IT'S HOW WE CONNECT

Submission to the Productivity Commission

Public Safety Mobile Broadband

5 June 2015

Contents

Executive Summary

Telstra welcomes the opportunity to respond to this important inquiry by the Productivity Commission (the Commission) into the costs and benefits of delivering a public safety mobile broadband capability in Australia. Telstra recognises that preserving the safety, security and prosperity of Australian communities is an essential public good that government is required to deliver.

Telstra acknowledges the important work that Australia's public safety agencies (PSAs) undertake to safeguard our communities and protect the lives and property of all Australians. These agencies must have the support and capabilities they require to manage these challenges, including taking advantage of the opportunities offered by new technologies to improve the effectiveness and efficiency of the services they deliver. Introduction of a public safety mobile broadband (PSMB) capability offers an important opportunity to improve the quality of communications within and between PSAs. It will also provide for expanding the scope of those communications, enabling PSA personnel to access and exchange a wider range of vital information wherever they are located.

In determining the most efficient, effective and economical means of developing Australia's PSMB capability the Commission will need to define a minimum set of requirements for the PSMB capability and assess the various ways of delivering the capability against their ability to meet the those requirements.

Essential requirements of a PSMB capability

Telstra believes that there are a number of essential requirements that will be critical for maximising the effectiveness of a PSMB capability, including that it should:

- Be delivered as quickly as possible.
- Cover as much of Australia's population base and land mass as possible. This coverage necessarily needs to include urban in-building and in-tunnel coverage and should also allow for temporary deployment of infrastructure outside the permanent coverage area.
- Be reliable and secure.
- Maximise the opportunity for interoperability, including between PSAs and across jurisdictions.
- Have sufficient capacity for day-to-day or 'business as usual' activities, but this capacity must also be scalable in order to meet the increased demands during extreme events such as natural disasters and major events.
- Be sustainable, including the ability to add new features as mobile broadband technology continues to evolve.

Options for providing a PSMB capability

Telstra notes that the Government has asked the Commission to investigate the options for deploying a PSMB capability, including three broad options as follows:

- A dedicated PSMB network that relies only on dedicated infrastructure.
- A fully commercial solution which would rely on commercial providers providing the PSMB capability 'as a service' using their own public carrier networks.
- A hybrid approach that sits between these above options.

Telstra believes a hybrid approach that uses a carrier core and combines some dedicated PSMB capacity with prioritisation of traffic on the carrier's public network capacity will offer the greatest overall benefit.

Leverage existing assets to avoid duplication allowing more efficient spectrum use

Building and operating a dedicated network from scratch would be a complex, time consuming and costly task. Leveraging an existing public carrier network would not only facilitate a more timely and cost effective introduction of the capability but will also offer coverage advantages. Further, restoration after natural disaster would be more cost effective as telecommunications resources can be focussed on repairs to a single set of infrastructure.

Coverage provided by a commercial mobile carrier is expected to be significantly better than that which could be afforded in the building of a dedicated network. Coverage will be greater both in terms of the total overall geographic footprint, and in the quality of in-building and in-tunnel coverage within metropolitan areas. Coverage can also be expanded to areas that are outside the permanent coverage footprint through deploying transportable base stations (cells on wheels) or by using satellite services. Additional base station sites could also be funded to address any critical black spots.

The combination of dedicated capacity to meet day-to-day or business as usual PSA needs and prioritised traffic on the public carrier network for times of peak demand, allows for an efficient use of spectrum and network assets. The alternative approach of provisioning a dedicated PSMB network with sufficient capacity for the peak requirements of natural disaster or other extreme events, is likely to be inefficient for day-to-day or business as usual activity. The opportunity cost of the underutilised spectrum would be high given the value placed on spectrum by commercial network operators to meet the growing demand from consumers and business for mobile services.

In some cases the public carrier network may need to be 'hardened' to increase redundancy and improve resilience to meet PSA requirements. However, any such hardening would be significantly less costly than building an equivalent level of redundancy into the building of a stand-alone dedicated PSMB network.

Tapping a more powerful global ecosystem

Telstra notes there is a large and sustainable ecosystem of devices available to suit commercial networks that have low unit costs because of global scale and harmonised spectrum usage. The creation of a dedicated PSMB network risks increasing the unit cost of devices as well as decreasing the available choice because of bespoke requirements. A dedicated network is more likely to involve a single vendor and proprietary solution which will limit choice and development options in the future. In contrast, embedding the capability in a public carrier network offers the advantage of being able to better tap into a global commercial ecosystem with many competing vendors that will increase development options as well as keeping costs down.

Development of a dedicated PSMB network also risks delays in bringing new features and capabilities to the network as technology evolves. Carriers have a commercial imperative to evolve and upgrade their networks and bring new features to market as technology evolves. This is often costly, but competitive pressures require that their networks continue to evolve and develop. A dedicated PSMB network will not face the same competitive pressures to evolve and develop which risks the dedicated network failing to keep pace with the evolution of technology. There is also a high risk that state based dedicated networks would evolve at different rates and with different, incompatible features that would hinder future interoperability.

It is vital that a PSMB capability provide for the evolution of its use in new and unexpected ways. Just as the introduction and expansion of public mobile broadband has lead to new, innovative and sometimes unexpected uses and to the disruption of traditional operating models, it can be expected that a PSMB capability will also evolve in new and unexpected ways. The best way to ensure this is to leverage global

standards for networks, devices and applications, noting that this global commercial ecosystem for mobile networks is a competitive one that is continuously driving innovation to reduce costs and introduce enhanced performance and new features.

Telstra believes this will be best achieved in a carrier environment that relies on the same global standards. For example, PSA communications may well move from a traditional 'command and control' model to a more open multi-modal system of communication that facilitates communication not only within and between PSAs but that includes intelligence gathering and mass communications to the public. A PSMB capability that is embedded in the public carrier network and relies on the same global standards as consumer devices and applications is far more likely to facilitate such communications than a dedicated stand-alone PSMB network solution.

Trusted and reliable technology partners

Telstra notes that the effectiveness of a PSMB capability that leverages an existing public carrier network has already been demonstrated on a number of occasions. In late 2013 Telstra LANES™ was used in Queensland and Western Australia and once again in late 2014 for the G20 Summit in Queensland. While Telstra LANES™ is just one model that leverages an existing public carrier network to provide dedicated capacity with prioritised traffic on of an integrated PSMB capability, these trials showed conclusively that a carrier can provide exclusive access to a partitioned spectrum allocation, a guaranteed preferential service on the public carrier network, and seamless mobility between the partitioned spectrum allocation and the public carrier network.

International harmonisation of spectrum

It is important that any spectrum identified for PSMB use in Australia is harmonised with the International Telecommunications Union (ITU) PPDR spectrum allocations for Region 3, so that Australia can benefit from global device supply and to help assist interoperability in disaster and other emergency situations across the region. Further consideration of harmonised spectrum for PSMB is on the agenda of the ITU World Radio Conference to be held in December 2015. Telstra believes it would be prudent to wait for the outcome of that conference before making any commitment to identifying specific spectrum for PSMB use in Australia.

Conclusion

Telstra thinks the option of a dedicated PSMB network would have a number of drawbacks including high costs, poor value for money, a long implementation timeframe, technological stagnation and performance that is dependent on public sector investment cycles. Conversely, leveraging a public carrier network offers an effective, flexible and responsive approach that is in keeping with the trend towards 'as-a-service' ICT sourcing models.

For all of these reasons, Telstra believes that the most efficient, effective and economical means of delivering a PSMB capability will be to leverage a public carrier network environment, and especially one which provides a seamless combination of dedicated capacity for business as usual traffic and prioritised capacity on the public carrier network for peak load scenarios.

1. Introduction and overview

Telstra welcomes the opportunity to provide input to the Productivity Commission's inquiry into public safety mobile broadband (PSMB). Telstra has been an active participant for some time in the public policy debate on how to best implement a PSMB capability and has already taken a number of steps to demonstrate that commercial network providers are capable of developing and implementing an effective, flexible and responsive approach to PSMB that is in keeping with the trend towards best practice 'as-a-service' ICT sourcing models.

1.1. Public safety challenges

Telstra recognises that Australia's public safety agencies (PSAs) work unceasingly to safeguard our communities and protect the lives and property of Australians. They are unstinting in the support they provide to all Australians across the country.

Australia is prone to harsh environmental conditions and unrelenting natural disasters. Between 2003 and 2013 Australia suffered over 50 flood, fire and storm disaster events, claiming hundreds of lives and costing many billions of dollars. Hundreds of thousands of people were affected and more than 7000 rendered homeless. South-eastern Australia's record-breaking heatwave of early 2009 led to significant damage and loss of life. Victoria's Black Saturday bushfires claimed the lives of 173 people while 347 heatwave-related deaths brought the death toll in the region to over 500. In Queensland, the floods of early 2011 caused most of the state to be disaster-declared and claimed 38 lives. The disaster cost the state almost $2.4 billion and the total impact on GDP was estimated to be almost $30 billion. The challenges are unrelenting. In 2013, serious bushfires swept across parts of Victoria and New South Wales and in early 2014 bushfires devastated approximately half of North Stradbroke Island in Queensland.

Alongside natural disasters, Australia's ability to attract major international events provides a set of challenges ranging from public order to the threat of international terrorism. Meeting the needs of these events and the day-to-day public safety requirements means our PSAs need to be equipped with modern, up to date communications methods. While land mobile radio (LMR) will doubtless continue to be a crucial method of voice communications for PSAs into the foreseeable future, the additional capabilities that mobile broadband offers means that a PSMB capability will become an increasingly important tool.

Telstra is strongly supportive of Australian Governments and PSAs in their ambitions to establish a PSMB capability. Telstra and the broader mobile broadband telecommunications industry have a long history of supporting PSAs in Australia. Today, the National Emergency Call Service (Triple Zero)[1], Wireless Priority System Service[2] and Community Information Warning System (Emergency Alert[3]) have priority on public carrier networks. Australia is fortunate that commercial network providers and Australian Governments have a positive culture and history of providing services to the community and/on behalf of PSAs. Telstra believes that this collaboration can also be expanded into the PSMB capability domain.

1.2. Desirable features of a public safety mobile broadband capability

In order to provide the maximum benefits to the Australian community, Telstra believes there are a number of essential requirements that will be critical for maximising the effectiveness of a PSMB capability, including that it should:

1 http://www.triplezero.gov.au/Pages/AbouttheEmergencyCallService.aspx
2 https://www.ag.gov.au/Publications/Budgets/Budget2009-10/Pages/StrengtheningourNationalSecurity.aspx
3 http://www.emergencyalert.gov.au

- Be delivered as quickly as possible.
- Cover as much of Australia's population base and land mass as possible. This coverage necessarily needs to include urban in-building and in-tunnel coverage and should also allow for temporary deployment of infrastructure outside the permanent coverage area.
- Be reliable and secure.
- Maximise the opportunity for interoperability, including between PSAs and across jurisdictions.
- Have sufficient capacity for day-to-day or 'business as usual' activities, but this capacity must also be scalable in order to meet the increased demands during extreme events such as natural disasters and major events.

Timeliness

Telstra welcomes the introduction of a specific target of introducing the PSMB capability by 2020 but considers that this deadline can be brought forward by leveraging existing public carrier network infrastructure. Building a dedicated PSMB network would undoubtedly be a complex and time consuming task, to the point that introduction by 2020 might be optimistic. Telstra thinks there is a significant opportunity to improve the timeliness of introducing a PSMB capability by using the already well established public carrier networks.

Coverage

Whether measured by the percentage of population covered, or by land mass coverage, Telstra believes that the PSMB capability should have the widest possible reach. There is no way of predicting where natural disaster will strike and our PSA personnel should have access to the full range of communications and information tools wherever they are required to perform their duties. In a land as large and sparsely populated as Australia, covering the entire land mass is not economic, but as a starting point, Telstra considers that the PSMB capability should be available wherever the general public has access to mobile broadband. Outside of these areas, there are alternative solutions such as satellite and if necessary, additional base station sites could be funded to address any critical black spots.

The concept of having a PSMB network that has a smaller reach than existing public carrier networks is at odds with the intention to deliver first class broadband communications to our PSAs.

Interoperability

The PSMB capability must allow for interoperability between PSAs and across jurisdictions. Lack of interoperability will not only compromise the daily activities of PSAs, in the event of large-scale disaster, it can create dire consequences. Three significant challenges face PSAs in almost every major disaster:

- The confusion caused as large numbers of public and private responders arrive, hindering the delivery of help.
- Insufficient information about the extent of the disaster, people affected and available responders and assets.
- Lack of co-ordination between PSAs.

Without ubiquitous, resilient and interoperable communications, PSAs will not have the situational awareness they need to overcome these challenges. Reliable communication within and between PSAs seems to be a key requirement.

Creation of the PSMB capability provides a unique opportunity to overcome the problems of disparate technologies and historical parochial interests to build a truly interoperable system that will improve the coordination of response.

Capacity

The PSMB capability must have sufficient capacity for day-to-day or 'business as usual' activities, but this capacity must also be scalable in order to be the increased demands of extreme events, such as natural disasters and major events without experiencing network congestion.

Sustainability and ability to evolve

The introduction of new features and capabilities is a key driver behind the push to deploy a PSMB capability, but technology is not stagnant and deployment of the capability is not a one off event. Technology will continue to evolve making new, as yet unconsidered, capabilities available in the future. The PSMB network must continue to evolve and develop to take advantage of the future possibilities. Failure to do so will also result in the capability becoming obsolete and eventually unsupported by vendors.

There is also a need to ensure that the capability is embedded in open and dynamic ecosystem for devices and applications. As mobile broadband technology has evolved, its use has moved in unanticipated directions. As PSA communications evolve away from a command and control approach towards a more community-centric model where members of the public are increasingly important sources of immediate on-the-ground information, it will be important that the PSMB capability is inter operable with public mobile broadband so that this information sharing between PSA personnel and members of the public can occur.

Cost effective

Budget constraints and the need to make the best use of scarce tax payer funds mean that the above PSMB requirements need to be delivered in the most cost effective manner possible and they must also be affordable over the longer term to allow for ongoing investment and make the capability sustainable.

1.3. Options for delivery

The ability to deliver these features in a PSMB capability necessarily has implications for the way in which the capability is delivered. PSAs have traditionally relied on dedicated communications networks. In some cases, these networks are PSA specific, in others they are shared across the various PSAs in a particular jurisdiction. There is also variability in the way they are managed: in some cases management of the network is contracted out to commercial network providers, while in others they are managed 'in-house' by the PSA (or a state body for all PSAs in that jurisdiction).

The claimed advantage of these dedicated networks is that they isolate the PSAs from possible congestion caused by the public traffic and any security threats from the carrier network environment. This isolation of capacity is seen by many as the reason to deploy a PSMB capability on a dedicated network and is a concern sometimes raised around the prospect of deploying a carrier based solution. However, as is discussed further below, and in response to a number of the Commission's specific questions, there are a number of disadvantages to deploying a dedicated PSMB network. These include cost of building a dedicated network with sufficient coverage and capacity to meet the requirements of Australia's PSAs and the expectations of the Australian public, and the limited scope to cost effectively evolve the network to align with longer term technology trends and PSA operational needs. A dedicated network is more likely to involve a single vendor and proprietary solution which will limit choice and development options in the future. In contrast, embedding the capability in a public carrier network offers the advantage of being able to better tap into a global commercial ecosystem with many competing vendors that will increase development options as well as keeping costs down.

Telstra notes that the Government has asked the Commission to investigate the options for deploying a PSMB capability, including three broad options as follows:

- A dedicated PSMB network that relies only on dedicated infrastructure.
- A fully commercial solution which would rely on commercial providers providing the PSMB capability 'as a service' using their own carrier networks.
- A hybrid approach that sits between these above options.

For the purpose of preparing this response to the Productivity Commission Telstra understand the three options to be as follows.

Dedicated network

Telstra understands a dedicated network relates to either:

- A fully private network with no carrier elements utilised in the delivery of the PSMB capability; or
- A privately built network that does not utilise a commercial network service provider mobile broadband core but does uses other commercial network facilities, infrastructure and/or backhaul services via commercial arrangements, as is the case currently in certain jurisdictions for the provision of LMR.

Hybrid network

Telstra considers there are two hybrid variations that are relevant for consideration:

- A private dedicated PSMB capability that can roam onto a public carrier network.
- Carrier provision of some dedicated PSMB capacity and seamless overflow to the carrier's public network (e.g. Telstra LANES™ model) where the PSMB traffic is given priority.

A fully commercial (or carrier) network

A carrier model is similar to a carrier hybrid model except no dedicated capacity (including spectrum) is made available. The PSMB data is prioritised and carried on the shared carrier network capacity.

In each of the above options it is assumed that existing LMR networks will be continued for voice operations for some time, and at least until their services can be cutover to the PSMB service.

Telstra's view of the preferred solution

The private model requires the largest possible allocation of spectrum to meet the operation requirements of the PSAs and therefore presents the greatest associated opportunity cost to Government of this finite and critical current and future asset. The quantity of spectrum required by this option in a major emergency is likely to be many times the business as usual quantum, which means this valuable resource would be underutilised for much of the time.

The hybrid option addresses this issue by reducing the demand for spectrum as the hybrid model embraces a carrier LTE core and commercial spectrum to provide the capability to PSAs in a much more effective manner. PSAs will still have access to a dedicated spectrum 'lane' coupled with prioritised traffic on carrier LTE spectrum to meet all eventualities. However, this model as with the carrier model relies on the utilisation of a commercial network services carrier core, as has been successfully demonstrated as part of the Telstra LANES™ strategy

Telstra submits that this specific type of hybrid solution – a mixture of dedicated capacity and prioritisation of traffic on shared capacity that also uses a carrier's core network – is the most appropriate way to deliver a PSMB capability. In particular, it provides for a consistent quality of service and no loss of data when handing over between the dedicated capacity and the public shared capacity. This approach provides the benefits of dedicated capacity, while limiting the cost of deploying a nationwide network with sufficient capacity to meet peak demands and also ensures continued connectivity as PSA personnel transition from the dedicated capacity to the prioritised public traffic. Compared to dedicated networks it also provides a lower cost and more flexibility roadmap for moving to future technologies and ways of working. This approach is discussed in more detail in the next section.

Other hybrid approaches, such as attempting to combine an independent dedicated PSMB network with roaming to a public carrier network, are less desirable because there will invariably be loss of connectivity in handing over data sessions between the two networks and variations in quality of service between the two networks.

The carrier option provides many of the benefits of the hybrid carrier option but it does not have the additional certainty associated with the use of dedicated capacity.

1.4. Benefits of combining dedicated capacity with prioritisation of traffic on a public carrier network

Telstra believes a hybrid approach that combines dedicated capacity with seamless integration to, and prioritisation of traffic on, shared capacity that is integrated into a carrier mobile broadband network offers the greatest overall benefit when considering the requirements of the PSAs for PSMB.

Timeliness

Building a dedicated PSMB network would necessarily be a complex and time consuming task. It is more complex than simply deploying mobile broadband equipment at existing LMR base stations. Telstra believes a PSMB capability would be delivered more quickly by an approach that leverages infrastructure which has already been built.

Coverage

Building a dedicated PSMB network will necessarily result in a smaller coverage footprint than existing commercial mobile broadband networks. For example, Telstra's data network coverage is unparalleled in Australia, extending across 2.3 million km^2 on land and over 1 million km^2 out to sea, utilising 8,200 network sites. Telstra's 4G coverage extends to 90% of the Australian population and will reach 94% by mid-2015. This is further enabled by 3G coverage to 99.3% of the Australian population. In contrast, the plan to build dedicated PSMB network being considered by the PSMB Steering Committee was contemplating coverage of major cities only with population coverage of just 80%.[4]

Integrating into a public carrier network offers the benefits of substantially increased coverage. Where commercial networks have not been deployed we can look to commercial discussions to deploy that coverage or alterative technology such as satellite can be used. Again, integration into a commercial network will facilitate use of these technologies. Carrier networks also provide more dense coverage in metropolitan areas including in buildings and tunnels.

If a dedicated PSMB network is adopted, PSAs may need 'roam' onto public carrier networks outside of the PSMB footprint. Assuming suitable arrangements for this type of roaming can be made, user experience will differ between the networks and continuity of service will be lost as PSA personnel

[4] http://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Law_Enforcement/Completed_inquiries/2010-13/spectrummobilebroadband/hearings/index

transition between networks. Such dropouts could have significant impacts as devices take time to connect to the new network. Integration into a public carrier network will avoid these problems even as devices transition between the use of dedicated capacity and carrier capacity.

Reliability and security

Commercial carrier networks already have a high degree of reliability and security and this can be further strengthened if desired by PSAs. Such networks already offer significant redundancy due to their scale – the large number of base stations and extensive back haul networks. It is not clear to Telstra that dedicated networks offer any greater degree of robustness in the event of a major disaster or emergency.

Similarly the security requirements of PSAs can be delivered under commercial agreement with public carrier network providers. Examples already include the commercial delivery of telecommunications requirements for the Department of Defence and the Queensland Government's wireless network.

Interoperability

Deploying an integrated commercial PSMB capability will ensure a standardised national approach that can provide for interoperability across all PSAs within individual states and interstate and other agencies such as national security agencies, Australian Defence Force, Utilities and Local Government.

Capacity

A hybrid approach that uses some dedicated capacity and also allows for prioritisation of traffic on the public carrier network capacity provides the advantage of allowing capacity to be seamlessly 'scaled' to meet the demands of particular circumstances without having to provision for peak demands. Deploying a dedicated network would necessarily have a high opportunity cost as there is no option to provide additional capacity. As a consequence, a dedicated PSMB network would need to be provisioned to meet the peak demands of a natural disaster or other extreme event. The hybrid approach allows dedicated capacity to be provisioned for day-to-day activity while ensuring additional capacity is available where and when it is needed.

Sustainability and ability to evolve

Commercial network operators face competitive pressures to continually enhance their networks and introduce new features and capabilities as technology evolves. This continual investment can be expensive, but competitive pressures require that their networks continue to develop and evolve. The operator of a dedicated PSMB network would not face these pressures and would find it difficult to fund the ongoing investment required. Leveraging the large competitive ecosystem of commercial mobile broadband network equipment, devices and applications is likely to deliver far more choice and at a lower cost for PSAs in the future. Implementing a hybrid approach that is integrated into a commercial network will more likely result in the new features and capabilities being introduced to the PSMB capability in a timely manner.

Cost Considerations

Deploying a PSMB capability in a commercial carrier network environment allows the infrastructure costs and risk to be shared with public users which should significantly reduce the cost incurred by PSAs.

1.5. International harmonisation of spectrum use

It is important that any spectrum identified for PSMB use in Australia is harmonised with the International Telecommunications Union (ITU) PPDR spectrum allocations for Region 3, so that Australia can benefit from global device supply and to help assist interoperability in disaster and other emergency situations across the region. Further consideration of harmonised spectrum for PSMB is on the agenda of the ITU

World Radio Conference to be held in December 2015. Telstra believes it would be prudent to wait for the outcome of that conference before making any commitment to identifying specific spectrum for PSMB use in Australia.

1.6. International developments

A number of countries are in the process of developing a PSMB capability. However, progress has been slow where governments have chosen to build a dedicated PSMB network.

In the United States a new Public Authority, the First Responder Network Authority (or FirstNet), was created in 2012 to build and operate a nationwide public safety broadband network. FirstNet recently held its first 'industry day'[5] and expects to issue a request for proposals in late 2015.

In Canada, 20 MHz of 700 MHz band was reserved for the development of a public safety broadband network in 2012.[6] In the 2015 budget, $3m was recently allocated, commencing in 2016-17 to take the initial steps to establish a PSMB network.[7]

While in the United Kingdom, the process of tendering future emergency service organisation communications to commercial mobile network operators is currently underway. This model involves provision of a wholesale only dedicated network which will provide access to mobile virtual network operators (MVNOs) who will provide services to PSAs.

Telstra believes it is too early to draw definitive conclusions but the US and UK models seem to be highly complex with multiple suppliers involved which creates the risk that interoperability, reliability and quality of service will suffer. The UK model would probably be more effective without the complexity of MVNOs and roaming between suppliers.

1.7. Conclusion

The option of a dedicated PSMB network offers escalating costs, poor value for money, delayed implementation, technological stagnation and performance that is dependent on investment cycles and choices. Conversely, leveraging the capacity of a public carrier network providers offer an effective, flexible and responsive approach that is in keeping with the trend towards 'as-a-service' ICT sourcing models.

For all of these reasons, Telstra believes that the most efficient, effective and economical means of delivering a PSMB capability will be to integrate it into carrier networks on a commercial basis.

5 http://www.firstnet.gov/news/firstnet-holds-successful-first-%E2%80%9Cindustry-day%E2%80%9D
6 http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf10122.html#pB2
7 http://www.budget.gc.ca/2015/docs/plan/ch4-3-eng.html#_Toc417204369

2 Response to specific questions

2.1. The Productivity Commissions proposed approach

1. What is the merit (or otherwise) of the proposed approach to undertaking first principles analysis in this study?

Telstra supports the Australian Government's PSMB capability review. Telstra believes that deploying a PSMB capability has the potential to result in improved communications within and between PSAs and will allow access to a wide variety of mission critical data services. Improved information exchange within and between PSAs will result in more efficient and coordinated responses to emergency, natural disaster and other extreme events.

Conducting a thorough 'first principles' analysis will provide the foundation for deploying a PSMB in the most efficient, effective and economical way.

2. What domestic or international developments, reports or experiences in PSMB (or related matters) are relevant to consider in this study?

Various nations are currently in the process of considering or are already implementing a PSMB capability. There are various models that are being pursued ranging from commercial network provider models such as the United Kingdom[8] through to what appears to be a federated network model in the United States of America (USA).[9]

The USA's endeavours to build a national PSMB capability provide an opportunity to explore the strategies and progress to establish a PSMB capability. The White House Report, *The benefits of transitioning to a nationwide wireless broadband network for public safety*[10] outlines the opportunity for a PSMB capability.

> *The development and deployment of LTE systems represent a new opportunity for public safety communications. For starters, public safety can develop and deploy a nationwide network that will enable greater levels of operability and interoperability in the mobile broadband arena than public safety has ever achieved in the world of traditional LMR systems. Moreover, this opportunity holds the promise of public safety systems that could be developed based on commercial standards to generate significant economies of scale, competition in equipment as well as services, and ongoing innovation of the kind experienced in the modern cellular industry. With the move to LTE, public safety can seize this very opportunity.*

Originally the USA model was predicated on the PSMB capability being provided by a commercial network service provider through the public auction of the Digital Dividend 700MHz D Block.[11] The original ambition was for a commercial network service provider to be able to utilise the 700MHz D Block to provide PSA services, while being able to use the spectrum for commercial purposes. However, commercial network providers in the USA did not purchase the 700MHz D Block.

Consequently, the USA Government had to craft an alternative strategy, which has become known as FirstNet with a budget commitment of $7 billion. FirstNet's charter is:

> *FirstNet was created to be a force-multiplier for first responders – to give public safety 21st century communication tools to help save lives, solve crimes and keep our communities and emergency responders safe. To do that, FirstNet will build a new Band Class 14 network designed to be reliable, functional, safe and secure, and provide optimal*

[8] Emergency services mobile communications programme https://www.gov.uk/government/publications/the-emergency-services-mobile-communications-programme

[9] FirstNet http://www.firstnet.gov/

[10] The Benefits Of Transitioning To A Nationwide Wireless Broadband Network For Public Safety' https://www.whitehouse.gov/sites/default/files/uploads/publicsafetyreport.pdf

[11] FCC sets 700MHz auction rules: limited open access, no wholesale requirement http://arstechnica.com/uncategorized/2007/07/fcc-sets-700mhz-auction-rules-limited-open-access-no-wholesale-requirement/

levels of operational capability at all times. For the first time, public safety communications will be based on commercial standards. This will bring the benefits of lower costs, consumer-driven economies of scale and rapid evolution of advanced communication capabilities.

However, as outlined in the Briefing on Interoperability and Communications Issues and FirstNet[12], FirstNet's consultant Televate issued a report[13] on the cost aspects of constructing a public safety network in the United States of America. Its findings include the following:

- $7 billion can only build a system that covers 3.5% of the country's land area and 50% of the expected user population. This represents the top 226 most populated jurisdictions in the nation.
- Cost estimates to build a system that covers approximately 75% of the country's land area and in excess of 85% of the country's population would require between $12.4 and $16.4 billion.
- Beyond the initial cost of building the system, the annual cost of operating and maintaining the system ranges from $1.49 to $3.37 billion depending on the land mass and population volume covered by the network.
- In every scenario the cost of operating the system is more than double the amount that public safety agencies currently pay (user fees, taxes, roaming charges, access fees, data fees, among others) to operate their existing systems.

The United Kingdom has approached the challenge of establishing PSMB capability by focussing its endeavours about a purely commercial network provider model. The United Kingdom Emergency Services Mobile Communications Programme (ESMCP) is one of the most advanced globally. The ESMCP is currently in a tender process for the provision of the service.

Of relevance to this study is the customer experience of Public Safety agents in both of these models, where roaming to (USA model) and between (UK model) commercial networks will result in a loss of data session and hence situational awareness. Australia has an opportunity to implement an improved model that combines some dedicated network capacity with prioritised public network capacity and using a common core to provide seamless transition between the two.

It is too early to draw definitive conclusions but the US and UK models seem to be highly complex with multiple suppliers involved - which creates a high risk that interoperability, reliability and quality of service (QoS) will suffer. The UK model would probably be more effective without the complexity of MVNOs and roaming between suppliers.

3. What are the implications (if any) of the Australian Government's review of the spectrum policy and management framework, and ACMA's ongoing work on spectrum allocation matters, for the delivery of PSMB in Australia?

The current direction of the review of the spectrum policy and management framework is seeking to make greater use of market forces in the allocation of spectrum and to treat all users more consistently through a single licensing framework. This approach suggests that the opportunity cost of spectrum will be an important consideration if any spectrum is to be identified for PSMB use.

[12] Briefing on Interoperability and Communications Issues and FirstNet April 2014 http://www.iaff.org/Comm/PDFs/Fire_Service_Communications.pdf

[13] The Business Modelling of the Nationwide Public Safety Broadband Network http://www.televate.com/library/whitepapers/70-firstnet-whitepaper

The ACMA's international work in the Asia Pacific Telecommunity and International Telecommunications Union forums on the harmonisation of spectrum for public protection and disaster relief (PPDR) is also relevant. It is important that any spectrum identified for PSMB use in Australia is harmonised with the ITU PPDR spectrum allocations for Region 3, so that Australia can benefit from global device supply and to help assist interoperability in disaster and other emergency situations across the region.

Consideration of harmonised spectrum for PSMB is also on the agenda of the International Telecommunications Union (ITU) World Radio Conference in December 2015. Telstra believes it would be prudent to wait for the outcome of that conference before making any commitment to identifying specific spectrum for PSMB use in Australia.

2.2. Public safety mobile broadband in Australia

4. Are there any other PSAs that should be considered within scope in this study? To what extent are communications between PSAs and the community relevant to this study?

Telstra considers the scope of the study should include national security agencies and other primary law enforcement agencies in the federal domain, along with the ability to dynamically include other agencies including the Australian Defence Force, Utilities, and Local Government. These agencies would be in addition to the first responder agencies of police, ambulance and fire services and emergency services identified in the Issues Paper.

5. How do the organisational and institutional arrangements for PSAs vary between the Australian jurisdictions? What implications (if any) does this have for the way in which PSAs procure, operate and use communications services?

Like many other Australian institutions, PSAs are instituted on a state-by-state basis and have evolved according to the different needs of each state. , A number of different police, ambulance and fire services currently provide public safety and security to the community in each of Australia's six states and two territory governments.

The situation, therefore, is that separate agencies with different mandates, structures and, indeed, cultures, exist side by side. Emergency operation models also vary between states and territories. Just as PSAs developed along different lines, so did the communications infrastructure they use. Historically, communications evolved along three separate paths: telephone, radio, and data. The Australasian Inter-service Incident Management System (AIIMS)[14], which provides a framework for unified management of resources from different PSAs, is a major step forward in this regard.

Telstra believes that development of a PSMB capability can play a pivotal role within AIIMS and sees the development of a PSMB capability as an opportunity to improve interoperability and information exchange between PSAs (as well as within them) and other organisations.

[14] Australasian Inter-service Incident Management System http://www.afac.com.au/research/incident/aiims

6. What is an appropriate definition of 'mission critical' communication systems and capability for the purposes of this study? What metrics should be used to assess whether capability is being delivered to adequate levels during mission critical circumstances? What evidence is there that existing capabilities are satisfactory or unsatisfactory?

Definition of 'mission critical' communications

Telstra is not aware of any universally accepted definition of 'mission critical' communications for voice or data. However, Telstra notes the United States National Public Safety Telecommunications Council (NPTSC) Broadband Working Group has been grappling with this issue for voice:[15]

> *"... The effort to establish an accepted definition for mission critical voice was undertaken by NPSTC because, as public safety transitions to the Nationwide Public Safety Broadband Wireless Network, voice communications may transition from today's Land Mobile Radio (LMR) channelized narrowband voice systems to voice over the broadband network. If this transition is to be accomplished, it is imperative that those companies who will be developing the technology to provide voice over broadband fully understand this document is intended to set the standard for the definition of mission critical voice as required by public safety in order to provide a starting point. Future revisions of this document will define the specifications and requirements that must be part of any broadband network which is to incorporate mission critical voice services. The key elements for the definition of mission critical voice include the following:*
>
> - *Direct or Talk Around: This mode of communications provides public safety with the ability to communicate unit to unit when out of range of a wireless network OR when working in a confined area where direct unit to unit communications is required.*
> - *Push to Talk (PTT): This is the standard form of public safety voice communications today the speaker pushes a button on the radio and transmits the voice message to other units. When they are done speaking they release the Push to Talk switch and return to the listen mode of operation.*
> - *Full Duplex Voice Systems: This form of voice communications mimics that in use today on cellular or commercial wireless networks where the networks are interconnected to the Public Switched Telephone Network (PSTN).*
> - *Group Call: This method of voice communications provides communications from one to many members of a group and is of vital importance to the public safety community.*
> - *Talker Identification: This provides the ability for a user to identify who is speaking at any given time and could be equated to caller ID available on most commercial cellular systems today.*
> - *Emergency Alerting: This indicates that a user has encountered a life threatening condition and requires access to the system immediately and is, therefore, given the highest level or priority.*
> - *Audio Quality: This is a vital ingredient for mission critical voice. The listener MUST be able to understand without repetition, and can identify the speaker, can detect stress in a speaker's voice, and be able to hear background sounds as well without interfering with the prime voice communications."*

Telstra believes the Commission should seek to align with evolving international definitions such as the one above.

Metrics to assess the adequateness of a capability in mission critical circumstances

Telstra currently provides services to PSAs in specific jurisdictions and enterprise customers. These services are provided within an Integrated Service Management (ISM) framework and deliver a single service management layer. This provides end to end support across multiple technology domains,

[15] Mission Critical Voice Communications Requirements for Public Safety National Public Safety Telecommunications Council Broadband Working Group http://www.npstc.org/download.jsp?tableId=37&column=217&id=2024&file=Functional%20Description%20MCV%20083011%20FINAL.pdf

products and services. This level of service capacity will manage and reduce the complexity of the ICT environment. The integration and standardised approach of Telstra's solutions delivers a higher standard of quality and control of ICT services and technologies, keeping end users connected to mission critical business applications and infrastructure.

Telstra would be happy to provide more information about this approach to the Commission on a commercial in confidence basis.

Suitable metrics are discussed further in response to question 35.

Are existing capabilities satisfactory?

Telstra is of the view that existing narrowband LMR networks will continue to be a crucial method of delivering voice communications to PSAs for some time. However, the additional capabilities that mobile broadband offers mean that a PSMB capability will become an increasingly important tool. The benefits of introducing a PSMB capability are discussed further in the responses to questions 62 to 67.

7. What applications do PSAs currently use on their LMR networks that are provided for mission critical purposes? Does this differ by jurisdiction?

LMR networks are predominately utilised for voice communications utilising capabilities such as Push To Talk (PTT). In addition, LMR networks have also evolved to provide narrow band data services.

Narrowband data services are primarily used as part of the first responder cycle. PSAs have had to incorporate computer aided despatching technology in the emergency response cycle. Narrow band data allows for computer aided despatch systems to monitor the real time location of PSA vehicles and personnel, and to transmit and receive dispatch information to the PSAs in lieu of using voice services. In addition narrowband data services have relieved voice congestion on LMR networks.

LMR networks also provide for Duress Alerting. As an example, the Queensland Government Wireless Network provides the capacity for a first responder to depress a duress button which provides and alert including GPS coordinates.

Across the jurisdictions there is no single model for PSA LMR. Some jurisdictions such as Queensland and South Australia have implemented a 'consolidated model' where police, ambulance and fire utilise a single LMR network, while others such as New South Wales and Western Australia operate a 'federated model' with separate PSA LMR networks. This has lead to issues with interoperability when a coordinated response has been required across different PSAs. Interoperability concerns are compounded in the event personnel have to travel from one jurisdiction to another in support of major events or disasters.

8. How often are PSA narrowband networks (such as LMR networks) renewed or upgraded, and to what extent are different jurisdictions at different points in this process? What are the costs involved in maintaining these networks?

Telstra as a commercial network service provider not only provides mobile broadband services but also LMR services. Telstra's Fleetcoms Network provides LMR services to a broad cross section of customers across a broad cross section of Australian industries16. In addition, Telstra designs, constructs and operates private LMR networks, including networks for PSAs in Australia.

[16] https://www.telstra.com.au/customer-terms/business-government/telstra-mobile/fleetcoms-service

Telstra is able to provide more information on this matter to the Commission on a commercial in confidence basis.

9. How do the different types of events that PSAs deal with affect their demand for communications capabilities? Can you provide examples or evidence to illustrate this?

Telstra agrees with the Commission's categorisation of the three types of events PSAs encounter (business as usual; planned events; and large scale emergency incidents). Each of these categories requires a different level of capacity and they are subject to varying levels of predictability. Provisioning a nationwide PSMB network for the peak demand of a 'large scale emergency' incident or even a major 'planned event' such as the G20 conference would be very costly. The spectrum required to provide PSMB capability is highly valued by commercial mobile network operators and therefore it also has a high opportunity cost.

Telstra believes the most efficient and effective way of providing sufficient spectrum to meet the needs of the various PSA events is to use a mixture of dedicated capacity combined with prioritised access to public carrier network capacity. Such an approach allows peak demand to be met while allowing commercial use of the spectrum for public carrier network capacity when it is not required for PSA use.

10. How, and to what extent, are PSAs using mobile broadband capability provided over commercial networks, and related products and applications, to support their operational activities? Are there any lessons or insights from these experiences, including the benefits that are being realised?

PSAs today utilise carrier network mobile broadband extensively in their operations. PSAs by their very nature are highly mobile. PSAs have gained significant productivity benefits in the use of mobile broadband. As an example, prior to mobile broadband police personnel would have to manually record their crime reports and then return to a police station to upload the information into a computer system.

Figure 1. PSAs and associated organisations use mobile broadband extensively today.

However, today many police agencies have enabled their personnel with mobile broadband devices. These devices are traditional consumer devices ranging from Apple iPads to Notebooks. The most recent organisation to embrace such capabilities is the Queensland Police Service.

The New South Wales Government has committed to providing similar technologies[17]. In addition, mobile broadband has enabled police to further enhance their productivity via their police vehicles. Police agencies have implemented Automatic Number Plate Recognition (ANPR) systems which have

[17] http://www.zdnet.com/article/nsw-govts-election-promise-digital-licences-and-police-tech/

increase substantial the number of vehicles that can be checked for being unregistered or stolen coupled with other operational and productivity gains[18] [19].

In addition to productivity, situational awareness has been area of major focus of the PSAs. The ability to steam real time video has significantly improved the capacity of the PSAs. As the New South Wales Fire Brigade outlines there are limitations in LMR networks in being able to obtain real time situation awareness of an incident.[20] Video streaming technologies have contributed significantly in this domain.

Telstra's observation is that PSAs are increasing their adoption of mobile broadband, which is aligned with similar trends across other Australian industry sectors. However, accurately forecasting the demand requirements of PSAs is more difficult than for other industries. For example, with a mine it is possible to quantify the number of trucks on a site or with a railway the number of trains that will commute across the tracks at anytime and so Telstra is able to anticipate, with reasonable accuracy, peak mobile broadband demand. As discussed in the response to question 10, PSAs responding to unexpected and/or large scale events will lead to sudden peaks in demand. As previously discussed the only manner in which Telstra can envisage engineering sufficient capacity for these extreme events is by using the scale provided by carrier network capacity, including carrier LTE spectrum.

11. How do other large organisations (such as government and corporate organisations with certain requirements which may be similar to those of PSAs) currently use mobile broadband services provided on commercial networks?

A number of large organisations are moving towards an 'as-a-service' model by acquiring mission-critical data services from carriers. They are seeking the type of dedicated capacity and security and resilience requirements that are similar to the requirements of PSAs and this demand is from a range of industries, including transport, defence and mining. Brief details of two examples are provided below.

Transport

Mobile broadband services are utilised extensively by both the government and the corporate organisations. As an illustration the Australian Railway Track Corporation (ARTC) which provides railway services from Brisbane to Perth has enabled its next generation train control systems to use a carrier network mobile broadband service supplied by Telstra.[21]

The ARTC had a broad cross section of disparate network technology spanning across Australia similar to the current PSAs. The ARTC took the opportunity to enable a coast to coast capability utilising mobile broadband technology. This endeavour involved construction of mobile broadband base stations across the vast open expanses of Australian including the Nullarbor as well as providing media for the numerous tunnels across Australia.

Today the ARTC has a modern mobile broadband capability underpinning its next generation of train control.

Defence

In 2013 the Department of Defence entered a six-and-a-half year agreement with Telstra that will transform its communications technology, including better integrating fixed telecommunications with satellite and tactical networks. The agreement will deliver Defence with robust and secure information communications technology, while creating greater efficiencies and lower costs.

[18] Telstra Case Study: WA Police Concept Car – Mobility https://www.youtube.com/watch?v=M1dv-HlSnJI
[19] Telstra Case Study: WA Police Forensic Solution – Mobility https://www.youtube.com/watch?v=jkWlHIyTD5s
[20] https://www.youtube.com/watch?v=bBccFE7cfAs
[21] https://www.youtube.com/watch?v=yeg_MsiAwQQb

The use of technology such as unified communications, advanced video conferencing as well as tablet and smartphone usage, will provide a vital link for connecting troops, commanders, bases and allies around the world.[22]

12. What lessons or insights can be taken from the previous trials of Telstra's LANES model, including during the G20 summit in November 2014?

In order to provide effective, timely, affordable and equitable public safety mobile broadband, Telstra has developed the LTE Advanced Network for Emergency Services (Telstra LANES™). This approach can provide PSAs with substantial additional capacity when needed by providing priority access to Telstra's extensive commercial network and spectrum portfolio. The latter has a value of several billion dollars and consists of approximately 217 MHz of spectrum in metropolitan and regional areas, and 167 MHz in remote areas. The opportunity for PSAs is to leverage Telstra's scale and capacity, delivering a responsive, scalable and equitable community-centric approach.

Telstra LANES™ is a unified national approach that involves integrating PPDR spectrum into the architecture of the Telstra commercial carrier network so that it can form a seamless and reliable service for first responders. This network can be 'hardened' through government investment to meet foreseeable resilience requirements. Such a strategy is the only realistic approach to provide PSAs with the capabilities they need. The Australian Communications and Media Authority (ACMA) agrees:

> *"…a number of potential models for the delivery of a PSMB capability were examined, comprising various combinations of commercial (by agreement with commercial carriers) and bespoke (dedicated network on dedicated spectrum) options. It was agreed that—regardless of how much, if any, dedicated spectrum was provided—the capability would need to be underpinned by the ability to use commercial networks (either for coverage or supplementary capacity)."*[23]

In Telstra LANES™, a portion of spectrum is specifically partitioned for PSA use only. PSA–only partitioned spectrum is then augmented with prioritised data on the carrier LTE spectrum in LTE coverage areas. The concept is depicted in Figures 2 - 4 below.

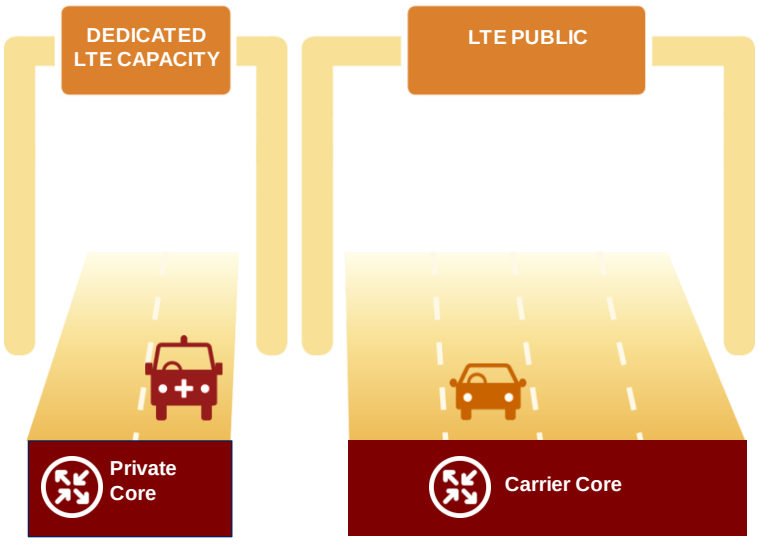

Figure 2. Dedicated Model

[22] http://news.defence.gov.au/2013/04/18/defence-awards-telstra-six-year-contract-for-enhanced-telecommunications/
[23] Australian Media and Communications Authority (ACMA), Spectrum for public safety radiocommunications - Current ACMA initiatives and decisions, October 2012.

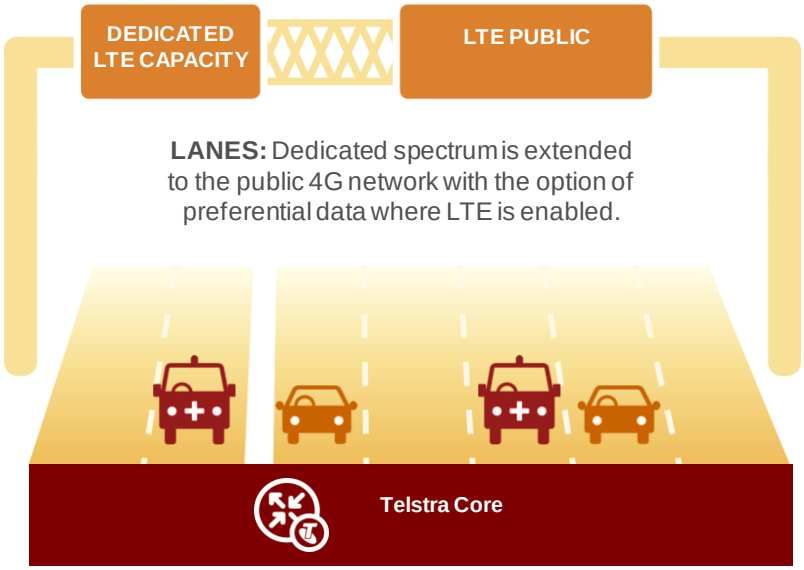

Figure 3. Hybrid Model: LANES™ – Dedicated spectrum augmented with carrier spectrum

Telstra LANES™ provides scalable and responsive high-capacity broadband to PSAs. In every day usage, PSAs will benefit from exclusive use of the PPDR spectrum. This ensures that critical communications are provided to urban centres and rural and remote areas more equitably. Then during major incidents and full-blown disasters, PPDR capability will be augmented immediately by providing priority access and preferential data treatment on the Telstra Mobile Network where LTE is enabled, PSAs will gain access to Australia's largest and most capable mobile broadband network.

Figure 4. Telstra LANES™: scalable and responsive high-capacity broadband to PSAs

Previous demonstrations of Telstra LANES™

The Telstra LANES™ capability was demonstrated successfully in Queensland and Western Australia during November 2013 and once again in November, 2014 at the G20 Summit in Queensland. The following features were demonstrated.

Exclusive access to a partitioned spectrum allocation

Telstra provided commercial network access at 1800 MHz and a dedicated PSA partition at 900 MHz. This demonstration showed unequivocally that PSA users could have exclusive access to the PSA partition while public users could only access the capacity on the public network spectrum.

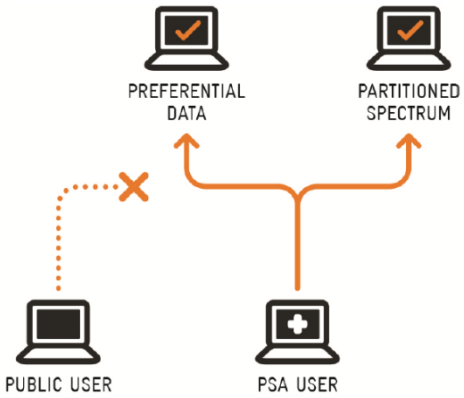

Figure 5. Exclusive PSA access to PPDR partition

Preferential service on the public LTE network

The Telstra LANES™ demonstration showed that through preferential data treatment Telstra could improve service quality and customer experience on the PSA partition.

Seamless transition from the partitioned spectrum allocation across to the commercial network

The Telstra LANES™ demonstration showed that a mobile user suffered no loss or disruption of service while moving between dedicated PSA capacity and the public network capacity.

13. Can commercial network solutions that involve dedicated spectrum for PSAs (and prioritised capacity in other spectrum bands during emergency incidents) allow for interoperability between networks operated by other mobile carriers and/or for end user to roam across multiple networks? Are there any technical, institutional or commercial barriers that would prevent this outcome?

In Australia, commercial network solutions do not allow for interoperability between networks operated by other mobile carriers. End users can roam across multiple networks but not with a seamless user experience. It should also be noted that interoperability between countries, albeit not seamless, is enabled by harmonised spectrum bands, particularly within a region, enabling devices to work within that region.

To effectively utilise the breadth of a carrier's LTE spectrum to seamlessly augment capacity requires a single LTE network core environment. Today this is demonstrated by the seamless mobile broadband experience one encounters irrespective of the spectrum frequency band being used, on a commercial mobile network anywhere in Australia.

The use of multiple networks may be acceptable in a private network model where congestion forces users off the private network and they have to seek service from an alternative mobile broadband network. This approach is possible today, but fraught with technology complexities, as outlined further below, and with user complexity as services would need to be re-established though the layers of network access, security and authentication. Without the appropriate preferential access and treatment in the situation where the carrier network itself could be congested, it would leave front line staff vulnerable with no mobile broadband service.

Interoperability

The 3GPP standards define several different multi network interoperability features that allow network operators to jointly develop and deploy networks. These features are designed to allow two operators to jointly operate a radio network in one area, but separate core networks, while operating different radio networks in other areas. No such network sharing scenario between commercial carriers exists in Australia today In the case of the PSA's with a dedicated network this would require three-way interoperability which introduces a number of commercial and technical difficulties that make it extremely difficult to implement in practice.

Key operational issues include:

- The need to ensure any interoperating networks are maintained with the same level of functionality. This then limits the ability of the operators to develop their network and forces a lowest common denominator approach.

- The optimisation of the individual networks is degraded, and hence the user experience, due to the need to consider the other network in the process. This impacts all customers of the interoperable networks, those who have access to only one network and customers who have access to multiple networks.

- The operational management of individual networks can interfere with the interoperating networks. An upgrade to one network will require co-ordination with the other networks.

Roaming

The network is only one layer of the ICT architecture. Consequently, today users can elect to 'roam' across terrestrial and non terrestrial networks such as satellite services. However, when roaming between networks the application session (eg. video call/stream from the front line, CCTV feed, access to a crime reporting system, or geographic information system) will be interrupted as authentication to the new network occurs and the session is re-established.

This can be considered as being similar in manner to international roaming, if the appropriate commercial and technical agreements are in place it is possible for end-users to roam between networks and have access to multiple networks at different points in time. Roaming requires a device to register on a particular network and this can take minutes each time a device changes network. During this time of transition from one network to the next, all services that were being delivered will be dropped and will need to be re-established on the new network, as there is no service continuity when roaming. In a roaming scenario it should also be noted that if a device loses a network even momentarily it will begin scanning for other networks, this could occur during situations such as entering a building or a car park and during this time it is not possible for the critical services to be accessed.

In addition to the time taken for the device to undertake the network selection, authentication to the new network and possibly re-authentication to the services are required. Application sessions require negotiation with the carriers security and access systems, the agencies security systems (firewalls) and application access control, authentication of users (may be multi-factor), and if in the case of police may involve national systems such as Crimtrac.

Hence, for operational purposes, the proposition to effectively roam between operator networks would not appear to be feasible or desirable from an agencies operational perspective. As an example, any interruption due to roaming across networks in a real time video feed for a hostage siege would be unacceptable.

Lastly, when roaming the user has access to the services that are available on the roamed network. Each roaming partner has a different set of features and so the user experience will be different on each

roaming partner's network. This leads to the implementation of services based on the lowest network capability to ensure a consistent, yet inferior, user experience.

14. What applications could PSAs use if they had access to PSMB capability? How could this be expected to vary across PSAs?

As discussed in response to question 10, PSAs are already using mobile broadband for a range of uses including uploading crime reports, automatic number plate recognition systems and accessing real time video streaming to improve situational awareness. Implementation of a PSMB capability is likely to result in new and unexpected applications and this is likely to changes over time.

Telstra considers that PSAs themselves are better placed to provide a more detailed response to this question.

15. To what extent could these applications replace or supplement the capability and systems currently used by PSAs on their narrowband networks?

Telstra considers that PSAs themselves are better placed to provide a more detailed response to this question.

16. How important are communications between PSAs and the community during emergency incidents?

Telstra believes that public safety should be seen as a collaborative effort involving community members (including those who are disadvantaged and at risk), community groups, non-profit organisations, the commercial sector, PSAs and all levels of government. It is now well-understood that community resilience is an effective lever in preserving lives, property and prosperity.

> *Resilience emerges, in large part, from the ability of local communities with support from all levels of government and the private sector to plan and prepare for, absorb, respond to, and recover from disasters and adapt to new conditions*[24].

A community-centric approach to public safety mobile broadband recognises that in public safety and emergency management it isn't as simple as PSAs delivering services for the public. Rather it is a collaborative effort, with everyone interacting within an interconnected ecosystem to make the best decisions they can and achieve the best outcomes possible. It is essential that those affected have access to the information they need to make those decisions.

[24] Disaster Resilience – a National Imperative, US National Academy of Sciences, 2012.

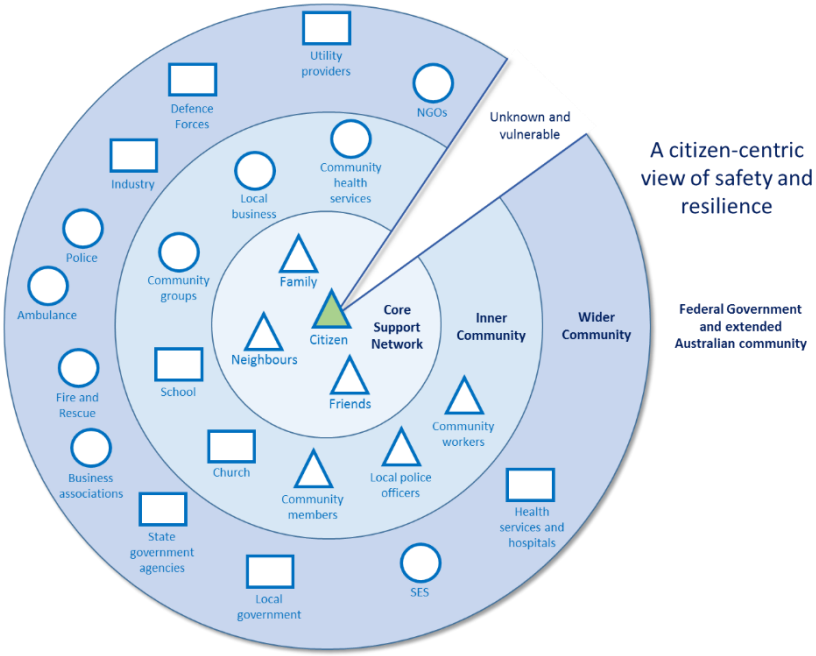

Figure 6. A community-centric view of the public safety ecosystem

For major events, community policing and emergency response, members of the public are increasingly important sources of immediate on-the-ground information. This amplifies the importance of unfettered access to broadband data.

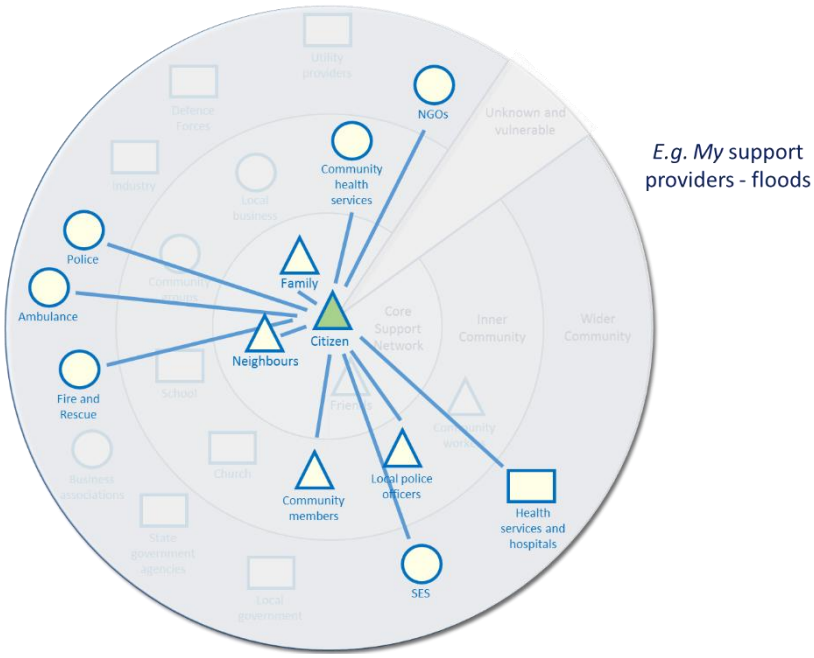

Figure 7. A community-centric view of support networks in a flooding scenario

In today's information-rich world community members are well-informed. They are able to make decisions to collect and share information about public safety events, and to arrive at collective decisions

about their own responses, making them inevitable participants in modern public safety. The benefits of a community-centric approach to mobile broadband extend beyond widening access to information. There is a real opportunity for governments and PSAs to harness community capacity and enable the community to share the public safety burden. PSAs can benefit from community members' willingness to gather and share intelligence.[25]

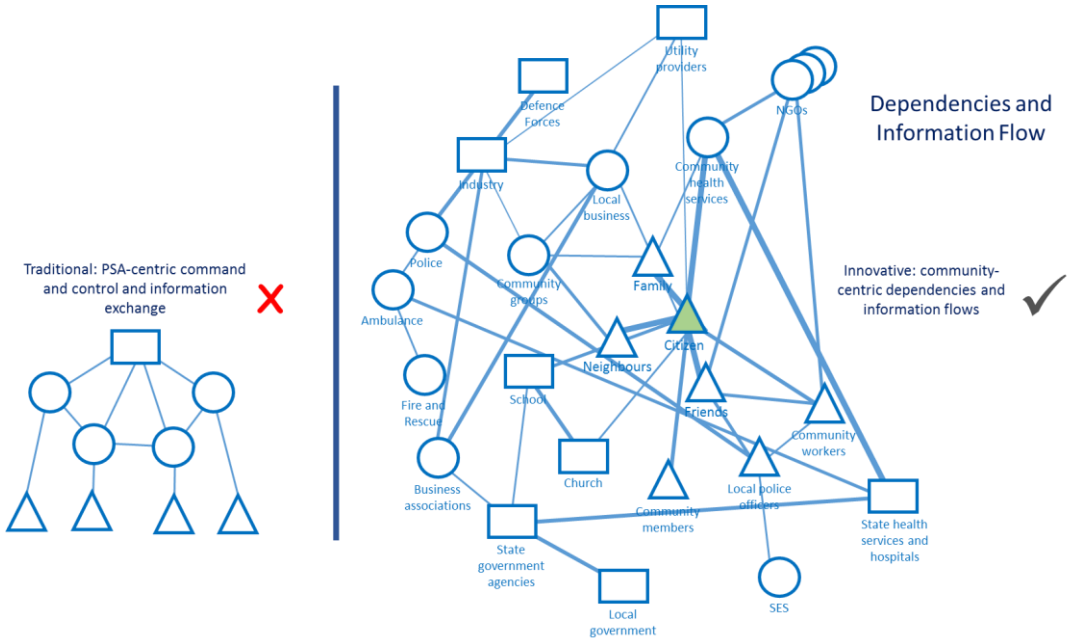

Figure 8. Community-centric information flows and dependencies

Often community groups and Non-Governmental Organisations (NGOs) will enable this process. Studies show that many of those involved in public safety and community resilience look first to NGOs (such as the Red Cross and Volunteering Australia) for information, advice and support. Community groups, local businesses and community support services all play important parts in community safety and resilience. Their ability to play their parts fully, share the PSAs' burden and place the safety of the citizen at the heart of their efforts is heavily dependent on access to information. This is why Telstra has adopted a community-centric approach to the delivery of PSMB.

2.3. Developing options for evaluation

17. What PSMB capability characteristics should be considered in this study?

As discussed earlier Telstra believes that a PSMB capability should have the following characteristics:

- It should be delivered as quickly as possible. Telstra notes the 2020 time frame, but believes the capability could be delivered more quickly.
- It should cover as much of Australia's population base and land mass as possible. This coverage necessarily needs to include in-building and in-tunnel coverage.
- The capability should feature national interoperability. This includes interoperability between PSAs and across jurisdictions.

[25] The Australian. (2010, June 03). Many must share the bushfire blame. Retrieved September 30, 2013, from http://www.theaustralian.com.au/opinion/many-must-share-the-bushfire-blame/story-e6frg6zo-1225874723416

- The capability needs to have sufficient capacity for day-to-day or 'business as usual' activities, but this capacity must also be scalable in order to be the increased demands of extreme events such as natural disasters and major events.
- The capability should be supported by a sustainable ecosystem of network equipment, devices and applications.
- New features should be capable of being added to the capability as technology continues to evolve.

18. How should 'national interoperability' be interpreted in this study? Does it include interoperability between networks, devices and applications used by PSA in different jurisdictions? Does it extend to integrating communications services between different local PSAs (for example, police, fire, ambulance and other responders)?

Telstra believes that this inquiry will lay the foundations of a once-off opportunity to create a national PSMB capability that addresses the limitations and lack of interoperability of PSA LMR networks that currently prevail throughout Australia.

Similar ambitions are being pursued by other nations and this is a significant departure from the legacy approach of LMR environments, which has been predominately pursued individually for Federal and State and Territory Governments for their respective PSA and other users of LMR.

This approach is not new in Australia. Australia has a number of national PSA services for example Triple Zero Service, the National Automated Fingerprint Identification System (NAFIS)[26] and Community Alert Information Systems (Emergency Alert). Telstra believes that the first principle to establish a PSMB capability is to establish an appropriate national governance environment approach that would undertake the enablement of a national PSMB capability. CRIMTRAC[27] provides a contemporary approach and possible model for a national PSMB capability for consideration by the Commission.

> *CrimTrac works in partnership with Australia's police agencies to provide services that allow police to easily share information with each other across state and territory borders. CrimTrac's information-sharing capabilities are specifically designed to equip police with the information needed to make decisions to assist in investigating and preventing crime. CrimTrac ensures that vital information is shared across Australia's nine police agencies to provide a national view of policing.*
>
> *Under the Australian Constitution, each state and territory is responsible for maintaining law and order within its borders, with the Australian Federal Police serving the Commonwealth. Criminals have exploited borders to avoid detection, but when police have a national view of policing information, this minimises opportunities for offenders to evade the law by crossing borders.*
>
> *It is essential to have effective and efficient information sharing systems to support law enforcement and the operational personnel who protect our community. Through its services, CrimTrac contributes directly to the effectiveness and efficiency of police and law enforcement agencies in Australia.*
>
> *CrimTrac was established in 2000 under an Inter-Governmental Agreement (IGA) [PDF 752KB] between the Commonwealth and each state and territory government. The IGA underpins CrimTrac's mandate to lead the delivery of national information-sharing services for law enforcement agencies. In 2006, CrimTrac and all state and territory police commissioners entered into a partnership Memorandum of Understanding [PDF 2.3MB], which supports the IGA.*

[26] http://www.crimtrac.gov.au/our_services/BiometricServices.html
[27] http://www.crimtrac.gov.au/about_us/index.html

19. Does delivering a PSMB capability raise any new opportunities for achieving national interoperability?

Without reservation creation of the PSMB capability provides a unique opportunity to overcome the problems of disparate technologies and historical parochial interests to build a truly interoperable system that will improve the coordination of response.

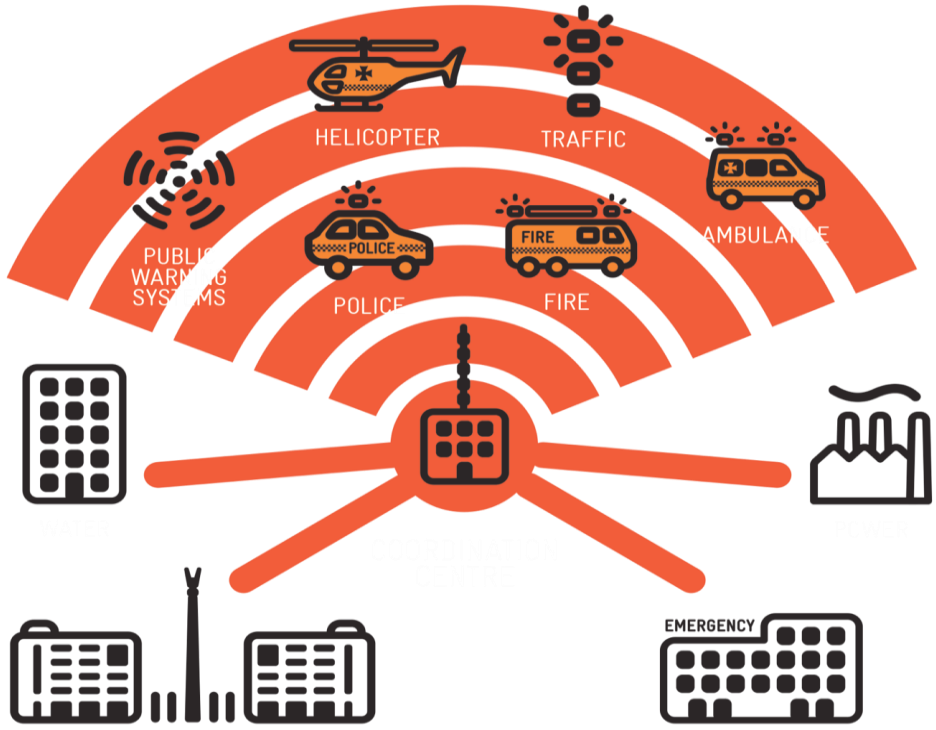

Figure 9. PSAs gain Australia wide mobile broadband network interoperability with a commercial network provider.

20. Would the benefits, costs and risks of achieving national interoperability vary under different deployment options? If so, how?

A commercial carrier's network is inherently interoperable on a national basis. Commercial telecommunication providers are configured to service the growing market need. Like other commercial providers, Telstra and its peers operate close to the efficient frontier of mobile broadband service delivery, having developed deep expertise and extensive capability over many years of building and running voice and data networks. Carriers have the opportunity to leverage assets from across their portfolio. Competitive pressures and customer feedback drive exceptional service delivery and demand that continue to push the boundaries of network performance. Constant investment in expanding our networks and enhancing capabilities is the result of these competitive pressures.

Conversely, the potential providers of dedicated PSMB networks have to build technology refresh and capability enhancement into their business models. In the end, state governments will pay the bills and PSAs will have to accept reduced performance and responsiveness.

Government costs and risks will be increased further because they cannot match commercial carriers' expertise in the design, delivery and management of data networks. Complex communication network

program delivery is core business for the commercial carriers; but risky business for governments and PSAs. These are the unavoidable economics of network delivery.

Telstra believes that dedicated PSMB networks would ultimately fall rapidly behind the commercial networks servicing consumers, enterprise and other parts of government. Capability trade-offs would be inevitable and a digital divide would emerge.

21. What progress has been made in putting in place arrangements to better coordinate emergency communications within and across PSAs and jurisdictions?

Telstra believes that the PSAs are best placed to provide details in response to this question.

22. What level of network coverage do the existing networks used by PSAs (for narrowband voice and low-speed data capability) currently provide? How does this vary across jurisdictions?

Telstra believes that the PSAs are best placed to provide details in response to this question.

23. What level of mobile broadband network coverage do PSAs require across metropolitan and regional Australia? Does this vary for different PSAs?

Telstra believes that the capability should provide coverage at least equivalent that provided by commercial carrier networks to the majority of the Australian population. In the case of Telstra, its LTE network will provide coverage to 94% of the Australian population by mid 2015, coupled with itinerant coverage using portable Cells-On-Wheels solutions (see the response to question 25 below) in other locations.

24. What is the most appropriate measure of network coverage for use in this study?

Commercial networks use population coverage as a key metric, and this is likely to be appropriate for PSMB's. Additional coverage metrics may also need to be considered, such as the number of square kilometres of land mass, the number of kilometres of highway coverage, coverage at sea, locations of national significance, and locations prone to natural disaster.

25. What options are there for extending the mobile coverage of commercial networks?

The breadth and depth of coverage of commercial networks is constantly being enhanced and extended by carriers in response to demand from their customers and the competitive commercial environment. The investment options for such extensions include direct investment by the carriers or a co-investment approach with corporate customers or government entities. The Western Australian Regions for Royalty scheme – Regional Mobile Broadband Communications Project and the Federal Government's Mobile Black Spot Programme are examples of government co-investment initiatives to extend coverage.

Extending the coverage of a PSMB capability on a carrier network could occur through a combination of public and private sector investment.

There are multiple options available to extend the coverage of commercial networks depending on the requirements. Temporary coverage can be provided by relocatable cells, with various configurations that are transportable, by car, truck or aircraft. These are often referred to as COWS (Cells on Wheels).

Customised coverage solutions for more permanent installations can also be developed based on the specific requirements. The funding of these solutions depends on the economics and for those that do not provide an investment justification to the operator some form of alternate founding may be required.

There are also developments in the 3GPP R13 standards that will provide capability to benefit the Public Safety community. LTE Direct is a new interconnectivity paradigm for communication between proximate devices/applications, meeting the need for communication among public safety users even if they are not in coverage of the network.

26. Would the benefits, costs and risks associated with achieving an acceptable level of network coverage for PSAs vary under different deployment options? If so, how? And with what operational consequences?

Yes – a nationwide commercial carrier network offers immediate access across the country, other solutions will evolve over time and may never achieve the same reach as a commercial mobile network.

A truly private mobile broadband network for police and emergency services would require a significantly higher density of sites than existing land mobile radio networks to provide satisfactory coverage including within coverage buildings. This would require significant investment from Government and involve a lengthy implementation period. This implementation period will also be dependent on resource availability, with a finite number of skilled resources being split across commercial and private network builds.

A carrier proposition could provide from day one a national footprint equal to the current coverage of a carrier network and at lower cost. With Telstra LTE this means 94% population coverage by mid 2015 and with plans to further expand this coverage in the future. The Telstra LANES™ proposition extends this further providing a national footprint to the current coverage of a carrier network from day one.

27. How could voice services — traditionally carried on narrowband networks — be integrated into a mobile broadband network capability? What challenges and risks need to be accounted for? Are the challenges at the local level (due to legacy factors) greater than those at the national level?

Mission critical voice services that have traditionally been carried on narrow band networks will be integrated into mobile broadband capability. The standards body responsible for the development of the LTE standards (3GPP) has been developing this support over the past few years with capability being delivered in both the R12 and R13 releases of the LTE standards. The standards for Mission Critical Push To Talk (MC-PTT) capability are included in R13 which is expected will be finalised in 2016, providing the necessary features including group calling capability.

Once these standards are in place it is expected that commercial providers will introduce suitable equipment and services. It is anticipated that this capability will be available well before 2020. In the interim, Voice over LTE (VoLTE) will become available and when enabled with preferential data treatment with Telstra LANES™ will be able to offer a prioritised voice calling capability.

Some state Governments have recently invested in Network to provide voice services. For example, the Queensland Government has a 15 year contract with Telstra for the provision of these services. Therefore, to achieve the desired return on this investment, it is unlikely the Queensland Government would be seeking a substantial transition of voice services to mobile broadband until the current Government Wireless Network requires replacement.

28. What challenges or opportunities arise (from a technical, institutional and/or commercial perspective) from such integration, and would the benefits, costs and risks vary under different options for PSMB? If so, how?

When MC-PTT capability is deployed it will include interworking to LMR PTT capability, enabling the interoperability of MC-PTT services between legacy and mobile broadband networks. This offers a great opportunity for PSA's to familiarise themselves with MC-PTT capability over LTE whilst continuing to utilise LMR networks. Telstra foresees a situation where voice services over LTE complement those provided by traditional LMR networks prior to transitioning fully to LTE.

The primary challenge to this integration is the life cycle of Government LMR investments. The costs associated with deploying integrated voice services vary between the different options for PSMB. In the carrier model and hybrid model the cost to deploy these services for Public Safety Agencies may be more cost efficient than private network builds as carriers can offer this product to a number of customer bases. In a carrier proposition all the risk associated with the integration, interworking, feature enhancements and lifecycle management of these capabilities is managed for you.

The VoLTE capability is being implemented as a consumer service and can be enhanced, for a small incremental cost, to provide prioritised and preferential treatment for Public Safety Agencies.

29. The Commission understands that there is currently work underway to develop voice applications for 4G/LTE networks for use in mission critical circumstances. When are these applications likely to become available?

Voice Services for Public Safety can be delivered over LTE networks in 2 complimentary ways:

- Voice over LTE (VoLTE).
- Mission Critical Push to Talk (MC-PTT).

Telstra is currently working towards implementation of VoLTE capability. This will enable voice calls to be delivered over the LTE 'all IP' public network. In addition to this, Video Calling over LTE (VoLTE) will

also be enabled. These two traffic types for public safety agencies can be prioritised and given preferential treatment as per all other Telstra LANES™ traffic.

MC-PTT standards are not expected to be finalised until 2016 (3GPP R13). In the meantime Push To Talk over Cellular (PTToC) applications are available over commercial mobile broadband networks today, as Over The Top (OTT) applications. In Telstra's opinion these OTT solutions do not meet the mission critical requirements that Public Safety Agencies would be looking for in LMR equivalent services. PTT services need to be integrated into the network to provide a prioritised, fast and reliable service and provide a true MC-PTT capability. It is also important to note that LTE-Broadcast (LTE-B) plays a key role in the delivery of MC-PTT services and as such it is important that the PSMB network has deployed LTE-B capability.

It is anticipated that fully integrated MC-PTT trials may commence in 2016 with first generation services available from late 2017. In the meantime Telstra believe that Push To Media services may be a complementary service to LMR where media, such as video, can be pushed to talk groups in a similar manner that voice is pushed to talk groups today.

30. What factors are important in ensuring the integrity and security of communications for PSAs? To what extent does this differ for different types of PSAs?

Telstra expects that the integrity and security requirements will vary between PSAs and that, as such, the PSAs are likely to be best placed to provide detailed answers to this question. While some will question the integrity, security and resilience of commercial carrier networks, the reality is that commercial networks can be 'hardened' to meet any specific integrity and security needs of individual customers. This already occurs under commercial agreements, for example with the Queensland Government and the Department of Defence.

31. Would the costs and risks associated with ensuring the integrity and security of communications differ depending on how a PSMB capability is delivered? If so, how?

The level of costs and risks will depend on how and what integrity and security policies a PSA requires to maintain a secure and reliable PSMB capability when responding to an emergency or normal business operations. The cost of ensuring the integrity and security of the PSMB network would depend on if (and how) such factors as encryption/security, robustness of the network, interoperability between different communications networks, authentication and what policies, functional requirements and capabilities are deployed across a PSMB system. Telstra believes that hardening existing commercial networks to meet specified standards will necessarily be less costly than building a new network to the same standards.

32. What methods or metrics could be used to define and/or measure the level of security provided over a network that delivers mobile broadband capability?

PSMB devices, from smart phones and tablets, to ruggedised bespoke devices, typically need to support multiple security objectives including: confidentiality, integrity, and availability. To achieve these objectives, PSMB devices should be secured against a variety of threats. Rather than trying to measure the level of security provided over a PSMB network, PSAs should develop policies that periodically mandate assessments to confirm that their PSMB device policies, processes, and procedures are being followed properly.

Assessment activities may be passive, such as reviewing logs, or active, such as performing vulnerability scans and penetration testing and operational processes that include checking for upgrades and patches, and acquiring, testing, and deploying them; ensuring that each PSMB infrastructure component has its clock synced to a common time source; reconfiguring access control features as needed; and detecting and documenting anomalies within the PSMB infrastructure, including unauthorized configuration changes to PSMB devices.

General security recommendations for any IT technology can be obtained from the Australian Signals Directorate. The Australian Government Information Security Manual (ISM) is comprised of three complementary documents designed to provide best practice security advice.[28]

33. What additional security needs do PSAs have compared to other sectors with high security requirements for their communications?

Telstra considers the PSAs are best placed to express their specific security requirements and notes that commercial carrier networks can be configured and 'hardened' to meet specific requirements security, network integrity or resilience requirements, as is currently the case under the Queensland Government Wireless Network Agreement and agreements with the Department of Defence.

34. How should PSA demand for mobile broadband capability be estimated in this study, including their expected demand requirements into the future?

Estimating PSA demand for mobile broadband is difficult for two reasons. First, there is uncertainty about how and for what applications PSA use of mobile broadband will develop over time. Second the unpredictable nature and location of events that PSAs are required to deal. For example a building fire could result in very high demand (but short lived) demand in an extremely localised location. As noted in the response to question 10, accurately forecasting the demand requirements of PSAs is more difficult than for other industries.

Telstra suggests starting by undertaking a structured study of recent use cases, both domestically and internationally. This should include who, how many, what services and what voice and data is typically required for access to cross discipline teams and support services. This information can then be used to inform the development of a demand range from typical day-to-day requirements up to unique peak events.

35. What methods or metrics could be used to define and/or measure the level of service capacity provided to PSAs?

Required service levels and the metrics to measure them will likely vary from PSA to PSA. Telstra believes these service levels and associated metrics can be agreed commercially. As an example, Telstra currently provides services to PSAs in specific jurisdictions and enterprise customers Telstra would be happy to provide this information to the Commission on a commercial in confidence basis.

Telstra's services are provided within an Integrated Service Management (ISM) framework which delivers a single service management layer. This provides end to end support across multiple technology domains, products and services. This approach will manage and reduce the complexity of the ICT environment. The integration and standardised approach of Telstra's solutions delivers a higher standard of quality and control of ICT services and technologies, keeping end users connected to mission critical business applications and infrastructure.

The service model provides a proactively monitored and managed solution. A 24x7 service desk staffed by specialists in the area of mobile and radio solutions who will deliver an ITIL aligned support framework. This service model is further strengthened by knowledgeable Field and Operational support staff.

Telstra can provide the following processes:

- Event Management.

[28] http://www.asd.gov.au/infosec/ism/index.htm

- Incident Management.
- Problem Management.
- Service Request Management.
- Change Management for Network, Monitoring and Maintenance.
- Service Level Management (SLA).
- Capacity Planning & Capacity Management.
- Reporting.
- Knowledge Management.
- Request Fulfilment.
- Access Management.
- Service Asset and Configuration.
- Service Catalogue.
- Third party management.

Telstra performs Service Monitoring and Event Management using recognised industry best-of-breed tools which ensure it can provide coverage across a diverse platform of networks and network devices, enabling Telstra to better manage and process any magnitude of events. Telstra's enhanced toolsets collect events from network element managers and perform appropriate actions based on the classifications of events, such as:

- Managing alarming and escalation based on predefined policies.
- Forwarding events to designated groups for appropriate response actions.
- Correlating events where a single incident causes multiple alarms.

Service Monitoring is a continual activity performed 24x7 and provides the fundamental input of alert and alarm information into the Event Management capability. Service Monitoring triggers the Event Management capability, where all alerts and alarms are correlated, categorised and prioritised. This determines which automated resolutions may be applied, and where escalation and notification occur.

Telstra classifies alerts and alarms into four categories:

- Critical - alarms relating to incident or outage having immediate effect on service.
- Major - alarms/events loosely defined as problems rather than incidents i.e. they could potentially cause problems if not rectified, but as yet have not caused a disruption in service.
- Minor - events deemed of no value and should be suppressed as close to the network element as possible.
- Notification - information only with no pending threat.

Underpinning Telstra's service desk model is a Relationship and Governance layer supporting the Telstra LANES™ solution. These dedicated resources manage the ongoing forums and senior stakeholder engagements, including innovation and technology trends, along with the ongoing performance reviews. The types of forums include:

- Innovation Forum.
- Monthly Operational and Network Forum.

- Strategy and Planning Forum.

Telstra uses a mixture of application (e.g. Active and passive robot data collection) and network based methods for reporting the network health. Typical measures include access success rate, service drop rates, throughputs, Quality of Service on traffic types, availability. These types of measures will be available as relevant, on the core network elements, transport and transmission network elements and Radio Access Network elements both on privately used and commercially used network.

Typical SLA measures will be:

- Incident Response Service Level – Priority 1 through to Priority 4.
- Incident Restoration Service Level – Priority 1 through to Priority 4.
- Service Desk Availability Service Level.
- Call answer time and Call Abandonment time.
- Network Availability (using aggregated uptime and downtime).
- Network Accessibility.
- Network Reliability.
- Ongoing Incident Notification during an impacting event.

Additionally historical information is kept to enable pro-active analysis and track any of the above information.

36. What level of capacity will PSAs need for a PSMB capability, and how will this differ between business as usual activities and large scale emergency incidents?

Telstra refers the Commission to previous consideration of this issue by the Australian Communications and Media Authority.29 Irrespective of the capacity estimates, Telstra notes that a hybrid solution combining some dedicated capacity with the ability to add prioritised traffic in the public carrier network will provide the greatest flexibility for meeting the unexpected peak demands of a large scale emergency or a 'security intensive' event such as the recent G20 conference while also limiting the opportunity cost of having underutilised spectrum reserved for PSA use.

37. How might the demand for PSMB capability differ between types of PSAs? How could competing demands amongst PSAs be managed? Should particular uses be prioritised?

Telstra believes the PSAs will be best placed to identify their demand for a PSMB capability and how demand for the capability might vary between them. With respect to competing demand, Telstra takes the view that the personal safety of both PSA personnel and the general public is paramount. It is essential that the relevant PSA personnel have access to the mobile broadband capabilities they require. This means ensuring that the PSMB capability is developed in a way that supports all PSAs and that has sufficient capacity to cope with the high levels of unpredictable demand that PSAs are often faced with.

The dedicated network model does not provide this capability. The dedicated network model has a finite quantum of spectrum that under similar circumstances will encounter the same congestion that commercial network service providers experience. Once this occurs there is no other option than to terminate users of the dedicated network to relieve the congestion on the dedicated network. However, in an extreme localised emergency situation, it could be any of the fire, police, or ambulance personnel, or a combination of all three that are required to respond.

[29] http://www.acma.gov.au/theACMA/the-acma-to-deliver-a-multi-layered-spectrum-solution

Telstra does not believe PSAs should be required to make prioritisation choices due to restricted spectrum availability. A hybrid option that has some dedicated capacity (spectrum) and that also allows the seamless use of additional capacity (with prioritised traffic) on public carrier network spectrum overcomes this problem of prioritising particular uses.

38. How would the benefits, costs and risks of ensuring sufficient capacity vary under different deployment options?

Telstra believes that a hybrid approach that uses some dedicated capacity and spectrum, but which is integrated into a public carrier network providing the ability of PSA personnel to seamlessly transition from the dedicated capacity/spectrum to commercial capacity/spectrum offers the most benefit.

The purely commercial carrier option is likely to be lowest cost but also provide fewer benefits. Telstra expects that under this model little or no additional spectrum and a limited incremental network build (e.g. some network hardening) would be required. Telstra expects benefits will be smaller with this option because the PSMB capability will not have dedicated capacity and could therefore be subject to a higher risk of congestion.

39. What level of resilience do PSA narrowband networks usually provide and how does this differ from commercial mobile broadband networks?

Commercial mobile broadband networks can be enabled to provide equivalent resiliency services to that of LMR. Indeed with the significant investment into mobile broadband infrastructure the opportunity now avails itself to utilise mobile broadband infrastructure to provide LMR capabilities to PSAs.

The Queensland Government Wireless Network which is a LMR network designed, constructed and operated for the police, ambulance and fire personnel of south east Queensland utilises mobile broadband infrastructure to provide LMR services. It would be an unnecessary expense to duplicate the mobile broadband infrastructure for LMR in this example. As illustrated in the photographs below the LMR antennae is collocated on mobile broadband infrastructure.

Figure 10. Delivering mission critical communications utilising carrier grade network infrastructure

Telstra has also made available to the Western Australia Police as part of the Western Australian Royalties for Regions Mobile Broadband initiative the capacity to collocate their LMR infrastructure.30

Telstra is happy to provide with the Commission with 'resiliency' information on a commercial in confidence basis.

40. What methods or metrics could be used to define and/or measure the level of resilience provided by the networks used to deliver PSMB?

Measurements of resilience can be defined in many ways, but ultimately what is important is the end to end availability of the service. Critical to this are:

- Sites optimised to deliver maximum radio resources that offer the best possible user experience at all times.
- Core network systems designed with redundancy to mitigate a single point of failure.;
- 24/7 network health monitoring and proactive capacity management to ensure that network issues are addressed before they impact performance.

30 https://www.youtube.com/watch?v=SNPqwHO1dFU
https://www.youtube.com/watch?v=Ir2DFmldKT4
https://www.youtube.com/watch?v=Wrik4fqTEnI

- Sites hardened through additional investment to provide additional resilience were required, including taking measures to reduce the risk of power loss at sites servicing rural communities.
- Diverse path transmission networks.

Telstra is able to provide additional information to the Commission on commercial in confidence basis.

41. What priority should be given to the capacity to stand up a replacement service within a specified timeframe in the event of a physical or network based disruption?

These arrangements are commercially available today. Telstra is able to provide additional information to the Commission on commercial in confidence basis.

42. Are there any barriers (for example, institutional, informational and/or technological) to, or challenges associated with, delivering a resilient PSMB capability? How might this differ between different deployment options?

As discussed earlier, Telstra has demonstrated that it is possible to deploy a carrier based PSMB capability that combines dedicated capacity with the ability to seamlessly transition to prioritised traffic on a carrier network today. Telstra considers that delivering a PSMB capability using a dedicated network model will be far more difficult. Commercial carrier networks can be hardened to meet any resilience requirements far more readily than building a new dedicated network.

It is important to remember the end-to-end ecosystem involved in resiliency and recognise that this involves not just the radio and core networks but also an extensively hardened backhaul network. Commercial networks provide this today, but it would require significant investment to build into a dedicated model.

43. How could future developments in technology, or growth in demand for mobile broadband services and capacity, affect the sustainability of PSMB capability under different deployment options?

As noted earlier, commercial carriers face competitive pressures to continually enhance their networks and introduce new features and capabilities as technology evolves. This continual investment can be expensive, but competitive pressures require that their networks continue to develop and evolve. The operator of a dedicated PSMB network would not face these same competitive pressures. Implementing a hybrid approach that is integrated into a commercial network will more likely result in the new features and capabilities being introduced to the PSMB capability in a timely manner.

There is also potential for longer term costs from locking into a dedicated network that doesn't have the scale and competitive environment of a carrier ecosystem. It is very likely that the availability of a PSMB capability will likely lead to new and unexpected uses of the technology that may or may not be specific to PSAs. It is important the PSMB capability (or network) continue to evolve and change to allow new features to be introduced as technology evolves. This includes having a wide range of compatible devices and applications.

44. How will the convergence of voice and data services affect the sustainability of PSMB capability under different deployment options?

Convergence of voice and data services is discussed in the response to questions 27 and 28.

45. What challenges are involved with delivering a mobile broadband capability to PSAs by 2020? Do these differ under alternative deployment options?

The challenges involved are very different depending on the deployment option chosen.

There would be a number of serious challenges associated with public safety agencies designing, rolling out and operating dedicated mobile broadband network that is nationwide and interoperable across state borders.

The key reasons are as follows:

- The cost of rolling out such a network would be significant, almost certainly several billion dollars. For example, the US public safety network is expected to cost approximately $US19 billion, with $US7 billion being funded by the federal government (from spectrum auction proceeds) and the remainder being funded by state governments and private sector investors.
- Telstra understands that individual States and Territories may be required to fund and build their own networks. This approach has the potential to result in a fragmented approach to network implementation and coverage.
- Funding constraints are likely to result in priority being given to the coverage of metropolitan areas. This would leave regional and remote areas underserved, and would fail to enhance the capability of emergency services in these areas to deal with natural disasters such as bush fires and flooding. The consequence will be a "digital divide" between public safety agencies in metropolitan areas and those in regional and remote areas.
- Building and operating large scale LTE networks is a complicated and specialised business. It is not the core business of governments or public safety agencies and they are not resourced to undertake such activity. Telstra considers that there will be a high risk of project failure if the network design, build and operation is not shared with a commercial network provider.

Telstra believes that the only realistic approach to addressing these issues is for the public safety agencies to form a national partnership with a commercial mobile network provider. This would reduce the cost of the project by allowing the public safety agencies to leverage the resources of a commercial network, including suitably hardened commercial infrastructure, augmentation with commercial spectrum and nationwide seamless operations management. It would also assist to ensure that the rollout is interoperable across state boundaries and not create a divide between metropolitan, regional and remote Australia. Such an approach is also necessary to provide a seamless user experience when roaming between public safety and commercial spectrum. Building a dedicated LTE network capability to meet requirements in extreme circumstances would be prohibitively expensive. Such a network having idle capacity over long periods of time would be extremely wasteful, especially when commercial networks utilising the same underlying technology could be integrated in a symbiotic manner.

In addition, the two carrier propositions could be effected quickly and with less investment relative to the dedicated model. The two carrier options can leverage the substantial commercial investment Telstra has already made in the capacity and coverage of its LTE network and augment this for the timely delivery of a cost effective public safety mobile broadband capability on a national basis. The dedicated network model would take much longer to deploy and is likely to be deployed at different rates across the states. By way of example, it takes commercial carriers in the order of 1-2 years to build out initial coverage for a new network and a further year to build out coverage to a high proportion of the population, and this is when key infrastructure such as backhaul networks, sites & towers etc are all already in situ. It is not unreasonable to expect a complete dedicated network build out to a lesser coverage footprint to service metro and major regional areas, with less backhaul redundancy & resiliency to take significantly longer. If this is combined with the challenges of sourcing a skilled workforce, coordinating inter and intra state funding, and intrastate design and interoperability the timeframes these timeframes will become extensively elongated.

Telstra observes that the challenges of delivering national private network capability is evident in the project in Australia that still struggling to deliver a Public Safety Radio Network (PSRN), based on legacy land mobile radio network technology. The ACMA has provided new spectrum in the 400MHz range to the emergency services agencies to contribute to achieving interoperability in the radio domain. However, a truly national interoperable PSRN appears to be some years away with differing technologies, versions of equipment and different operating procedures and process existing across Australia.

46. What potential obstacles exist to a mobile broadband network being fully compatible with a range of end-user devices? Does this depend on the network deployment option?

There are a number of factors involved in the development of devices, key amongst them are the Spectrum bands and number of bands supported, compliance to the 3GPP specifications, and the particular release of the specifications.

For commercial devices the vendors consider all the bands that are in use globally and which bands are used in different markets, then the likely volumes of device sold.

Global and regional harmonisation of the spectrum bands used for PPDR is very important to ensuring a cost effective device eco system development and will greatly increase the device range available. To achieve an economy of scale aligned with Australian's plans, Australia must take the lead in the Asia pacific Telecommunity and the ITU in defining the bands to be used.

A measure of the success of this approach can be seen in the regional and global adoption of the APT 700 band plan in which Australia and New Zealand played major roles in developing. Widespread adoption of this plan has led to the earlier than expected introduction of devices supporting the band, as well as significantly lower device unit costs.

Obtaining fully compatible devices doesn't depend on deployment option, provided the devices are compliant to the 3GPP specifications, but does require influence and effort to bring the ecosystem to market quickly, something which Telstra has developed a strong global reputation of achieving.

Volume is also essential for supplying affordable and compatible user devices. Carriers are involved in negotiating the supply of high volumes of user devices so the two carrier options are likely to give PSAs more ability to influence device compatibility. It is also likely to be much more cost effective to ruggedize existing commercial devices rather than developing and acquiring devices that are specifically made for the PSMB requirements.

47. How does the method of ensuring interoperability impact on the cost of the system to PSAs?

Use of a carrier proposition to provide PSMB capability will ensure that the cost of off the shelf devices is reduced in comparison to a dedicated network build due to:

- The economies of scale that carriers bring to purchasing.
- Device testing and certification alignment with existing activities.

48. What detailed options should be evaluated in this study? What underlying assumptions and key parameters would be associated with each option?

Telstra believes four detailed options should be evaluated by the Commission. The 'book-end' options of a purely dedicated PSMB network and a purely commercial option as well as two hybrid options that involve dedicated PSMB capacity with 'spill-over' to a commercial carrier network. One hybrid option

should involve combining a dedicated PSMB network with non-seamless roaming to a commercial carrier network. The second hybrid option should combine dedicated PSMB capacity with prioritised traffic on the carrier network on a common carrier core so as to allow seamless mobility between the dedicated capacity and the carrier capacity.

For each option, the Commission will need to address issues such as:

- The level of coverage each network will provide.
- The amount of additional spectrum each option would require.
- The amount of network build that each option will require.
- For hybrid options, the benefits of seamless mobility between the dedicated and the carrier network (or capacity).

49. What (if any) assumptions or parameters should be 'common' across all options?

Telstra believes these assumptions and parameters will vary across each option.

Coverage

A dedicated network will provide the lowest level of coverage. Coverage can be expanded to match the carrier option by roaming onto a carrier network in both the hybrid models.

Spectrum

The dedicated network will require the most spectrum if it is to be built to meet the extreme demand scenarios. This would result in a significant amount of spectrum being underutilised most of the time. Conversely, relying solely on a carrier network may mean no, or at least very little, additional spectrum is required, with PSA traffic being prioritised over the carrier's public spectrum. Under both the hybrid models, a smaller amount of spectrum could be dedicated to PSA use to meet day-today operations with extreme demand situations relying on the use of carrier spectrum.

Network build

The dedicated network will obviously require the greatest network build. Telstra notes that building a mobile broadband network will require a much larger number of base stations than the PSAs existing LMR networks require. Simply adding LTE radio equipment at existing base station sites will not be sufficient to develop sufficient coverage, especially in-building and in-tunnel coverage. Both hybrid options and the carrier may require some network hardening to meet PSAs resilience requirements, but this would be considerably less than the cost of building a dedicated network.

Benefits of seamless mobility

In assessing the difference between the hybrid options identified above, the Commission will need to consider the benefits of seamless mobility between the dedicated capacity and the carrier capacity of the carrier based hybrid over the loss of connectivity that will occur where in the hybrid option that involves roaming between the dedicated network and the carrier network.

2.4. Identifying and estimating costs

50. What are the sources of costs relevant to this study?

In its issues paper the Commission identifies a number of cost sources relevant to the current study. Telstra submits that these cost sources are indeed relevant to the issue of PSMB, noting that:

a) Network costs are — by a large margin — likely to be the most substantive driver of costs.
Capital infrastructure: Core, Backhaul, Sites, Radio O&M systems, IT/Application systems.
Operational costs: Service assurance, faults/repairs, optimisation, leasing/power etc.
Lifecycle costs: Asset replacement.
User Equipment Costs: Establishment of fleet of devices and lifecycle of those.

b) Spectrum opportunity costs, if relevant, are likely to be the second most substantive driver of costs given the high values associated with spectrum by MNO's.

c) Costs are likely to vary considerably between each of the options under consideration, and will also vary depending upon the exact way in which each option is specified (i.e. as per page 11, a combination or hybrid approach could entail partial or full reliance on commercial network infrastructure).

There is also potential for longer term costs from locking into a dedicated network that doesn't have the scale and competitive environment of a carrier ecosystem. It is very likely that the availability of PSMB capability will likely lead to new and unexpected uses of the technology that may or may not be specific to PSAs. It is important that there are appropriate incentives for the PSMB capability (or network) to evolve and change to allow new features to be introduced as technology evolves. This includes having a wide range of compatible devices and applications. Telstra submits that the best way of providing these incentives is to have the PSMB capability delivered using harmonised spectrum and delivered by a commercial carrier that faces competitive pressures. Carriers have a commercial imperative to evolve and upgrade their networks and bring new features to market as technology evolves. This is often costly but competitive pressures require that their networks continue to evolve and develop. This will also provide for a large range of compatible devices and a large market for the development of applications. A dedicated PSMB network will not face the same competitive pressures to evolve and develop and this risks the dedicated network not maintaining pace with the evolution of technology.

51. In what ways could delivering a PSMB capability affect non PSA users? How would these effects differ across deployment options? What methods could be used to estimate these effects?

Delivery of a PSMB capability has the potential to impact non PSA users in two ways — temporary, localised displacement of mobile broadband service availability when an emergency arises or a longer term restriction of aggregate cellular capacity as a result of dedicated capacity being availed to PSA's.

The first impact identified above is notionally associated with the commercial and hybrid approaches being considered by the Commission. However in the hybrid approach the impact will be lessened due to the nature of some dedicated spectrum delivering a quantum of capacity for PSMB use. That said, the incidence and scale of any 'displacement' impacts would be dependent on the nature of emergency, the geographic area affected, the cellular infrastructure in that area and the ability to augment cellular capacity via COW's or similar.

The second impact identified above is primarily associated with the dedicated approach being considered by the Commission — being linked to the availing of dedicated spectrum — but could also arise under either of the other options if they incorporated a quantum of dedicated spectrum. Currently this 'restriction' impact is largely hypothetical, but given the general scarcity of spectrum it is reasonable to contend that any availing of dedicated spectrum could — over time — translate to a lower aggregate

cellular capacity for non PSA users, especially if there was no non PSA utilisation of this spectrum in 'off peak' times. By extension, the scale of any 'restriction' impacts would be correlated with the quantum of spectrum which was deemed 'dedicated'.

The Commission could consider using work undertaken by the ACMA that assess the net spectral needs of Australia and the associated economic benefits associate with that. It could be considered in the context of excluding PSA specific spectrum form that and determine a opportunity cost. It is expected that PSA use of spectrum would have significantly lower average utilisation of spectrum than would non PSA use.

52. Is it appropriate to consider option values as part of the cost benefit analysis in this study? If so, how? What information or data is relevant?

Typically this approach is useful in determining strategic direction. The Commission could model the cost benefit outcomes of each option over a period that would typically relate to the life of the infrastructure. The resulting net present values of each option can then be compared. Differing discount rates can be considered reflecting relative risks. Sensitivities to technology and cost variance related to each option can be run as scenarios within each option.

If the Commission is inclined to consider option values as part of the cost-benefit analysis, Telstra submits that this may need to be accompanied by regard for changes in both construction costs and the opportunity costs of spectrum over time, variables that have tended to trend upwards over time.

53. Are the network cost elements identified in box 4 relevant for this study? What specific cost items would fall within these categories? What other network costs should be considered? What is the nature and materiality of these (and other relevant) costs under alternative PSMB options?

The network cost elements identified in 'box 4' of the Commission's *issues paper* are relevant, but not holistic. For the cost elements identified, table 1 details the specific cost items that fall within these categories. In addition, there are a number of costs missing, namely:

- Spectrum costs
- Costs to establish a networks operations centre
- Field work force costs
- Site Make Ready
- Cells on Wheels
- Device Certification & Testing costs (eg. screened rooms, anechoic chambers, labour etc)
- In building coverage
- Spares
- HW & SW lifecycle
- Licensing (SW, HW)

Table 1

The network cost elements identified in box 4	Specific Items that fall into this category	Nature & materiality of these (High/Mid/Low)
Radio Access Network Equipment	• Planning, Design, deployment & Commissioning Services • Tower Builds • Antennas • RAN Kit • Hut (incl. power, AC etc) • Headframe	Capex High
Site Hardening costs	• Backup Power • Replacement Power • Dual path transmission	Capex High
Backhaul transmission costs	• Optical Fiber • Edge Equipment • Huts to house	Capex High
Core network costs	• Home Subscriber Database • Enhanced Packet Core • IP Multimedia Subsystem Core • Media Gateways • Priority manager (optional) • Switching & routing equipment • Planning, Design, deployment & Commissioning Services	Capex Mid
Other equipment	• OSS • BSS • Network Monitoring Tools • Network Configuration Tools • Databases • External & Door Alarming • Capacity management tools • RF Modelling tools • Inventory management tools • Change management tools • Service Management tools • Incident & problem management Construction equipment (diggers, cranes etc)	Capex Mid
Handsets and other terminals	Smartphone's, bespoke form factors, in car terminals.	Capex Low
Additional Software Upgrades or new applications	Push To Talk servers	Capex Low
Network level costs (maintenance & network management)		Opex High
Organisational level costs	• Administration costs • people costs • Accommodation costs	Opex Mid
Leasing land, equipment, facilities and services	Site acquisition costs Site Access management	Opex Mid

54. What method(s) should be used to estimate the network costs of different deployment options for delivering PSMB? What studies should inform the Commission's thinking in this area?

Telstra submits that a 'bottom up' cost modelling approach is likely to be the most appropriate way of estimating the network costs of different deployment options for delivering a PSMB outcome. This may need to be supported by coverage, capacity and propagation models. Telstra anticipates that such an approach would resemble a building block type construct, whereby components of the network are considered and costed in turn for each deployment option, with potential for certain components to be grouped together if need be as a consequence of data availability. As noted by the Commission in its issues paper, this approach should also enable the identification of, and provision for, cost causation relationships.

In terms of potential grouping, some cost elements may be difficult to capture in isolation, due to issues such as aggregated raw data. Provided a consistent approach is adopted for the modelling of different deployment options, grouping should not be a substantive problem.

55. What network cost components are interdependent with other costs, or other parameters (such as assumptions about the amount of spectrum allocated)? What is the nature of these interdependencies?

The amount and frequency of spectrum used will drive the required Radio Access Network (RAN) solutions and resulting costs. The dimensions at play are coverage breadth, depth and capacity. The RAN solution will in turn drive the backhaul solution and its costs. A further key cost driver will be the desired resiliency and availability criteria.

56. What data sources could be used to estimate expected PSMB traffic requirements, and the network infrastructure elements required to deliver PSMB capability under different deployment options?

As part of the review of spectrum requirements for PSMB the ACMA developed a model of the PSMB applications. A key input to this model was the use cases and traffic requirements. This information provides a good source of the PSMB traffic requirements.[31] Telstra believes a detailed review of some recent use cases would assist in developing further developing an understanding of peak requirements. This should include highly localised requirements (such as the Lindt Cafe siege) and well as wide area events (such as bush fire situations). The network infrastructure elements required to meet the different PSMB traffic scenarios will vary greatly dependent on the particular scenario being modelled.

57. What data sources could be used to estimate the cost of the infrastructure, equipment and operation in delivering PSMB capability under different deployment options?

There are a number of public areas where the Commission may be able to access data to support its estimation of infrastructure equipment and operation costs in the context of delivering a PSMB capability. These include:

- Information on the ACMA's Digital Dividend auction, held early in 2013 – this auction allocated spectrum in both the 700 MHz and 2.5 GHz bands.

[31] A redacted version of this report is located at: http://www.communications.gov.au/__data/assets/pdf_file/0011/148691/A024-2012_-_Document_3.PDF

- Information on/from the Regional Backbone Blackspots Program (RBBP) – this program funded the construction, operation and maintenance of high-speed backhaul transmission links in regional areas, and is administered by the Department of Communications.
- Information on/from the Mobile Blackspots Program – this program will fund the extension of mobile phone coverage into known blackspot areas (mainly in regional areas), encompassing the acquisition or rental of land for cell towers, the construction of new cell towers at those sites and the construction of transmission links to the nearest backhaul transmission link or point of interconnect. This program is also administered by the Department of Communications.
- Information from the ACCC relating to regulated prices for the Domestic Transmission Carriage Service (DTCS) – as its name suggests, the DTCS is a high speed transmission service which is regulated in various parts of the country. For these areas, the ACCC has established a pricing calculator which generates prices based on desired attributes such as the level of capacity required, the technology interface and the inclusion or otherwise of protection.

The usefulness of the above data sources derives from the fact that the first three were all competitive market based processes, while the last of the areas identified uses competitive prices as the basis for a benchmarking process.

58. What is the appropriate approach (or approaches) to model the opportunity costs of spectrum under different deployment options? What issues does 'spectrum sharing' raise for estimating these opportunity costs, and how might they be addressed?

It can be assumed that spectrum used for a PSMB LTE capability will also be most useful for carrier network deployment. On this basis the opportunity cost is the value attributed to the spectrum by commercial mobile network operators.

This value can be estimated using various methodologies. As suggested by the PC, there are two general approaches – either attempt to directly calculate the price that commercial mobile network operators would pay to purchase the equivalent quantum of spectrum, or estimate the price from recent market data. The former can be done by identifying the additional infrastructure costs that would be incurred by mobile network operators if they were denied access to the spectrum identified for PSMB use. The market data approach is likely to be simpler and adequate for the purposes of this review. The potential data sources include the recent results for the auction of the 700 MHz and 2.5 GHz spectrum, and the prices offered by the ACMA to spectrum licensees for the reissue of their spectrum licences in the 850 MHz, 1800 MHz and 2 GHz bands (noting that the reissue prices include a premium for avoiding the uncertainty of facing an auction process).

Telstra notes that any dedicated spectrum is likely to identified in the sub 1 GHz range because of the additional coverage benefit that this range enables. The combination of this benefit and a scarcity of sub 1 GHz spectrum means that the opportunity cost (per MHz) of sub 1 GHz spectrum is higher than that of spectrum in higher frequency bands. It also means that the average opportunity cost of the blended spectrum in a carrier's public network (using spectrum from bands below and above 1 GHz) will be somewhat less than the opportunity cost of dedicated spectrum. The sharing of a public carrier network for PSA data is also expected to result in more efficient use of the spectrum resource (and associated infrastructure) which would further reduce the opportunity cost.

59. What data sources could be used to estimate the opportunity costs of spectrum under different deployment options for PSMB?

As noted above, the spectrum used for a PSMB LTE capability will also be useful for carrier network deployment. On this basis the opportunity cost is the value attributed to the spectrum by commercial mobile network operators.

60. What is the appropriate discount rate, or range of discount rates, to use in this study?

The choice of discount rate should reflect prevailing market conditions, including appropriate consideration of both the risk free rate and market risk premium (MRP). Telstra submits that in the current context particular attention should be directed towards the MRP component, given the integral role of spectrum in delivering a PSMB solution and the high opportunity cost attached to this public resource.

Telstra notes that the Bureau of Communications Research has recently detailed various discount rates applied to different NBN-related projections over the period 2010-14.[32] Telstra considers that these discount rates are on the low side of what might apply in the current context given the likelihood that a PSMB solution will have a shorter useful life than the NBN investment and be relatively more dependent on an asset (i.e. spectrum) for which there is a high opportunity cost. Similarly, the benefits of a PSMB solution will — in large — be available at, or shortly after, the time of commissioning whereas the benefits of the NBN are linked to completion of the NBN rollout, something which requires around ten years given it was commenced in 2010 and is not expected to be completed until 2020.[33]

61. How far into the future should costs and benefits be measured?

Telstra considers that a period of 15 years would be appropriate for the measurement of benefits and costs. This is view based on the propensity for costs and benefits discounted over a longer period of time than this to approach zero and the observation that spectrum licences in the significant 700 MHz band have a duration of 15 years. This latter point is relevant in that it reflects the dynamic nature of opportunities for using spectrum, balanced by the need to incent the harnessing of these opportunities by availing sufficient time for the development and implementation of related products and services.

2.5. Identifying and estimating benefits

62. What are the sources of benefits relevant to this study?

Introduction of a PSMB capacity has potential to dramatically improve communications within and between PSAs. These improvements relate to both the quality of communications (e.g. improved coverage, increased interoperability between PSAs and, potentially, seamless transitions between dedicated PSMB network capacity and carrier capacity) and the scope of communications (e.g. a PSMB capability will allow improved data streaming, allowing information such as closed-circuit television streaming to improve situational awareness. The improved quality and scope of communications will improve PSAs ability to respond to day-to-day situations and emergency events. Ultimately improved communications within and between PSAs may save lives.

[32] See Figure 4, page 22: http://www.communications.gov.au/__data/assets/pdf_file/0005/244913/NBN_non-commercial_services_funding_options_-_consultation_paper.pdf

[33] http://www.nbnco.com.au/corporate-information/media-centre/media-releases/nbnco-rolls-out-new-national-construction-plan.html

63. How can the potential benefits of PSMB capability (in terms of PSA outcomes) be estimated? Is scenario analysis useful? How should scenarios be constructed to reflect an appropriate range of situations faced by PSAs?

The range of PSA activities and outcomes is large and varies significantly between PSAs. Some events involve responses by multiple PSAs with each PSA playing very different roles. Telstra believes scenario analysis will be useful and considers a range of scenarios (based on feedback from PSAs) will need to be analysed. It may also be useful to consider case-studies from recent previous events.

64. Can you identify any trials or pilot programs of PSMB capability? Are there any insights to draw from these experiences about potential benefits (or costs)?

Telstra is happy to provide further information to the Commission on the G20 Telstra LANES™ experience on a commercial in confidence basis.

65. Can you identify evidence or examples that illustrate the effects of PSMB capability on PSA outcomes?

Telstra considers the PSAs will be best placed to answer this question in detail. However, Telstra is aware of anecdotal evidence on the effect of improved mobile communications for PSAs from the recent expansion of its mobile coverage as a result of Western Australia's Regional Mobile Communications Project.[34] These include remotely located ambulance officers being able to converse with a hospital in Perth during an emergency childbirth[35] and introduction of mobile access by police to their 'data-comms systems'.[36]

66. What method(s) should be used to value the effects of PSMB capability on PSA outcomes?

Telstra agrees that non-market valuation methodologies, such as stated preference and revealed preference techniques will be necessary to value the benefits of introducing a PSMB capability.

67. Is there research that considers how the costs of responding to natural disasters, crime or other events could be affected if PSAs had access to mobile broadband?

Telstra is not aware of any specific research of this nature.

34 https://www.commerce.wa.gov.au/industry-and-innovation/regional-mobile-communications-project
35 https://www.youtube.com/watch?v=SNPqwHO1dFU
36 https://www.youtube.com/watch?v=Ir2DFmldKT4