Are we unique?
A study in higher education IT
Wallace A. Chase
Executive Director,
Networking and Telecommunications
Clemson University
CEO, Carolina Light Rail Network
wchase@clemson.edu
So... Are we?
Well...

As any engineer will tell you...
Some of what we do is plumbing
At that point it’s just a simple math problem

\[ 5+5+5+5+5 = 5555 \]
So wait, plumbing is bad?
What makes up an academic network?

Students
What makes up an academic network?

Students

Professors
What makes up an academic network?

Students

Professors

Staff
What makes up an academic network?

- Students
- Professors
- Staff
- Business systems
What makes up an academic network?

- Students
- Professors
- Staff
- Business systems
Computational science –
It’s not just for particle physics anymore…

The aim of particle physics is to understand what everything’s made of, and how everything sticks together. By everything I mean me and you, the Earth, the Sun, the 100 billion suns in our galaxy and the 100 billion galaxies in the observable universe. Absolutely everything.

—— Brian Cox ——
The enterprise network...
The enterprise network...
The enterprise network...
The enterprise network...
The enterprise network...
Computational Research, an analogy...
Computational Research, an analogy...
Computational Research, an analogy...

Irrefutable proof the analogy is valid...
Computational Research, an analogy...
Computational Research, an analogy...
Computational Research, an analogy...
Computational Research, an analogy...

- Agile
- Moves Rapidly
- More Effective
- In Groups
Computational Research, an analogy...

- Agile
- Moves Rapidly
- More Effective
- In Groups
- Consumes All
  Available Resources
Computational Research, an analogy...

- Agile
- Moves Rapidly
- More Effective
- In Groups
- Consumes All
- Available Resources
- Cool
Computational Research, an analogy...

Is not reptile

- Agile
- Moves Rapidly
- More Effective
- In Groups
- Consumes All Available Resources
- Cool

Is reptile
When Computational Science Meets Traditional Networks
When Computational Science Meets Traditional Networks
When Computational Science Meets Traditional Networks
When Computational Science Meets Traditional Networks

I have some important research data...
...that is highly important to myself, the educational community, and all of mankind as a whole. It is imperative that this data be reasonably secured; yet, available to my research peers. The datasets are rather large, and they may need to be shared across institutions.
When Computational Science Meets Traditional Networks

Would it be possible to gain access to a secure, reliable, flexible, accessible, as well as high performing infrastructure?
When Computational Science Meets Traditional Networks
When Computational Science Meets Traditional Networks
When Computational Science Meets Traditional Networks

Hey, Jim!
When Computational Science Meets Traditional Networks
Gotta guy here. Says he needs stuff.
When Computational Science Meets Traditional Networks

What kinda stuff?
When Computational Science Meets Traditional Networks

Something about security and connectivity.
When Computational Science Meets Traditional Networks

We got plenty of that! Send ‘em in.
When Computational Science Meets Traditional Networks
When Computational Science Meets Traditional Networks
When Computational Science Meets Traditional Networks

Ye gads!
When Computational Science Meets Traditional Networks

Ye gads!

AHHHH!!
When Computational Science Meets Traditional Networks

Ye gads!

AHHHH!!

THE INHUMANITY!!!
When Computational Science Meets Traditional Networks

Ye gads!

AAHHH!!

THE INHUMANITY!!

HOM!
NOM!
NOM!
OBSERVATION: The *requirements* of the computational researcher and the *service profile* of the traditional enterprise computer network (or other “commodity” networks) do not always align!

*Ya’ think?!*
This can result in adverse consequences:

- Network performance issues for the researcher
- Network performance issues for everyone else
- Frustration for the researcher
- Frustration for IT staff
- General grumbling and complaining
When Computational Science Meets Traditional Networks

Sigh. I guess cancer cures can wait.
When Computational Science Meets Traditional Networks

But how do we overcome this? *I can’t stop my research* just because *I can’t figure out the technology*! Being able to collaborate is critical!
We got that covered! Let me make a call...
When Computational Science Meets Traditional Networks

We can help you with that!
Next exit - Assistance

- HPC
- Storage
- Data transport
- Expert help
Hey! This works!
Next exit - Assistance
- HPC
- Storage
- Data transport
- Expert help
One image - 4.3 Gigabytes

National Geographic • @NatGeo • Apr 1

Requiring 4.3 gigabytes of disk space, this photo provides a detailed glimpse of our nearest galactic neighbor, the Andromeda galaxy.

A Hundred Million Stars in 3 Minutes
In January 2015, NASA released the largest image ever of the Andromeda galaxy, taken by the Hubble telescope. By zooming into the incredible shot, video.nationalgeographic.com
In 2015.

One image - 4.3 Gigabytes
In 2015.

One image - 4.3 Gigabytes

In 2015.

Today its 2.4TB
Engagement across the entire stack

<table>
<thead>
<tr>
<th>OSI (Open Source Interconnection) 7 Layer Model</th>
<th>Central Device/Protocols</th>
<th>DOD4 Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application (7)</strong></td>
<td>User Applications</td>
<td>GATEWAY</td>
</tr>
<tr>
<td>Serves as the window for users and</td>
<td>SMTP</td>
<td></td>
</tr>
<tr>
<td>application processes to access the network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>services.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Presentation (6)</strong></td>
<td>JPEG/ASCII</td>
<td></td>
</tr>
<tr>
<td>Formats the data to be presented to the</td>
<td>EBIDC/TIFF/GIF PICT</td>
<td></td>
</tr>
<tr>
<td>Application layer. It can be viewed as the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Translator” for the network.</td>
<td></td>
<td>Process</td>
</tr>
<tr>
<td><strong>Session (5)</strong></td>
<td>Logical Ports</td>
<td></td>
</tr>
<tr>
<td>Allows session establishment between</td>
<td></td>
<td></td>
</tr>
<tr>
<td>processes running on different stations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transport (4)</strong></td>
<td>TCP/SPX/UDP</td>
<td></td>
</tr>
<tr>
<td>Ensures that messages are delivered error-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>free, in sequence, and with no losses or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>duplications.</td>
<td></td>
<td>Host to Host</td>
</tr>
<tr>
<td><strong>Network (3)</strong></td>
<td>Routers</td>
<td></td>
</tr>
<tr>
<td>Contains the operations of the subnet,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>deciding which physical path the data takes.</td>
<td></td>
<td>Internet</td>
</tr>
<tr>
<td><strong>Data Link (2)</strong></td>
<td>Switch Bridge</td>
<td></td>
</tr>
<tr>
<td>Provides error-free transfer of data frames</td>
<td>WAP</td>
<td></td>
</tr>
<tr>
<td>from one node to another over the Physical</td>
<td>PPP/SLIP</td>
<td></td>
</tr>
<tr>
<td>layer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical (1)</strong></td>
<td>Hub</td>
<td></td>
</tr>
<tr>
<td>Concerned with the transmission and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reception of the unstructured raw bit stream</td>
<td></td>
<td></td>
</tr>
<tr>
<td>over the physical medium.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Engagement across the entire stack
Engagement across the entire stack

Researchers → IT department → Network → IT department → Resource

Research Engagement
What’s in the toolbox?

• Networks
• HPC
• Storage
• Training
• Tools (software/hardware)
• Networking
What’s in the toolbox?

• Networks
• HPC
• Storage
• Training
• Tools (software/hardware)
• **Networking**
We are integrators
We are the experts in our field
Change the way we look at our mission
Change the way we look at our mission

Change the way you look at your role
Some things are plumbing
The plumbing must work. Always.
But, we have to find ways to be game changers
We provide the plumbing. That is a given. How do we engage at the next level?

Students

Professors
We provide the plumbing. That is a given.
How do we engage at the next level?
The enterprise side of the house

The research side of the house
For the researcher – research supporting systems are enterprise systems. Necessary to get the basic job done.
The end.
Thank you!

A very special thanks to Matt Younkins at OU, as the raptors are on loan from him!