



Public safety

TELCOMA



3GPP LTE FEATURES TO SUPPORT PUBLIC SAFETY

Public safety :

- Current public safety networks use technologies, such as TETRA (Terrestrial trunked radio) in Europe & project 25 (P25) in US.
- In the united states, the government created First responder network authority , an independent authority with in NTIA to provide a nationwide public safety broadband network.
- UK home office has a program for the emergency service network.



LTE FEATURES FOR PUBLIC SAFETY

Features :

- Group communications
- Proximity based services (Device - to - Device)
- Mission critical push to talk
- Mission critical video over LTE
- Mission critical data over LTE
- Prioritization
- High power
- Isolation operation
- Relays

Group communications :

- Available in Rel- 12.
- GCS (Group communication service) application server , using one - to - one & one - to - many communications will be able to send voice , video or data traffic to multiple public safety devices.
- Rel - 14 adds single cell point - to - multipoint transmission.

Proximity based services :

- Available in Rel- 12.
- User devices can communicate directly , a capability that benefits both consumers & public safety.
- With Rel - 13 , devices will be able to act as relays for out of coverage devices such as inside a building.

Proximity services :

- ProSe using D2D communication
- Public safety applications
- Commercial services
- Discovery of devices in proximity
- Direct communication between devices
- ProSe applications & services

Mission critical push to talk :

- Defined in Rel - 13
- Provides one - to - one & one - to - many push to talk communication services.
- Public safety organizations will be able to consider retiring legacy voice based systems .

Mission critical ViLTE & data over LTE :

- Defined in Rel - 14
- Designed to work with mission critical push to talk
- It gives first responder more communication options.

Prioritization :

- The network can bar consumer devices from attempting to access the network, thus reducing signalling load.
- The network can prioritize radio resources, giving public safety users high priority.
- Using a new capability called “ multimedia priority service” (MPS) , the network can prioritize a connection between an emergency worker & a regular subscriber.
- The network can assign specific QoS parameters to specific traffic flows including GBR. 3GPP has defined specific QoS quality class identifiers for public safety.

High power :

- Defined in rel-11 .
- It defines higher power devices for the public safety band that can operate at 1.25 watts.
- It improves coverage and reduce network deployment costs.

Isolated operation :

- Defined in rel-13 .
- A base station can continue offering service even with the loss of backhaul, a capability that will benefit public - safety personnel in disaster situations.



LTE FEATURES FOR PUBLIC SAFETY

Relays :

- Relays for LTE e.g to allow a BS mounted on a fire vehicle to relay communications from fire fighters in a basement back to the network.

3GPP Rel- 8 :

- Mobile data connections.
- Basic support for VoLTE
- Support for LTE band 14
- A rich set of Qos priority
- High secure authentication & ciphering

3GPP Rel- 9 :

- Location services & positioning support for LTE
- Multimedia broadcast , multicast services
- Emergency calling support
- Enhanced home LTE base station “cell on wheels”
- Self organising networks

3GPP Rel-10 :

- Physical layer enhancements to increase data throughput including LTE advanced features.
- Relays for LTE

3GPP Rel-11 :

- High power devices for public safety improving coverage of LTE network .

3GPP Rel- 12 :

- Group communications system enablers for LTE
- Proximity based services

3GPP Rel-13 :

- Mission critical push - to - talk
- Enhancement to proximity based services
- Isolated E-UTRAN operation for public safety
- MBMS enhancements



DEPLOYMENT APPROACHES

Deployment scenario :

- As huge investments would be required for a network dedicated solely to public safety , industry and government are evaluating approaches in which public safety uses can be added with existing commercial network deployments.

Shared network :

Multiple sharing approaches are possible :

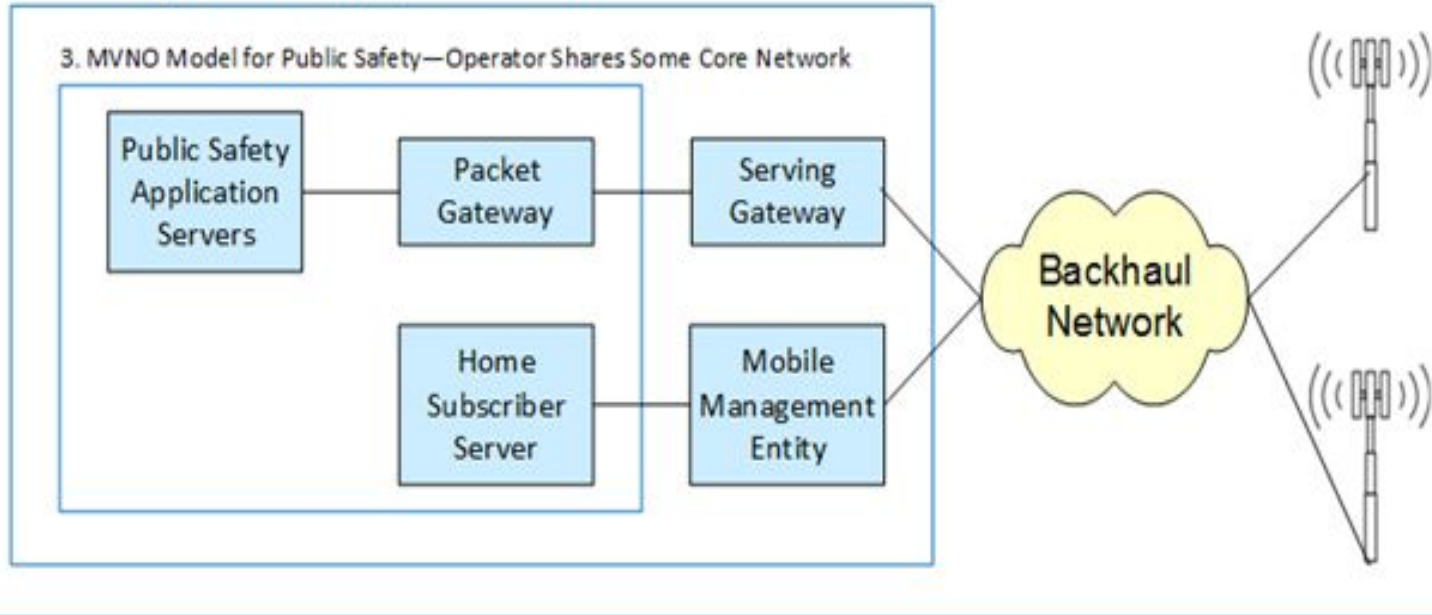
- A public safety entity owns and operates the entire network.
- A commercial operator shares its radio access network , including cell sites and backhaul.
- In an MVNO approach , the operator share its cell sites and backhaul as well as some core network functions such as MME & serving gateway

Sharing approaches for public safety networks :

1. Private LTE Network for Public Safety—Public Safety Owns Entire Network

2. RAN Sharing for Public Safety—Operator Shares RAN

3. MVNO Model for Public Safety—Operator Shares Some Core Network



Sharing approaches for public safety networks :

- Resilience
- Safety
- coverage

DEPLOYMENT APPROACHES

Device considerations for public safety :

- Access to commercial networks
- Device sharing

DEPLOYMENT MODELS

Deployment models for public safety networks :

Three broad options that either exist already or can be future model.

- Dedicated PPDR network
- Shared PPDR / Commercial network
- Virtual PPDR network

Dedicated PPDR Network :

PPDR operator owns the complete network & service applications including radio spectrum.

- Full control over the network operation & performance.
- Highly secure & reliable since network will be built e2e compliant to PPDR requirements.

Shared PPDR / commercial Network :

PPDR operator shares parts of network , spectrum & potentially service apps.

- Control over most critical parts of the network.
- Moderate investment & operation costs , leveraging commercial network.

Virtual Network :

PPDR operator operates as a virtual owing only the service application layer.

- Low investment & operation costs , leveraging commercial networks radio , transport & core.
- High flexibility & less operative involvement , focus on services.

DEPLOYMENT MODELS

Examples of deployment models :

- FirstNet in the USA
- Emergency services network in the UK
- Astrid network in Belgium

Decision criteria for selecting models :

There are three major to be asked :

- What kind of services or for what type of users the target broadband PPDR network shall be designed & constructed?
- What is the time frame in which network shall be deployed and in operation considering migration steps ?
- What is the maximum budget for deploying & operating the network ?

STANDARDISATION

Public safety standardisation :

- 3GPP rel- 12 & 13 were the first to address public safety specific requirements .
- Rel 15 & 16 begin to define 5G & IOT
- Public safety users have communication needs that are not addressed by standards defined for consumer use.
- Group calls & D2D communications are the main public safety functionalities that are not included in 3GPP rel 10 & 11 (LTE).

Public safety standardisation items :

- GCSE - Group call system enablers (rel - 12)
- Pro-Se - proximity services (rel-12 - rel -14)
- IOPS - isolated E-UTRAN operations for public safety (rel-13 - rel-14)
- MCS - mission critical services (rel-13 & rel-14)
- MCPTT - mission critical push to talk (rel-13 & rel-14)
- McDATA - mission critical data (rel - 14 & 15)
- Mcvideo - mission critical video (rel - 14 & 15)
- Interconnection of MC systems (rel 15)
- Interworking with legacy PMR systems (rel 15)

Public safety

Correct time for application :

- Time to start is determined by user needs.
- Easy way to start would be to use broadband data services with an MVNO arrangement which is improving service availability & security.
- Adding national roaming with all operators will increase coverage & availability further.

Best way to connect 4G & 5G solutions for public safety use :

- 4G solution means to implement network with 3GPP upto rel-14.
- 5G solution means to implement network with 3GPP from rel-15

Global public safety community aligning behind LTE

Community behind LTE :

- Early leadership in applying LTE to public safety applications came from USA.
- NPSTC & other organizations recognized the desirability of having an interoperable national standard for next generations public safety networks with broadband capabilities.
- TCCA believes that LTE holds the greatest prospect for delivering solutions.
- Now LTE will be baseline technology to support public safety networks

Technical features for LTE public safety

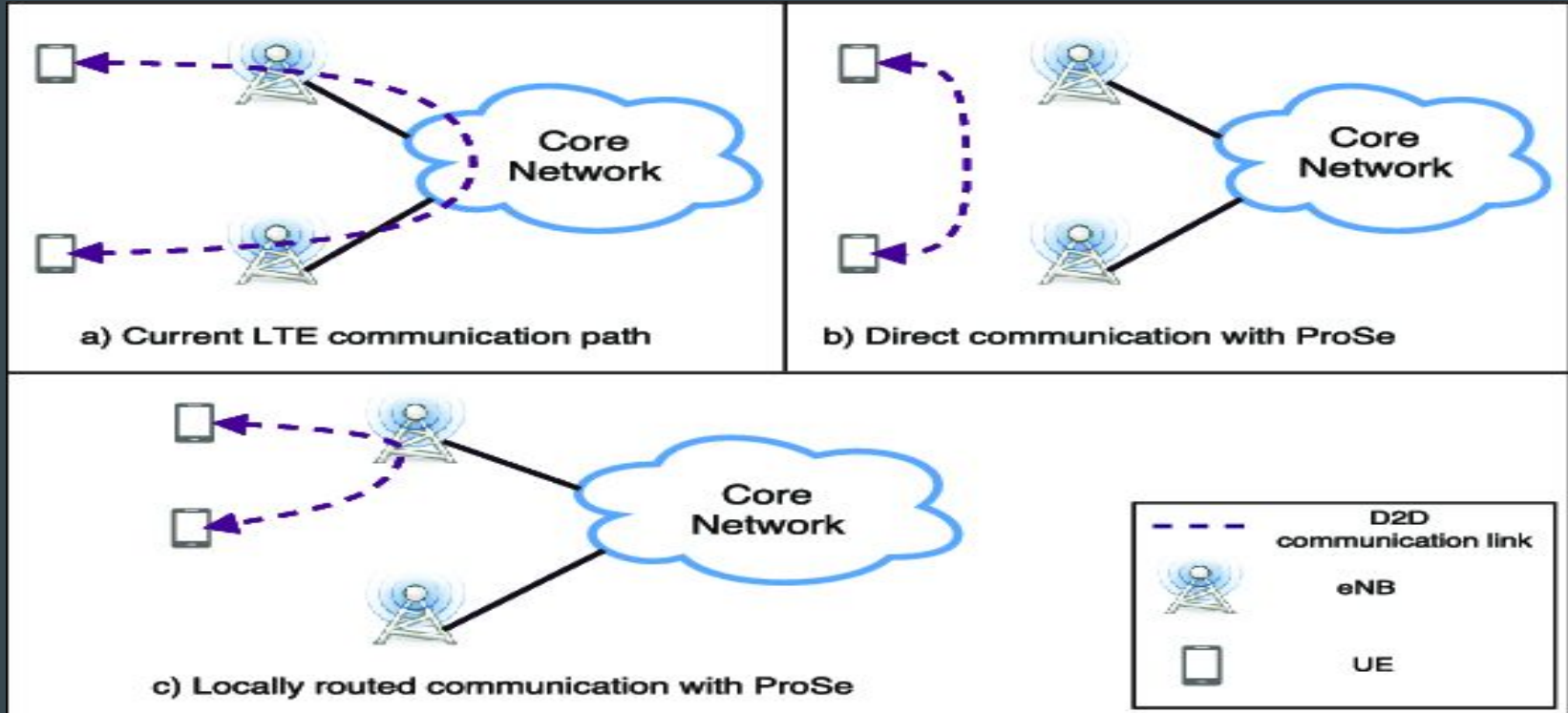
Technical features :

- Proximity services that identify mobiles in physical proximity and enable optimized communications between them.
- Group call system enablers that supports the fundamental requirements for efficient & dynamic group communications operations such as one to many calling & dispatcher working.

Technical features :

- Proximity services consists of two main elements : network assisted discovery of users with a desire to communicate who are in close physical proximity.
- ProSe meet the need for communication among public safety users even if they are not in coverage of the network.
- In the feature, “ user equipment to network relay “ one mobile acts as a relay for other mobiles and provides access to network services outside coverage area.

Proximity services example :

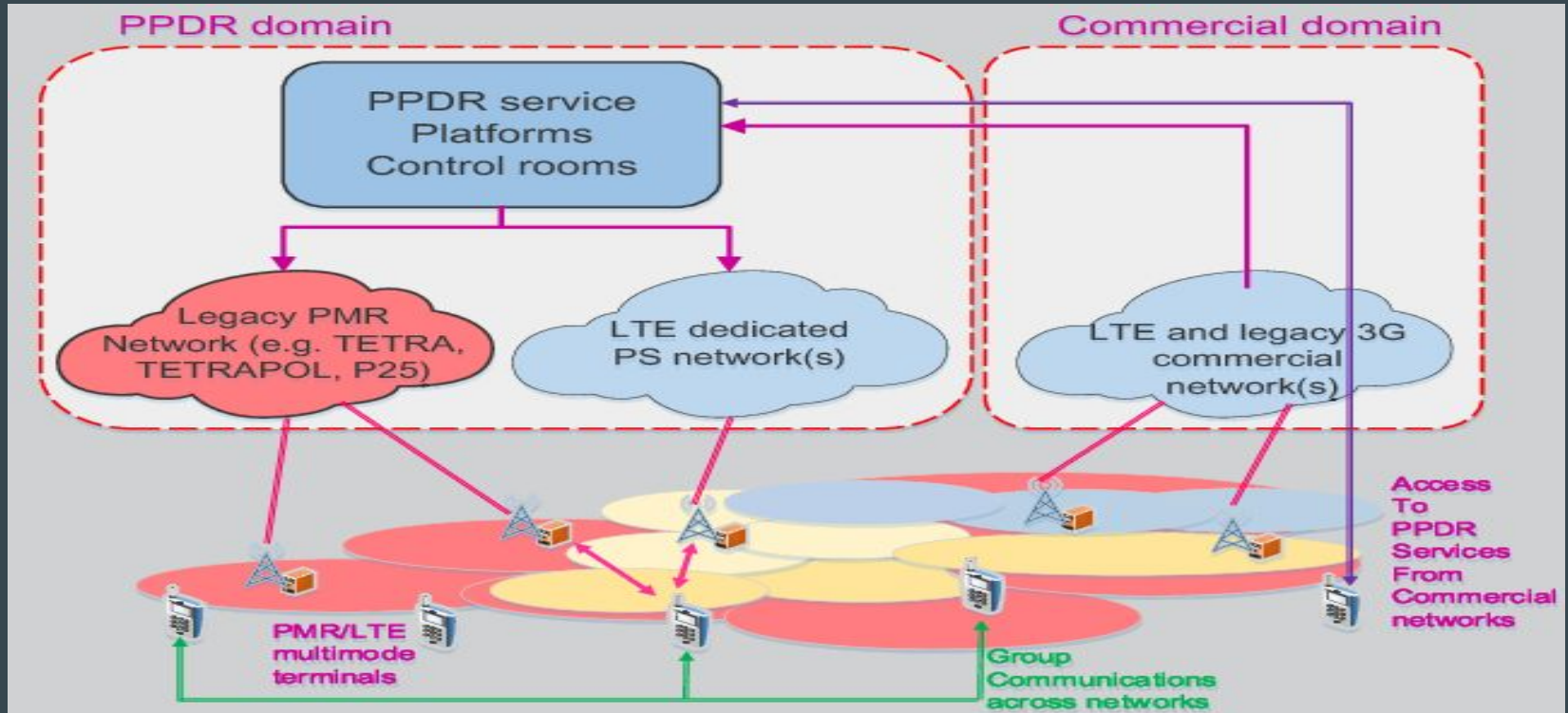


Technical features :

- Public safety users frequently need to communicate in dynamic groups that might involve both mobile users on the scene and fixed users “dispatchers” working in a control centre .
- These groups operate in a “push to talk “ mode.
- This mode of operation provide appropriate group management & floor control facilities.

LTE PPDR Network Architecture

LTE PPDR Network Architecture :



LTE PPDR Network Architecture :

- The LTE network should be interoperable with existing PPDR networks.
- The device should be able to connect both networks.
- In terms of frequency spectrum , Europe to use sub- 1Ghz bands
- Most likely spectrum bands 400 MHz & 700 MHz
- 400 Mhz is already used for PMR systems
- 700 Mhz band is available for this.

Proximity Services

Proximity Services :

- Services that become available once a device enters a specific area or comes near other device.
- Proximity is about how far you are from something (place, person or device).
- Requirement needed to be supported for public safety networks , two key technologies are supported by 3GPP
D2D ProSe communications
Group communications

ProSe Reference Architecture model :



Thanks