**3GPP TSG-CT WG4 Meeting #111-eC4-224315**

**E-Meeting, 18th – 26th August 2022**

Source: China Mobile, CATT, ZTE, China Telecom, Huawei, NTT DOCOMO, Vodafone

Title: New SID on 5GC Restoration Improvements

Document for: Approval

Agenda Item: 5

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>   
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on 5GC Restoration Improvements

Acronym: FS\_ResImp5

Unique identifier:

Potential target Release: Rel-18

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  |  |  | X |  |
| No | X | X | X |  |  |
| Don't know |  |  |  |  | X |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a

|  |  |
| --- | --- |
|  | Feature |
|  | Building Block |
|  | Work Task |
| X | Study Item |

## 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |  |  |  |
| --- | --- | --- | --- |
| Parent Work / Study Items | | | |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| N/A | N/A | N/A | N/A |

### 2.3 Other related Work Items and dependencies

|  |  |  |
| --- | --- | --- |
| Other related Work /Study Items (if any) | | |
| Unique ID | Title | Nature of relationship |
|  |  |  |

# 3 Justification

Restoration solutions for 5GC entities have been continuously studied and standardized since Rel-15. 3GPP TS 23.527 provides a set of generic restoration solutions for Service-Based entities, however during the deployment of 5G, several restoration issues have been identified regarding specific NFs/scenarios, which are not yet standardized by 3GPP:

Issue-1: NRF restoration

NRF is one of the key NFs in 5GC, it mainly provides the following functionalities:

- NF/service discovery. This is the essential functionality since all the signalling routing in SBA is based on NF/service discovery.

- NF information retrieval. NFs register its profile to the NRF, and in principle NF can include all kind of information in its profile. Thus NRF provides a way for an NF to retrieve the information of other NFs.

- NF restoration. NRF may maintain heartbeat with other NFs, thus NRF can be aware of the availability of other NFs. One NF can get notification on the failure of NF which is of interest from NRF and then trigger the restoration procedure.

To improve the availability of NRF services, it is common to deploy NRF in manners like NRF pool, primary-secondary backup, accordingly the following aspects need further standardization:

- NF profile synchronization. There are two kinds of information, one is relatively static information e.g. NF address, services provided by the NF, the other is dynamic information e.g. the load status of NF. It has not been specified how to keep the NRF’s knowledge up to date during restoration.

- Subscription and notification. NF may subscribe to event notification from NRF, NRF may subscribe to event notification from another NRF. During the restoration procedure the subscription and notification should keep available.

- Failback after recovery. In the primary-secondary deployment mode, after the failure and recovery of the primary NRF, the service load should be switched back to the primary NRF. It should be ensured that during the failback the information is synchronized and there is no signalling storm during the failback.

Besides the above aspects, problem has also been identified regarding NRF set. NRF can be used for NF healthy checking, i.e. the NRF may keep heartbeat between other NFs. Even the NRF instances within a set can share data via a common database, the context of heartbeat is not suitable to be stored in the common database. So if one NRF instance fails the corresponding heartbeat context is lost.

It is very common that NFs (e.g. AMF, SMF, UDM) communicate with NRF from a different vendor or different PLMN, therefore the NRF restoration procedure should be well defined to reduce the interoperability risks during restoration.

Issue-2: Restoration of PCF supporting both SBI and Diameter interfaces

Operators may deploy PCF supporting both SBI and Diameter interfaces. In such deployment the SMF will communicate with PCF via N7 interface, while the AF may communicate with PCF via N5 or Rx interface depending on the operator strategy and AF capability. Messages coming via N5/N7/Rx interfaces may trigger PCF reselection if the original target PCF is on failure. Concerning the Diameter interface is usually statically configured, the messages on N5/N7/Rx interfaces shall be routed to the same PCF instance after the reselection. The following issues are raised regarding PCF restoration:

- PCF reselection. NF set concept has been introduced to 5G and generic NF reselection mechanism based on SCP has been specified. However if the PCF is on failure and the first incoming message after the failure is a Diameter message, it is unclear how to apply NF set concept to Diameter interface.

- Triggering of session binding information update towards BSF. When the PCFs are deployed as PCF set, all the PCF instances are equal to the others and share a common data base. If one PCF instance receives an incoming HTTP/Diameter request, it is unclear how does the PCF instance identify this is a message due to PCF reselection and the PCF shall update the binding information towards BSF.

- Efficiency of session binding information update towards BSF. The session binding information is per PDU session granularity. When a PCF is on failure all the related session binding information need to be updated in BSF. If the service migration from the failed PCF to the backup PCF is per PDU session and triggered by N5/N7/Rx message, then for each PDU session there will be a service delay and more signalling is caused due to PCF reselection will be performed on each PDU session. If the session binding information are updated in the same period of time, it may cause congestion on the BSF. Thus a study on how should the PCF update the binding information efficiently is needed.

Issue-3: NF one-to-one backup

It is very common to deploy the network entities in one-to-one backup manner, which means one NF instance has a determined NF instance as backup. This is supported for AMF, where one AMF may explicitly register a backup AMF in the NRF. However the similar mechanism is not yet defined for other kinds of NFs. It is needed to study whether the similar mechanism is beneficial for other NFs, and if yes, how.

# 4 Objective

The study item includes the following tasks:

- To study the need and potential solutions of NRF restoration

NOTE: The data structure of shared data among NRF instances in an NRF set is out of scope of this study.

- To study the need and potential solutions of restoration of PCF supporting both SBI and Diameter interfaces

- To study the need and potential solutions of generic one-to-one backup for all 5GC NFs

# 5 Expected Output and Time scale

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| New specifications {One line per specification. Create/delete lines as needed} | | | | | |
| Type | TS/TR number | Title | For info  at TSG# | For approval at TSG# | Rapporteur |
| Internal TR | 29.8ab | Study on 5GC Restoration Improvements | TSG#99  (March, 2023) | TSG#100  (June, 2023) | Song Yue,  China Mobile,  songyue@chinamobile.com |

|  |  |  |  |
| --- | --- | --- | --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
|  |  |  |  |

# 6 Work item Rapporteur(s)

Song Yue, China Mobile, songyue@chinamobile.com

# 7 Work item leadership

CT4

# 8 Aspects that involve other WGs

# 9 Supporting Individual Members

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| --- |
| Supporting IM name |
| China Mobile |
| CATT |
| ZTE |
| China Telecom |
| Huawei |
| NTT DOCOMO |
| Vodafone |