RAPITA Systems
A DANLAW Company

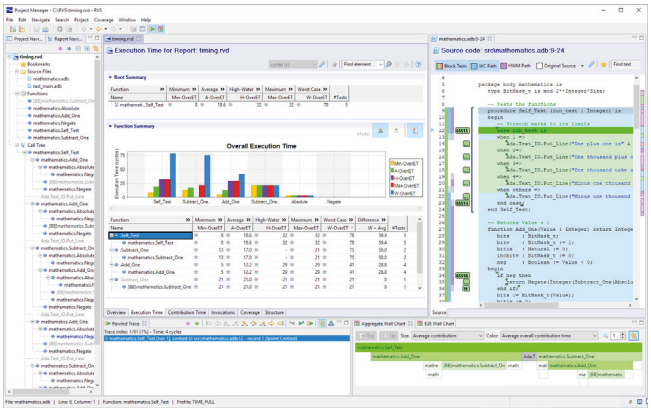
Product brief

Zero-footprint execution time analysis with RapiTime^{Zero}

RapiTime Zero

How can RapiTime^{Zero} help you?

RapiTime^{Zero} lets you observe the execution time behavior of object code from critical software without needing to make any modifications to, or even have access to, your project's source code.



Benefits

Verify the execution time behavior of critical software without needing:

- Any instrumentation.
- Project source code.
- Any modification to your development environment.

RapiTime^{Zero} use cases

- Execution time analysis for third-party libraries.
- Execution time analysis with no impact on the code base or development environment.
- Execution time analysis to meet DO-178B/C objectives.
- Execution time analysis to meet ISO 26262 requirements.

How does RapiTime^{Zero} work?

RapiTime^{Zero} reconstructs information on software execution behavior by matching branch trace information collected from the hardware (which must support this) with a control flow graph produced from a disassembly of the software binary.

Having matched this data, a reconstructed branch trace is created, which can be used to analyze the execution time behavior of the executable code while it ran.

The branch trace is a crucial component of the analysis process and this must be available in the existing development environment through the CPU and/or external hardware being used.

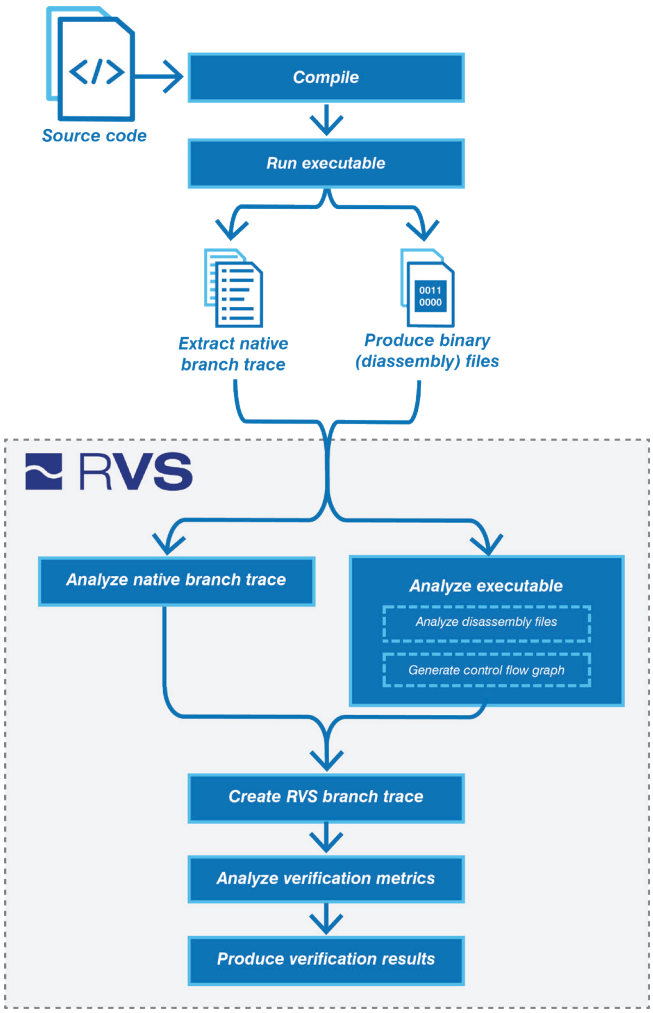


Figure 1. RapiTime^{Zero} verification process

Execution time analysis

- Calculation of detailed timing metrics for each function and sub-function:
  - Minimum, maximum and average execution time
  - Execution time density
  - Contribution to HWM path
- Merge results from different test runs, builds and strategies

Language support

- Any language that targets machine code
- Mixed source languages

Supported platforms

- It must be possible to produce and collect branch trace information from the platform during program execution
- It must be possible to observe context switch information from executables on the platform
- Platform Support Package required to interface between Rapi**Time**^{Zero} and platform (see Platform Support Packages)
- To assess whether a Platform Support Package is available for your platform, see the compatibility tab on our Rapi**Time**^{Zero} product page
- We can develop additional Platform Support Packages to support Rapi**Time**^{Zero} analysis for compatible platforms

Integration support

- Automatable testing environment
- Support for very large code bases
- No library/run-time dependencies or dynamic memory requirements
- Shared integration with other zero footprint R**VS** tools
- Continuous build servers *e.g.* Jenkins, Bamboo
- Multicore support (depending on hardware support)

Integrated testing environment

- Summary and detailed results views
- Invocation timeline, aggregate profile and treemap charts to help understand timing behavior at a glance
- Trace rewind feature to debug timing behavior
- Filter results by subprogram
- Code viewer:
  - View object code alongside source code, where available
  - Color-coded by high water mark path
- Show other code metrics *e.g.* #LOC
- Aggregate timing metrics by directory, file and functions
- Multiple export formats *e.g.* text, XML, CSV
- Compare reports
- Database-like search function
- Multi-user testing environment

Compatibility

- Runs on host operating systems
  - Windows 7+ and Windows Server 2008 R2+
  - Linux distributions including Ubuntu and Red Hat
- Results can be collected from systems without supported operating systems and transferred to a supported system for anlysis

Licensing

- Enterprise license gives you access to new versions, support and maintenance
- One-year support and maintenance included in purchase price
- Single price for all features
- Licenses transferrable across projects

Should I use RapiTime or RapiTime^{Zero}?

Rapi**Time**^{Zero} offers many benefits, but in some cases Rapi**Time** may be more appropriate for you. Consult Table 1 below to decide if Rapi**Time**^{Zero} or Rapi**Time** is best for you. For more information, contact us at info@rapitasystems.com.

*Table 1. Comparison of key Rapi**Time** and Rapi**Time**^{Zero} features*

Feature	**RapiTime**	**RapiTime^{Zero}**
Works without source code	No	Yes
Works without Instrumentation	No	Yes
Integration with development environment	Integration needed	No integration needed
Worst-case execution time analysis	Yes	No
Tool qualification support	Yes	Not yet available
Trace size and data processing time	Depends on applied instrumentation	Typically larger trace and longer data processing times
Supported platforms (target, data collection mechanism)	Flexible, almost any platform supported	Requirements on platform (branch trace and context switch information must be available), PSP needed

Platform Support Packages

To enable Rapi**Time**^{Zero} analysis on a specific platform, Platform Support Packages (PSPs) are needed for Rapi**Time**^{Zero} to interface with that platform in order to do the following:

- Convert the specific format of native branch traces generated by the platform into a format that Rapi**Time**^{Zero} understands and can use for subsequent analysis.
- Disassemble the object code to understand the structure and control flow of the code so this can be used for subsequent Rapi**Time**^{Zero} analysis.

Each PSP is designed to support various components of a platform. These include:

- The compiler(s) used to generate executables to be analyzed by Rapi**Time**^{Zero}
- The instruction set of object code to be analyzed by Rapi**Time**^{Zero}
- The native branch trace format generated from the platform – this depends on the mechanism used to generate branch traces, which may be the target hardware (or simulator) or a third-party device e.g. debugger.
- The real-time operating system on which executables to be analyzed by Rapi**Time**^{Zero} are to be run.

Different PSPs are needed to support analysis by Rapi**Time**^{Zero} when any of the above items are different between two platforms. PSPs that support Rapi**Time**^{Zero} analysis also support analysis by Rapi**Cover**^{Zero} and Rapi**Task**^{Zero}. For more information on how Zero-footprint PSPs support analysis by zero-footprint R**VS** tools including Rapi**Time**^{Zero}, see our *Requirements for zero-footprint RVS analysis* Technical note.

To see whether we have already developed PSPs compatible with the components on your platform, see the compatibility tab on our Rapi**Time**^{Zero} product page. If we have not yet developed PSPs compatible with one or more components of your platform, we may be able to develop them. For more information, contact us at info@rapitasystems.com.

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