



RadioNet3 & SKA

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RadioNet3 Advanced Radio Astronomy in Europe

www.radionet-eu.org

RN3 is an integrating activity that **coordinates all of Europe's leading radio astronomy facilities**

RN3 builds on the success of two preceding Integrating activities under FP6 and FP7

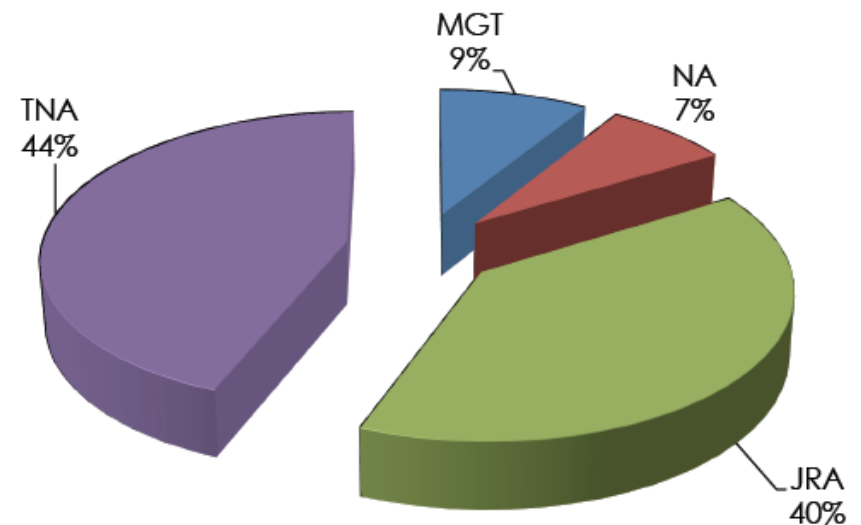
RN3 takes a leap forward as it includes facilitation of research with ALMA via a dedicated NA, and **4 pathfinders for the SKA**

RadioNet3 Advanced Radio Astronomy in Europe

Coordinator: Prof. Anton Zensus
*Director,
Max-Planck-Institut für Radioastronomie*

Duration: 2012 - 2015
Total cost: EUR 11 559 079
EU contribution: EUR 9 500 000

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RadioNet3 Advanced Radio Astronomy in Europe

RN3 is recognized as the European entity representing radio astronomy

This is of paramount importance, as a dedicated, formal European radio astronomy organization to coordinate and serve the needs of this community does not yet exist.

RN3 consists of a consortium of 27 partners



LOFAR



UNIVERSITE D'ORLEANS



JOINT INSTITUTE FOR VLBI IN EUROPE



iram
Institut de Radioastronomie
Millimétrique



Max-Planck-Institut
für Radioastronomie



ASTRON

Netherlands Institute for Radio Astronomy



SRON

Netherlands Institute for Space Research



Fraunhofer



Turun yliopisto
University of Turku

IAF



Universidad
de Alcalá



RadioNet3 Advanced Radio Astronomy in Europe

The general goals of RN3 are:

- provide and facilitate access to the complete range of Europe's outstanding radio-astronomical facilities, including the ALMA telescope and **SKA pathfinders**
- secure a long term perspective on scientific and technical developments in radio astronomy, pooling the skills, resources and expertise that exist within the RN3 partnership
- stimulate new R&D activities for the already existing radio infrastructures in synergy with ALMA and with the **SKA**

Transnational Access

The TNA programme is designed to stimulate the full exploitation of the **open skies policy**

The TNA offers to astronomers access to several radio telescopes and arrays, own and run by European organizations covering an

unprecedented range of wavelengths (from 10 MHz to 1 THz)

and

resolving power (from arcminutes to milli-arcseconds)

Transnational Access

Single-dishes and interferometer arrays:

European VLBI Network

James Clerk Maxwell Telescope

e-MERLIN

Effelsberg 100-m

Low Frequency Array

Westerbork Synthesis Radio Telescope

Plateau de Bure interferometer

Pico Veleta 30-m

Atacama Pathfinder Experiment

Sardinia Radio Telescope

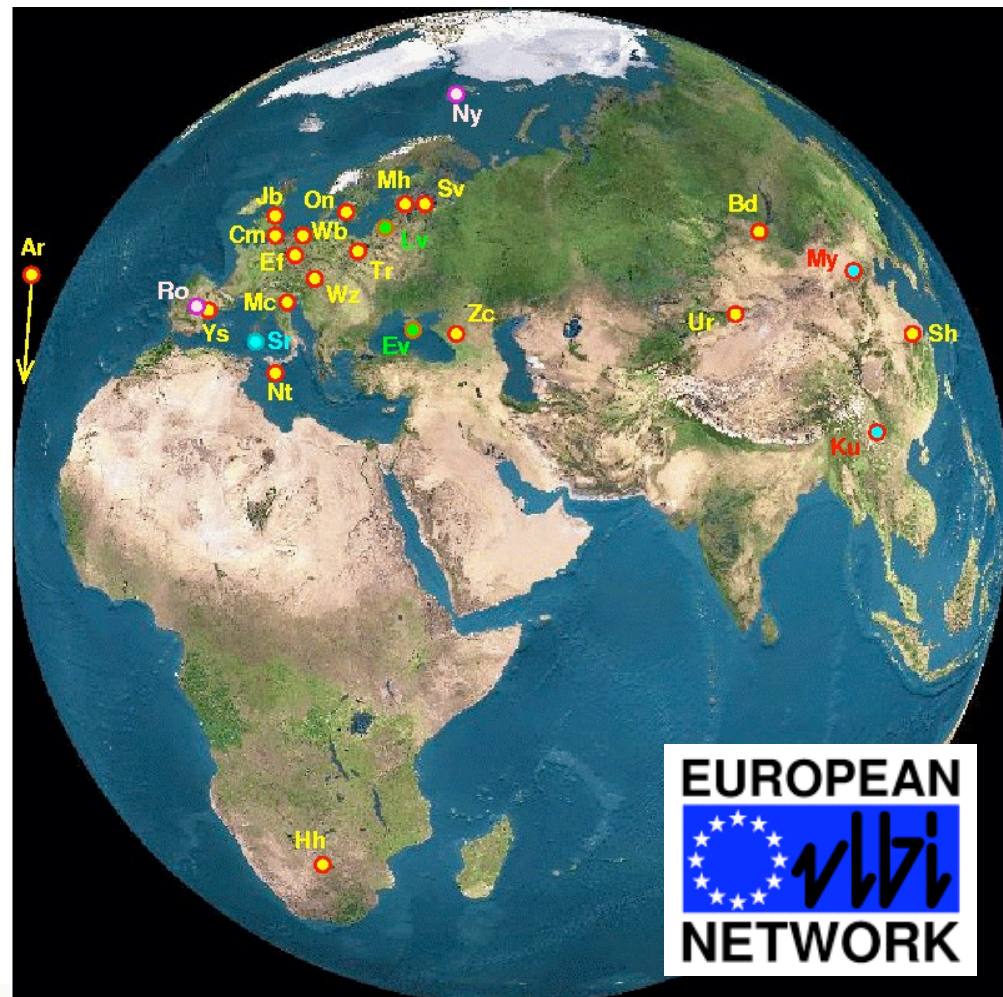
SKA Pathfinders

European VLBI Network

The EVN is a distributed network of **18** radio telescopes

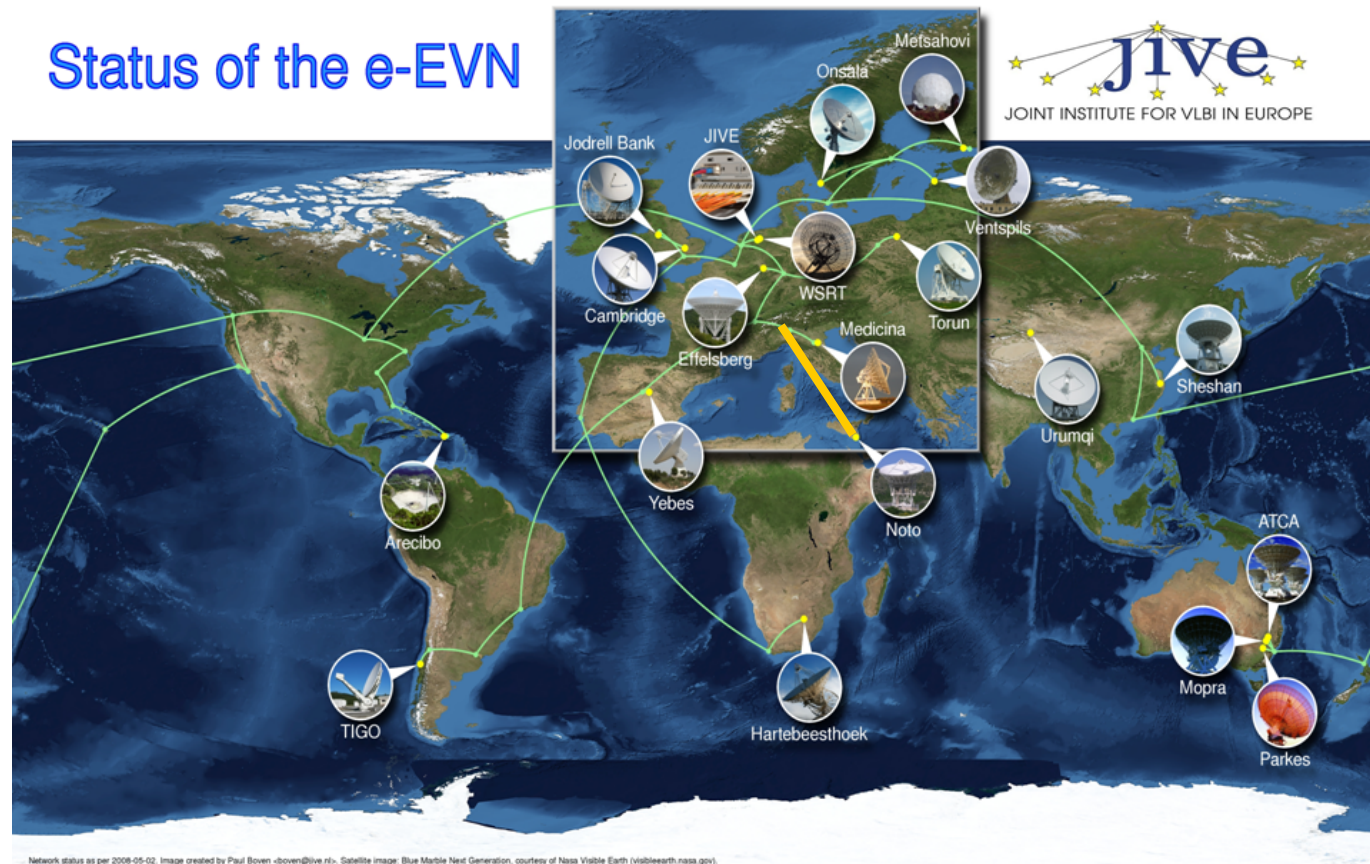
Joint observations with the **UK MERLIN** array and telescopes operated by **NRAO** (U.S.) are made on a regular basis

Signals from each telescope are combined together at a central processing facility at the **Joint Institute for VLBI in Europe (JIVE)** for correlation.



SKA Pathfinderers

Status of the e-EVN



Transnational Access

e-MERLIN

provides radio imaging,
spectroscopy and polarimetry

resolution 10-150 mas

μ Jy sensitivity at centimetre
wavelengths.



SKA Pathfinders

Low Frequency Array

Distributed array of 40 antenna stations operating at 10-240 MHz.

All stations are connected by fibre to the central data processing and archive facilities.



SKA Pathfinders

WSRT

The array has 14 25-m antennas; continuous coverage at decimeter and centimeter wavelengths.

The project **Apertif**: increase of the field of view with a factor 25, placing a *focal-plane array* in the focus of each parabolic dish .



Network Activities

The NAs transform the way science is conducted in Europe

NA's are a forum for discussion, collaboration, and organization of specialized events, and training

This is important with the emergence of new research opportunities through **SKA** and its pathfinder telescopes

Network Activities

- QueSERA** *to better integrate, represent and advertise the radio astronomical facilities and ambitions*
- SWG** central coordination in the dissemination of knowledge and scientific results
- New Skills** to equip astronomers to exploit current and future radio astronomy facilities
- MARCUs** to support user visits to the seven nodes of the EU ARC network for ALMA users
- ERATec** communication, training and scientific interaction between engineers and scientists involved in the development and operation of radio-astronomical instruments
- Spectrum** to keep the radio astronomy frequency bands free of man-made interferences

Network Activities

Science Working Group

central coordination in the dissemination of knowledge and scientific results

“Resolving The Sky - Radio Interferometry: Past, Present and Future”
Manchester 18-20 April 2012

“LOFAR’s view of galaxy clusters”, Nice 14-16 May 2012

“The Italian Pathway to SKA”, Rome 19-20 June 2012

11th EVN Symposium, Bordeaux 9-12 October 2012

LOFAR data analysis week, Leiden 28-31 January 2013

“The Modern Radio Universe”, Bonn TBD

Network Activities

New Skills - to equip astronomers to exploit current and future radio astronomy facilities

Young European Radio Astronomers' Conference
18-21 September 2012, Pushchino Radio Observatory, Russia

Preparing focussed events on SKA Pathfinders - November 2012

YERAC 2013 in South Africa

ERATec communication, training and scientific interaction between engineers and scientists

“The Power Challenges of Mega-Science Infrastructures: the example of SKA”
20-21 June 2012, Moura, Portugal

Joint Research Activities

Support targeted R&D to the facilities in the areas of new digital techniques

Main aims are:

- increase the observing bandwidth, including operation to beyond 1 THz
- increase the field of view of the telescopes (multi-feeds, phased array)

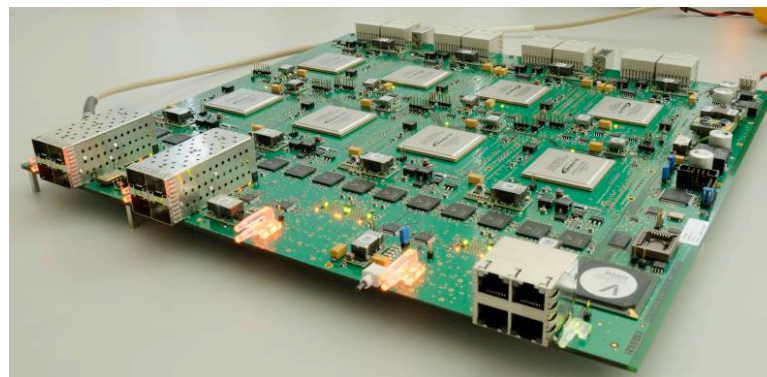
UniBoard2, AETHER, Hilado, DIVA

Some of the developments are specifically relevant towards reaching the ambitious goals that are set for the **SKA**

Joint Research Activities

UniBoard2

- an **FPGA-based**, generic, scalable, high-performance **computing platform** for radio-astronomical applications that will be ready for the next generation of astronomical instruments, notably the **SKA**
- a **digital receiver** application, which converts a wide input bandwidth into a variable number of data streams, which can then be further processed by a **correlator, a spectrometer or pulsar processor**



Joint Research Activities

Hilado optimized **software and demonstrator processing pipelines**

- **imaging pipeline** - to process in a realistic timescale LOFAR data for all 80 km baselines at full FoV, 30MHz bandwidth at the lowest frequencies.
- **fast transient imaging** - currently limited for LOFAR and other RadioNet facilities.

These developments will apply to RN3 **SKA pathfinders** e-Merlin, WSRT and EVN, and to MeerKAT (South Africa) and ASKAP (Australia)

Joint Research Activities

DIVA

- **DBBC** project: full digital sampling of IFs of GHz in the L-band, and to 2-4 GHz in the C-band
- **LNA Monolithic MIC** (MMIC)
- **low-noise cryogenic devices**, which will be designed for existing and upcoming VLBI facilities as well as for the **SKA**



the end

Thanks for your attention

