

newsflash

Pat Rogers given Ada Community Contributions award

At ACM SIGAda's High Integrity Language Technology (HILT) conference in Boston in December 2012, Pat Rogers received an "Outstanding Ada Community Contributions" award. Dr. Rogers, a member of AdaCore's senior technical staff, was acknowledged for his longstanding work in Ada real-time and fault-tolerant technology and his efforts in promoting Ada usage at NASA.

Terma selects GNAT Pro for Space Monitor project

Terma A/S has selected the GNAT Pro Safety-Critical development environment to implement onboard software for the Atmosphere-Space Interactions Monitor (ASIM) that will be mounted on the Columbus module of the International Space Station. Terma will use GNAT Pro Safety-Critical together with the GNATEmulator and GNATcoverage dynamic testing tools to develop and perform coverage analysis for the application prior to deployment on the actual LEON 3 embedded processor.

Rockwell Collins uses AdaCore's Traceability Analysis Package for DO-178B certification

Rockwell Collins has successfully used AdaCore's source-to-object code Traceability Analysis Package for DO-178B in the certification of the Integrated Display System (IDS) for a large, next-generation, commercial aircraft. The Traceability Analysis Package is part of the evidence needed to satisfy the DO-178B objectives for structural code coverage at Level A, the highest (most stringent) level for avionics software safety.

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Major New Release of CodePeer

CodePeer 2.2, the advanced static analysis tool that helps detect run-time and logic errors in Ada programs, was released on all supported platforms during Q1 2013. CodePeer is fully integrated into the GNAT Pro development environments and can also be used with other Ada compilers. The product comes with a coding standard verification tool (GNATcheck), a source code metrics generator (GNATmetric), a semantic analyzer, and a document generator.

Based on customer feedback, a number of enhancements have been incorporated into CodePeer 2.2. These include:

- ▶ Integration into GNATbench, the GNAT Pro Ada plug-in for Eclipse and Wind River Workbench
- ▶ Full support for GNAT project files
- ▶ Message review from HTML reports
- ▶ New "-level" switch to easily tune CodePeer messages and analysis
- ▶ More accurate analysis of mathematical functions and floating point computations
- ▶ Export of messages to spreadsheets

CodePeer is able to find errors by systematically analyzing every possible input and path through the program. The tool can be employed very early in the development cycle to identify defects when they are the least costly to repair, and it can also be used retrospectively on existing code bases to help detect latent vulnerabilities.

In light of its broad applicability, CodePeer directly satisfies the requirements in Section 933 ("Improvements in Assurance of Computer Software Procured by the Department Of Defense") of the United States' National Defense Authorization Act for Fiscal Year 2013. The provisions of this section "require use of appropriate automated vulnerability analysis tools in computer software code during the entire lifecycle of a covered system, including during development, operational testing, operations and sustainment phases, and retirement".

A demo of CodePeer 2.2 is currently available online. In addition to highlighting the new product features, the demo shows how to use Ada 2012 and CodePeer together to identify potential issues, and more generally explains how the tool can improve code quality. Please visit www.adacore.com/knowledge/demos/codepeer-2-2/

GNAT Pro Safety-Critical for ARM

The GNAT Pro Ada Safety-Critical product is now available for the bareboard ARM Cortex M3, M4F, and R4F microprocessors. Ada projects, especially those that need to meet safety standards in domains such as avionics, transportation, and space-based systems, can thus take advantage of the rich support ecosystem and the growing popularity of these low-cost, low-power processors.

The ARM implementation extends the range of bareboard platforms targeted by GNAT Pro Safety-Critical, which already includes the PowerPC and LEON processors. The technology does not require an underlying operating system, and it includes a Ravenscar tasking implementation that is efficient from both a memory usage and a performance perspective.

The product suite includes the following:

- ▶ Support for Ada 2012 (including the important "contract-based programming" features that make it easier to formalize the program's intent) and all earlier versions of the Ada language
- ▶ Support for the Ravenscar tasking profile

- ▶ A set of static analysis tools
 - GNATstack for stack analysis
 - GNATmetrics for complexity metrics computation
 - GNATcheck for coding standard verification
- ▶ The GNATtest unit test harness generator
- ▶ The GDB visual debugger
- ▶ A native Integrated Development Environment (IDE) as well as an Eclipse plug-in

GNAT Pro Safety-Critical for bareboard ARM supplies a fully configurable and customizable run-time library and includes High-Integrity profiles that are especially useful in safety-critical systems. The Zero Footprint Profile (ZFP) in particular defines an Ada subset that does not require any run-time routines, thus reducing the memory footprint to user code only.

In addition to the new bareboard ARM targets for GNAT Pro Safety-Critical, the standard GNAT Pro product line is also being extended with ARM support. A pre-release of GNAT Pro for ARM Android is available now, and GNAT Pro for ARM VxWorks 6 is on the roadmap for the future. For further information please contact info@adacore.com.

Hi-Lite Project Completed

The Hi-Lite project, a French government-sponsored effort to combine formal methods with traditional software development and verification techniques for High-Integrity systems in Ada and C, was successfully completed in May 2013. Hi-Lite's main goal was to make formal verification faster and easier to use for software subject to certification standards such as DO-178C for airborne systems, and the project has met this objective. Hi-Lite started in 2010 and was led by AdaCore, and has produced a variety of Open Source tools as well as new methodologies for applying formal methods in conjunction with unit testing. The Hi-Lite work has also led to a major upgrade to the SPARK language, known as SPARK 2014, and its toolset (see *In the pipeline* section, on this page). The tools and other products developed under Hi-Lite will be made available on the libre.adacore.com website. For more information, please visit www.open-do.org/projects/hi-lite/

< academia corner >

Professional Courses from AdaCore

AdaCore offers a wide range of live training, available for delivery at customer site. The courses span a variety of topics, and many are tailorable in duration and content to fit the customer's schedule and application requirements.

Ada Language (including Ada 2012)

- ▶ Ada Fundamentals (4 or 5 days)
- ▶ Ada Advanced Topics (4 or 5 days)
- ▶ Multi-Language Programming (1 to 4 days)
- ▶ Hard Real-Time & Embedded Systems Programming (4 days)

SPARK Language

- ▶ Software Engineering with SPARK (4 days)
- ▶ Advanced SPARK (1 to 5 days)
- ▶ Secure Software Development with SPARK (1 day)
- ▶ SPARK Overview (2 days)
- ▶ Refresh Your SPARK (1 day)

Software Safety Certification

- ▶ DO-178B and DO-178C for Software Professionals (1 to 3 days)

Tools and Technology

- ▶ Static Analysis Tools (1 day)
- ▶ Dynamic Analysis Tools (1 day)
- ▶ CodePeer (1 day)
- ▶ GNAT Pro with GPS (3 days)
- ▶ GNAT Pro with GNATbench (2 days)
- ▶ GtkAda (3 days)

Joint Product Training with Wind River

- ▶ GNAT Pro Safety-Critical for VxWorks 653 (4 days)
- ▶ GNAT Pro Safety-Critical for VxWorks Cert (4 days)
- ▶ GNAT Pro for VxWorks General Purpose Platform (GPP) (4 days)

For details on these courses please visit www.adacore.com/training/

< current releases >

GNAT Pro 7.1

This latest version of the GNAT Pro development environment and toolsuite was released on all supported platforms during Q1 2013. A summary of the major new functionality appeared in the *In the pipeline* section of the Autumn/Winter 2012-2013 issue of *GNAT Pro Insider*, available at www.adacore.com/newsletter/, and an extended list of new features is itemized at www.adacore.com/developers/product-updates/gnat-pro-711/.

GNATcoverage 1.1

GNATcoverage 1.1, the latest release of AdaCore's tool that provides complete code coverage analysis without requiring instrumentation or specialized hardware, includes a number of new features and enhancements:

- ▶ Support for GNAT project files to locate Source Coverage Obligations, so that users no longer need to compute the list of ALL files
- ▶ Improved GPS integration
- ▶ Support for full Ada run-time constructs such as task entries and select statements
- ▶ Support for analysis of optimized code (-O1) on all targets
- ▶ Support for source coverage analysis per generic instance, instead of merged for all instances.

GtkAda 3

GtkAda 3 is available with GNAT Pro 7.1. This new major release marks the switch to version 3 of the underlying Gtk+ toolkit, bringing new widgets, a CSS-based theming framework, and an improved and simplified API that incorporates a more homogeneous naming scheme.

< in the pipeline >

GNAT Pro for Android

A GNAT Pro release for Android-based ARM targets is planned for Q3 2013, and a pre-release is available now, supporting applications that are completely in Ada or that combine Ada and Java (for example using Java for the GUI and Ada for the computational logic). Extensive support is currently available in GNATbench 2.7 for this mixed language approach, including automatic Java binding code generation via AJIS, the Ada Java Interfacing Suite.

GNAT Tracker 3.0

AdaCore is currently working on a new version of the GNAT Tracker customer server. Based on customer feedback the new version (available later in 2013) will offer an improved and more customizable interface. It will also take advantage of modern design capabilities and support tablets and mobile devices.

Reminder: GNAT Tracker is an essential support portal for customers, giving access to a wealth of information. GNAT Pro users can log in to GNAT Tracker to download products, obtain wavefronts, ask questions about Ada or AdaCore products, and check their account status and details. GNAT Tracker can also be used to learn about product version numbering, licensing terms, AdaCore services, and more.

SPARK Technology

As part of the Hi-Lite project, major enhancements have been made to the SPARK language and toolset. The new SPARK 2014 language is both richer and more flexible, and exploits the Ada 2012 contract-based programming features. This will enable greater verification automation and also simplify the development of SPARK 2014 applications. The new toolset that will rely on SPARK 2014 will also provide innovative ways of combining formal verification with testing and will allow SPARK 2014 to be used incrementally in legacy projects. The first commercial release is expected in Q1 2014. For more information please visit www.spark-2014.org/



Interview with Valentine Reboul Software Engineer, AdaCore EU

Tell us about your background and how you came to be involved with Ada and AdaCore. What is your current role?

My university background came in two stages. First, a two-year program (Preparatory Courses) with a focus on Mathematics, Physics, and Engineering Sciences. Then a degree in Chemistry and Chemical Engineering at the Ecole Nationale Supérieure de Chimie de Montpellier (ENSCM) in France. At ENSCM, in addition to studying Organic, Material, and Analytic Chemistry, I discovered computer programming. Our Computer Sciences teacher was really motivated, even if we were all more or less “newbies”. After some Visual Basic, I asked for something more fun, and my teacher introduced me to a bit of Shell programming and C++. I knew then that I would not be working in Chemistry. You know that sensation when you enter an unfamiliar room and you feel comfortable and at home, compared to a familiar place that you are used to but which suddenly seems not quite right? Those were my feelings for Computer Science and Chemistry, respectively.

I enrolled at the Ecole Nationale Supérieure d’Informatique et de Mathématiques Appliquées de Grenoble (ENSIMAG) to get a more proper introduction to computers and software. And that is where I met Ada, which was the language used for teaching Algorithms. From that point on, working in any other language was not an option! Some training with Jean-Pierre Rosen and two years at Eurocontrol in Brussels reinforced my choice. After a brief period working on train control systems in the railway industry I joined AdaCore as the logical continuation of my career path.

At AdaCore I am currently working on the “Qualifying Machine”. This is a tool that assists with software safety certification by helping to maintain documentation and other artifacts, and by automating traceability and impact analysis.

You have a background in chemistry and chemical engineering. Are there any skills or problem-solving approaches from those disciplines that you find applicable in your present work?

From my chemistry background a crucial idea is that “environment does count”! Pieces of code influence one another, and as in chemistry, computer science works with blocks (components) to make a whole (system). There is also the essential need for proper processes / methodology: doing things correctly and in the right order. In chemistry you do not “just try first”: the “quick and dirty” approach is not effective and may literally blow up in your face. The disciplined technique to solving a problem has influenced my approach to coding, and was especially critical when I was working on air traffic control systems and train communication.

Any hobbies or outside interests that you’d like to share?

I have been practicing sailing for around three years. Success requires rigor and knowledge of both the boat itself and also your fellow crewmembers. And influenced by some AdaCore colleagues, I am complementing my nautical skills with scuba diving. Knowing the sea from both above and below will be one of my goals.

Another hobby, which I picked up in Grenoble, is the game of Go (“Weiqi”). Although you play against an opponent the game is not necessarily about war, but about negotiation. Compared to chess where you have to expressly beat the other player, Go is a matter of positioning and dealing with the environment. Unlike chess pieces the strength or weakness of a stone does not come from any specific attribute but rather from the way you use it with your other stones. You learn how to address your weaknesses before depending on your strengths. Here’s an interesting thought: a Go stone is declared dead when deprived of all its liberties. I may try to put together a “Go team” at AdaCore.

GNAT Pro User Day

This year’s GNAT Pro User Day will be held on Wednesday, September 25, in Paris. Attendees will hear news about the latest tools and toolset features, product roadmaps, and practical tips from technology experts. Updates on Open-DO projects and the SPARK 2014 language evolution will also be presented, and AdaCore staff will be on hand to answer questions. For registration details and further information, please contact events@adacore.com or visit www.adacore.com/gnatpro-day/.

Solving the Endianness Problem with GNAT

Porting applications across hardware with different endianness (byte order conventions), or processing persistent data on a machine whose endianness conflicts with the data representation, have traditionally been cumbersome and error-prone tasks, requiring the application to perform manual byte-swapping. A new GNAT attribute, `Scalar_Storage_Order`, offers a solution through Ada. Big-endian and little-endian data can peacefully coexist in the same program, and applications can be written to be endianness independent. Byte swapping may still be required, but the necessary code will be generated automatically by the compiler.

Ada's `Bit_Order` attribute is not in itself sufficient. It only defines how bits are numbered within multi-byte values stored in memory (known as "machine scalars"), but not how successive bytes in memory are assembled into a machine scalar. If the endianness changes, a record component that starts in one byte and ends in another will have a noncontiguous representation, which cannot be described using any standard representation clause.

The new implementation-defined attribute `T'Scalar_Storage_Order`, available on all platforms in GNAT Pro 7.1, overcomes this limitation. Its effect is to override the byte order in machine scalars for a given record type. For example:

```

type Packet is
  record
    A : Boolean;
    B : Character;
    C : Boolean;
  end record;

for Packet use
  record
    A at 0 range 0..0;
    B at 0 range 1..8;
    C at 0 range 10..10;
  end record;

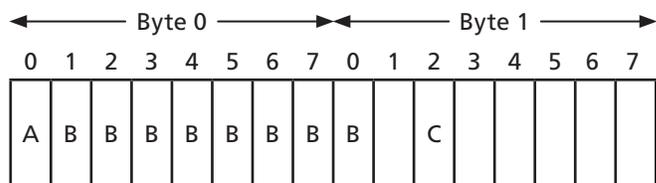
```

```

for Packet'Bit_Order use System.High_Order_First;
for Packet'Size use 16;

```

On a big-endian machine a Packet value would be laid out as follows:



However, if this code is compiled on a little-endian machine, the low-order byte would precede the high-order byte, resulting in a noncontiguous representation for B. Adding a `Scalar_Storage_Order` clause solves this problem:

```

for Packet'Scalar_Storage_Order
use System.High_Order_First; -- "big-endian"

```

On a little-endian machine the bytes constituting a Packet value will be swapped when read from or stored back to memory. Thus any possible value of this record type will be represented as the same sequence of bytes on all platforms, regardless of their actual endianness.

Existing code for a big-endian machine can thus be ported to a little-endian system (or vice versa) without any fuss, and without any change of data representation, just by adding appropriate attribute definitions on the relevant record type declarations.

Additional information, including a demonstration program and suggestions on transitional help where compatibility with legacy tool chains needs to be retained, can be found on AdaCore's Gem page: <http://adaco.re/34>.

Conferences / Events ■ April – November 2013

For up-to-date information on conferences where AdaCore is participating, please visit www.adacore.com/category/press-center/events/

STC 2013 - Software Technology Conference
April 8–11, 2013 / Salt Lake City UT, USA
 Ben Brosgol is presenting "Object-Oriented Programming for High-Integrity Software: Local Type Consistency Verification without Tears".
www.sstc-online.org

1st Tool Qualification Symposium
April 9–10, 2013 / Munich, Germany
 Matteo Bordin and Robertus Vingerhoeds are presenting "Open Qualification Material Approach in the Project P".
www.toolqualification2013.eventbrite.com

Design West
April 22–25, 2013 / San Jose CA, USA
 AdaCore is exhibiting at this conference, and there are presentations from Ben Brosgol ("Object-Oriented Programming for High-Integrity Systems: Pitfalls and How to Avoid Them") and Tucker Taft ("Systems Programming in the Distributed, Multicore World with Go, Rust, and ParaSail").
www.ubmdesign.com/sanjose/

Ada Conference UK 2013
April 25, 2013 / Birmingham, UK
 AdaCore is lead sponsor of this event. Tucker Taft is presenting an Ada 2012 tutorial, and Robert Dewar is giving the closing plenary talk "I'm as Mad as Hell, and I'm Not Going to Take This Anymore!".
www.ada-uk-conference.co.uk

RTECC - Real-Time & Embedded Computing Conference
May 7, 2013 / Nashua NH, USA
 AdaCore is exhibiting at this event.
www.rtecc.com/conferences/view/117

DASIA 2013
May 14–16, 2013 / Porto, Portugal
 Johannes Kanig and David Lesens (Astrium Space Transportation) are presenting "Formal Validation of Aerospace Software".
eurospace.org/dasia-2013.aspx

Certification Together
May 21–23, 2013 / Toulouse, France
 AdaCore is a Platinum sponsor of this event. Johannes Kanig is presenting "Integrating Formal Program Verification with Testing".
www.certification-together.com/index.php?option=com_content&view=article&id=73&Itemid=80

Ada Europe 2013
June 10–14, 2013 / Berlin, Germany
 AdaCore is a major sponsor and is exhibiting at this event. Thomas Quinot is presenting "Lady Ada Mediates Peace Treaty in Endianness War".
www.ada-europe2013.org

ARM-based Embedded System Design
June 25, 2013 / Sindelfingen, Germany
 Quentin Ochem is presenting "Ada for ARM".
www.iccmedia.com/mediadaten2013/armcon13.pdf

SAE Aerotech 2013
September 24–26, 2013 / Montreal QC, Canada
 Tucker Taft is presenting "Integrating Test and Proof in the Next Generation Verifiable SPARK Language, Using Contract-Based Programming Features and SMT Solvers".
www.sae.org/events/atc/

GNAT Pro User Day 2013
September 25, 2013 / Paris, France
 Please see the companion article on Page 3 of this newsletter.

IET Systems Safety
October 14–17, 2013 / Cardiff, UK
 AdaCore is a sponsor of this event and is exhibiting.
conferences.theiet.org/system-safety/index.cfm

ACM SIGAda's HILT 2013 - High Integrity Language Technology
November 10–14, 2013 / Pittsburgh PA, USA
 AdaCore is a Platinum Sponsor of this conference, Tucker Taft is Program Chair, and Greg Gicca is Publicity Chair.
www.sigada.org/conf/hilt2013

The GNAT Pro insider is published twice a year simultaneously in New York and Paris by AdaCore

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