Control System S/W Architecture R & D; an Introduction
Agenda

• Major Control System Software Issues
• Present State of Software Methodology
• Proposed R & D Projects
Major Control System Software Issues

- 20+ year development & maintenance time span.
- 90% of the code is outside of the IOC.
  - VMS (non-IOC) 263 Mbytes
  - RMX (IOC) 21 Mbytes
- Distributed runtime environment.
- Large Data Storage & Retrieval.
- Distributed development across labs.
World’s Shortest History of Computers


Mainframe

PC

Web

??
Technologies Driving the Web Era

- IP Everywhere doing Everything.
- Embedded IP enabled computers in Everything.
- The Web is the Universal Client/Server.
- The Inter-Galactic Object Web runs the Universe.
Present State of Software Methodology

• Object Oriented is in.
• Algorithms + Data Structures = Programs is out.

• S/W has always had H/W envy;
  – Need Field Programmable S/W ICs.
  – Assemble S/W ICs into S/W boards.
  – Combine S/W boards via a S/W bus to make a S/W System.

• Is S/W Salvation Finally at Hand?
S/W Salvation; the H/W Analogy

• The S/W backplane is the Internet or Intranet.
• An Object Request Broker (ORB) is the bus protocol.
• Sets of cooperating objects (components) are the boards.
• Individual objects are the ICs

• The real key to making this all work is the ORB
  – It can give anything an Object interface.
  – The object can live anywhere; on the same computer or the net.
  – It provides many object services.
The Two Buses: CORBA & DCOM

• CORBA - Common Object Request Broker Architecture
  – Supported by EBM (Everybody But Microsoft).
  – Standards maintained by the Object Management Group (omg.org).
  – Many implementations; freeware & for purchase
  – Embedded in Netscape, Oracle 8i and Java 2.
  – A real-time CORBA spec is in the works.
  – Has many services, only a few of which overlap Channel Access.
  – Newer versions have a “reasonable” efficiency of a few msec. to invoke an object on the net and get a result.
  – Language and machine independence

• DCOM - Distributed Component Object Model
  – The Microsoft parallel Universe (MPU?)
  – Embedded in Windows 2000
Java & CORBA; The Shotgun Wedding

- Java brings mobile code and machine independence.
- Remote Method Invocation (RMI) is Java specific.
- CORBA is now part of the Java 2 core.
Large Data Storage & Retrieval

- Object Database vs Object/Relational.
- BaBar has all of the arrows in its back with Objectivity.
- We must consider a database for Archive & Error log data.
- Also need a database for persistent object storage.
Distributed Development; UML etc.

- Industry has standardized on Unified Modeling Language
- UML uses simple graphics and a well-defined notation.
- Can be used at all levels:
  - Requirements
  - Conceptual Design
  - Detailed Specification
  - Implementation
  - Maintenance
- There are hooks for user extensions & interfaces.
  - GDCT replacement based on UML?
- Evaluate other Rational tools.
Proposed R & D Projects

- **CORBA**
  - Get copy of Visigenics & Freeware (GNU?) CORBA.
  - Check out PSI evaluations.
  - Write test programs and do timing for various services we’re likely to use; Life cycle, Persistence, Naming, Concurrency Control etc.
  - Interface Java, C++, C and Fortran code.
  - Test EPICS/Vxworks implementation.

- **Java**
  - Evaluate at least 2 development environments and JVMs on UNIX & NT platforms (MAC?, VMS?)
  - Organize a group class like we did for C++
  - Organize a group OO analysis & design class centered on Java & UML
Proposed R & D Projects cont’d

• **UML**
  – Get evaluation copy of Rational Rose.
  – Use it to write template requirements and design specs.
  – Explore how it can be extended for other EPICS use.
  – Evaluate other OO design products.

• **Oracle 8i**
  – Fully investigate and understand it’s Web/CORBA features.
  – Understand new features for large table support.
  – Evaluate Object/Relational implementation & performance.
  – Define how Database support is integrated into the larger NLC S/W architecture.
Proposed R & D Projects cont’d

• **OO Databases**
  – Evaluate use of Objectivity for Archive and Message Log data.
  – Consider it and other OO databases vs Oracle for general object persistent store.
  – Compare performance/flexibility tradeoff for pure OO vs OO/relational.

• **Evaluate and Compare DCOM and CORBA**
  – Compare performance and services
  – Look at DCOM/CORBA bridges

• **Lightweight Directory Access Protocol (LDAP)**
  – Can we use this? How? Where?
Proposed R & D Projects cont’d

• **XML**
  – Can we use it for all our structured data?
  – How is it used in Oracle 8, Office 2000 etc.?

• **Get Java DM implementation from Argonne**
  – Evaluate and extend it.
  – This can be both a learning tool and possibly lead to an NLC DM

• **Use SLC as Virtual NLC**
  – Do a full implementation of selected NLC functions.
  – Run them in parallel with similar SLC functions in the Control Room e.g. the NLC ultimate correlation plot.
  – If we do it right, we can migrate it to NLC with minimal work.
An Immodest Proposal

The Un-classic not-so-thin client with a JVM & XML

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<th>CDEV</th>
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<th>Channel Access</th>
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Non-IOC Application Cloud

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IOC Applications

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Inside the Application Cloud

- BPM Components
- Feedback Components
- COBRA compliant ORB
- ORACLE Databases
- Modeling Components
- LDAP Services

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The Last Slide

The End! ....

And the beginning.