

Management Briefing on Technology for Flexible Working

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Recent years have seen major advances in the technology which can support flexible working, and the predicted advances over the next few years are even greater. Small businesses in rural regions can sometimes feel left behind by this march of technology, because many of the first applications of new technology are based in the bigger cities. However, a great deal of flexibility can be introduced into working methods using technology which is already widely available and new technologies are emerging which will make it possible to extend the facilities enjoyed by urban companies to the more rural parts of Europe.

In this section, we outline some of the technology that is available now and how it can help in making flexible working possible. In future editions we will also look ahead to the technology which is emerging, either in the commercial arena or via programmes such as the European Union's Information Society Technologies programme.

The technology needed to make flexible working a reality can be loosely grouped under 6 areas:

- Applications – These are the tools or software programmes that you run to help you with your work. Typically, they might include word processors, e-mail packages, collaborative working tools, design packages, project management tools or web-browsing tools. Collaborative working tools, such as Lotus Notes, can be particularly useful for flexible working since they allow a geographically dispersed team to easily share information.
- Hardware – This is the equipment that sits on your site and lets you use these applications. In the majority of cases, a PC and standard communications equipment will be used but some specialised hardware may also be used.
- Intra-office networks – These are used to connect the different pieces of equipment on your site so that people in different offices or departments can work together more effectively.
- Services – Although not strictly a technology, providers of services (such as internet access or voice services) are essential if the technology is to be used to enable flexible working.
- Access networks – No business works in total isolation and, therefore, the networks which give access to the communications networks of the world are key elements in flexible working.
- Mobile – Mobile technology is really just a special case of all of the ones listed above. However, a fully mobile worker has particular needs, so these are discussed separately.

Each of these areas is discussed in more detail below.

2.3.1 General Guidance

Whenever a small business is thinking of adopting technology to make more flexible working possible, there are a number of general points that have to be considered.

1. Do not always assume that a massive investment in new technology is needed. A lot can be achieved with just a PC, a modem and a phone line. However, keep a watch on the new technology coming along so that you can take advantage of it when it meets your needs. The FlexWork website helps you to do this and a good supplier will also let you know what new technology will meet your needs (and what technology will not meet your needs).
2. The initial cost of the technology should not be the over-riding factor in the decision. Reliability, warranty and support from the supplier are far more important than a cheap initial price. Many

businesses have learnt that a “bargain buy” has cost them more to maintain and put them out of action when it has failed.

3. When buying hardware or applications to support your flexible working, do not assume that the most expensive is the most suitable. It is always wise to buy a system that allows plenty of room for you to expand the ways in which you use it, but take advice from a good supplier on exactly what configuration is best suited to your needs.
4. Use only technology that has been tried and tested by other people, and make sure that you have a good support contract with the supplier. The newest version of any technology will let you do things that older versions wouldn't but will inevitably have a few unresolved problems.
5. Don't be afraid of the technology! If, for example, you have never used e-mail before you will be surprised how easy it is to learn the basics and then gradually move on from there to be able to do more complicated tasks in a more effortless way.
6. Choose software and equipment that will inter-work with that used by your customers, colleagues and suppliers. You want to be able to open, and possibly modify, each other's documents, spreadsheets and drawings.

2.3.2 Applications

Applications are the software programmes that run on the hardware on your site. Careful choice of these applications can make it much easier to use flexible working. Many small businesses already have the most common applications available but perhaps do not realise how they can make a much more flexible approach to work possible. The possible range of applications which can be used is vast, and this section can only highlight a few of the more common examples.

Microsoft Word is by far the most common word processor in use by businesses. It contains features which make it possible for a document to be jointly written by authors in different locations and then merged into a single document. It also contains a good set of reviewing tools, so that a document can be passed by e-mail to reviewers in different locations (or companies) and their comments merged into a revised document (or ignored, if you prefer!). These features can also be found in the other main word processing packages.

E-mail software, such as Outlook Express and Netscape Communicator, are commonly used tools. In addition to sending messages, almost any document (for instance, a spreadsheet) can be attached to a message. This makes e-mail a good way for workers (either on the same or different sites) to share information and jointly create documents. E-mail software can also be simply set up to send the same message to a group of people (eg everybody in sales or all stationery suppliers). Messaging can operate direct to fax numbers as well as e-mail addresses. This is a very quick and easy way to communicate.

E-mail packages may have a number of useful features which make communication tasks less of a burden. These include: an address book for storing frequently used addresses; a method for filing and organising mail messages; automatic filtering of unwanted or 'spam' mail messages; remote mail management which forwards or redirects mail during periods of absence or arranges for auto-reply of a standard message ((e.g. Jim is on holiday and will reply to your email after his return on 10th May).

The concept of sharing information can be extended to greatly enhance the way we share information now, for instance when making a phone call. Conferencing applications, such as NetMeeting, make it possible to talk to colleagues in other locations while, at the same time, displaying and modifying a file (eg a Word document) on everybody's PC screens. They also provide other tools - such as an electronic white board which can be written on and viewed on the PC of everybody in the conference, no matter where they are located. Collaborative working features are built into many other tools, such as Lotus

Notes and Microsoft Office, to make it easier to share information and tasks between members of a dispersed team.

All of these tools exist now and can be used over a very basic communications connection, such as an ordinary phone line. However, some of them (eg the conferencing tools and those which share graphical information) work better if a higher bandwidth connection is available.

Specialised applications also exist which allow, for instance, the design of components to be shared between several sites or companies – in much the same way as Word allows joint authorship of documents. Later versions of this handbook will describe some of these tools.

Security

A particularly important set of applications, sometimes overlooked, is those connected with security. Whenever you connect your company's PCs to the outside world, they are vulnerable to attack from malicious intruders. Even if you live in a low-crime area where it is safe to leave buildings unlocked, the global nature of communications leaves you open to attack. Fortunately, it is possible to protect your business against all but the most determined attacker. Applications which deal with viruses, those which protect your connection to networks and packages which protect against equipment failure are all described in the later section on Security, (see Section 3.7).

2.3.3 Hardware

The ubiquitous PC (or its rival, the Mac) will meet the needs of most small businesses for most purposes. The only real choices to be made are between portable (or laptop) PCs and desk-based PCs.

For workers who always work from one location, whether from a company site or home, a desk-based PC is the obvious choice, since it can provide the same set of features as a portable PC at a lower price. The choice of specifications of these PCs is vast and the best advice that can be given when buying one is to be clear what you want to use it for and find a good supplier who will meet those needs. Don't simply be tempted by the latest and biggest PC – do you really need surround sound at each desk?

For workers who spend some time out of the office, eg visiting customers or other sites, or who may sometimes need to work at home, then a portable or laptop PC is worth considering. Again the advice is to take advice on your specific needs and don't simply go for the newest and fastest. Workers who move between locations could also consider the small computers used as Personal Digital Assistants. These tend to be pocket-sized and run cut-down versions of normal PC applications. They have the great advantage of being very easy to keep with you at all times but aren't really suitable for sustained use at a desk.

Once a company has several PCs on a site, it often needs to share files between them or to keep back-up copies of vital files. This is where a server is of use. This is basically a specialised PC which is designed to carry out tasks such as file storage (amongst others tasks) for a network of PCs. It also can allow workers who are not on the main site to have access to the same files and thus give greater flexibility in location.

Peripheral devices, such as printers, can make a major difference to the flexible working style of small businesses in rural regions. Colour inkjet and laser printers have advanced to the stage where they are a perfectly reasonable alternative to conventional printing for short runs. This means that material does

not have to be shipped to and from a printer and changes can easily be made before the next batch of material is printed.

To connect your PCs together in the office, you will need some kind of network. These are described in the next section. If you want to connect your PC to a public network (such as ISDN), you will need a modem to connect to the telephone network or to a cable TV system or a terminal adaptor to connect to ISDN. These networks are described below in “Telecommunications Access Networks”.

2.3.4 Networks within the office

Once a company grows past the point at which it needs more than one PC, or it needs to connect that PC to specialised tools such as a server or a machine tool, it has to start thinking about an intra-office network. For data connection, this is normally called a Local Area Network (LAN). The universally used LAN standard is called “Ethernet”. To connect the LAN (with all the PCs on it) to the Internet, a single device known as a “router” is required.

LANs have generally been provided by running cables between all the devices that need to be connected, and the logistics of that has tended to frighten small businesses off. Instead, they have used a set of unconnected PCs and have transferred data between them on paper or floppy disk. That can seriously hamper the flexibility within an office (or factory) and can be an even greater hindrance to flexible working when connection to external networks is needed.

Fortunately, interconnecting equipment on a site is becoming easier as cabling and connection devices are being developed to the point where they are much easier to install, and the software which controls the way PCs talk to each other is becoming more user friendly. Alternatives to cable are also now commercially available. These either use wireless connection or use the power cables within a building to carry data.

These new ways of building networks within sites are making it much easier to put the hardware where it is needed and to make changes when they are needed.

2.3.5 Services

Not all the applications and tools to run your business more flexibly need to be contained on your site, nor do they all need a PC to work. Messaging services, provided over the telephone network, can make it possible to keep in touch wherever you are, as long as you have access to a mobile or fixed phone. Network-based mailboxes will let callers leave a voice message or a fax whenever your site is unattended or all of your phone lines are in use. The message or fax can then be retrieved from any phone or fax machine at any time. The more sophisticated versions allow several mailboxes to be on one line, so that you could, for example, have separate mailboxes for accounts and sales. In a similar way, personal numbering or “follow-me” diversions allow your calls to be routed to wherever you are so that your contacts only ever have to remember one number for you.

Telephone conferencing (also known as “voice conferencing” or “audio conferencing”) services let you talk to a group of people (typically up to about 15) in different locations so that you can hold a meeting without travelling. They can rapidly be set up by a conferencing service, and the participants only need an ordinary telephone to take part. Telephone conferencing can be very efficient, saving a great deal of travelling time and expense, but it works best with people who have already met each other. For successful telephone conferencing, it is essential to nominate a chairperson and bear in mind that the participants can’t see each other! So when anyone joins the conference the chairperson should tell them who is already present. It is useful if participants say their name on starting to speak, as some people may not recognise everyone’s voice. The service providers offer options including telephoning all the participants to set up the conference, and recording the conference.

If you want to use e-mail or access the internet, then you will need an Internet Service Provider (ISP) that you reach over the access network (eg by calling a number over the telephone network or ISDN). Most ISPs will provide you with as many mailboxes for e-mail as you could ever need and sufficient space on their system to provide a web-site for your company. The cost of using an ISP for basic services is low, or even free. But be aware that some of the cheaper providers can be difficult to access at the more popular times of the day. Users should investigate the ISPs who are focussed on business use and sometimes make a (small) charge in return for a much better service.

We talked earlier in this section about the applications which small businesses can run locally to enhance the flexibility in the way they work. Some businesses may find that they would prefer not to use resources in installing, maintaining and updating their applications. A new class of service provider, the Application Service Provider (ASP) has emerged in recent years. ASPs host the applications at one of their sites and the user accesses these over the network. This removes any responsibility for maintaining the applications from the applications, but does mean that a good, always-on connection to the ASP network is needed. If the provision of applications that are crucial to your business is being left to an ASP, it is essential to make sure that they provide a reliable service and are good at dealing with problems.

2.3.6 Telecommunications access networks

Nobody works in total isolation. Everybody needs to communicate with other people and has to have access to the communications network to do this. Voice communication needs access to the local exchange of the telephony provider and Internet communication (eg e-mail) needs access to the service provider.

Figure 1 gives a simple view of communications networks connecting small businesses to their service providers, including voice services (eg telephony). The access device shown in this diagram is the interface between the hardware on the site and the access network. For instance, this could be a modem or an ISDN terminal adapter.

When looking at access network technologies, it is worth bearing in mind that not all technologies are suitable for all regions. Thus, cable TV might be very common in urban residential areas, but it will be much less common to remote farms.

The communications speed (known as “bandwidth”) available over a network is often quoted as an indicator of its capabilities. It is quoted in kilobits per second (kb/s) or megabits per second (Mb/s), a thousand kb/s being equal to one Mb/s. What can be sent over a network is also influenced by how much the information can be compressed before it is sent – this is done automatically by modems. As a rough guide, a modem on an ordinary (“analogue”) telephone line will, in practice, carry about 48 kb/s¹; an ISDN line will carry up to 128 kb/s – these are both adequate for e-mail, speech and transferring text documents. They can also carry poor quality video.

A bandwidth of, say 512 kb/s will happily carry larger files, eg graphics files, and provide reasonable quality videoconferencing. A bandwidth of 2 Mb/s² will provide good quality video. For these higher speeds, the newer communications services such as ADSL or cable modems are required, or else a leased line.

¹ 48 000 bits per second. A bit is a unit of data.

² 2 000 000 bits per second.

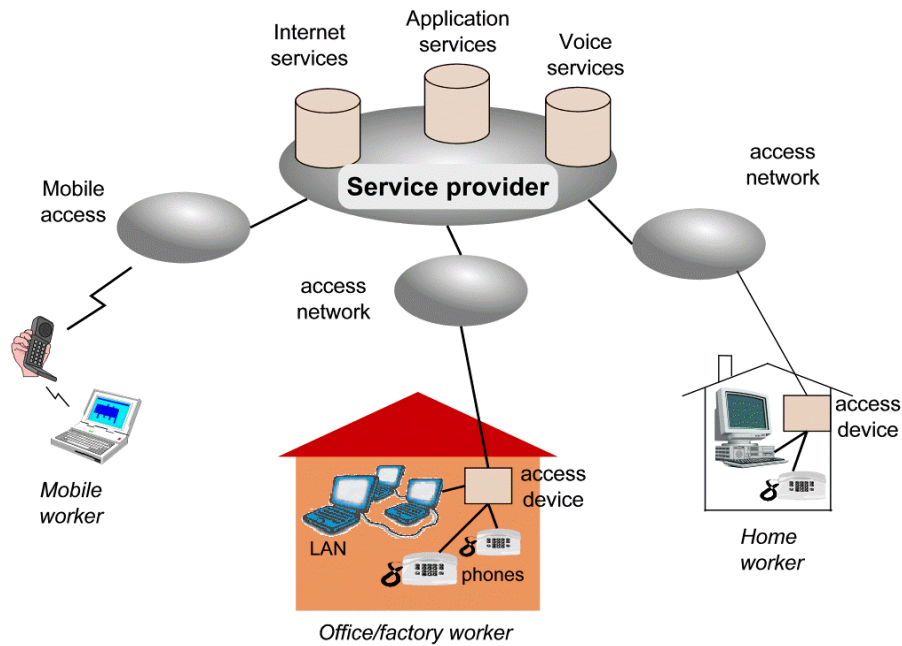


Figure 1 - communications networks

Telecommunications services which exist widely now

The telephony access network has existed for over 100 years from the earliest days of the telephone and has extended its reach to the vast majority of homes and businesses in Europe. Cable TV networks have also existed for many years and, in some parts of Europe, are very widespread.

Technologies in common use include:

1. **POTS** – the Plain Old Telephony Service. Originally designed for voice, it now in addition carries fax, and internet traffic via a modem card in the PC.
2. **ISDN** – the Integrated Services Digital Network. This was the first attempt to optimise the telecommunications networks for services other than voice and is widespread around Europe. It allows dialling of up to two links of 64 kb/s each for voice or data. A 64 kb/s ISDN link is only slightly faster than a 56 kb/s modem link. However some applications can combine both links into a single 128 kb/s link thus achieving twice the speed. This service enables new applications like videoconferencing, and bridging networks over ISDN links (integration of home network and office network, integration of SME network and corporate network, integration of multiple SME networks). The costs involved are as much as twice those for a standard telephone line.
3. **Leased lines** – which provide a fixed point-to-point connection for users. They come in many forms and in many bandwidths. A 64 kb/s per second leased line may be less expensive than ISDN if used regularly for many hours per day.
4. **Wireless local loop** – which replaces part of the copper network (normally used to connect you to the telephone network) with fixed wireless links. This has advantages in some situations but is not universally available.

Telecommunications services which are starting to come into use

New technologies are beginning to be introduced into commercial service which allow much more flexible use of the access network infrastructure. Amongst these are:

- **ADSL** – Asymmetric Digital Subscriber Line - enables a high speed always-on connection to be provided over an ordinary telephone line (typically of 2 Mbit/s downstream and 512 kbit/s upstream). This is unlikely to be generally available in rural regions outside towns for some years. Pricing is greater than normal telephony.

- **Cable modems** - provide a shared high speed interactive link over cable TV networks. This would typically allow a user to have a 2 Mbit/s link. This is unlikely to be available outside towns. Local cable companies will be able to advise about availability and the tariffs involved.
- **Satellites and terrestrial broadcasting** - can now provide high speed delivery of data and Web pages, using the telephone or ISDN network for the return path. This is particularly suited to rural regions if the main need is to receive rather than to send information. However these services are in their infancy and tend to be expensive.
- **Powerline.** Some operators have provided services using the electricity distribution network for communications. This has great potential but there are a number of technical and commercial problems to overcome.
- **Fixed wireless access** – systems which use radio links to provide connections to customers in fixed locations. It is suitable for broadcast applications as well as high speed telecommunications and is suited to rural regions. It is likely to become available around Europe in the next few years.

2.3.7 Mobile

The fully mobile user is perhaps the most flexible form of worker there is. Companies are increasingly finding that some workers, eg service engineers, only rarely need to visit the company's site and can spend much of their time out on the road, dealing with customers.

This freedom is made possible by the combination of mobile phones with lightweight portable computers. In the simplest form of mobile communications, a GSM mobile phone can be used for keeping in contact either by voice or by sending text messages. This allows new tasks to be allocated, progress reported and guidance to be obtained from the main office about any problems. This can then be augmented by a portable PC or a PDA linked to the main office via the mobile phone. The PC can contain documents (such as service manuals or customer data) and can contact the main office whenever updated or extra information is needed.

The main restriction at present is the limited transmission speed of the standard GSM network. This will send data at about 9.6 kb/s, which is much slower than a connection over an ordinary telephone line. Major updates to the PC are best handled either by visiting the main office or by using an ordinary phone line.

There are some changes to mobile communication which will improve this. Phones which can handle the Wireless Access Protocol are now widely available. These allow access to very basic web pages from a mobile phone. The GSM phone networks are now being augmented by GPRS and HSCSD networks which will allow faster data rates of between 2 and 12 times that available on current mobile networks. However, as with many innovations, they will be rolled out to major centres of population first. Slightly further away is UMTS, the 3rd generation of mobile systems which will allow Internet access at up to 2 Mbit/s.

These improvements in mobile communication, together with the reduction in size and increase in functionality of mobile phones and PDAs, will make fully mobile working a much more practical reality over the next few years.