



Collaborative Infrastructure - facilitating innovation on a global scale

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South Asia Feasibility Study

QUESTnet 2008 Royal Pines, Gold Coast



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The changing Internet environment



- China has overtaken the US as the country with the most internet users, even with less than 20% Internet penetration
- There will be more (much more) new undersea capacity deployed in the next 30 months than has collectively been deployed ever
- Pacnet has lit 1000 x 10Gbps lambdas on its pan-Asian subsea network – plan to move away from SDH to “IP over wave”
- The volume of intra-Asian traffic now significantly exceeds trans-Pacific
- Almost 60% of the world's population is located in the 5-hour timezone going west from Sydney
- Less than 2% of the world's population is located in the 5-hour timezone going east from Sydney



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How fragile has the Internet become?



International Research Networking

- The Internet had its origins in an environment of trust with a scope very different from what it is used for today
- Evolution or “clean slate”
 - NSF’s Global Environment for Network Innovations, www.geni.net
 - EC’s FEDERICA Federated technology-agnostic infrastructure, <http://www.fp7-federica.eu/>
 - Future Internet Research and Experimentation (FIRE), www.euroresearch.ch
 - Asia Future Internet, <http://www.asiafi.net/> (combines Asian work)
- There is “cross-fertilisation” among these initiatives
- Should Australia be more involved?

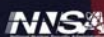


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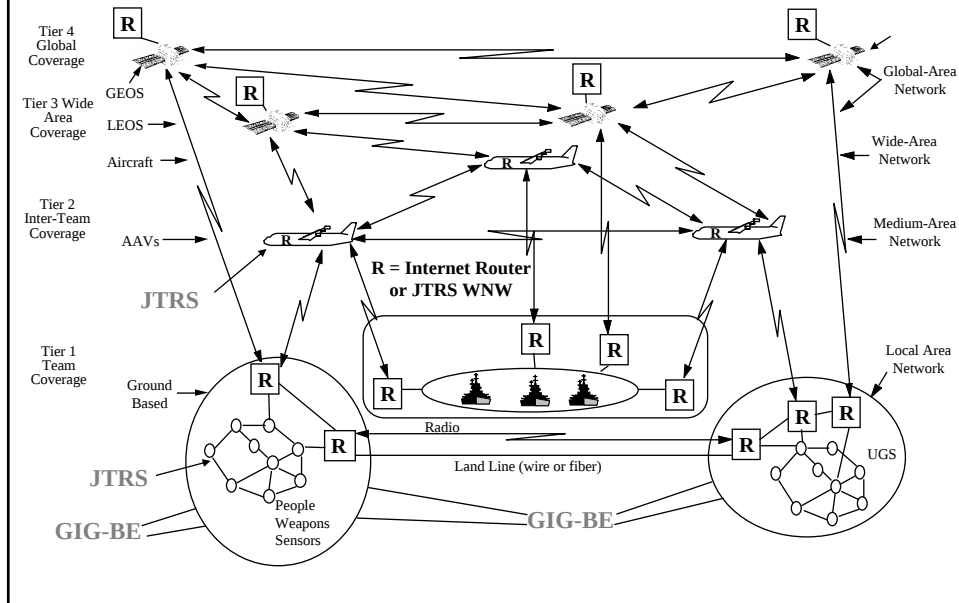
Federal Plan for Advanced Networking Research and Development and Trusted Internet Connections

Need to support:

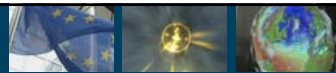
Federation across domains and widely differing technologies
Dynamic mobile networking with autonomous management
Support for sensor networks
Near-real-time autonomous discovery, configuration and management of resources
End-to-end security tailored to the application and user



♦ heterogeneous anytime anywhere networking



EARNEST Foresight Study

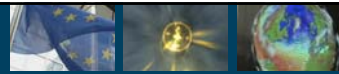


International Research Networking

- 2006-2008: key study areas including:
 - Researchers' requirements (led by European Science Foundation)
 - Campus issues (led by EUNIS)
 - Geographic issues
 - Economic and regulatory issues
 - Organizational and governance issues
 - Technical developments

EARNEST: Education And Research Networking Evolution Study

EARNEST Goals



International Research Networking

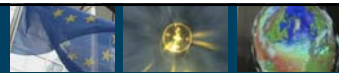
- To provide inputs for new initiatives
- To provide evidence of the impact on research that advanced networking has had in recent years
- To look at the development of the digital divide issues pointed out in the preceding foresight study, SERENATE
- To prepare the ground for further development after the completion of GÉANT2



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EARNEST

Researchers' Requirements study



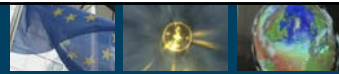
International Research Networking

- First stage - ESF carried out a large-scale survey to collect factual information as well as opinions from active researchers all over Europe
- Over 11500 contacts were provided by the ESF
- 4392 scientists responded
- Second stage - an in-depth investigation with interviewees drawn from the initial respondents & based on expertise and responses in stage 1
- Also focused on new ideas for the use of networks in the coming decade



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EARNEST - study reports



International Research Networking

List of study reports

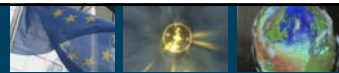
<http://www.terena.org/activities/earnest/publications.html>

- Final summary report (84 pages)
 - <http://www.terena.org/activities/earnest/docs/20080429-final-report.pdf>



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APAN Networks



International Research Networking

- Network platforms for virtual collaboration in Asia Pacific continue to be developed & enhanced: within countries; between countries; & between geographic regions.
- In addition to initiatives catalysed by Asian countries, intercontinental programs such as TransPac2, GLORIAD, Translight Pacific Wave, ORIENT and TEIN2 have significantly enhanced network connectivity to the US and particularly to Europe
- The next schematic illustrates the Jan 2008 situation with respect to the Asia Pacific Advanced Network (APAN) backbone



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TEIN2/TEIN3 part of the regional (APAN) network fabric



International Research Networking

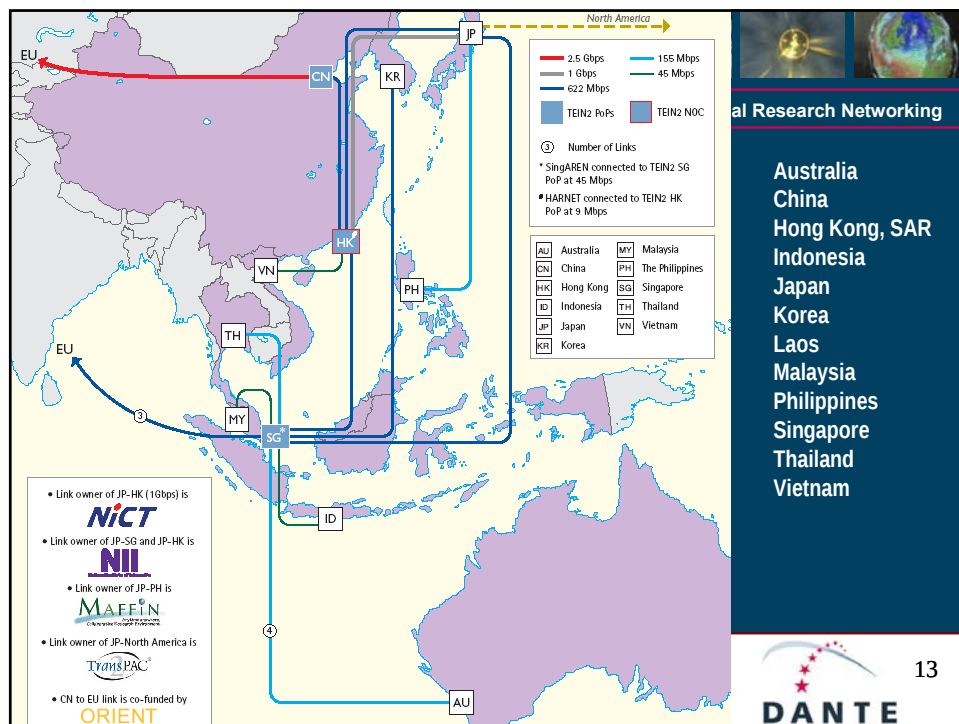
- TEIN2 is an acronym for the Trans Eurasian Information Network, Phase 2
- Launched at Halong Bay in June 2006
- Provides short paths to Europe (going west)
- Provides short paths WITHIN the APAN region (*cf* transit via US or Japan)
- Capacity ranges from 45Mbps to 2.5Gbps
- Complements the multi-Gigabit networks from Japan and Korea to the US
- Catalysed new NRENS (National Research and Education Networks) in Malaysia, Indonesia and Vietnam
- TEIN3 is the follow-on initiative and may include South Asian countries

TEIN3

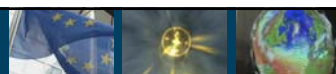


APAN

DANTE



Changing approaches to global connectivity co-funding/resourcing



International Research Networking

- The Higher Education Commission of Pakistan and the US National Science Foundation have equally co-funded a link from the PERN2 PoP in Karachi to the TEIN2 PoP in Singapore (financed by the EC and Asian TEIN2 partners)
- TEIN2 and Japan R&E network transit traffic from Singapore to the TransPac PoP in Japan
- TransPac transits traffic from Japan to Pacific Wave R&E exchange point in LA and from there to Internet2
- Funding/in-kind from Pakistan; NSF; EC; TEIN2 partners; Japan; TransPac; Pacific Wave

TEIN3



APAN

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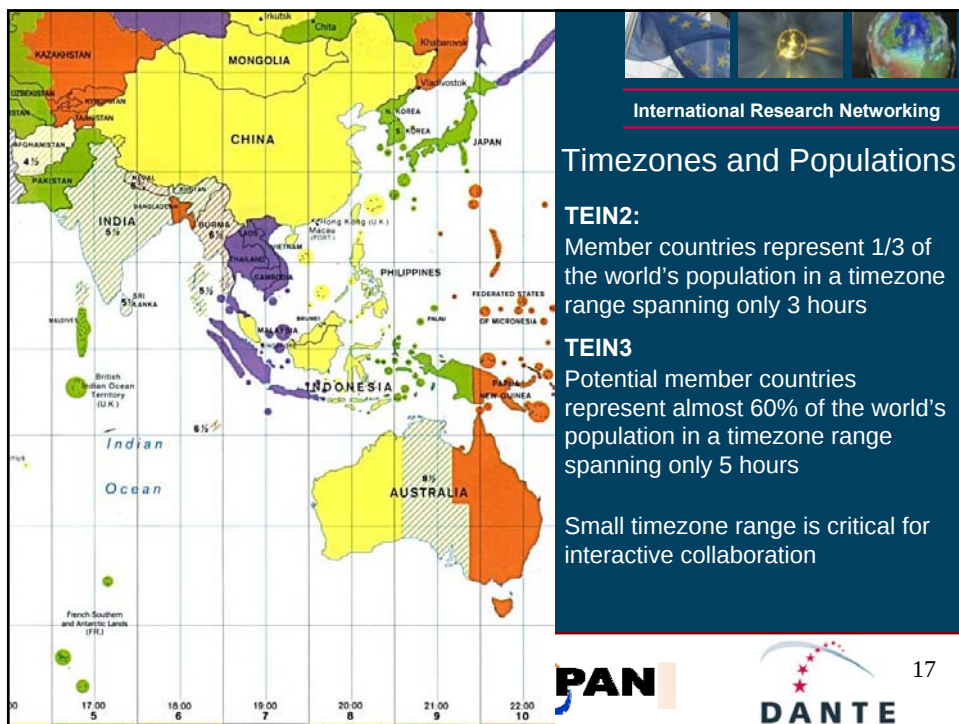


Next Phase – TEIN3



International Research Networking

- TEIN2 launched in June 2006
- Around 30million users and 4,000 institutions in 11 countries/economies now connect to TEIN2 via their NRENs
- European Commission has approved funding for follow-on (TEIN3) program to end 2011
- Intention to extend to South Asia (subject to feasibility study) – potential new partner countries are Afghanistan, Bangladesh [7], Bhutan, India [2], Nepal, Pakistan [6], Sri Lanka
- Further support for application development
- Transfer TEIN3 programme to Asian ownership
- Plan for 'TEIN4'



Formed by melting of glaciers

Large Lake, narrow outlet

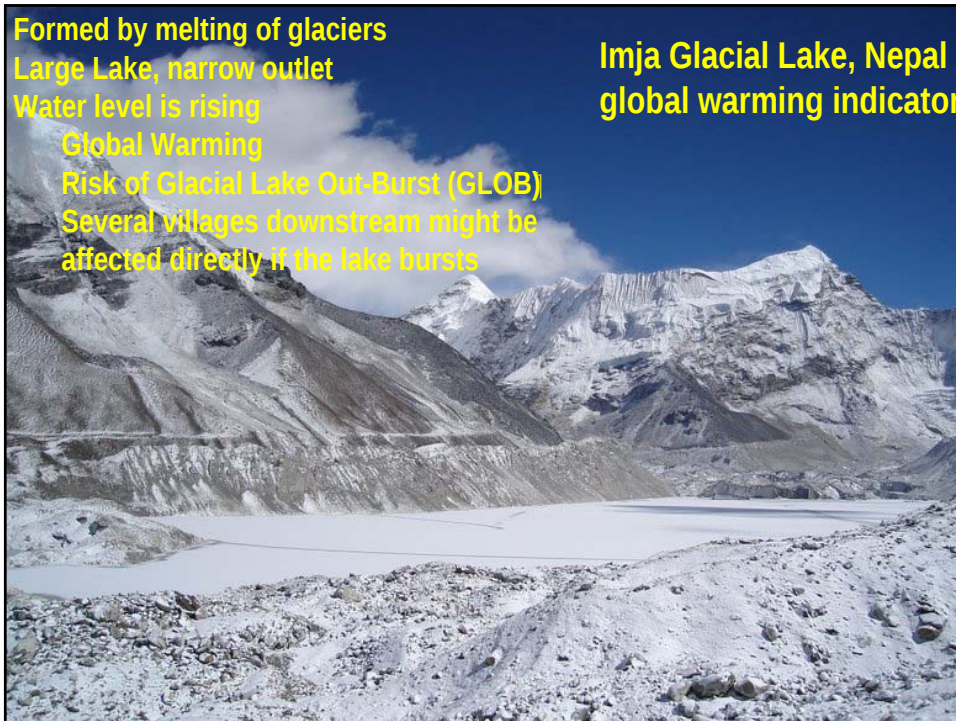
Water level is rising

Global Warming

Risk of Glacial Lake Out-Burst (GLOB)

Several villages downstream might be affected directly if the lake bursts

Imja Glacial Lake, Nepal
global warming indicator



Good Networks aren't enough

– “necessary but not sufficient”



International Research Networking

- Well supported networks **without compelling applications** that provide new/enhanced opportunities for research, innovation, education and societal benefit are of doubtful value
- Need an **enthusiastic user base** and **champions** that have the **tools and capabilities** to **exploit** the opportunities presented
- Need a **framework** that ensures that applications benefit researchers, educators and society in a powerful, reliable and easy-to-use way
- The underlying complexities of the routing/switching infrastructure and collaboration tools should be **transparent** to the end users

EuropeAid funding for TEIN2 Research vs Societal Benefit



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International Research Networking

- Good networking can vastly improve societal benefit using innovative approaches
- Improvement to peoples lives often a key element for funding support
- When combined with a research agenda eg
 - earthquake modeling/prediction
 - climate change research
 - remote immersive diagnostic systems for patient assessment
 - bioinformatics research to improve response and mitigation of emerging infections
 a compelling case may result
- Drivers depend on the needs of the country concerned and the ability to support the initiatives



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Teleconsultation/Telementoring - Paediatrics



International Research Networking

- TEIN2 has significantly enhanced the collaboration between the National Hospital for Paediatrics (NHP) in Hanoi and the Royal Childrens Hospital (RCH) in Melbourne, Australia
- This was demonstrated at the Halong Bay launch of TEIN2
- NHP and RCH now have regular videointeraction, telementoring and teleconsultation over TEIN2 to enhance joint activities



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Telehealth - Orthodontics



International Research Networking

- Dr Mike Snow, an orthodontist from Melbourne, comes to Vietnam three times each year to treat Vietnamese children with cleft lip and cleft palate deformities.
- He has developed a broadband-enabled dental assessment chair that will allow him to examine Vietnamese children while he is still in Melbourne
- Two broadband-enabled orthodontal examination chairs are now in Vietnam



Helping Children with Cleft Lip and Palate in Vietnam
GIÚP ĐỖ TRẺ EM KHE HỖ MÔI & HÀM ÉCH Ở VIỆT NAM



TEIN3

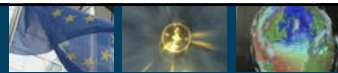


APAN

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Telesurgical training in developed countries



International Research Networking

- Play HD video clip

TEIN3



APAN

DANTE

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Earth Observation/Monitoring

International Research Networking

- Huge explosion in volume of data being collected from satellite, terrestrial and oceanographic sensors
- ALOS and WINDS satellites collect terabytes/day
- Data has to be stored in repositories, curated, accessed by different communities, analysed, visualised and used for predictions and modeling
- Increasing emphasis on (eg) climate change, disaster and natural hazard warning/monitoring systems, emerging infections and biosecurity require innovative exploitation of high capacity networks to maximise the benefit of massive amount of data coming on-stream.



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Critical Applications

International Research Networking

- (1) Crops Yield Forecasting; Rice, Sugar cane, Rubber, Palm, Cassava
- (2) Natural Resources Monitoring & Management; Forest and National Parks
- (3) Agricultural Land Reform, Land-use, Land-cover, Public Land
- (4) Flood Preparedness, Monitoring, Mitigation, Assessment
- (5) Water Reservoir & Dams and Irrigation
- (6) Draught Prediction and Water Management
- (7) Illicit crop monitoring
- (8) GIS development
- (9) Geo-spatial Data Sets
- (10) Image Intelligence and National Security

New applications focused on national economic value & impact



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International Research for Prevention and Mitigation of Meteorological Disasters in Southeast Asia



International Research Networking

Collaborating countries:

Japan
Indonesia
Philippines
Thailand
Cambodia
Laos
Vietnam
India
Bangladesh
Korea
Singapore
China
Malaysia

Risk of high-impact weather is increasing due to:

- economic development and urbanization
- global warming and climate change
- Probability information obtained by ensemble Numerical Weather Predictions is a critical to the development of decision support tools

Research environment is rapidly changing due to:

- growth of computer power
- improvement of internet infrastructure



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Other collaborative applications (TEIN2)



International Research Networking

- Natural Disaster systems – typhoon tracking, flood, tsunami and earthquake warning/prediction/monitoring
- Climate change, meteorology, environmental monitoring
- Link with Grid initiatives, computing and data repository sharing
- Emerging infections (bird flu, SARS)
- Bio-informatics, Agro-informatics, Astronomy, eVLBI
- E-learning
- Preservation of Digital Heritage (ADHX)

Important to prepare portfolios of applications & collaborations using the networks to illustrate the wisdom of the investment by funding agencies



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Applications Framework Contributions Summary

<http://www.tein2.net/server/show/nav.1862>



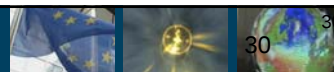
International Research Networking

- **Telemedicine** entry lists 14 activities. All TEIN2 partners involved in at least one activity, most involved in several and some involved in up to 10. Most activities involved several simultaneous partners (often 4 or 5)
- **Emerging Infections** entry lists only one activity but involves 9 partners
- **TeleTeaching** entry lists only one activity between two partners. Many more examples to add.
- **Meteorology and Climate** entry lists only one entry between two countries, though various presentations indicate there is more going on
- **Digital Heritage** entry lists 3 activities with 5 partner countries involved. There are likely to be quite a few more than this
- Many other entries yet to be added, including grid-related activities



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Critical steps for engagement



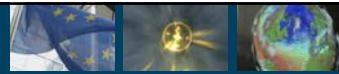
International Research Networking

- Awareness raising – what can infrastructure and advanced communications services do to enhance research and societal benefit
- Which discipline areas can most immediately benefit (exemplars)
- Identifying discipline-based champions (characteristics & skill-sets)
- Engaging facilitators (understanding of research requirements and opportunities for exploitation)
- Convincing funding agencies of the wisdom of investing in both infrastructure, applications and collaboration environments
- Getting the balance right between research, education and societal benefit
- Managing time zone differences for international real-time collaboration



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Ubuntunet and SKA

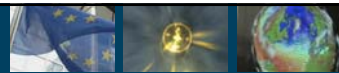


International Research Networking



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Australia's 8th Nobel Laureate



International Research Networking

- Peter Doherty was awarded the 1996 Nobel prize for Medicine
- The Beginner's Guide to Winning the Nobel Prize: A Life in Science
 - Focus on generating new information and insights and look for unexpected outcomes and results
 - Accept nothing at face value and get in the habit of thinking unconventionally
 - Work hard, work smart and with a bit of luck, serendipity will play its part.



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Sanity check

- Networks, no matter how good, don't make innovation happen
- Neither do organisations
- Nor funding agencies
- Nor committees
- It's those people with vision, with flair, who can see an opportunity to do things differently and more effectively, and who have the motivation and "fire in the belly" to make it happen



Questions?

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