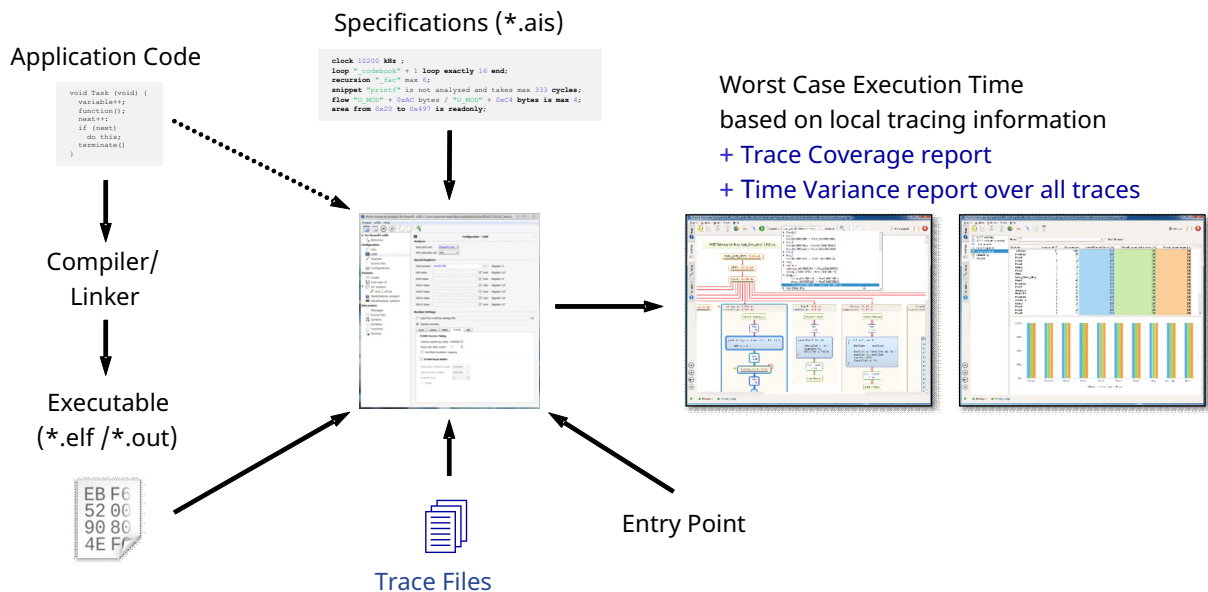# TimeWeaver

## Hybrid Worst-Case Execution Time Analysis

**TimeWeaver** combines static path analysis with real-time instruction-level tracing to provide worst-case execution time estimates. The computed time bounds provide valuable feedback for assessing system safety and for optimizing worst-case performance.

Application Code

Specifications (*.ais)

```
void Task (void) {
    variable++;
    function();
    next++;
    if (next)
        do this;
    terminate()
}
```

```
clock 10200 kHz ;
loop "_codebook" + 1 loop exactly 16 end;
recursion "_fac" max 6;
snippet "printf" is not analyzed and takes max 333 cycles;
flow "U_MOD" + 0xAC bytes / "U_MOD" + 0xC4 bytes is max 4;
area from 0x20 to 0x497 is readonly;
```

Worst Case Execution Time
based on local tracing information
+ Trace Coverage report
+ Time Variance report over all traces

Compiler/
Linker

Executable
(*.elf /*.out)

```
EB F6
52 00
90 80
4E FF
```

Entry Point

Trace Files

## Why do you need TimeWeaver?

- **TimeWeaver** analyses all potential execution paths and computes the **longest path** based on the execution times of trace segments observed in real-time traces.

- **TimeWeaver** supports **non-intrusive tracing**, e.g. Nexus branch history target messages. The computed time bounds are compliant to requirements of safety standards like DO-178B, DO-178C, ISO 26262, etc.

- **TimeWeaver** reports **test coverage** information at the instruction level with respect to all possible execution paths for all considered trace segments. This gives valuable feedback for improving the test coverage of the system.

- **TimeWeaver** generates **customizable reports** and **visualizations** for **documentation** and **certification** purposes, e.g.:
  - global end-to-end time, based on the maximum observed trace segment times combined to an overall bound
  - end-to-end time bounds for specific functions, depending on trace points
  - GANTT chart of task execution times extracted from trace data  `New`
  - total interrupt blocking time per trace segment  `New`
  - time variance of each trace segment
  - trace coverage
  - maximum possible (based on static program analysis) and maximum observed iteration counts for loops

- **TimeWeaver** supports **batch mode** execution and integration in **continuous integration** frameworks.

- On Tricore AURIX devices, **TimeWeaver** supports highly efficient **interactive MCDS tracing** via Infineon DAS.

## Supported architectures and trace formats

- All PowerPC boards able to emit Nexus program trace messages (IEEE-ISTO 5001, class 2 or higher), e.g.: PowerPC QorIQ P204x/P30xx/P40xx/P50xx (e500mc core), PowerPC QorIQ T series (e5500/e6500 core), PowerPC Qorivva line MPC55xx/MPC56xx/MPC57xx (e200 core).

- ARM using cycle-accurate ETM traces, e.g.: Cortex-A53, Cortex-R5F.

- TriCore AUDO family (e.g. TC1796), TriCore AURIX (e.g. TC275), and TriCore AURIX 2nd Generation (e.g. Tc3xx).

- Lauterbach Trace32 BRANCHFLOW export trace  `New`

AbsInt