Sharing Resources in the Cyberinfrastructure Environment:
The Virginia Tech Perspective

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About Virginia Tech

Main campus:
- Blacksburg, VA (rural southwest)

Academics:
- 110 bachelor’s degrees
- 170 master’s and PhD degrees
- 34,440 students

Selected research units
- Biocomplexity Institute
- Fralin Life Sciences Institute
- Virginia Tech Transportation Institute
- Institute for Creativity, Arts, and Technology
- Hume Center (cybersecurity and intelligence)
- Virginia-Maryland College of Veterinary Medicine
- Institute for Critical Technology and Applied Science
- Virginia Tech Carilion School of Medicine and Research Institute

Ranked 43rd in university research in US

Facilities:
- 213 buildings
- 2,600 acres (and an airport :-)

www.ivanmorozov.com
www.cnn.com
Virginia Tech Research Resources

- **Computing**
  - Cascades: general purpose; 236 nodes, 7312 cores, 63TB RAM, 100G IB; heterogeneous with large RAM and K80/V100 GPU nodes
  - DragonsTooth: general purpose; 48 nodes, 1152 cores, 12TB RAM, 10 GbE; homogeneous with 1.9TB SSD per node
  - NewRiver: general purpose; 173 nodes, 4380 cores, 53TB RAM, 100G IB; heterogeneous with large RAM, large disk, and K80/P100/K1200 GPU nodes
  - BlueRidge: general purpose; Cray C300: 408 nodes, 6528 cores, 27TB RAM; heterogeneous with large RAM and Intel Xeon Phi nodes
  - Huckleberry: deep learning; IBM S822LC; 14 nodes, 2240 cores, 3.5TB RAM; 10 GbE / 100 IB; homogeneous 4 P100 GPU per node with NVLink
  - ARC Cloud: on-premises OpenStack; 48 nodes, 1152 cores, 12TB RAM, 2x10 GbE, 26TB Ceph SSD storage
  - GENI rack: 12 HP Proliant DL360p nodes, 144 cores, 576 GB RAM, 24 TB disk, 1 GbE; InstaGENI software

- **Storage:**
  - /home: 281TB NFS
  - /work: 2.1PB GPFS & Lustre
  - /group: 1PB GPFS
  - Archive: CXFS

- **Networking:**
  - 10 GbE research network (VT-Rnet) and ScienceDMZ
  - 100 GbE data center network
  - 100 GbE campus backbone
  - 100 GbE to Internet2
  - Mid Atlantic Research Infrastructure Alliance (MAREA) regional network managed by VT Operations Center (VTOC)

- **Visualization:**
  - The Cube: 4 story theater with 360 degree sonic field from 124 speakers, 4 subwoofers, and 9 "spot" speakers
  - Visionarium: 10’x10’x10’ cube, three walls and floor

- **Awards**
  - NSF #1245827: ASCED (ScienceDMZ)
  - NSF #1340875: MAREA100G (removed bottleneck for VA universities)
  - NSF #1353831: FitGENI (GENI)
  - NSF #1541338: VT-Rnet (research network)

URL: https://www.arc.vt.edu/
VT Opportunities and Challenges

• Opportunities
  • More collaboration with regional (e.g., MARIA) and national partners
  • Better federation and sharing of resources
  • Champion and support the use of national research resources
  • Better participate in national research resource acquisition initiatives and planning

• Challenges
  • Need to mentally make the transition to being major research institution
    • Ranked 43rd as research university but funding for research infrastructure is still ad hoc and limited
    • Need 5- and 10-year research infrastructure plans and budgeting
  • Insufficient skilled personnel for creating/maintaining/operating research infrastructure
    • Need to develop appropriate training specialized to needs of research and academia
    • (Then need to figure out how to retain after trained)
  • Expand user-base:
    • Some sciences well represented; expand to other sciences/liberal arts
    • Greater and earlier student involvement and use of research resources to better foster curiosity-driven learning