Multi-agency and multi-deployment mission critical communications and dynamic service scaling in 5G-EPICENTRE project

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***Abstract*—The telecommunications segment development within the Public Protection and Disaster Relief (PPDR) is essential to give response to the day-to-day challenges that first-responders have to face in terms of high-demanding operational conditions. In this context, 5G-EPICENTRE project´s goal is, by means of an open-standard, innovative and interoperable end-to-end 5G experimentation ecosystem, to ensure that diverse first-party experimentation activities are capable to give response to diverse PPDR operational scenarios. Among the various use cases under 5G-EPICENTRE this paper covers the inter-agency communications for emergency services as a response to the current impossibility of first-responders to easily communicate with their peers using their common communication framework. To that end, the use case ensures 3GPP-compliant mission critical service (MCS) communication framework in which both agencies can not only coordinate their teams but provide a common coordination that could allow communication involving both agencies together in a seamless way for the first-responders in the field. Besides, the use case clearly targets service and organizational KPIs that range from alarm triggering delay, scaling or instance moving time between different point of presence to the actual creation delay of the merged talkgroup between first-responder agencies.**

I. Use case description

The use case called "Multi-agency and multi-deployment mission critical communications and dynamic service scaling" aims at providing a common coordination between first responders agencies in an emergency scenario for 3GPP Mission Critical communications (MCPTT for voice, MCData for data exchange and MCVideo for video call delivery). Taking advantage of the 5G-EPICENTRE testing platform and infrastructure, this use case will consider the provision of the mission critical service in a dynamic multi point-of-presence (PoP) manner. To do so, it will make use of the intrinsic monitoring and alarm system in 5G-EPICENTRE. As an additional improvement feature, via geo-localization tools, it will be possible to reduce the service delivery times to first-responders in the field deploying the service closer to the PPDR agency action point through available edge deployments. Nemergent Solutions will provide necessary Mission Critical Services which will fit together with 5G-EPICENTRE testbed to create a PPDR service testing framework focused on multi-agency 3GPP standardized Mission Critical Services (MCS) communications.

From an end-to-end point of view, the network elements identified in the experiment conduction are the following:

- The UEs for each first-responders participating in the use case equipped with the Nemergent MCS Android Client.
- Same RAN access, 5G cells and antennas zone where the simulated emergency event will take place.
- The 5G Core hosting all the necessary network services.
- The MCS Application Servers and management servers.

Also, from a services management point of view the elements that will be needed are:

- The experiment lifecycle management support.
- The orchestration system providing management and operation of network services instantiation and network slice creation across technological domains.
- The monitoring system: involving alarm and detection to notify variations from the expected KPI.

II. Deployment scenarios

A. MCS coordination between first-responders

The first scenario targets a common coordination between first-responders, each one from a different agency or authority with its own mission critical service, providing an interconnection "MCS Control" Virtual Network Function (VNF)/Container Network Function (CNF) that will seamlessly facilitate merged and temporary talk groups for the various agencies involved during the time the emergency event takes place. Both first-responders or authorities will have co-localised agents or members on the field, and when the experiment is launched, each respective MC instance will be launched. End to end slicing will be considered in order to allocate the necessary resources across the network and to guarantee a specific QoS for the Mission Critical flows.

B. MCS coordination between first-responders based on geo-localization

The second scenario, as an enhanced first scenario, will, via 5G gNB geo-localization mechanisms and/or MC GPS-based localization reports, make an Edge Mission Critical and 5G Core services instantiation, close to the emergency event, in order to adjust and improve the latency of the first-responders attending the emergency event localization and preventing any additional coordination delay.

Both first-responders or authorities will have co-localised agents or members on the field , and when the experiment is launched each one of the mission critical services will be

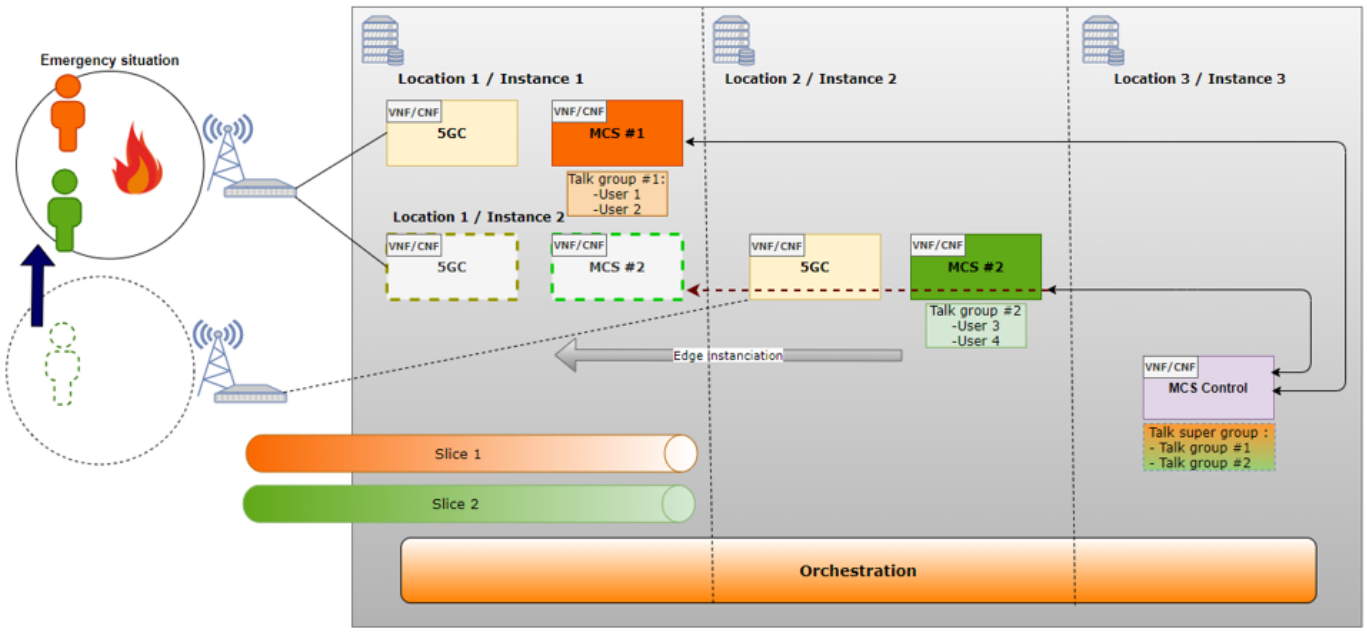

Fig. 1. MCS coordination between first-responders based on geo-localization.

launched. Considering that service instances related to each first-responder agencies are deployed in different locations and that the field location is divided into working areas that are directly related to the most adequate serving PoP, this scenario will re-instantiate one of the instances to co-locate the MCS instances in the same PoP, and therefore, resemble the first-responder location so that the most efficient service could be provided. This is, since we start with disperse instances deployment, the scenario implies re-instantiation to co-locate MCS #1 and MCS #2 in the service side and map directly to the physical position of the authority members or the first-responders.

End to end slicing will be considered to allocate the necessary resources across the network and to guarantee a specific QoS for the Mission Critical flows. Resources' re-allocation will be also considered to accommodate the new instances in their new PoP and virtualized infrastructures.

III. Conclusions

Facing the numerous emergency situations that spontaneously may occur in a worldwide context, mission critical communications and the coordination between diverse first-responders and agencies are vital to give common assistance in a quick and reliable way. The purpose of the above-described use case is to help settling the basis for seamless coordination between PPDR agencies considering improvement points like the location of the first-responders in the field and the possibility of deploying the service as close as possible to the human resources. In the course of the experimentation, and by means of 5G-EPICENTRE platform enabling cloud-native 5G implementations, some key KPI related to availability, latency, alarm triggering and merged communication groups creation time will be measured and evaluated in order to assess the already taken steps and the way forward in this field.