CRITICAL COMMUNICATIONS BROADBAND GROUP

WHITE PAPER

Mission Critical Mobile Broadband:

Practical standardisation & roadmap considerations

Important Note

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Foreword

This document has been produced by the TETRA and Critical Communications Association (TCCA)[1] Critical Communications Broadband Group (CCBG)[2] to provide supporting information and guidelines for critical communications users, operators and other interested parties who are considering the implementation of mission critical mobile broadband services. It sets out the predicted timeframe for availability of suitable standards and equipment, together with a consequent outline roadmap for LTE as a technology evolution for TETRA and other current mission critical systems.

The TCCA represents a global TETRA market supporting wide area Public Safety and other critical communications networks. The TCCA has developed and maintains a clear appreciation of critical communications users' requirements and operational needs.

About the Critical Communications Broadband Group

The CCBG is working together with other stakeholder groups worldwide to drive the standardisation of common, global, mobile broadband technology solutions for critical communications users and to lobby for enough dedicated harmonised spectrum for deployment of networks.

The CCBG is keen to share its understanding and to progress this work with interested parties from user organisations, operators, industry, and other stakeholder groups. This work is crucial to the ongoing existence of fit-for-purpose critical communications services.

Background

The global professional communications community's requirements for mission critical voice and data services are currently satisfied by a range of technologies like TETRA, Tetrapol, P25, and GSM-R. These are all narrowband digital systems and offer limited data capability. The growing demand for access to increasingly bandwidth-hungry data applications has resulted in individual user organisations adopting or considering 2,5G/3G/4G consumer devices for data communications, and relying on commercial mobile network operators for delivery of those services.

The sector has had very good experiences with interoperability of mission critical voice services until now due to common spectrum allocation and a common standard. The user community has an expectation that as the use of broadband data services increases, they will de facto become intrinsically mission critical as well. This has ongoing implications for public safety and other such mission critical users of mobile broadband services.

Many governmental and other critical communications organisations are seeking to address these issues through new initiatives. Different options are being considered. To achieve cohesion and common goals, the TCCA formed its Critical Communications Broadband Group (CCBG) to bring together all parties involved in the creation of future mobile broadband services and solutions for critical users.

Through the CCBG, the TCCA is working closely with governmental and other critical communications organisations such as the utilities and transportation sectors in developing a standardised, flexible and innovative approach to critical communications. We aim to drive the delivery of a high availability, mission critical, secure, resilient and interoperable mobile broadband solution for the future.

This document addresses:

- Technology considerations

- Standardisation process and timetable

- Impact of standards timetable on implementation options

- TCCA vision for Mission Critical networks evolution

Technology Considerations

LTE (4G mobile communications) is the next generation technology widely expected to address bandwidth limitations on all mobile networks. For mission critical communications, it combines high bandwidth data together with low latency, and offers a good platform on which to implement group communications requiring short access (call set up) times. A short message capability is supported, but LTE is not currently used as a bearer for voice communications in either the public or private sector.

Accordingly the CCBG is working to build a robust LTE migration roadmap for Public Safety and other critical communications network solutions, initially for data services.

Some technology vendors have already been exhibiting proof of concept demonstrations of Push-to-Talk (PTT) applications to show the feasibility of Public Safety and critical communications solutions in the future over LTE. But, the LTE standards have been developed to provide high bandwidth data services for generic commercial business and consumer use. There is much work to be done in terms of standardisation to make LTE a suitable solution to transport mission critical data applications. Adequate voice services over LTE are not expected until at least 2020.

CCBG participants are also members of the ETSI Technical Committee responsible for TETRA, as well as active contributors to the global 3GPP standards body (Third Generation Partnership Project), responsible for specifying the LTE standards. The CCBG is building consensus across the Public Safety and other critical communications sectors for mission critical requirements. It is essential that the industry operates in a coordinated and coherent way to bring to maturity standards relevant to Public Safety and other critical users. CCBG members are working to ensure that such requirements are incorporated into the LTE standards effectively.

Standardisation Process and Timetable

There are several Work and Study Items currently in progress or under consideration in 3GPP or other Standards Developing Organisations such as ETSI specific to the use of LTE for critical communications applications and delivery of the future services expected by mission critical users. These include:

- Group Communications System Enablers for LTE (3GPP GCSE_LTE)

- Proximity-based Services (3GPP ProSe)

- Public Safety Networks Resiliency

- Push-To-Talk (PTT) voice application standard over LTE and its evolution toward multimedia (voice, data, video, etc.) group communications

These items are described further below.

Group Communications System Enablers for LTE

Group Communications System Enablers for LTE (GCSE_LTE) is an accepted Work Item Description (WID)[3] in progress with 3GPP SA1 (System Architecture Working Group 1).

It is designed to address the 3GPP standards evolutions needed to support group communications of various media (voice, video, messaging, etc.) over LTE. It is based on input requirements provided by the main international Public Safety and critical communications user organisations such as US NPSTC, TCCA, APCO and UIC.

Based on the functional split between the 3GPP domain and the Application layer, the GCSE_LTE Work Item will consider the evolutions of the LTE standards that will allow the Application layer and the 3GPP system to jointly support group communication with the appropriate Priority handling, Performance and Resource efficiency.

There is in particular a need for an efficient multipoint transport service within LTE to complement the current LTE broadcast capabilities, which have been designed with commercial data applications in mind (in particular streaming video).

The objective of 3GPP is to include those evolutions in Release 12 of the 3GPP LTE standards, planned for publication at the end of 2014.

Proximity-based Services

Proximity-based Services (ProSe) is also an accepted Work Item Description (WID) in 3GPP SA[4]. It is designed to address both critical communications and commercial requirements for direct mode or proximity ('device-to-device') services on LTE.

Services that could be provided by the 3GPP system based on User Equipment (UEs) being in proximity to one other have been identified and ProSe will provide support for both critical communications and potential commercial services that would be of interest to operators and users. Those services include discovery mechanisms, direct communications and relay capabilities within network coverage under continuous operator network control, and also outside of network coverage, this latter case being limited to critical communications use.

For example, in TETRA systems Direct Mode Operation (DMO) makes it possible for users to communicate directly with each other over a few kilometres range in completely open terrain without any need for connection to a base station or to the core network. This is achieved using functionality like repeater software functions in the devices. It is essentially a "walkie-talkie" like ('device-to-device') capability. This gives an extra layer of resilience to TETRA systems, which is not

present in any commercial mobile technology implementation, including LTE, at the current time. Thus for the meantime, and in the absence of standardised proximity services, LTE is not inherently a resilient solution. Other related work such as higher power outputs for UEs will contribute towards a solution.

For normal commercial users, it is acceptable practice for an individual to move around to find a location with adequate coverage. This is not feasible in a mission critical environment. An incident cannot be moved. Public Safety and critical communications workers must have guaranteed communication at any incident location. Addressing this issue through the ProSe Work Item is an essential step to making LTE viable for critical communications applications.

The objective of 3GPP is to include these evolutions in Release 12 of the 3GPP LTE standards, planned for publication at the end of 2014.

Critical Networks Resilience

One other area of weakness in existing LTE network design, compared with current critical communications technologies is the capacity for 'graceful degradation of service', present in current PMR/LMR standards. For example, should the connection between the base station and the core network be lost in a TETRA network, it is still possible for the base station to be used to provide Push-to-Talk (PTT) voice services and voice broadcast services making use of the radio link locally.

In addition to providing voice, video, and data group communication services for critical communications users out of LTE network coverage, the network operator may deploy a mobile command post equipped with an LTE base station ('e-Node B' or eNB) or set of eNBs to facilitate communications for nearby users beyond those provided by ProSe in device-to-device direct communication mode. The eNB within a mobile command post could be either a single autonomous eNB without a link to the core network, or a set of eNBs without backhaul links but linked to each other.

It is vital for critical communications systems to support continuous mission critical network operations regardless of the existence of the backhaul link.

To address those scenarios, a new Feasibility Study will be proposed in 3GPP SA, as the first step for introducing a new Work Item entitled 'EPC-less E-UTRAN Operation for Public Safety'. This work item will seek to address additional concerns about resilience of LTE networks and their suitability for Public Safety and other critical communications systems.

The objective is to include this evolution in the Release 13 of the 3GPP LTE standards, planned for publication at the end of 2016.

Push-To-Talk (PTT) Voice Options for Critical Communications and their evolution toward Multimedia group communications

Towards the end of 2011, the first commercial LTE deployments were implemented, for data only services. The consumer voice evolution for LTE is still under discussion. Open Mobile Alliance (OMA) Push to talk over Cellular (PoC) is a group communication service defined, for 2G/3G networks built on top of 3GPP IMS specifications. The purpose of OMA PoC has been to:

- Allow ad-hoc group communications and chat–like communications for consumer and small commercial business applications

- Enabling individual users to dynamically build ad-hoc groups to talk and chat

Critical communications performance and interoperability requirements are not fulfilled using OMA PoC based solution. The current OMA PoC based solution does not provide an adequate solution for the delivery of mission critical voice group communications and a new Critical Mobile Communication Application standard has to be produced by an SDO (Standard Defining Organisation) for new multimedia group communications services.

In early 2012, ETSI TC-TETRA WG4 started such work leveraging TETRA standards to define the provision of mission critical services over LTE for the migration of the existing installed base. However, much more work needs to be done for the implementation of new multimedia group services as illustrated by CCBG use cases submitted to 3GPP. Creating a generic "LMR/PMR" interface to LTE would ideally allow all existing standards and technologies easy interfacing and migration.

Implementation of Critical Mobile Communication services over LTE demands standardisation both from ETSI and from 3GPP. The required LTE enhancements for efficient point to multipoint transport layers as well as interfaces to the LTE network are anticipated standardised within 3GPP through the GCSE-LTE and ProSe work items and the Critical Mobile Communication services themselves are anticipated standardised within ETSI.

The TCCA CCBG is contributing to these standardisation processes in order to reach a global consensus for Critical Mobile Communication standards meeting users' requirements while allowing a migration and interoperability strategy for existing systems in various different regions.

Impact of Standardisation Timetable

There is a necessary delay between the publication of standards and availability in the marketplace of technology which both meets the standards and is sufficiently mature to be relied upon for mission critical communications. In the TCCA's opinion, the earliest that LTE technology suitable for Public Safety and other critical data communications use could be available for purchase is 2018. This would mean that such users should continue to invest in current technologies for mission critical voice communications in the near to medium term.

An Evolution Vision for Critical Users

Understanding the standardisation timeline and the global visibility of the critical communications sector, TCCA has developed a vision for Critical Communications Networks evolution leveraging multiple radio access networks and standardised applications for a step-by-step migration toward an LTE mission critical network, as shown in Figure 1 below.
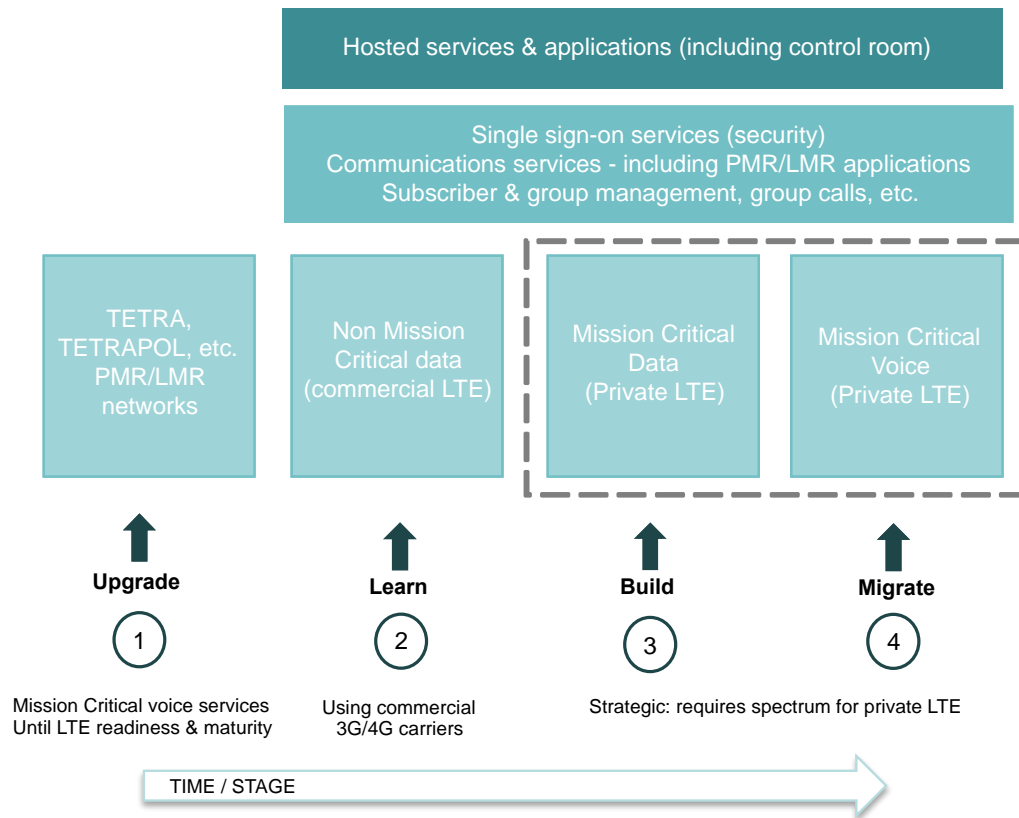
Figure 1: Evolution vision for critical users

References:

[1] http://www.tandcca.com

[2] http://www.tandcca.com/assoc/page/18100

[3] http://3gpp.org/ftp/tsg_sa/TSG_SA/TSGS_58/Docs/SP-120876.zip

[4] http://3gpp.org/ftp/tsg_sa/TSG_SA/TSGS_58/Docs/SP-120883.zip