In-Band Network Telemetry @ AmLight

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Abstract

The AmLight network uses a hybrid network strategy that combines the use of optical spectrum and leased capacity to build a reliable, leading-edge network infrastructure for research and education. AmLight supports high-performance network connectivity required by international science and engineering research and education collaborations involving the National Science Foundation (NSF) research community, with South America, the Caribbean and Africa.

AmLight has implemented a flexible Software-Defined Networking (SDN) fabric to support network experimentation, flexible forwarding pipelines, and the deployment of new network functions. AmLight offers the academic community 630G of upstream bandwidth to the U.S., dynamic provisioning, network programmability, network telemetry, integration with academic distributed orchestrators, and 100G DTNs.

The goal of this demo is to showcase the benefits and challenges of deploying In-band Network Telemetry (INT) in a long-haul production network. The INT solution was built leveraging off-the-shelf P4 white box switches with the Barefoot Tofino chip, NoviFlow NoviWare Network Operating System, and a telemetry data gathering solution developed by FIU called INT Collector. The INT switches deployed at AmLight have 32x100G ports, support P4 and flexible forwarding pipelines, and were expanded to support INT for TCP and UDP flows.

NoviFlow collaborated with the AmLight engineering team to define the INT use case and application (e.g., real-time monitoring). The objective of INT is to guarantee that the AmLight SDN network can deliver real-time troubleshooting and fault isolation activities to better support science communities with complex network requirements and real-time needs.

Goals

AmLight has already incorporated INT in its troubleshooting and monitoring toolkit with a few INT-switches in production since the beginning of 2021, generating hundreds of thousands of telemetry reports per second. The INT solution has supported AmLight's network engineering team to identify under-provisioned buffers, microbursts, evaluating perfSonar test results, as well as running packet tracing to evaluate QoS policies. The goal for this demonstration is to share with the academic community how beneficial INT can be to support network monitoring and performance evaluation, profile the network utilization at a per-packet level, evaluate the QoS policies implementation, and troubleshooting packet drops and jitter affecting science flows. All of this can be accomplished in real-time. During the demo, we plan to present the challenges, the implementation, the lessons learned, and opportunities for collaboration.

Resources

This NRE demonstration will be conducted using resources of the collaborating domains, see Involved Parties. Used resources will involve:

- AmLight 100G links
- AmLight INT switches
- AmLight SDN orchestrator
- Data Transfer Nodes (DTNs)

This NRE proposal submission will not rely on any local SC21 infrastructure.

Involved Parties

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