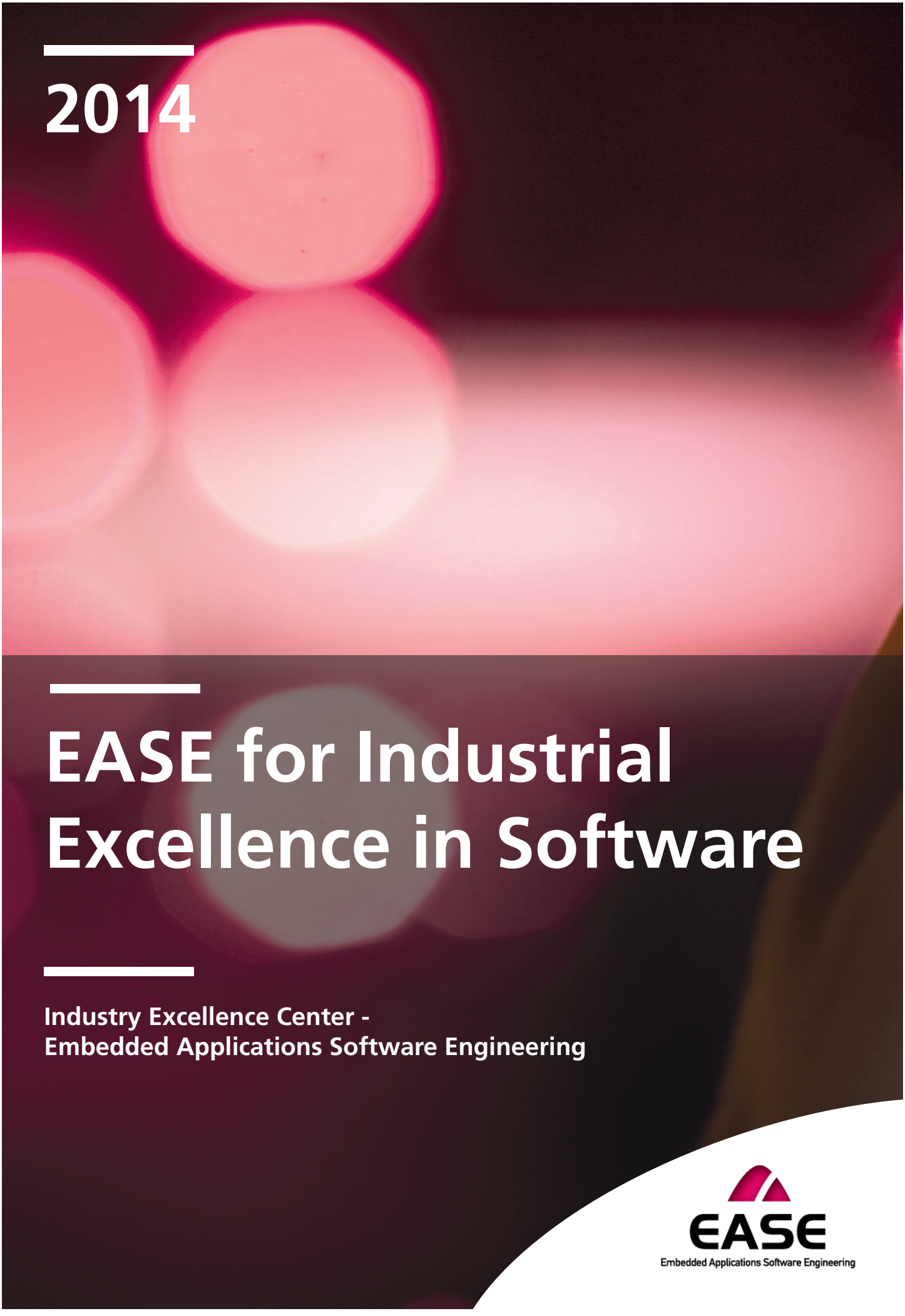


2014

EASE for Industrial Excellence in Software

Industry Excellence Center -
Embedded Applications Software Engineering

EASE
Embedded Applications Software Engineering

SPOTLIGHT

NAME: Elizabeth Bjarnason

LIVING IN: Lund

PHD THESIS NOVEMBER 2013: Integrated Requirements Engineering – Understanding And Bridging Gaps Within Software Development

PHD SUPERVISOR: Björn Regnell

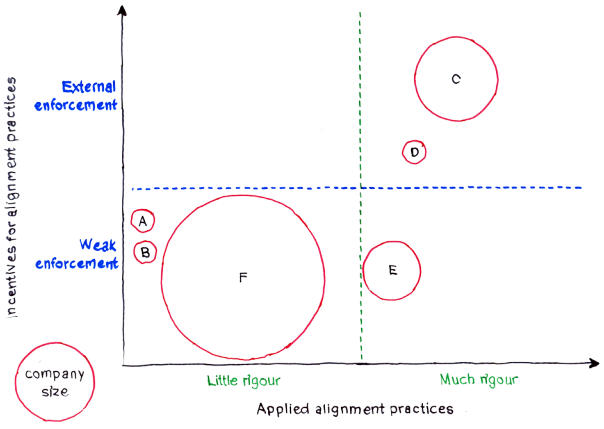
MINDING THE CRITICAL GAP

Collaboration and good communication can be a strong point and a safety net when running a software project. Similarly, bad communication can cause big problems. Therefore, Elizabeth Bjarnason has developed two methods to support project teams in identifying critical gaps and gaining insight into good practices.

Elizabeth Bjarnasson's research topic is the role and impact of requirements engineering (RE) within software development. In particular, she focus on how a closer integration of RE can support a more efficient and effective development of software products.

– I see 'collaboration' as a red thread that runs through both the initially investigative studies about challenges and practices for the alignment and coordination of RE with testing, and the two methods I have designed for supporting project teams in improving their development practices.

Distances, or gaps, between people and between artefacts can cause problems with coordinating and aligning the various activities within a software project. For example, gaps in communication between the business side and the development side of a company can result in that the development side works towards a different goal than what the business side intended. Similarly, if there are semantic differences, gaps, between the artefacts used for specifying the requirements and the test cases, a different set of requirements are tested than what was specified. Both of these gaps, if left unaddressed, will result in project developing software that doesn't match the product intentions, with delays and increased costs to put it right.



> Communication and coordination between people is vital, not least between requirements engineers and testers. As one interviewee said: 'Start talking to each other!'

Therefore, Elizabeth Bjarnason and her team has developed two improvement methods: Evidence-Based Timeline Retrospective (EBTR) and Gap Finder.

– One of the core strengths of the EBTR method is that it enables project teams to learn from past events. That is done by providing visualised time lines of project history around which the project members can reflect and discuss on weak and strong points of the project. The Gap Finder method gives project members new insights by providing a view of various project gaps as factors that can explain various issues. Physical distance can increase the risk of misunderstandings and delays, for example when it is far between the developers and the person who has insight into customer requirements, says Elizabeth Bjarnason. ■

SPOTLIGHT

NAME: Samireh Jalali

LIVING IN: Karlskrona

LICENTIATE THESIS MAY 2012: Efficient software development through agile methods

PHD SUPERVISOR: Claes Wohlin

THE AGILE MEASUREMENT GURU

When and how is agile development more efficient than regular software development? That is an important question for the whole software industry – and the main focus for Samireh Jalali, PhD student within EASE, at Blekinge Institute of Technology in Karlskrona.

– Everyone is claiming to be agile, even though there is really no specific definition for agility. So, we studied this and tried to measure and quantify the agility, says Samireh Jalali.

That was done through a case study at the Swedish software company Softhouse. By asking team members about their work routines and their agile practices (for example pair programming and test drive development), Samireh Jalali and her colleagues in EASE's "Team C" managed to find a most suitable tool to quantify agility.

Several existing tools were examined and only one of them was found to be most suitable for benchmarking and profiling agility in a software development team or organization.

– This tool asks simple questions about the team and its processes, then compares the answers with the answers given by other companies, and finally assigns a score to represent the degree of practicing agile in the examined organization, says Samireh Jalali.

Samireh Jalali came to Sweden in 2007, in order to study a master program in Software Engineering. In September 2009, she was accepted as PhD student, and has since then published 4 papers and articles, and collected data for a few more papers. Most cited is "Agile practices in global software engineering – A systematic map" which was presented at an IEEE conference about global software engineering in 2010.

Samireh Jalali is not only measuring agility, but also putting lots of effort into understanding the actual use of agile in software companies. She is collecting characteristics of team, organization, product, customer, etc. that help to successfully implement agile in software projects.

> The resulting framework helps us to asses and support clients wanting to improve performance based on the agile toolbox. The different perspectives and the unified model to measure agility will hopefully be a good contribution to the agile community and to our business.
>
> *Anders Sixtensson, Business Unit Manager, Softhouse*

The outcome of this research project is a framework that helps project managers to investigate the applicability of certain agile practices based on their current situation when they are setting up agile projects.

Currently, Samireh Jalali is doing a study about alignment between agile practices and product goals as well as how agile can help to mitigate challenges of distributed software development. The final results from this study will be presented in her dissertation, which is currently planned for late 2014.

– It is easy to have a perception of what you do as a software developer or manager, but in many cases, it is different from what you really do. People are often too busy to take a step back and reflect on what they actually are doing. That is why evaluations are required and they must be performed objectively, says Samireh Jalali. ■

SPOTLIGHT

NAME: Markus Borg

LIVING IN: Malmö

LIC THESIS SEPTEMBER 2012: Advancing Trace Recovery Evaluation – Applied Information Retrieval in a Software Engineering Context

PHD SUPERVISOR: Per Runeson

BRINGING ORDER TO INFORMATION

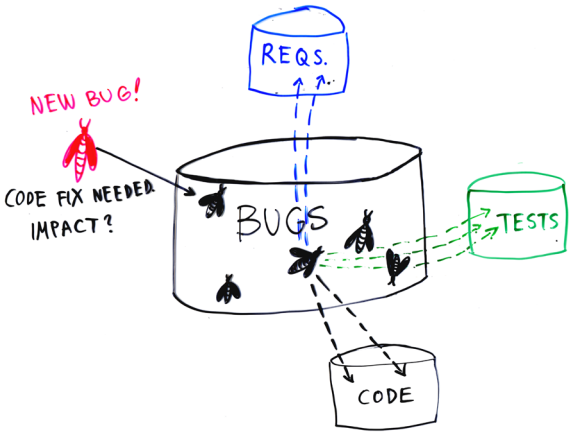
Markus Borg's research aims to support the engineers working in today's dynamic information space. His primary focus is aligning requirements and verification. Markus Borg is a Ph.D. Student in the Software Engineering Research Group at the Department of Computer Science in Lund, and his work is done in collaboration with Blekinge Institute of Technology.

– I'm looking into some of the challenges involved in the navigation of development artifacts maintained in large software engineering projects. The high number of requirements, test cases, issue reports, and source code files can really be difficult to overview – especially when aspects such as distributed development and product line engineering further complicate the everyday life of the developer. My research aims at supporting the 'poor engineers' working in this dynamic information space, says Markus Borg.

Information access and findability are two concepts that are important in any context. Additionally, Markus Borg believes that search technologies are really interesting to study. The research progress on search, especially on the web, has greatly changed the world.

– It feels really meaningful to explore how findability can be improved in the software engineering context. It is a challenge I've personally experienced as a developer: the challenge of finding the right information when needed, he says.

So far the project has focused on safety-critical software development. In this context there are formalized standards that put rigorous requirements on the development process, e.g. on software traceability throughout the entire product lifecycle. Looking at such traces as links between development artifacts, Markus Borg and his team have been able to construct large networked structures, i.e., semantic networks of software artifacts. Networks open possibilities for



sophisticated search solutions and tailored recommendation systems. The research suggests that issue reports – the individual issue tickets in issue repositories – can act as hubs in such networks, connecting various development artifacts.

Since it is very hard to study information overload in an isolated lab setting, collaboration with industry is absolutely necessary to understand its impact in realistic contexts. Markus Borg and his team have learned much from talking to practitioners and studying their development artifacts.

– Our close collaboration with industry is the major strength of my research group. When talking to PhD students from universities in other countries it really becomes evident that the academy-industry climate in Skåne and Blekinge is special, he says. ■

SPOTLIGHT

NAME: Jan Kasper Martinsen

LIVING IN: Karlskrona

PHD THESIS MAY 2014: Design and Implementation of Thread-Level Speculation in JavaScript Engines

PHD SUPERVISOR: Håkan Grahn

JAVASCRIPT PARALLELL PROGRAMMING

Parallel programming is known as complicated and difficult, but unlike many other programming paradigms, it is not entirely the programmers fault. Jan Kasper Martinsen has become an expert on so called Thread-Level Speculation for JavaScript in web applications.

In his research, Jan Kasper Martinsen allows programmers of web applications to continue programming as normal, while he and his colleagues are designing the run-time system to take advantage of parallel hardware and speed up JavaScript execution in popular web applications.

The execution of JavaScript test programs are not representative for the JavaScript execution found in web applications. The benchmarks often originate from benchmarks used within system programming and numerical computing. These workloads are rare in web applications and the result is that popular optimization techniques slow down JavaScript execution in web applications even though they speed up JavaScript execution in benchmarks.

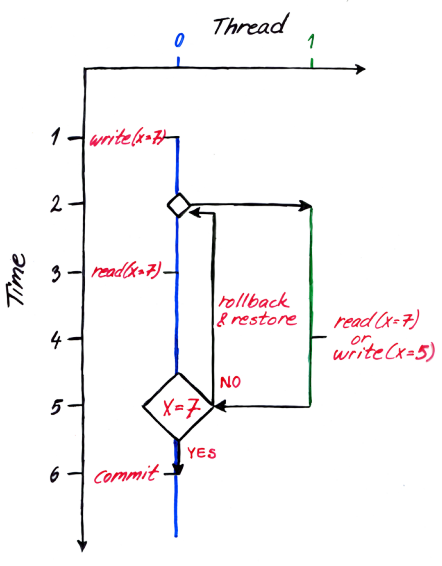
– Our subsequent discovery was that JavaScript execution in web applications takes advantage of a lot of JavaScript specific features, and that these are often great candidates to be executed in parallel. By executing speculatively, with Thread-Level Speculation, we have been able to gain significant speedups for a set of very popular web applications on a multicore computer, says Jan Kasper Martinsen.

Parallel computing and compiler design seems to have a never ending list of challenges that needs to be addressed. This has also grown to be a very important area within computer science, as it is becoming a field that is also important within desktop computing as well.

– It was actually representatives from the industry that suggested that we should look into improving the JavaScript execution time in web applications. Originally, we intended to find methodologies for executing legacy code on modern parallel architectures, he says.

So far, Jan Kasper Martinsen and his team have co-authored five scientific papers with the industrial partner Sony Mobile, and have three more in the pipeline. ■

> Understanding the characteristics of web applications and how these could benefit from introduction of multicore based processors is a big challenge the industry is facing right now. The EASE center gives Sony Mobile the means to get researchers to work with these challenges, influence the evolution and get more information about the latest findings within this area.
>
> *Anders Isberg and Fredrik Bjärenlöv, Sony Mobile*



SPOTLIGHT

NAME: Alma Oručević-Alagić

LIVING IN: Lund

LICENTIATE THESIS MAY 2013: Advancing Software Development Efficiency in an Open Source Software Context

PHD SUPERVISOR: Martin Höst

OPEN TO OPEN SOURCE

How can models of Open Source software development be beneficial to closed software development environments? And what therorethical framworks can be formulated when analysing the large data sets provided by the Open Source communities? These question are central ones to Alma Orucevi-Alagic on her quest to map out a better understanding of the evolution of software architechtures, developer's networks and communications networks.

Alma Oručević-Alagić is a PhD student with the Software Engineering Research Group at LTH's Computer Science department. Her journey into the world of Open Source software was initially motivated by the industry's adoption of many Open Source software products.

– Often, the software products were large-scale, complex and mature, yet developed by a community that in many major aspects was diametrically opposed to the traditional closed source development environments, says Alma Oručević-Alagić.

She explains:

– Open Source communities mostly engage developers who contribute the work on voluntary bases primarily communicating in an online type of environment. Those communities can have different governance forms, ranging from sole dictatorships to councils. In the councils, meritocracy is a key factor in determining developers' rank and therefore rights with respect to the project.

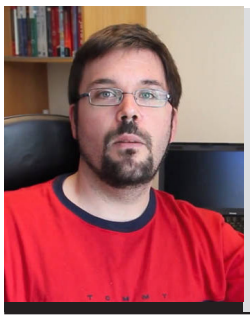
– Applying Open Source software development practices in-house challenges traditional software development practices used for decades, like communication channels, their transparency and the developers' roles, says Alma Oručević-Alagić.

Over the last decade, industry has recognized various benefits of Open Source software, ranging from the use of "free" software as a third party component or as an internal productivity tool to commercializing support for various Open Source software products. More recently, collaboration through an Open Source community – often governed by a company – has become a way for industry to share development costs as well as to secure leadership role.

> We expect that the network analysis model will be useful for us in visualizing our process changes towards a more agile way of working.
>
> *Sven Carlstedt, Ericsson*

As companies venture into the world of Open Source, new and often often unforeseen challenges tend to emerge. Using "free" software, especially within own software products tends to also to create a lasting bond with the Open Source community that produces the software from the perspective of Open Source software licensing as well as software maintenance. ■

SPOTLIGHT



NAME: Michael Unterkalmsteiner

LIVING IN: Karlskrona

PHD SUPERVISORS: Tony Gorschek, Robert Feldt

BRINGING EASE TO TESTING

Why don't requirements engineers and software testers talk to each other? If communication between the two had been better, Michael Unterkalmsteiner's research might not be needed. However, Michael Unterkalmsteiner is now helping four large Swedish organisations to improve their software development. He is also developing a system that will make it easier for Axis, a global surveillance camera developer, to select test cases ahead of launching new cameras.

It is rare in large companies that the people who write software specifications also carry out the necessary software tests. This alone does not pose a problem, but if those who write the specifications make changes to the software without informing the testers – then issues inevitably arise. Michael Unterkalmsteiner's research focuses on finding the problem areas in the communication between these two groups.

– One of the issues is that people who work for software developers rarely have enough time to deal with the administrative tasks that are vital in order for the process between the requirements engineer and tester to flow smoothly, Michael Unterkalmsteiner says.

In light of this, Michael Unterkalmsteiner and his colleagues have developed a framework called REST-bench, where RE stands for "Requirement Engineering", ST stands for "Software Testing", and bench stands for "benchmark". The framework is used by companies who need help to identify bottlenecks in the software development process.

Michael Unterkalmsteiner has thus far carried out consulting research assignments for four different companies: Ericsson, Volvo, CompuGroup and Sony Mobile.

– Some of the companies are really eager to make the necessary improvements. I am also planning to revisit the same companies in a year or so to see if there have been any lasting improvements made, says Michael Unterkalmsteiner. Alongside the REST-bench project, Michael Unterkalmsteiner is also working on another project together with surveillance camera developer Axis. When Axis develop a new camera they use the specifications from an earlier product as a base, adding the new features and changes the new product requires. The problem is that these changes can render the existing test cases for the camera irrelevant.

> This [RE-Test alignment] is a weak spot, but nobody is in charge of it now and we need to assign this responsibilty to someone in order to avoid similar problems in the future.
>
> *Senior manager, Ericsson*

Michael Unterkalmsteiner has therefore developed a tool that serves as a link between source code and test case. Axis has approximately 1600 different test cases, and the tool assigns a ranking score to how well different test cases correspond to different camera features.

– The aim is that Axis will not need to choose different test cases at random, but instead use the ranking scores to establish which tests are most relevant. This saves both time and money, says Michael Unterkalmsteiner. ■

PEOPLE 2014

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ABOUT EASE

EASE is a research program that aims to be a world class applied software research facility for embedded software applications. The objective is to ensure that industrial partners have a competitive advantage with respect to competency and innovation of novel solutions and effective engineering of embedded software applications with physical and logical mobility.

The centre impacts on the innovation system through provisioning of competency, via a continuous exchange loop between industry and academia, involving research challenges, industry personnel, researchers, students and research results. These range from technical solutions that can be used in products to improved work procedures for the development.

More info at http://ease.cs.lth.se

EASE is part of the Mobile Heights cluster

EASE
Embedded Applications Software Engineering

> Close collaboration with universities and companies in the region is very important to Sony Mobile in order to stay in the forefront of important research areas, as well as to locally secure competence and competetiveness for the future. The EASE center gives Sony Mobile the means to get researchers to work with key industry challenges, influence the evolution and get information about the latest findings. EASE also provides an important link to other research and education collaboration opportunities within Lund University and Blekinge Institute of Technoology
>
> *Johan Svenér, Sony Mobile, chairman of the EASE board*

RESEARCH THEMES

- **A** User Experience-Driven System Configuration
- **B** Flexible Execution of Software in Parallel Embedded Systems
- **C** Efficient Software Development
- **D** Aligning Requirements and Verification

7 CHALLENGES FOR 10 YEARS

1. Multi-purpose architecture
2. Dynamic resource utilization
3. Trade-offs betweenw actors
4. Homogenous user experience
5. Distributed development
6. Information management
7. Industry-academia research model

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