AAS

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TelstraClear Ltd

Report on Technical Issues Concerning the Draft Determination for UBS (Bitstream Access to Telecom Fixed PDN Service)

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Telecommunications Consulting

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Table of Contents

1. Introduction

1.1 Amos Aked Swift (NZ) Ltd (AAS)

AAS is a specialist and independent telecommunications and business consultancy, based in Wellington. We have wide experience in telecommunications networks, technologies and system operations; and suppliers. AAS currently employs six professional staff, with highly specialised and complementary skills. Across the team we have a comprehensive understanding of the whole telecommunications industry.

AAS has been requested by TelstraClear to provide an independent view of the technical aspects of Unbundled Bitestream Service (UBS), with particular reference to the public version of Telecom's submission to the Commerce Commission on the subject dated 20 May 2005.

1.2 Project Brief

TelstraClear Ltd (TCL) has asked AAS to provide technical and contextual commentary on two documents associated with the ongoing enquiry into "Bitstream Access" (also called Unbundled Bitstream Access (UBS)):

- Commerce Commission "Draft determination on the application for determination for access to and interconnection with Telecom's fixed PDN service 'Bitstream Access'" requested by TelstraClear Limited [Dated 21 April 2005]

- Telecom New Zealand Limited "Submission in respect of the Commission's draft determination on the application for access to and interconnection with Telecom's fixed PDN service ("Bitstream Access")" [Dated 20 May 2005 Public Version]

Particular aspects reported on include the effects of full speed ADSL transmission on other users in a cable sheath, the implications of real world speeds versus the maximum speed, and the effects of interleaving (on or off) on other users.

2. General Commentary

In general terms, Telecom has produced a very pessimistic document in its "Submission in respect of the Commission's draft determination on the application for access to and interconnection with Telecom's fixed PDN service ("Bitstream Access")".

In some places in their submission Telecom take a specific difficult situation and generalise it. We have commented before that acceptance of this type of argument will lead to the adoption of a 'lowest common denominator' service, which we do not believe is desirable. It is certainly not the approach that Telecom takes with its own services.

On the subject of cross talk, Telecom has, in our view, substantially overstated the risks to its network. This is dealt with in more detail below.

AAS recognises that the Conklin mini-DSLAMs used by Telecom to serve low density areas are exceptions to many of the comments made in the more detailed discussions that follow. We would expect that services provided over Conklin mini-DSLAMs would be treated as exceptions on an issue by issue basis.

3. Detailed Commentary

3.1 Downstream Transmission Speed

3.1.1 Introduction

Telecom submits that there are a number of reasons that the 'unconstrained downstream service' cannot be provided without significant risks to its network. In particular, Telecom argues that providing an unconstrained service to TelstraClear would:

1. Substantially increase the noise interference levels in cables, affecting the service received by other cutomers and meaning that some customers will not be able to receive ADSL-based services.
2. Cause buffer overloads at the DSLAM, affecting cutomers of Telecom's business services.
3. Bring about unfairness in resource allocation and have significant cost implications.

3.1.2 Effects on Other Users in a Cable

Telecom argues that "a non rate limited service raises issues of technical and operational management…and potential adverse impacts on other users of the DSLAM…and potentially on existing contractual arrangements to such users through noise, spectral pollution, and reduction in reach."

Telecom's argument is, essentially, that a non rate limited service must run at a higher power than a rate limited service. This higher power results in higher levels of crosstalk in cables, resulting in lower speeds and reduced reach for all other users of the cable (including existing ones).

Telecom also says that "The management of noise and interference is one of the key issues facing DSL providers globally", listing a number of industry forums that have this issue high on their agenda.

Internationally, the adoption of Local Loop Unbundling (LLU) in many countries has significantly raised the profile of cable spectrum management in copper cables. The requirement for the infrastructure owner to be able to impose limitations on the mix of technology that may be connected to its cable pairs has resulted in a great deal of study, and in many cases the production of Power Spectral Density (PSD) masks to provide definition as to which technologies will happily co-exist and those that will interfere with each other. The PSD masks and operational rules in an LLU environment have often been developed by industry-wide working groups, guided by the Regulator – e.g. the ACIF in Australia.

Telecom also needs to manage the spectrum in its cable sheaths, and this will become more important as the number of different types of DSL systems proliferate, including as a result of the addition of its own retail services delivered over new systems, such as ADSL2+. Management is always required because every digital system running in a cable sheath will induce crosstalk into every other system running in that cable sheath. The only difference from the environment created by LLU is that Telecom is the only installer and operator of digital transmission systems. Telecom has to 'self-manage', rather than being one of a number of operators deploying systems controlled by PSD masks. The principles, however, remain the same yet the practice is considerably simpler and more certain for bitstream management compared with LLU management.

3.1.3 A Crosstalk Primer

This section is not intended to be an exhaustive discussion of the nature of crosstalk. Rather, it is an introduction to those aspects of crosstalk that are useful in this discussion of spectrum management in cable sheaths.

The copper cables that are ubiquitous in Telecom's access network were not designed or intended for operation outside the normally accepted telephony voice frequency band of 300 – 3400 Hz, and to provide a DC loop.

All of the pairs in such a cable are electromagnetically coupled, so a signal on any one pair will appear on all of the other pairs at a lower level. The amount of coupling (and hence the amount of signal appearing on each of the other pairs) will depend on the length of the cable, the proximity of the pairs within the sheath, and the level of the original signal.

As some pairs will be physically closer to the pair with the signal and others will be further away, the level of the signal will vary between pairs according to the separation. A higher level of induced signal will be seen in the pairs closer to the signal, and a lower level in those further away.

Telecom's outside plant practices have varied over the years, with their copper access cables exhibiting the varied results of the last thirty years or so of such practices. It is therefore very difficult, if not impossible, to predict the proximity of two pairs for the length of a cable run, which will typically have several joints in it as the cable pair count tapers to smaller sized cables nearer the customers. Various sizes of cable are joined in series, and it is therefore very difficult to predict the coupling between, and therefore the amount of crosstalk between, two given pairs in a real copper cable network that has been built over a period of time. Telecom's plant and practices are similar to many other incumbent telcos. Telecom is not unique.

3.1.4 Telecom's Crosstalk Argument

Telecom argues that increases in speed lead to increases in signal level, which in turn lead to increases in crosstalk. This is, of course, elementary physics, and cannot be refuted.

From the discussion above it is clear that this is a matter of degree. All ADSL systems working in a cable will interfere with all other systems working in that cable. The degree of interference will depend, as discussed above, on the signal strength, the length of the exposure and the proximity of the cable pairs. ADSL systems are designed to deal with this, since it will be their normal working environment. The key question is, at what point and under what circumstances will the interference from other systems impact on the performance as seen by the user?

The noise induced will not be the same in each pair in the cable. It is therefore difficult to interpret the results of Alcatel's testing that Telecom has presented in Paragraph 83 of their submission and further interpreted in paragraph 84. It is entirely possible that there were a number of cable pairs in the cable tested that had less exposure to the induced crosstalk (due to greater separation) than the one that was measured, and will therefore have less noise.

The results of the test described in Paragraph 83 were achieved by restricting the line rate to 256 kbps and improvements were reported. However line speeds for the base case (from which the improvement is compared) are not reported. The figures quoted by Telecom in Paragraph 84 of their submission (an additional 6800 farmers could be offered broadband service etc) are therefore meaningless.

Telecom has provided no evidence of the theoretical problems that they raise.

In our view, the major effects of crosstalk will be seen at the periphery of the copper cable network, at the limit of the reach and capability of ADSL technology. It is our understanding that if this is a real problem, then in recognition of this, TelstraClear is willing to limit its request for unconstrained speed on lines that, measured objectively, have too high a noise level to support an unconstrained service. Such an operational constraint would need to be implemented by Telecom providing to TelstraClear the tools and reporting that would enable TelstraClear, at the time of ordering, to determine whether such a constraint was going to be necessary for the particular customer site.

3.2 DSLAM Input Buffer Overloading

In Paragraphs 88 – 95, Telecom describes the causes of input buffer overload in the UBS environment, and the likely impact on other customers.

Telecom does not make it clear in their explanation how this situation is (or would be) unique to the service TelstraClear has requested. The situation, as described by Telecom, would appear to be equally likely to occur with a Telecom Jetstream service, a non-TelstraClear UBS service, or a TelstraClear UBS service. The input buffer overloading as described by Telecom could occur when any ADSL line synchronises at a rate lower than the nominal PIR for that line. This lower than expected synchronisation speed could be due to a fault condition, either in the cable pair or in the customer's premises wiring, causing increased loss or noise levels. In AAS' view, the buffer overloading is unlikely to occur even then, due to the relatively low utilisation levels typical of ADSL circuits.

Impact on services with a contractual commitment (eg PON, One Office) could be relatively easily managed by ensuring that these services do not share a common DSLAM buffer with a UBS service if Telecom's configuration allows this.

3.3 Contention Ratio and Backplane Issues

There appears to have been some confusion over the issue of contention ratio. AAS apologises for any contribution we may have made to this confusion. A contention ratio of 50:1 based on raw line speed is clearly extravagant and would not be required in a real world situation.

An alternative, and perhaps more sensible approach would be to take a 'rule of thumb' utilisation and use this to calculate an appropriate contention ratio. Utilisations vary with time, and also depend on the service the customer is using.

For most services used by 'normal' customers of ADSL services, utilisation is relatively low. A reasonably generous average utilisation for general usage would be 25 kbps. Doubling this, to allow for growth in usage (users' behaviour and content) would result in a 50 kbps average, which is a reasonable general figure to use to calculate the contention ratio.

3.4 Interleaving

Interleaving is treated differently by different administrations around the world. None of the dire consequences predicted by Telecom have been reported so far, to our knowledge. Telstra have operated their ADSL networks in Australia so far with interleaving “off” (although they have a relatively low speed maximum offering). Ameritech have an ADSL product called ‘Fastpath’, which has interleaving off. This appears to be popular with their customers, particularly gamers.

Although some administrations report an improvement in performance at higher line speeds with interleaving “on”, it is difficult to see how whether interleaving is on or off will have any impact on other customers. The main effect is on each individual customer. Any problems created for TelstraClear by having interleaving “off” would therefore be experienced by their UBS customers, and would be up to TelstraClear to resolve.

AAS again understands that, pending the development of the standards we have recommended, TelstraClear is proposing that interleaving should be left on for unconstrained services, where interleaving will be of greatest benefit, but turned off for lines with the highest noise levels which can only support a slower speed service. Interleaving has limited value for slow speed services but does introduce disproportionate delay that can affect downstream services. However, ultimately, we believe that this interim solution to address Telecom’s concerns can and should be superseded by agreed standards.

End of Report