LBT-ADOPT
TECHNICAL REPORT

Doc.No : Soft-003 CAN: 486f005a
Version : 1.0
Date : October 2005

LBT-AdOpt Software Development Schedule November 2005 - January 2007

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ABSTRACT

In the following memo we report the current status of development of the LBT Adaptive Optics System Software and discuss the steps and milestones to the final product.

Contents

Glossary of terms and acronyms

AO System. The hardware and software components of the LBT first light Adaptive Optics System. Includes the Wavefront Sensor, the Adaptive Secondary Mirror, the AO Computer and some auxiliary devices (such as networking hardware).

AO-CI. The AO Software Command Interpreter: a component of AO-SW which can execute scripts.

AO Computer. The computer (or farm of computers) running the AO-SW.

AO Console. The operator console of the AO Computer.

AO-SS. the script executed to startup the AO-SW.

AO-SW. The software dedicated to the managements of the Adaptive Optics System. Its main component is the Supervisor.

AOS. A part (subsystem) of TCS dedicated to interaction with the AO-SW.

Supervisor. The software system which manages all the components of the AO System

TCS. Telescope Control System. The software dedicated to the management of the LBT telescope.

TCS Computer. The Computer (or farm of computers) running the TCS.

1 AO System Architecture

The overall architecture of the AO Software and of its main components, the Supervisor and the Real-Time Software, have been described elsewhere [1, 2]. Here we only report a brief resume for the purpose of the following discussion.

1.1 Hardware Architecture

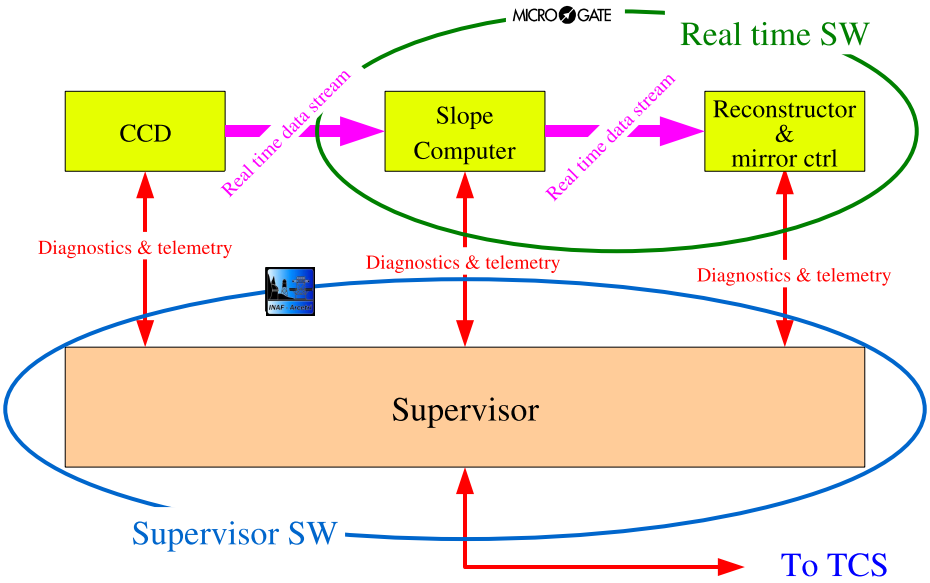

Figure 1: AO System HW Architecture and Dataflow

The AO System architecture is shown in figure 1. The main data path (referred to as "real-time data stream") is the stream of data from the Wavefront Sensor (WFS) to the Deformable Mirror. That stream is managed by dedicated hardware and is transported by dedicate optical fibers at a raw maximum rate of 2 Gbps. All operations needed for the adaptive optics loop are managed by real-time software running on DSPs in the Slope Computer and the Deformable mirror.

Management and housekeeping of the AO System components is performed by a software system running on a general purpose computer: the AO Computer. It provides such functionalities as

hardware initialization, firmware uploading, subsystem configuration, diagnostics and the like and is referred to as *AO Supervisor* in the following pages. Supervisor related data flows, used for telemetry controls and for diagnostics purposes are exchanged through standard Gigabit Ethernet connections (red arrows in figure 1).

1.2 Software Architecture

Figure 2 shows a diagram of the Supervisor components and their relationship with the hardware devices and other software components (e.g.: the TCS).

Note that the figure refers to a single AO System. The Supervisor software has been designed to allow for an arbitrary number of components whithout modifying the underneath structure, so that, even from the software point of view, the addition of the second adaptive mirror for the binocular configuration will not modify the overall system architecture.

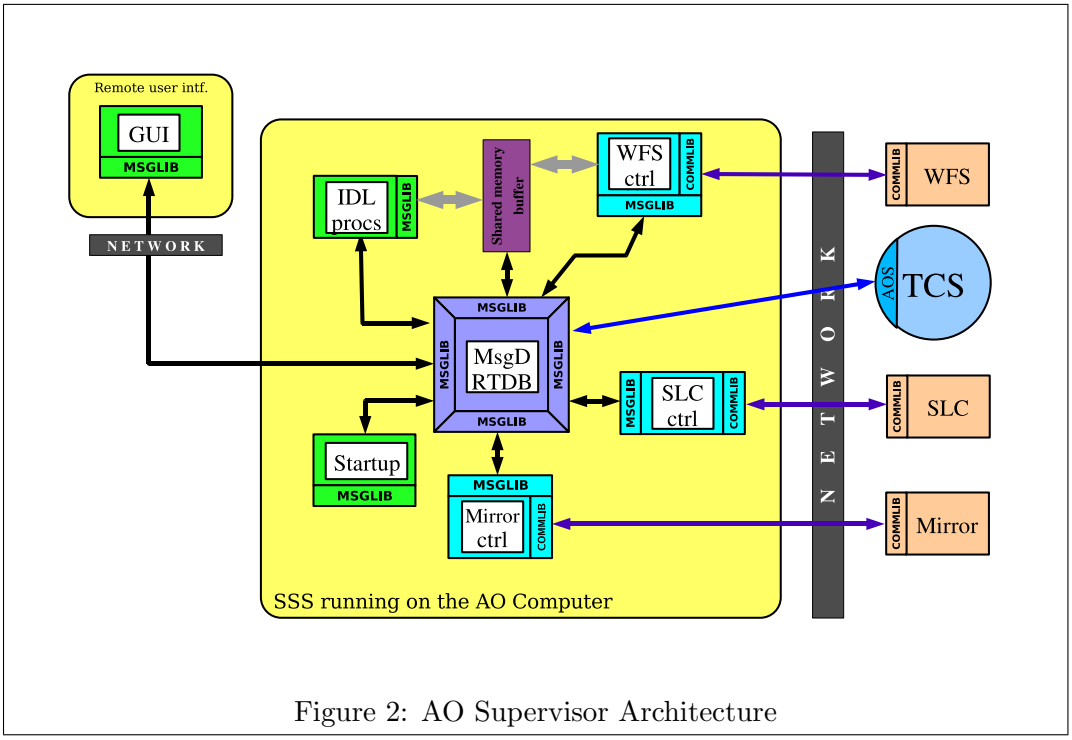

Figure 2: AO Supervisor Architecture

Each subsystem is implemented as an autonomous process which communicates with other processes via socket based connections through a central facility (`MsgD/RTDB`).

The `MsgD/RTDB` provides essentially three functions: i) communication services for interaction between the software components; ii) a variable repository function which allow data sharing between processes; and iii) support for the management of shared memory segments for fast communication of bulk data.

The entire AO Supervisor communicates with the TCS via a dedicated TCS subsystem (the AOS) which is, from the architecture point of view, another `MsgD/RTDB` client. A brief description of the AOS and its functions can be found in [3].

2 State of Art as of October 2005

Here follows a list of software components which are available as of october 2005. For each component a completion code is specified: **Alpha**, currently in developing stage; **Beta**, ready for laboratory tests, may need updates for the final telescope version; **Release**, ready for the final version.

Component	Completion Status	Description
`MsgD/RTDB`	**Release**	The Message Dispatcher and Real-Time Database was the first component developed and is intensively used in all running programs.
`BCUCtrl`	**Release**	Device controllers for BCU based hardware (the Adaptive Secondary and the Slope Computer).
`GUI`	**Beta**	Graphical User interfaces for laboratory use (and engineering operations at the telescope).
`PowerCtrl`	**Release**	Control programs for power switches and similar devices.
`SimpleMotorCtrl`	**Beta**	Control program for stepper motors. Used for: Rerotator, Filter Wheels, ADC.
`StageCtrl`	**Beta**	Control program for bayside linear stages.
`MirrorDiagnostic`	**Alpha**	Adaptive Mirror diagnostic programs.
`StartUp`	**Alpha**	Startup procedures.
`TTCtrl`	**Release**	Control program for the Tip-Tilt signal generator board.
`WFSCtrl`	**Release**	Control program for the WFS CCD camera.
`AOS`	**Alpha**	Interface to TCS.
Libraries	**Release**	The complete set of AO-SW libraries.
IDL	**Beta**	Support for IDL procedures.
PyModules	**Beta**	Wrappers for Python code and high level Python library.

3 Development Plans and Milestones

The planned activities for the completion of the AO Software project are detaild in the following table.

Time	Actions and milestones
Nov 2005	Preliminary integration test in Tucson. This will address problems such as correct use of API's, correct use of TCS provided software facilities, interaction between the two software teams, problems resulting from O.S. environment, and the like.
Dec 2005	Updates of the GUI, development of high level scripts for AO management at the telescope, development of prototype AOS with full functionality, documentation.
Jul 2006	Support of AO System test at Arcetri's solar tower.
Nov 2006	AOS integration test at the telescope.
Dec 2006	AOS integration test at Arcetri's solar tower with operating TCS. AO-SW + AOS version 1.0 is ready.
Feb 2007	Test of ENGINEERING state functions and support of AO System #1 commissioning.
Apr 2007	Test of OBSERVATION state functions as final actions of the AO unit #1 commissioning.
May 1 2007	AO-SW + AOS version 1.1 is operational at the telescope.
May 2007	Upgrade of AO-SW using lessons learned during first monts of actual usage.
Nov 2007	Installation of AO-SW + AOS version 2.0 at the telescope for the support of unit #2 commissioning.
Feb 2008	AO-SW + AOS version 2.1 is operational at the telescope

References

[1] L. Fini, A. Puglisi, and A. Riccardi, "LBT-adopt control software," in *Advanced software, control, and communication systems for astronomy. Edited by L. Hilton and G. Raffi*, vol. 5496 of Proc. SPIE, pp. 528-537, 2004.

[2] R. Biasi, M. Andrighettoni, D. Pescoller, "LBT AO Real Time Software". Presentation at *AO Progress Report Meeting. February 2005*. See:
`http://lbtwww.arcetri.astro.it/adopt/lbtao/review-feb-2005/`

[3] L. Fini, A. Puglisi, "Integration of the AdOpt Software into TCS", *LBT-AO Technical Report* Soft-002, Firenze, October 2005.