NSF Program: Campus Cyberinfrastructure (CC-NIE)

Program Area: Small Institutions  Award Number: 1541352

PI: Jorge Crichigno

co-PIs: Ivan Lopez-Hurtado, Mario Izaguirre-Sierra

Project Title: Northern’s Network Expansion for Large Science and Engineering Data Flows

Project Goals:

• Address the severe LAN and WAN data movement limitation imposed by the current 100 Mbps capacity.
• Establish a 10 Gbps dedicated research network and Science DMZ.
• Increase the undergraduate research activities in Science and Engineering.
• Enhance undergraduate programs to address workforce needs and preparation for graduate schools.
Northern’s Network Expansion for Large Science and Engineering Data Flows: Introduction

- Northern New Mexico College (NNMC) is located in Espanola, NM
- Student population of 75% Hispanics and 15% Native Americans
- First designated community college of NM, dual-mission since 2005
- 100 Mbps switched network and WAN connectivity

- ~50 msec RTT to ABQG, no traffic monitoring
- Border router Cisco 2800
- Single-mode 1 Gbps fiber among some buildings only

- P2P connection to ABQG; traffic monitoring
- Cisco ASR-family border router
- Multi-mode 10 Gbps; research network
- Research activity; workforce development
Northern’s Network Expansion for Large Science and Engineering Data Flows: Challenges

- No network engineer
- Available expertise includes engineering faculty, IT director
- Cyberinfrastructure funded by grants
  - EPSCoR 2010: campus enterprise network
  - CC*DNI 2015: Science DMZ and research network
  - EPSCoR 2015: storage area network
- Maintenance and operation
  - IT, faculty member and students
  - University of New Mexico
  - Contractor when needed
- Engagement
  - Teaching load is four classes per semester; motivated faculty usually includes tenure track
  - Undergraduate research, hands-on activities more recognized now

NNMC Espanola, New Mexico
Windstream Espanola, New Mexico
Windstream Albuquerque, New Mexico
Windstream Dallas, Texas
NTT Dallas, Texas
L3 Denver, Colorado
CENIC Denver, Colorado
CENIC Albuquerque, New Mexico
UNM Albuqurque, New Mexico
Northern’s Network Expansion for Large Science and Engineering Data Flows: Advancement

- Undergraduate research and workforce development

Albuquerque’s Prosperity site (utility company) to NNMC (finalist Platts Global Energy Award)

Plant genomics

3D convection modeling

National Center for Genome Resources (NCGR)
Northern’s Network Expansion for Large Science and Engineering Data Flows: Advancement

**Nurturing Success: Northern New Mexico College Student Lands Dream Job At LANL**

Submitted by Carol A. Clark on July 17, 2017, 10:00 am

Los Alamos Daily, July 17, 2017

**Science DMZ team, from left to right**

Chase: Comp. Sys. Professional 2, LANL; Joseph: Scientist 1 at LANL, GA Tech Master program; Sergio: to graduate in Fall 2017, intern at LANL, Analysis, Intelligence, and Technology, plan to attend GA Tech

**LANL – NNMC: Internship program, Biology and Information Engineering Technology, starting Spring 2018**

Albuquerque Business First, Aug. 24, 2017

Co-PI Biology team, NM IMBRE ‘16 Conf.

1<sup>st</sup> place award, Bioinformatics; 2016 NM IMBRE conference

Top: Maria, Colo. State Research Symp. ’16, 2<sup>nd</sup> place award
Bottom: Britney, NM Biomedical Symp. ‘16
Northern’s Network Expansion for Large Science and Engineering Data Flows: Advancement

- Undergraduate research and workforce development

**LANL – NNMC**

- 3-5 years for an employee to be fully involved
- Need for technicians, 2-year / 4-year degrees
- 3.0 GPA, no drug history, get Q-clearance
- Skills, aptitude, local, long-term employment
- Information Engineering Technology program: 10 interns technicians starting Spring 2018
  - To expand in cybersecurity
- Sciences: radiation protection, radiation control: 10 interns technician starting Spring 2018
- Bachelor graduates: analysts, net. engineers, Scientist I
Northern’s Network Expansion for Large Science and Engineering Data Flows: **Advancement**

**Entropy - Destination Port**

**Netflow-based IDS**

**Window-based Vs Rate-based Congestion Control**

**Throughput vs RTT - 1,500-byte MSS**

**Virtualization Effect on 10 Gbps Science DMZ**

**Maximum Segment Size (MSS) Impact**