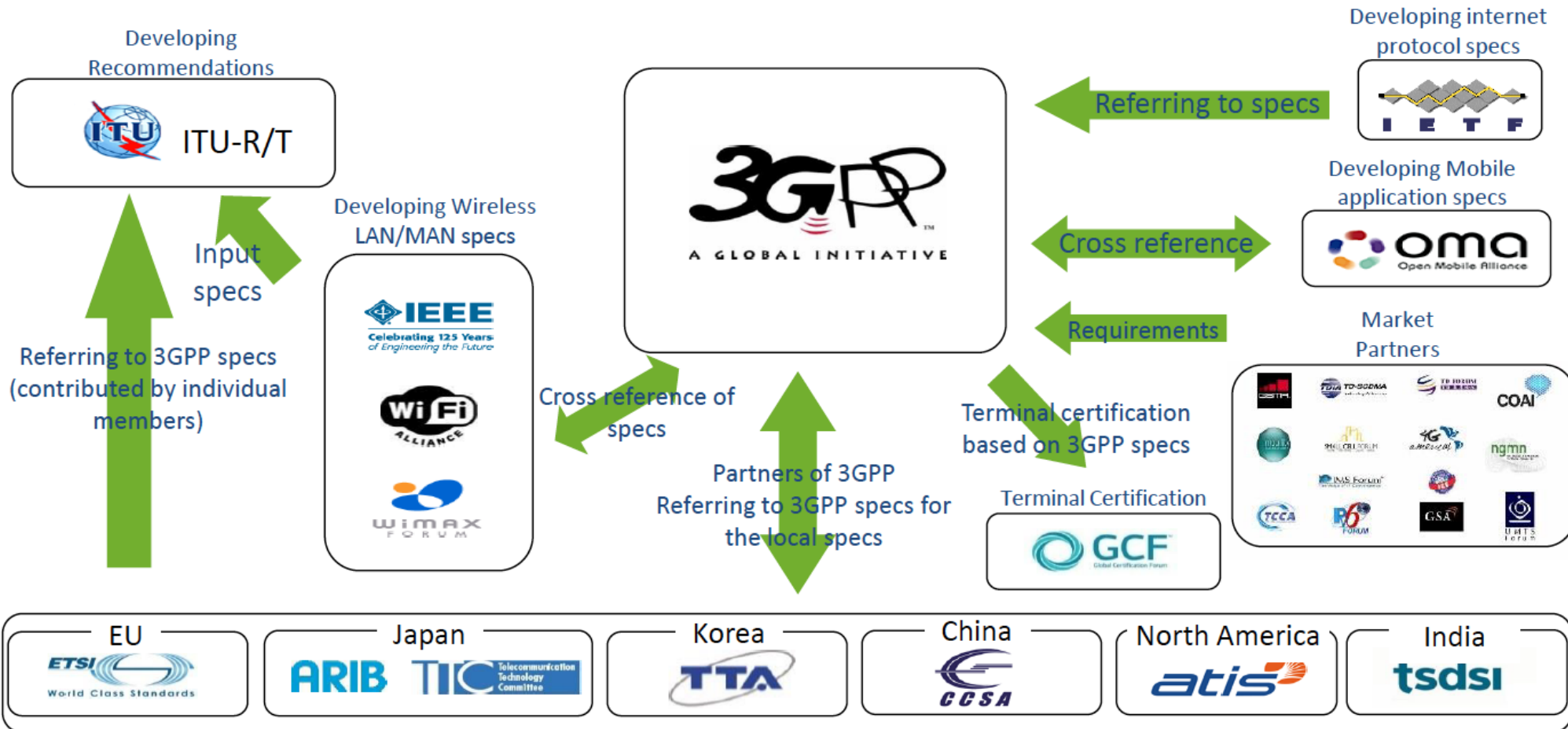# Comunicazioni radio per la sicurezza
Interoperabilità PMR/LTE per applicazioni mission critical

Martino De Marco – *Politecnico di Milano*

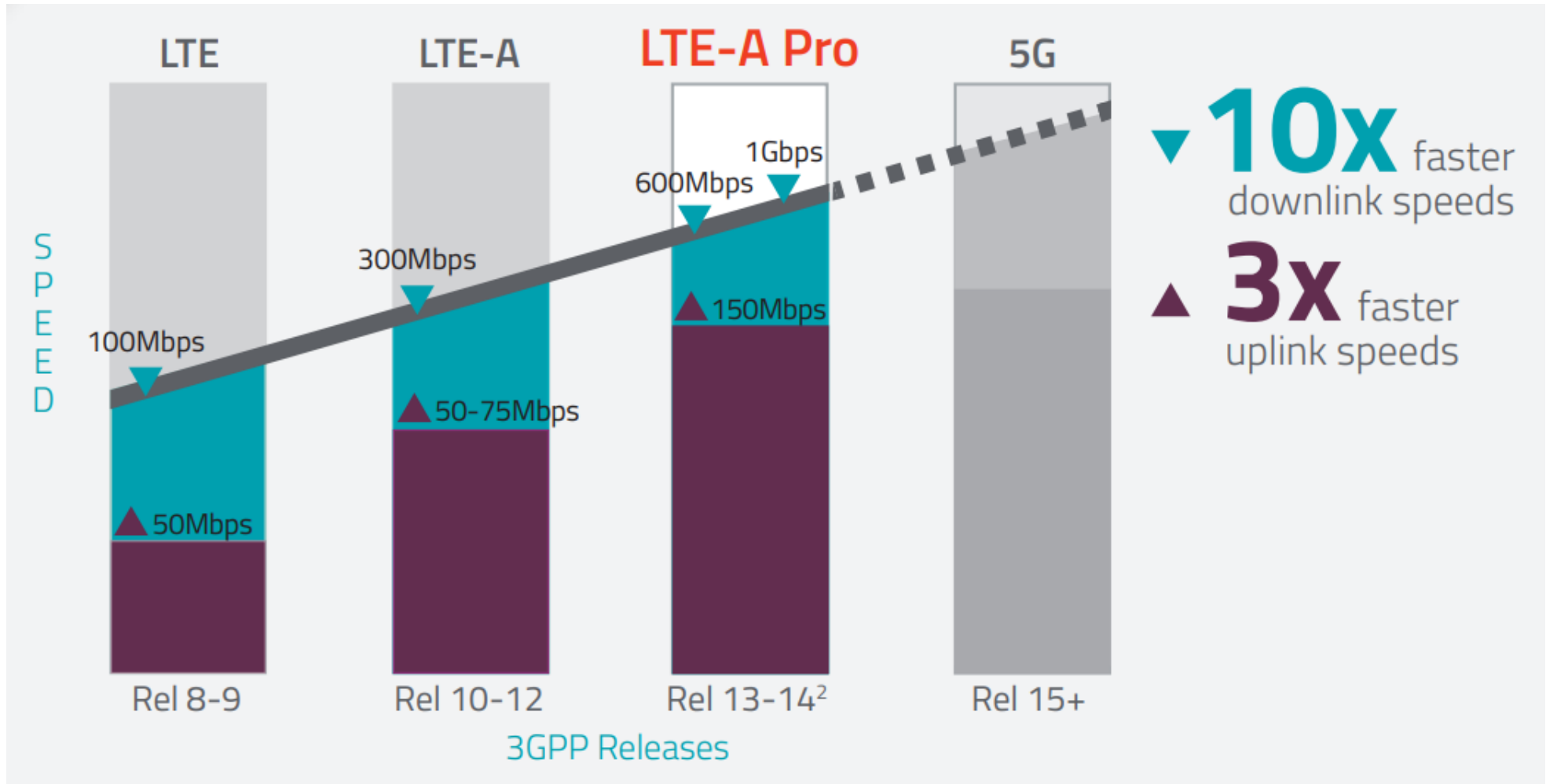Milano, 16 aprile 2018

3GPP standards for Mission Critical services

Rel-12

- Proximity Services
- Group Communication Service Enablers over LTE

Proximity Services
Device to Device Communication, UE to Network Relay

Group Communication
Unicast and Multicast/ Broadcast communication to efficiently transmit to a group; managed by an application.

End-to-End Service
Enabler

Rel-13

- Mission Critical Push to Talk
- Proximity Services Enhancements

MC Push To Talk
User authentication and service authorization; security; configuration; de/ affiliation; group calls on- and off-network; private calls on- and off-network; simultaneous sessions; dynamic group management; floor control on- and off-network; pre-established sessions; resource management; bearer control; location configuration, reporting and triggering; use of UE-to-Network relays.

Rel-14

- Enhanced Mission Critical Push to Talk
- Mission Critical Data
- Mission Critical Video
- Mission Critical Common Services

MC Common Services
For all MC services: User authentication and service authorization; security; configuration; de/affiliation; dynamic group management; identity management.

Mission Critical Data
Common + Short Data Service; File Distribution; Transmission Control; Disposition Notification...

Mission Critical Video
Common + Private & Group Video Call; Transmission Control

Rel-15

- Enhanced Mission Critical {Push to Talk, Video, Data}
- MC Communication Interworking between LTE and non-LTE Systems
- MC system migration and interconnection
- MBMS usage for MC communication services

MC Communication Interworking
LMR/PMR interworking with MC Services
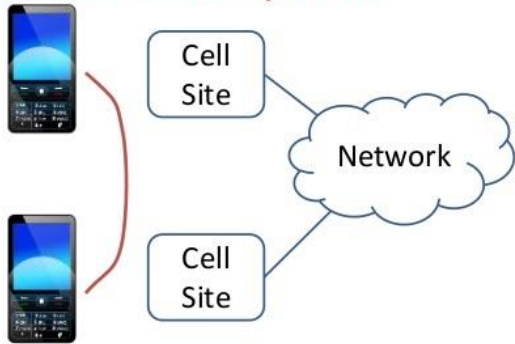
MC System Migration and Interconnection
Inter-agency / inter-server scenarios
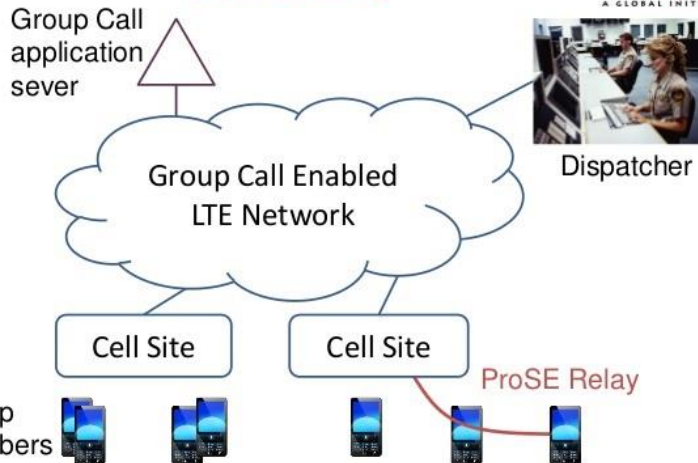
3GPP Release 12 – March 2015

Proximity services (ProSE)

Direct Communication with Proximity Service

Group calling

3GPP Release 13 – March 2016

### MCPTT – Mission Critical Push to Talk

- Voice services similar to existing radio systems
  - Private call
  - Group call
  - Broadcast call
  - Regrouping
- Stage 3 completed and approved March 2016
  - There is now a complete suite of Release 13 specifications for MCPTT
- 840 requirements in Stage 1
  - 70% covered in Release 13
  - 10% part covered in Release 13
  - 20% not covered in Release 13
- Further requirements will be satisfied in following releases:
  - Some aspects of group call and group management
  - Call back
  - Ambient listening
  - Interworking between systems
  - Interworking with non-MCPTT systems (PMR/LMR)
  - UE to UE relay
  - Enable/disable

Resilient E-UTRAN Operation

Isolated E-UTRAN can be formed following:

1. An Outage event within the infrastructure network
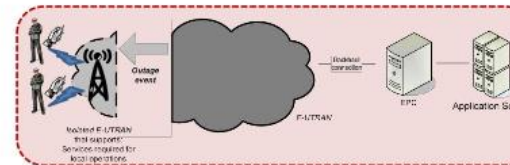
2. Deployment of Mobile Command Posts (MCPs)

June 2017

First ETSI LTE Mission-Critical Push to Talk interoperability tests achieve 85% success rate

TCCA to deliver vendor certification process for LTE mission-critical products and applications

- The first ETSI Mission Critical Push to Talk (MCPTT) **Plugtests™** event – interoperability test sessions for mission-critical LTE equipment – concluded on Friday, 23 June 2017, with 140 participants from **19 vendors**

- The event was held at the ETSI headquarters in Sophia Antipolis, France, in partnership with the **TCCA**, the representative body for the global critical communications community

- The test sessions were observed by seven government and public safety network operator organizations from Belgium, Finland, France, Norway and the UK

- More than **1000 tests were conducted**, with a **success rate of 85%.** The tests are based on 3GPP, ETSI and IETF standards.

- For this first session, a test specification has been developed for the 3GPP Release 13 MCPTT, comprising **47 test cases**

Rel-14 | Mission Critical Standards Architecture
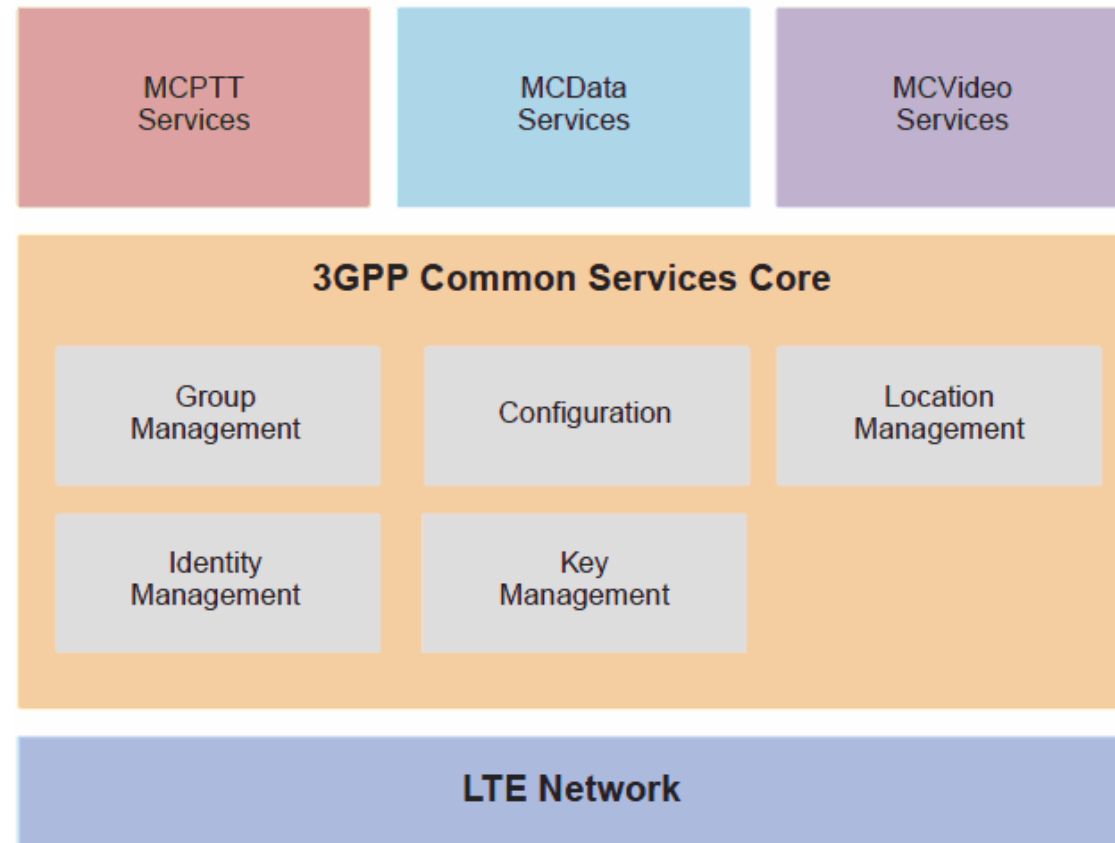
Rel-14 added additional MC Services and enhancements to its repertoire of standardized applications, specifically:

- Enhancements to MCPTT
- MCData
- MCVideo
- General framework which facilitates standardizing additional MC Services

The Rel-14 work on MC Services required not only a large set of new protocol additions and new **security** functionality, but also enhancements to the MCPTT Rel-13 specifications to enable **reuse of common functionality across MC Services**

MCVideo and MCData specifications offer equipment vendors as well as network operators a consistent and fully specified set of standards, ready **for initial implementation** and deployment

3GPP Release 14 – June 2017

MCPTT Services	MCData Services	MCVideo Services

3GPP Common Services Core

Group Management	Configuration	Location Management
Identity Management	Key Management	

LTE Network

Rel-14 | Mission Critical standard functions

3GPP Release 14 – June 2017

MCPTT – Mission Critical Push to Talk

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MCData – Mission Critical Data

- Mission critical data service
  - Prioritisation
  - Group services
  - Connected to user organisation, not MNO/Internet
- Simple messaging
  - Analogous to TETRA Short Data
  - Supports messaging and other applications
- Status
- File distribution
  - User and group based service
- Data streaming
- Point to point IP connectivity
- Performance suitable for remote control applications (robots, drones etc)

- Progress: in requirements phase (stage 1)
  - Part of Release 14
  - Requirements phase to be complete June 2016
  - Release complete ~ March 2017
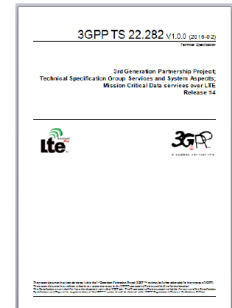
MCVideo – Mission Critical Video

- Mission critical video service
  - Performance – latency etc
  - Prioritisation
  - Group services
- Interoperable – does not replace other video applications, but ensures compatibility, e.g. during mutual aid etc
- Real time and non real time
- 'Push' and 'Pull'
- Standardised video codec(s) for interoperability
  - Control of resolution, frame rate etc
- Support for camera control protocols
- Robots and drones
- On and off-network (Direct Mode)

- Progress: in requirements phase (stage 1)
  - Part of Release 14
  - Requirements phase to be complete June 2016
  - Release complete ~ March 2017

MCCore – identification of common requirements

- Recognition that many aspects of mission critical service are common across all applications (speech, video etc)
  - Identification of users and groups
  - Group and broadcast communications
    - Including affiliation, late entry to calls etc
  - Prioritisation of services
  - Security
- May lead to common requirements and interfaces for future mission critical applications

- Progress: in requirements phase (stage 1)
  - Part of Release 14
  - Requirements phase to be complete June 2016
  - Release complete ~ March 2017

From stand-alone networks to MC-LTE interworking

Rel-15 | Mission Critical Standards Interworking

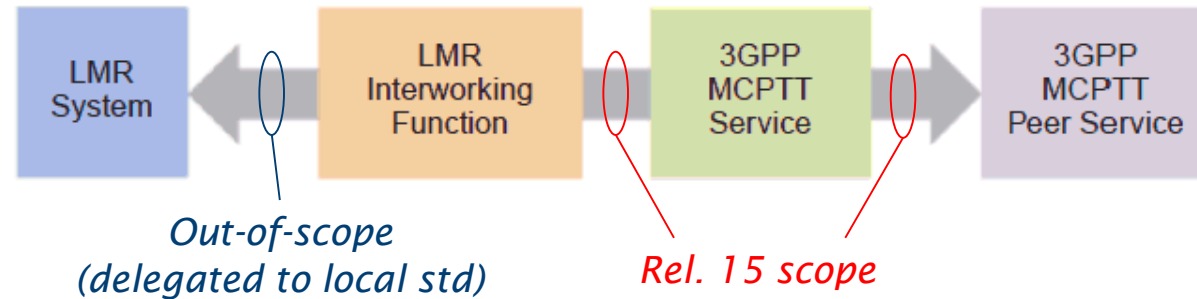**3GPP Release 15 – work in progress (expected for completion in 2018)**

In the past, 3GPP essentially defined standard for stand-alone mission-critical networks:

- Rel-12 to Rel-14 standards don't provide **mechanisms suitable for interworking with legacy mission-critical networks**
- Moreover, there was no **interconnect functionalities between MCPTT systems**
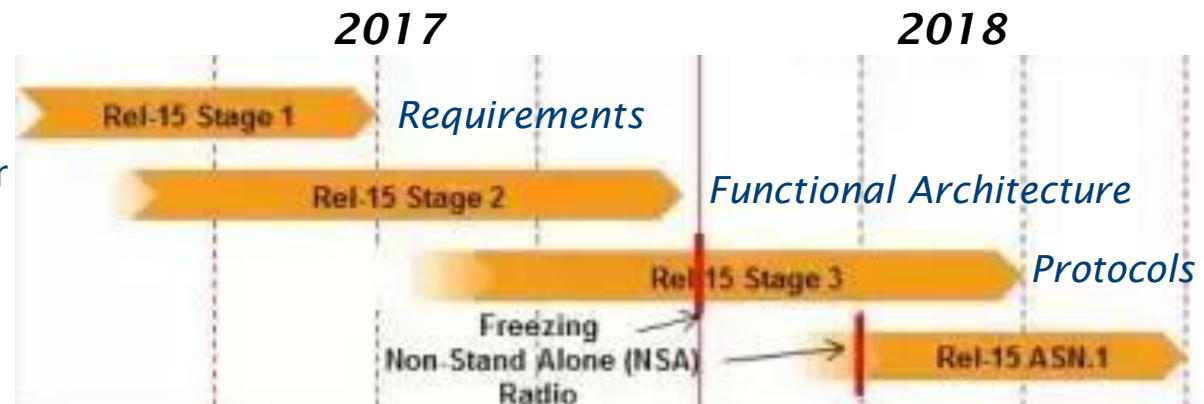
These functionalities are essential to enable **gradual introduction of LTE MCPTT** capabilities into current public-safety ops.

Rel. 15 introduces **LMR Interworking Function (IWF)** component, as a gateway or as an extension to LMR systems. The new standard **defines the interface between IWF and 3GPP MCPTT** services (it does not address the interface between IWF and LMR systems)

LMR/3GPP interworking framework

LMR System ⟷ LMR Interworking Function ⟷ 3GPP MCPTT Service ⟶ 3GPP MCPTT Peer Service

Out-of-scope (delegated to local std)

Rel. 15 scope

Rel-15 standardization roadmap

2017   *2018*

Rel-15 Stage 1 — *Requirements*
Rel-15 Stage 2 — *Functional Architecture*
Rel-15 Stage 3 — *Protocols*
Freezing Non-Stand Alone (NSA) Radio
Rel-15 ASN.1
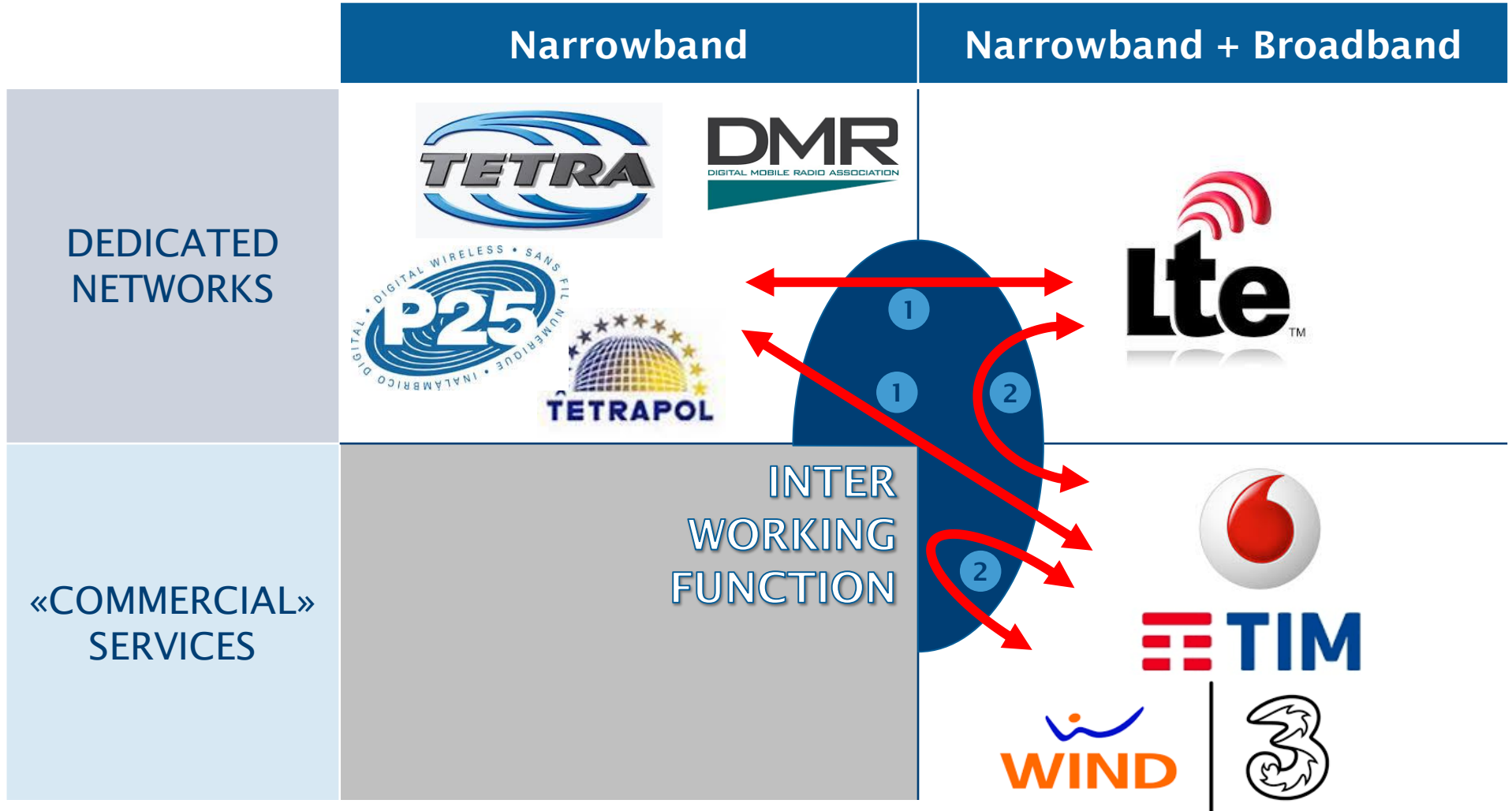
National Public Safety Broadband Network

In 2011 **FCC selected LTE as the long-term technology** of choice for public safety communications

- Congress has set aside **20 megahertz of spectrum** — a wide swath of the airwaves — in the "D block" of the **700 MHz frequency band** for the public safety network.

> *First responders currently use land mobile radio (LMR) networks for mission critical voice communications. When the nationwide public safety broadband network (NPSBN) is launched, it will not replace their LMR systems. The network is expected to initially transmit data, video, and other high-speed features, such as location information and streaming video, as well as non-mission critical voice. Public safety entities will continue to use LMR networks for their mission critical voice needs.*

- The winning bidder is expected to enter into a lease agreement with the FirstNet authority that provides them access to 100% of the network capacity

- While the FirstNet public safety network would be **prioritized for emergency responders**, the winning bidder would be able to **utilize the 20 MHz of radio spectrum for commercial purposes** and consumer services

- Congress earmarked $7 billion from the $42 billion raised in the AWS-3 spectrum auction, which ended last January, to the FirstNet project

- Those funds go to the winning bidder as start-up money to get the project underway. Analysts peg the entire project's costs at $20 billion to $30 billion

- States can opt out of the FirstNet project, but the Spectrum Act makes the process difficult

- The Alliance for Telecommunications Industry Solutions (**ATIS**) Wireless Technologies and Systems Committee (WTSC) initiated a joint project with **TIA** (WTSC-JLMRLTE) to support FirstNet

- Given the key role that ATIS has played in 3GPP and the central role TIA played in developing digital P25 (TIA-102) and analog (TIA-603) LMR standards in the U.S., **the joint project is significant because it seeks to address interworking LMR/3GPP**

- Given the current state of 3GPP MCPTT standards, **WTSC-JLMRLTE is expected to address the interfaces between 3GPP interworking gateways and LMR systems**

- Central to this issue is the use of standards as a key method for achieving interoperability

In addition to the statutory mandate for FirstNet to represent the interest of public safety in standards development activities, there is a second mandate for NIST to "accelerate the development of the capability for communications between currently deployed public-safety narrowband systems and the nationwide public-safety broadband network.

On the basis of the FCC's work, where suitable standards exist for interconnecting LMR systems into the NPSBN's MCPTT services, those standards must be used in lieu of proprietary interfaces.

Where standards do not exist, the FCC'sreport requires the use of solutions based on open specifications available to all authorized parties

Scope of ATIS-TIA joint project

Rel. 15 scope