



IBM Software Group

Linux Tools in IBM WebSphere Development Studio Client for iSeries

iSeries Application Development Team: IBM Toronto

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

This presentation reviews Linux as a development client for application development using IBM WebSphere Development Studio Client for iSeries.

Agenda

- Quick Introduction to IBM Application Development Tools Platform
 - Eclipse based Tools
 - IBM WebSphere Studio based Tools
- Target Linux as a development server
 - Using Development Studio Client to access a remote Linux server
- Linux as a development client
 - Using the Eclipse Workbench on Linux
 - C/C++ Tools for Linux
 - Other Eclipse tools available for Linux



IBM Software Group

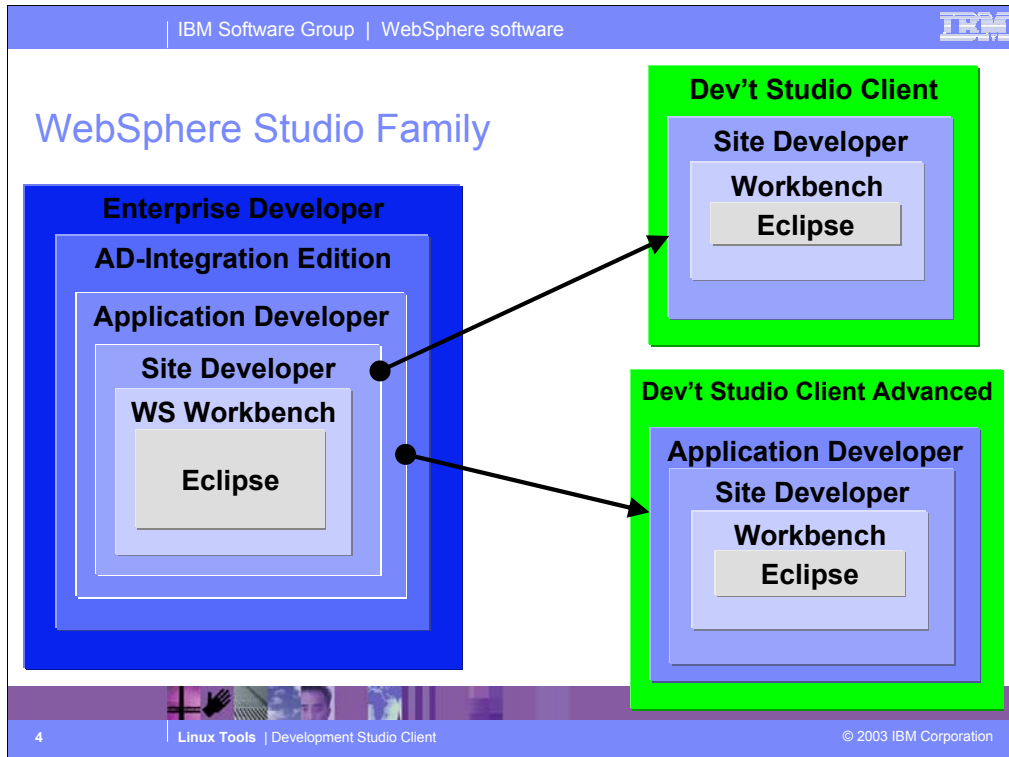
IBM Application Development Tools Platform

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation



Here you see that Development Studio Client is based on WebSphere Studio Site Developer, while Development Studio Client Advanced is based on WebSphere Studio Application Developer.

The Workbench is based on the open-source Eclipse technology about to be discussed. It is not for sale, but is the basis of all IBM WebSphere Studio products, and is available to business partners.

Site Developer is IBM's entry level offering based on eclipse, and it is for building dynamic Web sites out of non-EJB Java. Application Developer extends Site Developer and adds support for EJBs. Application Developer-Integration Edition extends Application Developer and adds support for JCA Connectors and for Workflow. Enterprise Developer extends Application Developer-Integration Edition and adds support for S/390 and Enterprise Generation Language (EGL), the follow-on to VisualAge Generator.

What is Eclipse?



- A base Integrated Development Environment
 - Foundation of all IBM Application Development Tools
 - Open source
 - Contributed by IBM, managed by consortium
 - Comes with built-in rich Java tooling
 - Extensible via plug-ins
 - Used as basis of products = Eclipse + plug-ins
 - Millions of user downloads
 - 35 products offerings powered by Eclipse
 - 25 companies in consortium
 - 175 companies writing plug-ins
- **FREE!!!**

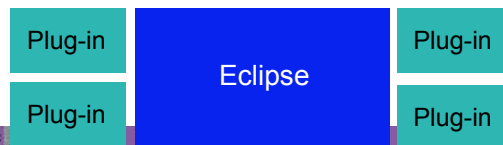
Eclipse was developed by IBM and donated to the open source community. That donation is estimated to be worth \$40 million. Anyone can download Eclipse for free, including the source code, from www.eclipse.org. Eclipse has generated extraordinary excitement in the development community and the tools community. It is written in Java, and can be extended by tools that are also written in Java. These tools are known as plug-ins. Out of the box, Eclipse offers an integrated development environment (IDE) that has built-in support for teams and projects and a robust and revolutionary user interface framework. It also has tools built-in to create Eclipse plug-ins. Further, there are extensive and very powerful tools built-in for developing Java applications with Eclipse. So, if all you want is the world's best Java toolset, then all you need is Eclipse. You can't beat the price!



IBM is not alone with Eclipse. The open-source consortium that oversees contributions made to it include a number of large companies, and that list is growing. Note that MKS is an iSeries tool vendor. See www.eclipse.org for the latest list.

What is Eclipse?


- **Eclipse + plug-ins = product**
Although it is a great Java IDE out of the box
- **Eclipse is already the basis of many products, and more to come**
Both from IBM and Business Partners
- **Eclipse is a huge opportunity for ISVs**
For writing and selling plug-ins



So what is Eclipse? With the exception of the built-in Java tools, Eclipse itself is not that interesting. It only gets interesting when you add to it some plug-ins (for example, tools) that do something interesting.

An Eclipse-based product is Eclipse plus a number of interesting plug-ins. IBM is building numerous such Eclipse-based products, including as we have seen Site Developer and Development Studio Client. Further, because Eclipse is free and business partners are free to include it in their products, there will be many other Eclipse-based products from other companies too, including Rational and TogetherSoft.

For business partners or software developers who write and sell application development tools, Eclipse is a fantastic opportunity. By writing plug-ins for Eclipse, those plug-ins can be sold to any developer using any product based on Eclipse or even just the raw Eclipse as downloaded from www.eclipse.org. This opportunity is not lost on iSeries tool vendors, who are all looking at offering Eclipse plug-ins for their tools. This will result in a rich offering of third party plug-ins for developers to choose from, all of which extend their core Development Studio Client development environment. One community, one core development platform, many IBM and 3rd party tools. This is community and excitement!

IBM Software Group | WebSphere software 

WebSphere Development Studio V5

RPG


COBOL

C/C++

PDM, SEU
SDA, RLU

V5R1 or V5R2
5722-WDS
No-cost V4 Upgrade 5903
www.ibm.com/software/awdtools/wds400

Unlimited Licenses



iSeries	iSeries	iSeries	iSeries	Web Facing	iSeries Projects
Java	Debug	Struts Web	Web Service	RSE	
Trace	Profiling	DB	XML	App Server	

+CODE
+VisualAge RPG

WebSphere Development Studio Client V5


8
Linux Tools | Development Studio Client
© 2003 IBM Corporation

There is now only one application development product sold by IBM, for iSeries, as of V4R5. This is WebSphere Development Studio (Development Studio), which includes all four host compilers, all traditional tools (ADTS = PDM+SEU+SDA+RLU+DFU+AFP+CGU), and unlimited licenses of the workstation-based toolset named WebSphere Development Studio Client (formerly WebSphere Development Tools).

If you are an existing customer who has a subscription, you can upgrade to Development Studio free of charge. Without a Software Subscription, there is an upgrade fee. New licenses of Development Studio are priced very competitive compared to the combined prices of all constituent products. As of V5R1, there is no way to purchase the compilers or tools individually. So if you have RPG at V5R1 or higher, you must have Development Studio and hence are entitled to Development Studio Client.

For consultants who do not have an iSeries of their own, but still wish to have the client tools, Development Studio Client is also made available as a passport advantage product so it can be purchased "off the shelf" from IBM Direct.

Development Studio has been a huge success, with over 80,000 licenses sold. Just as every development machine used to have PDM and SEU, every development machine will now have all the modern Application Development tools from IBM. This ubiquity is especially important for business partners who build and sell software. These Business Partners are now free to build software using any of the technologies or tools in Development Studio, and can assume their customers will have the tools required to tailor everything from RPG to Java and Web user interfaces. This effectively raises the lowest common denominator to a level unparalleled by any other operating system.

IBM Software Group | WebSphere software 

WebSphere Development Studio Advanced V5

NEW!

Unlimited Licenses

RPG	COBOL
C/C++	PDM, SEU SDA, RLU

V5R1 or V5R2
5722-WDS
Cost Upgrade 5904
www.ibm.com/software/awdtools/wds400

iSeries	iSeries	iSeries*	iSeries	Web Facing*	iSeries Projects	
Java	Debug	Struts Web	Web Service		RSE	
Trace	Profiling	DB	XML	App Server	EJB* J2EE*	Test Cases*

+CODE
+VisualAge RPG

WebSphere Development Studio Client Advanced V5

9 | Linux Tools | Development Studio Client | © 2003 IBM Corporation

The Advanced edition of Development Studio Client, and Development Studio, is new as of April 25th 2003. Development Studio Advanced is currently the same as Development Studio, except the customer is entitled to unlimited licenses of Development Studio Client Advanced versus just Development Studio Client.

The difference of Development Studio Client Advanced over Development Studio Client is that it has additional tools (blue boxes with asterisks) and some enhancements to existing iSeries tools (green boxes with asterisks) which will be discussed later in this presentation. The majority of the new tools are related to Enterprise Java Bean (EJB) development. You'll see later that Development Studio Client Advanced is based on WebSphere Application Developer (Application Developer) versus WebSphere Studio Site Developer (Site Developer).



IBM Software Group

Linux as a Development Server

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

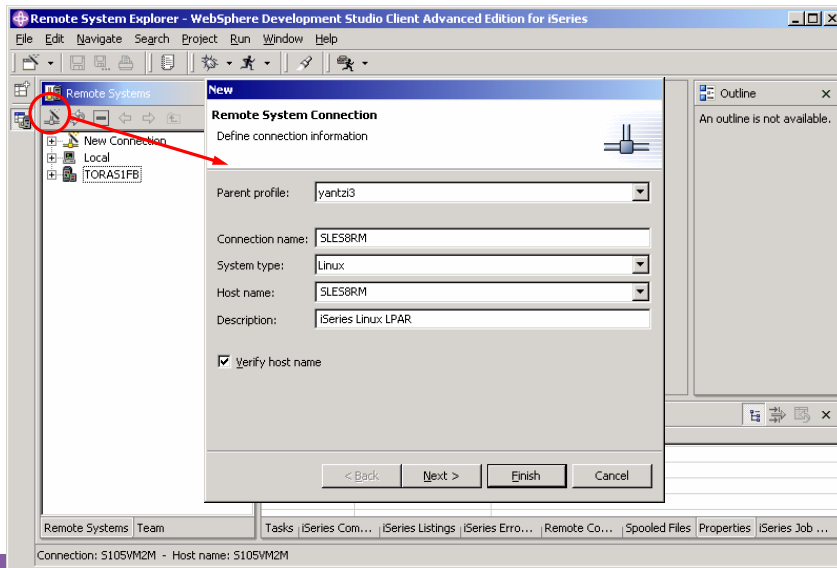
Linux as a Development Server

- Regardless of which type of development client you are using you may be deploying to a remote Linux server
- Or you may be using Linux as an infrastructure server (file, print, DNS, ...)
- WebSphere Development Studio Client
 - Use the Remote System Explorer to view, edit, compile, manage and run your remote Linux applications
 - You can use the same tools to view, edit, compile, manage, run and debug your remote iSeries applications
 - No need to learn two different toolsets!
- Does Development Studio Client run on Linux?
 - Not yet, but stay tuned!

Getting Started with Remote System Explorer

- Use the Remote System Explorer in Development Studio Client to work with your remote Linux server
- First open the Remote System Explorer perspective
- Next create a Linux Connection
 - An RSE connection represents a “connection” to a remote system
 - Specify a Connection name and TCP/IP hostname
 - You can also specify environment variables per connection
 - Create multiple connections to the same host to use different user IDs and environment variables
- Expand your new connection to connect to the Remote System and start working with it

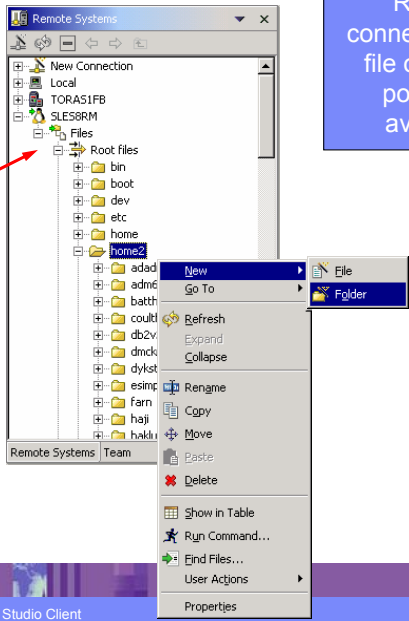
Remote System Explorer



Accessing a Linux Server

Expand the "Files" subsystem to see your filters.

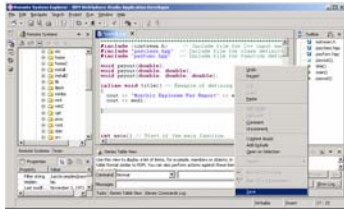
Two predefined filters:
Root files (/ *)
Home (/home / *)



Right click on a connection, subsystem, file or folder to see a popup menu with available actions

How Does it Work?

RSE Linux connection
In Development Studio
Client



RSE server
running on remote
Linux box.



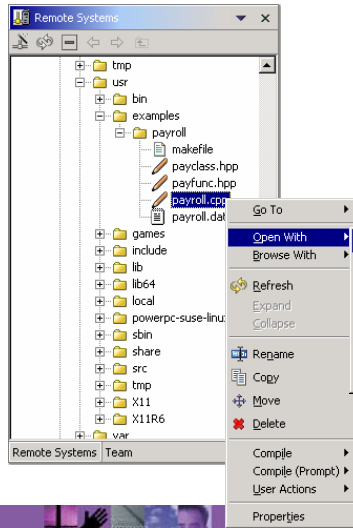
TCP/IP Socket Connection

RSE server must be installed and running on the remote Linux box. RSE server is written in Java and is shipped with WDS. Check the online help for step by step instructions on setting up the RSE server for Linux.

Remote System Explorer and Linux

- What can you do with a RSE Linux connection?
 - Edit remote files using any of the Workbench editors
 - Open a remote shell for the connection
 - Run interactive shell commands
 - Shell output is parsed to recognize files, folders, output from common Linux compilers and commands like grep, ...
 - Define filters to display remote files and folders in the Remote Systems view
 - Search for remote files
 - Compile remote .java, .c and .cpp files
 - Define your own compile commands for these or other file types!
 - Define and run user actions against remote files and folders

Editing Remote Files



All Workbench editors registered for the selected file type.
You can configure this list using the Workbench -> File Associations preference page

Remote Systems LPEX Editor is part of WDS
C Editor is part of CDT (more on this later)

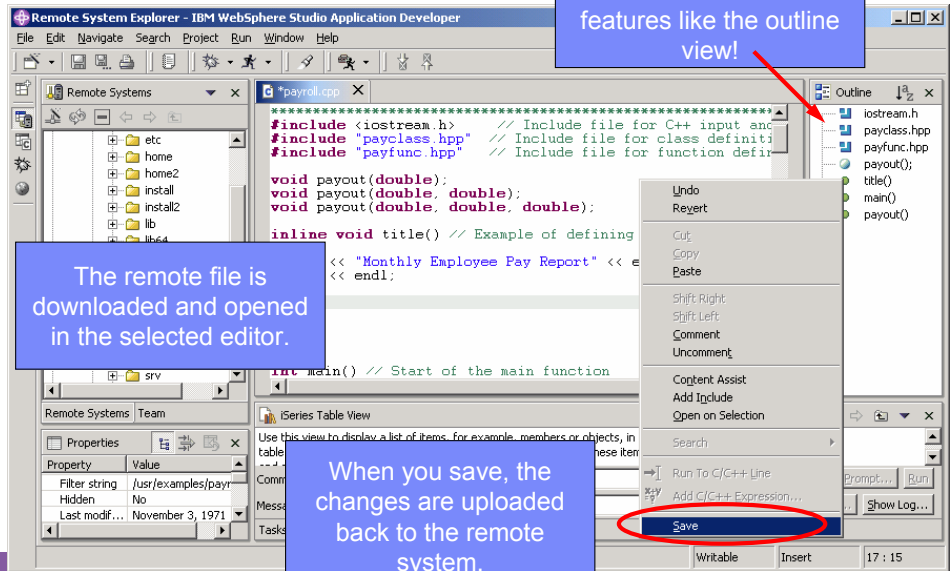
Use "Browse With ->" to Open the file in read-only mode

Editing Remote Files

You get full use of the editor and workbench features like the outline view!

The remote file is downloaded and opened in the selected editor.

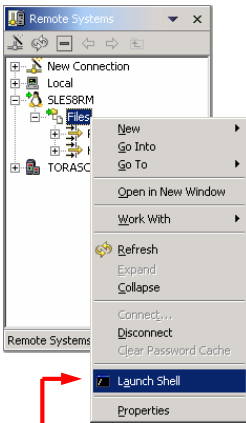
When you save, the changes are uploaded back to the remote system.



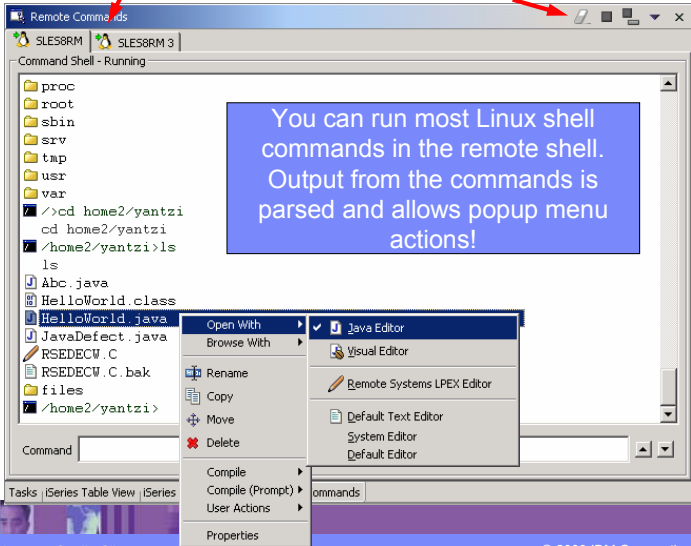
Remote Shell

Multiple shells open for each RSE Linux connection.

Use these controls to terminate and remote shells or launch additional ones



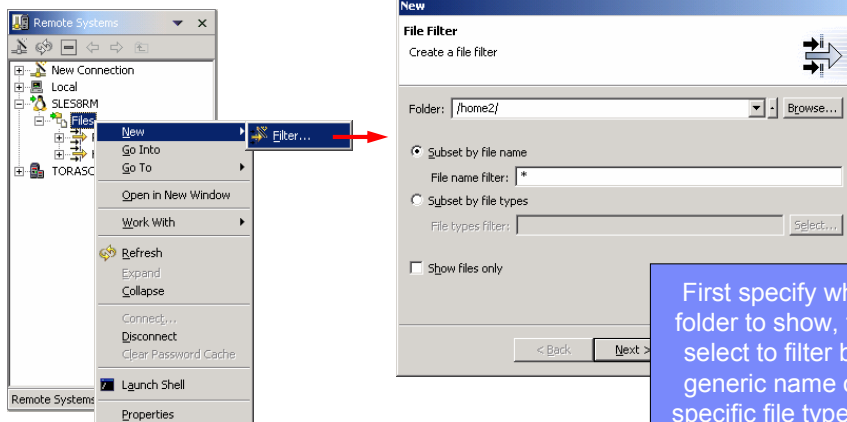
Right click on the Files subsystem and select "Launch Shell" to open a remote shell



You can run most Linux shell commands in the remote shell. Output from the commands is parsed and allows popup menu actions!

Defining New Filters

Filters allow you to show specific directories or files in the RSE Systems View under your connection.



First specify which folder to show, then select to filter by a generic name or a specific file type (i.e. all Java source files)

Defining New Filters - 2

New

File Filter

Name the new filter

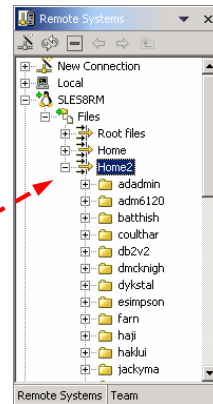
Filters are saved for easy re-use. Specify a unique name for this filter. This name will appear in the Remote Systems view, and will be expandable.

Filter name:

Select a profile to own the new filter. This determines if it is unique to you, or sharable by the team. It will be placed in the default filter pool for that profile.

Owner profile:

< Back Next > **Finish** Cancel

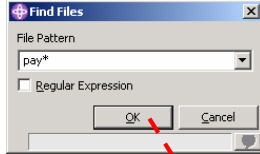
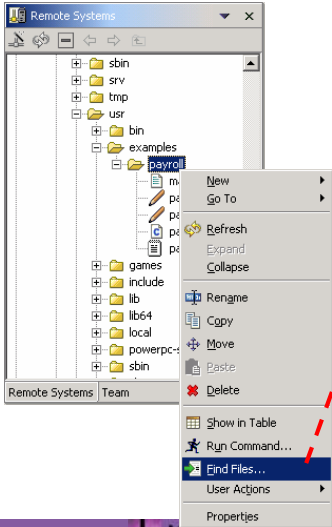


Next enter a meaningful name for your filter. Filters are saved so you can reuse them after shutting down and restarting the Workbench.

Remote Searching

Remote searching allows you to search for files based on either a generic name or regular expression.

Use the "Find Files..." action on the directory where you want to start searching from.



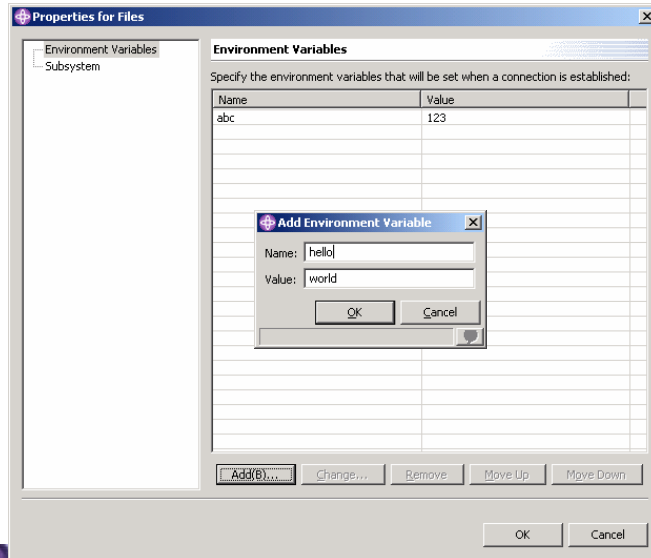
Name	Location	Last modified	Size	Read-only	Hidd
payroll	/usr/examples	November 3, ...	200 bytes	Yes	No
payroll.dat	/usr/example...	November 3, ...	13 bytes	No	No
payroll.cpp	/usr/example...	November 3, ...	4160 bytes	No	No
payfunc.hpp	/usr/example...	November 3, ...	3645 bytes	No	No

Search results are shown in the Remote Search view. Full popup menus are available on search results.

Setting Environment Variables

You can set environment variables for each RSE Linux connection. Each connection can have different environment variables.

Right click on the Files subsystem and select properties to get this dialog.



Compiling

Selecting the Compile (Prompt) action prompts the compile command so you can make changes before it runs.

To compile a file, right click on the file and select one of the compile options.

Output from the compile is shown in the remote shell. Double click on errors to open the file and position to the line with the error.

Remote System Explorer - IBM WebSphere Studio Application Developer

File Edit Navigate Search Project Run Window Help

Remote Systems

tmp
usr
examples
payroll
makefile
payclass.hpp
payfunc.hpp
payroll.cpp

Go To
Open With
Browse With
Refresh
Expand
Collapse
Rename
Copy
Move
Delete
Compile
Compile (Prompt)
User Actions
Properties

Location /usr/examples/
Name payroll.cpp

Prompt Compile Command

Optionally edit the command before running it. Press Run to run it.

Compile command
gcc -o payroll -lstdc++

Run Cancel

cd /usr/examples/payroll
gcc -o payroll -lstdc++

gcc -o payroll -lstdc++

payroll.cpp:51: previous non-function declaration 'int payou
payroll.cpp:150: conflicts with function declaration 'void p
double, double)'

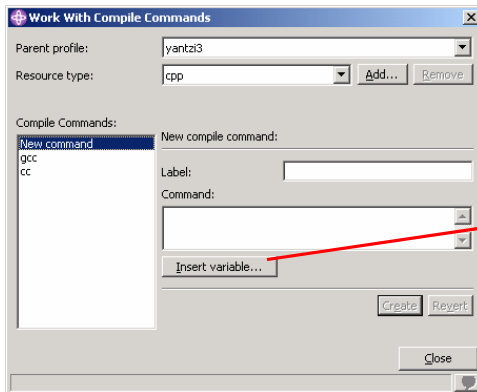
24

Linux Tools | Development Studio Client

© 2003 IBM Corporation

Work With Compile Commands

You can open the “Work With Compile Commands” dialog from the Compile popup menu or the File subsystem’s “Work With -> Compile Commands...” popup menu.



```

${container_name} - Name of folder containing selected resource
${container_path} - Path of folder containing selected resource
${resource_name_root} - Name of selected resource without extension
${resource_name} - Name of selected resource, unqualified
${resource_path_drive} - Drive letter on Windows, empty on Linux
${resource_path_root} - Root of selected file's path, "c:" on Windows, "/" on Linux
${resource_path} - Path of selected resource, including name and extension
${system_filesep} - File separator, "\" on Windows, "/" on Linux
${system_homefile} - Home directory on the target system
    
```

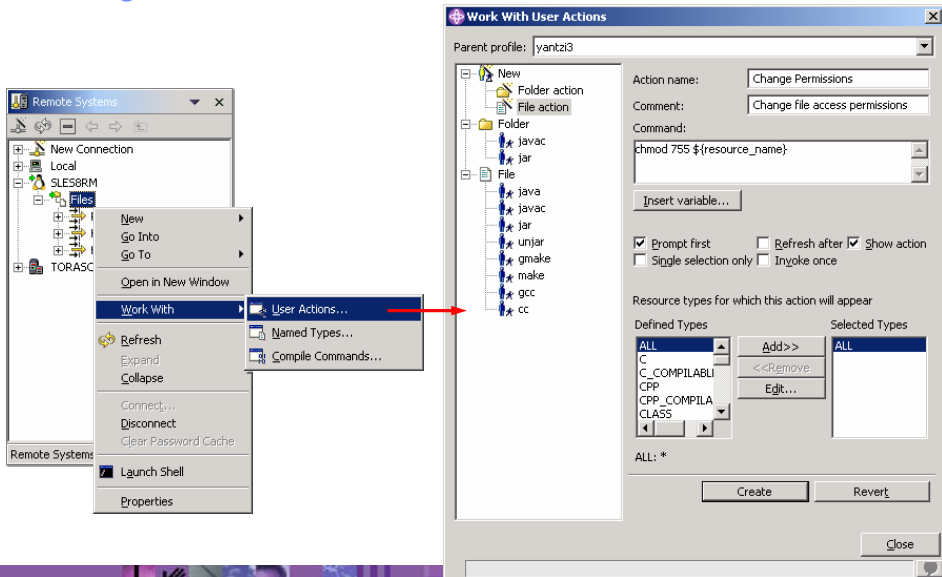
Use substitution variables to file in the resource name, resource type and other information based on the selection.

WDS provides some default compile commands for .java, .c and .cpp files types. You can add your own compile commands for any file type.

User Defined Actions

- You can add your own actions to the popup menus for folders and files in your Linux Connection
- Actions are scoped to a Folder or File
 - File actions can be further scoped to a named types
 - Name types are a collection of file types with a given name
 - For example: The "C" named type could include files of type .cpp, .c, .h and .hpp
- For your action, you can specify:
 - Substitution variables that are filled in at runtime based on the current selection
 - Whether or not to prompt your action first
 - Whether or not to refresh the view where your action was launched from
 - Incase your action creates or deletes resources

Creating User Defined Actions



Invoking a User Defined Action

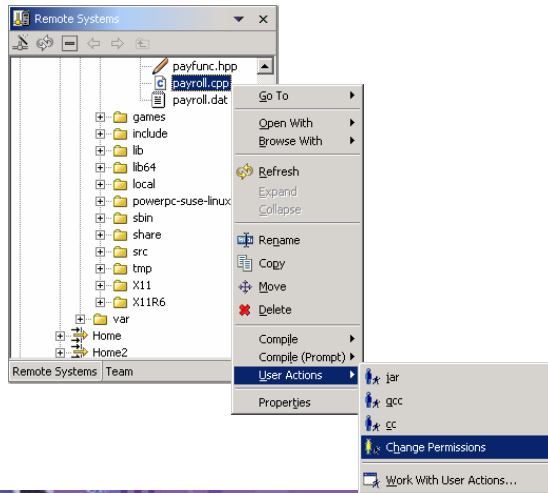


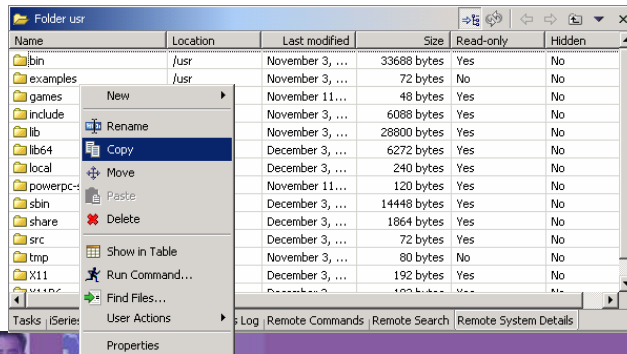
Table View

Instead of using the Remote Systems tree view you may want to use the table view.

The table view displays additional properties for each resource and provides the same actions as the Remote Systems view.

Use these controls to navigate through the table view

You can double click on folders to open the folder in the table view, or double click on files to open them in the editor





IBM Software Group

Linux as a Development Client

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

Linux as a Development Client

- So which tools run on Linux?

- The base Eclipse Workbench

- Download for free at eclipse.org

- Available using either Motif or GTK widget toolkits

- Lots of other open source plug-ins for Eclipse

- CDT: C/C++ Development Tools

- IBM WebSphere Studio Site Developer (WSSD)

- Java development

- Web development

- XML development

- IBM WebSphere Studio Application Developer (WSAD)

- WSSD +

- EJB Development

- Profiling Tools

Running WSSD or WSAD on Linux

- **First**
You need to buy and install either WSSD or WSAD for Linux

- **Next**
Running WSSD or WSAD on Linux is the same as running on Windows
Java, Web, XML and EJB technologies are cross-platform so it doesn't matter if you develop and test on Windows or Linux

Running the Base Eclipse Workbench

- **First:**
 - Download and install a Java Development Kit
 - Use JDK 1.3.x or higher
 - <http://java.sun.com>

- **Then**
 - Download and install the Eclipse Workbench
 - <http://www.eclipse.org>

- **It's all free!**

Base Eclipse Workbench

Workbench running on
Linux using GTK

- Base Workbench includes:

- Java Tooling

- Editor

- Syntax checking

- Content assist

- Refactoring

- Debugger

- Ant support

- CVS integration

- Easily share your Workspace

- resources with other team

- members

- JUnit support

- Automated Java unit test

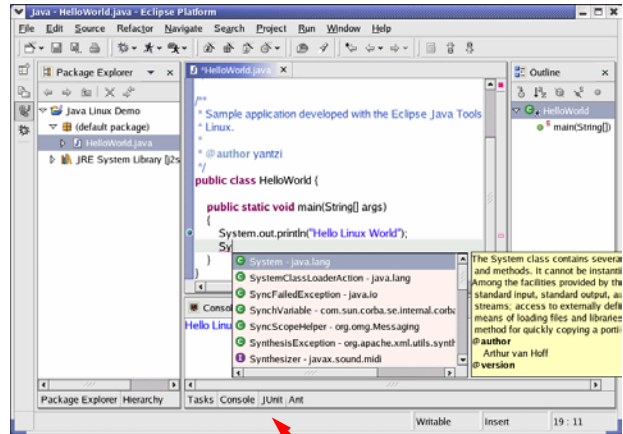
- framework and runtime

- Online help system

- Plug-in Development

- Use this to write your own

- Workbench tools!



Different views to display
output for the tools

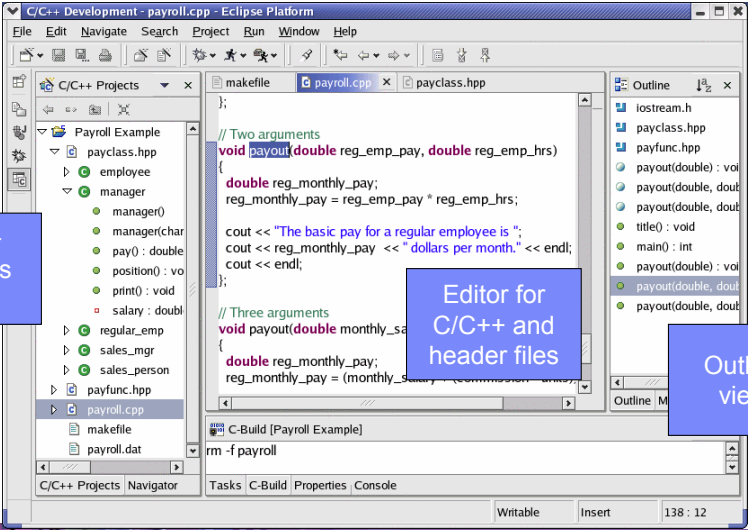
C/C++ Development Tools (CDT)

- Open source project to develop an IDE for C and C++ development on the Eclipse platform
 - Project hosted on eclipse.org
 - Primary focus is Linux as the development client and deployment platform
- CDT Includes:
 - Special C and C++ project types
 - Handle builds
 - Integrated error feedback with tasks view
 - Editor
 - Token highlighting
 - Outline view
 - Content assist
 - Templates
 - Debugger (uses GDB or GDB server if running remotely)
 - Searching

CDT Overview

C/C++ Perspective

C/C++
Projects
view

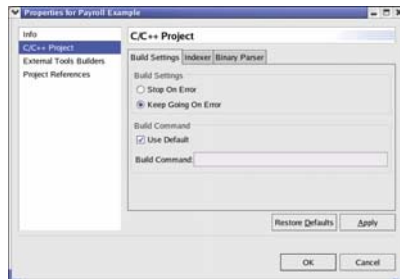


Editor for
C/C++ and
header files

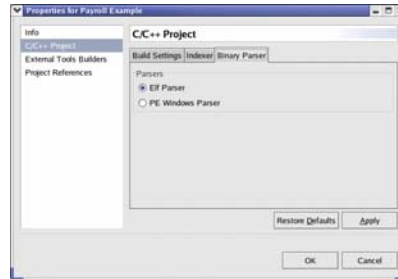
Outline
view

CDT: Setting Up Your Project

Setup your project builds, default is to use make



Binary parser allows you to expand binaries in your C / C++ project. Use Elf parser for Linux.



CDT provides a special C/C++ Project for doing C/C++ development. Project handles builds and parsing binary objects.

CDT: Building Your Project

Output from the build is shown in the C-Build view. Any errors from the build are added to the Tasks view. Double click on entries in the Tasks view to open the associated file and position to the error.

Use the Build actions on the project's popup menu. Use "Add Make Targets" to supply specific make targets to the Make -> menu

CDT: Running Your Application

The image shows two windows from the Eclipse IDE. The left window is the CDT editor for 'payroll.cpp', showing code for a payroll calculation. A red circle highlights the 'Binaries' folder in the project explorer. A red arrow points from this circle to the 'Run' dialog box on the right. The 'Run' dialog box is titled 'Run' and 'Create, manage, and run configurations'. It shows a configuration named 'Payroll Application'. A red arrow points to the 'Name' field. Another red arrow points to the 'C/C++ Application' field, which contains 'payroll'. A third red arrow points to the 'Run' button at the bottom of the dialog.

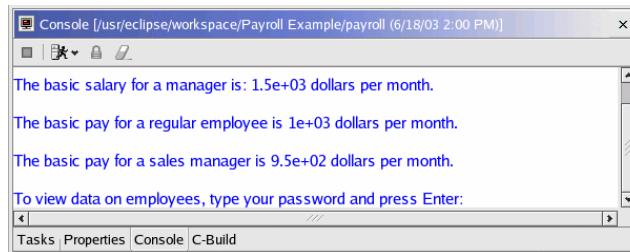
Enter a name for the launch configuration

Specify the application name, command line args, env vars, ...

CDT uses the launch configurations (Workbench standard) to run and debug C / C++ applications. Launch configurations are saved so you can easily re-run / debug your application.

CDT: Running Your Application

Application runs and all command line input / output is done using the Workbench Console view (same for run and debug)

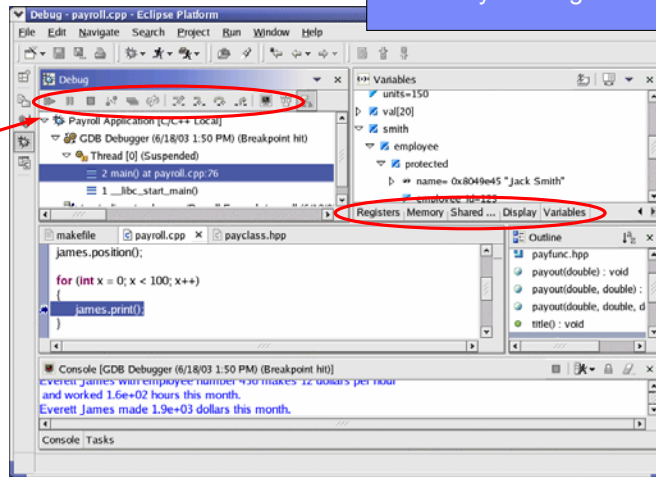


CDT: Debug

Use these views to examine variables, memory and registers.

Use these controls to resume, pause and stop the debugger, as well as step over, step into, ...

Debugger is launched the same way as run, except using the debug menu instead of the run menu



The same debug perspective is used for C/C++, Java, Web, RPG and COBOL!

EPIC Eclipse Perl Integration

- Collection of Perl plug-ins for Eclipse
- Currently contains:
 - Perl editor
 - Syntax highlighting
 - Syntax checking
 - Content assist
 - Outline view
 - Perl Debugger
 - Does not seem to be available yet, keep checking EPIC website
 - RegExp view
 - Regular expression evaluator and debugger
- Available from e-p-i-c.sourceforge.net

Warning:
Currently Under
Development

PHPeclipse

- Other open source projects:

COBOL Tools

Available from eclipse.org

PHPeclipse

PHP Editor for the Eclipse Workbench

Available from phpeclipse.org

Tons of others available!

Testing, Coding frameworks, ...

Additional Resources

- Eclipse.org
<http://www.eclipse.org>
- IBM DeveloperWorks
<http://www.ibm.com/developer>
- EPIC (Eclipse Perl Integration)
<http://e-p-i-c.sourceforge.net>
- PHPeclipse
<http://phpeclipse.org>

Agenda

- J2EE
 - A deeper look into J2EE
 - JDBC
 - J2EE Connector Architecture
 - Java Naming and Directory Interface
- Web Tooling
 - Web projects
 - J2EE Navigator and Hierarch Views
 - Cascading Style Sheets
 - Struts
- Server Tooling
 - Creating new server configurations in the test environment
 - Configuring the test environment

Introduction

- There are many different technologies at your disposal when creating Web applications (and lots of acronyms to go with them!)
 - J2EE, JDBC, JCA, JMS, CSS, HTML, JSP, WAS, ...
 - Each has it's own useful purpose
- However, some are more common than others
 - CSS – Cascading Style Sheets for defining a consistent look and feel across all your web pages
 - HTML and JSP – Replace DDS as way to define the user interface
 - Struts – Great architecture to follow for your overall Web application
 - JDBC – Database access and stored procedure call using SQL
 - JCA – Java Connector Architecture for calling iSeries programs and service programs

Purpose of this presentation is to cover the more common Web technologies in greater detail and provide you with a foundation to explore the others.



IBM Software Group

J2EE – The Technologies

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

J2EE - Components

- There are 4 main pieces to J2EE application model
 - Components
 - Containers
 - Services
 - Connectors

- Components (Modules)
 - You develop your code as components of a J2EE application
 - Many different types of components
 - Applets
 - Application clients (full graphical client)
 - Enterprise JavaBeans components (business logic)
 - Web components

J2EE - Containers

- Components run inside of a container
- Containers are typically provided by system vendors like IBM
 - Web and EJB containers are provided with WebSphere Application Server
- Provide services that can be used by used by the components which run in the container
 - Transaction support
 - Resource pooling
 - database connections
 - Often allow component behavior to be specified at deployment time instead of development time
 - Configuring which database to access
 - Maximum number of database connections

J2EE – Service Technologies

- The J2EE specification defines standard APIs to access many common services
 - JDBC
 - Database-independent method for using SQL
 - Database provides provide JDBC drivers
 - IBM, Microsoft, Oracle, ...
 - Java Transaction API
 - Naming Service
 - Java Naming and Directory Interface (more on this later)
 - J2EE Connector Architecture
 - Java Message Service (JMS)
 - There are others, but these are the main ones

J2EE – Connector Architecture

- Provides a standard / portable API to use in Java components to access Enterprise Information Systems (EIS)
- Typically provided by the EIS vendor
 - IBM provides connectors for
 - Calling an RPG or COBOL program
 - Accessing CICS

Everything is Components, Containers, Services and Connectors

***You develop your components using the help of the services
and connectors then deploy to a container!***



IBM Software Group

JDBC J2EE Connector Architecture (JCA) Java Naming and Directory Interface (JNDI)

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

JDBC

- Standard Java interface for running SQL
 - Independent of any single Database vendor
 - Works with DB2 UDB, Cloudscape, Informix, Microsoft SQL Server, Oracle, Sybase, ...
 - Lots of JDBC articles, books, web sites, ...
- Development time:
 - You write the code using JDBC and standard SQL
- Deployment time:
 - You specify which Database to use
 - This is configured in the “Web Deployment Descriptor” for you Web project (web.xml)
 - More on this latter!

JDBC Java Interfaces

- Use JDBC to:
 - Directly read, write and update DB2 UDB for iSeries using SQL
 - Call stored procedures written using RPG, COBOL or Java

- JDBC Terms
 - Connection (`java.sql.Connection`)
 - Live connection (session) with a specific database
 - Statements are associated with a Connection
 - Statement (`java.sql.Statement`)
 - Java interface used for executing SQL
 - PreparedStatement (`java.sql.PreparedStatement`)
 - Same as Statement, except it is precompiled for performance
 - Use PreparedStatement if you are running the same statement multiple times
 - CallableStatement (`java.sql.CallableStatement`)
 - Java interface used for calling stored procedures

JDBC Connection Pooling

- **Problem:**
 - In a typical web application there maybe 1000s of requests coming in every minute
 - There is a lot of overhead to create and close a connection to the database for every request
 - But you need a connection to run SQL queries
- **Solution:**
 - Use Connection pooling
 - Web App container creates JDBC connections in a pool
 - Instead of creating a Connection in your code you:
 - Ask the pool for a connection
 - Use the connection to run SQL statements
 - Return the connection to the pool so it can be reused

J2EE Connector Architecture (JCA)

- J2EE Connector Architecture provides a standard architecture for accessing various Enterprise Information Systems (EIS) from your Java application
 - RPG and COBOL programs or service programs
 - CICS
 - Enterprise Resource Planning (ERP) systems
- Resource Adapters
 - Provided by each vendor for their EIS system
 - Plugs into the application server and handles things like:
 - Communications
 - Transactions
 - Security

WDSC provides resource adapter for calling RPG and COBOL programs

```
D:\WDSC\iseries\eclipse\plugins\com.ibm.etools.iseries.webtools_5.0.1\lib\iseriespgmcall.rar
```


JNDI – How To Find Things

- **Problem:**
 - Many of the components to a web application are distributed across multiple servers
 - Components need to be dynamically changed or updated without having to modify the code and recompile
 - Changing a JDBC Database connection from the development database to the production database
- This is the domain of enterprise naming and directory servers
- Many different naming and directory server packages available
 - Need a standard way to interface with them so the code is not directly tied to a specific vendor's implementation

JNDI – How To Find Things

- Solution
 - Java Naming and Directory Interface (JNDI)
 - Allows developer to write programs that can lookup resources dynamically at runtime
 - Can easily change which database is used for JDBC without recompiling
 - Standard extension to the Java platform for connecting to and interfacing with naming and directory servers

- Use JNDI to locate other J2EE resources:
 - Database connections (JDBC)
 - RPG or COBOL program call resource adapters (JCA)
 - Message queue (JMS)

- JNDI is just an interface for locating services / components

Programming With JNDI – Two steps

- Writing you application using JNDI to locate components
 - Or have one of the wizards generate the code
 - iSeries Program Call wizard
 - Database pages wizard

- Configuring the naming and directory server with the components you need at runtime
 - For example: Define the Database connection and pooling information
 - In a Web application with is done by configuring the properties for the Web application server
 - More on this later...

Code Example: Using JNDI to Lookup JDBC Connection

```
// import JDBC Interfaces
import java.sql.Connection;
import java.sql.ResultSet;
import java.sql.Statement;

// import JNDI classes and interfaces
import javax.naming.Context;
import javax.naming.InitialContext;

...

// Retrieve JNDI context
Context initialContext = new InitialContext();
// Lookup JDBC DataSource using JNDI
DataSource datasource = (DataSource)
    initialContext.lookup("jdbc/customer");

// Use JDBC Data Source to run SQL query
Connection connection = datasource.getConnection();
Statement statement = connection.createStatement();
ResultSet results = statement.executeQuery("SELECT * FROM
    CUSTOMER");

// Do something with the result set
```



IBM Software Group

J2EE – The Tools

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

New Web Project Wizard

Use J2EE Web Project for Web applications with **dynamic content** (servlets and JSPs)

Checkboxes to automatically add Struts support and Tag libraries to your new Web Project

Use "Static Web Project" for Web sites with **no dynamic content** (just HTML and graphics)

Create a Web Project

Define the Web Project
Create a Web Project.

Project name: Demo Web Project

Use default
New project location: C:\Documents and Settings\yantzi\My Documents\IBM\wds Browse...

J2EE Web Project Static Web Project

Description:
In a J2EE Web Project you will be able to create content served by a traditional HTTP server (HTML, JavaScript, images, text...) as well as content to be served by a J2EE Application Server (Servlets, JSPs, EJBs...)

Web Project Features:

- Add Struts support
- Create a default .cvsignore file
- Create a default CSS file
- Include Tag Libraries for accessing JSP ot
- Include Tag Libraries for database access
- Include Tag Libraries for internationalizat

Description:
This Tag library is an implementation of the JSP Standard Tag Library. The JSTL provides a set of standard tags for common function. This feature should only be added to a Web Project with a J2EE level of 1.3.

< Back Next > Finish Cancel

New Web Project Wizard - 2

Each J2EE Web project must be associated with an **Enterprise application project**

Enterprise application projects are associated with test environment server configurations (for testing your Web Application)

Use J2EE 1.3 with WebSphere Application Server 5.0

Use J2EE 1.2 with WebSphere Application Server 4.0

Create a Web Project

J2EE Settings Page
Set the Enterprise Application project settings, context root, and J2EE level.

Enterprise application project: New Existing

New project name: DefaultEAR

Use default

New project location: C:\Documents and Settings\lyantzi\My Documents\IBM\wds Browse...

Context root: demo

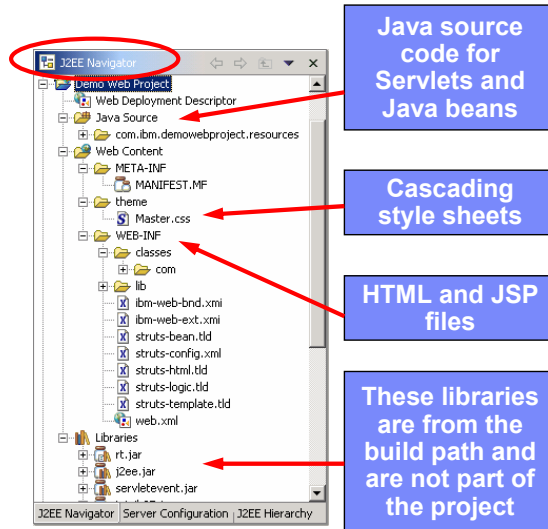
J2EE Level: 1.3

Description:
J2EE Level 1.3 includes a Servlet Specification level of 2.3 and a JSP Specification level of 1.2. Applications developed for this J2EE level typically target a WAS version 5.0 server.

< Back Next > Finish Cancel

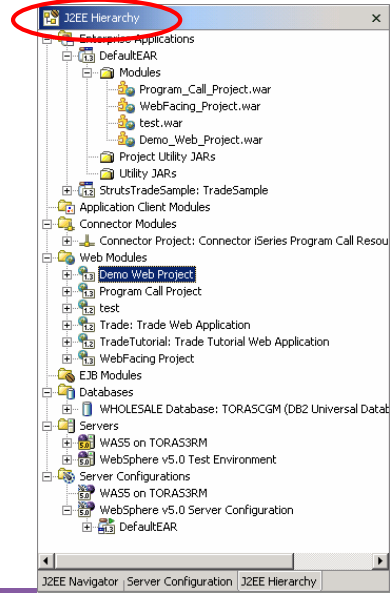
J2EE Navigator View

- The Web project that gets created complies (and enforces) the J2EE standard Web application structure
- J2EE Navigator view
 - Shows all J2EE related projects
 - Web Projects
 - EJB Projects
 - Connector Projects
 - Server Projects
 - Provides an easy way to manage your J2EE projects
 - Edit files
 - Copy, move rename and delete files



J2EE Hierarchy View

- Shows all of your J2EE resources in the workspace
 - Enterprise application projects
 - Web Projects (modules)
 - Enterprise JavaBean projects (modules)
 - Databases
 - Connectors
 - Test environment servers and configurations
- Displays resources in their hierarchy and how they are related
- Does not show projects



Cascading Style Sheets

- Cascading Style Sheets (CSS) provide a central place to define the appearance of all HTML and JSP pages in your Web app

Properties are specified for the various HTML tags like BODY, H1, H2, TABLE

Fonts, colors, spacing, margins, positioning, alignment, ...

- Stored in a separate .css file

Associated with HTML or JSP file using the HTML link tag

```
<LINK href="theme/Master.css" rel="stylesheet" type="text/css">
```

- CSS

Specialized graphical editor for working with CSSs

New HTML and JSP file wizards ask if you want to associate new file with an existing CSS

Cascading Style Sheet Editor

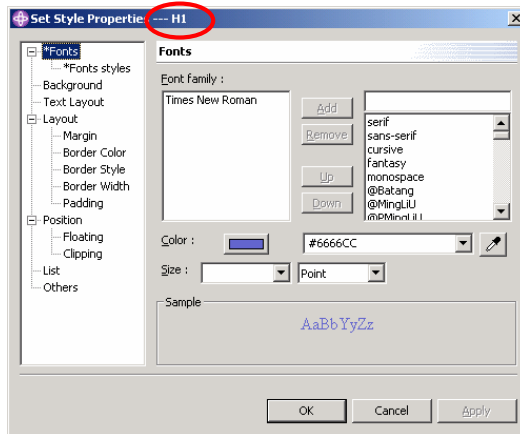
The screenshot displays the WebSphere Development Studio Client interface. The main window is titled "Web - WebSphere Development Studio Client Advanced Edition for iSeries". The "J2EE Navigator" on the left shows a project structure with "Master.css" circled in red. The "Properties" window below it shows CSS properties like "color" and "font-family". The central "Master.css" editor shows CSS code for BODY, H1, H2, and H3. A context menu is open over the H1 rule, with "Edit..." selected. The "Styles" view at the bottom right shows a preview of the H1 style, with "Style Of H1" circled in red. A blue callout box at the top right says "You can directly edit the CSS, or use the 'Styles' view at the bottom". Another blue callout box at the bottom right says "To use the 'Styles' view select the HTML tag, right click and select Edit...".

You can directly edit the CSS, or use the "Styles" view at the bottom

Preview area

To use the "Styles" view select the HTML tag, right click and select Edit...

Cascading Style Sheet Editor



Properties for the H1 (heading 1) HTML tag.

Changing a property here changes the look of all H1 tags in your Web application.

Dialog for graphically editing the properties for an HTML tag.

No need to know or learn the CSS syntax!

Struts

- What is Struts?
 - Open source framework for developing web applications
 - Sponsored by the Apache Software Foundation
 - Supports developing Web based applications that follow the
 - Model-View-Controller design

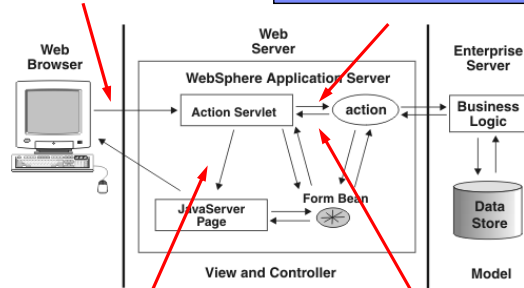
- How does it work?
 - Struts provides the Controller
 - You provide the Model and the View
 - Struts also provides:
 - Custom tag libraries for:
 - Internationalization

- Struts is supported by the WebSphere Studio development tools and the WebSphere Application Server runtime

Struts Overview

1. Incoming request from Browser

2. Struts ActionServlet looks up the corresponding action class for the request, populates the a form bean with incoming data and passes the request to the action class



4. ActionServlet forwards the request to the corresponding JSP which sends result to Browser as an HTML page

3. Action class processes the request (using OS/400 *PGMs and *SRVPGMs) places results in form bean and returns to ActionServlet

How Does It Work - Controller

- Struts ActionServlet is the Controller
 - Uses configuration file (struts-config.xml) to determine:
 - ActionFormBeans
 - Uses the <form-bean> tag
 - Global Forwards
 - Uses the <forward> tag
 - ActionMappings
 - Uses the <action> tag
- What do you do?
 - Create an ActionForm to send data between view and model
 - Write an Action class for each request
 - Configure ActionMapping for each request

How Does It Work – Controller - ActionForm

- Stores and validates data from incoming HTML pages
- Transfers data between the view and the model
 - Can be stored in either the session or the request
- Upon receiving a request, the controller populates the associated ActionForm with data from the request and forwards the form bean to the Action class
- ActionForm can optionally perform validation on input

Override the method:

```
validate(ActionMapping mapping, HttpServletRequest  
request)
```

Struts handles redisplaying input page with error messages

How Does It Work - Model

- Action class

Handle error checking and invokes business logic (model)

This is the part you have to code!

Implement the method:

```
public ActionForward execute(ActionMapping mapping,
                             ActionForm form,
                             HttpServletRequest request,
                             HttpServletResponse response)
```

Return ActionForward instance to specify where control goes next

Typically a JSP to return results of Action to browser

Maps to an **Global Forward** (defined in struts-config.xml)

- ActionMapping

This is how the ActionServlet determines which incoming URL requests get mapped to which Action classes

ActionMappings are stored in the struts-config.xml file, requires the following info:

Incoming URI

Name of Action class

Name of the form bean used by this Action

How Does It Work – View

- Struts includes tag libraries to help you
 - Create internationalized applications
 - Load in translated messages
 - Format dates and numbers for different locales
 - Automatically validate user input
 - Automatically redisplay input page with error messages from validation
 - Pre-fill HTML entry fields with data from your application

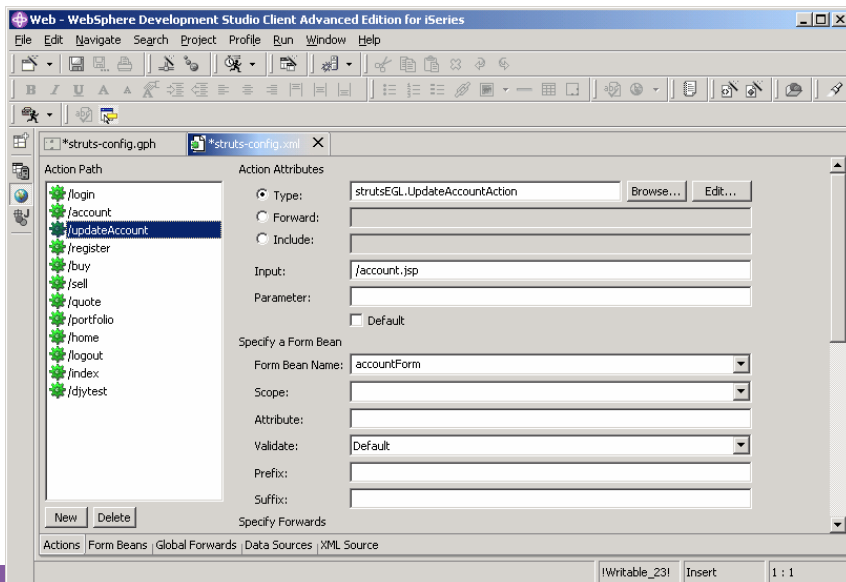
Struts Tools in Development Studio Client

- Enable Web projects for Struts, this automatically:
 - Creates struts-config.xml
 - Adds Struts tag libraries to the project

- Wizards to create
 - Form beans
 - Action classes

- Special Struts Configuration File Editor
 - You don't have to know XML or the XML syntax used in the struts-config.xml

Struts Configuration File Editor



Struts Tools – Web Diagram Editor

- Shows a graph view of your Struts based Web application
- Can be used as a central point for working with the Web app
- Useful for:
 - Adding new actions / form beans / JSPs
 - Editing existing actions / form beans / JSPs
 - Documenting overall architecture of the Web application
- As parts are added, deleted or updated in the Web diagram editor the struts-config.xml file is updated with changes

The screenshot displays the WebSphere Development Studio Client interface. The main workspace shows a Struts configuration diagram with nodes for 'index', 'index.jsp', 'login', 'home', 'portfolio', 'portfolio.jsp', 'account', 'register', 'register.jsp', 'buy', and 'vfo'. A 'Draw' menu is open, showing options for 'Action Mapping Node', 'Form Bean Node', 'Java Bean Node', 'Web Page Node', and 'Web Application Node'. A 'Web page' callout points to the 'index.jsp' node, and an 'Action Mapping Node' callout points to the 'index' node. A separate callout box states 'Double click on nodes to open associated editor.' The bottom of the window shows the status bar with '78', 'Linux Tools | Development Studio Client', and '© 2003 IBM Corporation'.



IBM Software Group

Server Tooling

Configuring the Test Environment

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

Servers and Server Configurations

- The test environment uses servers and server configurations to run and debug your web projects
 - The first time you test a Web project a server and server configuration is created for you
 - You can create your own, customize them and associate web projects with different servers
- Server Configuration
 - Setup and configuration information for a Server
- Server
 - Instance of a server configuration where you can test your Web applications
- Types of Servers and Server Configurations
 - WebSphere Application Server V5.0 and V4.0
 - Apache Tomcat V4.1, V4.0 and V3.2

Creating a New Test Environment Configuration

Create a New Server and Server Configuration

Create a new server and server configuration

Choose the properties for the new server.

Server name: Choose the properties for the new server.

Folder:

Server type:

- WebSphere version 5.0
 - Remote Server
 - Remote Server Attach
 - Test Environment
- WebSphere version 4.0
- Apache Tomcat version 4.1
- Apache Tomcat version 4.0
- Apache Tomcat version 3.2
- J2EE Publishing Server

Template:

Description: Runs J2EE projects out of the workspace on the local test environment.

Server configuration type:

Template:

Description: A server configuration for WebSphere version 5.0.

< Back Next > Finish Cancel

Create a New Server and Server Configuration

WebSphere Server Configuration Settings
Input settings for the new WebSphere server configuration.

Use default port numbers
HTTP port number:

Use consecutive port numbers
First port number:

**You will need to change the port number
if you plan on running multiple servers at
the same time.**

Editing a Server Configuration

Double click on the server configuration to open it in the editor

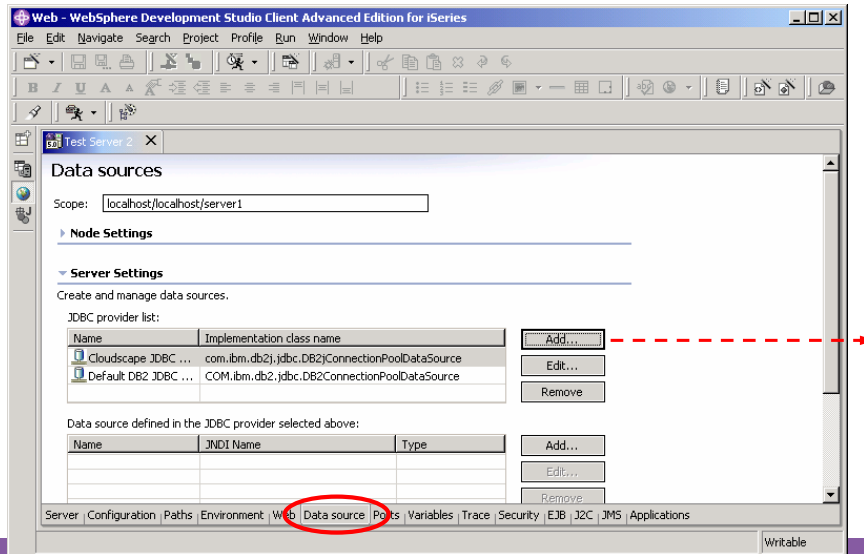
Various aspects of the server configuration that can be modified

Server	Status	Server State
Test Server 2	Stopped	The server should be republished
WebSphere v5.0 Test Environment	Stopped	The server should be republished
WASS on TORAS3RM	Stopped	The server should be republished

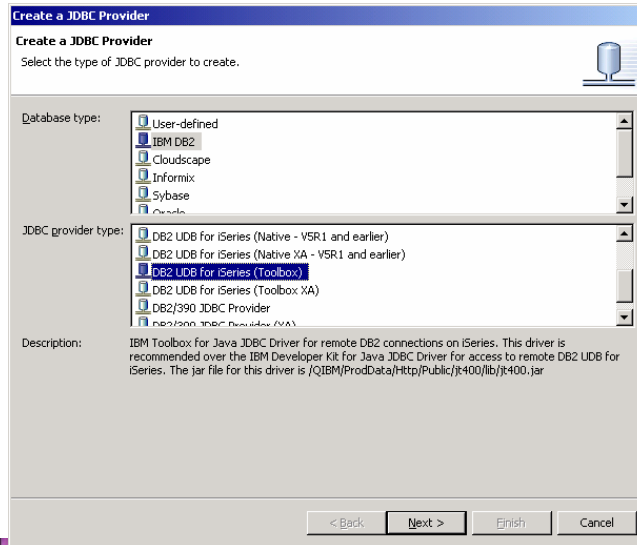
JDBC: Defining Connection Pools in the Test Environment

- Earlier we looked at JDBC, what it is and why you would use it
- Now we will look at how to configure JDBC connection pools in the WebSphere test environment
 - First you need to add the required JDBC driver to the **providers list**
 - Then you can define a connection pool for the JDBC driver

JDBC: Adding a Driver to the Provider List



JDBC: Adding a Driver to the Provider List - 2



JDBC: Adding a Driver to the Provider List - 3

Create a JDBC Provider

Create a JDBC Provider
Enter the properties of the JDBC provider.

Name:

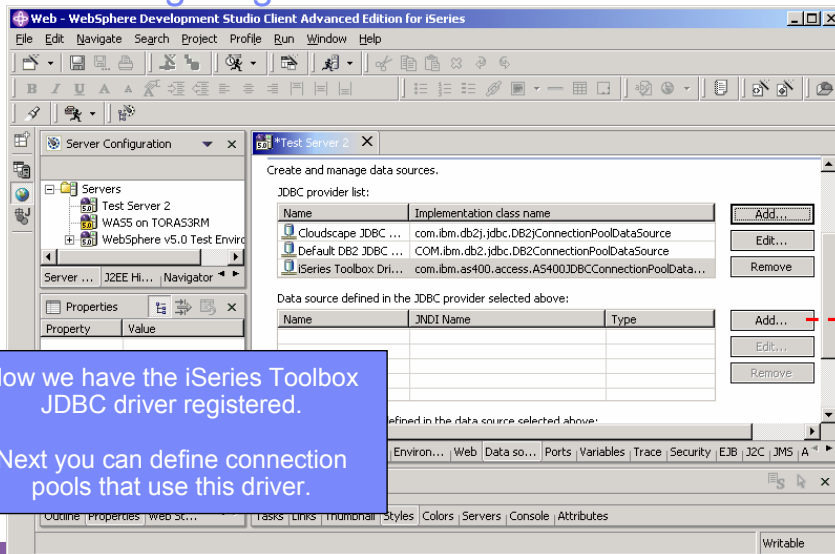
Description:

Implementation class name:

Class path:

Native path:

JDBC: Configuring a Connection Pool - 4



Web - WebSphere Development Studio Client Advanced Edition for iSeries

File Edit Navigate Search Project Profile Run Window Help

Server Configuration Test Server 2

Create and manage data sources.

JDBC provider list:

Name	Implementation class name	
Cloudscape JDBC ...	com.ibm.db2j.jdbc.DB2ConnectionPoolDataSource	Add... Edit... Remove
Default DB2 JDBC ...	COM.ibm.db2.jdbc.DB2ConnectionPoolDataSource	
iSeries Toolbox Dri...	com.ibm.as400.access.AS400JDBCConnectionPoolData...	

Data source defined in the JDBC provider selected above:

Name	JNDI Name	Type	
			Add... Edit... Remove

Now we have the iSeries Toolbox JDBC driver registered.

Next you can define connection pools that use this driver.

Modify Data Source
Edit the settings of the data source.

Name: Payroll DataSource

JNDI name: jdbc/payroll

Description: DataStore for accessing Payroll application database tables

Category:

Statement cache size: 10

Data source helper class name: com.ibm.websphere.rsadapter.DB2AS400DataStoreHelper

Connection timeout: 1800

Maximum connections: 10

Minimum connections: 1

Reap time: 180

Unused timeout: 1800

Aged timeout: 0

Burge policy: EntirePool

Component-managed authentication alias:

Container-managed authentication alias:

Use this data source in container managed persistence (CMP)

< Back Next > Finish Cancel

Use this JNDI name in your Code to lookup JDBC connections From this Data Source

Data Source settings for Payroll Database

Settings to control the number of Connections in this pool

Create a Data Source

Modify Resource Properties
 Edit the resource properties for this data source.

Resource Properties:

Name	Description
serverName	This property is required. The name of the server from which the data
access	This value can be used to restrict the type of operations that can be c
blockSize	This is the number of rows that will be fetched at a time for a result se
blockCriteria	Returns the criteria for retrieving data from the iSeries or AS/400 serv
cursorHold	Specifies whether or not ResultSets should remain open when a trans

Name: serverName
 Type: java.lang.String
 Required: Yes
 Value: TORAS1FB
 Description: This property is required. The name of the server from which the datasource will obtain connector

Additional properties specific to the JDBC driver, for example you need to specify a server name for the iSeries Toolbox JDBC driver.

< Back Next > Finish Cancel

Web - WebSphere Development Studio Client Advanced Edition for iSeries

File Edit Navigate Search Project Profile Run Window Help

*Test Server 2 X

JDBC provider list:

Name	Implementation class name	
Cloudscape JDBC ...	com.ibm.db2j.jdbc.DB2JConnectionPoolDataSource	Add...
Default DB2 JDBC ...	COM.ibm.db2.jdbc.DB2ConnectionPoolDataSource	Edit...
iSeries Toolbox Dri...	com.ibm.as400.access.AS400JDBCConnectionPoolData...	Remove

Data source defined in the JDBC provider selected above:

Name	JNDI Name	Type	
Payroll DataSource	jdbc/payroll	V5	Add...
			Edit...
			Remove

Resource properties defined in the data source selected above:

Name	Value	Type	
serverName	TORAS1FB	java.lang.String	Add...
access	all	java.lang.String	Edit...
			Remove

Server Configuration Paths Environment Web Data source Ports Variables Trace Security EJB J2C JMS Applications

Writable

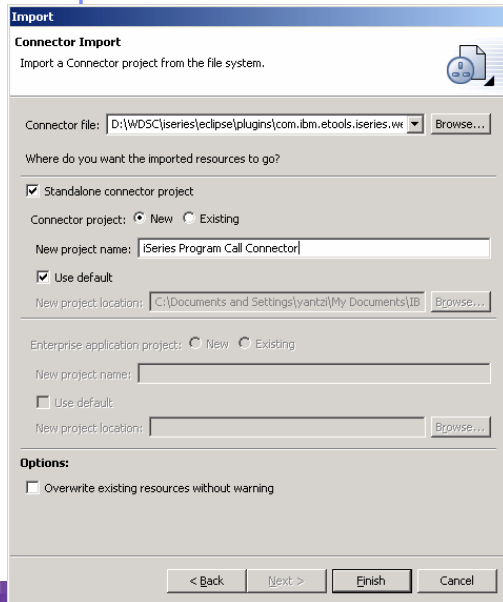
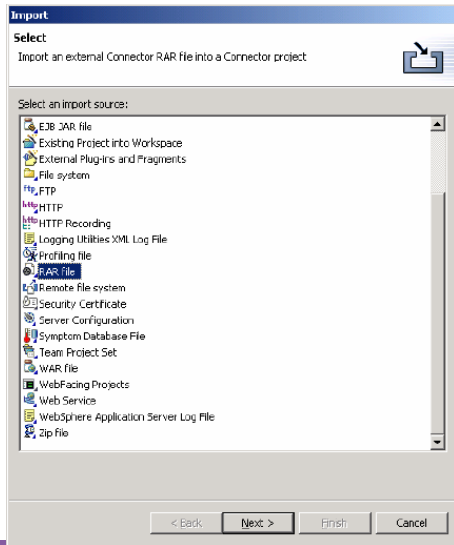
Done.

Now you can change which Database is used without having to modify the code.

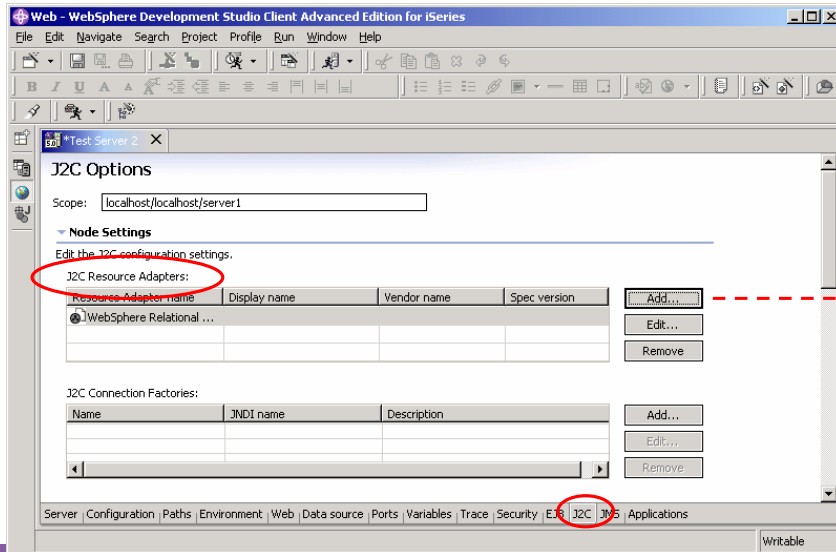
J2EE Connector Architecture

- Earlier we looked at the J2EE Connector Architecture, what it is and why you would use it
- Now we will look at how to configure JCA in the WebSphere test environment
 - First you need to import the required **Resource Adapter** into the Workbench
 - Resource adapters get imported into a special type of project called a Connector Project
 - Then you can define a Connection in the Server Configuration

JCA: Importing Resource Adapters into WDS



Adding Resource Adapters to the Test Environment



JCA: Configuring Resource Adapters in Servers

Create Resource Adapter

Resource Adapter Name: Series Program Call Connector

Display name: Series Program Call Resource Adapter

Version: 1.0

Description:

Vendor name: IBM

Spec version: 1.0

EIS type: ILE Program Call

License required:

License:

Transaction support: NoTransaction

Reauthentication support: false

Managed connection factory: com.ibm.connector2.iseries.pgmcall.ISeriesPgmCallManagedConn

Connection factory interface: javax.resource.cci.ConnectionFactory

Connection factory impl: com.ibm.connector2.iseries.pgmcall.ISeriesPgmCallConnectionFac

Connection interface: javax.resource.cci.Connection

Connection impl: com.ibm.connector2.iseries.pgmcall.ISeriesPgmCallConnection

Archive path: C:\Documents and Settings\yanitzl\My Documents\IBM\wds\w

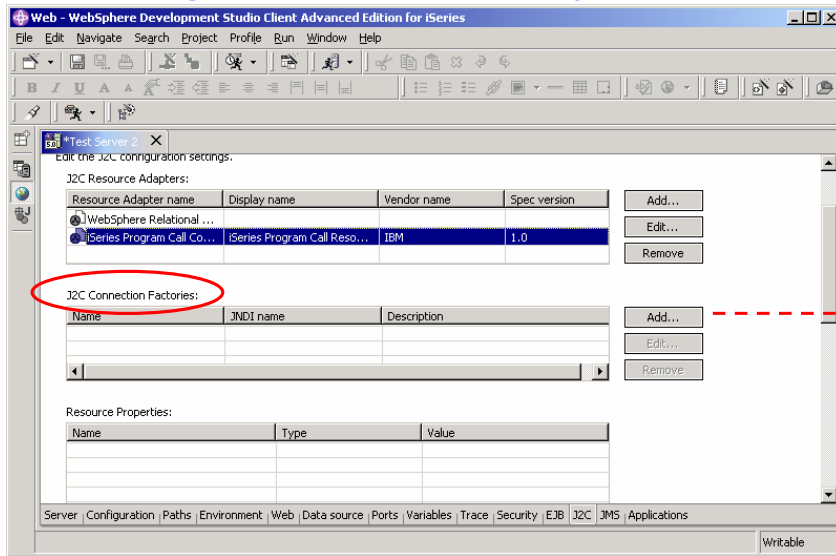
Native path:

Classpath: C:\Documents and Settings\yanitzl\My Documents\IBM\wds\w

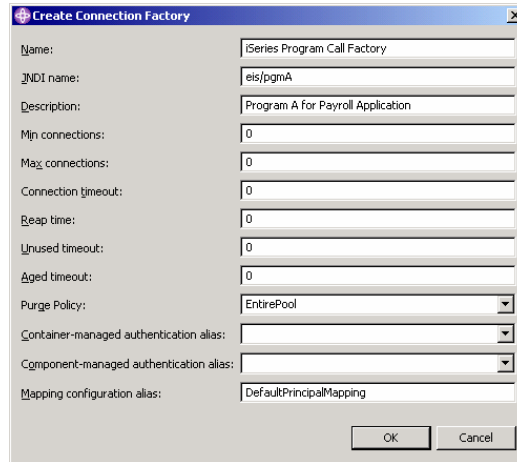
OK Cancel

Project where you imported the resource adapter

JCA: Creating A Connection Factory

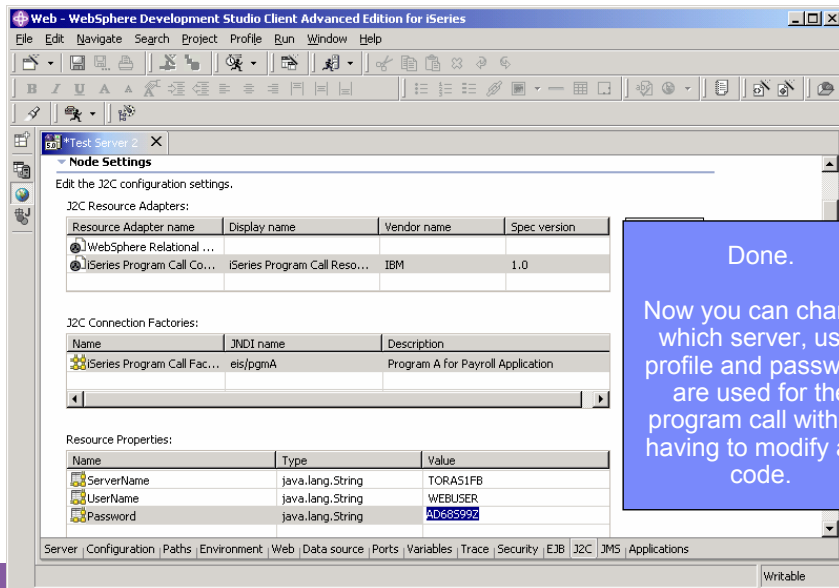


JCA: Creating A Connection Factory



Name:	iSeries Program Call Factory
JNDI name:	eis/pgmA
Description:	Program A for Payroll Application
Min connections:	0
Max connections:	0
Connection timeout:	0
Reap time:	0
Unused timeout:	0
Aged timeout:	0
Purge Policy:	EntirePool
Container-managed authentication alias:	
Component-managed authentication alias:	
Mapping configuration alias:	DefaultPrincipalMapping

JCA: Creating A Connection Factory



Web - WebSphere Development Studio Client Advanced Edition for iSeries

File Edit Navigate Search Project Profile Run Window Help

Node Settings

Edit the J2C configuration settings.

J2C Resource Adapters:

Resource Adapter name	Display name	Vendor name	Spec version
WebSphere Relational ...			
Series Program Call Co...	Series Program Call Reso...	IBM	1.0

J2C Connection Factories:

Name	JNDI name	Description
Series Program Call Fac...	eis/pgmA	Program A for Payroll Application

Resource Properties:

Name	Type	Value
ServerName	java.lang.String	TORAS1FB
UserName	java.lang.String	WEBUSER
Password	java.lang.String	AD68599Z

Server | Configuration | Paths | Environment | Web | Data source | Ports | Variables | Trace | Security | EJB | J2C | JMS | Applications

Writable

Done.
Now you can change which server, user profile and password are used for the program call without having to modify any code.



IBM Software Group

Summary

WebSphere. software



@.business software

July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation

Summary

- **Java 2 Enterprise Edition**
 - Standards based model for developing applications in Java
 - Web applications
 - Enterprise applications
 - Client / Server applications
 - Supported by major Web Application Server vendors

- **WebSphere Development Studio Client**
 - Great Web tools to make developing J2EE applications productive and easy
 - Views of your J2EE resources
 - Customized editors for all the various technologies
 - Cascading style sheets, JSPs, HTML, animations, server configurations, Web deployment descriptor, ...

Additional Resources

- J2EE Technologies
<http://java.sun.com/j2ee>
- Cascading Style Sheets
<http://www.w3c.org/Style/CSS/>
- Struts
<http://jakarta.apache.org/struts/>
- WebSphere Workbench Tools
<http://www.software.ibm.com/wsdd/zones/studio/>
<http://www.ibm.com/developer>

Trademarks & Disclaimers

© IBM Corporation 1994-2003. All rights reserved.

References in this document to IBM products or services do not imply that IBM intends to make them available in every country.

The following terms are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both:

AS/400	IBM (logo)
AS/400e	iSeries
e (logo) business	OS/400
IBM	

Lotus, Freelance Graphics, and Word Pro are registered trademarks of Lotus Development Corporation and/or IBM Corporation. Domino is a trademark of Lotus Development Corporation and/or IBM Corporation.

C-bus is a trademark of Corollary, Inc. in the United States, other countries, or both.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

ActionMedia, LANDesk, MMX, Pentium and ProShare are trademarks of Intel Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

SET and the SET Logo are trademarks owned by SET Secure Electronic Transaction LLC.

Other company, product and service names may be trademarks or service marks of others.

Information is provided "AS IS" without warranty of any kind.

All customer examples described are presented as illustrations of how those customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics may vary by customer.

Information in this presentation concerning non-IBM products was obtained from a supplier of these products, published announcement material, or other publicly available sources and does not constitute an endorsement of such products by IBM. Sources for non-IBM list prices and performance numbers are taken from publicly available information, including vendor announcements and vendor worldwide homepages. IBM has not tested these products and cannot confirm the accuracy of performance, capability, or any other claims related to non-IBM products. Questions on the capability of non-IBM products should be addressed to the supplier of those products.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only. Contact your local IBM office or IBM authorized reseller for the full text of the specific Statement of Direction.

Some information in this presentation addresses anticipated future capabilities. Such information is not intended as a definitive statement of a commitment to specific levels of performance, function or delivery schedules with respect to any future products. Such commitments are only made in IBM product announcements. The information is presented here to communicate IBM's current investment and development activities as a good faith effort to help with our customers' future planning.

Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

Photographs shown are of engineering prototypes. Changes may be incorporated in production models.

Disclaimer

- **Acknowledgement:**

This presentation is a collaborative effort of the IBM Toronto iSeries Application Development presentation team, including work done by:

Phil Coulthard, George Farr, Claus Weiss, Don Yantzi, David Slater, Alison Butteril, Linda Cole

- **Disclaimer:**

The information contained in this document has not been submitted to any formal IBM test and is distributed on an as is basis without any warranty either express or implied. The use of this information or the implementation of any of these techniques is a customer responsibility and depends on the customers' ability to evaluate and integrate them into the customers' operational environment. While each item may have been reviewed by IBM for accuracy in a specific situation, there is no guarantee that the same or similar results will result elsewhere. Customers attempting to adapt these techniques to their own environment do so at their own risk.

- **Reproduction:**

The base presentation is the property of IBM Corporation. Permission must be obtained PRIOR to making copies of this material for any reason.



IBM Software Group

Linux Tools in IBM WebSphere Development Studio Client for iSeries

WebSphere. software



July 2003 | Linux Tools: Development Studio Client

© 2003 IBM Corporation