



# PERformance EVALuation of Critical Communications



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[www.nemergent-solutions.com](http://www.nemergent-solutions.com)

*Fed4FIRE+ Engineering Conference (FEC4)  
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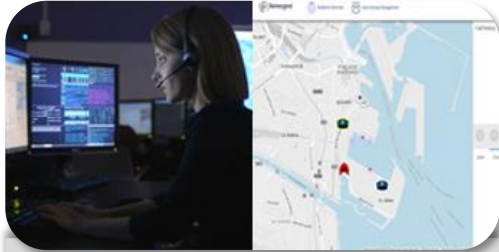
# Who we are



- Start-up from University of the Basque Country (UPV/EHU)
  - Located in Bilbao, Basque Country, Spain
  - Founded in January 2017
- 16 people involved (October 2018)
- Main areas
  - Next generation Mission Critical communications (3GPP MCPTT, MCVideo, MCDATA).
  - Next generation emergency communications (NG112)
  - Use of IoT for Public Safety
- Collaborations
  - Integration of systems
  - Pilots / PoC's / Demos
  - Research



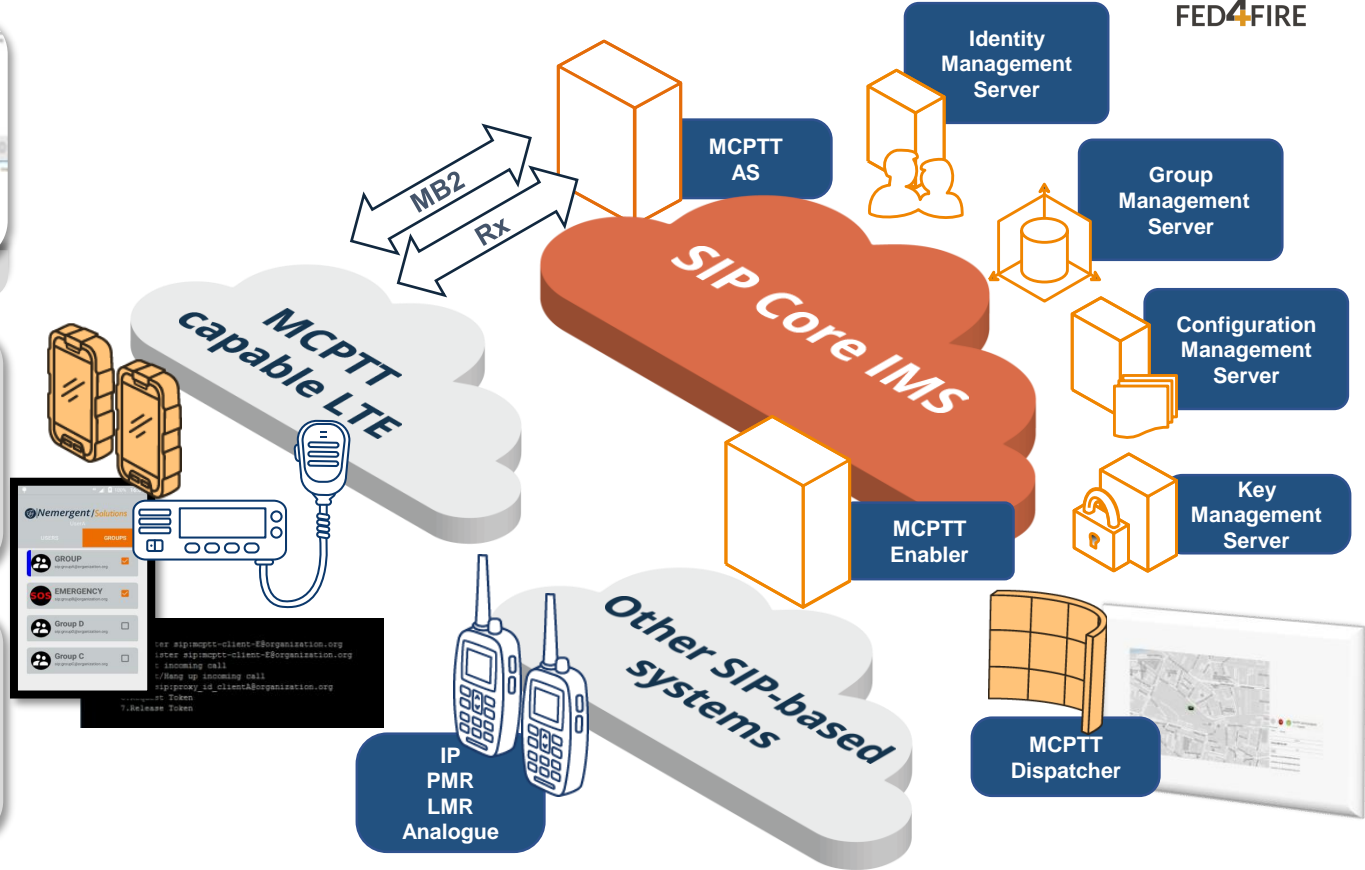
# What we do



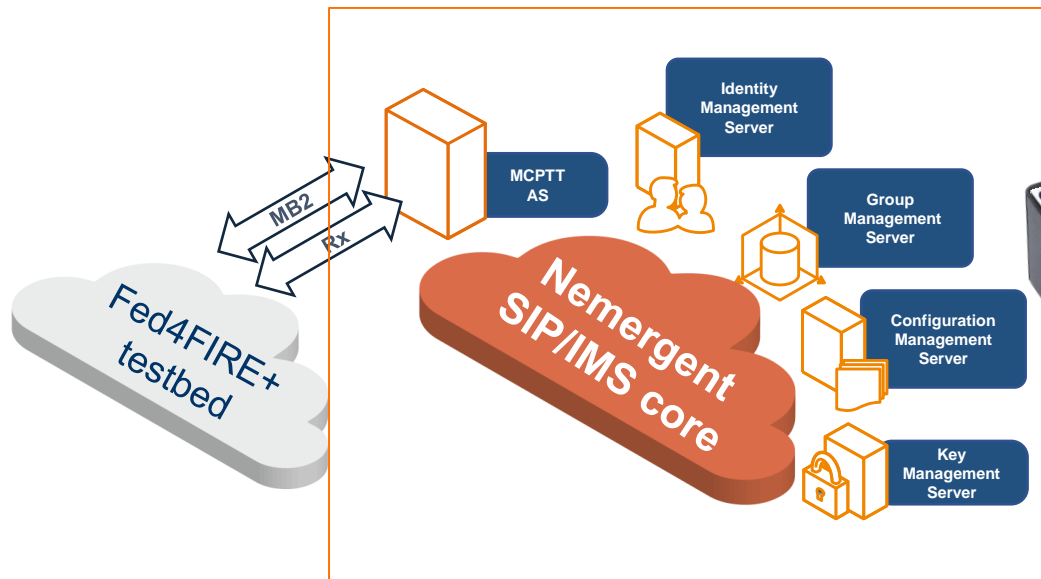
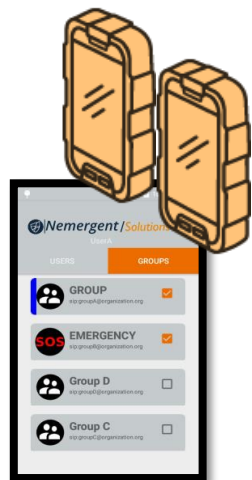
Emergency Control Centre (CCE)

Nemergent  
Solutions

MCPTT  
System



# The need for Fed4FIRE+



Fed4FIRE+  
testbed



Proof of  
concept



Product  
validation

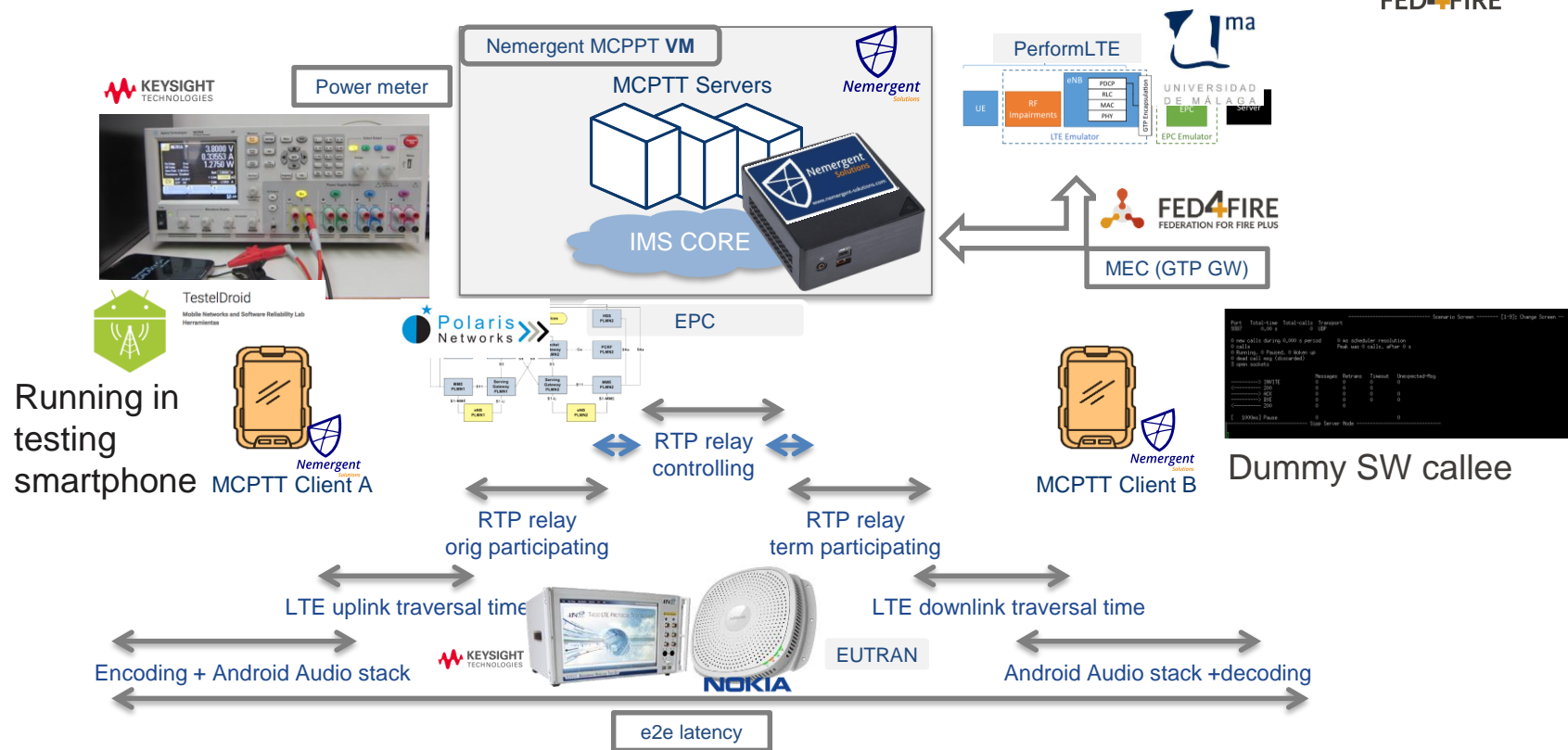


KPI  
evaluation

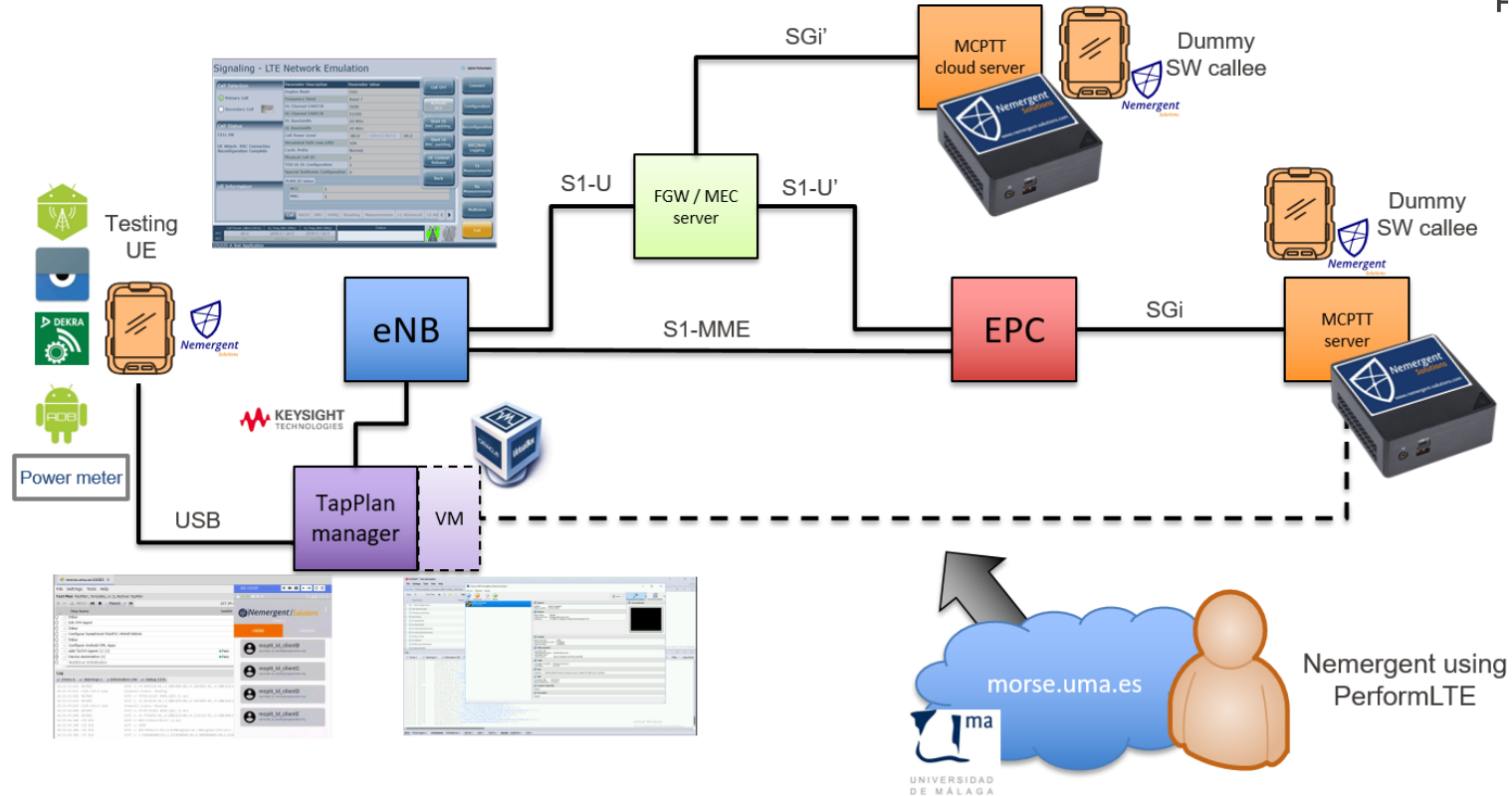


Product  
evolution

# Adaptation to PerformLTE (Fed4FIRE+) – Stage 1



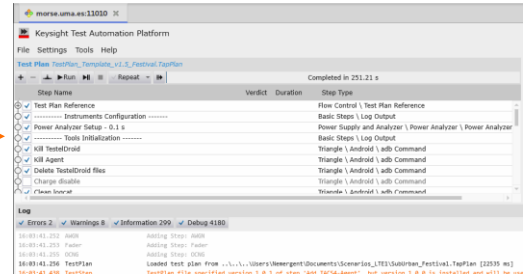
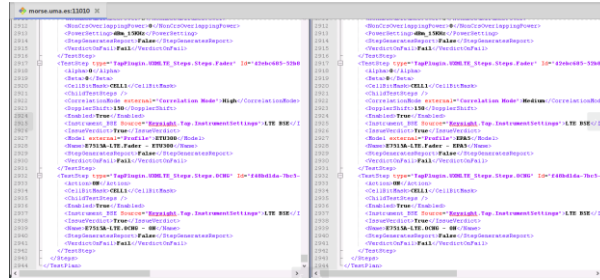
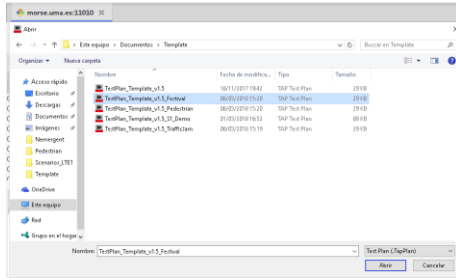
# Adaptation to PerformLTE (Fed4FIRE+) – Stage 2



# From theory to reality – Stage 1&2

- Deployment of MCPTT AS VM → straightforward
- Deployment of Client App
  - Rights must be granted while installing.
  - By default, no rights granted. Suggestion of “adb install” command modification.
- Testing tool
  - 1<sup>st</sup> Stage: JFed
  - 2<sup>nd</sup> Stage: Triangle GUI
    - Quamotion to define user flow
    - Triangle tool to define TAP model (urban pedestrian, busy hours, ...)
  - 3<sup>rd</sup> Stage: Remote Desktop to Keysight-connected computer
    - Keysight Test Automation Platform (TAP)
    - Tailored user flow provided by UMA with 130 seconds gap
    - Vysor to connect to the smartphone (install App, run App, MCPTT call, play with token, ...)

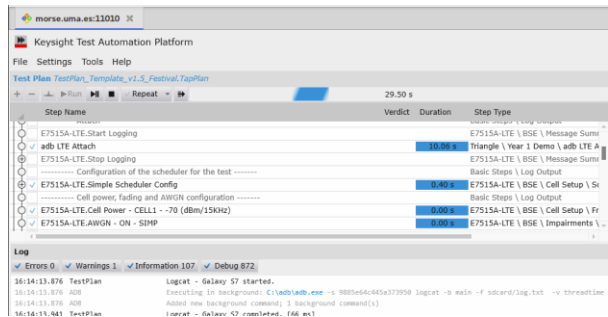
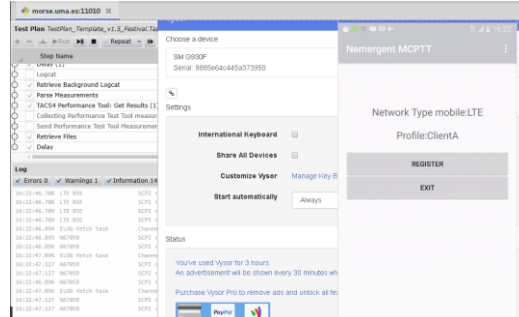
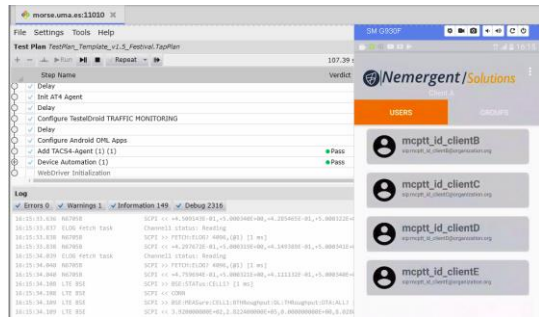
# Launching with R/P approach – Basic steps



Select network model

Each model – different cell power, fading, ...

Execute testing routine



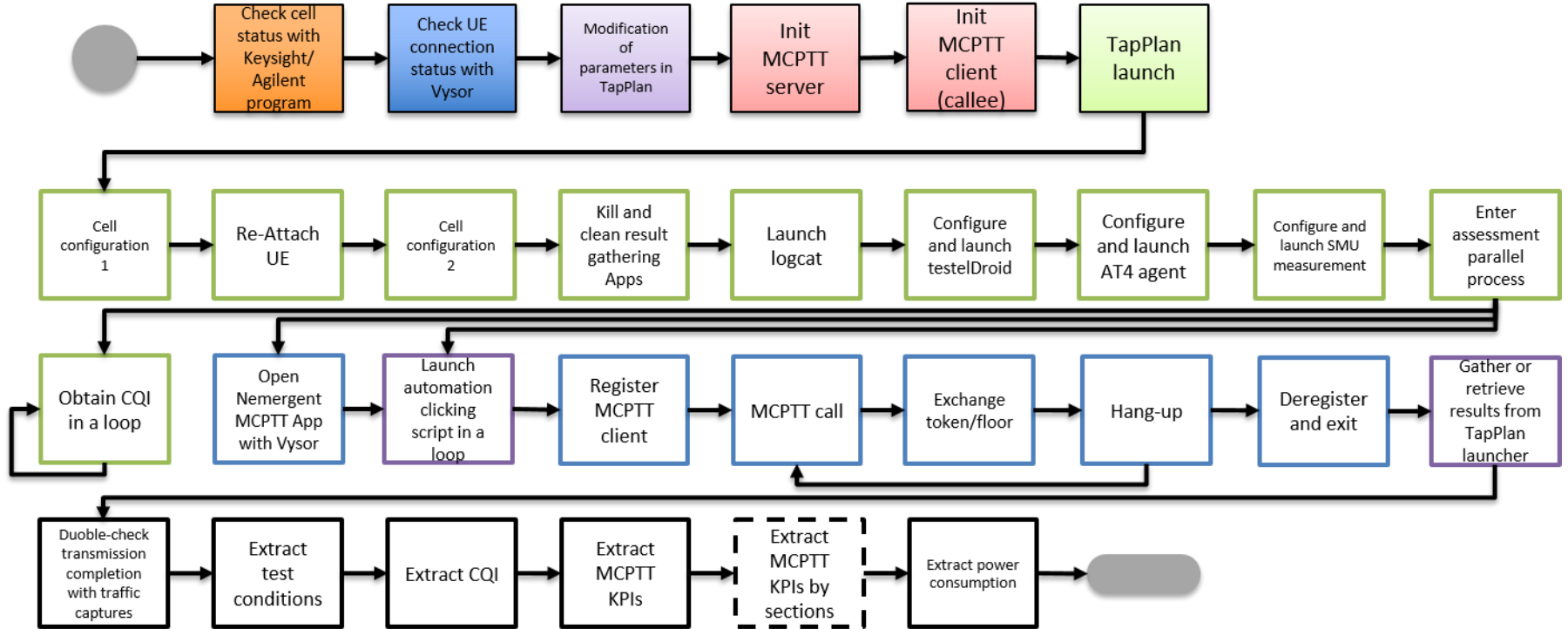
Client register

MCPTT App visualization

Free time-slot



# Launching with RDP approach – Complete set



# Successful MCPTT calls



**Step Name**

- Delay
- Init AT4 Agent
- Delay
- Configure TestelDroid TRAFFIC MONITORING
- Delay
- Configure Android OML Apps
- Add TACS4-Agent (1) (1) Pass
- Device Automation (1) Pass
- WebDriver Initialization

**Log**

```
16:15:09.444 N6705B SCPI << +3.689075E-01,+5.000291E+00,+3.722089E-01,+5.000294E+00
16:15:09.646 N6705B ELOG fetch task Channel1 status: Reading
16:15:09.647 N6705B SCPI >> FETCH:ELOG? 4096,(01) [2 ms]
16:15:09.647 N6705B SCPI << +3.836590E-01,+5.000299E+00,+4.222863E-01,+5.000331E+00
16:15:09.848 N6705B ELOG fetch task Channel1 status: Reading
16:15:09.850 N6705B SCPI >> FETCH:ELOG? 4096,(01) [2 ms]
16:15:09.850 N6705B SCPI << +4.102781E-01,+5.000314E+00,+3.950653E-01,+5.000312E+00
16:15:09.857 N6705B LTE BSE SCPI >> BSE:STATUS:CELL? [1 ms]
16:15:09.857 N6705B LTE BSE SCPI << CONN
16:15:09.857 N6705B LTE BSE SCPI >> BSE:MEASure:CELL1:8THroughput:DL:THroughput:OTA:ALL?
16:15:09.857 N6705B LTE BSE SCPI << 3.040000000E+02,2.822400000E+05,0.000000000E+00,8.028
16:15:10.059 N6705B ELOG fetch task Channel1 status: Reading
16:15:10.052 N6705B SCPI >> FETCH:ELOG? 4096,(01) [2 ms]
16:15:10.052 N6705B SCPI << +4.029279E-01,+5.000317E+00,+3.773135E-01,+5.000324E+00
```

**Test Plan** TestPlan\_Template\_v1.5\_Festival.TapPlan

**Step Name**

- Delay
- Init AT4 Agent
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- Delay
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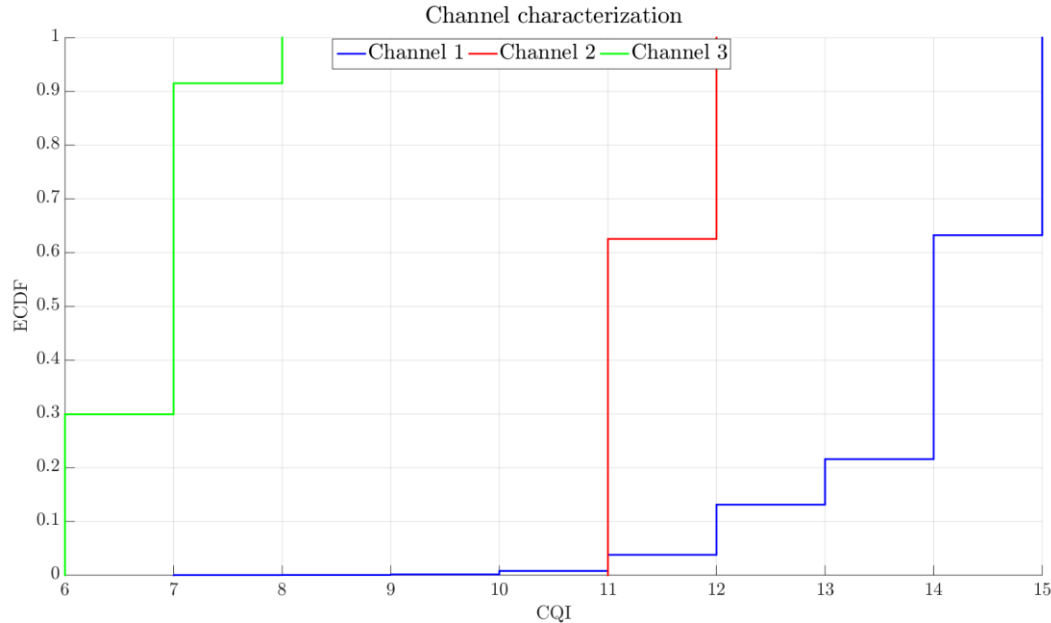
**Log**

```
16:15:45.106 N6705B SCPI << +3.697155E-01,+5.000267E+00,+4.351882E-01,+5.000309E+00
16:15:45.251 N6705B LTE BSE SCPI >> BSE:STATUS:CELL? [1 ms]
16:15:45.251 N6705B LTE BSE SCPI << CONN
16:15:45.252 N6705B LTE BSE SCPI >> BSE:MEASure:CELL1:8THroughput:DL:THroughput:OTA:ALL?
16:15:45.252 N6705B LTE BSE SCPI << 5.130000000E+02,7.056000000E+04,0.000000000E+00,8.028
16:15:45.306 N6705B ELOG fetch task Channel1 status: Reading
16:15:45.310 N6705B SCPI >> FETCH:ELOG? 4096,(01) [4 ms]
16:15:45.310 N6705B SCPI << +3.589520E-01,+5.000293E+00,+3.507634E-01,+5.000300E+00
16:15:45.510 N6705B ELOG fetch task Channel1 status: Reading
16:15:45.511 N6705B SCPI >> FETCH:ELOG? 4096,(01) [2 ms]
16:15:45.511 N6705B SCPI << +3.594294E-01,+5.000292E+00,+3.476327E-01,+5.000303E+00
16:15:45.712 N6705B ELOG fetch task Channel1 status: Reading
16:15:45.713 N6705B SCPI >> FETCH:ELOG? 4096,(01) [1 ms]
16:15:45.713 N6705B SCPI << +3.496211E-01,+5.000301E+00,+3.939367E-01,+5.000340E+00
```

# Gathered results/outcomes

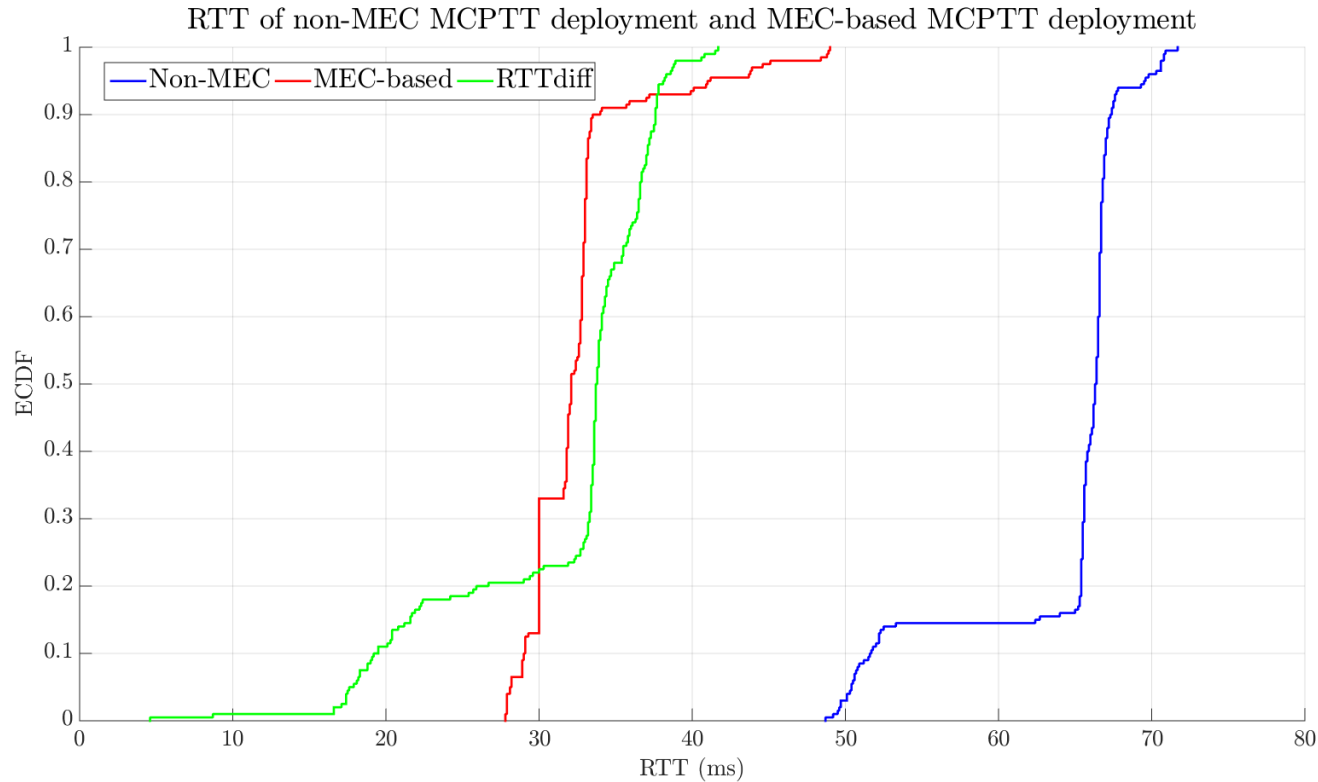
- Channel characterization (RSSI, RSRP, CQI, ...)
- More fine-grained stats of CQI
- RTT stats
- Power consumption output
- RAM consumption output
- Pcap
- Logcat
  - Timestamped clicking pattern
  - Sip messages by sectors (UE, network and server)
    - INVITE
    - 200 OK
    - Floor control (request and granted/idle/taken)

# Different network and channel conditions



- Pedestrian with good quality channel (-90dBm)
  - EPA5 fading
- Urban scenario in crowded area (-100dBm)
  - ETU300 fading
- Vehicular scenario away from the cell (-110dBm)
  - EVA70 fading

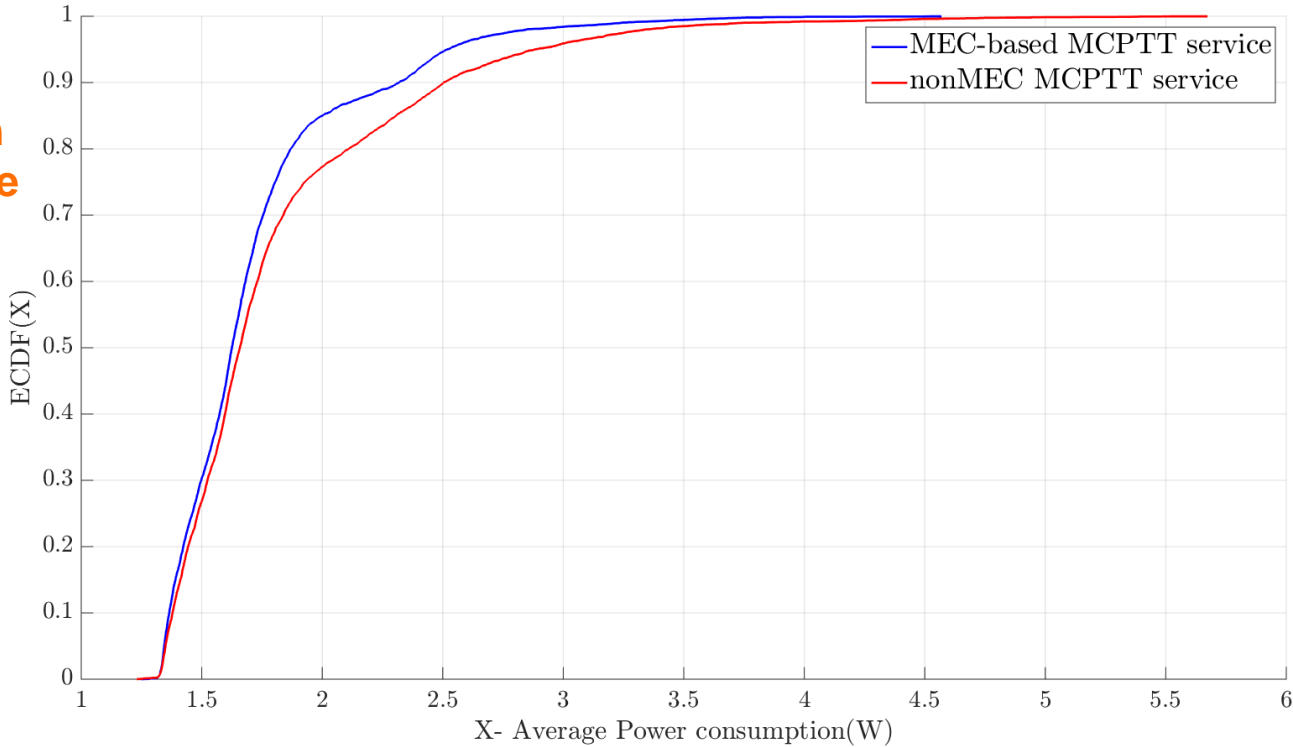
# Different MCPTT server deployment – MEC vs. non-MEC



# Impact on KPIs – Power consumption

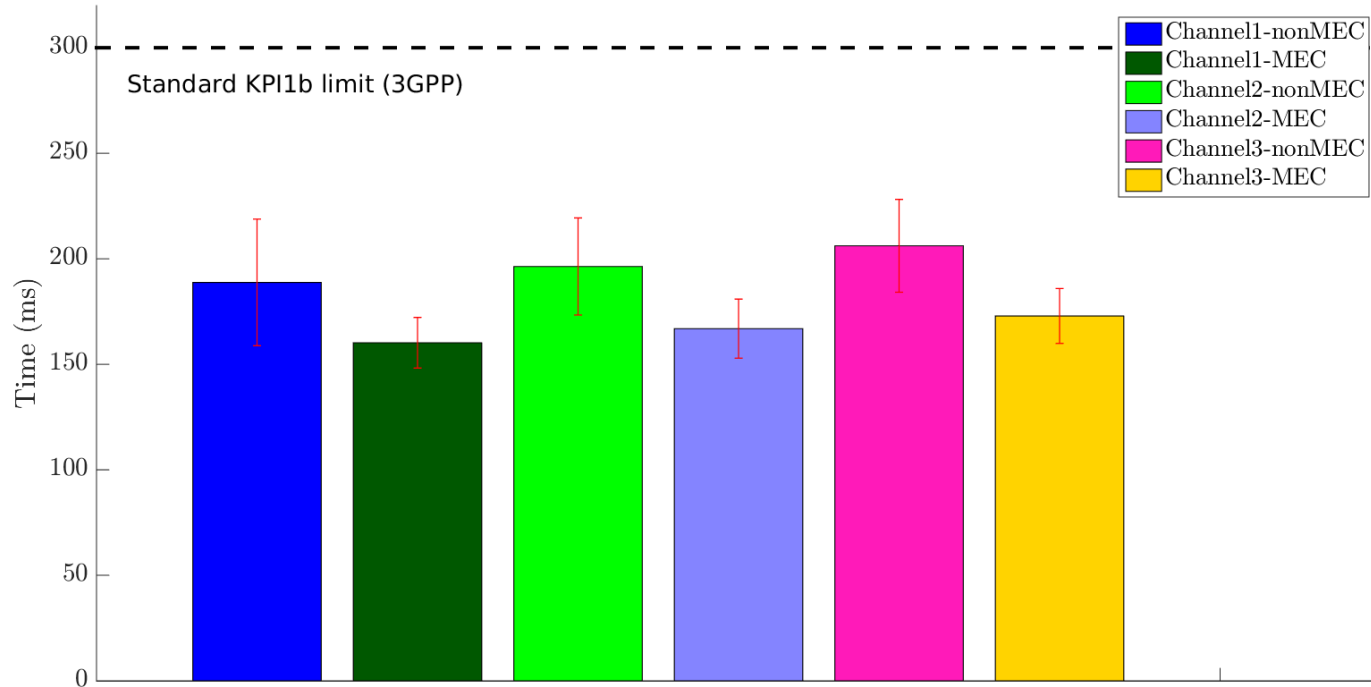


6%  
reduction  
on average



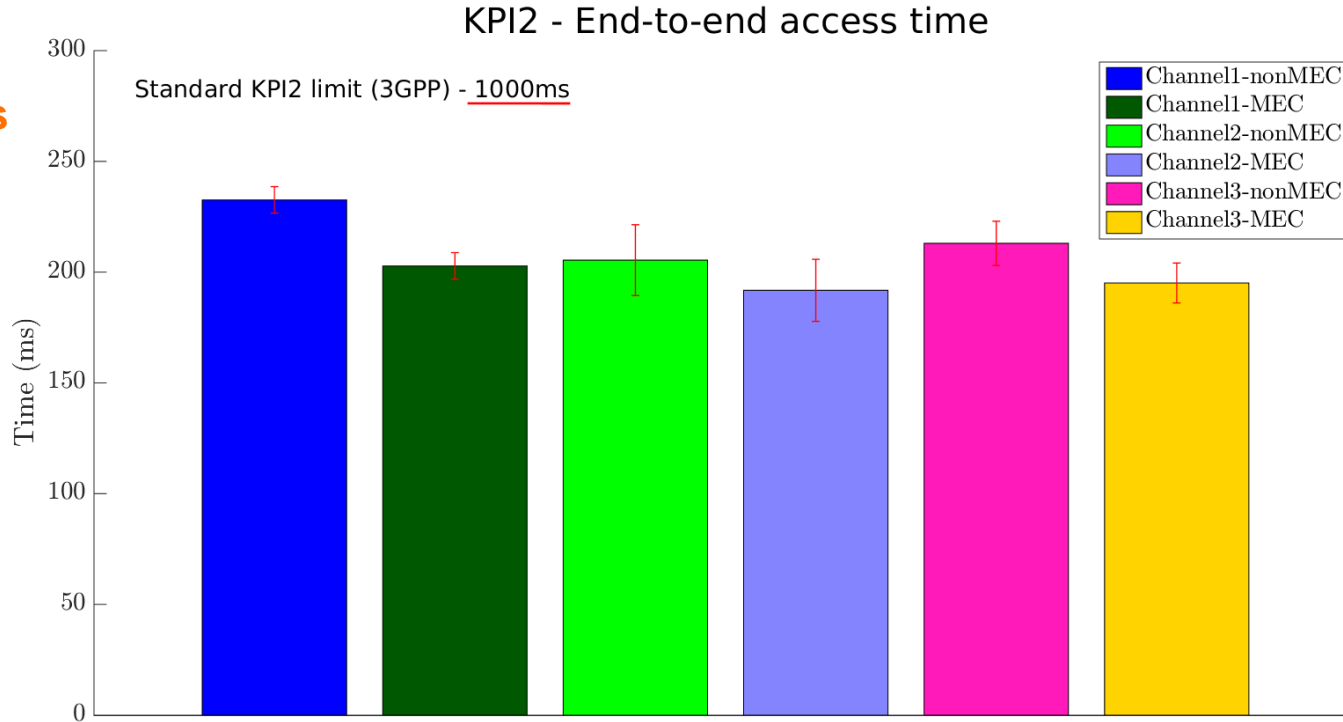
# Impact on KPIs – KPI1b (token request)

KPI1b - Access time (token request)



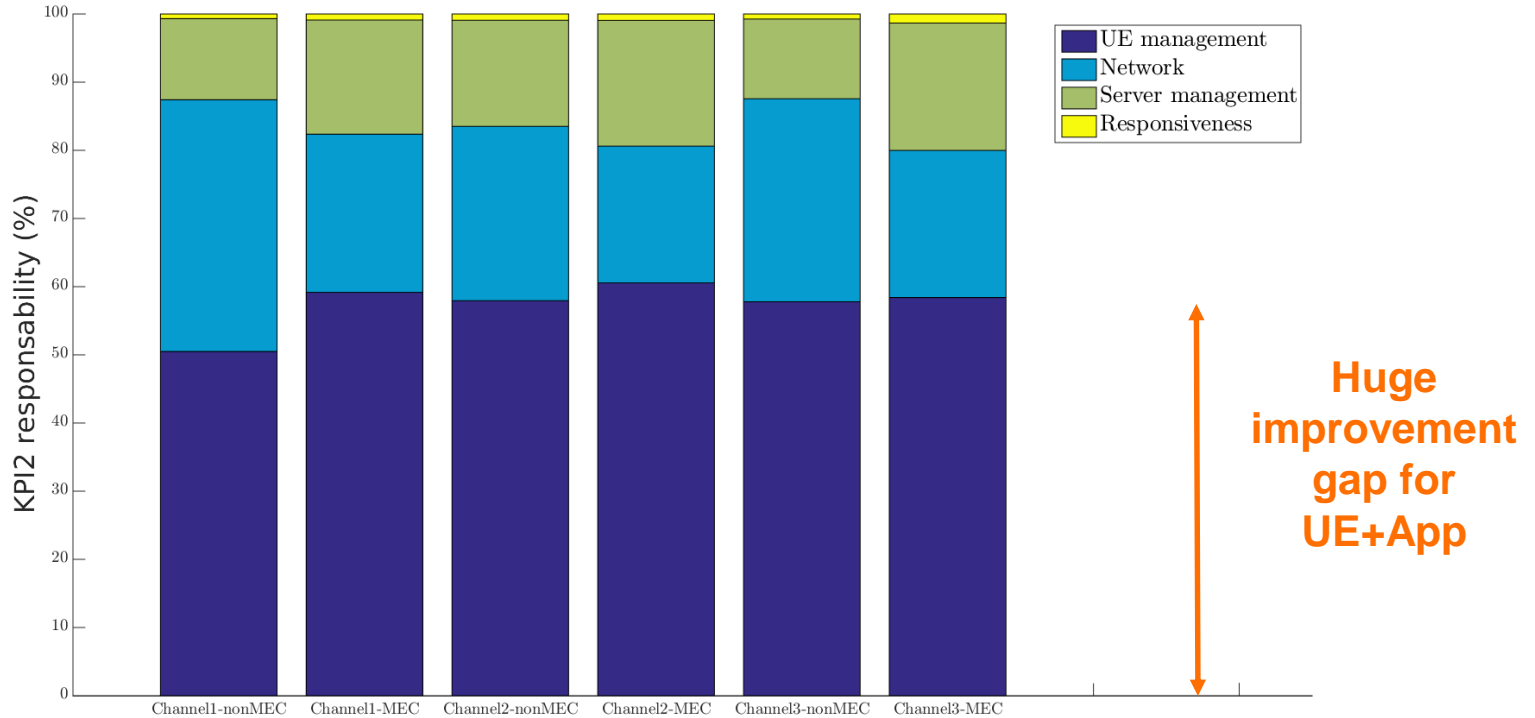
# Impact on KPIs – KPI2 (end-to-end access time)

2002 bytes  
Vs.  
20 bytes





# Impact on KPIs – KPI2 responsibility



# Business impact

- Position as technology provider to MC integrators demand:
  - The proper fulfillment of MC-grade KPI
  - The optimized power consumption to guarantee the operation of the UEs batteries for first responders
- Added value in delay and energy consumption → Gain position over competitors
- First phase of a polished integration of QoS/QoE monitoring and management in MCPTT AS product
- Knowledge of self-product and technology limitation
- New project opportunities – main one being 5GENESIS

# Feedback

- PERCCEVAL → identify a series of technical constraints in the chosen platform.
- From a technical perspective, the experience of the project provides insights of the baseline performance of MCPTT solutions over commercial LTE deployments in terms of:
  - KPIs
  - Energy consumption
- Adaptation of the platform to allocate deployments with mixture of MEC-based and non-MEC services.

# Post-mortem



- “Mission Critical as a Service (MCaaS)”: Dynamic and flexible MCPTT VNF in different places of mobile network
- Development of an automated post-processing tool → semi-automated analyses of the MCPTT KPIs
- Recognize Fed4FIRE+ as a pan-European deployment ready to test and verify next generation emergency networks
- Evaluate the impact of “to-the-edge” migration mechanisms into MCPTT in terms of resiliency improvement and KPIs
- Analysis of the impact of optimization mechanisms into e2e KPI(s)
  - 5G-like MEC-based MCPTT service.
  - Evolution of UE+App-side to reduce e2e delay.
- Concepts to reality – 5GENESIS – Málaga platform - UMA
  - MCPTT to MCS – Nemergent and Airbus.
  - MEC by Telefónica, Orchestration by Atos, 5G-ready network by Athonet and RunEL, 5G-UE by Eurecom.
  - Málaga police – end-user, first-responders.



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# THANK YOU

[WWW.FED4FIRE.EU](http://WWW.FED4FIRE.EU)

# Back-up slides



# The company profile



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  - Integration of systems.
  - Pilots / PoC's / Demos.
  - Research.