The development trend of 5G emergency system

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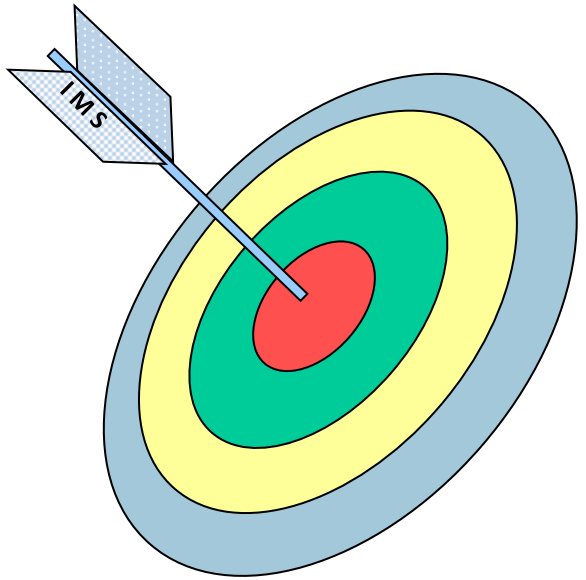
Course Objectives:

Introducing the development of emergency system technology and standard, the progress of emergency technology and industry in China, and the application situation in other countries.

Contents

- emergency system Summary
- International emergency system technology and standard
- emergency system Standards in China



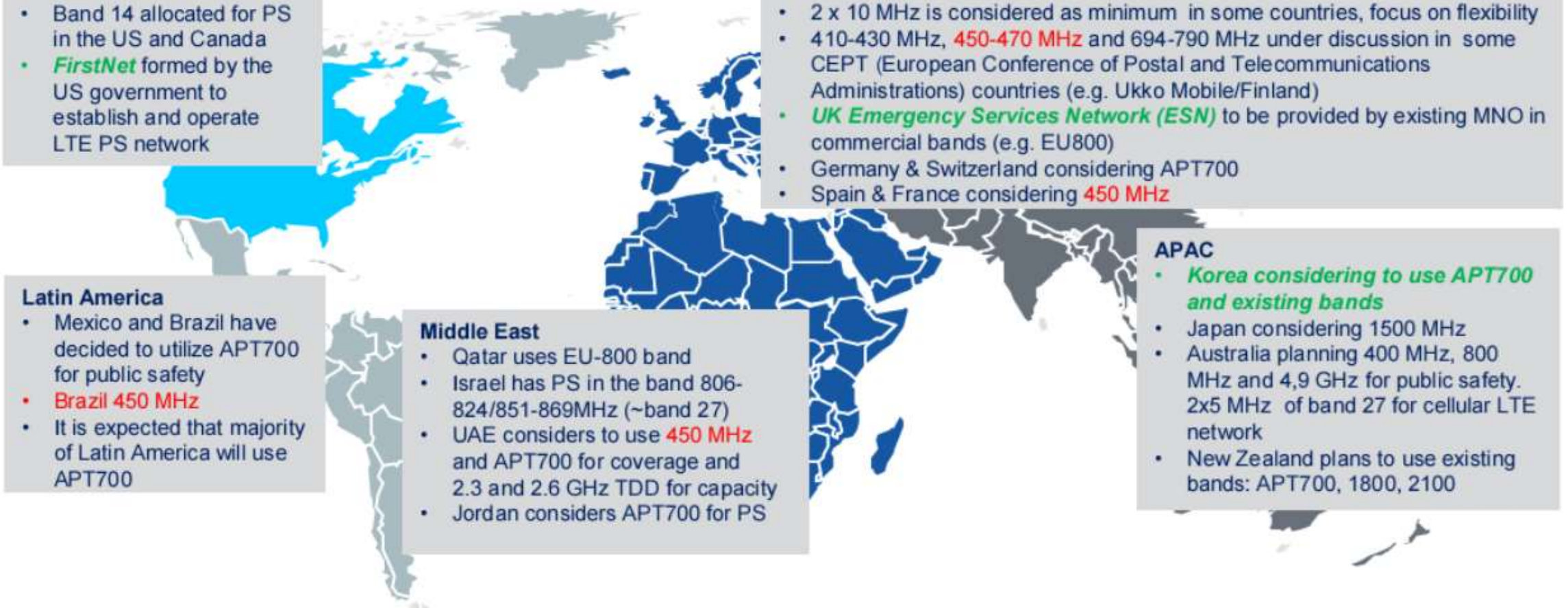
Four “legs” of emergency communications

- citizen-to-citizen
- citizen-to-government
- government-to-citizen
- government-to-government

Four “legs” of emergency communications

- **citizen-to-citizen** - An individual communicating an emergency to another individual or private organization via available options.
- **citizen-to-government** - An individual communicating an emergency message to appropriate authorities via available options.
- **government-to-citizen** - Government or authorized officials communicating alerts or details of an emergency to individuals and organizations via available options.
- **government-to-government -** includes governmental authorities communicating to each other, other agencies, and appropriate National Security/Emergency Preparedness (NS/EP)-designated private industry concerns and coordinators.

Global public safety spectrum planning



North America
- Band 14 allocated for PS in the US and Canada
- *FirstNet* formed by the US government to establish and operate LTE PS network

Europe
- 2 x 10 MHz is considered as minimum in some countries, focus on flexibility
- 410-430 MHz, 450-470 MHz and 694-790 MHz under discussion in some CEPT (European Conference of Postal and Telecommunications Administrations) countries (e.g. Ukko Mobile/Finland)
- *UK Emergency Services Network (ESN)* to be provided by existing MNO in commercial bands (e.g. EU800)
- Germany & Switzerland considering APT700
- Spain & France considering 450 MHz

Latin America
- Mexico and Brazil have decided to utilize APT700 for public safety
- Brazil 450 MHz
- It is expected that majority of Latin America will use APT700

Middle East
- Qatar uses EU-800 band
- Israel has PS in the band 806-824/851-869MHz (~band 27)
- UAE considers to use 450 MHz and APT700 for coverage and 2.3 and 2.6 GHz TDD for capacity
- Jordan considers APT700 for PS

APAC
- *Korea considering to use APT700 and existing bands*
- Japan considering 1500 MHz
- Australia planning 400 MHz, 800 MHz and 4,9 GHz for public safety. 2x5 MHz of band 27 for cellular LTE network
- New Zealand plans to use existing bands: APT700, 1800, 2100

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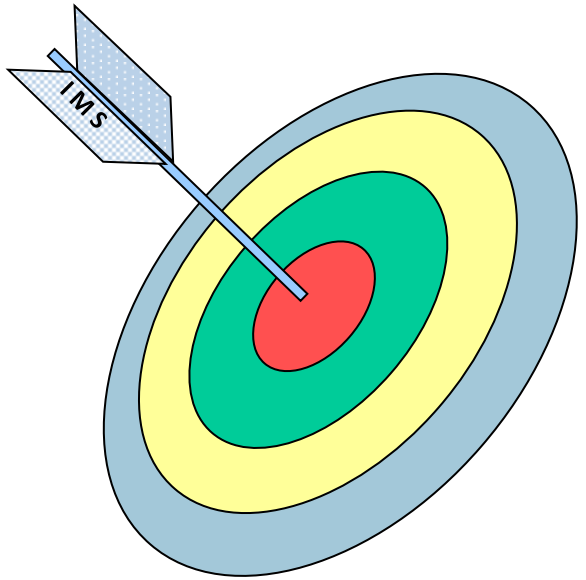


What is MCPTT

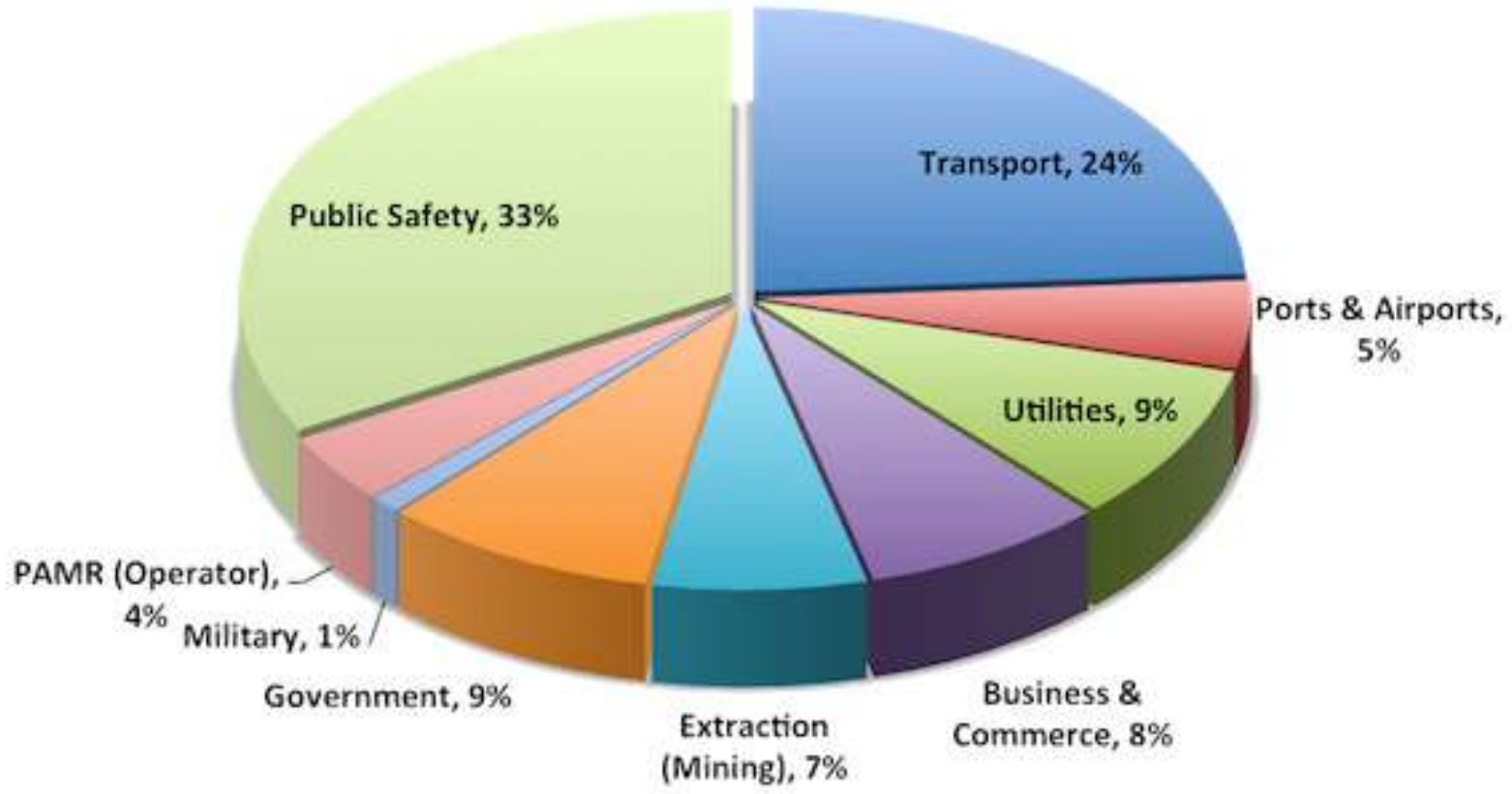
- MCPTT--Mission critical push to talk
- MCPTT new global standard, which will replace legacy group communication systems, such as VHF, TETRA, P25, iDEN and others.
- Features
  - Group communication system enablers for LTE-GCSE
  - Isolated E-UTRAN operation for public safety(IOPS)
  - Proximity service a.k.a prose , LTE-D,direct mode ,D2D
  - Enhanced bearer assignment (QCI values)
-

Who specified and support MCPTT

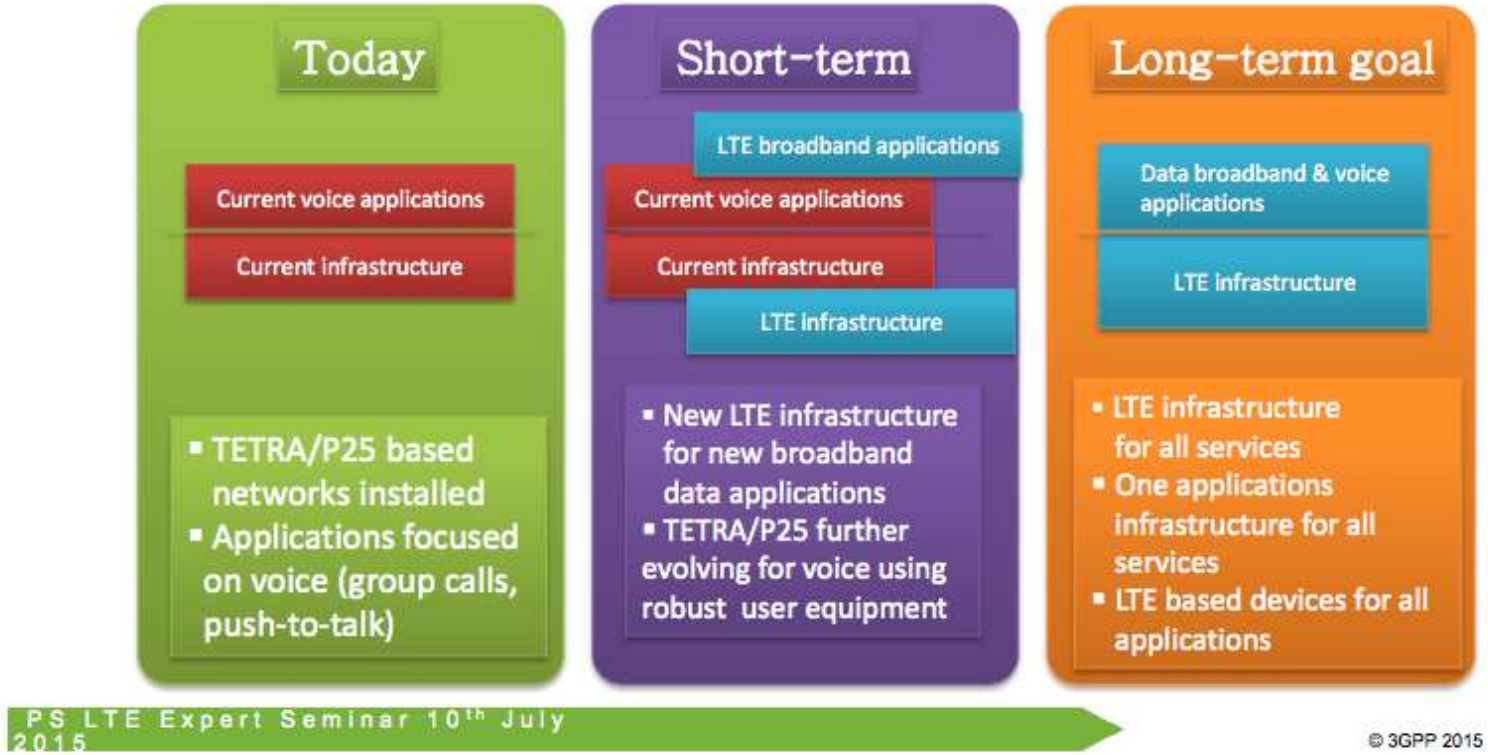
- FirstNet
- NPSTC
- The United Kingdom Home Office
- TCCA
- APCO
- TIA
- OMA
- ETSI

Who are MCPTT users

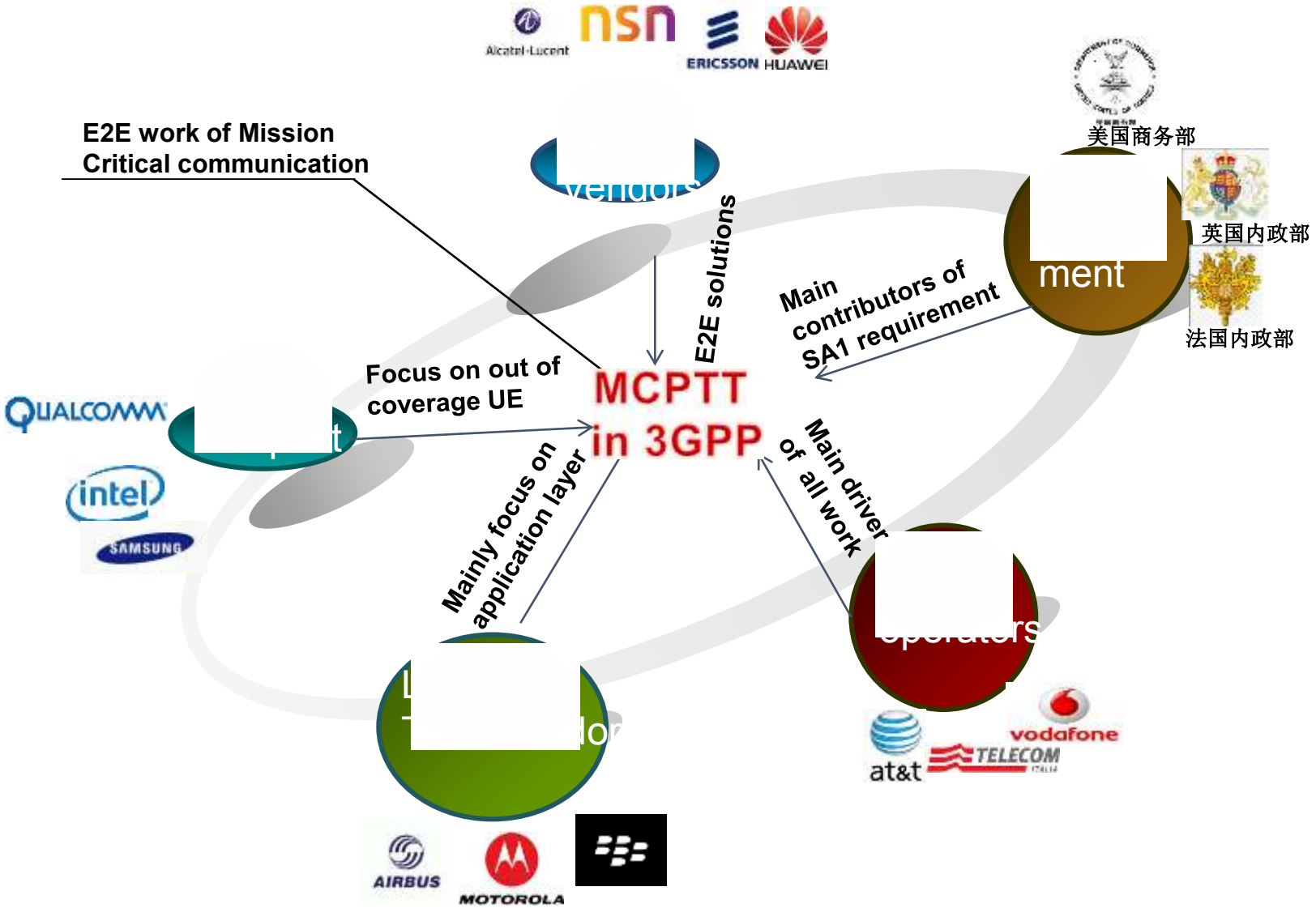
MCPTT market (users) comprises from several sectors:



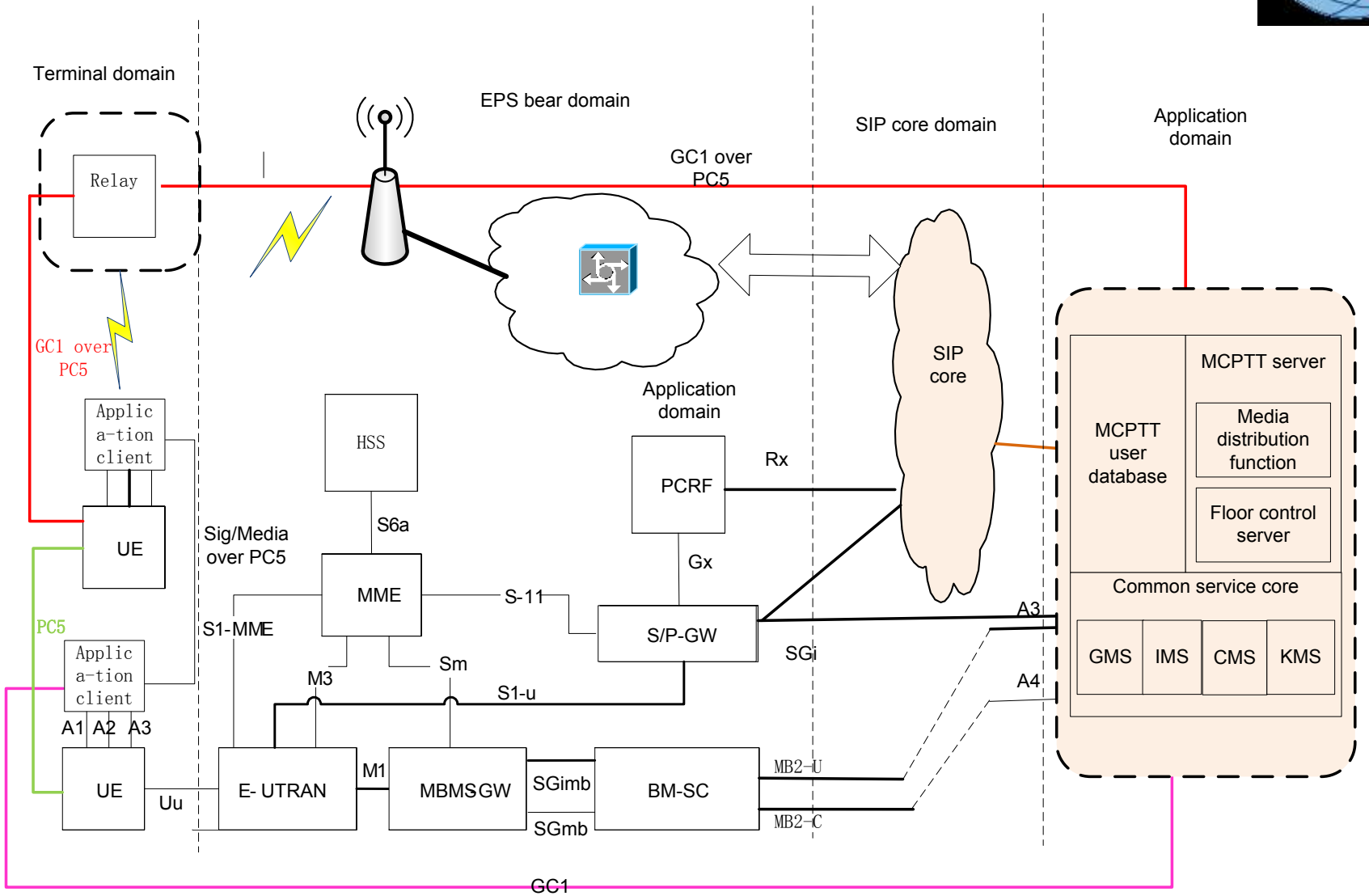
Technology migration



Main Players

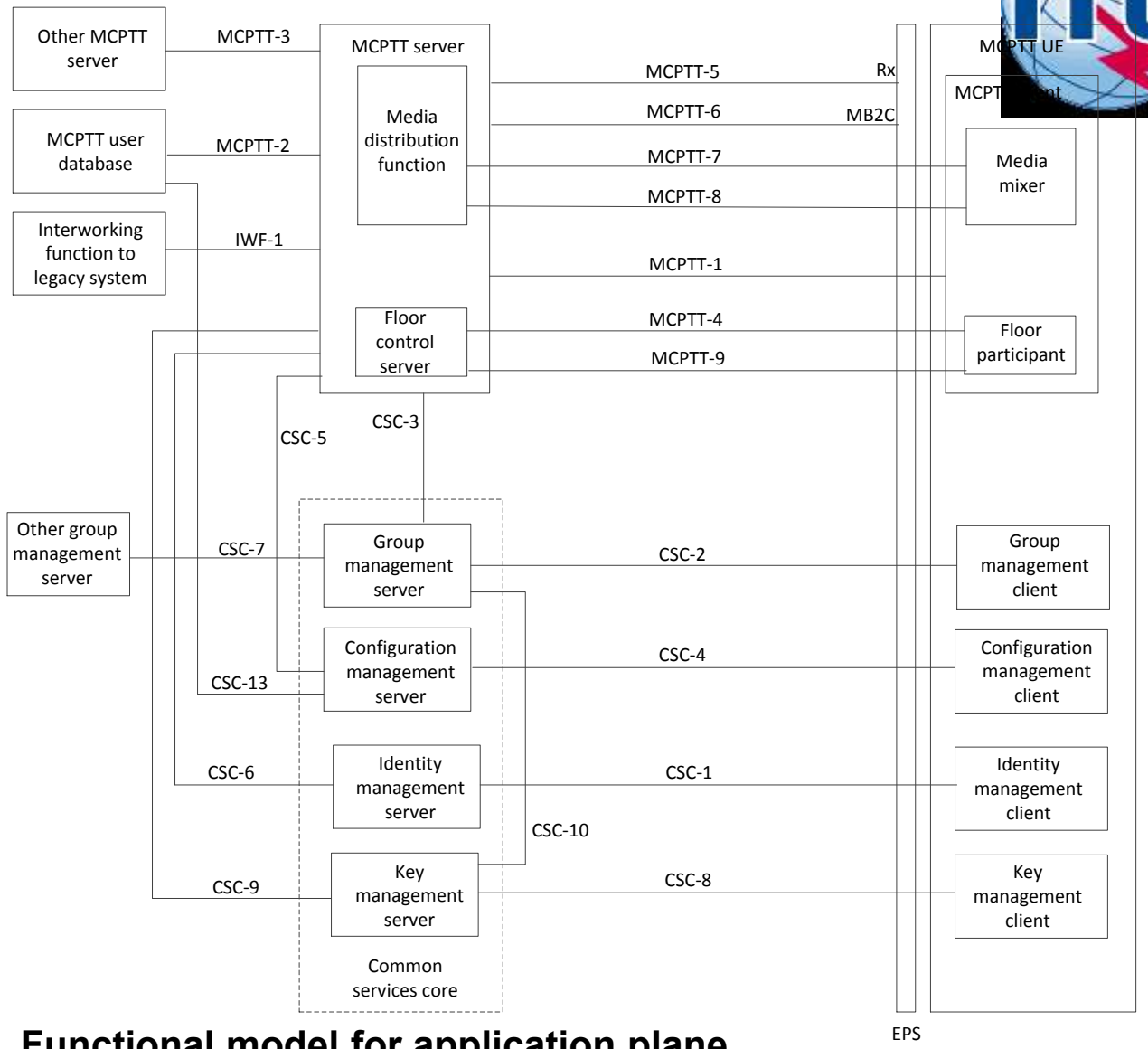


3GPP MCPTT architecture



Architecture

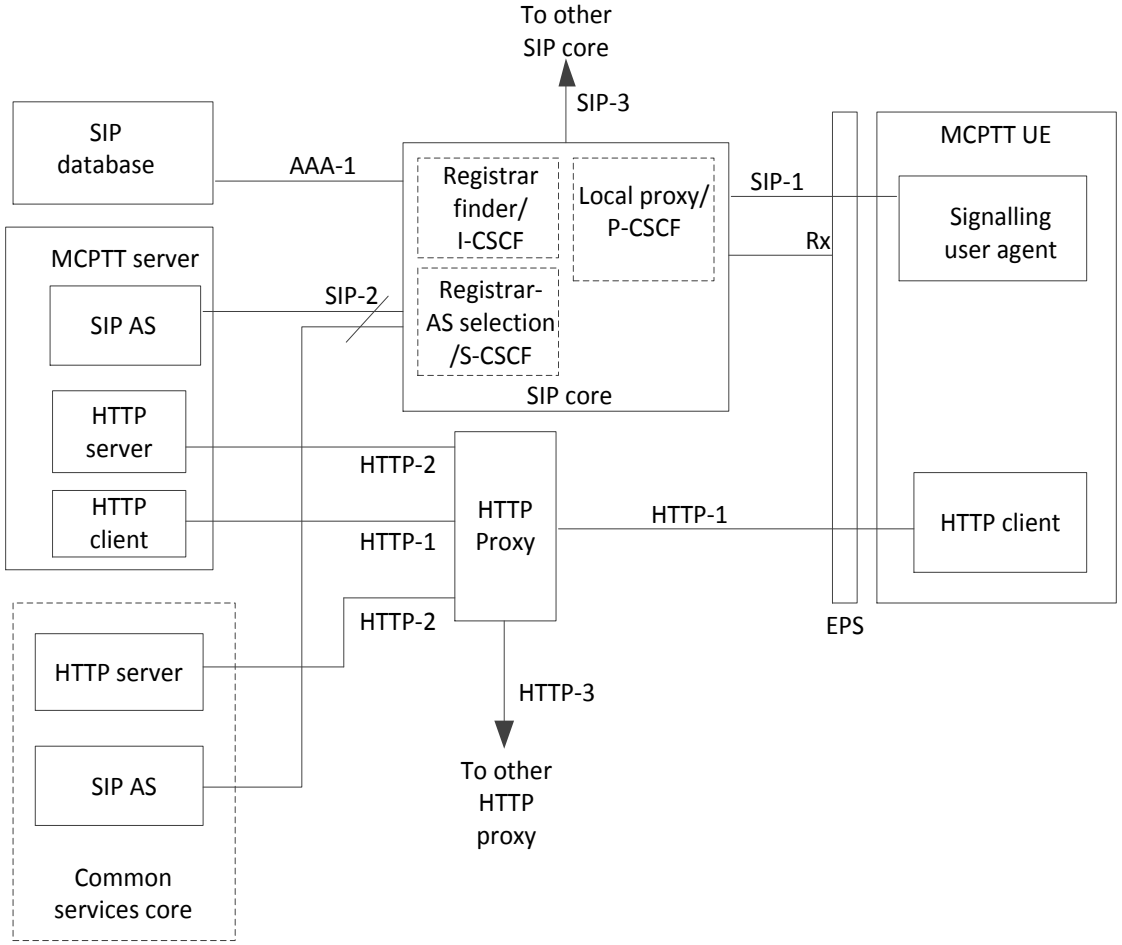
- MCPTT server
  - Call control
  - Floor control
  - Media handling
- Common server core
  - Group management
  - Identity management
  - Config management
  - Key management



Functional model for application plane

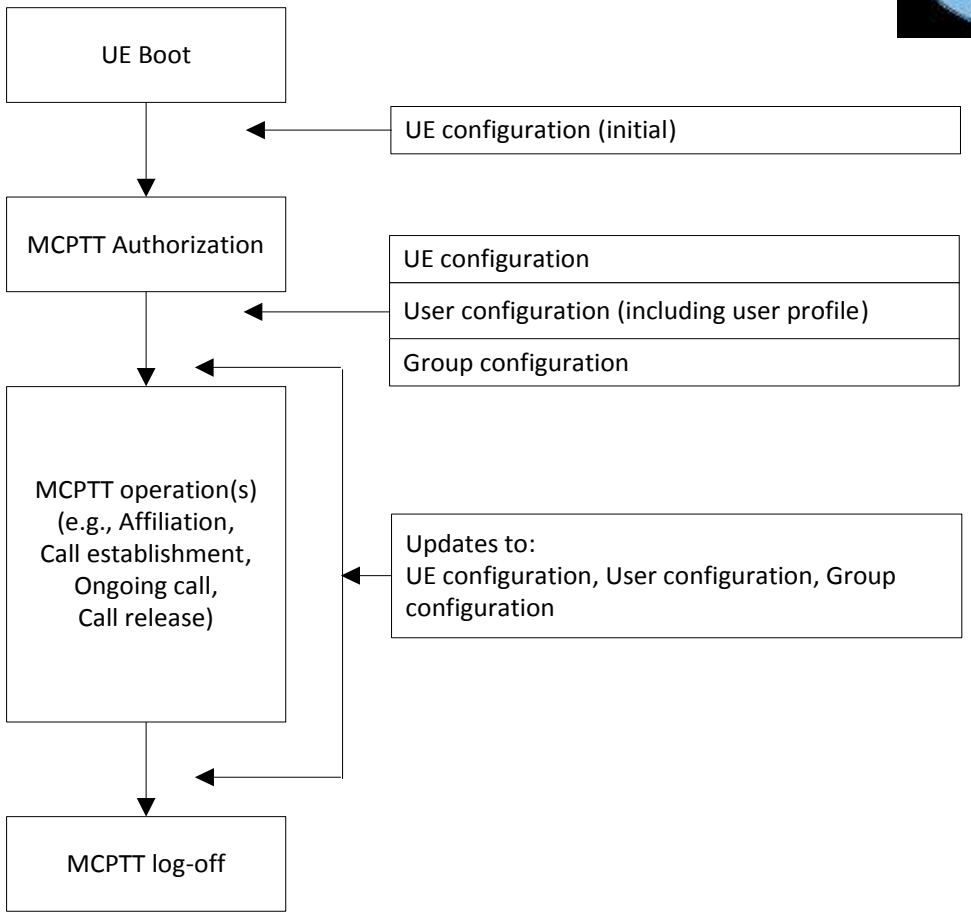
Architecture

- SIP core
  - compliant with IMS core; or simplified IMS core
  - Local proxy
  - Registration
  - Service selection
  - Security of SIP signaling



Functional model for signalling control plane

Functionalities



MCPTT service life circle

3GPP specifications status

Topic	Description	Release
Proximity Services (ProSe)	Basic discovery and communication functionality.	Release 12
Proximity Services (ProSe) and D2D	Restricted ProSe Direct Discovery for non-Public Safety use. Direct Discovery for Public Safety use. UE-Network relays for Public Safety use. UE-UE relays for Public Safety use. Direct Communication one-to-one for Public Safety use.	Release 13
Basic Group Communications (GCSE)	GCSE provides generic building blocks for resource efficient downstream communication to a group of UEs for the design of application layer functionality.	Release 12
Proximity Services (ProSe)	Group Communication via the network. Group Communication via the network and a ProSe UE-to-Network Relay. Relationship between a GCSE Group and members using ProSe Group Communication. Notably: interaction between group communication and ProSe UE-UE or UE-Network relays. Support for eMBMS single cell broadcast areas, for networks where this deployent scenario is needed.	Release 13
Mission Critical Push-to-Talk (MCPTT)	Provides arbitrated method by which two or more users may engage in communication. Designed to support mission critical usage, but can be deployed in non-mission critical scenarios. Emulates functions provided by PMR/LMR systems. Mainly for group call support, but private one-to-one calls supported too. Works in both on-network and off-network scenarios. Not all functions available when device operates off-network.	Release 13

Technical Requirement for 3GPP

- 1. Various media such as conversational type communication (e.g. voice, video) or
- streaming (e.g. video) or data (e.g. messaging) or a combination of them.
- 2. Group Communication end-to-end setup time less than or equal to 300ms.
- 3. Service continuity.
- 4. The number of Receiver Group Members is unlimited.
- 5. Security level for Group Communication.
- 6. Roaming and network interworking.
- 7. Charging.
- 8. High availability of Group Communication.

Or why should I be interested?

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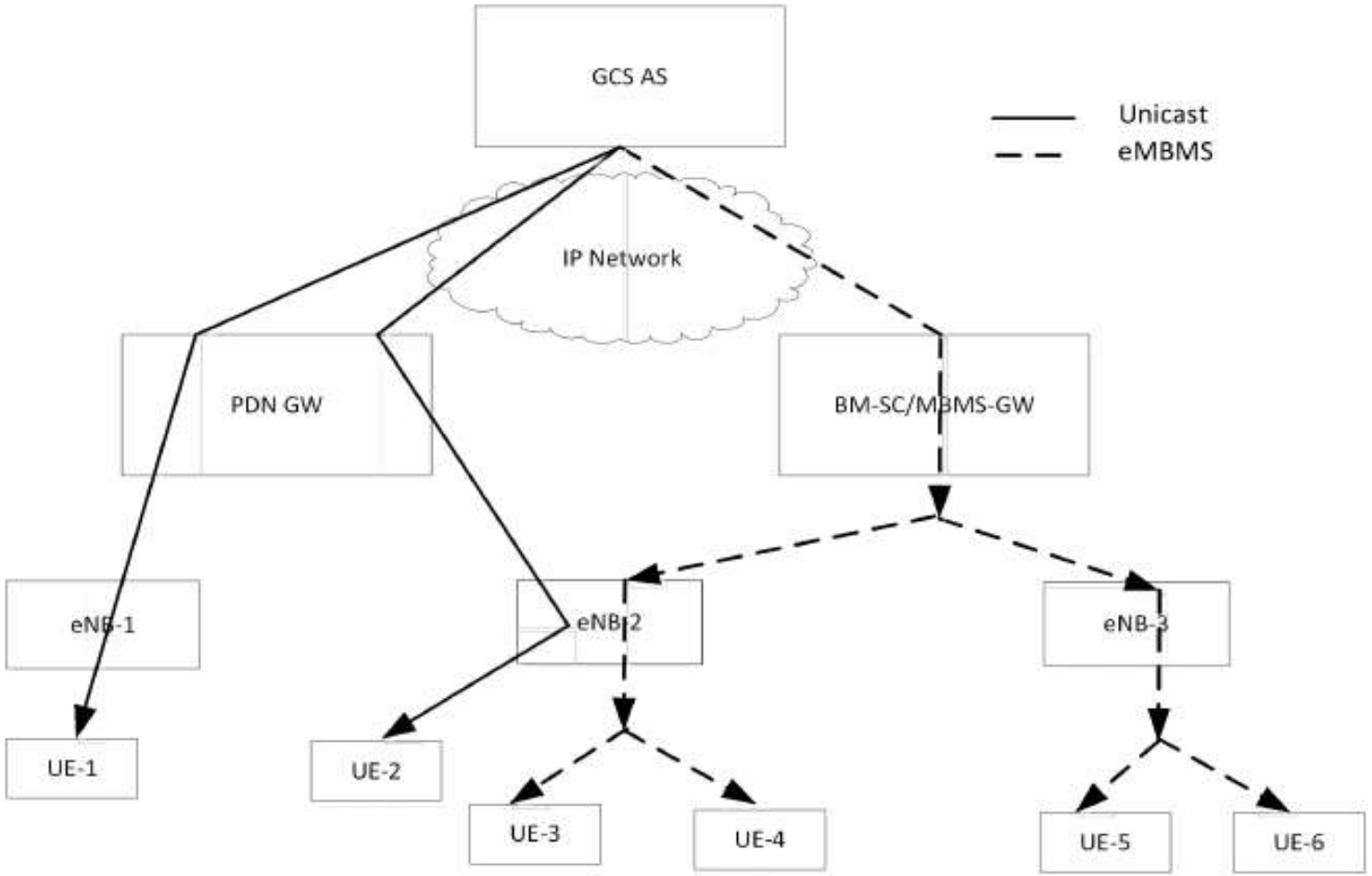
- **Quality:** MCPTT offer good audio and global coverage from day one. Requirements for MCPTT are set by governments and public-safety organization, but same technology is available also for commercial users.
- **Availability:** MCPTT service and devices are available multiple vendors. Single-supplier blackmailing wont work anymore.
- **CAPEX:** Investments to start using MCPTT is low, consisting only from device (phone) costs.
- **OPEX:** Usage cost per user is small compared to VHF, TETRA, P25, iDEN or other legacy systems

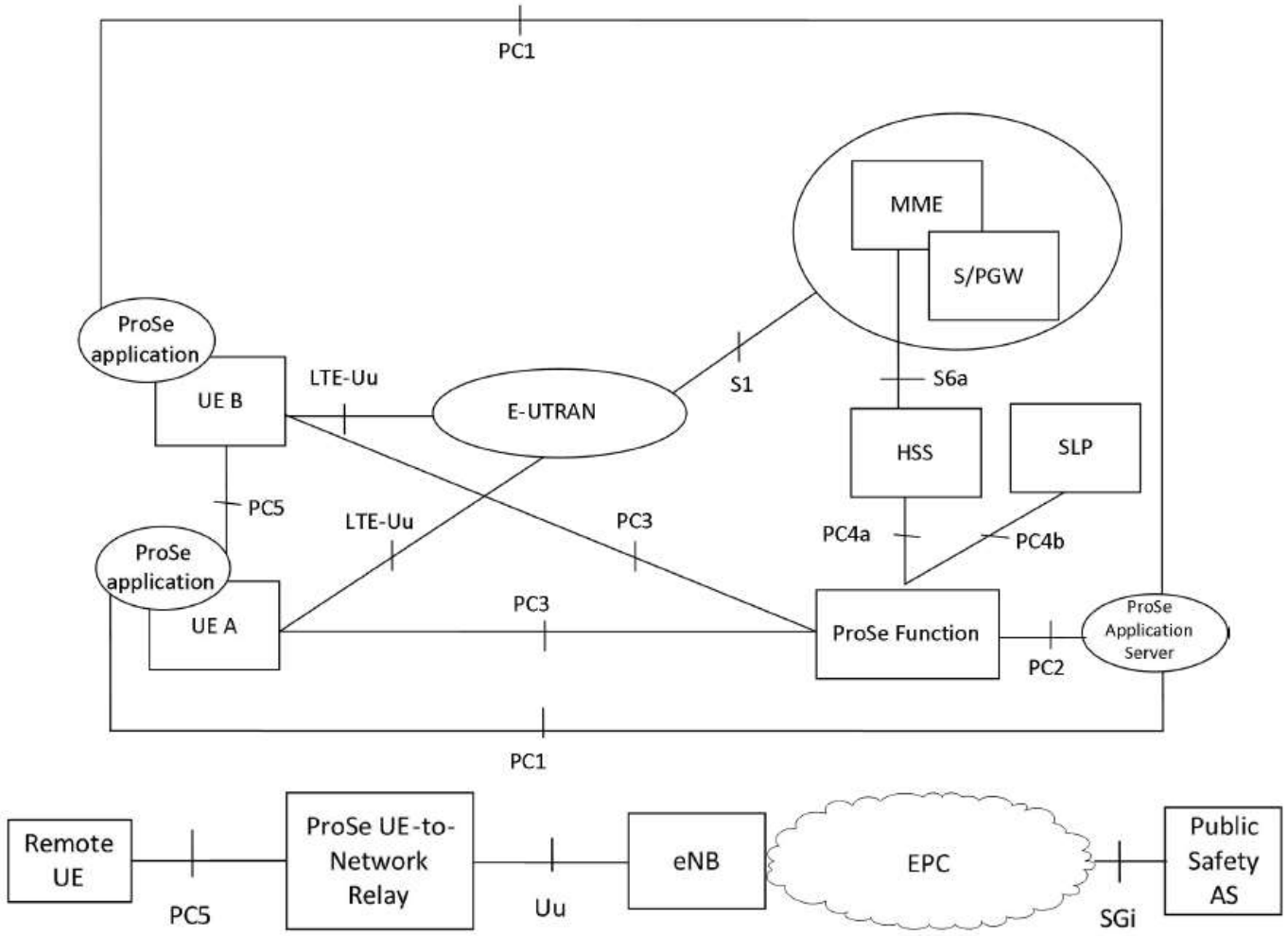
Release 12 (completed)

1. GCSE: Group communication system enabler
    - a. MBMS and EPS bearer
    - b. New QCI
    - c. Services Continuity
    - d. Priority and Pre-emption for Group Communication
    - e. Charging
    - f. Security
2. ProSe

Group communication system enabler for LTE



ProSe


PC1
MME
S/PGW
ProSe application
UE B
LTE-Uu
E-UTRAN
S1
S6a
HSS
SLP
PC5
LTE-Uu
PC3
PC4a
PC4b
ProSe application
UE A
PC3
ProSe Function
ProSe Application Server
PC2
PC1
Remote UE
PC5
ProSe UE-to-Network Relay
Uu
eNB
EPC
SGi
Public Safety AS

Rel-13 MCPTT (completed 2016)

- User authentication and service authorization
- Configuration
- Affiliation and de-affiliation
- Group calls on-network and off-network (within one system or multiple systems, pre-arranged or chat model, late entry, broadcast group calls, emergency group calls, imminent peril group calls, emergency alerts)
- Private calls on-network and off-network (automatic or manual commencement modes, emergency private calls)
- MCPTT security
- Encryption (media and control signalling)
- Simultaneous sessions for call
- Dynamic group management (group regrouping)
- Floor control in on-network (within one system or across systems) and in off-network
- Pre-established sessions
- Resource management (unicast, multicast, modification, shared priority)
- Multicast/Unicast bearer control, MBMS (Multimedia Broadcast/Multicast Service) bearers
- Location configuration, reporting and triggering
- Use of UE-to-network relays

MCPTT Key Features

Key features	Overview
Service registration	User registering to MCPTT server, updating its latest information (e.g. ,which UE it is logging on, preference service setting by user, terminal capability etc)
Configuration management	UE configuration User configuration Group configuration
Group management	User becoming a membership of MCPTT group Group creation User regroup Group regroup
Group affiliation	Show interest to specific group(s) before participating the group call Affiliation within one MCPTT system Affiliation to other MCPTT system Remotely affiliation
Group call（on network & off-network)	Call over pre-established session Pre-arranged call Chat group call Emergency altering
Private call	Call another MCPTT user, or being called
Floor control	Request floor for speaking during a group call or private call
Bearer & resource management	Get transmission resource for uplink and downlink media transmitting

Rel-14 MC Services (completed 2017)

1. MC Services Common Functionalities
2. MCPTT Enhancements
3. MCVideo, Common Functions plus
4. MCData, Common Functions plus

1.MC Services Common Functionalities

- User authentication and service authorization
- Service configuration
- Affiliation and de-affiliation
- Extended Location Features
- (Dynamic) Group Management
- Identity management
- MC Security framework
- Encryption (media and control signalling)

2.MCPTT Enhancements

- First-to-answer call setup (with and without floor control)
- Floor control for audio cut-in enabled group
- Updating the selected MC Service user profile for an MC Service
- Ambient listening call
- MCPTT private call-back request
- Remote change of selected group

3.MCVideo, Common Functions plus

- Group Call (including emergency group calls, imminent peril group calls, emergency alerts)
- Private Call (off-network)
- Transmission Control

4.MCData, Common Functions plus

- MCData, Common Functions plus:
- Short Data Service (SDS)
- File Distribution (FD) (on-network)
- Transmission and Reception Control
- Handling of Disposition Notifications
- Communication Release

MCVideo usage scenarios

- 1. Car Bombing Incident
- 2. Remote Monitoring of a Road Traffic Stop
- 3. MCVideo Pursuit scenario
- 4. Hostage Incident
- 5. Train Crash and Fire
- 6. Investigation of Police Officers

MCData services suite

MCData services suite includes the following:

- - short data service (messaging);
- - file distribution;
- - data streaming;
- - conversation management;
- - transmission and reception control; and
- - enhanced status.

Rel-15 MC Services (in progress)

- MC Services Common Functionalities Enhancements
- MCPTT Enhancements
- MCVideo Additions
- MCData Additions

MC Services Common Functionalities Enhancements

- Enhanced MCPTT group call setup procedure with MBMS bearer
- Enhanced Location management, information and triggers
- Interconnection between 3GPP defined MC systems
- Interworking with legacy systems

MCPTT Enhancements

- Remotely initiated MCPTT call
- Enhanced handling of MCPTT Emergency Alerts
- Enhanced Broadcast group call
- Updating pre-selected MC Service user profile
- Temporary group call - user regroup
- Functional alias identity for user and equipment
- Multiple simultaneous users

MCVideo Additions

- Video push
- Video pull
- Private call (on-network)
- Broadcast Group Call
- Ambient Viewing Call
- Capability information sharing
- Simultaneous Sessions
- Use of MBMS transmission
- Emergency and imminent peril private communications
- Primary and Partner MC system interactions for MCVideo communications
- Remote video parameters control capabilities

MCData Additions

- MCData specific Location
- Enhanced Status
- Accessing list of deferred communications
- Usage of MBMS
- Emergency Alert
- Data streaming
- File Distribution (FD) (off-network)
- IP connectivity

Timeline for MC Services and 3GPP Releases

- **Release 13**
- Mission Critical Push to Talk (MCPTT) completed in March 2016
- **Release 14**
- MCPTT Improvements completion 09/2017
- MCData completion 09/2017
- MCVideo completion 09/2017
- **Release 15 and beyond**
- MCPTT Improvements completion 06/2018
- MCData completion 06/2018
- MCVideo completion 06/2018
- Railways (FRMCS) study ongoing in SA6,normative work completion ~06/2018
- Interconnection between systems study completed,normative work completion ~06/2018
- Interworking with legacy systems study completed,normative work completion ~06/2018
- Maritime communications study ongoing in SA1
- Railways (FRMCS2) study and normative work ongoing in SA1
- MBMS APIs for MC Services study ongoing in SA6

3GPP Mission Critical Specifications

- **Stage 1 – Requirements**
- **Stage 2 – Functional Architecture and Procedures**
- **Stage 3 – Protocols**
- **Conformance Testing (so far only for Rel-13 MCPTT)**

Stage 1 – Requirements

- TS 22.280 - MCS Common Requirements
- TS 22.179 - MCPTT over LTE requirements
- TS 22.281 - MCVideo over LTE requirements
- TS 22.282 - MCData over LTE requirements
- TS 22.289 – Mobile Communication Systems for Railways
- TR 22.819 - Study on Maritime Communication Services over 3GPP system

Stage 2 – Functional Architecture and Procedures

- TS 23.280 – MC Common Architecture
- TS 23.379 – MCPTT Architecture and Flows
- TS 23.281 – MCVideo Architecture and Flows
- TS 23.282 – MCData Architecture and Flows
- TS 33.180 – MC Services Security aspects
- TS 23.283 – MC Interworking between LTE-based systems and non-LTE-based systems
- TR 23.790 - Study on application architecture for the Future Railway Mobile Communication System (FRMCS)

Stage 3 – Protocols

- TS 24.379 – MCPTT Call Control
- TS 24.380 – MCPTT Media Plane
- TS 24.481 – MCS Group Management
- TS 24.482 – MCS Identity Management
- TS 24.483 – MCS Management Object (MO)
- TS 24.484 – MCS Configuration Management
- TS 24.281 – MCVideo signalling protocol
- TS 24.581 – MCVideo media plane control
- TS 24.282 – MCData signalling protocol
- TS 24.582 – MCData media plane control
- TR 24.980 - Minimum requirements for support of MCPTT over the Gm

Conformance Testing (so far only for Rel-13 MCPTT)

- TS 36.579-1 Mission Critical Push To Talk (MCPTT) over LTE; Part 1: Common test environment
- TS 36.579-2 Mission Critical Push To Talk (MCPTT) over LTE; Part 2: User Equipment (UE) Protocol conformance specification
- TS 36.579-3 Mission Critical Push To Talk (MCPTT) over LTE; Part 3: MCPTT Server Application conformance specification
- TS 36.579-4 Mission Critical Push To Talk (MCPTT) over LTE; Part 4: Test Applicability and Implementation Conformance Statement (ICS) proforma specification
- TS 36.579-5 Mission Critical Push To Talk (MCPTT) over LTE; Part 5: Abstract test suite (ATS)

3GPP organization structure

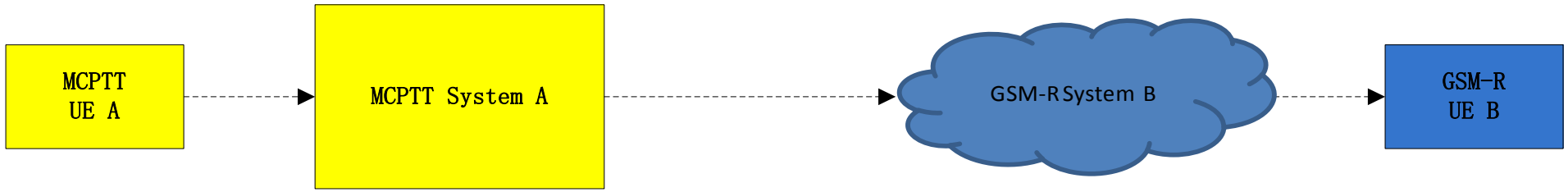
Project Co-ordination Group (PCG)

TSG RAN Radio Access Network	TSG SA Service & Systems Aspects	TSG CT Core Network & Terminals
RAN WG1 Radio Layer 1 spec	SA WG1 Services	CT WG1 MM/CC/SM (lu)
RAN WG2 Radio Layer 2 spec Radio Layer 3 RR spec	SA WG2 Architecture	CT WG3 Interworking with external networks
RAN WG3 lub spec, lur spec, lu spec UTRAN O&M requirements	SA WG3 Security	CT WG4 MAP/GTP/BCH/SS
RAN WG4 Radio Performance Protocol aspects	SA WG4 Codec	CT WG6 Smart Card Application Aspects
RAN WG5 Mobile Terminal Conformance Testing	SA WG5 Telecom Management	
RAN WG6 Legacy RAN radio and protocol	SA WG6 Mission-critical applications	

FRMCS Scenarios 1：

Interworking scenarios of private call

- MCPTT UE A initiates a private call to GSM-R UE B

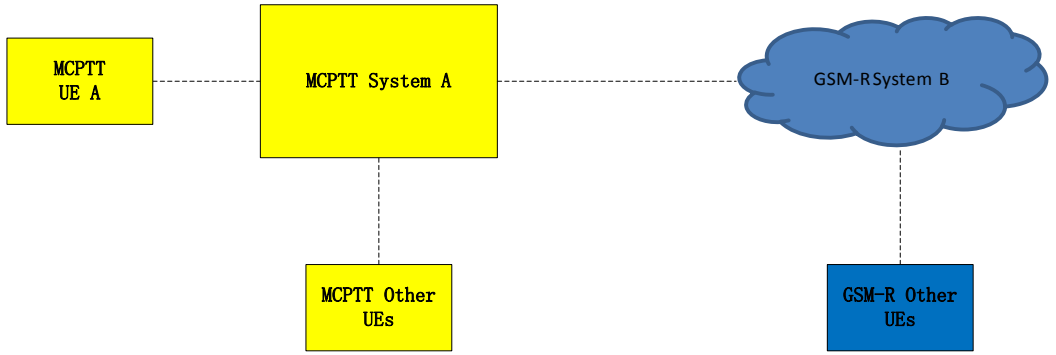


- GSM-R UE B initiates a private call to MCPTT UE A

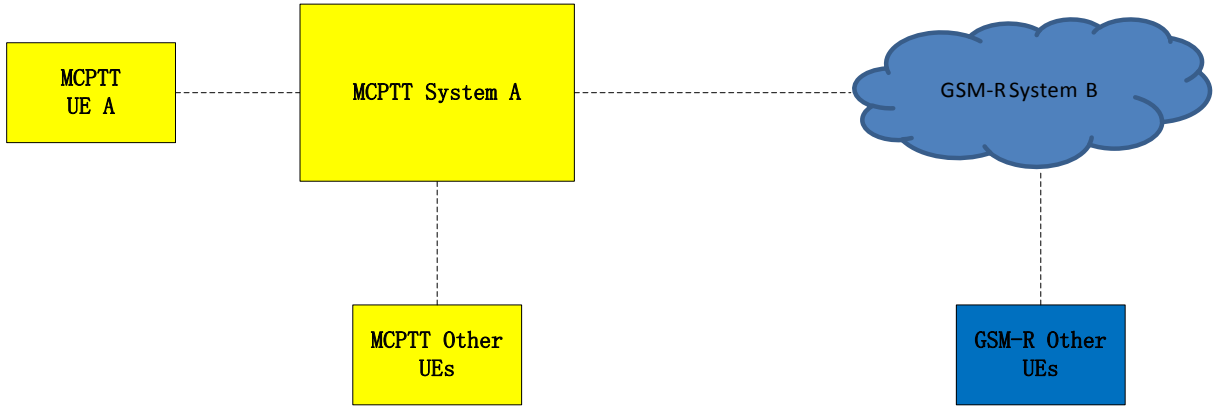
FRMCS Scenarios 2：

Interworking scenarios for group calls

- Group call for groups defined by the MCPTT system



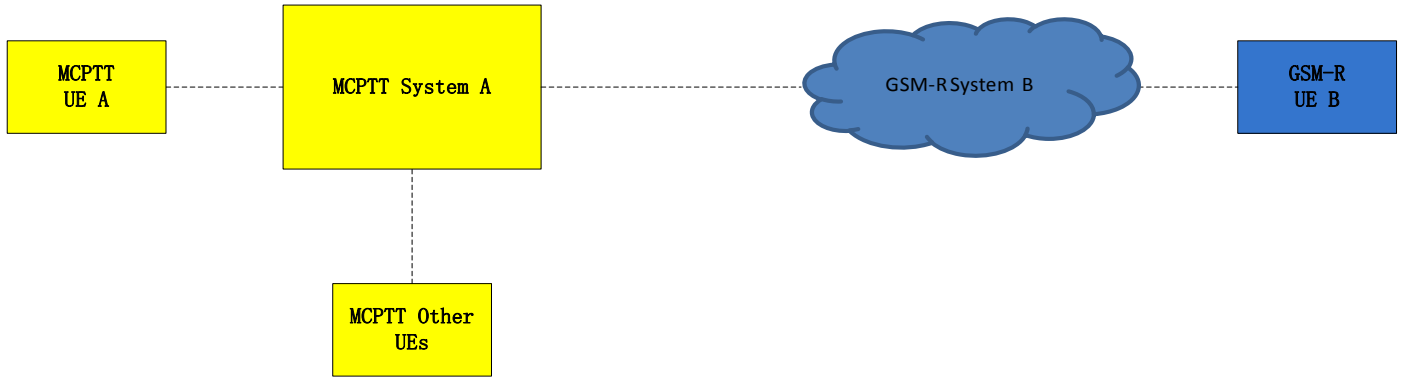
- Emergency group call for groups defined by the MCPTT system



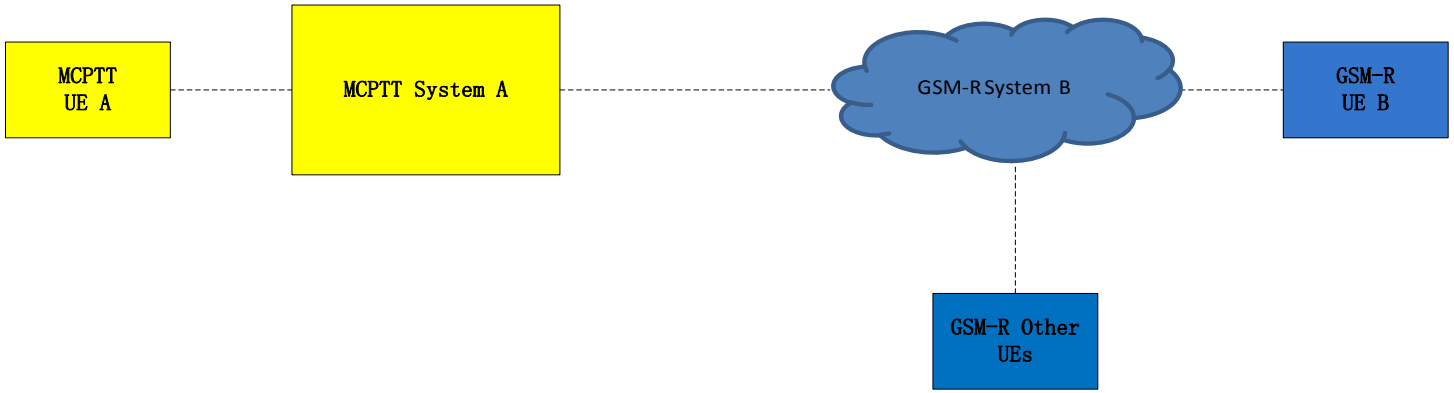
FRMCS Scenarios 3：

Interworking scenarios for location services

- MCPTT system obtains and shares the location information of GsM-R UEs



- GSM-R system obtains and shares the location information of McPTT UEs



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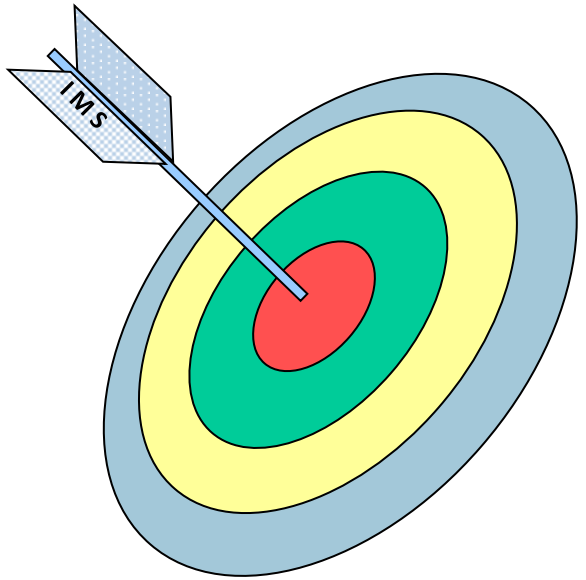
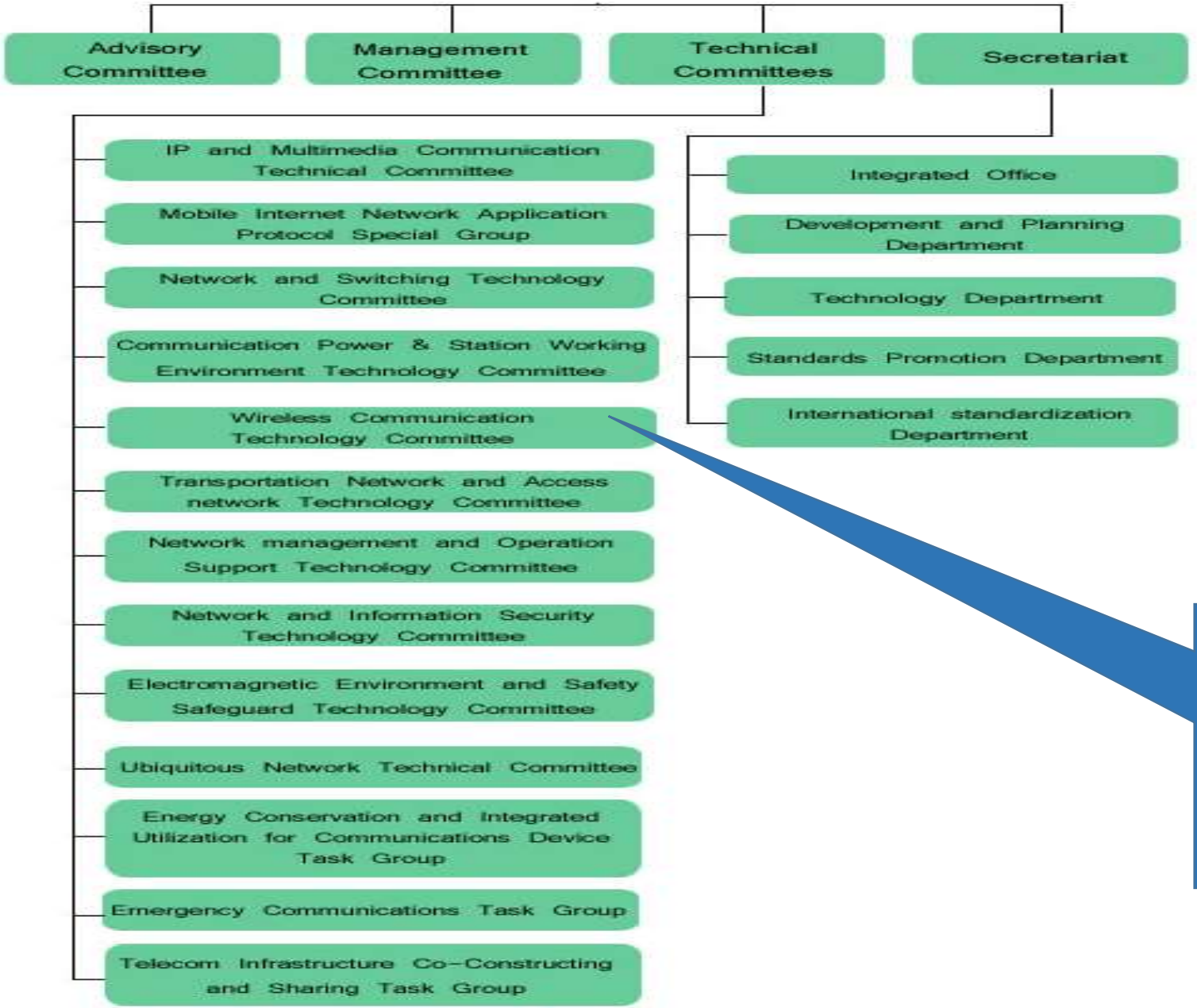


CCSA organization structure



Committee（TC5） is responsible for B-TrunC standards .

CCSA TC5 (Wireless Communication) B-TrunC Standardization

- Technical requirements for interface
- Technical requirements for equipments
- Test methods for interface
- Test methods for equipments

Apply

electricity

railway

metro

Public Safety

emergency

ports and airpors

Government

Quiz questions:

1. Which organization completes MCPTT standards： A. 3GPP B. 3GPP2 C.IEEE D.CCSA

2. Which organization completes B-TrunC standards： A. 3GPP B. 3GPP2 C.IEEE D.CCSA

3.What is the frequency of B-TrunC: A.1.4GHz B.700MHz C.1.8GHz

4. Group Communication end-to-end setup time less than or equal to 300ms.

5. The government network operator for the public safety community in the United States.

Assignment:

1. What is the most critical issue for the emergency system？
2. Please list 3 application scenarios for emergency communication.

Answer： 1. A 2. D 3.AC 4.T 5.T

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Thank you for your attention

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