



SUBMISSION TO THE DEPARTMENT OF BROADBAND COMMUNICATIONS AND THE  
DIGITAL ECONOMY

ON

BACKHAUL BLACKSPOTS INITIATIVE STAKEHOLDER CONSULTATION PAPER

AARNet Pty Ltd

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## **EXECUTIVE SUMMARY**

The Internet was born 40 years ago in a lab at the University of California. Today it spans the entire planet and is ubiquitous in the daily lives of more than 1.5 billion people.

It is easy to forget that it was the research and education community that was responsible for the introduction of the Internet. These institutions are the heart of demanding, advanced scientific applications. Universities are also the source of innovation in health care systems, cutting-edge health research, medical education, clinical care, and rural telemedicine. The bandwidth demands of today's advanced scientific applications – tens of gigabits per second – foreshadow similar bandwidth needs in homes and businesses in the future.

AARNet Pty Ltd (AARNet), as Australia's NREN, is therefore pleased to make this Submission to the Department of Broadband Communications and the Digital Economy (the Department) on the Backhaul Blackspots Initiative Consultation Paper.

AARNet makes this Submission on behalf of its Shareholders, the 38 Universities and CSIRO, who acknowledge AARNet as essential, enabling digital infrastructure for research and education both nationally and internationally:

AARNet welcomes the opportunity to comment on the approach being determined by the Department to address Australia's regional Backhaul Blackspots and endorses any initiative designed to provide access to long haul fibre in the underserved areas of Australia. AARNet submits that:

- a National Research and Education Network (NREN) such as AARNet deserves special consideration as a critical enabler and transformative power of an innovative economy (the rationale for which is set out in Appendix B);
- for Australia to outperform on innovation metrics, periodic government co-investment is required to provide equity of access for all and to enable the step changes that are provided by AARNet as a “digital staircase” in innovation for the Digital Economy;
- in a nation the size and scale of Australia, the geographic isolation of Australia also requires focus on international connectivity out of Australia; and

- the AARNet model of partnerships with infrastructure providers has produced a long term core national asset for research and education network infrastructure across Australia.

The Backhaul Blackspots Initiative is a vital precursor in meeting any of the objectives of the National Broadband Strategy. AARNet does not intend to comment on the competitive and regulatory issues impacting backhaul in Australia; suffice it to say they are inextricably tied to the success of the Government's vision. Rather, this Submission highlights what is necessary to continue AARNet's transformative role in the creation of innovation, jobs, and economic growth and on the infrastructure necessary for researchers to create the new tools for health care, education, and a low carbon economy.

The difficulties associated with the provision of backhaul transmission to the competitively underserved areas of Australia are widely acknowledged and well understood. AARNet acknowledges the Department's priority will be to facilitate backhaul for service providers to deliver vastly improved retail broadband services. However the passage of time has meant that AARNet has, in certain areas, already overbuilt commercial carriers who have been unable or unwilling to provide access to their infrastructure at the infrastructure layer. The immediate connectivity requirements for AARNet's customers means that the commissioning of civil works will continue.

In building the Australian NREN, AARNet has always worked collaboratively with government and with the corporate community – with telecommunications companies and others with a stake in advanced technology to create infrastructures that can quickly be hardened and deployed more broadly.

AARNet would submit that the proposed Backhaul Blackspots RFT should mandate:

- an allocation of dark fibre to Australia's NREN (AARNet), or that the infrastructure be available at a minimal cost;
- the infrastructure builder/s have a proven track record in the building of national long haul fibre links to ensure the integrity and quality of construction;
- the infrastructure providers/s have a proven track record in the ongoing operation of an integrated network to continuously maintain and operate the network infrastructure to a high level of performance;

- a limited and guaranteed timeframe associated with the proposed planning, construction and commissioning of backhaul infrastructure; and
- the ownership and operational arrangements of the resulting infrastructure that will guarantee the granting of a long term (for the life of the asset) Indefeasible Right to Use (IRU) ; we believe that the duration of these IRUs should be for the life of the fibre (72 years).

AARNet operates one of the largest research and education footprints in the world. It would diminish the value to a national entity to have infrastructure built on a state by state basis.

There is a direct and relevant parallel to the history of rail in Australia, which is most eloquently set out on the Australian Governments own web site:

<http://www.infrastructure.gov.au/rail/trains/history.aspx>

***Sadly planners gave little thought to connecting their railways with the other rail systems.***

*By Federation in 1901, all States except Western Australia were 'linked' by rail and more than 20,000 km of track had been laid. Sadly, those who envisaged a nation had not contemplated a national rail network. Three different gauges had been used.*

*New South Wales adopted the European standard gauge of 1435 mm, Victoria and South Australia built with the broad Irish gauge of 1600 mm, and Tasmania, Queensland, Western Australia and parts of South Australia used the narrow 1067 mm gauge. For many years, the different gauges handicapped the effective operation of interstate rail services.*



*In 1917, a person wanting to travel from Perth to Brisbane on an east-west crossing of the continent had to change trains six times.*

*The independent development of the State rail systems led to significant incompatibility problems, not only in relation to gauge but also equipment and operating practices.*

## 4 ISSUES FOR CONSULTATION

For ease of compilation of responses by the Department, AARNet has retained the Departments Consultative Paper clause numbers.

### 4.1 BACKHAUL BLACKSPOT LOCATIONS

#### 4.1.1 *Priority locations that are lacking an alternative backhaul supply and the reasons for their priority*

The locations which AARNet recognises as being especially underserved, both from the point of view of its own customers and that of the wider community, include but are not limited to the following and in the approximate order of priority:

Tasmania	AARNet would submit that Tasmania should be included in the Backhaul Blackspots Initiative. Without additional competitive infrastructure coming on stream it is unlikely that long term access to competitively priced wavelengths across Bass Strait will be available.
Perth to Geraldton	AARNet's primary interest is to support the ASKAP project and potentially the SKA, as well as the education and health sector in this regional location. AARNet also views Perth to Geraldton as an anchor link in the routes north to Port Headland and potentially on to Darwin for complete route diversity.
Darwin	There is a chronic need for long term competitive infrastructure from Adelaide to Alice Springs to Darwin which, without the investment of governments, will continue to be unmet, given the vast distances and sparse population.
Alice Springs	See Darwin above.

Far North Queensland	<p>There are no providers able to offer access at the infrastructure level. There are also only two independent service providers making for very limited opportunities to extend the AARNet Backbone north of Brisbane. It is not always their policy to provide access at the infrastructure level. This severely limits for example Reef research.</p> <p>Access from Brisbane to far North Queensland opens to possibilities for a proposed Townsville, Mt Isa, Darwin route.</p>
Riverina region of Victoria and NSW	<p>There is inadequate competitive access to fibre at the infrastructure level.</p> <p>For instance, Griffith in NSW is not big enough to attract independent fibre providers but it is a major regional centre whose education and health services form part of wider regional aggregations – the fact that Griffith is a black spot for backhaul means that the health or education aggregations that Griffith is part of are severely limited in their ability to utilise aggregation wide advanced IT services. This includes TAFE and health aggregations.</p>

AARNet presumes that the definition of ‘Backhaul Blackspots’ has been drawn from the ACCC’s review of the *Domestic Transmission Capacity Service* where a Backhaul Blackspot can be generally defined by its proximity to fibre infrastructure; and the relative level of market contestability.

*AARNet would argue that Domestic Transmission Capacity is insufficient to define a “Blackspot”.* Adequate fibre deployment on the other hand has the potential, in contrast to all other communications technologies, to support a very wide range of demands, from the modest needs of many homes (eg 1-20 Mbps at present), to the high-end requirements of research and similar activity (currently in the 1-10Gbps range). Just as the Pareto Principle applies to overall needs (the 10% of users represented by research and education account for 90% of the traffic),

it also applies to the research and education sector itself, so that the high-end scientific and research users have needs that are typically 1000 times that of typical homes.

To underscore the difference in needs between those of the research and education sector and the rest of the community, the following table illustrates network growth over the past 8 years, and projects that same rate of growth (50% pa) over the next 8 years, the period covered by the NBN.

	2001	2009	2017
Most homes:	40-800 Kbps	1-20 Mbps	25-500 Mbps
Leading-edge homes	4-8 Mbps	100-200 Mbps	2.5-5.0 Gbps
Businesses	4-8 Mbps	100-200 Mbps	2.5-5.0 Gbps
Research centres	40-400 Mbps	1-10 Gbps	25-250 Gbps

*Further detail of the special nature of the research and education needs is contained in Appendix A.*

*4.1.2 possible routes for the links to the priority locations, including any potential locations where backhaul capacity should be broken out*

AARNet has identified a number of desirable break-out points on routes designed to serve the locations identified in the table above, primarily to serve the needs of research, education and health sites *en route*. We are not in a position to comment on each route or on commercially desirable break-out points to serve general community needs.

On the Perth to Geraldton route above AARNet would submit that this route should be broken out at: Metropolitan North Perth Area, Gt North Highway, Brand Highway (Gin Gin and Gravity), Lancelin, Eneabba and Dongara.

*4.1.3 the contestable market in each location and the wholesale price points required to attract interest from access seekers*

AARNet has insufficient pricing information to make any response.

## 4.2 DESIGN AND OPERATIONAL PARAMETERS

AARNet endorses the importance of establishing design and operational maintenance parameters in the assessment of industry bids with the emphasis on design criteria that ensures fair and equitable access to the infrastructure layer to allow the lighting of dark fibre for long term capacity at an economic rate.

It is important that the Department makes an investment in a long-term (life of the fibre) and sustainable architecture. In answer to the specific parameters:

<i>Design Parameters</i>	<i>AARNet Response</i>
1. the type and capacity of services and associated operational arrangements that the network operator should provide to access seekers, including the costs of delivering these services and the charges that should be levied?	AARNet does not seek capacity rather, access to dark fibre or at a minimum, access to un-contended wavelengths. AARNet would advocate Gigabit Ethernet and 10 Gigabit Ethernet (over the 8 year period) at a cost that is commensurate with metropolitan charges. Any service should be fully monitored by a 24x7 optical NOC.
2. the locations at which points of interconnect should be sited to enable secure and ready access by access seekers?	To occur at logical points of aggregation such as data centres, exchanges, radio towers etc, with a clear preference for carrier neutral facilities.
3. the timeframes and costs associated with the planning, construction and commissioning of backhaul infrastructure in various terrains and locations?	It is essential potential providers prove their ability to deliver against the criteria in committed timeframe. There is a clear preference for purpose built dark fibre.  Value for money is an important consideration in that such infrastructure is also limited in quantity and quality.

4. the extent to which fibre repeater/regenerator equipment would be required at locations other than population centres, and the approach in regard to the powering and housing of this equipment?	International network standards currently require re-gen facilities at no more than 80km spacing.
5. the relative merits of deploying links that provide an alternate route to existing backhaul infrastructure?	Alternative routes are vital for resilience and for break-out points not served by the existing infrastructure.
6. the relative merits of completing ring architectures as opposed to constructing spurs?	Ring architectures are essential to ensure redundancy and resilience.

#### 4.3 OPERATIONAL AND OWNERSHIP ARRANGEMENTS

##### 4.3.1 *Building new optical fibre*

AARNet is cautiously supportive of the proposed operational and ownership arrangements as outlined in the Backhaul Blackspots Stakeholder Consultation Paper.

AARNet would strongly argue that where the Australian Government funds the development of new optical fibre transmission links to the underserved areas of Australia, it cannot be just the individual companies or consortia who build such infrastructure who are the recipients of a long term infeasible right of use over a number of optical fibres.

Indeed AARNet would encourage the Commonwealth to pursue ownership and operational arrangements that will ensure open whole access for all carriers at the infrastructure layer.

##### 4.3.2 *Partnership Arrangements*

AARNet supports the view that partnership arrangements will assist a number of regional centres and welcomes the opportunity to participate in, and collaborate with, the development of

the National Broadband Network. In the course of acquiring and deploying fibre across Australia and internationally, AARNet has had a long and successful record of partnering with a variety of telecommunications companies, government agencies, utilities and others possessing or desiring fibre assets. These partnerships range from the conventional carrier, to rail corporations to electricity and gas suppliers. There is a great variation the resulting product.

AARNet has pioneered the approach being espoused by the Blackspots initiative, whereby it commissions significant fibre builds to underserved locations, reserves some of the fibres for its own purposes, but then makes the balance available for deploying to the community, business or government via an appropriate third party agency or telecommunications provider; this is well illustrated in our response to the EIF Second Round – see <http://www.deewr.gov.au/HigherEducation/EIF/Pages/default.aspx>), enabling the investment for research and education to be leveraged to also support the needs of other sectors of the community, particularly health.

AARNet would welcome the opportunity to bring forward plans to deploy fibre to meet the currently underserved areas of research and education, especially in regional and remote Australia. AARNet would be amenable to making a portion of the deployed fibre assets available to other communities, or on a wholesale open access basis to other private sector Internet Service Providers (on suitable commercial terms). The financial assistance of the Department could assist and accelerate this deployment.

There is a long and highly successful tradition of major research universities partnering with smaller institutions in unserved and underserved regions of the nation to provide advanced connectivity, making these smaller institutions and regions more competitive. These efforts will continue and further develop with the closer ties sought under the Bradley Review. These universities will require AARNet to reach out and connect their research partners, VET, K-12 schools, libraries, public safety institutions, agriculture extension sites, government buildings, aged care centres and many more.

Leveraging AARNet's leadership in the development of advanced networking with the NBN telecommunications and policy leadership will ensure that this generation and future generations of Australians will continue to compete in the global economy.

#### *4.3.3 The involvement of an existing wholesale operator*

AARNet notes that the Stakeholder Consultation paper aims for access seekers to gain access on 'equivalent terms'. This suggests the existing wholesale arrangements of certain carriers who

also provide services to themselves. This raises the question of structural separation and AARNet would draw to the Department's attention the increasing importance of independent infrastructure owners and suppliers across the world.

#### *4.3.4 Transferring the ownership of infrastructure to the NBN*

AARNet raises the practical matter of asset ownership where telecommunications capacity is provided over an existing utilities infrastructure, such as OPGW on overhead cable, inside gas pipes or simply within a mining easement. In fact it is the value of the duct which is paramount not so much the fibre optic cable.

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## APPENDIX A - ABOUT AARNET

AARNet is a proud innovator of digital technology. 2009 will mark our twentieth anniversary as the genesis of the Internet in Australia. In 1989 the Australian Universities and the CSIRO, under the umbrella of the Australian Vice-Chancellors' Committee [AVCC], initiated a project called the Australian Academic and Research Network [AARNet].

2009 also marks twenty years of a successful and enduring entity, continuously supported by its Shareholders, the research industry and government alike. A short history of AARNet is set out below. These past two decades have witnessed a revolution in global communications – attributable to the marriage of computing and communications and its remarkable product, the world-wide Internet. The internet's 'organic growth' has given rise to numerous issues, such as security and scalability, which are well beyond the control of individual countries, public or private sector corporations or individuals. AARNet submits that because of these wide ranging issues, there has been a rapid development of private networks around the world. AARNet is one such 'for purpose private network' that is increasingly referred to globally as a model for advanced research and education networks.

However no network stands alone. It is the future development of the Internet and the building of telecommunications infrastructure that will enable connectivity into these backbone or private networks. Together these world networks form the solid basis for general purpose education, scientific communication, supporting collaboration and special uses.

The future Internet will enable virtual organizations to be created by groups of individuals whose members and resources may be dispersed geographically and/or temporally, yet who are able to function as a coherent unit through the use of end-to-end networked systems. Once the exclusive domain of the academic sector, the development of the Internet is now an international and commercial business in its own right.

Twenty years ago 99% of the Australian internet traffic was between AARNet's Shareholders [the Universities and CSIRO]. A small amount of commercial traffic emerged mainly from organisations that had a close association with the tertiary and research sector. In addition to providing support for the teaching, learning and research activities of universities and research organisations, AARNet also positioned itself as a wholesale backbone Internet Service Provider [ISP]. This encouraged smaller ISPs to emerge without the requirement for extensive capital investment in international and domestic infrastructure. This strategy grew the ISP market from 2 commercial ISPs in 1992 to over 300 by June 1995. By 1995 the total use by the non-AARNet user base had increased to ~20% of total traffic and the commercial customer base of AARNet

was sold to Telstra, spawning what was to become Telstra BigPond. This stimulated further growth of the commercial and private use of the Internet in Australia.

The intellectual property and expertise transfer to industry resulted in development of the Internet in Australia that would not have otherwise occurred at such a rapid rate.

AARNet Pty Ltd was incorporated on 22 December 1998 with the sole shareholder being the Australian Vice-Chancellors' Committee [AVCC]. The company became fully operational in March 2000 after completing the transfer of functions from the AVCC, with current shareholders being the 38 universities and CSIRO.

In 2001 AARNet deployed its first international capacity by acquiring 310 Mbps of capacity from Sydney via Hawaii to Seattle. This provided access to the advanced research and education networks of many countries including North America, Europe, Japan, Taiwan, Asia and South America. In 2002 AARNet was the prime motivator in implementing GrangeNet which provided the first high capacity research network [5 Gbps] from Brisbane to Sydney and 10 Gbps between Sydney, Canberra and Melbourne. However in the same year AARNet acquired dark fibre on all segments of the Nextgen network and built a fully diverse and redundant national backbone from Brisbane to Perth. Known as AARNet3 this was officially launched at Parliament House, Canberra on the 14th September 2006.

Today AARNet has completely transformed from a reseller of commercial capacity to the owner and operator of one of the largest research and education networks in the world. With a significant infrastructure development group AARNet has had to physically build thousands of kms of dark fibre, and to collaborate with infrastructure owners and ISP's in every state and internationally to secure the last mile access. With more than 30,000 kms of dark fibre and serving more than 2 petabytes of data annually AARNet is a model of a national research and education network increasingly looked to as an exemplar by the rest of the world.

## **APPENDIX B - THE UNIQUE ATTRIBUTES OF A NATIONAL RESEARCH AND EDUCATION NETWORK**

All developed nations have National Research and Education Networks (NRENs) not only to serve the specialised network requirements of scientific research but to underpin the development of the next generation of the internet. These NRENs around the world have evolved in parallel to meet the very demanding applications of research, education and health, and Australia peers with these networks on an equal footing to form an international grid.

### **B1 THE SPECIAL NETWORKING REQUIREMENTS OF RESEARCH AND EDUCATION**

The needs of the research and education community typically encompass the high-end of general community needs, but also go well beyond them in capacity and performance requirements. However it is the Pareto principle that applies to the research and education data traffic: 90% of users account for 10% of traffic, but remaining 10% of users account for 90% of traffic.

The current wave of innovation driving the demand for high band-width includes eVLBI, the Large Hadron Collider (LHC), high energy physics, medical research and telemedicine. The data-driven experiments, simulations, and analyses of science today all require high-speed broadband to move data from remote instruments to the lab and to share massive data sets among scientists globally. The current needs of astronomy are for gigabits of data per second and at a flat cost to the astronomers. Astronomy in Australia would simply be isolated from the rest of the world without the national and international network connections of AARNet. However more important is the architecture of dedicated light paths over these network connections. Lightpaths can only be effected with access to the underlying network infrastructure.

Why does this matter? Because these scientists will help us model climate change, discover genetic markers for inherited diseases, and explore the potential of low carbon and renewable energy sources. The future is one in which:

- Scientists and researchers from around the world collaborate using the techniques of eResearch to address global issues;

- telemedicine delivers efficient and personalized healthcare to all Australians;
- telepresence saves energy costs in travel and sparks new forms of collaboration and social interaction;
- eLearning and eScience provide high-quality education to the underserved with access scientific instruments and data;
- eGovernment creates a truly engaged and participatory democracy for all; and
- eCommerce allows all communities to participate more fully in the global economy.

To serve this demanding nature of research and education AARNet requires access to infrastructure, not to managed services to enable a swift and economical response. AARNet needs a national broadband strategy that considers these needs and links innovation in our research and education sector to a rapid upgrading of the commercial broadband infrastructure. This will promote innovation in our Universities and flow on to the wider community.

## B2 THE TRANSFORMATIVE POWER OF ADVANCED NETWORKS

The university community brought us ARPANET in the 1970's, the Internet in the 1980's, the graphical World Wide Web browser in the 1990's, and Google and Facebook in the current decade. These and other transformative innovations from the research and education sector around the world have generated countless millions of jobs and countless billions of dollars in economic growth. Universities continually educate new generations of innovators, workers, and consumers.

It is the higher education and research community that has pioneered the use of hybrid networks (packet-switched & dedicated fibre); the development of federated identity and access systems; and applied research into network use and development and generally stimulated innovation and technological advances of the internet.

This pioneering role continues as the research and education community brings to bear its considerable research, development and intellectual resources on the application of the Internet to further the economic and social development of Australia.

The value of this pioneering role makes it imperative that the research and education community continue to operate in a national, inclusive and cost effective way at the far extremes of the broadband capacity scale, well ahead of the market's ability to deliver that capacity at a realistic cost.

AARNet has a proven track record, working in concert with state and regional entities with the specific aim of reaching underserved communities with connectivity *and* content that are orders of magnitude more demanding than those of the general community, business and government.

Because of the specialised nature of many of the applications it supports, AARNet (in common with other NRENs) has developed considerable skill in its technical abilities in lighting dark fibre and deploying it to meet diverse needs in the most cost-effective fashion. This capability sets AARNet apart from most other network providers and as a source of independent network advice.

The research and education community has much experience in deploying, managing, operating, and continually upgrading broadband networks on campuses. AARNet with its advanced optical networks throughout the States and regional Australia has developed the highest-performing optical backbone capability in Australia. In the course of acquiring and deploying fibre across Australia and internationally to build this network, AARNet has had a long and successful record of partnering with a wide variety of telecommunications companies, government agencies, utilities and others possessing or desiring fibre assets.

Every nation must learn from experiences at the "bleeding edge" of any technological innovation. The experiences of the R&E community have demonstrated that the acquisition of very high bandwidth is only affordable and sustainable through the acquisition of infrastructure rather than the acquisition of capacity on a managed network, "managed services".

While AARNet recognises that the funding of NBN activities may require a continuation of the practice of selling communication services based on the potential returns from managed services, it strongly believes that any national fibre network must make special arrangements to preserve a percentage of the fibre for sale at construction cost plus, to support the particular very high bandwidth needs of research and education community.

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