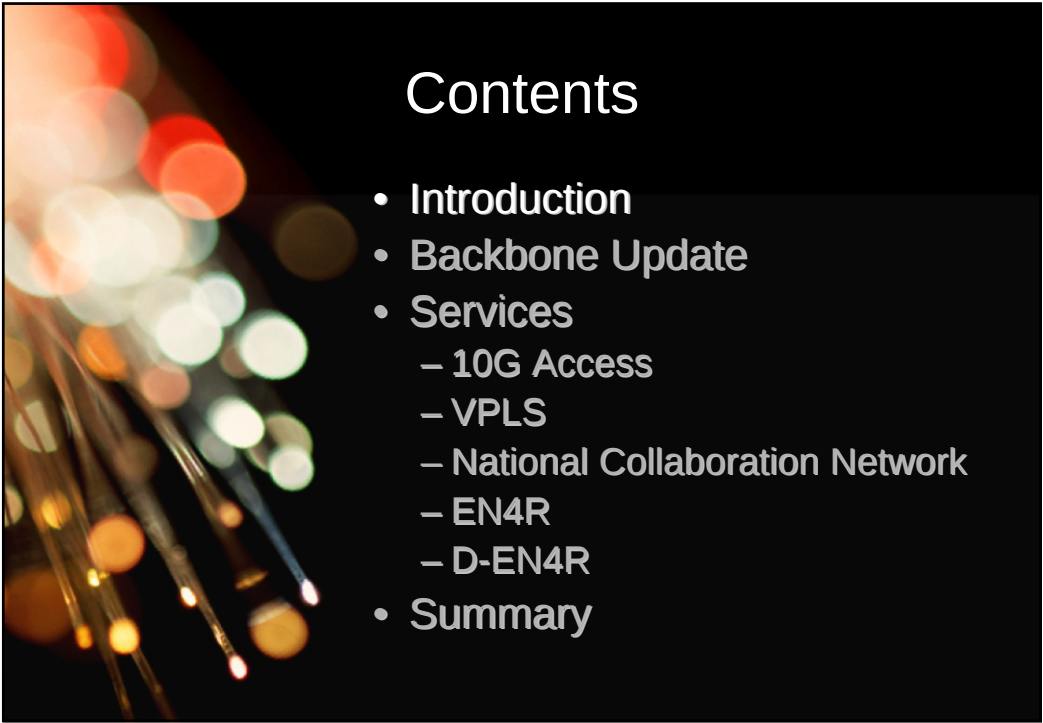




AARNet 3 Update
▪ Introduction ▪ Backbone Update ▪ Services ➤ 10G Access ➤ VPLS ➤ National Collaboration Network ➤ EN4R ➤ D-EN4R ▪ Summary



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Introduction

- AARNet 3 was designed in 2003/2004
- Since the design
 - hardware / technology has evolved
 - customer requirements have evolved
 - demand for 10G connectivity is irrefutable
- To implement 10G member connections it's necessary to subtly re-architecture the core.
 - The inner core is currently based on the Junipers routing with the Cisco 6500 handling switching.
 - The switches will be re-engineered to support routing.



Introduction

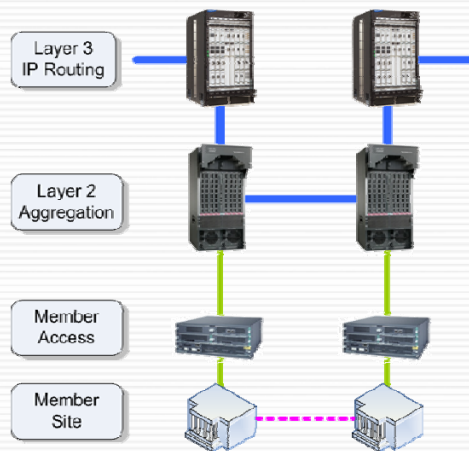
- **As part of this re-engineering the switches will also be equipped to terminate VPLS tunnels**
 - This new capability (VPLS) permits NCN and potentially D-EN4R
- **This presentation covers the architectural changes that will be undertaken in the AARNet core; and then describe the services that can be offered on this new architecture.**



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Existing Architecture



- **10G Backbone**
 - Inter capital
 - Inter POP
- **Access @ 1Gbps**
- **Dedicated connections using Optical Circuits**

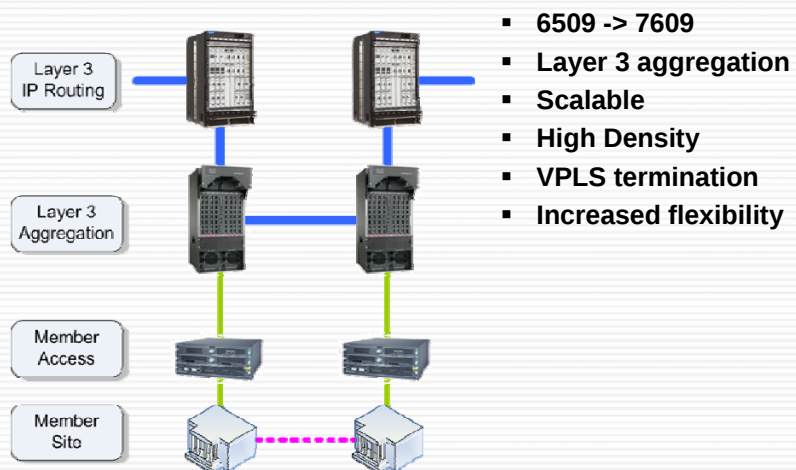
Drivers for Change

- **Customer demand for 10G IP Access Router**
- **Private connections further than Optical Footprint**
- **Traffic Engineering**
 - Splitting of On-net and Off-net
 - Provide a rate limited off-net port/VLAN
 - Provide a separate port/VLAN for on-net, *not* rate limited
 - Can compliment or replace current bundled service, depending on member needs

New Architecture

- **Overview:**
 - Increased IP aggregation density (support 10G)
 - L2 aggregation switch converted to L3 aggregation router
- **Aggregation layer changes:**
 - CatOS Switch (6509) to IOS Router (7609)
 - ES line cards to terminate VPLS
- **Results:**
 - Scalable very high density 10G IP aggregation
 - Backbone capacity will be upgraded as demand grows
 - Existing Juniper M320's remain as backbone routers

New Architecture





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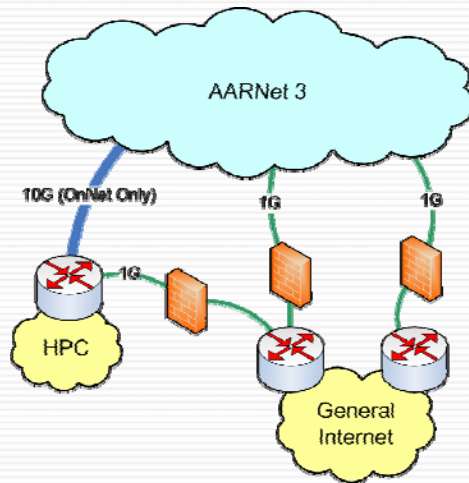
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10G Access

- **Overview:**
 - Same functional model as existing service endpoint
 - Hardware update to support 10G
- **Details:**
 - 1G CPE is a Cisco 7304 1G capable router
 - 10G CPE is a Cisco 7604 (RSP720-3CXL)
- **Service Delivery:**
 - Deployed with a 5Gbit/s rate limit (to protect the innocent)
 - Can be removed for specific requirements

10G Service Example



- HPC users require
 - Low latency
 - Low jitter
 - Open Access
- Treat HPC as “outside” your internal network
- Rate limited service

10G Service Delivery

- Rack Space & Power
 - Slightly larger than current CPE
 - Requires 15A 240V outlets, as standard install
 - Still deployed along side Edge Server
- Last mile implications
 - You will need dark fibre; or
 - WDM wavelength; or
 - 10G transmission services



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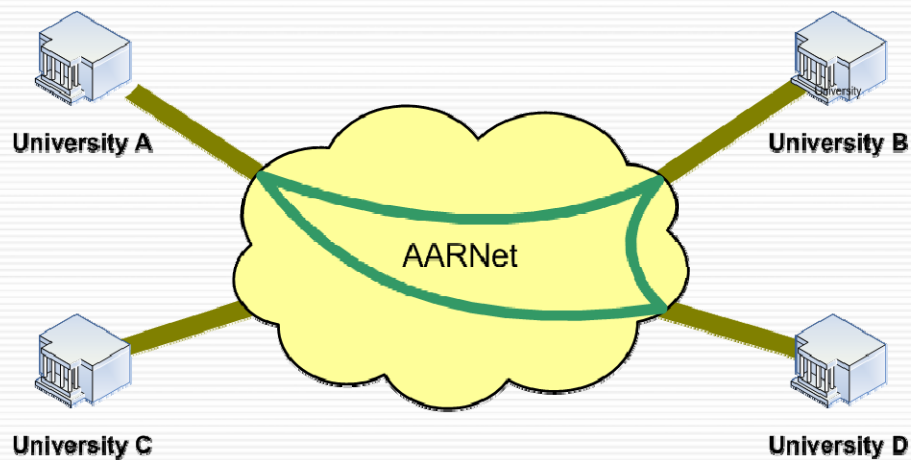
VPLS

- **Overview:**
 - Multipoint private LAN service
 - “Ethernet over MPLS”
 - Delivered as a port or VLAN on the CPE device
 - Backbone appears like a virtual Ethernet bridge
- **Details:**
 - Over provision on existing connection
 - Generous availability of VPLS resources (CAM table)
- **Service Delivery:**
 - Used to provide “National Collaboration Network”

VPLS

- **Deployment strategy**
 - Hierarchically – 802.1q trunking from the VPLS edge to the customer edge (7604)
 - Non-hierarchically – VPLS edge taken all the way to the customer edge (7304)
- **Service Level:**
 - Same class of service as regular on-net (Best effort)
 - Packets mingle with Layer 3 packets on connection to AARNet (and across the backbone)
 - No dedicated bandwidth

VPLS





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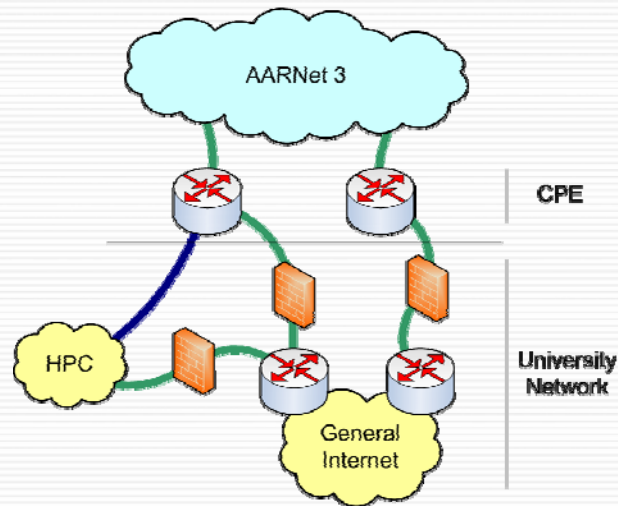
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National Collaboration Network

- **“Layer 2 VPN”**
 - Connect different institutions at Layer 2 (Ethernet Frames)
 - No dedicated / reserved bandwidth
 - Arbitrary endpoints
- **Utilises VPLS on AARNet backbone**
 - All endpoints must be directly connected to the AARNet backbone
 - Provisioned on access connection (1G or 10G).
- **National coverage**
 - All POPs

National Collaboration Network



National Collaboration Network

- **Instrumentation:**
 - Sensor networks
 - Medical instrumentation
- **Grid**
 - Super computing clusters
 - Data transfers
- **Collaboration tools**
 - Video Conferencing
 - OptiPortal
- **Generally**
 - Any application that can benefit from layer 2 adjacency



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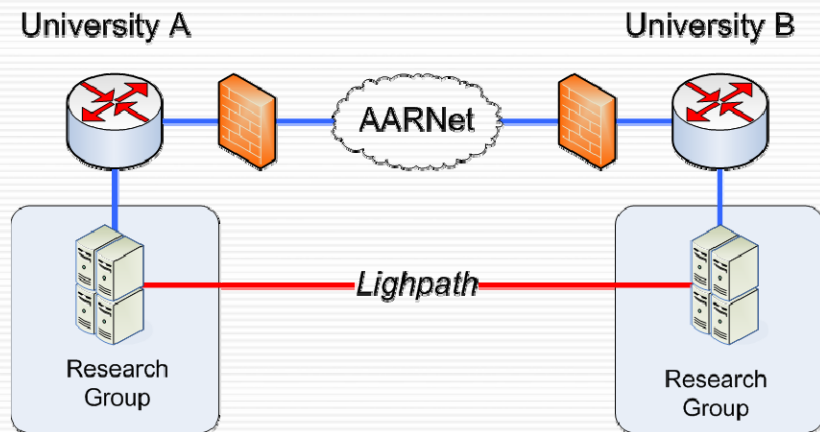
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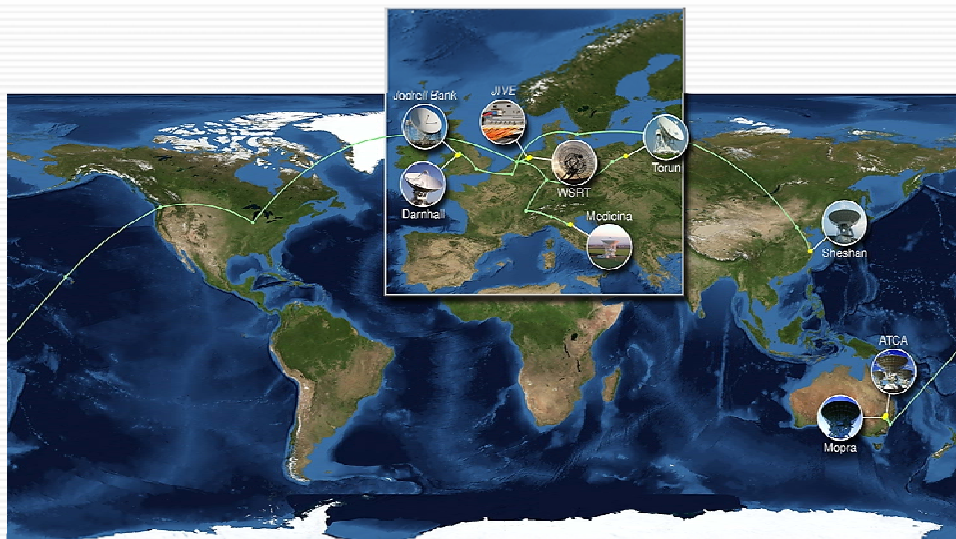
EN4R

- ***Experimental Network for Researchers'***
 - Layer 1 – Optical Circuits
 - *'Try before you buy'*
- **Details:**
 - Point to point connections
 - 1Gbps reserved bandwidth (lowest jitter, lowest latency)
 - Free for use up to 12 months
 - Must have connectivity to an Optical POP
- **Common uses:**
 - Astronomers (high bandwidth)
 - OptIPortal (high bandwidth / security)

EN4R Example



EN4R Example: APAN 24



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D-EN4R

- **Summary:**
 - EN4R – 1 Gbps circuits
 - Provisioning can take longer than the experiment duration
 - Need an 'effective solution' to less resources to support (ie: reduced provisioning time)
- **Solutions:**
 - DRAGON - Dynamic Resource Allocation in GMPLS Optical Networks
 - Internet2
 - Inter-domain support
 - UCLP – User controlled light paths
 - CANARIE



D-EN4R Architecture

The diagram illustrates the D-EN4R Architecture, showing the connection between AARNet's DNC to Internet2 and the internal network structure.

AARNet: DNC to Internet2

The diagram shows a central 3750 switch connected to various components:

- Left Side:** AARNet (NAB, VLSR) and a 3750 switch.
- Top Connections:**
 - 1x 1G to E
 - 1x 1G to GBR (SFO-GBR)
 - 2x 1G to IRL (SYD-IRL)
 - 2x 1G to ENR (SYD-ENR)
 - 2x 1G to BRB (SYD-BRB)
- Right Side:**
 - GBIC LX, 15454 SDH
 - GBIC LX, 15454 SONET
 - Core Director
 - Internet 2 (LA)

Internal Network Structure:

The internal network is a mesh topology connecting five sites: Brisbane, Sydney, Canberra, Melbourne, and Adelaide. Each site contains a 3750 switch and a VLSR. The connections are as follows:

- Brisbane:** 3750 switch connected to Sydney (4x 1G).
- Sydney:** 3750 switch connected to Brisbane (4x 1G), Canberra (2x 1G), Melbourne (2x 1G), and Internet 2 (SFO-IRL).
- Canberra:** VLSR connected to Sydney (2x 1G).
- Melbourne:** 3750 switch connected to Sydney (2x 1G) and Adelaide (2x 1G).
- Adelaide:** 3750 switch connected to Melbourne (2x 1G).

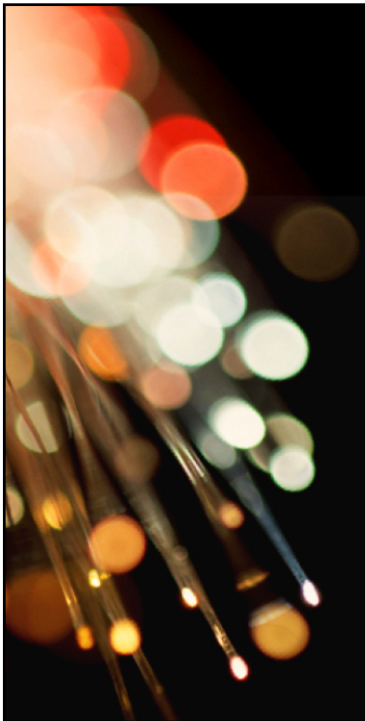
Legend:

- Optical Backbone
- Tail to Customer
- 1 to n-1 Utilizing
- Simple Mode Patch Lead
- Optical Patch Lead

Infrastructure Development Setup:

Document: DCH Architecture
 Author: Gregg Williams
 Date: 25-Jan-2002
 Version: 2.0

aarnet



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Summary

- 10G Access available now
- Backbone upgrades scheduled to be completed Q408
 - Permit VPLS
- National Collaboration Network (follows upgrades)
- EN4R available now
- D-EN4R is being evaluated

AARNet Network Roadmap

	Today AARNet 3	1-3 Years AARNet 3.5	4-6 Years AARNet 4
Research & Collaboration Tools	EN4R LightPaths	D-EN4R NCN	LambdaPaths
Customer Access CPE	1G Access	10G Access	40G Access
Network Services	P2P 1G Ethernet	L3 VPN VPLS	G.MPLS
IP Backbone	10G	40G	100G
DWDM Backbone	Near National 40 x 10G	National 80 x 40G	National 80 x 100G

AARNet – Your network



Questions?