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cost \$25-530 new. Laser toner cartridges last longer but are more expensive. Ribbons for dot-matrix printers are inexpensive. Ask the seller what the cost per page works out to.

Does the manufacturer offer a good warranty and good telephone technical support? Find out if the warranty lasts at least 2 years. See if the printer's manufacturer offers telephone support in case you have technical problems. The best support systems offer toll-free numbers and operate evenings and weekends as well as weekdays.

3.3.5. Sound, Voice and Video

Most PCs are now multimedia computers, capable of outputting not only text and graphics but also sound, voice, and video. Other kinds of output devices are needed as follows:

- *Sound output:* Sound-output devices produce digitized sounds, ranging from beeps and chirps to music. To use sound output, you need appropriate software and a sound card.
- *Voice output:* Voice-output devices convert digital data into speech-like sounds.
- *Video output:* Video consists of photographic images, which are played at 15-29 frames per second to give the appearance of full motion.

3.3.6. SECONDARY STORAGE

Information systems need to store information outside of the computer in a nonvolatile state and to store volumes of data too large to fit into a computer. The relatively long-term storage of data outside the CPU and primary storage is called secondary storage. Secondary storage is nonvolatile and retains data even when the computer is turned off. There are many kinds of secondary storage; the most common are magnetic disk, optical disk, and magnetic tape. These media can transfer large bodies of data rapidly to the CPU. However, secondary storage requires mechanical movement to gain access to the data, so in contrast to primary storage, it is relatively slow.

3.3.6.1. Magnetic disk

The most widely used secondary storage medium today is magnetic disk. There are two kinds of magnetic disks: floppy disks (used in PCs) and hard disks (used on commercial disk drives and PCs).

Floppy disks are removable and are made of plastics. *Hard disks* are thin metallic platters with iron oxide coating. A hard disk drive contains one or more hard disks mounted on a vertical shaft. Read/write heads attached to access arms move across the spinning disk or disks to read or write data on concentric, circular tracks. Data are recorded in form of magnetized spots as disks rotate. The read process converts data in magnetized spots form into electronic pulse form and relays them to CPU. All the parts of the hard disk are combined into a sealed module so as to prevent any-foreign matter from getting inside and causing head crash. Large mainframe or midrange computer systems have multiple disk drives because they require immense disk storage capacity.

Disk drive performance can be enhanced by using a disk technology called RAID (Redundant Array of Independent Disks). RAID devices package more than a hundred disk drives, a controller chip, and specialized software into a single, large unit. Traditional disk drives deliver data from the disk drive along a single path, but RAID delivers data over multiple paths simultaneously, accelerating disk access time. RAID is designed to provide highly reliable data backup and recovery features - fault tolerant capability. If one disk fails, data can be recovered from backup copies automatically stored on other RAID disks.

3.3.6.2 Accessing data on disks

Disk designers use either the sector (for micros) or the cylinder (for minis and mainframes) method to organize and physically store data. (See the diagram that follows.) Sector method is used with single disks in which disk surface is divided into tracks and tracks into sectors. Sectors store data and programs. Cylinder method is used where disks are in stacks and a number of access arms are used. Disks are divided into tracks which are numbered.



7.0. References

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Packet switching is a technology that breaks blocks of text into small, fixed bundles of data and routes them in the most economical way through any available communications channel. Packets include information for directing the packet to the right address and for checking transmission errors along with the data. Frame relay is a shared network service technology that packages data into bundles for transmission but does not use error-correction routines. It is cheaper and faster than packet switching. ISDN is an international standard for dial-up network access that integrates voice, data, and image and video services in a single link. DSL technologies, like ISDN, operate over existing copper telephone lines to carry voice, data, and video, but they have higher transmission capacities than ISDN.

b) Technology trends: Open systems with unrestricted connectivity, using Internet networking technologies as their technology platform, are today's primary telecommunications technology drivers. Web browser suites, HTML Web page editors, Internet and intranet servers and network management software, TCP/IP Internet networking products, and network security fire walls are just a few examples. These technologies are being applied in Internet, intranet, and extranet applications, especially those for electronic commerce and collaboration. This trend has reinforced previous industry and technical moves toward building client/server networks based on open systems architecture.

Open systems are information systems that use common standards for hardware, software, applications, and networking. Open systems, like the Internet and corporate intranets and extranets, create a computing environment that is open to easy access by end users and their networked computer systems. Open systems provide greater connectivity, that is, the ability of networked computers and other devices to easily access and communicate with each other and share information. Any open systems architecture also provides a high degree of network interoperability. That is, open systems enable the many different applications of end users to be accomplished using the different varieties of computer systems, software packages, and databases provided by a variety of interconnected networks. Frequently, software known as *middleware* may be used to help diverse systems work together.



Take Note

Telecommunications is also being revolutionized by the rapid change from analog to digital network technologies.

Telecommunication systems have always depended on voice-oriented analog transmission systems designed to transmit the variable electrical frequencies generated by the sound waves of the human voice. However, local and global telecommunications networks are rapidly converting to digital transmission technologies that transmit information in the form of discrete pulses, as computers do. This provides (1) significantly higher transmission speeds, (2) the movement of larger amounts of information, (3) greater economy, and (4) much lower error rates than analog systems. In addition, digital technologies allow telecommunications networks to carry multiple types of communications (data, voice, and video) on the same circuits.

Another major trend in telecommunication technology is a change from reliance on copper wire-based media and land-based microwave relay systems to fiber-optic lines and cellular, PCS, communications satellite, and other wireless technologies. Fiber-optic transmission, which uses pulses of laser-generated light, offers significant advantages in terms of reduced size and installation effort, vastly greater communication capacity, much faster transmission speeds, and freedom from electrical interference. Satellite transmission offers significant advantages for organizations that need to transmit massive quantities of data, audio, and video over global networks, especially to isolated areas. Cellular, PCS, mobile radio, and other wireless systems are connecting cellular and PCS phones, PDAs, and other wireless appliances to the Internet and corporate networks.

c.) Business application-trends: The changes in telecommunications industries and technologies just mentioned are, calling a significant change in the business use of telecommunications. The trend toward more vendors, services, Internet technologies, and open systems, and the rapid growth of the