



# SC20

Atlanta, GA | more  
than hpc.

## SCinet

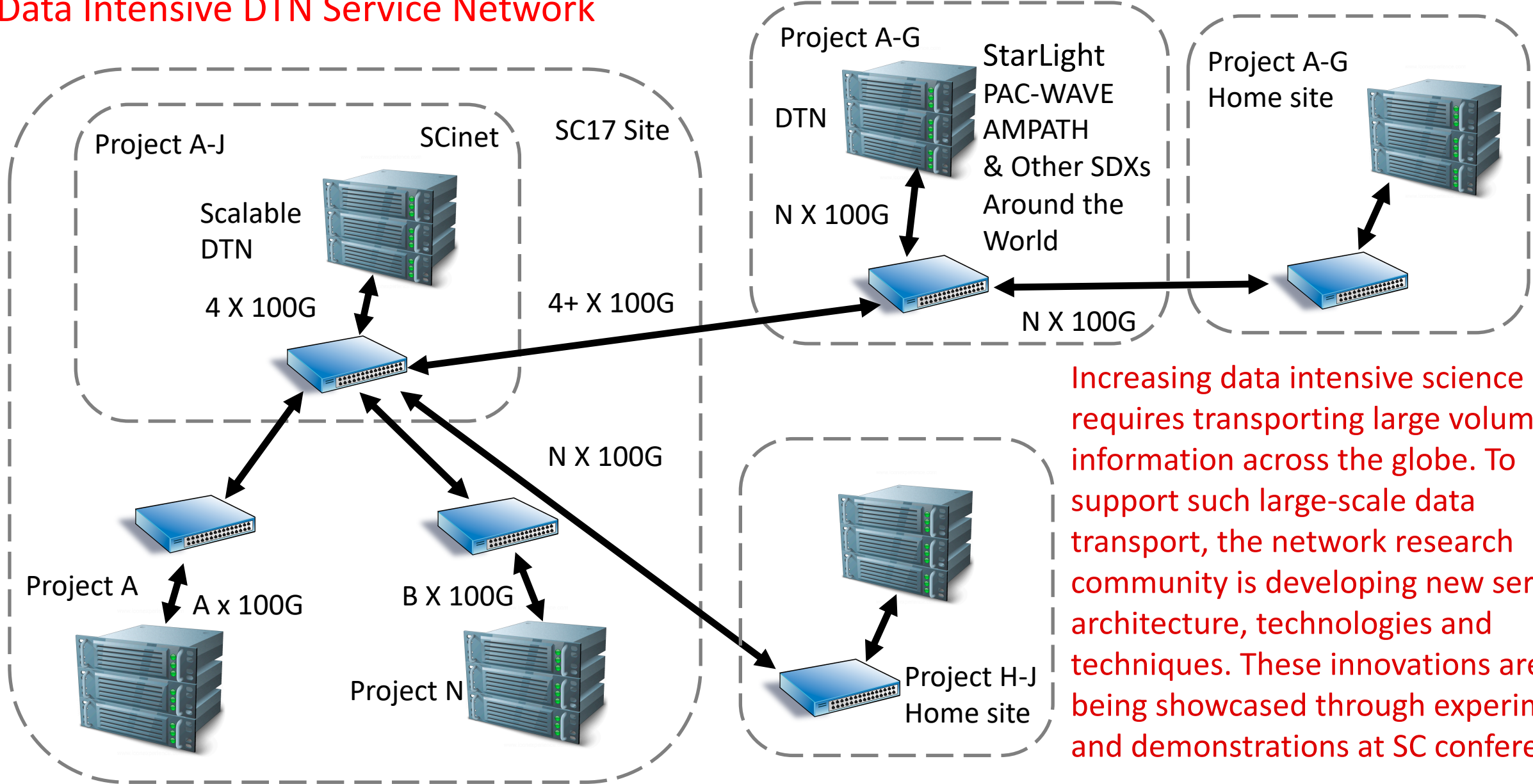
Se-young Yu, Jim Chen  
International Center for Advanced Internet Research  
Northwestern University

SC20 SCinet X-NET Presentation  
Part 2

Nov 13, 2020 •

# SC17 XNET SCinet Data Transfer Nodes(DTNs) Experiment

## Data Intensive DTN Service Network



Increasing data intensive science requires transporting large volumes of information across the globe. To support such large-scale data transport, the network research community is developing new services, architecture, technologies and techniques. These innovations are being showcased through experiments and demonstrations at SC conferences.

## TEAM MEMBERS

- Jim Chen NWU/StarLight
- Gonzalo Rodrigo Apple/LBL
- Ana Giannakou LBL
- Eric Pouyoul ESnet
- Fei Yeh NWU/StarLight
- Se-Young Yu NWU/StarLight
- Xiao(Shawn)Wang NWU/StarLight
- David Wheeler NCSA/UIUC

## Deliverables:

- 1) Develop 100G network fiber/link/vlan/route verification procedures with a portable tester to shorten set up time and improve readiness.
- 2) Prototype user experiment environment isolation & management solutions: Docker/Kubernetes/Rancher/VM, also plan to evaluate other Docker Integration
- 3) Design AI-Enabled DTN use case and workflow prototype

## Related & Supported Paper:

(1)"Analysis of CPU Pinning and Storage Configuration in 100 Gbps Network Data Transfer"  
-Se-Young Yu & others.

(2)"BigData Express: Toward Schedulable, Predictable, and High-performance Data Transfer"  
-Wenji Wu & other

(3)"Flowzilla: A methodology for Detecting Data Transfer Anomalies in Research Networks."  
-Anna Giannakou & others

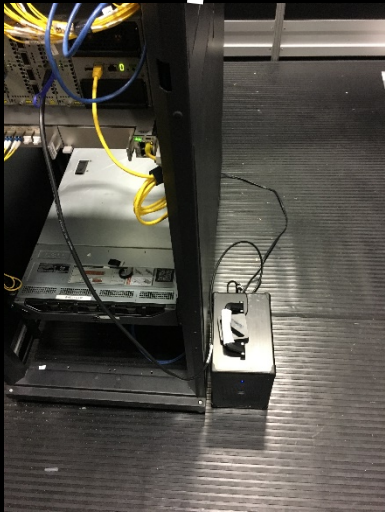
## Issues & Recommendations:

- DTN user cases link to science
- Prepare for 100G network data connectivity end to end tests
- DTN performance tuning over network

# SC18 X-NET Faucet and SCinet DTN Team Collaboration: Faucet Demo with 100G DTN Probe in DNOCs

**DNOC 2644**

**Allied Telesis  
SBx908 GEN2**



**NOC  
FAUCET**

**100 Gbps Flow**



**DNOC 420**

**Cisco  
C9500-32C**



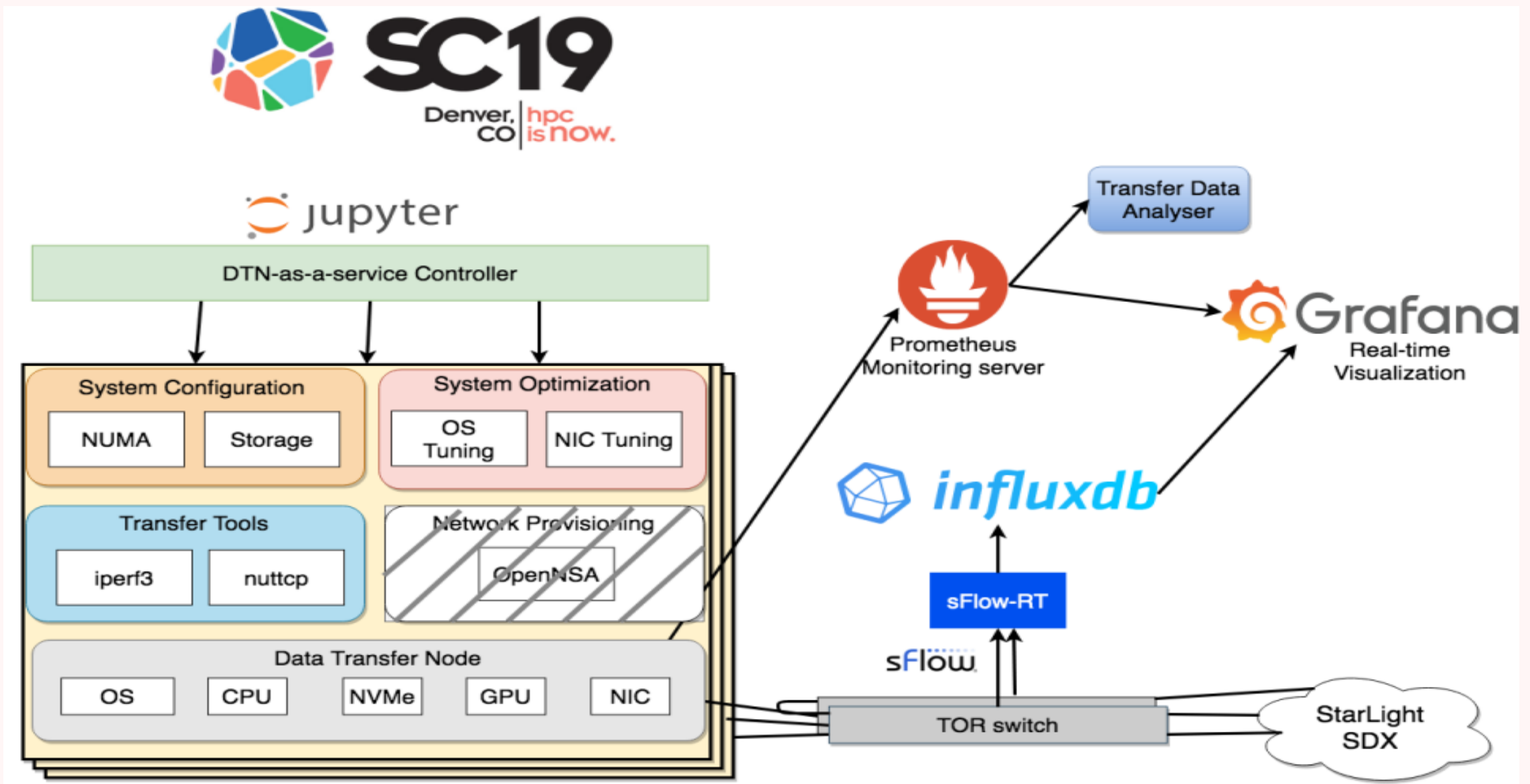
# SC19 X-NET : SCinet DTN-as-a-Service Overview

- SC19 SCinet DTN-as-a-Service is a 3rd year X-NET/NRE project.
- The project provides Data Transfer Node software and hardware platform as prototype services to support SC SCinet community before and during the SC conference.
- The project supports testing, demonstration, experimentation, evaluation and other SC SCinet related activities, especially those for data intensive science.
- SC19 new prototype services: Kubernetes, NVMeoF and 400G LAN/WAN experiments.
- For SC20, SCinet DTN plans to establish as part of DevOps Services
- Please see SC19 INDIS Workshop paper: “SCinet DTN-as-a-Service Framework” for detail.

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- Eric Pouyoul, ESnet, lomax@es.net
- Jim Chen, iCAIR/Northwestern University,

Visit us at Starlight booth 993 for real time monitoring

# SCinet DTN-as-a-Service Software Stack



# SC20 X-NET : Virtual SC20 and SCinet DTN-as-a-Service

- Since Q1 2020, many SC20 projects plan to move ahead with virtual/remote SC20 participation.
- SCinet X-NET lead invited the team for SC20 XNET collaboration.
- SCinet DTN-as-a-Service team supports testing, demonstration, experimentation, evaluation and other SC20 related activities, especially those for data intensive science.
- For SC20, we support XNET experiments, 12+ NREs: ROCE over WAN, P4 experiment/demonstration, SENSE/openNSA integration, Kubernetes Federation, PCI-e Gen4 DTNs and many more technology demonstrations.
- The “bring your own testbed(BYOT) and share with community” model works very well and continue expanding.



# NRE03--Global Research Platform(GRP) Software Distribution

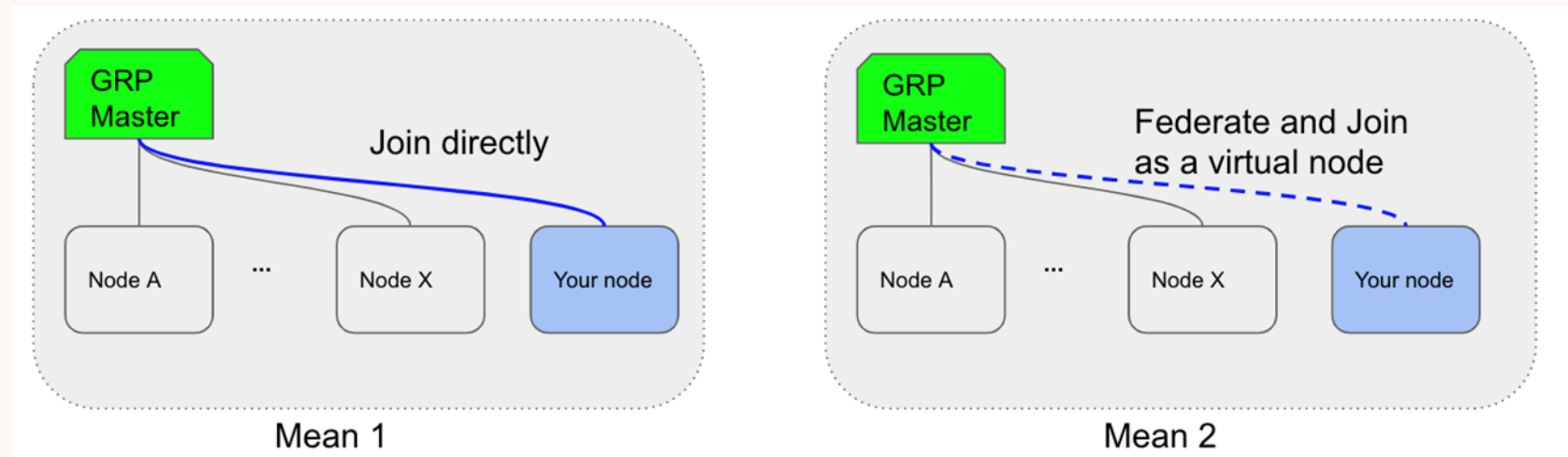
To enable partners to participate in Global Research Platform, a set of software stack is designed and distributed to participating systems for GRP.

For Providers:

- Kubernetes
  1. GRP-hosted: Participate your node in GRP directly
  2. Local-hosted(Federation): Create your own k8s cluster and federate with GRP
  3. NSI Network Control Automation(in progress)

For Users:

- DTN-as-a-Service
- International P4 Experimental Networks
- SAGE 2/3



# NRE11-GRP Service: Research Platforms Federation Demonstration **SCinet**

Goal: Secure multi-domain resource sharing cross regional, national and international research platforms

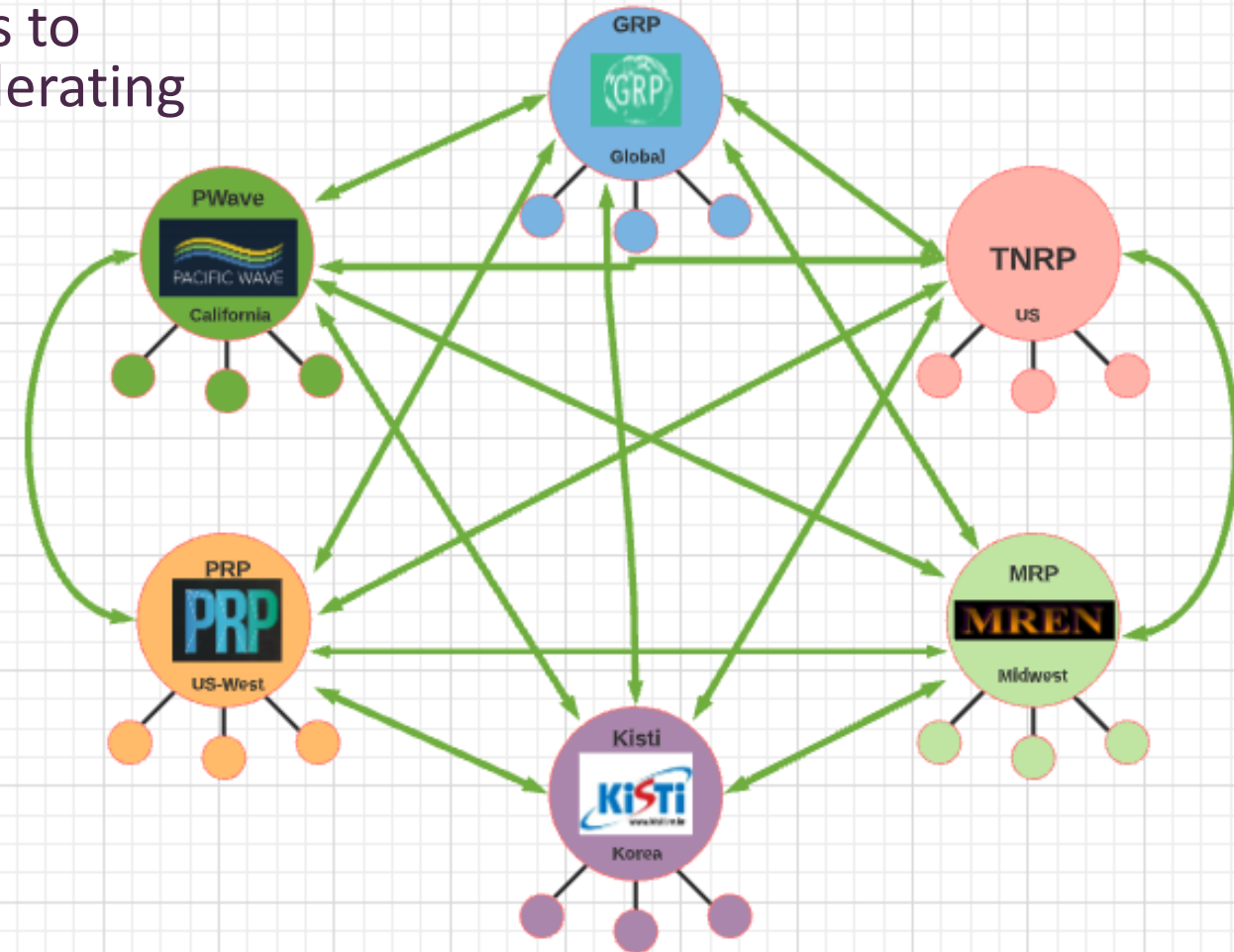
Solution: Admiralty. The software enables users to schedule workloads in a different cluster by federating the source and target clusters.

Participants:

- Global Research Platform(GRP)
- Pacific Research Platform(PRP)
- MREN Research platform(MRP)

MREN:Metropolitan Research and Education Network

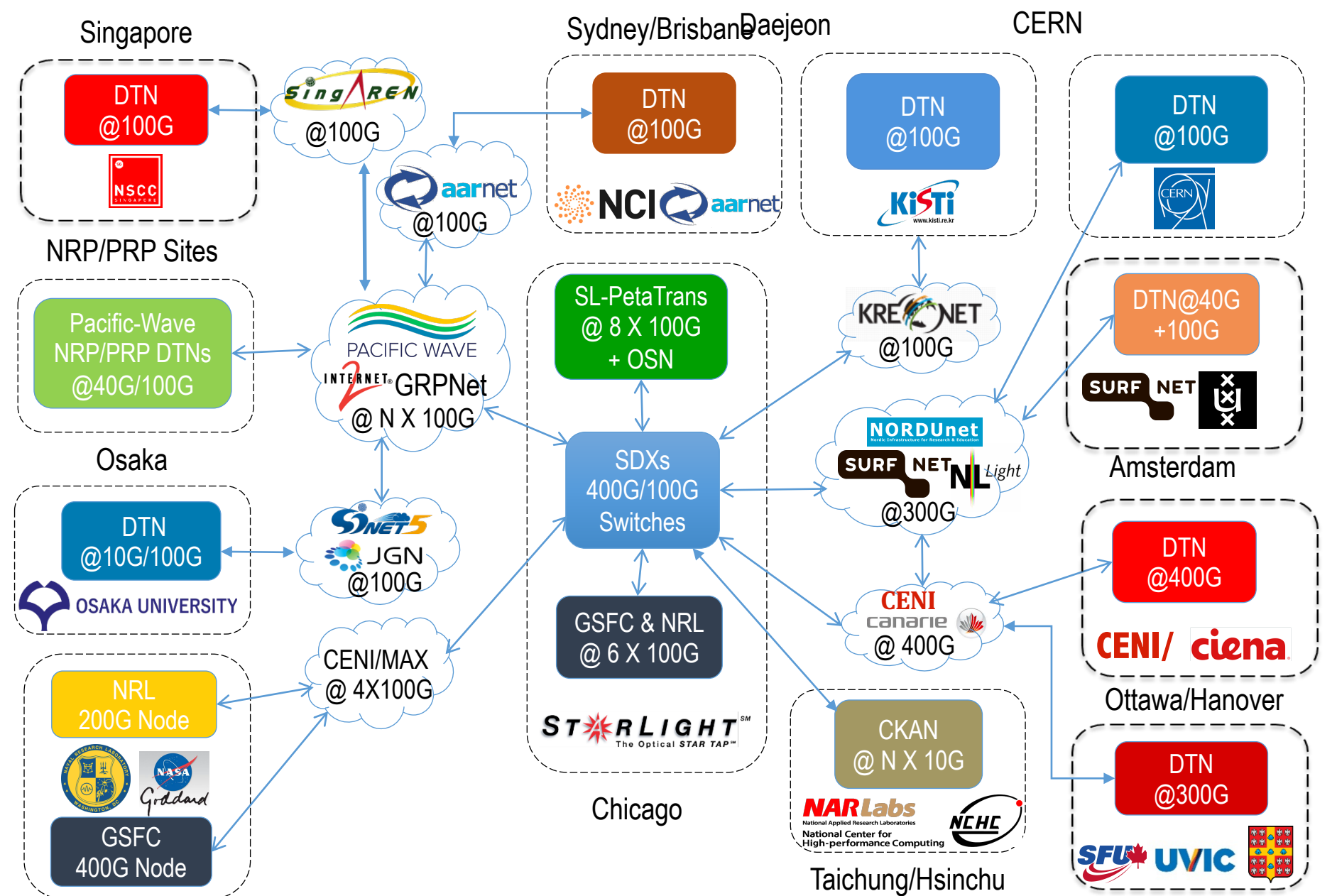
- Towards National Research Platform(TNRP)
- PacificWave
- KISTI



# NRE09/10-GRP Service: DTNaaS for Petascale Sciences Data Transfer

As Oct SC20 Supports

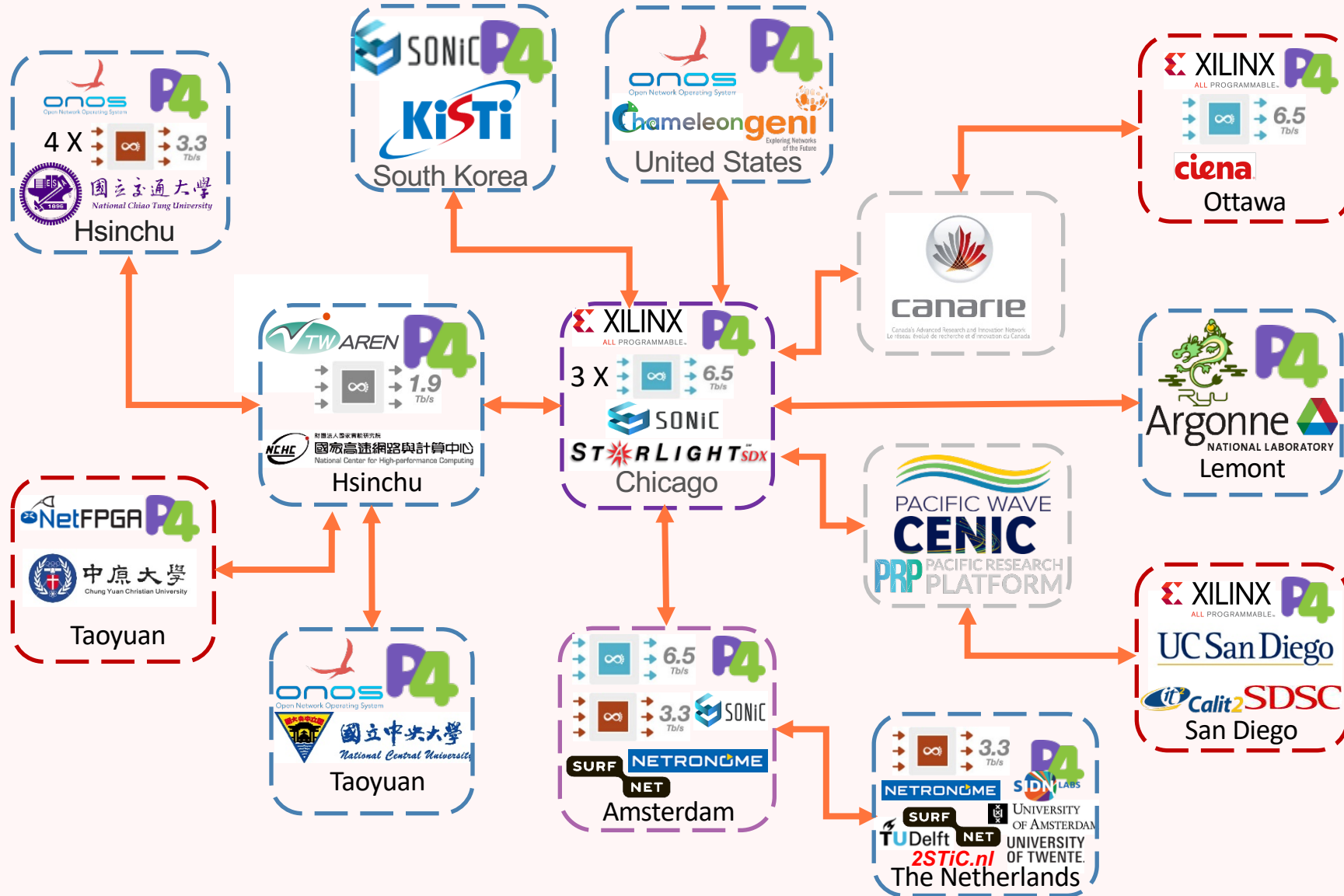
NRE03, NRE04  
 NRE05, NRE06  
 NRE10, NRE11  
 NRE12, NRE13  
 NRE14  
 Indis104s1  
 SCinet XNET



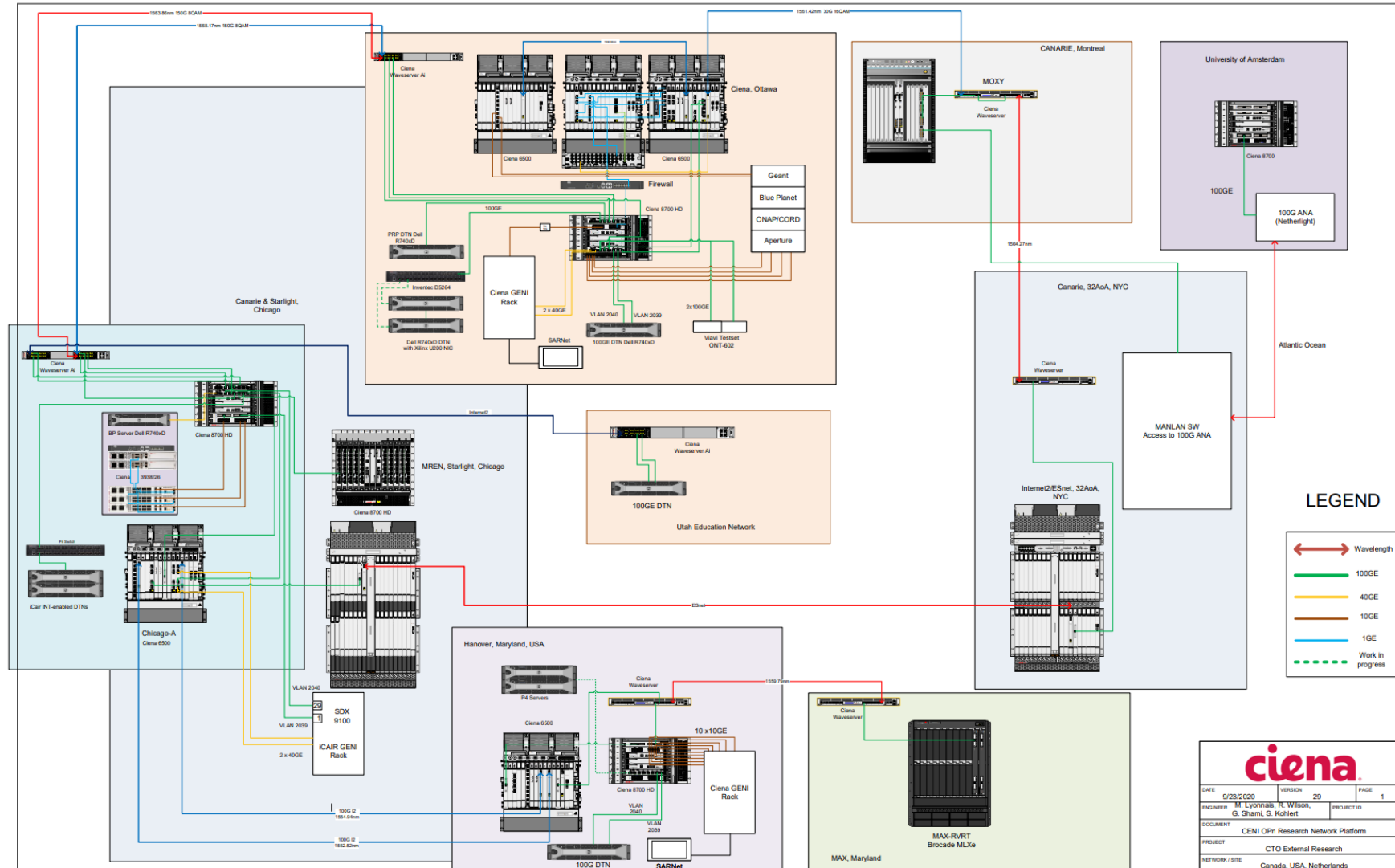
Washington D.C. 100G Science DTN testbeds Since 2011

Vancouver/Victoria/Quebec

# NRE08-GRP Service: International P4 Experimental Networks(iP4EN) **SCinet**



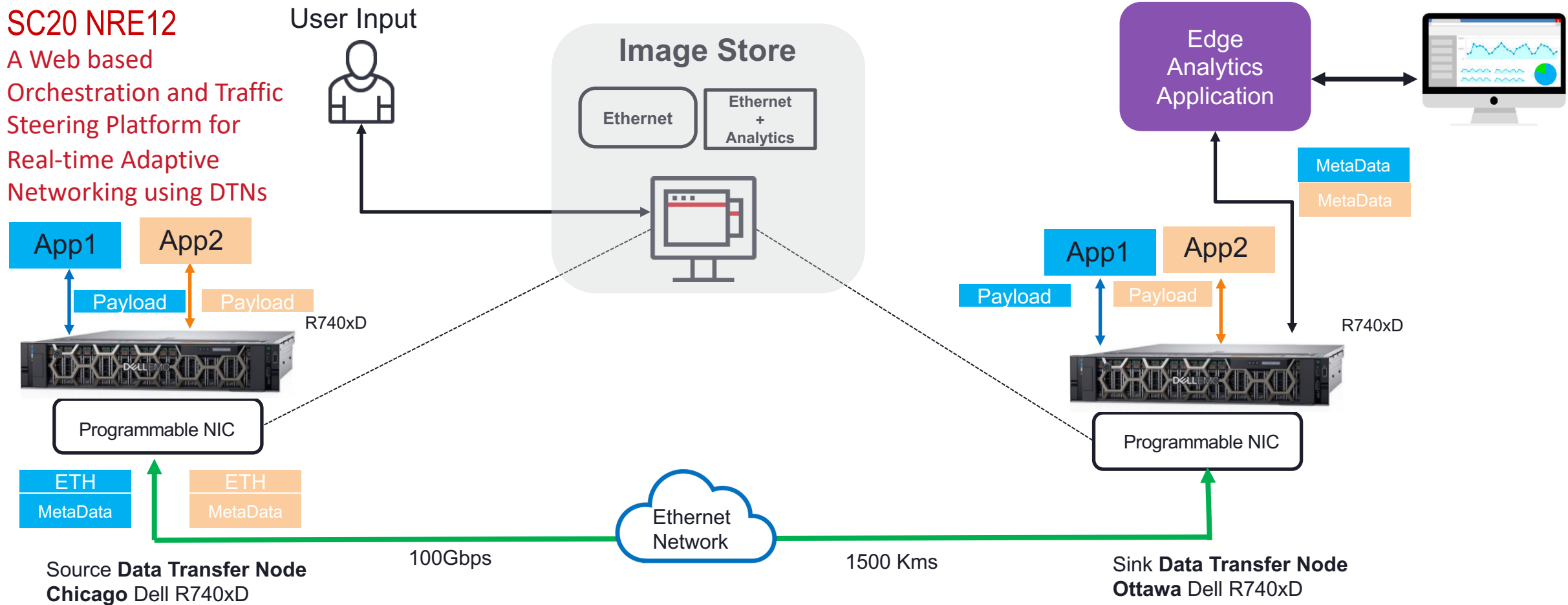
# CENI Platform



1. Two Data Transfer Nodes on CENI are fitted with Programmable NIC cards, capable at 100Gbps speeds.
2. User interacts with FPGA Image Store to enable In-band Telemetry on Xilinx NICs. The DTNs now act as INT Source and INT Sink nodes adding layers of Metadata into application packet headers.
3. An Edge Analytics application extracts metadata and hands off to visualization engine for live graphing and analysis of key parameters.

## SC20 NRE12

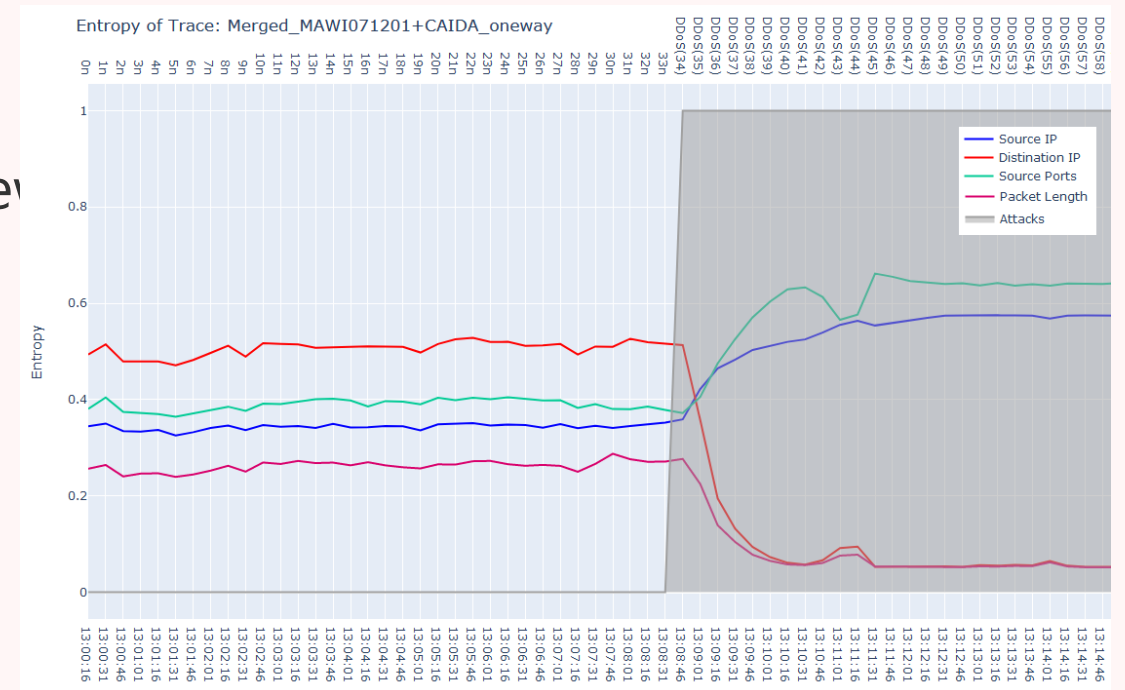
A Web based  
Orchestration and Traffic  
Steering Platform for  
Real-time Adaptive  
Networking using DTNs



**Unique data package flow produces analytical MetaData, Packet level latency measurements @ 100Gbps**

# GRP/iP4EN Experiment: Real-Time DDoS Attack Detection using Sketch-based Entropy Estimation on the NetFPGA SUME

- High-speed DDoS attack traffic detection
  - Shannon Entropy estimation in real-time of selected network traffic headers
  - Long Short-Term Memory Recurrent Neural Networks (LSTM-RNN)
- More detail: “Real-Time DDoS Attack Detection using Sketch-based Entropy Estimation on the NetFPGA SUME Platform” 12<sup>th</sup> APSIPA, Dec 7-10, 2020, Auckland, New Zealand



# P4 INT Analyzer with Web UI

- An **INT Analyzer** is designed to monitor P4-enabled network
  - DB Driver Layer** : read INT database supporting several formats (InfluxDB, Prometheus, ...)
  - Analyze Layer** : parse/analyze data into JSON format
  - UI Layer** : Configuration and Grafana visualization
- For future work, multi-domain INT analysis / visualization could be implemented for monitoring across P4-enabled NRENs

“網路遙測數據整合系統的設計/Design of an Integrated Analysis System for P4 In-Band Network Telemetry,” TANET2020 Taipei, Taiwan, 10/2020

**NAR Labs**  
National Applied Research Laboratories  
National Center for High-performance Computing

Database IP: 192.168.56.101 | Port: 8086 | Query Measurement: [ ]

Grafana IP: localhost | Grafana Port: 3000 | Grafana DB Name: InfluxDB\_p4test

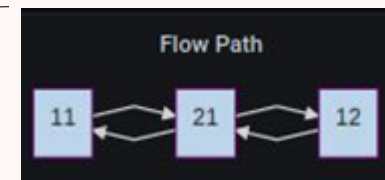
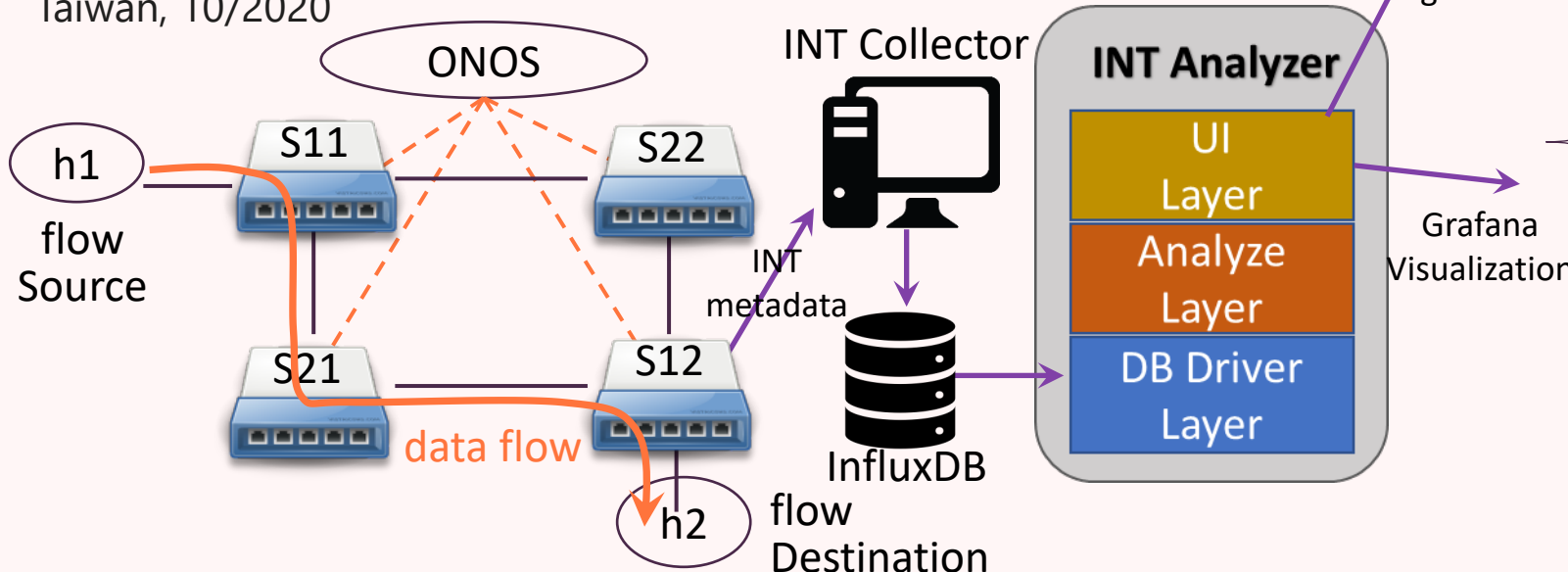
CreateDataSources  Create a DB sources  Don't Create a DB sources

show Database information  query dashboard  create or update dashboard

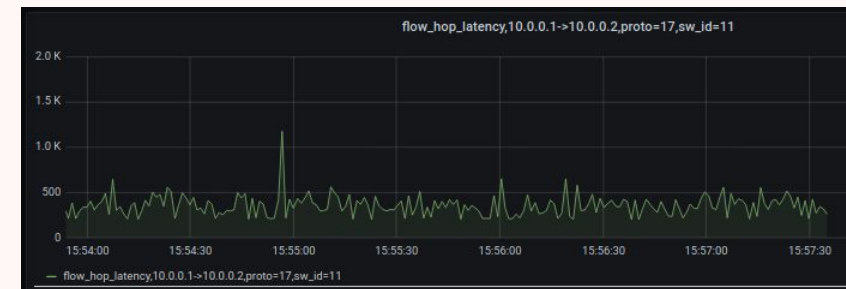
Grafana IP: localhost | Port: 3000 | Dashboard Title: P4test\_dashboard | DB Source Name: InfluxDB\_p4test

Great | DL\_PanelJson

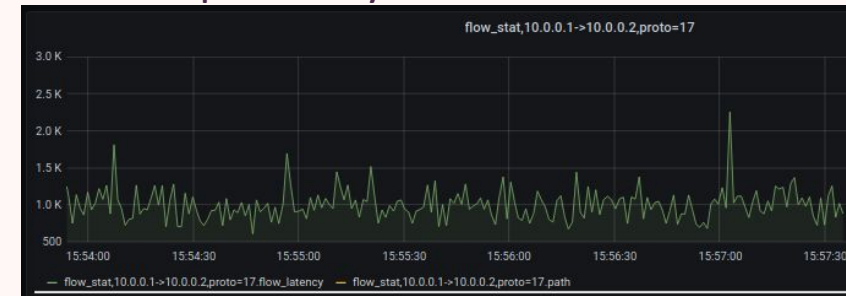
Dashboard Id	uid	title	version	hyperlink
11	5PS8rGKGz	p4test_dashboard	1	<a href="#">link</a>



Flow Path Visualization



Flow Hop Latency



Flow Statistics

DB and Grafana configuration

Grafana Visualization