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 & others

(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.
SC19 X-NET SCinet DTN-as-a-Service Team members

- Anna Giannakou, LBNL, AGiannakou@lbl.gov
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- Jim Chen, iCAIR/Northwestern University,

Visit us at Starlight booth 993 for real time monitoring
SCinet DTN-as-a-Service Software Stack

DTN-as-a-service Controller

System Configuration
- NUMA
- Storage

System Optimization
- OS Tuning
- NIC Tuning

Transfer Tools
- iperf3
- nuttcp

Network Provisioning
- OpenNSA

Data Transfer Node
- OS
- CPU
- NVMe
- GPU
- NIC

Transfer Data Analyser
- Prometheus Monitoring server
- Grafana
  - Real-time Visualization

sFlow-RT

StarLight SDX

TOR switch
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.
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
Goal: Secure multi-domain resource sharing across 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)
- Towards National Research Platform (TNRP)
- PacificWave
- KISTI

MREN: Metropolitan Research and Education Network
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
NRE08-GRP Service: International P4 Experimental Networks (iP4EN)
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
• 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)

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