

Philips Medical Systems Increases Efficiency of Geographically Distributed Development with IBM Rational Software Development Platform

Overview

■ **The Challenge:**

With its development team dispersed across three continents, Philips Medical Systems needed an effective way to manage geographically distributed software development. At the same time the company sought to improve the responsiveness, efficiency and predictability of its development initiatives.

■ **The Solution:**

Philips Medical Systems adopted an iterative development approach based on the IBM Rational Unified Process with rapid, one-week iterations. This approach was supported by tightly integrated tools from the IBM Rational Software Development Platform, including IBM Rational ClearCase and IBM Rational ClearQuest.

■ **The Benefit:**

The company has established a highly synchronized worldwide development team that responds quickly to changing priorities and business needs while delivering quality software systems with less risk and increased productivity.

Philips Medical Systems, a division of Royal Philips Electronics, is a leading supplier of diagnostic imaging equipment, information technology and related healthcare services. The company's Imaging Systems business develops X-ray, ultrasound and nuclear medicine imaging equipment used to create detailed images of various parts of the body for radiologists and cardiologists.

The software Philips Medical Systems develops to support these systems must be exceptionally stable and reliable. Further, this software must be developed and updated rapidly to keep pace with technology innovations, medical advances, and the demands of medical practitioners.

In Philips Medical Systems, the Healthcare IT development team has been delivering quality software for years. But in the past, the team's ability to react quickly to changing demands was hampered by the difficulties inherent in geographically distributed development and a waterfall development methodology. For development centers in the United States, the Netherlands and India — with between 15 and 25 engineers at each site — synchronizing and managing development projects was a considerable challenge. In addition, the waterfall approach — in which each phase of development is carried out sequentially, only starting after the previous phase has completed — made it hard to adapt to changes midproject.

A Comprehensive Approach

Philips Medical Systems Healthcare IT embarked on an enterprise-wide initiative to address these challenges by adopting an iterative development approach and other best practices of the IBM Rational Unified Process[®],

or RUP. Theo Engelen, Product Development Director at Philips Medical Systems Healthcare IT, explains, “Adopting the integrated RUP approach has helped us to increase the pace of improvement in our product creation process. It is also helping us achieve our goal of reducing lead-times of new releases from up to 15 months to 6-9 months”.

At the same time, the development team adopted a broad set of integrated tools from the IBM Rational® Software Development Platform, including IBM Rational RequisitePro® for requirements management; IBM Rational Rose XDE® for visual modeling; IBM Rational PurifyPlus™ for runtime analysis, IBM Rational Robot for automated testing, and IBM Rational TestManager for test scheduling and management. The development team also reconfigured its existing IBM Rational ClearCase® and IBM Rational ClearQuest® implementation to improve software configuration management performance in its geographically distributed environment.

To facilitate this transition, Philips Medical Systems engaged Ton Schoots, a senior consultant and software architect at Maiastra based in the Netherlands. Business leaders at Philips Medical Systems were encouraged by Schoots’ previous

customer engagement, in which he helped another company perform a similar transformation and achieve an estimated 25 percent improvement in development efficiency.

In addition to the productivity gains provided by IBM Rational tools, Schoots reports that a relatively short one-week time limit for each iteration contributed to the increased efficiency. Philips Medical Systems decided to replicate that approach but faced the additional challenge of completing the weekly iterations across multiple development sites.

Starting with Requirements

One of the first development initiatives to apply the RUP-based weekly iterations and multiple IBM Rational tools was an existing system for Cardiology Image Management that enables physicians to access images of different modalities like cardiac catheterization labs and echochardiography and use them for analysis, procedure planning and reporting.

Although the system has been in use commercially for several years, Philips Medical Systems continues to add functionality and improve performance. The development team uses IBM Rational RequisitePro to manage the requirements for this system as they evolve. Requests for new functionality, whether originated

by a customer or generated internally, are typically defined as use cases in Rational RequisitePro by a product team within Philips Medical Team responsible for handling input and requests for new features.

Schoots notes that Rational RequisitePro is a valuable communication and project scoping tool for the entire team. “We have people spread over multiple locations, and each group is using Rational RequisitePro: the marketing team, analysts, the development team, testers and project managers. It is really one repository where everyone can see what we are doing, what the scope of the next iteration is, and track our progress.”

Engelen agrees, “With Rational RequisitePro, we have implemented a requirements management process that helps us to manage requirements effectively across our multiple sites. It adds structure to our scoping process, assures prioritization of requirements to support our business priorities, and helps us balance functional and non-functional requirements.”

The “RUP Activity”

After the use cases are prioritized, the project manager generates a set of individual activities — called “RUP Activities” at Philips Medical Systems — in IBM Rational ClearQuest that will be performed to implement

each use case. The “RUP Activity” has a one week cycle, starts and ends within one iteration, and directly contributes to the progress of the project.

Each activity has four distinct phases: Submitted, Assigned, Opened and Closed. When a project manager assigns an activity to a particular developer or development team, the state is automatically set to “Assigned.” When an analyst or developer checks out a model or code using Rational ClearCase, he must associate that action with a specific activity in Rational ClearQuest — and that check out operation automatically sets the state to “Open.” After the analyst or developer finishes making the necessary changes and checks the asset back in, the state is set to “Closed.”

In this way, Schoots explains, Rational ClearQuest helps Philips Medical Systems automate and enforce its development process. “With Rational ClearQuest, we have an automated to-do list. We also use Rational ClearQuest to synchronize across all the sites. For example, all of our analysis tasks close on Monday. If we come in on Tuesday and see in Rational ClearQuest some analysis tasks still open, we know we have issues and some people are behind. We are also using Rational ClearQuest

MultiSite® which enables us to monitor the project from anywhere in the world very easily,” he notes.

IBM Rational ClearCase MultiSite also enabled the Philips Medical Systems development team to solve one of their most pressing issues: integrating the development activities after completion at several different sites around the world. These teams focus on production to implement the new functionality, which is ultimately merged back into the main development stream by the integration team. Schoots explains, “We created an overall integration stream in Rational ClearCase. Everyone delivers to and re-bases from that integration stream. Every day, all the sites update that one stream, and we get a new build every two hours. The testers can then pick up those new builds every two hours throughout the day and use them to pre-record test scripts and prepare for Friday’s testing. Rational ClearCase and the overall integration stream enable the weekly iterations and help us integrate across all the sites daily.”

An Iteration Every Week

Completing an iteration every week required some adjustments from the development team, but Schoots reports that following a proven process based on RUP made the transition easier. “Our process follows all the

principles of RUP— it is iterative, it is architecture-centric — the only aspect that is out of the ordinary is that we are iterating in one week.”

In fact, Schoots notes, the team quickly found they were more relaxed and confident with the new approach than they had been in the past. He explains, “I know it seems like a paradox, but development is much less chaotic now. Many people envision a weekly iteration as requiring a very high pressure, hyper-threading environment, when actually it does not. The key is to just schedule the workload you are capable of doing in a week’s time. The first time it is hard, but after two or three iterations it is quite easy to do.”

He continues, “In the past, one of the biggest challenges we had was that our engineers were under considerable stress. They felt they were being asked to take on a tremendous workload and there was frequent context-switching throughout the day. One rule that we established, is that we don’t change the work that we ask from an engineer during the week. The team has reacted very positively to that, and the entire process is much smoother now.”

According to Engelen, short iterations provide significant advantages in project management. “The integrated

RUP approach, with Rational ClearCase and Rational ClearQuest enables us to monitor progress of our project based on the completion of actual development activities. The weekly iteration cycle provides us with short feedback loops, up-to-date progress information, and accurate management reports,” he notes.

Busy Mondays

All iterations at Philips Medical Systems start on Monday and end on Friday. Monday’s focus is primarily analysis. “On the first day of the iteration everybody is working. Monday is quite a hectic day,” Schoots notes. The day’s activities follow the standard analysis workflow of RUP. An analyst defines the boundary, control, and entity classes and then creates a UML (Unified Modeling Language) sequence diagram using IBM Rational Rose XDE™ Developer.

In addition to standard analysis activities, the team must complete test analysis on Monday as well, in order to be able to complete tests for the iteration by Friday. Based on the activity diagram for the use case, the test team generates a test case document that includes every possible scenario for that activity diagram. The test team will test each scenario or will provide rationale for why that scenario will not be tested.

If a particular use case is unclear, a system analyst is allowed to change the use case on the fly on Monday. On any other day, changes must be initiated via a change request in a controlled manner.

“It is quite important that we finish the first day’s work in one day. That sets up the rest of the week: the system analyst goes to work on further requirements, developers start designing and coding, and testers begin work on test scripts,” says Schoots.

Forward and Reverse Engineering

Increased developer productivity through tool automation and integration is a significant factor in enabling the Philips Medical Systems development team to meet its weekly goals. One key example of this automation is the team’s use of Rational Rose XDE to generate code from UML models. This forward engineering is complemented by reverse engineering, which updates models after code has been modified — to ensure that code and models remain synchronized throughout each project.

“We forward engineer from the design model to code models and then code models to code using Rational Rose XDE,” says Schoots. “From there, we reverse engineer the design models

after code changes. And we created a Rational Rose XDE plug-in to take the next step and generate the design model and the overall architecture.”

Engelen reports that UML modeling in Rational Rose XDE has also helped the distributed development team improve communication and consistency. “We develop our products with experts in the medical domain located at different sites close to our customers. Because all of our developers work from one common UML model describing the system, we can ensure the consistency of our designs, detect problems early in the development cycle, and reduce communication overhead,” he explains.

Jumpstarting Tests

Philips Medical Systems also uses the Rational Rose XDE models to automatically generate test frameworks for automated functional tests using IBM Rational Robot. “We not only have an executable at the end of the week, but we also have the test scripts ready so we can do a test run on Friday. To meet this deadline, testers must pre-record scripts, based on the sequence diagrams for the new functionality. In order to achieve that we developed a test architecture and test design techniques that are based on model-

ing. The test architecture looks very similar to the design architecture, but it enables us to round-trip engineer Rational Robot scripts using a Rational Rose XDE plug-in. Our Rational Robot scripts are visible within the test design model and are synchronized with those models,” says Schoots.

This approach has also helped the testing team further increase productivity by reusing existing test assets. “The test design model has enabled us to put an infrastructure in place so we can quite easily find test scripts that were already created at any of our sites and reuse them,” Schoots adds.

Performance, Stability and Quality

Automated testing with Rational Robot has proven to be exceptional effective, helping assure Philips Medical Systems’ high standards for quality while reducing testing costs. Engelen reports, “As developers of software for the medical IT domain, testing is extremely important for us — but it is also very time consuming. By automating our tests with Rational tools we are able to increase our test coverage and repeat the full regression test daily without adding additional resources to our project teams. The pay back time of test automation has proven to be well within the scope of one release project.”

In addition to functional regression tests, the testing team also uses Rational Robot for performance testing of its applications to ensure medical personnel will have reliable, timely access to diagnostic images.

This testing is further complemented by developers and testers using Rational PurifyPlus™ to eliminate memory leaks, pinpoint memory access errors, profile application performance, and perform code coverage analysis during automated test runs.

Early feedback on the quality of the application after implementing IBM Rational tools has been very positive “We recently released a version to one of our customers for evaluation and they were very enthusiastic now about the stability of the application. We see that as one of the first successes of this new approach. Also, integrating our software on a daily basis has really helped improve quality and stability. We do not have a major ‘integration moment’ anymore somewhere at the end of the process. We integrate every day, and reduce that risk piece by piece,” says Schoots.

The Friday Wrap-Up

Each development site at Philips Medical Systems is responsible for implementing and testing new requirements, features, use cases,

or fixes every week. By noon on Friday, all work must be checked in using Rational ClearCase. A final full test run is then performed at each location using IBM Rational TestManager to organize and schedule the Rational Robot tests. Schoots explains, “Each site’s team does their assessment and their testing on Friday. The integration team, because of time differences, isn’t able to run their tests until Monday, so they close their iteration on Monday.”

Overall project progress — as well as weekly progress — is measured via traceability in Rational RequisitePro. Each requirement includes specific attributes that are set when the requirement is implemented, when a test script has been written for it, and when the requirement has passed its tests. “With IBM Rational tools, we have a much better handle on the requirements and can measure progress by seeing immediately what has been implemented and what has not. We can see where the pain points are and make adjustments,” says Schoots.

Changing Course and Correcting Problems

Among the advantages of using a relatively short iteration time is the ability to rapidly adjust to changing priorities, address risks, and undo problems introduced in an earlier

iteration. "One benefit of using a one-week iteration is that we can experiment in the early phases of the project and see if a new idea is working out in the application. If the idea is not delivering what you expect from it then you only lose a week," says Schoots.

With Rational ClearCase and Rational ClearQuest, Philips Medical Systems can easily roll back the development effort to any point in time. "If we create a huge problem in the system one week, we just run the system back one week and start over again. With Rational ClearQuest and Rational ClearCase, we know exactly what we did in each week and we have a good handle on the project and its organization. We couldn't develop without them," he adds.

Significant Benefits Realized

In the first fifteen months of Philips Medical Systems' transition from waterfall to iterative development supported by the IBM Rational Software Development Platform, the company has already seen significant improvements in efficiency, predictability and responsiveness. Engelen notes, "RUP and Rational tools have proven to be a driver for positive change in our organization. Although we are still in the process of implementing them across all of our projects, we have already seen

significant improvements, particularly in the areas of requirements management and test automation."

Schoots adds, "Using IBM Rational tools and RUP with a short iteration, we are able to adapt to and implement changes more quickly. When we change something in the system, we can see the outcome immediately, so in one week we have an understanding of how it is working out. One of the more important things that we achieved is that we are more predictable."

He concludes, "From a management perspective, every week we have a detailed report so we can see how the project is progressing. We don't have to wait for two or three months to find out if we are on track. The other advantage is that problems tend to arise earlier, when they are easier to address — as opposed to a waterfall process in which most problems pop up at the end of the life cycle. And, as we continue to improve efficiency we are able to implement more features in the same timeframe."



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