Singularity tests at CC-IN2P3 for Atlas

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Singularity

A container solution oriented for HTC/HPC scientific computing from it's primary design features :

- **Portability**
  - Works on **RHEL**, Debian, Arch, Alpine, Gentoo and Slackware.
  - Support compatibility back **to RHEL5**
- **Reproducibility and Mobility**
  - Singularity supports image files
  - Ext3, SandBox (chroot, e.g. cvmfs)
  - Squashfs, tar, tgz
  - URIs (e.g. Docker, Singularity)
- **Security**
  - No root owned daemon processes
  - No user contextual changes or root escalation allowed
  - Trusted and untrusted mode
- **Singularity** is released under a standard 3 clause BSD license
  - http://singularity.lbl.gov/about
  - https://github.com/singularityware/singularity/issues
  - Docker vs Singularity vs Shifter vs UGE Container

ATLAS Use Cases

- **Several operational problems can be solved by the usage of Containers**
  - Installation of different OS from SL/RHEL/CentOS
  - Minimal installation on the nodes, if sites prefer
  - OS upgrades don't need coordination with experiments anymore
- **May offer another approach to software distribution to sites that don't support CVMFS (HPC)**
  - Fat images
- **Payload isolation**
- **Data and Software preservation[*]**
- **User container deployment [*]**

“Singularity is suited for job execution at sites, while Docker[*] requires more complex deployment on a WLCG site”

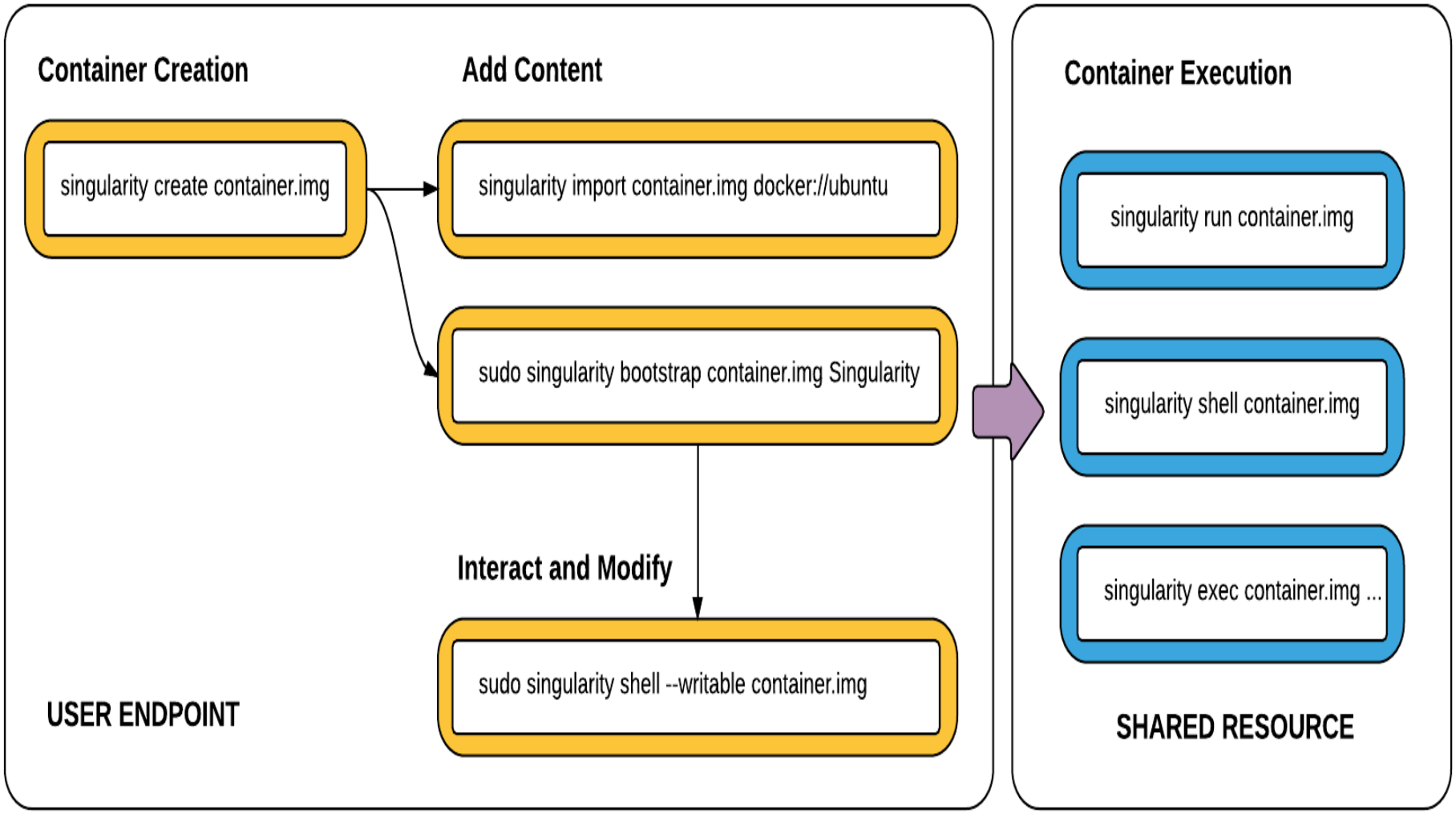
Atlas Containers Activity

- **Atlas activity and wide discussions on WLCG**
  - WLCG supports the deployment of Singularity in WLCG grid sites
- **Every second week meeting on Tuesday at 16:40 after the ADC weekly**
  - Agenda example → https://indico.cern.ch/category/1706/
- **Dedicated e-group:** atlas-adc-containers-deployment@cern.ch
- **Information for the sites' admins at** :
  - https://twiki.cern.ch/twiki/bin/view/AtlasComputing/ADCContainersDeployment

Atlas VO Plan from ADC TIM at CERN (20-22 Sep 2017)

- **Singularity**
  - Atlas WG starts with singularity deployment in **Wrapper Mode**
  - Start a container (e.g for SL6) launched by ATLAS wrapper on a SL7/CENTOS 7 WLCG Grid worker node
  - Central control/switch via AGIS parameter per Panda Queue
- **Big sites need to be tested as soon as possible**
  - (**all Tier-1s + big Tier-2s, possibly Tier-0**)
  - **BNL** use singularity in HTCondor (Whole batch mode)
  - **SigNet** integrated Slurm batch with Singularity (Whole batch mode)
- **Recommendations**
  - **Use latest 2.3.1 production version from WLCG/OSG repository**
    - RPMS based installation
    - see at https://opensciencegrid.github.io/docs/worker-node/install-singularity
  - Default parameters are sufficient for the tests
    - **allow setuid** is enabled by default
    - **overlay FS** is enabled by default
    - **allow pid ns** - NameSpace need attention **(**where a resource manager enforce resource limits in the total process tree)
  - http://singularity.lbl.gov/archive/docs/v2-3/

Singularity Workflows



Deployment Model and Site Control

Mode of deployment	Singularity installation /RPMS	Config	Image or Sandbox	Environment outside the Container	Environment inside the Container
Whole Batch	**Site (rpm)**	**Site**	**Site**	**Site**	**Site (?)**
Privileged mode Whole Wrapper/Pilot	**Site (rpm)**	**Site**	**VO**	**Site**	**VO (CVMFS)**
Unprivileged mode – Wrapper or pilot	**VO (cvmfs)**	**VO**	**VO**	**Site**	**VO(CVMFS)**

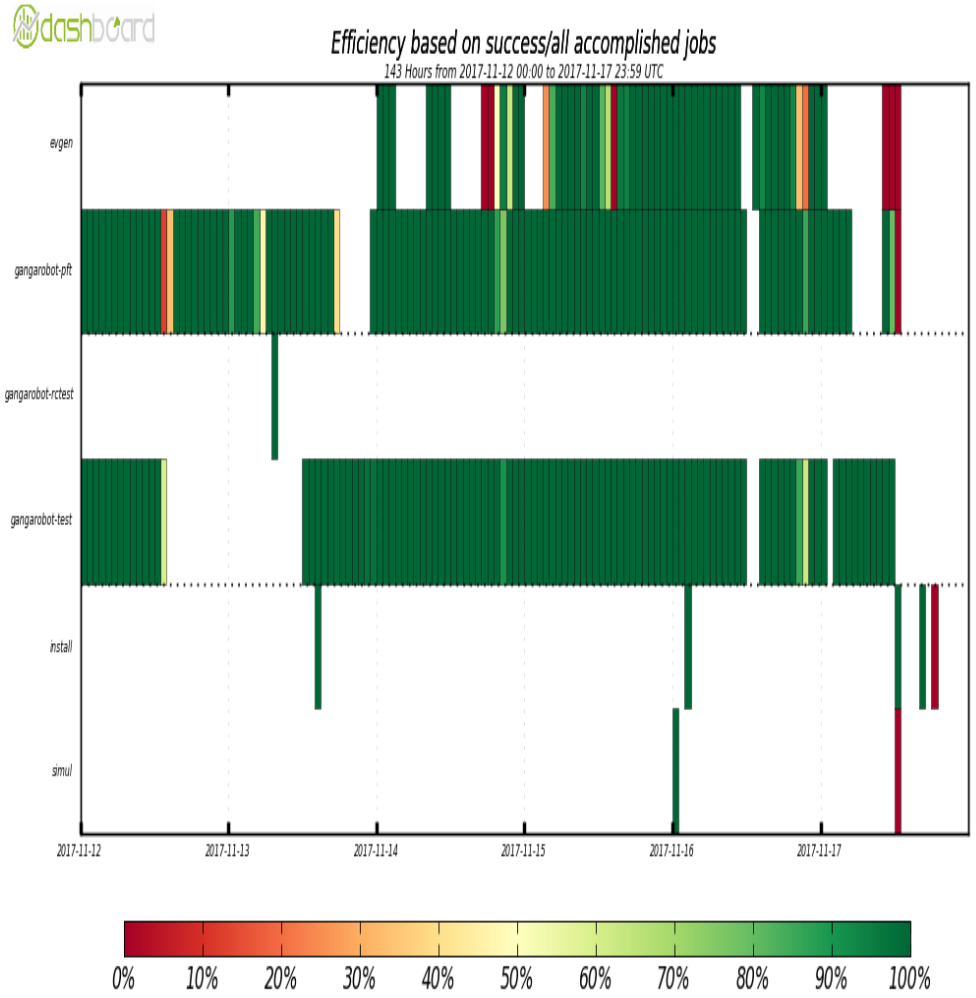
OSG Statements:

- *"Sites that want to support production jobs with singularity will need to choose the RPM method."*
- Full Statement at https://opensciencegrid.github.io/docs/worker-node/install-singularity

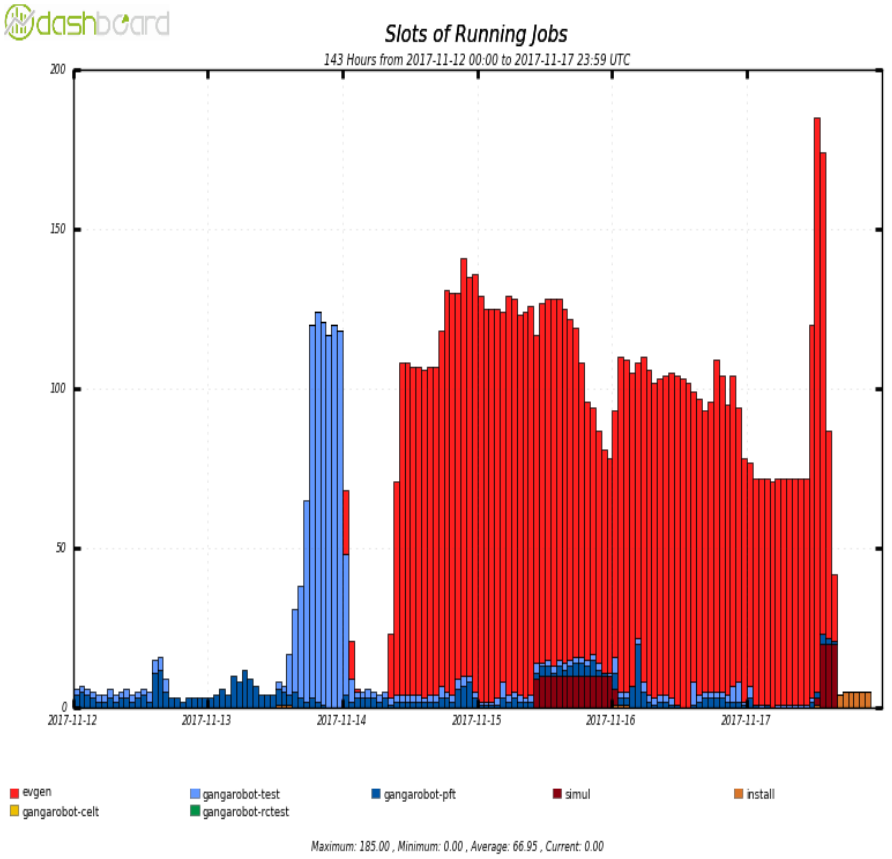
Singularity tests on Cloud T3 farm

- **IN2P3-CC-T2_VM1**
  - Openstack Cloud Resources & Direct submission from APF to HTCondor/Cloud
  - CERN-VM 4.0 beta & SL7.4 (Nitrogen)
  - Kernel 4.1.44-30.cernvm.x86_64
  - Atlas singularity image (from cvmfs)
  - Singularity 2.2.1 & Cloud Worker without Grid environment (!)
  - Atlas Grid Environment setup from CVMFS, automatically from the wrapper (!)
- **Panda queue AGIS parameters:**
  - **container options**: "-B/cvmfs,/var/lib/condor"
  - **container type**:"singularity:wrapper"
  - Image name and version are included in the pilot wrapper
- **Setup instructions for the sites on:**
  - https://twiki.cern.ch/twiki/bin/view/AtlasComputing/ADCContainersDeployment

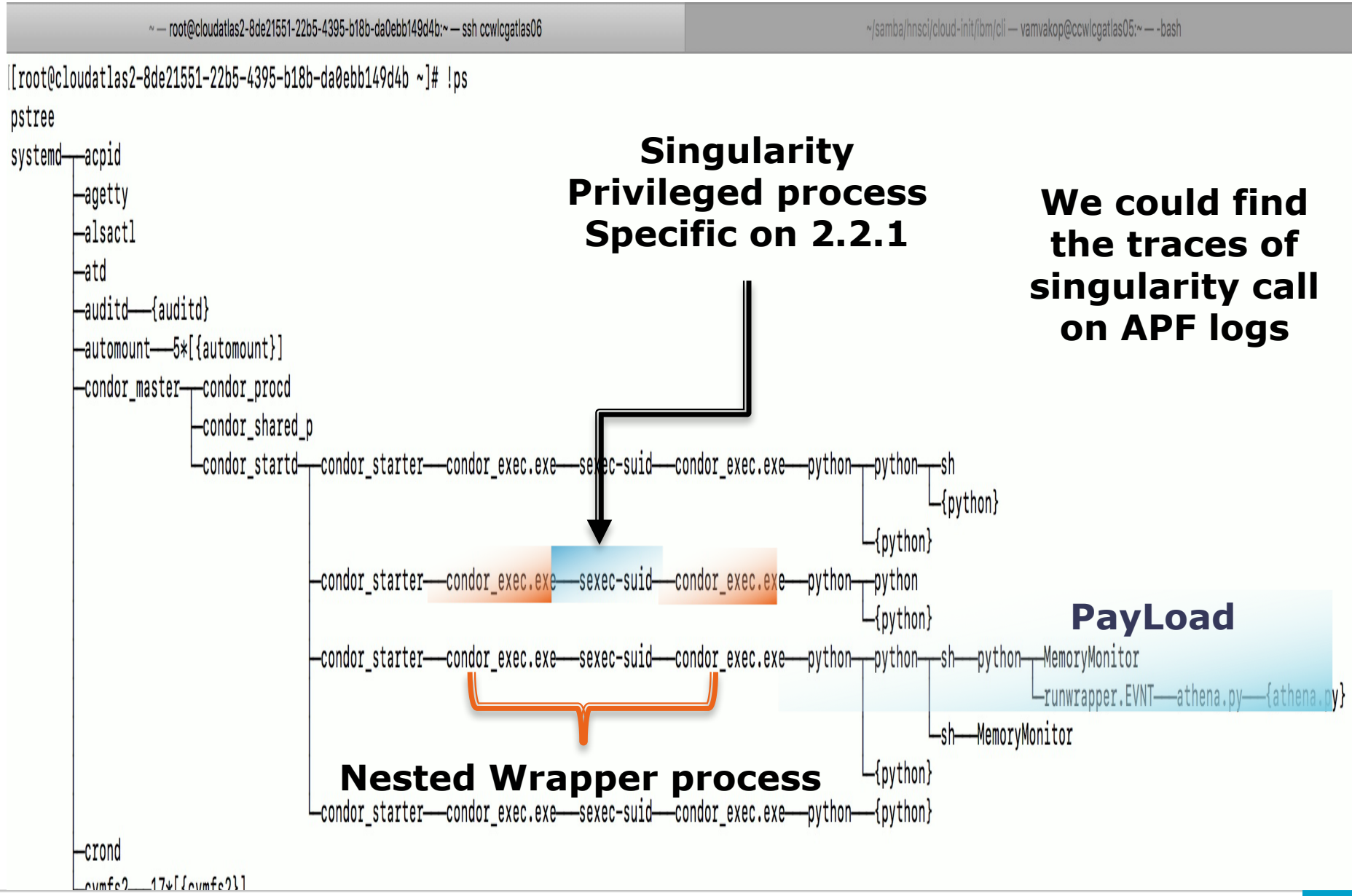
Simple tests with HammerCloud and Simulation jobs



~150 concurrent single core job



Wrapper mode (a nested process)



Singularity tests next step

- **Use a test bed environment in order to mimic the CC-IN2P3 production environment**
  - APF/CREAMs/GridEngine
  - Centos 7.x Worker Node with Grid environment
  - Tests on progress
- **Singularity 2.3.1**
  - With Image from cvmfs (atlas's image)
  - With Sandbox on cvmfs (atlas unfold image)
- **Check and test**
  - **The Privileged mode** (based on rpms)
  - **The unprivileged mode** (based on installation on CVMFS)
- Also, we are waiting the singularity version 2.4.1

Thank for your attention

Backup Slides

Image definition for the image of ATLAS

```
echo "Installing the packages inside the container"
rpm --rebuilddb
yum -y install vim-minimal
echo "Installing Development tools"
yum -y groupinstall "Development Tools"

echo "Installing basic packages"
yum -y install vim-enhanced man-db wget ntp gfal2-all gfal2-util autofs nfs-utils git perl perl-Data-Dumper automake autoconf libtool gcc gcc-c++ glibc flex make autofs


echo "Installing Atlas packages"
yum -y install time alsa-lib ……. [Too Long List ]
# Additional packages for belle
yum -y install binutils-devel python-devel
yum -y install wget
wget http://linuxsoft.cern.ch/wlcg/sl6/x86_64/HEP_OSlibs_SL6-1.0.17-0.el6.x86_64.rpm
yum -y localinstall HEP_OSlibs_SL6-1.0.17-0.el6.x86_64.rpm
yum -y install epel-release
yum -y install yum-priorities
yum -y install http://repository.egi.eu/sw/production/umd/4/sl6/x86_64/updates/umd-release-4.1.3-1.el6.noarch.rpm
yum -y install gfal2-all gfal2-util
yum -y install xrootd-client
yum -y install lcg-util
yum -y update
# Create dir for SLES11 systems
mkdir -p /scratch /gpfs/work /gpfs/scratch /cvmfs /etc/grid-security/certificates
```

Complete file at → /cvmfs/atlas.cern.ch/repo/containers/def/singularity