

Front Range GigaPoP and BiSON-West

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Overview

- Introduction to the Front Range GigaPoP (FRGP), the Bi-State Optical Network (BiSON) and BiSON-West
- Corey Bryndal and information about Region 10
- Nate Walowitz and information about Project Thor
- Questions



The Front Range GigaPoP (FRGP)

- <http://www.frgp.net>
- The FRGP is a consortium of research, education and non-profit organizations collaborating to share network services
- The University Corporation for Atmospheric Research (UCAR) provides the management, engineering, and NOC services
- Providing high-quality, high value services since 1999
- Self-funded - FRGP Participants share actual costs
- Serving over 1M users



Operational Premise: Economy of Scale

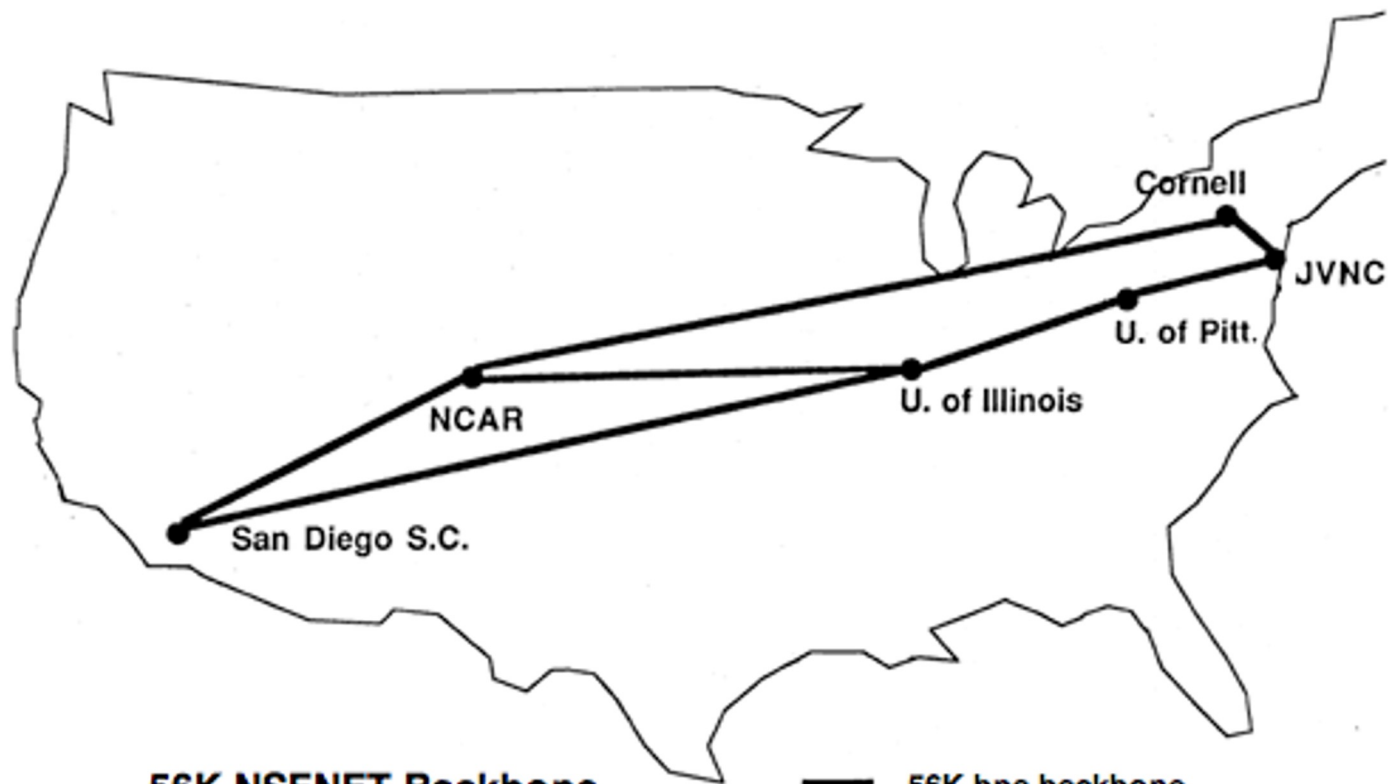
- Aggregation allows entities to share equipment, infrastructure and services
- Specialized expertise is hard/expensive to find, train and retain



Why Research & Education Networks?

- Research and education communities continue to push current the limits of networking technology
- Efforts to satisfy those demands have evolved into a collection of regional Research and Education Networks (RENs)
- The FRGP is one of many RENs in the US

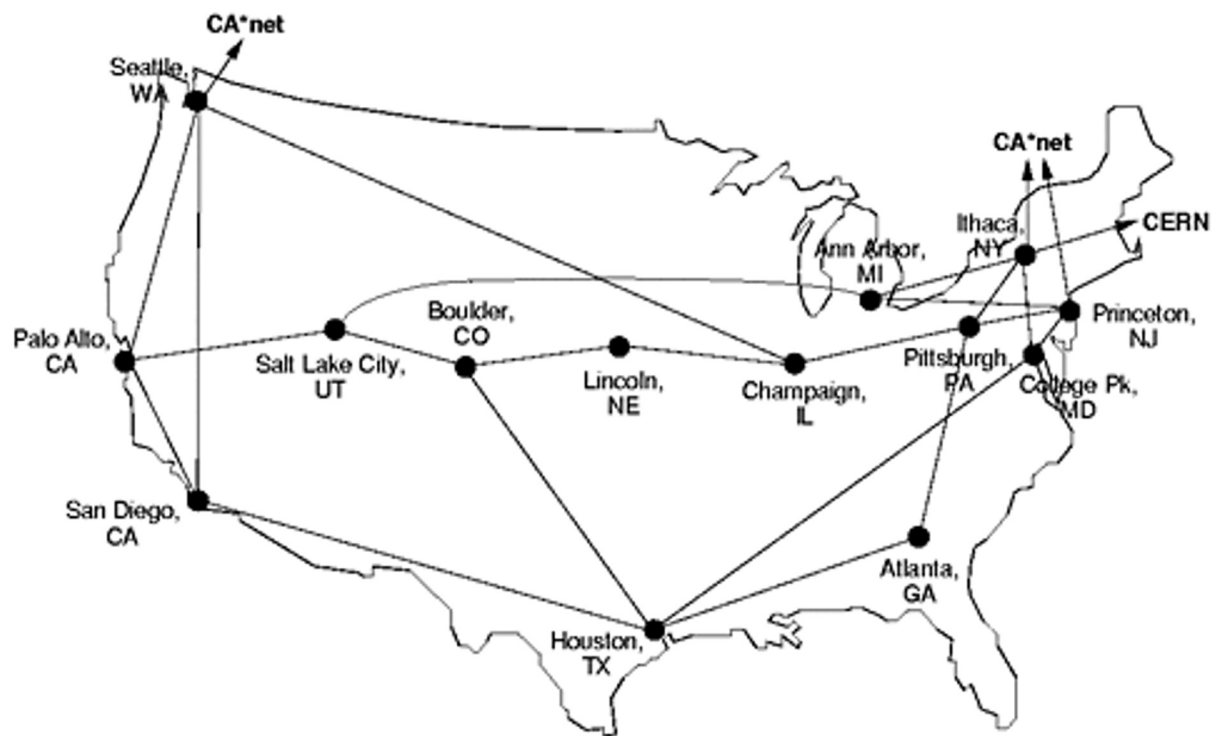




56K NSFNET Backbone
July 1986 - July 1988

— 56K bps backbone
● Fuzzball nodes

NSFNET T1 Network 1991



© Merit Network, Inc.

Abilene Next-Generation Core Topology

as of 29 August 2003



REGIONAL RESEARCH & EDUCATION NETWORKS IN THE UNITED STATES



3ROX

ARE-ON

Light
REE Network

CAAREN

CEN

CENIC

FLR

FRONT RANGE GIGAPOP

GPN

I-LIGHT

Indiana GIGAPOP

IRON

KANREN

KINBER

KYRON

LEARN

LINK OREGON

NI

MARIA

MAX

MCNC

MDREN

merit

MOREnet

MREN

NETWORKMAINE

NE

NEVADA NET

NJEdge

Northern Lights

OSHEAN

nysernet

OARnet

OneNet

PACIFIC

GIGAPOP

Sox

Sun Corridor Network

uen

WiscNet

WV

WV

FRGP Participants

- Colleges and Universities in the CO and WY
- Research Organizations
 - UCAR/NCAR, NOAA, NREL, NEON
- Government Agencies
 - State of Colorado, State of Wyoming
- Regional middle mile networks
 - Region 10 and Project Thor
- Secondary participants are aggregated behind primaries
 - Cities, Counties, School Districts, etc.
 - Eaglenet assets and connectors now managed by Zayo



FRGP Strategy

- Serve FRGP Participants in Colorado and Wyoming
- Provide technical and financial value-add
- Partner with others to pre-aggregate smaller entities: cities, counties, museums, school districts
- Identify relevant federal, state, local funding and partnerships
- Peer with commercial and municipal networks



FRGP Benefits

- Shared expertise and services
- Increased buying power
- Efficient routing between FRGP participants
- Direct connectivity to Google, the Energy Sciences network (ESnet), Internet2 and commodity Internet
- Leverage national purchasing agreements

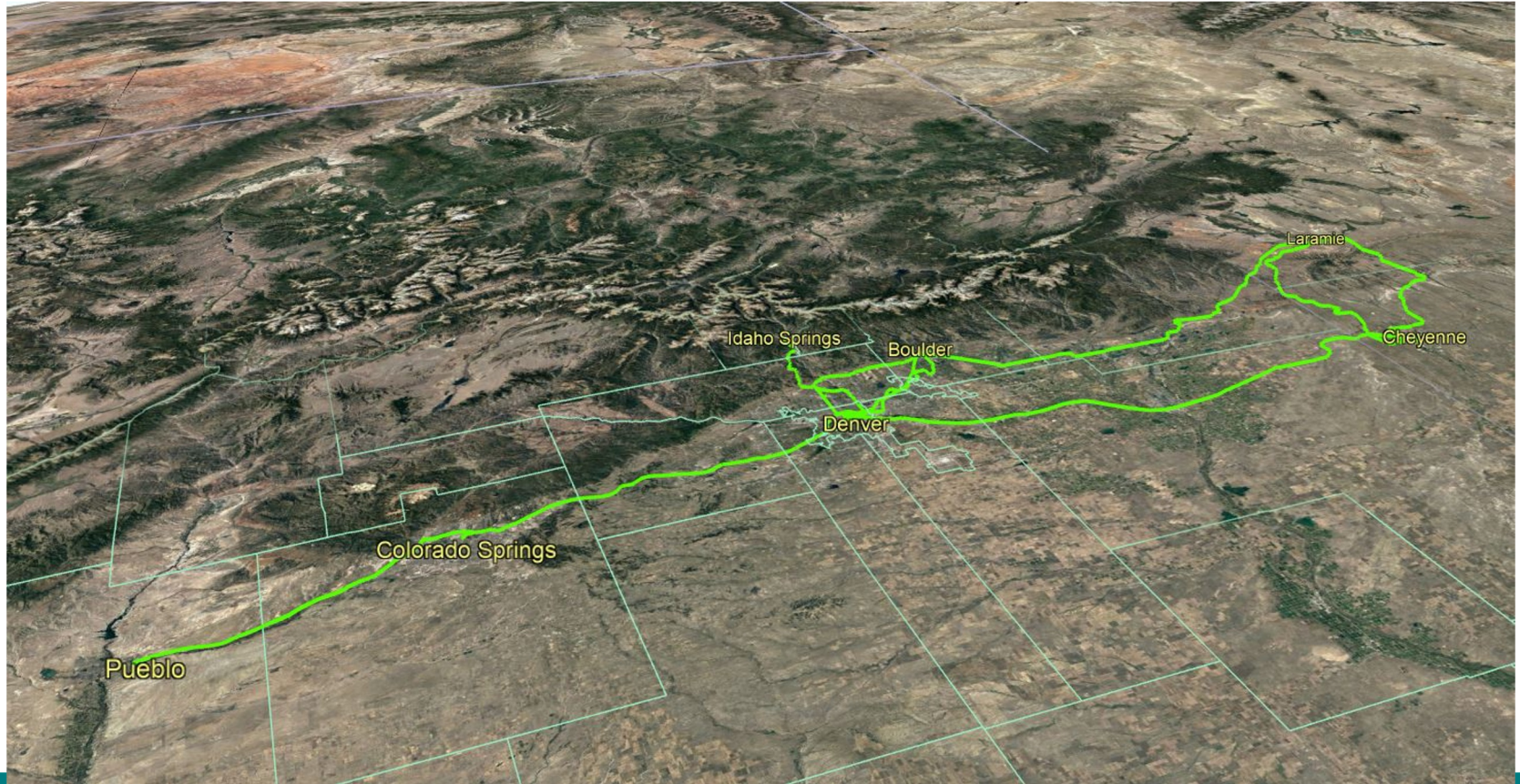


Bi-State Optical Network (BiSON)

- Underlying optical network utilized by some FRGP Participants
- Ring topology for redundancy and resiliency
- Primarily leased dark fiber
- Supports up to 40 circuits at 100-400Gbps each
- Provides reliable, affordable connectivity to the FRGP



Bi-State Optical Network (BiSON)

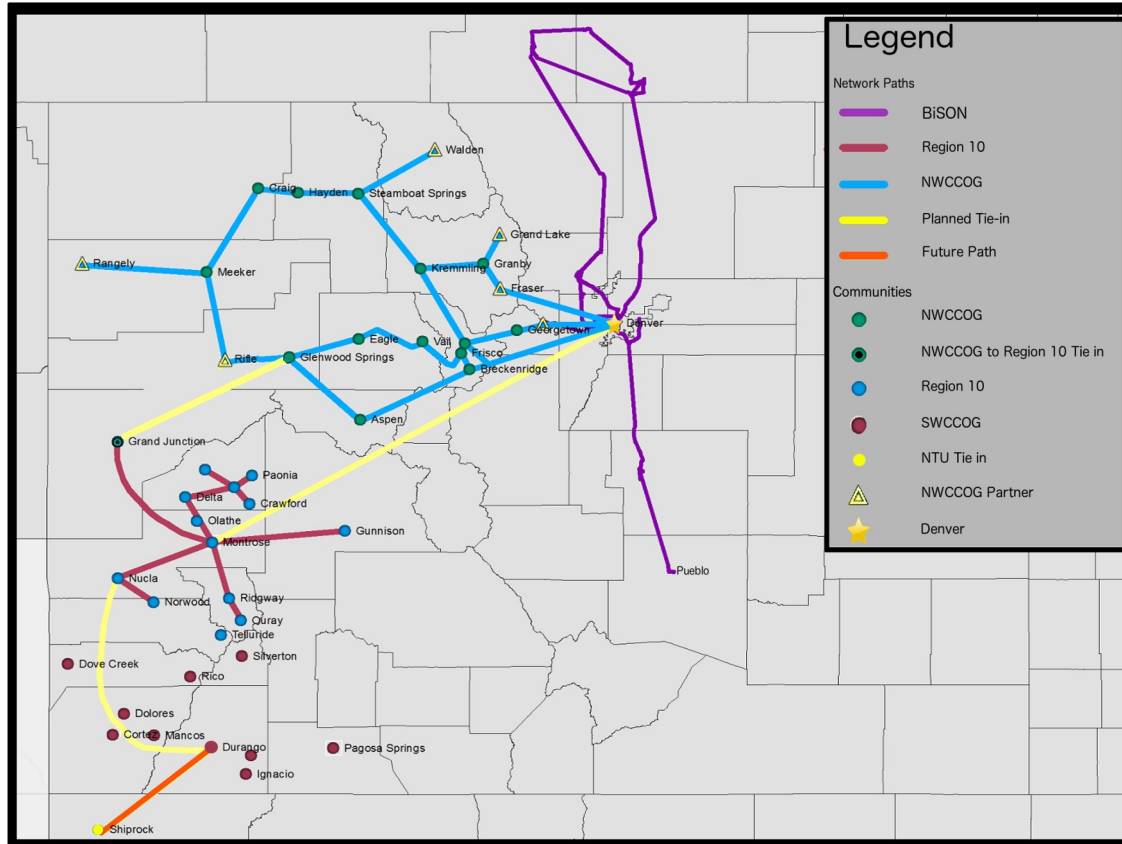


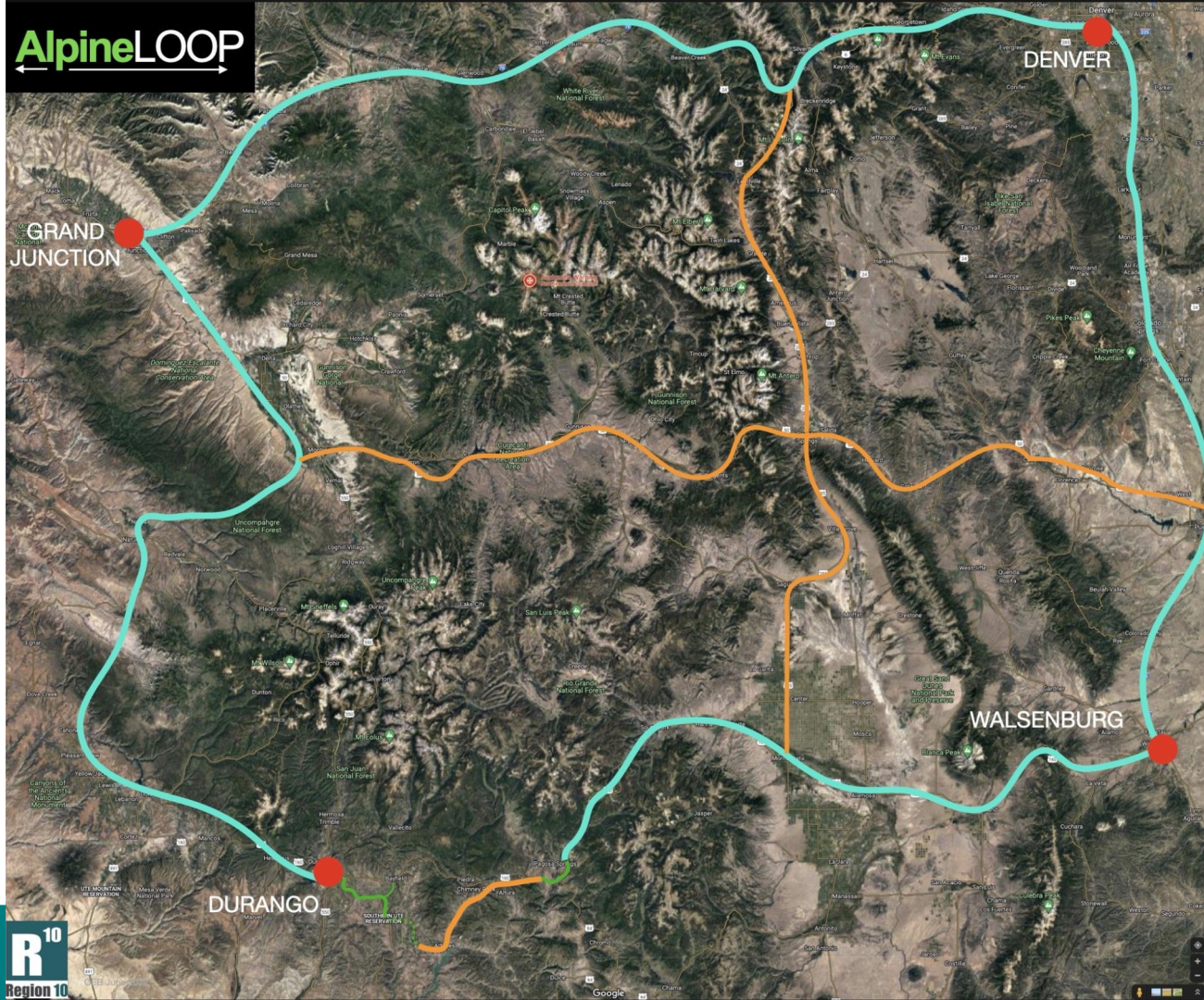
Extending BiSON to Western Slope

- Continental divide should not result in a digital divide
 - Submitted NSF proposal in January, 2019 to build a robust fiber network connected to the FRGP
- Reviews were positive, although some found it over-ambitious, weak science and education drivers
- Planning grant awarded to investigate, refine scope
- Much has been learned since then...



BiSON-West Proposed Design





BiSON-West (Cont'd)

- Plan to submit a revised NSF proposal in September, 2023, highlighting partnerships with Region 10, NWCCOG, and others
 - Retain the original focus on higher education
 - Benefits of FRGP connectivity in these communities would extend well beyond research and higher education
- Interested in exploring mutually beneficial initiatives with CBO and other Colorado entities
 - Aggregation points could tie into regional middle mile networks



Benefits of FRGP Participation

- Extremely high uptime and availability
 - Redundant Tier 1 Internet providers
 - Redundant co-location sites in Denver
- Local expertise and NOC support
- Peering and caching services
- Connectivity to Research and Education Networks
- Economy of scale through aggregation



Questions and discussion are most welcome

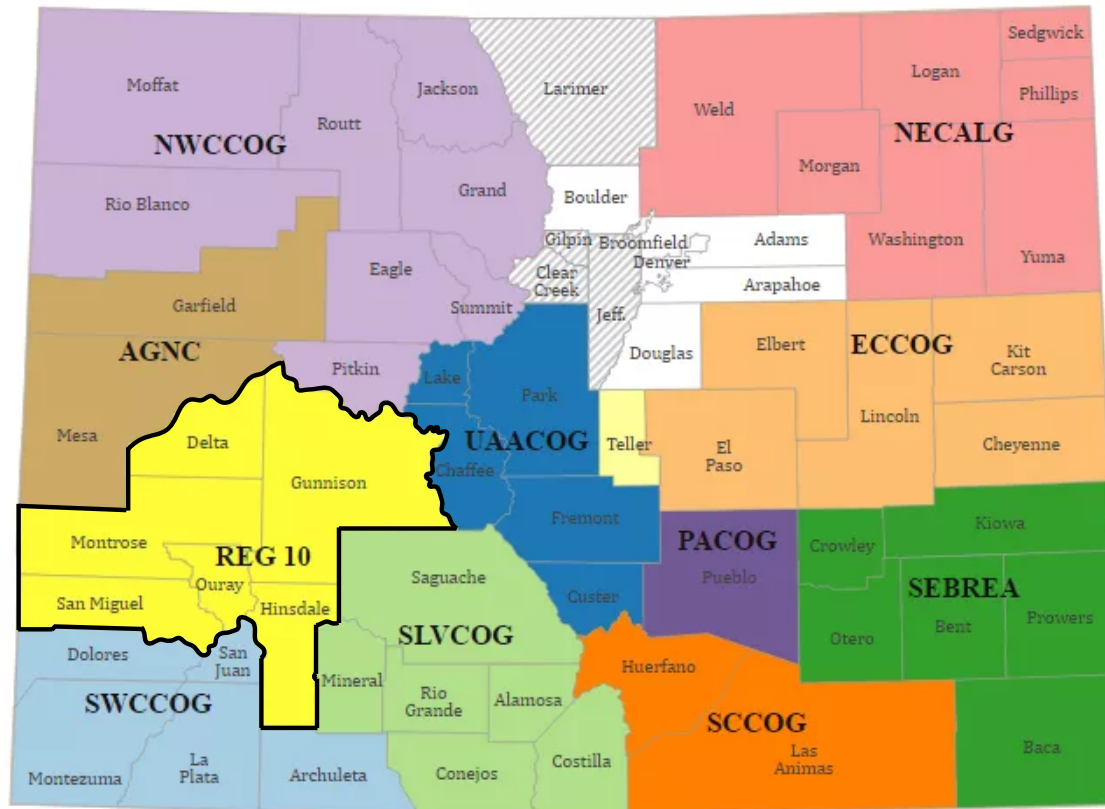
- Scott Baily – sbaily@ucar.edu





DOLA Regions

State of Colorado - Department Of Local Affairs



Simple Goals

Community Driven



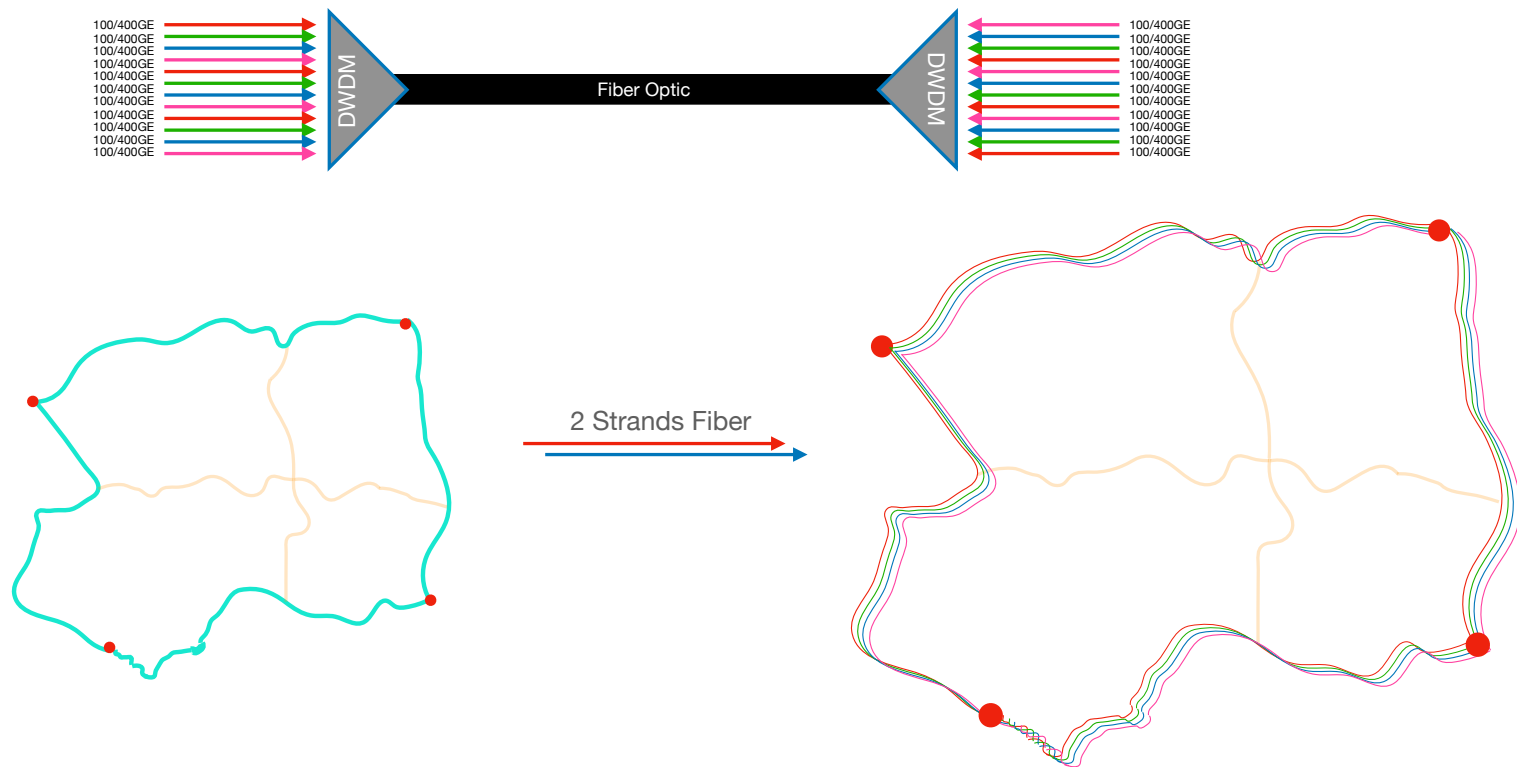
1. Capacity
2. Reliability
3. Cost

Reduce Barriers of Entry for Private ISP's to Invest

Optical Capacity

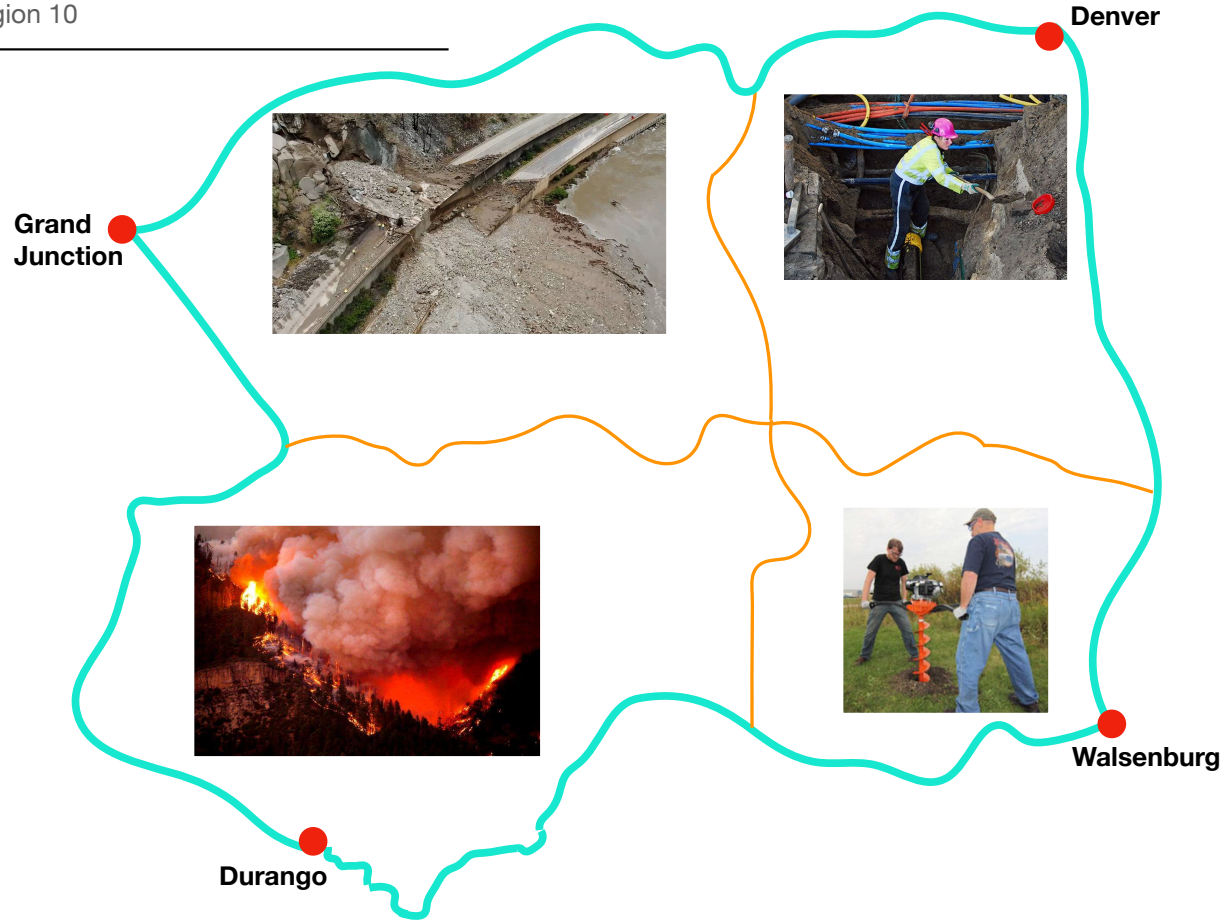
A Generational Increase

AlpineLOOP



Reliability

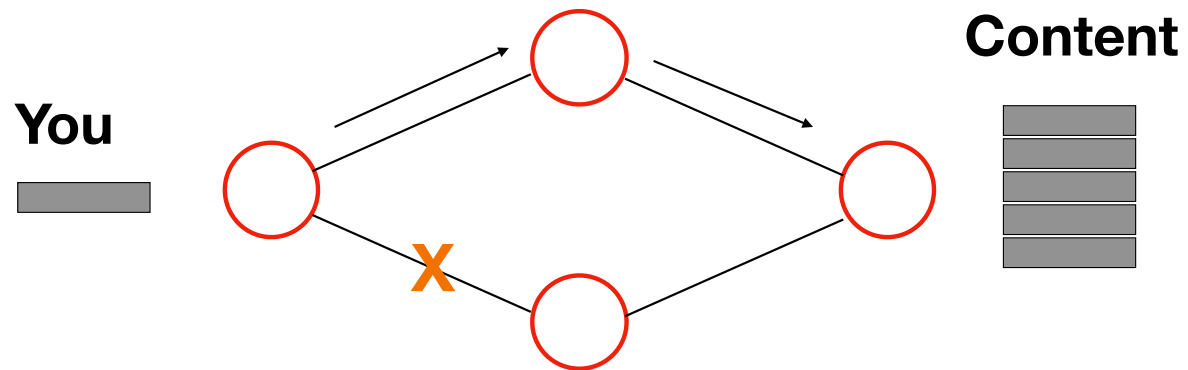
Region 10



Routing Matters

How Traffic Flows

AlpineLOOP



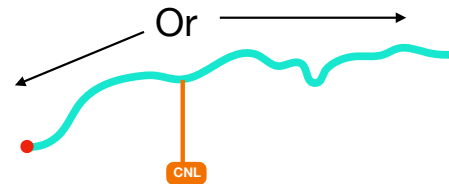
Routing Matters

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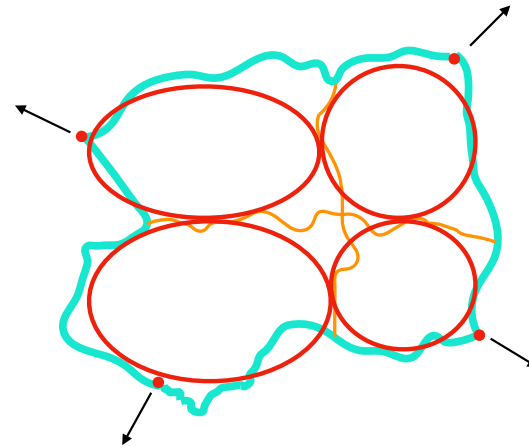
Local Routing

- inside CNL
- route selection
- monitoring, security



Backbone Routing

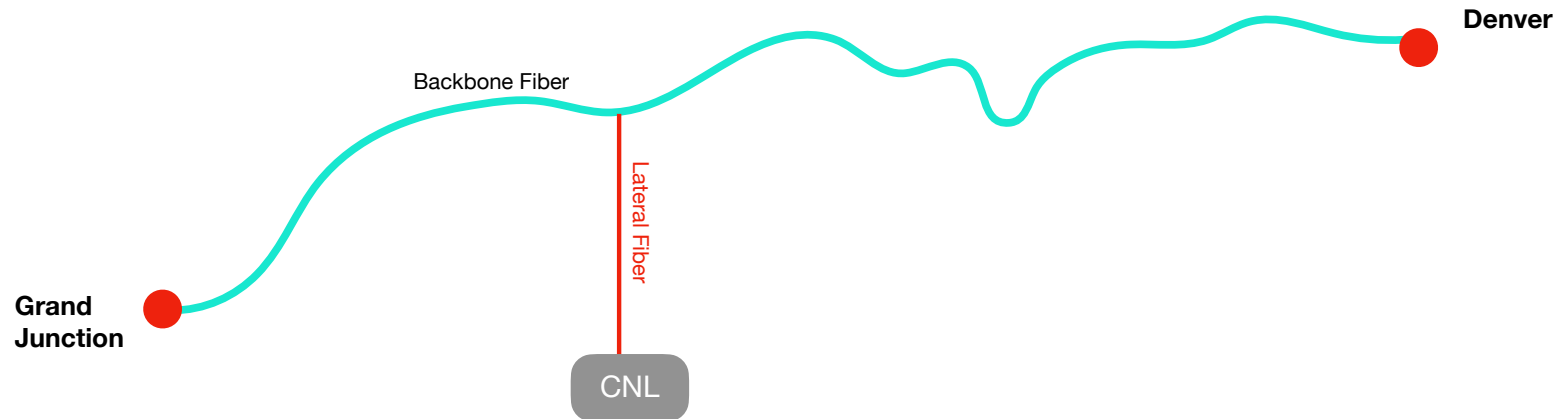
- Denver, Grand Junction, Durango, Walsenburg
- AS Path selection
- Performance (48 x 400GE)



Lateral Fiber

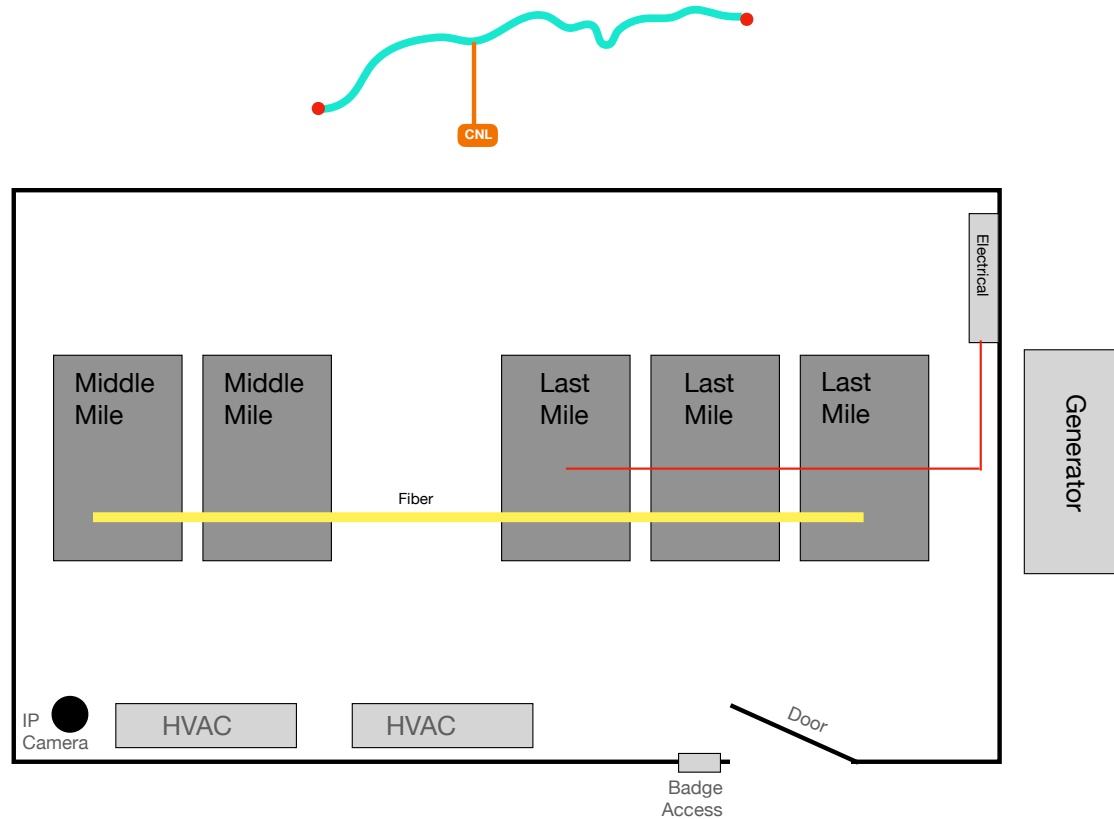
Community Driven

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Carrier Neutral Location (CNL)

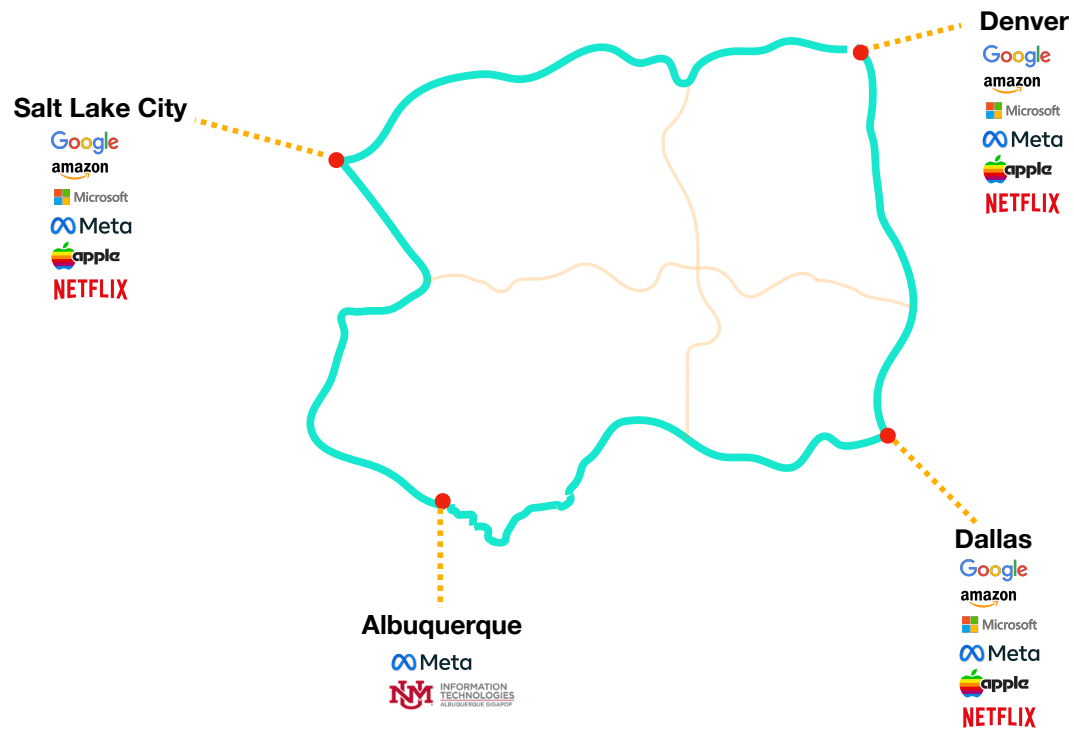
Broadband Equipment Rooms



Cloud & Content

Applications and Data

AlpineLOOP



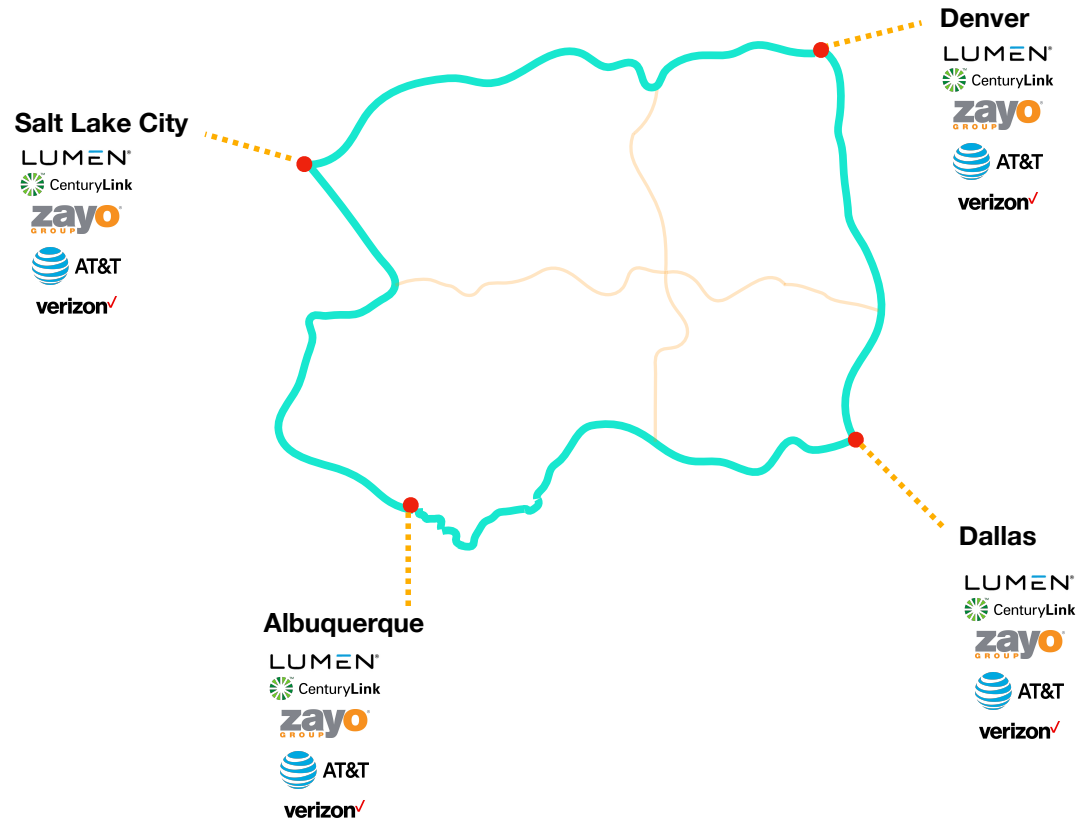


Tier 1 ISP's

Our place on the Internet

AlpineLOOP

AlpineLOOP





Carrier Neutral Locations



45 - Built, Planned, Concept

Existing CNL's (27)

Delta
Montrose
Grand Junction(TSGT)
Nucla
Crawford
Paonia
Hotchkiss
Olathe
Gunnison
WSCU
Ridgway
Ouray
Norwood
Crested Butte
Telluride
+ 12 THOR Meet Me

New CNL's (13)

Lake City
Fruita
Palisade
Collbran
Parachute
New Castle
Silt
Rifle
Rifle Landfill
Glenwood Springs
Pagosa Springs
Bayfield
Grand Junction(City)

Future CNL's (5)

Alamosa
Clifton
Whitewater, Loma
Mt. Crested Butte
Walsenburg

