DAAC 2018

Current Status of the OpenHPC Project

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openHPC
https://openhpc.community

Outline

- What is OpenHPC: project overview
  - mission/vision
  - members, governance
  - key takeaways
- More technical details
  - packaging conventions
  - build/test environment
- Highlights from latest release

What is the project's mission and vision?

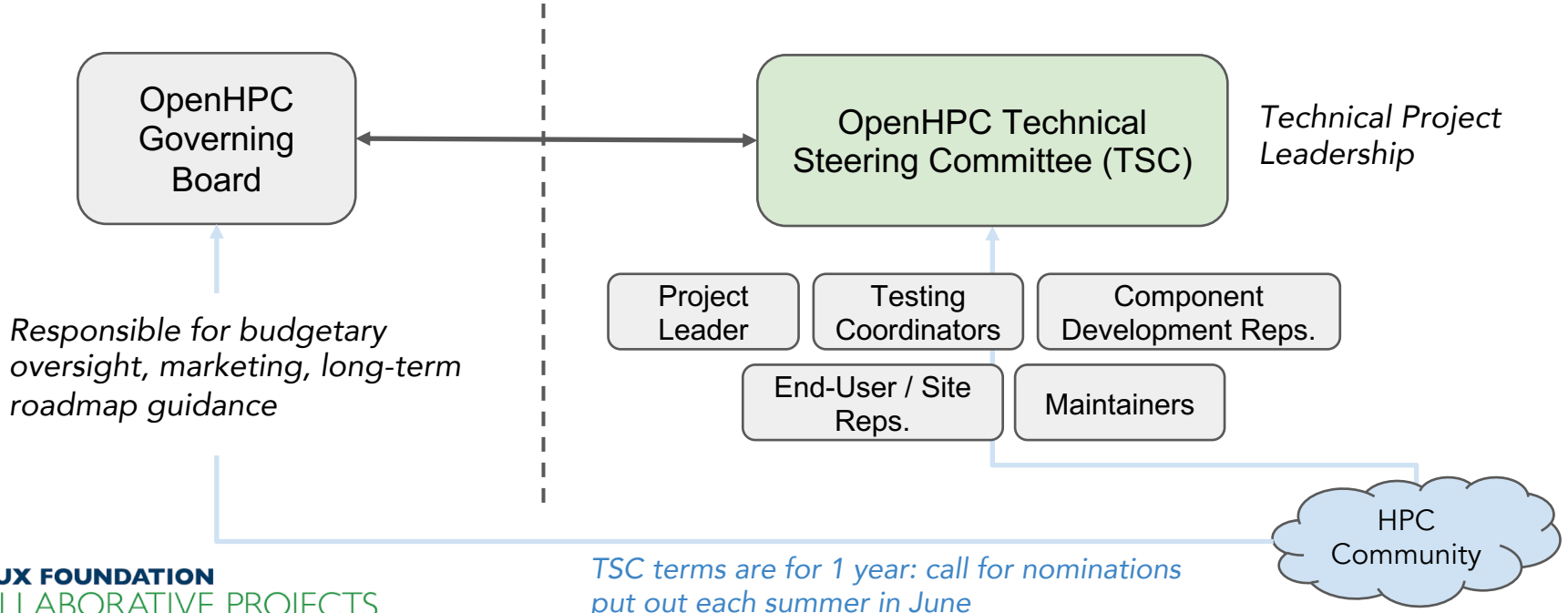
Mission: to provide a reference collection of **open-source HPC software** components and best practices, lowering barriers to deployment, advancement, and use of modern HPC methods and tools.

Vision: OpenHPC components and best practices will enable and accelerate innovation and discoveries by broadening access to state-of-the-art, open-source HPC methods and tools in a consistent environment, supported by a collaborative, worldwide community of HPC users, developers, researchers, administrators, and vendors.

OpenHPC: Project Members

How is the community project governed?

Governance is dual-pronged with a Governing Board + Technical Steering Committee



LINUX FOUNDATION COLLABORATIVE PROJECTS

OpenHPC TSC – Individual Members

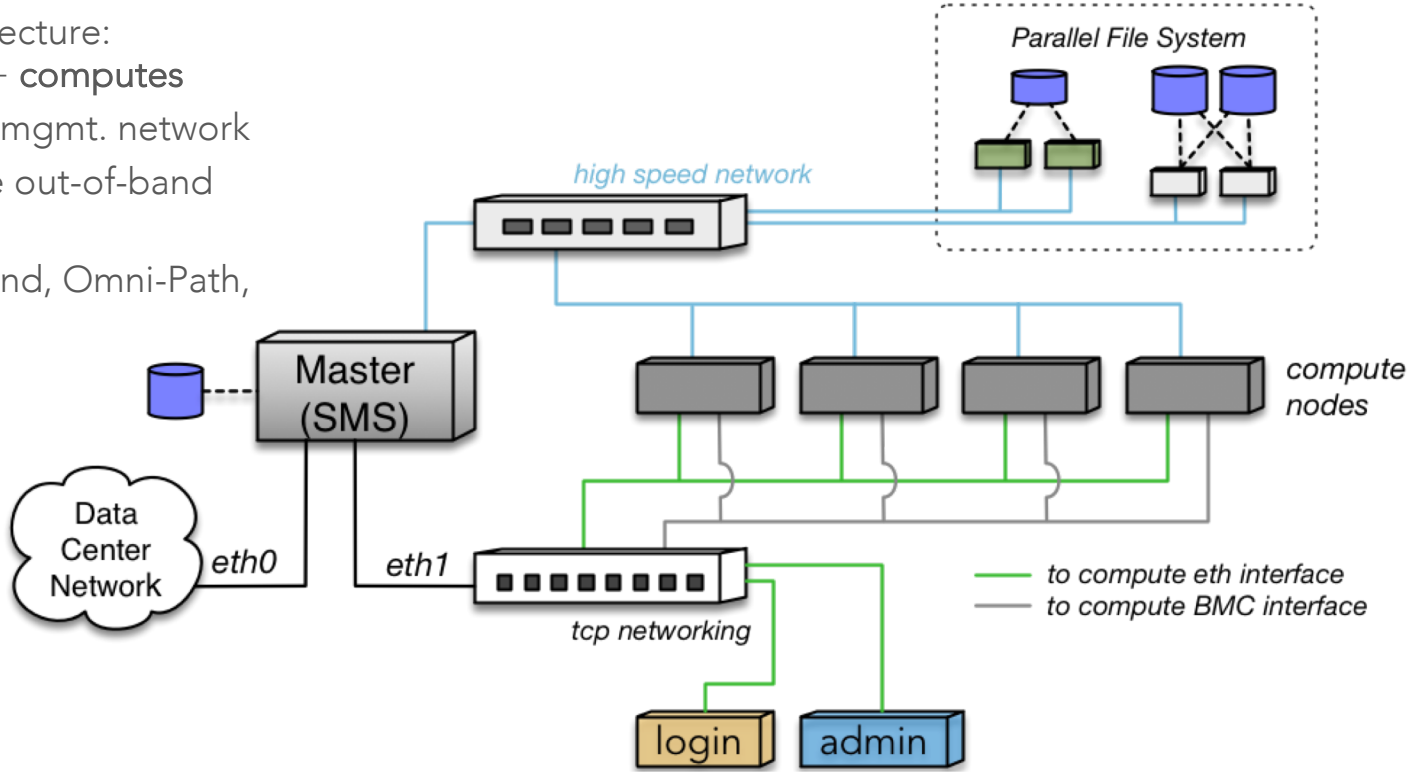
- Reese Baird, Intel (Maintainer)
- David Brayford, LRZ (Maintainer)
- Eric Coulter, Indiana University (End-User/Site Representative)
- Chris Downing, Red Oak Consulting (Maintainer)
- Craig Gardner, SUSE (Maintainer)
- Renato Golin, Linaro (Testing Coordinator)
- Michael Karo, Altair (Maintainer)
- Janet Lebens, Cray (Maintainer)
- Thomas Moschny, ParTec (Maintainer)
- Takayuki Okamoto, Fujitsu (Maintainer)
- Kevin Pedretti, Sandia National Laboratory (Maintainer)
- Paul Peltz, Los Alamos National Laboratory (Maintainer)
- Nam Pho, Harvard Medical School (Maintainer)
- Cyrus Proctor, Texas Advanced Computing Center (Maintainer)
- Adrian Reber, Red Hat (Maintainer)
- Karl W. Schulz, UT Austin (Project Lead, Testing Coordinator)
- Jeff Schutkoske, Cray (Component Development Representative)
- Derek Simmel, Pittsburgh Supercomputing Center (End-User/Site Representative)
- Chris Simmons, UT Dallas (Maintainer)
- Nirmala Sundararajan, Dell (Maintainer)

New for 2018-2019

perhaps someone from this workshop might be interested in volunteering next year?

Target System Architecture

- Basic cluster architecture:
  head node (SMS) + **computes**
- Ethernet fabric for mgmt. network
- Shared or separate out-of-band (BMC) network
- MPI fabric (InfiniBand, Omni-Path, or ethernet-only)



4 Key Takeaways…

OpenHPC: a building block repository

[Key takeaway]

- OpenHPC provides a collection of pre-built ingredients common in HPC environments; fundamentally it is a software repository
- The repository is published for use with Linux distro package managers:
  - yum (CentOS/RHEL)
  - zypper (SLES)

- You can pick relevant bits of interest for your site
  - if you prefer a resource manager that is not included, you can build that locally and still leverage the scientific libraries and development environment
  - similarly, you might prefer to utilize a different provisioning system
  - *public package repositories also makes it easy to include desired elements in customized containers (e.g. Docker, Singularity, Charliecloud)*

Repository Enablement

- Public repositories are available at: http://build.openhpc.community/OpenHPC:/

- There are two primary ways to access the available RPMs
  - enable public OpenHPC repo(s) on head node that can route to internet
  - host a local mirror of the OpenHPC repo(s) within your datacenter (you can download a tarball with entire repo, or rync locally)

- To facilitate the remote network access option, we provide an "ohpc-release" RPM
  - downloadable from front page of GitHub site (https://github.com/openhpc/ohpc)
  - here is an example install for CentOS/x86 and latest v1.3.x release:

```
# export OHPC_GITHUB=https://github.com/openhpc/ohpc/releases/download
# yum -y install $OHPC_GITHUB/v1.3.GA/ohpc-release-1.3-1.el7.x86_64.rpm
```

Repository Enablement (external network access)

- Note that ohpc-release configures two repos:

```
# yum repolist
Loaded plugins: langpacks
repo id              repo name                                          status
OpenHPC              OpenHPC-1.3 - Base                                    821
OpenHPC-updates      OpenHPC-1.3 - Updates                                 686
base                 CentOS-7 - Base                                     9,363
epel                 Extra Packages for Enterprise Linux 7 - x86_64     11,854
```

- With the initial release of a minor branch (e.g. v1.3), the [Updates] repo will be empty
- As subsequent micro releases are available (e.g. v1.3.1, v1.3.2, etc), the [Updates] is populated to match latest release

OpenHPC: A Hierarchical HPC Software Environment

[Key takeaway]

- Designation of compiler/MPI variants is **fundamental** to OpenHPC's build, test, and end-user environment
- OpenHPC packaging is architected to allow multiple variants to be added over time
- example: two gcc variants are installed

```
$ module list
Currently Loaded Modules:
  1) autotools   2) prun/1.2   3) gnu7/7.3.0   4) mvapich2/2.2   5) ohpc

$ module avail

---------------------------------- /opt/ohpc/pub/moduledeps/gnu7-mvapich2 ----------------------------------
   adios/1.13.1    mpiP/3.4.1             phdf5/1.10.2        py3-scipy/1.1.0    superlu_dist/5.3.0
   boost/1.67.0    mumps/5.1.2            pnetcdf/1.9.0       scalapack/2.0.2    tau/2.27.1
   fftw/3.3.7      netcdf-cxx/4.3.0       ptscotch/6.0.4      scalasca/2.3.1     trilinos/12.12.1
   hypre/2.14.0    netcdf-fortran/4.4.4   py2-mpi4py/3.0.0    scorep/4.0
   imb/2018.1      netcdf/4.6.1           py2-scipy/1.1.0     sionlib/1.7.1
   mfem/3.3.2      petsc/3.9.1            py3-mpi4py/3.0.0    slepc/3.9.1                    [ MPI tier ]

------------------------------------- /opt/ohpc/pub/moduledeps/gnu7 -------------------------------------
   R/3.5.0         likwid/4.3.2    mvapich2/2.2    (L)    openmpi3/3.1.0    py2-numpy/1.14.3    superlu/5.2.1
   gsl/2.4         metis/5.1.0     ocr/1.0.1              pdtoolkit/3.25    py3-numpy/1.14.3
   hdf5/1.10.2     mpich/3.2.1     openblas/0.2.20        plasma/2.8.0      scotch/6.0.4        [ compiler tier ]


----------------------------------- /opt/ohpc/pub/modulefiles -----------------------------------
   EasyBuild/3.6.1           clustershell/1.8       gnu7/7.3.0      (L)    ohpc          (L)    prun/1.2    (L)
   autotools          (L)    cmake/3.11.1           hwloc/1.11.10          papi/5.6.0           singularity/2.5.1
   charliecloud/0.2.4        gnu/5.4.0              llvm5/5.0.1            pmix/2.1.1           valgrind/3.13.0
```

Quick (hierarchical) installation example

- Once an OpenHPC repo is enabled, package installation follows standard package manager semantics
- Package interdependencies maintained within RPMs
- Consider example install of PETSc for gnu7/mvapich2 on bare bones head node

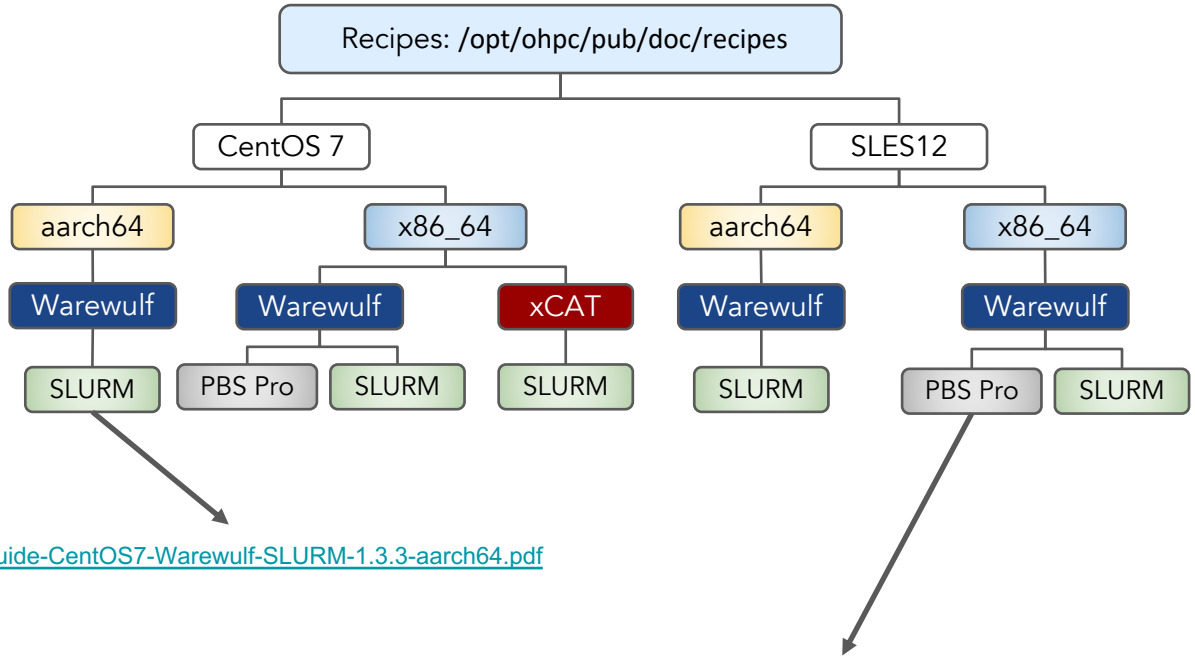
```
# yum install petsc-gnu7-mvapich2-ohpc
…
================================================================================
 Package                        Arch         Version           Repository      Size
================================================================================
Installing:
 petsc-gnu7-mvapich2-ohpc       x86_64       3.7.6-104.1       OpenHPC-updates 13 M
Installing for dependencies:
 gnu7-compilers-ohpc            x86_64       7.1.0-29.3        OpenHPC-updates 51 M
 mvapich2-gnu7-ohpc             x86_64       2.2-26.2          OpenHPC-updates 8.6 M
 openblas-gnu7-ohpc             x86_64       0.2.19-25.1       OpenHPC-updates 3.4 M
 phdf5-gnu7-mvapich2-ohpc       x86_64       1.10.0-83.1       OpenHPC-updates 2.9 M
 prun-ohpc                      noarch       1.1-21.1          OpenHPC         9.5 k
 scalapack-gnu7-mvapich2-ohpc   x86_64       2.0.2-39.1        OpenHPC-updates 3.4 M

Transaction Summary
================================================================================
```

OpenHPC: validated recipes for system install

[Key takeaway]

- In addition to being a package repository, OpenHPC provides validated recipes for bare-metal system installs
- Recipes organized by OS, architecture, and key administrative components
- Latest guides always available on main GitHub site:

  https://github.com/openhpc/ohpc



Install_guide-CentOS7-Warewulf-SLURM-1.3.3-aarch64.pdf

Install_guide-SLE_12-Warewulf-PBSPro-1.3.3-x86_64.pdf

OpenHPC: Multiple Architecture Support

x86_64

```
[train01@sms001 ~]$ module avail

--------------------- /opt/ohpc/pub/moduledeps/gnu7-mpich ---------------------
   adios/1.11.0    mpiP/3.4.1             petsc/3.7.6        scorep/3.0
   boost/1.63.0    mumps/5.1.1            phdf5/1.10.0       sionlib/1.7.1
   fftw/3.3.6      netcdf-cxx/4.3.0       scalapack/2.0.2    superlu_dist/4.2
   hypre/2.11.1    netcdf-fortran/4.4.4   scalasca/2.3.1     tau/2.26.1
   imb/4.1         netcdf/4.4.1.1         scipy/0.19.0       trilinos/12.10.1

----------------------- /opt/ohpc/pub/moduledeps/gnu7 -----------------------
   R/3.3.3        metis/5.1.0         numpy/1.12.1       openmpi/1.10.7
   gsl/2.3        mpich/3.2    (L)    ocr/1.0.1          pdtoolkit/3.23
   hdf5/1.10.0    mvapich2/2.2        openblas/0.2.19    superlu/5.2.1

-------------------------
   EasyBuild/3.2.1
   autotools          (L)
```

aarch64

```
train01@cavium1:~> module avail

--------------------- /opt/ohpc/pub/moduledeps/gnu7-mpich ---------------------
   adios/1.11.0    mpiP/3.4.1             petsc/3.7.6        scorep/3.0
   boost/1.63.0    mumps/5.1.1            phdf5/1.10.0       sionlib/1.7.1
   fftw/3.3.6      netcdf-cxx/4.3.0       scalapack/2.0.2    superlu_dist/4.2
   hypre/2.11.1    netcdf-fortran/4.4.4   scalasca/2.3.1     tau/2.26.1
   imb/4.1         netcdf/4.4.1.1         scipy/0.19.0       trilinos/12.10.1

----------------------- /opt/ohpc/pub/moduledeps/gnu7 -----------------------
   R/3.3.3        metis/5.1.0         ocr/1.0.1          pdtoolkit/3.23
   gsl/2.3        mpich/3.2    (L)    openblas/0.2.19    superlu/5.2.1
   hdf5/1.10.0    numpy/1.12.1        openmpi/1.10.7

------------------------- /opt/ohpc/pub/modulefiles -------------------------
   EasyBuild/3.2.1          hwloc/1.11.6       singularity/2.3
   autotools          (L)   ohpc         (L)   valgrind/3.12.0
```

[Key takeaway]

- aarch64 and x86_64 package repositories are available
- benefit is that OpenHPC provides consistent development environment to the end user across multiple architectures

Additional Technical Details…

More comments on:

- packaging conventions
- infrastructure
- build and test environment

Packaging Conventions

- OpenHPC tries to play nicely with underlying OS'es and other repositories
- We endeavor to avoid namespace conflict in a variety of ways:
  - install paths: end-user oriented components housed under /opt/ohpc/pub (also allow for multiple versions to coexist)
  - package names: RPMs provided via OpenHPC repos include "**-ohpc**" as the suffix for the package name, for example:

    lmod-**ohpc**-7.4.8-11.1.aarch64.rpm

  - dependencies: compiler/MPI variant dependencies are **explicitly** managed

```
%if "%{compiler_family}" == "gnu7"
BuildRequires: gnu7-compilers%{PROJ_DELIM} >= 7.2.0
Requires:      gnu7-compilers%{PROJ_DELIM} >= 7.2.0
%endif
%if "%{mpi_family}" == "mvapich2"
BuildRequires: mvapich2-%{compiler_family}%{PROJ_DELIM}
Requires:      mvapich2-%{compiler_family}%{PROJ_DELIM}
%endif
```

[relevant logic from OHPC_macros]

Packaging conventions: custom ohpc RPM plugin

To avoid namespace collision for resolving dynamic libraries (.so's), we apply an "ohpc" color delimiter to libraries installed in /opt/ohpc/ path

```
# rpm -q --requires gnu7-compilers-ohpc | egrep "libc.so|libgc"
```

default RPM dependency analysis

OHPC 1.3.1 RPM

```
libgcc_s.so.1()(64bit)
libgcc_s.so.1(GCC_3.0)(64bit)
libgcc_s.so.1(GCC_3.3)(64bit)
libgcc_s.so.1(GCC_4.2.0)(64bit)
libgcc_s.so.1(GCC_4.3.0)(64bit)

libc.so.6()(64bit)
libc.so.6(GLIBC_2.10)(64bit)
libc.so.6(GLIBC_2.11)(64bit)
libc.so.6(GLIBC_2.14)(64bit)
libc.so.6(GLIBC_2.16)(64bit)
libc.so.6(GLIBC_2.17)(64bit)
libc.so.6(GLIBC_2.2.5)(64bit)
libc.so.6(GLIBC_2.3)(64bit)
libc.so.6(GLIBC_2.3.2)(64bit)
libc.so.6(GLIBC_2.3.3)(64bit)
libc.so.6(GLIBC_2.6)(64bit)
libc.so.6(GLIBC_2.7)(64bit)
```

.so's contained within ohpc gcc build

.so's required from base OS supplied packages

Build with Updated Approach

```
libgcc_s.so.1()(64bit)(ohpc)
libgcc_s.so.1(GCC_3.0)(64bit)(ohpc)
libgcc_s.so.1(GCC_3.3)(64bit)(ohpc)
libgcc_s.so.1(GCC_4.2.0)(64bit)(ohpc)
libgcc_s.so.1(GCC_4.3.0)(64bit)(ohpc)

libc.so.6()(64bit)
libc.so.6(GLIBC_2.10)(64bit)
libc.so.6(GLIBC_2.11)(64bit)
libc.so.6(GLIBC_2.14)(64bit)
libc.so.6(GLIBC_2.16)(64bit)
libc.so.6(GLIBC_2.17)(64bit)
libc.so.6(GLIBC_2.2.5)(64bit)
libc.so.6(GLIBC_2.3)(64bit)
libc.so.6(GLIBC_2.3.2)(64bit)
libc.so.6(GLIBC_2.3.3)(64bit)
libc.so.6(GLIBC_2.6)(64bit)
libc.so.6(GLIBC_2.7)(64bit)
```

updated RPM dependency analysis using plugin

We introduced this new convention in v1.3.4 release

Packaging Conventions

- Packaging adopts a consistent environment variable schema in modulefiles (we rely on Lmod implementation of modules):
  - `${PACKAGE_DIR} - top level install path of package`
  - `${PACKAGE_BIN} - path to binaries supplied by package`
  - `${PACKAGE_INC} - path to include headers for package`
  - `${PACKAGE_LIB} - path to dynamic libraries for package`

- Recommend using these vars in build scripts, Makefiles, and interactive execution
- Let's consider an end user interaction example with previous PETSc install: assume we are a user wanting to build a PETSC hello world in C

```
$ module load gnu7 mvapich2
$ module load petsc
$ mpicc -I$PETSC_INC petsc_hello.c -L$PETSC_LIB -lpetsc
```

OpenHPC Development Infrastructure

What are we using to get the job done….?

The usual software engineering stuff:

- GitHub (SCM and issue tracking/planning)
- Continuous Integration (CI) Testing (Jenkins)
- Documentation (Latex)
- Bats (unit testing for Bash)

https://github.com/openhpc/ohpc

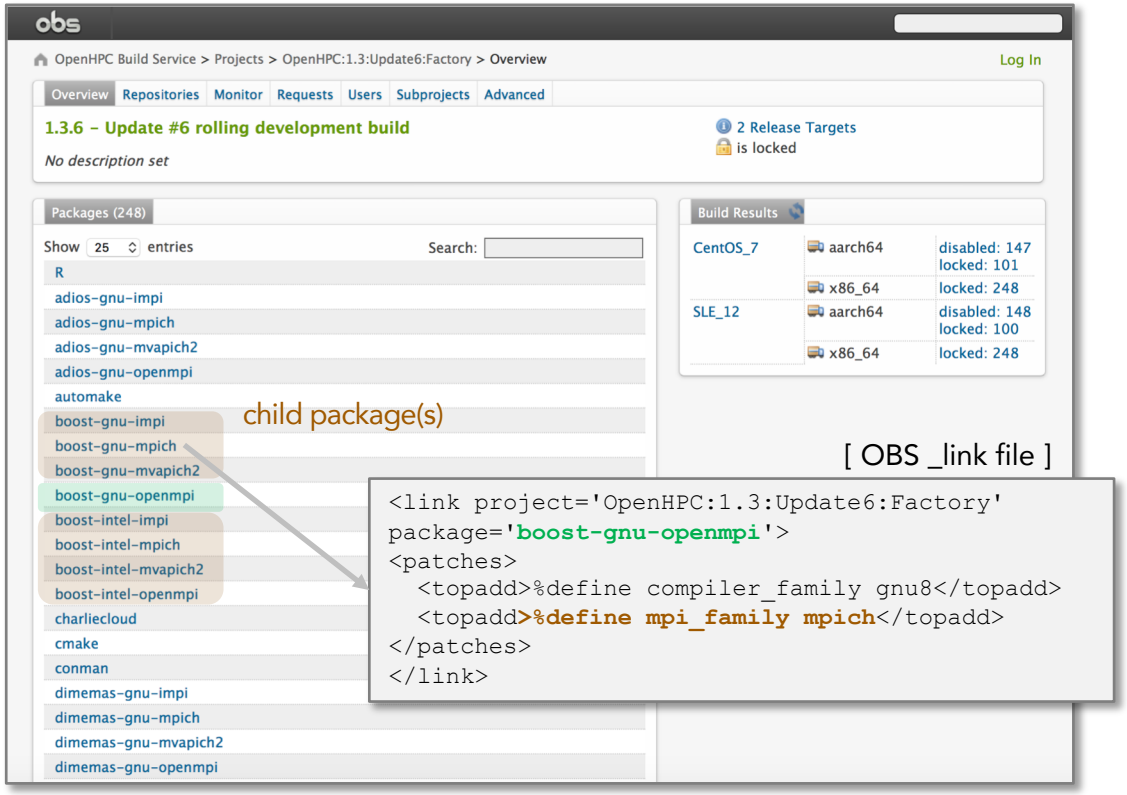
https://build.openhpc.community

Capable build/packaging system:

- Require flexible system to manage builds for multiple distros, multiple compiler/MPI family combinations, and dependencies across packages
- Have engineered a system using Open Build Service (OBS) which is supported by back-end git
  - git houses .spec files, tarballs, patches, documentation recipes, and integration tests
  - OBS performs automated builds and dependency analysis

Reproducible builds using OBS

https://build.openhpc.community

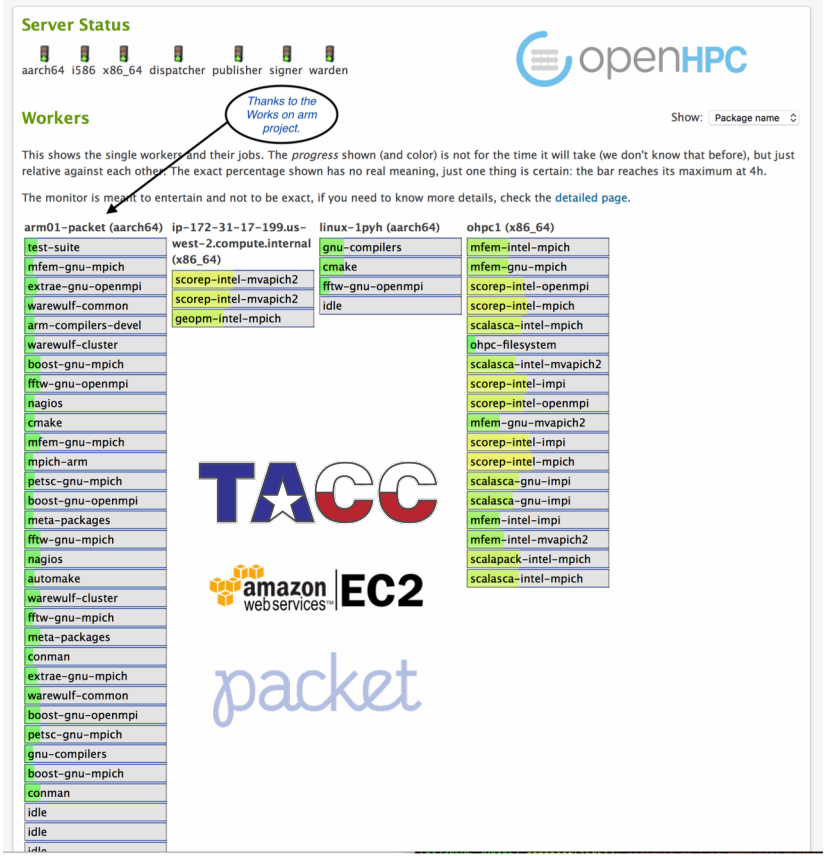


parent package

- We use the **Open Build Service** (OBS) to manage build processes
- OBS can drive builds for multiple OS's and architectures
- Repeatable builds carried out in chroot environment
- **Generates binary and src rpms**
- Client/server architecture supports distributed build slaves and multiple architectures
- OpenHPC adopts a **single** .spec file input for builds
- Dependencies are self-managed and designed to avoid namespace conflict with distro provided variants

Build system - distributed build servers

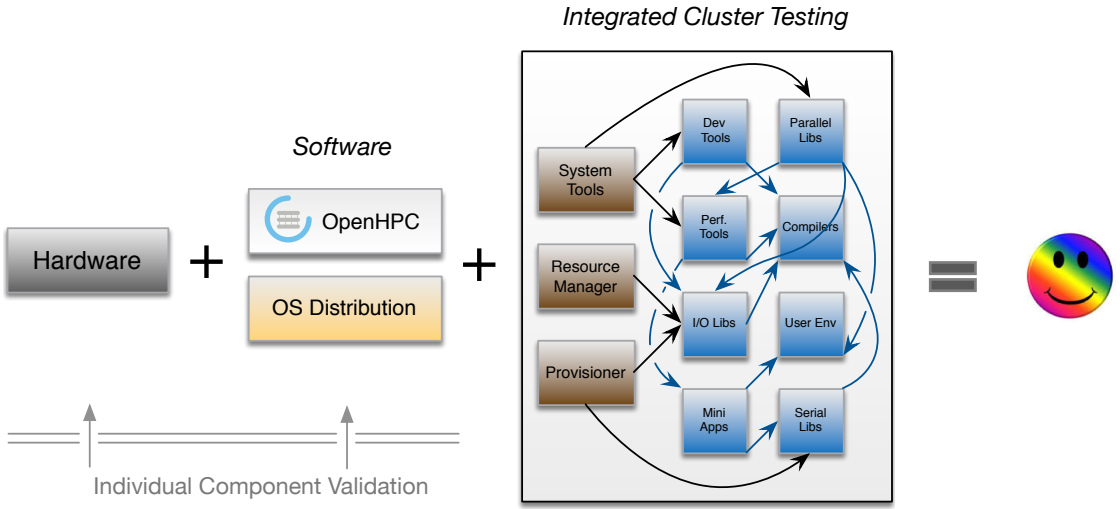
- We leverage ability in OBS to have distributed build servers:
  - x86_64: hosted at TACC (thanks to kind hardware donations) and on EC2
  - aarch64: hosted at Packet (thanks Works on Arm project)



Integration/Test/Validation

Testing is a key element for us and the intent is to build upon existing validation efforts and augment component-level validation with targeted cluster-validation and scaling initiatives including:

- install recipes
- cross-package interaction
- development environment
- mimic use cases common in HPC deployments
- upgrade mechanism



Post Install Integration Tests - Overview

Global testing harness includes a number of embedded subcomponents:

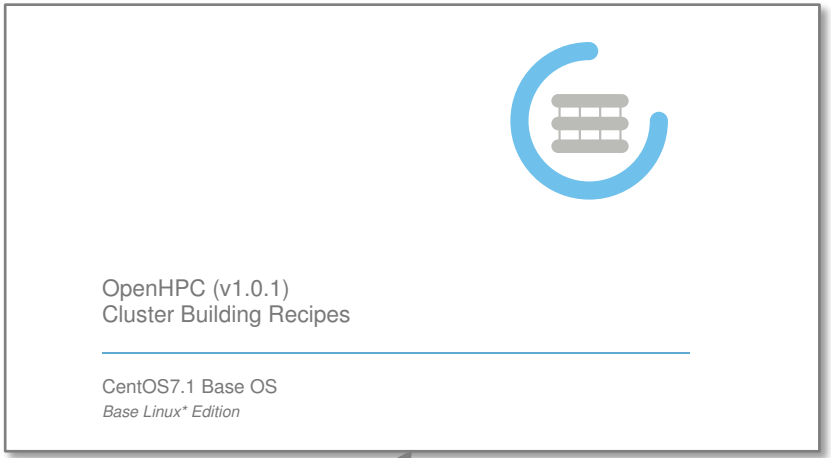
- major components have configuration options to enable/disable
  - end user tests need to touch all of the supported compiler and MPI families
  - we abstract this to repeat the tests with different compiler/MPI environments:
    - gcc/Intel compiler toolchains
    - Intel, OpenMPI, MPICH, MVAPICH2 MPI families

Example ./configure output (non-root)

```
Package version.............. : test-suite-1.0.0

Build user................... : jilluser
Build host................... : master4-centos71.localdomain
Configure date............... : 2015-10-26 09:23
Build architecture........... : x86_64-unknown-linux-gnu
Test suite configuration..... : long

Submodule Configuration:

User Environment:
    RMS test harness......... : enabled
    Munge.................... : enabled
    Apps..................... : enabled
    Compilers................ : enabled
    MPI...................... : enabled
    HSN...................... : enabled
    Modules.................. : enabled
    OOM...................... : enabled
Dev Tools:
    Valgrind................. : enabled
    R base package........... : enabled
    TBB...................... : enabled
    CILK..................... : enabled
Performance Tools:
    mpiP Profiler........ .... : enabled
    Papi..................... : enabled
    PETSc.................... : enabled
    TAU...................... : enabled
```

```
Libraries:
    Adios ................... : enabled
    Boost ................... : enabled
    Boost MPI................ : enabled
    FFTW..................... : enabled
    GSL...................... : enabled
    HDF5..................... : enabled
    HYPRE.................... : enabled
    IMB...................... : enabled
    Metis.................... : enabled
    MUMPS.................... : enabled
    NetCDF................... : enabled
    Numpy.................... : enabled
    OPENBLAS................. : enabled
    PETSc.................... : enabled
    PHDF5.................... : enabled
    ScaLAPACK................ : enabled
    Scipy.................... : enabled
    Superlu.................. : enabled
    Superlu_dist............. : enabled
    Trilinos ................ : enabled
Apps:
    MiniFE................... : enabled
    MiniDFT.................. : enabled
    HPCG..................... : enabled
    PRK...................... : enabled
```

Wider variety of recipes now available



Initially, we started off with a single recipe with the intent to expand.

10 recipes now available with v1.3.6 release

[we test all of these in a CI environment on bare-metal]

We continue to expand recipe option(s) with multiple resource managers, OSes, provisioners, and architectures:

x86_64:

- Install_guide-CentOS7-Warewulf-PBSPro-1.3.5-x86_64.pdf
- Install_guide-CentOS7-Warewulf-SLURM-1.3.5-x86_64.pdf
- Install_guide-CentOS7-xCAT-Stateful-SLURM-1.3.5-x86_64.pdf
- Install_guide-CentOS7-xCAT-Stateless-SLURM-1.3.5-x86_64.pdf
- Install_guide-SLE_12-Warewulf-PBSPro-1.3.5-x86_64.pdf
- Install_guide-SLE_12-Warewulf-SLURM-1.3.5-x86_64.pdf

aarch64:

- Install_guide-CentOS7-Warewulf-PBSPro-1.3.5-aarch64.pdf
- Install_guide-CentOS7-Warewulf-SLURM-1.3.5-aarch64.pdf
- Install_guide-SLE_12-Warewulf-PBSPro-1.3.5-aarch64.pdf
- Install_guide-SLE_12-Warewulf-SLURM-1.3.5-aarch64.pdf

Validating Installation Recipes

- To validate these documentation recipes, we cull instructions directly from the docs (LaTeX) to matching shell scripts -> recipe.sh
- Don't know all options in advance, so use simple input file to define MAC addresses, hostnames, etc
- For convenience, these template scripts are also provided with ohpc docs to aid installation or customization

```
# yum/zypper install docs-ohpc

# ls /opt/ohpc/pub/doc/recipes/*/*/*/*/recipe.sh
/opt/ohpc/pub/doc/recipes/centos7/aarch64/warewulf/slurm/recipe.sh
/opt/ohpc/pub/doc/recipes/centos7/x86_64/warewulf/pbspro/recipe.sh
/opt/ohpc/pub/doc/recipes/centos7/x86_64/warewulf/slurm/recipe.sh
/opt/ohpc/pub/doc/recipes/centos7/x86_64/xcat/slurm/recipe.sh
/opt/ohpc/pub/doc/recipes/sles12/aarch64/warewulf/slurm/recipe.sh
/opt/ohpc/pub/doc/recipes/sles12/x86_64/warewulf/pbspro/recipe.sh
/opt/ohpc/pub/doc/recipes/sles12/x86_64/warewulf/slurm/recipe.sh

# ls /opt/ohpc/pub/doc/recipes/*/input.local
/opt/ohpc/pub/doc/recipes/centos7/input.local
/opt/ohpc/pub/doc/recipes/sles12/input.local
```

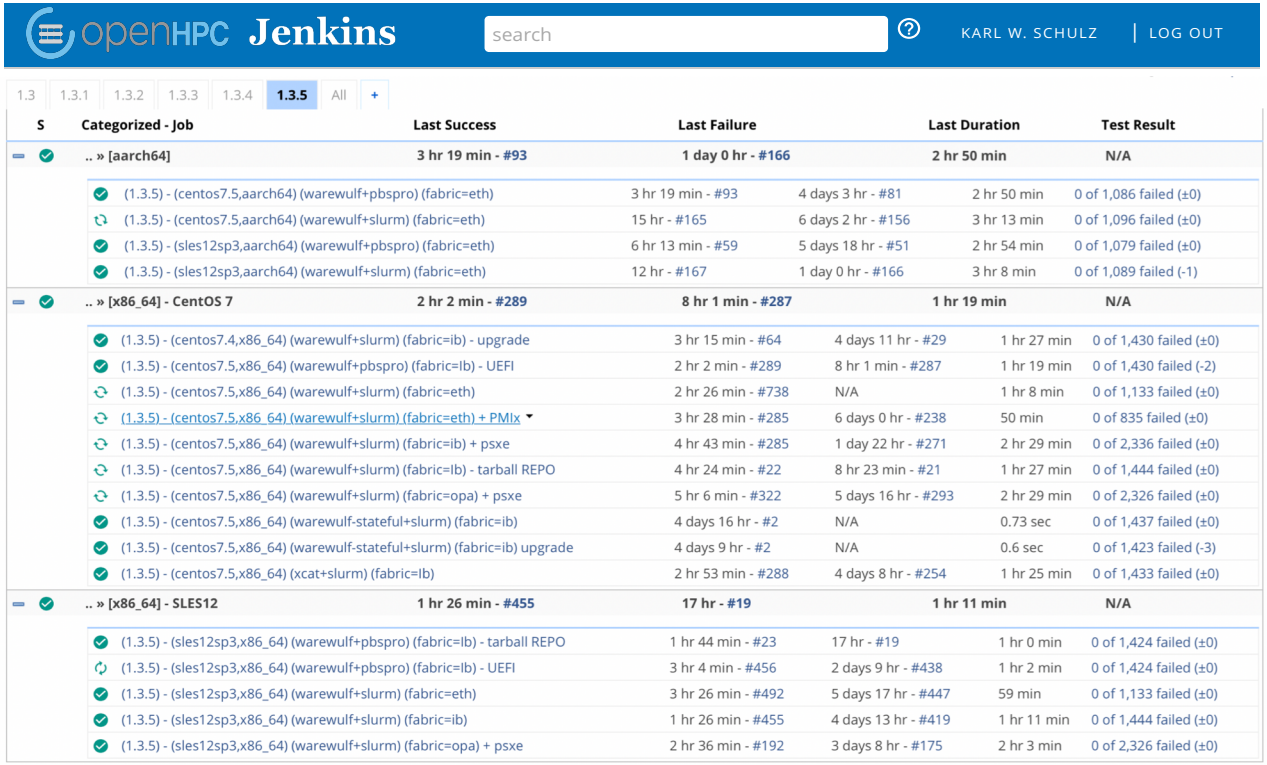
Local System Settings can be supplied to input file:

```
# compute hostnames
c_name[0]=c1
c_name[1]=c2
...
# compute node MAC addresses
c_mac[0]=00:1a:2b:3c:4f:56
c_mac[1]=00:1a:2b:3c:4f:56
...
```

input.local + recipe.sh == installed system (reproducible)

http://test.openhpc.community:8080

Community Jenkins Instance for CI Testing



S	Categorized - Job	Last Success	Last Failure	Last Duration	Test Result
	.. » [aarch64]	3 hr 19 min - #93	1 day 0 hr - #166	2 hr 50 min	N/A
	(1.3.5) - (centos7.5,aarch64) (warewulf+pbspro) (fabric=eth)	3 hr 19 min - #93	4 days 3 hr - #81	2 hr 50 min	0 of 1,086 failed (±0)
	(1.3.5) - (centos7.5,aarch64) (warewulf+slurm) (fabric=eth)	15 hr - #165	6 days 2 hr - #156	3 hr 13 min	0 of 1,096 failed (±0)
	(1.3.5) - (sles12sp3,aarch64) (warewulf+pbspro) (fabric=eth)	6 hr 13 min - #59	5 days 18 hr - #51	2 hr 54 min	0 of 1,079 failed (±0)
	(1.3.5) - (sles12sp3,aarch64) (warewulf+slurm) (fabric=eth)	12 hr - #167	1 day 0 hr - #166	3 hr 8 min	0 of 1,089 failed (-1)
	.. » [x86_64] - CentOS 7	2 hr 2 min - #289	8 hr 1 min - #287	1 hr 19 min	N/A
	(1.3.5) - (centos7.4,x86_64) (warewulf+slurm) (fabric=ib) - upgrade	3 hr 15 min - #64	4 days 11 hr - #29	1 hr 27 min	0 of 1,430 failed (±0)
	(1.3.5) - (centos7.5,x86_64) (warewulf+pbspro) (fabric=lb) - UEFI	2 hr 2 min - #289	8 hr 1 min - #287	1 hr 19 min	0 of 1,430 failed (-2)
	(1.3.5) - (centos7.5,x86_64) (warewulf+slurm) (fabric=eth)	2 hr 26 min - #738	N/A	1 hr 8 min	0 of 1,133 failed (±0)
	(1.3.5) - (centos7.5,x86_64) (warewulf+slurm) (fabric=eth) + PMIx	3 hr 28 min - #285	6 days 0 hr - #238	50 min	0 of 835 failed (±0)
	(1.3.5) - (centos7.5,x86_64) (warewulf+slurm) (fabric=ib) + psxe	4 hr 43 min - #285	1 day 22 hr - #271	2 hr 29 min	0 of 2,336 failed (±0)
	(1.3.5) - (centos7.5,x86_64) (warewulf+slurm) (fabric=lb) - tarball REPO	4 hr 24 min - #22	8 hr 23 min - #21	1 hr 27 min	0 of 1,444 failed (±0)
	(1.3.5) - (centos7.5,x86_64) (warewulf+slurm) (fabric=opa) + psxe	5 hr 6 min - #322	5 days 16 hr - #293	2 hr 29 min	0 of 2,326 failed (±0)
	(1.3.5) - (centos7.5,x86_64) (warewulf-stateful+slurm) (fabric=ib)	4 days 16 hr - #2	N/A	0.73 sec	0 of 1,437 failed (±0)
	(1.3.5) - (centos7.5,x86_64) (warewulf-stateful+slurm) (fabric=ib) upgrade	4 days 9 hr - #2	N/A	0.6 sec	0 of 1,423 failed (-3)
	(1.3.5) - (centos7.5,x86_64) (xcat+slurm) (fabric=lb)	2 hr 53 min - #288	4 days 8 hr - #254	1 hr 25 min	0 of 1,433 failed (±0)
	.. » [x86_64] - SLES12	1 hr 26 min - #455	17 hr - #19	1 hr 11 min	N/A
	(1.3.5) - (sles12sp3,x86_64) (warewulf+pbspro) (fabric=lb) - tarball REPO	1 hr 44 min - #23	17 hr - #19	1 hr 0 min	0 of 1,424 failed (±0)
	(1.3.5) - (sles12sp3,x86_64) (warewulf+pbspro) (fabric=lb) - UEFI	3 hr 4 min - #456	2 days 9 hr - #438	1 hr 2 min	0 of 1,424 failed (±0)
	(1.3.5) - (sles12sp3,x86_64) (warewulf+slurm) (fabric=eth)	3 hr 26 min - #492	5 days 17 hr - #447	59 min	0 of 1,133 failed (±0)
	(1.3.5) - (sles12sp3,x86_64) (warewulf+slurm) (fabric=ib)	1 hr 26 min - #455	4 days 13 hr - #419	1 hr 11 min	0 of 1,444 failed (±0)
	(1.3.5) - (sles12sp3,x86_64) (warewulf+slurm) (fabric=opa) + psxe	2 hr 36 min - #192	3 days 8 hr - #175	2 hr 3 min	0 of 2,326 failed (±0)

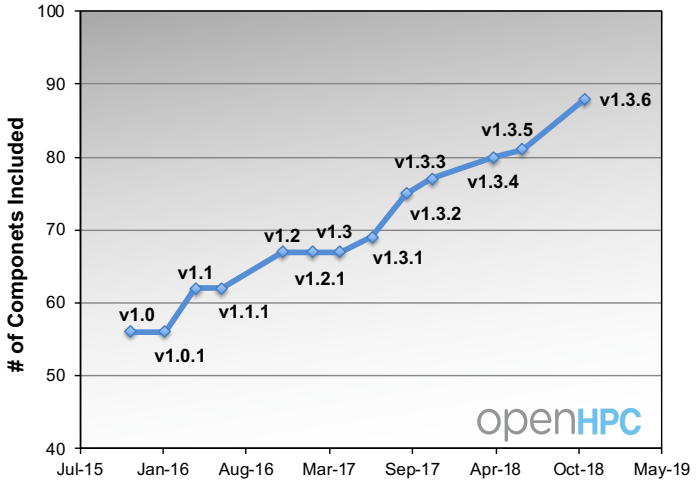
All recipes exercised in CI system (start w/ bare-metal installs + integration test suite)

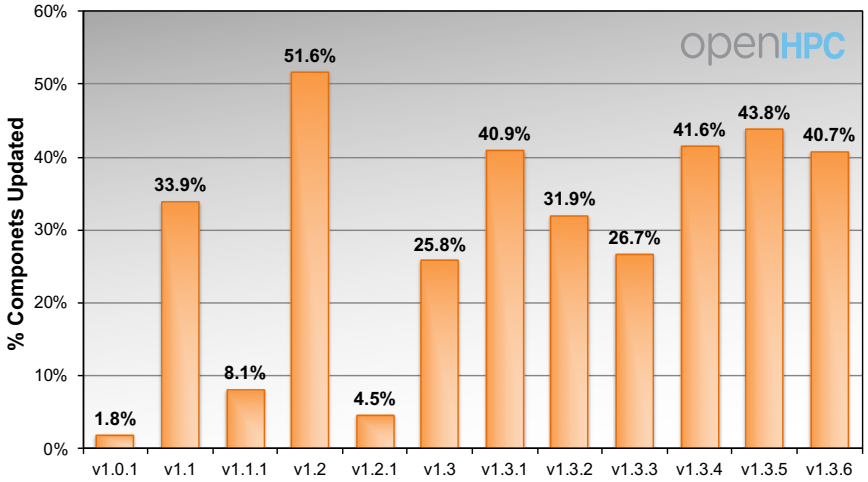
our CI "build" is really a cluster

Latest Release and Stats

Additions and Upstream Version Changes

- Part of the motivation for community effort like OpenHPC is the rapidity of S/W updates that occurs in our space
- We have been doing releases on a roughly quarterly cadence:
  - convention is to go with latest stable release of upstream components
  - additional components added over time





Released November 07, 2018

OpenHPC v1.3.6 - S/W components

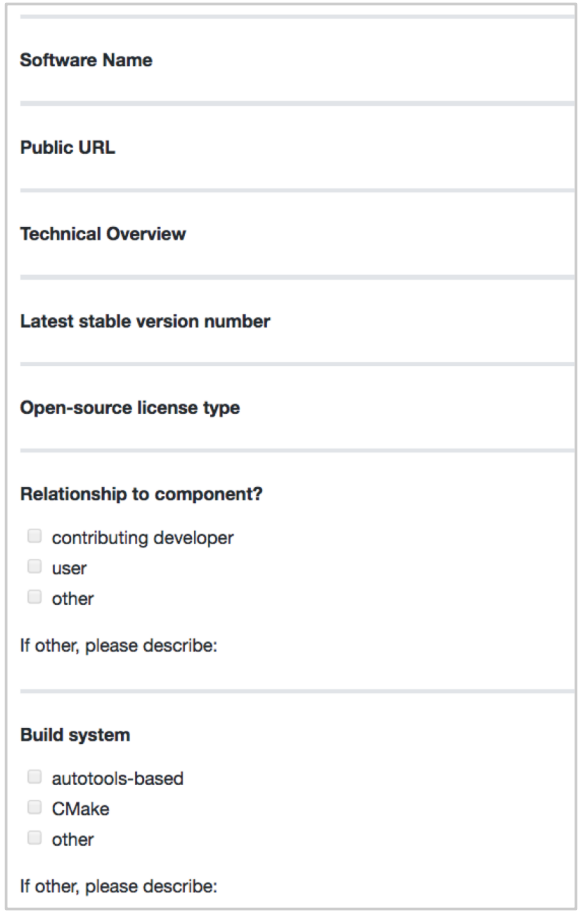
components available 88 | new additions 7 | updates 41%

Functional Areas	Components (new in v1.3.6 release)
Base OS	CentOS 7.5, SLES12 SP3
Architecture	aarch64, x86_64
Administrative Tools	Conman, Ganglia, Lmod, LosF, Nagios, NHC, pdsh, pdsh-mod-slurm, prun, EasyBuild, ClusterShell, mrsh, Genders, Shine, Spack, test-suite
Provisioning	Warewulf, xCAT
Resource Mgmt.	SLURM, Munge, PBS Professional, PMIx
Runtimes	Charliecloud, OpenMP, OCR, Singularity
I/O Services	Lustre client, BeeGFS client
Numerical/Scientific Libraries	Boost, GSL, FFTW, Hypre, Metis, MFEM, Mumps, OpenBLAS, OpenCoarrays, PETSc, PLASMA, Scalapack, Scotch, SLEPc, SuperLU, SuperLU_Dist, Trilinos
I/O Libraries	HDF5 (pHDF5), NetCDF/pNetCDF (including C++ and Fortran interfaces), Adios
Compiler Families	GNU (gcc, g++, gfortran), Clang/LLVM (introduced new gcc8 variant)
MPI Families	MVAPICH2, OpenMPI, MPICH
Development Tools	Autotools, cmake, hwloc, mpi4py, R, SciPy/NumPy, Valgrind
Performance Tools	PAPI, IMB, Likwid, mpiP, pdtoolkit TAU, Scalasca, ScoreP, SIONLib, GeoPM, msr-safe, Dimemas, Extrae, Paraver

- 3rd Party libraries are built for each compiler/MPI family
- Resulting repositories currently comprised of ~700 RPMs

How to Request Additional Software?

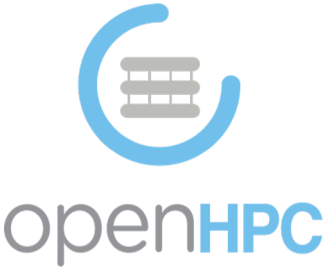
- We have a simple submission site for new requests:
  - https://github.com/openhpc/submissions
- Example components added via this mechanism since the v1.2. release (Nov' 16)
  - BeeGFS client
  - xCAT recipe
  - hwloc
  - Singularity
  - LLVM/clang
  - PLASMA
  - pNetCDF
  - SCOTCH
  - SLEPc
  - PMIx
  - MPI4py
  - Likwid
  - MFEM
  - NHC
  - Charliecloud
  - GeoPM
  - Dimemas/Extrae, Paraver
  - OpenCoarrays



Summary

- Provided an overview of the Linux Foundation project along with some technical updates over the last year:
  - 3 releases thus far this year
  - several new recipe additions
  - more component additions
  - packaging convention changes
- Other related items at SC'18 this year:
  - Birds of a Feather Session on Wed, November 14th (12:15-13:15)
  - happy hour event, Wed November 14th (17:00-19:00)

Thanks for your time….



- OpenHPC Home: http://www.openhpc.community/
- Primary GitHub Site: https://github.com/openhpc/ohpc
- Package Repositories: http://build.openhpc.community/OpenHPC:/
- Component Submission: https://github.com/openhpc/submissions
- System Registry: System Registration Form
- CI Infrastructure: http://test.openhpc.community:8080
- OpenHPC Wiki: https://github.com/openhpc/ohpc/wiki
  - includes links to overview paper and past presentations

- Mailing Lists: http://www.openhpc.community/support/mail-lists/
  - openhpc-announce
  - openhpc-users
  - openhpc-devel