By developing methods and tools for test case design and selection in configurable, variant-rich embedded systems, the ITEA project XIVT will enable effective, cost-efficient quality assurance and a shift to autonomous, flexible and adaptive applications in four complex domains.

ADDRESSING THE CHALLENGE
In the automotive, rail, industrial production and telecommunication domains, market diversification, customer demand and the increasing modularity and interconnectivity of smart devices have led to many product variants. For cyber-physical systems that contain configurable components, the design of suitable test cases is becoming a major problem; in a product line with just ten possible features, more than 1000 combinations must be tested. This problem is limiting the amount of development and quality assurance that can be performed to deliver software products given the increasing safety and security requirements posed in many industrial domains. If software testing is severely constrained, this implies that less time is devoted to assuring a proper level of software quality for a product line. As a solution to this challenge, methodologies are needed to allow variability-aware tests to be created with less effort and at lower cost.

PROPOSED SOLUTIONS
The XIVT (eXcellence In Variant Testing) project aims to deliver innovation in the interconnected areas of knowledge-based requirements analysis and test selection and generation. The former will use machine learning to develop a set of automatic procedures and methodologies, such as requirements extraction, automatic test case generation using association rules and testing at the model level for selecting the right set of test case to be used on the implemented software. The latter’s mechanisms will include variant selection to guarantee optimal variability coverage, a software certification proposal on the basis of product lines. Many of these innovations will be released as modules in open-source packets that can be integrated into existing testing tools and integrated development environments (IDEs). Other technologies will be implemented in an integrated toolchain, available as a platform, that will allow users to specify variant-rich systems at the domain level, build instances, construct test cases and assess test suites early on in the development process.

PROJECTED RESULTS AND IMPACT
XIVT has big ambitions: after three years, test optimisation will have increased by 10-20% and variability testing coverage, the detection of security vulnerabilities and toolchain accuracy by 30-50%. This will allow businesses to save money and create better products. In the automotive industry, for instance, OEMs expect to decrease the costs of validating new products and potential variants by at least 5%. Vehicle recall costs due to software bugs will also be significantly reduced, while the users of these vehicles will be safer. As the tools and core platform architecture are designed to be extendable, XIVT will allow other complex domains (such as aerospace, energy and healthcare) to reap such rewards – a truly all-encompassing project.
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Project leader
Gunnar Widforss, Bombardier

Project email
gunnar.widforss@pmir.se

Project website
https://www.xivt.org

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