SC18 INDIS Workshop Architecture, Xnet, NRE











1. Experimental Network - XNET

2. Network Research Exhibition - NRE

3. SCinet Architecture





XNET





SCinet Experimental Networks

Each year SCinet evolves and creates a new network to allow Researchers to perform new experiments and undertake new technical challenges.

SCinet has a team of volunteer subject matter experts (SMEs) that evaluate new technologies and new appliances to achieve this evolution. Some experiments are conclusive immediately, others require additional time to achieve the desired results.

For SC18, the Experimental Network (XNET) team was involved in 4 such experiments inside SCinet and on the Exhibit floor.





The XNET Experiments

- Optical Cross Connect
- Scalable 8x100G DTN
- FAUCET
- 400GE ring





Optical Cross Connect

Calient SC18 Architecture

The rationale behind the Optical Cross Connect was to allow multiple 100G WAN circuits to be tested with an unmanned capability.









Scalable 8x100GE DTN

The advanced DTN experiment is in its second year and is a NRE accepted submission.

Added activities this year are:

- Development of 100G network fiber/link/VLAN/route verification procedures with a portable tester to shorten set-up time and improve readiness
- Prototype user experiment environment isolation & management solutions:
 - Docker/ Kubernetes/Rancher/VM, as well as other Docker Integrations Design AI-Enabled DTN use case and workflow prototype





8x100G Network diagram







SCinet DTN related papers

"Analysis of CPU Pinning and Storage Configuration in 100 **GbpsNetwork Data Transfer**" -Se-Young Yu & others.

"BigDataExpress: Toward Schedulable, Predictable, and Highperformance Data Transfer" -WenjiWu & other

"Flowzilla: A methodology for Detecting Data Transfer Anomalies in **Research Networks.**" -AnnaGiannakou & others







Faucet

- FAUCET scales to terabits doing IPv4/IPv6 L2/L3 switching and routing
- FAUCET can control switches from multiple vendors, including P4 vendors who provide a P4-to-OF bridge, and interoperates with non-SDN networks
- FAUCET provides automated integration tests, allowing many bugs • to be caught early (sometimes even by the switch vendor) before shipping new releases





FAUCET Network Diagram







Science Drivers for these demonstrations:

- State of the art DTN design
 - Data transfers with disk I/O at 200Gbps
 - Able to provide network testing at 400Gbps
- Application Support
 - TCP-based applications like GridFTP, FDT, etc.
 - Low-latency RDMA-based applications like NVMEoF •
- Network Design
 - Support 100G, 100G and 400G switch ports to connect servers
 - Supporting new optics: OSFP, QSFP56 and O-Q adapters for 100G





400GE Network Diagram







NRE





- The Network Research Exhibition (NRE) team provides outreach and ongoing engagement with exhibitors wishing to undertake experiments at SC.
 - The process begins with a Preliminary Abstract, which provides an idea of where the research is headed.
 - Over several months, the NRE team works with the experimenter to determine the specific technical needs of the experiment, which are then bundled and provided to the SCinet team for provisioning. As the show approaches, the NRE team collects and prepares the final
 - abstracts for publication
 - The last step is to encourage the experimenters to share their results, typically gathered during the show, with the community at the following SC conference through the INDIS workshop





NRE Output

NRE Outcomes

- 36 accepted demonstrations
- 86 hours of meetings gathering data
- 361 VLANs involved
- 28 WAN connections involved
- 28 Booth drops involved
- 7 SCinet DTN connections involved
- Weekly communication with researchers and involved parties





NRE Layout









Demos of Note:

NASA and NRL DTNs Ongoing activities pushing the edges of how and how fast data can be moved over distance

• SENSE

Cross-domain scheduling and orchestration of resources to fulfill workflow requirements including hosts, LANs, security and WAN

• UTD

Infrastructure support for distributed control of autonomous driving vehicles using compute at multiple levels (cloud, edge and local)



NRE Demo Highlights #2

More demos of Note:

Security

- Poseidon Heuristic analysis in concert with FAUCET
- Diventi Leveraging intelligent data structures to organize and provide efficient access to security data
- ENSIGN Workflow analysis targeted at identifying attackers who avoid signature-based detection





Architecture







SC18 SCinet Architecture Diagram







WAN Connectivity to the World

- 4.02tbps from across the globe to Dallas
- multi-year effort to install 2.3 miles of fiber to the KBHCCD













Optical cross connect:

- Flexible circuit testing
- Dynamic reconfiguration of optical taps
- Automated patch panel with optical power level monitoring













400-gigabit Ethernet:

Demonstration of tomorrow while maintaining interoperability with today









Scinet

Highlights of the SC18 SCinet Architecture





Exhibitor Booths:

- 9.32 tbps delivered to SC18 exhibitors over 16.5 miles of floor fiber
- 4100 fiber patches across 158 patch panels
- 2260 interfaces modeled







Panel Discussion





Open Questions for Panel (I)

Questions for XNET:

- (optical):
- (DTNs): What type of AI is possible by having a DTN infrastructures?
- (400gig ring): Which new transport and routing capabilities are enabled by such ring?

Questions for NRE:

- (security):

Questions for Architecture

- How do we continue to design and build a network to showcase emerging technologies while simultaneously supporting an "operational" service to end-users?





1.Questions on network innovation:

Al and machine learning. Do you see more use of such techniques within SCinet and what do you expect to use them for?

2. Questions relating to SCinet role: What technologies is SCinet missing in its toolbox? What research is trending in the wider community that we should be building for and encouraging? How can we help elevate research in THIS community?

