



# AURA Networking: Many Use Cases

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R. Chris Smith  
AURA Observatory in Chile  
CTIO/Gemini/SOAR/LSST

# AURA Backbone Users & Use

- Large users
  - NOAO/CTIO (DECam!)
  - Gemini (Remote ops!)
  - SOAR (Remote observing)
  - **LSST (currently site mon.)**
  
  - Carnegie (La Serena)
  - NRAO/ALMA (Santiago)
  
  - GMT (pending)
- Smaller Users
  - SMARTS
  - PROMPT (x8 now)
  - GONG
  - ALO
  - WHAM
  - LCOGTN
  - **KASI/KMTnet**
  - **ASAS-SN**
  - mEarth (Harvard)
  - **“EvryScope”/Prompt**
  - T80S (Brazil)

# Key Use Case #1: Data Transfer

- Big Cameras, Big Data
  - NOW: DECam producing ~500Gb to 1TB/night
  - Near-real time reduction and analysis
    - Has moved from “goal” to “requirement”
    - Science example: Gravity Wave outburst detection
  - FUTURE: LSST!
- Small telescopes, Big Data
  - KASI/KMTnet 1.6m w/ four 9Kx9K CCDs
  - Evryscope & ASAS-SN covering whole sky with multiple mega-pixel cameras

# Key Use Case #2: Remote Observing

- SOAR
  - MSU, UNC are almost always remote
  - Brazilian and NOAO remote observations becoming more common
- Gemini
  - Over-the-shoulder observing offered
  - Mtn-base critical: no one in dome at night
- CTIO
  - DECam remote observing under development
- SARA
  - Fully remote: mtn to user critical

# Key Use Case #3: Robotic Telescopes

- Network connection critical
  - PROMPT has been doing it for years
  - LCOGTN with active (every 15 min) rescheduling
  - ASAS-SN with rapid alerts of SNe discovered
- Likely to become more common with LSST follow-up opportunities

# Key Use Case #4: Coordination

- **Real-time** communication and coordination is critical in transient follow-up
  - Target of Opportunity observing (ToO)
  - E.g., Gemini can get on target within minutes, and data is available in archive within minutes of being taken
- **Scientific importance** growing for all observatories
  - Opportunities for Gravity Wave follow-up
  - “Uncommon” transients identified by LSST

# Key Use Case #5: Data Access

- Archives are the starting point for a growing fraction astronomical research
- Key assets in Chile
  - ALMA archives for users
    - Chilean site under consideration
  - LSST Data Access Center
    - To host data products in La Serena

# AURA Network Backbone

- **Current** Three segments
  - Summits (Tololo+Pachón) to Base (La Serena)
    - Microwave link @ 2 x 155 Mbps
    - **Traffic has outgrown this solution**
    - Plus Two additional Radio Links
      - Cambium 300Mbps, Ubiquity 300-400 Mbps
    - **Eagerly awaiting fiber links**
  - La Serena to Santiago
    - REUNA @ 4Gbps (preliminary LSST step up)
  - Santiago to U.S. RENs
    - AmLight+LAUREN @ 1Gbps (up to 10Gbps)



# New Links for AURA/LSST:

- Outline of needs
  - “Segment 1” = Mountain-La Serena
    - LSST >200Gbps, Others >10Gbps
  - “Segment 2” = La Serena-Santiago
    - LSST >100Gbps, Others >10Gbps
  - “Segment 3” = Santiago-U.S.A.
    - LSST >200Gbps, Others >10Gbps

# Key Features of Solutions

- Meets demanding requirements for LSST Operations
- Meets AURA facilities current needs, with significant room for expansion (including those of affiliates like Carnegie, GMT, etc.)
- Meets AURA's commitment to Chileans to make best effort to invest in bandwidth through Chilean research and educational network infrastructure

*and*

- Work with REUNA to create an important segment in its national high-speed network strategy, including possible links to northern international observatories