THE MINISCULE ELT CONTROL SOFTWARE: DESIGN, ARCHITECTURE AND HW INTEGRATION

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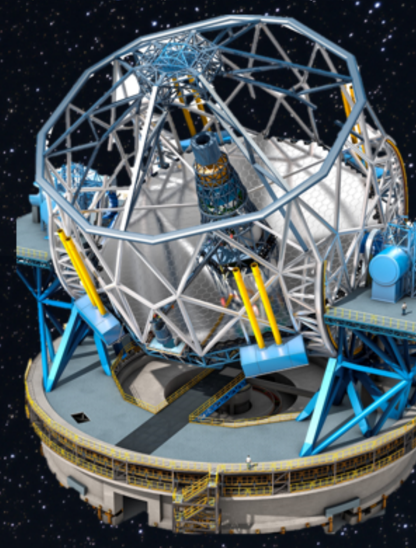
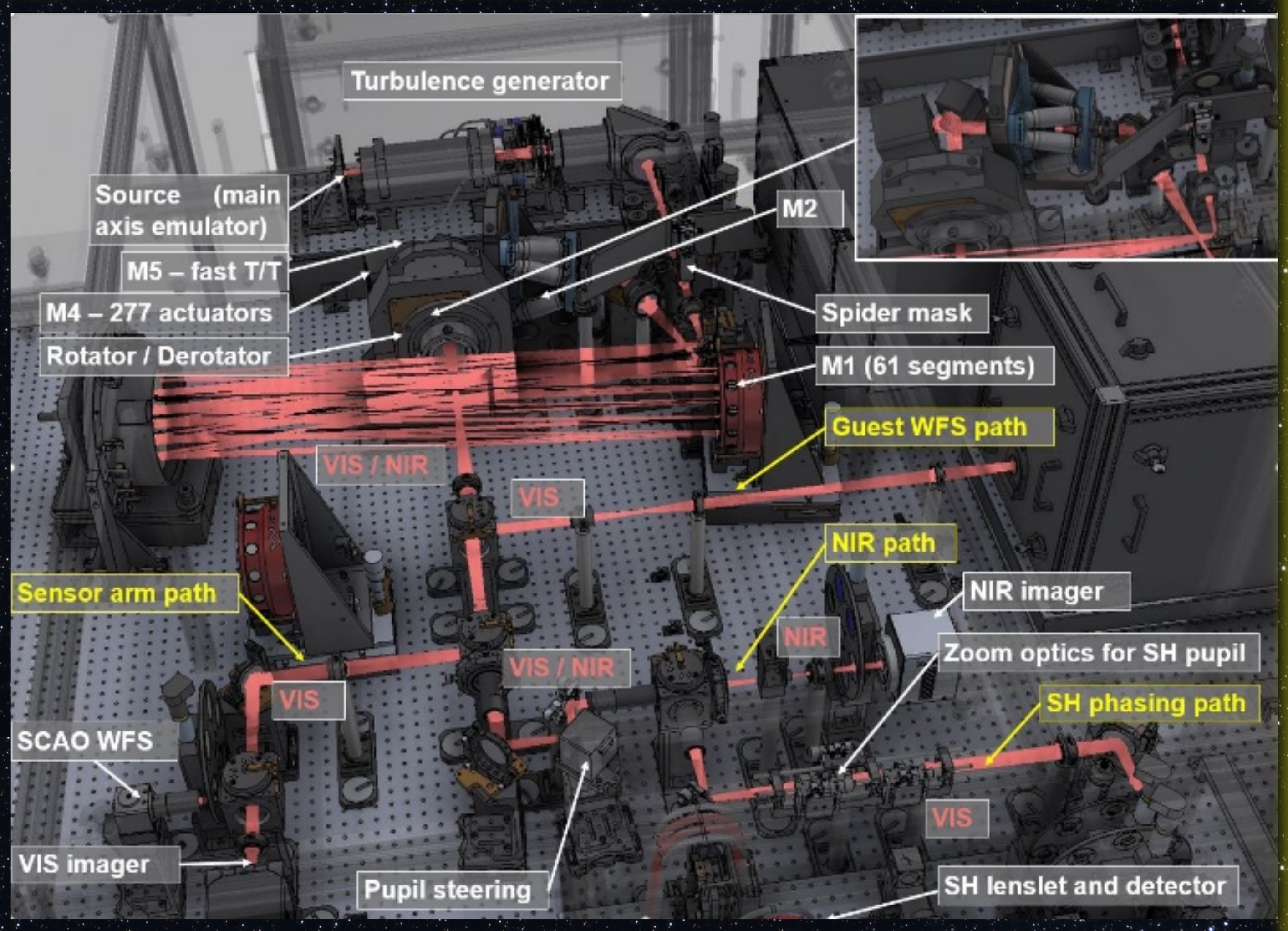


OVERVIEW

The Miniscule Extremely Large Telescope

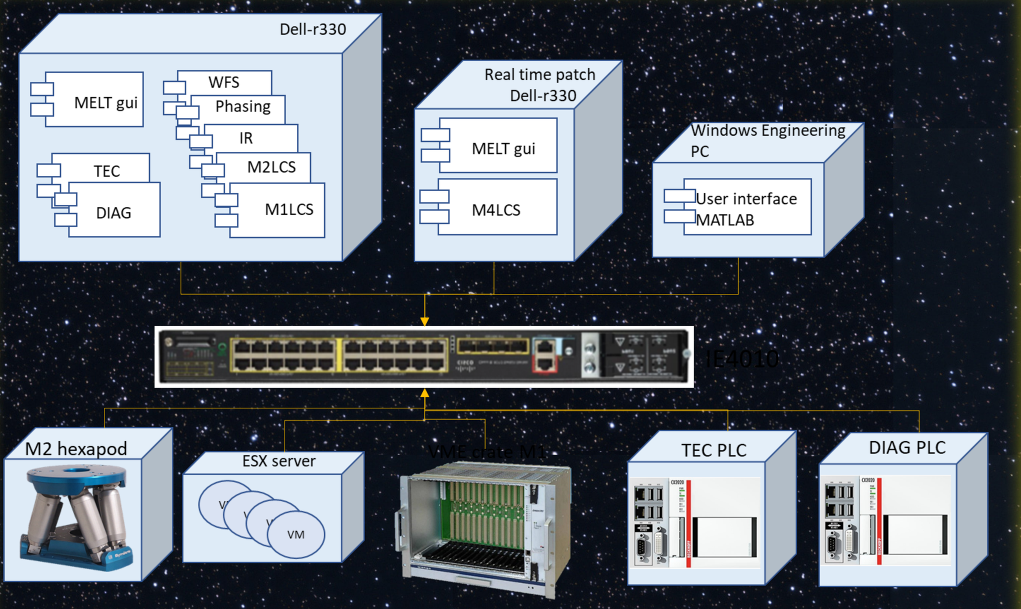
- Table-top emulator of the ELT.
- Used for testing and validating key functionalities of the ELT.
- Objectives of MELT are to deploy and validate the telescope control system.
- Validate wavefront control algorithms for commissioning and operations.

➔ MELT Control System Architecture follows the principles of the ELT Control Software and its Common Development Standards.



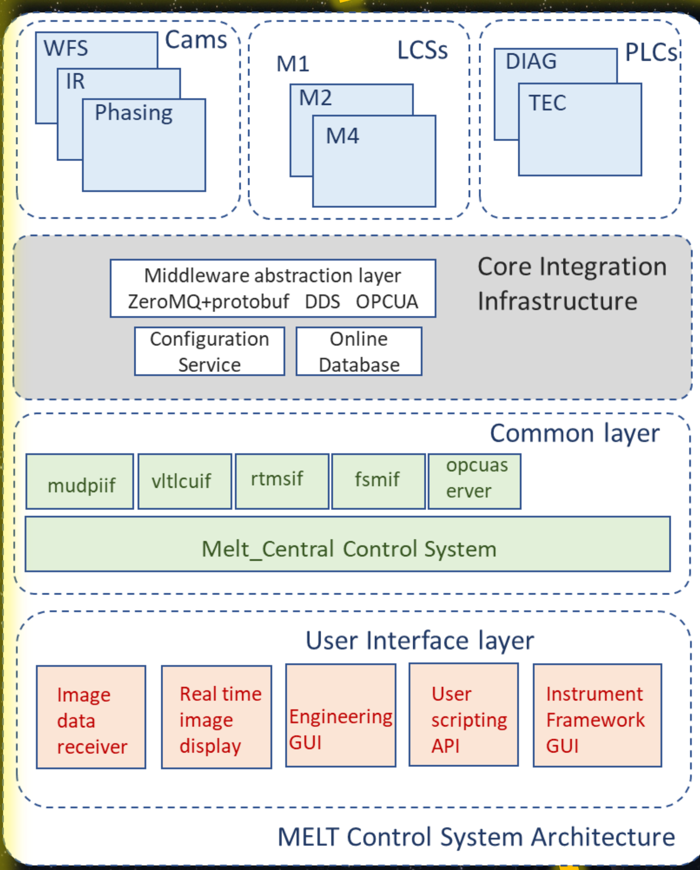
Source: Laser driven incoherent white light in the wavelength of 500–1700nm. M1 active segmented mirror: consisting of 61 segments, each driven by 3 piezos to control piston, tip, and tilt. M2 hexapod: hexapod is a compact 6DOF parallel kinematics system. M4 Deformable mirror: ALPAO 277 actuator deformable mirror. Sensor arm: Fast tip/tilt (M5) and VIS imager, SCAO SH WFS 256x256 pixel with 207µm lenslets. IR Path:pupil stabilization tip/tilt mirror, full frame readout performed by a 240x320 pixel IR camera. SH Phasing: WFS 512x512 pixels. Motors and Power control: Interface to two Beckhoff PLC

DEPLOY



MELT Control System is deployed in a distributed environment comprised of different servers and machines (Fig. 7): 3x Dell PowerEdge r330 16G RAM, XEON® CPU E3-1270 3.8Ghz: 1xCentOS7.4, 1xCentOs7.4 with RT patch, 1xWindows, VME crater for the M1 LCU, 2xBeckhoff CX2030 PLC, 4xVLT like LCUs

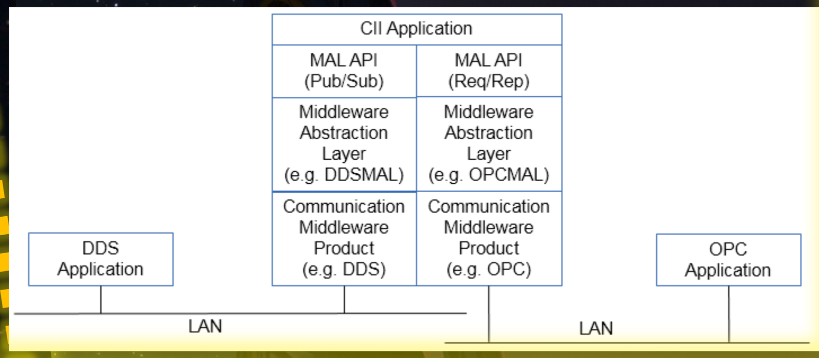
APPLICATION STACK



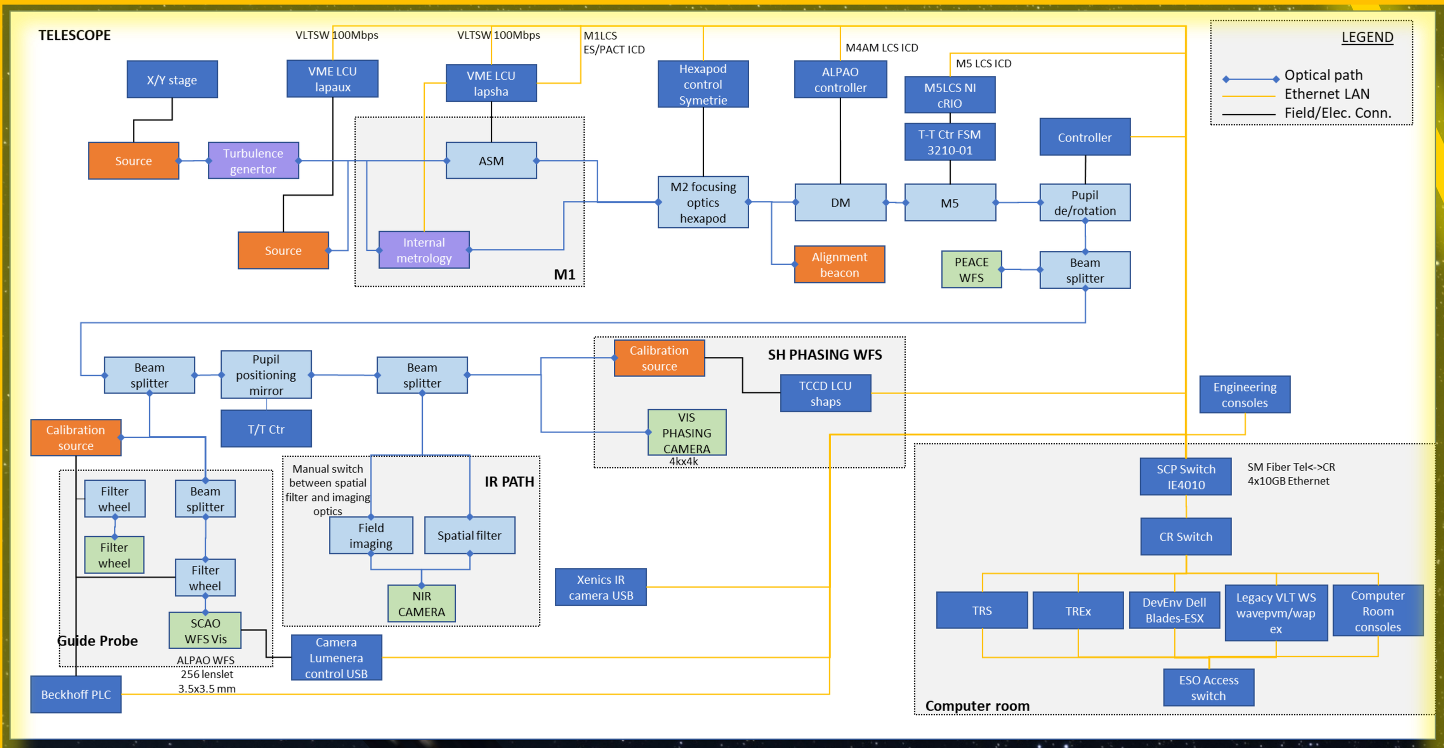
MELT control Software comprises multiple applications that run the required logic to command and measure the different devices. Due to the diverse nature of these devices, a wide set of programming languages and computer architectures are used.

It provides technologies and interfaces in-line with ELT, and uses ELT Development Environment and Common Integration Infrastructure and Instrument Framework. Two communication patterns are used: publish/subscribe and request/reply, then they are mapped to the underlaying communication middleware software stack, all abstracted within the Core Integration Infrastructure Middleware abstraction layer

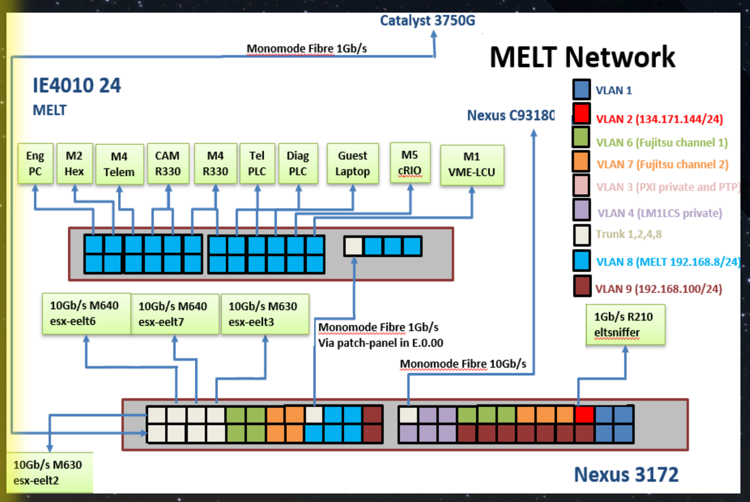
IFW is the toolkit to help instrument developers to implement their control systems. It includes a set of PLC standard libraries controlling common devices (motors, lamps, shutters, sensors, ADCs).



PERFORMANCE & BLOCK DIAGRAM



MELT network infrastructure uses the architecture baselined for ELT. IGMP snooping enabled: listening to Internet Group Management Protocol (IGMP) network traffic to control delivery of IP multicasts.



LAN closely follows the telescope LAN design, with the Nexus switch planned for the Service Connection Points (SCP) in the field and connected back to the computer room via single mode optical fiber.

The control loop collects observable data at frequencies up to 1KHz. Most demanding devices: ASM difference between the expected send time and the actual one is 0.1uSec. DM latency of 130us from first byte reception to the application of setpoints.

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