



# GLORIAD

## Internet2 Middle East SIG @ ASREN

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## GLORIAD is:

- A cooperative R&E network ringing the northern hemisphere linking scientists, educators and students in Russia, USA, China, Korea, Netherlands, Canada, the Nordic countries, Egypt, India, and Singapore with specialized network services; co-funded, co-managed by all international partners
- A Collaborative International Program to Develop/Deploy advanced Cyberinfrastructure between partnering countries (and others) as effort to expand science, education and cultural cooperation and exchange
- A vehicle for the collaborative construction of high performance international links between NRENs. GLORIAD infrastructure, in turn, serves as a collaboration platform for large multinational science efforts

**GLORIAD is a Collaborative Effort!**

# GLORIAD Partners & Sponsors

- Partners: SURFnet, NORDUnet, CSTnet (China), e-ARENA (Russia), KISTI (Korea), CANARIE (Canada), SingaREN, ENSTInet (Egypt), Tata Inst / Fund Rsrch/Bangalore Science Community, NLR/Internet2/NASA/FedNets, CERN/LHC
- Sponsors: US NSF (\$18.5M 1998-2015), Tata (\$6M), USAID (\$3.5M 2011-2015) all Intl partners (~\$220M 1998-2015)
- History: 1994 US-Russia Friends and Partners; 1996 US-Russia Civic Networking; 1997 US-Russia MIRnet; 2004 GLORIAD; 2009 GLORIAD/Taj; 2011 GLORIAD/Africa

**Many thanks to GLORIAD's  
Partners and Sponsors!**

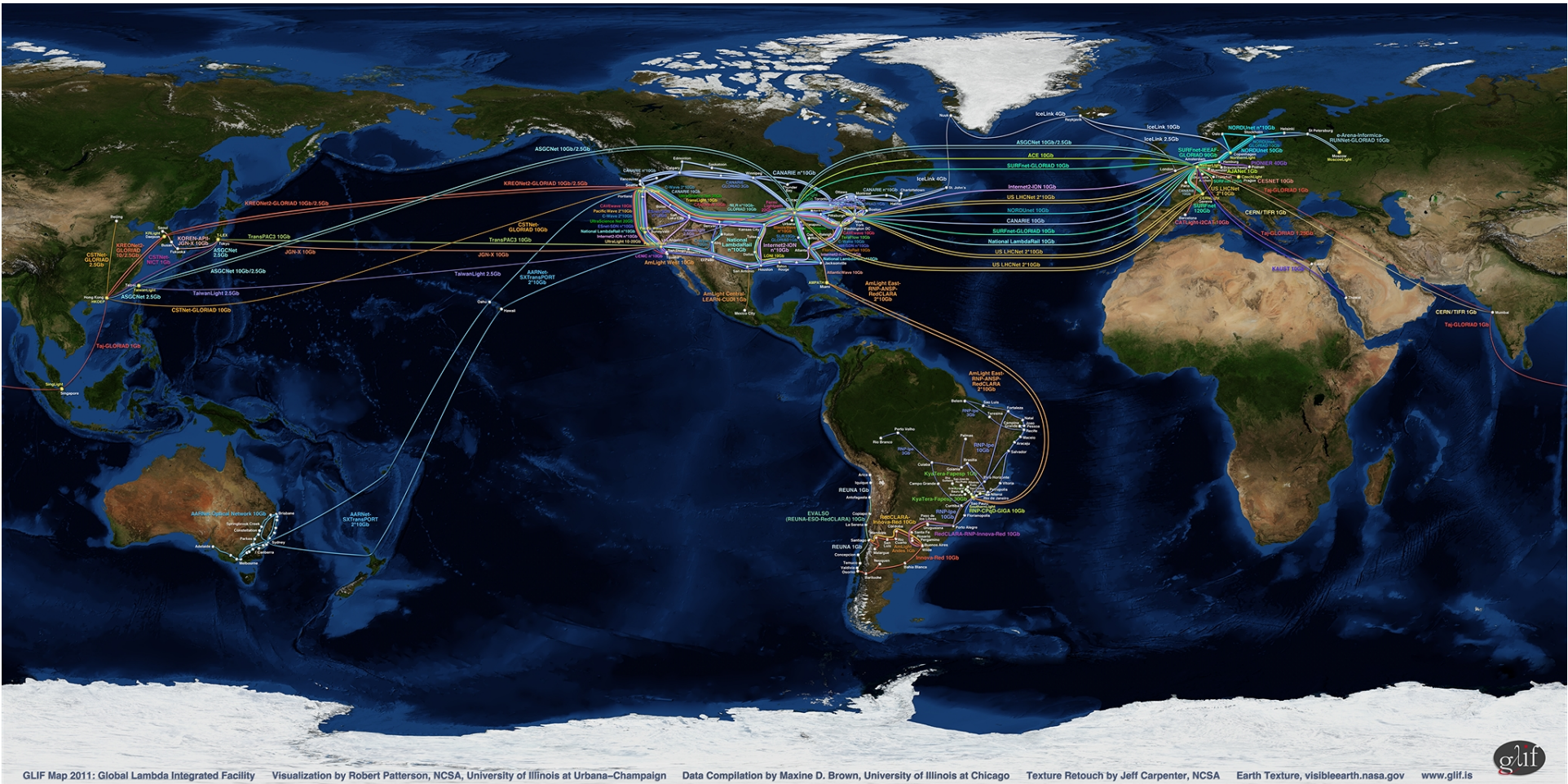
# GLORIAD-Taj Expansion



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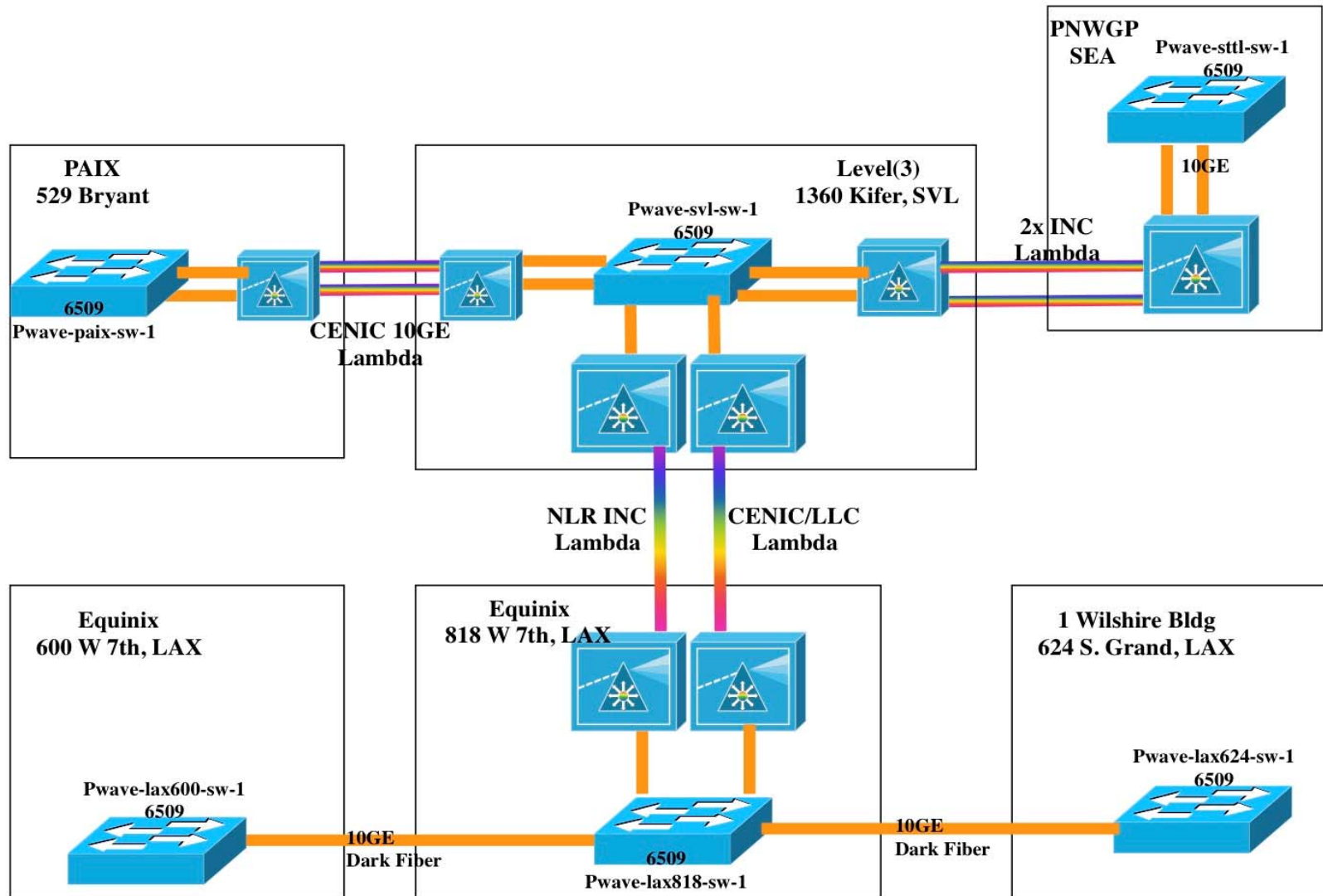
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# Distributed NREN Exchanges

- NREN Exchanges follow two models:
  - **Exchanges at a Point:** MAN LAN (New York); STAR LIGHT (Chicago); NetherLight (Amsterdam); AMPATH (Miami)
  - **Distributed Exchanges:** Pacific Wave (US West Coast); Atlantic Wave (US East Coast)
- **Historically the motivations behind exchange model choices have come down critical mass, which is heavily influenced by submarine cable landing points, and politics.**
- Distributed Exchanges are a good fit in some situations because they allow NRENs which may not have a critical mass of either Research & Education (R&E) Institutions or submarine cable landing points to band together to create that mass.
- For example the motivation/business case behind building Pacific Wave was to create enough critical mass to make it a “Destination” NREN Exchange.
- NRENs throughout Asia Pacific know that landing in either Los Angeles; San Francisco; or Seattle gets them free VLAN transit to any other point and to US and other International NRENs.
- More direct connectivity among US West Coast R&E Institutions are a benefit of Pacific Wave but were not a motivation for creating the exchange.
- Pacific Wave has been a great success. It is now a destination US landing point for Asian NRENs and has been a catalyst in enabling/driving collaboration between US West Coast R&E Institutions and their peers in Asia/Pacific.

## Pacific Wave









# NRENs and Higher Education in Persian Gulf

- There are NRENs up and running in the United Arab Emirates and Qatar
- NRENs are being built in Saudi Arabia and Oman
- NRENs are being considered in Bahrain and Kuwait
- But there are no NREN Exchanges in the region!

**NRENs and NREN Exchanges are as much about building collaborative research and education communities, which share resources, as they are about providing bandwidth and connectivity.**

# A Distributed Exchange for the Gulf

- Currently NRENs and individual universities in the Gulf are running their own circuits to Amsterdam, New York and Los Angeles with no cost sharing from the US or Europe and no savings from multi-customer bulk bandwidth pricing.
- A Distributed NREN Exchange in the Gulf would create a “Destination” Exchange that NRENs in the US and Europe would be willing to cost share to get to.
- Gulf NRENs could form purchasing alliances to get group pricing for circuits they could still purchase separately.
- ISPs connecting to an exchange in the Gulf might offer discounted rates and a distributed exchange has the potential to create a regional ISP market that would be more competitive than existing national markets.
- If Gulf Wave grows large enough it might attract transit connectivity from NRENs in countries further East like India and Pakistan and perhaps even China and Japan. It would then be able to use these links to provide a no cost path directly to NRENs in China and Japan for its members.

# Gulf Wave Today





## Near Term Possible Gulf Wave



# GLORIAD-Taj Expansion



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# Long Term Possible Gulf Wave Future



One potential Gulf Wave future would be for each participating NREN to contribute a local switch and bandwidth on one Global Link and one Regional Link to be shared as Gulf Wave Exchange resources.

This pooled infrastructure could be managed jointly or by a third party like the dvNOC.



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**Thank You / Shukran**