

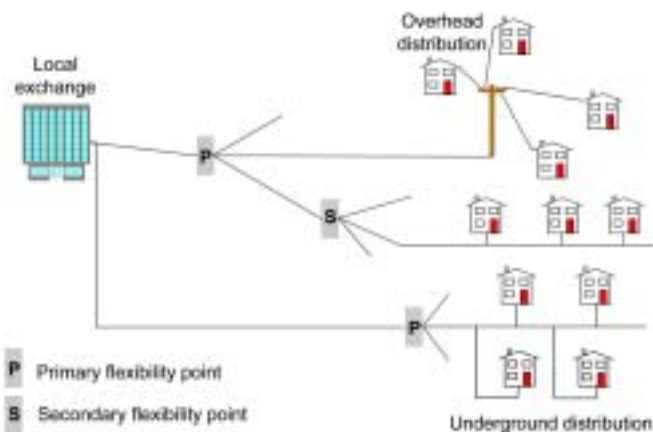
Telephony

What it is and what it can do

This is the phone service that we know and love, and it has been around in various forms for over 100 years. The telephone network consists of an access network, which connects your phone to the local telephone exchange, and a core network, which connects all of the telephone exchanges together. The access network largely consists of pairs of copper wires bundled together into underground cables or attached to roadside poles. A pair (or set of pairs) runs from each user's home or business to the Local Exchange or, as it is known in America, the Central Office. Flexibility in the way these pairs are allocated to customers is provided at a number of "flexibility points" between the user and the Local Exchange, where connections between cables can be rearranged. This gives the network more scope to cope with changes in growth patterns than if a continuous cable was run from each user all the way through to the exchange. The distance of users from the exchange can be anywhere between a few hundred metres to tens of kilometres.

Key messages for SMEs

- Don't forget the POTS (the Plain Old Telephone Service). It, and its offspring, ISDN, can handle most of your routine communications needs.
- The service is a commodity, so be prepared to haggle with potential suppliers over price and the quality of support that they offer.



Telephone engineers are pragmatic people. Sometimes they use "pair-sharing" technology to provide simultaneous connections to two or more customers over a single one pair of wires. They may also use radio links in places where cabling was impractical, eg to small offshore islands. This pragmatic approach to diversity in the physical infrastructure can cause problems when introducing new technology, such as ADSL.

The telephony network was designed to meet the requirements of a voice-only service. It now also carries fax traffic and supports modems¹ that are used for Internet access. These modems have been developed to the extent that they can now provide 56 kbit/s² connections under ideal conditions. The actual bitrate is often nearer to 40 kbit/s because it

depends on the distance from the Local Exchange and the quality of the wires connecting you to it. This bitrate is adequate for most Internet services, but downloading large files takes a long time and it can only deliver very jerky, low-resolution video.

There are basically two ways of carrying information through a telecommunications network. Analogue telephony carries speech through the network by converting it into an electrical signal that looks like a picture of the original sound waves. To carry computer information through an analogue network, it first has to be converted into electrical signals that look like "sounds". The modem does this, and the result is the whistles and clicks that you hear when your computer is connecting to the network.

Most of the telephone network now uses digital technology, which converts speech into a string of numbers, transmits these numbers over the network and reconstructs the sound at the far end. Digital networks are able to carry voice more efficiently and at higher quality than analogue networks.

¹ A modem (modulator-demodulator) is a device that is connected between a PC and a phone line and converts the information from the PC into signals that can be carried by the telephone network.

² This is 'kilobits per second' and is just a way of expressing how rapidly information can be transferred by modems over a telephone line. You do not need to understand how much information 56 kbit/s represents, but can simply use this as a way of comparing the relative speed of different ways of connecting PCs.

Because computer information is also digital, the telephone network is a good way of interconnecting computers.

ISDN (Integrated Services Digital Network) was intended to upgrade the telephone network to carry services other than voice. It extended the increasingly digital nature of the core network to the access network. Instead of providing analogue channels, and converting digital data into analogue signals, ISDN is based on 64 kbit/s digital channels, which correspond to the bitrate that used to be needed to carry a voice channel.³ All analogue services, such as voice, are converted into digital signals for transmission over ISDN. This aligns with the way that channels are provided in the core network.

ISDN is offered in 2 forms:

- The **basic rate** connection, which provides two 64 kbit/s channels plus a signalling channel⁴. The two 64 kbit/s channels can be combined to provide a 128 kbit/s channel.
- The **primary rate** service, which provides thirty 64 kbit/s channels plus a signalling channel over a 2 Mbit/s connection.

Basic rate connections give residential or small business users two high quality connections, which can be used for telephony or data, over their existing copper pair. Primary rate connections may be useful to medium sized companies, e.g. for PBX connection, and are usually be provided over a dedicated fibre or radio link.

When ISDN was originally launched, it offered a much faster data transfer than analogue modems but today's 56 kbit/s modems are only marginally slower than a single 64 kbit/s ISDN channel. However, the call set-up time is much shorter on ISDN and two or more 64 kbit/s ISDN channels can easily be used together to give a significant increase in speed. This, for instance, makes dial-up video services a much more attractive proposition.

ISDN was first introduced commercially in Europe in the 1980s but national network operators had very different marketing and pricing strategies. The result was that, for example, ISDN was initially much more popular in France and Germany than in the UK. These differences are now levelling out but ISDN is now being challenged by newer technologies, such as ADSL and cable modems, which can provide an even more flexible and bandwidth-rich service for residential users and small businesses.

Connecting a PC to the telephone network or ISDN

You need a modem to connect a PC to an Internet Service Provider by the **telephone** network. The current standards for these are known as 'V.90' or 'V.92'. Almost all new computers include a V.90 or V.92 modem but, if you have to buy a modem for an existing computer, make sure that it meets this standard. It is also possible to buy devices with a built in modem to connect small office networks to the POTS network (although ISDN is a better solution if it is available).

To connect a PC to an Internet Service Provider by the **ISDN** network, a Terminal Adapter (ISDN TA) is needed. An office network can be connected to ISDN by using a router with a built in ISDN network interface.

Advantages and Disadvantages

Telephony is universally available throughout the developed world. In western European countries all businesses and most homes have at least one line, and many homes now have more than one line. In eastern Europe, the penetration is lower but is growing rapidly.

ISDN is also available throughout Europe and has all the advantages of POTS but with faster call set-up, potentially greater bandwidth, and higher quality.

The reliability of the POTS/ISDN network is usually higher than that of the electricity or gas supply but it does depend on factors such as the skill of the local technicians and how prone the area is to flooding (for underground cables) or storms (for aerial cables).

³ Technology has moved on and today you can now compress a voice channel to a few kbit/s. Indeed you can now transmit a low-resolution, jerky moving picture over a 64 kbit/s link.

⁴ Used to set up calls and control the network.

The principal disadvantage of POTS and ISDN is that they are too slow for downloading large files or running applications that need high resolution or moving images.

What to buy

You probably have too much choice. The market has been opened up to competition and even the smallest and remotest SME will probably have several companies fighting to offer it telephone and ISDN services. The relative costs of ordinary telephony and ISDN vary greatly from country to country in Europe, and between different providers in each country. Some European telecommunications regulators (the government office that controls telecommunications) offer comparisons of the prices of different providers in their country. Links to these regulators can be found in the FlexWork briefing on “National Sources of Information”.

Questions to ask suppliers

Telephony/ISDN is a commodity and many companies will offer you broadly similar services. When choosing between them, ask about the monthly rental, the call charges (are these charged in increments of 1 second or 1 minute), discounts for multiple lines or calls to a particular destination, but above all:

- How rapidly do you guarantee to fix faults and how much does this service cost?