# AENEAS: An SKA Regional Centre for Europe

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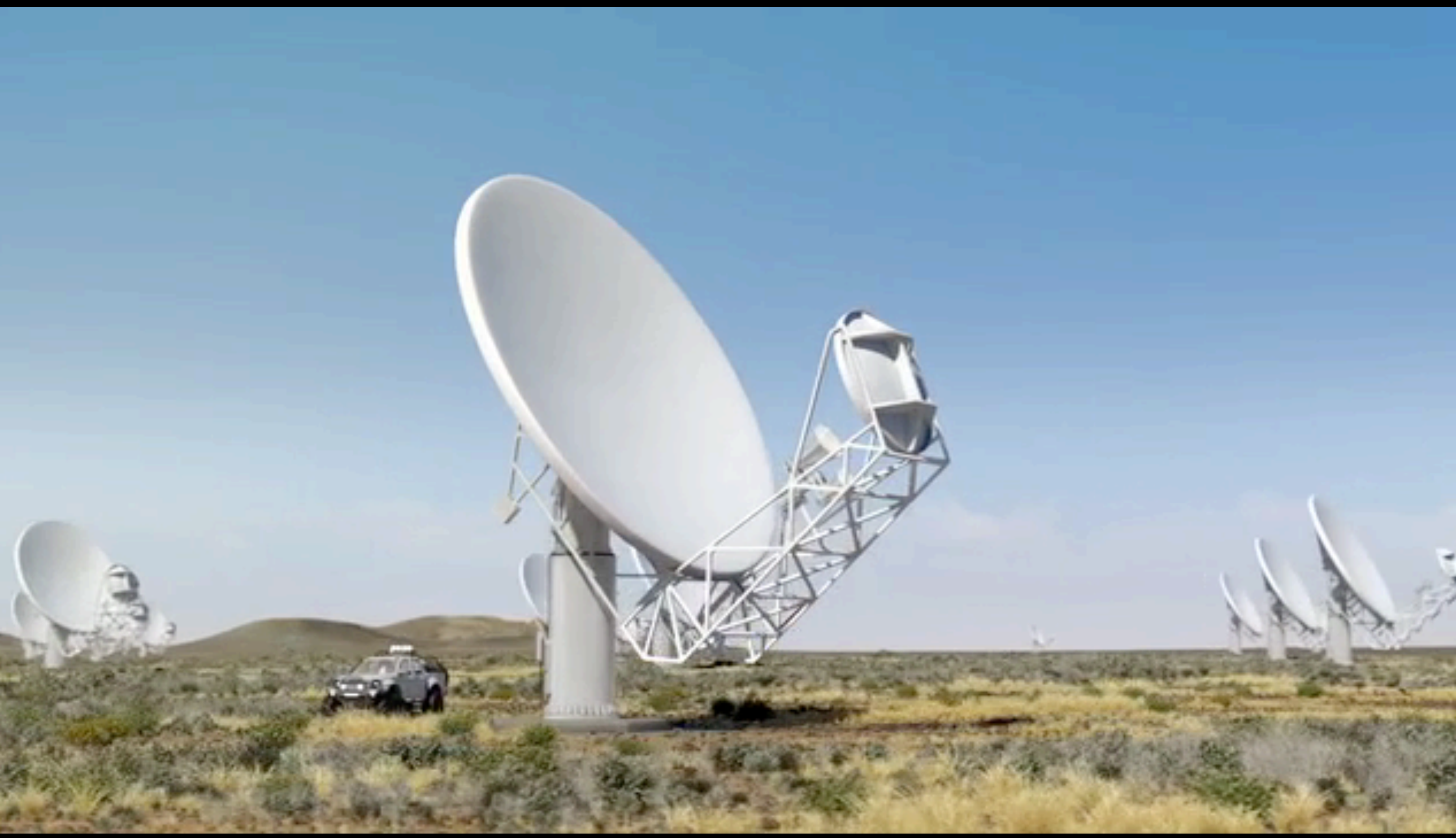
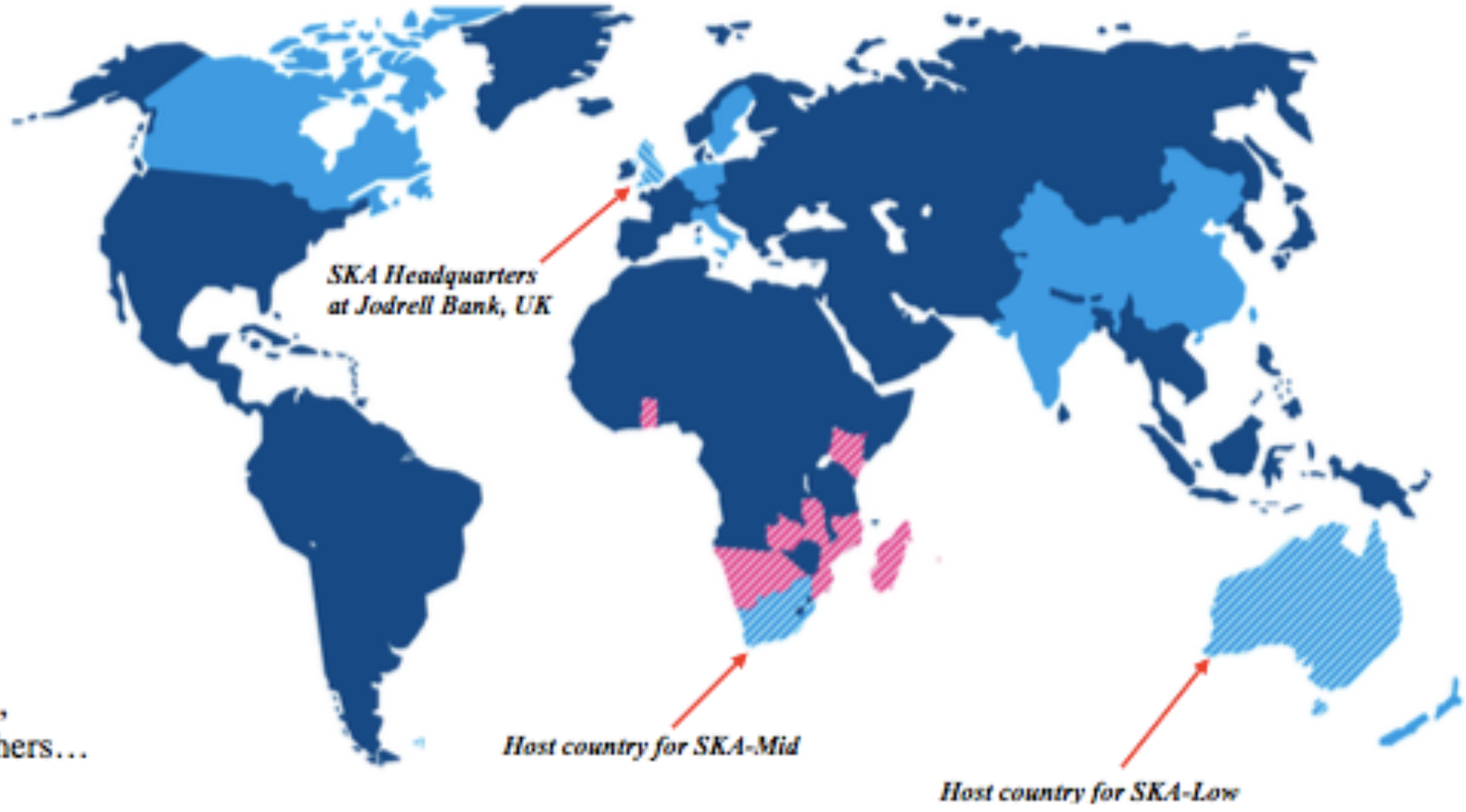
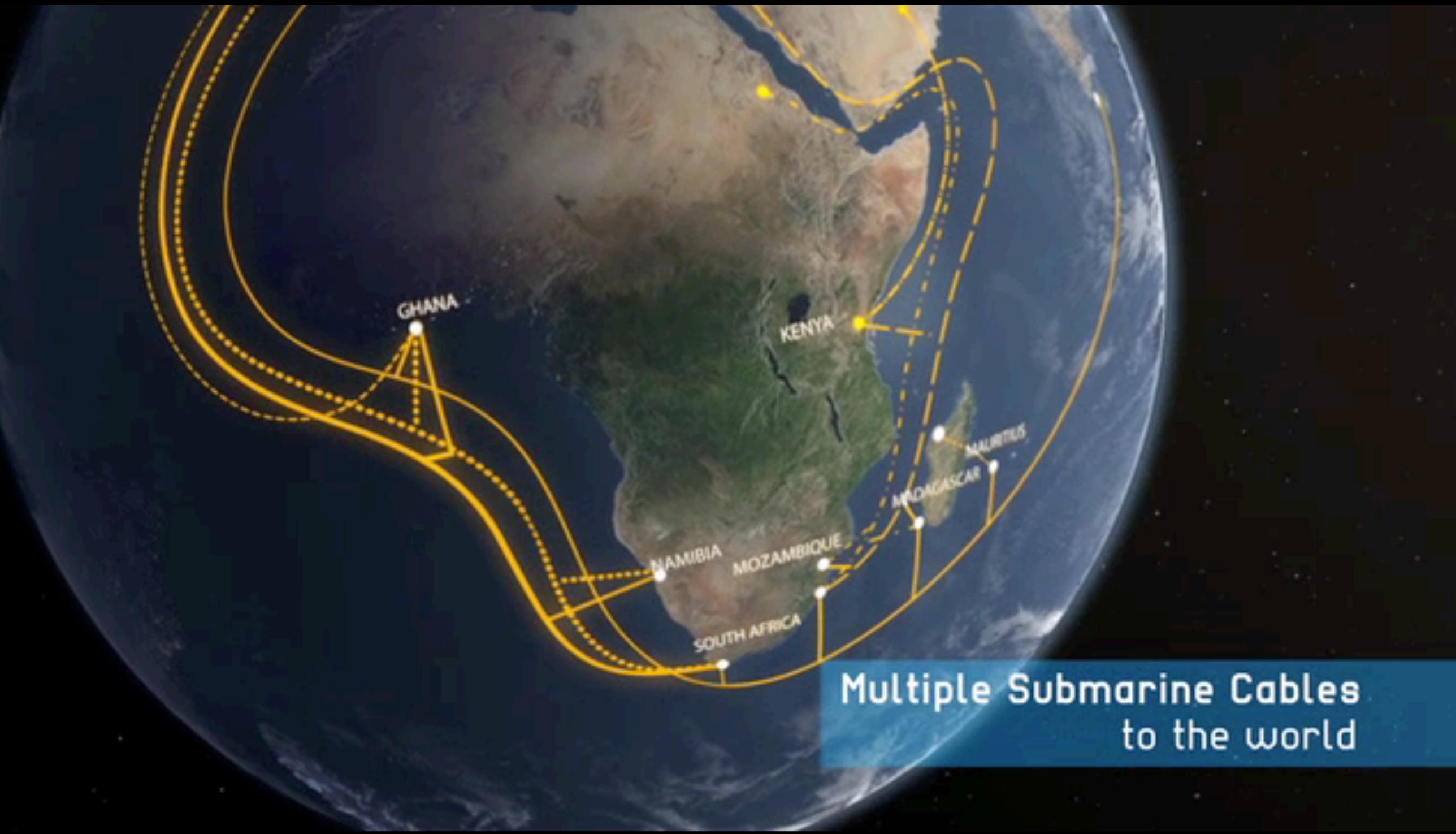


# The Square Kilometre Array

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

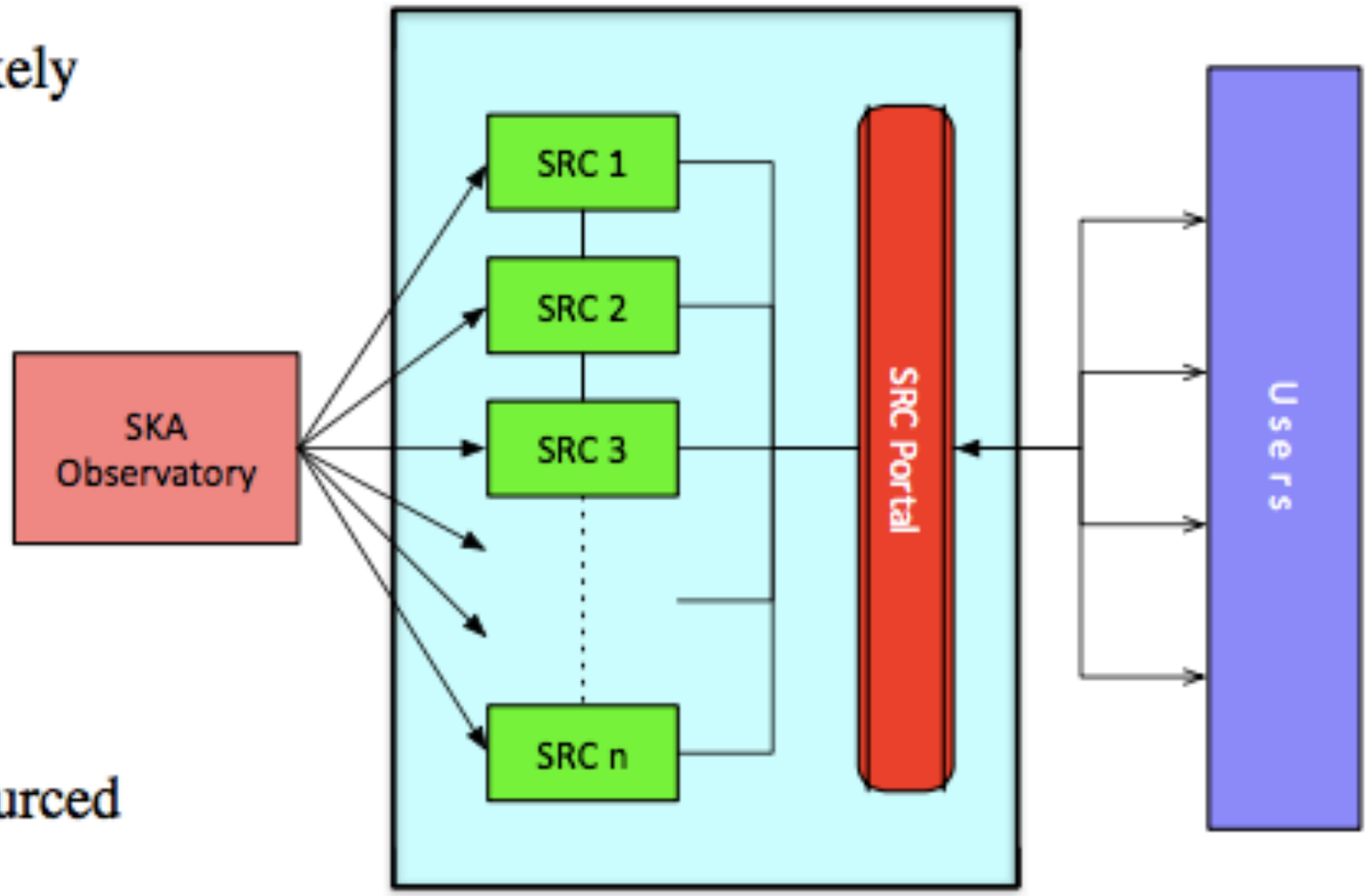
Potential new members: Spain, Portugal, Germany, France, others…

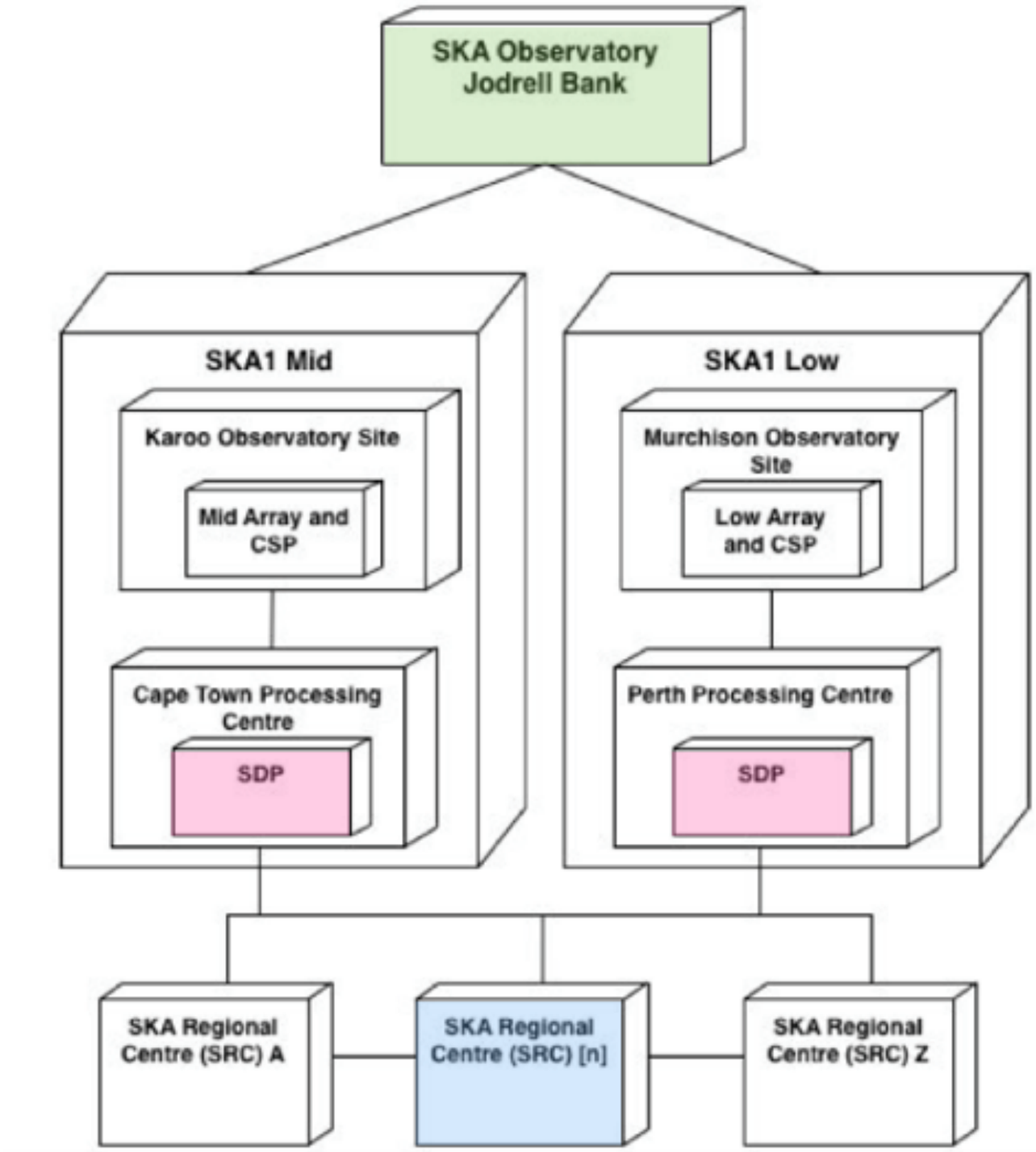



GHANA
KENYA
MAURITIUS
MADAGASCAR
NAMIBIA
MOZAMBIQUE
SOUTH AFRICA
Multiple Submarine Cables
to the world

# 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

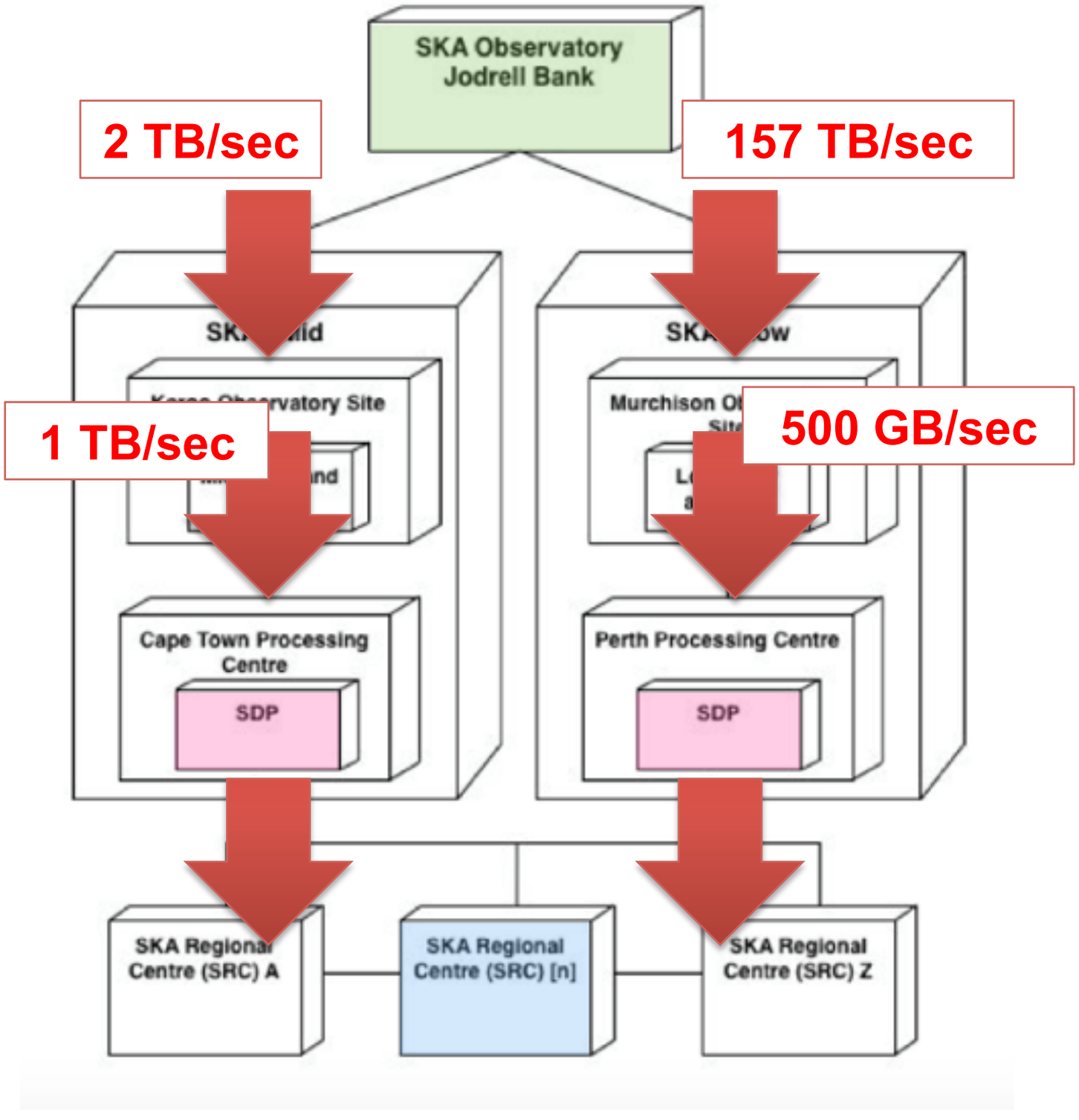





CENTRAL SIGNAL PROCESSING

SCIENCE DATA PROCESSING

REGIONAL DATA CENTRE

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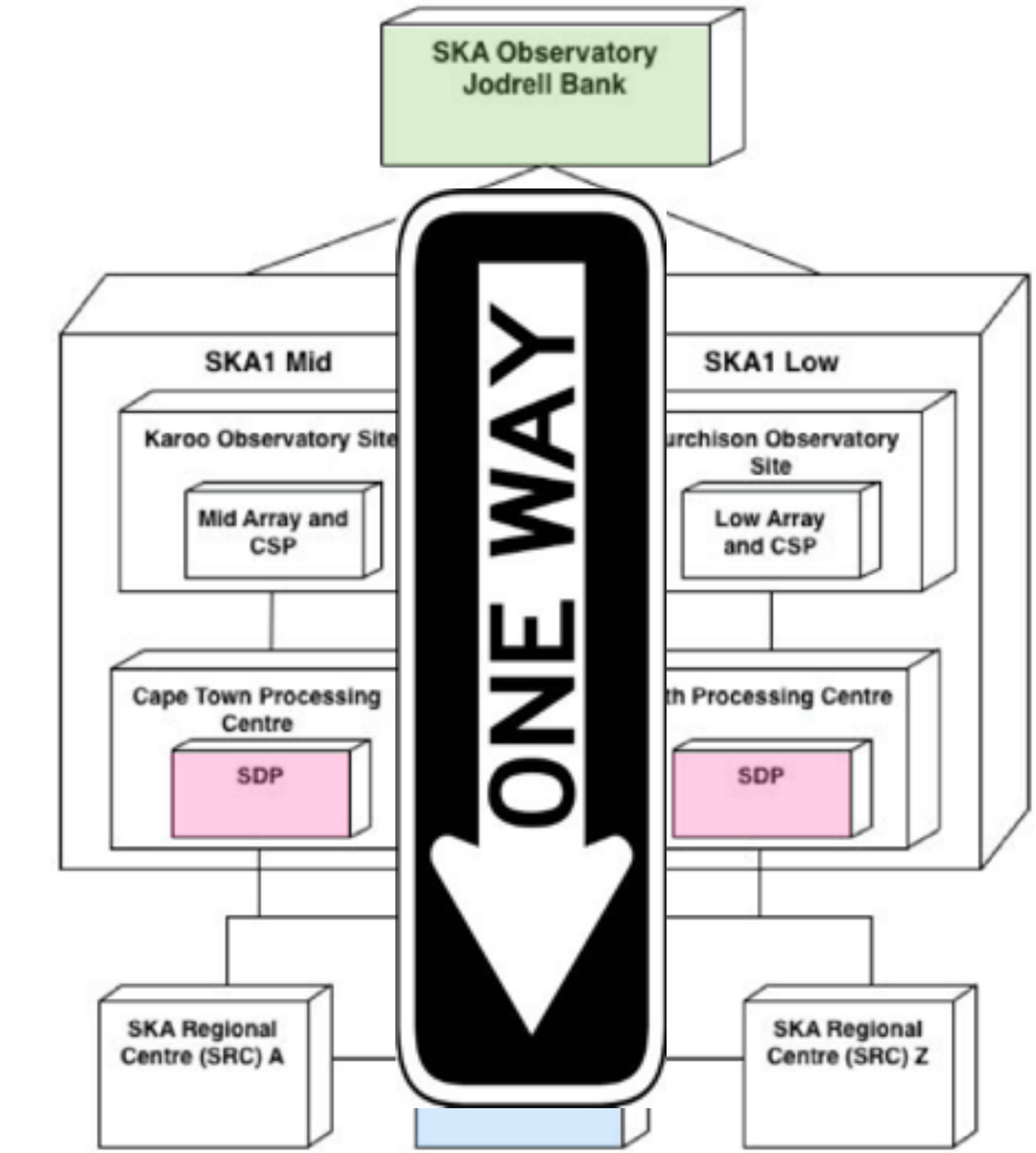



# Standardized data products

A standard SKA1-MID image data product has
**30k x 30k pixels**

SKA1 will have up to **65k frequency channels**
and **4 polarisations**

At 4 Bytes per voxel that equates to
30k x 30k x 65k x 4 x 4
= **936 TeraBytes**

# Future SKA Science Archive

2017
2021

uploads to
facebook
180PB

searches on
Google
98PB

CERN
73PB

LOFAR
Long Term Archive
25PB

YouTube
15PB

SKA
Phase1 Science Archive
300PB

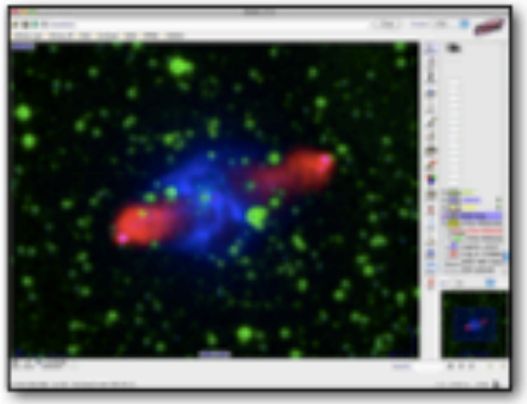
PER YEAR
- 1 Petabyte

# Global Network of Centres

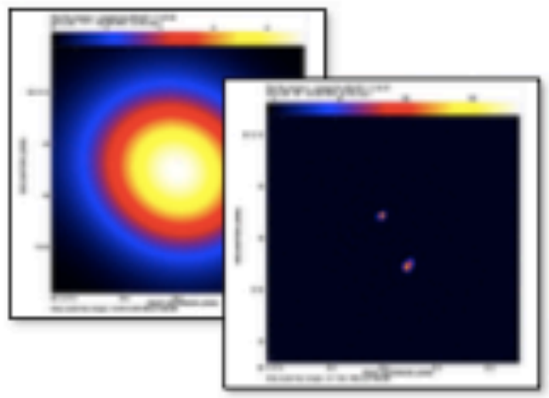
# Regional Centre Functionality

## *Data Discovery*

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



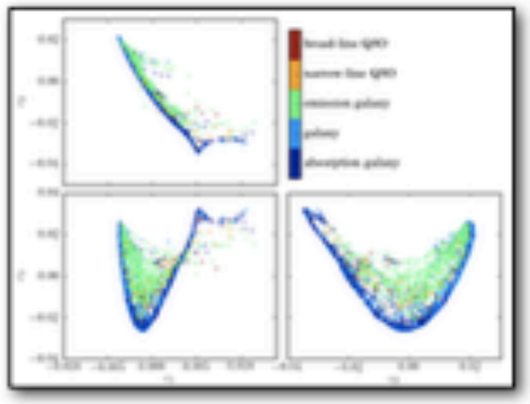
## *Data Processing*



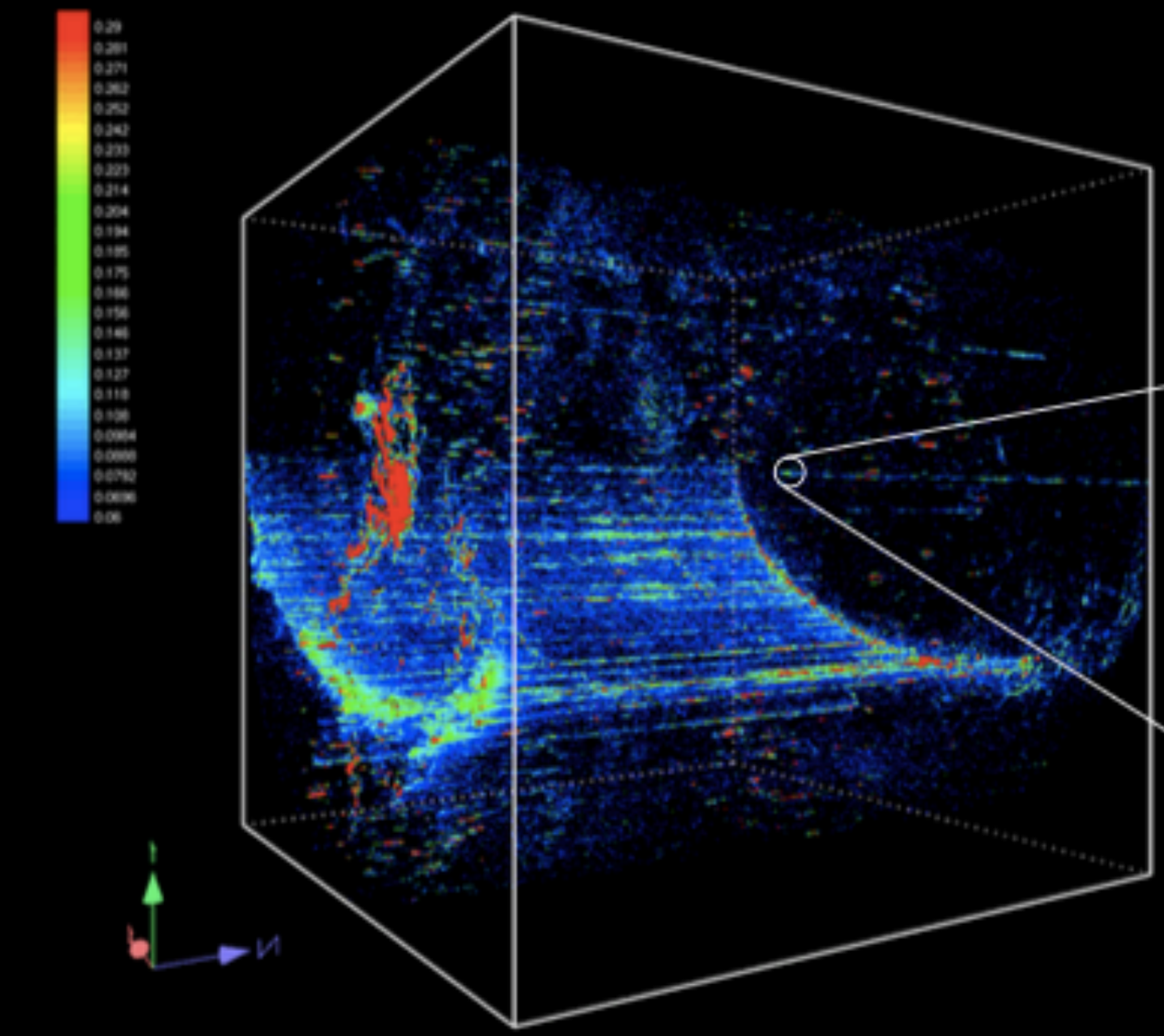
- Reprocessing
- Calibration and imaging
- Source extraction
- Catalog (re-)creation
- DM searches

## *Data Mining*

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

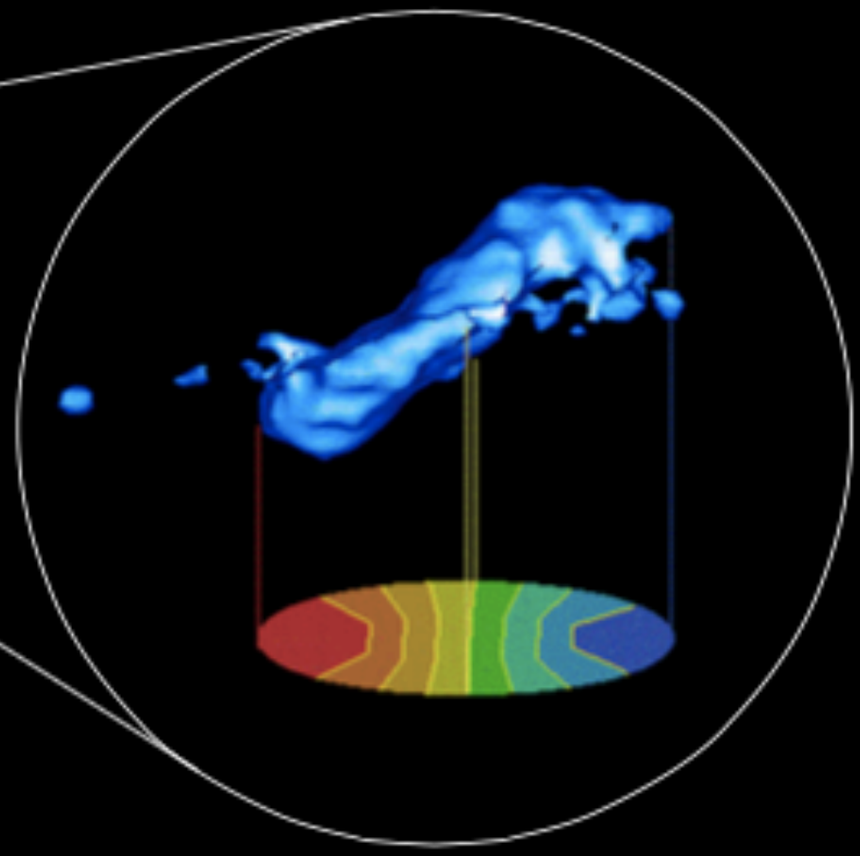


# Visualization, Classification, Inference



*HIPASS HI Cube (Jurek et al. 2010)*

***Automated detection and calculation of galaxy rotation curves in HI surveys***



Advanced European Network of E-infrastructures
for Astronomy with the SKA

***Design and specification of a distributed, European SKA Regional Centre to support the pan-European astronomical community in achieving the scientific goals of the SKA***

***EC Horizon 2020 (€3 million)***

***13 countries, 28 partners, SKAO, host countries, e-infrastructures (EGI, GÉANT, RDA), NREN's***

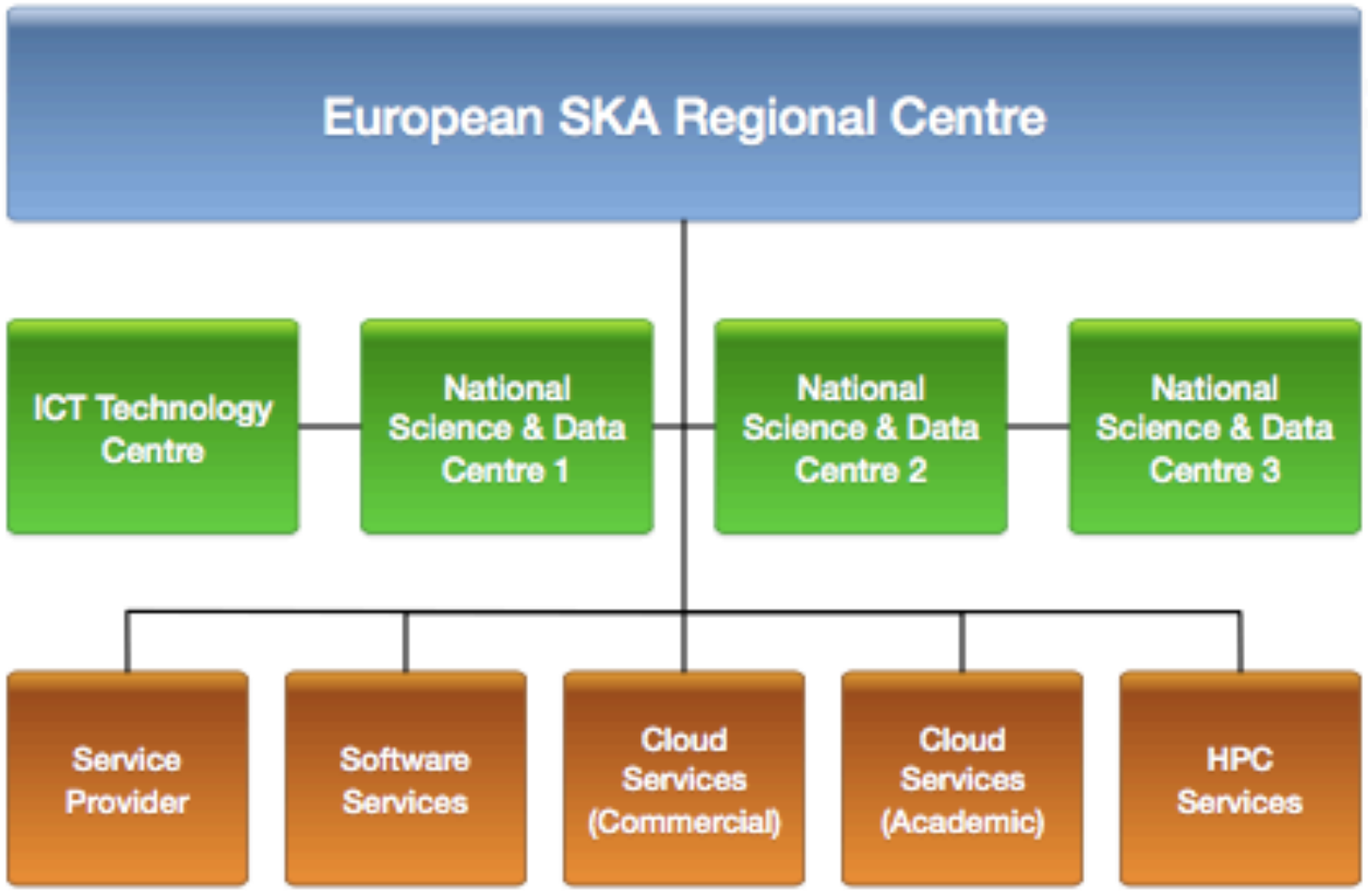
***Three year project (2017-2019)***

- WP1: Project Management
- WP2: Governance Structure and Business Models
- WP3: Computing and Processing Requirements
- WP4: Data Transport and Optimal European Storage Topologies
- WP5: Data Access and Knowledge Creation
- WP6: User Services

*The objective of the AENEAS project is to develop a concept and design for a distributed, federated European Science Data Centre (ESDC) to support the astronomical community in achieving the scientific goals of the Square Kilometre Array (SKA)*

# 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



# Division of Responsibilities

## Essential SRC functions:

- Development and provision of long-term SKA Science Archive
- Provision and management of computational resources for post-processing and analysis
- User support for SKA Science Archive data products and analysis
- Provide platform for continued development of software (pipelines and tools)

## Joint SKAO/SRC functions:

- User support for SKAO data products
- User support for SKAO provided software and tools
- Distribution of SKA data packs to users (potentially SDP or SRC)

# 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

# Open Questions

Where will the SKA science archive data be hosted?

How will that data be transported from the sites to Europe?

How can we take optimal advantage of existing infrastructure?

What are the processing requirements and technologies to consider?

What interfaces, tools, and techniques will users need for analysis?

How do we setup and operate an international network of SRCs?