Yum at scale

Keeping the software of your infrastructure under control

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Outline

Large installations are a mess

Yum's not meant for clusters

- All tools we use for managing our clusters are declarative
  - Quattor, Puppet, Chef...
- But Yum is imperative

```
yum install foo
yum remove bar
yum upgrade
```

- We'll show how to "abuse" Yum into a declarative model

Installation and upgrade policies

- You never upgrade all your infrastructure at once
  - Test environments
  - Critical services
  - Very exposed services
  - ...
- And you want to control **when** upgrades take place

What comes next?

- Making Yum an almost declarative package manager
- Keeping software installations of lots of hosts aligned

Lessons learned from Gentoo

Package sets in Portage

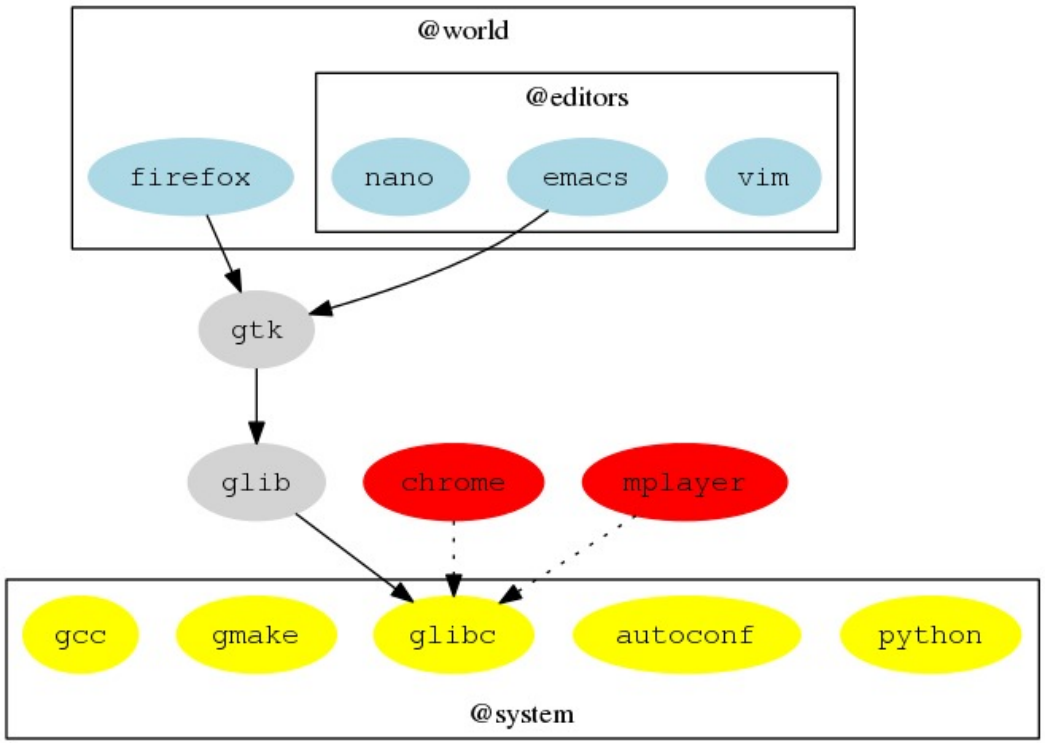


Figure : Package sets

- Package sets can contain other sets
- The **world** set contains all the packages declared by the user
- The **system** set contains all the "protected" packages
- Any package not in world or system is either a dependency or not needed anymore

Virtual dependencies

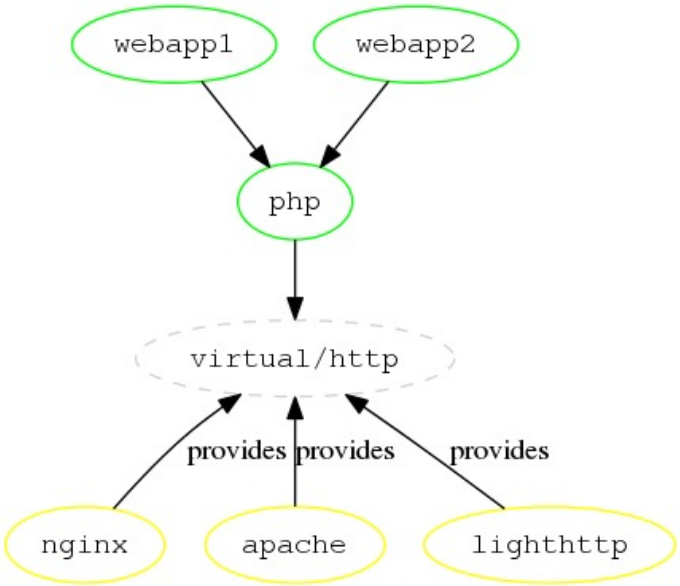


Figure : Virtual dependencies

- Allow to choose the implementation of certain services
- Better than RPM's `provides` and `requires`

Update vs. distro-sync

update install any newer versions available

distro-sync align yourself to the state of the repositories

- Install newer versions
- Remove packages that leave the repository
- Downgrade versions that leave the repository

- In Yum, repositories *declare the desired state*
- In Yum, repositories **are the source of truth**

Controlling which versions to install

- Some packages cannot change versions at the same speed as the repositories

Example

- Upgrade kernel to 2.6.32-358.456
- But the Infiniband drivers are available only for 2.6.358.123
- You lose Infiniband if you upgrade
- There is a critical security exploit on OpenSSL and you must upgrade

Controlling which versions to install

- Blacklisting unwanted versions may work...

Example

```
exclude=kernel-2.6.32-358.456.el6
```

- ... until a newer kernel version appears and you have to blacklist that one too

The versionlock plugin

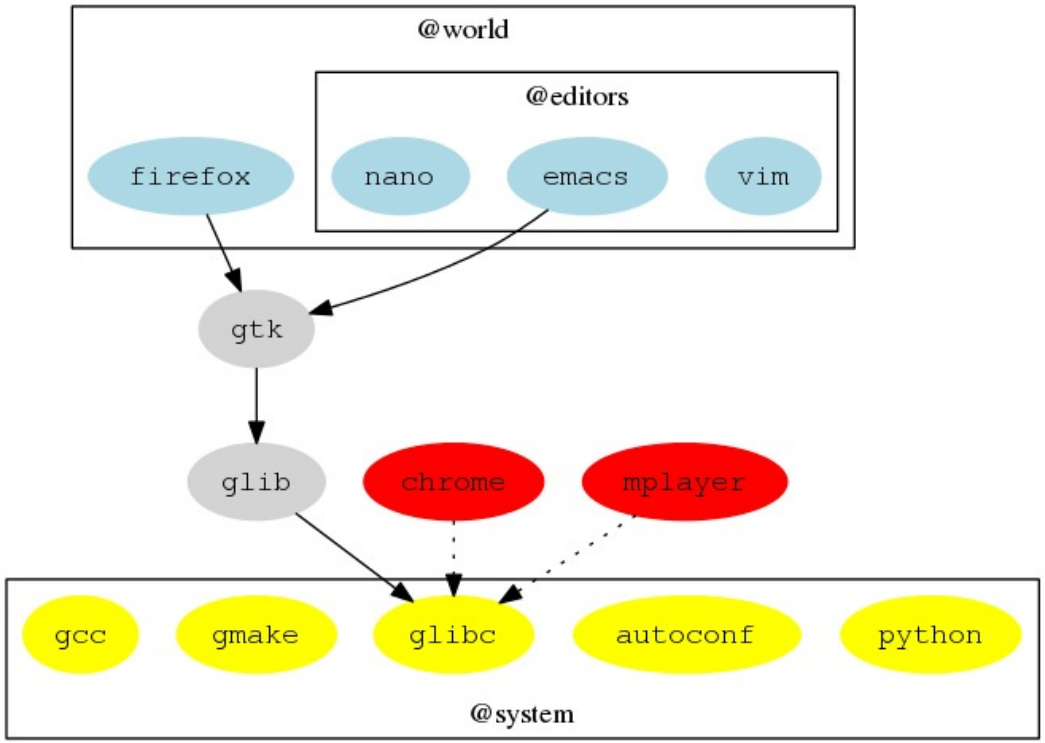
- We should be able to declare the versions of some packages, and not let them move
- ... and that's what the `versionlock` plugin does

Example

```
yum versionlock 0:kernel-2.6.32-358.123.el6.x86_64
```

- When your new IB drivers appear, just unlock the kernel or upgrade the version lock

Cleaning up the system



Cleaning up the system

- There is no equivalent for the *world* set in Yum
- Your configuration management tool should wrap it
- Quattor does
- On CentOS 6, set `clean_requirements_on_remove`

The post-transaction-actions plugin

- After a package operation, some things should happen

Example

- Restart Tomcat after upgrading/downgrading OpenJDK
- Restart Apache after upgrading/downgrading OpenSSL

- The post-transaction-actions plug-in does this

The post-transaction-actions plugin

- We can run arbitrary scripts on install, remove, upgrade, downgrade of packages

Example

```
openssl:upgrade:service httpd restart
java*:upgrade:service tomcat restart
```

Yum problems

- The shell doesn't report errors correctly

Example

```
$ yum -y shell
install idonotexist
transaction run
exit
$ echo $?
```

- Large, complicated transactions may raise conflicts
  - Lots of operations with repoquery to prevent them
- The Quattor wrapper around Yum is 411 lines of Perl code

The case of repoforge

- Repoforge (AKA RPMForge) contains lots of useful packages
- But it overlaps with CentOS, and the builds may be incompatible with each other
- Use it only for selected packages

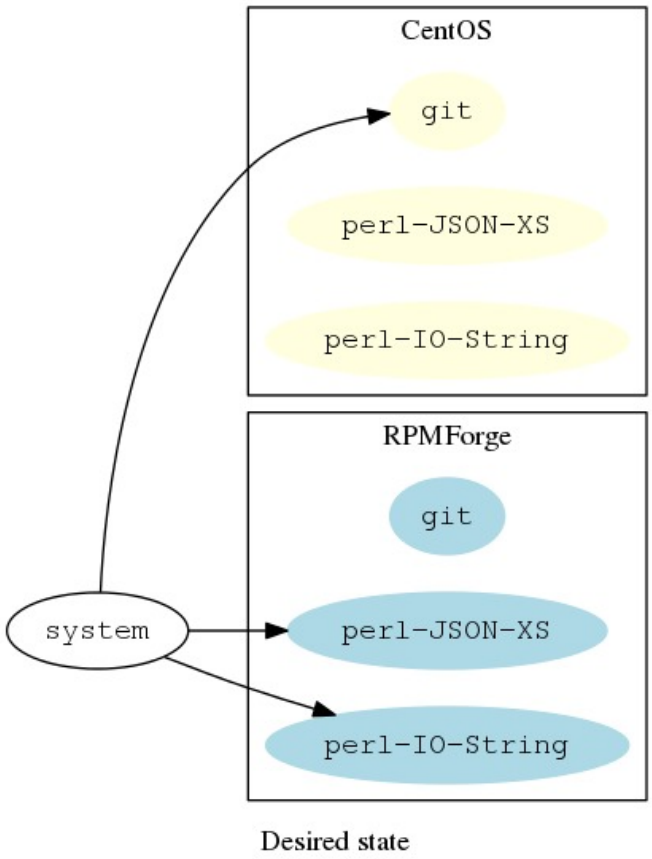
Example

```
[rpmforge]
name=rpmforge
...
enabled=1
includepkgs=dstat perl-IO-Pty-Easy
```

Advise for repository mirroring

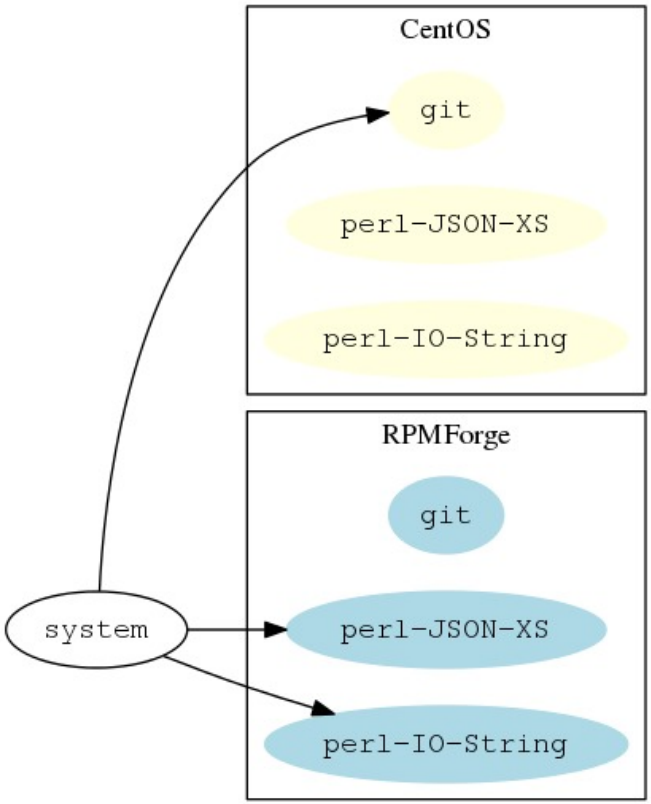
- Enable only the minimum set of repositories you need on your system
- Mirror existing upstream repositories when possible
- Don't mix different upstream repositories in a single local repository
- ... but you still need repositories for stuff you package yourself
- Try to keep them small

Avoid Yum priorities

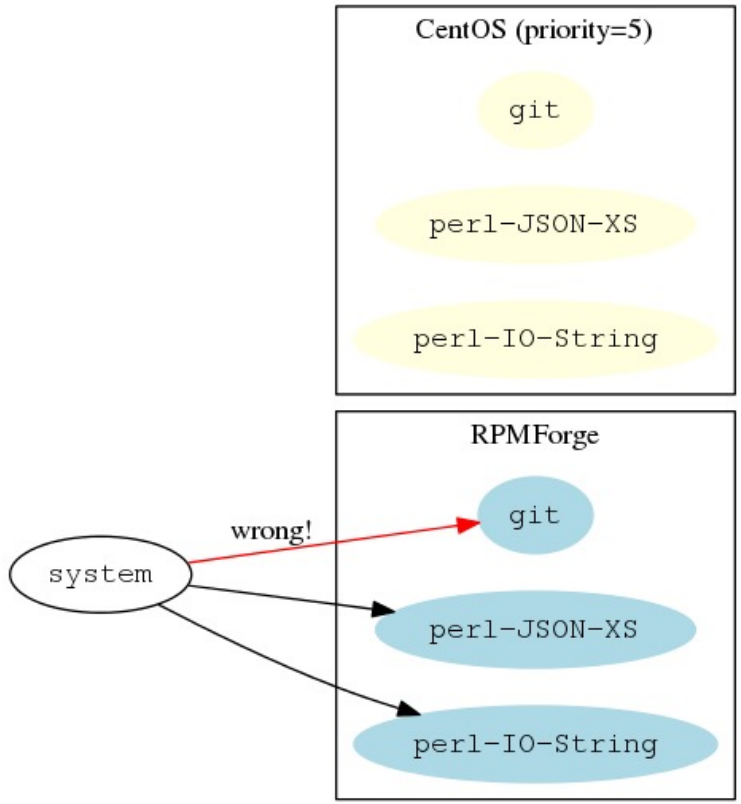


Desired state

Avoid Yum priorities

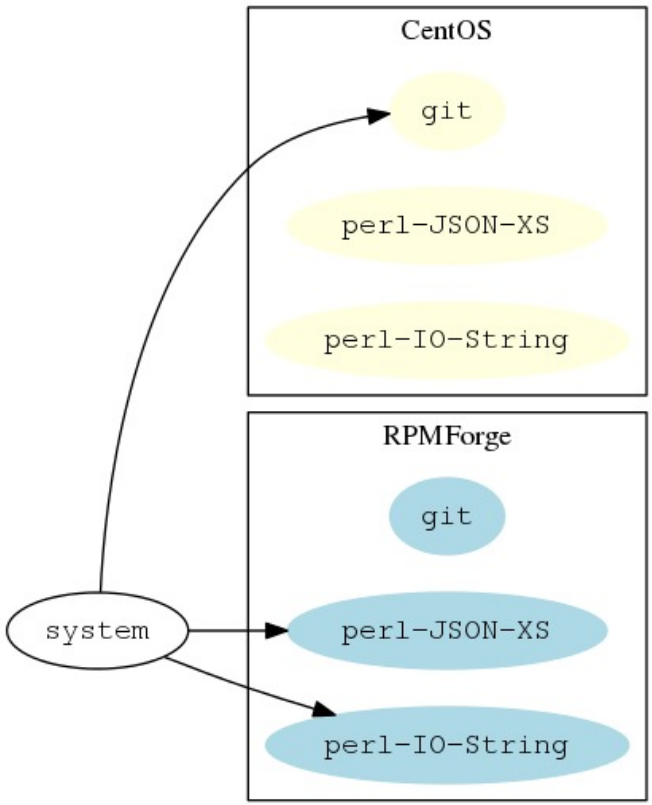


Desired state

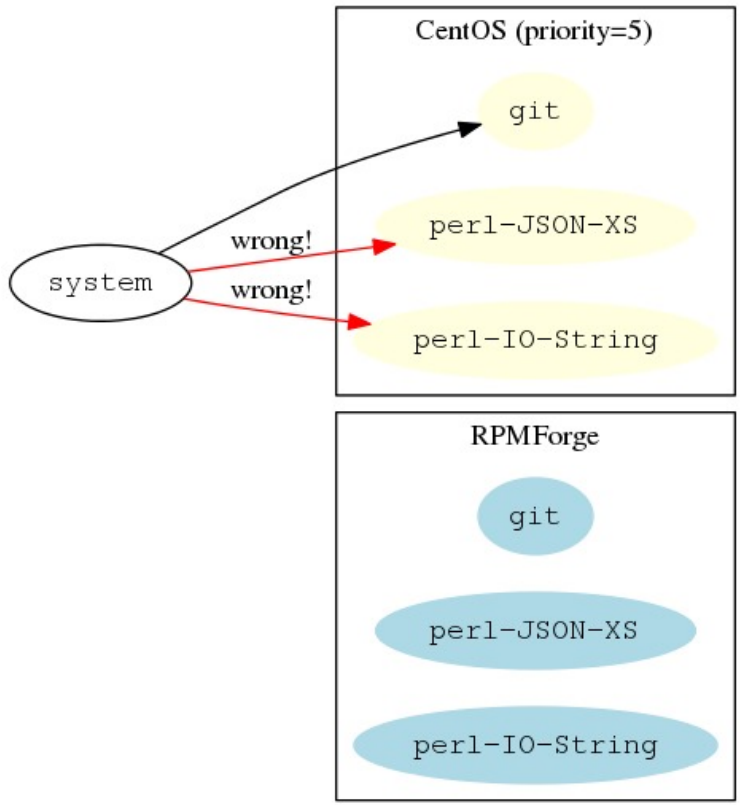


Raising the priority of repoforge

Avoid Yum priorities



Desired state



Raising the priority of CentOS

Requirements for an upgrade policy

- Upgrades must happen frequently
  - Bug fixes
  - Security fixes
  - New cool features
- But we need stability
  - And changes carry some risk
  - Risk depends on the service, exposure...
- Different portions of the infrastructure need different upgrade frequencies
- Surprises are not allowed

Requirements for an upgrade policy

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Many dimensions of an upgrade

$$\vec{system\,packages} = f\left(service, date, risk_{upgrade}, risk_{upgrade\,not}, \ldots\right)$$
$$risk = g\left(exposure, cost\ of\ downtime, resources, service, \ldots\right)$$

Repository management

- Probably we all mirror a lot of repositories into our organisation
- What do you use for the mirroring? And for the access control?

Repository management tools

- Does any of you use SpaceWalk? Satellite? Pulp?
- What is your opinion on those?

Repository management tools

- Most tools are based on having different repositories for different needs

Example

epel, epel_prod, epel_test, epel_devel, epel_uat, ...

- How do things move from _test to _prod?
- On large environments, the number of repositories explodes
- And reverting to old states is not simple

Versioned repositories

$$\begin{pmatrix} centos & v_{centos} \\ epel & v_{epel} \\ rpmforge & v_{rpmforge} \\ local & v_{local} \\ \dots & \dots \end{pmatrix} = f\left(service, date, risk_{upgrade}, risk_{upgrade\,not}, \dots\right)$$

Versioned repositories

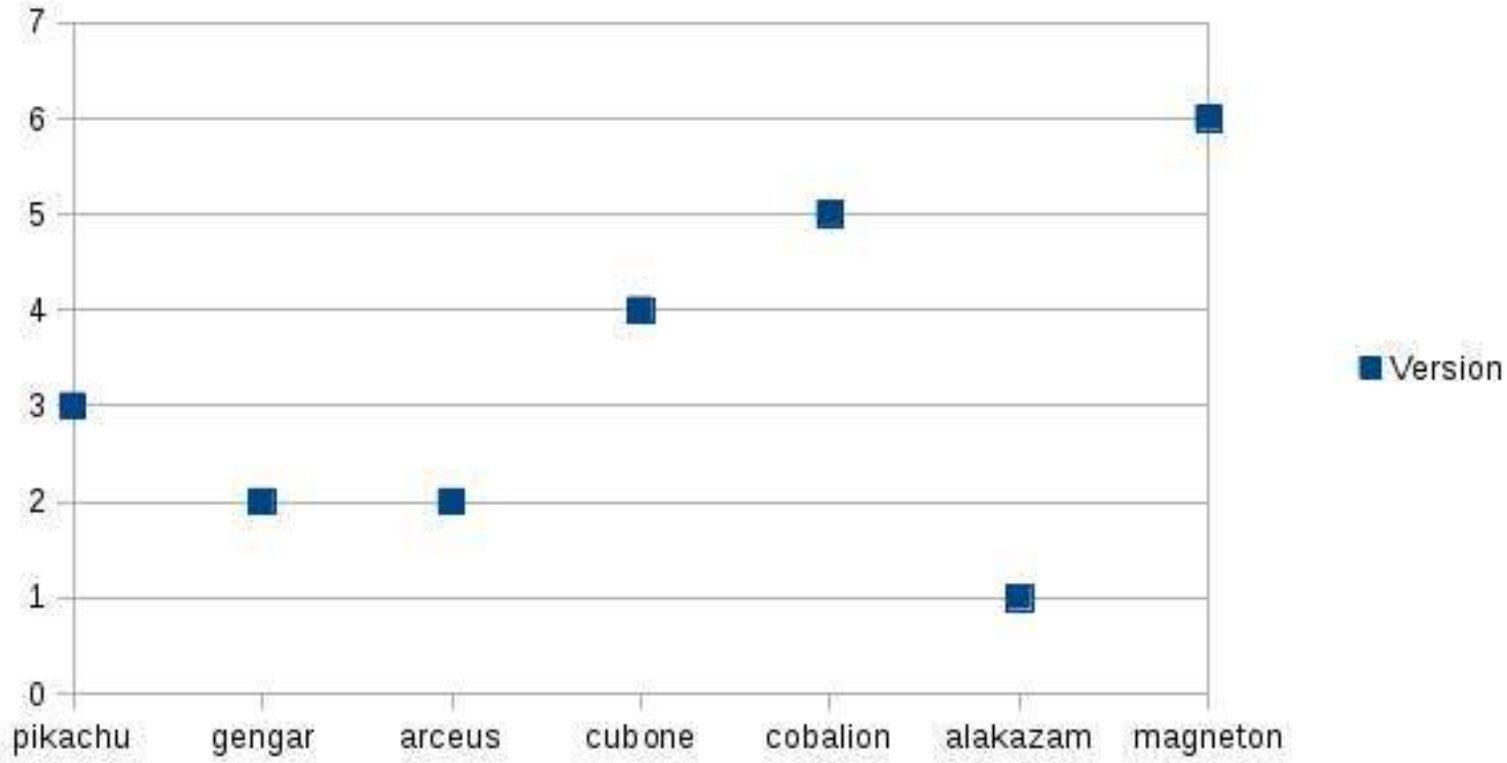


Figure : Subscriptions to repository versions per host

Versioned repositories

- Repository versions must be immutable
  - Having _dev, _test, ... repositories doesn't guarantee that
- All systems on version X of a repository must see the exact same repository at all times
- Easy to do with filesystem snapshots
  - LVM
  - ZFS
  - BTRFS
  - NetApp
  - ...

Upgrading systems

- Declare a newer version for your repository
- Run `yum distro-sync`

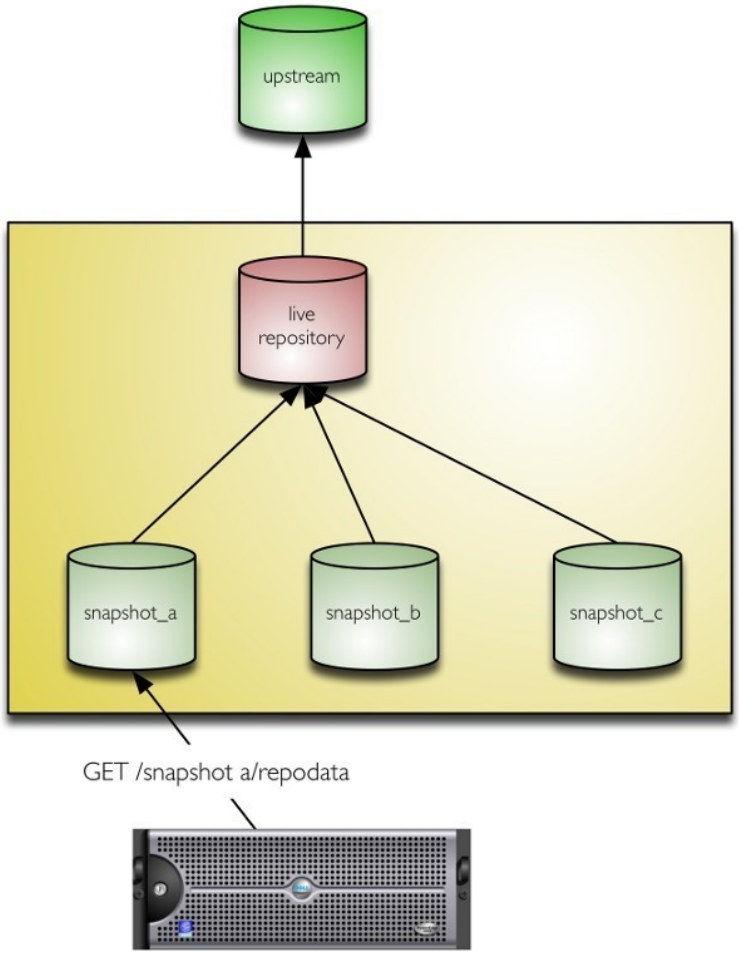
Rolling back a failed upgrade

- Declare a previous version for the repository
- Run `yum distro-sync`

Locking the kernel among upgrades

- Use the versionlock plugin
- Move the versions of any repositories at will
- Run `yum distro-sync`

HPC@UGent snapshotting architecture



HPC@UGent repositories for CentOS 5

Figure : List of mirrored and home-made repositories

HPC@UGent exposed

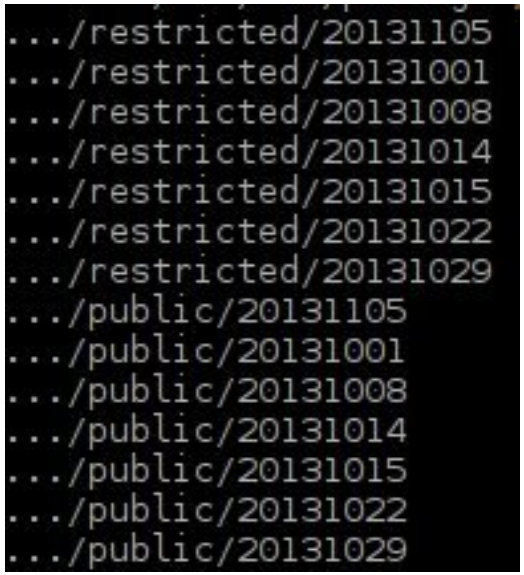


Figure : List of snapshots

Subscribing to a version of a repository

```
[epel]
name=epel
baseurl=http://a.host/20131008/epel_el5
enabled=1
...
```

Wrap-up

Questions?


CURIOSITY
KILLED THE CAT
quickmeme.com
9GAG.COM/GAG/4960942

Credits

- The *g* logo is property of the Gentoo Foundation.