

Research & Education Networking for the Pacific Islands

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Universities and the Internet

- TCP/IP and the Internet grew out of academic research sponsored by ARPA and NSF, primarily at US universities
- Universities played critical roles in early Internet development in most early adopting countries
 - Universities were often the first ISPs (primarily for students and staff)
 - Universities were among the first international IP connections
- University of Hawaii's rich history
 - Aloha protocols underlie most modern network development
 - First regular IP connections to many Pacific Islands via "dialup" over Peacesat
 - First International IP connections in the regions via UH PACCOM project: AARNet/AU, WIDE/JP, New Zealand, Korea...

Emergence of R&E Networks

- By the early 1990s, the Internet had gone mainstream and was commercialized
 - Many U.S. regional networks sold to telcos as their initial ISPs
 - AARNet network sold to Telstra
 - Same story in New Zealand
- By the mid-1990s, U.S. universities realized something was missing
 - Costs spiraling out of control
 - Limited development and deployment of new IP technologies
 - Connectivity via commercial ISPs hindered high-bandwidth academic apps and innovation
- Internet2 founded in 1996 by U.S. universities as the U.S. Research and Education (R&E) network
- Partnerships forged with many more countries in following years

R&E Networks 101

- Research and Education (R&E) networks directly connect colleges, universities, research facilities, schools, libraries, museums and sometimes hospitals
- R&E network connections tend to be higher speed and deploy advanced network capabilities earlier
- In most countries, R&E network connections are in addition to standard “commodity” Internet connectivity, not a replacement
 - Local exchange must be addressed
- R&E network connections enable advanced applications in research and education that are not feasible over commodity connections
- Higher/Tertiary education usually anchors R&E network initiatives
- R&E networks can be developed at the state/regional, national and international level

Another Missing Link

- With substantial progress in Southeast Asia, South Asia, Africa and a new Caribbean R&E network going live:

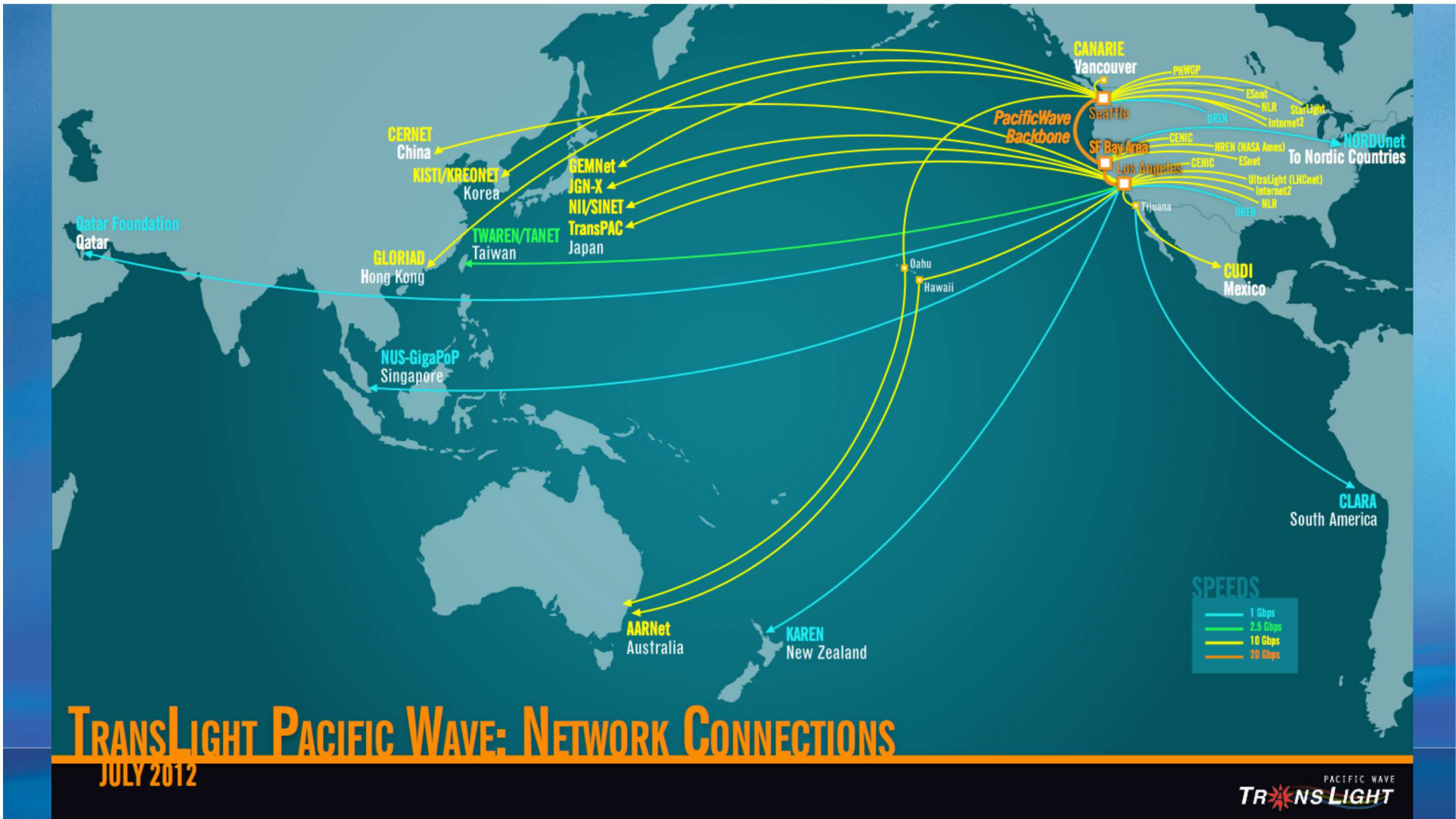
the Pacific is now the last region of the world with no initiative to develop a regional Research & Education (R&E) Network

- The U.S. NSF funded an exploratory project to identify needs and opportunities for R&E networking in the Pacific
- The European Commission has funded a similar study

Asia-Pacific Backbone Topology by funding source



As of Jan. 5th 2011





GLIF Map 2011: Global Lambda Integrated Facility Visualization by Robert Patterson, NCSA, University of Illinois at Urbana-Champaign Data Compilation by Maxine D. Brown, University of Illinois at Chicago Texture Retouch by Jeff Carpenter, NCSA Earth Texture, vislabearth.ncsa.gov www.glif.it



Challenges to Connectivity in the Pacific

- Highly distributed population
 - Low density, Significant distances, Island geographies, including domestic
- Weak economies
- Limited educational attainment
- Limited telecom infrastructure – internal and external
 - Economics and geography
- Developing and variable telecom regulatory environments
- Limited regional “glue”
 - Multiple political affiliations
- Lack of coordination by development partners
- **Connectivity is most critical to the most isolated communities; Unfortunately, they generally have the most limited capacity.**

Typical R&E Network Goals

- Connect education & research communities domestically and globally
 - Enable distance learning, training, access to content and academic collaborations
 - Enable cyberinfrastructure-empowered research
- Develop, deploy and transfer advanced network applications and technologies
 - Enable new generation of R&E applications
 - Transfer technology, knowledge and experience for broad commercial use
 - Increasingly, support academic cloud services

Benefits of R&E Networking for the Pacific – Education & Health

- Expand distance learning opportunities and improve educational capacity
 - Education, Public Health, Health Care, Social Work, STEM, Environmental Studies, Business...
- Access to global digital libraries and educational content repositories
- Enable collaboration with colleges, universities, NGOs and others throughout the world
- Telemedicine & Public Health outreach and research

Shifts in Research Today

- Research has become a Team Sport
- Research is increasingly interdisciplinary
- Research is increasingly international
- Research is increasingly data-driven and computationally enabled

*Research-based innovation and problem solving
requires adapting to these shifts*

Benefits of R&E Networking for the Pacific – Addressing National & Regional Problems

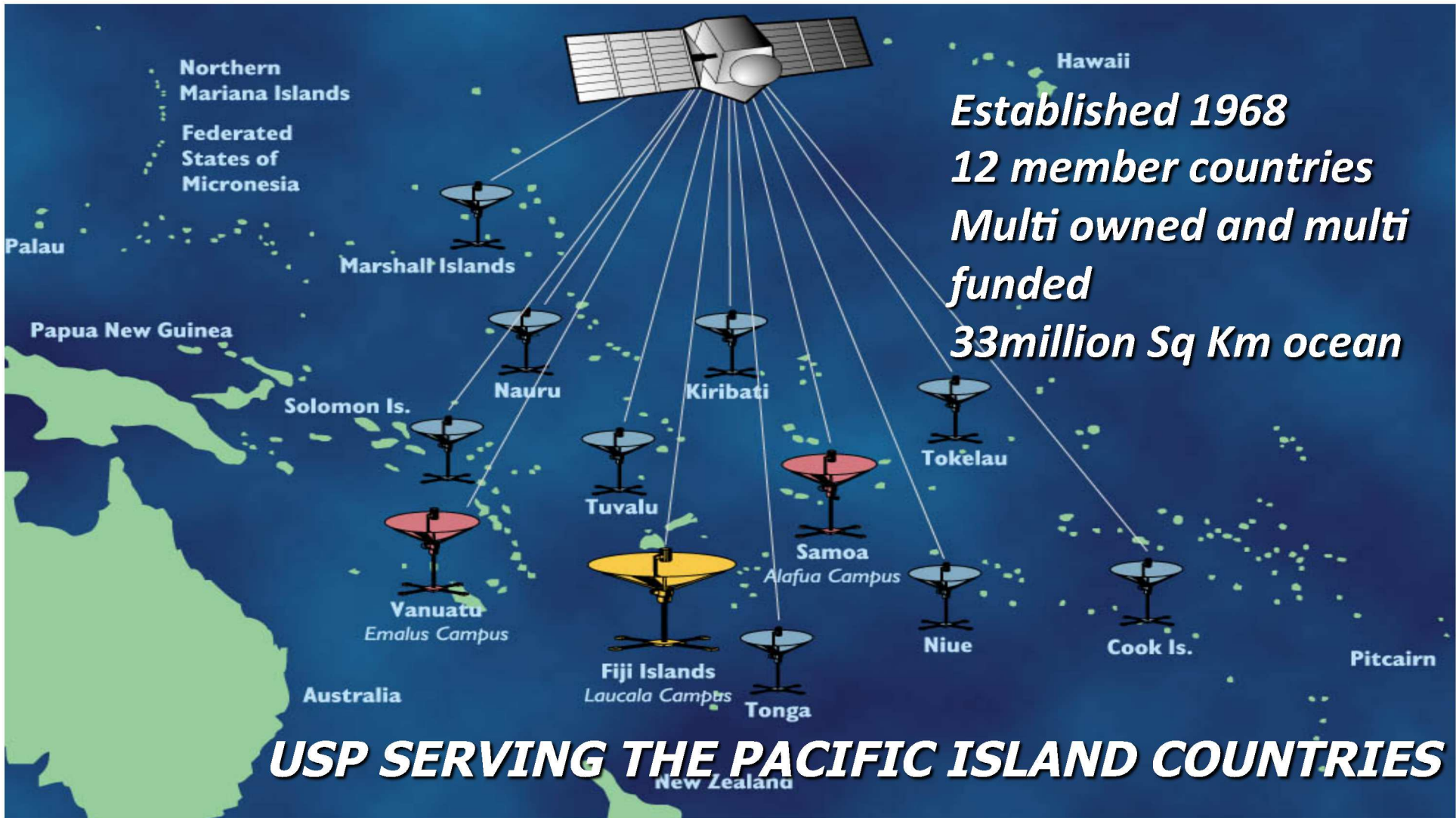
- Enable strategic research using modern cyberinfrastructure approaches:
 - Climate Change & Sea Level Rise, Ocean Acidification, Coral Reef Survival, Fisheries, Island Sustainability, Indigenous Culture Preservation, Sustainable Agriculture, Public Health, Bioinformatics applications to people and the environment, Earthquake & Tsunami Modeling, Disaster Resilience, Environmental Studies...
- WITH, not just FOR Pacific Islanders

Benefits of R&E Networking for the Pacific – Economic

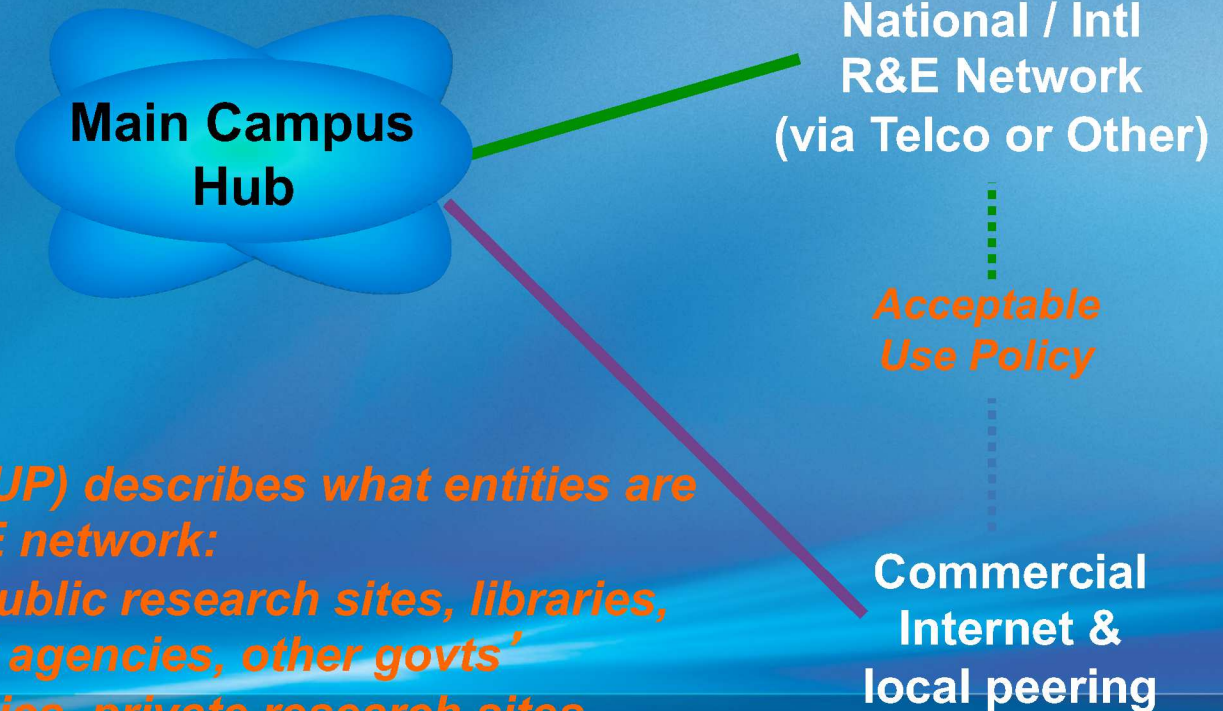
- Develop a workforce skilled with emerging technologies for local telecommunications and ICT industries
- Enable economic development through new information- and communications-based opportunities
- Build appreciation for higher speed broadband and demand for higher capacity services and infrastructure

New Connection Opportunities

- Currently available fiber
 - Fiji – AU/US (SCCN)
 - Guam – Hawaii (AAG)
 - Samoa - American Samoa – Hawaii
 - French Polynesia – Hawaii
 - Micronesia & Marshalls – Guam
 - Northern Marianas – Guam
 - New Caledonia – AU
 - PNG – AU & Guam
 - Tonga – Fiji **LIVE!**
 - Vanuatu – Fiji **RFS Jan 2014**
- Funded fiber projects underway
 - Solomons – Guam & AU (via PIPE)
- Fiber projects under consideration
 - Palau, Yap
- Satellite Projects
 - O3B Satellite
 - MEO – Low Latency (120 ms)
 - Ka Band – Gigabit speeds
 - 2013/2014 Launch & RFS
 - Kacific
 - Retail and consumer offerings
 - Highly affordable
 - 2017 Launch & RFS
- AU/NZ - HI/US Fiber Projects in Planning
 - Hawaiki
 - APX-East
 - Both offering branching units for Pacific Islands



Simple R&E Network Connection: Politics, Economics & Engineering



*Acceptable Use Policy (AUP) describes what entities are eligible to connect to R&E network:
Colleges & universities, public research sites, libraries, K12 schools, government agencies, other govts' agencies, hospitals & clinics, private research sites...*

Possibilities: American Samoa & Samoa

**American Samoa
Comm College**

Univ of Hawaii &
Internet2/etc

*Acceptable
Use Policy*

**National University
of Samoa**

Commercial
Internet &
local peering
(Samoa)

Commercial
Internet &
local peering
(Am Samoa)

Possibilities: Guam, FSM, RMI, CNMI

Commercial Internet & local peering (Saipan)

Northern Marianas College (Saipan)

Commercial Internet & local peering (Pohnpei)

College of Micronesia (Pohnpei)

Commercial Internet & local peering (Majuro)

College of Marshall Islands (Majuro)

Guam GigaPOP (UOG/GCC)

Commercial Internet & local peering (Guam)

Univ of Hawaii, Pacific Wave & Beyond

Possibilities: French Polynesia

Univ of Hawaii &
Pacific Wave
via Honotua

AARNet via
Gondwana

Berkeley, NSF,
Stakeholders

Univ of
French Polynesia
(Tahiti)

Renater
(France)

Univ of
New Caledonia

Commercial
Internet &
local peering
(FP)

Commercial
Internet &
local peering
(NC)



Potential Stakeholders for a Pacific R&E Network

- Pacific colleges and universities: PPEC, USP, UPF, UNC, NUS, PNG unis...
- Pacific research institutions and their owners/operators
- PITA members – Pacific Telecom Operators & Regulators
- APAN, PTC, PacNOG, PICISOC, APNIC...
- Owners of the new infrastructure (Fiber projects, Satellite systems)
- Pacific Island national & regional governments, leaders & consortia
- Existing R&E Networks in the U.S., Australia, NZ, France, Japan: Internet2, AARNet, REANNZ/KAREN, RENATER..
- National and international development agencies: ADB, WorldBank,, AUSAid, EC, JICA, APT, ITU, UNESCO...
- U.S. Government: NSF, Interior, State, Education, Commerce, USAID, CDC, NASA...

Why Should Telcos Support R&E Networks?

- Directly address meaningful national & regional problems with modern practices in education, health and research
- Develop the next generation qualified workforce for local telecommunications and ICT industries
- Enable economic development through new information- and communications-based opportunities
- Demonstrate utility of bandwidth abundance in a limited, affordable and safe setting