TM Services: An Architecture for Monitoring and Controlling the Square Kilometre Array (SKA) Telescope Manager (TM)

M. Di Carlo*[a], M. Canzari[a], M. Dolci[a], R. Smareglia[b], D. Barbosa[c], J.P. Barraca[c], B. Morgado[c]

[a]INAF Osservatorio Astronomico d'Abruzzo, Via M. Maggini snc, I-64100 Teramo, Italy; [b]INAF Osservatorio Astronomico di Trieste, Via G.B. Tiepolo, 11 I-34143 Trieste, Italy
[c]Instituto de Telecomunicações, Campus Universitario de Santiago, 3810-193 Aveiro

The SKA project is an international effort (10 member and 10 associated countries with the involvement of 100 companies and research institutions) to build the world's largest radio telescope. The SKA Telescope Manager (TM) is the core package of the SKA Telescope aimed at scheduling observations, controlling their execution, monitoring the telescope and so on. To do that, TM directly interfaces with the Local Monitoring and Control systems (LMCs) of the other SKA Elements (e.g. Dishes), exchanging commands and data with them by using the TANGO controls framework.
TM in turn needs to be monitored and controlled, in order its continuous and proper operation is ensured. This higher responsibility together with others like collecting and displaying logging data to operators, performing lifecycle management of TM applications, directly deal - when possible - with management of TM faults (which also includes a direct handling of TM status and performance data) and interfacing with the virtualization platform compose the TM Services (SER) package that is discussed and presented in the present paper.

Principle of work

- Study (and reuse whenever possible) the **best practises and known architectures** that could solve the problems highlighted by the requirements.
- Only if there are **no proven solutions then a new concept** or pattern would be developed.

Responsibilities

TM needs to be monitored and controlled like any other SKA element. In specific:

- **Generic Monitoring**
- **Lifecycle Management**
- **Logging Service**
- **Virtualization Service**

Context

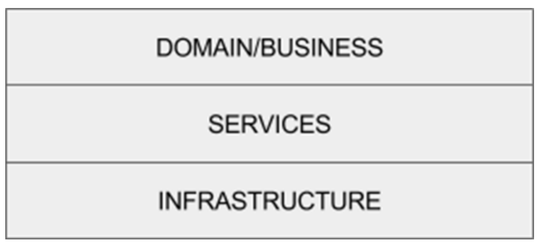

Fig. 1 TM SER Context

- **Domain/Business Layer**: functional monitoring and controlling of business logic performed by each application
- **Services Layer**: Monitors and controls processes on a generic level (not functionality) like web services, database servers, custom applications
- **Infrastructure Layer**: Monitors and controls virtualisation, servers, OS, network, storage

Entity decomposition

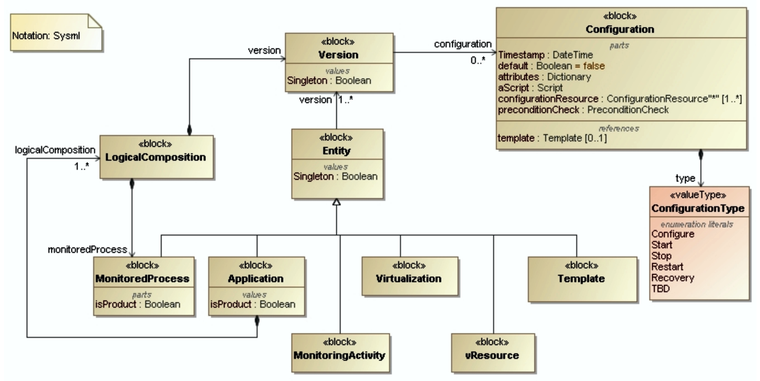

Fig. 2 Entity decomposition

Qualities for TM

SEI	ISO 25010
1) Availability	1) Modularity
a) Reliability	2) Reusability
b) Recovery	3) Analysability
2) Modifiability	4) Modifiability
3) Testability	5) Testability

Module Decomposition

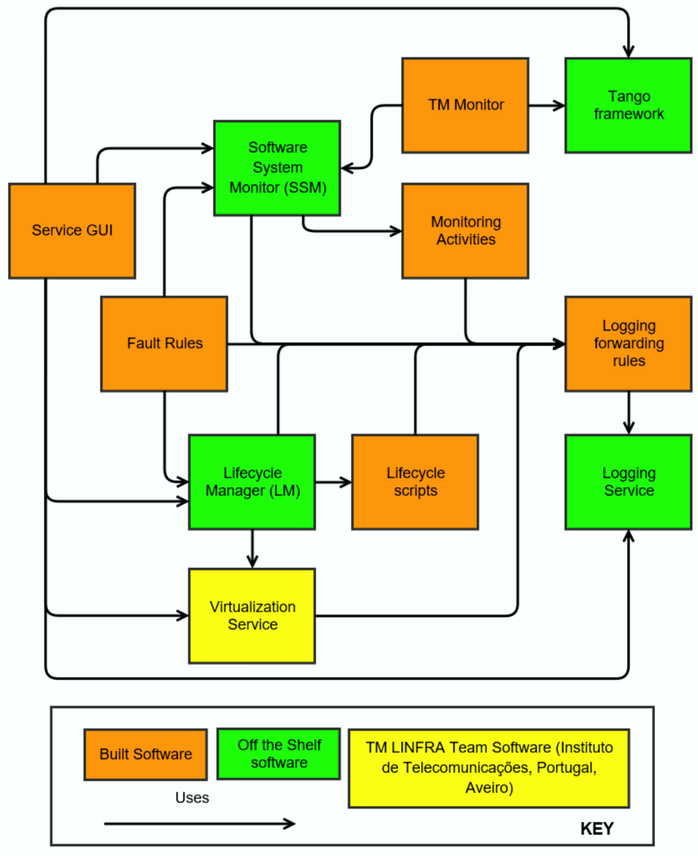

Fig. 3 Module decomposition

The **Lifecycle Manager** (composed by an engine and some scripts) realizes the lifecycle management that is the ability to control a software application in **configuration, start, stop, upgrade or downgrade**. All this activity can be done through a **IT automation tool** like puppet (puppet.com), chef (www.chef.io), ansible (www.ansible.com) and so on in **cooperation** with other sub-element.

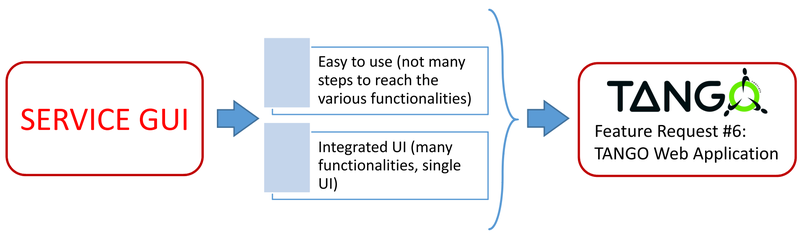

Fig. 4 Service GUI implementation roadmap

The **Generic Monitoring** is composed by a software system monitor (SSM) plus some **specific monitoring activities in order to monitor**:

- network services (SMTP, POP3, HTTP, NNTP, ICMP, SNMP, FTP, SSH)
- host resources (processor load, disk usage, memory, etc)
- any hardware (like probes for temperature, alarms, etc.)

It is also responsible of the **aggregation of the TM health status and the TM State** (of the various TM applications) for the Operator.

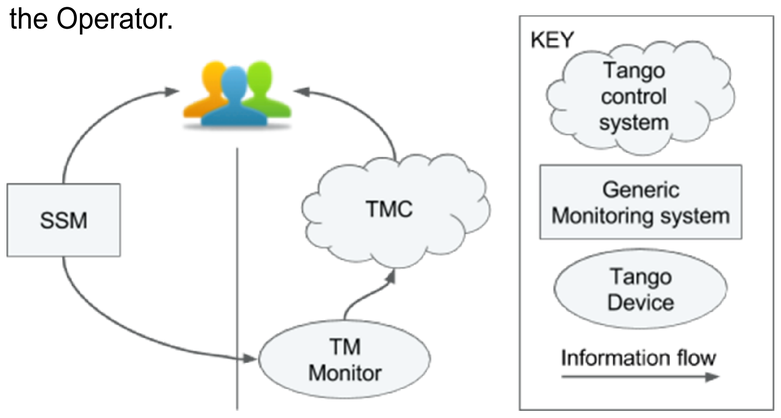

Fig. 5 Reporting mechanism

TM monitor is a Tango Device server (www.tango-controls.org) for reporting all the monitoring information into the control system (see Fig.5).

Runtime View

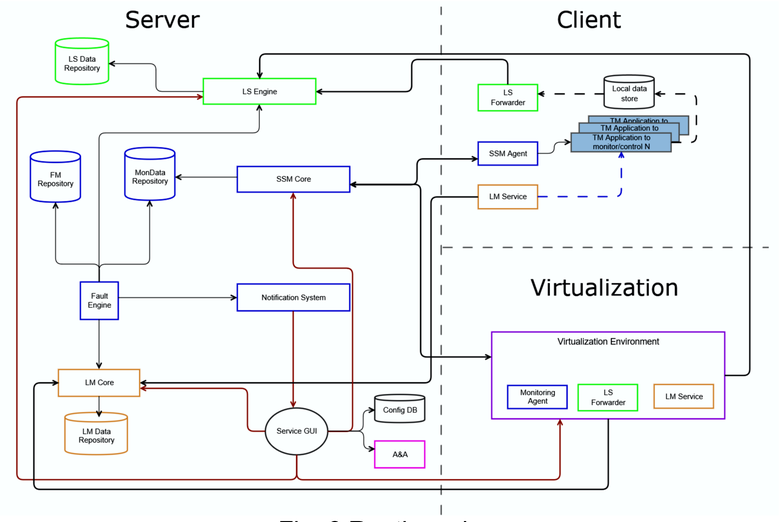

Fig. 6 Runtime view

Highlights the runtime components of the system and their relations.

A good logging service should focus on: how many inserts can the architecture support (throughput) and how the system manages the growth of event data.

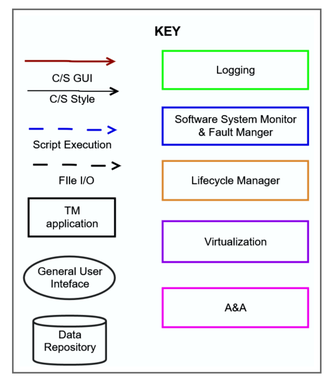

Fig. 7 Legend for Fig.6

Many possibilities available:

- Simple files (MeerKAT see for example [4])
- Relational DB (ASKAP see for example [5])
- NoSql DB (LHC see for example [6]): Focus on fast write and centralized solution

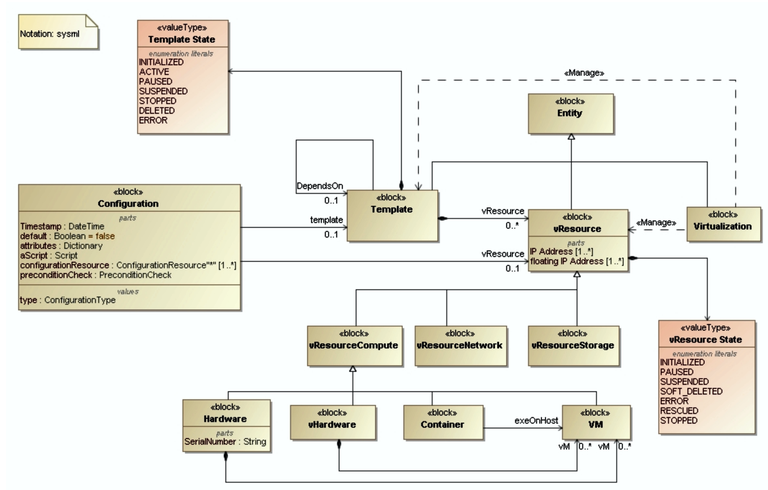

Fig. 8 Virtualization Service

The Virtualization block manages resources (vResources) assigned to a specific configuration of an entity. Usually, every entity has associated a template that is a description of the set of instances (servers, VMs or containers) with an SLA, user ACLs and network ACLs needed by the entity.

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*matteo.dicarlo@inaf.it; phone +39 0861 439706;

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