Why TheBuzz is better than Broadband VoIP

1. Introduction

Many households and businesses are beginning to take advantage of Voice over Internet Protocol (VoIP) technology to significantly lower their phone call charges. VoIP technology has been around for over a decade, but it has now matured to the point where VoIP is slowly gaining some market share. To be clear, VoIP is still a new technology, and the future will see more VoIP services being delivered to consumers with ever greater ease and with the same quality and reliability that we have come to expect from traditional telephony services.

This article discusses the issues that impact on providing reliable and high quality VoIP communications. Specifically, we look closely at typical broadband VoIP and show why this method of VoIP deployment is vulnerable to poor service quality. We also lay out the basic principles for the next generation of VoIP delivery that will result in better VoIP quality and reliability. Finally, we introduce TheBuzz VoIP service and show how we apply these basic principles in our network.

2. The Broadband VoIP Service Architecture

In todays residential and Small to Medium size Enterprises (SMEs) VoIP is mainly deployed using broadband internet, as shown in Figure 1

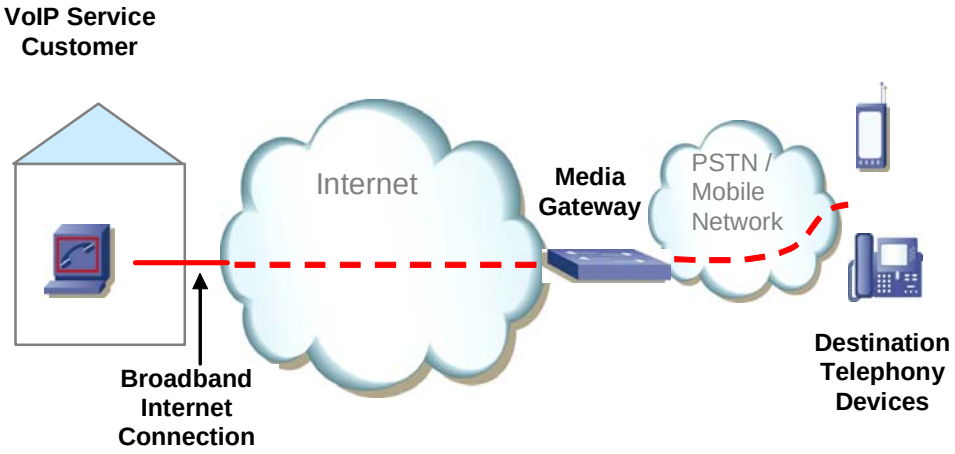

Figure 1 – VoIP/PSTN hybrid service delivery model

Here, the customer has broadband internet (e.g. ADSL) via an Internet Service Provider (ISP). Using broadband the customer is able to make VoIP calls through a VoIP Service Provider (VSP). VoIP calls can be made to other VoIP users but typically the VoIP call is to a regular phone on the PSTN or mobile network. The Media Gateway is used to bridge the VoIP and PSTN networks and vice versa. That is, the reverse is also possible where a regular telephone can call a VoIP phone (but using a VoIP number and not the callee's regular telephone number) .

In Figure 2 some commonly used VoIP interface options are shown. A popular device is the Analog Telephone Adaptor (ATA) which allows a regular analog phone to be used with the Broadband VoIP service. This makes the process of using VoIP simpler than other ways of making a VoIP telephone call. In some products the ATA is built into the broadband ADSL modem thereby reducing cabling and number of boxes.

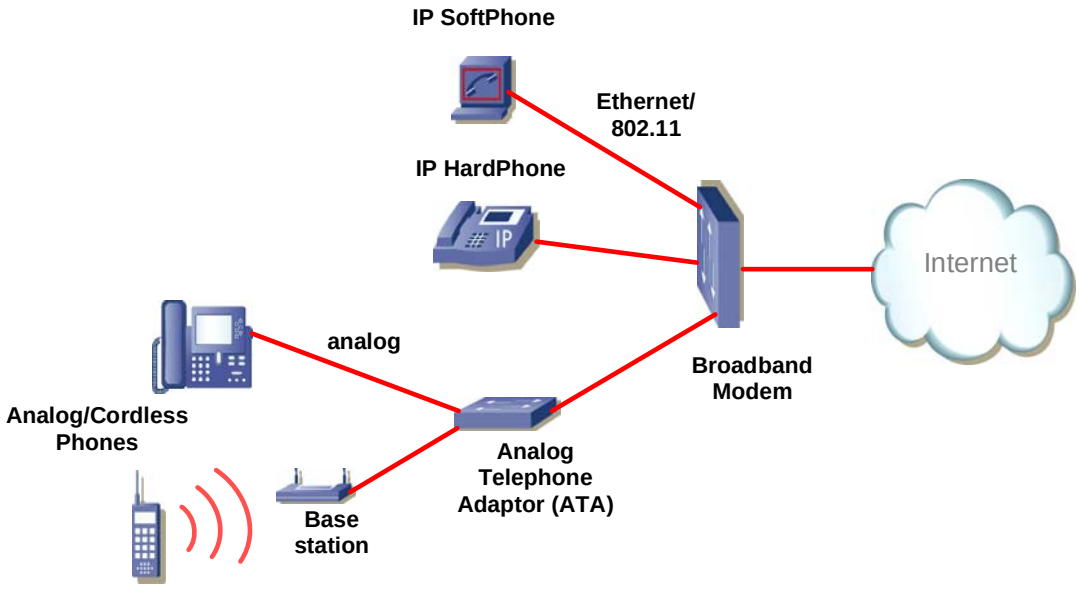

Figure 2 – VoIP interface options at the residential customer premises

In the following sections we look closely at the characteristics of Broadband VoIP.

2.1. Call and Service Quality

A more detailed diagram of the Broadband VoIP system is shown in Figure 3.

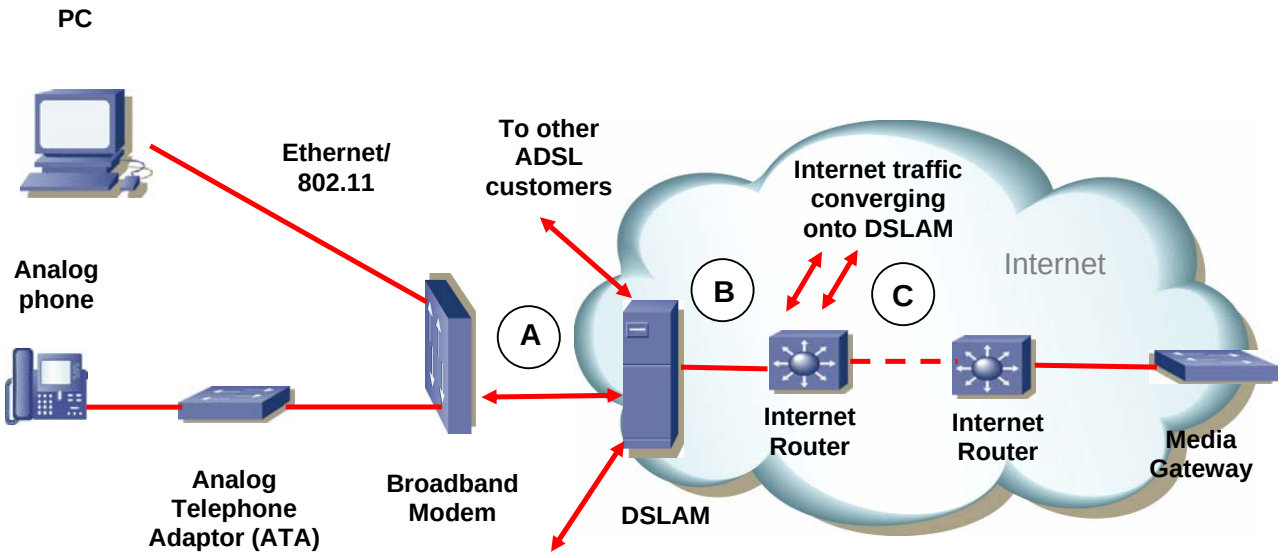

Figure 3 – VoIP transport from a residential VoIP user using ADSL broadband.

Here, the voice call commences at the user end, typically from a regular analog phone. This voice signal is fed into the ATA where it is converted to VoIP packets which are then sent to the Broadband modem. The connection speed to the modem is typically at Ethernet speeds (100Mbps) or 802.11 speeds (above 10Mbps). The modem collects VoIP packets from the ATA and other internet data packets from other devices within the home (i.e. PCs using email, web browsing, or up/downloading files to/from the Internet). The modem then routes IP packets to the DSLAM at the local exchange via Link A. The maximum speed, or bandwidth, of Link A depends on the ADSL technology and the distance the home is from the exchange, but typically these speeds range between 0.128 Mbps to several Mbps. The customer may be subscribing to a low speed plan, which limits the access speed on this link. At this point, there is a bandwidth mismatch between the home Ethernet/802.11 link and the modem link bandwidth at Link A, creating a point of congestion which can result

in lost VoIP packets, or delay and jitter of VoIP packets. When congestion occurs in this way it shows up as clicking sounds, breaks and poor speech during the voice conversation. This phenomena is a common experience amongst VoIP users. A recent survey of Australian VoIP users showed that "well over half of the VoIP consumers had experienced echo, noise or voice dropout on their calls" [1]. The VoIP Service Providers (VSPs) are also aware of this problem- it is not uncommon to find the following type of question on the FAQs (Frequently Asked Questions) on VSPs Websites:

> Q. *What do I do if the callers do not hear me while I am talking?*
>
> A. *High internet usage on your personal computer while talking on your phone may impact your phone calls. Do not send email or upload any files while on the phone.*

While congestion on Link A can be minimised by not sending "email or upload any files while on the phone", it is hardly satisfactory to expect all users within a residential or SME network to modify their behaviour when someone is making a phone call.

Continuing on, once VoIP packets arrive at the DSLAM from the modem, they compete with the neighbourhood of other ADSL Internet traffic connected to the same DSLAM. These neighbouring users may also be possibly using VoIP and also undertaking Internet data transfers. All this combined traffic from all users meet at the DSLAM and must share the link at B to enter the Internet. This is the second point of possible congestion for VoIP traffic, again the VoIP packets can be lost or delayed. The extent of this degradation will depend on the link bandwidth at B and the traffic from the other neighbouring ADSL customers connected to the DSLAM. The congestion at point B is not controllable by any one user and is potentially more serious situation for the VoIP user. Thus, depending on the essentially uncontrollable behaviour of many ADSL users, congestion at Link B can result in lower quality VoIP connections. To minimise the congestion problem at Link B, the bandwidth of Link B should be between 5 to10 times larger than the sum of the average traffic from all the converging ADSL users (including VoIP and non VoIP traffic usage). But to have this high bandwidth link would be more costly so there may be some resistance by some ISPs to pay for this. But even if it were possible, it is generally not under the control of the VSP but is usually the responsibility of the ISP providing the ADSL service.

Once the VoIP packets leave the DSLAM they will be sent to the Media Gateway through the Internet, hop by hop, via Internet routers. The VoIP transport service quality of this

path will depend on locations of the DSLAM and the Media Gateway, the quality of routers, the service bandwidth between routers and the behaviour of other Internet users sharing the same route path. The VoIP packet transport through this path is another area of congestion and can occur anywhere along the path. We show this area of congestion as point C in Figure 3, and again the VoIP packets can be lost, or delayed resulting in lower voice quality. To minimise this congestion, the Media Gateway should be placed as close as possible to the DSLAM and between them should be high bandwidth Internet paths within the core of the Internet rather than "low bandwidth" Internet paths that typically exist along the edges of the Internet. In general, however, these requirements cannot always be met and are generally out of the control of both the ISP and VSP.

Once the VoIP packets arrive at the Media Gateway they are converted to a PSTN circuit switched connection. This PSTN connection is designed to carry voice signal and has low delay and guaranteed bandwidth.

In summary, we can apply two simple principles to achieve delivery of high quality voice communications:

PRINCIPLE 1:

Along a voice communications end to end path, carry the voice signal as far as possible on the PSTN rather than the Internet.

PRINCIPLE 2:

For VoIP packets on the Internet, use the shortest path with the highest possible bandwidth

Unfortunately, for many broadband VoIP users, the above principles are not (or cannot be) upheld by the ISPs and VSPs resulting in a poor consumer experience.

2.2. Emergency Services

Emergency service support, taken for granted by PSTN users, is a problem for the VSPs and their customers. Although access to emergency services are offered by a small number of VSPs, the coverage is limited, resulting in many VoIP customers potentially not having access to the emergency service. Further, unlike a PSTN service, where the phone number is directly linked to an address, a VoIP phone number is not. Therefore, the customer must ensure that their location is continually updated to their VSP and it is up to the VSP to correctly store and use that information without error. There are cases which shows that

this arrangement is error prone as in [1] where it was reported that emergency services were sent to the wrong location.

2.3. Complexity in Network Setup and Service Configuration

Setting up a VoIP service is not that simple and we will now discuss some of the issues:

- If the user does not have broadband the customer must choose and subscribe with an ISP to a broadband service with,
    a. a minimum access speed of 256kbit/sec
    b. sufficient data quota that allows the user to operate the VoIP service (since VoIP itself generates its own data traffic).

    This user may also need to purchase a broadband modem and configure the modem correctly.
- If the user has a broadband service, the VoIP service user may still require an upgrade of the access speed to meet the minimum of 256kbit/sec and with sufficient data quota that allows the user to operate the VoIP service.
- The user must then choose and subscribe to at least one of the over 150 VSPs (in Australia) that will provide the VoIP service.
- If the user wants to use their regular analog handset, they must purchase, install and configure an Analog Telephone Adaptor (ATA). If the user wants to use a softphone then a suitable softphone will need to be installed and configured onto the users PC.

In summary, for new VoIP customers without broadband, will require the choice and subscription of both the broadband ISP and VSP services as well as the purchase, installation and configuration of two appliances. For non-technical consumers, this is very complex and can be frustrating.

2.4. Service Costs

The total ongoing cost (i.e. excluding setup costs) required to keep a VoIP service are the broadband Internet access cost and the VSP monthly service costs plus call costs.

These costs can be prohibitive for many consumers that require little or no Internet access and mainly require a low cost telephony service.

2.5. Telephone Number Change

Currently there is no number portability between a PSTN phone number and a VoIP telephone number. Therefore, to switch from a PSTN service to a full broadband VoIP service requires the consumer to get a new telephone number. This fact causes many consumers to resist switching to a VoIP service.

2.6. Reliability of Broadband Service Provider

We have shown how the quality and reliability of the broadband Internet connection can affect the performance of the VoIP service. It is a common experience that ADSL Internet connections go “down” from time to time. Whereas this may be an inconvenience when it comes to reading email or web browsing, it is a major inconvenience (or potentially disastrous) if a user is unable to make a phone call.

2.7. Reliability of VoIP Service Provider

Even when the broadband Internet service is “up” and operational, to make a VoIP call also requires the VSP to be ”up”. As with ISPs, it is not unusual for VSPs to be “down” from time to time. In these down times the VoIP customer cannot make telephone calls. This problem can be alleviated by subscribing to more than one VSP but this will generally require additional costs and user maintenance (VSP subscription costs and the ongoing manual maintenance of VSP settings at the ATA or softphone).

3. Towards higher quality, reliable and easy to use VoIP

Here, we introduce TheBuzz service and show how it offers higher levels of quality, reliability and ease of use when compared to the broadband VoIP service model discussed so far. TheBuzz fixed line telephony service model is illustrated in Figure 4.

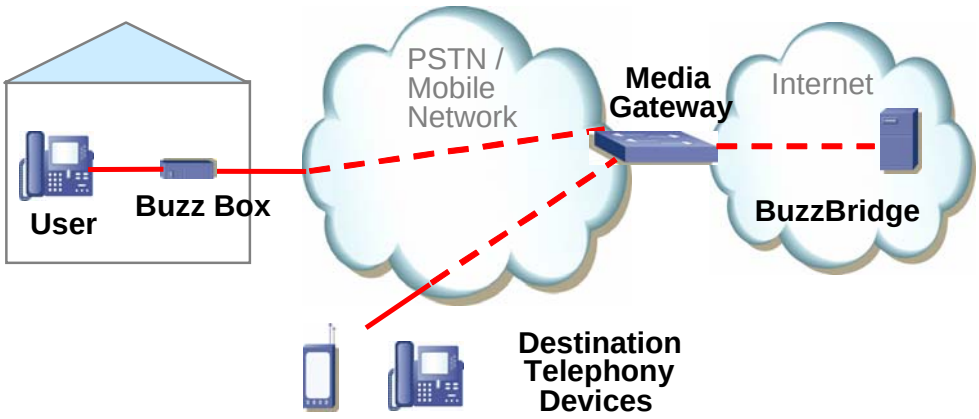

Figure 4 – TheBuzz fixed line telephony service model

TheBuzz's telephony service model introduces two key technology components:

1. The BuzzBox is a small appliance that interfaces between a customer's regular analog phone and the PSTN. The BuzzBox is responsible for initiating and establishing telephone calls between the calling user and called user.
2. The BuzzBridge is able to receive or make VoIP calls as instructed by the BuzzBox. It is also able to "bridge" calls such that the phone call between the calling user and called user is perceived to be direct

3.1. Call and Service Quality

A more detailed diagram of the VoIP transport mechanisms of TheBuzz's service is shown in Figure 5.

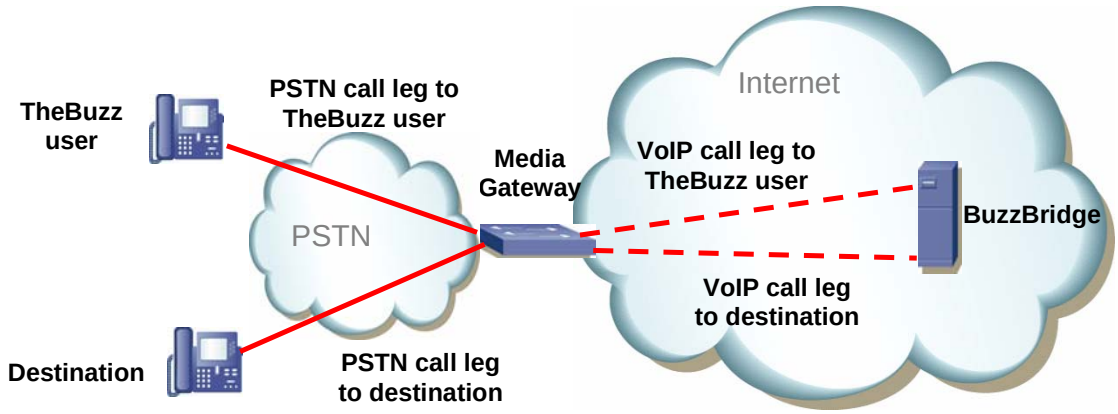

Figure 5 – Voice transport from a residential TheBuzz service user

The main features of TheBuzz' service model are:

1. There is always a PSTN call leg directly to the calling user and called user. This is in accordance with PRINCIPLE 1 described in Section 2.1 for maintaining good voice service quality.
2. For each end to end call, there are two VoIP call legs between the Media Gateway and the BuzzBridge. The high quality VSPs locate their Media Gateways within the core of the Internet in capital city locations. Similarly, the BuzzBrdiges are located within data warehouses that have high bandwidth into the Internet core. In some cases it is even possible to co-locate the BuzzBridge and the Media Gateway within the same data warehouse. In all these cases, the likelihood of VoIP packets encountering congestion between the BuzzBridge and Media Gateway is extremely small. This architecture maintains accordance with PRINCIPLE 2 as described in Section 2.1 for maintaining good voice service quality for local, national and mobile calls. In the case of an international call where the Media Gateway at the destination is remote to the user, it is important to choose wholesale VSPs that provision high speed or dedicated access to those destinations. For this reason, and to maximise call quality, TheBuzz has included the ability to choose its VSP for establishing PSTN call legs based on the destination number.

These fundamental insights has led TheBuzz to build a highly optimised network architecture and service model for maintaining high quality voice connections. Unlike broadband VoIP services, TheBuzz service is not influenced by the Internet behaviour usage of the customer, other Internet users in the neighbourhood of TheBuzz customer or the equipment and bandwidth provisioning particulars of the ISP.

3.2. Emergency Services

TheBuzz does not compromise emergency services. TheBuzz service directly connects to the PSTN and is able to transparently transfer emergency calls to it. Every TheBuzz customer, regardless on location, will have access to emergency services without any changes.

3.3. Complexity in Network Setup and Service Configuration

TheBuzz service was specifically designed to be easly installed with no configuration required. To install the BuzzBox device the customer disconnects the phone from the wall jack cable and plugs the cable into the BuzzBox. The BuzzBox is then connected to the phone and the install is completed and the service is ready for use. In a recent customer trial 9 out of 10 customers found TheBuzz's BuzzBox easy to install.

3.4. Service Costs

The total ongoing cost (i.e. excluding setup costs) associated with maintaining TheBuzz fixed line telephony service includes only the usage call costs, which are comparable to broadband VoIP call costs.

3.5. Telephone Number Change

TheBuzz service does not require any change to a customers existing telephone number.

3.6. Reliability of Broadband Service Provider

TheBuzz service does not rely on the customer having any direct Internet access, and only requires normal PSTN access which is generally considered extremely reliable.

3.7. Reliability of VoIP Service Provider

TheBuzz service is not linked to any one VoIP service provider for establishing its VoIP call legs and is able to provide a large degree of VoIP service provider redundancy. This ensures that TheBuzz service remains transparently operational under multiple VoIP service provider failure conditions.

4. Conclusions

VoIP technology has matured over the last decade to where it is now being seriously considered as a viable alternative to regular PSTN services. It has been shown in this article, however, that VoIP still far from being a just "buy and plug-in" product that delivers a reliable, good quality telephony service. TheBuzz has developed a product that solves the most critical problems associated with VoIP, delivering the most reliable and easy to use VoIP product in the market today.

5. References

[1] Ryan Sengara, "Consumer Experiences with VoIP", Telecommunications Journal of Australia, pp 17-22, Volume 57, 2007.