LAUTERBACH
DEVELOPMENT TOOLS

Debug and Profile with TRACE32® and RIOT OS

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AGENDA

1. Who are Lauterbach
2. TRACE32® Overview
3. TRACE32® Kernel Awareness
4. Usage Examples

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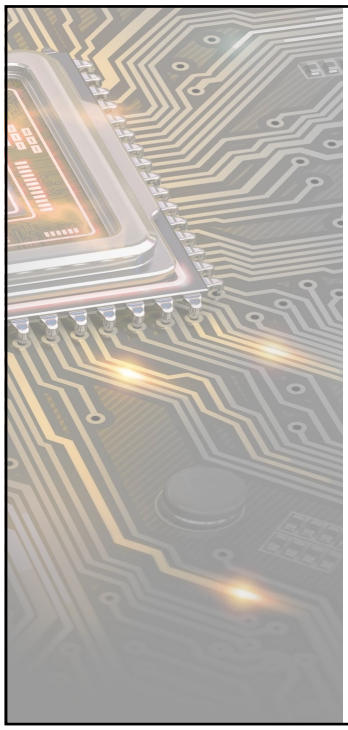

1) Who are Lauterbach

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Who are Lauterbach

- Largest Manufacturer of debuggers worldwide
- Founded in 1979
- Based in Höhenkirchen, near Munich
- Privately owned by the founders
- Approx. 120 employees worldwide, with subsidiaries in
  - China, France, Italy, Japan, Tunisia, UK, USA
  - Other territories covered by exclusive highly technical distributors

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The Lauterbach Difference

- Company is privately owned and engineering led
  - No chasing quarterly results or kow-towing to share holders
  - >80% worldwide staff are engineers
- All R&D, Engineering, and Production takes place at our facility outside Munich
- Excellent reputation for providing timely, high quality support
  - Even Mr. Lauterbach still answers support calls!
- We only make debuggers
  - We have to work with all compilers, RTOS, 3rd party tools, etc.
  - No dilution of effort
- Long-term close relationships with silicon vendors
  - Support for tens of thousands of devices from approx. 75 silicon vendors!

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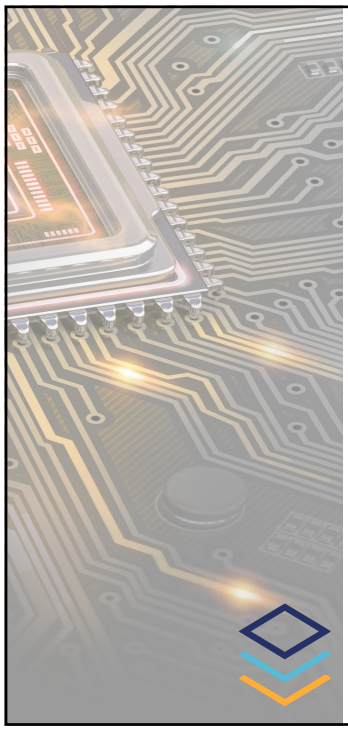

2) TRACE32® Tool Overview

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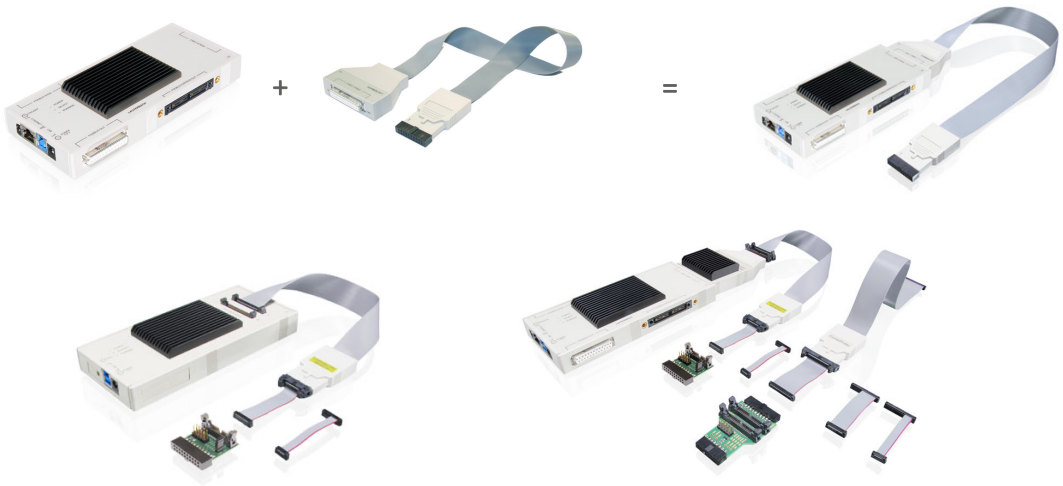
Modular tools designed to Grow

Debug tools



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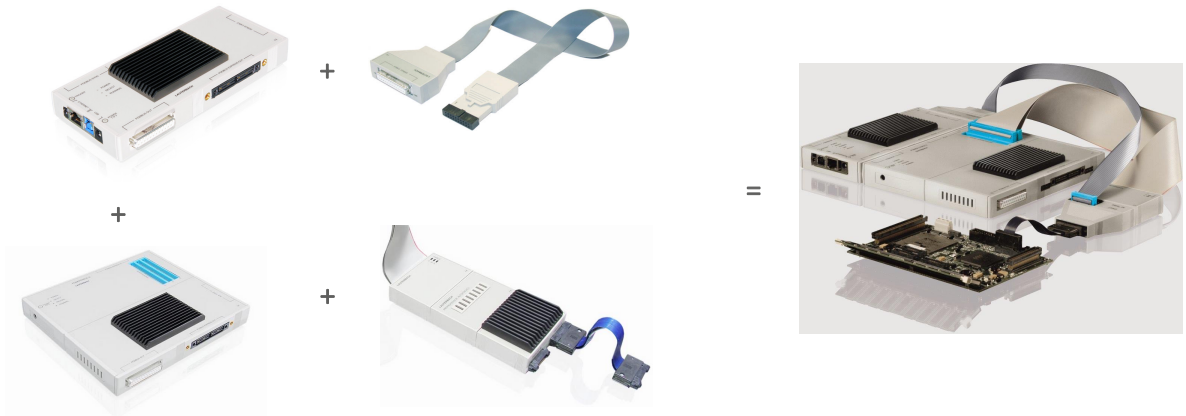
Modular tools designed to Grow

Debug and Trace tools



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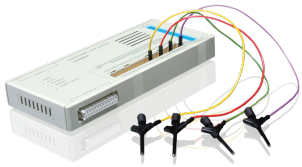
Modular tools designed to Grow

Digital and Analogue Logic Trace tools



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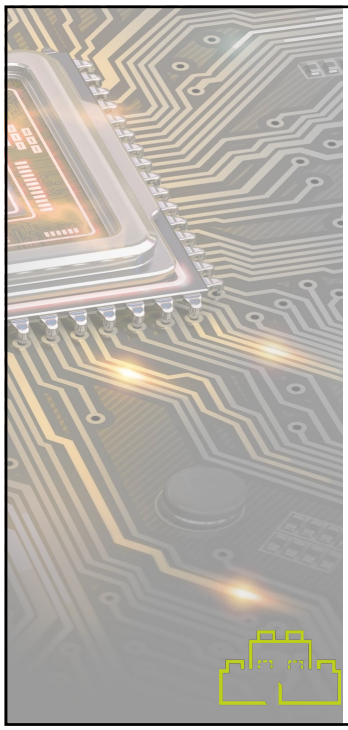

3) TRACE32® Kernel Awareness

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What is a Kernel Awareness

- Extension to the TRACE32® debugger
  - Currently over 80 RTOS' supported
  - All delivered free of charge (included on DVD or in software download image)
- Loaded at runtime
  - Two files: kernel awareness and menu to access features
  - Some optional scripts to simplify complex operations
- Provides access to RTOS resources at runtime
  - Display system objects, such as tasks, threads, semaphores, mailboxes, etc.
  - Set task aware breakpoints
  - Task aware performance monitoring
  - Task aware tracing
- May be built by Lauterbach, a TRACE32 user, or the RTOS developer

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To create a kernel awareness plugin

- Requires the Extension Development Kit (EDK)
  - Free of Charge
  - Signed NDA required
  - Supports Windows and Linux build hosts
    - I used Fedora Core 31
- EDK contains
  - C Library Routines
  - Make files
  - Custom Embedded C Cross compiler
  - Documentation
  - Examples

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Build Process Overview

- Take existing example and adapt it
  - Much easier than starting from scratch
  - Makefile and build environment already set
  - Skeleton functions exist for most OS objects
- A few mandatory functions need to be provided
  - Info about current task/thread
  - List of all tasks/threads
  - Details of registers saved/restored during a context switch
- Everything else is optional
  - All of the optional components are defined in the main awareness file
  - Define new commands
  - Define new functions
  - Define anything else to make the user's life easier when debugging your kernel/RTOS

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Other Requirements

- Header files and some source files for RTOS
  - Documentation and debug compiled kernel may be used
- RIOT OS is provided in source
  - Header files and Source files are well documented
  - Very helpful and knowledgeable community
- Working build environment
  - To create example applications to test the awareness against
  - Most of this can often be performed in a simulated environment, using TRACE32®
- Supported hardware target
  - Final testing on real hardware with real tools ☺

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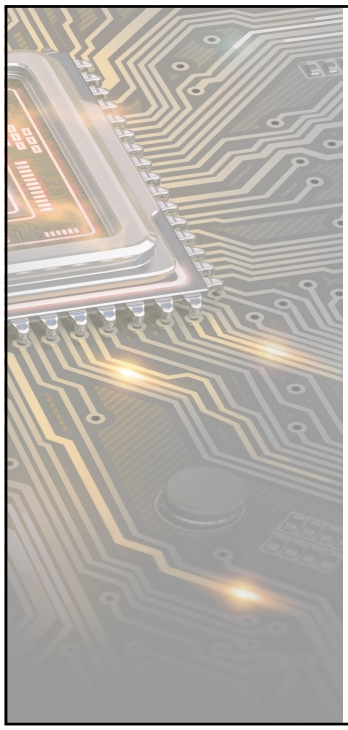

4)Usage Examples

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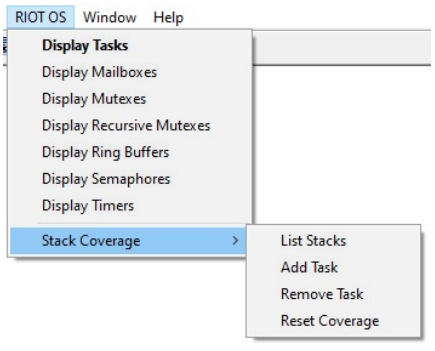
New Menu

- The menu file is part of the awareness
  - Added to the UI after the awareness has been loaded
  - Provides convenient access to many OS specific views



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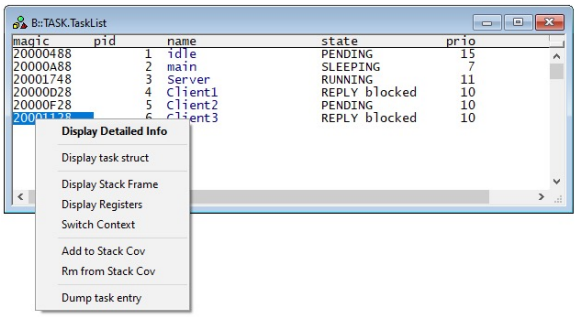
Task and Thread Lists

- Display a list of active tasks and threads
  - Where target supports dual port memory, lists are dynamic
  - 'magic' column has a right-click menu giving access to extra information about each task/thread



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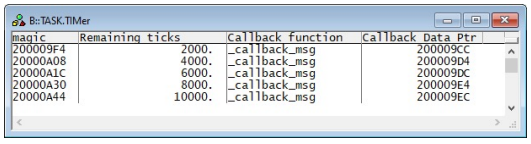
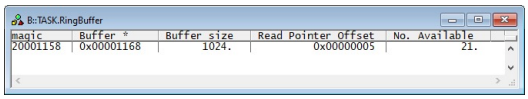
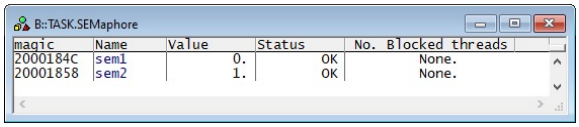
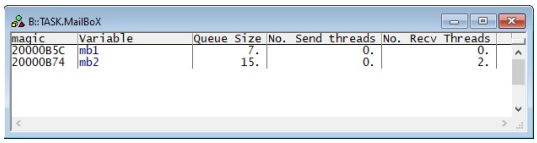
Access to System Objects









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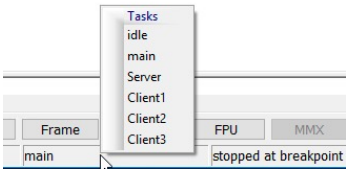
Switch between tasks/threads

- Handy dropdown on status bar to quickly switch between task or threads
- All open windows (unless otherwise anchored) will switch to the new context.
  - Source listing
  - Registers
  - Variables



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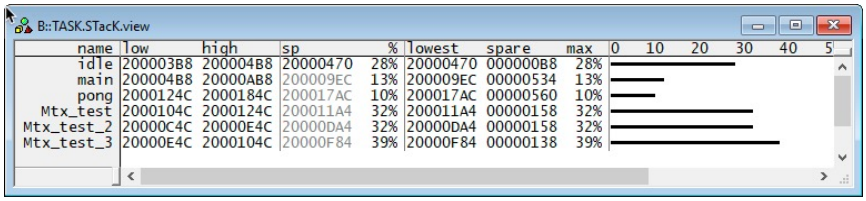
Stack frame for each Task/thread

- View stack usage for each task/thread
  - Supports standard and non-standard stack pre-fill values



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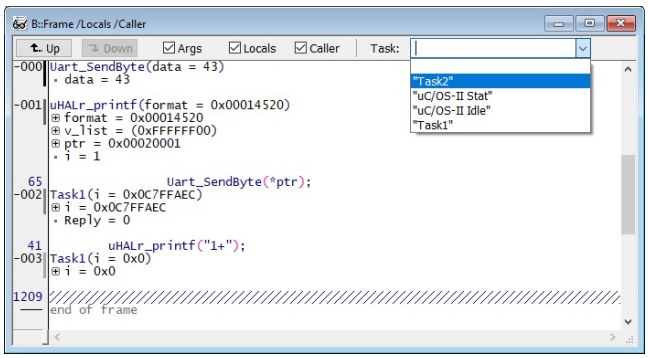
Stack frame for each Task/thread

- View call stack for each task or thread
  - Walk up and down the call stack – all relevant open windows change their view(s)



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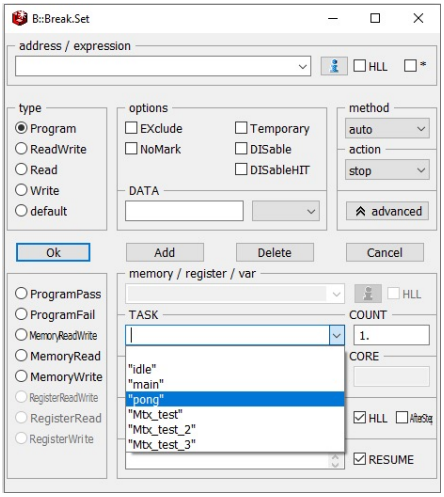
Task/Thread Aware Breakpoints

- Use dropdown to set task or thread aware breakpoints



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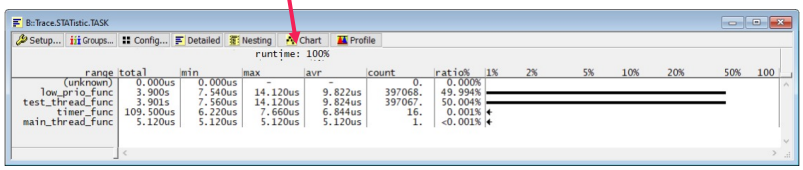
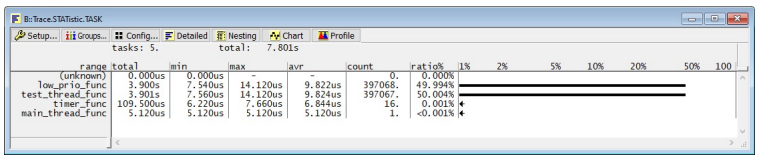
JTAG based task/thread profiling

- Use whatever features the CPU provides
  - If none, use Stop&Go
  - May be some level of intrusion
    - Runtime will be indicated on display

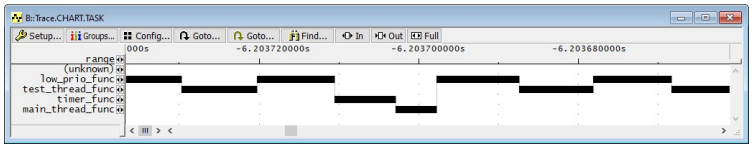


Trace based task/thread profiling

- Highly accurate task/thread runtime profiling

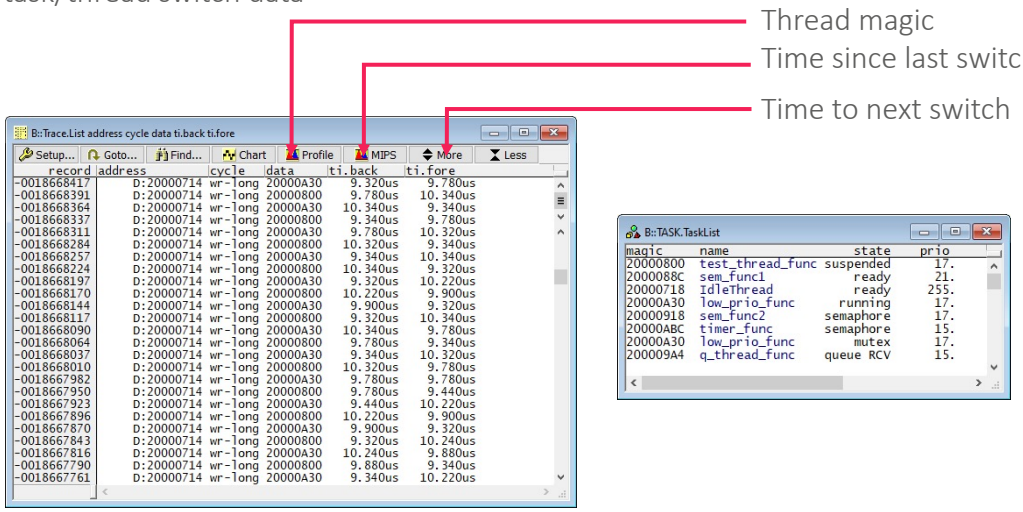


- Timeline view



Trace based task/thread profiling

- Raw task/thread switch data



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