USB Flash Drives Source:

Flash drives (sometimes called USB drives or flash drives) consist of flash memory media integrated into a self-contained unit that connects to a computer or other device via a USB port and is powered via that port. USB flash drives are designed to be very small and very portable. In order to be appropriate for a wide variety of applications, USB flash drives are available in a host of formats— including those designed to be attached to back packs or worn on a lanyard around the neck; those built into pens, necklaces, wristbands, or wristwatches; those thin enough to fit easily into a wallet; and those made into custom shapes for promotional or novelty purposes.

CONVENTIONAL DRIVE

LOW-PROFILE DRIVE

CUSTOM LANYARD DRIVE

MICRO DRIVE

OTHER TYPES OF STORAGE SYSTEMS

Other types of storage systems used with personal and business computers today include network storage, cloud storage, and smart cards.

NETWORK AND CLOUD STORAGE SYSTEMS

Remote storage refers to using a storage device that is not connected directly to the user's computer; instead, the device is accessed through a local network or through the Internet.

Two common types of network storage used today are network attached storage (NAS) devices and storage area networks (SANs).

NETWORK ATTACHED STORAGE (NAS) devices

▶ NAS devices are high-performance storage systems that are connected individually to a network to provide storage for the computers connected to that network. Some are designed for small business use; others are geared for home use instead. A growing trend, in fact, is home NAS devices designed to store multimedia data (such as downloaded music, recorded TV shows, and downloaded movies) to be distributed over a home entertainment network. NAS devices typically have room for two to eight hard disk drives and connect to the network via a wired or wireless networking connection.


Hard drives are located inside the NAS device.

Source: Western Digital Technologies, Inc.

STORAGE AREA NETWORK (SAN)

A storage area network (SAN) also provides storage for a network, but it consists of a separate network of hard drives or other storage devices, which is connected to the main network. The primary difference between an NAS and an SAN is how the storage devices interface with the network—that is, whether the storage devices act as individual network nodes, just like computers, printers, and other devices on the network (NAS), or whether they are located in a completely sepa rate network of storage devices that is acces sible via the main network (SAN). SANs can be more appropriate when a larger amount of network storage is needed; however, in terms of functionality, the distinction between NAS and SAN is blurring because they both provide storage services to the network. Typically, both NAS and SAN systems are scalable, which means that new devices can be added as more storage is needed, and devices can be added or removed without disrupting the network.
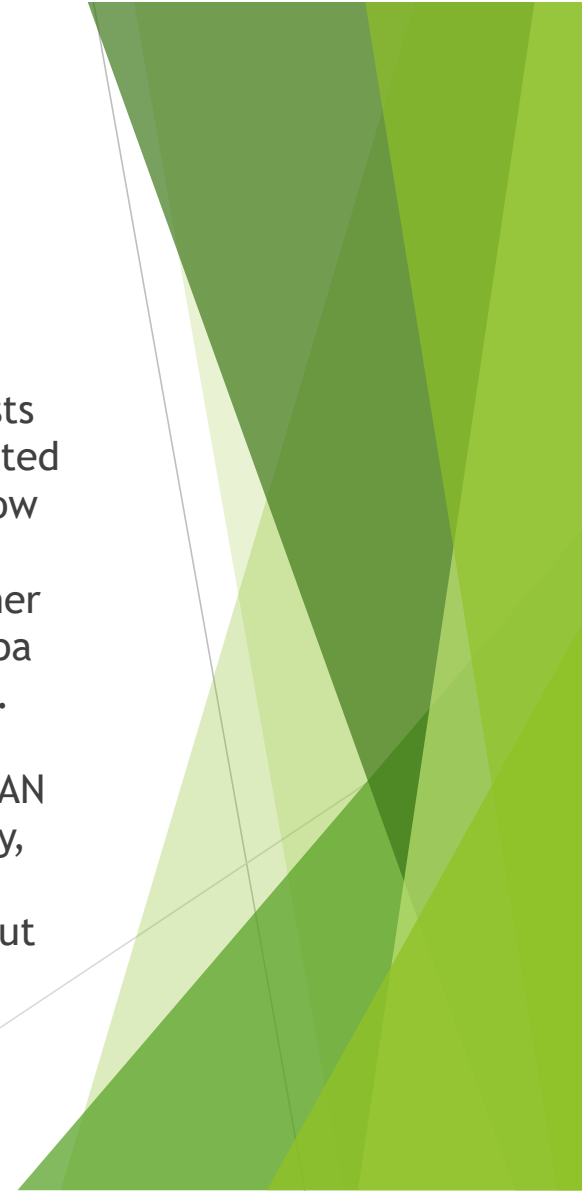
► Remote storage services accessed via the Internet are often referred to as cloud storage or online storage. Cloud storage can be pro vided either as a stand-alone service or as part of a cloud computing service. For instance, most cloud applications (such as Google Docs, the Flickr photo sharing service, and social networking sites like Facebook) provide online storage for these services. There are also sites whose primary objective is to allow users to store documents online, such as Box, Dropbox, iCloud, Google Drive, or Microsoft OneDrive. Cloud storage sites allow users to share uploaded files or folders with others via an e-mail message or a link to the shared content. For security purposes, cloud storage sites are usually password protected.
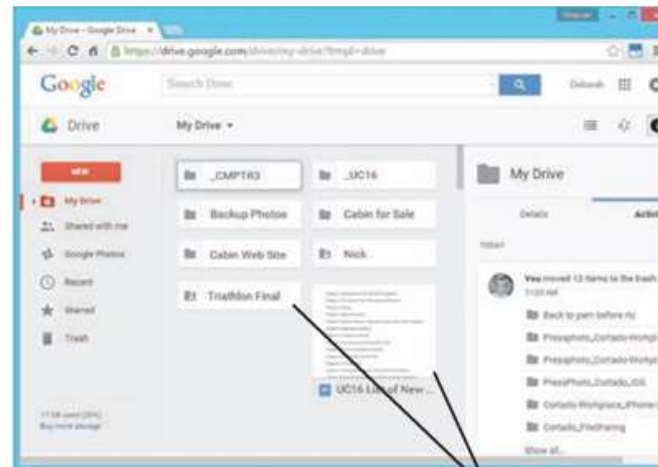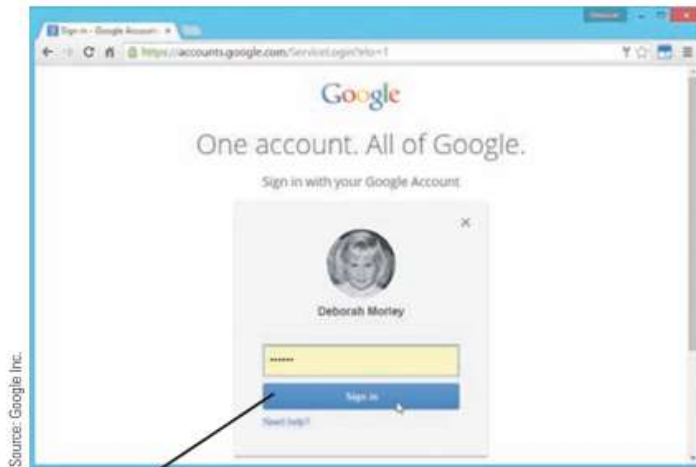
SMART CARD

A smart card is a credit card-sized piece of plastic that has built-in computer circuitry and components—typically a processor, memory, and storage. Smart cards today store a relatively small amount of data (typically 64 KB or less) that can be used for payment or identification purposes. For example, a smart card can store a prepaid amount of digital cash, which can be used for purchases at a smart card-enabled vending machine or to pay transit fares—the amount of cash available on the card is reduced each time the card is used. Smart cards are also commonly used worldwide for national and student ID cards, credit and debit cards adhering to the global EMV standard to increase security and decrease fraudulent use, as discussed in the Chapter 9 Inside the Industry box, and access cards for facilities or computer networks. Although these applications have all used conventional magnetic stripe technology in the past, the processor integrated into a smart card can perform computations—such as to authenticate the card, encrypt the data on the card to protect its integrity, and secure it against unauthorized access—and can allow data to be added to the card or modified on the card as needed. Smart cards can also store the identifying data needed to accelerate airport security and to link patients to the electronic health records (EHRs) increasingly being used by hospitals.
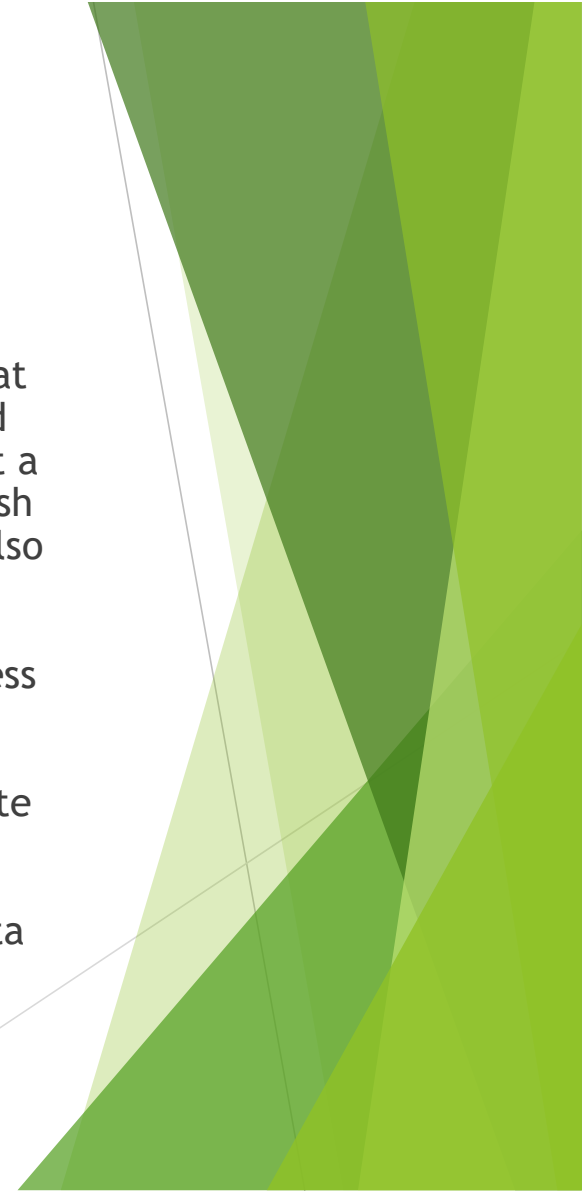
LOGGING ONTO A COMPUTER

MAKING A STORE PURCHASE

ACCESSING A SECURE FACILITY

USING TRANSIT TICKETS

Source: HID Global Corporation

Storage Systems for Large Computer Systems

Large storage systems are usually scalable so additional hard drives can be added as needed. HARD DRIVES Are located inside a drive enclosure; this enclosure can hold up to 24 drives of varying capacities—up to 3 TB each. This system can manage up to 240 hard drives for a total maximum capacity of 432 TB. Businesses and other organizations (particularly cloud providers) have tremendous storage needs. In addition to regular business data storage (such as employee files, customer and order data, business documents, and Web site content), new regulations are continually increasing the types and amounts of data that many businesses need to archive.
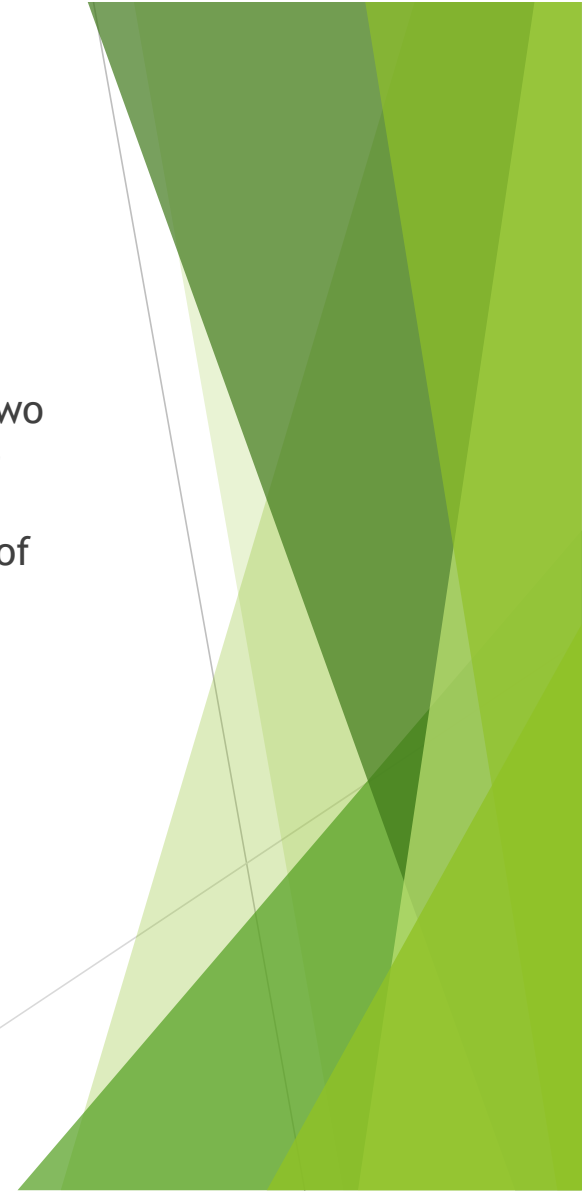
Storage for large computer systems (such as for main frames and servers) utilizes much of the same storage hardware, standards, and principles as those used with personal computers, but on a much larger scale. However, instead of finding a single magnetic or SSD hard drive installed within the system unit, you will likely find a large storage system (sometimes called a storage server)— a separate piece of hardware containing multiple high-speed hard drives— connected to the computer system or network. While some NAS devices today are classified as storage servers, large storage systems typically contain drawers of hard drives for a significantly larger total capacity.

In addition to being used as stand-alone storage for large computer systems, large storage systems may also be used in network attached storage (NAS), storage area network (SAN), and the RAID (redundant arrays of independent disks) systems.
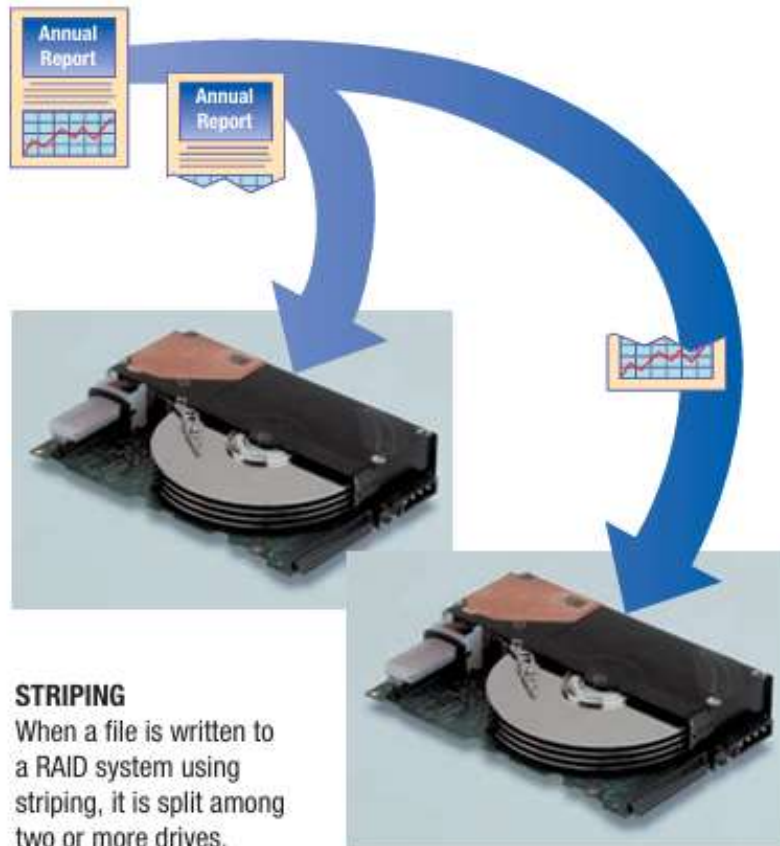
RAID

RAID (redundant arrays of independent disks) is a method of storing data on two or more hard drives that work together. Although RAID can be used to increase performance, it is most often used to protect critical data on a large storage system. Because RAID usually involves recording redundant (duplicate) copies of stored data, the copies can be used, when necessary, to reconstruct lost data. This helps to increase the fault tolerance— the ability to recover from an unexpected hardware or software failure, such as a system crash—of a storage system.

STRIPING
When a file is written to a RAID system using striping, it is split among two or more drives.

MIRRORING
When a file is written to a RAID system using mirroring, an identical copy of the file is sent to another drive in the system.

ARCHIVAL STORAGE SYSTEMS

Data archiving is the process of identifying and moving data that is no longer actively being used from regular storage systems to a separate long-term archival storage system. Data archiving is important because, while there is a great deal of data that needs to be retained for future reference or regulatory compliance, this data doesn't need to be accessed very frequently. Moving this data out of the regular storage systems improves performance of the regular systems while still meeting data storage needs. It also reduces backup time because less regular data needs to be backed up. As a bonus, data archival systems tend to be less expensive than regular storage systems.
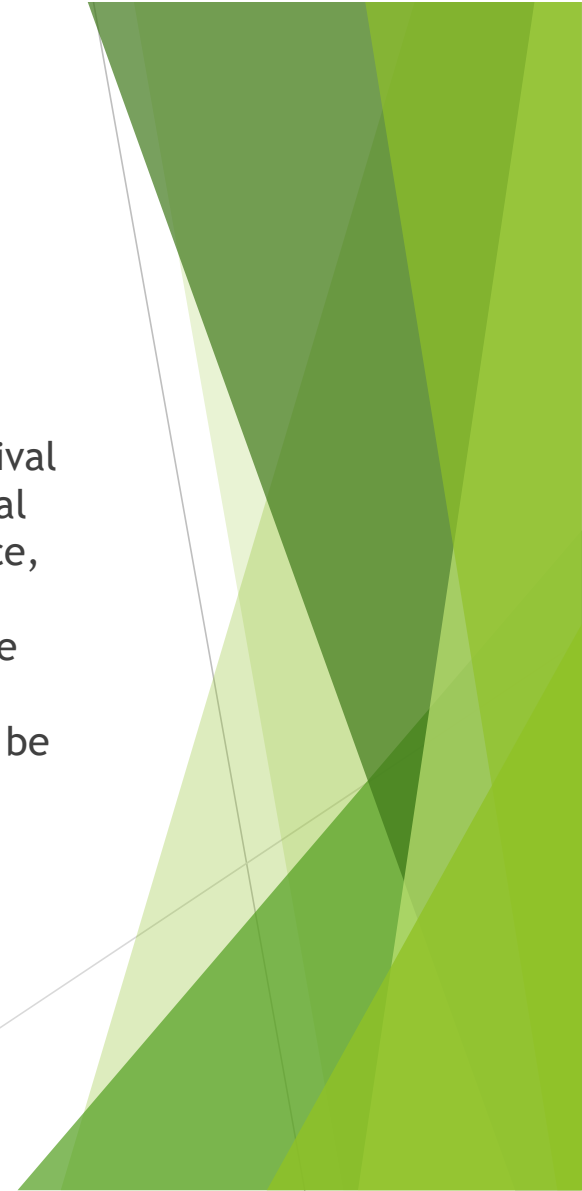
There are a number of options for data archival systems depending on the amount of data that will be archived. Large hard drives, such as the helium hard drive that holds 10 TB, is one option. Magnetic tape, which consists of plastic tape coated with a magnetizable substance that represents the bits and bytes of digital data, similar to magnetic hard disks, is another option. Magnetic tape uses sequential access so it is no longer used for everyday storage applications, but it is still used today for business data archiving, as well as in some backup systems. One advantage of magnetic tape is its low cost per terabyte.

FIGURE 3-25
Helium hard drive.

FIGURE 3-26
Magnetic tape.

Input and Output

Input devices

The most common input devices used with computers and mobile devices today—mainly, keyboards, pointing devices (such as a mouse or pen), and touch devices.