

- **HDD :**
 - Hard Disk Drive
 - Uses platters to store data (small magnetic fields → **Flux**)
 - Each platter has 2 heads, one on top, one on bottom
 - The closer the heads are to the platter, the more dense the data can be stored
 - **Data Encoding :**
 - **RLL (*Run Length Limited*)** : method to read fluxes, by reading groups (15 different group combinations)
 - About 7 fluxes at the time
 - **PRML (*Partial Response Maximum Likelihood*)** : more advanced method by analyzing each *flux reversal* and make a “best guess”.
 - Up to 16 or 20 fluxes at the time
 - **Geometry (CHS):** determines where the drive stores data
 - **Heads:** number of read/write heads
 - **Cylinders :** “vertical cylinder”
 - Each circle in the platter that stores data is called **track**
 - **Sectors per Track:** how many sectors in each track
 - **Sector :** piece of a track (512 bytes)
 - **Landing Zone:** Space where the head “rests” when not reading or writing
 - **Write Precompensation Cylinder :**
 - Sectors in center smaller than sectors toward outside
 - Data is spread a little farther
- **SSD:**
 - No moving parts
 - Faster (DRAM and Flash- based drives)
 - More expensive
- **Parallel and Serial ATA:**
 - **ATA - 1**
 - 40-pin ribbon cable
 - Master and Slave
 - **PIO = Programmable I/O**
 - **3.3 MBps to 8.3 MBps**
 - **DMA = Direct Memory Access**
 - **2.1 Mbps to 8.3 MBps**
 - **Maximum Capacity = 504 MB**
 - **ATA - 2**
 - AKA **EIDE** (Western Digital term)
 - **Maximum Capacity = 8.2 GB**
 - **LBA :** Logical Block Addressing
 - **Sector Translation**
 - **ATAPI** → CD drives
 - Second Controller (4 devices)
 - **PIO and DMA** → up to **16.6 MBps**

- **ATA - 3**
 - **S.M.A.R.T** = Self-Monitoring Analysis and Reporting Technology
 - Not many other changes
- **ATA - 4**
 - **Ultra DMA Modes**
 - **0 = 16.7 MBps**
 - **1 = 25 MBps**
 - **2 = 33 MBps** → **AKA: ATA /33**
 - These are forms of **DMA bus mastering**
 - **INT 13 :**
 - ATA-1 standard up to 137 GB
 - BIOS limited it to 504 MB due to CHS maximums
 - ATA - 2 implemented LBA to fool BIOS → up to 8.4 GB
- **ATA - 5**
 - **Ultra DMA Modes**
 - **3 = 44.4 MBps**
 - **4 = 66.6 MBps** → **AKA: ATA/66**
 - **40-pin cable, but 80 wires**
- **ATA/ ATAPI - 6**
 - **Replaced INT13 & 24-bit LBA** → **48-bit LBA**
 - Up to **144 PB**
 - **Ultra DMA Modes**
 - **5 = 100 MBps**
- **ATA - 7**
 - **Ultra DMA Modes**
 - **6 = 133 MBps**

	Cable	Keywords	Speed	Max size
ATA-1	40-pin	PIO and DMA	3.3 MBps to 8.3 MBps	504 MB
ATA-2	40-pin	EIDE ATAPI	11.1 MBps to 16.6 MBps	8.4 GB
ATA-3	40-pin	S.M.A.R.T.	11.1 MBps to 16.6 MBps	8.4 GB
ATA-4	40-pin	Ultra	16.7 MBps to 33.3 MBps	8.4 GB
INT13		BIOS Upgrade		137 GB
ATA-5	40-pin 80-wire	ATA/33 ATA/66	44.4 MBps to 6.6 MBps	137 GB
ATA-6	40-pin 80-wire	Big Drive	100 MBps	144 PB
ATA-7	40-pin 80-wire 7-pin	ATA/133 SATA	133 MBps to 300 MBps	144 PB

- **SATA**
 - **Point to Point connection**
 - Between device and **HBA (host bus adapter)**
 - **Max cable length** → 1 m
 - **Hot-swappable**
 - **No drive limit**
 - **150MBps to 600 MBps**
 - **2 Types:**
 - SATA 1.5 GB
 - SATA 3 GB
 - **eSATA**
 - Up to 2 m cable
- **AHCI**
 - **Advanced Host Controller Interface**
 - Windows Vista / 7 support
 - Efficient with SATA HBAs
 - **NCQ = Native command queuing** → faster read/write
 - Implement in CMOS before installing OS
- **SCSI :**
 - Choice for RAID
 - Replaced by SATA
 - **Internal Devices** → 68-pin cable
 - **External SCSI devices :**
 - **daisy chaining**
 - Up to 15 devices + host adapter
 - Each device has **Unique SCSI ID (0 to 15)**
 - Host adapters often 7 or 15
 - **Terminators** : to prevent signal reflection
- **RAID**
 - **0 - Disk Striping**
 - **Not fault tolerant**
 - Data across multiple drives
 - **1 - Disk Mirroring/Duplexing**
 - Minimum 2 drives
 - Mirroring = same controller
 - Duplexing = separate controller
 - **5 - Disk striping with distributed parity**
 - At least 3 drives
 - Most common RAID
 - **6 - Super Disk striping with distributed parity**
 - At least 5 drives
 - Can lose up to 2 drives at the same time and still recover

References :

- Mike Meyers - CompTIA A+ Certification All-In-One Exam Guide 8th edition