Joint Engineering Team (JET) Meeting Minutes

October 16, 2018, 12:00-2:00 ET
National Coordination Office
490 L'Enfant Plaza, Suite 8001
Washington, D.C. 20024

Participants (*In-person)

Shawn Armstrong	UAF (Alaska)	Paul Lang	NASA Goddard
Rich Angeletti	PSC	Joyce Lee*	NCO
Joe Breen	Utah	Paul Love*	NCO
Nick Buraglio	ESnet	Joe Mambretti	StarLight/MREN
Rich Carlson	DOE/SC	Linden Mercer	NRL
Bobby Cates	NASA Ames	Ed Moynihan	IU
Bill Fink	NASA Goddard	Aruna Muppalla	NASA Goddard
Dale Finkelson	Internet2	Mark Mutz	NOAA/N-Wave
Andrew Germain	NASA Goddard	Dave Reese	CENIC
Michael Gill	NIH	Chris Rob	Internet 2
Ann Keane	NOAA/N-Wave	Kevin Thompson*	NSF
Jonah Keough	PNWGP	George Uhl	NASA Goddard
Kevin Kranacs	NASA Goddard		
Padma Krishnaswamy	FCC		
Michael Lambert	PSC/3ROX		

Proceeding. This meeting was chaired by Rich Carlson (DOE/SC) and Kevin Thompson (NSF). August 2018 minutes were approved.

Presentation: *Connectivity across the Atlantic*, Dale Finkelson, Internet 2
ANA Activity (Slide 2)
ANA system has grown considerably: includes NEAAR (100G from NY to London integrated into ANA)
SINET: 2019, will finish bringing another 100G into Atlantic.

- Will also be integrated into ANA system and create aggregate 500G capacity on ANA system.
- Mutually redundant circuits available to do primary or secondary paths between varying sets of exchange points. Thus, can provide solid connectivity across Atlantic.

ESnet: Cooperative agreement to back up our systems or converse, in event of emergency

Moving Forward (Slide 3)
ANA operations manuals and tools:

- Operations group updating and ensuring accuracy.
- Put MADDASH in place – not full mesh; specifically constructed to show path and endpoints of each circuit.

NSI-Compliant:

- Alexander van den Hil bringing ANA system into NSI compliance.
- Needs to be brought into production levels.
- Goal: make it a production service to make it simpler for users.

ANA-300G +NEAAR = 400G R&E bandwidth (Slide 4)
Diagram of ANA (current state). MOXY- circuit is NORDUnet/surfnet

Collaboration with ESnet & NEAAR: 800G (Slide 5)**:** ESnet circuits on cable systems (much redundancy)

Who does ANA provide connectivity to? (Slides 6-7) (See slide for list)
Who does I2 peer with across ANA system or through MAN LAN? All of western and most of eastern Europe NRENs are connected through GEANT; Provide connectivity or have access to broad spectrum of sites across system. Connectivity through Peer with the following:

- NORDUnet – one of primary peers
- SINET- peer with them. Will bring 100G next year - will bring availability to National Institute of Informatics and perhaps other locations in Japan
- NKN via MANLAN – capabilities into Amsterdam. Provide path to India and connectivity through west side.
- UbuntuNet (London)
- KACST (Saudi Arabia) – peer across Netherlight and Amsterdam, and ANA system
- GEANT: multiple paths through ANA path
- Tenet (South Africa): Finishing peering across ANA
- SURFnet and Qatar- multiple peerings and connections
- CAnet-Toronto & Montreal – some circuits are essentially ANA circuits
- TWAREN
- GEANT (AMS & Frankfurt)
- SURFnet and Qatar– multiple peerings and connections

Other Activity (Slide 8) 2 paths being developed between Europe and Asia:

- Tokyo - Amsterdam & Singapore – Europe (developing 100G path; likely completion in 1Q 2019)
- Bella Consortium- Circuit on Ella link cable between Portugal and Fortalezza in Brazil. Direct connectivity between South America and Europe (Anticipated 2020)- first time built connectivity between Americas and Europe and not in North Atlantic. Provides redundant path not impacted by North Atlantic or traditional landing points in Western Europe or Britain.

Possible AsiaPac- Europe System (Slide 9): Ring between Europe and Asia.

- SCInet path: will take terrestrial path across Liberia, No. Russia and come down through Finland into Amsterdam.
- Other path: built by R-net, etc will be Sub-c path through Suez on one of cable systems from Marseilles to Singapore. Multiple 100G interconnects exist between Singapore and Japan.

Diagram of Bella system: what it will provide when it goes online. (Slide 10)

- Will run from Fortalezzea to Portugal and connects to GEANT through Portugal or Spain and connect into multiple connectivity in South America.
- Good backup to North-south connectivity existing between FL and AMPATH. Moving towards redundant rings.

October 4- October 11 Activity (Slide 11): Aggregate of current ANA 300 plus NEAR. Runs from 40G - 80/90G range. Most traffic is divided evenly between circuits.

More detail on system (Slides 12- 13)

Discussion
Bella circuit:

- 100G. Ring between SCInet and Marseilles; come into Amsterdam? Connect to Geant in London, Amsterdam and Paris. Both will land in Amsterdam (at least SCInet), but details may not be finalized.

North American endpoints for ANA connected via dedicated connectivity?

- Shared between other services/ Dedicated 100G between MAN LAN and WIX specifically for ANA purposes. 100G between MOXY (Montreal Open Exchange) and MAN LAN largely dedicated to this. MAN LAN and WIX have 100G connections into routers in Washington D.C. and New York.

Roundtables
Operational Security
CENIC: Dave Reese will discuss in presentation

ESnet: Nick Buraglio –2 talks given by colleague in Orlando: 1) Bro on the WAN: describe ESnet's experiences deploying Bro NSM on commercial exchange points in the WAN context; and 2) CEASE project(Correlation Evaluation and Security Enforcement) update

NIH: Nothing to add

NOAA: Nothing to add

PacWave: No update

TransPAC /NEAAR: No update

PSC: **Rich Angeletti**
Recently deployed FastNetMon , open source detection tool. Works well in detecting anomalous traffic; not automate logins. Centralized remote trigger black hole set using ExaBGP, open source project – updated the configuration and reload ExaBGP configuration and trigger black holes across our commodity Internet 2 and TR-CPS links.

Discussion: Nick: using wrapper around ExaBGP (e.g. NCSA black hole router)? No, would like to put user- friendly UI in front of it for ease of use by operational group. Looking into Ergoweb IU, but only supports previous ExaBGP version; running ExaBGP 408. Interested in sticking to 4 because of interest in BGP Flowspec in future as it supports flow rolls. NCSA black hole router should support ExaBGP 4. Nick and Rich will discuss offline about Flowspec, lessons learned, etc.

NRL: nothing to discuss

Internet2: nothing to discuss

Pacific Northwest Gigapop (PCNWGP): Jonah Keough
No updates. Looking into node slicing and opportunities combining equipment across regional networks.

StarLight: Nothing to report.

Networks Round Table
ESnet: Nick Buraglio

- More progress on optical RFP.
- Much work going into ESnet6.
- CEASE components and bro on the WAN are precursors to ESnet's security strategy; building them now and will migrate as go.
- Segment routing: much time on TE elements and controller-based topic (slides are shareable).

Internet2: Chris Robb

- MAN LAN WIX RFI will be going out shortly
- Optical RFI: good progress being made. Goal to share by end of October 2018.
- Undergoing internal restructuring of management network.
- Augment of allowable bandwidth for customers to use – 20G per 100G circuit, raising cap to 50G.
- Backbone augment policy –will be released shortly.
- Updating peering points (Chicago, by end CY 2018 and Ashburn (Jan 2019)) – newer hardware to provide more 100G capacity. Adding additional optical node into Equinix – new optical ring in Bay Area metro and will be migrating peering point as a follow up (early December 2018).
- Will be sunsetting Interdomain Any Source Multicast service in December 2018; not very heavily used (trend).

Mississippi Optical Network: Greg Grimes (via email)

- The Mississippi Optical Network(MissiON) went through a migration of providers. Since January of 2012 the MissiON network has been provided by AT&T. This was a redundant 10gbps network. An RFP was called to provide the next iteration of MissiON and CSpire won the bid. The core is a redundant 100Gbps network that connects to Internet 2 at 100Gbps in both Jackson, MS and Atlanta, GA for redundancy. Member institutions have the option to connect at anywhere from 10Gbps to 100Gbps.
- MissiON also increased its membership to include all of the MS Institutes for Higher Learning. The membership consists of Mississippi State University, University of MS, University of Southern MS, Jackson State University, Delta State University, Alcorn State University, MS Valley State University and Mississippi University for Women with connections to the Stennis Space Center and the U.S. Amy Engineer Research and Development Center.

NASA: Kevin Kranacs – no changes.

NIH: Mike Gill No updates.

NOAA: Mark Mutz

N-wave will be moving to 100G. Will be upgrading the backbone across I2 to 100G around the ring. Including 100 to major campus site in Boulder, CO and upgrading DWDM ring in D.C. metro area using Ciena waveserver AI boxes for multi-100G capacity around the ring. Will proceed with upgrades once equipment is delivered, etc.
Discussion: Fairmont is included.

NRL: Linden Mercer
Preparing for SC18 and establishing longer term test environments with MAX and Ciena testbed.

NEAAR: Ed Moynihan
Nothing to add.

TransPAC: **Ed Moynihan**
2 x 10G v circuits from Guam to Hong Kong are live. Working on peering in Hong Kong with I2.
African/Europe: stable.

- WACREN 10G connecting London to Lagos is live. Provide connectivity into Nigeria and 10G into Ghana.
- Umbuntu net alliance – recently connected new NRENs, including Somalia and the DRC.

PSC 3ROX: No updates.

XSEDE: Michael Lambert
Part of transition to L3 VPN: NICS peering session established, but no routes yet. Trying to move other sites. Running into issues (e.g., edge router upgrade). Also reached out to TACC (Texas Advanced Computing Center).

NASA Ames: Bobby Cates
Installed another 10G to Equinix SB1 in San Jose, CA.

StarLight: Joe Mambretti
Preparing for SC18. Working with NRL and NASA Goddard, preparing 1300G from Starlight into Dallas and 6 x 100G from Washington, D.C. and 2 x 100G from D.C. to StarLight to support about 35 sets of different demonstrations, including point-to-point service for LHC networks.

- Working with LSST on demonstration of sending data from Chilean mountaintop to Sao Paolo to Miami to Dallas to StarLight to NCSA as a prototype service for data transfer.
- Will showcase SDX part of IRNC program and SDX part of Genie program (includes deploying P4 testbed)
- Working on DTN as a service for SCInet
- Will support Sage2 out of SL booth and various service stacks for DTNs
- Working with Fermilab on Big Data Express with Korea Institute of Science and Technology Information (KISTI)
- Demonstrations: SingAREN
- Showcase open storage network. Working with USC and Caltech on 400G LAN on the showfloor -first showcases for 400G NICs.

WIX and MANLAN: Chris Robb covered in other update.

LSN Update: Joyce Lee
JET tasking was presented to LSN and no changes made to tasking. Just need to work on details on tasking in coming months.

***International Research Connections*: Dave Reese (CENIC)**
Contributors: David Reese (CENIC), Kevin Thompson (NSF), Julio Ibarra (AmLight), Joe Mambretti (StarLight), David Lassner (PIREN), Jennifer Schopf (IU International Networks)

North America Exchange Points (Slide 2)
East coast: MOXY, MANLAN and WIX
Pacific Wave (PacWave)
GOREX (Guam Open Research & Education eXchange)- includes Guam because of new exchange point.

Networking Programs and investments (Slides 4-7)
- IRNC- International R&E Network Connections: funds experiments on exchange points. Includes performance flow measurement, monitoring, training
- 2018 Program Status infrastructure and backbone is big piece of it.
- International Research Network Vision
- NSF's other R&E networking infrastructure Program **(**Diagram, **Slide 7)**

AmLight, AMPATH, SouthernLight: **Julio Ibarra (PI) (Slides 8-15)**
Connectivity from Miami to S. America:
- Working on obtaining diverse connectivity and diverse paths.
- Leading way in spectrum allocation; obtaining and lighting spectrum from undersea fiber
- Partners and Goals (List, Slide 10)
- Regional network Infrastructure (Diagram, Slide 11): Diverse paths, connections, and capacities
- Regional Aggregation**:** AMPATH and SouthernLight International Open eXchange Points
- Provisioning additional spectrum; working on getting spectrum and enhancing resilience
- Network virtualization and programmability diagram reflects current experiments/work regarding SDN and SDXs (e.g., slicing/virtualization) (Diagram, Slide 15)

StarLight: **Joe Mambretti (Slides 16-25)**
SL is one of initial recipients of an IRNC award and the first to receive awards for international open exchange (Star Tap, 1997).
- Supports research with 100+ private networks, 25+ research testbeds, 57 100GBPs paths into SL.
- One of founding partners of GLIF (global connectivity map)
- PacWave, SL and AMPATH coordinating on SDN/SDX research so that testbeds will interconnect and can assist with transiting from Asia Pacific, Europe and South America.
- SL is a SDX for global R&E
- Petascale sciences data transfers. E.g.: slicing the network to support elephant flows of SC17 demonstration: slicing for 100G flows through the fabric, so they're identified and supported and not dropping packets when doing end-to-end in a single flow.
- Emerging SDX interoperable fabric- NSF- funded experimental exchange points (PacWave, StarLight, AMPATH) and incorporating Southern Crossroads and MAX (also part of SENSE project -Scheduling resources across the network).
- Global research Platform –leader in connecting PRP; building international research platform.

Pacific Wave: Louis Fox, Dave Reese (PI) (Slides 26-35)
Int'l Peering Exchange
Broad connectivity across Asia Pacific:

- Big portion in Japan (3 networks in Japan working together); open exchange point through Singapore (SingAREN network-operated) and 100G from Singapore to Japan.
- Not on map: TransPAC's work: 2 x10G out of Guam to Hong Kong using GOREX. New cable system also has additional capacity from New Zealand to Seattle.
- Current exchange is creating a sandbox separate from production service (Diagram, Slide 29)
- Pacific Research Platform (PRP): PacWave and CalRen is core part of PRP (Diagram, Slide 31)

Recent accomplishments:

- 2 additional 100G circuits with a total of 3 on west coast; 1 allocated to GLIF/AutoGole
- Member of Asia-Pacific Ring collaboration: 7 entities with capacity moving around Asia Pacific and U.S.; important due to outages due to storms.
- Developing DTN dashboard for internal DTNs (Diagram, Slide 33)
- Future activities: adding PacWave AS number; Moving to L1 backhaul capacity; collaboration with IRNC activities and NetSage collaboration (contributing flow data)
- Supplemental Grant: Connecting LEARN, OneNet, GPm to PacWave

PIREN (Pacific Islands R &E Network): David Lassner (Slides 36-49)

- Hawai'i: history and early cycle of academic networks.
- Asia-Pacific backbone topology (Diagram, Slide 38): displaying capacity and contributors
- Pacific islands: substantial progress, Pacific Island Countries (Diagram, Slide 39 and Map, Slide 41)
- Benefits of R&E networking: climate change and sea levels significantly impacts this area; monitoring and working on these issues.
- Explosion of fiber infrastructure in the Pacific- new cable systems, major area of growth (List, Slide 44)
- Provides domestic support for AARNET
- Guam and the cable system (Diagram, Slide 46). GOREX: launched by PIREN and University of Guam; 100G from Guam to Hawai'i and 2x 10G from Guam to Hong Kong (Diagram, Slide 47)
- Pacific island fiber systems (Diagram, Slide 48)
- Hawai'i Astroflows project: will leverage 100G capacity: observatories; PIREN will deploy DTNs throughout this project. Will work to get Hawaii telescope data connected (Diagram, Slide 49)

NEAAR/TransPAC: Jennifer Schopf, IU International Networks (Slides 50-55)

- Reach of IU networks (Diagram, Slide 51)
- NEAAR Collaboration: Funding and partners (Slide 52); see Dale's presentation
- Science collaborations: ESnet (Slide 53)
- R&E Connectivity: South African focus (Diagram, Slide 54)

TransPAC(Slides 56- 65)

- Connectivity between U.S. and Asia-Pacific. APR- similar model to ANA.
- 2 new 10G Circuits between Hong Kong and Guam went live Aug/Sept 2018 (Map, Slide 58)
- Guam circuits' different paths (Map, Slide 59-60)
- GOREX, highlighting connectivity with Hong Kong (Diagram, Slide 61)
- Research & Engagement, Training Sessions (Listing, Slides 62-63)

- NEAAR and TransPAC connectivity (Map, Slide 64)

Meetings of Interest

October 15-18	2018 Technology Exchange, Orlando, FL
November 3-9	IETF 103, Bangkok, Thailand
November 11-16	SC18, Dallas, TX
December 2-3	e-AGE18, Amman, Jordan 2018

Next meeting

November 13 (1:30-3:30 p.m. CT), SC18, Kay Bailey Hutchinson Convention Center, Rm D175