UCI Lightpath

A Dedicated Network for Big Data Research on Campus

Supported by NSF CC-NIE Grant

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OIT
5/20/2014
Topics

• UCI’s NSF CC-NIE Grant
• UCI Lightpath – A Dedicated Research Network on Campus
• Current Implementation Status
• Next Step
• How this Advisory can help
UCI’s NSF CC-NIE Grant

• CC-NIE: Campus Cyberinfrastructure – Network Infrastructure and Engineering
• Total Funding: $499,999; almost all for network equipment
• Starting on 1/2014 for two years
• PI and Co-PIs
  – VCR John Hemminger, CIO Dana Roode, Prof. Doug Tobias and Prof. Aynes Taffard
• Senior Personnel
  – Jessica Yu, Brian Buckler and Allen Schiano of OIT
What’s Proposed

• UCI Lightpath – a dedicated network infrastructure for data-intensive research on campus

• 10Gpbs link to CENIC/Internet2

• PerfSoNAR servers to measure network performance
**Big Data: Volume**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Value</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte (Byte)</td>
<td>1000</td>
<td>1s</td>
</tr>
<tr>
<td>Kilobyte (KB)</td>
<td>1000</td>
<td>20 mins</td>
</tr>
<tr>
<td>Megabyte (MB)</td>
<td>1000</td>
<td>11 days</td>
</tr>
<tr>
<td>Gigabyte (GB)</td>
<td>1000</td>
<td>30 years</td>
</tr>
<tr>
<td>Terabyte (TB)</td>
<td>1000</td>
<td>300 centuries</td>
</tr>
<tr>
<td>Petabyte (PB)</td>
<td>1000</td>
<td>30 million years</td>
</tr>
<tr>
<td>Exabyte (EB)</td>
<td>1000</td>
<td>30 billion years</td>
</tr>
<tr>
<td>Zettabyte (ZB)</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Yottabyte (YB)</td>
<td>1000</td>
<td></td>
</tr>
</tbody>
</table>

*Patrice KOEHL, UC Davis*
UCI Data Intensive Research Groups

- **Experimental Particle Physics at the Large Hadron Collider (LHC-ATLA)** (Prof. Lankford, Taffard, Chen, Feng, Rajaraman, Whiteson, Shirman and Tait)
- **Genomics and Bioinformatics** (Prof. Sandmeyer, Baldi and Thornton)
- **Hydrologic Modeling and Remote Sensing** (Prof. Famiglietti)
- **Flow and Combustion Dynamics of Liquid Fuels and the UCI Combustion Laboratory** (Prof. Elghobashi, Dunn-Rankin and La Rue)
- **Biomolecular Simulations** (Prof. Tobias, Andricioaei, Lou and Poulos)
- **Climate Modeling** (Prof. Zender)
- **Cosmology and the Center for Galaxy Evolution** (Prof. Bullock, Abazajian, Barth, Buote, Cooper, Cooray, Fang, Kaplinghat and Smecker-Hane)
# Potential Locations

<table>
<thead>
<tr>
<th></th>
<th>Building Name</th>
<th>Disciplines</th>
<th>Data Intensive Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rowland Hall</td>
<td>Physical Sciences</td>
<td>Hydrologic Modeling and Remote Sending</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>UC System Center for Hydrologic Modeling</td>
</tr>
<tr>
<td>2</td>
<td>Reines Hall</td>
<td>Physical Sciences</td>
<td>LHC/ATLAS Project</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Cosmology and the Center for Galaxy Evolution</td>
</tr>
<tr>
<td>3</td>
<td>Steinhaus Hall</td>
<td>Biologic Sciences</td>
<td>Genomics and Bioinformatics</td>
</tr>
<tr>
<td>4</td>
<td>McGaugh Hall</td>
<td>Biologic Sciences</td>
<td>Genomics and Bioinformatics</td>
</tr>
<tr>
<td>5</td>
<td>Natural Sci I</td>
<td>Natural Sciences/Chemistry</td>
<td>Molecular Dynamics and Theoretical Biophysical Chemistry</td>
</tr>
<tr>
<td>6</td>
<td>Engineer Gateway</td>
<td>Engineering</td>
<td>UCI Combustion Laboratory</td>
</tr>
<tr>
<td>7</td>
<td>Croul Hall</td>
<td>Natural Sciences</td>
<td>Climate Modeling</td>
</tr>
<tr>
<td>8</td>
<td>Data Center</td>
<td>all Sciences/Engineering</td>
<td>Campus Computing Clusters, research computing storages, Servers by researchers</td>
</tr>
</tbody>
</table>
Current Campus Network

- Most of the end-user connections are 100Mbps
- Not all buildings have 10Gbps uplinks to campus CORE
- Lack of high performance link to OITDC
- Lack of 10Gbps connections beyond campus
Typical Campus Building Network Architecture

Old buildings

Campus Core

1 Gigabit/s

1 Gigabit/s or 100 Mb/s

Building Router

1 Gigabit/s

Floor SW

100 Mb/s

Users

Floor SW

100 Mb/s

Users

Newer buildings

Campus Core

10 Gigabit/s

1 Gigabit/s

Building Router

10 Gigabit/s

Floor SW

100 Mb/s

Users

Floor SW

100 Mb/s

Users
How does UCI Lightpath Help

- 10Gbps link to outside campus
- 10Gbps Lightpath infrastructure
- 1Gbps or 10Gbps to servers
- Can be used by UCI storage infrastructure
- Data transfer speed improvement for researchers
High speed data flow from UCI LightPath beyond campus

High speed data flow between campus data intensive research facilities
It’s not a Cure All

• It’s not always the network that slows down data transfer

• Often they’re the applications

• PerSONAR will be a tool to help distinguish network issues from non-network ones

• User education is also the key: we need to work together
Current Status

- UCI Lightpath network is partially implemented & ready for early adopters
- Reaching out to researchers identified in the proposal to discuss how to connect them
- Deployed three perfSONAR servers and testing bandwidth between the nodes in the network.
- CENIC HPR 10Gbps implementation will start soon (waiting for CENIC to get the equipment)
Characteristics & Challenges

- Not designed with absolute redundancy; stretch funding to cover more locations – UCINet is the backup
- No existing policies to follow – set and fine tune along the way
- New paradigm needs more collaborations between users and OIT initially
- Lack of fiber infrastructure within buildings – need to build connections on a case-by-case basis
Next Step

• Continue to extend the UCI Lightpath to locations identified in our proposal
• Continue to identify and help potential users to connect to the network
How You Can Help

• Let us know researchers who would benefit from the UCI Lightpath
• Provide feedbacks
• Advise on future directions
  – How to expand the infrastructure
  – Plans after the grant period is over, etc.
Questions?