# Broadband Supplementary Paper

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## *Introduction*

This supplementary paper has been written in several parts to follow on from the first paper and to tidy up some unfinished answers that came from being a witness in the Senate Hearing Committee in Sydney 13-Nov-2003.

## *RIM and DSLAM Utilisation*

### RIM: Introduction

A RIM (Remote Integrated Multiplexer) is one of many similar devices that connect via a digital stream to a parent exchange, and provide terminal exchange (local loop access with loop disconnect line signalling) for telephone, fax and analogue (dial-up) modem services.

The network beauty of this type of equipment is that the parent exchange can be several kilometres from the remote RIM and this RIM can look like a local telephone exchange, so the copper loop can be that much shorter.

The engineering beauty of these devices is that the connection into and from the parent exchange is entirely digital, and to all intents and purposes, the RIM looks and behaves exactly like a local (terminal) exchange.

### RIM: CAN – IPN/IEN Demarcation

Electrically, for analogue (dial-up/loop disconnect signalling) service connections, the demarcation between the Inter-Exchange Network (IEN/IPN) and the Customer Access Network (CAN) is at the line interface card, where the digital signal is converted into analogue signal and vice versa. This demarcation rule fits very comfortably with all terminal/local exchanges, and it aligns perfectly with RIM technology. Politically this is not comfortable, as many see the RIM as part of the CAN.

The political problem is that some earlier RIMs did not connect digitally to the parent exchange. These RIMs connected with an exchange part RIM located in another terminal exchange at the line loop interface and then a digital connection to the remote RIM and as such these RIMs (both ends) are in-fact entirely part of the CAN, as the demarcation point is in the local exchange and everything beyond the first analogue/digital conversion out of the IEN/IPN is part of the CAN.

### RIM Utilisation

As described above the vast majority of RIMs provide a very simple way of dramatically shortening the copper local loop and replacing old Crossbar and Step by Step switching equipment with an effectively equivalent digital line card that would be in a local terminal exchange.

In many cases the RIM directly replaced the remote exchange equipment in small exchange huts, and the old switching equipment was never removed – just unpowered.

In newer urban areas, cost advantages could be seen by placing RIMS in cabinets on the streets and running the copper to those street cabinets.

In some situations when number ranges run out at particular exchanges, or for special privacy reasons, it is advantageous to connect RIMs to that exchange from a foreign parent exchange and get the customers connected – even though they do not have the same or similar number range.

## DSLAM Connection

A DSLAM (Digital Subscribers Line Access Multiplexer) is a device that converts a digital Internet (TCP/IP) stream to ADSL protocol – usually this is encapsulated in Point to Point protocol on Ethernet (PPOE), and in some cases it is encapsulated in Point to Point protocol on ATM (PPOA), where ATM stands for Asynchronous Transfer Mode.

Either with Ethernet or ATM, both of these digital streams require a wide bandwidth and that means a large amount of infrastructure to carry the Internet, and in many non-urban areas, there simply is not the infrastructure.

Where cost-effective the (optical) transmission infrastructure already exists can take the Internet load, and DSLAMS are then fitted to those local/terminal exchanges. If this optical transmission infrastructure does not exist then there is no way that DSLAMS can be installed.

In the case of RIMs, this equipment is already in remote locations and usually on limited copper or optical digital transmission connections. It does not matter if the RIM is connected to a parent exchange directly or through a local exchange and extended:

I believe that if the optical transmission infrastructure is not there to support a 155 Mb/s ATM stream, then the DSLAM cannot be installed at the RIM location. I believe that this is the reason that Telstra put a blanket ‘no’ on services provided through a RIM or similar pair-gain system arrangement.

In some instances where DSLAMS are located in a particular exchange for local exchange use, many of the customers there may well be on pair gain systems as RIMs or like RIMs, and there is no reason that I know of (other than the above paragraph) to explain why these customers should be refused Broadband ADSL facility from the DSLAMs in that local exchange.

## Broadband – ADSL Solution

As I recall, every piece of equipment in every exchange (switch) and every transmission link includes an alphanumeric code that identifies the site (building) where the equipment is located. The exceptions to this rule would be some remote regenerator equipment on some transmission links, and some small CAN pair gain equipment.

The building code consists of a 4-alpha code, where the first three alpha specifies the location / building and the fourth letter indicates the switching or transmission system identity. Some large sites have more than one building code identifier – so some knowledge and experience is necessary. Transmission links have two building code identifiers (one for each end).

The solution here is to geographically locate the remote RIM and see if the first three letters of the second location code assigned to that transmission link also can associate with the remote DSLAM. If there is an association and there are spare ADSL ports, then I believe that these customers should be able to be provided with Broadband (ADSL) service.

ADSL is a very poor stopgap Broadband technology measure.

## *Broadband Development Standards*

The International Telecommunications Union (ITU) has long been established as the global reference point for recommended telecommunications practices. Australia has been and actively follows this body and in general most of Australia's major telecommunications engineering structures follow these recommendations.

The ITU has for some years been active in developing recommendations the field of Optical Fibre to the Home / Premises (FTTH / FTTP) technology. As such the ITU already have a set of well-structured industry (not company) based recommendations that effectively are the standard to manufacture, install, commission and maintenance this technology. These ITU recommendations are also the basis that legislation should be built around, and this process stops legislation that favours a particular business or company, and provides an overall cheaper product as the products for installation and application have a true global market.

## *Top Down Broadband Approach*

### Optical Fibre Standards

The optical fibre cable specifications recommended by the ITU-T are in G.652, G.653 and G.655. In all these case they recommend a Single Mode Optical Fibre (SMOF) operation as it has been proven over decades that this mode has the least loss (attenuation) with distance and the production process is very inexpensive. The recommendations specify the physical dimensions and acceptable testing requirements to make a serviceable transport medium.

### CAN Transmission Standards

ITU-T recommendation G.983.3 specifies a download rate of 622 MB/s and an upload speed of 155 MB/s, together with an 880 MHz download band for Community Access Television (CATV).

ITU-T recommendation G.983.4 specifies a download rate of 1.24 GB/s and an upload speed of 622 MB/s, together with an 880 MHz download band for Community Access Television (CATV).

While both of these recommendations sound as though the data rates seem to be very excessive, it is important to look at the proposed access network structure, because this optical structure is radically different than as for copper pairs that were ideal for telephony or coax distributions that was somewhat effective for community access television distribution.

### Network Access Structure

#### *Passive Optical Network*

Single Mode Optical Fibre (SMOF) has a typical loss of about 0.35 dB/km and the maximum loss to be tolerated in an access network situation is be about 24 dB, so in simplistic terms the maximum distance for a single fibre without any splitting or amplification would be about 68 km (almost 70 km).

One of the agreed access plans is to have a passive optical network (PON) that allows typically 32 to 128 customers connect (split) off one cable in metropolitan areas, and lesser (4 to say 16) splits in regional and remote areas. Special optical splitters are capable of cheaply dividing the cable into a large number of individual customer feeds and in the process the power is halved through each splitter.

### *Distance Considerations*

In consideration that the maximum loss tolerated would be about 24 dB and SMOF has an attenuation of about 0.35 dB/km, then for 128 customers off the one bearer would involve a 21 dB loss then these would have to be shorter than 8 km and that covers all the metro and most regional connections.

With 64 customers per bearer the splitting losses would be 18 dB and that would allow up to about 15 km from the terminal end or head end. For a 32 way split, the maximum distance limit would be about 25 km. With a 16 way split, the maximum distance would be about 32 km and for an 8 way split the distance would be about 40 km. A 4 way split would allow a distance of 50 km.

In other words almost all metropolitan, regional and remote situations could be connected to Broadband access with this technology approach. It would solve almost all regional and remote Broadband access network connection issues, as customers as far away as 50 km from an optic fibre head could be serviced with Broadband.

The overall infrastructure to provide Broadband to the fibre heads is another issue, but a large proportion of Australia is already wired with optical fibre infrastructure, providing telephony, mobile and data services. This infrastructure will have to be re-engineered to provide Broadband on the existing optical fibre infrastructure.

### *Bandwidth Considerations*

With this Broadband access structure a download bandwidth of say 622 Mbit/s is effectively reduced to a simple average of about 4 Mb/s per customer on an even usage basis per 128 customers, but we know that data usage is 'bursty' so the real usage is much more like 10 Mb/s as much higher data rates are possible for short times for all customers.

Further it is quite possible to implement multiple 'colours' (wavelengths) on the Broadband network by Coarse Wave Division Multiplexing (CWDM) so that different service standards can be provided to different customers over the same Broadband access network. Major businesses could have a full 622 Mb/s and other customers have typically a 622 Mb/s shared access between say 120 customers – all on the same access fibre!

### *CATV Usage*

The beauty of the PON under the ITU recommendations is that as well as true Broadband Internet access CATV would be available for everyone, and at a high standard too. Currently the competitive engineering design limitations of coax access (CATV) in Australia are so tight that residences on battle-axe (or recessed) blocks can't connect to without extra (off street) amplification. (In a non-competitive environment, the engineering would have allowed for all 'homes passed', to have service, and not simply 'homes passed' – but no available service). With SMOF as the access medium this would not be a problem because distance considerations are considered in km for SMOF and not metres as in the case for coax.

As far as I am aware the IEEE specifications do not provide the inclusion of CATV into the Broadband access where the ITU recommendations do. (Australia in general follows the ITU recommendations.)

### *SMOF Development*

Australian research has for years been at the pinnacle of optical fibre research, and there is no shortage of technology here in this area. Australia also has some of the best silica sands in the world that make the ideal resource material for the manufacture of optical fibre and associated components.

The problem areas may be in technology based patents where although Australians have been doing the research, these technology patents may have not been really appreciated and consequently these may have been sold off or sponsored by foreign interests making Australia in a position to really pay heavily for what we had researched as an art but not developed as Australian based technology patents.

We have the opportunity to develop several SMOF manufacturing plants in many regional areas in Australia.

### *Optical Fibre Component Manufacturing*

Australia's Universities have led the push to research new and innovative ways to develop optical fibre component technology, and this art is in a very fragile situation with the opportunity of patents and manufacturing development not high on the economic priority list.

One of the most important optical components is the optical fibre line termination and light splitter (OLT) that is required in every home. To date the manufacturing yields have been low and few businesses have mechanical methods of manufacture, making these components unreasonably expensive.

Australian Universities working in conjunction with Australian manufacturing development business have the time-limited opportunity to develop mechanical methods of optical fibre component manufacture, and the manufacturing patent spin-offs have the potential as tremendous wealth earners for Australian Universities and businesses in the coming decades.

## Legal Side-Industry (Technology Patents)

In more recent years we have had an internal oversupply of Lawyers/Solicitors, and many of these have moved their attention to litigation as their main means of income. This action I believe has been to the detriment of our society and we now have a very high number of unnecessary personal litigation cases flooding our Court system.

With Australia's development of Intellectual Property, and the sheer number of development patents that Australia should be creating, it makes common sense to me that these litigation specialist Lawyers should be moved away from litigating Australians to litigating people and businesses internationally and in so doing securing Australia's technology future.

## *Privatisation/Competition is the Major Impediment*

The earlier paper that I wrote covered the terms of reference as requested, and these terms were:

*a) the current and prospective levels of competition in broadband services, including interconnection and pricing in both the wholesale and retail markets;*

*b) any impediments to competition, and to the uptake of broadband technology;*

*c) the implications of communications technology convergence on competition and other emerging markets;*

*d) the impact and relationship between ownership of content and distribution of content on competition; and*

*e) any opportunities to maximise the capacity and use of the existing broadband structure.*

This supplementary paper goes that little bit further to show that the next stage in access network convergence in Australia should be that optical fibre is the preferred way to go and that the engineering recommendations refer to this technology as already mature.

This situation further addresses reference terms b) and c) and shows that the policies of maximising shareholder value have actually stifled network development. In other words, the policy of 'privatising' the telecommunications industry has done several things to stifle network growth and development:

*a) The connection / calling costs have not dropped due to competitive pressures (this was only caused by technology improvements).*

*b) Development of the access network over the past 10 years has not happened as the focus has been on sustaining existing technologies to return maximum dividends to shareholders. (Not in the public interest).*

*c) An internal war has been caused that now sees the Wholesale and Retail arms of most privatised telecommunications businesses vying for a market of diminishing returns. That means that some of these businesses must collapse. (Not in the public interest).*

*d) Where regulation was once well controlled and to a high engineering standard, now several legally based activity groups are pushing their own interests and not working together under one management. (Not in the public interest).*

*e) Almost all telecommunications companies have had to resort to high level advertising and sponsoring to try to win the hearts and minds of the relatively fixed market and the cost of these expenses are lumped onto the connection and calling plans. (Not in the public interest).*

*f) Teams of marketing / sales people have been employed along with lawyers to 'create' products and services that are deliberately packaged (bundled) to be more confusing by increasing the options or choices. These unnecessary overhead costs have to be included into the end product (service and call connection fees). (Not in the public interest).*

*g) Proposals are in place to introduce several Demand (Service) Aggregation Brokers to formulate Business Cases to pull together several businesses telecommunication needs and hopefully arrange a Broadband solution for a region or district as required. From the look of the proposal it is obvious that these people have a very limited knowledge of telecommunications infrastructure and in that sense, their fragmented knowledge will not provide the right engineering specification that is required to build the most cost-effective long term integrated solution from a national perspective. (Again this proposal is not in the public interest).*

It should be very obvious that the act of privatising the telecommunications industry in Australia is the main impediment to the uptake of broadband technology and very little else.

It is because of this that impediment that proposals such as in g) above come out to try to stop gap catastrophic situations caused by multiple telecommunications carriers providing an increasing number of 'services' to a limited market.

As I alluded to in my main paper on Broadband, the only way to address this looming disaster is to leave the retail areas to compete/fight amongst themselves, and save the wholesale area from private and multinational business concerns, who are totally intent on routing Australia's infrastructure for themselves and taking it out of Australian Government hands.

With this proposed solution the telecommunications network is not to be owned by the competing businesses, they merely rent parts of it at wholesale rates and on-sell those services at retail rates to the general public and businesses. That means putting a knife through Optus and Telstra and a few other concerns, and give the Retail parts of those businesses the right to on-sell the wholesale network.

The current wholesale telecommunication network (i.e. the network as it stands), is of a very limited value with Broadband becoming the mainstay, and as such this limited telephony, data and television based infrastructure needs to be taken underwing and totally managed by a national telecommunications authority/commission for the good of the Australian Nation and its people.

As stated before, I am one of a few people in Australia that have a very extensive wealth of knowledge in most facets of the Australian telecommunications industry, including and not limited to network architecture engineering, public and private switching and transmission systems, major transmission systems expertise, customer access network and customer premises equipment expertise, experienced people management skills, seasoned business / tender / bid management skills and I am highly computer literate. I am available in whatever capacity is required to bring the Australian telecommunications infrastructure out of the doldrums and into the future backbone for Australia's emerging information based economy.

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