APPLIED SCIENCES FACULTY

APPS@UCU

Linux course

Linux File systems

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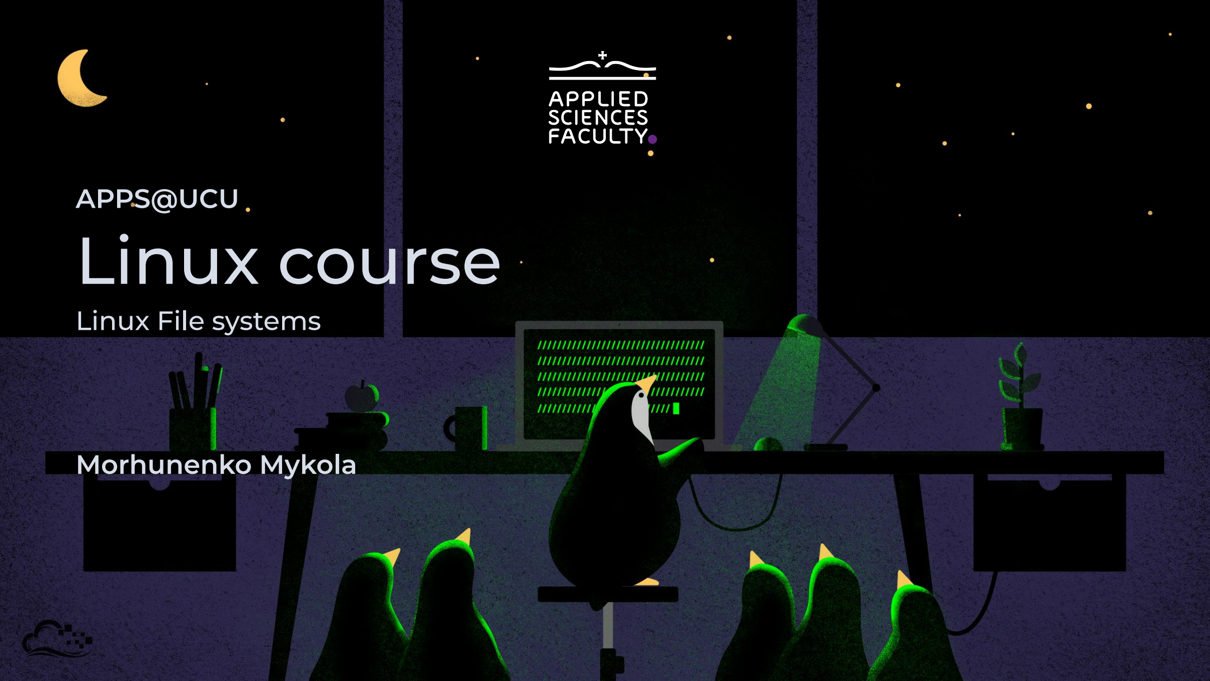

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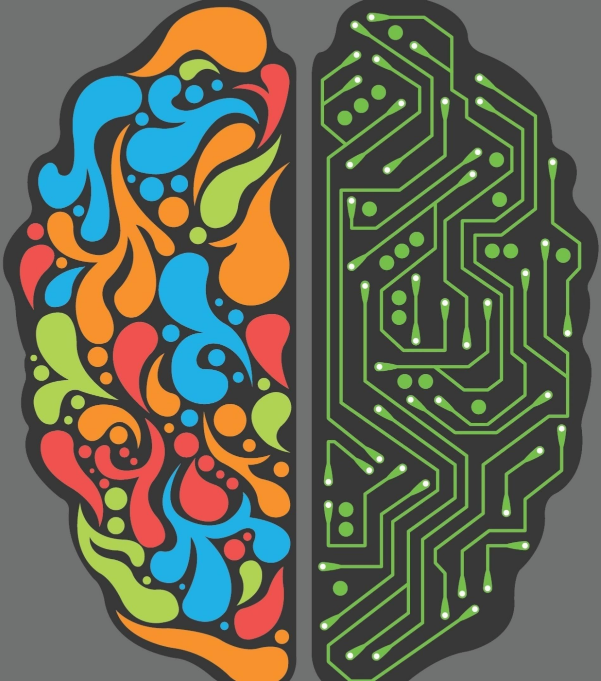
Intro

- This is not an overview of some hardware memory staff
- Neither a presentation with deep File systems implementation details
- More about that you should learn at the Operating systems course
- This is just an overview of file systems that system administrators use in their everyday life
- If you think that you are not a system administrator - think one more time, because you administrate your own system every day

Memory

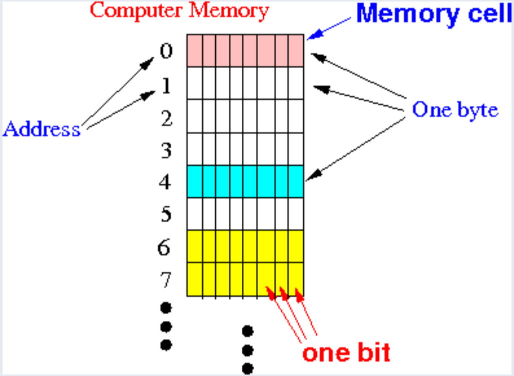


Drives

- All data stored on some physical devices
- It has different storage approaches on each device (HDD, SSD, CD, DVD, Flash, RAM, DDR memory modules)
- But now we are going to overview the memory from user point of view
- How to manage files and file systems, how to choose the most suitable

Memory storage

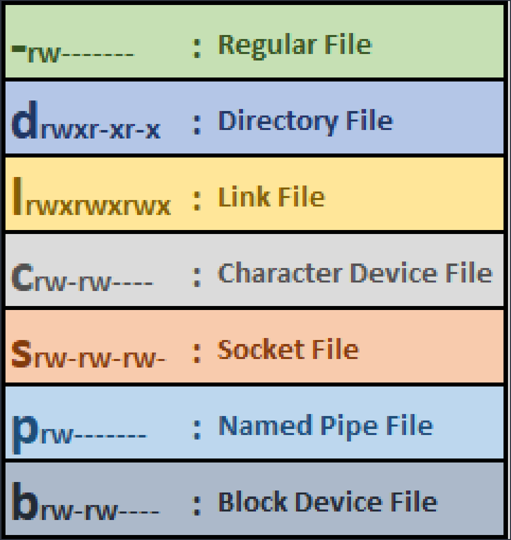
- Memory as abstraction looks like an array, where bites are stored one by one in a row
- File system - a method of data structure that the operating system uses to control how data is stored and retrieved
- A file is an ordered collection of data blocks
- In Linux system, everything is a file, and if it is not a file, it is a process
- So File systems are very important for this OS



Everything is a file

File types

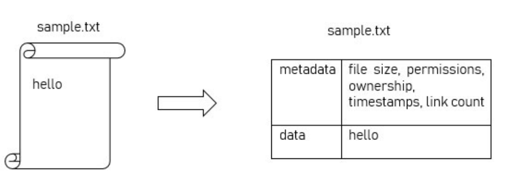
- There are a lot of file types, but the most important for us are:
- Regular Files - some files with data stored inside
- Directories - files, that allowed to group other files and keep tree filesystem structure
- Character files - for simulating character devices as terminals, keyboard, network etc
- Block files - for modelling block devices as disks, flash drives
- Links - entry points to other files
- There are pipes , sockets



-rw-------	:	Regular File
drwxr-xr-x	:	Directory File
lrwxrwxrwx	:	Link File
crw-rw----	:	Character Device File
srw-rw-rw-	:	Socket File
prw-------	:	Named Pipe File
brw-rw----	:	Block Device File

File metadata

- File also save a metadata about itself, as:
- Protection, password
- Creator, owner
- Flags (r w x)
- Size
- Creation time, last update time (timestamp)



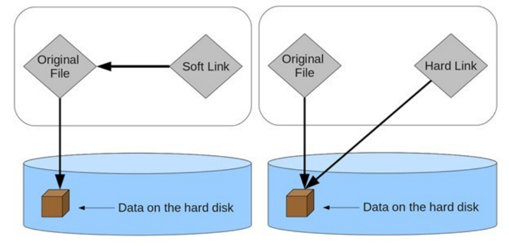
metadata	file size, permissions, ownership, timestamps, link count
data	hello

Inode

- The inode is data structure, that describes files on Unix-like OS's
- Each inode stores disk block location, some atributes, file's metadata
- Directory - just a file with list of inodes
- File's inode number can be found with ls -i command
- From the inode number, the kernel's file system driver can access the inode contents, including the location of the file, thereby allowing access to the file
- More about inodes in the Operating systems course

Links

- There are two types of links: symbolic (soft) and hard
- They are totally different types of file
- Maybe first few years you will not use
- But with experience it becomes more and more useful
- Here we will make only a brief overview and comparison



Hard vs Soft links

Hard links

- Exact replica of a file
- Share same inode with other hard links
- Can not be made across filesystems
- Changes in hl will reflect in other files
- Deleting of a hardlink wil not affect other files
- Can links to files only

Soft links

- Alias to a file
- Has another inode
- Can be established outside filesystem
- Link becomes inaccessible without original file
- Can links to both files and directories

Kunden-Rechnungen
2015
Kunden-Rechnungen
A – G
+
Gutachter-rechnung
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Kunden-Rechnungen
H – QU
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Kunden-Rechnungen
R - Z
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Lieferanten-Rechnungen
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Lieferanten-Rechnungen
M – Qu
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Lieferanten-Rechnungen
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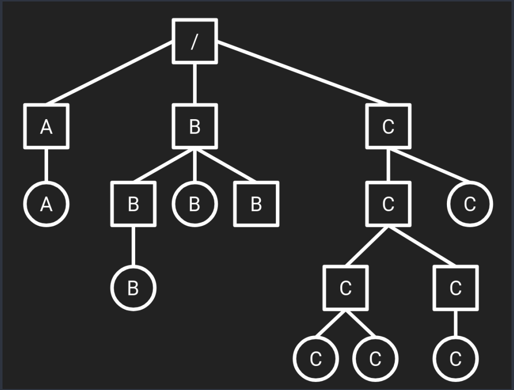
Fyle systems types overview

- There are several file systems types. Just for your information. the most important will be in orange colour
- Disk file systems for simple disks, a.e. FAT16/32, NTFS, ext2-4, brtfs etc
- Flash file systems - consider speciality of flesh memory devices
- Database file systems - another concept for file management
- Transactional file systems
- Network file systems - acts as a client for a remote file access protocol, providing access to files on a server, a.e. FTP
- Shared disk file systems - a number of machines (usually servers) all have access to the same external disk subsystem
- Flat file systems - no subdirectories, directory entries for all files are stored in a single directory

Fyle system abstraction

- We used to see a filesystem as a tree. It is really the most comfortable structure as for now
- There is a CLI tool to see your filesystem structure called tree
- Using such abstraction programmer works with files and directories, not with memory cells or some low level staff, but with files, directories and subdirectories



Working with file systems

Review of previous topics

- It’s part of presentation abot shell , but let’s make a brief overview
- Every proces has it’s own working directory.
- `pwdx $(pgrep process_name)` - show working directories for a process_name
- `pwd` - print working (current) directory
- `ls` - list what is instde the working directory
- `cd` - change directory
- `./` - spesial, current directory
- `../` - spesial, parrent directory (in a tree struct)
- `~/` - `$HOME` directory for current user
- `cp <from....> <to>` - copy
- `mv <from....> <to>` - rename (inside one fs, or move - from one to another fs)
- `mkdir` - make directory
- `touch <filename>` - update the last acces date (if no such file - create)
- `rm <filename>` - remove
- `cat` - show the file content

Devices

- Everything is a file , devices are not an exception
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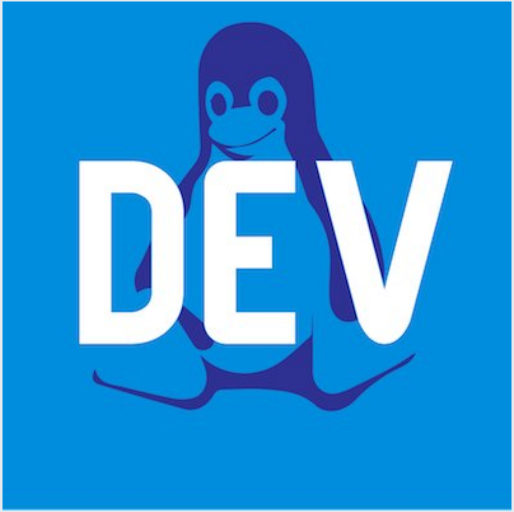
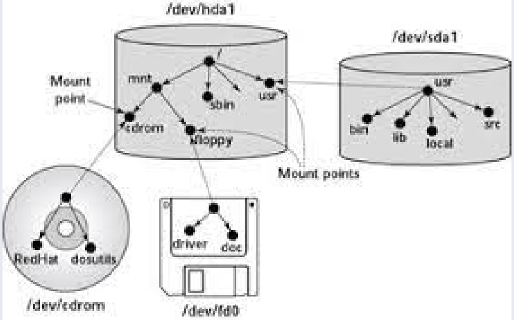


Mounting

- a


/dev/hda1
/
mnt
sbin
usr
cdrom
floppy
Mount point
/dev/sda1
usr
bin
lib
local
src
Mount points
RedHat
dosutils
/dev/cdrom
driver
doc
/dev/fd0

Something new about filesystems usage

- mkfs - make a file system on a device
- mount - mount device to some mountpoint

Linux Filesystems Hierarchy (LFS)

- This topic worth a separate lecture, but lets make it short
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Sources

Sources

- UCU Linux Club
- File systems Wiki
- Linux file systems
- Differences between hard and soft links on Unix systems
- Mounting and unmounting on Linux