



CHPC - RESEARCH COMPUTING SUPPORT FOR THE UNIVERSITY

UNIVERSITY INFORMATION TECHNOLOGY

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Container-based Virtualization

Containers allow users to deploy complex software environments in a portable package. A container is deployed on a operation system host, and shares the basic functionality (kernel, network, peripherals) with the host, but, OS like functionality like the system libraries and the rest of the OS stack is defined by the container and may be different than the host OS. Thanks to this lightweight design, application performance in the container is comparable to the native host.

Docker is the de-facto standard in containerization, however, it requires elevated privileges that make it problematic in HPC environments. For that reason, CHPC does not allow Docker. However, there are tools that allow to create and run Docker containers. Our recommended approaches are described in the table below. See our [OS-level virtualization \(container\) policies](#) for details on allowed and restricted container use.

What we want to do	What tool we recommend	Other tool that can be used
Run Docker container from Docker hub or other Docker container repository	Singularity	udocker Charliecloud
Create a Docker container	Charliecloud	
Create a Singularity container	Singularity	
Create any container (don't care what tool)	Singularity	

In short, we can use all three tools, udocker, Singularity and Charliecloud, to run existing containers. To build containers, one has to either use Singularity or Charliecloud, and have to do it either on a machine where one has administrator rights, or on a special server that we provide for container building.

[Singularity](#) is a complete container solution, which allows both to build and run containers. Its simple interface and good interoperability with DockerHub containers makes it our choice to run Docker containers. Building a container requires administrator privileges and as such it is not permitted on CHPC production machines.

[udocker](#) is a lightweight Docker runtime, which allows to run and modify (to certain extent) Docker containers. It is also easy to use and is implemented completely user space implementation, which provides a good alternative to Singularity in running DockerHub containers. However, we have seen some DockerHub containers that don't run with udocker but do with Singularity.

[Charliecloud](#) also allows to both build and run containers, but it's leveraging Docker to build the containers, and requires both administrator privileges and functioning Docker installation to build the containers. Therefore we also don't allow container building with Charliecloud on CHPC production machines.

Please, see our help page for each tool for details and how to use it.

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IMAGINE  THE UNIVERSITY OF UTAH



THE CENTER FOR HIGH PERFORMANCE COMPUTING
155 S 1452 E, RM. 405
SLC, UT 84112-0190
801.585.3791

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