DIAMOND LIGHT SOURCE

- Diamond Light Source is a third generation 3GeV synchrotron light source based on a 24-cell double bend achromatic lattice of 561m circumference. The photon output is optimised for high brightness from undulators and high flux from multi-pole wigglers.
- Accelerators and the first seven photon beamlines were constructed between 2002 and 2007.
- Second phase of fifteen photon beamlines from 2006 to 2012.
- Third phase of ten photon beamlines were approved in 2011 to 2017.

ORIGINAL CONTROL SYSTEM

- Uses the EPICS toolkit and provides a high degree of integration.
- Most equipment is interfaced through a range of generic VME IO based on VME IP carriers, IP modules.
- Motion control, initially used OMS VME68 for straightforward applications on the accelerators; whereas for the photon beamlines for synchronous control, the Delta Tau PMAC controller is largely used.
- Programmable Logic Controllers (PLCs) from Omron are used for interlocking and from Siemens for process control.
- Client side tool use the standard EPICS tools for display panels (EDM), archiving (Channel Archive) alarm management (ALH) and restoring system state (BURT and Save/Restore).
- Diamond has standardized on a combination of EPICS and GDA for the control of photon beamlines, experimental stations and detectors.

EVOLUTION OF CORE SOFTWARE COMPONENTS

- Policy is to try and keep all systems on a common version of EPICS base, core components and modules.
- Initial machine control system EPICS 3.13.9 with 3.14 for the Libera BPMs and soft IOCs.
- During 2008 to 2011, the machine control system was upgraded to 3.14.8.2.
- As of 2013 majority of control systems are now at EPICS version 3.14.11 with an upgrade underway to 3.14.12.2.
- All applications are built on a build-and-deployment-server, thereby ensuring consistency of the tool chain for the build of all operational systems.

EVOLUTION OF OPERATING SYSTEM

- Standardized on Linux for development.
- 2003 Red Hat version 9, for development.
- 2004 Red Hat Enterprise Linux 3 development and initial operations.
- 2005 Red Hat Enterprise Linux 4 development and operations.
- 2006 Red Hat Enterprise Linux 5 development and operations.
- 2011 Red Hat Enterprise Linux 6 at 64 bit for development and operations.
- Coincident with operating system uplift a new version of EPICS Base, Extensions and external modules are taken; along with other dependent software components.
- IOCs predominantly run under Linux or VxWorks, there are inevitably a few Windows systems, where only Windows drivers are available for a given piece of hardware.

EVOLUTION OF HARDWARE

- The new control systems standard is based on running EPICS IOCs on 1U x86 PCs running Linux with real-time extensions.
- IOCs are located within equipment they control as so are not regarded as a “soft IOCs”.
- All instrumentation is then connected to the IOC by local network connections.

CONCLUSIONS

- VME was an excellent basis for the Diamond control system.
- Longevity of product and standard.
- Open standard with multi-vendor support.
- Good hardware interoperability.
- Key aspext to building a distributed control system and subsequently maintaining it.
- Control systems interface requirements have largely moved on with increased availability of “intelligent instruments” with communication based interfaces.
- Performance (response time and resolution) of PLCs has also evolved considerably in the past decade and costs have fallen.
- Commercial hardware and more mainstream operating systems provides great with benefits in functionality and cost.
- Loss of physical interoperability.
- Loss of cross vendors operability in the case of PLC solution.
- Reduced life expectancy of hardware.
- Loss of mechanical standards.
- Loss of the inability to accurately timestamp an acquisition or transition of a signal.

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