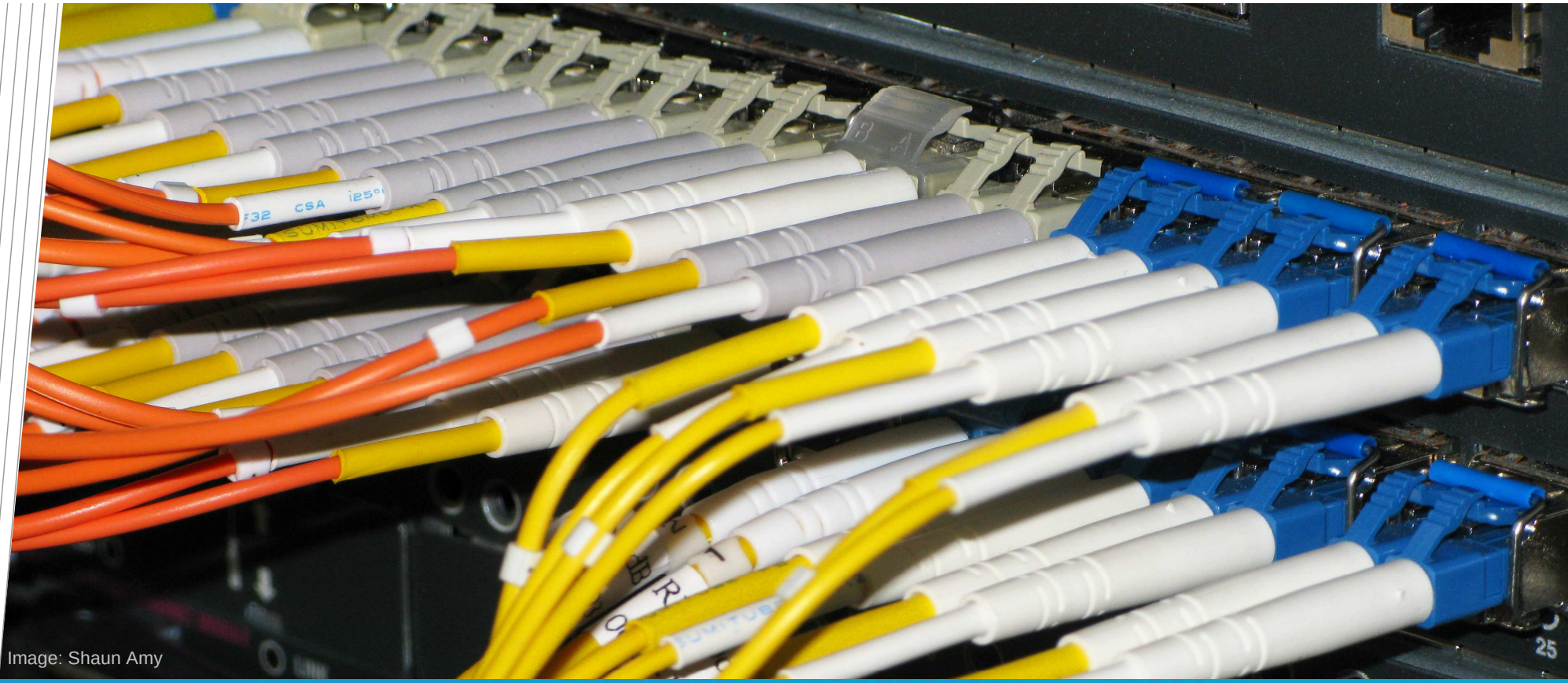


Image: Shaun Amy

www.csiro.au

An ASKAP Networking Update

WP2 Oxford Oct 2010

Ron Beresford & Shaun Amy

CSIRO Astronomy and Space Science

28 October 2010

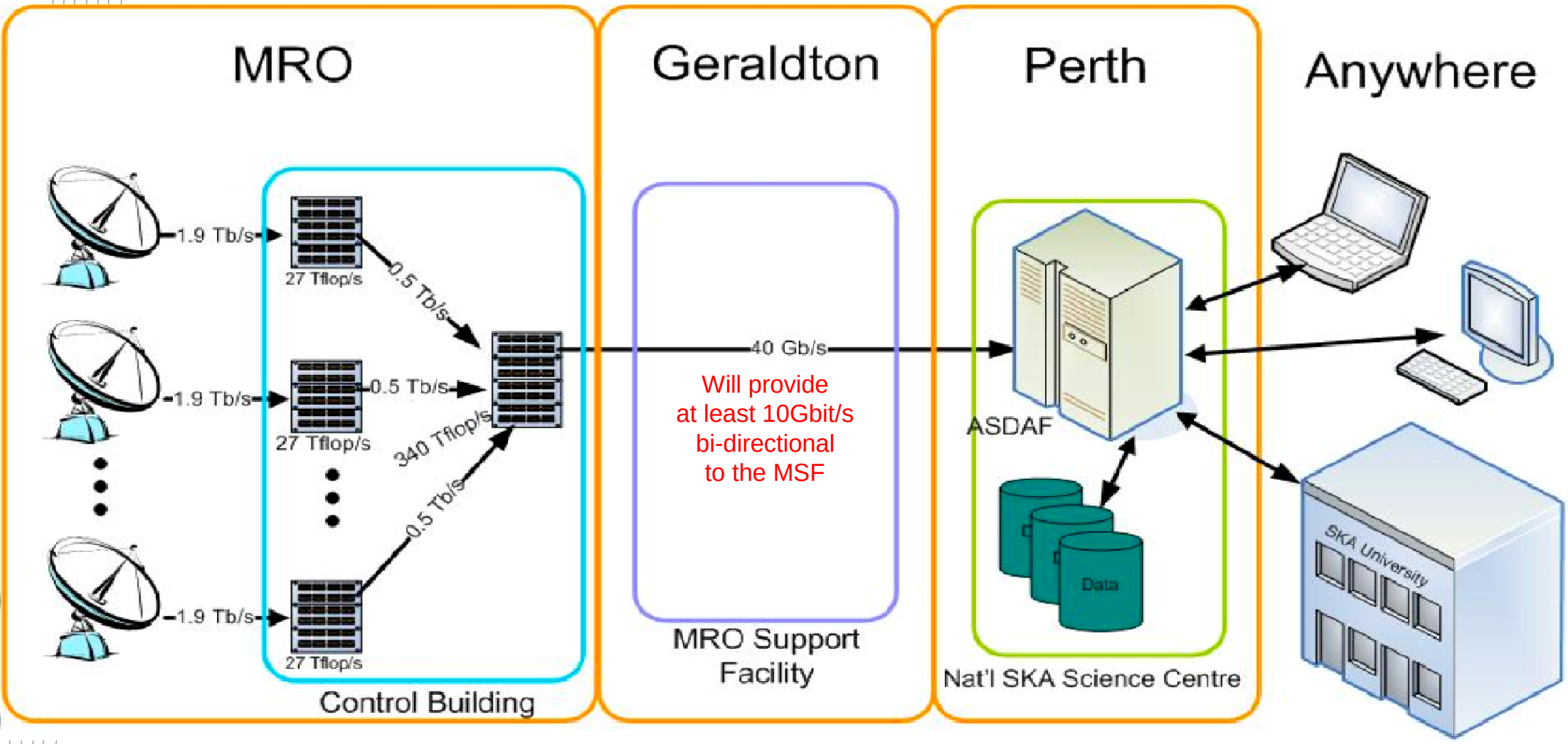
CSIRO

ASKAP Today (Antennas and Integration Path)

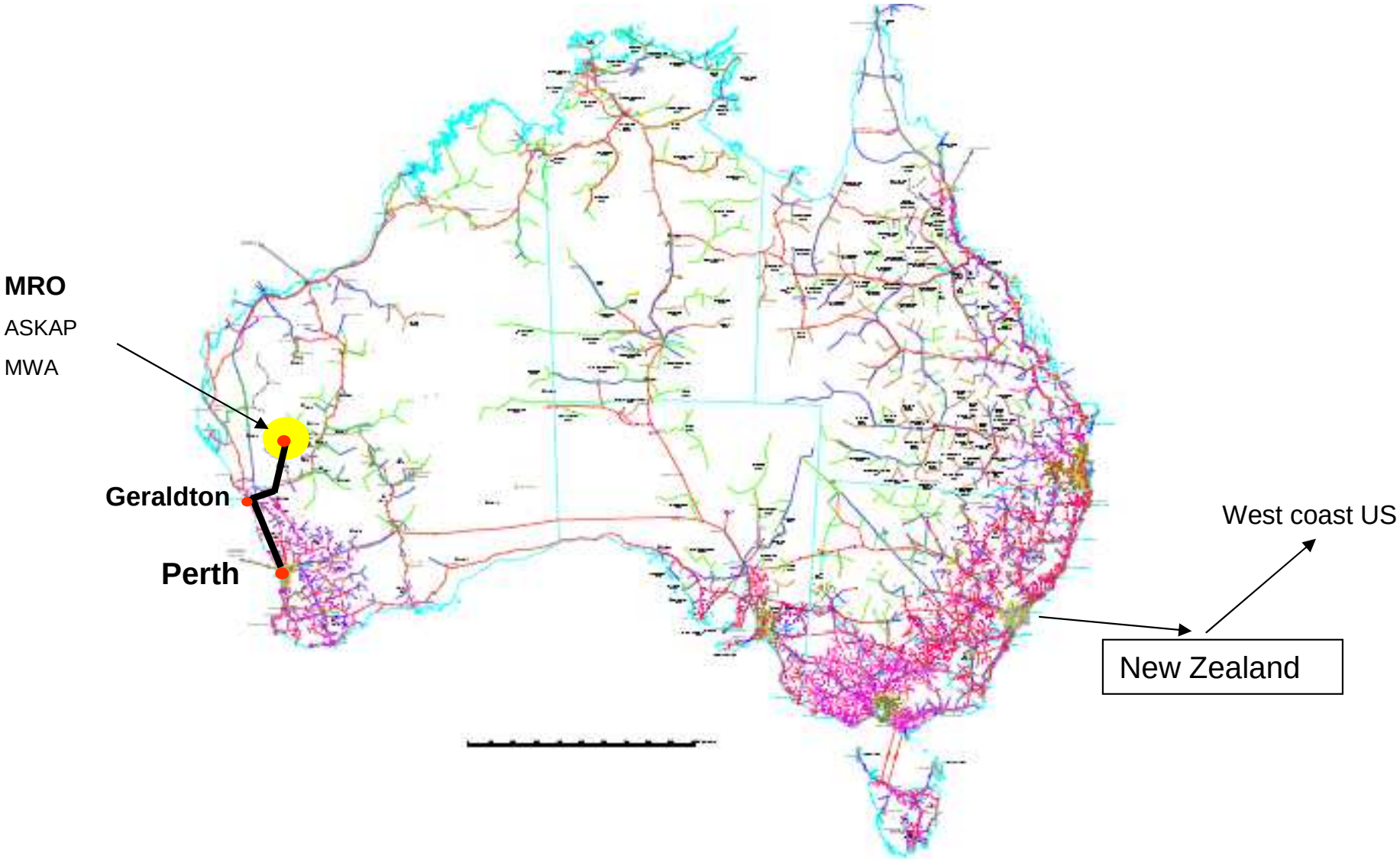
- Currently one completed antenna with five more nearing completion:
  - these six antennas form the Boolardy Engineering Test Array or BETA.
- Construction of all 36 antennas will be completed by the end of 2011.

- MATES: The Marsfield ASKAP Test and Engineering System
  - Build up systems at Marsfield to test prior to installation at the observatory:
  - 1 Build testbed network in Sydney
  - 2 Build a similar network at Parkes 12m to use with 64m
  - 3 Develop a network in Sydney for ASKAP BETA(6)
  - 4 Develop Architecture for full ASKAP(36)

ASKAP System and Data Flow



Longhaul Fibre



Associations

Design Specification and $$$

Carrier License

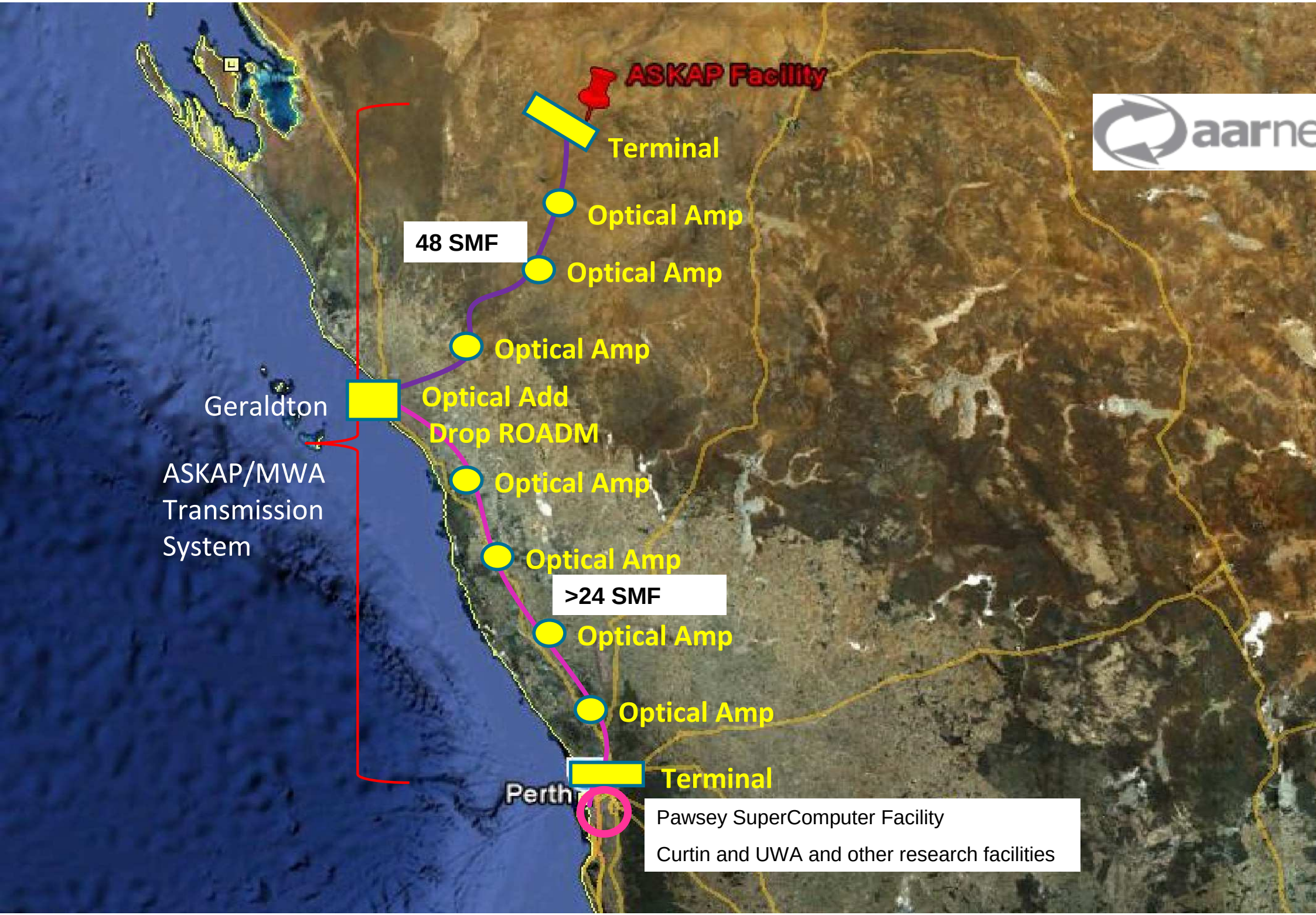
CIVIL WORKS

CCTS	MRO- Geraldton 390km section	***Commenced Oct2010***
Nextgen	Geraldton – Perth 450km section	***Commenced May2010***
	National Broadband and SKA	

200km South of MRO last week

RBBS Start of Construction – May 2010

Image: Shaun Amy


ASKAP Facility
Terminal
Optical Amp
48 SMF
Optical Amp
Optical Amp
Geraldton
Optical Add
Drop ROADM
ASKAP/MWA
Transmission
System
Optical Amp
Optical Amp
>24 SMF
Optical Amp
Optical Amp
Terminal
Perth
Pawsey SuperComputer Facility
Curtin and UWA and other research facilities
aarne

CSIRO CEV: Mullewa

Image: Shaun Amy

ASKAP Datarate

▪No Antennae	36
▪No Baselines N(N-1)/2	630
▪No Beams (max)	36
▪Effective Baselines	22680
▪4 Stokes 32+32i	5.806e6
▪16384ch	9.513e10

95GigaBits per INT cycle.

Typical Cycle is 5 secs ~ 19Gbps

For BETA6

2.3GigaBits per INT cycle

For 5 sec ~ 460Mbps

Terminal Equipment LH

- DWDM 80ch per fibre.
- The future is DPQPSK Coherent Detection 1550nm band
- 100Gbps per channel
- Already cheaper than conventional 10x10G
- Feature EDC
- 1310nm 10Gbps client side demux
- Amazing distances on legacy fibre (4000km +) FEC G709
- Fibre of choice G652 ULL 0.17dB/km ASKAP
- Research underway for 500G+ per ch systems

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Doing ASKAP and being SKA Ready

- Given 100Gbps/ λ DWDM
- 10Tbps / Fiber core
- 48 SMF Cable capacity 480Tbps

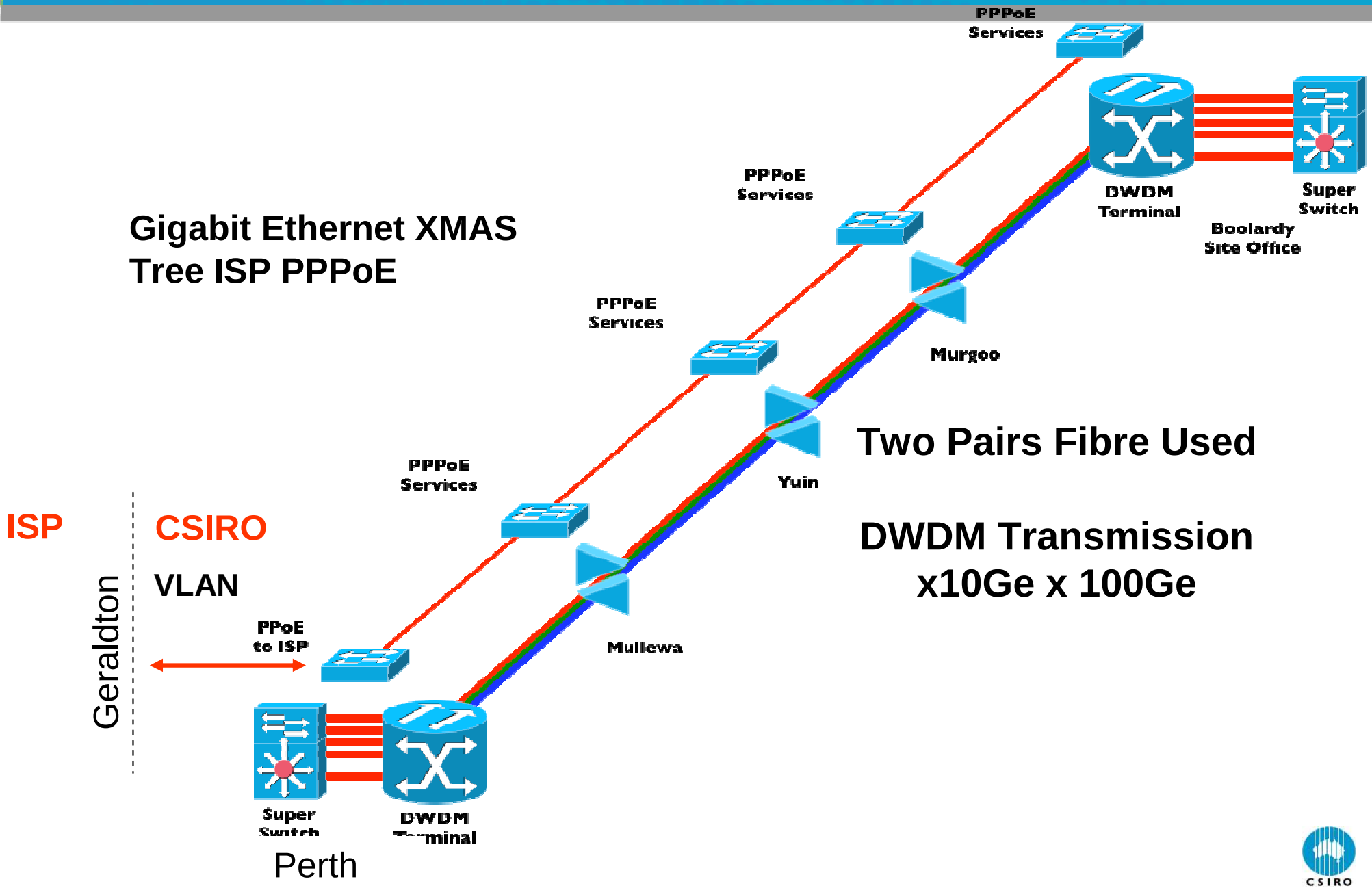
▪ASKAP ~ 1% SKA	*2 SMF*
▪10% SKA = 200 PAF antennae	
▪10% SKA = 1 Tbps (5sec INT)	*1 SMF 100G/ λ*
▪10% SKA = 400Tbps (Raw ADC)	*40 SMF 100G/ λ*
▪75% SKA = 1500 PAF antennae	
▪75% SKA = 8 Tbps (5sec INT)	*1 SMF 100G/λ*
▪75% SKA = 3000 Tbps (Raw ADC)	*? $$$$$$*

The Network(s)

- There are TWO wide-area networks.
- Long-Haul High-Bandwidth:
  - DWDM (nominal 80 channels/fibre pair),
  - carrier-class transmission equipment,
  - $n \times$ 10/40/100Gbit/s per λ,
  - only amplification required,
  - cross-connect or ROADM in Geraldton.
  - COTS Coherent detection DPQPSK 100Gbps per λ

- MRO – Geraldton "Christmas-Tree Lights" Network:
  - Likely to be the first network implemented (no more VSAT!),
  - Transceivers (+ CWDM if needed): COTS equipment
  - $n \times$ 1Gbit/s ($1 \leq n \leq 8$ per fibre pair)
  - O-E-O (regeneration) at each CEV using Ethernet switches,
  - allows monitor and control and access to the network at each CEV,
  - backhaul for the homesteads.

Long Haul Route – Network Schematic

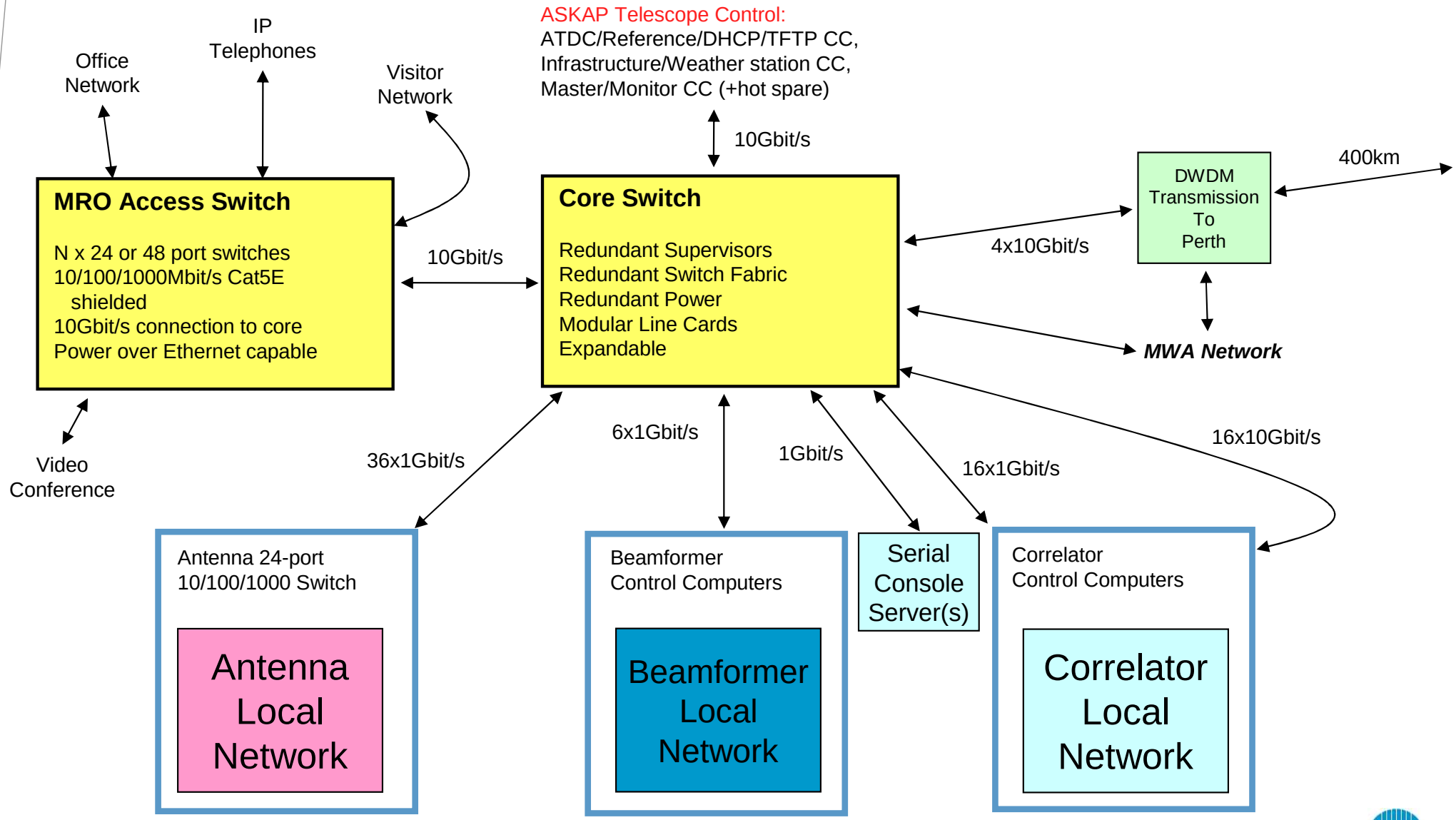


Gigabit Ethernet XMAS Tree ISP PPPoE

Two Pairs Fibre Used

DWDM Transmission x10Ge x 100Ge

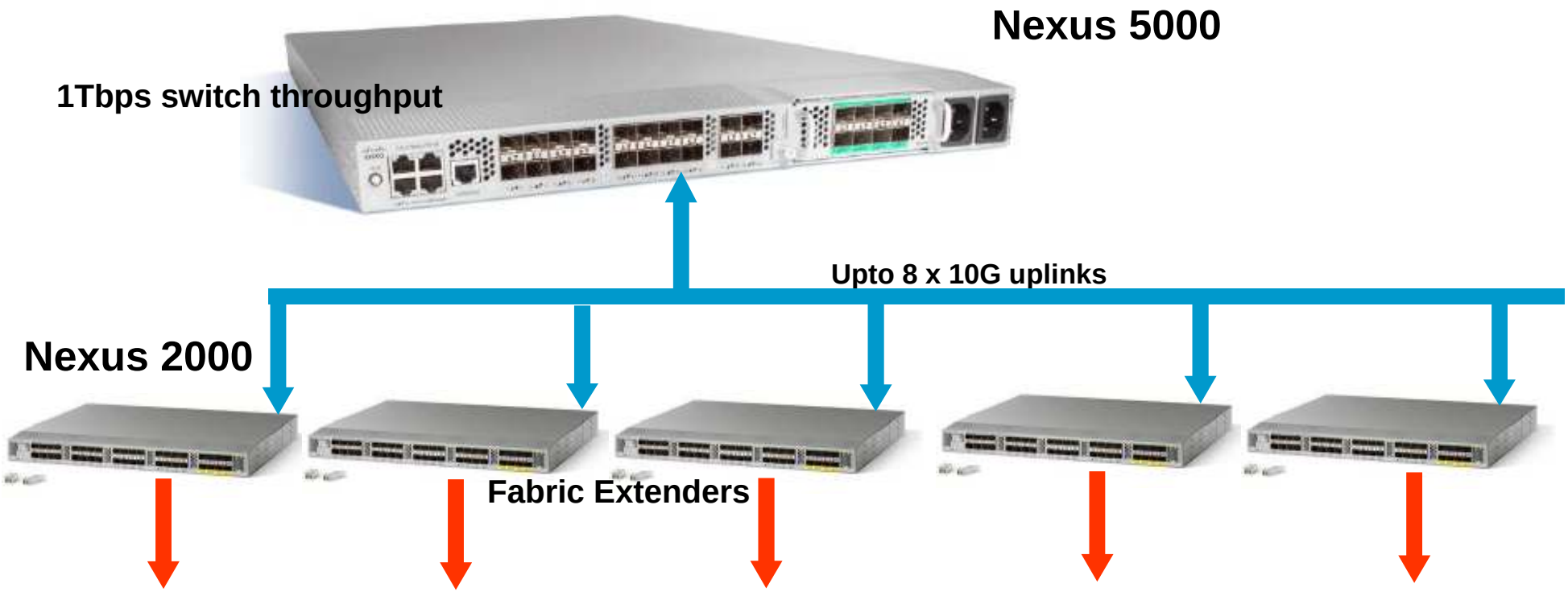
MRO Site Network: Conceptual Architecture



MRO Site Network Considerations

- The network core will consist of a large chassis-based switch with scalable switching fabric capacity to Tbit/s.
- Need to consider carefully over-subscription:
  - most vendors have some over-subscription,
  - need to understand the data flows (sustained and peak) to ensure no data loss (critcal for UDP).
- Considering data centre class switches and plan to trial a small version for BETA
- Need to consider client-side connections and I/O at each end.
- Each antenna will have a dedicated switch in the pedestal.
- Will make extensive use of virtual LANs to segment (and secure) classes of traffic:
  - data versus monitor and control,
  - standard production and visitor connectivity

CISCO Nexus 5000 ASKAP BETA



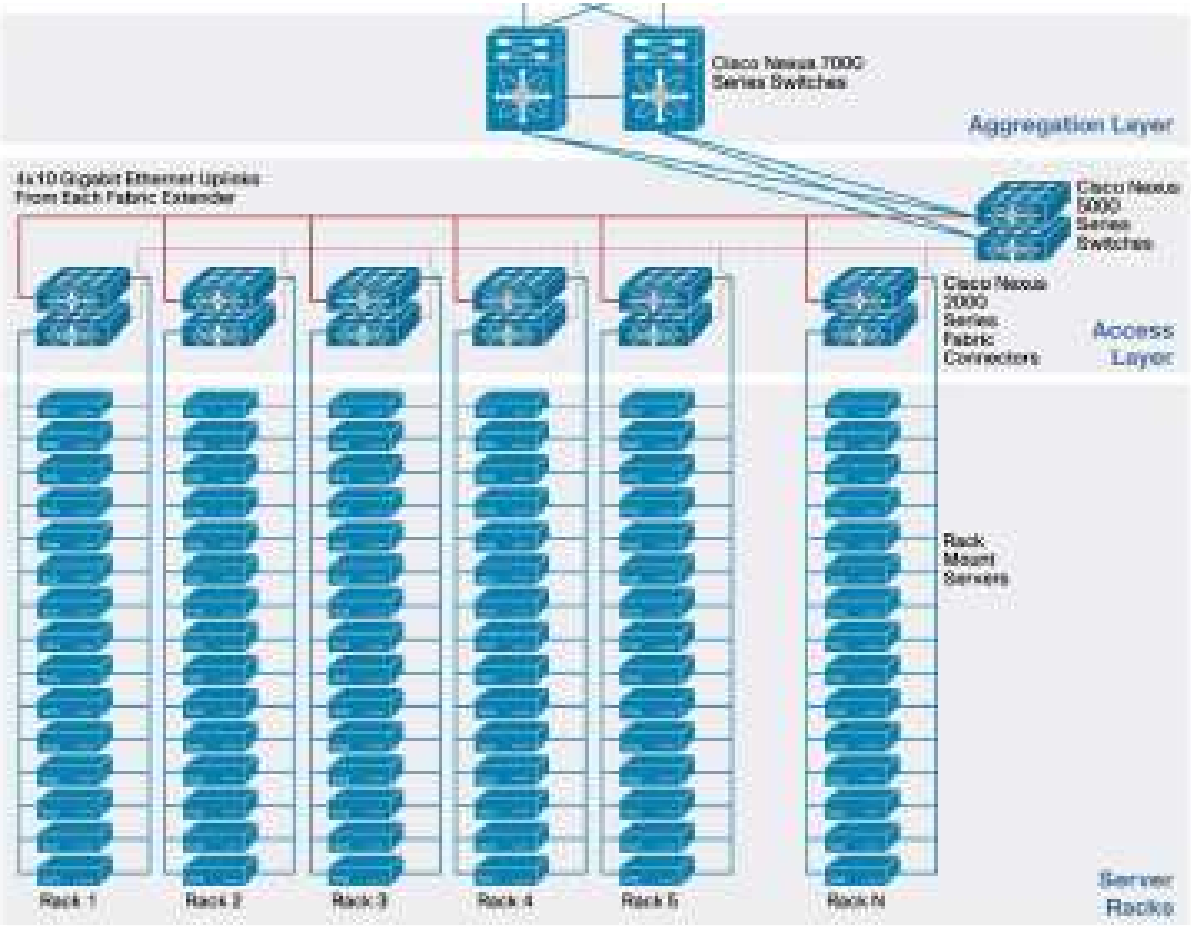
- •576x 1Ge
- •UDP bursty
- •Extensive VLAN separate Control and Monitor from sky data paths
- •Low power
- •Data Centre architecture

Equipment Racks

Antennas

DSP cards &cages

Full ASKAP


Cisco Nexus 7000 Series Switches
Aggregation Layer
4x10 Gigabit Ethernet Uplinks From Each Fabric Extender
Cisco Nexus 5000 Series Switches
Cisco Nexus 2000 Series Fabric Connectors
Access Layer
Rack Mount Servers
Rack 1
Rack 2
Rack 3
Rack 4
Rack 5
Rack N
Server Racks

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Thank you

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