

Spack

Test of concept at CERN



Outline

- Introduction to LCG Releases
 - LCG SPI team
- Integrating Spack
- Building and installing with LCGCMake vs Spack

Introduction to LCG Releases

LCG SPI team (Packages & Releases project)

- Part of the EP-SFT
- Software distribution to the experiment groups.
 - Releasing full configurations. Content, versions and platforms discussed/agreed with experiments
 - Providing this service to the experiments successfully for the last 10 years
- Implementation
 - Builds are done with a home-made tool based on CMake (LCGCMake)
 - The output are Tarfiles that are installed in CVMFS and available to experiments
 - Generation of 'Views'

Problem to solve: build packages and combinations

Packages

Externals (~300)	MC Generators (~80)	Group's projects (6)
Python, GSL, Boost...	Pythia	ROOT
About 10 Grid packages	Herwig	GEANT4
FTS, WMS, DPM...	HepMCAnalysis	...
	...	

Combinations

Packages, versions and combinations agreed with experiments

Compilers	Architectures	Operating systems	Build types
<ul style="list-style-type: none">gcc4.9.3, gcc6.2.0clangNativeicc17	<ul style="list-style-type: none">Intelarm64	<ul style="list-style-type: none">SLC6CentOS7Ubuntu16Mac 10.11	<ul style="list-style-type: none">ReleaseDebug

Graphic credit: Patricia Mendez

Integrating Spack

New Packages

Group's Projects	Externals	Grid Externals	MC Generators	Others
ROOT * Geant4 * DD4hep	castor vdt vecGeom vectorclass vc fast-jet fjcontrib xqilla pcre pacparser ... (total of 21)	gfal dcap srm_ifce	agile alpgen yoda	+25 R-Packages +35 Python-Packages

<https://gitlab.cern.ch/sft/cern-spack>

Source repo to Spack mirror structure

```
/eos/project/1/lcg/www/lcgpackages/tarFiles/sources
```

```
|─ 4Suite-XML-1.0.2p1.tar.gz
```

```
//
```

```
|─ Python-2.7.6.tgz
```

```
|─ Python-2.7.9.p1.tgz
```

```
|─ Python-2.7.9.tgz
```

```
|─ Python-3.2.2.tgz
```

```
|─ Python-3.5.0.tgz
```

```
|─ Python-3.5.2.tgz
```

```
|─ python-gitlab-0.17.tar.gz
```

```
//
```

- One single directory

<http://lcgpackages.web.cern.ch/lcgpackages/tarFiles/>

```
/eos/project/1/lcg/www/lcgpackages/tarFiles/spackmirror
```

```
|─ 4suite-xml
```

```
| |─ 4suite-xml-1.0.2p1.tar.gz
```

```
//
```

```
|─ python
```

```
| |─ python-2.7.6.tgz
```

```
| |─ python-2.7.9.p1.tgz
```

```
| |─ python-2.7.9.tgz
```

```
| |─ python-3.2.2.tgz
```

```
| |─ python-3.5.0.tgz
```

```
| |─ python-3.5.2.tgz
```

```
|─ python-gitlab
```

```
| |─ python-gitlab-0.17.tar.gz
```

```
//
```

- One directory per package
- Lower case conversion
- Links to the existing packages

External compilers

- All provided compilers in a common place:

```
/cvmfs/sft.cern.ch/lcg/contrib/<compiler>/<version>/<platform>/content
```

- Added to Spack configuration
 - Need to add compiler libs to LD_LIBRARY_PATH

```
compilers:  
- compiler:  
  extra_rpaths: []  
  flags: {}  
  modules: []  
  operating_system: scientificcernslc6  
  paths:  
    cc: /cvmfs/sft.cern.ch/lcg/contrib/gcc/4.9.3/gcc  
    cxx: /cvmfs/sft.cern.ch/lcg/contrib/gcc/4.9.3/g++  
    f77: /cvmfs/sft.cern.ch/lcg/contrib/gcc/4.9.3/gfortran  
    fc: /cvmfs/sft.cern.ch/lcg/contrib/gcc/4.9.3/gfortran  
  spec: gcc@4.9.3
```

compilers.yaml

Hierarchy of repositories

- Use of three different repositories
 - `cern-spack`
 - `hep-spack`
 - `builtin`
- Reasons:
 - Private testing
 - Overridden packages
 - Cern-specific packages

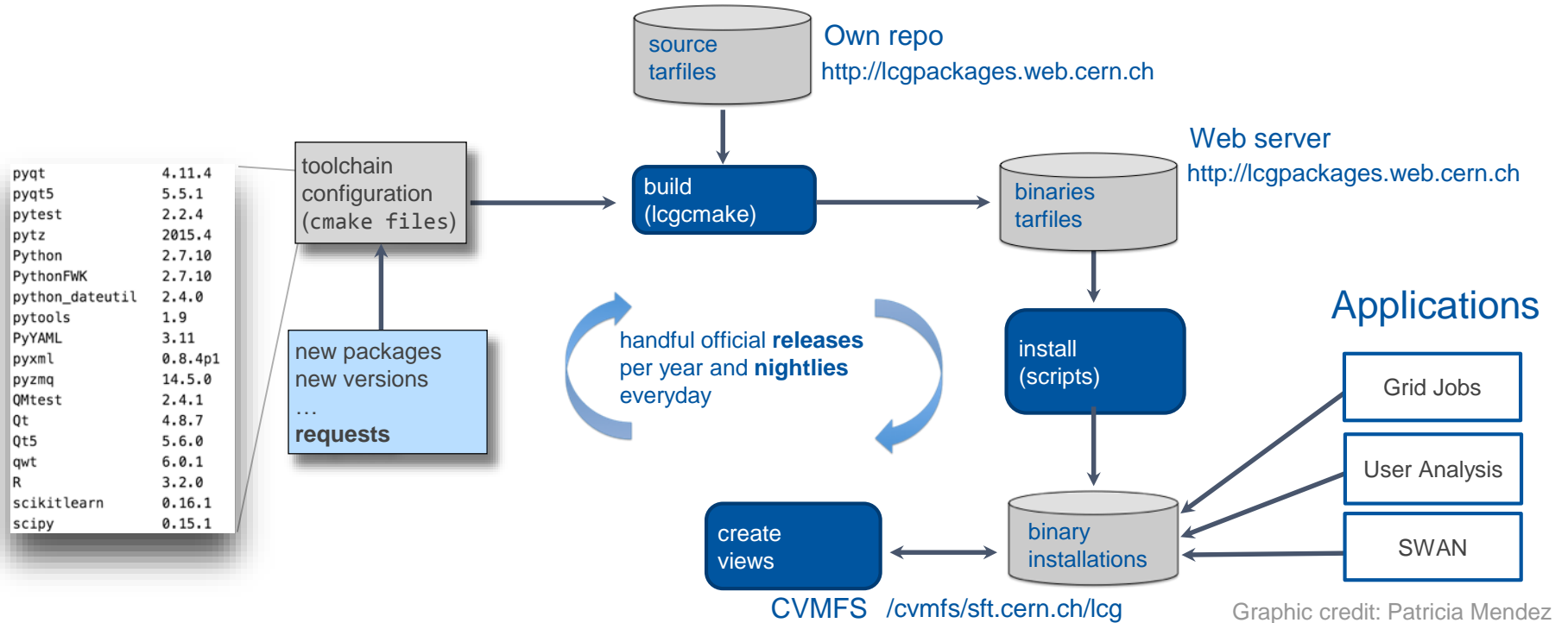
```
repos:  
- $spack/var/spack/repos/cern-spack  
- $spack/var/spack/repos/hep-spack  
- $spack/var/spack/repos/builtin
```

repos.yaml

<https://gitlab.cern.ch/sft/cern-spack>

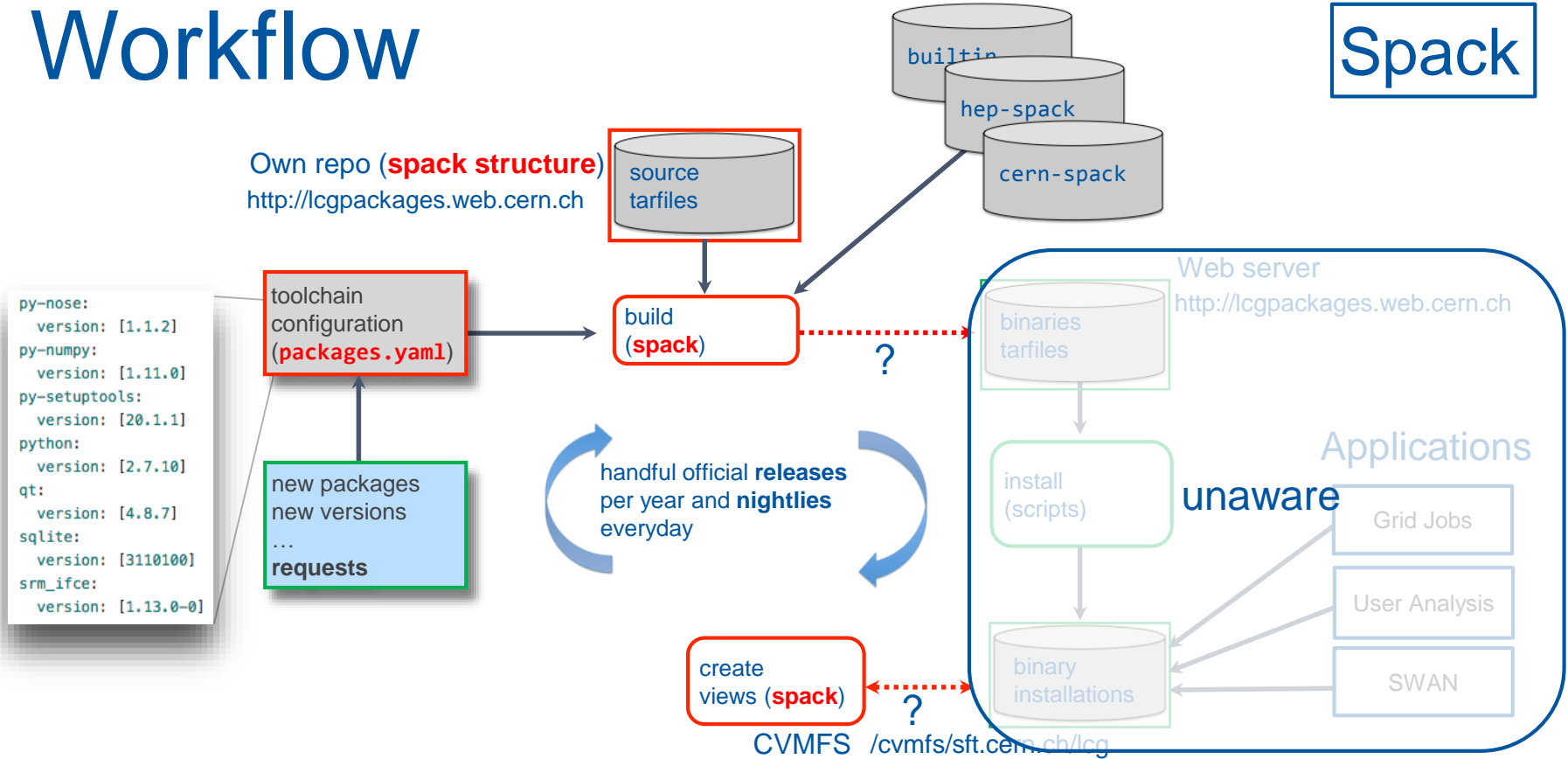
Workflow

LCGCMake



Workflow

Spack



Build orchestration



Jenkins

- Automate builds with different configurations
 - Different compilers and platforms
 - Different options, branches and target to install
- Similar to the approach used with LCGCMake
 - Jenkins is application-unaware
- Similar performance
- Some initial issues
 - ENVIRONMENT VARIABLES
 - ENVIRONMENT SETUP

```
==> Successfully installed ROOT
Fetch: 1m 11.41s. Build: 32m 55.80s. Total: 34m 7.20s.
[+] /mnt/build/jenkins/workspace/spack_experimental/BUILD
28/spack/opt/spack/linux-centos7-x86_64/gcc-4.9.3/ROOT-HEA
[description-setter] Could not determine description.
[PostBuildScript] - Execution post build scripts.
[lcgapp-centos7-x86-64-28] $ /bin/bash -x /tmp/hudson55375
[WS-CLEANUP] Deleting project workspace...[WS-CLEANUP] don
Finished: SUCCESS
```

Monitoring

Not real log info divided into steps



LCGCMake

dev3										
Site	Build Name	Update	Configure		Build		Test		Build Time	
		Files	Error	Warn	Error	Warn	Not Run	Fail		Pass
lcgapp-centos7-x86-64-22.cern.ch	dev3-x86_64-centos7-gcc62-dbg	0	0	0	10	3	0	0	6	19 hours ago
lcgapp-cc7-x86-64-6.cern.ch	dev3-x86_64-centos7-gcc62-opt	0	0	0	10	3	0	0	6	19 hours ago

Experimental										
Site	Build Name	Update	Configure		Build		Test		Build Time	
		Files	Error	Warn	Error	Warn	Not Run	Fail		Pass
lcgapp-slc6-physical1.cern.ch	nco@4.6.1%gcc@4.9.2+mpi arch=linux-scientificcernslc6-x86_64-oo34iba		0	0	0	0	13	1	2	Nov 30, 2016 - 23:35 UTC
lcgapp-slc6-physical1.cern.ch	ncview@2.1.7%gcc@4.9.2 arch=linux-scientificcernslc6-x86_64-rlupugm		0	0	0	0	17	0	22	Nov 30, 2016 - 23:33 UTC

Spack



Monitoring



Info should be per package or platform (building multiple pkgs)

LCGCMake

dev3										
Site	Build Name	Update	Configure		Build		Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass	
lcgapp-centos7-x86-64-22.cern.ch	dev3-x86_64-centos7-gcc62-dbg	0	0	0	10	3	0	0	6	19 hours ago
lcgapp-cc7-x86-64-6.cern.ch	dev3-x86_64-centos7-gcc62-opt	0	0	0	10	3	0	0	6	19 hours ago

Spack

Experimental										
Site	Build Name	Update	Configure		Build		Test			Build Time
		Files	Error	Warn	Error	Warn	Not Run	Fail	Pass	
lcgapp-slc6-physical1.cern.ch	nco@4.6.1%gcc@4.9.2+mpi arch=linux-scientificcernslc6-x86_64-oo34iba		0	0	0	0	13	1	2	Nov 30, 2016 - 23:35 UTC
lcgapp-slc6-physical1.cern.ch	ncview@2.1.7%gcc@4.9.2 arch=linux-scientificcernslc6-x86_64-rlupugm		0	0	0	0	17	0	22	Nov 30, 2016 - 23:33 UTC



Monitoring

Lack of detailed output taken from nodes



LCGCMaKe

Configure (0 errors, 0 warnings)

```
Start Time: 2017-03-12T23:10:14 UTC
End Time: 2017-03-12T23:10:26 UTC
Configure Command: "/cvmfs/sft.cern.ch/lcg/contrib/CMaKe/3.7.0/Linux-x86_64/bin/cmake" "-DLCG_VERSION=dev3" "-
DCMAKE_INSTALL_PREFIX=/build/jenkins/workspace/lcg_ext_dev3/BUILDTYPE/Debug/COMPILER/gcc62/LABEL/centos7/install" "-DPDFsets=minimal" "-
DLCG_INSTALL_PREFIX=/cvmfs/sft.cern.ch/lcg/releases" "-DLCG_SAFE_INSTALL=ON" "-DLCG_IGNORE=Gent4" "-DCMAKE_VERBOSE_MAKEFILE=OFF" "-DLOG_SOURCE_INSTALL=OFF" "-
DLOG_TARBALL_INSTALL=ON" "-Wno-dev" "-DCMAKE_BUILD_TYPE:STRING=Debug" "-GUnix Makefiles"
"/build/jenkins/workspace/lcg_ext_dev3/BUILDTYPE/Debug/COMPILER/gcc62/LABEL/centos7/lcgcmake"
Configure Return Value: 0
Configure Output:
```

```
-- The C compiler identification is GNU 6.2.0
-- The CXX compiler identification is GNU 6.2.0
-- The Fortran compiler identification is GNU 6.2.0
-- Check for working C compiler: /cvmfs/sft.cern.ch/lcg/contrib/gcc/6.2/x86_64-centos7/bin/gcc
-- Check for working C compiler: /cvmfs/sft.cern.ch/lcg/contrib/gcc/6.2/x86_64-centos7/bin/gcc -- works
```

Build (10 errors, 3 warnings)

```
Build command: make -k -j12 all
Start Time: 2017-03-13T00:10:33 UTC
End Time: 2017-03-13T01:58:39 UTC
```

```
[ 55%] Performing build step for 'ROOT-v6-08-00-patches'
-- madgraph5amc-2.4.0 build command succeeded. See also /mnt/.../build/generators/madgraph5amc-2.4.0/src/madgraph5amc-2.4.0-stamp/madgraph5amc-2.4.0-b

[ 55%] Performing install step for 'madgraph5amc-2.4.0'
-- madgraph5amc-2.5.2.atlas build command succeeded. See also /mnt/.../build/generators/madgraph5amc-2.5.2.atlas/src/madgraph5amc-2.5.2.atlas-stamp/ma

[ 55%] Performing install step for 'madgraph5amc-2.5.2.atlas'
-- madgraph5amc-2.4.2 build command succeeded. See also /mnt/.../build/generators/madgraph5amc-2.4.2/src/madgraph5amc-2.4.2-stamp/madgraph5amc-2.4.2-b

[ 55%] Performing install step for 'madgraph5amc-2.4.2'
CMake Error at /mnt/.../build/generators/madgraph5amc-2.4.0/src/madgraph5amc-2.4.0-stamp/madgraph5amc-2.4.0-install.cmake:26 (message):
Command failed: 1
```



Monitoring

Lack of detailed output taken from nodes



Spack

History
Show Build History
Build History Filter

Notes
Add a Note to this Build

Graph
Show Build Graphs

Configure (0 errors, 0 warnings)
Start Time: 2016-11-30T23:33:55 UTC
End Time: 2016-11-30T23:33:55 UTC
Configure Command: spack install
Configure Return Value: 0
Configure Output:

```
nco@4.6.1%gcc@4.9.2+mpi arch=linux-scientificcernslc6-x86_64^antlr@2.7.7%gcc@4.9.2~csharp+cx- java-python arch=linux-scientific
```

View Configure Summary

Build (0 errors, 0 warnings)
Build command: spack install
Start Time: 2016-11-30T23:35:53 UTC
End Time: -0001-11-30T00:00:00 UTC

View Errors Summary

Build Warnings (0)

View Warnings Summary

Test (2 passed, 1 failed, 13 not run)
View Tests Summary

Monitoring

Results per each dependency package (good)
But any detailed info



Spack

22 tests passed.

Name	Status	Time
ncview@2.1.7%gcc@4.9.2 arch=linux-scientificcernslc6-x86_64-rlupugm	Passed	5m 51s 450ms
libpng@1.6.24%gcc@4.9.2 arch=linux-scientificcernslc6-x86_64-ks5cjk	Passed	25s 470ms
udunits2@2.2.20%gcc@4.9.2 arch=linux-scientificcernslc6-x86_64-x64huof	Passed	30s 100ms
expat@2.2.0%gcc@4.9.2 arch=linux-scientificcernslc6-x86_64-nqilc6n	Passed	13s 590ms



Testing summary for `\n ncview@2.1.7%gcc@4.9.2 arch=linux-scientificcernslc6-x86_64-rlupugm\n` performed between 2016-11-30T01:00:00 and 2016-12-01T01:00:00

Show Test Failure Trend
Download Table as CSV File

Site	Build Name	Build Stamp	Status	Time (s)	Build Revision
------	------------	-------------	--------	----------	----------------

Current goal

- Show a proof that Spack could be a possible LCGCMake alternative
 - Provide a full software stack using Spack:

```
heptools-rootext20161129.cmake [gitlab link]
```

Total packages	260
Spack builtin	120
Cern-spack	60
Pending	87*

- Contains the full list of possible ROOT dependencies
- ROOT team should be able to run over this stack without noticing the change of tool in the build-step.
- No environment tool but a simple script (spackdev, spack setup, ...)

*Some overwritten packages

Desired Spack features

- Incremental build using a custom repository
- Binaries support in `package.py` (good for grid externals)
- Performance improvement in packages with big DAG's
- Parallelism at package level (PR [#843](#))
- Better testing and monitoring tools
- Automatic setup of `LD_LIBRARY_PATH` in `spack compiler add`

FCC use-case

FCC software is built against LCG's CVMFS installation

- First step: create packages .yaml file describing LCG specs
 - Using LCG compiler and packages files
- Allows to build with Spack against LCG stack

Emulating
incremental
build

Nice test-bed as the software is not very extensive

- Easy to maintain and define stack
- Package definitions on github:
 - Using HEP-SF/hep-spack as a basis (recent PR)
 - Separate HEP-FCC/fcc-spack for fcc-specific packages

Slide credit: Joschka Lingemann

