Something you didn’t know about

... 

Rapita/Ada/Software

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What does Rapita do?

Advanced technologies for reducing V&V costs

Revolutionize your software verification
RVS: Software verification tools and hardware

- Manage **tests** from system to unit level
- Apply and **run** tests on-target and on-host
- Significantly reduce testing times

**RapiTest Framework**

- Measure **code coverage** to MC/DC level
- Lowest **on-target** overheads on the market
- Merge coverage from multiple tests and builds

**RapiCover**

- Calculate **WCET** and high water mark times
- Identify where to focus **optimization**
- Single & multi-core analysis

**RapiTime**

- Visualize system **scheduling** graphically
- Highlight rare timing events e.g. race conditions
- Identify system capacity issues

**RapiTask**

- **Test simulation models** and software code
- Provide evidence that code meets requirements
- Test on target ECU

**MX Suite**

- Trace 100+ million events per second for days
- Minimal **instrumentation overheads**
- Target-independent tracing

**RTBx**
Talk to us about…

- Commercial projects (tools and services)
- Custom V&V tools
- Academic use
- Partnerships
- R&D projects
- Ada!
Supporting Ada & Aerospace – recent things

- **RapiTest**
  - Major product investment (Ada/C/C++)

- **Multi-core timing analysis/WCET**
  - Industrial solution for safety-critical MCP

- **Automatic test generation**
  - For RBT, coverage and formal modelling
Functional testing for critical software

RapiTest: Functional testing for critical software
RapiTest Philosophy: Efficient People

Unit and system testing tool (Ada, C, C++)

*Designed for aerospace and Ada.*

In many DO-178C projects, testers cannot even “see” the source

No “User code” – tester should not have to write any code to test Ada
After 3 years of development and test

- RapiTest version 1.4a
  - C, Ada, C++
  - DO-178C Qualification
  - Lots of really good feedback from first users

- Would you like to try it?
  - We welcome your ideas and feedback. What more it could do?

- Technology maturity:
  - Successfully completed 3 V&V projects
    - DO-178C DAL A – software accepted by OEM/DER
  - In use on several DO-178C DAL A projects in US & UK
  - Further pilots/eval ….
RVS-Core

What’s inside? (What people don’t normally see)
Rapita Verification Suite

Unit and System Test
- RapiTest
- RapiCover

Timing and WCET
- RapiTime
- RapiTask

RVS Core

Structural Code Coverage

Scheduling/tracing
RVS-Core is..

- A powerful set of language parsing libraries
  - Ada 83-2012, C, C++
- Many Target/embedded integration libraries
- Reporting/GUI
- Written in Ada (mostly)
  - Except the bits in Java, Python, JavaScript, Perl, C and 3 DSLs
- Tested with RVS
RVS on RVS (Statement Coverage from System Tests)
RVS Core can...

- Do “anything” to source code
  - Code injection/modification
  - Analysis
  - Tracing
  - Data/Control coupling verification
  - Auto test-generation

- Q: How else can we use the core?
Technologies and dataflow inside RVS-Core

- Software Parsing
  - Verification database
  - Domain specific languages
  - Rapita Code Injection
    - Embedded target libraries
    - Tracing and analysis
  - Reporting

Domain specific languages:
- XLS
- RTS
- RCI
Domain Specific languages in RVS

XLS

[Set of] spreadsheet-based languages for writing tests (including legacy compatibility converters)

RTS

Rapita Test Script
Text-language for writing tests (e.g. unit tests, system tests, etc)

RCI

Rapita Code Injection
Text-based language for source code manipulation
RCI Example: dump function call arguments at run-time

- At run-time, create a “trace” of all subprogram calls and their parameters

- Simple Implementation is 28 lines of RCI language not including target tracing code.
RCI code injection at start and end of subprograms
Example: test context switching

- Do some robustness testing of context switches by forcing far more to happen than normal?
  - RCI code injection to force a context switch every line
Example: RapiTest - Unit test using private types

Test Strategy (ideas)

1. Make Speed_data a non-private type?
2. Create hook functions to read/write components of speed_data?
3. Create user-code to do the test?
Example: RapiTest Unit test using private types

That's it. No hooks, probes, test points, user code. RapiTest adds any code necessary to “see” private types.

```
package ...

type Speed_Data is private;

function Get_Speed(Velocity : Float) return Speed_Data;

private

type Motion_Type is (Stationary, Forward, Backward);

function Get_Speed(Velocity : Float)
  return Speed_Data is
  result : Speed_Data;
  begin
    if Velocity < 0.0 then
      result.Speed := -Velocity;
      result.Direction := Backward;
    elsif Velocity > 0.0 then
      result.Speed := Velocity;
      result.Direction := Forward;
    else
      ... (case statements)
  end if;

  return result;
end Get_Speed;
```

Variable | Operation | Value | Value | Value
---|---|---|---|---
Velocity | set | -4.1 | 5.2 | 0
return.speed | check | 4.1 | 5.2 | 0
return.direction | check | Backward | Forward | Stationary
Multi-core Timing Analysis

An *industrial approach* for multi-core airborne software timing verification using DO-178C/CAST-32A

Ian Broster, Christos Evripidou (Rapita)
Francisco Cazorla, Enrico Mezetti, Suzana Milutinovic (BSC)
Practical DO-178C/ED-12C training workshops

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RapiTetris

Test Results

<table>
<thead>
<tr>
<th>Tests</th>
<th>Pass %</th>
<th>Message</th>
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Test Suites

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Requirements:
- Requirements 11
- Requirements 12
- Requirements 13
- Requirements 14
RapiTetris

- Test your software testing skills
- Prize for highest structural code coverage
- Try on our stand
- Download and play
  - www.rapitasystems.com/TetrisComp