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Broadband Options

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Date: July 2010

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Introduction

ict active is the national standard for the provision of Information Communications Technology (ICT) in office buildings.

As a scheme, ict active ratifies both the infrastructure and services provided by a building and is designed to promote office spaces that have a high quality ICT offering. **ict active** is based on a British Standards Institute Publicly Available Specification (PAS 700) published in Spring 2009.

As part of the service offered by ict active, we aim to help building operators to optimise the efficiency of their ICT offering by identifying areas where improvements could be made. This is done through making solid recommendations for improvements and by improving access to information regarding the various equipment and service options available for implementing a high quality business ICT infrastructure.

As part of this process, this white paper on Broadband Options aims to:

- demystify the technology involved
- explain the different types of Broadband Services available
- improve understanding about Broadband Service availability in the UK
- provide information about future trends for Broadband Services
- provide links to further information

Defining Broadband

At its most simple, the term 'broadband' is used to describe any high-speed data connection to the internet. These types of connection generally have common factors:

1. They are 'always-on'. This means that when you want to visit a website, or send an email, you can do it straight away – the link to the internet is continuously available and there is no need to wait for your computer to go through a connection process, as with a dial-up modem connection.
2. They are classed as digital links, as opposed to old-fashioned modem links, which were analogue. The difference can be thought of as follows: digital is the language of computers and is made of sequences of 1s and 0s in specially coded patterns, whereas analogue is like human speech and is made from continuously variable physical quantities (like sound frequencies).
3. They are classed as high speed links. This is usually accepted to mean better than 64kbps (kilo bits per second). The fastest old style analogue dial-up modems are only 56kbps. These older style links are called narrowband.

A broadband link enables more information to be transmitted at the same time, therefore any single piece of information can be transmitted faster than on a narrowband link. This greater speed also makes the exchange of large files more practical and allows you to run multiple online applications at the same time.

Broadband also provides additional value in the variety of services that can be delivered over a broadband link. Broadband allows 'on-demand' (i.e. instantly available when you need to use it) access to internet gaming, internet TV and movies, online training and many other forms of interactive multimedia. As these require the transfer of large amounts of information in very short time periods, they are not available to people using narrowband links.

In the UK, broadband services are provided through local agents known variously as Service Providers, Internet Service Providers (ISPs) or the local telephone company, depending on their presence in the area.

It is usually necessary to apply for a Broadband Service package. These are generally for a specified term of between 12-24 months, depending on the provider and the details of the relevant package.

After signing up to accept one of these packages, the Service Provider will usually install the necessary cable connection to the premises (in many cases where a telephone line is used, this will already be installed). Then, the provider will arrange for a technician to visit the premises at an agreed time/date and install the terminal equipment.

The terminal equipment is used to connect the customers' computer/s to the broadband link. The type of terminal equipment depends on the type of cable connection being used for the broadband link. In many cases, the Service Provider will also provide additional equipment to connect multiple computers to the broadband link, such as a WiFi Router for wireless connections. The technician will normally perform the initial configuration of the terminal equipment and computer/s as part of the installation. In most cases, the initial installation and configuration will incur a small one-time charge.

Types of Broadband Service

Broadband services are classed according to the type of distribution media that is used, that is, the type of cable or link used to supply the service to the premises. Broadband services can also be further classified according to the target user type, that is, business or home user.

The types of link are:

1. Broadband over Telephone cable (normal single pair telephone cable used for a standard telephone connection)
2. Coaxial cable, as used for standard cable TV services.
3. Fibre Optic cable
4. Satellite, similar in principle to that used for satellite TV reception
5. Wireless, which includes such differing techniques as WiFi, Microwave and WiMax.
6. Ethernet LAN services.
7. Leased Lines

1. Broadband over telephone cable.

At present, this type of broadband delivery can be broken down into two types of service. Firstly there is ISDN (Integrated Services Digital Network). This is an older technology, but it is still widely available and offers between 64 and 128kbps connections. It is no longer commonly used for broadband access and has generally been relegated to use for digital telephone connections.

The other more widely used broadband delivery system is DSL (Digital Subscriber Line). This comes in many flavours such as ADSL, SDSL, XDSL, VHDSL. These changes in terminology merely reflect small differences in how they are implemented. At root, they remain the same system but with alterations to the bandwidth allocation on the upload (from you to the internet) and download (from the internet to you) sides.

DSL systems make use of a modem to convert the data from computers into a simulated digital signal which can be more efficiently transmitted over a single telephone wire pair. There will be a similar modem in the telephone exchange which converts the signal back into standard computer data for connection to the ISP's main network.

This signal is severely affected by the length of the cable between the exchange and the customer premises. The maximum distance between the two is normally about 5km, but bandwidth decreases with increasing distance i.e. a DSL link giving 2Mbps at 500 metres from the exchange may only give 256kbps bandwidth at 5000 metres from the exchange.

The most common forms of DSL service available in the UK today are SDSL (Symmetrical Digital Subscriber Line) and ADSL (Asymmetrical Digital Subscriber Line). A symmetrical link gives equal bandwidth for upload and download, whereas an asymmetrical link gives a higher proportion of the total bandwidth to the download direction. The reason for the difference is based upon how the internet link would be used.

For general users of the internet, the great majority of the data is in a download direction, that is, the user takes data from the internet onto their computer and normally only control data or low level information (such as e-mail) is sent back to the internet. In this case, an ADSL link is a good match for this type of user. However, for situations where the user may be uploading large amounts of data to the internet, such as when the user has a web server or e-mail server, they may need as much upload bandwidth as download bandwidth. In this case, an SDSL link would be more appropriate.

Another solution for businesses that require higher levels of upload bandwidth is a bonded ADSL service. This requires the use of a number of Analogue telephone lines or conversion of existing digital lines, the number being equivalent to the total bandwidth required. This solution offers an excellent choice based on price/performance ratios and can be very favourably compared to a similarly specified leased line solution.

When choosing a bonded adsl broadband service it is worthwhile to be aware of the following:

Bonded ADSL comes in two flavours, those that offer genuinely bonded lines, utilising MLPPP (multilink point to point protocol), or software linked services using VPN bonding. Each service has it's own adherents but other than anecdotally, there is little evidence to favour either service over the other. However, in the UK there are some factors that should be taken into account when choosing one type over the other.

a. MLPPP based services are generally accepted to offer higher overall bandwidth than equivalent VPN solutions, but at lower levels of resilience.

However it has been reported that much of the problems with the MLPPP solutions in the UK stem from poor support for the technology from BT. Here is BT's official stance:
"The BT Wholesale IPStream Network does not offer a guarantee that Bonded DSL or DSL lines employing Multi-link Point to Point Protocol (MLPPP) can be supported. Whilst it may be technically possible for a Customer (ISP) to deliver Bonded DSL or MLPPP to an End User, as its not a supported product feature we have no way of guaranteeing support for Customers (ISPs) providing Bonded DSL or MLPPP."
Further to this BT have implemented new core routers in support of the progression to an IP based core network. Neither the new routers, nor the existing network components support the use of Multilink PPP.

If opting for this solution, it would be to opt for a solution that comes from a provider that does not offer it's solution over the BT core network, but uses their own or some other core network. It is also highly recommended that the service is checked to ensure that the SLA's and support package guarantee performance and technical support.

b. VPN based services are generally accepted to offer lower levels of performance, but increased levels of reliability. However, the increased complexity of this solution is likely to lead to higher costs in set up and subsequent maintenance or configuration. Again, it is therefore imperative that the service is checked to ensure that the SLA's and support package guarantee performance and technical support. Access to information from other satisfied customers would be highly recommended.

Despite the above information, an MLPPP based bonded ADSL solution could be an good choice for businesses on a tight budget, but needing additional upload capacity.

Advantages of DSL are:

1. It is available to anybody within 5km of a telephone exchange (most people already have the cable for their existing telephone connection).
2. There is an option to transfer the broadband service to another provider with a better price/service offering, without needing to install a new or different cable connection.
3. Multiple lines can often be combined to offer increased performance.
4. It offers a good price for the level of performance and reliability.

Disadvantages are:

1. The distance from an exchange can seriously affect the performance.
2. DSL is not available everywhere and is often not available to rural customers.
3. Technical breakthroughs have increased performance significantly over the last few years, but it is likely that the maximum levels of performance have already been reached with this technology. Users looking to move to significantly higher levels of bandwidth in the future may need to look at an alternative option, rather than select DSL-based broadband.
4. DSL is affected by contention ratios, meaning the internet access is shared by multiple users and, as the number of users in the local area increases, peak time performance is reduced. Most DSL services will specify what the contention ratio is. This allows a potential subscriber to plan for the likely impact on their peak time performance and to purchase a DSL plan to match their needs.

2. Broadband over coaxial cable

This type of service is generally referred to as simply 'cable broadband'. Like DSL services, a cable broadband service uses a modem to convert the computer data and transfer it over the coaxial cable to the service provider, where another modem reconverts the signal before sending the data over the ISP's network.

Advantages of cable broadband are:

1. It is not usually affected by the same distance restrictions as DSL, because the provider usually has a cabinet located in the area which acts like an extension of the exchange and therefore the coaxial cable only runs a short distance.
2. Bandwidth is usually much higher for a DSL link of similar cost.
3. Bandwidth can usually be upgraded easily.
4. Maximum bandwidth capability is much higher than for other types of broadband connection, presently second only to fibre optic for maximum capability.

5. It is highly likely that cable broadband is still likely to see further increases in performance with future technological advances, meaning it is a good choice for businesses needing high performance now with an option to increase bandwidth in the future.

Disadvantages are:

1. A cable broadband provider has to have a presence in the area for the local cabinet to exist to make the connection, otherwise cable broadband service will not be available. This means it is not as widely available as DSL services.
2. As the cable system belongs to a single provider and most of these providers have recently merged into a single business entity, there is no option to transfer the service to another provider with a better price offering.
3. Like DSL services, cable is also troubled by contention ratios, meaning as the number of users in the local area increases, peak time performance is reduced. Most cable services will not specify what the contention ratio is. This means a potential subscriber cannot plan for the likely impact on their peak time performance and so should plan to purchase the highest grade of service they can afford to try to mitigate peak time performance.

3. Broadband over fibre optic cable

Currently in the UK, this type of service is still not widely available to users and, where it is, it tends to be at a premium price. Fibre optic connections are purely digital and use a suitably equipped router to allow direct connection from computers on the premises to the ISP's network.

There are several schemes ongoing in the UK to roll out fibre optic connectivity to premises. Some of these schemes will implement Fibre To The Curb (FTTC) where, similar to the cable broadband system, the fibre will terminate in a cabinet in the street and a standard telephone cable will be used to link from the cabinet to the premises. The advantages of this scheme are that installation costs are reduced as it makes use of existing infrastructure and deployment can be fairly speedy, once started.

The disadvantage is that the final telephone cable link will limit the maximum possible bandwidth available to the end user to a level far below the maximum capability of the fibre optic link and the use of the telephone system means the links are still contended i.e. the actual bandwidth of the fibre will be shared between multiple telephone subscribers.

Other schemes are planned to use Fibre To The Home (FTTH) where the fibre optic cable will terminate directly within the premises. Advantages of this scheme are that the link will be almost future proof as far as bandwidth goes, as the limits are those of the actual fibre optic cable. There is already a successful scheme operating in Dundee and Bournemouth, where the fibre optic cable was delivered using the sewerage system to keep installation costs low. The big disadvantage to this scheme is that it is proving slow to implement, but it is expected that increased demand will lead to a significant improvement to the rollout times around the UK.

Some service providers currently offer fibre optic leased lines (similar in principle to the FTTH offering), which offer excellent performance, reliability and service guarantees, but usually incur a very high installation cost and high annual service charges.

Overall, fibre optic is the best solution for truly scalable high-speed broadband service, but current availability is patchy and generally costs far more than for an equivalent bandwidth DSL or cable broadband offering.

4. Broadband over Satellite

This type of service is similar to satellite TV, in that it makes use of a satellite dish and receiver to connect to data satellites orbiting high above the earth over the equator. However, as internet services require two-way communication, this type of broadband service requires a method of uploading data to the satellite. This is done in one of two ways. Either the transmitted data is sent over a telephone line connection using a modem/ISDN link or, more commonly now, it is sent directly from the dish over a separate satellite link in an upwards direction. Instead of a receiver (which only receives data), this form of satellite broadband uses a transceiver capable of two-way data transfer. The output from the receiver is usually an Ethernet connection, meaning computers or networks can connect directly to the transceiver to make the internet connection.

Advantages of satellite broadband are:

1. Available anywhere that has a direct line-of-site view of the southern skies.
2. Currently offers speeds up to 8Mbps down and 2Mbps up.
3. Makes broadband available to even the most remotely situated subscribers.
4. Prices are rapidly reducing as more subscribers make use of this type of service and performance is also improving rapidly with increased usage driving the technology..

Disadvantages are:

1. The signal must travel approximately 22300 miles to reach the satellite and 22300 miles to come back to the user's receiver. This leads to transmission delays in the signal (known as latency) which can disrupt interactive services, such as IRC and Video On Demand.
2. As the satellite system belongs to a single provider, there is no option to transfer the service to another provider with a better price offering.
3. Connections using the modem/ISDN upload offering have a slow upload speed for transmitted data and may be unsuitable for business use.
4. Weather, sunspot activity and other climatic conditions can seriously affect satellite services.
5. Generally, satellite broadband is more expensive than for similar types of DSL or cable service and limits to the daily/monthly allowances for downloaded data tend to be more restrictive. Costs for installation and annual charges are very similar to those for urban leased lines, but installation charges are considerably cheaper for rural customers who may be many miles from an ISP's connection point.

5. Broadband over wireless

Wireless broadband systems come in a variety of services, all of which use some form of radio system to transfer data from the user to the internet. They generally come in two varieties: a 'Fixed' network or a 'Hotspot' for roaming users. Fixed networks are stationary and designed to deliver Internet access over wide areas, while Hotspots are cheaper localised

methods of Internet access that have been designed to cover smaller areas, such as train stations or restaurants where temporary users are prevalent. These types of system are still not widely available for private and business use, being mostly confined to small local public connections. However, there is increasing interest in these types of systems and there are now numerous operators of Wireless Internet Services dotted around the country.
There are currently two common types of technology that can offer wireless internet connectivity and there are two more that are expected to soon be in competition for the wireless user market.

The two currently more widely available technologies are WiFi and WiMAX.

The claimed performances for these two services are dependant upon the frequency band of operation and are commonly given as below:
Wi-Fi 802.11a Frequency band 2.4GHz or 5GHz Up to 2Mbps data speed
Wi-Fi 802.11b Frequency band 2.4GHz Up to 11Mbps data speed
Wi-Fi 802.11g Frequency band 2.4GHz Up to 54Mbps data speed
Wi-Fi 802.11n Frequency band 2.4GHz or 5GHz Up to 100Mbps to 600Mbps data speed
WiMAX 802.16 Frequency band 2.3GHz, 2.5GHz, 2.6GHz, 3.5GHz (UK) Up to 100Mbps to 600Mbps data speed

WiFi
WiFi was originally specified as a domestic wireless service, but its widespread adoption for business use highlighted the poor security and performance of the first systems. This has led to several upgrades to the security and performance of current systems. WiFi now offers a good, secure option for the extension or creation of local area networks for businesses in those situations where a similarly specified cabled solution is not a viable choice. Being the older of the current crop of wireless technologies, WiFi is better supported and more widely understood than it's competitors. There are now numerous smaller ISP's providing WiFi based WAN's in various locations around the UK to offer internet access for private users and businesses. Many of these solutions cater to rural based users and businesses, which may otherwise be unable to get anything better than dial-up internet access. The big advantage of WiFi is that it is not restricted to line-of-sight and can even operate through walls in many circumstances. It is also relatively cheap to install and annual service charges are usually similar to those for ADSL or cable packages.

WiMAX

WiMAX is an acronym for Worldwide Interoperability for Microwave Access. It can be used for a number of applications, including 'last mile' broadband connections, hotspots and high-speed enterprise connectivity for businesses. WiMAX enables the delivery of wireless broadband access as an alternative to cable and ADSL. It comes in two flavours, fixed or mobile. In this respect it is similar to WiFi and for end users it generally offers the same features, but with usually better performance. The big advantage of WiMAX over WiFI is that it offers considerably more bandwidth and range, so can accommodate more users in a larger geographical area per equipment installation. It can also be used as a backhaul link to connect a business to an ISP or another branch, so effectively it acts like a leased line. The disadvantage of WiMAX is the poorer availability in the UK and the higher costs of installation. Annual service charges are comparable to those for WiFi, ADSL and cable services.

Other wireless services

Current 2/2.5 and 3G mobile telephone systems also offer wireless data services, but they offer generally limited performance/reliability and often have severe limits to the amount of data that can be downloaded. Overall they cannot offer a genuine broadband experience for business users.

The other two technologies that expected to compete for the wireless market are 4G mobile telephone services and Local Multipoint Distribution System (LMDS), both of which are claimed to offer very high speed broadband.

LMDS is a broadband two-way radio system that operates at frequencies above 10GHz and can effectively deliver broadband services from a single location to multiple users premises. There are several interpretations of the technology, many of which claim to offer up to 1.5Gbps links and to have overcome many of the problems that affect other radio systems. It isn't yet widely available in the UK, but there are several offerings available in the market. Unfortunately, they are currently aimed at ISP's and there is little scope for this system to be made directly available to smaller enterprises. The picture is less bleak for larger enterprises that need to connect several branches and possibly also link to the internet, as the increased revenue from a larger installation base means this solution is a distinct possibility.

4G mobile service, also known as LTE (Long Term Evolution) is the latest standard of the mobile telephone networks. It is claimed that the system will provide downlink peak rates of at least 100 Mbps and an uplink of at least 50 Mbps. LTE is essentially a mobile broadband system that can run

telephony and other multimedia services. Users will initially need a dongle or USB stick to connect for broadband services, but it is expected that laptops and PC's with in-built connectivity solutions will soon follow. Extensive trials are already taking place in the UK and current predictions are for rollout of the technology to be taking place from late 2010 for a 2011 start up of national services.

NB LTE is actually 3.9G, real 4G is the next step, also known as LTE Advanced!

Microwave

The one wireless technology that can prove very valuable to remote locations is microwave. Microwave technology makes use of a line-of-sight radio link to access the internet backbone by linking a remote site and another location which already has a high-speed internet connection. This could be a telephone exchange, POP site (a point of presence site, where major internet or communications equipment is sited) or any other location which has a high speed internet connection and is willing to share the bandwidth.
Microwave can be effective at distances up to 50 miles, but only if line of sight between the two locations can be assured i.e. there are no physical obstructions between the sites. The other main advantage of microwave is that it permits very high speed connections which are scalable, i.e. the bandwidth can be adjusted according to needs.
For remote locations which have no access to other broadband access technologies, microwave can be a much better option than satellite, as it offers much higher bandwidth, with upload speeds generally about 25% of download speeds, at a reasonable price. The disadvantages of microwave are that it is not available everywhere, has higher initial installation costs and like all radio systems, is susceptible to the same problems as other radio based solutions.

Advantages of wireless broadband:

1. Can be made available everywhere as it is not dependant upon the need for physical cabling.
2. Installation costs to end users are usually considerably cheaper than for a similarly performing cabled service.
3. Allows mobility for users to move around whilst using the service.
4. Generally low latency, so interactive services, such as IRC and Video On Demand usually perform well.

Disadvantages of wireless broadband:

1. Spotty availability of the various services at this time.
2. Not as secure as a similarly specified cable service and security measures are generally more difficult to implement for non-technical users.
3. Service packages are generally more restrictive than a similarly specified cable service and often have heavy download restrictions.
4. Pricing for services is less uniform than similar cabled services.
5. Access often requires a different type of equipment/dongle for each of the differing services.
6. Wireless performance is affected by distance; weather (for external systems); solid objects in the line of the radio path, such as walls or trees and the presence of other radio systems broadcasting in the same area. The end result is that the claimed speeds are very rarely experienced by users, even when they are located right next to the source.

Unfortunately, wireless internet broadband, whilst on paper looking a good bet for wide-scale, simple and fast broadband internet connectivity, is beset by conflicting standards, systems and incompatible or spotty implementation. Until a standard can be agreed and implemented for national and international conformance, wireless is a very poor choice for business broadband connectivity. Whilst the technologies themselves look promising, generally wireless should only be considered as a last resort where cabled services are not available are prohibitively expensive or the majority of users are expected to be temporary or roaming users.

6. Ethernet LAN services

This type of service, whilst widely available, is usually restricted to large corporate organisations requiring dedicated connections between offices. It offers very high-speed full-duplex connectivity, high reliability and unlimited traffic for a fixed price. It essentially offers a VPN link over the ISP's existing WAN (wide area network) with a dedicated bandwidth share and a service guarantee between two geographical points such as two branch offices. However, it is not generally available outside of large urban centres, is relatively high cost in both initial implementation and ongoing charges and is available usually only as a point-to-point connection, so cannot usually be used as a general connection to an Internet Service Provider.

7. Leased Lines

Leased lines are the most common of the 'last mile' access solutions for high-speed, guaranteed broadband services for businesses. A leased line is a contractual provision of a dedicated connection between a customer premises and an ISP or another premises. In the UK they are also known as 'Private Circuits' or 'Data Lines'. They offer the same features as Ethernet LAN links, but the whole bandwidth of the line is dedicated to the customer. This offers better scope for increasing the bandwidth if more is needed, as it is limited by the cable type and the terminal equipment - no other customers of the ISP share the line. They are always symmetrical lines; that is upload and download speeds are the same. Most leased lines are now provided over fibre optic cable, as this offers better scope for increasing the speed and thereby increasing revenue for the provider. Leased lines come with service level agreements that define the performance criteria, the reliability, technical support levels and the rates of compensation if these guarantees are not matched. There is usually an indication of how the performance will be monitored, to ensure that the terms of the SLA can be audited.

Leased lines are generally the most expensive solution for accessing high-speed broadband. Installation cost is based entirely on the cost of the terminal equipment and the difficulty in getting a cable to the property. This means installation charges can vary from a few hundred to many thousands of pounds, dependant upon the location of the property in relation to the service provider's nearest connection point. As it is an uncontended connection, the annual service charges also tend to be very high. Many service providers will drop or heavily reduce the installation charges for a longer contract term. Minimum contract terms tend to be one year.

Broadband for Businesses

- **What do we mean by business-quality broadband?**

There are no specific industry agreed terms for what constitutes 'business-grade broadband'. However, there are a few factors which are generally to be found with most business-grade solutions.

1. Provision of a Service Level Agreement, which should cover some or all of the following additional characteristics of a business-grade service.
2. Guaranteed performance rates for upload and download.
3. Guaranteed availability of the service.
4. Improved latency (i.e. speedier response times over the provider's network).
5. Traffic Shaping or Quality of Service management (i.e. optimisation of the network for different types of network traffic).
6. A clearly defined technical support scheme with a timetable of response times for the various scenarios.
7. Lower contention ratios (i.e. ADSL is often at 5:1 or better as opposed to 10:1 for residential-grade).
8. Definition of a penalty scheme for non-compliance with some/all of the above points.

- **Why is residential-quality not good enough for business?**

Residential-grade broadband is frequently offered at the same performance level as an equivalent business-grade service. However, it will have few or none of the additional service characteristics of the business-grade service as indicated above. This means that the actual performance may be far below that specified and technical support is on a first come, first served basis. Resolution of problems can be lengthy and there is often no financial restitution available for degraded service and/or losses incurred. The higher contention ratios for residential-quality services often equate to serious degradation in performance at peak times.

- **What problems will you get if you use sub-standard broadband?**

Poor broadband services can translate into degraded, intermittent or lost service. For a business that relies on fast, reliable internet connectivity, this can have a serious impact on productivity, create disharmony with clients or suppliers and result in serious financial losses.

- **What advantages will you get from having business-quality broadband?**

Improved quality of service, reliability and guarantees that the situation will not change and if it did, financial compensation may be available.

Choosing A Broadband Service

The main factors affecting the choice of broadband are:

1. Number of potential users – the higher the number of potential users, the higher the broadband upload and download speeds need to be. The following table is designed to measure compliance for the purposes of ict active, but is still a good guide for calculating the bandwidth necessary for a given number of users and their likely requirements:

Number of users	**Minimum downstream data rate not contented** kbps	**Minimum upstream data rate not contended** kbps
1 to 20	2,000 total	500 total
21 to 100	100 per user	50 per user
100 +	10,000 for the first 100 users, plus 50 per each additional user	5,000 for the first 100 users, plus 10 per each additional user

Note 1 The minimum required internet connection speed is based on the number of users and not the user capacity of the workplace.
Note 2 The number of users should take into account the number of visitors expected in the workplace and should not be less than the number of ICT-ready work areas in the workplace.
Note 3 Contention refers to contention of the line itself and not any contention further upstream in the network or at the communications services provider.

2. Network services that will be in use by users, as these will affect the required up/download and reliability levels.
   For example:
   a. E-mail/browsing/IRC – requires low upload speeds/low download speeds/residential reliability.
   b. Video conferencing/web server/e-mail server – requires high upload/ high download/ business-grade reliability
   c. VoIP telephony - requires medium upload/ medium download/ business-grade reliability
3. Quality of building ICT infrastructure – The network cabling, the configuration of the network security, the type of network equipment and the configuration of access to the internet connection can all have a big impact on actual broadband speeds for an individual user.
4. Availability and pricing of the different types of broadband services in the locality.

Conclusion

The UK has a vibrant and competitive broadband services market, but still lags behind some other countries in the overall quality of services available.
However, it is an area subject to rapid and frequent change. There are widespread plans from both government and the private sector to accelerate the improvement of broadband services to the whole of the UK.

Before committing to a particular broadband access technology, one should examine all of the above criteria and compare the various broadband access technologies available locally. In particular, where user numbers may fluctuate, are likely to increase, or the intended usage of the internet connection is subject to change, it is important to pay attention to the ability of the broadband service to be upgraded or changed. A more expensive service, which offers better upgrade options may prove better value in the long term.

A well designed and implemented network structure can result in very good internet performance for users from a lower grade broadband service, whereas a poorly designed and implemented network can give very poor internet performance from a very high grade internet connection.

As the broadband market is subject to such rapid fluctuations caused by technological change and investment by private enterprise, it is necessary to check the local broadband services at a frequent interval, as a better option may become available at any time.

A good place to start is by using Internet Broadband comparison sites, which offer quick searches of broadband availability by post code or telephone number (see next page for some suggested sites). Remember, it is often a good idea to call a local provider and enquire if they can offer cable or fibre services to the premises, as many can do this at a price. This initial expense can be offset by the much improved service and flexibility of cable and fibre services.

Links To More Information

Broadband comparison sites:
http://www.cable.co.uk/
http://www.broadband-finder.co.uk/compare-broadband/business-broadband.html
http://www.samknows.com/broadband/
http://www.broadbandchecker.co.uk/broadband-checker.html
http://www.ispreview.co.uk/broadband_wireless.php

Major Broadband Service Providers:
http://fibrecity.eu/
http://www.ntltelewestbusiness.co.uk/
http://business.bt.com/broadband-and-internet/internet-access/broadband

Satellite Broadband Providers
http://www.tariam.co.uk/
http://www.avonlinebroadband.co.uk/
http://www.broadbandwherever.net/
http://www.bentley-walker.com/

Microwave Broadband Providers
http://www.ogierelectronics.com/
http://www.cablefreesolutions.com/cablefreeuk/products.htm

http://www.broadband.uk.com/1/default.asp?zoneID=2&leveloneid=2&leveltwoid=28
http://www.trangobroadband.com/

Other Technical Resources and Information:
http://www.iec.org/online/tutorials/
http://www.service-level-agreement.net/
http://www.getsafeonline.org/nqcontent.cfm?a_id=1046
http://www.thinkbroadband.com/guides.html
http://www.nb2bc.co.uk/home/
http://en.wikipedia.org/wiki/Broadband_Internet_access

Glossary Of Broadband Technology Terminology

10BaseT

An Ethernet specification that operates at 10Mbps over two pairs of twisted-pair category 3, 4, or 5 cabling. One pair is used to send data and the other is used to receive data. 10BaseT has a distance limit of about 100m. See also 100BaseT and Fast Ethernet.

100BaseT

The Fast Ethernet specification operating at 100Mbps using UTP wiring. See also 10BaseT and Ethernet.

ADSL

Asymmetric Digital Subscriber Line (ADSL)
ADSL is a technology for transmitting digital information at a high bandwidth on existing telephone lines. Unlike a regular dial-up telephone service, ADSL provides an "always on" connection. ADSL is asymmetric in that it uses most of the channel to transmit downstream to the user and only a small part to receive information from the user. ADSL simultaneously accommodates analogue (voice) information on the same line. See also Digital Subscriber Line (DSL).

Broadband

A transmission technology that allows multiple signals to share one cable.

Crossover cable

A type of Ethernet cable that connects a switch to a switch, a host to a host, hub to hub or switch to hub. See also straight-through cable.

Digital Subscriber Line (DSL)

DSL is a technology for bringing high-bandwidth information to homes and small businesses over ordinary copper telephone lines. xDSL refers to different variations of DSL, including ADSL, HDSL, and RADSL. See also Asymmetric Digital Subscriber Line (ADSL).

Domain Name System (DNS)

Used to resolve host names to IP addresses

Dynamic Host Configuration Protocol (DHCP)

DHCP is a protocol that uses a server to dynamically configures a client when requested. DHCP is similar to BootP with the addition of address pools and lease times. See also Bootstrap Protocol (BootP).

Ethernet

A LAN specification created by the Xerox Corporation, and then improved by Xerox, Digital Equipment Corporation and Intel. Operates over cables at 10Mbps. See also Fast Ethernet, 10BaseT and 100BaseT

Fast Ethernet

Any Ethernet specification operating at a speed of 100Mbps (i.e. 10 times faster than 10BaseT). See also Ethernet, 10BaseT and 100BaseT.

Firewall

A barrier between any connected public network and private network that prevents unauthorised traffic passing through it.

Hub (network)

A device that is essentially a multiport repeater. When an electronic digital signal is received on a port, the signal is amplified and forwarded out on all segments except the segment from which the signal was received. See also switch.

Internet Protocol (IP)

A network layer protocol that is part of the TCP/IP stack and allows connectionless service.

IP Address

Often called an Internet Address, this is an address which uniquely identifies any device on the internet.

Local Area Network (LAN)

Any network linking two or more computers and devices within a limited geographical area.

MAC address

A hardware address that every port or device needs in order to connect to a LAN segment.

Modem

modulator-demodulator - a device that converts digital signals to analogue and vice-versa so that digital information can be transmitted over analogue communication facilities, such as telephone lines.

Network Address Translation (NAT)
: An algorithm that minimises the requirement for globally unique IP addresses. Typically used to enable hosts on a private network to connect to the internet without having unique IP addresses (or Internet-routable IP addresses).

Network Interface Card (NIC)
: An electronic circuit board placed in a computer that enables the computer to communicate with a LAN.

Plain Old Telephone Service (POTS)
: This refers to the traditional analogue phone service commonly encountered.

Point-to-Point Protocol (PPP)
: The protocol most commonly used for dial-up internet access.

Point-to-Point Protocol over Ethernet (PPP)
: PPPoE is the protocol used by many ADSL Internet Service Providers to connect customer computers to a remote site (i.e. the ISP) through standard telephone equipment.

Port Address Translation (PAT)
: Allows a single IP address to represent multiple resources by altering the source TCP or UDP port number.

Router
: A device that decides on the best path to use for the transmission of network traffic. Also referred to as a Gateway.

Server
: Hardware and software that provide network services to clients

Straight-through cable
: Type of Ethernet cable that connects a host to a switch, a host to a hub, or router to a switch or hub. See also crossover cable

Switch (network)
: A device that is similar to a hub but with additional intelligence. Digital signals received on a port are forwarded out only on the port required for the signal to reach it's destination. This reduces network collisions and improves network performance. See also hub.

Transmission Control Protocol (TCP)
: A connection-oriented protocol that provides reliable delivery of data.

Transmission Control Protocol/Internet Protocol (TCP/IP)
: The suite of protocols underlying the Internet.

Unshielded Twisted Pair (UTP)
: Copper wiring used in small-to-large networks to connect host devices to hubs and switches.

User Datagram Protocol (UDP)
: A connectionless transport layer protocol in the TCP/IP protocol stack that simply allows datagrams to be exchanged without acknowledgements or delivery guarantees.

Wide Area Network (WAN)
: Is a designation used to connect LANs together.