ANT Team Feedback

SKA Engineering Meeting - Stellenbosch - October 2016

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SQUARE KILOMETRE ARRAY
Exploring the Universe with the world's largest radio telescope

Agenda

1. Approach to M&C - Nick Rees - 20min

1. CS_Guidelines feedback - 20min
   LMC Harmonisation - 0. SKA Control System Guidelines (main)

1. Roadmap - 20min
   Including TM - <Element> ICD templates - Paul Swart

1. Patterns overview - 1h00
   LMC Harmonisation - 1. Element & Central Alarms Handling
   LMC Harmonisation - 2. SKA Logging
   LMC Harmonisation - 3. SKA Device Naming Convention
   LMC Harmonisation - 4. SKA Control Model
   LMC Harmonisation - 5. Configuration & Control
   LMC Harmonisation - 6. Integrating Distributed TANGO Facilities
   LMC Harmonisation - 7. Element Archiving & Central Archiving
   LMC Harmonisation - 8. SKA TANGO Developers Guideline

Approach to Monitoring and Control

Approach to Monitoring and Control

- Firstly, congratulations to the LMC Harmonisation team on the work to date.
- Big thanks to the ANT team in particular
  - Lize
  - Sonja
  - Simone
  - Andrea
  - Lorenzo

Current Status

0	Control System Guidelines	✅
1	Element & Central Alarms Handling	
2	Logging	✅
3	Device Naming Convention	
4	Control Model	
5	Configuration & Control	
6	Integrating Distributed TANGO Facilities	
7	Element Archiving & Central Archiving	✅
8	SKA TANGO Developers Guideline	
9	HMI Requirements and Guidelines	

Going forward - 1

- We need to look at how top level control flows down into the system.
  - There is a lot of good stuff in the two control documents.
  - These explore many of the options, but lack guidance on the central architecture.
    - Timing
    - Global state machines
    - Sub-arrays
- This could be said to be part of TM…
  - However, the architectural approach will significantly affect the complexity of each LMC.
  - It can also affect the difficulty of writing efficient execution scripts.

Going forward - 2

- Need to look at some of the TANGO issues
- How many of our TANGO assumptions have really been tested?
- Need to implement evolutionary prototypes of a large system based on our ideas.
    - No TANGO site has built up a system of systems in quite the way we propose.

Going forward - 3

- Need to develop the device naming convention
  - Possibly a good job for the office.

- Need to develop the HMI Guidelines.
  - Is it all Taurus?

- Anything missing?
  - Role of Sardana?

Going forward - 4

- How do we want TANGO to evolve?
    - Multi-parameter commands.
        - Richer data types
    - Updating the alarm state machine - IEC 62682
        - Deadbands
    - Handling multi-facility systems more transparently
    - Changes to make event-driven publishing easier to implement

Summary

- Need to:
  - develop a consistent vision on the SKA software architecture.
    - Will depend critically on TM
    - I plan to have some meetings on this.
  - move from a documentation phase to a validation phase by:
  - building evolutionary prototypes of
    - The core SKA classes
    - A representative SKA-sized system
  - complete the outstanding documentation based on these inputs.
  - join the TANGO consortium and start making key contributions.

CS_Guidelines feedback

CS_Guidelines feedback

www.tinyurl.com/SkaLmcShared / LMC Harmonisation

- Major cleanup and rework on the working documents of each topic and of the CS_Guidelines (SKA Control System Guidelines) main document

- CS_Guidelines main document now contains summaries the design patterns of the different topics.

- Drafts of two new topics:

    #7. Element Archiving & Central Archiving
    #8. SKA TANGO Developers Guideline

- The birth of the term "**ElementMaster**" to replace Element "LMC" for the top-level TANGO Device Server

CS_Guidelines feedback

This is what we have "ready" for the Engineering meeting:

- LMC Harmonisation - 0. SKA Control System Guidelines (main)
- LMC Harmonisation - 0.1 Element TANGO Interface Template
- LMC Harmonisation - 1. Element & Central Alarms Handling
- LMC Harmonisation - 2. SKA Logging
- LMC Harmonisation - 3. SKA Device Naming Convention
- LMC Harmonisation - 4. SKA Control Model
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Most work went into numbers 0, 1, 2, 3, 4, 7 and 8. 2 is "done".

CS_Guidelines feedback

- Summaries in the CS_Guidelines are a bit of a moving target as work is still continuing on the different topics,
- as are the actual design patterns

Patterns to finalise e.g.

- In the area of States and Modes:
  - there is an SKA TT Resolution Team that were convened and some SKAO work on Observing modes that happened in the last 2-3 weeks
  - also a TT team on Subarrays
- Alarms Handling to be aligned with the IEC 62682 standard
- ElementMaster presenting a discovery gateway to support Integrating multiple TANGO facilities
- also Telescope Model

Roadmap - CS_Guidelines

Focus to finalise CS_Guidelines early 2017:

- SKAO and ANT team to review CS_Guidelines and finalise design patterns with regular ±weekly telecons

- First "formal" numbered version to be issued by Dec 2016 (goal)

- Early 2017 - active review of full set of guidelines by the whole LMC community:
    - does it cover all use cases of your Element
    - suggest updates/improvements/alternatives

Roadmap - ICDs: Template

- interface implementation sections,

- enables adoption of CS_ Guidelines,

- ICD effort can focus on specific attributes & commands,

- WIP - got comments; inputs from SDP & Dish consortia

- Update from latest CS_Guidelines,

- [Google doc](#).
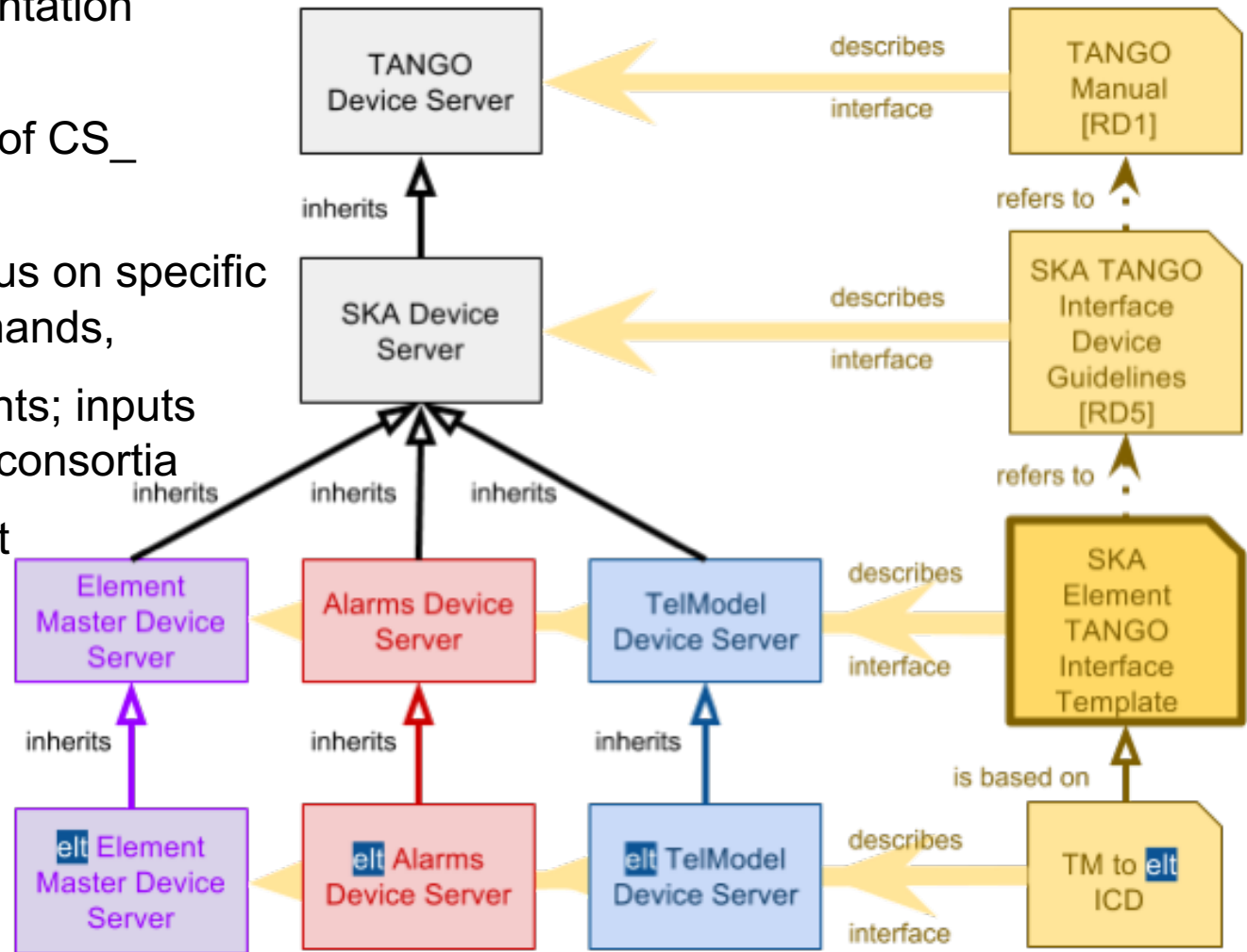
Roadmap - ICDs: Views

- Logical/functional structure
    - Element reports in hierarchical functional structure.
        - i. determine structure - derive from functional allocations to the Element from Mid & Low functional analysis.
        - ii. consortium breaks down allocated functions into lower functions.
    - To support observation scheduling, execution & monitoring, Element Capabilities are important functional aggregations of concern.
    - Navigation from Capability health to eqt resources.
    - Logical groups as TANGO devices/groups.
- Physical structure for Element M&C information:
    - based on PBS of the Element.
    - TANGO devices represent items in this structure.
- TANGO facilitates: user inspect & traverse structures.

Roadmap - ICDs: Alarms, Failures

- Alarms
  - Definition: *audible and/or visible means of indicating to the <u>operator</u> an equipment malfunction, process deviation, or abnormal condition requiring a timely response* ✧
  - Alarms philosophy to be promulgated by SKAO (suggestions from TM Consortium).
  - ICD population follow alarm identification, rationalisation.
- Failures
  - Definition: *The inability of an item to perform within <u>previously specified limits</u>* ✦
  - Consortia use FMECA analysis (per SKA ILS Plan) to systematically identify failures, and failure detection methods.
  - SKAO review to identify attributes that TM should subscribe to in order to forward to the ILS System as failure detection methods.

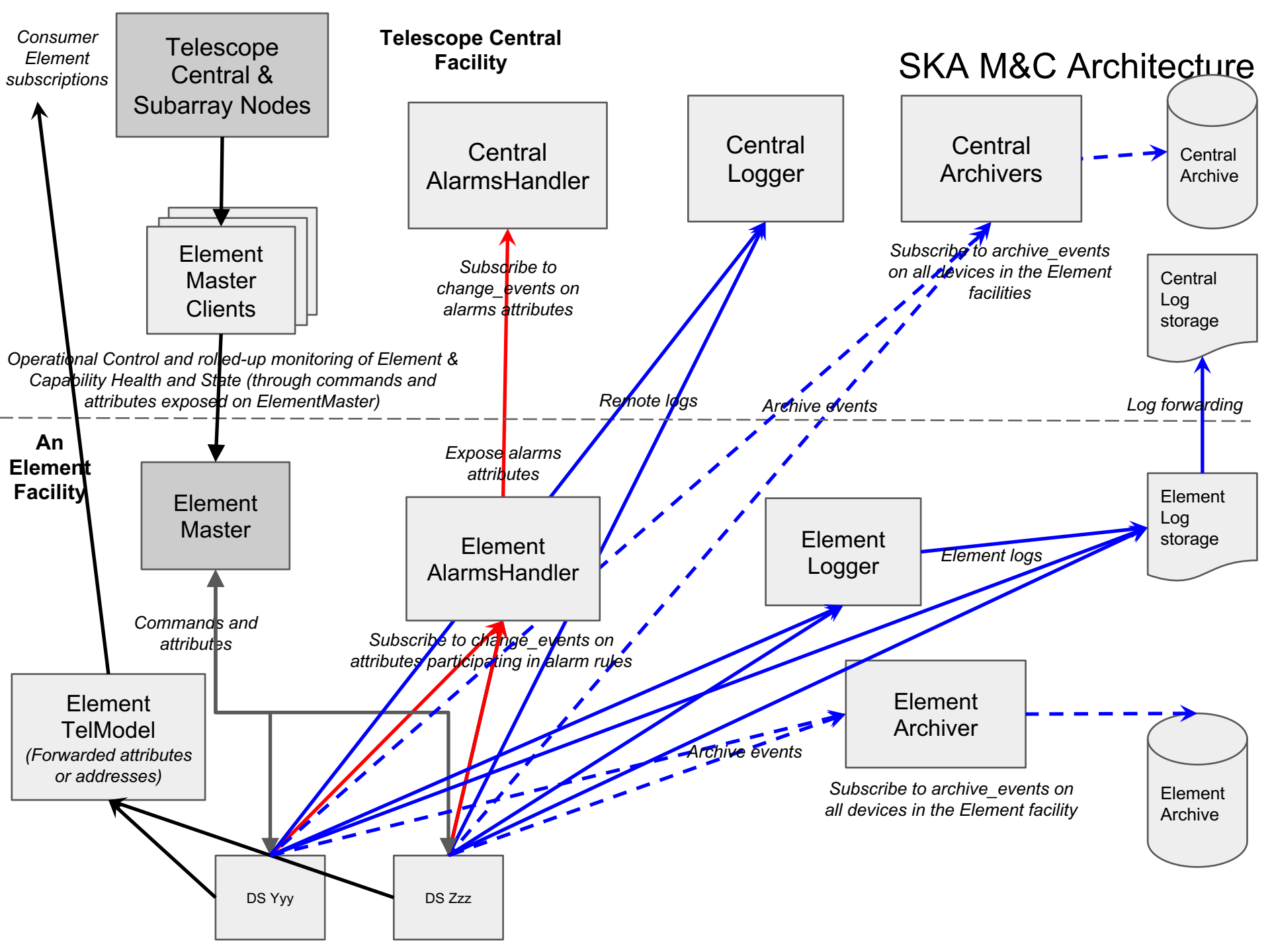✧ per ISA-18.2 / IEC 62682 Management of Alarms Systems for the Process Industry
✦ per MOD DEF STAN 00-60 Integrated Logistic Support Part 0 (referred to by SKA Integrated Logistic Support Plan)

Roadmap - Next topics?

- Requirements for Element level and SKA Device Base classes
  (to be included in SKA TANGO Developers Guideline)
- Combining real and simulated devices/facilities
- Remote Software/Firmware upgrade patterns
- HMI Guidelines:
  - standardised technologies
  - common look and feel
  - how to support drill-down from TM/Central facility/tools into Engineering interfaces supplied by Elements, etc
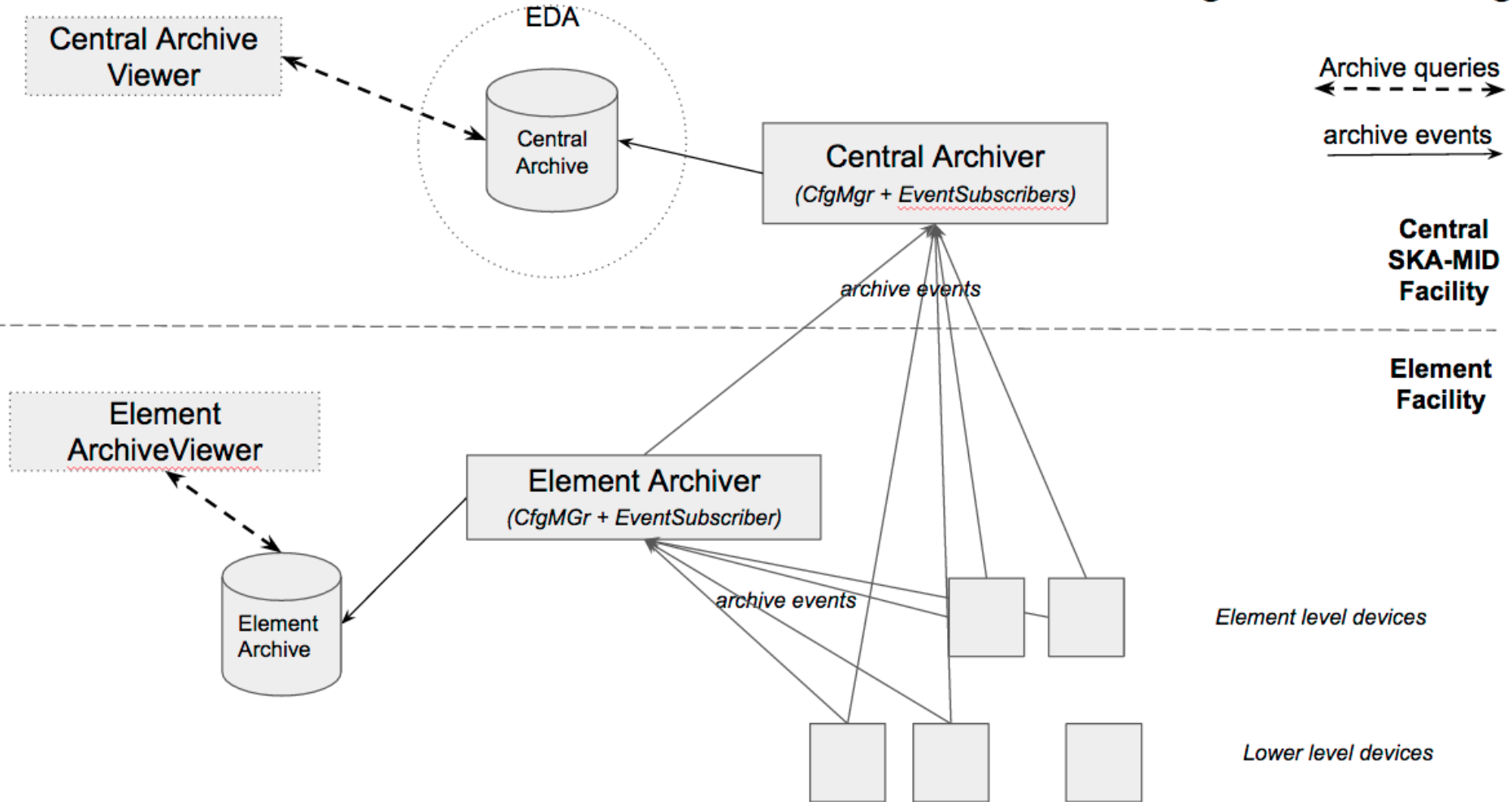- Suggestions from the floor:
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  –

Patterns overview

- LMC Harmonisation - 0. SKA Control System Guidelines (main)
- LMC Harmonisation - 1. Element & Central Alarms Handling
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SKA M&C Architecture

Telescope Central Facility

Consumer Element subscriptions

Telescope Central & Subarray Nodes

Central AlarmsHandler

Central Logger

Central Archivers

Central Archive

Element Master Clients

Subscribe to change_events on alarms attributes

Subscribe to archive_events on all devices in the Element facilities

Central Log storage

Operational Control and rolled-up monitoring of Element & Capability Health and State (through commands and attributes exposed on ElementMaster)

Remote logs

Archive events

Log forwarding

An Element Facility

Element Master

Element AlarmsHandler

Expose alarms attributes

Element Logger

Element Log storage

Commands and attributes

Element logs

Subscribe to change_events on attributes participating in alarm rules

Element TelModel
(Forwarded attributes or addresses)

Element Archiver

Element Archive

Archive events

Subscribe to archive_events on all devices in the Element facility

DS Yyy

DS Zzz

New: #7 Element & Central Archiving

Integrated Archiving

New: #8 SKA TANGO Developers Guideline

- New guideline - for TANGO device classes
- Supercedes LIG and TIG
- Various aspects including:
  - Use of Quality Factor on all attributes
  - Implementation of "device_interface_changed" events
  - MariaDB as the TANGO configuration database
  - Polling and event configuration
  - Naming conventions for commands, properties, attributes, enums
  - List of standard commands, properties and attributes for Element Level devices and SKA devices
  - Template for Device Class Documentation

#1 Element & Central Alarms Handling

- Each SKA alarm will be configured as a rules-based aggregation
- SKA alarm is separate from attribute quality factor `ATTR_ALARM`
- Each SKA alarm will be exposed as an alarms attribute on the ElementAlarms handler
- CentralAlarms handler to subscribe to alarms on all ElementAlarms devices
- CentralAlarms implements its own rules-based aggregations for telescope wide alarms
- Standard commands on Alarms Handlers to support CentralAlarms
  - GetAlarmRule - Get all configuration info of the alarm, e.g. rule, defined action, etc - if not yet available
  - GetAlarmData - Get list of current value&quality factor&status of all attributes participating in the alarm rule

- Next steps:
  - Finalise SKA alarms format, levels and actions to be aligned with IEC 62682 standard
    [http://www.exida.com/2015/Alarm_Management_Rationalization_Poster_Sept2015.pdf]
  - Guidelines on when/what to define as alarms vs faults / failures and health status

#4 SKA Control Model

Impacts:

- SKA MID/LOW TT Resolution team and SKAO work on high-level telescope and subarray states and modes, and observing modes
- SKA MID TT Resolution team on Subarrays

1. TANGO Device State will be used to reflect the SKA Operational State.
2. Proposed SCM contains the following items: (some will be mandatory, others optional, different items apply to different levels like Element, Capability, subarray, LRU)
   a. Operational State: OFF, INIT, ON, ALARM, FAILED, LOW-POWER, UNKNOWN
   b. Health Status: OK, DEGRADED, FAILED
   c. Usage Flag: IDLE, CONFIG, ACTIVE, STANDBY
   d. Admin Mode: ENABLED, DISABLED, MAINTENANCE, NOT-FITTED
   e. Observing Mode :   IDLE, IMG-CONTINUUM, IMG-SPECTRAL-LINE, IMG-ZOOM,
   f.   PULSAR-SEARCH,   TRANSIENT-SEARCH, PULSAR-TIMING, VLBI
   g. Control Mode: UNRESTRICTED, CENTRAL, LOCAL
   h. Simulated Flag: TRUE, FALSE
   i. Test Mode: NORMAL, custom values

#5 SKA Configuration & Control facilities

- Priority topic to be finalised next
- Use Cases has been drafted
- Elements to review to ensure their Element's use cases are adequately captured
- Topics described in CS_Guidelines (main) includes:
    - Element configuration/sequencing
    - Structured command parameters & command validation
    - Using commands vs write attributes
    - Long running/future dated commands
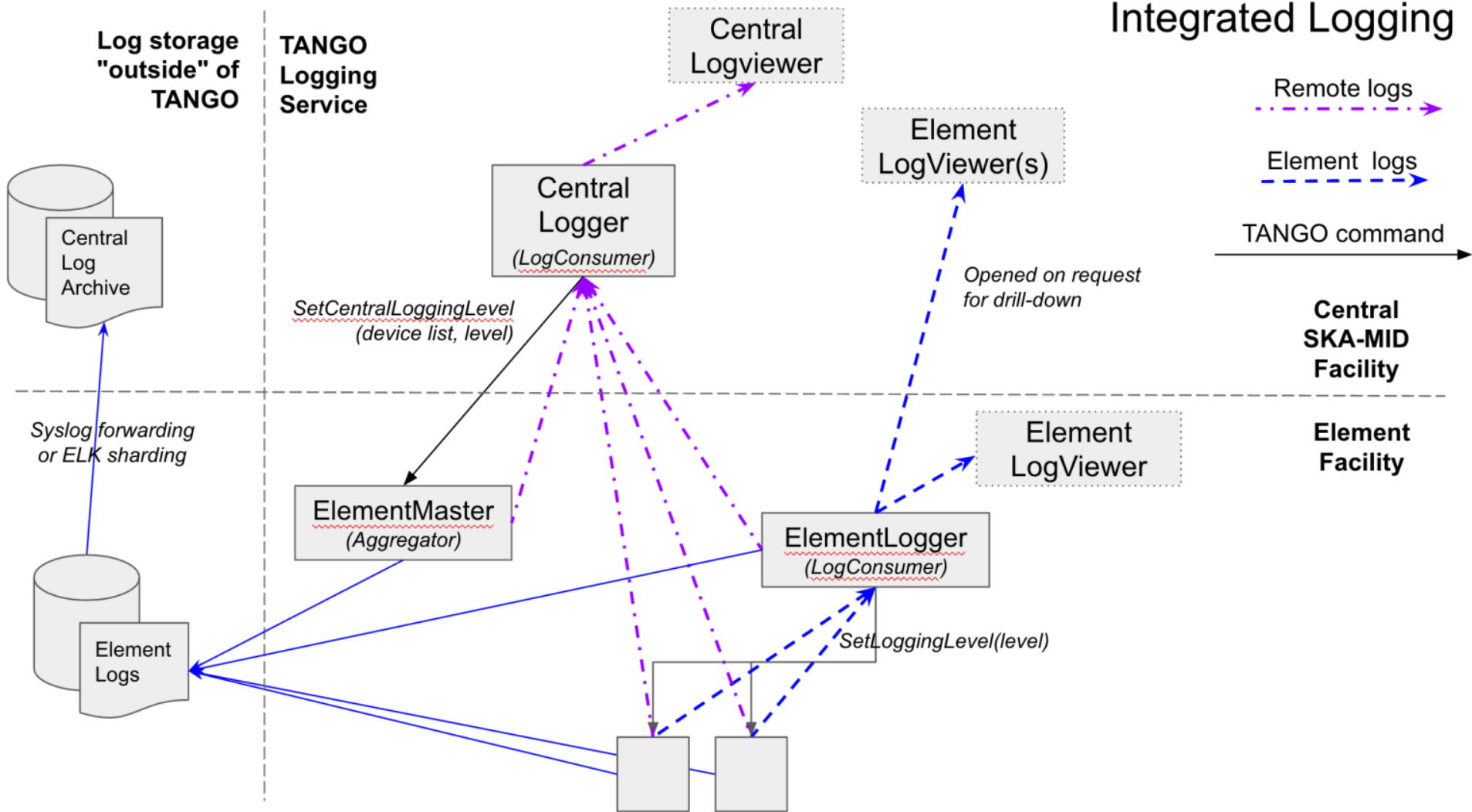   - Progress feedback

#3 SKA Device Naming Convention

- <u>Globally</u> unique TANGO device names
  (across Observatory, MID_SKA and LOW_SKA telescopes)
- Separate TANGO facility for each Element (and every instance in case of DSH)
- Central TANGO facility for each telescope (SKA_MID and SKA_LOW)
- **SKA Facilities** - fixed set of SKA facilities; UPPERCASE with dash "-"
  e.g. SKA-MID, SKA-LOW, MID-CSP, LOW-SDP, LOW-LFAA, MID-DSH-nnnn, MID-SADT, LOW-SAT
- **SKA device names** (/DOMAIN/FAMILY/MEMBER) in lowercase with underscore "_" as a separator, no dots, no dashes.
- **SKA domains -** limited, predefined set of domains per Element,
  e.g. for LOW-CSP it can be low_csp, low_csp_lmc, low_csp_cbf, low_csp_pss, low_csp_pst
- Logical "**aliases**" will be used always to find/reference devices to allow for simulated and real facilities to be combined easily
- Examples of Element devices are populated in the guideline, to be reviewed and updated by each Element

#2 SKA Logging

Integrated Logging

Questions?