



Rational ClearCase Version 7.1 Release Report

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1 Introduction

This document provides a high-level overview of the content of the IBM® Rational® ClearCase® 7.1 release, and highlights the value of this release to IBM Rational customers.

Rational ClearCase Version 7.1 focuses on the following areas:

Business Value: Improving features and addressing Requests For Enhancement (RFEs) to benefit our customers.

Testing Methodology and Metrics: Testing the code to ensure that it meets feature requirements and that it does not regress the performance of previous releases.

System Performance: Ensuring that the Rational ClearCase release is scalable, reliable and meets performance requirements.

Customer Feedback: Working with customers to understand and incorporate their feedback into Rational ClearCase to better meet business needs.

2 Rational ClearCase Version 7.1 Feature Business Value

To succeed, a product must provide business value to customers. The following aspects of enhancing business value were the focus of this release:

- Reducing time to return on investment
 - Consumability and productivity
 - Ease of use
 - Globalization

- Increasing compliance, governance, and lifecycle capabilities
 - Lifecycle integrations
 - Security and compliance management

- Reducing Total Cost of Ownership
 - Infrastructure improvements
 - Application lifecycle management

The following sections detail the features included in the release.

2.1 Reducing Time to Return on Investment

2.1.1 Consumability and Productivity

ClearCase Remote Client (CCRC) improved ClearCase common operations dialogs

The Rational ClearCase operations dialogs for actions like checkin, checkout, and add to source now have two display options: simple and detailed. Users can customize what appears in this display or choose to set the detailed display as the default. The detailed version displays all options available with an operation: for example, a resource table, an activity list, and a comment field.

- Allows users to proceed through standard use case scenarios supplying minimal information
- Allows users to configure their dialogs to show fields that are relevant to them

CCRC Pending Changes view

CCRC has the ability to determine when there are updates to the views that the user is working in. The frequency at which the clients can check for updates is controlled by the user for actions such as check for new baselines or view updates.

- Consolidates all changes (deliver, rebase, update) into one view to make it easier to take action on the changes
- Users can see when changes are occurring and decide whether to incorporate those changes or not

CCRC schedule notification for pending update

The CCRC client now has the ability to determine when there are updates to the views that the user is working in. The frequency at which the client checks for updates is controlled by the user for actions such as new baseline to update to and view updates.

- Allows a user to know when the view is out of date and needs updating
- User can control how often CCRC checks to see if changes exist to optimize this operation to suit their needs

CCRC Unified Change Management (UCM) Toolbar

The new UCM toolbar gives users one-click options for creating or selecting new activities, delivering, rebasing, and joining a project.

- Provides UCM functionality on the tool bar, which allows users to find these functions more readily
- Increases the productivity of users by reducing the number of clicks needed to perform actions
- Decreases the learning curve for new users by allowing them to perform UCM operations using one-click actions

CCRC Deliver and Rebase enhancements

The new one-step default, deliver, and rebase functionality allows users to perform these operations with fewer user interactions.

- Default options for single button operation are available to users
- Settings for default streams and views, silent check-in, and automatic completion allow users to minimize their interactions with these interfaces
- Advanced options allow users to override any of the default settings as needed
- Scheduled updating and notification of changes from the integration branch and stream allows users to know when they need to perform synchronization operations.

CCRC Create Stream wizards

Users can create development streams without using the Join Project wizard. The feature allows users to create child streams using the new wizard without needing to create other artifacts that the Join Project wizard creates.

- Reduces the number of ClearCase constructs when creating new streams
- Allows users to create streams with fewer steps

CCRC enhanced Apply Label wizard

This feature allows users to start the Apply Label wizard to from the context of a view. This enhancement provides an interface to manage the activity of applying labels.

- Supports access to the wizard from the context of a view, allowing for a more integrated work flow

CCRC Version Tree supports Merge

This feature gives users the ability to perform merge operations in the version tree. Users can perform common operations such as drawing merge arrows and merging targeted artifacts to a selected view.

- Provides users with another method to perform a ClearCase merge, making it easier to perform complicated merge scenarios.

CCRC improved comparison support

Type managers and the diff/merge tool support UTF-8 encoded file content, providing improved comparison support.

CCRC revised menu structure – true context menus

CCRC implements context-sensitive menu options consistent with the Eclipse look-and-feel constructions. Users are given appropriate options depending on where they are in the tool.

- Work flows related to menu options are as Eclipse users expect them to be
- Leads to quicker adoption of the tool in addition to easier memory recall of features that are less frequently used

CCRC consolidated Explorer views

The CCRC Navigator and Metadata Navigator views have been combined into one view context. This allows users to perform actions on both assets and associated metadata from one context.

- Improves user interaction with assets and the associated metadata leading to easier modification of the assets and metadata
- Makes metadata interfaces more readily available to users
- Increases the Eclipse look-and-feel of the product, allowing for easier adoption

CCRC Working Sets feature

The CCRC Tree view supports enhanced filtering making it easier for users to find and act on ClearCase resources.

- Limits the number of artifacts that users can access to those that are needed to complete the task
- Reduces the number of mouse clicks needed to find and open a folder
- Allows for quick and easy creation of working sets that bring users directly to the objects that users want
- Avoids repetitive navigation deep into the directory structure
- View filters are persistent across sessions, allowing users to pick up where they left off
- Adds and removes elements from existing working sets as needs change
- Exported Working Sets can be shared between installations and users, which allows users to have reusable environments

CCRC Change Set view

The Change Set view allows users to see change sets for a given view. Users can drag versions onto an activity in addition to between change set views. Users can enter an activity selector and view change sets for that activity.

- Drag-and-drop versions allow users to manage their change sets more easily

- The activity selector feature allows users to find activities more easily, allowing for facilitation of code reviews in addition to other day-to-day activities

CCRC Macintosh OS X support

Macintosh OS X is a supported platform for CCRC.

- Allows users to develop applications on this platform using ClearCase capabilities

CCRC browse performance improvements

Through retrieval of primary and secondary artifact data in a two-phase approach, the CCRC client has reduced the time that load operations take.

- Users can perform actions on assets after a first load pass has occurred, allowing for users to perform follow-on actions sooner

Global Monitor

Global Monitor simplifies MultiSite administrative tasks by providing a central viewpoint for collecting data, and monitoring the IBM Rational ClearCase MultiSite deployment.

- Creates specialized tasks and directly reports job results
- Monitors key ClearCase processes at remote locations
- Receives expert advice on problem resolution
- Looks at a global deployment at different levels of detail
- Using Logical Views, users can make logical associations between components in a deployment to see the deployment in different contexts

IPv6 Support

Rational ClearCase Version 7.1 supports mixed IPv4 and IPv6 environments. The improvements in IPv6 over IPv4 are in the following list.

- Substantial increase in address space (as required by the impending IPv4 address pool depletion)
- Eliminates the need for NAT (network address translation), a cause of several networking problems
- Improved quality of service
- Network-layer security (encryption and authentication)
- More efficient routing
- Stateless auto-reconfiguration of hosts
- Reduced management requirement

Improved registry server performance

ClearCase registry performance has improved significantly. These changes include:

- Delayed write to disk on registry write transactions
- In memory view tag lookup
- Increased throughput and reliability of the registry server handling large amount of RPC calls within a short period
- Reduced CPU utilization on the registry server
- Improved ClearCase transactional performance for almost all ClearCase operations that need to interact with the registry in production environment

- Improved ability of the registry server to handle large number of registry entries

z/OS Extensions Enhancements

Several improvements in the areas of performance and error handling have been made to the z/OS Extensions. These improvements include:

- Performance during file uploading
- Error handling
- Log file management
- Server performance for large numbers of users
- Restructured documentation for installation and customization

2.1.2 Ease of Use

CCRC improved integration with Rational ClearQuest

The improved integration reduces the amount of developer interaction needed to perform activities involving ClearQuest integration, including better support in a GDD environment.

- The integration supports a development use case set including the ability to run queries, change states, and create new activities
- Browse ClearQuest workspace (folders and queries)

CCRC support for Compare and Merge

CCRC allows users to use the native merge tools, the UTF-8 merge tool, and the built-in Eclipse merge tools.

CCRC enhanced ClearCase Details view

The ClearCase Details view supports persistent customizable sorting and column size for each object type in a workspace.

- Allows users to sort ClearCase elements by their preference allowing users to find what they are looking for more quickly

CCRC enhanced Properties view

Users can view various Rational ClearCase properties directly in the interface rather than in individual dialog boxes.

- Allows users to view properties and their values with less effort

CCRC Edit Configuration window

A new Edit Configuration window allows users to edit the view configuration. This window opens from the View Configuration context.

- Reduces the number of steps needed to modify configuration specifications
- Allows users the ability to replicate configuration specifications from other views facilitating creation of view configurations
- Provides the ability to hide private VOBs and project VOBs allowing users to only view the VOBs that they are interested in

CCRC common ClearCase and ClearQuest login

If user IDs and passwords are identical for Rational ClearCase servers and Rational ClearQuest databases, only one login is needed.

- Allows users to log in to Rational ClearCase and reuse those credentials for ClearQuest actions allowing for easier cross-tool interactions.

Build flexibility and control enhancements

Omake output can now be directed to standard output files, allowing build information to be captured with other standard output data, making it readily available for users and automated processes.

The CCASE_NO_WINKIN_VIEWS environment variable allows those users who build with Clearmake to specify views that will not be searched for a derived object to winkin at build time. This feature allows for additional flexibility and control over the build environment.

The CCASE_TEMPFILE_UMASK environment variable allows those users who build with Clearmake to specify a umask flag that is different from the umask value set for derived objects allowing more control over the attributes of the derived object created by the build process.

Clearmake now supports a number of GNU-make standard conventions allowing users to more easily import GNU-make makefiles into the ClearCase Clearmake build process.

Parameterized Build for z/OS Extensions

A parameterized build helps automate the creation and submission of Remote Build scripts from the ClearCase Explorer, Windows Explorer, or TSO Client.

- Using the parameterized build feature, a ClearCase administrator can add user-defined attributes to ClearCase artifacts. These attributes define the element type, the components required for it to execute, and the environment.
- Remote Build uses these attributes to generate a build script for each part. The build script automatically allocates the data sets required for the build, compiles the elements with the proper compile and link options, and saves the build output.
- ClearCase users can submit their z/OS artifacts to the mainframe system for compiling simply by selecting a context menu item from the ClearCase Explorer or the Windows Explorer.
- TSO Client users can select files on the distributed ClearCase system for build, upload, or submit link job functions.

UCM reset view enhancement

The commands rebase and deliver include a new option that users can use to specify a new view if the view in use becomes lost during a rebase or deliver

operation. Another option for these commands removes references to the lost view from all VOBs that register it.

- Allows users to deal with edge error cases and recover more quickly and easily from issues related to rebase and deliver

Common Help System

All Rational ClearCase help systems and documentation are provided as a common component. This allows a user to enter the help system from any UI and expand their search across the entire product help system instead of the specific UI help system. This provides the user a more consistent user experience. In prior releases, UIs used different help systems forcing the user to search multiple help systems to find answers. Now all help delivered with the product is based on the IBM Eclipse Help System. The product help is also available as an information center on IBM.com.

<https://publib.boulder.ibm.com/infocenter/cchelp/v7r1m0/index.jsp>

2.1.3 Globalization

Translation to IBM Group 1 Languages

The following clients and features are now translated in to IBM Group 1 Languages allowing users the option of using Rational ClearCase in their native language.

- CCRC Client (server host messages coming from CM Server and CM API)
- Global Monitor
- Installation Manager

For reference, IBM Group 1 Languages are Chinese (simplified), Chinese (traditional), Japanese, Korean, French, German, Italian, Spanish, Portuguese (Brazil)

zOS Extensions Japanese Message Catalog

The Remote Build feature now delivers the Japanese message catalog on Windows, the UNIX system and Linux systems so that Japanese messages are displayed in the code page appropriate to each system.

2.2 Increased Compliance, Governance and Lifecycle capabilities

2.2.1 Lifecycle Integrations

Change Management (CM) API

CM API is a Java™ API that provides a common object model for resources in Rational ClearQuest and Rational ClearCase repositories. CM API is a unified collection of Java interfaces and classes that specifies a public API through which programming clients can interact with the IBM Rational products that provide change and configuration management services. These clients can be graphical or command-line user interfaces, custom scripts, or programs that need such services.

The following features allow customers to create integrations with other tools in their organizations to better integrate Rational ClearCase into their processes.

- Create, load, update, and browse Web views
- Check-in, check-out, create, and hijack elements
- Create label types and apply labels
- Create branch types and hyperlink types
- For UCM: join projects, create activity, compare baselines and create projects, project folders, streams, or activities

2.2.2 Security and Compliance Management

CCRC multiple region support

Allows administrators to restrict which VOBs and views are accessible to groups of users who access Rational ClearCase through the CM Server. Users can further reduce the number of VOBs they have to select from through a filter mechanism.

- This feature provides a mechanism for customers who have sensitive artifacts to restrict who has access to the VOBs that contain them.

CCRC improved group identity support

ClearCase remote client now supports CLEARCASE_PRIMARY_GROUP and CLEARCASE_GROUPS environment capabilities

- CCRC supports these override mechanisms in the same way as other clients

2.3 Reduced Total Cost of Ownership (TCO)

2.3.1 Infrastructure Improvements

Change Management (CM) Server

CM Server builds upon the wide variety of potential WebSphere Application Server (WAS) deployments, which means improved scalability across all dimensions and configurations (not all configurations will be enabled at initial release). CM Server leverages the WebSphere Application Server infrastructure, a state-of-the-art enterprise-ready application hosting platform that includes customizable administration and troubleshooting tools, in addition to IBM developerWorks resources and documentation.

- Provides a more scalable and flexible middle tier to service ClearCase Remote Client users
- A high-performing server-based deployment model that is easily managed, administered, and upgraded
- Single technology stack for ClearQuest and ClearCase servers
- Provides WAS-based servers

IBM Installation Manager Support

IBM Installation Manager provides a common installation technology for many IBM products including Rational ClearCase.

- Lowers administration costs by offering one-click updates to install deliverables
- Enhanced Deployment Management
 - Manage Installation Repositories
 - Search for updates to install the latest version of a package
 - Track packages that users have installed, can install, and are about to install
 - Manage licenses for the packages that users have installed
 - Multi-Product Installation capability
 - Silent uninstall
 - Roll back packages to previous versions
 - Uninstall full packages

2.3.2 Application Lifecycle Management

Agile development support in the CCRC client

There are a number of improvements that are designed to support Agile development processes.

- These features together support Agile practices and methodologies
 - Explorer enhancements to show “buried” changes without expansion

- Scoped common operations to take advantage of that knowledge
- Undo Checkout/Hijack on Views, Projects, Directories, Activities
- Recursive Add To Source Control, Checkout and Hijack, with filtering
- Pending Changes View
- Supports both base ClearCase and UCM
- Deliver and Rebase
- “Default” option for single button operation under optimal conditions
- Settings for default streams and views, silent check-in, and automatic completion
- “Advanced” option for complete control
- Scheduled updating and notification of changes from integration branch and stream

2.4 Release Requirements and Requests for Enhancements (RFEs)

The Rational ClearCase Version 7.1 includes more than 80 features that were in response to feedback received from Voice of the Customer Event (VoiCE) sessions, customer engagements, RFE reviews, and market analysis. In addition, more than 300 RFEs were addressed. The charts below illustrate the breakdown of RFEs and Release Requirements by business value and Rational ClearCase component.

2.4.1 Implemented Release Requirements

The chart below shows the distribution of Rational ClearCase Release Requirements (RRs) implemented in version 7.1 by targeted business values. The distribution percentages show a significantly greater contribution from the Reduced Time to Return on Investment (ROI) segment, but there were significant improvements made in all of the three targeted business values.

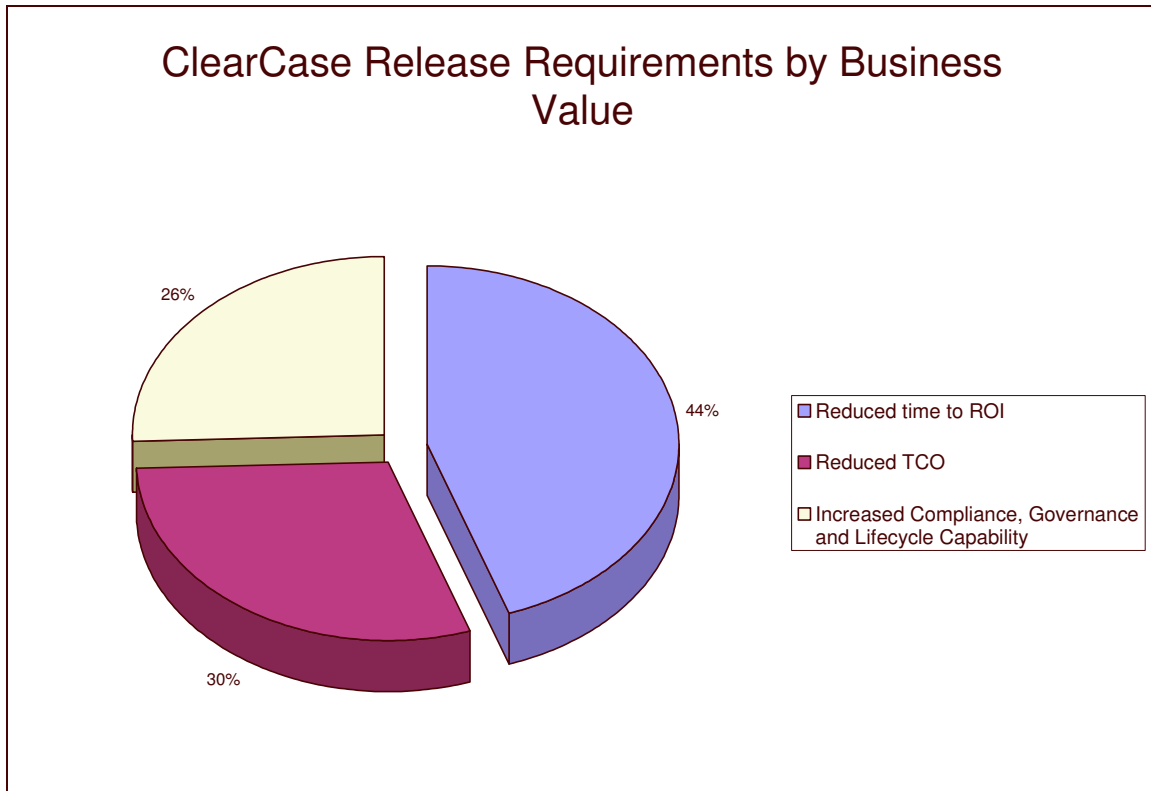


Figure 1: Rational ClearCase Release Requirements by Business Value

Business Value	Percentage
Reduced time to ROI	44%
Reduced TCO	30%
Increased Compliance, Governance and Lifecycle Capability	26%

The chart below shows Rational ClearCase Release Requirements in terms of the component targeted. The largest percentage of release requirements targeted the CCRC interface.

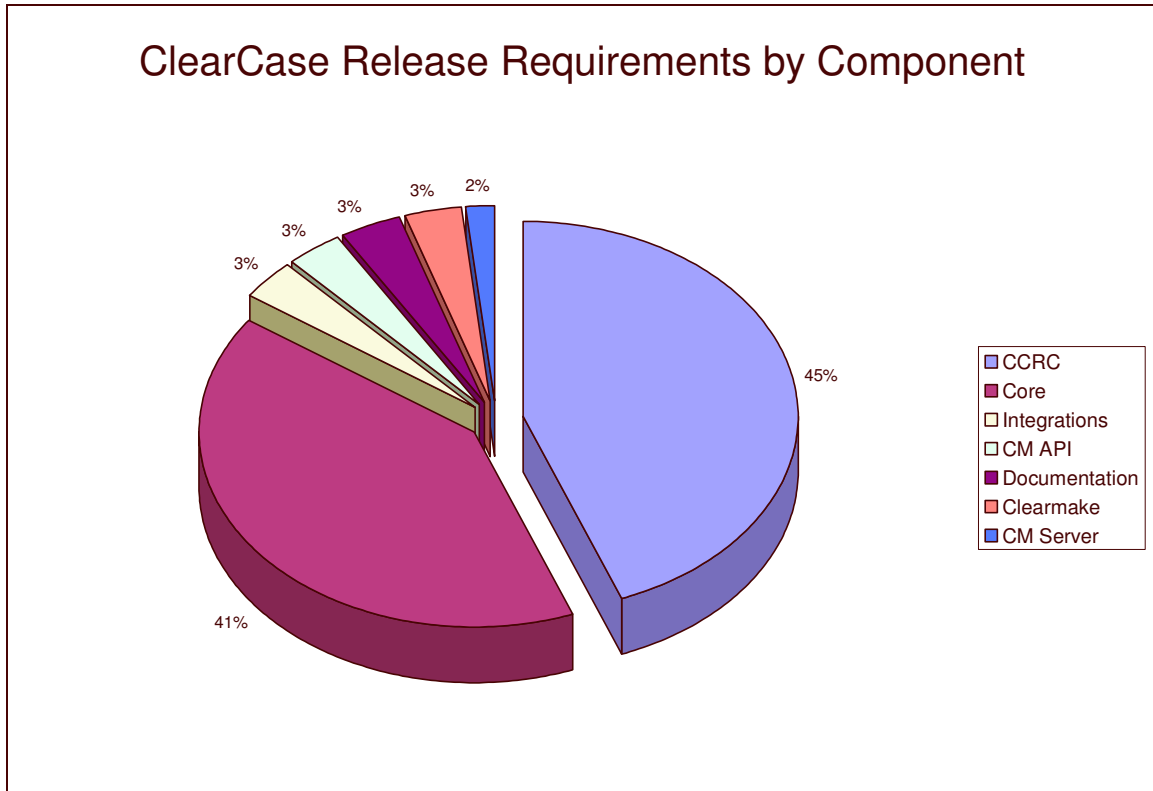


Figure 2: Rational ClearCase Release Requirements by Component

Component	Percentage
CCRC	45%
Core	41%
Integrations	3%
CM API	3%
Documentation	3%
Clearmake	3%
CM Server	2%

2.4.2 Implemented Requests For Enhancements

The chart below illustrates the breakdown of RFEs by business value. The highest percentage of RFEs was in the area of Reduced Time to ROI, although there were also a significant number of RFEs addressed in the other two areas.

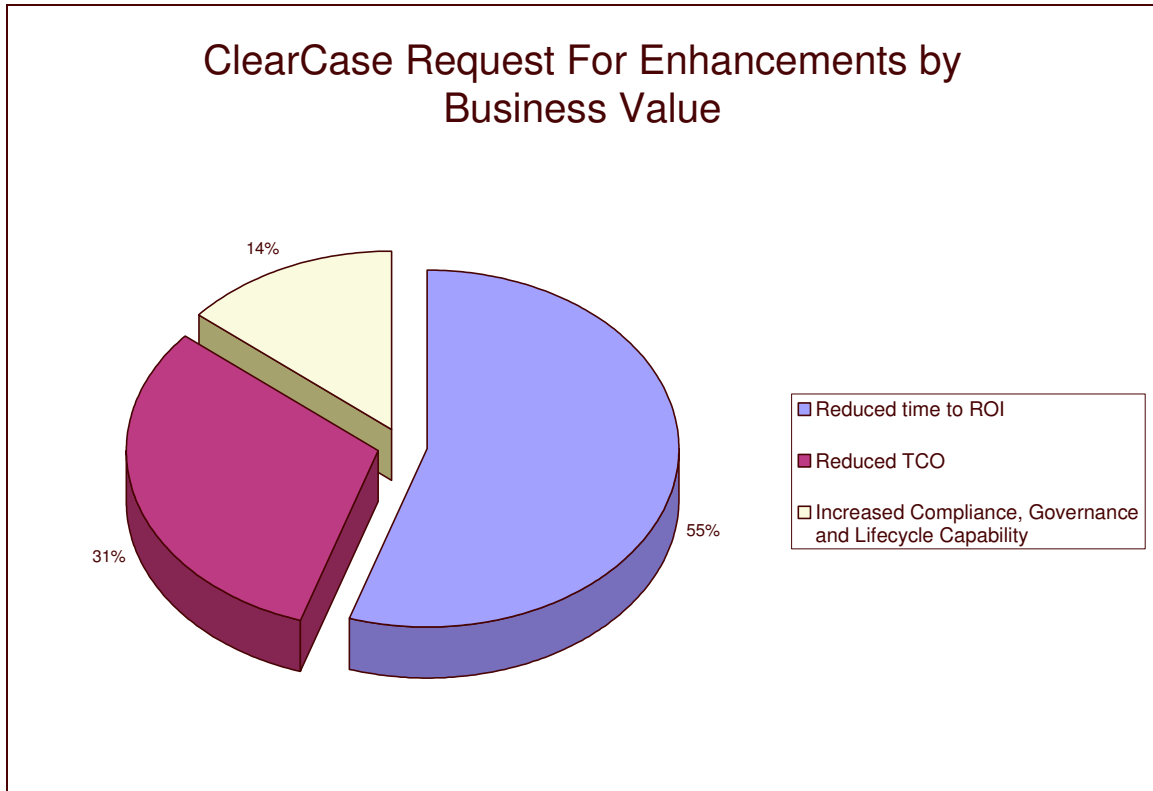


Figure 3: Rational ClearCase Requests for Enhancements by Business Value

Business Value	Percentage
Reduced time to ROI	55%
Reduced TCO	31%
Increased Compliance, Governance and Lifecycle Capability	14%

The chart below shows the breakdown of RFEs by component. The CCRC interface comprises the greatest number of enhancements, but there were also enhancements to many other Rational ClearCase components.

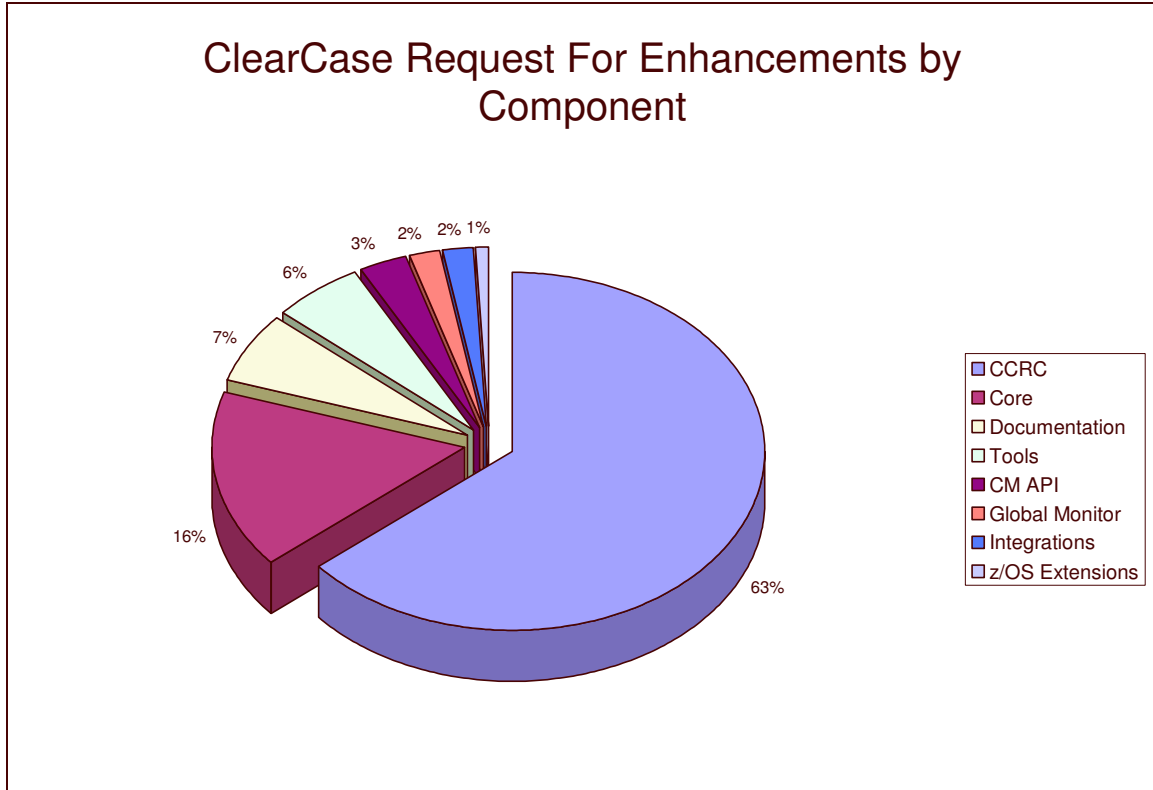


Figure 4: Rational ClearCase Requests for Enhancements by Component

Component	Percentage
CCRC	63%
Core	16%
Documentation	7%
Tools	6%
CM API	3%
Global Monitor	2%
Integrations	2%
z/OS Extensions	1%

3 Testing Methodology and Metrics

To ensure the reliability of Rational ClearCase, tests were run to validate as much of the product’s functionality as possible, while providing comprehensive client and server platform coverage.

3.1 APAR and Defect Fixes

The IBM Corporate Instruction definition of reliability is that the software must “execute with no program errors and produce correct results in all client usage scenarios.” One element of reliability commitments is to focus on the improvement of the quality of the product in terms of APARs, which are defects that have been reported by a customer. For Rational ClearCase version 7.1, 83% of reported APARs were fixed and closed. The chart below shows the percentage of APARs by severity that were fixed in Rational ClearCase version 7.1.

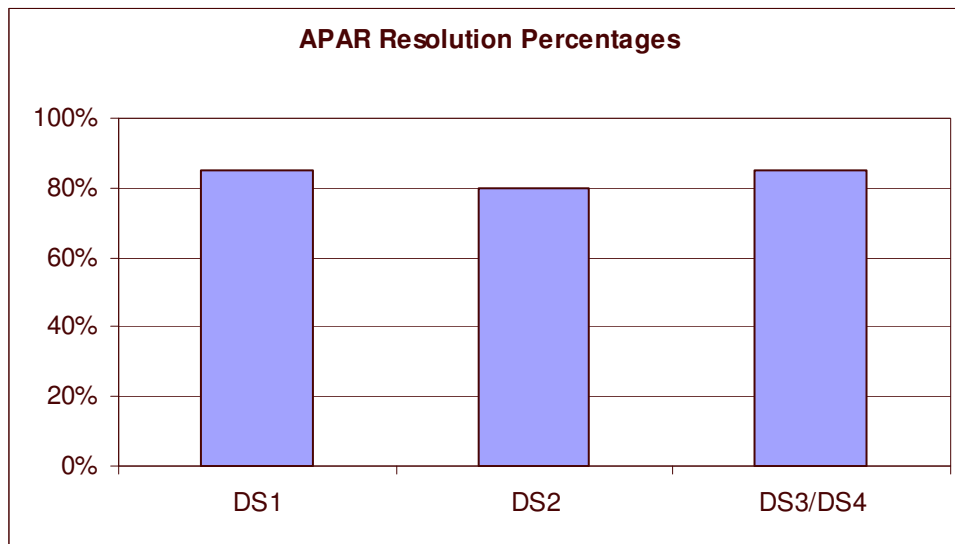


Figure 5: Rational ClearCase 7.1 APAR fix percentages by severity

The severity distribution for the internally found defect fixes in this release is shown below, with DS1 being most severe and DS4 being least severe.

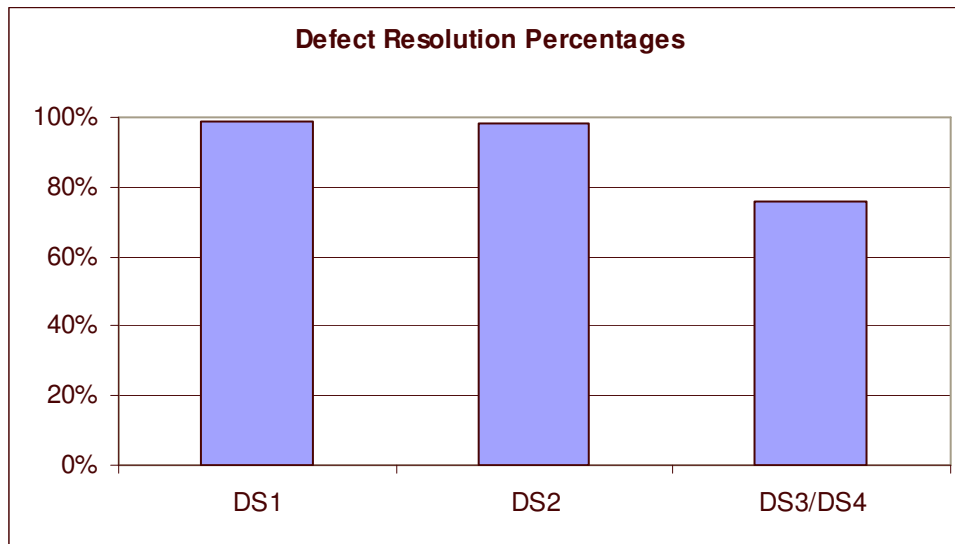


Figure 6: Rational ClearCase 7.1 defect closure percentages

3.2 Testing Strategy

The testing strategy for Rational ClearCase includes both Functional and System testing. Functional tests examine each feature area or component and validate that the user can perform the expected actions. System tests examine typical customer usage: deploying Rational ClearCase into a large enterprise, using Rational ClearCase Remote Client in a dynamic development environment, and ensuring high availability for servers.

Products are tested in a complex MultiSite production deployment. Rational ClearCase, Rational ClearCase MultiSite, and Rational ClearQuest are used in the development process. Before Rational ClearCase is installed on internal servers or clients, testing occurs to ensure that there have been no regressions since the last release and that all new features are qualified.

Functional testing is a combination of automated and manual validation. The chart below shows the overall functional test coverage by method:

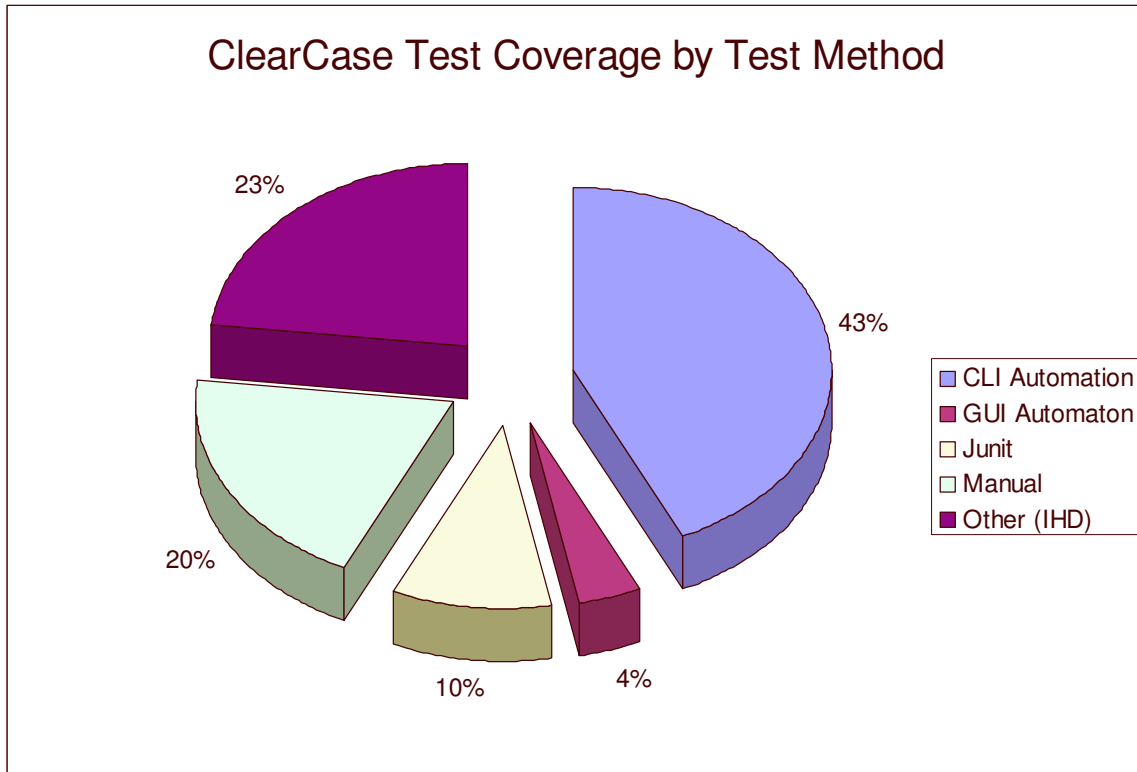


Figure 7: Rational ClearCase test coverage by test methodology

Test Method	Percentage
CLI Automation	43%
GUI Automaton	4%
Junit	10%
Manual	20%
Other (IHD)	23%

Functional testing provides regression testing for all functional areas. The chart below shows the final regression test coverage.

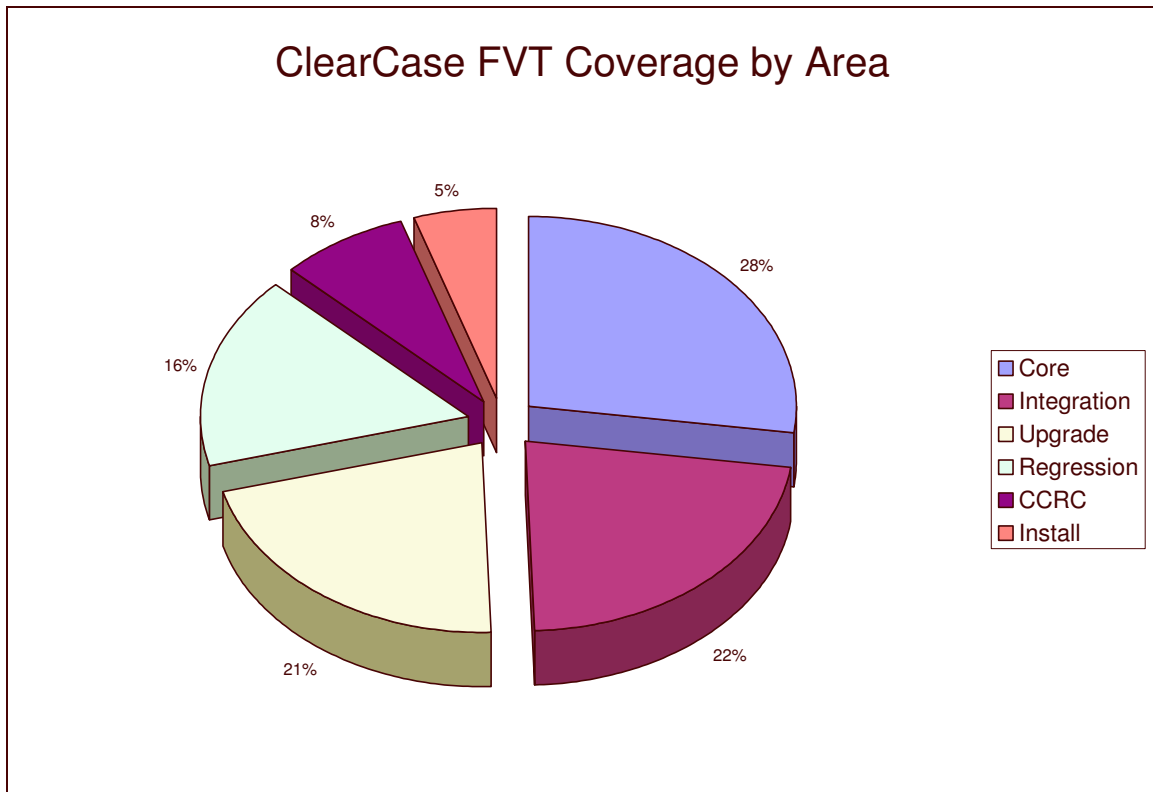


Figure 8: Rational ClearCase test coverage by functional area

Functional Area	Percentage
Core	28%
Integration	22%
Upgrade	21%
Regression	16%
CCRC	8%
Install	5%

4 System Performance

In terms of system performance, the following areas were the focus for Rational ClearCase Version 7.1:

- Performance: The ability of a system to respond acceptably to user requests
- Scalability: The ability of a system to respond to increased load and still respond with acceptable performance
- Availability: The ability of a system to respond for long durations with consistently acceptable performance

Disclaimer for the Performance Data:

- *Any performance data contained herein was determined in a controlled environment. The results obtained in other operating environments may vary significantly. Actual results may vary. Users of this document should verify the applicable data for their specific environment.*
- *These test results are specific to the product software, test configuration, workload, and environment that were used.*
- *Product performance in other environments or conditions may be different compared to the data reported in this document.*

4.1 Testing Approach

The Change Management (CM) API is the official API based on Java™ for IBM Rational ClearCase and Rational ClearQuest Version 7.1 releases. The CM API was used as the foundation for customized integrations. An infrastructure was developed for testing the performance and availability of the API. Prior to the release of Rational ClearCase Version 7.1, the Performance test team used unpublished custom APIs measure ClearCase Remote Client server performance and HTTP scripts to measure ClearQuest Web performance.

Early in the version 7.1 release cycle, IBM developed an Eclipse-based plug-in for the CM API. This plug-in was used in performance, scalability, and availability tests. Another benefit of testing at this level was that a benchmark was created against which to measure the performance of interfaces, which are used by both the ClearCase remote client and ClearQuest Web GUIs. Using these benchmarks, performance problems were isolated within the GUI and the core API.

For the General Availability (GA) of the Rational ClearCase version 7.1, results for the CM API benchmark performance are on developerWorks.

<http://www.ibm.com/developerworks/rational/performance/>

4.2 Performance

The Rational ClearCase version 7.1 release had a performance release requirement of a 10% improvement in the transactional response for the Rational ClearCase and ClearCase remote client over the previous 7.0.1 performance benchmark. The performance of the ClearCase API was tested using the new Rational Performance Tester (RPT)-based CM API performance tool plug-in.

The diagram below shows the transaction schedule within the new RPT-based plug-in, including the transactions performed during the RPT run. All transactions are executed in a schedule within RPT for 50 iterations.



Figure 9: Rational test execution interface

Performance tests were run for single user and multi-user (100 user) scenarios and transactional performance was compared to the 7.0.1 benchmark to verify a 10% improvement in server API response.

The graphs below show the ClearCase response data for the 7.1 release compared to the prior release. Significant CCRC API performance improvements were achieved in the 7.1 release over that of 7.0.1:

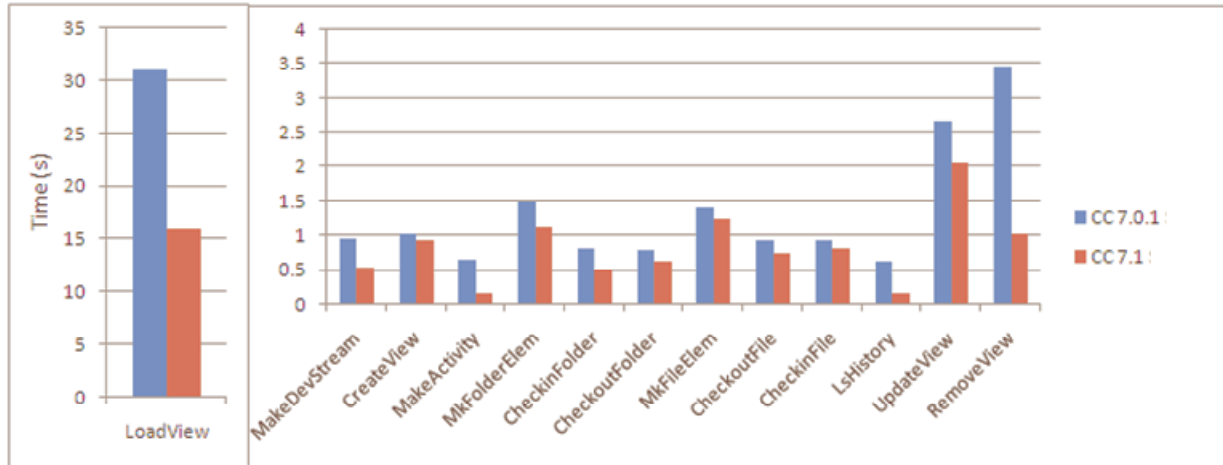


Figure 10: Rational ClearCase single user benchmark (SUB) testing

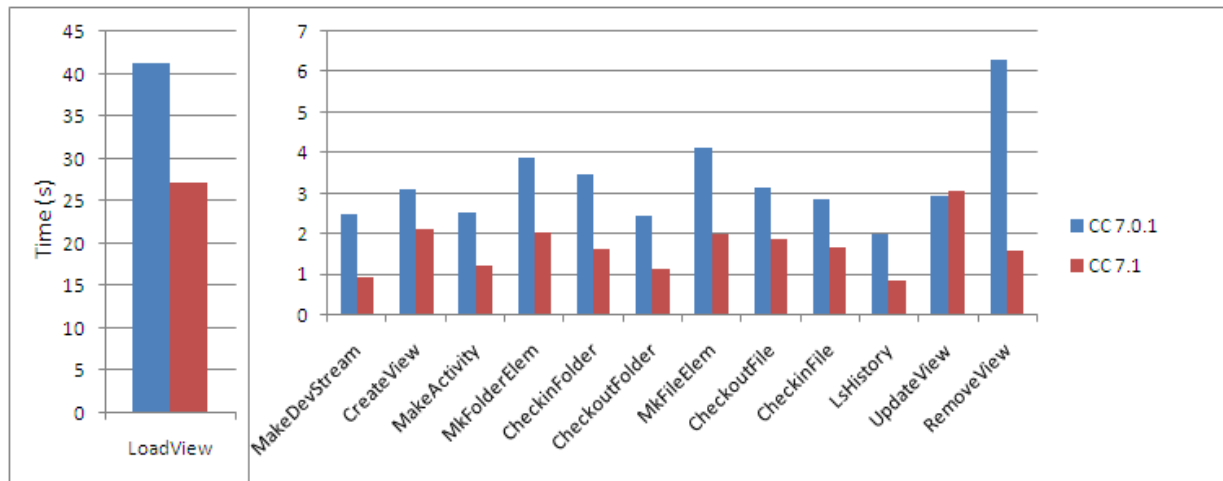


Figure 11: Rational ClearCase multi-user benchmark testing

Test results proved that there were significant performance improvements in both the single and multi-user scenarios with 100 ms of latency between the RPT test driver and CM server. In both the single and multi-user tests, all transactions improved and exceeded the goal of 10% improvement in transactional response.

Rational ClearCase version 7.1 transactional performance improved for a number of ClearCase operations directly due to scalability enhancements in the registry server. This

improvement will be particularly noticeable in ClearCase deployments with large registries and frequent registry transactions. These enhancements are also available in fix packs for prior releases for 7.0 (starting with 7.0.0.3) and 7.0.1 (starting with 7.0.1.2).

A summary of ClearCase registry performance improvements for 7.1 includes:

- Delayed write to disk on registry write transactions
- Faster in-memory view tag lookup
- Increased throughput and availability of the registry server handling large amount of RPC calls within a short time period
- Reduced CPU utilization on the registry server.

For more details on the specifics of the performance test environment and results, see the datasheets for the Rational ClearCase 7.1 release on IBM developerWorks:

<http://www.ibm.com/developerworks/rational/performance/>

Performance Improvements using third-party partner solutions:

Certeon, an IBM business partner, recently completed the Ready for Rational Software (RFRS) certification for their aCelera WAN accelerator solution. IBM worked with Certeon to develop a WAN accelerator and “blueprinted” (customizing WAN acceleration algorithms based on application behavior) for the CCRC application. For more details on the Certeon WAN acceleration solution, see the IBM Rational performance developerWorks Web site listed above or the Certeon Web site:

<http://www.certeon.com>

4.3 Scalability

During the 7.1 development cycle, numerous scalability tests were conducted and the results were compared to the prior release. During the development cycle, iterative scalability testing enabled development to continuously focus on target areas for performance improvement. See the graph below for the results of these efforts (scalability response for 50, 100, 150 and 200 simulated users). Note that multi-user scalability tests were executed at a transaction rate for each user of 15 transactions per hour (typical developer scenario).

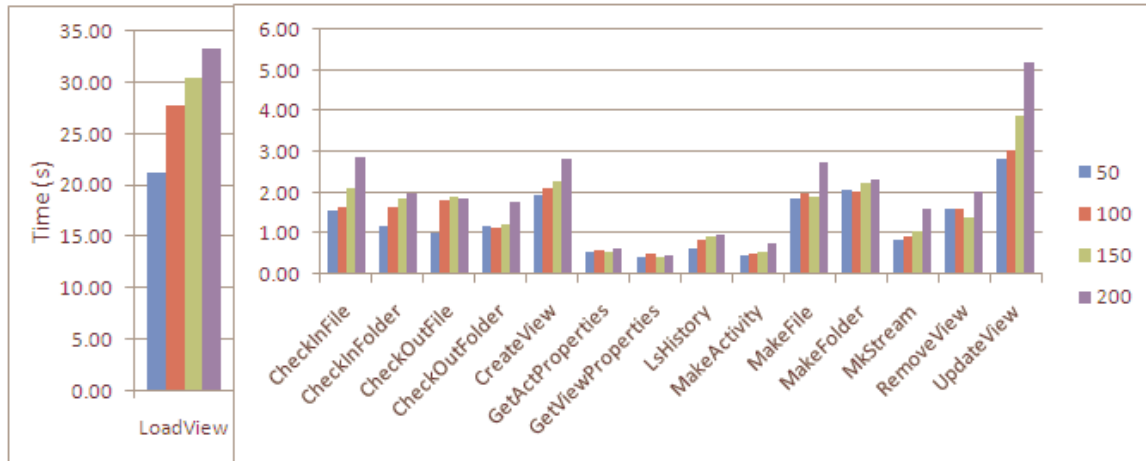


Figure 12: Rational ClearCase scalability comparison

For more detailed Rational ClearCase 7.1 scalability performance information and performance tuning guidance for CM server, see IBM developerWorks site:

<http://www.ibm.com/developerworks/rational/performance/>

4.4 Availability

Throughout the 7.1 development cycle, the availability of Rational ClearCase was continuously tested via the use of 5- and 10-day workloads. These workloads were designed to keep the system running at very high loads during which time metrics were taken at regular intervals to validate the server's availability.

4.4.1 ClearCase Large Customer Scenario

Testing of Rational ClearCase Version 7.1 utilized a “large customer simulation” environment to test primarily system availability and secondarily performance. These simulations were modeled on the workloads and data volumes of large Rational ClearCase customers.

The goals of the ClearCase Large Customer Test Scenarios were as follows:

- Test availability of large ClearCase deployment under high concurrent user loads and enterprise scale data volumes for extended periods of time.
- Measure and record performance characteristics under load and stress to ensure no degradation in current release and also release over release after benchmark is established.
- Identify and resolve any availability, performance, or deployment related defects prior to general release (GA).

The quality targets and requirements of the ClearCase Large Customer Test Scenarios were as follows:

- System remains stable and responsive for extended period (5 or 10 days) with no unplanned restarts.
- System remains stable and responsive under normal and stress level workloads without failures or data corruption.
- System remains stable and responsive with all of the following concurrent workloads:
 - 500 users (developers) performing a mix of transactions that match or exceed the operational distribution and weekly targets of the large customer under test provided data
 - 24 parallel builds of 2 to 3 hour average duration occurring 24 hours per day
 - MultiSite replication across 5 replicas with 50 user (developer) workloads per site (250 user total simulation) performing a mix of transactions that are synchronized with the master site every 20 minutes.

Infrastructure and Topology

The systems included in these scenarios consisted of multiple operating systems and a variety of hardware and software configurations. The goal of the environment is to simulate an actual production enterprise deployment. This environment will serve as the basis for availability testing for future Rational ClearCase releases.

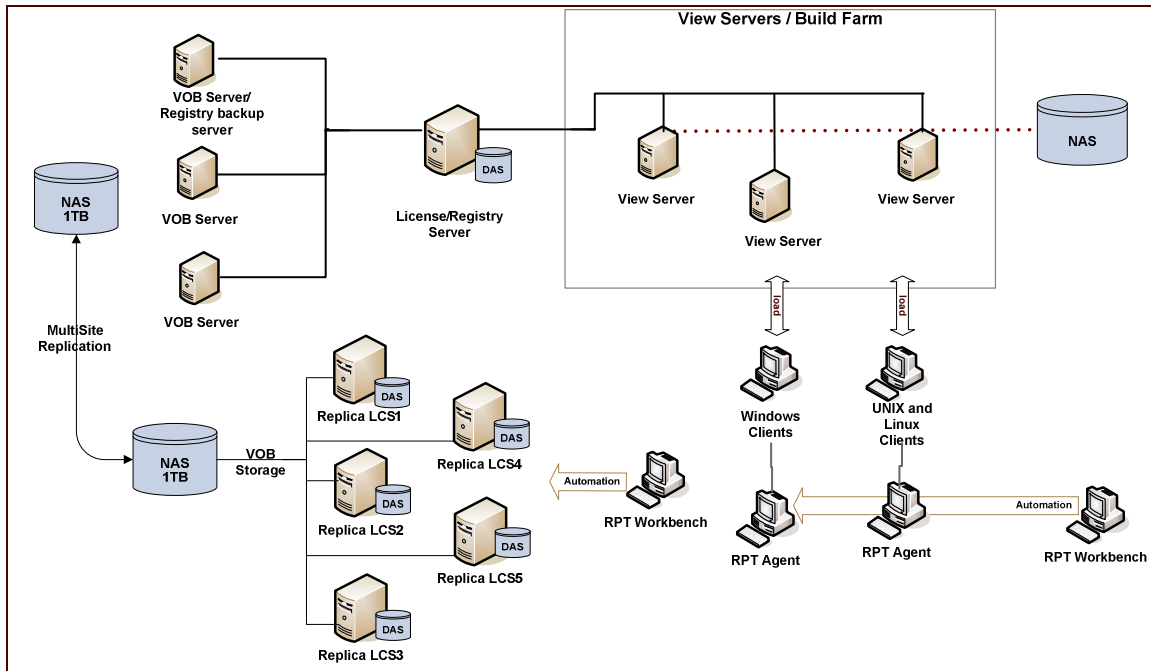


Figure 13: Large Customer simulation topology

The topology consists of a heterogeneous mix of the UNIX system and Windows server platforms. All VOB and view storage is contained on a Network Appliance FAS6080 filer. Each storage location is exported as its own volume.

Test Data

The Samba VOBs were imported from SourceForge®. Each VOB contains all 40 versions of Samba. Each version is on its own branch. These VOBs were copied 300 times and replicated across all sites.

The TestVOB1 – 7 VOBs were created from customer-supplied Raima databases. Scripts were used to restore the VOBs based on the metadata read from the databases.

Finally, the CC_v3 VOB was created to allow for the generation and replication of V3 oplogs. This VOB was created using the same basic scripts used to load the Samba VOBs and is set to feature level 1.

The following table summarizes the VOBs used in this test.

VOB	#	Size	Elements	Versions	Branches	Hyperlinks	Labels
CC_v3	1	362 MB	4,894	86,169	4,895	39,942	7,798
Samba	300	613 GB	5,370	37,589	21,420	0	86,555
TestVob1	1	101 GB	357,180	2,798,825	1,309,274	246,545	19,982,361
TestVob2	1	29 GB	29,717	213,374	102,405	327,396	7,013,303
TestVob3	1	68.9 GB	337,105	2,644,571	1,311,332	2,086,594	14,784,188
TestVob4	1	87.5 GB	44,145	878,850	363,560	568,914	13,059,558
TestVob5	1	68.5 GB	287,256	1,933,144	940704	659,100	1,4598,901
TestVob6	1	68.5 GB	567,070	6,064,292	2,643,345	1,823,623	1,2597,502
TestVob7	1	70.5 GB	358,199	2,716,653	1,298,742	470,304	7,138,259

Automation Driver Infrastructure and Tools

System testing used Rational Performance Tester (RPT) to simulate multi-user workloads against the system under test. RPT has been extended using the RPT Protocol SDK to enable the execution of cleartool commands via telnet. User workloads were created that executed on target systems to simulate many simultaneous (100, 500+) active users to exercise the load, stress, and volume characteristics of the application.

Execution Procedure

Each workload was started independently and allowed sufficient ramp up time to reach the desired targets. After all workloads were running (500 user, builds, replica), the performance probe was executed for a 6-hour period to collect metrics. Additionally, metrics were also collected continuously by several tools and system utilities on a 24-hour basis at varying intervals to get multiple data points for analysis of standard deviations and averages.

During execution of the workloads, data was collected in 10- and 15-minute intervals. The data collected included transaction rates, active processes, active users, and MVFS load.

Workload Description

Three separate workloads were used to create stress on the ClearCase test environment. One additional workload (performance probe) was used to simulate a “single” developer activity set to allow measurement of those activities. Each of the workloads was run for

5 or 10 days (depending on the test case). Metrics were obtained from the test infrastructure at regular intervals.

The environment used to execute the workloads consisted of six ClearCase sites: one Master site and five replica sites.

500 User Workloads

This workload is designed to model the operational profile found at a large customer site. The profile was determined using information obtained from MultiSite operation logs. This workload consists of 500 concurrent users. The operations are distributed equally against the VOBs in the master site. The transaction profile and weekly targets for this workload are listed below. The overall target was 150K write operations per week. A write operation is defined as any operation that changes the underlying meta-data of the VOB.

All targets were exceeded during a single calendar week of test execution.

Operation	Weekly Target	Value Achieved	Operation	Weekly Target	Value Achieved
Mkatrr	32,669	132,115	Checkin	7,185	318,887
Checkout_v3	13,356	74,151	Rmbranch	7,007	20,025
Unreserved	10,805	99,646	Rmelem	51	3,420
Rename	8,807	108,523	Mkslink_v3	37	514
Uncheckout	8,664	83,470	Reserve	2,260	20,871
Mkbranch_v3	8,297	17,169	Mkbranch	1,651	168,365
Rmbrtype	8,012	110,017	Mkhlink	1,168	2,121
Mklbtype_v3	965	1,800	Mkhlink_v3	5,852	7,295
Mklabel	629	1,346	Chevent	5,378	13,988
Chmaster	455	992	Rmhlink	4,216	5,538
Mklbtype	413	3,614	Mkbrtype	3,107	157,583
Rmlbtype	216	1,556	Checkout	2,821	529,965
Mkelem_v3	92	18,135	Lname	2,366	3,982
Rmlabel	68	918	Protect_v3	90	319
Mkslink	58	132	Protect	72	2,071
Mkbrtype_v3	6,698	13,969	Mkelem	71	142,837
Rmname	6,375	9,592	Rmslink	69	2,078

Build Workloads

This workload builds a single version of the Samba source code distribution. Builds happen in two parts: a “configure” stage which prepares the source tree for building, and a “make” phase which runs Clearmake (J=6). There were 24 builds executing in parallel on each server with each build lasting approximately 3 hours, and after an individual build completes, it is restarted in a continuous loop. The parallel builds are not distributed across servers as they are different platform architectures. Each loop consists of a full build with no more than 6 audited build execution processes.

The number of audited build execution processes is determined by the overall stress on the build server. In order for a new process to be launched, the CPU utilization on a given system must not exceed 50%.

Metric	Target	Achieved
Parallel Builds	24	24
Concurrent Build Auditing Processes	MAX 146 (24 * 6)	AVG 45, MAX 170

Replica Workloads

This workload is designed to provide active replication between sites. The transaction profile described in the 500 user workload also runs against each replica site (LCS1-5) at a smaller 50 user scale. Each replica site hosts an average of 60 VOBs and processes requests from 50 concurrent users. The replication occurs every 20 minutes to the master site.

MultiSite Metrics Targets

The targets for MultiSite are based on the average amount of data processed at each site over a given time period, usually 5 to 10 days. Based on the replication topology, the main site will process approximately 75% more data than the smaller sites.

Metric	Target	Achieved
Packets Received per Replica	1923 / week	2379 / week
AVG Packet Size (K)	25K / packet 1GB Max	440 KB / packet
AVG Operations/packet	100 / packet 50K max	1469 / packet

Performance Probe

The performance probe is a single user benchmark simulation used to gather metrics that can be used to compare performance improvements release over release. This test case is executed concurrently with larger, background workloads (500 user, build, and replica) and is executed once per day for duration of 6 hours. To ensure repeatability, this test case is executed against source code for Samba version 3.0.20 which was embedded into the TestVOB6 VOB and is stored in its own source branch.

Volume and Data Targets

The following table details all of the high level volume and data targets that the ClearCase scenario was designed to meet. All targets were successfully met for the release.

Metric	Target	Achieved
Build Simulations	1	Achieved
Complexity (servers per site)	Master Cell 10 servers Replica Cells avg 3 servers	Achieved
Largest VOB	40GB	70GB
Max Concurrent workloads	4	Achieved
Number of users	500 users	536 Users
Operation Coverage	100%	Achieved
Performance measures under Stress	1 single user benchmark	Achieved
Rate of changes per week	150K writes	2.1 Million writes
Total Number of elements	600K	2.4 Million
Total Number of versions	10 million	20 Million
Total Number of VOBs	315 VOBs	Achieved
Total Storage	3.5TB	Achieved
Total Views	700 Views	715 Views
Trigger Executions per server per day	350 Triggers	19053 Triggers
VOB Replicas	30 Replicas	Achieved

Additional Information

Documents with details of the tests, test environment, and test results will be published on IBM developerWorks:

<http://www.ibm.com/developerworks/rational>

4.4.2 CM Server CCRC Availability Scenario

The CM Server availability scenario tested the CM Server architecture on Solaris and Windows platforms under load.

The goals of the CM Server CCRC availability scenario were as follows:

- Assess the availability of the single CM Server under conditions that simulate the maximum number of supported users (200), a reasonable user activity rate (15 transactions per hour per user), and long run duration (5 days)
- Measure and record performance characteristics under load and stress to ensure no major degradation during a 5 day time period
- Identify and resolve any availability or deployment related defects prior to general release (GA).

The quality targets and requirements of the CM Server availability scenarios were as follows:

- System remained stable and responsive for extended period (5 days) with no unplanned restarts.
- System remained stable and responsive under normal and stress level workloads without availability failures or data corruption.
- System remained stable and responsive while servicing a 200 user workload performing a mix of CCRC CM API transactions that simulated a typical large customer deployment.

Environment Preparation and Characteristics

The goal of this scenario was to test the availability of a CM Server deployment while under load. The test environment was built using WebSphere version 6.1 Network Deployment (ND) to ensure that all of the functionality found in a larger WebSphere deployment would be incorporated.

System Topology

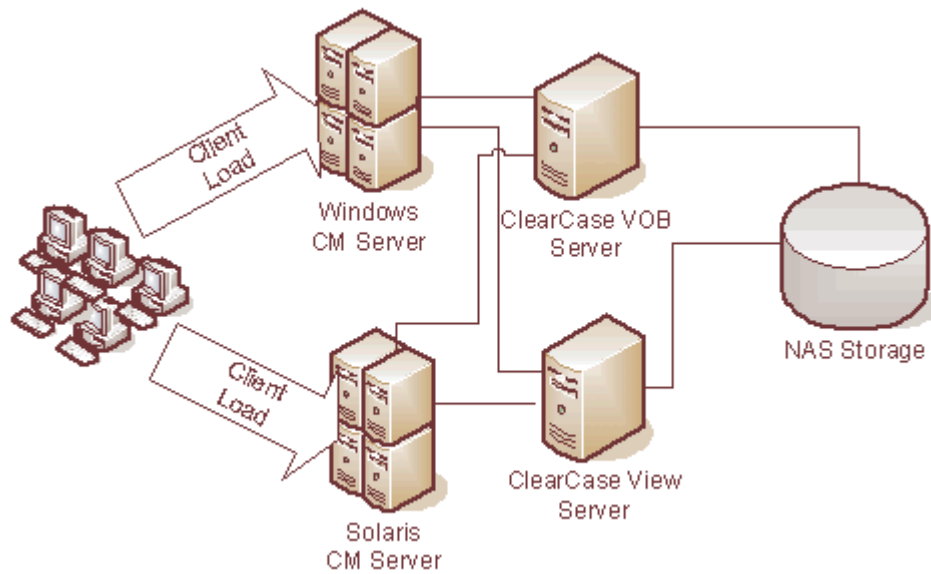


Figure 14: CCRC availability scenario system topology

Test Data

Each Samba VOB was 430MB and had the structure described in the following table:

VOB	#	Size	Elements	Versions	Branches	Hyperlinks	Labels
Samba	20	430 MB	358	2,505	1,428	0	5,770

WebSphere version 6.1 Configuration

The following WebSphere settings were used for all tests:

Description	Value
"Default" thread pool with minimum and maximum sizes	Min=200/max=400
"Web container" thread pool with minimum and maximum sizes	min=200 max=400
CcRpc connection factory (max number of connections)	200
oncrpcCallThreshold	5000
idleServerInterval	120
serverThresholdCount	40
maxServersPerCredential	5
maxServerCount	200
interactionRequestTimeout	300
busyServerPossiblyIdleLimit	14400
Non-interactive desktop heap size increased	1024
JVM heap size	1GB
Total desktop heap size from (SessionViewSize)	192
Trace files	disabled

Automation Driver Infrastructure and Tools

System testing utilized Rational Performance Tester (RPT) to simulate multi-user workloads against the system under test. The RPT tool has been extended via RPT Protocol extensions that allow you to automate the execution of various workloads using the CM Server public API. This allowed for the creation of user workloads that execute on target systems to simulate 200 active users to exercise the load, stress, and volume characteristics of the application.

Execution Procedure

The Base ClearCase workload on the Windows and Solaris platforms are started independently and allowed sufficient ramp up time to reach the desired targets. After all workloads are running 200 users, the performance probe is executed for a 6-hour period to collect metrics. Additionally, metrics are also collected continuously by several tools and system utilities on a 24-hour basis at varying intervals to get multiple data points for analysis of standard deviations and averages.

Workload Characteristics and Results

The ClearCase CM API workload was used to create load on the ClearCase test environment. This workload was designed to model the operational profile found at a large customer site and consisted of 200 concurrent users executing transactions at a rate of 15 per hour per user. The operations were distributed equally against the VOBs.

This workload was run for five days on the Windows and Solaris CM Servers and metrics were obtained from the test infrastructure at regular intervals. The following table lists the transactions executed as part of this workload.

Transaction	Description
CCRC Login	Login to the CM Server by specifying the user name/domain/password
Create View	Create a Base ClearCase View
Set Configuration Specification	Load the source VOB
Make Element	Create a new file or directory element in ClearCase
Checkout Directory	Checkout a specific directory under the root level
Undo Checkout	Undo Checkout of a file or directory
Get Property of VOB	Gets a VOB tag list of the currently registered VOBs and the robust set of the properties for each



Transaction	Description
Get Property of file	Get property of the specific file
Modify File	Check Out a specific file, modify it and check it in
Make Type	Make Type – Label Type
Get View Property	Get the property of the current Base ClearCase View
List History	Get the List History of the specific file
Make Label	Create an apply a new label attribute on an existing element
Update View	Update the current Base ClearCase view
Remove View	Remove the current Base ClearCase view

Windows CM Server Results

Day	Total Completed Users	Transactions Completed	Transactions per hour per user (TPH) Observed
Day1	200	71,575	15
Day2	200	90,587	19
Day3	200	90,010	19
Day4	200	90,230	19
Day5	200	89,698	19
Summary	200	432,100	18

Solaris CM Server Results

Day	Total Completed Users	CCRC Completed	Transactions per hour per user (TPH) Observed
Day1	200	81,240	17
Day2	200	80,961	17

Day	Total Completed Users	CCRC Completed	Transactions per hour per user (TPH) Observed
Day3	200	81,332	17
Day4	200	80,924	17
Day5	200	80,747	17
Summary	200	405,204	17

Overall results

CM Server was able to process transactions for 200 users over 5 days without restarting. The results for both Windows and Solaris servers were consistent with an average transaction rate of 17.5 TPH/U. No performance degradations were observed.

Performance Probe

This performance probe is used to gather metrics that can be used to compare performance improvements release over release. This test case is executed concurrently with larger, background workloads (200 users) and is executed once per day for a duration of about 6 hours. To ensure repeatability, this test case is executed against source code for Samba v3.0.20 which has been embedded into the TestVOB6 VOB and is stored in its own source branch.

The table below describes the Single User Benchmark (SUB) CCRC transaction statistics:

Transaction	AVG Transaction Time (seconds)	Standard Deviation (seconds)
Create View	3.770	0
Set Configuration Specification	.610	0
Make label type	.703	0
Make Folder	11.080	2.511
Make File	10.710	2.916
Checkout File	.900	.336
Checkout Folder	.731	.232



Transaction	AVG Transaction Time (seconds)	Standard Deviation (seconds)
Get Properties	2.600	.552
Get View Properties	.845	.151
List History	.135	.044
Undo Checkout Folder	3.015	.845
Checkin File	1.299	.442
Get Properties VOBS	.906	0
Make label	.156	0
Remove View	1.375	0
Update View	5.375	0

4.4.3 ClearCase High Availability on Solaris

In the Rational ClearCase version 7.1 release, the High Availability (HA) solution (Solaris support only) was tested using Veritas Cluster Software version 5.1. The ClearCase HA solution is now supported on both NAS and SAN storage.

In version 7.0.1, Rational ClearCase provided support for HA using Veritas version 4.1 on NAS only; for Rational ClearCase version 7.1 the testing involved upgrading to a newer version of Veritas and running a set of planned (graceful) and unplanned (for example, machine failure) failover tests.

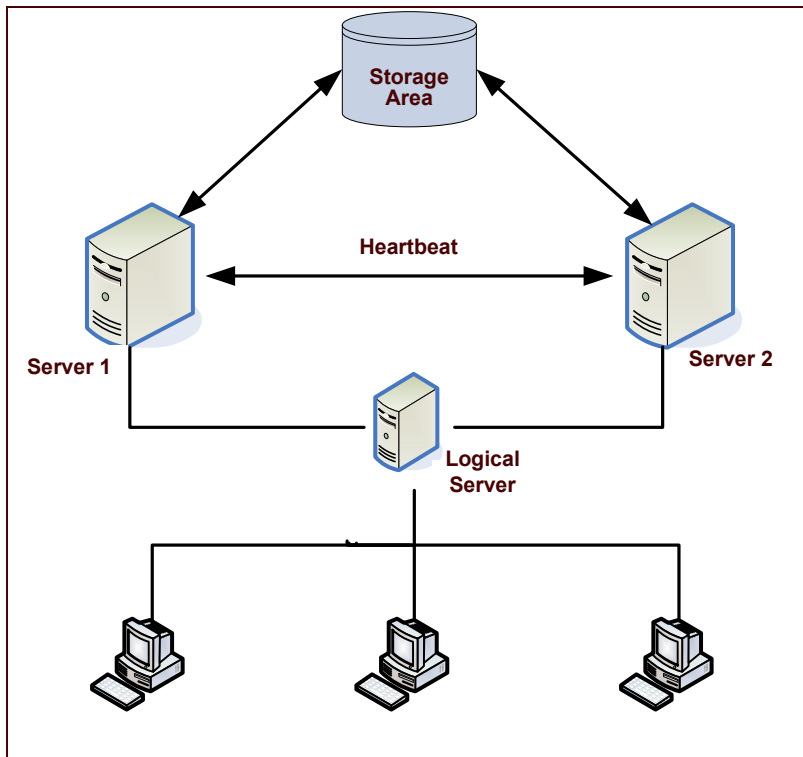


Figure 15: High Availability topology

All planned and unplanned failover test scenarios were successful with no issues.

4.4.4 Rational ClearCase for IPv6 Compliance and Availability

The operations of Rational ClearCase are network-intensive and necessitate extensive tests for IPv6 transition. Wherever network interactions are involved, components must be able to communicate via both the IPv4 and the IPv6 stacks.

New APIs must take care of IPv6 based interactions. The performance and availability of these must be verified in varied deployments. The different deployments that were tested to ensure availability and performance are described in the following figures and text.

Test Environment Configuration

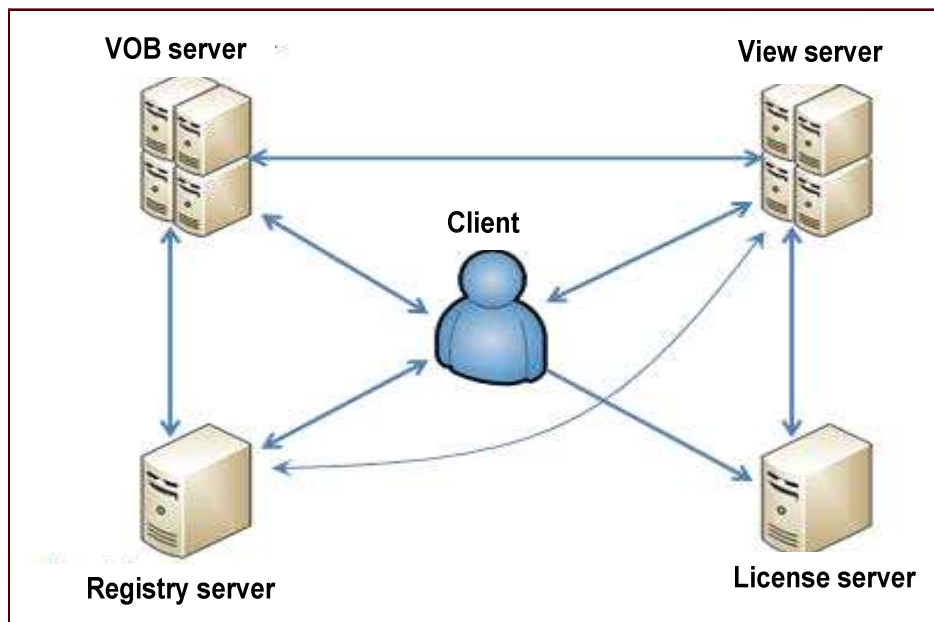


Figure 16: IPv6 compliance and availability topology

The servers were deployed on different machines having different IP protocol stacks.

The setups included:

- IPv4-only: Only the IPv4 stack is present in the IP layer.
- IPv6-only: Only the IPv6 stack is present in the IP layer.
- Dual-Stack: Both the stacks are present in the IP layer.

ClearCase MultiSite Objectives:

- To ensure that the ClearCase MultiSite works reliably in a Dual Stack/IPv6 environment.
- Synchronization between VOB replicas of different sites
- Changes in Mastership for the VOB replicas

Distributed Build using Clearmake Objectives:

- To ensure that distributed builds work reliably in a Dual Stack/IPv6 environment.

Global Monitor using ITM Objectives:

- To ensure that IBM Tivoli Monitoring agents and reporting extensions in conjunction with Rational ClearCase work seamlessly in a Dual Stack/IPv6 environment.
- TEPS (Tivoli Enterprise Portal server) and TEP (Tivoli Enterprise Portal server) client: Provides the monitoring UI.
- TEMS (Tivoli Enterprise Monitoring Server): Collects and processes monitoring data for consumption by TEPS.
- TDW (Tivoli Data Warehouse): Stores selected ClearCase agent data for reporting purposes
- TEMA (Tivoli Enterprise Monitoring Agent): Runs on every ClearCase server to be monitored.

CM Server Objectives:

- To ensure that ClearCase Remote Client (CCRC) and ClearQuest Web (CQWeb) client work reliably in a Dual Stack/IPv6 environment.

ClearQuest Integration Objectives:

- To ensure that ClearCase integration with Rational ClearQuest works reliably in a Dual Stack/IPv6 environment
- Base ClearCase integration with Rational ClearQuest
- UCM ClearCase integration with Rational ClearQuest

Rational ClearCase worked reliably in different IPV6 deployments without any significant performance or availability issues.

5 Customer Feedback

The Rational ClearCase version 7.1 release development cycle involved a high level of customer interaction to create a usable and consumable product. Customers influenced the product through the IBM Rational Design Partner Program (DPP), Usability Testing, Beta Program, and additional customer feedback through the Rational Software Development Conference (RSDC), Voice of the Customer Event (VoiCE), and reports from customers to the IBM Rational Support system.

5.1 The Design Partner Program

The Design Partner Program helps IBM acquire continuous customer feedback that can be leveraged early in the product development cycle, and used to influence the product strategy, direction, and features. Customers from various industries such as Healthcare, Electronics, and Financial Services participate in the program and share their ideas. The goal of continued collaboration with Design Partners is to deliver the right features and improve consumability, while increasing customer satisfaction and loyalty. The DPP is also interested in vetting product strategy, new cutting-edge development, and ensuring our future roadmaps align with the overall business needs of our customers. As a result of the Design Partner Program, IBM is able to create products that customers are excited about and committed to, because these customers exerted considerable influence on the development plans.

Many design partners participated in the Beta Program for Rational ClearCase version 7.1, some deploying on large distributed environments, and others in small and medium environments. Design Partners participated in activities such as feature presentations and feedback discussions, individual customer interviews, surveys, and usability testing on Rational ClearCase version 7.1.

Rational ClearCase version 7.1 enhancements that were based on feedback from the Design Partners included:

- The CM API provides a programmable interface for those customers who want to integrate Rational ClearCase with other tools.
- The Global Monitor logical view generator gathers deployment information from machines running the Global Monitor agent in order to create a MultiSite-knowledgeable hierarchical tree navigator. As agents are installed and uninstalled from VOB servers, the corresponding nodes in the navigator are updated automatically.
- CCRC provides the ability to create working sets, enabling users to control the number of views and VOBs in their display.

5.2 Usability Testing

Usability tests are opportunities for the IBM Rational User Experience Team to observe customers using the software and to collect immediate feedback. Customers can evaluate every aspect of a new design, from text legibility to interaction with the design. Areas where customers have problems are noted, so that simpler, more intuitive, or consistent interactions can be designed and tested.

In addition to performing usability testing as part of the IBM Design Partner Program, customers had the opportunity to participate in usability testing at IBM events, such as Voice of the Customer Events and the Rational Software Development Conferences.

Rational ClearCase version 7.1 enhancements that were based on feedback from usability testing include:

- Updates in the CCRC interface to better indicate the state of an artifact and whether an object is either a directory or a VOB.
- The ability to complete the UCM deliver operation in CCRC is more pronounced and visible. In addition, customers have the ability to set user preference options for the operation.
- Customers of CCRC now have the ability to leverage the Eclipse compare tool.

5.3 Beta Program

Rational conducted an extensive 11-month Beta program for this release. Forty-five customers from around the world downloaded and evaluated early versions of the code. Interactions with beta customers included:

- Weekly meetings with customers and engineers to educate customers on the features of the product and to gather feedback on the customers' experience with the beta code.
- Quality Surveys to gather feedback on specific strengths and weaknesses of the beta. Engineering was able to make adjustments to the final release based on this customer feedback. Customers of the Rational ClearCase beta took particular interest in the new Installation Manager, Global Monitor, and CCRC features.

The Rational Beta Program provides customers with the following benefits:

- Early access to beta code
- Free education
- Free support
- Early development of skills
- Direct input to Rational Development and Product management to influence the development of the software
- Early ability to assess how the new release can benefit their organization

The Beta Program provides Rational with the following benefits:

- Validation of product acceptability (functionality, usability) with key customers to provide input for this and future releases
- Validation of General Availability (GA) readiness and support capability
- Direct customer input to development, marketing, and sales
- References and testimonials from early users of the product
- Ability to provide selected IBM customers and Business Partners with the opportunity to gain early experience with the product

Rational ClearCase version 7.1 enhancements which were based on feedback from the Beta Program include:

- Double-clicking a record in a result set or an activity in a ClearQuest enabled UCM view opens the ClearQuest record form.
- Double-clicking an activity in a view not enabled for ClearQuest opens the change set.

5.4 Future Feedback

Customers interested in learning more about the Rational Design Partner Program, future Beta Evaluation programs, usability testing, VoiCE events or Rational Software Development Conferences should contact their local sales representative.