

# Vermont's Statewide Research and Education Network

Patrick Clemins, Vermont EPSCoR

Peter Drescher, Vermont Agency of Education

David Todd, University of Vermont



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# Why do it?

- Promote collaboration among independent-minded school districts
- Provide low-latency/low-jitter service for HD video
- Integrate with other community anchors (libraries, museums, etc.)



# Why Us?

- State not likely to invest in building a new network
- VTA given \$40M in bonding authority in 2006 – but no money
- Attempt to leverage VELCO ring development in 2008 unsuccessful
- Opposition from ISPs would be extremely vehement – too little population, too much competition

# Overall Strategy

- Forge strong partnerships
  - EPSCoR-institution
  - Inter-institutional
  - Institutional-private sector
- Exploit the long-term value of high-performance networking across the region and throughout the state
  - Leverage Internet2 SEGP / U.S. UCAN Framework



# A Regional View

- UVM working with UNH, UME, NEREN to develop “Atlantica”
- ME, NH, VT are EPSCoR states: our EPSCoR directors and science faculty & students collaborate joint research projects
- Network development has been fueled by close partnership between Vermont EPSCoR and UVM ETS; started in 2007
- EPSCoR/INBRE has a state outreach role for STEM research & education – all K-20 institutions



# Atlantica

- Vision promoted by Jeff Letourneau (UME) and Doug Green (UNH); UVM joined starting about 2007
- Planned 10G service from Boston into NH, ME, Dartmouth, Burlington, Albany
- Agreed to work toward common vision: 10G half-ring through upper New England – “NEREN North”
- UME+UNH share path Manchester NH to Boston

# ATLANTICA vision



**Legend:**

- Existing R&E RONS
- Under construction/acquisition
- RII Track 2 candidates
- Future
- Canada carrier fibers





# Previous EPSCoR in Vermont

- Burlington-Albany
  - 12 10G EN circuits over waves
  - Will share 4/4/4 with ME, NH
  - Lit up last summer; two drop points in Albany. (Ah, and by chance, I2 left a 100G add/drop at Albany)
- Burlington-Hanover (Dartmouth)
  - 12 10G circuits over waves
  - Will share 4/4/4 with ME, NH
  - Lit up in January



# ATLANTICA 2013

**Legend:**

-  Existing R&E RON
-  Canadian Carrier fibers

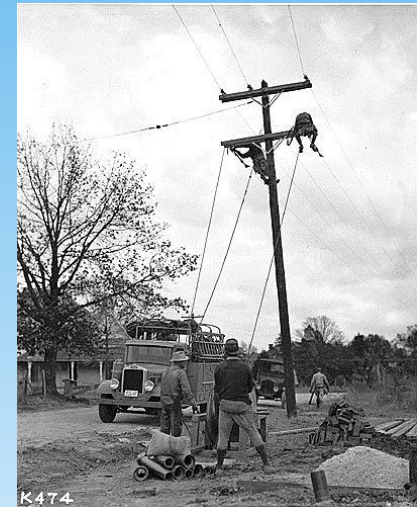


# Lightweight Acquisitions

- All acquisitions done by RFP – partner with private sector rather than compete
- We chose to purchase IRU's on waves rather than fibers:
  - Small networking staff, not prepared to support long-haul fiber runs
  - Acquire enough waves to share with friends 😊

# AoE Program

- Education Technology Coordinator role:
  - State Agency coordination
  - When stimulus funding appeared, floated RFP to try to solicit an entity to lead a statewide K-12 specific network: developed relationship with Educational Networks of America (ENA)
  - ENA and its relationship with the AOE/schools ... viability of ENA actually becoming vehicle for statewide network.



# K-12 Education Governance

- Agency of Education under Governor's office as of January 2013
- 60 Supervisory Unions function independently
- 288 School Boards
- 308 schools; student populations from 19-1300



# ISP's serving Education

- 308 K-12 schools served by 24 independent ISPs – no common interconnects
- ISPs serve 1 to 66 schools
- Bandwidth variable: ~20% have <2Mbps; 18% have  $\geq$  100Mbps
- Inter-district service highly variable

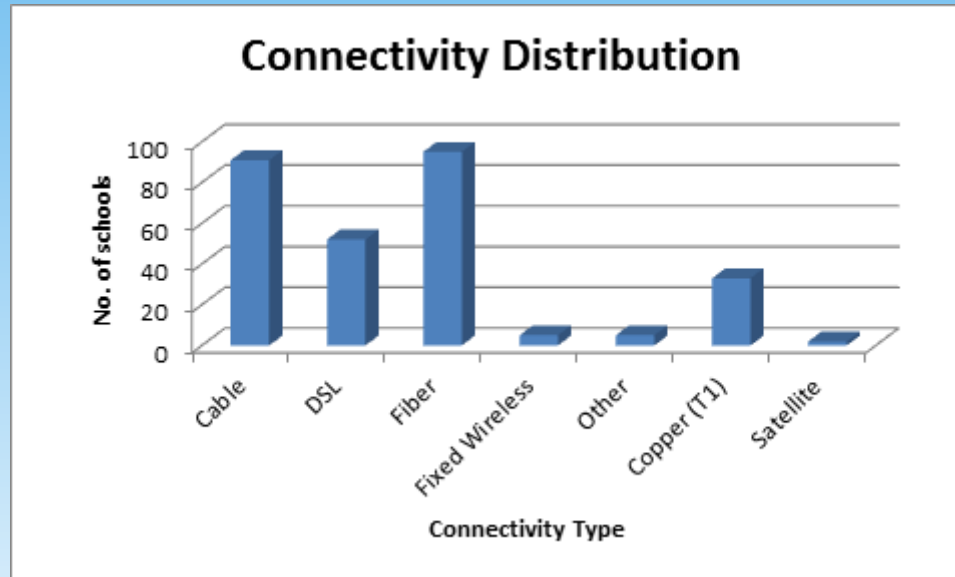




# AoE Broadband Data Collection

- Status
  - 53% of schools at  $\leq 20\text{Mb/sec}$
  - 15% at  $\leq 2\text{Mb/sec}$
  - Local challenge: Costs jump \$50/mo  $\rightarrow$  \$1200/mo
  - Making the case: SBAC Readiness, Longitudinal Data Project, Online learning

# VT K-12 Connectivity – 2012

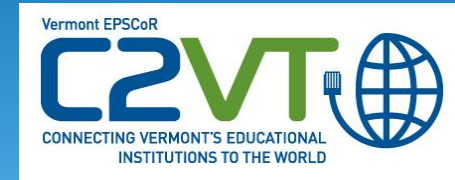






# The In-State Network

- EPSCoR Campus Connectivity (C2) grant was awarded to:
  - Underwrite SEGP membership for 2 years
  - Support an Internet 2 “evangelist” (that would be Patrick)
  - Connect Vermont State Colleges through UVM for I2 service and in support of EPSCoR collaborative teaching/research projects



# A New Era in Collaborative Education

CONNECT.



INTEGRATE.



EMPOWER.



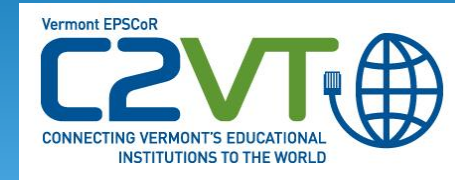
# CONNECT.



## Internet2 Network Infrastructure Topology

March 2013





# CONNECT.

- National Internet2 SEGP Network
  - 42 States, 65,000 Institutions
- Vermont's SEGP Network
  - Leverages...
    - Over \$160 million in new federal fiber investments
    - Relationships with VT higher education and ISPs
  - To create...
    - A state-wide Research and Education Network



## Our Offer to ISPs

- We'll make a 1G port available to ISPs for BGP peering – no cost either side
- Offer is to ISPs, in support of education – UVM CIO contacts ISPs, AoE and EPSCoR contact K-12's
- We'll pass I2 traffic over our pipe to the NoX (but not Commodity Peering – no competition with commercial providers, remember?)
- This arrangement supplements the ISPs external connections outside the state but does not replace them



## Other Peers

- Same offer to higher ed
- Same offer to State Library and local libraries (again, no network, but they're trying to build one – we may be able to foster that)
- Museums



# INTEGRATE.

- Strategies
  - Build trust in the educator and technology integrator community
  - Adapt existing networks and resources (i.e. VLC)
  - Add broadband experiences to existing programs
  - Build an effective collaboration with Agency of Education (Peter) to explore ways to encourage adoption by the K-12 community



# AoE and Vermont STEM

- AoE building implementation plan for STEM program support for local K-12 schools. What leads to success?
  - Focus on younger students and problem solving/critical thinking skill building.
  - Connection to STEM and this connection with I2: beginning conversations about the ways schools can interact on network

# EMPOWER.

- Building a Community
  - Outreach to build awareness
  - Connecting Vermont to existing nationwide communities
  - Supporting local and regional leaders
  - Utilizing online tools to encourage collaboration
    - Vermont Education Exchange
    - Internet2 K20 Initiative's Muse



# AoE and Vermont STEM

- Currently building more connections with school and regional community to alert them to the I2 connections that their ISP's are now connecting to the I2 network
- Presentations for this Spring
- TechJam (Burlington, Fall 2013) and its role in fostering careers, showcasing for VT employers a commitment from AOE on STEM/connectivity to national projects via I2.

# Current Progress – K-12

- 4 ISPs representing 15% of school districts are connected
- 2 ISPs representing another 27% of school districts are preparing to connect
- 1 ISP representing another 5% is interested and discussing internally
- 2 ISPs representing another 33% said “no” but are still discussing
- So, within about 6 months, we’ll likely have ISPs representing 50% of Vermont schools connected into a common interconnect

# Current Progress – Others

- Fletcher-Allen Health Care
- Middlebury
- Vermont State Colleges (22 campuses)
- St. Michael's
- Champlain College
- Green Mountain College
- State Libraries

# Network Impact

- UVM runs 1G pipe to I2, uses about 500Mbps at peak
- Middlebury uses about 20Mbps at peak
- Current K-12 aggregate peaks at about 1Mbps at most
- Expect to have bandwidth capacity when 10G pipe is lit this summer
- Will increase service capacity as needed ... may need to share costs, but remains to be seen – will depend on how much service is offloaded from ISPs

# Future / Issues

- Sharing service costs?
- What is the value to K-12's of I2 access?
  - So far, they haven't seen much: We need to help facilitate collaboration among K-12 nationally (internationally), package programs for easy digestion by K-12's, and promote intra-state collaboration within Vermont
- I2 can help, and we can help I2: K-12 STEM education is a national crisis





# Summary

- We leveraged the private sector rather than compete with them (we were lucky to find good partners!)
- Kept in touch with colleagues, engaged in regional planning, engaged in Internet2
- Networking: it's not just about cables and optronics – it's about the people, too.



# Themes

“Chance favors the prepared mind” – Louis Pasteur, University of Lille, December 1854.

“If you build it, (he) they will come” – Field of Dreams, 1989