



# SKA related activities at NCRA

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Collaborators (the Indian Consortium) :

- NCRA-TIFR (National Centre for Radio Astrophysics)
- IUCAA (Inter-University Centre for Astronomy & Astrophysics)
- TRDDC-TCS (Tata Research Design & Development Centre)
- PSL (Persistent Systems Limited)
- CDAC (Centre for Development of Advanced Computing)

SKA-2010, Manchester, 22 March 2010

# SKA related activities at NCRA



- *Software engineering :*
  - *Collaboration with industry partners*
  - *M&C systems*
  - *Proposal submission, scheduling software, Virtual Observatory India*
- *Next generation back-ends :*
  - *Real-time software back-end for the GMRT*
  - *Hybrid back-ends (FPGA + CPU-GPU computing)*
- *Other activities (from GMRT upgrade works) :*
  - *Broadband analog optical fibre links*
  - *Transient analysis pipeline for the GMRT*



# Software Engineering



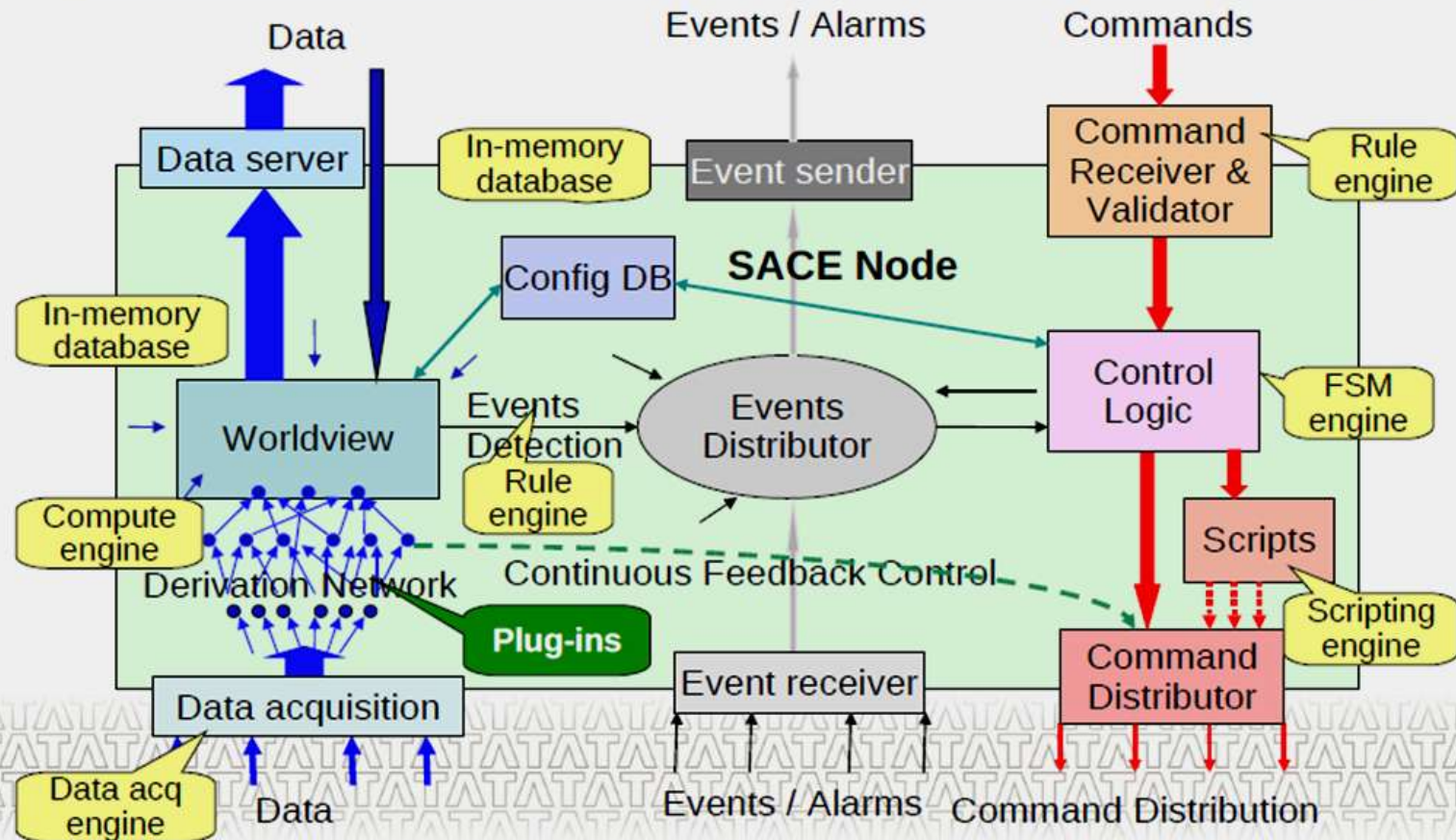
- We have built up a **academia-industry partnership** model :
  - Astronomy research groups (e.g. NCRA, IUCAA) are collaborating with
  - Industry partners (e.g. PSL, TCS) for software engineering projects
  - this is of great significance :
    - as a model for industry interactions for the SKA
    - as well as for tapping the Indian software industry for SKA work
  
- Our Consortium has already made significant contributions to :
  - Development of the **SKA CoDR document for M&C**
  - We have also proposed a generic solution for the design of the SKA M&C system
  - A model driven approach to development of system software for large N telescopes (also applicable to other large projects like ITER)
  - A sample version is being tried out at the GMRT

*(talk by N. Swaminathan on 24th)*
  
- Some other relevant activities of consortium members :
  - Development of automated scheduling software for the GMRT
  - Tool for optimized antenna placement strategy for large N arrays
  - Development of automate proposal submission and evaluation software for the GMRT
  - Development of next generation data archival system for the GMRT
  - Implementation of software tools for **Virtual Observatory India**



TATA RESEARCH DEVELOPMENT AND DESIGN CENTRE

## A SACE nodes architecture





# Software Engineering



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# Next Generation Back-ends



- Software Back-ends :
  - We have built a **fully real-time** software back-end for the GMRT
  - 32 stations, 32 MHz, full polar correlator + beamformer
  - now released for regular observations at the GMRT
  - Supports raw voltage dump mode for upto 12 hr recordings
  - Highly optimized performance in terms of Flops/\$ & Flops/Watt

**(Roy et al. Astro-ph : 0910.1517)**
- Now working on hybrid back-ends which can combine
  - the best of FPGA computing (using CASPER technology) with
  - our expertise in CPU computing
  - coupled with benefits of GPU computing
  - first version of a **basic GPU-based correlator is getting ready**
  - **prototype 8-station hybrid back-end** will be ready by the second half of this year – collaborative effort with SKA-SA (and CASPER group).



# SKA relevant activities and the GMRT Upgrade



- Significant achievements in **room temperature, wideband LNA design**
- Development of inexpensive, broadband analog fibre links :  
**2.5 GHz BW; 20 dB S/N; 40 dB dynamic range; < \$ 2000 per tx– rx set**
- Installation of **Aperitif-like FPA (from ASTRON, Netherlands) at the GMRT** -- single dish try-out under discussion
- Development of **Software Backends** and related hybrid techniques
- Development of modern **software for telescope operations** – control & monitor, proposal submission, scheduling, data archiving and retrieval, VO tools – in collaboration with software industry
- Transient Search Pipeline for the GMRT



# Transient Search Pipeline for the GMRT

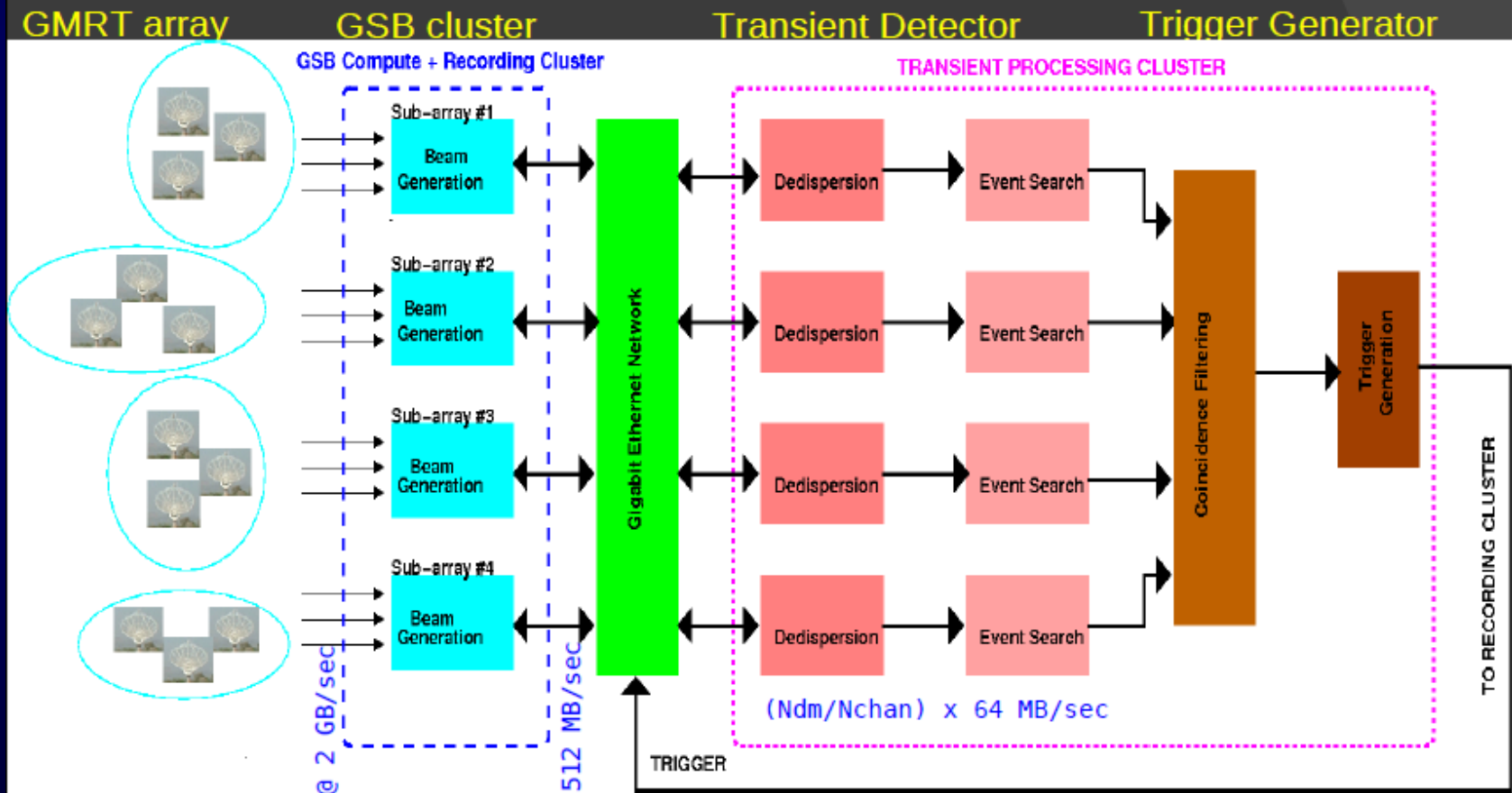


- Collaborative effort of NCRA, Swinburne University of Technology & Curtin University
- Will run in **piggy-back mode** simultaneously with any other observation
- Object of interest : Fast transients -- nanosecond to 100's of millisecond
- Exploits multi-element capability of the GMRT & availability of software backend
- Event detection : based on the sensitivity of 8 antennae incoherent array beam over 32 MHz, using multiple sub-arrays
- Search in dispersion measure space : Discriminate fast radio transients from RFI – **will use GPU-based computing for efficient realisation**
- Coincidence or anti-coincidence filter : **Multiple sub-array multiple beam coincidence filter** reduces the false triggers due to noise or RFI
- Real-time trigger generation accompanied by recording of identified raw voltage data buffers → **off-line detailed imaging analysis** to localise the transient source





# Transient Detection Pipeline for GMRT



...currently under implementation at the GMRT

# Thank You

On behalf of the Indian Consortium :

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