

Comprehensive Management of the Software Development Lifecycle with PTC Integrity in Compliance with Functional Safety Standards, Improvement in Software quality.

DENSO CORPORATION

Automatic identification of extent of impact of changing requirements

PTC Japan Inc. (PTC) holds private events to introduce PTC's latest solutions, technologies, product strategies, and user cases for leading companies. At the keynote speech for this event, Junichi Fukuda, deputy director of the Electronic Systems Planning Office in the Corporate ePF Department at the Denso Corporation, spoke about "Required Environments for Developing Automotive Software: Achieving Efficient Software Development with the Introduction of PTC Integrity."

At the start of his speech, Mr. Fukuda said, "In the automotive industry, the introduction of electronic control has progressed since the Muskie Law (legislation to regulate automotive exhaust) was enacted in 1970. Today, most automotive functions, such as powertrain systems, chassis systems, body control systems, and communication systems, are controlled by vehicle electronic systems. In addition, progress has begun in the linkage of functions that provide new functions and services by integrating multiple functions that previously had been independent. Inevitably this will lead to larger and more complex vehicle electronic systems."

As the role of vehicle electronic systems grows, the size of software is increasing at an accelerated pace. In 2015, it is expected that the total number of lines of code in automotive software (control codes) will reach 100 million.

Thus, if automotive software is large and complex, its development becomes more difficult. Although people often think that it is easy to make changes to software, for each requirement that is changed, one must identify the related changes in design, change the source code carefully, and implement comprehensive tests. The development volume increases at an accelerated pace due to increases in size and complexity. Further complexity arises through the division of labor for global software development. Failure to achieve smooth communication between engineers

will lead to failure to correctly communicate changes in requirements and leaks in design reviews, making it easy for schedule delays and cost overruns to occur.

In addition to these issues, support must also be given for compliance with automotive functional safety standard ISO 26262, which was formulated with a focus on approximately 30 of the world's largest automobile manufacturers. ISO 26262 was standardized as a result of increased awareness for full accountability regarding safety in the industry. It was officially issued in November 2011 as an international standard that systematically stipulates development procedures, criteria, and policies believed effective in ensuring functional safety.

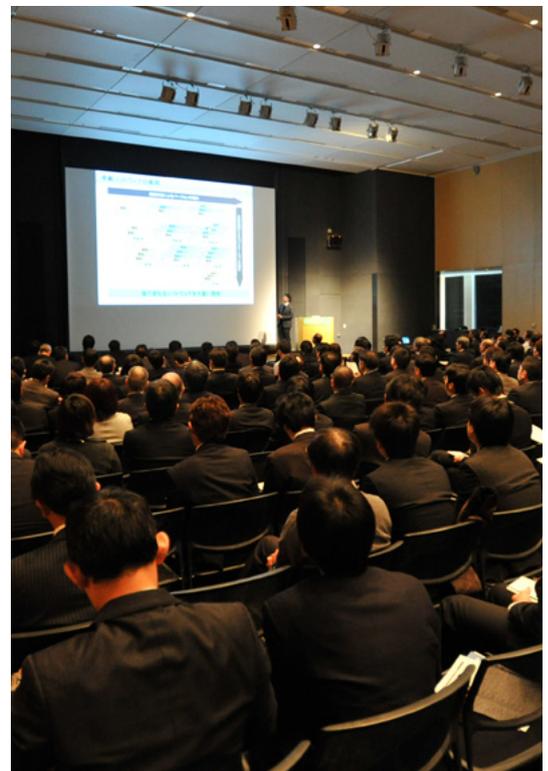
Mr. Fukuda said, "Up until that time, we designed and verified software from the perspective of safety as a matter of common sense. However, the causal relationship for deliverables produced through a series of development processes, such as design and source code tests for safety requirements, was not focused upon by engineers and was simply managed for traceability in Excel. With the progress in the size and complexity of automotive systems, we came to see the limitations in ensuring the traceability of requirements through such methods. Then, in 2003 we began to consider introducing requirement management tools."

During the initial study, it was expected that the open-source Eclipse would become a global trend. In 2009, a system was completed based on Eclipse, providing an environment that supported basic management for configuration changes. However, it was clear that this system required additional effort for advanced traceability management and to comply with the requirements for tool qualification in ISO 26262. As a result of studying a variety of new tools, the ALM (application lifecycle management) tool PTC Integrity was praised highly for its proven technical capabilities, advanced reliability in compliance with ISO 26262, and full support system. It was selected in 2011 to be implemented company-wide. This tool makes it possible to trace requirements, manage changes, and manage configurations throughout all stages of the software development process.

Currently, we are making an effort to establish the use of this tool, and we have begun to see gradual results at this stage. PTC Integrity associates and manages all requirements, documents, source code, and test cases for managed items in a single repository. This allows complete traceability of deliverables from all development processes,



Junichi Fukuda
Deputy Director, Electronic Systems Planning Office,
Corporate ePF Department, Denso Corporation





to more easily assure software quality. Further, needless rework is reduced dramatically through communication between all teams at all development processes as they check requirements. Development efficiency has been improved.

Further, if a requirement is changed, PTC Integrity automatically indicates the scope of the impact. A significant result of this is that it is now easy to determine areas of the design that are affected, areas in the source code that are changed, and what test cases should be performed. As a result, reductions in manhours are expected. Although there are variations according to the project size, the increased workload due to thorough traceability management is expected to be reduced by an average of 13%.

Mr. Fukuda said, "The greatest achievement from the introduction of PTC Integrity is the ability to handle larger and more complex software development without changing the concept of 'quality first'."

He closed his speech by saying, "PTC Integrity is essential for software development today. In the future, PTC Integrity can be used in systems where a variety of issues are shared between distributed development bases, some overseas, to aim for even further improvement in quality and development efficiency."

For details, please see: PTC.com/product/integrity

For any questions, [contact us](#).

© 2012, PTC. All rights reserved. Information described herein is furnished for informational use only, is subject to change without notice, and should not be construed as a guarantee, commitment, condition or offer by PTC. PTC, the PTC Logo, PTC Creo, PTC Elements/Pro, PTC Mathcad, PTC Windchill, PTC Windchill PDMLink, Pro/ENGINEER, and all PTC product names and logos are trademarks or registered trademarks of PTC and/or its subsidiaries in the United States and in other countries. All other product or company names are property of their respective owners. The timing of any product release, including any features or functionality, is subject to change at PTC's discretion.

J1929-DENSOArticle-EN-0912