



IBM Software Group

IBM® Rational® Web Developer V6.0
IBM® Rational® Application Developer V6.0
Team Programming



@business on demand.

© 2004 IBM Corporation
Updated January 25, 2005

Goals

- To understand the new team programming features in IBM Rational Application Developer V6.0



The goal of this presentation is to understand the new team programming features in IBM Rational Application Developer V6.0.

Agenda

- Overview
- ClearCase® Plug-in
- ClearCase Remote Client
- CVS Client
- Summary / References / Appendix



The best way to transfer these skills will be to walk through a quick overview so you can start with a foundation of information for learning team programming features.

Then you will hop right into team programming with the ClearCase Plug-in, known in the development circle as the ClearCase SCM Adapter plug-in. Then you will learn about the ClearCase Plug-in's successor, the ClearCase Remote Client, and the improvements it has over the ClearCase Plug-in.

You will finish up with CVS and its new features that were added to Eclipse 3.0, then packaged within IBM Rational Application Developer V6.0.

Team Programming: Overview

- Team programming software is needed to manage a development team's source code with version control
 - ▶ each team member's contributions are saved, not overwritten or lost
- Rational ClearCase Plug-in and ClearCase LT
 - ▶ Entire team programming solution in the box, client and server
 - ▶ Stores versioned data in a network-accessible Version Object Bases or VOBs (repository)
 - ▶ Uses Views to "look at" data in VOBs
 - ▶ The client plug-in provides all the control functions (ex: synchronize, checkout, update)
- CVS (Concurrent Versioning System)
 - ▶ CVS is a free open-source SCM (Source Control Management) software mostly used by UNIX-based development teams, server not packaged with IBM Rational Application Developer V6.0
- Both have a client – server architecture



To start, you need to know why team programming software is used. The best way to show why is to use an example. Lets say a team of developers edit the same file at the same time. What happens when they try to save that file? Without team programming software, that file could be overwritten and your updates lost, 1 person editing a file at one time only, etc. Therefore, team programming software is needed to manage your source code so that it is not lost or overwritten.

So what is ClearCase? Rational ClearCase (acronym CC) is a comprehensive client-server tool for version control, workspace management, and build management. It allows for the version control of files and directories. Then it stores this versioned files and directories in a network-accessible Version Object Base or VOB (repository).

ClearCase has two pieces, a server and a client. IBM Rational Application Developer V6.0 provides the client software (or plug-in) that connects to a ClearCase server. This client piece provides all the control functions (synchronize, checkout, update, etc) that you need to interact with the server, and the server simply stores the information in the VOBs.

Server prerequisites hinge upon the installation on Windows™ NT/2000/Server machine. The client is part of IBM Rational Application Developer V6.0, therefore it takes IBM Rational Application Developer V6.0's prerequisites.

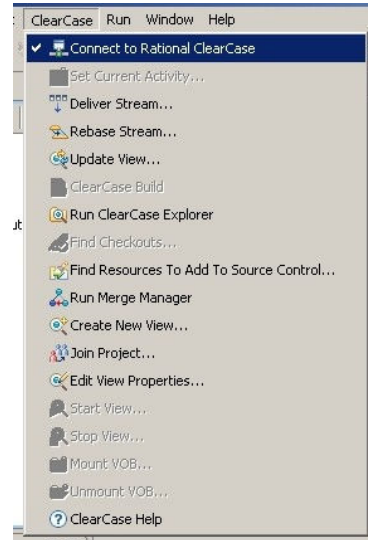
CVS stands for Concurrent Versioning System. It is an open source SCM mostly used by UNIX-based development teams, but is available for Windows and Macintosh operating systems. Open source simply means the server is a free download from cooperating sites, therefore there are many users. CVS also uses a client server model like ClearCase, though more simplified. wincvs.org, cvsnt.com

Section

ClearCase Plug-in

ClearCase Plug-in: Installation

- The ClearCase Plug-in (a.k.a. - CC SCM Adapter Plug-in) and ClearCase Light server is included with all Rational Software Development Platform products
 - ▶ Exception: ClearCase Light is not packaged in Rational Web Developer V6.0
- ClearCase Plug-in is installed by default with base IBM Rational Application Developer V6.0
- ClearCase LT server is still an install option from the launchpad but leads to a download site

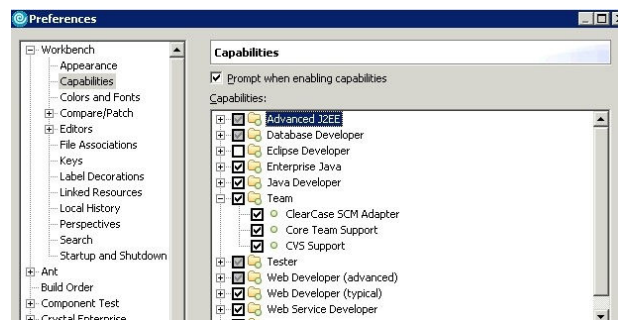


The ClearCase Plug-in (a.k.a. - CC SCM Adapter Plug-in) is included with all Atlantic SDP products, as is ClearCase Light (CC LT v2003.06.13 (SR3 , with the exception of RWD.

CC SCM Adapter (or ClearCase Plug-in) is installed by default, so there is no need to choose optional component at install time (like in V5). However, the ClearCase server (full or light version) still needs to installed. ClearCase LT is still an option from the IBM Rational Application Developer V6.0 launchpad.

ClearCase Plug-in: Capabilities

- ClearCase Plug-in (SCM Adapter Plug-in) added to new Eclipse “Capabilities” feature
 - ▶ allows for a plug-ins menus and functions to appear/disappear as needed
- The ClearCase Plug-in capability is **disabled** by default
- Automatically enabled under following conditions:
 - ▶ CC/CC LT is detected at IBM Rational Application Developer V6.0 startup
 - ▶ A project is imported from a ClearCase view
 - ▶ A project is added to source control (using Team > Share) in a CC view



CC SCM Adapter added to new Eclipse “Capabilities” feature.

Capabilities allow for a plug-ins menus and functions to be turned on and off as needed.


CC SCM Adapter capability is disabled by default and are automatically enabled under following conditions:

CC/CC LT is detected at IBM Rational Application Developer V6.0 startup

A project is imported from a ClearCase view

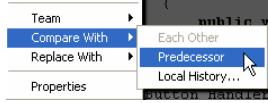

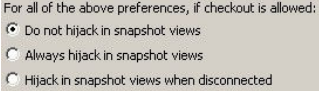
A project is added to source control (using Team > Share) in a CC view

Can be turned on and off manually. Go to Window > Preferences > Workbench > Capabilities > Team > ClearCase SCM Adapter.

IBM Software Group 

ClearCase Plug-in: New Features

- Improved diff/merge support
 - ▶ Integrated with Eclipse compare/merge framework
- Workspace / view management
 - ▶ Support for workspace switching (Eclipse feature)
- Improved Disconnected Mode
 - ▶ Manual Disconnect option
 - ▶ New preferences to auto-hijack a file
- Miscellaneous usability enhancements
 - ▶ New Join Project operation from the ClearCase Menu bar
 - ▶ Background task for connect operation

Team Programming 8 © 2004 IBM Corporation

Rational development has worked to improved their diff/merge support by integrating with the Eclipse compare/merge framework. The new compare/merge framework updated in Eclipse v3.0 proved to be very robust, therefore IBM Rational Application Developer V6.0 adds to this framework.

The support for workspace switching (Eclipse feature) helps ClearCase customers, since many times they use a workspace for a ClearCase View. Views are how ClearCase “looks at” the data stored in VOBs. For example, if you want to look at library books sorted by author and written in the 1960s, you would use a view.

Also there is a new preference to auto-hijack a file. Auto-hijack is necessary when you are trying to edit a file when working offline or if the file is locked. So if checkout is allowed, you can set IBM Rational Application Developer V6.0 to never hijack, always hijack, or hijack just when disconnected.

Now there is a Manual Disconnect option when starting IBM Rational Application Developer V6.0. Previously you would have to shut down the IDE and bring it back up and choose not to connect if you wanted to disconnect.

For usability enhancements, there is a new New Join Project operation from the ClearCase Menu bar. This allows you to combine two ClearCase projects.

When connecting to a ClearCase server, the connect operation now has been added as a Run In Background operation. Therefore, when connecting to a large amount of data, you can click the Run In Background button, and continue working while it connects.

ClearCase Plug-in: Preferences

ClearCase SCM Adapter

When files under source control are edited or saved and...

- Checked in files are edited by an internal, interactive editor: Prompt to checkout
- Checked in files are edited by an internal, non-interactive editor: Automatically checkout
- Checked in files are saved by an internal editor: Automatically checkout

For all of the above preferences, if checkout is allowed:

- Do not hijack in snapshot views
- Always hijack in snapshot views
- Hijack in snapshot views when disconnected

When workspace is closed: Prompt to checkin

When new resources are added: Prompt to add to source control

ClearCase decorations: Enable Icon Decorations

When parent directory is automatically checked out to move, rename, or delete an element: Automatically check in parent directory

Save dirty editors before ClearCase operations: Prompt to save all editors

Build command: make -s -f "\${ProjPath}\\${ProjName}.mak

Automatically connect to ClearCase on startup

Set default to check out files after adding them to source control

Perform Refresh Status operations recursively

Decorate project root names with viewtags

Request Status information on demand only

Advanced Options...
Restore Defaults Apply
OK Cancel

ClearCase Plug-in: Preferences

- Diff Merge Patterns preference page allows you to specify the file patterns you wish to merge
 - ▶ Only valid for file types that can be compared/merged in Eclipse
- New Compare/Merge Server preference page under Workbench option controls behavior of the Eclipse compare/merge server
 - ▶ Important for compares/merges that are invoked externally
- Changed preferences:
 - ▶ Auto connect to ClearCase, disabled by default.
 - ▶ Fetch CC status on demand only
 - enabled by default
 - improves performance.
- Known Limitations
 - ▶ Eclipse compare/merge integration will only work for
 - performing comparisons from within IBM Rational Application Developer V6.0
 - for merges that result from checking in a old file (not the latest version of a file)



Diff Merge Patterns preference page allows you to specify the file patterns you wish to merge using either native CC Diff Merge tools or Eclipse tools

Only valid for file types that can be compared/merged in Eclipse

New Compare/Merge Server preference page to control behavior of the Eclipse compare/merge server

Important for compares/merges that are invoked externally

New preferences to control hijack status when files are edited

Allow for more control of how files are treated when working offline

Preference to manually enable/disable capability is under Workbench > Capabilities > ClearCase SCM Adapter

Changed preferences:

One of the options in V5 that caused some problems was Auto-connect to ClearCase when starting IBM Rational Application Developer V6.0. This is now disabled by default.

Fetch CC status on demand only, enabled by default, improves performance.

Known Limitations

Eclipse compare/merge integration will only work for performing comparisons from within RAD or for merges that result from checking in a non-LATEST file

All compares/merges that occur external to RAD will result in bringing up the native CC DiffMerge tools, regardless of Compare/merge preference

Section

ClearCase Remote Client

ClearCase Remote Client: Overview

- Successor to the ClearCase Plug-in (SCM Adapter Plug-in)
- Available with SR4 release of ClearCase
- Improved WAN performance
 - ▶ Designed for high latency networks
 - ▶ Provides a complete solution for remote developers (regardless of their IDE)
- Full lifecycle application development support
 - ▶ Improved user experience for Eclipse-based developers
 - ▶ Enhanced Team integrations with the Rational Software Development Platform
- Consistent UI for Windows™ and Unix/Linux® platforms
 - ▶ Based on Java™/Eclipse technology

12

Team Programming

© 2004 IBM Corporation

Rational Development will continue to make fixes and minor enhancements to the CC SCM Adapter. Major development effort for Eclipse is focused on the new ClearCase Remote Client feature, which will eventually replace the CC SCM Adapter

The CC SCM Adapter will also be made available for Eclipse 3.0 users to download

Plug-in will be available on developerWorks

<http://www-106.ibm.com/developerworks/rational/library/1376.html>

Improved WAN performance

Designed for high latency networks

Provides a complete solution for remote developers (regardless of their IDE)

Full lifecycle application development support

Improved user experience for Eclipse-based developers

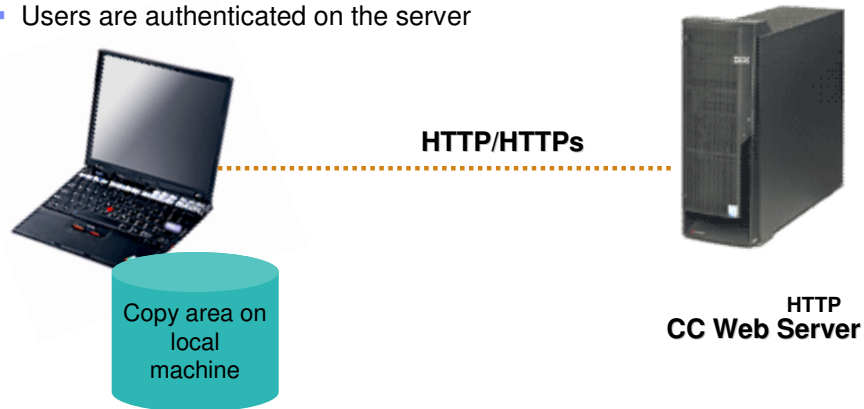
Enhanced Team integrations with the Rational Software Development Platform

Consistent UI for Windows and Unix/Linux platforms

Based on Java/Eclipse technology

ClearCase Remote Client: What is it?

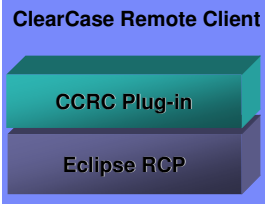
- Designed for high latency networks
 - Utilizes HTTP or HTTPS to communicate with the server instead of RPC calls
- Requires only a single port to traverse firewalls
 - Supports reverse proxy
- Users are authenticated on the server



Designed for high latency networks. Utilizes HTTP or HTTPS to communicate with the server instead of RPC calls. Requires only a single port to traverse firewalls, in addition supports reverse proxy. Users are authenticated on the server by way of basic authentication or windows authentication

ClearCase Remote Client: Overview

- Based on Eclipse Rich Client Platform (RCP)
- Targeted at any CC developers and Eclipse Developers who need remote access to ClearCase
- Support for Rational lifecycle integrations, including ClearQuest Client for Eclipse



ClearCase Remote Client

ClearCase Navigator View

ClearCase Details View

ClearCase Synchronize and Search Results View

Name	Size	Kind	Modified Time	State	Version
AdminFrame.java	3051	File Element Vers...	May 20, 2004 6:25:49 PM	Loaded	{man}
CDAdmin.java	2313	File Element Vers...	May 20, 2004 6:25:50 PM	Loaded	{man/Rel3_Integration/1}
CDMainPane.java	17189	File Element Vers...	May 20, 2004 6:25:50 PM	Loaded	{man/1}
CustomerMainPane.java	17452	File Element Vers...	May 20, 2004 6:25:50 PM	Loaded	{man/1}
Fonts.java	3612	File Element Vers...	May 20, 2004 6:25:50 PM	Loaded	{man/Rel3_Integration/1}
Login.java	4761	File Element Vers...	May 20, 2004 6:25:51 PM	Loaded	{man/Rel3_Integration/1}
TaMainPane.java	12131	File Element Vers...	May 20, 2004 6:25:51 PM	Loaded	{man/1}

Name	State	Path
.classpath	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
project	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
admin	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
AdminFrame.java	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
business	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CD.java	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CDAdmin.java	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CDAdminServlet.java	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CDCatalogServlet.java	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CDCustomerIDServlet...	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CDDB.java	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CDDetailsServlet.java	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...
CDFeedbackServlet.1...	Loaded	C:\Documents and Settings\sschurma\stef_Rel3_dev\Classics...

ClearCase Remote Client: Service Release 4 Features

- Eclipse Integration (not applicable to stand-alone version)
 - ▶ Supports Eclipse 3.0
 - ▶ Supports any of the Rational Software Development Platform 6.0 products
 - Including Rational Application Developer, Rational Software Architect, etc.
 - Comprehensive compare/merge support for UML models
 - ▶ Complete ClearCase perspective & views
 - Integrates with any other Eclipse perspective
 - ▶ Eclipse Team provider support
 - Ability to import and export Team Project Sets from the CC perspective, automatically updates load rules
 - Ability to Import Projects from the CC perspective
 - ▶ Integration with the Eclipse compare/merge tools for performing structured Java comparisons
 - ▶ Supports Eclipse Compare/Replace With operation



Eclipse Integration (not applicable to stand-alone version)

Supports Eclipse 3.0

Supports any of the Rational Software Development Platform 6.0 products

Including Rational Application Developer, Rational Software Architect, etc.

Comprehensive compare/merge support for UML models

Complete ClearCase perspective & views

Integrates with any other Eclipse perspective

Eclipse Team provider support

Ability to import and export Team Project Sets from the CC perspective

Automatically updates load rules

Ability to Import Projects from the CC perspective

Integration with the Eclipse compare/merge tools for performing structured Java comparisons

Supports Eclipse Compare/Replace With operations

ClearCase Remote Client: Installation & Packaging

- Remote Client is bundled with ClearCase Web Server on the ClearCase product media
- No need to install full ClearCase client on user desktop
- Installing the ClearCase Web Server will automatically configure the Remote Client download site with...
 - ▶ a default URL to download and install the Stand-alone Remote Client
 - ▶ a default Eclipse Update Site to install the Remote Client into existing Eclipse instances
 - ▶ Customers can manage their own update sites for user upgrades

Remote Client is bundled with ClearCase Web Server on the ClearCase product media

No need to install full ClearCase client on user desktop

Installing the ClearCase Web Server will automatically configure the Remote Client download site with...

- a default URL to download and install the stand-alone Remote Client

- a default Eclipse Update Site to install the Remote Client into existing Eclipse instances

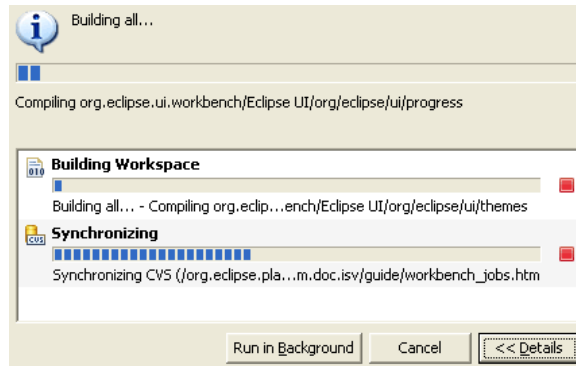
- Customers can manage their own update sites for user upgrades

Section

CVS Client

CVS Client: Enhancements

- New Progress view
 - ▶ Shows CVS checkout
 - ▶ Workspace building in background operation (Run In Background)

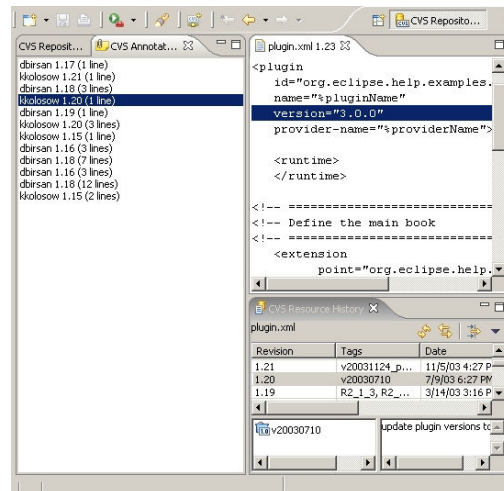


The new Progress view showing the progress of a CVS checkout and a Workspace build background operation. Many user operations can now optionally be run in the background. When you see the progress dialog with the Run In Background button you can select it and the operation you are running will allow you to continue to work. CVS operations have been enabled to run in the background. This means that you can spend more time working and less time looking at the synchronize, update, compare, and checkout progress dialogs.

This dialog also shows you the details of other currently running operations in the workspace and informs you when one operation is blocked waiting for another to complete.

CVS Client: Blame View – Annotate View

- Shows which user changed or added code to a text based file
- Opens the file in editor and highlights code changed when clicking on annotation entry



Blame View - Show Annotation

Assume you have found a bug on line 65 of a file and you don't understand the code. Who do you ask, or blame, for the change? Well you could start by looking at the resource history for the file, but that won't tell you who changed that particular line. This is why the Annotate command is useful. You can pick any ASCII file (see note on binary files) and get a listing of who changed what line.

The Show Annotation action is available from the following places: History View, Repository Explorer, Synchronize View, and the Resource and Packages View. When the annotate is run you will be able to:

Step through changes in the Annotate View and the text editor will highlight the associated lines associated with the selected change.

You can select a line in the text file and the Annotate View will select the change that is associated with that line.

The History View will show the history for the opened file and highlight the revision of the currently selected change. This allows you to quickly see the commit comment for a particular change.

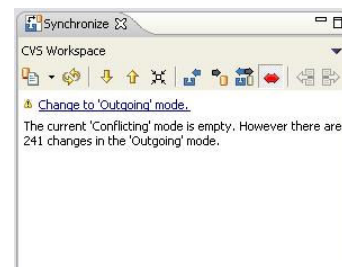
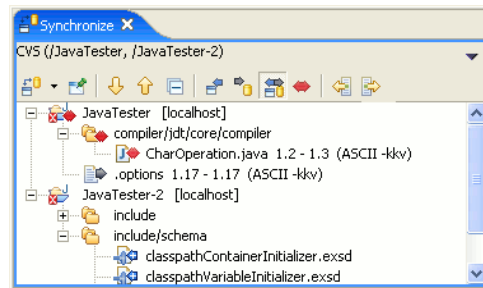
Only works with text files

The annotate command will only work with files that are marked as ASCII in the CVS repository. Also, the command will open a text file to show the changes even if the associated editor in the workbench is a non-text editor. For example, if you run annotate on a plugin.xml file a simple text editor will be opened instead of the full PDE editor.

CVS Client: Synchronize View

■ New Features

- ▶ Multiple synchronizations viewable
- ▶ Dynamically update with workspace changes
- ▶ Problem Markers and label decorations
- ▶ Warnings about filter changes



The Synchronize View has changed significantly since 2.1. Here is a short list of the new features:

Multiple synchronizations can appear in the view. A dropdown action allows navigating between them.

The view dynamically updates when changes are made to the workspace. This means that you don't have to synchronize to browse outgoing changes.

There are new helpful decorations: problem markers are displayed, conflicts are propagated to parents, and when a background operation is working on an element in the view it appears in italics until the operation is complete.

You can configure a synchronize to periodically run in the background.

There are new layouts: hierarchical, compressed folders, commit sets.

Problem Markers

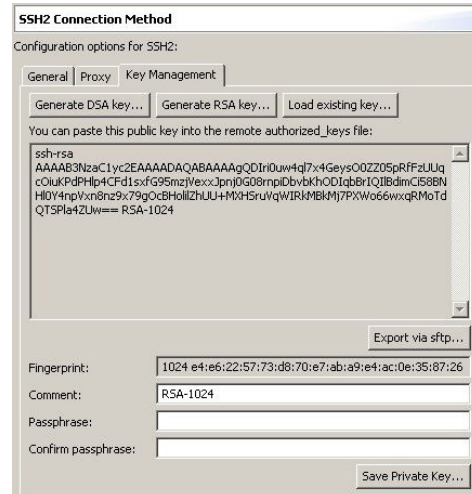
The Synchronize View now shows error and warning problem markers. This will help users avoid releasing changes that contain problems or are in projects that contain problems.

Global Synchronize Action

A Team Synchronize action has been added that allows quick access to the synchronize actions for loaded repository tools. For CVS, it allows scoped synchronization and ability to schedule synchronizations. The action can be key-bound for quick access.

CVS Client: SSH2 Support

- SSH2 Encryption added
- Can generate keys from CVS preferences
- Includes an SSH client for accessing a remote CVS server



21

Team Programming

© 2004 IBM Corporation

The **extssh** CVS connection method now supports connecting to CVS servers running SSH2. The **Team > CVS > SSH2 Connection Method** preference page also allows you to create and manage your SSH2 keys. SSH2 Encryption added

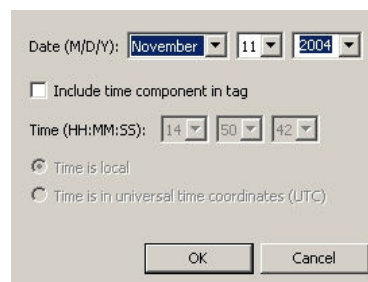
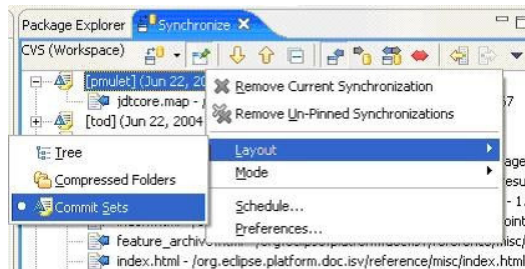
Connecting and configuring CVS with SSH

Eclipse includes an SSH client for accessing a remote CVS server. The client supports both the SSH1 and SSH2 protocol versions. To use SSH2 with a CVS repository select the extssh connection type.

Different methods can be used to authenticate, depending on the level of functionality and security you want. User authentication methods used by the client by default are, in the following order: public-key, Keyboard-Interactive, and password authentication.

CVS Client: Miscellaneous Updates

- New Layouts
 - ▶ Tree
 - ▶ Compressed folders
 - ▶ Commit Sets
- CVS operations run in background
 - ▶ Synchronize
 - ▶ Update
 - ▶ Compare
 - ▶ Checkout
- CVS Date Tags



There are three options for Synchronize view layout for CVS: Tree, Compressed Folders and Commit Set.

Tree layout shows the resource hierarchy as it is shown in the Resource Navigator.

Compress Folders shows changes grouped by project and then by folder. This results in a hierarchy that is at most three levels deep with folder paths being compressed into a single level (similar to a Java package).

Commit Sets shows incoming changes grouped by commit comment which is handy for seeing who released what and why. Since outgoing changes have no commit comment, they are shown at the root of the tree.

CVS operations have been enabled to run in the background. This means that you can spend more time working and less time looking at the synchronize, update, compare, and checkout progress dialogs. You can now use date tags to compare, checkout, merge, or simply browse a CVS repository. You can add date tags from either the CVS Repositories view or from any tag selection page.

Summary

- Rational Team Programming software and CVS integrate within IBM Rational Application Developer V6.0
- The ClearCase Plug-in will be superceded by the ClearCase Remote Client
- CVS Plug-in, part of Eclipse 3.0, will continue to improve functionality



Rational Team Programming software and CVS integrate within IBM Rational Application Developer V6.0

The ClearCase Plug-in will be superceded by the ClearCase Remote Client

CVS Plug-in, part of Eclipse 3.0, will continue to improve functionality

References

- **ClearCase Plug-in (SCM Adapter Plug-in)**
 - <http://www-128.ibm.com/developerworks/rational/library/1376.html>
- **ClearCase LT (Light)**
 - <http://www-306.ibm.com/software/awdtools/clearcase/cclt>
- **ClearQuest Client**
 - <http://www-1.ibm.com/support/docview.wss?uid=swg24007802>
 - <http://www-306.ibm.com/software/awdtools/clearquest/>
 - <http://www-306.ibm.com/software/awdtools/clearquest/features/index.html>
- **CVS Client**
 - www.cvshome.org
 - <http://dev.eclipse.org/viewcvs/index.cgi/platform-vcn-home/main.html?rev=1.27>
 - <http://dev.eclipse.org/viewcvs/index.cgi/>

Section

Appendix

Glossary

- CC LT = ClearCase Light
- CC SCM = ClearCase, Source Control Management
- SDP = Software Development Platform (Rational SDP)
- RCP = Rich Client Platform, an Eclipse project
- SR3/SR4 = Service Release 3/ Service Release 4
- ClearCase Plug-in = ClearCase SCM Adapter Plug-in
- CVS = Concurrent Versions System

Since there are new additions to the ClearCase lineup, there is a need to introduce a few acronyms....

CC LT = ClearCase Light, the limited server packaged with IBM Rational Application Developer V6.0

CC SCM = ClearCase, Source Control Management. This is used in ClearCase SCM Adapter Plug-in, otherwise known as the ClearCase Plug-in.

SDP = Software Development Platform. Used in Rational SDP. This is the Eclipse based platform for Rational's development tools. You will notice the Rational Software Development Platform when you install IBM Rational Application Developer V6.0 that there is a link to

Atlantic = The development name for all Rational software based on Eclipse v3.0.

RCP = Rich Client Platform, Eclipse base. The Rich Client Platform is a starting base for vendors that do not want to IDEs, but want to use the Eclipse base plus some client tools. Offered as an Eclipse project, not part of Rational or IBM.

SR3/SR4 = Service Release 3/ Service Release 4 for Rational products

ClearCase Plug-in = Rational SCM Adapter Plug-in

CVS = Concurrent Versions System

VOB = Version Object Base

Trademarks, Copyrights, and Disclaimers

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

IBM	CICS	IMS	MQSeries	Tivoli
IBM (logo)	Cloudscape	Informix	OS/390	WebSphere
e(logo)/business	DB2	iSeries	OS/400	xSeries
AIX	DB2 Universal Database	Lotus	pSeries	zSeries

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 registered trademarks of Microsoft Corporation in the United States, other countries, or both.

Intel, 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.

Linux is a registered trademark of Linus Torvalds.

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

Product data has been reviewed for accuracy as of the date of initial publication. Product data is subject to change without notice. This document could include technical inaccuracies or typographical errors. IBM may make improvements and/or changes in the product(s) and/or program(s) described herein at any time without notice. Any statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only. References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business. Any reference to an IBM Program Product in this document is not intended to state or imply that only that program product may be used. Any functionally equivalent program, that does not infringe IBM's intellectual property rights, may be used instead.

Information is provided "AS IS" without warranty of any kind. THE INFORMATION PROVIDED IN THIS DOCUMENT IS DISTRIBUTED "AS IS" WITHOUT ANY WARRANTY, EITHER EXPRESS OR IMPLIED. IBM EXPRESSLY DISCLAIMS ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT. IBM shall have no responsibility to update this information. IBM products are warranted, if at all, according to the terms and conditions of the agreements (e.g., IBM Customer Agreement, Statement of Limited Warranty, International Program License Agreement, etc.) under which they are provided. Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products in connection with this publication and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. IBM makes no representations or warranties, express or implied, regarding non-IBM products and services.

The provision of the information contained herein is not intended to, and does not, grant any right or license under any IBM patents or copyrights. Inquiries regarding patent or copyright licenses should be made, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. All customer examples described are presented as illustrations of how those customers have used IBM products and the results they may have achieved. 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.

© Copyright International Business Machines Corporation 2004. All rights reserved.

Note to U.S. Government Users - Documentation related to restricted rights-Use, duplication or disclosure is subject to restrictions set forth in GSA ADP Schedule Contract and IBM Corp.