Computer memory: SSD, HDD

SSD and HDD memory

First we chose computer because today we use much computers and laptops. But then we needed to go a bit deeper and we wanted to choose the computers memory systems HDD and SSD because these memory systems enable saving, storing and reading information. Physics is involved to this because there is magnetism, electromagnetism, mechanical reader, data and electrical signals. There are multiple kinds of storage Hard Disk Drives (HDD) and Solid State Drive (SSD). HDD is slower than SSD memory and it won't work so many years as the SSD does, but SSD's capacity is lower than HDD's. SSD is used be a storage location for example to Windows operating system. Explanations to the abbreviations are at the end of the article.

HDD

Hard Disk Drive (HDD) is based on moving discs (platters) which KOOOSTUA from four different layers: aluminium on the bottom, then chromium, 3rd is the most important magnetic layer and after that carbon overcoat. HDD's other important parts are Actuator and the Slider & Head. The Actuator includes two strong magnets and voice coil of actuator's arm. The magnets and voice coil make the actuator's arm and head moving that the data can be read from the discs wrote to them. The voice coil works using electromagnetic attraction and repulsion. The data is read and saved by the mechanical reader "Head".

The most popular hard disks are usually about 500 GB but generally some laptops could have only 160-320 GB Hard disks.

SSD

Solid State Drives are electronic working of silicon memory chips and it uses NAND based flash memory. There are any moving parts like spinning platters so they are very fast and shock resistant. Inside the SSD are five main parts. These are controller, NAND flash memory (the black boxes on the picture's circuit board, cells), SATA interface, SSD PCB and card (the circuit board). The most of the Solid State Drives' capacity are 30/32, 60/64 or 120/128 GB. On of the reasons that capacity is lower than HDD's because the technology is more expensive.

The NAND Flash Technology of SSD
How the HDD works?

The current is supplied from two directions alternately to the voice coil which affects electromagnetism because the coil is between the two magnets N pole and S pole. The electromagnetism affects the actuator's arm motion (as the second picture below) so the Head and Slider move above the discs.

The motion above the magnetically coated discs causes an induction to the Head (the head has coil and ferromagnetic core) because the head moves above the magnetically coated plate and as it passes the sections of the platter it measures changes of the magnetic poles. So as in the Faraday's law the current is induced to the current loop (in other words coil) when the magnetic flux through to the loop changes.

How is data read from SSD?

The information is travelling from the SSD to the computer through a standard SATA connection. Inside the SSD the controller is an embedded processor that bridges flash memory components to the host (such as a computer).

The controller executes codes provided by the SSD's firmware (a mini operating system) to full-fill the data requests from the host. The information is stored and read also in SSD with zeros and ones in cells. The memory cells store voltage and in SLC cells can be either an on (1) or off (0) which allows them to store data in binary form.

SSD = Solid State Drive
The data is stored digitally as tiny magnetized bits on the disk. A magnetic orientation in one direction on the disk could represent a "1" and an orientation in the opposite direction could represent a "0". As you can see from the later picture, when the arrows are in the same direction the value is zero (0) and if the arrows are in different direction the value is one (1). For example letter A can be 00011.

HDD = Hard Disk Drive
SLC = Single-level cell
MLC = Multi-level cell

Picture2. How data is stored in HDD from computer's user interface

Sources:

http://www.tomshardware.co.uk/forum/294936-32-basics


Pictures:

Picture1.: http://www.pcguide.com/ref/hdd/op/z_wdc_hdop.jpg

Picture2.: http://www.virtualizationpractice.com/wp-content/uploads/2013/01/HardDiskDriveStorage.png

Picture3.: http://i.i.cbsi.com/cnwk.1d/i/tim/2013/03/01/SSD.jpg

http://www.victimoftechnology.com/images/hard/hdd/dd001.png