GLIF Tech
3-26-15

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Goal for this session

- Given the development of the ANA-200/300 and the GNA what is the role the GLIF can play in the emerging Global activity?
  - Recall that Lars brought this up in Singapore as well.
  - More on that later

Brief History

- ANA-100
  - A consortium of Internet2, NDN, Surfnet, GEANT, Canarie and Esnet worked together to obtain and install a 100G from NY to Amsterdam.
  - This was in place from June of 2013 till Oct of 2014.
  - If you are interested in lessons learned from this there is a document about that.
- ANA-200
  - Starting in the summer of 2014, Internet2, NDN, Surfnet and Canarie began work on procuring and building the ANA-200. Esnet at the same time was building EEX.
  - That is now installed and operational. It is not a trial any longer. This was built as a fully resilient interconnect between the US to Europe.
  - It is working very well.
- ANA-300
  - GEANT is in the process of coming to a determination of adding their recently installed 100G from Paris to MAN LAN to the ANA group.
  - When done this will extend the installation to 300G of Trans-Atlantic connectivity.
  - This link would also add to the resiliancy of the system.

Principles of the ANA Activity

- We are committed to advancing the state of the art of trans-oceanic networking for R&E, and to find innovative and efficient ways in working together in achieving this.
- ANA-100G has served as a pathfinder for the CEO Forum's Global Network Architecture (GNA), and ANA-200G and beyond will continue to do so.
- We are committed to advancing federated operations, and finding novel and efficient way to have our NOCs learn, interact, and jointly ensure the best quality of service.
- We are committed to work with able and willing OLE operators to find the most optimal ways to do traffic engineering for intercontinental high-performance transmission facilities.
- Open Lightpath Exchanges are the touch down points for intercontinental lambdas which are part of the ANA-200G collaboration.
- The ANA-200G facility is operated jointly by the partners, in a federated operations model.

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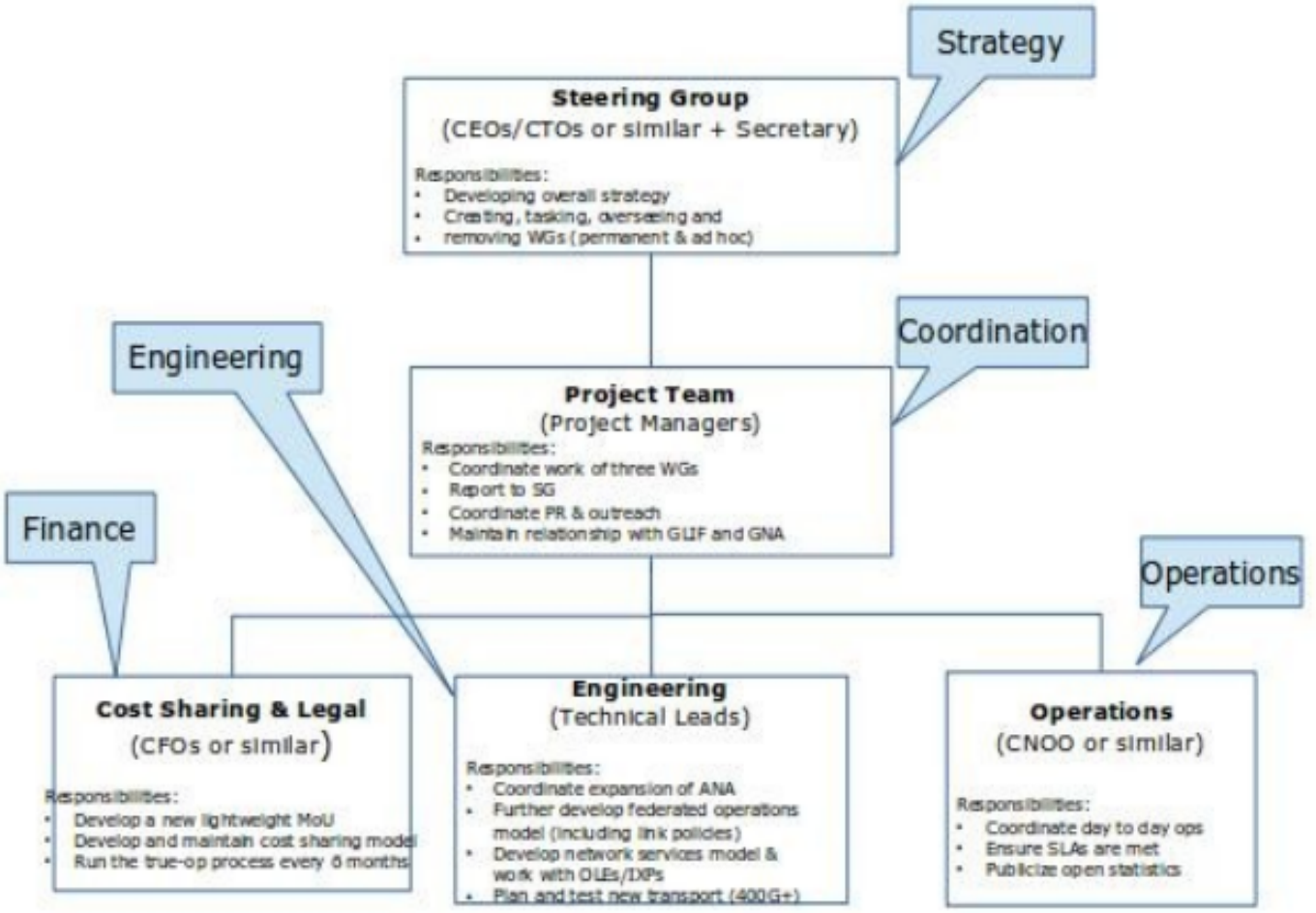
Governance



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GNA

- The GNA as a set of participants exists to foster the development of an effective Global Architecture for delivery of services around the Globe.
  - What does “effective” mean here?
  - What does “Architecture” mean here?

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GNA

- The goal is to build an effective Global Network Architecture. What does that really mean?
  - For it to be effective these characteristics are required:
    - It must be resilient, physically redundant, operationally stable and able to meet the service needs of the participants.
  - In part the Architecture of the GNA is about the physical connections, as generally stated that means:
    - TransOceanic (Intercontinential) links that are connected to Open Exchange points where participant networks also connect.
    - Seems pretty easy doesn't it?

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GNA

- Then why is it taking so long and so many peoples time and energy?
  - You could I suppose argue its hard to select the sites and what the real need is, but I don't think that is it.
- Architecture in this context has a broader (if not a new) meaning.

Architecture in the GNA

- This is not architecture in the sense of designing a network.
- Its Architecture in the sense of creating a new paradigm for a Global system of interconnected facilities capable of service delivery on a par with domestic network service delivery – anywhere – anytime.
  - This is a much harder task.

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Architecture in the GNA

- In this environment the ***architecture*** is a multi-faceted design with at least the following components:
  - Governance
  - Policy
  - Completely Open AUP
  - Capability to offer end-to-end SLA's
  - Economics/cost sharing
    - Investment vs return?
  - Changing dynamics of circuit costs.
  - Changing realities of where R&E needs to connect to do its work.
  - Need to go well beyond best effort IP.
  - Changing Operation models
  - Production quality Exchanges able to meet needs and deliver desired services.
    - Not your traditional Layer 2 interconnect any more.

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Architecture in the GNA

- Key differences in this model from previous approaches:
  - A fully open AUP recognizes that there is no clear distinction any longer between R&E traffic and Commercial.
    - Much of R&E depends critically on access to services provided by the commercial internet.
  - The participating NREN CEO's see having the ability to deliver end-to-end SLA's as critical to the success of their institutions globally.
    - Service deliver should be seamless whether its local or global.

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Where does the GLIF come in?

- With that background (sorry if it was too long) what role does the GLIF have moving forward?
- Global Lambda Integrated Facility – sort of sounds like what I am describing doesn't it?
  - Governance?
  - Operations?
  - Technology?
  - Service Delivery Standards?
  - Procurement?
  - Open Exchange Point modeling?
  - ?????

Where does the GLIF come in?

- I suspect that defining the role and standards for Open Exchanges is the place to start.
- Within the GNA world there has been a good deal of effort toward defining what it takes to be a “GNA Capable Exchange”.
- Many of these characteristics are what we discussed in New Zealand.
  - Let me remind you.

Components and Capabilities of a Global R&E Exchange Point

- A Global R/E exchange consists of the following components/ service capabilities
- For now this does not distinguish between necessary/ required and optional/desired capabilities
  - Termination and cross-connection point for international circuits as well as domestic connection
  - Facility/Location: Ideally, an exchange will be housed in an open neutral commercial carrier space that is a natural hub location for domestic and international circuits with no single carrier dominating. The space and facilities should be free of external imposed AUP limitations.
  - Cross connects: Global R&E exchanges will flourish best in a facility that encourages convenient and low-cost fiber cross-connects.

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Components and Capabilities of a Global R&E Exchange Point

- Peering Fabric: In addition to supporting fiber interconnects, the exchange point should house a peering fabric is able to accommodate a consistent set of port types, such as 1 Gig Ethernet, 10 Gig Ethernet, 40 Gig Ethernet, 100 Gig Ethernet, and SONET/STM Interfaces. The exchange may also provide a service that can translate between SONET/STM traffic and Ethernet.
- Collocation: Exchange participants should be able to house at least a modest level, and ideally more of their own equipment at the exchange to support management, performance monitoring, services not provided by the exchange, and innovation.
- Remote hands and on call support: On call support should be available 24x7x365, and staff managing the facility should be available for scheduled assistance and or remote hands, at nominal labor rates.

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Components and Capabilities of a Global R&E Exchange Point

- Security and access: The facility will be locked and monitored, and the building will monitor both access to the building and the floor where the exchange point is located. The organization managing the facility will maintain a list of personnel with authorized access.
- Power and air conditioning: The facility will supply adequate protected power appropriate to the region and air conditioning for the exchange and all collocated equipment.
- Finally, an exchange should be flexible and agile in trying to accommodate evolving technologies and needs

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OPEN EXCHANGE POINT Principles of Operation:

- *Open Acceptable Use Approach: Ability to interconnect with any R&E Entity*
- *Open Acceptable Use Approach: Support for "Commercial" Traffic*
- *Production Quality Operations Regime & Community Engagement*
- *Measurement capabilities*
- *Open Statistics*
- *Privacy of Data, Use of Network Flow Data, Packet Capture*
- *Performance Assurance Node and perfSONAR*
- *CoS / Queuing Support*
- *Open Access to colocation, cross-connects and Carrier Facilities*
- *Timeliness of Service Support and Service Delivery*

Technology and Functionality:

- **Required:**
  - To support the network services required by the GNA Architecture more than just a layer 2 best-effort will be required. This section highlights the functionality required of exchange points.
- Layer 2 circuits
  - Support VLAN translation
  - Support path protection and restoration
  - Support Guaranteed Bandwidth allocation
  - Policer and Shapers on per VLAN and set of VLANs basis
  - Traffic Burst allowed
  - QinQ capabilities

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Technology and Functionality:

- Dynamic Circuit Provisioning
  - The participating exchange points will support dynamic circuit provisioning
  - NSI
- Policy Implementation
  - GNA will consist of links from several participants it is expected that exchange points will be able to implement and enforce different policies on each link as requested by the link owner
  - The exchange points should be able to act as both Policy Decision Point (PDP) and Policy Enforcement Point (PEP) to enforce admission and user control

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Technology and Functionality:

- **Developing**
- OpenFlow/SDN/SDX
  - Network virtualization and Openflow 1.0 support is required to allow collaborators in separate NRENS to provision end-to-end vlans using the OESS interface. One can imagine other provisioning tools or SDN-enabled applications that may want to operate across exchanges.
  - Exchange points should support network virtualization
- Policer and shapers based on 802.1P tags and policer etc

Are We Done Yet?

- Consider (from Lars)
  - Transport ✔
  - Cross-connect ✔
  - Topology Exchange
  - Performance Verification for end-to-end
  - Service Level management
  - Link Policy management
  - Identity Management
  - Virtualization
  - GOLE service architecture
  - Security

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What does the GLIF want to do?

- Open discussion