Argonne NATIONAL LABORATORY

The EPICS IDE and Probe on Steroids

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Acknowledgements

- Janet Anderson
  - EPICS build system
- Andrew Johnson
  - EPICS base, IOC usage, MakeBaseApp

Topics

- EPICS development in Eclipse
  - CDT Plug-in (C/C++)
  - CVS
  - EPICS IDE Plug-in
- Probe as a prototype RCP application
  - RCP
  - AWT vs. SWT
  - JProbe
  - Legacy code

EPICS Development in Eclipse Overview

- The CDT Plug-in supplies most of what you need
  - It supports C/C++ Standard Make
  - EPICS builds via Make
  - QED
- The Team support may be useful if you use CVS for EPICS
- The EPICS IDE Plug-in is designed for new and casual users
  - Especially IOC developers / maintainers
  - Provides New Project and New Application Wizards
    - *Based on EPICS MakeBaseApp*
- More Wizards are envisioned
  - Adding and configuring support modules, etc.

CDT
Necessary Ingredient

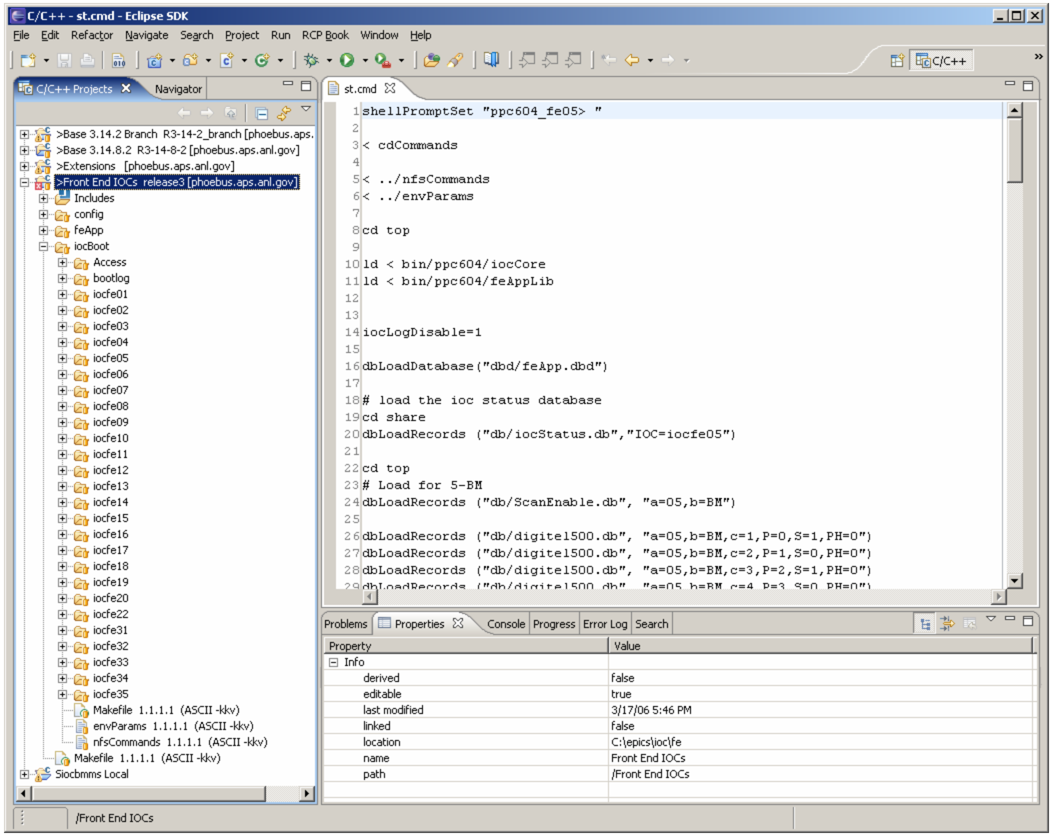
- Is supposed to be comparable to JDT but for C/C++
- Primarily it runs Make
  - You supply the Make
  - Can be C/C++ Standard Make (Just runs Make on your Makefile)
  - Or C/C++ Managed Make (Decides what needs to be built)
- Editor
  - Has Content Assist, Syntax Highlighting, other modern features
  - Does not have a good indentation engine, customization
  - Far less developed than the JDT Java editor
  - You probably want to turn off Build Automatically
- EPICS base and applications can be built and run on Windows
  - Using Cygwin tools (cygwin-x86)
  - Using Microsoft tools (win32-x86)
  - Can build for VxWorks, as well (cross compile)

C/C++ View

- The C/C++ View from CDT is similar to the Navigator View
- Shows icons on the files for errors, warnings, etc.
- Easy to do builds from this View
- Displays only elements relevant to C and C++ projects
  - Does not show other properties
    - *In particular, EPICS IDE properties*
- The EPICS IDE New Application Wizard **does not work** in this view
  - The reason is beyond the scope of this presentation
    - *Cannot find the project*
    - *Reason is that the tree items are CProject, CContainer, etc.*
    - *The real items are IProject, IFolder, IFile (Subclasses of IResource)*
    - *CProject is not an instance of IProject*
    - *Cannot use IResource.getProject()*

Real-Life IOC Development
APS Front-End IOCs in Eclipse

- As checked out from CVS



```
>Base 3.14.2 Branch  R3-14-2_branch [phoebus.aps.
>Base 3.14.8.2  R3-14-8-2 [phoebus.aps.anl.gov]
>Extensions  [phoebus.aps.anl.gov]
>Front End IOCs  release3 [phoebus.aps.anl.gov]
    Includes
    config
    feApp
    iocBoot
        Access
        bootlog
        iocfe01
        iocfe02
        iocfe03
        iocfe04
        iocfe05
        iocfe06
        iocfe07
        iocfe08
        iocfe09
        iocfe10
        iocfe11
        iocfe12
        iocfe13
        iocfe14
        iocfe15
        iocfe16
        iocfe17
        iocfe18
        iocfe19
        iocfe20
        iocfe22
        iocfe31
        iocfe32
        iocfe33
        iocfe34
        iocfe35
        Makefile  1.1.1.1  (ASCII -kkv)
        envParams  1.1.1.1  (ASCII -kkv)
        nfsCommands  1.1.1.1  (ASCII -kkv)
    Makefile  1.1.1.1  (ASCII -kkv)
Siocbmms Local
```

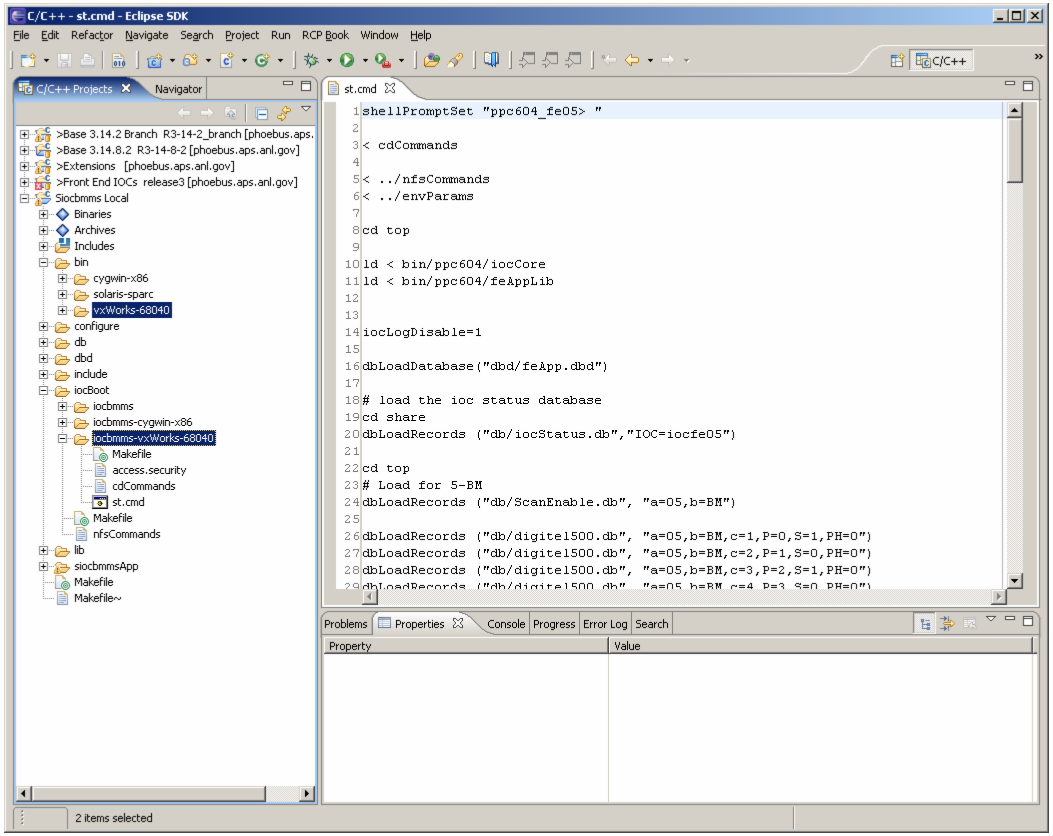
```
shellPromptSet "ppc604_fe05> "

< cdCommands

< ../nfsCommands
< ../envParams

cd top

ld < bin/ppc604/iocCore
ld < bin/ppc604/feAppLib


iocLogDisable=1

dbLoadDatabase("dbd/feApp.dbd")

# load the ioc status database
cd share
dbLoadRecords ("db/iocStatus.db","IOC=iocfe05")

cd top
# Load for 5-BM
dbLoadRecords ("db/ScanEnable.db", "a=05,b=BM")

dbLoadRecords ("db/digitel500.db", "a=05,b=BM,c=1,P=0,S=1,PH=0")
dbLoadRecords ("db/digitel500.db", "a=05,b=BM,c=2,P=1,S=0,PH=0")
dbLoadRecords ("db/digitel500.db", "a=05,b=BM,c=3,P=2,S=1,PH=0")
dbLoadRecords ("db/digitel500.db", "a=05,b=BM,c=4,P=3,S=0,PH=0")
```

Property	Value
Info	
derived	false
editable	true
last modified	3/17/06 5:46 PM
linked	false
location	C:\epics\ioc\fe
name	Front End IOCs
path	/Front End IOCs

/Front End IOCs

Managing an IOC on Several Platforms Including VxWorks

- You can build on the platform you are on and cross compile
- This IOC was built
  - On Windows
    - *cygwin-x86*
    - *vxWorks-68040*
  - On Solaris
    - *solaris-sparc*



```
shellPromptSet "ppc604_fe05> "

< cdCommands

< ../nfsCommands
< ../envParams

cd top

ld < bin/ppc604/iocCore
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dbLoadRecords ("db/digitel500.db", "a=05,b=BM,c=2,P=1,S=0,PH=0")
dbLoadRecords ("db/digitel500.db", "a=05,b=BM,c=3,P=2,S=1,PH=0")
dbLoadRecords ("db/digitel500.db", "a=05,b=BM,c=4,P=3,S=0,PH=0")
```
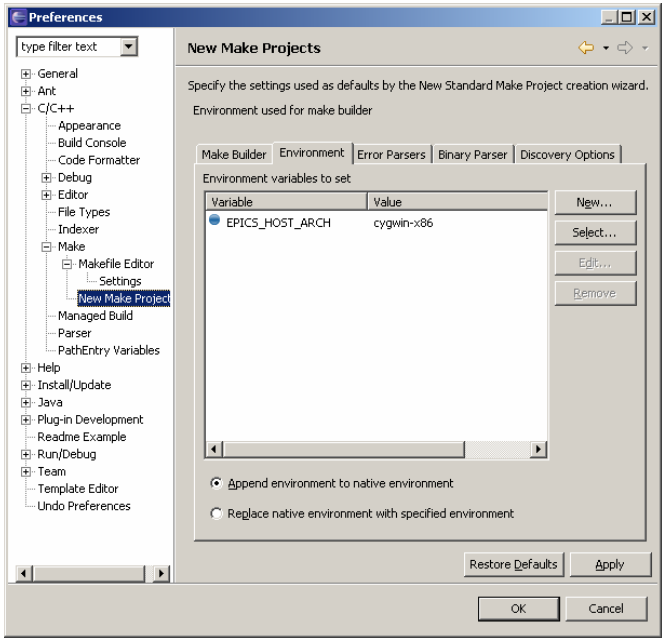

HOST_ARCH

- The environment variable HOST_ARCH (or EPICS_HOST_ARCH) needs to be set for builds
  - Used by Make to determine the platform
- Suggest setting it in the Preferences for C/C++



Preferences

New Make Projects

Specify the settings used as defaults by the New Standard Make Project creation wizard.

Environment used for make builder

Environment variables to set

Variable	Value
EPICS_HOST_ARCH	cygwin-x86

● Append environment to native environment

○ Replace native environment with specified environment

CVS
Optional Ingredient

- The Eclipse CVS support is good

- Eclipse has fixed ideas about how projects are organized and where the files are located
  - I would like MEDM, StripTool, etc. to be separate projects
  - I found it hard to checkout:
    - *extensions/config*
    - *extensions/configure*
    - *extensions/src/medm*

    and have MEDM be in a separate project but in the same directory

EPICS IDE Plug-in Supplemental Ingredient

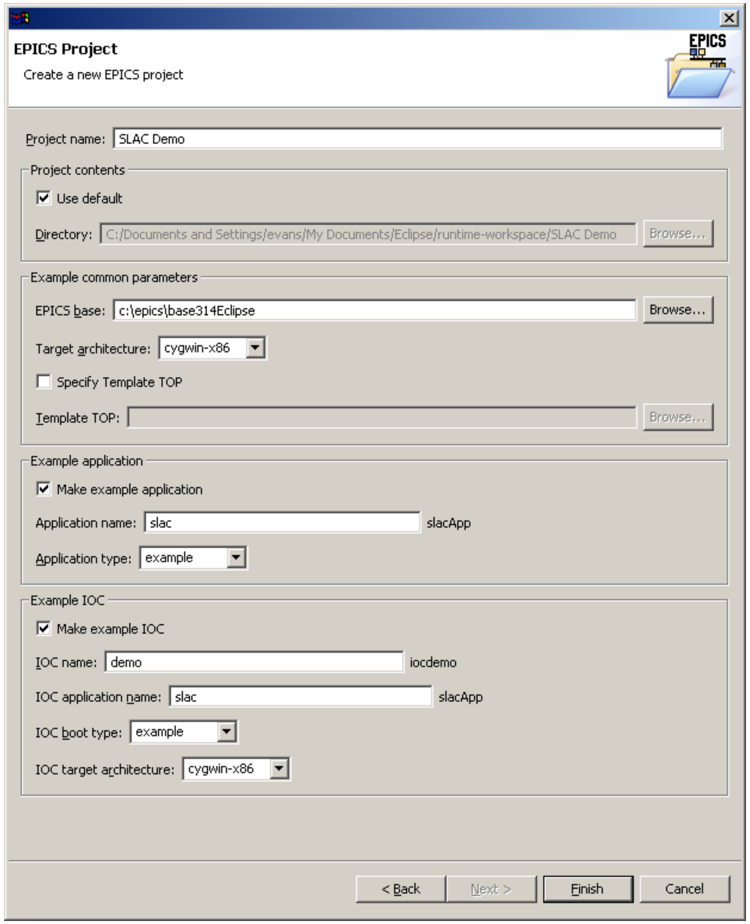
- Designed to make it simple to manage IOCs
  - Especially for new and inexperienced IOC managers
  - Or those that have other responsibilities
  - Aim is to provide Wizards to ease and speed development
- Most of the work is done by CDT and the EPICS build system
- EPICS IDE has its own nature plus C/C++ natures
  - Thus it has all the features of a C/C++ project and more of its own
- Relies on EPICS MakeBaseApp to create new projects and applications
- Is not limited to IOCs
  - Will also do applications
  - Actually, anything with a template MakeBaseApp understands

MakeBaseApp

- A Perl script that has come with base since at least R3.13.0.beta4
  - Creates directories
  - Copies template files
  - Expands macros in the files
- Has several templates, depending on the version
  - Support
  - IOC
  - Example (Support plus IOC)
  - caClient
  - caServer
- Varies by EPICS base version
  - Thus it is better to run it than rewrite it in Java
  - The EPICS IDE has to exec it and read its output

EPICS IDE
New Project Wizard

- You can make a simple project or example projects
  - Example Application (xxxApp)
  - Example IOC (iocyyy)
- If examples are selected, you specify:
  - EPICS base
  - Target architecture (HOST_ARCH)
  - Names and other parameters
- Choose from available types and architectures
- Dialog is populated from
  - MakeBaseApp
  - Looking at what is built in base
- Dialog checks responses are valid



EPICS Project

Create a new EPICS project

Project name: SLAC Demo

Project contents

☑ Use default

Directory: C:/Documents and Settings/evans/My Documents/Eclipse/runtime-workspace/SLAC Demo

Example common parameters

EPICS base: c:\epics\base314Eclipse

Target architecture: cygwin-x86

☐ Specify Template TOP

Template TOP:

Example application

☑ Make example application

Application name: slac slacApp

Application type: example

Example IOC

☑ Make example IOC

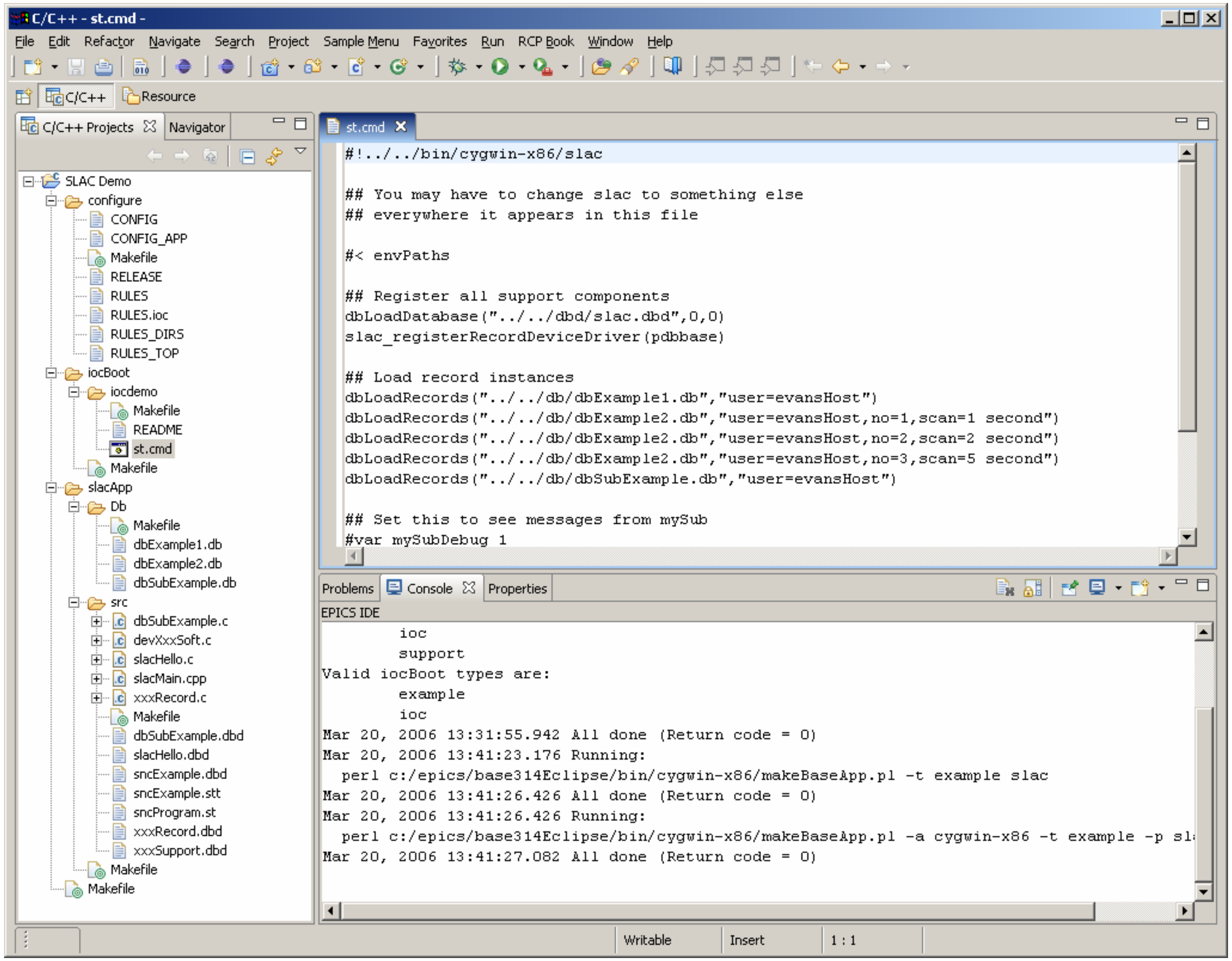
IOC name: demo iocdemo

IOC application name: slac slacApp

IOC boot type: example

IOC target architecture: cygwin-x86

Result of New Project

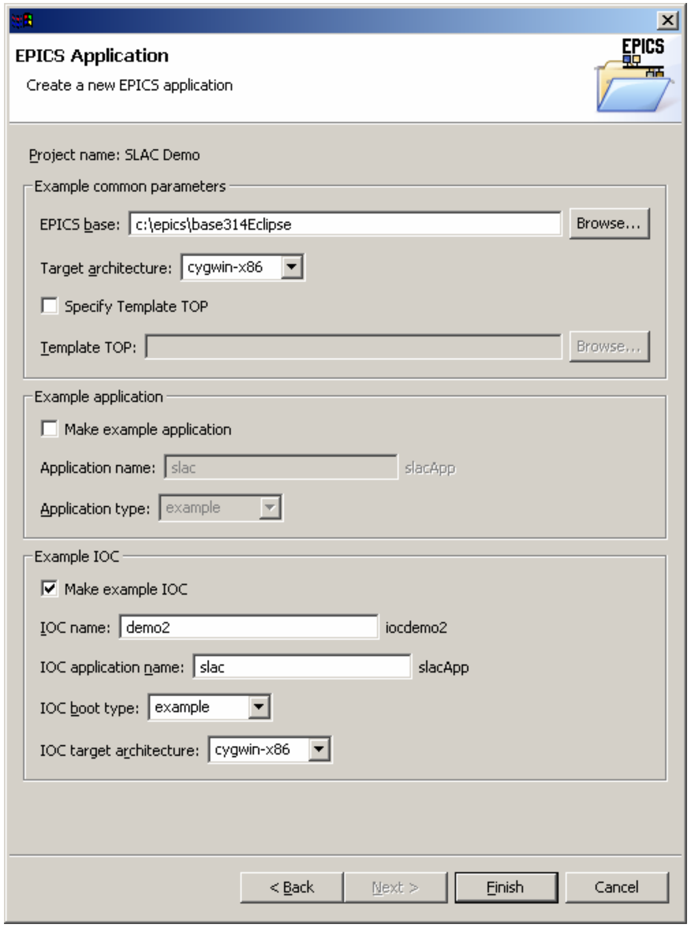


```
#!../../bin/cygwin-x86/slac

## You may have to change slac to something else
## everywhere it appears in this file

#< envPaths

## Register all support components
dbLoadDatabase("../../dbd/slac.dbd",0,0)
slac_registerRecordDeviceDriver(pdbbase)

## Load record instances
dbLoadRecords("../../db/dbExample1.db","user=evansHost")
dbLoadRecords("../../db/dbExample2.db","user=evansHost,no=1,scan=1 second")
dbLoadRecords("../../db/dbExample2.db","user=evansHost,no=2,scan=2 second")
dbLoadRecords("../../db/dbExample2.db","user=evansHost,no=3,scan=5 second")
dbLoadRecords("../../db/dbSubExample.db","user=evansHost")

## Set this to see messages from mySub
#var mySubDebug 1
```

```
        ioc
        support
Valid iocBoot types are:
        example
        ioc
Mar 20, 2006 13:31:55.942 All done (Return code = 0)
Mar 20, 2006 13:41:23.176 Running:
  perl c:/epics/base314Eclipse/bin/cygwin-x86/makeBaseApp.pl -t example slac
Mar 20, 2006 13:41:26.426 All done (Return code = 0)
Mar 20, 2006 13:41:26.426 Running:
  perl c:/epics/base314Eclipse/bin/cygwin-x86/makeBaseApp.pl -a cygwin-x86 -t example -p sl
Mar 20, 2006 13:41:27.082 All done (Return code = 0)
```

EPICS IDE
New Application Wizard

- Add to the project via the New menu on a selected project, folder, file, etc.
  - *e.g*. add an IOC
- Dialog is populated from
  - Project properties
  - MakeBaseApp
  - Looking at available builds



EPICS Application

Create a new EPICS application

Project name: SLAC Demo

Example common parameters

EPICS base: c:\epics\base314Eclipse

Target architecture: cygwin-x86

□ Specify Template TOP

Template TOP:

Example application

□ Make example application

Application name: slac slacApp

Application type: example

Example IOC

☑ Make example IOC

IOC name: demo2 iocdemo2

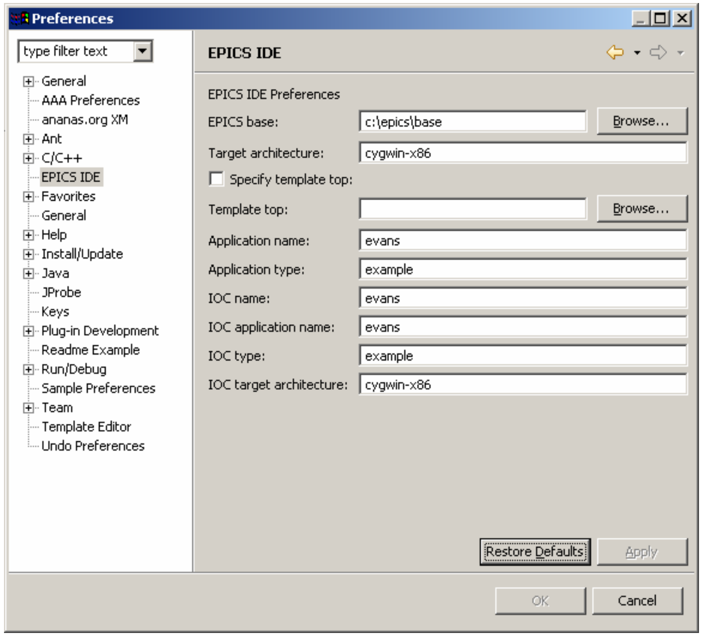
IOC application name: slac slacApp

IOC boot type: example

IOC target architecture: cygwin-x86

EPICS IDE
Preferences and Properties

- Preferences exist to set defaults
  - Window | Preferences | EPICS IDE
- Properties are set for a project
  - By the New Project Wizard or by the user



EPICS IDE

EPICS IDE Preferences

EPICS base: c:\epics\base

Target architecture: cygwin-x86

□ Specify template top:

Template top:

Application name: evans

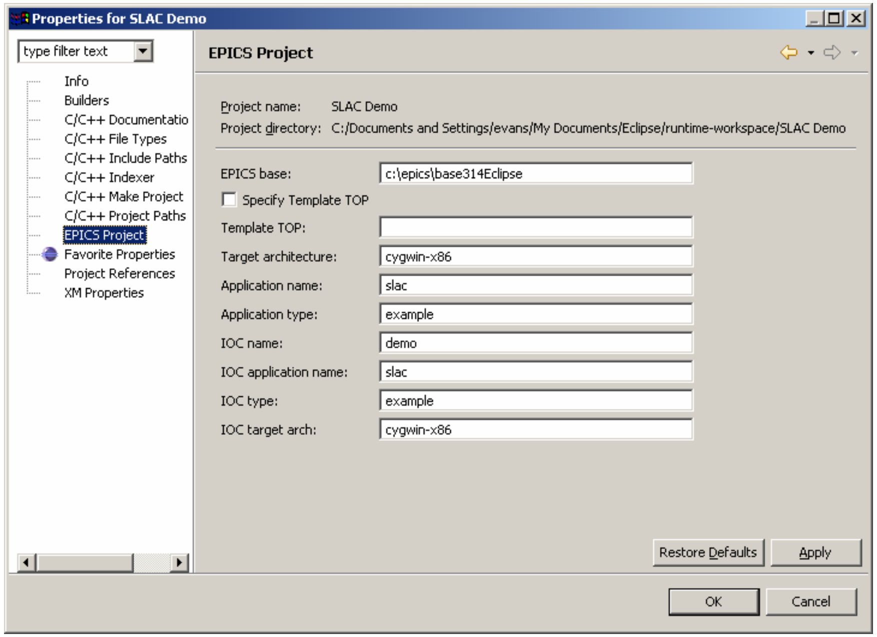
Application type: example

IOC name: evans

IOC application name: evans

IOC type: example

IOC target architecture: cygwin-x86



EPICS Project

Project name: SLAC Demo

Project directory: C:/Documents and Settings/evans/My Documents/Eclipse/runtime-workspace/SLAC Demo

EPICS base: c:\epics\base314Eclipse

□ Specify Template TOP

Template TOP:

Target architecture: cygwin-x86

Application name: slac

Application type: example

IOC name: demo

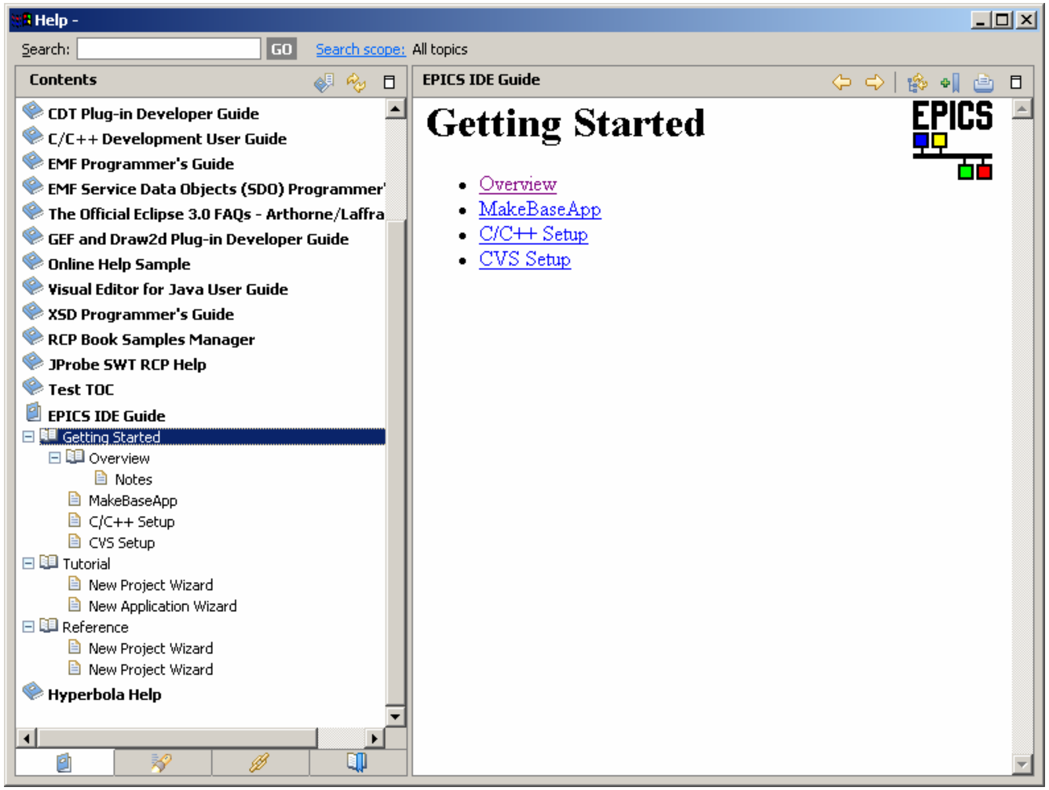
IOC application name: slac

IOC type: example

IOC target arch: cygwin-x86

EPICS IDE
Help

- Help is implemented as separate plug-in (gov.anl.epics.ide.help)



Help -

Search: GO Search scope: All topics

Contents

- CDT Plug-in Developer Guide
- C/C++ Development User Guide
- EMF Programmer's Guide
- EMF Service Data Objects (SDO) Programmer'
- The Official Eclipse 3.0 FAQs - Arthorne/Laffra
- GEF and Draw2d Plug-in Developer Guide
- Online Help Sample
- Visual Editor for Java User Guide
- XSD Programmer's Guide
- RCP Book Samples Manager
- JProbe SWT RCP Help
- Test TOC
- EPICS IDE Guide
  - Getting Started
    - Overview
      - Notes
    - MakeBaseApp
    - C/C++ Setup
    - CVS Setup
  - Tutorial
    - New Project Wizard
    - New Application Wizard
  - Reference
    - New Project Wizard
    - New Project Wizard
- Hyperbola Help

EPICS IDE Guide

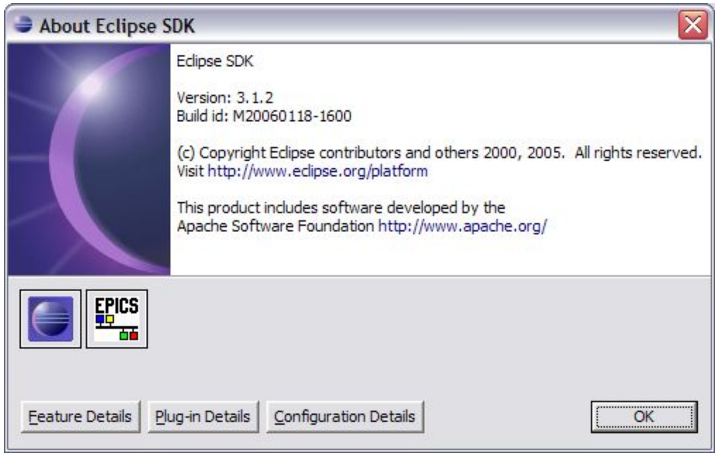
Getting Started

EPICS

- Overview
- MakeBaseApp
- C/C++ Setup
- CVS Setup

EPICS IDE Feature

- The EPICS IDE is implemented as a Feature with an Update Site



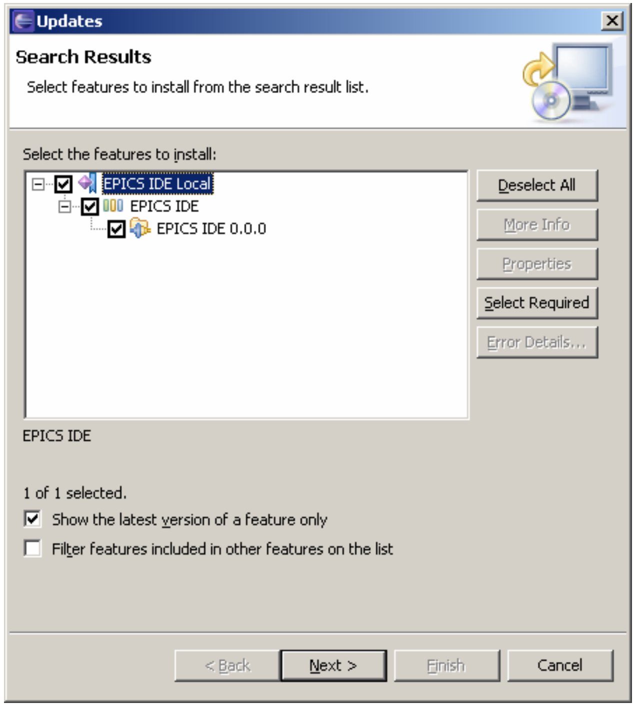
About Eclipse SDK

Eclipse SDK

Version: 3.1.2
Build id: M20060118-1600

(c) Copyright Eclipse contributors and others 2000, 2005. All rights reserved.
Visit http://www.eclipse.org/platform

This product includes software developed by the
Apache Software Foundation http://www.apache.org/



Updates

Search Results

Select features to install from the search result list.

Select the features to install:

☑ EPICS IDE Local
☑ EPICS IDE
☑ EPICS IDE 0.0.0

EPICS IDE

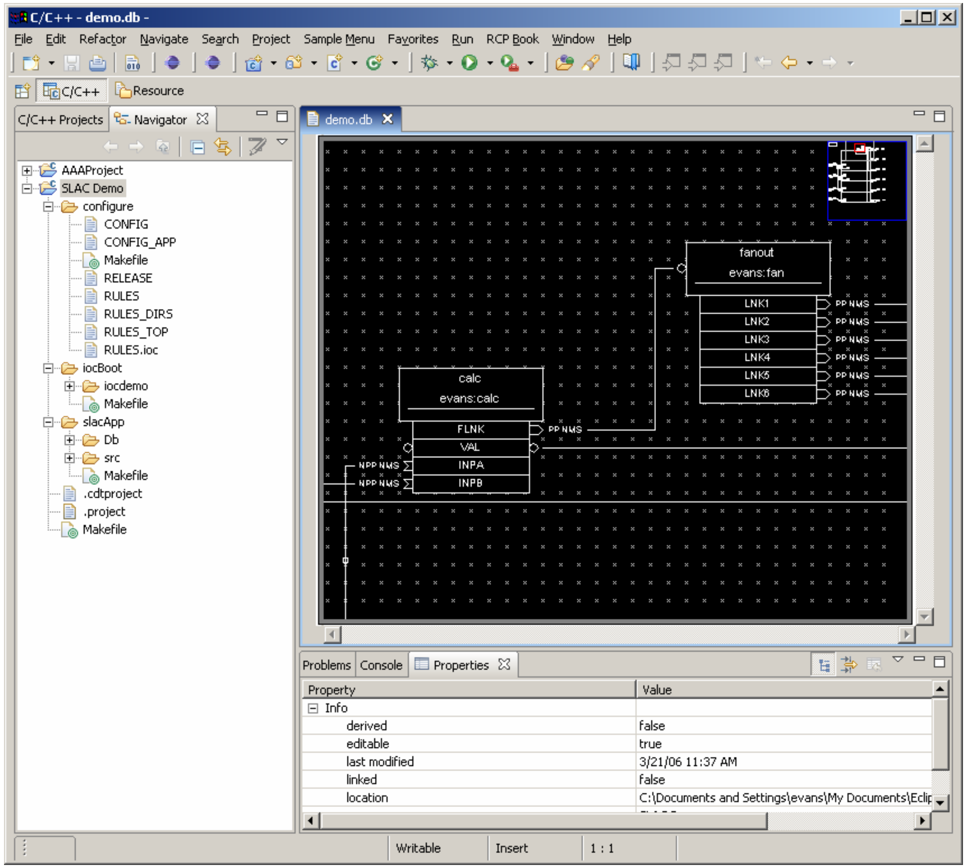
1 of 1 selected.

☑ Show the latest version of a feature only

☐ Filter features included in other features on the list

VisualDCT
Implemented as an EPICS IDE Editor

- Currently vaporware



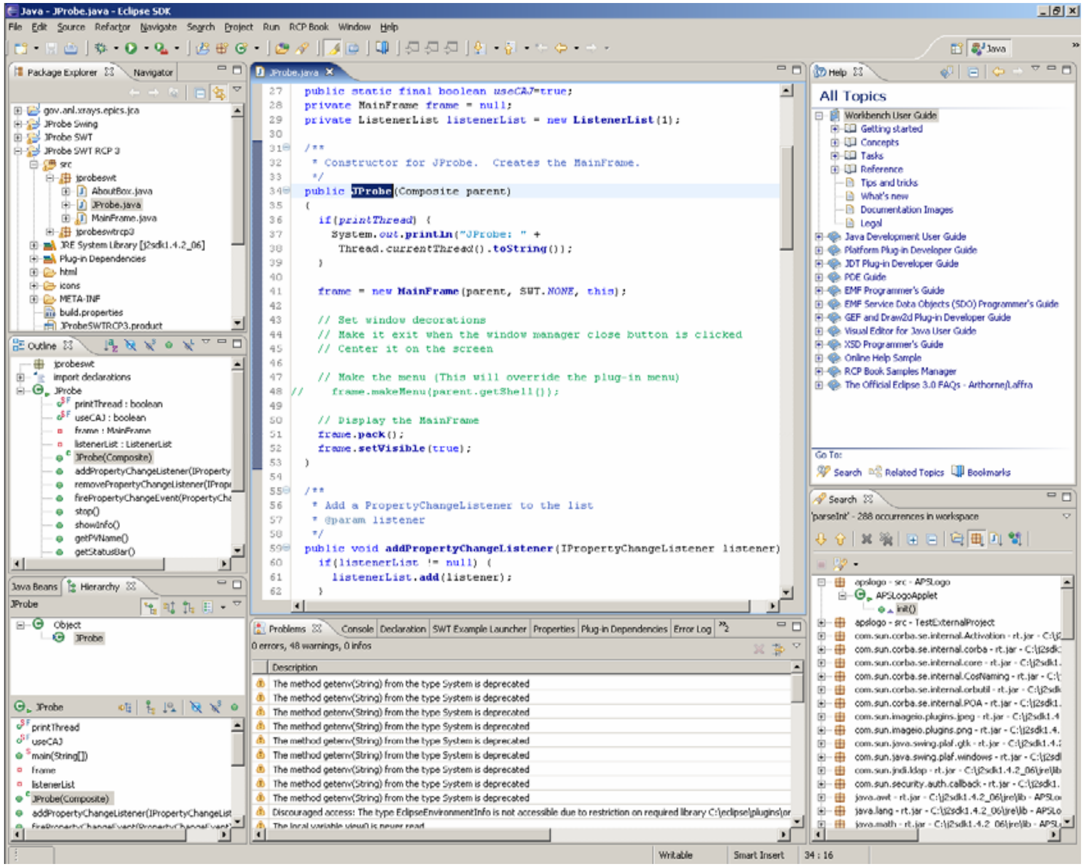
Property	Value
⊟ Info	
derived	false
editable	true
last modified	3/21/06 11:37 AM
linked	false
location	C:\Documents and Settings\evans\My Documents\Eclip

Rich Client Platform (RCP) Overview

- “Rich Client” is a term from the early 1990’s that distinguished applications built with Visual Basic and the like from “Console” or “Simple” applications
- Eclipse is particularly suited to Rich Client applications
- The possibility of using the Eclipse platform for applications was there from the beginning, but foreshadowed by its use as an IDE
  - In the early days it required hacking to make Rich Clients
- RCP is now (as of Eclipse 3.1) supported by the interface and encouraged
- You essentially use Eclipse as a framework for your application
  - You inherit all of its built-in features
  - As well as those from other community plug-ins
- You include only the plug-ins you need
- Is a very extensible development platform
  - You can use plug-ins developed by others as needed
  - Others can use yours and extend them

Eclipse
As a Java IDE

- Primarily for Java developers, not users

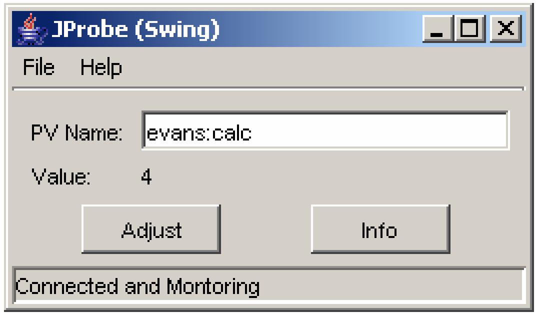


```
public static final boolean useCAJ=true;
private MainFrame frame = null;
private ListenerList listenerList = new ListenerList(1);

/**
 * Constructor for JProbe.  Creates the MainFrame.
 */
public JProbe(Composite parent)
{
  if(printThread) {
    System.out.println("JProbe: " +
     Thread.currentThread().toString());
  }

  frame = new MainFrame(parent, SWT.NONE, this);

  // Set window decorations
  // Make it exit when the window manager close button is clicked
  // Center it on the screen

  // Make the menu (This will override the plug-in menu)
//    frame.makeMenu(parent.getShell());

  // Display the MainFrame
  frame.pack();
  frame.setVisible(true);
}

/**
 * Add a PropertyChangeListener to the list
 * @param listener
 */
public void addPropertyChangeListener(IPropertyChangeListener listener)
  if(listenerList != null) {
    listenerList.add(listener);
  }
```

```
0 errors, 48 warnings, 0 infos
Description
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
The method getenv(String) from the type System is deprecated
Discouraged access: The type EclipseEnvironmentInfo is not accessible due to restriction on required library C:\eclipse\plugins\or
The local variable view0 is never read
```

Eclipse
As a Rich Client Platform

- Looks like an application, not an IDE
- Inherits a lot of functionality
  - Persistence (Properties and Preferences)
  - Help
  - Featured About dialog (like Eclipse's)
  - Splash screen
  - Dockable windows, and much more …

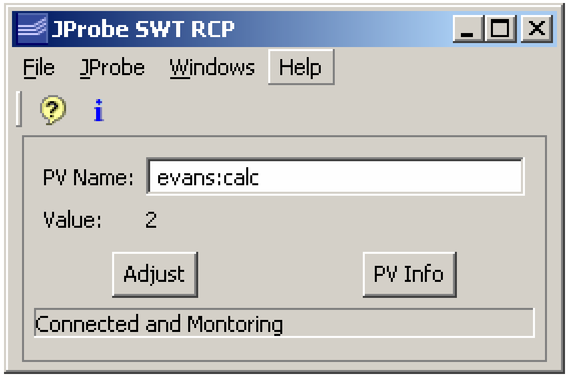


PV Name: evans:calc

Value: 4

Connected and Montoring

Java Application



PV Name: evans:calc

Value: 2

Connected and Montoring

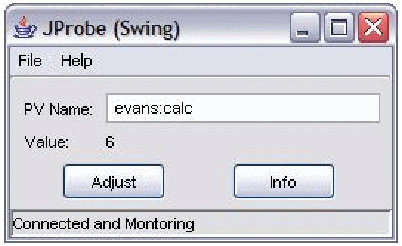
RCP Application

AWT vs. SWT
You have to decide

- AWT / Swing (Abstract Windowing Toolkit)
  - Write once, run anywhere
  - Formerly ugly, with bad performance
  - Now look and work well
  - Use garbage collection
  - Come with the JDK and JRE
- SWT / JFace (Standard Window Toolkit)
  - The important fact is that Eclipse uses SWT, not AWT
  - Supposed to look better, run faster
  - A thin wrapper around native widgets
  - SWT components must be disposed (vs. garbage collected)
    - *Owing to need to free native resources*
  - Need JNI libraries for each platform
  - Distribution is through the Eclipse Foundation, not Sun

AWT vs. SWT
More Considerations

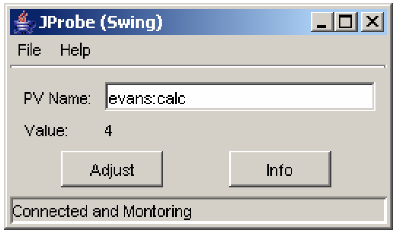
- It is not easy to convert between them
- The SWT look is not obviously better
- The performance difference may not be there either, today
- Eclipse uses SWT
  - They are supposed to mix and match, but ???
- Sun is unlikely to include SWT support in the JDK and JRE soon



PV Name: evans:calc

Value: 6

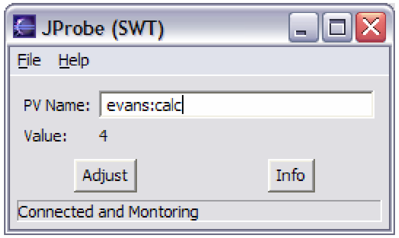
Connected and Montoring



PV Name: evans:calc

Value: 4

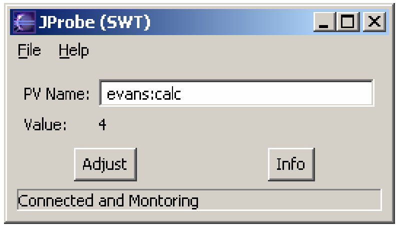
Connected and Montoring



PV Name: evans:calc

Value: 4

Connected and Montoring



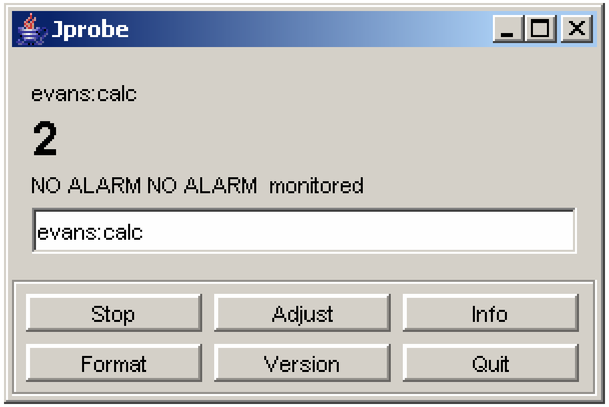
PV Name: evans:calc

Value: 4

Connected and Montoring

Jprobe
A Simple GUI that Does EPICS

- JProbe was originally written as an example for EPICS training
- Has the right stuff for an example application
  - GUI (If you can do this, you can do any Java GUI)
  - Uses Channel Access (If you can do this you can do any CA)
- Is not the Jprobe developed by Janet Anderson and others
  - That one has a lower-case “p” and more EPICS features
  - Is available as an EPICS Extension

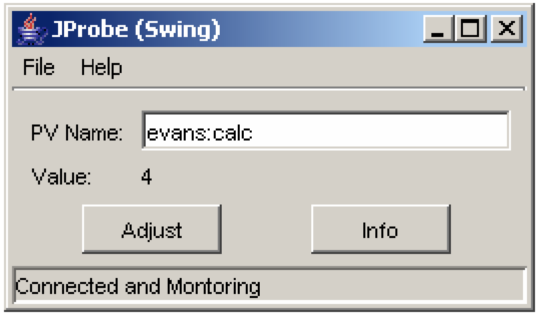


evans:calc

2

NO ALARM NO ALARM monitored

evans:calc



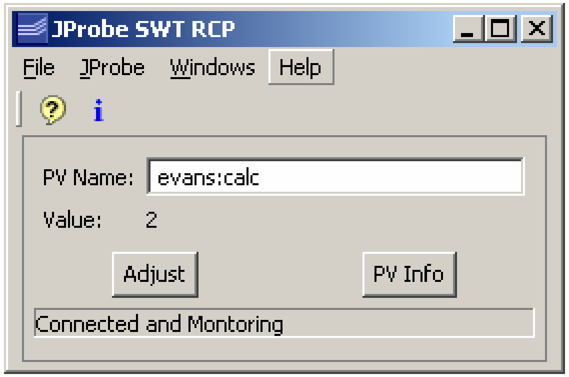
PV Name: evans:calc

Value: 4

Connected and Montoring

JProbe RCP
A Simple GUI that Does EPICS and RCP

- RCP version of JProbe
- Purpose is to explore RCP
  - Not to make a better Probe
  - In particular, to explore implementing legacy code in RCP
    - *C, C++, FORTRAN, Perl, etc.*
- Is more full featured than Jprobe, in a different way



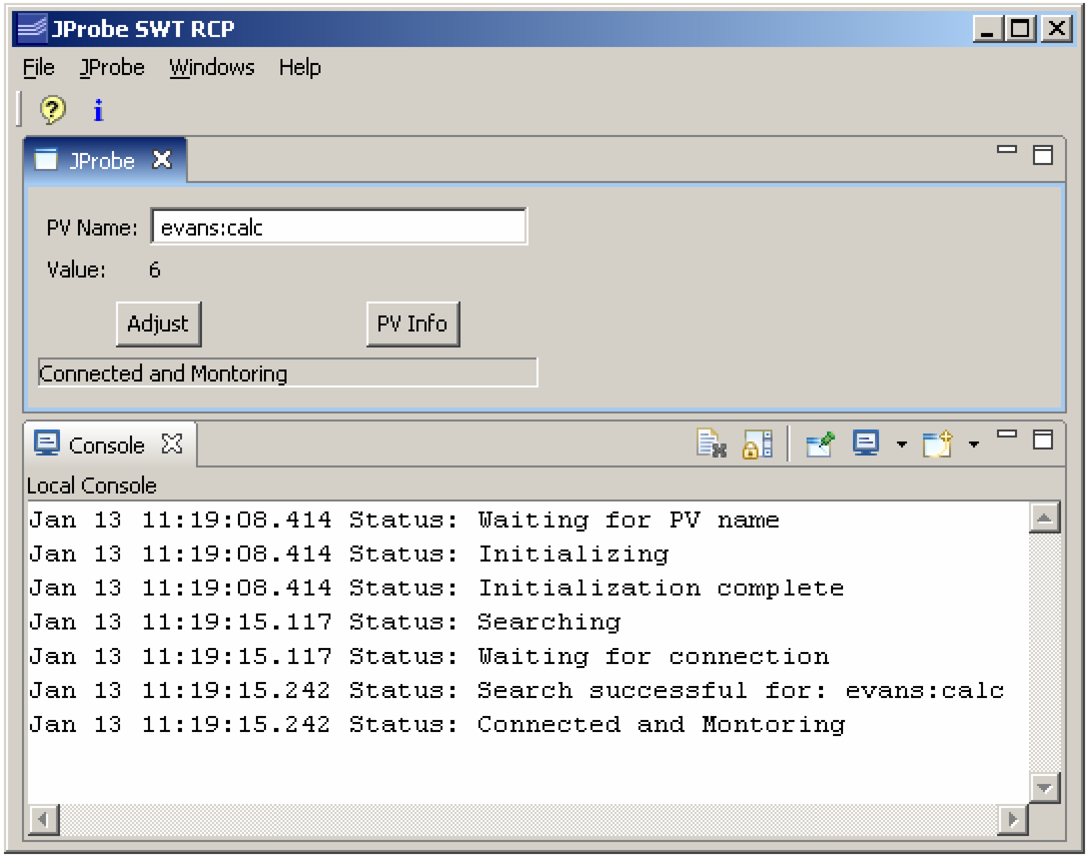
PV Name: evans:calc

Value: 2

Connected and Montoring

JProbe RCP
Additional RCP Functionality

- Debug Mode



PV Name: evans:calc

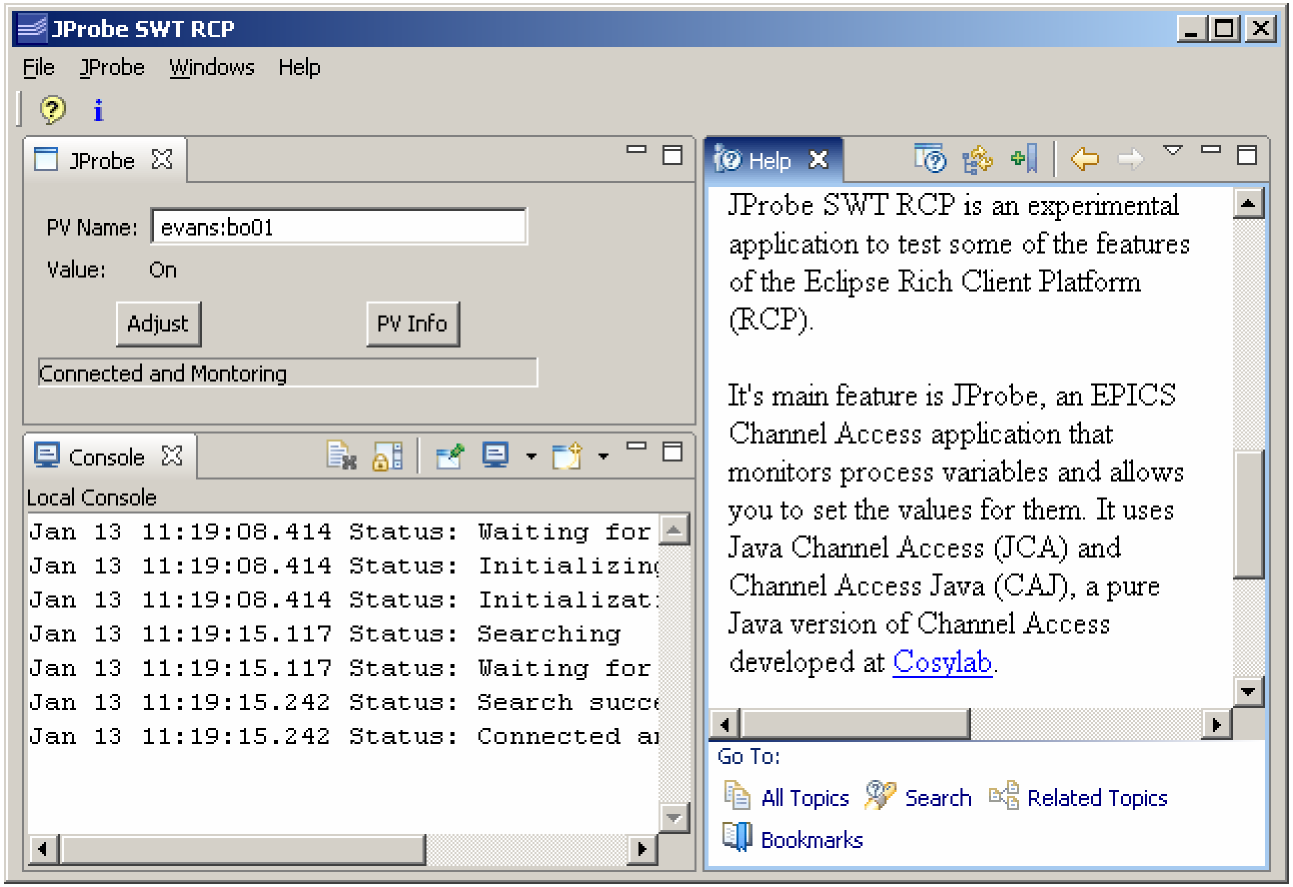
Value: 6

Connected and Montoring

```
Jan 13 11:19:08.414 Status: Waiting for PV name
Jan 13 11:19:08.414 Status: Initializing
Jan 13 11:19:08.414 Status: Initialization complete
Jan 13 11:19:15.117 Status: Searching
Jan 13 11:19:15.117 Status: Waiting for connection
Jan 13 11:19:15.242 Status: Search successful for: evans:calc
Jan 13 11:19:15.242 Status: Connected and Montoring
```

JProbe RCP
Additional RCP Functionality

- Help



PV Name: evans:bo01

Value: On

Adjust

PV Info

Connected and Montoring

```
Jan 13 11:19:08.414 Status: Waiting for
Jan 13 11:19:08.414 Status: Initializing
Jan 13 11:19:08.414 Status: Initializat:
Jan 13 11:19:15.117 Status: Searching
Jan 13 11:19:15.117 Status: Waiting for
Jan 13 11:19:15.242 Status: Search succe
Jan 13 11:19:15.242 Status: Connected an
```

JProbe SWT RCP is an experimental application to test some of the features of the Eclipse Rich Client Platform (RCP).

It's main feature is JProbe, an EPICS Channel Access application that monitors process variables and allows you to set the values for them. It uses Java Channel Access (JCA) and Channel Access Java (CAJ), a pure Java version of Channel Access developed at Cosylab.

JProbe RCP
Still More Additional RCP Functionality

- Splash screen
- Dockable windows
- Extensive Help | About dialog
- Preferences
- Properties
- Views
- Console
- Multiple windows
- Runs as an executable and acts like an executable, not a class

- See the demo

- But does Probe need all this?

Handling Legacy code

- The JNI version of JProbe does **not** run in Eclipse RCP
  - Has to do with Eclipse class loaders and its handling of CLASSPATH
    - *Your RCP application executable is really eclipse.exe*
    - *-classpath = startup.jar, period*
- Problem is generic and not limited to JCA
  - Bottom line: Your working JNI application may not work under Eclipse
- Has been worked around for JCA by rewriting the JNI part of JCA
  - A problem, since I do not own this code

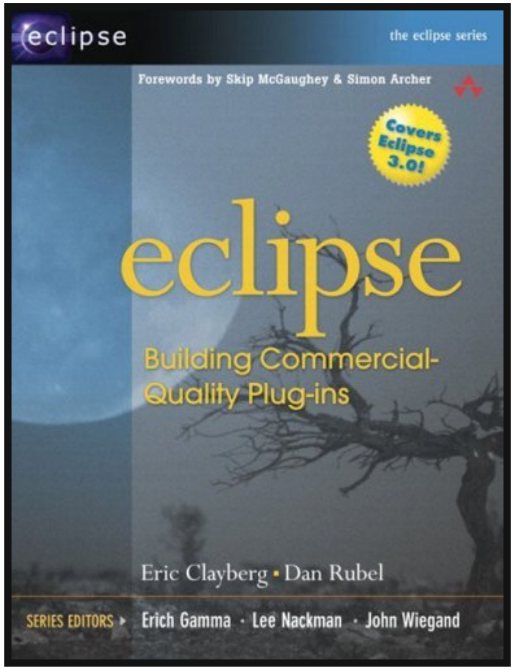
- Further explanation is beyond the scope of this presentation

XRAYS
X-Ray Analysis Software

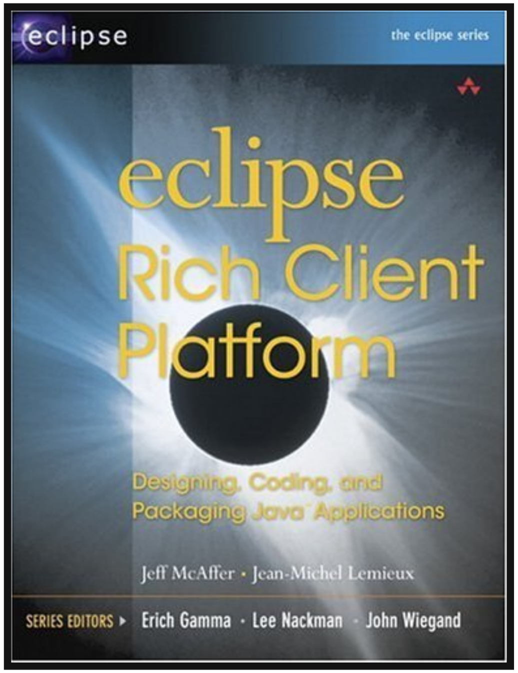
- Intended to be for the X-ray community what DANSE, GumTree, and ISAW are for the Neutron Scattering community
- Currently in “Finding the Ballpark” stage
- We expect significant overlap with Neutron Scattering software
- Needs to implement legacy code, especially FORTRAN

Useful Books

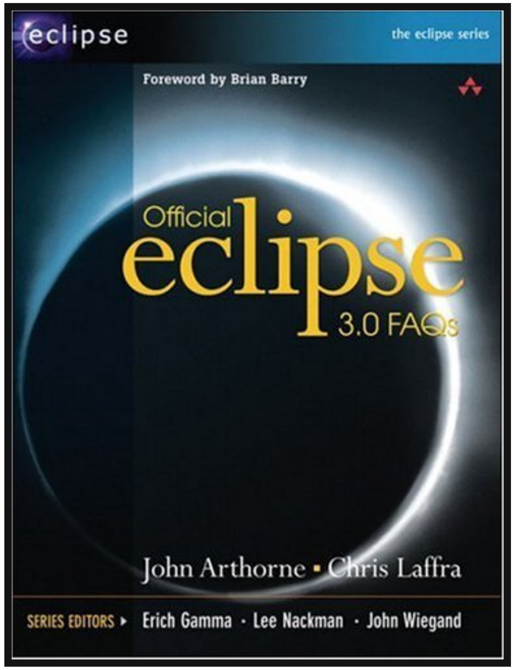
Excellent, Must have


eclipse
the eclipse series
Forewords by Skip McGaughey & Simon Archer
Covers Eclipse 3.0!
eclipse
Building Commercial-Quality Plug-ins
Eric Clayberg • Dan Rubel
SERIES EDITORS ▸ Erich Gamma · Lee Nackman · John Wiegand

Only RCP book


eclipse
the eclipse series
eclipse
Rich Client Platform
Designing, Coding, and Packaging Java Applications
Jeff McAffer • Jean-Michel Lemieux
SERIES EDITORS ▸ Erich Gamma · Lee Nackman · John Wiegand

For the Help Plug-in


eclipse
the eclipse series
Foreword by Brian Barry
Official
eclipse
3.0 FAQs
John Arthorne • Chris Laffra
SERIES EDITORS ▸ Erich Gamma · Lee Nackman · John Wiegand

Thank You

This has been an

APS Controls Presentation

Thank You

This has been an

APS Controls Presentation