The TESTOMAT Project

The value of investments in test knowledge

EXECUTIVE SUMMARY
The ITEA TESTOMAT Project pushes the state-of-the-art in test automation towards agile development, allowing companies to identify their own 'next level' through a Test Automation Improvement Model while optimising their testing with dozens of open-source tools.

PROJECT ORIGINS
In software development, reliability and agility often seem like opposing forces. This issue is exacerbated by the increasing complexity of software and the constant drive towards faster release cycles for maximum market impact. Manual testing cannot meet these challenges, yet many safety-critical and hardware-oriented companies believe that test automation is irrelevant to them. SMEs, meanwhile, may miss out due to a lack of awareness or investments in automated agile testing. To strike the perfect balance between quality and speed, a new approach to automation is needed.

In the TESTOMAT Project - The Next Level of Test Automation, companies do not buy a result; they invest in knowledge. This 'next level' differs per organisation and depends on factors such as sector, size and practices. Many automation-related variables are unknown to the organisation, so the TESTOMAT Project focuses on providing software teams with personalised roadmaps for improving their automated testing in a cost-efficient manner. The consortium has also developed and enhanced over 40 tools in areas ranging from test scheduling to simulation-based testing, allowing software teams to pick and choose the most relevant innovations for their own agile automated development process.

TECHNOLOGY APPLIED
The TESTOMAT Project’s technological innovations began with the Test Automation Maturity Survey, which was completed by 151 respondents in 101 organisations and 25 countries. This provided the consortium with the status of test automation and key issues worldwide. On this basis, a Test Automation Improvement Model (TAIM) was developed to define measurable steps for improvement. The TAIM web interface is open source to ensure maximum usage, aided by two handbooks on Test Automation. Continuous integration tools and logs provide quantitative data on the actual development and test execution, minimising potential flaws of human interpretation.

Success in the TESTOMAT Project is measured in terms of test effectiveness, test optimisation and quality and standards in testing. Effectiveness refers to ability to find bugs and maintain the test suites. A specific test method yielding success has been to deploy mutation testing, through e.g. the open-source TESTURA tool, which provides local and cloud support for C# testing, or the Dextool Mutate used in a safety-critical environment. Test optimisation, means selecting only relevant test cases for regression testing from the millions created through automation. One element of this is clone detection and similarity analysis, which enable the maintenance of much larger suites. Finally, quality and standards address non-functional aspects such as security and performance testing. Here, the TESTOMAT Project has worked to bring automation into standards that previously focused on manual testing and has also contributed to standard extensions and to the release of a completely new standard: UML Testing Profile 2.0.

To demonstrate the project’s versatility, its ten use-cases can broadly be grouped into the following categories: trains, planes and telecoms; forestry, machines, robotics, banking, wind turbine maintenance with drones and port integration.
TEOMAT Project
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**Partners**
- Finland
- Comiq
- Efikode
- Ponsse
- Gentilin Quality Intelligence
- Siili Solutions
- Symbio
- University of Oulu
- VTT Technical Research Centre of Finland
- Germany
- AKKA Germany
- EKS InTec
- Expleo Germany
- FFT Produktionsysteme
- Fraunhofer FOKUS
- IFAK
- OFFIS
- Parasoft Deutschland
- The Netherlands
- Axi
- Testwerk
- The Open University of the Netherlands
- TNO
- Spain
- Alerion Technologies
- Prodevelop
- University of Mondragón
- Sweden
- Bombardier
- Empear
- Ericsson
- KTH
- Mälardalen University
- RISE
- Saab
- System Verification Sweden
- Veriflyer
- Turkey
- Kuveyt Turk Bank
- Saha Bilgi Teknolojileri

**Project start**
October 2017

**Project end**
December 2020

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ITEA is a transnational and industry-driven R&D&I programme in the domain of software innovation. ITEA is a EUREKA Cluster programme, enabling a global and knowledgeable community of large industry, SMEs, startups, academia and customer organisations, to collaborate in funded projects that turn innovative ideas into new businesses, jobs, economic growth and benefits for society.

ITEA3 is the third edition of the ITEA programme. ITEA3 is a fully industry-driven R&D&I programme in the domain of software innovation. ITEA3 is a transnational and industry-driven R&D&I programme in the domain of software innovation. ITEA3 is a EUREKA Cluster programme, enabling a global and knowledgeable community of large industry, SMEs, startups, academia and customer organisations, to collaborate in funded projects that turn innovative ideas into new businesses, jobs, economic growth and benefits for society.

More than 80 publications (e.g. ACM SIGSOFT, IEEE SANER, STVR, APSEC, JSS, ESEM, IEEE ETFA, IEEE/ACM AST, ICOSOFT, IEEE AITESTING, IFAC/EEAI, ACM MaLTeSQuE, IEEE Software).

133 presentations at conferences/fairs (e.g. dvcon, mtvcon, SAM, IWSF/SHIFT, RCIS, ISOLA, AUTOMATION, EKA, ICCSA, REFSQ, VVioT, INSTA) and 25 workshops organised.

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**MAJOR PROJECT OUTCOMES**

**Dissemination**
- More than 80 publications (e.g. ACM SIGSOFT, IEEE SANER, STVR, APSEC, JSS, ESEM, IEEE ETFA, IEEE/ACM AST, ICOSOFT, IEEE AITTESTING, IFAC/EEAI, ACM MaLTeSQuE, IEEE Software).
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**Exploitation (so far)**
- Oxygen, a tool that empowers the user to convert the results of any testing tool or framework to Robot Framework’s reporting to consolidate all test reporting (Efikode).
- Web based tool for MBT in CI includes features for semi-automated requirements formalisation as well as automated test generation, prioritisation and test execution (AKKA, IFAK & EKS Tech).
- Testura, a mutation testing tool for C# .NET, which is a code wrapper around the Roslyn API and used for generation, saving and compiling C# code (System Verification & RISE).
- Dextool Mutate, a Clang based tool for mutation testing of C/C++ projects (Saab).
- Testar tool and videos for automated scriptless GUI testing (The Open University of the Netherlands).
- Cityscape test visualisation using Unity3D (RISE & Veriflyer).

**Standardisation**
- Charter of OMG UTP 2.2 RTF, which includes chairing the UML Task force.
- Contribution of Release of UML Testing Profile 2.1.
- Extended UTP2 with cascading arbitrations, which enables UTP2 to be used for verdict arbitration in situations where functional arbitration is not sufficient such security or fault-tolerance testing.

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