General Concepts of the $\overline{\text{P}}$ANDA DCS

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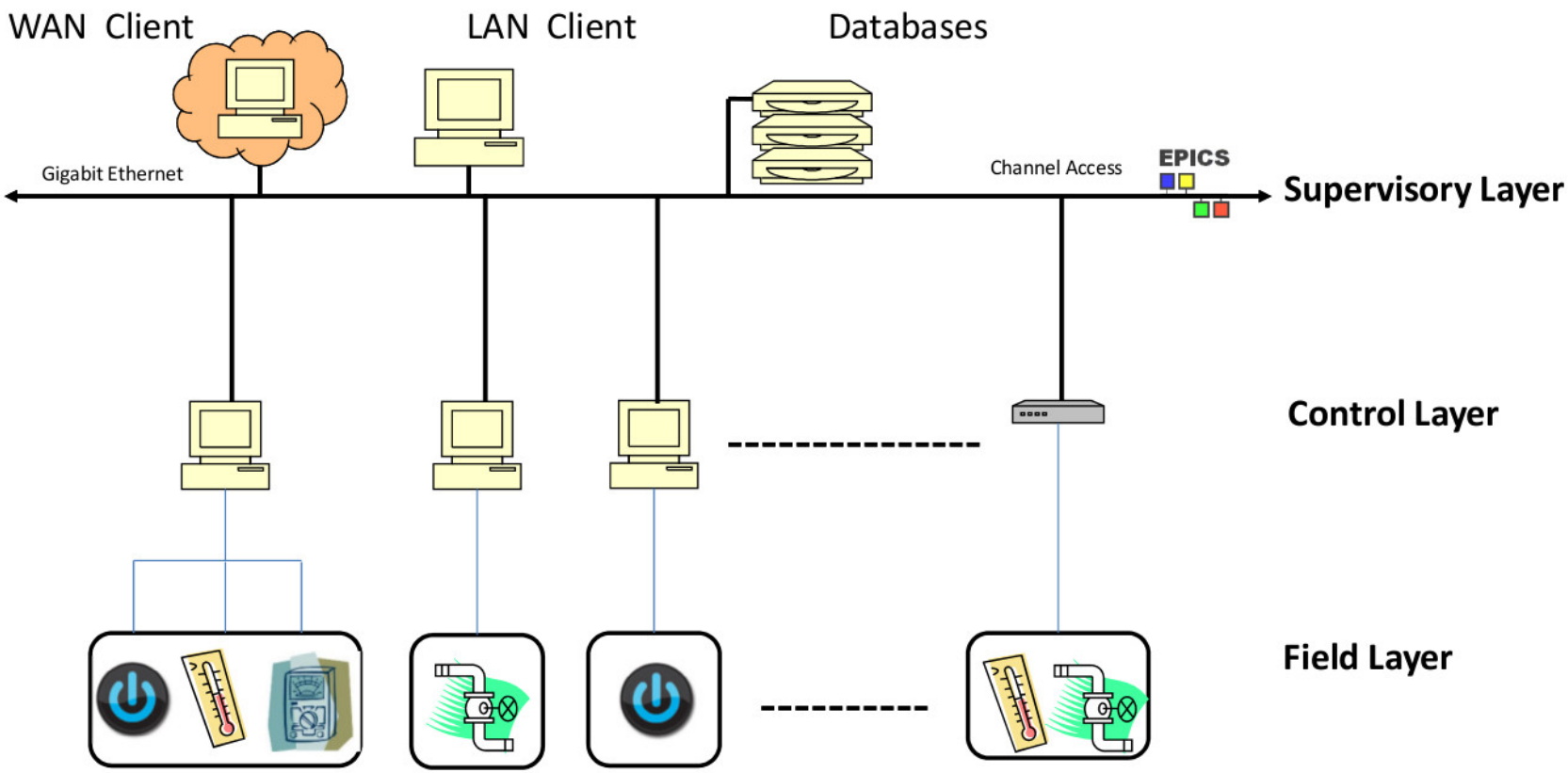
Requirements of $\overline{\text{P}}$ANDA DCS

(Some) Requirements of $\overline{\text{P}}$ANDA DCS:

- Scalable, modular
- Autonomous operation of each sub-detector (calibration, physics runs, maintenance)
- Common operation of all sub-detectors in *one* DCS system
- Archiving
- Alarm handling
- Non-expert operation
- Graphical UI

16 sub-detectors, 2 magnets, targets, beam
$\Rightarrow$ order of $2 \cdot 10^4$ "slow" channels expected

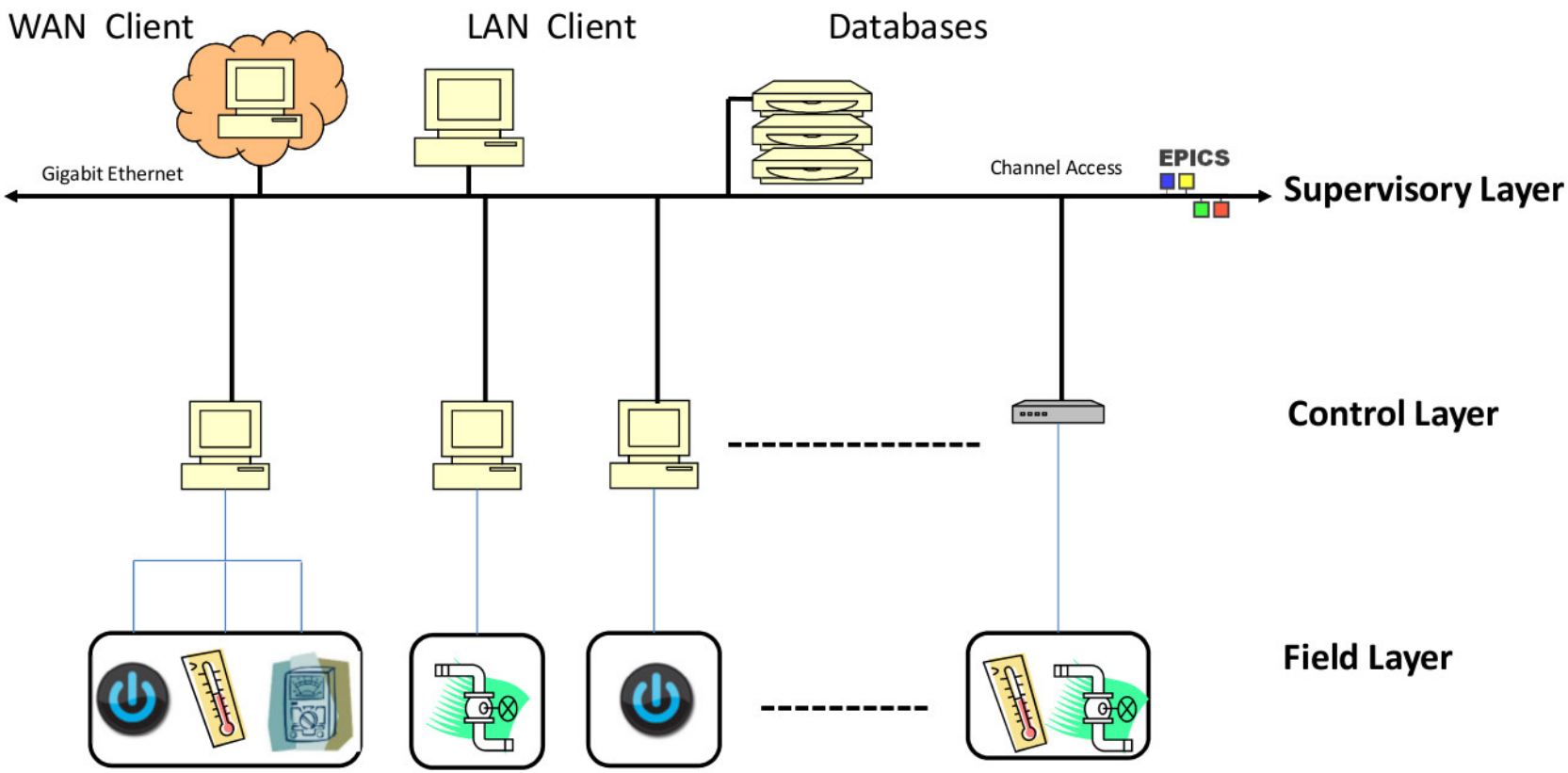
$\overline{\text{P}}$ANDA DCS Overview



Field Layer (FL):

- Temperature monitoring, power supplies, valves,...
- Every device that is monitored or controlled

$\overline{\text{P}}$ANDA DCS Overview



Control Layer (CL):

- Input/Output controller communicating with devices in FL
- Used protocols RS232, RS485, TCP/IP, SNMP, CAN bus, ...
- Communication with Supervisory Layer via Ethernet

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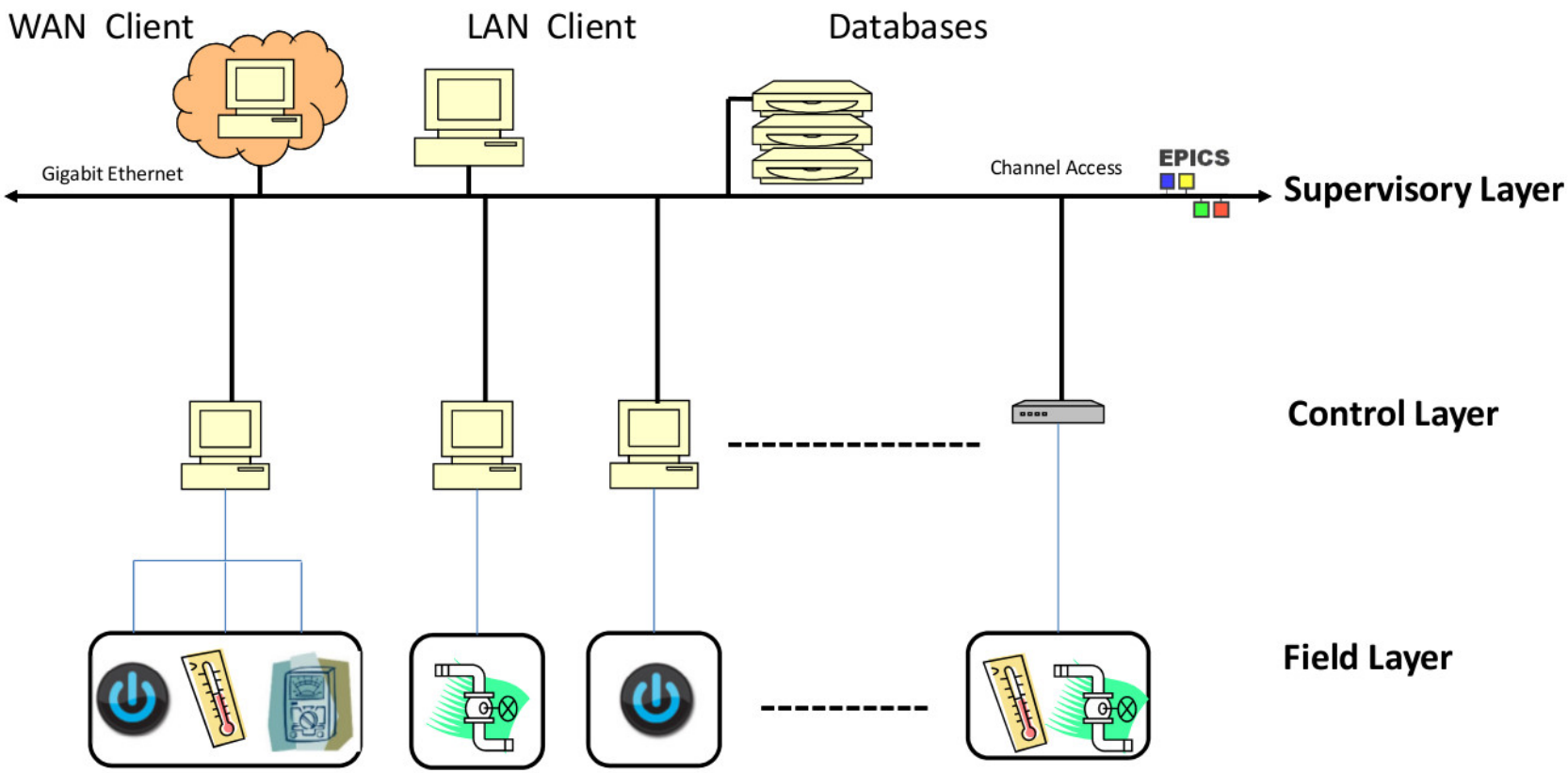
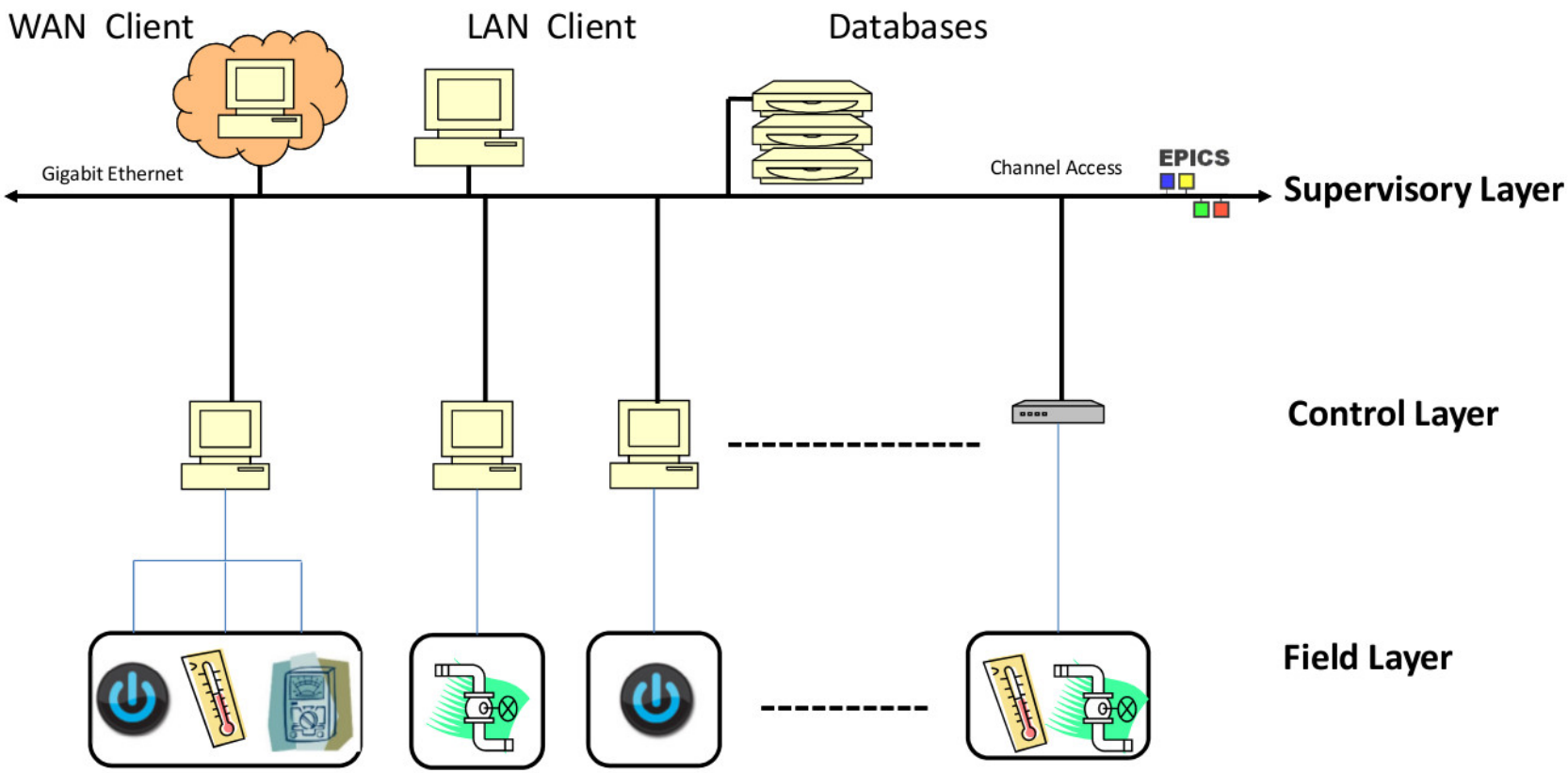


Supervisory Layer (SL):

- Databases for data storage
- LAN Clients for graphical user interfaces

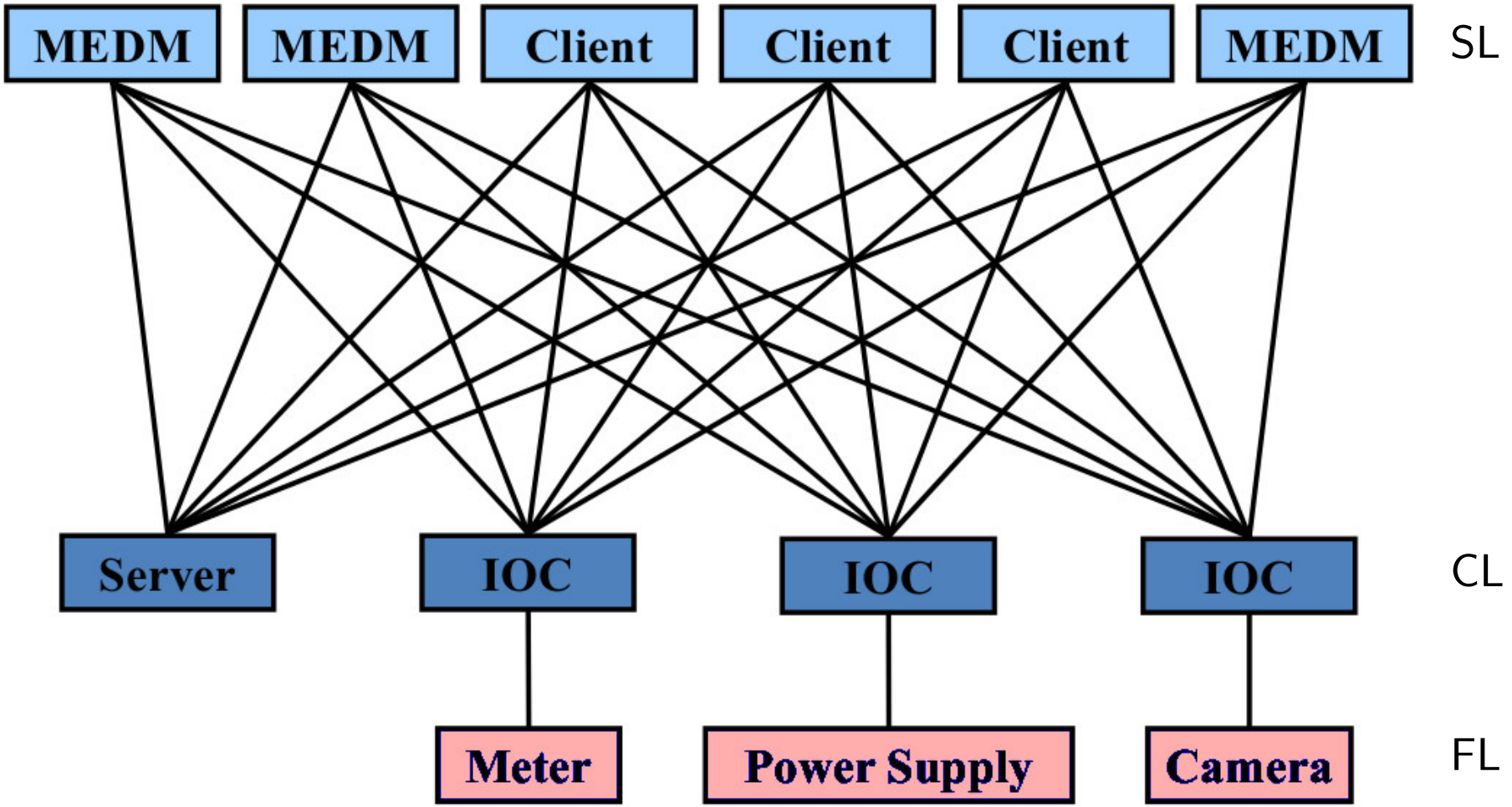
$\overline{\text{P}}$ANDA DCS Overview



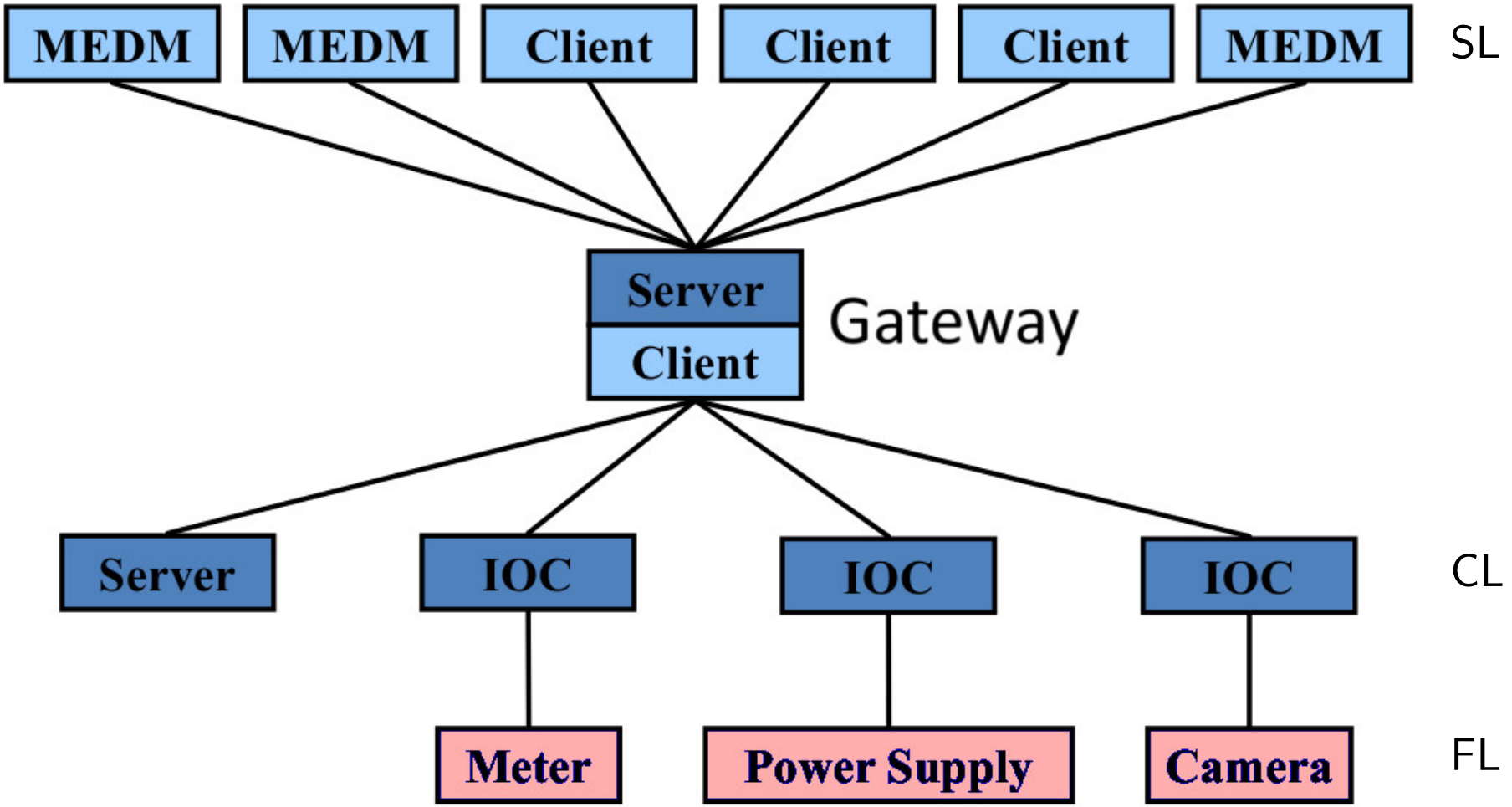
EPICS - **E**xperimental **P**hysics and **I**ndustrial **C**ontrol **S**ystem

- Network protocol based on UDP and TCP ("Channel Access")
- Decentralized architecture
- Freely scalable

EPICS Channel Access

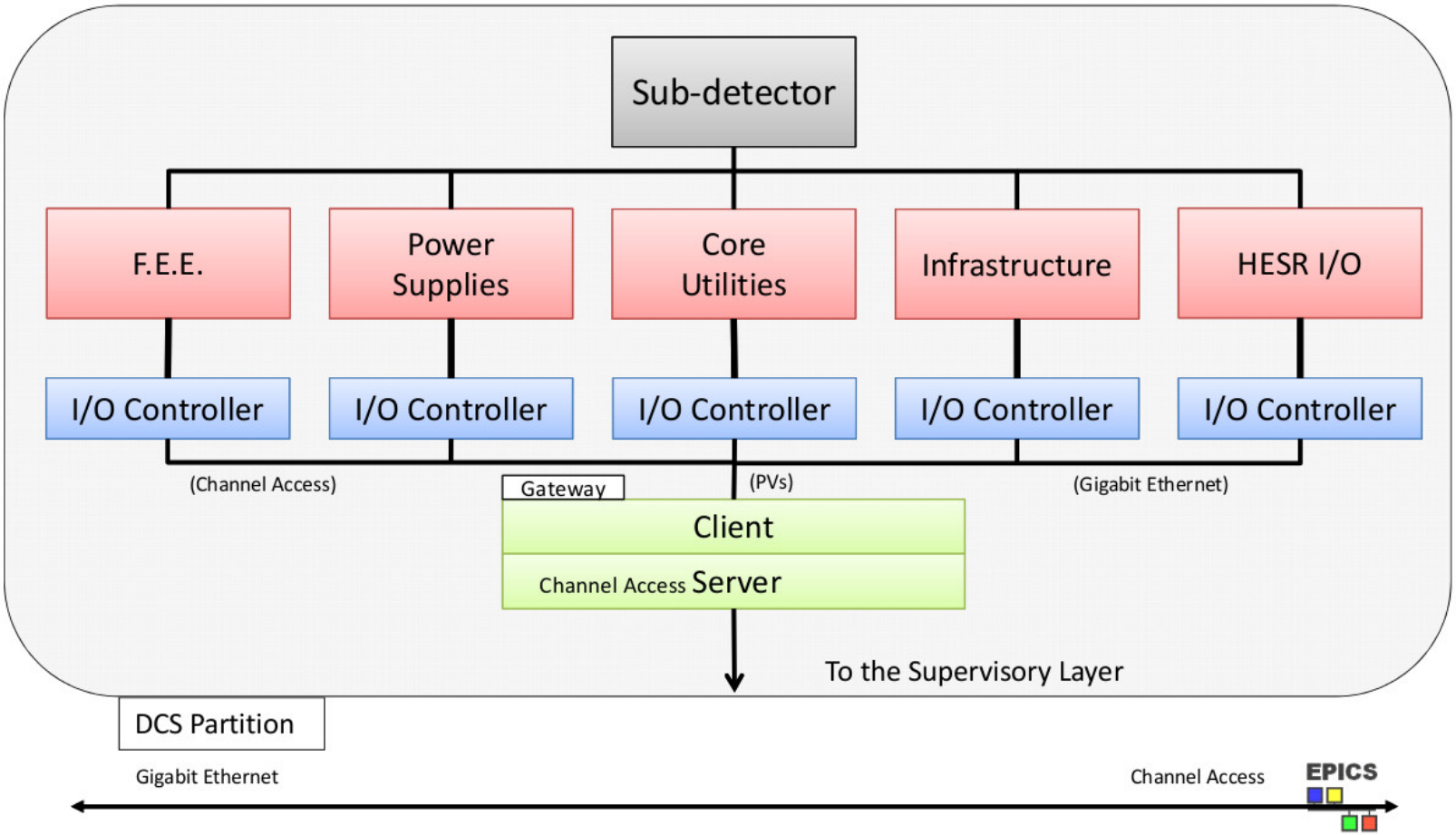


EPICS Channel Access



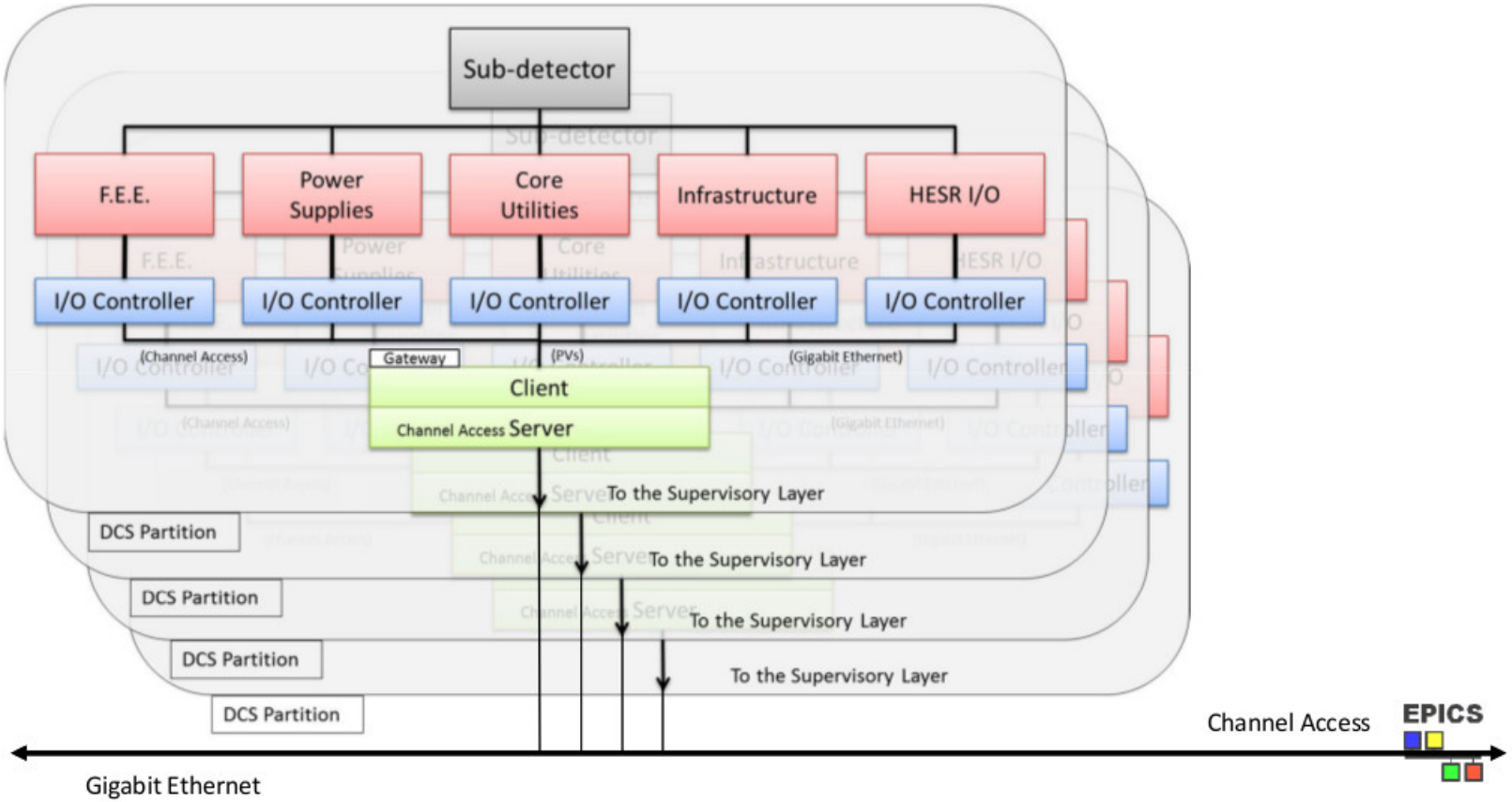
$\overline{\text{P}}$ANDA DCS Architecture - Sub-detector

$\overline{\text{P}}$ANDA DCS partitioning: Each sub-detector has its own DCS Partition



$\overline{\text{P}}$ANDA DCS Architecture - Modularity

Partitions and components in the supervisory layer communicate via Gigabit Ethernet network

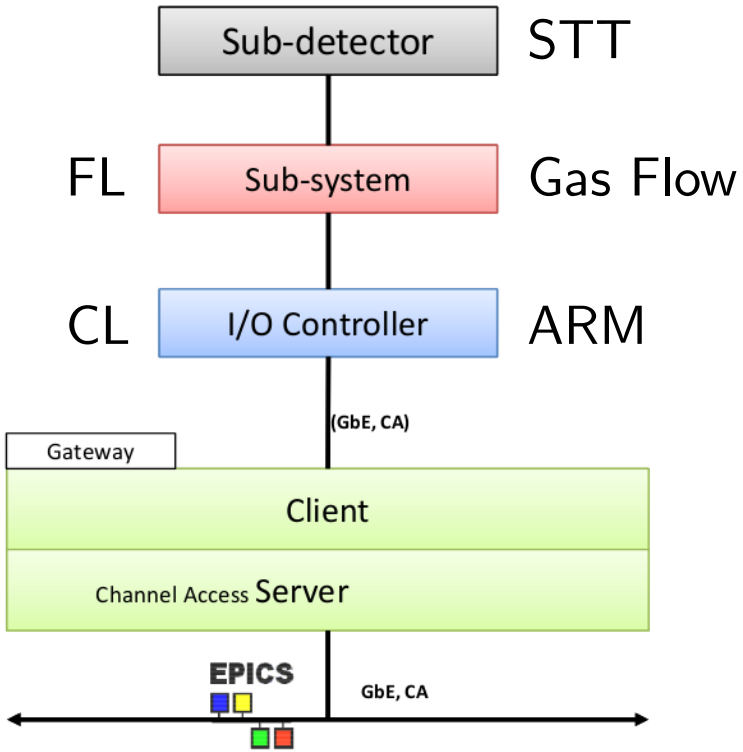


$\overline{\text{P}}$ANDA DCS Architecture - I/O Controller

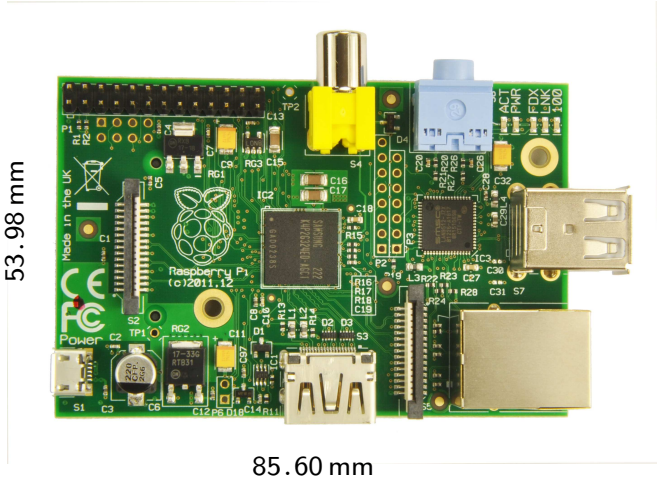
I/O Controller (IOC)

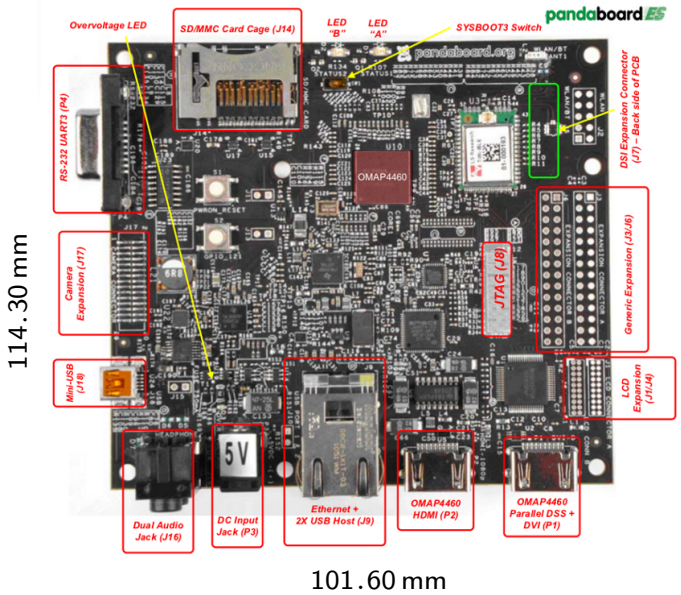
- All devices managing the I/O of a subsystem (PC, micro-controller board, FPGA board etc.)
- Usage of IOCs running on embedded Linux devices
- ARM Development Boards currently used:
  - ARMv6: Raspberry Pi Computer
  - ARMv7: PandaBoard ES

Example:



Linux Ready ARM IOC candidates





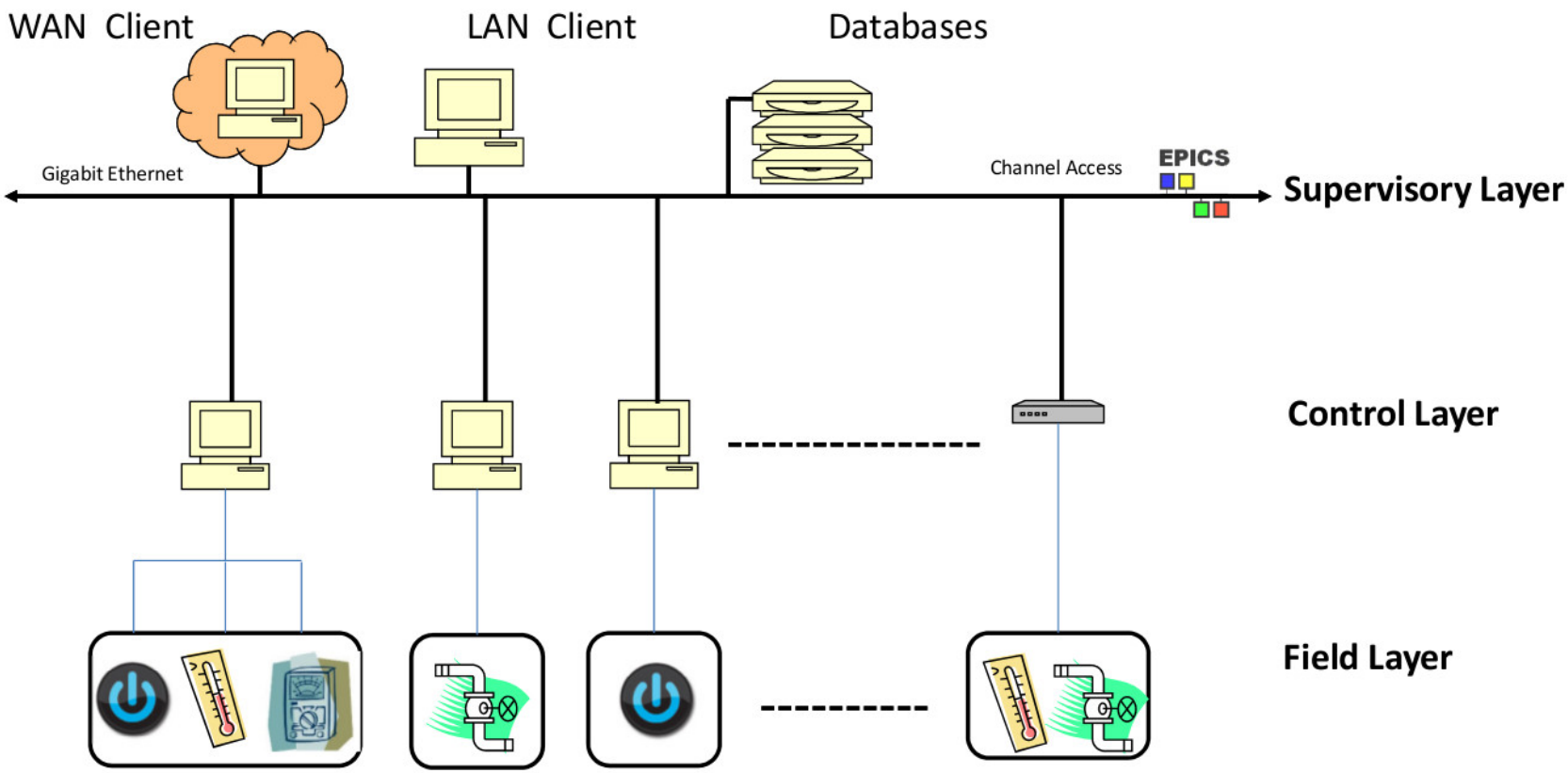
Raspberry Pi Computer

- ARM CPU, 700 MHz
- 512 MB RAM
- 10/100 Ethernet
- 2x USB 2.0, GPIO expansion header

PandaBoard ES

- Dual-core ARM CPU, 1.2 GHz
- 1 GB DDR2 RAM
- 10/100 Ethernet, 802.11 b/g/n Wi-Fi
- 3x USB 2.0, RS-232, GPIO expansion header

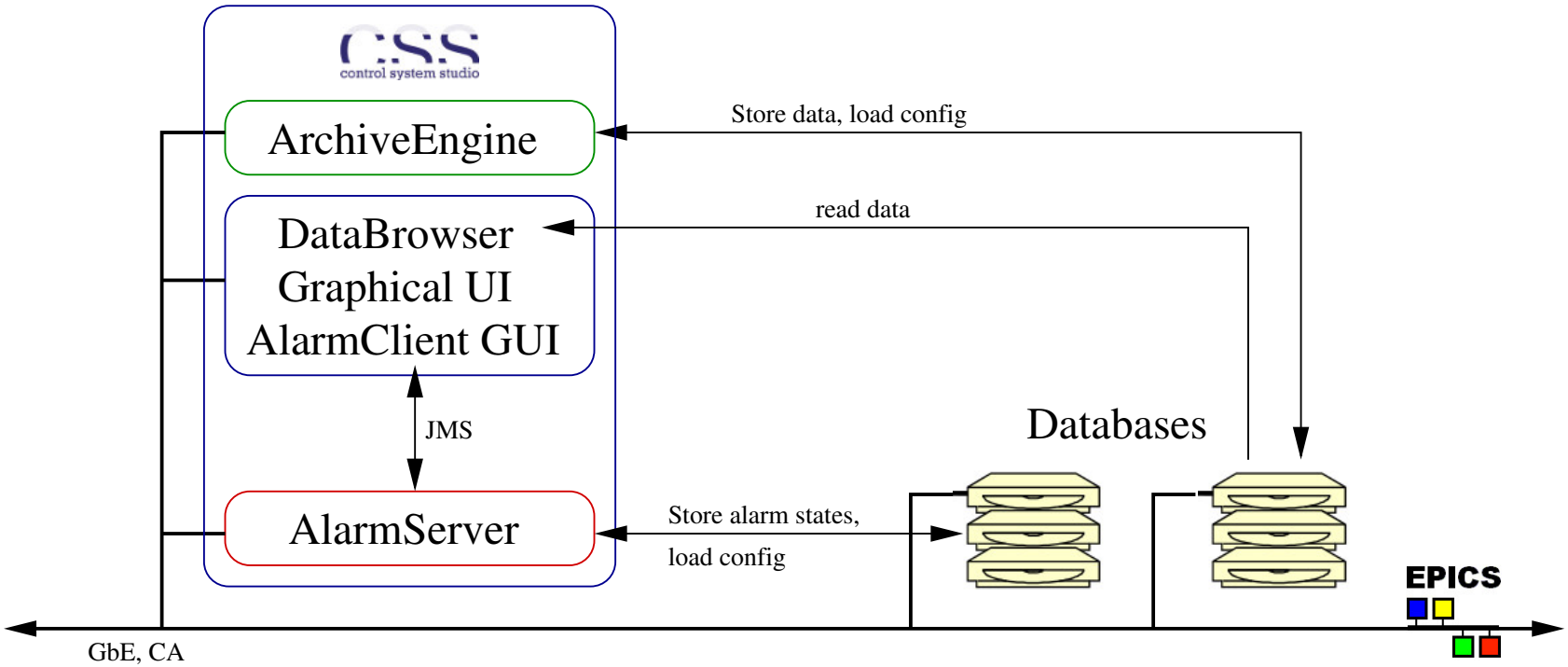
$\overline{\text{P}}$ANDA DCS Supervisory Layer



SL: $\overline{\text{P}}$ANDA specific version of Control System Studio (cs-studio)

- Collaboration between DESY, SNS, CLS, BNL, ITER, ...
- Toolkit based on Java and Eclipse RCP
- Modular infrastructure

$\overline{\text{P}}$ANDA DCS Supervisory Layer



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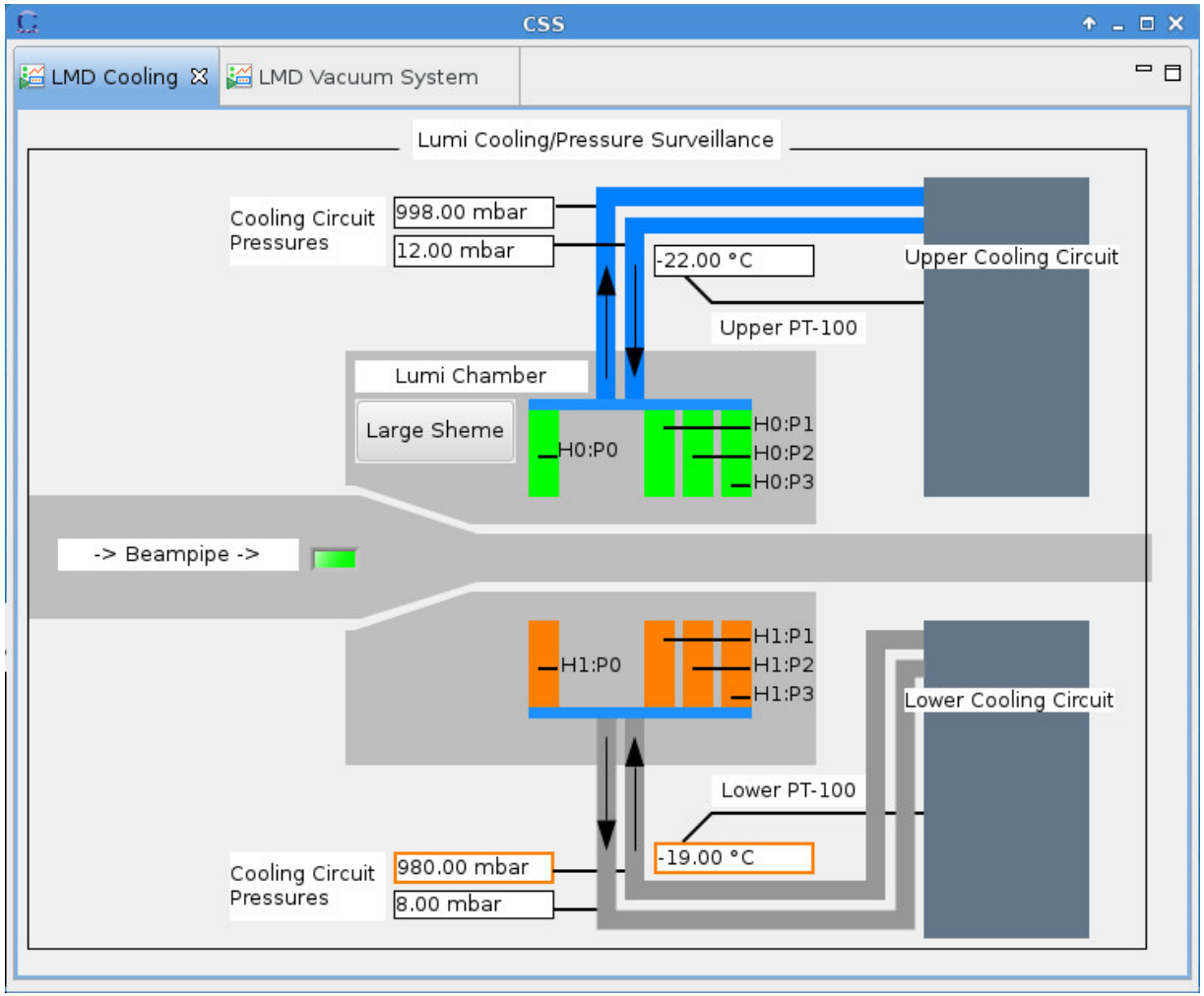
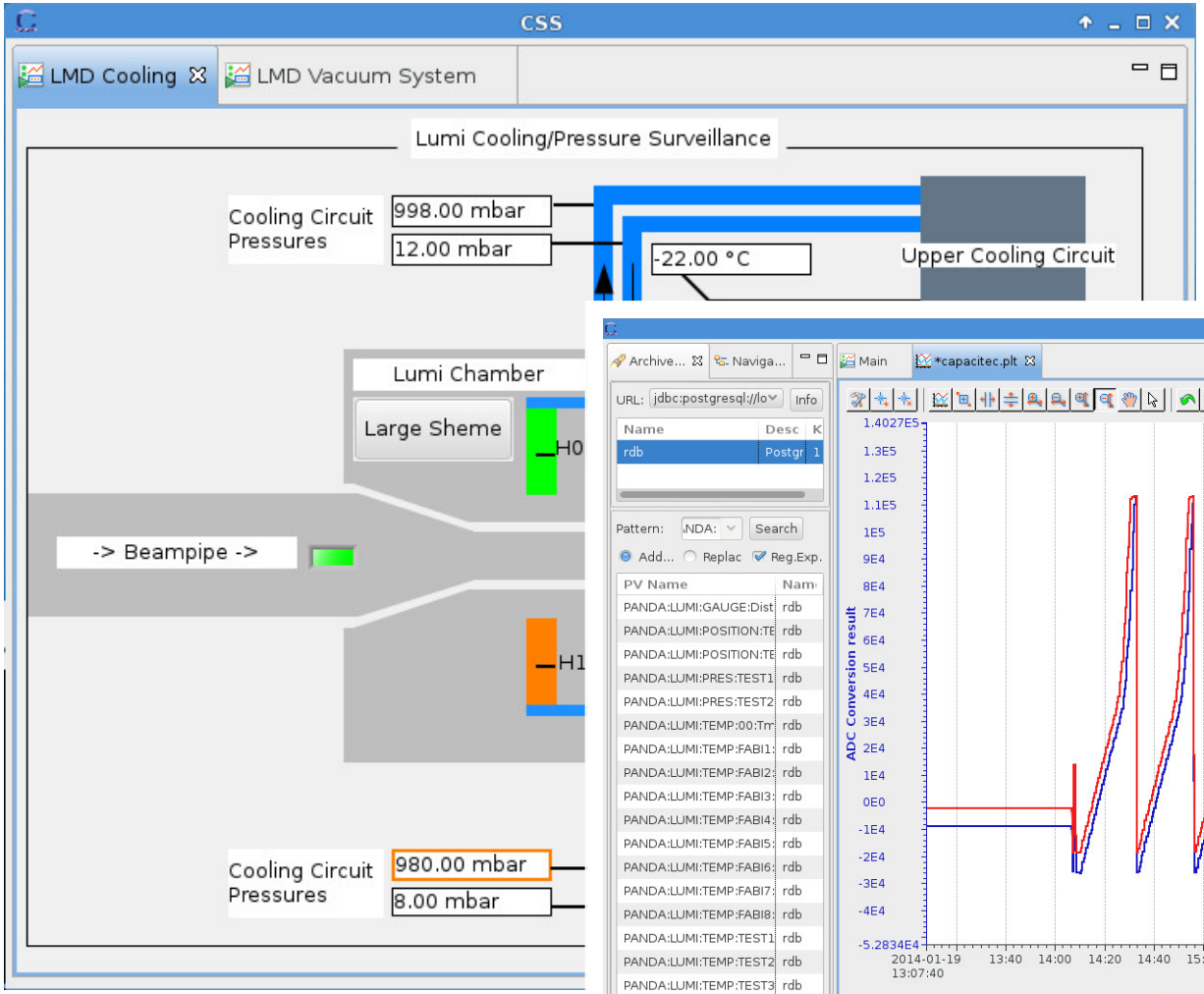
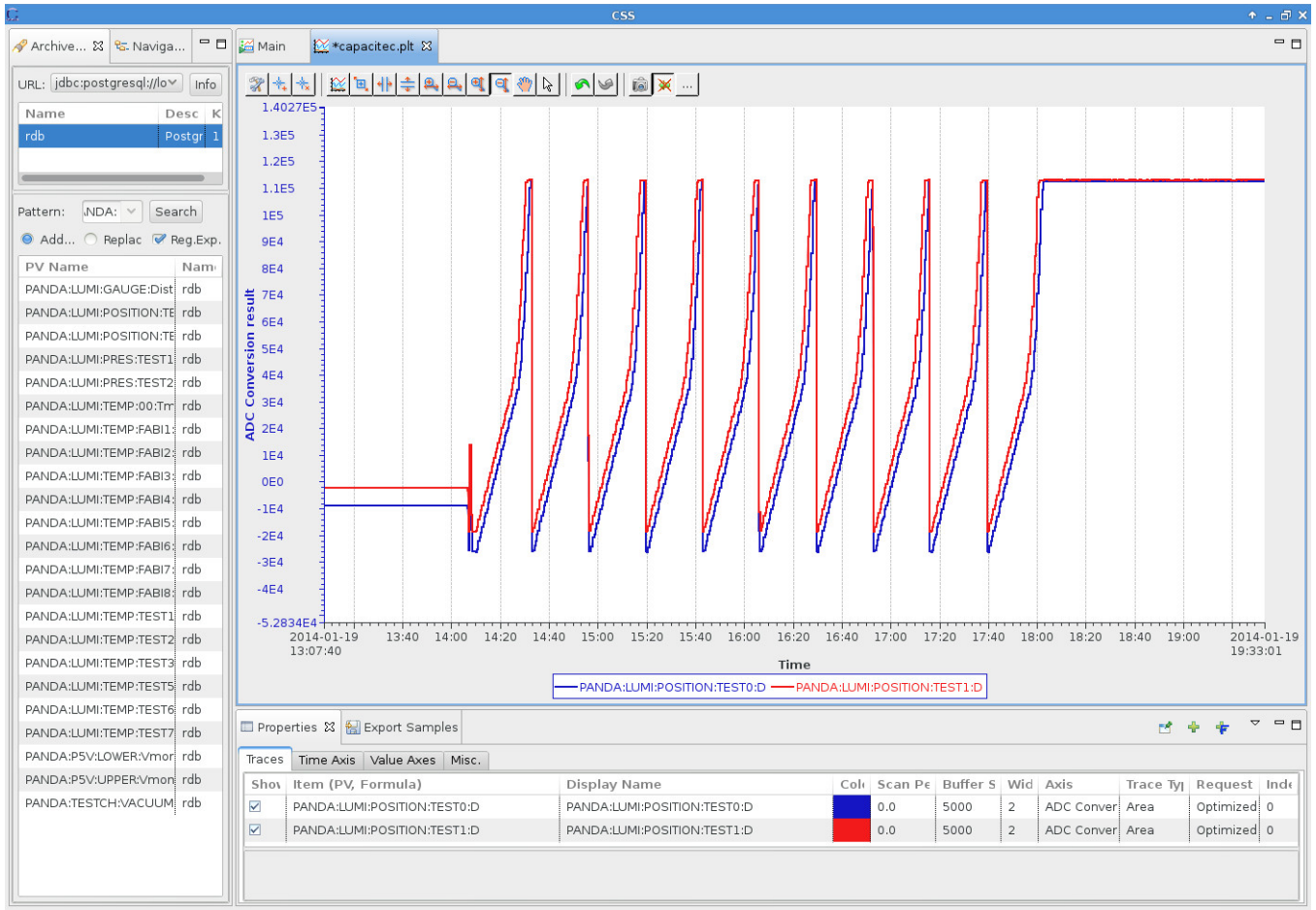


PANDA DCS Supervisory Layer





Summary

- $\overline{\text{P}}$ANDA DCS based on EPICS and cs-studio
- Modularized architecture
- I/O Controller running on embedded Linux devices
- EPICS CA Gateway to reduce network traffic
- Available/supported hardware $\Rightarrow$ Talks by Tobias and Robin