



The IN2P3 LSST Computing Effort

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First large scale Data Challenge in summer 2013 Goals :

- SDSS Stripe 82 reprocessing with LSST Stack
- Test the Satellite (a.k.a. Split) Data Release Processing together with NCSA

Processing :

- Calibrated images from SDSS in 5 bands (u, g, r, i, z)
- Individual image processing and photometric calibration
- Co-addition
- Forced photometry

Coordination with NCSA and DM team

- File transfer between the 2 sites using the CC-IN2P3 iRODS system
- Output cross validation on a predefined overlapping region





At IN2P3 only :

- 10⁵ CPU hours 700 CPU cores in // during 2.5 months
- Input data : 4.8 TB in 4.4 million files
- Output data : ~100 TB in 21 million files stored in GPFS
- Data exchanged between NCSA and CC-IN2P3 through the network
- Output products stored in a large MySQL database
- Test of the Dirac middleware system at CC-IN2P3

Some issues :

- Database issue completely underestimated
 - Several 700 GB tables with 2 billions lines => took ages to create index
- Lack of production control tools (book-keeping, etc...)

But very successful :

- Validated the Satellite DRP concept
 - Demonstrating that a coordinated production between both sites was achievable with reasonable efforts





Figure: 5 sq. deg. background-matched coadd composite

(g,r,i) ~55 epochs

Region: Aqr Galactic lat = -35.0

Slide: Yusra AlSayyad



Qserv



A relational database system able to store trillions of objects, managed and queried via SQL

Qserv : developed at SLAC + IPAC Design optimized for astronomical queries







Qserv will be a crucial component for LSST science

- Strong interest at IN2P3
- "Big Data" component (XLDB consortium)

Collaboration with the CNRS multi-disciplinary project : PetaSky

- Connection with computer science research
- Connection with GAIA

Active participation from LPC + CC-IN2P3

- Fabrice Jammes (LPC) spent 6 months at SLAC in the Qserv team
- CC-IN2P3: hardware procurement and installation, software deployment, cluster management and operations, software packaging





In 2013 CC-IN2P3 provided a 300-node test cluster for qserv

- Limited storage (refurbished nodes)
- Crucial for the Qserv team / LSST \rightarrow Database Architecture Review
- Some scaling issues have been identified and resolved

CC-IN2P3 is providing a new testbed platform

- Thanks to a partnership with Dell
- 50 servers (25 now + 25 later) : aggregated 400 CPU cores, 500 TB
- 8 cores 1 TB disk / core 16 GB Memory / core

Status :

The platform (25 nodes) is installed and Fabrice Jammes is deploying the Qserv software – 25 more nodes being deployed now

Platform maintained with production quality standards by CC-IN2P3 engineers





Satellite Data Release Processing

- Requires a plan to ramp up the CC-IN2P3 infrastructure
- Periodic Data Challenges
 - > To stress and validate the infrastructure
 - To test middleware and tools
 - > To explore possible alternative strategies, hardware and software

Avoid doing "DC for the sake of DC" but would rather try to make them scientifically useful

- A lot of expertise at IN2P3 on CFHT / Megacam with the SNLS group (LPNHE + CPPM)
- CFHT / Megacam much closer to LSST than SDSS (drift scan)
- All the data are already at CC-IN2P3
- Number of scientific results and technical procedures has been published
 - First and only Weak Lensing dataset publicly available

CFHTLS reprocessing



Ideal use case to learn and understand the LSST stack in details

- Start from an initial work from Simon Krughoff (UW)
- Excellent collaboration with the DM team

Contributions from :

- DB : Development and test of the obs_cfht package
- LPNHE : Image reduction Algorithms Camera
- CPPM : Transient detection (comp. science PhD student from Bogota)
- LAL : Data analysis / validation
- LPC : Data analysis / validation code development data production
- LUPM : Joining the effort Transient detection

Technical work at CC-IN2P3 (Fabio Hernandez)

- Binary distribution of official LSST software releases through CernVM FS, available worldwide
- Analysis of I/O activity during data processing
 - Could serve as input data for another comp. science PhD : simulation of large scale computing infrastructure (SimGrid)





CFHTLS reprocessing







A full program of work to :

- Assess pipelines' quality
- Tune parameters
- Implement new algorithms

Benefit from HSC expertise on LSST DM stack













Next steps

- Continue validation and deployment of new functionalities as they become available in the LSST stack
 - Turned out to be a crucial task in order to assess DM stack release quality before being distributed
- Large scale production / data challenge
 - > Data will be available for DESC
- Ingest data into Qserv prototype
 - > Test Qserv system with realistic queries
 - Feedback to Qserv development team





- Discussions have started in order to make use of the strong expertize developed in France for SNLS in the area of image processing algorithms
 - Simultaneous astrometry for high accuracy image coaddition
- This work is also relevant for understanding the I/O load and to define the best infrastructure to support it





IN2P3 is already strongly involved in LSST computing

- Data Challenges
- Qserv
- CFHTLS image reprocessing
- Tool development / performance measurement

The IN2P3 organization allows a lot of flexibility in budget and manpower allocation (with respect to the US science organization)

- A good coordination with LSST DM is necessary to make the best possible use of this flexibility
- Explore non-baseline solutions / alternative approaches

The main goal of IN2P3 involvement in computing is to enable the best possible science with LSST / DESC





Parties :

• IN2P3 – LSSTC – LSSTPO – NCSA

Purpose :

- Establish a partnership to enable participation by French scientists in the scientific exploitation of the LSST database
- Specify the terms of an IN2P3 contribution to the LSST Data Release Processing during the survey operations

Agreement :

- NCSA is the lead production data processing center, i.e. the Archive Center for LSST and the Data Access Center for the US
- CC-IN2P3 is a satellite data processing Center
- NCSA and CC-IN2P3 will process 50% of the data (level 2)
- A full dataset will be available in both sites





Agreement (cont.):

- IN2P3 will coordinate with RENATER to establish the necessary bandwidth between CC-IN2P3 and Chicago StarLight POP
- CC-IN2P3 and NCSA : reciprocal disaster recovery centers for LSST
- Joint Coordination Council (JCC) to collaborate in the planning, technical and operational constraints ==> Implementation plan
 - NCSA has the lead responsibility for defining the constraints
 - Guarantee that IN2P3 contributions are consistent with the LSST
 Data Management
 - Joint tests of Satellite DRP no later than the start of Commissioning (October 2019)
- CC-IN2P3 contribution valuated to 900 k\$/year in operation cost
 - Data rights for 45 new PI on top of the data right granted from the Camera MOA