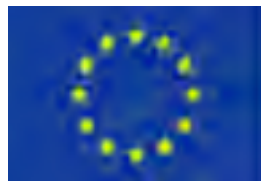


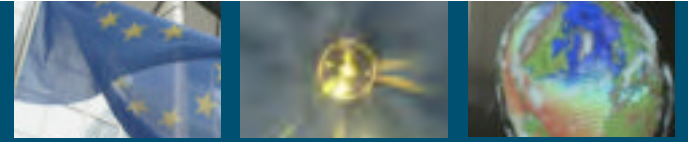
International Research Networking

TEIN2 and TEIN3 enabling emerging R&E networks

George McLaughlin, APAN Vice-Chair &
Coordinator, TEIN2 Applications & Collaboration Framework

Emerging R&E Networks SIG
21 April 2008





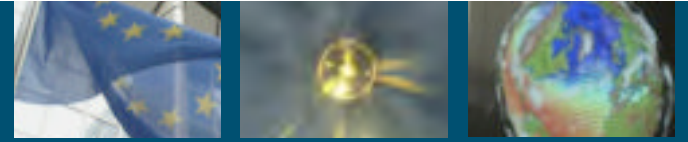
Emerging R&E networks in Asia

- Although a number of the developed countries in Asia are at the forefront of R&E networking, others are at a much earlier stage of development, and some have yet to establish an R&E network
- One of the objectives of TEIN2 is to reduce the digital divide among the ASEM countries in the region
- Two categories of Asian Partners
 - -non-Beneficiaries (Japan, Korea, Singapore & Australia)
 - -Beneficiaries (China [1], Indonesia [4], Malaysia [46], Philippines [12], Thailand [19] & Vietnam[13]) where [n] is population ranking
- Indonesia, Malaysia and Vietnam had no R&E network at start of TEIN2
- Laos (beneficiary) and Hong Kong, SAR (non-beneficiary) now joined

Asia-Pacific Backbone Topology



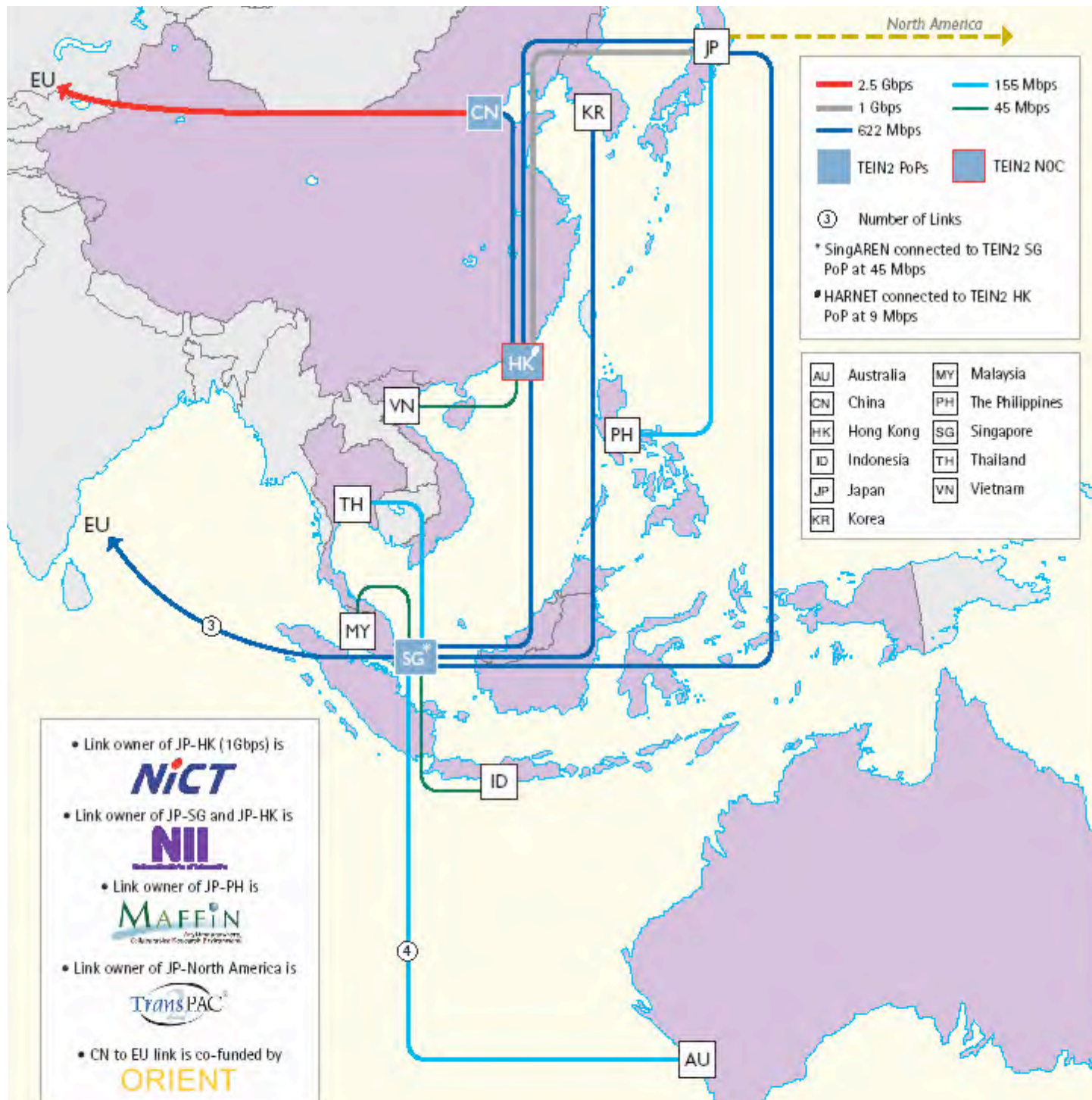
As of End of Oct. 2007



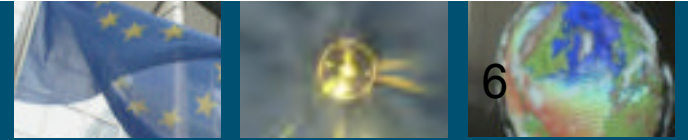
What is TEIN2?

- Intra-Asia regional network
- with Asia-Europe intercontinental links (both trans-Siberian and Indian Ocean)
- Funded by 10million Euros from European Commission + contributions from Asian partner countries
- TEIN2 programme aims to:
 - build and operate a regional network
 - promote network usage through catalysing applications
 - train technical staff in developing countries
 - reduce the digital divide

TEIN2 Topology as at January 2008

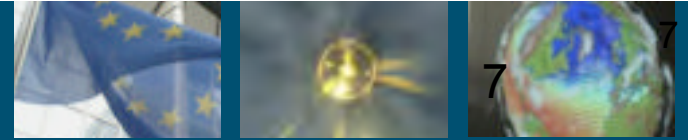


- Australia (AARNet)
- China (CERNET)
- Indonesia (ITB)
- Japan (MAFFIN, NICT, NII)
- Korea (NIA)
- Malaysia (MDC)
- Philippines (ASTI)
- Singapore (SingAREN) **5**
- Thailand (ThaiREN)
- Vietnam (VIA-REN)



The three TEIN2/NREN pillars

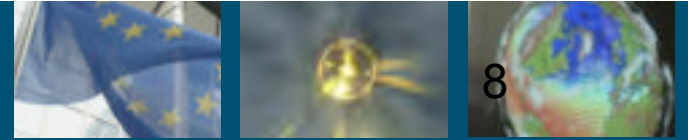
- Research, Science and Technology
 - Researchers able to participate in global collaborative teams
 - Resources/knowledge available to the global research community
- Societal benefit (including education, development and health)
 - Improving lives as a result of implementing advanced communications that support the well-being of the population
- Catalysing and stimulating the information economy
 - Providing services to transform business, society, and personal lives.
 - Implementing collaborative innovation and access to information
 - Acting as incubator for technology transfer to industry and commerce



Criteria for success of ERENs

- 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

EuropeAid funding for TEIN2 Research vs Societal Benefit



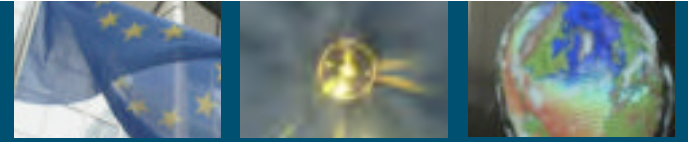
International Research Networking

- Good networking can vastly improve societal benefit
- 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 infectionsa compelling case may result
- Drivers depend on the needs of the country concerned and the ability to support the initiatives

TEIN3



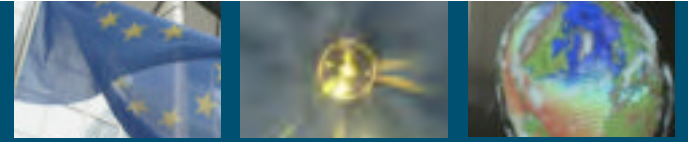
8



Societal Benefit - Paediatrics

- 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 videoconferences over TEIN2 to enhance joint activities



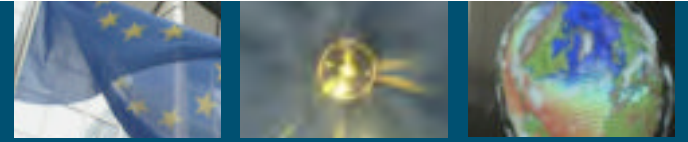


Societal Benefit - Orthodontics

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



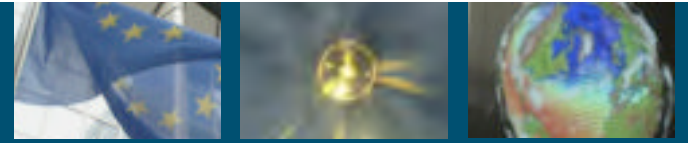


Bridging the Digital Grid Divide

International Research Networking

- Do-Son school on Advanced Computing & GRID Technologies for Research organised by VAST, Vietnam; ISGC AS Taiwan; & CNRS France
- The school trains students and young researchers from all over Asia in the state of the art for grid technology
- The students were taught how to become users of grid infrastructures and how to use tools for simulation and data analysis
- Outcomes: researchers and students trained and 5 laboratories equipped to become grid nodes in Vietnam. Three laboratories were left with machines already configured as grid services using TEIN2.

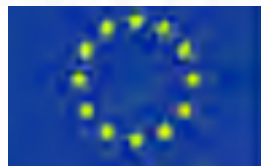
eVLBI using Trans-Siberian Path



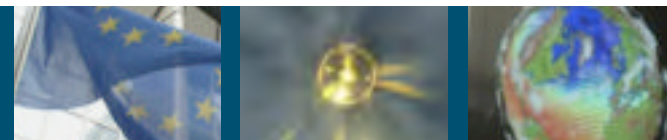
Status of the e-EVN



Network status as per 2011/08/21. Image created by Phil Brakenbury/ESO. © - Satellite image: Blue Marble Next Generation, courtesy of NASA Visible Earth (earthdata.nasa.gov)



Intercontinental Grid reduces latency via TEIN2

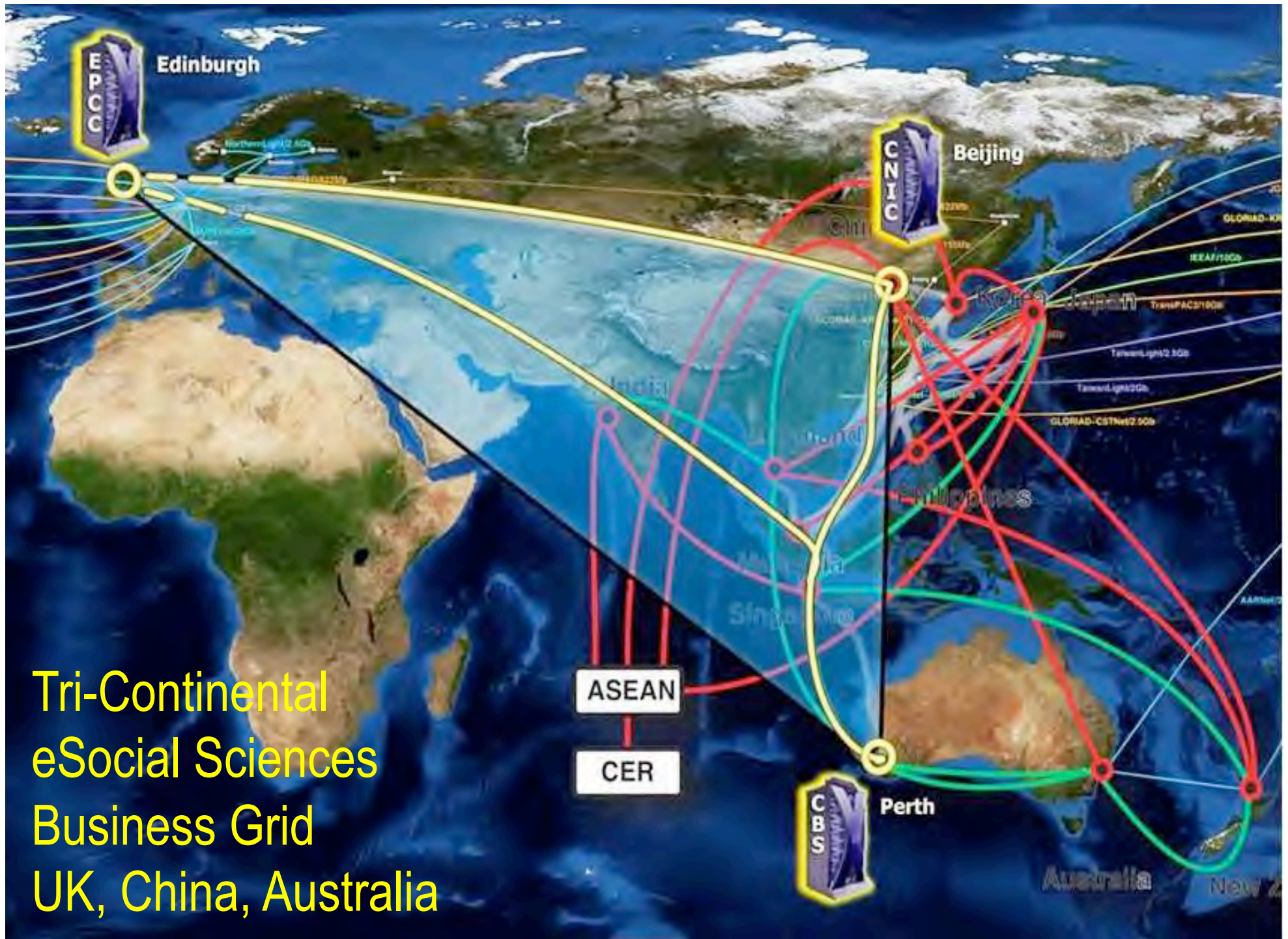


International Research Networking

- see Grid Today article - <http://www.gridtoday.com/grid/2180703.html>
- An e-social science “collaboratory” focused on understanding regional socio-economic behaviour in the context of global markets, involving the UK China and Australia (see next slide)
- Prior to TEIN2 – all exchanges between these countries went via long trans-US routes with significant latency and complex routing issues
- TEIN2 lets data transit the shortest possible network paths improving performance of distributed computing jobs and providing a route that is faster, easier to manage and potentially more secure.
- While collaboration determines the endpoints of the network, the best-performing route depends on the match between the application and the network’s characteristics

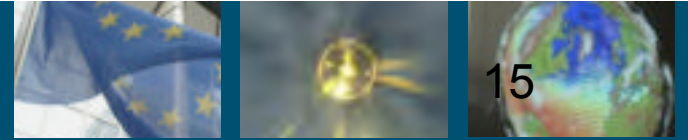
TEIN3





Tri-Continental
eSocial Sciences
Business Grid
UK, China, Australia

The power of telemedicine as an exemplar

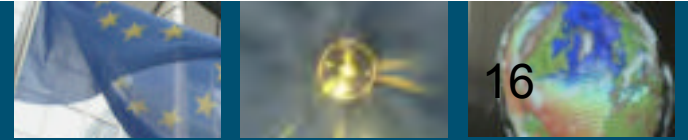


International Research Networking

- Lends itself well to exploitation of networks and technology
- eg Keyhole surgery involves a DV camera as part of the procedure – transmitting DV signals across networks allowing remote observation & questions provides a disruptive change to telesurgery training/mentoring
- Same applies for remote diagnostic immersive environments for patient consultation & assessment; nurse/medical training, case discussions, etc
- Access to specialists, and delivery of complex procedures over vast distances
- The collaboration tools can be redeployed for tele-immersive collaboration in other disciplines



Telemedicine APAN Manila, January 2007



International Research Networking

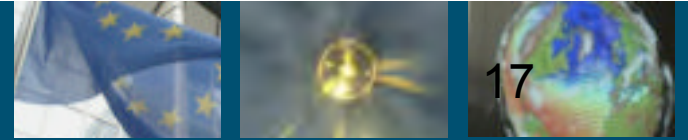
During the APAN meeting in Manila, January 2007, demo'd live telemedicine (including live surgery) between all TEIN2 partners plus India and the US. Involved 12 countries and ~100 people

- DVTS and I{v6 multicast now deployed across all TEIN2 member NOCs

- **Beneficiary partners**
 - Indonesia
 - Malaysia
 - Philippines
 - Thailand
 - Vietnam
 - China
- **Non-beneficiary partners**
 - Korea
 - Singapore
 - Japan
 - Australia
- **Others**
 - India
 - US



Other collaborative applications (TEIN2)



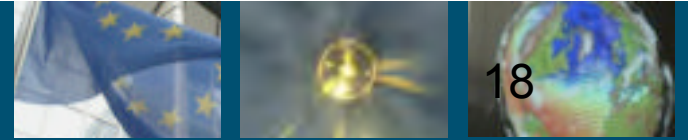
International Research Networking

- 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

Good Networks aren't enough

– *“necessary but not sufficient”*



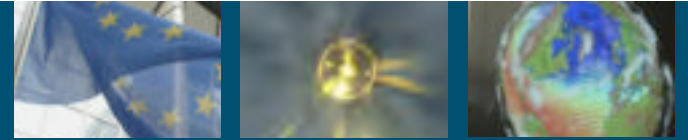
International Research Networking

- Well supported networks **without compelling applications** that provide new/enhanced opportunities for research, 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

Applications Framework

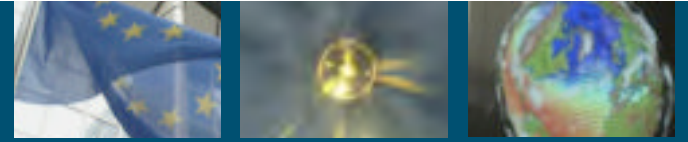
Contributions Summary <http://www.tein2.net/server/show/nav.1862>

www.tein2.net/server/show/nav.1862



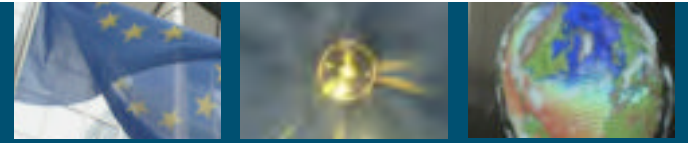
International Research Networking

- **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



Next Phase – TEIN3

- TEIN2 launched in June 2006
- Around 30million users and 4,000 institutions in 10 countries 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 (feasibility study kick-off meeting 13-14 May)
- Further support for application development
- Transfer TEIN3 programme to Asian ownership
- Plan for 'TEIN4'



International Research Networking

Timezones and Populations

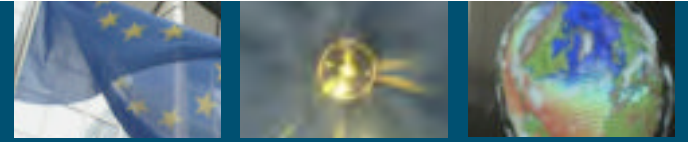
TEIN2:

Member countries represent 1/3 of the world's population in a timezone range spanning only 3 hours

TEIN3

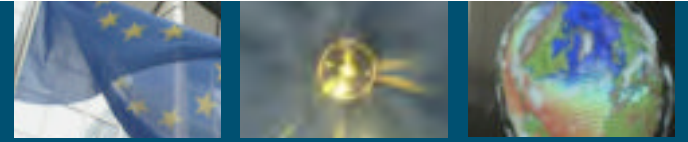
Potential member countries represent almost 60% of the world's population in a timezone range spanning only 5 hours

Small timezone range is critical for interactive collaboration



TEIN3 Network Topology

- To be determined from the tender results (not pre-defined)
- Current TEIN2 hub locations to be reviewed
- Europe-Asia links going West from Asia, likely to be 2.5 or 10Gbps
- Intra-Asia links likely to be in range 155Mbps to 10Gbps depending on partner needs, affordability by project and partner, and topology requirements (cost for some countries still currently very high)



Tender Timescales

International Research Networking

April 2008:

- Contract Notice published in EU Official Journal and on DANTE website

May 2008:

- Initial tender documentation sent to interested organisations

June – Sept 2008

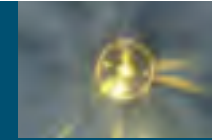
- Tender discussions and negotiations (timetable subject to tender procedure adopted)

September/October 2008

- First Contracts awarded

January 2009

- TEIN3 network starts service



In conclusion

- The TEIN2 program is demonstrably helping the emergence of new NRENS and the development of established NRENS in the less developed countries
- The Asian partner countries of the TEIN2 program include 5 of the top 13 most populous countries in the world
- If India, Pakistan and Bangladesh participate in TEIN3, this swells to 8 of the top 13 most populous countries
- There are critical success factors other than good networking needed for success
- Combining the efforts of the various parties that can help will give a greatly enhanced outcome



Questions?

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www.apan.net