October 11th 2011 – USATLAS Facilities Meeting
Shawn McKee, University of Michigan
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DYNES Project Updates

Agenda

- Project Management Details
- Demos
- LHCONE/NDDI
- Next Steps

DYNES Phase 1 Project Schedule

- Phase 1: Site Selection and Planning (Sep-Dec 2010)
  - Applications Due: December 15, 2010
  - Application Reviews: December 15 2010-January 31 2011
  - Participant Selection Announcement: February 1, 2011
- 35 Were Accepted in 2 categories
  - 8 Regional Networks
  - 27 Site Networks

DYNES Phase 2 Project Schedule

- Phase 2: Initial Development and Deployment (Jan 1-Jun 30, 2011)
  - Initial Site Deployment Complete - February 28, 2011
    - Caltech, Vanderbilt, University of Michigan, MAX, USLHCnet
  - Initial Site Systems Testing and Evaluation complete: April 29, 2011
  - Longer term testing (Through July)
    - Evaluating move to CentOS 6
    - New functionality in core software:
      - OSCARS 6
      - perfSONAR 3.2.1
      - FDT Updates

DYNES Phase 3 Project Schedule

- Phase 3: Scale Up to Full-scale System Development (14 months) (July 1, 2011-August 31, 2012)
  - Phase 3-Group A Deployment (9 Sites): March 1-Fall, 2011
  - Phase 3-Group B Deployment (13 Sites): July 31-Late Fall, 2011
  - Phase 3-Group C Deployment (11 Sites): July 18 2011- Winter, 2012
  - Full-scale System Development, Testing, and Evaluation (Winter 2012-August 31, 2012)

- Phase 4: Full-Scale Integration At-Scale; Transition to Routine O&M (12 months) (September 1, 2012-August 31, 2013)
  - DYNES will be operated, tested, integrated and optimized at scale, transitioning to routine operations and maintenance as soon as this phase is completed

Phase 3 – Group A Schedule Details

- Phase 3-Group A Deployment (10 Sites) (March 1-Late Fall 2011)
  - Teleconferences and Planning with individual participants: March 28-May 2, 2011
    - Completed initial telecons with all Group A members
    - Subsequent interaction during installation
  - Finalize Phase 3-Group A Equipment Order List: June, 2011
  - Place Equipment Order: July, 2011
  - Receive DYNES Equipment: Week of July 11th, 2011
  - Configure and Test Individual Participant Configurations: Late July 2011
  - Ship Phase 3-Group A Equipment to sites: Late July 2011
  - Deploy and Test at Phase 3-Group A Sites: Through July 31, 2011
  - Site Level configurations: Through Fall 2011 (delays due to local factors for the most part)

Phase 3 Group A Members

- AMPATH
- Mid-Atlantic Crossroads (MAX)
  - The Johns Hopkins University (JHU)
- Mid-Atlantic Gigapop in Philadelphia for Internet2 (MAGPI)*
  - Rutgers (via NJEdge)
  - University of Delaware
- Southern Crossroads (SOX)
  - Vanderbilt University
- CENIC*
  - California Institute of Technology (Caltech)
- MREN*
  - University of Michigan (via MERIT and CIC OmniPoP)

- Note: USLHCNet will also be connected to DYNES Instrument via a peering relationship with DYNES

* temp configuration of static VLANs until future group

Phase 3 – Group B Schedule Details

- Phase 3-Group A Deployment (15 Sites) (July 18 2011-Late Fall 2011)
  - Teleconferences and Planning with individual participants: 3rd and 4th Week of July 2011
    - Completed initial telecons with all Group B members
    - Subsequent interaction during installation
  - Finalize Phase 3-Group B Equipment Order List: Sept 2011
  - Place Equipment Order: Late Sept 2011
  - Receive DYNES Equipment: Late Sept – Early Oct 2011
  - Configure and Test Individual Participant Configurations: Oct 2011
  - Ship Phase 3-Group B Equipment to sites: Expected Late Oct 2011
  - Deploy and Test at Phase 3-Group A Sites: Expected Nov 2011
  - Site Level configurations: Expected through Dec 2011

Phase 3 Group B Members

- Mid-Atlantic Gigapop in Philadelphia for Internet2 (MAGPI)
  - University of Pennsylvania
- Metropolitan Research and Education Network (MREN)
  - Indiana University (via I-Light and CIC OmniPoP)
  - University of Wisconsin Madison (via BOREAS and CIC OmniPoP)
  - University of Illinois at Urbana-Champaign (via CIC OmniPoP)
  - The University of Chicago (via CIC OmniPoP)
- Lonestar Education And Research Network (LEARN)
  - Southern Methodist University (SMU)
  - Texas Tech University
  - University of Houston
  - Rice University
  - The University of Texas at Dallas
  - The University of Texas at Arlington
- Florida International University (Connected through FLR)

Phase 3 Group C Members

- Front Range GigaPop (FRGP)
  - University of Colorado Boulder
- Northern Crossroads (NoX)
  - Boston University
  - Harvard University
  - Tufts University
- CENIC**
  - University of California, San Diego
  - University of California, Santa Cruz
- CIC OmniPoP***
  - The University of Iowa (via BOREAS)
- Great Plains Network (GPN)***
  - The University of Oklahoma (via OneNet)
  - The University of Nebraska-Lincoln
- Supplemental Applications
  - RENCI/Duke/MCNC
  - Texas A&M
  - University of Florida
  - Remaining Regional Networks (e.g. GPN/MOREnet have expressed interest, KANRen too)

** deploying own dynamic infrastructure

*** static configuration based

Deployment Next Steps

- Fall 2011
  - Group C Deployment
  - Group A, B, and PI site Testing
- Winter 2011
  - Group A, B, C, and PI site Testing
  - Software upgrades as needed
  - Additional sites come online as funding allows
- 2012 - 2013
  - Robustness and scalability testing
  - Hardware evaluation – determine if refresh is possible/necessary
  - Outreach to other scientific communities
  - Encouraging integration of basic ideas into other software packages (e.g. coordination with other in-progress efforts)

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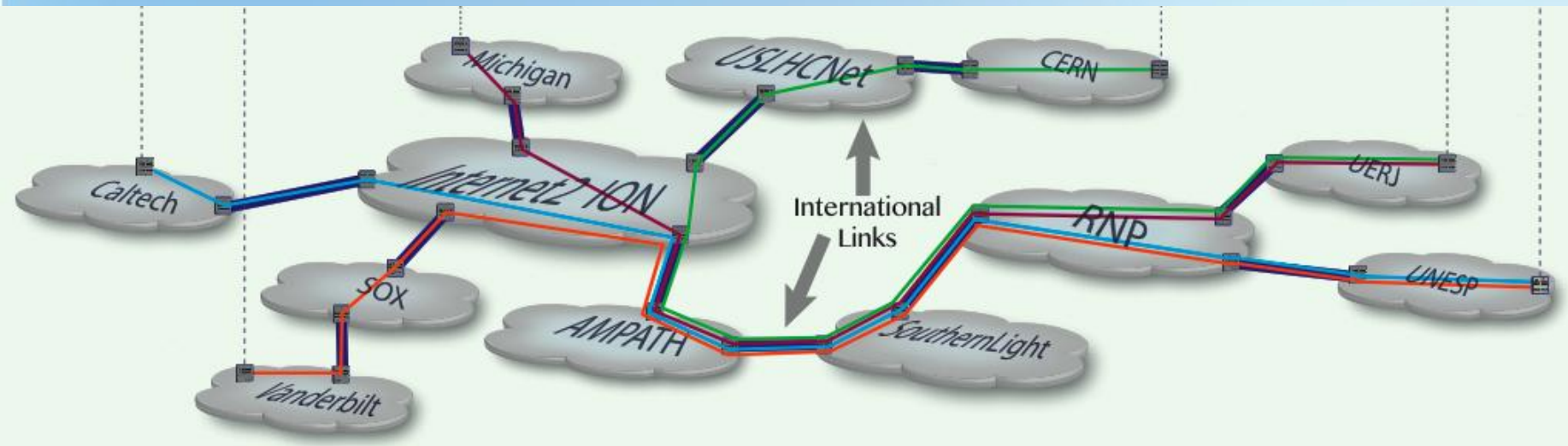
Demonstrations

- DYNES Infrastructure is maturing as we complete deployment groups
- Opportunities to show usefulness of deployment:
  - How it can 'stand alone' for Science and Campus use cases
  - How it can integrate with other funded efforts (e.g. IRNC)
  - How it can peer with other international networks and exchange points
- Examples:
  - GLIF 2011
  - USATLAS Facilities Meeting
  - SC11

GLIF 2011

- September 2011
- Demonstration of end-to-end Dynamic Circuit capabilities
  - International collaborations spanning 3 continents (South America, North America, and Europe)
  - Use of several software packages
    - OSCARS for inter-domain control of Dynamic Circuits
    - perfSONAR-PS for end-to-end Monitoring
    - FDT to facilitate data transfer over IP or circuit networks
  - Science components – collaboration in the LHC VO (ATLAS and CMS)
  - DYNES, IRIS, and DyGIR NSF grants touted

GLIF 2011 - Topology



GLIF 2011 - Participants

USATLAS Facilities Meeting

- October 2011
- Similar topology to GLIF demonstration, emphasis placed on use case for ATLAS (LHC Experiment)
- Important Questions:
  - What benefit does this offer to a large Tier2 (e.g. UMich)?
  - What benefit does this offer to smaller Tier3 (e.g. SMU)?
  - What benefit does the DYNES solution in the US give to national and International (e.g. SPRACE/HEPGrid in Brazil) collaborators?
  - Will dynamic networking solutions become a more popular method for transfer activities if the capacity is available?

SC11

- November 2011
- Components:
  - DYNES Deployments at Group A and Group B sites
  - SC11 Showfloor (Internet2, Caltech, and Vanderbilt Booths – all are 10G connected and feature identical hardware)
  - International locations (CERN, SPRACE, HEPGrid, AutoBAHN enabled Tier1s and Tier2s in Europe)
- Purpose:
  - Show dynamic capabilities on enhanced Internet2 Network
  - Demonstrate International peerings to Europe, South America
  - Show integration of underlying network technology into the existing 'process' of LHC science
  - Integrate with emerging solutions such as NDDI, OS^{3}E, LHCONE

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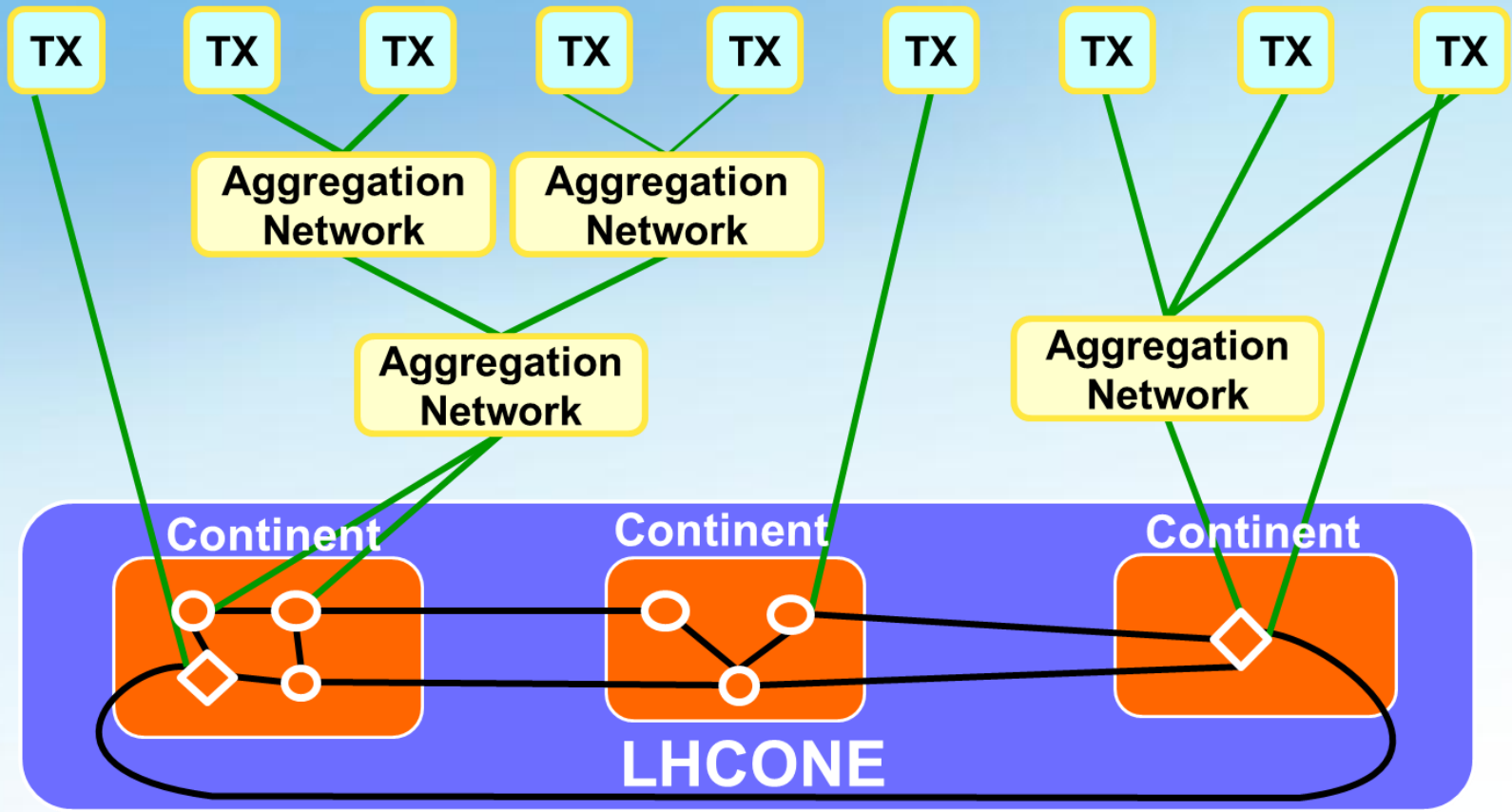
LHCONE and NDDI/OS^{3}E

- LHCONE
  - International effort to enhance networking at LHC facilities
  - LHCOPN connects CERN (T0) and T1 facilities worldwide
  - LHCONE will focus on T2 and T3 connectivity
  - Utilizes R&E networking to accomplish this goal
- NDDI/OS^{3}E
  - In addition to Internet2's "traditional" R&E services, develop a next generation service delivery platform for research and science to:
    - Deliver production layer 2 services that enable new research paradigms at larger scale and with more capacity
    - Enable a global scale sliceable network to support network research
    - Start at 2x10 Gbps, Possibly 1x40 Gbps

LHCONE High-level Architecture



Network Development and Deployment Initiative (NDDI)

Partnership that includes Internet2, Indiana University, & the Clean Slate Program at Stanford as contributing partners. Many global collaborators interested in interconnection and extension

Builds on NSF's support for GENI and Internet2's BTOP-funded backbone upgrade

Seeks to create a software defined advanced-services-capable network substrate to support network and domain research [note, this is a work in progress]

Components of the NDDI Substrate

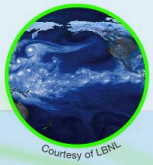
- 30+ high-speed Ethernet switches deployed across the upgraded Internet2 network and interconnected via 10G waves
- A common control plane being developed by IU, Stanford, and Internet2
- Production-level operational support
- Ability to support service layers & research slices

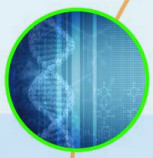
64 x 10G SFP+	1.28 Tbps non-blocking
4 x 40G QSFP+	1 RU

INTERNET 2

Support for Network Research

- NDDI substrate control plane key to supporting network research
  - At-scale, high performance, researcher-defined network forwarding behavior
  - virtual control plane provides the researcher with the network “LEGOs” to build a custom topology employing a researcher-defined forwarding plane
- NDDI substrate will have the capacity and reach to enable large testbeds



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Deployment

NDDI / OS^{3}E Implementation Status

- Deployment
  - NEC G8264 switch selected for initial deployment
  - 4 nodes by Internet2 FMM (e.g. Last Week ☺)
  - 5th node (Seattle) by SC11 (T – 1 Month and counting …)
- Software
  - NOX OpenFlow controller selected for initial implementation
  - Software functional to demo Layer 2 VLAN service (OS^{3}E) over OpenFlow substrate (NDDI) by FMM
  - Software functional to peer with ION (and other IDCs) by SC11
  - Software to peer with SRS OpenFlow demos at SC11
  - Open source software package to be made available in 2012

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Next Steps

- Finish the deployments
  - Still struggling with some of Group B, need to start C
  - Add in others that weren't in the original set
- Harden the “process”
  - Software can use tweaks as we get deployments done
  - Hardware may need refreshing
  - Internet2 ION will be migrating to NDDI/OS^{3}E. More capacity, and using OpenFlow
- Outreach
  - Like minded efforts (e.g. DOE ESCPS)
  - International peers, to increases where we can reach
  - Other “Science” (e.g. traditional, as well as computational science – LSST is being targeted)

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For more information, visit http://www.internet2.edu/dynes

