Network updates

CHECO CIO Meeting
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Acronym soup

- University Corporation for Atmospheric Research (UCAR; http://www.ucar.edu)
- National Center for Atmospheric Research (NCAR)
- Front Range GigaPoP (FRGP)
- UCAR Point of Presence (UPoP)

Questions and discussions throughout please – and as for acronym soup ingredients, please ask if we miss one or check the decoder page at http://bit.ly/acronym-soup
Reviews and updates

- Front Range GigaPoP (FRGP)
- UCAR Point of Presence (UPoP)
  - Colorado K-12 networking
  - Colorado Telehealth Network (CTN)
- NCAR Wyoming Supercomputing Center (NWSC)
- National networking activities
  - The Quilt, Inc.
  - Internet2
  - NLR
  - NTIA BTOP/ stimulus
  - FCC NBP
  - Others/misc
FRG P

- Front Range GigaPoP
- 10 years of operation by UCAR Network Engineering and Telecommunications Section (NETS)
- 15 Members
- http://www.frgp.net
Front Range GigaPoP (FRGPP)

- Increasing traffic
  - Qwest and Level3
  - TransitRail (TR) and Internet2/Commercial Peering Service (CPS)
    - working toward integrating these two peering services
  - Peering

- Continued support for the CSU/Lander trace infrastructure and research
  - Proposed 10G capture

- DYNES with CU Boulder
FRGP members

- Albuquerque GigaPop (ABQG)/University of NM
- Colorado School of Mines
- Colorado State University System
- Ithaka
- National Oceanic and Atmospheric Administration (NOAA-Boulder)
- State of Colorado
- United States Antarctic Program
- University Corporation for Atmospheric Research
- University NAVSTAR Consortium (UNAVCO)
- University of Colorado Boulder
- University of Colorado Colorado Springs
- University of Colorado Denver
- University of Denver
- University of Northern Colorado
- University of Wyoming
FRGP and WRN

- FRGP and Utah Education Network (UEN) Summit agreement ended June 2010
- Western Regional Network (WRN): a multi-state partnership to ensure robust, advanced, high-speed networking availability for research, education, and related uses through the sharing of network services
- Expansion and sharing of network services in support of advanced research and operations
- Support of academic, economic development, and inter-regional services
WRN members

- Pacific Northwest GigaPop (PNWGP)
- Front Range GigaPoP (FRGP)
- The University of New Mexico (on behalf of the State of New Mexico)
- Corporation for Education Network Initiatives in California (CENIC)
- http://westernregional.net/
WRN states

Increased potential for shared applications among communities across the west—networking services to the following states:

- Alaska
- California
- Colorado
- Idaho
- Montana
- Nevada
- New Mexico
- Washington
- Oregon
- Wyoming
WRN for FRGP

- Intra-region peering
- NLR and Internet2 services shared and backed-up
- Back each other up (provide diverse layer 2 and 3 to cover on-net failures)
- Efficient and cost-effective CIS as well as TR and CPS connections
- Place to land for-profits from CTN, EagleNET, US-UCAN, others
WRN services vs. FRGP services
proposed 2010-10-22, Pete Siemsen

1. Protects FRGP against a failure of WRN switch 1 or 2 in Denver
2. Saves money on Level 3 by sharing with UNM
3. Allows WRN transit VLANs through WRN switches without touching FRGP gear
4. Allows potential commercial traffic to transit WRN without touching FRGP infrastructure
UPoP

- UCAR Point of Presence
- http://upop.ucar.edu
- 3 years of operation
- 21 members
UPoP members

- Auraria Higher Education Center
- Colorado Association of Research Libraries
- Centennial Board of Cooperative Educational Services
- City of Boulder
- City and County of Denver
- Colorado Community College System
- Colorado Telehealth Network (not active yet)
- Community College of Denver
- Colorado Department of Higher Education
- Colorado Mountain College
- Deproduction
- Denver Health and Hospital Authority
- DIA
- EDUCAUSE
UPoP members

- Fort Lewis College
- Front Range Internet, Inc. (two school districts)
- Metropolitan State College of Denver
- St. Mary's Academy
- Science and Technology in Atmospheric Research (STAR) Institute
- UCD Educational Support Services
  - San Luis
  - Montrose-AHEC
  - Greeley-AHEC
  - Western-AHEC
  - Craig Memorial-AHEC
  - SW Health Hospital
  - Pueblo CC
- University of Colorado Hospital (not active yet)
UPoP – future connections

- Additional school districts
- WICHE - [http://www.wiche.edu/](http://www.wiche.edu/)
- PacketRail [http://www.packetrail.net](http://www.packetrail.net) connections (e.g., FLC)
- Frequent discussions with a variety of others
Colorado Telehealth Network

- FCC Rural Health Care Pilot Program (RHCPP)
  - Colorado Health Care Connections (CHCC; from Colorado Hospital Association (CHA))
  - Rocky Mountain Healthcare Network (RMHN; from Colorado Behavioral Healthcare Council (CBHC))

- CTN has FCC RHCPP funding
- Qwest rolling out network now

- [http://www.cotelehealth.com](http://www.cotelehealth.com)
- Internet2 Health Network Initiative:
  - [http://www.internet2.edu/health/](http://www.internet2.edu/health/)
EAGLE-Net

- Educational Access Gateway Learning Environment Network
  - [http://www.co-eaglenet.net/](http://www.co-eaglenet.net/)
- BTOP round 2 award received
- Intergovernmental Agency (IGA)
  - rolling out from CBOCES
  - Board in place
  - Technical Advisory Committee being formed
SEG P updates

- Intended to allow expanded access to the Internet2 network for regional education networks
  - through sponsorship by Internet2 university members

- State and regional networks connect K-20 educational institutions

- The program began in early 2001 and, as of July 2009, there are 39 SEGPs
  - Including one of the newest: **Colorado - 2009**
BiSON partnership

* Bi-State Optical Network (BiSON)

* 5 year old partnership between NCAR, NOAA-Boulder, University of Wyoming, University of Colorado and Colorado State University

* Goal: create an optical WDM network connecting Boulder, Denver, Laramie, Fort Collins and Longmont
BiSON N beginnings

- Began as Lariat network in 2004
- Connected the University of Wyoming to the Front Range GigaPoP in Denver, CO
- Movaz (now ADVA) equipment used to extend the distance of Gigabit Ethernet links
- Only a single lambda with no multiplexing
In 2005 expanded into the BiSON ring.

Connected Boulder, Longmont and Fort Collins, CO.

All of the individual spans were point to point links with no pass-through lambdas.

Ethernet switches at each site passed VLANs instead.
BiSON evolution

- In 2006 upgraded Boulder - Denver span to support 10G
- Provided a dedicated 10G connection to connect the National Center for Atmospheric Research to the TeraGrid
- The TeraGrid link is still operational today
- An additional 10G lambda on the span provides other commodity and R&E connectivity
BiSON evolution

- In 2010 the remainder of the ring was upgraded to be 10G capable
- Existing Movaz hardware upgraded with better amplification and dispersion compensation
- New Adva FSP3000-R7 based shelves added to support new 10G lambdas
- Pass-through lambdas enabled to allow direct connections between any two sites
BiSON current deployment

- Six 10G lambdas lit from Denver
  - 1 new 10G to UW
  - 1 new 10G to CSU
  - 2 new 10G to NOAA in Boulder
  - 2 old 10G from Boulder

- ADVA hardware
  - Amplifiers and older lambda on the RayExpress platform
  - New 10G lambdas on the FSP3000 platform.
BiSON future plans

- Expand dark fiber plant to include NCAR Wyoming Supercomputing Center (NWSC)
- Initially at least four 10G circuits will be active
- Expansion to 40G and 100G a possibility
- Direct connections for High Performance Computing to other BiSON members also a possibility
BiSON Capacity

- System is engineered for 40 individual lambdas
- Each lambda can be a 10G, 40G, or soon a 100G connection
- Independent lambdas can be sent each direction around the ring
- With a major upgrade system could support 80 lambdas
- $100 \text{ Gbps} \times 80 \text{ channels} \times 2 \text{ paths} = 16 \text{Tbps}$
NWSC WAN Conceptual Diagram

- NCAR Internal to ML
- FRGP / Internet / R&E
- Optional UW Dedicated

All links are 10G Ethernet carried via BiSON DWDM.
NWSC

- NCAR Wyoming Supercomputing Center
- [http://www.cisl.ucar.edu/nwsc](http://www.cisl.ucar.edu/nwsc)
- Scheduled to be operating in early 2012
- BiSON fiber connectivity
Dave Lambert new CEO replacing Doug Van Houweling

http://www.internet2.edu
National Lambda Rail (NLR)

- Glenn Ricart resigned; Wendy Huntoon Acting CEO
- http://www.nlr.net
FCC NBP


- Implied acknowledgement that non-profit networking works?
  - It meets the needs of a select groups of customers that perhaps the commercial marketplace hasn't historically served well enough?
  - Legitimizes public and R&E networking?

- [http://www.nlr.net/nationalbroadband.php](http://www.nlr.net/nationalbroadband.php)
US UCAN

- Internet2 BTOP proposal (~$97M) – NLR declined to participate

- United States Unified Community Anchor Network (US UCAN)
  - hopes to provide essential national infrastructure
  - complement and link together regional community anchor networks

- Open search for US UCAN director

- Optical vendor chosen

- Regular calls with RONs on design, schedule, impacts
SHLB Coalition

- Schools, Health, and Libraries Broadband Coalition (SHLB Coalition)
- Supports FCC’s National Broadband Plan and US UCAN
- Focus on higher capacity bandwidth to community anchor institutions
Rise of the RONs

- Increasing RON fiber ownership and operation
  - increasing after ARRA awards (e.g., PA, NC and others in NTIA BTOP round 2).

- Potential for changing landscape for non-profit (R&E et al) networking in U.S.
Example stimulus links

- http://broadbandusa.gov/
- http://broadbandcensus.com
- http://www.educause.edu/Resources/Browse/EconomicStimulus/34622
- http://www.colorado.gov/recovery
- http://www.ntia.doc.gov/broadbandgrants/
- http://www.recovery.gov
The Quilt, Inc.

- http://www.thequilt.net

- 28 members currently:

- http://www.thequilt.net/participants.html

- Non-profit regional network aggregators providing advanced network services in support of research and education

- Several work groups, lots of tracking, coordination and strategic planning efforts
.Global Environment for Network Innovations

http://www.geni.net/

http://groups.geni.net/geni/wiki/SpiralTwo
NOAA-WAVE (N-WAVE)

- NOAA building national NOAA research network called N-WAVE
- Utilizing I2 and NLR 10Gbps lambdas
- Initial sites: NOAA-Boulder, NOAA-DC, GFDL, ORNL
- Secondary sites: Seattle, Florida, Oklahoma
ESNet

- ARRA Advanced Networking Initiative (~$62M)
- 100G Prototype Network and Testbed
- DOE scientists are now generating data at the terabyte scale, and datasets will soon be in the petabyte range
- LHC: also a very large networking experiment
Discussion

- Any follow up questions or feedback on items covered?
- Other items?

Thank you!