The Global Research Platform, StarLight Software Defined Exchange (SDX), SC24 NREs

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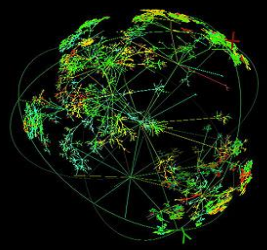
iCAIR, Northwestern University, StarLight/MREN
IEEE/ACM International Conference on High Performance Computing, Networking, Storage, and Analytics
Atlanta, Georgia
November 17-21, 2024



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STARLIGHT SDX

The GRP: A Platform For Global Science

A Next Generation, Software Defined, Globally Distributed, Multi-Domain Computational Science Environment

Next Generation eScience Ecosystem

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Selected Applications/Instruments

GENI
www.geni.net

Open Storage Network
www.openstorage network.org

OSG
www.openscience grid.org

Polar Geospatial Center
www.pgc.umn.edu

LSST
www.lsst.org

ISS
www.nasa.gov/ station

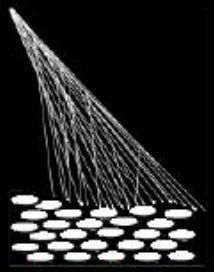
Virgo
www.virgo-gw.eu

LHC
home.cern/science/ accelerators/large-hadron-collider

GLEON
www.gleon.org

GRP
theglobalresearch platform.net/

IceCube
icecube.wisc.edu



Pierre Auger Observatory
www.auger.org

LIGO
www.ligo.caltech. edu

SKA
www.skatelescope. org

LHCONE
twiki.cern.ch/twiki/bin /view/LHCONE/ WebHome

USGS EROS
www.usgs.gov/ centers/eros

Blue Waters
bluewaters.ncsa. illinois.edu

Chameleon
www.chameleon cloud.org

Jetstream
www.jetstream-cloud.org

Belle II
www.belle2.org

XENON
xenon.astro. columbia.edu

SDSS
www.sdss.org

LHCOPN
twiki.cern.ch/twiki/bin /view/LHCOPN/ WebHome

PRAGMA
www.pragma-grid.net

CHASE-CI
www.calit2.net/ newsroom/artic le.php?id=2910

Genomic Science Program
genomicscience. energy.gov

LBNF/DUNE/ ProtoDUNE
lbnf.fnal.gov

NOvA
novaexperiment. fnal.gov

ALMA
www.alma observatory.org

NEON
www.neonscience. org

CENTRA
www.global centra.org

SAGE2
sage2.sagecommons. org

IVOA
www.ivoa.net

Compilation by Maxine Brown and Joe Mambretti

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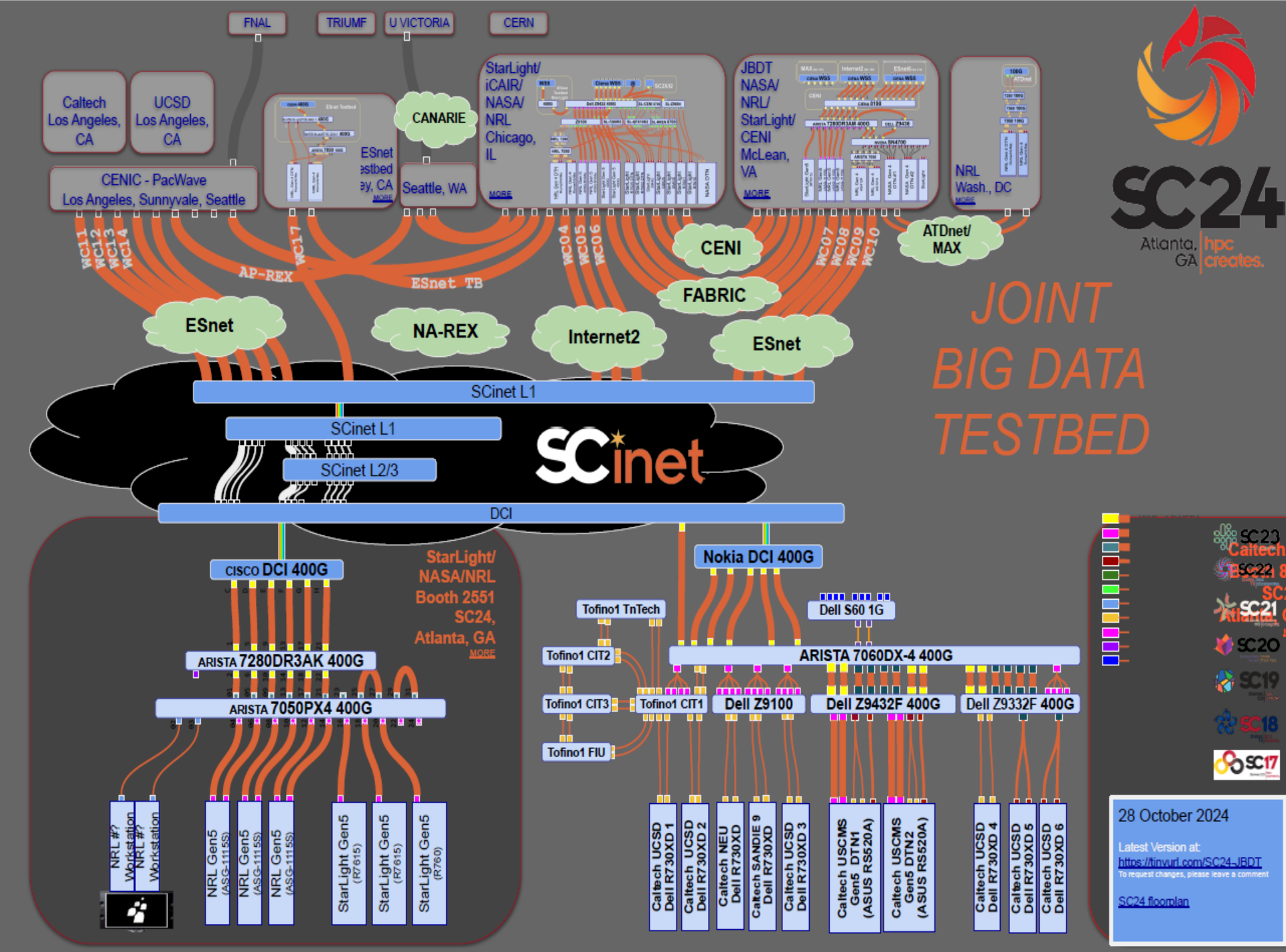
Next Generation Research Platforms (Data Science Ecosystems)

- US National Research Platform
- Asia Pacific Research Platform
- Korean Research Platform
- EU SLICES
- Worldwide LHC Computing Grid (WLCG)
- DOE Integrated Research Infrastructure (IRI)
- Open Science Grid
- Open Science Data Grid
- Major Instrumentation Sites
- Et Al

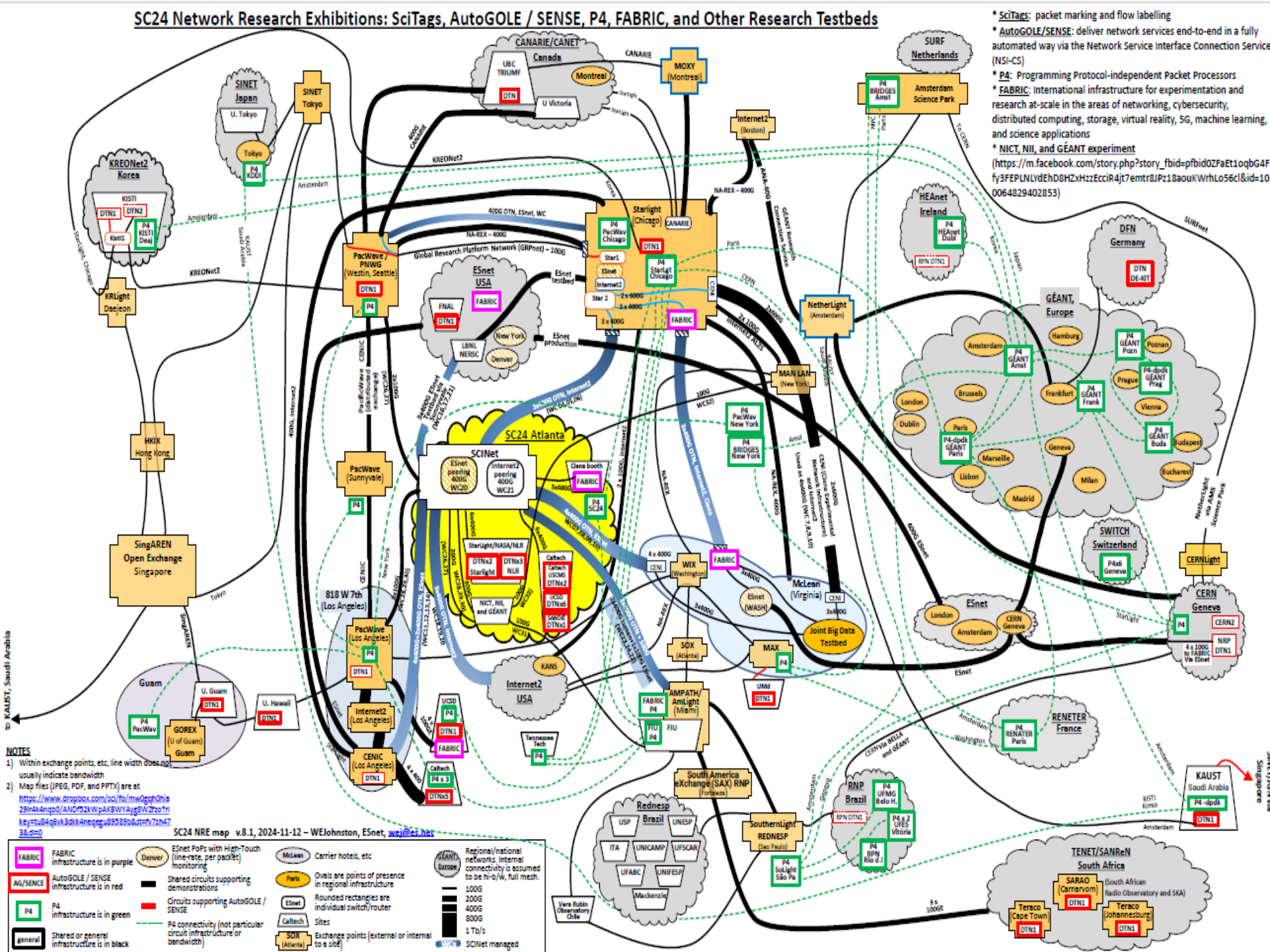
Major Service, Architecture, Technology Themes

- Orchestration Among Multiple Domains
- Large Scale High Capacity WAN Services
- High-Fidelity Data Flow Monitoring, Visualization, Analytics, Diagnostic Algorithms, Event Correlation AI/ML/DL
- International Testbeds for Data-Intensive Science
- Persistent Specialized Platfoms and Facilities (e.g., High Performance Networks, Open Exchange Points)


FNAL
TRIUMF
U VICTORIA
CERN
Caltech Los Angeles, CA
UCSD Los Angeles, CA
CENIC - PacWave Los Angeles, Sunnyvale, Seattle
ESnet Testbed ey, CA
MORE
CANARIE
Seattle, WA
StarLight/ iCAIR/ NASA/ NRL Chicago, IL
MORE
JBDT NASA/ NRL/ StarLight/ CENI McLean, VA
MORE
NRL Wash., DC
MORE
WC11
WC12
WC13
WC14
AP-REX
WC17
ESnet TB
WC04
WC05
WC06
CENI
FABRIC
WC07
WC08
WC09
WC10
ATDnet/ MAX
ESnet
NA-REX
Internet2
ESnet
SCinet L1
SCinet L1
SCinet L2/3
SCinet
DCI
JOINT BIG DATA TESTBED
SC24
Atlanta, GA
hpc creates.
StarLight/ NASA/NRL Booth 2551 SC24, Atlanta, GA
MORE
CISCO DCI 400G
ARISTA 7280DR3AK 400G
ARISTA 7050PX4 400G
Nokia DCI 400G
Tofino1 TnTech
Tofino1 CIT2
Tofino1 CIT3
Tofino1 FIU
Tofino1 CIT1
Dell S60 1G
ARISTA 7060DX-4 400G
Dell Z9100
Dell Z9432F 400G
Dell Z9332F 400G
NRL #? Workstation
NRL #? Workstation
NRL Gen5 (ASG-1115S)
NRL Gen5 (ASG-1115S)
NRL Gen5 (ASG-1115S)
StarLight Gen5 (R7615)
StarLight Gen5 (R7615)
StarLight Gen5 (R760)
Caltech UCSD Dell R730XD 1
Caltech UCSD Dell R730XD 2
Caltech NEU Dell R730XD
Caltech SANDIE 9 Dell R730XD
Caltech UCSD Dell R730XD 3
Caltech USCMS Gen5 DTN1 (ASUS RS520A)
Caltech USCMS Gen5 DTN2 (ASUS RS520A)
Caltech UCSD Dell R730XD 4
Caltech UCSD Dell R730XD 5
Caltech UCSD Dell R730XD 6
SC23
SC22
SC21
SC20
SC19
SC18
SC17
28 October 2024
Latest Version at:
https://tinyurl.com/SC24-JBDT
To request changes, please leave a comment
SC24 floorplan

SC24 Network Research Exhibitions: SciTags, AutoGOLE / SENSE, P4, FABRIC, and Other Research Testbeds

* SciTags: packet marking and flow labelling
* AutoGOLE/SENSE: deliver network services end-to-end in a fully automated way via the Network Service Interface Connection Service (NSI-CS)
* P4: Programming Protocol-independent Packet Processors
* FABRIC: International infrastructure for experimentation and research at-scale in the areas of networking, cybersecurity, distributed computing, storage, virtual reality, 5G, machine learning, and science applications
* NICT, NII, and GÉANT experiment (https://m.facebook.com/story.php?story_fbid=pfbid0ZFaEt1oqbG4Ffy3FEPLNLYdEhD8HZxHzzEcciR4jt7emtr8JPz18aouKWrhLo56cl&id=100064829402853)



Example SC24 SCinet Network Research Exhibitions

- Global Research Platform (GRP)
- SDX 1.2 Tbps WAN Services
- SDX E2E 400 Gbps 800 Gbps WAN Services
- 400 Gbps DTNs & Smart NICs
- Orchestration With Packet Marking (SciTags)
- ESnet High Touch Network Measurements
- NA REX Continental Backbone For Data Intensive Science
- SDX International Testbed Integration
- StarLight SDX for Petascale Science
- DTN-as-a-Service For Data Intensive Science With Scitags
- P4 Integration With Kubernetes, P4 Global Lab
- NASA Goddard Space Flight Center HP WAN Transport Services (400 G Dsk-Dsk)
- **Resilient Distributed Processing & Rapid Data Transfer**
- AutoGOLE/SENSE E2E Orchestration Net Services And Workflow Integration
- Open Science Grid Demonstrations
- National Research Platform Demonstrations
- Chameleon FABRIC/FAB Integration
- SciStream Multi Site Data Streaming Orchestration
- Distributed Pipelines Over WANs For On-Line Data Analysis
- DTNs for Research Enhanced Environments (ONION-RED ONION)
- Distributed Hybrid Quantum Computing With PQC/QKD Secured Links

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StarLight DTN 400G TCP WAN Service Prototypes

25 TCP streams between SL IntelG5 and SL AMDG5 Servers

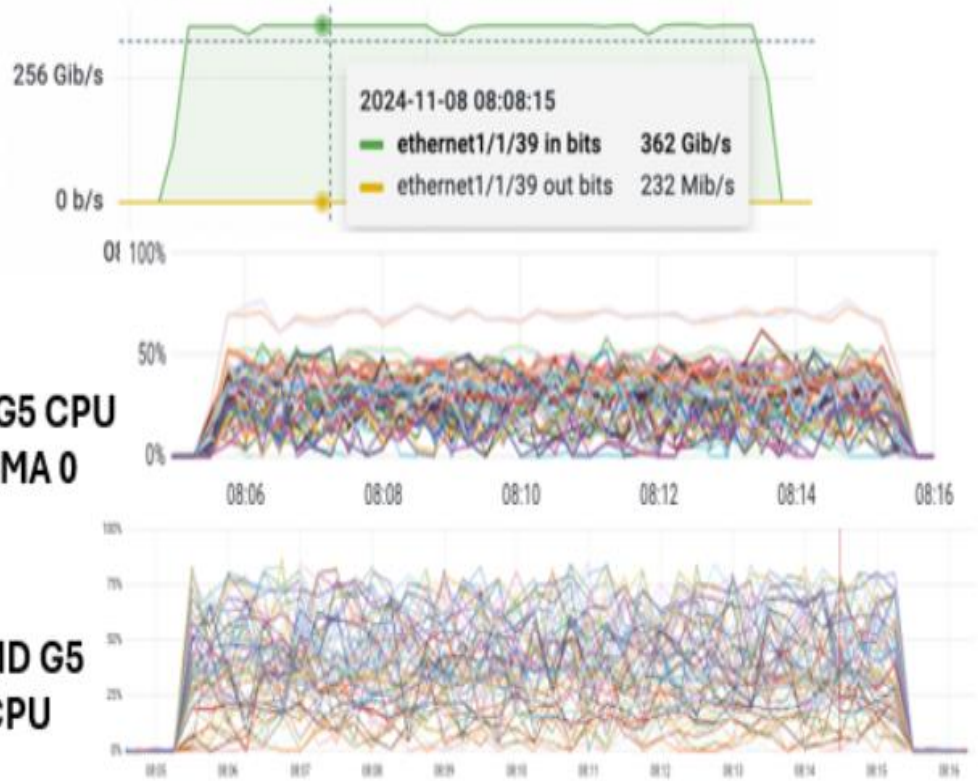
Nov 8 2024 Test Results

L.A. loop (NA-REX) RTT 89.6 ms

Avg: 378Gb/s Range: 376-382 Gb/s

McLean loop (CENI) RTT 27.8 ms

Avg: 386Gb/s Range: 381-391 Gb/s



Intel G5 CPU NUMA 0

AMD G5 CPU

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國立成功大學 National Cheng Kung University

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StarLight Science Data Exchange Service Prototypes

GEN3 https://gen3.org/

- Gen3 is a **data platform** for building **data commons and data ecosystems** .It consists of several **open-source software services.**
- It support the **healthy data ecosystems** by enabling the interoperation and creation of **cloud-based data resources**, including data commons and analysis workspaces.
- *Powered by CTDS, University of Chicago*
  - *http://ctds.uchicago.edu*
- *Apache-2.0 license*

scitags https://scitags.org/

- **Scientific network tags (scitags) is an initiative promoting identification of the science domains and their high-level activities at the network level.**
- It provides an open system using open-source technologies that helps *Research and Education (R&E) providers* in understanding how their networks are being utilized while at the same time providing feedback to the *scientific community* on what network flows and patterns are critical for their computing.
- The initiative offers an **open collaboration on the research and development of the packet and flow marking prototypes** and works in close collaboration with the scientific storage and transfer providers to enable the marking capability.

中原大學
Chung Yuan Christian University

KANSAI UNIVERSITY

StarLight 400G Real-Time Packet Processing Prototype

400G-100G Packet Header Processor Over WAN With Tofino2 + FPGA

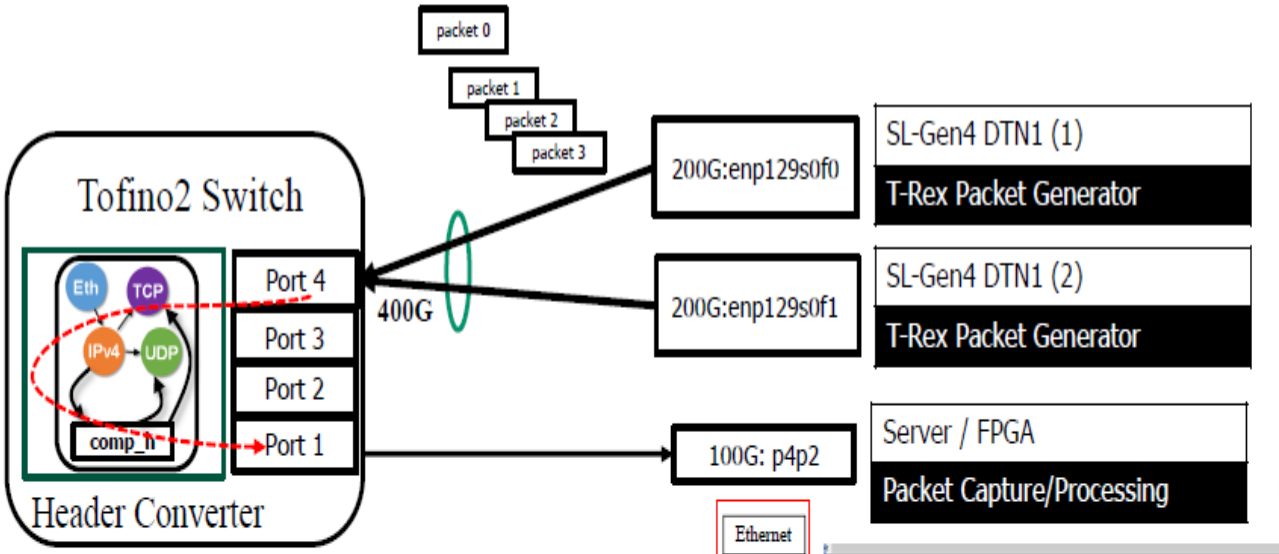
Yu-Kuen Lai, Miura Hideyoshi*, Yi-Siang Lin, Yu-Jui Chang, Kouji Hirata

Department of Electrical Engineering, Chung-Yuan Christian University, Chungli, Taiwan

*Graduate School of Science and Engineering, Kansai University, Japan

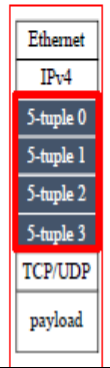
Jim Hao Chen, Joe Mambretti

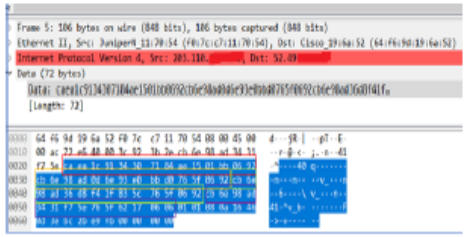
International Center for Advanced Internet Research Northwestern University, USA



```
header comp_h {
    bit<32> src_addr;
    bit<32> dst_addr;
    bit<16> src_port;
    bit<16> dst_port;
    bit<8> protocol;
    bit<8> comp_type;
}
```

```
struct switch_header_t {
    ethernet_t   ethernet;
    ipv4_t       ipv4;
    comp_h       comp_0;
    comp_h       comp_1;
    comp_h       comp_2;
    comp_h       comp_3;
    tcp_t        tcp;
    udp_t        udp;
}
```





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STARLIGHT SDX

Annual Global Research Platform Workshop – Co-Located With IEEE International Conference On eScience Sept 16-17, 2024

Other GRP Events

- GRP Demonstrations, IEEE/ACM International Conference on High Performance Computing, Networking, Storage and Analytics, Atlanta, Georgia, November 2024
- Mini-Global Research Platform Workshop, Co-Located With the Supercomputing Asia Conference, Singapore, March, 2025
- GRP Demonstrations, OFCnet, OFC Conference, San Francisco, California, March 2024
- Global Research Platform Workshop, Co-Located With IEEE International Conference on eScience, Chicago, Illinois, September, 2025

Please Visit StarLight Booth 2551
(Near SCinet NOC)
Note Presentations In SCinet Theater

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www.startap.net/starlight

**Thanks to the NSF, DOE, NASA, NIH, DARPA
Universities, National Labs, International & Industrial Partners,
and Other Supporters**

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