

What really is “Business Grade” VoIP?

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Many service providers claim they can deliver business grade voice over the Internet however experience shows that end-to-end network engineering for VoIP is necessary to meet business expectations. The Telco concept of “Toll Quality” voice sets a standard for acceptable business VoIP quality.

“Business Grade VoIP” is a loosely used term

As someone who writes about Voice over IP (VoIP) services for business I have found myself struggling for terms to distinguish the kind of service a business would accept for its primary telephone line. “Business Grade VoIP” is a term that comes to mind but a Google search of the phrase returns over 10,000 entries describing a bewildering array of quality. So what really is business grade VoIP?

“Toll Quality” voice

In 2000 while building Australia’s first national converged network we did base line testing to find out what network parameters we needed to deliver corporate VoIP. We found that the “Toll Quality” voice could only be delivered using the industry standard Codec G.711 (no data compression) provided the network had packet loss of less than 1% and jitter of less than +/- 20 milliseconds.

The term “toll-quality” is used by Telcos to describe voice transmission of a high quality. Telecommunications carriers use a benchmark known as the Mean Opinion Score (MOS) to determine the quality of sound produced by network protocols. With MOS, wide ranges of listeners judge the quality of a voice sample on a scale of one (bad) to five (excellent). The scores are averaged to provide the mean opinion score for that sample. “Toll Quality” voice from IP Systems is of a standard to receive a mean opinion score greater than 4 (good to excellent).

Many service providers prefer to use a compressed codec such as G.729 even though it’s best is a MOS of 3.9 because it uses less bandwidth and does not deteriorate so quickly when the network gets congested. When you listen to G.711 and G.729 together they don’t sound very different but if you ask any customer service person after a day on the phone with G.729 they will give you a definite opinion. They hate compressed voice. The reason is compression filters out emotional nuances that are so important to good communication making it much more difficult to recognise people by their voice and to pick up feelings and shades of meaning. The end result is much higher listening effort by service staff and poorer service to the caller.

Network congestion and a VoIP Service Level Agreement (SLA)

It gets worse. Try to provide customer service on a VoIP over a congested IP network and people will eventually throw down the phone in frustration, which brings us to a key issue with VoIP.

IP networks are designed to drop packets of data. That is how they regulate data flows. The data protocols recognise a dropped packet as a warning to send the same packet again and to slow down the sending rate. Unfortunately talking really slowly is not an option during a business conversation (although a friend of mine assures me he has research proving that Queenslanders use less bandwidth than New South Welshmen because they talk slower). So here is the crunch. It is

not possible to provide consistent “Toll Quality” VoIP without serious traffic engineering to ensure the voice packets are sent fast and very consistently. It is basically impossible to do this on a public Internet connection. Let me explain why.

If you add up the bandwidth capacity of all the broadband connections to a public Internet service the total will be many times greater than the provider’s core network capacity. Every now and then a big proportion of the members try to download at the very same moment and there is just not enough capacity to meet the demand. So some packets get delayed and some dropped. If you happen to be on a VoIP call at that moment you are going to hear some funny stuff or get a call dropout and that’s where VoIP gets its reputation for poor quality. You can imagine the disruption this causes to business when ten callers are cut off at the same moment then all 10 call back to reception at the same time. The bottom line is that you can’t deliver true consistent business grade VoIP over a public Internet service no matter what the advertisements tell you.

So how can so many major companies be using VoIP if the quality is so unreliable? The answer is that their networks are designed for VoIP from the ground up to ensure that voice gets the special treatment it needs. There are a number of specialist providers in Australia who provide the specific network SLA required for business grade VoIP. Companies like IP Systems provide Quality of service (QoS) classes that exactly match the needs of voice, video and corporate data services. This distinguishes each class of application running on the network and the network capacity and performance it requires. The network is engineered to provide an end-to-end QoS class for each application.

Our Multi Protocol Label Switching (MPLS) based architecture enables the implementation of Quality-Of-Service (QoS) through the use of packet prioritisation based on traffic types, and source and destination addressing. This is achieved by using MPLS Traffic Engineering. MPLS Traffic Engineering uses the Resource Reservation Protocol (RSVP) to reserve the bandwidth for a guaranteed reservation across the core network. A Traffic Engineering 'tunnel' is configured for each link to carry voice traffic from the customer site, all the way through the IP network to the Public Switched Telephone Network (PSTN). The result is better network optimisation and improved application performance together with increased flexibility with application implementation. In other words each application gets the network performance it needs to perform perfectly all of the time.

Congestion in DSL access networks

The same issue occurs in DSL access networks. Most DSL networks were engineered to deliver dumb Internet services. They are built with the concept of a contention or oversubscription ratio. This means the core network capacity is oversubscribed compared to the aggregate capacity of the end user tail circuits. For example a DSLAM with 200 customers connected each at a download speed of 1.5Mbps might have just 1.5Mbps of core network capacity back to the Internet connection point. That equals a contention ratio of 200:1 and is typical of most consumer and small business broadband services. Obviously with that much competition for bandwidth, voice conversations will at times deteriorate to poor quality.

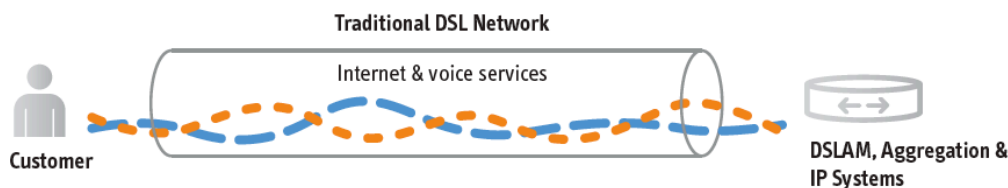


Figure 1 With ordinary broadband Internet voice gets lost in the general mish-mash

It is possible to deliver un-contended end-to-end bandwidth for business voice services delivered over DSL while delivering Internet access at the same time. Provisioning multiple logical circuits known as PVCs on a single physical circuit does it. A voice PVC must have dedicated network capacity with the necessary characteristics (packet loss, delay and jitter) suitable for business grade VoIP.

Table 1 Network SLA for Business Grade VoIP - “Toll Quality” Voice

Service Class	Mean Opinion Score	Round Trip Latency	Packet Loss	Jitter
Business Grade VoIP “Toll Quality”	>4	<80 ms	< 1%	<+/- 20 ms

A business grade voice PVC must be dimensioned with enough capacity to carry the required number of concurrent voice conversations at that site. Think of these as virtual dedicated phone lines. The result is that your converged telephone service works and sounds exactly like an ordinary business phone service with consistent clear quality. When these virtual lines are not in use the unused bandwidth is available for data applications and web browsing.

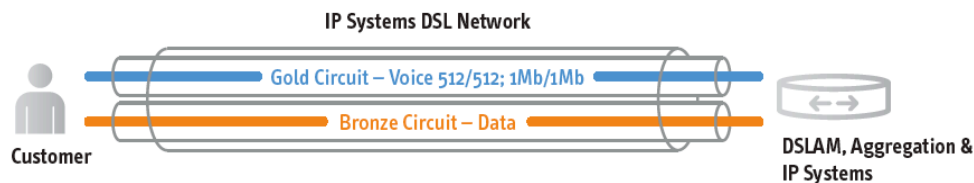


Figure 2 VoIP must be given special capacity throughout the network

Providing un-contended capacity all the way from the customer’s premises to the core network and beyond is a more expensive than regular broadband Internet. Customer’s experience proves it is well worth the extra cost.

The Local Area Network Pitfall

The last danger area for business grade voice is on the customer premises. Small business Local Area Networks (LAN) often use inexpensive hubs and switches with a simple broadband modem for internet access. This works fine for web browsing but means trouble when you try to use it as a business phone system.

IP Systems uses intelligent Cisco equipment that allows voice services to be separated into Virtual LANs (VLANs). This logically segregates voice devices from the data network even though they use the same physical boxes and cables. In a properly engineered VoIP LAN the data VLAN could suffer major congestion from virus storm but the voice VLAN would be unaffected.

Until recently the complexity of the engineering and cost of the devices put them out of the reach of small businesses but newly released product ranges have made segmented VLANs for voice as simple as plug and play



So how do you ensure business grade VoIP?

Here are three simple guidelines;

1. Insist on “Toll Quality” Voice (MOS score >4 and uncompressed G.711 codec)
2. Insist on a service provider who can deliver a VoIP network SLA of <1% packet loss, round trip ping <80 Milliseconds and jitter < +/- 20 Milliseconds
3. Ensure your local office network is configured with a voice VLAN that connects to the VoIP service from the network provider