

Wharf: Sharing Docker Images Across Hosts From a Distributed Filesystem



Chao Zheng, Lukas Rupperecht, Douglas Thain, Vasily Tarasov,
Amit S. Warke, Dimitrios Skourtis and Mohamed Mohamed

{czheng2, dthain}@nd.edu, {Lukas.Rupperecht, Dimitrios.Skourtis}@ibm.com
{vtarasov, aswarke, mmohamed}@us.ibm.com

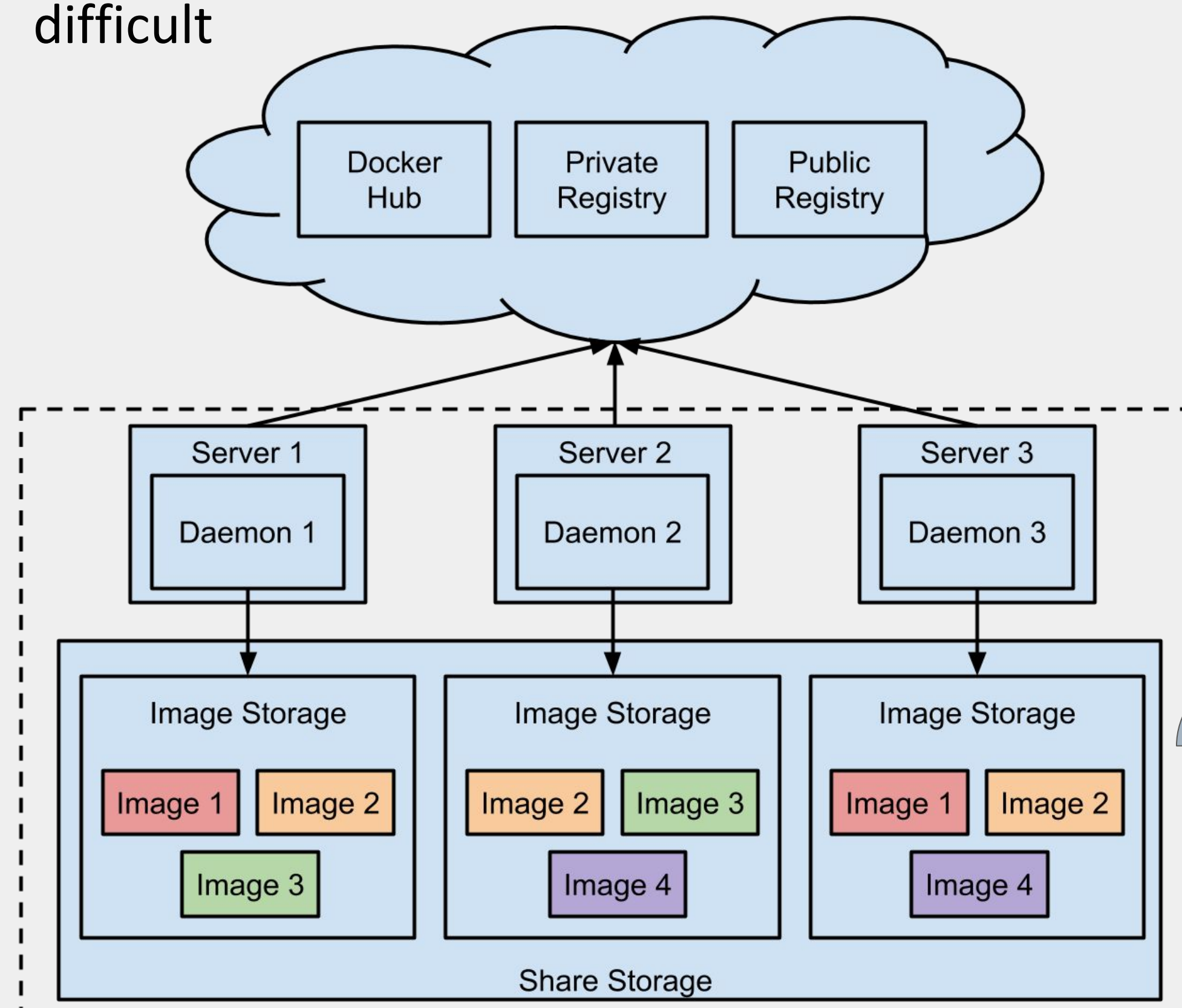
The Need for Sharing Images

- Containers becoming increasingly popular for deploying and running large-scale HPC workloads
- Workloads often run **many identical containers** that share the same image
- Diskless clusters or burst buffer-enabled** clusters access their data via a shared storage layer

Docker needs to be able to run on shared storage

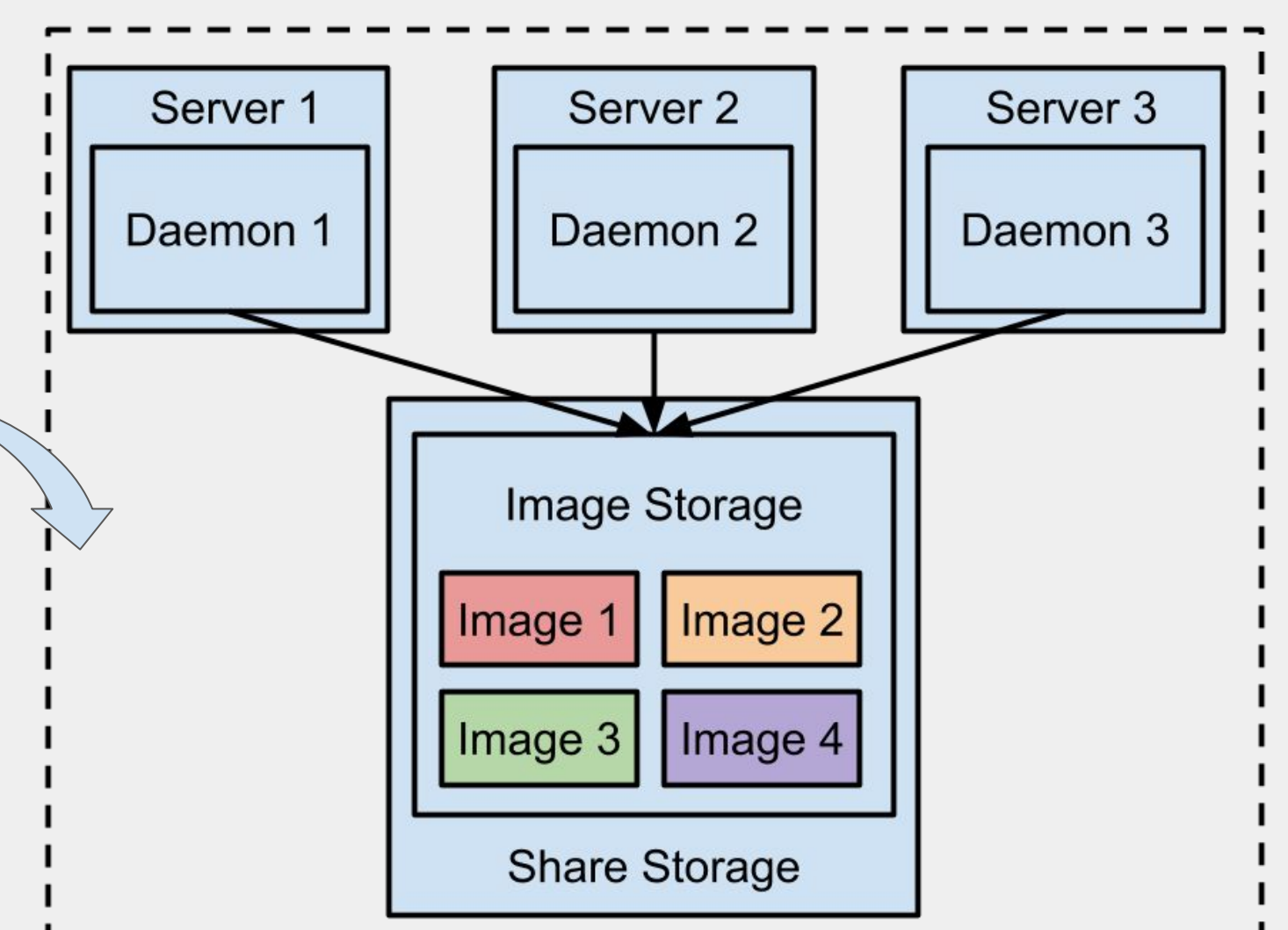
Problems with Naive Sharing

- Redundant pulls **waste network bandwidth**
- Multiple copies of identical image **waste disk space**
- Managing storage space** on local cluster nodes is difficult

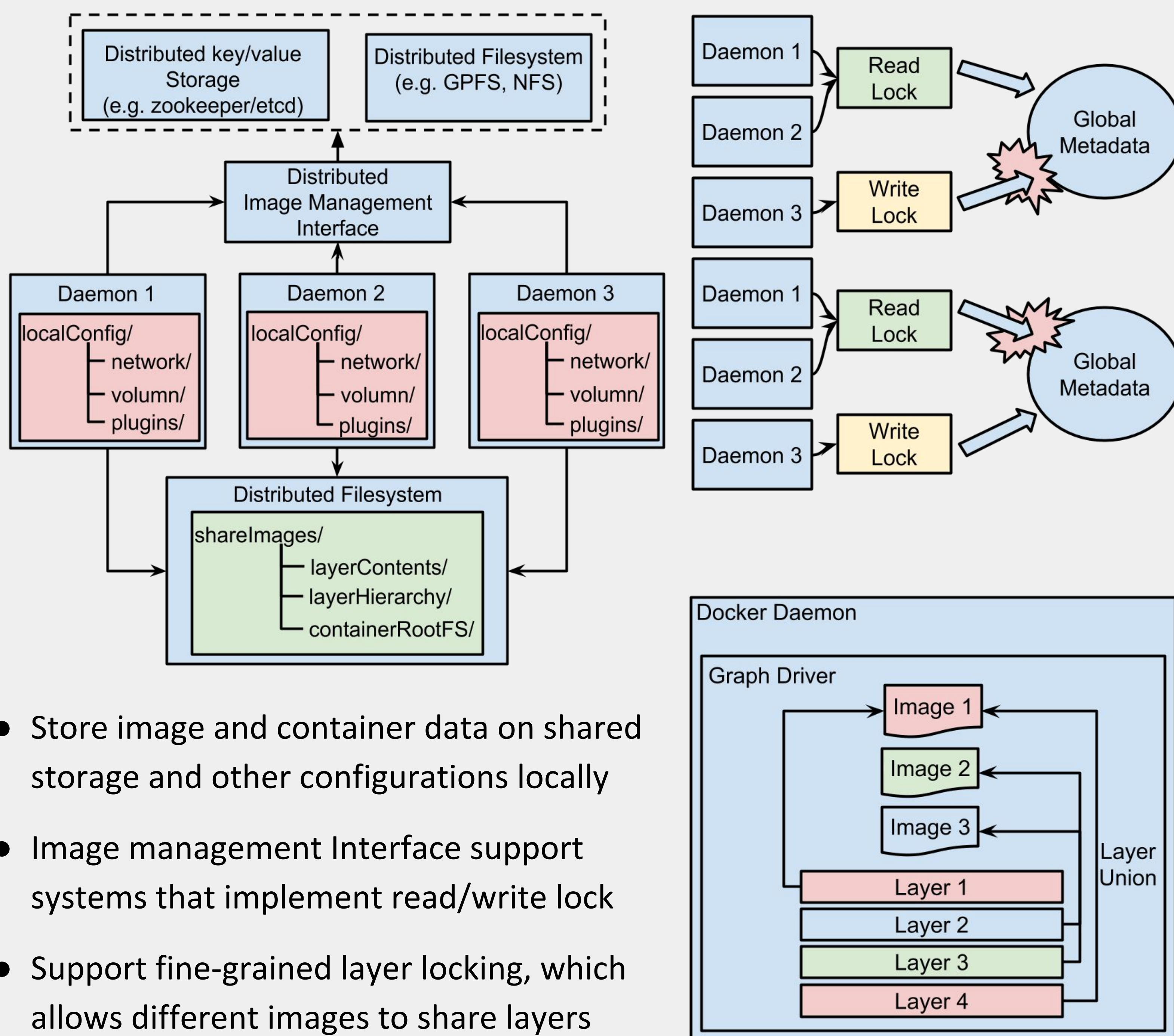


A Shared Image Store

- Benefits
 - Save disk space and network bandwidth
 - Speed up the application startup time
 - Increase the layer reuse rate
 - Enable container migration between daemons
- Challenges
 - There exist contention between daemons
 - Sharing images may affect the performance



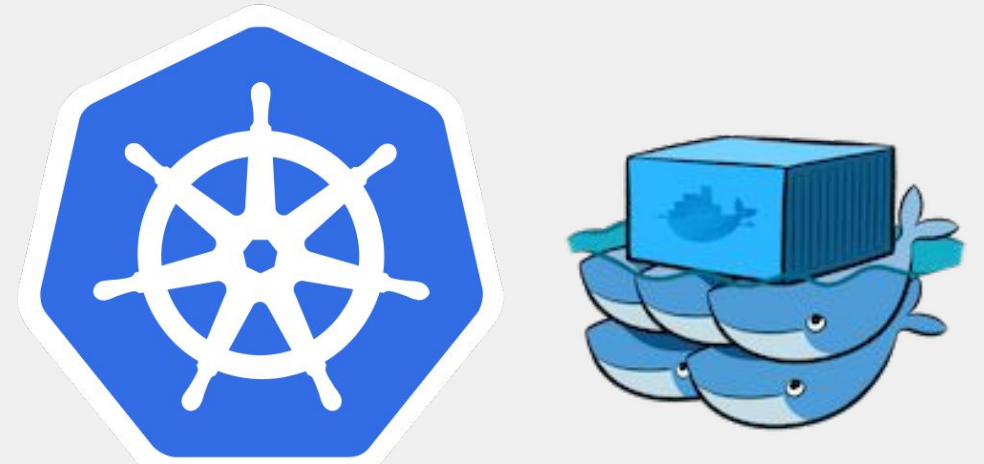
Wharf Architecture



- Store image and container data on shared storage and other configurations locally
- Image management Interface support systems that implement read/write lock
- Support fine-grained layer locking, which allows different images to share layers

Future Work

- Enable images that share same layers to **pull different layers concurrently**
- Implement the **container migration** function
- Integrate Wharf with **container schedulers** (Kubernet, Apache Mesos or Swarm)
- Evaluate the performance of Wharf by running **large-scale scientific workloads** with Makeflow
- Dynamically **detect contention** and add replication for popular layers



Summary

In this project, we explore how to efficiently share images through a shared storage layer to improve startup times of large-scale, parallel applications. We proposed **Wharf**, a shared Docker image store that loads images into a distributed file system to prevent redundant fetches, boost startup time and increase the layer reuse rate.