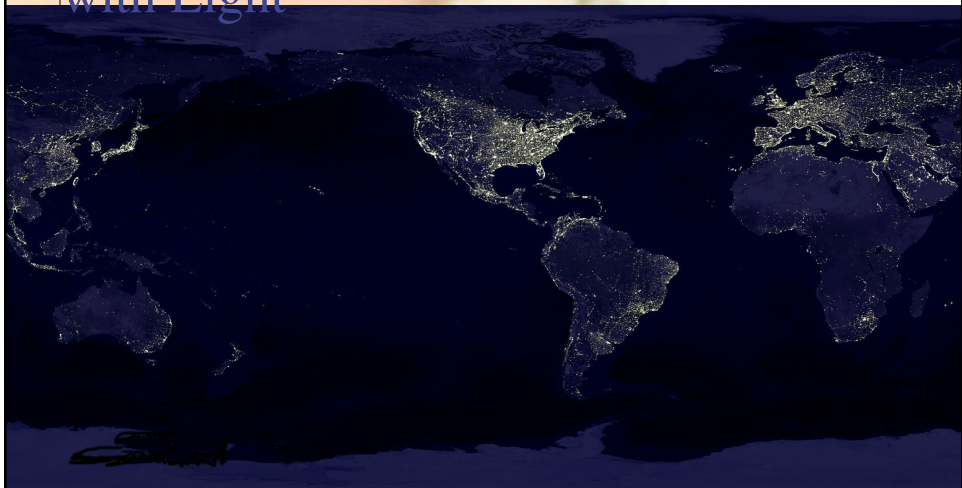


QUESTnet 2005: Linking the World with Light



1

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Andrew Howard
George McLaughlin
Mark Prior

1

Andrew Howard
George McLaughlin
Mark Prior

[illegible]

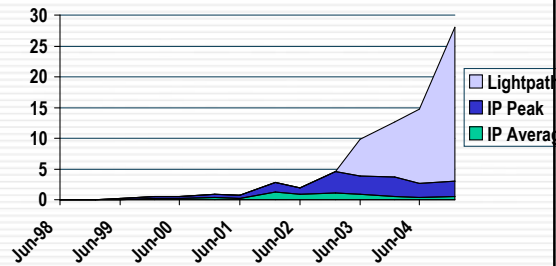
2

Why?

Lightpaths for Massive data transfers

- From CANARIE

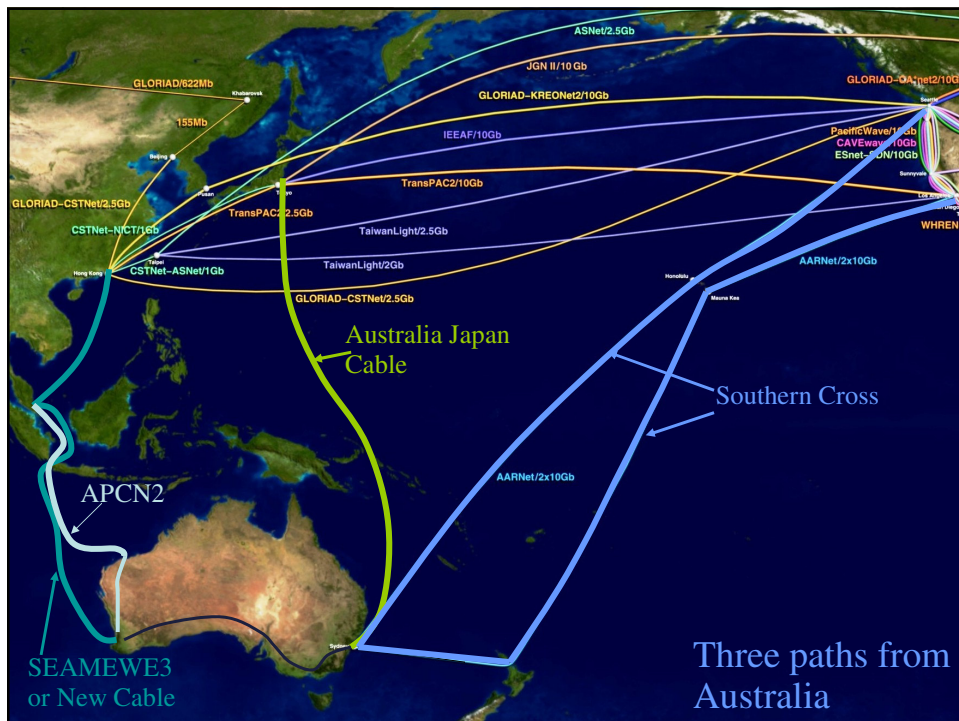
A small number of users with large data transfer needs can use more bandwidth than all other users



Mark to cover later

3

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Trans Eurasian Information Network (TEIN2)

An initiative of the European Commission with the objective of improving connectivity in certain developing countries of the Asia Pacific region



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Partners

Beneficiaries:

China (CERNET)
Indonesia (ITB)
Malaysia (MDC)
Philippines (ASTI)
Thailand (ThaiREN)
Vietnam (MOST)

Non-beneficiaries:

Korea (KISDI)
Singapore (SingAREN)
Australia (AARNet)
France (RENATER)
Netherlands (SURFnet)
UK (UKERNA)

TransLight Pacific Wave

An initiative of the US National Science Foundation's International Research Network Connections Program



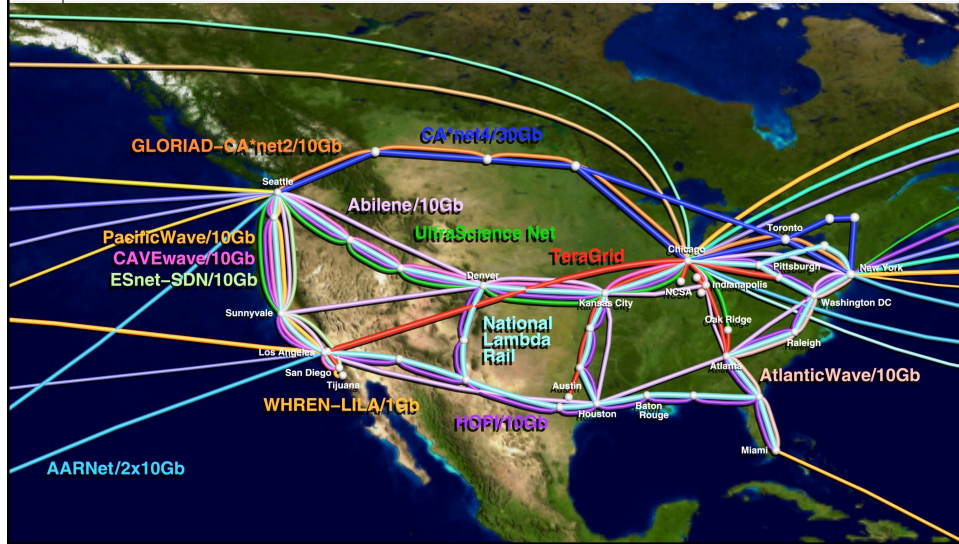
6

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- Partners: AARNet, CENIC, Pacific Wave, University of Hawaii
- Distributed International Peering Exchange along US West Coast
- Hybrid Optical Packet Infrastructure
- Seed Global Astronomy Initiative based around the international telescopes at Mauna Kea, Hawaii
- GLIF infrastructure between US, Hawaii and Australia

AARNet, Pacific Wave, NLR,

.....



User Controlled Light Paths

- Techno speak for end user created dedicated Gigabit Ethernets
- Could be across the campus or across the world
- Various organisations working on creating the point and shoot interface

Why?

- Cees de Laat classifies network users into 3 broad groups.
 1. Lightweight users, browsing, mailing, home use. Who need full Internet routing, one to many;
 2. Business applications, multicast, streaming, VPN's, mostly LAN. Who need VPN services and full Internet routing, several to several + uplink; and
 3. Scientific applications, distributed data processing, all sorts of grids. Who need very fat pipes, limited multiple Virtual Organizations, few to few, peer to peer.

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Type “3” Users

- How many times can you say “CERN”? :)
- Astronomers, eVLBI
- Synchrotron
- Music Master Class
- High Definition TV over IP
- Massive data transfers from experiments running 24x7

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AARNet Perspective

- Utilise the AARNet3 Optical network
- Need “excess” edge interfaces accessible to end users
- Share “excess” trunk capacity
- Seeding idea with researchers and educators
- IT staff need to consider implications
 - SECURITY!!
 - Network Design

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What would the user see?

- Ideal case is a web form
 - Source interface
 - Destination interface
 - Timing information
 - “Make it so” button
- Current version more hands on
 - Email exchanges
 - Possibly physical patching of circuits

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What is the GLIF?



- Global Lambda Infrastructure Facility
 - <http://www.glif.is>
- International virtual organization that supports persistent data-intensive scientific research and middleware development
- Provides ability to create dedicated international point to point Gigabit Ethernet circuits for “short term” experiments
- AARNet is Australia’s participant

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Huygens Space Probe

Very Long Baseline Interferometry (VLBI) is a technique where widely separated radio-telescopes observe the same region of the sky simultaneously to generate images of cosmic radio sources

- Cassini spacecraft left Earth in October 1997 to travel to Saturn
- On Christmas Day 2004, the Huygens probe separated from Cassini
- Started its descent through the dense atmosphere of Titan on 14 Jan 2005
- Using this technique 17 telescopes in Australia, China, Japan and the US were able to accurately position the probe to within a kilometre (Titan is ~1.5 billion kilometres from Earth)

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AARNet - CSIRO ATNF contribution

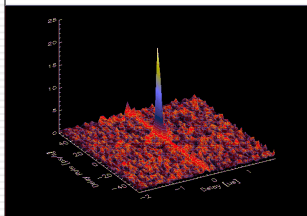


- Created “dedicated” circuit
- The data from two of the Australian telescopes (Parkes [The Dish] & Mopra) was transferred via light plane to CSIRO Marsfield (Sydney)
- CeNTIE based fibre from CSIRO Marsfield to AARNet3 GigaPOP
- SXTransPORT 10G to Seattle
- “Lightpath” to Joint Institute for VLBI in Europe (JIVE) across CA*net4 and SURFnet optical infrastructure

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AARNet - CSIRO ATNF contribution

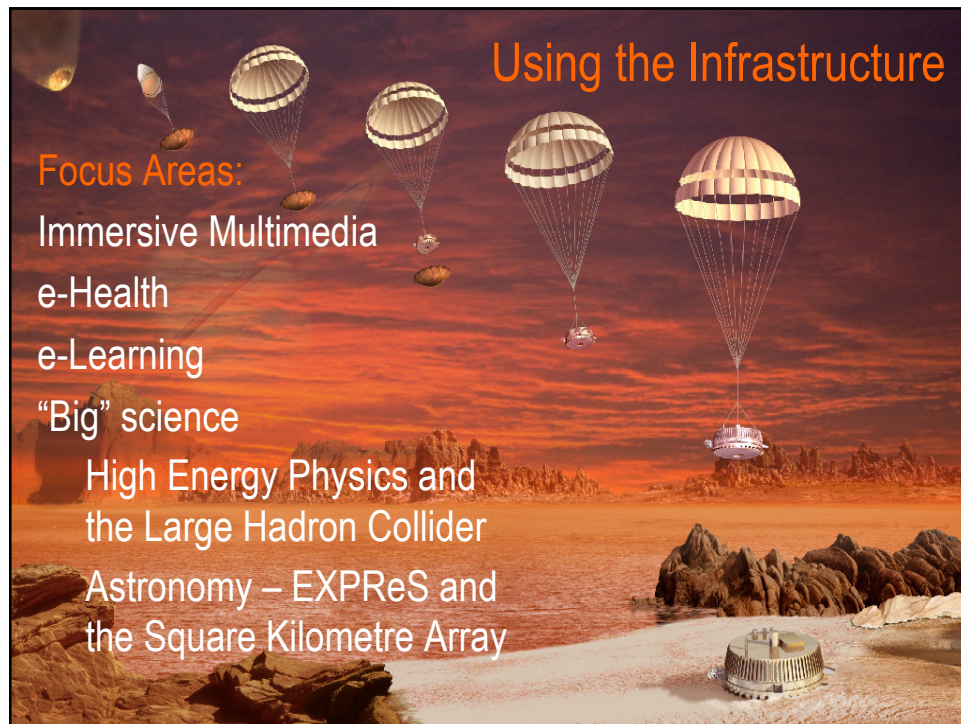


VLBI Fringes

- The data was transferred at an average rate of 400Mbps
- 1Gbps path was available, TCP stack tuning important
- The data from these two telescopes were reformatted and correlated within hours of the end of the landing
- This early correlation allowed calibration of the data processor at JIVE, ready for the data from other telescopes to be added

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ResearchChannel Global	
Delivering Australian Research and Education content to the nation and the world 	• Consortium of International Research and Education organisations collaborating on Standard and High Definition Immersive Multimedia capture, storage and delivery – AARNet (Australia) – ANF (Korea) – I2Cat (Spain) – Surfnet (Netherlands) – LARC (Brazil) – Wide (Japan) – ResearchChannel (USA)
18	Copyright AARNet 2005

ResearchChannel Activities

- Capture
- Stream
- Edit
- Store
- Supercomputing 2004
 - Uncompressed HD video Canberra, Seattle, Pittsburgh
- APAN – Bangkok Thailand
 - Access Grid HDV
- Nordunet – Svalbard Spitburgen
 - European streaming and repository technology
- National Association of Broadcasters 2005 – Las Vegas USA
 - Exhibition of Audio, Video and Broadcast equipment



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ResearchChannel Activities

- Capture
- Stream
- Edit
- Store
- University of Washington – Seattle USA
 - DigitalWell
 - Next version of HD video systems using HDV
- Internet2 Members Meeting – Washington DC
 - Dual technology development streams
 - USA
 - Europe/Asia Pacific



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APEC Emerging Infections Network

Build a network of people able to facilitate and support medical personnel during disease outbreaks



- Initiative of University of Washington to build contacts, technology and experience to respond to global pandemic disease outbreaks within the APEC community
- SARS and Avian Influenza
- Tabletop exercises
- Facilitate and Develop Human networks and Infrastructure capabilities

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e-learning



Image taken remotely by a Canadian student using the Charles Sturt remote telescope "the Eye"

- Repositories of learning objects
- Videoconferencing nationally and internationally (Joint project with UK)
- Promotion of science in schools through participative virtual environments and remote control of instruments (Faulkes Telescope and "the Eye")

22

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Large Hadron Collider

The worlds largest data generating source – Terabytes/sec

28km circumference underground tunnel – particle collisions expected to find new sub-atomic matter

- Working with Geoff Taylor's High Energy Physics Group – UniMelb
- Australia will be a Tier2 Site



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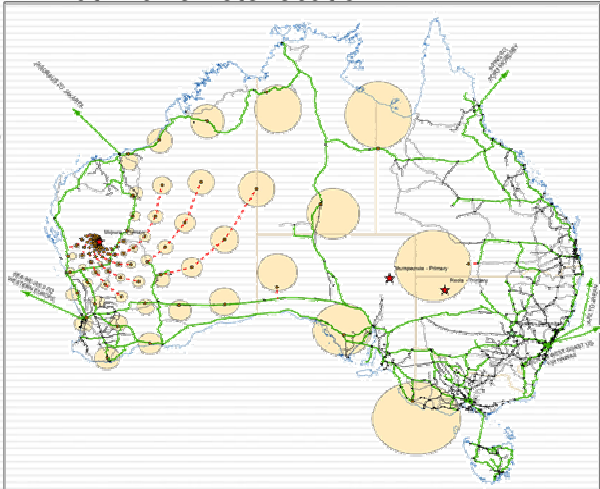
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EXPRoS and Square Kilometre Array

Australia one of countries bidding for SKA – significant infrastructure challenges

AARNet and CSIRO ATNF partners in Eu Commision funded EXPRoS project to link 16 radio telescopes around the world at gigabit speeds

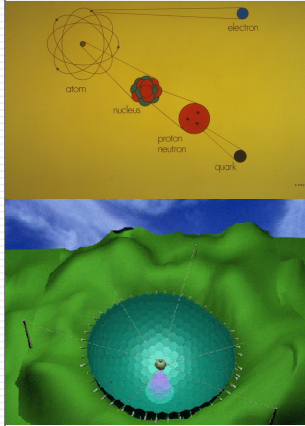
- SKA bigger data generator than LHC
- But in a remote location



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In Conclusion



- AARNet (on behalf of its members) is well represented in international initiatives
- Focus is on new opportunities that the infrastructure provides
- What has been presented is no more than a brief snapshot of the sorts of activities that we're involved in (time constraints)
- Please talk with us during the conference to find out more