NWSC Network Planning

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Agenda

• Wide Area Networking (WAN)
• Local Area Networking (LAN)
• HPC Networking (HPCN)
WAN Overview

• Background: Bi-State Optical Network (BiSON) Partnership
• Expanding BiSON Into The NWSC
• Costs and funding
• Current Status
BiSON Partnership

- Partners are UCAR, NOAA-Boulder, University of Wyoming, University of Colorado, and Colorado State University
- Partnership is over five years old
- Fiber network connecting Boulder, Denver, Laramie, Fort Collins, and Longmont in a ring
- ADVA/Movaz Wave Division Multiplexing (WDM) equipment used to 'light' the fiber
Adding NWSC to BiSON

• Two major changes to BiSON required to incorporate NWSC.
  – The fiber path needs to include NWSC
  – WDM equipments needs to be upgraded to 10G/40G/100G capability

• State of Wyoming assisting with the fiber changes

• Upgrade will be funded by BiSON partners and a NSF ARI grant
## Fiber Costs

<table>
<thead>
<tr>
<th>IRU Option</th>
<th>Length</th>
<th>Fiber Cost</th>
<th>O&amp;M</th>
</tr>
</thead>
<tbody>
<tr>
<td>WY Level3/Broadwing</td>
<td>535</td>
<td>$100,000.00</td>
<td>$0 (confirming)</td>
</tr>
<tr>
<td>FiberCo Broadwing</td>
<td>535</td>
<td>$1,155,600.00</td>
<td>$3,616,600.00</td>
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<tr>
<td>Qwest ENRON</td>
<td>1003.9</td>
<td>$2,208,580.00</td>
<td>$3,513,650.00</td>
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</tbody>
</table>

### Private Spur Build

<table>
<thead>
<tr>
<th>Private Spur Build</th>
<th>Budgeted</th>
<th>$/mile</th>
<th>Approximate mileage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albany County (Laramie spur)</td>
<td>$1,000,000.00</td>
<td>150000</td>
<td>6.7</td>
</tr>
<tr>
<td>Laramie County (Cheyenne spur)</td>
<td>$500,000.00</td>
<td>150000</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Status

- State of Wyoming Level3/Broadwing Fiber approved April 2010 for use by UW
  - Statement of Work drafted for Albany county and Laramie county builds
  - Rider to state legislation for $1M to UW that have to openly bid build
- Hope to have build on NWSC land tied to electrical install
  - Pending UCAR contracts
- I-25 build (not applicable now – future BiSON resiliency
  - Pending NTIA BTOP Round 2 proposal
NWSC WAN Access

- Dual WAN entries and redundant ADVA switches in NWSC
- Access to full FRGP WAN services
  - Intra FRGP
  - I2
  - NLR
  - ESnet
- Availability of dedicated 10, 40, 100Gbps waves/lambdas to any BiSON site including FRGP for Teragrid, etc.
WAN Bandwidth

- UCAR will have 5 lambdas
  - 1 – NWSC to FRGP
  - 1 – NWSC to Teragrid
  - 2 – NWSC to Mesa Lab
  - 1 – Mesa Lab to FRGP shared with BiSON
- Other BiSON partners will have 6 lambdas:
  - 3 – NOAA (2 Boulder to FRGP, 1 NWAVE)
  - 1 – Wyoming (Laramie to FRGP)
  - 1 – CU–Boulder (Boulder to FRGP)
  - 1 – CSU (Fort Collins to FRGP)
Day 1 System Capacity:

- Shelf at NWSC has 16 slots
- Total 16 x 10Gbps = 160Gbps capacity
- Shelves in Boulder and Denver are shared with other BiSON partners
- Additional shelves are only ~$3,500 so shelf capacity is a minimal barrier to expansion
WAN Capacity

Short Term Capability

- Overall system capable of handling 40 channels
- Capacity of 400Gbps using 10Gbps or 1.6Tbps using 40Gbps (shipping today)
WAN Capacity

- Long Term Capability
  - 100Gbps due late 2011 for 4Tbps of capacity
  - 80 channels with a major equipment upgrade for 8Tbps total
  - East and West paths could be used in parallel to achieve 16Tbps
LAN

- 4 communication closets plus computer room
- Standard CAT6A and 50micron fiber to the wallplate
- Cisco 6509 closet switches
  - 1Gbps to the wall
  - Standard phone support
- 802.11n wireless
- Cellular support
HPCN

- Plug and play 50micron fiber deployment
- Cisco Nexus switches planned for 10Gbps support, but evaluating vendors now
  - Dual core and access layer switches
  - In-service software upgrades (ISSU) support
  - Virtual Port Channel (vPC) allowing end systems to connect to two switches
Nexus 7000

16-way port channel

Nexus 5000
Questions?