STORAGE DEVICES AND MEDIA

CHAPTER 3



What is a backup?

A backup is another store of data that is stored away from the original files (this is important when answering exam questions); this is in case something happens to the original files and the data needs to be recovered. Files need to be backed up regularly to make sure the backup is up-to-date. Simple, right?

Why do we backup data?

The general reason we backup data is so we are able to recover it if it becomes unusable. Here are some examples of how where a backup may be helpful:

- If something were to happen to the storage device where the originals are stored (for example: it crashes or gets damaged in a fire or flood)
- One of the originals is accidentally overwritten by another file
- The files somehow get corrupted (maybe via hacking or malware)
- If the files need to be used somewhere other than where the originals are saved

Serial access:

This method of access is where the user states which record they want to access in a file, the system then starts at the first record in that file and searches through all of them (i.e. the first record, then the second, then the third etc.) until it finds the right record. The obvious problem with this method of access is that it takes so long to actually access the record because the system has to search through all these records to find the right one. It is mainly used on magnetic tape. When a magnetic tape that uses this method of access needs to be updated, there are two things that are used that you will need to know. These are the master file and the transaction file. Don't worry; this is a relatively easy thing to understand. The master file is the original data (so the data that needs to be updated), and the transaction file is the data that will be used to update the master file (so basically all the new stuff that has been saved since the master file was last updated). From these two tapes, a new tape is created that has all of the original files from the master file as well as all the new stuff from the transaction file. The only other important thing to remember is that the master file and the transaction file have to be sorted in the same way (i.e. have the same key field which is the field that all the rest of the data in the file is sorted from). If they are not sorted the same way, then all the data will get messed up.

Direct access:

This method makes use of the key field to work out where the record should be in the file. This means that it is obviously much faster than serial access. It also means that when the data is updated, there is no need for the records to be sorted; the new file just overwrites the old one.

You should all be familiar with the sizes in which files are stored and which is biggest and smallest, but in case you need a refresher, here they are in order of smallest to biggest:

Bytes

Kilobytes (kB): 1000 bytes

Megabytes (MB): 1000000 bytes

Gigabytes (GB): 100000000 bytes

Terabytes (TB): 100000000000 bytes

You will not need to know the sizes in bytes, just the size order

There are three types of storage media that we will cover here

Magnetic storage media:

Pretty self-explanatory, the media makes use of the magnetic properties of certain materials and uses a special coating that let's information be converted to 1s and 0s. There are three main types of magnetic storage media:

Fixed/internal hard disk drive (HDD):

This is the main storage device that is installed on all computers. Generally, this data is written to and read from the disk contained in the drive. This disk also stores what is called the DOS (Disk Operating System) as well as the system software.

Advantages:

- Fast data transfer rate and access time
- Large memory space

Disadvantages:

- Easily damaged if the computer is not shut down properly; this can lead to loss of data
- Lots of moving parts
- They can be quite noisy compared to SSDs

Portable hard disk drives:

These are just the same as internal hard disk drives except they are connected to the computer via USB (Universal Serial Bus) instead of being built into the computer.

Advantages:

- Fast data transfer rate and access time
- Large memory space
- Can be used to transfer data between computers

<u>Disadvantages:</u>

- Easily damaged if the computer is not shut down properly; this can lead to loss of data
- They are easily damaged since they are not built into the computer (i.e. they can be dropped)

Magnetic tapes:

These are thin strips of plastic that are coated in a layer of that makes it magnetic. The magnetic area can then be used to store data. This type of storage cannot be used for real-time and online applications because it is too slow. It is used more in batch and offline processing.

Advantages:

- They are cheaper than hard disks
- They are robust
- They have an extremely large amount of storage space
- Fast data transfer rate

Disadvantages:

- Slow data access times
- Requires a whole new tape to update the data
- Can be affected and corrupted by other magnetic fields (i.e. a strong magnet)

Optical storage media: *CD/DVD disks:*

The way a CD/DVD works is that the disk has small grooves in the surface of the disk where data is written to and read from. A red laser is used to read and write the data.

There are 4 types of CD/DVD:

CD-ROM and DVD-ROM:

The fact that the disks are ROM (Read Only Memory) means that the data on the disks can only be read, not written to. These are the kinds of CD/DVD that are used in music albums or movies. You cannot buy a movie on DVD and then go and add new files to the disk.

Advantages:

- They can hold more data than a floppy disk
- They are cheaper than hard disks

Disadvantages:

- They have a slower data transfer rate/access time than hard disks
- Less robust than hard disks (this goes for all types of CD/DVD)

CD-R and DVD-R:

These are blank disks that can be written to once only. After is has been written to, the disk becomes a CD ROM or DVD ROM. The disks are written to by "burning" them with a laser. The laser produces heated and unheated spots on the disk that can be distinguished by a laser beam and read from.

- They are cheaper than RW disks
- Data is protected after the disk is burned (cannot be altered afterwards)

Disadvantages:

- If something is wrong with the data during or after the burning process, the disk has to be thrown away and a whole new disk has to be made
- Some devices can't read CD-R/DVD-R disks

CD-RW and DVD-RW:

In the case of these disks, the RW stands for "re writable". This means that even once the disks have been written to, they can then be written to again and again afterwards.

Advantages:

- They can be written to multiple times
- They can save multiple different file formats each time

Disadvantages:

• They are more expensive than CD-R and DVD-R

DVD-RAM:

DVD RAM basically performs the same task as DVD-RW, but better. They can be re-written to over 100000 times. They are great for archiving files since the disk can survive for so long. They work a little differently as instead of making heated and unheated areas, the laser changes the physical properties of parts of the disk, turning them from shiny to dull.

- Extremely long life (upwards of 30 years)
- They can be re-written to over 100000 times as opposed to the 1000 times that RW provides
- Fast data access times
- No need to throw away the disk if something goes wrong
- Large storage capacity
- Can read data to the disk and data can be read form the disk at the same time

Disadvantages:

- Less compatible with devices as DVD-R and DVD-RW
- More expensive

Blu-ray disks:

These disks are read by a blue laser (I know. Mind-blowing, right?) which allows the grooves in the disk to be a lot smaller so that the disk can store more data. This is why Blu-ray movies are higher definition than DVD movies, because they have the capacity to hold the larger file.

Advantages:

- Large storage capacity
- Fast data transfer rate
- Fast data access speed
- Have a built-in encryption system that prevents piracy and copyright infringement

Disadvantages:

- More expensive than normal CD/DVDs
- There can sometimes be problems with the encryption system

Solid State Drives (SSDs):

These are taking over from HDDs because of this reason. They are more reliable because they save data using electrons instead of magnetism.

- Since there are no moving parts, there is less risk of something going wrong
- They are lighter than HDDs
- HDDs have to get the disk to a certain speed to work, this is not a problem for SSDs
- They consume less power than HDDs
- They have a faster data access time than HDDs

The main disadvantage is that they can't take as many write operations as HDDs

Memory sticks (pen drives):

These are a smaller way of storage and carrying data; thus their main advantage is that they are extremely small and portable. They can be used to transfer data between computers, and, more recently, they are used as a form of piracy protection (the memory stick or **dongle** contains a validation key that would have to be broken before the software can be accessed).

Advantages:

- Extremely small and portable
- Robust
- Compatible with most computers
- Not affected by magnetic fields like magnetic tape

Disadvantages:

- No way of protecting the data that is saved on the memory stick
- They are easy to lose since they are small
- If the memory stick is removed without ejecting first, the data can become corrupted

Flash memory cards:

A micro-SD and its adapter that makes it the same size as a regular flash card

These are the smallest form of solid state memory (especially with micro-SD cards). They are mainly used in digital cameras and mobile phones because of their size.

- Extremely small and easily removable
- Robust

Disadvantages:

- Relatively expensive
- Can only be read from or written to a certain number of types
- Smaller storage space than HDDs