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Productivity Commission

Public Safety Mobile Broadband Issues Paper – NEC Response

Australian Government
Productivity Commission

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Executive Summary

As the only active Australian-based contributor to the 3GPP(LTE) standards body (the de facto standard for next generation Public Safety Mobile Broadband (PSMB)), NEC is honoured to have an opportunity to respond to the Productivity Commission's Issues paper on PSMB.

As a commercial enterprise, NEC is committed not only to work in the interests of its shareholders but also those of society in general. In our recent publication on NEC's Vision for Social Value Creation, we set-out our aspiration for how social infrastructure can by enhanced by the use of ICT to benefit society. Today, many of NEC's current business activities are now focussed on how we can help to provide safe and secure services to society to benefit us all.

In the specific area of PSMB, recent independent research has reemphasized the benefits to society of providing spectrum for use by public safety agencies and concludes that the potential lost revenue from the commercial sale of spectrum is far outweighed by the benefits to society of providing spectrum for use by emergency services. As such, there can be little doubt remaining that the provision of spectrum for this purpose is of paramount importance in Australia as well as overseas.

The adoption of 3GPP(LTE) as the de facto standard for PSMB will be driven in no small part by the sheer volume of deployed commercial networks & devices. According to GSMA report, there were 3.6 billion mobile subscribers and 7.3 billion SIM connections in 2014. More importantly, the demand for new products and services by users is leading to a rate of innovation not previously seen in consumer devices. These technology enhancements can now be adopted very rapidly in the PSMB space giving our first responders the best chance of improving outcomes.

Further, the availability of a mobile broadband capability to public safety agencies will be driven by the adoption of increasingly bandwidth hungry applications that deliver enhanced results both for agencies and society on the whole. Such technologies improve situational awareness to first responders and increasingly are used to proactively prevent crime eg, fingerprinting, facial recognition, cameras with image processing to detect early signs of crime.

In this document, NEC will put forward its' vision for the future use of communications technologies and highlight a number of factors that also need to be considered prior to the formalisation of an approach to market - including the use of only standards-based solutions, Commercial Off The Shelf (COTS) equipment and some considerations for likely future drivers of PSMB requirements.

Takashi Tada – General Manager, Corporate Strategy, NEC

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Public Safety Mobile Broadband (PSMB) Network Operational Scenarios and Needs

The public safety mobile broadband (PSMB) network should provide communication services such as voice calls, video streaming and live video feed for monitoring and surveillance, and transfer of high resolution imagery, and other data application services to various public safety agencies (PSA). These communication services should support the following operational scenarios:

1. Normal operation scenario
    - Business as usual activities such as responding to incidents that involve limited number of PSA officers, and require lower communication services.
    - Planned events such as major sporting events or music festivals that involve larger number of PSA officers, and require higher communication services.

    For this scenario, the demands for the communication services are normally stable and predictable. It is easy to plan and build PSMB network for this scenario.

2. Crisis operation scenario
    - Large scale emergency or unexpected incidents such as natural disasters and terrorist attacks that involve very large number of PSA officers from various PSA divisions, and require very high communication services.
    - In some cases, the communication infrastructure might be destroyed or damaged.

    For this scenario, the demands for the communication services are normally unstable and unpredictable. PSMB network needs to be built considering the unpredictable demand and unavailability of the communication infrastructure.

3. Post-crisis operation scenario
    - Various utility and health service providers get involved in the post-crisis scenario to rebuild and restore normalcy in the crisis area, and their communication needs to be fulfilled by PSMB network, until public communication infrastructures are restored.

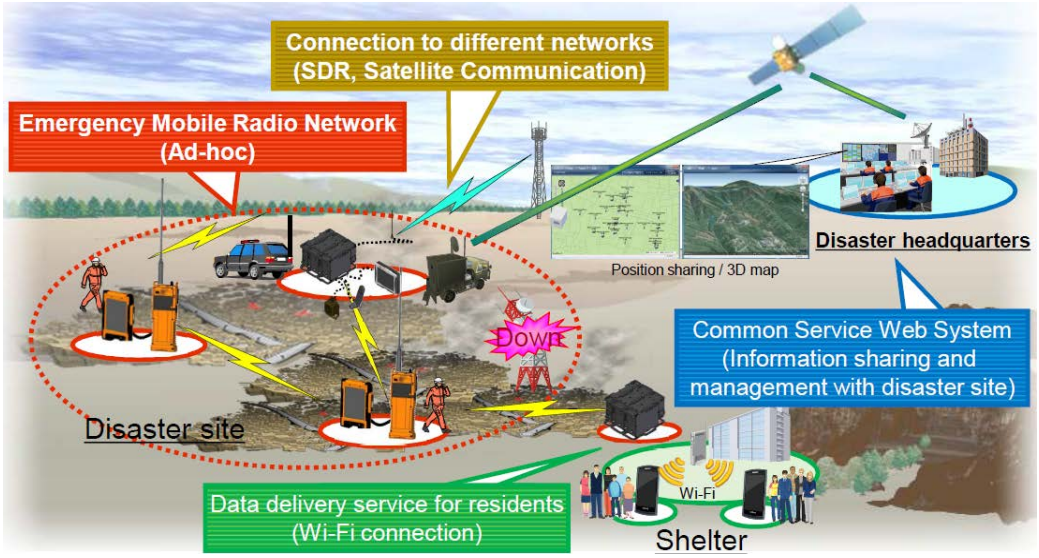

Figure 1: Crisis operation scenario

Sharing live video feed among PSA officers in the field and backend command control centre is becoming very important for these entire PSMB operational scenarios. From public safety operational scenarios, PSMB network

- Shall be capable of providing efficient live video communication services
- Shall be scalable in terms of providing required coverage and capacity for the communication services to PSA
- Shall be capable of providing communication services outside PSA if needed. That is to closely align with commercial technology.
- Shall be capable of operating in the failure of communication infrastructure.
- Shall be always available for PSA

Choice of technology

To ensure cost effective and longevity of the PSMB network, its design principles should embrace contemporary design concepts and technologies that are aligned with forward-looking initiatives of relevant Standards Developing Organizations. Key near-term initiatives relevant to the PSMB implementation include Software Defined Radio (SDR), Software Defined Network (SDN), Network Function Virtualization (NFV), Machine-to-Machine (M2M) communication, Internet of Things (IoT), Cognitive Radio Technology (CRT), millimetre wave communications and 5G mobile broadband communication systems.

3GPP unites seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), and provides complete mobile broadband communication technology specification for global deployment. 3GPP LTE technology, including radio access, the core transport network, and service capabilities - including

work on codecs, security, quality of service, has been developed taking into account on emerging technologies and market demands.

- 3GPP eco-system is driven by global commercial network operators, industry standard organizations and forums, chip manufacturers and very large number of vendors.
- Global 3GPP eco-system drives huge number of innovative mobiles devices being released regularly without significant increase in device price to consumers. According to GSMA report, there were 3.6 billion mobile subscribers and 7.3 billion SIM connections in 2014.

Public Safety LTE

Many public safety (PS) and mission critical communication (MCC) organizations and industry recognized the desirability of having an interoperable national standard for a next generation public safety network with broadband capabilities, and selected 3GPP LTE as baseline technology for “Next Generation Public Safety Network”.

- National Public Safety Telecommunications Council (NPSTC), TETRA Critical Communication Association (TCCA), European Telecommunication Institute (ETSI) Technical Committee TETRA are collaborating with 3GPP to define “Public Safety Features” to the LTE technology.
    - It is notable that NPSTC in US is strongly supporting P25 for mission critical communication and its interoperability among PSA in US.

- USA has reserved spectrum in the 700MHz band (Band 14) for an LTE based public safety network with US$7billion in funding, and started rolling out first “LTE public safety” network (called, “FirstNet”).

- Los Angeles Regional Interoperable Communications System (LA-RICS) Authority has chosen LTE system to provide wireless day-to-day broadband data communication services for the public safety providers of the greater Los Angeles region.

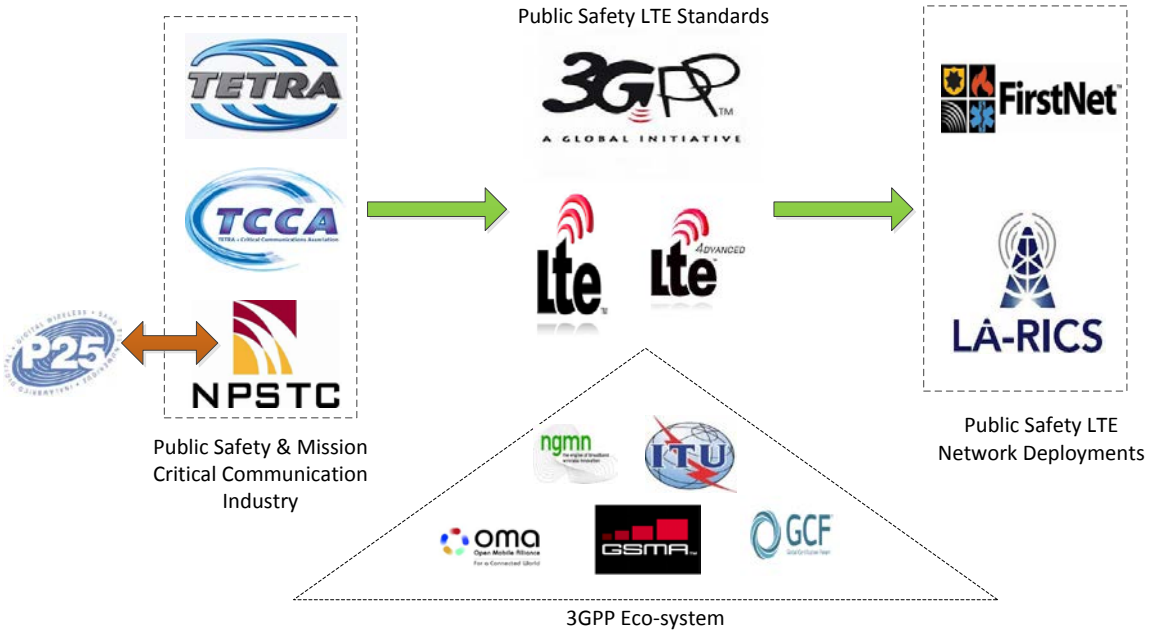

Figure 2: 3GPP and Public Safety LTE

With the backing of 3GPP eco-system and economy of scale, the rest of the world is following the US path on using Public Safety LTE.

On the other hand, the public safety industry has been pushing for standardization of their requirements in 3GPP for public safety LTE.

- Two main areas of 3GPP LTE enhancement have been agreed in 3GPP to address public safety applications are [TR22.803, TS23.703 and TR36.843]:
  - Proximity services that identify mobiles in physical proximity and enable optimized communications between them.
  - Group call system enablers that support the fundamental requirement for efficient and dynamic group communications operations such as one-to-many calling and dispatcher working.
- 3GPP defined radio performance requirements for LTE public safety mobile devices to operate in various frequency spectrums [TS36.101].
  - LTE public safety mobile devices operating in 700 MHz spectrum in US (Band 14) is defined with high transmit power (31dBm) to have wider coverage, while commercial LTE terminals operate with lower transmit power (23dBm).
- 3GPP has created a new Working Group, WG SA6, to undertake specification work for applications in the mission critical communications space, in September 2014. This new 3GPP working group, SA6, will initially focus on the Mission Critical Push to Talk (MCPTT) application in Release 13 while developing in to the generic home for all future 3GPP missions critical application work, on top of a common architecture.

3GPP use case scenarios for Public Safety LTE

There are multiple use cases associated with the application of LTE to Public Safety Mobile Broadband & 3GPP use case scenarios to drive for public safety technical specification in 3GPP [TS22.802] are well aligned with the needs of public safety operational scenarios.

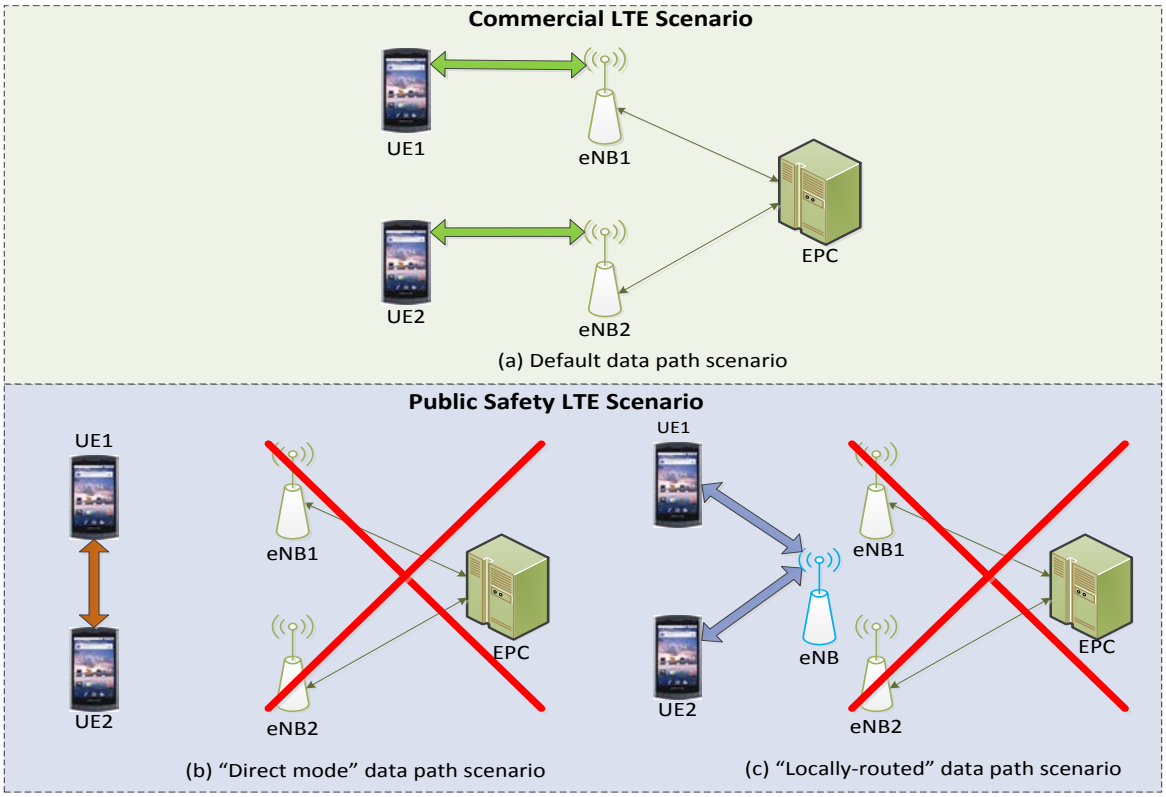

Figure 3: 3GPP use case scenarios for public safety

3GPP roadmap for Public Safety LTE

3GPP uses multiple "releases" over time to provide stable specifications for implementations, and to add features and enhancements required by market demands. A baseline specification for Public Safety LTE has been completed in 3GPP in Releases 12. 3GPP is continuing enhancing the baseline features and adding more advanced features for Public Safety LTE, which will be available in the coming releases.

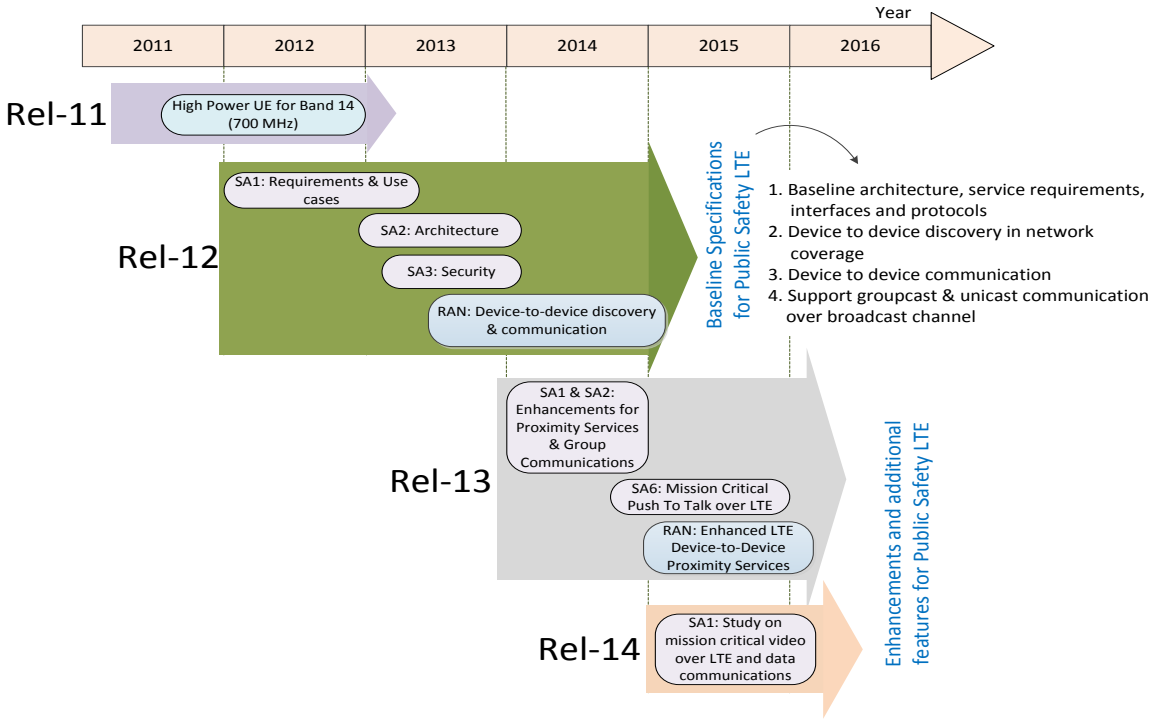

Figure 4: 3GPP Public Safety LTE standardization progress

3GPP LTE Standards are written in support of multi-vendor environment. PSMB network should take advantage of (and require) open interfaces between Core, RAN, and Applications specified by the standards to enable the freedom of selecting multiple Core, RAN, and Application vendors.

NEC Vision for Public Safety Network in Australia

At present Australia has multiple disparate networks in each State for applications such as voice, data & paging. The voice networks utilised by public safety agencies are commonly deployed using commercially available (typically P25) equipment and are often operated by private organisations under contract to the States.

Over time, NEC expects to see consolidation from multiple disparate legacy communications networks and technologies to larger, open-standards-based, interconnected networks in a manner not dissimilar to the way the internet has joined disparate computer systems together.

Additionally, we expect that there will be a step-change with the deployment of M2M or IoT devices in the near-term that will require networks to support remote monitoring and analysis for the purposes, in this context, of prevention of incidents that affect public safety.

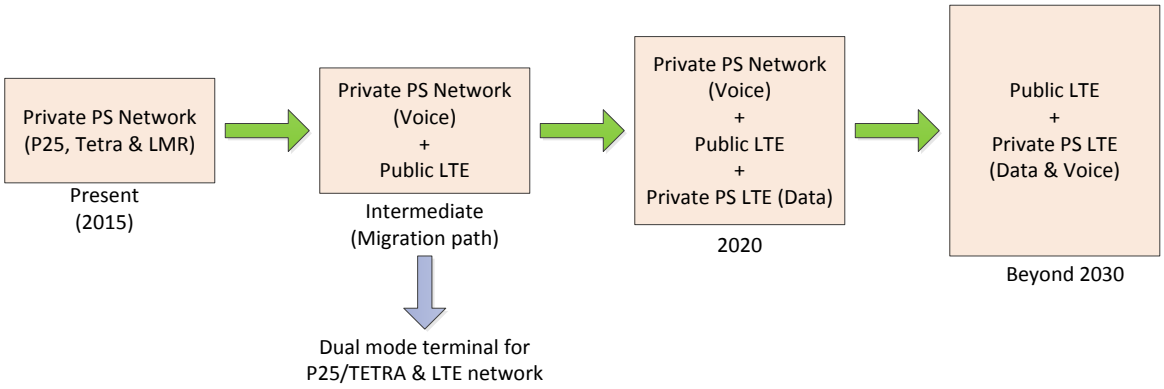

Figure 5: NEC vision for Public Safety Network Evolution

In the context of evolution of communication systems and networks, it is inevitable that there will be periods of transition between current and future systems. To address this, NEC sees the most cost-effective solution being the use of multi-mode products (for example, the NEC Mobile Access Controller (MAC)) along with reconfigurable terminals that can be used on multiple systems (for example, NEC's Software Defined Radio (SDR)). In this way, public safety communications users will be able to migrate simply between different frequency and protocol solutions and without needing separate end user devices for each network.

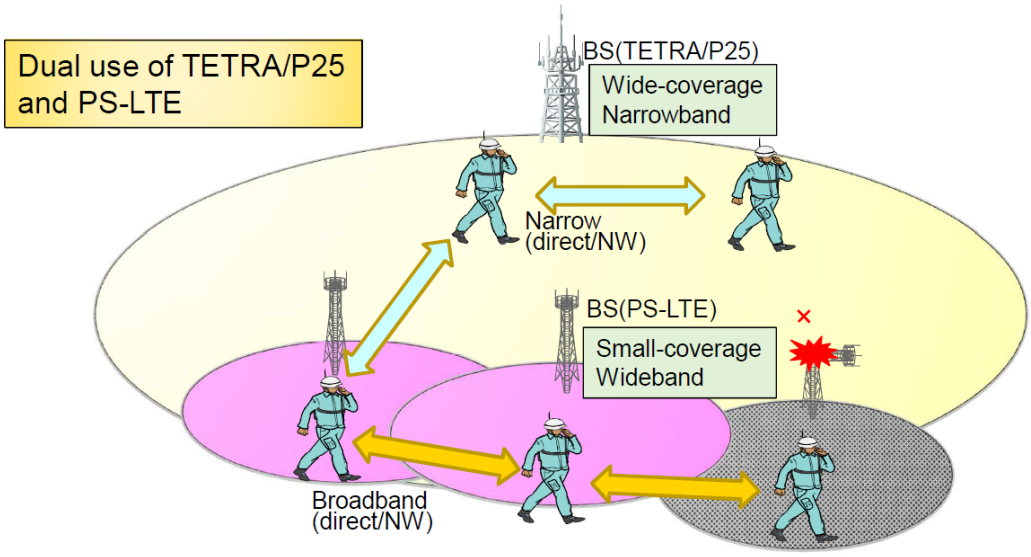

Figure 6: Dual mode terminal use in TETRA/P25 and PS LTE network

Public vs Private vs Shared Solutions

Solely publicly-owned technology solutions often suffer from using bespoke technology implementations raising issues around cost, maintainability, access to qualified skills for support & maintenance etc. Although such solutions often, at the time of implementation, give complete responses to requirements, over time and through only having a single investor-customer, they decline much more rapidly than more commercial offerings. Conversely, publicly owned facilities often have higher levels or resilience, availability and reliability far in excess of those provided by commercial-grade solutions. This is important in environments where natural disasters can occur and for

Solely commercially owned infrastructure can suffer from a different set of issues that can affect performance. As purely commercial entities, the organisations that own and operate equipment need to do so at a profit. This means that costs will be minimised, which can affect factors such as resilience which are paramount importance for an emergency services network.

Shared facilities may end up being too compromised to offer a good solution to either commercial or emergency services users. Thus careful consideration should to be given to all aspect of a PSMB before choosing any one architecture. Ideally, a combination of public and private solutions can be used to give best value for money to the acquirer reusing existing commercial networks wherever possible (and when they meet the required resilience attributes for emergency services) and back-filling with additional infrastructure where required. NEC sees small-cell LTE as being vital in this regard.

A significant time and economic expense associated with wireless network deployment is site acquisition and build-out of the RAN. PSMB can defray or avoid these costs by seeking “site-sharing” arrangements with carriers or network that may already have such facilities (i.e. P25), or leasing of space at PSMB equipment sites to other entities.

Open vs Proprietary Solutions

In many areas of technology (for example, telephony, IT, radio communications), history has shown across multiple public and private systems that open standards and solutions yield better value for money, support multi-vendor interoperability and competition and allow greater long-term supportability over proprietary solutions. Proprietary solutions lock customers in to sole-source agreements with vendors which provide poor value for money & increase through-life supportability issues.

NEC strongly recommends to its partners that they use open, industry, standards for their technical solutions and in the case of broadband offerings this means using completely standards-based solutions for base-stations, back-haul and terminal equipment. Even seemingly small enhancements offered by vendors can surreptitiously lock customers in to expensive single-source agreements by stealth – ultimately leading to poor quality outcomes particularly for publicly-owned systems.

Additional factors affecting proprietary solutions that should be considered are:–

- low volume solutions which cannot be amortized across multiple user groups or deployments, leading to more expensive deployments
- reduced number of spares due to fewer customers supported
- reduced number of technical experts available to support upgrades/ changes / fixes etc
- few, or no, upgrade paths as technology ages resulting in more expensive future migration

Public safety spectrum arrangements

NEC develops technical solutions to support market adoption. Ideally, all international territories would use the same banding for PSMB's to yield the simplest & most widely deployed equipment configuration resulting in the greatest competition between vendors and ultimately the most cost-competitive solution to customers.

Of course, the world is not so ideal and various pre-existing arrangements in all regions of the world will ultimately preclude this from occurring. NEC will typically manufacturer and supply solutions to support most if not all local regulatory requirements. But it should be remembered that the economic necessity of research, development & manufacturing means that lower volume market technology solutions will typically be more expensive (in order to recoup Non-Recurring Engineering costs) than if greater levels of commonality are achieved across multiple territories. Therefore, and as much as possible, NEC would advise the government to seek the greatest level of commonality with comparable (off-shore) territories as possible.

As a 3GPP(LTE) contributor we are aligned with the bands allocations as detailed in the standards definition task.

Public safety devices

It is expected that multiple equipment form factors will continue to be required – in particular personal (hand-held) and in-vehicle communications equipment which address slightly different requirements and consequently have differing attributes such as longevity, range, environmental attributes (eg IP & MIL STD ratings).

Notwithstanding the above, we are clearly in a period of rapid movement towards and adoption of mobile computing platforms and we expect to see continued uptake of equipment in this space. Thus it is important that, in order to reuse COTS equipment wherever possible, that again open-standards are used to enable use of such commercial-grade equipment.

As per open standards above, governments should give good consideration to the use of COTS devices wherever possible to reduce up-front and on-going costs. Again, this exemplifies the importance of selecting standards-based solutions.

Growing with technology advancements and trends

Drivers of bandwidth for a PSMB include the following items:-

- Video Surveillance & Analysis
- Bio security (facial recognition, finger print)
- Biometrics
- GIS / GPS data
- ANPR
- Portable Xray / Chemical / Biological analysis

NEC's key developments in the area of *safer cities* has identified a number of technologies that will benefit by the use of PSMB & NEC has product offerings in many areas of these functional areas today.

In addition to applications known today as candidates for drivers of PSMB, additional consideration should be given to technologies currently still on the horizon such as:-

- 5G
- M2M

- IoT

Although it is difficult to determine exactly how these applications will evolve and therefore how they will impact on any PSMB, it can be estimated given analysis of historical growth in data bandwidth consumption, for example, how these are likely to evolve over time.

Other items that should be give due consideration that are non-traditional drivers of technology deployment are Information security & integrity and provision of managed services (OpEx deployment models). NEC can propose significant expertise in both these domains along with deployment examples and modelling expertise.

NEC Solutions to Public Safety Sector

NEC offers a range of network solutions for the Public Safety sector. These solutions include Small Cells, an Evolved Packet Core, Mobile Backhaul, and value added integrated Applications that leverage the broadband network.

The NEC microwave Mobile Backhaul product family has been selected and is in the process of being integrated in the Los Angeles Regional Interoperable Communications System (LA-RICS) – a Broadband Technology Opportunities Program (BTOP) - in co-operation with a partner System Integrator, in United States.

NEC Band 14 Microcell eNB has been installed and operational at the Public Safety Communications Research (PSCR) lab in Boulder, Colorado since 2012, and is being used extensively on an ongoing basis for evaluation, testing, and measurement. This system was also used to support live demonstrations at the 2014 PSCR Stakeholder Conference.

The NEC Facial Recognition Biometrics solution has achieved the highest performance evaluation in a recent Facial Recognition Vendor Test (FRVT) 2014 performed by the U.S. National Institute of Standards and Technology (NIST). Results were released in NIST's Interagency Report - NISTIR 8009 - Performance of Face Recognition Algorithms. The NIST report is widely viewed as the benchmark of determining which face recognition software solution is the most accurate for one-to-many searching under a variety of situations.

NEC as a gold partner to the 2020 Tokyo Olympics will be developing and trialling further novel public safety solutions. One particular area is in the use of real-time sensor data for big data analytics for public safety. NEC would welcome the opportunity to showcase these technologies to the Australian Government.

Deployments in Other Markets

Australia will, of course, be interested in the developments of similar PSBN in off-shore territories such as North America (USA) and Europe (UK) in particular. The FirstNET deployment currently underway in the USA, which NEC has contributed to, has already resulted in useful data points and NEC would suggest that Australia currently has the opportunity to provide a 'nation-wide' solution or framework for PSBN deployment in the coming years. Piecemeal, state-by-state-specific solutions, will potentially preclude cost reduction through amortisation and the easy deployment of resources

References

Please find references made to external work made in this document below:-

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NEC Contact

If you have further questions regarding this submission, your NEC contact details are:

Contact Name:	Takashi Tada
Title:	General Manager, Corporate Strategy
Phone number:	131 632
Email address:	Takashi.Tada@nec.com.au
Postal address:	649 - 655 Springvale Rd Mulgrave VIC 3170 Australia

About NEC

NEC Australia is part of the global NEC Corporation – comprised of companies in 130 countries with more than 140,000 employees. Founded in Japan, the organisation has been in existence for well over 100 years. The Australian organisation has been operational for more than 40 years, providing Information and Communication Technologies to a wide range of Government and Corporate customers. With over 5,000 customers, 60,000 systems and millions of assets currently under maintenance, NEC is truly a quiet leader in the Australian communications arena.

The foundation of NEC is innovative, high quality engineering. It is ranked as one of the leading patent producers, inventing the technologies that are used by hundreds of high profile “big brand” manufacturers. The NEC commitment to the advancement of technology, along with its enshrined commitment to the advancement of the community, may be seen in its involvement within various Standards Organisations, defining the futures of the industry and advancement of user community.

It is the depth and breadth of involvement in the computing and communications world that marks NEC as a world leader; uniquely placed to deliver converged solutions. Along with making one of the world’s fastest super-computers and manufacturing the equipment for some of the largest storage networks, NEC provides the transmitters that distribute more than 90% of ABC, SBS and commercial HD TV in Australia; was instrumental in the development of ADSL and with its SV series of communications servers is the preeminent provider of collaboration products spanning the transition from traditional telephony through voice over Internet solutions to collaboration enabled process.

NEC realise that they need to partner with other vendors in order to bring complete and well-rounded offerings to the market. These alliances ensure that interoperability is built into the solutions at the DNA level. By close partnering with other organisations, NEC can offer best in class end-to-end solutions – particularly in the collaboration and mobility sectors. These partnerships have lead NEC to be a leader in multi-vendor maintenance, providing product and geographic coverage unequalled in Australia.

NEC prides itself on partnering with organisations to ensure the application of new technologies is low risk, user inclusive and smoothly implemented. The involvement of NEC brings with it the capability to design, build, implement, maintain and enhance the solutions from the cradle to the grave.