

Tandy Supercomputing Center

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Oklahoma Supercomputing Symposium
October 2013



TANDY
SUPERCOMPUTING
CENTER

100 S. Cincinnati Ave. | Suite 1405 | Tulsa, OK 74103

An initiative of the Oklahoma Innovation Institute

tandysupercomputing.org

Outline

- Who we are
- Who we serve
- Where we came from
- Our mission
- Our model
- Tandy: design & deployment
- Today & where we're going



- **Tandy Supercomputing Center**
 - Shared supercomputing center to broadly serve the Tulsa community
 - Academia, private, public, and the community at large (public good)
 - Provide and support education, workforce development, and a "Community Supercomputer" resource
 - Part of Tulsa Research Partners...



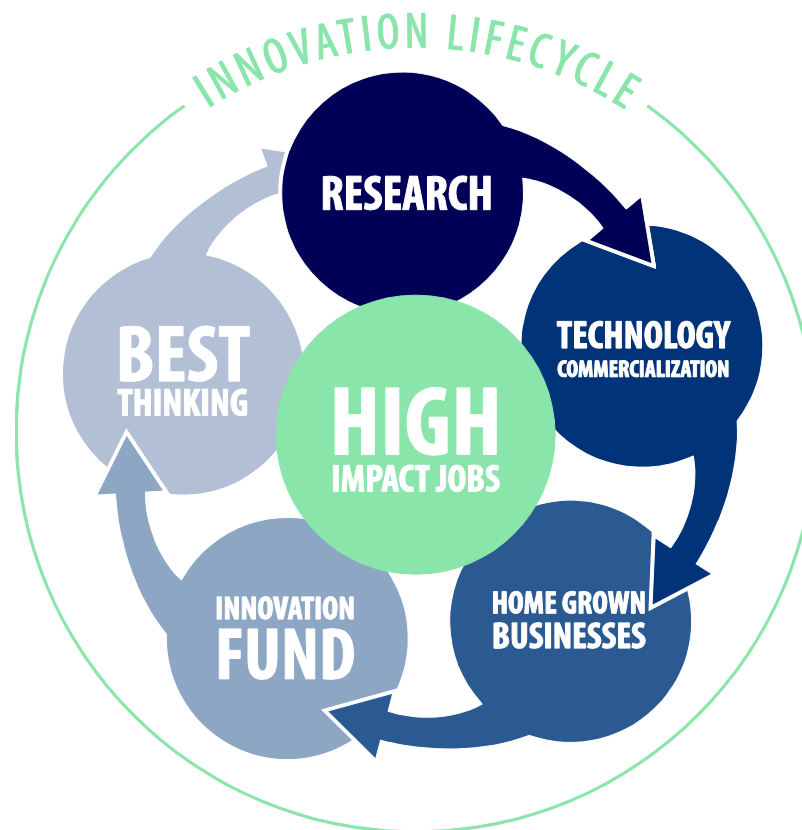
- **Tulsa Research Partners**
 - Collaboration of
 - Oklahoma State University in Tulsa
 - The University of Tulsa
 - The University of Oklahoma – Tulsa
 - Tulsa Community College
 - Foster and support collaboration between area institutions; facilitate technology transfer; support multi-institutional grant opportunities
 - Under the Oklahoma Innovation Institute...



- **Oklahoma Innovation Institute**
 - Oklahoma Innovation Institute
 - 501(c)3 non-profit committed to building an innovative economy in the Tulsa region
 - Research and development collaboration
 - Entrepreneurship and company creation and retention
 - Lifelong learning and early childhood education
 - STEM Alliance

Who we are

- **Oklahoma Innovation Institute**
 - “Research to High Impact Jobs”



Where we came from: OII

- **Step Up Tulsa! - 2006**
 - Grassroots effort led in part by the Tulsa Community Foundation to "move the Tulsa community and region forward in critical quality-of-life areas"
(http://www.tulsacf.org/index.php?option=com_content&view=article&id=52&Itemid=90)
 - 350+ citizen involvement
 - Economic development goal: "Focus investment in collaborative research and actions to foster a community environment that assures more competitive jobs and increased productivity throughout the region."

Where we came from: TSC

- Multiple Tulsa campuses were in need of HPC resources
 - Things and/or people
- Born out of a desire to avoid duplication of efforts in Tulsa
- “Supercomputing as infrastructure”
 - Private philanthropy
 - Lead gift from the A.R. & Marylouise Tandy Foundation
 - EDA
 - #080104715, “Tulsa Community Supercomputer,” \$800,000

Our Mission

- Provide shared supercomputing resources to our members and the community
 - Outreach to non-commercial users
 - Support emerging growth companies
 - Promote a local "research industry"
- Lower the barrier of entry to supercomputing
 - Education and outreach
 - Expertise and support
- Workforce development and capacity building
 - Develop a savvy and competitive workforce
- Provide a competitive advantage
 - Both to members and the region (see #2)

- "Community Supercomputer" model
 - Open to all as first-class members
 - Academia, business, government
- "Condo" cluster
 - Distinction between infrastructure and compute
 - Start-up fee to acquire hardware; operating fees to sustain operations; reserve fund for infrastructure
- Rolling upgrades
 - Can we mitigate the obsolescence cycle? (Even a little?)

Our model: Community Supercomputer

- Supercomputing Center
- Tandy Community Supercomputer
 - Seeded by academics (OU, TU, OSU, TCC)
 - Community allocation
- Designed to grow as a center
- Invested in infrastructure (Philanthropy, EDA)
 - Power/Cooling
 - Network
 - People
- Financially stable with very modest growth

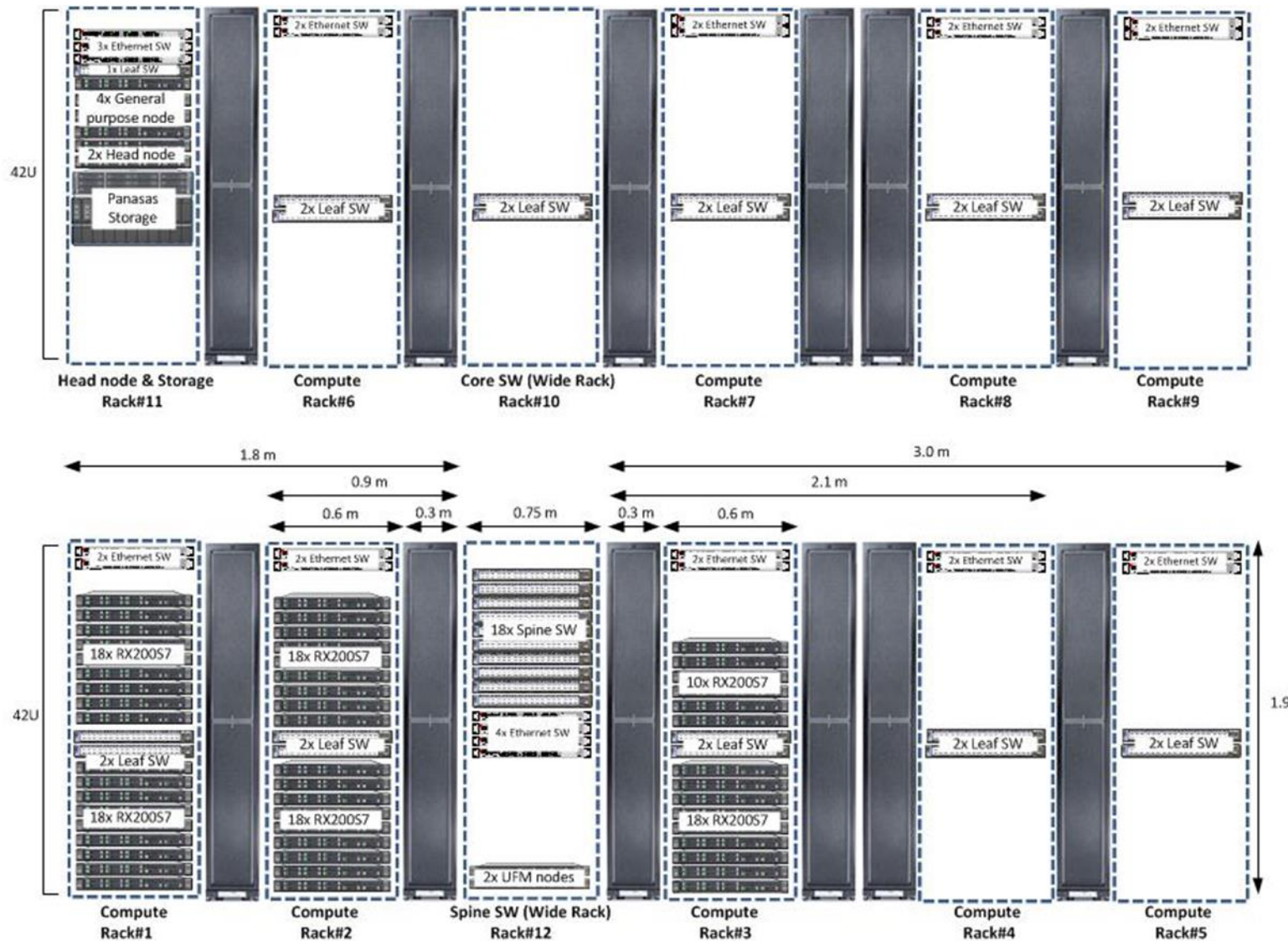
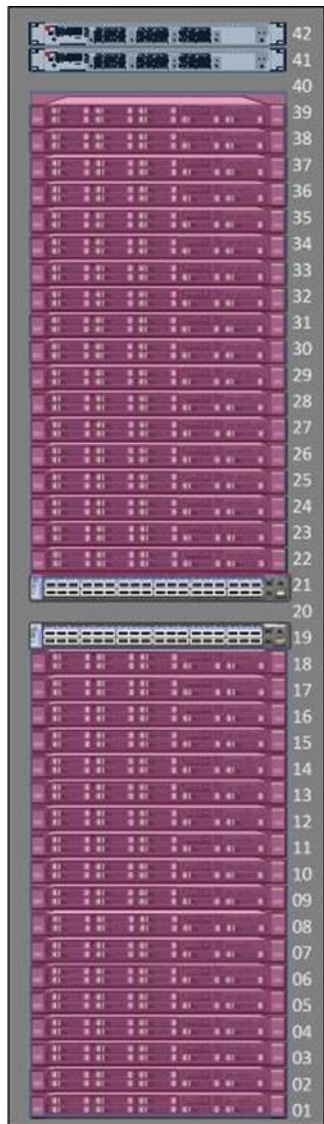
Our model: Rolling upgrades

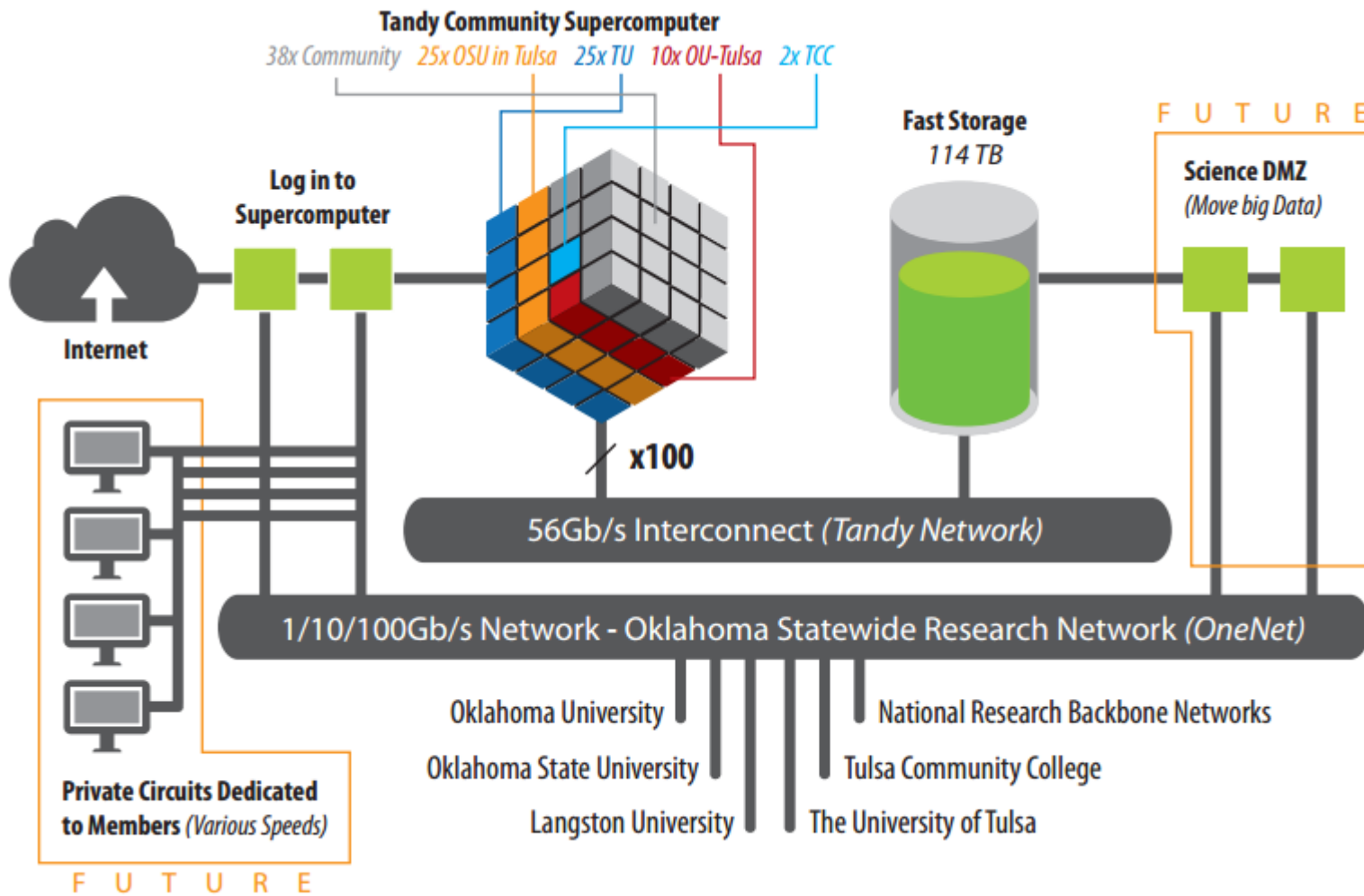
- **Scale our cluster**
 - Try to smooth out the upgrade cycle
 - Business involvement and smaller grants
- **Starting at 1/3 of compute node capacity**
 - Power, cooling, networking to spare
 - Rack and plug in
 - Expand as we have more users come onboard
- **Use "community" nodes for new purchases, refresh "community" with new generations**
- **Operations budget retains money for capital upgrades**
- **Experimental at this scale**

Our resources

- Tandy Community Supercomputer (Tandy)
 - 100 compute nodes
 - 2x Xeon E5-2680 (16 cores per node)
 - 128 GB RAM each
 - 1 GbE, 1.6:1 oversubscribed (Brocade ICX and MLXe)
 - 56 Gb/s FDR InfiniBand, 1:1 fat tree (Mellanox)
 - Platform LSF
 - Panasas storage
 - 2x PAS 11
 - 114 TB raw
 - Limited to no archive (none procured yet)
 - Equipment and infrastructure to support 324 nodes, largely EDA funded
 - “Supercomputing as infrastructure”

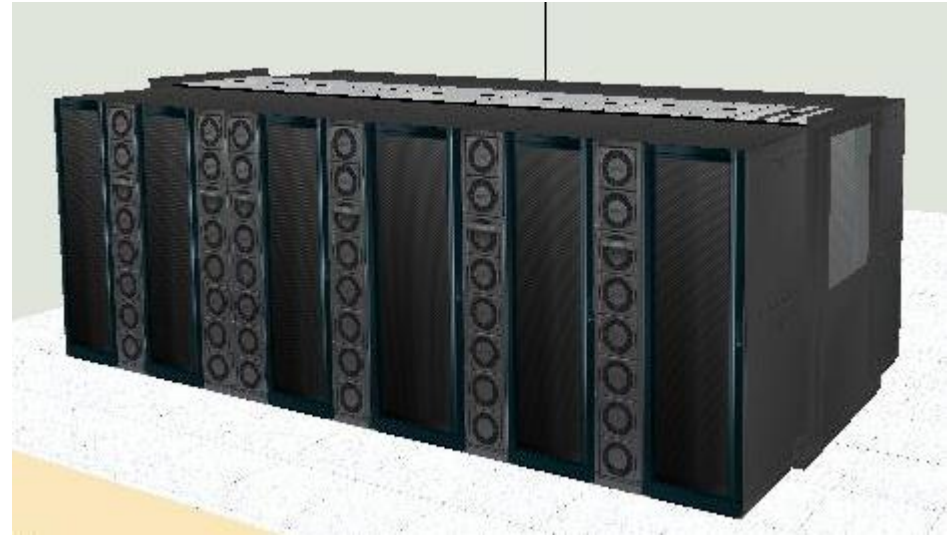
- Tandy Community Supercomputer (Tandy)
 - 2 networking racks
 - InfiniBand spine (18x switches)
 - Ethernet core and border (Brocade)
 - 1 admin rack
 - Head node
 - Storage
 - 9 compute racks (36 nodes)





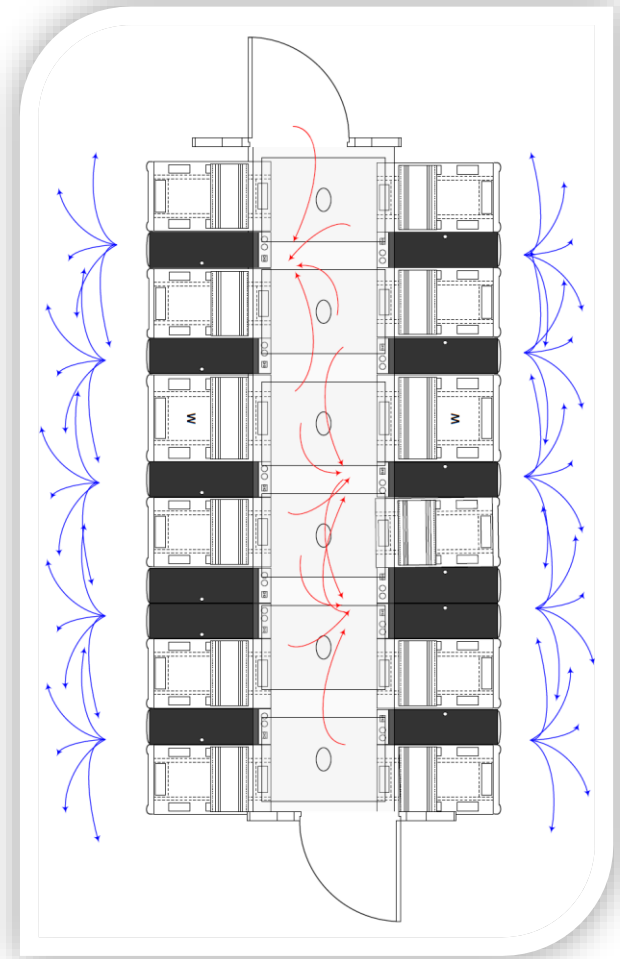
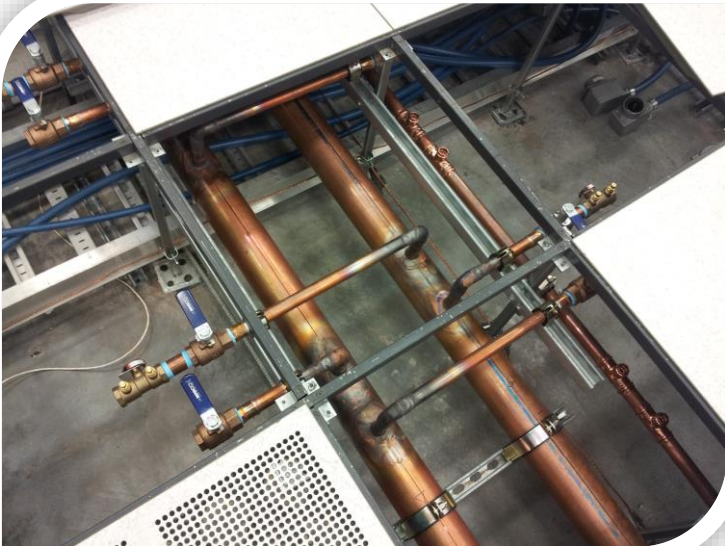
Our resources: Data center

- Hot aisle containment pod
- 12 racks



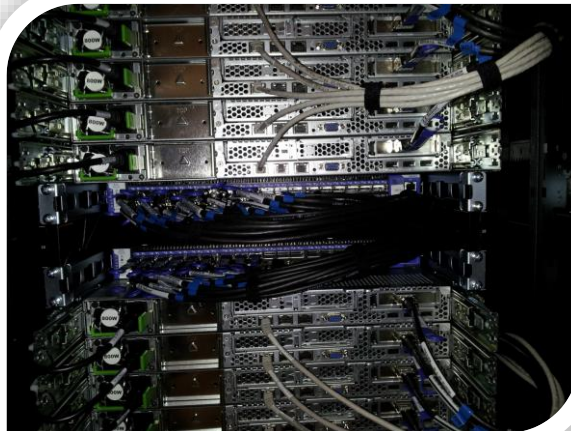
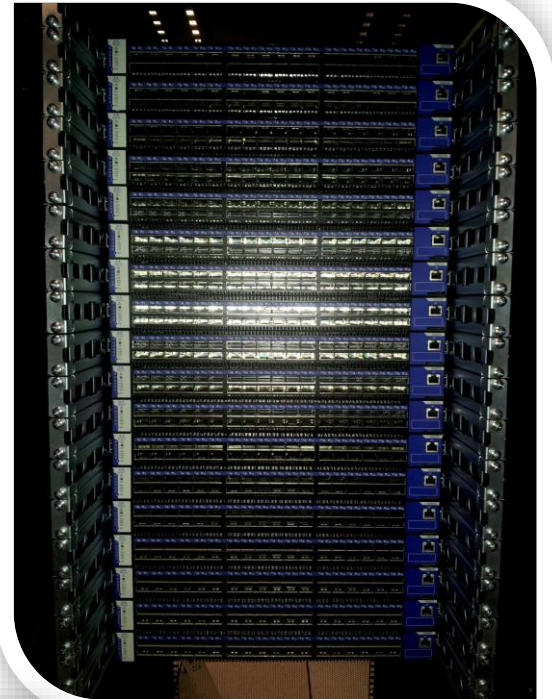
Our resources: Data center

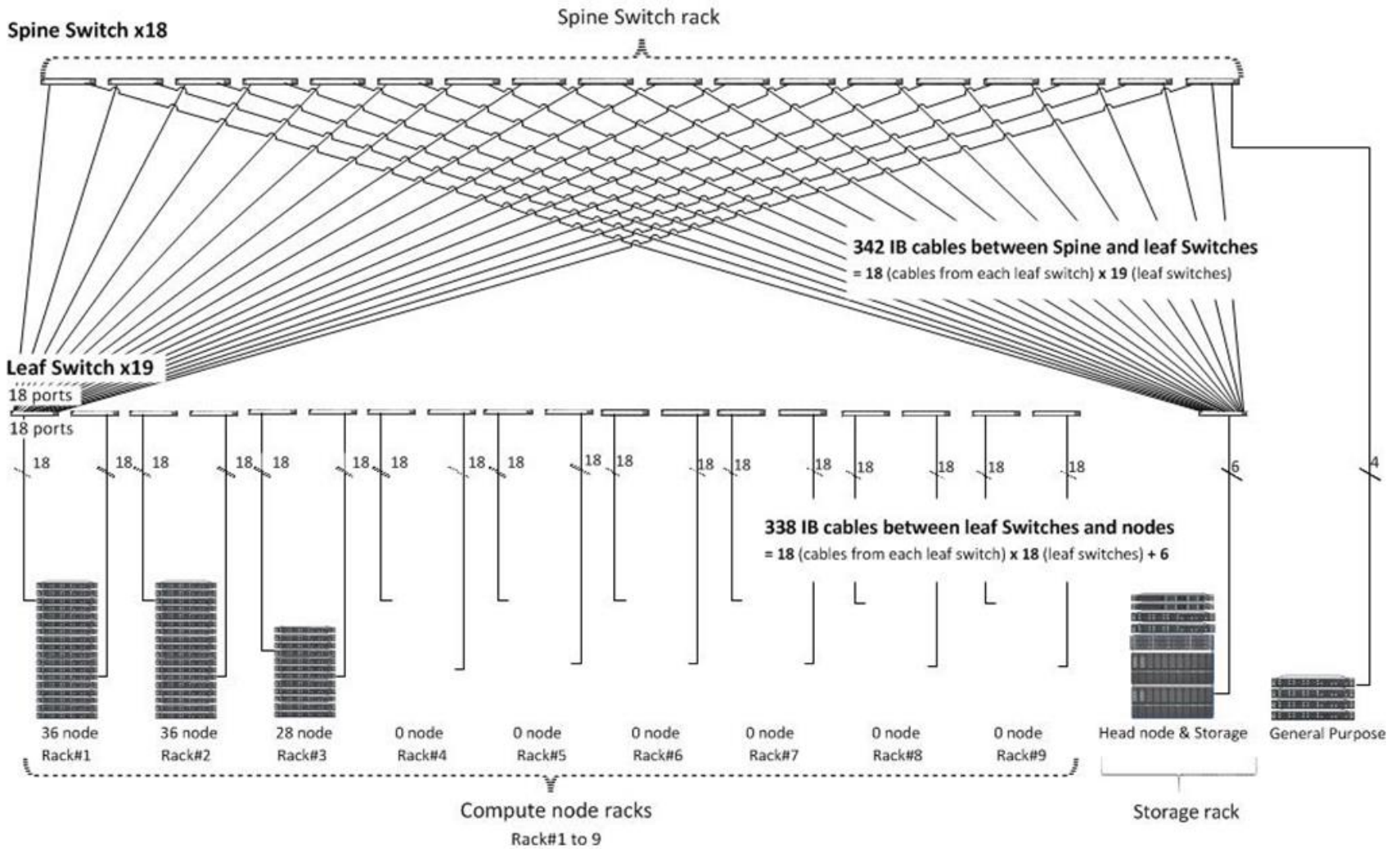
- Per rack @ 100%:
 - 16.76 KW total active power
 - 55,364 BTU heat emission
 - 1,441 ft³/m airflow
 - 17.6°C Δt



Our resources: Interconnect

- **Mellanox FDR InfiniBand**
 - Cascading 36 port switches
 - Non-blocking 1:1 (fat tree)
 - 2 leaf switches per compute rack
 - 18 switch spine
 - Copper from node to leaf
 - Fiber from leaf to spine





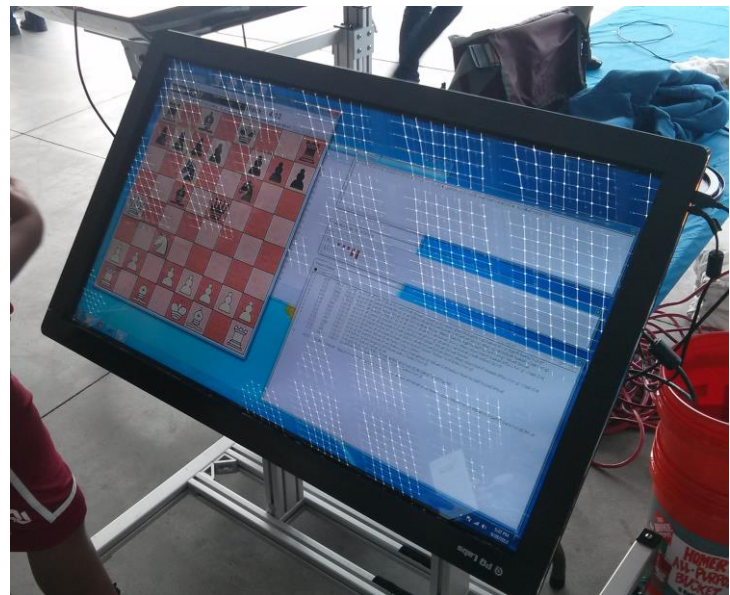
Our resources: Administrative

- **Connectivity**
 - Currently commercial
 - OneNet and City of Tulsa partnership
 - Metro Ethernet and BGP capable
- **Support**
 - VMware Pool
 - Netapp
 - OM4 Fiber Path - MTP
- **People**
 - TSC Advisors
 - Community IT leaders
 - Partnerships with the City of Tulsa



Our resources: People

- 1 Director/computer scientist
- 1 System administrator
- 1 open position
- Internship program



Growing Pains

- "Sales tax? At *my* 501(c)(3)?"
- "How can we even *apply* for grants?"
- "Chart of accounts?"
- "We can run other people's Matlab code but not our own?"
- "Why can't any of these slide rule types understand which wall we want the pipes on?"
- Multi-institutional approvals, processes, scheduling



Today & Where we're going: Usership

- Tandy is in the last stages of “early user mode”
 - Peaked so far at over 60% utilization
- First user training classes tomorrow, hosted by TCC

Today & Where we're going: Usership

- **So far:**
 - Molecular dynamics (materials science)
 - Bioinformatics
 - Phylogenetics
 - ECE modeling
- **Anticipated**
 - Materials science
 - Bioinformatics and healthcare informatics
 - CFD (Petroleum to sports science)

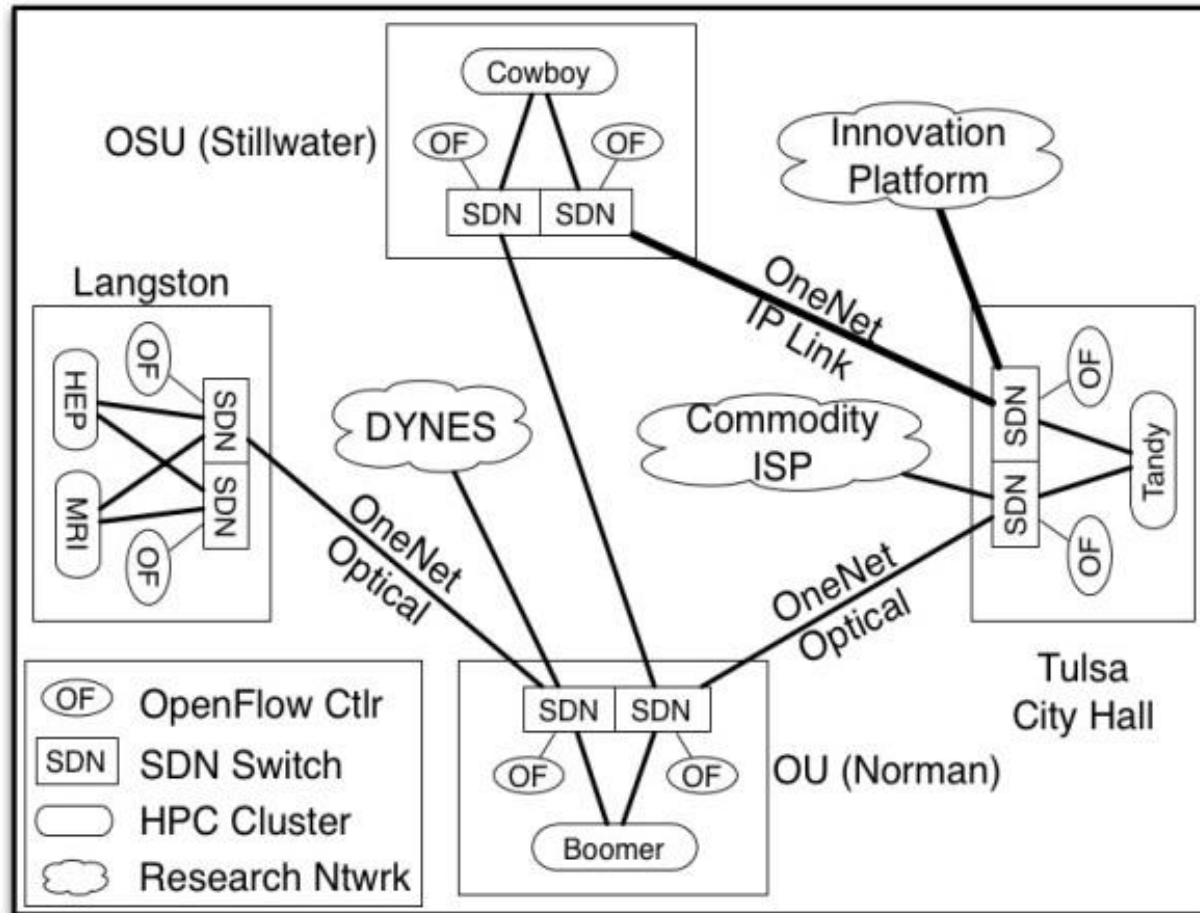
Today & Where we're going

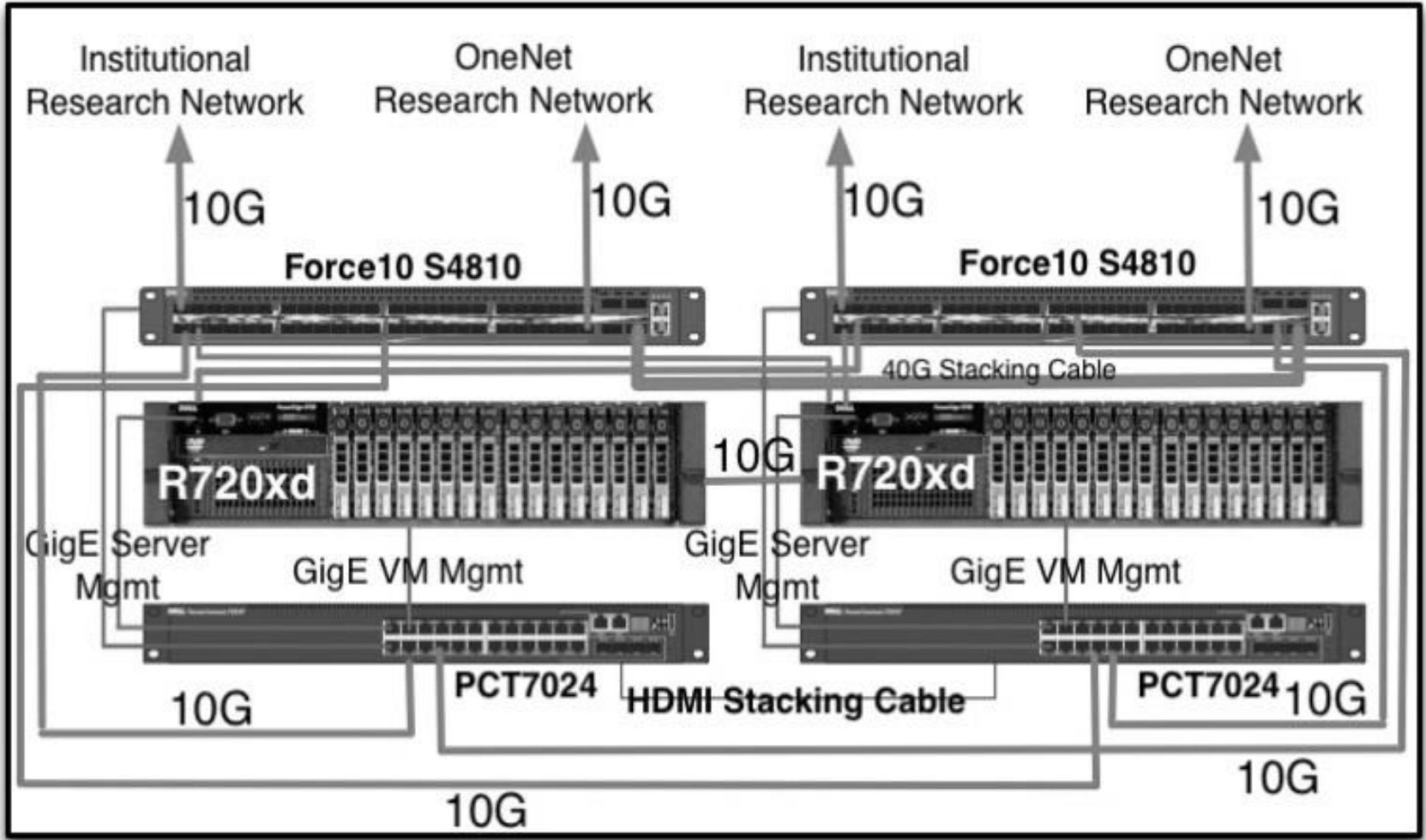
- Administrative challenges are lagging the technical ones
- Just awarded: NSF CC-NIE Infrastructure “OneOklahoma Friction Free Network” (OFFN)

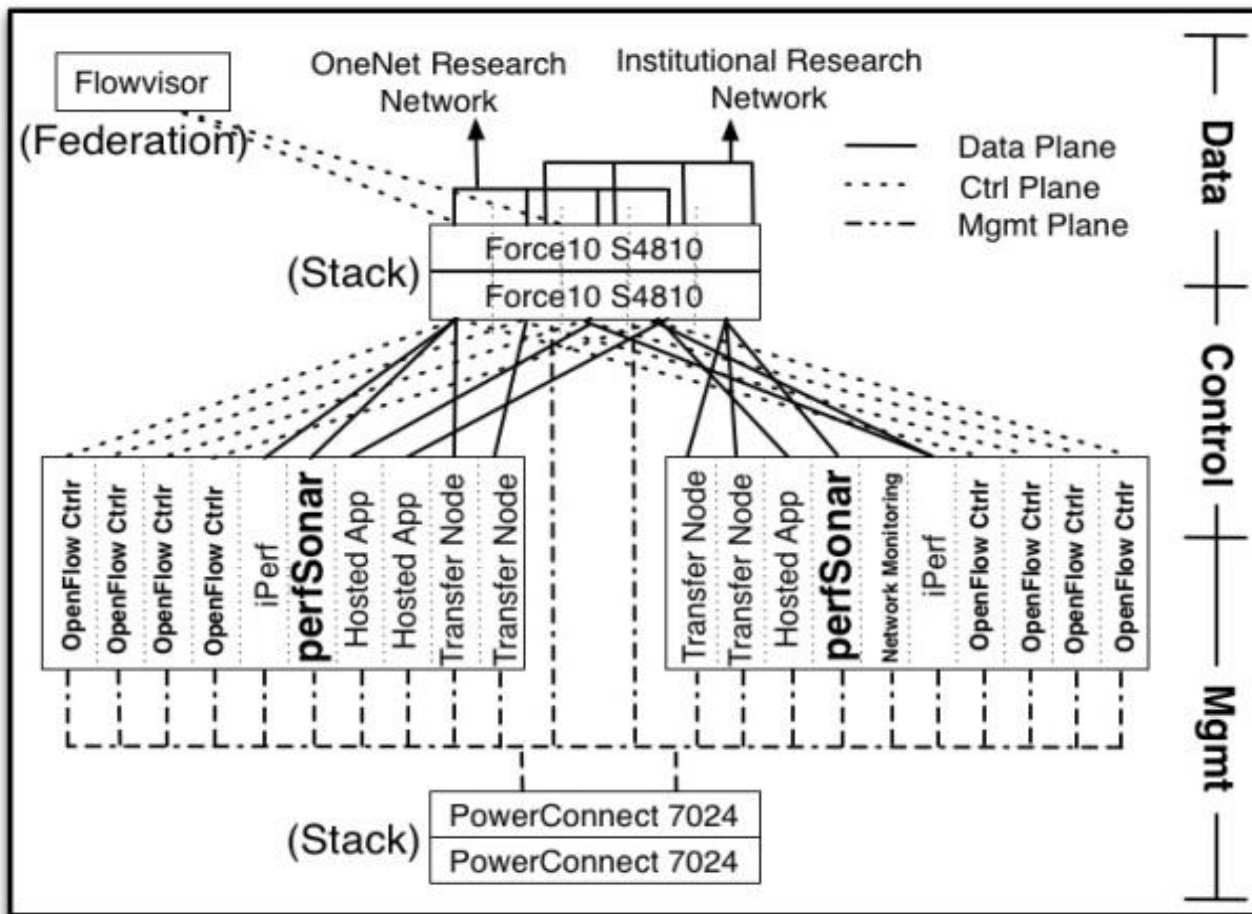
OneOklahoma Friction Free Network (OFFN)



Today & where we're going







Questions, Discussion?

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