SKA

Computing Model

Pete Clarke
EUT0 meeting 4-Sept-2017
Paris

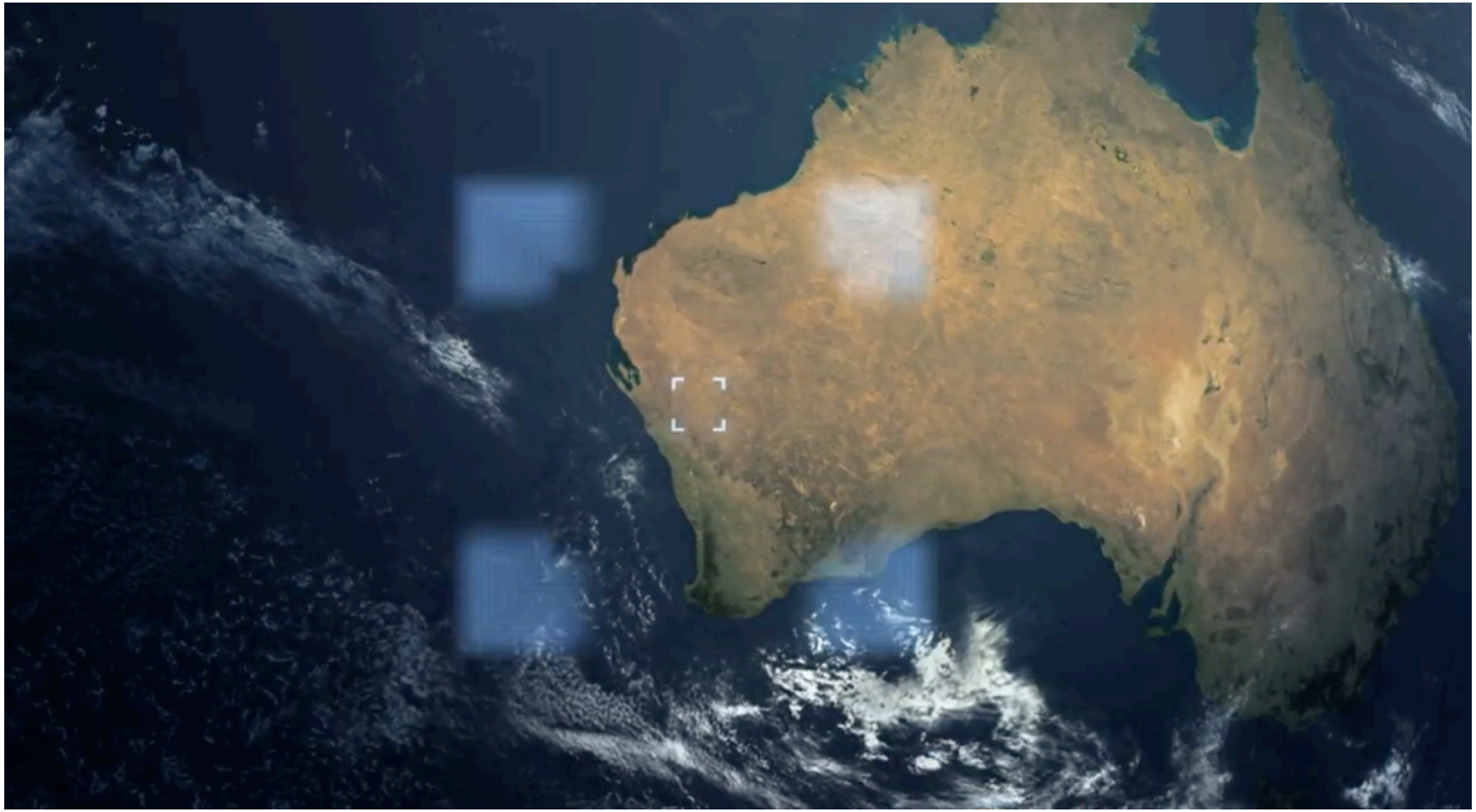
Im only repeating slides i have taken from:
Paul Alexander
Anna Scaife
Rosie Bolton
Nick Rees

so thanks !!!

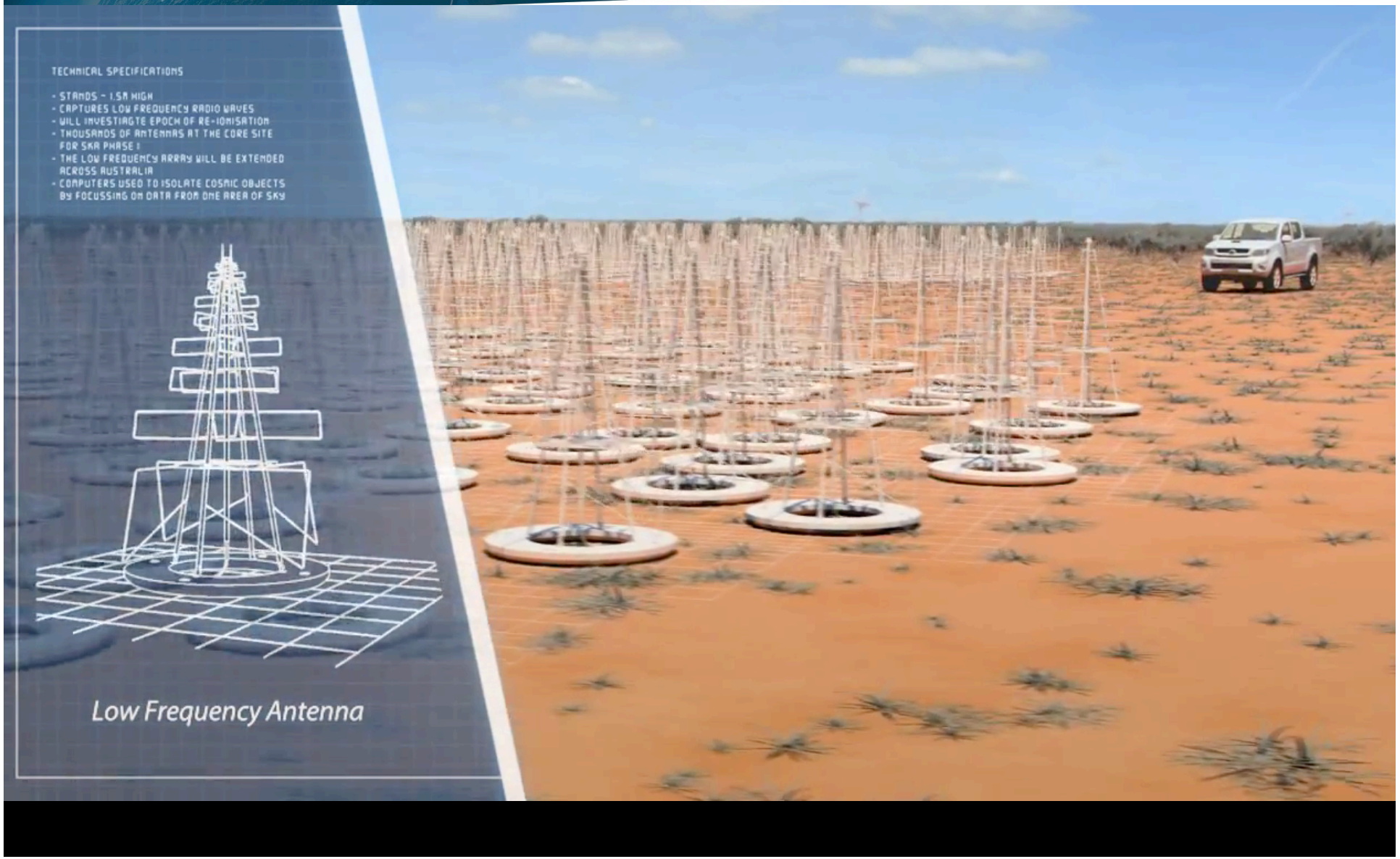
SKA South Africa

Mid frequency dishes : 350MHz – 24 GHz

SKA Australia



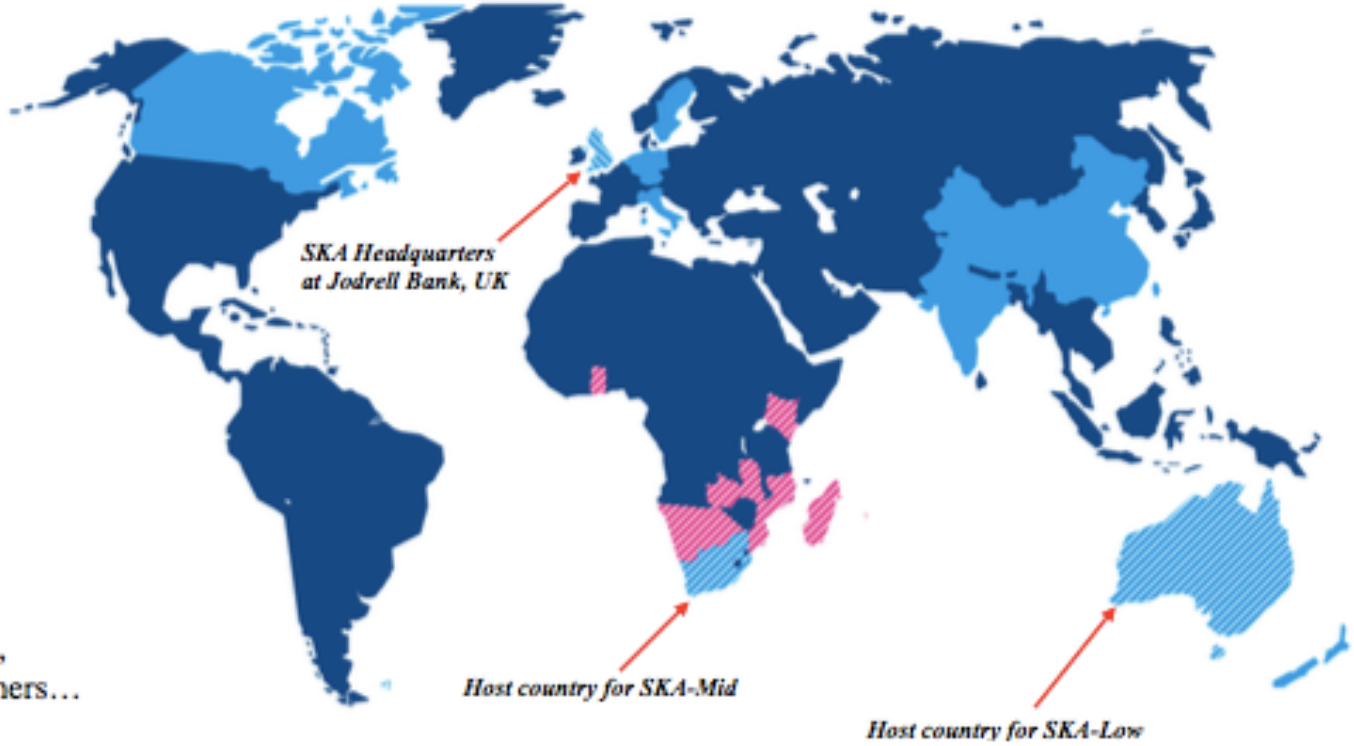
Low frequency phased arrays : 50-350 MHz

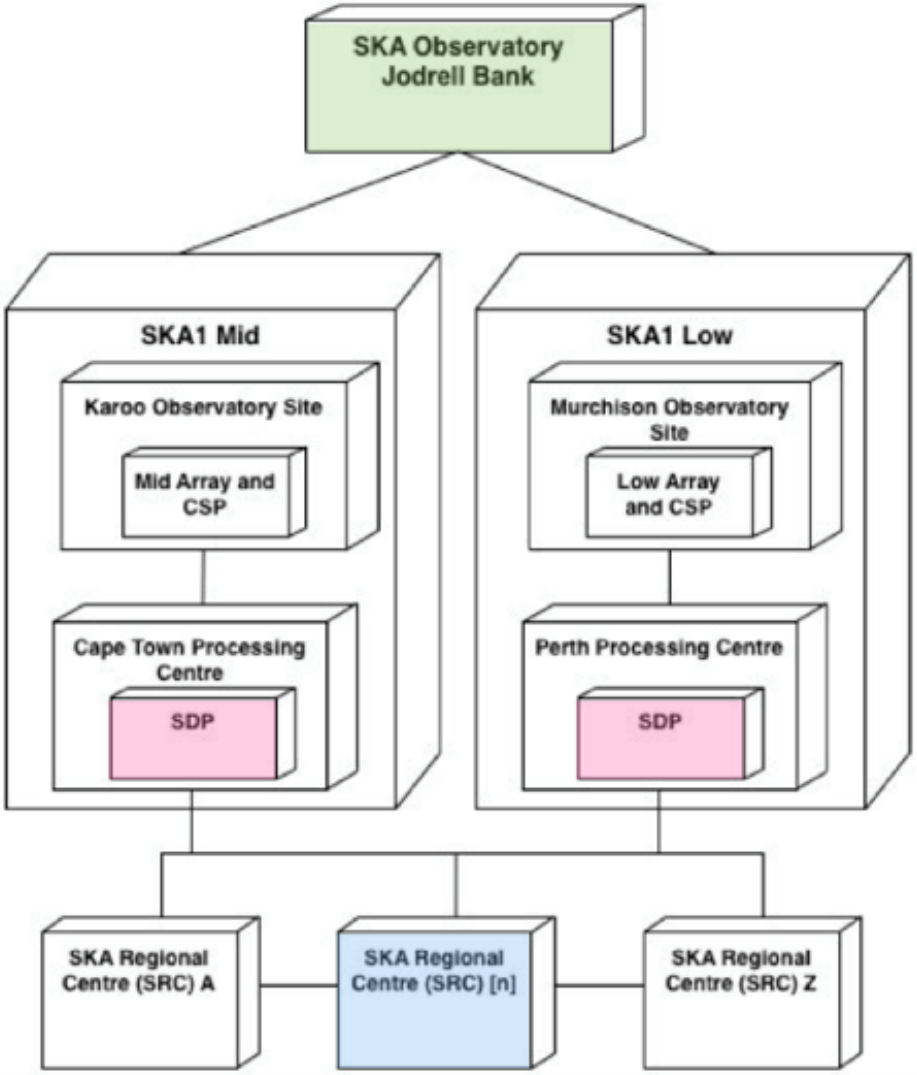


The Square Kilometre Array

- Australia
- Canada
- China
- India
- Italy
- Netherlands
- New Zealand
- South Africa
- Sweden
- UK

Potential new members: Spain, Portugal, Germany, France, others…

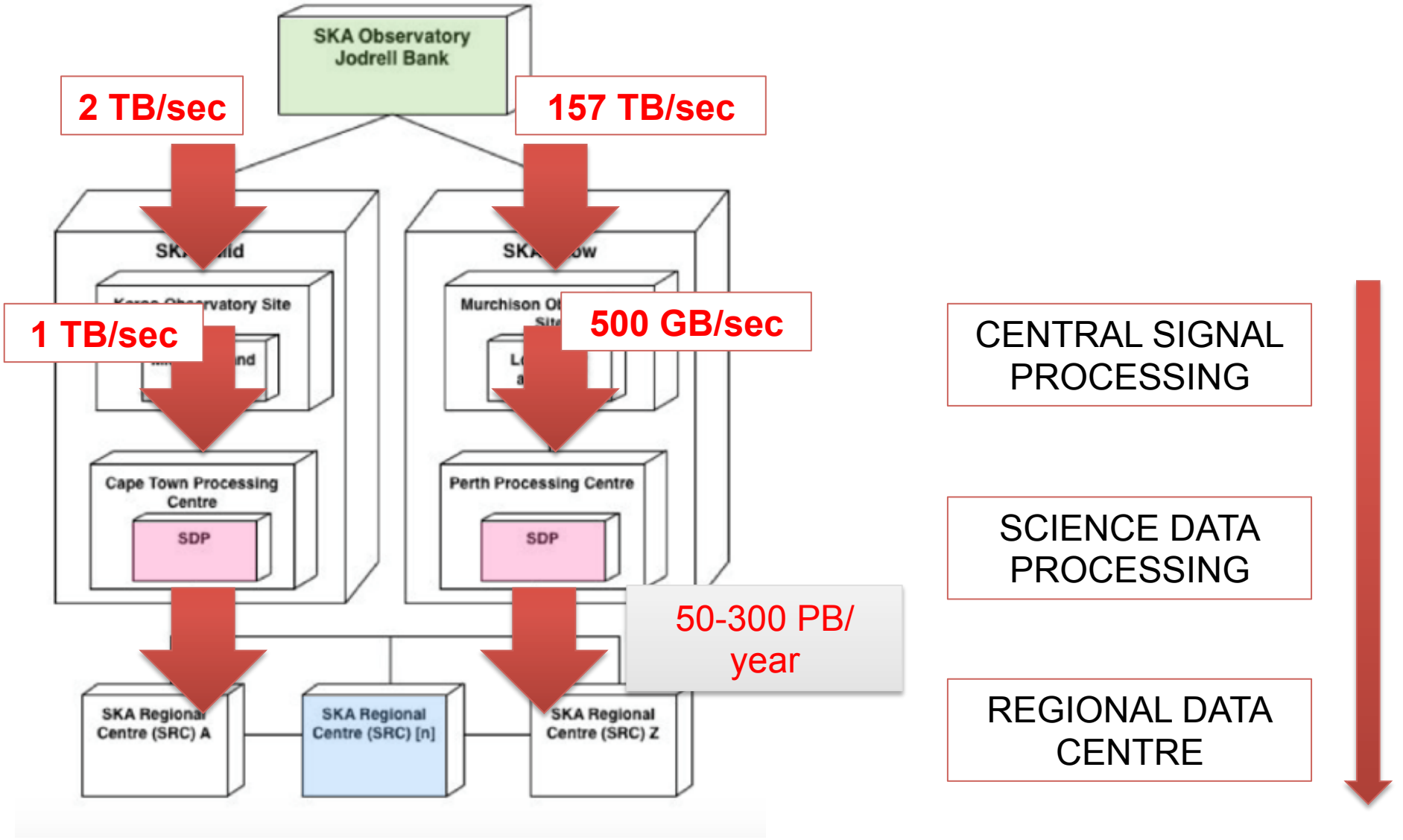




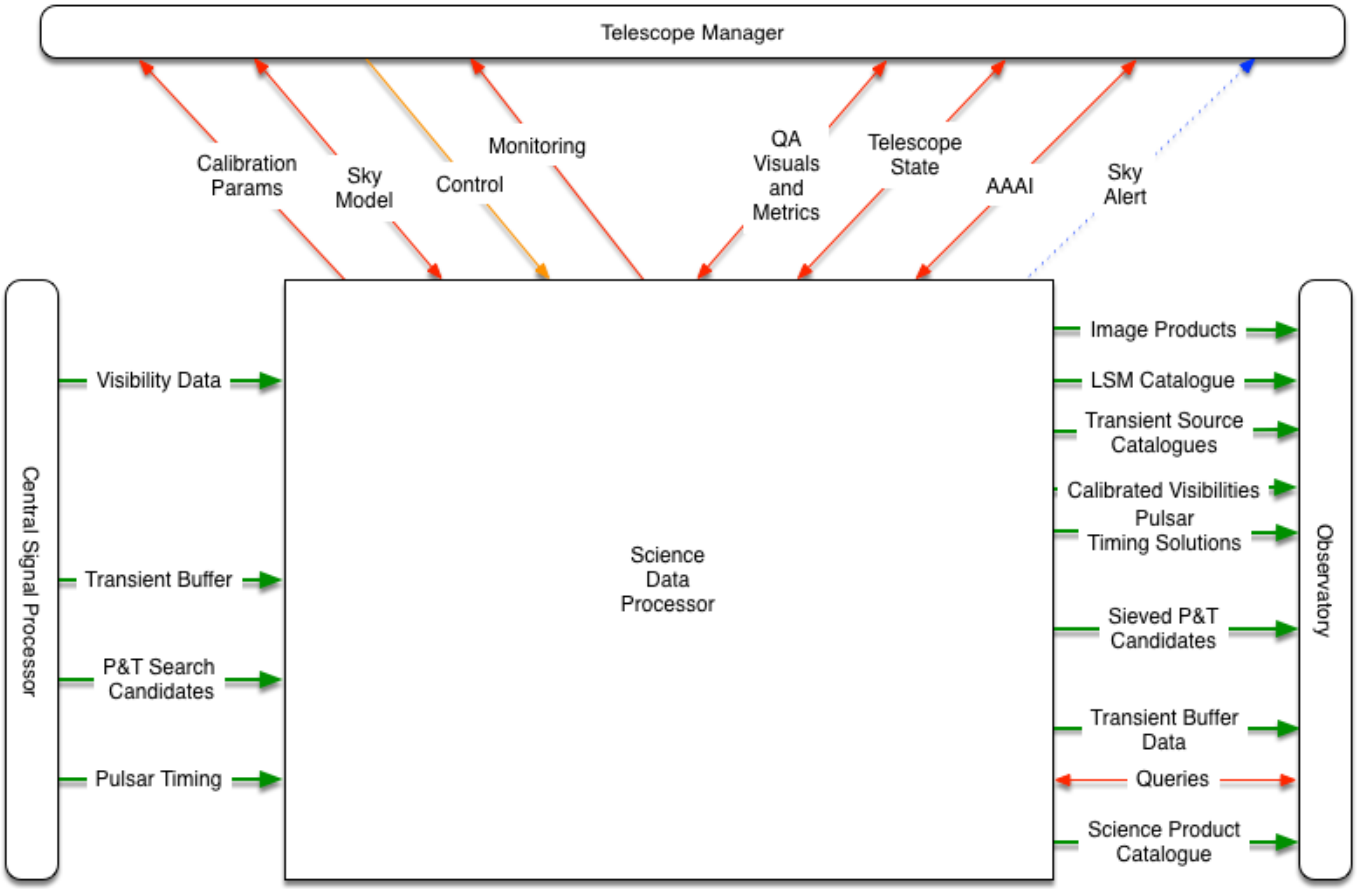
CENTRAL SIGNAL PROCESSING

SCIENCE DATA PROCESSING

REGIONAL DATA CENTRE

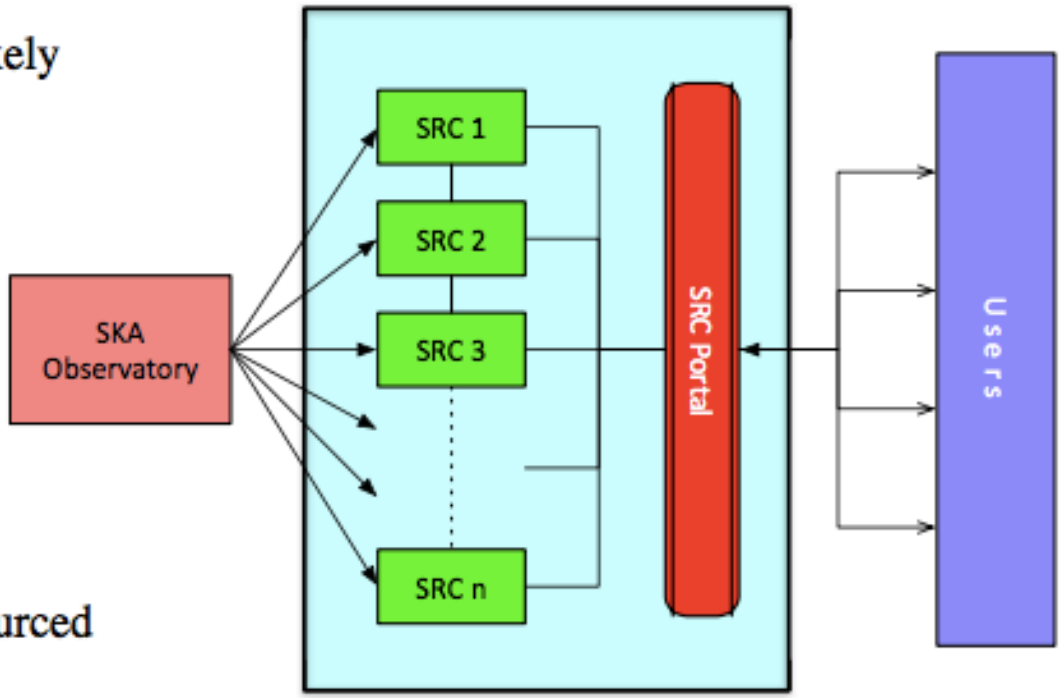

SKA Observatory
Jodrell Bank
2 TB/sec
157 TB/sec
1 TB/sec
500 GB/sec
Cape Town Processing Centre
SDP
Perth Processing Centre
SDP
50-300 PB/ year
SKA Regional Centre (SRC) A
SKA Regional Centre (SRC) [n]
SKA Regional Centre (SRC) Z
CENTRAL SIGNAL PROCESSING
SCIENCE DATA PROCESSING
REGIONAL DATA CENTRE

SDP


Telescope Manager
Calibration Params
Sky Model
Control
Monitoring
QA Visuals and Metrics
Telescope State
AAAI
Sky Alert
Central Signal Processor
Visibility Data
Transient Buffer
P&T Search Candidates
Pulsar Timing
Science Data Processor
Image Products
LSM Catalogue
Transient Source Catalogues
Calibrated Visibilities
Pulsar Timing Solutions
Sieved P&T Candidates
Transient Buffer Data
Queries
Science Product Catalogue
Observatory

SKA Regional Centres

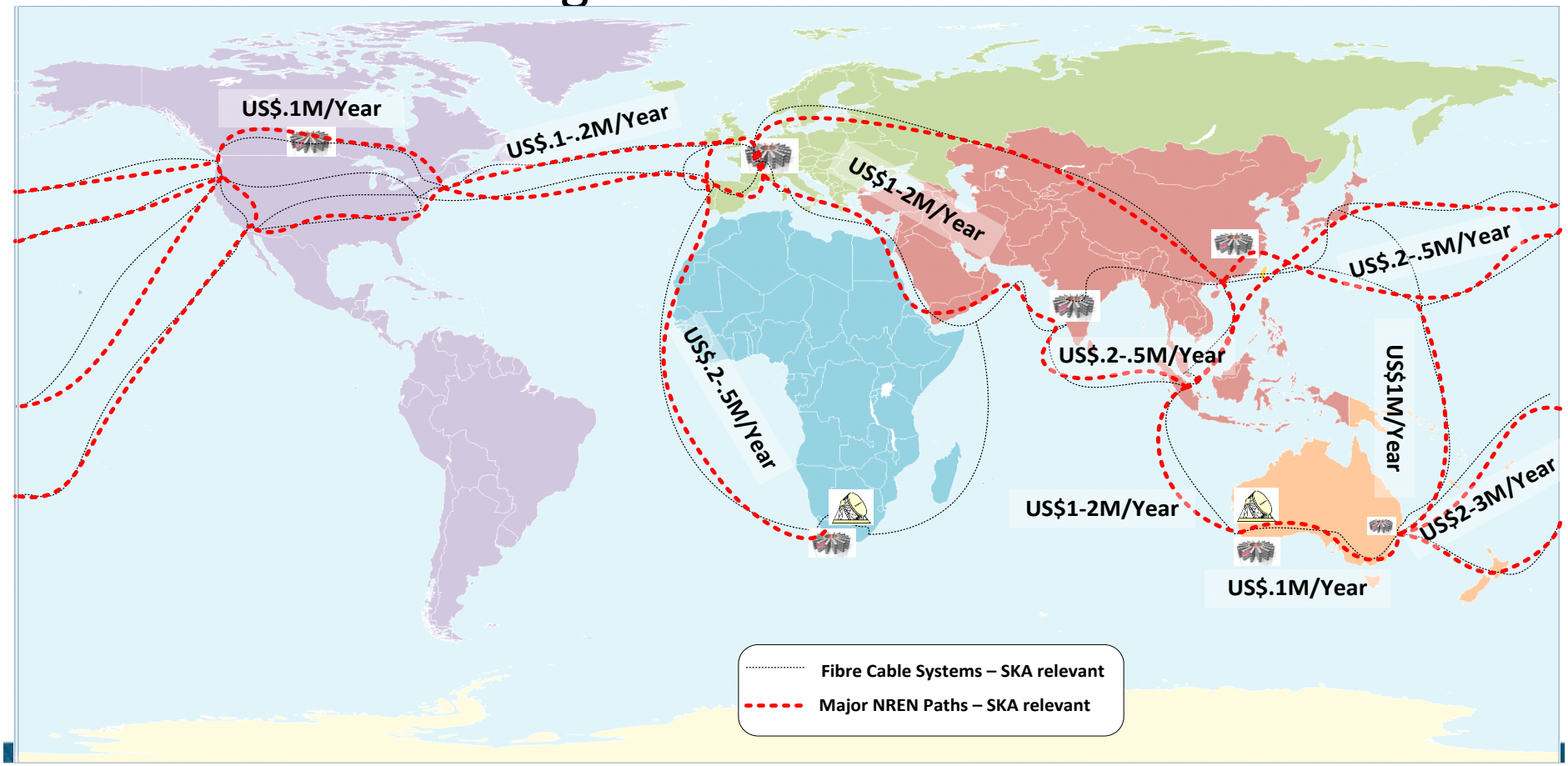
- Science Data Centres (SDCs) will likely host the SKA science archive
- Provide access and distribute data products to users
- Provide access to compute and storage resources for users
- Provide analysis capabilities
- Provide user support
- Multiple regional SRCs, locally resourced



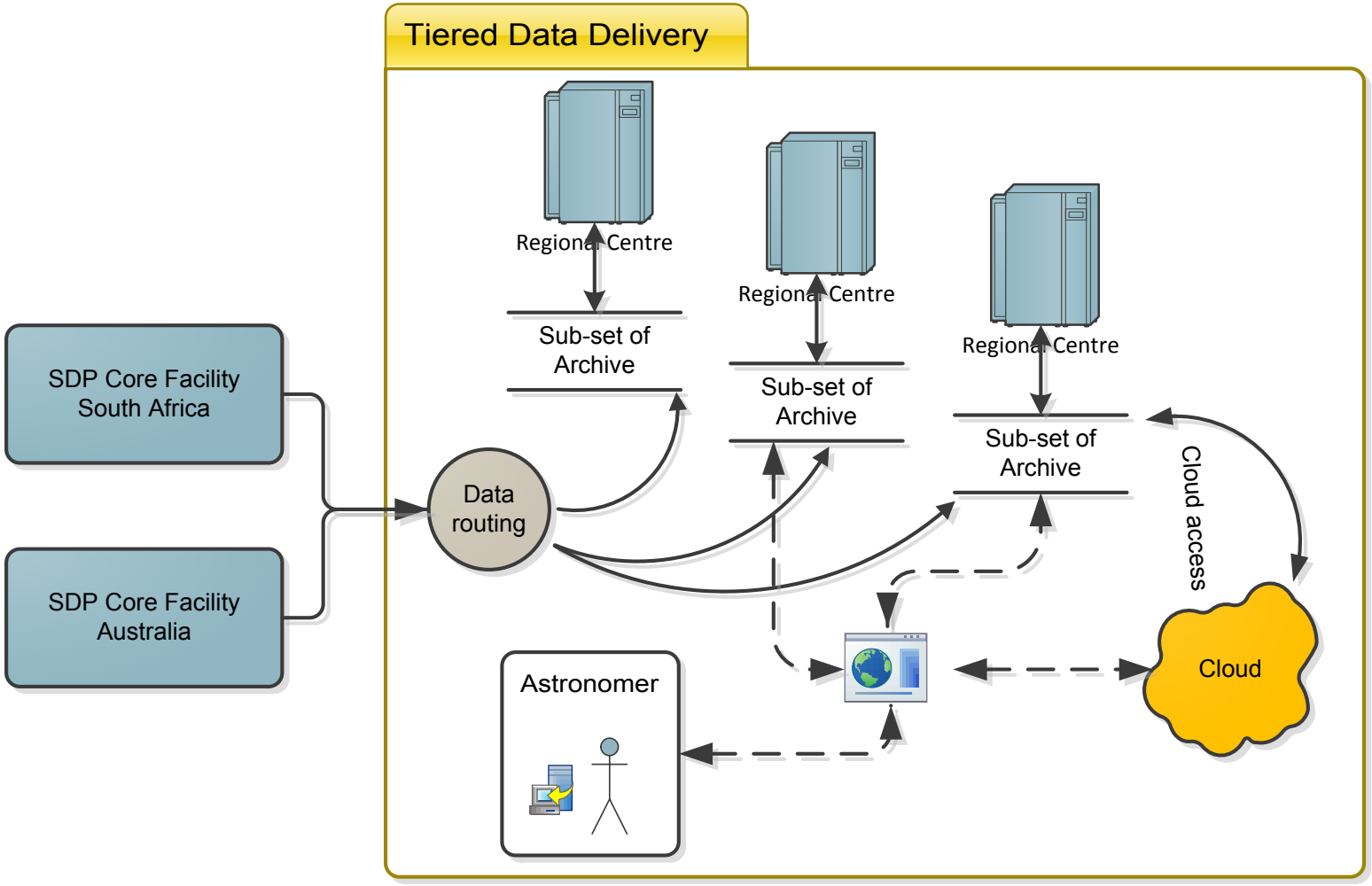
Key difference to LHC: SRCs are not subservient to the observatory. Their principal responsibility is to the Astronomy community

SRCs

- 10 year IRU per 100Gbit circuit 2024-2033 (2015 est.)
- Guesstimate of Regional Centre locations

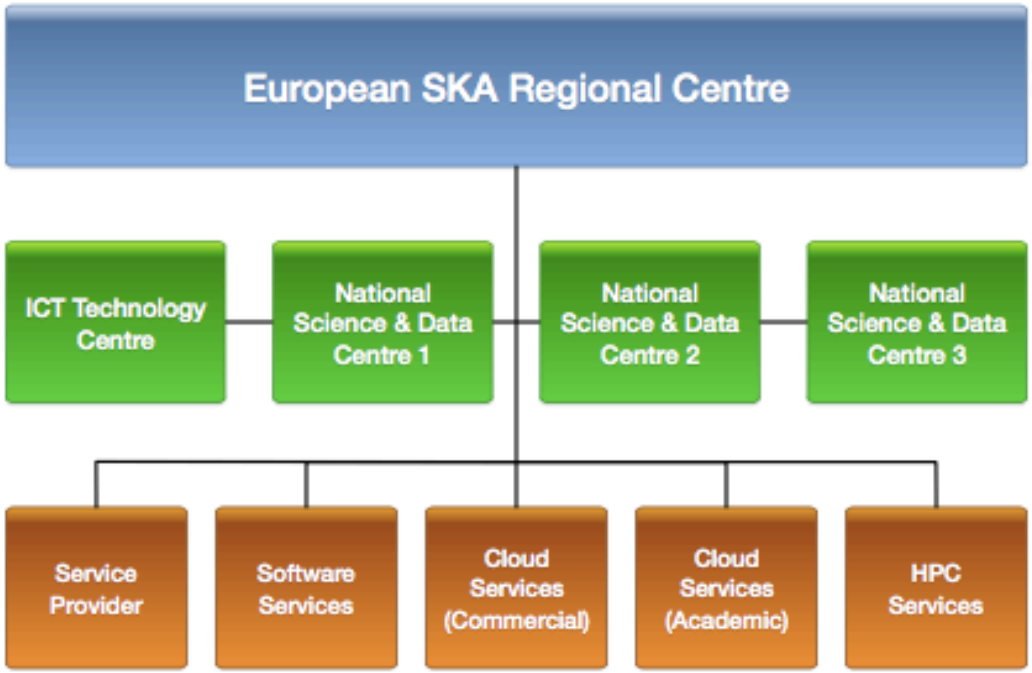


Data Flow

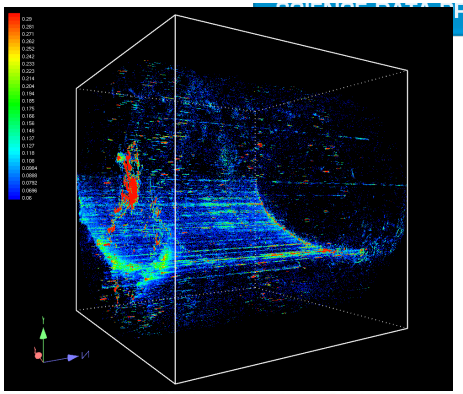

Tiered Data Delivery
Regional Centre
Regional Centre
Regional Centre
Sub-set of Archive
Sub-set of Archive
Sub-set of Archive
SDP Core Facility South Africa
SDP Core Facility Australia
Data routing
Cloud access
Cloud
Astronomer

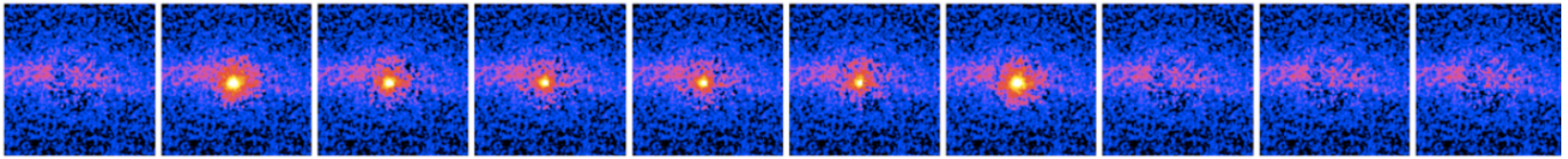
European SKA Regional Centre

- Create a European-scale, federated Regional Centre for the SKA
- Provide resources for SKA science extraction to users
- Coordination with ICT communities, industry, and service providers
- Facilitate shared development, interoperability, and innovation
- European counterpart for engagement with other SRCs internationally



- Image cubes (2 spatial dimensions, plus radio spectral frequency, polarization)
  - Each can be huge, typically minutes-to-hours integrated together
  - High speed image plane searches





- Deep-cube: per 6 hours integration, O(50k x 50k) pixels, 50k channels, 4 polarisations: 5 Petabytes. 1.85 Tbits/s (20 x 100gbit/s links)
- Image plane searching: per 1 second, O(5k x 5k) pixels, 10 channels, 1 polarisation: each cube 25 Gbytes, 200 gbit/s

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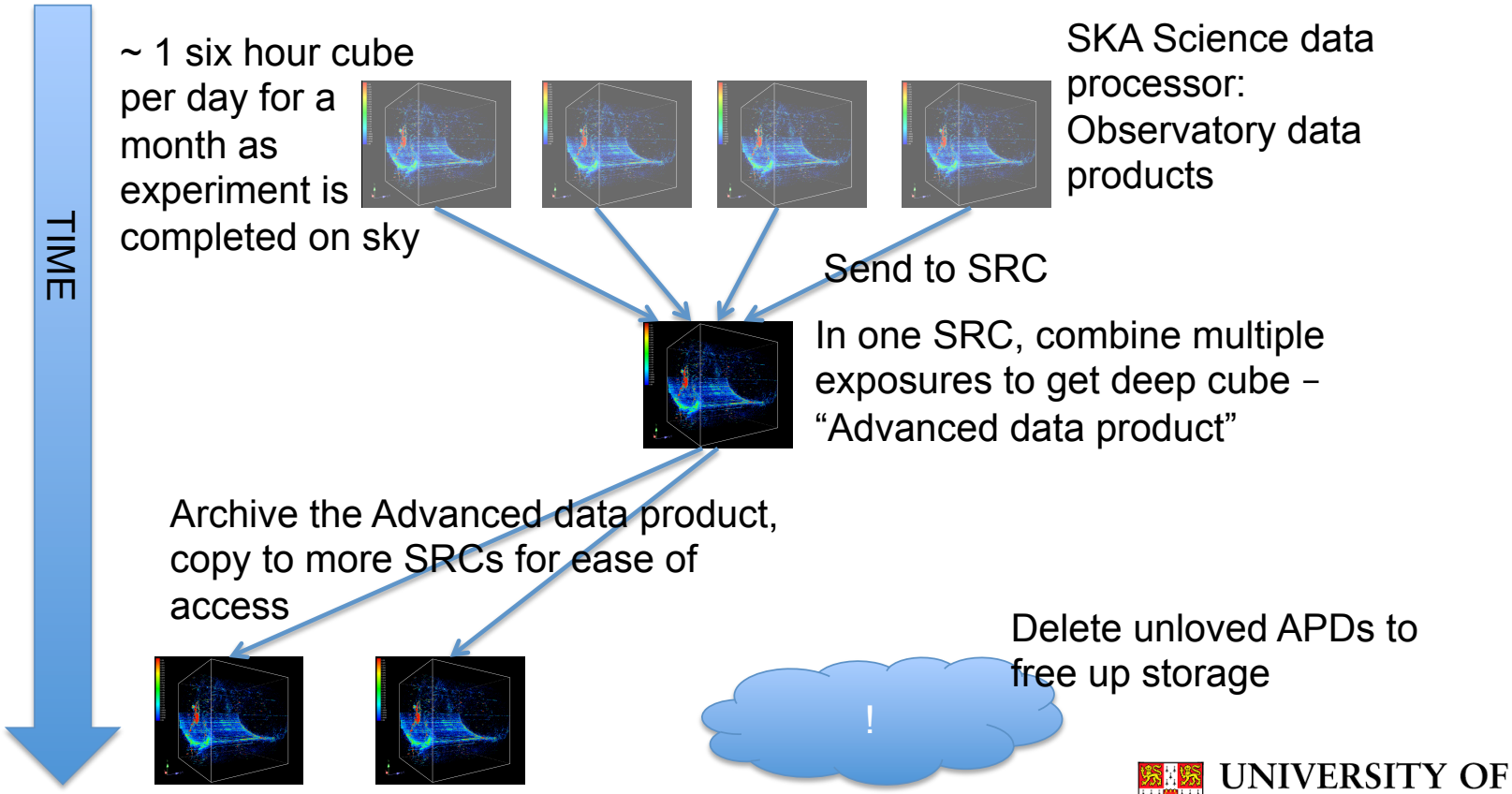
SKA Data



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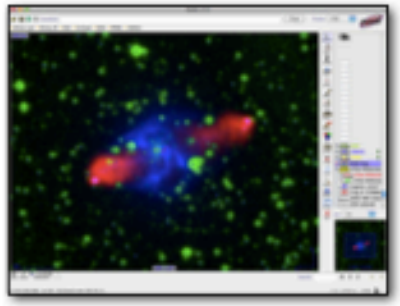
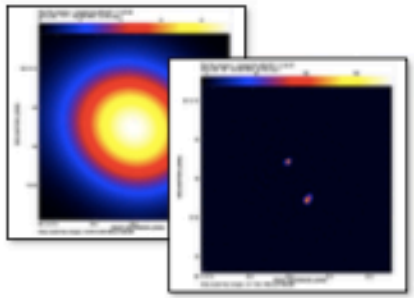
Regional Centre Functionality

Data Discovery

- Observation database
- Quick-look data products
- Flexible catalog queries
- Integration with VO tools
- Publish data to VO



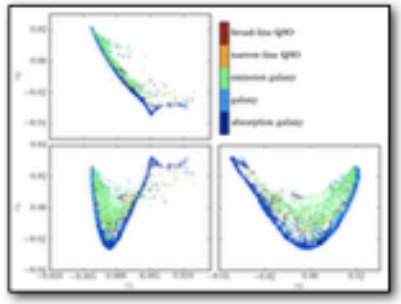
Data Processing



- Reprocessing
- Calibration and imaging
- Source extraction
- Catalog (re-)creation
- DM searches

Data Mining

- Multi-wavelength studies
- Catalog cross-matching
- Transient classification
- Feature detection
- Visualization



SRC features

- The mode of operation for SKA, LSST, EUCLID will be different to previous Astronomy, where astronomer queries an archive and gets results back to their home to analyse.
- Queries will have huge output - you wont shift results back to Astronomer – and they probably wouldnt have compute capacity
- So query has to be analysed at SRC
- SRCs will have to have very high performance Data Bases close to compute power.
- Compute likely to be cloud (lots of talk of OpenStack at present)
- Maybe DBs will be virtualised ? this is not known yet

Boundary Conditions

- SKA Regional Centres must adhere to the data policies as defined by SKA
- SRCs must meet minimum requirements to join the network
- An accreditation process for SRCs in the network will be defined by SKAO
- SRCs will be heterogeneous in nature with common, core functionality
- Some SRCs may provide additional or community-specific functionality
- SRCs must support the Key Science Project Teams as well as general users
- Support for regional SRCs will come from the local communities

AENEAS: An SKA Regional Centre for Europe

Anna Scaife
Jodrell Bank Centre for Astrophysics
University of Manchester

CERN-SKA Agreement

- http://skatelescope.org/news/ska-signs-big-data-cooperation-agreement-cern/