# Diamond's Transition from VME to Fieldbus Based Distributed Control

## Existing architecture and reason for change

Accelerator and beamline control systems use a consistent approach to interface to the control system, with most equipment interfaced through embedded VME systems.

- In excess of 250 VME based systems.
- Embedded VME using
- Industrial Pack Modules
- Transition modules or front-panel connections
- VME microprocessor MVME5500 running VxWorks real-time OS and EPICS.
- The Machine Protection is realised using Omron CJ1 PLCs and dedicated I/O wiring.
- Video cameras interface to VME using Firewire and PMC Firewire adapter.
- Electron BPMs run EPICS on the Libera hardware (embedded Linux).

# Reasons for Change

- The existing architecture was defined nearly 10 years ago and it is timely to reconsider the standards used, in the context of the design of the next phase of beamlines.
- It is also apparent that most I/O functionality required for beamline control equipment can be realised using Ethernet attached I/O and Linux based EPICS IOCs.
- Ever increasing pressure on rack space
- Flexibility in the design pattern

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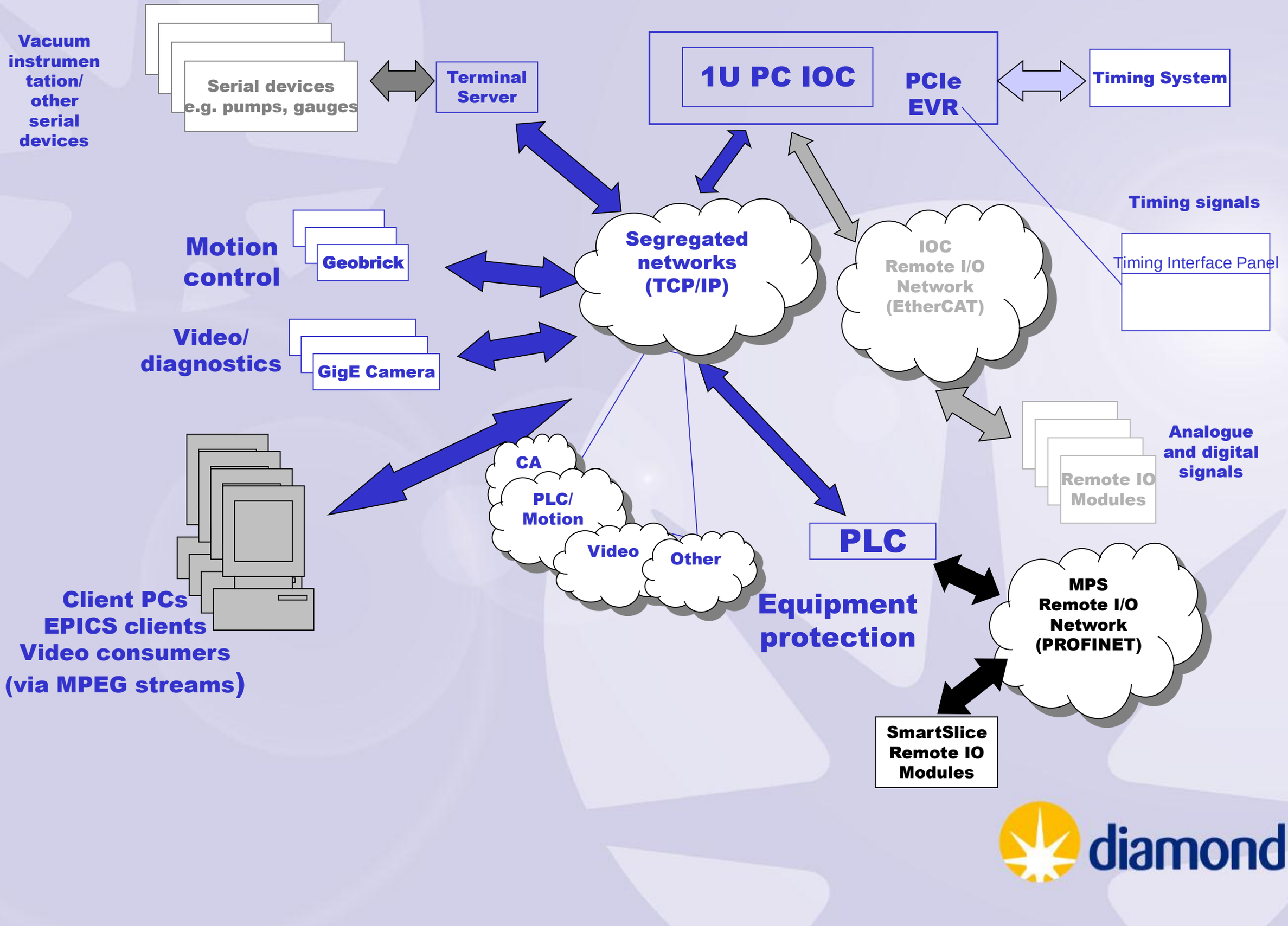
## Proposed hardware solution

- The IOCs will run on 1U Linux PC located within the beamline and accelerator instrumentation areas.
- The hardware will be connected directly to the PC using several physically separate network connections to support the different systems.

# Proposed Hardware Solution



# Major Benefits of Proposed Hardware Solution

- Greater partitioning of IOC by technical area, thereby minimising disturbance when changes require restarting an IOC.
- Reduced I/O specific cabling, thereby eliminating the need to wait for beam downtime to “pull cables”
- I/O associated with the control system can be located close to the equipment interfaced
- Use of standard 1U servers and Linux based EPICS IOCs on PC architecture.
- Management of hardware obsolescence

# Progress to Date – Ethernet Devices

- Ethernet based motion control subsystems are already implemented and deployed on a number of beamlines connected to both PC and VME IOCs.

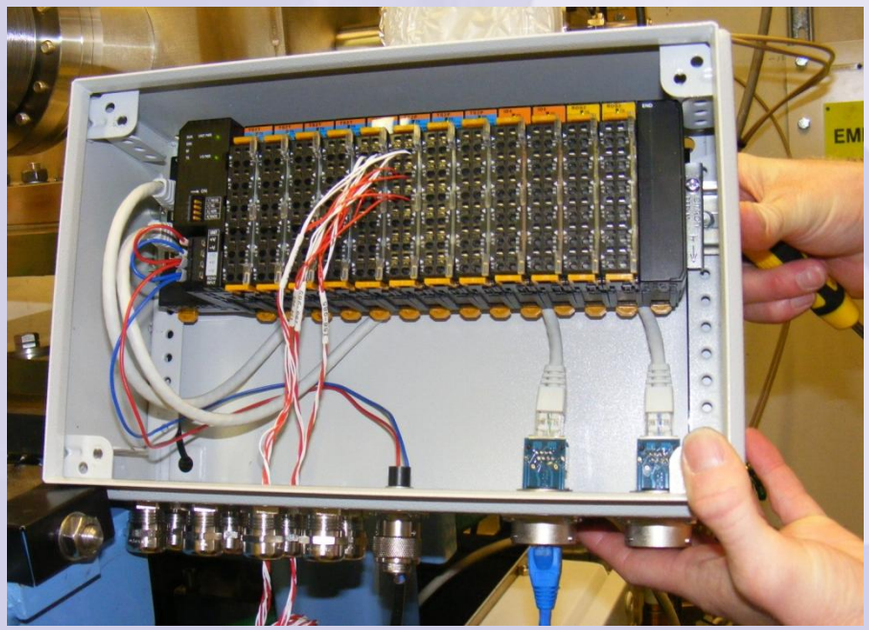
- They have proved to provide control of stepper and servo motor systems, e.g. monochromators, slits, mirrors etc. Remote diagnostics and configuration are proving to be very valuable.

- Interfacing a range of instruments over terminal servers is also actively being used

- The FINS interface to the Omrom PLC has been implemented and deployed to integrate a single PLC controlling LN2 distribution

# Progress to Date – Remote I/O

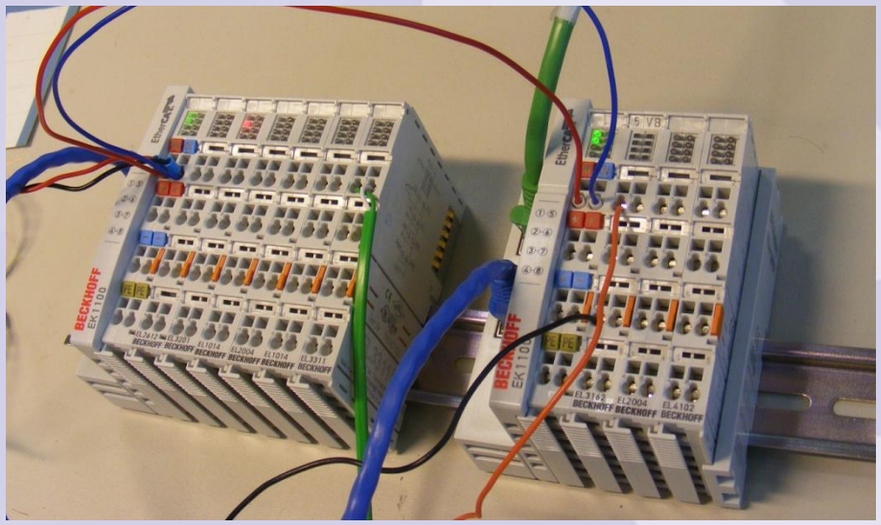
- The design of standard remote I/O modules has been undertaken.
- Given the risk with possible radiation damage, SmartSlice remote I/O units have been in soak-test for the past two months, in one of Diamond's optics hutches.
- The implementation of SmartSlice systems are being planned for forthcoming beamline control and front-end equipment protection systems.



SmartSlice modules in radiation soak-test

# Progress to Date - EtherCAT

•EtherCAT based remote I/O has been through initial evaluation and testing with a Linux x86 PC as a host.
•Initial tests have been performed using an Intel E1000 controller on a standard RHEL5 dual-core Intel Pentium 4 Xeon PC.
•A user-space polling process, fully using one of the two available cores, was able to reproduce a pulse read from an ADC and drives a digital output with a delay of 200 microseconds.
•Further effort is planned to develop EPICS device support for the various EtherCAT I/O modules to be used at Diamond.

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# Questions?