Networks Construction and Commissioning

Jeffrey Kantor

South American Astronomy Coordination Committee (SAACC) Meeting

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Rubin Observatory

Summit and Base Sites
Telescope and Camera
Data Acquisition
Long-term storage (copy 1)

Base Center
Chilean Data Access Center

Dedicated Long Haul Networks
Two redundant 100 Gbit links from Santiago to Florida (existing fiber)
Additional 100 Gbit link (spectrum on new fiber) from Santiago – Florida
(Chile and US national links not shown)

French Site
Satellite Processing Center
CC-IN2P3, Lyon, France
Data Release Production (50%)
French DAC

Archive Site
Data Facility
Alert Production
Data Release Production (50%)
Calibration Products Production
Long-term Storage (copy 2)

Data Access Center
Data Access and User Services

Dedicated Long Haul Networks

Camera Site
Camera Support

Data Release Production (50%)
Calibration Products Production
Long-term Storage (copy 2)

Data Access Center
Data Access and User Services

Data Release Production (50%)
French DAC

Data Facility
Alert Production

Camera Site
Camera Support

Summit and Base Sites
Telescope and Camera
Data Acquisition
Long-term storage (copy 1)

Base Center
Chilean Data Access Center

HQ Site
Science Operations
Observatory Management
Education and Public Outreach
LSST Data Products and Distributed Computing

• Nightly data products
  • Alerts
  • Difference images and catalogs
  • 60s latency from time of readout from camera

• Annual data products
  • Process all accumulated data from start of survey (distributed US, France)
  • Produces all nightly data products plus
  • Catalogs of deep, faint objects
  • “Forced” photometric measurements

• Supporting community-developed data products
  • “Nearby” computing and storage at Data Access Centers
  • Software (middleware, pipelines, algorithms, tools)
Nightly Data Flows

- **VOEvent Broker Server** (Non-DM)
- **Archive Site**
- **Base Site**

**DM Data (up to 39 Gbps)**
- Northbound: Raw Images, Wavefront Images, Raw Calibration Images
- Southbound: DIAObject Catalog, DIA Source Catalog, Calibration Images

**OCS/TCS Data (up to 1 Gbps)**
- Engineering Facility DB
- Data Quality Metrics
- Atmospheric Telescope Images and Spectra

**Raw Images**
- 24 - 30 TB / night
- 6.4 GB per image
- 18-bit uncompressed
- Compressed at Base Site

**60 second requirement stops here**

**10M Alerts per night (average)**
Non-Nightly Data Flows and Distributed Computing

Archive Site

- US DAC
  - Calibration products
  - L2 Data Products

- EPO Center

- Base Site
  - Chilean DAC
    - Calibration products
    - L2 Data Products

French Site

- Eastbound
  - Raw images
  - Calibration products
  - Engineering Facility Database
  - 1/2 of L2 Data Products (coadds, catalogs, SDQA)

- Westbound
  - 1/2 of L2 Data Products

Data Release:
- Coadds
- Object catalog
- Source catalog
- Forced Source catalog

Physical Shipments
- Archive Site to Base Site Annually
  - Hardware
  - Data Release Products (secondary method)
LSST Long Haul Network Links (Baseline FY20)

- **Tucson**: 10Gb ESnet (in institutional)
- **La Serena**:
  - 40x10Gb AURA (Science Data)
  - 10x10Gb Non-LSST AURA (Fail-over)
- **Cerro Pachon**:
  - 2x100Gb AURA (OCS/TCS Control)
- **SLAC, Other DOE**:
  - 100Gb (spectrum)
    - AmLight/RNP/RedCLARA (via Buenos Aires)
- **Boca Raton**:
  - 100Gb (spectrum)
    - AmLight/ANSP/RedCLARA
- **Sao Paolo**:
  - 2x10Gb Amlight/ANSP/RedCLARA
- **Panama**:
  - 1x100Gb
  - 1x 40 – 100 Gb REUNA
- **Santiago**:
  - 2x100Gb path diverse
  - AMPATH/FLR (shared)
- **Miami**:
  - 2x 100Gb path diverse
  - Internet2 AL2s
- **Chicago**:
  - 2x20Gb Esnet/I2 (shared)
  - 2x 10Gb Amlight/Internet2
  - 1x100Gb shared, path diverse
- **Champaign**:
  - 2x20Gb Esnet/I2 (shared)
  - 2 * 100Gb NCSA/ICCN
  - 2 x 10Gb+ IN2P3
- **Atlanta**:
  - 100Gb (shared)
  - Internet2 AL2s
- **Jacksonville**:
  - 100Gb (shared)
  - Internet2 AL2s
- **Internet2 AL2S**:
  - 1x100Gb shared, path diverse
- **LSST**:
  - 40x10Gb AURA (Science Data)
  - 2x100Gb AURA (OCS/TCS Control)
- **Secondary Path**
  - Shared links are guaranteed 40 Gb
LSST Long Haul Network Links (Baseline FY22)

- Tucson
- La Serena
- Cerro Pachon
- SLAC, Other DOE

- 40x10Gb LSST (Science Data)
- 2x100Gb LSST (OCS/TCS Control)
- 10x10Gb Non-LSST AURA (Fail-over)

- 10Gb ENSNet (institutional)

- Boca Raton
- Santiago
- Sao Paolo

- 100Gb (spectrum) AmLight/RNP/RedCLARA (via Buenos Aires)
- 2 x 100Gb Amlight/ANSP/RedCLARA

- 10Gb AmLight/Internet2
- 10Gb Amlight/Angola Cable

- 1x 100Gb (spectrum)

- CC-IN2P3 Lyon
- Chicago
- Champaign
- Atlanta
- Internet2 AL2S
- Jacksonville

- 2 x 10Gb+ IN2P3
- 2 x 100Gb NCSA/ICCN
- 2x 100Gb ESnet (dedicated)
- 1x 100Gb (shared)

- Internet2 AL2s
- 2x 100Gb path diverse AMPATH/FLR (shared)

- Miami
- Panama

- 2x 100Gb path diverse

- 1x 100Gb
- 1x 40 – 100 Gb REUNA

- Secondary Path
- Shared links are guaranteed 40 Gb
End-to-End Network Bandwidth Evolution

<table>
<thead>
<tr>
<th>MILESTONE LEVEL</th>
<th>ID</th>
<th>ACTIVITY</th>
<th>BASELINE FINISH</th>
<th>PROJECTED FINISH</th>
<th>END-TO-END B/W, Cerro Pachon - La Serena - NCSA</th>
<th>END-TO-END B/W, La Serena - NCSA</th>
<th>Bandwidth Achieved through Demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>DM-NET-1</td>
<td>Base - Archive Network Functional 1 Gbps</td>
<td>6/11/15</td>
<td>6/11/15</td>
<td>0.5 Gbps</td>
<td>Max 1G Best Effort</td>
<td>0.5 Gbps (operational)</td>
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<tr>
<td></td>
<td>DM-NET-2, 3, 6, 2, 9, DMTC-6800-1310</td>
<td>Mountain - Base Network Functional 2 x 100 Gbps, Summit LAN installed, initial Network Ready (Summit), Network Acceptance/Verification Review for Early Integration</td>
<td>5/27/18</td>
<td>6/30/18</td>
<td>2 x 100 (shared AURA DWDM)</td>
<td>Max 20G Best Effort</td>
<td>466Gb/s (LSST First Light demo)</td>
</tr>
<tr>
<td></td>
<td>DM-NET-4, DMTC-6800-1320</td>
<td>Base LAN installed, Network Acceptance/Verification Review for Full Integration</td>
<td>11/10/18, 7/3/19</td>
<td>10/15/15</td>
<td>6 x 100 (dedicated LSST DWDM) + 2 x 100 (shared AURA DWDM)</td>
<td>Max 20G Best Effort</td>
<td>80Gb/s (LSST SC18 demo)</td>
</tr>
</tbody>
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Note: LSST internet, web, voice, video go over AURA circuits, which are shared, and are currently limited by 1G Firewalls in LS and 10 Gbps internet2 links in the US. This will be improved by the end of FY19 by the move to 10 G firewalls in LS.