cosylab
CONTROL SYSTEM LABORATORY

MicroIOC: A Simple Robust Platform for Integrating Devices

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I Have A Dream

- Imagine a smart "black box" IOC:
  - attach motors, serial and GPIB devices
  - signals in, EPICS/CA out
  - plug&play, no building, configuring, etc.
- Integrate devices right into EPICS
  - or I/O for digital/analog signals and timing
- Use it stand-alone at accelerators, beam lines and other experimental systems

Some more explanations:

- This microIOC should be a black box for installation:
  - with a built-in EPICS database
  - already with preconfigured records
  - everything must be very user friendly, with wizards, in a plug&play manner..

- And made of standard components:
  - an Ethernet 10/100 MBit connector
  - an onboard linux/RTEMS processor
  - a Web server for configuration and viewing
  - Off-the-shelf parts to replace
    - No moving parts (fan, disk) to break in first place

Possible Hardware Solutions

- normal PC
  - Cheap and abundant, but...
  - Not robust enough
- VME
  - High reliability and flexibility, but...
  - Expensive
- Embedded PC
  - Cheap
  - Can be made reliable (no disk/ fan, good PS)

Enter microIOC

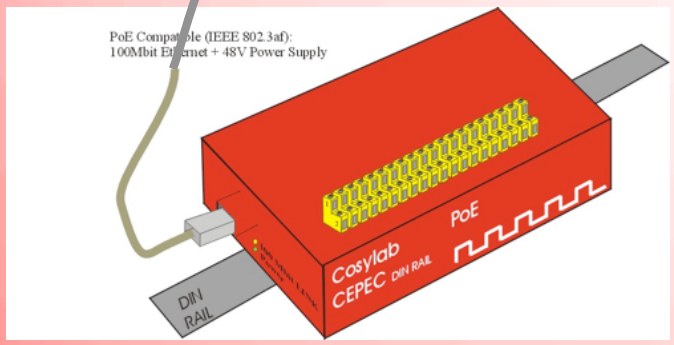
small embedded computer interfacing different devices

Small

Fanless & Diskless

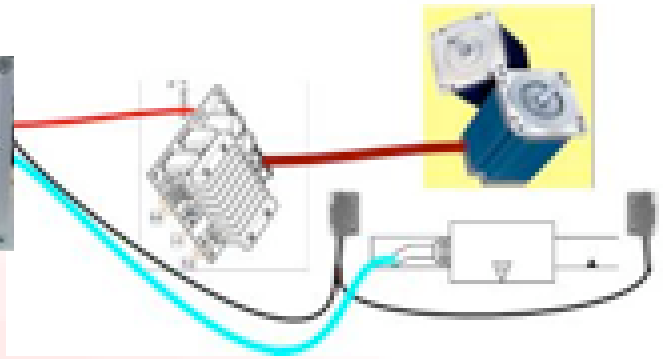
Ethernet

Ultra Low Power
PoE – Power Over Ethernet



Analog & Digital IO

Various IO



Motor & Control

What's new about this?

- In principle, nothing
- All can be done with existing hardware

- The idea is to package everything together and make it easy to use, because there are many people, who don't have the time to learn how to install and use it in detail.

Implementation Details

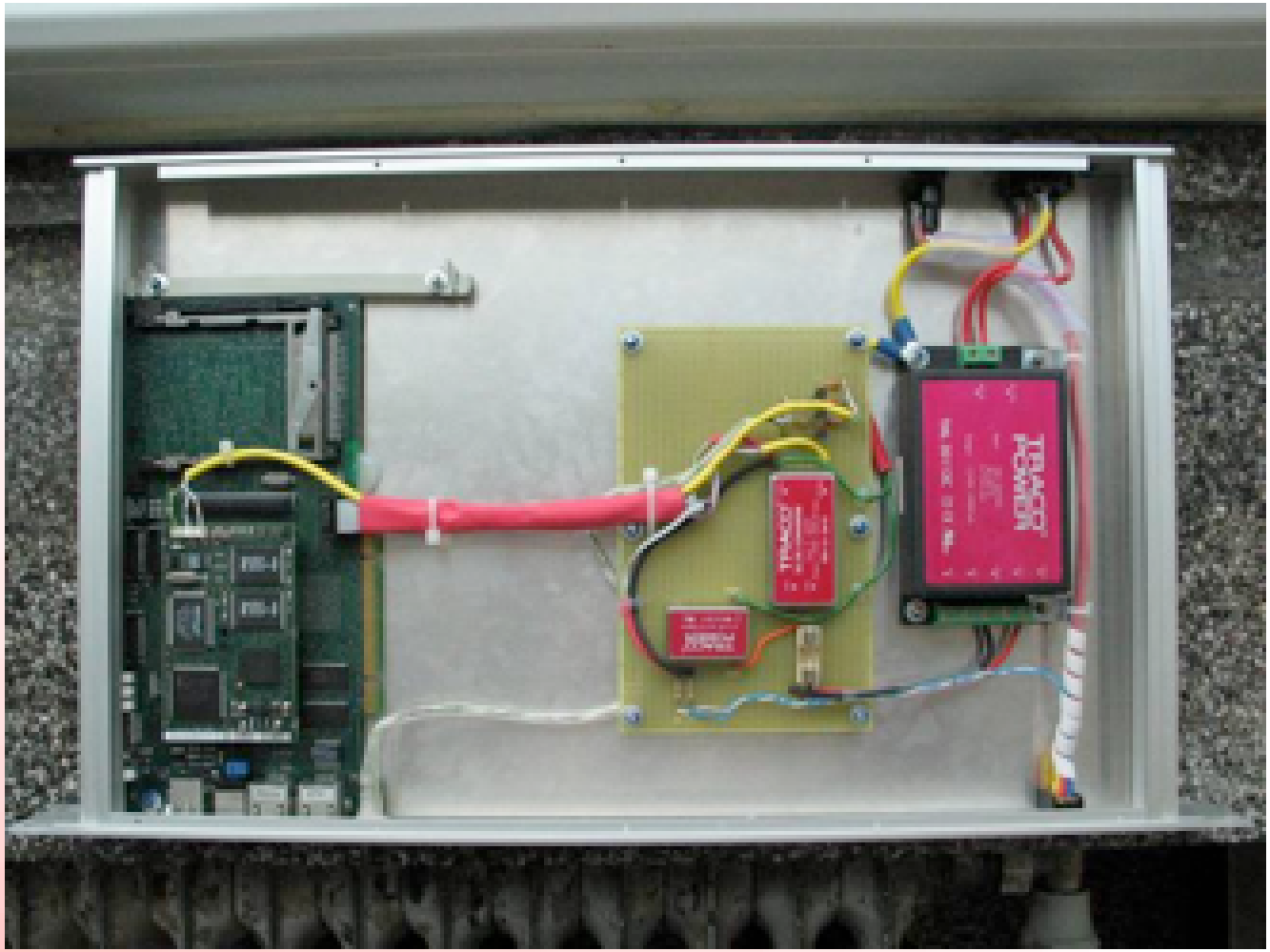
- dual Ethernet port allows to separate microIOCs and devices from the rest of the control system
- available with Linux and RTEMS operating systems and on request with vxWorks
  - Giving resonable performance and realtime
- database can be persisted in flash, avoiding problems due to network failures
- hardware components of the microIOC are of high quality and have long life times
  - PS has 500,000 h MTBF (55 years)
- by design, mechanical parts such as hard disks and fans are avoided

The Main User Features Are:

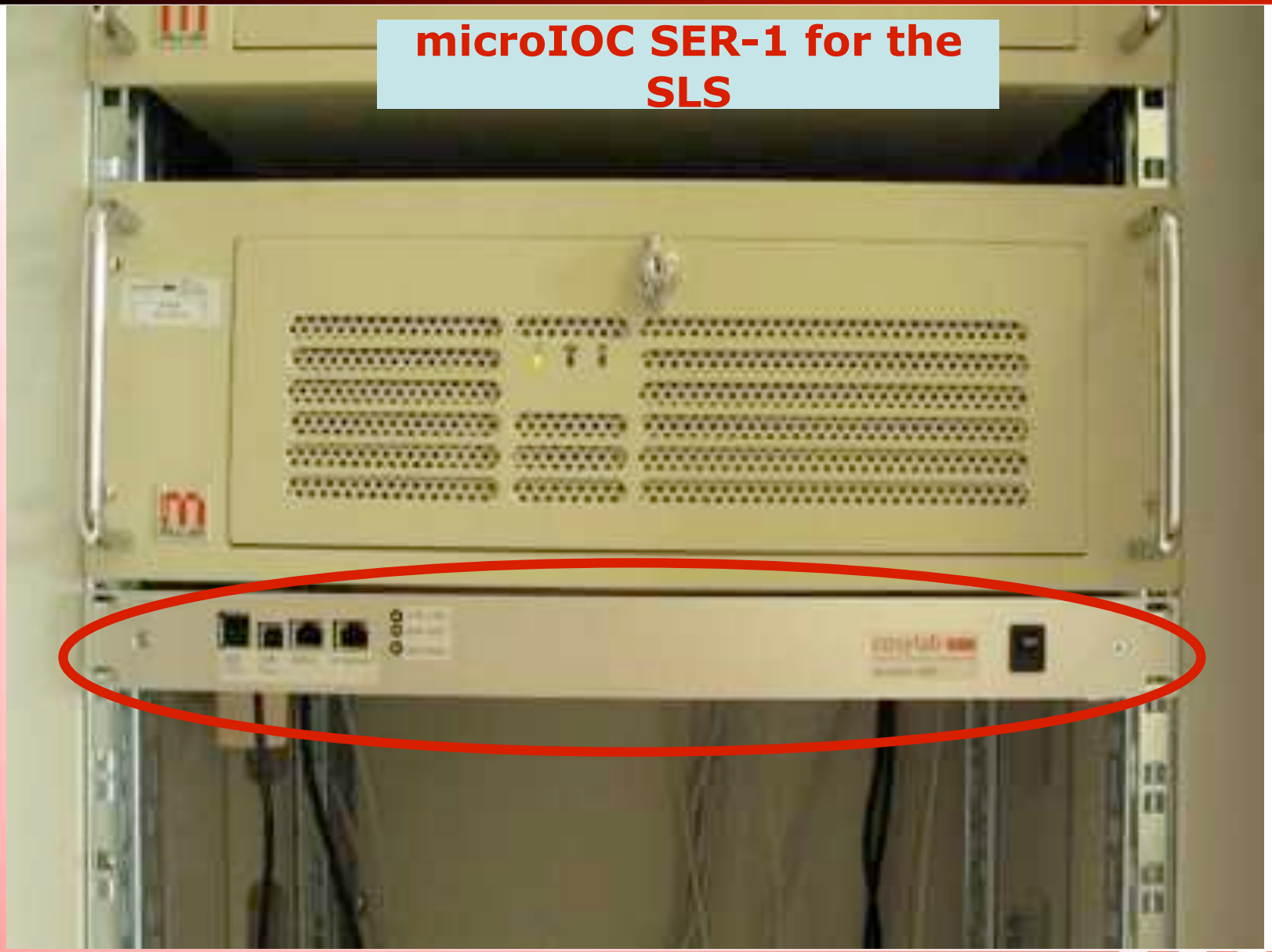
- completely stand-alone, no VME/PCI or boot PC necessary
- plug&play: configure IP (DHCP), connect cables and it works
- simple configuration through Web server, built-in EPICS db
  - VDCT preconfigured db file for standard devices: PLCs, vacuum, timing, motor control and monochromators
  - a simple wizard to configure record names and constants
- installed EDM, Java and Web-based panels for display and setting
- monitor system health
- upgrade management
- professional support and replacement contract as option
- lower price than a comparable VME system

microIOC SER-1

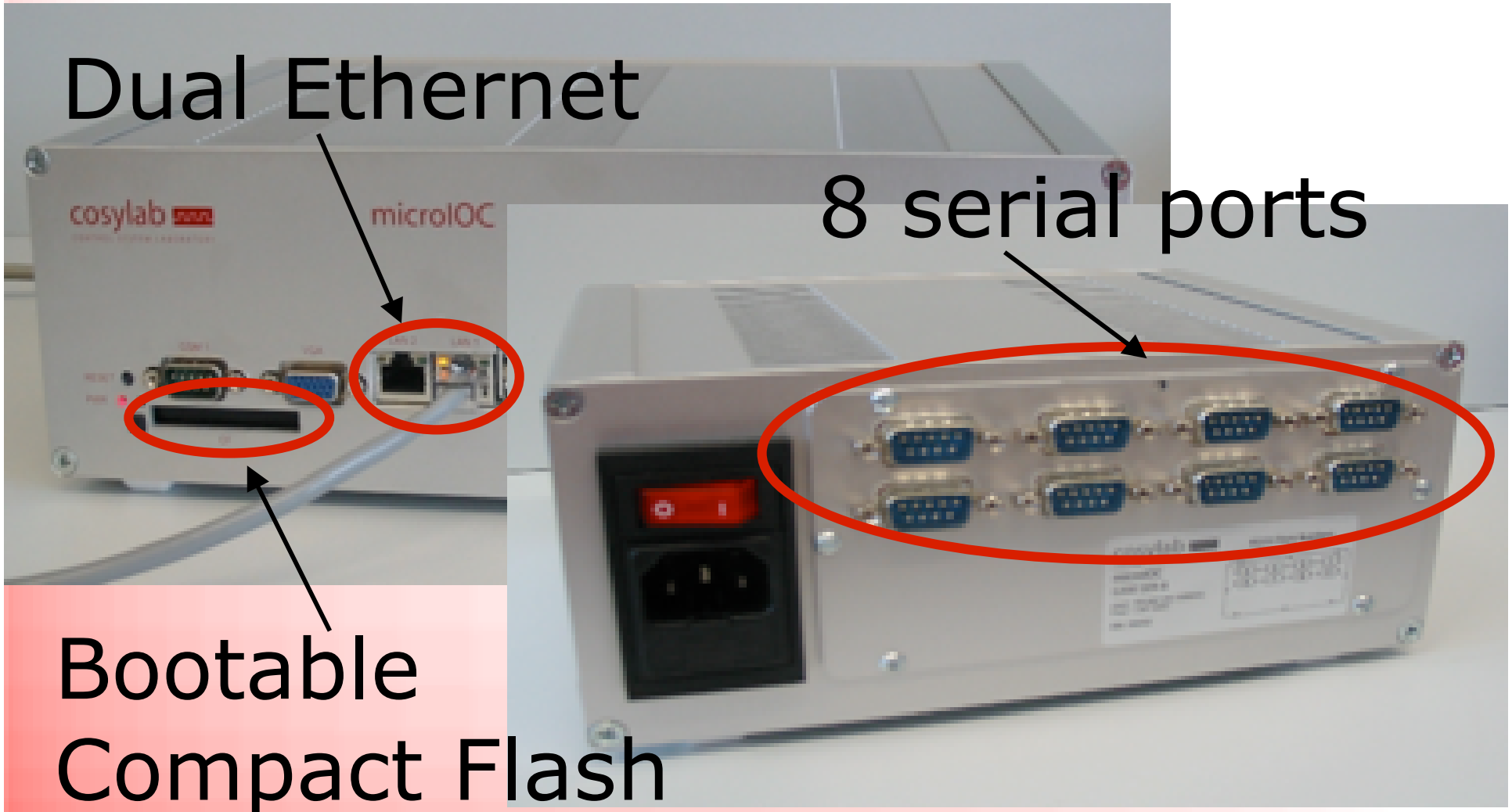
First customer:
SLS @ PSI
In 2003



microIOC SER-1 for the SLS



microIOC – Second Generation in 2004

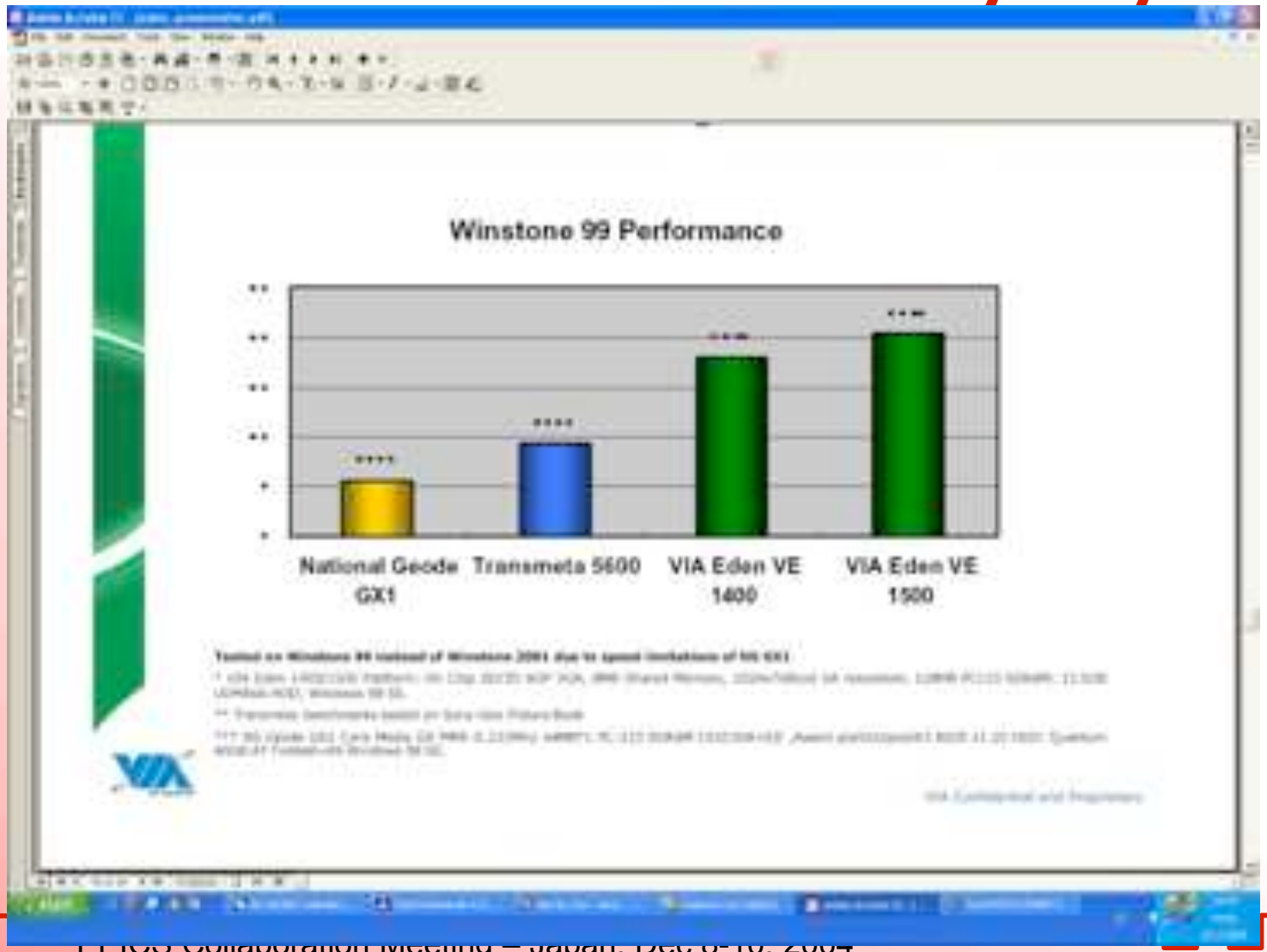


Local Control of Motors

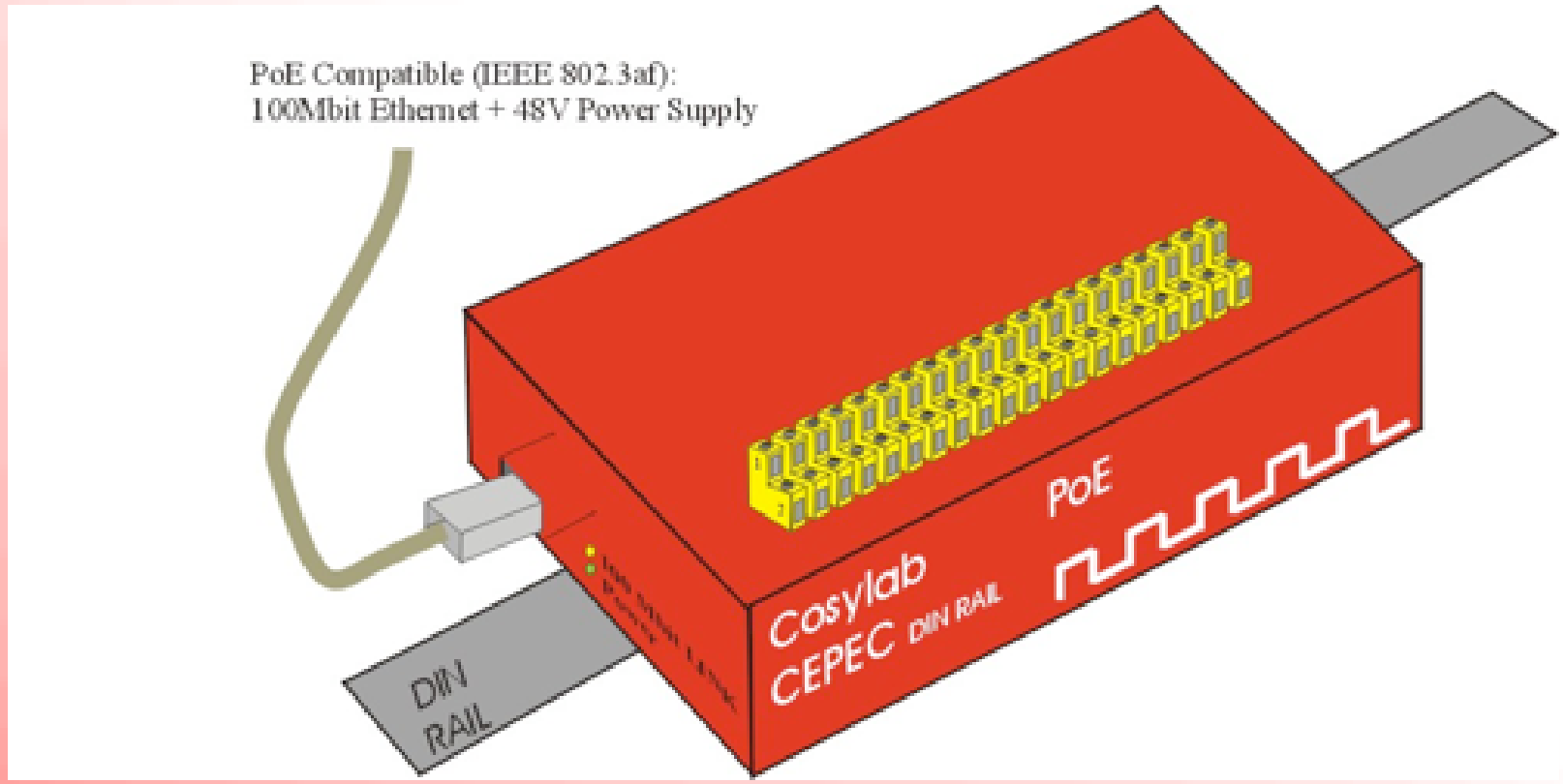
Possible Applications

- Diskless booting – reduce boot-up time
- Massively distributed systems (array of telescopes)
- Integrate a few signals here and there (utilities)
- Integrate PLCs into EPICS
- isolate device Ethernet network from other IOCs
- EPICS hardware gateway
- Protocol converter: eg. Modbus - EPICS
- Allows equipment vendors to integrate EPICS
- Network sniffer/debugger, specially for CA
- Office desktop EPICS development/test system
- EPICS course hardware
- Replacement contracts
  - 24h replacement shipping

Fanless Processors for Everybody



DIN Rail Enclosure + PoE (Power Over Ethernet)



Conclusion: Is It Really Cost-Effective WRT VME?

- Price per channel determined by
  - Price of I/O
  - Price of crate and supply
- A full VME crate is cost-effective, a nearly empty one is not!

- But the real value of the microIOC is in its simplicity and user-friendliness without compromising robustness.