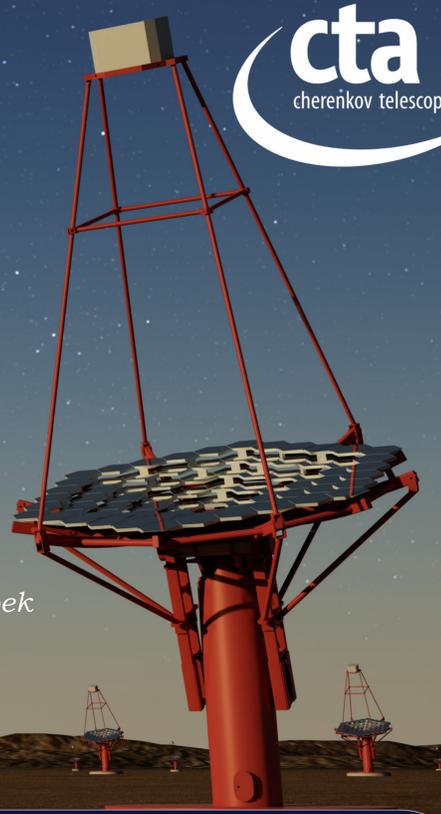


# Status and Plans for the Array Control and Data Acquisition System of the Cherenkov Telescope Array



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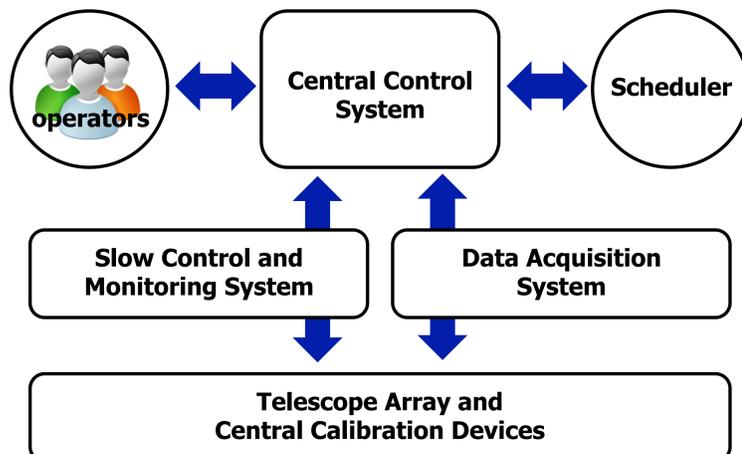
## ABSTRACT

The Cherenkov Telescope Array (CTA) will be a ground-based very high energy gamma-ray instrument consisting of two installations and more than 100 telescopes in total, to be deployed on the northern and southern hemispheres. The performance requirements and the inherent complexity in operation, control and monitoring of such a large distributed multi-telescope array leads to new challenges in designing and developing its control software and data acquisition (ACTL) system. Among these challenges, the system will have to acquire data at rates of few GB/s, while monitoring the hardware and environmental conditions which are provided by tens of thousands of sensors. An extensive set of solutions has been proposed to fulfill the requirements. The solutions are being benchmarked via an intense prototyping activity, both in prototype telescopes and in a newly deployed test-bed computing system.

## SYSTEM OVERVIEW

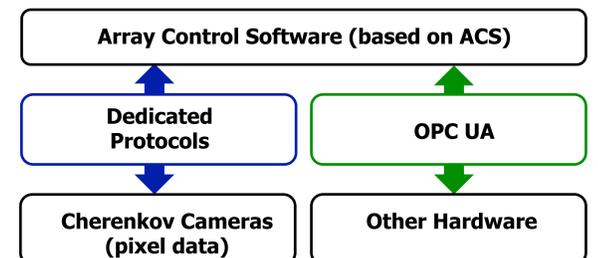
CTA operations will be carried out from on-site data centres at the sites. For each installation, the following will be provided:

- The software to control, acquire scientific data, and monitor the instrumental performance of the arrays.
- The interface for the operators on site to steer the system.
- The computing hardware for execution of this software, mass storage, and on-site analysis procedure [1].



## THE SOFTWARE FRAMEWORKS

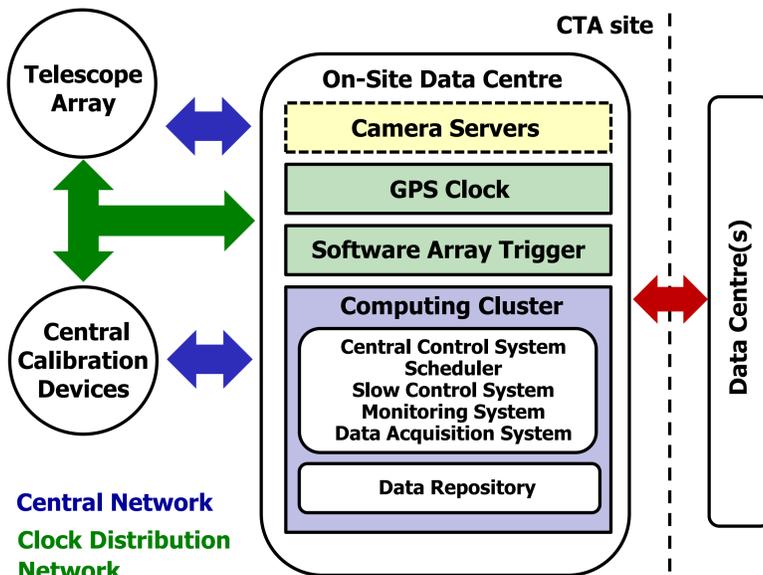
- The software will be implemented within the Alma Common Software (ACS) framework [2].
- ACS implements a container-component model and supports C++, Java and Python.
- Hardware devices will be accessed via the industry standard OPC UA [3].
- The data from the cameras will be transmitted via specialized protocols [4].



## ACTL SYSTEM ELEMENTS

### HARDWARE

- A total of ~1500 cores for the CTA southern array (~870 for northern one).
- An on-site storage system with 3PB (1.5 PB) capacity for the southern (northern) installation.
- Network to connect each telescope via a fibre cable allowing for 12 single connections (up to 10 Gbit/s each).
- A time synchronisation system based on the White Rabbit technology [5].
- A test-bed computing system to validate the software before deployment.



### SOFTWARE

- An automatic scheduler based on AI technologies for optimizing the array operations and maximizing the scientific return [6].
- A central control system which executes observations, controls, and coordinates the whole array.
- A data acquisition system for the acquisition of telescope Cherenkov data, implementing the further filtering of data and its storage.
- A software array trigger for array-level selection of events.
- A slow control system, integrating the low level control of devices.
- A centralized configuration and monitoring system.

## ACKNOWLEDGEMENTS

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