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April 12, 2018

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Recommended Citation

JHM, Thippeswamy, "Seamless Traffic preemption for emergency vehicles using USSD services with SET Triggers", Technical Disclosure Commons, (April 12, 2018)
https://www.tdcommons.org/dpubs_series/1166



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Seamless Traffic preemption for emergency vehicles using USSD services with SET Triggers

Abstract

This paper attempts to explore a method and system for providing a solution for preemption of the traffic for Emergency vehicles such as ambulance, Fire service and VIP vehicles using SUPL enabled terminals (SET) using Unstructured Supplementary Services.

Problem statement

Following are the disadvantages with the current vehicular preemption device methods

1. Manual control: Disadvantage is Manual intervention required.
2. Localised Radio signal: The major drawback of radio-based traffic signal preemption systems is the possibility of interference from other devices that may be using the same frequency at a given time and location.
3. Line of sight : Drawbacks of line-of-sight systems include obstructions, lighting and atmospheric conditions, and undesired activations. Obstructions may be buildings on a curving road that block visual contact with a traffic signal until very close, or perhaps a large freight truck in front of a police car blocking the traffic signal from receiving the emitter's signal from the police car.
4. GPS method : In dense cities with tall buildings, GPS receivers may have difficulty obtaining the four required GPS satellite signals, required for [trilateration](#) to determine location
5. Acoustic : A major disadvantage is that sound waves can easily be reflected by buildings or other large vehicles present at or near an intersection, causing the "reflected" wave to trigger a preemption event in the wrong direction.

Our solution

Our solution is Traffic preemption

Activtate/Deactivate Traffic preemption trigger can be made automatically, i.e. without manual intervention in the following scenarios.

- Send the USSD *`<activate traffic preemption>`# command to activate preemption from the device when the Emergency Vehicle enters to the intended geographical area.
- Send USSD *`<Deactivate traffic preemption>`# command when the Emergency Vehicle leaves the intended geographical area.

USSD message will be received by the HLR and HLR will send it to USSD GW, which in turn will send the appropriate traffic system, where the emergency vehicle is entering or exiting as mentioned in Fig1 and Fig2 below.

The proposed solution is to harness the SUPL triggering functions (STF) provided as from SUPL2.0 architecture. (SUPL 3.0 is latest). The SUPL Triggering Function is the function of communicating periodic and event based triggers between the SLP and the SET and evaluating when those trigger conditions have been fulfilled.

Since the SUPL2.0 provided triggers is the mechanism to obtain the location of the handset, the expectation would be the handset has to be a SUPL enabled terminal (SET). SET Initiated Area Event triggers will provide the location of the SET as and when the SET moves into a fence. Trigger criteria will be entering the target geographical area (ex. Some library area or some auditorium in an university).

The “Entering” and “Exiting” trigger types both mean the SET should report as soon as it detects that it is inside/outside the target area. Whenever the SET sends a report, it must wait for the minimum reporting interval before checking if the trigger condition is fulfilled again. A provisioning tool will provide the various geographical targets that will be treated as “Entering triggers”. The SET user shall have defined different profiles based on the geographical location co-ordinates.

Each time the SET area event trigger identifies that the SET has “Entered” into a particular geofence (. A geofence is a small geographic area that is defined to generate a location event as soon as a user enters or leaves this geofence and to process this event in the context of Location Based Server), the call activation/deactivation shall be made accordingly.

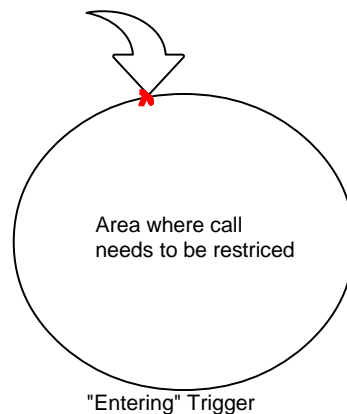


Figure – 1

Illustration of area based triggers in entering a geopos fence.



Figure – 2
Illustration of area based triggers in leaving a geopos fence.

Use cases

- No manual intervention.
- No interference from other devices.
- Advantages of USSD
 1. USSD provides cost effective messaging worldwide.
 2. USSD allows messages to take place during a call.
 3. USSD is much faster than other messaging options, as it is session based – always having an active connection.
 4. USSD is not mobile software or SIM based. i.e. it can run without both. Just requiring a connection to the the GSM network.
- Using area event triggers provided by SUPL2.0/3.0 architecture.
- Solution caters to LTE devices.
- More accurate since this solution provides precise position compared to GPS (Most of the available solutions are time based or GPS location based).

Evidence the solution works

Area based triggers will be supported by the SUPL stack on the SET, the proposed application will make use of established trigger mechanism. And Unstructured Supplementary services in GSM network already supported feature in HLR/HSS of Hewlett Packard Enterprise.

Competitive approaches

Our solution would be a state-of-art approach for the LTE. Additionally, the since triggers are originated from the mobile device without user intervention, this solution has the uniqueness of eliminating manual intervention.

Current status

HP HLR is deployed in the customer site , supports the Unstructured supplementary service .This is theorized version of the proposed solution.

Next steps

Next would involve having POC and simulation with a SET.

References

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Abbreviations

LBS	Location Based Server
LTE	Long Term Evolution
POC	Proof of Concept
SIM	Subscriber Identity Module
SET	SUPL Enabled Terminal
STF	SUPL Triggering Function
SLP	SUPL Location Platform
SUPL	Secure User Plane Location
MAP	Mobile application Part
HLR	Home Location Register

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