NOIRLab: International Gemini Observatory

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ITOPS

AMREN Project Meeting - June 2021

Agenda

- **General Overview: Gemini Observatory**

- **ITOps (Information Technology Operations Service)**

- **Backbone Networks**

- **MSO (Medium Scale Observatories) & Gemini South Integration**

- **Main Network Activities During 2020**

- **Future Network Activities**

NOIRLab: National Optical and Infrared Astronomy Research Laboratory

Discovering Our Universe Together

General Overview: Gemini Observatory

Mission:

"To advance our knowledge of the Universe by providing the International Gemini community with forefront access to the entire sky"

"Enable breakthrough discoveries in astrophysics developing and operating state-of-the-art ground-based observatories and providing data products and services for a diverse and inclusive community"

NOIRLab Programs

- CTIO (Cerro Tololo Interamerican Observatory)
- CSDC (Community Science and Data Center)
- International GEMINI Observatory - Introductory Video: Gemini Observatory
- KPNO (Kitt Peak National Observatory)
- Vera Rubin Observatory (LSST Telescope)

AURA operates these facilities and NSF's NOIRLab under a cooperative agreement with NSF

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General Overview: Gemini Observatory
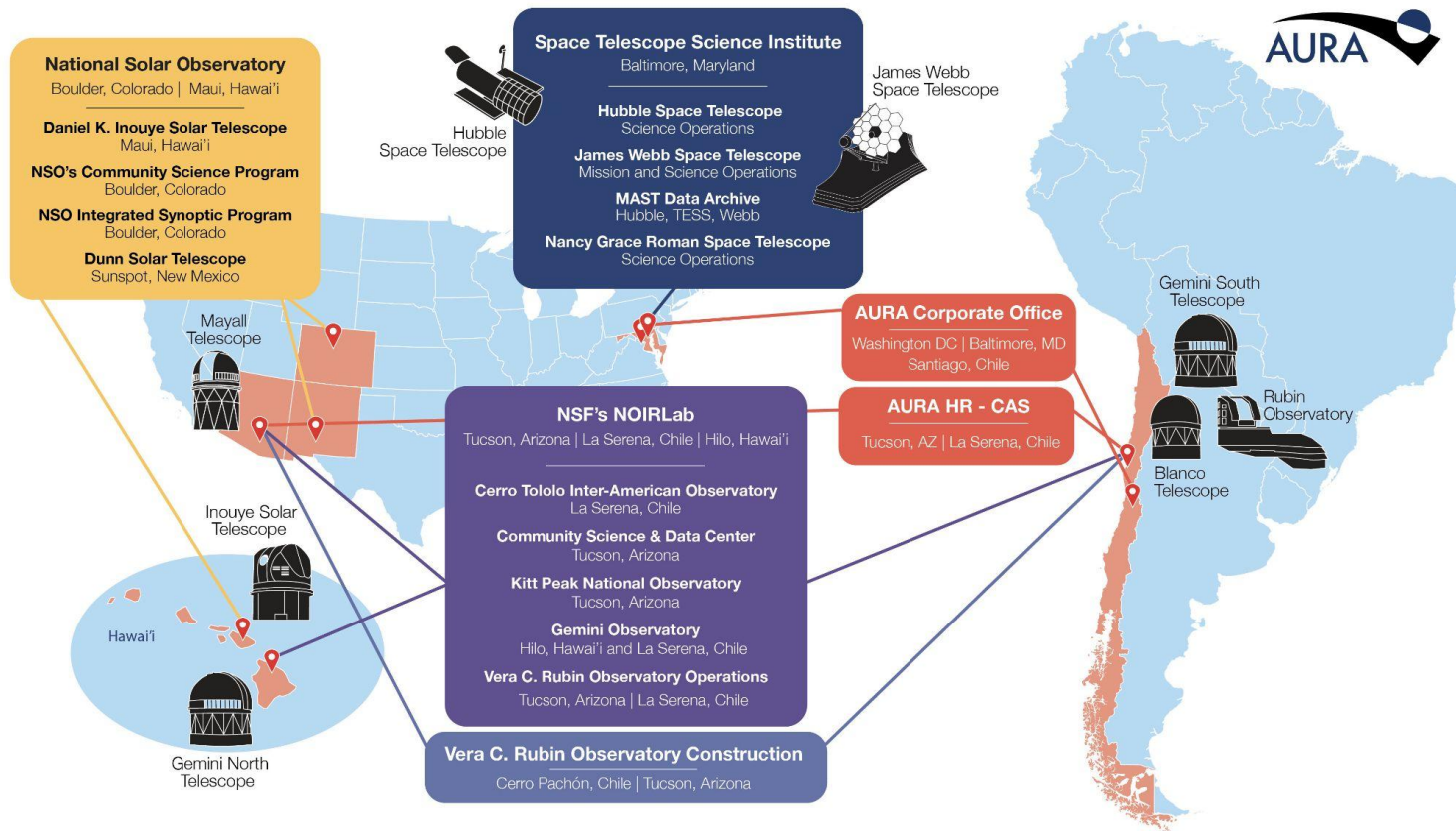
General Overview: Gemini Observatory

" One Observatory, Two Telescopes"

Gemini Telescopes

- Gemini North
  - Mauna Kea Mountain Operations(MKO), Hawaii

- Gemini South
  - Cerro Pachón Operations(CPO) , Chile

Gemini Partners

- United States
- Canada
- Chile
- Brazil
- Argentina
- Korea

ITOps

Overview

ITOps infrastructure and operations support standardizes system deployment and management as well as IT support requirements reaching all levels of NOIRLab. This includes Astronomy IT Operations, Business IT Operations, NOIRLab business and service areas.

Business IT Operations

Delivers and supports integrated IT services across all NOIRLab sites. Provides the IT services necessary to run the business of a modern, globally distributed organization.

Astronomy IT Operations

Delivers and supports enterprise computing services dedicated to supporting science.

The Team

23 staff distributed across all NOIRLab sites in Chile, Hawaii and Tucson

NOIRLab - GEMINI ITOps
Data Centers / Key uses cases

Gemini North

- Hilo Base Facility (HBF), Hilo
- Mauna Kea Operations (MKO), at 4200m

Gemini South

- La Serena Base Facility (SBF), La Serena
- Cerro Pachón Operation (CPO), at 2700m

- **Base Facility Operations**: Remote Observing - VPN access

- **Summit Base Data Transfer**: High Bandwidth

- **High Availability**: World-Class availability (>99%)

- **High Reliability**: Maximum MTBF (>10 years)
  (MTBF: Mean Time Before Failure)

- **Cross-site Coordination**: Low Latency between : Hilo - La Serena & La Serena - Tucson

- **Cloud Data Archiving**: Upload/Download from AWS
  (AWS: Amazon Web Services)

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NOIRLab - GEMINI ITOps
Data Centers / Key uses cases

- **Base Facility Operations:**
  - Remote Observing - VPN access

Gemini South: Control Room in La Serena, Chile

- **Instrumentation**
  - Each Telescope is equipped with four instruments fed by advanced AO Systems:
    - GMOS
    - GSAOI
    - GPI
    - FLAMINGO-II
    - GEMS
    - GCAL
    - GHOST
    - SCORPIO
  - Visiting Instruments
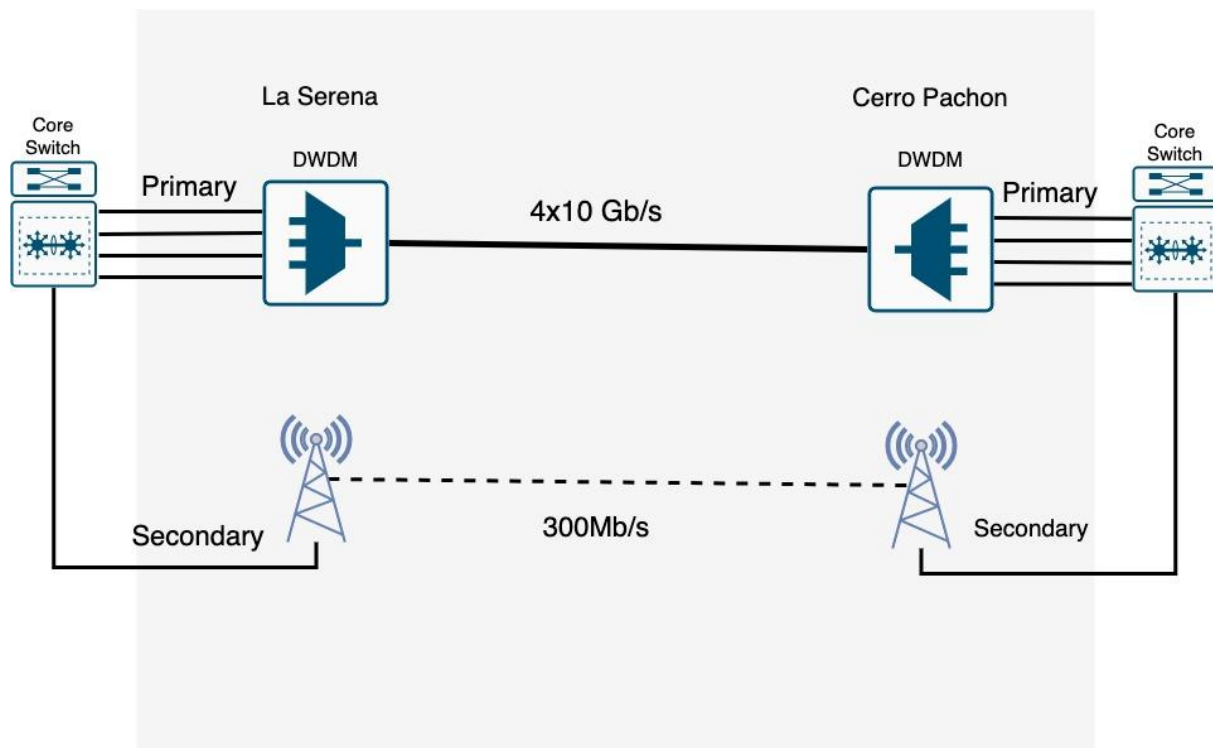   - DSSI
    - Phoenix
    - IGRINS
    - ZORRO

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Source: https://www.gemini.edu , https://noirlab.edu/

NOIRLab - GEMINI ITOps
Data Centers / Key uses cases

- **Summit Base Data Transfer:** High Bandwidth

Data Centers / Key uses cases

- High Bandwidth

40 Gbps Primary link through valleys

4 Gbps Backup link through the coast

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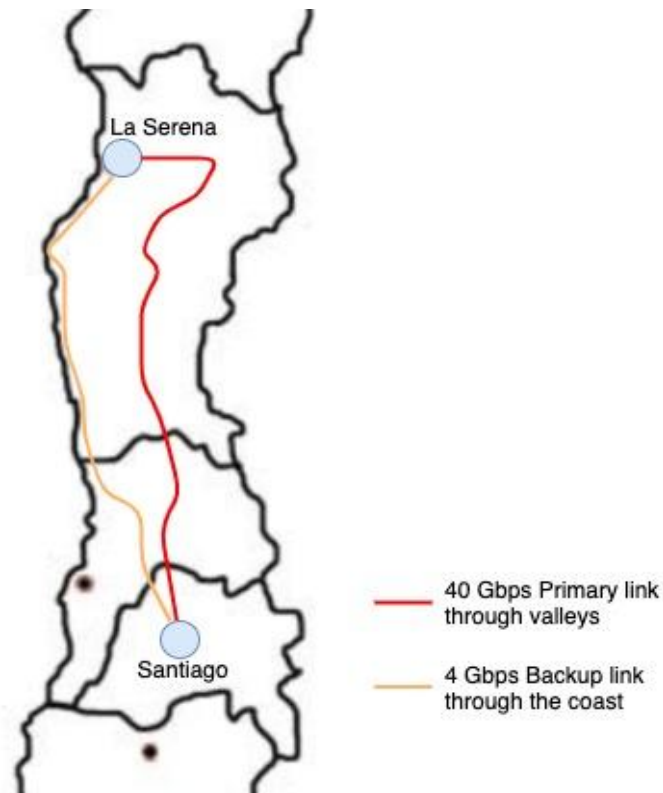
NOIRLab - GEMINI ITOps
Data Centers / Key uses cases

- High Bandwidth

- 10Gbps burstable to 40Gbps on both links

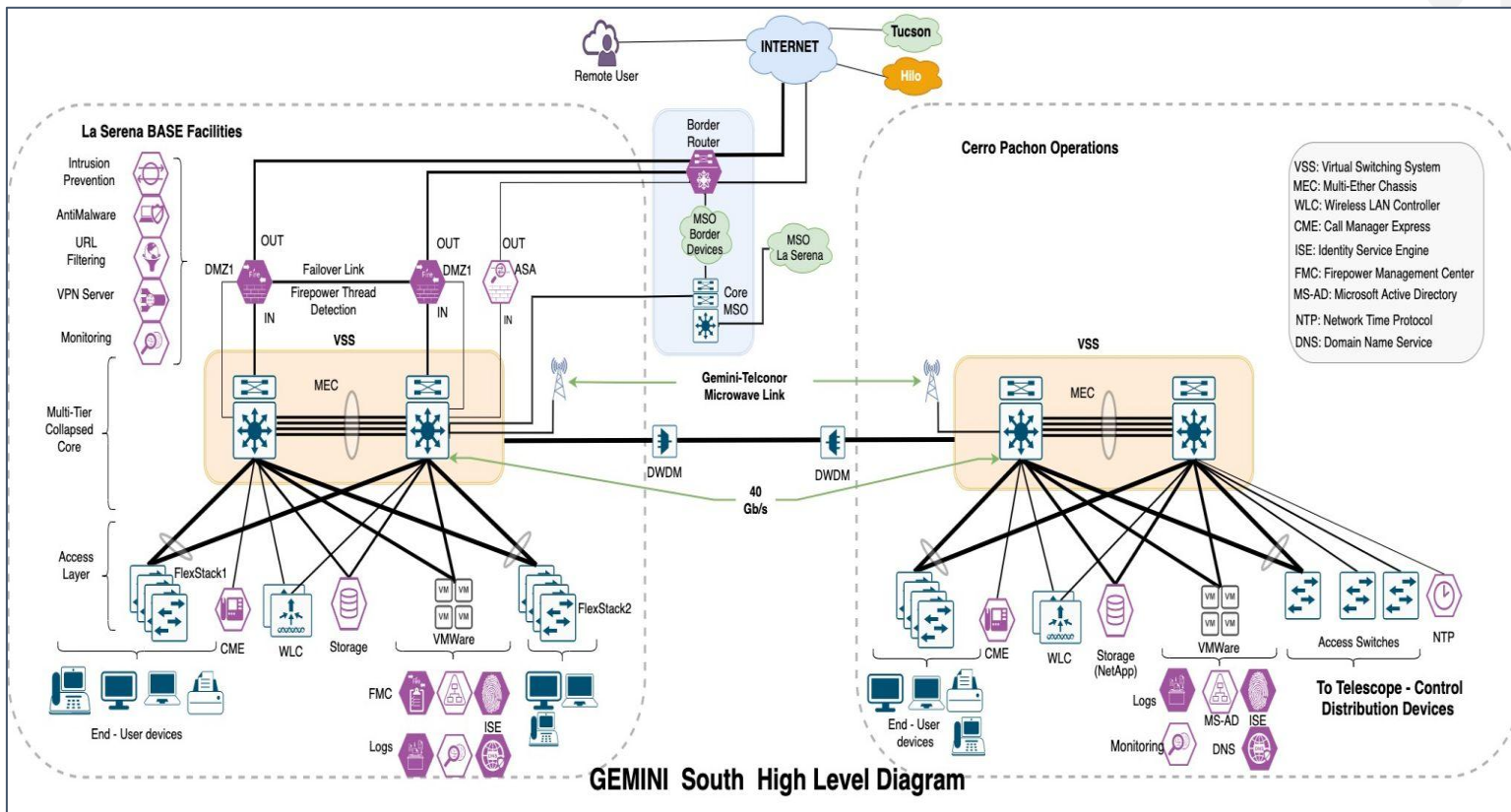- Reuna backup 10Gbps shared link

- RedClara support as Tertiary Link

Primary link Pacific Coast
Backup link Atlantic Coast

NOIRLab - GEMINI ITOps

Data Centers / Key uses cases
High Availability / High Redundancy

GEMINI South High Level Diagram

NOIRLab - GEMINI ITOps

Data Centers / Key uses cases
Cross Site Coordination

VPN Site to Site - Cross Site Coordination

Line	Description
← - - - ►	VPN IPSEC Site-to-Site Gemini North - Tucson
← - - - ►	VPN IPSEC Site-to-Site Gemini North - CTIO
← - - - ►	VPN IPSEC Site-to-Site Gemini South - Tucson
← - - - ►	VPN IPSEC Site-to-Site Gemini South - Gemini North

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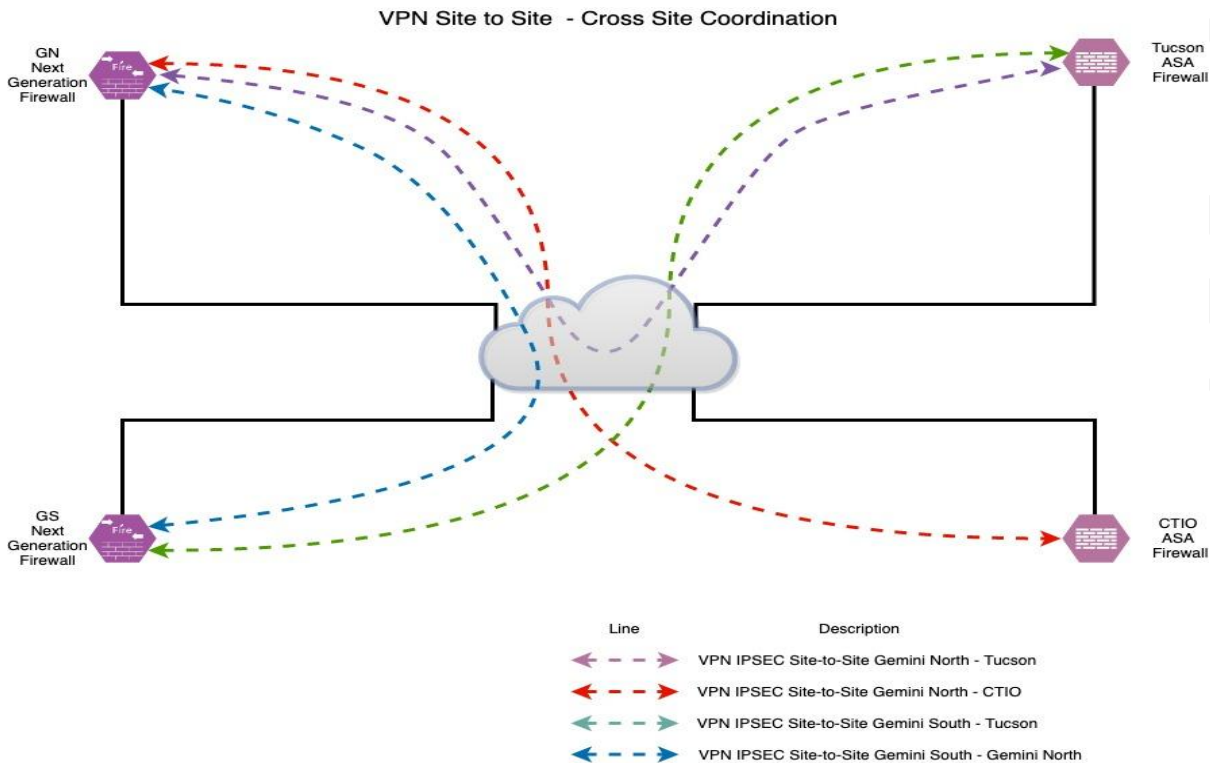
Integration Gemini - MSO

Activities During 2020

- In Layer 2: Sharing estrategic VLANs between both Programs

- In Layer 3: Adding static routes to reach specific subnets in La Serena

- WiFi :

    - Extending SSID's from Gemini to MSO buildings

    - Extending SSID's from MSO to Gemini buildings

- VoIP: Modifying Dial-Peers to communicate between both VoIP Systems

- VPN S2S: To provide encrypted connection to Authentication Servers

Gemini & MSO Integration

Integration Gemini - MSO in La Serena Base Facilities

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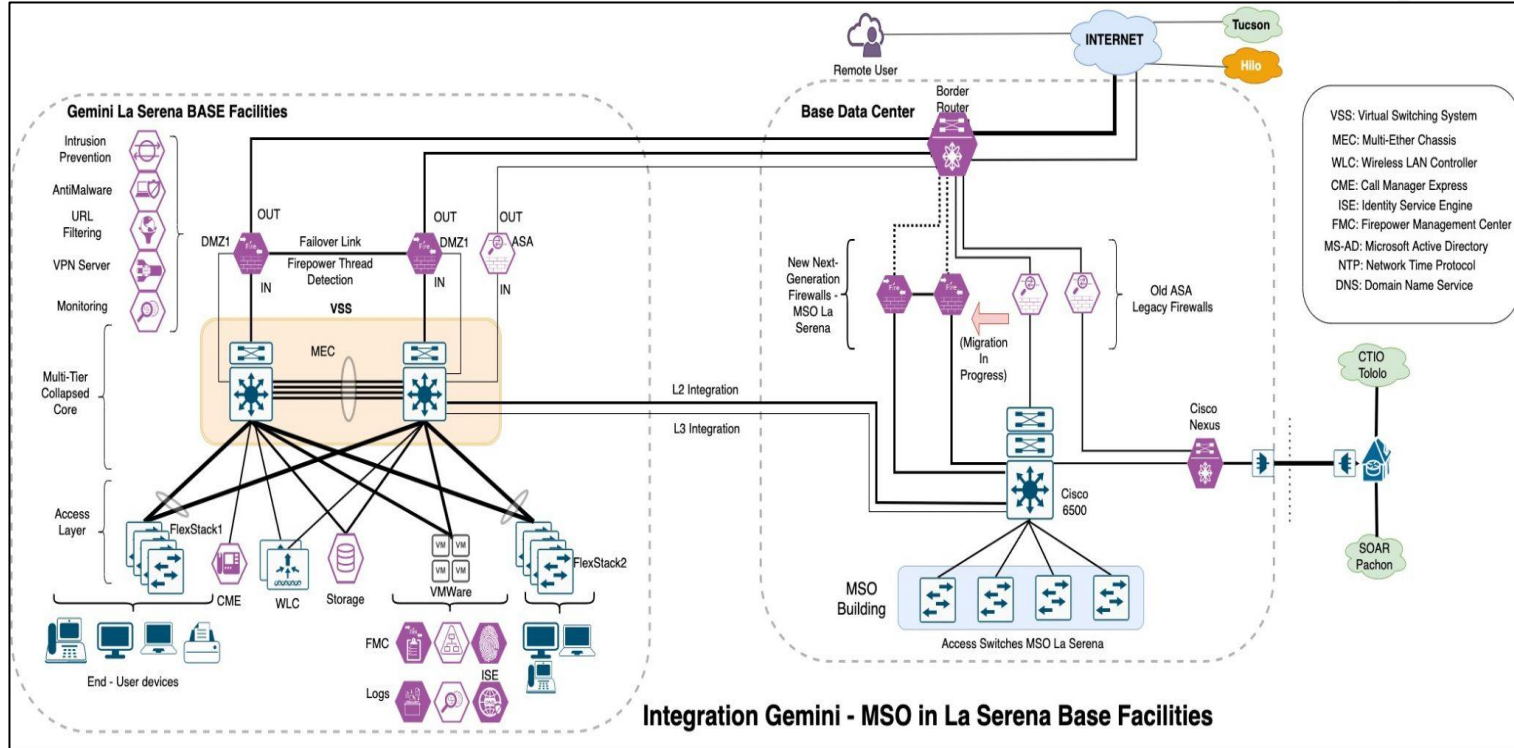
Gemini South Improvements 2020

Next Generation Firewalls

- Increased number of Tunnel Profiles to Provide access to Remote users (GS and GN)
- Implementation of URL Filtering
  - Cisco URL License
  - ResearchSOC Initiative (https://researchsoc.iu.edu/)
- Traffic Control to Cerro Pachón Operations
  - Decommissioned old Cisco ASA on CPO

Network Services & Collaborative Tools

- Authentication & Authorization :
  - Improvement ISE Nodes deployment, Licensing, Many new Policy Set Statements
- Cloud Service Desk (CSD)
- Google Workspace deployed to All

Integration Gemini & MSO (CTIO)

NOIRLab GEMINI
Future Activities and Initiatives

NOIRLab Networking Upgrade Project

- LAN Design in all Locations
  - (La Serena, Cerro Pachón, Cerro Tololo, Hilo, Mauna Kea, Tucson, Kitt Peak)
- WAN Design
- WiFi Upgrade

NOIRLab VoIP upgrade

- Evaluating Cloud-Based Solutions

Firewall Upgrade

- MSO Upgrade is still in Progress
- Design and Planning upgrades in many locations

Collaboration and Integration with Vera Rubin Observatory

NOIRLab GEMINI
Future Activities and Initiatives
Network Upgrade Project

Based on standard technologies which could include :

- Traditional Multi-Tier design
  - Core - Distribution - Access Topologies
  - Stacking Topologies
- Fabric L2 Leaf-Spine (Using Multi-Link Aggregation - MLAG)
- Fabric L3 Leaf-Spine (Using VXLAN/BGP/EVPN Technologies)

Requires studying vendor capabilities

- Such as: Cisco - Juniper - Arista
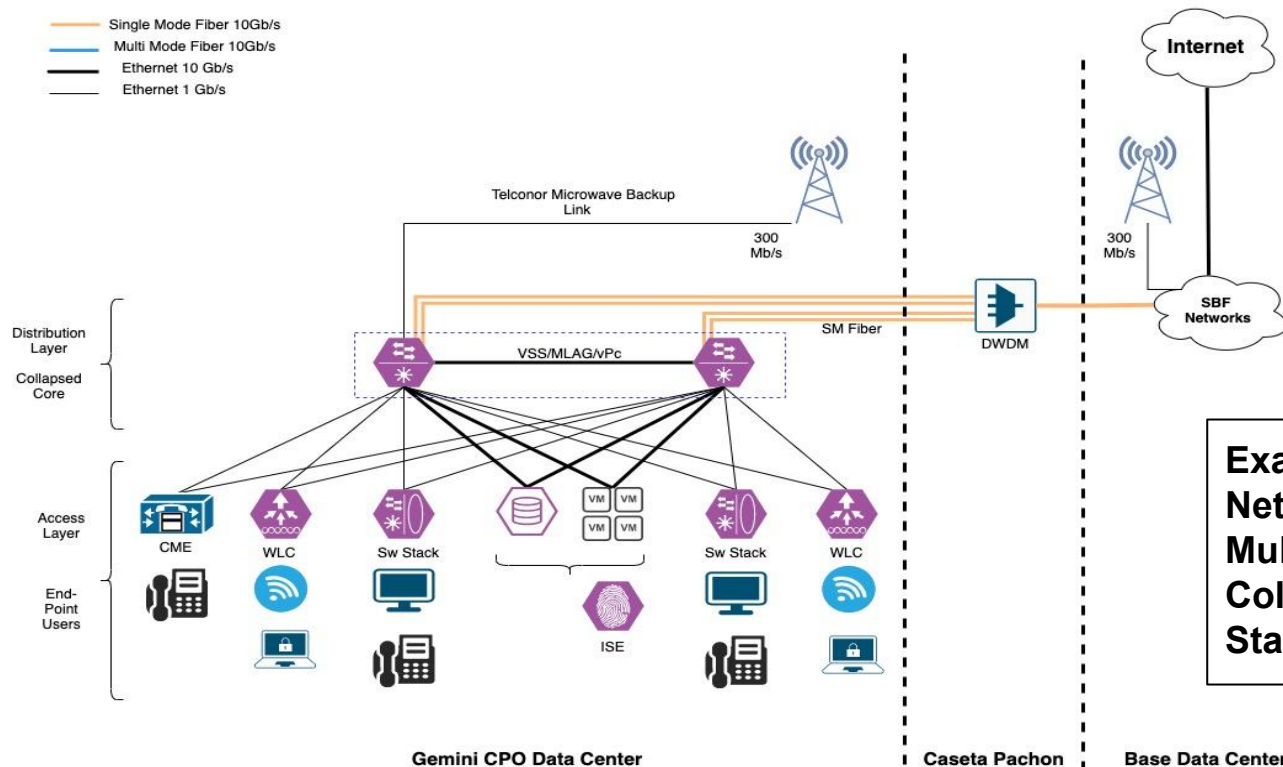
~3 years to cover all locations

Will involve important NOIRLab stakeholders

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Future Activities and Initiatives
Network Upgrade Project
Preliminary LAN Design using Multi-Tier topology on CPO

Single Mode Fiber 10Gb/s
Multi Mode Fiber 10Gb/s
Ethernet 10 Gb/s
Ethernet 1 Gb/s

Internet

Telconor Microwave Backup Link

300 Mb/s

300 Mb/s

SM Fiber

SBF Networks

DWDM

Distribution Layer

Collapsed Core

VSS/MLAG/vPc

Access Layer

CME   WLC   Sw Stack   VM VM / VM VM   Sw Stack   WLC

End-Point Users

ISE

Gemini CPO Data Center   Caseta Pachon   Base Data Center

Example 1: Draft of CPO Network Design using Multi-Tier Design , Core Collapsed and Switch Stacking

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Acronyms

AWS: Amazon Web Services
CPO: Cerro Pachon Operations
CSDC: Community Science and Data Center
CTIO: Cerro Tololo Inter-American Observatory
DWDM: Dense Wavelength Division Multiplexing
GN: Gemini North
GS: Gemini South
HBF: Hilo Base Facility
ITOPs: Information technology Operations Services
MKO: Mauna Kea Operations
MLAG: Multi-Link Aggregation
MSO: Medium Scale Observatory
MTBF: Mean Time Before Failure
LAG: Link Aggregation
NOIRLab: National Optical and Infrared Astronomy Research Laboratory
SBF: La Serena Base Facility
SM Fiber: Single-Mode Fiber
VM: Virtual Machine
vPc: Virtual Port-Channel
VPN: Virtual Private Network
VSS: Virtual Switching System

Reference Web Pages :   https://www.gemini.edu/
https://noirlab.edu
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