

MCS C Development Platform

 **BOSCH** GTM Tech Day 2022



Saarbrücken Germany, 22.09.2022

HighTec

Vision

Worldwide leading supplier for functional safety products including certified Compiler technology and certified Real-Time Operating System meeting the highest safety and reliability standards in both automotive & industrial devices.

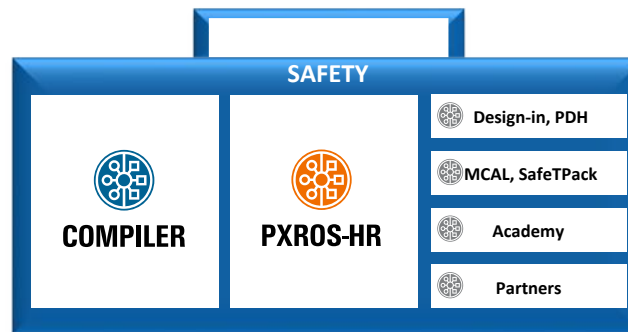
Mission

To provide tools, software, and solutions that meet the highest level of functional safety standards for our customers and partners while providing support throughout the product life cycle under consideration of our environmental protection and health & safety company standards.

About HighTec



- An **independent**, privately owned company, since 1982
- **Worldwide** presence, offices and partners

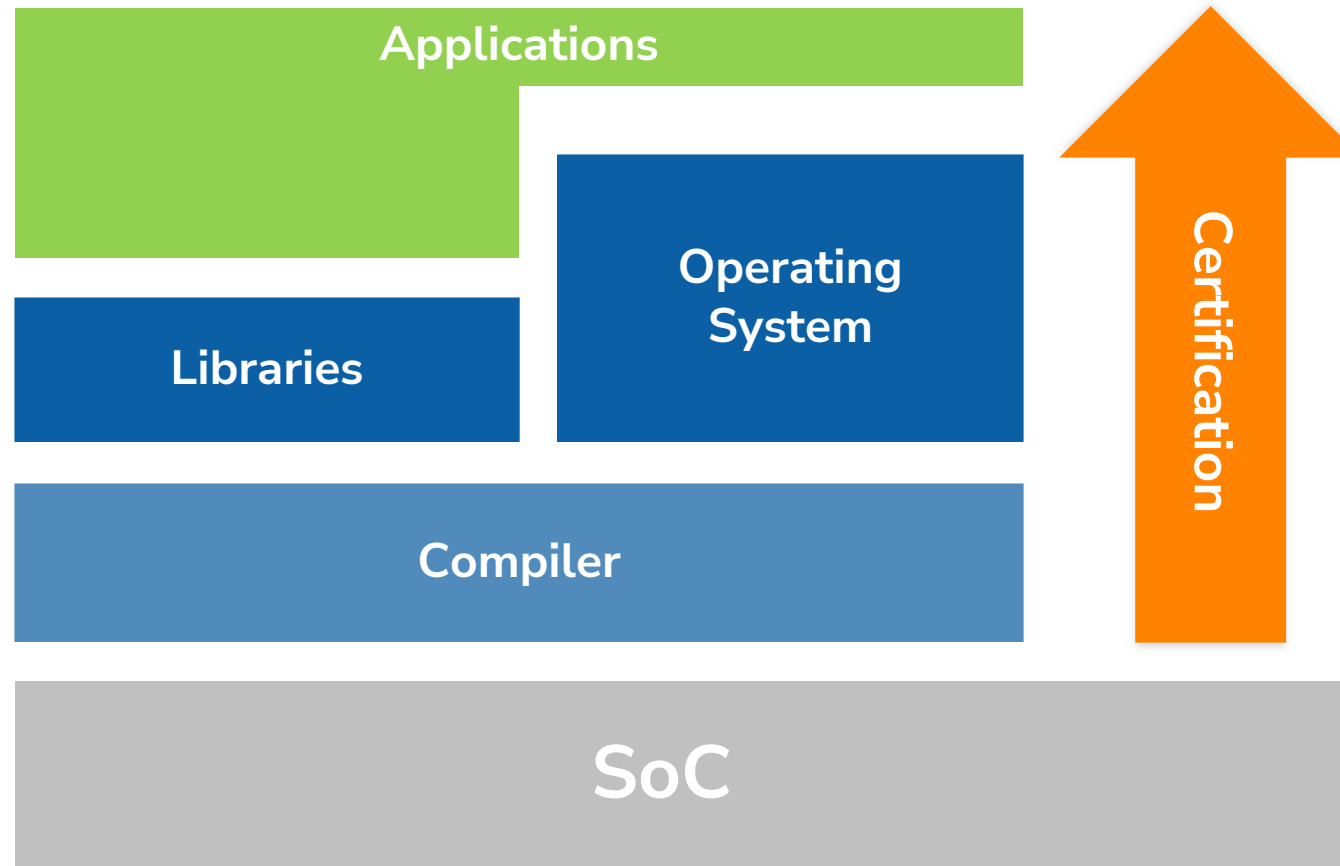


- Specialized on embedded development **tools** and **design-in services**
- Preferred Design House (Infineon, ST)



- Focus on **automotive** and **industrial** markets with high safety demands

Certified From Bottom to the Top



ISO 26262:2018 - Cars, motorcycles, trucks, buses, trailers and semi-trailers
IEC 61508:2010 – Electrical / electronic / programmable electronic safety-related systems

HighTec – Certificates

Addressing the increased demand for safety applications



- Software
- C-Library
- ISO 26262:2018



- Functional Safety
- IEC 61508



- Functional Safety
- ISO 26262



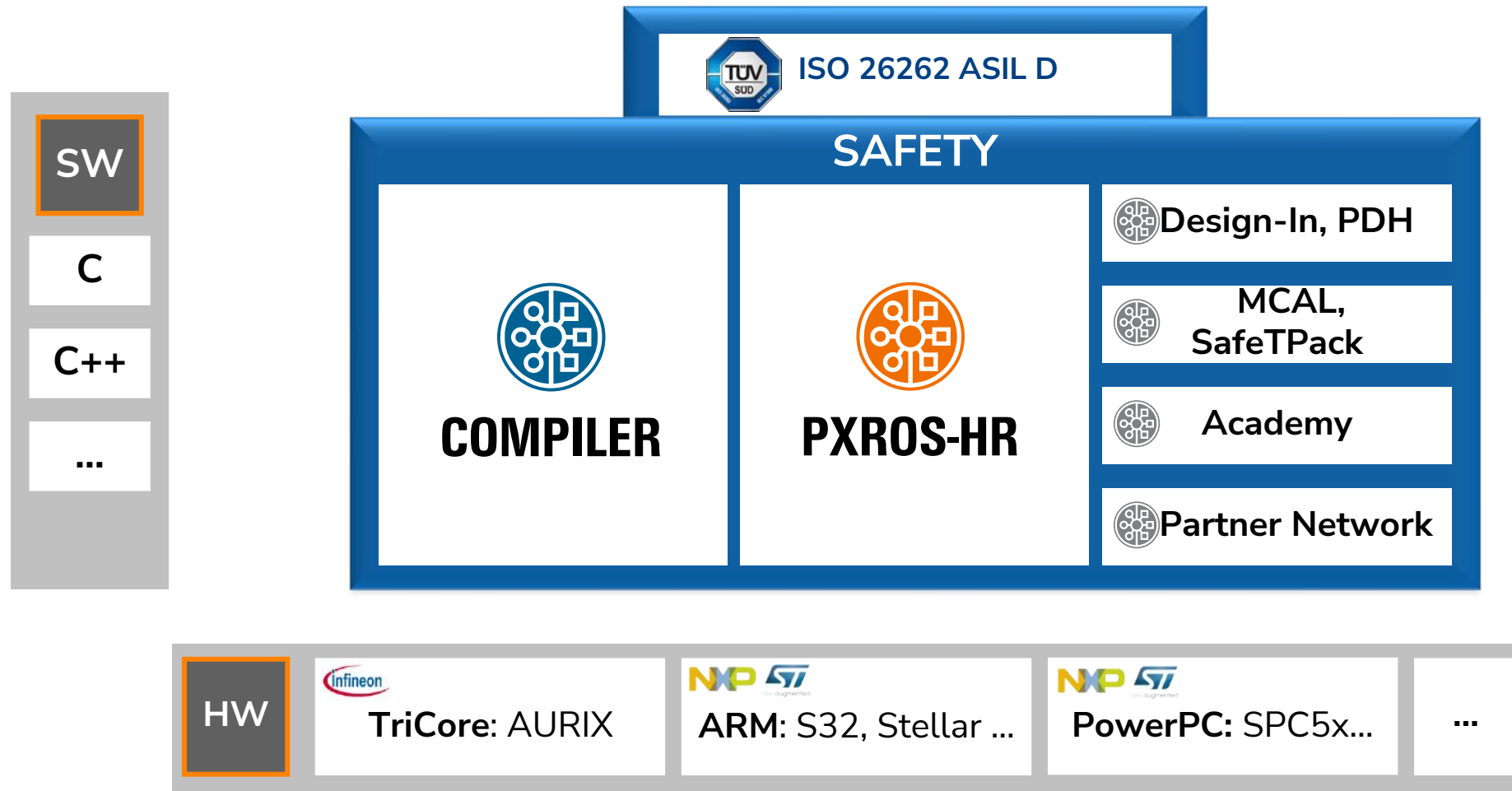
- ISO 9001



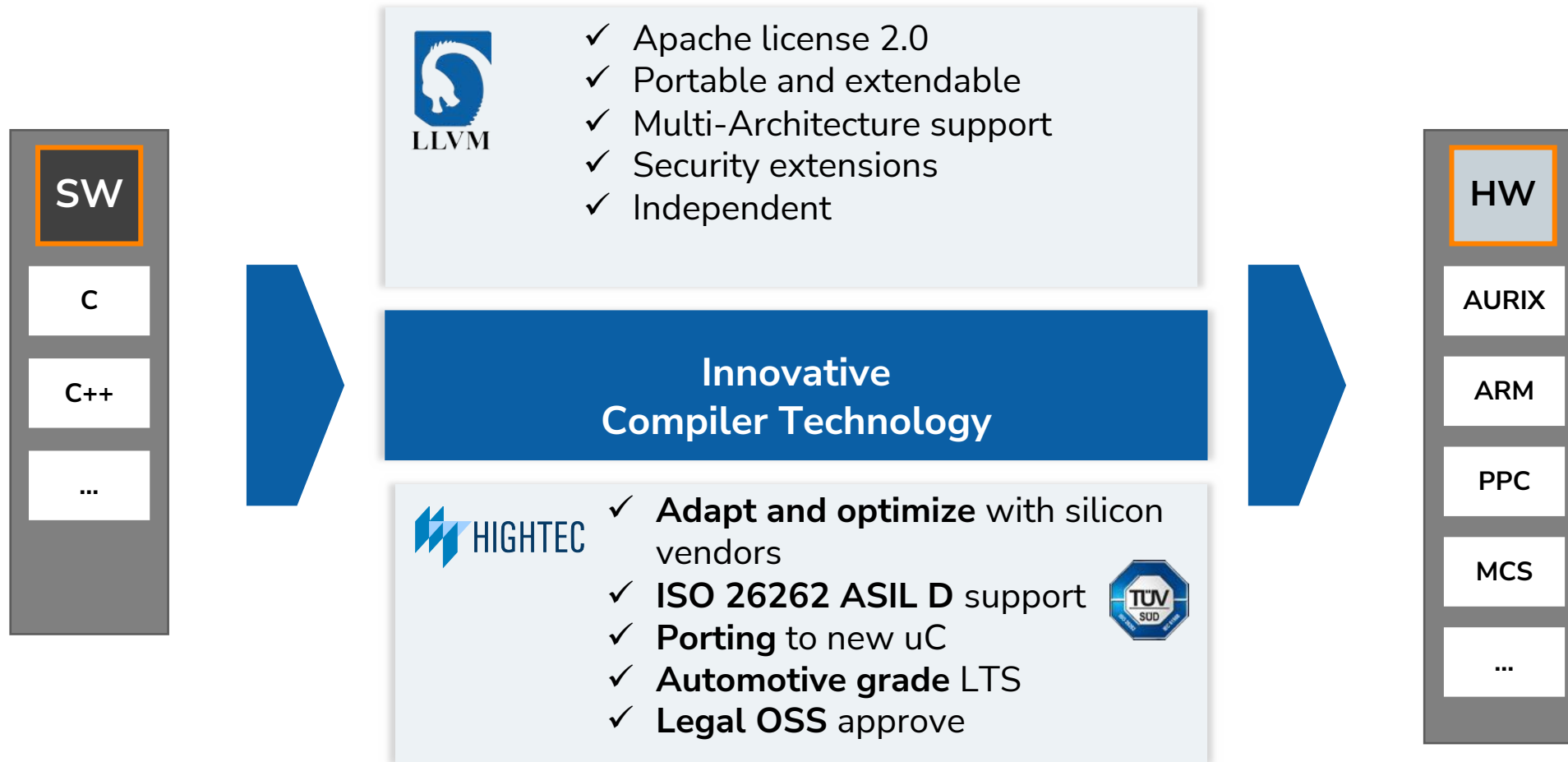
- Software
- Operating System
- IEC 61508 (SIL3)
- ISO 26262 (ASIL D)

The HighTec Safety Toolbox

Toolbox for Tools and Design-in services

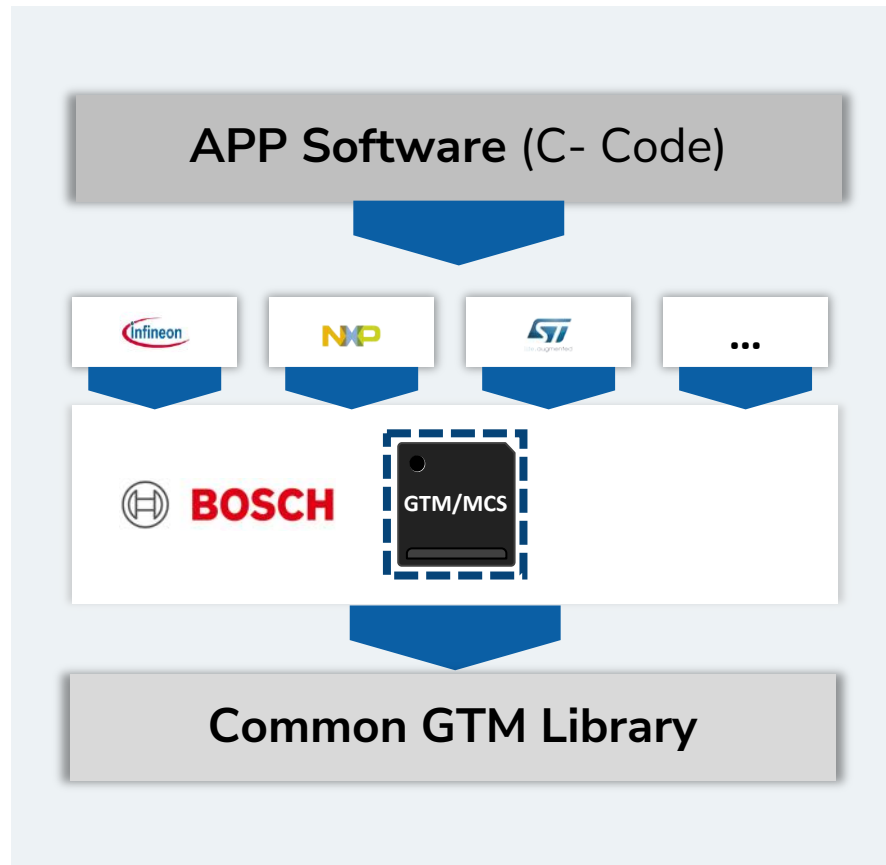


Nº 1 Automotive Grade Open Source C/C++ Compiler



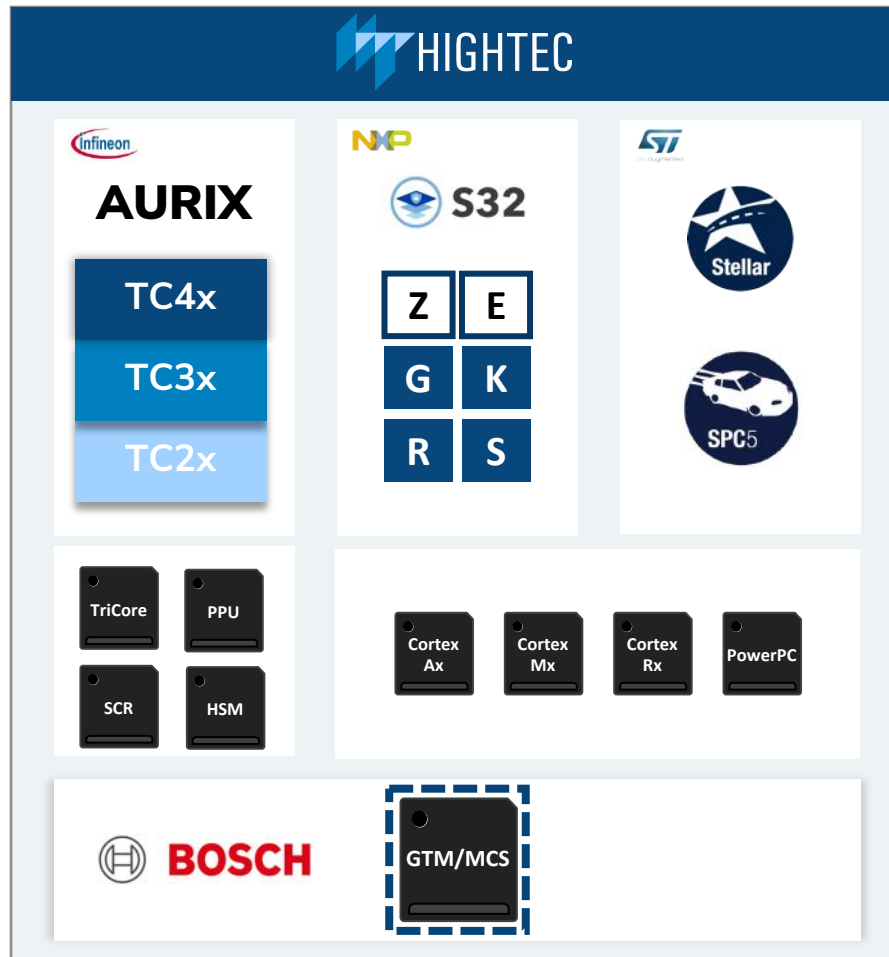
GTM – Vision – Portability in mind

Unified complex timer functions across silicon vendors



- ❑ GTM/MCS **minimizes interdependencies** between timer software functions
- ❑ Ensure **real-time** requirements
- ❑ MCS can server **multiple IRQs**
- ❑ Host can change **GTM configuration**
- ❑ **Challenges:** Low level real-time programming - Heterogenous multi-core - Safety - Ecosystem - Technical support

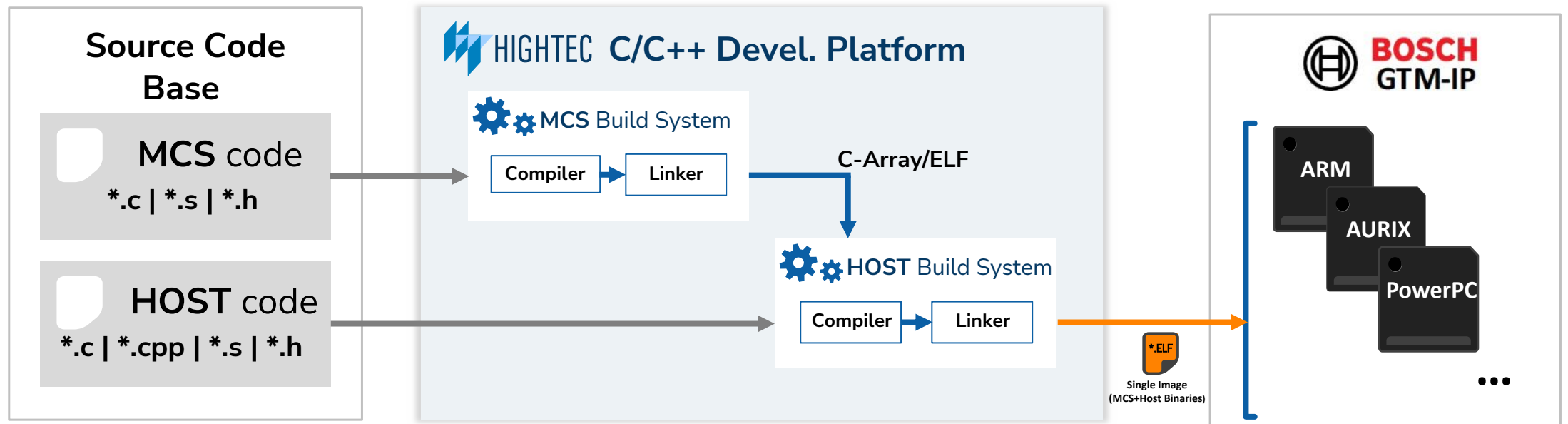
HighTec GTM / MCS C compiler: GTM v4.x



- HighTec **multi-architecture** host compiler
- GTM / MCS C compiler (ANSI / ISO **C99**)
- Advanced **Optimizations**
- MCS **debug support** (Lauterbach, PLS, iSYSTEM)
- Built-in **compiler intrinsic functions** for: Special Function Registers, wait instructions, ARU and AEI bus access

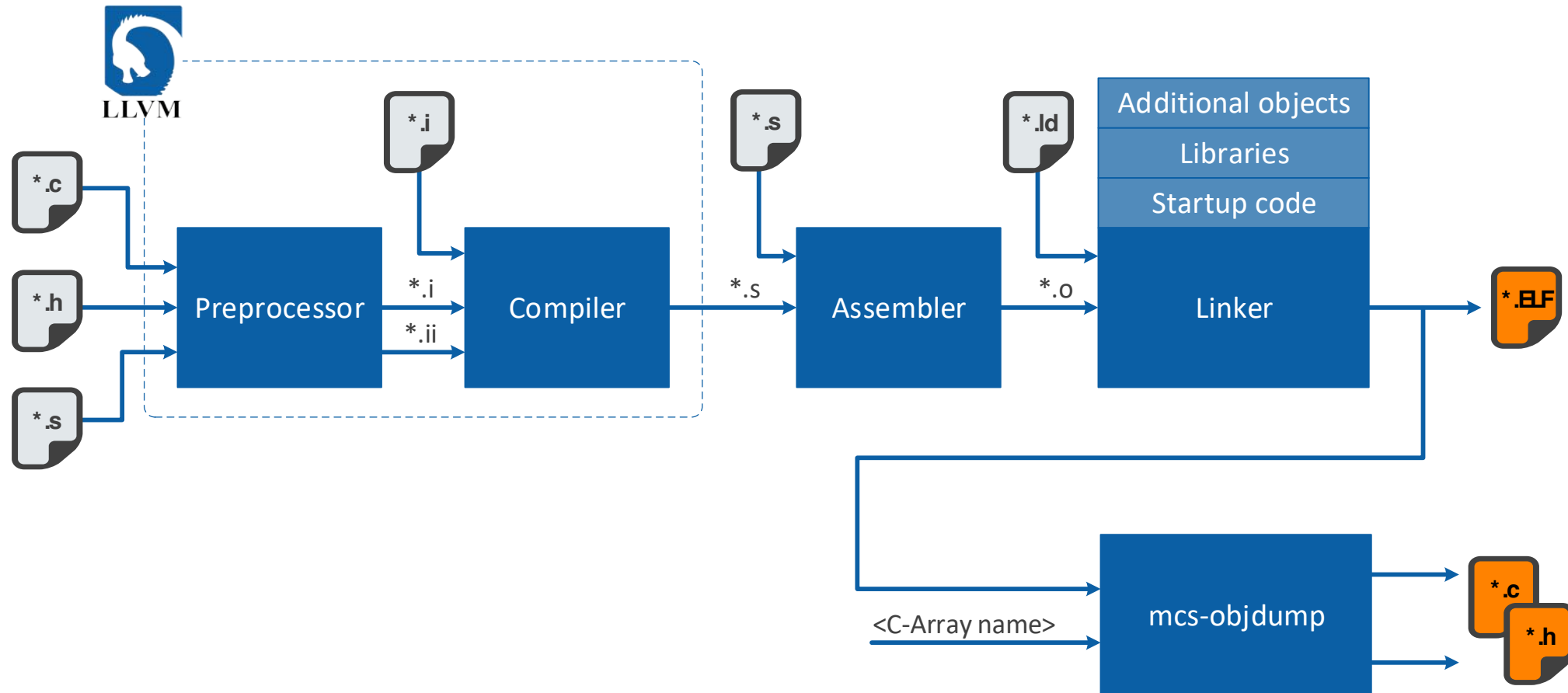
HighTec's Unified Development

GTM/MCS in the heterogeneous multicore environment



MCS Source Code Build Process

MCS Development Suite



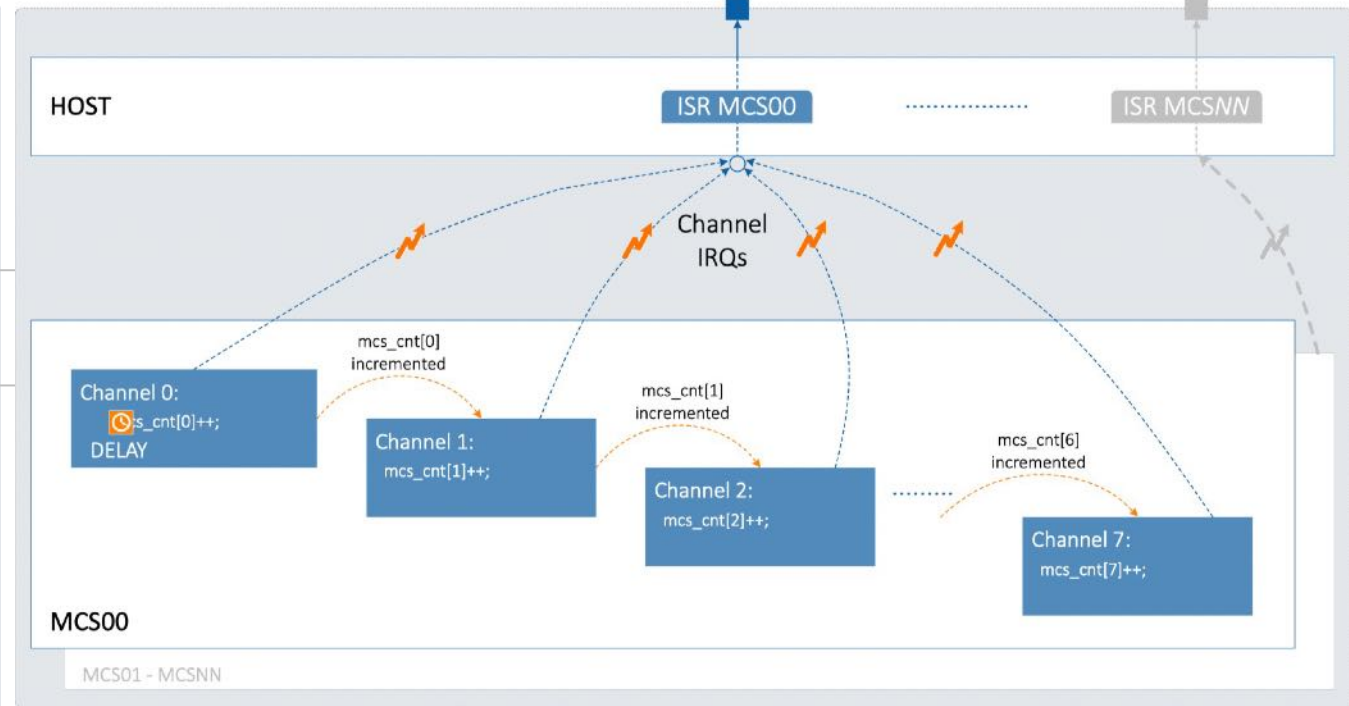
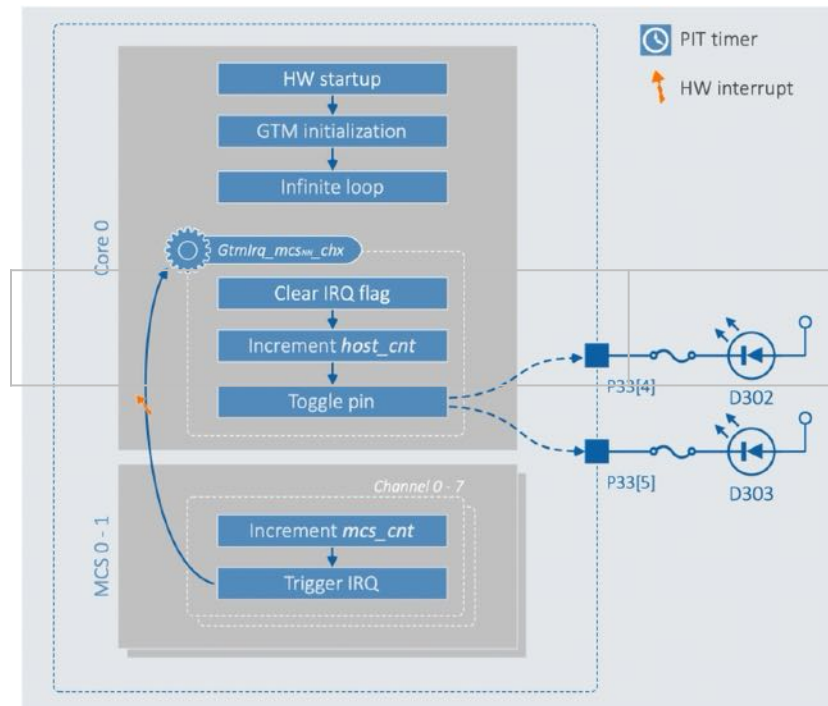
MCS – C Code App Note

Content Manager – Example, App Notes

HOST uC Part



MCS Part



GTM/MCS C Compiler

Overview

ANSI/ISO
C99
GTM EABI

Native Data
Types

24 and 48 bits

Built-in
Intrinsic
Functions

SFR, WAIT, ARU/AEI

Extensive
Link
Command
Language

Technical
Support

PDH
Examples and
Application
Notes

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Latest
GTM-IP v4.x

3rd party
Debugger
Support

Lauterbach, pls, iSystem

Advanced Optimizations

Size vs. speed performance balance
Target-specific options

Based on LLVM compiler and GNU linker script syntax

HighTec MCS C Compiler - Features

- ❑ **MCS channel creation** fct. (vector table entry, stack initialization)
- ❑ **Intrinsic functions:** ARU transfer, BUS master, Suspending Wait instructions and SFR file access
- ❑ **Extended register support** -> save stack & provide more register
- ❑ **Standard GNU assembler** and attribute support
- ❑ **LLVM #pragma section** syntax
- ❑ **Standard debug info** (dwarf-support)

Signal an Interrupt to Host uC

```
__set_STA(__get_STA() | MCS_SFR_STA_IRQ_MASK);
```

Suspend the MCS Channel

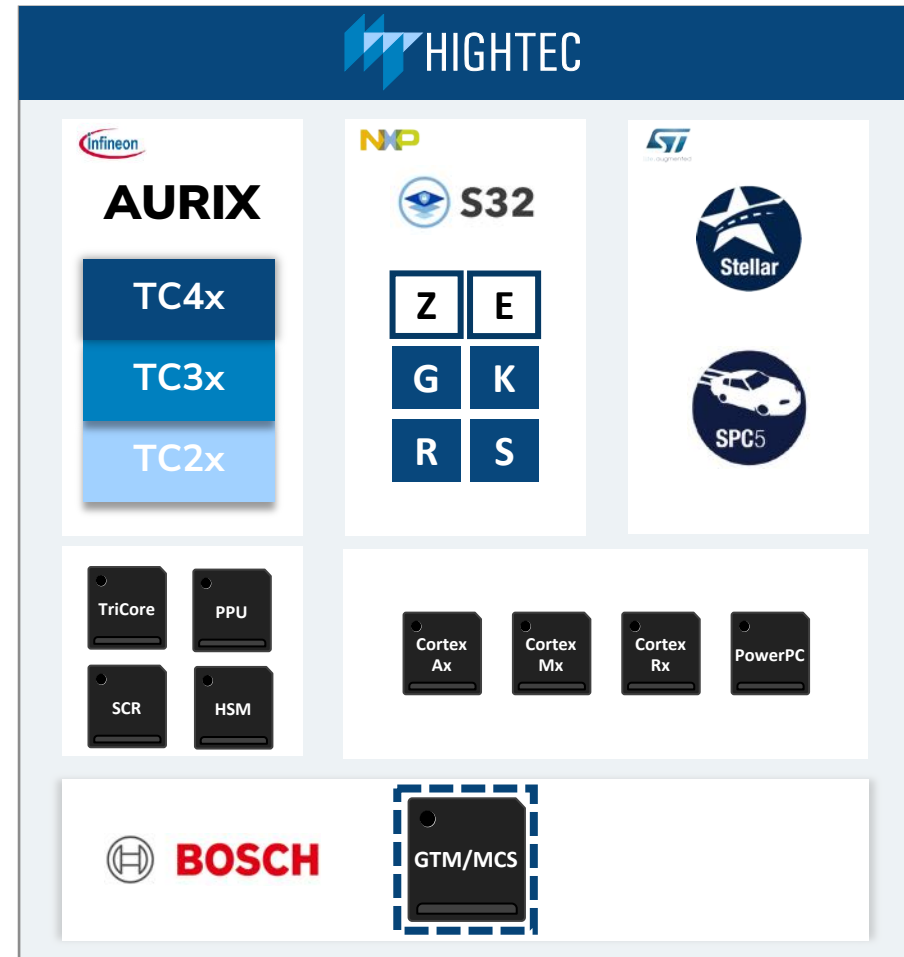
```
__wurmx(STRG, WURM_TMP_VAL, WURM_TMP_MASK);
```

Clear the Trigger for the next time

```
temp_CTRG = __get_CTRG() | 1;  
__set_CTRG(temp_CTRG);
```

HighTec Long-Term Commitment GTM

- **New release v4.0 (Q3/2022)** – support latest GTM 4.x features
- **MCS debug support**
- **Multi-architecture** – GTM/MCS examples and Application Notes (**Content Manager**)
- **Trainings and consulting** with partner network



Partner Network and GTM eco system

Makes it easy to do business with HighTec



...to Scale solutions across leading automotive MCU architectures



...to Cooperate with Open Source Community



...to Distribute the HighTec safety solutions



...to Integrate the HighTec safety solutions into the ecosystem

...to Develop custom solutions and development services



HighTec Reliable Support



- **No.1 Open Source Compiler with Safety (ASIL D)**
- **Key technology provider** for OEMs and Tier1s
- **Close cooperation** with **semiconductor vendors**
- **Infineon and ST Preferred Design House (PDH)**
- **Supporting material** for all major automotive uC
- **WW presence:** EMEA, APAC and US and partner network to develop custom solutions



5 Min. Q&A Session



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