2° Forum della Ricerca Sperimentale e Tecnologica

SKAO OMC software development: the INAF contribution

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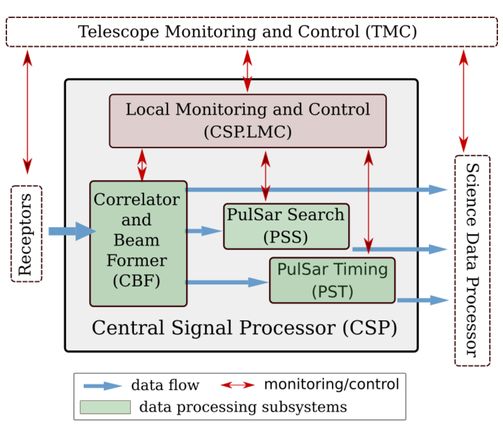
OBSERVATION MANAGEMENT & CONTROLS (OMC)

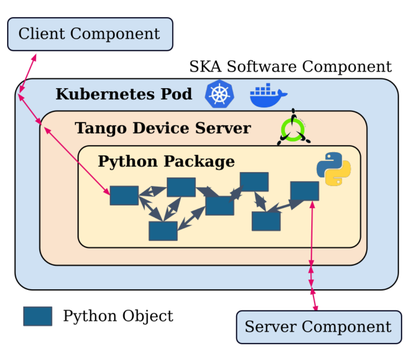
Observation Management and Controls ART develops and maintains SKAO systems, products and services.
Its high-level objectives are:

- Manage the proposal submission & management, design, scheduling, and execution of observations on both MID and LOW telescopes.
- Correctly operate and monitor the observatory and telescopes (including Local Monitoring and Control - Central Signal Processor Local Monitoring and Control).
- Development of TANGO device interfaces.
- Integration of engineering operations software products.

CENTRAL SIGNAL PROCESSING LOCAL MONITORING AND CONTROL (CSP.LMC)

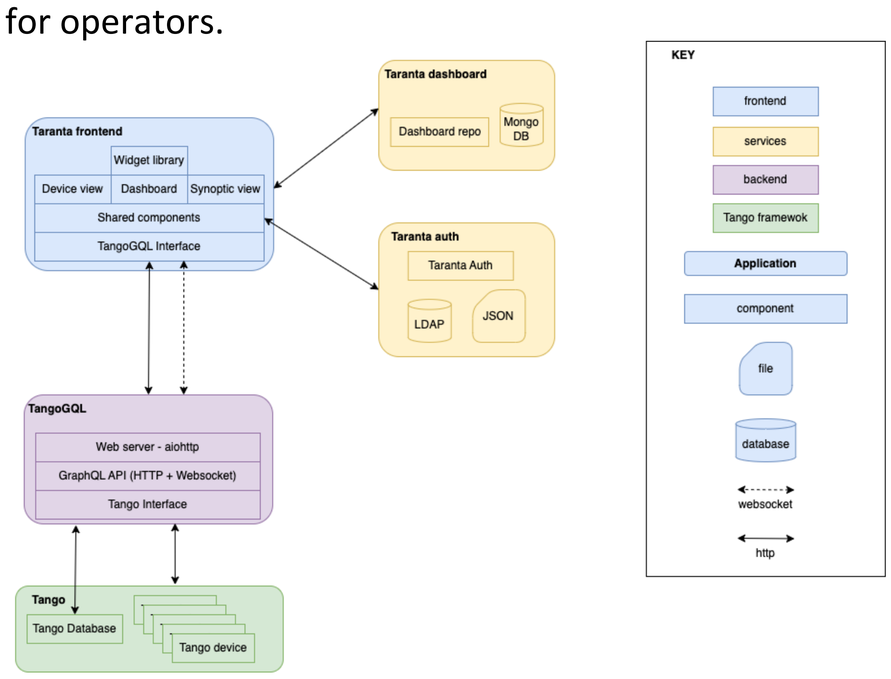
The Central Signal Processor (CSP) is a critical component of the SKA telescope, responsible for the real-time processing of the vast amount of data collected by the SKA antennas, essential to make the data available for scientific analysis. CSP is composed of three main instruments (Correlator and BeamFormer - CBF, PulSarSearch - PSS and PulSarTiming - PST) each related to a specific data processing task. On top of them, the Local Monitoring and Control (CSP.LMC) guarantees the smooth functioning of the CSP by offering **real-time health monitoring, performance metrics and adaptive control**.
CSP.LMC is meant to provide **the interface of the entire CSP instrument** to the Telescope Monitoring and Control (TMC) system, serving as the bridge between the TMC and the individual components of the CSP.
CSP.LMC is a common component between Low and Mid telescope, employs an **object-oriented approach** and it comprises multiple Tango Devices. CSP.LMC Devices are written in Python, containerized with Docker and orchestrated with Kubernetes. Such a layered structure, request **a multi-level testing strategy**, in order to ease the integration effort with other components and to ensure the highest quality of the code.





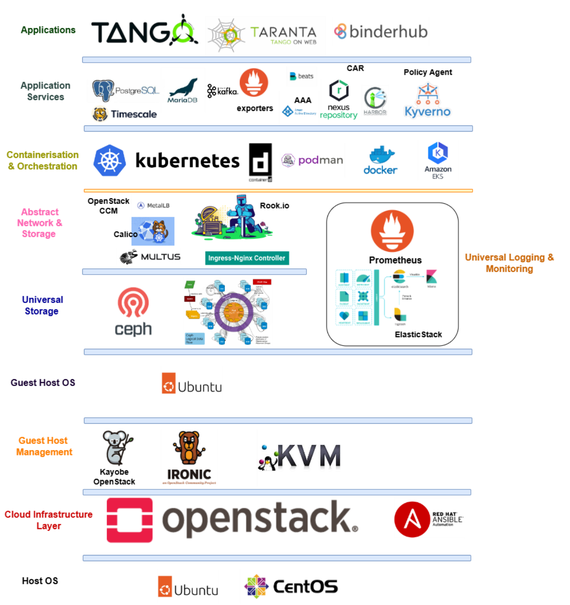
USER INTERFACES

Taranta is a contribution from the Cream Team to the development of the Square Kilometer Array (SKA), providing a crucial tool for building graphical interfaces in the SKA control system. As one of the **most widely used UI platform** in this phase of the project, Taranta offers a **no-code**, **web-based** approach for creating dashboards that integrate multiple Tango devices. Custom widgets have been developed based on user requests, and the recent introduction of SVG support allows for even more customizable dashboards. With all the necessary features to develop interfaces for monitoring and controlling complex facilities like SKA, Taranta stands as a flexible and scalable **candidate** for future adoption in the **SKA control room**, where it could serve as a unified platform for operators.



SYSTEM-LEVEL COLLABORATION

Main contribution is given to the integration and orchestration of software sub-systems using CI/CD methodologies.
Large use is made of cloud-native technologies, in particular Kubernetes, a platform for abstracting and managing the complexities of compute, storage, and network resources. GitLab is used as web-based DevOps tool. Monitoring with Prometheus and Grafana, logging with Elasticsearch.
TANGO integration with Helm.



COLLABORATION FRAMEWORK(s)

The SKAO software development process is governed by a customized implementation of the **Scaled Agile Framework® (SAFe®)**, coordinating and synchronizing the efforts of approximately 190 individuals across 32 agile teams of varying sizes (ranging from 3 to 14 members). These teams are organized into five Agile Release Trains (ARTs). Out of them, INAF plays a significant role in contributing to the *OMC* and *Services* ARTs, with seven units (equivalent to 4 full-time employees) actively engaged in software development and management roles.

SKAO SW development in numbers:

- 6 ARTs
- 38 teams (includes management)
- 15 countries
- 52 institutions (public/private)
- 320 people (includes suppliers' representatives and stakeholders)

Activities are carried within a Framework Contract (FC) signed by INAF and SKAO at the end of 2021. It is updated (re-issued) yearly and implemented in the form of quarterly Professional Service Short Contracts (PSSC), called Work Orders. These are timely aligned with the SAFe cadence periods called Program Increments. FC and PSSC follow the **NEC4 ® contract structure**. Its management required the implementation of a *trait d'union* between SKAO management and INAF offices, starting from a clear definition of Roles and Tasks, Timing of implementation and Monitoring of the contract terms.
Relationships between SKAO and INAF follow the **Vested ® Relational Contracting** approach, a set of shared Guiding Principles (*Reciprocity, Honesty, Autonomy, Equity, Loyalty, Integrity*) and Intended Behaviours (*Alignment, Engagement, Inclusion, Respect, Commitment, Responsiveness, Technical Excellence, Transparency*) at the basis of the SKAO Shared Vision:
"We are a global collaboration committed to building and delivering a world-class software and computing ecosystem, enabling the SKAO community to achieve transformational science. Our culture of innovation, shared governance, and respect for diversity creates mutual value for all."

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