

# GNA-G Update

## Global Network Architecture Network Engineering Workshop *Session 1*

Alex Moura

Colombo, Sri Lanka

23 Aug 2023



# Welcome to today's agenda

- Introduction to GNA-G
  - Motivation, vision and mission
  - Strategy and objectives
  - Technology Trends and Solutions
  - Topics
- Updates
  - TNC23 session
  - GNA-G Q3 Call

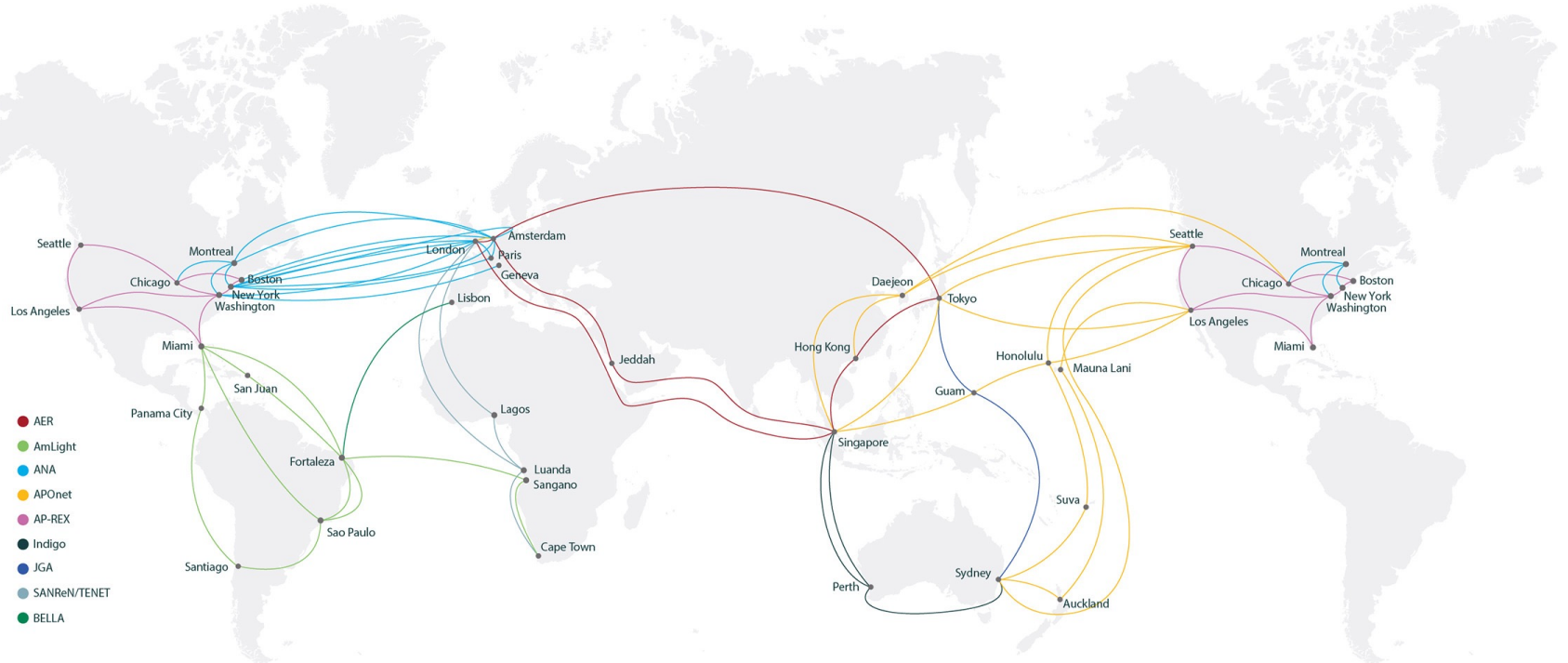


# Agenda (cont.)

- RENS Planning
  - Intercontinental connectivity
  - Layer 1, 2, 3 Renewal
  - Automation and Orchestration
  - Big Science Requirements
  - Operations
    - Multi-domain operations
    - Securing the GREN
- Closing



# The Global R&E Network

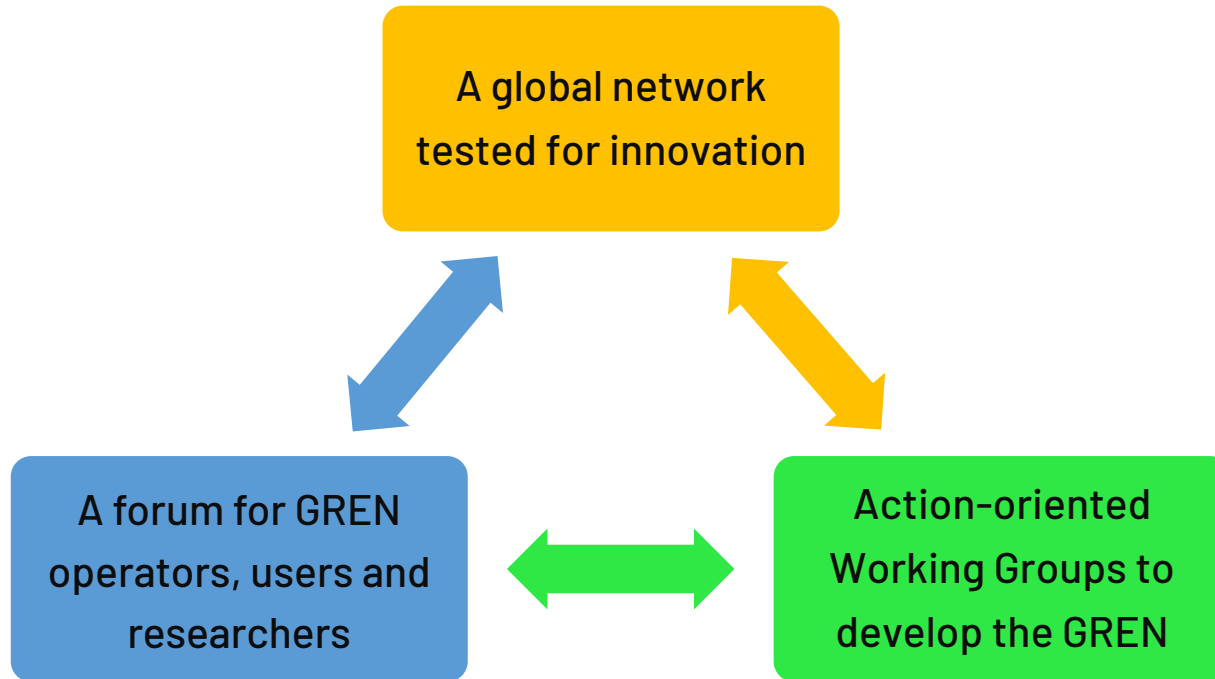


# Components

- AER (AsiaPacific Europe Ring) [↗](#)
- AmLight (United States to Latin America) [↗](#)
- ANA
- APOnet (Asia Pacific Oceania Network) [↗](#)
- AP-REX (Atlantic Pacific Research and Education Exchange) [↗](#)
- INDIGO (Sydney, Perth and Singapore) [↗](#)
- JGA (Japan Guam Australia) [↗](#)
- SANReN/TENET [↗](#)



# Decomposing the GNA-G



# Motivation

- Gather experts worldwide around topics of their interest
- Provide a platform to:
  - **Communicate:** share information, experience & knowledge
  - **Contribute:** establish working groups around immediate opportunities
  - **Collaborate:** establish peer-liaison around common goals and initiatives



# Platform to communicate, contribute & collaborate

- Communicate
- Contribute
- Collaborate

- Knowledge sharing
- Prototyping
- Proof of concept
- Testbeds
- Deployment
- Shared operations
- Shared services
- ...

- Technologies, trends and solutions
- Use cases
- Risk assessment and mitigation
- Security
- Performance
- Monitoring, reporting, alarming
- System behaviour (Log) Analysis
- Multi-domain
- AI/ML
- Energy efficiency
- ...





# Vision



*A unified global advanced network infrastructure  
to support the unique needs of research and education.*



# Mission



To foster *worldwide collaboration in Research and Education*, enabling *data-intensive* activities through a unified, *intelligent global network* built on *dependency, democracy, and diversity*.



# Strategy

## Vision

- A unified global advanced network infrastructure to support the unique needs of research and education.

## Mission

- Foster worldwide collaboration in research and education
- Enabling data-intensive activities through a unified, intelligent global network
- Built on dependency, democracy, and diversity

## Strategic Objectives (Work in progress)

- Forum to gather researchers & network operators
- Focus: big science & data-intensive research projects
- Improved operations
- Innovative services & testbeds
- Increase security maturity (*planned*)
- Increase awareness of GNA-G (*planned*)

## Strategic Initiatives & Roadmap

- Work in progress

We have 1 and 2, and elements of 3  
but need 4 to be more clearly articulated and delivered.

# Strategy

## Vision

- Global collaboration for Research & Education Networks (GREN)
- Diverse global infrastructure
- Building on existing Success
- Efficient resource utilization
- Unified blueprint for spending
- Enhanced services & support for science

## Mission

- Supporting Global R&E
- Emphasizing Network Needs
- Enhancing Data Collaboration
- Common Global Infrastructure
- Core Principles
- Strategic Actions

## Strategic Objectives (Work in progress)

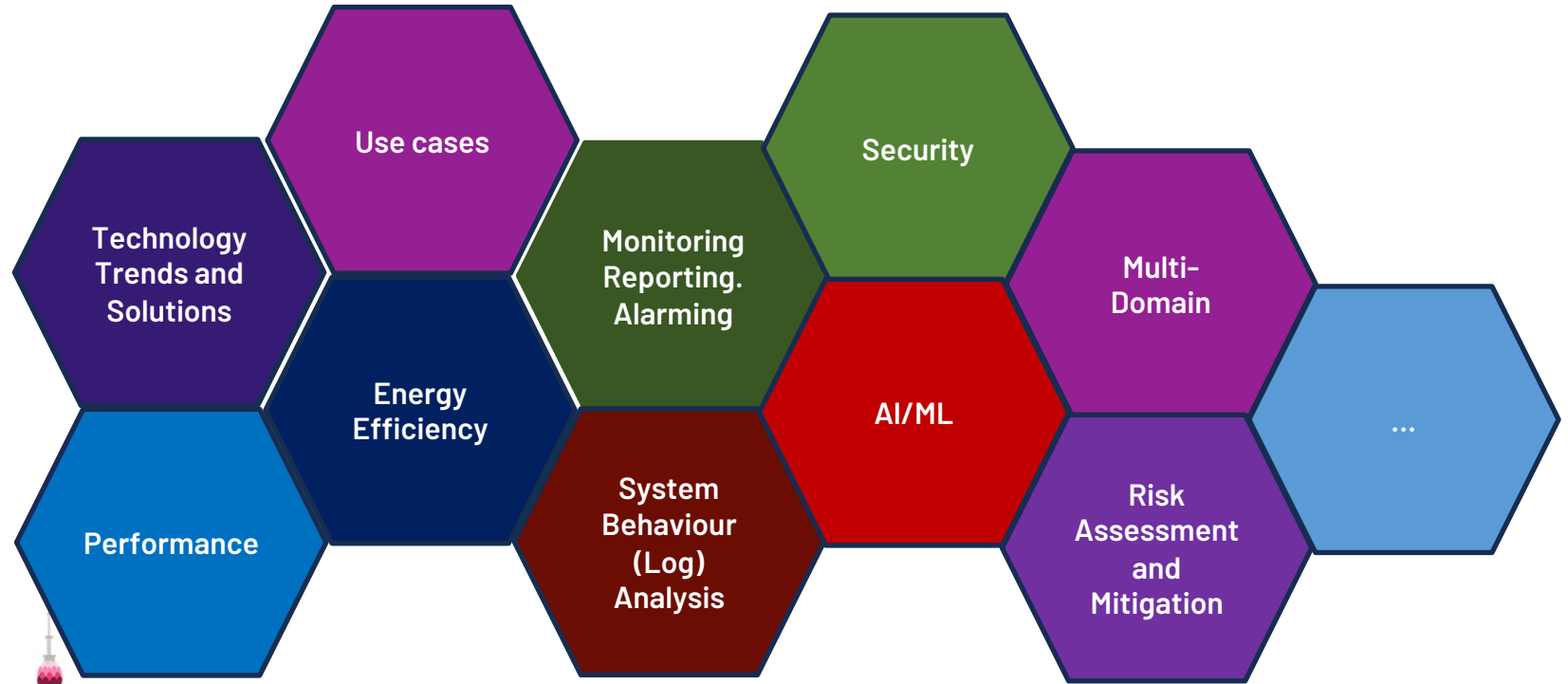
- Forum to gather researchers & network operators
- Focus: big science & data-intensive research projects
- Improved operations
- Innovative services & testbeds
- Increase security maturity (*planned*)
- Increase awareness of GNA-G (*planned*)

## Strategic Initiatives & Roadmap

- Work in progress

We have 1 and 2, and elements of 3  
but need 4 to be more clearly articulated and delivered.

# Topics



# Strategic Pillars

## **GREN Innovations**

- Global Test Facility
- e.g.: SC Demos; P4 Testbed
- Innovative network services
- Data movement

## **GREN Operations**

- Global Network Services
- Coordinated operations
- Automation, orchestration
- Monitoring, reporting, GREN map
- Secure GREN; MANRS

- A forum for discussion
- Support for global big science & data intensive projects



# Execution

- Organising periodic community meetings
- Creates knowledge base of (document, code...) repositories



# Structure



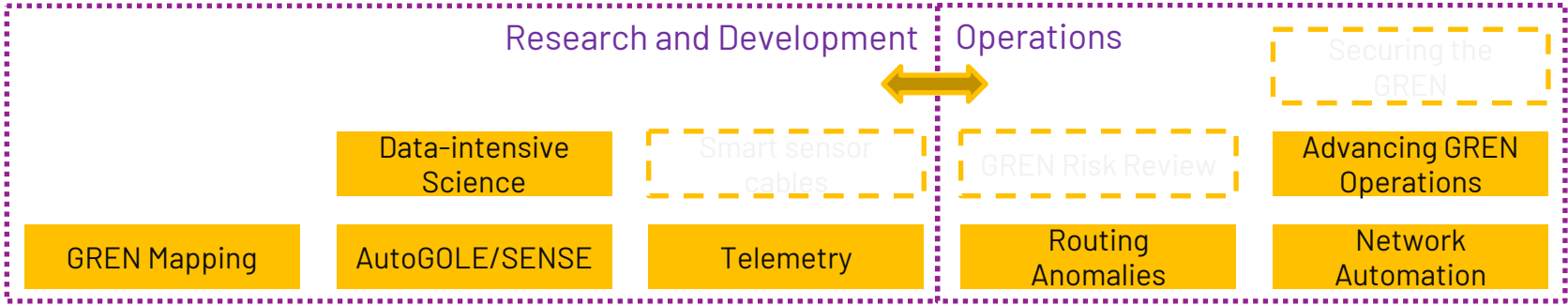
GNA-G Participant CEOs/Directors  
Global NREN CEO Forum

GNA-G Executive Liaison



GNA-G Leadership Team

GNA Architecture 2.0



GXP Architectures & Services

Link consortia AER APR ANA AmLight APOnet ...

GREN: Collaboration on the intercontinental transmission layer





# GNA-G Leadership Team 2023



Ⓞ **David Wilde, Chair**

AARNet (Australia)

---



Ⓞ **Harvey Newman**

Caltech (USA)

---



Ⓞ **Buseung Cho**

KISTI (South Korea)

---



Ⓞ **Ivana Golub**

PSNC (Croatia/Poland)

---



Ⓞ **Marco Teixeira**

RedCLARA (Latin America)

---



Ⓞ **Alex Moura**

KAUST (Saudi Arabia)

---



# Work Groups

1. AutoGOLE/SENSE
2. Data-intensive Science
3. GREN Map
4. Network Automation
5. Routing
6. NomCom
7. GREN Engineering Advancement



# Updates

- Takeaways from previous meetings
- TNC23 Meeting
  - Proposed Strategic Objectives for GNA-G
  - GNA-G Outreach
  - Progress in the past 12 months
  - Upcoming 12 months
  - Advancement opportunities for GREN
  - Promoting the GNA-G vision
- “Planning and Development in R&E Networks” (TNC23)
- “Securing the GREN”



# Updates (cont.)

- Trust as basis for services: community, network and identity federation
  - Community cooperation working as friends, different from commercials
- Capacity planning coordination for GREN
- Knowledge Base: strength in sharing services and best practices
  - Set up and maintain a knowledge base for topics explored within GNA-G
- Continuity and capacity planning, vulnerability assessment; striving for redundancy and resilience
- GREN Map helps simulations and capacity planning



# Updates (cont.)

- Inter-continental links used for redundancy and resilience
  - A system instead of collection of links, thanks to collaboration in GNA-G
- Space for advancement
  - Procedures, tools, above “best-effort” network and operations
  - GREN Engineering: not just operational, but architectural work
- Security
  - Mutually Agreed Norms for Routing Security (MANRS)
  - Secure the GREN
  - Vulnerability assessment



# Operations and Innovation

- Focus on innovations like Digital Twins/P4Lab and Virtual Routing @GXPs
- Overview of Multi-domain Operations and Securing the GREN
- New working groups, the nomination committee, and leadership team engagement
- Ongoing collaboration and investment in new projects.



# AutoGOLE/SENSE

- AutoGOLE: Automated Global Lambda Integrated Facility (GLIF) Open Lightpath Exchanges
- SENSE: Software-defined Network for End-to-end Networked Science
  - Intelligent network services for Science Workflows
  - Collaboration of open exchange points and R&E networks to deliver services end-to-end in a fully automated way using Network Service Interface Connection Service (NSI-CS)
- Objectives
  - Deliver automated circuit provisioning on the trans-Atlantic ANA system
  - Develop & deploy SENSE in AutoGOLE networks, exchanges and endpoints
  - Build a persistent infrastructure for science on top of dedicated connectivity, NSI and SENSE
- WG Chairs: ESnet, KISTI, RNP, SURF



# Data Intensive Science

- Collaboration between science & network communities on addressing the growing demand for network-integrated workflows, cross-institution data management, automation, resource management, etc.
- Objectives
  - Share, deploy, develop tools and services, provide a forum to support science programs across network and science communities
  - Develop new tools and services, new modes of GREN operations
  - Build a persistent infrastructure for science on top of dedicated connectivity, NSI and SENSE
- WG Chairs: Caltech, ESnet, AmLight/FIU





# GREN Map

- Development of a unified visualization system of the high-level connectivity in the community of R&E networks around the globe
- Objective
  - Dynamic visualization of the GREN that is perpetually up-to-date without requiring parallel data collection and maintenance activities
- WG Chairs: Canarie, GÉANT



# Network Automation

- Develop a catalogue of tools to drive automation in network configuration, security auditing, change control activities and intra-domain automation activities
- Objectives
  - Deliver a standardised glossary of network automation tools
  - Maintain a catalogue of network automation tools
  - Deliver network automation training
  - Identify a common set of network automation activities each NREN could re-use
  - Identify common APIs that NRENs use
  - Identify and agree on a common API set for communicating between NRENs
- WG Chairs: AARnet, SURF



# Routing

- Optimal data routing, good performance, determined/expected data paths in single and multi-domain networks
- Engages network owners and NRENs to discuss and address ineffective routes and act proactively across community to systematically create policies to prevent ineffective routes
- Objectives
  - Engineering:
    - Promoting and supporting advanced tools to identify and resolve routing issues
    - Collaboration between network owners and operators to resolve network issues
  - Policy: Collaboration with higher-level networking operators to detail their routing policies and be able to check if the traffic follows the policy
- WG Chairs: Indiana University, AARnet



# GREN Engineering Advancement WG



- The aim of this workgroup pioneer, try, test, experiment with solutions to better/more efficiently/redundantly run services over links part of the GNA-G
- Objectives
  - Enhance operation on systems between production networks
  - Effective and efficient multi-domain service orchestration
  - Disseminate gather knowledge and work results
- WG Chairs: Indiana University, AARnet



# NomCom

- NomCom = The Nominations Committee
- Differs from other working groups
- Gathers in November of every odd calendar year to nominate candidates to serve on the leadership team
- Consists of volunteers from the GNA-G community
- Objective
  - Elect members of the GNA-G Leadership Team



# Developing and Planning R&E Networks

Global Network Advancement Group

- Side-meeting during last TNC23
- Inputs for discussion later today (join Session 4)



# Bis Science Requirements

- Explore how requirements gathering reports among NRENs have been shared and utilized for network development
- Learn from ESnet's approach to requirements workshops and how it has influenced network planning
- Discuss the concept of a register that tracks current connectivity tasks
- Propose strategies for creating a unified "global" R&E network pitch for funding agencies and experiments to strengthen external engagements



# Intercontinental Connectivity

- Create a systems view of trans-oceanic and logical connectivity for extensive science collaborations
- Discuss initiatives by science engagement and technical coordination groups to improve efficiency, resiliency, and joint operations
- Coordinated groups
  - Science engagement group to experiments approach to coordinate requirements, co-design, solutions etc
  - Technical coordination group to explore efficiency, resiliency, etc, across the various trans-oceanic connectivity, and potentially joint operations
- Dedicate effort to work on the various coordinated tasks





# Renewal of Layer 1, 2, 3

- List of networks and associated services, hardware, and protocols
- Tender information, e.g., RFP, and potentially reasoning for selection
- Technology and vendor roadmaps
- Network element testing tools, methodology and results
- Have a unified view of what we could be tendering in 5-7 ys
- Service coordination
  - Building consistent end-to-end services. May require us to review our services and simplify if warranted



# Automation & Orchestration

- Share insights on automation and orchestration efforts in R&E networks based on lessons learned from previous bilateral collaborations
- Share system-level architecture design documentation, workflow models, and functions to improve information consolidation and sharing
- Discuss coordinated training and outreach activities to enhance network automation expertise in the community
- Coordinated training and outreach activities
- Join the "#automation" channel in the "NREN" Slack

<https://bit.ly/nren-slack>  (link valid for 30 days)



# Operations

- Multi-domain operations
- Securing the GREN



# Securing the GREN

- Community VCs held on June 26th 2023 6am and June 27th 2023 10pm
- Contributions



# Join and participate to advance the GREN

- GNA-G Community **mailing-list**: [all@lists.gna-g.net](mailto:all@lists.gna-g.net)
- **Join a working-group**
  - <https://www.gna-g.net/working-groups/>
- **Contribute your thoughts & ideas at the next meeting/VC:**
  - <https://www.gna-g.net/meeting/>
- **Reach out to the Leadership Team**
  - Web: <https://www.gna-g.net/contact-us/>
  - Email: [leadershipteam@lists.gna-g.net](mailto:leadershipteam@lists.gna-g.net)



# Thank You

Questions?

