Introduction

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Topic

- Hard Disk Drive (Internal)

What Is Hard Disk ?

A **hard disk drive** (**HDD**) is a data storage device used for storing and retrieving digital information using rapidly rotating disks (platters) coated with magnetic material.

An HDD retains its data even when powered off. Data is read in a random-access manner, meaning individual blocks of data can be stored or retrieved in any order rather than sequentially.

History

- HDDs were introduced in 1956 as data storage for an IBM real-time transaction processing computer and were developed for use with general purpose mainframe and minicomputers.
- The first IBM drive, the **350 RAMAC**, was approximately the size of two refrigerators and stored 5 million 6-bit characters (the equivalent of 3.75 million 8-bit bytes or 3.75 MB or megabytes) on a stack of 50 disks.

History

- In 1961 IBM introduced the **model 1311 disk drive**, which was about the size of a washing machine and stored two million characters.
- As the 1980s began, HDDs were a rare and very expensive additional feature on PCs; however by the late 1980s, their cost had been reduced to the point where they were standard on all but the cheapest PC.

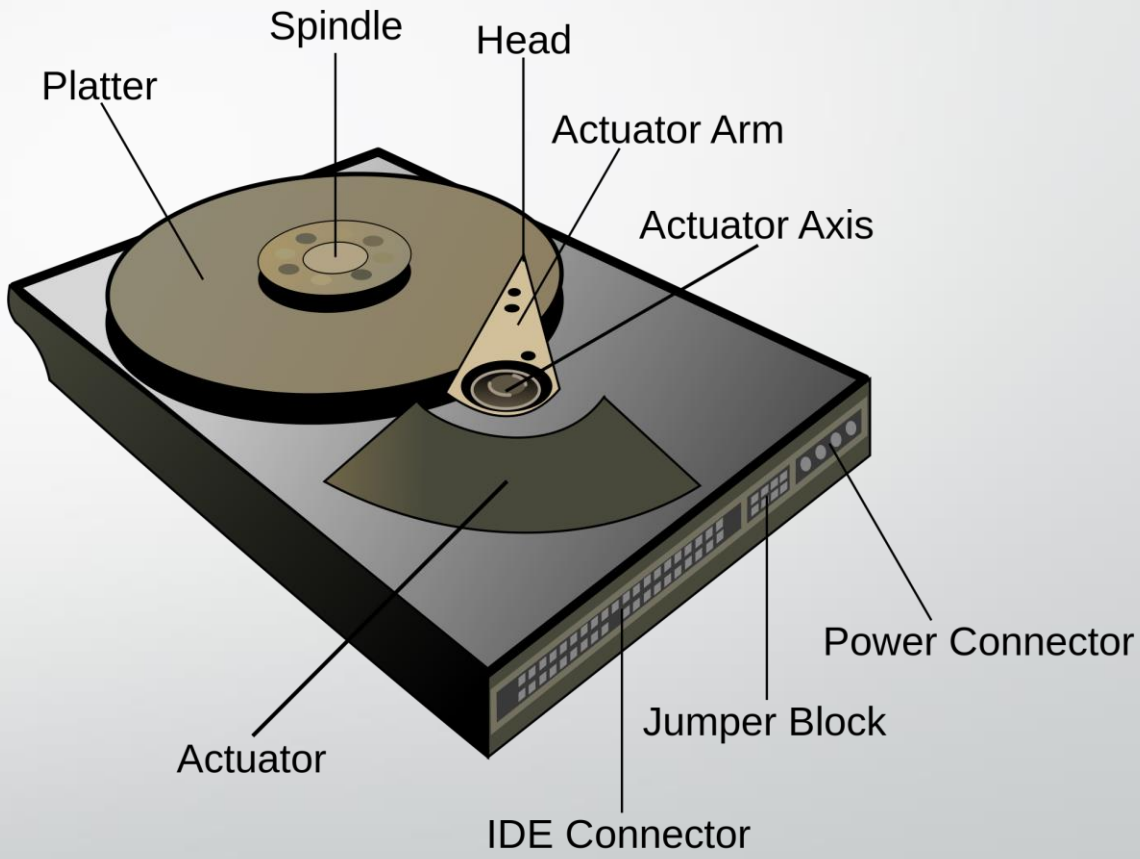
Technology

Magnetic recording

- An HDD records data by magnetizing a thin film of **ferromagnetic** material on a disk. Sequential changes in the direction of magnetization represent binary data bits.
- The data is read from the disk by detecting the transitions in magnetization. User data is encoded using an encoding scheme, such as run-length limited encoding, which determines how the data is represented by the magnetic transitions.

Components

- A typical HDD has two electric motors, a spindle motor that spins the disks and an actuator (motor) that positions the read/write head assembly across the spinning disks.
- The disk motor has an external rotor attached to the disks; the stator windings are fixed in place. Opposite the actuator at the end of the head support arm is the read-write head.

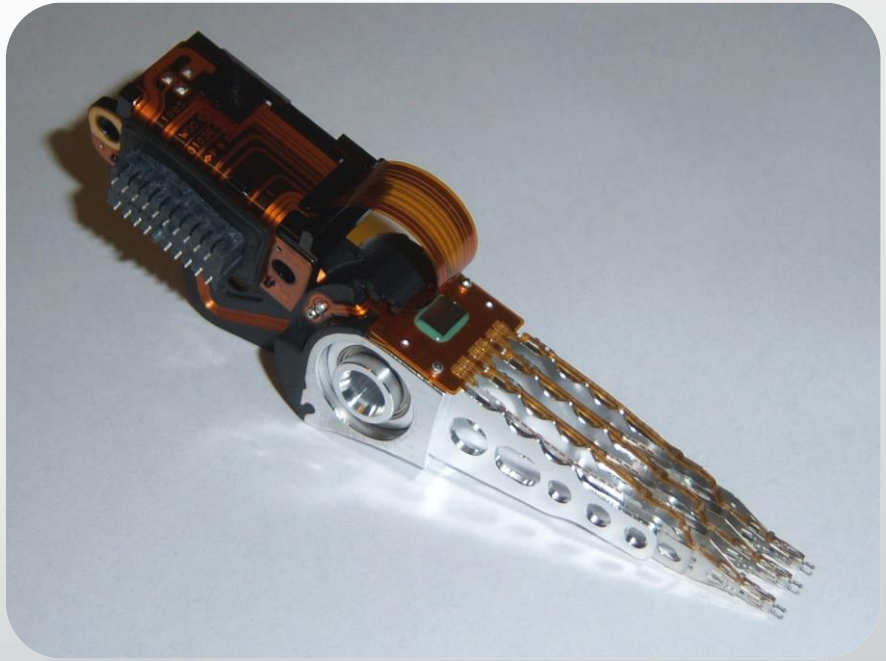


Platters

- A typical HDD design consists of a *spindle* that holds flat circular disks, also called platters, which hold the recorded data. The platters are made from **aluminium alloy, glass, or ceramic**, and are coated with a shallow layer of magnetic material typically **10–20 nm** in depth, with an outer layer of **carbon** for protection

Read/Write Head

Read/Write head Is used for read/write data in magnetic Form



Platter's Structure

A. Track

The HDD is divided into number of concentric circlues called tracks.

Circular path in sector is called track.

B. Sector

Data storage area in one track multiple divided into the multiple block is called sector.

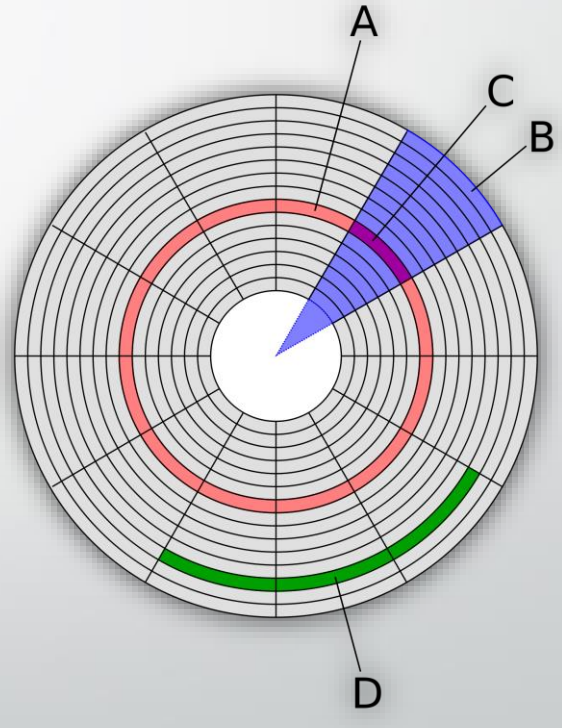
Each sector can have 512 bytes of the data.

C. Cylinder

A set of corresponding tracks in all sides of a hard disk is called cylinder.

D. Storage Capacity

cylinders x heads x sectors x 512 bytes = () /1024 to convert to kilobytes =() /1024 to convert to megabytes



Error rates and handling

- Error Correction Codes (EECs)

  The S.M.A.R.T-Self-Monitoring, Analysis and Reporting Technology system counts the total number of errors in the entire HDD fixed by ECC and the total number of remappings, as the occurrence of many such errors may predict HDD failure.

- Silent Data Corruption

  The worst type of errors are those that go unnoticed, and are not even detected by the disk firmware or the host operating system. This is known as "silent corruption".

Interfaces

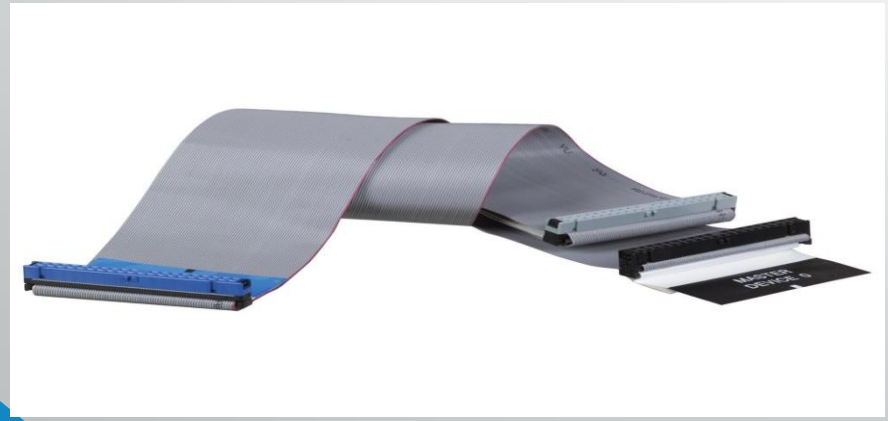
- **They are three types of interfacing in hard disk**

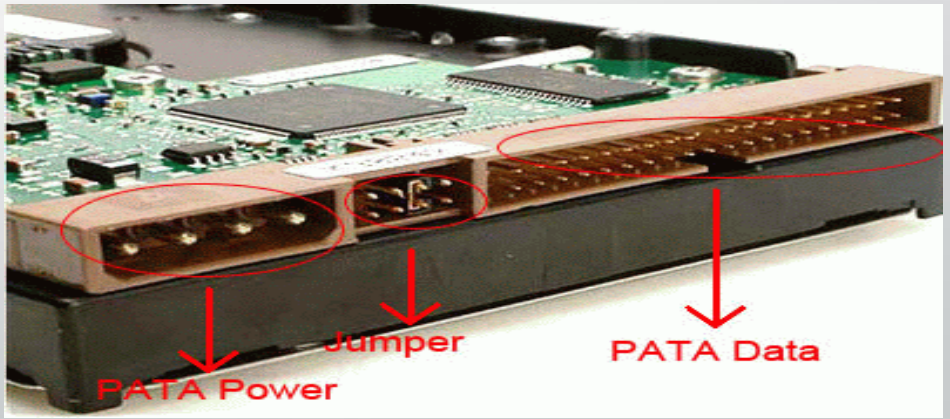
- EIDE
- SATA
- SCSI

EIDE (Enhanced Integrated Device Electronics) PATA (Parallel Advanced Technology Attachment)

- It has a 40 pin connector.
- Data transfer rate is 133mbps.
- when installed this type of hard drives ensure that the jumpers are correctly configured.
- If you have two devices connected to one IDE controller.

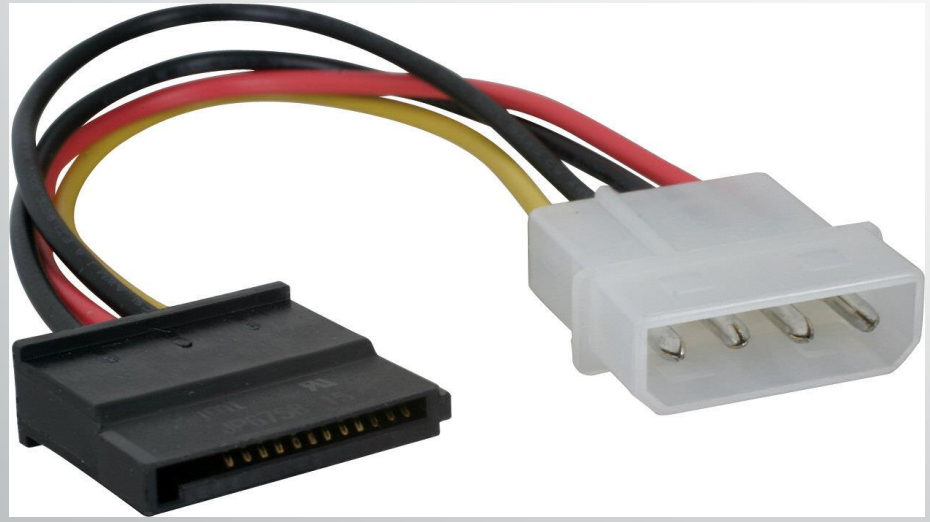
  (one must be set to master and the other must be set to slave).





SATA (Serial Advanced Technology Attachment)

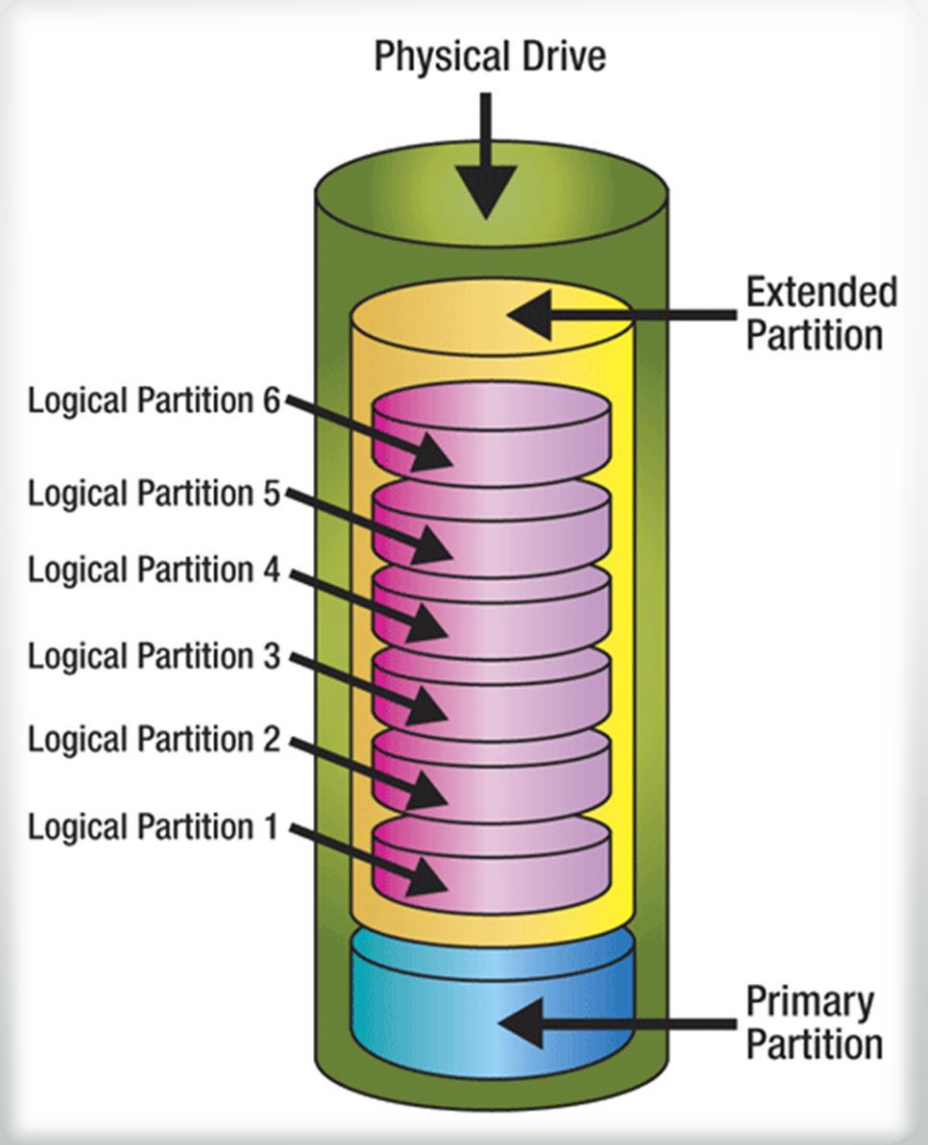
- It has a 7pin connector.
- It is the latest high-speed type of hard drive connectors.
- Data transfer rate is 300mbps. As there are faster than old IDE interface.
- the latest hard drives are using this type of interface.
- As there are faster than old IDE interface.



SCSI (Small Computer System Interface)

- It has a 50 or 68 pin connector.
- The data transfer rate is 600Mb/s .
- These require a SCSI adapter card connected into the system.
- Nowadays, most desktop computers did not use the SCSI.

Disk Partitioning



Disk Formatting

- The process of initializing these logical blocks on the physical disk platters is called **low level formatting** which is usually performed at the factory and is not normally changed in the field.
- **High level formatting** then writes the file system structures into selected logical blocks to make the remaining logical blocks available to the host OS and its applications.

File Systems

- The structure and logic rules used to manage the groups of information and their names is called a "file system"

FAT(File Allocation Table)	NTFS (New Technology File System
Its less secure	It is secure
Partition size is max 32GB	Partition size is 1 (Tera Bytes)
Does not support data compression	It support data compression
Window os conformability (95,98.ms-dos)	Window os conformability (2000,xp ,vista,win 7)

Unit Prefix for Capacity

Term	Equal to
Bit	0 or 1
Kb(Kilobit)	1,000 bits
Byte	8 bits (approximately one character in a Word document)
KB(Kilobyte)	1,000 bytes
MB(Megabyte)	1,000 Kilobytes or 1,000,000 Bytes
GB(Gigabyte)	1,000 Megabytes or 1,000,000, 000 Bytes
TB(Terabyte)	1, 000 Gigabytes or 1,000, 000, 000, 000 Bytes
PB(Petabyte)	1, 000 Terabytes or about 1,000,000,000,000,000 Bytes
EB(Exabyte)	1, 000 Petabytes or about 1,000,000,000,000,000,000 Bytes
ZB(Zetabyte)	1, 000 Exabytes or about 1,000,000,000,000,000,000,000 Bytes
YB(Yottabyte)	1, 000 Zetabytes or about 1,000,000,000,000,000,000,000,000 Bytes

Form Factors

Past and present HDD form factors							
Form factor	Status	Length [mm]	Width [mm]	Height [mm]	Largest capacity	Platters (max)	Capacity Per platter [GB]
3.5"	Current	146	101.6	19 or 25.4	6 TB (2013)	5 or 7	1000
2.5"	Current	100	69.85	5, 7, 9.5, 12.5, or 15	2 TB (2012)	4	694
1.8"	Current	71	54	5 or 8	320 GB (2009)	2	220
8"	Obsolete	362	241.3	117.5			
5.25" FH	Obsolete	203	146	82.6	47 GB (1998)	14	3.36
5.25" HH	Obsolete	203	146	41.4	19.3 GB (1998)	4	4.83
1.3"	Obsolete		43		40 GB (2007)	1	40
1" (CFII/ZIF/IDE-Flex)	Obsolete		42		20 GB (2006)	1	20
0.85"	Obsolete	32	24	5	8 GB (2004)	1	8

Form Factors

Performance characteristics

- **Latency**

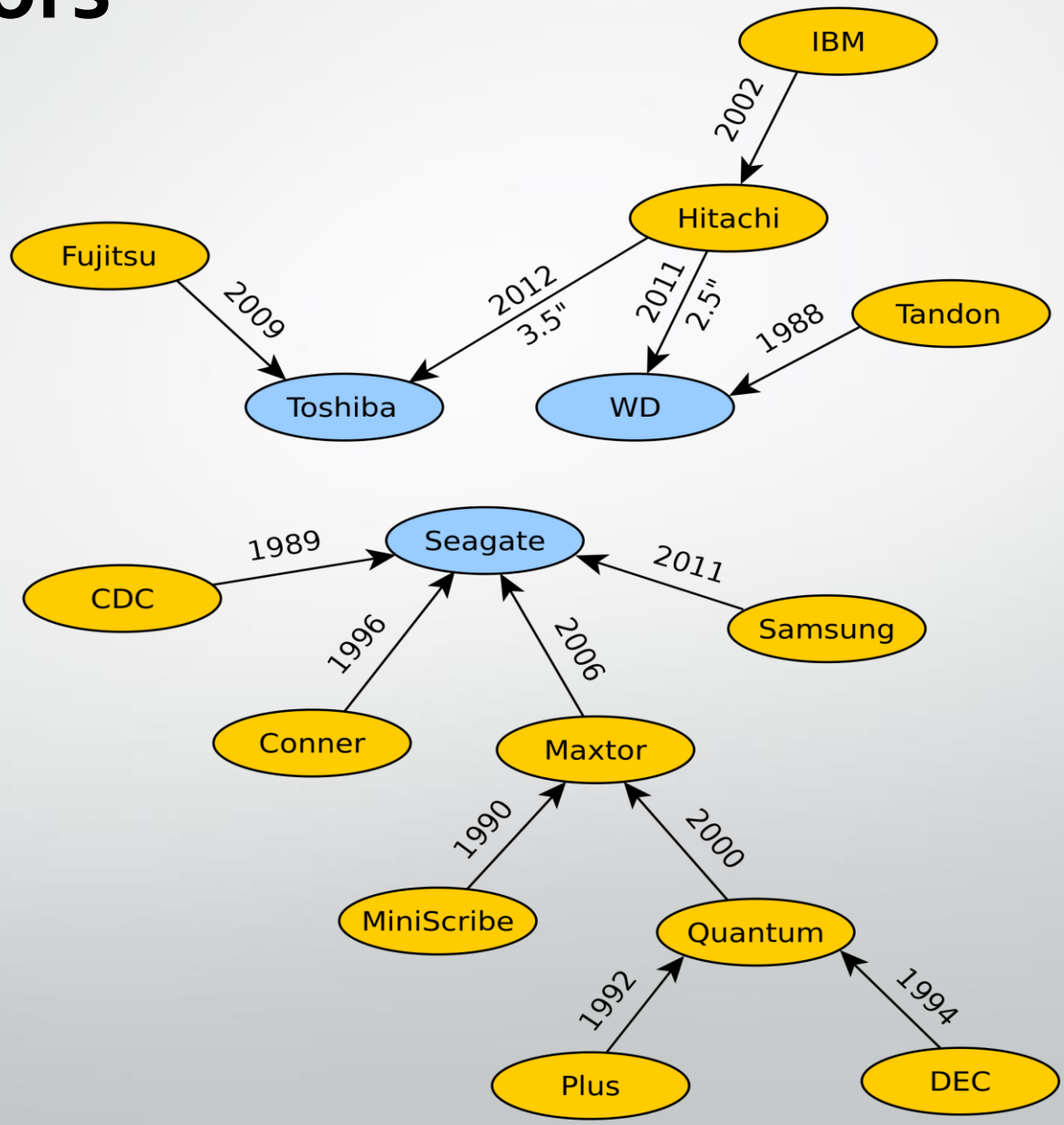
Latency is the delay for the rotation of the disk to bring the required disk sector under the read-write mechanism. It depends on rotational speed of a disk, measured in **revolutions per minute (rpm).**

Average rotational latency is shown in the table below, based on the statistical relation that the average latency in milliseconds for such a drive is one-half the rotational period.

- **Data transfer rate**

Rotational speed [rpm]	Average latency [ms]
15,000	2
10,000	3
7,200	4.16
5,400	5.55
4,800	6.25

Popular Vendors



Future Development

- Desktop 3.5" drives estimated to hit 12 TB around 2016.

Thank You