TEchnologies for Telescopes and Instrument control Software

Control Software Activities at INAF – OAPd

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On behalf of the group: A. Balestra, I. Baronchelli, A. Baruffolo, D. Fantinel, D. Ricci, B. Salasnich, M. De Pascale
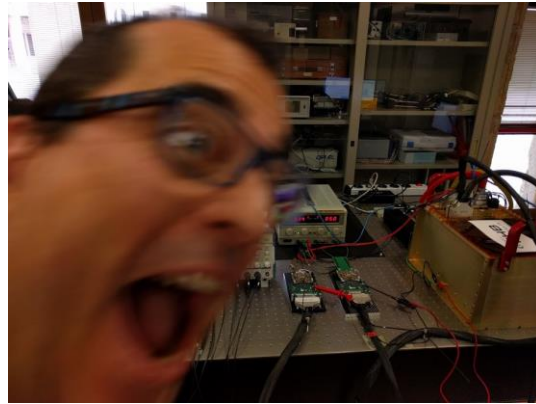
Tuesday, October 27, 2020

Outline

- Brief introduction of the group

- A bit of history

- Bird's-eye view of current projects
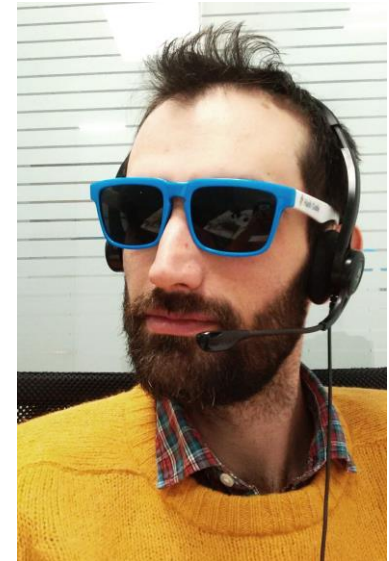
- How do we work

- Outlook

People

Bernardo Salasnich

Andrea Balestra

Ivano Baronchelli

Marco De Pascale

Davide Ricci

Daniela Fantinel

Andrea Baruffolo

Team experience

- About 30 years experience for the "less young" members

- Experience acquired also while working with other groups and/or Institutes

- [Mainly] instrument control software for optical and near-IR [mostly] ground-based Astronomical telescopes
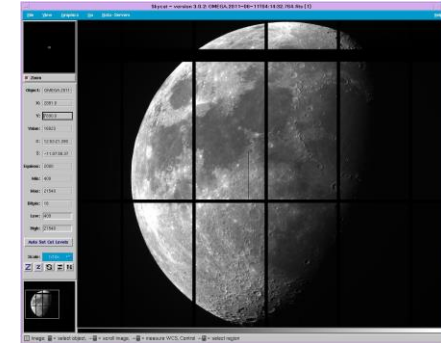
A bit of history - 1

- TNG Control SW ('90s)
  - Distributed control system of WS and LCUs
  - Base SW for Telescope and Instrument Control applications
  - Later applied at AdOpt@TNG Instrument SW
- FIERA/NGC SW (late '90s, still operational)
  - controller for CCD then IR and AO detectors
 - DSPs & Sparc board
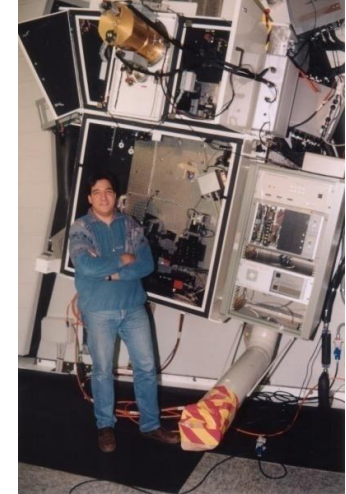
A bit of history – 2

- OmegaCAM Instrument Control SW (INS)

- Function Control SW (ICS) for MAD

- SPHERE Instrument Control SW (INS)

- All based on VLTSW
  - Functions control based on SBC running VxWorks
  - Monitoring and control on (HP then) Linux WS
  - Development of:
    - SW device drivers
    - DCS extensions
    - On-line data processing
    - Monitoring and control GUIs
    - Observation, Calibration and Maintenance procedures ("templates", ~Tcl scripts)
   - Autoguiding, Image Analysis (ActOpt)

A bit of history – 3

- Euclid/NISP

- OAPd (Bortoletto, Bonoli) responsible for NISP focal plane control electronics and onboard processing software.

- Processing includes also data compression and transmission.
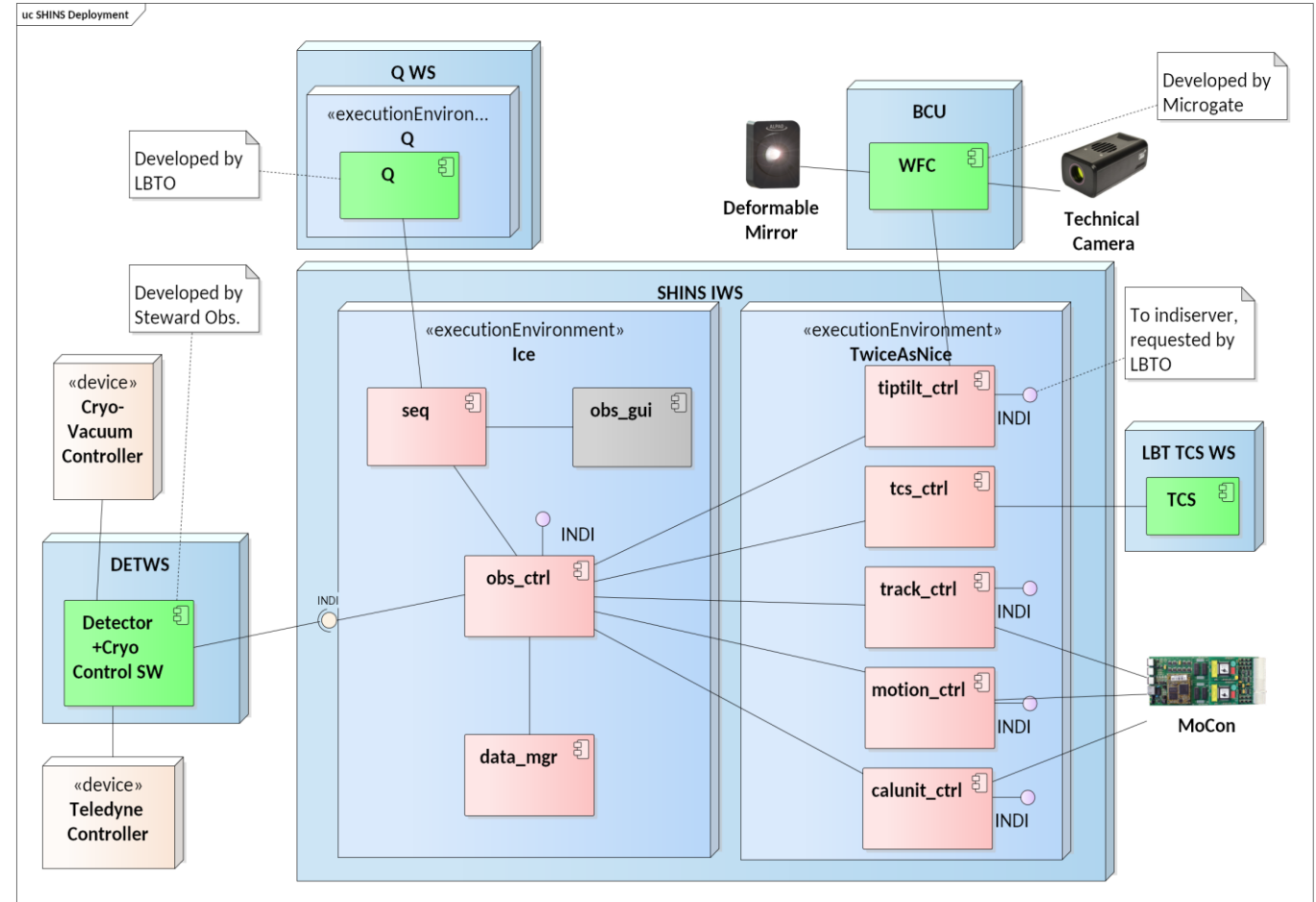
- PPC-based CPU board + VxWorks
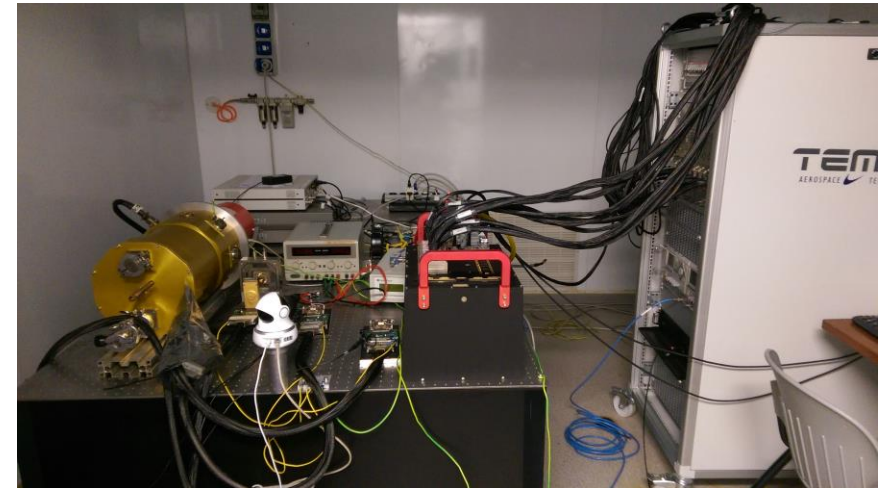
Current projects – 1

- Instrument control SW for ERIS @ UT4 and SOXS @ NTT

- Based on VLTSW + "new" ESO standard for function control:
 - Beckhoff PLC + TwinCAT

Image courtesy AAO group
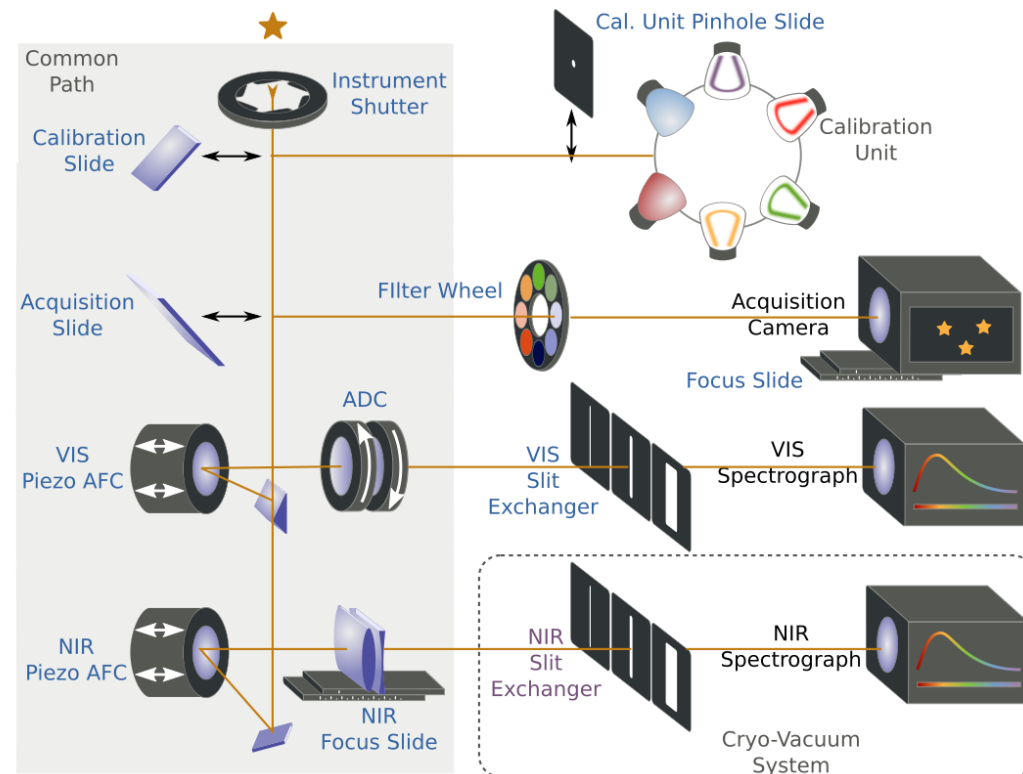
Current projects – 2

- SHARK-NIR for LBT

- Instrument SW as "glue"
  - INDI for Camera Control
 - TAN for function control
  - ICE for telescope I/F

Current projects – 3

- MAORY ICS and MAVIS @ UT4
- Based on ELT Framework
- See:
  - M. Kiekebusch talk on ELT FW Tue @ 9:00
  - B. Salasnich talk on MAORY ICS Tue @ 9:50
- Coordination of instrument/module operations
  - HW functions
  - Wavefront Sensor Cameras
  - AO RTC
  - Telescope
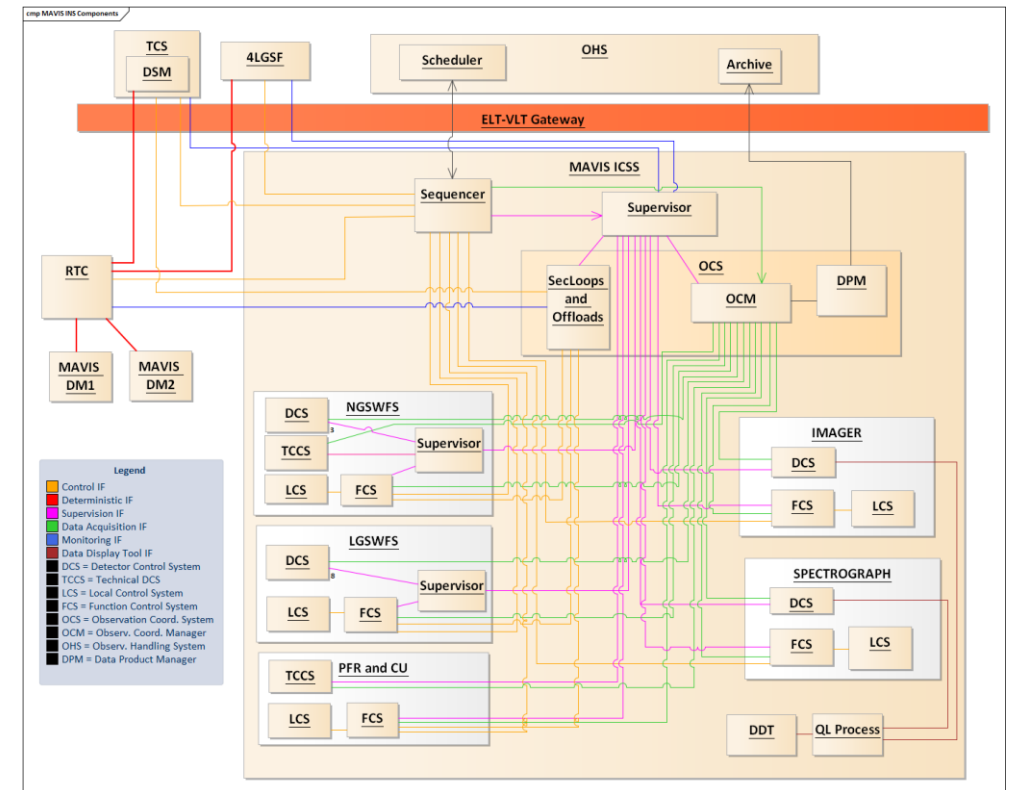
Current projects – 4

- MAORY Real-Time Computer
- Composed of
  - HRTC
    - Hard Real-Time Core
    - Must keep up with RT AO loops
  - SRTC
    - Soft Real-Time Cluster
    - Optimizations, auxiliary tasks, data recording
    - IT servers + [opt] accelerators
  - Communication Infrastructure
    - 10/25/40/100 Gb Eth & switches
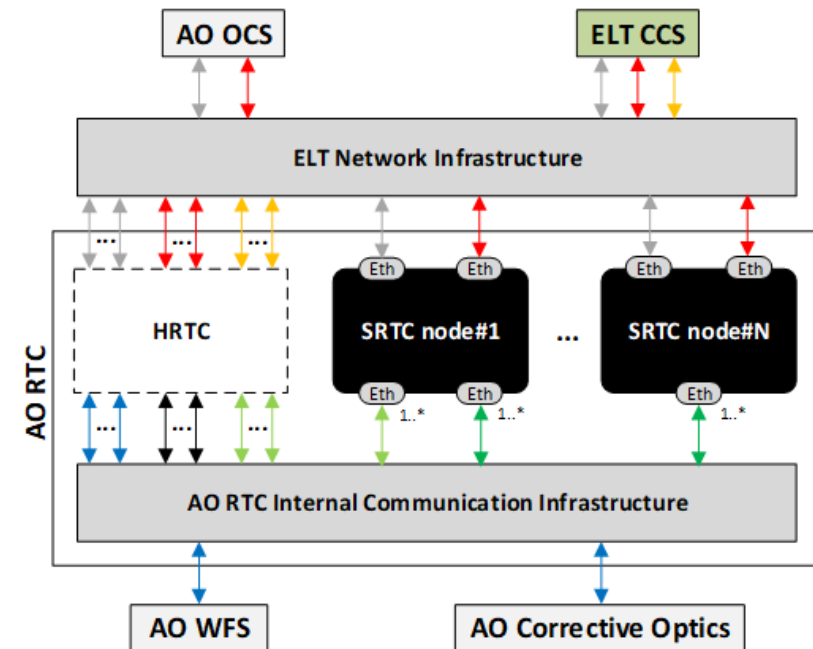
Collaborations

- ESO main partner
  - Customer for SPHERE, ERIS, MAORY, SOXS, MAVIS
  - Provider of frameworks: VLTSW, ELTSW

- International collaborations

MPE@Garching	ERIS/SPIFFIER
ATC@Edinburgh	ERIS/NIX
IPAG@Grenoble	SPHERE/IRDIS, MAORY/LGSWFS
ING@LaPalma	WEAVE/SPE
MPIA@Heidelberg	SHARK-NIR
LBTO@Tucson	SHARK-NIR

- In INAF

INAF@Teramo	ERIS/CU, MAORY/CU
INAF@Arcetri	ERIS/AO, MAORY/NGSWFS
INAF@Napoli	SOXS, MAVIS
INAF@Bologna	MAORY/RTC

Typical role of our group

- We take responsibility for whole "INS" package

- Coordinate work for all phases

A Instrument concept and TLR definition

B Definition and analysis of SW requirements. Ends with PDR.

C Design and definition of algorithms. Definition of test procedures. Ends with FDR.

D SW Development. SW support during MAIT. Ends with PAE.

E SW support during reintegration at final destination and commissioning. Ends with PAC.

Development process

- Not all projects follow a clearly-defined process

- All processes (up to now) are "document centric"

- When process is defined (e.g. ESO projects) it is
  - Kind of waterfall (Requirements, Architectural Design, …)
  - Iterative development/incremental delivery
  - Perceived to fit the typical Instrument-building project
    - But I'm interested to hear about other experiences

Tools

- Development Server (about to be replaced)
  - Dell PE R720, 24 cores, 192 GB RAM, 8 TB disk
  - VMWare ESXi 5.5.0, ~20 VMs
- PLC test bench (aka "pakko")
  - Test PLC code, SW drivers in VLT/ELT env
- Remote connections via NoMachine NX
  - Or VPN (no persistence)
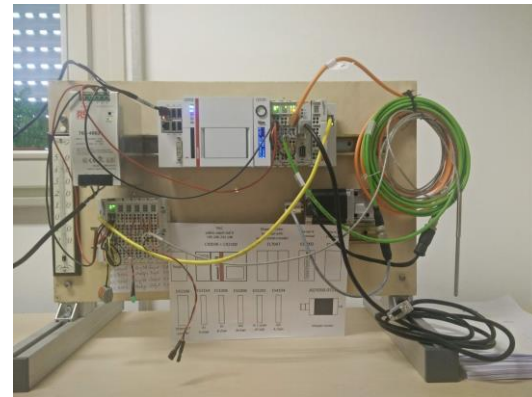
Outlook

- Our main "customer" is ESO
  - Current projects will keep us busy for the foreseeable future

- We adopted ESO technologies, standards, practices, processes…

- In the future, higher attention on PA/QA
  - We need to improve on that
  - This workshop is an opportunity
    - Talks (e.g. Natalia's, Valentina's, …)
    - Raise interest

- But we're also interested in MBSE, virtualization, collaboration tools, …

TETIS

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Thank you for your attention.
Any questions?