

SC25 Network Research Exhibition: Demonstration Abstract

Prototype 1.2 Tbps WAN Infrastructure: Architecture, Technology, and Control Systems

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Abstract

Large scale data production within and among science research collaborations and sites continues to increase, a long term trend that continues to accelerate, driven especially by the deployment of new science facilities, including high luminosity research instrumentation and next generation computational science centers. Consequently, the science networking community is planning networking infrastructure that can support services beyond 100Gbps, with one thematic focus on 400 Gbps LANs and WANs (represented also by other NRE demonstrations planned by this consortium). However, this consortium is also investigating capabilities for WAN services beyond 400 Gbps, including those approaching 800 Gbps, 1.2 Tbps, and multi-Tbps WAN and LAN services. This NRE describes the required infrastructure for a prototype 1.2 Tbps WAN. *NB: A companion NRE describes a demonstration of the 1.2 Tbps services that will be supported by this infrastructure.*

Overview

When 100 Gbps WAN/LAN services were initially being anticipated, the science networking community began to develop techniques to effectively utilize that level of capacity. Standard implementations and configurations as commonly used were not able to rise to the level of available network capacity. Similarly, today, the requirements and implications of WAN and LAN services beyond 400 Gbps are being explored, including technologies that potentially will be able to support 800 Gbps, 1.2 Tbps WAN services and multi-Tbps services E2E. (NB: LHC Tier 1 site and some Tier 2 sites are planning for minimal 1 Tbps connections.) These SC25

demonstrations showcase capabilities and technologies that may assist in providing such services by demonstrating prototype 1.2 Tbps WAN transport services from the StarLight International/National Communications Exchange Facility in Chicago to the SC25 venue, 1.2 Tbps from the JBDT Facility in McLean Va. to the SC25 venue, and 2*1.2 Tbps between StarLight and the JBDT Facility at McLean, Virginia, and 1.2 Tbps between the ESnet testbed in Berkeley to the StarLight Exchange.

Goals

With its research partners including the SCinet WAN group, the Ciena research group, the International Center for Advanced Internet Research (iCAIR) at Northwestern University is designing a 1.2 Tbps WAN service among the sites noted. Multiple issues are being investigated to enable to utility of 1.2 Tbps WAN services E2E. One area of investigation is the potential to implement E2E lightpaths for data intensive science across multidomain networks, avoiding as much as possible (and in some cases totally) L3 devices.

1. At the edges of the WAN paths, this project will implement multiple optimized Gen5 Data Transfer Nodes (400 Gbps DTNs, minimal 3 at each site--the potential for G6 is being explored to enable 800 G on a single DTN).
2. These DTNs have been implemented with 400 Gbps smart NICs, high performance optical transport interfaces. Currently, 800 Gbps smart NICs are being investigated by this consortium.

3. These DTNs will be connected to deep buffer 400 Gbps L2 switches. This consortium is researching the evolution of 800 Gbps switches.
4. In addition, these demonstrations will showcase the performance and flexibility of WAN open line systems and open transponder platforms
5. Other technologies being explored are high performance optical transport switches, long range transceivers (including ZR/ZR+ transceivers, with various formats being investigated including those based on Indium Phosphide that do not require EDFAs or tunable optical filters and silicon photonics), and various types of breakout cables.
6. This infrastructure incorporates a mobile FABRIC node that will be implemented at the SC25 venue.

optics, developing additional monitoring and analytics using AI techniques etc.

Resources

Required resources from SCinet WAN are 1.2 Tbps WAN transport services from the StarLight International/National Communications Exchange Facility in Chicago to the SC25 venue, 1.2 Tbps from the JB DT Facility in McLean Va. to the SC25 venue, and 2*1.2 Tbps between StarLight and the JB DT Facility at Mclean (e.g., 3*400 Gbps on FABRIC and 3*400 Gbps on the CENI testbed).

Involved Parties

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- StarLight International/National Communications Exchange Facility and Consortium
- Metropolitan Research and Education Network (MREN)
- SC25 SCinet

Impacts

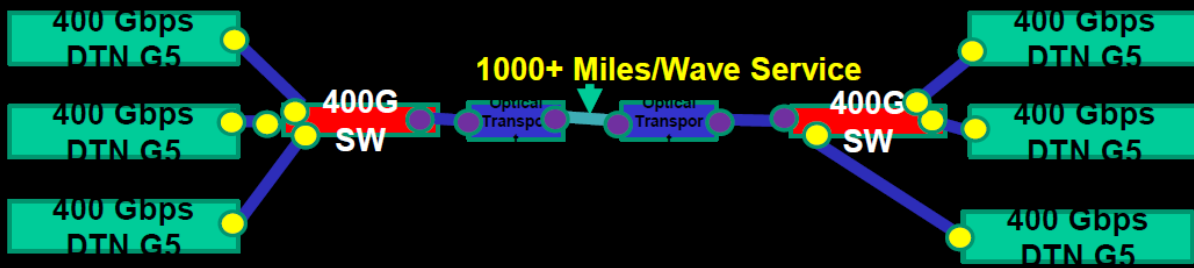
- 1) This series of research projects is directed at developing resources to meet the demands of increasingly large capacity WAN transport for large scale data intensive science. This NRE is focused on WAN infrastructure that supports 1.2 Tbps services. (ref related NRE on 1.2 Tbps WAN services)
- 2) SCinet supports capabilities that enable innovative 1.2 Tbps WAN techniques to be demonstrated at a national scale.
- 3) Multiple next steps include migration to Gen6 servers, 800 G smart NICs, extending capabilities to international sites, integrating new protocols, integrating ZR/ZR+ coherent

Below is an abstract of the prototype 1.2 Tbps infrastructure architecture

1.2 Tbps WAN Service Prototype for Data Intensive Science

StarLight International/National
Communications Exchange Facility, Chicago, IL

Joint Big Data Testbed
McLean, Va



● LR4 Transceiver + Smart NIC, e.g., CX7

● Transceivers