tai'

 - name: preferred-nf-instances

 in: query

 description: preferred NF Instances

 schema:

 type: array

 items:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfInstanceId'

 minItems: 1

 style: form

 explode: false

 - name: If-None-Match

 in: header

 description: Validator for conditional requests, as described in IETF RFC 7232, 3.2

 schema:

 type: string

 - name: target-snpn

 in: query

 description: Target SNPN Identity

 content:

 application/json:

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/PlmnIdNid'

 - name: af-ee-data

 in: query

 description: NEF exposured by the AF

 content:

 application/json:

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/AfEventExposureData'

 - name: w-agf-info

 in: query

 description: UPF collocated with W-AGF

 content:

 application/json:

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/WAgfInfo'

 - name: tngf-info

 in: query

 description: UPF collocated with TNGF

 content:

 application/json:

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/TngfInfo'

 - name: target-nf-set-id

 in: query

 description: Target NF Set ID

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfSetId'

 - name: target-nf-service-set-id

 in: query

 description: Target NF Service Set ID

 schema:

 $ref: 'TS29571\_CommonData.yaml#/components/schemas/NfServiceSetId'

 - name: nef-id

 in: query

 description: NEF ID

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/NefId'

 - name: notification-type

 in: query

 description: Notification Type

 schema:

 $ref: 'TS29510\_Nnrf\_NFManagement.yaml#/components/schemas/NotificationType'

 - name: serving-scope

 in: query

 description: areas that can be served by the target NF

 schema:

 type: array

 items:

 type: string

 minItems: 1

 style: form

 explode: false

 - name: imsi

 in: query

 description: IMSI of the requester UE to search for an appropriate NF (e.g. HSS)

 schema:

 type: string

 - name: preferred-api-versions

 in: query

 description: Preferred API version of the services to be discovered

 content:

 application/json:

 schema:

 type: object

 additionalProperties:

 type: string

 minProperties: 1

 responses:

 '200':

 description: Expected response to a valid request

 content:

 application/json:

 schema:

 $ref: '#/components/schemas/SearchResult'

 links:

 search:

 operationId: RetrieveStoredSearch

 parameters:

 searchId: $response.body#/searchId

 description: >

 The 'searchId' parameter returned in the response can be used as the

 'searchId' parameter in the GET request to '/searches/{searchId}'

 completeSearch:

 operationId: RetrieveCompleteSearch

 parameters:

 searchId: $response.body#/searchId

 description: >

 The 'searchId' parameter returned in the response can be used as the

 'searchId' parameter in the GET request to '/searches/{searchId}/complete'

 headers:

 Cache-Control:

 description: Cache-Control containing max-age, described in IETF RFC 7234, 5.2

 schema:

 type: string

 ETag:

 description: Entity Tag containing a strong validator, described in IETF RFC 7232, 2.3

 schema:

 type: string

 '307':

 description: Temporary Redirect

 headers:

 Location:

 description: 'The URI pointing to the resource located on the redirect target NRF'

 required: true

 schema:

 type: string

 '400':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/400'

 '401':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/401'

 '403':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/403'

 '404':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/404'

 '406':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/406'

 '411':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/411'

 '413':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/413'

 '415':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/415'

 '429':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/429'

 '500':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/500'

 '501':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/501'

 '503':

 $ref: 'TS29571\_CommonData.yaml#/components/responses/503'

 default:

 $ref: 'TS29571\_CommonData.yaml#/components/responses/default'

***(… text not shown for clarity …)***

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*The end of changes\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*