SC25 Network Research Exhibition: Demonstration Publishable Abstract

FABRIC

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Abstract

This demonstration will show the FABRIC Research Cyberinfrastructure in operation:

- FABRIC
  https://portal.fabric-testbed.net

FABRIC (FABRIC is Adaptive ProgrammaBle Research Infrastructure for Computer Science and Science Applications) is an International infrastructure that enables cutting-edge experimentation and research at-scale in the areas of networking, cybersecurity, distributed computing, storage, virtual reality, 5G, machine learning, and science applications.

The FABRIC infrastructure includes a distributed set of equipment at commercial collocation spaces, national labs and campuses. Each of the FABRIC sites has large amounts of compute and storage, interconnected by high speed, dedicated optical links. It also connects to specialized testbeds (5G/IoT PAWR, NSF Clouds), the Internet and high-performance computing facilities to create a rich environment for a wide variety of experimental activities.

The FABRIC Network includes 35 sites distributed across the United States, CERN (Switzerland), University of Amsterdam (Netherlands), University of Bristol (England), and University of Tokyo (Japan).

Figure 1 shows a map of the FABRIC infrastructure. Ciena has built a "FABRIC Traveling Rack" which is normally connected to the FABRIC STAR node as part of the FABRIC Production topology. For SC25, this traveling rack will be located within the Ciena Booth on the Conference Exhibit Floor.

The Ciena Traveling FABRIC Rack will be connected to the SCinet network infrastructure, local exhibit booth, and the rest of the FABRIC via wide area circuits made available as part of the SC25 SCinet infrastructure. The SCInet network is custom built every year for the SC conference, and is an extremely powerful and advanced network. Industry, academia, and government experts volunteer to design, build, and administer this cutting-edge SCinet infrastructure.

The Ciena Traveling FABRIC Node, connected within the SCinet infrastructure, will be used to connect resources inside SC25 Exhibit Booths as part of demonstrations and research activities. This deployment will leverage the extensive wide area connectivity engineered into SCinet to connect back to the external globally distributed FABRIC infrastructure. Figure 2 shows a topology diagram of this SC25 SCinet FABRIC Node deployment along with the connections back to the external FABRIC sites.

Additional detail regarding FABRIC is available in the following paper:

- FABRIC: A National-Scale Programmable Experimental Network Infrastructure
  Ilya Baldin, Anita Nikolich, James Griffioen, Indermohan Inder S. Monga, Kuang-Ching Wang, Tom Lehman, Paul Ruth
  DOI: 10.1109/MIC.2019.2958545
  https://ieeexplore.ieee.org/document/8972790

Goals

The SC25 goal of this experiment is to showcase the FABRIC Research Cyberinfrastructure and the ease with which other resources and sites can be integrated. These demonstrations will highlight the use of the FABRIC infrastructure which includes network embedded compute and storage resources. FABRIC compute capability includes CPU, FPGA, GPUs, and DPU based resources. FABRIC programmable networking includes automated network provisioning, P4 controlled elements, and realtime monitoring. Multiple FABRIC experiments will be shown which use the SC25 local FABRIC resources with connections thru the SCinet WAN links to the global FABRIC infrastructure.

The FABRIC infrastructure includes an architectural concept known as "Facility Ports". These are attachment points to resources which are external to the FABRIC core infrastructure. These Facility Ports provide a mechanism for these external resources to be included in FABRIC Slices and Experiments. External research infrastructure which is integrated with FABRIC in this manner includes Chameleon, CloudLab, National Research Platform (NRP),

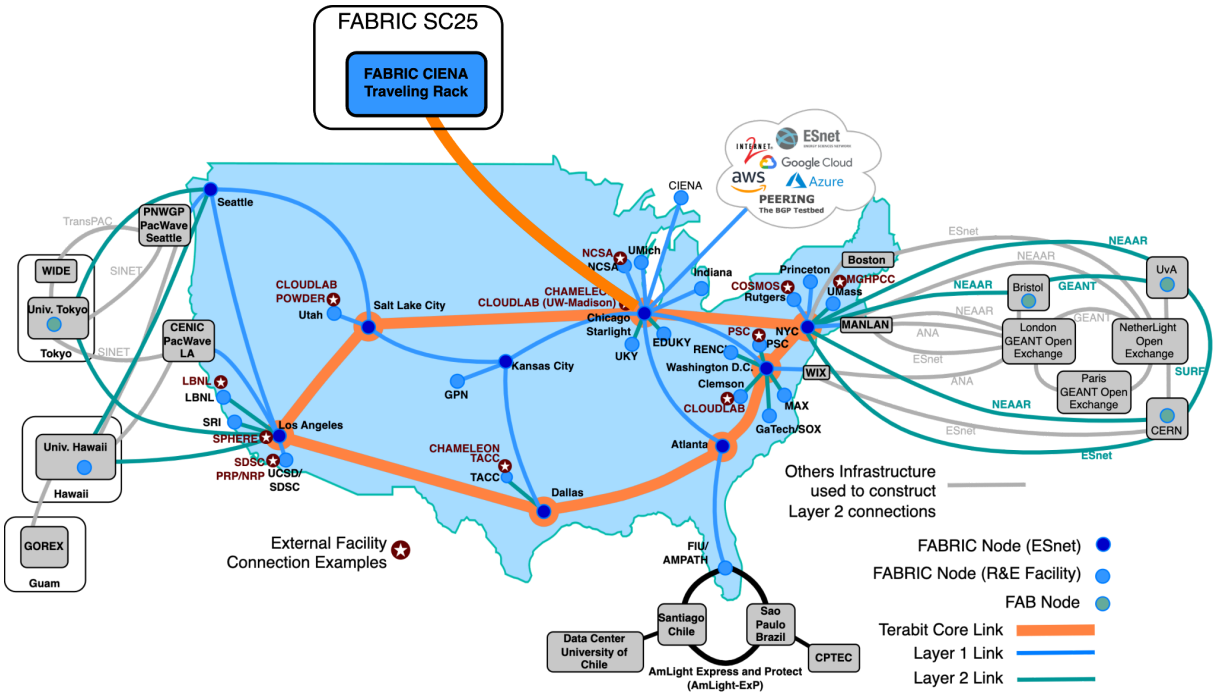

Figure 1 FABRIC Topology with SC25 Connection

Internet2 AL2S and Cloud Connect Services, ESnet OSCARS Layer2 services, CENIC, PacWave, AMPATH/AmLight, and others.

The SC25 SCinet FABRIC node deployment will include multiple "Facility Ports" facing specific research and demonstration resources in the Exhibit Floor. In this manner these SC25 Exhibitors can leverage the connectivity back to the entire FABRIC globally distributed infrastructure for their demonstrations.

The FABRIC Demonstrations for SC25 will highlight the many types and methods available for connections to external resources such as edge/site resources and other networks. This includes connections to multiple National Research Platform (NRP) sites and other R&E networks.

Impacts

FABRIC is a research infrastructure which enables unique cyberinfrastructure research where wide area network embedded compute (cpu, gpu, fpga, dpu), storage, and programmable network service can be combined to develop and test new application workflow services. This wide area infrastructure is combined with a rich set of interconnects to sites, edge systems, and production facilities for near production prototypes which provide a valuable method for testing new systems and services prior to deciding on production deployments. The SCinet infrastructure enables demonstration of FABRIC capabilities on the Exhibit floor which include high performance connections to the globally distributed research infrastructure and production systems. This provides a unique opportunity to demonstrate prototype and production systems working together.

Resources

This NRE demonstration will be conducted using resources of the FABRIC infrastructure, SC25 SCinet for connections to other SC25 local resources and to WAN links. As shown in Figure 2, multiple wide area links will be utilized to connect to the core FABRIC infrastructure from STAR to the SCinet at the SC25 Exhibit floor. Resources for the FABRIC demonstrations will also be located in other booths on the SC25 Exhibit Floor. The following SC25 SCinet resources are identified:

- Connections between Ciena Traveling Rack and the SENSE controlled network element inside the SCinet NOC
- Access to VLAN paths from StarLight, Caltech, ESnet WAN Circuits to the FABRIC Traveling Rack
- IPv4 and IP6 routable IP addresses

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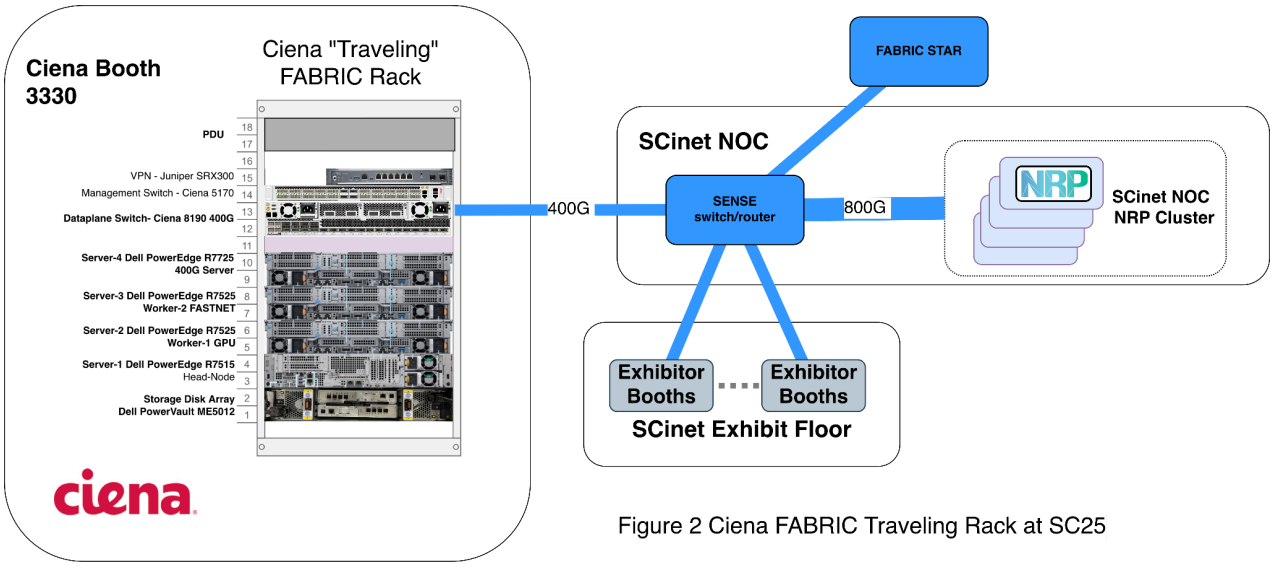

Figure 2 Ciena FABRIC Traveling Rack at SC25