

Using DSL for Business

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History of Broadband

When the Internet really started to take off during the 1990's, the primary means of access for home users and small business was by dial-up modem. Leased lines were available to larger business users starting at 64Kbps, although these were relatively expensive.

By the late 1990's, it was clear that the Internet was a useful tool for both business and home, and applications were envisaged that required large amounts of bandwidth, such as video on demand. Back in 1989, technology was being developed to use "spare" capacity on voice lines to carry data, but it wasn't until 2000 that ADSL, as it became known, was commercially available. Demand was high, and although coverage was patchy at first, there was an aggressive rollout of DSL to exchanges around the country.

Initially there were limited options available, 512Kbps, 1Mbps and 2Mbps download speeds, all with 256Kbps upload. Distance from the local exchange was critical and many people who lived a little too far away were not able to obtain service. Over time this changed and continues to change, with the introduction and refining of rate adaptive services.

One of the main drivers for broadband - video on demand - has actually not really found a market, but the massively increased use of the Internet and the rich content within has taken over as a driver for ever higher bandwidth, ensuring the continued development of broadband technology and coverage.

ADSL "Flavours"

The concept of ADSL is based on the fact that the human ear is only able to hear a small band of frequency, and of that, an even smaller band is used during spoken conversation. Limiting the frequency range for voice on a standard phone line then leaves a large range of spare frequency available for data, which is used by ADSL.



Frequency split for a standard ADSL circuit showing the ranges used for voice, upload and download. Not to scale.

Another key feature of ADSL is that it is asymmetric and has a greater download capability than upload. This suits the usage pattern of home users very well as most of their outbound traffic will be requests and therefore minimal compared to all the content that will be inbound.

As stated before, the initial availability of ADSL was limited to 256Kbps upload with a choice of either 512Kbps, 1Mbps or 2Mbps download, depending on line capability and cost. There was a cut-off of line quality and distance that

determined what service could be supported if at all, meaning that many customers were denied any service. Rate adaptive services were introduced that overcame this limitation by allowing the bandwidth to adapt to the prevailing line conditions thereby extending the reach of services.

More recently we have seen the introduction of Max services that give up to 8Mbps download and 800Kbps upload. These services are an evolution of the rate adaptive services, and require an extended settling period of around 10 days before they fix their normal operating bandwidth range. This caused a lot of confusion for early adopters, but the service seems to have settled now.

The latest technology around ADSL is 2+, which can double the frequency band of ADSL connections up to 2.2MHz and therefore double the number of downstream bits. This increases the maximum downstream bandwidth to 24Mbps, as it is always dependent on the line quality and the distance from the exchange. The upstream bandwidth also increases to up to 1.4Mbps. Annex M is an addition to 2+ technology that shifts the frequency split between upstream and downstream data to give double the number of bits available for upstream data. This allows upload speeds of up to 2.5Mbps.

Using a similar technology to ADSL, SDSL was introduced as a premium service offering symmetric upload and download speeds. A dedicated line was required that could not be used for voice, along with special SDSL router equipment. Initially SDSL was a viable and cheaper alternative to traditional leased lines, although keener pricing of leased lines means that the difference is no longer clear cut. BT's SDSL coverage is also limited and there are no plans to increase this in future, although BT is not the only supplier of SDSL services.

Contention

This subject warrants a complete section of its own as it is a much misunderstood concept that never really existed and should now not be referred to.

Basically, if a typical user is supplied with a certain amount of bandwidth, the likelihood is that they will use a fraction of it most of the time, only rarely spiking up to anywhere near what they have available. It is therefore not cost-effective to supply them with that amount of clear, uncontended bandwidth all the way through to the Internet hand-off point. The fact is that there is so much that cannot be controlled once traffic is handed off and any bottleneck is likely to be somewhere out in the public Internet.

What BT did was to content the ADSL users or make them share bandwidth over the ADSL network. The figure quoted was one of 50:1 for domestic use, which led many people to believe that if they had a 1Mbps circuit for example, that they were sharing it with 49 other customers, which does not sound like a recipe for a good service. In fact, some suppliers other than BT did operate on a small scale contention model, but this is not the case now.

In fact, the scale was much greater, which when combined with the typical usage pattern and "bursty" nature of most traffic, actually gave a good user experience to most people. Of course there were, and indeed are, times when things do slow down due to the number of users actively online.

Ironically, one of the early drivers of broadband, video on demand would have actually exacerbated this issue as it would involve many users streaming high bandwidth data.

In fact, although the network has always been contended, the actual methodology used for different levels of service is one based on prioritisation. Given that there is not enough total bandwidth for all users to run at near maximum, there will be times when there is congestion. During those times, Quality of Service policies come into play to give priority to traffic based on the level of service that it is entitled to. For example, someone paying more for a premium service will have their traffic marked as a higher priority and it will therefore be pushed through ahead of lower priority traffic.

The Suppliers

It is no secret that BT is involved in the supply of all DSL services as they own the PSTN infrastructure in the UK. Initially, they also managed all of the exchange equipment and the core DSL network. However, BT supplied ADSL as a wholesale product which was delivered to the ISP via central pipes. This gave a level playing field for the access part of the product, with ISP's being differentiated by the quality of their service and support as well as the capacity and connectivity of their core network. Many ISP's sold broadband, and were joined by a number of other suppliers such as supermarkets who simply rebranded others' offerings.

Then came Local Loop Unbundling (LLU), where BT allowed other providers into the exchanges so that they could have users directly connected into their networks at that point and gain greater control and economies of scale. This also gave opportunity to run higher capacity services where they were available. A number of large providers have been through this process and can compete with BT quite effectively, although there is always the "last mile" to the customer premises that remains in BT's hands

More recent times have seen a lot of consolidation of ISP's for various reasons, leaving fewer larger organisations. For example, Pipex went through a run of acquisitions, buying up Nildram, Freedom to Surf, Bulldog's customers and some others, before selling all its broadband business to Tiscali.

Although the term "broadband" commonly refers to DSL services, there are alternatives in some areas such as ntl's cable service which makes use of their cable TV infrastructure to deliver broadband services as part of a package. Theoretically, it is possible to deliver much higher bandwidth in this way, but coverage is limited to premises that have been physically cabled.

Business Use

Businesses saw a lot of potential in ADSL technology, which gave even small organisations the ability to get on the Internet at high speed for a fraction of the cost of a traditional leased line. Initially, the relatively poor SLA offered by ADSL was not an issue as few businesses relied too heavily on their Internet connection, but that soon changed with Internet connectivity, e-commerce and email becoming vital to day-to-day operations.

In more recent times, we have seen convergence come to the fore, where the IP network supplying an organisation with Internet access also carries their private

inter-site traffic and voice. Clearly, a failure of a circuit would have a large impact on the business.

This is where careful thought must go into decisions to use ADSL for business connectivity. Whilst the price is attractive and the bandwidth available appears to be plentiful, it is not always the best choice for the following reasons:

- **Bandwidth**
ADSL is ideal for use when most of the traffic is inbound and the large download bandwidth can be taken advantage of. In a business scenario, there is often as much upload as download. For example, where a remote site is accessing a Citrix server or where a site is providing services to others. In these cases, the limitation of upload bandwidth can become an issue
- **Availability**
Whilst actual availability of ADSL as a service is not normally a problem for businesses, there may be limitations on what can be supplied from a given exchange. For example, smaller exchanges may not be able to offer high bandwidth business grade services. Even if these services are available, the rate-adaptive nature of them can make predicting the actual bandwidth supplied difficult, especially where line quality and/or distance from the exchange are an issue.
- **SLA**
Whereas leased lines typically have a robust SLA with guaranteed fix times of 4 hours, this is not true for ADSL. Should there be a failure of the circuit, it can take up to 2 days for a resolution. This is a function of the BT SLA on the underlying PSTN circuit and there is no way around it. Beware of ISP's offering better SLA's as they will normally exclude line problems, rendering them effectively useless
- **Voice**
Whilst it is possible to run VoIP over ADSL circuits, the limiting factor is the upload speed rather than the download, as each call requires equal upload and download bandwidth. It is also worth bearing in mind that ADSL with less priority may suffer from congestion within the DSL network, which can affect the quality of voice calls.

The DSL Marketplace Today

Now that DSL has been available for almost a decade, it has come a long way in that time for a number of reasons. Firstly, coverage is now extensive, with only remote rural areas not well served. In terms of business coverage, it is unlikely that anywhere suitable to run a business would not be within reach of some kind of DSL service. Secondly, from an initial maximum of 2Mbps, if line conditions were favourable, bandwidth has kept pace with the demands of ever richer content, with up to 24Mbps download and 2.5Mbps upload available.

With consolidation of the marketplace, there are now just a few big players who actually own DSL infrastructure in the exchanges. BT remains in front unsurprisingly, but Cable and Wireless and Tiscali are probably the biggest of the remaining wholesale providers.

There are many ISP's who can provide business-grade broadband connections, most of whom are re-selling products from one of the wholesale providers mentioned. However, it is not true that a Cable and Wireless service bought from one provider will be the same as one bought from another. Although the connection from the customer premises to the ISP will be similar, the onward transit to the Internet will be provided by that ISP, and will therefore only be as good as their network.

Most ISP's currently have some kind of usage cap or fair usage policy as an attempt to limit the amount of data that individual users can pass through their ADSL connection. This became a necessity as file sharing became popular and small numbers of users would affect the access of the majority through massive bandwidth use. The ISP's responded in various ways, some even terminating contracts of their highest users. Now, most ISP's are upfront about their usage caps on cheaper services, but not all are as forthcoming about fair usage policies on their "unlimited" services.

8el's DSL offerings

8el understand that there is a need for DSL as part of a services portfolio that covers the widest range of customer requirements possible. For small offices and remote workers, ADSL solutions are a cost-effective way of providing the connectivity required. In order to provide a wide range of ADSL services that blend together to cater for the needs of differing sites, 8el partner with two of the major wholesale suppliers, Tiscali and Cable & Wireless.

As previously mentioned, the provision of the ADSL link to the customer premises is only half of the story and 8el's MPLS core ensures that customers get the best possible onward link to the Internet. A further advantage to this is that 8el are able to provide ADSL circuits that terminate directly into customers' private WANs, removing the need for multiple firewalls and VPNs. This way, remote offices and workers have full access to corporate WANs without the support headache that this usually brings.

Technically, the ADSL connection to 8el from the wholesale provider is via Gigabit interconnects through which all the connections are routed from 8el's ADSL customers. These connections are formed at layer 2 using the Layer 2 Tunnelling Protocol (L2TP). This tunnel is created from the customer exchange all the way back to 8el's LNS (Layer 2 Network Server). This enables 8el to exercise a great deal of control over the properties of the ADSL connection, including authentication, encapsulation and the bandwidth available.

Tiscali

As discussed in the section on contention, there is no contention within the Tiscali ADSL network, but a system of different weightings within the backhaul that effectively offers different priorities for different classes of service. As with all QoS setups, if there is no congestion, then all services run with full bandwidth available. If there is congestion within the Tiscali ADSL network, then QoS takes effect as detailed in the service descriptions below:

The first service offered is based on a low backhaul weighting and is called "Standard". This has the lowest performance under congestion with no

guaranteed minimum bandwidths. Bandwidth options are shown in the table below:

Speed	Max Down	Max Up
0.5Mb	512Kbps	256Kbps
1Mb	1Mbps	256Kbps
2Mb	2Mbps	256Kbps
Max	8Mbps	400Kbps

The Standard service is not suitable for running voice or critical applications, but is a cost-effective option for non-essential or home use.

Next is the service based on a medium backhaul weighting called "Business". This has twice the performance under congestion as the standard service, but still no guaranteed minimum bandwidths. Bandwidth options are shown in the table below:

Speed	Max Down	Max Up
0.5Mb	512Kbps	256Kbps
1Mb	1Mbps	256Kbps
2Mb	2Mbps	256Kbps
Max	8Mbps	800Kbps

The Business service is not suitable for running voice, but is an option for running data and providing connectivity to smaller remote offices and users.

Finally, is the "Premium" service based on the highest backhaul weighting. This has five times the performance under congestion as the standard service and has a guaranteed prioritised download and minimum upload. Bandwidth options are shown in the table below:

Speed	Max Down	Max Up	Prioritised Down	Minimum Up
0.5Mb	512Kbps	256Kbps	200Kbps	200Kbps
1Mb	1Mbps	256Kbps	200Kbps	200Kbps
2Mb	2Mbps	256Kbps	200Kbps	200Kbps
Max	8Mbps	800Kbps	500Kbps	500Kbps

The Premium service with its guarantees is a good option for running voice and data for small offices, or voice only for slightly larger sites. It is best to assume that the minimum upload is actually the maximum available for voice, so with a Max service, up to nine voice channels (using the G726 codec) could run within that, but with a good amount of potential spare bandwidth.

Note that the download does not have a guaranteed minimum, but a prioritised bandwidth, which is effectively a minimum unless the Tiscali network is really under stress. Based on our experience so far of the Tiscali wholesale setup, it appears that this is unlikely and that the overall setup is stable and robust. Further evidence of Tiscali's commitment to providing a good service is that their threshold for reporting a fault with packet dropping is half that of previous suppliers.

Enhanced Care is an option on Premium services that provides a better SLA for the BT line over which the DSL runs. The standard SLA includes a 48 hour fix time, which is reduced to 24 hours with Enhanced Care. BT also offer 24 hour repair services 7 days a week with Enhanced Care compared with 8am to 6pm, Monday to Friday with standard.

Although Tiscali's coverage is extensive, not all exchanges are capable of supporting the Premium services.

Cable & Wireless

There are two basic Cable and Wireless services that 8el will be offering, ADSL 2+ and SDSL.

ADSL 2+ gives a theoretical download speed of up to 24Mbps and upload speed of up to 1.4Mbps. However, given that the actual download speed will be variable, 8el prefer to set an achievable expectation and will market and sell these services as 10Mbps download. This will be achieved using the control 8el have at the LNS level and will result in stable and predictable bandwidth services. There may be instances where the maximum achievable bandwidth is less than 10Mbps due to line quality and distance considerations, but these will be rare. There will also be a chargeable option of increasing the available bandwidth above 10Mbps where available.

SDSL is available at all Cable & Wireless unbundled exchanges and can offer synchronous upload and download speeds up to 2Mbps. SDSL is a good alternative to leased lines, giving similar levels of performance. However, due to the fixed cost nature of the service, it may be a similar or slightly greater cost per annum than a leased line if the site is easy to provision. The leased line will have a greater install cost, but a much better SLA, with a 4 hour fix compared to 24 or 48 hours for an SDSL circuit.

For more information on 8el's DSL offering, contact sales on 0118 338 3062 or visit www.8el.com