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 21, 2019, 12:00-2:00p.m. ET

Participants

Don Anderson, NASA/EOS
Shawn Armstrong, University of Alaska
Nick Buraglio, ESnet
Bobby Cates, NASA/Ames
Shawn Cronin, NASA
Dave Diller, MAX
Bill Fink, NASA/GSFC
Mike Gill, NIH
JJ Jamison, Juniper
Jin Jung, NASA/GSFC
Jonah Keough, Pacific Wave/PNWGP
Kevin Kranacs, NASA/EOS
Padma Krishnaswamy, FCC
Paul Lang, NASA/GSFC
Paul Love, NCO
Chris Lowe, USDA/REE
Joe Mambretti, StarLight/MREN
Deep Medhi, NSF
Ed Moynihan, International Networks/IU
Aruna Muppalla, NASA
Glenn Ricart, US Ignite/University of Utah
Patrick Smith, NSF
Kevin Thompson, NSF
George Uhl, NASA/GSFC
Eldar Urumbaev, NOAA/N-Wave

Proceeding: This meeting was coordinated by Paul Love (NCO/NITRD).

I. **Action Items** (carry forward): Update on plans for ESnet6's Optical Core. May be done as a webinar or TBD if done as a webinar or an in-depth brief to the JET. TBD

II. **Review of the Minutes** of the April 2019 meeting: No corrections to the minutes for the April 2019 were mentioned. (Note: Subsequent to the meeting the list of meetings of interest was updated and a formatting error corrected. These changes have been incorporated into the final minutes.)

III. **Operational network security roundtable** (None attending had comments.)

IV. **Networks Round Table**

A. ESnet: Nick Buraglio: ESnet completed the final design review of ESnet6. The review of the proposals received for the Open Line System is nearly completed. ESnet is now working through the details of the network section by section. It has found that there isn't enough hardware in the lab for all concurrent testing being done on the ESnet6 sections. ESnet has spun up a virtual network lab that is used where the area being tested is primarily protocols.

B. International networking at Indiana University: Ed Moynihan
    a. TransPAC: peering with LHCONE is up for the pair of 10G circuits between Guam and Hong Kong. It's peering with ESnet over the PIREN circuit
    b. NEEAR: Democratic Republic of Congo has connected to UbuntuNet. Liberia has become a member of WACREN though it is not yet connected. NEEAR's circuits and peerings are all stable. perfSONAR workshops are being held - the next workshop will be in Mozambique follows by one in India in July.
C. NASA/EOS: Kevin Kranacs: No updates at this time.
D. NIH: Mike Gill: No changes to report.
E. USDA/REE: Chris Lowe: Nothing currently. It is putting together an end of FY activity to increase the number of sites available through Internet2.
F. University of Alaska: Shawn Armstrong: No significant changes. The university has finalized its utilization with Quintillion for low latency access to sites along Alaska's northern coast.
G. US Ignite: Glenn Ricart: Southern Nevada is discussing putting together a Smart City data exchange network. This will be across several communities and the inter-municipal coordination is underway.

V. **Exchange Points Round Table**

A. StarLight: Joe Mambretti
    a. StarLight (SL) and several other international participants recently participated in the first Data Mover Challenge at the Asia Supercomputing Conference. SL won an innovation award for its approach to WAN DTNs as a service.
    b. SL, working with international partners, is organizing the first Global Research Platform Workshop. This will be held at UCSD September 17-18. The workshop is focused on the distributed fabric that supports data intensive science worldwide.
B. MAX: Dave Diller:
    a. MAX is working with NRL for a 2x100G path using Ciena alien waves across its existing Fujitsu infrastructure to connect to the Ciena research platform and thence to SL.
    b. MAX has increasing demand for 100G to Ashburn over its DWDM ring. This, combined with a new, small (3U) MX from Juniper, is allowing MAX to deploy gear at Ashburn to reduce amount of backhaul.
C. NASA Ames: Bobby Cates
    a. Work continues on USGS' migration from Menlo Park to Moffett Field.
    b. Support effort continues on the hosting of DREN's Technical Interchange Meeting scheduled for September.
    c. An automated transfer switch for the electrical feed will be installed on June 22. UPS and generators will be working so no impact is anticipated. Utility work is anticipated for all of the weekend.

VI. Brief on Networking in the Polar Regions – Patrick Smith (NSF)

A. Both polar areas have similar challenges:
    a. Commercial communications satellites, which are in geosynchronous orbit, are limited:
        i. Technically they aren't useable much higher than 81°+/- degrees
        ii. There are limited commercial markets (terrestrial, aircraft and shipping) in the northern areas and almost none in the southern areas
        iii. Since these are commercial undertakings they are put up to provide service where there are markets (the FCC requires coverage between 70°N and 55°S).
    b. Submarine cable systems have similar commercial drivers resulting in:
        i. Southern polar area: none
        ii. Northern areas: very limited
            1. Northern Alaska coast – Nome to Prudhoe Bay/Deadhorse
            2. Southwestern coast of Greenland
            3. Svalbard: Longyearbyen and Ny-Alesund

B. NSF has three sites in the Arctic:
    a. Barrow Arctic Research Center, Utqiagvik, AK, connected via fiber to Prudhoe Bay, Fairbanks and then CONUS
    b. Toolik Field Station, North Slope, AK, connected via fiber that runs from Prudhoe Bay to Fairbanks
    c. Summit Station, Greenland, connected via commercial communications satellite
    d. Other locations of NSF research: Thule AFB and Kangerlussuag in Greenland and Longyearbyen and Ny-Alesund in Svalbard. The Greenland sites are served by commercial satellite. The Svalbard sites by submarine cable.

C. In the Antarctic
    a. NSF was made the Executive Manager of the US Antarctic Program by President Nixon in 1970.
    b. NSF has 3 year round sites: Palmer, McMurdo and South Pole
        i. Palmer Station is located at 64.77°S and McMurdo at 77.85°S therefore both can use commercial geosynchronous satellites. Palmer has 6Mbps (total; symmetric up and downlink). McMurdo has a total of 20Mbps inbound with 60Mbps outbound for all users. NSF's portion is 10Mbps inbound and 18Mbps outbound. (McMurdo's connectivity is arranged by NOAA in agreement with NSF. The bulk of the bandwidth is used by NOAA and EUMETSAT for satellite data.)
        ii. At the South Pole connectivity is provided by several older satellites whose orbits migrated and have been repurposed. The available bandwidth varies during the day as the various satellites come into view. There are period where none are visible resulting in communication blackouts. To help fill the blackouts of the broadband services NSF is inverse muxing several 2.4Kbps Iridium data circuits. Enough to flow seismic data from a sensor plus very basic (à la 1990s) email. Total daily outbound traffic maximum capacity is ~470GB/day (actual daily data

flows can vary from 100 GB/day up to the maximum capacity). With the coming of big science to the South Pole NSF is anticipating a maximum needed bandwidth of 10TB/day by late 2020s.

c. NSF has two research vessels working in the Antarctic:
    i. Normal operational area has a mixture of satellite coverages: from high (maximum information rate: 4Mbps inbound/2Mbps outbound; CIR: 512 Kbps inbound/256 Kbps inbound; due to VSAT contention) too low to none.
    ii. A further constraint on bandwidth is the ship's physical limit for antennas to 1m.
d. Questions:
    i. Could all the Antarctic stations working together be able to fund a submarine cable system? Probably not since all but a few are on the coast and able to use commercial satellites. Plus most coastal stations are scattered out except on the Antarctic Peninsula (where there is good communications satellite coverage). NSF also has looked at a cable from McMurdo to the South Pole. This doesn't seem practical as the ice covering Antarctic moves
    ii. What's the status of OneWeb and its super low orbit communications satellites? It has the initial 6 satellites up. Starting later this year it plans to launch clusters of 30 satellites every 4-6 weeks. Target is 600 satellites with initial commercial service at about half that. Catch is that both ground stations need to see the same satellite – no inter-satellite communications.

VII. Leveraging 400GbE to Improve Network Economics while Driving Performance – JJ Jamison (Juniper)

D. While Ethernet speeds originally grew in multiples of 10 that has ceased. Speeds now range from 2.5-400GbE (though some are very much for niche markets). 800GbE and 1.6TbE are on the horizon for the next five years.
E. The drives for features used in the R&E networks come from outside that market:
    a. Carriers: fast/reliable/low cost routers; IPv6; and node slicing in peering points
    b. Wall Street: Multicast; and express paths in firewalls
    c. Social media: perfSONAR (really any third party app) on routers and switches
    d. Datacenters: 400GbE
        i. In turn driven by: high compute intensive applications on parallel clusters; exponential growth in internet data traffic; enterprise and consumer workloads; global digital transformation in business; and hyper-scale speed increases
        ii. Rapid adoption: A Dell' Oro Research Report forecasts 400GbE to comprise 20% of data-center switching revenue by 2020
F. Driving trends for 400GbE uptake in R&E
    a. Massive instruments' data where preference and/or costs pushes processing away from the instrument locations

b. Proliferation of science DMZs and DTNs
c. Growth in number and size of elephant flows

G. Economics of 400GbE
   a. Currently pricing of 400GbE is about equal to 3x100GbE – good but not exciting
   b. Coming of silicon photonics (SP), making light on a chip, will make exciting pricing (being done by Juniper and at least Intel):
      i. SP leverages all the benefits in silicon chip design and production systems
      ii. An SP has the needed indium phosphide material deposited in the normal production flow allowing the SP to generate or amplify light
      iii. A single SP die includes all photonic pieces of an optical transceiver's laser and detector
      iv. These techniques greatly lowers the cost of production and testing optical transceivers
   c. Juniper can package their "Opto-ASIC" 400GbE into the existing QSFP form factor
   d. In the future it may be possible to integrate the photonics and a network processor in one package

H. 400GbE in R&E
   a. At SC18 Juniper drove 400GbE 6,100 feet – from the Internet2 POP to the SCinet NOC. On the show floor Arista ran 400GbE between booths.
   b. For SC19 Juniper working with Ciena is planning on drive 400GbE from Bloomington, IN, to StarLight in Chicago, IL, and then onto to Denver via 4x100GbE on a DWDM path. (But note that it is still early days for SC demos so the details may well change by November.)

Meetings of Interest 2019

June 10-12	NANOG76, Washington, DC
June 16-20	TNC19, Tallinn, Estonia
July 20-26	IETF 105, Montreal, Quebec, Canada
July 22-26	APAN48, Putrajaya, Malaysia
Sep 10-12	DREN Technical Interchange Meeting, Moffett Field, CA
Sep 17	GLIF Americas Workshop, San Diego, CA
Sep 17-18	Global Research Platform Workshop, San Diego, CA
Sep 19-20	GLIF community/GNA meeting, San Diego, CA
Sep 24-25	National Research Platform, Minneapolis, MN
Oct 28-30	NANOG77, Austin, TX
Oct 30 – Nov 1	ARIN 44, Austin, TX
Nov 16-22	IETF 106, Singapore
Nov 17-22	SC19, Denver, CO

Next JET meetings (n.b.: These three meetings will be virtual)

Jun 18, 2019	12-2 p.m. ET
Jul 16, 2019	12-2 p.m. ET
Aug 20, 2019	12-2 p.m. ET