CI objectives

- Provide coordinated, high-performance information technology resources and services to CI-WATER team and other Utah and Wyoming EPSCoR researchers

- Support research data analysis, management, and curation; modeling; and simulation needs

- Tools: computing cycles, data storage, advanced networking, visualization environments, middleware, software libraries, software development, data centers

- Strategies
  - Leverage campus facilities and services
  - Leverage Utah Education Network (UEN), Front Range Gigapop (FRGP), and Internet2 for advanced networking
  - Leverage other public sector partners – e.g., UDOT, UTA

CI topics today

- Wyoming HPC cluster development and NWSC coordination

- CI-WATER STORE data repository

- USU CI development

- Interaction with emerging CI facilities in Utah
  - Downtown SLC Data Center
  - Optical network (EPSCoR RII Cyber Connectivity project)

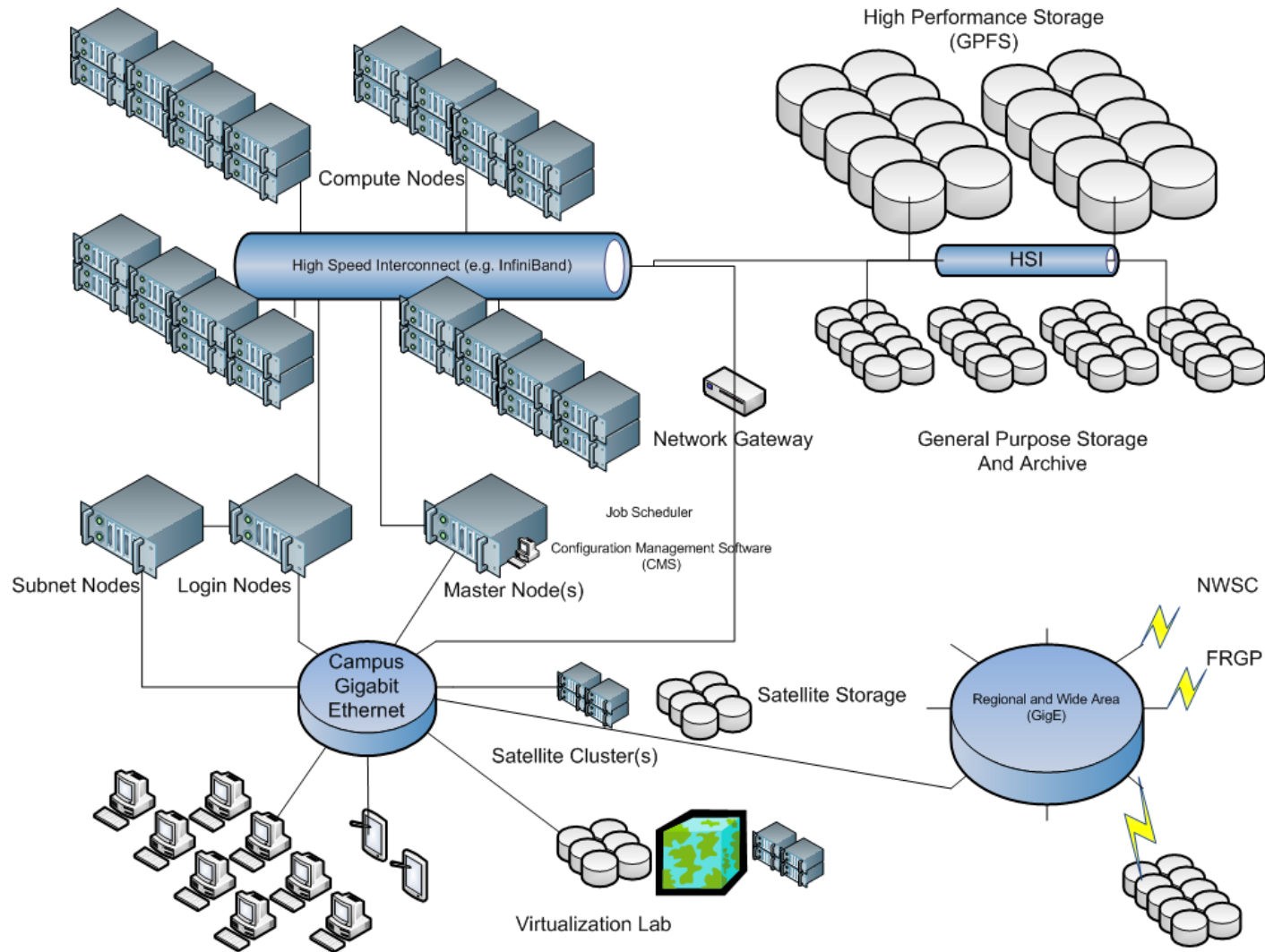# Advanced Research Computing Center (ARCC) Overview

Tim Kuhfuss

UNIVERSITY OF WYOMING

ARCC Overview

- Campus Compute Cluster = Mount Moran
  - Condo Model
  - CPU/GPU Nodes
  - Fat/Thin Nodes
- Campus Storage Cluster = Big Horn
  - Scales up to 3 PB
  - Current Configuration = 350TB Usable
  - GPFS File System

University of Wyoming

ARCC Architecture

CI-WATER data repository for Big Data

- Support acquired and simulated data curation needs of project
  - Key driver: atmospheric science simulations (Court Strong)
  - Needs: access to high speed computation; long-term preservation
  - Help support EPSCoR Track 1 projects

- Goal: 250 Terabytes in Year 2; 350 Terabytes by Year 3

- Leverage existing data storage system at Univ. of Utah CHPC (HP iBRIX)

- Location: new Univ. of Utah Downtown Data Center in Salt Lake City

- Distributed storage: Develop and maintain high-performance connectivity to ARCC resources at UWyo as well as HPC/CI resources at BYU and USU

- Access: Open to all CI-WATER collaborators

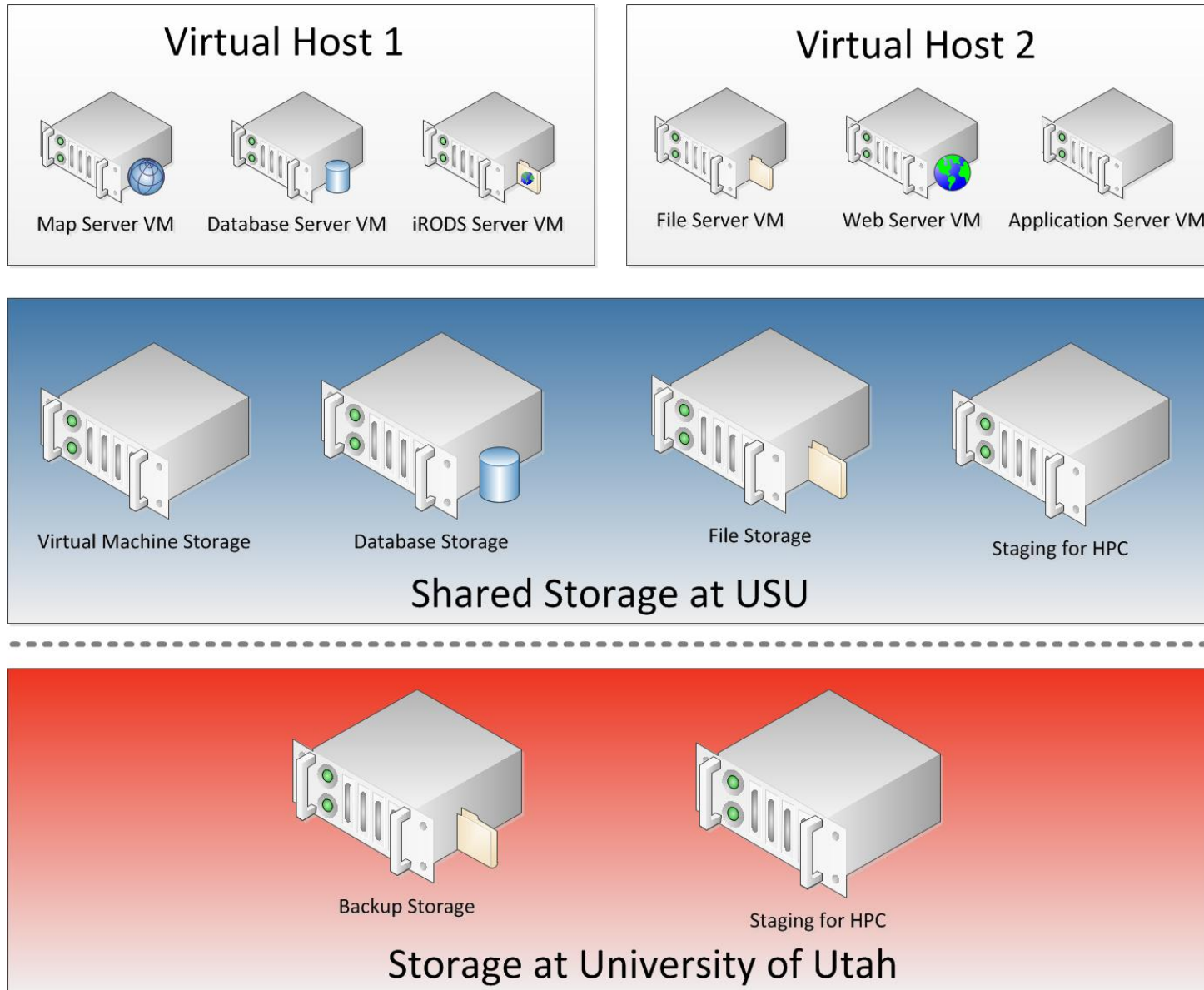- Status: Hardware specification and procurement underway

USU Hardware

- Developing a virtualized server infrastructure
- Designed in collaboration with USU Information Technology
- Will serve the data service development, prototyping, and hosting needs of CI-WATER

- Designed by pooling resources to meet the needs of 3 NSF-funded projects: CI-WATER, iUTAH, and HydroShare

Required Functionality

- Serve as a research platform (CI-WATER, HydroShare)
  - Development, prototyping, and testing of software applications and services on multiple platforms (e.g., Windows, Linux)
  - Host virtual machines allocated for modeling, analysis, and computational tasks
- Serve as a production data service and application hosting platform (iUTAH)
  - Web servers
    - Data web services
    - Web applications
  - Database servers
  - Map servers
  - File servers
  - Data harvesters and automated data processing applications

Virtual Server Architecture

Virtual Host 1

Map Server VM Database Server VM iRODS Server VM

Virtual Host 2

File Server VM Web Server VM Application Server VM

Virtual Machine Storage Database Storage File Storage Staging for HPC

Shared Storage at USU

Backup Storage Staging for HPC

Storage at University of Utah

Leveraging related CI projects

CI-WATER

A Utah-Wyoming Cyberinfrastructure Water Modeling Collaboration

New Downtown Data Center

- 74,000+ sq ft^2 former industrial building south of downtown SLC (~4 miles off-campus)
- Designing for enterprise & HPC (2.4 MW)
- Co-location by research groups & partners
- Low industrial electric power rates in Utah
- Energy efficient design (low PUE)
- Now in production

Cyber Connectivity Award

- Special EPSCoR program based on ARRA funding
- Collaboration partners: UofU, USU, BYU, and UEN
- Award: $1.17M (9/1/2010 for three years)
  - One-year no-cost extension granted through 8/31/2013
  - Better coordination with Tracks -1 and -2 outreach efforts
- Leadership
  - S. Corbató (PI) and Jim Ehleringer, U. of Utah
  - Larry Baxter and Kelly McDonald, BYU
  - Mike Petersen, UEN/USU
- Key partners
  - Eric Hawley and Robert Spall, USU
  - Jim Stewart and Laura Hunter, UEN

Regional Optical Network Development in Utah

- Collaboration of Utah Education Network (UEN) , Univ. of Utah, Utah State, and Brigham Young Univ.
  - Leverage UEN operational capability & statewide reach
- Motivations
  - New University off-campus data center in downtown SLC
  - Reach national R&E networks (Internet2, ESnet, N-Wave) at SLC Level 3 PoP at 100 Gbps
  - Enhanced interconnectivity among 3 research universities in Utah – BYU, USU, and UofU
 - Connect federal R&D partners: NOAA/NWS, USFS RSAC

Regional Optical Network Development in Utah - II

- Leverage public sector partner assets (fiber & conduit) wherever possible
  - UDOT (Interstate/state highway RoW)
  - Utah Transit Authority (UTA/TRAX light rail)
- Work with wholesale oriented carriers (e.g., Zayo, Syringa)
- Leverage federal stimulus funding
  - NSF EPSCoR RII Cyber Connectivity award - $1.18M (S. Corbató, U of Utah)
  - NTIA BTOP Round 1 award - $13.4M (M. Petersen/ D. Sampson, UEN) – revised statement of work
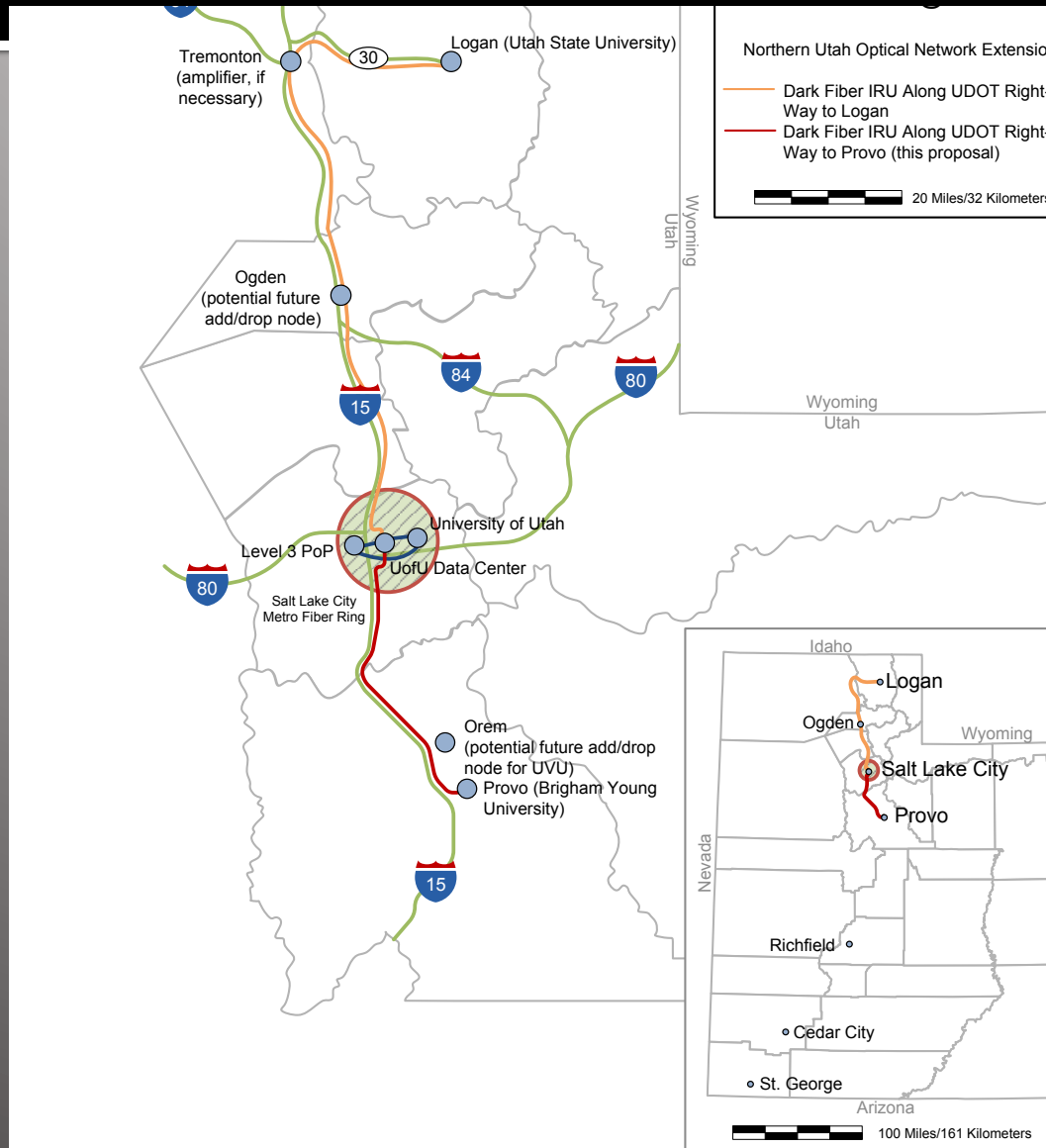
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Salt Lake City metro optical network
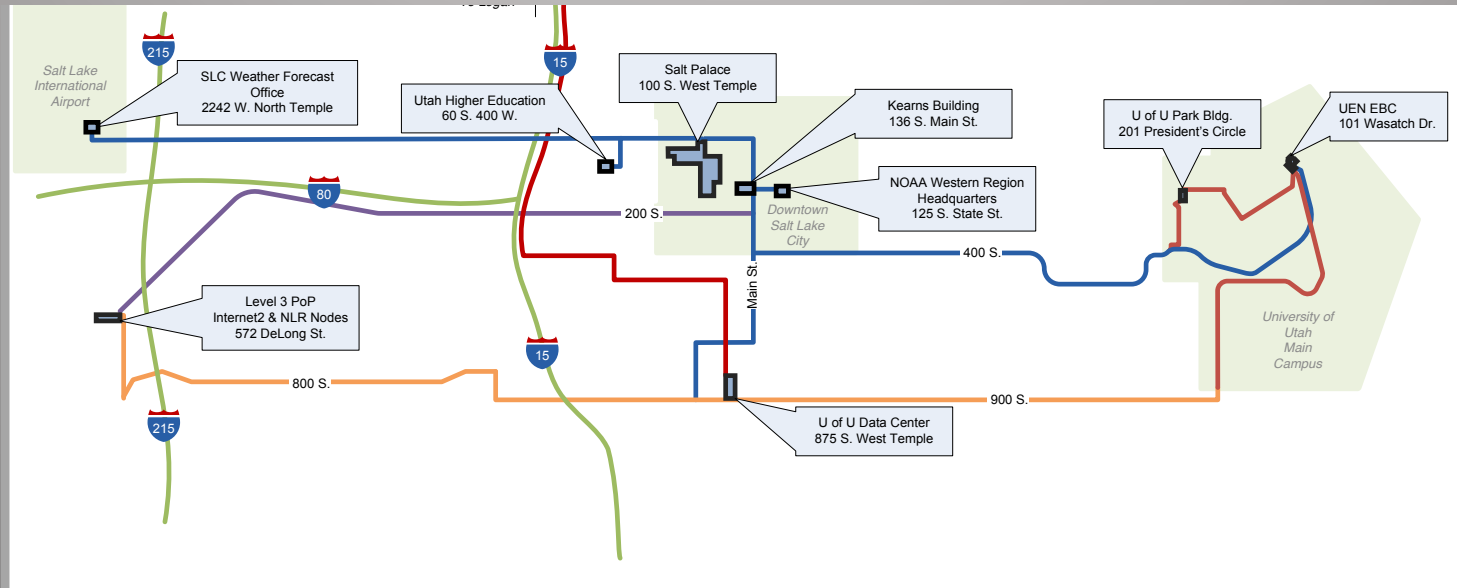
Research@UEN: Salt Lake City Metro Optical Network

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

- November 10-16, 2012 – Salt Palace
  - International conference and exhibition for HPC & computational science
  - Large Utah and EPSCoR presence
- \>10K attendees and >160K s.f. exhibit space
  - General chair: Jeff Hollingsworth, U Maryland
  - SCinet chair: Linda Winkler, Argonne National Lab
    - Jim Stewart & Kevin Quire, UEN
  - Exhibits: Mary Hall & Steve Corbató, Univ. of Utah

http://sc12.supercomputing.org/

Questions?

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