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**Source: Nokia, Nokia Shanghai Bell, China Mobile**

**Title: KI#4 Solution #12 update and conclusions update**

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*Abstract of the contribution: This paper proposes update to the solution #12 for KI#4 and proposes updates to the conclusions in section 8.4 of TR 23.700-81.*

# Discussion

This paper proposes a technical enhancements to Solutions #12, #44 and #66 as discussed during the SA2#153E meeting. The technical enhancements consists in a DCCF service consumer indicating its support to handle a data source change, contained in the subscription request issued to the DCCF. The DCCF, upon receiving the indication, will determine to either executing DCCF relocation or DCCF reselection according to the value of the indicator.

# Proposal

It is proposed to update TR 23.700-81 as follows

\*\*\* Start of changes \*\*\*

## 6.12 Solution #12: DCCF and MFAF Relocation

### 6.12.1 Description

In scenarios where multiple DCCF and/or MFAF instances are deployed in the same network, there are some cases that the serving DCCF and/or MFAF may need to be changed, such as when a UE moves (e.g. due to idle mode mobility or a handover), the data or analytics source may change (e.g.: a new NWDAF, a new AMF, a new SMF). The new data source may not be in the area served by the current DCCF and/or the current MFAF. This solution proposes a way to change the DCCF and/or MFAF upon data source or analytics source change so the serving areas of the DCCF/MFAF and data source remain aligned.

The DCCF and MFAF relocation comprises the following steps:

- When a DCCF coordinates data or analytics collection for a UE or a group of UEs, the DCCF subscribes to event notifications for UE mobility to outside of the serving area of the DCCF (for example area of interest as specified in clause 4.15.4.2 of TS 23.502 [3]). If an MFAF is used, the DCCF also subscribes to receive notifications of UE mobility to outside of the serving area of the selected MFAF.

- When a DCCF coordinating data or analytics collection receives a mobility event notification:

- It determines if the UE is still within the current DCCF serving area. If not, it determines a new DCCF (e.g. by querying the NRF). It then interacts with the new DCCF to transfer the UE DCCF context for the UE.

- If an MFAF is used, the DCCF determines if the UE is within the current MFAF serving area. If not, it determines a new MFAF (e.g. by querying the NRF). The DCCF then interacts with the new MFAF to initiate a UE MFAF context transfer from the old MFAF or to establish a new UE MFAF context.

- If there is a new MFAF or if there is a new DCCF and an MFAF is not used, the DCCF updates the Data Source with the new Notification Endpoint address. Subsequently, the data source sends notifications to the new DCCF or new MFAF.

MFAF UE Context information transferred or setup in the new MFAF may include information from on-going processing, such as buffered notifications and processed data, and configuration information such as Formatting Instructions, Processing Instructions, Data Consumer or Analytics Consumer information and MFAF notification information as described in clause 9.2.2 of TS 23.288 [5].

DCCF UE Context information transferred to the new DCCF may include information from on-going processing, such as buffered notifications and processed data, and configuration information such as Service Operation, Analytics or Data Specification, Time Window, Formatting Instructions, Processing Instructions, Data Consumer or Analytics Consumer information and DCCF notification information as described in clause 8.2.2 of TS 23.288 [5].

### 6.12.2 Procedures

Upon change of a source DCCF and/or MFAF instance, it is required to inform the related consumer of the event and possibly to update subscriptions between the DCCF and the consumer. The subscriptions can be renewed between the target DCCF instance and the consumer.



Figure 6.12.2-1: DCCF and/or MFAF Context Transfer

Figure 6.12.2-1 illustrates the procedure for DCCF and/or MFAF Context Transfer.

0. A consumer NF subscribes to DCCF Data Management services. The consumer NFsets to “False” the “No relocation” indicator in the subscription request.

NOTE. The “No relocation” indicator is used by DCCF to determine whether to execute the relocation procedure (No Relocation set to “False”) or not (No Relocation set to “True”).

1. AMF sends DCCF-1 a notification indicating that the UE is in a new area of interest.

2. DCCF-1 determines that the UE is no longer in the area served by the DCCF-1 or in the area served by the MFAF-1.

3. DCCF-1 may query the NRF to discover a DCCF and/or MFAF that can serve the UE in its new location. In the case of data subscriptions from multiple DCCFs, the DCCF-1 may preferably select a target DCCF that is already serving the consumer.

4. If DCCF-1 determined in step 2 that it is no longer in the serving area of the UE, it selects a new DCCF (DCCF-2) to serve the UE. If the DCCF determined in step 2 that MFAF-1 is no longer in the serving area of the UE, it selects a new MFAF (MFAF-2) to serve the UE.

5. If a new MFAF (MFAF-2) is selected, DCCF-1 sends a message to MFAF-2 requesting MFAF-2 to become the new MFAF and to retrieve the MFAF UE context from MFAF-1.

6. If MFAF-2 receives the message in step 5, it retrieves the UE context from MFAF-1.

7. MFAF-1 forwards to MFAF-2, notifications related to the UE (where formatting and processing may be performed by MFAF-2).

8. MFAF-2 indicates to DCCF-1 that MFAF UE context transfer/setup is complete and provides MFAF-2 Notification Endpoint information to the DCCF-1.

9. If a new DCCF (DCCF-2) is selected in step 4, DCCF-1 sends a message to DCCF-2 requesting DCCF-2 to become the new DCCF. If DCCF-2 accepts the transfer request:

a. DCCF-2 retrieves the UE Context from DCCF-1.

b. If an MFAF is used, DCCF-1 indicates to DCCF-2 the MFAF (MFAF-1 or MFAF-2).

c. If an MFAF is not used, DCCF-2 provides DCCF-2 Notification Endpoint information in the response to DCCF-1.

d. DCCF-1 and DCCF-2 determine whether subscriptions to Data Sources need to be updated.

NOTE 1: As in clause 5A.2, each Data Source NF or Set of Data Source NF should be associated with only one DCCF instance or DCCF Set. Therefore based on the subscription information for the UE provided by DCCF-1, DCCF-2 should select a new Data Source NF and inform DCCF-1.

e. DCCF-2 confirms the context transfer from the DCCF-1.

10. If a new DCCF (DCCF-2) is selected in step 4, DCCF-2 informs the MFAF (MFAF-1 or MFAF-2) that DCCF 2 is now the DCCF for the UE.

11. If the DCCF has not changed, DCCF-1 informs the Data Source of the MFAF (MFAF-2) notification endpoint information (either via update of a subscription to the existing data source or via a new subscription to a new data source if selected by DCCF-1). Notifications are subsequently sent from the Data Source to MFAF-2.

12. If the DCCF has changed, DCCF-2 updates/subscribes to the Data Source, providing MFAF-2 Notification Endpoint Information (if there is a new MFAF 2), or DCCF-2 Notification Endpoint Information (if MFAF is not used) and indicating that DCCF-2 is the new DCCF subscribing for data/analytics.

a. If an MFAF is used, DCCF-2 indicates to Data source the MFAF (MFAF-1 or MFAF-2).

b. If an MFAF is not used, DCCF-2 provides DCCF-2 Notification Endpoint information to Data source.

13. DCCF-1 unsubscribes with the data source(s) that are no longer needed for the remaining data subscriptions.

14. The consumer is informed by DCCF-1 that its subscription to DCCF-1 is now being handled by DCCF-2. In this message, the new Subscription Correlation ID, which was assigned by DCCF-2, is provided as the Subscription Correlation ID parameter and the old Subscription Correlation Id, which was allocated by DCCF-1, is provided as the Subscription Change Notification Correlation ID parameter.

NOTE 2: For this procedure, following constraint is assumed for data collection for group of UEs or any UE. The NF consumer will select a DCCF(s) that serves the area(s) where the group of UEs or any UE reside and the selected DCCF(s) will select MFAF(s) that serves the area(s) where the group of UEs or any UE reside.

### 6.12.3 Impacts on existing nodes and functionality

DCCF/MFAF:

- New services and service operations for UE Context Transfer.

\*\*\* End of 1st change \*\*\*

\*\*\* Second change \*\*\*

## 6.44 Solution #44: DCCF Reselection when multiple instances of DCCF exist in a network

### 6.44.1 Description

The proposed solution is based on the following principles:

- Multiple instances of DCCF are operating in one PLMN where each instance can be configured to collect data from any combination of Serving Area Information, or NF types/set ID of data sources.

- The network is configured in a way that service consumers will interact with data sources through DCCF.

- Reselection is initiated by service consumers to unsubscribe from source DCCF and subscribe to target DCCF.

- A data source NF is bounded to a specific DCCF instance or set as defined in Rel-17.

- Source DCCF notifies the service consumer if it cannot serve a UE anymore. The service consumer is capable of receiving such notification and includes an indication that such capability is supported in the service request to DCCF

- Service consumer unsubscribes from the data collection to source DCCF.

Each instance of DCCF can be identified using a discovery mechanism through NRF which is specified in TS 23.501 [2]. Moreover, a service consumer NF e.g. another DCCF, can use information about the Serving Area to query a DCCF.

When a service consumer NF receives notification from the source DCCF about not being able to serve the UE, it unsubscribes from the source DCCF. Then the source DCCF will unsubscribe from data sources and ensure all collected data is sent to the service consumer NF.

NOTE 1: All serving areas are logical areas within one PLMN. Each serving area will have its own instance of DCCF and optionally other NFs e.g. data providers, etc.

NOTE 2: At UE mobility, DCCF takes no action for subscriptions on group of UEs or Any UEs.

### 6.44.2 Procedures

The procedure in Figure 6.44.2-1 is used when a service consumer NF determines to use a DCCF, known as target DCCF. The procedure is triggered e.g. when a UE location no longer lies within the serving area of the source DCCF, so that the source DCCF will notify the service consumer that it cannot serve the UE anymore, and includes all pending data to be notified. Other internal triggers that may result in DCCF reselection are handled within NF sets as specified in TS 23.501 [2] and TS 23.502 [3].



Figure 6.44.2-1: DCCF reselection initiated by target DCCF selected by service consumer

0 A consumer NF sends a subscription request to the DCCF using Ndccf\_DataManagement\_Subscribe request, including the “No relocation” indicator set to “True”. The indicator enables the DCCF to notify the service consumer that it can no longer serve the UE.

1. Source DCCF notifies the service consumer that, e.g. location of UE falls outside the serving area of the DCCF, so it cannot serve the UE anymore. A cause code is also added with the notification (e.g. UE moved outside DCCF serving area, if data source is added in subscription - UE moved outside data source serving area).

2. Service consumer for the source DCCF determines to select a new instance of DCCF and discovers and selects the target DCCF.

3. The service consumer sends a subscription request to the target DCCF using Ndccf\_DataManagement\_Subscribe request.

4. [OPTIONAL] The service consumer unsubscribes from the source DCCF since it will be served by the target DCCF from now on.

5. [OPTIONAL] Target DCCF may subscribe to relevant data source(s), if not yet subscribed.

### 6.44.3 Impacts on Services, Entities, and Interfaces

DCCF:

- Notify service consumer that it cannot serve the UE, including a cause code. If there is any pending data, it is also delivered to the service consumer NF.

Service consumer NF:

- Indicates support to receiving notifications when DCCF cannot serve the UE anymore.

\*\*\* End of 2nd change \*\*\*

\*\*\* Third change \*\*\*

## 6.66 Solution #66: DCCF relocation initiated by source DCCF or central DCCF

### 6.66.1 Description

This solution addresses Key Issue #4 "How to Enhance Data collection and Storage".

According to the definition of the Rel-17, DCCF is the data acquisition coordination node of the core network, the data acquisition area of DCCF is fixed, and the data source NF or data source NF set in the same area should be associated with only one DCCF instance or DCCF set. As described in TS 23.501 [2], multiple instances of DCCF may be deployed in a network. The NF consumers shall utilize the NRF to discover DCCF instance(s). NF consumers can select an available DCCF based on parameters such as DCCF service area information, S-NSSAI, and NF type of the data source, etc.

In scenarios where multiple DCCF instances are deployed in the same 5G network, there are some cases that the serving DCCF may need to be changed during the operation due to, e.g. UE mobility, change in DCCF profile, new addition or removal of DCCF instances, etc.

When the data consumer subscribes to the source DCCF directly, upon change of a source DCCF instance, it is required to inform the related data consumer of the event and possibly to update subscriptions between the DCCF and the data consumer. If the central DCCF is deployed, data consumer collects UE data via the central DCCF, thus, data consumer may not need to be notified of the UE mobility events and DCCF reselection events.

The following figure illustrates the DCCF relocation initiated by source DCCF or central DCCF.



Figure 6.66.1-1: DCCF relocation initiated by source DCCF or central DCCF

### 6.66.2 Procedures



Figure 6.66.2-1: Procedure for DCCF relocation initiated by source DCCF or central DCCF

0. The data consumer subscribes source DCCF. The data consumer sends UE(s) ID, enabling DCCF to determine whether the UE(s) data subscription transfer procedure is applicable. If the central DCCF is deployed, the data consumer subscribes to central DCCF optionally, then central DCCF discovers and selects a source DCCF. The consumer NF sets to “False” the “No relocation” indicator in the subscription request.

NOTE. The “No relocation” indicator is used by DCCF to determine whether to execute the relocation procedure (No Relocation set to “False”) or not (No Relocation set to “True”).

1. Source DCCF or central DCCF subscribes UE(s) mobility events from AMF.

2. If UE(s) moves out of the service area of the source DCCF, source DCCF or central DCCF determines UE(s) data subscription to be transferred to target DCCF(s), e.g. triggered by a UE mobility event notification from AMF.

3. Source DCCF or central DCCF may query the NRF to perform a DCCF discovers and selects the target DCCF(s), e.g. based on the UE location information received from AMF.

4. Source DCCF requests or central DCCF triggers source DCCF to request, using Ndccf\_DataManagement\_Transfer Request service operation, a transfer of UE(s) data subscription to the target DCCF(s).

5. Target DCCF(s) accepts the data subscription(s) transfer.

6. Target DCCF informs the data consumer or central DCCF about the successful UE(s) data subscription transfer using a Ndccf\_DataManagement\_Notify message. And central DCCF may not need to notify data consumer of UE mobility events and/or DCCF reselection events based on configuration.

7. [Optional] Target DCCF subscribes to the relevant data source(s), if it is not yet subscribed to the data source(s) for the data required for the data subscription.

8. Target DCCF confirms UE(s) data subscription transfer to the source DCCF.

9. [Optional] Source DCCF unsubscribes with the data source(s) that are no longer needed for the remaining UE(s) data subscriptions. And target DCCF may subscribe to relevant data source(s), if not yet subscribed.

NOTE: At this point, UE(s) data subscription transfer is deemed completed.

10-11. Target DCCF collects data from the data source(s) and notifies the data consumer using a Ndccf\_DataManagement\_Notify message or via central DCCF.

### 6.66.3 Impacts on Existing Nodes and Functionality

DCCF:

- Supports UE(s) data subscription transfer procedure.

- Supports Ndccf\_DataManagemen\_Transfer service operation to inform the target DCCF of handover preparation and handover of data subscriptions.

Data Consumer:

- Supports subscription renewal with a target DCCF instance.

- Supports Ndccf\_DataManagement\_Transfer service operation for DCCF relocation.

\*\*\* End of 3rd change \*\*\*

\*\*\* 4th change \*\*\*

## 8.4 Key Issue #4: How to Enhance Data collection and Storage

1. For Managing Impact of storing data in NFp during muting, Solutions #41 and #45 are adopted for normative work.

2. For ADRF / NWDAF Data Storage Management, a consumer may request data deletion alert and provide life time of the data to the ADRF. NWDAF or ADRF may be configured with operator policies for data storage as defined in Solution#46.

3. Data records can be stored at ADRF with an associated DataSetTag. The DataSetTag can be used to retrieve the whole set of data records associated to such tag. The DataSetTag may be included in the service requests to AnLF and MTLF to indicate the data set to be used by the AnLF, respectively by MTLF.

4. Data can be stored at and retrieved from ADRF using techniques of data compression and/or data synthesis. The DSC indicator is used to represent the technique of data compression and/or data synthesis. The value of DSC is up to vendor agreement and up to implementation. How to support data transportation using the techniques of data compression and/or data synthesis is out of the scope of 3GPP.

NOTE 1: How DSC is conveyed in the SBI message is up to Stage-3 design.

5. To optimize the reporting of network data, data can be reported according to a non-fixed sampling ratio. Data consumer can indicate the non-fixed sample ratio in the data subscription request. Data consumer can update the data sampling ratio dynamically by updating the data subscription. Data provider can use different sampling ratio according to local configuration and provide the sampling ratio info in the data notifications to the data consumer.

6. Normative change (only impacting stage 2) is recommended to allow NWDAF to register in the UDM for the served UE, also for Analytics IDs that are not UE-related, as defined in Solution #65.

7. For storing ML models in ADRF, MTLF can store ML model in ADRF based on MTLF policy. ADRF shall not duplicate the functionality provided by MLModelProvision Service.

8. MTLF sends the ML model address to ADRF by triggering ADRF's ML model storage service, according to Rel-17, with no additional parameters to ADRF. A URL where the model file is stored in the ADRF is included in the response from ADRF to MTLF.

NOTE 2: Whether the ADRF further downloads the ML model based on the ML model address and locally stores the ML model is left for implementation.

NOTE 3: When storing ML models at the ADRF, whether and which additional security-related parameters need to be sent by MTLF to ADRF are to be determined with SA WG3.

Editor's note: Whether the MTLF sends the ML model address or ML model to ADRF is FFS.

9. When a DCCF and optionally MFAF is no longer able to serve a data consumer due to data source change, procedures for DCCF and optionally MFAF re-location (respectively re-selection) are supported according to solutions 12 and 66 (respectively 44). The selection of the appropriate procedure may be determined by the DCCF based on a “No relocation” indicator provided by the DCCF service consumer.

NOTE x. The “No relocation” indicator is used by DCCF to determine whether to execute the relocation procedure (No Relocation set to “False”) or not (No Relocation set to “True”).

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