

# Network updates

CHECO CIO Meeting

December 2010

Marla Meehl

Jeff Custard

# 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

# FRGP

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

# Front Range GigaPoP (FRGP)

- \* 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

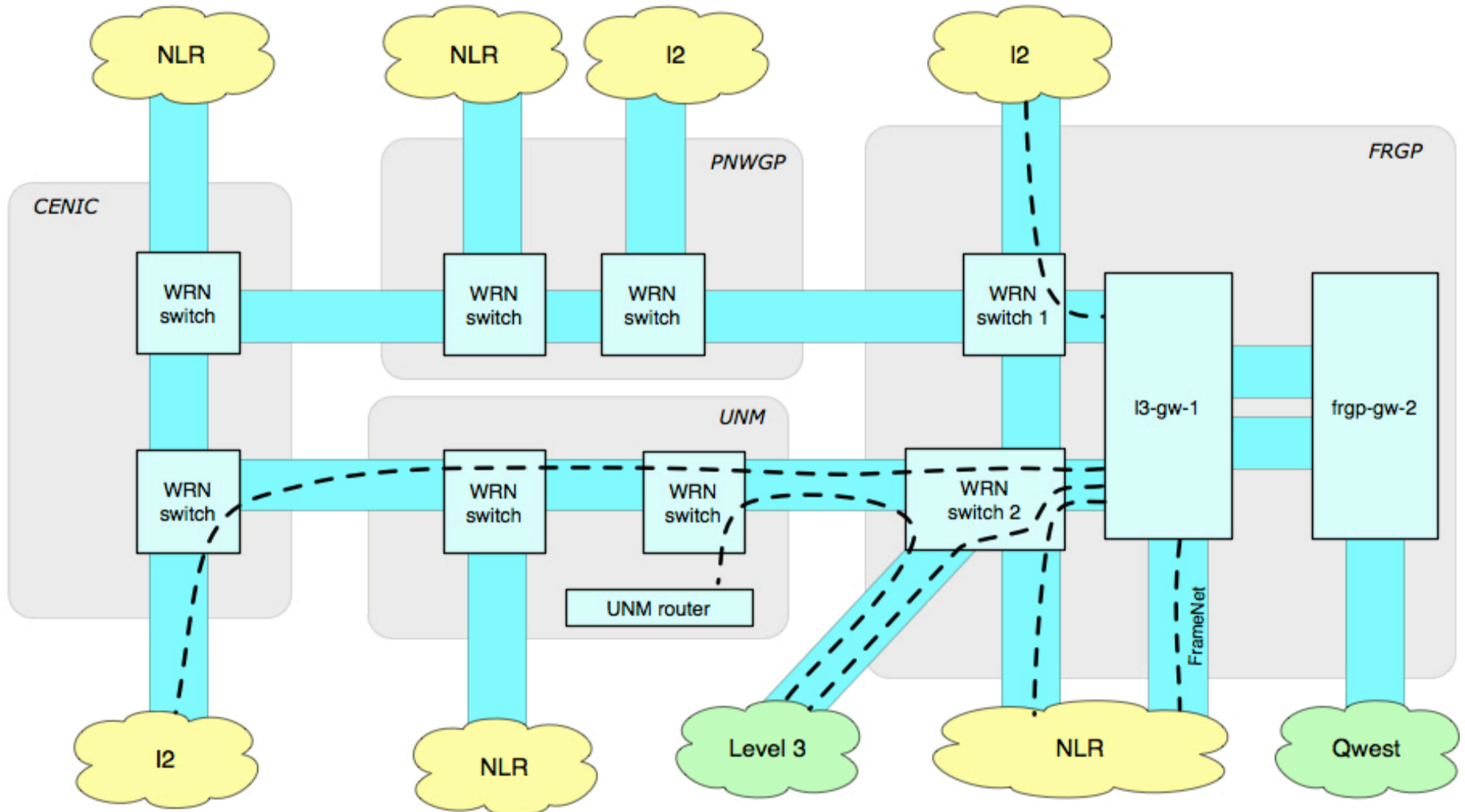
# WRN for FRGP

- \* 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



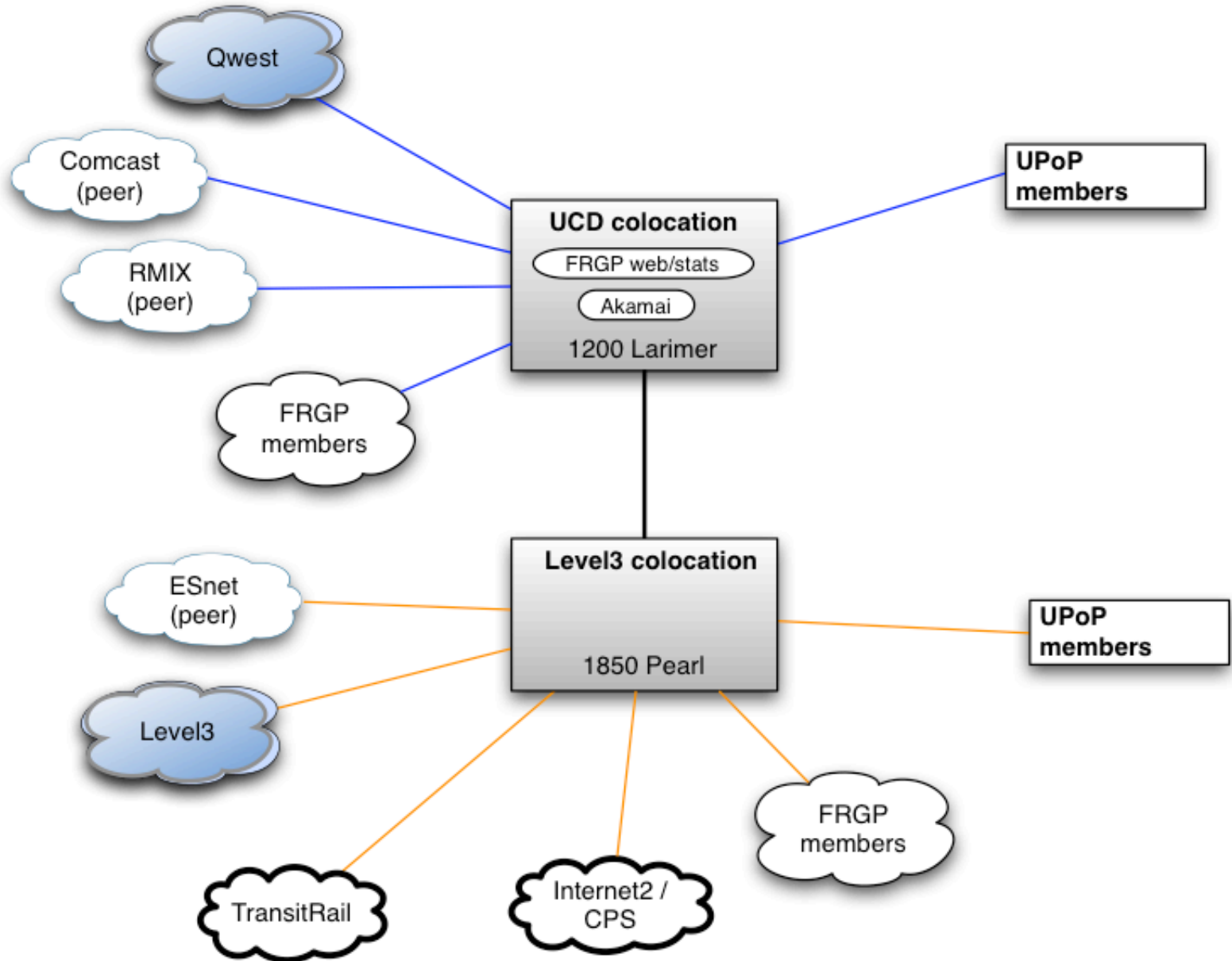
# UPoP

- \* UCAR Point of Presence
- \* <http://upop.ucar.edu>
- \* 3 years of operation
- \* 21 members

# UCAR Point of Presence - member and service connection overview

<http://upop.ucar.edu>

2009-12-08 (JC)



# 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/>
- \* PacketRail [ <http://www.packetrail.net> ]  
connections (e.g., FLC)
- \* Frequent discussions with a variety of others



# Colorado Telehealth Network

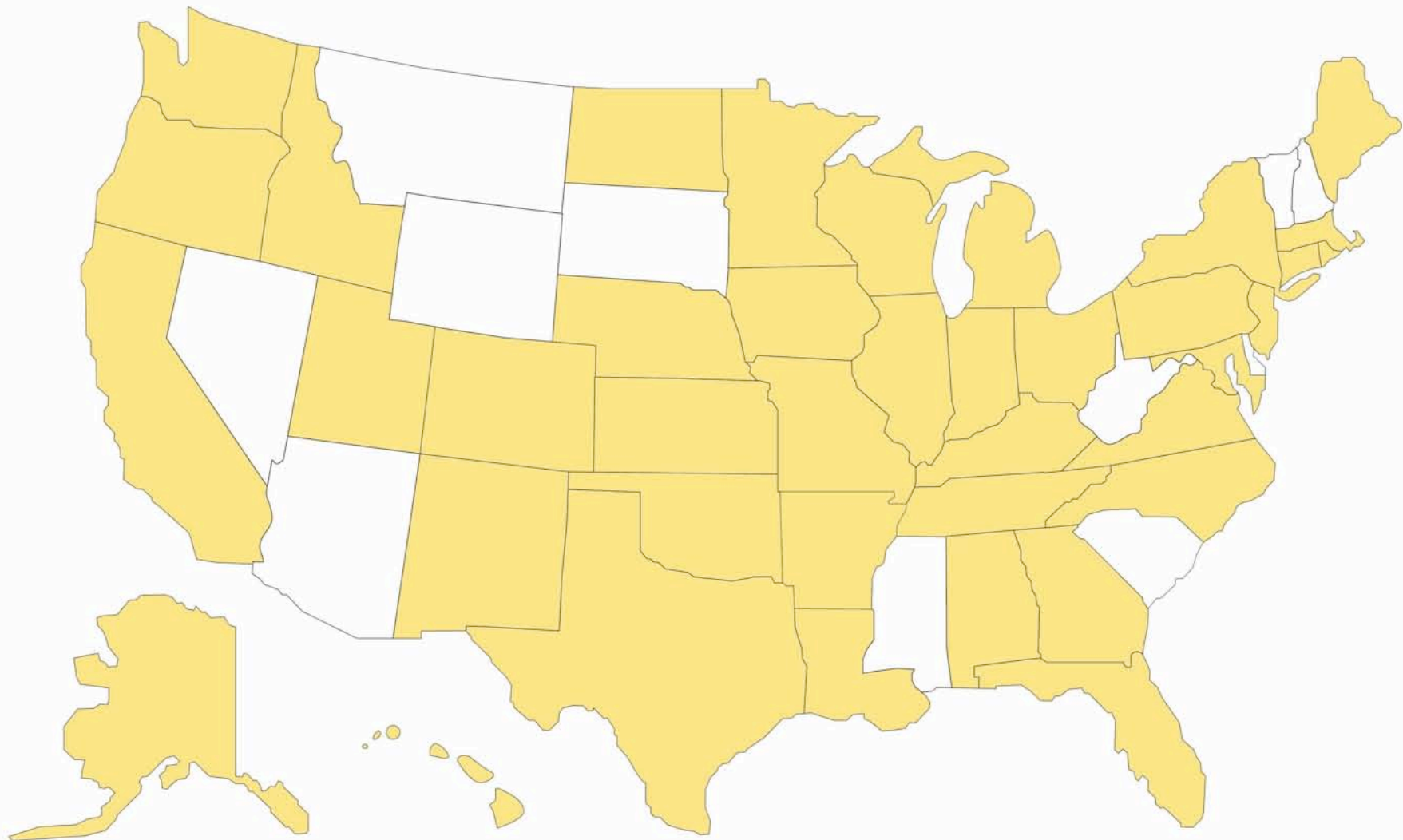
- \* FCC Rural Health Care Pilot Program (RHCPP)
  - \* Colorado Health Care Connections (CHCC; from Colorado Hospital Association (CHA))
  - \* Rocky Mountain Healthcare Network (RMHN; from Colorado Behavioral Healthcare Council (CBHC))
- \* CTN has FCC RHCPP funding
- \* Qwest rolling out network now
- \* <http://www.cotelehealth.com>
- \* Internet2 Health Network Initiative:
  - \* <http://www.internet2.edu/health/>

# EAGLE-Net

- \* Educational Access Gateway Learning Environment Network
  - \* <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

# SEGP 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**



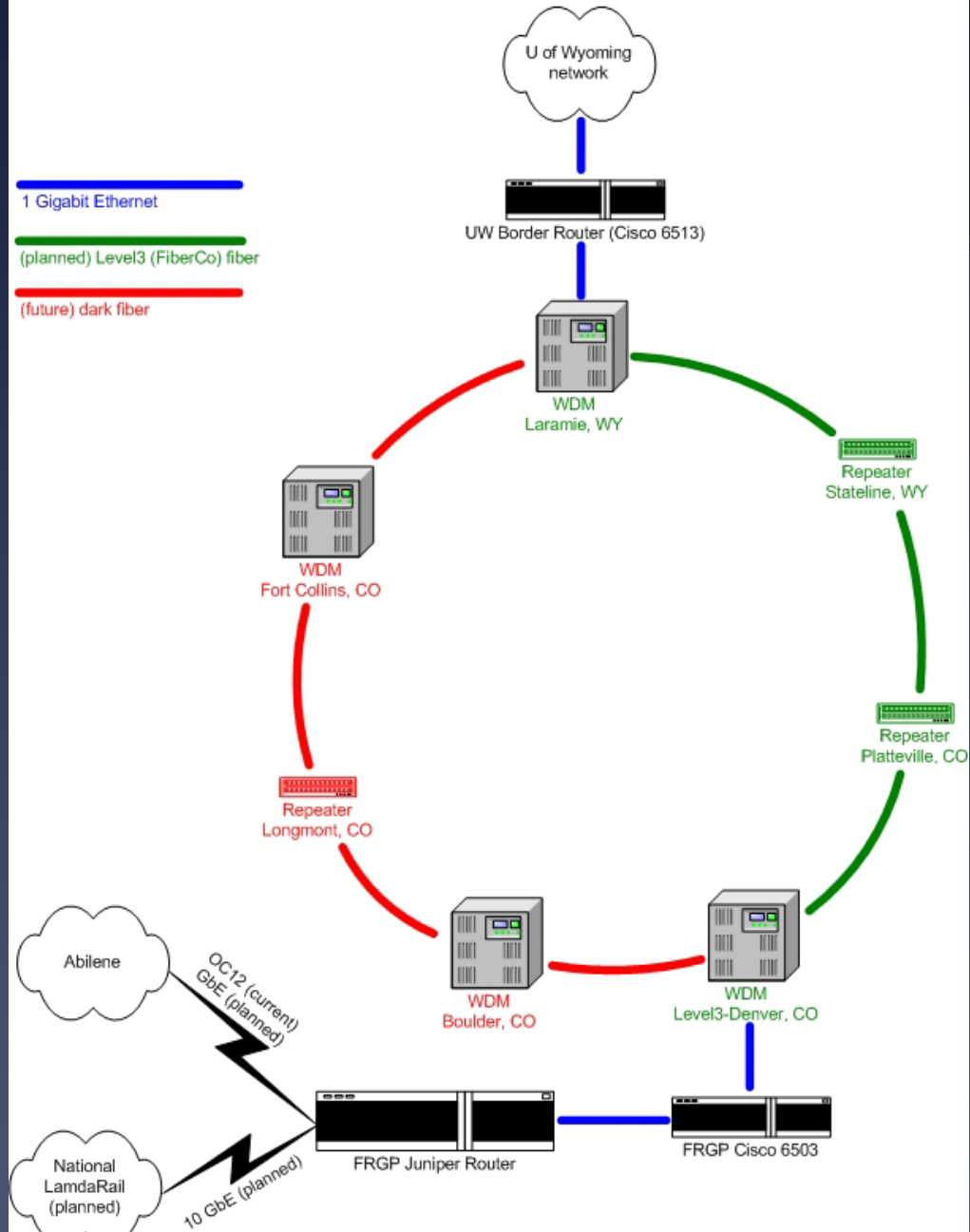
# BiSON partnership

- \* 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 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

# University of Wyoming Lariat Network 1 April 2004

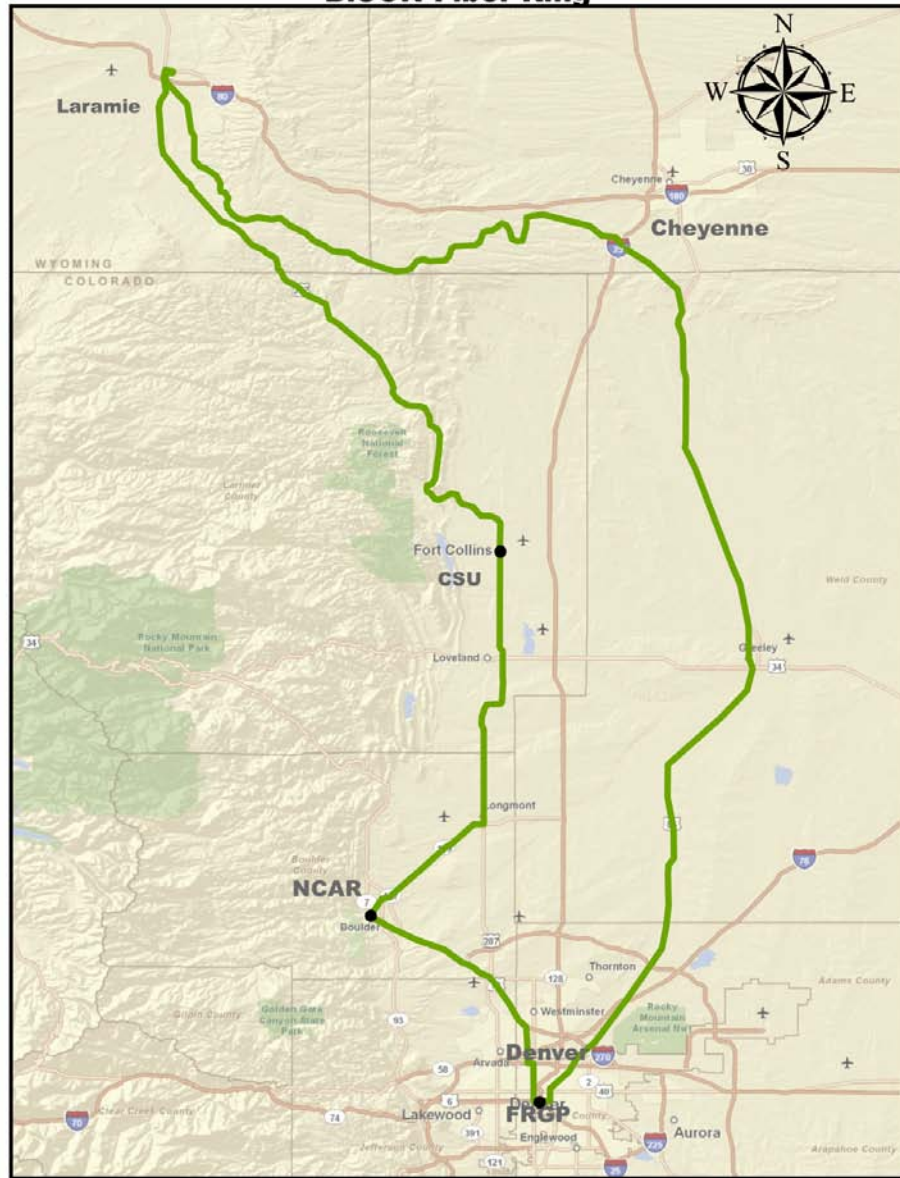


# BiSON evolution

- \* 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 Fiber Ring



# 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.

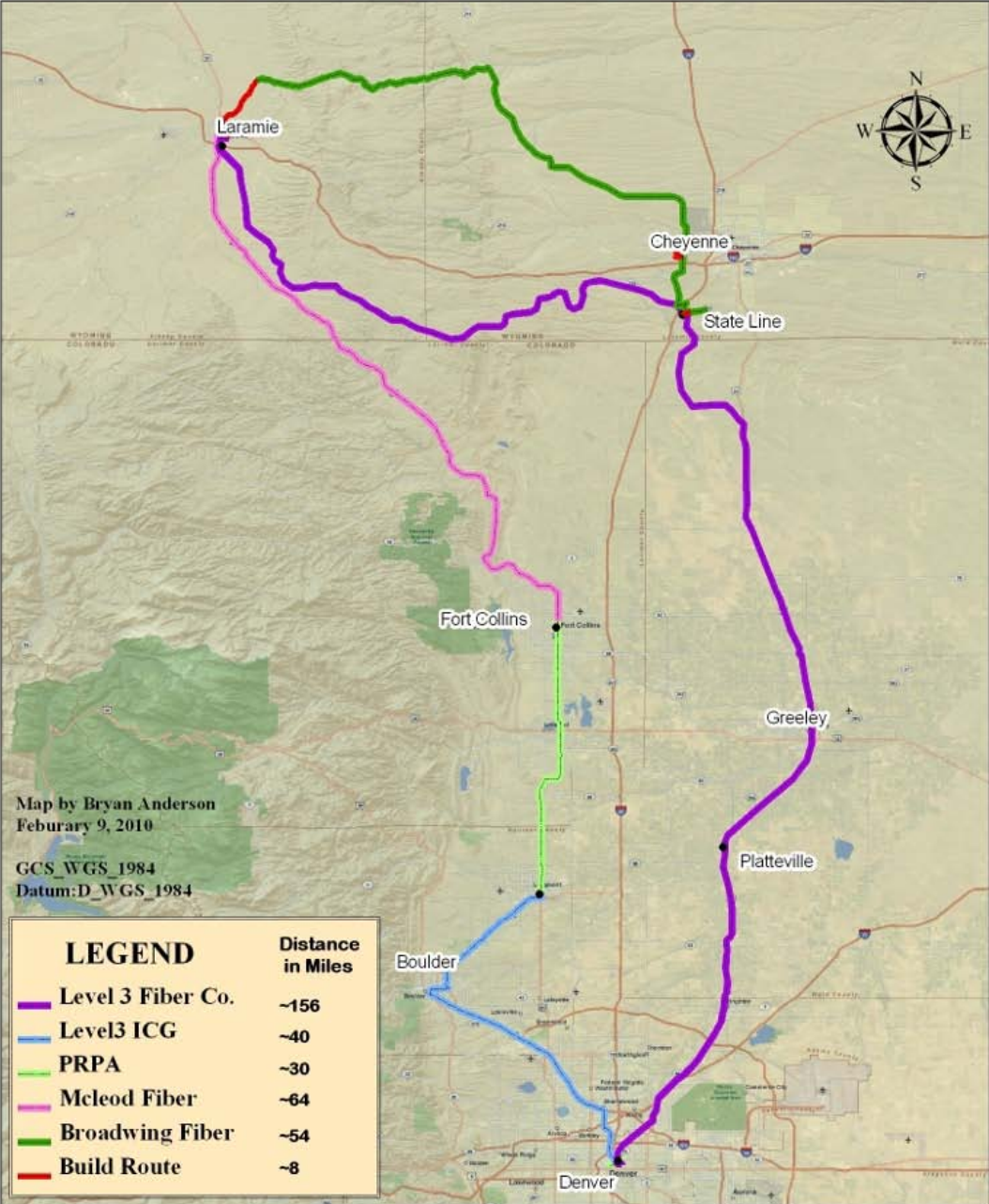
# BiSON future plans

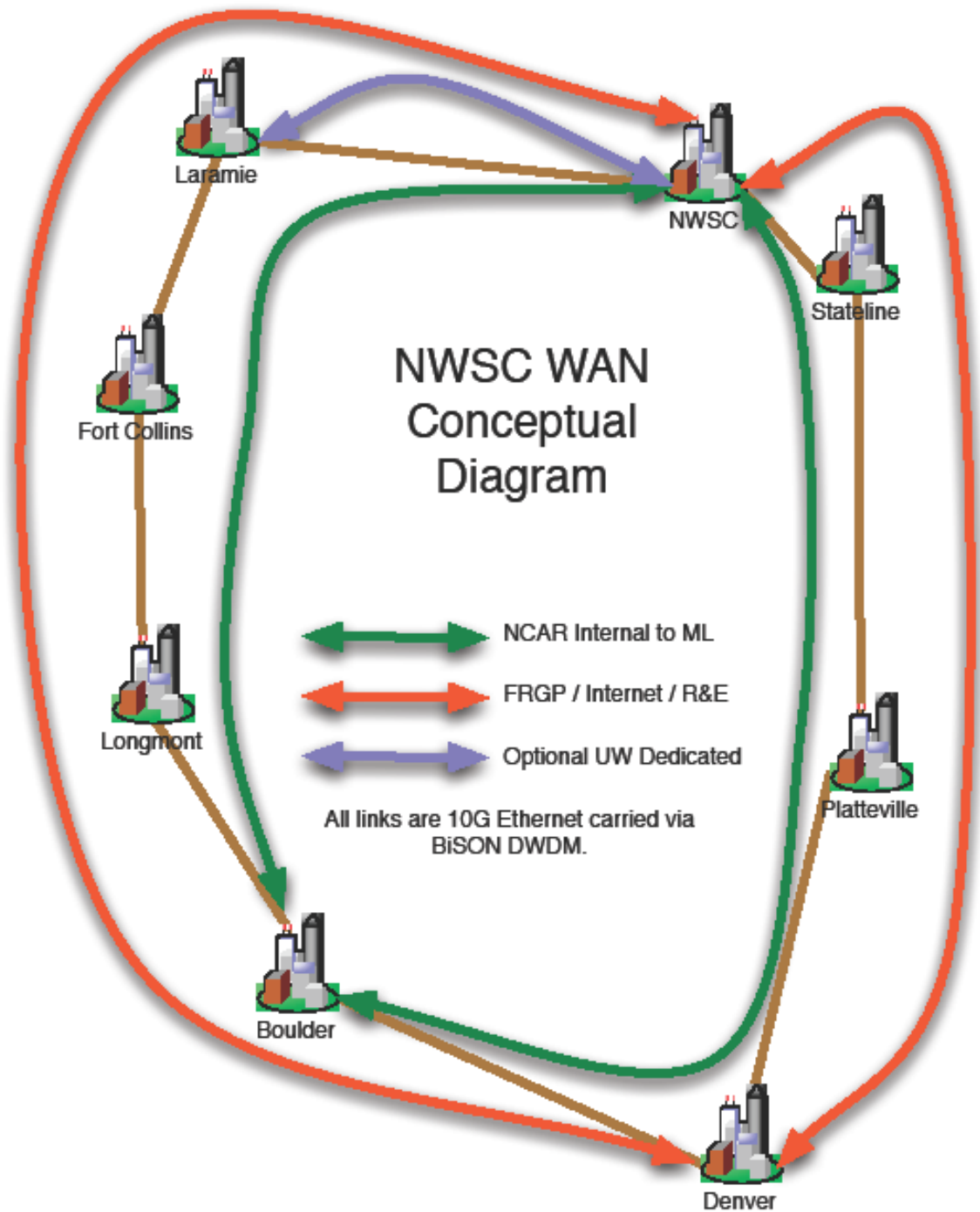
- \* Expand dark fiber plant to include NCAR Wyoming Supercomputing Center (NWSC)
- \* Initially at least four 10G circuits will be active
- \* Expansion to 40G and 100G a possibility
- \* Direct connections for High Performance Computing to other BiSON members also a possibility

# 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
- $100\text{Gbps} * 80 \text{ channels} * 2 \text{ paths} = 16\text{Tbps}$

# Bi-State Optical Network (BiSON)







# NWSC

- \* NCAR Wyoming Supercomputing Center
  - \* <http://www.cisl.ucar.edu/nwsc>
- \* Scheduled to be operating in early 2012
- \* BiSON fiber connectivity

# Internet2

- \* Dave Lambert new CEO replacing Doug Van Houweling
- \* <http://www.internet2.edu>

# National LambdaRail (NLR)

- \* Glenn Ricart resigned; Wendy Huntoon Acting CEO
- \* <http://www.nlr.net>

# FCC NBP

- \* <http://www.broadband.gov/plan/>
- \* 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>

# 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>
- \* <http://www.internet2.edu/government/stimulus.html>



# 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

# GENI

- \* 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

- \* <http://www.es.net/> and <http://www.lbl.gov/>
- \* 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!