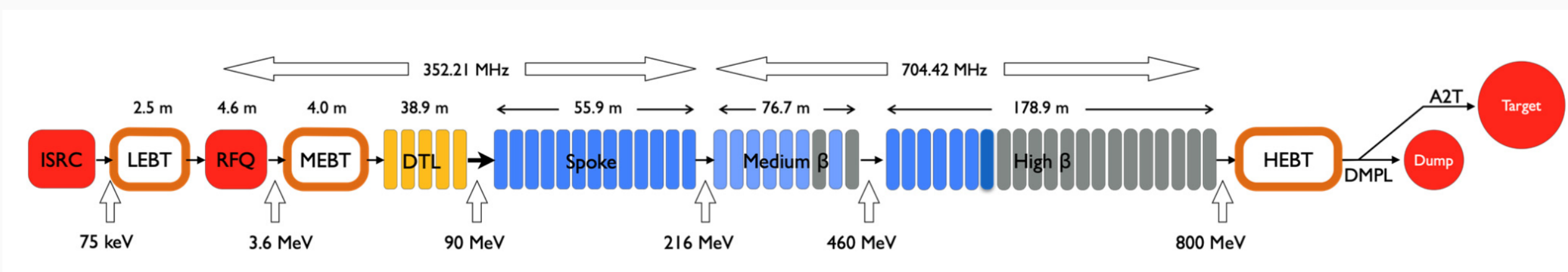


FULL STACK PLC TO EPICS INTEGRATION AT ESS

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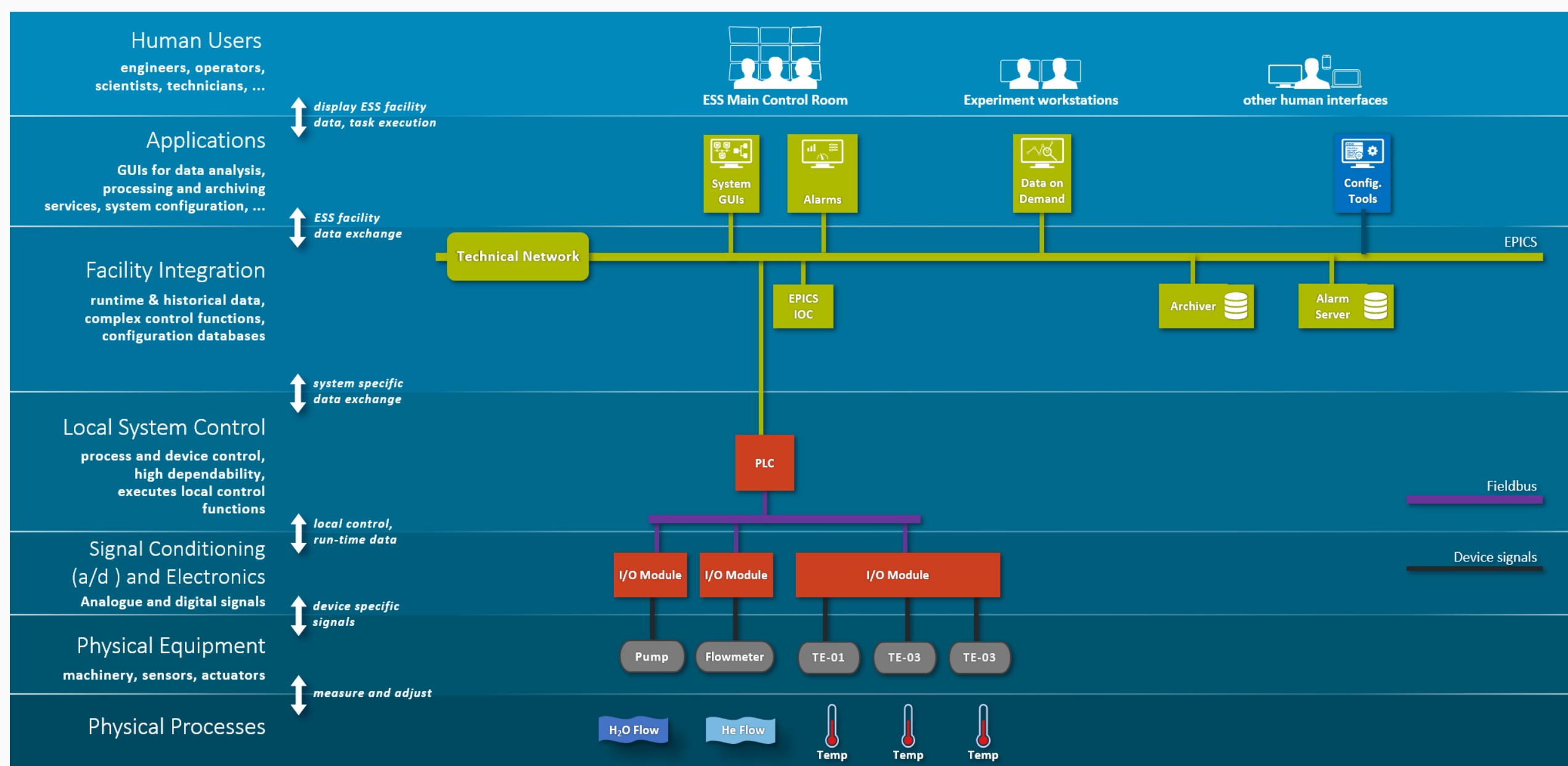
ESS LINAC configuration



The ESS Project

The European Spallation Source is currently under construction in Lund, Sweden. Due to budget constraints, the accelerator power has been reduced to 2 MW by decreasing the beam energy from 2 GeV to 800 MeV, and the total number of neutron instruments reduced to 15. The first beam on target is expected in 2025, with user operation of the first few instruments planned for 2026 and the full 2 MW LINAC and 15 instruments operational at the end of 2027.

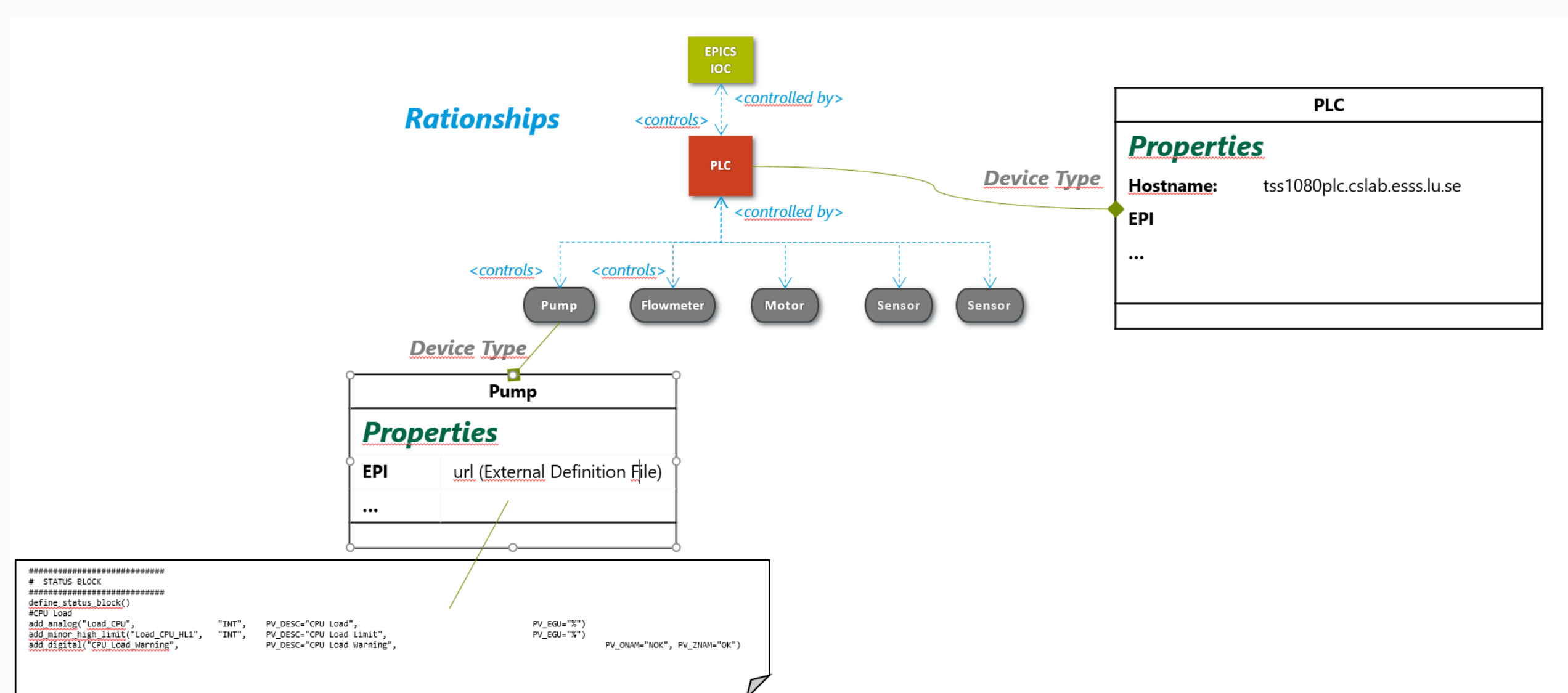
Layer Architecture of a PLC-based Control System



ICS Automation Section

The Automation Section within the Integrated Control System division (ICS) at ESS, has the scope to coordinate the design, develop, maintain and test of PLC-based Control Systems. The ICS division has adopted different standardised hardware technologies for implementing the ESS control systems based on performance: for mid-range (< 100 kHz) Beckhoff/EtherCAT, and for slower signal (< 10 Hz), Siemens. The PLC Software Engineer Stations used are Beckhoff/TwinCAT3 and Siemens TIA Portal. Versiondog and GitLab are the tools used for archiving and versioning.

Modelling of a PLC-based Control System

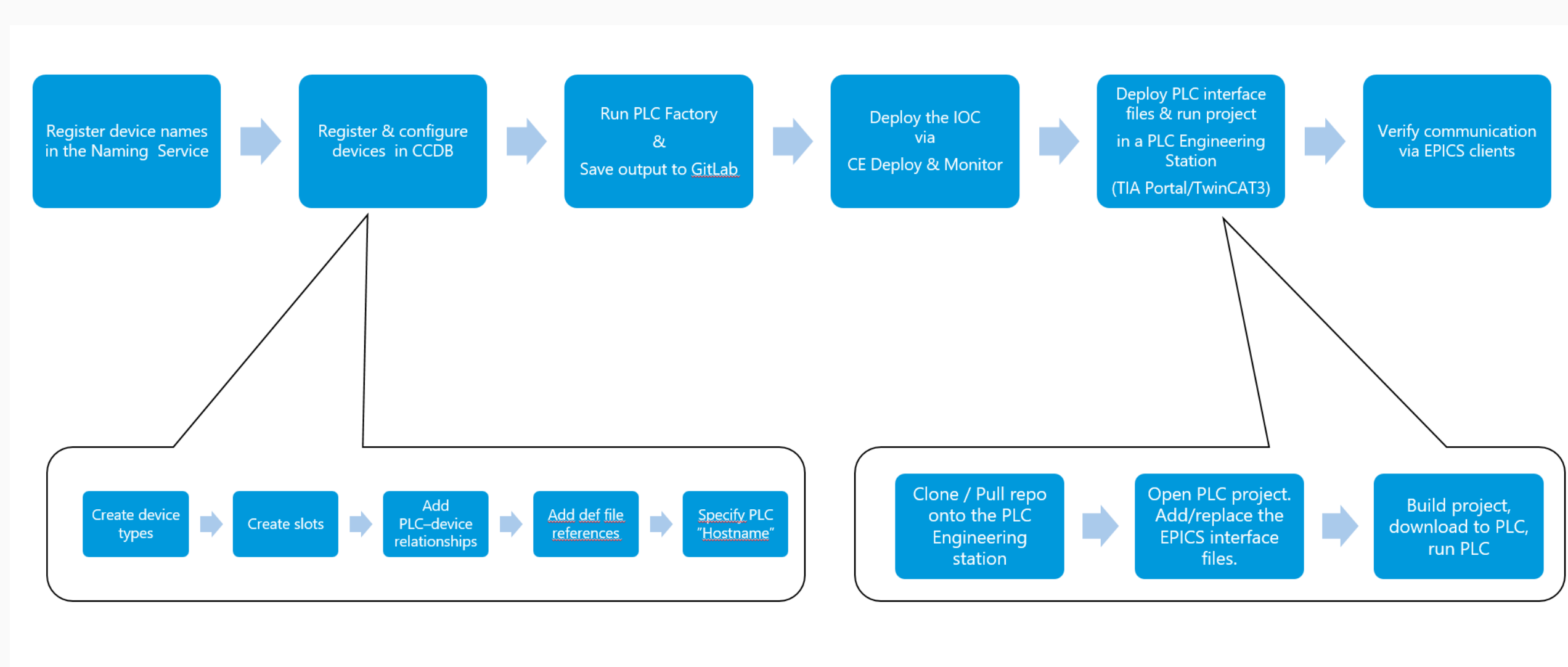


Control Management Ecosystem

The Control Management Ecosystem has been built to facilitate management and maintenance of integrated control systems, composed of a number of different services and complimentary tools:

- Naming Service : provides to assist users of the ESS naming convention and to register ESS Names.
- CCDB : contains configuration information relevant for controlling physical and logical devices such as valves, pumps, etc. This information is aggregated in the CCDB in one model of the ESS
- PLCFactory : is a python-based software tool that is used to generate the set of codes necessary to achieve integration between a PLC and EPICS; it generates a set of code with linked variables for the PLC and the produced EPICS IOC source files.
- CE Deploy & Monitor Tool : It is a deployment tool, that installs and manages the runtime of IOCs on a host machine. It can monitor the IOC and performs a few select remote procedures.

Overview of the PLC-EPICS integration workflow



Future Upgrade

The CCDB service was originally designed to be a “database of everything”, which is ill-suited for storing types of devices and relationships between them. The goal is to properly integrate this into our standard IOC deployment toolchain. This will allow us to include the generation of PLC-based IOCs with the same toolchain and workflow that we use for all IOCs.

The current PLC-EPICS TCP/IP communication protocol has some speed limitation for motion control projects. One solution that is currently under investigation is the use of OPC UA, which can be used both for Siemens and Beckhoff PLCs. The use of only one protocol could be then an advantage in term of maintenance.

Acknowledgments

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