



Thanks to Markus  
Buchhorn, APAN GM!

# NREN infrastructure and applications in the Asia-Pacific

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*LHCONE - ISGC2016*

# The Asia Pacific...

- More than half the world's population
  - Rapidly growing proportion of global R&D
  - Rapidly growing population in education at all levels
  - Strong social pressures around food, health
  - Immense diversity
  
- APAN: Partnership of NRENs
  - 16+ Economies as primary members, 22+ Affiliates, Associates, Liaison and Industry partners
  - Formed 1995, incorporated 2009
    - MoU partnership became APAN Ltd (HK)
  - Independent, self-governing, many investors
  - Started with high speed links of 1-2Mb/s... *within the region*

# Asia-Pacific Backbone Topology



APAN/TransPAC3(Affiliated)  
GEANT2/TEIN3(Affiliated)  
JGN-X SINET4  
AARNet GLORIAD(Affiliated)  
Others

As of July 17th, 2013

0.5Mb/s -> N\*10-100Gb/s over the last fifteen years

# Asia-Pacific Backbone Topology by funding source



Asia Pacific  
United States  
Europe

As of February 8th, 2013



# Domestic/international bandwidth

- Domestically: few Mb/s up to 10Gb/s
- Internationally: 10-100Mb/s up to 1-10Gb/s
- Several 100Gb/s international paths emerging
  - TransPAC4 (US/Asia, dual paths?)
  - Singapore, Australia, China, ...
  - Asia/EU still growing, 10Gb/s

# NRENs and RRENs

## ■ Benefits of NRENs

- Enabling infrastructure for Research and Education
- Value scales exponentially with community size
- Provide national services to members
- Provide 'burst' capacity

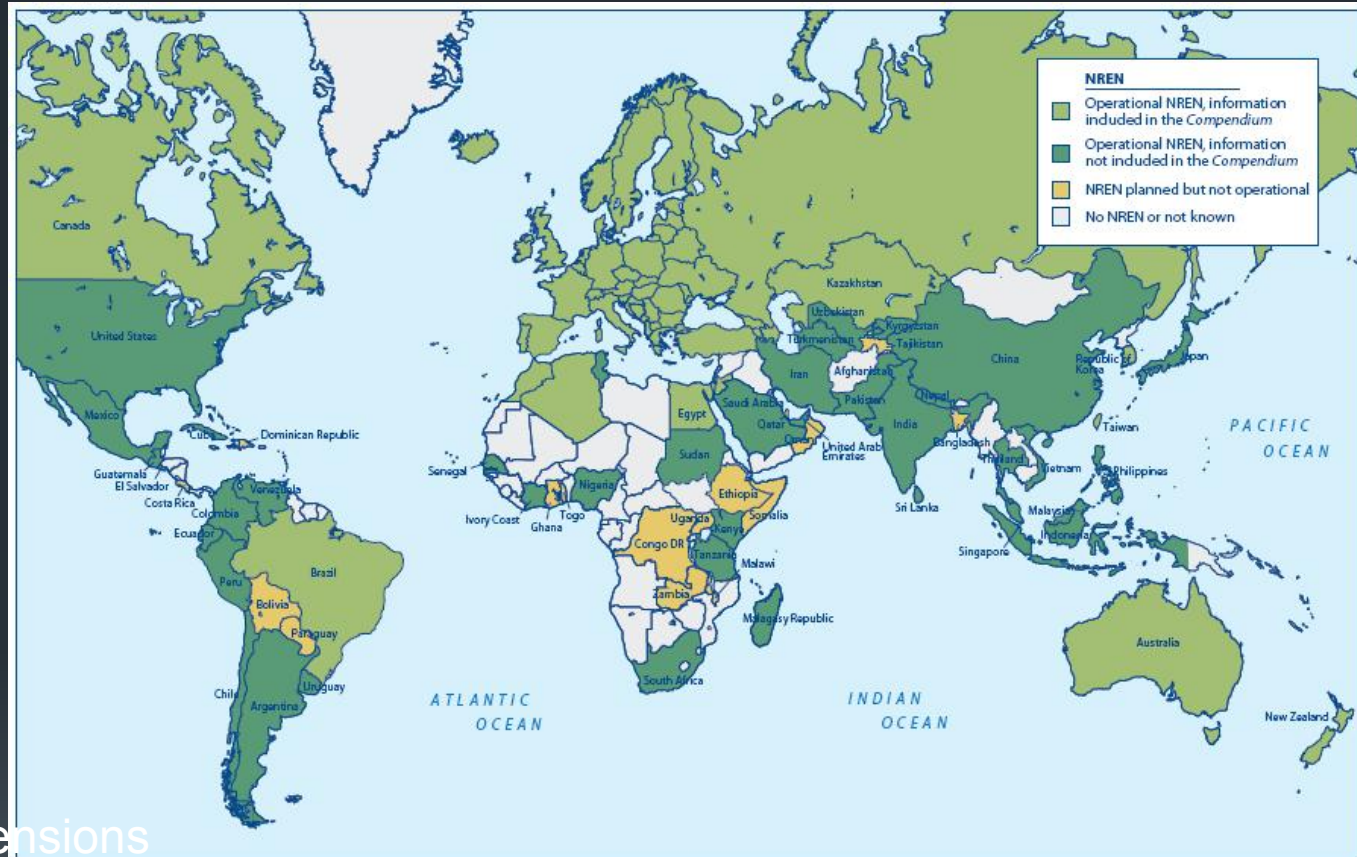
## ■ Benefits of RRENs

- Work on common interests/needs across a region
- Aggregate demand and supply
- Support cross-border activities
  - Most research and education is becoming internationally collaborative

# Challenges for NREN/RRENs

- APAN economies range from >1.2billion to <1 million people, from very-developed to very-developing
  
- NRENs have very diverse models – they have to!
  - As companies, partnerships, government agencies, lead entities
  - Funding through subscriptions, project grants, fee-for-service, ...
  - Offering service portfolios:
    - Domestic connectivity, international connectivity
    - Computing, storage, collaboration, certificates, identities, data management, training, project support, software development, ...
    - Harmonising is hard!
  
- Some major investments in the region
  - Australia has put about \$500M into e-infrastructures over last 7 years
    - Focus on production services

# Comparing NRENs

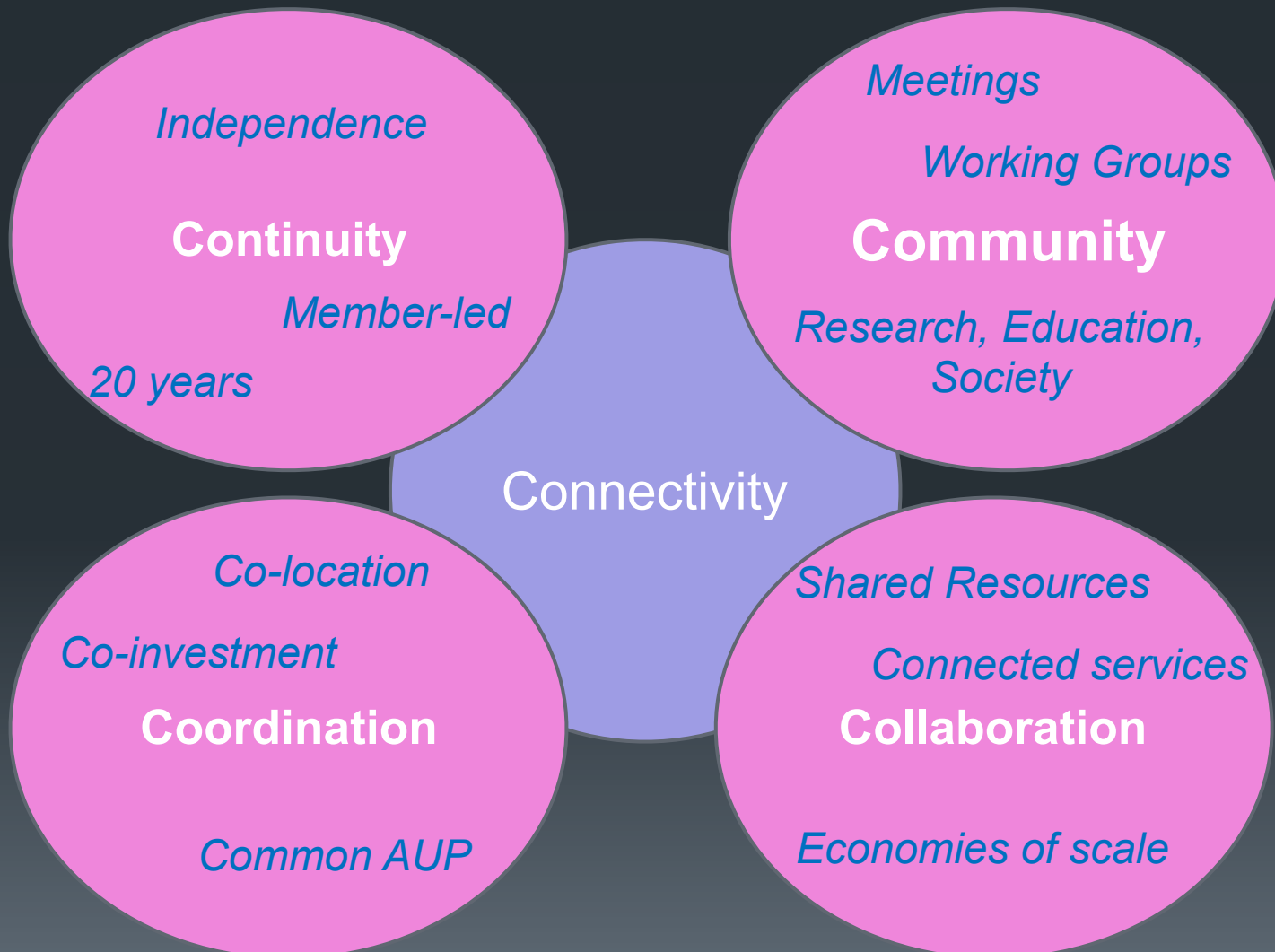


TERENA  
NREN  
Compendium  
2013

Best view of all NRENs  
Includes historical data  
Measures on many dimensions  
Services, costs, business  
*Needs more participation*  
*Global effort to collect data*  
*Trying to make it more valuable*  
*and much easier*



# APAN's role



# Community: focus on users

- *Enhance opportunities, access, and adoption of resources*
- Research, Education and Societal Benefits
  - **Applications:** Agriculture, Earth Systems and Sensing, Culture and Arts, Astronomy, HEP, Bioinformatics, Medicine, Education, Disaster Management (natural, medical, etc.), ...
  - **Tech:** UC, IPv6, HDTV, Future Int., SDN, IdP Fed., Grid, Cloud, ...
- Two major meetings each year, 300+ attendees
  - APAN-42: Hong Kong, 43: India (tbc), ...
- Participation and engagement with many community events
  - Within the region, and globally

# Coordination

- Many funding sources, many needs, many bilateral links
  
- Coordinate planning to maximise benefits
  - Connect and share backbone links
  - Attract and direct investments for new links
  - Demonstrate demand for capacity in emerging areas
  - Co-location and peering points – internet exchanges
  - ...
  
- International peering and planning
  - Coherent AUPs simplify peering and routing
  - Any user on any NREN globally can reach any APAN institution

# Collaboration

- With large partnerships come economies of scale
  
- Sharing infrastructure connected to the network
  - Collaboration systems, videoconferencing – unified communications, MCUs, directories, ...
  - High-performance computing, grid and cloud technologies
  - Data hosting and movement, ...
  - Identity federations, eduroam, ...
  - People, support, operations, skills, ...
  - Standards, best practices, ...
  - ...



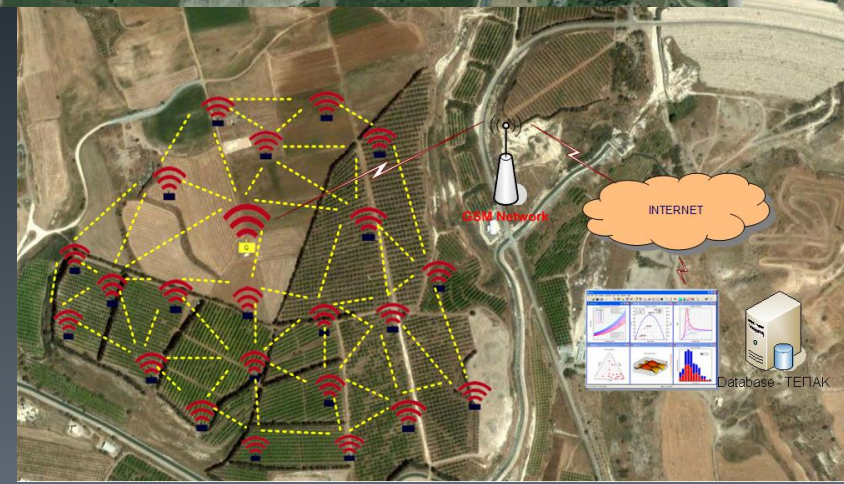
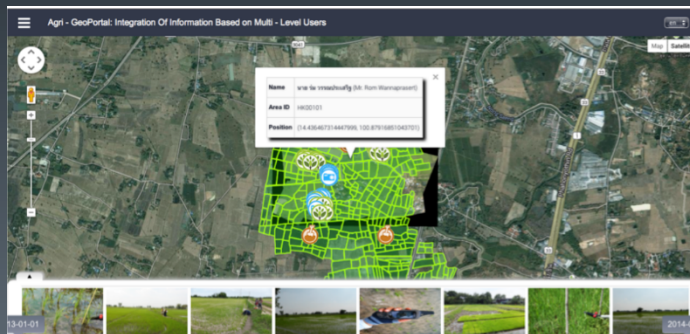
# Continuity

- *More than 19 years of meetings now*
- A member-owned partnership
  - Governance by the interested parties
- No single project dependency
  - Funding is independent, flexible, and largely recurrent
- No single government dependency
  - Politics can be reduced...
  
- Ongoing evolution & demonstration of value to the community
  - It's more than "just" connectivity

# e-Research Infrastructure

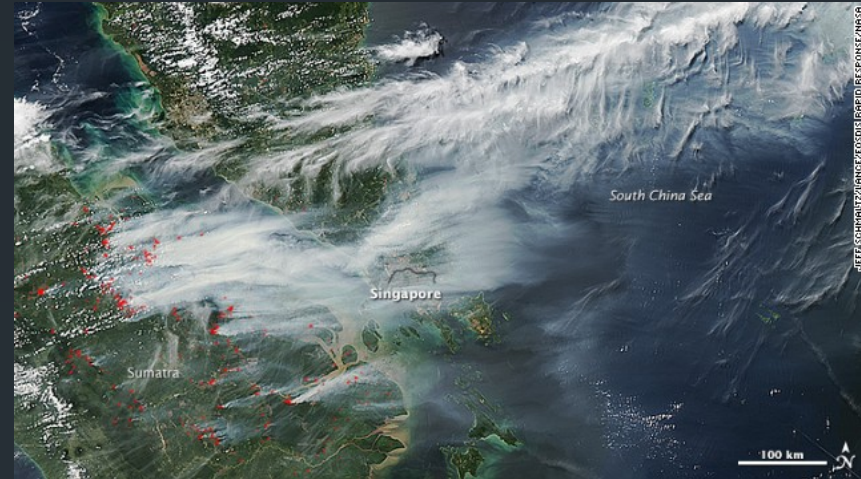
- IT **Enhancing** and **Enabling** research
- Computing - **Analysis**
- Data – **Storage**, **Integration**, Management
- Collaboration - **Group to group**
- Networking – **Connectivity**, wide and deep
- Security - **Trust**

# APAN Supports... Agriculture





# APAN Supports... Disaster Management



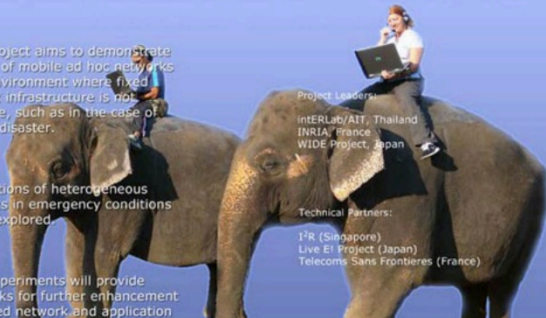
ursday, January 23, 14

## Digital Ubiquitous Mobile Broadband OLSR (DUMBO)

The project aims to demonstrate the use of mobile ad hoc networks in an environment where fixed network infrastructure is not available, such as in the case of natural disaster.

Operations of heterogeneous networks in emergency conditions will be explored.

The experiments will provide feedbacks for further enhancement of related network and application



Project Leaders:  
interLab/AIT, Thailand  
INRIA, France  
WIDE Project, Japan

Technical Partners:  
I²R (Singapore)  
Live 21 Project (Japan)  
Telecoms Sans Frontières (France)





# APAN Supports... Remote sensing

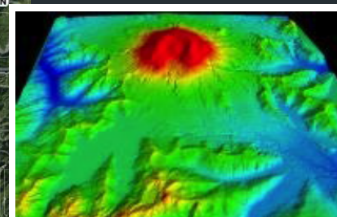
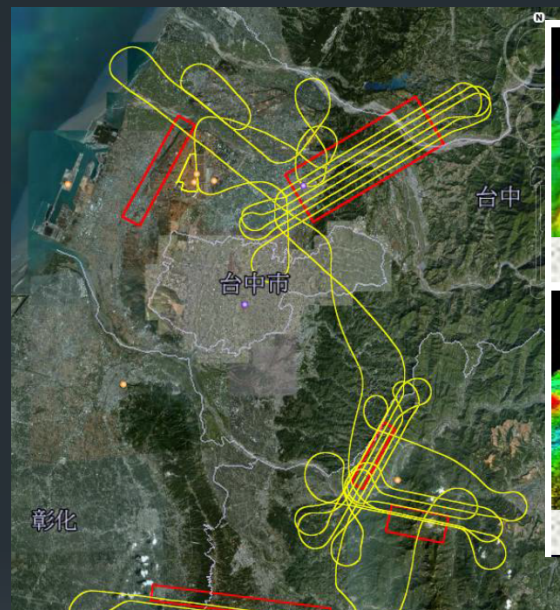
Boats



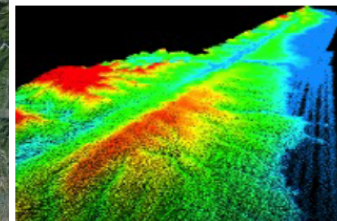
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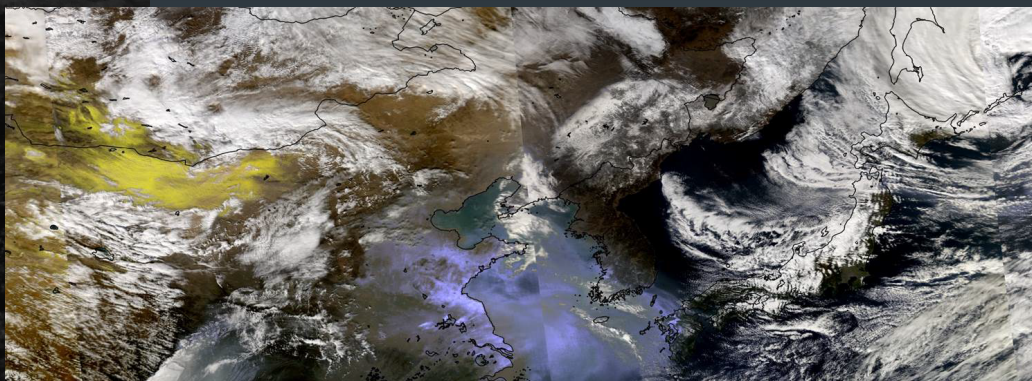
Taiwan



Volcano monitoring



Earthquake faults







*Asia-Pacific Advanced Network*

# APAN Supports... Collaboration, Education



# APAN Supports... Telemedicine

## [1] Live Video Distri

Operating Room

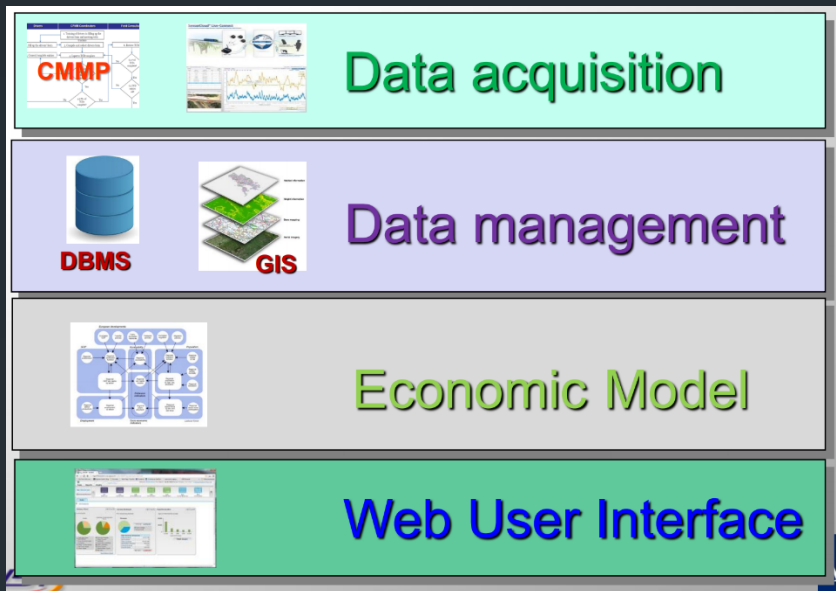
Images of  
Procedure



Japan side: Kyushu University

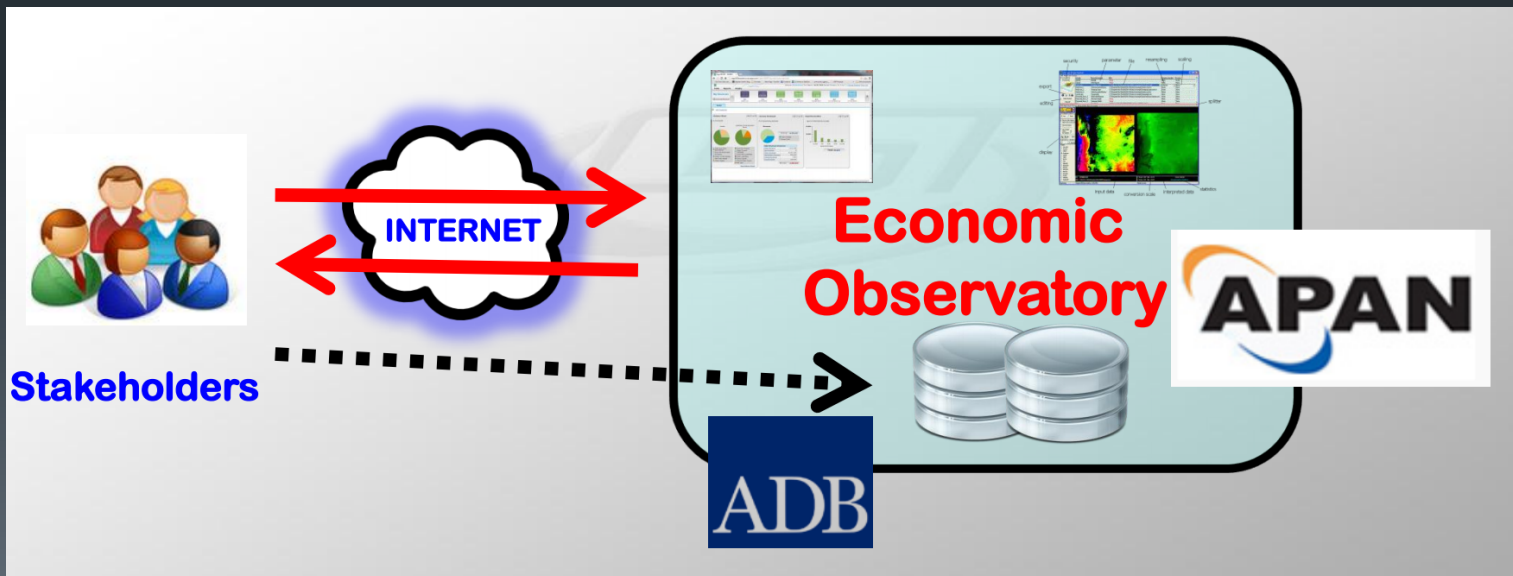






# APAN and ADB working together

- Data Integration and presentation
- Education
- Collaboration,
- .....





## In summary

- APANs members span over half the world's population
  - And many many political, cultural, organisational differences
  
- There is no such thing as a 'typical' NREN
- Partnerships of NRENs can achieve things they individually cannot
  - Imagine if we had a global partnership!
  
- APAN's partnership model is light-weight, low-cost but high benefit
  - And will continue to get better!
    - All we need are more money, time, people, ....

# Learnings from nearly 20 years

- Plan for sustainability, growth and change.
- Focus on the users
  - Foster the communities
  - Make it easy for ordinary users
  - Support advanced technologies for advanced users
- Plan & build collaboratively, to maximise the benefits
  
- Look to the Asia-Pacific region as well, where more than half the world is looking to collaborate and share with you!



*Asia-Pacific Advanced Network*

Thank you