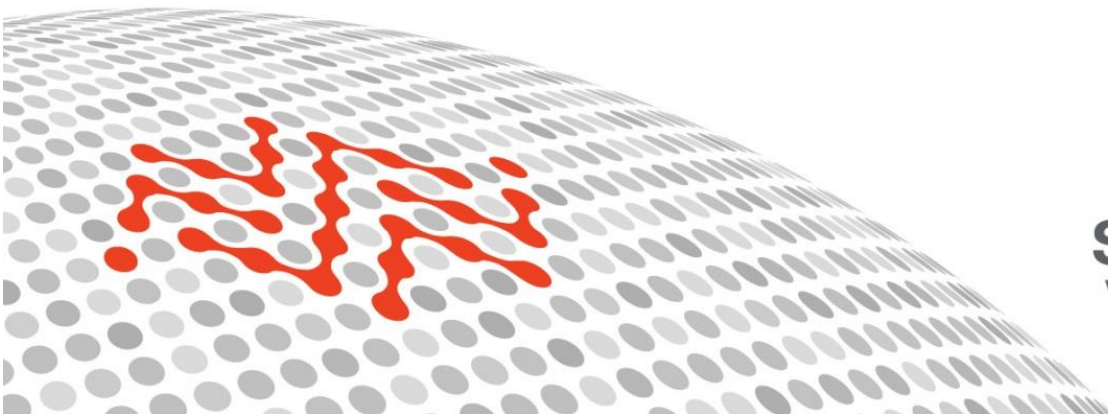




eCall Service API

Release 15.07 Beta



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OVERVIEW

This document describes Legato's eCall interface.

A manager for the InBand Modem is provided that complies with either PAN European eCall or Russian ERA GLONASS.

The eCall API is started in the mode specified in the Configuration tree settings.

The eCall API also provides functionality for reading emergency numbers from SIM and managing eCall Only mode.

Code Format Examples

REFERENCES LIST

- [1] Intelligent transport systems - ESafety - eCall high level application requirements (HLAP) using GSM/UMTS circuit switched networks
CEN - FprEN 16062:2014 E
- [2] Intelligent transport systems - ESafety - ECall minimum set of data
CEN - FprEN 15722:2014 E
- [3] Intelligent transport systems - ESafety - ECall end to end conformance testing
CEN - prEN 16454:2014 E
- [4] Intelligent transport systems - ESafety - Pan-European eCall operating requirements
CEN - FprEN 16072:2014 E
- [5] Global navigation satellite system ROAD ACCIDENT EMERGENCY RESPONSE SYSTEM
GOST R 54620-2011
- [6] eCall Data Transfer; In-band modem solution; General description
3GPP TS 26.267:

AUTOMATED ECALL

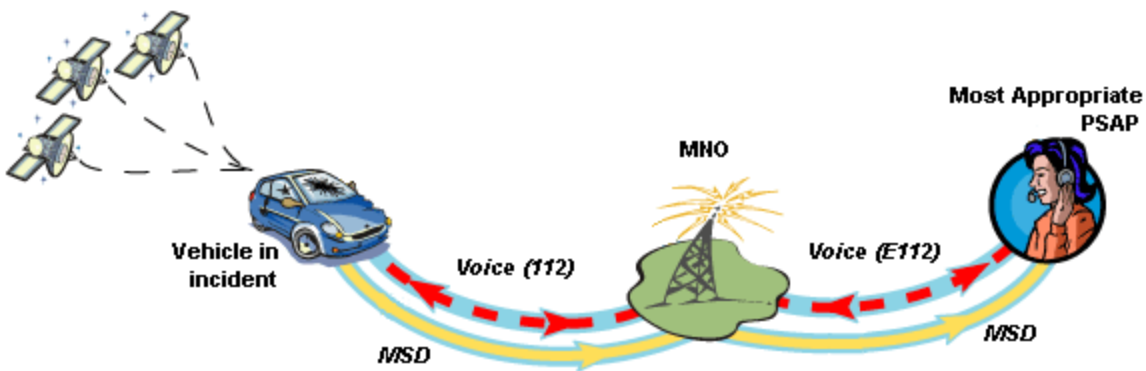
Overview

Normal emergency call has been around for a long time and is well established. A problem is that persons involved in car accidents are often unable to call the emergency operator.

If the vehicle could automatically launch an emergency call to the emergency operator and also transmit position and status of the vehicle many more lives could be saved.

An effort was launched to see what could be done.

The result was a modem, called InBand Modem, that uses the voice channel was developed and tested in collaboration with the concerned parties.



InBand Modem

The InBand Modem, is a modem that uses a normal voice connection to transfer data from the IVS to the PSAP. At the connection phase it is able to use different modulation, to be able to handle bad connections.

The code and behavior of the InBand Modem is standardized by 3GPP [6].

MSD

Minimum Set Data, MSD, is the data that should be collected and sent by the vehicle. It contains position and data about the vehicle and its passengers.

Please refer to Intelligent transport systems - ESafety - ECall minimum set of data

It is encoded into ANS.1 unaligned PER encoding and sent using the InBand Modem. Currently there exists a version 1 and 2 of the MSD.

Note that the MSD also contains an optional part in the end. As of writing only ERA GLONASS uses this part.

PSAP

The Public Safety Answering Point, PSAP, is the emergency operator. It also contains a InBand Modem and is able to receive a MSD.

The IVS normally sends the MSD automatically the first time the call is established. Once the IVS has tried to send the MSD, the call is unmuted, and there PSAP operator should be able to communicate with passengers in vehicle over the handsfree speaker system. No action is normally necessary from the passengers.

The PSAP operator is able to request new MSD from the IVS during a call.

IVS

The In Vehicle System (IVS) is all that is in the vehicle. It is the part responsible for gathering information, establishing the eCall and handling audio and speakersystem.

The call can be triggered automatically or manually. It is also responsible for conforming with the audio requirements for mute and unmute during the InBand Modem activities.

PAN European eCall

The EU launched an effort to introduce automate emergency call in all vehicles sold within the European Union, it resulted in a standard, referred to as PAN European eCall.

The standard covers redial behavior and more, please refer to the following documents for more information [1][2][3][4].

ERA GLONASS

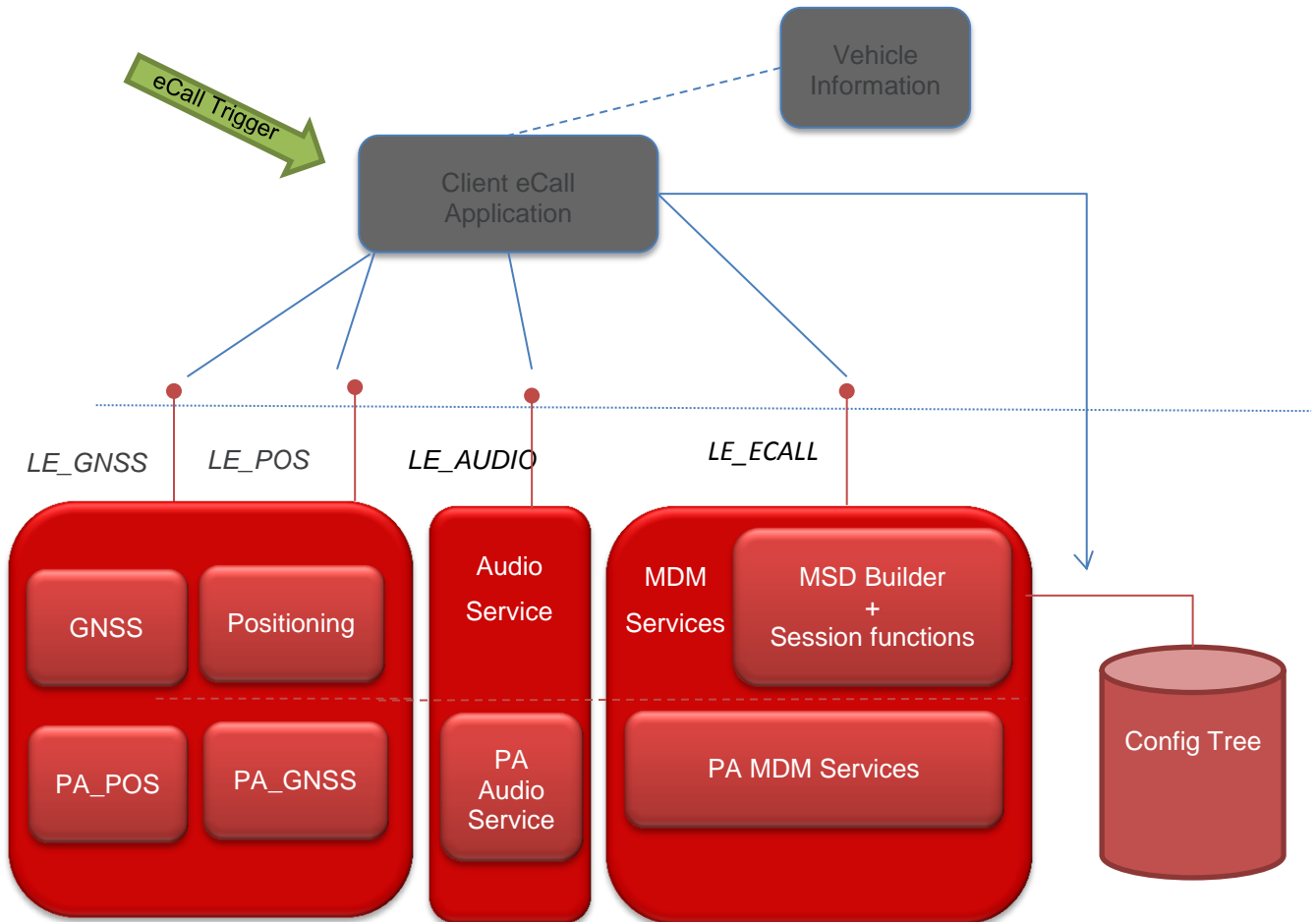
Russia, neighboring the EU, decided to also develop a compatible version of automated eCall, called ERA GLONASS. As the names gives, the ERA GLONASS solution mandates that the GNSS receiver used must support GLONASS.

The standard covers redial behavior, which differs from PAN EU, and more, please refer to the following GOST document for more information [5].

LEGATO eCALL API

The Legato eCall solution offers a eCall solution that is compatible with either PAN European eCall or ERA GLONASS. The desired one is set a initialization.

The Legato system in overview is as follows.



What le_eCall Does

The Legato eCall API handles:

- The call and retries
- InBand Modem
- MSD encoding
- eCall Only mode
- Reads Test and Reconfiguration from SIM

The service tries to establish the call and handles redials according to standards if the call attempt fails.

It runs the underlying InBand Modem and tries to send the MSD.

It handles the eCall Only Mode behavior during the call.

eCall Only Mode is when the unit does not register at startup, but only when the call is initiated. It also stays registered after a call, allowing PSAP callback, in accordance to specifications.

eCall Only Mode

In eCall Only mode, the IVS does not register to the network beforehand, thus not giving any burden to the network. It does however listen to cells to be prepared for make an eCall.

To allow callback after an eCall, it is stated that the IVS should stay camped on the network minimum 1 hour (T9) and maximally 12 hours (T10).

The LE_ECALL component offers interfaces for the Client Application to handle this, please refer to *le_ecall_ForceOnlyMode* and *le_ecall_ForcePersistentOnlyMode* for more information.

Redial Mechanism

When a call is cut the IVS might do a redial depending on several aspects.
This part describes how the redial works for the two standards.

ERA GLONASS redialing

ERA GLONASS has a restriction in the specification of either 10 tries or 5 minutes, whatever comes first. These default values can be changed via *SetEraGlonassManualDialAttempts*, *SetEraGlonassAutoDialAttempts* and *SetEraGlonassDialDuration*.

This is implemented as follows.

Each time a call is started a DIAL_DURATION timer, per default 5 minute, is also started. When a call fails, it counts as one try. If the timer expires before the call is connected then the redialing is over, regardless if there is tries left.

If more than a times have passed, default is 10, then it will stop redialing, regardless if it took less than 5 minutes.

To not exhaust the 10 times in cause of bad radio, the retries are spaced out in time. The default is a 30 seconds interval between each start of each call attempt. It can be changed via *le_ecall_SetIntervalBetweenDialAttempts*.

If a call attempt takes longer than 30 seconds before failing, it will start directly after 1 second.

If a call is connected and then fails, the timer of 5 minutes is restarted, but the counter is not. So if it took 6 tries to connect the first call, it will only be 4 retries left if it the call fails.

PAN EU redialing

The PAN European [1] redialing is differently restricted. Before the call is connected the first time, there is no formal restriction to the number of retries. In this case it is up to the application to implement eventual limits.

But if a call has been connected once before, and the MSD has not yet been sent, it has 120 seconds to reconnect the call. The 120 seconds are counted from the time the connected call was disconnected.

This is because a PAN European eCall PSAP should call back after 3 minutes.

If the MSD has been successfully sent, there will be no redials from the IVS if the call is disconnected.

The retries are spaced out in time. The default is a 30 seconds interval between each start of each call attempt. It can be changed via *le_ecall_SetIntervalBetweenDialAttempts*.

If a call attempt takes longer than 30 seconds before failing, it will start directly after 1 second.

State Machine and Events

The LE_ECALL component does not expose any internal state machine. It does however expose the following events that indicates what is happening.

Event name	Comment	InBand Modem active after event?
LE_ECALL_STATE_STARTED	eCall session started.	Yes
LE_ECALL_STATE_CONNECTED	Emergency call is established.	Yes
LE_ECALL_STATE_DISCONNECTED	Emergency call is disconnected.	No
LE_ECALL_STATE_WAITING_PSAP_START_IND	Waiting for PSAP start indication.	Yes
LE_ECALL_STATE_MSD_TX_STARTED	MSD transmission is started.	Yes
LE_ECALL_STATE_LLACK_RECEIVED	LL-NACK received.	Yes
LE_ECALL_STATE_LLACK_RECEIVED	LL-ACK received.	Yes
LE_ECALL_STATE_MSD_TX_COMPLETED	MSD transmission is complete.	Yes
LE_ECALL_STATE_MSD_TX_FAILED	MSD transmission has failed.	Yes
LE_ECALL_STATE_ALACK_RECEIVED_POSITIVE	AL-ACK received.	Yes
LE_ECALL_STATE_ALACK_RECEIVED_CLEAR_DOWN	AL-ACK clear-down received.	Yes
LE_ECALL_STATE_STOPPED	eCall session has been stopped by the PSAP.	No
LE_ECALL_STATE_RESET	eCall session has lost synchronization.	Yes
LE_ECALL_STATE_COMPLETED	eCall session completed. The modem successfully completed the MSD transmission and received two AL-ACKs (positive). Can now switch to voice path.	No
LE_ECALL_STATE_FAILED	Unsuccessful eCall session.	No
LE_ECALL_STATE_END_OF_REDIAL_PERIOD	End of the redial period.	No

InBand Modem Timer Values

In the InBand Modem there is a number of timer running on the IVS side. This describes their default values and if they are handled by the LE_ECALL component.

Name	Description	Default Value	Handled by LE_ECALL
T1	Manually initiated eCall (MleC) false triggering cancellation period.	-	No
T2	IVS Call Cleardown Fallback Timer (CCFT)	3600 s (1h)	Yes
T3	IVS INITIATION signal duration	2 s	Yes
T5	IVS wait for SEND MSD period	5 s	Yes
T6	IVS wait for AL-ACK period	5 s	Yes
T7	IVS MSD maximum transmission time	20s	Yes
T9	IVS NAD minimum network registration period. See T10.	3600s	No
T10	IVS NAD network 'Deregistration Fallback Timer' (DFT). Is only applicable to eCall Only mode.	12h	Yes

CLIENT APPLICATION

The client eCall application is responsible for a number of things, some of the main points are

- Initiating the eCall
- Driving the GNSS and saving positions.
- Gathering vehicle info and setting MSD
- Handling Audio
 - Playing audio prompt
 - mute/unmute
 - Speaker and microphone.

The client application detects the eCall trigger and initiates the eCall.

It drives the GNSS and should have a position, both present and optionally pasted, ready when the eCall is triggered. Note that ERA GLONASS mandates that the GNSS supports GLONASS.

It also continuously gather information about the vehicle and sets the data for the MSD.

The Client application is also responsible for audio handling.

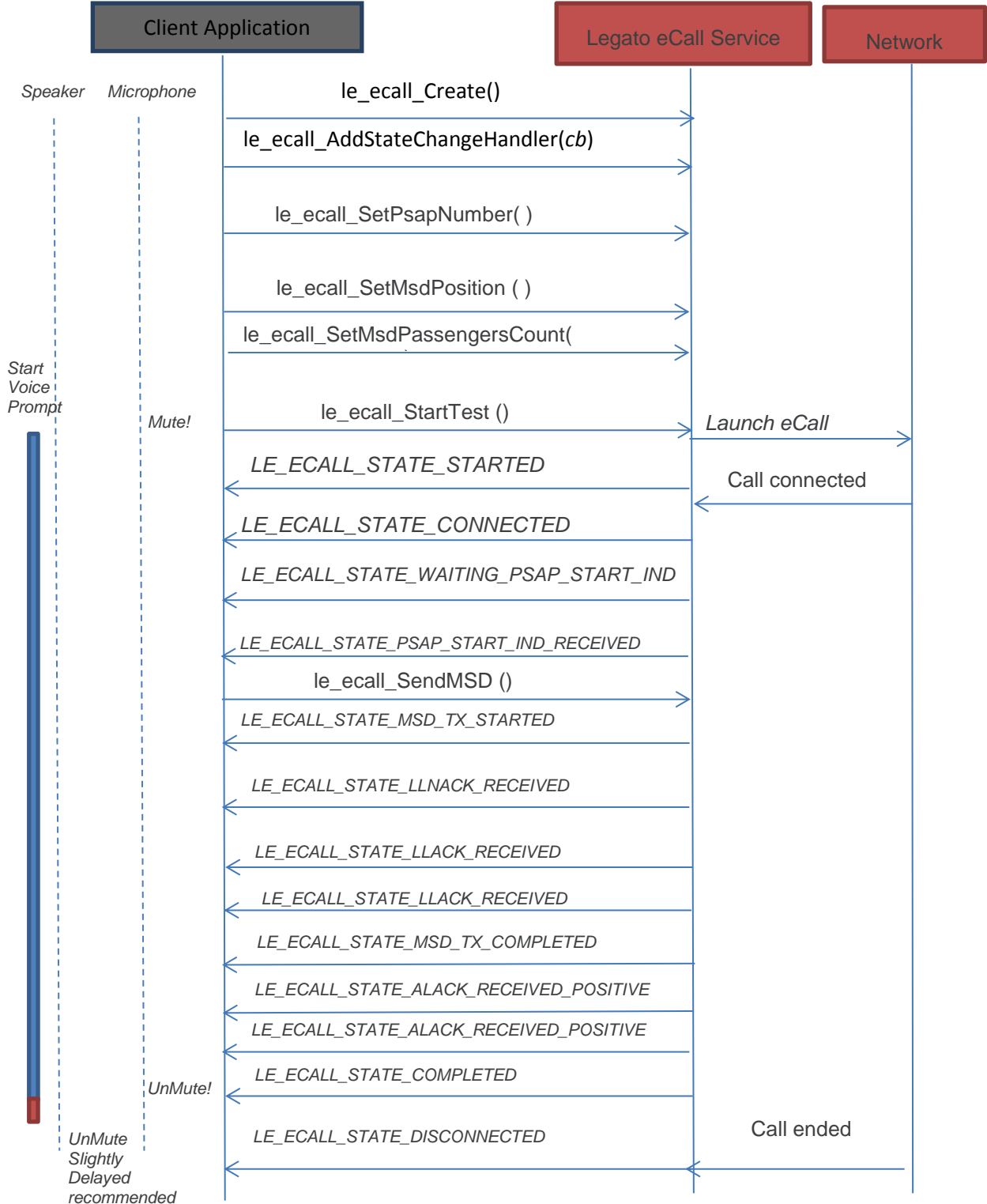
The audio handling should be synchronized with the MSD sending. It is recommended to mute the audio of the call when the eCall is triggered, until such a time that the Legato eCall Service reports that the MSD sending phase is over.

During this time an audio prompt should be played giving the passengers in the vehicle an indication of what is happening over the speaker system.

Please refer to the respective standard documents for exact details.

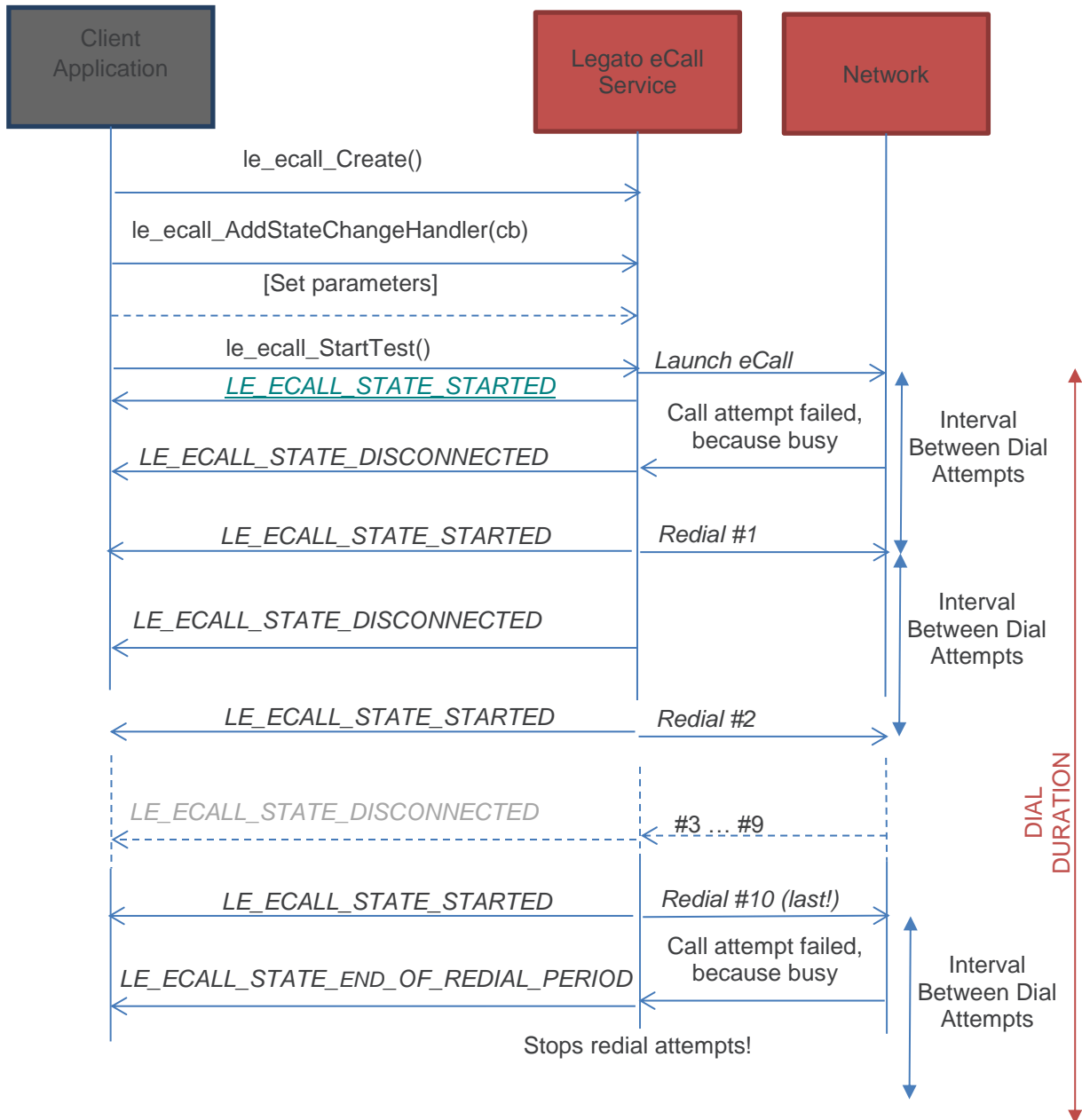
Starting eCall to a test PSAP Server

To avoid real emergency calls during tests, it's important and useful to override the PSAP number. Note that the mute and unmute is up to the client application to fine tune. The timing for doing this has been illustrated in the diagram below. Note that the unmute of the speaker is recommended to be slightly delayed to avoid noise.



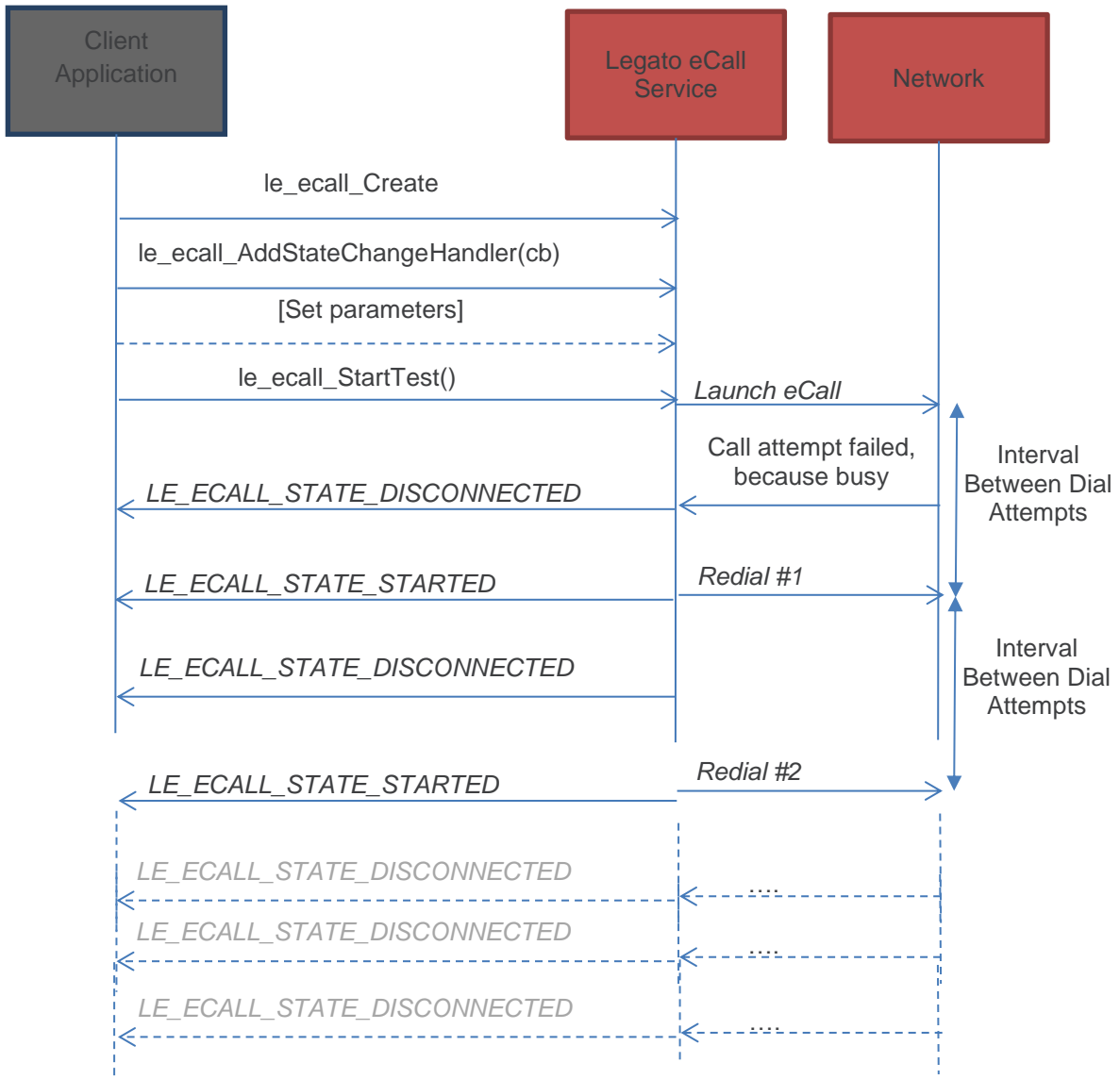
ER GLONASS eCall and Call Fails

This simulates that a call in ERA GLONASS mode that is being made and the call fails due to busy. The IVS the redials by default, 10x within the 5 min limit, with each redial spaced out in intervals of 30s.



PAN EU eCall and Call Fails

This simulates that a call in PAN EU mode that is being made and the call fails without ever connecting. The Legato eCall Service redials until connected or action is stopped by Client Application.



PAN EU eCall Connects then Fails

This simulates that a call in PAN EU mode that connects and then fails. The Legato eCall Service then redials during maximally 120s from the call disconnected. Interval Between Dial Attempts is set to a big value just for this demonstration.

If the call would reconnect and then drop, then the 120s timer would restart.

