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Week 5 Assignment: FAT, NTFS, ext, HFS+, ZFS

Points to hit:

* OS system and use
* Capacity Limits
* Journaling
* Other

First, what is journaling? Journaling is a file system where activities/events of a computer are stored. Specifically, with a file system, a journal serves as a log of data manipulations to the hard drive. This then creates a log of the actions taken to alter the hard drive that can be utilized later on for security reasons, or simply to track these logs.

FAT:

* OS system and use: FAT is used by the OS for file management on hard drives or the actual computer system. Both Linux and Windows support FAT.
* Capacity Limits: FAT has a maximum file capacity of 65,536. This will differ on the number if clusters. The number of files decreases accordingly as the number of clusters, and therefore storage. FAT32 and FAT16 both are capable of reaching near that file maximum.
* Journaling: FAT is also fully capable of time stamping for its journals. It can track create time, create date, last date of access, write time, and write date.
* Other: It is widely used for external storage, such as USB sticks or memory cards. It has a root directory that is linked to the first cluster of each file, and then traverses down the line looking into each cluster. This system is supposed to decrease seeking times minimizing use of the hard disc.

NTFS:

* OS system and use: Used mostly for Windows, NTFS stores and organizes files for hard disks so that it can find and sort through files efficiently. It is also capable of file compression so that storage can increase for users. Mac OS can use this, but need a third party for support.
* Capacity Limits: NTFS has a similar cluster storage type, and storage amounts will depend on the cluster size. Default cluster size is 4kb, giving a max size of 16tb. The max size is quite large, with a cluster size of 2048kb giving 8pb. Max file length is 32,767 characters.
* Journaling: NTFS journaling is also similar to FAT, logging files added, modified, and deleted.
* Other: NTFS has great recovery abilities due to file log and checkpoints. It is able to remap these connections from a bad sector. It even monitors and corrects corruption issues actively. Like FAT, it also utilizes access to ACL permissions settings. NTFS even has a bitlocker drive encryption for increased security.

ext:

* OS system and use: Used for Linux systems, extFS aids in reading or writing HDD, SSD, and flash drives, much like the other FS programs so far. Can also use 3rd party applications to utilize on a different machine.
* Capacity Limits: I found that it has a max size of 16tb.
* Journaling: Like the others, ext is very good at organizing and compressing files to speed up drive access as well as reduce its size. It is also very good at tracking where a user is should a system crash occur. This prevents file system corruption.
* Other: Has an interface for ease of use for mounting, unmounting, verifying, and repairing drives. Easily integrated with typical Apple formatting for ease of use as well. Currently on its fourth version ext4. Helps with restoring after system crashes. One thing that seems very different with this language is that there are multiple versions, not just one version being updated (least that’s how it appears).

HSF+:

* OS system and use: Intended for Mac OS for hard disk formatting. Similar uses as the previous FS’s. Similar block structure to FAT and NTFS. Goal it to optimize hard disks by reducing file minimum sizes, as well as increasing the number of allocation blocks.
* Capacity Limits: Maximum number of files/folders is 2.1 billion, with a max size of almost 8eb on newer mac versions.
* Journaling: Very good for keeping files intact from disconnected devices or failed devices. It creates partitions so that should a fatal disconnection happen, HSF+ will be able to reboot using the logs and partitions created using the FS extension.
* Other: I found that FAT was able to be corrupted and users could lose data. This was something that HSF+ was able to do much more adequately. It appears to be stock for most Mac devices. HSF+ is a case-sensitive file system.

ZFS:

* OS system and use: Used for Linux and Windows.
* Capacity Limits: It is said, surprisingly, it has a max storage 256 QUADRILLION zettabytes of storage. Up 256 trillion files/folders.
* Journaling: ZFS has a lot going on. It serves the same purposes of journaling and keeping logs as the others, but it also has the checksum to back this data, has a cache, copy creating, and different reading/writing than typical FS. So yes, it does journal just like the others, but in a very different manner.
* Other: ZFS is very different from all the previous FS services. ZFS eliminates volume management, a weakness other FS use. Uses storage pools, allowing multiple devices to use one file system together. It has dynamically growing file system sizes. It also verifies data using things like checksum.

References:

Computer Hope. (2018, April 1). *What is a Journal?* https://www.computerhope.com/jargon/j/journal.htm

*FAT File System*. (2021). File System Component. https://www.keil.com/pack/doc/mw/FileSystem/html/fat\_fs.html

*HFS+ Overview - NTFS.com*. (2021). NTFS.Com. http://ntfs.com/hfs.htm

J. (2020, September 30). *NTFS overview*. Microsoft Docs. https://docs.microsoft.com/en-us/windows-server/storage/file-server/ntfs-overview#additional-information

*Maximum File Size - an overview | ScienceDirect Topics*. (2021). ScienceDirect. https://www.sciencedirect.com/topics/computer-science/maximum-file-size

Mesevage, T. G. (2021, March 16). *What Is NTFS and How Does It Work?* Datto. https://www.datto.com/blog/what-is-ntfs-and-how-does-it-work#:%7E:text=NT%20file%20system%20(NTFS)%2C,on%20a%20hard%20disk%20efficiently.&text=Performance%3A%20NTFS%20allows%20file%20compression,storage%20space%20on%20a%20disk.

van Beijnum, I. (2007, May 18). *Pick the right file system for your Mac’s internal or external storage*. Ars Technica. https://arstechnica.com/gadgets/2007/05/pick-the-right-file-system-for-your-macs-internal-or-external-storage/

*What is ZFS?* (2010). Oracle. https://docs.oracle.com/cd/E19253-01/819-5461/zfsover-2/

*Write/read access to Linux files under macOS High Sierra – extFS by Paragon Software for Mac*. (2021). Paragon Software Group. https://www.paragon-software.com/us/home/extfs-mac/