DEBUG & TRACE
Debug and Trace Support

AURIX™ TC4xx Microcontroller

V1.0.0 2024-09

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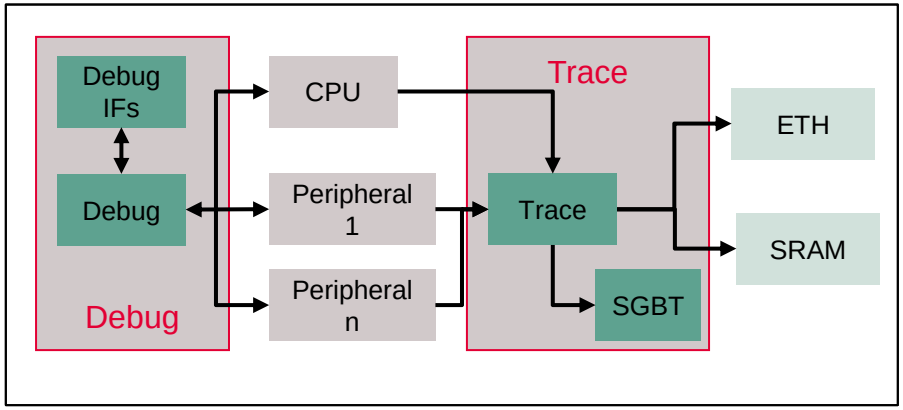


Highlights

- Intrusive debug, non-intrusive trace and tool access are incorporated in the On Chip MultiTool Support (OCMTS) module
- Safe and secure debug is granted through two DAP modes and JTAG
- Trace offers three different interfaces: DAP, Ethernet and Serial GigaBit Trace (SGBT) with a bandwidth covering from 15 MBps to 6.25 Gbps

Key Features

Trace in a safe and secure system

Debug support for virtualization

Multiple tool interfaces for debug and trace

Customer Benefits

- Analysis in the field can be done in a safe and secure way in order to identify any anomalies
- Identify and fix bugs under hard real time conditions without having access to all software
- JTAG, DAP, Ethernet and SGBT cover all applications from low to high performance

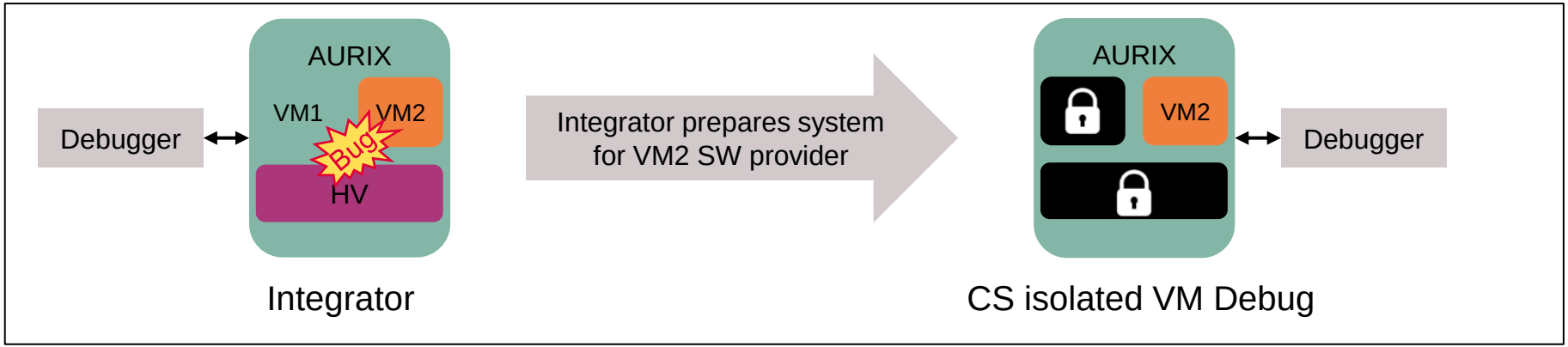
DEBUG & TRACE
Trace in a safe and secure system

- The On-Chip Debug System (OCDS) enables the access, configuration and triggering of debug functions
- These functions are implemented in multiple subblocks attached to different system components
- OCDS features:
  - Safe and secure debug function handling
  - Enable tool access to debug and functional resources
  - Internal and external trigger action and reaction

- Tracing provides configuration, monitoring and event signaling functionality
- It collects trace data, which is forwarded to a local storage from where it is sent out through one of the trace interfaces
- Different program and data trace sources can be selected, e.g. all CPU(s) in parallel, PPU, GTM, …
- Very efficient filters and optimized trace message compression can be used to reduce the needed bandwidth

- In AURIX™ TC3xx, tracing was only possible when debugging was enabled. In AURIX™ TC4xx, these two system are decoupled. This enables the usage of trace functionality in a safe and secure system while debugging is disabled.
- AURIX™ TC4xx microcontrollers offer full Multi-Code Debug Solution (MCDS) tracing on productive devices

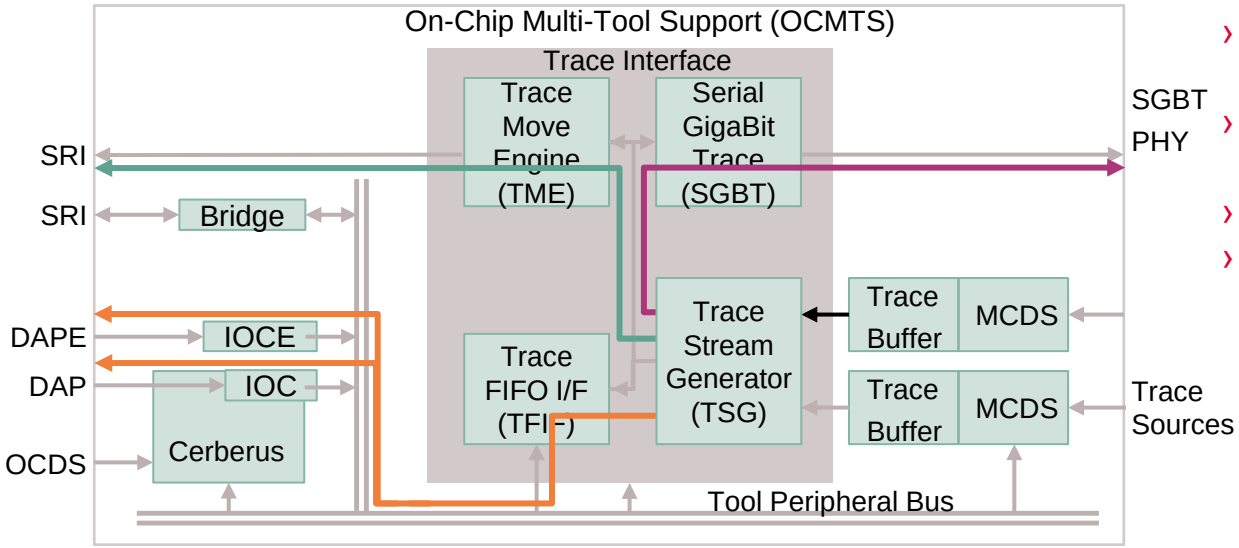
DEBUG & TRACE
Debug support for virtualization



- Two debug scenarios are supported: debugging one specific Virtual Machine (VM) or the whole system (all VMs, hypervisor, etc.) in one session
- The VMs can be used as trigger and qualifier for debug and trace based on their own master tags
- A bug might only occur under hard real time conditions or in the real system. In this case, not all software should be accessible by all parts. AURIX™ TC4xx has the unique feature that the trace observation points and the filtering based on the VM master tags can be controlled by the integrator

DEBUG & TRACE
Multiple tool interfaces for debug and trace

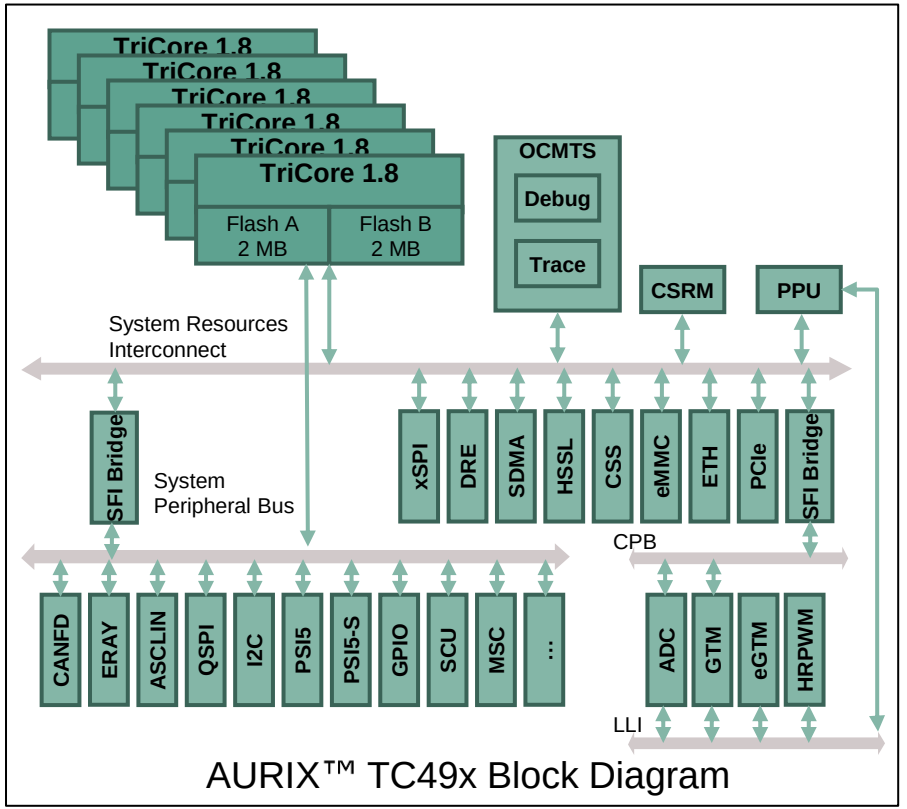
› AURIX™ TC4xx offers very flexible trace options for every phase in the product life from software debug to measurement and in field analysis



› SGBT (Aurora) with up to 6.25 Gbps
› DAP, DAPE with 15/30 Mbytes/s each
› On-chip RAM
› Ethernet (exclusive for tracing or sharing the bandwidth with the application)

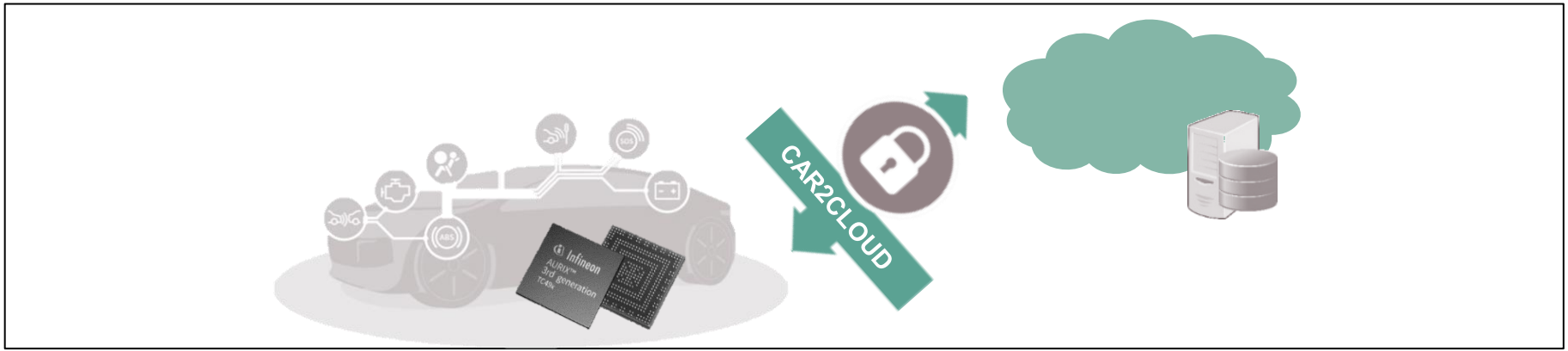
DEBUG & TRACE
System integration

- The On-Chip Multi Tool Support (OCMTS) is a central block enabling intrusive debug and non-intrusive trace of the device functions
- The debug infrastructure is not a monolithic block, but a network of tightly couples add-ons in other system components
- The OCMTS block is bridging to the main system interconnects (SRI) as well as to the debug communication paths for debug, trigger and trace
- Additional trace capabilities are granted via the Trace Peripheral Bus (TPB) inside OCMTS, which enables transactions to the Shared Resource Interconnect (SRI) or the System Peripheral Bus (SPB)



AURIX™ TC49x Block Diagram

Application example
Safe and secure analysis in the field



Overview

- Description of issue: An unintended system behavior is observed in the field, without knowing the root cause
- Procedure: OTA configuration of the trace system to capture and analyze data around the point in time, when the issue appears

Advantages

- Non-intrusive method to obtain more data about the system in the field and secure way of transmitting it to the cloud for further analysis
- Trace data can contain both program and data information, therefore enabling the user to easily find the root cause

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