TUTORIAL

Object Storage for High Performance I/O

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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

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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 this

Timetable

- 14.00 Introduction
- 14.10 Object storage and storage hardware
- 14.40 Practical: Benchmarking different storage approaches
- 15.00 Overview of DAOS
- 15.30 DAOS programming APIs
- 16.00 Break
- 16.30 Practical: Hands-on DAOS programming
- 17.00 Ceph storage interfaces and librados
- 17.15 Librados programming API
- 17.30 Practical: Using DAOS and/or Ceph for applications
- 17.50 Performance, design, and summary
- 18.00 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...

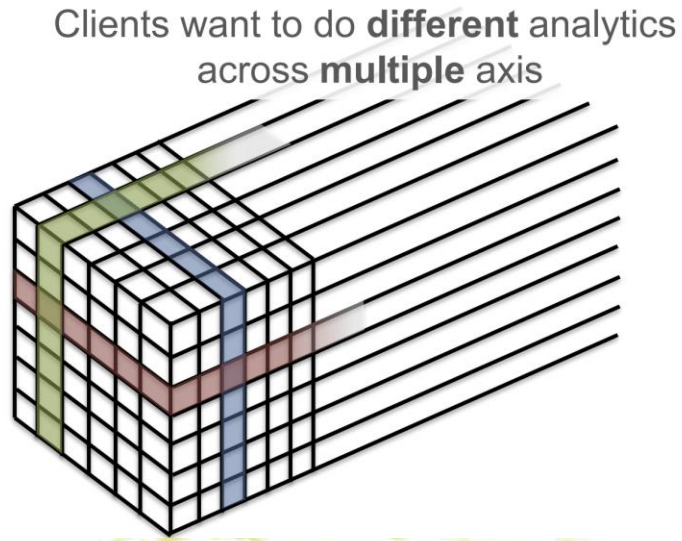
Object storage

- Data stored in unstructured objects
  - Data has identifier
  - Size and shape can vary
  - Metadata can also vary

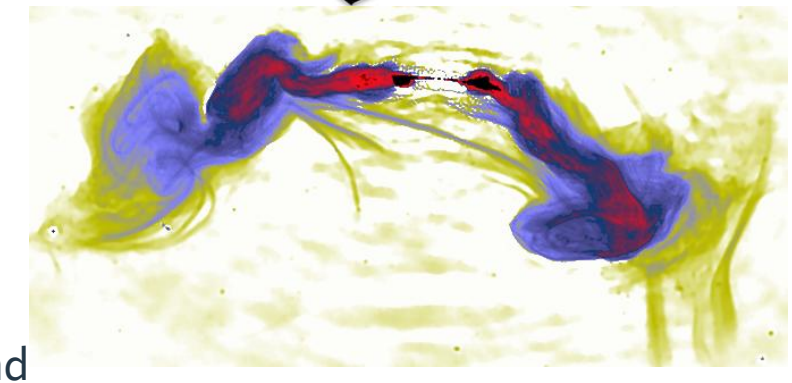
- Originally designed for unstructured data sets
  - Bunch of data with no specific hierarchy required

- 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



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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 (if you use the subject "Object store account" that will help us respond to the emails)