

TUTORIAL

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

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Aims

- Understand object storage hardware and software
- Learn about DAOS and Ceph
- Learn about DAOS and Ceph lower-level APIs and using them for your applications
- Get hands on with DAOS, Ceph, and high performance storage hardware
- Learn how to program, and design, for object storage systems

Aims cont.

- Understand/think about your application data requirements
 - Both storage and discovery
- 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/adrianjhpc/ObjectStoreTutorial>
 - Exercises will be done on remote system (GCP)
 - We will provide access for these

Timetable

- 13.30 Introduction
- 13.40 Object storage and storage hardware
- 14.00 Practical: Benchmarking different storage approaches
- 14.15 Overview of DAOS
- 14.35 DAOS programming APIs
- 15.00 Break
- 15.30 Practical: Hands-on DAOS programming
- 15.45 Ceph storage interfaces and librados
- 16.15 Librados programming API
- 16.25 Practical: Using DAOS and/or Ceph for applications
- 16.50 Performance, design, and summary
- 17.00 Finish

Object Storage

- Design and performance considerations are the challenge
 - Programming against the interfaces is (relatively) easy(ish)
 - Direct use often straight forward (i.e. filesystem interfaces)
 - More intelligent functionality takes more work/more specialised
- 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...

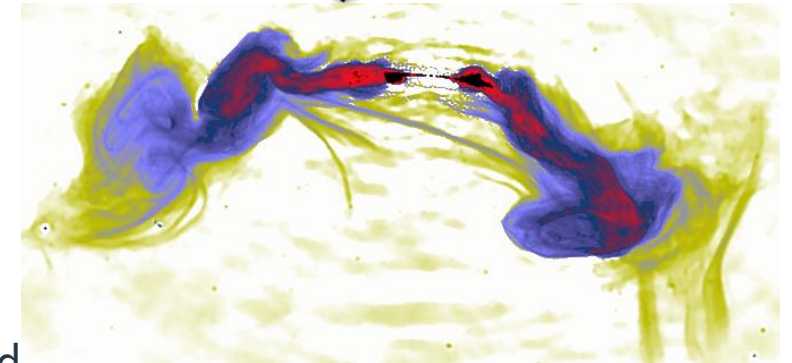
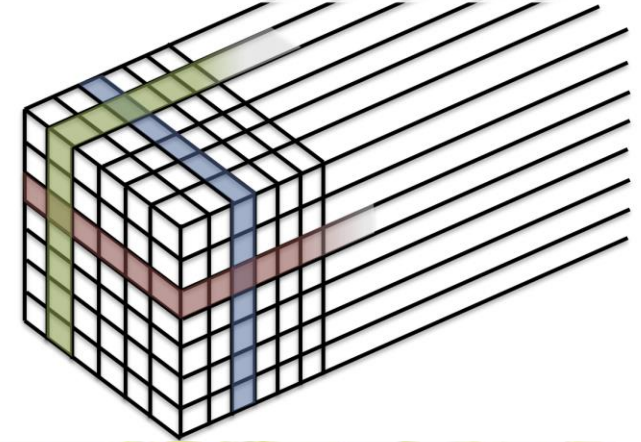
Object storage

- 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

- Can 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 layout/pattern from production
- 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 (not really enough time to finish them during the tutorial today)
 - Email nicolau.manubens@ecmwf.int to get an account on the system we will use for practical/try out sessions