PUBLIC SAFETY AND SECURITY

Emergency-grade Mobile Broadband for the Public Safety and Security Sector

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1. EXECUTIVE SUMMARY

By December 2013, Australian free-to-air television broadcasters will switch from analogue to digital broadcasting. This will free a large block of spectrum at the upper end of the Very High Frequency (VHF) and Ultra High Frequency (UHF) transmission bands.

The Digital Dividend is a once-in-a-generation opportunity to improve communication services in Australia

The Australian Government has decided to release this broadcasting spectrum for the long-term benefit of the Australian community and economy. Known as the Digital Dividend, it presents a "...once-in-a-generation opportunity to improve communication services available in Australia."[1]

One suggestion is to allocate some of the freed spectrum for emergency services

One suggestion, primarily from within Emergency Service Organisations (ESOs), is to allocate some of the freed spectrum for mobile broadband to a relatively small number of emergency services. Currently, emergency services use narrowband Land Mobile Radio networks, or use mobile broadband from commercial network providers like Telstra. Today, commercially provided mobile broadband delivers many benefits to ESOs including improved control and co-ordination, situational awareness and officer safety.

Building and maintaining private emergency networks would incur both financial cost and opportunity cost

If ESOs are to use the freed spectrum for their own mobile broadband, they will need to build and maintain their own networks, either by themselves or in partnership with a network provider. That would incur substantial capital costs and tie up significant resources in ongoing management. As well as a financial cost, it would be an opportunity cost, reducing potential expenditure on other much needed emergency services. Furthermore, this course of action would still only achieve very poor spectral efficiencies. Telstra believes that ESOs can continue to gain all the benefits of mobile broadband with less expense by exploiting existing commercial broadband networks.

Emergency communications have three key requirements: coverage, reliability, and certainty of access to communications even when a network is experiencing high demand during an incident. To date, commercial network providers have not been able to meet all of these criteria.

Telstra will be introducing innovative functionality to increase certainty and performance levels

While Telstra's expansive Next G® network has a track record of providing reliable service, or recovery of services during natural disasters, we will soon be adding to these capabilities. During 2012, Telstra will be introducing innovative functionality to further increase certainty and performance levels which will be of interest to select customer groups such as ESOs.

1. EXECUTIVE SUMMARY

Telstra already has capability built into our 2G network to provide access priority for government voice communications, known as the Wireless Priority System[2]. This service is in collaboration with the Commonwealth Attorney General. In the near future, Telstra plans to have voice and data Quality of Service (QoS) on our Next G® network to provide performance levels and certainty of access as required by select customers.

Quality of Service can substantially improve the existing strengths of the Telstra Next G® network

QoS can substantially improve the existing strengths of our network. As Australia's largest and fastest national mobile broadband network, the Telstra Next G® network already provides deeper in-building coverage to more places than any other mobile network in Australia, and speeds that are being continually enhanced. In addition, future enhancements will enable the network to interoperate with emergency radio networks. The Telstra Next G® network also covers more than 2.1 million square kilometres and 1 million square kilometres out to sea, and is supported by Australia's largest technical field force.

Given these capabilities, we believe the Telstra Next G® network will be able to deliver emergency-grade mobile broadband in the near future, making it an effective and more economical alternative to building and maintaining private ESO wireless broadband networks.

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2. BACKGROUND

Moving from analogue to digital broadcasts will release high-frequency spectrum

The Australian Government will use the spectrum for the benefit of the Australian community

Since 1956, Australian free-to-air television stations have been broadcasting analogue signals over the radio-frequency spectrum in the Very High Frequency (VHF) and Ultra High Frequency (UHF) bands. The conversion to digital broadcasts allows a large part of that spectrum to be released for other uses.

The television spectrum used by analogue signals in the UHF bands is especially suited to mobile telecommunications because of its ability to carry signals over long distances, penetrate buildings and carry large amounts of data[3]. Consequently, the Australian Government has decided to release the spectrum for the benefit of the whole Australian community.

In common with other developed economies, the government is also consolidating the bandwidth to create one contiguous block of spectrum. A contiguous block is more valuable than scattered areas of free spectrum since it is more able to support communications like fixed and mobile wireless broadband. In all, the Australian Government plans to release 126MHz of contiguous spectrum in the ultra-high frequency band, across the frequency range of 694 to 820 MHz inclusive.

The government also plans to align the allocated spectrum to that of other developed countries in order to use the communications equipment produced for these countries, and to facilitate global roaming by using harmonised frequencies[4].

3. ALLOCATING SPECTRUM TO PUBLIC SAFETY AND SECURITY

In terms of evaluating spectrum for emergency services, it is worthwhile to consider the example of the United States, which completed its transition to digital broadcasting in 2009. The US spectrum regulator, the Federal Communications Commission, has set aside spectrum in the 700 MHz band for public safety wireless broadband communications. This spectrum will be used for the 4G wireless technology standard known as Long Term Evolution or LTE.

Telstra has the view that such an allocation is an inefficient use of spectrum. As we anticipated, the nations in global telecommunications Zone Three, comprising Asia and Australia, adopted a different model to the USA in Seoul in September 2010.

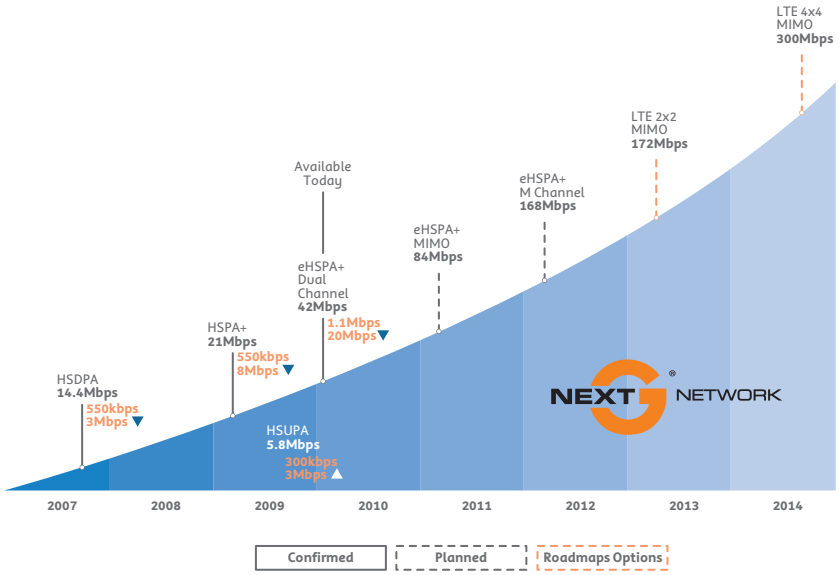
The government has a choice of LTE standard bands to allocate spectrum to emergency services

In Australia, the government could allocate spectrum from the Digital Dividend in the 700 MHz band for ESOs to establish mobile broadband networks. Nevertheless, there are a number of other LTE standard bands that could be used, including the 1800 MHz, 2100 MHz and 2600 MHz bands, as well as other bands referred to in the LTE standards. However, lower frequencies such as 700 MHz and 400 MHz have superior propagation characteristics over distance when compared to high frequencies such as 2.6 GHz.

We believe that higher frequencies for LTE will be more popular and available earlier

Australian LTE deployments will be influenced by availability of spectrum and the order in which different spectrum bands become available. In our opinion, it seems more likely that higher frequencies – such as the 2.6 GHz band – will be more popular worldwide and available earlier for LTE.

Chart 1: Roadmap for the evolution of the Telstra Next G® network



3. ALLOCATING SPECTRUM TO PUBLIC SAFETY AND SECURITY

LTE is not a revolution for our architecture, it is an evolution to offer more capacity

As for LTE, it is the technology of choice for the Telstra 4G roadmap to operate as a complementary technology to the 3G HSPA technology in existence today. As such, Telstra does not view LTE as a revolution for our architecture. The Telstra Next G® network, based on HSPA and Enhanced HSPA+ technology, is giving our customers speed and capacity benefits today, so we do not see LTE as the key to unlock more speed. Rather, it is an evolution to offer more capacity. Essentially, the Telstra approach is to use low frequency bands for coverage, and when that spectrum becomes fully utilised, use high frequencies in high-density areas for capacity.

Telstra would therefore use the 700 MHz spectrum, if available, primarily in areas where additional capacity was required on the Telstra Next G® network, rather than as a complete overlay of Telstra's 3G environment with the 4G LTE standards.

4. THE NEED FOR MOBILE BROADBAND

There is no doubt that mobile broadband will continue to have a major impact on the delivery of emergency services. At present, ESOs use Land Mobile Radio networks in the UHF or VHF bands with 12.5 kHz or 25 kHz channel spacing. Yet when they have used bandwidth in the Megahertz range from commercial wireless broadband networks, the outcomes have been dramatic.

Mobile broadband allows responder organisations to exploit new and powerful capabilities

The extra bandwidth has not only supported more data traffic, it has allowed responder organisations to exploit new and powerful capabilities. This has enabled a clearer and more timely assessment of incidents, as well as more effective command, control and co-ordination across the responder organisations and their agents and assets in the field. The result has been a faster and more appropriate response to incidents, with a more productive use of resources. As further advantages, officer safety and efficiency have improved.

Mobile broadband is the best opportunity to improve the scope and quality of services within budgetary constraints

ESOs are experiencing a steadily increasing demand for services due to factors such as natural disasters, the threat of terrorism and an ageing and growing population. Yet these services have to be delivered within limited budgets. Mobile broadband is the best opportunity the public safety and security community has to improve the scope and quality of services within their budgetary constraints.

5. BROADBAND OPTIONS FOR EMERGENCY SERVICES

To exploit the capabilities that broadband communications offer, ESOs essentially have three options:

- Build and maintain their own mobile broadband networks
- Build and maintain a network in partnership with service providers
- Use the existing mobile broadband capabilities of commercial network providers.

The first two options would require dedicated spectrum to be allocated to the public safety and security sector. The third option would require less spectrum from the Digital Dividend since much of the bandwidth would come from the commercial network provider.

It is worth examining the ramifications of each of these options.

Option 1: ESOs build and maintain mobile broadband networks

ESOs would have exclusive use of a section of spectrum, with absolute network ownership and control

The attraction of this option is exclusive use of a section of spectrum for public safety and security. ESOs would, with significant investment in network infrastructure and maintenance, experience a high level of availability of communications and would potentially have headroom for disaster response. This is critical when large-scale disasters occur since the rest of the spectrum is usually inundated with network traffic from calls by the general population.

ESOs would also have absolute ownership and control. They can set and manage their own service levels for network availability to ensure they are of an acceptable standard.

Building proprietary public safety and security mobile networks could cost more than $1.5 billion

Apart from the inefficiency of spectrum usage, the major disadvantage of this method is cost – both initial network investment and ongoing lifecycle management, as well as annual operations and maintenance. From Telstra's experience building the Next G® network, we estimate that building proprietary public safety and security mobile networks could cost more than $1.5 billion, depending on network reach and resiliency. To manage and maintain those networks would cost a further $400 -$500 million per year.

To our knowledge, emergency services have not budgeted for this course of action. Funds would need to be allocated from government budgets that are already stretched coping with the recent spate of natural disasters. The opportunity cost to both government and ESOs would also be high. These funds could be used on other priorities, from enhancing traditional radio through to health, education, disaster mitigation programs or additional police officers and ambulances.

Emergency services would also have to invest in the management and technical resources needed to maintain those networks. This could create extra management complexity. In addition, the lack of skilled IT resources in Australia could make hiring trained staff difficult.

5. BROADBAND OPTIONS FOR EMERGENCY SERVICES

Option 2: ESOs build a network and maintain it through service providers

Like the previous option, ESOs would have exclusive use of a section of spectrum for public safety and security to ensure communications. While they would no longer build or manage the network infrastructure, they could set the service level agreements with their provider to ensure high availability.

Again, the disadvantage of this option is significant capital investment and the inefficiency of spectrum usage

Again, the disadvantage of this option is the significant capital investment that would be incurred and the inefficiency of spectrum usage within the industry. Management and maintenance costs may be lower if ESOs can leverage the service provider's economies of scale. Administration and staff recruitment would also be simpler since the only people required are those who manage the relationship with the provider. However, the administration of the network would require regular reviews to ensure service levels are being maintained as well as having plans and procedures in place should failings or outages occur.

Option 3: ESOs use the existing mobile broadband capabilities of commercial network providers

ESOs would not incur the expense of building networks and the ongoing cost of management, maintenance or technology and skills upgrades

With this option, ESOs would not incur the expense of building networks - a cost saving of more than $1.5 billion. They would also avoid the ongoing cost of management and maintenance, as well as the expense of technology upgrades and training or updating IT skills. In essence, ESOs would replace large capital expenditure with a consistent operating cost. In addition, the time and cost of supplier administration would be reduced.

For some in public safety and security, the drawback of this option is the lack of dedicated spectrum. Doubts would arise as to whether the network provider could offer enough bandwidth to guarantee communications in the event of a disaster. Similarly, the resilience of the network would be questioned, and in the event of an outage, the ability of the provider to quickly restore connectivity.

Telstra has already taken steps to address these concerns. We believe the new capabilities planned for the Telstra Next G® network – outlined below - will provide the resilience needed for public safety and security in the community.

6. EMERGENCY-GRADE MOBILE BROADBAND

Communications are critical to create an accurate picture of an emergency, and support a timely and co-ordinated response

During any incident, ESO operations centres need to communicate with their officers and assets in the field to direct action and preserve officer safety. Collaboration between separate responder agencies and governments is also vital to foster a timely and co-ordinated response. And lastly, communications are critical in creating an accurate picture of the nature and extent of the emergency.

However, emergency events and especially large-scale disasters can damage communications infrastructure. At the same time, massive peaks in call volumes from the public can tie up available bandwidth, impeding ESO communications.

We believe the inherent strengths of the Telstra Next G® network, combined with new capabilities, can overcome these challenges:

Wireless Priority Service for voice

Telstra is deploying new enhancements to enable the Next G® network to meet the exacting standards of availability that emergency services need. We already provide access priority for government voice communications over our 2G network, known as the Wireless Priority System[2], in collaboration with the Commonwealth Attorney General. This will be enhanced for the 3G Telstra Next G® network during 2012.

Quality of Service for data communications

Quality of Service will enable Telstra to give greater certainty of throughput speeds for ESO traffic

Essentially, Quality of Service gives important traffic priority. For example, it will enable Telstra to give greater certainty of throughput speeds for ESO traffic. In the near future, we plan to have Quality of Service for data over our 3G, High Speed Packet Access enabled Telstra Next G® network.

QoS can substantially improve the existing strengths of our network. It will help to preserve critical communications between governments, responder agencies and field operatives even when the network experiences heavy demand from the public. With QoS in place, we believe ESOs will no longer need dedicated spectrum to ensure connectivity during a disaster, or the large financial investments to build and operate such networks.

Backup communications

Telstra has designed and built transportable mobile broadband base stations called Cells on Wheels (CoWs). Our fleet of CoWs and SatCoWs (Satellite Cells on Wheels) are fitted with all current mobile technologies and can be transported by helicopter or 4-wheel drive and be set up in 1.5 hours. A CoW enables field officers to communicate on the Telstra Next G® network even if a permanent base station does not exist or has been damaged. Communications are relayed to the terrestrial network via satellite.

6. EMERGENCY-GRADE MOBILE BROADBAND

Telstra deployed a SatCoW during the grounding of the coal carrier Shen Neng on the Great Barrier Reef in April 2010. Set up on a small atoll on the Great Barrier Reef, the SatCoW facilitated communications between Australian maritime personnel to co-ordinate an effective rescue of the stricken carrier.

Integration with fixed line and emergency radio networks

Integration affords seamless connectivity from the field to access information like maps, telemetry or real-time video streams

The Telstra Next G® network easily integrates with the fixed-line Telstra Next IP™ network or with an organisation's virtual private network*. This affords seamless connectivity from the field to access emergency services databases for information such as maps, telemetry or real-time video streams.

Recently, Telstra conducted a successful Group Radio Solution trial to integrate voice communications between private radio networks and the Telstra Next G® network. If deployed, the Group Radio Solution would provide interoperability between Fleetcoms and Government Radio Networks with the Telstra Next G® network.

High capacity broadband

Telstra has introduced successive upgrades to our network and will continue to increase speed and capacity

Telstra has introduced successive upgrades to our mobile broadband network such as HSPA+ technology throughout, and also Dual Carrier HSPA+ in all capital CBDs, many metropolitan hubs and selected regional and rural locations. Telstra will continue to increase network speeds and capacity in the future.

These developments are backed by Ethernet backhaul to some 90 per cent of the population which maximises the benefit of Telstra's extensive Next G® network coverage, and ensures the network is LTE ready.

The widest coverage

The Telstra Next G® network covers over 2.1 million square kilometres and more than 99 per cent of the Australian population. In addition, the network covers more than 1 million square kilometres out to sea. Coverage is more than double that of our nearest 3G competitor, and more than the combined footprint of all other Australian 3G networks. It has also been designed to provide better in-building coverage than any other mobile network in Australia.

*With appropriate virtual private network (VPN) settings. Additional software and/or hardware may be required.

6. EMERGENCY-GRADE MOBILE BROADBAND

Australia's largest technical field force enables prompt detection, repair and deployment of network equipment

Support

Telstra has Australia's largest technical field force spread across the country to respond to disasters, enabling prompt detection, repair and deployment of network equipment if required. Our Telstra Next G® network base stations also have battery backup and much of the network core infrastructure is equipped with backup electricity generators in case of power failure.

Security

The Telstra Security Operations Centre monitors all communications 24/7 on both our mobile broadband and fixed-line networks to ensure the security and confidentiality of communications.

7. TELSTRA MOBILE BROADBAND AT WORK

The Telstra Next G® network has already proven its worth for many ESOs across the country. In fact, the adoption of the network by emergency services shows a significant degree of confidence in its resilience and capability. The benefits have been undeniable.

Situational awareness has improved

Situational awareness is one area that has improved. Seamless connection between the Telstra Next G® network and ESO networks allows a range of services to be accessed by first responders in the field, or operators and incident commanders in operations centres. These include real-time video, geographic information, telemetry and more. The ability to have a clear picture of the incident can help ESOs respond more quickly and appropriately.

Fire brigades use video streaming in real time over the Telstra Next G® network to enhance situational awareness. Live video is being sent from the front via fire engines, aerial ladder platforms, and helicopters. Footage can be viewed by senior officers via BlackBerry® as well as forward incident controllers, so they can make operational decisions on the spot. Command and control has improved with better mobile communications as well. The ability to communicate with operatives in the field enables operations centres to make more timely and effective tactical decisions, and maximise the use of available resources.

Source: Telstra Customer Case Study[5]

Officer safety has benefited

Officer safety is another area that is benefiting from the advanced capabilities of mobile broadband. For example, in-vehicle GPS tracking is being used to ascertain the location of field personnel so they can be warned or assisted if danger arises. Police are also downloading information in real time which helps to warn them of the type of incident they are responding to.

WA Police officers are using the Telstra Next G® network to log onto police applications such as electronic mapping systems to download street maps and floor plans. They can access details of people who have called for assistance if they are on police information systems and can request a list of persons of interest within a 150 metre radius of their location.

Source: Telstra Customer Case Study[5]

7. TELSTRA MOBILE BROADBAND AT WORK

Personnel can do more or better quality work in less time

Mobile broadband is demonstrating its capacity to improve productivity – always a priority with limited emergency services budgets. The ability to do more or better quality work in less time assists emergency service personnel to perform their duties even if incidents increase in number and severity. It also helps reduce the effect of staffing constraints.

WA Police were originally recording 800 enquiries per day from officers seeking car registrations, checking addresses and other factors concerning criminal history. More recently, they recorded 360 devices logging in on a single day, making 26,200 enquiries.

Source: Telstra Customer Case Study[5]

8. CONCLUSION

Mobile broadband communications deliver substantial benefits to the Australian public safety and security sector. These include improvements in command and control, co-ordination between agencies and governments, situational awareness, productivity and officer safety.

In a perfect world, allocating spectrum to public safety and security to build private broadband networks might be an attractive option. In the real world, financial and practical considerations clearly suggest otherwise: the cost of building and maintaining private ESO mobile broadband networks across Australia would be prohibitive. A more cost-effective method is to use the unique capabilities of Australia's largest commercial wireless broadband network.

Australia is in a unique position since the Telstra Next G® mobile broadband network already covers 99 per cent of the population. It provides better in-building penetration, speed, reliability and can link seamlessly with private ESO networks. The Telstra Next G® network is also supported by Australia's largest and most geographically dispersed technical field force, and backed by standby measures such as the Telstra CoW and SatCoW. Enhancements to the network will soon see QoS to give greater certainty for emergency communications in times of heavy demand on the network.

Many ESOs have already displayed their confidence in the network's resilience and capabilities. As the Telstra Next G® network continues to expand in speed, capacity and coverage, we believe it can deliver emergency-grade mobile broadband for public safety and security, and will be by far the most economical option.

9. APPENDICES

The Telstra Next G® network

Technology Facts

- The Telstra Next G® network is built upon the 3GPP standards, which defines a migration path of increasing speeds and capabilities on HSPA+ to LTE and 4G technologies, and on to fourth generation technology, Long Term Evolution Advanced (LTE-A) which is expected to deliver 1Gbps* peak network downlink
- The Telstra Next G® network builds upon the established 3GPP world standard used by more than 89 per cent of mobile phone services across the globe
- Coverage can typically extend 20 to 70 kilometres out to sea from mobile base stations located near the coast. Maritime coverage maps are available on Telstra's website and display more than one million square kilometres of out to sea coverage
- On 24 December 2008, Telstra became the first operator in the world to activate HSPA+ 21Mbps technology^ on a live network
- HSPA+ capability on the network allows us to carry more customers and their traffic at the same time and makes the network more efficient in the way it handles traffic
- From 24 August 2010, customers with a Telstra Ultimate® USB Modem (Dual Channel compatible) were able to experience typical user speeds of 1.1Mbps-20Mbps in all capital CBDs and selected metropolitan, regional and rural areas.

User Experience

With more than 7,000 base stations across Australia operating at a lower frequency than other 3G networks, Telstra Next G® network customers enjoy more consistent performance across the network to enhance user experience:

- Call establishment and reliability on voice
- Signal strength that supports better in-building penetration
- An always 3G experience for data and voice, with no need to drop back to 2G
- An industry leading network performance for call drop rates at much less than 1 percent
- On average faster data throughput uplink and downlink.

LTE

- LTE has been on Telstra's technology roadmap since 2005 and we have been watching global LTE developments closely
- Telstra carried out three trials of LTE technology in 2010, including urban and rural evaluation
- LTE is an exciting new step for Telstra, although it is not a revolution for our network technology because HSPA+ is already setting the benchmark for our customers' experience. We are already achieving speeds and capacity that are among the best in the world so we do not see it as delivering a quantum speed increase
- LTE is an evolution for Telstra and is an option to allow us to carry more capacity. We will upgrade to LTE when the time is right.

* Peak network speed. Actual customer speeds will be lower.
^ Peak network speed. Next G® Network customers using compatible devices experience typical download speeds of 550kbps-8Mbps and typical upload speeds of 300kbps-3Mbps in all capitals and selected regional areas.

10. ABOUT THE AUTHOR

Alex Stefan

Alex Stefan is the National General Manager, Public Safety and Security for Telstra Enterprise and Government. Based in Brisbane, Alex is responsible for overseeing Telstra's customers in the justice and emergency services sector. An industry veteran with over 24 years' experience, Alex's expertise is in the provision of 24/7 ICT systems in support of mission critical operations for the police, ambulance, fire and state emergency services.

Prior to joining Telstra Enterprise and Government, Alex spent eight years as the Chief Information Officer for the Department of Emergency Services (DES) Queensland, which includes the Queensland Ambulance Services (QAS), the Queensland Fire and Rescue Service (QFRS) and Emergency Management Queensland (EMQ). In this role, Alex managed a team of 230 professionals on a state-wide level and coordinated the Department's information management and ICT strategies in line with its business goals. Earlier, Alex spent 11 years in senior management roles at the Queensland Police Service.

Alex holds a Bachelor of Science from Griffith University. He is also an Associate Fellow of the Australian Institute of Management and a Senior Member of the Australian Computer Society.

11. REFERENCES

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Why Telstra?

Telstra provides network services and solutions to more than 200 of the world's top 500 companies. They rely on us to do business across 240 countries and territories and to enable greater productivity, efficiency and growth.

Telstra solutions offer the best of all worlds – skilled people and a rich portfolio of services delivered on our world-class Telstra Next IP™ network and Next G™ network. To ensure reliable performance, they're monitored and maintained from our dedicated centres using advanced management and operational systems. And they're backed by Telstra Enterprise-grade Customer Service® and one of Australia's largest and most qualified field and technical workforce.

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT **ALEX STEFAN, NATIONAL GENERAL MANAGER, PUBLIC SAFETY AND SECURITY**
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