End-to-End Mission Critical Push-to-Talk: Pushing for the future

Nemergent Solutions SL
Sonim Technologies, Inc.

National Institute of Standards and Technology
U.S. Department of Commerce

PSCR

2019 PSCR Public Safety Broadband Stakeholder Meeting | NIST

July 9th, 2019 Chicago, IL

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Agenda.

- Project objectives (Bob)
- Client UE/application. (Bob)
- MCPTT server-side. (Oscar)
- Functional & performance testing. (Oscar)
- Test deployments. (Oscar)
- Dissemination. (Oscar)
- Project summary. (Bob)
- Demonstration. (Bob)
- Q & A (All)


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Public Safety Innovation Acceleration Program (PSIAP)

- **Project objectives**
- Client UE/application.
- MCPTT server-side.
- Functional & performance testing.
- Test deployments.
- Dissemination.
- Project summary.
- Demonstration.
- Q & A

Project Objectives

Statement of Work

- Middleware for MCPTT Client Integration on Android UE
  - LTE-level support
  - Application-level support
  - Mission Critical Experience / UI
- MCPTT Service Implementation (next slide)
- Testing
  - Protocol testing
  - Interoperability testing
  - System integration tests / KPI
  - Field tests

Sonim Technologies, Inc.
PSIAP - Project: End-to-End Mission Critical Push-to-Talk: beginning June 1 2017
NIST # 70NANB17H179

G = June 1st

Table 1: Project Deliverables and Timeline **Revised**

Section	Deliverable	Owner	Date
Section 3.1.1	**Service Integration**		
	PTT App Integration on UE	Sonim/Nemergent	G+ 2W
	ISIM API/APN for data connection	Sonim/Nemergent	G+ 14W
	MCPTT Integration - Service Level	Nemergent	G+ 40W
	QCI integration / Broadcast Services	Sonim/Nemergent	G+ 40W
	E2E Broadcast Services SDK	Sonim	G+ 52W
	Service Level Integration SDK Pkg	Sonim	G+ 52W
Section 3.1.2	**Mission Critical Experience**		
	PTT Key integration / SDK	Sonim	G+ 2W
	PTT Android framework modifications	Sonim	G+ 14W
	PTT SDK / guide	Sonim	G+ 40W
	PTT Audio path demo	Sonim	G+ 52W
	CSM - Generic API	Sonim	G+ 14W
	CSM Accessory Prototype for UE	Sonim	G+ 30W
	MCPTT integration with CSM	Sonim	G+ 40W
	CSM SDK Pkg	Sonim	G+ 40W
Section 3.2	**MCPTT Server Components**		
	First Release of MCPTT System	Nemergent	G+ 2W
	Second Release of MCPTT Management Servers	Nemergent	G+ 30W
	Second release of MCPTT AS	Nemergent	G+ 40W
Section 3.3	**Testing**		
	Integration Testing (Definition)	Nemergent/Sonim	G+ 14W
	Interoperability Testing	Nemergent	G+ 52-70W
	Field Testing	Sonim / Partner	G+ 52-80W
	Test Reports	Sonim	Per milestone

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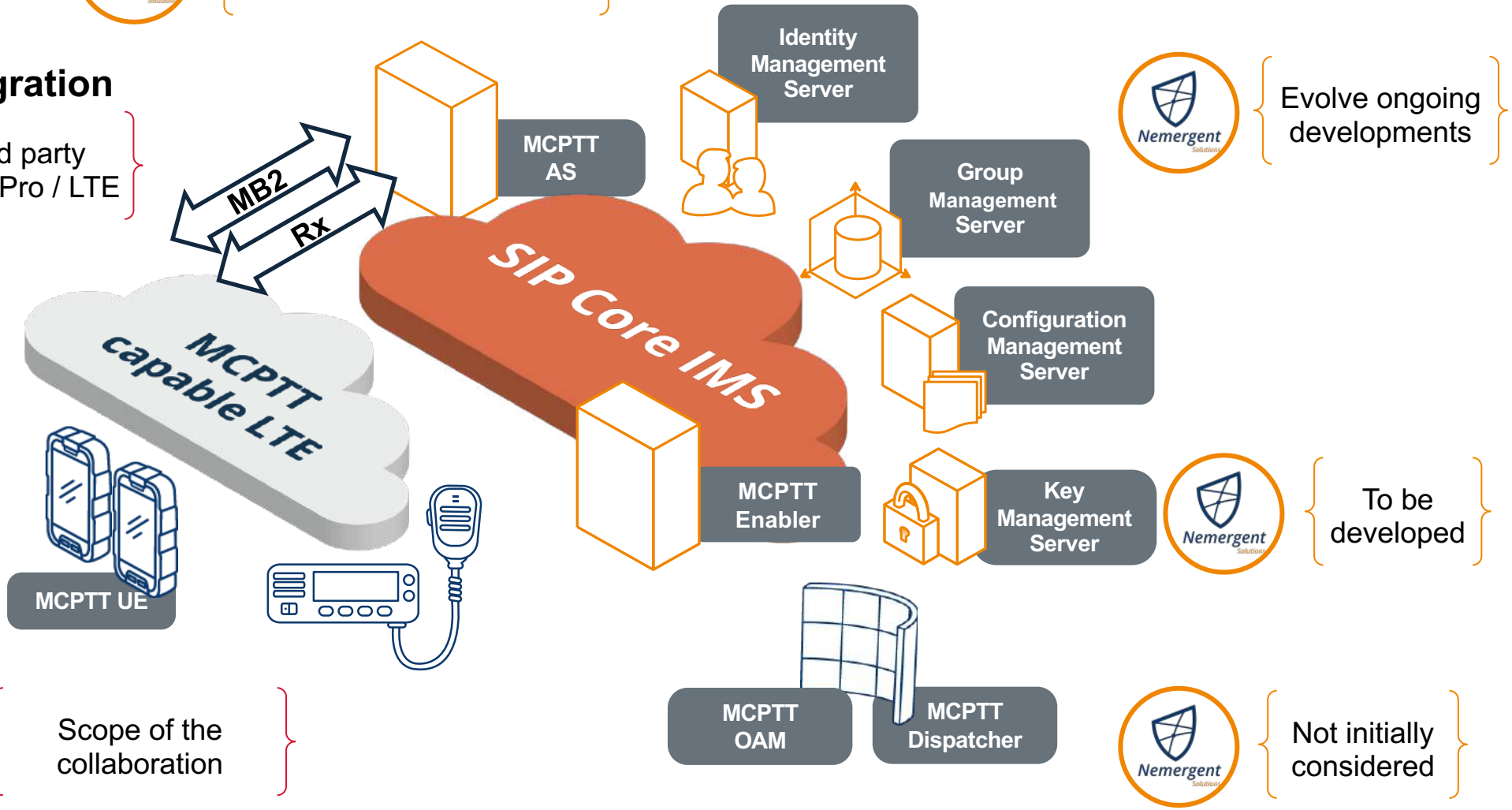
Technical objectives

Own development
Evolve R2016 to R2017

Integration

Third party
LTE-A Pro / LTE



Evolve ongoing developments

To be developed

Not initially considered

Scope of the collaboration

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Project Objectives Revisited

First Year Progress – Highlights – Platform Integrations

- Server side
  - Full 3GPP R13 compliant servers with QoS and eMBMS support
  - Ongoing evolution to R14
- Client side
  - Hardware button integration for PTT, Yellow and Red keys
  - Channel Selection Module SDK and Integration on MCPTT client
  - DSP Audio calibration for MCPTT, resulting in enhanced audio clarity and noise cancellation
  - QCI Integration
  - eMBMS integration using Qualcomm middleware
- KPI measurements

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	Test Reports	Sonim	Per milestones

Legend
- TBD
- Completed
- In Progress

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Objectives for 2018-2019

Better KPI

Better UI and UX

Presence and Location Integration

Contacts and Group Management

Rigorous Testing for Mission Critical Readiness

Public Safety Innovation Acceleration Program (PSIAP)

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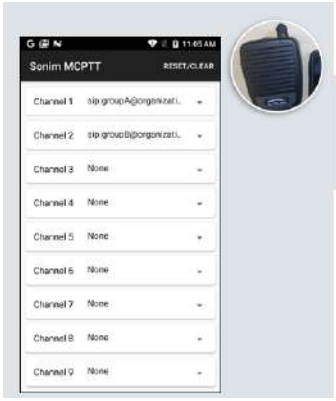
PSIAP work – First year highlights

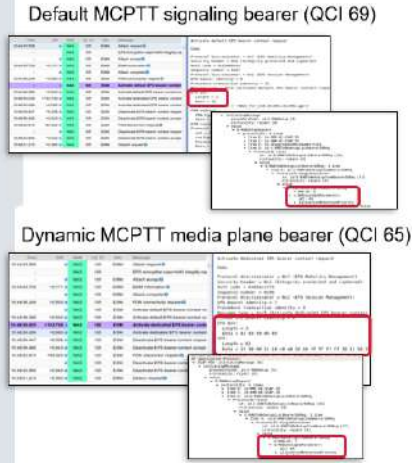
Channel Switching Module (CSM) SDK APIs



Integrated MCPTT client with CSM SDK

Audio Quality Improvements – DSP profiles

MC- QCI Integration



eMBMS Integration using QC MSDC API

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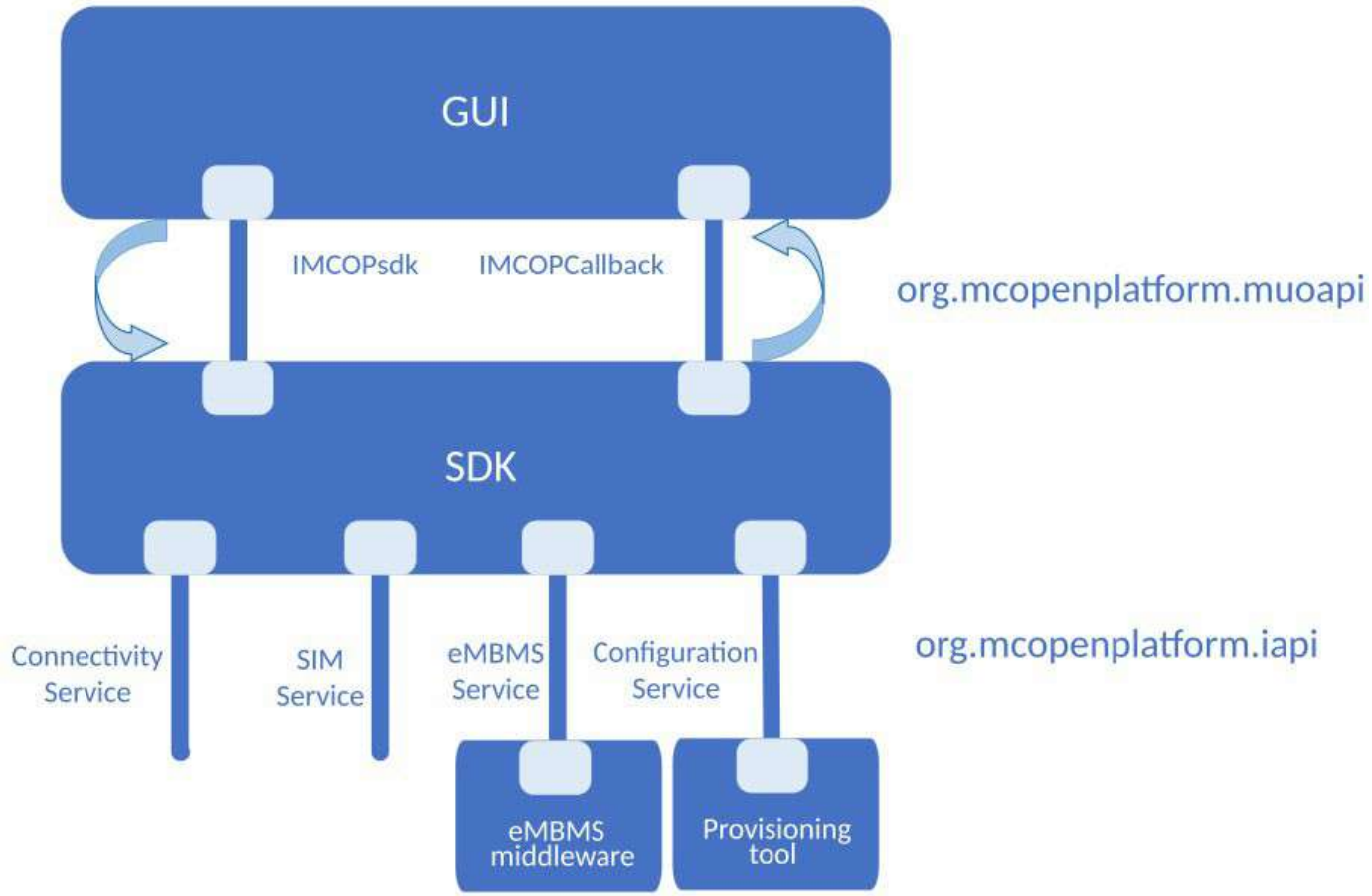
Support of MCOP interfaces

MUOAPI integration (northbound)

IAPI integration (southbound)



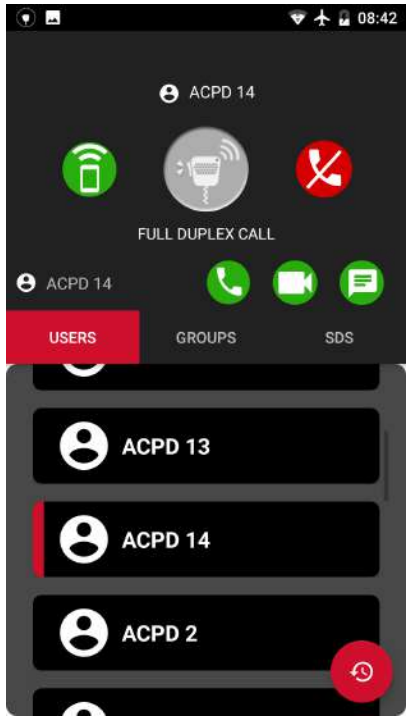
Evolution of Rel13 call types and features

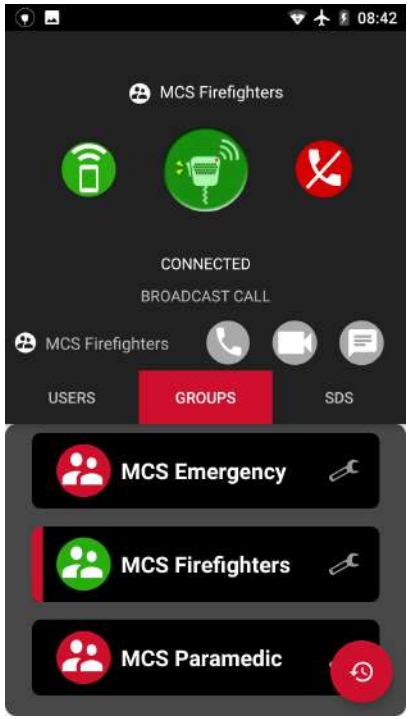
Full-duplex calls

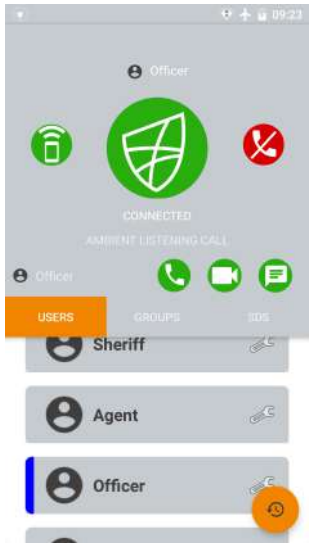
Broadcast (w and w/o emergency)

Ambient (local and remote)

Improved Idms, CMS and GMS



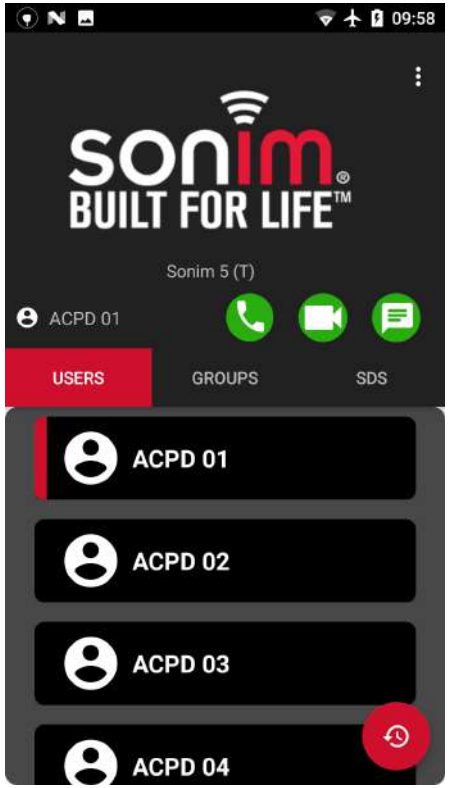


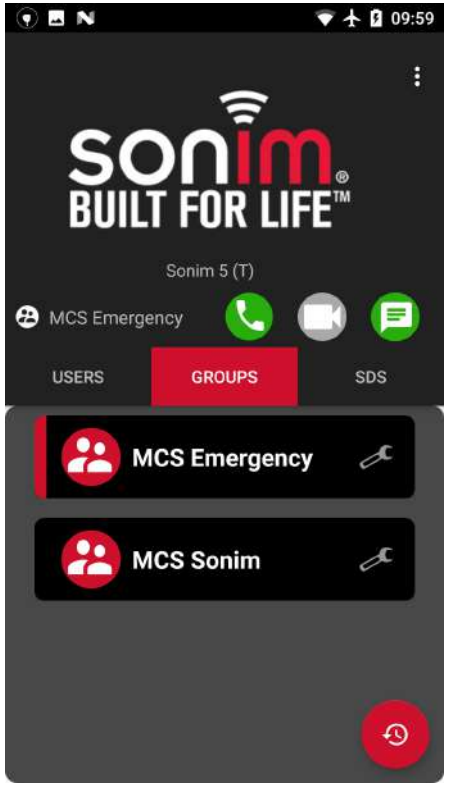


Evolution of centralized contact and group management

User-profiles for each MCPTT ID

```
<PrivateCall>
        <PrivateCallList index="token">
                <PrivateCallURI>
                <entry index="token">
                        <uri-entry>sip:mcptt_id_clientA@organization.org</uri-entry>
                        <display-name xml:lang="">ACPD 01</display-name>
                </entry>
                <entry index="token">
                        <uri-entry>sip:mcptt_id_clientB@organization.org</uri-entry>
                        <display-name xml:lang="">ACPD 02</display-name>
                </entry>
                <entry index="token">
                        <uri-entry>sip:mcptt_id_clientC@organization.org</uri-entry>
                        <display-name xml:lang="">ACPD 03</display-name>
                </entry>
```





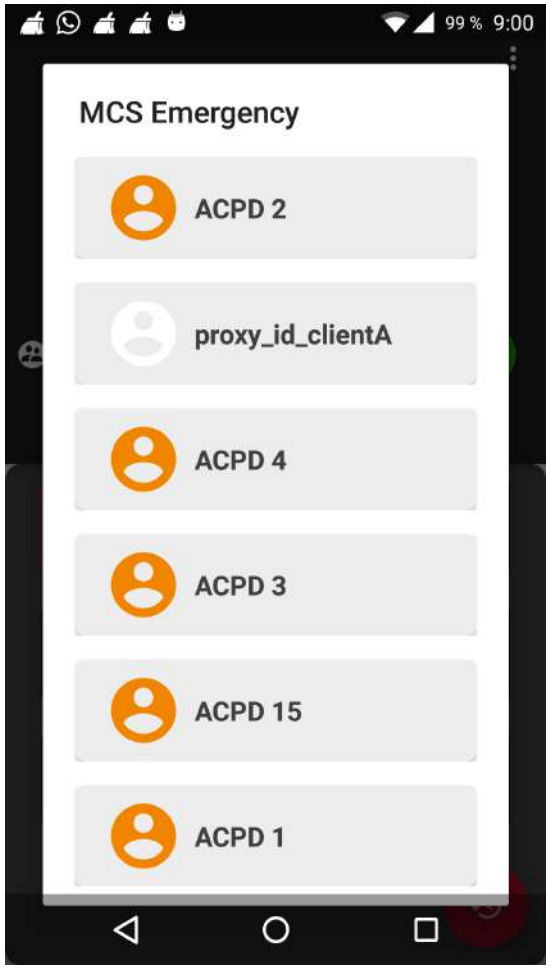

```
    <OnNetwork index="token"><MCPTTGroupInfo lang="en"><entry entry-info="LocallyDetermined" index="0
"><uri-entry>sip:emergency@organization.org</uri-entry><display-name lang="en">MCS Emergency</display
-name></entry><entry entry-info="LocallyDetermined" index="1"><uri-entry>sip:sonim@organization.org</
uri-entry><display-name lang="en">MCS Sonim</display-name></entry></MCPTTGroupInfo>
```

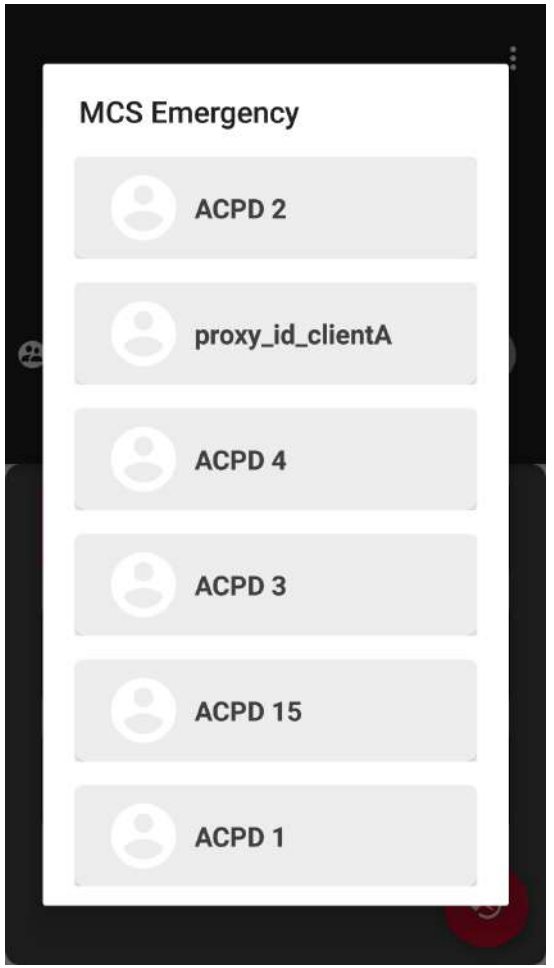
Location and first-step presence

Location

Group members

Subscription to group members' affilition status





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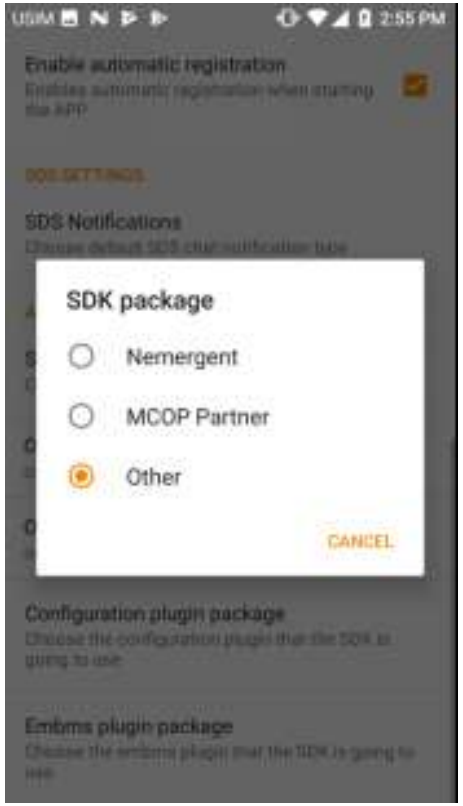
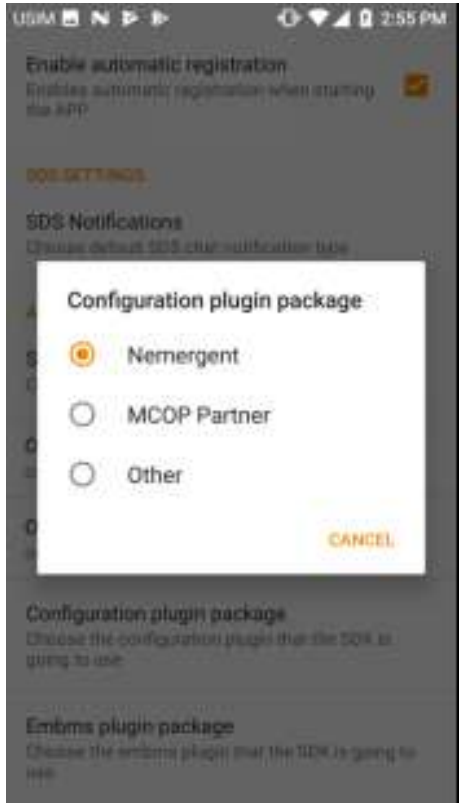
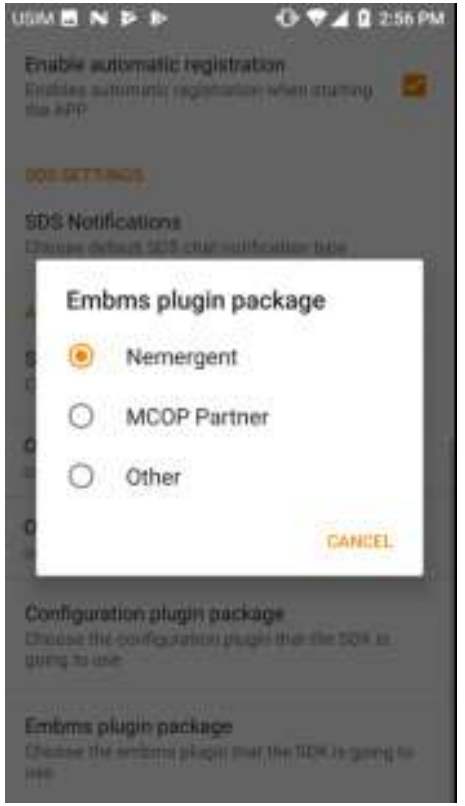
Evolution to support different MCS client providers

SDK selection

Plugins selection







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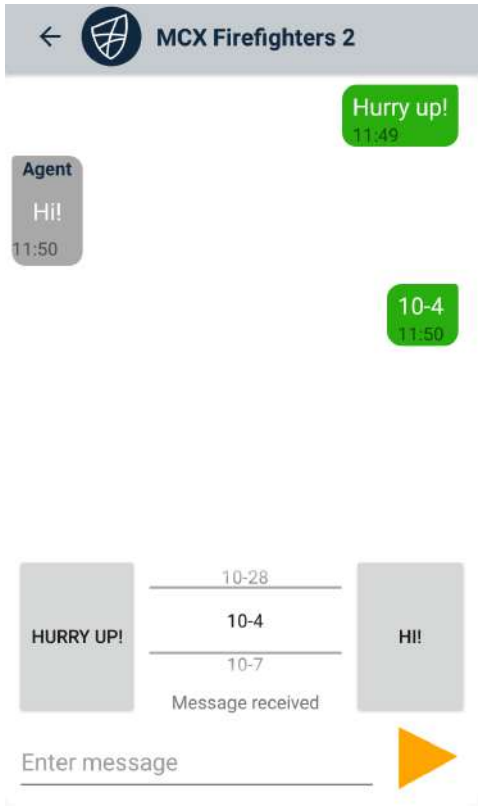
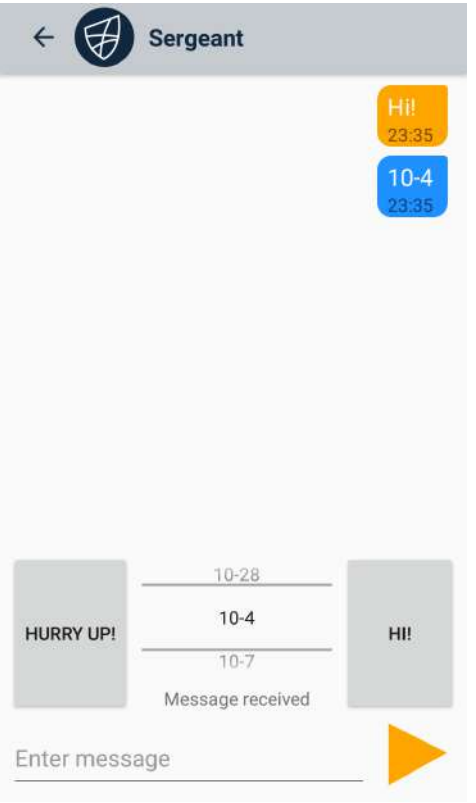
Addition of some Rel14 features

- Private MCVideo calls
- Private and Group SDS
- SDS notifications





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Interoperability (Plugtest events + dif.providers and vendors)

STANDARDS

2nd ETSI MCPTT Plugtest (June 2018)


ETSI The Standards People

Certificate of Participation

awarded to

Sonim Technologies

for their attendance at the 2nd MCPTT Plugtests event

College Station, USA, 25th-29th June 2018

STANDARDS

3rd ETSI MCX Plugtest (December 2018)


ETSI The Standards People

Certificate of Participation

awarded to

Sonim Technologies

for their attendance at the 3rd MCX remote Plugtests Event

from 3rd December 2018 to 31st January 2019

4th ETSI MCX Plugtest (Sept. 2019)

In Process…

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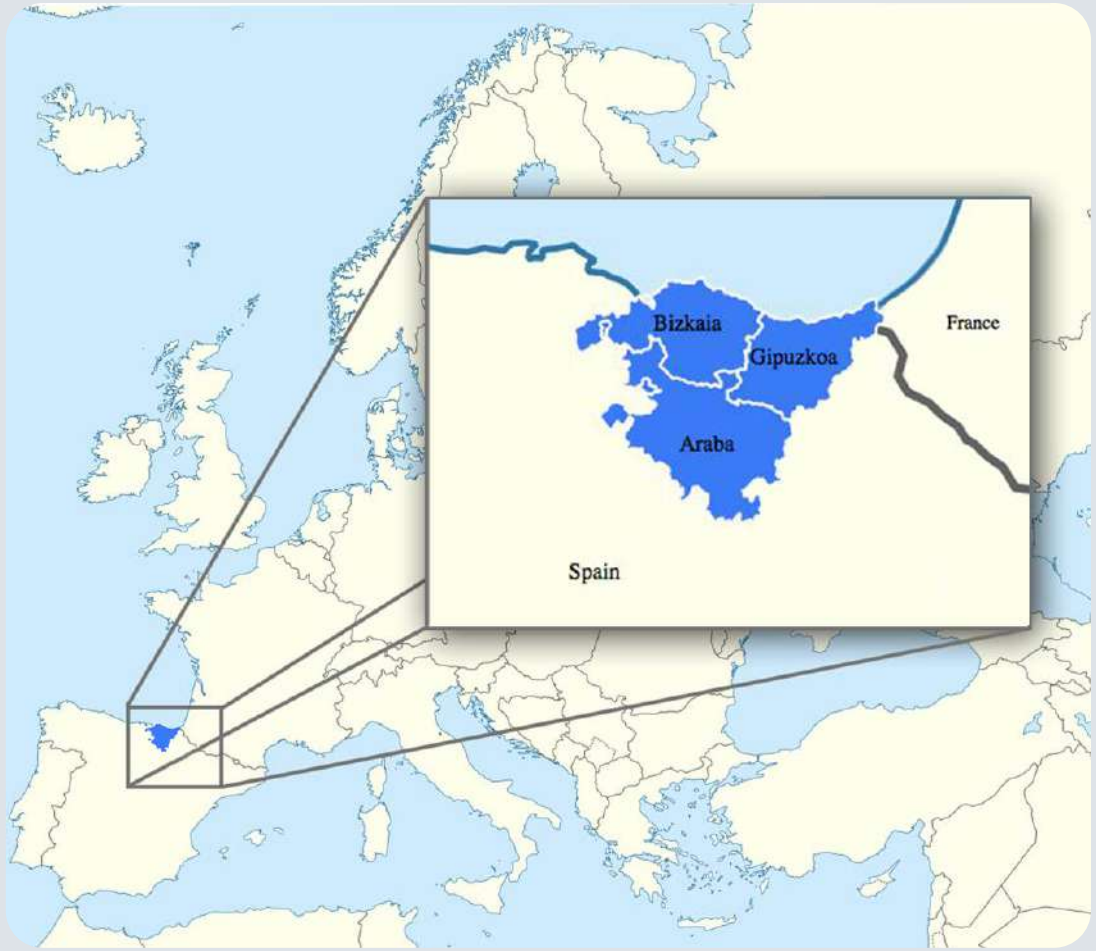
Located in Bilbao, Basque Country, Spain.

Founded in January 2017.

Next generation Mission Critical communications

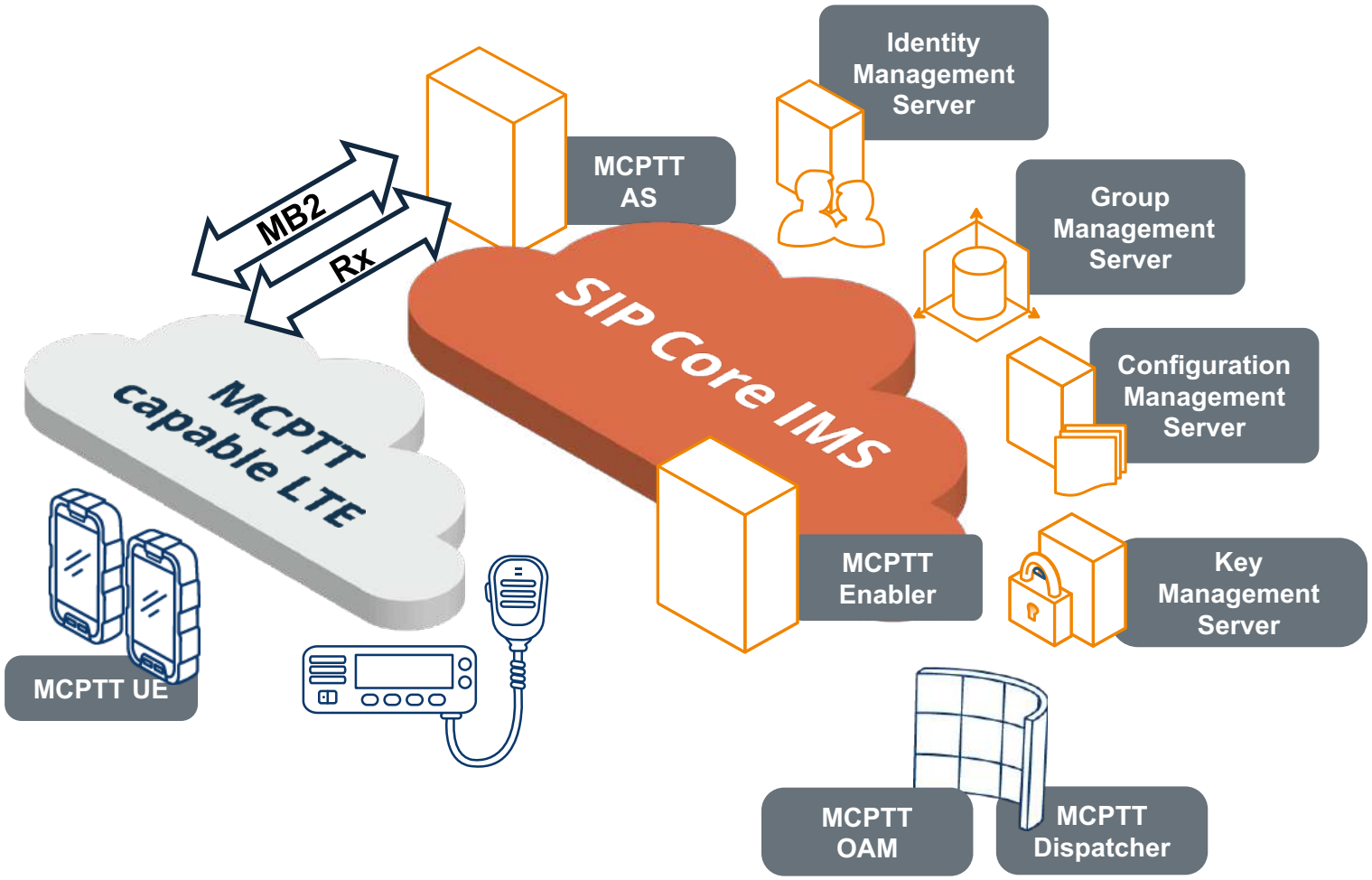
- 3GPP R13 MCPTT
- 3GPP R14 MCVideo & MCData



Year 2 - MCPTT/MCS System in short

- **Rel13 features**: Late call entry, ambient, broadcast, emergency alert, …
- **Rel14 features**: SDS, FD with HTTP, MCVideo TC,…
- Enhanced R13 and R14 OAM front-end and back-end
- Security (ciphering for MCPTT, MCData, eMBMBS, …)
- Hard upgrade of management servers to update them to R15 and beyond
- MCPTT enabler with enhanced capabilities (location, enhanced OAM procedures, group membership and affiliation,…)

Technical evolution



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Interoperability (Plugtest events + dif.providers and vendors)

STANDARDS

1st ETSI MCPTT Plugtest (June 2017)

STANDARDS

2nd ETSI MCPTT Plugtest (June 2018)

STANDARDS

3rd ETSI MCX Plugtest (December 2018)

4th ETSI MCX Plugtest (Sept. 2019)

In Process…

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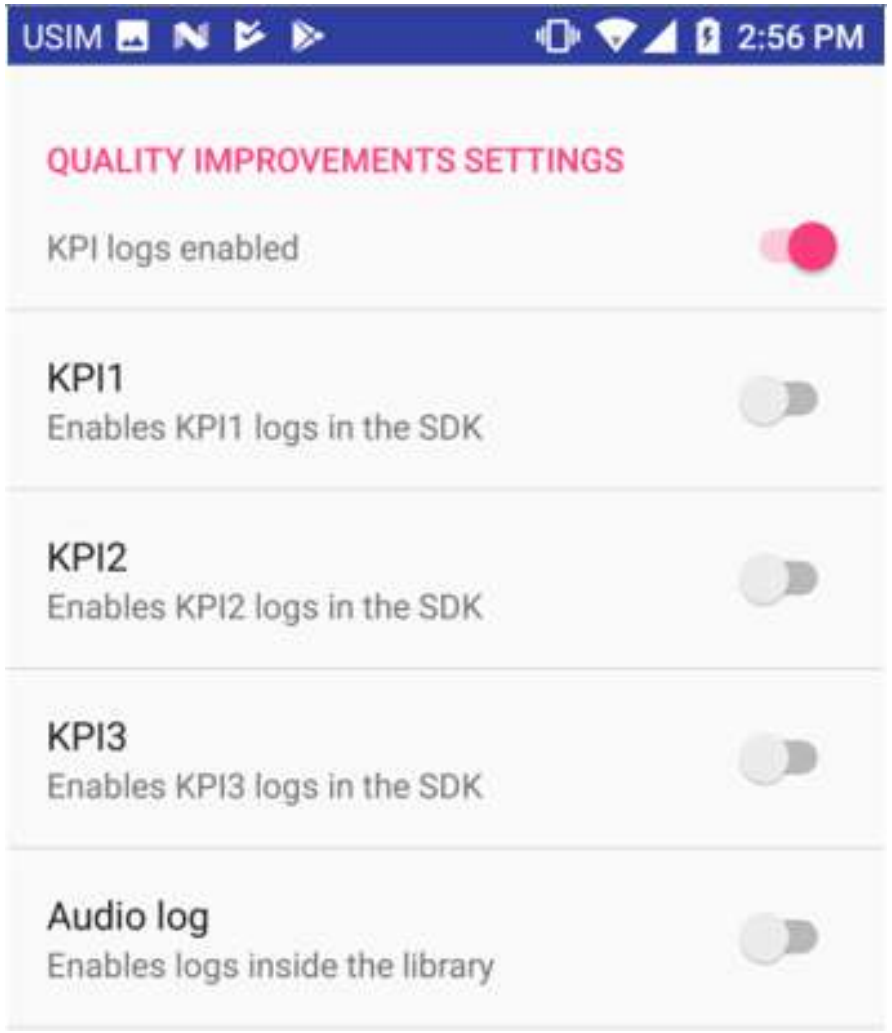
Evolution to log KPIs in client

KPI1

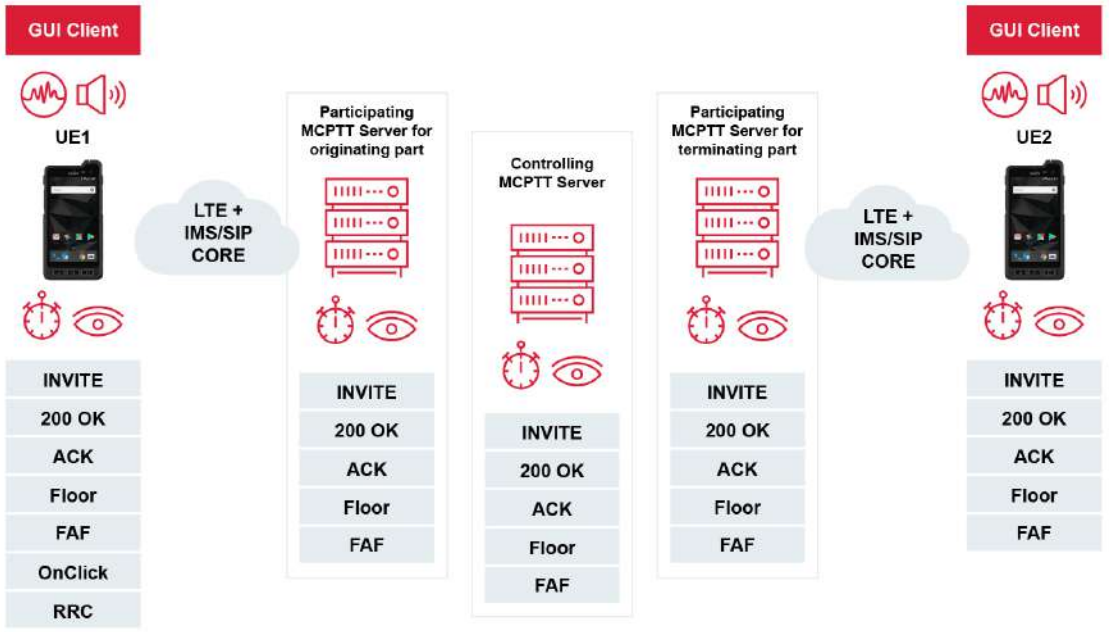
KPI2

KPI3 + Audio path log

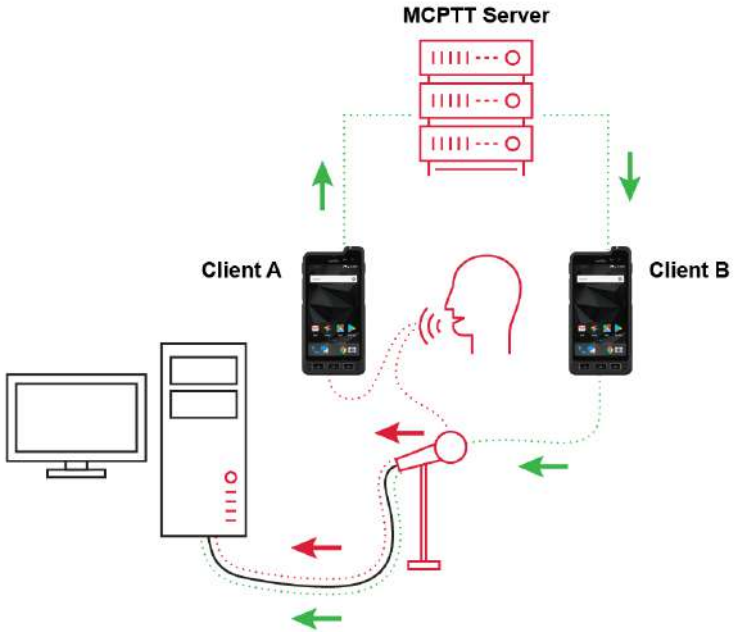


KPI measurements

On-site measurements



Lab measurement



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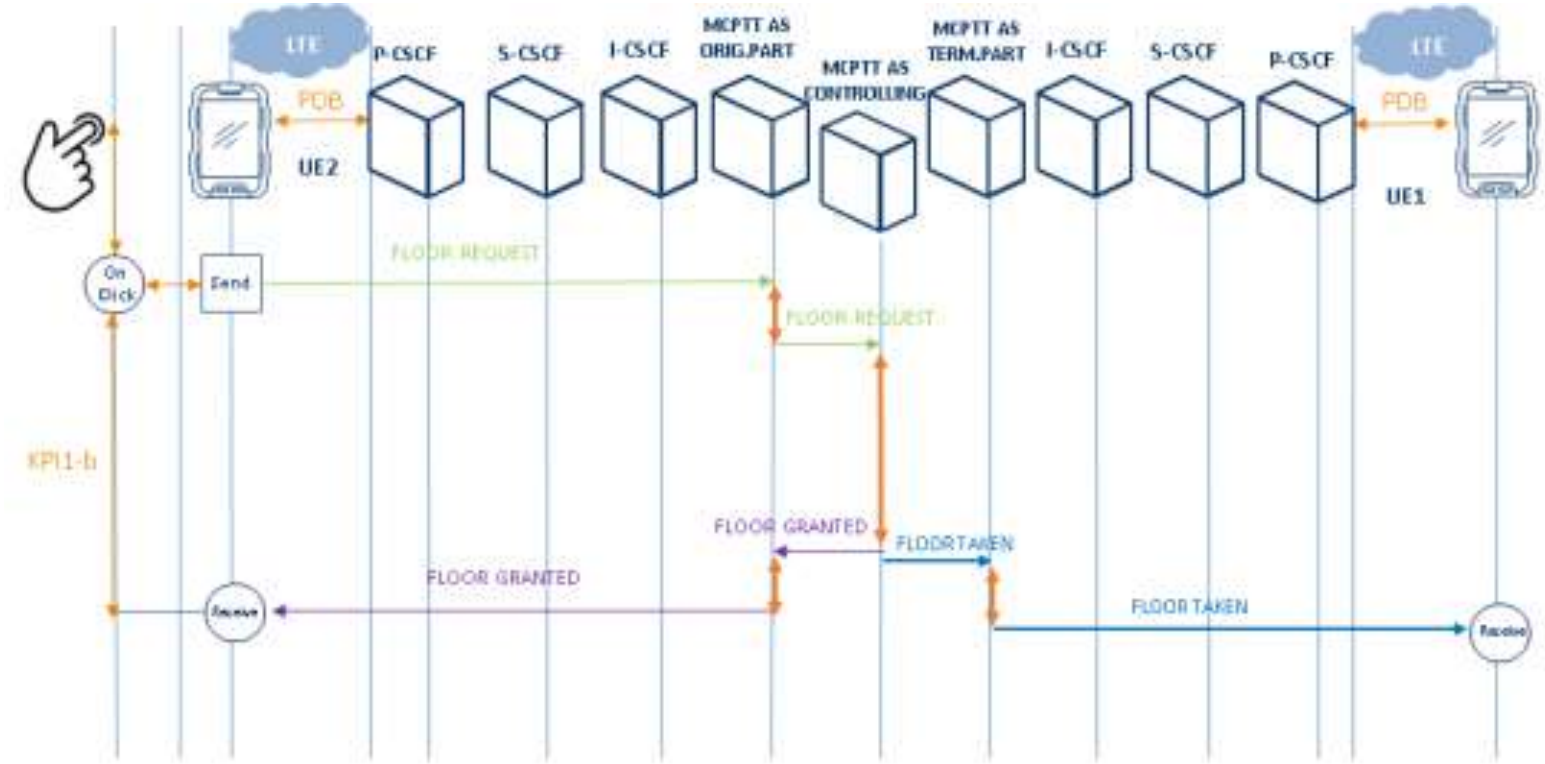
Target KPIs

MCPTT KPIs	Threshold	Likelihood	LTE Packet Delay Budget
MCPTT KPI 1 – Access Time	< 300 ms	95% of all MCPTT requests	< 60 ms
MCPTT KPI 1 – Access Time (Emergency)	< 300 ms	99% of all MCPTT requests	< 60 ms
MCPTT KPI 2 – End-to-End Access Time	< 1000 ms	N/A	< 60 ms
MCPTT KPI 3 – Mouth-to-Ear Latency	< 300 ms	95% of all voice bursts	< 75 ms
MCPTT KPI 4 – Late Call Entry Time (encrypted calls)	< 350 ms	95% of all Late Call entries	< 60 ms
MCPTT PESQ	MOS-LQO ≥ 3.0	N/A	N/A
MCPTT POLQA	MOS-LQO ≥ 3.0	N/A	N/A

KPI1

Year 1 results: 110-250ms
Year 2 results: 110-250ms
Standard limitation: 300ms



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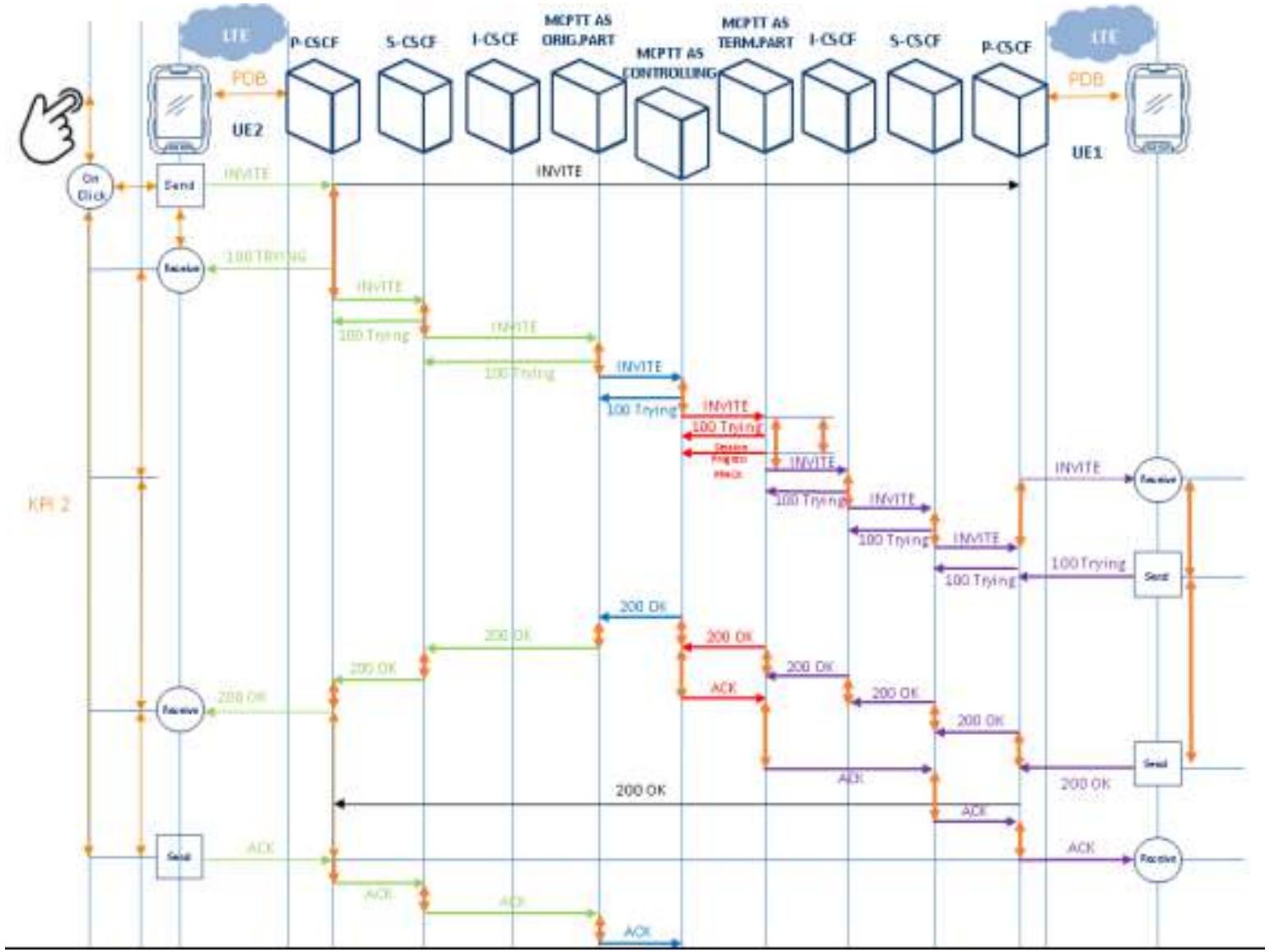
KPI2

Year 1 results: 660ms
Year 2 results: >500ms
Standard limitation: 1000ms



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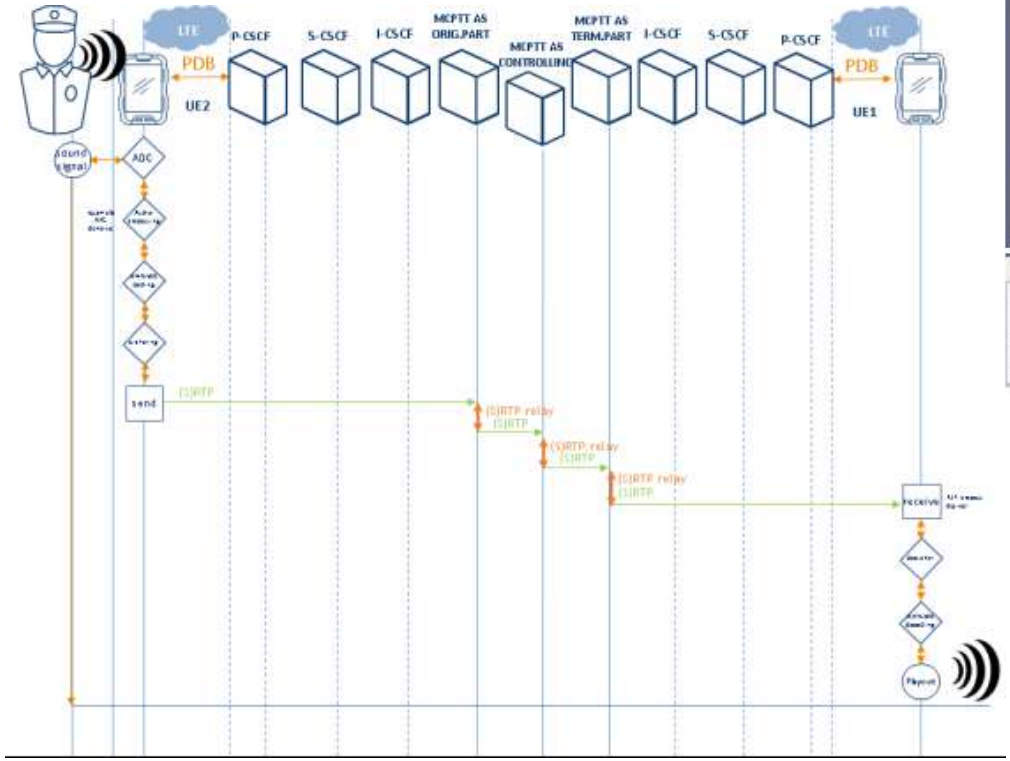
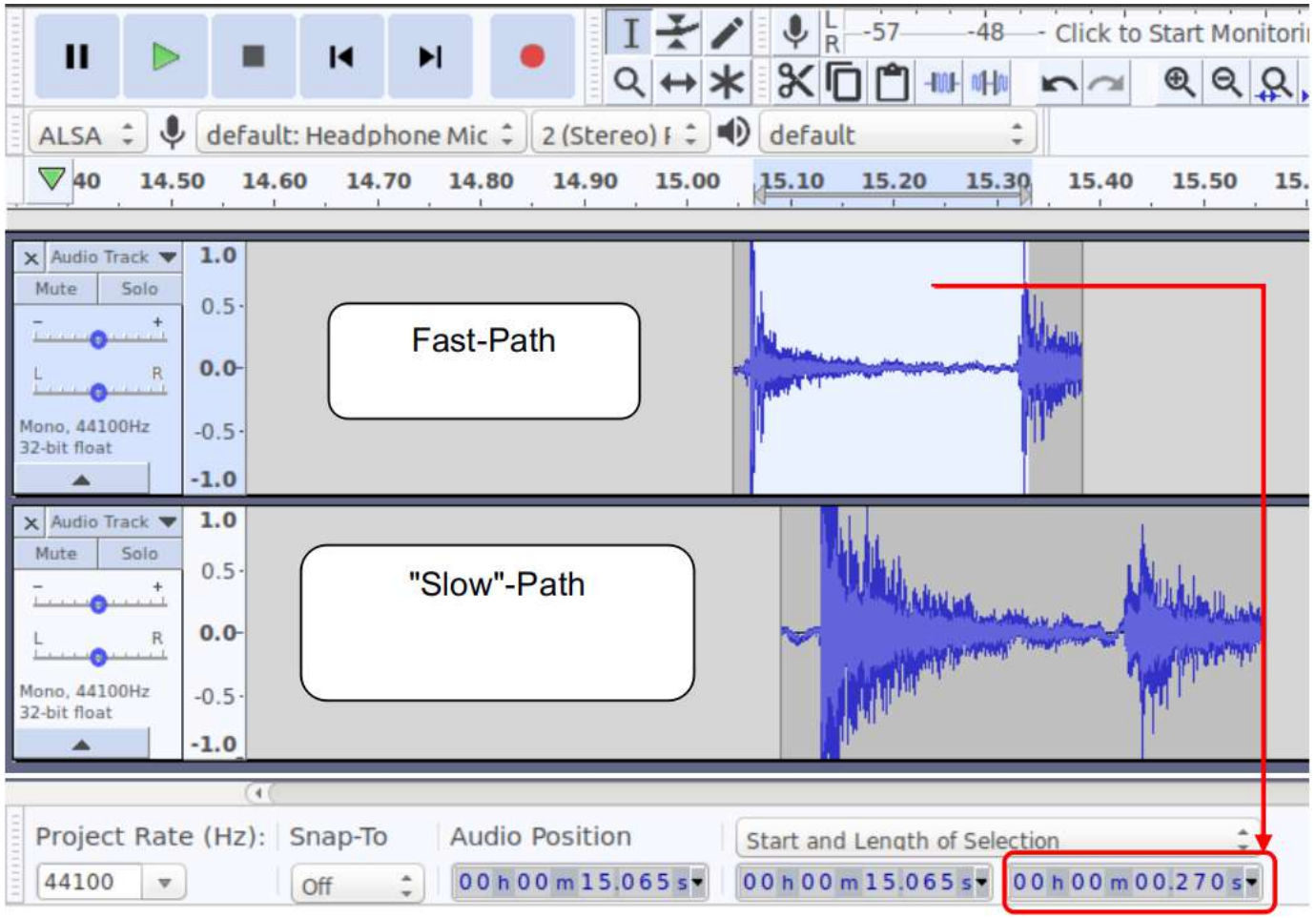
KPI3

Year 1 results: 450ms
Year 2 results: 260-310ms
Standard limitation: 300ms





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POLQA

Year 1 results: Unregistered
Year 2 results: 4.26
Standard limitation: >3

ETSI 2nd MCPTT PLUGTESTS | June 2018

Audio Quality Mean Opinion Score (MOS) Performance Report

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Results show the composite score for 10 samples obtained over 200 seconds of test time as measured via Umetrix Voice evaluation system. (Note the standard report accommodates up to 6 channels, but only two downlink channels were used for this testing.)

	Downlink MOS						Uplink MOS					
	DL	DL	DL	DL	DL	DL	UL	UL	UL	UL	UL	UL
Average		4.26										
Standard Deviation		0.07										
Maximum Score	0.00	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Count	0	10	0	0	0	0	0	0	0	0	0	0
% MOS greater than or equal to 3.2		100.00%										
% MOS less than 3.0		0.00%										
% MOS less than 2.0		0.00%										
% MOS less than or equal to 1.8		0.00%										
Scoring Algorithm	POLQA	POLQA					POLQA	POLQA				
Narrowband Ratio		0%										
Wideband Ratio		100%										

Downlink MOS Distribution

	4.8+	4.7-4.8	4.6-4.7	4.5-4.6	4.4-4.5	4.3-4.4	4.2-4.3	4.1-4.2	4.0-4.1	3.9-4.0	3.9-3.8	3.8-3.7	3.7-3.6	3.6-3.5	3.5-3.4	3.4-3.3	3.3-3.2	3.2-3.1	3.1-3.0	3.0-2.9	2.9-2.8	2.8-2.7	2.7-2.6	2.6-2.5	2.5-2.4	2.4-2.3	2.3-2.2	2.2-2.1	2.1-2.0	<2.0
DL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DL	0%	0%	0%	0%	10%	10%	60%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DL	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

MOS Range

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Testing platforms

- Online platform for Atlantic City Police Department
- Online platform for Fairfax
- Online platform for Sonim
- Online platform for MCOP
- Integration with Enensys/Expway EPC
- Integration with Polaris EPC and One2many multicast module (NIST/PSCR Boulder Labs, CO)
- All-in-one LTE+MCPTT deployable platform (NIST/PSCR Boulder Labs, CO)
- Installation and integration of MCPTT enabler in Boulder premises as pre-standardized inter-working function (IWF) with P25 legacy network.

Atlantic City Police Department (ACPD)

Tests started the 23rd of May

First-hand feedback received

Questionnaire circulated

Plan to have a post-mortem meeting with proposed changes in the MCS client

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First-responder experience with MCS system

1.- How easy is the MCS client to use? *4*
(considering 1: Very hard, 2: Hard, 3: Neutral, 4: Easy and 5: Very easy)

Could you elaborate?
After minimal training we found all users were able to operate the MCS client with relative ease.

2.- In your previous experience with public safety communications, what do you miss most? Is the interoperability with other agencies a desirable feature?

Compared to a standard radio I miss the knobs on the top of the radio making turning the device on/off, volume control and switching channels easy and effortless. The speaker mic was not useful on the MCS as you did not know who you were calling/answering without looking at the display.
Interoperability with other agencies is an extremely desirable feature.

3.- Which feature of the MCS client is the most important in your daily life? Why?

Coverage area is extremely important. Need the MCS to work when needed inside of buildings and throughout the city. This is important for officer safety. The MCS did not function when the bandwidth was congested during the Beach Concerts; whereas the phone and text messaging worked without issue on the FirstNet system.

4.- Which feature of the MCS client is the least important in your daily life? Why?

1)The MCS did not allow attachments (photo) and you had to leave the application to share a photo (although the video worked well).
2) The main problem with the MCS client was the creation of an 'Open Mic'. A sincle touch of the user to be called created an open mic (transmitting without keying the PTT) and the user could be unaware. This was very problematic and should be ELIMINATED.

5.- Is there any feature that you would strongly recommend us to add? Why?

1) Addition of an ALERT feature to signal the recipient of the call. Very useful in a high noise environment and to show an attempted call was missed.
2) Ability to share attachment in the application (photo) without exiting.
3) Ability to use the application with others not on a Sonim platform (restricts available users).
4) Administration portal to clone or set up all users remotely, and not have to program each device individually. Items like changing alias names, talk groups, settings etc.
Attachment to the phone with knobs similar to a traditional radio.

6.- In the experience with the MCS client, please, describe a situation where the product was useful.

The product was useful during the beach concerts in Atlantic City. Our SWAT team utilized the sonim phones with MCS client to communicate amongst each other. The Firstnet netwok worked flawlessly while the traditional cellular networks were experiencing congestion issues making phone calls difficult. We had no issues on the FirstNet network.

7.- Do you foresee the future utilization of the MCS client? Do you want to be involved in the evolution of the MCS client?

Yes, if it is improved. and Yes.

8.- Could you describe a real issue in the field that could be solved with enhanced communications but yet, you have not found the appropriate product/solution?

With our current traditional radio network we are unable to communicate with other agencies if their radio channels were no preprogramed into our radio or a patch is not initiated. Need a more robust with the ability to add in users without any advanced notice.

9.- Would you recommend the MCS client to other first-responders?
Yes, if improved.
10.- Rate the overall experience.
(considering 1: Very bad, 2: Bad, 3: Neutral, 4: Good and 5: Very good) *4*

Could you elaborate?

Was a good experience, with further enhancements this product could be very useful to law enforcement. Some features of the ATT Client application should be examined.

Public Safety Innovation Acceleration Program (PSIAP)

- Project objectives
- Client UE/application.
- MCPTT server-side.
- Functional & performance testing.
- Test deployments.
- **Dissemination.**
- Project summary.
- Demonstration.
- Q & A

PSIAP work - Dissemination

EVENTS

Berlin, Germany
18-21 September 2018

InnoTrans

- Frequentis dispatch system
- LTE-in-a-box
- Nemergent MCPTT
- SONIM XP8

Nemergent / Solutions | sonim

PSIAP work - Dissemination

EVENTS

Barcelona, Spain
25-28 February 2019

GSMA MWC19™ Barcelona

- First event with adapted MCPTT/MCS client to MCOP interfaces
- LTE-in-a-box (with eMBMB support)
- Nemergent MCS
- SONIM XP8

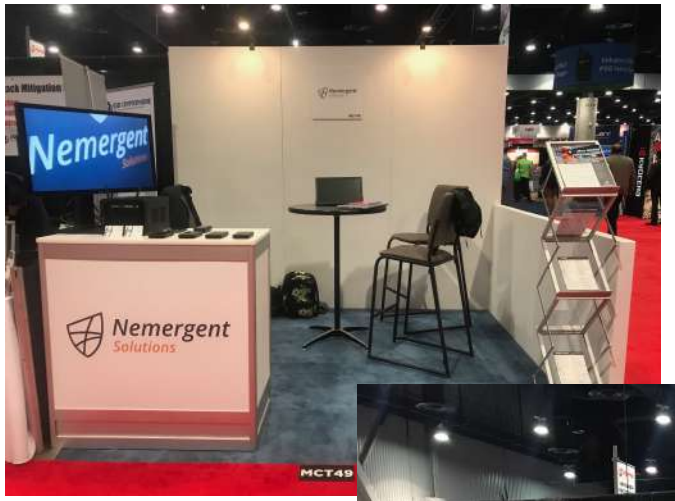
Nemergent / Solutions | sonim

PSIAP work - Dissemination

EVENTS

Las Vegas, NV
6-7 March 2019

IWCE
INTERNATIONAL WIRELESS COMMUNICATIONS EXPO



- Focused on showing Rel14 MCVideo and MCData
- LTE-in-a-box (with eMBMBS support)
- Nemergent MCS
- SONIM XP8

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PSIAP work - Dissemination

EVENTS

Coventry, UK
12-13 March 2019

TCCA Critical Communications Europe 2019

BAPCO The Annual Event 2019

- Multi-technology and cross-device MCPTT system
- Nemergent MCS
- SONIM XP5, XP8, Bittium, Telo, P25 devices, …

Nemergent / Solutions | sonim

PSIAP work - Dissemination

EVENTS

Malaga, Spain
6-7 May 2019

5G FORUM

- Influence in European projects
- Focused on providing technology for first-responders
- Nemergent MCS
- SONIM XP8

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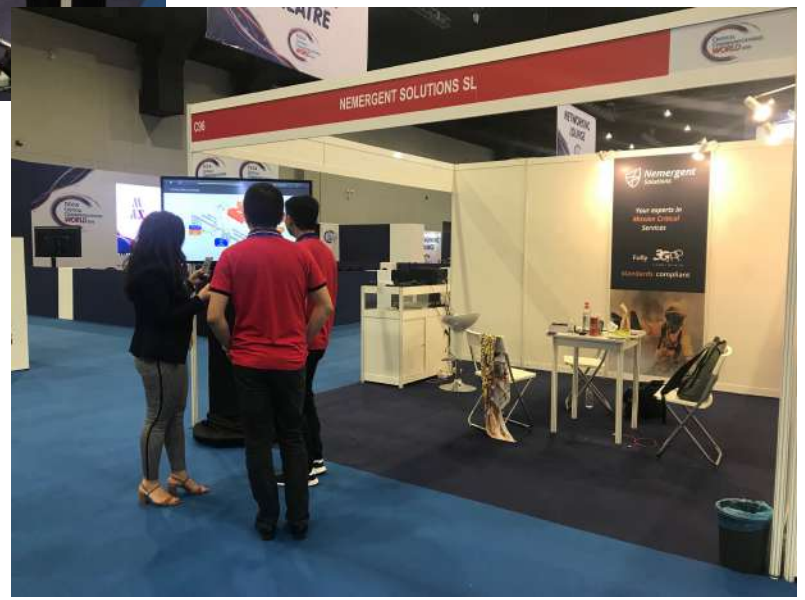
PSIAP work - Dissemination

EVENTS

Kuala Lumpur, Malaysia
18-20 June 2019

TCCA CRITICAL COMMUNICATIONS WORLD 2019



- Enhanced MCS OAM interface
- LTE-in-a-box (eMBMS support)
- Nemergent MCS
- SONIM XP8

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Project Objectives Revisited

Second Year Progress – Highlights – Platform Integrations

- **Service Integration**
  - Completed 100% of planned deliverables
- **Mission Critical Experience**
  - Completed 100% of planned deliverables
- **MCPTT Server Components**
  - Completed 100% of planned deliverables
- **Testing**
  - Completed 100% of:
    - Integration Testing Definition
    - Interoperability Testing (through 3rd ETSI Plugtest)
    - 90% of planned field testing
    - 90% of planned test reports

* Plan is to complete all field testing and test reports by 9/2/2019

Deliverable	Percentage Complete %	Planned Completion Date
Service Integration		
PTT App Integration on UE	100	4-Aug-17
APN for data connection	100	14-Sep-17
MCPTT Integration - Service Level	100	Jun 18 2018
QCI integration	100	Apr 20 2018
E2E Broadcast Services SDK	100	Jun 18 2018
Service Level Integration SDK Pkg	100	Jun 18 2018
Mission Critical Experience		
PTT Key integration / SDK	100	Dec 18 2017
PTT Android framework modifications	100	Apr 20 2018
PTT SDK / guide	100	March 31 2019
PTT Audio path demo / guide	100	Jan 31 2019
CSM - Generic API	100	March 28 2018
CSM Accessory Prototype for UE	100	Jan 05 2018
MCPTT integration with CSM	100	Apr 23 2018
CSM SDK Pkg	100	Feb 03 2018
KPI Improvements	100	March 31 2019
Presence	100	Apr 20 2019
Professionally designed UX/UI	100	Mar 31 2019
MCPTT Server Components		
First Release of MCPTT System	100	September 29 2018
Second Release of MCPTT Management Servers	100	December 31 2018 (tentative- 3GPP specs still in progress)
Second release of MCPTT AS	100	Feb 27 2019
Testing		
Integration Testing (Definition)	100	December 31 2018
Interoperability Testing	100	June 30, 2019 (expected / 2019 MCPTT Plugtest)
Field Testing	90	April 30, 2019 – August – 2019
Test Reports	90	Monday, September 2, 2019

Legend
- TBD
- Completed
- In Progress

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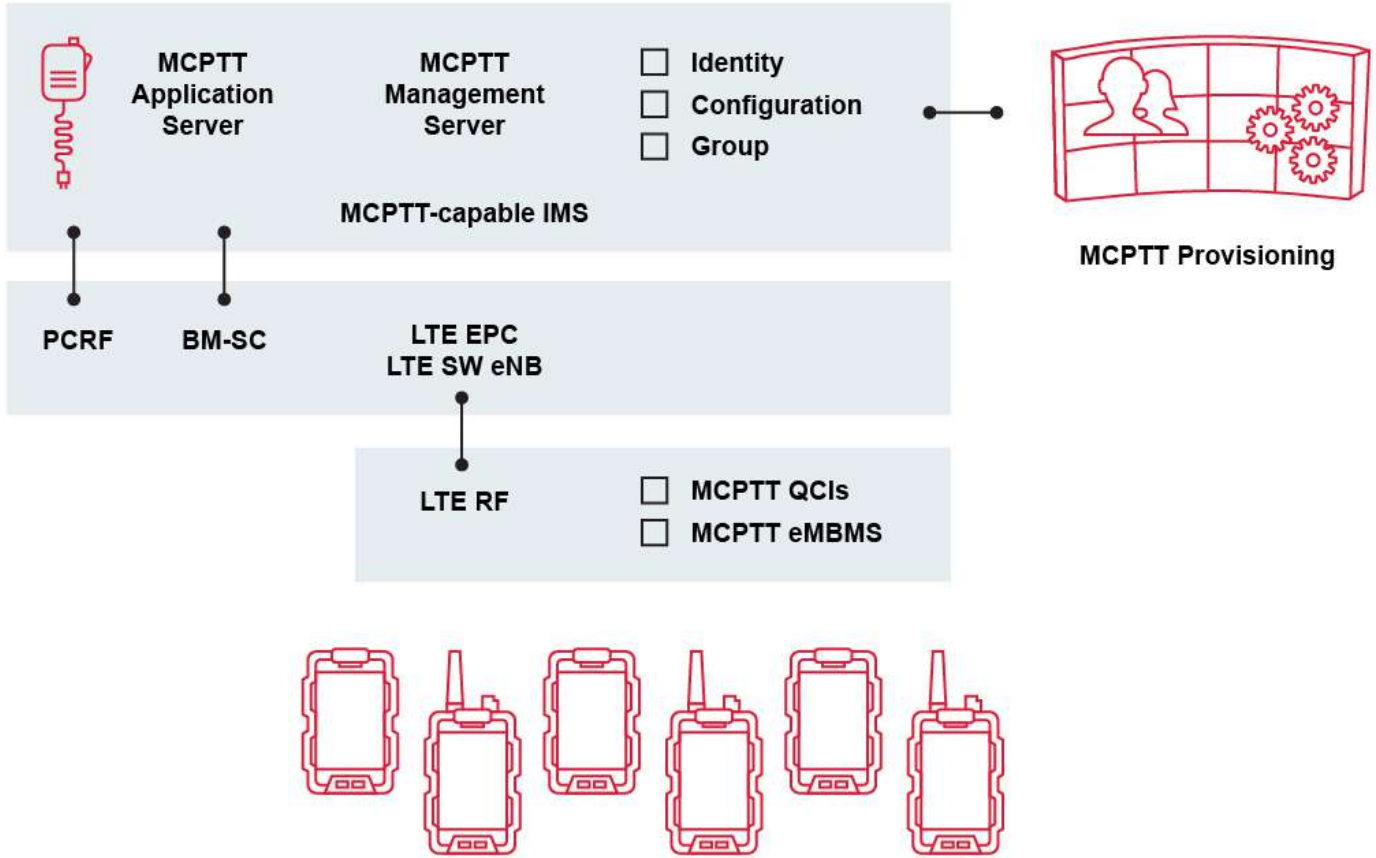
Small scale / Portable demo



Portable MCPTT + IMS system

SW-based SDR LTE system

MCPTT compliant UEs

3GPP QoS support - QCI 65 and 69

3GPP eMBMS support

MCPTT GUIs (client, OAM, dispatch)

Protocol traces

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NIST National Institute of Standards and Technology U.S. Department of Commerce

PSCR

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Thank you.

NIST National Institute of Standards and Technology U.S. Department of Commerce

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