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testing times

The IPL Software Products Newsletter

Cantata++ V5 Now Released

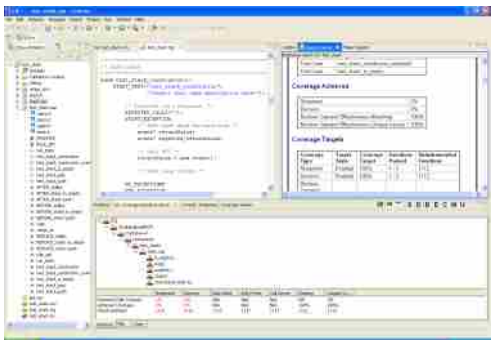
BUILT ON eclipse

In November 2006 IPL started shipping the latest release of Cantata++ featuring unprecedented automated test script generation facilities. This major upgrade is built on Eclipse 3.2 and makes it possible to generate a test script, build and run a test with just a few clicks. The all-new interface allows engineers the choice to develop test projects in either their own compiler IDE or using the built-in Eclipse C/C++ Development Tools (CDT). Initial customer response to this innovation has been very positive.

The key to the improved functionality is the Cantata++ parser which 'understands' the source code, its external calls and global data. Cantata++ then uses this information to create a structured template test script for each function or method within the source file. Data declarations and automated checks for local variables, negative checks on accessible global data and call order control (with full stubs and wrappers to aid external call simulation), are all auto-generated in the template test script. All that is required is for the tester to complete the values for input and expected outputs and set stub/wrapper call instances.

We have also taken the opportunity presented by the new release to implement an option to run tests in environments which do not allow dynamically allocated memory, such as those which support the ARINC 653 standard. At the same time, the range of supported Cantata++ platforms has been extended to include **Microsoft Visual Studio 2005**, and **64-bit Linux**.

Future plans for Cantata++ include a Spring 2007 release with extended graphical test script management functionality, and a Q4 2007 release with further unit and integration testing enhancements and test suite management capabilities, built on the Eclipse 3.3 release, scheduled for June 2007.



Cantata++ running with the Eclipse IDE. Eclipse is an open source community focused on providing open development platforms for building software

AdaTEST 95

Since the last newsletter we have released a new variant of AdaTEST 95 which supports running tests in environments which do not allow dynamically allocated memory, such as those compliant with the **Ravenscar profile**. We have previously implemented platform-specific solutions to this problem, but this is the first general-purpose solution. For the future, we are addressing the challenges of supporting the new Ada 2005 language standard.

Klocwork

Klocwork announced that their flagship enterprise source code development suite, K7, has been named **"Best Source Code Analyzer"** by InfoWorld.

InfoWorld 2007 TECHNOLOGY OF THE YEAR AWARD

Klocwork has been presented with an InfoWorld Technology of the Year Award in the Application Development category for 2007. Selected by InfoWorld Test Center editors and reviewers from more than 230 products tested during 2006, Klocwork's K7 **automated static analysis suite** and 40 other hardware and software products represent the best and most innovative in their class. "Klocwork K7 is a robust and scalable analytical suite for C, C++, and Java, featuring excellent defect discovery and extensive tools for managing the many results. In addition, it provides superior code navigation and analysis tools," wrote InfoWorld judges. "This is a comprehensive and very impressive package." To read the full release, please visit www.klocwork.com/company/releases/01 09 07.asp

IPL and German distributor (Emenda) are planning some Klocwork workshops to take place this Spring. The venues and dates currently planned are:

April 17, Bath
April 19, Cambridge
April 24, Paris
April 26, Munich

For more information please contact klocwork@ipl.com.

Bugz Bunny

- A software glitch, subsequent navigation errors and resultant excessive fuel use led to the failure of an automated **NASA spacecraft** designed to rendezvous with a Pentagon satellite last year. *www.space.com, May 2006*

- UK's new fully computerised **MoT system** (cost £230m) went live in March and promptly crashed, leading to a reversion to the paper system. *Private Eye, May 2006*

- A glitch in a new IT system at **confectionary company Cadbury Trebor Bassett** led to over-production of chocolate, which in turn led to an estimated £12m loss of profit for the current financial year. *www.silicon.com, June 2006*

- All 23,500 **Segway electric scooters** sold since the product went on the market in 2002 are being recalled because a software fault could unexpectedly send the device into reverse. *The Guardian, September 2006*

- A fault in a **GPS system** resulted in an ambulance taking an unnecessary 200 mile detour. The trip took more than eight hours instead of half an hour which it should have done. Fortunately the ambulance was not on an emergency mission at the time. *www.hacking-gps.com, December 2006*

Inside

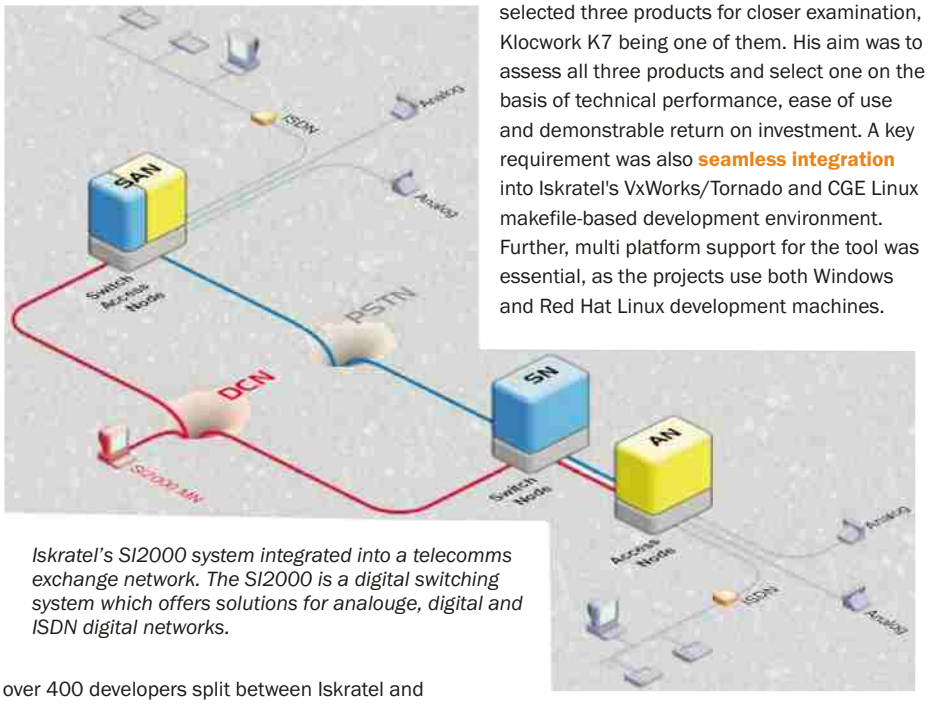
Iskratel, Slovenia

Klocwork Case Study

Iskratel is one of the world's leading providers of state-of-the-art communications solutions, with more than 50 years experience in the development of complete solutions for fixed and mobile telephony, convergence networks, next-generation networks and network management. Based in Kranj, Slovenia, Iskratel is a joint venture between Siemens AG and Slovenian investors. The company's primary market presence is in Eastern and Western Europe, with development and production also in Russia and the Ukraine.

Iskratel's core product line includes Class 4 and 5 Switches, Soft Switches, Broadband Access, Digital Subscriber Line Access Modules (DSLAM) and Voice Gateways. Class 4 and 5 Switches support the SS7, DSS1, V5.2, QSIG and Channel Associated Signaling (CAS) protocols, for up to 500,000 subscribers per system. Their Broadband product range includes support for the ADSL, ADSL2+ and VDSL protocols. With a workforce of over 1,100 people, Iskratel are recognized as the clear market leaders in the WireLAN market.

To support such advanced technologies, Iskratel relies on applying the latest, cutting-edge software development techniques, employing over 400 developers split between Iskratel and Siemens at the Kranj site. The majority of source code is written in C, SDL, Java, and some C++, with C being used for algorithm development, and Java powering the interfaces for the management networks. In all, there are between 1 and 1.5 million lines of code for a typical application, including 3rd party software. An average project requires 200 man months, and 80 man years for some of the larger applications.



Iskratel's SI2000 system integrated into a telecomms exchange network. The SI2000 is a digital switching system which offers solutions for analouge, digital and ISDN digital networks.

> **"We were astonished with the speed of the analysis of the Klocwork tool."**

With such complex software being developed, it became apparent that Iskratel would require advanced testing solutions to find and eliminate software bugs at an early stage in the lifecycle. It was the task of Sani Rus, Development Manager at Iskratel, to find appropriate tools that would assist with **early identification and removal of software bugs** from application code. "As with all software departments, we were struggling with the usual quality issues: writing bug free code that was easy to understand, maintain and extend. We began looking for tools that would help us find defects early; not just source code defects, but also architectural problems, buffer overflows and security problems", said Mr Rus. "There was a desire in the department to increase the quality of the software we were developing, and increase developers' productivity by freeing them from costly code reviews and inspections. We wanted a fully automated solution".

After some research, Mr Rus identified and selected three products for closer examination, Klocwork K7 being one of them. His aim was to assess all three products and select one on the basis of technical performance, ease of use and demonstrable return on investment. A key requirement was also **seamless integration** into Iskratel's VxWorks/Tornado and CGE Linux makefile-based development environment. Further, multi platform support for the tool was essential, as the projects use both Windows and Red Hat Linux development machines.

During the second half of 2005 and early 2006, Iskratel invited three leading companies in static source code analysis to their offices in Kranj. "We decided to put all products through their paces using one of our applications as a benchmark", Sani explained. "We ran their tools over an application of around 40,000 lines of code."

Sani states: "All of the tools found some bugs, but we were astonished with the speed of analysis of the Klocwork tool, and the diversity of bugs found by Klocwork K7. Klocwork's analysis phase took about the same amount of time as the GNU compiler we use. After a detailed analysis of the results, we concluded that Klocwork found an order of magnitude more relevant bugs than the other tools. It also had a superior user interface, and was a more fully featured tool than the others. We thus made a positive decision for Klocwork".

One issue in particular impressed the software development team at Iskratel. The team had been struggling with a bug in the application that led to an infinite loop occurring under random, special conditions. Several man-weeks of development effort had already been allocated in order to track the problem down. Klocwork found the buffer overflow problem immediately. Mr Rus remarks: "If I took all resources allocated to find this bug, it would run into several weeks. 3 or 4 developers and designers were in the labs, hunting for the bug, and of course, while that happens, there are project delays and everything stops. This bug was on the critical path, and the whole verification phase was being held up". We ran Klocwork and in much less time, we found the same bug. We were deeply impressed with Klocwork's ability to find such difficult bugs in a short space of time."

Dejan Potocnik, senior developer at Iskratel on the Soft Switch project, agrees: "Klocwork Enterprise Developer is a very useful tool, finding some critical bugs such as **buffer overflows, array boundary violations, memory leaks, suspicious semicolons and dead code**. Klocwork Architectural Analysis is also extremely useful, providing an easy-to-use graphical view of the architecture and relationships between components and entities."

So what about the future? Sani concludes: "Using Klocwork has definitely improved the quality of the software we develop, increased the productivity of the software developers and reduced the number of bugs in our applications. We are more than happy with Klocwork K7, and we have plans to extend the use of Klocwork for future software projects at Iskratel".

IPL and Klocwork would like to thank Iskratel for their participation in this case study. We wish them well for this project, and for all future projects.

Smiths Aerospace

AdaTEST 95 Case Study

Smiths Aerospace located in Cheltenham UK is a prominent supplier of avionics systems to both military and civil manufacturers such as Boeing Commercial Airplanes. The systems that it supplies frequently have safety implications, which mean that failure of the system could endanger the lives of passengers or crew on the aircraft. This places a great burden on software developers to ensure that such systems are produced and tested to the highest appropriate standards.

In the 1990s Smiths Aerospace won contracts from Boeing relating to two systems for the new 777. One system was called the Electrical Load Management System (ELMS) and the other was the Fuel Quantity Indicator System (FQIS). These systems were both classed as Level B safety category under the avionics industry software safety standard, DO-178B. The code for both of these was to be written in Ada (as was much of the software on 777 systems), and full testing at module, integration and system levels was an integral part of the development plan.

Evaluation

Smiths had some existing tool sets in place at the start of the development projects but it shortly became apparent that these were not quite up to the job. They failed to make the testing efficient and to provide the all-important certification evidence to satisfy the systems' safety auditors. At the end of 2000 project leader, Anne Lowe, contacted IPL about use of AdaTEST 95. By the start of 2001, an evaluation copy of AdaTEST 95 had been installed on Smiths target development kit, and two engineers had been trained in its use.

One of these was Martin Halls, who spent the next few months working his way through a series of evaluation exercises intended to satisfy himself and others that the tool really would work. By the summer of 2001 Martin was satisfied that AdaTEST 95 was the right tool for the job.

Outsourcing

Around that time Smiths made a strategic decision to use an Indian subcontractor in Bangalore for the bulk of its module and integration testing. This fact necessitated the construction of a robust mechanism for generating and running tests and being able to get the results out, showing both the outcome of functional (logic) and stress tests on the code, as well as the all-important coverage information.

An initial batch of AdaTEST licences was bought in September 2001, which then allowed Martin to develop the process around which all subsequent work has been carried out. This involved the Smiths team sending work packages to Bangalore containing code modules (corresponding to Ada sub-programs) and code specifications. Using Smiths-supplied software test procedures, the subcontractor's staff developed test specifications for scrutiny back in the UK, and then performed the automated generation and execution of the tests themselves.

AdaTEST 95 Tool Audit

An important part of satisfying the DO-178B development process is being able to demonstrate that the tools used are fit for purpose. For verification tools (such as AdaTEST) the requirement is for the developers to satisfy themselves that the tools 'meet their operational requirements'. Quite early on in the ELMS and FQIS projects Smiths asked IPL if they could carry out an audit of AdaTEST. In April 2003, a small team from Cheltenham visited IPL to spend a day going through the product quality records in detail. The conclusion was that, "AdaTEST 95 ... is documented, controlled and verified to a level beyond that required by DO178B."

Working with the Electrical Load Management System (ELMS).This system is classed as Level B safety category in accordance with DO-178B standards.

ELMS and FQIS Update

For the last three years the person in charge of ELMS software has been Steve Coates, assisted by John Sobkowicz. During this time around 600 Ada code units (comprising a total of about 22 KLoC) have passed through the ELMS development process. Steve was pleased to find a development process in place which seemed to be functioning very smoothly. He notes, "With minimal fuss we can now send our code modules to our subcontractor for either fresh test or re-test, and be sure that within the allowed time we will get the results that we need. Our process has quite a lot of safety margin built in. For example, module test plans always stress a module's functional envelope using extreme values. In reality, we know that these values would never occur, but the fact that we have tested all modules beyond their normal limits gives us a great deal of confidence that they will work correctly under all circumstances."

"AdaTEST 95 is documented, controlled and verified to a level beyond that required by DO178B."

John Sobkowicz adds the observation that test results tended to expose non-functional errors in the code. In the early days of ELMS there were also some interesting discoveries about the test environment used, in particular the revelation that the target simulator used was not in fact wholly accurate! John has continued to improve the testing process originally developed by Martin Halls. The necessity for stubbing external calls is an occasional vexation, but the mechanism now allows for most stubs to be generated on the fly from the test specifications, used, and then deleted. It is only in rare cases that manual intervention is needed and more permanent stubs have to be produced.

On FQIS, the engineer in charge of software testing has been John Parrott. So far, about 730 module tests have been performed using AdaTEST 95, comprising about 41 KLoC. According to John the most significant change to their process was the decision to unit test all modules (except for the most simple) regardless of coverage results obtained during integration testing. Of the tool, John says, "AdaTEST will continue to be used on this program. It has proved to be an effective and efficient tool for module testing."

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Conclusions and Looking Ahead

Smiths current programme staff are pleased that Martin's testing process designed around AdaTEST has worked so well. The fact that a clean interface is available allowing the smooth handover of testing work packages to the Indian subcontractor, and the easy receipt of results, is a tribute to both the tool and martin's work on the ELMS project. As for the future, there are many years left in ELMS with a freighter version of the B777 aircraft just about to start development. FQIS is already into the B777-200LR variant development, which will continue until next year. Asked whether there are any plans to change the current use of AdaTEST 95, Steve is confident that things will stay pretty much as they are now.

IPL wishes to thank Smiths Aerospace for their cooperation in the production of this case study, and we take this opportunity to wish them well with ongoing and future programs.

News in Brief

- From January 1st IPL is represented in Germany, Austria, and German-speaking Switzerland by a new company, **Emenda Software**. The company may be new but the personnel are well-known to IPL customers as they are **Neil Langmead** and **Steve Howard**, both long-standing IPL staff members with approximately 20 years experience of IPL products between them. IPL wishes them viel Gluck!
- From January 1st IPL is represented in Denmark, Finland, Norway and Sweden by **Nohau Elektronik AB**. Previously acting as a sales agent, Nohau have now become a full IPL products distributor able to offer a full sales and technical support service to customers in Scandinavia.

New Customers

Barclays Capital
Beijing Economy Technology Research Institute
Deloitte
Eppendorf Instruments
Embraer
Hirschmann Controls
Indra Espacio
Iskratel
Jidian Engineering Inst.
KunMing Physical Inst.
Pilz
Qinetiq
Rossmanith
Sagem
Selectron
Shenyang Design Research Inst.
Siemens Miltronics
Taiwan National Space Programme
TTTech
Thales Communications
Thales Raytheon Systems
Thales ATM
Zhuhai Southern Software Test Center

New Salesman

Dave Liddament has recently joined the IPL Software Products sales team. He comes from several years within IPL projects, and will be helping clients mainly in the UK with Cantata++ and Klocwork.

New Support Team Members

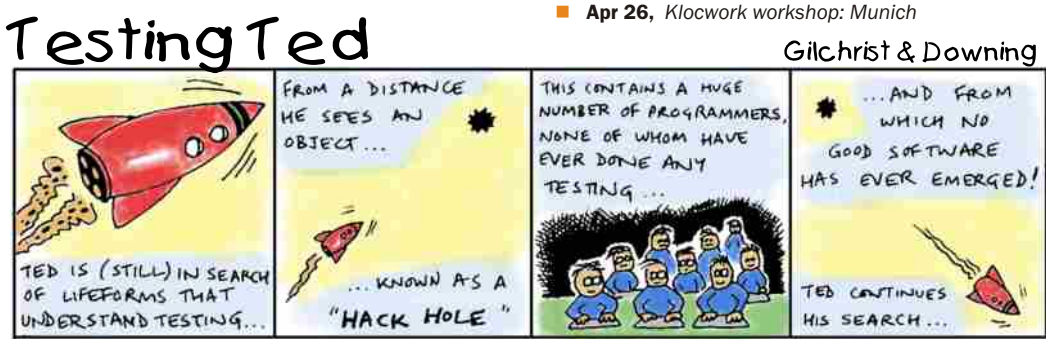
To support our growing Klocwork consultancy effort, Luke Marsden has joined the team after 4 years working on a variety of IPL projects.

The Cantata++ and AdaTEST 95 technical support staff is currently augmented by three new people: Phil Dadd, Adam Thacker and Jonathan Stratford.

Adam, Phil, Jon and Luke

Meet Us

- **Mar 6-8,** *RTS 2007, Paris*
- **Mar 23,** *WSS07, Eindhoven, Netherlands*
- **Apr 17,** *Klocwork workshop: Bath*
- **Apr 19,** *Klocwork workshop: Cambridge*
- **Apr 24,** *Klocwork workshop: Paris*
- **Apr 26,** *Klocwork workshop: Munich*



Ports

In the past 6 months the following **Cantata++** ports have been completed:

- MS .Net 2005
- 64-bit Linux
- Blackfin/Visual DSP++
- ST10/Tasking
- HC12/Comic
- Renesas M32/IAR
- XC164/Keil
- C166/gcc
- ARM/ADS

Training

We offer standard classroom courses and flexible packages of on-site consultancy training For details please see **www.ipl.com/tools/training** or contact your supplier.

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