5G ESSENCE -
Use Case 1: 5G Edge Network Acceleration at a Stadium
Use Case 2: 5G E2E Slicing for Mission Critical Applications

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5G ESSENCE

Use Cases – General Context

- ***5G ESSENCE will explore the means to deliver its achievements to the market***, with emphasis in the **quantification of benefits**, *especially in terms of total cost of ownership, revenues and profits.*
- ***5G ESSENCE will allow the sharing of existing and new infrastructure by many operators in a multitenant environment***, *thus* ***enabling new business models*** *that will help new entrant market players to develop and analyse the perspectives of potential win-win strategies based on the developed solutions.*
- ***Key actors, revenue streams, and cost/performance drivers*** ***of the various RAN partitioning options*** ***will be identified.***

The main benefits of 5G ESSENCE include:

- the **maximisation of resource usage**,
- the **reduction of equipment and management costs**, *and*
- the **QoS improvement**,

thus encouraging ***network innovation*** *and* ***deployment of distinct network services****.*

OTE GROUP OF COMPANIES

Use Case 1:
5G Edge Network Acceleration for a Stadium

Objectives

- ***Implementing the setup of 5G edge network acceleration at a football stadium and, actually, to conduct the demonstration campaign.***

- ***Collecting and consolidating valuable feedback for the behaviour of the developed 5G ESSENCE prototype platform under real-life conditions.***

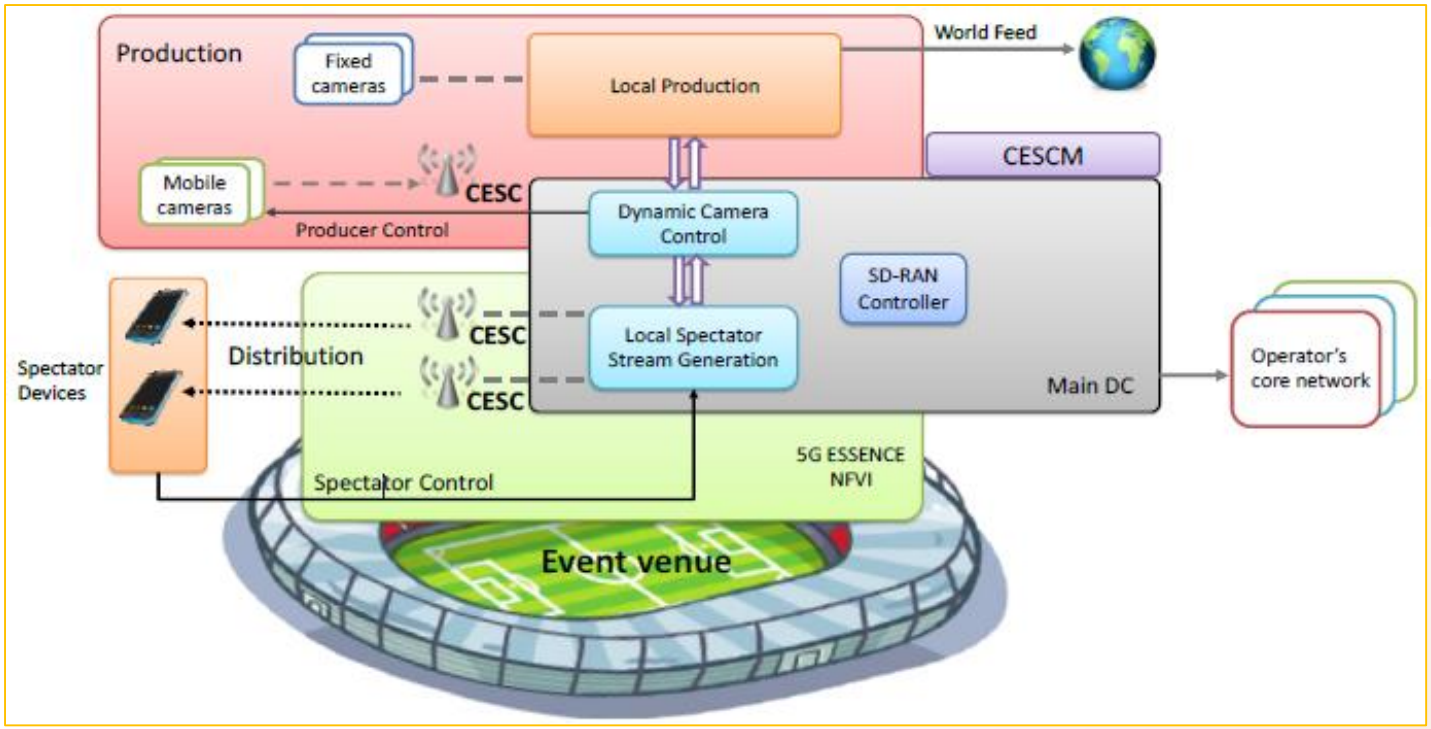
- ***The integration and the trials will take place at the municipal football stadium "Stavros Mavrothalasitis", at the centre of Egaleo town. The stadium is open, with capacity of about 8.000 spectators.***

Key Stakeholders

- **Network operators:**
  - ***Optimise network usage**, resulting in lower OPEX, in the context of the infrastructure sharing support;*
  - ***rapidly deploy new services**, delivered directly to users with higher QoE, and **offer "Content as-a-Service", increased bandwidth, and storage solutions** to content providers and venue owners.*
- **Content providers:** *The reduced latency and improved user QoE by positioning content on mobile edge, **offer augmented services** by leveraging the network information.*
- **Stadium owner:** ***Obtains additional benefits** by leveraging the deployed infrastructure and its functionalities, by capitalising live content to spectators from many cameras, statistics, etc.*

Use Case 1 – Description_(1/5)

- ***Demonstration of a combined 5G-based video production and video distribution for delivering benefits to media producers and mobile operators,*** *who will be able to offer enriched event experience to their subscribers.*
- ✓ *This, coupled with value-added services and rich user context,* ***will enable secure, high-quality and resilient transmission,*** *in real-time and with minimal latency.*



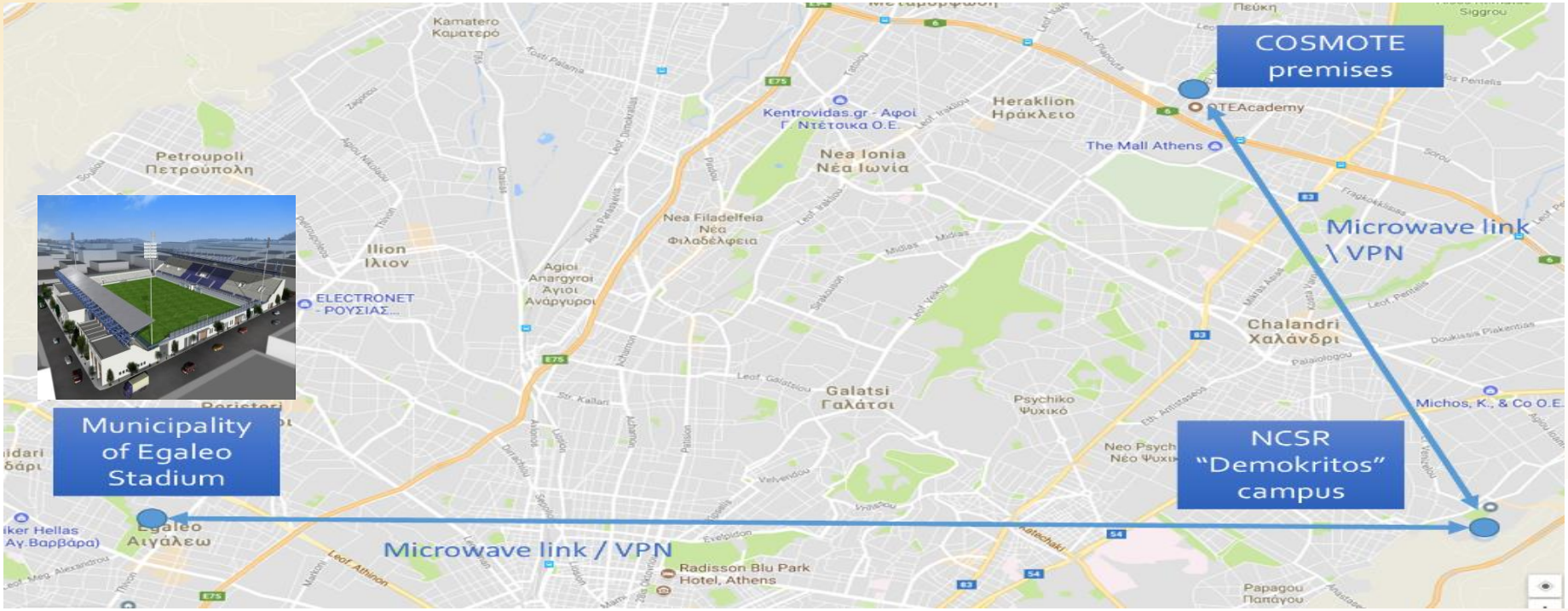
Use Case 1 – Description_(2/5)

- ***The scenario provides the logic for distributing the live video feeds received from the local production room to local spectators in a highly efficient manner. Different scales' facilities can be used for the validation of the deployment topology.***

- ***The selected facility will be covered with:***
  - ***A cluster of multitenant, eMBMS** (enhanced Multimedia Broadcast Multicast Service) **enabled CESCs** and, **together with the CESCM and the Main DC, they will be connected to the core networks of multiple telecom operators.***
  - *The **video content from cameras** will be sent for processing locally, at the Edge DC.*
  - *The **video streams** will be broadcasted locally, by using the CESCs.*
  - ***Spectators will be able to dynamically select** between different offered broadcast streams.*
  - ***Massive data traffic will not affect nor overload the backhaul connection,** as it will be produced, processed and consumed just locally.*

Use Case 1 – Description_(3/5)

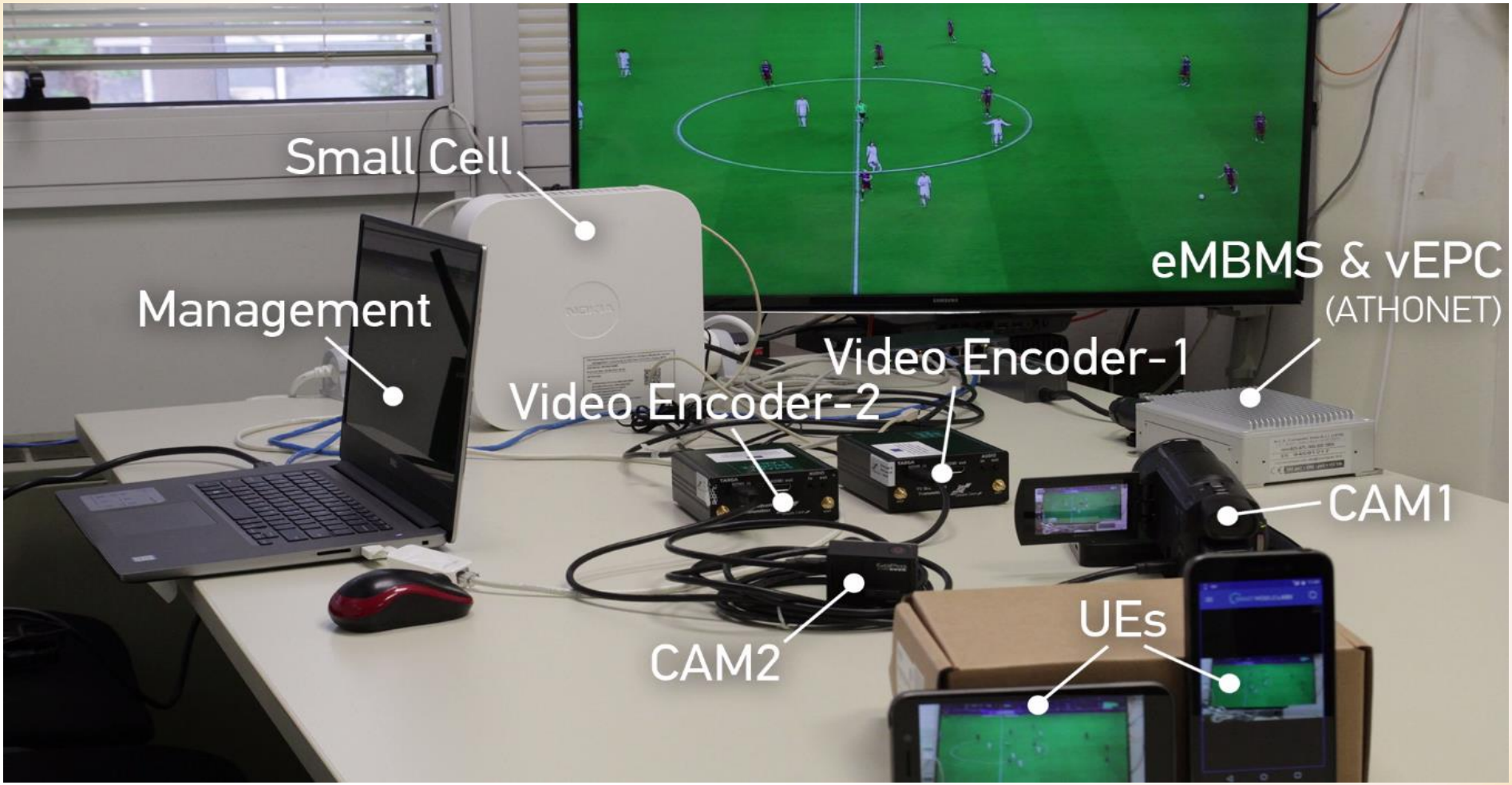
Cloud Testbed



- The campus NCSR "Demokritos", combining indoor and outdoor environments, covered by five software-driven 5G wireless nodes and supported by an optical backbone.
- The OTE building (OTEAcademy), is a multi-functional complex, combining various indoor and outdoor usage scenarios.
- The Egaleo stadium, is an actual "field" testbed, supporting a wide variety of real-life scenarios, ranging from massive MTC to flash crowd events.

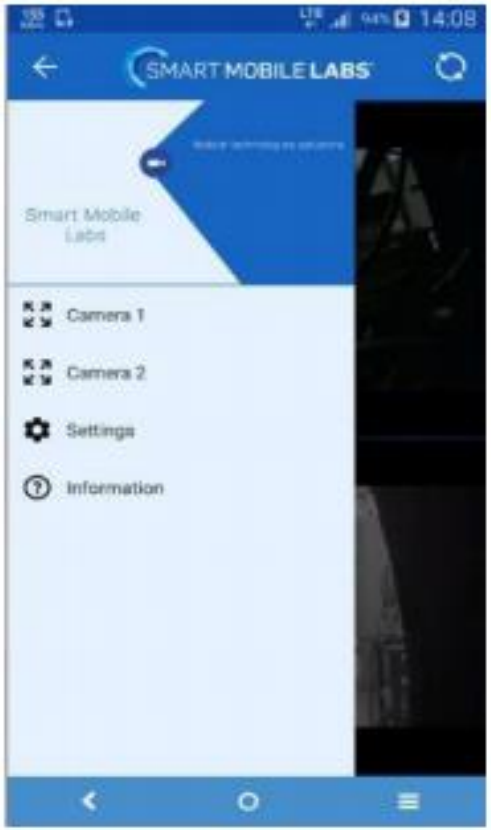
Use Case 1 – Description_(4/5)

Lab Testbed

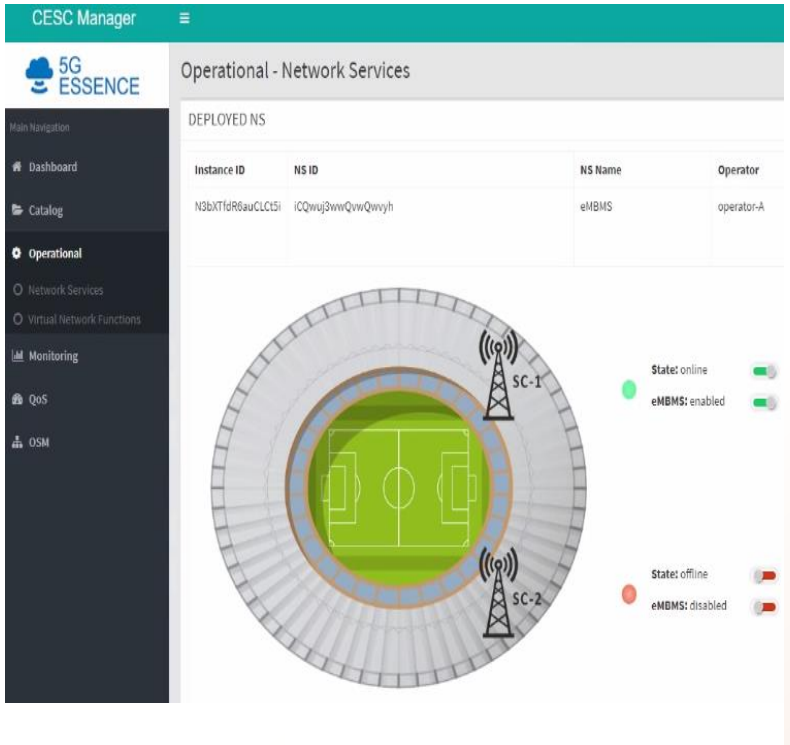


Use Case 1 – Description_(5/5)

User Equipment Application



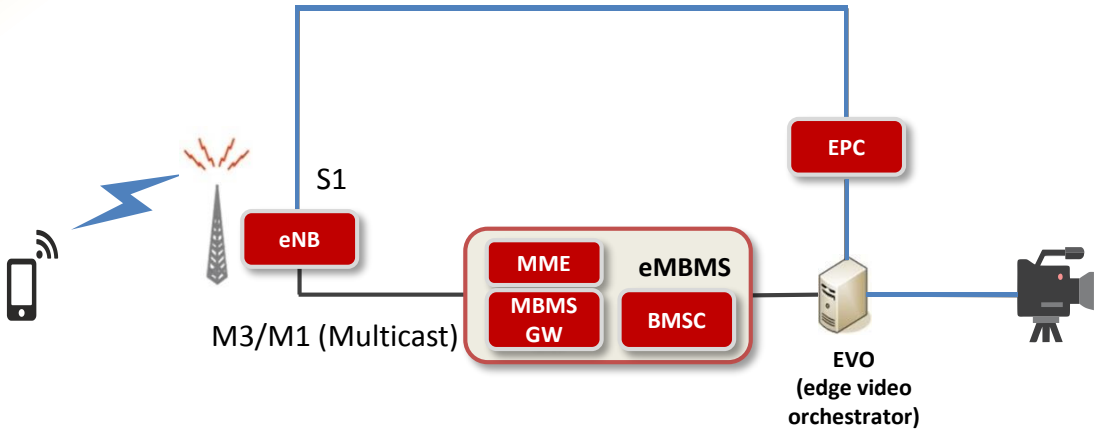
Network Services and Integration PoC_(1/6)



- **UC1 services and corresponding list of tests**
  - ***Multicast Video Delivery in Multi/Single View***
  - ***UE View Switching during the Video Delivery***
  - ***Video Delivery with Handover***
  - ***Unicast vs. Multicast Video Delivery***

- **Progress on Integration**
  - ***Video distribution in unicast mode***
    - Deployment of eMBMS network service through CESCM and service instantiation *Open Source MANO & OpenStack*
    - eMBMS feature enabled across all components *EVO (Edge Video Orchestrator) & EPC (Evolved Packet Core) management*
  - ***Video distribution in multicast Mode***

Network Services and Integration PoC_(2/6)



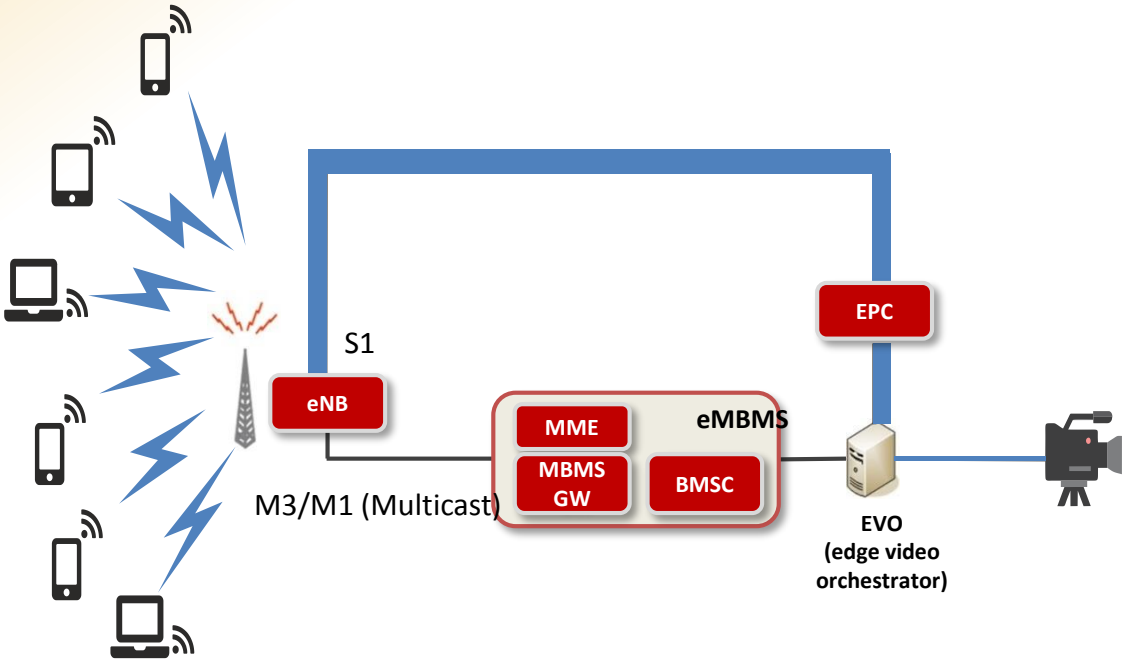
Video distribution in unicast mode

BMSC: *Broadcast Multicast Service Center*
eMBMS: *enhanced Multimedia Broadcast Multicast Service*
eNB: *Evolved Node B*
EPC: *Evolved Packet Core*
EVO: *Edge Video Orchestrator*
GW: *Gateway*
GTP: *GPRS Tunnelling Protocol*
MBMS: *Multimedia Broadcast Multicast Service*
MME: *Mobility Management Entity*

M1: GTPv1-U interface between the MBMS-GW and the eNB (***3GPP TS 36.445***). IP Multicast is used for the point-to-multipoint delivery of packets.

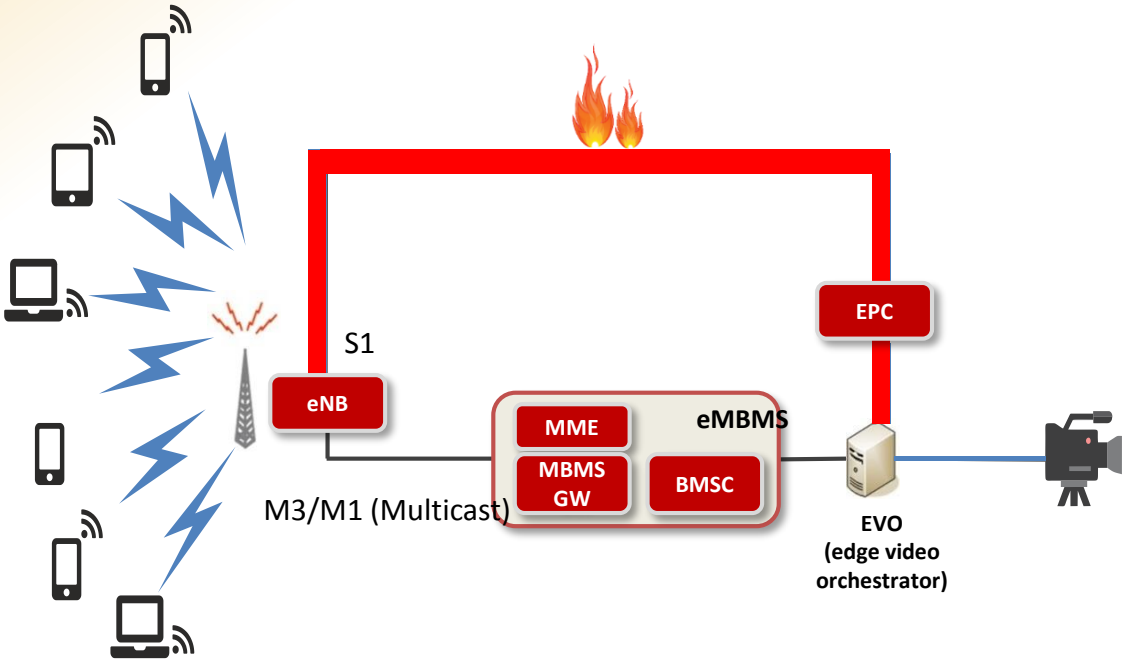
M3: M3-AP interface between the MME and MCE (Multi-Cell / Multicast Coordination Entity) (***3GPP TS 36.442-36.444***).

Network Services and Integration PoC_(3/6)



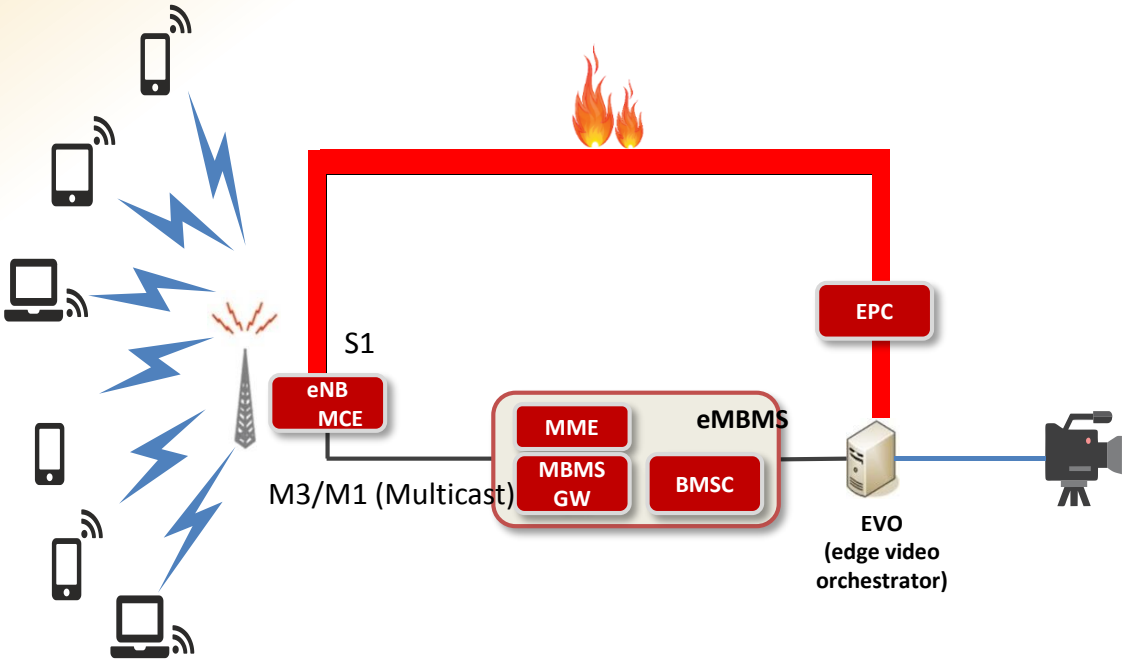
As more UEs receive the video stream, the Backhaul traffic is increased.

Network Services and Integration PoC_(4/6)



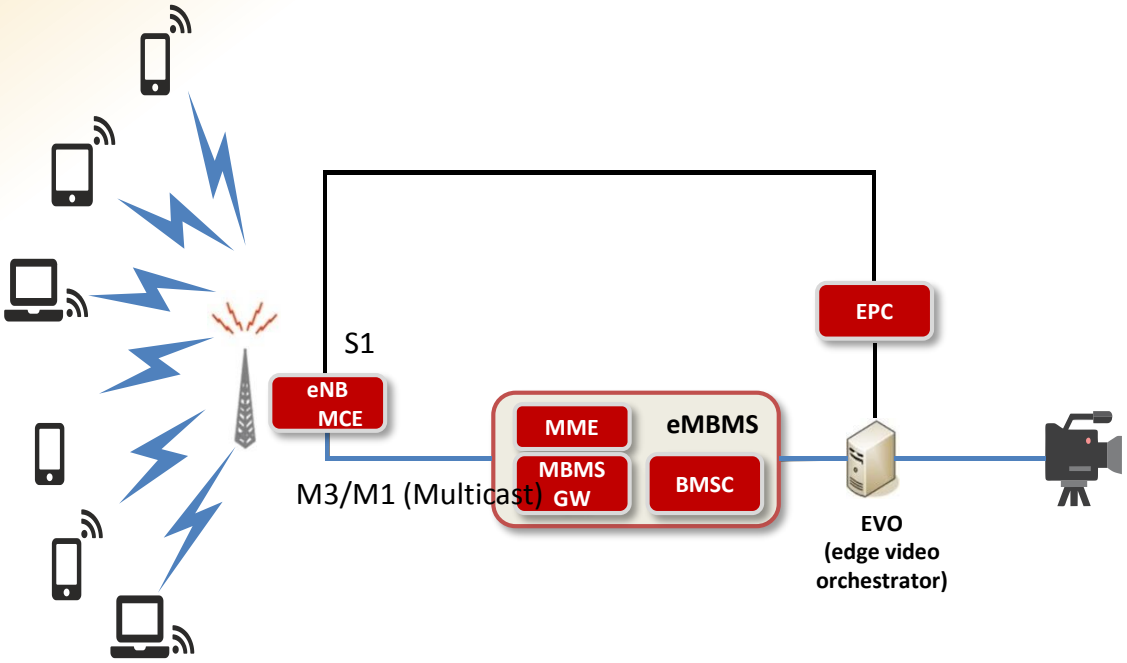
The Backhaul is overloaded.

Network Services and Integration PoC_(5/6)



To solve this problem, eMBMS is introduced

Network Services and Integration PoC_(6/6)



Traffic goes through eMBMS and Backhaul is relieved.

Use Case 2:
5G End-to-End Slicing for Mission Critical (MC) Applications

Objectives

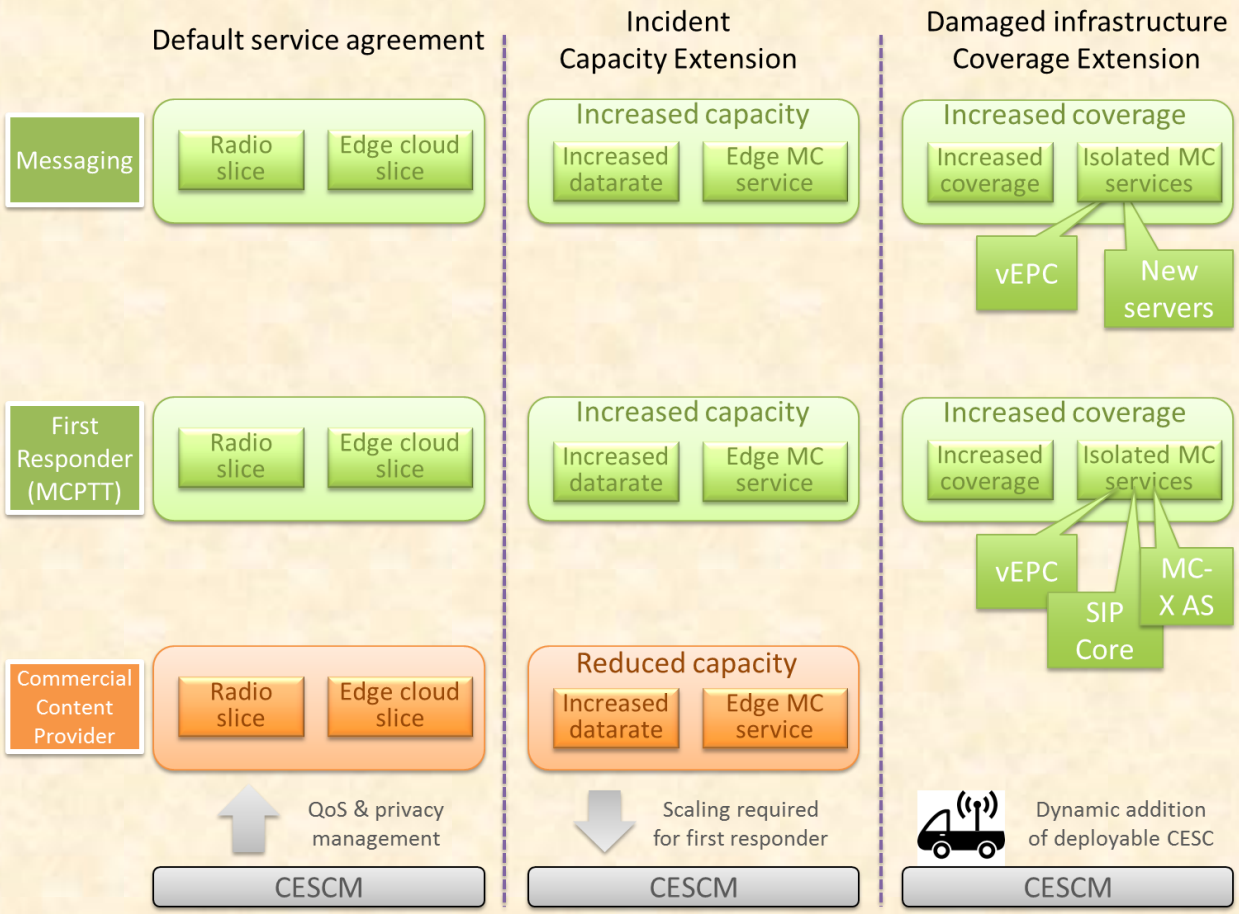
- ***Priority access of first responders to the 5G ESSENCE prototype platform*** *and, more generally,* ***access to a virtualised communication infrastructure.***
- ***Dimensioning and elastic resource allocation to first responders*** ***of radio, network and cloud resources through CESCM module, in case of emergency.***
- ***The integration of first responders' deployable communications systems*** *(macro base-stations, multi-RAT devices)* ***to the 5G ESSENCE platform****.*
- ***Hosting of MC applications*** ***(i.e. group communications and MCPTT (Mission Critical Push-to-Talk)) and virtualised EPC to Edge DC for extremely low latency.***

Key Stakeholders

- A **legacy mobile operator** (Platform owner) offering its infrastructure to classical end-users, as well as to PS virtual operators.
- A **PS (Public Safety) operator** that offers connectivity services with "strict" QoS guarantees to First Responders.
- **First Responder 1**, i.e. firefighters, are end-users exploiting the connectivity offered by a PS operator, *through a dedicated slice*.
- **First Responder 2**, i.e. paramedics, are another set of end-users relying on the same PS operator or another slice coming from a different operator, in *order to exchange chat messages, as well as pre-registered pictures for situation assessment.*
- **Legacy end-users** constitute classical users that have subscribed to the legacy operator communication and Internet data offers. *(They are not part of any First Responder entity but exploit only the network of the legacy mobile operator, without any intermediary).*

Use Case 2 – Description_(1/5)

Overall Scenario



Use Case 2 – Description_(2/5)

- ***Stage 1:*** **The 5G ESSENCE platform owner provides the required network slices to the different tenants.** Each network slice is composed of an allocated data rate over a coverage area and an allocated of cloud resources.
  For the service of PS organisations, normal operations require a certain amount of access capacity and communications features supported in the area of the CESC cluster. ***This requirement will be "mapped" to a number of KPIs in the CESCs*** *and the deployment of Group Communication service instances at the edge for multimedia and mission-critical Application Servers (ASs) for voice with enhanced responsiveness.*

- ***Stage 2:*** ***In the case where there is an emergency in the area, the CESCM will be able to react to the new service requirements. Based on pre-arranged or on-demand service scaling policies, the CESCM will implement new elastic resource allocation schemes, giving priority access to First Responders*** *and taking into account both radio and cloud resources.*

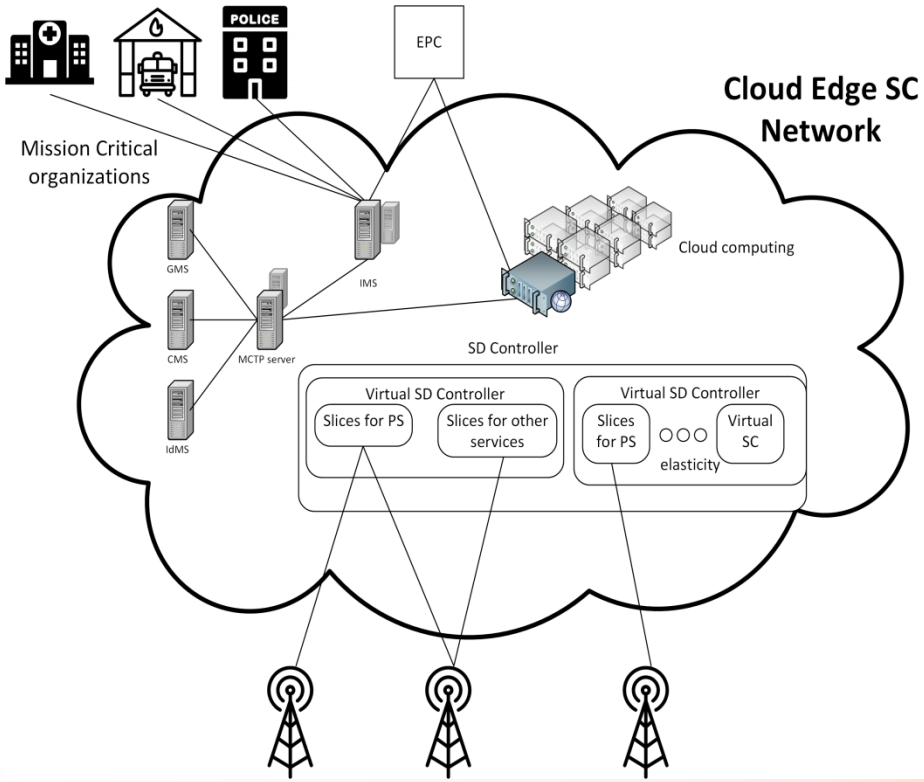
- ***Stage 3:*** ***In case that ICT infrastructure is damaged during a natural disaster or a terrorist attack, the first action should "address" the need for radio coverage extension. A deployable system to mitigate the damage in the macro base stations will be used.*** *In order to "better orchestrate" the radio transmissions, the deployable system will be considered as a new CESC that can be dynamically integrated to the small cell cluster. Thus, the enhanced 5G ESSENCE SON (Self-Organising Networks) and RRM (Radio Resource Management) features can be applied to the coverage extension unit.*

Use Case 2 – Description_(3/5)

- **1st Scenario: MCPTT Service for Public Safety deployment.**
- ***MCPTT** is a relevant component of MC communications and is the first service to be standardized by 3GPP in its Release 13.*

MCPTT is a public safety mission-critical voice communication type, aimed at the coordination of emergency teams that are organized in groups.
It provides an arbitrated method by which two -or more- users may engage in communication. Users may request permission to transmit (e.g., traditionally by means of a press of a button) and the MCPTT service provides a deterministic mechanism to arbitrate between requests that are in contention (i.e., Floor control).
***When multiple requests occur, the determination of which user's request is accepted and which users' requests are rejected -or queued- is based upon a number of characteristics** (including the respective priorities of the users in contention).*

Besides, **the MCPTT service provides a means for a user with higher priority** (e.g., MCPTT Emergency condition) *to override (interrupt) the current talker*.
MCPTT Service also supports a mechanism to limit the time a user talks (hold the floor) **thus permitting users of the same or lower priority a chance to gain the floor**. *As it appears, the management of this type of half-duplex communications is not trivial, since it requires an appropriate management of priorities and privileges to allow communication.*

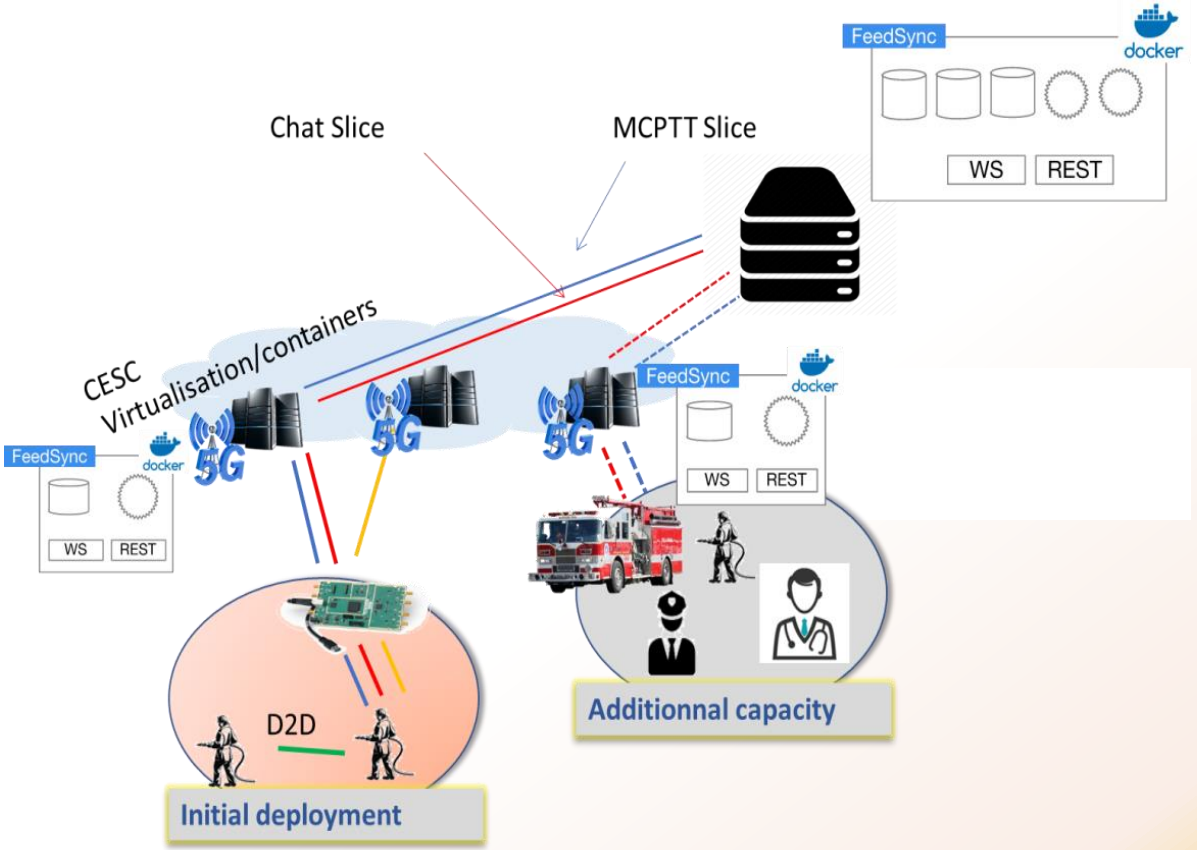


Use Case 2 – Description_(4/5)

- ***2nd Scenario: Mapping the 5G ESSENCE architecture to a PS deployment for messaging a localisation.***

In an operational situation, **public safety agents need to exchange a set of well-defined information**.
In addition to the communications between deployed rescuers, an interaction with the command centre is also required.

In this location, ***the exact position of all deployed agents as well as a history track of exchanged messages can help enhance the efficiency of the operations.***



Use Case 2 – Description_(5/5)

Business Aspects

- The PS operators "shift" their business model from a completely owned infrastructure model to one playing the role of an MVNO between multiple parties owning and operating mobile networks and PS end-users.

- Reduced costs of buying, installing and maintaining dedicated infrastructures to serve provision of high-quality services.

- Flexibility to adapt a variety of offering to the customers.

For further communication…

http://www.5g-essence-h2020.eu

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