**3GPP TSG-SA WG6 Meeting #49-e S6-221046r01**

**E-meeting, 16th – 25th May 2022 (revision of S6-220842)**

**Source: CATT**

**Title: Pseudo-CR on solution#1 update**

**Spec: 3GPP TR 23.700-96 v0.5.0**

**Agenda item: 9.7**

**Document for: Approval**

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**1. Introduction**

This contribution updates architecture for fused location service and provides evaluation for solution#1.

**2. Reason for Change**

According to S6-221045 Discussion on fused location service architecture, additional functions are addressed in solution#1, with an update on functional architecture diagram.

**3. Proposal**

It is proposed to agree the following changes to 3GPP TR 23.700-96 v0.5.0.

\* \* \* First Change \* \* \* \*

## 7.1 Solution #1: Standalone functional architecture for fused location service

### 7.1.1 Solution description

This solution addresses key issue #1: Architecture enhancement of application enablement for location.

#### 7.1.1.1 Functional architecture

The figure 7.1.1.1-1 identifies the architecture of fused location service enabled by 5GS.



Figure 7.1.1.1-1: Functional architecture of fused location service

The architecture is composed of logical function modules that are not necessarily physical entities and can reside in or co-locate with existing application layer entities as appropriate.

In the architecture the Fused Location Server (FLS) and Application Specific Server can be within the MNO domain or third party service provider domain.

The FLS architecture supports multiple possible sources of location information including:

-AMF location service exposed by NEF (as defined in 3GPP TS 23.502 [12]);

- LCS location retrieved from either NEF or GMLC (as defined in 3GPP TS 23.273 [4]);

- SUPL location retrieved from SLP (as defined in OMA AD SUPL [10]);

NOTE: Whether and how the SUPL location service can be exposed by 5GC is within the remit of SA2.

- Certain RAT-independent positioning retrieved from 3rd party location server or Fused Location Client.

- Positioning retrieved from the target UE via the FLS-1 interface via the non-3GPP defined accesses.

#### 7.1.1.2 Functional components and reference points

The Fused Location Server provides location information of the target UE based on positioning or location data retrived from one or multiple location source. The Fused Location Server can get the location information via the non-3GPP defined access from the Fused Location Client and additionally can get location information via the 3GPP access. The Fused Location Server selects one or more access types, one or more location methods (as described in 3GPP TS 29.572 [14]) and Control Plane /User Plane (e.g. SUPL [10]) methods based on the requested location QoS. The Fused Location Server provides normalized description of location data to the application specific server (e.g. of ecosystem partners) through the northbound API.

There are five types of interaction defined in TS23.273 between the 5GC and target UE. The first type of interaction is to get the location information from the target UE as described in clause 6.11 of TS 23.273. The second type of interaction is to provide the location notification to the target UE and to get the guarantee from the target UE to allow/block the location information as described in clause as described in clause 6.1.2 of TS 23.273.The third type of interaction is for the mobile terminated deferred location service to install the (periodic or triggered) location event to the target UE as described in clause 6.3.1, the target UE can (e.g. periodically) enter the CMM-Connected state based on the events to support the location information retrieving. The fourth interaction is to provide the Location Privacy Indication from the target UE as described in clause 6.12. The fifth interaction is to provide the Network Assistance Data and the cipering keys to deciper the Network Assistance Data as described in clause 6.14.

For the non-3GPP defined accesses, the FLS also needs to support the five types of interaction with the Fused Location Client to retrive the location information via the non-3GPP defined accesses:

* Get the UE location information;
* Provide location notification to the target UE and get guarantee to get location information from the target UE;
* Install location event triggers in the target UE to support the target UE terminated deferred location information;
* Get the location privacy indication udpated by the target UE;
* Provide the location assistant data and ciphering key to the target UE;

FLS can retrieve the target UE's Location information via different accesses from multiple PLMNs. E.g. retrieves the target UE's Location information via

* 3GPP access in PLMN-A and a non-3GPP defined access from PLMN-B IP connection, or
* 3GPP accesses in PLMN-A and non-3GPP access in PLMN-B as described in TS23.501[5].
* EPS and 5GS accesses in the same PLMN-A for the Multiple-USIM UE as describd in TS23.501[5];
* EPS access in the PLMN-A and 5GS access in the PLMN-B for the Multiple-USIM UE as describd in TS23.501[5];

In such case, FLS can get location information from multiple PLMNs, and the location server (e.g. SEAL LMS or FLS ) within the PLMN-B can be consider as a 3rd party location server for the FLS and the FLS supports the interfaces to different location servers of the different PLMNs.

The Fused Location Server(FLS) additionally provides the following core location services through the northbound API as below (not exhausted):

* Location format mapping
* Location Event Trigger provision, invoke, revoke
* Periodic and or event Triggered location reporting
* Real time location information Pushing
* Geofencing
* (Indoor) Map provision
* Location Alerting
* Real time Tracing request or playback (continuous locations in a map)
* History Trace request or playback
* Time information of the first entering and the last leaveing an area (e.g. working campus)
* The length of time to stay in an area
* The times to re-enter and re-leave an area
* Location information analysis
* Heatmap
* Speed
* Heading Direction

To support the the core location services, the FLS may needs to store the location data to its internal database and to retrieve the location data from the database.

The 3rd Party Location Server provides the location of a certain location technology (typically the network-based positioning) e.g. Bluetooth.

The Fused Location Client represents the client of target UE providing the UE-based poisitioning via the non-3GPP defined access and location related information and provides the UE location information via the non-3GPP defined access to the Fused Location Server via an IP connection.

NOTE : How does the Fused Location Client get the UE location information via the non-3GPP defined access is out of scope of 3GPP.

The NEF (as defined in 3GPP TS 23.501 [5]) exposes location service of 5GC when Fused Location Server is external to MNO domain.

The GMLC (as defined in 3GPP TS 23.273 [4]) provides LCS when Fused Location Server is within the MNO domain.

The SLP (as defined in OMA AD SUPL [10]) provides location of SUPL network.

The interfaces are described as followed:

**FLS-1:** Reference point supporting location reporting, location determination, location management and exchange of location contextual information (e.g. the GPSI, MSISDN, UE Application ID, location capabilities of the non-3GPP defined access, the available non-3GPP defined accesses ) over application layer transactions between the Fused Location Server and the Fused Location Client of the target UE . The FLS-1 may support HTTP or WebSocket and the IP connection between the Fused Location Client and Fused Location Server can be provided by the 5GS PDU Session.

**FLS**-**2:** Service-based interface exposing fused location data and core location services to the applications (including e.g. the vertical applications, the applications of ecosystem partners and etc.). The FLS-2 may support HTTP or WebSocket.

**FLS-3: R**eference point between the FLS and a database for storing and retrieving location information for the target UE and user profile for the target UE.NOTE: The definition of FLS-3 is out of scope of this specification.

**FLS**-**4:** The reference point is used for location retrieval of the target UE from that 3rd party location server. The FLS-X can be a service-based interface. The FLS-4 may support HTTP or WebSocket. The FLS-4 can use the location services via the API provided by the LM-S.

NOTE: If the FLS-4 is not LM-S, the definition of FLS-4 is out of scope of this specification.

**Nnef:** Service-based interface as defined in 3GPP TS 23.501 [5].

**Le:** Reference point as defined in OMA AD MLS [11].

**LM-UU:** Reference point as defined in 3GPP TS 23.434 [13].

**LM-S:** Reference point as defined in 3GPP TS 23.434 [13].

#### 7.1.1.3 Merged Architecture to support interaction between FLS and SEAL LMS

FLS fuses different location information from multiple resources and provide a better location service/information to the Application Server via its northbound API. And the SEAL LMS can be one of its location source as described in figure 7.1.1.3-1

The SEAL LMS does not support to get location information from the non-3GPP defined access, the FLS needs to have the interface FLS-1 to get location information from the non-3GPP defined access.

The FLS needs to get the location information from other PLMNs if the target UE is with multiple PLMN accesses , in such cased, the FLS-4 referece point is to provide such location information from different PLMNs.

The FLS-3 reference point is defined for storing and retrieving location information for the target UE and user profile for the target UE.



Figure 7.1.1.3 Merged architecture with Interaction between Fused Location Server and SEAL LMS

### 7.1.2 Solution evaluation

The merged architecture defined in figure 7.1.1.3-1 is selected as the basic architecture to merge the Fused Location Server and SEAL LMS and solutions in this TR are updated with this merged architecture.

Based on the merged architecture, the SEAL LMS needs to upgrade to support Le interface.

SEAL LMS only gets the location information for the target UE via the 3GPP defined accesses and provides the location information to the FLS via the LM-S interface, additionaly, the FLS gets the location information via the non-3GPP defined accesses from the FLS-1 reference point.

FLS supports the target UE with multiple PLMN connections and the FLS can get location information from multiple PLMN via the FLS-4 interface. And the FLS-4 interface can be the LM-S reference point from different PLMNs.

The Fused Location Server(FLS) additionally provides the core location services through the northbound API via the FLS-2 and the SEAL LM also provides some core location service as descrbied in TS23.434[13].