What is FABRIC?

Future Arrays of Broadband Radio-telescopes on Internet Computing

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EXPreS::FABRIC

- Future Arrays of Broadband Radio-telescopes on Internet Computing
  - JRA (Joint Research Activity), looking at the future of eVLBI
    - R+D project, deliver documents, prototypes, test reports
      - A work-package on 4Gb/s data acquisition and transport
      - A work-package on distributed correlation
  - For a total of 29 man years
    - 14.5 man year contributed by the EC
    - 1253 k€ over 3 years
  - 7 participating institutes:
    - Jodrell Bank, protocols and interfacing to eMERLIN network
    - Metsahovi, next generation data acquisition
    - Onsala, testing high speed connectivity
    - MPI Bonn, integrating with operational VLBI systems
    - ASTRON/LOFAR, interfacing of E-LOFAR
    - JIVE, algorithm and correlator cores software
    - PSNC Poznan, Grid methods and virtual Lab for radio-astronomy

Part 1: Scalable connectivity

- 1.1. Data Acquisition
  - 1.1.1. Data acquisition architecture (MRO)
    - Scalable data acquisition system, off-the-shelf components new version of PC-EVN?
  - 1.1.2. Data acquisition prototype (MRO)
    - Prototype for 4Gb/s?
  - 1.1.3. Data acquisition control (MPI)
    - Control data acquisition, interface for protocol, distributed computing
- 1.2. Broadband Data path
  - 1.2.1. Broadband protocols (JBO)
    - IP protocols, lambda switching, multicasting
  - 1.2.2. Broadband data processor interface (JBO)
    - Data from public network to eMERLIN correlator
  - 1.2.3. Integrate and test (OSO)
    - 10 Gb/s test environment for OSO-eMERLIN (and LOFAR?)
  - 1.2.4. Public to dedicated interface (ASTRON)
    - LOFAR transport over public network, LO & timing

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Part 2: Distributed correlation

- 2.1. Grid resource allocation (PSNC)
  - 2.1.1. Grid VLBI collaboration
    - Establish relevant tools for eVLBI
  - 2.1.2. Grid workflow management
    - Tool to allocate correlator resources and schedule correlation
  - 2.1.3. Grid routing
    - Data flow from telescopes to appropriate correlator resources
- 2.2. Software correlation (JIVE)
  - 2.2.1. correlator algorithm design
    - High precision correlation on standard computing
  - 2.2.2. Correlator computational core
  - 2.2.3. Scaled up version for clusters
  - 2.2.4. Distributed version, middleware
    - Deploy on Grid computing
  - 2.2.5. Interactive visualization
  - 2.2.6. Output definition
    - Output data from individual correlators
  - 2.2.7. Output merge
    - Collect data in EVN archive

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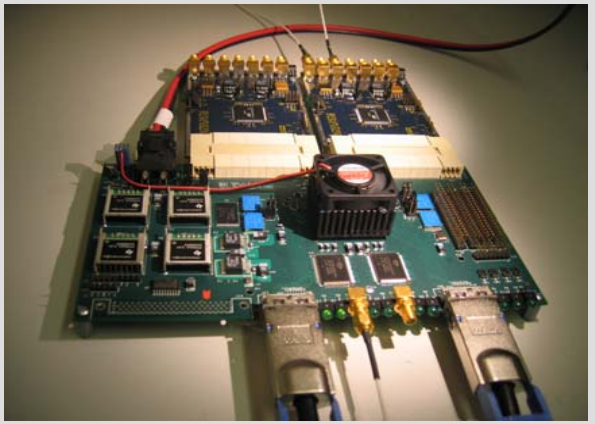
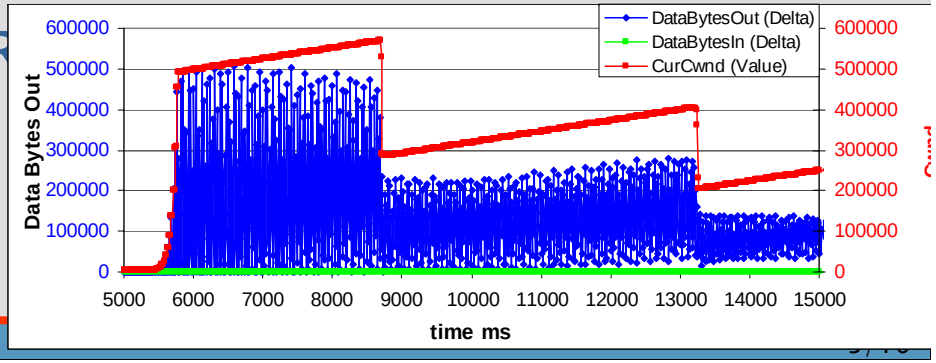
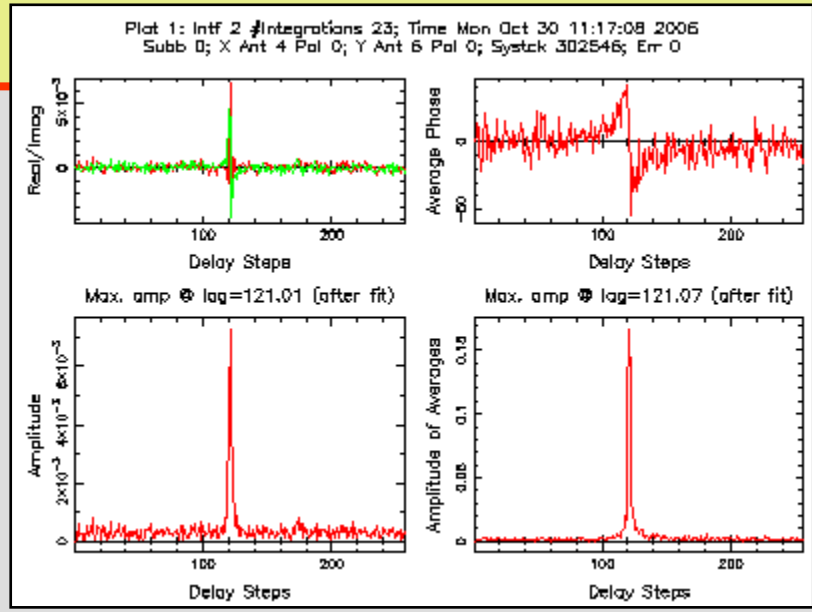
Work on broadband acquisition

- Reaching consensus to work with iBOB's and 10GbE
  - considered options with Mk5 and PC-EVN
    - XilinX FPGA with 2 10Gb Ethernet
    - Also at heart of Haystacks DBE
    - Also for eMERLIN ⇔ VLBI interface
  - Trying to put an order in…
    - May delay the development
- Continuous work on protocols
  - Mostly carried out at Jodrell
    - Reports available on wiki
  - Tied to connecting outside to MERLIN
    - and MERLIN to outside
  - Similar questions for E-LOFAR

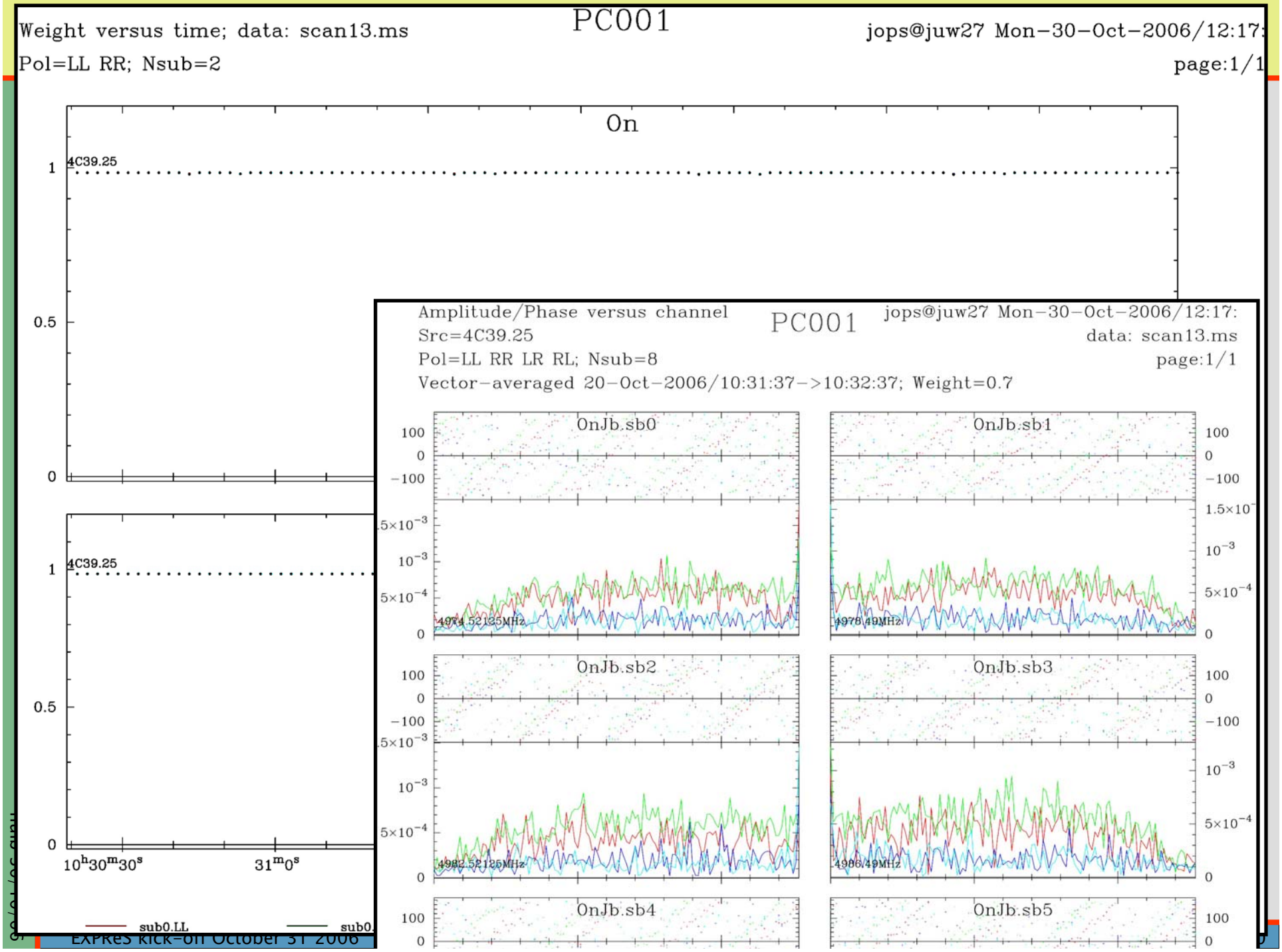




7 month demo

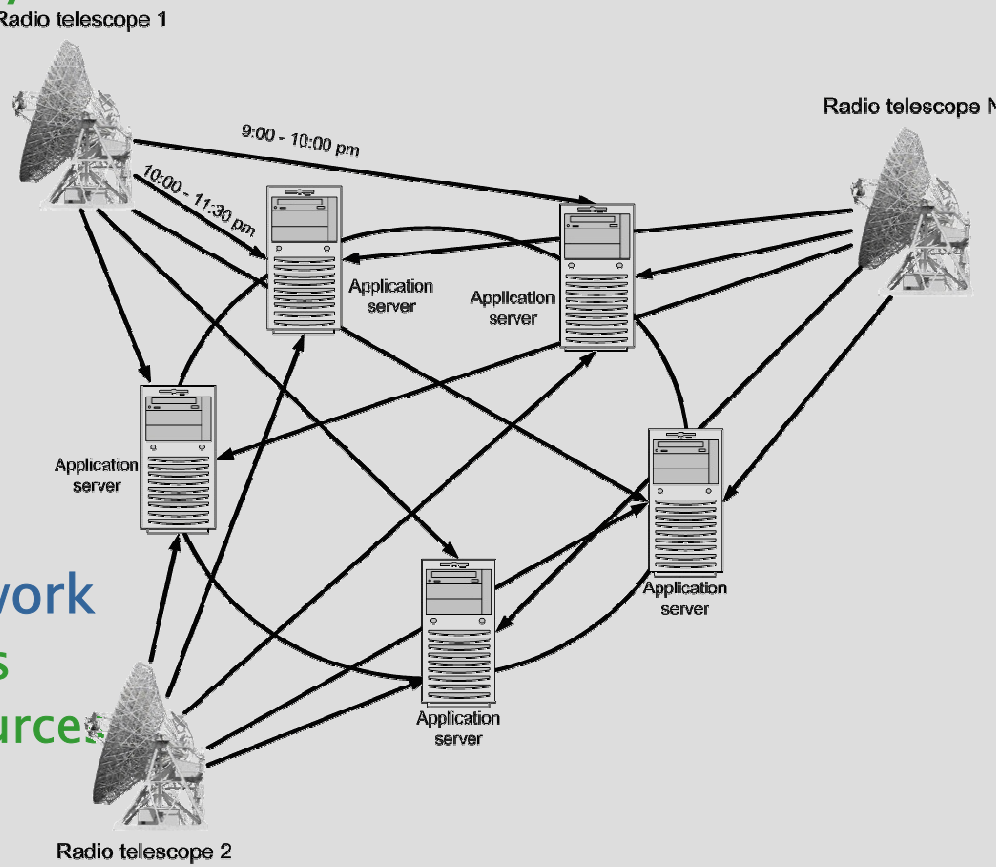


- October 20 between On and Jb
  - Data recorded on PC-EVN locally
    - Some issues at Jb at 512 Mb/s
    - Due to wrong buffer setting
  - Transfer to JIVE after recording
    - Tsunami reached 800Mb/s
    - Hick-ups in copy to Mk5, now OK
- Also included streaming to Metsahovi
    - has 2.5 Gb/s connection
    - and parallel data capturing machines
  - Transfer OK for 2 x 512 Mb/s
- Actually a useful exercise
    - Not only to secure the money, milestone on request
  - Exercise different protocols in future tests
  - Learning experience for people new to the projecy

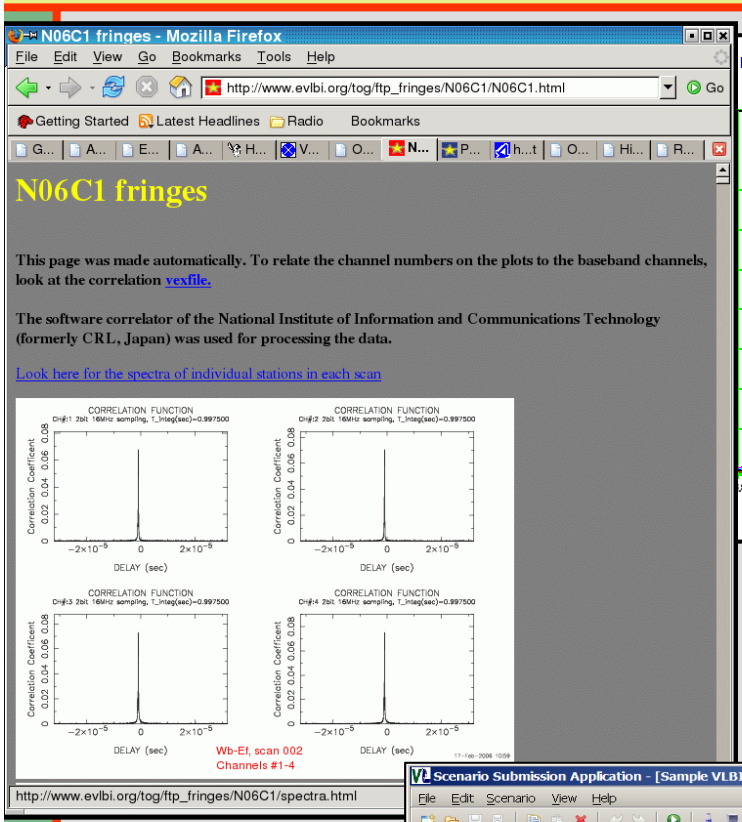

PC001
Weight versus time; data: scan13.ms
Pol=LL RR; Nsub=2
jops@juw27 Mon-30-Oct-2006/12:17:
page:1/1
On
4C39.25
1
0.5
0
$10^h30^m30^s$
31^m0^s
sub0.LL
Amplitude/Phase versus channel
Src=4C39.25
Pol=LL RR LR RL; Nsub=8
Vector-averaged 20-Oct-2006/10:31:37->10:32:37; Weight=0.7
PC001
jops@juw27 Mon-30-Oct-2006/12:17:
data: scan13.ms
page:1/1
OnJb.sb0
OnJb.sb1
OnJb.sb2
OnJb.sb3
OnJb.sb4
OnJb.sb5
4974.52125MHz
4978.49MHz
4982.52125MHz
4986.49MHz
100
0
-100
5×10^{-3}
10^{-3}
5×10^{-4}
1.5×10^{-3}

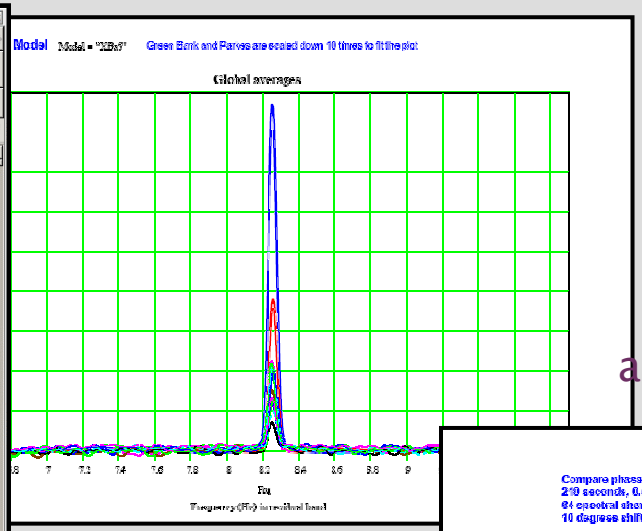
Distributed correlation

- Get CPU cycles from the Grid
  - Explore software correlation
    - Better accuracy and flexibility
    - Portable, Grid friendly code
  - Use net as crossbar switch
    - a-synchronous correlation
  - Seek boundaries of the Grid
    - "Real time" applications
    - data transfer limitations
- Demo application:
  - Monitoring EVN network
  - Continuous small eVLBI network
    - Monitoring transient sources
    - Astrometry, spectral line sources
  - spacecraft navigation
  - pulsar gating



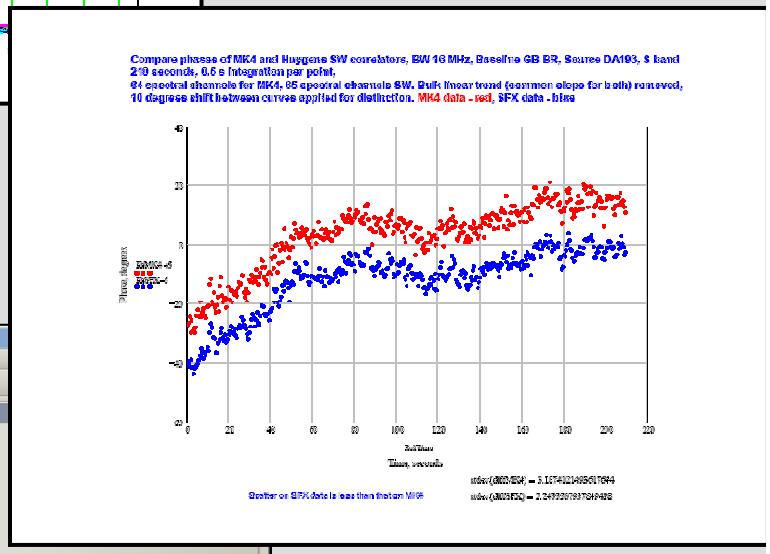
Progress and previous experience

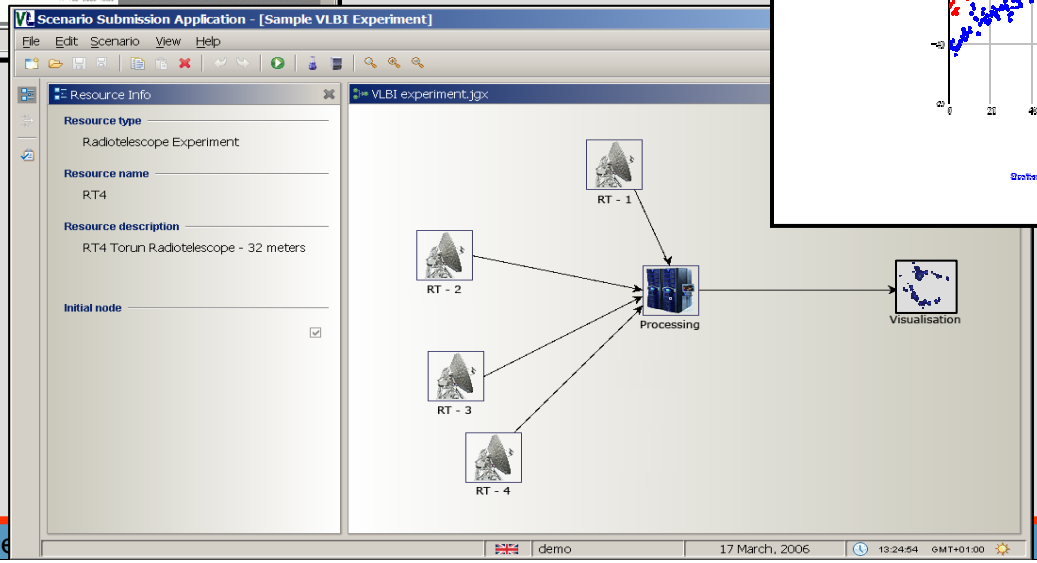




High accuracy
Huygens detections

Comparison software
and hardware correlation





ftp VLBI
EVN monitor

Virtual Lab
developed at Poznan

Progress seems fair

- Project ramping up to satisfactory pace
  - Had kick-off meeting in March (Dwingeloo)
  - And progress meeting in September (Poznan)
- Have approximately 4 new people employed
  - And 2 more coming December 1
    - Means a late start in various places
- Still need to complete design phase
  - To clear up work packages for all parties
  - And order these iBOB's
- Already passing milestones
  - Design documents, Demo's, Software

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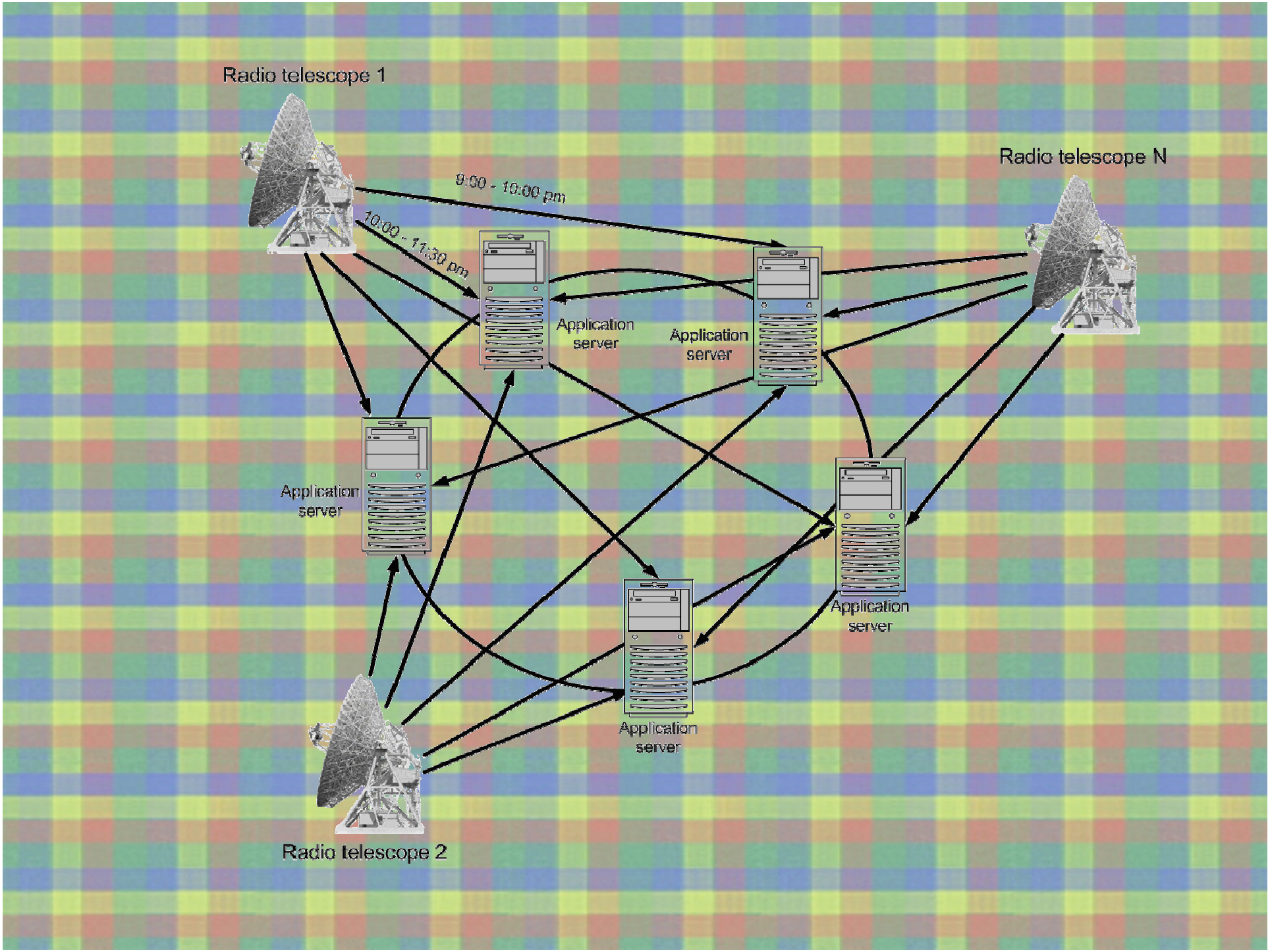
Radio telescope 1
9:00 - 10:00 pm
10:00 - 11:30 pm
Radio telescope N
Application server
Application server
Application server
Application server
Application server
Application server
Radio telescope 2