

Professional development tools for RISC-V

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Agenda



- IAR Systems
- Embedded Workbench for RISC-V
- Compiler
 - Optimizations
- Debug
 - I-jet
- Code quality and Safety
 - Static analysis
 - Certified toolchain
- Demo

Providing developers of embedded systems with world-leading software tools



Listed on
NASDAQ/
Stockholm

36 years
in the industry

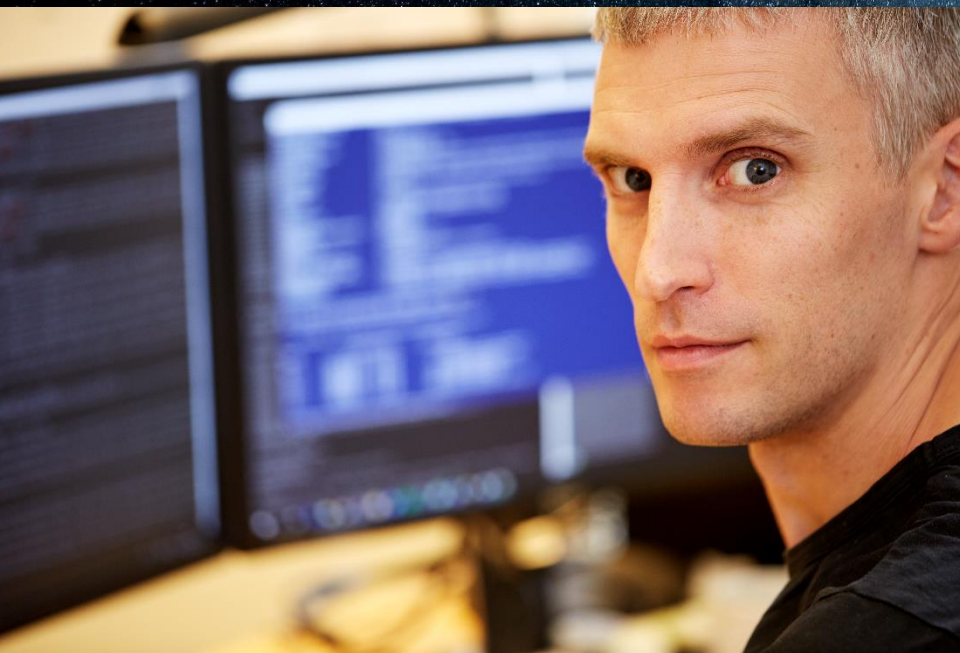
Global professional technical support in 9 languages

Large ecosystem of partners

32% of revenue invested in R&D

11 offices worldwide with HQ in
Uppsala, Sweden

Uppsala Munich Cambridge Paris Tokyo Seoul
Shanghai San Francisco Dallas Boston Los Angeles
+ Distributor representation in 43 countries



IAR Embedded Workbench for RISC-V

IAR Embedded Workbench

Complete build and debug toolchain for RISC-V



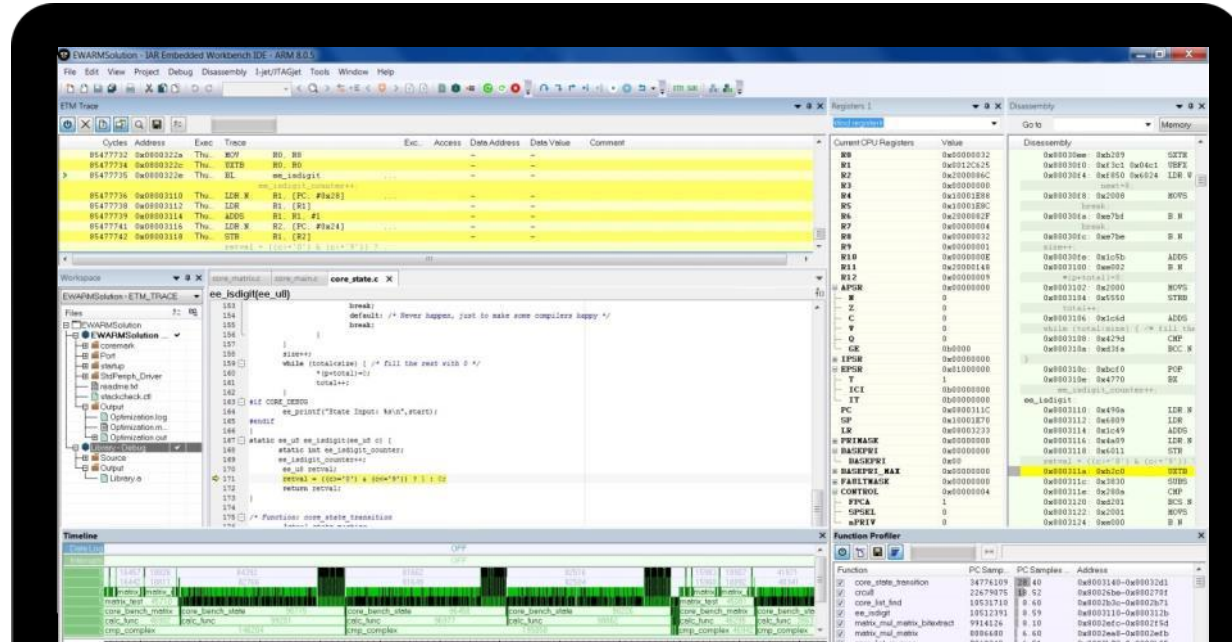
User-friendly IDE features and
broad ecosystem integration

Outstanding performance through
sophisticated optimization
technology

Comprehensive debugger

ISO/ANSI C/C++
compliance with
support for
C11 and C++17

Integrated static analysis



IAR Embedded Workbench

Device support for RISC-V



RV32I Base Int instruction set

Supported extensions:

M – integer mul & div

F – single precision float

D – double precision float

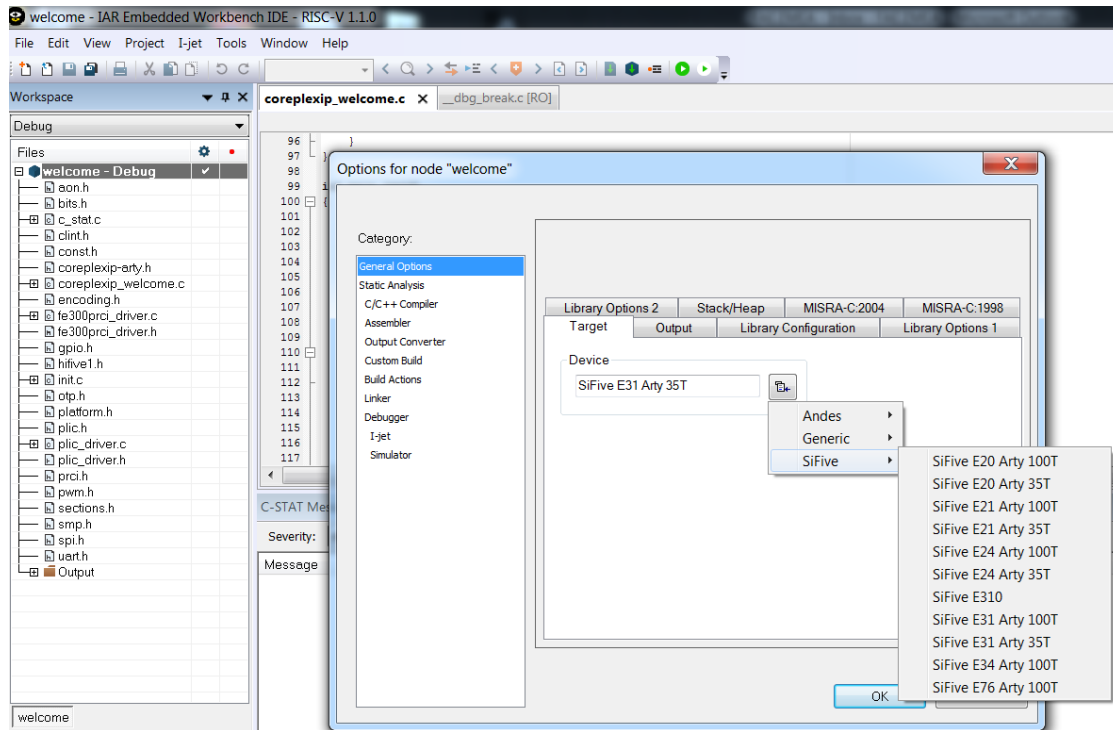
C – compressed instructions

Support for SiFive E Cores

32-bit embedded cores

Single core options

Out-of-the-box experience on
Digilent Xilinx Arty A7 35T/100T
board.



Compiler

Compiler



- Proprietary design based on 36 years of experience
- Based on a platform that is common among different targets to handle global optimizations, etc.
- Target unique backend for specific adaptations and optimizations
- RISC-V specifics
 - Primary focus will be on adding standard extensions
 - Initial prioritization is on code size



IAR C/C++ Compiler

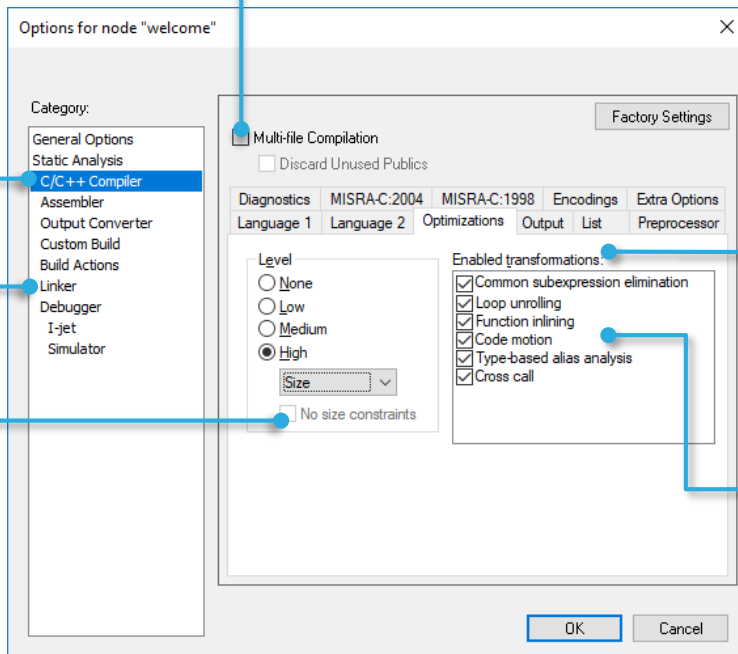


Multiple optimizations levels for code size and execution speed

The linker can remove unused code

Option to maximize speed with no size constraints

Multi-file compilation allows the optimizer to operate on a larger set of code



Language standards

- ISO/IEC 14882:2015 (C++14, C++17)
- ISO/IEC 9899:2012 (C11)
- ANSI X3.159-1989 (C89)
- IEEE 754 standard for floating-point arithmetic

Major features of the optimizer can be controlled individually

Balance between size and speed by setting different optimizations for different parts of the code

Well-tested

Commercial test suites

- Plum-Hall Validation test suite
- Perennial EC++VS
- Dinkum C++ Proofer

In-house developed test suite
>500,000 lines of C/C++ test code run multiple times

- Processor modes
- Memory models
- Optimization levels

Debug

Debugger



Integrated debugger for source and disassembly debugging

Dockable windows and tab groups

Complex breakpoints

Semihosted terminal I/O

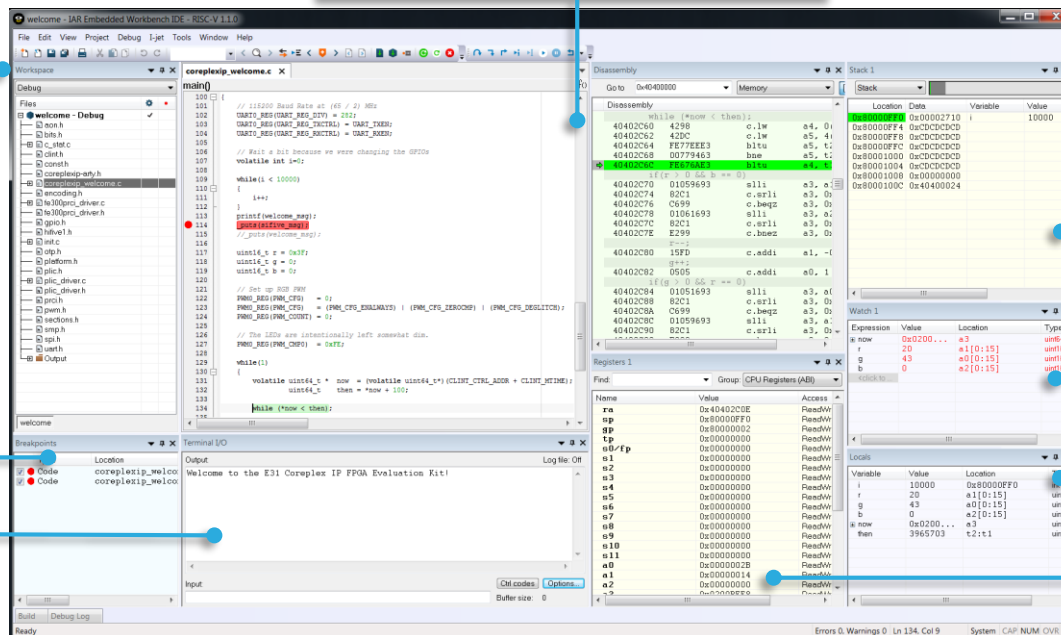
- C like macro system
- Built-in simulator
- RTOS aware
- Trace

Stack usage

Watch

Locals

Registers



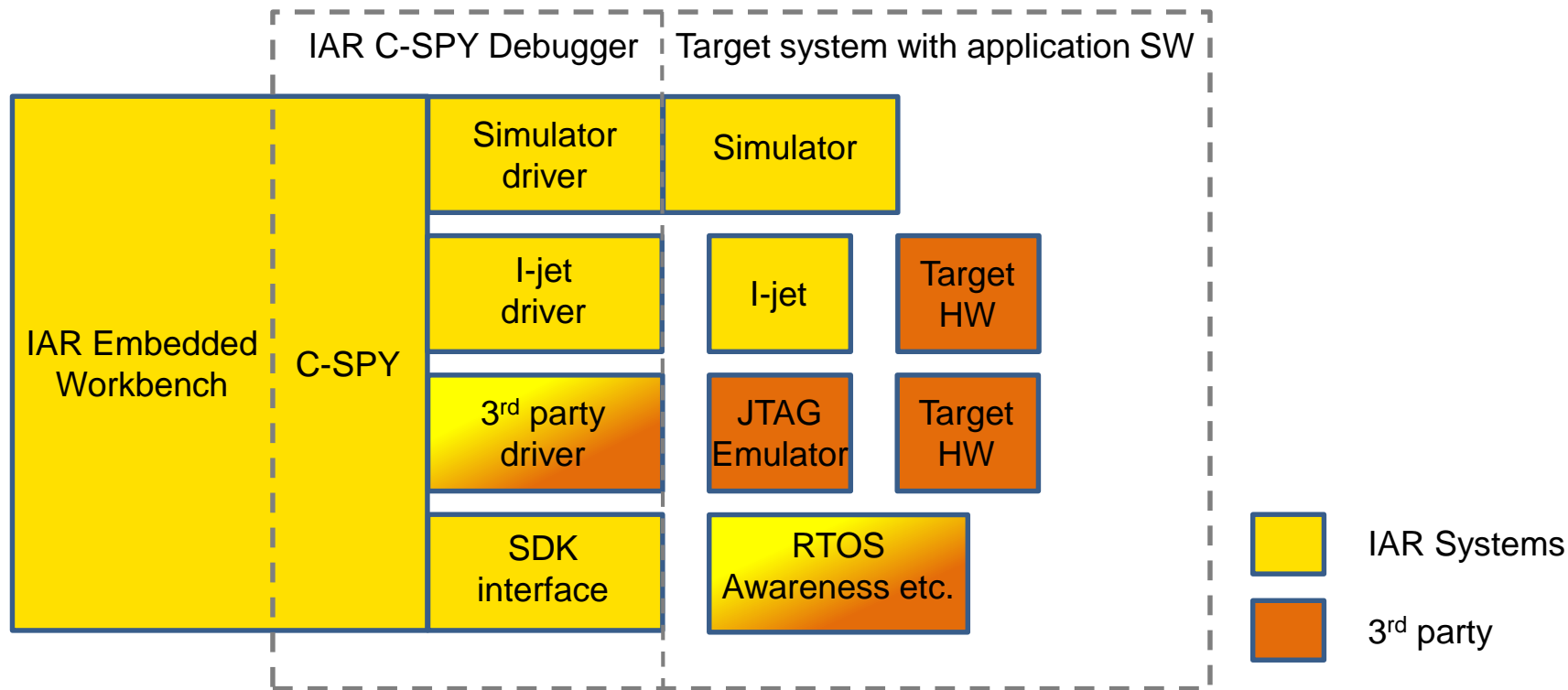
I-jet in-circuit debugging probe



- Supports RISC-V and Arm cores
- Hi-speed USB 2.0 interface (480Mbps)
- Target power of up to 400mA can be supplied from I-jet with overload protection
- **Target power consumption** can be measured with $\sim 200\mu\text{A}$ resolution at 200kHz
- JTAG and Serial Wire Debug (SWD) clocks up to 32MHz (no limit on the MCU clock speed)
- Support for **SWO speeds of up to 60MHz**
- **Unlimited flash breakpoints** (*to be added for RISC-V)
- Debug adapter for Arty 7 board



IAR C-SPY Debugger overview



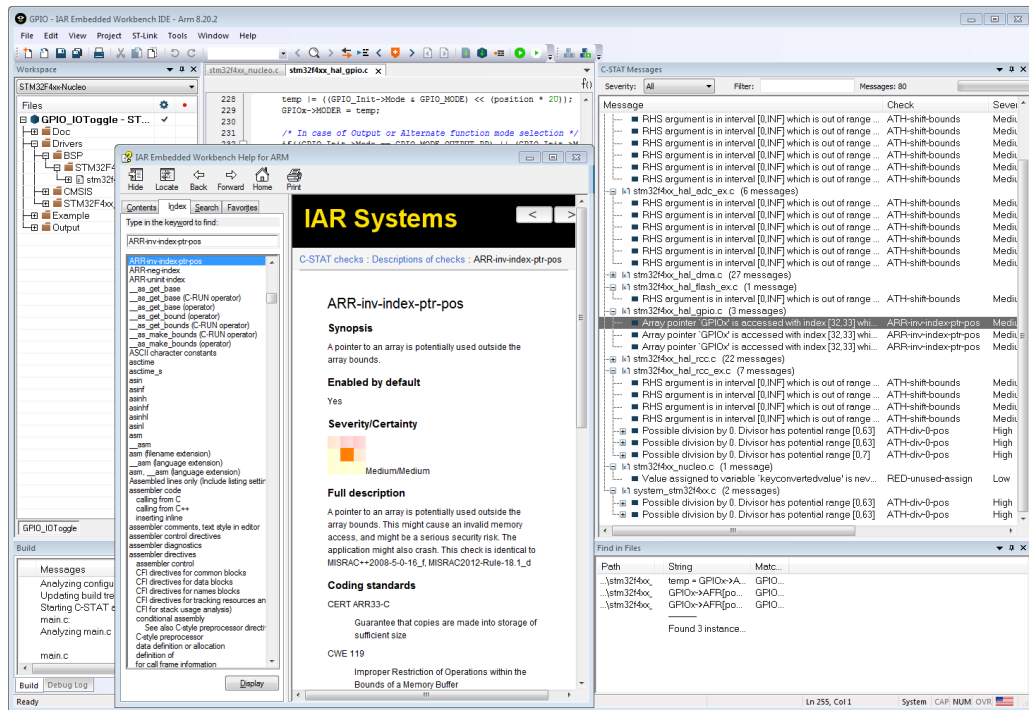
Code quality and Functional Safety

C-STAT Static analysis



Complete static analysis tool fully integrated in IAR Embedded Workbench

- Intuitive and easy-to-use settings with flexible rule selection
- Support for export/import of selected checks
- Support for command line execution
- Extensive and detailed documentation
- List of messages and data base file available
- Checks compliance with MISRA C:2004, MISRA C++:2008 and MISRA C:2012
- Includes ~250 checks mapping to hundreds of issues covered by CWE and CERT C/C++



Solutions for safety-critical applications

- **Certified toolchain**
 - A special functional safety edition of IAR Embedded Workbench
- **Simplified validation**
 - Functional Safety certificate from TÜV SÜD
 - Safety report from TÜV SÜD
 - Safety Guide
- **Guaranteed support through the product life cycle**
 - Prioritized support
 - Validated service packs
 - Regular reports of known problems



Standards

IEC 61508

ISO 26262

EN 50128

IEC 62304

Demo

Thank you for your attention!

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