# SC23 Network Research Exhibition: Demonstration Abstract

# Toward 1.2 Tbps Services WAN Services: Architecture, Technology and Control Systems

Joe Mambretti, Jim Chen, Fei Yeh, International Center for Advanced Internet Research - Northwestern University

j-mambretti, jim-chen, fyeh@northwestern.edu, Rod Wilson, Ciena, rwilson@ciena.com, Marc Lyonnais, Ciena, mlyonnai@ciena.com, Scott Kohlert, Ciena, skohlert@ciena.com, Gaurauvdeep Shami, Ciena, gshami@ciena.com

**Abstract**

Large scale data production within and among science research collaborations and sites continues to increase, a long term trend that continues to accelerate, especially because of the deployment of new science instrumentation, including planned high luminosity research infrastructure. Consequently, the science networking community has begun to prepare for service paths beyond 100Gbps, with a thematic focus on 400 Gbps LANs and WANs (represented in other NRE demonstrations by this consortium). However, this consortium is also investigating capabilities for WAN services beyond 400 Gbps, including those approaching 800 Gbps, 1 Tbps, and multi-Tbps WAN and LAN services.

**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 1.2 Tbps WAN services and multi- Tbps services E2E. (NB: LHC Tier 1 site are planning for minimal 1 Tbps connections.) These SC23 demonstrations showcase capabilities and technologies that may assist in providing such services using 1.2 Tbps WAN transport services from the StarLight International/National Communications Exchange Facility in Chicago to the SC23 venue, 800 Gbps from the JBDT Facility in McLean Va. to the SC23 venue, and 1.2 Tbps between StarLight and the JBDT Facility at McLean, Virginia.

**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 Gbps WAN services E2E. One area of investigation is the potential to implement E2E lightpaths across multidomain networks, avoiding as much as possible (or totally) L3 devices.

1. At all ends of the paths, this project will implement high performance optical transport and L2 switches.
2. Those switches will be connected to optimized Data Transfer Nodes (DTNs), e.g., 400 Gbps DTNs.
3. These demonstrations will leverage experimental research into the optimal design, configuration, components, and integration technologies for DTNs, including 100, 200 and 400 Gbps NICs, NVMe over Fabric, and techniques for kernel bypass using zero-copy for memory and disk copy to avoid bottlenecks in large scale data transfer over 1.2 Tbps WAN and optimal affinity bindings for NUMA architecture for higher resource utilization
4. These demonstrations will also showcase middleware required to orchestrate

infrastructure resources for reliable, optimized high-speed network data transfers.

5. These demonstrations will also show measurement techniques for real-time monitoring, benchmarking and evaluation.
6. Other technologies being explored are optical transport switches, transceivers, and breakout cables.

**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 SC23 venue, capacity approaching 1.2 Tbps from the JBDT Facility in McLean Va. to the SC23 venue, and 1.2 Tbps between StarLight and the JBDT Facility at Mclean.

**Involved Parties**

- Joe Mambretti, iCAIR, jmambretti@northwestern.edu
- Jim Chen, iCAIR, jim-chen@northwestern.edu
- Fei Yeh, iCAIR,fyeh@northwestern.edu
- Rod Wilson, Ciena, rwilson@ciena.com
- Marc Lyonnais, Ciena, mlyonnai@ciena.com
- Scott Kohlert, Ciena, skohlert@ciena.com
- Gaurauvdeep Shami, Ciena, gshami@ciena.com
- StarLight International/National Communications Exchange Facility and Consortium
- Metropolitan Research and Education Network (MREN)
- SC23 SCinet