# Singularity

DOE LCF HPC container usage

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64
  - Cray, IBM, Torque, Moab, LSF, etc.

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64
  - Cray, IBM, Torque, Moab, LSF, etc.
- Works well with old kernels(Titan is running kernel 3.0.x)

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64
  - Cray, IBM, Torque, Moab, LSF, etc.
- Works well with old kernels(Titan is running kernel 3.0.x)
- Single file containers work with existing infrastructure

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64
  - Cray, IBM, Torque, Moab, LSF, etc.
- Works well with old kernels(Titan is running kernel 3.0.x)
- Single file containers work with existing infrastructure
  - Share container using standard file techniques

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64
  - Cray, IBM, Torque, Moab, LSF, etc.
- Works well with old kernels(Titan is running kernel 3.0.x)
- Single file containers work with existing infrastructure
  - Share container using standard file techniques
- Interoperates well with Docker

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64
  - Cray, IBM, Torque, Moab, LSF, etc.
- Works well with old kernels(Titan is running kernel 3.0.x)
- Single file containers work with existing infrastructure
  - Share container using standard file techniques
- Interoperates well with Docker
- No root owned daemon processes required

# Singularity

- Easy to install across diverse architectures and software stacks
  - x86, ppc64le, arm64
  - Cray, IBM, Torque, Moab, LSF, etc.
- Works well with old kernels(Titan is running kernel 3.0.x)
- Single file containers work with existing infrastructure
  - Share container using standard file techniques
- Interoperates well with Docker
- No root owned daemon processes required
- Portability with no performance penalty!

# Container builder - OLCF

- Provide `container-builder` utility to build containers
  - Interactive builds from Titan/Summit
  - Safely builds container on remote virtual machine
    - Transparent to the user
  - Support building containers from Singularity as well as Docker definitions

# Building containers - OLCF

- Use base containers specific to each HPC system
- Containers provide system specific vendor software
  - MPI
  - CUDA
- Accessible from `container-builder`

# Non x86 arch

- Containers work on just about any system that runs Linux
- Docker Hub has support for multiple architectures
- Running ppc64le Singularity containers without issue at OLCF
  - Have done limited testing on arm64
- Building containers can be tricky due to limited hardware access
  - Use QEMU and binfmt_misc to build with virtualization on x86 hosts
  - `container-builder` supports ppc64le builds

# Singularity HPC jobs

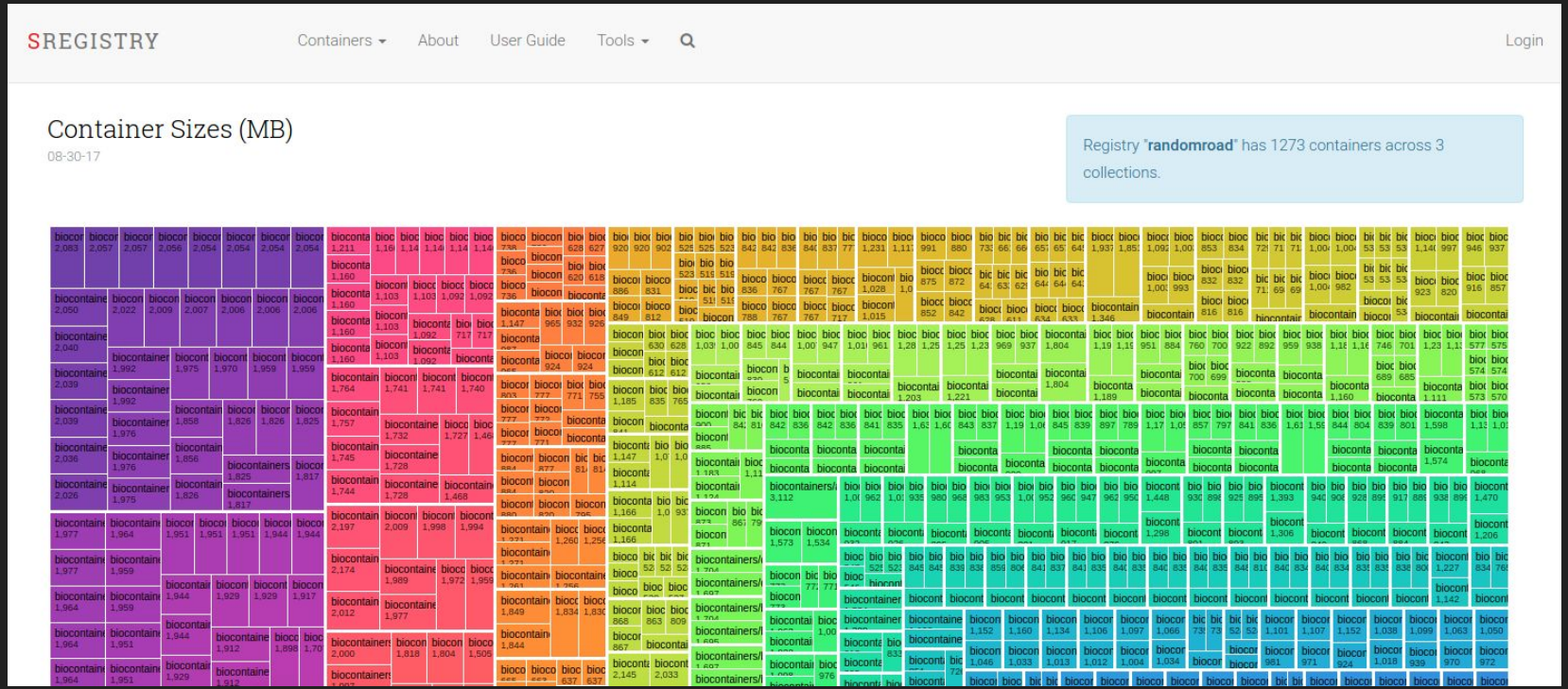
- Singularity is scheduler agnostic. Users simply run Singularity jobs via small modifications to their batch scripts. Examples:

```
singularity exec container.img <command>

mpirun -np 4 singularity exec container.img
/my/mpi/cmd
```

# Singularity Registry

- A web-based repository for Singularity images



# Singularity Registry

- Using the registry is extremely easy with the ‘pull’ subcommand:

```
$ singularity pull
shub://singularity.alcf.anl.gov/vsoch/hello-world:master
```

*"Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Networking and Information Technology Research and Development Program."*

The Networking and Information Technology Research and Development (NITRD) Program

**Mailing Address:** NCO/NITRD, 2415 Eisenhower Avenue, Alexandria, VA 22314

**Physical Address:** 490 L'Enfant Plaza SW, Suite 8001, Washington, DC 20024, USA Tel: 202-459-9674, Fax: 202-459-9673, Email: nco@nitrd.gov, Website: https://www.nitrd.gov