Section 2: Week 4: Network and Node File Systems

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# Network and Node File Systems

Different optimization objectives exist between remote and local file systems. These differences must account for the scenario’s specific needs and purposes. For instance, an embedded device might choose FAT32, because it doesn’t need the multi-user security overhead of NTFS. Or, Linux’s EXT4 is sufficient for a branch office file server but might be more challenging than Hadoop’s HDFS to manage large data sets.

# Compare Common File Systems

Table 1 enumerates the strengths and weaknesses of a collection of commonly used file systems. This table is by no means an exhaustive list of popular file systems.

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| --- | --- | --- | --- | --- |
| File System | Technical Features | Strengths | Limitations | Use Cases |
| FAT16 | Stores allocations in a single table | Easy to implement | Max size is 4GB | Legacy Systems and embedded devices |
| FAT32 | Increased the max sizes of FAT16. | Highly portable and supported across devices | Limited file system level security | Modern single user systems (e.g., smart devices) |
| NTFS | Added Access Control Lists, Compression, and Encryption | Defact-o standard across Windows products | Max size is 9.2EB Limited support outside on Unix | Any modern Windows client/server environment |
| NFS (Unix) | Remote mounted and treated as-if local storage | Lightweight protocol | Network latency can impact performance | Brach office file servers, small computer labs |
| AFP (Apple, 2019) | Remote mounted storage | Transparent to User | Portability, all operations are byte ordered | Mostly Mac OS.  Some MS-DOS |
| AFS (Apple, 2019) | Expands on HFS+ and exclude space in sparse files | Defact-o standard across Apple products | Case sensitive file names | Any modern Apple product (e.g., iOS) |
| HFS+ (Siracusa, 2011) | Free space shared between partitions on a volume. Added journaling support | Analogous to FAT32 improvements | Based on a 25 year old technology | Legacy Mac OS scenarios |
| ZFS (Oracle, 2010) | Virtualizes storage into storage pools | Removes the volume manager | Distributed technology | Server storage arrays with multiple volumes |
| Apple Xsan (Apple, 2004) | Remote Clustered Storage (Storage Area Network) | A cheap and performant mechanism to bring Enterprise concepts to smaller offices | 64 parallel consumers | Small to mid-sized business shared networking scenarios on Mac OS |
| VMFS | Virtualized device storage, a clustered storage abstraction for virtual machines | Sharable across multiple VMWare versions and concurrent users | VMWare Product specific | Businesses that centralized on VMWare Product line |
| APPN (IBM, 2010) | Maintain a list of SNA resources to reduce complex MPIO | Abstracts the notion of local and remote storage | Requires pairing with APPC | IBM Mainframes |
| APPC (IBM, 2010) | A protocol over APPN for abstracting communication with an entity | Facilitates the conversation of store/load over a network or local disk | Requires pairing with APPN | IBM Mainframes |

Table 1: File Systems