**3GPP TSG-SA2 Meeting #161  *S2-2402982***

**Athens, Greece, 26nd Feb 2024 - 01st Mar 2024**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.502** | **CR** | **-** | **rev** | - | **Current version:** | **18.4.0** |  |
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| *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:*** | NF discovery and selection by target PLMN | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai-Bell | | | | | | | | | |
| ***Source to TSG:*** | S2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | TEI19\_TPlmnNfSel | | | | |  | ***Date:*** | | | 2024-01-12 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | In scenarios where NFc and NFp pertain to different domains (e.g. different PLMNs, NPNs, or different regional organizations in a same PLMN) and using Indirect Comunication with Delegated Discovery, the operator (or organization) of the target domain may prefer to perform the discovery and selection of the NFp in the target domain, e.g. for the following reasons:   * to avoid disclosing information about candidate NFp that may be sensitive or change frequently (e.g. load and capacity info); * to enable the operator of the target domain to deploy its own discovery/selection policies, independently from NF implementations in other domains; * because SCPs in the target domain have the best knowledge about candidate NFp instances and sets, incl. load and capacity info, NF service status, etc | | | | | | | | |
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| ***Summary of change:*** | | Based on operator's policy, for inter-domain NF discovery requests, the NRF from the target domain may return an NF discovery response without candidate NF profiles and with the indication that the discovery and selection of the target NF is preferred to be delegated to the target domain; the NF Discovery response may additionally contain:   * Information about SCP(s) to which the request should be forwarded. * the NF types for which delegated discovery and selection to the target domain is supported and preferred. | | | | | | | | |
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| ***Consequences if not approved:*** | | Target PLMN cannot prevent disclosing information about network topology and network load and cannot select NFs based on own policies. | | | | | | | | |
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| ***Clauses affected:*** | | 4.17.10, 5.2.7.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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's revision history:*** | |  | | | | | | | | |

1st change

4.17.10 Indirect Communication with possible delegated service discovery when NF service consumer and NF service producer are in different PLMNs

**Figure 4.17.10-1: Delegated NF service discovery when NF service consumer and NF service producer are in different PLMNs**

1. The NF service consumer intends to communicate with an NF service producer. The NF service consumer sends the request to an SCP. The request includes at least the source PLMN ID and the target PLMN ID in the discovery and selection parameters necessary for the SCP to discover and select a NF service producer instance. The discovery and selection parameters are included in the request by the NF service consumer in a way that the SCP does not need to parse the request body.

2. The SCP recognises that the request is for a NF service producer in another PLMN. SCP interacts with NRF using the Nnrf\_NFDiscovery service. The SCP may include an indication of “support of indirect communication with delegated discovery with NF selection at target domain feature” (Model D in Annex E of TS 23.501 [2]) and/or an indication of “support of indirect communication without delegated discovery with NF selection at target domain feature” (Model D in Annex E of TS 23.501 [2]),

3. NRF in PLMN-1 and NRF in PLMN-2 interact using the Nnrf\_NFDiscovery service. See step 2 in clause 4.17.5. . If the SCP provided an indication of “support of indirect communication with delegated discovery with NF selection at target domain feature” and/or of “support of indirect communication without delegated discovery with NF selection at target domain feature” in step 2 and the NRF in PLMN-1 supports those features, the NRF in PLMN-1 includes an indication of support of those features.

Based on operator's policy and the received indication of support of related features, the NRF in PLMN-2 provides an NF discovery response that contains:  
- either NF profiles matching parameters provided in the NnrfDiscovery request; or  
- if an indication of “support of indirect communication with delegated discovery with NF selection at target domain feature” was received and that option is preferred by NRF in PLMN-2, no candidate NF profiles but the indication that “indirect communication with delegated discovery with NF selection at target domain is requested” and optionally NF types for which the indication applies.  
- if an indication of “support of indirect communication without delegated discovery with NF selection at target domain feature” was received and that option is preferred by NRF in PLMN-2, candidate NF profiles and the indication that “indirect communication without delegated discovery with NF selection at target domain is requested” and optionally the NF types for which the indication applies.  
The NRF in PLMN-1 may cache the response.

If the SCP provided an indication of “support of indirect communication with delegated discovery with NF selection at target domain feature”, based on operator's policy and configuration, the NRF in the PLMN-1 may also determine without interaction with the NRF in the PLMN-2 that indirect communication with delegated discovery with NF selection at target domain is requested for communication for that remote PLMN, and step 4 then does not apply.

NOTE 2: For indirect communication without delegated discovery with NF selection at target PLMN, when the request indicates the NF set, the selection of the target NF instance in the set is delegated to the SCP of the target domain. This is also possible for follow-up requests if indirect communication with delegated discovery with NF selection at target domain was negotiated and applied for the first request.

4. SCP gets Nnrf\_NFDiscovery service response with NF profile(s) or the indication that “indirect communication with delegated discovery with NF selection at target domain is requested” and/or sthe indication that “indirect communication without delegated discovery with NF selection at target domain is requested”. The SCP may chache the response.

Steps 5 and 6 apply if the Nnrf\_NFDiscovery service response in step 4 contained no indication that “indirect communication with delegated discovery with NF selection at target domain is requested” and no indication that “indirect communication without delegated discovery with NF selection at target domin is requested”.

5. SCP in PLMN-1 (re)selects a NF service producer instance in PLMN-2.

6. SCP in PLMN-1 forwards the request to the selected NF service producer instance in PLMN-2.

Steps 7 to 10 apply if the Nnrf\_NFDiscovery service response in step 4 contained the indication that “indirect communication with delegated discovery with NF selection at target domain is requested” and/or the indication that “indirect communication without delegated discovery with NF selection at target domain is requested”.

7. If an indication that “indirect communication without delegated discovery with NF selection at target domain is requested” was received, the SCP may perform a partial (re)selection based on the received NF profiles (e.g. selecting an NF set). SCP in PLMN-1 forwards the request with discovery and selection parameters to PLMN-2. The ingress SEPP at PLMN-2 forwards the request to the SCP in PLMN-2.

8. Unless the SCP in PLMN-2 has appropriate cached information, it interacts with NRF in PLMN-2 using the Nnrf\_NFDiscovery service. Candidate NF profiles are returned.

9. SCP in PLMN-2 (re)selects a NF service producer instance in PLMN-2.

6. SCPin PLMN-2 forwards the request to the selected NF service producer instance in PLMN-2.

Alternatively, SCP in PLMN-1 may send the discovery request directly to the NRF in PLMN-2, if it has the relevant NRF address and is authorized by the NRF in PLMN-2. Thus step 2 goes from SCP to NRF in PLMN-2 and step 4 goes from NRF in PLMN-2 to SCP, and step 3 is omitted.

2nd change

5.2.7.3.2 Nnrf\_NFDiscovery\_Request service operation

**Service operation name:** Nnrf\_NFDiscovery\_Request

**Description:** provides the IP address or FQDN of the expected NF instance(s) and, if present in NF profile, the Endpoint Address(es) of NF service instance(s) to the NF service consumer or SCP.

**Inputs, Required:** one or more target NF service Name(s), NF type of the target NF, NF type of the NF service consumer.

If the NF service consumer intends to discover an NF service producer providing all the standardized services, it provides a wildcard NF service name.

**Inputs, Optional:**

- S-NSSAI and the associated NSI ID (if available), DNN, target NF/NF service PLMN ID (or realm in the case of network specific identifier type SUCI/SUPI, see clause 4.17.5a), NRF to be used to select NFs/services within HPLMN or Credentials Holder, Serving PLMN ID (or PLMN ID and NID in the case of SNPN, see clause 4.17.5a), the NF service consumer ID, preferred target NF location, TAI.

NOTE 1: For network slicing the NF service consumer ID is a required input.

- FQDN for the S5/S8 interface of the SMF+PGW-C, to discover the N11/N16 interface of the SMF+PGW-C in the case of EPS to 5GS mobility.

- If the target NF stores Data Set(s) (e.g., UDR, BSF): SUPI, GPSI, IMPI, IMPU, Data Set Identifier(s). (UE) IPv4 address, IP domain or (UE) IPv6 Prefix.

NOTE 2: GPSI is relevant for BSF.

NOTE 3: If the request includes a subscriber identifier the NRF may need to use the association between the supplied subscriber identifier and the appropriate NF Group ID as described in clause 6.3.1 of TS 23.501 [2] to determine the applicable set of NF instances for the response.

NOTE 4: The (UE) IPv4 address or (UE) IPv6 Prefix is provided for BSF discovery: in that case the NRF looks up for a match within one of the Range(s) of (UE) IPv4 addresses or Range(s) of (UE) IPv6 prefixes provided by BSF(s) as part of the invocation of Nnrf\_NFManagement\_NFRegister operation. The NRF is not meant to store individual (UE) IPv4 addresses or (UE) IPv6 prefixes.

- If the target NF is UDM or AUSF, the request may include the UE's Routing Indicator, or the UE's Routing Indicator and Home Network Public Key identifier.

- If the target UDM or NF is AUSF, the request may include the UE's HNI: PLMN ID in the case of PLMN, PLMN ID + NID in the case of SNPN. Optionally, some NFs may additionally include a Home Network Identifier in the form of a realm e.g. in the case of access to an SNPN using credentials owned by CH with AAA Server or in the case of SNPN Onboarding using a DCS with AAA Server.

- If the target NF is NSSAAF, the request may include Home Network Identifier in the form of a realm e.g. in the case of access to an SNPN using credentials owned by CH with AAA Server or in the case of SNPN Onboarding using credentials from a DCS with AAA Server.

- If the target NF is AMF and the consumer NF is MB-SMF for broadcast service, the request includes TAI(s) (see clause 7.3 of TS 23.247 [78]).

- If the target NF is AMF and the consumer NF is other than MB-SMF, the request may include:

- AMF region, AMF Set, GUAMI and Target TAI(s).

- If the target NF is UDR or UDM or AUSF or PCF or BSF, the request may include UDR Group ID or UDM Group ID or AUSF Group ID or PCF Group ID or BSF Group ID respectively.

NOTE 5: It is assumed that the corresponding NF service consumer is either configured with the corresponding Group ID or it received it via earlier Discovery output.

- If the target NF is UDM, the request may include SUPI, GPSI, Internal Group ID and External Group ID.

- If the target NF is UPF, the request may include SMF Area Identity, UE IPv4 Address/IPv6 Prefix, supported ATSSS steering functionality

NOTE 6: The (UE) IPv4 address or (UE) IPv6 Prefix is provided for UPF discovery: in that case the NRF looks up for a match within one of the Range(s) of (UE) IPv4 addresses or Range(s) of (UE) IPv6 prefixes provided by UPF as part of the invocation of Nnrf\_NFManagement\_NFRegister operation. The NRF is not meant to store individual (UE) IPv4 addresses or (UE) IPv6 prefixes.

NOTE 7: Discovering UPF at PDU Session Establishment time and creating the N4 association assumes full connectivity between SMF and UPFs.

- If the target NF is CHF, the request may include SUPI or GPSI as specified in TS 32.290 [42].

- If the target NF is PCF or SMF, the request may include the MA PDU Session capability to indicate that a NF instance supporting MA PDU session capability is requested.

- If the target NF is PCF, the request may include the DNN replacement capability to indicate that a NF instance supporting DNN replacement capability is preferred.

- If the target NF is PCF, the request may include the 5G ProSe Capability as specified in TS 23.304 [77].

- If the target NF is PCF, the request may include the V2X capability as specified in TS 23.287 [73].

- If the target NF is NWDAF, the request may include Analytics ID(s) (possibly per service), TAI(s), Analytics aggregation capability, Analytics metadata provisioning capability, a Real-Time Communication Indication per Analytics ID, NF Set ID and NF Type of the NF data sources. The request may include the S-NSSAI(s) and Area(s) of Interest of the Trained ML Model required when the target is an NWDAF containing MTLF. Details about NWDAF discovery and selection are described in clause 6.3.13, TS 23.501 [2].

NOTE 8: Analytics metadata provisioning capability is only applicable when NF service consumer is NWDAF.

- If the target NF is HSS, the request may include IMPI, and/or IMPU and/or HSS Group ID.

- If the NF service consumer needs to discover NF service producer instance(s) within an NF instance, the request includes the target NF Instance ID and NF Service Set ID of the producer.

- If the NF service consumer needs to discover NF service producer instance(s) in an equivalent NF Service Set within an NF Set, the request includes the identification of the equivalent NF service Set and NF Set ID of producer.

NOTE 9: TS 29.510 [37] specifies the mechanism to identify equivalent NF Service Sets.

- If the NF service consumer needs to discover NF service producer instance(s) in the NF Set, the request includes the target NF Set ID of the producer.

- If the target NF is SMF, the request may include:

- the UE location (TAI); or

- TAI list.

- If the target NF is P-CSCF, the request may include UE location information, UE IP address/IP prefix, Access Type.

- If the target NF is NEF, the request may include Event ID(s) provided by AF, and optional AF identification as described in clause 6.2.2.3 of TS 23.288 [50]. When the consumer is an AF, the request may include an External Identifier, External Group Identifier, or a domain name. If the target NF is local NEF, the request may include the parameters of list of supported TAI or list of supported DNAI additionally.

- If the target NF is SMF, the request may include the Control Plane CIoT 5GS Optimisation Indication or User Plane CIoT 5GS Optimisation Indication.

- If the target NF is NSACF, the request may include S-NSSAI(s) of the NSACF located network and served by NSACF, NSACF Serving Area information, and NSACF service capability. Details about NSACF discovery and selection are described in clause 6.3.22 of TS 23.501 [2].

- If the target NF is SCP, the request may include information about:

- SCP domain(s).

- Remote PLMN reachable through SCP.

- Endpoint addresses or Address Domain(s) (e.g. IP Address or FQDN ranges) accessible via the SCP.

- NF sets of NFs served by the SCP.

- If the target NF is MB-SMF, the request may include UE location (i.e. TAI), MBS Session ID and Area Session ID. Details about MB-SMF discovery and selection are described in TS 23.247 [78].

- If the target NF is 5G DDNMF, the request may include SUPI, IP Address or FQDN of 5G DDNMF.

- If the target NF is DCCF, the request may include TAI(s), NF type of the NF data sources, NF Set ID of the NF data sources. Details about DCCF discovery and selection are described in clause 6.3.19 of TS 23.501 [2].

- If the target NF is EASDF, the request may include S-NSSAI, DNN, N6 IP address of the PSA UPF, location as per NF profile and DNAI(if exist). Details about EASDF discovery and selection are described in clause 6.3.23 of TS 23.501 [2].

- If the target NF is AMF or SMF, the request may include the support of SNPN Onboarding to indicate whether the target NF instance supports SNPN Onboarding or not.

- If the target NF is NEF, the request may include the support of UAS NF functionality.

- If the target NF is NSSAAF, the request may include SUPI or Internal Group ID.

- If the target NF is in another PLMN or domain, the request may include an indication of “support of the indirect communication with delegated discovery with NF selection at target domain feature” and/or an indication of “support of indirect communication without delegated discovery with NF selection at target domain feature”,

**Outputs, Required:** Either aset of NF instances or an indication that “indirect communication with delegated discovery with NF selection at target domain is requested”, a validity period for the discovery result, containing per NF Instance: NF type, NF instance ID, FQDN or IP address(es) of the NF instance and if applicable, a list of services instances, where each service instance has a service name, a NF service instance ID, and optionally Endpoint Address(es)

Endpoint Address(es) may be a list of IP addresses or an FQDN for the NF service instance.

NOTE 11: SCPs does not have any service instances.

**Outputs, Optional:** Per NF instance, other information in the NF profile listed in clause 6.2.6 in TS 23.501 [2] related to the NF instance, such as:

- NF load information.

- NF capacity information.

- NF priority information.

- If the target NF stores Data Set(s) (e.g. UDR): Range(s) of SUPIs, range(s) of GPSIs, range(s) of external group identifiers, Data Set Identifier(s). If the target NF is BSF or P-CSCF: Range(s) of (UE) IPv4 addresses or Range(s) of (UE) IPv6 prefixes, Range(s) of SUPIs, range(s) of GPSIs.

NOTE 12: Range of SUPI(s) is limited in this release to a SUPI type of IMSI as defined in TS 23.003 [33].

- If the target NF is UDM, UDR, PCF, BSF or AUSF, they can include UDM Group ID, UDR Group ID, PCF Group ID, BSF Group ID, AUSF Group ID respectively.

- If the target NF is HSS, it can include HSS Group ID.

- For UDM and AUSF, Routing Indicator, or Routing Indicator and Home Network Public Key identifier.

- If the target NF is AMF, it includes list of GUAMI(s). In addition, it may include list of GUAMI(s) for which it can serve as backup for failure/maintenance.

- If the target NF is CHF, it includes primary CHF instance and the secondary CHF instance pair(s), if configured in CHF instance profile.

- For the UPF Management: UPF Provisioning Information as defined in clause 4.17.6.

- S-NSSAI(s) and the associated NSI ID(s) (if available).

- Information about the location of the target NF (operator specific information, e.g. geographical location, data centre).

- TAI(s).

- PLMN ID.

- If the target is PCF or SMF, it includes the MA PDU Session capability to indicate if the NF instance supports MA PDU session or not.

- If the target is PCF, it includes the DNN replacement capability to indicate if the NF instance supports DNN replacement or not.

- If the target NF is NWDAF, it includes the Analytics ID(s) (possibly per service), NF Set ID and NF Type of the NF data sources, if available, NWDAF Serving Area information. In addition, it includes Analytics aggregation capability and/ or Analytics metadata provisioning capability, if such capability is provided by the NWDAF. It may include the Supported Analytics Delay per Analytics ID. If consumer is NWDAF, it may also include the ML model Filter information parameters S-NSSAI(s) and Area(s) of Interest for the trained ML model(s) per Analytics ID(s), if available (see clause 5.2, TS 23.288 [50]). Details about NWDAF specific information are described in clause 6.3.13, TS 23.501 [2].

NOTE 13: The Supported Analytics Delay is provided for an Analytics ID only when the NRF had received Real-Time Communication Indication for this Analytics ID in the NWDAF discovery request.

- If the target is a trusted AF, it includes one or multiple combination(s) of the S-NSSAI and DNN corresponding to the AF. In addition, it may include supported Application Id(s), Event ID(s) supported by the AF and Internal-Group Identifier.

- NF Set ID.

- NF Service Set ID.

- If the target NF is SMF, it may include the SMF(s) Service Area.

NOTE 14: If no SMF Service Area is provided, the AMF assumes that a SMF can serve the whole PLMN.

- If the target NF is P-CSCF, it includes P-CSCF FQDN(s) or IP address(es) and optional Access Type(s) associated with each P-CSCF.

- If the target NF is NEF, it may include Event ID(s) provided by AF and/or it includes one or multiple combination(s) of the S-NSSAI and DNN corresponding to the untrusted AF served by the NEF.

- SCP domain the NF belongs to.

NOTE 15: Only one SCP domain is registered in NF profile for an NF.

- If the target is SCP:

- SCP domain(s).

- Remote PLMNs reachable through SCP.

- Endpoint addresses or Address Domain(s) (e.g. IP Address or FQDN ranges) accessible via the SCP.

- NF sets of NFs served by the SCP.

- If the target NF is 5G DDNMF, it may include IP Address or FQDN of 5G DDNMF.

- If the target NF is MB-SMF, it may include the MBS Session ID(s), Area Session ID(s), corresponding MBS service area(s) as described in TS 23.247 [78].

- If the target NF is DCCF, it includes DCCF serving area information, NF type of the NF data sources, NF Set ID of the NF data sources. Details about DCCF specific information are described in clause 6.3.19 of TS 23.501 [2].

- indication that “indirect communication without delegated discovery with NF selection at target domain is requested”.

- If an indication that “indirect communication with delegated discovery with NF selection at target domain is requested” or an “indication that “indirect communication without delegated discovery with NF selection at target domain is requested” is provided, optionally:

- the NF types for which NF selection to the target domain is supported and preferred.

See clause 4.17.4 and 4.17.5 for details on the usage of this service operation.

End of changes