



CONTROL AND MONITORING OF THE ONLINE COMPUTER FARM FOR OFFLINE PROCESSING IN LHCb



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LHCb is one of the 4 experiments at the LHC accelerator at CERN. The LHC delivers 40 MHz of collision data to LHCb which needs to be reduced:

- Two-level trigger system – one hardware based, one software based (HLT – High Level Trigger)
- HLT (High Level Trigger) runs on a dedicated computer farm (25.000+ cores)

Outside data taking periods the available CPU capacity on HLT farm can be used to run DIRAC (Distributed Infrastructure with Remote Agent Control) and produce, for example, simulation data.

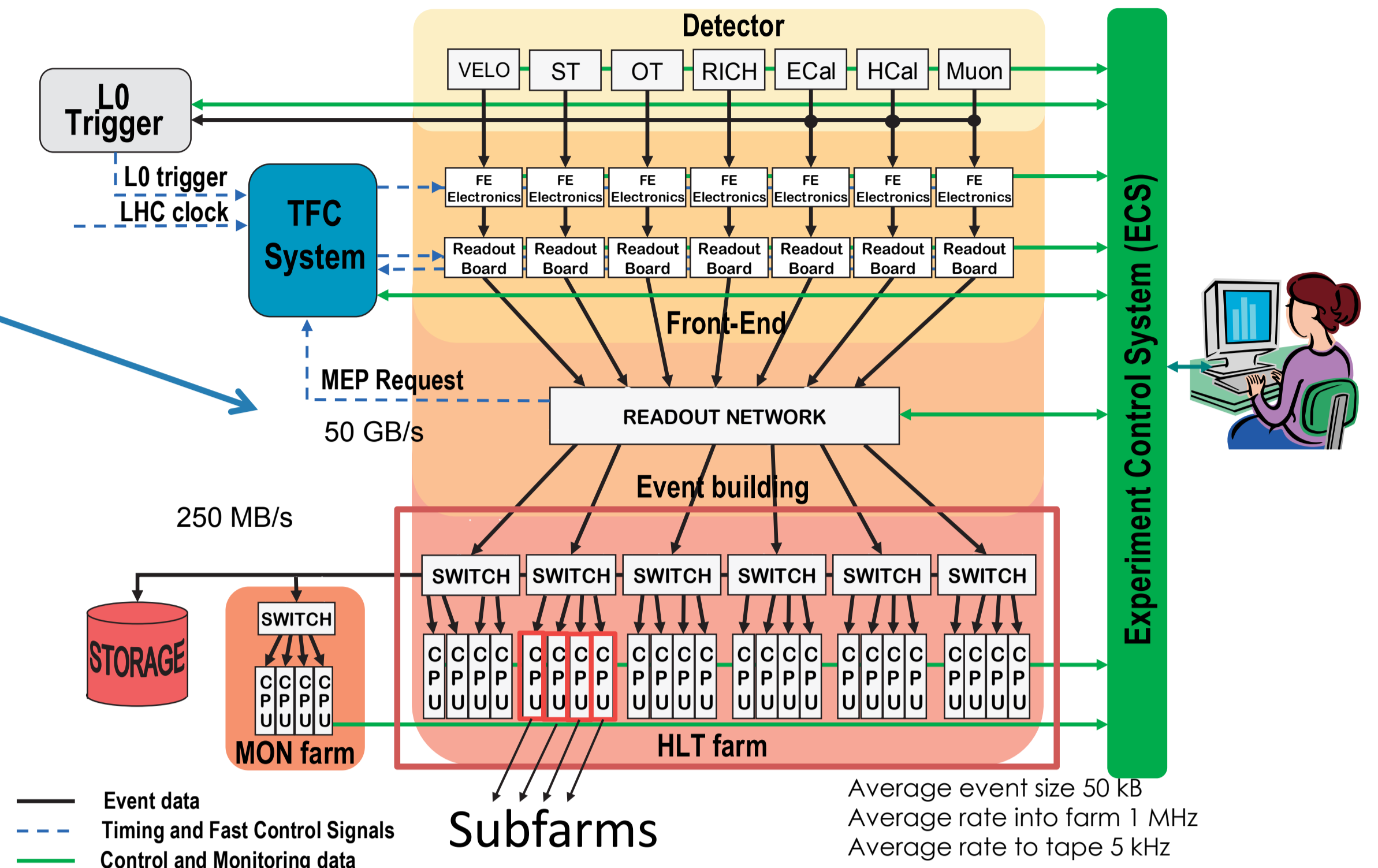


Fig 1. LHCb Data Acquisition Architecture

The DIRAC System is a specialized system for data production, reconstruction and analysis of the data produced by HEP experiments (e.g. LHCb).

DIRAC Pilot Agents:

- Software components which run as independent processes.
- Deployed close to the computer resources
- Presented in a uniform way to the DIRAC WMS (Workload Management System)
- Pull the workload from the central Task Queue in WMS

A Control System was developed to allow the usage of the HLT Farm for offline data processing:

- Based on the existing Online System Control infrastructure
- Developed on the PVSS SCADA and the FSM toolkit.
- Runs on a Linux Control PC connected to all the worker nodes via the LHCb private network
- NAT masquerading allows worker nodes access to the public LCG network

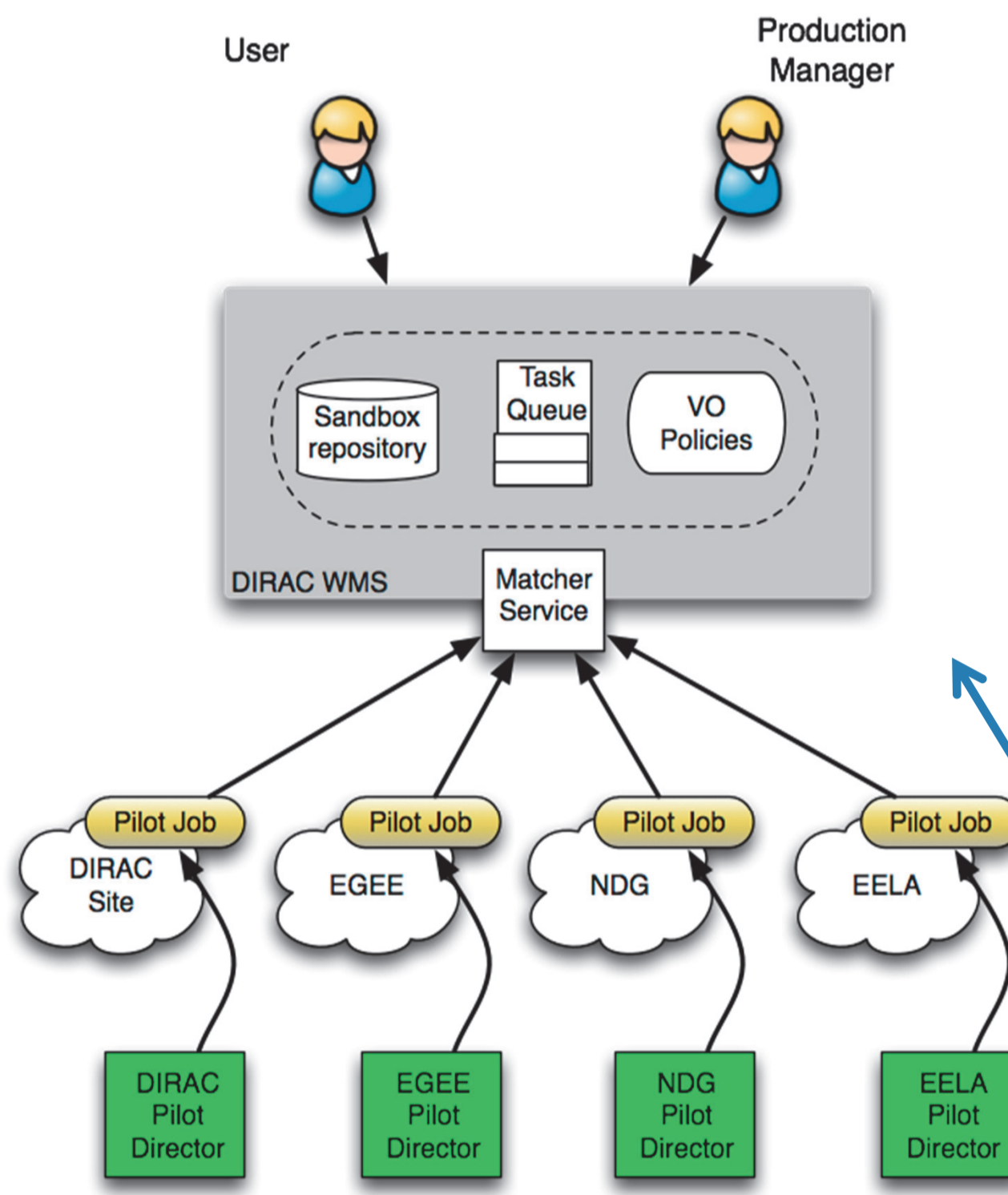


Fig 2. DIRAC computing structure

The Control System:

- handles the launching, monitoring and management of the DIRAC Agents
- Connects to the FMC (Farm Monitoring and Control) servers on the worker nodes
- FMC servers launch the DIRAC Script and report process status to the PVSS system

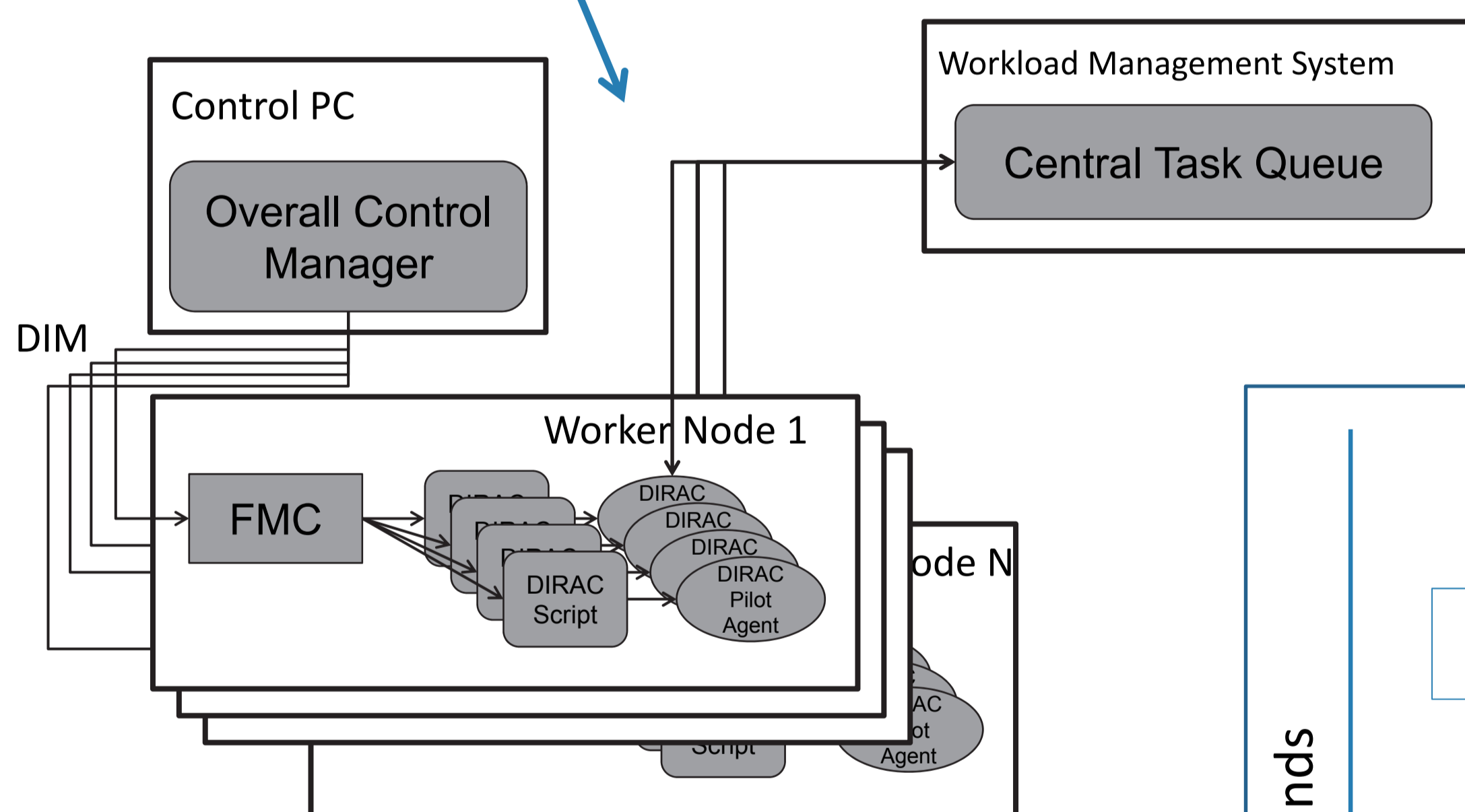


Fig 4. Online DIRAC Control System

Control System modelled as FSM objects and arranged as an FSM Tree

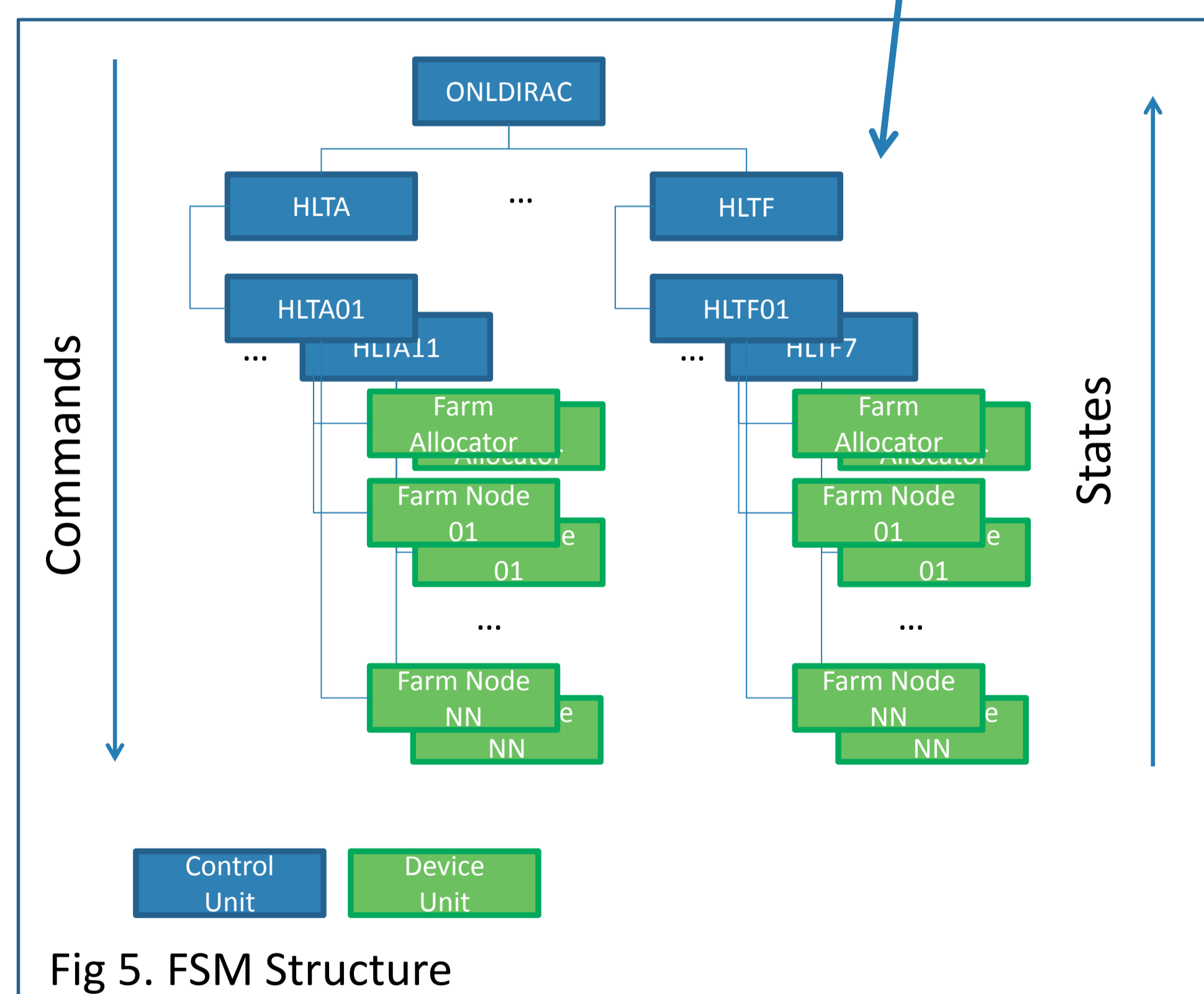


Fig 5. FSM Structure

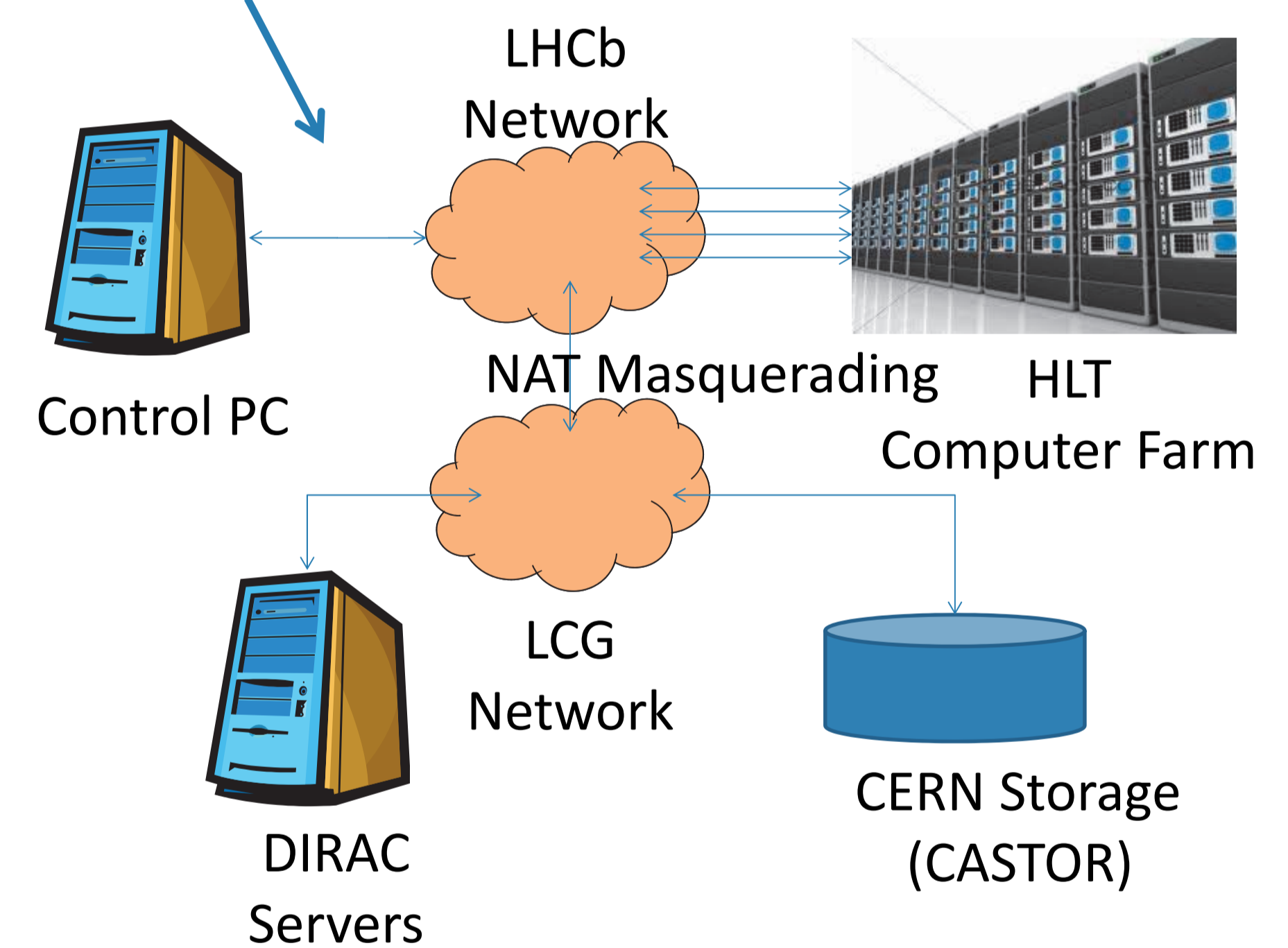


Fig 3. Online DIRAC Control System Architecture

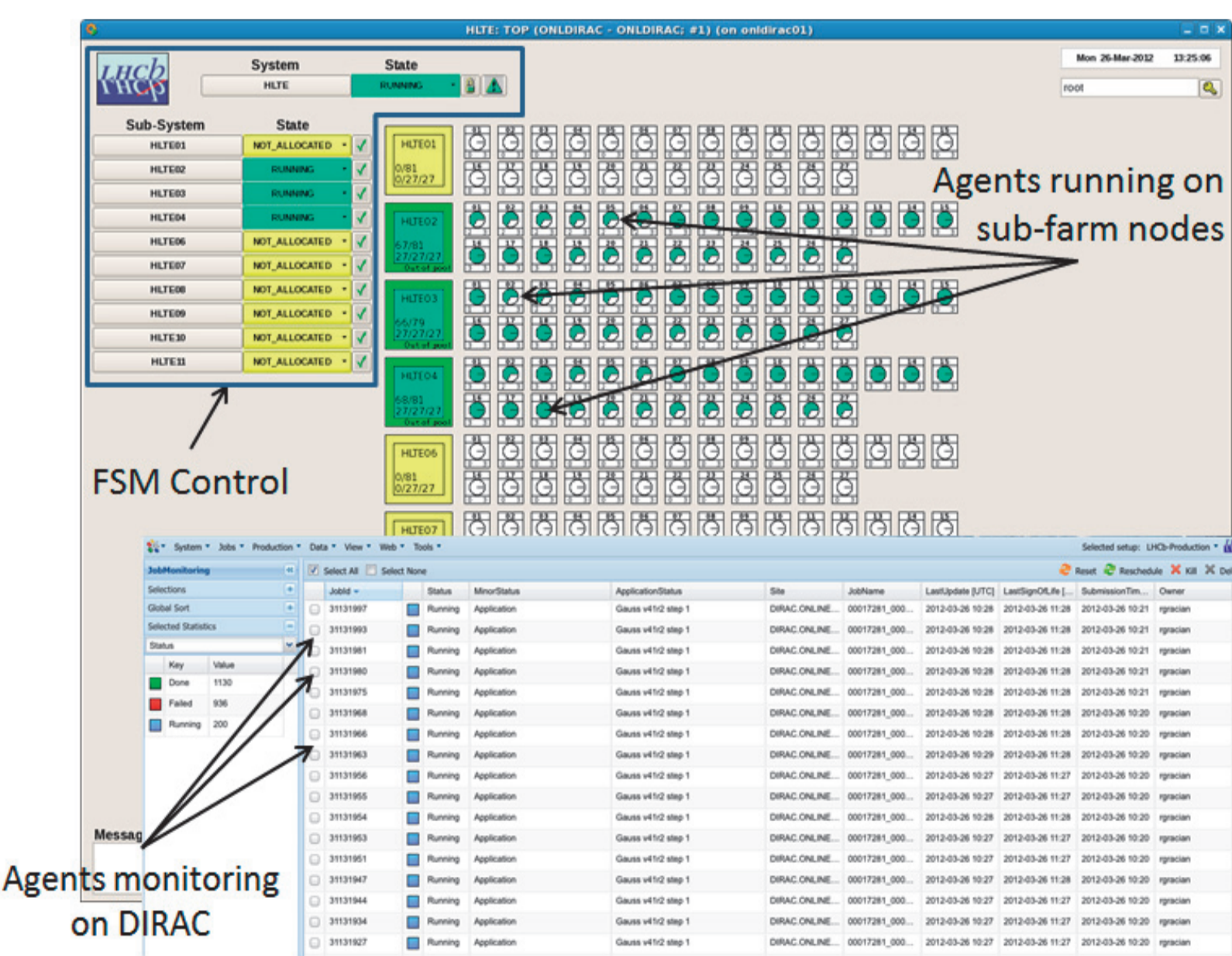


Fig 6. User Interface

The User Interface:

- Coherent Look and Feel with the other Control Software of the Experiment.
- Synoptic panels shows the current status of the system
- FSM interface for PVSS.

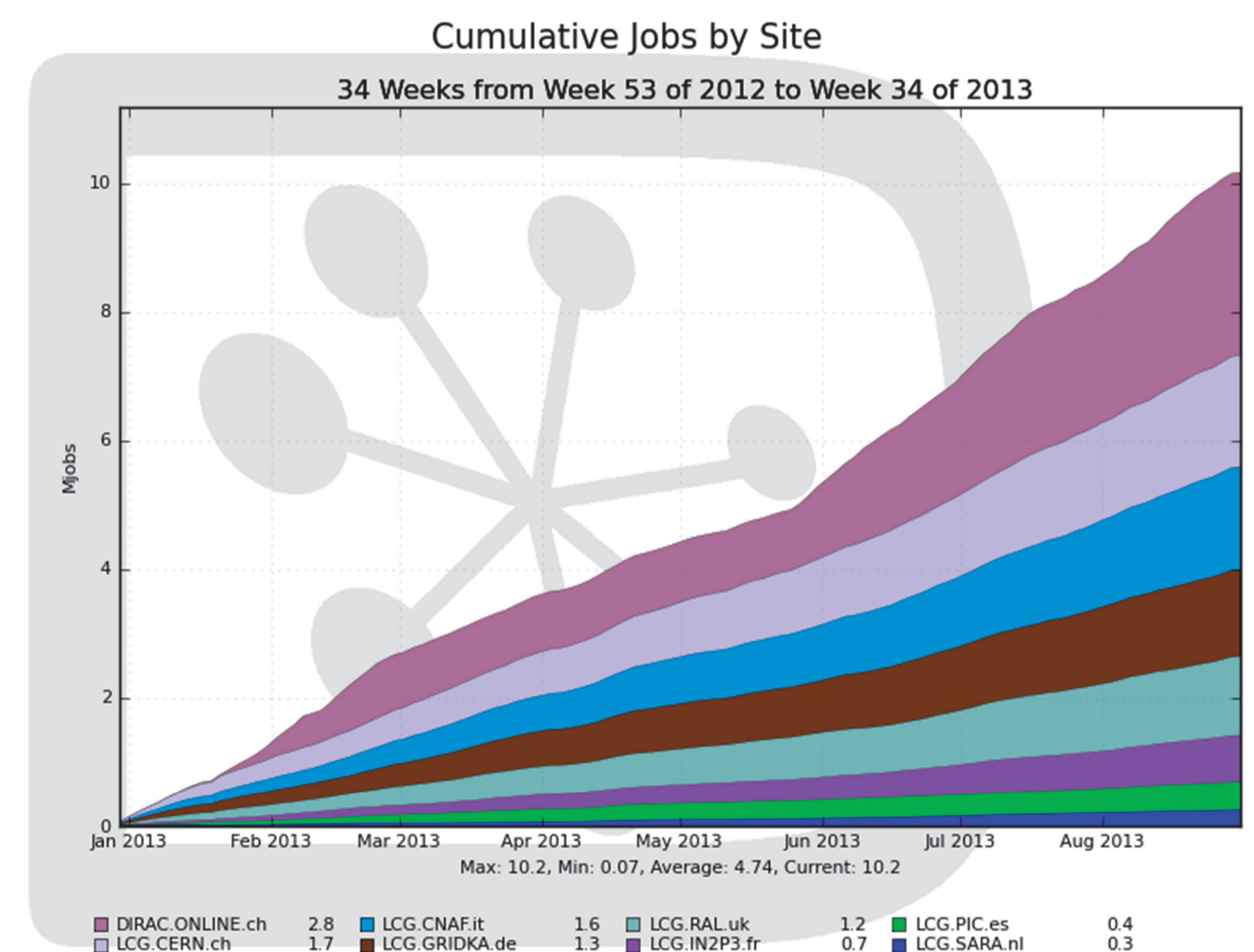


Fig 7. Cumulative Number of jobs for the main job production sites

The efficiency of the online farm usage greatly improved with the usage of this Control System. The system is now in production in LHCb and has been used very successfully. Using the full HLT farm, the system is able to process 22.000+ jobs simultaneously and, since the beginning of 2013, around 2.8 MJobs have been processed using the LHCb online HLT farm. At this time, the LHCb HLT online farm is the biggest single producer of DIRAC jobs.