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The SKA Telescope will use a highly accurate Synchronization and Timing (SAT) system, designed by the Signal and Data Transport (SaDT) [1] consortium to provide and distribute time and frequency information across the telescope.

The local monitor and control system for SAT (SAT.LMC) will monitor and control the working of the SAT system consisting of:

- SAT.CLOCKS (CLK) *timescale generation system*
- SAT.STFR.FRQ (FRQ) *frequency distribution system*
- SAT.STFR.UTC (UTC) *timing distribution system*

SAT.LMC enables Telescope Manager (TM) to perform SAT maintenance and operations.

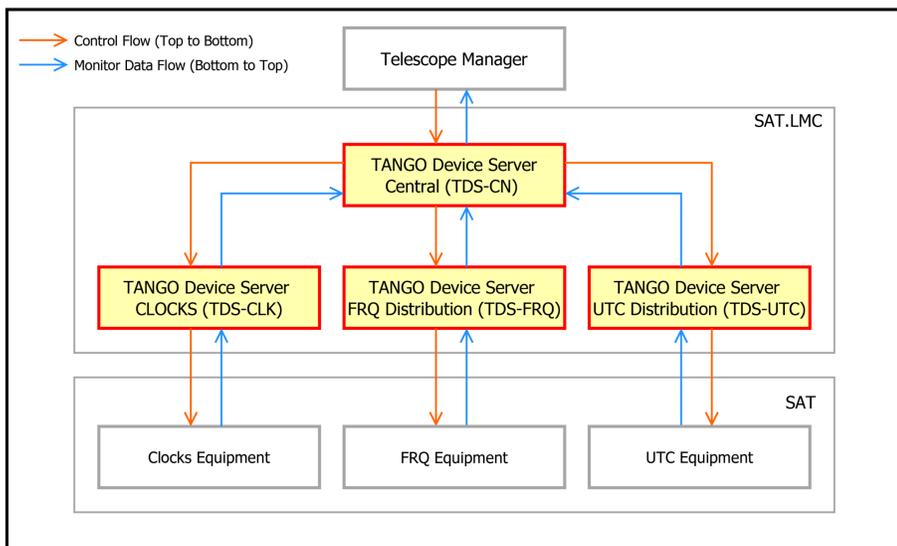


Figure 1: SAT.LMC Hierarchical solution.

The SAT.LMC is a 2-tier hierarchy, Figure 1, which connects:

- Top-down from TM
- Bottom-up from SAT equipment

SAT.LMC will be implemented using the TANGO Controls Framework [2]. This allows the architecture [3] to comply with the SKA harmonised approach to implementing monitor and control.

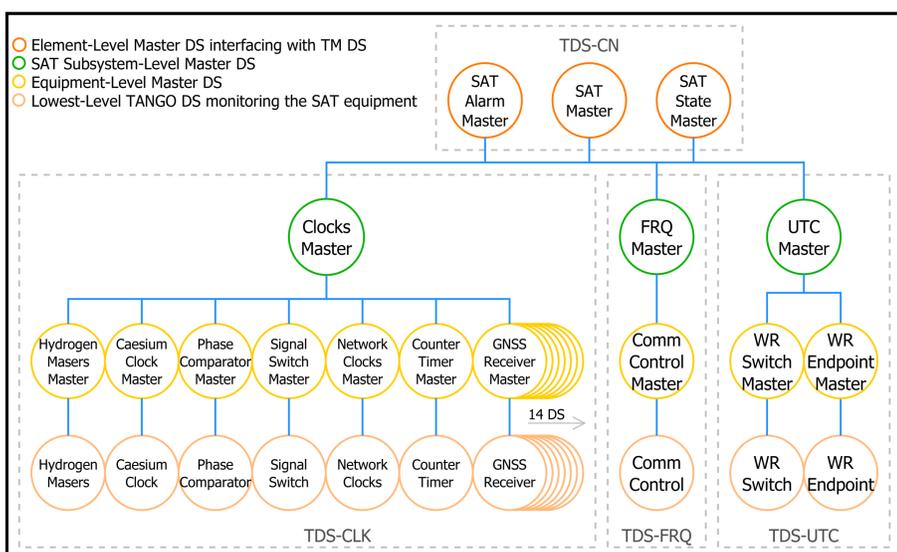


Figure 2: SAT.LMC TANGO Device Server Hierarchy.

Figure 2 presents the proposed TANGO device servers associated with each SAT subsystem that SAT.LMC monitors and controls.

Master device servers (amber, green and yellow layer) are in place to aggregate data. These master device servers can also, where needed, facilitate elementary data processing

References

- [1] K. Grainge *et al.*, "Square Kilometre Array: The radio telescope of the XXI century", *Astronomy Reports*, vol .61, no. 4, pp. 288-296, 2017.
- [2] TANGO, <http://www.tango-controls.org>
- [3] R. Warange, R. Braddock *et al.*, "SKA Synchronization and Timing Local Monitor Control – Software Design Approach", presented at ICALEPCS' 2017, Barcelona, October 2017, THCLP04, this conference.
- [4] R. Warange, R. Braddock and U. Horn, "SAT.LMC Prototype Design Report", SKA-TEL-SADT-0000212_DRE-SAT.LMCProtoDesRep, July 2017.

Communication

Common approach to communication for all SAT Systems. This includes the handling of:

- Alarms
- Commands and Attributes
- Events

The Communication model, Figure 3, of SAT.LMC aligns to those of other SKA monitor and control systems. This is aided through the use of TANGO.

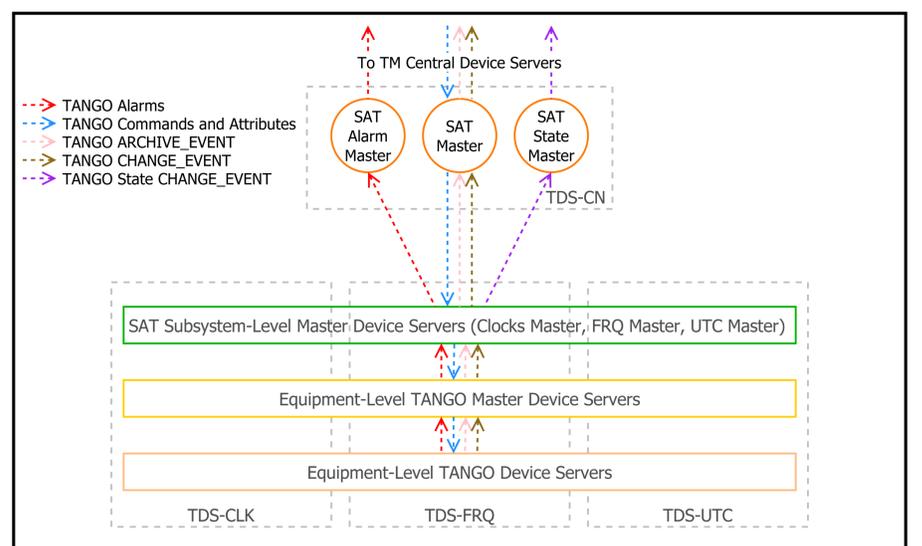


Figure 3: SAT.LMC Communications.

Containerization

As part of the SAT.LMC prototype work, "containerization" was evaluated. Figure 4 highlights the use of Python and Docker containers.

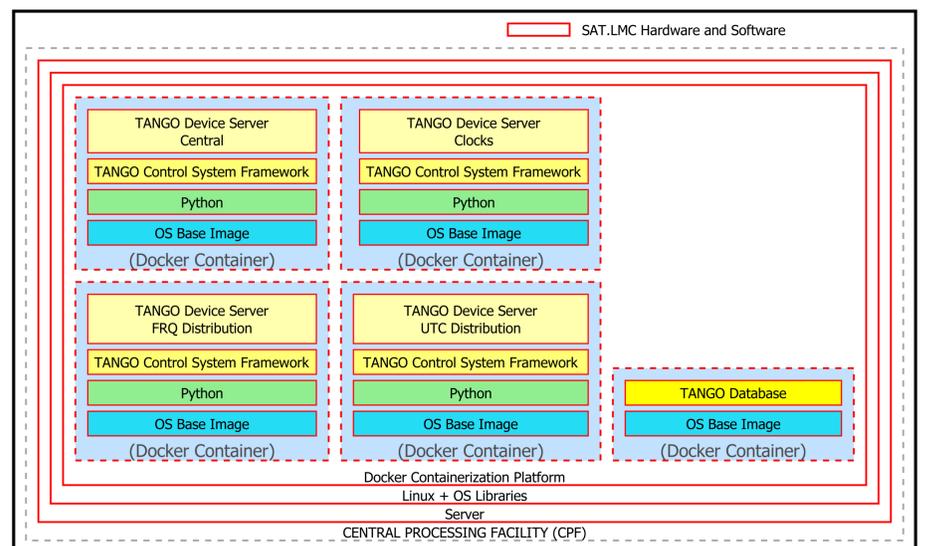


Figure 4: SAT.LMC TANGO Deployment View.

Prototyping

SAT.LMC was prototyped [4] over a 1 year timeframe. During this time novel aspects of SAT.LMC were tested. TANGO was central to the work undertaken. In summary the following were covered:

- SAT.LMC to SAT simulators
- SAT.LMC to TM simulator
- SAT.LMC to Hydrogen Maser
- SAT.LMC to GNSS Receiver
- SAT.LMC to Communication Control Module
- SAT.LMC to White Rabbit Switch