



Managing quality of service issues for standard telephone services in an IP environment

Submission by the Australian Communications Consumer Action
Network to the Australian Communications and Media Authority

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About ACCAN

The Australian Communications Consumer Action Network (ACCAN) is the peak body that represents all consumers on communications issues including telecommunications, broadband and emerging new services. ACCAN provides a strong unified voice to industry and government as consumers work towards availability, accessibility and affordability of communications services for all Australians.

Consumers need ACCAN to promote better consumer protection outcomes ensuring speedy responses to complaints and issues. ACCAN aims to empower consumers so that they are well informed and can make good choices about products and services. As a peak body, ACCAN will activate its broad and diverse membership base to campaign to get a better deal for all communications consumers.

About this submission

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1. Executive Summary

ACCAN thanks the ACMA for the opportunity to contribute to the Technical Advisory Group in its review of Quality of Service (QoS) issues relating to standard telephone services delivered using Internet Protocol technologies over high speed broadband networks.

Telephony services are extremely important to consumers and the actual quality and the perceived quality of the consumers' experience is very important to ACCAN. Consumers generally do not have an understanding of the complexities of the underlying technology that allows them to make and receive telephone calls, nor should they be expected to. Consumers rely on the service provider industry and regulation to ensure the perceived simple service of voice telephony will continue to function as they expect it to, unless they have made a conscious and informed choice to take up a service that provides a different experience.

ACCAN's key submissions and recommendations are set out below. The remainder of this document sets out the relevant technical, regulatory and policy issues in greater detail.

1.1. General submissions

In this paper, ACCAN makes the following general submissions:

Submission 1: A service should not fall outside the definition of a "standard telephone service" simply because it operates on an IP-based network. In particular, an NBN telephony service, using VoIP, is still a standard telephone service, and is provided over a fixed line (the optical fibre). End-users should be able to rely on the NBN telephone service providing a quality of experience at least as good as that of the legacy analogue telephone service, and should not need any extra information to choose an appropriate service – the service should already be appropriate.

Submission 2: A distinction should be drawn between "internet telephony" and "VoIP" or "IP telephony" services. The term "internet telephony" should be reserved for unconditioned telephony services delivered over the internet, such as Skype, that offer no guarantee of particular service quality. IP telephony services generally are entirely capable of being conditioned to deliver the standard of service quality consumers require, and ACCAN submits that an industry code is required to define this standard.

Submission 3: The ACMA's preferred approach (Approach 2) of requiring RSPs to provide information to consumers on the expectations they should have of the quality of the service they are acquiring is a necessary but incomplete response, particularly where the quality expectations differ from the traditional fixed-line telephone service characteristics. Where no caveats are used, the default position for a service described or represented as a standard or normal telephone service should be a quality level equivalent or better than traditional analogue copper telephone services.

Submission 4: The information provided to consumers describing different types of telephony service should not refer to technical characteristics and industry jargon, such as VoIP, PSTN, "carrier-grade" or similar. These terms are largely meaningless to a lay consumer. The information provided to consumers should be in terms they can experience and describe – for example the degree of delay, echo, distortion, loudness or softness, presence of brief or extended dropouts, and similar characteristics. These should be the same characteristics that are tested against for a telephony service quality standard.

Submission 5: The provision of information to consumers about quality of experience, by itself, is not sufficient. New or modified industry codes or standards are required (Approach 3) to ensure service quality is maintained for all standard telephone services, regardless of underlying technology, and to provide objective measurement methods for the characteristics used in consumer-oriented product descriptions.

Submission 6: Many of the possible quality impairments identified in the ACMA's position paper for VoIP services have nothing to do with VoIP or IP carriage. Instead, they are caused by problems during the conversion of an analogue voice signal into a digital signal, and these can and do also occur in fixed line STS services that are not IP-based. There is a danger that regulating only VoIP technologies will have too narrow a focus and fail to cover poor quality non-VoIP telephone services.

Submission 7: A code or standard that mandates service quality outcomes based on underlying technical parameters for IP or VoIP technologies is likely to be ineffective due to rapid technological change, and would need to be frequently updated or become superseded. Such an approach may risk stifling technical innovation.

Submission 8: A telephony performance quality standard, similar to [C519], which applies to all STS (including when provided by VoIP over the NBN or any other system) is required. This is likely to have the effect that it will be unnecessary to develop technical regulation specifically for VoIP service quality aspects, as the desired outcome will be clear, and service providers can be left to identify the best technology to achieve the outcome.

1.2. Recommendations

In light of the discussion in this paper, ACCAN makes the following specific recommendations:

Recommendation 1: C519:2004 should be amended to ensure it applies to services operating over IP-based networks, in addition to the currently used technologies. The amendment process should draw on expert technical knowledge and consumer representation as well as industry input.

Recommendation 2: The amended C519:2004 should set out high-level, "quality of experience" requirements that are understandable to consumers as well as being able to be measured objectively. Such requirements could include, for example, the acceptable levels of echo, delay and loudness (requirements which are already present in the Code as it currently stands).

Recommendation 3: The quality of experience requirements in the amended C519:2004 should be technology-neutral – it should not matter whether a call is made over a traditional telephone network, a network with an IP component, a network that is entirely IP-based, or indeed any future network technology.

Recommendation 4: Compliance with the amended C519:2004 should be independently monitored, with the results made available to consumers and the public.

Recommendation 5: Providers must clearly identify whether or not a particular product complies with the quality of experience requirements set out in the amended C519:2004.

Recommendation 6: Further consideration should be given to the question of whether providers should be permitted to sell products and services that do not meet the quality of experience requirements set out in the amended C519:2004, and if they are, what notification consumers should receive that their service will not comply with the amended Code.

2. Statement of principles

While using a service, consumers require some assurance that the quality of voice services will not be negatively impacted by the transition to the NBN. While there may be a range of IP-based telephony options available over the NBN, there needs to be a clear option for consumers who wish to have a voice service with quality and characteristics at least as good as they have come to expect from voice services on more familiar infrastructure, such as the existing copper network. Consumers using such services should not need to be aware that the underlying technology is VoIP, and should not be protected by different codes, standards or other arrangements than those that protect consumers using more traditional technologies.

While the ACMA paper *Managing Quality of Service issues for standard telephone services in an IP environment* focuses on Internet Protocol and VoIP service quality, it is important to understand that IP service quality is a technical means to a non-technical goal, not a goal in itself. The non-technical goal is to preserve or enhance the quality experienced by a user while using the service, in aspects that the user can understand and measure – aspects such as quality of audio reproduction, delay, echo, call dropouts, and intelligible speech, and those characteristics identified in [ACMA 2013] p 7.

These aspects are not limited to telephony over IP networks; they are universal properties of *all* telephony services. To the extent that ACMA believes that traditional telephony services are adequately regulated in regards to quality (and ACCAN submits that they no longer are), we outline in this paper why we believe that explicit regulatory action is required in the form of developing new codes or standards – not just for services using IP technologies, but for *all* telephone services irrespective of underlying technology (Approach 3 in the ACMA’s paper). Relying solely on customer education and information given to customers by service providers (Approach 2 in the ACMA’s paper) is not sufficient to ensure customers are protected from purchasing and using poor quality services when that is not their expectation, and potentially finding that their services are not fit for purpose.

3. Prior study and references

We are aware of, and our members have participated in, several past initiatives looking at telephony services operated over broadband networks and over IP networks, by organizations such as the ACMA, Communications Alliance, its predecessor ACIF, DBCDE and its predecessor DCITA. This paper draws on the following key references produced during these many reviews.

[ACMA 2013] ACMA, “Managing quality of service issues for standard telephone services in an IP environment”, April 2013

[ACMA 2013-A], ACMA, “Attachment A – Potential QoS issues for VoIP services”, April 2013

[G632] Communications Alliance, “G632:2012 Quality of Service parameters for networks using the Internet Protocol”, August 2012

[G633] Communications Alliance, “G633:2012 Quality of Service parameters for networks using the Internet Protocol – Test methods”, August 2012

[G634] Communications Alliance, “G634:2012 Quality of Service parameters for Voice over Internet Protocol (VoIP) services”, April 2013

[G635] Communications Alliance, “G635:2012 Testing Arrangements for Quality of Service parameters for Voice over Internet Protocol (VoIP) services”, April 2013

[G646] Communications Alliance, “G646:2012 National Broadband Network Wholesale Service Definition Framework – Telephony Access Service”, August 2012

[ACIF QOS], Australian Communications Industry Forum, “Discussion Paper on Quality of Service (QoS) VoIP Service Interconnectivity”, March 2006

[CA TERMS] Communications Alliance, “A basic guide to VoIP technical terms and issues”, Version 2, 28 August 2006

[C519] Communications Alliance, “End-to-End Network Performance for the STS”, 2004, reconfirmed 2009

4. Current STS and quality requirements

All the reviews of STS, including [ACMA 2013], note that the current conventional technology STS has telephone service quality measures regulated by [C519], which is a registered mandatory industry code, developed by Communications Alliance and administered by the ACMA. [ACMA 2013] on page 9 states that:

The regulatory framework that has long been successful in the management and coordination of QoS for standard landline services will likely be ill-equipped to face the emerging challenges of an NBN-connected country.

ACCAN disagrees that the current regulatory framework is likely to be ill-equipped to face the emerging challenges of an NBN-connected country. Rather, we believe that the current framework could be adapted to an NBN telephony system with minimal changes.

One of the strengths of the current regulatory framework is that it describes and regulates the service characteristics at a high level, largely independently of the underlying technology – the regulatory framework is, with a few exceptions, technology-agnostic. This allows technology to change without having to modify service descriptions, characteristics or expectations of outcomes. The regulatory framework, by defining an STS in the broad and simple terms that it does, has withstood several transformations of the underlying telephone technology (including the introduction of digitisation of exchanges, introduction of optical fibre in the inter-exchange network, the use of ISDN to provide telephone services) and should broadly be able to cater for the transformation to fixed-line VoIP using the NBN and other broadband networks for call transport with little change required. Provided a service can call another STS, then it is an STS, and all the consumer protections that arise from the obligations and requirements for an STS should be expected to apply. This is as true for STS provided using VoIP as it is for STS provided using ISDN, for example.

Other than an explicit limitation to non-IP services in clauses 3.2.8 and 3.2.9, [C519] also has its quality measures in technology-agnostic measures applicable to telephone services over almost any infrastructure. Delay, echo, audio frequency response, are measurable features of any generic telephone service, including the use of VoIP technology. We cover this more fully in section 9 below.

ACCAN also disagrees that C519 has long been successful in management of service quality for standard landline services. This is an illusion. The carve-out for IP-based transport in clauses 3.2.8 and 3.2.9 has meant this code may not have applied to the majority of calls made in the current landline environment for many years, as many providers use VoIP technology within the core of their switching and transport network, invisible to the customer.

Much of the Optus HFC telephone service is an example of a “standard landline” telephone service which uses an analogue telephony adapter (ATA) built into the cable modem, using VoIP within the Optus network, in precisely the same way that the NBN UNI-V does. Consumers are completely unaware they are using VoIP – they plug a standard analogue handset into a standard analogue socket, hear dial-tone and place and receive calls. Optus estimates approximately 500,000 subscribers use this system.¹

In November 2005 Telstra proposed replacing 116 class-5 traditional telephone switches with “5 mated pairs...of VoIP soft switches.”² Had they done this (and they may have done this already in some of their network – there is no way of determining this from the outside), the majority of PSTN calls in Australia – whether originating, terminating or both in the Telstra network, would have been carried over IP transport at some stage.

For many years corporations have been implementing extensive VoIP systems for their internal communications,³ particularly in call centres. The consumers who call in or receive calls from these corporate IP PBX systems are usually using conventional landline and mobile STS services.

In each of these cases, had there been a systemic telephone service quality issue, the consumers would have been surprised to find out that the requirements of [C519] do not apply to them, as there was an IP carriage segment within the end-to-end path. They would not have been protected by this code, despite having no awareness that the call traversed a VoIP leg at some stage, including possibly within their own home in the case of an Optus HFC subscriber. C519 ceases to protect any user if the far end, unknown to them, is using VoIP, or when both parties believe they are using a conventional landline but there is a VoIP trunk somewhere in between.

ACCAN believes a revised C519 or similar document is required, without a carve-out for any particular underlying technology, to provide an end-to-end quality standard for current STS. This will restore the protections the Code was intended to provide to the current telephone services as well as those to be offered in future. With the increasing presence of IP-based transmission sections in portions of the end-to-end network that are outside the control and visibility of consumers, the current C519 in many cases does not apply when it would be reasonable to expect that it should.

¹ Hutchinson J, *Optus grows cable broadband base*, itNews, 14 August 2012, <<http://www.itnews.com.au/News/311927,optus-grows-cable-broadband-base.aspx>>.

² See Telstra, *Telstra's Strategy for Growth*, media and ASX release, 15 November 2005, <<http://www.telstra.com.au/abouttelstra/media-centre/announcements/telstras-strategy-for-growth.xml>> and Alcatel-Lucent, *Telstra, Australia – Partnership for IP Transformation*, <http://www3.alcatel-lucent.com/technology/oss_bss/docs/TELSTRA_7_41207.pdf>.

³ See CISCO, *Cisco Sells its 6 Millionth IP phone as Worldwide Demand Soars for IP Communications*, 21 September 2005, <http://newsroom.cisco.com/dlls/global/asiapac/news/2005/pr_09-23.html> and Finextra, *Westpac signs with Telstra for IP telephony system*, 18 August 2003, <<http://www.finextra.com/news/fullstory.aspx?newsitemid=9756>>.

5. NBN telephone services are still fixed-line STS services

In several areas [ACMA 2013] appears to make a distinction between fixed-line STS services, and telephony services provided over the NBN. For example, ACMA states on page 9 that:

Concerns with fixed-line voice QoS are likely to manifest with end-users who rely on a fixed-line standard telephone service. This sector of the population may have had no experience with other telecommunications services. This demographic is likely to include consumers with particular reliance on legacy communications services including priority assistance and the use of personal alarms. These end-users may lack the information required to choose an appropriate service based on specific needs.

This paragraph implicitly identifies NBN telephone services as “other telecommunications services” distinct from “fixed-line standard telephone services”.

ACCAN submits that this distinction does not exist – an NBN telephony service, using VoIP, is still an STS, and is provided over a fixed line (the optical fibre). It is a fixed-line standard telephone service, and should be indistinguishable from and comply with all the requirements and functionality of a standard telephone service. These end-users should be able to rely on the NBN telephone service providing a quality of experience at least as good as that of the legacy analogue telephone service, and should not need any extra information to choose an appropriate service – the service should already be appropriate.

6. Three methods of providing an STS using the NBN

Within a generic optical fibre-based access network, the end-to-end architecture for telephony services simplifies into three general regions:

- End User Premises Region – contains the Customer Equipment and possibly service providers’ CPE (residential gateway) on the end-user side of the FTTP network optical network terminal (ONT).
- Wholesale Access Region – contains the Access and Aggregation and Transport functional groups in the reference model, generally operated as a wholesale service. It includes the ONT (the customer premises equipment for the FTTP network) and the POI with a service provider.
- RSP Infrastructure Region – the Retail Service Provider network and equipment, from the RSP side of the POI network boundary with the FTTP network into the RSP’s core network where the telephony switching function is located.

These regions are illustrated below in Figure 1.

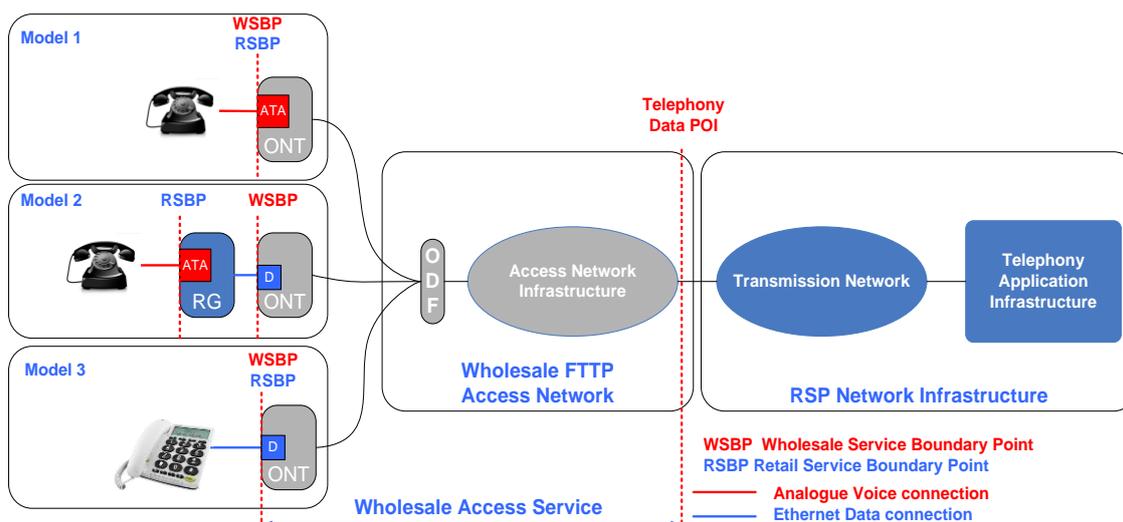


Figure 1 - Three regions and three delivery models of a FTTP-based telephone service

Service providers deliver the STS in one of three different delivery models differing primarily in the equipment and service boundary interfaces in the end user’s premises. These models are listed below and described in more detail following:

- Delivery Model 1: Analogue POTS interface via an ATA in the ONT;
- Delivery Model 2: Analogue POTS interface of a residential gateway device supplied by the RSP; and
- Delivery Model 3: IP telephony handset.

Note that each of these models provides a Standard Telephone Service as defined in the Act, and so should be covered by a telephony service quality standard similar to [C519]. This will ensure service providers understand the telephone service quality characteristics and quality levels that their solution must deliver for them to be permitted to label their service as a Standard Telephone Service. This will ensure consumers receive a telephone service that works within their expectations.

6.1. Delivery Model 1 – ATA in the ONT

In a generic optical fibre network model, a traditional (non-IP) telephone handset is connected directly to a dedicated voice terminal on user’s optical network terminal (ONT). Specifically, the service is provided by an analogue POTS interface embedded within the FTTP network ONT. The analogue interface is driven by an analogue telephony adapter (ATA) within the ONT that converts the analogue telephony signals into a digital voice-over-data⁴ protocol transparently to the end user, for carriage through the optical fibre access network. This arrangement is illustrated in Figure 2.

⁴ The term “voice over data” is used here, as the data protocol is unspecified, being internal to the FTTP network. Several different protocols could be used, include voice-over-Frame Relay, voice-over-ATM, and digital voice such as ISDN. In the NBN, a particular voice-over-IP technology and protocol is specified by NBN Co.

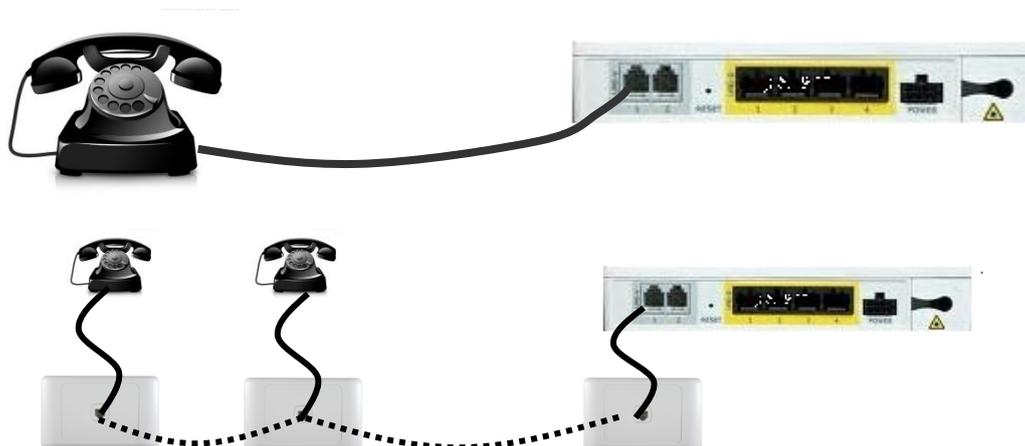


Figure 2 - Analogue telephony adapters located in optical network terminals

For the NBN, the customer’s conventional analogue handset is connected directly into a UNI-V port of the NBN network termination device (NTD). The embedded ATA transforms the telephone service into an IP telephony service using the SIP signalling protocol and G.711 audio CODEC. Note this is the same CODEC used in conventional telephone exchanges to convert the analogue signal arriving on a copper phone line to a 64kbps digital signal, and the same CODEC used in corporate PABX systems.

Use of the integrated SIP ATA within the NTD connected to the NBN Co fibre network removes the need for any additional devices at the End-User Premises (other than a POTS handset). This UNI-V interface is supplied with power via an external battery-backup unit, for continued operation in the event of a power failure. The end-user should not need to be aware that the telephone service is carried as IP telephony from the NTD through the NBN to the RSP’s equipment.

The retail service boundary and the wholesale service boundary are the UNI-V port, which functions as a standard analogue POTS socket.

At the POI (in a FTTP wholesale model) the telephony service traffic information is handed over to the RSP in the voice-over-data protocol, and the RSP processes all the signalling and call routing in its own equipment in its own network. The FTTP network is not involved in telephone service processing.

6.2. Delivery Model 2 – ATA in a residential gateway

In an alternative model, the service is provided by an analogue POTS interface embedded within a residential gateway device installed and provided by the RSP. This setup is similar to the setup in Delivery Model 1, except that the ATA is located in a residential gateway outside the optical network terminal. The residential gateway connects to the ONT using a data port, probably shared with an internet service. This arrangement is illustrated in Figure 3.

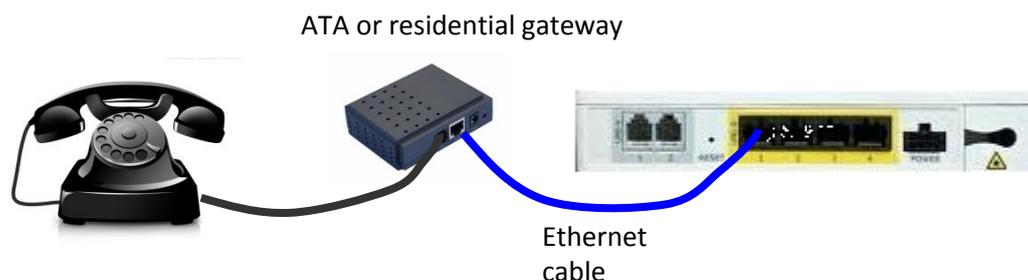


Figure 3 - Analogue telephony adapter located in a residential gateway

In this model the FTTP network provides the UNI-D as a wholesale service boundary between the FTTP network and the RSPs residential gateway, and the telephony components within the ONT are bypassed. The retail service boundary is still an analogue telephony port, but the port and voice-over-data transformation is performed in the RSP’s residential gateway, not in the FTTP network’s ONT.

This is the typical method for RSPs to provide a telephone service over other broadband infrastructure, such as ADSL or HFC cable technologies. RSPs might choose to continue using this method on the NBN for ease of support and consistency with their non-NBN customers.

A risk with this method is that the telephone service is carried through a UNI-D port, which is not powered by the NBN battery in the event of a mains power failure. A power failure will cause the telephone service to be interrupted.

6.3. Delivery Model 3 – IP telephony handset

The final Delivery Model considered here makes use of an IP telephone that sends a VoIP signal, removing the need for a separate ATA. Numerous models of IP telephone handsets are available where the VoIP telephony functions are embedded within the handset device, and the device connects directly to an Ethernet data network, as illustrated in Figure 4.



Figure 4 - IP telephone handset connected directly to Ethernet network

In some models the device supports a Wi-Fi data connection, such that the handset device has no communications cable to it at all (although it usually requires a power cable). Basic IP handsets are available on the market for as little as \$40, however most are designed for corporate use and cost from \$100 up to \$1000 or more.

The ATA functions are embedded within the handset as Customer Equipment. The FTTP network is generally not aware that a telephone service is being provided by the RSP, although the telephony traffic may be prioritised above other traffic in order to enhance reliability of the service.

This model is common in new premises in greenfields housing estates, where the handset cost is minor compared to the rest of the dwelling, and the enhanced features of the IP telephone handset can be leveraged as a marketing feature. It is not common for migrations in existing premises, where it is often desirable to maintain the use of a familiar analogue handset.

7. NBN telephone services are not “VoIP services”

In the diagrams above, Model 1 and Model 2 forms of service in particular should not be described as a “VoIP service”, since there is no VoIP technology aspect under the control or knowledge of the consumer – the consumer is buying a “telephone service”, with demarcation at the analogue telephone port. The conversion to VoIP is an internal process buried within the service provider or carrier’s network, and is invisible to the consumer. Provided this supplies the expected quality of telephone service characteristics in terms of audio quality, delay, echo etc., there is no reason the consumer need be bothered by aspects of the underlying technology. It would only be a “VoIP service” if the consumer’s equipment was involved in the conversion of the audio signal into IP packets, and the traffic passing through the service provider’s service boundary point consisted of IP packets.

For Model 3, where an integrated IP handset was used, if the IP handset was expected to be sourced by the consumer, then the service could be described as a VoIP service. If the IP handset was supplied and installed by the service provider, such that the consumer experienced and was sold the service as a traditional handset with a thicker telephone cable, then arguably this should also not be described as a VoIP service. It is still a telephone service, provided using IP technology.

8. Nature of telephone service quality impairments, and relationship to digitisation and Internet Protocol transmission

It is important to understand the process of transmitting an analogue audio signal using VoIP technologies, in order to understand the role that VoIP plays in causing impairments.

Transmitting a sound is a two-step process.

Firstly, the analogue sound wave from the microphone is digitised into a continuous digital signal stream, using a CODEC – a standard method of transforming analogue information into digital information. There are many CODECs that could be used: the G.711 CODEC produces a 64kbps digital signal, while a G.729 CODEC uses compression to produce a smaller 8 kbps or 16 kbps signal at the expense of audio quality.

Secondly, the continuous digital stream is segmented into regular blocks of data. The blocks are then encapsulated into IP packets, and sent to the destination.

At the destination, this two-step process is reversed – the contents of the IP packets are concatenated to form a continuous stream, and the continuous digital stream is passed through a matching CODEC to form an analogue signal sent to a loudspeaker in the handset.

It is important to understand that many of the voice impairments occur in the first step of converting analogue signals to digital signals and back again, and that these CODECs are precisely the same CODECs used in traditional digital telephone exchanges and in the line cards in the exchange that the analogue copper pairs are connected to. Mismatches in audio levels, where the other party sounds too soft or too loud, are caused by incorrect digitisation, not in the transmission over IP. Similarly the presence of echo is caused by a lack of echo-cancellation in the CODEC process, not in the IP stream. Each CODEC introduces a different amount of time delay in processing – the more compression, the longer the delay. It is this compression step that contributes to increased end-to-end delay in a telephone conversation, rarely is this due to an issue with the IP packets.

These impairments can and do occur in traditional telephone systems. If a conventional analogue telephone provider decided to use the G.729 CODEC in their digitisation stage, they would save bandwidth in their TDM network while delivering poorer quality audio – and it is the use of this CODEC that frequently blocks alarms, faxes, modems etc.

The G.711 CODEC used in the NBN ATA produces the same digital signal as a normal Telstra exchange line card, and will successfully carry audio data signals such as those produced by security and personal health alarms.

In general, most of the telephone quality impairments described can occur in non-IP networks as much as they can occur in IP networks. For this reason, ACCAN recommends against focusing specifically on the VoIP transmission method as a target for service quality regulation, as this will create too narrow a focus and will not protect non-IP networks that are accidentally or deliberately configured to have the same poorer quality audio signal characteristics. Instead, technical quality specifications should focus on the telephone quality of experience characteristics of concern, and set clear limits on the amount of delay, echo, loudness problems, audio frequency range and other characteristics that define a lay consumer's experience of a telephone service. In this way, the desired outcome is clear and documented. This is preferable to specifying the method of achieving the desired outcome, which would rapidly become out-of-date as new technology evolved.

As an example, if a specific VoIP quality standard had been produced a few years ago, it would likely have only applied to IPv4. With the increasing use and drive of the next generation Internet Protocol IPv6, such a standard would have to be revised. Similarly, the document would likely have to be revisited for each new CODEC as they are developed. This approach risks stifling innovation and improvement by preventing improved technologies being introduced until regulation catches up. In contrast, by specifying the desired outcome in terms of audio quality characteristics, then carriers and service providers can use the most appropriate technological tool to deliver according to the documented quality level.

9. Analysis of C519:2004 as it might relate to NBN telephony using VoIP

This Code specifies minimum performance levels for end-to-end network performance together with a methodology for demonstrating compliance. The Code aims to ensure an acceptable overall level

of performance for consumers in an environment with multiple service providers and multiple networks.

This Code documents requirements for the service of a STS. In many cases these requirements are expressed in technology-neutral terms, and can apply without modification to telephony services deployed over optical fibre, using VoIP technology and other broadband infrastructure.

C519 includes parameters that are applicable to the fixed (copper local loop) network and the public cellular mobile network. Some of the requirements that are applicable to voice-over-fibre services are those that are also applicable to mobile network, as each forms a fully digital end-to-end transmission path.

The following table identifies the clauses and requirements that are applicable to the deployment models for the STS when provided over an optical fibre infrastructure using one of the deployment models identified earlier.

Clause	Description	Applicability to NBN using VoIP	Notes
3.1	Objectives of the Code	Applicable	
3.2	Scope and Application	Not applicable to IP networks	Note 1
6.2.4	End-to-end Connection Setup Failure Rate	Applicable	Note 2
6.2.5	Post Dialling Delay	Applicable	Note 2
6.2.6	Transmission Loss	Applicable to Deployment Models	
6.2.7		1 and 2. Not applicable to Deployment model 3	
6.2.8	Overall Loudness rating	Applicable	
6.2.9	Circuit Noise	Not Applicable	There is no Circuit Noise in an end-to- end digital path, so VoIP services should comply automatically
6.2.10	Access Path Attenuation Asymmetry	Not Applicable	
6.2.11	Transmission Delay	Applicable	Note 2
6.2.12	Echo Control	Applicable to Deployment models 1 and 2.	
6.2.14	Synchronisation and Slip	Not Applicable	Only for 64kbps TDM digital networks
6.2.15	Real-time Text Telephony 0	Applicable	Note 3
6.2.16	Character Corruption Ratio		
7.1	Compliance process Overview	Applicable to Code Signatories	
7.2	Network Design Verification	Applicable	
7.3	Compliance Declaration	Applicable	
7.4	Direction to Demonstrate Compliance	Applicable	
8.1	Exception Test 1 – Connectivity Testing	Applicable	
8.2	Exception Test 2 – Network Design Verification	Applicable	
5.4	Electro-acoustic transmission and reception	Applicable for all line types	Note 1

Table 1: Application of C519:2004 clauses to NBN VoIP services

Note 1: Clauses 3.2.8 and 3.2.9 carve out STS where IP technology is used at any point along the end-to-end path, including within a CSPs network or wholesale arrangements with another CSP or carrier. All telephone calls using the NBN will involve IP telephony technology, whether or not the consumer is or needs to be aware of this. Accordingly, for this code to be relied on to regulate STS services (including USO services) on the NBN or other fibre optic networks, the code will need to be reviewed by Communications Alliance and these caveats removed.

Note 2: C519, developed in 2004, uses “fixed” to refer to copper local loop or other TDM network infrastructure. The same parameters are applicable to voice-over-fibre STS if the optical fibre access network is also considered to be an example of a “fixed” network.

Note 3: Character Corruption Ratio for Real-time Text Telephony is applicable when the real-time text terminal is operating across a STS by utilising voiceband data transmission. When an optical fibre (or other technology) broadband network is available, more efficient protocols incorporating digital transmission and error detection and correction may be available as an alternative to using voiceband data techniques, using a data network service.

ACCAN submits that, because the C519 quality measures are mostly described in technology-neutral terms, many of the quality measures should apply and can be complied with by a path containing IP elements.

Some measures of quality are specific to older and legacy technology – but these are clearly labelled as such. In many cases a digital or VoIP system will comply with the requirement in any case – for example, VoIP systems do not have any synchronization or clock-slip problems, so their measured value of 0 will comply with the requirement even though it makes little sense in the context. Requirements that are not applicable to IP networks can be marked as such.

Without pre-empting the results of a review, ACCAN submits that a review and refresh of C519, or creation of a similar document with no carve-out for specific technologies, would be appropriate to create a technology-neutral STS performance specification. This would be applicable to all STSs, and restore the quality protections that have been eroded by the introduction of IP carriage into various areas of the Australian interconnected telephone network. It would ensure service providers were aware of the minimum quality thresholds required, and therefore provide the required assurance to consumers that their telephone services will deliver as expected – including over the NBN.

This would obviate the need to produce quality measures specifically targeted at VoIP carriage.

10. Variations in telephone service quality and service labelling

ACCAN understands and shares the ACMA’s concerns that telephone services of variable quality may emerge, and that consumers should be able to identify and make an informed choice when they wish to acquire a reduced quality service in exchange for a reduced price.

Without any further labelling or other information, the default position must be that a service sold as a “normal” (to avoid the regulatory “standard” definition) telephone service must comply with the STS quality characteristics that match or exceed the expectations for an analogue telephone service today. A provider should not be able to market a lower-quality, unconditioned internet

telephony product as a standard telephone service; only a conditioned IP telephony service should be able to be labelled as such.

If an agreed definition of a label and associated lesser quality telephone service characteristics can be determined (Silver, Bronze, or B-class and C-class etc.), then a service that delivered to those lower telephone service quality characteristics (as defined in a new or revised C519-like code) would then need to be labelled and marketed using the agreed label and information appropriate to that service offering. Any service that falls below the defined standards would still need to meet a minimum quality in order to avoid consumers being sold products that are not fit for purpose.

The default position must match the expectations of telephone service characteristics that are experienced on the analogue copper network today, to ensure that unsophisticated consumers who “just want a normal telephone line” will receive the quality level and characteristics they expect.

11. Telephone service quality for IP telephony

11.1. Quality of experience for IP telephony

In 2006 and 2007 Communications Alliance opened several parallel working groups and initiatives to look at the issues of the long term migration of the Australian PSTN to an all-IP model. Different provider’s IP telephony networks and soft switches could interconnect at the IP layer and calls between different IP networks could remain as VoIP calls end-to-end without having to be converted into a conventional TDM segment in the middle.

In parallel with the working committee that created [G632] Service quality Parameters for IP Networks document, another working committee created a companion guideline dedicated to VoIP service quality [G634], recently updated in 2013. Quality of service in this context is synonymous with conversational quality, sometimes termed “quality of experience” rather than the more technological use of the term in the IP Networking series of documents – matching the ACMA use of the term “telephone QoS”.

[G634] specifies the categories of speech transmission quality in terms of limits of Transmission Rating Factor R and provides an overall indicator of the quality of VoIP services. Providers of VoIP services can use this Guideline for transmission planning purposes and to inform end-users. In addition, it provides information on the impairments that determine conversational voice quality for VoIP Services based on ITU-T recommendations and Australian requirements.

The anticipated benefit to consumers of VoIP services is a consistent approach by service providers to the delivery of quality of experience for VoIP services. This will enable the customer to make an informed choice of VoIP services and provide the customer with improved confidence that the VoIP services will operate as expected and will operate between different networks.

The guideline addresses the measurement of four factors that affect conversational voice quality on a telephony service, being delay, distortion, echo and loss/level gain. In this sense, it is a VoIP specific version of the C519 industry code, describing audio service characteristics that can be described and measured by consumers, rather than using complex technical jargon for the characteristics to be measured and managed. It could be used as an initial starting point for revising

C519 to include specific guidance to VoIP providers on how to comply with the overarching audio quality requirements, delivering an STS with acceptable end-to-end performance.

12. Other observations

12.1. Applicability of the Customer Service Guarantee

The Customer Service Guarantee (CSG) is a standard setting minimum performance and repair requirements for fixed-line telephone service customers. In [ACMA 2013], page 8, footnote 2, ACMA states that “[i]n the main, IP-based voice services are currently not covered by the CSG Standard, due to the widespread practice of seeking customer agreement to waive CSG rights”.

ACCAN observes that this practice has little to do with telephony being IP-based, and so the footnote may be misleading. Instead, providers seek CSG waivers when they are using a wholesale connectivity service such as ULLS, LSS or Wholesale DSL, where the wholesale infrastructure provider’s service level commitments for service installation and repair of the underlying infrastructure are longer than the CSG provisions, preventing the retail provider from achieving CSG timeframes.⁵ That they may also provide voice using IP technologies is incidental. Providers who use traditional telephone technologies over ULLS also seek or negotiate CSG waivers⁶ while IP-based voice service providers using their own infrastructure, such as Optus HFC, TransACT, and many FTTP estates, do not seek CSG waivers.

⁵ See e.g. Optus, *Submission to DBCDE Telecommunications (CSG – Retail Performance Benchmarks) Instrument (No1) 2011 Exposure Draft, June 2011*, sections 2–3, pp 2–6, <www.dbcde.gov.au/_data/assets/pdf_file/0005/138164/Optus.pdf>. Note that Optus does not appear to seek CSG waivers even when using ULLS.

⁶ Primus, *Digital Direct SFOA*, paras 8.4 and 8.5, <<http://210.50.7.4/NR/rdonlyres/7FB75265-20CA-457A-A459-C26D1C8598EC/0/DigitalDirectSFOA.pdf>>.

13. Appendix 1: table of acronyms

Acronym	Meaning
ACMA	The Australian Communications and Media Authority
ATA	Analogue Telephony Adapter A device that converts analogue voice input into a digital signal suitable for use on IP networks.
CODEC	Coder-Decoder An application that converts audio signals into a digital code, and converts the digital code back into audio signals.
CSG	Customer Service Guarantee A standard setting minimum performance and repair requirements for fixed-line telephone service customers.
DBCDE	The Department of Broadband, Communications and the Digital Economy
FTTN	Fibre To The Node A network design in which fibre optics terminate at nodes, with other connections (typically copper wires) connecting the nodes to premises. Distinguished from FTTP.
FTTP	Fibre To The Premises A network design in which fibre optics terminate at the premises of the end user.
HFC	Hybrid Fibre Coaxial A type of network combining optical fibre and coaxial cable. Used for cable internet services as well as cable TV services, typically using the DOCSIS standards.
IP	Internet Protocol The standard network layer protocol for transmitting data over the internet.
ISDN	Integrated Services Digital Network A standard for transmitting data over a traditional voice communications network.
ITU-T	International Telecommunications Union Telecommunications Standardization Sector A division of the International Telecommunications Union (ITU) responsible for developing standards for telecommunications systems.
kbps	Kilobits per second A measure of the speed that data is transmitted over a network.
NBN	The National Broadband Network
NTD	Network Termination Device Hardware that connects an end user's voice and data equipment to a network.
ONT	Optical Network Terminal A network termination device for connecting to a fibre optic network. In the case of the NBN, the ONT is an "NBN Box" installed at the end user's home.
POI	Point of Interconnect The points on the NBN network where traffic is passed from the NBN to RSPs.
POTS	Plain Old Telephone Service A traditional telephone service based on circuit switching technology.
QoS	Quality of Service Refers to the level of quality in a communications system. Can also refer to a specific mechanism for distinguishing different types of traffic (e.g. voice and non-voice data) based on the level of quality they require.
RSBP	Retail Service Boundary Point In a communications network, the RSBP marks the limit of the network that is under end user's control.
RSP	Retail Service Provider A provider of retail services that operate over the NBN, such as voice or internet services.
STS	Standard Telephone Service A regular telephone service providing local, national and international calls, access to emergency services, directory assistance, etc.
UNI-D	A data port on an NBN termination box. Data devices such as computers or home routers can

	be connected to this port to use data services over the NBN.
UNI-V	A voice port on an NBN termination box. A traditional (non-IP) phone can be connected to this port to use voice services supplied over the NBN.
VoIP	Voice over Internet Protocol (Voice over IP) A technology for transmitting voice over an IP network.
WSBP	Wholesale Service Boundary Point In a communications network, the WSBP marks the limit of the network that is under a wholesale provider's control.

14. Appendix 2: other technical terminology

Terminology	Description
Ethernet	A protocol for transmitting data over a network.
Fibre optic	A network cable that sends pulses of light along a glass wire, and is capable of very high bandwidths.
Frame relay	A protocol for transmitting data over a network.
Inter-exchange network	Sections of a network that connect local exchanges.
Internet telephony	Telephony services delivered over the internet without any additional network conditioning (e.g. Skype, Google Talk).
Line card	A piece of hardware in a communications network that provides various functions, including converting between analogue and digital signals.
Quality of service	Refers to the level of quality in a communications system. Can also refer to a specific mechanism for distinguishing different types of traffic (e.g. voice and non-voice data) based on the level of quality they require.
Residential gateway	A device for connecting a user's home network, including phones and computers, to the internet. Modem/router devices typically contain a residential gateway.
Soft switch	Software that connects telephone calls from one phone line to another.