

# Preparing a disk for use

Before a disk can be used by a computer it must undergo three separate processes. It is only the last of these (high level formatting) which creates the file system specific to an operating system e.g. the [FAT 16 or FAT 32 systems](#) used by Windows and MSDOS.

1. [Low level formatting](#)
2. [Partitioning](#)
3. [High level formatting](#)

## Low level formatting

Hard disks are laid out in blocks.

the number of blocks on a disk is calculated by the formula

heads X sectors X tracks.

Each block will usually hold 512 bytes of information.

The laying out of this track and sector information together with finding and marking any bad areas of the disk is called low level formatting. This will be done at the factory before the disk is sold.

## Partitioning

Before a disk can be used by a computer a partition table must be created on the disk. This tells the computers BIOS whether the disk should be used as a single disk or whether it should be split into two or more logical disks. The partition table also tells the BIOS which part of the disk an operation system boot sector can be found on.

New disks have to be partitioned manually before they can be used. The most common tool used to partition disks is an MSDOS utility called FDISK.

Because there are restrictions that are placed on some file system types, in particular. the maximum size of FAT16 partitions is 2.1Gigabytes, the FDISK program will only create partitions of up to 2.1 Gigabytes if FAT16 file systems are to be used, even though the file system itself is not laid out at this point. When the program starts, FDISK will ask if large partitions are required, if you answer 'Y' to this then the partitions will be created and marked to be used for FAT32 file systems, and the size restriction will not be applied.

## Formatting

Sometimes called high level formatting. Formatting a disk laid out a file system. The disk format used will make a disk usable by any operating system the supports the file system being used. MSDOS and WINDOW 9X both use what are called [File Allocation Table](#) (FAT) file systems. There are two types of FAT systems [FAT 16](#) and [FAT32](#) each of which will have [benefits](#) under different circumstances.

### File allocation tables file systems

FAT systems group together the blocks of a disk into work units called clusters. Each cluster will be a group of one or more disk blocks. As each block will be 512 Kilobytes, the capacity of the cluster will be 512 X the number of blocks per cluster.

The cluster is the basic unit of storage. Each file stored on a FAT formatted disk will take up at least one cluster. No two files can ever be stored in the same cluster.

This means that a FAT disk which is using 30 blocks per cluster will have clusters that take up 15 Kilobytes of disk space. Any file stored on this disk will therefore take up at least 15K no matter how small the file is. If a FAT disk is using 60 blocks per cluster then the cluster will take up 30K and each file on this disk will use up 30K of disk space no matter how small the file is. This means that the more blocks per cluster that are used, the more space small files take up.

The result of this is that is that is the contents of a 90% full one gigabyte disk is copied on to a two gigabyte disk, the new disk will often end up 60 - 70 % full!

Because of this problem there are currently two FAT file-system types FAT 16 and FAT 32

## **FAT 16**

FAT 16 file systems use a 16 bit number to index the file allocation table. The largest 16 bit number is 65536. This means that a FAT 16 disk can have no more than 65536 clusters, no matter how big the disk is. Bigger disks simply use more blocks per cluster. This means that very often bigger disks will not hold that much more than smaller disks because each file, no matter how small will be using more space. The maximum size of a windows 95 FAT16 disk has been restricted to 2.1 Gigabytes because of this problem.

## **FAT 32**

FAT 32 disks use 32 bit numbers to index their file allocation table. This means that fewer blocks per cluster can be used. This means that small files will take up much less space. Large file will however load slightly slower as they will be split into more clusters as each cluster will hold less information.

## **Benefits of FAT 16 vs. FAT 32**

FAT 16 disk can be used by a wide range of operating systems, e.g. Windows NT, Linux , Windows 95, MSDOS etc. FAT 32 can only be used by Windows 98, Windows 2000 and some service releases of Windows 95.

FAT 32 disks can be larger than 2.1 Gigabytes. FAT 16 disks must be smaller than 2.1 Gigabytes (or 3.5 Gigabytes if used with Windows NT)

Small files take up less room on FAT 32 disks. FAT 32 disks can therefore hold more information.

Large files tend to load slightly faster from FAT 16 disks than FAT 32 disks.

FDISK can create up to four partitions per disks. This means that the largest disk that can be used with FAT16 is 8.4G (4 X 2.1 G). To use disk larger than this FAT32 must be used.