

ASTRON

Netherlands Institute for Radio Astronomy

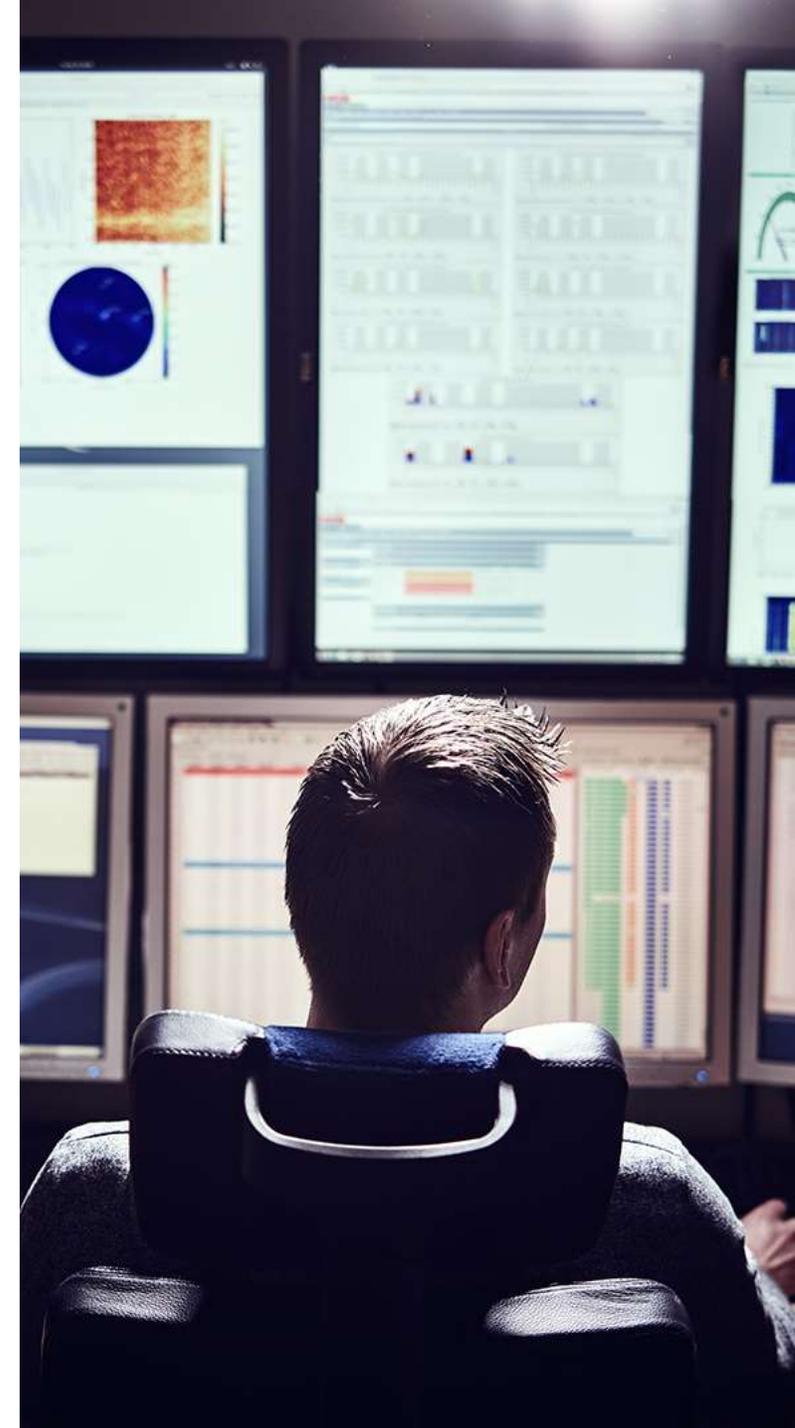
The ASTRON Science Data Centre

Yan Grange, Zheng Meyer-Zhao, Michiel van Haarlem

NL-RSE19

ASTRON

Netherlands Institute for Radio Astronomy



Radio astronomy – instruments



DRT (1956)

(opened by the Dutch queen)



WSRT (1970)

(opened by the Dutch queen)



LOFAR (2010)

(opened by the Dutch queen)

Metal



Software



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LOFAR

LOFAR



- 38 Dutch stations (144 antennas each)
- 13 International stations (192 antennas each)
- (2 more coming; Latvia and Italy)



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LOFAR

Challenges for LOFAR



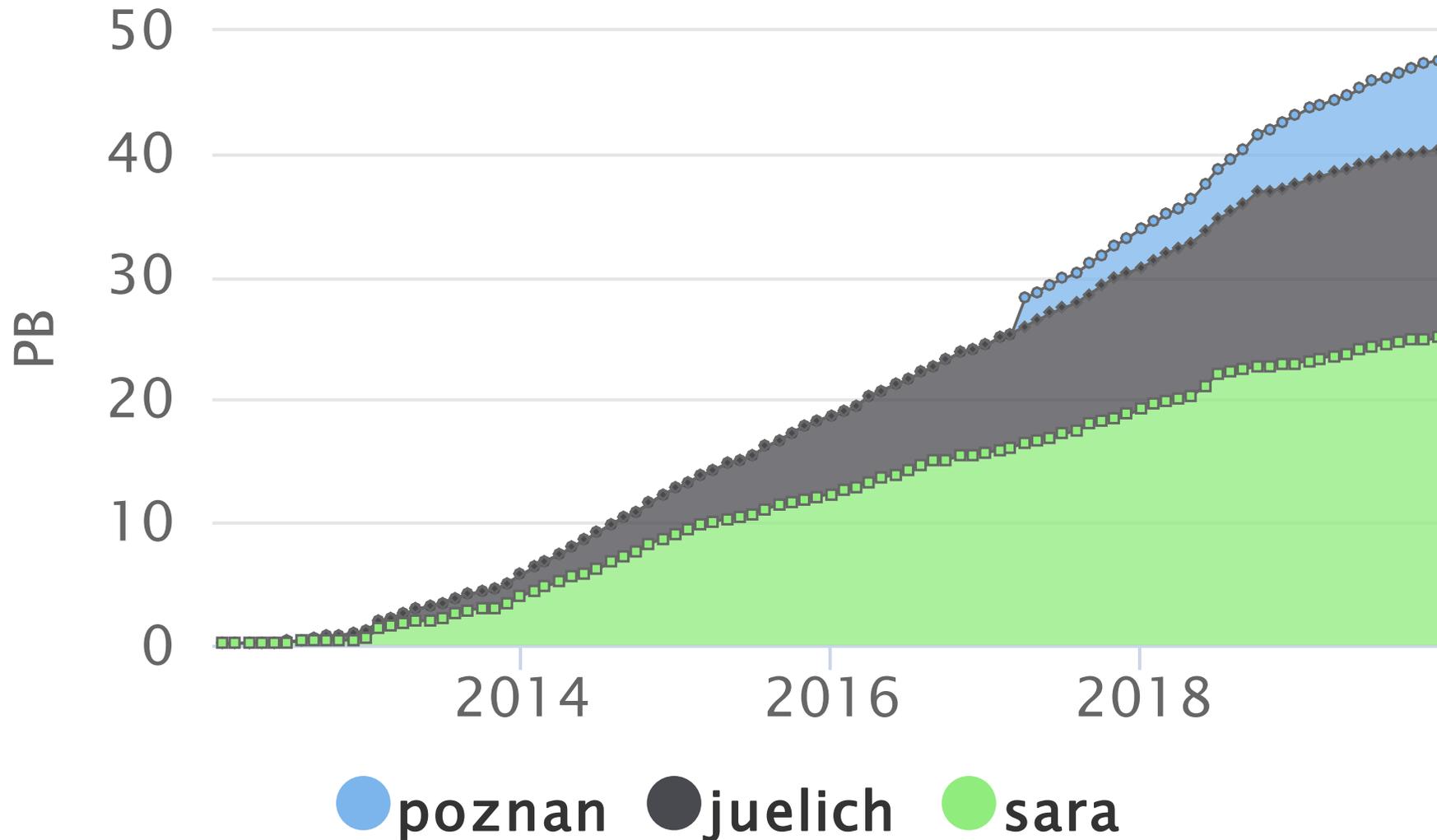
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LOFAR

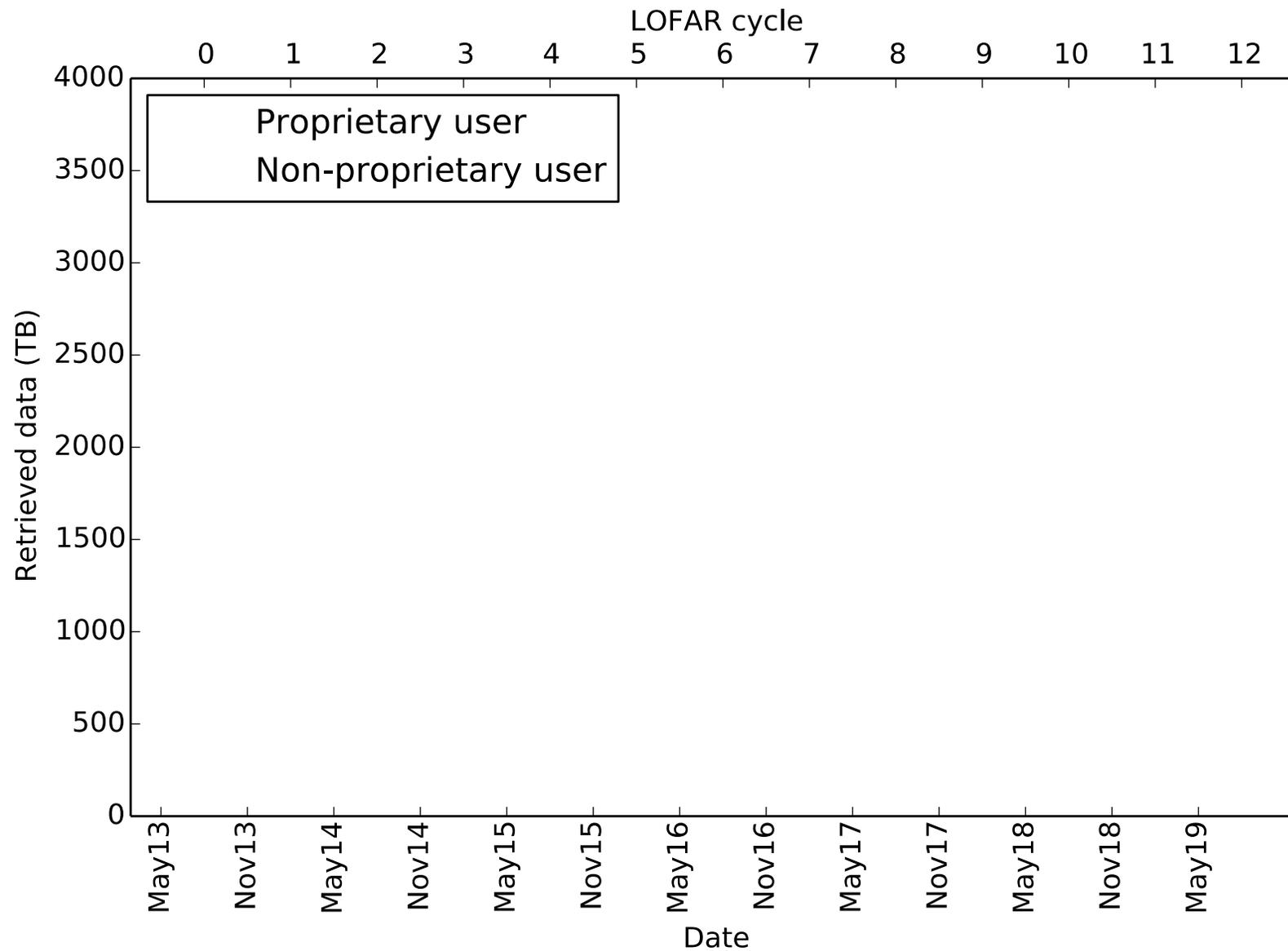
Challenges for LOFAR (apart from nature)

LTA Storage Site Usage Trend



● poznan ● juelich ● sara





Factor > **10** between PI and non-PI downloads



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LOFAR

The Square Kilometre Array (SKA)

SKA1-mid - the SKA's mid-frequency instrument



Frequency range:
350 MHz to
14 GHz



~200 dishes
(including 54 MeerKAT dishes)

Total collecting area:
33,000m²



Maximum distance between stations:
150km

SKA1-low - the SKA's low-frequency instrument



Frequency range:
50 MHz to
350 MHz



~130,000
antennas spread between
500 stations

Total collecting area:
0.4km²



Maximum distance between stations:
>65km

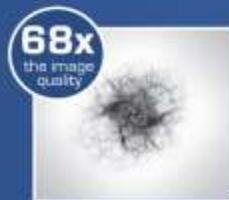
How SKA1-low compares with the LOw Frequency ARray (LOFAR), the current best similar instrument in the world

SKA1 LOW

418,000m²
~130,000 antennas



25% better resolution
8x more sensitive
135x the survey speed



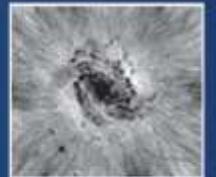
How SKA1-mid compares with the Jansky Very Large Array (JVLA), the current best similar instrument in the world.

SKA1 MID

33,000m²
~200 dishes



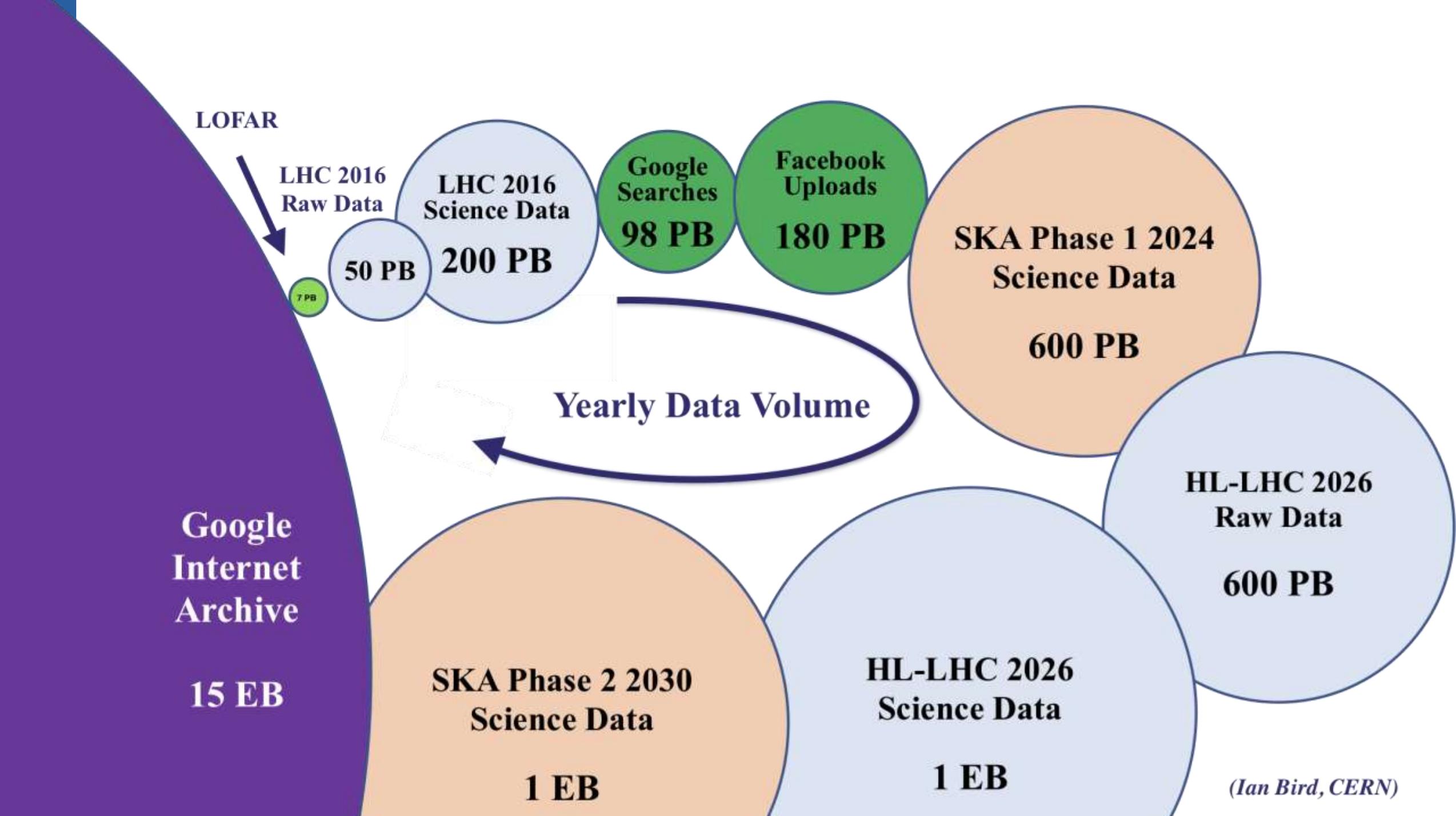
4x the resolution
5x more sensitive
60x the survey speed



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LOFAR



LOFAR

LHC 2016
Raw Data

7 PB
50 PB

LHC 2016
Science Data
200 PB

Google
Searches
98 PB

Facebook
Uploads
180 PB

SKA Phase 1 2024
Science Data
600 PB

HL-LHC 2026
Raw Data
600 PB

SKA Phase 2 2030
Science Data
1 EB

HL-LHC 2026
Science Data
1 EB

Google
Internet
Archive

15 EB

Yearly Data Volume

(Ian Bird, CERN)

Processing radio data



?



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LOFAR

Challenges for modern radio astronomy

- Software is hard to obtain and install
- Data is too large to process on own system
 - Users need to be helped
- Astronomers (think they are) tech-savvy
 - This is a Good thing! (but also very hacky user code)
 - Higher threshold
- Published data sets are hard to find and obtain
- Data formats are specific to radio astronomy
- Astronomers do not like throwing away (raw) data



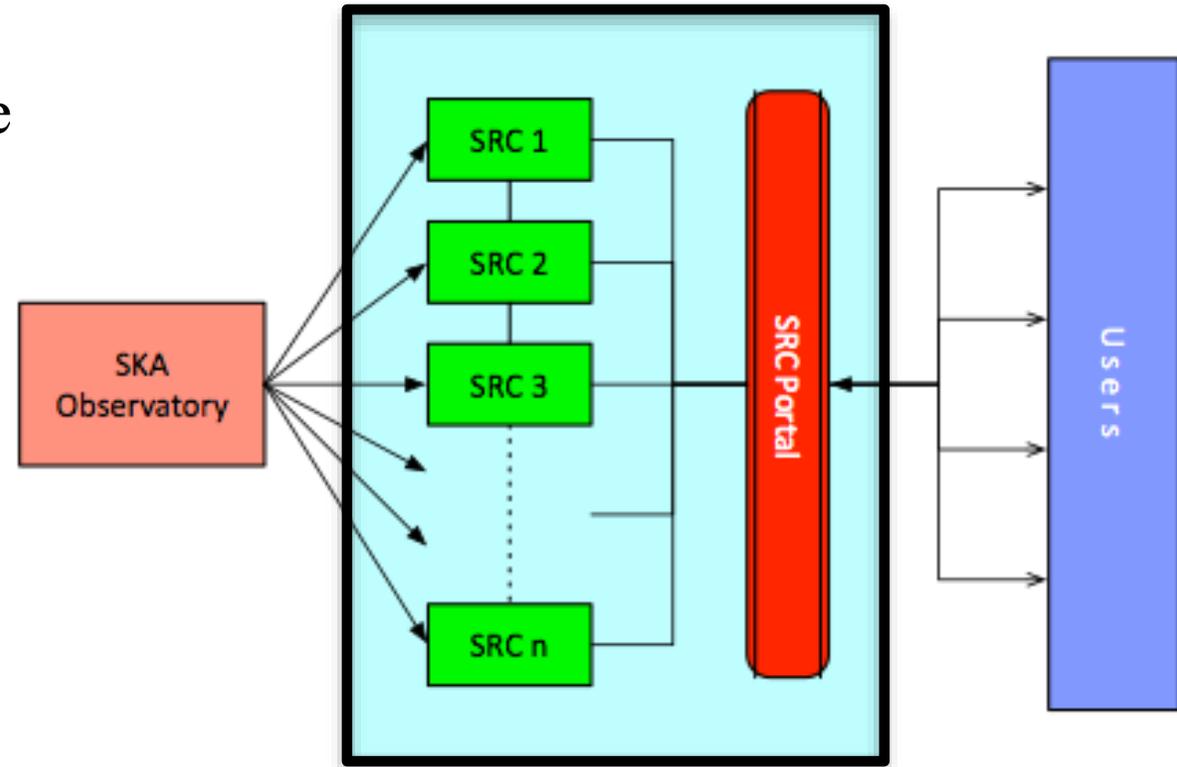
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LOFAR

SKA Regional Centres (SRCs)

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



Primary interface for SKA data analysis

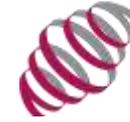
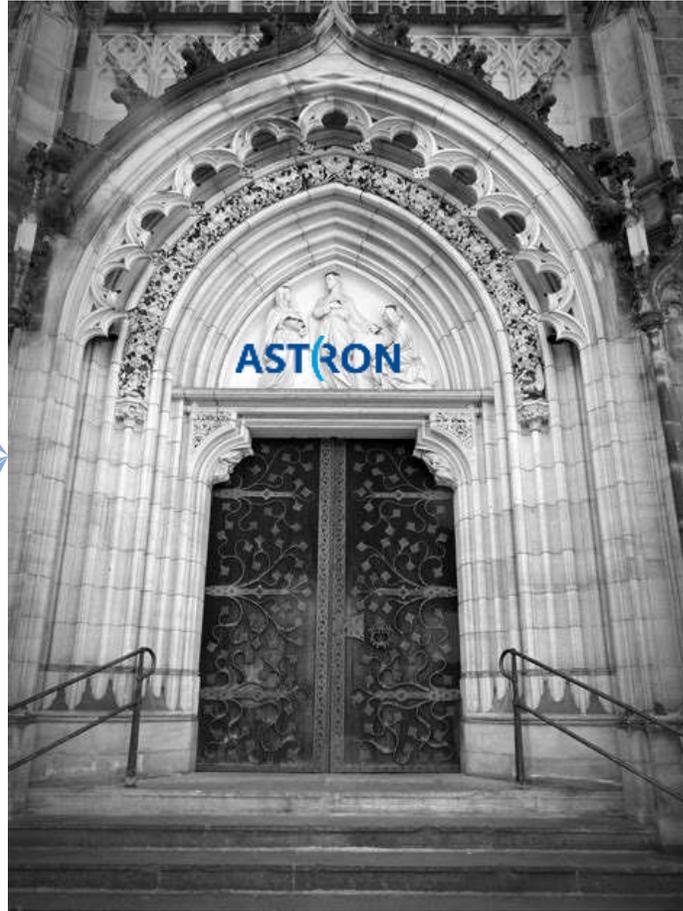
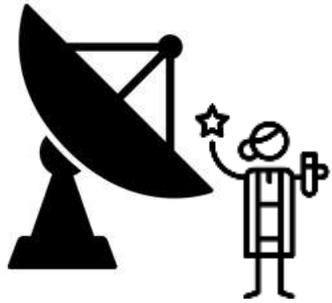


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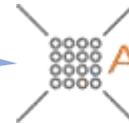


LOFAR

ASTRON Science Data Centre (SDC)



LOFAR



APERTIF

APERture Tile In Focus



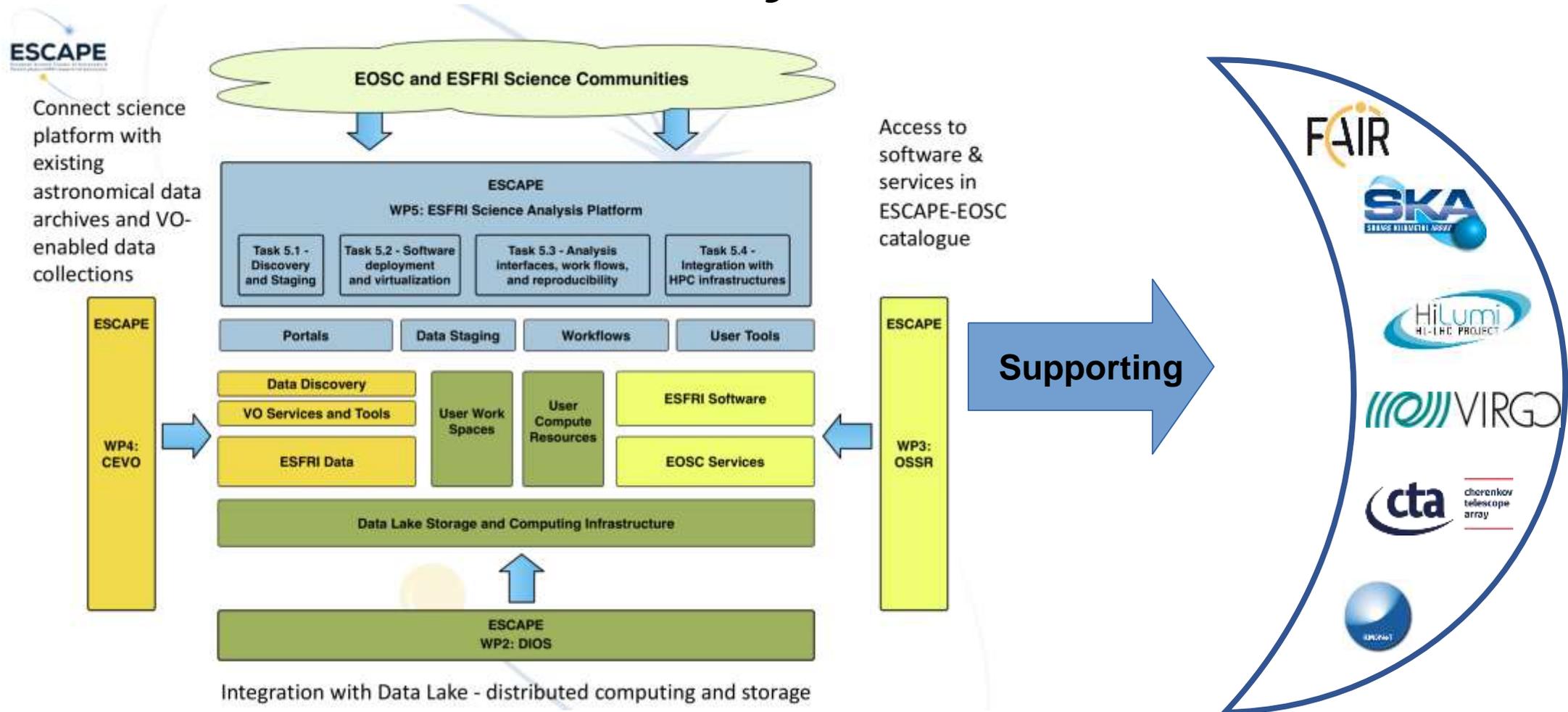
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ESCAPE Science Analysis Platform

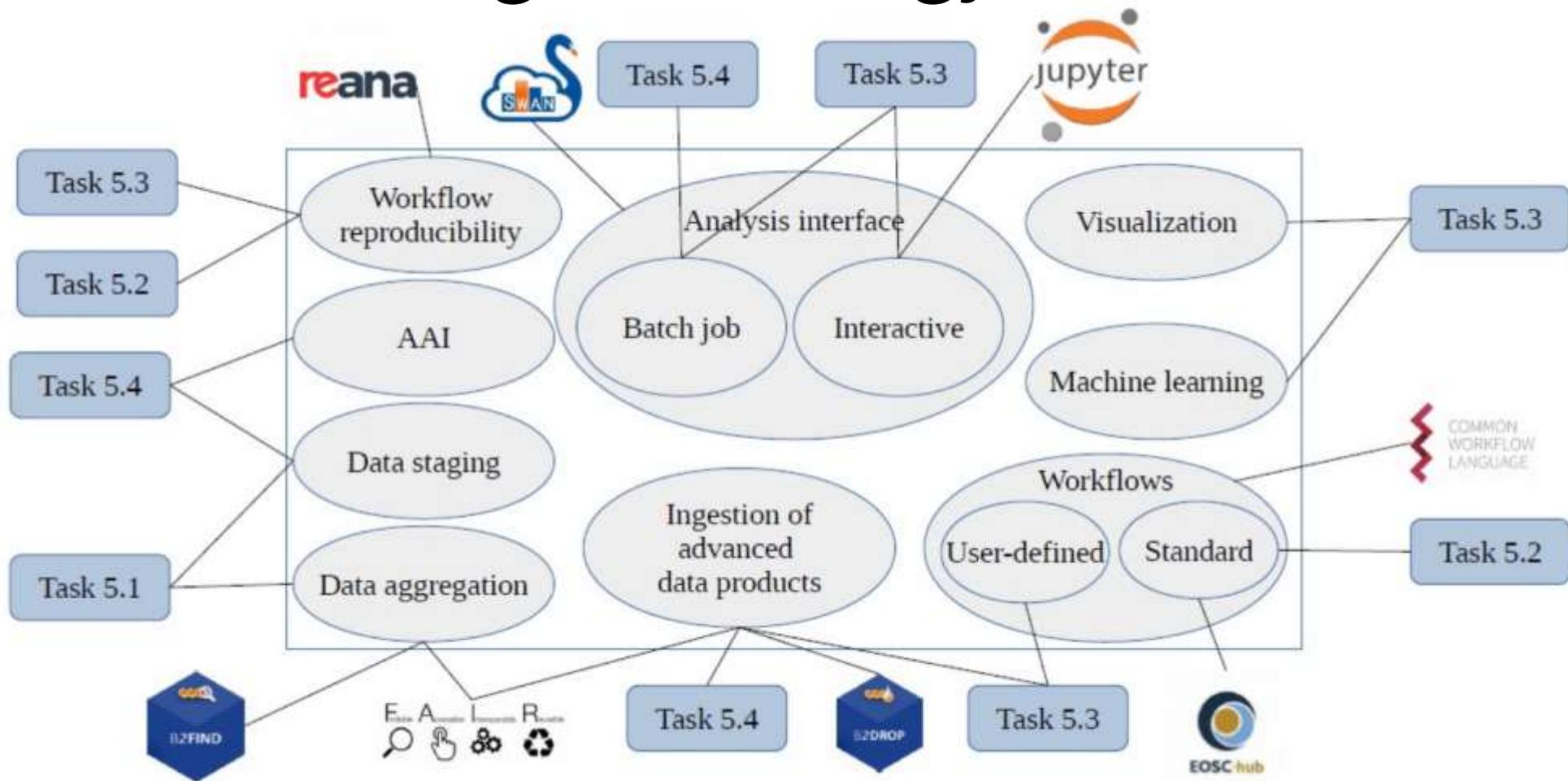


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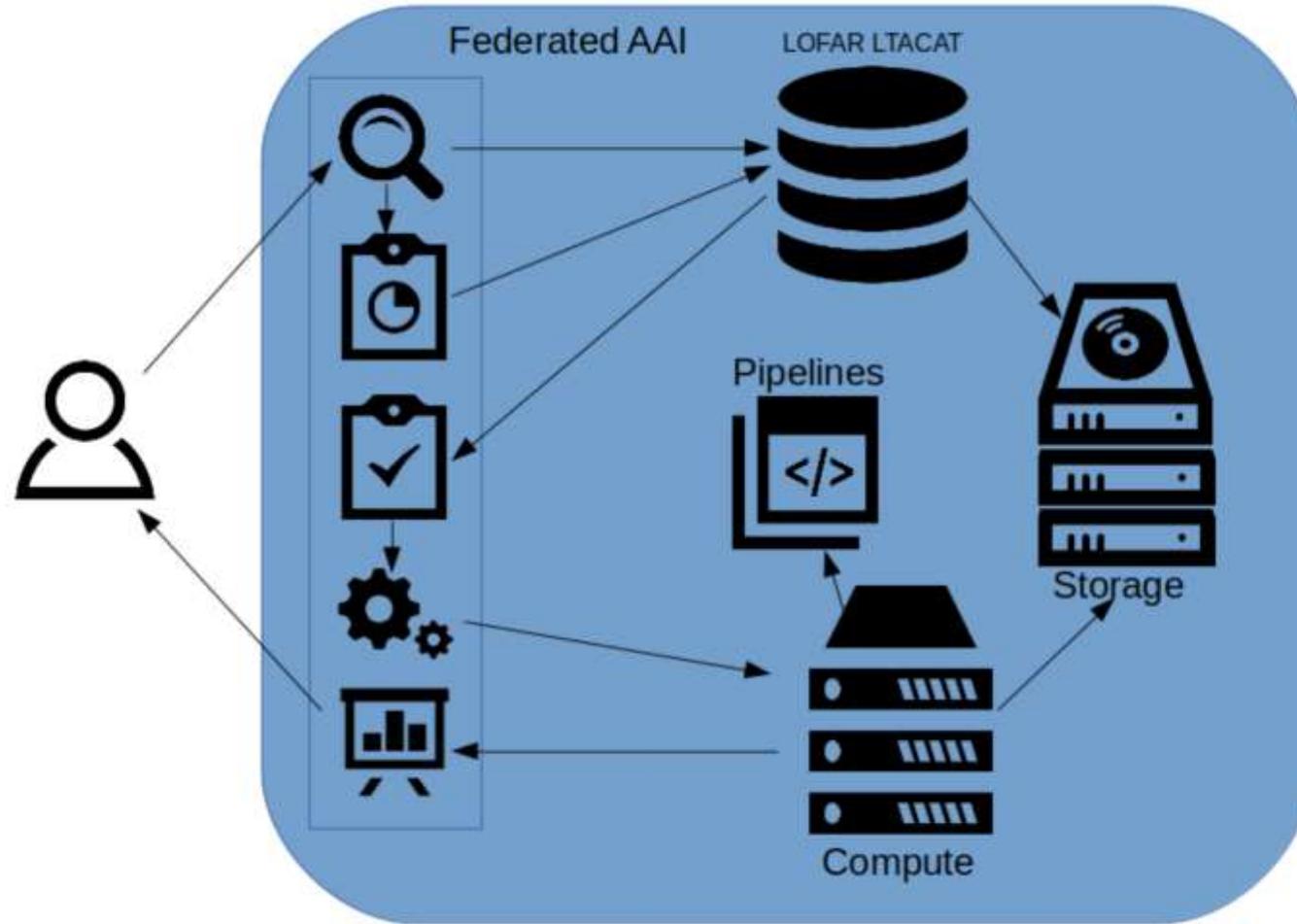


LOFAR

Links to existing technology



“Minimal Viable Product”



Questions



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