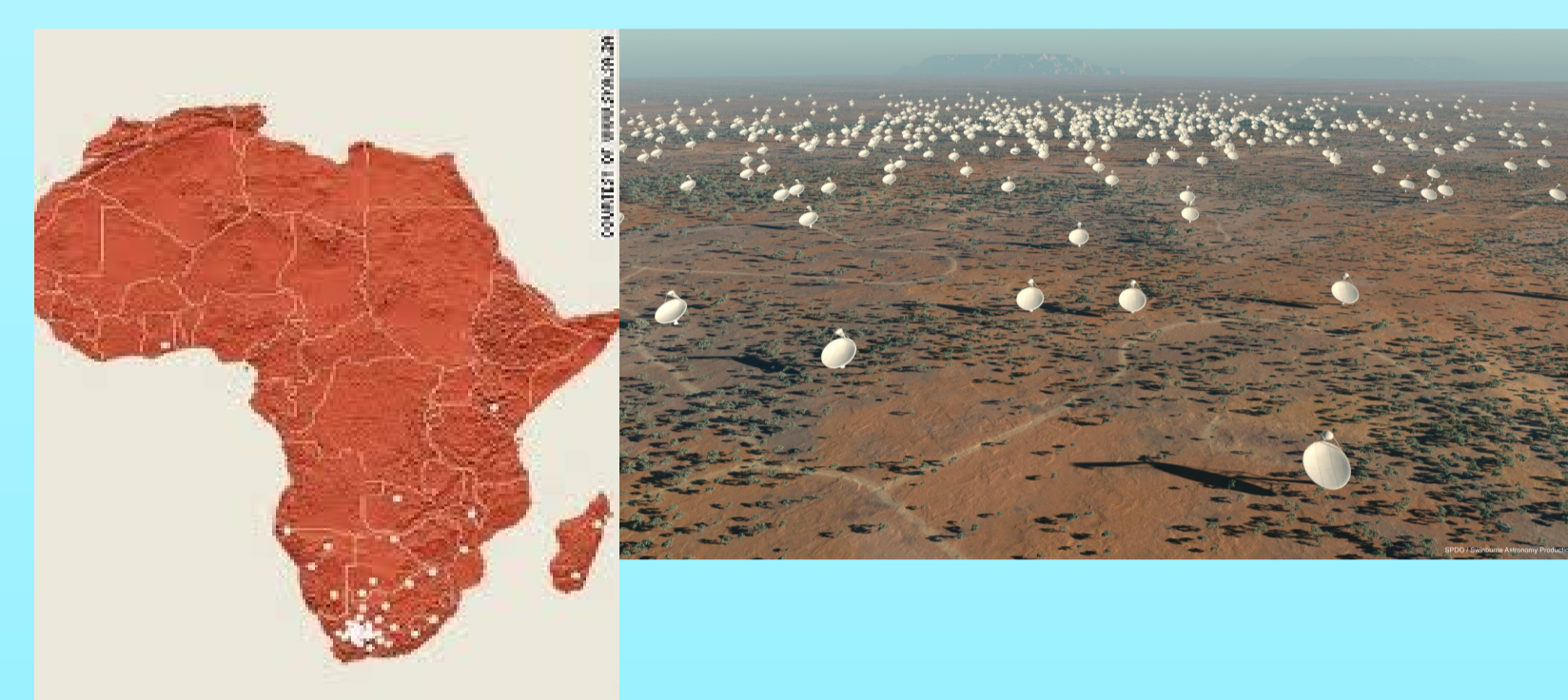


Abstract

This project is too large to be managed in pseudo-real time, due to the ensemble of interacting hardware and software which make it extremely complex. Once we have identified the right tools to solve it, the current challenge is to find the smartest strategies to implement the whole SKA project by using the Tango Control framework. In particular we are developing a uniform class schema proposal and some alternative approaches to program and control the complex subsystems which constitutes a large part of SKA.

0 - SKA Overview

- Low frequency array correlator
- Mid frequency array correlator and pulsar beam-former
- Pulsar search machine
- Pulsar timing machine



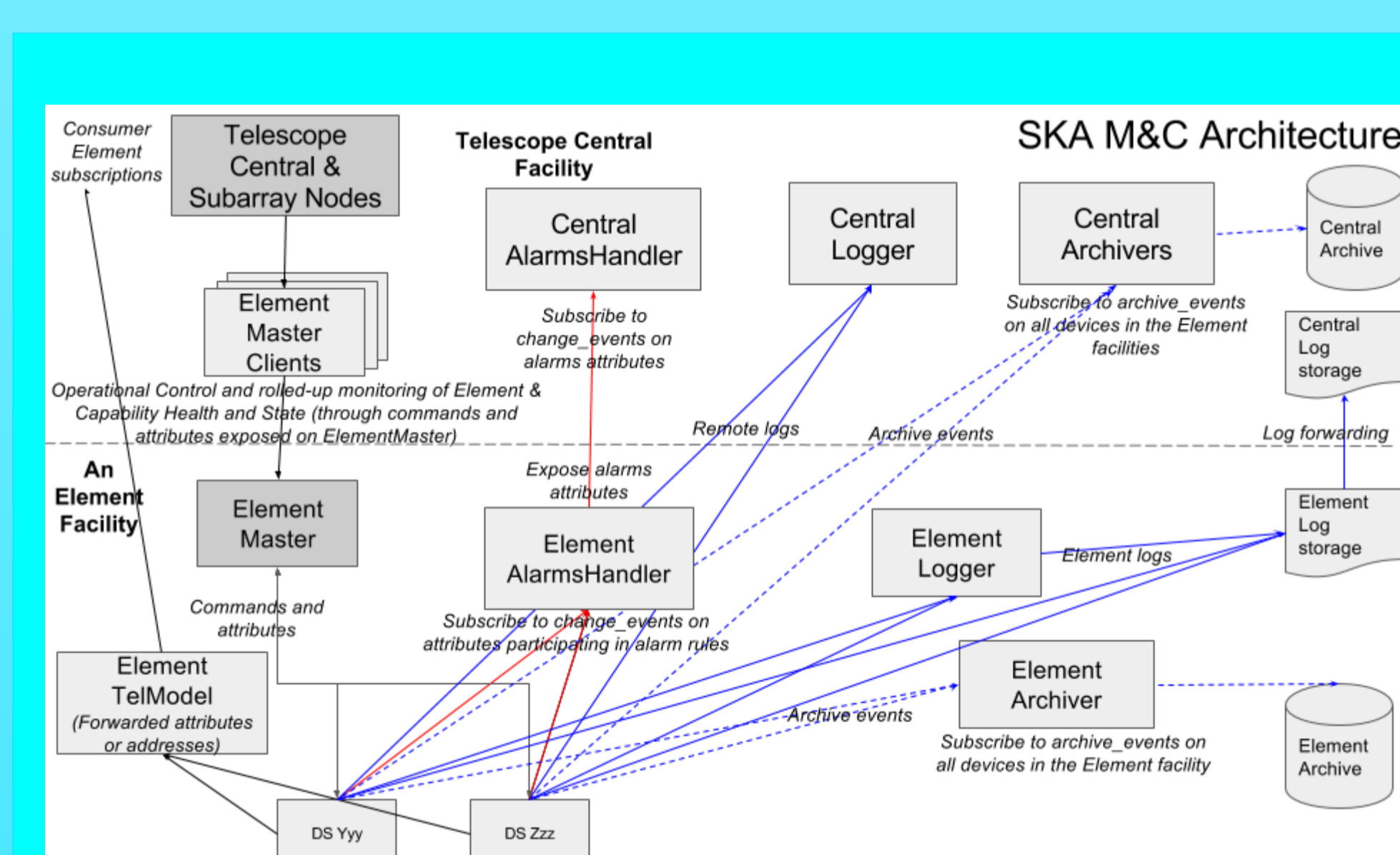
5 - Future Development

- **Device Naming Convention for SKA** - A common device naming convention across all TANGO facilities for the full SKA project. It will include conventions to facilitate "static" TANGO groups, and potentially other mechanisms for identification of groups of homologous devices.
- **Integrating Distributed TANGO facilities** - To coordinate independent Element TANGO facilities and a Central TANGO facility into a working unit as an integrated instrument.

- **Device/Element Simulators** - To explore design patterns to combine simulated and real Elements across and within facilities and identify utilities needed to support this.

- **SKA TANGO Facility standardisation** - To analyse further common design patterns to implement within each SKA TANGO facility.

- **Simulating TM with TANGO Tools** - To explore ways that Elements can operate in absence of TM and identify standard TANGO Tools that can be used.

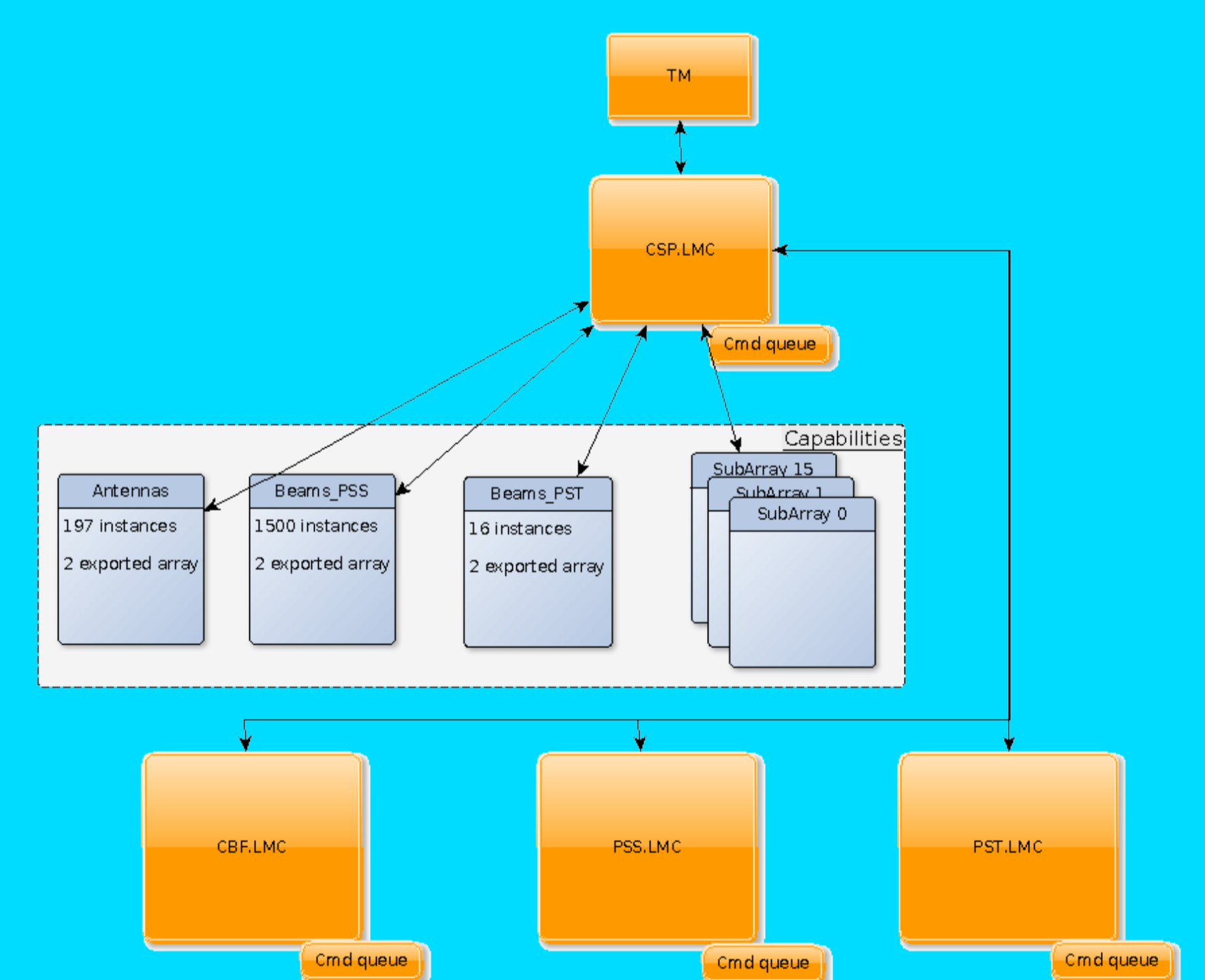


1 – SKA Control Model

- a) Telescope Manager (TM)
- b) Central Signal Processor (CSP)
- c) Dish (DSH)
- d) Low-Frequency Aperture Array (LFAA)
- e) Science Data Processor (SDP)
- f) Signal and Data Transport (SaDT)
- g) Infrastructure Australia and Africa (INFRA)

The control model assumed for the whole telescope is a **top-down** model: all the interactions with the observer and all the controls of the underlining structure are assigned to the Telescope Manager (TM). Moreover each element should have a single point of monitor and control (Element-LMC). In this way each node control points (or Element Master) should provide a wrap-up situation of the element and give the possibility of an engineering drill-down to sub-elements. Such control model is recommended to be applied, as far as possible, to lower level components.

Basic Control Schema of a SKA element (CSP)



2 – Tango The Software Infrastructure

SKA consortia chose Tango Control as the infrastructure of all Monitor and Control operations. TANGO Control is an open source object oriented software framework for building distributed control systems, developed collaboratively by an international community of research institutions.

- Equipment/hardware (e.g. a power supply)
- A set of equipment (e.g. a set of 3 motors, x-y-z axes, driven by the same controller)
- A set of software functions/components
- A group of equipment/components constituting a subsystem

- the first fundamental step when writing a TANGO device:
- A TANGO device must be self-consistent
- It must enable the access to all the features of the modelled device
- The limit of its responsibilities, meaning the separation of concerns, is clearly defined:
1 device = 1 entity of the system

4 - Main points in Monitor and Control structure

2) Single point of control/coordination for general operations:
The Element Master is the single point of control and coordination of an Element for general operations from TM. For normal operational control TM will communicate only with the Element Master device.

3) Rolled-up monitoring and reporting: The ElementMaster will also be the entry point for Element Level monitoring by central tools during general operations. The ElementMaster shall intelligently interpret information from sub-elements and lower level devices for rolled-up reporting of status, health and configuration on the Element level and the Element Capabilities.

4) **Rolled-up SKA alarms reporting:** All Elements will adhere to the common SKA design pattern for standardised alarms reporting. SKA alarms are rules-based configurable conditions that can be defined over multiple attribute values and quality factors, and are separate from the "built-in" TANGO attribute alarms. Hierarchies of alarms handlers may be implemented in the Element, but the top-level ElementAlarms shall interpret all internal alarms and expose SKA alarms attributes.

5) **Centralised Telescope archiving and Element archiving:** The TM will maintain a central archive. In principle the Element does not have to implement any special archiving functionality in addition to the standard TANGO mechanisms and core device servers available.

6) Centralised Telescope logging and Element logging: The TM will maintain a central log archive and in principle the Element does not have to implement any local logging. However the Element developers can choose to implement a local repository to support development and maintenance.

3 - The LMC Devices Strategy

SKA project started a LMC Harmonization process to set a common controlling structure and the use of common strategies across the different components of this huge project. The developer community appointed a small committee (The Ant Team) to collect the different solutions proposed and to match those which comply with the Tango Best Practices to the different needs of the various sub-projects.

The Ant Team collected the vast bulk of SKA Control community preliminary work in a set of documents:

0. SKA Control System Guidelines (main)
1. Element & Central Alarms Handling
2. SKA Logging
3. SKA Device Naming Convention
4. SKA Control Model
5. SKA Configuration & Control
6. Integrating Distributed TANGO Facilities
7. Element Archiving & Central Archiving
8. SKA TANGO Developers Guideline

Following the Tango standard approach the hierarchy of the Tango Device driver structure follows the functional decomposition of the Telescope. In particular a parallel structure (MID and LOW) will be implemented following, as far as possible common solutions. Also the logical structure of the topmost components (the Elements) can be replicated at lower levels when it offers advantages

6 – Further resources

- SKA Telescope astronomical site

- Arcetri SKA technology site

Part of the material of this poster and the SKA M&C figure comes from ANT Team documents.

Address of this poster:

