

TUTORIAL

High Performance Object Storage: I/O for the Exascale Era

Johann Lombardi
Mohamad Chaarawi



Adrian Jackson
(a.jackson@epcc.ed.ac.uk)



Aims

- Understand storage hardware and software
- Learn how to program, and design programs, for storage systems
- Learn about DAOS and Ceph
- Learn about DAOS and Ceph apis and exploiting them from your applications
- Get hands on with DAOS, Ceph, and high performance storage hardware

Aims cont.

- Understand data movement and think about application data requirements
- Thinking about different ways you undertake I/O or storing data
- Move beyond bulk, block-based, I/O paradigms

Format

- Lectures and practicals
- Slides and exercise material available online:
 - <https://github.com/NGIOProject/ObjectStoreTutorial>
 - Exercises will be done on remote system (GCP)
 - We will provide accounts for these

Timetable

- 08.30 Introduction
- 08.45 Storage hardware and software
- 09.00 Practical: Benchmarking different storage approaches
- 09.30 Overview of object stores, DAOS, and Ceph
- 10.00 Break
- 10.30 DAOS API and programming object stores
- 11.00 Ceph storage interfaces and librados
- 11.30 Exploiting DAOS and/or Ceph for applications
- 12.00 Summary and finish

Object Storage

- Design and performance considerations are the challenge
 - Programming against the interfaces is (relatively) easy(ish)
- Design for functionality
 - When to store, when transactions should happen, what granularity I/O operations should be, what failures can you tolerate, etc..
- Design for performance
 - Memory size, I/O, data access costs, etc...

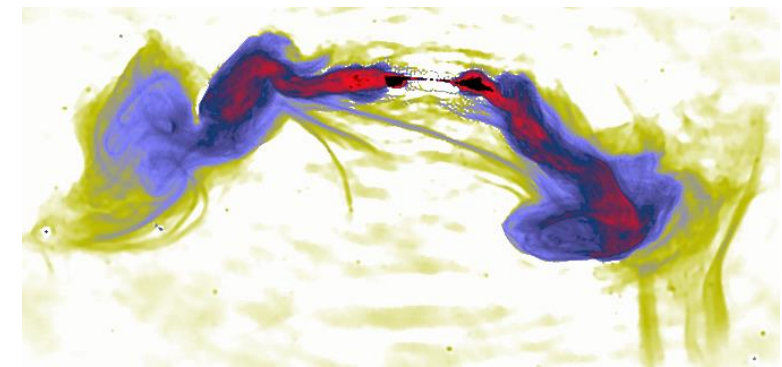
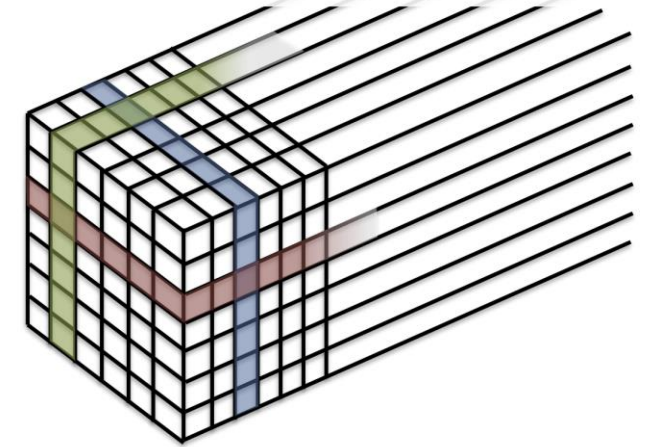
Object storage

- Data stored in unstructured objects
 - Data has identifier
 - Size and shape can vary
 - Metadata can also vary
- Originally designed for unstructured data sets
 - Bunch of data with no specific hierarchy required
- Can also enable efficient/fast access to data in different structures
 - Supports different creation, querying, analysis, and use patterns

Object storage

- Originally designed for unstructured data sets
 - Bunch of data with no specific hierarchy required
- Can also enable efficient/fast access to data in different structures
 - Supports different creation, querying, analysis, and use patterns
- Granular storage with rich metadata
 - Data retrieval leverages metadata
 - **Build structure on the fly**
- Weather/climate
 - Pursuing optimal I/O for applications
 - Weather forecasting workflows
 - End-to-end workflow performance important
 - Simulation (data generation) only one part
 - Consumption workloads different in dimension from production workloads
- Radio astronomy
 - Data collected and stored by antenna (frequency and location) and capture time
 - Reconstruction of images done in time order
 - Evaluation of transients or other phenomenon undertaken across frequency and location

Clients want to do **different** analytics across **multiple** axis



Summary

- Please don't hesitate to ask questions!
- We have a practical sessions
 - Login account will remain active for you to try out using Ceph and DAOS after the tutorial
 - Email a.jackson@epcc.ed.ac.uk to get an account on the system we will use for practical/try out sessions