



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 19, 2022, 12:00-2:00 p.m. ET

This meeting was held virtually

Participants

Shawn Armstrong, University of Alaska
Jeff Bartig, Internet2
Nick Buraglio, ESnet
Bobby Cates, NASA Ames
Rich Carlson, DOE/SC
Basil Decina, NRL
Jonah Keough, PNWGP/Pacific Wave
Ann Keane, NOAA
Bill Fink, NASA/GSFC
Kevin Kranacs, NASA/GSFC – EOS

Michael Lambert, PSC/3ROX
Paul Love, NCO/NITRD
Joe Mambretti, StarLight/MREN
Linden Mercer, NRL
Edward Moynihan, Indiana University
Aruna Muppalla, NASA/GSFC
Mark Mutz, NOAA
Glenn Ricart, US Ignite
Christian Todorov, Internet2
Chris Wilkinson, Internet2

Proceeding: This meeting was chaired by Rich Carlson (DOE/SC).

I. Action Items:

- Planning for the JET's tasking for 2023 with the initial discussion at the August meeting.
- Final updates from Internet2 and ESnet on their respective new networks.

II. Review of the Minutes of the June 2022 meeting: Corrections were received via email and have been incorporated in the posted final minutes.

III. Discussion of the JET's tasking on tools to help with inter-domain issues – Joe Breen (via email)

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

The related, live map is at: <https://www.globalresearchmap.org/>

- A. The project continues to make slow progress.

IV. IPv6-only progress – Mark Mutz, Bobby Cates and Nick Buraglio

A. N-Wave (Mark Mutz):

- a. N-Wave is a carrier, an ISP and is fully IPv6 compliant as far as transport is concerned.
- b. It's holding regular meetings with its downstream customers to encourage adoption which can be a bit slow in the various programs.
- c. To encourage adoption all new connections are configured with IPv6.

- d. When N-Wave was starting, and much smaller, it received an allocation of IPv6 addresses – a /32. The Department of Commerce used much of that leaving N-Wave a small number of addresses. With N-Wave’s growth it recently requested and received a /20.
 - e. NOAA is still working through the challenges of IPv6-only planning.
 - f. N-Wave is working with the NOAA cyber security group and some Web operations groups on NAT64/DNS64. The process is through planning and nearing implementation. They’ll be collocated with TICAP stacks cyber security and N-Wave operate (Honolulu, HI, Seattle, WA, Denver, CO, and Washington, D.C. area. An additional TICAP is be relocated to Anchorage, AK.) N-Wave is working with cyber security on the next iteration of the TICAPs – 3.0 – which is influencing the timeline for NAT64/DNS64.
- B. NASA Ames (Bobby Cates – via email): AIX has a couple of VLANs for IPv6 only use and a /48 IXP micro-allocation.
- C. ESnet (Nick Buraglio):
- a. ESnet as with N-Wave, ESnet is an ISP, so most of its focus relative to IPv6-only is at the two data centers it operates and how to transition them and the services ESnet offers to IPv6-only.
 - i. IPv6-only trials:
 1. More than a year ago ESnet built an IPv6-only network for its Champaign-Urbana, IL, office which has ten people on metro-fiber owned by ESnet. This is ESnet’s unofficial prototype. Central pieces is a Palo Alto network device that is running NAT64 and NAT44. The network is dual tacked to support IOT devices. There is DNS64 for local address resolution.
 2. ESnet took the design from the Champaign-Urbana office and made an official trail in its west coast data center. It has DNS64/NAT64 and as many different types of hosts that ESnet runs in production on it. The goal was to get a good estimate of what worked and what didn’t. A Palo Alto 100G UTM was used to test the various NAT64/DNS64 options (using different resolvers), validate ESnet’s internal tools (security functions, automation and provisioning) worked without degradation or significant operational issues when there is an absence of IPv4, and test performance and monitoring. Since ESnet has been dual stacked for many years most items worked with little or no needed changes. Connections were at 10G with no performance degradation at that speed. The trial also had a stretch goal of developing DHCPv6 tools. ESnet was able to get all working with DHCPv6.
n.b.: DHCPv6 is significantly different so this needs to be allowed for in a network’s migration planning.

3. Next Steps:
 - a. Additional NAT64/DNS64 option testing at a Washington, D.C. area site. This should give more flexibility in host testing options. The hope is that these will permit testing for IPv4 literal mitigation.
 - b. ESnet has been testing CLAT. So far it doesn't work very well on a host – it is more aimed for a mobile environment – so probably not for ESnet deployment.
 - c. Next big step is testing the backbone in an IPv4 free environment. ESnet has concerns with such things as EEROs when there aren't any IPv4 endpoints. It has done some testing, but not yet exhaustive. ESnet worked with Nokia to correctly export flow data to an IPv6 collector.
 - d. More product testing.
 - e. ESnet also needs to do more planning on the steps needed to transition its data centers to IPv6-only. It is anticipating the need to adjust load balancing on inbound traffic.
- ii. Department of Energy
 1. Working on policy documents.
 2. So far the Department's implementation plan doesn't need any changes.
 3. There has been a fair amount of data collection along with two data calls. There is a pretty good understanding of what's enabled and what's possible. So far low single digits have migrated to IPv6-only.
 4. Community of practices calls are being held. Anybody – operator, security, or user – can join and ask questions on anything related to the migration. These calls have been very successful.
 5. There seems to be pretty good uptake by the various divisions. Everybody knows the migration has to happen. The community of practice calls have brought it back front and center. Good participation with questions ranging from policy to deep technical.

V. Operational Security Round Table

- A. ESnet (Nick Buraglio): As part of the deliverables for ESnet6, ESnet has deployed an in house developed operational black hole router service. It's a framework and tracking mechanism for doing extensive black hole routing across the backbone. It was written in such a way that it will migrate over to support flowspec with 5-tuple filtering from the customer to the backbone. The service is now operational available.

VI. Network roundtable

- A. ESnet (Nick Buraglio):
 - a. ESnet is doing a lot of work on automation.

- b. A paper on orchestration was presented at TNC22. A testing platform, Rover, has been developed that permits a piece of ESnet to be brought up, using real configurations drawn from the existing configuration source. All the peripheral services are also constructed in Rover so nothing in the operation network is used. IPAM, several routers, etc. are all inside Rover built using real configurations. No changes are needed to test what will be used to orchestrate the operational network. Most of ESnet's network engineers are in NSO training to make good use of Rover.
- B. Internet2 (Chris Wilkinson): Internet2 (I2) has discovered a bug in the Cisco code that occurs when the box enters maintenance mode, adjacencies are lost and the site is isolated. Route entries are not being removed from the route table. A lot of work with Cisco to isolate. Fairly complicated – a combination of the router being overloaded by doing route updates due to a large route withdrawal situation such as a site isolation along with the usual route additions and subtraction. It's had relatively little operational impact so far with just a single occurrence but certainly could. The cause has been isolated, Cisco has been able to recreate and has a patch. It seems to be primarily an 8200 issue. The bug ID is CSCwc34896.
- C. International Networks – Indiana University (Edward Moynihan):
 - a. Transatlantic: International Networks/Indiana University (IN/IU) circuits are stable as is the rest of ANA.
 - b. The big thing last month was TNC22 – the first real, in person, meeting of the international R&E networking community in over two years.
 - i. Good discussions there around the new transatlantic agreements. The NRENs signed a strategy document. Work on a new engineering document is nearly complete for the current and potential new transatlantic circuits.
 - ii. NORDUNet is still looking at a transpolar cable. It seems to be moving slowly over the summer. The Far North Fibre project will use the Northwest Passage.
 - iii. IN/IU is helping KAUST integrate its 100G circuits into European and Asia Pacific collaborations. Good discussions on this at TNC.
 - iv. The Routing WG – a joint effort by GNA-G and APAN – continues to expand its efforts to identify and fixing routing anomalies. It held its first in person meeting during TNC.
 - c. Transpacific: IN/IU's new Guam<>Singapore 100G circuit went down around the July 1 and remains down. Target for restoration is July 28. APOnet is expanding its monitoring and measurement infrastructure on the circuit.
 - d. IN/IU is working with FABRIC to set up VLANs for FAB as part of the ANA engineering work.
 - e. Africa: UbuntuNet is holding a meeting its November in Botswana which will be face-to-face. IN/IU is hoping to learn more on infrastructure investments as part of AfricaConnect3 at this meeting.
- D. NASA/EOS (Kevin Kranacs): No update today.

- E. NASA/GSFC (Bill Fink):
 - a. Work continues with Joe Mambretti at StarLight and Linden Mercer and company at the Naval Research Laboratory on preparations for SC22 this fall in Dallas, TX.
 - b. Work also continues with Linden and Basil Decina from NRL along with other agencies in the Washington, D.C. area on the DCQNet quantum networking project.
- F. NOAA (Mark Mutz): N-Wave's big project, the upgrading of its core routers to the Juniper PTX with 400G interconnects, is completed except for one circuit which still has some errors.
- G. NRL (Linden Mercer): As Bill mentioned, NRL is working towards Supercomputing in Dallas. With others it is also looking at 400G network interfaces working in Gen5 systems to learn what they can do and how soon we could do something with them.
- H. Pacific Wave (Jonah Keough):
 - a. Pacific Wave (PW) continues to work on IGROK servers for measurement and monitoring. The initial set has been deployed and PW is deciding on the next few sites. PW is particular concerned with a suitable location to analyze international traffic.
 - b. PW preparations for SC22 are also continuing.
 - c. PW's West Coast optical upgrade is nearly completed – just awaiting a few more items from Ciena. These aren't impacting capacity. Everything is online and running to start the transitioning PW's service structure to a community cluster.
 - d. For AutoGOLE automation PW is testing a layer 2 path with University of Hawaii and Guam for the ASTROFLOW project. Some reduced latency has been measured.
 - e. PW is also working with NYSERNet and others on additional automated layer 2 paths.
 - f. The route servers continue to progress.
 - g. PW's testing of streaming telemetry for monitoring is wrapping up. PW will have some results and conclusions in the near future.
 - h. PW is working on some interconnects to FABRIC in California.
- I. PSC/3ROC/XSEDE (Michael Lambert): The XSEDE project is winding down and at the end of August will transition to CONNECT. PSC will be working with Internet2 to transition the VPN – renamed and with some site changes.
- J. University of Alaska (Shawn Armstrong): Nothing to report this month as the contracts for the new intra- and inter-state WAN circuits for the university are still being finalized.
- K. US Ignite (Glenn Ricart): US Ignite (USI) has an NSF grant to help support seven new Community Networks to do the exploration work on technologies and techniques for many new Community Networks to follow using the Congressional BEAD Program funding of \$42 million. USI tried to pick the seven communities using different technologies. Technologies/lessons learned include:
 - a. Quick deployment of RF relay in an area that had just experiences a wildfire
 - b. Metro fiber installs in some cities require lots of permits that take time to process

- c. With the help of the Schmidt Foundation CBRS was deployed to reach low income housing. It was learned that CBRS needs outside antennas for any reasonable speed if the location is more than a block or two from the base station – even a pane of glass causes a large amount of attenuation.
- d. In the Puerto Rico experiment it was determined that with the island’s wiring and power issues the best solution was for local residences to come to a community center which was connected via a cell network rather than attempt to connect individual homes.
- e. In Cleveland, OH, USI was able to piggyback on an existing effort to connect 1500 homes. The program started using CBRS. When that ran out of capacity it moved to millimeter wave. In turn, when the millimeter wave ran out of capacity the migration path was to fiber. This progression brought fiber late in the project when it was more affordable.

USI’s project is winding down and concludes the end of September. USI has recorded about an hour of lessons learned from these seven Community Networks efforts to aid others. Wherever possible please help a local community get connected.

VII. Exchange Points Round Table

A. StarLight (Joe Mambretti):

- a. As Bill and Linden mentioned StarLight (SL) and they are working with the SCinet WAN team to provision an 800G ring between SL in Chicago, IL, SC22 in Dallas, TX, and the Joint Big Data Tasking (JBDDT) testbed facility in McLean, VA. The SL<>McLean link may grow to 1.2Tbits.
- b. At SC there will be many demonstrations using 400G connections, DTNs, switches, NICs, etc.
- c. SL continues to work with DREN to bring in its DREN 4 equipment.
- d. SL will be installing an IGROK node from UCSD for the National Research Platform.
- e. SL is working on the AutoGOLE, P4 and other testbeds.
- f. Jerry Sobieski at George Mason University has an NSF funded research network. It’s just brought up 100G from Paris to Ashburn, VA. It will continue to McLean, then to New York City with a return to Europe. The project will be installing an aggregation switch in McLean to interconnect several networks there as well as the Joint Big Data facility.

B. MAN LAN/WIX (Chris Wilkinson):

- a. Internet2 (I2) is developing its AutoGOLE support at its exchange points. This is in support of FABRIC and other users who have expressed interest.
- b. I2 is doing a study to determine what the two exchange points should have for their future architecture and hardware. I2 is deploying 400G as part of the ANA consortium and MAN LAN and WIX both need a refresh to support. Currently both are QFX switches. They may remain QFXs or migrate to I2’s Cisco platform for consistency in management. The timeline expectation is two to three months. The goal is manage the exchange points in a consistent fashion to the rest of I2’s hardware – same tools, etc.

- c. The current ETA for the 400G international link is Q2 2023.
- C. Ames (Bobby Cates via email): AIX has a project with USGS and Zayo which will light a fiber down the state. It will then test and evaluate new earthquake monitoring technology using fiber cables to see if it's effective.
- D. PNWGP (Jonah Keough): Nothing new today.

Meetings of Interest 2022

Note: Meetings whose format has changed have been updated.

Jul 23-29	IETF 114 , Philadelphia, PA
Aug 22-26	APAN54 , Jinan, China, primarily virtual with possibly limited local attendance
Sep 19-21	National Science Foundation Campus Cyberinfrastructure PI Workshop , Minneapolis, MN
Sep 20-22	The Quilt Fall Meeting , Minneapolis, MN
Sep 20-22	KNIT 5: A FABRIC Community Workshop , Chicago, IL
Oct 10-11	3rd Global Research Platform Workshop , Salt Lake City, UT
Oct 11	Americas' Research Platform Workshop , Salt Lake City, UT
Oct 11-14	ESnet Annual User Meeting , Berkeley, CA
Oct 17-19	NANOG 86 , Hollywood, CA
Oct 20-21	ARIN 50 , Hollywood, CA
Nov 5-11	IETF 115 , London, UK
Nov 13-18	SC22 , Dallas, TX
Dec 5-8	Internet2 Technology Exchange , Denver, CO
<u>2023</u>	
Jan 15-18	PTC'23 , Honolulu, HI
Feb, dates TBA	APAN55 , Nepal
Feb 13-15	NANOG 88 , Atlanta, GA
Mar 7-9	The Quilt Winter Meeting , virtual meeting
Mar 25-31	IETF 116

Next JET meetings

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

Aug 16, 2022	12-2 p.m. ET
Sep 20, 2022	12-2 p.m. ET
Oct 18, 2022	12-2 p.m. ET
Nov 16, 2022	10:30 a.m. – 12 p.m. CT, Room A309-310, Kay Bailey Hutchison Convention Center Dallas, 650 S Griffin St, Dallas, TX. <i>n.b.:</i> This is conjunction with SC22 <i>This meeting will be held in person with remote access.</i>