Filesystems

Sumner Evans and Sam Sartor

November 9, 2017

Mines Linux Users Group

Introduction

What are Filesystems?

- Filesystems manage the storage and retrieval of files from storage media.
- Filesystems are an abstraction layer between storage media (SSDs, HDDs, disk drives, even tape drives).
- Filesystems exist on *partitions*, physically contiguous segments of the disk.

Filesystems are Responsible for...

- **Space management:** filesystems allocate and manage space in discrete chunks. Filesystems must keep track of what data is stored at each chunk.
- **Filenames:** identify a storage location in the file system. Can be case sensitive (ext4) or case insensitive (HFS, NTFS).
- **Directories (folders):** group files into separate collections. Modern filesystems allow arbitrary nesting of directories.
- **Metadata:** filesystems store book-keeping information about their contents (e.g. file sizes, last accessed date, owner and permissions, etc.).
- **Access Control:** prevent unauthorized access to files on disk.
- **Data Integrity:** filesystems must be resilient to failure, some are better at this than others.

History of Filesystems

The filesystem was originally thought of as part of the operating system. One of the first filesystems that had a name was DECTape. DECTape stored an astoundingly small 184 kilobytes (kilo, not mega) of data per tape on the PDP-8.

Current Filesystems

Linux

Windows & mac

Flashdrives

Alternative Filesystems

Network Filesystems

What is a network filesystem?

You can access remote storage devices over the internet using a
network filesystem.

Virtual Filesystems

What is a virtual filesystem?

There is no reason why a filesystem needs to be backed by a real partition on a real storage device. The exist plenty of *virtual filesystems* that are purely procedural or abstract other kinds of devices.

- Filesystem in Userspace (FUSE) is an interface for creating filesystems without writing any kernel-level code
- Available in Linux, FreeBSD, OpenBSD, NetBSD, OpenSolaris, Minix 3, Android, and macOS
- Access through libfuse for C (bindings exist for Python, Rust, etc.)

- Implemented using FUSE
- Mount a directory on a remote system through SSH

# Configuration/maintenance

Questions?

References

- https://en.wikipedia.org/wiki/File_system
- http://www.tldp.org/LDP/sag/html/filesystems.html
- https://arstechnica.com/gadgets/2008/03/
  past-present-future-file-systems/2/

Copyright Notice

This presentation was from the **Mines Linux Users Group**. A mostly-complete archive of our presentations can be found online at `https://lug.mines.edu`.

Individual authors may have certain copyright or licensing restrictions on their presentations. Please be certain to contact the original author to obtain permission to reuse or distribute these slides.
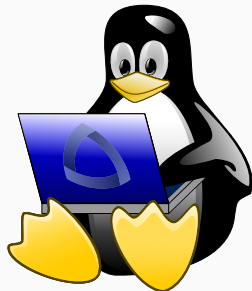
Colorado School of Mines
Linux Users Group