

**Juniper Networks, Inc.  
Submission to National  
Broadband Network  
RFP Development**

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# Introduction

This paper presents some ideas of Juniper Networks that we believe will enhance the Australian National Broadband Network RFP process, which will result in improving the chance of success of this important initiative to deliver access to world-class telecommunications infrastructure for all Australians.

Based on Juniper's worldwide experience in developing broadband solutions, we see the need to follow a standards based approach is as absolutely necessary. The general benefits of such an approach are initially discussed and are explained in the context of applicability to the Australian National Broadband Network process and achievement of the end goal

Next, the method for following a standards based approach is discussed. This is based on the use of a well constructed Reference Architecture to articulate the National Broadband Network Requirements.

Lastly Juniper Networks proposes the use of the DSL Forum's Broadband Multi-Service Reference Architecture. This is on the basis of it being the most applicable in the industry considering the end-to-end network scope and it's support for regulated wholesale broadband access.

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## Standards Based Approach

The benefits of standardisation are well understood by the broad technology industry. There are numerous organisations focused on different areas of technology which aim to bring these benefits to fruition for Service Providers as well as Consumer and Business subscribers, much of it relevant to broadband networks. The general benefits realised by following and adopting standards based approaches are presented below, all of which are directly relevant to Australia's National Broadband Network:

- **Increased ROI & lower prices for subscribers**  
Standardised solutions promote greater economies of scale for vendors, which results in lower capital expenditure costs for network operators. Less often discussed, however, is the opportunity to adopt industry best practises by following standardised approaches. This has an even greater impact overall as it leads to lower ongoing operational expenditure for network operators. Leveraging this factor for the National Broadband Network to reduce the network build and ongoing operational costs will lead to a greater return on investment and in turn will promote further investment in the National Broadband Network. This should also translate to lower prices and improved value for Australian subscribers.
- **Interoperability**  
Interoperability is traditionally achieved with a modular approach and well defined interfaces. This enables vendor solutions to address components of the overall network architecture, implementing the well defined

interfaces between modules to allow vendor interoperability. In effect interoperability promotes vendor competition.

Interoperability is a key factor for the National Broadband Network, both in the context of network equipment, but also in Australia with respect to services and service providers in a regulated wholesale environment. In Australia, it is the issue of services and service provider interoperability that is especially important. The following section, relating to the use of a Reference Architecture, details how the network ecosystem can be modularised with well defined, interoperable interfaces. This enables a fair, open-access regime promoting a sustainable and competitive wholesale and retail environment.

- Flexibility

Standards bodies and industry forums treat the provision of backwards compatibility with previous standards and best practises as imperative. This is to allow network operators to continue to provide existing services whilst moving forward to take advantage of the new capabilities.

In addition network operators, in support of their infrastructure requirements, are driving to have multiple types of access technology catered for concurrently in best practice and architecture specifications.

Both of these benefits will be significant for Australia's National Broadband Network. Firstly, we must understand that to reach up to 100% of the Australian population, multiple access technologies will be required to leverage this multi-access broadband network to deliver a consistent set of services to all Australians, regardless of location. It is important in achieving this to avoid network duplication to minimise network capital and operational costs.

Plus it is imperative that the NBN continues to provide the most advanced communications capability, so as to continue to provide the social and economic benefits to Australians. To achieve this goal, the network must be able to take advantage of new technologies as they emerge, and be able to seamlessly integrate them into the existing network

- Decreased time to market for new services

A goal of the telecommunications industry at large, including standards bodies and industry forums, is to generalise networks to support multiple services concurrently and to allow a far greater speed in deploying new services over a common infrastructure.

This will provide the best possible opportunity for retail service providers in Australia to launch their existing and future new services, avoiding to the greatest extent any impediment from the wholesale-retail separated arrangement that is decided through the RFP process.

- Leverage World Wide Experience

There are always issues and pit falls that present themselves in any new technology or network deployment, a benefit of following a standards based approach is the leverage of the collective lessons learned by the contributing organisations to the standard. In practice this means avoiding technology or deployment problems which have already been considered and addressed by the standard body or industry forum.

This will benefit the National Broadband Network by reducing costs and time to deploy as well as lowering the risk of unforeseen limitations arising in the future from choices made in the initial network deployment.

# The Need for a Reference Architecture

In addition to the benefits delivered from a standards-based approach to technology, Juniper believes it is necessary for the National Broadband Network to adopt an abstract, flexible standard Reference Architecture for the purpose of the RFP process.

What is meant by a standards based Reference Architecture is the representation of the end-to-end network, including the interfaces to relevant external components. This representation includes decomposition of the end-to-end network into functional modules, to allow easier specification of the overall network functions. The interfaces between these modules are well defined and the function of each module is specified to an appropriate level of detail. For the National Broadband Network this level of detail is likely to be the overall functional description of each module. This will allow enough structure to provide a clear definition of what the National Broadband Network is to achieve, whilst also allow flexibility for RFP respondents to provide innovative solutions. In the future the National Broadband Network operator will extend these definitions to exact nodal requirements in order to procure equipment.

In order to provide Open Access, the structure of a Reference Architecture and the clear, well defined external interfaces are absolutely necessary.

The following summarises the benefits that Juniper believes can be gained from adopting a Reference Architecture in the National Broadband Network RFP process.

## Clearly Defined Problem

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The reference to a clearly defined, decomposed network functional model will provide a means to articulate the overall goals and required capabilities of the National Broadband Network.

The definition of the interfaces interconnecting the individual modules within the National Broadband Network framework will facilitate in the overall definition as well as assist in the clear communication of the overall goals and measures of success. It will allow respondents to provide a solution to only a sub-portion of the end-to-end network, delineating at the defined interfaces according to the Reference Architecture. This takes advantage of the natural boundaries that exist in communications network technology, enabling a combination of best-of-breed vendor solutions and components as deemed appropriate.

The definition of the National Broadband Network external interfaces will be critical for the overall problem definition. Examples of these external interfaces are those to retail service providers and equipment in the subscriber premises. These interfaces will be clear drivers for the functions to be provided by the network which will be attributed to the relevant functional modules of the Reference Architecture. This will allow both respondents and the different service providers in the market place to consider how innovative services will be efficiently delivered over the broadband network to the different types of subscribers.

The use of a chosen Reference Architecture developed by a standards body or industry forum will include the defined component modules and the interface specifications. It is expected that this will be adapted and

expanded upon to articulate the Australian National Broadband Network's specific requirements, such as the wholesale and regulatory environment.

The presentation of the vision of Australia's digital economy and the clear specification of the National Broadband Network with the use of a standards based Reference Architecture will facilitate respondents in providing accurate and timely solutions to the RFP.

## **Facilitate Evaluation of Proposals to the National Broadband Network RFP**

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Further to clearly defining the National Broadband Network problem in the RFP, which will facilitate responses, the use of a standards based reference Architecture will also allow and ease objective assessment of the collective submissions.

This will ease the understanding of the relevance of responses to all or portions of the National Broadband Network and the objective comparison of competitive responses.

It is important to not underestimate the possibility for great variance in the capabilities provided in the solutions proposed for the National Broadband Network. Therefore it is necessary to reach an appropriate level of detail during the RFP process to allow evaluation and comparison on both a capability and economic basis of the final submissions.

Requiring respondents to utilise the basis of the functional decomposition as laid out in the Reference Architecture provides the structure and therefore the means to allow this evaluation.

## **Leverage Existing International Industry Progress**

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There are a number of countries that have deployed fibre based broadband networks and are providing innovative new services as a result. This experience has directly fed into the creation of associated standards and industry best practice. This is a large benefit to the National Broadband Network at this time, in providing a well established starting point upon which Australian specific requirements can be built.

It is possible and of course necessary to leverage this experience, however this should be done in a manner that is abstract enough to not be overly prescriptive of the solutions sought.

Utilising this approach will allow the RFP process to be carried out in a shorter time frame without stifling creativity and innovation. For the Australian Government to succeed in this positive initiative in a time-frame to provide maximum national benefit, this approach is a very sensible option.

## **A Unique Australia Competing Globally**

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The Australian market place has its unique characteristics and therefore requirements for the National Broadband Network, however there are developments in other markets around the world which could be desirable in Australia in the future. It is therefore very important to allow the National Broadband Network to be utilised in new ways as this can be a major input of innovation for services offered to Consumer and Business subscribers.

This can be achieved by utilising a Reference Architecture, which is a generalised solution catering for these requirements which would not immediately be presented in Australia. This will provide an opportunity for new types of services and service providers to evolve even though they may not be driving requirements at the current time.

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# Suggested National Broadband Network Reference Architecture

Through active participation in all of the major industry forums, Juniper has looked for the work that most closely matches the goals of the National Broadband Network. Of all these bodies, an industry forum that focuses on the combining of technologies to articulate an end-to-end architecture, and deployment best practices is best suited to the Panel of Experts needs. Knowledge and experience of the types of regulation governing broadband networks is also important so as to adequately cater for a breakdown into wholesale and retail divisions to deliver the outcomes sought.

Juniper Networks believes that the DSL Forum, which is an international industry forum that provides the aforementioned benefits to service providers and broadband markets globally, has the most value to offer the Panel of Experts. The DSL Forum has been in operation since 1994 and has provided the industry with technical reports to define, initially high speed Internet over DSL networks, and later multiple services in unison, with assured Quality of Service (QoS). In the last few years the DSL Forum's service provider member base, as well as improving technologies, have driven the forum to incorporate into their end-to-end Reference Architecture different access mediums including fibre-based access.

The evolution of the DSL Forum's scope to incorporate fibre access networks is evident in the technical report "Broadband Multi-Service Framework & Architecture Requirements", TR-144 [1], published in August 2007.

In addition the DSL Forum is currently in the final stages of completing a technical report that delves to a more granular level of detail in specifying the delivery of triple-play application services over a GPON access network with Ethernet aggregation. This complements and is in the same vein as the previous TR-101 [2] for DSL access networks.

These detailed architecture technical reports continue to be improved and refined with best practice nodal requirements, for all technologies including fibre based broadband networks and the DSL Forum remains at the forefront of these developments.

## DSL Forum Broadband Multi-Service Reference Architecture

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The DSL Forum technical report TR-144 [1] details the requirements service providers have for delivering services over multiple types of access network for the foreseeable future.

Of primary use to the National Broadband Network RFP process is the reference model and interface descriptions in section 6 of [1]. Reproduced from this section is Figure 1: DSL Forum TR-144 Broadband Multi-service Reference Model.

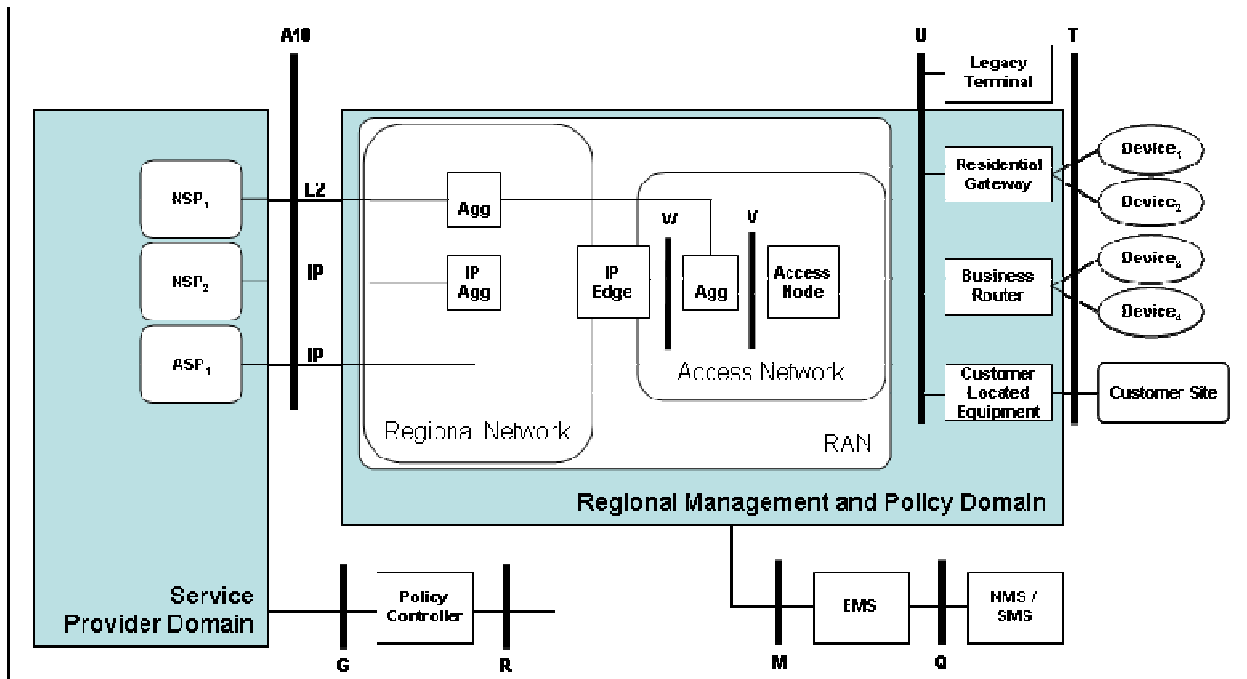


Figure 1: DSL Forum TR-144 Broadband Multi-service Reference Model

## Demographic Awareness

This Reference Architecture can be utilised to describe the differing requirements with respect to demographics. These differing requirements will include aspects such as reach, population density and communities of interest.

The use of a Reference Architecture facilitates this specification of the requirements for all of the Australian population. This can be achieved by defining different versions of the Reference Architecture modules according to demography.

The use of a Reference Architecture will also facilitate the presentation of the different proposed solutions. Identifying which modules of the Reference Architecture are deployed around Australia will articulate these capabilities.

## DSL Forum External Interface Specification

Further in section 6 of [1] are the descriptions of each of the interfaces shown in this model. Of significant importance are the A10 interface and the U interface.

The A10 interface specifies the interconnect with service providers and is the primary method of providing wholesale access. The different instances of the A10 interface are worthy of note.

- A10-NSP1: is Layer 2 bitstream based wholesale access, in the Network Service Provider (NSP) model
- A10-NSP2: is Layer 3 (IP or L2TP) based wholesale access, which is the same paradigm as those wholesale services provided in Australia today
- A10-ASP: is Layer 3, IP based wholesale access for Application Service Providers, which would be a new regulated wholesale access in Australia. The fundamental difference with ASP wholesale access is that the

ASP is focused on providing a particular application or set of applications accessible to all subscribers of the broadband network, along with all other ASPs. This represents a many-to-many relationship between ASPs and subscribers, where an NSP operates in a one-to-one relationship with any given subscriber. ASP and NSP services can be delivered simultaneously to subscribers of the broadband network.

The DSL Forum definitions of NSP and ASP can be found in section 7 of TR-058 [3].

The U interface specifies the hand off from the broadband network at the subscriber premises. The specification of this interface as the potential boundary for wholesale services is key to the overall working of the broadband architecture to deliver advanced multiple services.

## Australian Wholesale Environment

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The DSL Forum Reference Architecture caters for NSP Layer 2 and Layer 3 wholesale access, as well as ASP wholesale access. It is Juniper's belief that these methods of wholesale be specified for the National Broadband Network and be provided in conjunction with an equivalent ULL-like access, as already well articulated by the Australian industry. In addition it is also well understood that the existing network infrastructure deployed under regulated access must be allowed to continue to operate.

The reason for the several differing levels of wholesale access is to allow tiers of access catering to differing types and needs of retail service providers. It is through these means that further innovation can occur in the retail service provider market and enable strong competition.

There are a number of utility type services being discussed to be provided via the National Broadband Network to all Australians, such as the e-Gov and e-Health grouping and Smart Grids. It is important to look for the new ways in which the National Broadband Network can be utilised whilst also providing as much flexibility as possible for uses that have not been defined. A benefit to providing these tiers of wholesale access is where ASP access can enable these utility services to be defined and offered to all Australians accessible via the National Broadband Network without needing to establish bilateral business relationships with all Internet service providers in Australia and requiring all premises to have an active Internet service

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## Summary

This paper has presented the general benefits sought from standardised approaches and the applicability to the Australian Broadband Network. It is felt that much of this is well understood and is already included in the National Broadband Network debate. However, Juniper feels that the process for leveraging the established standards in a practical sense and specifically for the National Broadband Network may need further consideration.

As a result this paper continued to discuss how to utilise the existing standards, with the assertion that adapting and building upon a standards based Reference Architecture provided an appropriate and beneficial approach. The use of a Reference Architecture in the National Broadband Network RFP process will allow the Panel of Experts to: clearly define the problem at hand; facilitate and ease respondents to provide solutions; objectively evaluate the proposals; leverage the knowledge and experience of the global industry to the greater benefit of

Australia; provide a framework to allow new services and service providers to innovate and evolve utilising the National Broadband Network investment.

Finally based on Juniper Networks knowledge and participation in technology standardisation and the development of best practices by industry forums, we propose the use of the DSL Forums Broadband Multi-Service Reference Architecture. The DSL Forum Reference Architecture provides a sound basis for the definition of the National Broadband Network requirements for inclusion in the RFP.

Should the Panel of Experts follow this approach it will be possible to capture these benefits and greatly enhance the National Broadband Networks chances of success in providing every Australian with the economic and social benefits that only a truly world-class broadband network can deliver.

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## References

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<http://www.dslforum.org/techwork/tr/TR-144.pdf>
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- [3] TR-058 - "Broadband Multi-Service Architecture & Framework Requirements", Elias, M & Ooghe, S, September 2003  
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