Indian contribution to SKA- Telescope Manager

The past, Present and Future Plans

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- India's Role in SKA-Telescope Manager Pre-construction
- **SKA Telescope Manager : Architecture and Design**
- Capabilities Developed
- Indian Plans for OMC Construction Phase
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The SKA Telescope Manager

The Telescope Manager element includes all the hardware and software necessary for the Telescope monitoring and control, and observatory software for scheduling the Telescope operations.

India's Role in SKA Pre-construction

India's Role in SKA Pre-construction - High Level View

Areas of Indian Contribution

- SKA Telescope Manager (TM)
 - Led TM consortium
 - Responsible for Telescope Management (TelMgt) sub Work Package (WP)
 - Participated in other sub WPs of TM
- Signal and Data Transfer (SaDT)
 - Part of two LMCs SAT and NMGR
- Central Signal Processor (CSP)
 - Part of CSP LMC
 - Part of Signal Processing
- GMRT an SKA Pathfinder
 - Early adopters of TANGO control system framework
 - Developed and deployed TANGO based Monitoring and Control (M&C) System
 - Contribution to TANGO community forum

India's Role in Pre-construction - SKA TM Element

SKA Telescope Manager

- NCRA led the consortium of seven countries India, SA, UK, AUS, Italy, Canada and Portugal
- TM was the first work package to be assessed and passed the CDR (Jul-2018)
- Of the ~ 25 FTEs over the Design Phase, India provided roughly half the FTEs including key roles like Project Lead, Project Engineer, Project Scientist, Project Manager.
- TCS Research and Innovations (R&I) along with a team from TCS led the TelMgt sub WP
 - Successfully delivered Architecture and Design for TelMgt
 - Prototyping of key design aspects and technology for risk mitigation
- Indian team participated in the Observation Management (ObsMgt) sub-WP
- Contributed to other sub WPs like System Engineering (SE), Local Infrastructure (LINFRA), Enabling Systems (EA), Prototyping (PROTO), GUI, etc.

India's Role in Pre-construction - TM WBS Details

TM Pre-construction WBS

- Project Management (PM)
- System Engineering (SE)
- TelMgt / TMC Software
- ObsMgt / OSO Software
- Enabling Systems (EA)
- TM LMC
- Local Infrastructure (LINFRA)
- Prototyping (PROTO)
- Graphical User Interface (GUI)

- Led PM WP and provided Project Lead, Project Manager and PMO roles
- Led **TelMgt** WP and delivered Architecture and Design for Telescope M&C
- Participated and supported other WPs SE, ObsMgt and LINFRA.
- **Prototyping** of core M&C aspects, Data Archival, Internal Interfaces, GUI

- Either led or participated in most WP of TM
- Gained domain knowledge in relevant Telescope M&C areas
- Prototyping: hands-on experience on technology (e.g.TANGO) selected for SKA

SKA Telescope Manager : Architecture and Design





Ongoing Involvement

Bridging Activities - Prototype Development

- Monitoring and Control
 - Monitoring of Telescope elements includes CSP, SDP and Dish
 - Telescope Control:
 - Startup and Standby the telescope
 - Allocation and deallocation of resources to/from a subarray
 - Configure a subarray for observation - includes configuring the CSP, SDP and Dish
 - Perform scan for specified time duration
 - Calculate Dish Pointing
- Engineering Data Archive
 - Archive monitoring data using HDB++
 - View historical monitoring data in GUI

- Alarm Handling
 - Alarm handling
 - Alarm configuration
- Logging
 - Facility to log to multiple targets with separate logging levels
- Delay Model
 - Exploration of CALC11
- Other
 - Support to multiple subarrays (currently tested for three)
 - Web based interface
 - Non-Functional Requirements
 - Fault isolation between subarrays

Expertise and Capabilities Build - India Value Proposition

- In depth understanding of TM involvement since project inception, PDR, CDR
- Developed skills and competencies required to execute the project
 - Radio Astronomy domain
 - Technology TANGO framework and platform tools
 - Large Scientific Program Management
 - SAFe Agile Framework adoption, SAFe certified teams
 - Dev-Ops, Continuous Integration (CI) practices
- Experience in implementing TANGO based Control System for GMRT
- Proven Collaborations with Industries and Independent Research Organizations
- Leverage the experience from other scientific programs ITER, TMT
- Availability of diverse skills- SW, HW, Firmware, Engineering, Project Management, etc.



Proposed New WP for TM Construction - OMC

OMC Construction WBS

- Program Support
- AAA
- Enabling Systems
- OSO Software
- TMC Software
- Services software (TM LMC)
- LINFRA Software
- LMC software
 - Infra LMC
 - Dish LMC
 - MeerKAT Dish LMC
 - CSP LMC
 - SAT LMC
 - MCCS
 - NMGR

- TM now referred as Observation Management and Control (OMC)
- OMC construction WBS is similar to TM WBS expect that element LMCs are now part of OMC
- India either led or were part of **BLUE** work packages of the proposed WBS during pre -construction
- India participated in three LMCs CSP, SAT and NMGR
- Developed prototype for SAT LMC
- SAFe Methodology to be used for SKA Software Development
- Two Agile Release Trains (ART) have been envisaged for SKA Software
 - Data Processing
 - OMC

Proposed Indian Involvement in OMC ART - SAFe View



Lean-Agile Leadership

Plans for Indian Involvement in OMC Construction

- India has been identified as lead party in OMC Tier 1 WP
- India is ready to lead the package and contribute 50% or more
- Expect 1 Program Level and 7-8 Agile Teams during construction
- India plans to provide most Program level Roles and 3-4 Agile Teams
- Continue to lead and deliver OMC.TMC software package development
- Be part of OMC.OSO software package development
- Can lead SKA LOW LMC (i.e. MCCS) and CSP LMC construction
 - Leverage past experience in LMC Base Classes, SaDT and CSP LMC
 - Natural extension of work done during pre-construction
- Expand to other areas of software work
 - SDP, Enterprise Software implementation, SDP, Machine Learning, etc.
- In discussion with other interested SKA member countries and open for collaboration on the roles for each member

About TCS





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Thank You!