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
August 16, 2022, 12:00-2:00 p.m. ET
This meeting was held virtually

Participants

Jeff Bartig, Internet2
Nick Buraglio, ESnet
Bobby Cates, NASA Ames
Rich Carlson, DOE/SC
Basil Decina, NRL
Dave Diller, MAX
Jonah Keough, PNWGP/Pacific Wave
Bill Fink, NASA/GSFC
Michael Lambert, PSC/3ROX
Paul Love, NCO/NITRD
Joe Mambretti, StarLight/MREN
Linden Mercer, NRL
Joe Metzger, ESnet
Aruna Muppalla, NASA/GSFC
Mark Mutz, NOAA
Kevin Thompson, NSF

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

I. **Action Items**:

- Planning for the JET's tasking for 2023 – concluding discussion at the September meeting.

II. **Review of the Minutes of the July 2022 meeting:** No corrections were received.

III. **ESnet6 Status and Lessons Learned – Joe Metzger**

A. The ESnet6 project has been completed
    a. There were two sets of Key Performance Parameters – Threshold and Objective
        i. On July 29 the project received approval to close out as all the Threshold KPPs had been met in April.
        ii. The Objective Scope has been transferred to the ESnet program for completion. The technical work will continue without interruption using a much lighter weight project management framework. Target for completion remains the end of 2023.
    b. The closeout will take a couple of months for the paperwork to be completed
B. Review of architecture, statistics and hardware
    a. Smart edge with a hollow core remains unchanged.
    b. ESnet6 locations
        i. Hubs: 28 sites, 3-5 racks, caged suite.
        ii. Amplifiers: 274 sites, 1 rack, opened or caged.
        iii. Labs: 47 locations, ¼ - 2 racks.

c. 15k miles of fiber; 13k acquired in 2010-2011. The balance acquired as part of the ESnet6 project. The longest run of new fiber is Salt Lake City, UT, to the Los Angeles, CA, area. There were also small fiber changes/cleanups in the Chicago, IL, area and the San Francisco, CA, Bay Area.
d. ESnet6 is a colorless, directionless and contention-less Open Line System (OLS) using the Infinera Flex ILS platform (MTC -6 and -9 chassis).
    i. RAMAN on ~23% of the fiber. Generally spans with > 20dB.
    ii. OTDRs added to all RAMAN segments and metro segments.
e. Transponders:
    i. Phase 1: 74 Infinera Groove G30 chassis with CHM2T modems.
    ii. Phase 2: 54 chassis of Ciena Waveserver 5s with WaveLogic 5 Extreme Dual modems.
    iii. All optical nodes use both to enhance resiliency.
    iv. Segments are always bookended with the same transponder on each end.
    v. Long haul the Waveservers are running at 400G. Metro areas at 800G.
f. As part of wrapping up the project, ESnet is in the process of turning down the Nx100G Grove express waves used for ESnet5 during the transition. On a couple of instances some of the Groove transponders may be moved around. These are being repurposed as next neighbor 400Gs. The end result will be at least one Groove 400G and one Waveserver 400G on each path between nearest neighbors.
g. For layer 3 ESnet6 is using Nokia SR-2s at all sites:
    i. Large sites use higher density XMA-s 36 port cards with a license for 4.8 Tbps.
    ii. Smaller sites use lower density, 18 port cards with a license for 1.2 Tbps.

C. Automation – High Touch Service
    a. A lot has been accomplished despite supply chain issues including both Threshold KPPs. ESnet has just received the first completed device which is being tested & verified that is as expected. (To meet the KPPs ESnet used lab machines to demonstrate the needed services last April.)
    - A High Touch box has among other things, an FPGA and a very high precision clock. It is able to look at unsampled flows in real time providing much higher fidelity flow information than IPFIX data. Simple computation tasks on the flow data can also be done at line rate. More detailed computational analysis is done off board as the data is also streamed to ESnet's Stardust measurement platform.
    b. High Touch boxes will be installed at all large sites and all hub locations.

D. Lessons Learned: Things that went better than expected
    a. Risk Management: ESnet brought in a Risk Management expert at the start to train all staff. ESnet's Risk Manager worked with all leads to identify, quantify and develop mitigation strategies, then update them throughout the project. "All the early effort we put into thinking through risks and mitigations associated with getting a properly trained person the equipment and their tool kit physically

in front of the right rack at the right time to do an install paid huge dividends in the end." The anticipated problems weren't always the encountered ones, but the formal risk management planning developed the tools to deal with what was encountered.

b. Team Growth: ESnet grew from 45 in 2017 to 120 in 2022. Most hiring was done remotely and most staff work remotely. This hiring and onboarding was critical.
c. DOE Order 413.3B Program and Project Management for the Acquisition of Capital Assets:
    i. Office of Science was able to tailor a bit. ESnet6 used Milestone Execution Index for metrics rather than Earned Value Management.
    ii. ESnet6 used Project Acceptance Memos to incrementally accept and retire scope, turning it over to the ESnet Program for operational use.

    Using this framework ensured that LBNL and DOE leadership were 100% in sync with the project and able to fully support throughout.

    In 2017 ESnet did some project management but had no dedicated project managers on staff. It now has a six person full time project management team. This allows the other SMEs to focus on the subject matter they are experts in. The net result is that ESnet is more efficient with more is getting done.
d. Hired a consultant to help with procurement: A consultant was hired to help with the OLS procurement. This was somebody with a lot of experiences with commercial companies purchasing telecom equipment. This helped the technical team layout the requirements, the RFP, in a way that was easy for the vendors to understand, easy for ESnet to evaluate the responses and integrate the vendor responses into the requirements in the contract. In turn this simplified and reduced effort by the procurement officer helping to stay on schedule. What was learned with the OLS procurement was applied to other large ESnett6 procurements.

E. Lessons Learned – Things that could have gone better
    a. Colocations acquisition and buildout; Extending dark fiber to ESnet6 racks (with thanks to Joe):
        i. Challenges
            1. Fibers not consistently extended to the right rack.
            2. Fiber extensions had the wrong connector.
                n.b.: Infinera RAMAN & EDFA amps have a different connectors
            3. Rack rails not set properly during the colocation builds.
            4. Couldn't verify in pictures that equipment was installed in the correct RU.
        ii. What we could have done.
            1. Define more detailed rack specifications, with more explicit photo documentation requirements.
            2. Better rack labeling (rack ID, RU), so labels would be readable in all future installers' completion photos.
            3. Better cable management equipment & standards.

4. Spend more staff resources in this part of the project.
5. In-person audit a larger sample of the 300+ locations.

b. Installation subcontractors: The plan was for each large procurement to include the install. This was with the expectation of having experts for whatever was being installed. It also simplified the procurement process. The reality was a much larger set of people doing the installs which greatly complicated the process of overseeing the installs: verifying skill sets, establishing standards and expectations, building relationships, and addressing problems. The OLS installs worked well as the installers had the expected deep knowledge. For the other layers the installers many times didn't.

c. Challenges with lab installs vs field installs: ESnet had each subcontractor do its first install at LBNL for the benefit of both ESnet and subcontractor. There wasn't enough time and effort to make sure that the lab setting fully matched that in the field. There also wasn't enough time for the ESnet staff to identify needed changes before the first field install was underway.

F. Summary (with thanks to Joe):
   a. ESnet upgraded its network including: lighting 15,000 miles of fiber, installing equipment at over 300 locations across the US and Europe, automating significant portions of our configuration management, and greatly increasing the capacity and flexibility of services delivered to our user community.
   b. This was a high-visibility project which was carefully planned and executed using the DOE 413.3B Capital Acquisition process during a pandemic.
   c. While the high-visibility and high-stakes portion of the project is done, we are still working hard to complete the objective scope and deliver all of the benefits to all of the ESnet users.

G. Questions
   a. On the Ciena gear: If you have 2x600G on the line side can that support 3x400G on the customer side? (A 400G plus 200G on each line side.)
   Answer: Can't answer that exact question, but more generally ESnet has seen this sort of arrangement work. There may need to be particular ports used to make it work.
   b. Is ESnet6 designed for easy expansion?
   Answer: Yes. Straight forward at the optical layer. For layer 3:
      - Most of the large routers have plenty of 400G capacity.
      - Two or three larger routers are starting to have issues support all the miscellaneous 100Gs along with the new 400Gs. ESnet may add a second router in these locations. ESnet6 is designed to support this. This would also give enhance resilience.
   c. Are any encryption options in use? Does the optical gear support it?
   Answer: ESnet has not deployed encryption on any of its backbone, internal links. It has licenses for some of the new gear. No requirement yet so not investigated. Once the remaining small routers are deployed then there will be resources to investigate. Key management would take a good bit of resources to do properly.

IV. **Operational Security Round Table:** No updates were given.

V. **Network roundtable**

A. ESnet (Joe Metzger): ESnet is actively working to install the remaining dozen and a half small routers in the US and the four in Europe. Target is the end of CY2022.
B. Internet2 (Jeff Bartig):
    a. Internet2's NGI is wrapped up with all the old hardware removed from its POPs.
    b. Internet2 (I2) is focused on hiring and expanding its team.
    c. I2's contract with the Global NOC (GNOC) is being worked on. I2 is going through a new onboarding with the GNOC to ensure I2 is making full use of all the GNOC has to offer.
    d. I2 has been expanding its capacity with CSPs – both with IP peering and its Cloud Connect Service (CCS).
    e. I2 is adding Oracle to the set of CSPs available via CCS. It has recently turned up peering with Oracle's US West region – I2 now has 100G peering connections to Oracle's US East (Ashburn, VA) and US West (Los Angeles, CA, and Dallas, TX) regions.
    f. I2 is working with both Amazon and Microsoft to upgrade remaining Nx10G peerings to 100G.
C. NASA/GSFC (Bill Fink): No updates today.
D. NOAA (Mark Mutz): The remaining segment in N-Wave's 400G backbone upgrade is now clean. It should be brought online in the next week or two which will complete the project.
E. NRL (Linden Mercer): NRL continues to work towards SC22 in Dallas. Good things are happening between NRL; GSFC; the Joint Big Data Testbed facility in McLean, VA; StarLight and Dallas, TX. Also some good things with StarLight using the ESnet testbed. Too early to report on but seeing 200G RDMA performance.
F. Pacific Wave (Jonah Keough):
    a. Pacific Wave (PW) is seeing some pretty significant bandwidth demands for SC22 demos coming from Tokyo. It is working with its partners to ensure there will be sufficient capacity both across the Pacific and to Dallas from Seattle, WA, and Los Angeles, CA.
    b. PW is working on have route server connectivity for TransPAC soon. No date yet.
    c. PW's other projects are progressing well – no specific items to describe today.
G. PSC/3ROC/XSEDE (Michael Lambert): No update today.

VI. **Exchange Points Round Table**

A. PNWGP (Jonah Keough): No update today.
B. Ames (Bobby Cates): Nothing new today.
C. MAN LAN/WIX (Jeff Bartig): No updates.
D. StarLight (Joe Mambretti):
    a. As with Bill Fink at GSFC and Linden Mercer and Basil Decina at NRL, StarLight (SL) is in full prep for SC22. SL is working closely with the SCinet WAN team for

the landing of the national and international testbeds that are regularly part of SC.

i. Currently SL is focused on 800G between SL and the Joint Big Data Testbed in McLean, VA. Another 800G from McLean to the SL booth in Dallas. Completing the ring, it is anticipated that there will be 1Tb from the SL booth back to SL
ii. Scott Kohler (Ciena) has just finished implementing Waveservers on the SL<>McLean path. Having over two months of additional time to test SC demos will be incredibly helpful.
iii. All together SL is anticipating about 20 demos and experiments with various NREs at this year's SC.

b. The implementation of the Verizon gear for DREN 4 in SL is moving forward.
c. SL is preparing to host FABRIC's Knit 5 workshop in September.
d. SL will also participate in KREONET's 30th anniversary conference in October.
e. Also in October are the LHC workshop and the collocated Global Research Platform Workshop and the Americas' Research Platform Workshop.

VII. Initial discussion of the JET's potential tasking for CY2023

For reference, the JET's CY2022 tasking is in the Appendix at the bottom of these minutes. Also for reference, the administration's current priorities are at: https://www.whitehouse.gov/wp-content/uploads/2022/07/M-22-15.pdf

A. Today is the initial discussion on what the JET will suggest to the LSN at its Annual Review at its October meeting. As the LSN meets the week before the JET, at next month's meeting the JET will need to wrap-up this discussion and have a set of recommendations for the LSN.
B. The tasking for this year included some carry over tasking along with three new tasks. One was to encourage participation in the JET from diverse communities including underrepresented and disadvantaged groups. A second was to encourage and support JET participants to help connect unconnected communities. The third was to track members' steps in the transition to running IPv6 only across the entire federal government.
C. What of the ongoing tasking should be removed, what kept?
No suggested removals.
D. On the new tasking to encourage more participation in the JET and to help unconnected communities the JET can do more. Next month Glenn Ricart will outline some of the lessons learned from the US Ignite project that's just wrapping up - how can JET participants help?
E. Discussion:
    a. The administration's current priorities have a strong focus on diversity and equity.
    b. How can the JET bring in representatives from MSI campuses to understand their problems, provide help and guidance, and to increase interactions with them on a regular basis?

c. Invite one or two WINS (Women in IT Networking at SC) awardees to talk at a JET meeting about the issues they've seen. (Nov?)
d. Would AI be something for the JET to include? It can provide better utilization of resources – would that help to expand access for underserved and unconnected communities?
e. Should resilience be a topic? Again AI can help with that.
f. Security is important – but hard for many to discuss in JET venue.
g. Should the JET be more active in tracking/discussing new hardware supporting increasing bandwidth - 400G, 800G, 1T? Similarly with Gen 5, storage and memories systems, GPUs, and application specific processing. Are there crossovers with other NCO teams, such as MAGIC or others?

Meetings of Interest 2022

Note: Meetings whose format has changed have been updated.

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
Nov, 15	BoF at SC on IPV6 & IPv6-only, Dallas, TX
Dec 5-8	Internet2 Technology Exchange, Denver, CO
2023	
Jan 15-18	PTC'23, Honolulu, HI
Feb 13-15	NANOG 88, Atlanta, GA
Feb 13-17	APAN55, Nepal
Mar 7-9	The Quilt Winter Meeting, virtual
Mar 25-31	IETF 116, Yokohama, Japan
May 8-11	Internet2 Community Exchange, Atlanta, GA

Next JET meetings

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

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.

n.b.: This is conjunction with SC22.
This meeting will be held in person with remote access.

Dec 20, 2022 12-2 PM ET, virtual (*n.b.*: Held only if needed)

Appendix: JET Tasking for CY2022

Ongoing JET Tasks

- Assist in the planning of technology and application demonstrations of SDN & Big Data at SC22.
- Technology tracking: perfSONAR, SDN/SDX/SDI, Science DMZs, and network automation & orchestration.
- Hold two meetings collocated with R&E networking community conferences:
    - Internet2 Global Summit (22-25 May)
    - SC22 (November)
- Continue to schedule meeting round tables of updates on members' networks, operational network security, exchange points and meetings of interest to the community
- Track Segment Routing.
- Continue coordinating the development of tools to monitor cross-domain workflows and automate the detection of transport issues. Additionally facilitate the sharing of measurement date between networks - anonymized as needed.

New JET tasking for 2022

- Encourage participation from diverse communities, including those from disadvantaged and underrepresented groups. This has the goal of creating awareness and opportunities for equal access and the benefits of science and technology. This would be done by a combination suggested contacts from the JET's participants, by utilizing NITRD's Minority Serving Institutions (MSIs) data base and the Women in IT Networking at SC (WINS) participants.
- Encourage and support JET participants to use their networking knowledge to provide expertise to projects connecting the unconnected in the communities they serve and to enhance the connections of those who are under-served. This will help provide the opportunity for equal access to the benefits of science & technology.
- Track members' steps on transitioning to IPv6-only over the next 4 years.

Potential JET Workshop: TBD