



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

May 18, 2021 12:00-2:00 p.m. ET

This meeting was held virtually

Participants

Joe Breen, UTEN/University of Utah

Erik-Jan Bos, NORDUnet

Tony Brock, Oregon State University

Nick Buraglio, ESnet

Rich Carlson, DOE/SC

Bobby Cates, NASA/Ames

Basil Decina, NRL

Dave Diller, MAX

Bill Fink, NASA/GSFC

Jonah Keough, PNWGP/Pacific Wave

Kevin Kranacs, NASA/GSFC – EOS

Michael Lambert, PSC/3ROX

Paul Love, NCO/NITRD

Chris Lowe, USDA/ARS

Joe Mambretti, StarLight/MREN

Linden Mercer, NRL

Alex Moura, RNP

Edward Moynihan, Indiana University

Aruna Muppalla, NASA/GSFC

Glenn Ricart, US Ignite

Anne Richeson, Lumen

Jennifer Schopf, Indiana University

Kevin Thompson, NSF

George Uhl, NASA/GSFC

Proceeding: This meeting was chaired by Rich Carlson (DOE/SC) and Kevin Thompson (NSF).

I. Action Items:

- Internet2 and ESnet updates on their respective new networks.

II. Review of the Minutes of the April 2021 meeting: No corrections were received.

III. Trans-Atlantic R&E connectivity: Update and outlook on ANA and friends – Erik-Jan Bos

Note: The slides for this talk are posted on the JET's web page at:

<https://www.nitrd.gov/nitrdgroups/images/2021/JET-Erik-Jan-Bos-05182021.pdf>

- A. Trans-Atlantic R&E networking: The early days
 - a. 1989/90: European Academic Research Network, 9.6 kbps, sponsored by IBM and running proprietary IBM protocols. Included a trans-Atlantic link from southern France to US.H
 - b. 1994: SURFnet had multiple 2 Mbps trans-Atlantic circuits running IP (as all future circuits used).
 - c. 1995: NORDUnet, initially 2 Mbps trans-Atlantic, moved to 34 Mbps.
 - d. Other early trans-Atlantic circuits were from NSF, Ebone, DANTE, DGIX, etc.

- e. Some experiments in sharing a link, but mostly everybody did their own circuits (including the then 38 European NRENs) with very little reciprocity. Circuits were acquired on short term leases.
- B. Global Lambda Integrated Facility (GLIF) era: A series of workshops in 2001-2003 lead to the formation of the GLIF and more coordination in buying bandwidth, working groups, meetings, global R&E network maps, and the forming of a community. Circuits still acquired on short term leases
- C. The Advanced North Atlantic Collaboration – ANA
 - a. Resulted from the merger of GLIF and Global Network Architecture (GNA) into the Global Network Advancement Group (GNA-G)
 - b. The founding optical R&E networks (NORDUnet, SURF (formerly SURFnet), Internet2, and ESnet) challenged the market with a request for a trans-oceanic 100G circuit in 2012.
 - i. First ever intercontinental 100G (New York<>Amsterdam) jointly purchased.
 1. Worked jointly with Ciena and Tata Communications. Ciena provided transponders for this experiment. Tata provided spectrum. ANA was permitted to put its Ciena transponders in Tata’s submarine cable shore stations.
 2. It took about two months to get the 100G to run error free and was inaugurated in 2013 at TNC13.
 3. The GLIF’s existing trans-Atlantic 10G circuits remained in use until the second 100G circuit came into operation (late 2014/early 2015) to provide capacity & resilience.
 - ii. Going forward: Joint buying of 100G lambdas
 1. Between Global R&E Exchange Points (GXP)
 2. Federated Operations Model – a single box at each site supporting all circuits terminated there. (ESnet is the exception to the shared hardware.)
 3. MOUs between partners
 4. "Token-based", back-up arrangements
 5. Now totaling 1 Tbps (10x100G)
 6. Diversity has been maximized – only one cable system carries two circuits.
 7. Circuits acquired on longer term leases than previously.
 - c. New partners over time: CANARIE, GÉANT, NEA³R and SINET/NII.
- D. Other parts of the Atlantic. Until recently the Mid and South Atlantic did not have R&E circuits on submarine cables between South America and either Europe or Africa.
 - a. BELLA (Building the Europe Link to Latin America)
 - i. BELLA-S runs Portugal<>Fortaleza, Brazil over the new EllaLink cable system. There is an Iberian extension to Madrid and thence GÉANT.
 - ii. BELLA-T runs Brazil<>Buenos Aires<>Santiago and north to the Bogotá and the Caribbean coast. When three gaps are completed there will be a

- ring around South America from Fortaleza. While BELLA-T is primarily terrestrial, a few segments are on submarine cables.
 - iii. GÉANT and RedCLARA are anchor tenants on EllaLink for the spectrum of half a fiber pair. RNP is also an anchor tenant.
 - iv. This is expected to be operational the beginning of June.
 - b. AmLight-Exp
 - i. An NSF sponsored link Fortaleza<>Angola on the SACS cable system. It's in use now.
 - ii. In Angola it connects to the WACS cable to reach Cape Town. In Cape Town connections can be made to UbuntuNet Alliance, TENET and SANReN with interconnections to many other African R&E networks. The South African portion of the SKA is also reachable.
 - iii. An open GXP is being built in Fortaleza where AmLight-Exp brings significant bandwidth.
 - c. There are discussions ongoing to provide backup paths for BELLA-S and the Fortaleza<>Africa circuits. The initial thought is to make use of ANA<>AmLight-Exp and the bandwidth available Cape Town<>Europe with experiments planned on different ring topologies.
- E. Global Summary (see slides 10 and 11 of the presentation)
 - a. Though the rest of the world does not have the density of trans-oceanic R&E circuits found in the North Atlantic much of the world is interconnected with 100G rings: ANA, Asiapacific Europe Ring, Asia Pacific Ring, and NII/SINET global ring.
 - b. Some cables are seeing R&E networks becoming anchor tenants – partial owners of the cable. CAE-1 (Connect Asia Europe 1) has several Asian and European NRENs as IRU owners. BELLA as mentioned. AARNet has IRUs on both INDIGO on the west coast of Australia and JGA on the east side, the Norwegian NREN (Uninett) in the Svalbard archipelago, some of the circuits in ANA, and ACSC (see below).
- F. Arctic Connect Submarine Cable System
 - a. One area of ocean with no cable systems is the Arctic from Europe east through Bearing Strait to Asia and northwestern North America.
 - b. A consortium of Norway, Finland, Russia and Japan are planning the Arctic Connect Submarine Cable (ACSC) system. The project is led by Cinia from Finland. NORDUnet and GÉANT working on the R&E portion – Arctic Connect R&E – with Cinia. Arctic Connect R&E would make the R&E capacity available to all R&E users.
 - c. Russia is a partner in the ACSC alliance. Arctic Connect is a dual cable system - a Eurasian cable system and a Russian cable system. Both are in one outer sheath, but the Russian system will only touch Russian cable landing stations and be fully powered from Russian while the Eurasian system is only powered by non-Russian landing stations and does not touch Russia.
 - d. Current landing stations for the Eurasian cable are planned for Northern Norway (Kirkenes)/Northern Finland, Tokyo and on the island of Hokkaido. The plan

- includes a landing in North America – either Vancouver or Seattle. A landing site on the west coast of Alaska is being considered – primarily if electrical power is needed.
- e. ACSC European backhaul is challenging as it's a long way from Kirkenes to the rest of Europe. Cinia is exploring two options:
 - i. A terrestrial path south through Finland and then a submarine path into northern Germany or The Netherlands.
 - ii. A submarine path along the coast of Norway and into The Netherlands.
 - f. The European Union under the presidency of Portugal has promulgated a ministerial declaration on a European Data Gateway Strategy. It was signed by all EU member states plus Norway and Iceland. It uses primarily submarine cable systems, along with some terrestrial cables, to reinforce European internet connectivity with global partners and digital independence. ACSC would support this.

IV. Discussion of the JET's tasking on tools to help with inter-domain issues – Joe Breen, James Deaton, all

This is a community project to collect shared data from all who are willing to share.

- A. Prototype/pilot: The various pilots continue to progress. Work continues to get basic measurement data from different universities and RONS.
 - a. Work continues with MERIT for a sharing of its data.
 - b. From a discussion earlier today LEARN is willing to share its data.
 - c. Work continues with REDClara on needed ACLs to make its data available.
 - d. Work continues with TENET on making its data available.
 - e. Discussions are ongoing with C-Light.
 - f. The project is moving data to the Internet2 Performance Working Group's web site and a Google shared drive from personal drives to make it more widely available and accessible.
- B. Background on efforts lead by Eric Boyd, Joe Breen, James Deaton, Dan Doyle, and Karl Newell:
 - a. The project gets basic SNMP metrics from groups around the country that are willing to share for trouble shooting and research. Metrics include link utilization, discards and errors. These are collected hop by hop as the path crosses multiple domains.
 - b. Several prototypes are going along with the drafting a basic letter of intent for those wishing to participate.
 - c. Tools: Telegraf container as an option for local collection. Nearly ready for production use.
 - d. Tracking sheet of networks willing to share data. Please update your network's entry. See:
https://docs.google.com/spreadsheets/d/1pMW_PNVpeT42nAxa3bW4QostMxcCHTXkWSPlFwE/edit#gid=0
The spreadsheet also has an embedded link to measurement templates for

- campus, regional and national networks setting out what data is desired. See: <https://drive.google.com/drive/folders/1l-LRyri16u4AvBeY6NlvYyYalNRpjByA>
- e. The Internet2 Performance Working Group Community Measurement, Metrics, and Telemetry project holds meetings on the second Tuesday for those participating or interested. If you are interested, please contact Joe: [Joe Breen <Joe.Breen@utah.edu>](mailto:Joe.Breen@utah.edu)
 - f. General information about this project can be found at: <https://spaces.at.internet2.edu/display/PerformanceWG/Internet2+Community+Measurement%2C+Metrics+and+Telemetry+Project>
 - g. While NASA polices preclude EOS from sharing this data, EOS has an internal perfSONAR (pS) mesh. They are happy to open their firewalls to permit pS testing by prior arrangement. Contact George at: ["Uhl, George D." <george.d.uhl@nasa.gov>](mailto:Uhl, George D. <george.d.uhl@nasa.gov>)

V. Operational network security roundtable No updates received.

VI. Network roundtable

A. ESnet (Nick Buraglio):

- a. The Department of Energy's (DOE) IPv6 only working group, the IPT, released its data call today. The data call was the result of about five weeks of work to develop a comprehensive set of questions for DOE's sites to answer. DOE is using an iterative approach. Sites can answer on this first call with "needs more work". This gives the IPT a broad-brush overview and gives the sites more time to dig out full answers for a second data call. DOE is on track to meet OMB's timeline.
- b. The commercial path computation engine (PCE) that ESnet has purchased has been stood up in ESnet's lab. When in production the PCE will replace what OSCARS does to support workflows and has a few features beyond what OSCARS provided.
- c. ESnet 6:
 - i. Router deployment continues
 - ii. In response to a timeline question: ESnet6 is not off schedule
 - iii. The annual IPR review of the ESnet6 project went well and was completed last week.

B. International Networks – Indiana University (Ed Moynihan):

- a. NEA³R: The pair of trans-Atlantic 100G circuits are in use and stable. Work continues in setting up the backups within ANA as well as peerings. Work is also continuing to get the measurement and monitoring infrastructure setup. This will provide more insights into how traffic is moving across the Atlantic. Traffic has been observed using bad routes, e.g. South America to Africa via United States and Europe, which need to be corrected. A working group has been brought up under GNA-G for engineers to discuss and work on these issues.

- b. TransPAC: The 100G Guam<>Singapore consortium continues its procurement. The new circuit will replace the remaining 10G Guam<>Hong Kong circuit which is scheduled to be turned down in a month.
- C. NASA EOS (Kevin Kranacs): No update today.
- D. NASA GSFC (George Uhl): No update today.
- E. NRL (Linden Mercer): NRL is working with iCARE/SL/GSFC to develop demos for SC21.
- F. Oregon State University (Tony Brock via email): No updates today.
- G. Pacific Wave (Jonah Keough): No big updates from last month. Pacific Wave (PW) continues to work on route server deployments. PW anticipates being able to share its product selection next month. PW has some West Coast capacity upgrades coming.
- H. RNP (Alex Moura via chat): No updates today.
- I. SCinet (Paul Love): (See the appendix for the SCinet drawing.) If you are considering an exhibit or demonstration that will require significant bandwidth at SC21 this November, please respond to the Call for Bandwidth sent to the JET list before this meeting. Please also let the SCinet WAN team know if you have needs in a city not on the map distributed. The WAN team's email is:
 - wan-leads@scinet.supercomputing.org
- J. 3ROX (Michael Lambert): No updates this month for PSC, 3ROX or XSEDE.
- K. University of Utah/ UTEN (Joe Breen): UTEN is rolling out more metro upgrades to 400G over the next month. These include measurement and monitoring at both the optical & router layers to implement streaming telemetry from the Cisco equipment across the main core backbone nodes.
- L. USDA/ARS (Chris Lowe via chat): No updates today.

VII. Exchange Points Round Table

- A. PNWGP (Jonah Keough): No updates today.
- B. Ames (Bobby Cates): Not that much since last month. Work continues with USGS's migration. The next step is to integrate USGS with the California Office of Emergency Services as USGS will be setting up a tower to support its two emergency communications radios.
- C. StarLight (Joe Mambretti):
 - a. For SC StarLight (SL) is working with NRL and GSFC on a testbed with 400G between DC (McLean, VA), SL & SC. SL hopes to extend the circuit to UCSD.
 - b. SL continues to assist in the design the Data Mover Challenge testbed that will be used in the run-up to next year's Supercomputing Asia (March 1-3, 2022). Part of this a 200G circuit sponsored by KAUST from Amsterdam to KAUST to Singapore.
 - c. The p4 testbed integration between GÉANT and SL continues.
 - d. SL continues work with the international AutoGOLE/SENSE (AG/S) consortium to develop a global multi-point testbed.
 - e. SL continues working with CERN on the NOTED project. NOTED's goal is to use ML to anticipate large flows of experimental data and do just-in-time circuit provisioning.
 - f. SL continues to work on FNAL's ROBIN project – an integration of the Rucio data manager, FNAL's Big Data Express and DOE's SENSE data orchestrator.

- g. SL continues to work on several provisioning efforts. Most notably with campus cyber infrastructure at Michigan State University and integrating FABRIC with the Chameleon testbed.
- D. MAX (Dave Diller):
- a. The FABRIC node is in and powered. Some network connections remain to be completed. It'll soon be ready to hand it over for use.
 - b. MAX continues with its 400G refresh. Unable to share more details right now.
 - c. The refresh is giving MAX a chance to look at other pieces. For example, currently MAX has just a pair of 10G perfSONAR (pS) nodes. These will be replaced with 100G pS nodes at the core and 10G pS nodes at all the edge.

Meetings of Interest 2020

Note: Meetings cancelled since the May JET have been removed from this list. Those moved to a virtual format have been updated.

Jun 14-16	NANOG 82 , virtual meeting
Jun 21-25	TNC21 , virtual meeting
Jul 24-30	IETF 111 , virtual meeting
Aug 2-6	APAN52 , moved to a virtual meeting a
Sep 20-21	The 2nd Global Research Platform (2GRP) Workshop , virtual meeting
Sep 28-30	The Quilt Fall Members Meeting , virtual meeting
Nov 1-3	NANOG 83 , Minneapolis, MN
Nov 4-5	ARIN 48 , Minneapolis, MN
Nov 6-12	IETF 112 , Madrid, Spain
Nov 14-19	SC21 , St. Louis, MO. Anticipated to be a hybrid meeting
Jan 16-19, 2022	PTC'22 , Honolulu, HI

Next JET meetings

Note: It is anticipated that JET meetings will remain virtual for the foreseeable future. The possible exception will be the November meeting if SC21 remains a hybrid conference.

Jun 15, 2021	12-2 p.m. ET
Jul 20, 2021	12-2 p.m. ET
Aug 17, 2021	12-2 p.m. ET

Appendix: SCinet WAN Initial Circuit Plan: End Points and Proposed Bandwidth

