

Solution Description VoLTE

Ericsson Dynamic Activation 1

TECHNICAL SOLUTION DESCRIPTION

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1 Introduction

As the network evolves from 2G/3G to 4G/LTE, wireless communication supports more widely used mobile services and applications. For voice communication, Long Term Evolution (LTE) provides secure, and high-quality voice services through seamless integration with the IP Multimedia Core Network Subsystem (IMS) services, that is, Voice over LTE (VoLTE).

The host operator and the service provider are the same. To access the VoLTE service, end users need to sign a VoLTE service contract with an operator. In turn, the operator establishes the VoLTE subscription of user in the comprehensive network, and charges for it. For existing end users, the former user experience and subscribed services, in addition to the VoLTE subscription, can be kept. For areas that the LTE network does not cover, the operator is still providing 2G/3G services.

To establish a VoLTE subscription in a combined network, a VoLTE subscription is provisioned in all the following networks:

- Centralized IMS network - providing the IP voice service
- Evolved Packet System (EPS)/LTE network - providing the IP accessing and bearing service
- 2G/3G network (optional) - providing the traditional Circuit Switched/Packet Switched (CS/PS) service for Single Radio Voice Call Continuity (SRVCC)

In this way, the voice service can be delivered to the end user over LTE, and also, in co-existence scenarios, over 2G/3G.

Ericsson™ Dynamic Activation (EDA) supports IMS Centralized Services (ICS) and provides an end-to-end VoLTE provisioning solution.

1.1 Purpose and Scope

The purpose of this document is to describe VoLTE provisioning, supported by Dynamic Activation, from a solution perspective.

The classic Monolithic solutions, Data Layered Architecture (DLA) and Cloud, are currently used for handling application user data and business logic. The network is realized by the corresponding architectures. Dynamic Activation supports all these network deployments for user service provisioning. For more information, see *Product Overview*, Reference [3].

This document focuses on VoLTE provisioning in DLA.



1.2 Target Group

The target group for this document is as follows:

- System Administrator
- Network Administrator
- System Integrator

For information about the different target groups, see *Library Overview*, Reference [1]

1.3 Typographic Conventions

Typographic conventions are described in *Library Overview*, Reference [1].

For information about abbreviations used throughout this document, see *Glossary of Terms and Acronyms*, Reference [2].

2 VoLTE Solution Overview

Dynamic Activation supports VoLTE provisioning. For normal provisioning, Dynamic Activation receives the order from BSS and executes it. For auto provisioning, Dynamic Activation receives the notification from Core Network, such as the CUDB notification triggered through HSS. And Dynamic Activation decides whether to provision the attached end user. If the decision is positive, Dynamic Activation executes it with the default service profiles and notifies BSS of the result.

Dynamic Activation offers off-the-shelf provisioning for standard applications, Designer Studio, and an Integrated Development Environment (IDE) for Customer Adaptations, whereby to realize an end-to-end VoLTE provisioning solution. The solution also provides service models implementation for VoLTE provisioning decision and execution.

The decision service model implements the VoLTE auto provisioning criteria. The VoLTE auto provisioning does not work in the following cases:

- The end user is VoLTE user already.
- The end user is doing IMSI changeover.



The decision service model makes basic decisions, call the execution with the default service profiles and notify BSS the result as template. Designer Studio and IDE provide a flexible framework and a Software Development Kit (SDK), allowing customers to extend the service model, for full support of the VoLTE auto provisioning criteria. For example, customer can extend the decisions to check whether the UE is VoLTE capable before the execution, and send the subscription request to UPG to automatically synchronize the supplementary service after the execution is successful.

The execution service model implements the VoLTE fundamental provisioning, orchestrating the corresponding:

- IMS subscription in Home Subscriber Server (HSS)
- IMS-based Multimedia Telephony (MMTel) subscription in Multimedia Telephony Application Server (MTAS)
- ENUM subscription in IPWorks
- EPS/LTE subscription in HSS
- Optional, EPC subscription in Service Aware Policy Controller (SAPC)
- Optional, 2G/3G subscription in the Home Location Register (HLR)
- Optional, VoLTE service data synchronization from HLR to MTAS

The execution service model initiates each subscription with the basic VoLTE features as template. Likewise customers can extend the service model, for full support of the VoLTE subscription features.

If VoLTE subscription data is inconsistent in the network, the execution service model also supports rollback.

For more information about Designer Studio, refer to *User Guide for Designer Studio*, Reference [4].

3 VoLTE Provisioning Architecture

The following figure depicts the support for VoLTE provisioning in the DLA. For detailed information about the BSS integration and NE configurations, refer to *OSS/BSS Integration Guide*, Reference [11] and *Configuration Manual for Resource Activation*, Reference [12].

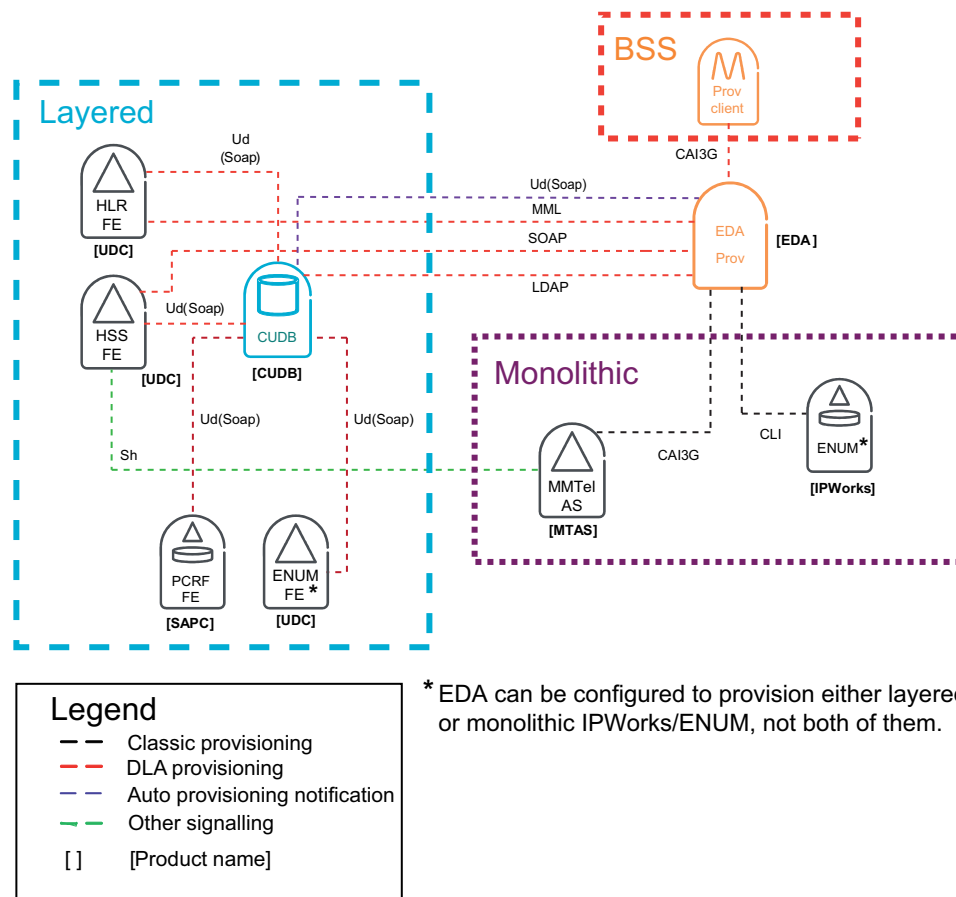


Figure 1 VoLTE Provisioning Architecture in DLA

- **BSS** - Initiates the provisioning request towards Dynamic Activation.
- **EDA** - A provisioning system that provides a single provisioning interface towards the Business Support System (BSS) and other entity, by hiding the complexities of provisioning multiple underlying Network Elements.
- **Layered Network Elements**

Includes:

- **CUDB** (13B or Later) - The Back-End database offered by the Ericsson realization of DLA, which decouples the user data storage from the application logic in the Front Ends (FEs).
- **HSS-FE** (14A or Later) - A real-time network element to support the network entities that are handling calls (sessions). It resides in the home domain of the operator. It provides support for user authentication, authorization, mobility management, roaming, charging, identification, and subscription management for IMS, EPC, and Wireless Local Area Network (WLAN) networks.



- **HLR-FE** (13B or Later) - A real-time network element that has a central role within the Global System for Mobile communication (GSM), General Packet Radio Service (GPRS), and Wideband CDMA (WCDMA) networks. It manages mobile subscriber profiles, subscriber location and subscriber activity, and handles the supplementary services.
 - **SAPC-FE** (14B or Later) - A central policy node that is responsible for network performance. It includes the functionality defined in the Policy and Charging Rules Function (PCRF), as described in the 3GPP standard, applies subscriber and service-centric policy control capabilities to mobile broadband, mobile IMS, SAE, and fixed deployments. The main policy types supported are related to Service Access Control, Quality of Service (QoS) control, and Charging Control.
 - **ENUM-FE** (16A or later) - A Telephone E.164 Number Mapping (ENUM) FE that has a central role for the DNS. It provides the resolution of the IMS-related domain names, the users private, and public addresses in the IMS network.
- **Monolithic Network Elements**

Includes:

 - **ENUM** (14B or Later) - A ENUM server that has a central role for the DNS. It provides the resolution of the IMS-related domain names, the users private, and public addresses in the IMS network.
 - **MTAS** (14B or Later) - An Application Server for the MMTel, which implements the standard multimedia telephony based on 3GPP IMS R6 with certain additions for 3GPP R7, Telecoms & Internet converged Services & Protocols for Advanced Networks (TISPAN).

4 VoLTE Provisioning Data Model

The following figures show the VoLTE provisioning data model in Centralized User Database (CUDB).

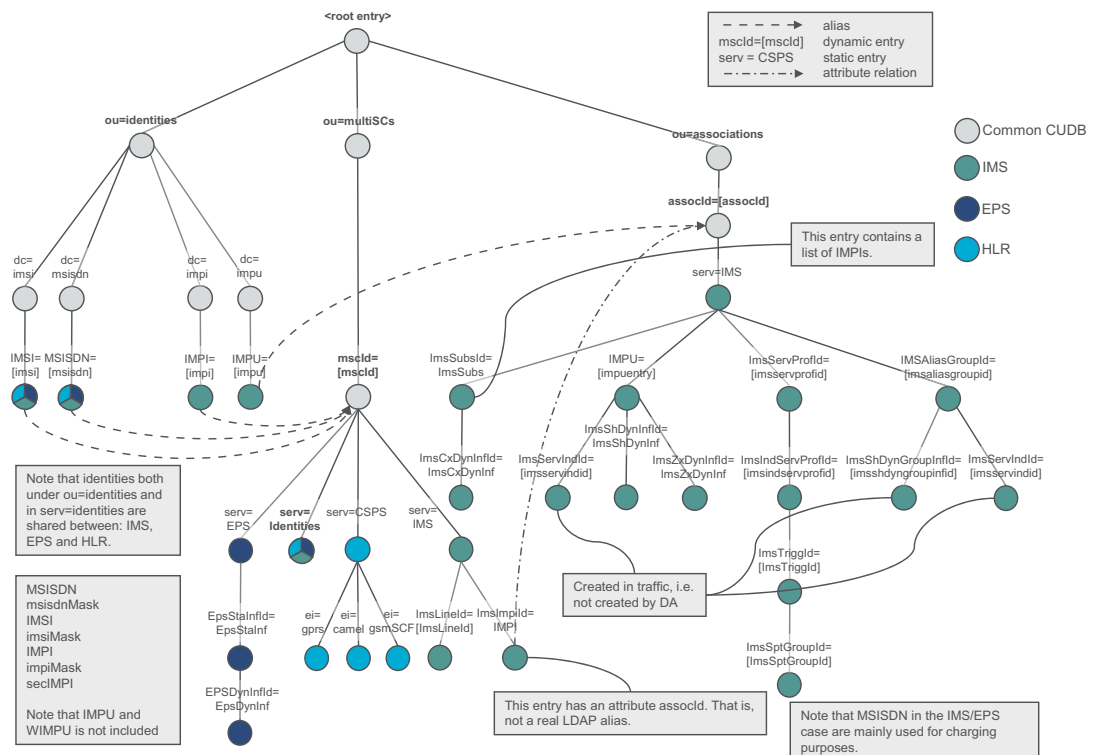


Figure 2 VoLTE Provisioning Data Model in CUDB (IMS/EPS/HLR)

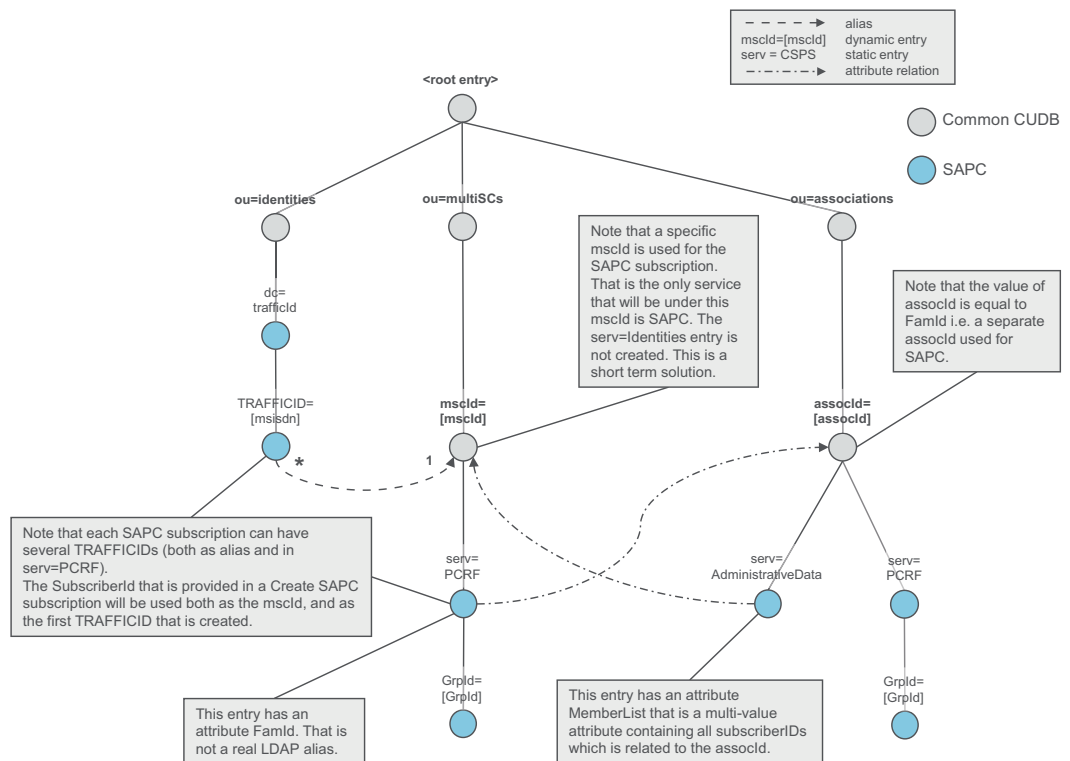


Figure 3 VoLTE Provisioning Data Model in CUDB (SAPC)

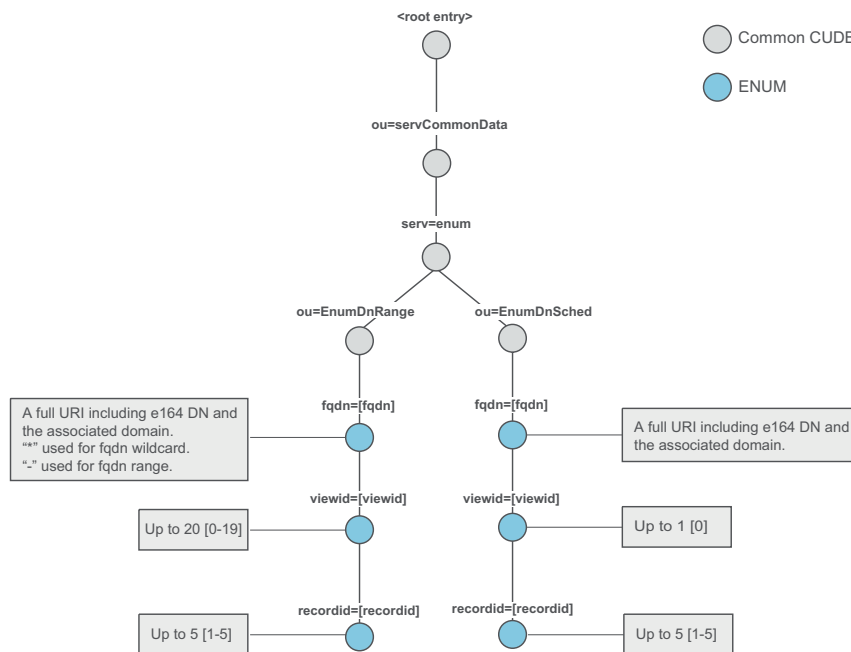


Figure 4 VoLTE Provisioning Data Model in CUDB (ENUM)

A VoLTE subscription is composed of several subscriptions in different functions of the system. Subscriptions are set up with corresponding functional Subscriber Data and consumed as services. Dynamic Activation provisions such Subscriber Data and consolidates these services in CUDB, as needed.

- An IMS subscription or association, which is also able to associate more than one user VoLTE subscription.
- A VoLTE subscription is required to consolidate the IMS, EPS/LTE, and CS/PS services in CUDB. This means that IMSI is required for the IMS service. For a new IMS user, it must be obtained through either IMPI implicitly derived from IMSI, or explicitly input. For an existing IMS user without IMSI, there are the following options:
 - set IMSI in the IMS Association before imitating a VoLTE subscription. For more information about IMS service, see *Layered IMS Provisioning over CAI/3G*, Reference [5].
 - upgrade IMS subscription to be VoLTE subscription, for more information, see Section 6.2.3 on page 13.
- A SAPC subscription is not consolidated with the other services in CUDB.
- An MMTel subscription, XML user documents containing resource configuration, is provisioned through MTAS/XDMS, owner of the MMTel subscription. It is stored in CUDB, through HSS-FE, as Sh transparent data.
- An ENUM subscription is stored in layered or monolithic IPWorks.

A VoLTE subscription needs to serve different VoLTE features, adapting to different customer preferences and deployment needs. The VoLTE provisioning solution intends to offer a VoLTE subscription with a basic service setup in each function. The function includes Service Profiles as individual Service Profiles, common Service Profiles including Authentication Profiles and Charging Profiles, and so on.

Note: VoLTE relevant common Service Profiles need to be either preconfigured or preprovisioned in the related functions. The VoLTE subscription referring to these common Service Profiles, acquire the contents from both the common Service Profile and the individual Service Profile. Individual Service Profile has higher priority and overrides the common properties of the common Service Profile.

In addition, the solution also offers the flexibility for customers to develop specific VoLTE features according to own needs. For example, the basic VoLTE subscription contains an MMTel common Service Profile. If a customer needs additional individual Subscriber Data, as for example, specific Supplementary Services, such extension is supported and easily performed. For more information about full MMTel subscription, see *MTAS Provisioning over CAI3G*, Reference [6].

For information about the basic VoLTE provisioning service model in each function, see *VoLTE Provisioning Customer Adaptation Guide*, Reference [7].

5 VoLTE Provisioning Interface

This section includes information about Notification, and the Northbound and Southbound provisioning interfaces used in the VoLTE provisioning solution.

5.1 Notification

The notification function is implemented through the CAI3G `Create` interface provided by Dynamic Activation for customers to trigger the VoLTE auto provisioning. The CAI3G request contains IMSI, MSISDN, IMPI identities, and so on, as the input. The successful response contains the IMSI, and the failed response contains the IMSI and error information.

Dynamic Activation also supports CUDB notification trigger for the VoLTE auto provisioning. CUDB notification contains IMSI identity as the input. Notification receiver converts the received CUDB notification to the CAI3G `Create` request.



For more information about CUDB notification, refer to CUDB SOAP Interwork Description.

Notification works in the asynchronous way.

5.2 Northbound Interface

The VoLTE provisioning Northbound Interface is over CAI3G. To support all potential VoLTE subscription features with a unified interface, it integrates the complete off-the-shelf application interfaces, including IMS/HSS, MMTel/MTAS, ENUM/IPWorks, EPS/HSS, SAPC, and HLR. From a VoLTE business abstraction point of view, the Northbound Interface is agnostic to the underlying network deployments. The fundamental Northbound Interface can be used by the BSS for the VoLTE normal provisioning. And it can also be triggered by the notification for the VoLTE auto provisioning.

The VoLTE execution service model implements the Northbound Interface and maps the northbound service model request to the southbound application commands, before the activation.

5.3 Southbound Interface

As shown in Figure 1, the VoLTE provisioning southbound interfaces are supported by the off-the-shelf applications.

6 VoLTE Provisioning Use Cases

To auto provision a VoLTE user, Dynamic Activation receives the notification; the decision service model makes decision, *Creates* the default service profiles through the execution service model, and notifies BSS of the result.

To set up a VoLTE user through the auto provisioning and normal provisioning, the VoLTE execution service model supports the *Create/Set/Get/Delete* VoLTE subscription operations. It also supports rollback, see Section 6.1 on page 11.

The execution service receives and validates the incoming CAI3G request, breaks it down into the standard sub-MO requests and starts the following out-of-the-box applications:

- 1 Centralized IMS/HSS



- 2 MMTel/MTAS
- 3 ENUM/IPWorks
- 4 EPS/HSS
- 5 SAPC

SAPC is optional. If there is no SAPC subscription for a VoLTE user, SAPC applies a default service profile for it.

- 6 HLR

HLR is optional. If an HLR request is received, provisioning of HLR is performed. This is depending on whether the operator supports ICS, in 2G/3G/4G network co-existence scenarios.

Note: For the `Create` operation, IMS must be created at first. Then MMTel, ENUM, and SAPC can be created in parallel. EPS and HLR must be created in sequence to prevent concurrent subscriber provisioning in CUDB.

For the `Set` operation, MMTel, ENUM, and SAPC can be set in parallel. IMS, EPS, and HLR must be set in sequence to prevent concurrent subscriber provisioning in CUDB.

For the `Get` operation, IMS must be retrieved first, whereby IMS response can obtain other applications identities. Other applications can be retrieved in parallel.

For the `Delete` operation, IMS must be deleted at last. This is because the `associationId` must be deleted at last, for loose-error-handling purposes. Other applications can be deleted in parallel.

The following includes typical VoLTE provisioning use cases. As previously mentioned, based on customer needs, the service is possible to be extended by Customer Adaptations (CAs). For detailed information, refer to *VoLTE Provisioning Customer Adaptation Guide*, Reference [7].

Attention!

Prerequisites:

Authentication profiles must have been preprovisioned in EPS or HLR. Define the following VoLTE relevant common Service Profiles in the related target, FE, or CUDB. For preconfigured common Service Profiles, see node-related configuration guides. For preprovisioned common Service Profiles, see related Dynamic Activation **Function Specifications**, and **Interface Specifications**.



- IMS Configured Service Profiles in HSS
- MMTel Service Profiles in MTAS
- Configured EPS Profiles in HSS
- Subscriber Groups in SAPC
- Subscriber, GPRS, and CAMEL Profiles in HLR

6.1 Rollback

For the `Create` and `Set` operations, if any provisioned applications fail, the previously successful ones are rolled back.

- For the `Create` operation, the `Delete` rollback applies.
- For the `Set` operation, the following rollback scenario applies:
 - On `Set-Set` operation, the `Set-Set` rollback with old value applies.
 - On `Set-Delete` operation, the `Set-Add` rollback with old value applies.
 - On `Set-Add` operation, the `Set-Delete` rollback applies.

Note: If the concerning NE does not support removal of attributes, the `Set-Delete` operation fails.

Regardless if the rollback is successful or not, the standard error response with specific error message is returned.

For standard error responses and messages, see:

- *Layered IMS Provisioning over CAI3G*, Reference [5].
- *MTAS Provisioning over CAI3G*, Reference [6].
- *IPWorks/ENUM Provisioning over CAI3G*, Reference [13].
- *Layered EPS Provisioning over CAI3G*, Reference [8].
- *SAPC Provisioning over CAI3G*, Reference [9].
- *CAI3G Interface Specification for HLR Components*, Reference [10].

For the `Delete` operation and rollback failure cases, the repair action is expected as follows:

- For the `Create` operation - delete the VoLTE subscription and create it again.
- For the `Set` operation - set the VoLTE subscription again.

- For the `Delete` operation - delete the VoLTE subscription again.

If any of the above suggestions fail, manual repair is needed.

6.2 Create a VoLTE Subscription

This section contains the operations for `Create` VoLTE subscription.

6.2.1 Auto Provisioning

Figure 5 shows the sequence of how to do the auto provisioning of a 4G user to a VoLTE user. For the execution of the VoLTE fundamental provisioning, see Section 6.2.3 on page 13. For detailed information about the decisions and default service profiles, refer to *VoLTE Provisioning Customer Adaptation Guide*, Reference [7].

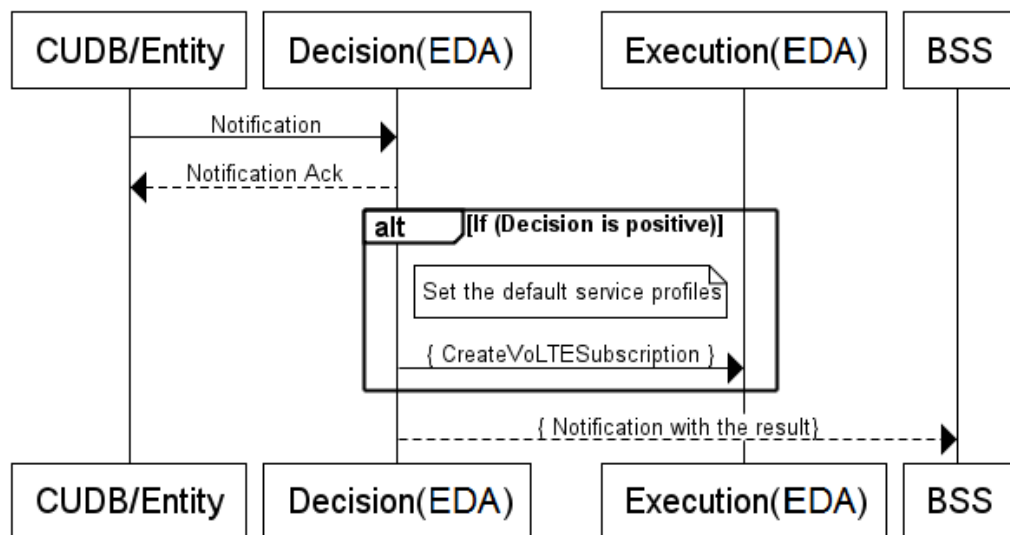


Figure 5 VoLTE Auto Provisioning Workflow

6.2.2 Initiate

Figure 6 shows the sequence of how a new VoLTE user with a new VoLTE subscription is initiated in IMS/HSS, MMTel/MTAS, ENUM/IPWorks, EPS/HSS, SAPC, and HLR, and how the service data is synchronized from HLR and MTAS.

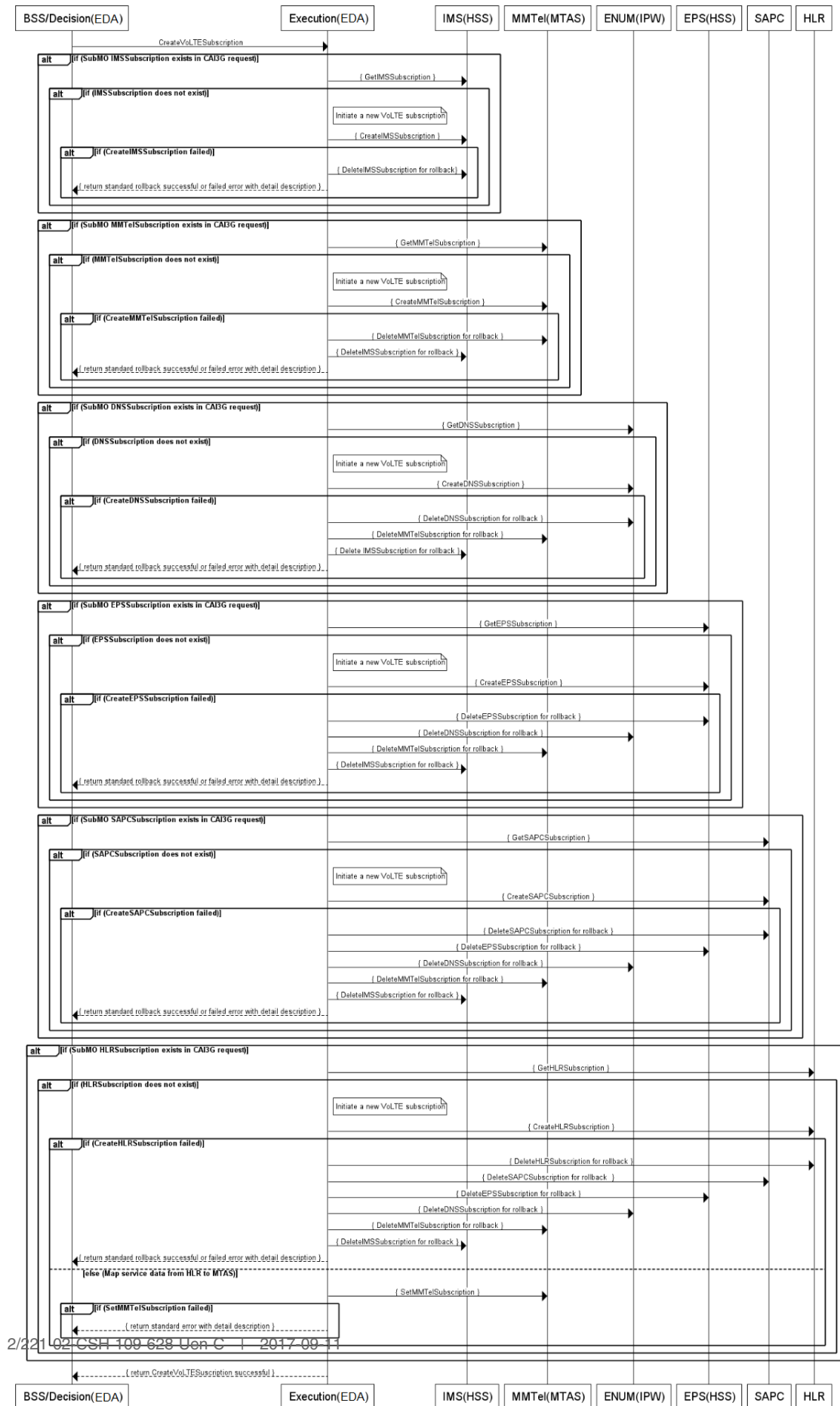




Figure 7 shows the sequence of how an existing 2G/3G/4G user is upgraded to a VoLTE user with a VoLTE subscription in IMS/HSS, MMTel/MTAS, ENUM/IPWorks, EPS/HSS, SAPC, and HLR, and how the service data is synchronized from HLR and MTAS.

Note: It is also possible to upgrade an existing IMS or SAPC user to a VoLTE user with VoLTE subscription.

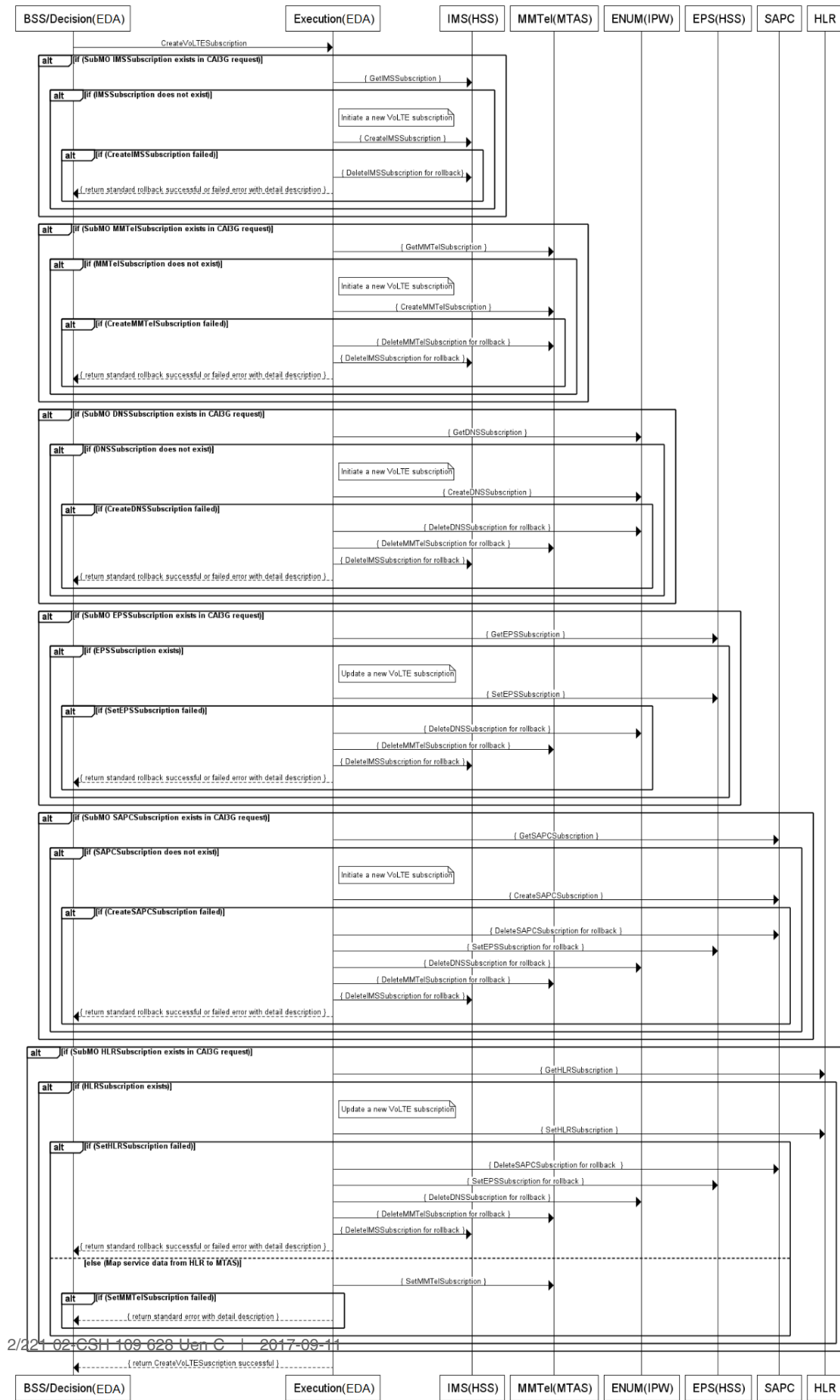


Figure 7 Upgrade VoLTE Subscription



the standard application errors are returned to the BSS. A `Create` of a new VoLTE subscription is needed.

Figure 8 shows the sequence of how a VoLTE subscription is `Set` to an existing VoLTE user.

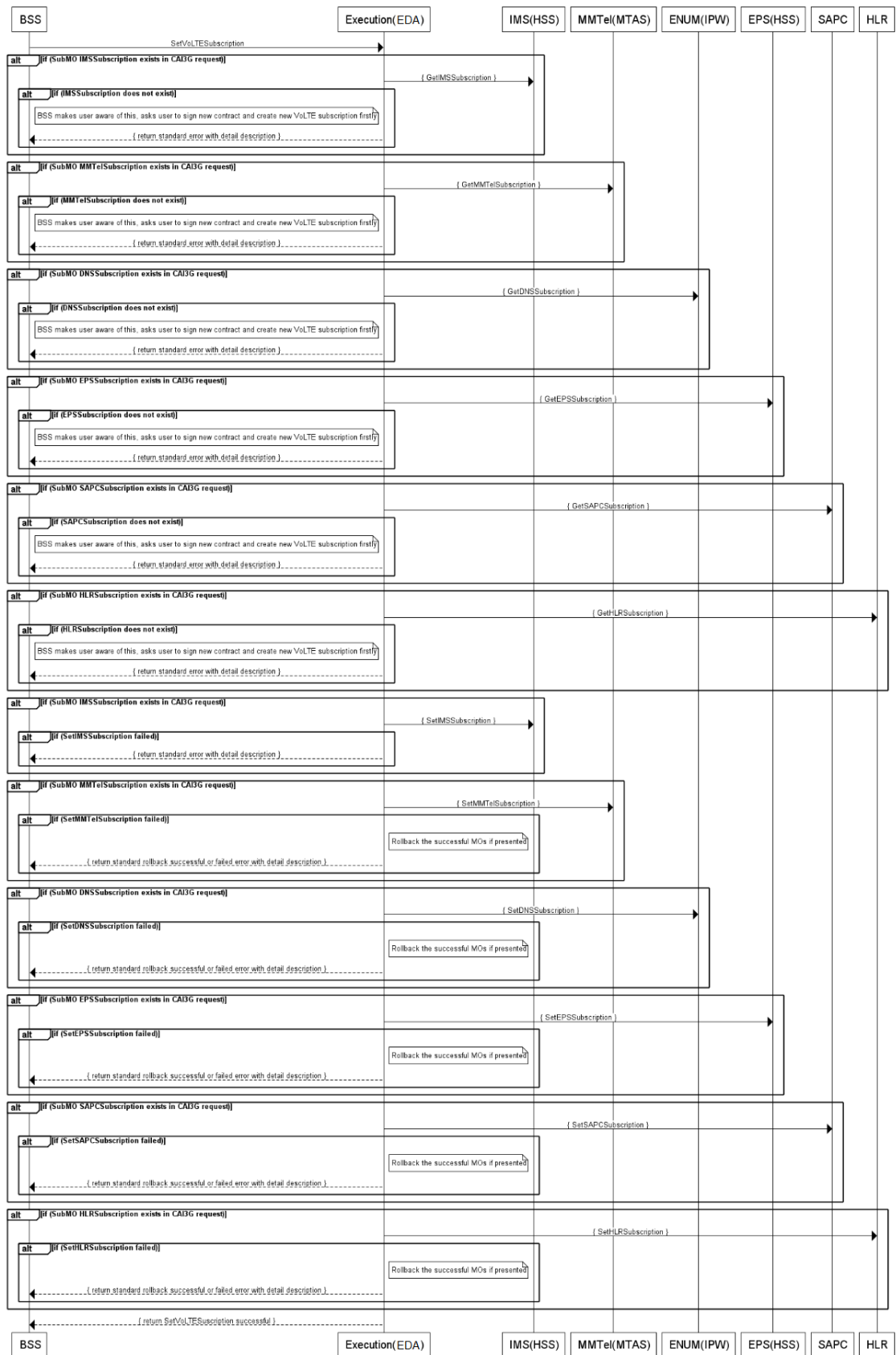


Figure 8 Set VoLTE Subscription

6.4 Get a VoLTE Subscription

If a VoLTE user, that should exist but, does not exist in any of the following nodes: IMS/HSS, MMTel/MTAS, ENUM/IPWorks, EPS/HSS, SAPC, or HLR, the standard application errors are returned to the BSS. Data inconsistency can occur, repair action is expected as mentioned in Section 6 on page 9.

If the VoLTE user is not an ICS user, which means the ICS flag in HLR is not set to 1, the VoLTE subscription will not include the HLR subscription.

Figure 9 shows the sequence of how the `Get` operation for an existing VoLTE user with VoLTE subscription is processed.

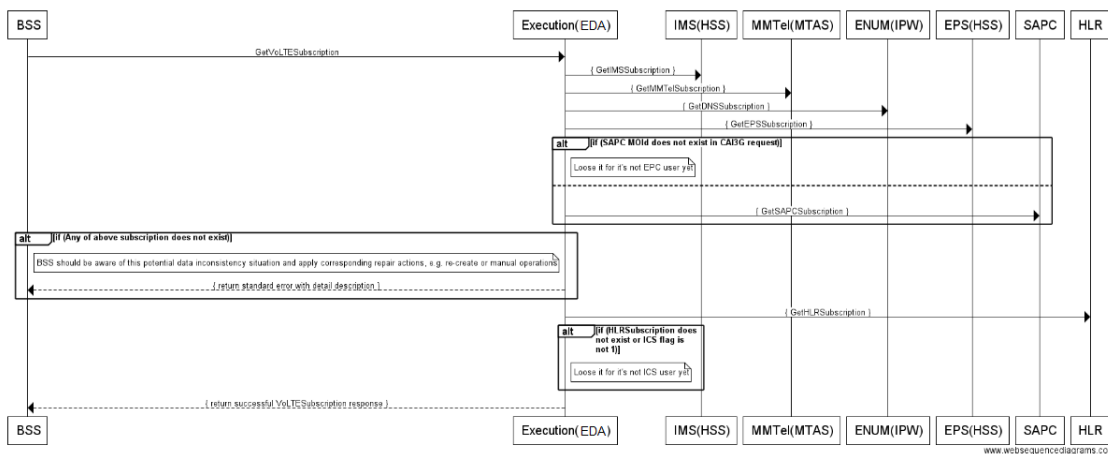


Figure 9 Get VoLTE Subscription

6.5 Delete a VoLTE Subscription

If a VoLTE user, that should exist but, does not exist in any of the following nodes: IMS (HSS), MMTel/MTAS, ENUM/IPWorks, EPS/HSS, SAPC, and HLR, the standard application errors are ignored and the operation is treated as a successful deletion.

If the VoLTE user is not an ICS user, which means the ICS flag in HLR is not set to 1, the HLR subscription is not deleted, and the end user can still use the 2G/3G service.

Figure 10 shows the sequence of how an existing VoLTE user with VoLTE subscription is deleted.

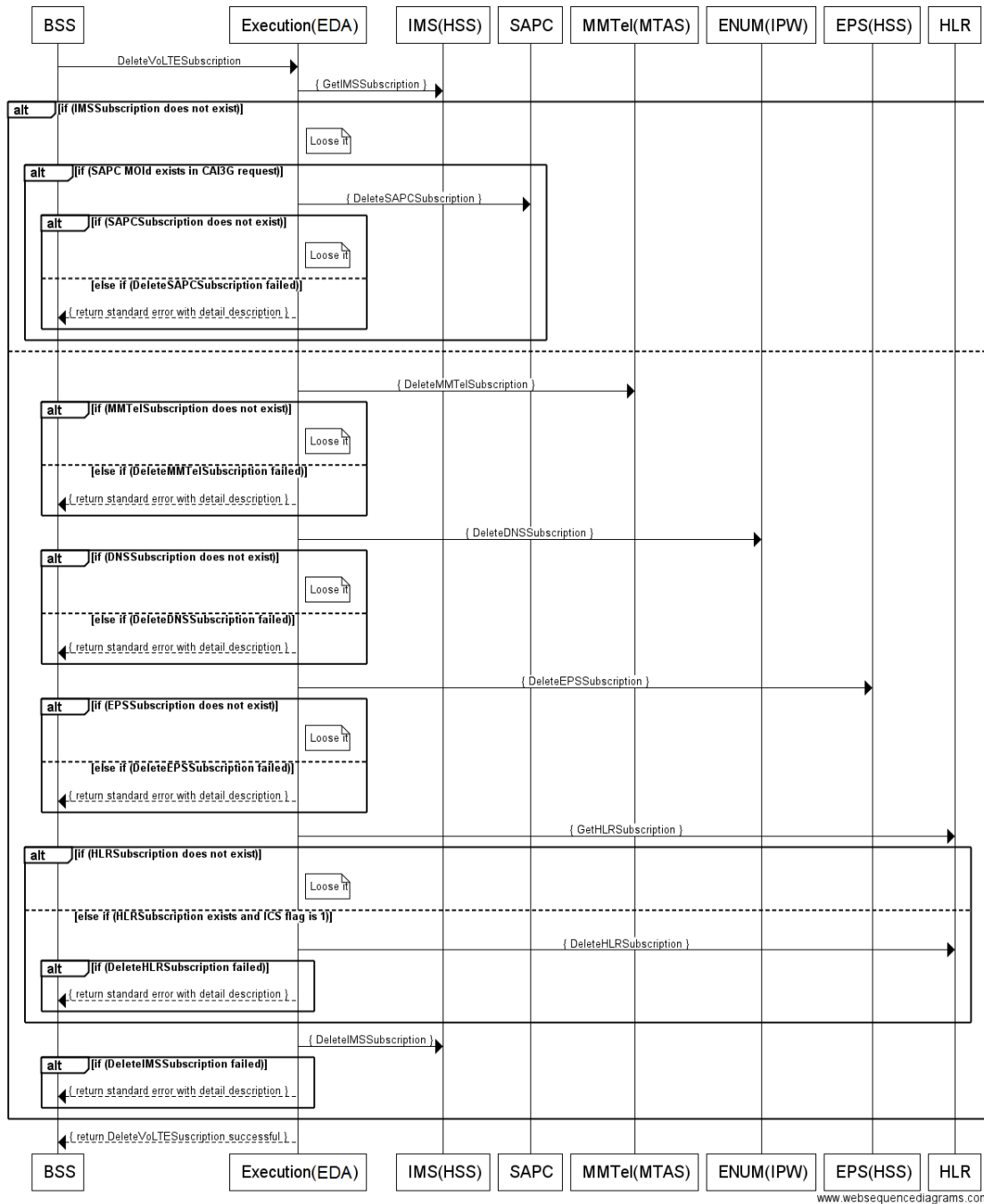


Figure 10 Delete VoLTE Subscription



7 Tools

The VoLTE provisioning solution is developed by Designer Studio and Dynamic Activation IDE, which implements the previously mentioned VoLTE service models, as templates. IDE, including the templates, and SDK, are delivered in the Customer Adaptation Package. Customers can use the template to develop Customer Adaptations for VoLTE. For more information about VoLTE service model templates, see *VoLTE Provisioning Customer Adaptation Guide*, Reference [7].

8 License

VoLTE service model templates belong to the Dynamic Activation Basic Packages. For VoLTE relevant off-the-shelf applications, see Dynamic Activation Value Packages in EDA Product Packaging Description.



Reference List

Library References

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