# Rapi**Time**™ + Worst-case execution time analysis

# Rapi**Time**
# Worst-Case Execution Time Analysis Tool kit

## How long does your software take to run?

+ **Determine worst-case execution times**
+ **Identify code on the worst-case path**
+ **Optimise worst-case hotspots**
+ **Eliminate timing problems**
+ **Provide code-coverage metrics**

## Real-**Time Systems**

**Obtaining accurate information about the longest time a software component can take to run, termed the worst-case execution time, is key to ensuring that time constraints are met and that an embedded real-time system will operate correctly.**

## Worst-Case Execution Time Analysis

Rapi**Time** is an analysis tool set that provides a unique solution to the problem of determining worst-case execution times, a solution that works for complex software running on advanced embedded microprocessors.

## Key Features
**The RapiTime tool set can be used to:**

+ Determine accurate **worst-case execution times** for each software component

+ Identify code that is on the **worst-case path**

+ Provide detailed analysis of **worst-case hotspots** and their contribution to the worst-case execution time

+ Provide **code-coverage metrics** ensuring confidence in the analysis results

+ Generate **Execution Time Profiles** illustrating the variability in execution times due to hardware effects

## Analysis Capability

Rapi**Time** produces easy to navigate WCET reports, graphs of execution time variation and colour-coded source highlighting code on the worst-case path and any gaps in testing.

Rapi**Time** can analyse complex embedded software comprising upwards of 50,000 lines of C or Ada code.

Rapi**Time** supports 8, 16 and 32-bit CPUs including the very latest microprocessors with advanced hardware features such as data and instruction caches, pipelines and branch prediction units.

## Innovation
**RapiTime uses an innovative combination of three techniques:**

**1**. Recognising that the best possible model of an advanced microprocessor is the microprocessor itself. Rapi**Time** uses on line testing to measure the execution time of short sub-paths through the code.

**2**. By contrast, off line static analysis is the best way to determine the overall structure of the code and the paths through it. RapiTime therefore uses path analysis techniques to build a precise model of the code structure.

**3**. Rapi**Time** combines measurement and path analysis information using state-of-the-art statistical methods, to compute worst-case execution times in a way that accurately captures the execution time variation on individual paths due to hardware effects.

This innovative approach means that Rapi**Time** is the only commercially available solution that can provide accurate worst-case execution time information for complex software running on the latest generation of advanced microprocessors.

RAPITA Systems Ltd.

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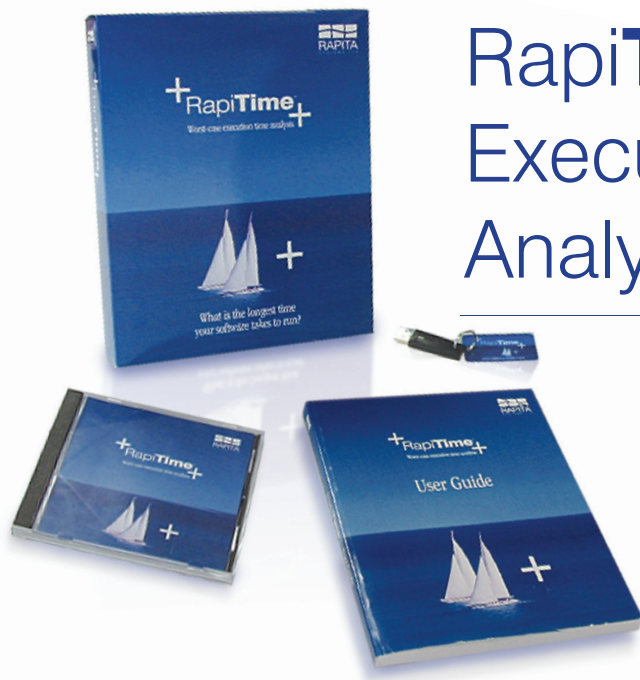
## Benefits

+ **Shorten time to market**
+ **Reduce development costs**
+ **Avoid costly hardware upgrades**
+ **Minimise unit costs in production**
+ **Enhance product quality**
+ **Protect brand image**

## Shorten time to market

**RapiTime provides accurate worst-case execution time information. This enables engineers to take a systematic and scientific approach to ensuring that time constraints are met. In effect allowing them to engineer timing correctness into a system rather than spending a great deal of time and effort trying to get timing bugs out. This shortens time to market and reduces development costs making** Rapi**Time a key asset in engineering embedded real-time systems.**

Rapi**Time** identifies code on the worst-case path. This is particularly useful when the worst-case execution time needs to be reduced. Engineers can focus their optimisation efforts where it is known to have a benefit.

## Avoid costly hardware upgrades

Rapi**Time** also provides detailed information about worst-case hotspots. These are sections of code that contribute the most to the worst-case execution time.

By contrast, conventional profiling techniques identify the lines of code that execute the most on average, which is very different. Worst-case hotspot analysis ensures that optimisation is targeted where it will be most effective, reducing the effort required to resolve timing issues and minimising any subsequent maintenance burden.

## Minimise unit costs in production

Targeted worst-case hotspot analysis and optimisation makes it possible to extract the maximum performance from the most cost-effective processor variants, minimising unit costs in production and making it possible to add new functionality without the need for expensive hardware upgrades.

## Enhance product quality

Rapi**Time** provides code coverage analysis identifying those parts of the code that have not been exercised during testing. Code coverage analysis has the benefit of increasing the quality of unit testing, reducing the number of functional and timing problems that make it through to the integration phase.

## Protect brand image

Rapi**Time** helps engineers obtain an improved understanding of the worst-case timing behaviour of embedded systems. This is of great benefit when timing problems are so severe that the structure of the code needs to be changed. Rapi**Time** can highlight designs that, although having good average-case performance, lead to an excessively long worst-case execution time and hence have the potential to cause intermittent timing problems. This knowledge helps engineers design more robust software.

## Return on Investment

For companies in the Avionics, Space, Telecommunications and Automotive Electronics markets, the return on investment from utilising Rapi**Time** technology is excellent. Rapi**Time** offers the prospect of far fewer timing bugs going undetected through unit test and integration phases. Identifying timing issues early in development has the proven impact of reducing development cost, reducing time to market and enhancing the company's reputation and brand through higher quality, more reliable product.

**For more information please ask for a copy of the** Rapi**Time White Paper.**