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Legacy PSTN applications cause confusion

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Abstract

When faced with the need to move their services to the National Broadband Network (NBN), many consumers discover quite late in the process that their new NBN-based service has left their legacy PSTN connect devices behind.

Introduction

As the National Broadband Network (NBN) rollout continues, many consumers are facing the forced disconnection of their copper landline (NBN 2014 [5]) and the requirement to move to the NBN if they want to retain landline services.

While the technical aspects of shifting to a new broadband service are reasonably well understood and to a certain extent expected, many Australian residential and business consumers face unanticipated problems if they have a monitored burglar alarm or EFTPOS terminal connected via the PSTN. Some only discover after they have left the PSTN that their new NBN-based service has left their legacy PSTN connect devices behind.

The NBN website states ?The nbn? network presents opportunity in education, business, entertainment, health care and sociability giving everyone the potential to be more productive, more creative, more efficient and more connected for decades to come.? (NBN 2015a [6]). The website goes on to encourage readers to ?find out more about the benefits of fast broadband? without any mention of the disadvantages of possibly losing some or all of their PSTN functionality.

The need for legacy modems and DTMF signalling

A common device consumers expect to connect via the NBN is a fax machine, and this is supported by the NBN (NBN 2015b [7]: 29). It is a scanner and printer connected to another scanner and printer via modems that operate at 9600 or 14400 bits per second. This is within NBN?s specifications (NBN 2015c [8]), so there is no NBN-imposed technical barrier to a retail service provider (RSP) (NBN 2015d [9]) supporting this service connected via a UNI-V port.

Similarly, PSTN-connected EFTPOS terminals are a user interface, card reader and printer connected via a 9600 bits per second modem to a service provider and once again this is within NBN?s UNI-V specification.

Consumers are likely to find themselves needing to send numbers from a CPE keypad using dual tone multiple frequency (DTMF) signals. Examples include activating credit cards, responding to surveys and accessing customer service phone queues and PABX extensions.

There are also some hidden uses of DTMF such as many medical alarms, home automation devices and some monitored alarms.

The current situation with legacy services

Some providers like Telstra (Telstra 2014 [10]) and iiNet (iiNet 2015 [11]) state on their websites and in documentation to their subscribers that they can support such legacy services, but that subscribers need to talk to the operator of the legacy service to determine if the service is capable of working via the NBN at all.

Other providers like TPG (TPG 2015a [12]) state that their NBN home phone service does not work with EFTPOS or older Foxtel set top boxes. TPG does not offer an NBN business service (TPG 2015b.2) so those subscribers not only face the disruption of having their copper disconnected but also need to find a new service provider.

FTTP is a mature technology so why is this a problem?

The fibre to the premises NBN was developed from a popular platform used by vertically integrated carriers in other countries. It was adapted for the NBN to support wholesale RSPs that are not obliged to provide telephony services. While it is obviously feasible for any RSP to supply a PSTN replacement voice service, only some have chosen to do so and all are naturally reluctant to take on any responsibility after cutting over from Telstra or their own dial-tone.

How is voice delivered over the FTTP NBN?

There are three ways an RSP can supply voice services. The first is via what NBN call the UNI-V port on the Network Termination Device (NTD). Inside the NTD is a Voice over IP (VoIP) analogue terminal adaptor (ATA) that connects to an RSP using session initiation protocol (SIP). The IP packets are carried by NBN via dedicated network capacity to one of the 121 points of interconnect (POI), where they are handed over the RSP.

It is also possible for the RSP to deliver voice services via the UNI-D port to some sort of IP connected customer premises equipment (CPE) device provided by the RSP. This can be functionally identical to the UNI-D service inasmuch as the traffic can be carried over dedicated NBN aggregation network capacity if the RSP tags the packets appropriately and acquires appropriate NBN Connectivity Virtual Circuit (CVC) services at the serving POI. A key benefit for the RSP is that they can control the CPE entirely and monitor the performance of the voice network on a call-by-call basis if necessary to ensure call quality.

Some RSPs choose to deliver voice services along with general Internet services via the ?best efforts? Internet delivery CVC. With attention to quality of service (QoS) traffic engineering it is possible to achieve a regular high level of call quality, but there are congestion situations within NBN?s service level agreement (SLA) with RSPs in which this is not possible and there is no guarantee this will not coincide with the subscriber?s alarm reporting a burglary or fire.

Finally subscribers can supply their own VoIP CPE which may be used with a service from their RSP or from some over the top (OTT) provider of voice services. In this situation there is little opportunity for control of the QoS and voice audio quality can be highly uncertain.

Technical challenges supporting modems

At the POI, NBN hands over UNI-V and priority voice traffic to the RSP that can either immediately move them to a time division multiplexed (TDM) network and carry them as they would traditional voice services. Alternatively, they can prioritise the transport of these packets in their network to ensure zero packet loss and minimal jitter. If a third party MPLS network is used to carry this voice traffic there may be factors outside the RSP?s control that can cause packet loss or jitter and thus cause interference with the call?s audio quality.

At 9600 bits per second a modem data connection is 2400 symbols per second encoded using quadrature amplitude modulation. Any loss of signal results in the decoder losing synchronisation and the modem either drops the call or re-establishes synch. This makes for an unreliable connection which slows transaction processing, leaves visible distortion on fax images or may cause an alarm monitoring service to miss a message from an alarm panel.

The widely used G.729 VOIP codec effectively regenerates human speech at the receiving end using a ?vocoder?. This makes the codec completely unsuitable for carrying modem traffic.

Technical challenges supporting DTMF

DTMF is also used for dialling phone numbers and as such VoIP ATA CPE and service provider gateways have DTMF detectors built in to look for these key presses. It can ignore the event, perhaps because it knows the call is under way or it can send a signal to the remote end of the call to say that a DTMF digit was detected (RFC2833 [13]). One reason for sending a signal is that codecs like G.729 rely on data compression techniques to deliver network efficiency and as such they don?t carry the actual DTMF signal over audio reliably. So if a signal was sent the receiving end can suppress the call audio for a moment and generate a perfect local DTMF digit. You hear this sometimes when you are on an international call and a part of the remote person?s voice is altered into a DTMF tone while they speak. This is being done by the VoIP system used by one of the international voice carriers handing the call.

It may not be obvious but DTMF detection ruins modem connections so it must be disabled during a modem call.

Some CPE sends an audio version of the DTMF and the out-of-band RFC2833 signal. When this arrives at the receiving end, part of the original audio DTMF digit arrives and then the local copy is produced resulting in the actual service looking for the tones becoming confused.

Are there other technical problems?

One feature of alarm diallers and often of fax machines is the ?Mode 3? wired socket that allows the dialler to disconnect all the telephone handsets connected to the PSTN line to ensure there is no interference while it makes its very important call. Making this wiring work for NBN connections is often time consuming for the installer, so in some cases it gets bypassed, leaving the consumer with a handset connected on the NTD side of the Mode 3 socket, thus rendering it useless. The NBN provide a brochure (NBN 2013a [14]) for RSPs in an attempt to improve their familiarity with these issues including Mode 3 wiring. It is an indication of how little businesses with a solid background in providing Internet services know about providing telephony.

Does fibre to the node (FTTN) improve things?

The NBN has not published a Product Schedule for FTTN. The Test Agreement for FTTN required participating RSPs to provide any voice service via existing exchange copper (NBN 2015c [8]). At this point it isn?t possible to determine if things will be substantially different with FTTN but an educated guess is that NBN?s node equipment will be able to provide an equivalent to the UNI-V service on the same copper loop that delivers the VDSL service.

The problem of double legacy equipment

There remain in use today some automated decadic pulse diallers, often part of a domestic alarm system. This is already legacy equipment on the PSTN and they continue to work only because many Telstra PSTN exchange lines are still capable of supporting decadic pulse dialling. These diallers will need to be replaced because the NBN UNI-V port does not support decadic dialling.

What about non-technical problems?

Many RSPs do not offer number portability with all the other RSPs. Some RSPs offer it with some other RSPs. Some consumers will find that their options are limited if they need to change provider due to their current provider not offering some services via the NBN that they need for the daily business. A few will discover that they are trapped on an island where they can?t move away without losing their phone or fax number.

Some technical solutions

One way VoIP operators can avoid these problems is to embed a modem within the CPE either in accordance with ITU T.38 (ITU 2010 [15]) or using some proprietary system.

T.38 is specifically used for facsimile traffic. It emulates a remote fax machine and specifies the protocol for communicating with a remote station that in turn emulates a fax machine to complete the call to the recipient. Many VoIP providers support T.38 and given that a fax is often connected to a dedicated PSTN line, there is little harm in migrating this concept to the new world. Some fax machines don?t seem to like some implementations of T.38 but fax machines are so cheap now that having to replace an old one is hardly onerous.

Proprietary embedded modem systems can emulate an EFTPOS service or alarm monitoring service or some other modem answering station, communicate via modem or DTMF and send communications out via the internet via the NBN or via 3G or 4G wireless. The disadvantage for RSPs is that the consumer has reduced their need for telecommunications services and in some cases their need will have reduced to the point where they don?t need an RSP at all.

Some further solutions

In 2013 the NBN funded a ?Plug Bench? facility to allow equipment suppliers and network connected service providers to test their services with a variety of RSPs over the NBN. This service requires the cooperation of RSPs and many small providers do not have the resources to support providing the necessary services.

One way to improve the current situation would be to imposing a requirement that all large NBN RSPs offer the option of a legacy PSTN compatible voice service.

Another would be to require all NBN RSPs offering UNI-V services to comply with their any-to-any obligations under the CommsAlliance Local Number Portability Code (CommsAlliance 2013 [16]) and ensure they can port numbers to and from all the other telephony providers. This would have the effect of forcing some RSPs off the UNI-V ports entirely because they aren?t really competent to provide ?carrier-grade? services over them.

A requirement for any RSP providing UNI-V services should be to provide a service at the Plug Bench.

And a further improvement would come from finding an economically viable way for the voice service and the data service to be provided by two different providers. Under the current pricing rules each provider would have to acquire a basic service which is a bundle of a UNI-V and a UNI-D port and that is cost prohibitive. A further barrier to this is that if an RSP does engage a third party specialist voice carrier to handle the migration of legacy PSTN services, that provider finds it difficult to achieve a local number port without disrupting the existing ADSL service on the PSTN line, because a Cat-A port will cause the PSTN and ADSL services to be both torn down and a Cat-D port will be refused because the voice carrier is not the carrier doing the NBN service migration. CommsAlliance has a working group WC50 looking at this but it is incredible how little progress there has been to date given that it?s 2015 and we are rapidly approaching the millionth NBN connection.

Conclusions

The forced migration from copper to fibre was needed to move everyone from cheap-to-use copper to expensive-to-use fibre for the good of the nation. It?s a little harder to understand now that fibre to the node is part of the mix, and it appears much of the voice will be provided over the legacy copper that runs back to Telstra exchanges.

The primary consequence of this forced migration is to leave consumers to choose from harmful or painful options with no clear right answer. For many the best solution is to find a way to live without the NBN for voice services.

Some of these issues would be less confusing for consumers if RSPs and the NBN made clearer statements about what is known to work and what is known to not work rather than hiding behind disclaimers and leaving it to thousands of consumers to hunt down businesses that no longer exist that sold products that are now obsolete.

I commend more suppliers of PSTN delivered services to take their devices to the Plug Bench, test them against various RSP telephony services and publish the results.

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