Market Clarity

Australia's Source for Telecommunications Intelligence

Demystifying Business VoIP Services

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Foreword from Arrow Voice & Data

VoIP or Voice-over-IP is one of the most important technologies to arrive in the world of business communications in the last ten years. However, for much of its life as a business technology, VoIP has been deployed chiefly in large businesses.

As it becomes more accessible to the SME market, VoIP has the power to radically change the cost and efficiency of even small companies. It offers lower call costs, more efficient networking and access to new applications which have until now been the preserve of the large enterprise.

For SMEs to get the most out of this exciting technology they need information. There are now more than 200 VoIP providers in Australia alone so potential business users need to be able to choose the provider who best suits their needs. Businesses can make the right choice without having a deep understanding of VoIP technology — but they do need to understand their use of business telephones, their business requirements and how to choose between lower cost and better service.

For that reason, Arrow Voice and Data is proud to sponsor the publication of this brief guide to business VoIP services. *Demystifying Business VoIP Services* provides an invaluable guide to help SMEs understand their needs and to choose the VoIP provider most suitable for their requirements.

Brend Johnston,
Director of Sales and Marketing,
Arrow Voice and Data.

1 Introduction

While VoIP is an exciting technology, the profusion of networks, service providers and applications also makes it a confusing technology.

The safest way for a business to approach the VoIP world for the first time is to do so with a sound understanding of how it now uses its telephone system. This, combined with a straightforward analysis of current call costs and the different services available to you, will go a long way towards protecting you from the risks and traps involved in implementing VoIP.

As a VoIP user, Market Clarity is aware both of the benefits but also of some of the pitfalls which the business VoIP user faces and it's our hope that our own experience will help provide some guidelines for others, with independent and accurate information.

Preparing a document such as this one is time-consuming. We are therefore very grateful for the kind assistance of Arrow Voice & Data for their sponsorship of this publication.

1.1 The Difference Between VoIP and IP Telephony

VoIP is a very simple technology. It is the name given to the encapsulation of voice traffic in IP packets which traverse any TCP/IP-based network, including the Internet. As such, VoIP is not a telephone system. To create a telephone system requires a host of services, including:

- The ability to make and receive calls;
- The ability to sense and respond to conditions on the network (from simple engaged signals all the way through to complex call routing algorithms);
- The ability to track and account for call activity; and
- Support for complex, advanced network and service features.

Taken together, these systems and services are referred to as "IP Telephony". And, for this reason, Market Clarity generally prefers to describe complete services and solutions as "IP Telephony". However, to avoid overwhelming readers with acronyms, in this document we have used the expressions "business VoIP" and "IP Telephony" interchangeably.

2 Understanding Different Types of Business VoIP Services

VoIP, or Voice over IP allows telephone calls to be carried on IP-based data networks. One of the most important benefits this offers is the chance for smaller businesses to enjoy benefits such as advanced features which have previously been available only to bigger businesses. To understand how to get business benefits out of VoIP, companies need to understand how the different types of networks and VoIP services are related to each other.

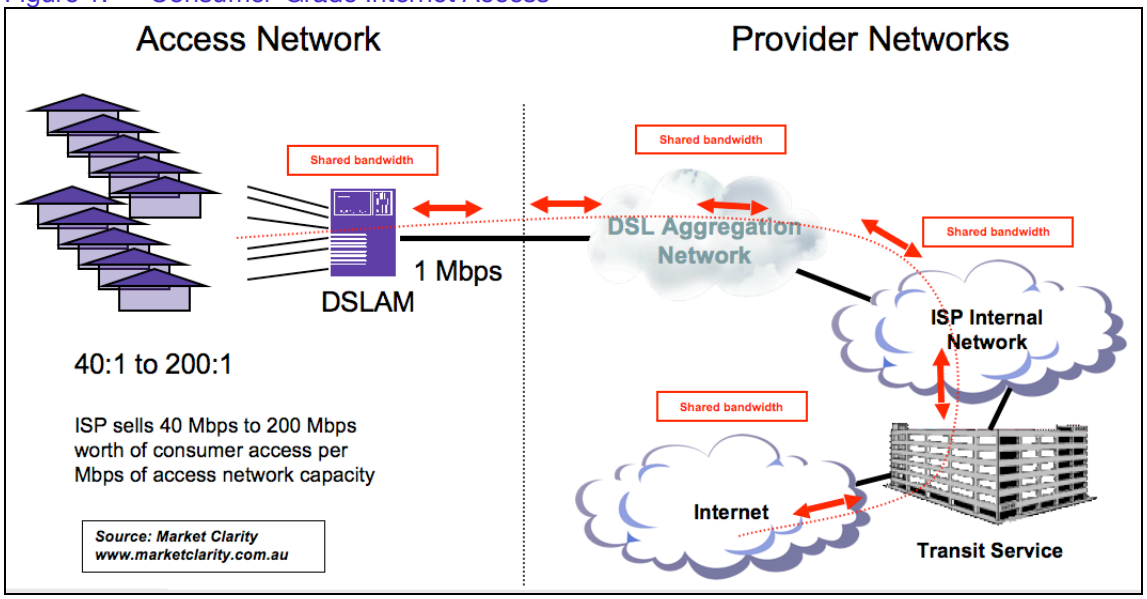
This Section provides a brief discussion of:

- The difference between consumer-grade and business grade Internet services; and
- Different applications of VoIP on these two kinds of networks.

2.1 Internet Services: Consumer-Grade and Business-Grade Broadband

To understand the nature of different VoIP applications we first need to differentiate consumer-grade broadband from business-grade broadband. Figure 1, below, illustrates the path from a consumer-grade link to the Internet.

Figure 1. — Consumer-Grade Internet Access



In the consumer-grade Internet link, for each megabit per second (Mbps) of network bandwidth, the provider sells between 40 Mbps and 200 Mbps of customer connections.

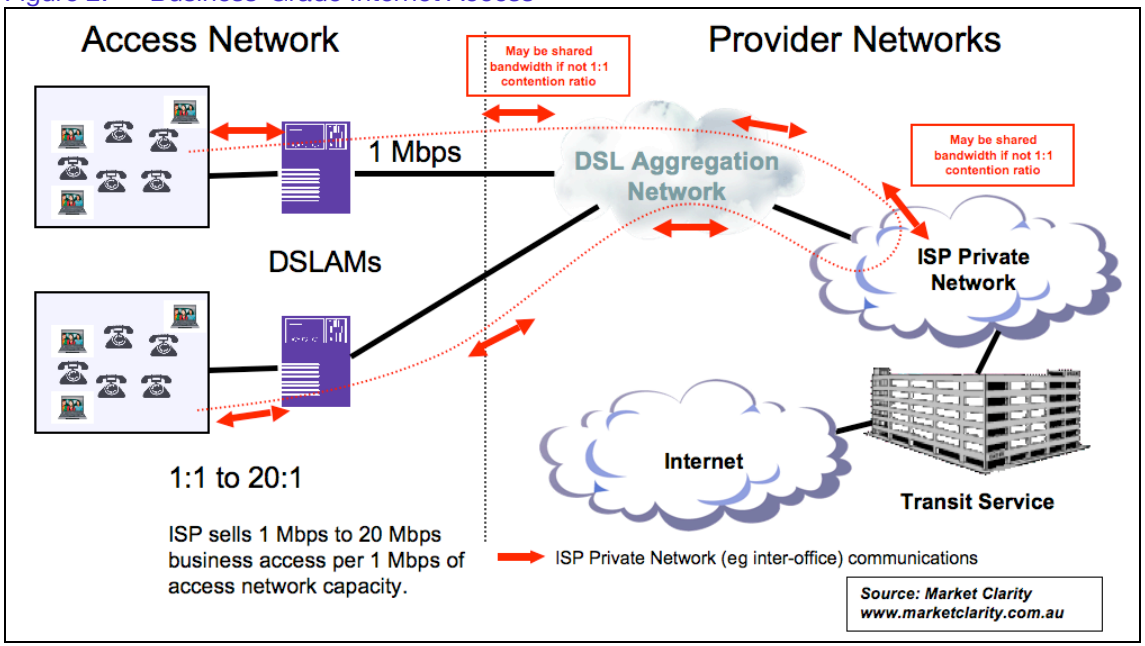
This “oversubscription” (also known as “contention”) leads to slow performance when many subscribers are using their bandwidth heavily at the same time.

For a business using the Internet for e-mail and Web browsing applications, heavily oversubscribed links are affordable and may offer acceptable performance most of the time.

However, applications such as VoIP are highly sensitive to delays in the network and will suffer extreme degradation when the Internet service is congested.

Figure 2 below illustrates a business-grade broadband service.

Figure 2. — Business-Grade Internet Access



The amount of oversubscription varies by service provider and at times on individual links. Market Clarity recommends that businesses require their service providers to provide contention information for all links.

In a business-grade broadband service, oversubscription is much lower. For each Mbps of network capacity, the provider will sell between 1 Mbps and 20 Mbps of customer capacity.

Moreover, high-quality business services will also make a service level agreement (SLA) commitment which explicitly states the level of oversubscription applicable to a service. In this way the customer can make an informed decision about the trade-off between price and guaranteed performance.

The best service quality is offered by 1:1 (no contention) services in which network capacity is not shared with any other customer. However, this is also the most expensive service and may be unaffordable for SME customers.

Business-grade services will also offer quicker fault resolution and better uptime guarantees than consumer-grade services.

Companies implementing VoIP for business applications should seek low-contention business-grade broadband services.

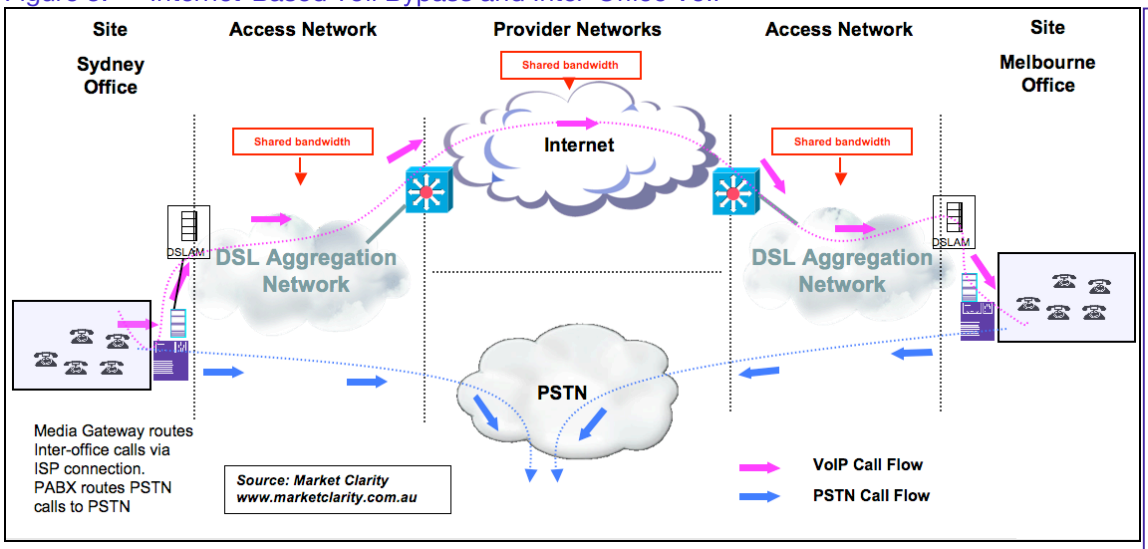
2.2 Internet-Based Services

This Section discusses the use of Internet-based VoIP for toll bypass, VoIP in conjunction with PSTN services, and VoIP as a replacement for PSTN services. Note: in this section, references to PSTN also imply ISDN capabilities.

2.2.1 Internet-Based Toll Bypass and Inter-Office VoIP

"Toll Bypass" refers to companies using data connections such as the Internet to carry voice calls between different locations without requiring a PSTN call. This assumes that the company has a suitable data service connecting locations. Figure 3, below, shows the use of the Internet as a toll bypass mechanism. Although business-grade access links are recommended, some businesses opt for cheaper, more congested, residential links.

Figure 3. — Internet-Based Toll Bypass and Inter-Office VoIP



Note that this application of VoIP is only suitable for customers operating multi-site networks.

A company using traditional PABXs will need IP interfaces either in the PABXs or as separate units. These IP interfaces, referred to as media gateways, convert telephone calls into IP streams for routing across the Internet.

In this illustration, users in the two offices can call each other using the Internet. Users in both locations can still make calls outside the company using the PSTN.

A company choosing to implement its own toll bypass solution does not need an external VoIP provider. It does, however, need the skills to implement and maintain media gateways at its locations.

While there is no "gateway" from the Internet back to the PSTN in this model, a Sydney user can make "local" calls to Melbourne numbers (and vice versa) by using the outbound PSTN line of the remote PABX. This, however, depends on there being sufficient PSTN lines available at the remote end and suitable call routing in each PABX.

In the mid-1990s, toll bypass produced significant savings for many companies. Today, these savings can also be achieved via negotiating PSTN rates with your selected carrier(s).

Where IP-capable PABXs have been deployed customers gain access to more advanced applications such as Presence (in which the system can detect whether a particular individual is logged into the telephone system and where that user is located).

2.2.2 Internet-Based VoIP with Internet-PSTN Gateway

In Figure 4 below the customer is making use of a VoIP provider to extend the functionality of its inter-office VoIP solution.

The configuration depicted in Figure 4 has another benefit — redundancy. As a result, a number of additional scenarios are possible:

- Using the VoIP links as a backup, rather than primary path;
- Using the VoIP links for call overflow during unexpected peaks;
- Experimenting with multiple VoIP providers; and/or
- Establishing a VoIP test bed, used only for calls with a designated prefix.

Figure 4. — Internet-Based VoIP with Internet-PSTN Gateway (Multi-Site)

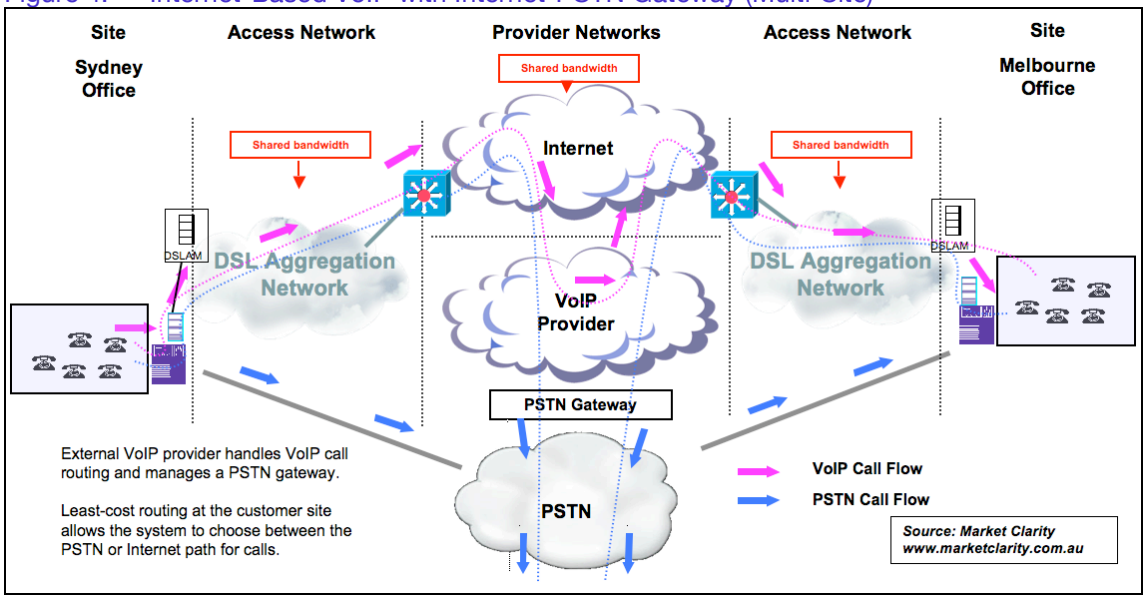


Figure 4 shows a sample topology for a multi-site network, whereas Figure 5 (next page) shows a single site implementation.

While the behaviour of Sydney-Melbourne Internet-based calls remains the same, in this illustration a VoIP provider manages a gateway between the Internet and the PSTN.

This allows the customer to gain extra benefits from its VoIP implementation.

By offering a bridge between the Internet and the PSTN, the VoIP provider enables the customer to make lower-cost calls to external PSTN locations.

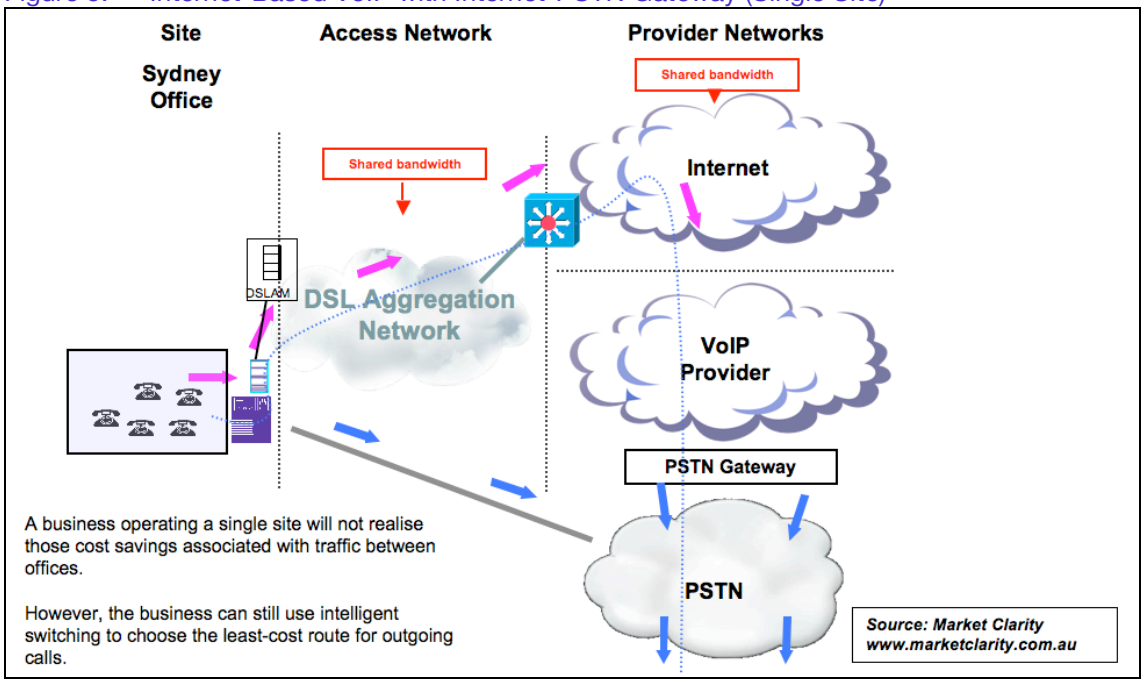
Additional software in the customer's PABX can automate "least cost routing". When a user requests an outside line and dials a number the system chooses the lowest-cost network connection to carry that call.

If the VoIP service is carrying its maximum number of calls the system can still revert to the PSTN for new calls. The available capacity of the VoIP service will depend on the bandwidth of the customer's broadband links and the maximum number of simultaneous calls permitted under the customer's contract with the VoIP provider.

If the VoIP provider maintains inbound calling in many locations, it can give outside callers the ability to call the company with a local call outside the "footprint" of the Sydney and Melbourne offices.

Figure 5 below shows a similar deployment for a customer operating a single site only.

Figure 5. — Internet-Based VoIP with Internet-PSTN Gateway (Single Site)



A business operating out of a single location needs to identify benefits other than free inter-office calls to justify its VoIP implementation.

The implementation shown in Figure 5 will still reduce call costs, since the customer can choose to route calls over the Internet.

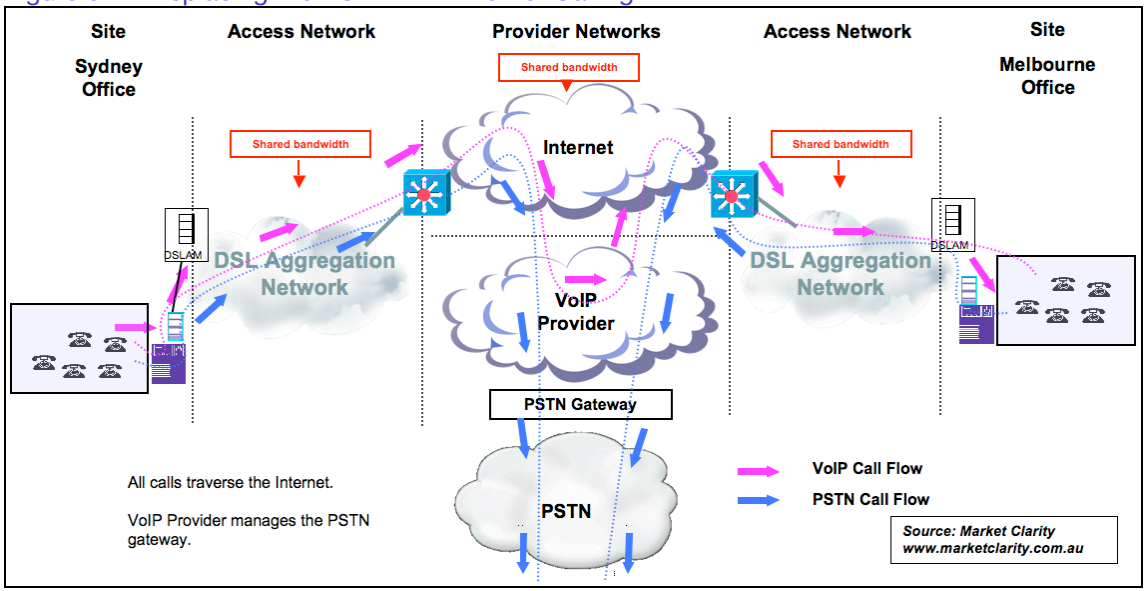
Another benefit is that the VoIP service gives staff access to their business telephone service even when working away from the office.

Single-location SMEs will obtain lower-cost calls across the VoIP network and will also realise “soft” benefits such as improved access for staff working away from the office.

2.2.3 Replacing the PSTN with Internet Calling

In Figure 6, below, the customer has moved all of its voice traffic to its VoIP provider.

Figure 6. — Replacing the PSTN with Internet Calling



Further savings are available if the company decides to abandon the PSTN connections serving its PABXs and allows the VoIP provider to process all of its calls, including those to the PSTN.

This simplifies the customer's environment since there is no need to make any cost-based call routing decisions: all calls traverse the company's broadband service. Similarly, all incoming calls from the PSTN are handled by the VoIP provider and routed to their destinations.

In all Internet-based models, however, the performance of the VoIP system is limited by the performance of the Internet service the company is using. On a low-quality, highly oversubscribed service, the customer is likely to experience poor call quality and high levels of echo.

In the following Section, we will examine these models for customers using private network services over business-class broadband links.

While providing a seemingly simple architecture, this scenario carries significant risk.

- First, in situations where the broadband provider and VoIP provider are unrelated companies, neither company has an end-to-end view of a voice call — making troubleshooting problematic.
- Second, the broadband connection at each site represents a single point of failure, although this can be overcome via the use of multiple broadband links at each site. For diversity, businesses may wish to consider a combination of DSL and wireless links at each site.

- Third, understanding your VoIP provider's architecture is also important. For resilience, a VoIP provider needs multiple paths to the PSTN.

As with Figure 5, the customer operating a VoIP system in a single site will not obtain lower cost inter-office calls.

2.3 Private Network-Based Services

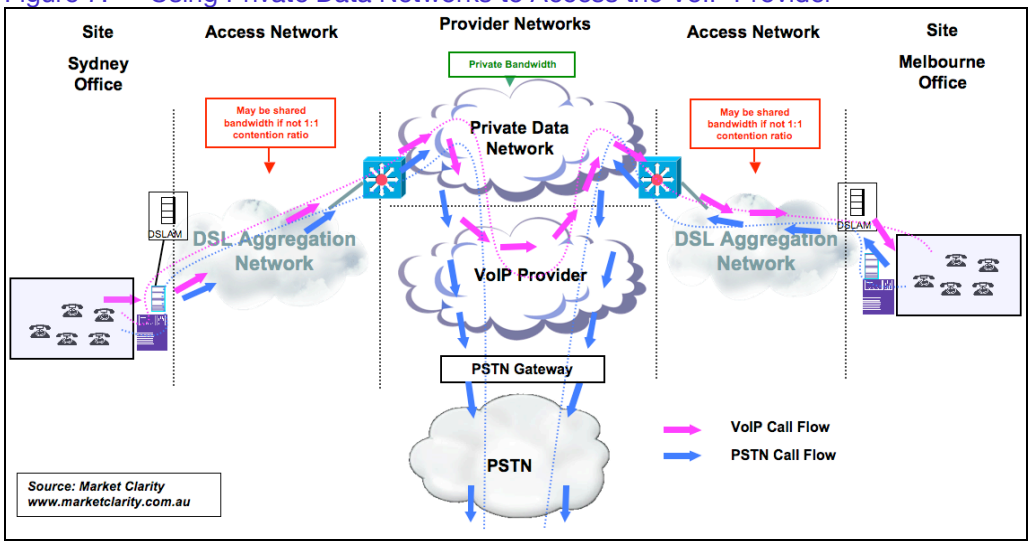
In this Section we present VoIP environments in which consumer Internet services have been replaced by private network connections. Note: the private network connections may use technologies other than IP.

2.3.1 Private Network Service with Provider-based VoIP

Figure 7 below shows the implementation of a VoIP model based on the use of a private data network service. In all of the private network models discussed in this paper, Market Clarity assumes that the VoIP provider has a sufficiently close relationship with the network provider that the two parties can establish direct connections without forcing customer traffic to traverse the Internet. Many business-grade VoIP providers require that customers purchase both the broadband links and the VoIP service in order to correctly architect an end-to-end solution, provide service level guarantees — and to troubleshoot if things go wrong.

Another benefit of buying a broadband / VoIP bundled solution is that a service provider can proactively monitor voice quality across these links.

Figure 7. — Using Private Data Networks to Access the VoIP Provider



In the previous Figures we have assumed access to the VoIP provider uses the public Internet.

If the company uses a private data network between itself and the VoIP provider, it can eliminate one of the greatest threats to the VoIP implementation: congested public Internet services causing degradation to call quality.

Customers connecting to private data network services also can choose products with much less sharing (oversubscription) than is available using public Internet services. A 1:1 business-grade broadband service will have no shared bandwidth between the customer and the private data network.

In the illustration inter-office calls remain on the private network while the VoIP provider also supplies PSTN gateway services. Calls to and from the PSTN can be made as local calls wherever the VoIP provider maintains gateways.

However, this architecture has many of the same limitations shown in Figure 6 — namely, each site's broadband access link represents a single point of failure. The work-arounds described in Section 2.2.3 can also be applied here.

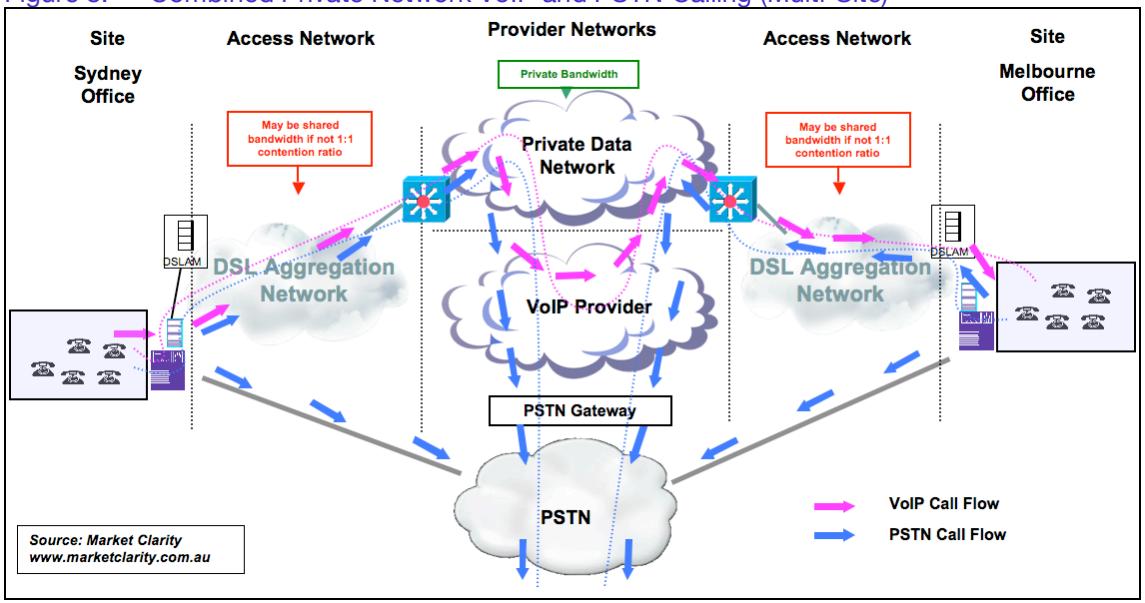
The customer can still gain access to the Internet since carriers and service providers offering private data network products also implement network-hosted Internet gateways.

A single-site SME may find it more difficult to justify the cost of a 1:1 (uncontended) service since lower-cost calls are the main source of ROI. Such customers may seek low-contention rather than zero-contention DSL services for their VoIP implementation.

2.3.2 Private Network VoIP with PSTN Gateway

In Figure 8 below, the customer is accessing a VoIP provider through a private data network while retaining separate PSTN links to its PABXs.

Figure 8. — Combined Private Network VoIP and PSTN Calling (Multi-Site)



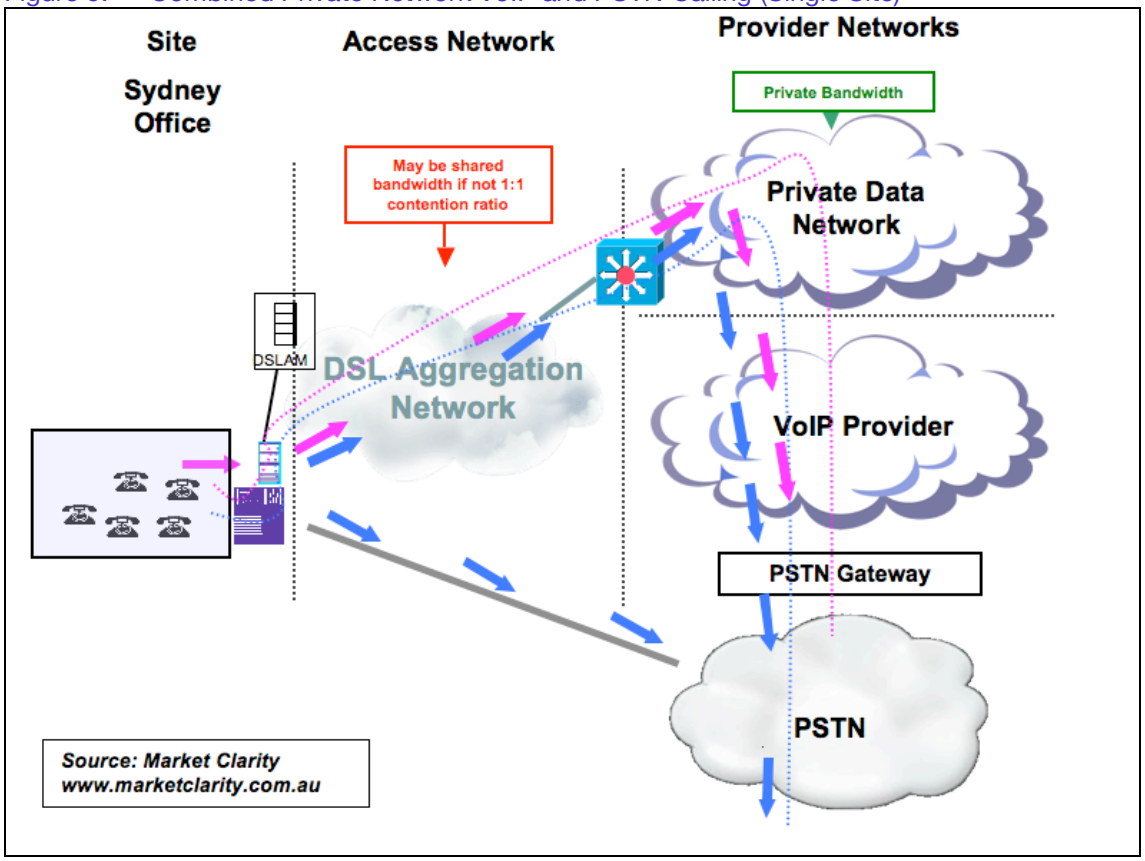
This model retains the low cost routes available through the VoIP provider but adds PSTN (or ISDN) links from the company's PABXs.

This approach is recommended for service redundancy and may also be adopted by organisations which need to maintain PSTN connections for some services, such as lifeline telephones (such as are installed in elevators and other building safety applications).

Figure 8 shows a sample topology for a multi-site network, whereas Figure 9 (next page) shows a single site implementation.

Figure 9 illustrates the implementation of the combination of VoIP and PSTN calling for a customer operating a single location.

Figure 9. — Combined Private Network VoIP and PSTN Calling (Single Site)



As a single-site configuration the model shown in Figure 9 may only be suitable for customers with a relatively large office.

Since the cost benefits of free inter-office calling are not available it may become excessively expensive to maintain PSTN and VoIP links to the existing PABX.

Should a single-site customer need to maintain PSTN links for lifeline access or similar requirements, it may be more cost-effective to maintain this connectivity separately from the office telephone system.

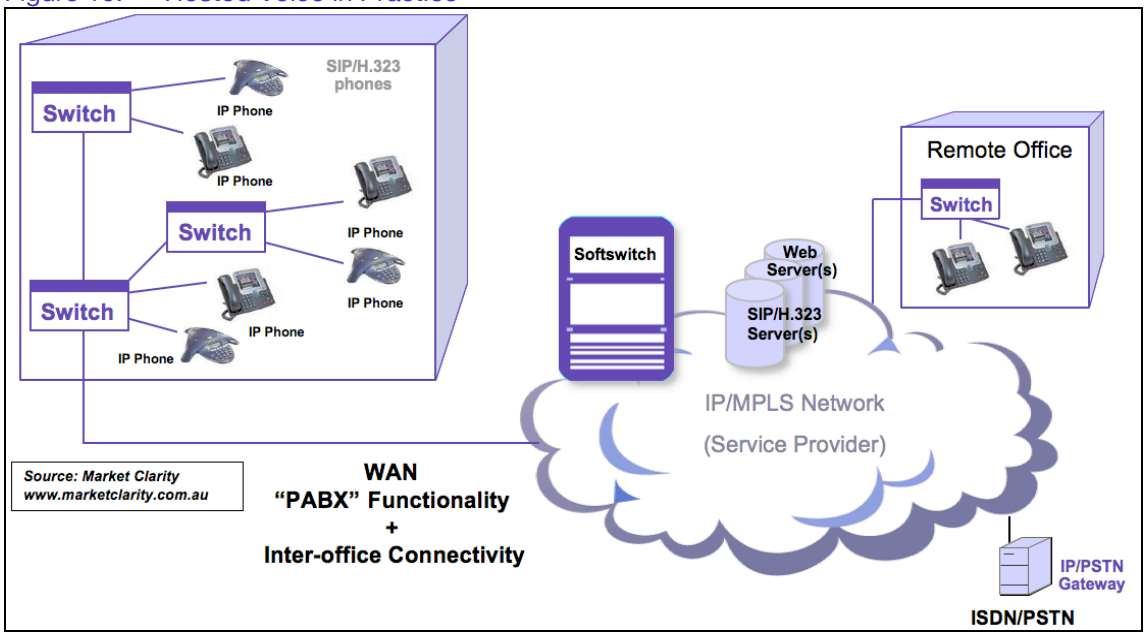
Another common requirement is fax support, which may be expensive to implement in a small-scale telephony system.

2.4 Hosted Voice ("IP Centrex") Value-Added Services

Some providers relieve the customer of the need to operate and manage their own voice switches. Instead, this functionality is implemented within the service provider's infrastructure (for example, a data centre). This important value-add to VoIP is referred to as Hosted Voice or IP Centrex. A Hosted Voice (IP Centrex) solution may be accessed either over the public Internet or through a private IP network connection. The Hosted Voice (IP Centrex) provider may be the broadband provider or a separate, unrelated company.

The hosting of the VoIP infrastructure in the service provider's facilities is illustrated in Figure 10, below.

Figure 10. — Hosted Voice in Practice



By moving key infrastructure such as the softswitch and SIP servers into its own infrastructure, the Hosted Voice provider is able to spread the costs of that infrastructure across a larger number of customers.

This allows the provider to offer services on a monthly fee basis which may be attractive to organisations wishing to conserve capital expenditure.

This model also moves the technical risk of the telephony solution from the customer to the service provider.

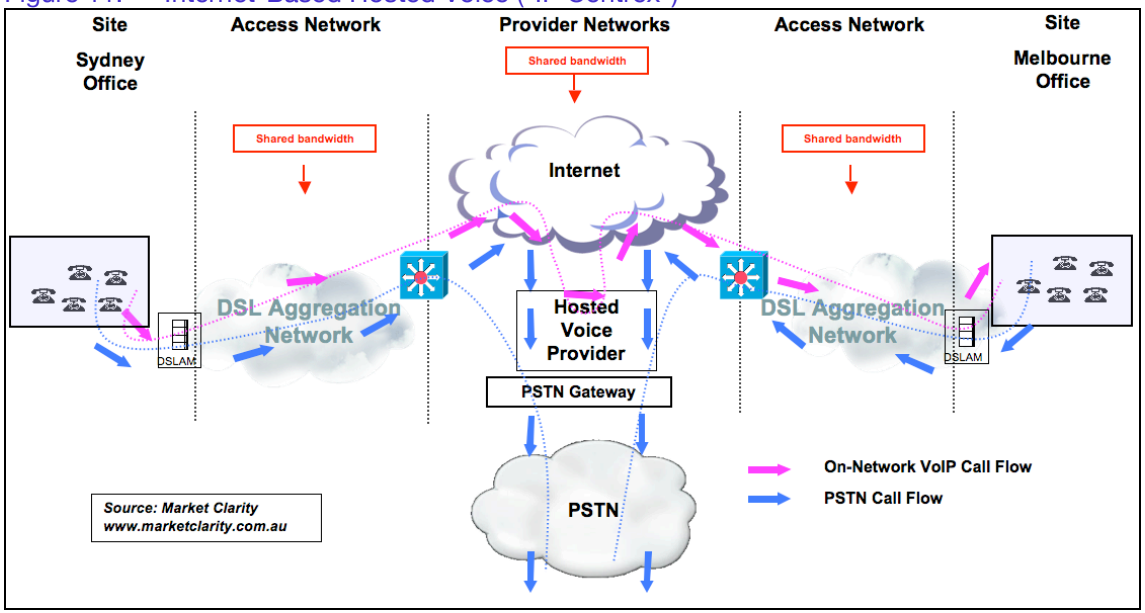
If implemented correctly, it should also offer a more resilient VoIP implementation than if customers host their own infrastructure, since the service provider is able to bear the costs of "carrier-class" infrastructure and high reliability data centres.

A hosted voice environment is highly suited to SMEs even at the single-site level since it eliminates the capital investment required in a PABX or key telephone system purchase. Some hosted systems can also be retro-fitted to existing business telephone systems if required.

2.4.1 Internet-Based Hosted Voice ("IP Centrex")

Figure 11, below, shows how a Hosted Voice ("IP Centrex") service may be accessed through the public Internet.

Figure 11. — Internet-Based Hosted Voice ("IP Centrex")



VoIP allows the service infrastructure to be separated from the telephone handsets. As a result, the infrastructure can be hosted and managed by a third party (in this case, the Hosted Voice Provider). The customer uses an Internet-grade broadband service to access the hosted voice service.

This provides very low-cost access, but it also makes the customer's voice network dependent on its Internet service. Heavy congestion may make the service inaccessible to the customer or may severely degrade voice call quality.

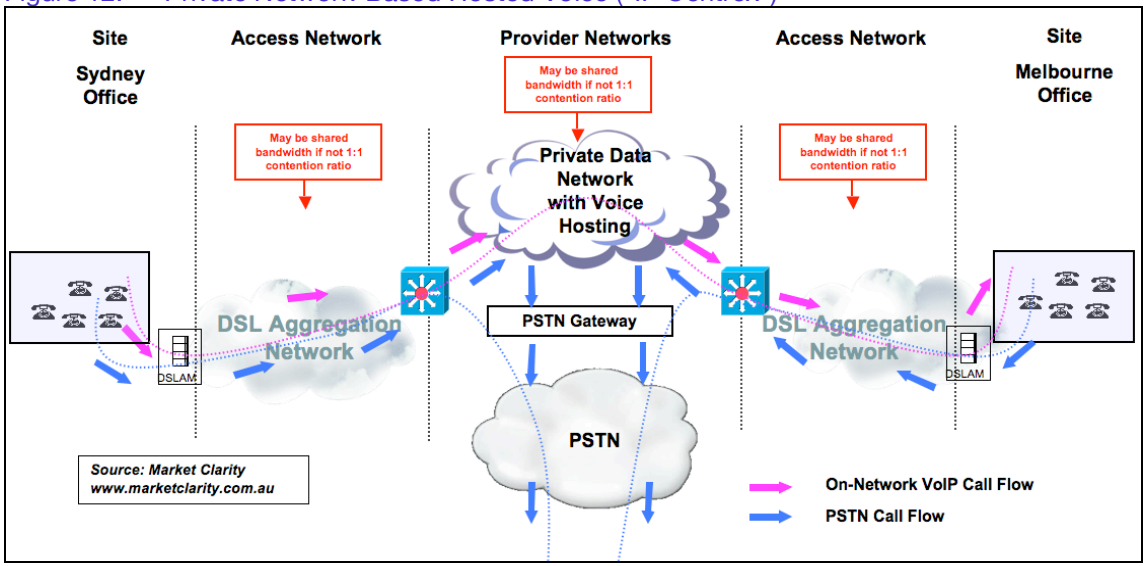
Also, with an Internet-based hosted voice model, the customer must maintain very high security connections, since their ability to use the telephone depends on the integrity of the Internet connection.

Internet-based IP Centrex may also suit a very small customer operating a single site, if that customer is able to purchase a broadband service of relatively low contention and if the business is able to ensure that its data network traffic will not adversely impact its voice traffic.

2.4.2 Private Network-Based Hosted Voice ("IP Centrex")

Figure 12 below shows a "Hosted Voice" (also known as "IP Centrex") service model in which a private network is used for access to the service and the hosted voice systems are operated by the network owner.

Figure 12. — Private Network-Based Hosted Voice ("IP Centrex")



In this model the customer does not require their own PABX. Instead, this infrastructure is hosted and managed by the service provider.

All calls are delivered as IP streams directly to IP handsets at the customer site. The provider can spread the cost of the softswitch or IP-PABX infrastructure across a large number of customers.

These services are usually offered under "per handset, per feature, per month" deals. This gives customers access to system features which may otherwise be unaffordable.

The voice hosting may exist separately from the owner of the private data network. As long as private data services connect the network owner to the VoIP host, this should not result in any degradation of service to the customer.

While ROI on a 1:1 service is harder to achieve for a customer with only one office, the IP Centrex system eliminates the need to invest in a PABX. This may justify the business case for a service of low or zero contention even for a relatively small customer.

3 Understanding Business Telephony Requirements

3.1 Outline of Business Requirements

Many of the considerations which apply to companies selecting a VoIP provider are also applicable to traditional telephone systems and networks. These include:

- **Capacity —** The incoming broadband service must have enough bandwidth for your telephone needs. In a PSTN service the number of lines set the limit to the number of simultaneous calls a company could make. In a VoIP service this limit depends on the available bandwidth on the broadband service and the maximum number of simultaneous sessions permitted by the VoIP provider. You will also need spare bandwidth for data above and beyond the voice service requirements. The choice of a voice codec — used to encapsulate voice into digital format — also impacts the amount of bandwidth that is required for each call.
- **Network Reach —** Companies with multiple offices should ideally seek network providers who are able to meet their requirements at all locations.
- **Reliability —** While 99.9% reliability is common for Internet and data services, 99.99% or better is often a requirement for a voice network. This will make the data service more expensive but even at "four-nines" reliability there is the risk of more than 5 hours' downtime in a year.
- **Call types —** While a complete telephone bill analysis is a matter for experts, you need to have a clear idea of your company's typical usage patterns to make an intelligent service choice. For example, some VoIP plans are optimised for international calls and others for domestic calls.
- **Compatibility —** Different VoIP systems are not yet 100% compatible. Different systems use different standards (for instance, SIP and H.323) and vendors implement proprietary extensions to standards which may prevent some system features from crossing network boundaries. Compatibility between your VoIP systems and those of your service provider is vital.

3.1.1 Indicative Codec Requirements

Table 1, below, provides indicative capacity requirements for a single conversation using a variety of different codecs, As you will see, bandwidth over and above the voice sampling size is required. This is because there is "protocol overhead" required to transmit the voice sample inside an IP packet.

Table 1. — Indicative Codec Requirements

Codec	Indicative Capacity Required
G.711 (PCM) 64 Kbps uncompressed	96 Kbps
G.723.1 (ACELP) 5.3 Kbps compression	16 Kbps
G.726 (ADPCM) 32 Kbps compression	64 Kbps
G.728 (LD-CELP) 16 Kbps compression	48 Kbps
G.729A (CS-CELP) 8 Kbps Compression	40 Kbps

Market Clarity also notes that use of voice compression techniques may cause voice quality issues when voice packets are compressed, decompressed and re-compressed (transcoded) as they pass between networks.

For example, a VoIP call to a mobile telephone will be encoded in the VoIP network; decoded and re-encoded for passage across the PSTN, and decoded and re-encoded for transmission across the mobile network. If the voice packets are also compressed, these transcoding steps will introduce excessive degradation to voice quality.

3.2 Service Features

A company choosing a VoIP service provider must ensure that the provider can deliver all of the service features it needs. A full list of service features is beyond the scope of this white paper. However, a partial list of service features is provided below. Market Clarity has also indicated whether features not available from a VoIP service provider may be implemented in the user's VoIP system instead.

Table 2. — VoIP Service Features

Feature	Implemented in Service Provider Only, Customer System, Either, or Both?[1]	Impact
13 / 1300 / 1800 Support	Service Provider Only	13 / 1300 / 1800 support requires a separate service if not available from the VoIP provider.
000 (Emergency Service) Calling	Service Provider Only	000 support should be considered a critical requirement for a business telephone system.
Geographic Numbering	Service Provider Only	Geographic numbering should be considered a critical requirement for a business telephone system.
Number Portability	Service Provider Only	If numbers are not portable, business customers will incur extra costs to move away from an unsatisfactory service.
QoS — Priority for VoIP Packets	Both — must be supported by the customer system and the service provider network.	Services with QoS support should be considered preferable for businesses implementing VoIP systems. QoS support within the LAN is also required to protect conversations during times of heavy network traffic.
DTMF Support	Both — must be supported by the customer system and the service provider network.	Without DTMF support, users will be unable to make outgoing calls to IVR and similar systems. The VoIP service provider must pass DTMF tones in both directions, and the customer system must be configured to properly handle DTMF tones on VoIP trunks.
Incoming Calling Line ID (CLID)	Both — must be supported by the customer system and the service provider network.	The VoIP service provider must pass CLID in both directions and the customer system must be configured to properly handle CLID.

[1] In cases where a business also has a PSTN or ISDN service, these features may be available from those services.

Feature	Implemented in Service Provider Only, Customer System, Either, or Both?[1]	Impact
Outgoing Calling Line ID (CLID)	Both — must be supported by the customer system and the service provider network.	The VoIP service provider should allow customers to configure whether to pass outgoing CLID. The customer system must also be configured to properly handle outgoing CLID.
Call Features (Hold, Wait, Transfer, Forward, Queue)	Either	If these features are not available from the VoIP service provider, they may be implemented within the customer system.
Multi-Party Conferencing	Either	If these features are not available from the VoIP service provider, they may be implemented within the customer system.
Voicemail	Either	If these features are not available from the VoIP service provider, they may be implemented within the customer system.
Music On-Hold	Either	If these features are not available from the VoIP service provider, they may be implemented within the customer system.

3.3 Service Level Agreements (SLAs)

3.3.1 The Need for SLAs

The service level agreement (SLA) is the basis for your business relationship with the supplier. Key aspects of the SLA include:

- **Data Service Performance —** if you are using a data network to transport voice calls, you need a data network of much higher and more predictable performance than is required for Internet access or data applications.

- **Voice Service SLAs —** Since you are handing some or all the management responsibility for your voice systems to an outside service provider, an SLA is vital to ensure end-to-end voice service delivery.
- **Support SLAs —** You also need to know that your service provider will respond quickly to problems and can act quickly to new requirements.

SLAs consist of targets and penalties, each of which is briefly discussed below.

3.3.2 Data Service SLAs

Data network SLAs cover:

- **Latency —** The length of time it takes data to cross the network. Since telephone users will notice delays of more than 150 milliseconds, the SLA should specify low latency for voice traffic.
- **Jitter —** How much latency varies over time. Excessive jitter degrades the performance of a VoIP call, introducing audio distortion, echo and other problems.
- **Packet Loss —** IP applications are designed to detect and correct data that gets lost in the network. However, packet loss is unacceptable for voice calls since it is perceived by the user as a call “breaking up”. For VoIP applications networks should maintain low packet loss.
- **Availability —** Availability specifies how much “downtime” a customer can expect in the course of a month or a year. Businesses need to work out the impact of losing their telephones and ensure that their data service availability is sufficient to meet that requirement.
- **Penalties —** Few service providers will guarantee their latency, jitter and packet loss targets with penalties. However, some will include heavily degraded performance in their definition of “availability”, so that customers can be compensated for extremely poor network performance.

It is important to define the metrics used in all of the above SLAs, so that the business and the service provider have the same understanding of service levels which fall outside of the accepted agreement.

3.3.3 Voice Service SLAs

Voice service SLAs should at least cover:

- **Availability —** This sets availability targets for the voice application.
- **Call Success / Failure Rates —** The VoIP service should not become a barrier to phone calls, so the customer should seek a commitment that the provider's ability to successfully complete calls is equal to that of a PSTN carrier.
- **Billing —** Billing processes, including dispute handling, are a necessary component to the voice service SLA.

3.3.4 Support SLAs

Support SLAs cover:

- **Installation and Activation Time —** How long, from the time you sign your contract, will it take before all of your sites are "live" on both the data network and the voice network?
- **Fault Response —** If there is a network problem, how long does it take your provider to answer your help desk call, and how long does it take to diagnose faults?
- **Fault Resolution —** How quickly can faults be fixed?
- **Penalties —** Does the service provider offer penalties in the form of refunds or rebates if it fails to meet any of these SLA conditions?

3.3.5 Establishing Responsibilities in SLAs

When purchasing a complex service, your company may find itself depending on the ability of several companies to deliver their piece of the solution. Your supplier list will probably include:

- **Systems Integrators —** Responsible for delivering, installing and configuring hardware and software at each of your sites.

- **Telecommunications Carriers —** If the broadband provider is using a third-party's infrastructure (for example, a Telstra service to deliver its DSL access tail), the carrier will be responsible for the integrity of the physical access. The carrier is also responsible for providing the access cable between your premises and its exchange. Customers need a clear understanding of the boundary of the carrier's responsibility. For example, which party is responsible for ensuring that "dialtone" is available all the way to your DSL modem?
- **Cabling Contractors —** The cabling contractor's responsibility is similar to that of the carrier. Customers must understand the boundary of this responsibility, to ensure that any problems with the carrier connection can be swiftly resolved.
- **Broadband Providers —** The broadband provider is responsible for ensuring that your DSL service (and service features such as QoS, if these are offered) performs within the SLA.
- **VoIP Service Provider —** The VoIP service provider is responsible for the quality, integrity and reliability of the VoIP service. Only if the VoIP service is hosted by the broadband provider will the same company be responsible for VoIP downtime caused by a problem with the broadband connection. Customers must seek a clear definition of the relationship between the VoIP provider's responsibilities and those of the broadband service provider.
- **Reseller —** A reseller may provide you with a service bundle comprising some or all of the above elements. If purchasing services from a reseller, it is important to understand their ability to take end-to-end responsibility for the contracted services.

To avoid finger-pointing between different providers, make sure you establish clear lines of responsibility for each activity. Best of all, try and find a provider which will act as a "single point of contact" responsible for managing all of the other relationships.

3.3.6 Call Quality Testing

In many cases the quality of VoIP calls exceeds that of a PSTN call. VoIP supports better audio quality than a PSTN telephone and in favourable network conditions users will experience near-CD sound across a VoIP connection. There remain however conditions under which the VoIP call quality will deteriorate:

- **LAN or Router Congestion** — if the LAN does not support VLANs or QoS, then heavy downloads will degrade call quality. This is also true of the router connecting the customer network to the broadband service.
- **Internet Congestion** — A VoIP call traversing the Internet is subject to traffic conditions on the Internet. These will often be beyond the control of an individual service provider.

It is important to keep in mind that call quality is “asymmetrical”. The call quality experienced at one end of the call may be completely different to that at the other end of the call.

Since it is impossible for the business VoIP user to test call quality outside their own network, businesses considering a VoIP implementation should ask their providers to outline their strategies for testing call quality on a regular basis.

4 Choosing a Business VoIP Service

The selection of a business VoIP service has to balance the savings the service offers against its ability to meet as many of your requirements as possible.

4.1 Telecommunications Subscription and Call Costs

To assess which VoIP service is the best for your business you need to understand your current spending on telecommunications services. You also need a clear idea of what new costs you will incur setting up your VoIP service. Table 3, below, provides a reference list of telecommunications cost items for consideration.

Table 3. — Costing Telecommunications Services

Service Component	Comments	Impact of VoIP Implementation	Your Current Monthly Costs	Predicted Costs After VoIP Implementation
Line Charges	Include all incoming PSTN connections at all offices.	Reduction of line charges as PSTN services are replaced by broadband service. Some PSTN lines may still be required for fax and lifeline services.		
VoIP subscription charge	Include if the proposed VoIP service incurs a separate subscription charge in addition to call charges.	This is a new cost component specific to the VoIP service.		
Geographic Number/s	PSTN numbers are bundled with the line fee. On the other hand, some VoIP providers offer free geographic numbers. Others charge a separate fee for each number required.	May rise depending on VoIP provider tariff policies.		

Service Component	Comments	Impact of VoIP Implementation	Your Current Monthly Costs	Predicted Costs After VoIP Implementation
PSTN call bundles	Most business telephone services include some allowance for free or low-cost call bundles.	Neutral — included for comparison between PSTN and VoIP bundles		
VoIP call bundles	Call bundles are also available from some VoIP providers.	Neutral — included for comparison between PSTN and VoIP bundles		
Untimed Local Calls	Some VoIP services treat all calls, including local calls, as time-charged calls.	Dependent on VoIP provider tariffs.		
National Long Distance	Includes long-distance calls within Australia. Most VoIP providers offer savings on these calls.	Potential reduction of long-distance call charges.		
Calls to Mobiles	VoIP service providers offer little or no difference in the cost of calls to mobiles.	Dependent on VoIP provider tariffs. May be higher than current PSTN plan.		
International Calls	VoIP service providers offer extremely low-cost international calls to most destinations.	Reduction of international call costs.		
Broadband subscription	VoIP implementation may require a substantial upgrade to your broadband service. Note: VoIP requires symmetrical bandwidth.	Broadband service charges may rise for each site using VoIP.		
Broadband download fees	Download (and, where applicable, upload) fees for broadband services may rise after VoIP implementation due to increased traffic.	Increased download fees may apply, or plan adjustment for larger download volume may be required.		
TOTAL	**Calculate the expected impact of the VoIP implementation**			

4.2 Business Requirements

In choosing a VoIP service provider, price alone is not enough. You also need to understand how well that service provider can meet your business needs.

Table 4 below is provided to aid in this process. It outlines the business requirements, service features and SLA information described in Section 3. This can be turned into a simple score by tallying the number of your requirements a VoIP service provider can meet. You can also apply weightings to indicate the importance of each requirement.

Table 4. — Business Requirements Checklist

Business Requirement (including service features and SLAs)	Your Requirement	Does VoIP provider meet requirement? (Yes / No)	Score (1 = Yes)
Capacity	Number of simultaneous calls required at each office.		
Network Reach	Is VoIP service equally available from all locations?		
Reliability	Does VoIP service meet my reliability requirements?		
Call Types	Are all my current call types supported by this provider?		
Compatibility	Is this provider's VoIP protocol compatible with my VoIP system?		
Critical Service Features	Does the VoIP provider support all of my critical service features?		
Optional service features	How many of my optional service features from Table 2 does the VoIP provider support? Score: (VoIP Provider Offering) / (Number of Option Features Required)		

Business Requirement (including service features and SLAs)	Your Requirement	Does VoIP provider meet requirement? (Yes / No)	Score (1 = Yes)
SLAs	Does the VoIP provider's SLA meet my requirements?		
Responsibility	Do I clearly understand the responsibilities of different service providers?		
Support	Does the provider offer a guaranteed service restoration time?		
End-to-End Service Ownership	Can I purchase all elements of the VoIP service solution from a single provider?		

4.3 Choosing a Provider

The selection of a VoIP provider can be made according to the results you reached in Sections 4.1 and 4.2. For each provider, calculate the predicted cost impact and measure this against how well the provider fits your business requirements (remembering that the cheapest provider is not suitable for you if it cannot meet any of your business requirements).

5 Key Implementation Considerations

Table 5 below provides a brief checklist for SMEs preparing a VoIP implementation. Companies should seek expert advice to customise their checklist to their own requirements.

Table 5. — Implementation Considerations

Item	Explanation	Yes/No
System Feature List	Make a list of your required call features before contacting service providers and systems integrators. This will ensure the provision of accurate prices.	
Service Feature List	Make a list of features required from your VoIP service provider. Prioritise the list according to "must-have" features (such as number portability and 000 support) and optional features (such as music-on-hold).	
Compatibility	Check that any VoIP telephone systems you purchase are compatible with all features of the service provider's VoIP environment.	
Security	Is your internal network secured against attacks via the VoIP service? Are your VoIP systems protected against Internet-borne threats?	
Backup Power	Does your VoIP system, server and LAN have sufficient backup power for your requirements?	
VLANs	Does your network support VLANs with inter-VLAN routing?	
QoS on Broadband Service	Does your broadband service provider support QoS for VoIP traffic?	
Business-grade Broadband Service	Does your broadband provider offer a low-contention business-grade service?	
End-to-End Responsibility for VoIP Service	Does your service provider take end-to-end responsibility for the VoIP service?	
SLAs	Do your broadband and VoIP service providers offer service-level agreements?	
LAN Installation / Upgrade Date	Is your LAN "VoIP-ready"? This should be completed before connecting to the VoIP service, unless you are implementing a simple "toll-bypass" model.	
IP addressing	Does your IP Telephony system require static IP addresses on your broadband connections?	

Glossary of Acronyms

A complete technical glossary is beyond the scope of this document. Below is presented a glossary of acronyms for the convenience of readers.

ACCC	Australian Competition and Consumer Commission
ACIF	Australian Communications Industry Forum
ACMA	Australian Communications and Media Authority
Codec	Coder/decoder
CoS	Class of Service
DSL	Digital Subscriber Line
DSLAM	DSL Access Multiplexer
IP	Internet Protocol
ISP	Internet Service Provider
LAN	Local Area Network
PSTN	Public Switched Telephone Network
QoS	Quality of Service — used to describe the capacity of a network or service to function according to a given set of service parameters.
SIP	Session Initiation Protocol
SLA	Service Level Agreement
TCP/IP	Transport Control Protocol / Internet Protocol
VLAN	Virtual Local Area Network
VoIP	Voice over Internet Protocol
WAN	Wide Area Network