MANCHESTER 1824

The University of Manchester

NCRA • TIFR

MANCHESTER 1824
The University of Manchester

# SKA SYNCHRONIZATION AND TIMING LOCAL MONITOR AND CONTROL

## - Software Design Approach

October 12th 2017

Rajesh Warange (NCRA-TIFR)
Ralph Braddock (University of Manchester)

SKA SQUARE KILOMETRE ARRAY

SIGNAL AND DATA TRANSPORT

# 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

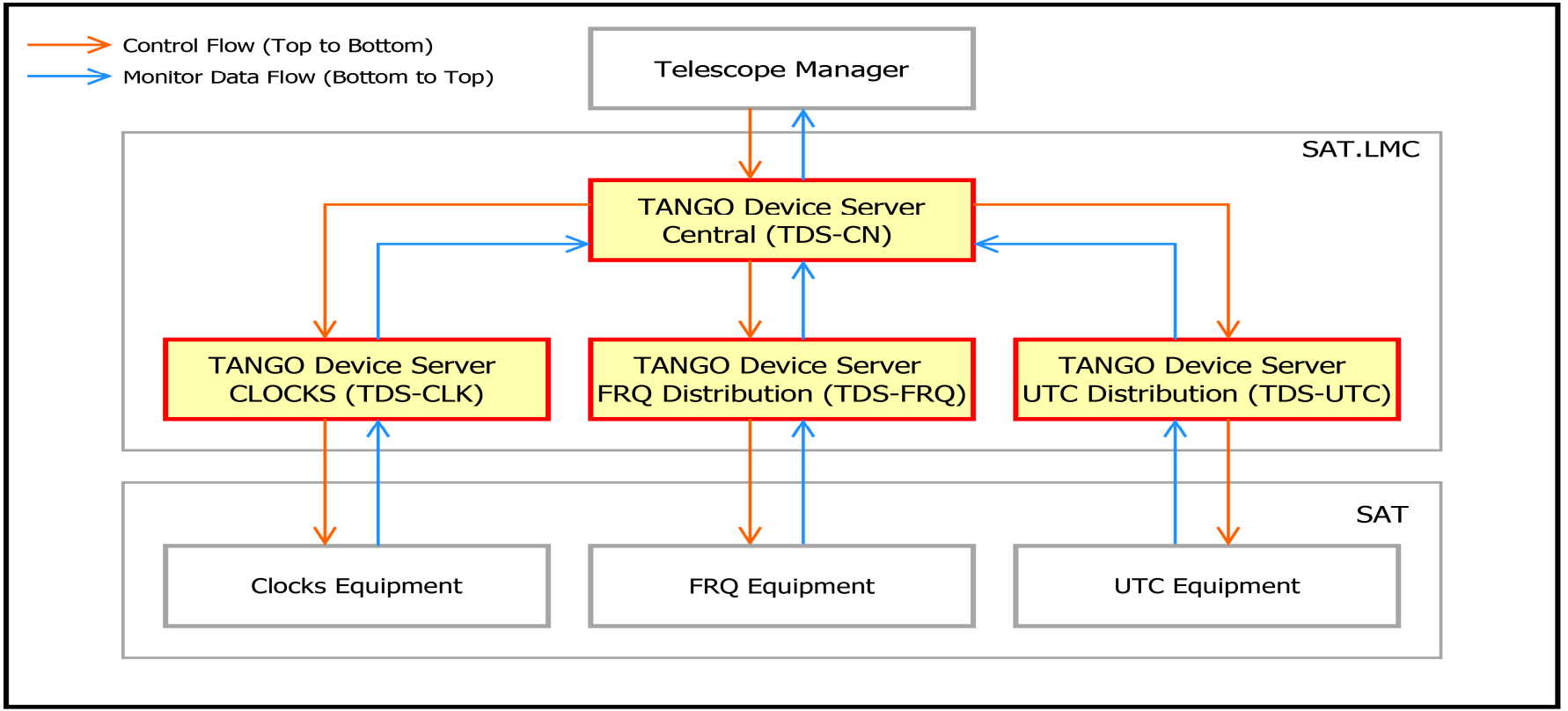
# Software Design

# 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 (1 Aside)



# 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

# Software Design (3)

- 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)

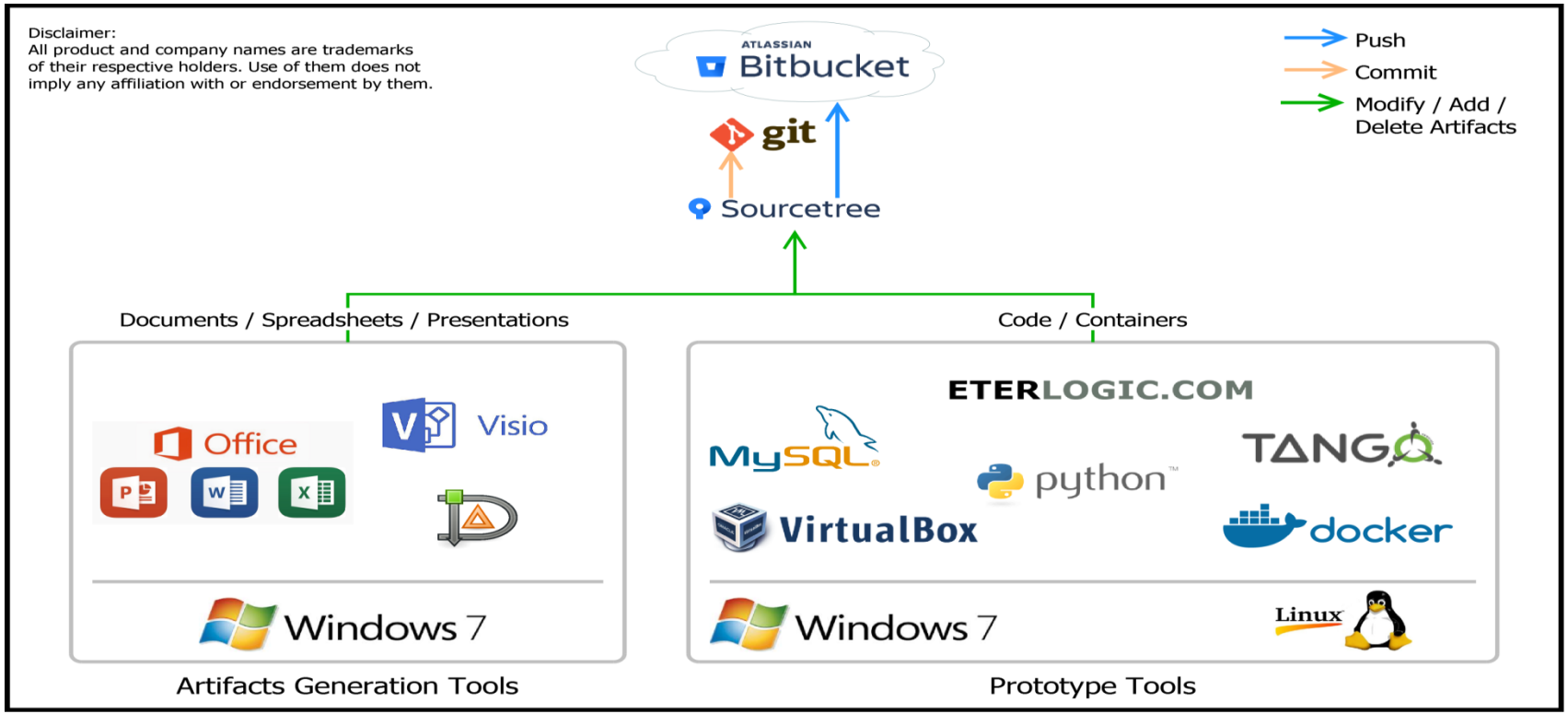
- Project Management
  - Local vs. Consortium wide
  - Focus on artefact ownership
  - Avoidance of Micromanagement
  - Discussion on progress rather than autonomous tracking (box ticking)
  - Risk Management
    - Risk Register
      - Impact on Cost
      - Impact on Schedule
      - Proposed Mitigation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

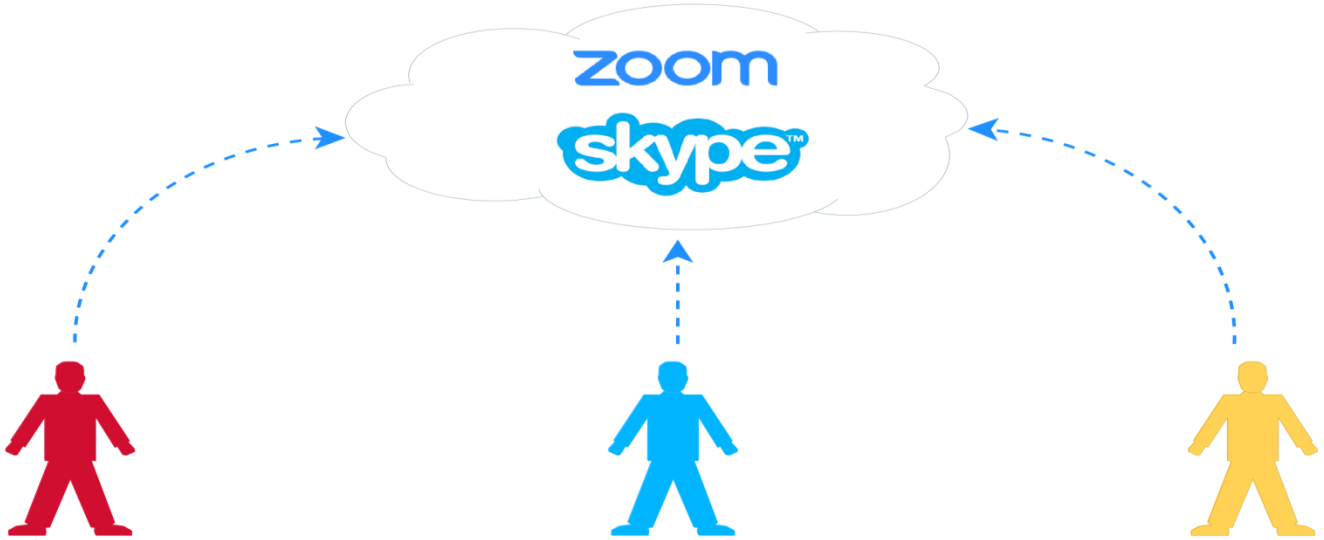


# Communication Tools

- 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

# Overview Communication Tools

Disclaimer:
All product and company names are trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by them.



# 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)


Science & Technology Facilities Council

MANCHESTER 1824
The University of Manchester

NCRA • TIFR

SANReN
South African National Research Network

# 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