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 :

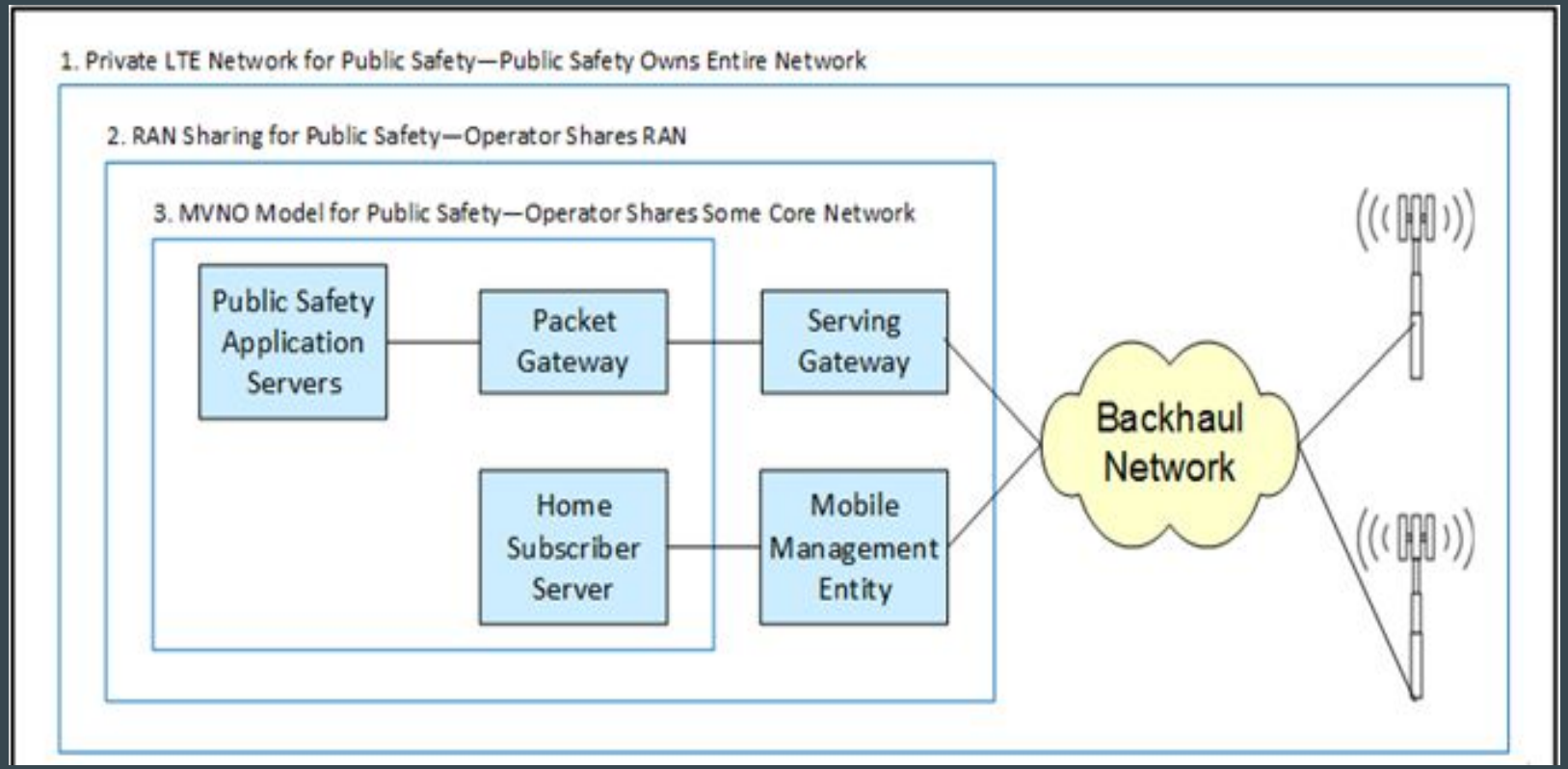
- As huge investments would be required for a network dedicated solely to public safety , industry and government are evaluating approaches in which public safety uses can be added with existing commercial network deployments.

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 :



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 complaint 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

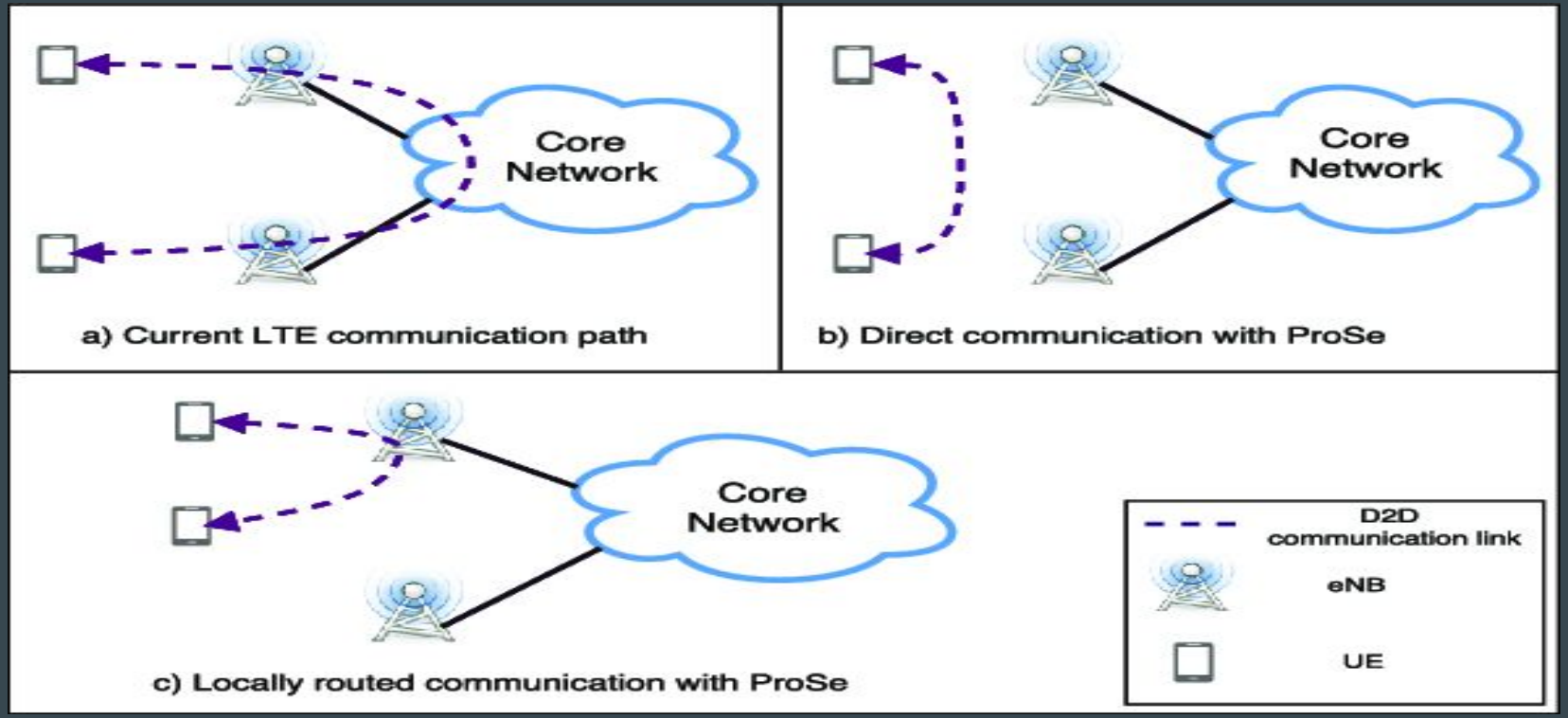
Technical features :

- 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 :

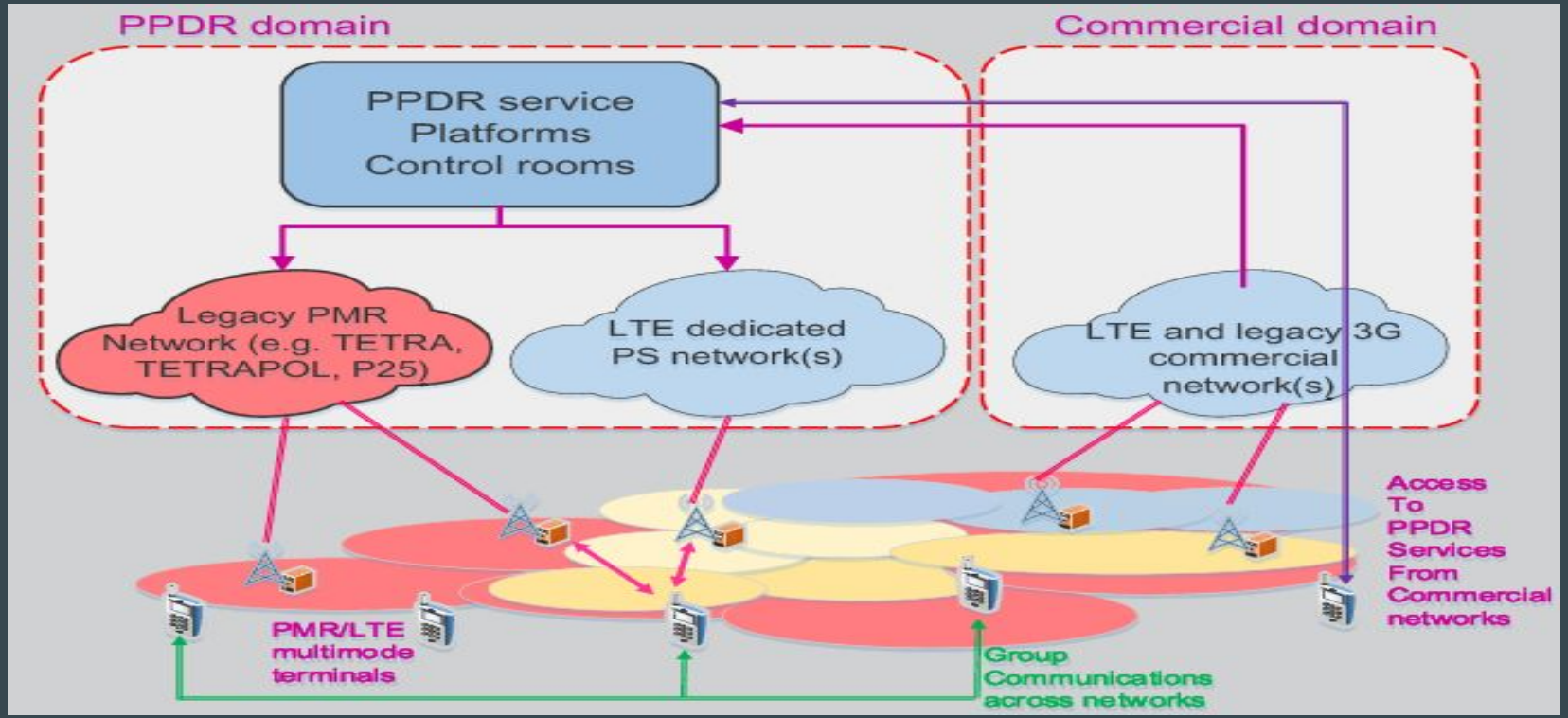


Technical features :

- 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 :

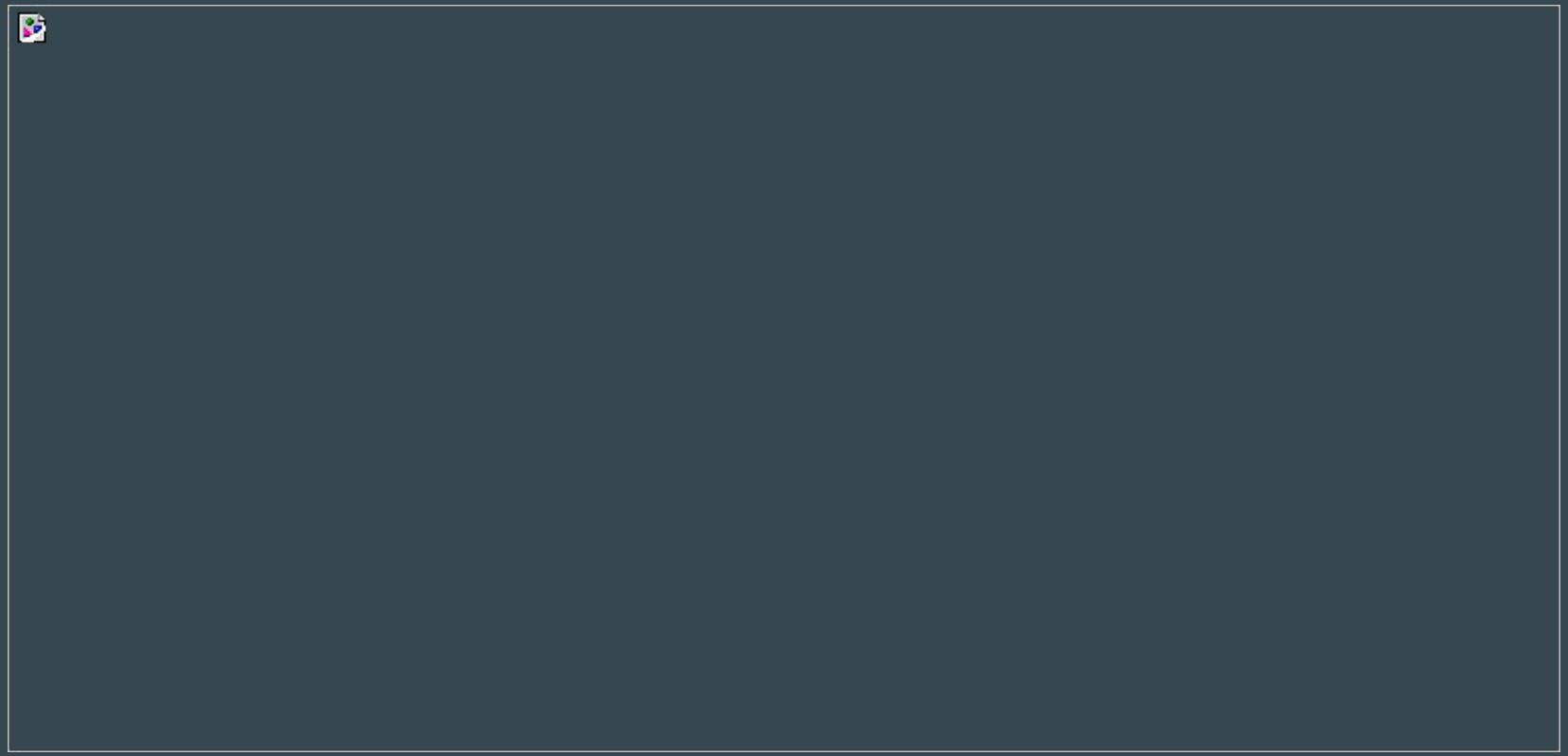
- The LTE network should be interoperable with existing PPDR networks.
- The device should be able to connect both networks.
- In terms of frequency spectrum , Europe to use sub- 1Ghz bands
- Most likely spectrum bands 400 MHz & 700 MHz
- 400 Mhz is already used for PMR systems
- 700 Mhz band is available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