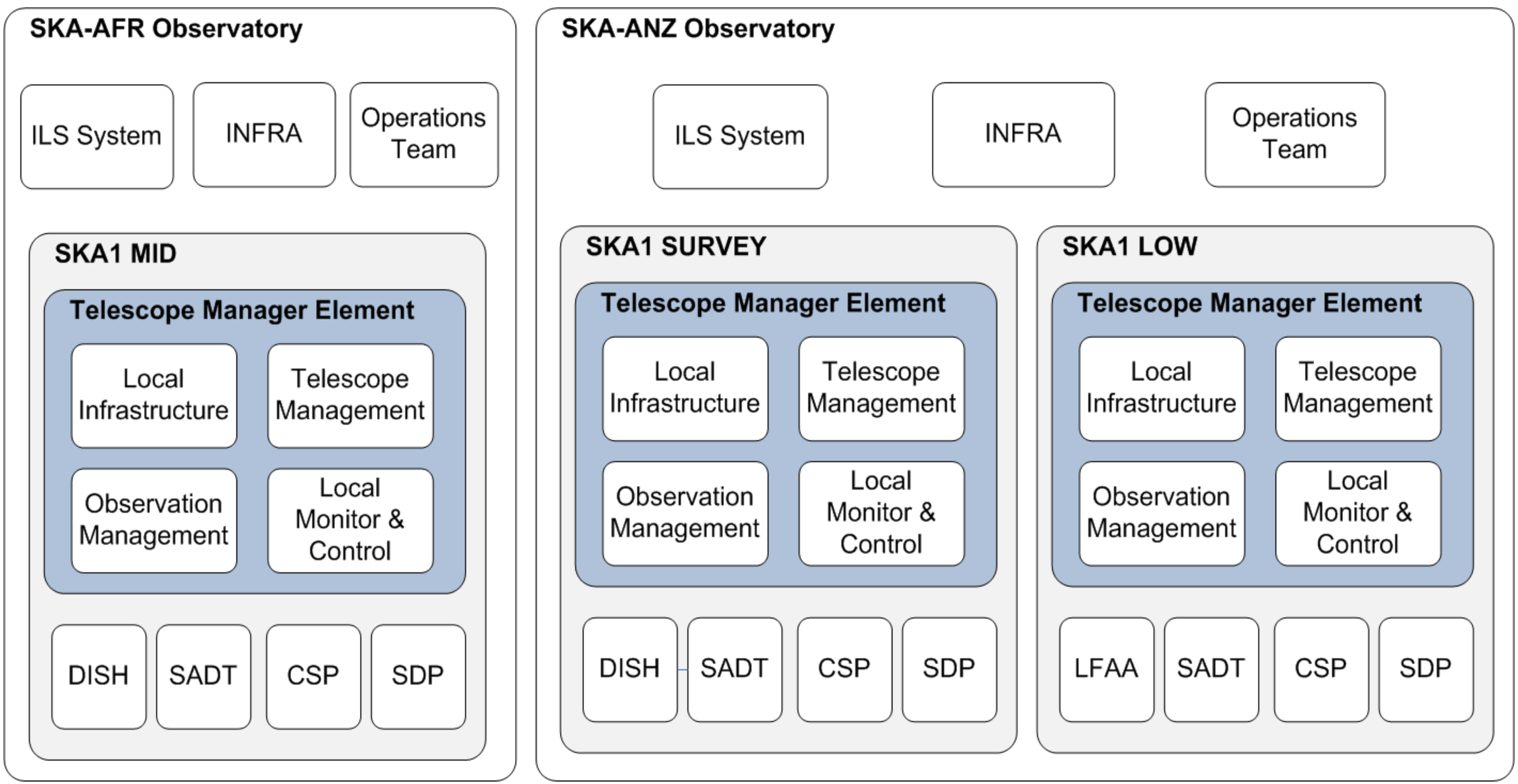
TM Interfaces

Interface Management Workshop
June 2013

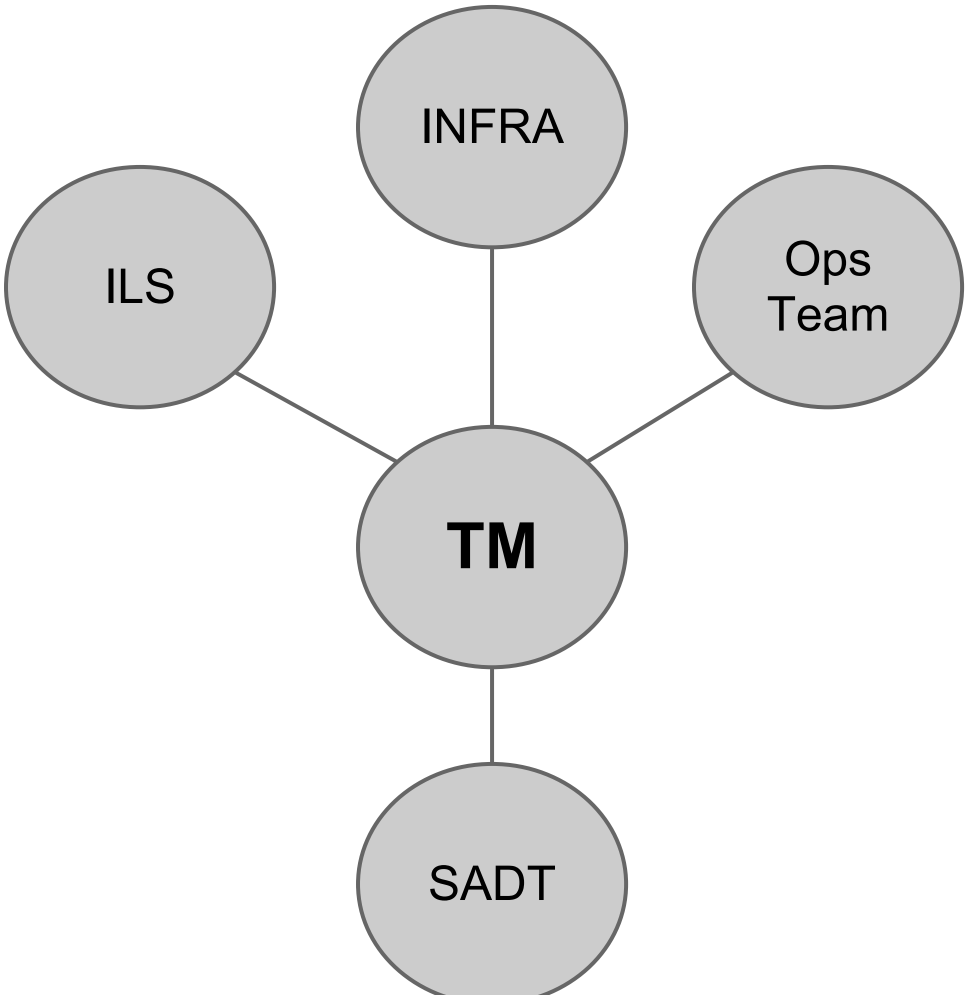
TM Scope and Boundaries

- TM in SKA PBS



TM Scope and Boundaries

- TM Physical Context (Direct interfaces)

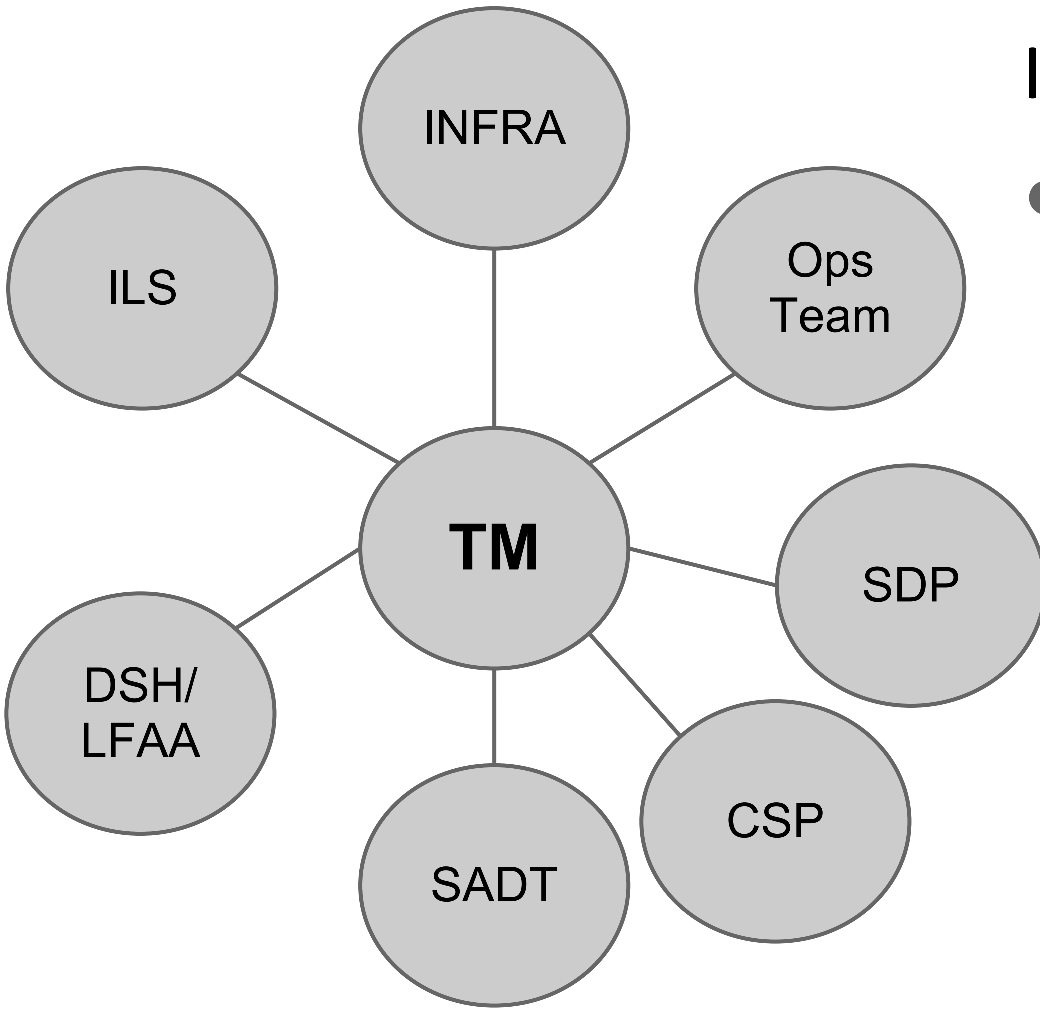


Interface Classes:

- Mechanical
- Electrical
- Electronic (connector)
- Human

TM Scope and Boundaries

- TM Functional Context (Indirect interfaces)



Interface Classes:

- Data exchange

TM Conceptual Approach

- TM is likely to be hierarchical, with the concept of a Central M&C, and (logical) regional M&Cs. It is likely that TM will be largely identical across the three telescopes, and will integrate precursor M&C systems.
- Elements and components will be semi-autonomous i.e. their internal monitoring, control, alarm handling and fault & safety situation detection and response will all be done by their own LMC. LMCs interface with TM as a higher-level hierarchical controller through a consistent LMC interface standardised across all elements.
- TM will collect data, events and alarms from every Element, process it to derive status, parameters and metadata, make this information available to Elements, present it at operator & engineer interfaces, and accept commands from them that will be relayed to Elements
- TM will provide metadata for science products
- TM's role is to schedule and execute observations, provide operator and engineer interfaces, and provide system-wide coordination, backup safety detection & response, support for engineering activities (commissioning, diagnostics, upgrades etc)

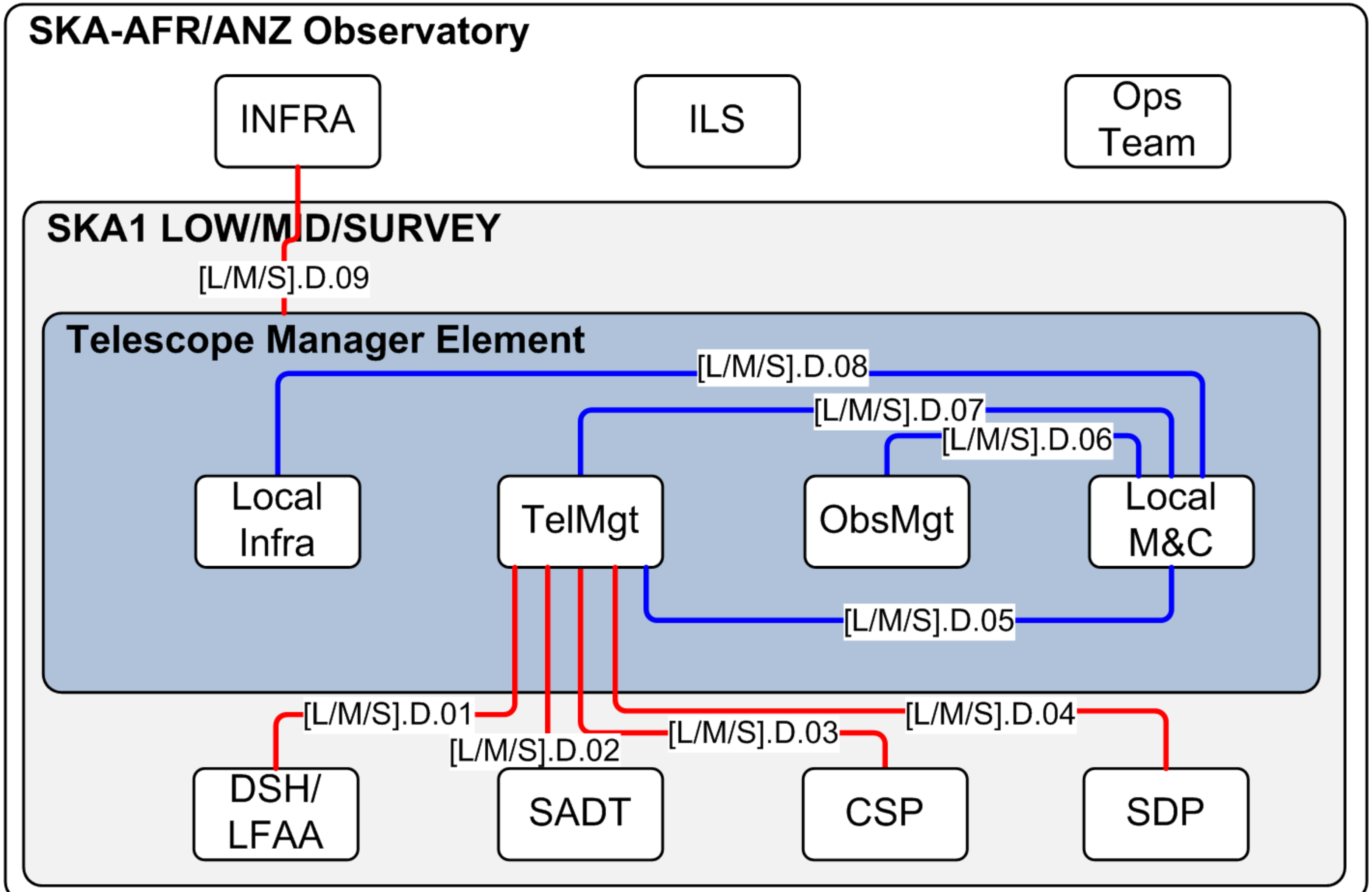
TM Working Assumptions

Current scope & boundary assumptions, for comments and feedback:

- LAN design for M&C is part of SADT.TM, not TM.
- TM gives input to the operator control room design (concept design). TM provides operator and engineer but not scientist interfaces.
- Facilities monitoring capabilities (e.g. video cameras) will be defined and probably implemented by INFRA (responsibilities to be mutually defined)
- The observation operations of the three telescopes are mutually independent. There may be some minimal coordination of engineering operations (e.g. software updates). It is not clear whether there will be any shared equipment e.g. network links that will necessitate interaction between the TM instances for each telescope

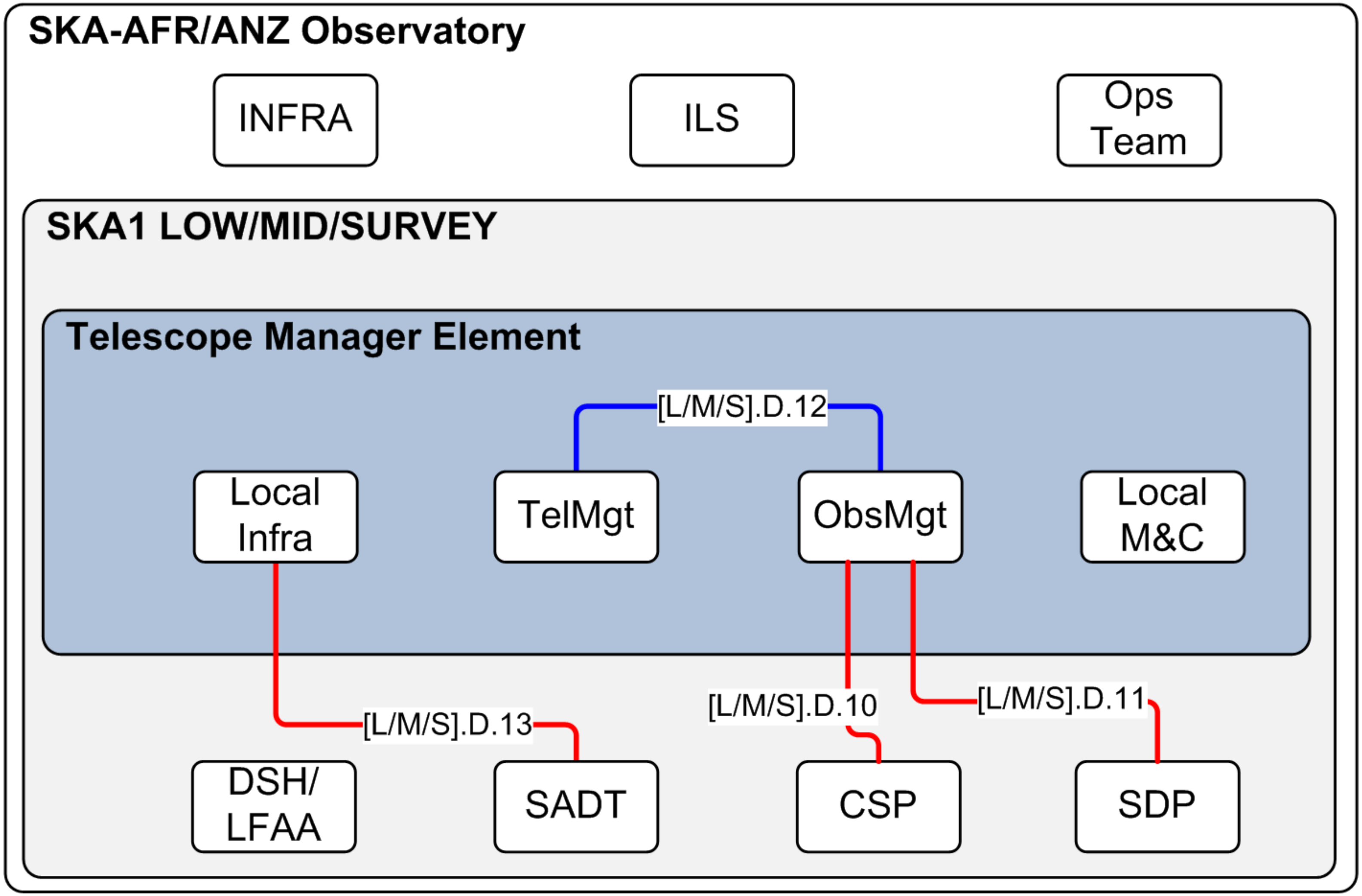
TM Interfaces Overview

- TM Monitoring and Control Data Exchange



TM Interfaces Overview

- TM Other Data Exchange



CSP Interfaces - our concept

- TM lead (to be discussed with CSP)
- Standardised M&C interface with CSP.LMC
- CSP is likely to need parameters from various parts of the system. CSP to define set of parameters needed, and the associated timing specifications (particularly critical to identify tight timing requirements early, since they will have critical architectural impact on TM). TM to work out how each parameter is to be collected and conveyed to CSP and meet timing targets.
- CSP may need to implement feedback control loops: relay problems / commands / settings back to devices. CSP to identify needs for feedback control. TM to define APIs to enable this, mechanisms to relay with desired timing.

DSH/LFAA Interfaces - our concept

- TM lead
- Standardised M&C interface with LMCs
- Set of Commands, Events, Alarms to be mostly provided by monitored Element, with TM to enhance based on inputs from CSP, SDP, perhaps INFRA (notification of weather conditions etc)
- Elements to provide inputs on their information needs, including safety situations (e.g. wind speed information from weather stations)
- TM can provide the role of backup safety situation detection & response. Element will need to identify situations where this is needed and schema for performing the role. TM to work out how to implement schema.

SDP Interfaces - our concept

- SDP lead
- Standardised M&C interface with SDP.LMC
- Supply of metadata to SDP. Obtain requirements on metadata timing. SDP to define metadata needs and how each is to be derived (as necessary), TM to work out how to collect and process it with required timing. TM will also provide support for any feedback control from SDP to other devices, as needed.
- Common software platform, technologies commonality
- Agreement on GUI standards, terms & nomenclature
- Collaborate on capabilities for dynamic reconfiguration and other observation management aspects

SADT Interfaces - our concept

- SADT Lead
- Standardised M&C interface with SADT.NM, SAT.LMC
- Work with SADT via SADT.TM to define requirements for PNET, ENET, SNET
- TM may need to coordinate with SADT on network security aspects e.g. access control for engineering personnel at remote stations, use of network capabilities as part of larger scheme for ensuring system security

INFRA Interfaces - our concept

- INFRA Lead
- Standardised M&C interface with INFRA.LMC
- Work out boundaries of responsibility for facilities and environment monitoring, including video cameras, audio monitoring, weather stations, building security …
- Possibly interact with INFRA on providing support for Smart Resource Management (SmartGrid type ideas, using knowledge of observation schedules and quality requirements to perform smart power management)

Local M&C Standardisation

- Interface between TM TelMgt and Local M&C of all elements (incl. TM itself)
- TM will generate guidelines for M&C standardisation
- TM will work with Elements to define a Standard Component Interface to be implemented by all LMCs for TM interaction
- top layers of OSI model
- standard monitoring information
    - element level health (fit-for-use)
    - LRU health and serial numbers
    - availability indication per capability at element
    - occurrence of failures
    - fault finding info
    - alarms TBC
    - occurrence of safety critical conditions
    - software and firmware versions

Other Standardisation Opportunities

- Local M&C to Local Infra interfaces - electronic data exchange
  - standardization of safety and power distribution instrumentation e.g. sensors, actuators, fieldbuses, PLCs etc., probably driven by SPO,
  - standardisation on safety and power distribution equipment results in standard interfaces.
- Human-machine interface consistency
  - User interface guidelines
  - information layout
  - interaction mechanisms and sequences
  - nomenclature
  - look and feel (style)
  - coherent user interface technologies

Key Issues

- **Operations concept - Important for TM.**
  What stakeholders are where and what do they do? SKA-AFR, SKA-ANZ, SKA Regional science centres, SKA HQ, ILS systems, Operations teams. E.g. TM human-machine interface for maintainer.
- **Boundaries between TM and SDP: Proposal Management & Observation Planning:**
  It is uncertain where the responsibility lie for the observing proposal process, including proposal submission and handling, and observation preparation. Exchange of data structures: observation schedules, observation control scripts, resource status ?. APIs: Monitoring & control API that can be used by SDP to create scientists' monitoring and observation mgmt interface, observation control scripts APIs and capabilities, other APIs to be identified …

Key Issues

- **Networking interfaces and services:**
  There are potentially various networking interfaces/ services required across the complete SKA that have not been identified yet. Some examples would be name resolution services, DHCP, firewalls, gateways, authentication. Perhaps all of these could/should be brought within the scope of the full SKA project. If not, which of these should be provided by TM and which are included in SADT? Note that the data exchange [L/M/S].D.13 indicates that such services are provided by SADT to TM.

Key Issues

- **Responsibility to drive standardisation:**
TM consortium expects to play a leading role in standardisation of monitoring and control interfaces between TM and elements. SKA Office involvement there? Will the SKA Office drive standardisation of e.g. general network, Local Infra (refer par. 4.3) data exchange and human-machine interfaces?

- **Baseline design clarification - sub-arrays:**
Baseline design states "“The number of sub-arrays can be as large as the number of antennas.” TM suggests to rephrased this to allow any single dish in a subarray (e.g. for maintenance) but not simultaneous subarrays for all n antennas. If it remains as stated, it has a very significant impact on TM design.

Key Issues

- **External interfaces to the the world/other e.g. to get catalogues from?**
  Confirm: Is it SDP responsibility to obtain these? Some examples would be science source catalogues, calibrator catalogues, image servers, spectral line catalogues, ephemerides. From operator via human-computer interface, or from some external system via the SADT? We should identify this interface even if its with an external system. Could/should these be brought within the scope of the full SKA project? If not, which of these should be provided by TM?
- **External interface to the world/other: earth orientation parameters**
  Is it TM responsibility to obtain?

TM Interface with System (SKA.SE)

- This is mostly not an operational interface, but coordination needed during requirements and design
- Needs for TM capabilities to support operations, based on Concept of Operations document
- Needs for operations support databases
- Understand boundaries of responsibility towards safety, security, availability and reliability e.g. who identifies the set of system-wide safety threats to be addressed?
- Need for external interfaces e.g. weather observatories, resource providers e.g. power companies (for coordination)
- Need for interfaces with enterprise systems e.g. asset management, personnel management (for system security)
- Need for pointing models to be implemented and boundary of responsibility for these

TM Information Needs for Requirements Phase

- (This list is provided to help other Elements prepare for interface interactions)
- Set of devices with LMC interfaces and their locations
- Number of monitoring points expected (order of magnitude)
- Monitoring data rates: order of magnitude
- Major alarm types and device statuses
- Any special coordination needs with other Elements, including information exchange, feedback control
  - In particular, tight timing requirements on coordination, or on alarm response from operator or higher-level controller
- Special needs relative to safety or other control aspects

Broadly, any needs that may have an architectural impact on TM

What we plan to provide

- (These are on our ASAP to-do list, though of course it is too early to tell when even a raw draft will be available)
- Preliminary bandwidth requirements, to SADT
- Requirements for redundancy, to SADT and INFRA
- Early draft of standardised interface for Local M&C, for feedback
- Preliminary outline of infrastructure requirements, to INFRA
  - Probably just categories of needs and order-of-magnitude sizing
- Work with precursors on understanding the challenges in integration
- Concepts for observation execution, for boundary definitions with SDP

End of Presentation