SKA SYNCHRONIZATION AND TIMING
LOCAL MONITOR AND CONTROL
- Software Design Approach

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Background

• What the project is
  – The Square Kilometre Array (SKA) is a global project that aims to build a large radio telescope in Australia and South Africa
  – The Signal and Data Transport (SaDT) consortium, includes all the software and hardware necessary for the transmission of data and information between elements of SKA
  – Synchronization and Timing (SAT) system that provides frequency and clock signals.

• Who we are
  – The local monitoring and control system (SAT.LMC) monitors and controls the SAT system.

• What is to be Presented
  – The approach taken to Designing the SAT.LMC software and what tools were used
  – The internal SAT.LMC team communication model, cross culture sensitivity and leadership principles adopted to keep the project on track and deliver quality design products
Software Design
Software Design (1)

• Methodology
  – Simple and Informal architecture
  – Incremental process
  – Release Packs
    • A snapshot of the artefact progression
    • Keeps Consortium Informed

• Architecture Model
  – SAT.LMC follows “The Open Group Architecture Framework” (TOGAF)
    • Architectural Design Method
      – Design
      – Planning
      – Implementation
      – Governing
Software Design (2)

- **Prototype**
  - Duration of 1 year
  - Mainly In-house testing
    - Small amount of field testing

- **Interfaces**
  - Specifications are captured in Spreadsheet(s)
    - Each row is a functional interface
    - Contains communication protocols
    - Data rates
    - Mechanisms for exchange
  - Internal & External Interface Considerations
• Assumptions
  – Allows design evolution when uncertainty remains
  – Regular review is essential
    • Assumptions should eventually be replaced by facts
  – Master Data Assumptions List (MDAL)
    • Assumptions are recorded centrally within the Consortium – Visible to EVERYONE
• Extensibility and Flexibility
  – Many factors can and have impacted upon the SAT.LMC architecture evolution
    • Combat by maintaining a level of abstraction between SAT.LMC and the interfacing SAT systems
Software Design (4)

• Project Management
  – Local vs. Consortium wide
  – Focus on artefact ownership
  – Avoidance of Micromanagement
  – Discussion on progress rather than autonomous tracking (box ticking)
• Risk Management
  • Risk Register
    – Impact on Cost
    – Impact on Schedule
    – Proposed Mitigation Strategies
Tools
Hands On Tools

• “Paid for” vs “free”
  – Many trade offs
• Microsoft Office Suite
  – But watch out for “quirks” when editing each others documents!
• Software Development Prototyping
  – TANGO Control System Framework
  – Docker containerization
  – Emulators & Simulators
  – Various Operating systems
Overview of Hands On Tools

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- **Push**
- **Commit**
- **Modify / Add / Delete Artifacts**

Documents / Spreadsheets / Presentations

- **Office**
- **Visio**

Artifacts Generation Tools

- **Windows 7**

Prototype Tools

- **ETELOGIC.COM**
- **MySQL**
- **Python**
- **TANGO**
- **VirtualBox**
- **docker**

- **Windows 7**
- **Linux**
Communication Tools

• Key to the success of the SAT.LMC team
• Progression
  – Skype became limiting
  – Zoom adopted
• Other means of communication used, but soon dropped
  – WebEx
  – Telephone
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Team

• Face to Face meeting
  – At least once per year
• 3 countries
  – India
  – United Kingdom
  – South Africa
• 4 research institutes
  – NCRA-TIFR
  – Jodrell Bank Centre for Astrophysics, University of Manchester
  – South African National Research Network (SANReN)
  – Science and Technology Facilities Council (STFC)
Collaboration & Structure

• Collaboration Time
  – Office Hours Crossover
    • Convenient for our team. Not always the case though
    • Spend up to 5 hours per week speaking

• Leadership
  – Devolved Responsibilities
    • Ownership of artefacts
    • Everyone cannot do everything
    • Internal Review aids common understanding
Conclusion

• This way of collaborating worked well for us
• Not a formally structured way of collaborating
• Common ground goes a long way
• Computerized tools have allowed our team to do things not possible in the past