

# External Memory Technologies

Computer Architecture (ICT1252)



W.M.P.N. Jayaweera  
TG/2018/392  
Department of ICT  
Faculty of Technology  
University of Ruhuna

# Table of Contents

<b>Today's technologies</b>	<b>2</b>
Magnetic Storage	2
Floppy disks	2
Hard drives	3
Recording tapes	4
Magnetic strips	4
Optical Storage	5
CD	5
DVD	6
Blu-Ray	6
Semiconductor Storage	6
Flash Memory	7
<b>Next gen technologies</b>	<b>7</b>
Helium Drives	7
Shingled Magnetic Recording (SMR)	8
DNA	8

# Today's technologies

## Magnetic Storage

Magnetic storage stores data in patterns of positive and negative magnetic polarity on magnetic medium.

Devices like floppy disks, tape recorder cassettes and Hard disks are all using magnetic storage technology. Inside hard disks, there are round platters which are made of metal oxide material and they rotate around the spindle at a high speed.

Similarly they have mechanical parts. The patterns are stored in the form of bits through magnetizing the platters in positive and negative polarities.

## Floppy disks



Early computers did not have CD-ROM drives or USB, and floppy disks were the only way to install a new program onto a computer or backup your information. Capacity of a floppy disk is 1.44 MB.

A floppy disk is a magnetic media and stores and reads data on the floppy disk using a read head. When a floppy diskette is inserted into the drive, the metal slide door is opened and exposes the

magnetic disk in the floppy diskette. The read/write head uses a magnetic polarity of 0 or 1. Reading this as binary data, the computer can understand what the data is on the platter. For the computer to write information to the platter, the read/write head aligns the magnetic polarities, writing 0's and 1's that can be read later.

## Hard drives



A hard disk drive is a non-volatile data storage device. It contains one or more platters, housed inside of an air-sealed casing. Data is written to the platters using a magnetic head, which moves rapidly over them as they spin.

Internal hard disks reside in a drive bay, connected to the motherboard using an ATA, SCSI, or SATA cable. They are powered by a connection to the computer's power supply unit.

Data sent to and read from the hard drive is interpreted by the disk controller. This device tells the hard drive what to do and how to move its components. When the operating system needs to read or write information, it examines the hard drive's File Allocation Table to determine file location and available write areas. Once they have been determined, the disk controller instructs the actuator to move the read/write arm and align the read/write head. Because files are often scattered throughout the platter, the head needs to move to different locations to access all information.

## Recording tapes



A tape is a magnetically thin coated piece of plastic wrapped around wheels capable of storing data. Tape is less expensive than other storage mediums, but it is a much slower solution because it is sequential access and is often used for backing up large amounts of data.

The storage capacity of a tape drive all depends on the type of tape drive and technology being used. The IBM TS1155 generation 6 tape drive released in 2017 is capable of storing 15 TB of uncompressed data.

## Magnetic strips

A magnetic strip is a type of strip capable of storing data by modifying the magnetism of tiny iron-based magnetic particles on a band of magnetic material on the strip. The magnetic stripe, sometimes called swipe card or magstripe, is read by swiping past a magnetic reading head.

Credit cards use this technology to store data.

## Optical Storage



Optical storage technology uses laser reflection to read or write data. The optical media which are circular discs and optical drives which have the laser beam source for lightening and the photodiodes for generating the voltages patterns when the reflection beam hits them are required for optical storage technology.

### CD

Compact disc (CD) is a flat, round, optical storage medium invented by James Russell. The first CD was created at a Philips factory in Germany on August 17, 1982. The standard CD is capable of holding 650 MB/700 MB of data.

A CD is made from 1.2 millimetres thick, polycarbonate plastic and weighs 15–20 grams. From the center outward, components are: the center spindle hole (15 mm), the first-transition area (clamping ring), the clamping area (stacking ring), the second-transition area (mirror band), the program (data) area, and the rim. The inner program area occupies a radius from 25 to 58 mm.

A thin layer of aluminum or, more rarely, gold is applied to the surface, making it reflective. The metal is protected by a film of lacquer normally coated directly on the reflective layer.

## DVD

Short for digital versatile disc or digital video disc, a DVD or DVD-ROM is a disc capable of storing a significant amount more data than a standard compact disc. One of the most common DVDs is the single-sided, single-layer disc, capable of holding 4.7 GB.

This uses the same technology as CD (as mentioned above) but in more advance.

## Blu-Ray

Short for Blu-ray disc is an optical disc format developed by thirteen consumer electronics and PC companies. Blu-ray was first introduced at the CES on January 4, 2006, stores up to 25 GB single-layer disc.

This type of disks uses blue lasers for reading and writing data.

## Semiconductor Storage

A device for storing digital information that is fabricated by using integrated circuit technology.

Semiconductor memory technology is an essential element of today's electronics. Normally based around semiconductor technology, memory is used in any equipment that uses a processor of one form or another.

With the rapid growth in the requirement for semiconductor memories there have been a number of technologies and types of memory that have emerged. Technologies such as EEPROM, Flash memory are used as external memory technologies.

## Flash Memory



Flash memory: Flash memory may be considered as a development of EEPROM technology. Data can be written to it and it can be erased, although only in blocks, but data can be read on an individual cell basis. To erase and re-programme areas of the chip, programming voltages at levels that are available within electronic equipment are used. It is also non-volatile, and this makes it particularly useful. As a result Flash memory is widely used in many applications including memory cards for digital cameras, mobile phones, computer memory sticks and many other applications.

Flash memory stores data in an array of memory cells. They have the ability to store an electrical charge for extended periods of time (2 to 10 years) even without a connection to a power supply.

This technology is very popular nowadays and used in Pen drives, SSD hard drives, smartphones etc.

## Next gen technologies

### Helium Drives

Helium-filled hard drives have lately been pushing the capacity boundaries of hard drives, which are typically filled with air. By using helium instead of air, helium-filled drives use less power to spin the disks (which spin more easily thanks to less resistance compared to air), they run cooler, and they can pack in more disks. This technology is still expensive. Still, these high performance



drives will likely only get cheaper and even more expansive—perhaps affordable enough even for consumer use.

## Shingled Magnetic Recording (SMR)

SMR is a new hard drive recording technology. SMR technology allows for higher capacity on hard drives than traditional storage methods.

SMR achieves higher areal densities by squeezing tracks closer together. Tracks overlap one another, like shingles on a roof, allowing more data to be written to the same space. As new data is written, the drive tracks are trimmed, or shingled. Because the reader element on the drive head is smaller than the writer, all data can still be read off the trimmed track without compromise to data integrity or reliability. In addition, traditional reader and writer elements can be used for SMR. This does not require significant new production capital to be used in a product, and will enable SMR-enabled HDDs to help keep costs low.

## DNA

The molecule that stores biological information could be used to store other kinds of data. Harvard researchers in 2012 were able to encode DNA with digital information, including a 53,400-word book in HTML, eleven JPEG images, and one JavaScript program. DNA offers 2.2 petabytes data capacity per gram, DNA is ideal for long-term storage: it will last more than 400,000 years.

DNA takes a long time to read and write to and this technology is still too expensive to be usable now.