Telescope Manager

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on behalf of TM Consortium

Agenda

- Overview
  - Functionality, consortium, relationships to other Elements, work plan
- Preliminary architectural concept
  - Architectural issues and options
- Science lifecycle support
  - Core features and enablers
- Engineering lifecycle support
  - Approach to quality attributes
- LMC Interfaces
  - Interaction model
  - TM & LMC roles and responsibilities
- Next Steps
  - Requirements, ICDs, Gaps, risks & issues
- Deliverables

Functionality Overview

Monitoring & Control

- Acquire monitoring data, roll-up & drilldown views to operators, engineers
- Provide parameters and metadata to CSP/SDP, support feedback loops if required (at least during calibration)
- Commands to support the science and engineering lifecycles
- Logging & engineering data archives for diagnostics, science data interpretation

Health & Status Management

- Detection, automated response to alarms, health & safety situations
- Backup safety detection & response
- Operator control rooms & Uis
- Support remote diagnostics and management Uis for engineers
- Ensure performance, reliability, availability, safety , security

Observation management

- Scheduling and possibly dynamic rescheduling
- Configuration for observations
- Orchestration, monitoring and management of observations
- Support for sub-arrays, targets of opportunity, dynamic rescheduling

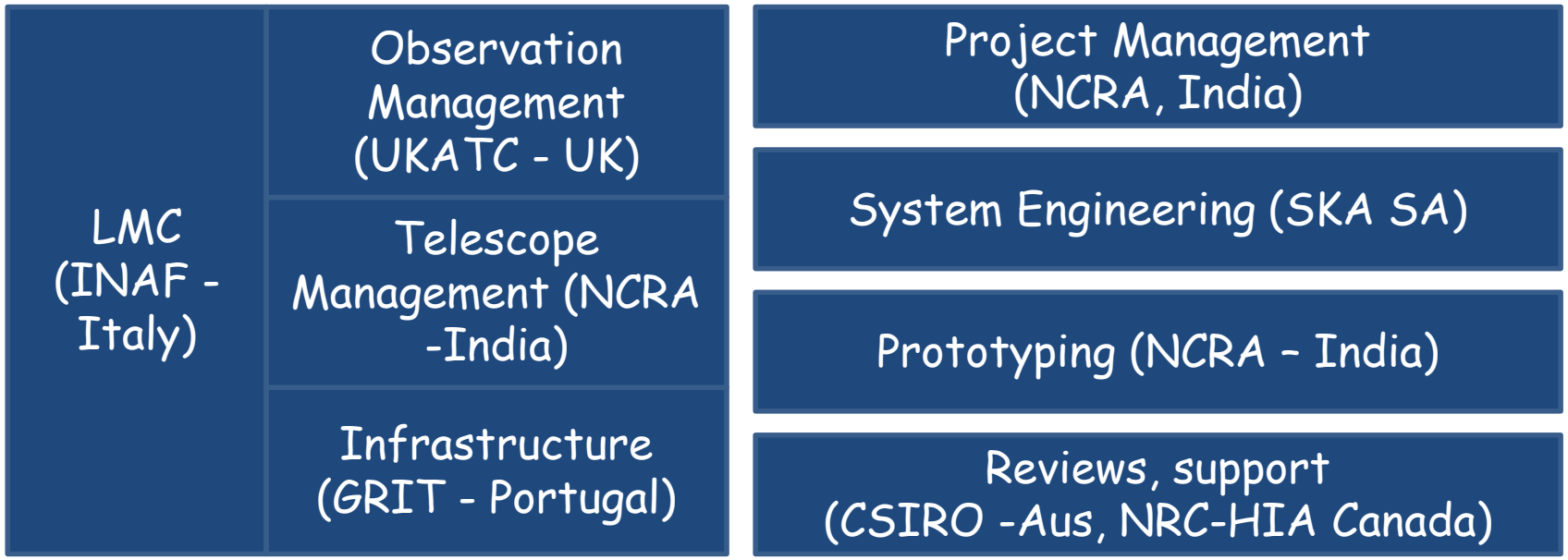
Support Instrument Lifecycle

- Commissioning
- Setup and calibration
- Diagnostics and repair
- Maintenance and Upgrades
- Support for Asset & Config mgmt

Proposal Lifecycle

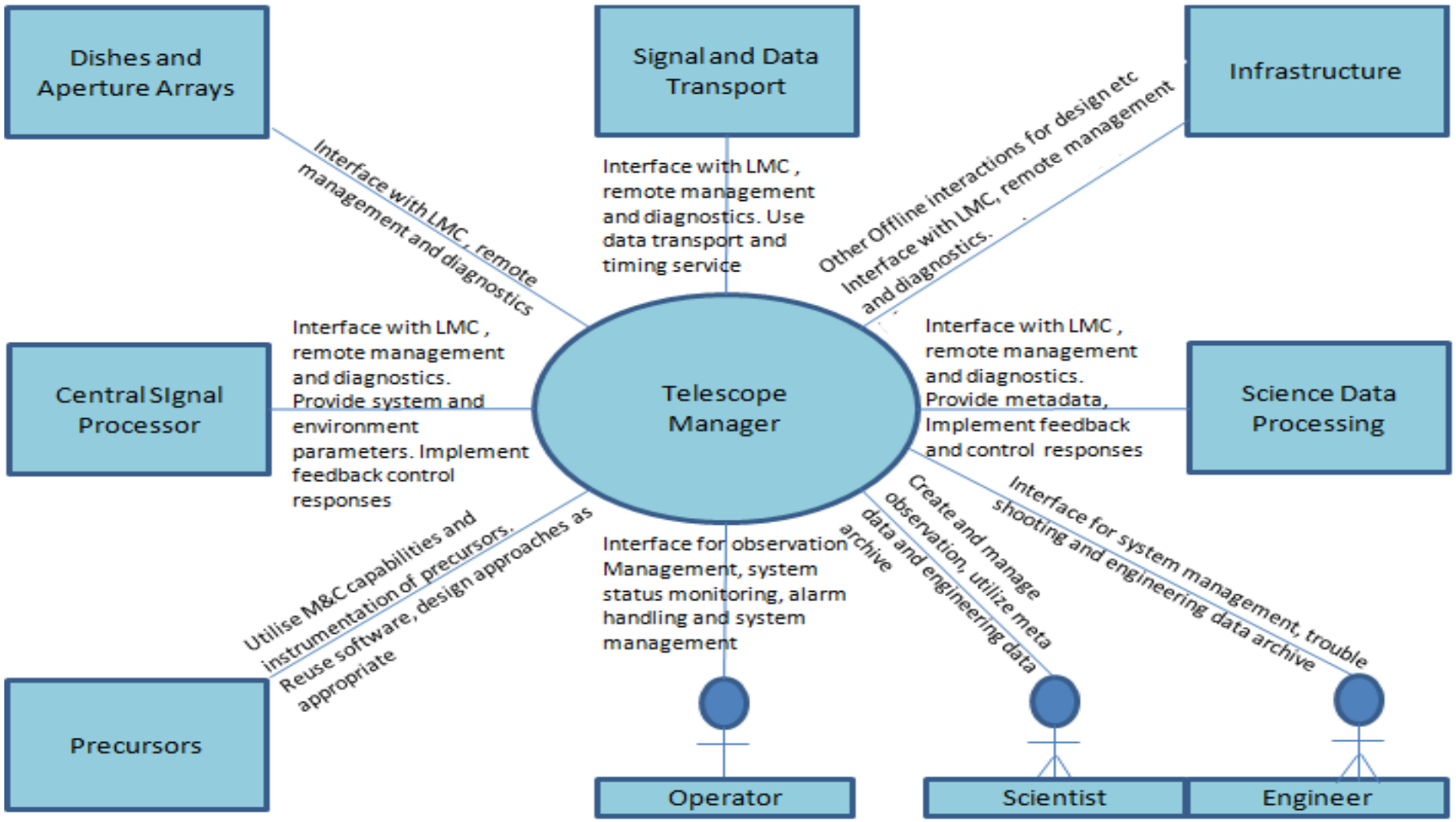
- Proposal Lifecycle Support may be added

TM Consortium : Level 4 Packages & Leads



- Participation from precursor M&C teams: MeerKAT, ASKAP
- Significant industry participation

Relationships to Other Elements

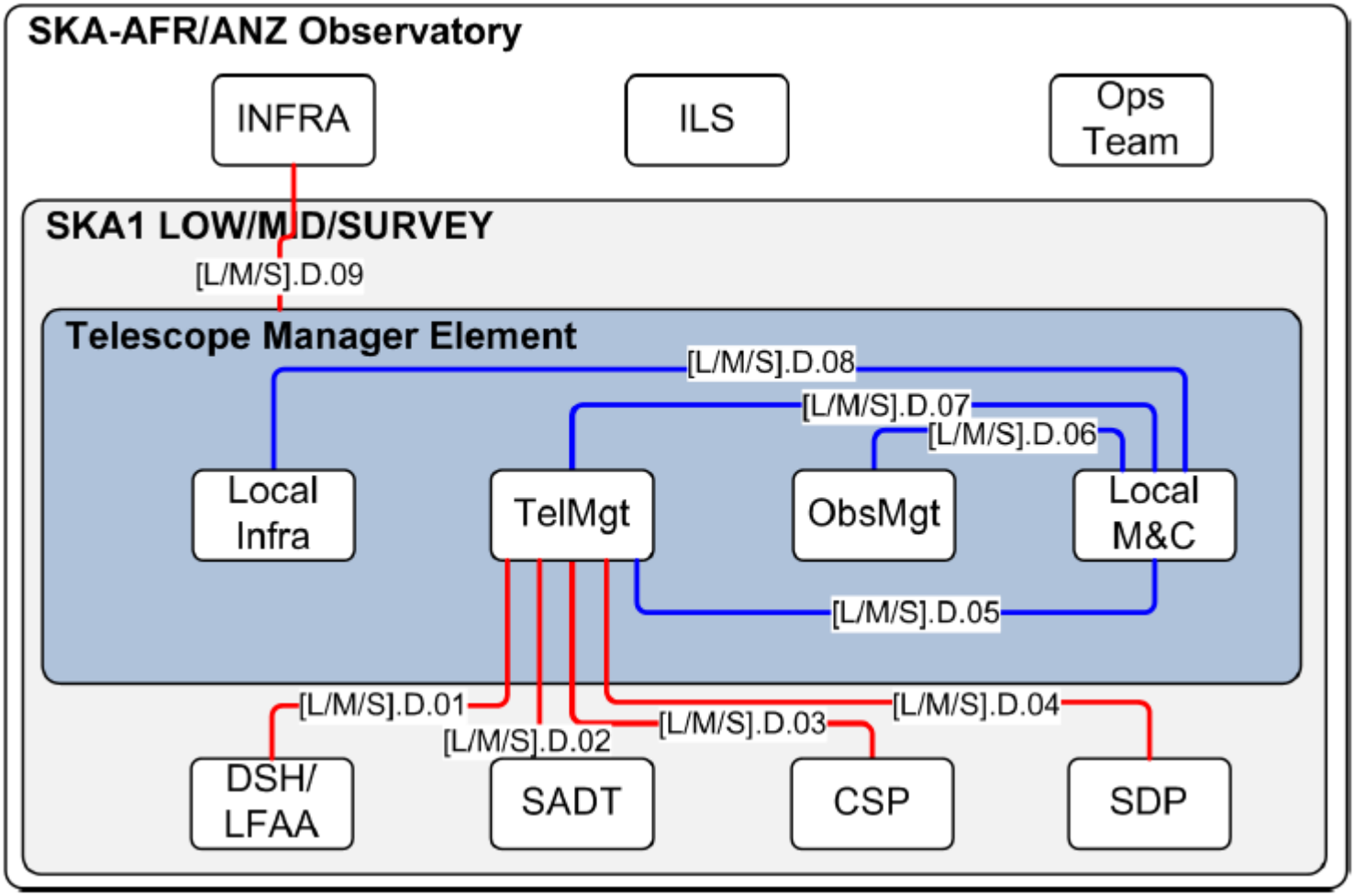


LMC interfaces to all other Elements, some flexibilities e.g. MeerKAT BMS

Provide parameters & metadata to CSP, SDP

SADT, INFRA provide services

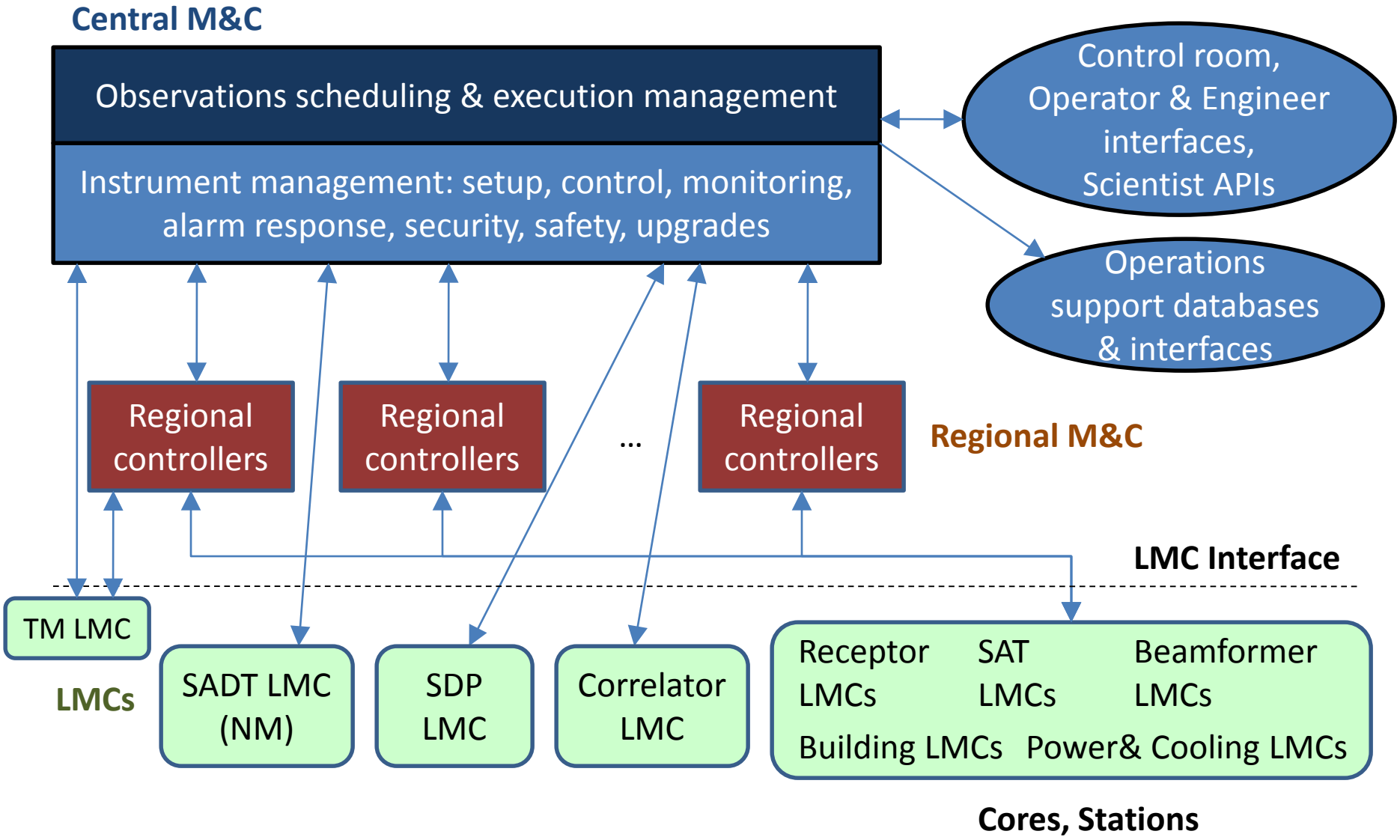
Sample ICDs


SKA-AFR/ANZ Observatory
INFRA
ILS
Ops Team
SKA1 LOW/MID/SURVEY
[L/M/S].D.09
Telescope Manager Element
[L/M/S].D.08
[L/M/S].D.07
[L/M/S].D.06
Local Infra
TelMgt
ObsMgt
Local M&C
[L/M/S].D.05
[L/M/S].D.01
[L/M/S].D.02
[L/M/S].D.03
[L/M/S].D.04
DSH/ LFAA
SADT
CSP
SDP

Plan for next few months

- Requirements
  - Obtain L1 requirements from SKAO
  - Interact with other Elements to obtain preliminary requirements
    - Monitoring points, data rates, control & configuration needs
    - Video cameras, weather stations and other special monitoring needs
    - Special needs (e.g. timing constraints, facilitate cross-Element interactions, cross-Element error detection & response)
    - Metadata, parameters, cross-Element feedback control
  - Stakeholder requirements [elicitation, role play]
  - Requirements outline by Q1 2014, models & docs by Q3 2014
- Architecture
  - Issues, candidate options by Q2 2014
  - Feedback to baseline update by Q3 2014
- LMC interaction model: Q2 2014
- LMC interface definitions ICDs: Q2 2014

Preliminary Architectural Concept

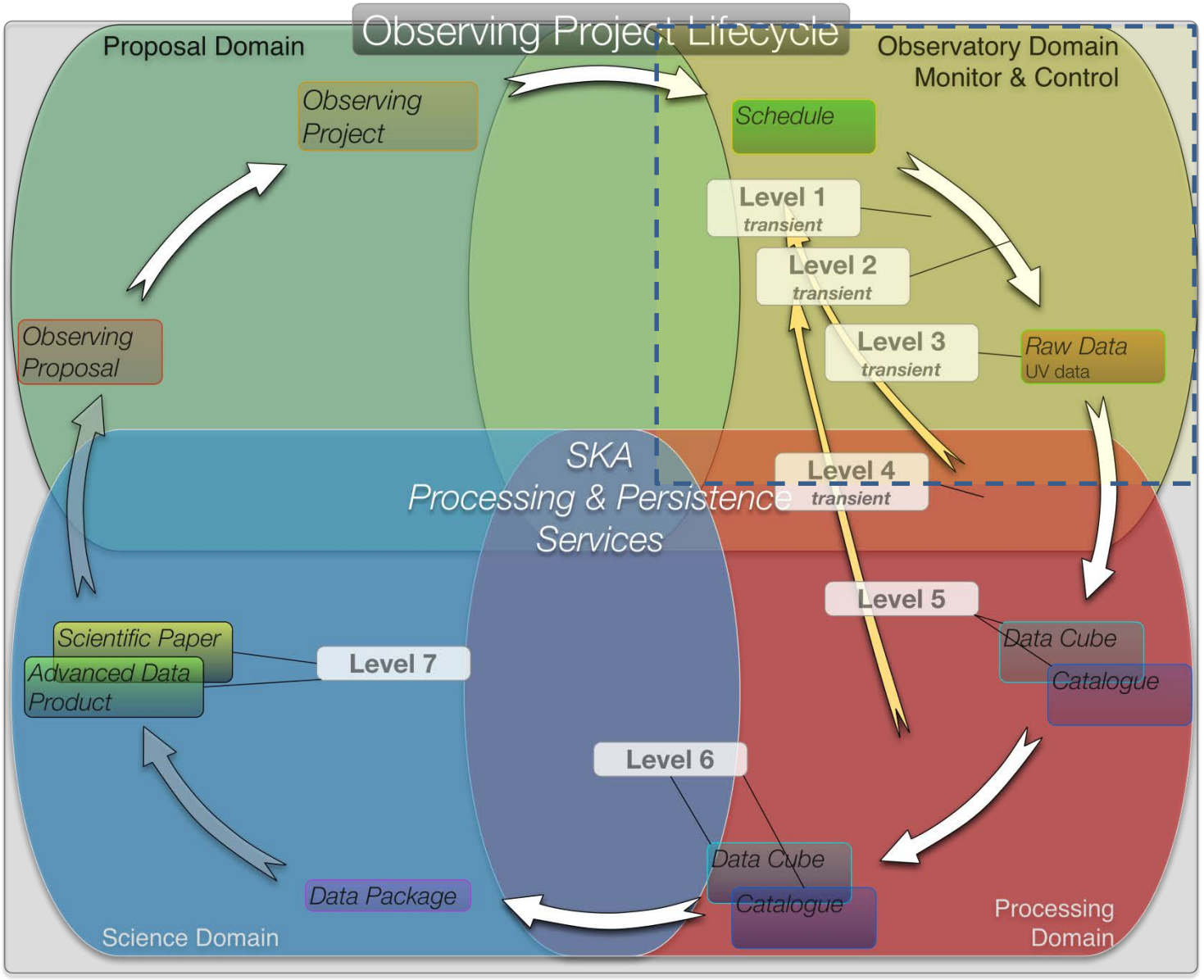


TBD whether one or more LMC interfaces per Element

Architectural Issues and Options

- Single TM with variabilities vs. Multiple TM instances with commonalities
  - Focus on individualized needs of each telescope vs. unified view of problem
- Integration of precursor TM systems: can replace, integrate precursor receptors as region with its own controller.
- Sub-arrays: Create dynamic controller nodes within Regional M&C or central M&C.
- Deployment of Regional M&Cs within each region or at the centre.
- Single vs. multiple LMC interfaces per Element
- Specifications-driven approach to minimize effort and reduce lifecycle costs.

Science Lifecycle



Current TM Scope

Observation Management: Features

- Proposal submission, handling and preparation
  - To Be Confirmed with SKAO
  - Will carry out initial analysis of options
- Scheduling of Observations
  - Long/medium/short term scheduling
  - Allocate resources for observation;
  - Sub-array management;
  - Respond to resource availability, environment, etc;
  - Manage multiple concurrent observations;
  - ToO response
- Observation Execution
  - Configure, set up, calibrate, execute;
  - Manage meta-data collection & delivery to CSP, SDP;
  - Respond to any unexpected events

Observation Management: Enablers

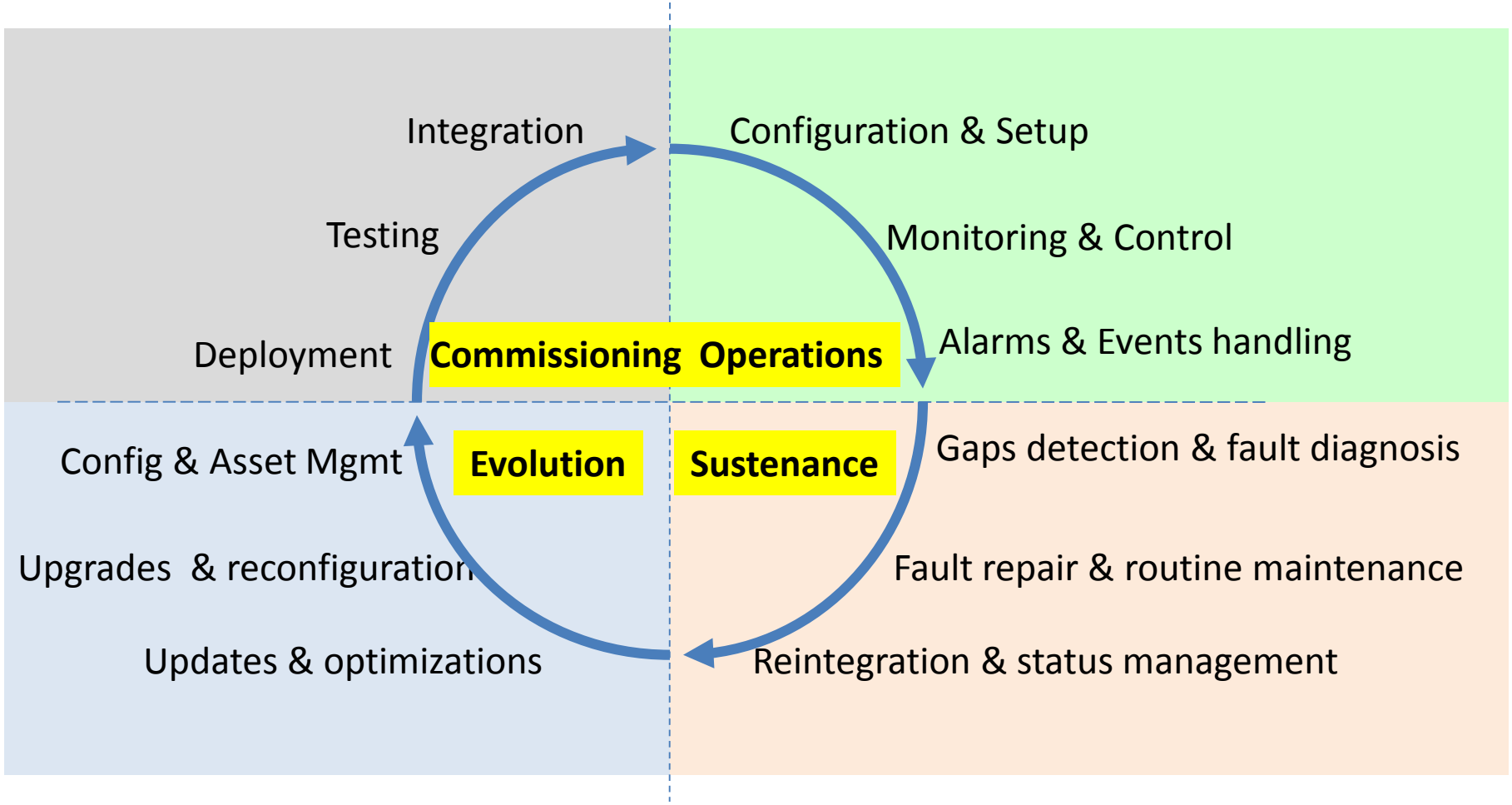
- Support development of observing modes, scripts
- Support for observatory calibrations
- Simulation capabilities
- Track project execution & lifecycle
- Support for three separate telescopes
- User interfaces to all tools

Cost-cap may lead to de-scoping of features

Challenges:

- Concept of Operations drives many requirements
- SKA1 is a very heterogeneous system, especially with pre-cursors absorbed.

Engineering Lifecycle



Telescope Management: Features

- Commissioning and integration
  - Continuous commissioning: separation of commissioning traffic from operational traffic
  - Simulators to enable pre-integration testing
- Operations
  - Commands distribution to the receptors allocated to each observation
  - Data processing to derive parameters and metadata
- Sustenance: Health and status management
  - Analysis of data from multiple sources for situation detection and response (faults, safety situations, behaviour optimization)
  - “Forensic analysis”
  - Automation of non-local situation responses
- Evolution
  - Automation support for updates and upgrades, including state management and backward compatibility support for upgrades

Approach to Quality Attributes

- Performance
  - Avoid tight real-time control loops across Components & Elements
    - Delegate hard real-time behaviour to LMCs, reduce effort & cost
  - Target 250 – 500ms (TBD) latency for monitoring & alarms notification
- Security
  - Support physical security (surveillance & response), network security (e.g. location-based access), authentication & authorization, logging
- Safety: People & equipment protection
  - Backup safety detection & response, cross-Element safety, safety scenarios analysis
- Reliability & Availability
  - LMC interface serves as heartbeat for all Elements & Components
    - Detection & handling of faults & failures, usually as backup
  - Framework to facilitate proactive detection & response
  - Failed and in-maintenance entities as part of normal operating situation
- Evolution
  - Standardization, technology modularity (layers, interfaces, protocols, configurability)

Interface with LMCs

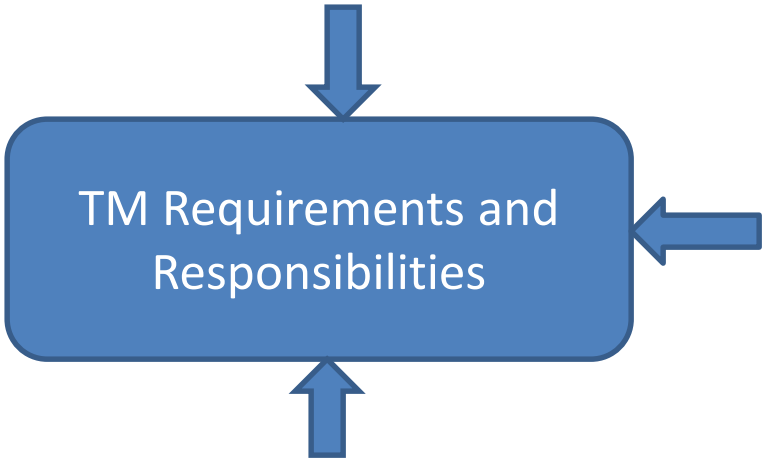
- Goal: Uniform Interaction Model with all LMCs
  - Roles and responsibilities for LMCs, TM
  - Interaction Concepts (State abstraction, statuses etc)
    - E.g. States such as {Operational, Faulty, Not Integrated, Not Fitted}
  - Interface style (Commands, Data, Events, Alarms, Logs etc)
  - Configurable specifics (List of commands, data, data rates, alarms, events, external control model)
  - Application protocols uniformity: naming conventions, field names, common commands etc
- Basic interaction concept
  - TM sends commands to LMCs, to perform observations or to manage
    - Configuration, startup/shutdown, orchestration (e.g. TRACK), state & status management, lifecycle management (e.g. Upgrade)
  - TM acquires data and does processing & analysis, to generate monitoring views and to detect events & undesirable situations
  - TM provides automatic responses to alarms and events, as well as communication of alarms to operators and relaying of responses
  - Engineers can do diagnostic either via TM or access LMC directly
  - Elements decide number and scope of LMC interfaces

TM & LMC Roles & Responsibilities

LMC	TM
Internal monitoring, roll-up & drilldown status & health, state & status abstractions	Data acquisition from LMCs, system-level status with drilldown for operators, engineers
Internal coordination to achieve higher-level capability. Define external control model	Orchestrate based on defined external control model to achieve science & engineering goals
Detect & handle faults and alarms, especially if fast response required. Escalate to TM / Operator if needed.	Cross-Element detection and handling. Automation of fault handling, operator interfaces
Primary responsibility for local safety & equipment protection.	Backup detection & response, cross-Element safety situations.
Interfaces for remote diagnostics, with drilldown to FRU level.	“Tunnelling” access to diagnostic interface, remote diagnostics support
Self-description interface to retrieve list of commands, data, alarms etc	Engineering archive to facilitate diagnostics, science data interpretation

Next Steps: Firming up Requirements

L1 Requirements
Concept of Operations
DRM use case analysis



Inputs from other Elements

- Control responsibilities
- Number & type of monitoring points
- Situation detection and automated response requirements
- Metadata, parameters and associated timing requirements
- Special needs

Engineering use cases analysis
Architectural options analysis
Requirements from similar projects
Constraints, including precursors

ICD Creation

- Scope of ICDs
  - LMC ICDs: define the monitoring & control interface
  - Metadata & parameter ICDs
  - TM as consumer: SADT, SAT and INFRA interfaces
- Plan
  - Identify set of ICDs that need to be created
  - Generate early draft contents for each ICD
  - Agree upon overall interaction model and responsibility split
  - Identify special needs
  - Work out detailed aspects together: set of common commands, naming conventions etc.

Gaps, Risks and some key issues

- Detailed ConOps document is essential for TM
- Commonality between 3 telescopes from point of view of TM
- Proposal lifecycle responsibilities
- Responsibilities towards safety : need clarity with SKAO
- Interface with Precursors : need clarity with AIV
- Who is responsible for interfaces with external sources of information sources for the observatory (source catalogs, earth ephemerides etc)
- Stakeholder requirements elicitation, including operators, engineers
- Sub-arrays requirements needs more clarity / refinement

Deliverables

Timeline	Approx date	Milestone
T0	Nov-13	Kick Off
T0+13	Feb-14	Closure of requirements
T0+21	Apr-14	Analysis report of LMC Standards
T0+30	Jun-14	Architecture Analysis Report
T0+34	Jul-14	Analysis and solutions for proposal management and observing prepa
T0+43	Sep-14	Input to baseline Design
T0+52	Nov-14	PDR submission
T0+56	Dec-14	Closure of PDR post negotiations

Timeline	Approx date	Milestone
T0	Jan-15	Kick Off
T0+8	Apr -15	Verification of Requirements Analysis
T0+21	July -15	Prototyping Plan
T0+52	Jan-16	Frameworks/Technologies Analysis
T0+65	Apr-16	Test reports on prototypes / prototypes early version
T0+74	Jun-16	TM Test readiness review
T0+87	Sep-16	Procurement Docs for tendering process
T0+91	Oct-16	CDR Docs Delivery
T0+104	Jan-17	CDR Closure

Thank You!

Questions?