EPFL, LAMS
« Industrial Automation » course

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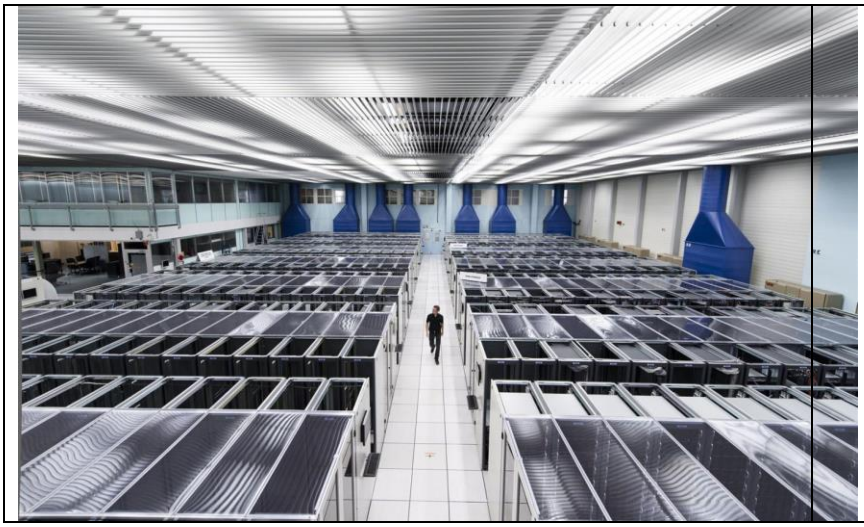
Project for the course "Industrial Automation" 2017



CERN Data Center

The CERN data center hosts all computing, administrative and scientific infrastructure of CERN, which includes more than 10,000 servers hosted in three rooms running 24/7. A remote extension of the data center is hosted at the Wigner Research Center for Physics in Hungary, which is connected to the main CERN campus through two independent and dedicated 100Gb/s fibre optic lines. The LHC experiment alone produces over 30 petabytes of data per year, and the center has more than 130 petabytes of stored data currently. To have such a massive computing center running, two main technical infrastructures are critical: power distribution and cooling and ventilation. The cooling and ventilation of the computing rooms is done through cold air introduced in the building via big pipes coming from the roof and going down to the floor. Three chillers on the building roof are responsible for pushing down the air into the building

For this homework, you will consider yourself as system integrator biding for the control system of the cooling infrastructure of the CERN computing centers in Switzerland and Hungary. As a constraint, the supervision system needs to be integrated with a TANGO control system.

Considering the system presented previously, you will have to perform the following tasks:

1. Define the overall system architecture for such a supervision system, including the communication infrastructure, hardware, software and communication protocols. You will have to pay special attention to:
    a. The distributed nature of the installation.
    b. The number and type of sensors (temperature, humidity, etc.)
    c. The protocols between the supervision system and the sensors
    d. The supervision is critical, since the servers will be stopped if the supervision system fails, to avoid overheating and fires.
2. Present a P&ID of the supervision infrastructure for one of the two sites.
3. Using Tango (http://www.tango-controls.org/):
    a. Develop a simple device server providing simulated data to the supervision system
    b. Develop the synoptic view(s) required for the supervision of the installation. The synoptic views should be designed according to the principles presented in class regarding the development of industrial HMIs.
4. Perform a security analysis of the system from a cyber security point of view considering the different software required to run Tango. The list of software and their version present in the Tango box can be a starting point.
5. Estimation of cost for integration and development to turn all the components into one system.

The project shall be executed by interdisciplinary teams. During the second part of the semester, time will be dedicated during the classes for the team to work on the project and interact directly with the instructors to refine the requirements and make the necessary assumptions.