Innovations to Transition a Campus Core Cyberinfrastructure to Serve Diverse and Emerging Researcher Needs

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Topics of Discussion

- Proposal Overview
- Equipment Purchase and Locations
- Personnel Hiring and Collaboration Logistics
- Project Success Metrics

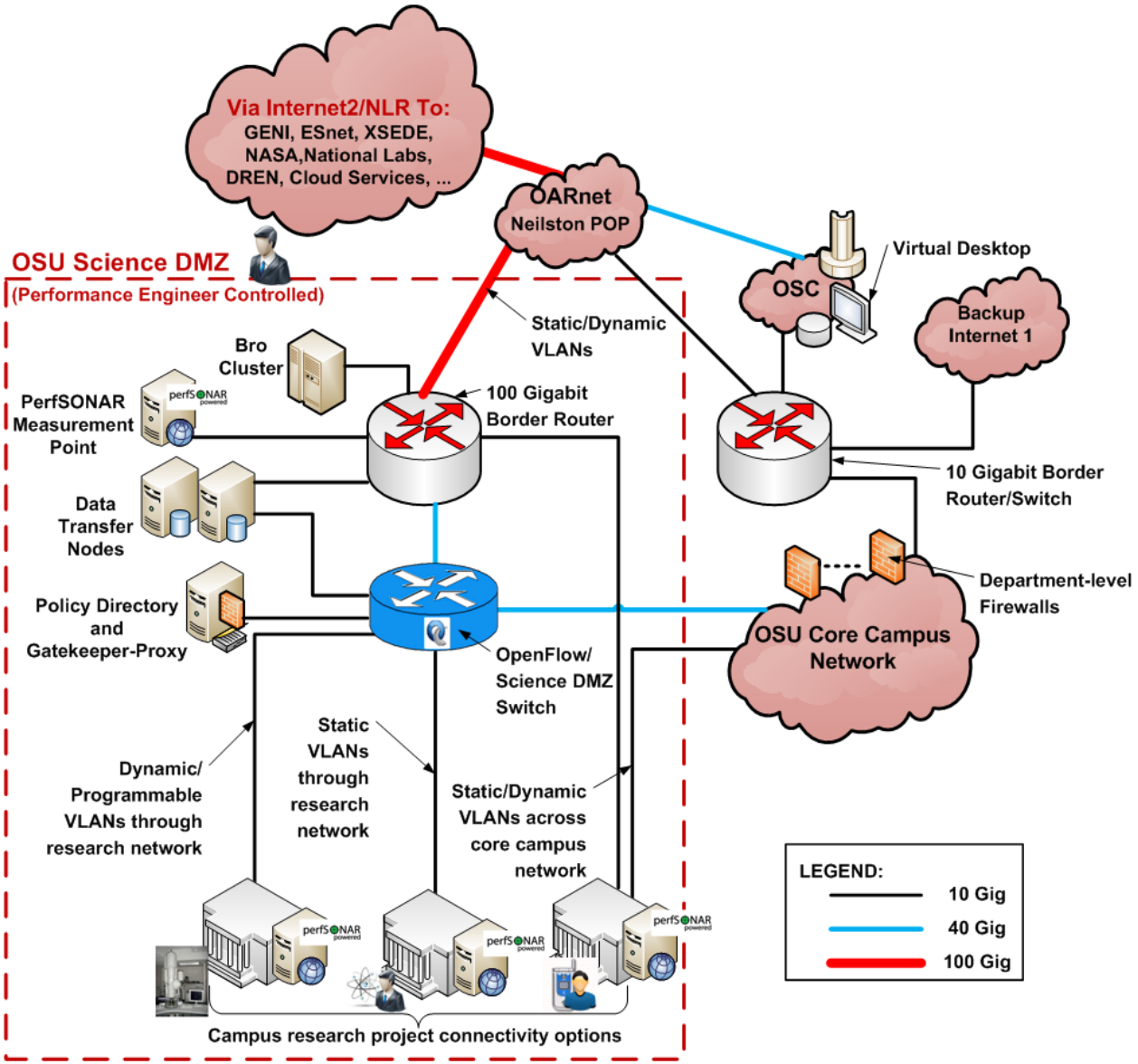
Ingredients for Success

- Include all groups – Must build bridges amongst all stake holders
  - Campus Production Network
  - Office of Research
  - Campus IT Security
- Must address Policy Issues
  - Elephant in the room – Security
    - Policy –
      - no dual homed hosts
      - All DMZ components must come normal security mechanisms to access enterprise network

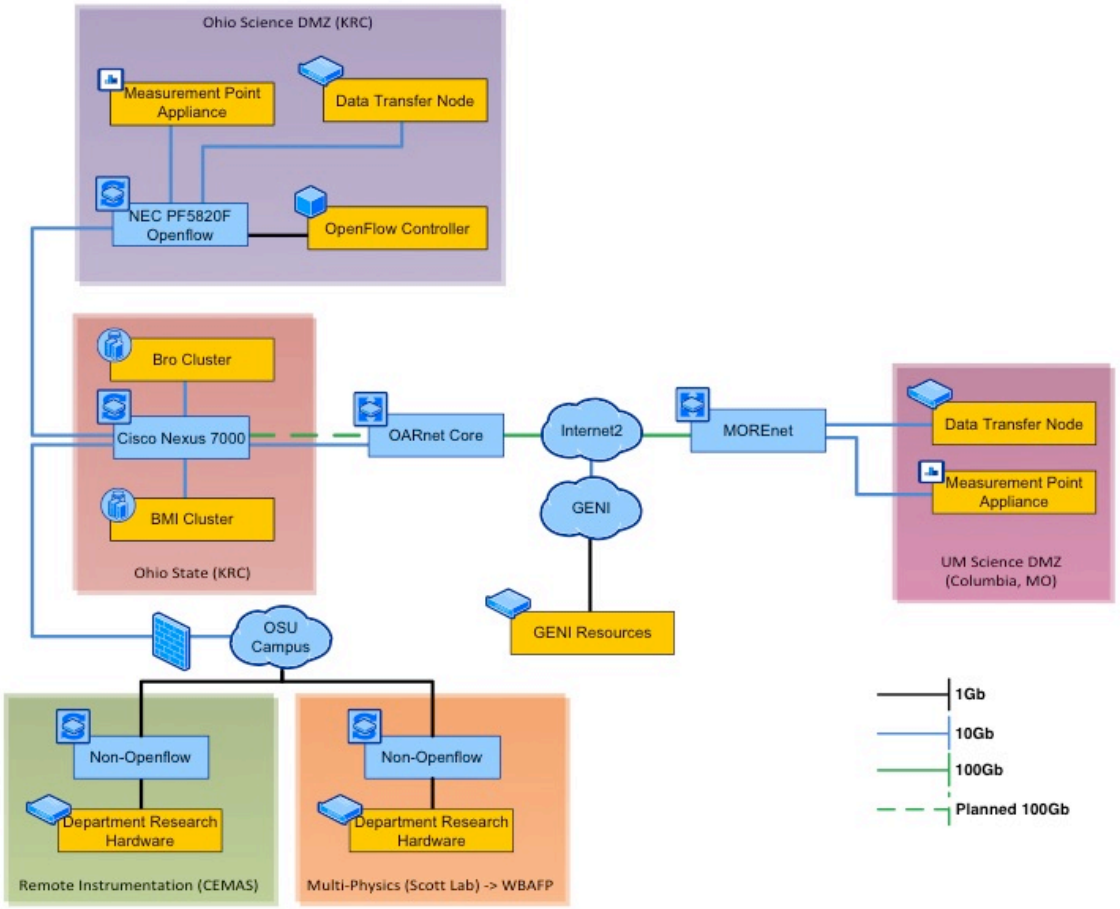
Proposal Overview

- Science DMZ construction with advanced technologies
  - 100Gbps connectivity, perfSONAR, OpenFlow, RoCE/iWARP, Bro
- Connect OSU at 100Gbps to OARnet-Internet2 peered network
  - Aggregate research VLANs arising from internal OSU departments
- Define and establish role of a “Performance Engineer on Campus”
  - App development to help operations, policy development, funding model
- Wide-area experimentation case studies with Co-PIs
  - *OSU – MU experiments*: Brain imaging, Soybean translational genomics
  - *OSC experiments*: adoption of cloud-based technologies for big-data import, storage and collaboration, as well as related analytics
  - *OSU HFCMPL experiments*: foster multi-physics research collaboration and high-resolution simulation steering; graduate capstone project
- Outreach and support for Co-PI experiments in Year 1 other campus researchers in Year 2

OSU Science DMZ



Science DMZ Locations



Equipment Purchase and Locations

- 100 Gbps border router – connect to OARnet-Internet2 peered network
  - Cisco Nexus 7009 - 100Gpbs – Carries all R&E traffic and DMZ
- OpenFlow switch – configure VLANs to remote sites (e.g., MU, GENI)
  - NEC PF5820F-64XW
- OpenFlow controllers Open Daylight - POX
- perfSONAR measurement points – collect end-to-end performance metrics
  - One at border next to OpenFlow switch; instrument at 2 or 3 depts.
- Data transfer nodes – wide-area RDMA-based, GridFTP integrated technologies
  - Pinnacle 2X2601H8
- Policy-directory server – enforces researchers' project-specific policies
  - Dell R710 – Containers running Policy, controllers and perSONAR
- Bro Cluster – investigate the tradeoffs to be balanced between researcher flow performance and campus security practices
  - Arista 7150S switch
  - Juniper EX3200 24 port 10/100/1000BaseT
  - Myricom Myri-10G-network adapter
  - Silicon Mechanics Rackform iServ R304.v3 "10Gb Bro IDS Cluster Worker"
  - Sniffer10G 9v.2.0)

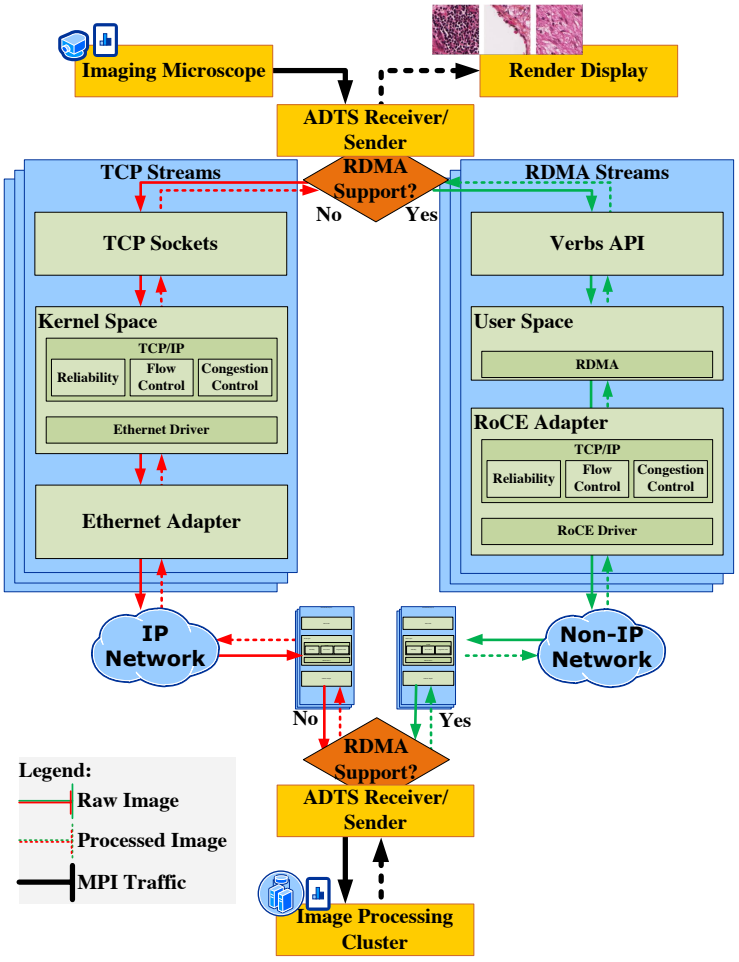
Personnel Hiring and Collaboration Logistics

- Performance Engineer: Keeper and Help-desk for Science DMZ
  - Reports to Paul Schopis; Interacts closely with John Heimester, Jay Young and Steve Romig
  - Location: OSC/OARnet
- Graduate Student -1: RoCE/iWARP experiments
  - Reports to: Dhabaleswar Panda; Interacts closely with Prasad Calyam
  - Location: OSU CSE
- Graduate Student -2: Imaging Analysis experiments
  - Reports to: Umit Catalyurek; Interacts closely with Prasad Calyam
  - Location: OSU BMI
- Graduate Student -3: OpenFlow experiments
  - Reports to: Dhabaleswar Panda
  - Location: OSC/OARnet

OSU-MU Experiments

- Common testbed setup tasks
  - Federation of OSU and MU Science DMZs – user accounts/roles
  - perfSONAR instrumentation and measurement
  - Establishment of VLAN extensions and IPv6
  - Set up optimized end-to-end data transfers with RoCE and iWARP
- Brain imaging analysis
  - MU “Brain Explorer” experiments with OSU for data-intensive brain imaging modeling, analysis and visualization functionalities
  - Data Cutter at OSU BMI to be leveraged to improve computation speed
- Soybean translational genomics and breeding (Scalability experiments)
  - MU “Soybean KB” database experiments with OSU for set up of GENI slices to dynamically change user load patterns from remote campuses
  - Service response time analysis of distributed databases, web-services for remote user access’ scalability

Experiment Application Workflow



The Curious Case of CEMAS

- **C**enter for **E**lectron **M**icroscopy and **A**nalysi**S**
- Project with AFRL and AFIT at WPAFB
- Renderer needs L2 and 1 Microsecond PDV
- WPAFB needs to do connectivity thru OARnet/DREN peering at L3
- Requirements:
  - Must buffer and alter timestamps at receiver
  - Must encapsulate in IP at sender, pass through security inspection and decapsulate before receiver
  - Starting POC this summer