SC26 Network Research Exhibition: Demonstration Abstract

Smart Network Control over Geographic Areas

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Abstract

To investigate the programmable network technology over large-scale topology, we integrate P4 switching and computing resources of participating parties through several domestic and international circuits. In order to implement smart network control, we exploit Intent-Based Networking (IBN) technology which translates high-level business objectives into actionable network policies. Using natural language processing and semantic reasoning, the IBN interprets user intent (from formal policy languages to natural language), resolves ambiguities, handles conflicts, and decomposes complex intents into atomic operations mappable to specific configurations and routing decisions.

We will demonstrate practical feasibility of multi-domain smart network control using IBN through international collaboration, contributing both academic knowledge and practical evidence for next-generation network infrastructures.

Goals

In this NRE demonstration, we will perform smart network control over participating parties over geographical areas with the following challenges:

(1) Interconnecting of heterogeneous P4 switches, including Tofino switch, SmartNIC, and software BMv2.
(2) Controlling large-scale network mixed of 10Gbps and 100Gbps circuits
(3) Using IBN to translate user requests into network configurations and deploy the commands.

Demonstration will be made by ping results or data/stream transmission from several sources to SC26 venue through SCInet. Commands will be given through dialogue Interface of IBN to set up suitable connection. In the future, we could make the AI-enhanced decisions from the monitored network states. We could also perform the source routing with SRv6 implemented with P4 language for better software-defined granularity.

Impacts

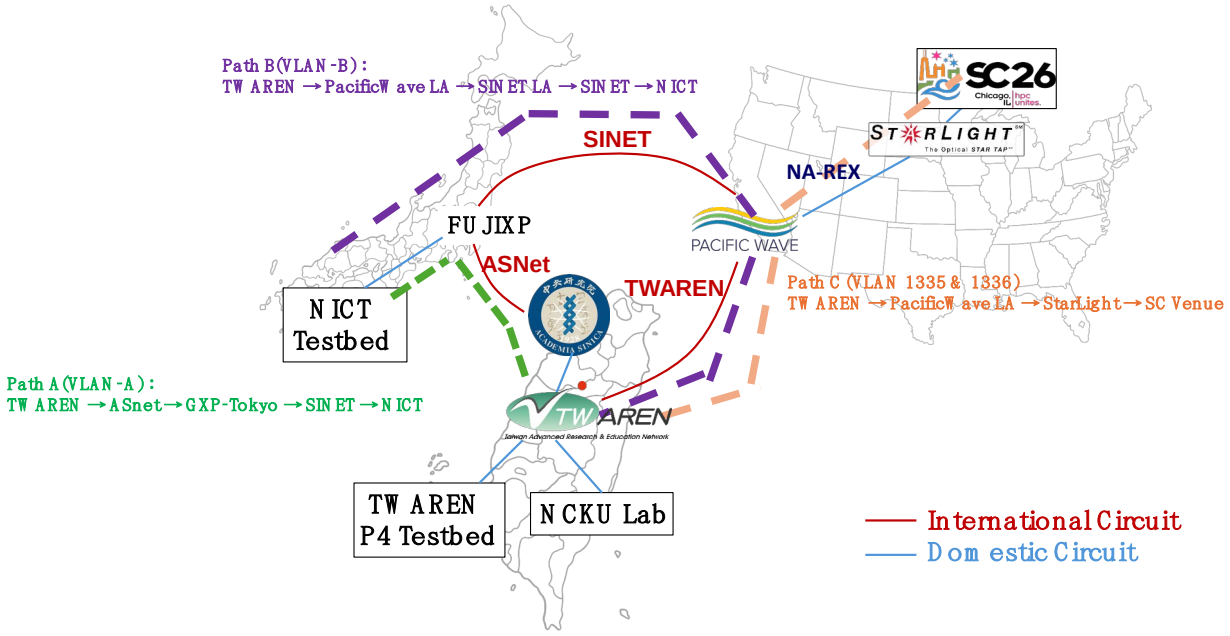
Through this demonstration, we exhibit the possibility of smart network control by incorporating Intent-Based Networking technology. With TWAREN 100G international circuits and support from NRENs and SCInet, dynamic circuits are made from several sources to the venue. This research not only enhances availability for network operators but also creates broader impacts by aligning network control with strategic goals.

Resources

(1) Programmable switch Testbed resources among participating parties, including Tofino P4 switches, SmartNICs, servers and VMs.
(2) Interconnection of the testbeds at Internet exchange points, including StarLight, FUJIXP, and PacificWave.
(3) Circuits from TWAREN, ASCC, NII, and NA-REX bring the Testbeds resources to the Internet exchange points.

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Demonstration Topology



Intent-Based Networking User Interface