An User & Developer Perspective on Immutable OSes

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About ~~Me~~ What I do

- Virtualization Specialist Sw. Eng. @ SUSE since 2018, working on Xen, KVM, QEMU, mostly about performance related stuff
- Daily activities ⇒ how and what for I use my workstation
  - Read and send emails (Evolution, git-send-email, stg mail, ...)
  - Write, build & test code (Xen, KVM, Libvirt, QEMU)
  - Work with the Open Build Service (OBS)
  - Browse Web
  - Test OSes in VMs
  - Meetings / Video calls / Online conferences
  - Chat, work and personal
  - Some 3D Printing
  - Occasionally play games
  - Occasional video-editing
  - Maybe scan / print some document
- Can all of the above be done with an immutable OS ?

Immutable OS: What ?

Either:

- An OS that you cannot modify

Or, at least:

- An OS that you will have an hard time modifying

What do you mean “modify” ?

- E.g., installing packages
- ⇒ An OS on which you cannot install packages
- ⇒ An OS on which you will have an hard time installing packages

Immutable OS: What ?

Seriously?

```
dario@Wayrath:~> cat /etc/os-release | grep ID
ID="opensuse-microos"
ID_LIKE="suse opensuse opensuse-tumbleweed"
VERSION_ID="20210104"
dario@Wayrath:~> sudo zypper install git-core
This is a transactional-server, please use transactional-update to update or modify the system.
dario@Wayrath:~>
```

```
[dario@localhost ~]$ cat /etc/os-release | grep ID
ID=fedora
VERSION_ID=33
PLATFORM_ID="platform:f33"
VARIANT_ID=silverblue
[dario@localhost ~]$ dnf install git-core
bash: dnf: command not found
[dario@localhost ~]$
```

Immutable OS: Why ?

Because it will stay clean and hard to break

- Does this sound familiar?
  - Let's install `foo`, and it's dependency, `libfoobar_1`
  - Let's install `bar` (depends from `libfoobar_1`, we have it already)
  - Actually, let's add an external repo. It has `libfoobar_2` that makes *foo* work better!
  - Oh no... `libfoobar_2` would break `bar`!!
- Yeah. It happens. Even in the best ~~families~~ distros :-)
- Well, the fewer the packages ...
  ... the less likely this is to happen
- How about: only the base OS + the Desktop Environment

Immutable OS: Why ?

Decoupling OS and Apps

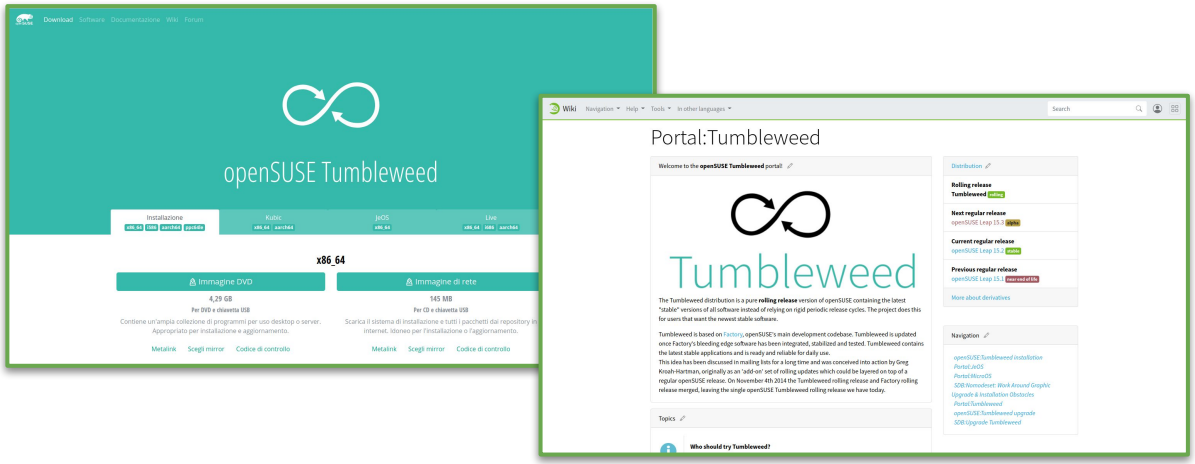
- Base OS + the Desktop Environment
  - Comes form “system packages” (RPMs, DEBs, ...):
    - E.g., on GNOME: no further than gnome-shell
  - Packaging these would be the main focus for distro developers
  - No apps!

- Apps?
  - Cross-distro application distribution solution

Mutable or Immutable ?
Tumbleweed + OpenQA

Tumbleweed == openSUSE's pure rolling distro

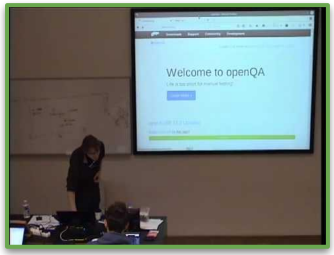
- A new snapshot (~= release) multiple times a week
  - https://software.opensuse.org/distributions/tumblewed
  - https://en.opensuse.org/Portal:Tumbleweed
- Nevertheless, we want it stable and reliable



Mutable or Immutable ?
Tumbleweed + OpenQA

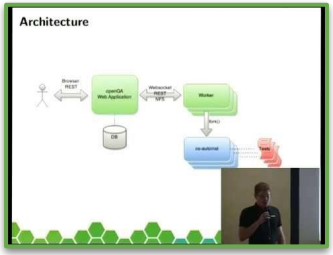
OpenQA == OS Testing “The way they’re userd”

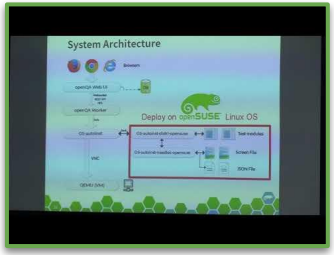
- ~~Passive Testing~~ Active Testing
- ~~Quality Control~~ Quality Assurance

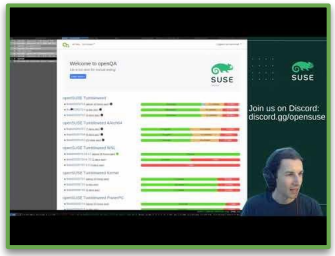


Some cool materials:

- http://open.qa/docs/

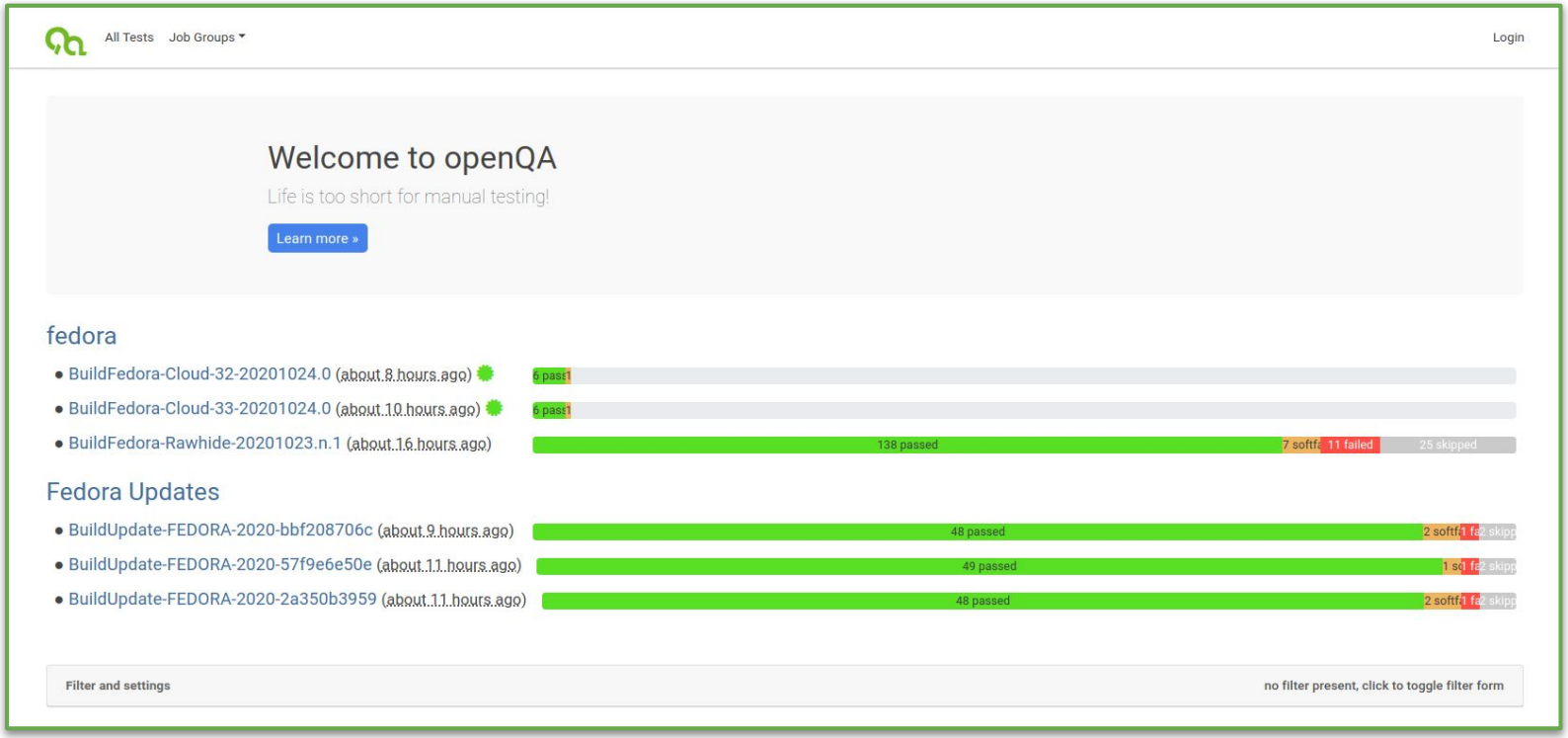






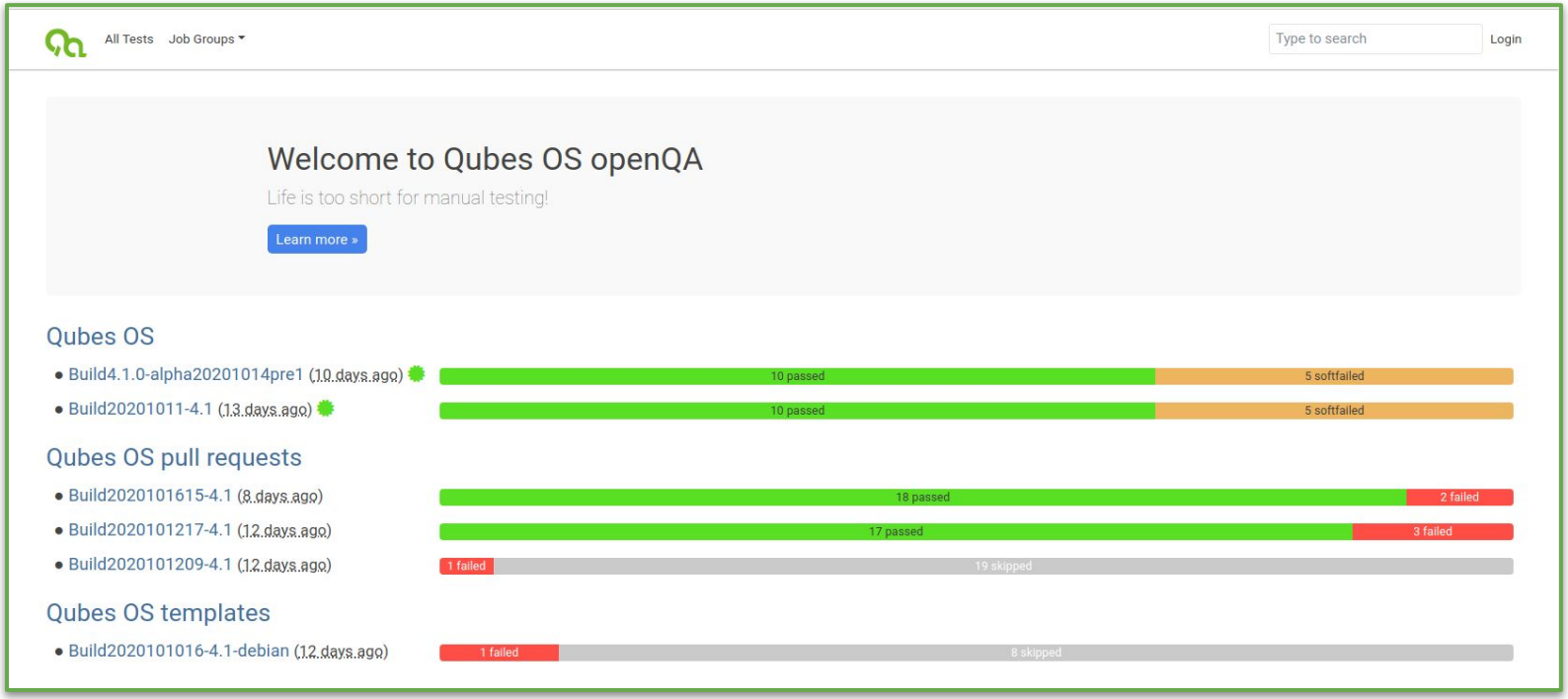
OpenQA @ Fedora Project

How_Fedora_uses_openQA



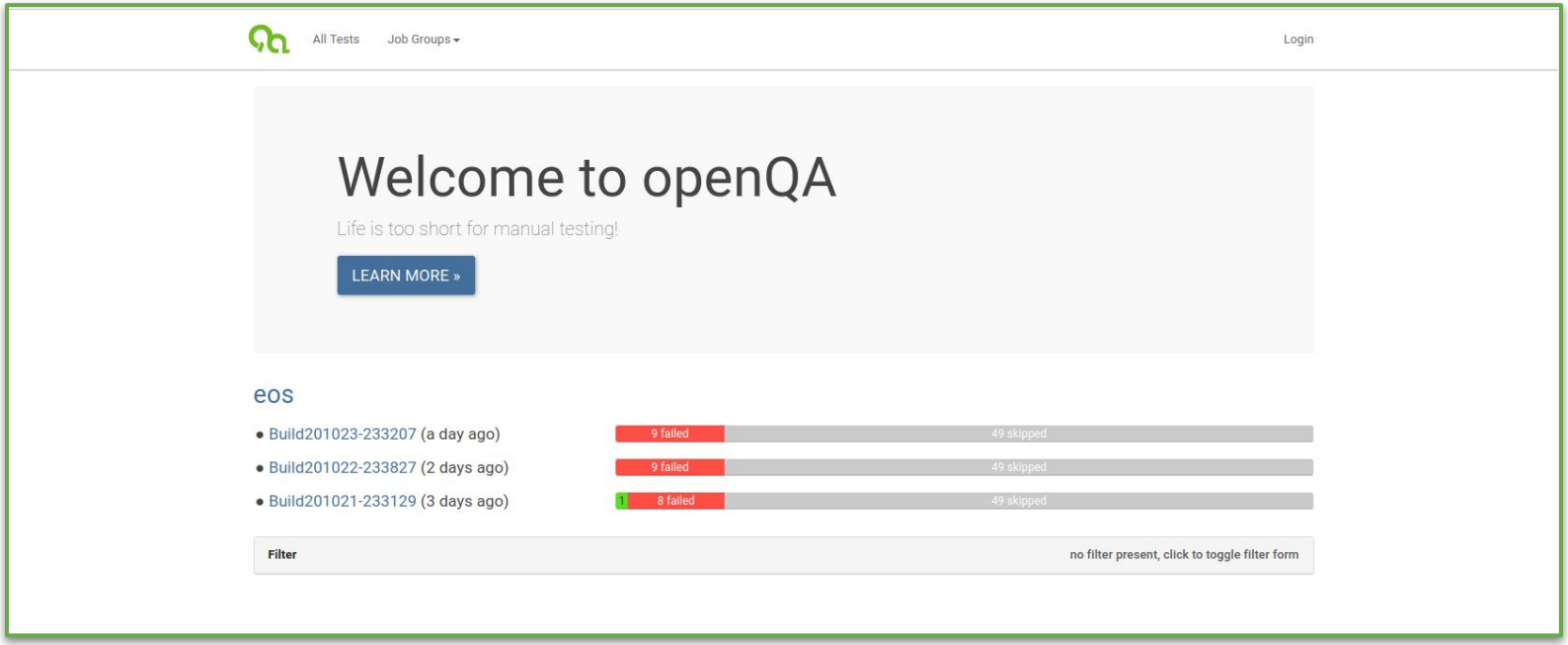
OpenQA @ QubesOS

https://openqa.qubes-os.org/

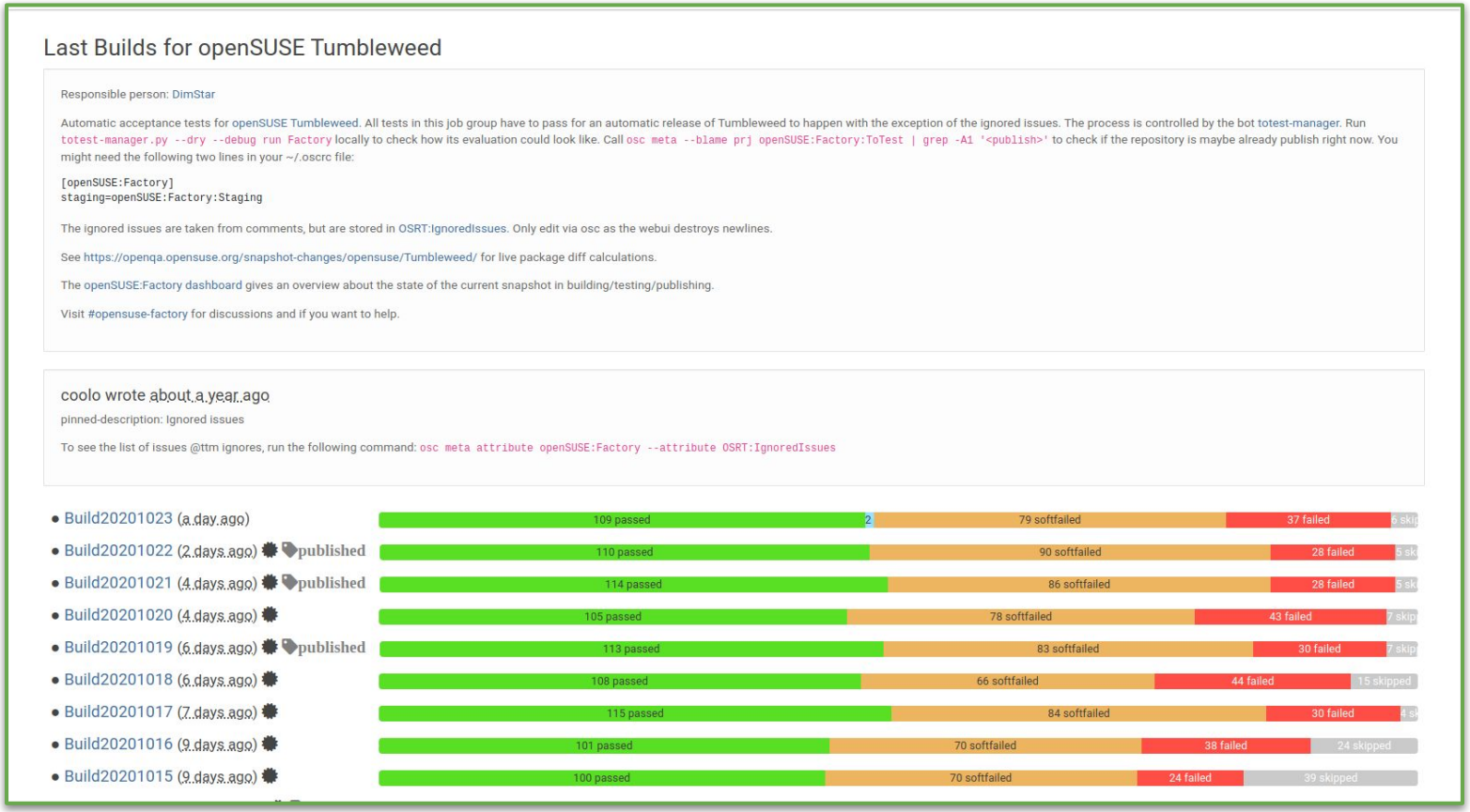


OpenQA @ EndlessOS

https://openqa.endlessm.com/



OpenQA @ openSUSE (Tumbleweed)



Last Builds for openSUSE Tumbleweed

Responsible person: DimStar

Automatic acceptance tests for openSUSE Tumbleweed. All tests in this job group have to pass for an automatic release of Tumbleweed to happen with the exception of the ignored issues. The process is controlled by the bot totest-manager. Run `totest-manager.py --dry --debug run Factory` locally to check how its evaluation could look like. Call `osc meta --blame prj openSUSE:Factory:ToTest | grep -A1 '<publish>'` to check if the repository is maybe already publish right now. You might need the following two lines in your ~/.oscrc file:

```
[openSUSE:Factory]
staging=openSUSE:Factory:Staging
```

The ignored issues are taken from comments, but are stored in OSRT:IgnoredIssues. Only edit via osc as the webui destroys newlines.

See https://openqa.opensuse.org/snapshot-changes/opensuse/Tumbleweed/ for live package diff calculations.

The openSUSE:Factory dashboard gives an overview about the state of the current snapshot in building/testing/publishing.

Visit #opensuse-factory for discussions and if you want to help.

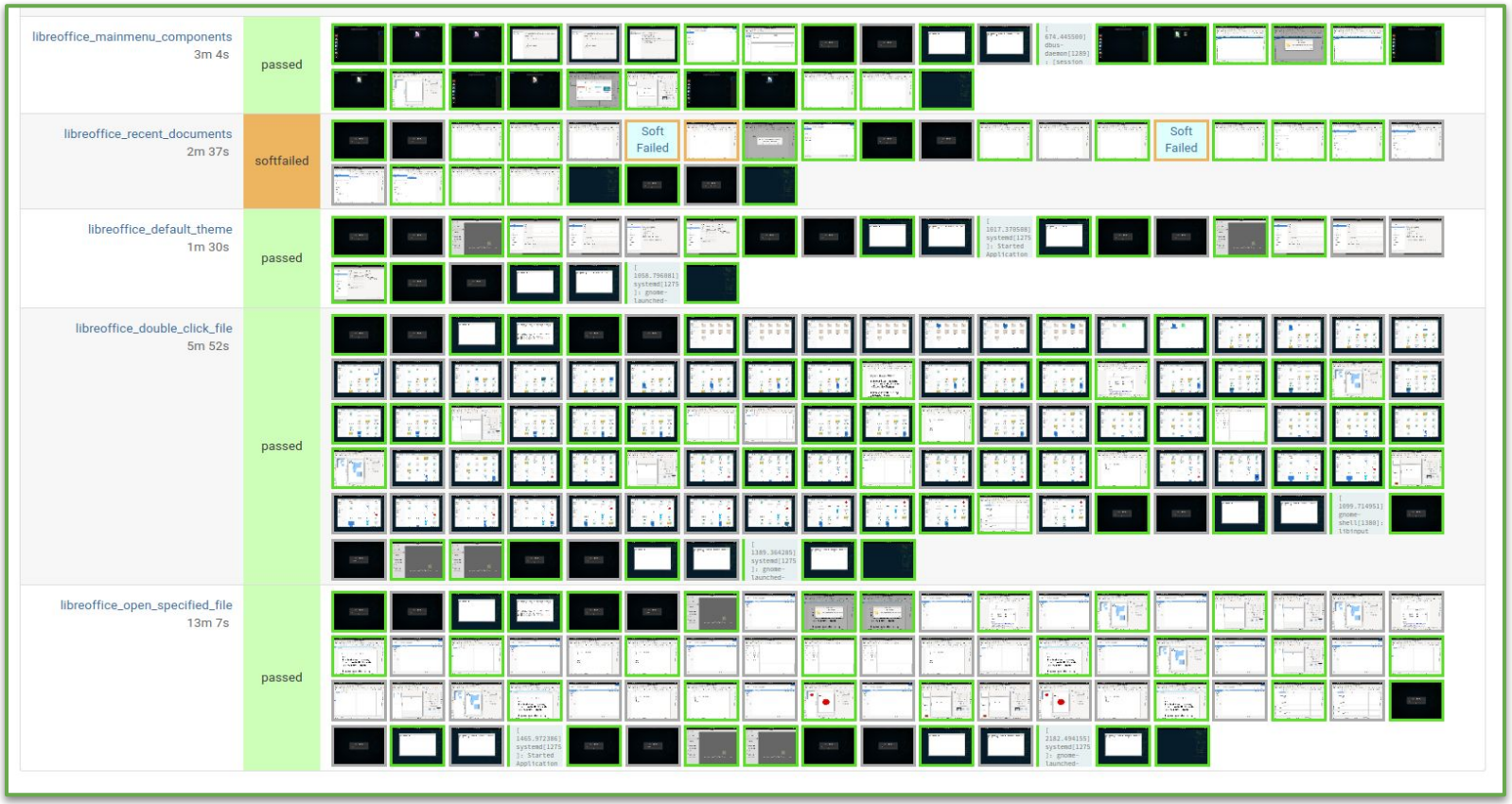
coolo wrote about a year ago

pinned-description: Ignored issues

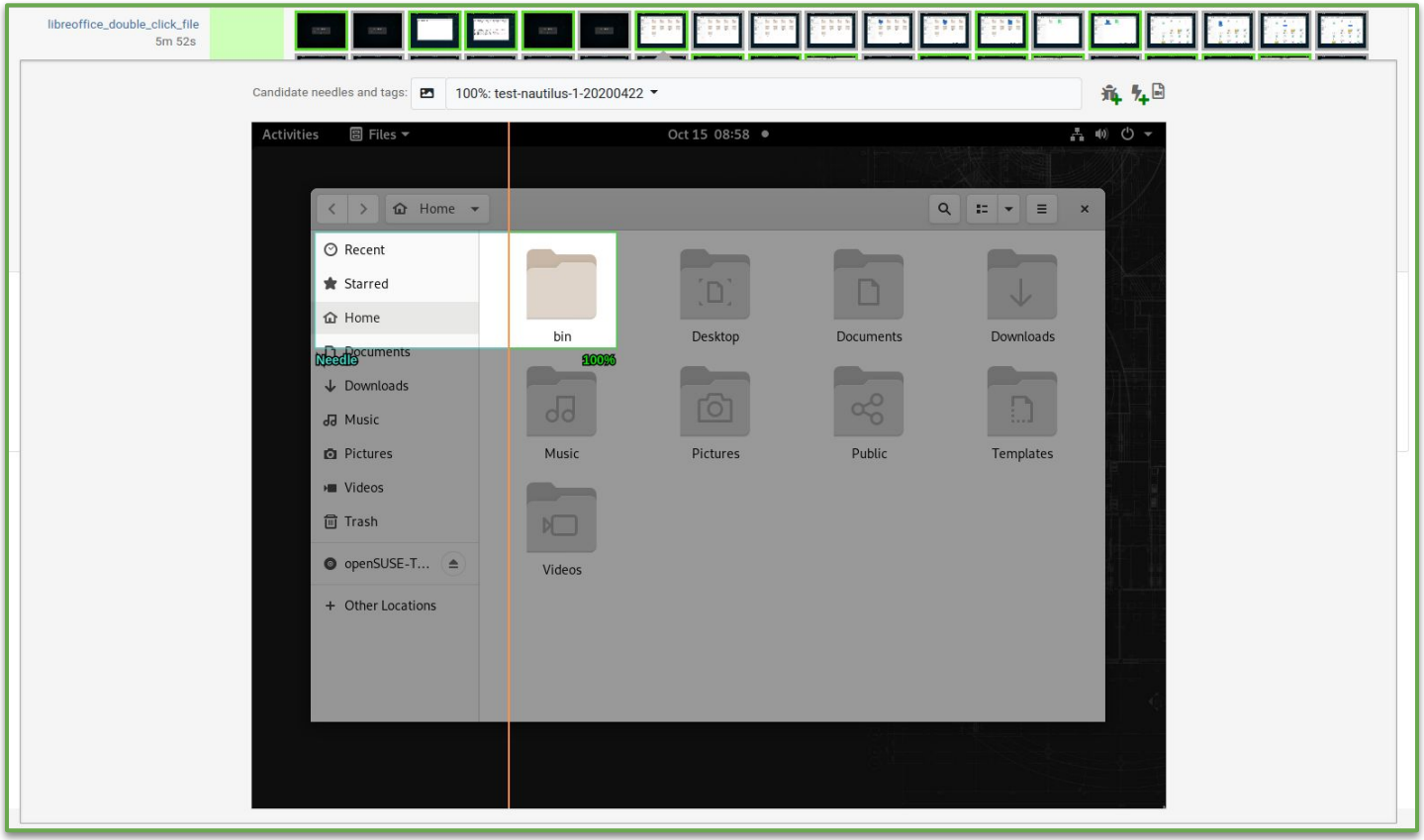
To see the list of issues @ttm ignores, run the following command: `osc meta attribute openSUSE:Factory --attribute OSRT:IgnoredIssues`

Build20201023 (a day ago)	109 passed	2	79 softfailed	37 failed
Build20201022 (2 days ago) published	110 passed		90 softfailed	28 failed
Build20201021 (4 days ago) published	114 passed		86 softfailed	28 failed
Build20201020 (4 days ago)	105 passed		78 softfailed	43 failed
Build20201019 (6 days ago) published	113 passed		83 softfailed	30 failed
Build20201018 (6 days ago)	108 passed		66 softfailed	44 failed
Build20201017 (7 days ago)	115 passed		84 softfailed	30 failed
Build20201016 (9 days ago)	101 passed		70 softfailed	38 failed
Build20201015 (9 days ago)	100 passed		70 softfailed	24 failed

OpenQA: How It Works



OpenQA Can Test DEs and GUI Apps!



Mutable or Immutable ?
Tumbleweed + OpenQA

Tumbleweed is rock solid, thanks to OpenQA:

- We test the OS, we test the DE(s), we test the main apps
- We release only when (enough) green

But:

- We cannot test all the apps **you** use
- As soon as adding an additional repository, you may be out of tested territory!

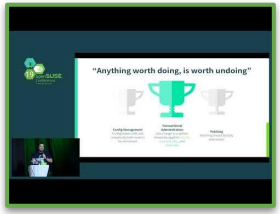
So, to be 100% safe:

- You should not use RPMs of apps we don't test
- You should not use external repositories (not even Packman / RPMFusion for CODECs, etc)

⇒ An Immutable OS gives you just that!

Immutable: Which ? openSUSE MicroOS

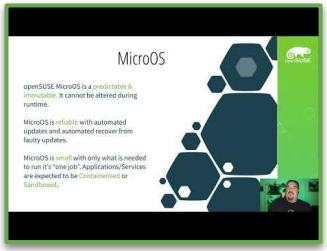
- Immutable single purpose OS, based on Tumbleweed
  - https://microos.opensuse.org/
  - https://en.opensuse.org/Portal:MicroOS
- Based on Tumbleweed ⇒ It's rolling
- Automatically (atomically) updates and reboot itself
- If update went wrong, automatically rollback to a working state
- Each install does only one thing:
  - One thing == Hosting containers (originally born for this)
  - One thing == Managing a K8S Cluster (Hey, that's Kubic!)
  - One thing == Hosting VMs
  - One thing == Set Top Box

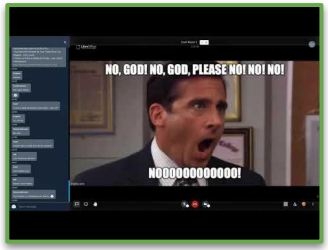


Immutable: Which ? openSUSE MicroOS

One thing == Your Desktop / Workstation

- Still early stage ~= ALPHA state
  - But usable already
  - It’s actually what I’m using since a few months
- Growing community of users
- Small community of developers
  - We need your help! :-)





Stay in this very Devroom, for more, from Richard (at 14:45)

- openSUSE MicroOS, a platform for everything from containers, to IoT, and even the desktop

Immutable: Which Others ?

- Fedora Silverblue

https://silverblue.fedoraproject.org/

“[...] unlike other operating systems, Silverblue is immutable. [...] Silverblue’s immutable design is intended to make it more stable, less prone to bugs, and easier to test and develop.”

- EndlessOS

https://endlessos.com/

“Endless is designed to feel natural and intuitive, making it easy to use even if you have little or no computer experience.”

Immutable OS: How ?

Filesystems are read-only

- Silverblue & EndlessOS
  - Sort of: only `/usr` is + some OSTree's "magic"

```
[dario@localhost ~]$ mount | grep 'boot\|luks'
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /sysroot type btrfs (rw,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on / type btrfs (rw,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /usr type btrfs (ro,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /var type btrfs (rw,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /var/home type btrfs (rw,relatime,seclabel,space_cache,subvolid=256,subvol=/home)
/dev/vda1 on /boot type ext4 (rw,relatime,seclabel)
[dario@localhost ~]$
```

```
dario@endless:~$ mount | grep vda
/dev/vda2 on /sysroot type ext4 (rw,relatime,errors=remount-ro)
/dev/vda2 on / type ext4 (rw,relatime,errors=remount-ro)
/dev/vda2 on /boot type ext4 (rw,relatime,errors=remount-ro)
/dev/vda2 on /usr type ext4 (ro,relatime,errors=remount-ro)
/dev/vda2 on /var type ext4 (rw,relatime,errors=remount-ro)
dario@endless:~$
```

Immutable OS: How ?

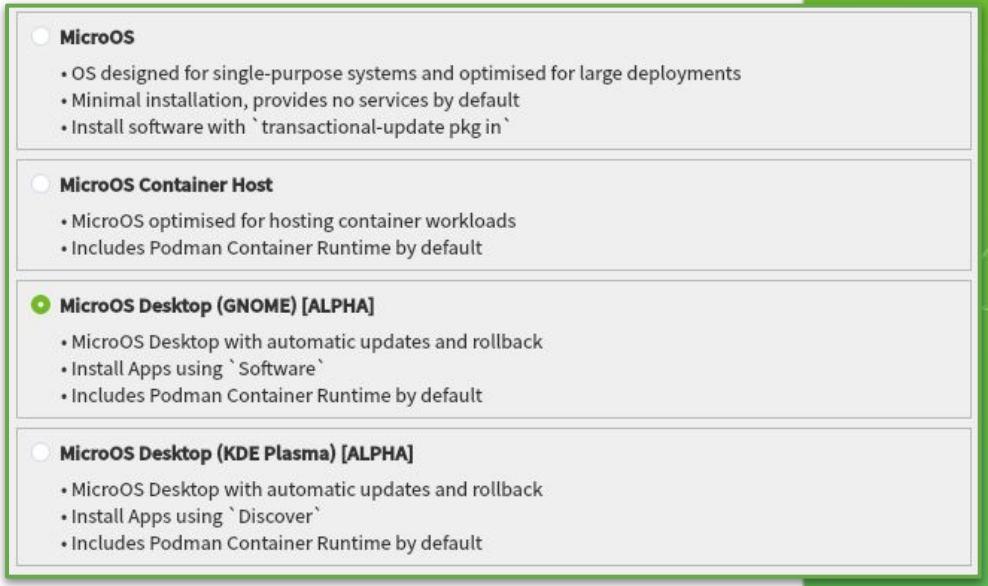
Filesystems are read-only

- MicroOS
  - Yes, all `/` is + we even have `ro` subvolume property

```
dario@localhost:~> mount | grep cr_root
/dev/mapper/cr_root on / type btrfs (ro,relatime,space_cache,subvolid=279,subvol=/@/.snapshots/6/snapshot)
/dev/mapper/cr_root on /root type btrfs (rw,relatime,space_cache,subvolid=261,subvol=/@/root)
/dev/mapper/cr_root on /var type btrfs (rw,relatime,space_cache,subvolid=258,subvol=/@/var)
/dev/mapper/cr_root on /.snapshots type btrfs (rw,relatime,space_cache,subvolid=267,subvol=/@/.snapshots)
/dev/mapper/cr_root on /home type btrfs (rw,relatime,space_cache,subvolid=263,subvol=/@/home)
/dev/mapper/cr_root on /srv type btrfs (rw,relatime,space_cache,subvolid=260,subvol=/@/srv)
/dev/mapper/cr_root on /boot/grub2/x86_64-efi type btrfs (rw,relatime,space_cache,subvolid=265,subvol=/@/boot/grub2/x86_64-efi)
/dev/mapper/cr_root on /boot/writable type btrfs (rw,relatime,space_cache,subvolid=264,subvol=/@/boot/writable)
/dev/mapper/cr_root on /boot/grub2/i386-pc type btrfs (rw,relatime,space_cache,subvolid=266,subvol=/@/boot/grub2/i386-pc)
/dev/mapper/cr_root on /usr/local type btrfs (rw,relatime,space_cache,subvolid=259,subvol=/@/usr/local)
/dev/mapper/cr_root on /opt type btrfs (rw,relatime,space_cache,subvolid=262,subvol=/@/opt)
dario@localhost:~> sudo btrfs property list /
ro                  read-only status of a subvolume
label               label of the filesystem
compression         compression algorithm for the file or directory
dario@localhost:~>
```

Installation

- Silverblue
  - Grab the image here and install
- EndlessOS
  - Grab the image here and install
- Grab the image here and install
  - Choose one of the “MicroOS Desktop [ALPHA]” flavors



Installation With Encrypted Disk

A must have, e.g., for laptops

- Silverblue
  - Works just out of the box
  - `/boot` is not encrypted
  - Asks the password once (during boot)
- EndlessOS
  - Didn’t check ;-P
- MicroOS
  - Works just out of the box
  - Everything is encrypted, including `/boot`
  - Asks the password twice
    - But, can be fixed: Avoiding typing the passphrase twice

Filesystem & Filesystem Layout

EndlessOS

- Typical layout of an OSTree managed system
- Filesystem is ext4, by default

```
dario@endless:~$ mount | grep vda
/dev/vda2 on /sysroot type ext4 (rw,relatime,errors=remount-ro)
/dev/vda2 on / type ext4 (rw,relatime,errors=remount-ro)
/dev/vda2 on /boot type ext4 (rw,relatime,errors=remount-ro)
/dev/vda2 on /usr type ext4 (ro,relatime,errors=remount-ro)
/dev/vda2 on /var type ext4 (rw,relatime,errors=remount-ro)
dario@endless:~$
```

Filesystem & Filesystem Layout

Silverblue

- BTRFS, / and /home subvolumes
- No properties, all COW

```
[dario@localhost usr]$ mount | grep btrfs
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /sysroot type btrfs (rw,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on / type btrfs (rw,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /usr type btrfs (ro,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /var type btrfs (rw,relatime,seclabel,space_cache,subvolid=258,subvol=/root)
/dev/mapper/luks-b7080271-39a6-46ae-addb-c3363adcffa8 on /var/home type btrfs (rw,relatime,seclabel,space_cache,subvolid=256,subvol=/home)
```

```
[dario@localhost usr]$ sudo btrfs subvolume list /
ID 256 gen 3082 top level 5 path home
ID 258 gen 3110 top level 5 path root
[dario@localhost usr]$
[dario@localhost usr]$ sudo btrfs property get /
label=fedora_fedora
[dario@localhost usr]$ sudo btrfs property get /home
```

```
[dario@localhost usr]$ lsattr /
--------------e----- /boot
-------------------- /sysroot
-------------------- /usr
-------------------- /var
-------------------- /etc
```

Filesystem & Filesystem Layout

MicroOS

- BTRFS, with the classic openSUSE subvolumes layout
- / has ro set, the others don’t

```
/dev/mapper/cr_root on /var type btrfs (rw,relatime,space_cache,subvolid=258,subvol=/@/var)
/dev/mapper/cr_root on /boot/writable type btrfs (rw,relatime,space_cache,subvolid=264,subvol=/@/boot/writable)
/dev/mapper/cr_root on /.snapshots type btrfs (rw,relatime,space_cache,subvolid=267,subvol=/@/.snapshots)
/dev/mapper/cr_root on /boot/grub2/x86_64-efi type btrfs (rw,relatime,space_cache,subvolid=265,subvol=/@/boot/grub2/x86_64-efi)
/dev/mapper/cr_root on /boot/grub2/i386-pc type btrfs (rw,relatime,space_cache,subvolid=266,subvol=/@/boot/grub2/i386-pc)
/dev/mapper/cr_root on /home type btrfs (rw,relatime,space_cache,subvolid=263,subvol=/@/home)
/dev/mapper/cr_root on /opt type btrfs (rw,relatime,space_cache,subvolid=262,subvol=/@/opt)
/dev/mapper/cr_root on /srv type btrfs (rw,relatime,space_cache,subvolid=260,subvol=/@/srv)
/dev/mapper/cr_root on /usr/local type btrfs (rw,relatime,space_cache,subvolid=259,subvol=/@/usr/local)
```

```
dario@localhost:~> sudo btrfs property get /
ro=true
label=
dario@localhost:~> sudo btrfs property get /home
ro=false
dario@localhost:~> sudo btrfs property get /var
ro=false
```

Filesystem & Filesystem Layout

MicroOS

- More on subvolumes...

```
dario@localhost:~> sudo btrfs subvolume list /
ID 256 gen 33 top level 5 path @
ID 258 gen 906 top level 256 path @/var
ID 259 gen 841 top level 256 path @/usr/local
ID 260 gen 36 top level 256 path @/srv
ID 261 gen 658 top level 256 path @/root
ID 262 gen 36 top level 256 path @/opt
ID 263 gen 902 top level 256 path @/home
ID 264 gen 24 top level 256 path @/boot/writable
ID 265 gen 26 top level 256 path @/boot/grub2/x86_64-efi
ID 266 gen 58 top level 256 path @/boot/grub2/i386-pc
ID 267 gen 872 top level 256 path @/.snapshots
ID 268 gen 68 top level 267 path @/.snapshots/1/snapshot
ID 271 gen 55 top level 267 path @/.snapshots/2/snapshot
ID 272 gen 322 top level 267 path @/.snapshots/3/snapshot
ID 274 gen 462 top level 267 path @/.snapshots/4/snapshot
ID 278 gen 469 top level 267 path @/.snapshots/5/snapshot
ID 279 gen 478 top level 267 path @/.snapshots/6/snapshot
ID 281 gen 657 top level 258 path @/var/lib/containers/storage/btrfs/subvolumes/0d6854efeed9b1
60f925
ID 282 gen 658 top level 258 path @/var/lib/containers/storage/btrfs/subvolumes/2c8491680004e9
ab1ede
ID 283 gen 827 top level 258 path @/var/lib/containers/storage/btrfs/subvolumes/31c962f14202ea
b0bef7
```

At install time

During usage

Filesystem & Filesystem Layout

MicroOS

- Some COW, some noCOW
- Personally, I think /home should become COW

```
dario@localhost:~> sudo lsattr / 2> /dev/null
---------------C---- /etc
-------------------- /boot
---------------C---- /home
-------------------- /opt
-------------------- /root
-------------------- /srv
-------------------- /usr
---------------C---- /var
-------------------- /lib
-------------------- /bin
-------------------- /lib64
-------------------- /mnt
-------------------- /sbin
```

Post Installation Configuration

- Silverblue
  - Add Flathub
    - (more on this later...)
- EndlessOS
  - Nothing, you're all set
- MicroOS (Hey, we're still in ALPHA!)
  - Add Flathub
  - For toolbox to work:

```
# echo "dario:100000:65536" > /etc/subuid
# echo "dario:100000:65536" > /etc/subgid
```

  - For controlling update/reboot yourself

```
$ sudo systemctl disable --now transactional-update.timer
$ sudo systemctl disable --now rebootmgr.service
```

```
$ flatpak remote-add --user flathub \
 https://flathub.org/repo/flathub.flatpakrepo
```

Adding Packages (packages, not flatpaks)

You shouldn't! But what if you really want/need?

- EndlessOS
  - Truly and fully immutable
  - You can add (or remove) anything

- Silverblue
  - Possible. It's called "layering"
  - Handled via `rpm-ostree` (E.g., Adding Layered Packages)
  - **Always reboot** ASAP after layering something
  - Changes visible after the reboot

Adding Packages (packages, not flatpaks)

- MicroOS
  - Possible. Handled via `transactional-update`
    - `$ sudo transactional-update pkg install git-core`
    - `$ sudo transactional-update shell`
      `#> sudo zypper ref`
      `#> sudo zypper install git-core`
  - Check `transactional-update shell --continue`
  - **Always reboot** ASAP after using `transactional-update`
  - Changes visible after the reboot

- So, `transactional-update` ~= `rpm-ostree` ?
  - Technically, not at all (although usage and “effects” are similar)
  - Transactional update leverage BTRFS

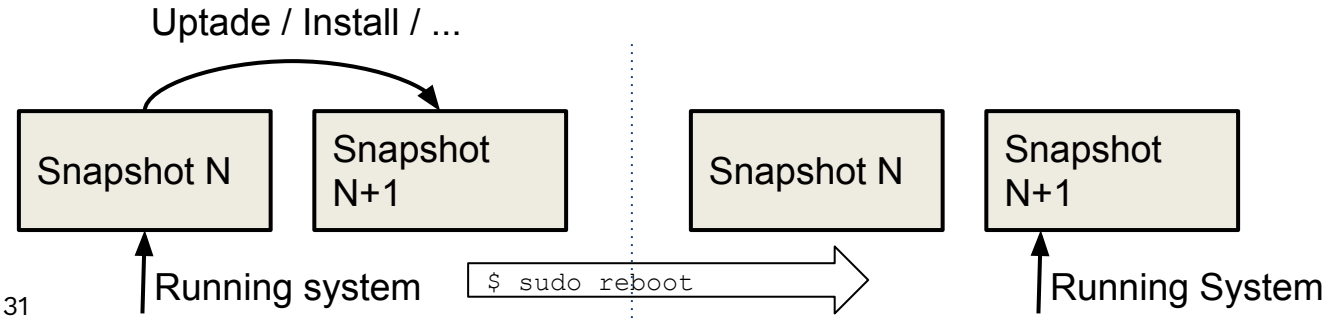
Transactional Updates

BTRFS is awesome

- We can modify the system (e.g., install packages) without affecting the instance of it that is running
- We do not need anything more than BTRFS itself

Implementation:

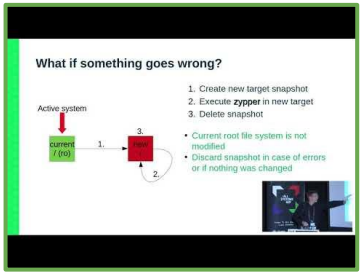
- The FS and subvolumes are really read-only
- Request to modify ⇒ we create a snapshot and do that in there
- At next reboot, we boot in the new snapshot

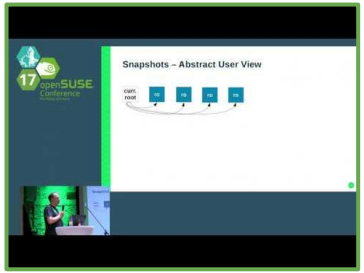


Transactional Updates

Materials:

- The Transactional Update Guide





Altering The Root Filesystem

For instance:

- Running NVIDIA's `.run` driver installer
- Adding a wireless card's hex file in `/lib/firmware`
- Whatever...

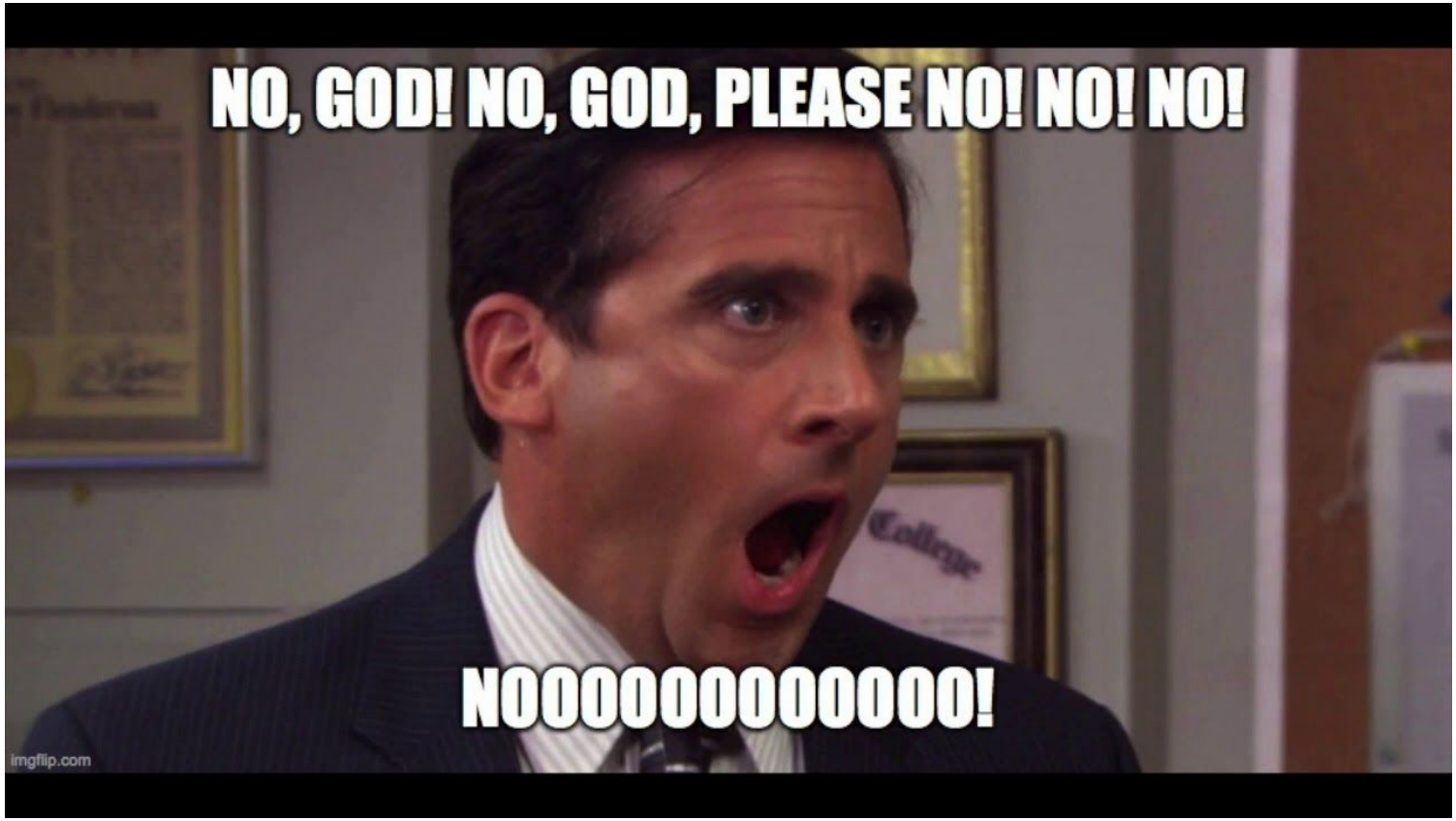
EnlessOS & Silverblue

- No way
  - EndlessOS: no way to alter the FS at all
  - Silverblue: layering. **But** it's only for packages

MicroOS

- ```
  $ sudo transactional-update shell
   #> <do_what_you_need>
   #> exit
  $ systemctl reboot
  ```
  ```

Shall We Alter The Base OS A Lot Then ?



Are We Constantly Rebooting ?

This is my MicroOS workstation. Judge yourself:

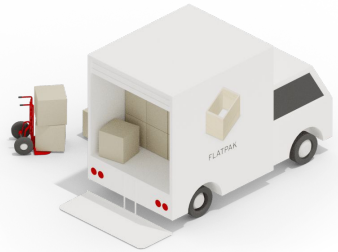
```
dario@Wayrath:~> uptime
 22:34:38  up 7 days  5:40,  2 users,  load average: 3,30, 2,95, 2,37
dario@Wayrath:~>
```

How so?

- For apps:
  - Flatpak
- For troubleshooting or debugging:
  - toolbox
- For development or “non-Flatpaked” apps:
  - toolbox

Installing/removing packages on the base OS tends to zero

Flatpak



Flatpak, https://flatpak.org/

- Application are self-contained
- There's some sharing (via Runtimes)
- All needed file installed either in `/var` or `$HOME`

App repositories (remotes)

- MicroOS
  - Use Flathub "official" remote. To be added manually
- Silverblue
  - Has its own (preconfigured) remote but not many apps
  - You most surely need Flathub. To be added manually
- EndlessOS
  - Flathub + their own (both preconfigured)

Flatpak

What's there, just immediately after install?

- EndlessOS
  - Lots of flatpaks pre-installed
  - System already usable for its intended use-case
- Silverblue
  - Some flatpaks pre-installed (from Fedora's own remote)
  - Browser (Firefox) installed from RPMs
  - System is ok for basic usage, need Flathub for more apps
- MicroOS
  - No flatpak pre-installed
  - Do add Flathub and pick apps as first thing!
    - To Be Done: preinstall something. Not trivial, though
  - No browser
    - To Be Done: not clear

Free? Not Free? Let's Have a Beer! (Wait, was it like that?)

Flathub has:

- Free Software
- Free Software built with CODECs for "patent encumbered" formats (e.g., VLC, OpenShot)
- Proprietary Software

IANAL but, most likely:

- Flathub as a remote cannot be enabled by default in MicroOS
- We cannot pre-install stuff from Flathub in MicroOS
- I don't think we fancy pre-installing stuff we don't build

Silverblue:

- Firefox is "layered"
  ⇒ Even if a Flatpak exist?
- They build some flatpaks their own
  ⇒ Only a handful, Flathub needed anyway
  ⇒ Duplication with same apps from Flathub

 To Be Done: think about it...

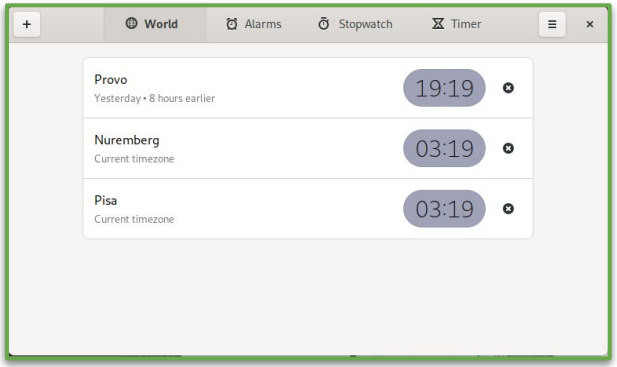
Installing & Updating Flatpaks

Installing / Updating flatpaks:

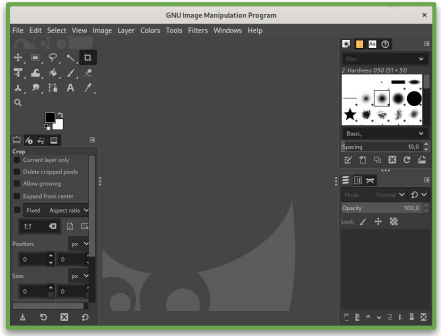
- Via CLI
  - EnlessOS / Silverblue / MicroOS:
    - Flatpak update
- Via GUI
  - EndlessOS:
    - Via GNOME Software
    - (with their customized UI)
  - Silverblue:
    - Via GNOME Software
  - MicroOS:
    - Via GNOME Software or Discover
      - To Be Done: They work, but need some tweaking

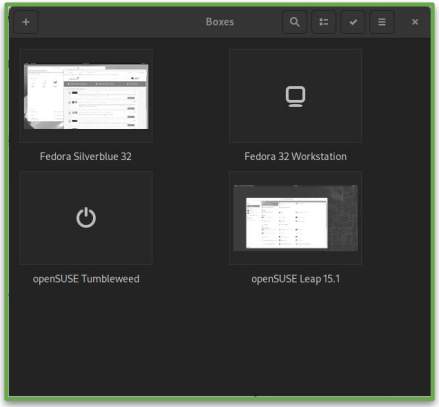
Email, Calendaring, IM & Office Apps

- Mail, calendaring, contacts, ...
  - Evolution, org.gnome.Evolution
  - Calendar, org.gnome.Calendar
  - Contacts, org.gnome.Contacts
  - GNOME Clocks, org.gnome.clocks
  - Weather, org.gnome.Weather
- Documents
  - Evince, org.gnome.Evince
  - GNOME Documents, org.gnome.Documents
  - LibreOffice, org.libreoffice.LibreOffice
- Messaging
  - RocketChat, chat.rocket.RocketChat
  - Pidgin, im.pidgin.Pidgin
  - Telegram, org.telegram.desktop
  - Signal, org.signal.Signal



Editors, Tools, Graphics

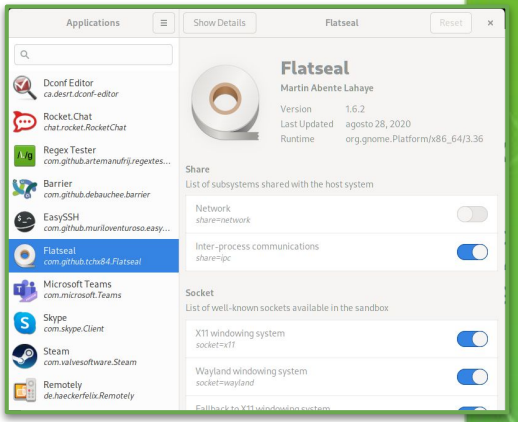


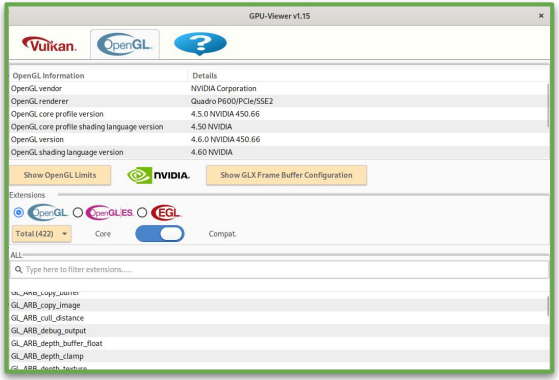


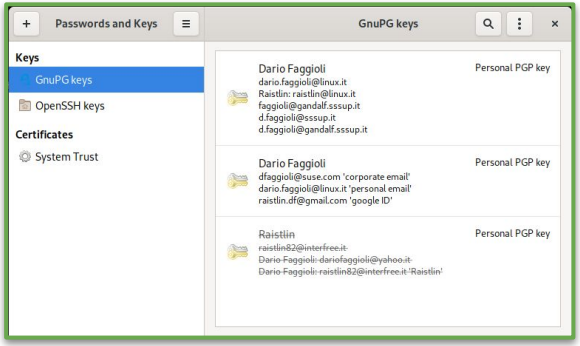
- Editors:
  - Vim, org.vim.Vim
  - Gedit, org.gnome.gedit
  - Setzer, org.cvfosammmm.Setzer
  - Eclipse, org.eclipse.Java
- Graphics
  - GIMP, org.gimp.GIMP
  - Krita, org.kde.krita
  - Blender, org.blender.Blender
- VMs:
  - GNOME Boxes, org.gnome.Boxes
- Tools:
  - Regex Tester, com.github.artemanufrij.regextester
  - Meld, org.gnome.meld
  - Boop-GTK, uk.co.mrbenshef.Boop-GTK

Utilities, Configuration

- Misc utilities:
  - SyncThing, me.kozec.syncthingtk
  - Barrier, com.github.debauchee.barrier
  - Seahorse, org.gnome.seahorse.Application
- Config:
  - Dconf Editor, ca.desrt.dconf-editor
  - Flatseal, com.github.tchx84.Flatseal
  - GPU-Viewer, io.github.arunsivaramanneo.GPUViewer

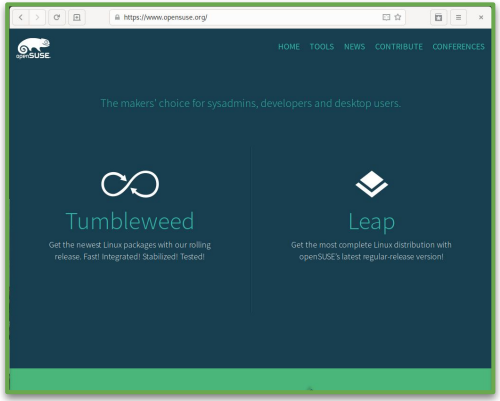


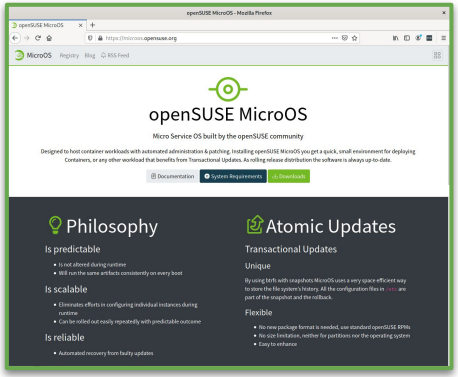




Browsing

- Firefox, org.mozilla.firefox
  - Works great, including video codecs
- Epiphany, org.gnome.Epiphany
- Chromium, org.chromium.Chromium
  - Works great, including video codecs
- Google Chrome, com.google.Chrome
  - Available in flathub-beta
  - Tested briefly, seems to work fine





NB: GNOME Shell Extension can't be installed from a "Flatpak-ed" browser yet:

- Browser installed from RPM
- An application for managing them
  (MicroOS: we're investigating this second solution)

Gaming

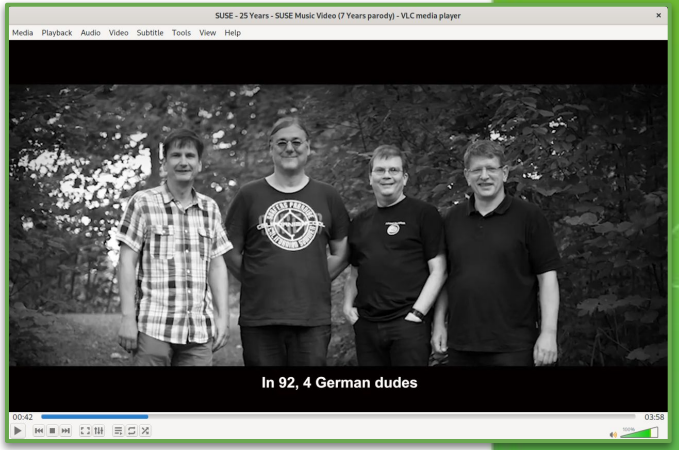
- Steam, com.valvesoftware.Steam
  - Works great, even SteamPlay/Proton
- NVIDIA Drivers
  - ```
    $ sudo transactional-update shell
      #> zypper ar https://download.nvidia.com/opensuse/tumbleweedNVIDIA
      #> zypper ref
      #> zypper in nvidia-glG05 x11-video-nvidiaG05
      #> exit
    $ sudo reboot
    ```
    - Brings in gcc and some development packages (not ideal... Thanks NVIDIA, I guess :-/)
  - NB flatpak picked up automatically:
    ```
    org.freedesktop.Platform.GL.nvidia-450-66
    org.freedesktop.Platform.GL32.nvidia-450-66
    ```


    ```

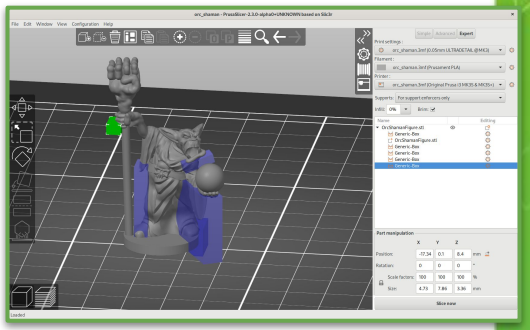
Video: Viewing, Editing & Codecs

Remember: no ffmpeg and/or CODEC RPM (e.g., from Packman/RPMFusion) installed on system

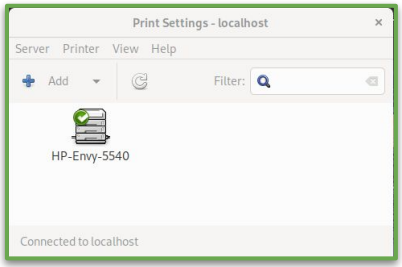
- VLC, org.videolan.VLC
  - Has the proper codecs
- Pitivi, org.pitivi.Pitivi
  - Has the proper codecs
- Openshot, org.openshot.OpenShot
  - Has the proper codecs
- Shotcut, org.shotcut.Shotcut
  - Has the proper codecs
- Cheese, org.gnome.Cheese
  - Works well with my webcam



[3D] Printing & Scanning



- 3D Printing
  - Prusa Slicer, com.prusa3d.PrusaSlicer
- Printing
  - Drivers must be installed on the system (RPMs ⇒ PPDs)
  - The ones for the most common Ones are (on all the 3 OSes)
  - You may need to add drivers with (e.g., with `transactional-update`)



- Scanning
  - Paperwork, work.openpaper.Paperwork
    - Not working yet… Still not sure why
    - (Yeah, well, most scanners, e.g., from All-in-one printers, have Web-ish interface)

Toolbox

An easy way to start a read-write environment (in a podman container):

- With your user configured
- You have your home there, in its usual place
- Your files have the proper owner, group, permissions
- You reach your SSH agent (running on the host)
- You can launch graphical apps
- You have `sudo`
- You can install and remove packages

Sounds pretty handy:

- For installing apps not available/not working as Flatpaks
- For doing development inside it
- For troubleshooting and debugging the immutable OS

Check this other talk (tomorrow): “By The Power of toolbox!”

Toolbox

A launcher for a privileged podman container

- Silverblue & EndlessOS
  - github.com/containers/toolbox
  - Was Bash, now Go (EndlessOS still using the old bash version)
- MicroOS
  - github.com/kubic-project/microos-toolbox
  - Bash

BEWARE:

- It’s for convenience
- It’s not a security enhancing tool!

Project You Go, toolbox You Find

UI is (almost) compatible, at least!

- Create a toolbox
  - Silverblue: `toolbox create`
  - MicroOS
    - Either: `toolbox -u`
    - Or: `toolbox create`
- Entering a toolbox:
  - Silverblue:
    - `toolbox enter`
  - MicroOS
    - Either: `toolbox -u   # creates it, if doesn't exist`
    - Or: `toolbox enter`
- Create (and enter) a toolbox as root:
  - Silverblue: `sudo toolbox create && sudo toolbox enter`
  - MicroOS:
    - Either: `toolbox -u -r`
    - Or: `toolbox create -r && toolbox enter -r`

Toolbox for Development: Building Xen

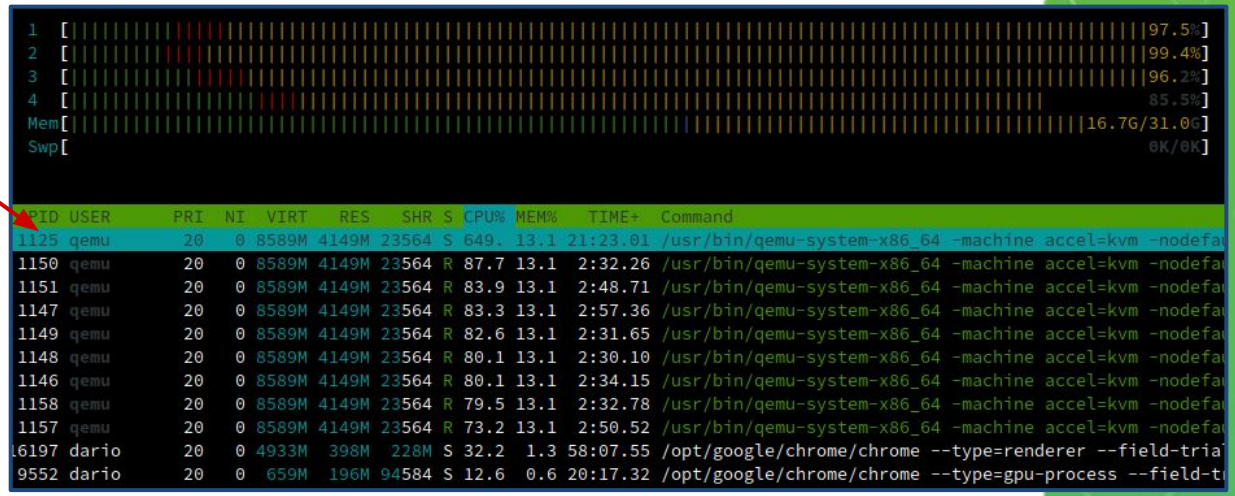
- Dependencies for building Xen from sources:
  - `acpica bc bin86 bison bzip2 checkpolicy clang cmake dev86 discount flex gcc gcc-c++ gettext-tools git glib2-devel glibc-devel glibc-devel-32bit gzip hostname libSDL2-devel libaio-devel libbz2-devel libext2fs-devel libgnutls-devel libjpeg62-devel libnl3-devel libnuma-devel libpixman-1-0-devel libpng16-devel libssh2-devel libtasn1-devel libuuid-devel libyajl-devel lzo-devel make nasm ncurses-devel ocaml ocaml-findlib-devel ocaml-ocamlbuild ocaml-ocamldoc pandoc patch pkg-config python3-devel systemd-devel tar transfig valgrind-devel wget which xz-devel zlib-devel`
- Toolbox to the rescue:
  - ```
    $ toolbox enter
      $> sudo zypper in <all_the_dependencies_above>
      $> git clone git://xenbits.xen.org/xen.git xen.git
      $> cd xen.git
      $> ./configure
      $> make -j8 xen tools
    ```
    ```

Toolbox for Development: Working With OBS

Requires installing packages, using VMs for building, etc.

- I need a `-r` toolbox, for mounting filesystems in the build VM (I think)

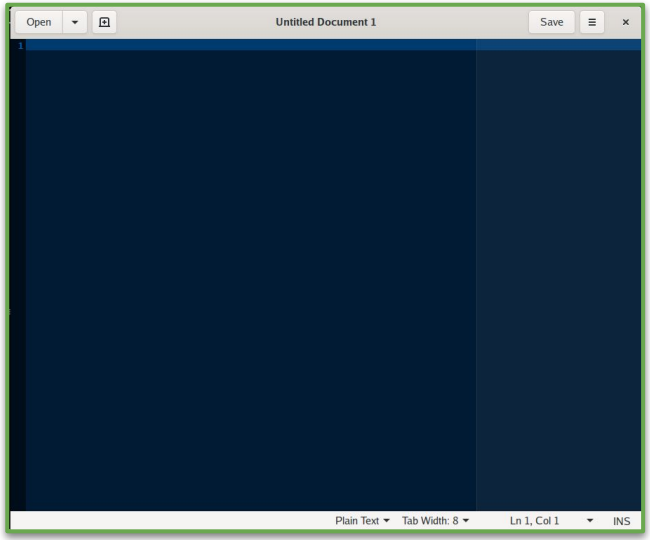
```
$ toolbox create -r
$ toolbox enter -r
  $> zypper ar https://download.opensuse.org/[...]/openSUSE:Tools.repo OBS
  $> zypper in cpio osc build [...]
  $> osc mkpac / co / vc
  $> [...]
  $> osc vc
  $> osc build --vm-type=kvm
  $> osc commit
```

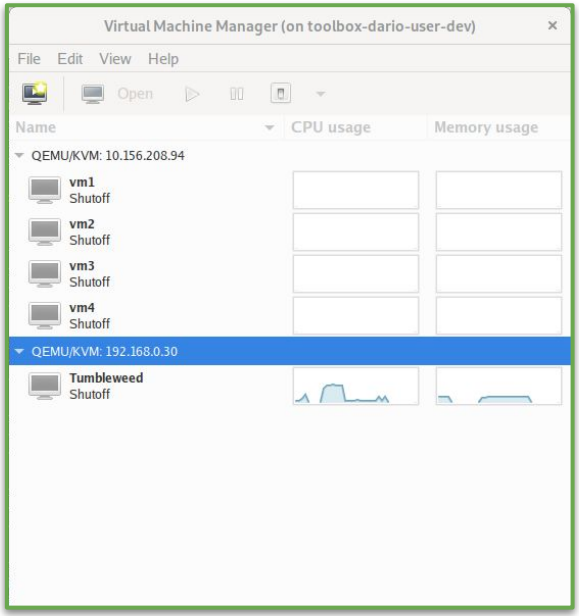


Toolbox for Graphical Apps

- They work too! ⇒ No need installing them in base OS
-
```
$ toolbox enter
  $> sudo zypper in gedit virt-manager
  $> gedit
  $> virt-manager
```

```
On MicroOS also do, inside the toolbox:
  $> sudo zypper in xorg-x11-fonts-core
  $> sudo zypper in adwaita-icon-theme
```

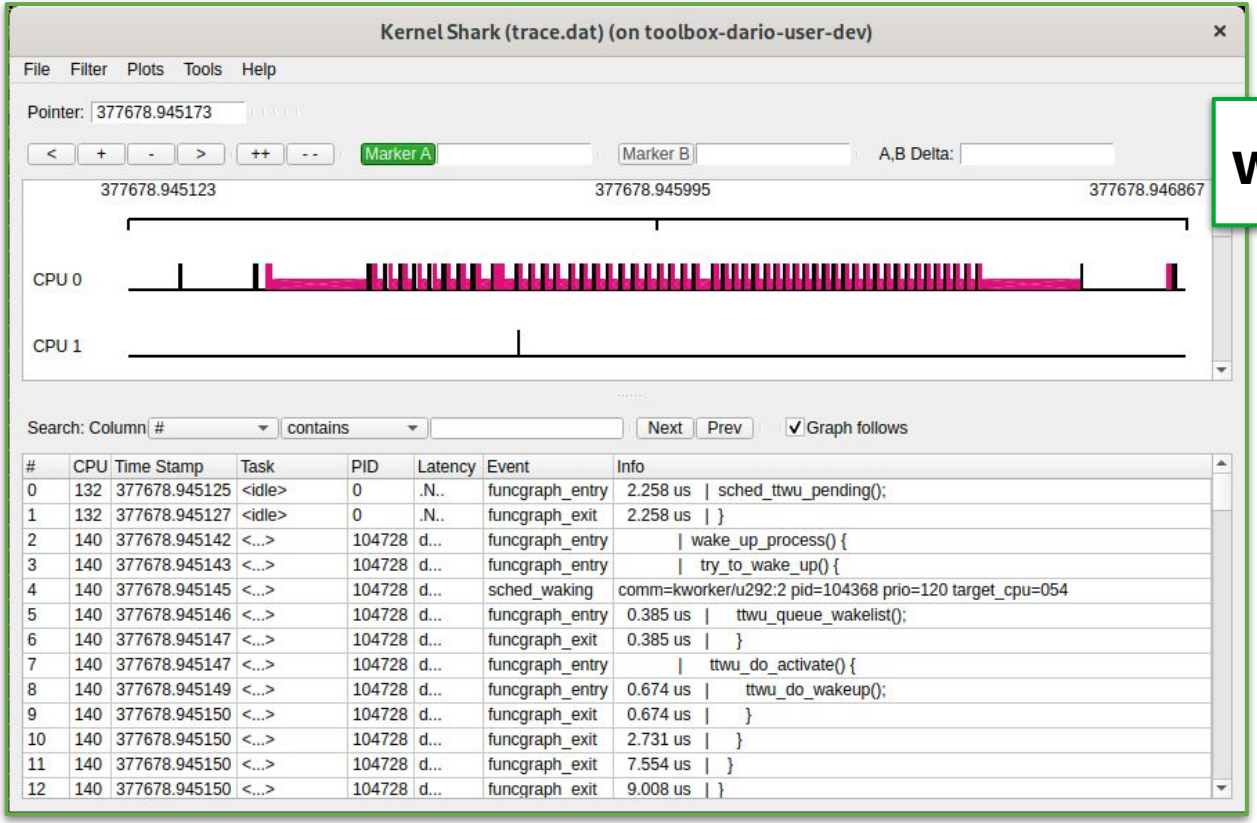




Toolbox for “GL” Graphical Apps

- Kernelshark as an example:
  - ```
    $ toolbox enter
    $> kernelshark
    libGL error: No matching fbConfigs or visuals found
    libGL error: failed to load driver: swrast
    QOpenGLWidget: Failed to create context
    QOpenGLWidget: Failed to create context
    qt.qpa.backingstore: composeAndFlush: QOpenGLContext creation failed
    qt.qpa.backingstore: composeAndFlush: makeCurrent() failed
    ...
    ```
- I have NVIDIA with proprietary drivers here. What if...
  - ```
    $ toolbox enter
    $> sudo zypper addrepo https://download.nvidia.com/opensuse/tumbleweed NVIDIA
    $> sudo zypper ref
    $> sudo zypper in x11-video-nvidiaG05
    ```
- It installs stuff like:
  - `kernel-default-devel`, `nvidia-gfxG05-kmp-default`, `nvidia-glG05` Inside the container ? :-O

Toolbox for “GL” Graphical Apps



#	CPU	Time Stamp	Task	PID	Latency	Event	Info
0	132	377678.945125	<idle>	0	.N..	funcgraph_entry	2.258 us | sched_ttwu_pending();
1	132	377678.945127	<idle>	0	.N..	funcgraph_exit	2.258 us | }
2	140	377678.945142	<...>	104728	d...	funcgraph_entry	| wake_up_process() {
3	140	377678.945143	<...>	104728	d...	funcgraph_entry	| try_to_wake_up() {
4	140	377678.945145	<...>	104728	d...	sched_waking	comm=kworker/u292:2 pid=104368 prio=120 target_cpu=054
5	140	377678.945146	<...>	104728	d...	funcgraph_entry	0.385 us | ttwu_queue_wakelist();
6	140	377678.945147	<...>	104728	d...	funcgraph_exit	0.385 us | }
7	140	377678.945147	<...>	104728	d...	funcgraph_entry	| ttwu_do_activate() {
8	140	377678.945149	<...>	104728	d...	funcgraph_entry	0.674 us | ttwu_do_wakeup();
9	140	377678.945150	<...>	104728	d...	funcgraph_exit	0.674 us | }
10	140	377678.945150	<...>	104728	d...	funcgraph_exit	2.731 us | }
11	140	377678.945150	<...>	104728	d...	funcgraph_exit	7.554 us | }
12	140	377678.945150	<...>	104728	d...	funcgraph_exit	9.008 us | }

Well, it works!

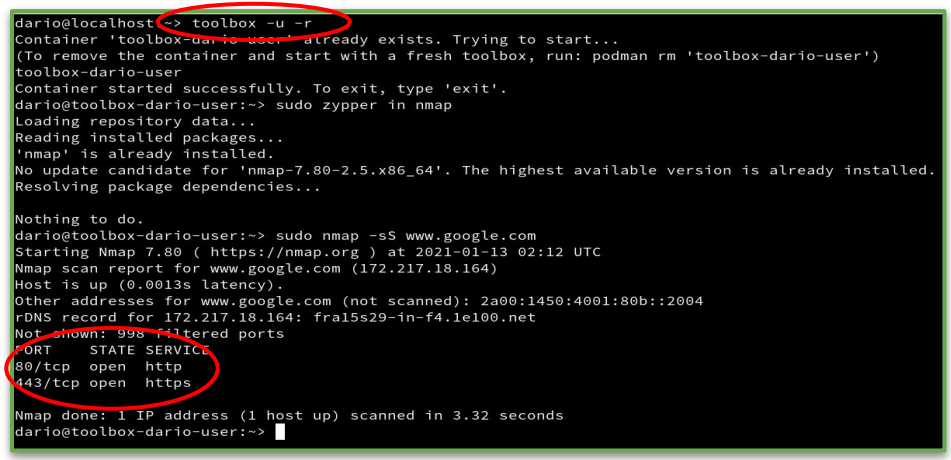
Toolbox for Troubleshooting

E.g., I need to do an `nmap`

- It's not installed
- I don't want to reboot now!

On Silverblue, it would be:
`$ sudo toolbox enter`

```
$ toolbox enter -r  # runs as root on the host (necessary for scanning "low ports")
 #> zypper install nmap  # we can add packages, no problem
 #> nmap -sS www.google.com
```



Some Stats

- RPM Packages
  - When I was using Tumbleweed: more than 4000 packages
  - On my MicroOS Desktop: less than 1000 packages
    - Inside a development toolbox there: ~1300 packages
      - (has GUI apps & libs too)
  - On a stock Fedora Silverblue: ~1200 packages

- Flatpaks
  - Apps installed: 112
  - All flatpaks (Apps + Runtimes + Locales): 202
  - Disk space: ~50 GB

Update the OS Packages

Silverblue & EndlessOS

- Handled by OSTree
- Integrated in GNOME Software
  - It handles both packages via OSTree and flatpaks
- MicroOS
  - By default: completely automatic
  - Every day the OS checks, installs updates and reboots itself
  - Super cool... But not necessarily for a Desktop:
    - we want to be in control of the reboots
    - I personally have this disabled
    - TBD: Integrate updates in GNOME Software or similar

All 3 ⇒ Reboot required after an update

How About: Rebooting Even Less?

Can we “containerize more” ?

- That would mean having to reboot even less

- Current situation (all 3):
  - Base system + Desktop Environment come from packges
- @fcrozat super-cool (WIP!) idea:
  - Desktop Environment in a container
    - GDM Containers
    - Updating DE packages means no reboot!

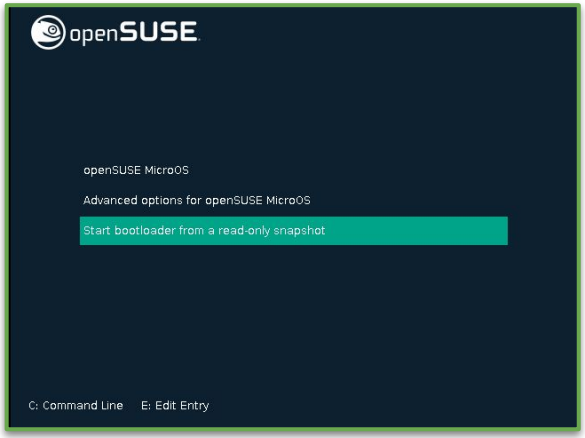
Rollback After a Bad Update

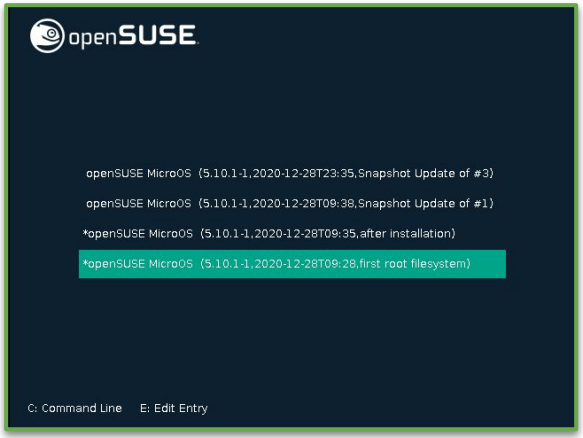
Silverblue

- At boot, pick a previous version
- Once booted: `rpm-ostree rollback`

MicroOS

- At boot, pick a previous snapshot
- Once booted: `transactional-update rollback`





Remember this?

- Daily activities ⇒ how and what for I use my workstation
  - Read and send emails (Evolution, git-send-email, ...)
  - Write, build & test code (Xen, KVM, Libvirt, QEMU)
  - Work with the Open Build Service (OBS)
  - Browse Web
  - Test OSes in VMs
  - Meetings / Video calls / Online conferences
  - Chat, work and personal
  - Some 3D Printing
  - Occasionally play games
  - Occasional video-editing
  - Maybe scan / print some document

Remember this?

- Daily activities ⇒ how and what for I use my workstation
  - Read and send emails (Evolution, git-send-email, ...) **Check**
  - Write, build & test code (Xen, KVM, Libvirt, QEMU) **Check**
  - Work with the Open Build Service (OBS) **Check**
  - Browse Web **Check**
  - Test OSes in VMs **Check**
  - Meetings / Video calls / Online conferences **Check**
  - Chat, work and personal **Check**
  - Some 3D Printing **Check**
  - Occasionally play games **Check**
  - Occasional video-editing **Check**
  - Maybe scan / print some document **Check**

About Myself

- Ph.D on Real-Time Scheduling @ ReTiS Lab, SCHED_DEADLINE
- 2011, Sr. Software Engineer @ Citrix
  The Xen-Project, hypervisor internals, NUMA-aware scheduler, Credit2 scheduler, Xen scheduler maintainer
- 2018, Virtualization Software Engineer @ SUSE
  Still Xen, but also KVM, QEMU, Libvirt; Scheduling, VM's virtual topology, performance evaluation & tuning


openSUSE