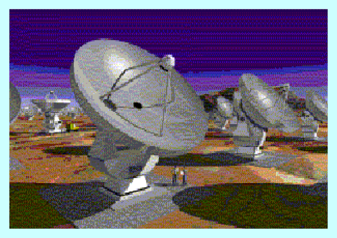

Atacama
Large
Millimeter
Array

# The ALMA Common Software (ACS): Status and Developments

ICALEPCS
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## OVERVIEW

The ALMA Common Software (ACS) is a set of application frameworks built on top of CORBA to provide a common software infrastructure to all partners in the ALMA collaboration. The main purpose of ACS is to simplify the development of distributed applications by hiding the complexity of the CORBA Middleware and guiding the developers to use a documented collection of proven design patterns.

ACS was presented at ICALEPCS 2001 and was at that time covering the basic needs for the development of Control System applications. In these two years, the core services provided by ACS have been extended and made stable and reliable, while the coverage of the application framework has been extended to satisfy the needs of high level and data flow applications.

At the same time, the focus of development has moved from C++ to Java.

The complete ALMA SW development and in particular the Control System of the ALMA Test Interferometer, currently used for the evaluation of the three ALMA prototype antennas, are based on ACS. Also other projects are collaborating with ACS, already using or evaluating it, since ACS is publicly available under the LGPL license. In particular, the ANKA Synchrotron in Karlsruhe is in scientific production, the APEX radiotelescope in Chile is under commissioning and the 1.5m Hexapod Telescope in Chile is in an advanced implementation stage.

The status of ACS and the developments of the last two years are presented using the ALMA system as an example, and showing where and how ACS is used.

A detailed description of the services provided by ACS and a live demo can be found in the poster "ACS Services" presented by I.Verstovsek.

## 1) Real Time and Control System support

ACS was first developed to satisfy the requirements of the Control Software development, to support:

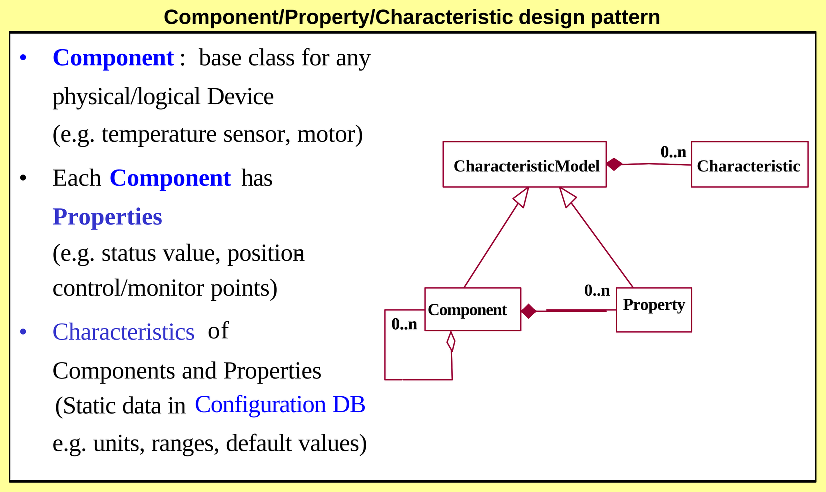
- the ALMA Test Interferometer Control Software, used for the evaluation of the 3 prototype antennas.
- the ANKA Control System

Since **ACS 0.0** (that demonstrated ACS capabilities driving the Kitt Pek 12 meter telescope) we are supporting C++ Linux, Sun and VxWorks. The ANKA accelerator is running ACS on Microsoft Windows workstations.

Development of Control System devices is supported by the framework with the implementation of the Component/Property/Characteristic design pattern.

In **2004** ACS support for control system applications should receive a boost from the eACS (embedded-ACS) project. A consortium from the astronomical and accelerator communities and industrial partners is studying the implementation of solutions based on ACS and Abeans for embedded platforms such as PC104 and CEP (Custom Embedded Platform).

Component/Property/Characteristic design pattern

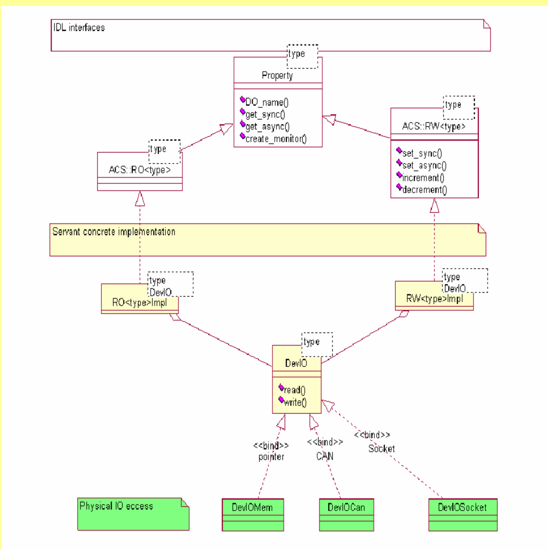



## 2) Abstract Hardware interface

Since **ACS 1.1**, the Component/Property/Characteristic model provides an abstract interface to the hardware with the implementation of **DevIO** classes.

The actual interface to the hardware (for example access for IO boards, CAN bus, serial ports) is implemented as a subclass of the abstract DevIO interface.

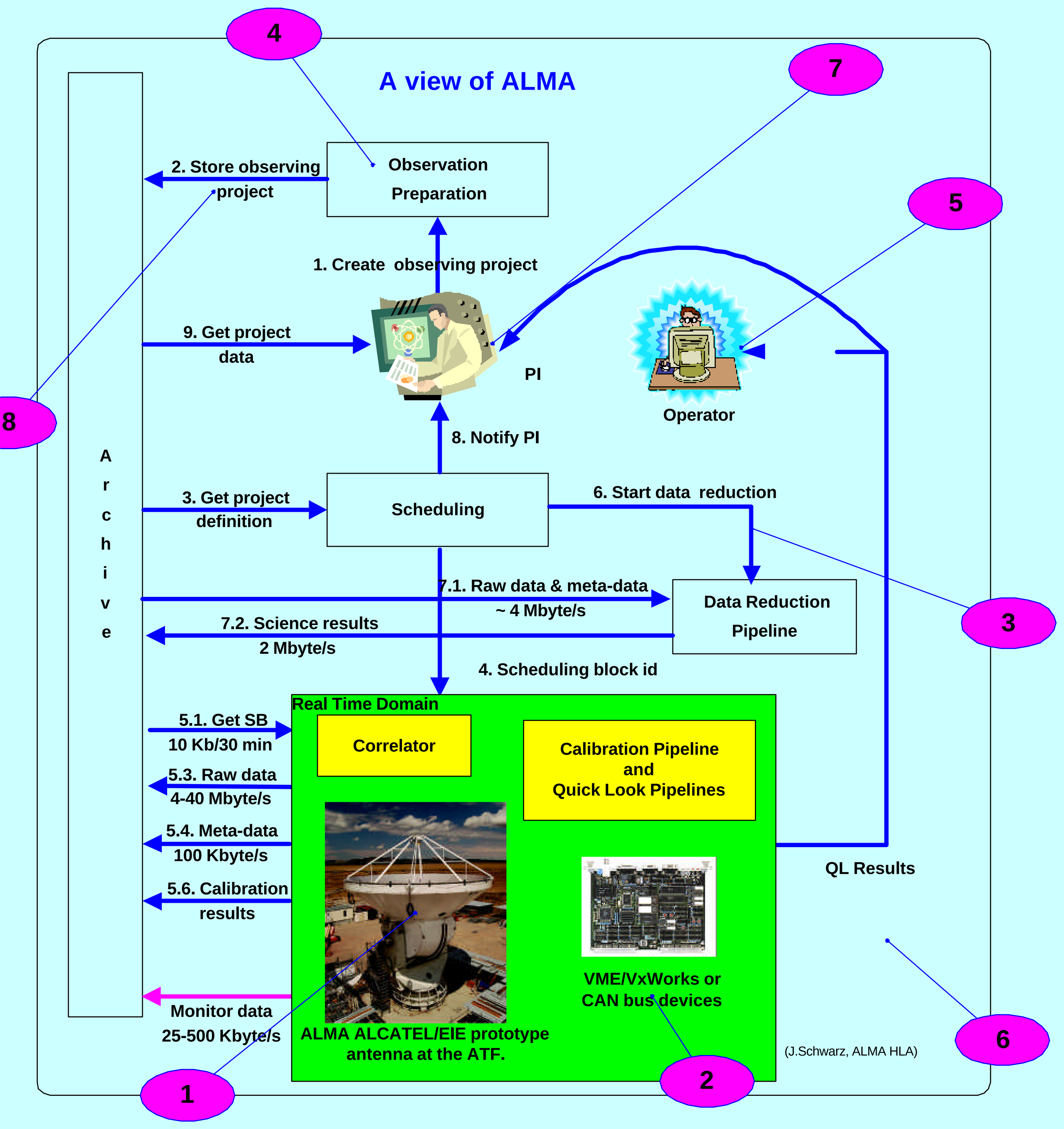
Properties use only the abstract interface to provide read and/or write access to values in the hardware as well as monitoring and alarm capabilities.



## 3) Decoupled Publisher/Subscriber design pattern

Since **ACS 1.1**, a layer on top of the CORBA Notification Channel provides support for Publisher/Subscriber programming model. This is extensively used to notify ALMA subsystems of events occurring in other subsystems and to drive the flow of data. **ACS 2.0** and **3.0** have provided extensions to this framework.


ALMA Site - Chajnantor, Atacama Desert, Chile




## 7) Pure Java ACS

Requirements from the Observing Tool development team have pushed us in providing High Level multi-platform ACS support, to deploy ACS-aware applications with little configuration requirements and support directly on the PCs of astronomers.

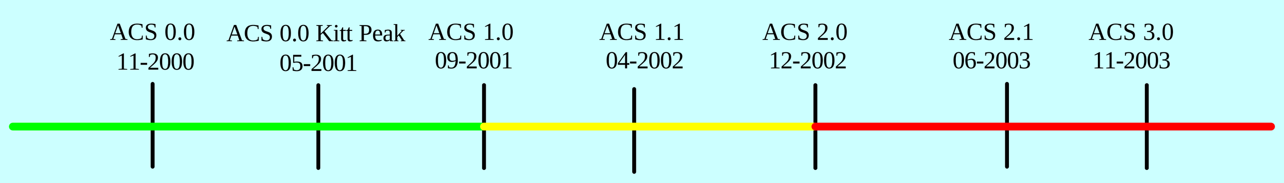
With **ACS 3.0**, a "pure Java" sub-set of the ACS framework is available for easy deployment with the WebStart technology. This allows to have most high level ACS features available in a pure Java environment., where specific functionality available only in C++ of Python is not required.

This includes **Abeans 3.0** and allows to deploy from the web ACS applications, GUIs and tools on any platform supporting a Java Virtual Machine.

## 8) XML Serialization

Since **ACS 2.0**, the Java Container supports transparent XML serialization of complex data entities (like a complete Observing Proposal or an Observing Script) through CORBA. Binding classes are automatically generated so that data entities are accessed through native language classes and (de)-serialized transparently on the wire. The archive is capable of handling directly XML serialized data entities.

This capability (XML Serialisation) is very important to allow a smooth data flow from high level software down to the Control System.




## ACS Time Line

ACS is released every 6 months, alternating one major and minor (bug fixing, minor extensions) release.

Patch releases are made available if necessary.

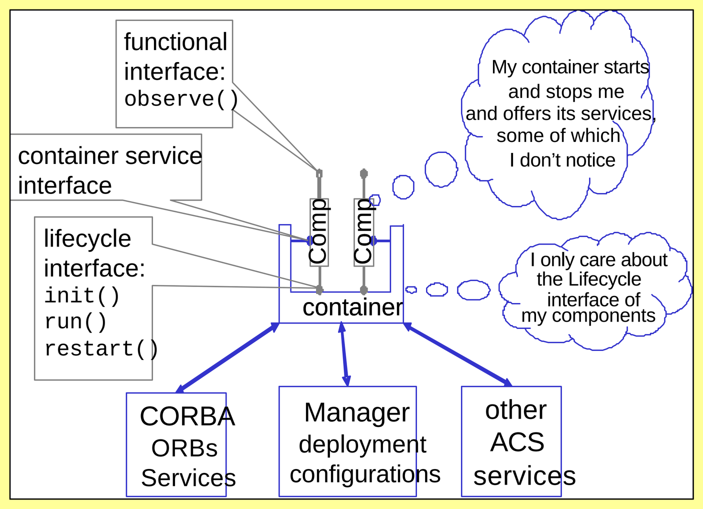
## 4) C++ versus Java

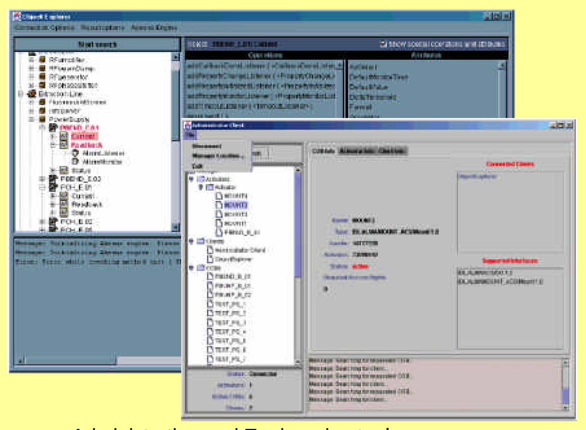
While C++ remains the language of choice for high performance and real time applications in the Control System domain, Java is considered the most suitable general purpose development language for higher level and coordination applications, also in the Control System domain.

**ACS 2.0** has introduced Java Containers.

## 5) Administration

Deployment, system configuration and administration are supported by the ACS Component/Container model.
The original model in **ACS 0.0** and **1.0** was tailored to Control System applications. Only C++ Components and Containers were supported.
**ACS 2.0** extends the model based on the requirements of high level subsystems and introduces Java Conmponents and Containers.
**ACS 3.0** introduces fully dynamic Components to support pipeline and AIPS++ requirements. It also introduces support for Python Components and Containers.
Administration of Components and Containers is transparent to the implementation language.
A set of Tools and GUIs allow an operator to administrate the system.



Administration and Engineering tools

## 6) General services

Containers written in C++ (**ACS 0.0**), Java (**ACS 2.0**) and Python (**ACS 3.0**) manage the lifecycle of components implemented in these languages and provide them a very simple way to access common centralized services like logging, alarms, error handling, configuration database, archive, object location and, at the same time, hide most of CORBA. Clients written in any CORBA-aware language can access these Containers and Components while the implementation of the servant side in any other of these languages would be easy.

## ACS Collaboration

ACS is developed for the ALMA Project and made available under the GNU LGPL Licence.

The development is distributed among the sites of various ALMA partners and external institutes collaborating in the development.

A number of external projects are already using ACS or are evaluating the possibility of using it.

This map shows the major sites involved in ACS Development, the ACS installations and some external projects using or evaluating ACS.
The availability of ACS can trigger other collaboration projects, like eACS (embedded ACS )