

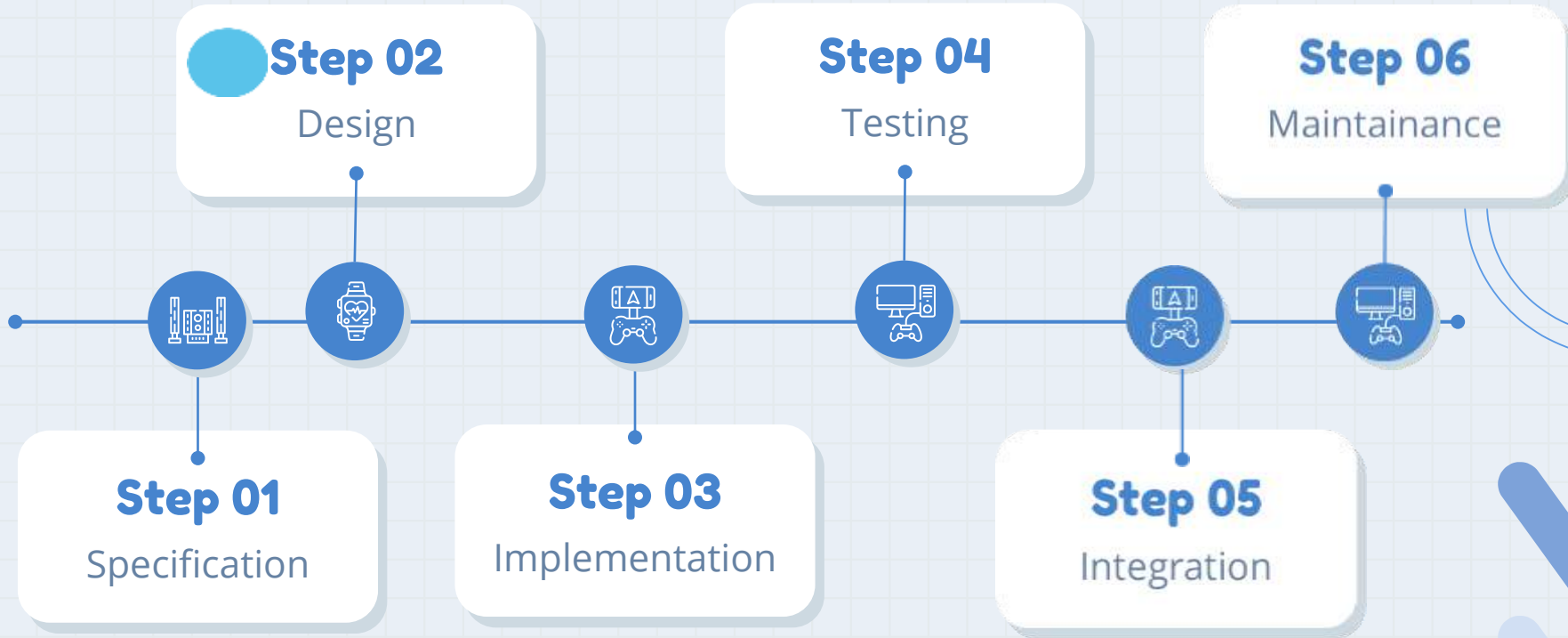
Design of Automation Systems for Experimental Facilities

Task 1



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Life Cycles of Automated Systems (DCS)



Design of Automation Systems

The objective of this task is to search for the design parts of automation systems for different experimental facilities through TDR & CDR then find ways to develop them

In the design phase, distributed control system (DCS) is designed and engineered based on the project requirements

This includes selecting appropriate hardware and software, designing the control strategy, and creating the wiring and network diagrams

Some Standards for designing of Automation Systems

Control System Frameworks Engineers working on control systems have access to control system toolkits, they provide essential functionalities for designing, building, and modifying control systems

Hardware and networking the control system architecture involves a mix of hardware, networking, and application software. The control system ensures remote control and monitoring of all devices and subsystems

Collaboration, standardization, and adaptability are critical for designing effective automation systems for accelerators

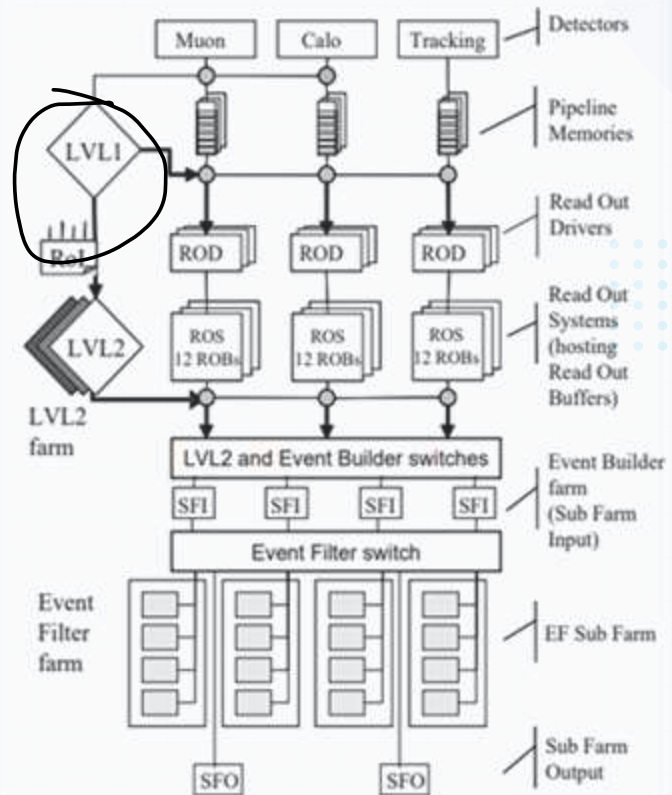
Example.1

ATLAS

HLT(High Level Trigger)
Uses calorimeter and muon detector information to select events at 75 KHz

LVL-2
Provides additional rejection factor of 20-30 bringing the rate to 3 KHz

EF (Event Filter Farm)
Analyzes the entirety of each event data to achieve a further rate reduction to 200Hz



Example.2

SPD

High Level

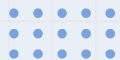
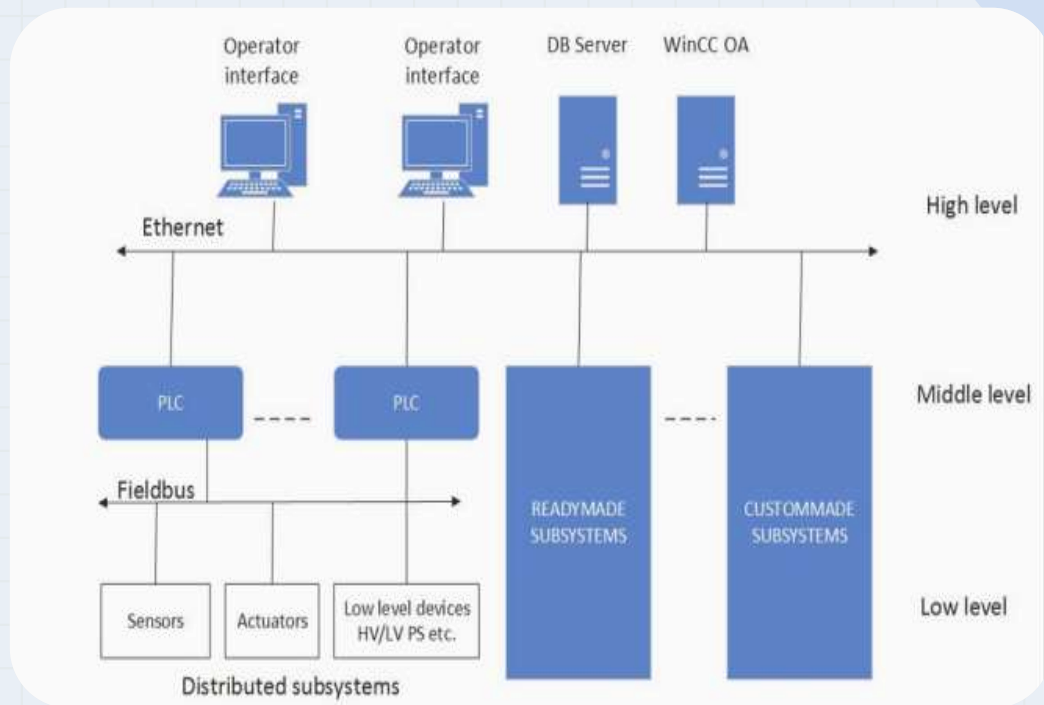
To provide human-machine interface for operators, communicate with the external world(accelerators)

Middle Level

Represented by programmable logic controllers and integrated ready-made and custom-made subsystems

Low Level

Includes measurement channels built into the front end electronics and DAQ of the detector part, I/O devices, and low and high voltage power supplies



Suggestions and planning for Improving

1

Use of artificial intelligence to optimize accelerator operations and improve machine performance

2

Energy efficiency and power management

3

High-Level Synthesis



References

<https://cds.cern.ch/record/1035150/files/daq-conf-2007-022.pdf>