Design Strategies in the Development of the Italian Single-dish Control System

Team

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The Italian National Institute for Astrophysics (INAF) manages **three radio telescopes**: the Medicina and Noto dishes and the newly-built SRT [1]. In order to make their capabilities more valuable to the scientific community, we started the DISCOS (Development of the Italian Single-dish COntrol System) project. DISCOS is implemented according to a distributed **Component-Container** model provided by the **ALMA Common Software** (ACS) framework [2], and it hides to the users the differences among the telescopes by presenting the same user interface and the same data format.

The complexity of coping with three heterogeneous instruments was handled by designing a software development infrastructure with a wide monolithic codebase (libraries, components and generic interfaces), which is completely shared among the three product lines while specific differences are managed via configuration files or via polymorphism only when strictly necessary. This design permits to produce new software components with a minimum effort and to set up the same test suites for all the environments, thus leading to an affordable development and maintenance process.

WORKFLOW

In recent years we have tried to formalize the development workflow of new components, resulting in clearer and more maintainable code.

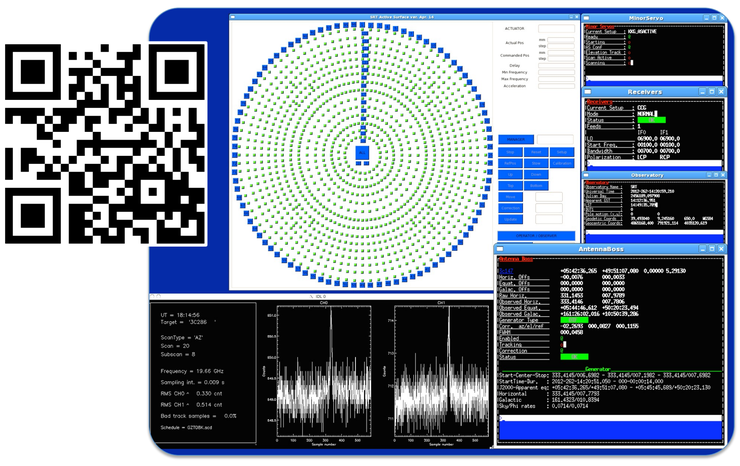
- **development** of new components is split into: development of a hardware simulation server, development of a standalone hardware communication library and development of the ACS component exploiting the library
- **maintenance** is handled with regression tests: each time a bug is found, the developer writes a test that reproduces the buggy behaviour, then the fix is not committed into the patch release until the test executes correctly.
- **continuous integration** is performed via a Jenkins server. At present we run nightly builds of the trunk branch of each telescope and of every maintained release. This infrastructure also permits test automation and to collect the results on the whole project.

DESIGN

The design of the DISCOS control software highly relies on the ACS patterns and services. In the ACS model, the basic unit performing a task is a component, each component exposes an interface and is individually configured to determine its exact behaviour inside the system.
The station-specific modules consist essentially in the low-level and no-logic control of the devices and of the telescope hardware.

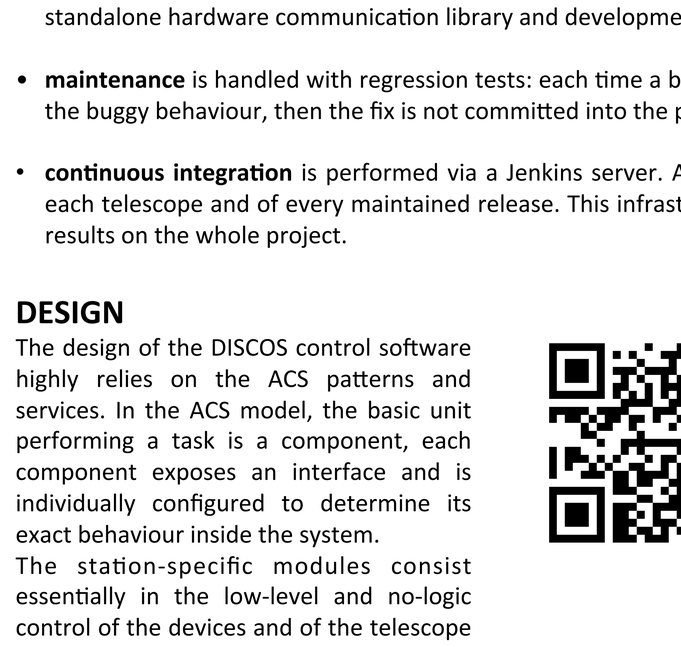
[1] G. Grueff et al., “Sardinia Radio Telescope: the new italian project”, Proc. SPIE vol 5489, p 773-783 (2004)

[2] G. Chiozzi et al., “The ALMA Common Software: a developer-friendly CORBA-based framework”, Proc. SPIE vol 6274, September 2004, p. 205 (2004)

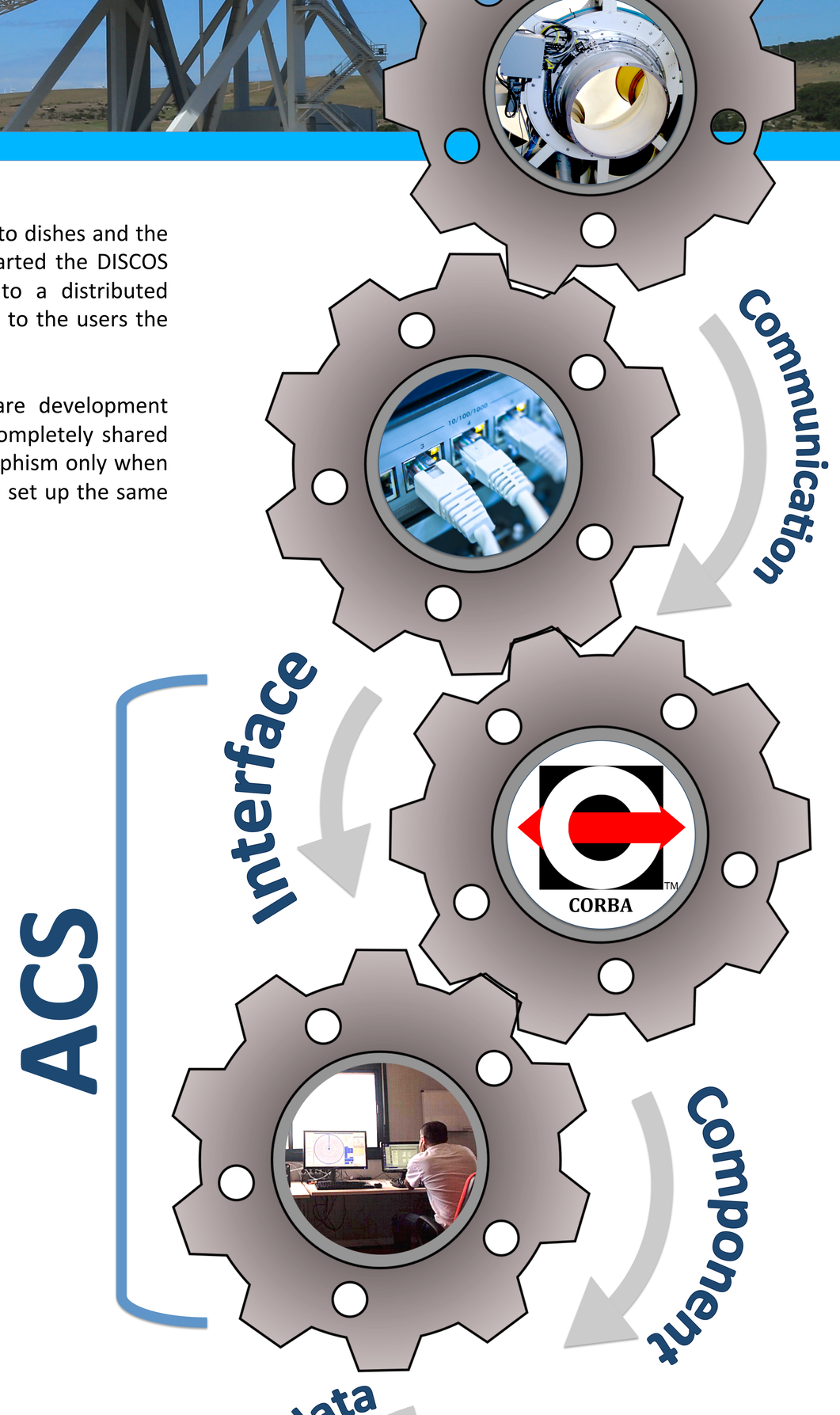


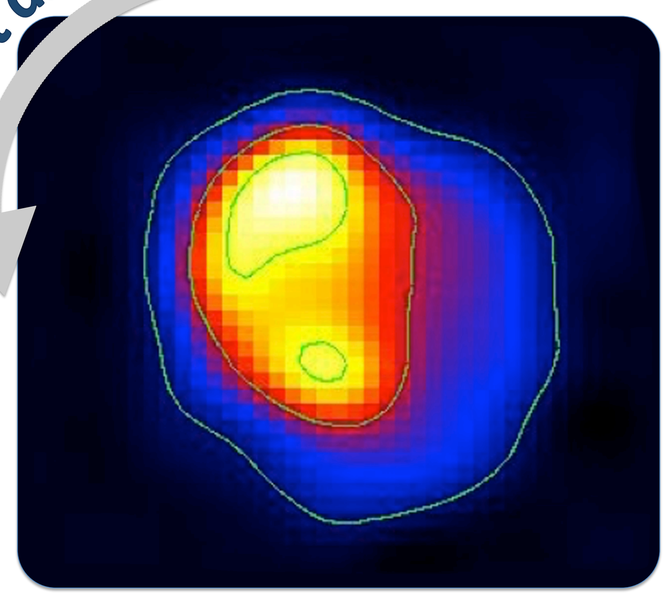
Above: screenshot of the DISCOS GUI. Bottom left: the Italian radiotelescope sites. Table below: basic features of the three antennas. Right (top to bottom): schematization of the control system architecture.

The DISCOS project documentation can be found following the above QR code.



	SRT	Medicina	Noto
Main mirror	64 m	32 m	32 m
Antenna Control Unit	Beckhoff PLC Ethernet Vendor protocol	VxWorks-based PC Ethernet Vendor protocol	VxWorks-based PC Ethernet Vendor protocol
Active surface	Yes	No	Yes
Current receivers	P, L, C, K band	L, S, C, X, K band	P, L, S, C, X, K, Q band
Current back-ends	Total Power XARCOS Roach boards DFB	Total Power XARCOS	Total Power





5 GHz raw map of the supernova remnant 3C157/IC443, obtained with the Medicina 32-m dish. Courtesy of Alberto Pellizzoni et al. (2013).