



Joint Engineering Team (JET) Meeting Minutes

National Coordination Office for Networking and Information Technology R&D (NCO/NITRD)
490 L'Enfant Plaza SW, Suite 8001, Washington, DC 20024

November 20, 2024, 10:15-11:45 a.m. ET

This meeting was held as a hybrid in Atlanta, GA, at the Georgia World Congress Center,
285 Andrew Young International Blvd NW, Atlanta, GA 30313

Participants

Jeff Bartig, Internet2	Paul Love, NCO/NITRD
Fady Bekhit, CENIC	Joe Mambretti, StarLight/MREN
Erik Blanco, NCO/NITRD	Ralph McEldowney, DREN
Christopher Bruton, CENIC/Pacific Wave	Marla Meehl, FRGP/UCAR/NCAR
Anne Burkhart, VA	Linden Mercer, NRL
Dale Carder, ESnet	Ken Miller, KeystoneREN
Basil Decina, NRL	Jennifer Oxenford, KeystoneREN
Bruce Curtis, NDSU	Ivanna Park, Internet2
Cas D'Angelo, SoX	David Rouse, Verizon
Basil Decina, NRL	Hiroataka Sato, APAN-JP
Kirk Dohne, NITRD/OSTP	Ann Schwartz, NITRD/OSTP
Phil Dykstra, DREN	Jennifer Schopf, TACC
Clark Gaylord, GWU/CAAREN	Robert Sears, NOAA
Ken Gonzales, Verizon	Michael Sinatra, ESnet
Felton Hayes, Verizon	Nik Sultana, IIT
Usama Kabive, Verizon	Dom Vicinanza, GÉANT
Jonah Keough, Pacific Wave	Chris Wilkinson, Internet2
Michael Lambert, PSC/3ROX/ACCESS	

Proceeding: This meeting was chaired by Ralph McEldowney (DREN).

I. **Action Items:** (none pending)

II. **Review of the Minutes of the October 2024 meeting:** No corrections were received. The final minutes have been posted on the JET's web page.

III. **Combined roundtable**

A. NOAA (Rob Sears):

- a. Alaska: NOAA's N-Wave program has spent the last two years building out a core network from Seattle, WA, node on its domestic backbone, to support its activities in Alaska. (The CONUS backbone is 400G.) The loop Seattle-Anchorage-Fairbanks-Seattle is currently 2G with all connections on 10G ports. It currently

supports three of NOAA's Line Offices – National Environmental Satellite, Data, and Information Service (NESDIS); National Marine Fisheries Service (NMFS) and National Weather Service (NWS).

- b. N-Wave is working to enhance its Alaska<>CONUS redundancy and is exploring terrestrial or other submarine options.
 - c. NOAA's nearest TICAP is in Seattle so to keep as much Alaska local traffic in state N-Wave has funded an open exchange in Anchorage (AlaskaIX) and NOAA's cybersecurity group will be deploying a TICAP in Anchorage early in 2025. The TICAP will enhance warnings issued from the Tsunami Warning Center in Palmer, AK, and the exchange of data between various NOAA facilities and the University of Alaska and offices of the State of Alaska.
 - d. The AlaskaIX is operational and open to all. It can be found at:
<https://alaskaix.net/>
- B. FRGP (Marla Meehl):
- a. FRGP is working with NOAA to put in some new 400G paths to Denver.
 - b. FRGP is continuing to grow its network and upgrade its gear.
 - c. FRGP has a NSF CC* award to connect Colorado's western slope. That project is moving along well – connectivity is targeted for spring 2025.
- C. DREN (Ralph McEldowney and Phil Dykstra):
- a. The Hawaiian Intranet Consortium (HIC) is set to meet 29-30 January 2025 on Oahu. It will held at the Hale Ikena Community Activity Center on Fort Shafter.
 - b. A DREN collaboration for nearly a year is with CAIDA at SDSC on some data analysis. DREN has placed eight CAIDA probes on its peering network – outside its security boundary which lets them be used more freely for research efforts. They have been used to see how traffic flows from DREN to locations outside. It's been observed that packet heading to, say, Australia, may pass through half a dozen countries, some of which are interesting/surprising. With intentional, strategic peering you could do significantly better to make sure your packet doesn't pass through countries you aren't anticipating. DREN is working with CAIDA on doing overlay routing to have more control.
 - c. A second collaboration, fairly new, is with ESnet and N-Wave. This is aimed at mutual disaster backup. The conversations on this are just getting underway but if you overlay the three networks, even adding Internet2, the transcontinental paths are pretty much the same. Perhaps 80% the same. DREN realized that the failure of two links would cut the network in half. For the short term it's added a new path to remove that possibility. A better solution is to work with other federal networks for the needed redundancy. The intention is to set up hot standbys with an active route with a metric so that, if your network gets partitioned, you will automatically switch over to another network. With ESnet DREN is planning on setting three up three points of contact: DC, Sunnyvale and Seattle.
Besides the disaster backups, the next step will be to carry some traffic for each other. DREN has circuits to Hawaii while ESnet doesn't. However, DOE's Sandia National Laboratory has a site at the Kauai test facility so DREN will transit a

VLAN for ESnet. Likewise, there's a DOD supercomputer at Los Alamos which ESnet can connect to for DREN.

- d. DREN's partner, Verizon, is providing a diverse pair of 100Gs from Seattle to SC with plans to do 2x400G for SC25 in St Louis. They noted that on their commercial side they are seeing a lot of growth driven by AI hyperscalers.
- D. ESnet (Michael Sinatra and Dale Carder):
- a. ESnet has just about concluded its VRF transition.
 - b. ESnet's IPv6-only project is moving forward.
 - c. ESnet has nearly concluded its requirements review for the high energy physics community. That is expected to lead to a significant expanding of its capacity for LHCONE. In both transatlantic capacity and 400G connections to Tier 2 sites. The timeline is during 2025.
 - d. The Tier 2 growth will in turn have impacts on the RONS which support universities with Tier 2 site.
- E. CENIC & Pacific Wave (Christopher Bruton):
- The Pacific Wave map can be found at: <https://pacificwave.net/about-us/maps>
The current CENIC map can be found at:
<https://assets.cenic.org/maps/CalREN-11-20-23.pdf?v=1701810593>
- a. The major focus this past year has been the 400G upgrades to the backbone sites of Seattle, Sunnyvale, Los Angeles, Albuquerque, Denver and Chicago.
 - b. Work continues on client capacity but the demand from participants isn't quite there yet.
 - c. An EVPN implementation has recently been concluded which improves layer2 provisioning and de-provisioning. It's being used pretty successfully for on NA-REX here at SC.
 - d. The project to extend Pacific Wave to Fairbanks is targeted for completion during 2025.
- F. PSC/3ROX/ACCESS (Michael Lambert):
- a. PSC has received a CC* award for a multi-institution science DMZ covering PSC, CMU and the University of Pittsburgh. Work is starting and the hope is that the budget that was originally submitted can be stretched to cover 400G.
- G. GWU/CAAREN (Clark Gaylord):
- a. GWU is doing some testing from here at SC over a 100G back to the CAAREN network.
 - b. CAAREN can support agencies, universities (with or without needs for Internet2 connections), etc. Please contact Clark if you're interested.
- H. APAN-JP (Hirotaka Sato):
- a. To support experiments at SC24, APAN has 4x100G from Tokyo to SC.
 - b. APAN59 is being hosted by APAN-JP next March in Yokohama, Japan.
 - c. They plan to upgrade to 400G the path to Los Angeles, New York and Amsterdam.
- I. GÉANT (Dom Vicinanza):
- a. GÉANT's 3rd generation network, part of the GÉANT4 project, is nearly finished. It is made up of nearly 30,000 miles of fiber stretching from Dublin to Kyiv,

London to Athens. GÉANT is boosting capacity to 400G but working to be ready for 800G.

- b. GÉANT is working on transatlantic spectrum deals, in line with what ESnet is doing.
- J. SoX (Cas D'Angelo):
 - a. SoX has been upgrading their connections: ESnet is now at 400G at Nashville and SoX is planning on upgrading its Atlanta ESnet connection to 400G.
 - b. If anyone is looking for connectivity in Atlanta SoX would like to talk with you on partnering.
 - c. SoX has been expanding its participant base by working with smaller schools in its area. This has been helped by an NSF award. As part of the process SOX has been holding workshops, teaching how to make use, or better use, of their expanded network resources.
- K. KeystoneREN (Jennifer Oxenford and Ken Miller):

The slides for this talk are available on the JET website at:
<https://www.nitrd.gov/coordination-areas/lsn/jet/jet-meetings-2024/>

 - a. KeystoneREN (KSR) is the R&E side of Kimber, created when FirstLight bought the physical assets of Kimber and its commercial customers. As was Kimber, KSR is the only statewide R&E network.
 - b. KSR is reestablishing approximately 45 connections and has several new schools in the pipeline. It's reestablishing 100G connections across the state and installing a new router in State College in the next weeks.
 - c. KSR retained the Internet2 (I2) connections/services that Kimber had as well as the Member's Exchange. KSR is looking into upgrading the I2 connection in Philadelphia to 400G and probably at its secondary connection in Pittsburgh.
 - d. KSR has a grant to establish a science DMZ supporting under-resourced schools across the state. The grant covers the hardware and connectivity, installation and support for the initial two years. The initial grant covered five schools. KSR has a proposed second grant that would expand the coverage.
 - e. KSR will be adding a managed router service for smaller schools that aren't able to support BGP so that they can prefer R&E networks where appropriate.
- L. Internet2 (Chris Wilkinson and Jeff Bartig):
 - a. Internet2 (I2) is really focused on its path to 800G. As its current platform, Cisco's 8000 series, is limited to 400G, it has ongoing lab tests on various pieces of hardware gear from Cisco, Juniper and Nokia that could go into such a system. Depending on the hardware selected, I2's target to have 800G in use is 2025-2026.
 - b. Programmatically I2 is doing a deeper view as to what services are offered of the current platform and what should be offered on the new one - the "trusted infrastructure platform" - and what services I2 offers, their adoption and what should be offered.
 - c. I2 has a group exploring the use of BGP local preferences. It has partnered with CAIDA and has installed an instance of CAIDA's Scamper software on a host on the I2 network. The goal is to actively probe the network to see if folks are using

local preference to prefer I2 routes over commodity routes. Scamper makes it easy to send probe packets and to receive the responses.

The Scamper host is dual homed, so it also has a connection to the commodity internet. A ping is sent to a receptive host on a campus and the path of the response tracked – is it via an R&E path or a commodity path? Initially the testing was done with I2 participants. It was then expanded to I2's NREN peers. The data collection has been completed, and it's being analyzed. I2 is working with CAIDA on a potential paper submission to the active measurement conference.

- d. Another outcome of this local preference probing/data collection is expected to be a BGP education activity to help the R&E community enhance its use of the R&E network assets and to make educated egress decisions. (Next month's I2's TechEX will have several BGP workshops on Monday.)
- e. NA-REX has been mentioned. Christopher Bruton from Pacific Wave, Joe Mambretti from Starlight and many others have been instrumental in the building out a minimum of 1x400G connectivity for NA-REX, initially in support of SC24. The international exchange points will be dual 400Gs. The consortium of Pacific Wave, Starlight, AmPath, I2 and CANARIE has built for SC what will be a persistent infrastructure for experimentation and other uses. The buildout is somewhere between 50% and 66% to the final form. AutoGOLE/SENSE with I2 at the exchange points will be brought up over the next six months. The remaining 400Gs are targeted for the same timeframe.
- f. I2 has a large amount of capacity landing here on the show floor. It's hoping to flip that to system infrastructure in some way.
- g. The transatlantic consortium, ANA, has been doing a lot of upgrades. NEA3R just moved to 400G on its New York to Amsterdam link giving ANA about 2.7T in total.

Discussion: DREN said that it had failed the I2 test for return paths. It noted that being a wide area carrier makes it a good bit more complicated than it would be for a campus. DREN will lead a community discussion at a meeting in 2025.

M. Starlight (Joe Mambretti);

The slides for this talk are available on the JET website at:

<https://www.nitrd.gov/coordination-areas/lisn/jet/jet-meetings-2024/>

- a. Starlight (SL) is representing a number of different communities here including the Global Research Platform (GRP) which is addressing the future needs for large scale, data intensive science. Much of these projects are multi-disciplined, multinational and only possible with large scale, shared resources including networks. Several GRP demonstrations are being shown at SC. GRP will also have some demonstrations at SupercomputingAsia (Singapore) and the OFC conference (San Francisco), both in March.
As an example, the Large Hadron Collider is being upgraded to high luminosity which will greatly increase the data generated. Its primary analytic centers or Tier 1 sites, which are currently using 100G connections, are moving to 400G and then to 1T.

- b. The LHC network, LHCOPN, has an overlay, the LHCONE, which supports other related research projects.
 - c. The exchange points of NA-REX and worldwide having AutoGOLE/SENSE are key to large scale science and knitting all together.
 - d. One of the exchange points on NA-REX is in Chicago at Starlight (SL). SL works as a proving ground for next generation network services via several testbeds with other sites. It has over 100 100G connections, over two dozen 400G connections – 15 were just for SC. It's prototyping 800G. SL is connected to all the major R&E networks.
 - e. SL supported SCinet in general and the design and implementation of the network for Atlanta in particular. Paths to SC were 400G, 800G and 1.2T. The terabit WAN services are being showcased at SC24.
 - f. SL has a long-standing partnership with NRL. As part of that the Joint Big Data Testbed facility in McLean, VA, has been put together. Initially it expanded greatly for an SC, it now has persistent resources enabling ongoing research by NRL and others. There are a pair of 1.2T links between JBDT and SL. One is 2x600G, the other 3x400G.
 - g. Besides AutoGOLE/SENSE there are demonstrations of the SciTags, P4, FABRIC and NOTED testbeds. SciTags identifies individual packets from different science groups allowing for traffic engineering and shaping and measurements for specific science projects. NOTED looks at traffic from CERN and, using AI, predicts future flows with about 95% accuracy.
 - h. This year SCinet has put together an 800G science DMZ that's available to NRE researchers at SC. The facility is persistent, returning at future SCs.
 - i. Using ESnet's High Touch analytics tool, SL has made a real time packet processing prototype for 400G in conjunction with Chung-Yuan Christian University in Taiwan and Kansai University in Japan.
 - j. ESnet's Gamma Ray Energy Tracking Array (GRETA) prototype is using on net computing to avoid the need to take data off the net to a server and then back onto the net.
 - k. In support of quantum networking, SL is putting together a quantum exchange testbed in Chicago. It uses private fiber and is used to show the ability to carry both quantum & classical on the same fiber. Currently its furthest reach is about 150 km.
- N. NRL (Linden Mercer and Basil Decina):
- The slides for this talk are available on the JET website at:
<https://www.nitrd.gov/coordination-areas/lsn/jet/jet-meetings-2024/>
- a. NRL is deeply appreciate of all the collaboration with Starlight (SL) and to the many people who put so much effort into building the environment here.
 - b. DOD has a global problem space. Global data acquisition, with a challenge of resiliency for its distributed processing, and the need for immediate data access anywhere. The goal is for faster and better decision cycles in the face of things being disabled and questions always changing.

- c. NRL's Center for Computational Science's SC24 demonstration has the specific goals of:
 - i. Rapid network deployment, monitoring, reporting, and redeployment.
 - ii. Tbps RDMA data movement over global distance for timely Terabyte transfers (goal << 1 min Tbyte transfer on an N by 400G network).
 - iii. Dynamic shifting of processing and network resources from one location/path/system to another (in response to demand and availability).

The demonstration makes use of compute and storage resources in its booth at SC, at the Joint Big Data Testbed (JBDDT) facility in McLean, VA, and at SL in Chicago. It also makes use of networking support from Internet2 (I2), FABRIC, ESnet and the ESnet testbed.

- d. During the demonstration various pieces are being removed and added. The priorities of various processes are changed. The task was not to let any of these disrupt the workflows and their timely completion.
- e. The NRL booth/demo had 2.4T of outside bandwidth coming in. With that NRL demonstrated moving a TB in under 15 seconds (using 2x400G) over 2800 km. (NRL's first SC, Dallas in 2000, had 2.4G into the booth and across the WAN.)
- f. A key, learned a long time ago, was that you have to fill the pipe. You must have enough data in flight plus not need to stop and await acknowledgements. Question: Regarding the control plane. How do you decide what to move, where and when?
Answer: How dynamic can this be? Not as dynamic as we might like. Some of the highest priority items might be just gigabytes, but you don't need to, want to, reserve for 10 minutes when only a fraction of a second is needed. Right now, there are rules on periodization. Those can be changed, but on a different timescale. And not a lot of changes at one time.

Meetings of Interest 2024-2025

Nov 17-22, 2024	SC24 , Atlanta, GA
Dec 9-12, 2024	Internet2 Technology Exchange , Boston, MA
Jan 19-22	PTC25 , Honolulu, HI
Jan 28-30	6NRP , San Diego, CA
Jan 29-30	HIC , Honolulu, HI
Feb 3-5	NANOG 93 , Atlanta, GA
Feb 3-6	The Quilt Winter Meeting , Tempe AZ
Mar 3-7	APAN59 , Yokohama, Japan
Mar 10-13	SCA25 , Singapore
Mar 15-21	IETF 122 , Bangkok, Thailand
Mar 27-30	ARIN 55 , Charlotte, NC
Apr 28-May 1	Internet2 Community Exchange , Anaheim, CA
May 12-16	RIPE 90 , Lisbon, Portugal
Jun 9-11	NANOG 94 , Denver, CO
Jun 9-13	TNC25 , Brighton, UK

Jul 19-25 [IETF 123](#), Madrid, Spain
Jul 28-Aug 1 [APAN60](#), Hong Kong
Aug 7-8 [APNet'25](#), Shanghai, China

Next JET meetings

Note: It is anticipated that most JET meetings will remain virtual for the foreseeable future

Dec 17, 2024 12-2 p.m. ET *n.b. This meeting will be held only if needed.*
Jan 21, 2025 12-2 p.m. ET
Feb 18, 2025 12-2 p.m. ET