INTEGRATION OF MEERKAT AND SKA TELESCOPES USING THE KATCP⇔TANGO TRANSLATORS
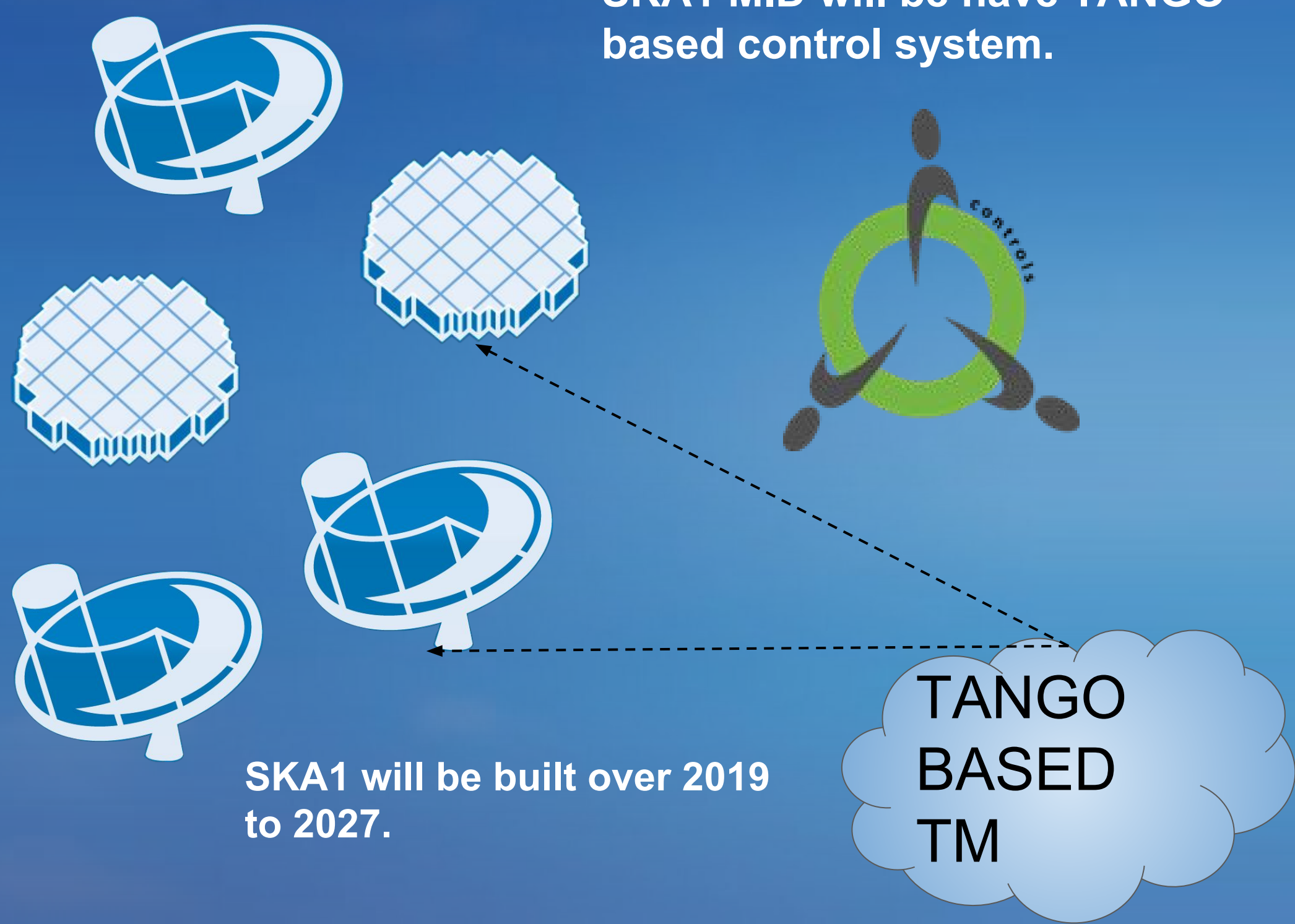
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(THSH201)

SKA AFRICA
SQUARE KILOMETRE ARRAY

NRF — National Research Foundation
SARAO — South African Radio Astronomy Observatory
science & technology — Department: Science and Technology, REPUBLIC OF SOUTH AFRICA

SKA Africa — SQUARE KILOMETRE ARRAY

The MeerKAT radio telescope control system uses KATCP protocol and technology stack developed at SKA SA. The future SKA project chose the TANGO controls technology stack. However, MeerKAT and phase 1 of the SKA-mid telescope are intimately related: SKA-mid will be co-located with MeerKAT at the SKA SA Karoo site; the first SKA-mid prototype dishes will be tested using the MeerKAT systems; MeerKAT will later be incorporated into SKA-mid. To aid this interoperation, TANGO to KATCP and KATCP to TANGO translators were developed. A translator process connects to a device server of protocol A, inspects it and exposes an equivalent device server of protocol B. Client interactions with the translator are proxied to the real device. The translators are generic, needing no device-specific configuration. While KATCP and TANGO share many concepts, differences in representation fundamentally limits the abilities of a generic translator. Experience integrating TANGO devices into the MeerKAT and of exposing MeerKAT KATCP interfaces to TANGO based tools are presented. The limits of generic translation and strategies for handling complete use cases are discussed.

SKA 1 MID TELESCOPE

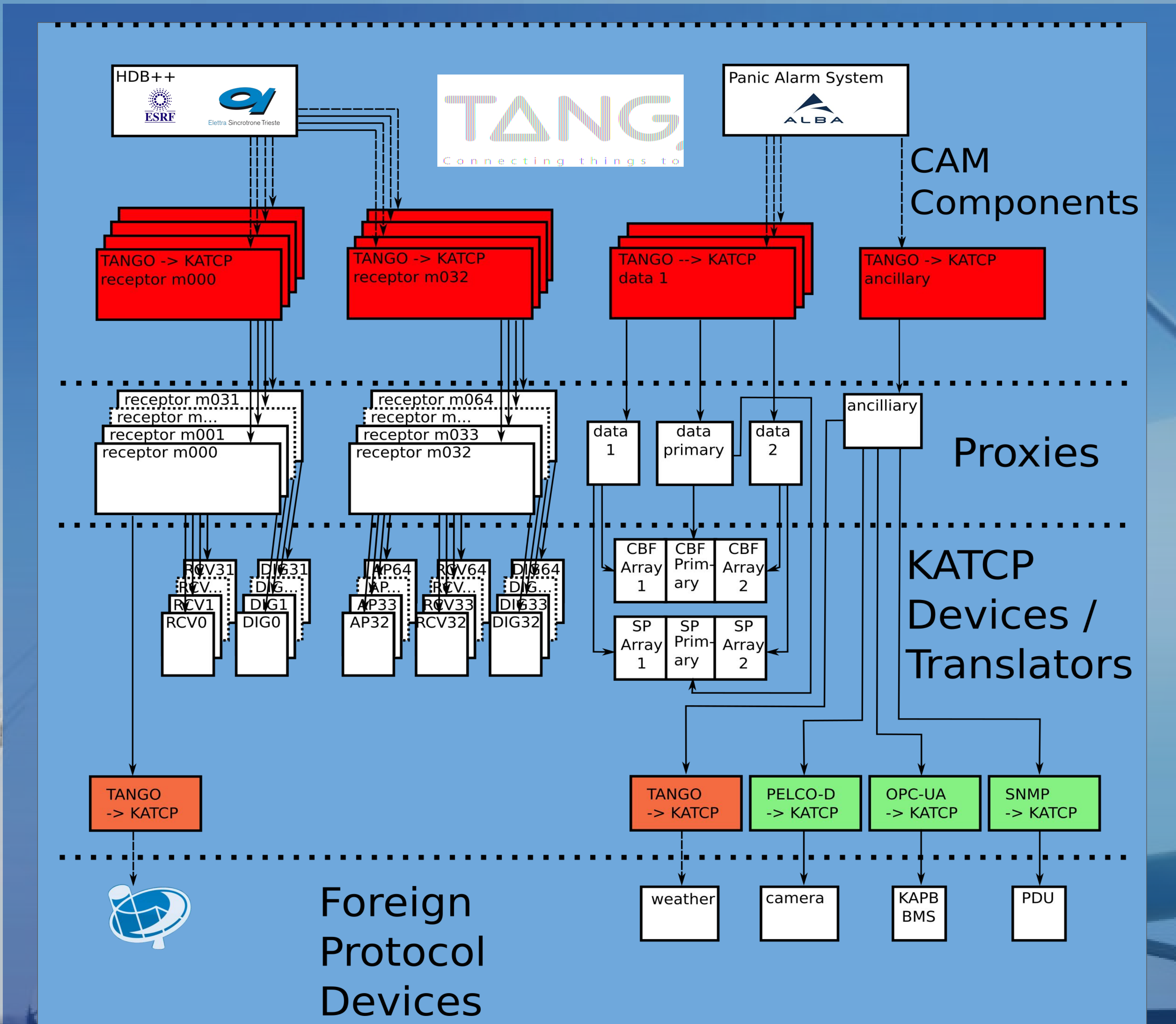SKA1 MID will be have TANGO based control system.

SKA1 will be built over 2019 to 2027.

TANGO BASED TM

MEERKAT TELESCOPE

A precursor to the full SKA system. Made up of 64 offset Gregorian dishes.

MeerKAT's control system is based on the KATCP protocol.

KATCP BASED CAM

TANGONIZED MEERKAT CONTROL AND MONITORING (CAM) ARCHITECTURE

HDB++ ESRF

TANG — Connecting things to

Panic Alarm System — ALBA

CAM Components

TANGO -> KATCP receptor m000
TANGO -> KATCP receptor m032
TANGO --> KATCP data 1
TANGO -> KATCP ancillary

Proxies

receptor m031 / receptor m... / receptor m001 / receptor m000
receptor m064 / receptor m... / receptor m033 / receptor m032
data 1 / data primary / data 2
ancillary

KATCP Devices / Translators

RCV31 / DIG31 / RCV1 / DIG1 / RCV0 / DIG0
AP64 / RCV64 / DIG64 / AP33 / RCV33 / DIG33 / AP32 / RCV32 / DIG32
CBF Array 1 / CBF Primary / CBF Array 2
SP Array 1 / SP Primary / SP Array 2

TANGO -> KATCP

TANGO -> KATCP
PELCO-D -> KATCP
OPC-UA -> KATCP
SNMP -> KATCP

Foreign Protocol Devices

weather / camera / KAPB BMS / PDU

Connections along solid and dashed lines are from *Karoo Array Telescope Control Protocol* (**KATCP**) and **TANGO** clients to servers, respectively.

The architectural design of the simulated *MeerKAT CAM* system with the *SKA MID DISH* prototype fully integrated.

The proxy layer protects all the hardware and the MeerKAT subsystems from direct access.

KATCP/TANGO & TANGO/KATCP TRANSLATORS

The translators are generic, they have no precoded idea of the TANGO or KATCP device that they are translating.

The TANGO *DeviceProxy* object is responsible for making client connections to the TANGO devices. It is a high level class which provides the client with an easy-to-use interface to TANGO devices

The translator interrogates the device for TANGO attributes and commands and exposes them over a KATCP server interface as KATCP sensors and requests, respectively.

Once the KATCP server inside the translator has been initialized, to remain synchronised with TANGO device, the TANGO *DeviceProxy* sets up attribute polling and subscribes to most, if not all, the attribute events.

The KATCP/TANGO translator is made up two major components, the ktcp-inspecting client and the TANGO device server. The katcp-inspecting client does is that it interrogates the KATCP device for its sensors (monitoring points) and requests. The *katcp_inspecting_client* makes use of the katcp_client instance to establish a connection with the KATCP device/simulator.

The TANGO device server component in turn exposes these KATCP sensors and requests as TANGO attributes and commands, respectively

Limitations of the TANGO/KATCP translator:
- It does not handle a TANGO device that dynamically changes its attributes or commands.
- Does not handle TANGO commands that take or return arrayed values, however this can be handled by simply using **kattype** with **multiple=True**.
- It only supports scalar attributes. KATCP does not define how sensors with 1-D or 2-D arrayed values should be handled.

KATCP client connection

TANGO -> KATCP
KATCP server
TANGO inspecting client
TANGO DeviceProxy

TANGO client connection

FUTURE WORK

There is a plan in place to have the SKA-mid prototype dishes installed and tested on the MeerKAT telescope as part of the SKA Dish Qualification Model (SDQM).

This, once the DSH LMC simulator has been developed, will entail the improvement/development of the TANGO/KATCP translator for the MeerKAT RTS and the SDQM LMC.