Collaborative Data Intensive Science

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Agenda (10 min!)

• Use case: LSST
• Collaborative Data-life cycle Management
  – Scale-up and Scale-out
• Current efforts
  – DASH, iRODS
• We need more
  – Data I/O protocols with control channels
  – Storage Time Machine (if there is time for this)
• Q&A
How many of you know what is LSST?
LSST

• Large Synoptic Survey Telescope (LSST)
  – Survey entire sky every 3 nights
  – Dark Energy, Dark Matter, Near Earth Asteroids, …
  – Largest digital camera in the world (3 billion pixels)
  – Images 3000 times wider than Hubble

• LSST Data Management
  – Data from Chile to US and rest of the world
  – 15 TB/night, over hundred(s) petabytes
  – Multiple data centers around the world
  – Trillions of rows database (~15 PB)
  – Hundreds of millions of files (~80 x 3 = ~240 PB)
Site Roles and their Functions

- **Base Facility**
  Real-time Processing and Alert Generation, Long-term storage (copy 1)

- **Archive Center**
  Nightly Reprocessing, Data Release Processing, Long-term Storage (copy 2)

- **Data Access Centers (DACs)**
  Data Access and User Services

- **System Operations Center (SOC)**
  System Supervisory Monitoring Control & End User Support/Help Desk

* Co-located DAC: shares infrastructure with Archive Center
** Co-located DAC: shares infrastructure with Base Facility
LSST and CDLM

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.
LSST and CDLM

i\exp\file1.fits
i\exp\file2.fits

/euro/exp/file2.fits

/res/chile/exp/file1.fits
/exp/file1.fits
/exp/file2.fits
Topic and current problems (related to this talk)

• Collaborative Data-lifecycle Management
  – “Data by itself is a process”
  – Data has to be social and “collaborate” with many including producer(s), consumer(s)

• Scale-out
  – Data Grid or Data Cloud or ?
  – iRODS.org

• Scale-up
  – IO latency (CPU cycle >>>> IO cycle)
  – SDSC DASH
iRODS: Logical File System
Scale out to multiple data centers

• iRODS
  – Data Grid Management System for Digital Libraries, Persistent Archives and Data Grids
  – Open Source BSD
  – Version 2.1
SDSC DASH
(one small step for byte, one giant leap for a petabyte)

- Prototype effort for data intensive computer
  - Scale-up is EXPENSIVE (supercomputer)
  - Reduce IO latency with more memory (cheap) and SSD

- vSMP node
  - Aggregate multiple nodes into a single powerful node using software: Global memory as commodity

- SSD
  - 4TB of SSD
  - 3 IO nodes
If I had a billion bucks…

• IO latency
  – Smarter storage with CPU attached (just for storage control) and new protocols that can get control messages about h/w at a very low-level.

• Inter-processor and Inter-data center IO
  – IO for scale-up and scale-out
  – Improvements in CPU or data management software are handling the symptoms rather than the cause

• Data to Knowledge Communities
  – Data, Information, Knowledge
  – People, Communities
Storage Time Machine

- Capacity: Infinite
- I/O latency: Almost None
- Persistence of data: 10,000 years ++;
- TCO: Almost Zero
- Scalability: Few exabytes
- Start-up time: TBA (its ok don’t need to perfect)
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