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STMicroelectronics Unveils Features of Multi-Application, Deterministic Automotive Microcontrollers to Maximize Safety and Security in Next-Generation Domain/Zone Architectures

- *ST jointly developed with Bosch deterministic high-performance open-market MCUs that can host multiple applications including virtualization of safety and security by HW functionality*
- *New approach enables integration of multiple applications developed with different tooling and on different software schedules, in contrast to today's Linux/Posix-based integration-platform solutions*
- *Non-volatile Phase-Change Memory (PCM) supports safety by delivering single-bit overwrite capability and very effective Over-the-Air updates with no downtime*

Geneva, Switzerland, October 20, 2020 – STMicroelectronics (NYSE: STM), a global semiconductor leader serving customers across the spectrum of electronics applications, has revealed further details of its innovative Stellar automotive microcontrollers (MCUs) to show how the devices ensure reliable and deterministic execution of multiple independent real-time applications. This is one of the toughest challenges facing manufacturers in today's automotive sector as the complexity of new car architectures leads to the consolidation of independent applications into a single powerful Integration MCU and typically involves choosing either determinism or virtualization. Stellar delivers both.

Pioneering this new class of controllers, Stellar Integration MCUs are designed with exceptional computing power to significantly simplify the concurrent and deterministic execution of multiple-sourced software while guaranteeing the highest levels of safety and performance. These capabilities meet system requirements in the electrics/electronics (E/E) architecture of the next generation of connected cars. To do this, Stellar introduces features that include a state-of-the-art processor with hardware support for virtualization, quality of service settings, the ability to firewall peripherals, and perform resource separation at interconnect levels. These features allow independent applications, or Virtual ECUs, to coexist in the same physical MCU by guaranteeing freedom from interference and secure compartmentalization of software functions while supporting concurrent multiple ASIL safety levels.

ST has developed this new technology with Bosch, the well-known tier-one automotive electronic module supplier, to meet future OEM integration demands.

We have set up Stellar's functionality to cover integration challenges, while maintaining isolation and compartmentalization," said Axel Aue, Vice President, Bosch. *"The computing performance for this kind of system is outstanding, with Phase Change Memory performance equal to, or surpassing, that of alternative Flash technologies. Moreover, Stellar's performance concerning Firmware Updates Over-the-Air (FOTA) has been flawless with zero down time and zero recovery time."*

"We designed Stellar to meet the demands of future Domain/Zone architectures and service-oriented communication needs, setting aggressive real-time performance, safety, and determinism goals," said Luca Rodeschini, Strategy & Automotive Processors and RF Division General Manager, STMicroelectronics. *"The setup, evaluations and validations performed by Bosch now provide expert confirmation, showing that our teams' integration of outstanding real-time performance, embedded PCM non-volatile memory, and comprehensive virtualization ensure efficient software isolation and compartmentalization that will add to consumers' safety and convenience in their vehicles."*

Further Technical Information

Stellar embeds multiple Arm® Cortex®-R52 cores — some operating in lockstep and some in Split/Lock – and features a 2-level Memory Protection Unit and a low-latency Generic Interrupt Controller. The MCU is suited to hard real-time applications up to the highest safety integrity level, ASIL-D, specified in the automotive functional-safety standard, ISO 26262. There are also multiple powerful accelerators for secure data routing, processing, and mathematical functions, with advanced security support and extensive communication command and control.

The Integration MCU offers a comprehensive virtualization at multiple levels using a Virtual Machine ID (VMID) at the network-on-chip and memory levels. Firewalls ensure complete separation at all interconnect levels including the peripherals. These firewalls allow Stellar to manage Virtual Machines (VMs) accesses and privileges to peripherals, ensuring the isolation of entire mission-critical functions.

With its unique architecture and hardware-based virtualization capabilities, Stellar assures safety through freedom from interference. It also provides significant advantages over software virtualization, including offloading of processor cores and reducing virtualization's impact on memory.

At the same time, Stellar manages increasing software complexity and integration with better utilization of its hardware resources. This reduces total overhead of multiple separate ECUs performing their own housekeeping and managing communication-stack-related latency. In fact, Stellar can support several real-time operating systems (OSes) running independently, without interference. These OSes can separately manage applications with different functional-safety levels and superior processing capabilities for encrypted communication over Ethernet or CAN[1] buses with dedicated AES[2] accelerators to offload the main Hardware Security Modules (HSM) for MACSec[3], IPSec[4], and CAN authentication.

Stellar Integration MCUs feature non-volatile Phase-Change Memory (PCM), offering fast read access times, and single-bit alterability that is not available in Flash memory. PCM ensures Over-The-Air (OTA) updates with zero down time, even for full-sized memory updates. In addition to increasing flexibility and erase/write cycles, single-bit alterability at runtime (no erase

[1] Controller Area Network
[2] Advanced Encryption Standard
[3] Media Access Controller (MAC) Security
[4] Internet Protocol Security

required) extends safety setup by refreshing bits to eliminate single-bit failures and extend the memory's lifetime.

ST's embedded-PCM technology has been developed and tested to operate within the most stringent automotive requirements for robust high-temperature operation, radiation hardening, cycling and data retention. ePCM achieves automotive requirements for AEC-Q100 Grade 0 with an operating temperature up to +165°C.

To date, ST has delivered more than 3000 samples to customers and samples have been running in vehicles for about a year. For additional information, please contact ST sales.

About STMicroelectronics

At ST, we are 46,000 creators and makers of semiconductor technologies mastering the semiconductor supply chain with state-of-the-art manufacturing facilities. An independent device manufacturer, we work with our 100,000 customers and thousands of partners to design and build products, solutions, and ecosystems that address their challenges and opportunities, and the need to support a more sustainable world. Our technologies enable smarter mobility, more efficient power and energy management, and the wide-scale deployment of the Internet of Things and 5G technology. Further information can be found at www.st.com.

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