**SA WG2 Meeting #S2-144E S2-210xxxx**

**April 12 - 16, 2021, Electronic, Elbonia**

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **23.502** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **17.0.0** |  |
|  |
| *For* ***HE******LP*** *on using this form: comprehensive instructions can be found at 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:***  | Enhanced NRF services for MBS |
|  |  |
| ***Source to WG:*** | CATT |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** | 5MBS |  | ***Date:*** | 2021-02-10 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP TR 21.900. | *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:*** | NRF services needs to be enhanced to support MBS, e.g. for MB-SMF discovery and selection as specified in TS 23.247. |
|  |  |
| ***Summary of change:*** | Add enhancements to NRF services for MB-SMF discovery and selection. |
|  |  |
| ***Consequences if not approved:*** | MBS related functions such as MB-SMF discovery and selection cannot be supported. |
|  |  |
| ***Clauses affected:*** | 5.2.7.1, 5.2.7.2.2, 5.2.7.2.3, 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 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 5.2.7 NRF Services

#### 5.2.7.1 General

The following table shows the NRF Services and Service Operations:

Table 5.2.7.1-1: NF services provided by the NRF

|  |  |  |  |
| --- | --- | --- | --- |
| Service Name | Service Operations | OperationSemantics | Example Consumer(s) |
| Nnrf\_NFManagement | NFRegister | Request/Response | AMF, SMF, UDM, AUSF, NEF, PCF, SMSF, NSSF, UPF, BSF, CHF, NWDAF, P-CSCF, HSS, UDR, SCP, 5G DDNMF, MB-SMF |
|  | NFUpdate | Request/Response | AMF, SMF, UDM, AUSF, NEF, PCF, SMSF, NSSF, UPF, BSF, CHF, NWDAF, P-CSCF, HSS, UDR, SCP, 5G DDNMF, MB-SMF |
|  | NFDeregister | Request/Response | AMF, SMF, UDM, AUSF, NEF, PCF, SMSF, NSSF, UPF, BSF, CHF, NWDAF, P-CSCF, HSS, UDR, SCP, 5G DDNMF, MB-SMF |
|  | NFStatusSubscribe | Subscribe/Notify | AMF, SMF, PCF, NEF, NSSF, SMSF, AUSF, CHF, NRF, NWDAF, I-CSCF, S-CSCF, IMS-AS, SCP, UDM |
|  | NFStatusNotify |  | AMF, SMF, PCF, NEF, NSSF, SMSF, AUSF, CHF, NWDAF, I-CSCF, S-CSCF, IMS-AS, SCP, UDM |
|  | NFStatusUnSubscribe |  | AMF, SMF, PCF, NEF, NSSF, SMSF, AUSF, CHF, NRF, NWDAF, I-CSCF, S-CSCF, IMS-AS, SCP, UDM |
| Nnrf\_NFDiscovery | Request | Request/Response | AMF, SMF, PCF, NEF, NSSF, SMSF, AUSF, CHF, NRF, NWDAF, I-CSCF, S-CSCF, IMS-AS, SCP, UDM, AF (NOTE 2), MBSF |
| Nnrf\_AccessToken | Get | Request/Response | AMF, SMF, PCF, NEF, NSSF, SMSF, AUSF, UDM, NWDAF, I-CSCF, S-CSCF, IMS-AS, HSS |

NOTE 1: HSS\_IMS services are defined in TS 23.228 [55].

NOTE 2: The AF is a trusted AF by an operator.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 2nd Change \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

##### 5.2.7.2.2 Nnrf\_NFManagement\_NFRegister service operation

**Service Operation name:** Nnrf\_NFManagement\_NFRegister.

**Description:** Registers the consumer NF in the NRF by providing the NF profile of the consumer NF to NRF, and NRF marks the consumer NF available.

**Inputs, Required:** NF type, NF instance ID, FQDN or IP address of NF, Names of supported NF services (if applicable), and PLMN ID e.g. if NF needs to be discovered by other PLMNs.

NOTE 1: for the UPF, the addressing information within the NF profile corresponds to the N4 interface.

NOTE 2: For the purpose of the Nnrf\_NFManagement service, the SCP is treated by the NRF in the same way as NFs. Specifically, the SCP is designated with a specific NF type and NF instance ID. However, the SCP does not support services and related NF profile parameters do not apply (e.g. NF Set ID, NF service set ID, Endpoint Address(es) of instance(s) of supported service(s)), see TS 23.501 [2], clause 6.2.6.3.

**Inputs, Optional:**

- If the consumer 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 consumer is BSF: Range(s) of (UE) IPv4 addresses or Range(s) of (UE) IPv6 prefixes, IP domain list as described in clause 6.1.6.2.21 of TS 29.510 [37].

NOTE 3: Range of SUPI(s) is limited in this release to a SUPI type of IMSI as defined in TS 23.003 [33].

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

- For UDM and AUSF, Routing Indicator.

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

- If the consumer is CHF, it may include Range(s) of SUPIs, Range(s) of GPSIs, or Range(s) of PLMNs as defined in TS 32.290 [42].

- If the consumer is P-CSCF, the P-CSCF IP address(es) to be provided to the UE by SMF.

- If the consumer is HSS, IMPI range, IMPU range, HSS Group ID (as defined in TS 23.228 [55]) can be used as optional input parameters.

- 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).

- DNN(s) if the consumer is PCF or BSF.DNN(s) per S-NSSAI if the consumer is SMF or UPF.

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

- TAI(s).

- NF Set ID.

- NF Service Set ID.

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

- If the consumer is NWDAF, it includes Analytics ID(s) (possibly per service), NWDAF Serving Area information and Supported Analytics Delay per Analytics ID(s) (if available). In addition, it includes Analytics aggregation capability and/ or Analytics metadata provisioning capability if such capability is provided by the NWDAF. It may also include model(s) supported per Analytics ID(s). Details about NWDAF specific information are described in clause 6.3.13, TS 23.501 [2].

Editor's note: Whether analytics metadata provisioning capability needs to be registered in NRF or to be queried from NRF is FFS.

- If the consumer is NEF, it may include Event ID(s) supported by AFs, Application Identifier(s) supported by AFs, range(s) of External Identifiers, or range(s) of External Group Identifiers, or the domain names served by the NEF.

- Notification endpoint for default subscription for each type of notification that the NF is interested in receiving.

- Endpoint Address(es) of instance(s) of supported service(s).

- NF capacity information.

- NF priority information.

- If consumer is NF, SCP domain the NF belongs to.

- If the consumer is SCP, it may include:

- SCP domain(s) the SCP belongs to.

- 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 consumer NF is MB-SMF, it may include MB-SMF service area, and the MBS Session ID(s) if available.

**Outputs, Required:** Result indication.

**Outputs, Optional:** None.

See clause 5.21.2.1 in TS 23.501 [2], the AMF registers itself to NRF.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 3rd Change \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

##### 5.2.7.2.3 Nnrf\_NFManagement\_NFUpdate service operation

**Service Operation name:** Nnrf\_NFManagement\_NFUpdate.

**Description:** Provides the updated NF profile of NF consumer to NRF.

**Inputs, Required:** NF instance ID.

**Inputs, Optional:** If replacing the full NF profile, the full NF profile shall be provided. If updating parts of the NF profile, the NF profile elements that needs to be updated shall be provided.

- If the consumer NF is MB-SMF, it may include the MBS Session ID for a new MBS Session which is configured/established in the MB-SMF.

**Outputs, Required:** Result indication.

**Outputs, Optional:** None.

See clause 5.21.2.1 in TS 23.501 [2], the AMF adds or updates the associated GUAMI(s).

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 4th 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, NRF to be used to select NFs/services within HPLMN, Serving PLMN ID, 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, IMPI, IMPU, Data Set Identifier(s). (UE) IPv4 address, IP domain or (UE) IPv6 Prefix.

NOTE 2: 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 TS 23.501 [2] clause 6.3.1 to determine the applicable set of NF instances for the response.

NOTE 3: 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.

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

NOTE 4: 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 5: 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 6: 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 NWDAF, the request may include Analytics ID(s) (possibly per service), TAI(s), Analytics aggregation capability, and Analytics metadata provisioning capability and a Real-Time Communication Indication per Analytics ID. If consumer is NWDAF, Consumer may also include model(s) supported per Analytics ID(s). Details about NWDAF discovery and selection are described in clause 6.3.13, TS 23.501 [2].

NOTE 7: Analytics metadata provisioning capability is only applicable when NF service consumer is NWDAF.

Editor's note: Whether analytics aggregation capability needs to be supported as input parameter for discovery of NWDAF is FFS.

Editor's note: Whether analytics metadata provisioning capability needs to be registered in NRF or to be queried from NRF is FFS.

- 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 8: 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 TS 23.288 [50], clause 6.2.2.3. 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 SMF, the request may include the Control Plane CIoT 5GS Optimisation Indication or User Plane CIoT 5GS Optimisation Indication.

- 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 the MBS Session ID.

**Outputs, Required:** A set of NF instances, 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 9: 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.

NOTE 10: 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 or AUSF, they can include UDM Group ID, UDR Group ID, PCF Group ID, AUSF Group ID respectively.

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

- For UDM and AUSF, Routing Indicator.

- 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).

- 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) and 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. Details about NWDAF specific information are described in clause 6.3.13, TS 23.501 [2].

Editor's note: Whether analytics metadata provisioning capability to be registered in NRF or to be queried from NRF is FFS.

- NF Set ID.

- NF Service Set ID.

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

NOTE 11: 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.

- SCP domain the NF belongs to.

NOTE 12: 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.

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

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of Change \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*