DEBUG

Debug Support

AURIX™ TC3xx Microcontroller Training
V1.0 2020-06

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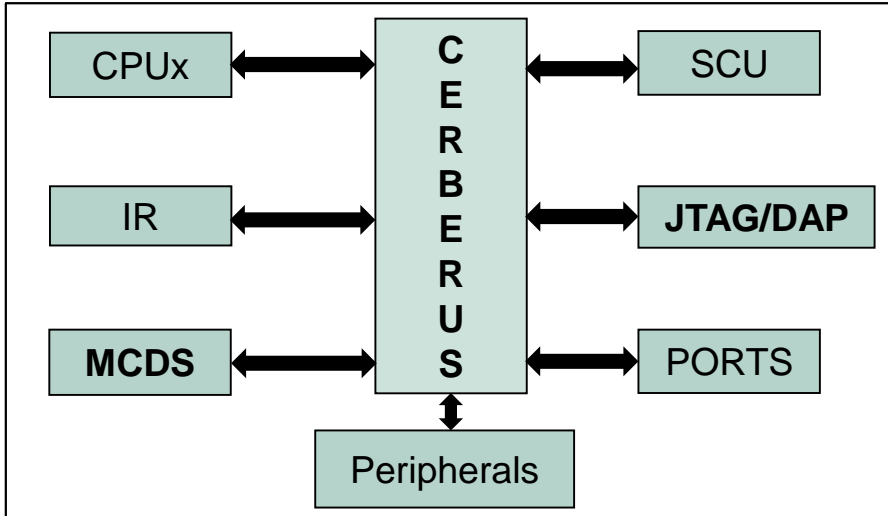
Highlights

Debug support is based on two components: OCDS (On-Chip Debug System) and MCDS (Multi Core Debug Solution), which offer debugging and performance optimization for the software and system hardware.

Eight hardware breakpoints for instruction and data address together with dedicated interrupt resources make the debug events easy to handle.

Key Features

Effective debug & trace solution
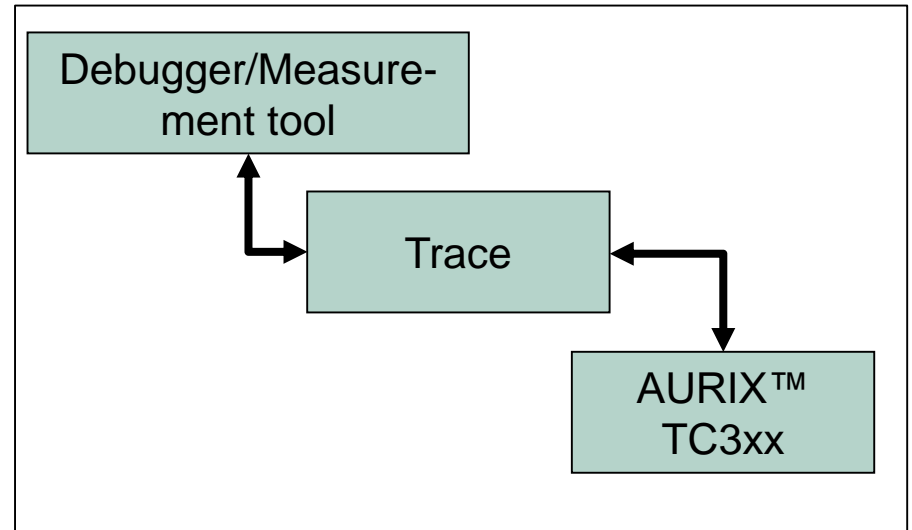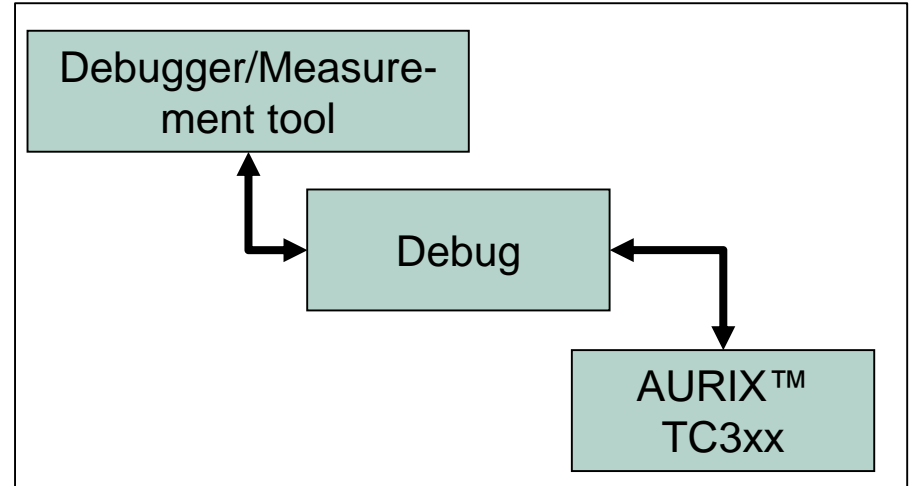
Non-intrusive debugging with trace
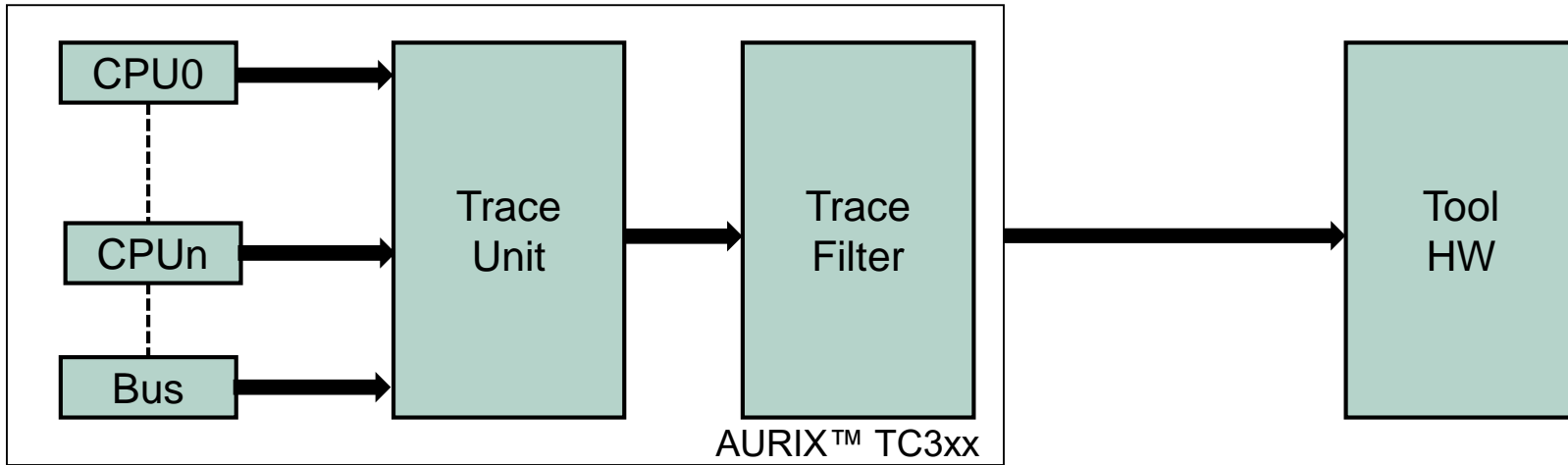
Low cost tool interface (DAP)

Customer Benefits

› Fast bug fixing and performance analysis at very low costs

› Debugging & tracing do not influence system's timing behavior

› Debugging with the same tooling possible from the lab to the target system

DEBUG
Effective debug & trace solution

› Debugging of specific features can be done via Trigger Lines that collect debug events from various sources (e.g. CPUs, interrupt requesters, peripherals, MCDS, input pins)

› The Central Suspend Switch allows the user to configure which CPUs or peripherals to be halted as reaction to a debug event

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Debugger/Measure-    Debug    AURIX™
ment tool                     TC3xx
```

› Tracing enables the user to create a log of the program execution, which helps in finding the causes of system's misbehavior and analyzing of performance

› For example, tracing the interrupt system offers valuable information about which interrupts are serviced by a particular CPU

› For AURIX™ TC3xx, the tracing system comes in different flavours: MCDS, MINIMCDS or MCDSLight, depending on the device's type

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Debugger/Measure-    Trace    AURIX™
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Non-intrusive debugging with trace

Diagram: CPU0, CPUn, Bus → Trace Unit → Trace Filter → Tool HW (AURIX™ TC3xx)

› The debugging with trace enables the user to get a log of program execution with time information added. The main advantage of this type of debugging is that it does not impact the user's code execution and timing behavior

› The full trace capabilities are available together with the MCDS module (on emulation devices), where up to three CPUs can be monitored in parallel together with the busses

› Depending on the complexity of the trace, DAP (up to 15 MByte/s) or Aurora (2.5 Gbit/s) can be used as interfaces

Note: MCDSLight and MINIMCDS modules are used for tracing on non-emulation devices and have a smaller set of features.
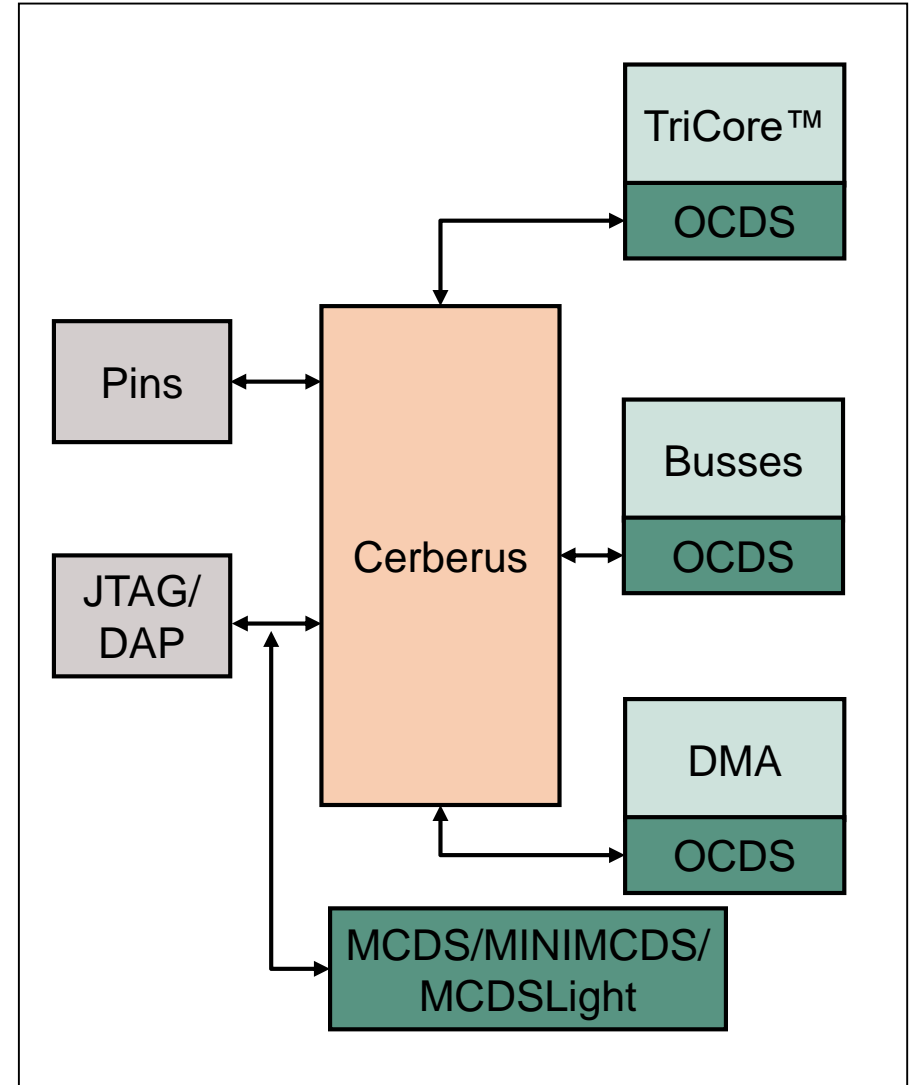
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Low cost tool interface (DAP)

› The Device Access Port (DAP) is a convenient way to connect a debugger or a measurement system to AURIX™ TC3xx due to the small dimension and low pin-count (right figure)

› The synchronous clocking ensures that DAP is a high-speed interface, enabling a block access up to 15 MByte/s for block read or write

› The protocol is based on telegrams protected by 6-bit CRC (Cyclic Redundancy Code), which minimizes the overhead for the protocol. Optionally, 32-bit CRC can be used for critical communication sequences

› Additionally, for emulation devices, two DAP interfaces are available, which permits the simultanous connection of two tool (e.g. a debugger and a calibration tool)
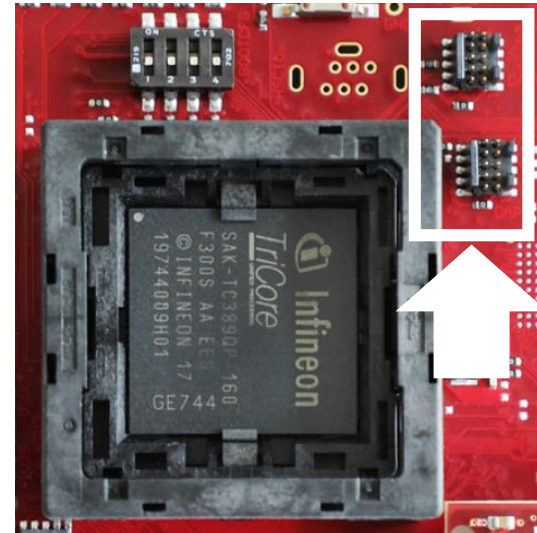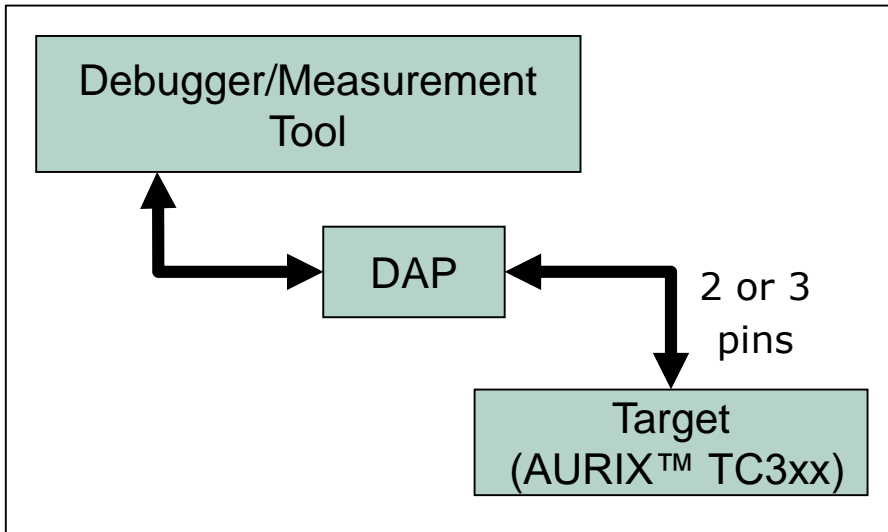
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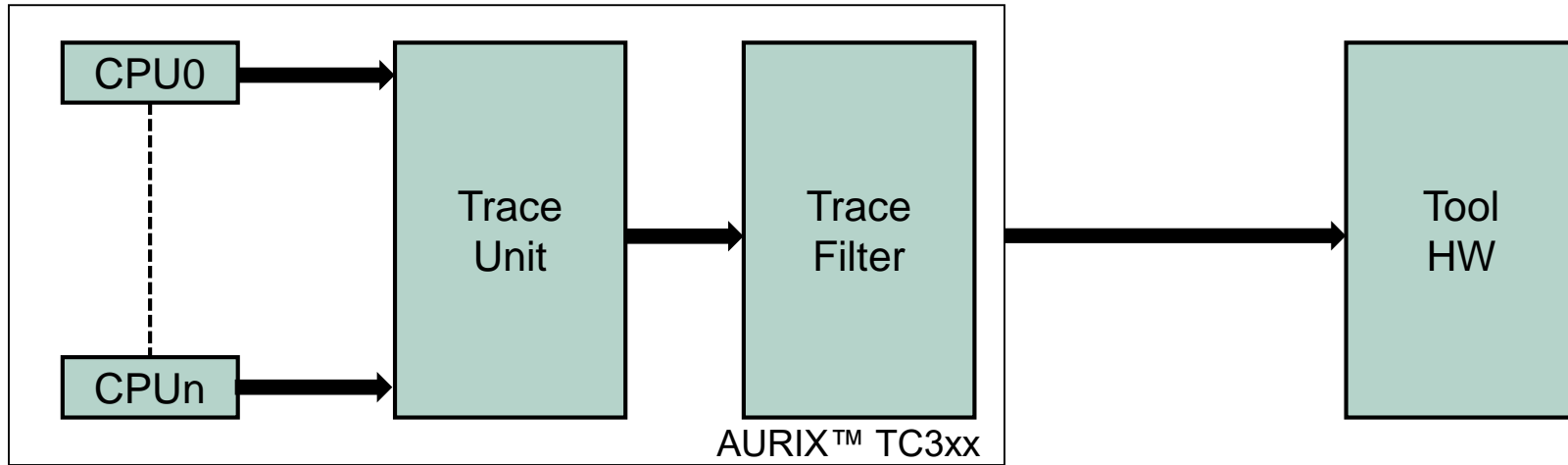# System Integration

› OCDS infrastructure is a network of tightly coupled add-ons to other system components

› This structure enables:

  – Peripheral triggering and tracing

  – Collect debug events from various sources like CPUs, interrupt requesters, bus controllers, peripherals, etc.

› MCDS enables the user to trace up to three CPUs together with the busses

Application Example
Debugging an issue of the system

```
┌─────────────────────────────────────────────────────────────┐
│  CPU0 ───────▶   Trace      Trace                            │
│   ┊              Unit   ───▶ Filter  ───────────▶            │   Tool
│  CPUn ───────▶                                               │   HW
│                                        AURIX™ TC3xx          │
└─────────────────────────────────────────────────────────────┘
```

Overview	Advantages
› Description of issue: An unintended system behavior (e.g. random reset) is observed, the root cause is unknown	› Non-intrusive method to find issues (no risk of errors due to changes in the code)
› Procedure: Analyze the trace data taken around the point in time when the issue appears	› Trace data can contain both program and data information, therefore enabling the user to debug easily any possible mistake in the software

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