Obelics WP 3.2 D-GEX LOFAR status

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Obelics F2F Madrid, 14 September 2016
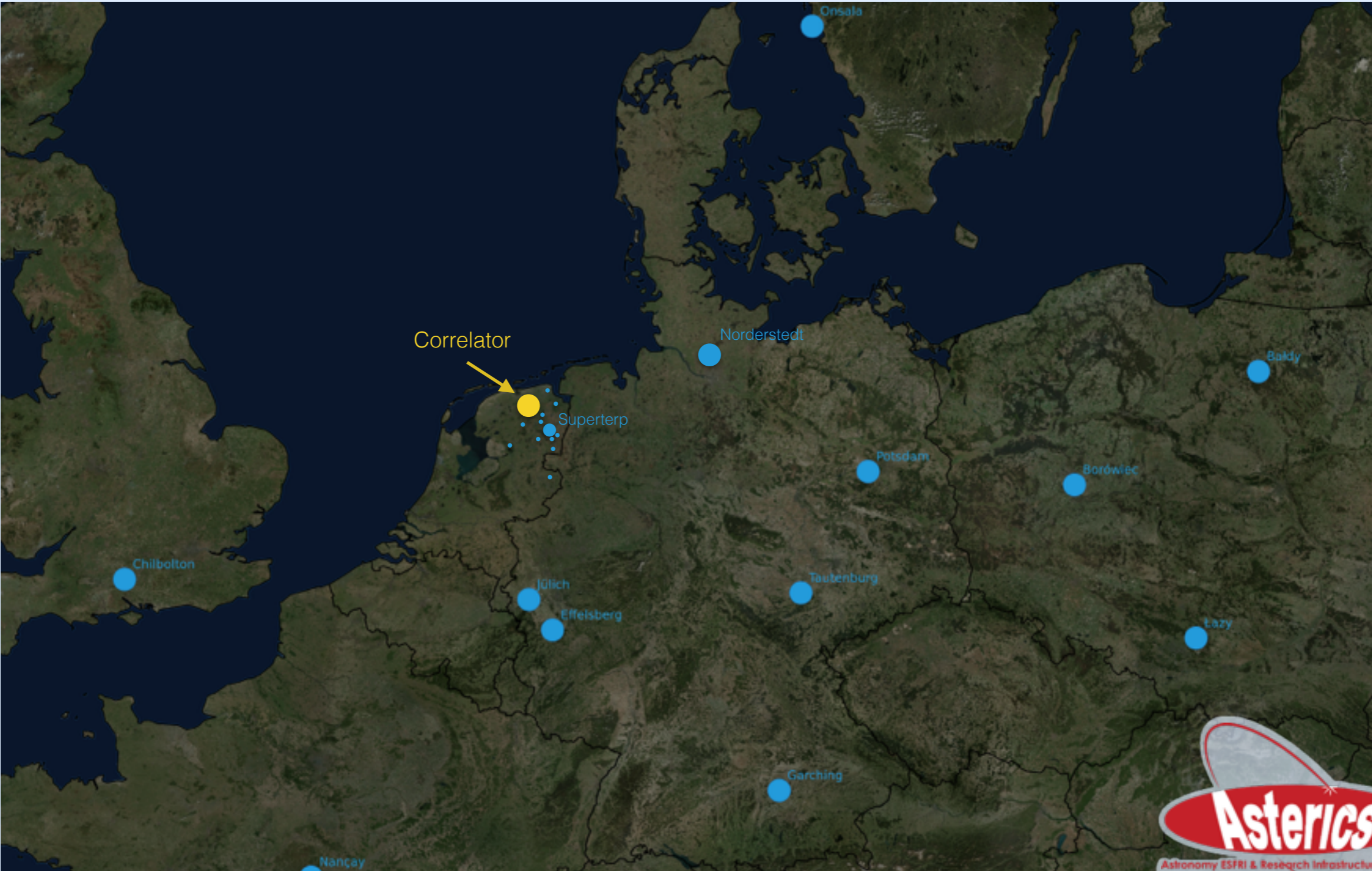
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ASTERICS
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Astronomy ESFRI & Research Infrastructure Cluster

Outline

- LOFAR overview

- Data formats

- Low power architectures

LOFAR overview

LOFAR online processing

- ~60 stations across Europe
- < 240 Gbit/s connection to central correlator
- Central correlator consists of 8 GPU machines (Kepler K10)
- To online storage system < 80 Gbit/s
- Semi-online processing cluster
  - For online flagging, calibration, averaging
  - 2.2 PB temp. storage
  - 50 CPU, 4 GPU machines
  - Distributed file system (Lustre)
- Long Term Archive (LTA) in the grid
  - Jülich, Amsterdam, Groningen, Poznan

LOFAR offline processing

- Calibration

  - Model fitting, solve for instrument, ionosphere, …

  - StefCal[1], Sagecal[2] and extensions

- Imaging

  - Gridding correlated data (visibilities) onto a UV grid

  - FFT + deconvolution + FFT^{-1}

  - Degridding

  - AWImager, WSClean

[1] Salvini, S. and Wijnholds, S. (2014): Fast gain calibration in radio astronomy using alternating direction implicit methods: Analysis and applications. A&A, 571.

[2] Yatawatta, S. et al. (2009): Radio interferometric calibration using the SAGE algorithm,. IEEE 13th Digital Signal Processing Workshop and 5th IEEE Signal Processing Education Workshop, pp. 150, Piscataway, NJ, USA.

LOFAR data format

- Casacore Data Table System (CTDS)[1]
  - Used at e.g. WSRT, LOFAR, ASKAP, JVLA, ALMA
  - Part of casacore[2] and thus CASA
  - Pluggable storage managers
    - Raw storage manager for LOFAR data
    - Tiled storage manager
    - Compressed storage manager

- Metadata stored in Measurement Set
  - Bindings to C++, Python, etc.
  - Table Query Language (a la NoSQL): TaQL

[1] Van Diepen, Casacore Table Data System and its use in the MeasurementSet, Astronomy & Computing, 2015
[2] https://github.com/casacore/casacore

LOFAR Measurement Set
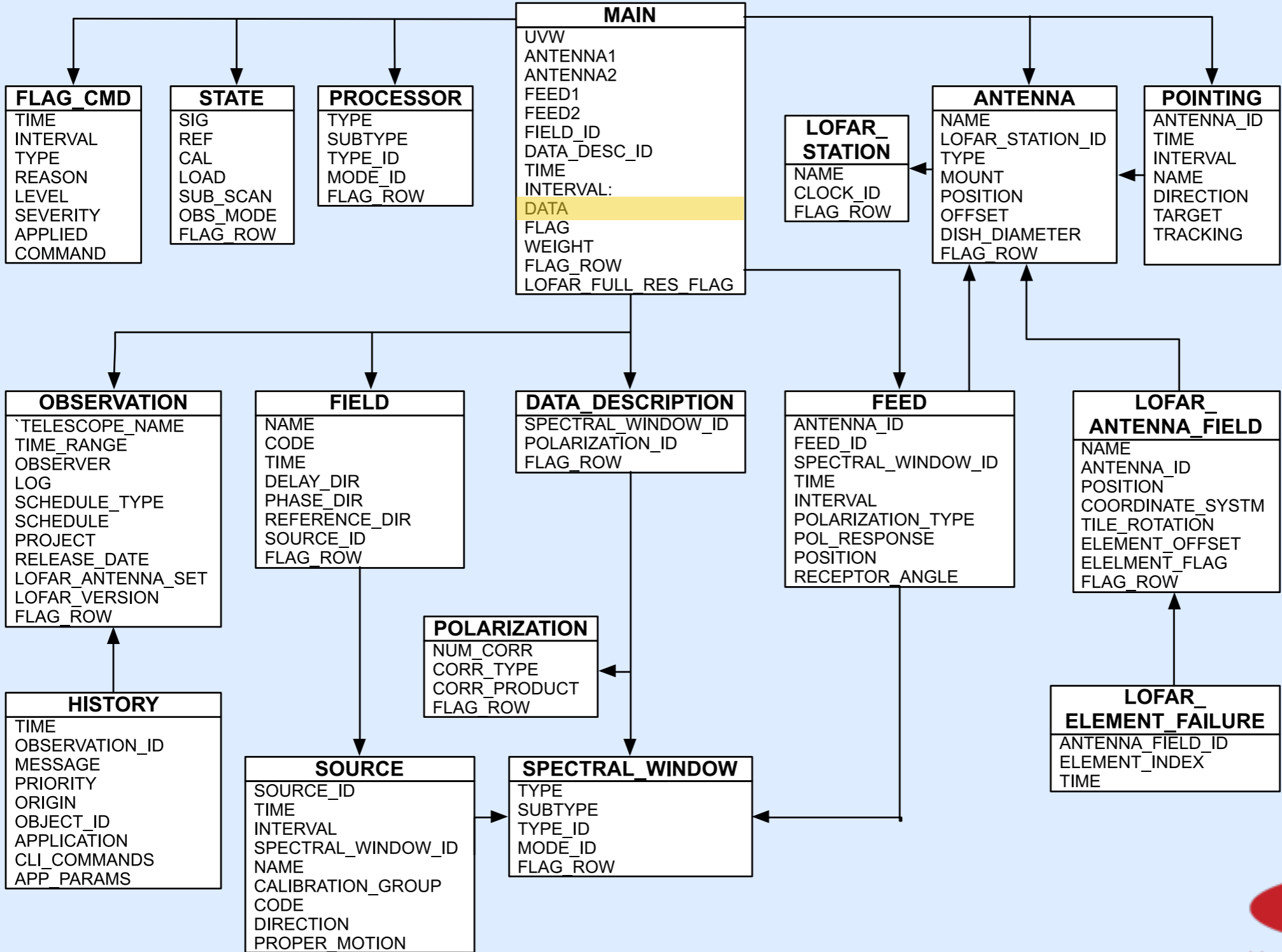
Low power architectures

- Most demanding task in offline processing: (de)gridding
  - Method developed in WP3.4 to map this to GPU
  - "Image domain gridding" (IDG)
  - IDG benchmarked on various GPUs
    - Using DAS5 infrastructure[1]

- ASTRON developed UniBoard2 (FPGA) and codeveloped DOME microserver

[1] Henri Bal et al: "A Medium-Scale Distributed System for Computer Science Research: Infrastructure for the Long Term", IEEE Computer, Vol. 49, No. 5, pp. 54-63, May 2016.

Questions?