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Safety through quality

CASE STUDY

RapiTime

Proving and improving worst-case execution times on
the Alenia Aermacchi® M-346®

Case study: Rapi**Time**

"With RapiTime, we discovered the possibility to reduce by 10% the time spent by a Computer Software Configuration Item."

Alenia Aermacchi® has built over 7,000 aircraft and supplied 2,000 trainers to more than 40 countries worldwide.

A military transonic trainer aircraft designed for training combat pilots for front line fighter aircraft, the Alenia Aermacchi M-346® Master is powered by a digital flight control system.

An important part of the development of this system's software is the efficient capture and use of worst-case execution time data.

Summary

The challenge

- To measure and improve the overall execution time of the flight control system on the Alenia Aermacchi M-346 Master

The solution

- Use Rapi**Time** to measure worst-case execution times, identify worst-case hotspots and optimize the appropriate code

The benefits

- WCET determined with a high level of confidence and reduced effort
- Rapid identification of software bottlenecks, leading to 10% reduction in WCET

Alenia Aermacchi planned to use Rapi**Time** to:

- Reduce the effort required to carry out timing analysis on the flight control software
- Optimize code which powers the flight control system and reduce worst-case execution times
- Compare the benefits of using Rapi**Time** with established manual approaches

Challenge

In developing the flight control software, the challenge for Alenia Aermacchi was to simultaneously reduce the costs and improve the quality of worst-case execution time measurements.

Rapi**Time**

Recognizing that manually determining execution times is expensive and time consuming, Alenia Aermacchi selected Rapi**Time** (part of the Rapita **Verification Suite**, R**VS**) because it was the only commercially available tool that could deliver WCET measurements given the existing hardware/software architecture.

Solution

Measuring worst-case execution times

Rapi**Time** was first used to measure the execution time of short sub-paths between decision points in the code. This measurement is combined with static path analysis information to compute worst-case execution times and execution time variations.

Highlighting worst-case hotspots

Conventional code profiling techniques identify the lines of code that execute the most on average. By contrast, Rapi**Time** identified worst-case hotspots in Ada sub-programs and even specific lines of source code from the point of view of their contribution to the overall worst-case execution time.

Once identified, hotspots were:

- Stripped of code contributing heavily to worstcase execution times
- Provided with rewritten code

Benefits

According to Alenia Aermacchi engineers working on measuring and improving the overall execution time of the M-346 flight control system,

> "The main advantage [of using Rapi**Time**] is the possibility to identify the software bottlenecks that can be subject to optimization.
>
> Without Rapi**Time**, the mandatory code optimization would have been done without the knowledge of where to concentrate the efforts.
>
> With Rapi**Time**, we discovered the possibility to reduce by 10% the time spent by a Computer Software Configuration Item"
>
> **Alenia Aermacchi**

Next steps

Alenia Aermacchi are now exploring a number of options after using Rapi**Time**, including:

Possible use of worst-case execution time information to aid DO-178B qualification;

Selecting Rapi**Cover** to help meet code coverage measurement requirements.

To learn how Rapi**Time** can help reduce the cost and effort of execution time analysis, see our product page at rapitasystems.com/products/rapitime.

To enquire about what Rapita can do for you, contact us at info@rapitasystems.com.

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About Rapita

Rapita Systems provides on-target software verification tools and services globally to the embedded aerospace and automotive electronics industries.

Our solutions help to increase software quality, deliver evidence to meet safety and certification objectives and reduce costs.

Find out more

A range of free high-quality materials are available at:
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Rapi**Test**	Integration Services	Multicore Timing Solution
Rapi**Cover**	Qualification	
Rapi**Time**	SW/HW Engineering	
Rapi**Task**	Compiler Verification	

Contact

Rapita Systems Ltd.
Atlas House
York, UK
YO10 3JB
+44 (0)1904 413945

Rapita Systems, Inc.
41131 Vincenti Ct.
Novi, Mi, 48375
USA
+1 248-957-9801

Rapita Systems S.L.
Parc UPC, Edificio K2M
c/ Jordi Girona, 1-3
Barcelona 08034
Spain

rapitasystems.com

linkedin.com/company/rapita-systems

info@rapitasystems.com