



# Rootless containers with udocker

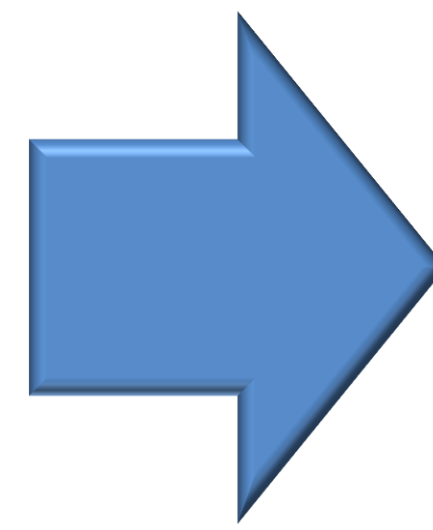
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Running scientific applications across infrastructures can require considerable effort from the end-users

- Several computing systems
- Notebooks, Desktops, Farms, Cloud, HPC
- Several operating systems
- Linux flavors, Distribution versions
- Specific computing environments
- Compilers, Libraries, Customizations
- Multiple applications often combined
- Portability, Maintainability, Reproducibility



Need a consistent portable way of running applications across the infrastructures eco-system



Containers are a great way to encapsulate applications and run across different systems but also have limitations

Often need privileges for installation and/or execution

Container technologies often raise security concerns

Container tools may not be available everywhere

May require system administrator intervention

Users may need to use different container tools across the infrastructures

udocker enables the execution of application containers in user space without requiring privileges or sysadmin intervention

Empowers end-users

Pulling from docker repositories

Import of directory tarballs

Load of docker images

Multiple execution modes supported

Most execution modes without privileges

Works across multiple Linux distributions

Adequate for HTC, HPC and GPGPU computing in batch and interactive clusters

pull

import

load

create

run

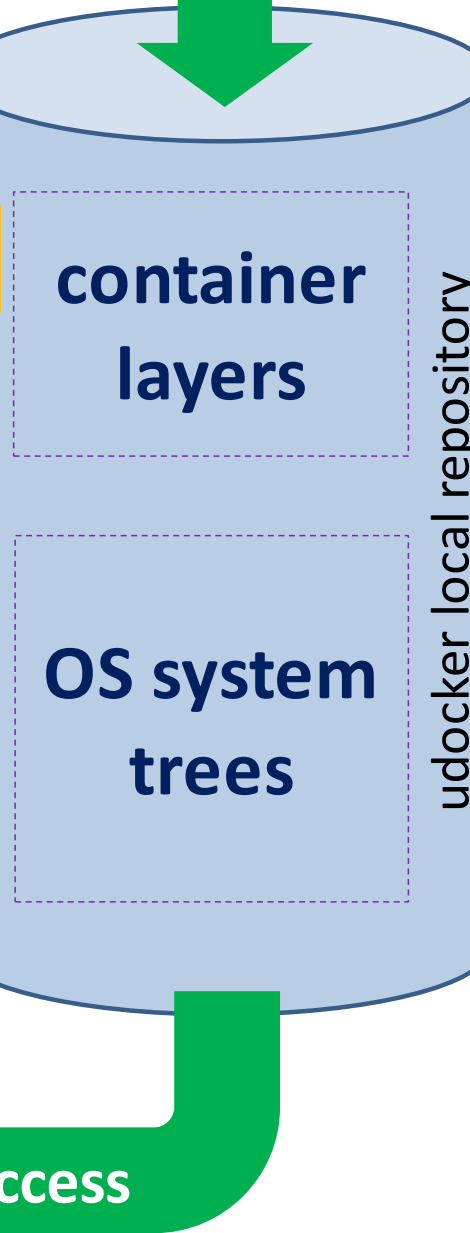
store

extract

flattening

Prepare execution

access



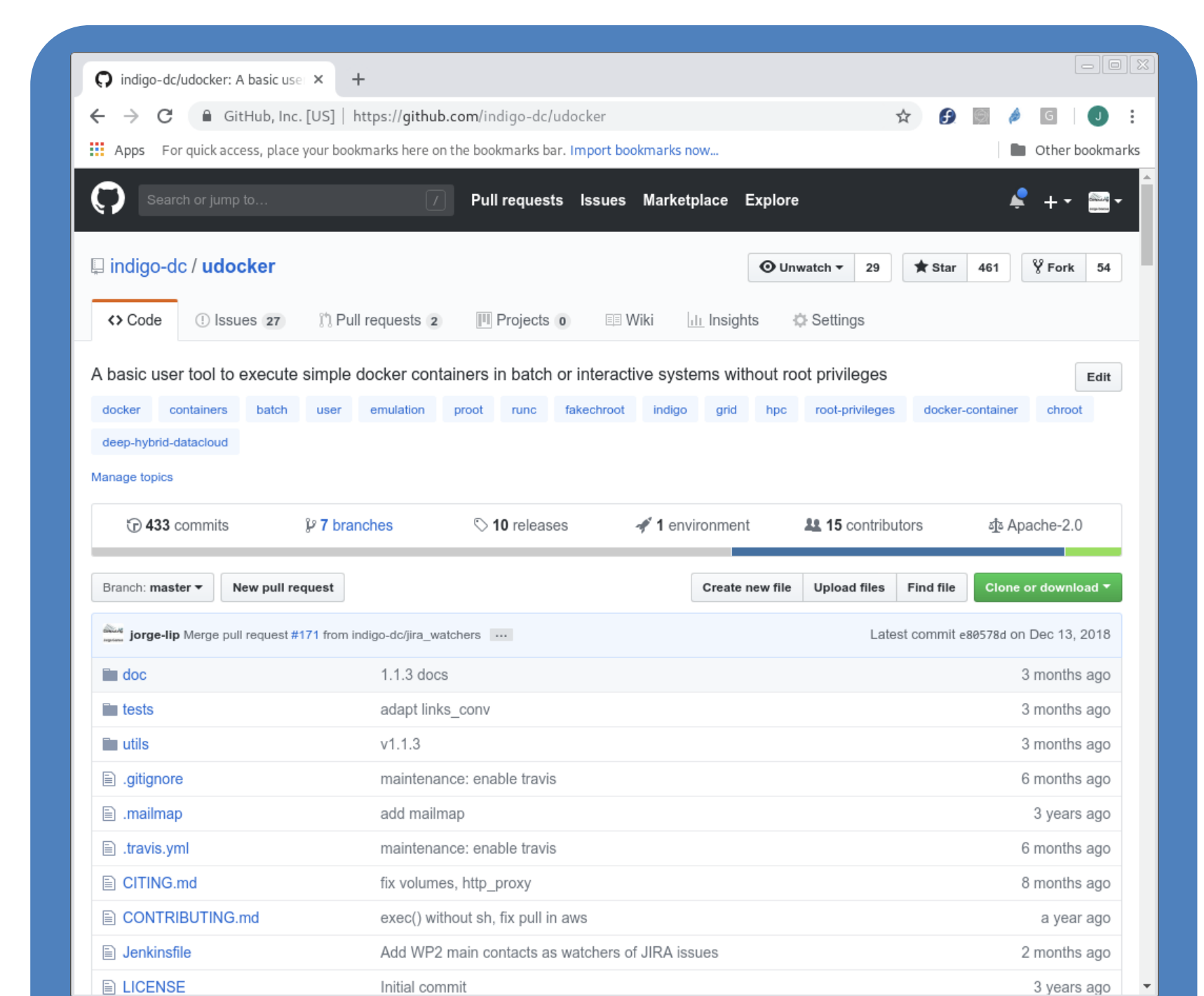
P modes F modes R modes S modes

Linux ptrace

shared lib preload

rootless namespaces

singularity



udocker is available on github:  
<https://github.com/indigo-dc/udocker>

## Basic usage

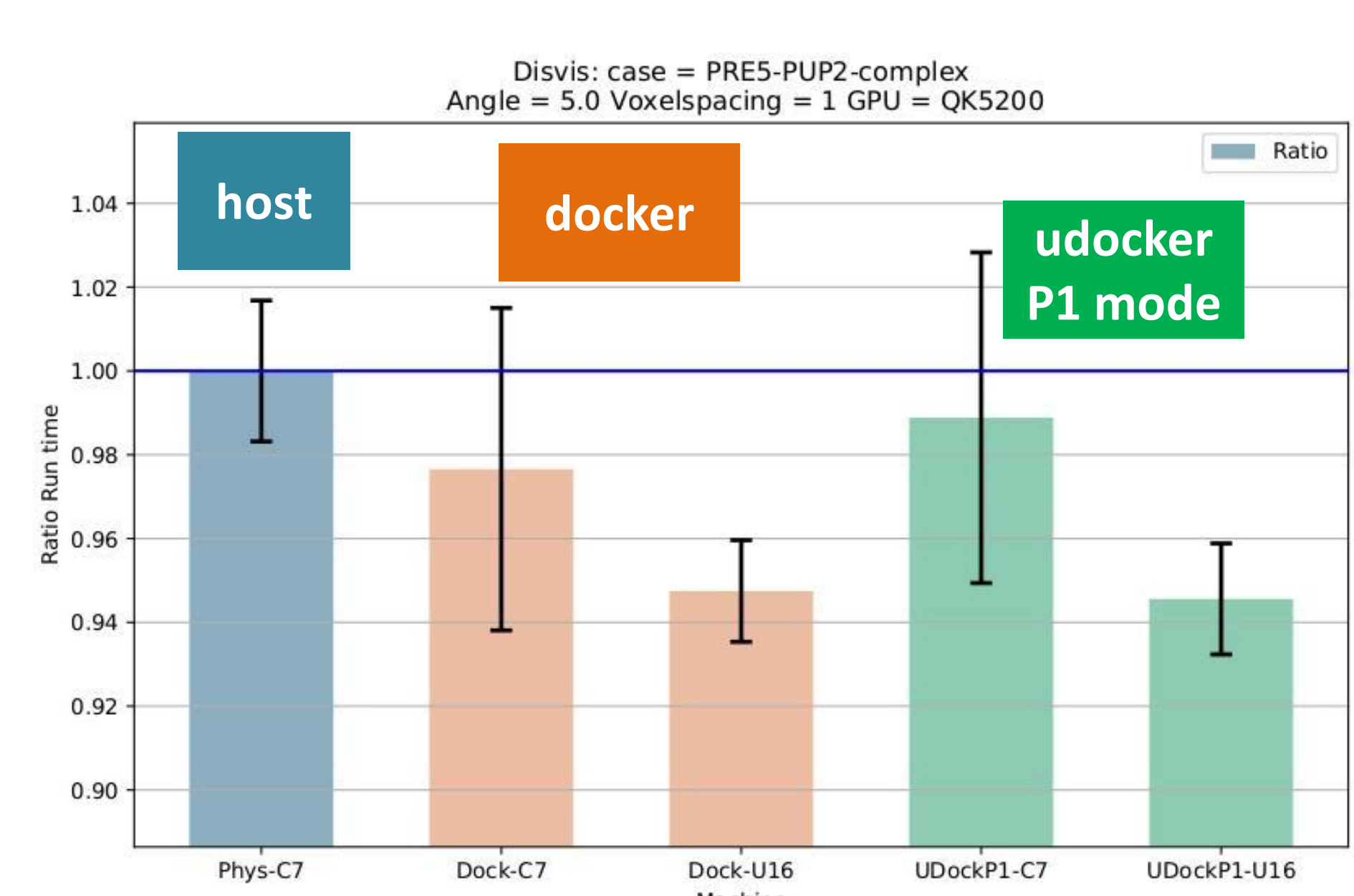
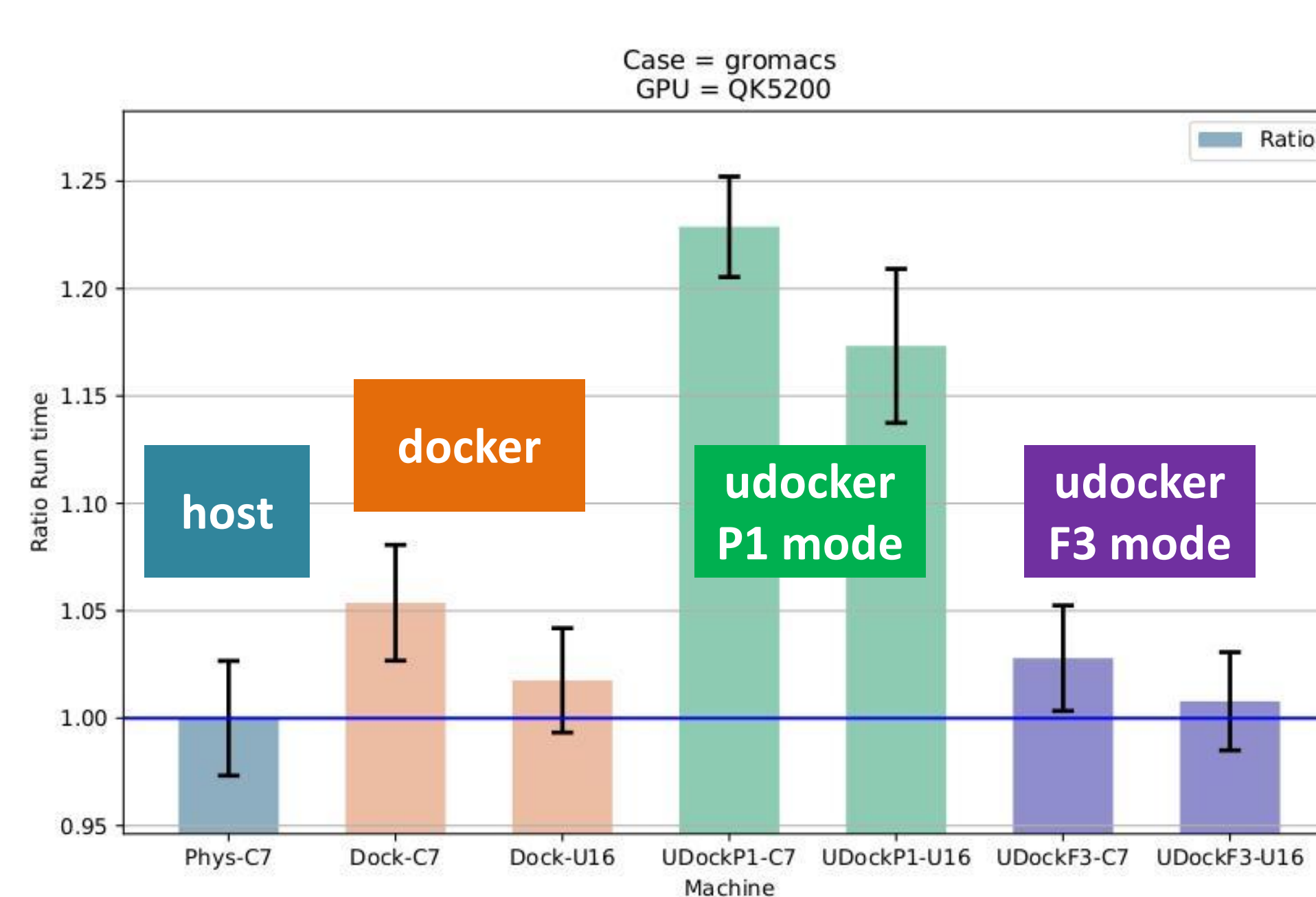
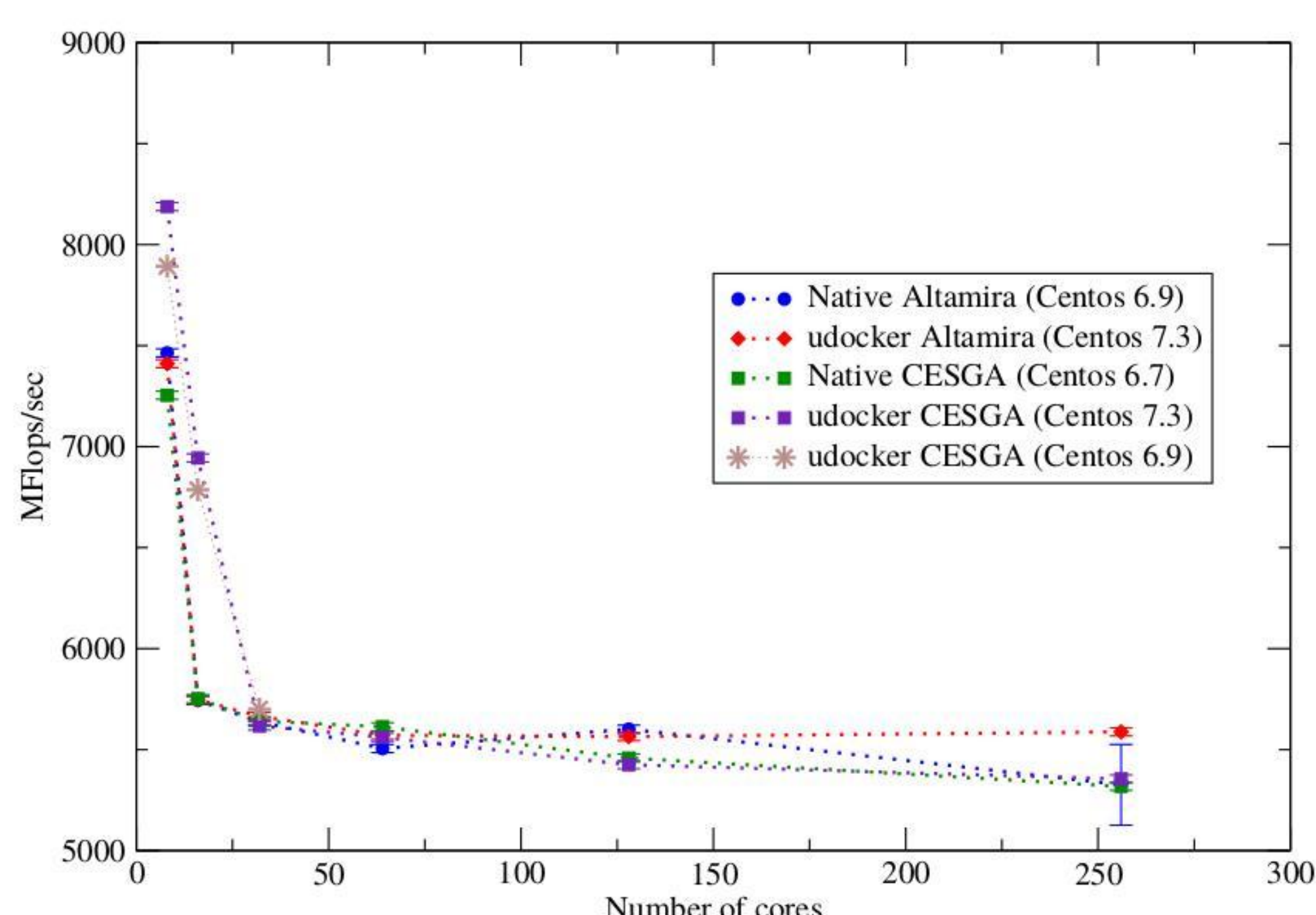
```
$ curl https://raw.githubusercontent.com/indigo-dc/udocker/master/udocker.py > udocker
$ chmod u+rx ./udocker
$ ./udocker install
$ ./udocker run ubuntu:18.04
```

← Pull and run the container from docker hub

## Roadmap

- Installation with Python pip
- Porting to Python 3
- Improved translation of volume pathnames
- Improved support for MPI libraries
- Improved root emulation
- Support for OCI containers
- Network port remapping in Fn modes
- Expand the set of execution engines

## Application examples and execution performance



OpenQCD code for lattice simulations

Using OpenMPI

Scaling performance as a function of the cores for the computation of application of the Dirac operator to a spinor field.

udocker in default execution mode P1

Gromacs code for molecular dynamics

Using OpenCL with Nvidia GPUs in combination with OpenMP

udocker P1 mode has lower performance than docker

udocker F3 mode has better performance than docker

DISVIS code to visualize and quantify the information content of distance restraints between macromolecular complexes

Using OpenCL and Nvidia GPUs

Performance with docker and udocker are similar and very close to the physical host. Better performance with Ubuntu container.

udocker in default execution mode P1

udocker is an open source product initially developed by the INDIGO-datacloud H2020 project.

udocker is being further developed in the DEEP-HybridDataCloud H2020 project to support deep learning and data analysis with accelerated computing. udocker maintenance and support is performed by LIP ([www.lip.pt](http://www.lip.pt)) and INCD ([www.incd.pt](http://www.incd.pt)) with support from the EOSC-hub H2020 project.