Case Studies in the Use of Rational Jazz for Systems and Software Development

Collaborative Product Development Associates (CPDA)

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EXECUTIVE SUMMARY

Embedded systems have been growing in complexity for decades. Given their interactions with the physical world, they face inherent constraints in their reliance on host environments that are not traditional servers or PCs. Engineers rely increasingly on efficient tools and processes to manage these interactions and provide systems engineering solutions that regularly cross domain boundaries. These Mechatronic systems integrate the mechanical, electronic, and embedded software disciplines in a synergistic manner to create features and functions that were previously either impossible or, at minimum, too difficult or expensive to implement. This rising complexity drives the need for efficient and effective processes and tools.

As numerous end-users confirmed in interviews with Collaborative Product Development Associates (CPDA), IBM Rational tools solve many issues in systems development. Leading users from six different companies, who are leveraging IBM Rational solutions for the execution of embedded systems development, confirm the strength and potential for the platform. The attention to collaboration throughout the entire lifecycle establishes a key strength of the Rational tool suite – and especially for Rational Team Concert.

For integration and interaction between tools, the Jazz platform and the Open Services for Lifecycle Collaboration (OSLC) standards – when they are fully developed – will support framework solutions that forego the massive need today to duplicate data across the enterprise. Jazz is IBM Rational’s open enterprise platform for data integration and collaboration among tools. OSLC is a community effort to create standards-based definitions of interfaces to data leveraged throughout the software development lifecycle. We found the capability of Rational Team Concert, supported by the open integration of the Jazz platform and OSLC definitions, to be an impressive move in the right direction.

The in-depth discussions covered six companies that represent the telecommunications, industrial automation, aerospace and defense, and application development industries. Especially noteworthy discussions with a global telecommunications equipment provider, a major aerospace and defense component manufacturer, and a European electronics company are highlighted in this report. Through a combination of scorecard discussions and targeted interviews, CPDA assessed the usage of IBM Rational tools within each company.
Overall, the group concentrated on the eight areas outlined in the table below with the highest priority accorded to the first three:

| Collaboration | Collaboration drives a common shared approach that gets diverse design groups to target the same objectives and rely on the same language. To achieve that goal, status tracking and data sharing must represent an automatic part of the collaborative process itself. |
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| Process Support | Process Support, as provided out of the box with Team Concert minimizes the need for base tool customization. Since every company uses different processes to design, test, and implement embedded systems, this flexibility represents a major payoff. |
| Integration | Integration of data across multiple applications enables any team member to assess the context of their work by tracing any change, specification, or requirement back to its source. Based on the Jazz platform and Open Services for Lifecycle Collaboration (OSLC), the infrastructure links data sets supported by the individual tools, and avoids the duplication of data into a single, monolithic solution. |
| Requirements Management | Requirements Management benefits dramatically from the full integration with operations to identify the impact and criticality of proposed changes. Rational DOORS, a leader in requirements management for systems, and Rational Requirements Composer, a newer Jazz-based product, provide requirements solutions. |
| Modeling | Modeling the system validates behavior and functionality early in the development cycle. Rational Rhapsody fully supports models that use Systems Modeling Language (SysML). |
| Testing | Testing of the system must confirm code functionality and performance. Rational Quality Manager supports the benefits of integration, monitoring, change control, and collaboration as the product builds on the Jazz platform. |
| Re-Use | Re-Use is promoted through search capabilities, which identify existing products with targeted functionality. The ability of the Rational suite to link requirements, designs, architecture, and testing elements greatly reduces the effort necessary to identify all re-usable data. |
| Configuration and Change Management | Configuration and Change Management present very different challenges for software development compared to mechanical or electronic efforts. Tremendous value can be gained by leveraging OSLC standards to manage content changes for cross-domain Mechatronic systems. |

Overall, embedded systems development represents a highly complex effort requiring the proper alignment of iterative processes and integrated tool suites to be competitive in today’s market. Through the advantage of IBM Rational offerings, centered on Rational Team Concert, companies are able to perform full impact analysis, global work sharing, and detailed collaboration, all within a single
environment built on the Jazz framework. Rational Team Concert, Rational Quality Manager, Rational Requirements Composer, and Rational Project Conductor – all based on the Jazz platform – strengthen the benefits of iterative development by fully supporting traceability and integration across all development activities. The Rational offerings clearly support frequent communication and collaboration across global teams, and distribution of ownership of work items. A low IT footprint and moderate implementation effort reinforces the value proposition for Rational Team Concert and the associated Rational offerings.

Issues do remain, however, with the lack of standards-based interfaces to incorporate PLM systems and other modeling and simulation packages, leaving gaps in the integration landscape. All companies interviewed reported disconnects between the software development environment and the product data management (PDM) and bill of material (BOM) environments. Large solution providers are encouraged to build OSLC-based connections to their tools, which will bridge these gaps. The largest hurdle relates to the transition from existing tools to new offerings, as this transition comes at a cost. With the increase in globally distributed workgroups, the benefits of collaboration should encourage companies to begin piloting collaborative tools suites with out-of-the-box functionality that was only available previously in the form of highly customized and expensive implementations.
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CPDA: Collaborative Product Development Associates, LLC

CPDA’s Product Lifecycle Management (PLM) research programs target the critical decisions in PLM challenging Design, Engineering, Manufacturing, and Information Technology managers and executives. CPDA’s collaborative research programs provide in-depth analysis of strategies, products, issues, processes, technologies, trends, case studies, and surveys for assessing technology, business goals and objectives, and implementation road maps. The four collaborative research programs include:

**Design Creation and Validation (DCV):** The DCV service identifies and tracks advances in design technologies with a bottom-up view of engineering requirements spanning the full development cycle from the desktop across the enterprise. The service advises clients on best approaches in parametric and direct geometric modeling as well as knowledge engineering with templates and rule-based architectures. Increased outsourcing forces the need for dramatically improved model content, quality, and global collaboration. DCV reports on insights and best practices for horizontal integration of design modeling across all product development domains within the enterprise.

**Design/Simulation Council (DSC):** The DSC supports a framework to provide an integrated environment to optimize the diverse and divergent specialist activities currently fragmenting design efforts. For simulation-driven design, CAE must fully integrate with geometry creation up front, before detailed design for manufacturing, with test, and with requirements. A detailed scorecard on Simulation Data and Process Management (SDPM) focuses on end-user requirements and best practices, and analyzes twenty-five leading users from over fifteen companies. A strategic, high level review and scorecard of the offerings by leading SDPM vendors also is continuously updated.

**PLM Integration / Product Definition (PLMI/PD):** The PLMI/PD program clarifies and evaluates the new capabilities required to reconcile deepening detail and escalating complexity across domains in product development, manufacturing, and downstream functions; highlights the best, most advanced uses of leading technologies; and provides a link between IT infrastructure and the realization of business value. Sponsors seek guidance for defining an implementation road map, reducing product and process complexity and cost, and harmonizing information and product architectures. The strategic analysis planned for 2010 concentrates on: Requirements Management, Model Driven Development, and Generic Product Structures.

**Product Value Management (PVM):** The Product Value Management program extends detailed analysis of PLM throughout the full cycle of product development. The highest current priority applies to the integration of the mechanical, electronic, and software development specialties whose isolation fragment design efforts. The Mechatronics Council supports industry-wide efforts to establish a framework of common terminologies for collaboration; to unite data, processes, tools, and people to enable cross-domain impact-analysis at all levels of design. In order to distribute this knowledge, the data model and traceability must be captured at the detailed level. This program identifies best practices in cross-domain collaboration, and through a series of scorecards and benchmarks, provides specific recommendations for improvements.

Collaborative Product Development Associates was formed by the PLM research team of D.H. Brown Associates, Inc. (DHBA).
User Experiences with Rational Jazz Offerings

INTRODUCTION

While extensive discussions took place with six companies, three companies stood out. All three are heavily engaged with Jazz offerings and have detailed experiences to share. The first section of this report highlights the three end-user stories, while the second section assesses IBM Rational tools across eight critical focus areas.

CASE STUDIES

A GLOBAL TELECOMMUNICATIONS EQUIPMENT PROVIDER

TARGETING A TRANSFORMATION SUPPORTED BY RATIONAL TEAM CONCERT, QUALITY MANAGER, REQUIREMENTS COMPOSER, AND RHAPSODY

A leading provider of telecommunication equipment leverages several IBM tools for their development activities. They have also initiated a significant transformation of their tool landscape with the adoption of Jazz-based Rational offerings. With a strong priority for collaboration, Agile and Scrum practices are common and growing throughout the company. The company intends on leveraging OSLC interfaces to the greatest extent possible to integrate their current tools. Next, they will pursue a strategic migration to the full Rational suite, which they strongly believe will reduce the number of applications necessary for any specific purpose, such as change management.

As the heart of the collaborative effort, Rational Team Concert is currently being deployed to design teams throughout the company, which has eighty distributed Scrum teams running in parallel. With a migration target of fifty teams by the end of 2010, they are anxious to realize the efficiency gains found in Team Concert. With manual integration today, impact analysis and work item tracking are unnecessarily burdensome and in some cases impossible, due to the lack of connections between their current tools. With a strong focus on Scrum, the company recognizes the critical nature of links between artifacts, and has prioritized the deployment of Rational tools to manage this risk. They have high expectations to achieve these integrations out of the box, while simultaneously accomplishing a move from document-based approaches to deeper levels of detail that promote better alignment for specific content.

Requirements management currently demands considerable effort through human intervention and intelligence for impact analysis and the identification of
interactions. The company plans to replace document-centric approaches with Rational Requirements Composer, which they rate as sufficiently mature to initiate implementation. The complex mechanisms for versioning and tracking of requirements relationships will be greatly simplified once they complete the migration to Jazz-based Requirements Composer. The need to generate requirements documents, which are then placed under change control in a separate system, will be eliminated when Requirements Composer directly manages change control. The move to Requirements Composer is targeted for early 2011, allowing full integration of requirements into their process.

System modeling in the form of use cases, state machines, and sequence diagrams are all performed within the company. The results, however, are de-coupled. Based on the strategy to leverage Rational Rhapsody, which they will integrate with Requirements Composer and Team Concert, the company will move the modeling activity into a central tool suite.

The implementation of Rational Quality Manager for test management provides an opportunity to enhance the disconnected approaches used today. Once deployed, Team Concert and Quality Manager will centralize test tracking and reporting, including test automation for both simulated testing and physical hardware execution. Currently, the company integrates test cases, test data, and requirements coverage by hand. For requirements, the move to Quality Manager provides the potential to automatically link requirements to the testing activity. The move to Quality Manager is targeted for the end of Q2 2010.

The company achieves strong process collaboration through the leverage of Rational Method Composer, which supports process optimization and evaluation. Given the daily measurement of key performance indicators and the evaluation of the complete design status on four-hour cycles, mature processes become an imperative. Method Composer represents just one example where the company has found IBM solutions to be more easily adapted to fill existing technology gaps than offerings from other vendors.

The company recognizes the need for collaboration during the development of their products and leverages their Scrum teams and agile processes to fulfill that need. They also understand the necessity that tool solutions align with this priority. They have launched a fundamental strategy to deploy Rational Team Concert, Rational Quality Manager, Rational Requirements Composer, and Rational Rhapsody throughout the company. By integrating requirements, modeling, and testing into a collaboration-centered platform, the company anticipates a new level of performance which they believe is very important for the future.
A MAJOR AEROSPACE AND DEFENSE COMPONENT MANUFACTURER

RATIONAL TEAM CONCERT AS THE BACKBONE FOR COLLABORATION AND INTEGRATION

A global supplier of systems and services to aircraft and engine manufacturers, airlines, and defense forces around the world, this major A&D company’s products are found on almost every aircraft.

With a large range of solutions containing complex electronics, the company engages in software development in nearly every one of their businesses. Due to acquisitions, the company now relies on several flavors of tools and processes that they have worked to unify over the past two years. They began working with IBM in early 2009 and their first deployments are under way.

Recognizing the need to focus on collaboration as the highest priority, the company has begun to deploy Rational Team Concert, a product they welcome due to its low IT footprint and strong collaborative features. By comparison, other products require significant support organizations to manage and maintain. Team Concert allows them to implement the application and hand it off to engineering for immediate use without requiring extensive IT support. In addition to embedded software developers and their traditional IT organizations, other non-software disciplines at the company have expressed an interest in using Team Concert. They anticipate the use of Team Concert as a standard product engineering desktop tool for visualizing the full development lifecycle – an approach their software groups have targeted for some time. As an effective mechanism to capture all actions and tasks, along with monitoring the progress of all efforts, Team Concert provides a solid solution in comparison to cumbersome scheduling tools. By offering built-in dialogues to capture all project communications, Team Concert provides an alternative to the traditional e-mail or voice mail conversations to capture informal discussions.

Requirements integration, and the traceability back to the collaboration platform, is the next target for implementation. The company relies on Rational DOORS for managing fine-grained requirements that derive from high level customer needs. The anticipated integration with Team Concert will allow iterative collaboration and refinement to requirements as they finalize the product definition.

With integration at the backbone of the collaborative platform, users can link requirements, modeling, and testing artifacts seamlessly. This solves a significant problem at this particular company, where they rely on more than seventy tools during the design of a typical electronics-based product. Today, the integration of these tools, and the artifacts generated by the tools, is through a purely manual approach enabled by people and processes. With deployment of Team Concert, which manages every step and artifact within the Jazz framework, the tracking becomes automatic. This strong linkage fully captures the context of each artifact.
This differs from ordinary PLM tools where, according to the company, “you lose the why and how, which is captured in e-mail and hallway conversations.”

Team Concert provides solutions to many problems in the systems and software development arena by unifying solutions into a single platform. With collaboration, configuration management, change management, and tight integration, all without heavy customization or a large IT footprint, the company tracks and monitors activities throughout the development lifecycle. With support for both waterfall and iterative approaches, the end users, rather than IT departments, can easily configure the tool, to satisfy process needs.

A EUROPEAN ELECTRONICS COMPANY

COLLABORATION AND INTEGRATION, NEXT TARGET QUALITY MANAGER

This European electronics company recognized the need for mature collaboration practices years ago, allowing them to realize rapid growth in their company. To support this collaboration, the company implemented a tailored version of IBM’s Rational ClearQuest to support their entire product development lifecycle on a majority of their product programs and on four of their key processes within the company. If Rational Team Concert had been available at the time, the company declared that they would have leveraged the tool, as it inherently contains the features and functions out of the box that they found necessary for effective collaboration.

While their customized implementation of ClearQuest is very effective, the company notes that Rational Team Concert offers some advantages, including process flexibility and easier task re-assignment. Moreover, any cultural resistance slowing adoption has begun to fade as colleagues see a major payoff through real life examples with their peers as more groups leverage their implementation of ClearQuest for collaboration. In addition, the collaboration features implemented for integration with testing, requirements management, and other tools are now directly supported by Rational Team Concert. Given their highly mature implementation of ClearQuest, through a challenging and successful customization effort, the company will focus next on Rational Quality Manager before migrating to Team Concert.

For change and configuration management, the traditional ClearQuest and ClearCase tools are leveraged and linked closely, promoting process enforcement and stability. Rational Team Concert will offer a unified approach to change and configuration management by automatically linking content across the lifecycle and managing it within a single platform. As with Team Concert, their customized ClearQuest implementation allows impact analysis and level-of-effort evaluations across the enterprise.

The strategic alignment between processes and tools receives tremendous attention at the company. By using workflows, reporting, charting, and dashboards, they execute their development process with a coordinated suite of
tool solutions. This approach allows effective monitoring of key performance indicators and reports of progress and accomplishments at monthly status reviews, where cross-domain representatives participate.

As mentioned earlier, integration with test management activities is the next highest priority at the company. After considering other solutions in this space, they selected Rational Quality Manager for Proof of Concept, based on its ease of use and the minimal effort required to configure the implementation to match their test processes. Quality Manager will provide the ability to centrally manage all work associated with test results, linking test execution details with their change management system. In addition, Quality Manager allows the user to embed the results of their testing, even when those results include a picture of an oscilloscope screen as evidence of functionality. By using the built-in reporting functionality, the company can generate properly formatted reports of qualification test results as compliance evidence for official authorities. Once fully deployed, Rational Quality Manager will replace several custom tools currently in place to manage testing activity.

Through the custom implementation of collaboration features now found in Rational Team Concert, this company has been able to leverage Rational ClearQuest to integrate with their testing and change-management activities across the company. Team Concert will support those features out of the box without extensive coding, although Quality Manager represents a higher short-term priority for the company.

*The complete version of this report includes an assessment of IBM Rational tools across eight critical focus areas. To download the full paper, go to:*

http://cpd-associates.com/download/index.cfm?download=RationalCaseStudies1