SC26 Network Research Exhibition: Demonstration Abstract

Software Defined Exchange (SDX) Multi-Services for Petascale Science

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Abstract

With multiple national and international partners, iCAIR is designing, developing, implementing, and operating an international Software Defined Exchange (SDX) at the StarLight International/National Communications Exchange Facility, which integrates multiple services designed for large scale global data intensive science. The StarLight SDX is based on a flexible, scalable, programmable platform. This SDX, which is managed by a multi-organizational consortium, has been proven able to integrate many different multi-domain services and to ensure services isolation, e.g, to segment large capacity science flows from other flows, and to segment research testbed flows from production flows, including segments for connecting quantum networking testbeds, which will be supported at SC26. Services include those based on Gen5 400 Gbps Data Transfer Nodes (DTNs) for Wide Area Networks (WANs), including trans-oceanic WANs. Currently, a key focus is scaling to multi-400 Gbps, 800 Gbps, 1.2 Tbps, 1.6 Tbps WAN and LAN E2E technologies that provide high performance transport services for exascale science, controlled using Software Defined Networking (SDN) and AI techniques. Planning has begun on evaluating Gen6 DTNs and 800 Gbps switches. SDN enabled DTN services are being designed specifically to optimize capabilities for supporting large scale, high capacity, high performance, reliable, high quality, sustained individual data streams for science research.

Goals

1 As an extension of an initiative initially funded by the National Science Foundation's (NSF) International Research Network Connections (IRNC) program, iCAIR is designing, creating and implementing as a prototype, and experimenting with an international Software Defined Exchange (SDX) at the StarLight International/National Communications Exchange Facility (StarLight), which provides WAN services that enable Software Defined Networking (SDN) techniques to support data intensive science.

2 This SDX has been optimized specifically for supporting services for high capacity individual data streams for science research over many thousands of miles supported by multi-domain networks.

3 The integration of these services with DTN based services using SDN has also been designed to ensure high performance for those streams and to support highly reliable services for long duration data flows.

4 End-To-End (E2E) high performance, reliable data transfer for large scale individual data streams has been a major challenge for science community for many years.

5 Resolving this issue requires addressing and optimizing multiple components in an E2E path, processing pipelines, high performance protocols, kernel tuning, OS bypass, path architecture, buffers, memory supporting WAN transport, and many other individual components.

6 iCAIR has developed and is experimenting with a prototype model for an integrated SDN/SDX/DTN design, which will be showcased with multiple enhancements, including AI techniques, at SC26.

7 Enhancements include additional capabilities for using AI to dynamically adjust to real time conditions and for slicing resources across the exchange to segment different science communities while using a common infrastructure.

8 This initiative is also developing capabilities for interoperability among other national and international open SDXs.

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, including remote access to large scale instrumentation. This NRE is focused specifically on open

communications exchange facilities (including those supporting multi-tbps WANs) based on Software Defined Networking techniques.

2) SCinet supports capabilities that enable innovative inter open exchange connections techniques to be demonstrated at a global scale.
3) Multiple next steps include developing additional interconnection, orchestration, optimization, monitoring and analytics using AI techniques.

Resources

Required resources from SCinet are use of some portion of 1.2 Tbps path SCinet has been asked to provision from the StarLight facility in Chicago to the StarLight booth on the SC26 showfloor and from StarLight to the JBDT Facility in McLean Virginia. The AutoGOLE/SENSE and NA REX infrastructure will also be used. Ref: NRI 103.

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- AutoGOLE/SENSE consortium
- NA REX

