Computing Report – Storage Media

Magnetic Tapes

Tape Drives

Tape drives have been successfully used as a backing storage medium for many years now, with storage capacity increasing as technology is improved. It is often used as the preferred backup method for servers and small companies.

Advantages are:

- It is often useful for people who create a large amount of data to back up weekly or monthly. With tape drives, this can be done without the need for multiple hard drives. Infrequently used data can be arch ived to tapes, which can also be accessed off site.
- Tape drives are used when high reliability and relatively high capacity is needed. For example, some have a MTBF (*Mean time between failures*) of one million hours when used for 20% of the day, or many hun dred thousand hours used constantly.
- Tape drives can be expensive initially, but become extremely inexpensive when you factor in the low cost of the media over time.

Disadvantages are:

- Tape backups store and retrieve data sequentially. The last file backe d up can't be accessed until the rest of the tape is read; other types of backup storage (for example: Hard Disk Drives) use random access, which enables any file on the device to be located and used in mere seconds.
- Whenever multiple tapes or disks must b e used to make a backup, the chances of backup failure increase. Disks also have to be loaded manually, or using an autoloader. This may sometimes rule out the possibility of backing up overnight, etc.
- Writing data to tape drives is generally quite slow, w ith about 30 GB of data taking a few hours. Even with faster tape drives, there are problems: They often have minimum data transfer rates, because if they went slower than their rated minimum, they wouldn't record a good quality signal and would lose data. If a tape drive with a 50MB/sec (*mega bytes per second*) write speed is fed a data stream at only 25MB/s, it fills up a buffer memory and then writes at 50MB/s for a few seconds, rewinds and then writes at 50MB/s again. This can in effect lead to the actua lly writing speed to be much lower than stated.

Memory Capacity	Data access (seek) Time	Data transfer rate	Price
Varies: 20 – 800GB	64 seconds typical for a 200 GB tape (native)	Varies with products: Highest – 80MB/s Average: 25-50MB/s	£829.91 for a 200GB drive (400GB compressed)

DAT (*Digital Audio Tape*) Drives

This type of storage was invented by Sony for music storage use, but it is now often used as backing storage. It uses DDS (*Digital Data Storage*) technology to store up to 160GB of data with DDS -5.

Advantages are that:

- It uses USB (*Universal Serial Bus*) technology for universal 'plug and play' connectivity.
- The low cost means that it is usually less expensive than tape drives for home users and small companies to back up data.
- They have a broad compatibility with a wide range of servers, operating systems, and backup software:
- Generally faster than tape drives, albeit with smaller storage.

Disadvantages are:

- They are still not as high capacity, or as fast reading/writing as hard disk drives.

Memory Capacity	Data access (seek) Time	Data transfer rate	Price
Varies: 20 – 160GB (compressed)	68 seconds for a 36GB drive (72GB compressed)	Burst rate: 6.4 MB/s asynchronous; 160 MB/s synchronous	£572 for 160GB capacity (uncompressed)

Magnetic Disks

Floppy Disks

One of the oldest storage mediums (dating back to the 1980's), floppy disks were used to store the operating system, application software and other data on very basic computers. It has now been superseded by higher capacity storage devices, such as hard disk drives, and Tape / DAT drives.

Advantages:

- Floppy disks are inexpensive and very portable if you want to transfer only a few small documents.

Disadvantages:

- They have a very small capacity – essentially useless if you want to transfer a file over 1.44MB.
- Floppy disk technology is now in its last years of life; many computer manufacturers do not include floppy disk drives in their base units.

Memory Capacity	Data access (seek) Time	Data transfer rate	Price
Varies:	//	0.06 Mb/sec	Typically less than £1

1.44MB	//		

Hard Disk Drives

The hard disk drive is the main storage device within a computer. Read / Write times and storage capacity outstrip most rivals in the storage media market. Hard disk drives are also widely used to back up data.
Advantages:

- Extremely large storage capacity and often the cheapest in terms of cost per GB (Giga byte) of memory.
- High performance disks with RPM (*Revolutions per minute*) speeds of 7,000 / 10,000 increase the performance of computers, as the internal data transfer rate increases as well.
- Backups can be created easily using a variety of techniques such as RAID (Redundant Array of Independent Disks), a category of disk drives that employ two or more drives in combination for fault tolerance and performance. RAID disk drives are used frequently on servers. RAID1 mirrors all the data on one disk onto the other, and in the case of one drive failing, all data is still accessible.

Disadvantages:

- All magnetic disks are vulnerable to magnetic fields. Therefore, if you expose a disk to a strong magnetic field, it is possible that some of the bits on your disk will be switched, obliterated or otherwise changed from what they should be.
- If enough dust enters the hard drive casing, or the drive is jolted suddenly (for example, if you dropped a laptop.) The head of the hard drive may crash against the platter, destroying the thin magnetic coating on the disk. As most modern hard drives run at around 7,000RPM the damage caused to the magnetic coating can be extensive. However, many laptop manufacturers now use hard drives that 'park' the read/write heads if it is jolted, so this is generally avoided.

Memory Capacity	Data access (seek) Time	Data transfer rate	Price
From around 20GB to 1TB (1,000GB)	8.9 ms on a 1000Gb drive	200 - 600 Mb/s	£29 - £500

Optical Disks

There are many types of optical disk now available. Many of these are of the WORM variety (*Write Once Read Many.*) CD-ROM (*Compact Disk – Read Only Memory*) is used for computer data, such as software. CD-R disks can have data written onto them once, and then only read from the disk. CD-RW disks allow the user to write and rewrite data onto the disk many times. DVD's store more data than CD-ROM's and can also be writeable and rewriteable
Advantages:

- For home users, CD's and DVD's can be easily used to store valuable data, or back up parts of the computer. With about 4.7 GB for single layer disks and 8.5 GB for dual layer disks.
- They can be easily written, using 'drag and drop' systems with Windows Explorer.
- Optical Disks are not vulnerable to magnetic fields, and breaking one is physically difficult. The storage life of optical disks is also very large, with a design life of 20 to 100 years in ideal conditions.
- CD-R and CD-RW disks can also be used to store music, which can then be played by most CD players.
- CD-R and DVD-R disks have become quite inexpensive, with packs of 50 retailing as less than £5.

Disadvantages:

- They do not have as much storage capacity as most other storage media.

Memory Capacity	Data access (seek) Time	Data transfer rate	Price
CD: up to 700MB DVD: 4.7 GB/ 8.5GB	CD: 80 – 280ms DVD: 96 – 297ms	Varies with CD/DVD. CD: 7.8Mb/s. DVD: 16.2Mb/s	CD-R: 10p DVD-R: 20p

FLASH Memory

This is the type of memory that is used in the now common USB pen/thumb drives. NAND Flash memory is generally used, and it is non -volatile, allowing it to store data without any power. Flash drives have gained popularity in recent times, due to their small size, relatively large capacity and low cost (a typical 1GB drive will only cost aro und £5.)

Advantages:

- It is quick and easy to transfer files. They can be written and rewritten easily, with an average life cycle of several hundred thousand rewrites.
- As they are SSD (*Solid State Drives*) with no moving parts, the only limiting factor in file transfer is the maximum speed of the USB 2.0 connection.
- USB flash drives can be used to carry recovery and anti -virus software to infected PCs.

- USB flash drives are also used to carry different applications for installation. For this purpose configuration for flash drives are created. Examples of these kinds of configurations are Mozilla Firefox and Opera browsers.
- Flash drives can also be used as audio players, with Apple's iPod shuffle and the Creative Labs MuVo being nothing but a smart combination of digital audio players with flash drives.

Disadvantages:

- USB drives rarely have encryption as standard. As such, valuable data from large companies can be easily lost or stolen. Their small size means that they are easily misplaced.

- There is lower recoverability with Flash drives. For example, after mechanical failure the data is completely lost as the cell is destroyed, while if normal HDD (*Hard Disk Drive*) suffers mechanical failure the data is often recoverable using expert help. Subsequent investigations in to this field, however, have found that data can be recovered from SSD memory.

With the advance of technology in this area new Solid State Disks have been made that can be substituted for mechanical hard drives. The typical access time for a Flash based SSD is about 35 - 100 micro-seconds, whereas that of a rotating disk is around 5,000 - 10,000 micro-seconds. That makes a Flash-based SSD approximately 100 times faster than a rotating disk.

These drives are only available in relatively small sizes (64GB), but there are many advantages for laptops. SSD's have no moving parts, so they use much less power than their mechanical equivalents, and are silent as well.

Memory Capacity	Data access (seek) Time	Data transfer rate	Price
USB drive: 64MB – 20GB+ SSD Drive: Up to 64GB	Almost none existent	67-megabytes per second (read)	USB drive: £2 - £80 + SSD Drive: £300+