From Physics to Industry: EOS outside HEP
Data production is outdistancing storage solutions

Nowadays’ *normal* data volumes are difficult to handle

*DIY* solutions not scaling: +$$\$\$ \neq +TBs

’a PetaByte’ is not remarkable anymore
Physics pioneered Large Scale Computing

- HEP
- Earth Sciences
- Climate
- Life Sciences
- Bio
- WLCG
- Digital Imaging
- EDU
Computing **technologies** that can **percolate** from High Energy Physics to Industry is a major success for **CHEP community** and science.

**WLCG** successfully exposed **new technologies**. Some still **hidden** but some being **unveiled**: Workload Management Systems, Data Management Frameworks and **Storage Technologies**.
Interfaced CERN storage services with Blue Waters NCSA using WLCG’s FTS3 to manage the data workflow.

Open door for HPC environments to link with our HTC and Distributed Computing expertise.

Mapping Proton Quark Structure in Momentum and Coordinate Space using PetaByte Data-Sets from the COMPASS Experiment at CERN.
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HEP community was already data hungry before the commodity-data explosion and we developed solutions to cater EOS as a Large Scale Storage System is opening a new door. HEP-designed but interesting for the outside world.
Not Your Average
BROWNIES

Our brownies are packed with as much of the finest chocolate as we could possibly fit in the pan for a moist, rich chocolatesplosion in every bite. Decadent? Yes. Worth every bite? Absolutely. Someone grab the ice cream.

Baked by: Michael
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Together with CERN Openlab we started a project with a company (COMTRADE) to start the productisation of EOS.
“The project scope is the evolution of the EOS system in the direction of simplified usage, installation and maintenance and to extend its utilisation by adding new supported platforms. In the initial phase the emphasis will be in providing a robust installation kit to allow rapid installation of EOS on an agreed set of platforms. The kit will include the necessary installation instructions and tools for operations (admin guide) and for user (user guide). A test suite will exercise the native EOS interface (xroot) and the main access protocols (Fuse, Webdav/HTTP)
evolution of the EOS system
simplified usage, installation and maintenance

providing a robust installation kit

installation instructions and tools for operations
CERN's Disk-only Large Scale Storage System

- Easily scalable
- Performant and manageable
- CERN main storage platform

**Adaptable**
- Catering with different uses
- Experts in-house
- Adapt when required
- Re-design if needed

**Community storage**
- Collaboration
- Share
- Offline work
- Sync
- Bridge BigData PersonalData

**Sync & Share**
- Data processing
- User Analysis
- LHC Data Recording

**EOS now**
- October 2016
- +1200
- +45000
- 850M
- 150PB
- 850M files
Installation shell script:
- Fully compliant EOS instance
- Headnodes (master and slave)
- Storage nodes

**Summary of resources installed and status:**
- Servers, available space, etc.
- Functional tests

**Uninstallation and rollback capabilities**

**Access/authentication:**
- Kerberos, LDAP integration, shared secrets

**Build platform:**
- Gitlab > Jenkins > Docker

**Support for different Linux distributions**

**Documentation**
- EOS whitepaper
- Installation script how-to
- Administration
- System description

**Phase-I :: provide tools and expand**
Phase-I :: provide tools and expand accomplished
- Scale-out filesystem underneath the ownCloud app, using the eosd fuse interface for file IO

- Geo-distributed setup: Brisbane, Melbourne, Perth
  - ~1PB (scale to ~20PB next year)

- Australian National University, in Acton Canberra: mirror archives of both genome sequences and open or freely available software distributed among three sites

“*This system is presently running 0.3.187, and has been so trouble free that I keep forgetting it’s there.*” David Jericho - AARNet Solutions Architect
Components of the JRC Earth Observation Data Processing Platform (JEODPP)

**Batch Processing Interface**
- Direct access interface through HTCondor scheduler for experiment/projects use cases

**Interactive Processing Interface**
- Web access interface for end users based on Jupyter, Leaflet, and custom built image processing libraries

**High performance network**

**Batch processing**
- Job Scheduler

**Interactive processing**
- Direct access interface through HTCondor scheduler for experiment/projects use cases

**Distributed file system**
- FILESYSTEM
  - EOS
    - 2 MGM servers
    - 10 FST servers
    - 240 6 TB disks
    - TOTAL SPACE: 1.44 PB

**Current usage:**
- 24.5M files
- 336TB

**Processing**
- 9 2U processing servers
- 16 1U processing servers
- TOTAL: 600 cores
- 7+TB memory

@V.Vasilev, F.Eyraud (JRC)
Future

Multi-site EOS cluster:
- Geo-scheduling
- RAIN configuration
- Erasure Coding

Automated testing
- Functional tests
- Benchmarking

Continue evolving:
- Installation
- Documentation
- Distro support

Monitoring
- System overview
- Basic metrics

Support

Installation/admin
- Docker deployment
- Admin GUI

Clients
- Native Windows client

Documentation
- EOS admin guide
- EOS system