



AARNet: Serving the Academic and Research Community

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QuestNet
12th July 2007



Contents

- AARNet
- e-Research and AARNet
- EN4R
- Researcher Involvement
- Summary



Contents

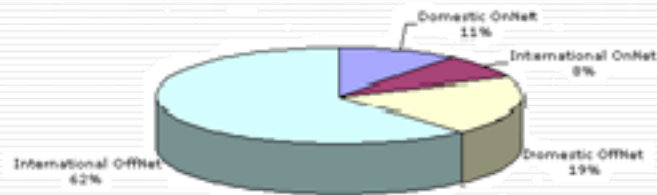
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Overview

- **Offices:** BNE, SYD, CBR, MEL, ADL, PER
- **POPs:** 24
- **Routers:** 100+ Access routers
- **Locations:** 150+
- **Built fibre:** 300Km +
- **Systems:** 200 servers (500+ disks)
- **Staff:** 35+

2006 Traffic Ratios



2,000,000,000,000,000 Bytes Carried!

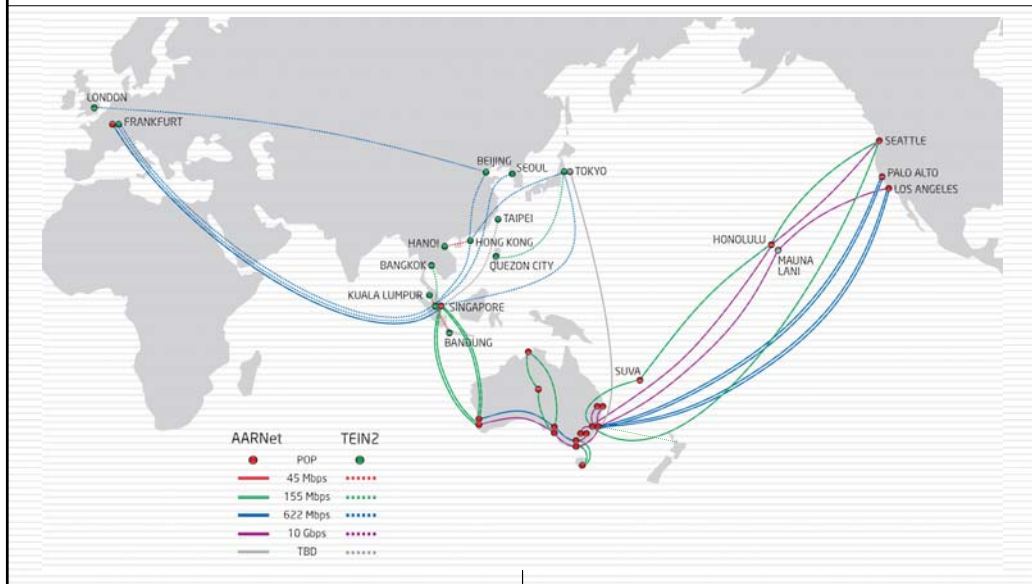
10G Backbone



Optical Network Footprint

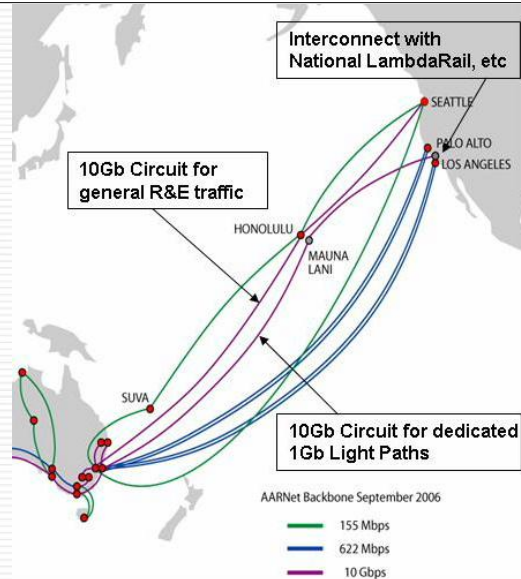


International Links



International Optical Network

- Available across Southern leg of SXTransPORT
- Up to 9x1G circuits
- Connects to Domestic optical circuits in Sydney
- Connects to US National LambdaRail in Los Angeles and thence to other light paths in Canada, UK, Europe
- 2x1G reserved for EN4R activities



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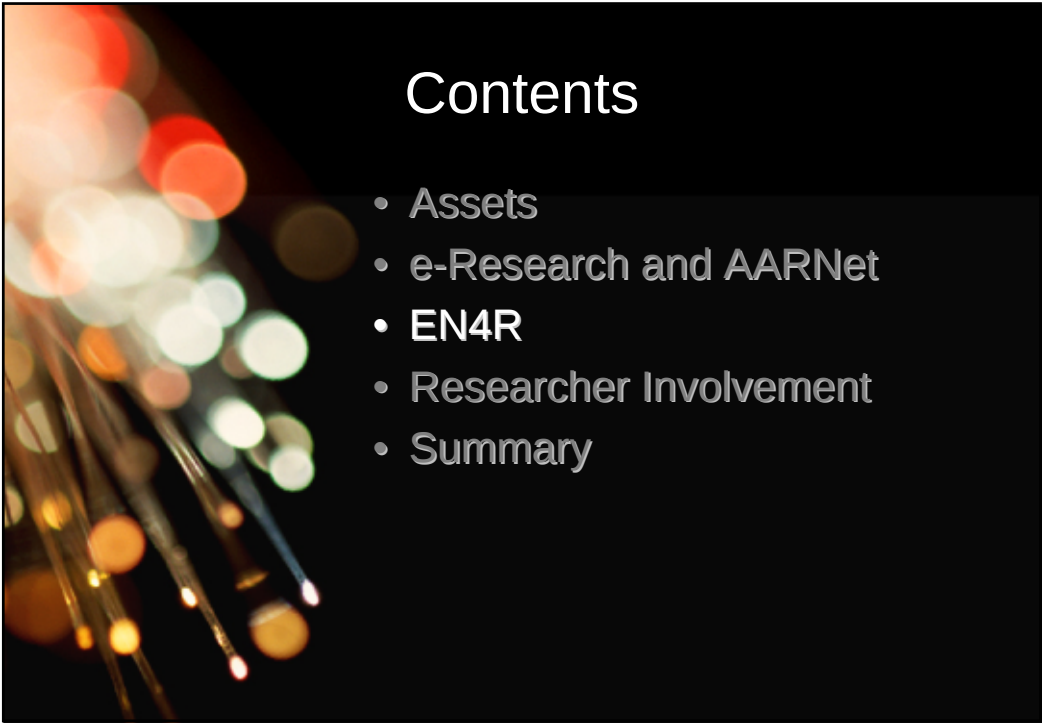
Liaison with Researchers

- **Contacts**
 - via IT Directors, Researchers, Conferences, NCRIS
- **Consultation**
 - Understand requirements
 - Identify impediments to further research use, eg:
 - Campus issues
 - Charging regime
 - Awareness
- **Results**
 - Identify special network needs
 - Tune service offerings to better fit those needs
- **Promote**



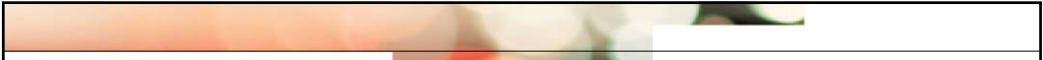
Rationale

- **AARNet is a national asset**
 - Research use is the raison d'être of AARNet
- **Stimulate**
 - Increase collaboration
 - Facilitate research use
- **eResearch Boom**
 - Global emphasis on e-enabling
 - NCRIS



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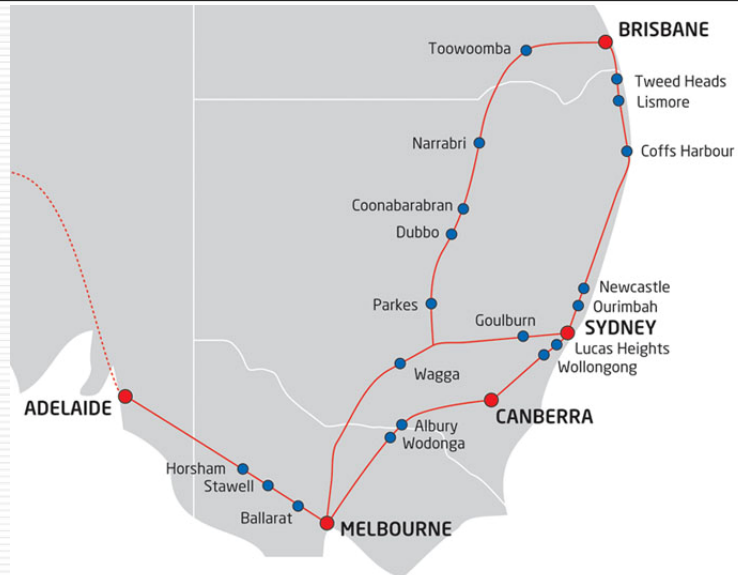
EN4R

- ***'Experimental Network for Researchers'***
 - Layer 1 – Optical Circuits
 - *'Try before you buy'*
- Point to point connections
- **Types:**
 - Short Term (UCLP / GLIF) – period of less than 2 months
 - Long Term – up to 12 months

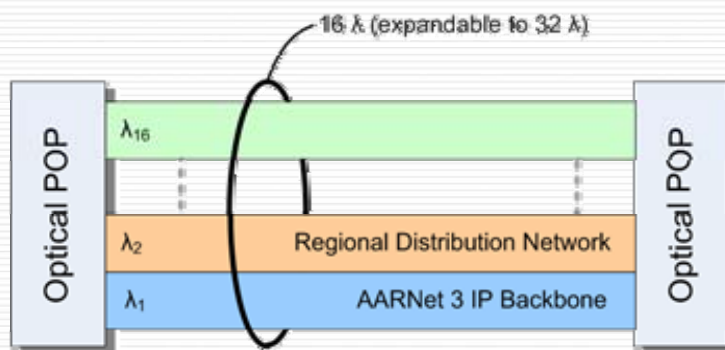
Domestic Optical Network

- 63 equipment locations
- 5,800Km of Nextgen fibre cable.
- 5 trunk paths

Optical POP ●
CEV ●

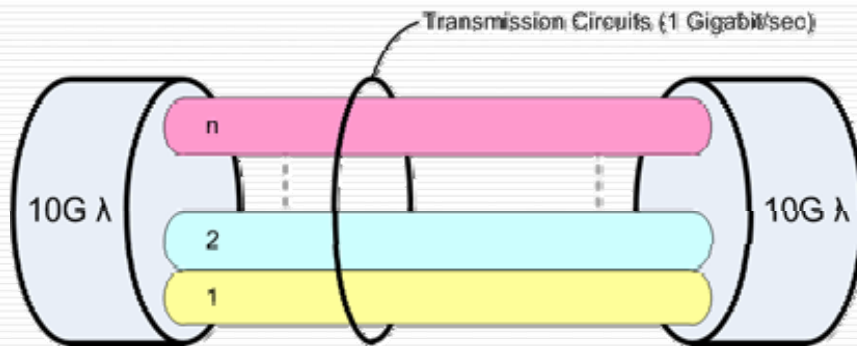


The AARNet DWDM Backbone



- Provisioned for 16 wavelengths today
- Expandable to 32 wavelengths
- 40G (STM256) compatible

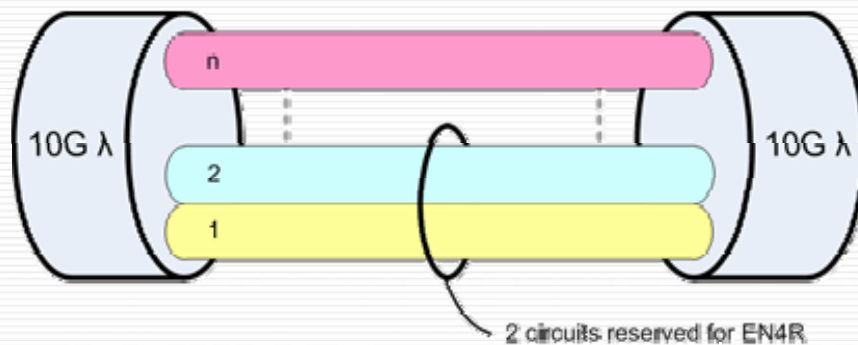
Regional Distribution Network



- One 10G (STM64) bearer can carry:
 - 9 x 1 Gigabit/sec transmission circuits using GFP-F (VC4-7v)
- Only accessible at CEVs

EN4R: Allocation

- On all regional distribution trunks 2 circuits are reserved
 - Not yet available to Queensland (pending install of 10G λ)





EN4R: Experimental Networks for Researchers

- **Purpose:**
 - Encourage researchers to 'think differently' about transferring data
- **What?**
 - Dedicated gigabit circuits between two geographically disparate locations
- **How?**
 - No cost (for up to 6 months)
- **Who?**
 - Researchers affiliated with a full AARNet connected institution



EN4R: Experimental Networks for Researchers

- **Research projects needing dedicated circuits:**
 - Bandwidth Reservation
 - Dedicated links for research traffic
 - Confidentiality
 - Lowest latency / lowest jitter
- **Project Durations:**
 - Short Term (Weeks)
 - Long Term (Months+)
 - Projects > 6 months transitioned into charging model
- **Not suitable for all projects:**
 - routed IP network goes further
 - More than 2 endpoints

EN4R: Mechanics

- Process to make circuits available
- Research Committee to Approve and Rank Proposals:
 - IT Directors
 - Research Peers
- **For Research Use**
 - traffic must conform to the AARNet AUP
 - One end must terminate in an AARNet member institution
- **Contractually:**
 - Exchange of letters
 - Cancellation without penalty
- **Any tail costs to be met by proposer**
- **AARNet may lend terminating equipment (eg GBICs, switches)**

EN4R: Program Charges

Time	Charge*	Notes
0 – 6 months	Free	▪ No cancellation fee
6 – 9 months	\$8,500	▪ No cancellation fee ▪ Quarterly payments
9 – 12 months	\$8,500	
12+ months	\$60,000 / \$34,000	▪ Transition to full service ▪ Contract requirements

** Prices are per circuit per trunk; tail charges not included*



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Working with Researchers

- ATLAS: University of Melbourne
- EXPreS: ATNF (CSIRO)

LHC: Large Hadron Collider

- **4 Experiments:**

- **ATLAS**
A Toroidal LHC ApparatuS
- **CMS**
The Compact Muon Solenoid
- **LHCb**
Large Hadron Collider beauty experiment
- **ALICE**
A Large Ion Collider Experiment at CERN LHC



The large ring is 27Km in circumference

ATLAS @ the LHC

- **Data distribution:**
 - Tier 0 – Geneva
 - Tier 1 – Taipei
 - Tier 2 – Melbourne
 - Tier 3 – Melbourne / Sydney
- **Data Rate:**
 - 300Mbit/sec 24x7
- **Users:**
 - University of Melbourne
 - Sydney University
 - Wollongong University
- **Online: 2008**



Toroid End Cap

ATLAS & Uni Melb

- **Tier 2 @ Uni Melb**
 - Currently 7 TB of data
 - Initially 28 TB of storage available
- **TCP “Goodput” issue**
 - Long path from Taipei to Melbourne (via Hawaii)



Installation of Inner Detector End-Cap

EXPreS

- **“Express Production Real-time e-VLBI Service”**
 - eVLBI: “electronic Very Long Baseline Interferometer”
 - Telescopes ‘connected together’
 - Creates a large virtual telescope
 - Each telescope transmits data back to Jive
 - Processed by a hardware correlator
 - Demonstrate Australia’s abilities (SKA)
- **ATNF: Australia Telescope National Facility**
 - Three telescopes participating
 - Narrabri
 - Parkes
 - Mopra

EXPreS

- **Data Path:**
 - Telescopes to Marsfield
 - Marsfield to AARNet
 - AARNet to Jive
- **Trial:**
 - June
 - 3 x 256Mbit/sec streams
 - Using routed network
- **Full Test:**
 - October
 - 3 x 512Mbit/sec streams
 - Using circuits



Parkes

EXPreS: Results

- **TCP**
 - “goodput” an issue
 - Bandwidth required 768 Mbit/sec and 1.5Gbit/sec
 - Must use SX Transport
 - ~ 400ms RTT
 - Stack tuning
 - Buffer sizes
 - Low level packet loss somewhere
 - Extremely difficult to locate

EXPreS: Results

- **Circuits:**

- AARNet's first foray into '*international circuits*'
- Marsfield to Amsterdam (heading east)
 - 1G in July
 - 3 x 1G in October
- NOCs involved (all very helpful!):

NOC	'A'	'B'
AARNet	Sydney	Los Angeles
CENIC	Los Angeles	Seattle
CaNARIE	Seattle	Chicago
SurfNET	Chicago	Amsterdam

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EN4R: Summary

- **The “upfront” costs of circuits can be expensive**
 - For research the ROI may be uncertain
- **This program breaks barriers by:**
 - Setting a \$0 entry point for 6 months
 - Leveraging AARNet surplus capacity to assist with tails
 - Provide loan equipment
 - Minimising contractual requirements
 - Providing technical support for Network tuning
- **Connectivity:**
 - Domestic - Domestic
 - Domestic - International

Working with Researchers

- **Researchers:**
 - Many use the network
 - Few *‘push’* the network
- **Opportunity:**
 - Engage to provide support
 - AARNet often provides better support than the host institution
 - Strive to improve
- **Challenge:**
 - Identify new *‘power’* users of the network
 - Ride the e-Research *boom*

AARNet – Your network



Questions?