Project Results

Model-based testing cuts development costs

High-performance methods and tools proven in industrial software applications

The D-MINT project turned model-based testing into an industrial reality to cut the cost of developing high quality, complex software. Demonstrators from street lighting to mobile phones clearly showed how such an approach can close the productivity gap in the cost-effective development of software-intensive systems. The project developed the methodology, tools and training material to enable this approach to be widely used. The resulting techniques are already being exploited.

Software is playing an ever greater role in industrial products. Half of the components in modern cars depend on software. And software development has become a major bottleneck in telecommunications with increasing use of standard off-the-shelf hardware. Cost-effective and efficient development of complex software systems is therefore key to European competitiveness.

MORE EFFECTIVE APPROACH
Some 40 to 60% of the overall costs of developing complex software systems are associated with testing. This is why D-MINT applied a model-based approach for more efficient and effective testing of complex software systems.

Working at higher levels of abstraction with models rather than code makes it possible to reuse models.

In addition, the modelling paradigm makes developers think more at the beginning about what is being specified. By investing effort in the initial specification phase, it is possible to save time and effort because errors are detected far earlier.

Model-based testing is not new but has not been used systematically in industry as there was a large gap between academic work in this area and industrial reality. While the academic approach is fine for thousands of lines of code and hundreds of states, a mobile phone for example needs software with millions of lines of code and 10,000 parameters.

Moreover, academic modelling tends to apply the same language and tools throughout, making tool integration straight-forward. The industrial world involves more than one specification language, one tool and one level of abstraction. A key innovation in D-MINT is the ability to extract information from different levels and different abstractions of models and put that together into a single model-based testing framework.

ADVANTAGES ACROSS INDUSTRY
New methodologies developed in the ITEA 2 project offer many advantages for industrial scale and quality. Model-based testing was demonstrated successfully across a very wide range of domains in six separate industrial sectors. Applications ranged from street-lighting control to video-conference units, from telecommunications to automotive control systems and from industrial engineering to machine tools.

Despite operating in many different domains, results were remarkable homogenous, indicating that this approach can be successfully applied to a very wide range of other industrial domains. The case studies showed that adaptation efforts for model-based testing – such as initial training and integration into existing test processes – are high but are a one-off

Project Results

activity. They also confirmed that this approach is particularly beneficial for testing activities with several iterations.

The demonstrators involved parallel developments using classical and model-based testing approaches for direct comparison. Analysis of real costs in time and investments across all consortium members showed that not only could direct test costs be reduced by 15% using model-based testing, but that test coverage could be improved by 10%. This translates into an overall improvement of some 20 to 25% in overall test costs.

FAST EXPLOITATION POSSIBLE
D-MINT techniques were used in real product development with genuine advantages obtained in all the applications. One result is that three tool vendors have already put their products on the market: iXtronics Toolbox, Testing Tech TTmodeler and Conformiq Qtronic.

Moreover, several industrial partners are already starting to use the D-MINT techniques in their own product development:

■ Engineering company ABB will use D-MINT results for the next version of its Softstarter control products as this approach proved significantly better than its current technology;
■ Carmaker Daimler is planning to use D-MINT technology for electronic control unit software testing in the future; and
■ ICT specialist ELIKO used D-MINT technology and tools for a street-lighting control card that is now widely employed in Estonia, speeding retesting when a major redesign was required – demonstrating that the greater the change, the more the improvement obtained.

Major project outcomes

DISSEMINATION
■ 10 Project presentations at exhibitions and symposia. Received the ITEA Exhibition Award 2009 at the ITEA & ARTEMIS Co-summit 2009
■ 130+ publications & project presentations
■ MBT-Workshop Series established
  • MoTiP'08 @ ECMDA '08, 12 June 2008, Berlin, Deutschland
  • MoTiP'09 @ ECMDA '09, 23 June 2009, Enschede, Niederlande
  • MoTiP'10 @ ECMFA '10, 15 June 2010, Paris, France
■ Coaching & Training: 3-steps coaching plan, 60+ measures, D-MINT webinar series, Web-based trainings, Certified training program,
■ D-MINT Tutorials
  • @ICSSEA: 10 Dec 2008
  • @TTCN-3 User Conference: 3 Jun 2009

EXPLOITATION
D-MINT 'productisable' Solutions:
■ MBT solution for embedded systems - PikeTec TPT / iXtronics TestRig, FOKUS ADT
■ MBT solution for reactive systems - Elvior MOTES
■ MBT solution for telecommunication systems- Abo MATERA / Conformiq Qtronic, Conformiq Qtronic / Nethawk EAST

New or improved Products from D-MINT on the market:
■ iXtronics Toolbox
■ Testing Tech TTmodeler
■ Conformiq Qtronic

STANDARDISATION
■ Testing of Telecom systems (ETSI)
■ Embedded systems (IEC 61508, AUTOSAR)
■ Training courses (ISTQB certificate)

EUREKA

D-MINT
(ITEA 2 ~ 06014)   October 2010