openSUSE MicroOS Design

A functional read-only OS
in an imperfect world

Ignaz Forster

✉ iforster@suse.com

Topics

- OS Design

- Update And Rollback Mechanisms

- Configuration File Management

- Full Disk Encryption / Trusted Boot

openSUSE Distributions

Tumbleweed

Rolling Release distribution

Leap

Stable distribution
based on SUSE Linux Enterprise

MicroOS

Leap Micro

Ingredients

- RPM packages

- Btrfs
  - Snapshots!
  - Copy-on-write
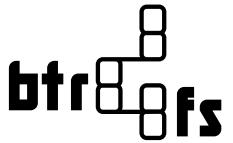
So what's the difference?

- **Read-only** root file system

- "Minimal" package selection

- "Single purpose system", e.g. for
  - Running containers
  - Any other dedicated workload

- Self-maintaining system

Updates

1.

- Btrfs Snapshots of root ('/') file system
- One of them is the default snapshot, running the active system

2.
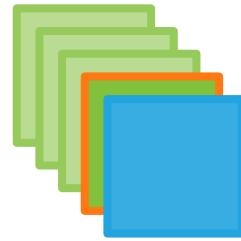
- Create new snapshot
- Perform anything in there (e.g. update the system)

3.
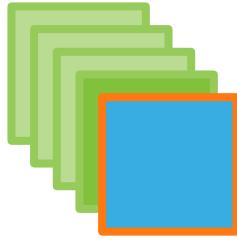
- If everything was successful mark new snapshot as default snapshot
- On errors, just discard snapshot – back to square one

transactional-update / tukit

- **transactional-update** (*SUSE specific wrapper script, e.g. calling *zypper* for package management)

- **libtukit** (platform-agnostic library for updating image-based systems, including C, C++ & D-Bus bindings)

https://github.com/openSUSE/transactional-update

Snapshot activation

- **Reboot** to activate new snapshot

- **New** in transactional-update 4.2.0:
  `transactional-update apply`

  - Live apply the new snapshot!

  - Made possible by moving all read-only parts `/usr`

Rollback

- If it doesn't work: Just set the previous snapshot as default

- health-checker for checking system state and automatic rollbacks if system doesn't boot as expected

https://github.com/openSUSE/health-checker

/etc overlays

```
overlay /etc overlay defaults,
upperdir=/sysroot/var/lib/overlay/1069/etc,
lowerdir=/sysroot/var/lib/overlay/1068/etc:/sysroot/etc,
workdir=/sysroot/var/lib/overlay/1069/work-etc,
x-systemd.requires-mounts-for=/var,
x-systemd.requires-mounts-for=/var/lib/overlay,
x-systemd.requires-mounts-for=/sysroot/var,
x-systemd.requires-mounts-for=/sysroot/var/lib/overlay,
x-initrd.mount 0 0
```

Layer transparency

upperdir (/var/lib/overlay/x/etc)
         | file2 | file3 | file4 | |

lowerdir1 (/var/lib/overlay/x-1/etc)
         | | file3 | | file5 | file6

lowerdir2 (/etc of snapshot x-2)
 file1 | file2 | file3 | | | file6

possible
conflict

Move system config out of /etc!

- Default **system** configuration in /usr

- Only **admin** changes in /etc

- Most MicroOS default packages are migrated

https://github.com/openSUSE/libeconf

Full Disk Encryption / Secure Boot
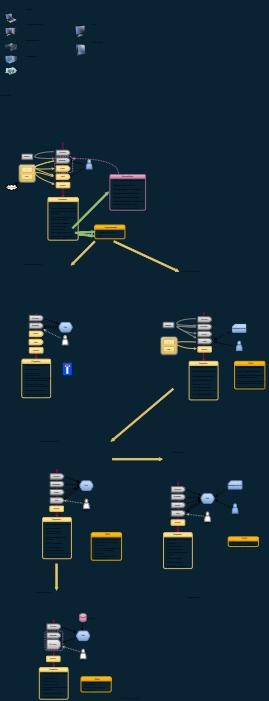
openSUSE MicroOS

A functional read-only OS
in an imperfect world

https://microos.opensuse.org/