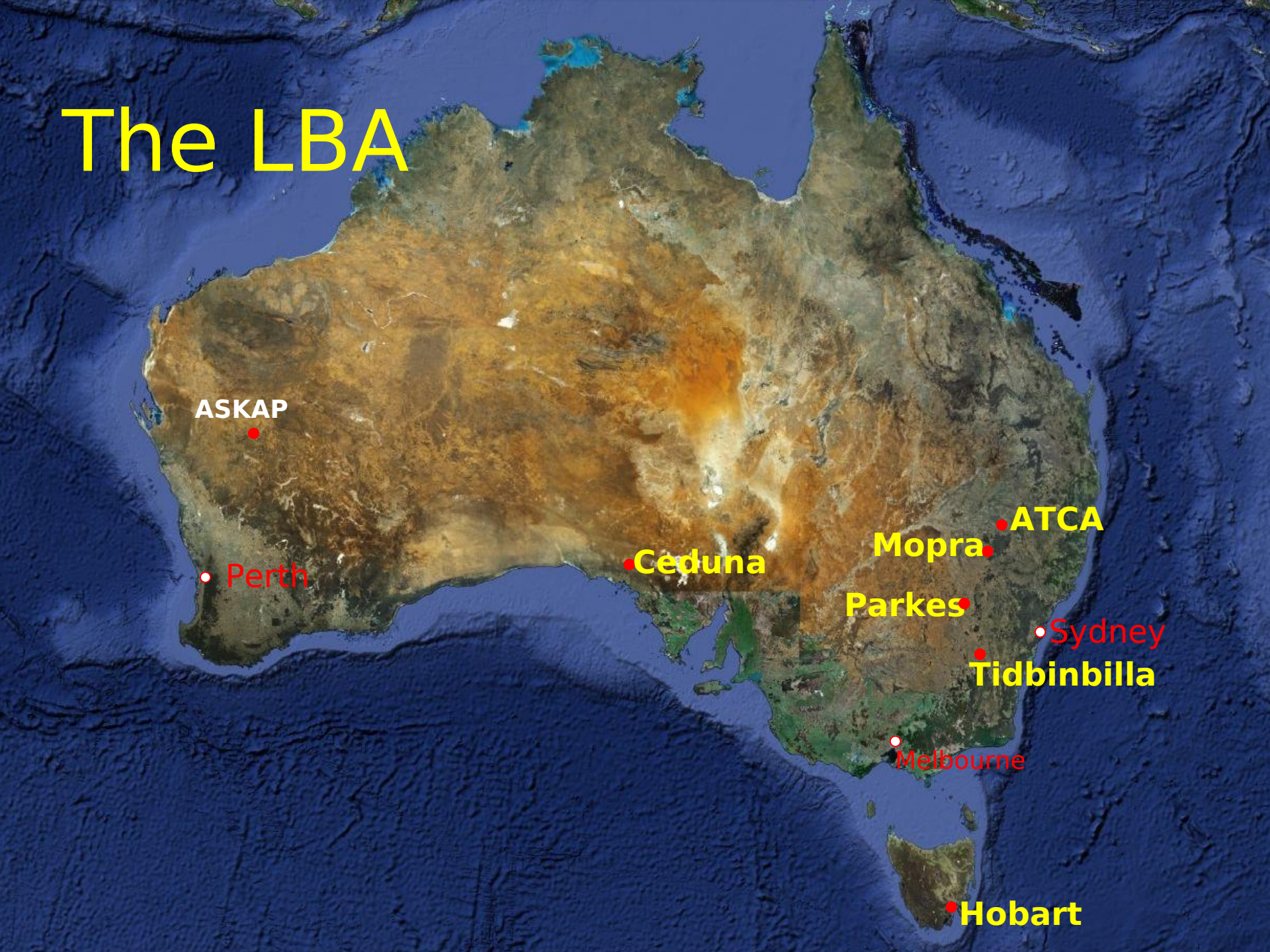
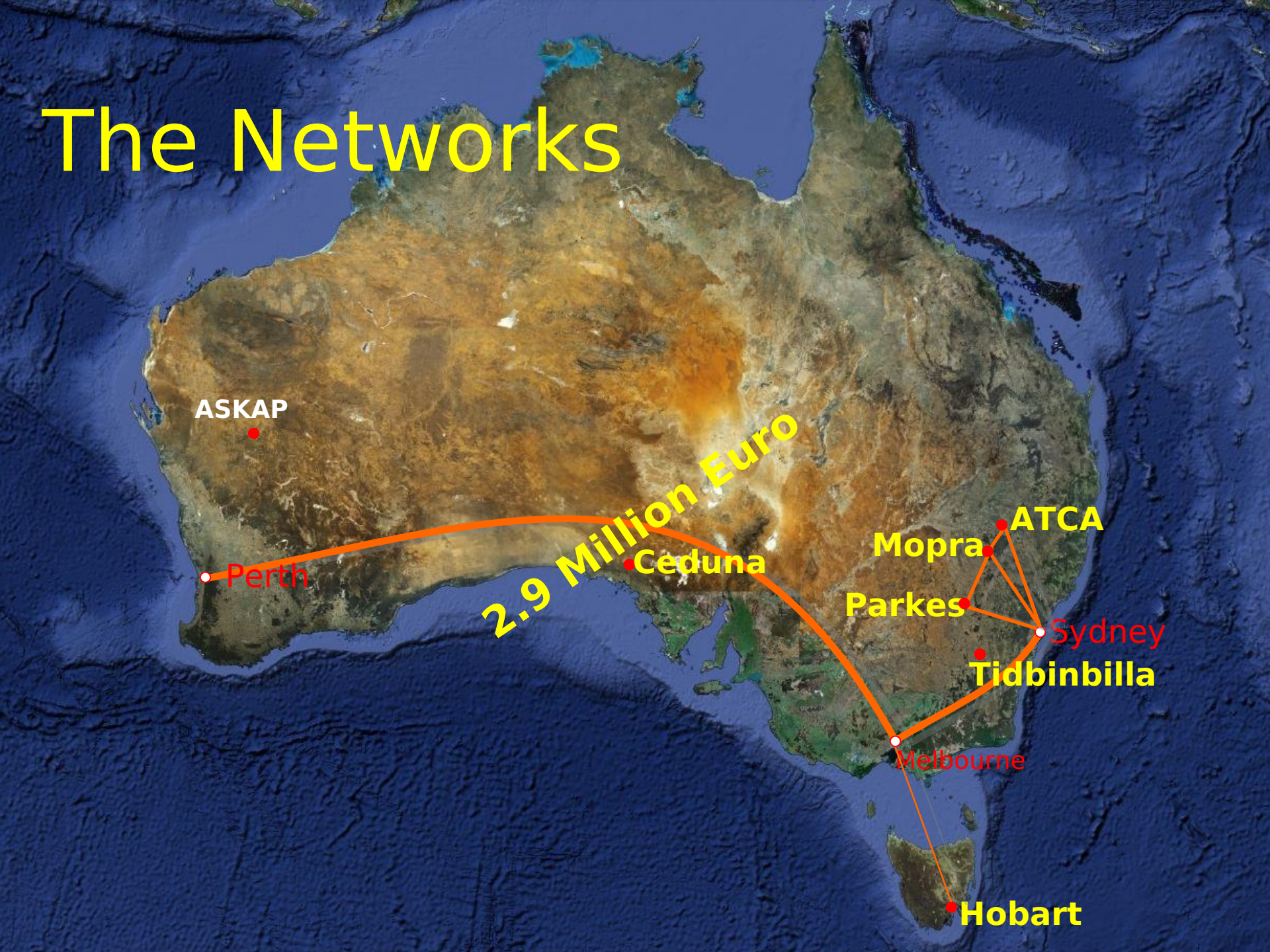
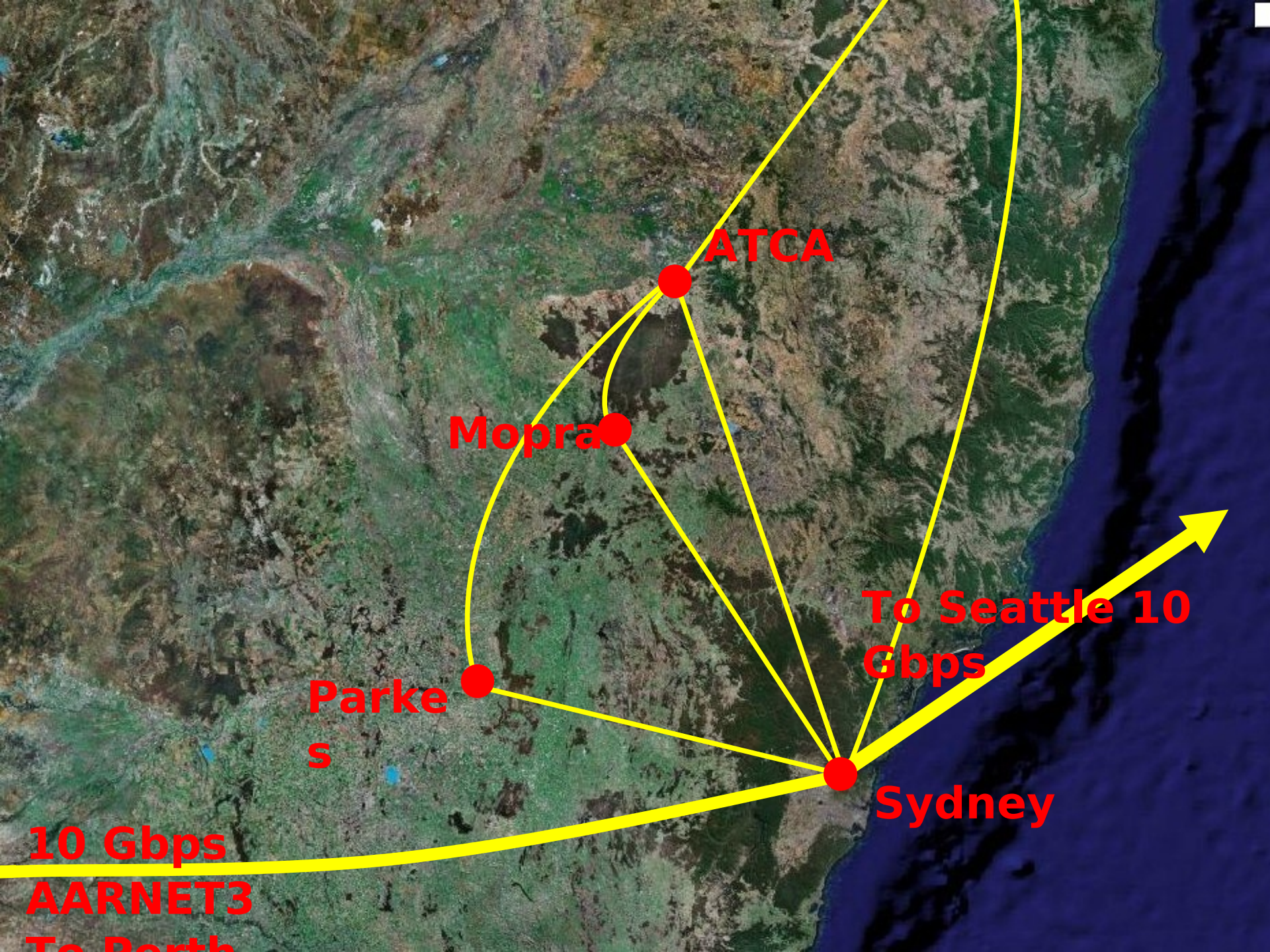
eVLBI Developments on the LBA

Chris Phillips
eVLBI Project Scientist
25 June 2009

CSIRO


The LBA
ASKAP
Perth
Ceduna
ATCA
Mopra
Parkes
Sydney
Tidbinbilla
Melbourne
Hobart


The Networks
ASKAP
Perth
2.9 Million Euro
Ceduna
ATCA
Mopra
Parkes
Sydney
Tidbinbilla
Melbourne
Hobart


ATCA
Mopra
Parkes
To Seattle 10 Gbps
Sydney
10 Gbps AARNET3 To Perth

LBADR – LBA Data Recorder

- Cousin of MRO/EVN-PC
  - Commodity PC with VSIB input card
  - Primarily record onto Apple Xserve RAID
- Control software highly modified from original MRO
- Mark5b emulation mode
- eVLBI with TCP or UDP
- Very flexible
  - Data written to normal Linux filesystem
  - Realtime sampler statistics
  - Flexible realtime fringe checking

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DiFX - eVLBI

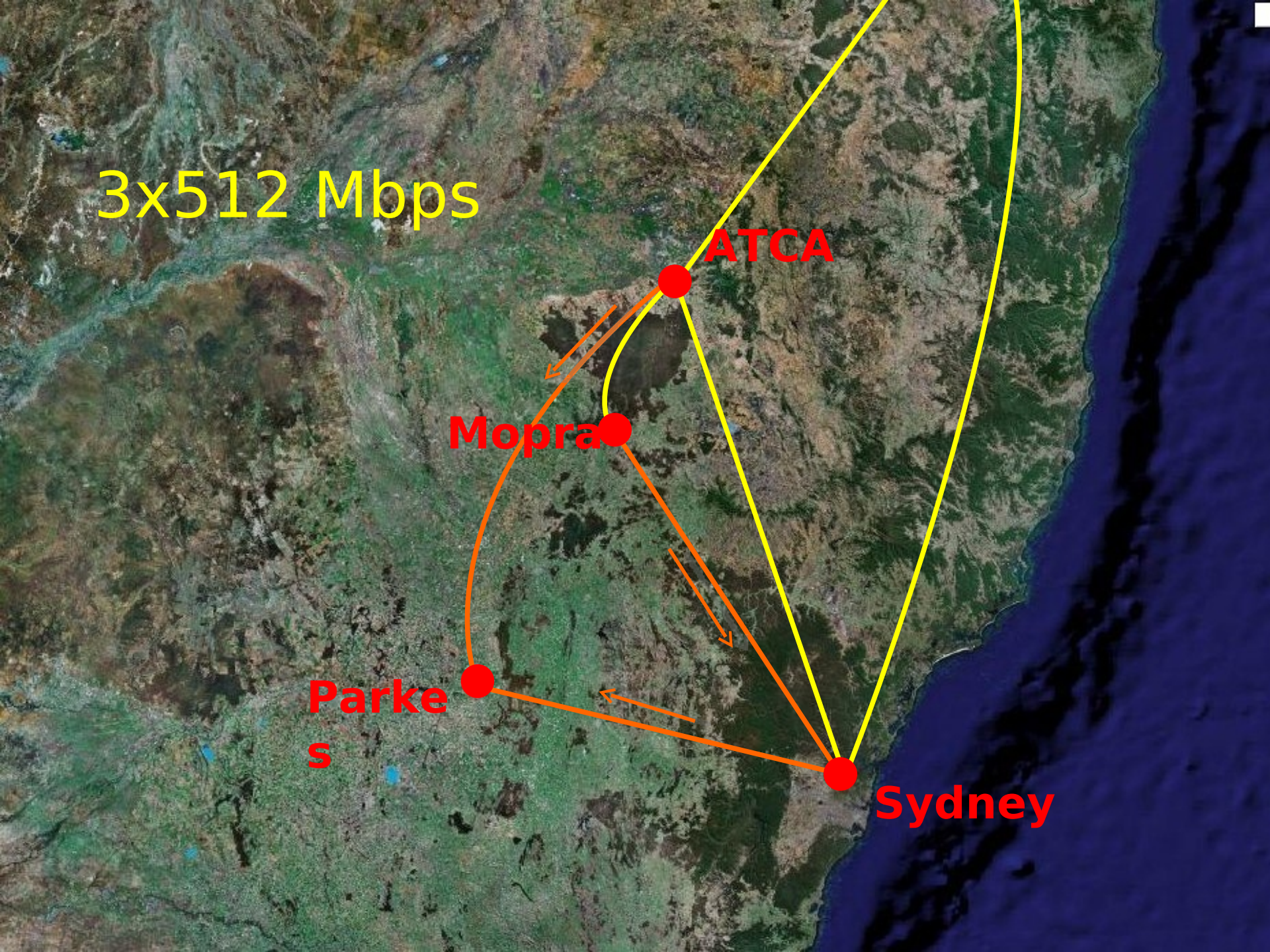
- All LBA correlation now runs on DiFX
  - Distributed FX
  - Based on Intel Integrated Performance Primitives
  - MPI parallelization on Beowulf style cluster
- Written by Adam Deller at Swinburne University of Technology, now NRAO
  - Active development also from Walter Brisken
  - Available free of charge for scientific research
- 3 modes of eVLBI operation
  - TCP with LBADR format
  - TCP & UDP with Mark5a/b

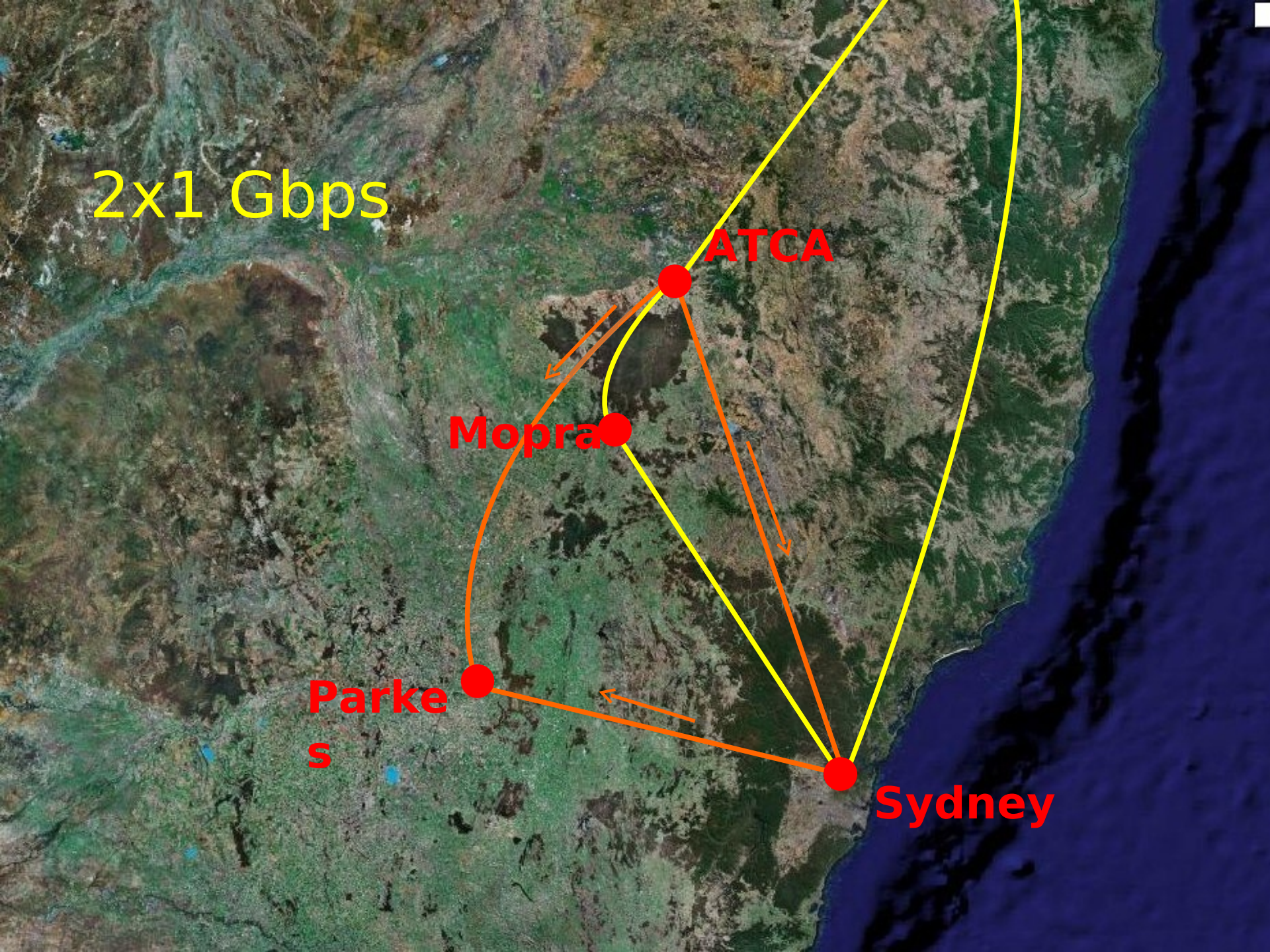
DiFX installations

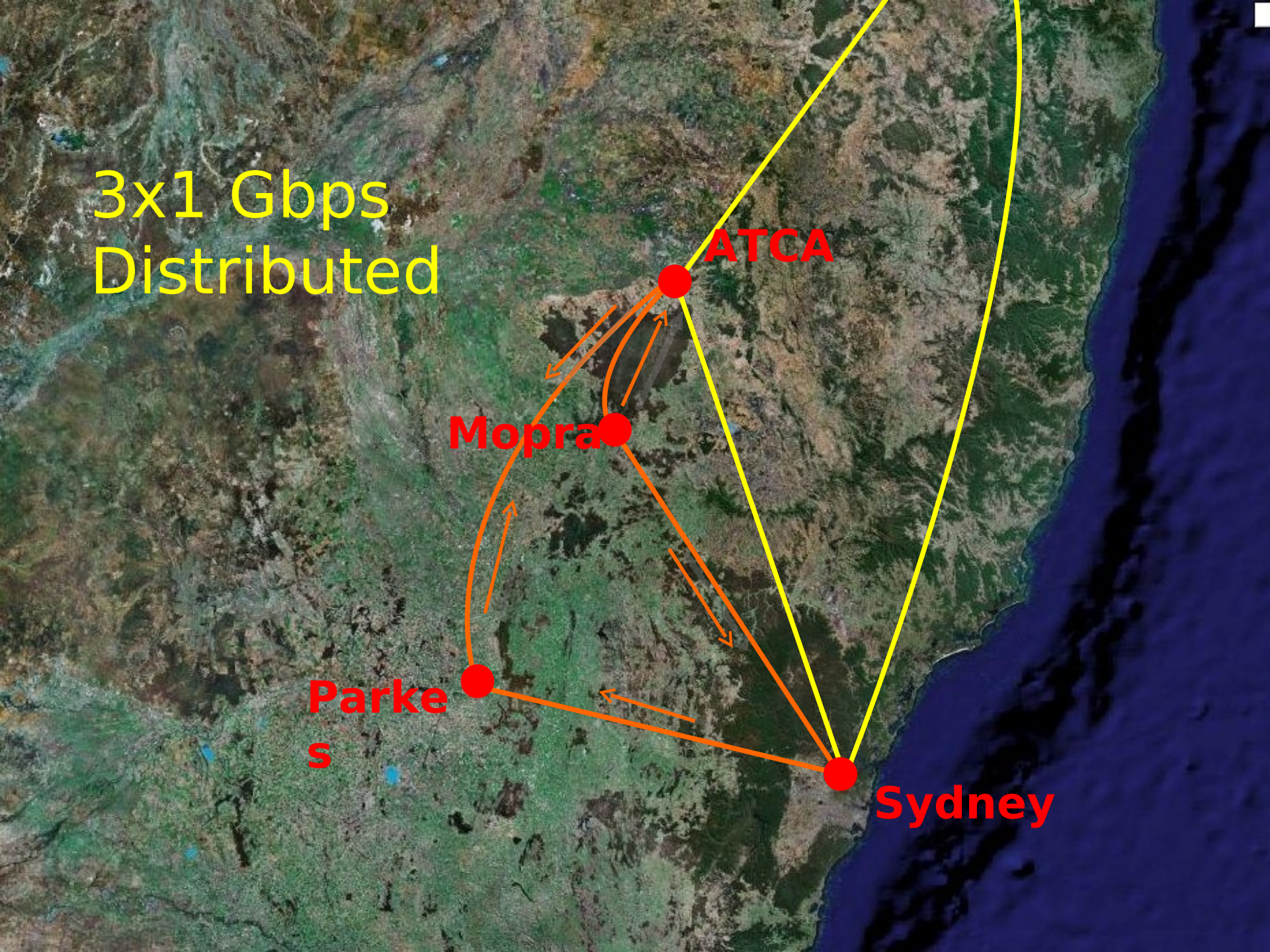
- 3 (and a bit) clusters running DiFX across Australia
- Cuppa at Curtin
  - 20 Nodes
  - Dual CPU, Quadcore, Intel Xeon X5355 2.66GHz
- CAVE at ATCA
  - 14 Nodes
  - Dual CPU, Quadcore Intel Xeon E5440 2.83GHz
  - +36 TB “Thumper”
- APSR at Parkes
  - 18 Nodes
  - Dual CPU, Quadcore, Intel Xeon E5345 2.33GHz
- PAMHELA at Parkes (APSR I/O nodes)
  - 5 Nodes
  - Dual CPU, Dualcore, Intel Xeon 5130 2.00GHz

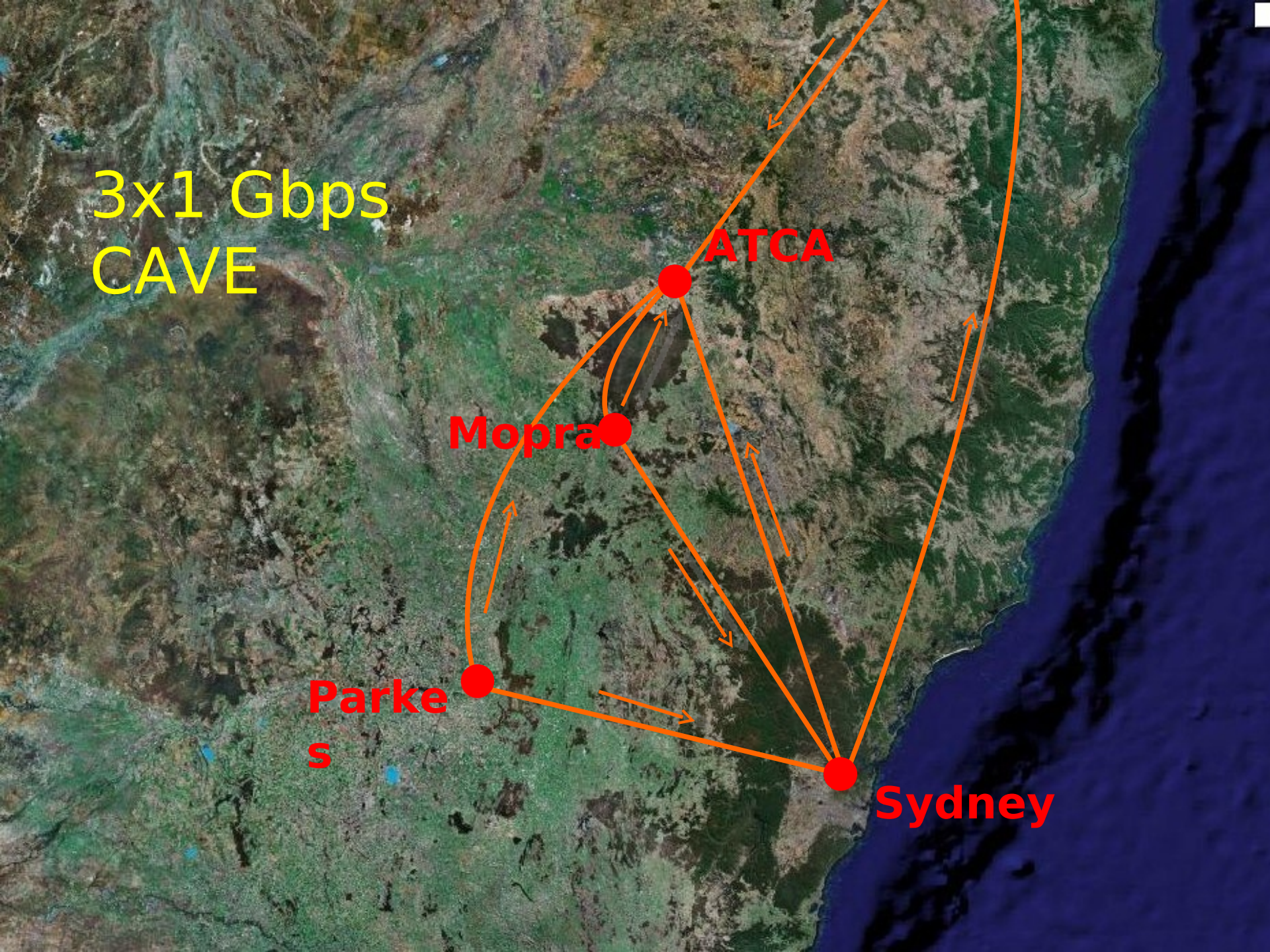
PAMHELA

- Running regular user experiments
  - APSR at Parkes
  - 3x512 Mbps+128 Mbps
  - 2x1024 Mbps
- ATCA Curtin cluster “CAVE”
  - Just installed
  - Will allow 2x3x512 Mbps (3x1 Gbps distributed)
  - Probably 3x1 Gbps on CAVE


3x512 Mbps
ATCA
Mopra
Parkes
Sydney


2x1 Gbps
ATCA
Mopra
Parkes
Sydney


3x1 Gbps
Distributed
ATCA
Mopra
Parke
s
Sydney

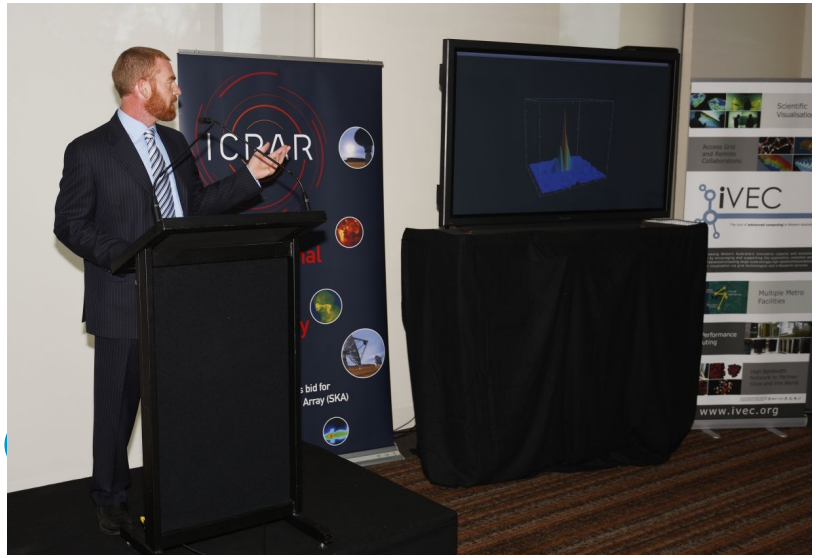

3x1 Gbps
CAVE
ATCA
Mopra
Parke
s
Sydney

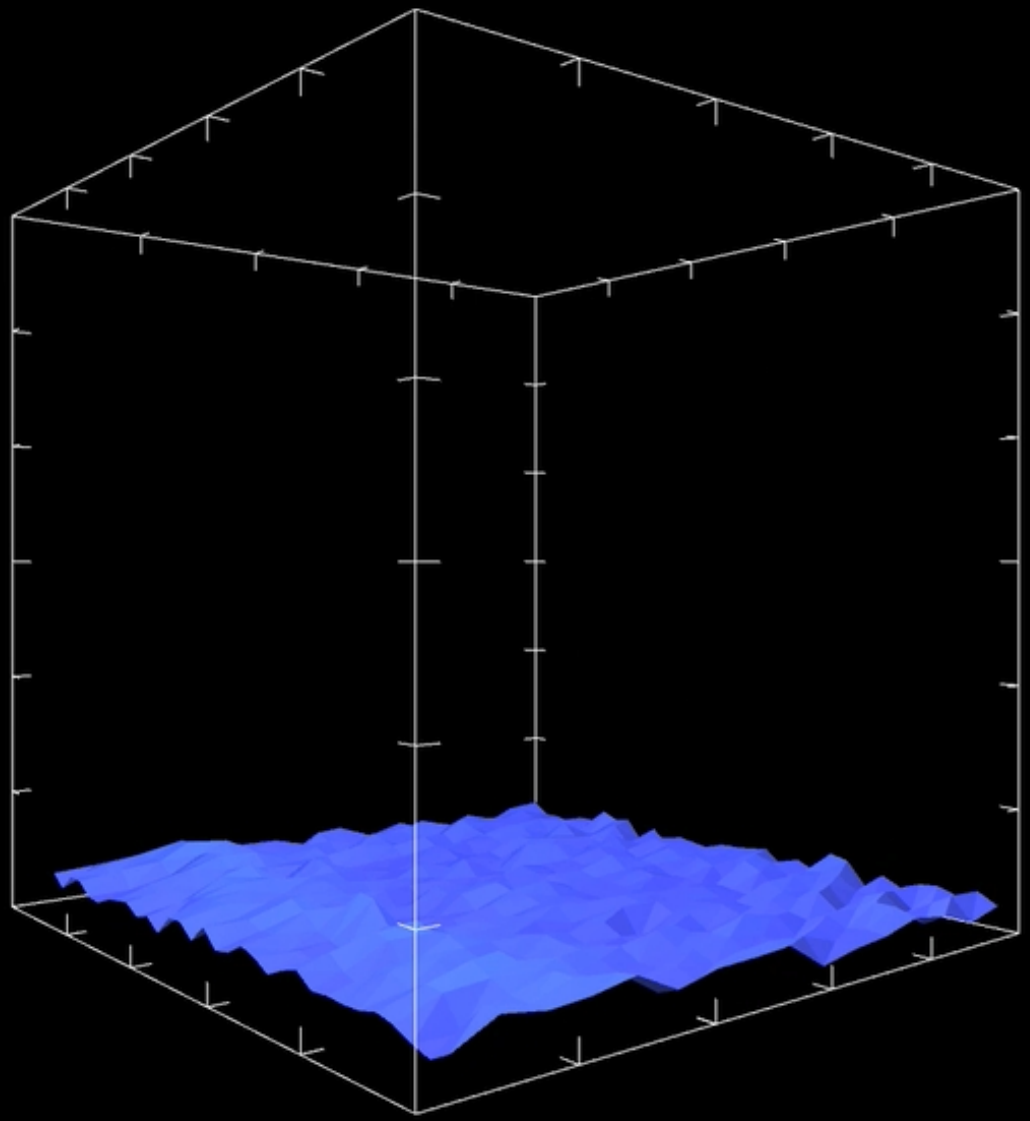
Data Transfer

- Mopra recorded remotely at ATCA always
- All data Pa,Mp,At from Feb 2009 transferred electronically to Curtin (Perth)
  - Gridftp
  - Managed entirely by “ARCS”
- Hobart to be trialed July 2009
- Tidbinbilla data transported via “USB” disks to local ARCS node
- Southern Hemisphere Calibrator Survey
  - All LBADR data (Mp,At,Cd) translated to Mark5b and sent to Bonn via Tsunami
- Investigating Tsunami from Wetzell

Curtin Demo

- 2x622 Mbps links from each ATNF observatory to Sydney
  - 1024 Mbps, 4x64 MHz
  - Mark5b UDP data
- 128 Mbps from UTAS
  - 1 bit 64 MHz
- Using AARNet backbon
  - Sydney-Perth, 3.2 Gbps
- 10 Gbps AARNet3 access into IVEC
  - GRE tunnel across backbone
- “Distributed” correlation approach on Cuppa
  - Each 64 MHz frequency correlated separately





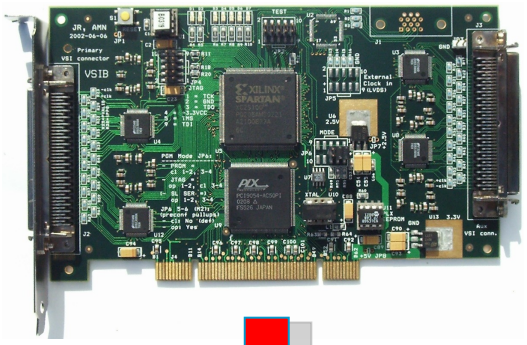
Fringe-dynamic-edit2.mov

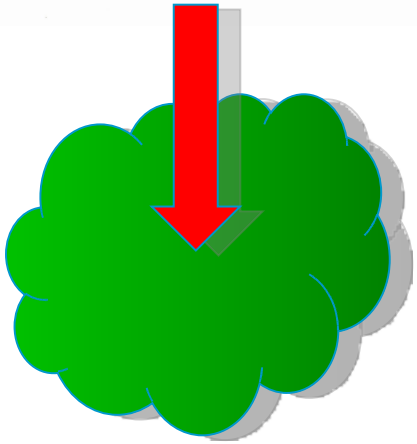
VDIF

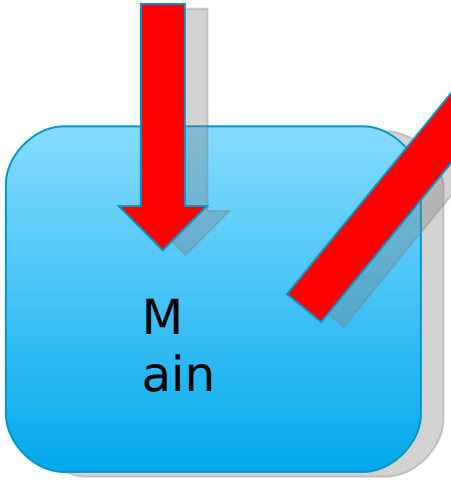
- LBA fully supports VDIF
  - Standard mode of recording asap
- LBADR has VDIF recording mode
  - Still experimental
  - Can make sample data available if request
- Will work with NRAO to develop VDIF support for DiFX

Hybrid eVLBI

- Record to disk and eVLBI simultaneously
  - eVLBI results immediately, full correlation (Ceduna, Tidbinbilla, Hobart) later
- In active development
  - Works – Fringes 4 June
  - Supports any number of output streams
  - Multiple network, disks etc
  - Different datarates etc supported
  - Multithreaded approach
  - Write LBADR, Mark5b, DIFX simultaneously






M
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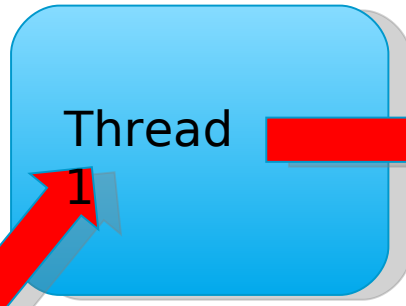
Thread
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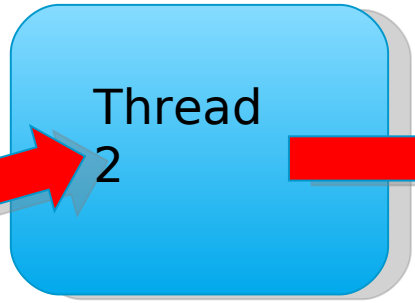
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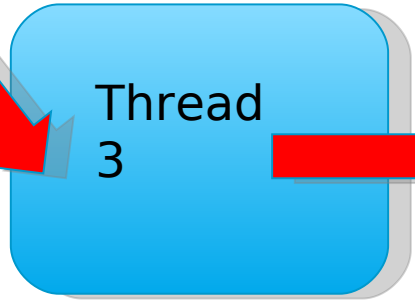
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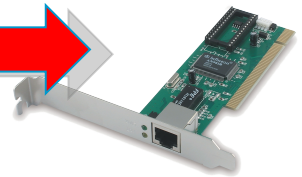

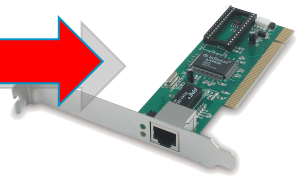

eVLBI to Tidbinbilla!

- Tidbinbilla is DSN station in Australia
  - Located just outside Canberra
- Fringe 15 June!
  - 3 hr test
  - Commercial 50 Mbps link
  - 32 Mbps eVLBI test with Mopra
  - 8.4 GHz
  - 1x16 MHz, 1bit data
  - TCP, Mark5b format
  - Stable network performance
  - Not usable for science

eVLBI Next stage

- 10 Gbps connection between ATCA/Parkes
  - 16 Gbps eVLBI (8 Gbps each way)
  - APSR/CAVE
  - 4 bit, 1 GHz, dual pol
  - Should be feasible on DiFX
    - May need changes to I/O distribution
- CABB at ATCA
  - Requires multiport 10 Gbps switch at Narrabri
- Modified DFB3 at Parkes

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Thank you

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