

SC23 Network Research Exhibition: Demonstration Preliminary Abstract

Global P4 Lab

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Abstract

GP4L (Global P4 Lab) is a global overlay network composed of 100G/400G programmable switches from the GNA-G AutoGOLE / SENSE Persistent Multi-Resource Testbed and the GÉANT P4 Lab. It uses SONiC and RARE/FreeRtr, which are full featured open source network operating systems (NOSes) that at the same time implement traditional networking protocols and can be extended to integrate next generation features as an opt-In strategy. GP4L provides the means to implement production oriented feature experimentations and protocols, without impacting the rest of the network.

This showcase will include demonstrations of new deployed sites and interconnections with other testbeds like FABRIC and BRIDGES, Digital Twin capabilities, automated generation of real time world map topology and also support other NREs that are experimenting with at scale advanced/novel networking protocols and use cases, like PolKA (Polynomial Key-based Architecture) a stateless source routing protocol based on arithmetic operations over a polynomial encoded route label, and IPv6 Flow Label Packet Marking initiative from WLCG, called SciTags.

The GP4L Digital Twin capabilities intend to provide a platform to create automated digital copies of its network, consisting of the full topology or a partial slice of devices and links. It runs 1:1 instance of the same NOS instance that is used on GP4L, which can be used for many use cases:

- Realistic training and testing sandbox environments;
- Flexible development environment for new dataplane features;
- Faithful development of control, management and orchestration solutions which require constant validation and integration;
- Multi-vendor integration tests using other commercial and open NOSes

This Digital Twin solution is being developed based on the follow Open Source projects: [Netbox](#), [Netreplica](#), and [Containerlab](#)

Another feature in development is the automated generation of a real time world map dashboard of the network, which will dynamically import the devices and links information and

coordinates from a central inventory system (Source of Truth), keeping it up to date with infrastructure changes without manual intervention. This solution is based on integrations between [GlobalNOC WorldView Panel](#), [Netbox](#), and GP4L network monitoring data.

Additionally, we are also applying the digital twin and world map generation at the RNP backbone to also demonstrate its validity with production environments based on brownfield commercial networks and showcasing their multi-vendor and multi-domain capabilities.

Goals

Demonstrate a global programmable network testbed and its capability to accelerate the development, deployment and adoption of new protocols and management paradigms.

1. Support intercontinental high capacity transfers (100G and over) of next generation protocols, i.e: PolKA
2. Creation of on-demand digital twin of GP4L
3. Automated generation of a real time world map dashboards of GP4L
4. Migration path for innovations developed in GP4L to production environments, i.e: RNP backbone

Resources

Capacity from trans-continental, international and regional networks manually provisioned or through AutoGOLE/SENSE.

P4 devices and DTNs from AutoGOLE/SENSE and GEANT/RARE P4 testbed sites.

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