Advanced Operating System with UNIX

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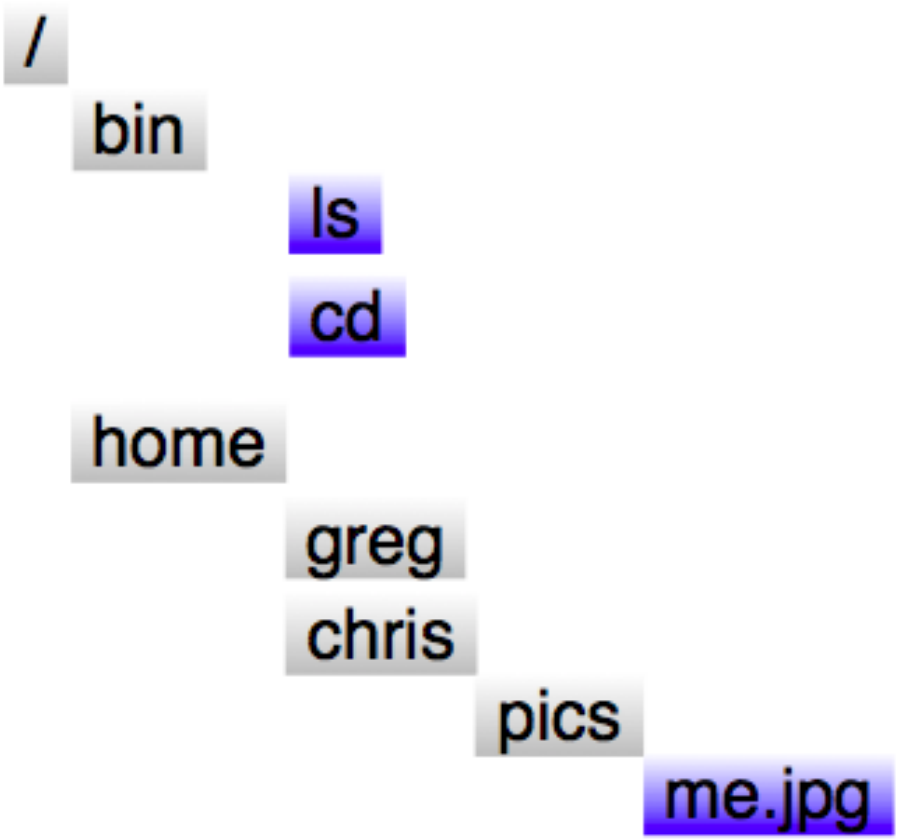
Introduction

- There are only directorys or files, thats it!
- everything is a file, wether it is
  - a command, textfile, archive, etc.
  - a resources, setting

In General

- The filesystem looks like a tree



In Detail

- The basic folder-hierachie should be

/	
bin	Essential command binarys
boot	Static files of the boot loader
dev	Device files
etc	Host-specific system configuration
lib	Essential share libraries and kernel
media	Mount point for removeable media
mnt	Mount point for mounting temporarily
opt	Add-on application software packages
sbin	Essential system binarys
srv	Data for serives provided by this system
tmp	Temporary files
var	Variable Data
usr	Secondary hierarchy
bin	
sbin	

File System Types 1

- The Filesystem-Type defines how to use (speak to) the physical device
- There are several ones out there
  - historical types
    - **s5** for the old SystemV OS
    - **msdos**,**pcfs** for old versions of DOS / Windows
  - to use windows-partitions
    - **fat16**,**fat32** the old Windows-Filesystem
    - **ntfs-3g** to support WindowsXP,Vista and 7

File System Types 2

- not that common
  - **ufs(2)** for FreeBSD
  - **bfs** boot file system for SystemV
- in broad use
  - **iso9660**,**hsfs** for cdroms
  - **proc**,**procfs** pseudo-FS in the memory to handle processes
  - **ext2**,**ext3** RedHat,debian-derivates
  - **xfs** SUSE
- upcomming
  - **ext4** due to long history of ext2,ext3
  - **zfs** pushed by sun, manage a consistant FS
  - **btfs** speak BetterFS, like ZFS but OpenSource

Swap? Whats that about?

- If the memory is fully loaded the OS could outsource some process data to the swap partition
- a drawer (swap) in your desk (RAM) instead of the cabinet (filesystem)
- when the OS uses the swap we say 'the machine is swapping'
- very bad, because its way slower then the normal RAM!

Fdisk,mkfs

- with fdisk you are able to create,alter and delete the partition-table
- new partitions could be set up with a filesystem by using mkfs

mount,umount

- if you want a device be part of your 'File-System'-tree?
- use `mount -t type device mountpoint` to do it
- if you want it to disapear use `umount device` or `umount mountpoint`

data errode to your fingertips

- power blackout
- 'my dog bites on my pen-drive'
- you name it!

it causes inconsistent states

- multiple inodes claimes the same disk block
- a free block is not listed in the superblocks
- a used block is marked free
- ...

soloution 'fsck'

- Phase 1 (simple stuff)
  - Validates the inodes for correctness (format, block numbers)
  - declares blocks BAD (number out of Range), DUP (claimed by another inode)
- Phase 2 (what files/directories are involved?)
  - Starting from root,
    searches for OUT OF RANGE inode numbers detected in P1
  - found one, than removes the 'dir' or 'file'

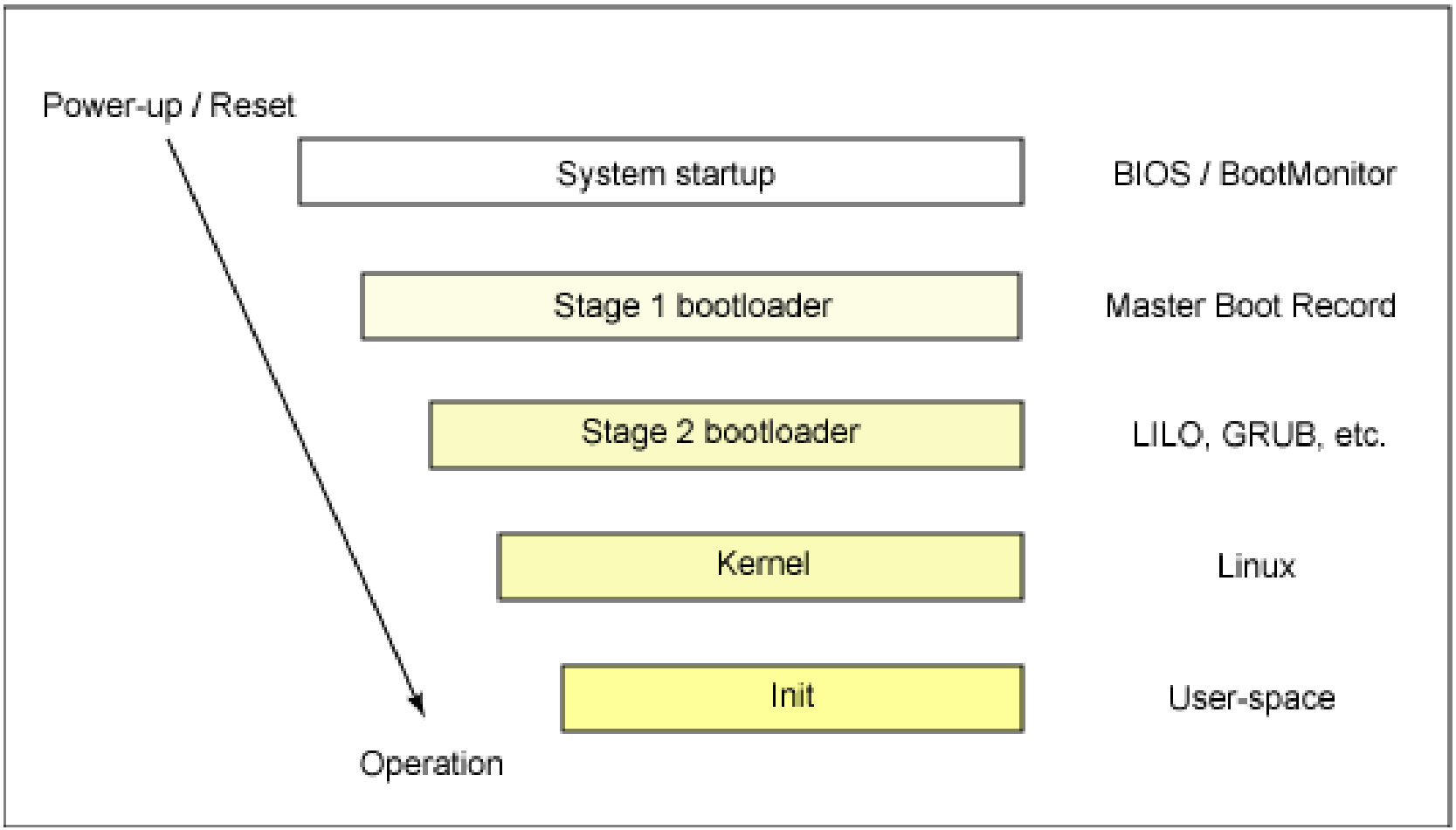
soloution 'fsck'

- Phase 3 (lost+founds)
  - Looking for unreferenced directories and stores their files in '$l + f$'
  - the files are named as the inode number
- Phase 4 (check counter)
  - compares link count information from Phases 2 & 3, correcting discrepancies

Get it on

- Hole process from pushing the button to have a login prompt
  - The memory-resident code
  - self-test
  - probes bus for boot device
  - Reading boot-sector from boot device
  - Boot-program reads kernel and initrd an passs control
  - Kernel identifies,initialise and configure the devices
  - Runs appropriate startup scripts (single- / multi-usermode)

Get it on


Power-up / Reset
System startup
BIOS / BootMonitor
Stage 1 bootloader
Master Boot Record
Stage 2 bootloader
LILO, GRUB, etc.
Kernel
Linux
Init
User-space
Operation

Startup-process

- The kernel ist kind of a puppetmaster who pulls the strings
- If he hadn‘t initialise a device, it will not be available

What comes up?

- To start the machine there are various processes that have to run
- the first process called 'swapper' it became PID 0 (but lives not long)
- the 2nd one is the init-Process (PID 1), which forks all the startup-scripts (init-scripts)
- on usual Unix-Systems the PID 2 is the first process created by the init-process and gets the PID 2

process table

UID	PID	PPID	C	STIME	TTY	TIME	CMD
root	1	0	0	Jul11	?	00:00:01	init [2]
root	2	0	0	Jul11	?	00:00:00	[kthreadd]
root	3	2	0	Jul11	?	00:00:00	[migration/0]
root	4	2	0	Jul11	?	00:31:45	[ksoftirqd/0]
root	1071	2	0	Jul11	?	00:00:00	[ata/1]
root	1072	2	0	Jul11	?	00:00:00	[ata/2]
root	1500	1	0	Jul11	?	00:00:02	udevd --daemon
root	2297	2	0	Jul11	?	00:00:00	[kpsmoused]
root	2302	2	0	Jul11	?	00:00:00	[hd-audio0]
root	2552	2	0	Jul11	?	00:00:00	[kjournald]
daemon	2666	1	0	Jul11	?	00:00:00	/sbin/portmap

As we are speaking of it...

- the init-process (PID 1) are able to start scripts in various ways
- inittab (like in the SMU-book)
- Entry looks like `1:2345:respawn:/sbin/getty 38400 tty1`
- The entrys are `id:runlevels:action:command`

id	Identifier
runlevel	in which runlevels the command should be started
action	what action should be taken for this command, maybe:
commands	specifies the shell command to be run

add Users

- if you simply want to add a user you user `useradd USERNAME`
  The User will be created without any further Questions.
  Parameters like `-G,-g,-s` are possible to add more information
- if you want to be guided you should use `adduser USERNAME`
  You will be asked about the Username and some other Information
- To alter user information you use `usermod USERNAME`
- `userdel USERNAME` deletes the user (-r wipes the home too)

Groups

- same as for users (`groupadd` , `groupdel` , `groupmod`)
- the information are stored in `/etc/groups`

/etc/passwd

- As we said earlier, all settings are stored in files
- So do usersetings:

`root` : `S3ah8kaR` : `0` : `0` : `System Administrator` : `/var/root` : `/bin/sh`

name — crypt. PW — uid — gid — description — home-dir — command/shell

`kniep` : `...` : `1000` : `1000` : `Christian Kniep,,,` : `/home/kniep` : `/bin/bash`

uid > 999 — gid > 999 — GECO-String

- Some User-ID explanation :
  - From start there where 15bit UID ($2^{15} = 32768$)
  - modern systems may provide more (now up to 64)

id=0	tied to the root-User
id<100	reserved for system-user
id<1000	reserved for users which are running services
id>999	normal useraccounts
id=32767	traditionally the user nobody (opposite to root)

you shoud now

- since everything is a file you shoud backup the whole filesystem, so you will be well prepared for malfunction
- there are a couple of ways to do that:

dump according to the book you could use dump, this will copy blockwise on e.g. a tape

tar tar is the right choice to zip files/directorys

dd with (one name-legend said) DiskDump you could copy a data stream. This could be a harddisk, or a file, 'you name it!'. The beauty of it is the simplicity and the power.
You could cut byte out, count it, whatever you want.

additional stuff

split do you want to split a large file in many smaller ones?

- `split -a 1 -l 50 test.txt c`
  This will split the test.txt in files ca,cb,cc,.. containing 50 lines
- `split -a 1 -b 50 m test.img d`
  This will split the test.img in files da,db,dc,.. containing 50MB

cat to bring them back together you use:

```
cat c* > test.txt
cat d* > test.img
```