From Singularity to Apptainer

Presented by Forrest Burt, Ctrl IQ, Inc.

From Singularity…

- Singularity is a mature open source containerization platform built for HPC use cases
  - Uniquely well-suited among container platforms for HPC
- Favors "integration over isolation" to enable use of HPC hardware/software
  - Interconnects
  - GPUs
  - MPI
  - Parallel filesystems
- Features include signable, encryptable, easily portable containers
- Widely used for enterprise, academic, and government applications
- Utilizes the Singularity Image Format (SIF)

…to Apptainer

- Unanimous community member agreement on software direction led to inroads with moving Singularity into the Linux Foundation
    - Good basis for increased collaboration with:
        - Cloud Native Computing Federation
        - Open Container Initiative
        - OpenHPC
    - Endorsed by HPC experts and entities/institutions like SNL, LBNL, Fermilab, Intel, AMD, and HPCNow
- New name decided via vote
    - Done as existing commercial Singularity products precluded use of same name per LF trademark requirements
- New LF management structure calls for a technical steering committee
    - Apptainer's currently made up of five primary project members: Cedric Clerget, Dave Dykstra, Gregory Kurtzer, Ian Kaneshiro, and Krishna Muiriki
    - TSC follows policies laid out in a Technical Charter document
- Based in a new repository; old Singularity repo will be made read-only

Current Status

- Project in a transitory phase
- Release candidate encompassing below out now - updates in a moment
- Current project activities include:
  - Ensuring proper backwards compatibility with Singularity
  - Removal of third-party commercially-controlled APIs
    - Remote builder
    - Default library resource
  - Planning for future of project and what features will be prioritized in subsequent releases
- Community meetings happening every two weeks

Versioning Information

- Versioning:
  - First release will be Apptainer 1.0.0
  - Would have been Singularity 3.9.0 if rebranding hadn't occurred
  - Would also have been Apptainer 4.0.0 because of removed third-party functionality if the reset to 1.0.0 hadn't been decided on
- Apptainer 1.0.0 has most changes made to SingularityCE through version 3.9.4
  - Differences include the "--nvccli" option not being supported in privileged mode due to security risks, and the introduction to Apptainer of instance checkpointing capabilities

v1.0.0-rc1 Updates - Singularity/Apptainer switchover

- Released Jan. 19th
- Many backwards compatibility changes
  - Executable, /etc/apptainer, etc.
  - Depreciation warnings and migration notices added to encourage movement of environments from Singularity structure to Apptainer structure
- Removal of default third-party remote endpoint for library:// scheme
- Default keyserver changed to keys.openpgp.org from third-party server
- Remote builder option removed
- Other behaviors changed:
  - GPU support
  - How certain executables and libraries are found
  - LABELs from Docker/OCI images are now inherited
  - Numerous others

v1.0.0-rc1 Updates - New features

- Container checkpointing with DMTCP
  - Halt containers and checkpoint their state at that point for recovery later
- New options for Docker/OCI compatibility
  - ——compat command line option that infers several options related to those
- New way to interface with NVIDIA GPUs through the nvidia-container-cli
- ——writable—tmpfs can now be used with %test section for tests that need to write to the container FS
- New bind mount options to increase compatibility with other runtime CLIs
  - Allows for bind paths with certain special characters
- ——apply-cgroups can be used on systems with the v2 unified cgroups hierarchy
  - Specified in cgroups v1 format, then translated to v2

Near/Long Term Plans

- Primary goal for the moment is to continue project stability after move
  - And get the 1.0.0 release proper out!
- Numerous new features on the roadmap, generally:
  - More options around security features
  - Continuing to improve support for HPC and emerging HPC technologies
  - Codebase cleanup
  - Tentative roadmap can be found in links
- Much left to be explored of Apptainer's new home

Questions?

- Website: apptainer.org
- GitHub: github.com/apptainer/apptainer
- V1.0.0-rc1 download and full changelog
- Current project roadmap
- Community meeting contact
  - Email dwd@fnal.gov for community meeting information if above link doesn't work
- Community announcement about change
- Linux Foundation press release about change