Use Case #1

Multimedia MC Communication and Collaboration Platform

Overview and Objectives

ADS utilized the 5G-EPICENTRE platform to experiment with its Multimedia Communication and Collaboration Platform (server/client components) and integrated them with the architectures, innovations and devices developed within the project. In this UC, the main services provided to first responders in the field and in the control room will leverage the broadband connection, including: MCPTT, real-time voice group communication and private communication; MC Data, real-time and non-real-time data group communication; MC Video, real-time video group communication and private communication. Access to built-in services, e.g. rich multimedia content, voice, messaging, video, map & tactical situation will be provided by the ADS MC Services application. The goal is to demonstrate the benefit of the novel concepts proposed in the project for the selected PPDR services and application.

Use Case Description

UC1 (Multimedia MC Communication and Collaboration Platform) will support the following sub-use cases:

- PPDR mobile users and dispatchers will be able to experiment with Mission Critical Services (MCS) applications enabling the following functionalities:
  - Group and individual voice calls;
  - Group and individual messaging;
  - Group and individual multimedia messaging;
  - Individual video calls;
  - Emergency calls; and
  - Location and map services.
- Applications developers will be able to integrate their solution with the Airbus MCS enabling the same functionalities as listed above. This will be done via Application Programming Interface (API) methods.
- Video device providers (such as fixed, wearable, and drone cameras) will be able to send video streams coming from their devices to MCS clients (both mobile and dispatcher). This will be done either:
  - via network protocols for establishing and controlling media sessions and for delivering media
  - or via MCS APIs
- PPDR mobile users and dispatchers will be able to experiment with Mission Management mobile and desktop applications enabling the tactical situation information exchange (resources detail and positions, drawing, documents and instant messages).

This project has received funding from the European Union's Horizon 2020 Innovation Action programme under Grant Agreement No 101016521.

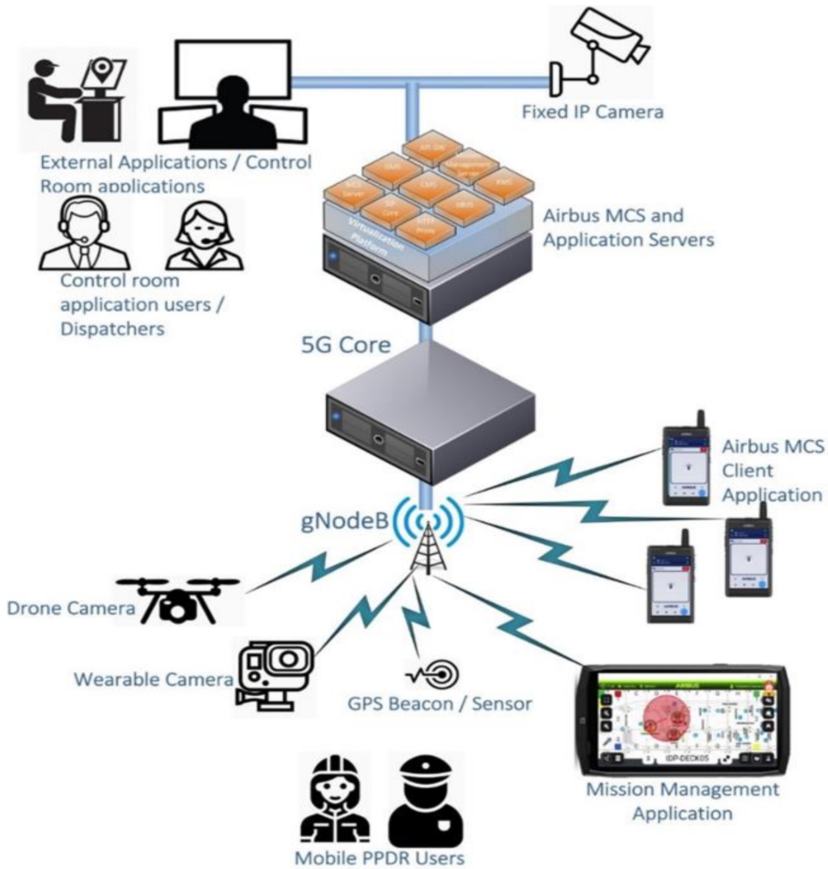

Figure 2: UC1 Architecture

Experiment Setup/Methodology/Deployment

ADS media microservices work with mixed protocols, Transmission Control Protocol (TCP), and User Datagram Protocol (UDP), potentially increasing performance and Quality of Experience (QoE).

Below is the description of the various microservices of the UC1 critical communication platform:

- Identity Management Function (IdMF): is responsible for authenticating an MCPTT client in the system. For testing purposes, the server can accept any new registration;
- Situation Management Function (SMF): is responsible for managing the situation information (status, locations, etc.);
- Audio Signalisation Function (ASF): handles floor control for audio communications;
- Audio Media Function (AMF): handles real-time packets for audio communications;
- Video Signalisation Function (VSF): handles control for video communications;
- Video Media Function (VMF): handles real-time packets for video communications;
- Data Management Function (DMF): handles non-real-time data streams;
- KPI Function (KPIF): Records KPI-related to communications;
- Cloud native architecture features for PPDR needs, as depicted in Figure 2;
- Fast service creation: One of the core performance-related KPIs defined by the 5G PPP calls is for average service creation time cycles to be drastically reduced, thereby ensuring that within minutes, a complete communication platform can be instantiated, especially for crisis management; and

- Increased Resilience and scalability: Cloud native core optimally schedules Containerized, or Virtual Network Functions (CNFs/VNFs) to run on the available infrastructure; scale in and out on demand; and utilize container-level isolation and health monitoring, so as to rapidly restart instances in case of failure. If a service fails, the infrastructure will immediately and automatically create a new instance of the service, so that the critical mission can be achieved, without any intervention from the user or the operator.

Results

UC1 application integrated to 5G-EPICENTRE analytics engine, where all KPI measures captured by the application are sent to 5G-EPICENTRE framework for performance assessment and easy visualization.

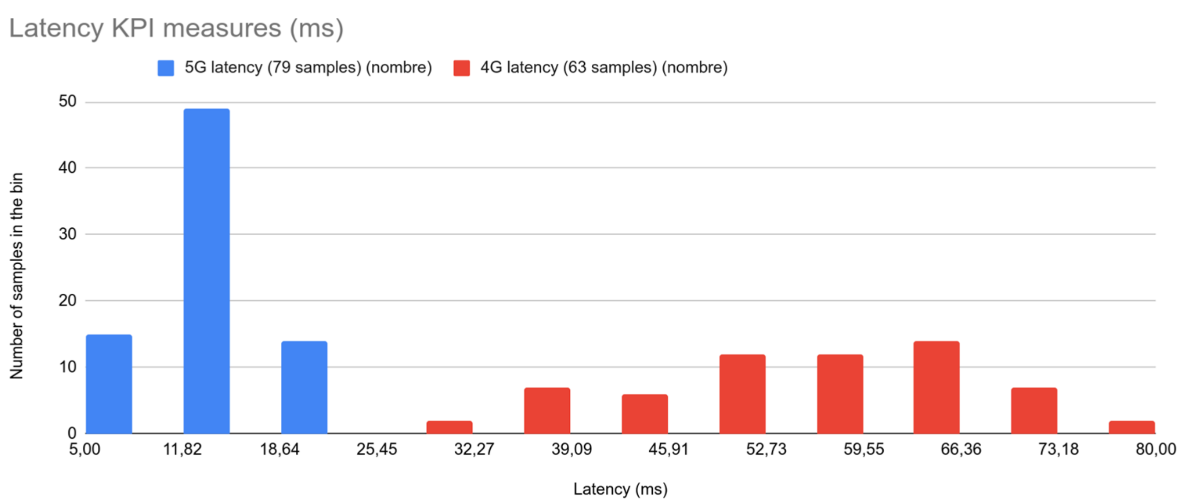

Figure 2: 5G vs 4G Video latency measured at network application level

UC1 applied a 5G QoS Identifier (5QI) to Protocol Data Unit (PDU) session, for guaranteeing QoS and resources for communication flow (Policy authorization session request to the Policy Control Function/PCF). The KPIs were assessed on UMA infrastructures are focused on real-time media: latency, (average) throughput and maximum throughput. A measure was taken each time a real-time stream (audio or video) was activated, and the measure is completed with some metadata describing the conditions under which the measure has been captured

Figure 2 above showcases KPIs captured during the experiment with the slices, highlighting the main KPIs in yellow. On heavy traffic generated in the non-PPDR slice, the measure fails and gives a result that is not significant (0 is obtained, as the backend was not able to respond to measures beacon in the due time), while the PPDR slice maintained uninterrupted services with consistent KPIs.

The MCPTT Access Time is the time between when an MCPTT subscriber requests to speak, i.e. by pressing the Push To Talk (PTT) control on the UE, and when this user receives the notification to start speaking without confirmation from receiving group members. Within a group call, the MCPTT Access Time is defined as the duration from sending a “Floor Request” message by any of the participating MCPTT subscribers within the group call until receiving the “Floor Granted” message at this MCPTT subscriber. In addition, the Mouth-to-ear latency (KPI 3) is the time between an utterance (or pre-defined sound) by the transmitting user (talking party) and the beginning of the playback of the very same utterance (or sound) at the receiving side (listening party). The Late Call Entry Time is the time to enter an ongoing MCPTT group call measured from the time when a user decides to monitor such an MCPTT group call to the time when the MCPTT UE's speaker starts to play the audio.

Table 1: UC1 Key Performance Indicators

KPIs	Results expected	Experimentation results
UC 1.1	End-to-End Delay U ≥ 50ms > A ≥ 10ms > O	U ≥ 20ms > A ≥ 10ms > O
UC 1.2	Throughput U ≤ 25Mbps < A ≤ 50Mbps < O	Throughput U ≤ 25Mbps < A ≤ 50Mbps < O
UC 1.3	MCPTT Access time U ≥ 1500ms > A ≥ 1000ms > O	U ≥ 40ms > A ≥ 10ms > O
UC 1.4	Mouth-to-ear latency U ≥ 500ms > A ≥ 300ms > O	Mouth-to-ear latency U ≥ 250ms > A ≥ 50ms > O
UC 1.5	Late call entry time U ≥ 500ms > A ≥ 350ms > O	Late call entry time U ≥ 600ms > A ≥ 350ms > O

The results shown on the 5G Malaga platform confirms the need of 5G for PPDR. The slicing guaranteeing the quality of service in terms of availability, latency and redundancy forces even in case of network overload for the PPDR is a real need to cover secure critical missions.

Conclusions

Airbus demonstrated N5 interface implementation: Airbus 5QI management-enabled application validated on 5G infrastructure with a PCF provided by ATH/HPE: first time in Europe for a PPDR application. Airbus demonstrated 5G fast service creation, 5G increased resilience, latency high performances, 5QI integration (a very advanced feature at the European level), and Augmented Reality glasses integration. In addition, Airbus also demonstrated 5G slicing: two network slices were established, and mission-critical video streaming was launched using M6 application. On heavy workload traffic generated, while the non-PPDR slice experienced disruptions, the PPDR critical slice maintained uninterrupted service with consistent video quality and latency.

The results shown on the 5G Malaga platform confirms the need of 5G for PPDR applications. The slicing guaranteeing the quality of service in terms of availability, latency, and redundancy forces even in case of network overload for the PPDR is a real need to cover secure critical missions. Airbus demonstrated:

- N5 interface implementation: Airbus 5QI management enabled application validated on 5G infrastructure with a PCF provided by ATH/HPE: first time in Europe for a PPDR application.
- 5G fast service creation, 5G increased resilience, latency high performances, 5QI integration (very advanced feature at European level), and Augmented Reality glasses integration.
- 5G slicing: two network slices were established, and mission critical video streaming was launched using M6 application. On heavy workload traffic generated, while the non-PPDR slice experienced disruptions, the PPDR critical slice maintained uninterrupted service with consistent video quality and latency.

Finally, the KPIs measurements carried out corresponds to expectations for mission critical services and demonstrates the interest for PPDR customers.