

# Utah's Optical Research Network, a Private/Public Partnership

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Cyberinfrastructure, Utah Educational Network (UEN)

# Outline

- Overview of HPC@USU
  - Compute resources
  - Storage
  - Networking
  - Visualization
- The Utah Cyberinfrastructure Consortium
  - Mission
  - Members
  - Activities
- The UEN@Research
  - The research network
  - Partnerships

# Utah State University

- Established: 1888
- Faculty: 870
- Staff: 1,800
- Undergraduate: 19,775
- Postgraduates: 3,848



# HPC@USU

- Center under VP of Research
  - [www.hpc.usu.edu](http://www.hpc.usu.edu)
- Created: September 2005
- Director: Thomas Hauser
  - Email: [thomas.hauser@usu.edu](mailto:thomas.hauser@usu.edu)
- System Administrator: Nate Benson
  - Email: [nate.benson@usu.edu](mailto:nate.benson@usu.edu)
- Program Coordinator: Barbara Sidwell
  - Email: [barbara.sidwell@usu.edu](mailto:barbara.sidwell@usu.edu)
- Location
  - Engineering Lab Building 290

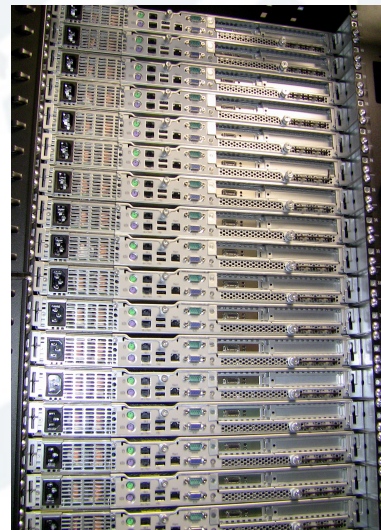


# HPC Facilities

- Machine room
  - IT data center in SER building
  - Pay-for-use model to IT
  - Enough power to house large machines
  - Air conditioning may be supplemented by chilled water cooling
- Visualization Lab EL 237
  - Small 3D projection system
  - Smart board
  - 6 monitors for visualization
  - Access Grid Node for remote collaboration
- Networking
  - Shared 10 Gbit link to the outside world

# Computational Resources

- Uinta cluster
  - 62 nodes
    - Two dual core AMD processors @ 1.8 GHz
    - Myrinet interconnect
    - 4 Gbyte of memory per node
- Wasatch cluster
  - Online since September 09
  - 64 nodes
    - Two quad-core AMD processors @ 2.3 GHz
    - Infiniband interconnect
    - 8 Gbyte of memory per node
  - Double capacity of Uinta



# Storage Resources

- Shared home directory
  - 40 TB
  - 95% usage
- Parallel file systems
  - 80 TB Panasas
  - Mainly for climate and water research
  - Provides a large scratch file system

# Funded Projects

- Low power cluster for Particle Image Velocimetry - NSF
- LES of high heat flux flow - DOE
- Unsteady DSMC simulations - SDL
- LU decomposition on FPGAs - Lockheed Martin
- CFD on overset moving grids - John Deere
- ACRES - USDA
  - Agricultural research and education system
  - Research in life science with agricultural relevance
  - Education of agricultural researchers in computational science

# Definition of Cyberinfrastructure

- Cyberinfrastructure consists of
  - Computational systems
  - Data and information management
  - Advanced instruments
  - Visualization environments
  - People
- All linked together by
  - Software
  - **Advanced networks**
- To improve
  - Scholarly productivity
  - Enable knowledge breakthroughs
  - Discoveries
- Not otherwise possible

# Utah Cyberinfrastructure Consortium

- Cyberinfrastructure roundtable March 2007 at USU
- Presentation to Utah's Higher Education CIOs July 2007
- Creation of a cyberinfrastructure consortium
  - USU: T. Hauser, Director HPC@USU - chair
  - UoU: J. Facelli, Director CHPC
  - UoU: Steve Hess, CIO
  - UoU: Steve Corbato
  - WSU: John Armstrong, Assistant Professor Physics
  - SUU: Mikhail Bouniaev, Dean C. of Computing, Integrated Eng. & Technology
  - UVSC: Keith Olson, Prof. Computer Science
  - UEN
- Funding request was presented to Utah Board of Regents, commissioner and legislative analyst
  - \$1,000,000 distributed to all 5 partners of the committee
  - Joint acquisition of computing equipment
  - 10% of computing resources set aside for industry
  - \$100,000 planning grant for centralized Utah HPC data center



# Utah Cyberinfrastructure Goals

- Develop a 10 year vision/plan for Utah cyberinfrastructure
  - Stable evolutionary technology
  - Services for end users
  - Support for end users
  - Partner with
    - UEN - working partnership
    - Industry
    - USTAR
- Develop and communicate a non-technical business case for strategic investment
  - Communicate to leadership for funding
    - Governors' science advisor
    - Economic development
  - 2 unsuccessful proposals to the legislature
- Develop a grass-roots cyberinfrastructure organization
  - Exists for 3 years
- EPSCoR status of Utah and federal stimulus funding opportunities have accelerated the planning process

## Utah CI consortium: Activities

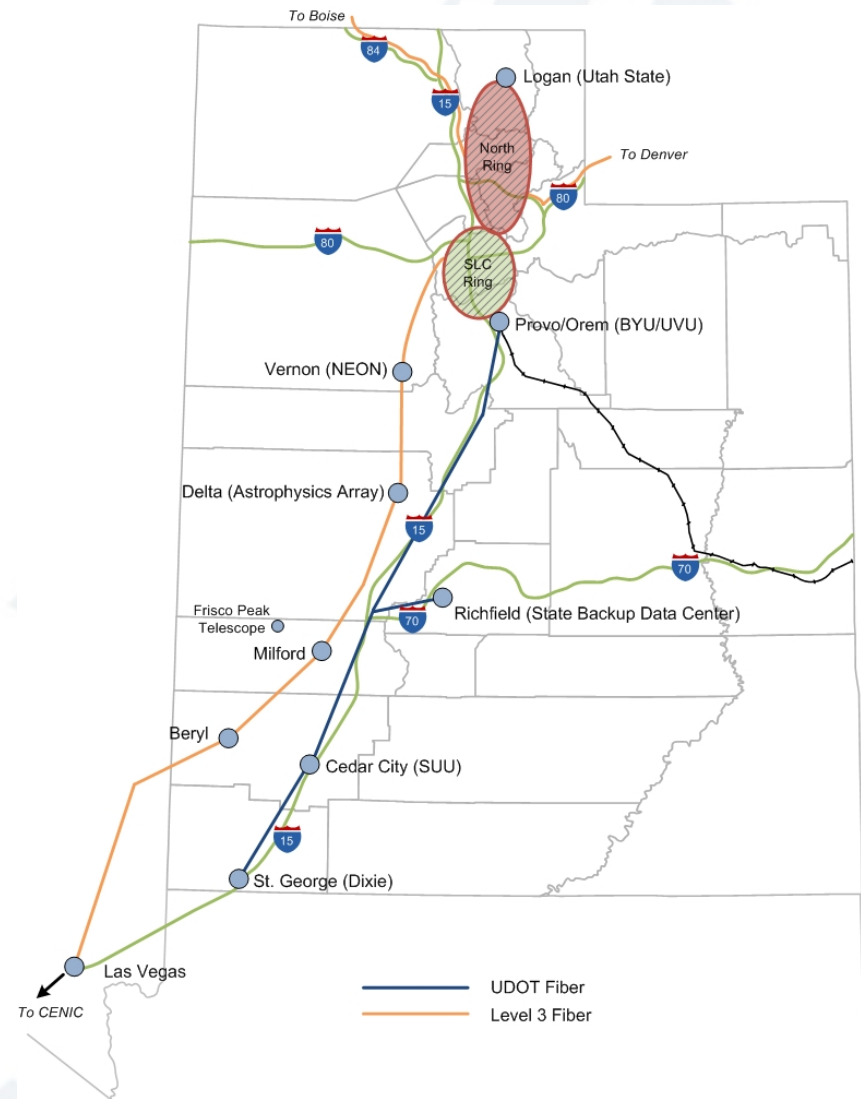
- Joint research exhibits at Supercomputing conferences 2006, 2007, 2008 and 2009
- ACRES Symposium in Spring 2007
- Utah CI Council - monthly meetings
- UoU and USU workshops at SUU 2007
- Utah Advanced Computing Summer Institute (UACSI) at SUU in Summer 2008
- Collaboration on a prototype grid
  - Already some sharing of resources and expertise between the current partners
  - Activities postponed because of network link was needed for other purposes
  - Shows need for dedicated research network

# Research Network for Utah

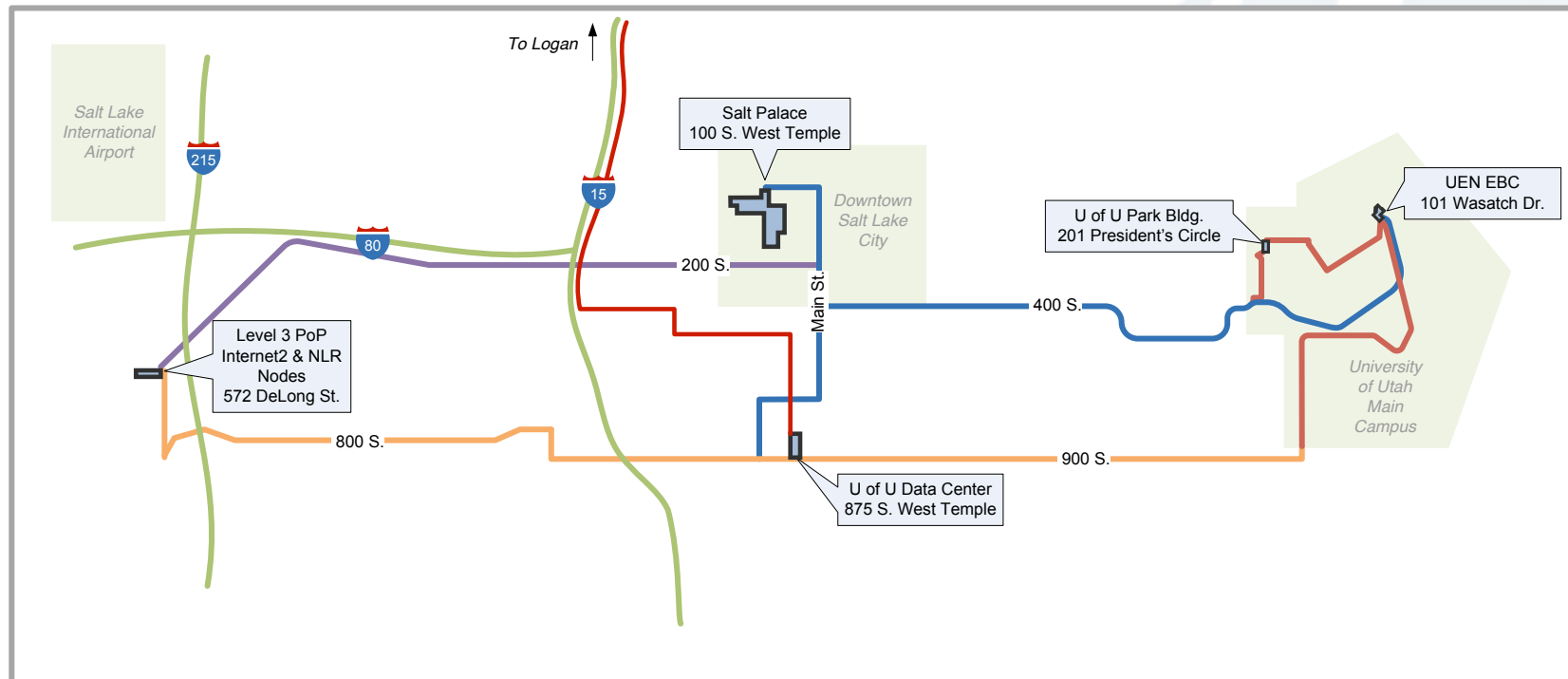
- Research@UEN
  - Research-focused optical network in Utah
  - Collaboration between
    - UEN – Utah Educational Network
    - University of Utah
    - Utah State University
    - Other teaching and private universities
      - Brigham Young University (private)
      - Weber State University (teaching)
      - Utah Valley University (teaching)
      - Southern Utah University (teaching)
    - Utah Department of Transportation (UDOT)
    - Private telecommunications companies

# Utah's optical networking plan

- SLC ring
  - Connect University of Utah to downtown data center
  - Already under way
- North ring
  - Connect Utah State University to the SLC ring
  - Partnership between UEN, UDOT and Syringa
  - Part of a NSF ARI<sup>2</sup> proposal
- Expansion south
  - Connect BYU/UVU
  - Science sites
  - Southern Utah



# Research@UEN: SLC Metro



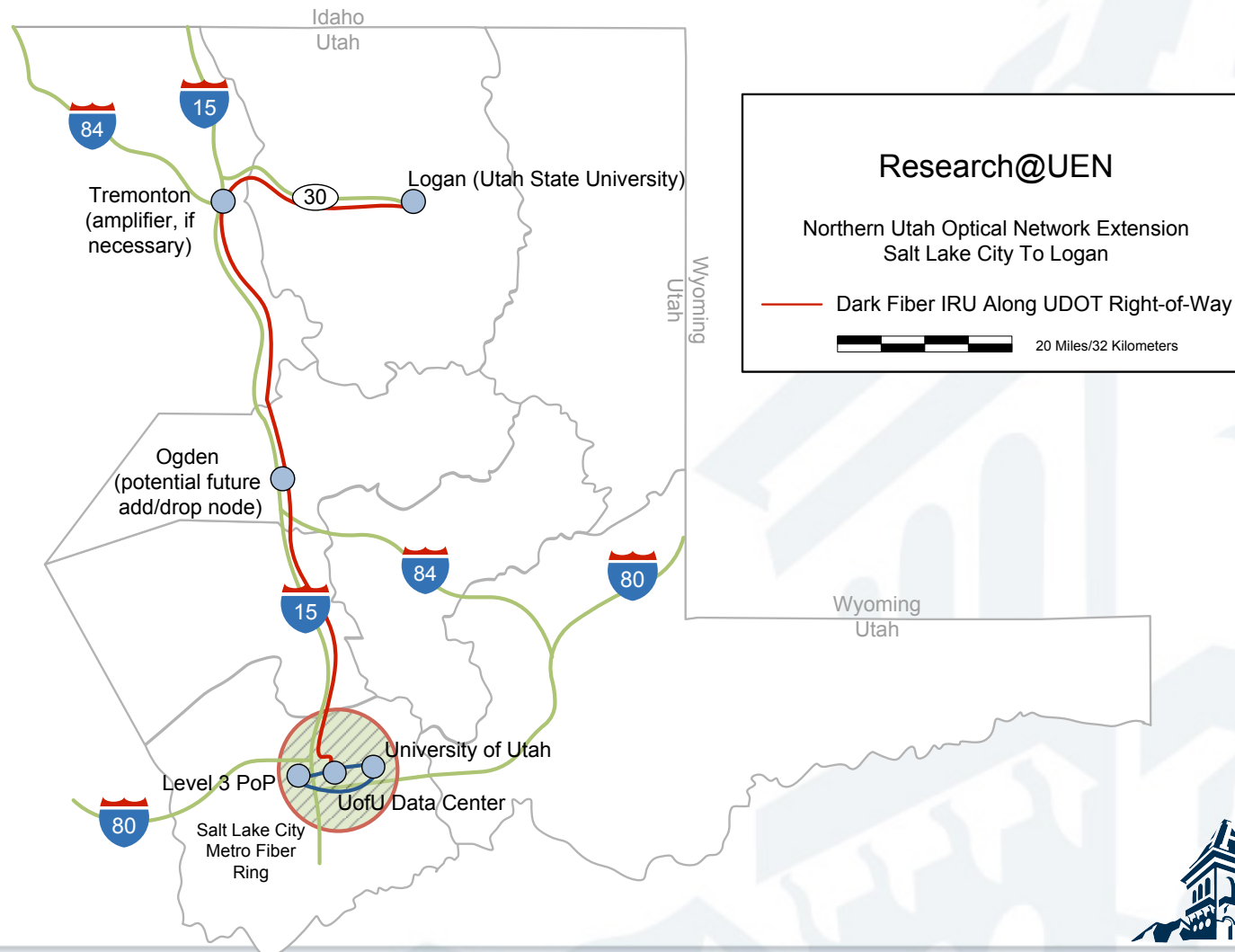
## Research@UEN: Salt Lake City Metro Optical Network

- U of U Campus Fiber
- UTA Light Rail Routes (proposed)
- CENIC/LLC Fiber IRU (through AFS)
- AFS Fiber IRU (proposed)
- Northern Utah Extension (proposed)

1 Mile

Carrier proprietary information included

# Research@UEN: SLC metro and Logan





# Realizing the optical network

- Lease dark fiber
  - Telecommunications and cable companies are not willing to partner on this network
- Partnerships
  - Utah Department of Transportation facilitated long-term dark fiber IRU between Salt Lake City and Logan
  - Syringa is working with UDOT on joint fiber builds in northern Utah

# Funding

- SLC Metro and Northern Utah Loop
  - ARI proposal to NSF
  - Additional funding from UEN
- Expansion south
  - Funding with EPSCoR C2 proposal

# EPSCoR Cyber Connectivity (RII C2)

- Stimulus-funded program (ARRA)
  - \$20M to 20 EPSCoR jurisdictions (2 year terms)
- Proposal: expand Research@UEN optical network to the south in support of EPSCoR research and state CI objectives
  - Explore expanded partnership with UDOT for optical fiber south of SLC along I-15 and I-70
  - Connect BYU, UVU, State Data Center/Richfield, and potentially SUU
  - Explore carrier-based, high-speed connectivity for science sites in West Desert

# Conclusions

- Advanced Networking critical for scholarly cyberinfrastructure
- Patience very important
- Partnerships important
  - Telecommunication companies would like to sell services, not dark fiber
  - Right partners, e.g. UDOT may help
- Research@UEN
  - Salt Lake Metro ring in progress
  - Logan loop ready to go if funding is available
  - Planning for the network extension south under way

New coordinates: Nov. 2nd  
Associate Director Research Computing  
Northwestern University

**QUESTIONS?**