File System Report

SEMESTER: **7**

BY:

Sujit Upadhyaya(C30101200033)

BACHELOR OF INFORMATION & COMMUNICATION TECHNOLOGY SCHOOL OF SCIENCE & TECHNOLOGY

ASIA e UNIVERSITY

ACKNOWLEDGEMENT

I express my gratitude to VIRINCHI COLLEGE for including provision for minor project in the syllabus of BICT 7TH semester. I have learned and enjoyed a lot while working on this report. We would like to express our thankfulness to all those who helped us to complete this report. We are deeply indebted to our supervisor, course facilitator too, lecturer whose support, suggestion, encouragement helped us all the time while working on writing project report.

ABSTRACT

In this report we can learn about different file system like NTFS, exFAT, FAT32 and EXT2/3/4. We get knowledge about file system deeply. This report helps us to get information about different file system and how to format different file system to other in terminal.

Table of Contents

Table of Figures

1. INTRODUCTION TO FILE SYSTEM

The file system is a method and data structure that the operating system uses to determine how data is stored and retrieved. By separating the data into chunks and giving each one a name, the data can be easily isolated and identified. Taking its name from the naming convention of a paper-based data management system, each group of data is referred to as a "file". The structure and logical rules used to name the data groups and their names are called the "file system".

2. WHY FILE SYSTEM IS IMPORTANT?

The file system helps the operating system to manage data and files logically. It allows users to easily access, protect, read, write and modify the data on their storage devices. Instead, data on a disk without the file system will be stored in a messy manner, taking up huge storage devices and making it difficult for users to access and search for the desired files. The file system also makes it easy to find lost files

3. HOW FILE SYSTEM WORKS?

A file system indexes all data information on a storage device, including file size, attributes, location, and hierarchy in the directory. The file system also specifies the path to a file through the directory structure with a format.

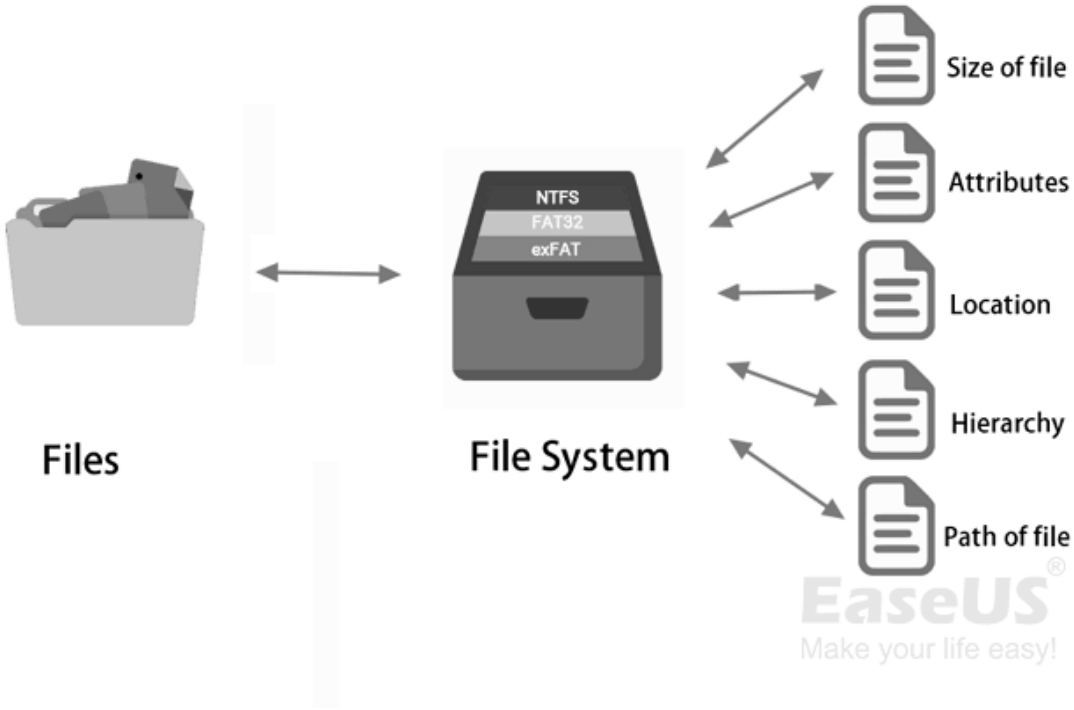

Figure 1: File System works

4. STRUCTURE OF FILE SYSTEM METADATA

All the data information of files on a storage drive is stored in the file system metadata:

1) Date created
2) Date modified
3) Last date of access
4) Last backup
5) User ID of the file creator
6) Access permissions
7) File size

5. HOW THE OS ACCESS FILE SYSTEM

Here is how the operating system uses the file system to process and access files on a storage device:

1) You create a partition on a hard drive or external drive.

2) You add a file system format to the drive.

3) You store a file in a folder, a directory, or a subdirectory on the drive.

4) The file system record the location information of these files.

5) OS uses the file system to store and locate these files on your storage devices.

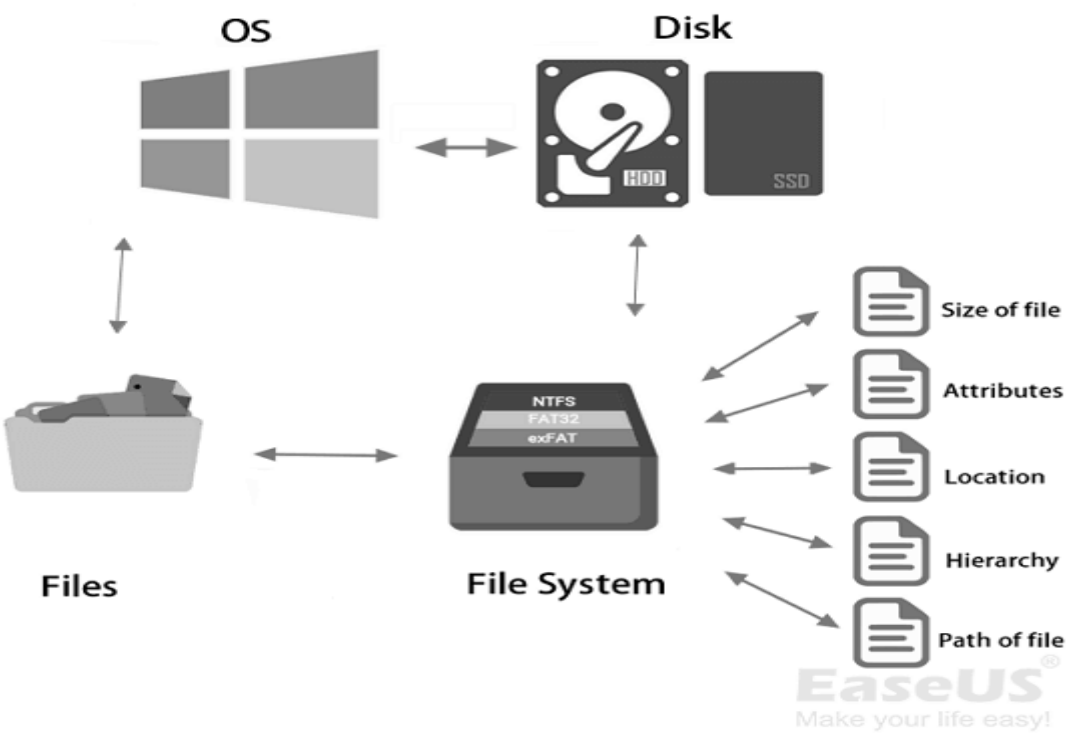

Figure 2: How os access file system

6. TYPES OF FILE SYSTEM

- Windows File System: FAT, NTFS, exFAT
- MacOS File System: HFS, APFS, HFS+
- Linux File System: EXT2/3/4, XFS, JFS, Btrfs

What is NTFS, FAT, exFAT and EXT2/3/4 File System?

NTFS:

NTFS, also known as New Technology File System, is a proprietary journaling file system developed by Microsoft. Starting with Windows NT 3.1, this is the default file system of the Windows NT family. It replaced File Allocation Table (FAT) as the preferred file system on Windows and is also supported in Linux and BSD.

It was initial release in 1993 by Tom Miller, Gary Kimura, Brain Andrew, and David Goebel. The last version of this file system is V3.1,(Commonly called NTFS 5.1).

NTFS File System Structure:

The NTFS file system has 5 components: O Boot Record ， MFT1, MFT Metadata, MFT2, and Data Area.

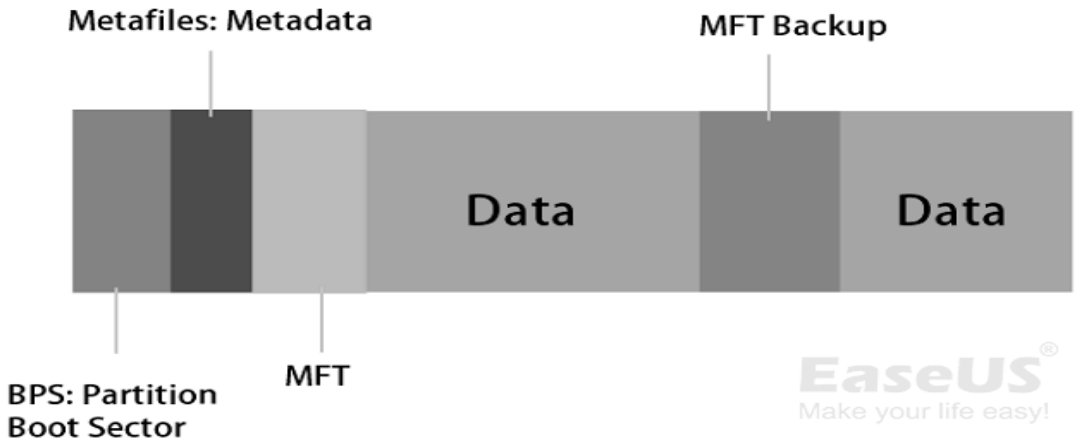

Figure 3: NTFS File System Structure

FAT or FAT32:

FAT, also known as File Allocation Table, is a file system developed for PC. Originally developed in 1977 for use on floppy disks, it has been adapted for use on hard drives and other devices. It is often supported by today's PC operating systems and many mobile and embedded systems for compatibility reasons, allowing data to be exchanged between different systems.

It was initial release in 1997 by Microsoft, NCR, IBM, Caldera, and more. The last version of this file system was FAT32.

FAT File System Structure:

The FAT file system consists of four major components: Reserved sectors, FAT Region, Root Directory Region, and Data Region.

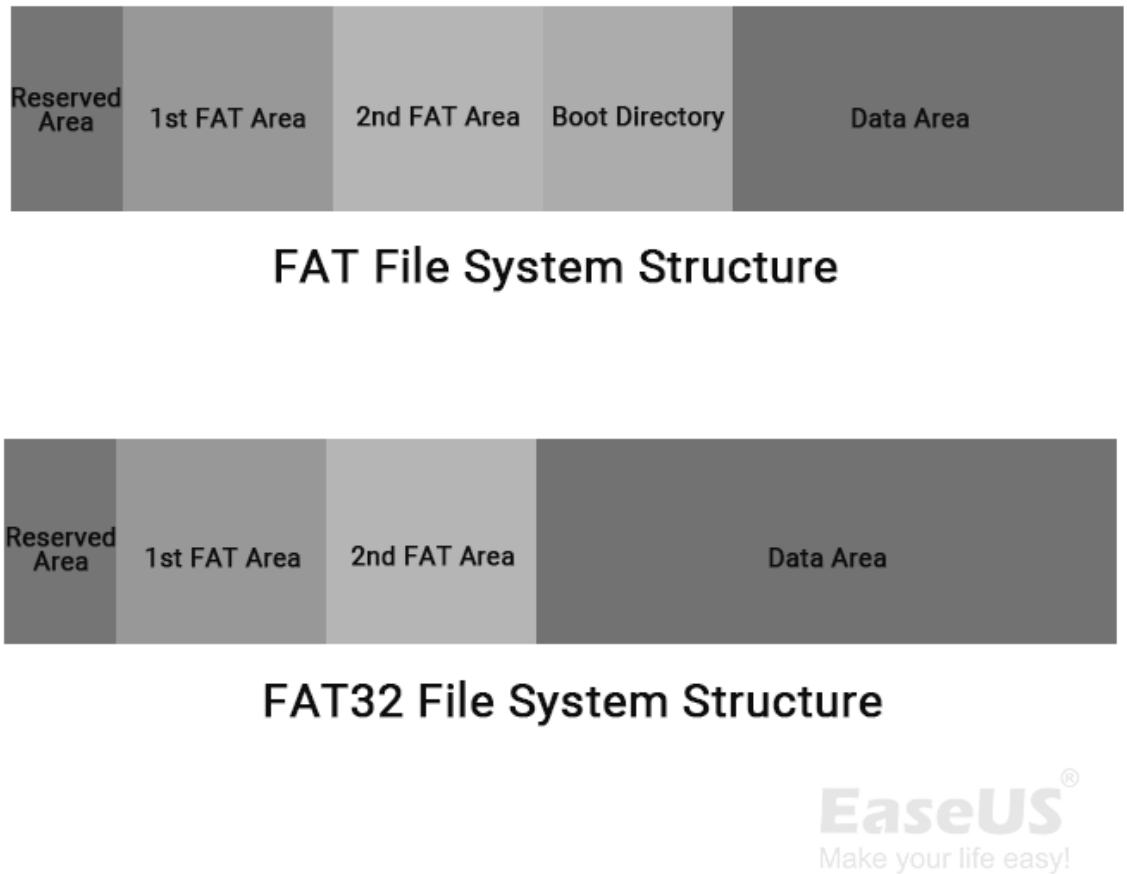

Figure 4: FAT and FAT32 File System Structure

exFAT:

exFAT is a file system introduced by Microsoft in 2006 and optimized for flash storage devices such as USB drives and SD cards. exFAT was proprietary until August 28, 2019, when Microsoft released its specification.

It was initial realease in 2006 by Microsoft. The last version of this file system was exFAT.

exFAT File System Structure:

The exFAT file system consists of 4 main sections: the Main Boot Region, Backup Boot Region, FAT Region, and Data Region.

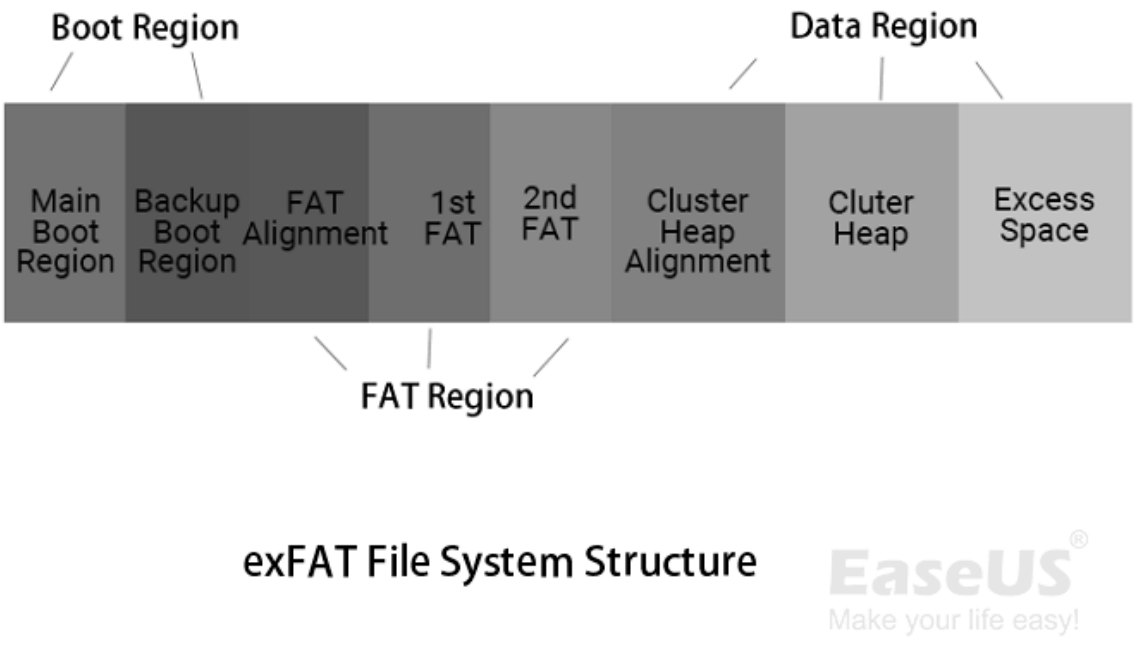

Figure 5: exFAT File System Structure

EXT2/3/4:

EXT was implemented in April 1992 as the first file system built specifically for the Linux kernel. It has a metadata structure inspired by traditional Unix file system principles and was designed by Remy Card to overcome some limitations of the MINIX file system.

It was initial release in 1992 by Remy Card. The last version of this file system is EXT4.

EXT File System Structure:

The EXT file system can be divided into one block and two groups, including the Boot Block, Block Group 0 (which contains Super Block, Group Descriptors, Data Block Bitmap, Inode Bitmap, Inode Table, and Data Blocks), and Block Group n.

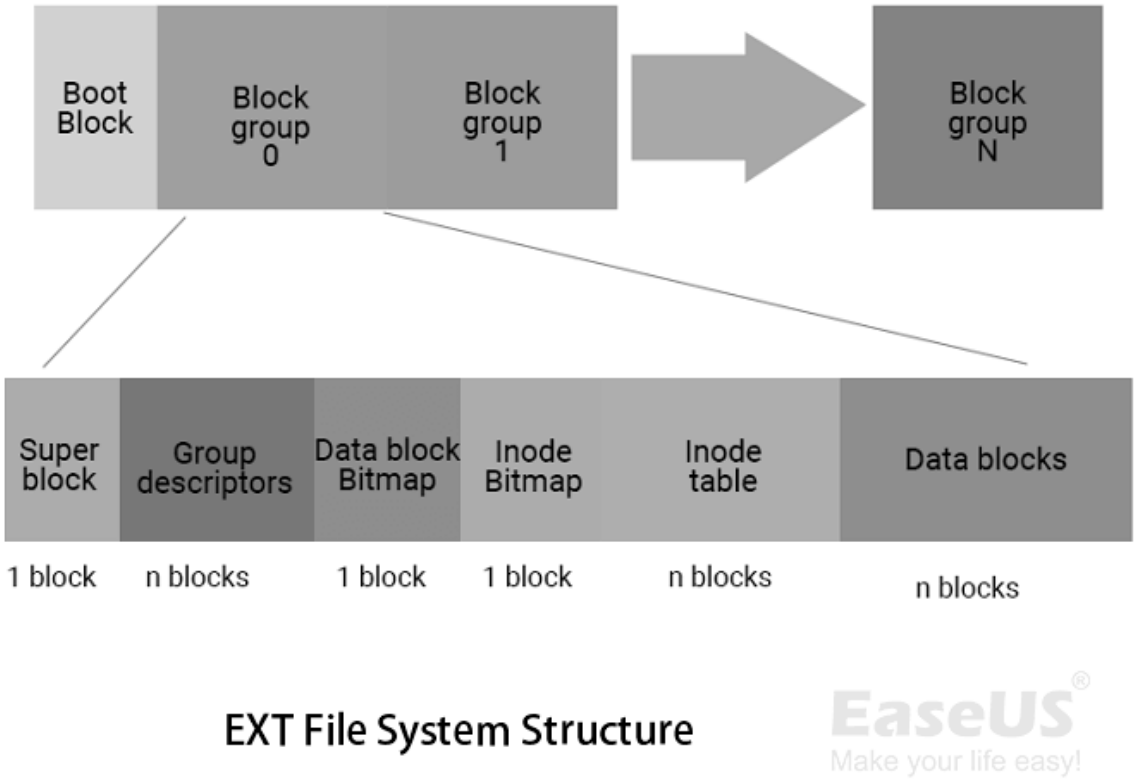

Figure 6: EXT File System Structure

7. DIFFERENCE BETWEEN DIFFERENT TYPES OF FILE SYSTEM

Differences	Max File Size	Max Volume Size	Operating System
NTFS	• 16EB - 1KB • 16TB - 64KB • 256TB - 64KB • 8PB - 2MB	• 256TB - 64KB • 8PB - 2MB	• Windows NT3.1 and later • macOS X 10.3 and later (Read-only) • Linux kernel 2.6 and later (read-only) • FreeBSD, NetBSD, OpenBSD(read-only), Chrome OS, Solaris, ReactOS(read-only)
FAT32	• 4GB	• 2TB - 512 byte • 8TB - 2KB • 16TB - 4KB	• Windows 95OSR2, Windows 98, XP, 7, 8, 10, and 11. • macOS • Linux
exFAT	• 128 PB	• 128 PB	• Windows XP, Vista, 1/8/10/11, Windows Server 2003/2008/2008 R2 • Linux kernal 5.4 and later, FUSE • Mac OS X 6.5 and later
EXT2/3/4	• 4TB - 1KB	• 4TB - 1KB	• Linux kernel 0.96

• 8TB - 2KB • 16TB - 4KB • 256PB - 64KB	• 8TB - 2KB • 16TB - 4KB • 256PB - 64K	and later

8. HOW TO FORMAT DIFFERENT FILE SYSTEM TO OTHER

NTFS to FAT32:

I am using Linux Operating System so i will do in terminal. Lets go.

Step 1: Open Terminal.

Step 2: Insert pendrive / flash drive.

Step 3: Locate USB Drive using command “df” or “sudo df”.

Step 4: Unmount and format Usb drive using command “sudo unmount /dev/sdc1” and “sudo mkfs.vfat /dev/sdc1”.

Step 5: Verify usb drive using command ”sudo fsck /dev/sdc1”.

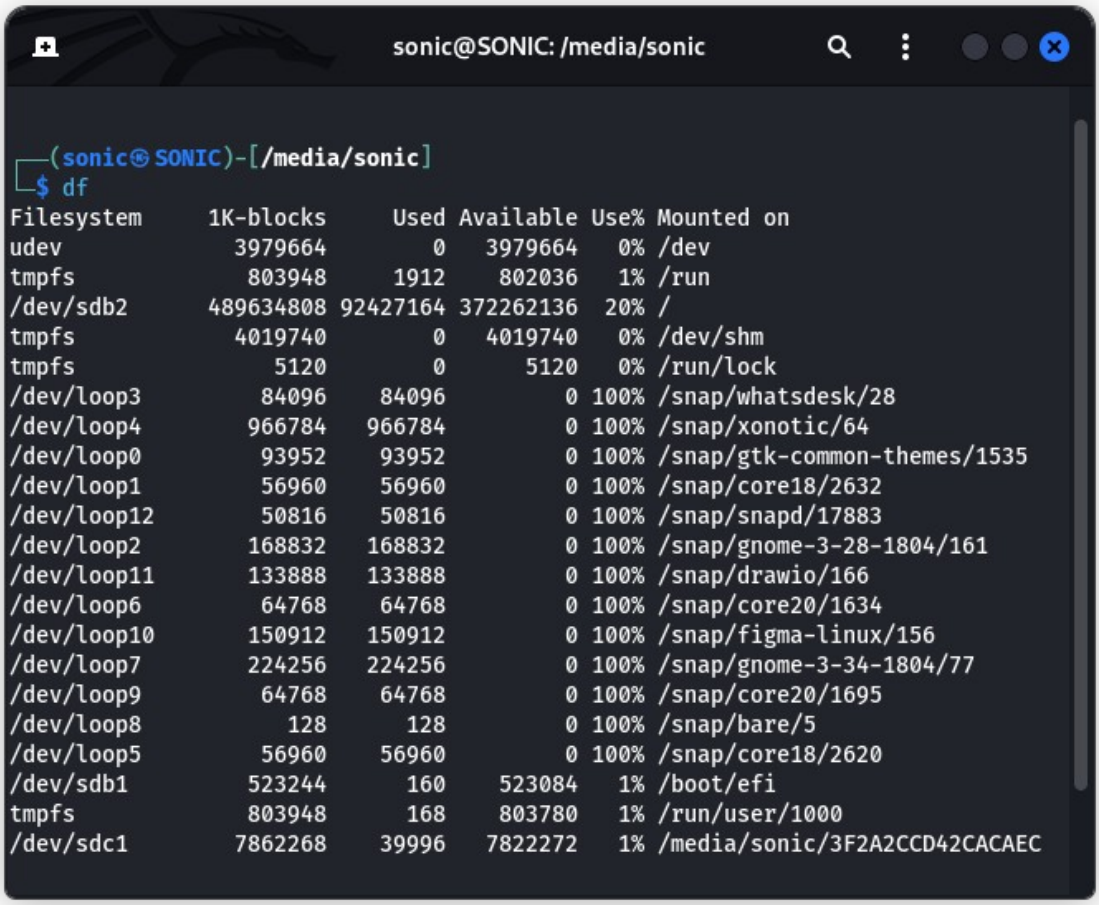

Figure 7: checking usb drive

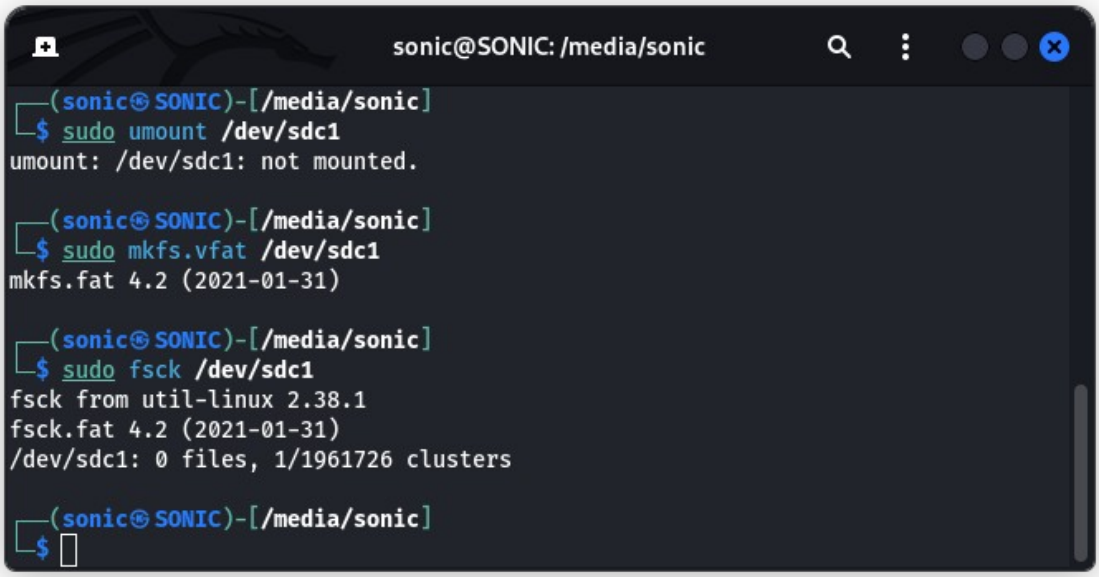

Figure 8: unmount and format to fat

FAT32 to exFAT:

I am using Linux Operating System so i will do in terminal. Lets go.

Step 1: Open Terminal.

Step 2: Insert pendrive / flash drive.

Step 3: Locate USB Drive using command “df” or “sudo df”.

Step 4: Unmount and format Usb drive using command “sudo unmount /dev/sdc1” and “sudo mkfs.exfat /dev/sdc1”.

Step 5: Verify usb drive using command ”sudo fsck /dev/sdc1”.

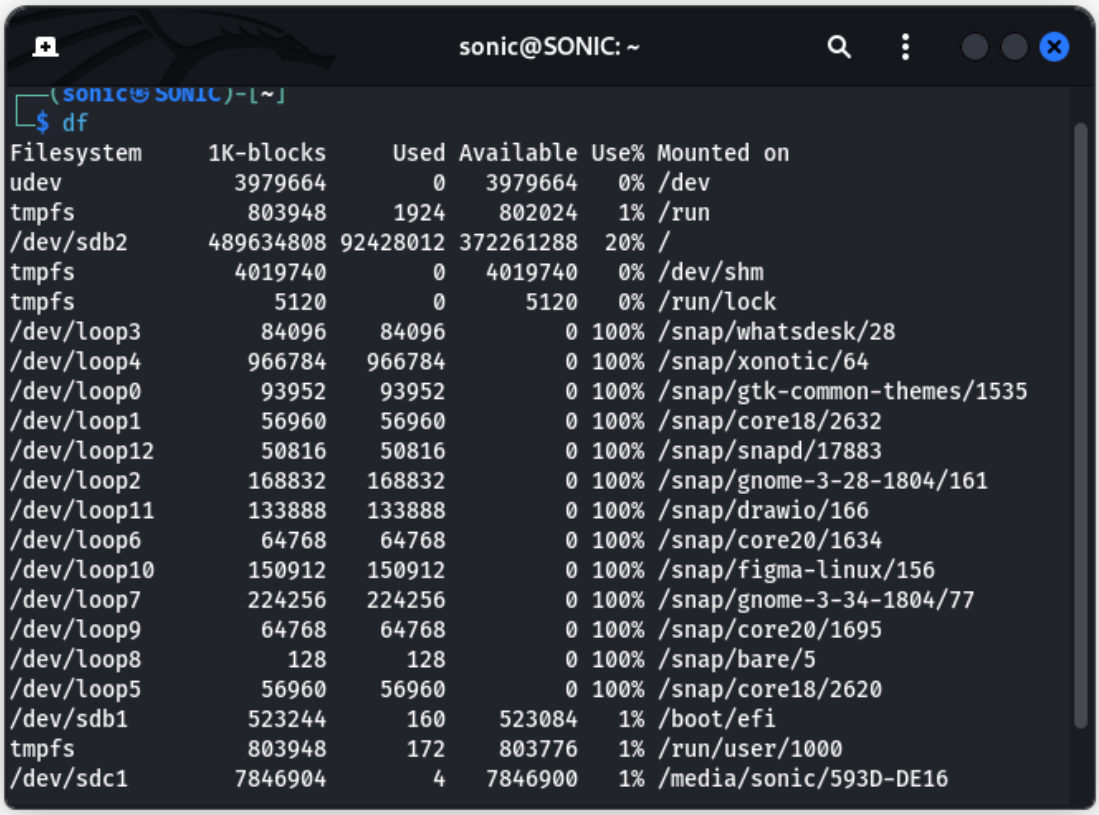

Figure 9: Checking usb drive

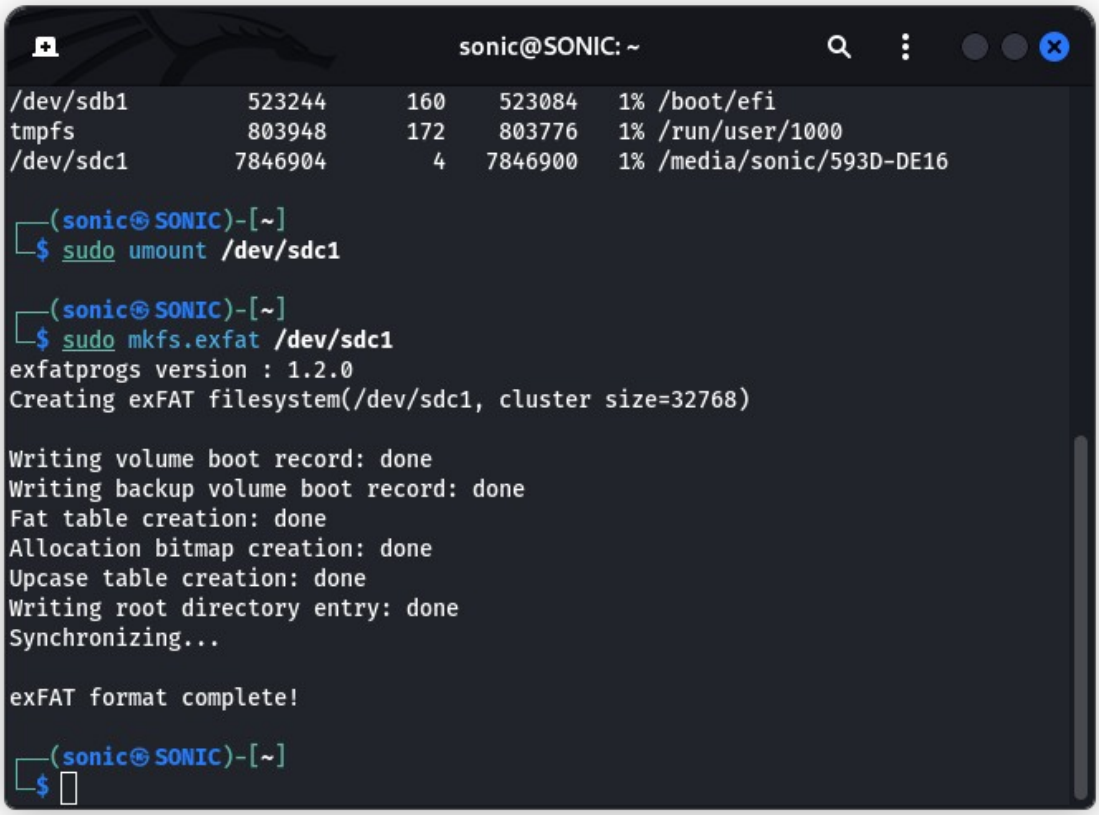

Figure 10: unmount and format to exfat

exFAT to EXT4:

I am using Linux Operating System so i will do in terminal. Lets go.

Step 1: Open Terminal.

Step 2: Insert pendrive / flash drive.

Step 3: Locate USB Drive using command “df” or “sudo df”.

Step 4: Unmount and format Usb drive using command “sudo unmount /dev/sdc1” and “sudo mkfs.ext4 /dev/sdc1”.

Step 5: Verify usb drive using command ”sudo fsck /dev/sdc1”.

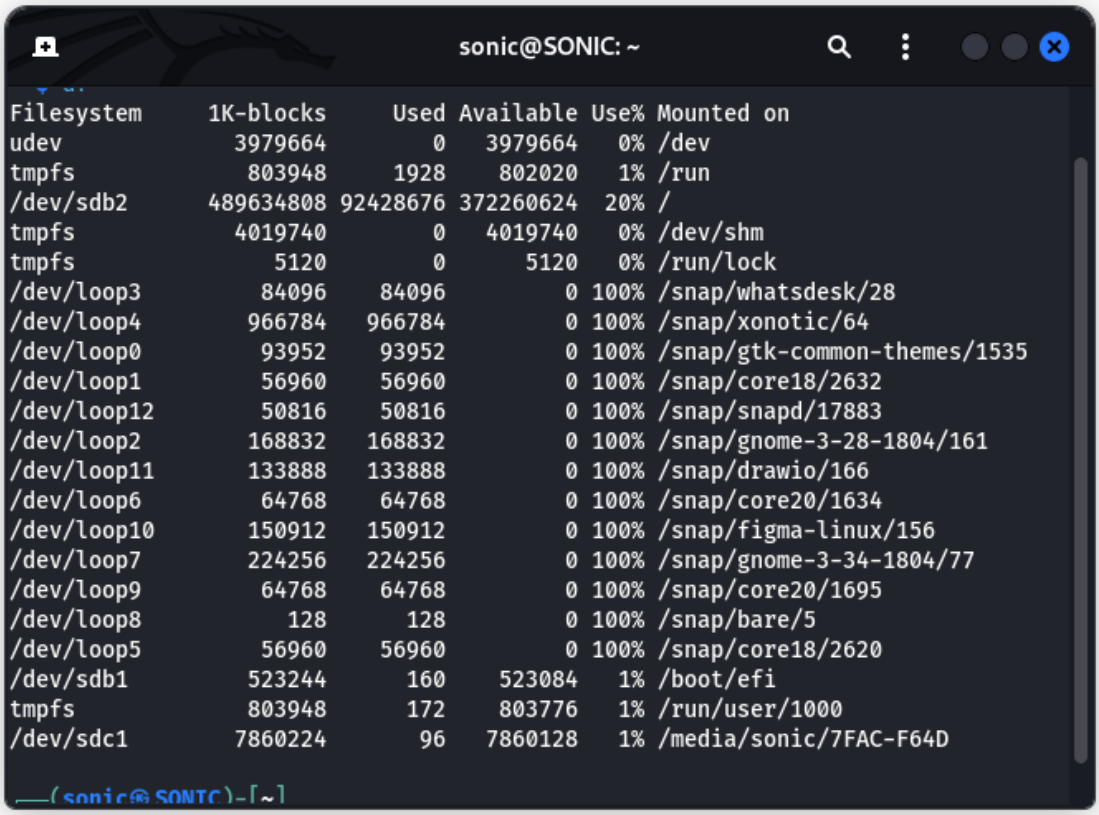

Figure 11: checking usb drive

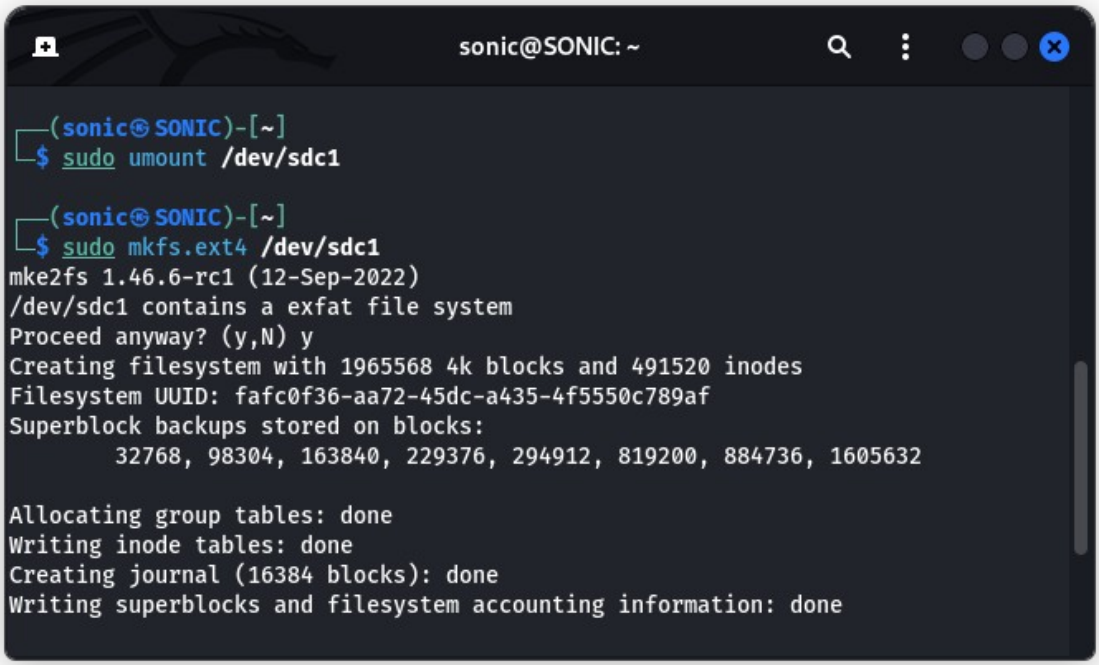

Figure 12: unmount and format to ext 4

Figure 13: verifying usb drive

9. CONCLUSION

From this report we can get knowledge about file system and we can know how to format drive to different file system. I am using linux operating system so i had used terminal to format the drive to different file system.

10. REFERENCES

1. https://www.techtarget.com/searchwindowsserver/definition/NTFS
2. https://www.sweetwater.com/sweetcare/articles/what-fat32/
3. https://www.minitool.com/lib/extended-file-allocation-table.html
4. https://opensource.com/article/17/5/introduction-ext4-filesystem
5. https://www.easeus.com/diskmanager/file-system.html