

# Embedded software management

## Managing released binaries for integrated hardware/software development

### Benefits

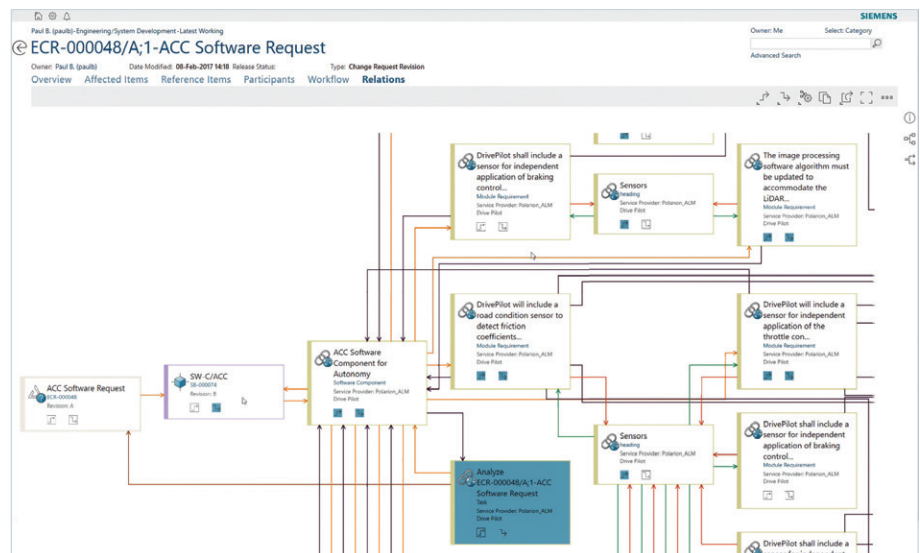
- Improve change process efficiency by using a single view of mechanical, electronic and software design information
- Introduce more reliable product features by tying them to product requirements
- Accelerate product development by rapidly validating related hardware and software
- Increase quality by managing functional dependencies in a product-configuration context
- Lower the cost of managing embedded software, including its development, integration, point-of-service and supply chain
- Improve service-related response times by enabling teams to better understand software and hardware relationships and dependencies.

### Summary

Teamcenter® embedded software management capabilities improve the design process by enabling product teams to manage released binary software as a “part” in the same single source of product and process knowledge they use to manage their electronic, electrical and mechanical

design information. Teamcenter lets users create and manage signals, messages, software-to-software, software-to-electronic control unit (ECU) and ECU-to-ECU dependencies. Since binaries are treated as a part in the product bill-of-material (BOM), they can be linked to product requirements and leveraged in workflows and change processes.

Many advanced features in today's products are enabled through the use of software-driven electronics. Digital cameras use embedded software to stabilize images and optimize picture quality. Home appliances have software-powered “brains” designed to conserve energy. Automobiles have autonomous driving modes and advanced safety feature. This level of complexity requires companies to manage software as an integral part of the product lifecycle.



# Embedded software management

## Business challenges

- Products are increasingly differentiated on the basis of their embedded software features
- Embedded software dramatically increases product complexity
- Software development teams are not integrated with electronic and mechanical design teams
- Feature creep negatively impacts the software development cycle
- It is difficult to manage the growing number of distributed processing units
- Development teams find it hard to identify which hardware/software modules are compatible
- Software development is often outsourced, but system integrity is still the responsibility of the OEM engineering group
- Software lifecycle issues increase today's service and repair costs

## Features

- Leverage a single source of product and process knowledge
- Manage released software binaries as a part in the BOM
- Integrate software into workflow and change processes
- Manage signals and messages for any ECU communications architecture
- Configure families of binaries, boot loaders, configuration files and calibration files into binary packages
- Track and validate software-to-software, software-to-ECU and ECU-to-ECU dependencies
- Assign specific binary packages to different product configurations

## Treating software as a "part"

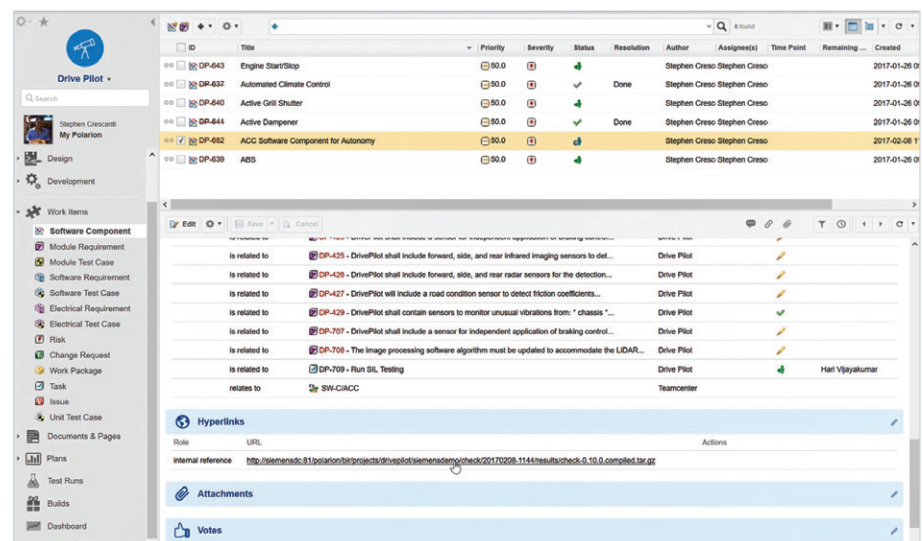
Teamcenter embedded software management capabilities enable product teams to extend their engineering BOM by treating software as a separate and unique part. Leveraging the Teamcenter and Polarion ALM integration product teams are able to manage software requirements, models, development, distribution, legal compliance and reuse across the entire product lifecycle.

Product development, assembly plant and service teams can leverage Teamcenter to track as-defined, as-manufactured and as-serviced software BOMs. Teams can use embedded software management in conjunction with the Teamcenter and Polarion ALM integration capabilities to quickly trace in-service software problems to their ECU, binary and source code origins – thereby improving a team's ability to rapidly and efficiently resolve problem-related events.

## Integrating the software and hardware development process

Companies need a software development process that is integrated with the electronic and mechanical aspects of the product design process to meet today's development schedule, cost, quality and product reliability targets. To enable companies to effectively manage the embedded software life-cycle, Siemens PLM Software's Teamcenter and Polarion ALM provide true ALM-PLM interoperability.

Polarion ALM provides software development organizations a unified solution for project transparency. By connecting teams and projects, it improves application development with easy access to product requirements, models, code, test, and release information and processes.



Teamcenter Product Lifecycle Management provides best-in-class support for the management of software binaries. Teamcenter enables product teams to treat these binaries as a “part” in the product definition and product configuration. As a result, these binaries can be leveraged in requirements definition, product development, workflow management, configuration management, manufacturing management and change control processes.

### Linking product requirements to software parts

The ability to design and manage complex software systems is crucial to success in today’s marketplace. To deliver testable, high quality software, developers must fully understand a product’s requirements and share a common vision of the product with other members of the development team.

By integrating software in the design flow and treating it as a part, Teamcenter and Polarion ALM enable design teams to plan the product design at the system level and associate functional and logical requirements to the physical implementation of software features. In turn, the associativity of system and software requirements allows software development teams to trace features and functions across the entire product lifecycle. This level of traceability improves product quality and test coverage while eliminating feature creep and unnecessary rework that leads to schedule delays and cost overruns.

### Tracking and validating functional dependencies

Software binaries often generate software messages upon which other hardware and software functions rely for their proper operation. In many instances, these dependencies and their impacts are not recognized early enough in the software development process to prevent software-related product failures.

The Teamcenter-Polarion ALM integration addresses this issue by tracking these messages and validating that their hardware and software dependencies are satisfied in any product level configuration. Once these messages have been validated for a specific binary and the binary solution has been configured to a processor (ECU), an engineer can create the software-to-software, software-to-ECU and ECU-to-ECU dependencies.

The ability to track and validate message dependencies across ECUs within a binary software module or to the source code file allows even widely dispersed design teams to accelerate the product development process.

### Managing product configurations

Products that contain multiple embedded processors and multiple executables can be combined in different ways to support various product configurations. Teamcenter enables teams to define the software binaries that need to be installed in products containing one or more embedded processors. These binaries can be modeled as configurable families of binaries, boot loaders, configuration files and calibration files.

Teamcenter enables users to assign binary families to a processor which is configured into the product as an ECU or central processing unit (CPU). The product configuration can consist of one or more ECUs. The user can qualify these associations with product-level configuration rules. Use of the Teamcenter-Polarion ALM integration for embedded software management ensures product teams that correct software versions are configured into software families, as well as that correct software families are configured into processors and that the correct set of processors is configured into the product.

This robust level of configuration management improves product quality and serviceability by enabling users to trace product issues to a specific ECU, binary software module or source code file.

**Siemens PLM Software**  
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