Towards a "GREN": Practical Challenges and Opportunities

Ed Moynihan, Executive Director

INDIANA UNIVERSITY

International Networks
at Indiana University

International Networks @ Indiana University (IN@IU)

- **25 year history of operating international networks and building partnerships**

- **Currently support 4 100G links with 2 US NSF awards (TransPAC and NEA3R)**

- **Coordinate globally to ensure US researchers have worldwide access to networking services**

- **Work with research groups to improve international data flows via engagement and training**

- **Projects carry traffic data from researchers in 84% of the world**

Copenhagen
London
Amsterdam
Seattle
New York City
Tokyo
Guam
pore

Connections

TransPAC5	NEA³R
A 100G TransPAC + Pacific Wave	C 100G NEA³R
B 100G Guam Singapore Circuit Consortium	D 100G NEA³R

Network Reach

- NEA³R
- TransPAC5
- TransPAC5 & NEA³R
- None

INDIANA UNIVERSITY

International Networks
at Indiana University

Operating NSF-funded links since 1998

- TransPAC - 1998- 2005, Chicago > Tokyo; 35Mpbs to 73Mpbs to 100Mbps to 155Mpbs
- TransPAC2 - 2005 - 2010, 10Gb Los Angeles > Tokyo; 155Mb Singapore > Karachi
- TransPAC3 - 2010-2015, 2 10Gb Los Angeles > Tokyo
- America Connects to Europe (ACE) - Multiple 10Gb US <> Europe
- TransPAC4 - 2015 - 2021, 100Gb Seattle > Tokyo; 10Gb Guam > Hong Kong
- NEAAR - 2016 - 2021 - 100Gb New York > London
- NEA3R - 2020 - current - 2 100Gb links New York > London; New York > Amsterdam
- TransPAC5 - 2020 - 2025, 100Gb Seattle > Tokyo; 100Gb Guam > Singapore
- ?

IN@IU Research Areas

- ***Supporting and Advancing Global Collaborative Systems***

- Measurement and Monitoring tools for R and E

- Advanced Network Research and Support for Experimentation

- End-to-End Performance Improvement

- Leading Community Diversity Initiatives

Global Collaborative Systems

- **Integrated set of trans-oceanic circuits contributed and shared by members**
  - Examples: ANA, APOnet, AER, and others.
  - Driven by MoUs and Collaboration Statements based on:
    - Supporting Highly Available Connectivity Among Multiple Parties
    - Backup Traffic
    - Cooperation and Coordination
    - Network Research and Services
    - Application Development and Support
    - External Experiment Support
    - Preferred Route Identification and Resolution.
    - Sharing of Measurement Data

INDIANA UNIVERSITY

International Networks
at Indiana University

ANA — Advanced North Atlantic Consortium

Opportunities

- Procuring links and signing MoUs are a start
- Opportunities exist to improve our approach to operations and policy
- 12+yrs since ANA v1, is there desire and momentum in the community to move forward?

INDIANA UNIVERSITY

International Networks
at Indiana University

Operations

- Operational capabilities have not been prioritized
- Varying operational philosophies and priorities
- Resource restrictions
- Changing technologies and market landscape
- Increases in capacity, # of links, routes, etc

Perceived Need for:

- Developing pragmatic operational capability at the systems level
- Developing parameters for measuring performance and system metrics
- Translate metrics into business impacts
- Aligning future investments with Science and Engineering needs

INDIANA UNIVERSITY

International Networks
at Indiana University

Operations

Questions:

- Is there a desire for further harmonizing operations - at what scale?
- Can network automation and orchestration become an operational reality?
- How do we measure success of these systems?

INDIANA UNIVERSITY

International
Networks
at Indiana University

Coordinating and Improving Operations and Engineering

- Building Common Dashboards
- Developing Operational Procedures
- Documenting Resources (VLAN management and analysis)
- Cultivating Future Improvements (Automation, etc)
- Collecting and Disseminating Best Practices

INDIANA UNIVERSITY

International Networks at Indiana University

Policy

- Autonomy vs Shared
  - Are we getting what we pay for?
  - Rules for the "commons"
  - Built on trust - more than sum of parts
- Meeting our various organizational missions and the mission of the system
- Mix of capacity contributions
- Geography and geopolitics
- Architecting and aligning investments as a system

Perceived Need for:
- Further defining rules of participation and governance models
- Further defining rules for usage

INDIANA UNIVERSITY

International Networks
at Indiana University

Policy

Questions:

- What does it mean to be a member of the system? Contributing capacity? OXP operation? other?
- Is it possible for "large" partners to provide capacity for "small" partners?
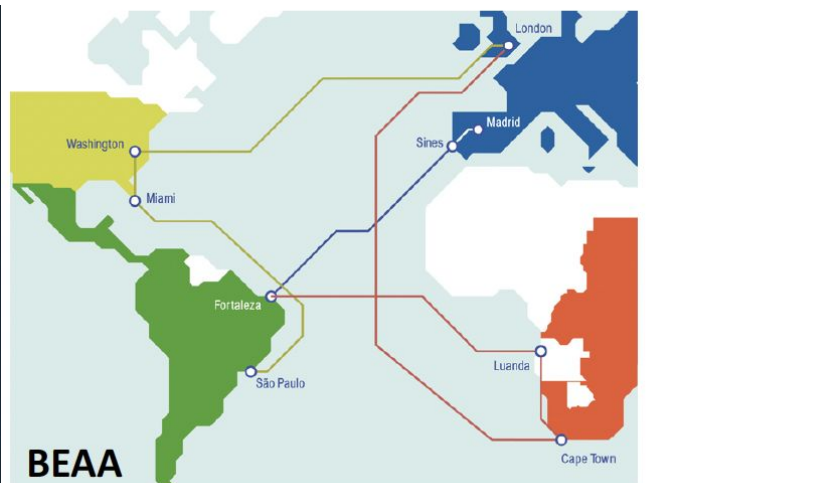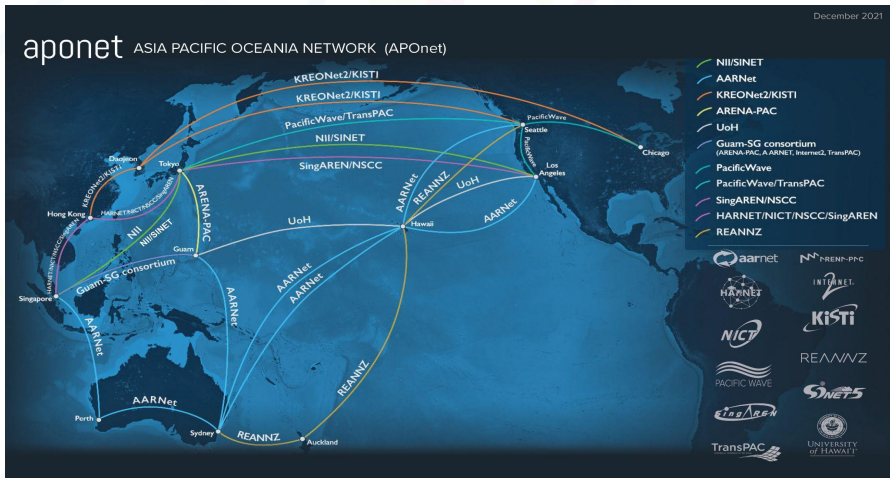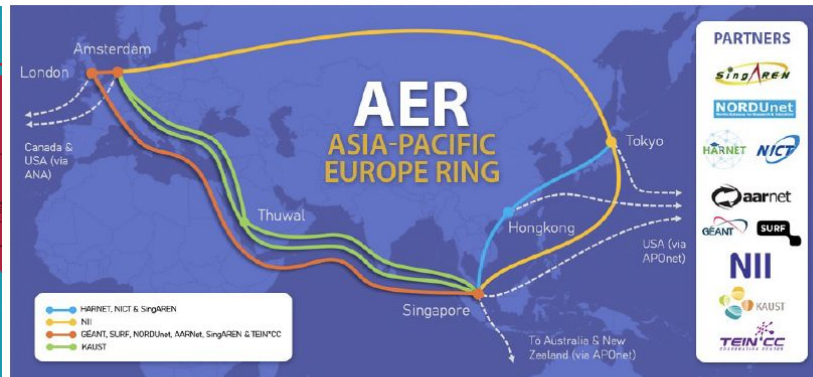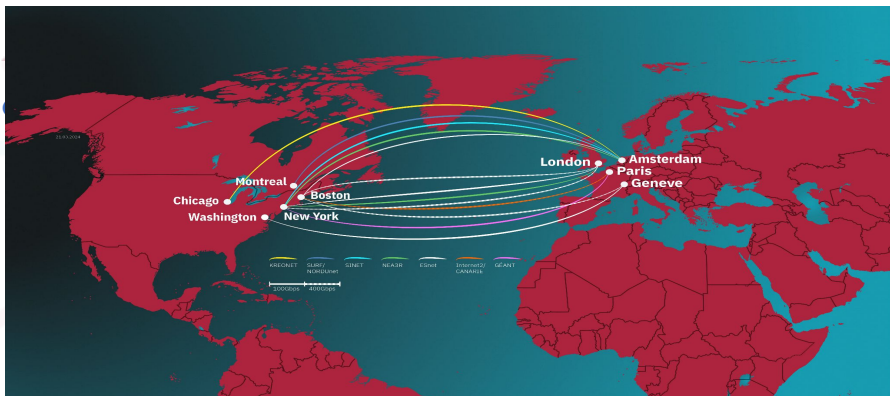- Is this model still viable? Who decides?

INDIANA UNIVERSITY

International Networks
at Indiana University

What do we mean by "GREN"?

- **edmoyn@iu.edu**

- **IN@IU Funding:**
  - US NSF Award #2028501 TransPAC5
  - US NSF Award #2028495 NEA3R

INDIANA UNIVERSITY

International Networks
at Indiana University