



## Format Methods on Storage Media (Hard Disk) for Optimization Data Storage Capacity

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### Abstract

This research is to determine how much storage capacity in the File Allocation Table 16 (FAT16), File Allocation Table 32 (FAT 32) and New Technology File System (NTFS), the use of the hard drive is currently the of the maximum capacity will not be able to use when not using the appropriate partition, because it can affect the amount of storage capacity available after the hard disk in the partition. This type of research is reviewed based on its purpose of use, so the research to be conducted is applied research because the products of this research can be used by all computer users. Ultimately, the findings from this study will contribute to a comprehensive understanding of how file system selection and partitioning can influence the actual storage capacity of hard drives, thus informing best practices for maximizing available storage space.

**Keywords:** New Technology File System, File Allocation Table, Storage Media

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## INTRODUCTION

Hard disk is a category2 device (requiring special treatment in its use) where the storage media (hard disk) plays a very important role in a computer device, whether it's a Personal Computer or a Desktop Computer [1]. This storage media (hard disk) can be found in various brands, types, and with a wide range of capacities. However, the hard disk also depends on other devices to perform operations or to access data stored within it. Computers are created to assist in solving human logic-based problems, whether binary or hexadecimal logic. Computers are designed to help humans solve the problems they face, but to do so, humans need to follow logics that can be understood by the computer processes. Due to the wide variety of storage media (hard disks) available in the market, it is

important to consider the formatting method to be used in creating partitions on a storage media (hard disk) according to specific needs.

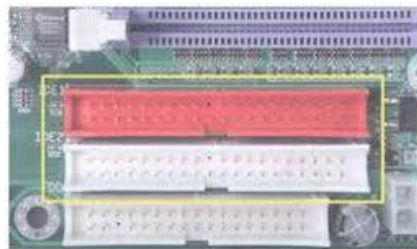
The hard disk factor is a secondary storage device where data is stored as magnetic on spinning metal disks that are integrated. Or it can be interpreted as a hard disk. Data is stored on the hard disk in what is called a track. Each starting point for reading (track) is divided into several parts known as sectors. To perform data read and write operations to and from the disk, the storage media (hard disk) uses a head to transfer it, which is located on each disk. This head will then search for specific sectors to perform operations on the disk. The time used to search for a sector is called seek time [1]. After finding the desired sector, the head will rotate to find the starting point for reading (track). The time used to find this starting point is called latency. The storage media (hard disk) is designed to be able to store data in very large capacities. This is because there are application programs that cannot fit on a single floppy disk and also require large file storage media, such as a database for an institution. Not only that, the storage media (hard disk) is also expected to be balanced in terms of its access speed. The transfer speed of the storage media (hard disk) when compared to a regular floppy disk is much faster [2]. This is because the storage media (hard disk) has a different mechanism and, of course, better material technology than a regular floppy disk. Without the storage media (hard disk), one can imagine how much would need to be provided to store the data of an institution's employees or to store application programs. This is certainly not efficient, as reading data is very slow when using conventional floppy disk storage media. If opened, you can see the hard disk head at the end of the lever arm attached to the disk [3].

The function of a hard disk is to store data. It is a storage medium designed to store data in large capacities, serving as a secondary storage device where data is stored as magnetic pulses on spinning metal disks. The data is stored on hard disks in units called tracks. Each starting point for reading (track) is divided into several segments known as sectors [4]. To perform read and write operations to and from the disk, the hard disk uses a head to transfer data, which is located on each disk. This head is responsible for moving to locate specific sectors for reading or writing operations. The time required to locate a sector is called seek time. After finding the desired sector, the head will rotate again to locate the track. The time required to locate this starting point for reading (track) is called latency. Hard disks are designed to store data in very large capacities [5][6][7]. This is due to the presence of application programs that cannot fit on a single floppy disk and also require large file storage media, such as a database for an institution. Furthermore, the hard disk is expected to be balanced in terms of its access speed. When compared to regular floppy disks, the access speed of a hard disk is significantly faster [8]. This is because hard disks have different mechanisms and utilize superior material technology compared to regular floppy disks. Without hard disk storage, one can imagine the amount of resources required to store an institution's employee data or application

programs. This would be highly inefficient. Additionally, the read and write speeds are very slow when using floppy disks [9][10].

The latest version of SATA, which is almost similar to PATA/133, has many advantages (such as native command queuing) that result in higher transfer speeds and the ability to work in multitasking environments. At the beginning of the SATA/150 period, adapter and drive manufacturers used bridge chips to convert existing designs with PATA peripherals. Bridge devices have SATA connectors and some power supply connectors. Gradually, bridge products accommodate native SATA. Currently, the SATA transfer speed is 3GB/s, and experts are now designing technology for SATA 6GB/s. Power and SATA cables have undergone significant changes compared to Parallel ATA cables [11][12]. SATA data cables use 7 conductors, 4 of which are active lines for data. Because they are more flexible and smaller in size, SATA cables are easier to use in tighter spaces and more efficient for cooling. Serial Advanced Technology Attachment (SATA) storage media (hard disks) have been widely used by computer users worldwide [13]. Motherboard developers are also more inclined to develop support for SATA storage media rather than the long-standing IDE.

Figure 1. The ATA port on the motherboard



Source: [https://simple.wikipedia.org/wiki/Parallel\\_ATA](https://simple.wikipedia.org/wiki/Parallel_ATA) Figure

Figure 2. The ATA type hard drive



Source: <https://www.seagate.com/id/id/products/external-hard-drives/>

Types of Hard Drives ATA/EIDE disks, storage media with EIDE (Enhanced Integrated Drive Electronics) or ATA (Advanced Technology Attachment) type, are the latest standard for a disk interface suitable for connecting to the data bus. Many hard drive manufacturers use the EIDE/ATA interface, and such disks can be directly connected to the PCI bus, which is used in many personal computers [14][15][16]. The significant advantage of EIDE/ATA drives is their lower cost due to their widespread use in the market. One major drawback is the need for a separate controller for each drive when two drives are used together to improve performance. Some chip manufacturers include controllers that allow EIDE/ATA disks to be directly connected to the motherboard.

SCSI Disks, known for their high performance and reliability, often come equipped with interfaces specifically designed to connect to the standard SCSI (Small Computer System Interface) bus. While these drives tend to be pricier compared to their counterparts, their superior performance justifies the cost, largely due to the inherent advantages of the SCSI bus over the PCI (Peripheral Component Interconnect) bus. One notable advantage lies in the SCSI bus's ability to facilitate simultaneous access to multiple disk drives. Unlike the PCI bus, where drives remain passively connected, SCSI drive interfaces are actively connected to the bus only when the drive is ready to read or write data [17][18].

This unique feature proves particularly advantageous in scenarios where there is a constant influx of requests for small files, a common occurrence in environments such as file servers. By allowing for simultaneous access to multiple drives, SCSI disks excel in handling these intensive workloads efficiently. This capability not only enhances overall system performance but also ensures smoother operations, especially in demanding computing environments where the rapid retrieval and transfer of data are paramount. Thus, while SCSI disks may come at a premium, their superior performance and robust functionality make them indispensable assets in settings requiring high-speed data processing and reliable storage solutions [17][19].

SCSI Disks, many disks have interfaces designed to connect to the standard SCSI bus. This type of hard drive tends to be more expensive but offers better performance, made possible by the advantages of the SCSI bus over the PCI bus. Simultaneous access can be performed to multiple disk drives because the drive interfaces are actively connected to the SCSI bus only when the drive is ready to read/write data. This is particularly useful in applications where there are a large number of requests for small files, which often occurs in computers used as file servers [20][21].

RAID disks promise outstanding performance and provide large, reliable storage. This type of disk is used in high-performance computers or in

systems that require higher reliability than normal levels. As their prices continue to decrease to more affordable levels, these disks are becoming more attractive even for average-sized computer systems [22][23].

SATA disk, a storage media (hard disk) with the SATA (Serial Advanced Technology Attachment) type, is an ATA (Advanced Technology Attachment) disk interface with its Serial version using thin cables that have a total of about two-thirds of the total cables of EIDE or ATA disks, which have 39 pins [24][25]. SATA has a very high data transfer speed and reduces interference. Thus, this serial bus can exceed the transfer speed of a parallel bus.

SATA transfers data sequentially or serially through its cables and also technically organizes the connected disk to the motherboard without a master, slave, or secondary system. Thus, the SATA cable can only be used for one hard disk [26][27]. The types of storage media (hard disks) discussed in this article all fall into the category of internal hard disks, meaning they are installed inside the CPU.

In addition to internal storage media (hard disks), there are also external storage media (hard disks) (hard disks located outside the CPU), so they can be moved around. External storage media (hard disks) have a transfer speed of 7200 rpm upon installation [28]. These external hard disks provide convenience in terms of portability and flexibility, allowing users to easily transport data between different locations or devices.

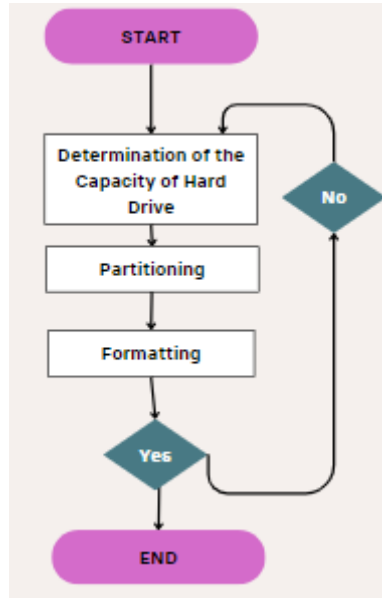
External storage media offer a viable solution for individuals seeking additional storage capacity or a means of backing up important data without necessarily opening up their computer's case [29][30]. Furthermore, with the transfer speed of 7200 RPM, these external hard disks deliver reasonable performance for everyday use, making them suitable for various applications ranging from data backup to media storage and file sharing. SATA transfers data sequentially or serially through its cables and also technically organizes the connected disk to the motherboard without a master, slave, or secondary system [31]. Thus, the SATA cable can only be used for one hard disk. The types of storage media (hard disks) discussed in this article all fall into the category of internal hard disks, meaning they are installed inside the CPU [32]. In addition to internal storage media (hard disks), there are also external storage media (hard disks) (hard disks located outside the CPU), so they can be moved around. External storage media (hard disks) have a transfer speed of 7200 rpm upon installation [33][34].

## **METHOD**

To provide examples of things that need to be known in this research process and to facilitate the implementation of research objectives, there are several things that will be discussed including: types, locations, variables, instruments, and research designs for all studies. This type of research is

reviewed based on its purpose of use, so the research to be conducted is applied research because the products of this research can be used by all computer users. Meanwhile, based on its method, this type of research is experimental because several experiments will be conducted to obtain the expected variable values.

Figure 3. Research Flowchart



**RESULT AND DISCUSSION**

From the research results and observations of all partition processes using Seagate and Western Digital brands with a capacity of 1TB, it can be seen in the table as follows

Table 1. Partition Sizes

		FAT 16		FAT 32		NTFS	
Hardisk 1TB	Merk	Number of Volumes	Number of Partitions	Number of Volumes	Number of Partitions	Number of Volumes	Number of Partitions
	Seagate	8 GB	4	20 GB	4	9351 GB	1
	Western Digital	8 GB	4	20 GB	4	9351 GB	1

From the research results and observations of all partition processes using Seagate and Western Digital brands with a 1TB capacity, it can be seen that on a 1TB hard disk, when partitioned using FAT16, the maximum storage capacity that can be utilized is 8 GB. Therefore, with such a large capacity, it is not being fully utilized. When partitioning using FAT32 on a 1TB hard disk with Seagate & WD brands, a maximum capacity of 20 GB is obtained. However, if

the partitioning process uses the XP operating system, the maximum capacity is 384 GB, indicating that there is still a significant amount of unused capacity, thus not being optimal. When using an NTFS partition, the maximum readable capacity is 9351 GB. In this study, the most optimal option is found to be using an NTFS partition.

Through experimental partitioning processes, it was determined that NTFS partitions offer the most optimal utilization of storage capacity for 1TB hard disks. With a maximum readable capacity of 9351 GB, NTFS partitions surpass FAT16 and FAT32 partitions in terms of efficiency and capacity utilization. This study highlights the importance of considering various factors such as storage capacity, transfer speed, and reliability when selecting and partitioning hard disks. Understanding the characteristics and capabilities of different types of hard disks is essential for optimizing computer systems' performance and storage management.

## CONCLUSION

In conclusion, the significance of hard disks in computer systems cannot be overstated. They serve as vital secondary storage devices, storing data efficiently in large capacities. The various types of hard disks, including ATA/EIDE, SCSI, RAID, and SATA, offer different advantages in terms of cost, performance, and reliability. ATA/EIDE disks provide a cost-effective solution, while SCSI disks excel in high-performance and multitasking environments. RAID disks offer both outstanding performance and reliable storage, particularly suitable for high-demand computing systems. SATA disks, with their high-speed sequential data transfer and reduced interference, represent the forefront of storage technology.

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