SC26 Network Research Exhibition: Demonstration Preliminary Abstract

Network-Awareness-Based, Application-Centric SDX Automation Technology

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Abstract

KREONET (Korea Research Environment Open Network) operates as a backbone network with a minimum of 200 Gbps to a maximum of 4.2 Tbps per-link capacity, anchored by 17 regional network centers nationwide covering 200 R&E member institutions. NDeX is a dedicated infrastructure that interconnects supercomputers, AI data centers, and private/public cloud data centers at high speed, and is also directly interconnected with KREONET. Researchers can access data centers at high speed through KREONET-NDeX.

KREONET has developed a Software-Defined eXchange (SDX) technology to provide researchers with application-centric SDX automation technology through network awareness. Rather than relying on conventional BGP-based network path policy configuration, the NDeX-SDX platform collects network data including packet loss rate, per-port utilization, and BGP information (via SNMP, sFlow, and BGP) and upon forwarding this data to the Root Server, gains awareness of per-port conditions across the SDX network. Based on this awareness, the platform automatically generates optimal network path policies and triggers automatic network slicing, providing a flexible network operation environment through Application-Specific Peering technology.

The demonstration consists of two scenarios. In the first demo, the SDX network connected over a 100 Gbps link establishes a network connection with StarLight in the United States. Scientific data held by KREONET member institutions needs to be selectively routed to different destinations based on the nature of the data and its intended use. To address this, the demonstration showcases Application-Specific Peering technology, in which specific data is forwarded to the Daejeon DTN (Data Transfer Node) server, while other data is branched and transmitted to the U.S. DTN server.
The second demo utilizes KREONET and the NDeX network to connect NDeX with StarLight in the United States over a 400 Gbps link, demonstrating bandwidth utilization through data transfers between DTN servers in Korea and the U.S. The DTN node of the Korea Astronomy and Space Science Institute (KASI) in Daejeon, Korea, is connected to NDEX at 400 Gbps, enabling the transfer of LSST data between Korea and the United States.
Through both demonstrations, the NDeX-SDX platform implemented as a web interface provides each functional capability. The demonstrations validate the technology through the platform's network control features, visualize real-time SDX network topology changes in response to control actions, and confirm data transfer performance over the 400 Gbps Korea-U.S. network.

Resources

For this demonstration, the Korean network connection links the KREONET international network and the NDeX network over a 400 Gbps link, and connects the NDeX network to the SDX network over a 100 Gbps link. The Korea-U.S. network connection is established through the KREONET international network, linking to StarLight in Chicago. Application-Specific Peering technology is also validated utilizing

the SDX infrastructure. Additionally, 400G DTN servers are deployed at Daejeon and Chicago StarLight. Figure 1 illustrates the overall network configuration.

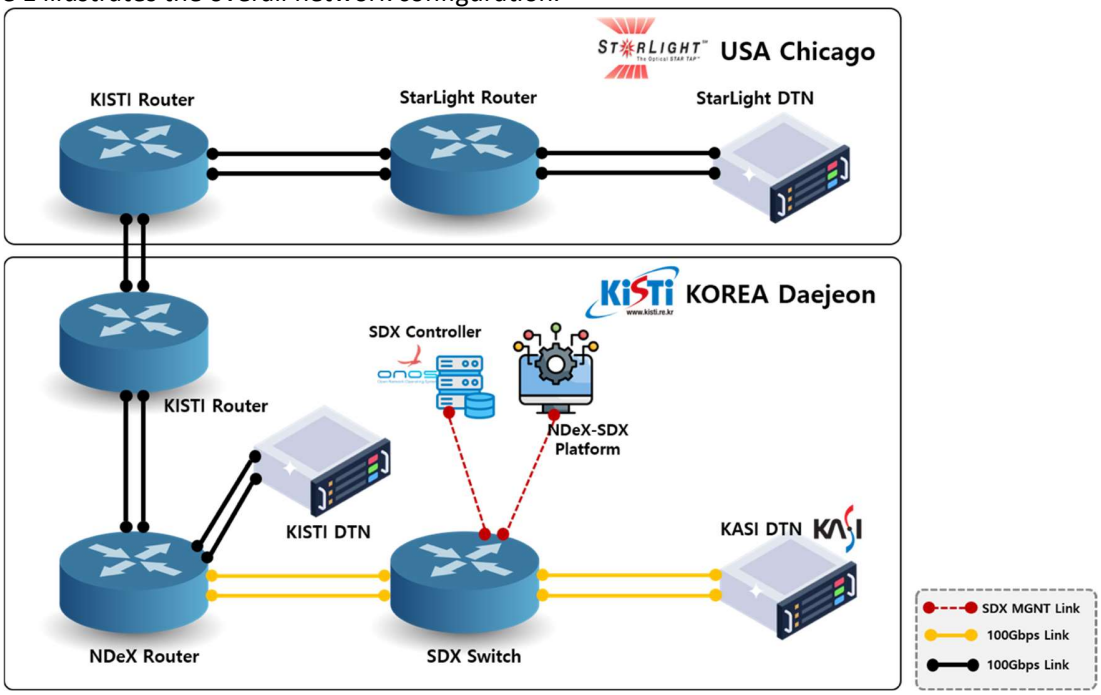


Figure 1. Simplified Overall Network setup

Impacts

This demonstration aims to show how the NDeX-SDX platform, leveraging the NDeX infrastructure, dynamically provides each connected network with the optimal path on a per-application basis. The demonstration validates that the solution is viable in a real Korea-U.S. network environment. The services and features to be demonstrated are as follows:

- Dynamic detection and automated slicing (QoS / Security) of user-requested NDeX network resources
- Dynamic per-application SDX network path reconfiguration based on user requirements
- Real-time SDX network topology visualization
- Data transfer performance measurement utilizing the Korea-U.S. NDeX 400 Gbps network

By measuring and validating large-scale scientific data transfer performance between Korea and the U.S. using the NDeX 400 Gbps high-speed network infrastructure, this demonstration confirms the feasibility and stability of data distribution in an international research collaboration environment. Quantitative performance metrics including transfer speed, latency, and throughput compared against existing networks are obtained, and the effectiveness of the high-bandwidth research network-based data exchange framework is substantiated.

By applying Application-Specific Peering technology to scientific data held by KREONET member institutions, a configuration is realized that enables selective, branched forwarding to either the Daejeon DTN server or the U.S. DTN server, depending on the intended use of the data and the requirements of the collaborating institutions. Rather than relying on a single network path, this configuration allows the

optimal transfer path to be dynamically designated according to data characteristics, thereby simultaneously enhancing both the flexibility and efficiency of data distribution among domestic and international research institutions.
The NDeX-SDX platform showcased in this demonstration directly contributes to the advancement of the Global Research Platform (GRP), an international scientific collaboration dedicated to building next-generation distributed cyberinfrastructure for data-intensive research over 100/400Gbps inter-continental research network.

Involved Parties

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