**3GPP TSG-WG SA2 Meeting #164 *S2-2407689r3***

**19 - 23 August, 2024, Maastricht, Netherlands (revised from S2-2407689r2, S2-2407689r1)**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **.502** | **CR** | **4863** | **rev** | **-** | **Current version:** |  |  |
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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:*** | Support of UPF selection according to the conclusion in FS\_UPEAS\_Ph2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | SK Telecom, Vodafone, Deutsche Telekom, China Mobile, Rakuten, Samsung, Nokia, Huawei, Ericsson? | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | UPEAS\_Ph2 | | | | |  | ***Date:*** | | | 2024-08-15 |
|  |  | | | |  | |  | | |  |
| ***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:*** | | As concluded in clause 8.1 of TR 23.700-63:  - The following UPF functionalities are added in the N4 capabilities and UPF NF profile stored in NRF:  - The functionality of NAT information exposure.  - Packet Inspection functionality (to differentiate between IP or MAC filter based packet detection, and the packet detection based on other means, e.g. layer 7 DPI).  - Defining operator configurable parameter in the N4 capabilities and UPF NF profile which can be used for non-standard or partially supported features and configured by operator to extend the baseline UPF capabilities. The format of the parameter is to be determined by stage 3.  - for example, the operator may configure values for this parameter to represent customized configuration (e.g. hardware accelerators (for example GPU, DPU etc.), Firewall, DDos Protection, etc.).  - The SMF may determine the PSA UPF functionalities for PDU Session based on:  - Subscription information from the UDM/UDR: The SMF may receive subscription information from the UDM, during (or after) the establishment of the PDU session, indicating functionalities that are required and/or preferred for the PDU session.  Based on the above conclusions for KI#1, the enhancements on UPF selection are proposed:  - operator configurable parameters | | | | | | | | |
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| ***Summary of change:*** | | Support of UPF selection by providing a selected user plane functionality | | | | | | | | |
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| ***Consequences if not approved:*** | | This new defined capability of UPF selection in UPEAS\_Ph2 will not be supported. | | | | | | | | |
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| ***Clauses affected:*** | | 4.17.6.1, 5.2.7.2.2, 5.2.7.3.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 23.501 CR 5441 | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* \* First change \* \* \* \*

#### 4.17.6.1 General

This clause describes the provisioning of available UPFs in SMF using the NRF as documented in clause 6.3.3 of TS 23.501 [2].

This optional node-level step takes place prior to selecting the UPF for PDU Sessions and may be followed by N4 Node Level procedures defined in clause 4.4.3 where the UPF and the SMF exchange information such as the support of optional functionalities and capabilities.

As an option, UPF(s) may register in the NRF. This registration phase uses the Nnrf\_NFManagement\_NFRegister operation and hence does not use N4.

For the purpose of SMF provisioning of available UPFs, the SMF uses the Nnrf\_NFManagement\_NFStatusSubscribe, Nnrf\_NFManagement\_NFStatusNotify and Nnrf\_NFDiscovery services to learn about available UPFs.

NOTE 1: The protocol used by UPF to interact with NRF is described in TS 29.510 [37]

UPFs may be associated with UPF Provisioning Information in the NRF. The UPF Provisioning Information consists of:

- a list of (S-NSSAI, DNN);

- UE IPv4 Address Ranges and/or IPv6 Prefix Range(s) per (S-NSSAI, DNN); and

NOTE 2: The above information can be used by the SMF for UPF selection when static IP address/prefix allocation is required for a UE.

- a SMF Area Identity the UPF can serve. The SMF Area Identity allows limiting the SMF provisioning of UPF(s) using NRF to those UPF(s) associated with a certain SMF Area Identity. This can e.g. be used if an SMF is only allowed to control UPF(s) configured in NRF as belonging to a certain SMF Area Identity.

- the supported ATSSS steering functionality, i.e. whether MPTCP functionality or ATSSS-LL functionality or MPQUIC functionality, or any combination of them is supported.

- the supported UPF event exposure service and supported Event IDs, e.g. local notification of QoS Monitoring to AF or e.g. events for data collection to NWDAF by Nupf\_EventExposure\_Notify.

- the supported functionality associated with high data rate low latency services, eXtended Reality (XR) and interactive media services, specified in clause 5.37 (for example, ECN marking for L4S, specified in clause 5.37.3, PDU Set Marking, specified in clause 5.37.5, UE power saving management, specified in clause 5.37.8).

- operator configurable UPF capability as described in clause 5.8.2.X of 23.501 [2].

The SMF Area Identity and UE IPv4 Address Ranges and/or IPv6 Prefix Range(s) are optional in the UPF Provisioning Information.

\* \* \* \* Next 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, the supported UPF event exposure service and the supported Event IDs that can be subscribed, supported operator configurable UPF capability. And if UPF can expose NAT information, the UE IPv4 address/IPv6 Prefix seen by the DN (e.g. a Public IP address).

NOTE 6: If UE's IPv4 address or IPv6 Prefix is provided for UPF discovery, then the NRF looks up for a match within one of the Range(s) of IPv4 addresses or IPv6 prefixes provided by UPF in the NF profile at the invocation of Nnrf\_NFManagement\_NFRegister operation. The NRF is not meant to store the UE's individual IPv4 addresses or 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 or SMF, the request may include the slice replacement capability to indicate that a NF instance supporting slice 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 PCF, the request may include the A2X capability as specified in TS 23.256 [80].

- If the target NF is PCF, the request may include the URSP delivery in EPS capability.

- If the target NF is PCF, the request may include the Ranging/SL Positioning Capability as specified in TS 23.586 [88].

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

- Analytics ID(s) (possibly per service).

- TAI(s).

- Analytics aggregation capability and/or Analytics metadata provisioning capability.

- A Real-Time Communication Indication per Analytics ID, NF Set ID and NF Type of the NF data sources.

- Roaming exchange capability if data/analytics exchange between PLMNs is needed.

- The S-NSSAI(s), Area(s) of Interest of the Trained ML Model required and NF consumer information when the target is an NWDAF containing MTLF.

- Required FL capability type (i.e. FL server, FL client, if available) and Time period of interest when the target is an NWDAF containing MTLF with FL capability. When the target is an NWDAF containing MTLF with FL client capability, NF Set ID(s) of data source and NF type(s) where data can be collected as input for local model training may be included.

- If the target NF is NWDAF containing MTLF with ML Model Accuracy checking capability, it includes ML Model Accuracy checking capability for ML model Accuracy Monitoring (see clause 5.2 of TS 23.288 [50]).

- If the target NF is NWDAF containing AnLF with Analytics Accuracy checking capability, it includes Analytics Accuracy checking capability for Analytics Accuracy Monitoring (see clause 5.2 of TS 23.288 [50]).

Details about NWDAF discovery and selection are described in clause 6.3.13 of TS 23.501 [2].

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

NOTE 9: NF consumer information such as vendor ID is defined in stage 3.

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

- Data and analytics storage and retrieval capability.

- ML model storage and retrieval capability.

Details about ADRF discovery and selection are described in clause 6.3.20 of TS 23.501 [2].

- 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 10: 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 a NSACF, the request may include the S-NSSAI(s) of the PLMN or SNPN where the NSACF is located , the NSAC Service Area Identifier 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, support for relocation of data subscription. 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, Supported DNS security protocols, 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, 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 SMF, the request may include the support of User Plane Remote Provisioning to indicate whether the target NF instance supports User Plane Remote Provisioning or not as described in clause 5.30.2.10.4.3 of TS 23.501 [2].

- If the target NF is NEF, the request may include the support of UAS NF functionality, the capability to support Multi-member AF session with required QoS and the capability to support member UE selection assistance functionality.

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

- If the target NF is DCSF, the request may include IMPU of calling party, SIP URI or Tel URI of called party.

- If the target NF is MF, the request may include the list of required data channel media capabilities or MF location information as specified in TS 23.228 [55].

- If the target NF is MRF or MRFP, it includes the list of required IMS media services (as defined in TS 23.228 [55]).

- 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:**

- One of the following:

- A set of NF instance profiles; or

- 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" together with a set of NF instance profiles;

- a validity period for the discovery result.

The set of NF instance profiles shall contain 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 of 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 may include:

- Analytics ID(s) (possibly per service).

- NF Set ID and NF Type of the NF data sources, if available, NWDAF Serving Area information.

- Analytics aggregation capability and/ or Analytics metadata provisioning capability, if such capability is provided by the NWDAF.

- Supported Analytics Delay per Analytics ID.

- If the target NF 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) and ML Model Interoperability indicator per Analytics ID(s), if available (see clause 5.2 of TS 23.288 [50]).

- If the target NF is NWDAF with FL capability, it may also include FL capability information per analytics ID containing FL capability type (i.e. FL server and/or FL client, if available) and Time interval supporting FL, if available (see clause 5.2 of TS 23.288 [50]).

Details about NWDAF specific information are described in clause 6.3.13 of 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, support for relocation of data subscription. Details about DCCF specific information are described in clause 6.3.19 of TS 23.501 [2].

- 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:

- an indication that the reply applies to all NF types; and/or

- the address of an SCP where to send the request.

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

\* \* \* \* End of changes \* \* \* \*