

Public Safety

Mobile Broadband

Independent Submission to the Productivity Commission

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by Professor Reg Coutts
<http://www.couttscommunications.com>



CouttsCommunications

Telco Subject Matter Expert

*ICT Consulting – wireless,
telephony and broadband
specialisation*

Acknowledgement

This submission is independent of any of my clients interests. While I acknowledge that Vodafone has funded me to consider the future of the USO, they have not sought my views on **PSMB**. My submission does draw on the views (and some text) of the Vodafone submission, I only do so when I am in agreement but includes additional views in relation to the NBN.

Introduction

I welcome opportunity to comment on the Productivity Commission's Issues Paper of Public Safety Mobile Broadband (**PSMB**). Decisions over the PSMB network will have significant implications for the telecommunications infrastructure in Australia.

I strongly support the Productivity Commission's decision to undertake a first principles analysis of this issue. This is the best means of ensuring the proper identification of benefits and costs, as well as any unintended impacts each option may have for competition within the mobile services market.

I believe a hybrid approach is the best option. The Productivity Commission should be cautious in its assessment of options that require PSAs to either build a separate specialised network OR rely on a single MNO to deliver PSMB services. The presence of three MNOs is not necessarily sufficient to constitute a competitive market for public mobile communications let alone assure the delivery of PSMB services.

Options that involve PSAs contracting with a single MNO to deliver PSMB services will likely further distort competition in the mobile services market. The potential award of large government contracts, which could include capital payments for network coverage augmentation or upgrades to network resilience, to a single MNO is likely to have adverse effects on mobile competition. While I believe the envisaged PSMB network should not be a separate network and should integrate with the MNOs extensive network infrastructure, it should not distort the mobile services market.

I believe that public safety agencies have the opportunity to develop a more innovative and collaborative cross-industry approach and use their sizable expenditure to enhance the state of the market rather than distort it. This requires implementing a solution with multiple MNOs rather than pursuing a solution with a single MNO.

I agree the Productivity Commission should consider a service provider model one of which is suggested by Vodafone to utilize multiple MNOs on a "pay-per-use" basis. There are alternatives. An innovative model not examined in this submission is being pursued in the US. Rivada¹ an independent commercial entity argues there is an opportunity to provide wholesale spectrum on a true 'on demand basis' but with priority access. I am overall persuaded a multiple MNO model will improve ex-post contract contestability as well as delivering additional benefits:

- better coverage redundancy;
- more capacity – all participating MNOs provide slices of capacity during

¹ Rivada <http://rivada.com> has patented Dynamic Spectrum Arbitrage and Tiered Priority Access and plan to fund and build LTE networks in the USA and elsewhere based primarily on receiving the right to wholesale capacity not needed for public safety. They believe that there is growing demand for spectrum and an opportunity to profit from spot prices. They are getting a good hearing around the world and seem to be influencing the USA planning for a national public safety network.

critical incidents;

- commercially optimised for PSAs to get the best offer for ‘business-as-usual’ and planned events; and
- maximises the use of spectrum assets for the public benefit.

I consider there is significant merit for PSAs and for taxpayers under the multiple MNO model. I urge the Productivity Commission to consider this option further and I am happy to assist.

Given the particular challenge of the future PSMB network providing services outside metro areas, further issues which are outside the scope of the Productivity Commission Inquiry but are relevant to the Government’s consideration are:

- how the NBN fixed (currently!) wireless infrastructure can be of potential benefit in considering a future PSMB network
- the potential² for a revised USO which might include both fixed *and* mobile broadband, would further impact any solution

Network technology

The choice of Network Technology is now the easy part and presents a real opportunity for realizing a sustainable, best of breed PSMB network for Australia.

Historically, Public Safety Agencies (**PSA**) have relied on dedicated ‘land mobile radio’ (**LMR**) networks to provide basic (mainly voice) communications. PSA networks are now reaching ‘end of life’ and they do not provide the potential broadband capability that is possible using modern telecommunications technology. The lack of genuine broadband capability inhibits PSAs from effectively and efficiently performing routine operations and responding to critical incidents. PSAs require a new communications network that is capable of delivering the full suite of telecommunications services.

I understand PSAs requirements are somewhat different to those of a typically commercial Mobile Network Operator (**MNO**). PSAs place much greater emphasis than MNOs on particular characteristics including:

- very high security protocols,
- greater resilience,
- prioritisation
- capacity during peak demand periods.

² There is now public discussion on suggested changes the USO policy. I have suggested the inclusion of both fixed and mobile broadband.

I believe an additional characteristic – longevity or economic sustainability – should be critical to the assessment of PSAs’ requirements. Network longevity is a function of technology lifecycles. These lifecycles can be prolonged through choosing standardised, widely adopted network technologies rather than proprietary technologies. In the mobile industry, this prolonged technology lifecycle is evident through the evolution from the first generation AMPS networks of the eighties to the second generation GSM networks of the nineties, then on to the third generation WCDMA networks at the turn of the century through to the fourth generation LTE networks of today.

Proprietary network technologies may meet PSAs short-term needs, but they will make it difficult for PSAs to integrate new radio-communications innovations and may limit PSAs’ scope to deploy their own network applications. The use of standardised technologies has propelled the mobile industry forward. By contrast, companies that have pursued proprietary technologies or less widely adopted standards (e.g. WiMax) have typically not survived in the wireless broadband industry.

Internationally, new network technology for PSAs is gravitating toward mobile (e.g., 3GPP) standards. This is a positive step and provides PSAs in Australia the opportunity to capitalise on this trend regardless of whether they build their own network or acquire services from MNOs. By leveraging the incentives the mobile industry has itself to continue to drive standards’ development, the public safety mobile broadband network will insure itself against technological obsolescence and prolong the useful life of its network investments.

PSAs have expressed a desire for voice and data interoperability between different agencies within a State/Territory and with agencies in other State/Territory/national jurisdictions. The use of mobile technology standards supports inter-operability as this is an essential feature in the mobile industry. In that context, the use of standardised mobile technology has a second important dimension – the potential for interoperability between PSA and MNO networks. Both inter-jurisdictional and PSA/MNO interoperability dimensions are critical for maximising the utility of the PSAs’ networks and ensuring that PSAs’ requirements are met in a cost-effective manner.

The use of standardised mobile technologies is likely to low end-user device costs when compared to proprietary technologies. However, PSAs may have a range of purpose-specific device costs that may make devices more expensive than typically is the case for MNO devices.

Services

I understand the Productivity Commission has identified three broad categories of services required by PSMB networks:

- **voice services** including push-to-talk, dispatch and group communications;
- **download / upload of high resolution imagery** including satellite images,

biometrics (e.g., fingerprints), images of persons of interest, building layout maps; and

- **video streaming and live video feed** including remote medical support, in-progress incidents or surveillance, wireless clip-on cameras, in-building fire rescue and airborne assessment of fire and flood scenes.

The desired service availability across these categories is very high, with 99.999% availability or better and failover and recovery mechanisms for mission-critical radio services.

The services identified belong in the network applications layer rather than the connectivity layer. For this reason they are related to, but somewhat independent of the connectivity layer decision. While the design of the network applications layer and the connectivity layer should be performed by a single entity, it is possible to use one supplier to build and operate the connectivity layer, while another supplier provides the services operating in the network applications layer. There is merit in considering the separation of these layers during the next phase of the Productivity Commission's Review.

The service categories noted above could be augmented by emerging machine-to-machine technology to deliver a more comprehensive telecommunications solutions for PSAs. Examples of machine-to-machine services include:

- **remote sensing** including early detection of rural fire incidents and traffic incident monitoring;
- **vehicle and asset tracking** to facilitate logistics management and incident response;
- **monitoring and alarms** (e.g., remote health and medical services).

I agree there are other well-established technologies that PSAs may find useful to augment their PSMB services. For instance, Vodafone has provided paging services to some PSAs for many years now. Paging has proven highly economical, reliable and efficient at alerting responders to critical incidents. It has also proven a resilient solution where cellular technology cannot be used or where cellular coverage is limited.

It is also important to consider the PSMB network requirements in the broader context of public safety communications requirements. For instance, communications with the public is often an important part of public safety responses during critical incidents. Today, the National Emergency Warning System (**NEWS**) is an example of how PSAs cooperate with MNOs to deliver public communications. Changes to the technology capability of PSAs could improve the efficiency, effectiveness and reach of public communications beyond traditional mobile channels to include channels like social media.

Prioritisation

The Productivity Commission suggests PSA demand for communications services can be split into three categories. I agree with the notion proposed by Vodafone to split PSAs telecommunications needs into four categories as the resource inputs required for critical incidents will vary depending on the nature of the incident:

- **business as usual** – such as responding to general incidents that involve a limited number of PSA officers. In modern contexts, it may also include the routine collation of sensor information. Demand for business as usual communications services is relatively stable and predictable.
- **planned events** such as major sporting events, music festivals or G20 meetings which require a larger than usual PSA presence. During these events, demand for communication services is expected to be relatively high in localised areas and it is predictable.
- **localised, large scale emergency incidents** – includes terrorist attacks, siege situations, fires in major buildings or other infrequent incidents which require large, cross-agency PSA responses. During these incidents demand for communications is expected to be very high in localised areas.
- **wide-area, large scale emergency incidents** – includes large bushfires, major floods, tropical cyclones and other that have significant impacts over a wide-area. Typically, these incidents occur in regional locations or on the outskirts of major incidents however they can occur in major cities (e.g., 2003 Canberra bushfires). During these incidents demand for communications is expected to be high over wide areas (and ongoing use of mobile networks by the community will typically be essential). Different geographic locations can be classified into broad risk categories, which facilitates forward-planning of network requirements.

The geographic aspects of PSAs needs are important to consider in assessing the requirements for a PSMB network. Demand for network **capacity** can be expected to reflect areas of population density and business activity, however demand for network **coverage** may exceed existing mobile network's coverage in some circumstances. In metropolitan areas, PSAs are likely to desire blanket coverage across greater city locations. In regional areas, coverage may be required at remote property locations, on infrequently used roads (including unsealed roads) and in remote bush lands.

This issue is particularly relevant to how best to utilize the rural infrastructure of the MNOs (without distorting competition) and leverages the NBN infrastructure.

Build or buy?

The fundamental choice facing governments, and the subject of the Productivity Commission review, is whether PSAs should **build** a dedicated PSMB network or

buy services from a commercial MNO or pursue some hybrid of these two options.

Building a PSMB network

Networks are expensive to build and manage. Capital costs associated with site acquisition, building a tower, deploying network equipment and installing transmission infrastructure are very high. Additional capital costs will be incurred in building core networks and data centres, with these costs likely to be duplicated across each jurisdiction (and depending on agency arrangements they could be duplicated within a jurisdiction). Operating costs include electricity, maintenance, site lease costs and may include transmission lease costs and managed service fees.

Nevertheless, the build option (and various increments of the build option) should be fully explored by the Productivity Commission. The build option may provide a viable approach to meeting business-as-usual PSMB requirements. A PSMB network would not necessarily need to duplicate existing access network infrastructure. Indeed, there is significant scope to reduce the cost of building a PSMB network through a careful choice of spectrum bands and through leveraging existing telecommunications infrastructure.

Even if PSAs pursue a build option, developing relationships with multiple MNOs and with the NBN is likely to be of benefit. This will ensure cost-effective network deployment and to ensure appropriate access to available spectrum resources during critical incidents. Co-location of sites with MNOs and the NBN, combined with location of sites on Crown Land, will reduce deployment costs. Rather than pursuing exclusive arrangements with a single MNO, PSAs should utilise the site portfolios of multiple MNOs to determine their optimal set of site locations. In addition, the ubiquitous access network being built by the NBN means the cost of backhaul for PSAs might be based on the incremental cost of the NBN connecting PSMB network locations. These factors make the cost of building a PSMB network much lower than is the case for a standalone, “greenfield” telecommunications network. PSAs could form co-location and roaming agreements with multiple MNOs to maximise contestability during the contract period.

A build option will provide PSAs with full control over purpose-specific aspects of the PSMB network. By contrast, while MNOs can theoretically provide a PSMB network with “mission critical” capability, this may require access to new spectrum, physical upgrades to existing network sites, core network upgrades and costs in designing and building purpose-specific network applications.

If PSAs identify requirements to build new sites beyond existing MNO and NBN wireless footprints, there may be opportunities for PSAs to defray their incremental capital and operating costs. PSAs could generate cost recovery revenue streams by encouraging MNOs to co-locate at the new sites and, if they choose to do so, by selling transmission capacity to these sites. Similarly, PSAs that are allocated dedicated spectrum could significantly reduce the opportunity cost of being allocated this spectrum if they sell excess capacity during non-critical incidents (while ensuring protocols are in place for priority access when a critical incident occurs). If PSAs build and manage PSMB networks then it may be beneficial to appoint a PSA telecommunications authority to coordinate State/Territory solutions, and to establish

a national committee to take responsibility for ensuring interoperability and defining standards and protocols for inter-agency use of the PSMB network.

A multiple MNO service model

An alternative, less infrastructure dependent approach to delivering a PSMB services is for PSAs to pursue a service provider model underpinned by agreements with multiple MNOs on a “pay-per-use” basis. This solution could be implemented via agreements with two or three MNOs. In addition to significantly improving ex-post contract contestability, a multiple MNO solution would deliver several benefits:

- better coverage redundancy;
- more capacity – all participating MNOs provide slices of capacity during critical incidents;
- commercially optimised for PSAs to get the best offer for ‘business-as-usual’ and planned events; and
- it maximises the use of spectrum assets for the public benefit.

The proposed multiple MNO solution requires participating MNOs to implement Quality of Service prioritisation capability in their Core Network. It will also require arrangements to enable PSA services (USIMs) to roam on each participating MNO (and roaming agreements may be required between MNOs). PSAs will be able to steer their USIMs to the desired network as required and do so in a way that maximizes contestability (e.g., a dynamic pricing approach might introduce contestability via an auction process). If the PSA identifies coverage gaps to the multiple MNO solution, incremental network build could be charged on a cost recovery basis taking into account any commercial value co-locating MNOs receive from the additional coverage.

The option of directly procuring some telecommunications services from MNOs is likely to be attractive in certain circumstances. For instance, the provision of wide-area machine-to-machine services is supplied in a more contestable market than general mobile services (as less spectrum capacity is required and there are lower deployment and backhaul costs). Moreover, machine-to-machine technology is developing rapidly and MNOs are more likely to stay at the cutting edge of those developments and have an incentive to offer innovations to PSAs given the contestability of the market.

Issues with the single provider model

The traditional tender process for PSA telecommunications services has not delivered value for money and resulted in distorting the adjacent mobiles market. MNOs who deliver to the specifications required by a PSMB network may require additional spectrum and may incur significant incremental costs, which they will recover via their contracts with PSAs. As such, any cost-benefit analysis must consider the unintended flow-on impacts, the award of such a contract (and possibly additional spectrum) to a single MNO will have on competition in the mobile services market.

Moderate savings in the procurement of PSMB networks could be offset by the economic cost of a less competitive mobile services market that could ensue from the award of such contracts.

I agree one should not consider charging a single MNO with the task of delivering a PSMB network will deliver the best outcome for PSAs for the following reasons:

- **Lack of genuine contestability** among MNOs to deliver a PSMB network – Telstra is widely recognised as delivering superior geographic coverage and enterprise solutions. It is unlikely that other MNOs can effectively compete with Telstra to deliver PSMB services if geographic coverage is a relevant. It would therefore be difficult for PSAs to establish a competitive procurement process for the delivery of PSMB services and make it less likely that innovative PSMB solutions will emerge.
- **Avoidance of lock-in.** Once a network partner is selected it will be very difficult to change to an alternative provider and PSAs may be economically captured by their service provider. While there may be perceived short-term benefits from selecting a single MNO as a partner, the economic cost of such a decision may significantly increase through time particularly if PSAs cannot switch to alternative suppliers at a later date.
- **Need to maximise opportunities to leverage MNO assets in PSMB network.** Each MNO has spectrum, sites and transmission assets that could be utilised by a PSMB network. If PSAs select a single MNO as a partner it may unduly limit the utilisation of assets held by other MNOs (and is almost certain to distort the economic incentives for pursuing this option) leading to higher cost or constrained capacity choices during low probability, high impact emergency situations.

Spectrum requirements

Spectrum is an essential input into the provision of a PSMB network. Under the multiple MNO service provider model, PSAs may not need additional spectrum. However, under any of the models where PSAs have greater responsibility for infrastructure decisions, spectrum will be an essential requirement. Of course, allocating spectrum to PSMB networks may have significant opportunity costs, particularly if that spectrum deprives mobile networks of the capacity required to support consumers' forecast demand for mobile broadband services. Hence any decision over allocating spectrum to PSAs must be carefully considered.

PSAs' temporary demand for network capacity during critical incidents can be met without depriving the mobile industry of valuable spectrum resources. The temporal aspects of PSAs' demand for spectrum capacity during critical incidents enables innovative sharing solutions that minimise opportunity costs. For instance, MNOs could set up prioritisation protocols for PSAs to access existing spectrum when it is required during critical incidents. I would also encourage the Productivity Commission to explore this option during the next stage of the Review.

That said, dedicated spectrum may be deemed appropriate for PSAs to meet business-as-usual PSMB needs. It is therefore important that spectrum solutions are tailored to PSAs' specific requirements. I understand the most effective connectivity solution for PSAs will be one that:

- delivers widespread geographic coverage, with higher baseline capacity in metropolitan areas and high risk regional locations;
- enables capacity to scale for localised and wide-area emergency situations;
- enables deployment of ultra-high capacity solutions for localised, large-scale emergency situations as required; and
- delivers a cost-effective approach to remote sensing, vehicle/asset tracking and monitoring/alarms.

These requirements suggest a multi-band spectrum solution, as envisaged by the ACMA. However, I can see merit in proposed modifications to the ACMA proposal by Vodafone that would enable more efficient delivery of PSMB solutions while minimising the under-utilisation of spectrum when it is not required for critical incidents. If spectrum is required by PSAs, I can see merit in a solution that comprises internationally harmonised LTE spectrum in the 400 and 800 MHz bands. This could potentially be augmented by drawing on MNOs spectrum in the 900 MHz band and potentially in higher frequency bands.

I note the leadership from the ACMA³ identifying the need for spectrum to support national smart infrastructure to working with Government and industry and could be tasked to evaluate the various options canvassed by industry.

However, I would strongly oppose the use of unallocated 700 MHz spectrum for a PSMB network as this band is the most internationally harmonised for mobile use and will be required by Australia's mobile networks in the future. It will be critical to meeting the future data demands of mobile consumers. Given the array of spectrum options available for a PSMB network and international standardisation of the 800 MHz band for Public Protection and Disaster Relief, we do not consider there is any merit in exploring the use of the 700 MHz band by PSAs.

I agree it is likely that the Productivity Commission will need to rely on direct calculation approaches to measure the opportunity cost of allocating specific spectrum to PSMB purposes.

Concluding remarks

A PSMB network will have a profound impact on the delivery of services for Australia's PSAs and deliver enormous benefits to first-responders in the police, fire,

³ See <http://www.acma.gov.au/theACMA/About/The-ACMA-story/Meeting-our-standard/spectrum-for-national-smart-infrastructure>

ambulance and emergency services. It is also important to realise that decisions over the PSMB network will impact adjacent markets, of which the mobile services market is probably the most relevant but the relationship to the NBN is equally important. In this context, the Productivity Commission's first principles approach to developing Cost-Benefit Analysis (CBA) is particularly important. It is imperative for the Productivity Commission to consider the direct impacts of the PSMB network on the delivery of Public Safety services and the indirect impacts that building and operating a PSMB will have on competition in the telecommunications industry. I have canvassed options that will meet the requirements of PSAs, while minimising the opportunity cost from setting aside spectrum for low frequency, high impact incidents. I look forward to further exploration of these options during the next stage of the Productivity Commission's Review.

Attachment - Professor Reg Coutts – Brief CV

Summary

After 17 years in Telstra from 1976 till 1993 covering research through to executive management when Dr Coutts was appointed to the Chair in Telecommunications at the University of Adelaide. As well as research and some teaching, the role was to build links between the University and the telecommunications industry. At the end of 2003 Professor Coutts left the University as Emeritus Professor to establish his own company Coutts Communications Pty Ltd (www.couttscommunications.com) that provides strategic advice to government and industry both in Australia and overseas. In mid 2006, Professor with a business partner established a new telecommunications venture Red Button Technologies www.redbutton.com.au.

The breadth and scope of his experience across the industry, government policy, legal disputation, research and technical innovation domains have given him management experience together with the acquisition of interpersonal and political skills very useful in isolating areas of disputation and building consensus. His depth of experience, knowledge and expertise has been particularly recognized recently with his appointment to the Government's expert panel in 2008 on broadband and in 2010 with his appointment as a part-time member of the national regulator the ACMA www.acma.gov.au

Throughout his career particularly from the early 1990s, Professor Coutts has contributed to the technical, economic and regulatory evolution of spectrum management practices.

Reg holds a BSc, BE (Hons) and PhD degrees from the University of Adelaide and is a Fellow of the Australian Institute of Engineers (IEAust) and a Senior Member of the American Institute of Electrical and Electronic Engineering (SMIEEE) and a Fellow of the Australian Computer Society (FACS). In 2010 Reg became a graduate of the Australian Institute of Company Directors (AICD)

Examples of Consultancies

As **Coutts Communications** since 2004 particular examples of recent experience as Coutts Communications are:

- Conducted a series of pilot interviews for the Collaborative Research Centre's (CRC) Smart Internet 2010 in January 2004. This involved looking at issues relating to the future of the Internet from the user's perspective including spam, digital rights management, the trade-off between cost and quality, fixed and mobile access to the internet, and the impact of other applications using IP such as VoIP.
- Provided expert advice in 2004/2005 on "man made radio noise" to the West Australian Planning Authority. The advice through their legal counsel was on behalf of a group of landowners arguing against the objections by Telstra Corporation to the rezoning of land adjacent to one of Telstra's major satellite

earth stations.

- 2007 as part of a task for the Australian economic regulator the ACCC on the comparison of WiMAX and HSPA technologies, a key question in was the likely availability and utility of suitable spectrum. This issue is very important in the consideration of broadband options in regional Australia.
- In March 2008 the Minister for Broadband, Communications and the Digital Economy, Senator the Hon Stephen Conroy, announced the 6 member Panel of Experts which included Professor Reg Coutts to assess proposals to build the National Broadband Network to advise the Government on the awarding of a A\$4.7 billion contract to part fund the construction of the national broadband infrastructure. The panel submitted its report to the Government on the 21st of January 2009. The Government incorporated the advice of the Panel of Experts into the NBN policy announcement of April 9th 2009 to build the \$43 billion FTTP network now being implemented. A key platform technology for the NBN that was advised by Professor Coutts was the Ka band satellite component.
- At the end of January 2009, Professor Coutts appeared as an Expert Witness before the Judicial Enquiry into the conviction of Mr Phuong Ngo for organising the murder in 1994 of the NSW Politician Mr Newman.
- Through 2009/12 Reg advised a number of clients in Australia and the US on their strategies to take best advantage from the Government's NBN policy.
- Since 2009 Professor Coutts has acted as an expert witness in various legal cases in regard to the use of mobile phone records
- In October 2010, Professor Coutts was appointed by the Government for a 5-year term as a part-time member of the Australian Communications and Media Authority (ACMA see www.acma.gov.au) which is the national regulator of the ICT industry in Australia much like the Federal Communications Commission (FCC) in the USA. He resigned in May 2014 to resume private practice.
- Since 2011 to the present Reg provides expert advice on Spectrum Auctions outside Australia
- In 2014 Reg undertook a study for Commercial Radio Australia (CRA) to consider the capability of mobile broadband networks to obviate the need for broadcast digital radio (<https://www.radioinfo.com.au/news/mobile-good-supplement-not-replacement-radio-new-report>)