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Transactional Updates

with Btrfs and RPM

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TOC

Concept of Transactional Updates

What is a Transactional Update?

An update that

- **is atomic**
  - Either fully applied, or not applied at all
  - Update does not influence the running system
- **can be rolled back**
  - A failed or incompatible update can be quickly discarded to restore the previous system condition

Implementations

Common concepts shared between all distributions:

- Read-only root file system
- Transactional / atomic updates
- Often designed for large deployments (Clouds)
- Minimal base system
- Automatic updates / reboots
- Integrity protection

Examples:

container linux

RED HAT ENTERPRISE LINUX ATOMIC HOST

Core

Kubic

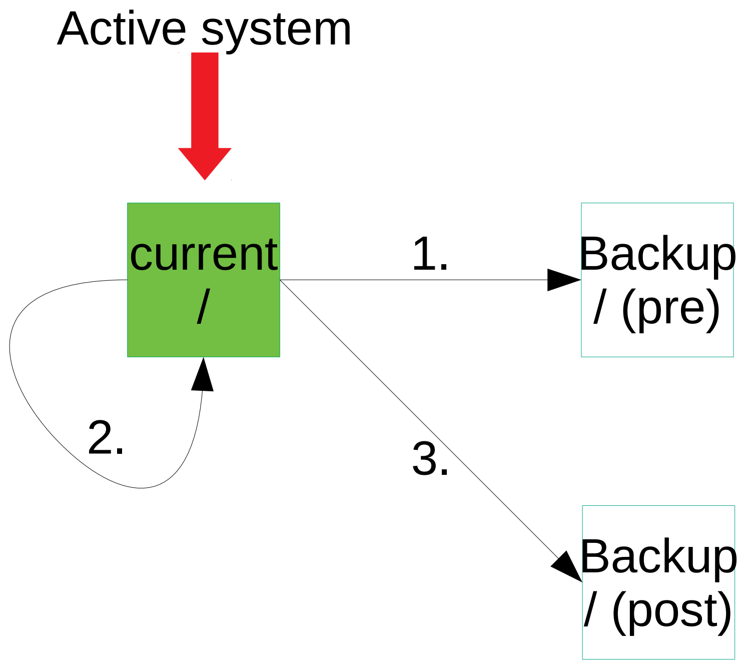
PROJECT ATOMIC

Transactional Updates with Btrfs and RPM

Snapper

- Snapshotting tool
- Called upon invocation of system tools (e.g. zypper or YaST)
- Uses Btrfs snapshot mechanism (but also supports ext4 and LVM)
- Available for a variety of other distributions

Updates with snapper



1. Create “pre” snapshot
2. Update the current system
3. Create “post” snapshot

Update is modifying the currently active file system
Restarts services immediately

Updates with snapper

A Transactional Update is an update that

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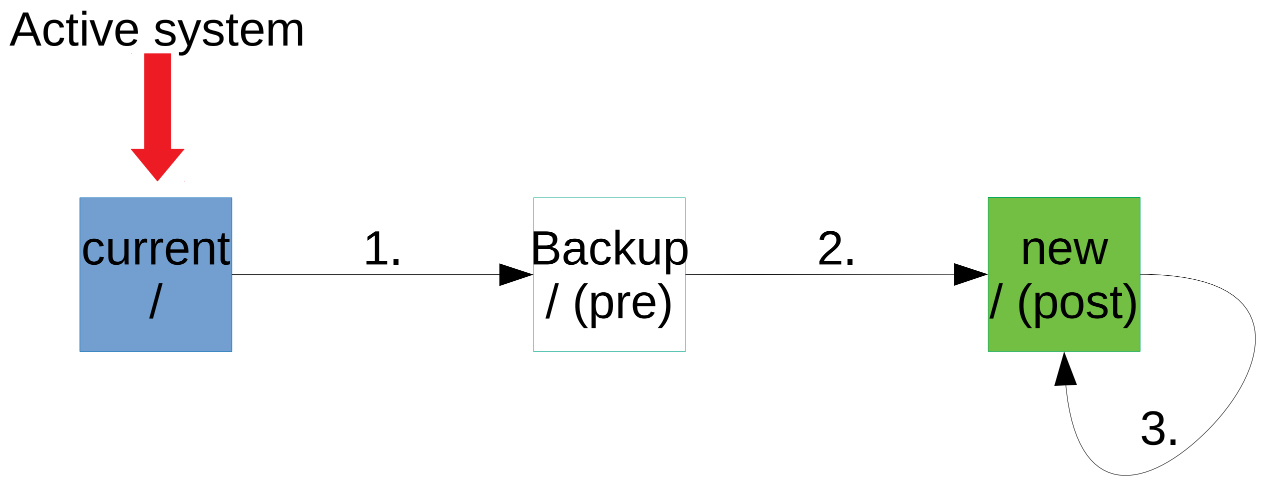
Updates with transactional-update

- Using zypper & snapper in the background
- Also creates two snapshots
  – Pre: Backup of the current system
  – Post: Working snapshot
- Will not touch the currently running system
- Sets “Post” snapshot as new default btrfs root file system
- Changes applied on reboot
- If something goes wrong during the update nothing will be changed at all

Updates with transactional-update



1. Snapshot of current system
2. Create new target snapshot
3. Update system and set as default for next boot

Current root file system is not modified

Live demo

Live Demo

Cheat Sheet

Transactional Updates

List repositories
```
zypper lr -d
```

Refresh repositories
```
zypper ref
```

Update installed packages
```
transactional-update up
```

Perform a distribution update
```
transactional-update dup
```

Install package(s)
```
transactional-update pkg in <name>
```

Update package(s)
```
transactional-update pkg up <name>
```

Remove package(s)
```
transactional-update pkg rm <name>
```

List snapshots
```
snapper list
```

Mark snapshots for removal by snapper
```
transactional-update cleanup
```

View default subvolume
```
btrfs subvolume get-default /
```

Open shell
```
transactional-update shell
```

Request reboot
```
transactional-update reboot
```

System rollback
```
transactional-update rollback [number]
```

Pitfalls

- **Snapshots will be branched from the *current* system**
  → snapshots will not contains the previous snapshot’s contents if the system hasn’t been rebooted!
- **When using transactional-update on a read-write system**
  → don’t forget to reboot your system before making any changes to the root file system!

A deeper look

Handling of special directories

Writable directories on an otherwise read-only system:

- **/var**
- **/etc**

/var handling

- **/var is a special directory as it contains variable data**
  - has to have read-write permissions
- **Cannot be rolled back**
  - A rollback would usually delete production data (e.g. your new orders in your database or your Docker images)
- **Typically stored on a separate subvolume or partition**
- **/var will not be mounted into the update snapshot, i.e. packages can not modify it (but we have some special handling for plain files and directories)**

/etc handling

- **On read-only systems /etc has to be writable**
  - Mounted as an overlay file system
  - Overlay stored in /var
- **On snapshot creation /etc contents will be synced into root file system**
  - Configuration is part of the snapshot
- **On reboot into new snapshot delete overlay contents**
- **Only files modified after snapshot creation will remain**

Other subvolumes

- /opt**,** /var/log **and** /boot/grub2 **will be bind mounted into the update snapshot**
- **Everything else, including** /srv**, won’t!**

➔ **Packages have to follow the FHS and packaging guidelines**

Helper applications: health-checker

- Add your own checker scripts to check for system consistency
- Automatic rollback if checks fail

Helper applications: rebootmgr

- transactional-update.timer triggers daily update including reboot
- rebootmgr manages reboot (e.g. in maintenance windows or synchronized via etcd)

What else is worth noting?

- **Works with any standards-compliant RPM package**
- **General purpose tool: Especially useful for servers and clusters**
- **Fast snapshot switching**
- **Sane /etc and /var handling**
- **Only works with BTRFS root file systems**

- **Configuration file:** /etc/transactional-update.conf **(template in** /usr/etc/transactional-update.conf**)**
- **Snapper will clean up old snapshots**
- **transactional-update is the only way to update a read-only system**

Alternatives

What’s next?

Availability

SUSE CaaS Platform

openSUSE Kubic

openSUSE Tumbleweed
openSUSE Leap 15
("Transactional Server" role)

Future development

- Integration into SLES 15
- Integrate transactional-update as zypper plugin
- IMA / EVM support for system verification / integrity
- Fix RPM packages with scripts modifying /var and /srv

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