Industry:
Medium-Range Weather forecasting

Organization:
European Centre for Medium-Range Weather Forecasts (ECMWF)

Description:
ECMWF utilizes the collective scientific and technical resources of 21 European States to generate complex medium-range weather forecasts and disseminate this critically needed weather information daily to European Met services and other international customers.

Business Problem:
ECMWF developers must continuously modify massive amounts of source code in order to provide its meteorologists and computer scientists with the most sophisticated software tools possible. A comprehensive and flexible software configuration management product was essential to efficiently managing the organization's large development projects, which typically involved many developers working independently, yet concurrently, on common files.

Rational Solution:
Rational ClearCase

Key Benefits:
Large numbers of developers can work concurrently on common code

Developers can work independently and privately until modifications are thoroughly tested

FORTRAN files can be accessed quickly for viewing; no extraction is required

Files can be easily compared, merged

Software is easy to use, even without training

Code can be modified and delivered quickly, maximizing productivity of scientists

Technical Architecture:
Number of Developers: 20-30
Platform: UNIX

Rational. software

Rational ClearCase Helps ECMWF Keep Europe on Top of the Weather

Generating medium-range weather forecasts — which predict weather patterns from three to as many as 10 days ahead —presents numerous scientific challenges for meteorological scientists at the European Centre for Medium-Range Weather Forecasts (ECMWF), an international organization supported by 21 European states. Equally challenging is the task of maintaining the massive amounts of source code behind the many software programs the meteorologists require to do their complex job.

For more than six years, ECMWF has relied on Rational ClearCase to manage its never-ending efforts to improve the way it predicts the weather and to ensure daily, on-time delivery of medium-range weather forecasts to European Met services and other international customers.

A Continual Challenge to Modify and Improve

ECWMF is one of the few organizations in the world with an integrated forecasting system specifically geared to medium-range forecasting. Founded by the European States, and taking advantage of their collective scientific and technical resources, the ECMWF's sophisticated numerical models, comprehensive database of weather observations, and powerful computers help Member States provide a wide range of end users with critically needed weather information to help them plan and prepare.

To maintain its reputation as one of the best outfits of its kind in the world — and continue to meet the needs of Member States across the continent — ECMWF faces a significant, ongoing challenge of finding new and better ways to do its job and serve its constituents. "You don't just create a weather model and run it forever... you're always striving to improve it," explained David Dent, principal programmer at ECMWF. As a result, the organization's large group of in-house meteorologists are continually making modifications to the software they use — which creates a significant technical challenge: how to manage that exercise.

Flexibility Critical to ECMWF's Large Development Environment

ECMWF discovered Rational ClearCase in 1992 when converting its development environment to a total UNIX shop. Despite the obvious benefits of replacing its front-end interactive system, the organization was losing its [good] existing built-in source code maintenance system — with no obvious equivalent available in the new environment to do an adequate job. A search of commercially available systems identified the solution: Rational ClearCase.

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"You don't want to be influenced by what others are doing until the time is right. Rational ClearCase allows you to avoid this problem very nicely."

The feature-rich software configuration management product offered ECMWF a number of facilities not available in other UNIX tools — most importantly, the ability to have many different versions of a file, and for the user to have the flexibility to label each private version however he chose. "Freedom to label how you identify your private version of the file is important. We have a fairly large development environment. Our primary weather code which we run in production is also the subject of regular and fairly intensive development to improve its functionality. Rational ClearCase appeared to do the job — and we grabbed it," said Dent, who is responsible for providing general computing application support for ECMWF's meteorological research workers.

Parallel Development Key to Innovation, Productivity and Security

Rational ClearCase allows both meteorological researchers (who seek better ways to predict the weather) and computer scientists (who are responsible for the graphics and related applications for presenting the forecasts) to work independently on code modification — while being able to get at other people's versions when they need to. With 20 to 30 people working concurrently, this means that there could be as many as 20 to 30 varieties of modified code at any time. "You don't want to be influenced by what others are doing until the time is right. Rational ClearCase allows you to avoid this problem very nicely." Dent said.

Being able to work independently is essential at ECMWF. This allows specialists to address improvements on specific aspects of the weather model — convection, radiation or rainfall prediction capabilities, for example — each of which represents separate code elements within the overall structure of the model. Each specialist can essentially work in isolation "behind closed doors," with full access at any time to standard source in production, previous versions of standards, and modifications in progress by other staff. With Rational ClearCase, users can make private copies of these files, label them any way they like, and keep them private for as long as necessary, with no impact on system operation or other development efforts. Team leaders meet periodically to review the development efforts and agree on what modifications are to be implemented.

ECWMF maintains many thousand separate FORTRAN files (routines). A developer may be responsible for modifying 10 to 20 of these files at any time, a process that involves accessing and viewing production (standard) files, making the desired modifications and then testing the modified files to see if they represent an improvement. "It's very important that what the developer does is not wrong, faulty, or will fail or be worse than what he's comparing it to," explained Dent."Furthermore, what he does must not affect anybody else before he's ready. He must test it out thoroughly. Keeping modifications private is crucial. If we didn't have a secure method of doing that, we could very easily influence and destroy the work of other people. Their time could be wasted."

Users Value Easy Access to Text Files, Difference and Merging Tools

Rational ClearCase offers ECMWF users some important technical benefits over performing software configuration management with UNIX tools, Dent said. “To look at the FORTRAN in one of 2,000 files, you may have to issue a command to extract what you want out of the database before you look at it. Rational ClearCase avoids that problem; you can see the files themselves [in read-only mode] without extraction. You can use ordinary UNIX tools that users are familiar with, such as UNIX editors or other commands, directly on these files without specifically issuing any Rational ClearCase commands until you want to make a change. You can get at the source you want to study without doing anything special. This makes it very easy for a new arrival to go in without training and look at files with his existing knowledge of UNIX — that’s a big advantage.”

Two highly used Rational ClearCase features of particular value to ECMWF are its difference and merging tools. “We’ve reached the stage where there are many different versions of particular files in production over the years, and many versions being tested by developers,” said Dent. “I can compare what I’m doing with today’s production files or with other standards from several years ago — under the same umbrella — and I can merge what’s been done with what I’m doing using merge tools provided by Rational ClearCase. These are very valuable features.”

Rational ClearCase Used for Wide Range of Projects

ECMWF uses Rational ClearCase (Versions 3.0, 3.1 and 3.2) for a variety of projects, from the major production weather model (the largest) to dozens of others of all sizes, including MetView — a workstation tool for drawing and manipulating forecast information on weather maps — and a number of other, much more technical, weather-related applications.

Effective management of software development and modifications with Rational ClearCase has a direct impact on the success of ECMWF’s mission-critical production files. Customers expect the latest forecast results to arrive at a certain time of day or night, every day, in order to meet their reporting obligations to newspapers, television, shipping companies and others. This means that production software must run on schedule and without problems — starting and ending computations at a specific time. Any problems resulting from modified source code could destroy the precise timing and the quality of the results.

“For us, the value of Rational ClearCase is not measurable in terms of hours or dollars,” said Dent. “The bottom line is that we must be able to look at and modify the source code we are maintaining — easily and quickly — without having to learn lots of things and wait a long time. We cannot get in the way of scientific research and development. And we must maximize the productivity of our scientists. Rational ClearCase allows us to achieve this bottom line.”

“Rational ClearCase provides the flexibility to efficiently manage large source code development projects.”

“Rational ClearCase enables our scientists to develop modified versions of code in a safe and secure way, with good access to developments by other scientists and to previously released versions.”

About Rational

Rational provides a software development platform that improves the speed, quality, and predictability of software projects. This integrated, full life-cycle solution combines software engineering best practices, market-leading tools, and professional services. Ninety-six of the Fortune 100 rely on Rational tools and services to build better software, faster. This open platform is extended by partners who provide more than 500 complementary products and services.

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