



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
July 18, 2023, 11:45a.m. – 1:00p.m. ET
This meeting was virtually

Participants

Shawn Armstrong, University of Alaska
Jeff Bartig, Internet2
Erik-Jan Bos, NORDUnet
Dale Carder, ESnet
Bobby Cates, NASA/Ames
Basil Decina, NRL
Ann Keane, N-Wave
Marl Johnson
Jonah Keough, Pacific Wave/PNWGP
Michael Lambert, PSC/3ROX/ACCESS
Andrew Lee, N-Wave
Caren Litvanyi, N-Wave
Paul Love, NCO/NITRD

Joe Mambretti, StarLight/MREN
Aruna Muppalla, NASA/GSFC
Ralph McEldowney, DREN
Linden Mercer, NRL
Alex Moura, KAUST
Per Pedersen, NWS
Amy Philipson, PNWGP
Michael Sinatra, ESnet
Patrick Smith, NSF
Kevin Thompson, NSF
Chris Wilkinson, Internet2
Jim Williams, Indiana University

Proceeding: This meeting was chaired by Kevin Thompson (NSF) and Ralph McEldowney (DREN).

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

II. **Review of the Minutes of the June 2023 meeting:** No corrections were received.

III. **Polar Connect: Can Arctic submarine cable systems enhance secure intercontinental connectivity? – Erik-Jan Bos**

The slides for this brief can be found at:

<https://www.nitrd.gov/coordination-areas/lsn/jet/jet-meetings-2023/>

- A. Vision 2030 is a project of NORDUnet with commercial partners to run two different, trans-Arctic submarine cables between Europe and North America/Asia by the end of this decade. It is co-funded by the European Union.
- B. NORDUnet serves the R&E networks of the five Nordic countries – Iceland, Norway, Sweden, Finland and Denmark. NORDUnet interconnects the NRENs and connects them to the rest of the world. (*n.b.: the Nordic countries include Greenland, the Faroe Islands and Svalbard.*)
- C. Submarine cable systems, which carry about 99% of all internet traffic between countries, primarily lay of the sea floor (being buried only where they come ashore to a

cable landing facility) and are about the diameter of a garden hose. Over the last five years the most dramatic area of traffic growth has been consumer video – online business meetings, entertainment videos and online lecture streaming – driving the need for far more capacity between countries and continents. Europe-Asia bandwidth capacity is expected to double between 2020 and 2024 (to ~400TBps). There is currently a lack of cable infrastructure in the lower southern hemisphere – Africa<>southern Latin America and southern Latin America<>New Zealand/Australia which drives even more traffic to run over the northern hemisphere systems. Many of the current submarine cable systems are nearing their end of life – some for technical reasons, some for economic ones.

- D. Research done by ESnet has shown that resilience starts with 4 connections – terrestrial or submarine. NORDUnet has followed this for all its inter-country connections with the exception of Iceland. Looking between Europe and Asia, trans-Arctic paths are both shorter than other routes and permit the goal of 4 paths with diverse end points.
- E. The European Council has concluded that digital sovereignty, a strategic digital autonomy, is key for the Union to have. To that end it has identified four European Data Gateways: Atlantic, Mediterranean, Baltic to Black Sea and North Sea/Arctic.
- F. NORDUnet is focusing on the North Sea/Arctic gateway with its commercial partner, Cinia, a Finnish telecommunications company, which has built and operates both submarine and terrestrial systems in Finland and between Finland and Central Europe.
- G. The initial three pieces of the Gateway are upgrades to terrestrial fiber in Finland, a new submarine cable between Finland and Central Europe (C-Lion2) and Far North Fiber. The latter starts in Ireland and northern Norway and comes together south of Iceland. There will be a branching unit there to Iceland. The cable continues south and west of Greenland and west through the Canadian Arctic. Possible landing sites are in northwestern Greenland and two or three locations in the Canadian Arctic. Another potential landing site is in the Northwest Territories, around the Mackenzie River, and then one at Prudhoe Bay, Alaska. From there the path would be on across the top of Alaska, down through the Bering Strait to Tokyo, Japan, with a branching unit for a landing on Hokkaido. Hokkaido has the potential for green data centers due to its cool temperatures. Likewise the Nordics have the potential for green data centers. (It is roughly six times less expensive to place data centers in cold areas where you have power and transport the data rather than the other way around. Additionally, the excess heat from a data center can be captured to heat other buildings.
- H. Concurrently a new fiber system between Norway and Svalbard is being planned. This will go on to Iceland with a landing on Jan Mayen. (Svalbard and Jan Mayen both host significant scientific research.
- I. Far North Fiber (FNF) is being driven by Far North Fiber, an American company based in Anchorage, Cinia and Arteria Networks, a Japanese network company. It's anticipated to be operational by the end of 2026.
- J. Around 2030 or so, NORDUnet is looking at an even more direct trans-Arctic fiber – Polar Connect (PC). It goes north from Norway, touches at Svalbard, runs under the permanent Arctic ice north of Greenland and the Canadian Arctic and then follows a similar path to FNF to Japan. PC and FNF are not viewed as competitors but rather as a

ring yielding resiliency and redundancy while retaining the reduced latency that trans-Arctic cables provide to Europe<>Asia traffic. (Stockholm<>Tokyo RT will be about 60% of the current best path on the Suez Canal route.) It is believed that running a fiber ring through the Arctic and under the ice will enhance security.

- K. Submarine cable systems can also be a scientific research instrument – a Smart Cable. It's planned to have PC be a smart cable. There are discussions with FNF about doing the same on the first trans-Arctic fiber. Sensors envisioned include for those for Earth observations, marine biology observations, seismic research and geological research as well as acoustic sensors.
- L. Summary and next steps (with thanks to Erik-Jan)
 - a. Looking for Improved Connectivity to Asia
 - b. Increased redundancy and security
 - c. Cheaper to move data than electric power
 - d. Gap analysis for the envisioned route
 - e. Gathering requirements from stakeholders
 - i. Data communication
 - ii. Science & Research

Question: With the increasing number of LEO systems with inter-satellite communications (ISC), how do you view the very expensive submarine cables vs. LEOs for intercontinental data traffic?

Answer: LEO systems with ISC will be extremely important for access networks. But their capacity will not approach that of modern fiber systems. FNF and PC will both be multi-fiber cables with a high fiber count. With improvements in multiplexing each will have 100-200TB capacity.

Related: For pure speed on long distances LEOs with ISC will be faster than submarine cables since photons in fiber run at roughly 66% of the speed of light vs at light speed in space.

Question: Will FNF fiber land on the west coast of Alaska? One map showed it was, a later one didn't.

Answer: The business case for FNF is still being developed. Landing at Prudhoe Bay is pretty assured, the west coast site is still under review.

IV. JET's tasking on tools to help with inter-domain problem resolution

- Remains on hiatus while Joe Breen is engaged with other matters.

V. Operational Security Round Table: No updates received.

VI. Network roundtable

- A. DREN (Ralph McEldowmey):
 - a. DREN officially finished the transition from DREN III to DREN 4 on 16 Jun.
 - b. DREN is now able to explore some feature the DREN 4 contract has that it was unable to explore during the transition including:
 - i. Building out DREN4's intelligent core with additional routing and security capabilities and adding compute and storage to the core.

- ii. Building out DREN's second NOC data center.
- B. ESnet (Dale Carder and Michael Sinatra):
 - a. IETF 117 is coming up in San Francisco, CA. Both I and Nick Buraglio will be there mostly engaged on IPv6 sessions. Nick more on the operational side while I'll be representing high energy physics community and ESnet's application of packet marking. We're hoping to get some feedback. If it's useful we'll report on a future JET call.
 - b. On ESnet's core routers we're doing a L3VPN migration in a very structure way. Customers, management plane, control plane, service plane will all be separated.
 - c. ESnet is improving its traffic management for the trans-Atlantic circuits it operates. This a bit of fallout from now having both 100 and 400G circuits between the US and Europe. ESnet is using segment routing - basically an array of tunnels and then using weighted ECMP to get them into different sets of sources and sinks on the European side. It's working pretty well with reduced contention and better use of the 400G links.
- C. Internet2 (Chris Wilkinson and Jeff Bartig):
 - a. Internet2 (I2) is doing its first major software upgrades to both its optical and packet platforms since NGI was deployed.
 - i. Cisco's current code will allow I2 to leverage more segment routing and traffic engineering on the platforms. These weren't available when NGI was rolled out but are now and the upgrade is progressing.
 - ii. The software upgrades are going in step with some optics replacements with I2 is transitioning from AOC cables to discrete optics.
 - iii. Both of these will be rolled out over the next month or so. The intention is to be done before TechEX.
 - b. Concurrently I2 is doing a fairly major code upgrade on the Waveservers. The change will allow I2 a lot more flexibility to optimize line rates and client interface configurations.
 - c. I2 is also reviewing edge device configurations. The goal is to provide better cloud connect services. This is significant for I2 as the existing platform, Cisco 8202s, have some known limitations. I2 had planned to work on the edges two years into NGI so this is right on target. More details at TechEX or a bit later in the fall.
- D. Indiana University/International Networks (Jim Williams):
 - a. With the Pacific area's significant issues are resolved all circuits have been stable.
 - b. On the staff side:
 - i. Ed Moynihan and Brenna Meade are heading to Colombo, Sri Lanka, for APAN56.
 - ii. Hans Addleman is this year's SCinet chair
- E. NRL (Linden Mercer): Continuing to work on getting ready for SC in Denver. Just this past week Scott Kohlert (Ciena/SCinet) brought up 3x400G from the Joint Big Data Testbed facility in McLean, VA, to the JBDT switch at StarLight. Having circuits early will be a significant help in being ready for NRL's experiments during SC.

- F. Pacific Wave (Jonah Keough):
 - a. Pacific Wave (PW) is progressing on its planned 400G upgrades. The order has been placed for the Juniper PTX that will support the backbone upgrades as well as some new 400G circuits PW anticipates coming into Los Angeles, CA, for SC.
 - b. PW continues to work on demos for SC.
 - c. Conversations are continuing with new AP-REX partners. There should be more news on this around TechEX or shortly thereafter.
- G. University of Alaska (Shawn Armstrong): No update this month.

VII. Exchange Points Round Table

- A. MAN LAN, WIX and Boston (Chris Wilkinson and Jeff Bartig):
 - a. I2's MAN LAN exchange point is now capable of 400G using Arista switches. A second 400G capable switch is going into Boston, MA, to be ready for I2's initial 400G trans-Atlantic circuit which is due in late September or early October and will land in Boston. WIX is planned to also go to 400G. All three will be interconnected at 400G. They will also be integrated into the AP-REX infrastructure I2 is working on with StarLight and Pacific Wave. No hard timeline at this point but the hope is to have the first east-west 400Gs through Starlight and AmPath by SC. The needed hardware is in inventory.
- B. StarLight (Joe Mambretti):
 - a. As Chris Wilkinson and Jonah Keough have mentioned, StarLight (SL) is working with them and others on AP-REX 2.0. Over time this will have 400G interconnects between the open exchanges in Los Angeles, Sunnyvale, Seattle, SL, WIX, MAN LAN, Boston and AmPath. A later extension will be to Montreal Open Exchange.
 - b. SL continues to work with an international consortium on the Data Mover Challenge (DMC) testbed. This remains a partnership with SupercomputingAsia (*n.b.: SCAsia 2024 will be in Sydney, Australia.*)
 - c. SL is also working on a submission to DMC which will be about crisis response with multiple large scale, worldwide flows that are suddenly disrupted. Recovery will be via LEO satellites with flows priority selected for recovery (such as those of hospitals and first-responders).
 - d. SL is working with SCinet to get circuits for demos at SC up early – as Linden mentioned, 1.2T just came up between the JBDT and SL on capacity provided on Internet2's backbone. Prototype terabit demos are expected in support of largescale science. 400G switches and DTNs are being configured and implemented.
 - e. SL is planning for the Global Research Platform workshop that will be in conjunction with IEEE's 19th International Conference on e-science. It'll be held in early October in Cypress. The workshop will address a number of issues; networking for large scale science, 400 and 800G WANs, telemetry, etc. There will also be an overview of international testbeds that are under development to support demonstrations and experiments for data intensive science.
- C. NASA Ames (Bobby Cates): Nothing new today.
- D. PNWGP (Jonah Keough): No update today.

Meetings of Interest 2023

Jul 17-20	Routing Security Summit 2023 , virtual
Jul 22-28	IETF 117 , San Francisco, CA
Aug 21-25	APAN56 , Colombo, Sri Lanka
Aug 23-24	DREN TIM , Dallas-Fort Worth, TX
Sep 18-21	Internet2 Technology Exchange , Minneapolis, MN
Sep 25-28	The Quilt Fall Meeting , Columbus, OH
Oct 8-9	GRP workshop at IEEE eScience , Limassol, Cyprus
Oct 16-18	NANOG 89 , San Diego, CA
Oct 16-18	ESnet Confab23 , Washington, DC
Oct 18-19	CANARIE Summit 2023 , Montreal, QC, Canada
Oct 19-20	ARIN 52 , San Diego, CA
Oct 19-20	ESCC , Washington, DC
Nov 4-10	IETF 118 , Prague, Czech Republic
Nov 12-17	SC23 , Denver, CO
Dec 12-14	AINTEC , Hanoi, Vietnam
2024	
Jan 21-24	PTC'24 , Honolulu, HI
Jan 30-Feb 1	HIC, Kauai, HI
Feb 5-7	NANOG 90 , Charlotte, NC
Feb 19-22	SupercomputingAsia 2024 , Sydney, Australia
Mar 4-7	Internet2's Community Exchange , Chicago, CA
Mar 16-22	IETF 119 , Brisbane, Australia

Next JET meetings

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

Aug 15, 2023	12-2 p.m. ET
Sep 19, 2023	12-2 p.m. ET
Oct 17, 2023	12-2 p.m. ET