

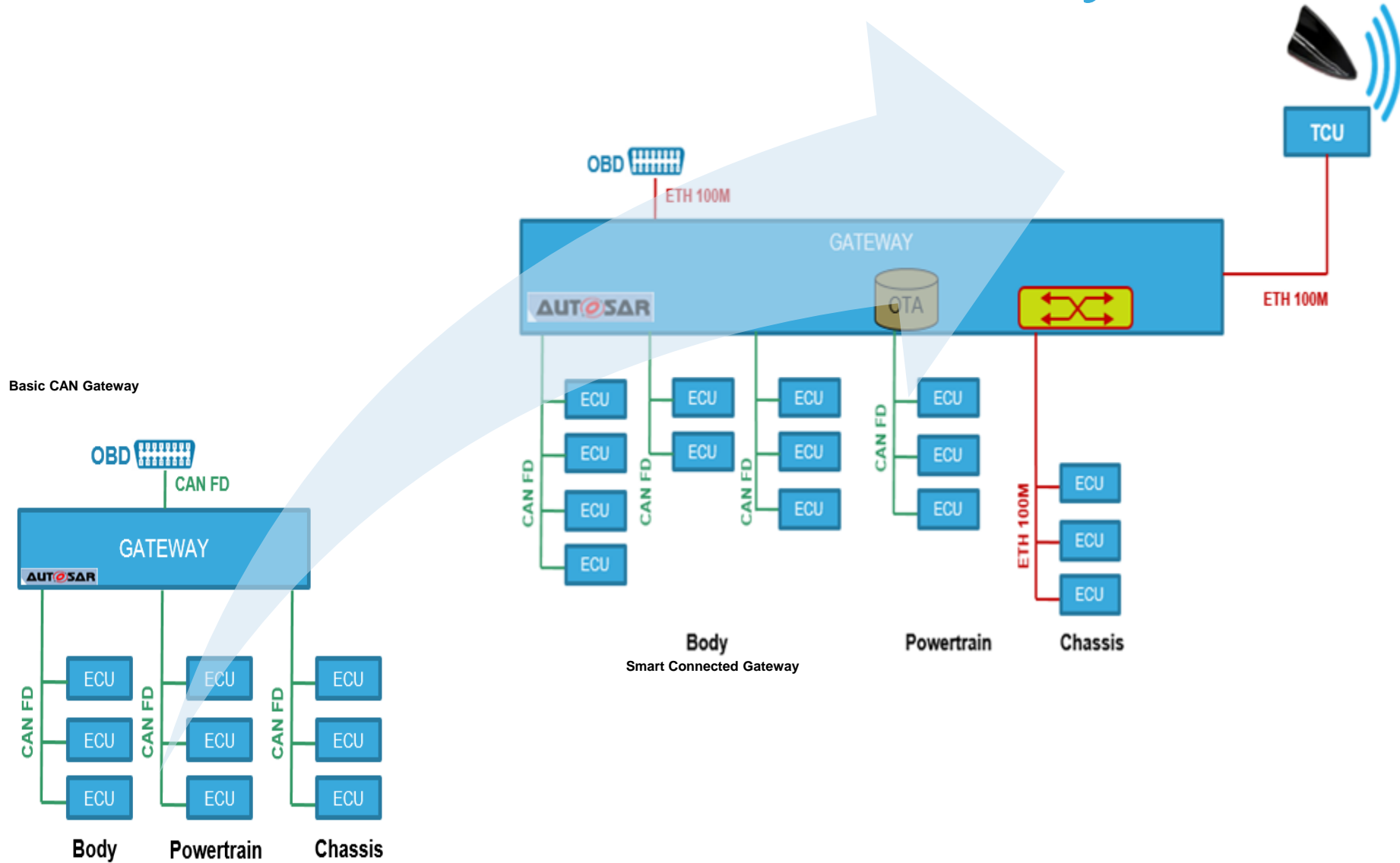
SPC58 Chorus Gateway Solution

Fanny XU

Application Manager, Micro BU
ADG Marketing and Application
Greater China & South Asia Region
STMicroelectronics



Gateway Evolution



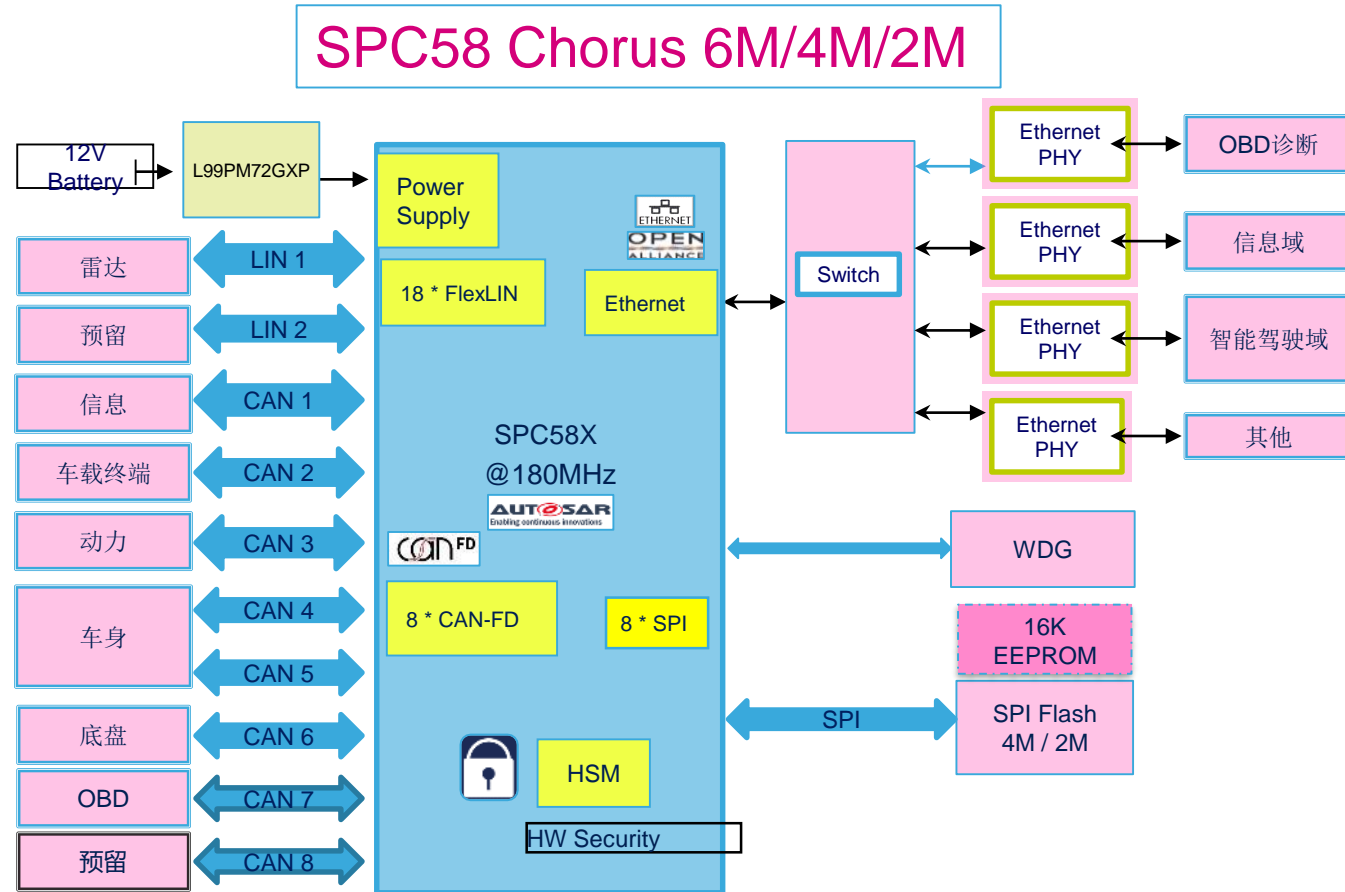
Chorus Basic Gateway Solution

Application Highlight

- Unprecedented Scalability
 - HW & SW compatibility / Single Core 64MHz to triple core 180MHz / Flash size
- Communications
 - Streaming Ethernet shell ETH AVB2 and TSN support
 - 8 CAN-FD I/F, 18 * LIN, up to 10 DSPI, 1 * FlexRay
- Versatile low power modes
 - AUTOSAR start-up time <100ms
 - Standby current 50-150uA
- Isolated Hardware Security Module
 - Secure Boot
 - Crypto accelerator (sym and asym algorithm)
 - HSM Evita medium

★ Chorus_10M Enhancement

- CPU core to triple core 200 MHz
- 16 * CAN-FD , 24 * LIN , 2x Ethernet (1GBb/s,100Mb/s)
- EMMC,OSPI external memory interface
- HW Flash context SWAP for OTA
- HSM Evita Full
- Enhanced SSWU smart standby wake-up unit



SPC58 Chorus 6M for dual Ethernet controller !

In-car Network Communication

Secure Processor

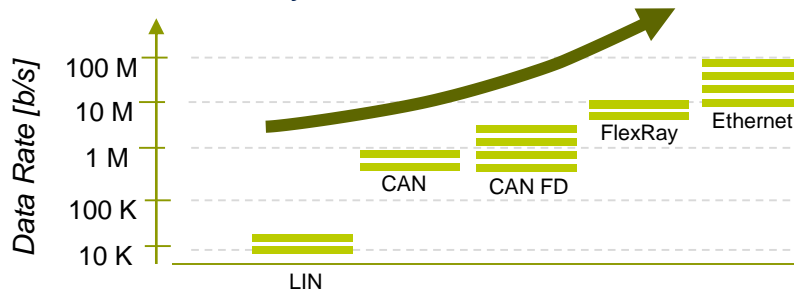


- Dual ARM A7 +M3 processor with enhanced security
- Embedded hardware cryptographic engine
- Advanced automotive connectivity interfaces
 - CAN FD, Ethernet AVB
- Rich OS Support
- Automotive grade

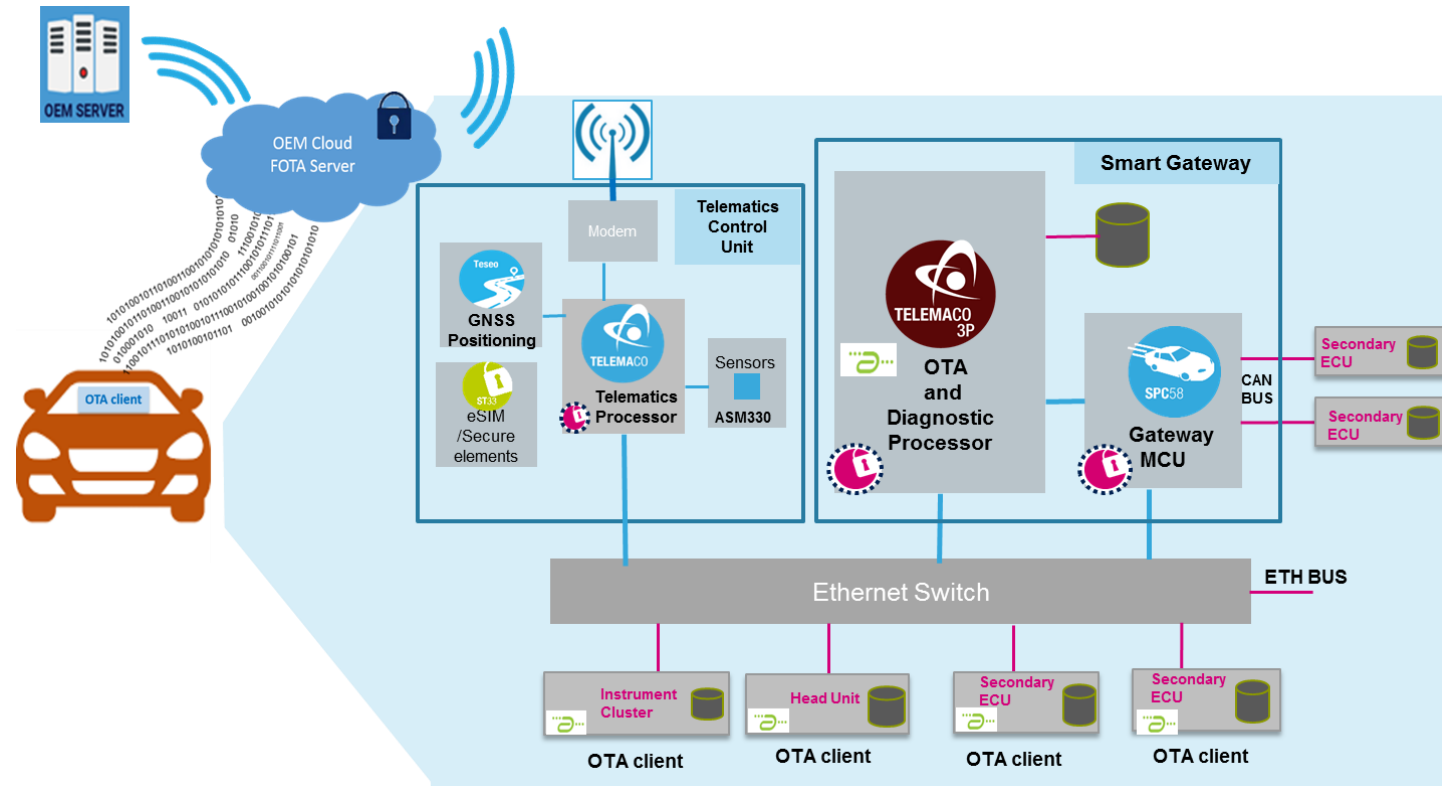
Automotive Bus Connectivity



- High speed secure micro
- Low-Power Stand-by and fast boot
- Interfaces for any automotive bus
- scalable family embedded flash



Secure Smart Gateway



Introducing ST Family of Chorus 32-bit MCU Family

#.1 Leader in Gateway Market

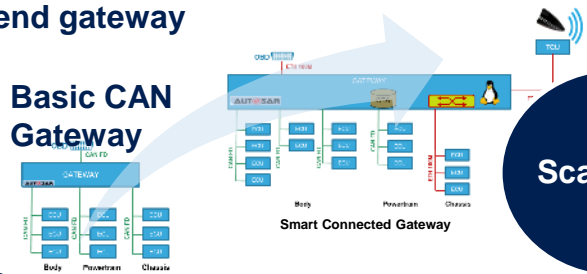
- In production
- 80Mu shipped until 2020

Unprecedented Scalability

- HW & SW compatibility
- single core 64Mhz up to triple core 200Mhz
- 512KFlash up to 10MFlash
- QFP64 up to BGA386

One MCU platform from low-end to high-end gateway

Basic CAN Gateway



Scalability

Low Power

Versatile Low Power Modes

- Standby current < 50uA
- Smart Wake-up unit for periodic monitoring
- Fast start-up time < 500us
- AutOSAr start-up time < 100ms

OTA

Ready for SW Over The Air update

- Flash partitioning
- Flash A/B contexts with HW swap
- eMMC for mass-storage
- Hyperbus for flash/RAM extention



CHORUS

Security & Safety

Isolated Hardware Security Module

- Secure boot
- Crypto accelerator (sym and asym algo)
- Evita medium and full



COM

Streaming Ethernet shell

- 2x ETH (100Mb / 1Gb)
- AVB2 and TSN support

CAN-FD with DMA

- 16x CAN I/F (4x Sub-system)

24 x LIN

1x FlexRay

Connectivity in Chorus Family

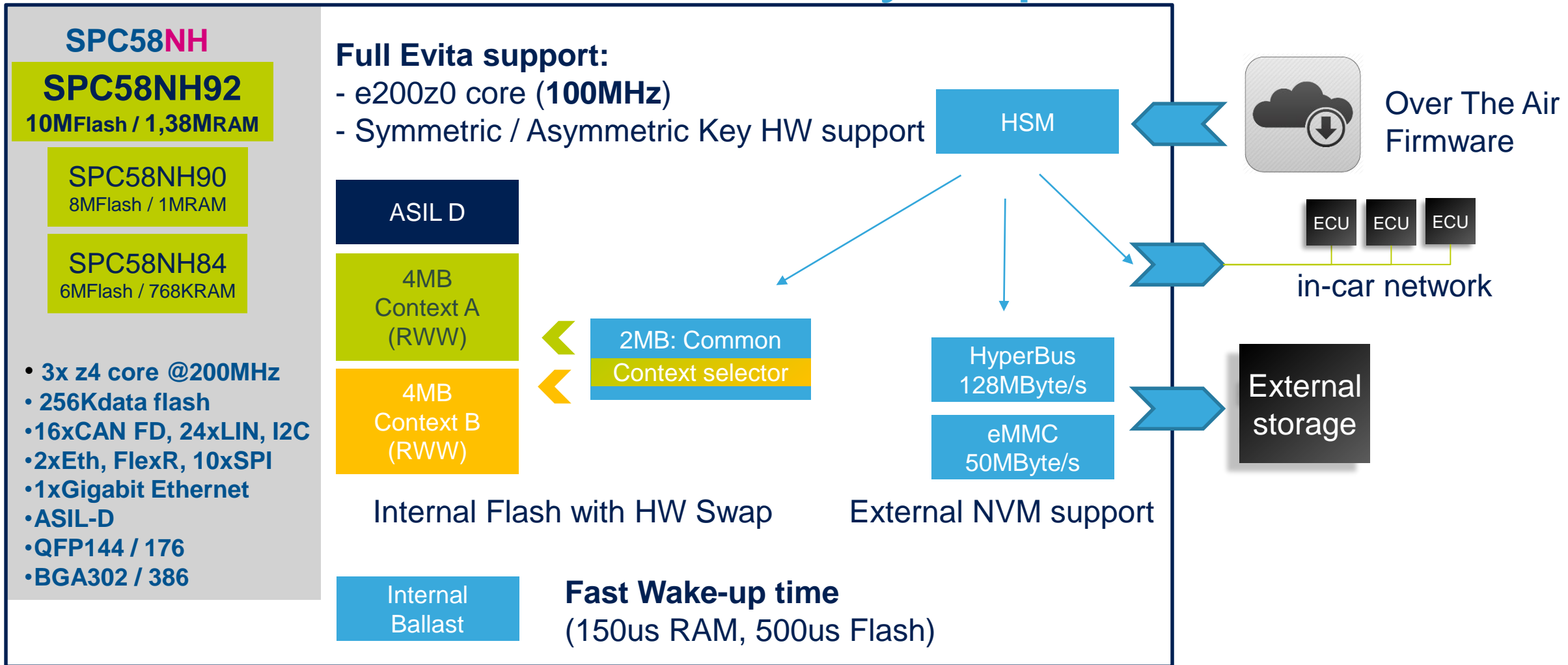
- **Chorus 2/4/6M** (Synopsys Ethernet IP version 4.20a)
 1. ETHERNET_0 : 10/100M – Half/Full Duplex
 - MII/RMII modes
 2. ETHERNET_1 : 10/100M – Half/Full Duplex
 - MII/RMII modes

- **Chorus10M** (Synopsys Ethernet IP version 5.00a)
 1. ETHERNET_0 : 10/100M – Half/Full Duplex
 - MII/RMII modes
 2. ETHERNET_1 : 1000M– Full Duplex
 - MII/RMII/RGMII modes

- Chorus Ethernet features
 - IEEE 802.3-2008 compliant Ethernet MAC
 - IEEE1588-2008 Timestamping
 - IEEE 802.1AS and IEEE 802.1Qav (AVB-Feature)
 - IEEE 802.1Q VLAN tag detection
 - IEEE 802.3az-2010 Energy Efficient Ethernet (EEE)

MCU	Peripheral
Chorus 1M SPC582B60	<ul style="list-style-type: none"> • 7 x MCAN / ISO CAN-FD • 6 x LINFlex
Chorus 2M SPC584B70	<ul style="list-style-type: none"> • 8 x MCAN / ISO CAN-FD • 14 x LINFlex • 1 x Ethernet (100Mb/s, time stamping, AVB, IPv4 Checksum, VLAN)
Chorus 4M SPC58EC80	<ul style="list-style-type: none"> • 8 x MCAN / ISO CAN-FD • 18 x LINFlex • 1 x Ethernet (100Mb/s, time stamping, AVB, IPv4 Checksum, VLAN) • Dual Channel FlexRay (10MB/s, 128 buffers)
Chorus 6M SPC58NG84	<ul style="list-style-type: none"> • 8 x MCAN / ISO CAN-FD • 18 x LINFlex • 2 x Ethernet (100Mb/s, time stamping, AVB, IPv4 Checksum, VLAN) • Dual Channel FlexRay (10MB/s, 128 buffers)
Chorus 10M SPC58NH9X	<ul style="list-style-type: none"> • 16 x MCAN / ISO CAN FD • 24 x LINFlex • 2 x Ethernet (1x 100Mb/s ETH0, 1x 1Gbit ETH1, TSN, IPv4 Checksum, Split Header, TCP segment offload, VLAN) • Dual Channel FlexRay (10MB/s, 128 buffers)

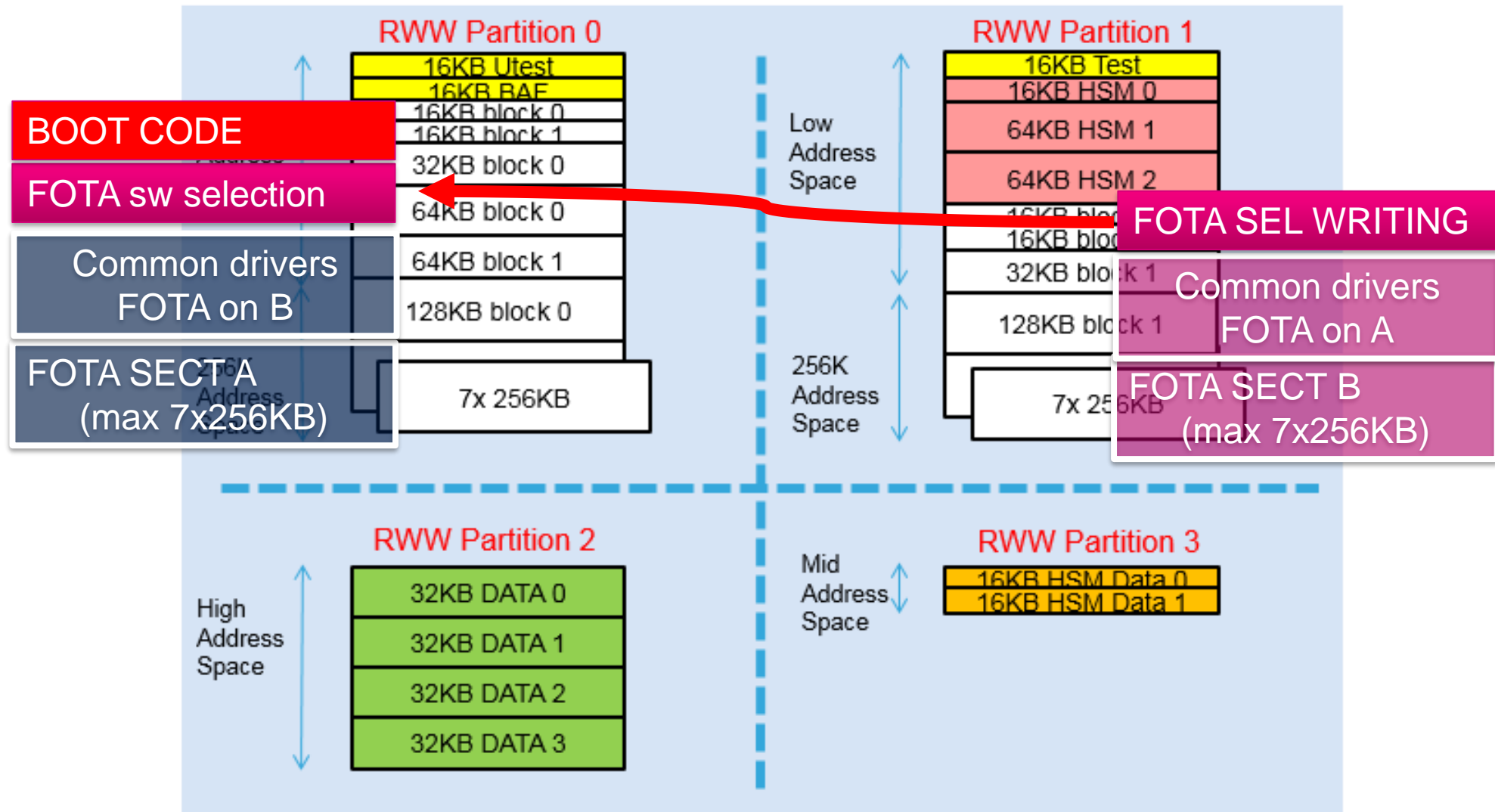
Chorus H line – Family Top End device



Chorus H: designed for Secure Firmware over the Air Management

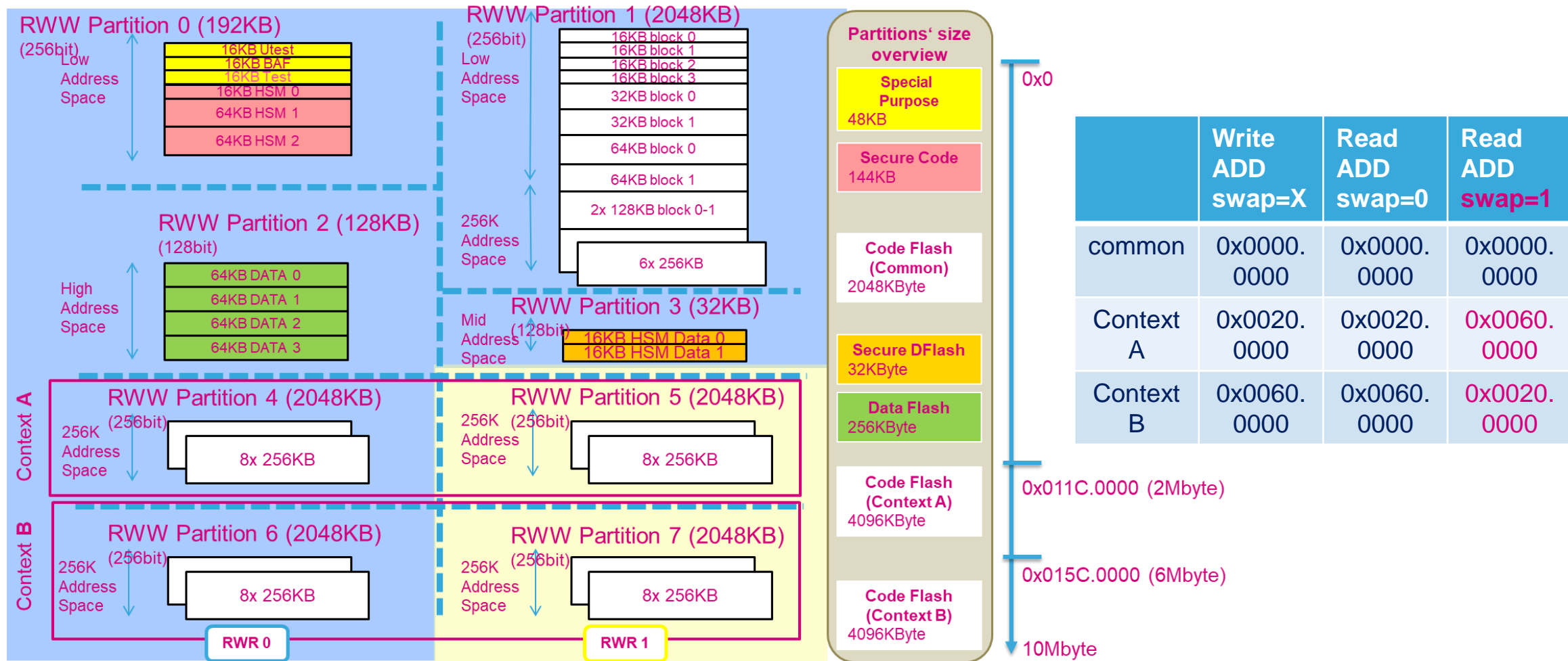
Software FOTA with More Than One RWW Partition

- Overview - SW Partitioning Concept Drawing Schema - CHORUS 4M – 6M

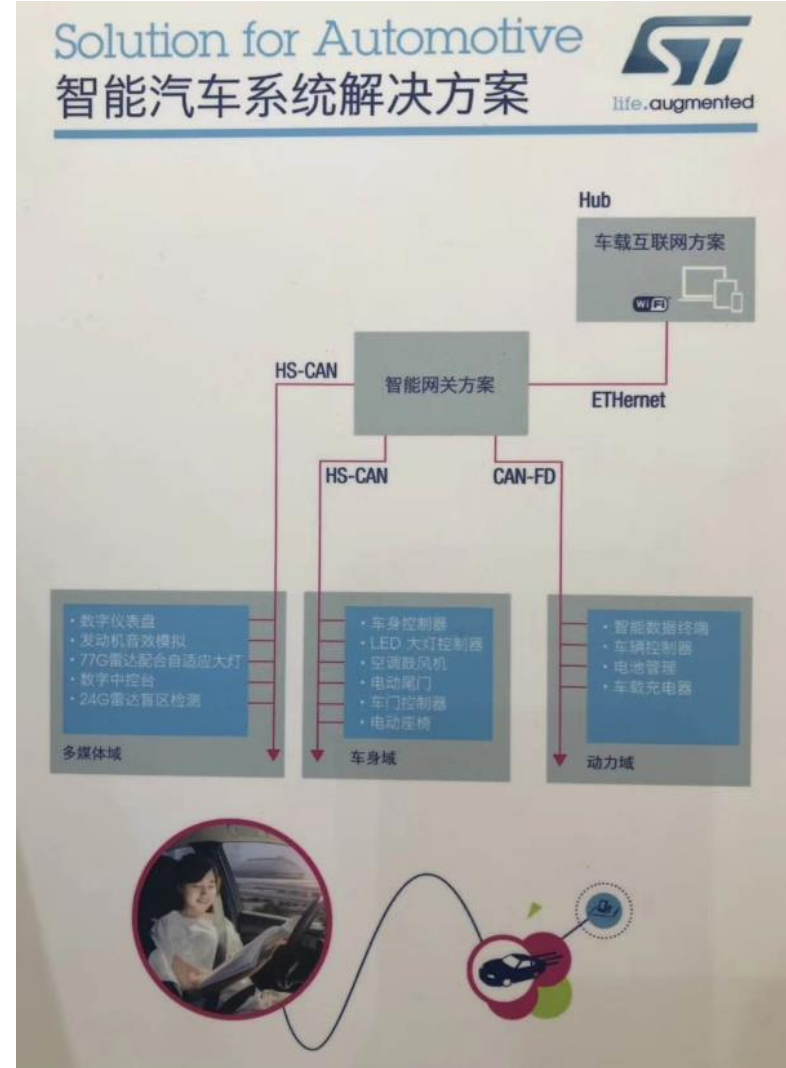


Hardware Support Mechanism for FOTA applications

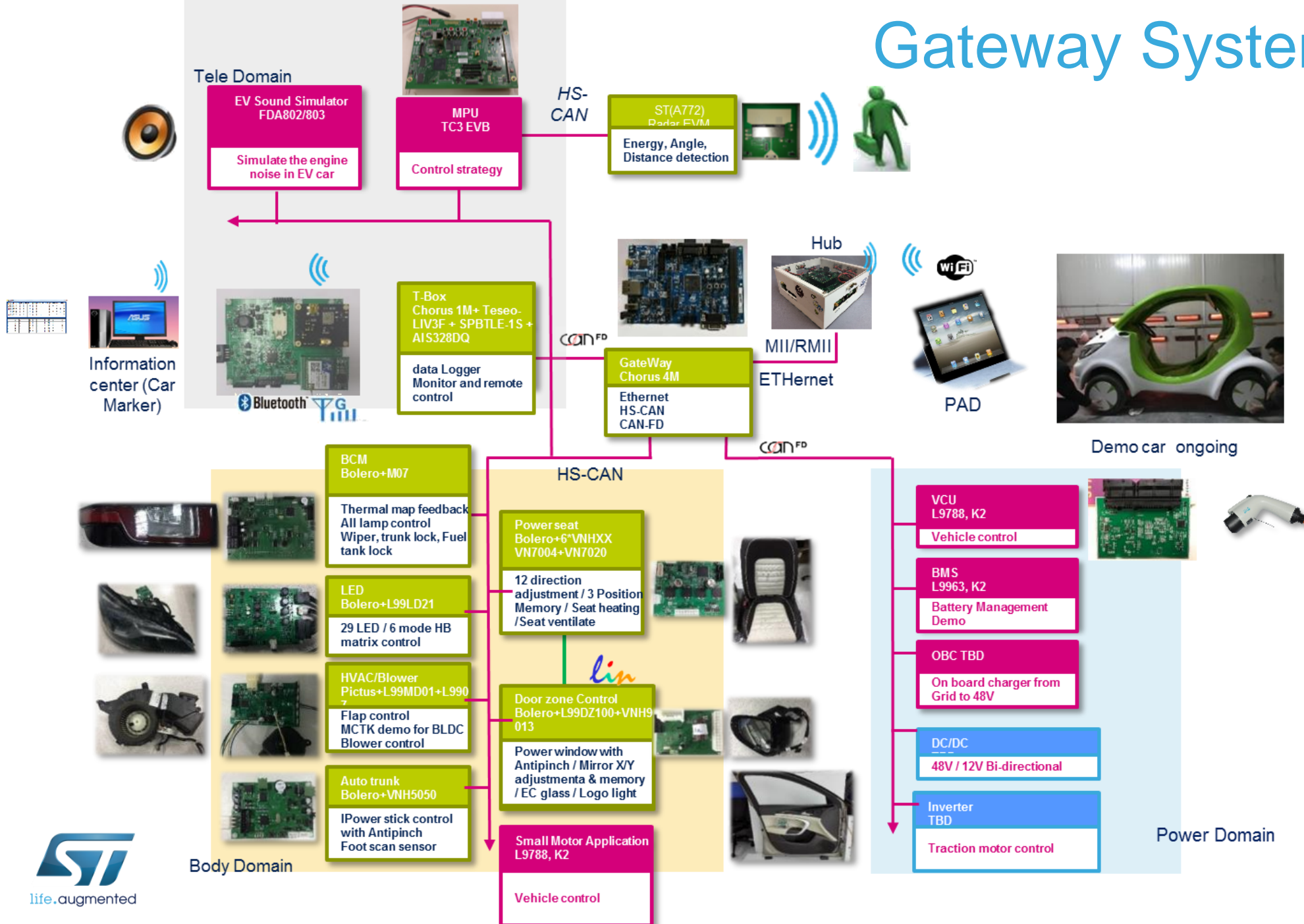
- Overview – Embedded Flash Partition Schema - CHORUS 10M



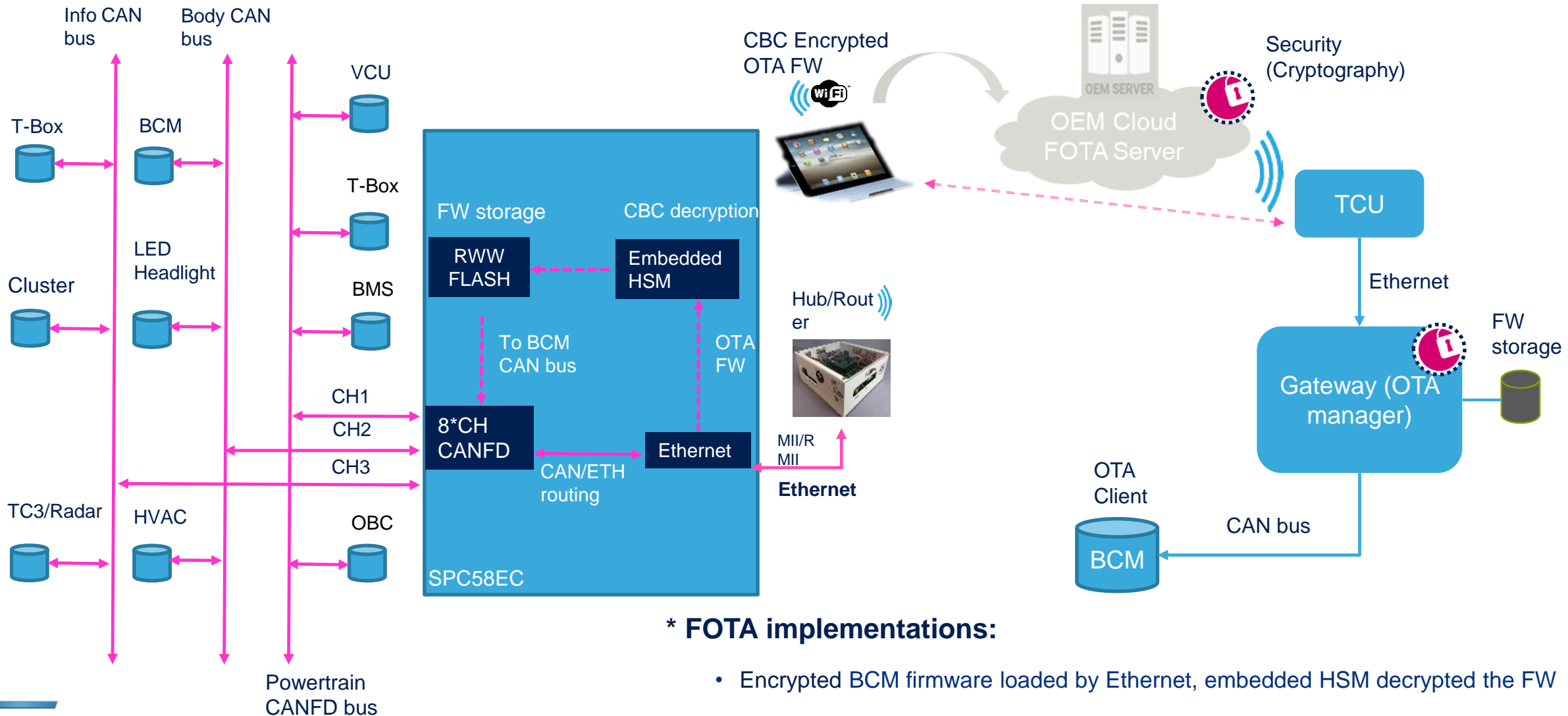
ST Demo Car with Ethernet Gateway Solution



Gateway System Demo



Demo Car Gateway Diagram with FOTA

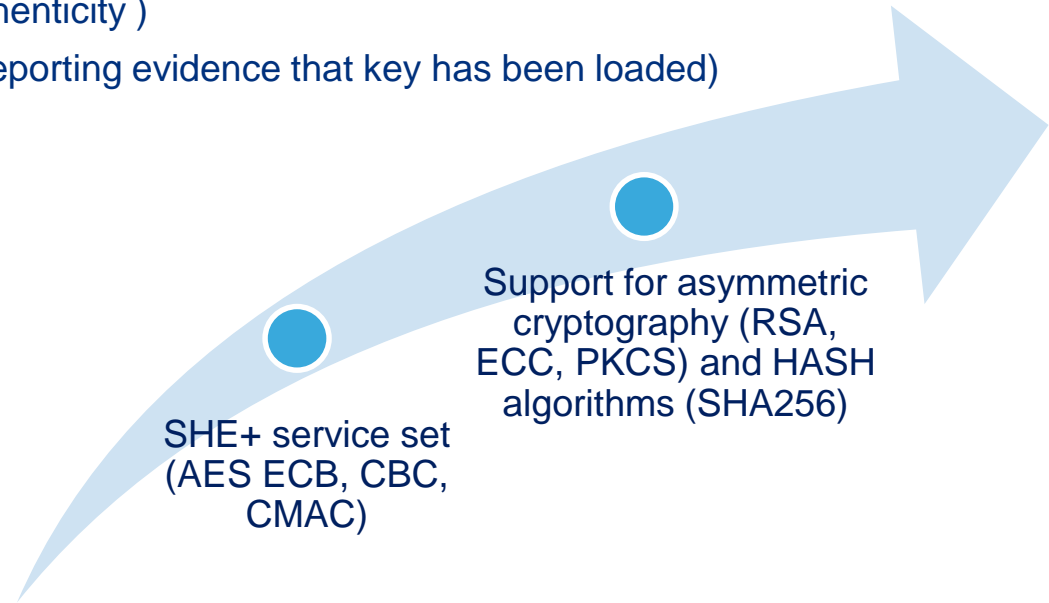


* FOTA implementations:

- Encrypted BCM firmware loaded by Ethernet, embedded HSM decrypted the FW
- Flash Driver implemented to store BCM firmware during RUN time
- Communicate with BCM module to run bootloader through CAN bus

HSM SHE+ Firmware Command Set

- Cryptographic functions
 - AES ECB and CBC encryption and decryption
 - AES CMAC generation and verification
 - Using indexed keys ... after usage restriction flags enforcement
 - Note : Dedicated command index for extended user key set
 - RSA PKCS1.5 with HASH functions (SHA1, SHA224, ...) for encryption/decryption and signature
 - Supported by hardware in Cho10m
- KEY management
 - RAM Key loading (“clear” text)
 - RAM key export (protected, with integrity, confidentiality and authenticity)
 - Protected KEY loading (NVM, with integrity, confidentiality and reporting evidence that key has been loaded)
 - Note : Dedicated command index for extended user key set
- RNG
 - PRNG initialization and re-seed
 - Random stream from TRNG or PRNG
 - TRNG online test
- New use cases push for more crypto support
 - Ex: Car to Car, Car to Infrastructure
 - FOTA



Gateway Start-up Enablement Package

Documents

- Official ST website
 - Reference Manual
 - Data Sheet
 - Technical Note, Application Note
- Training Slides & FAQs
- Security Manual
- Safety Application Guide, FMEDA , DFA, safety assessment report



New

Software Package

- SPC5 Studio
 - Low level driver
 - Application library and examples
- AUTOSAR
 - MCAL (including Crypto driver) & Complex driver by ST
 - RTE and BSW provided by 3rd parties
- Core self test
- HSM FM & HSM DEMO



Chorus EVA Board

- Chorus Discovery Boards
- Chorus Mother Boards with Mini Module



IDE

- SPC5 Studio
- HighTec
- GHS
- Wind River



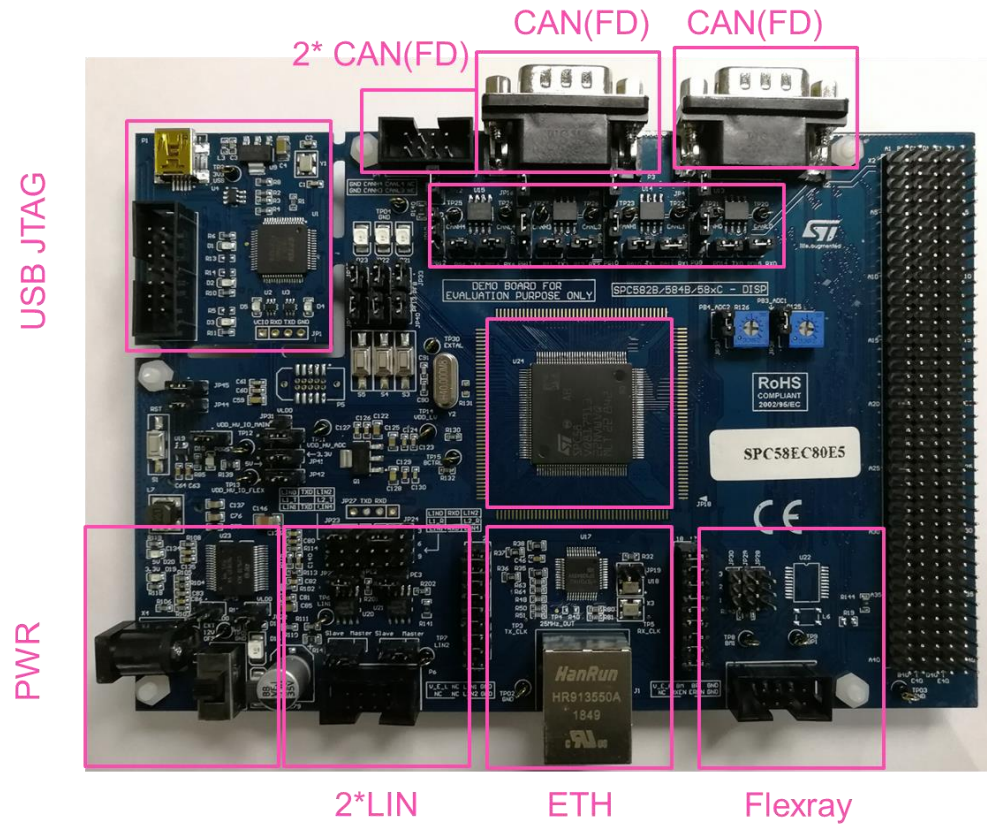
Debug tool

- UDE STK
- Lauterbach Trace 32
- Isystem

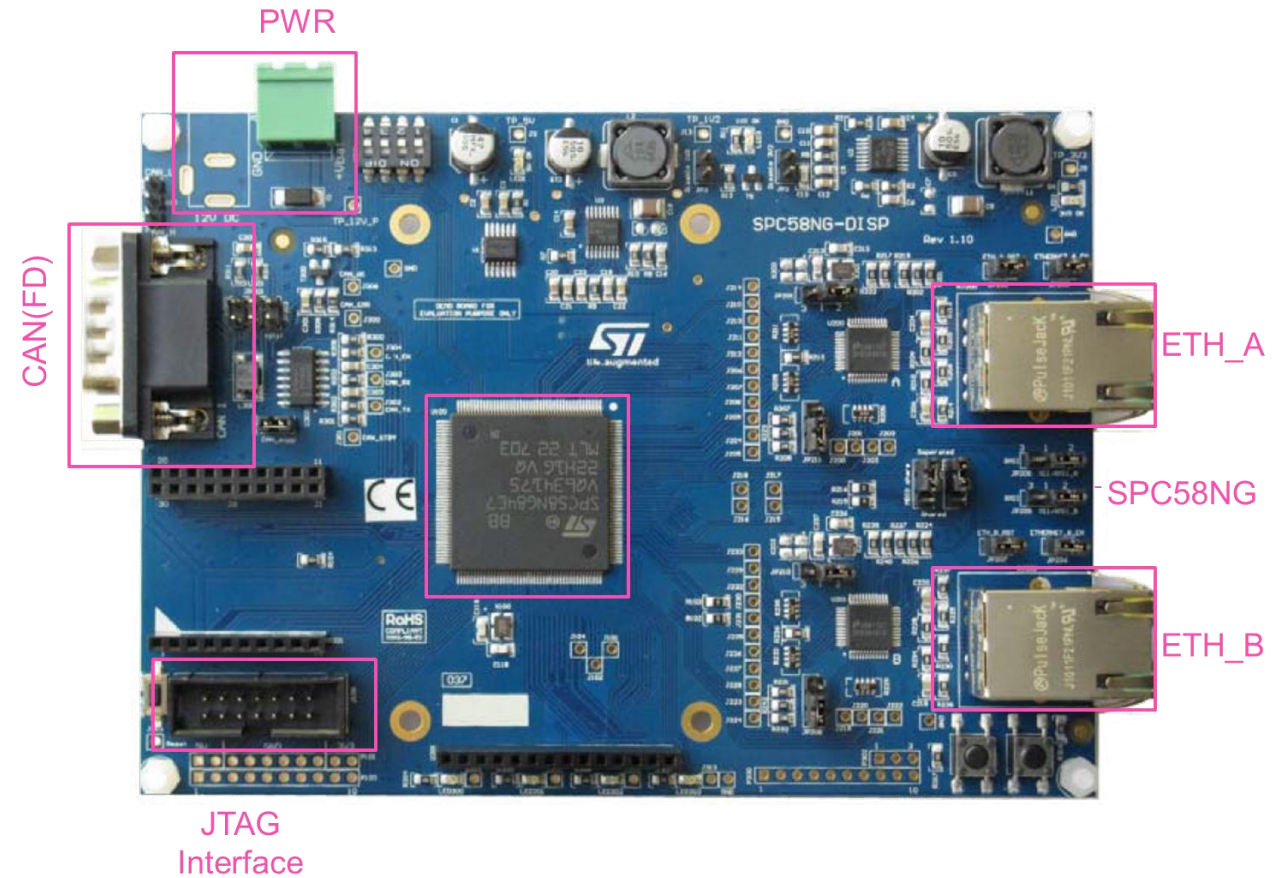


SPC5 MCU Start-up Package V3-201904

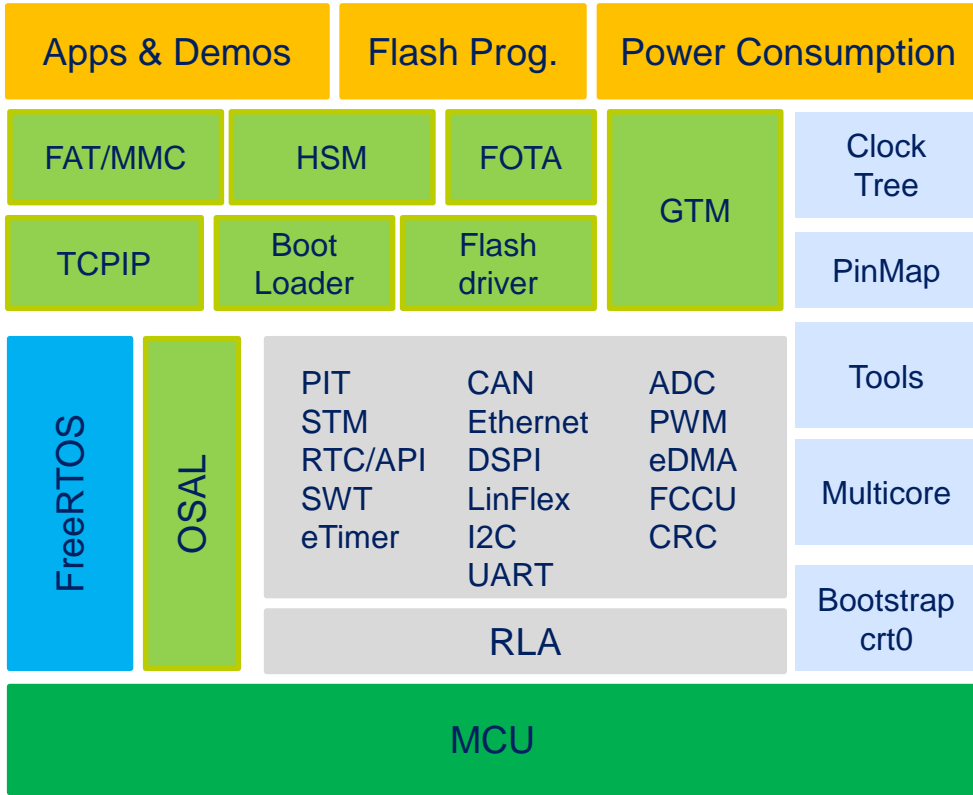
Chorus1M/2M Chorus4M Discovery board



Chorus6M Discovery EVA board



SPC5Studio Gateway Components



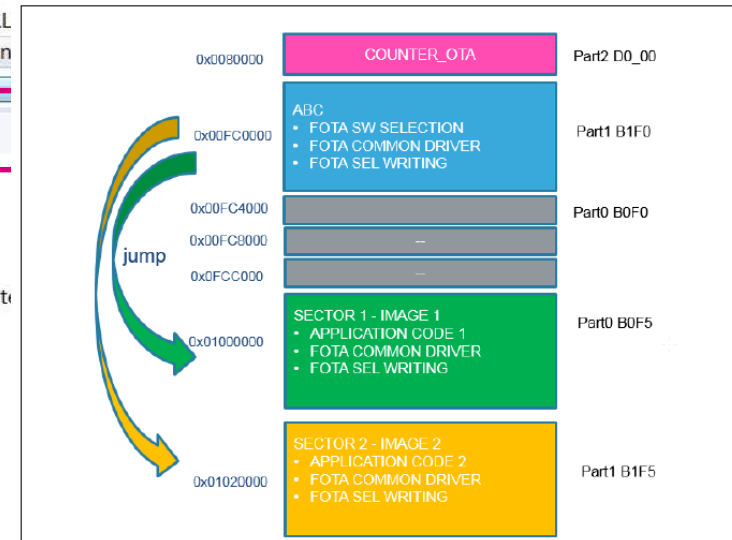
- Gateway application components
- CAN
- LIN
- Ethernet
- FreeRTOS
- TCP/IP
- FAT
- MMC
- FOTA, Bootloader
- Flash driver

AN5206

SPC58xCx FOTA SW update in background

Figure 6. SPC5Studio FOTA projects

Figure 2. SPC58xCx OTA sectors and routines



ST SPC58 Chorus MCAL Product Offer

Microcontroller Drivers

- GPT Driver
- Watchdog Driver
- Mcu Driver
- Core Test

Memory Drivers

- Internal EEPROM Driver
- Internal Flash Driver

Communication Drivers

- SPI Handler Driver
- LIN Driver
- CAN Driver
- FlexRay Driver
- Ethernet Driver

I/O Drivers

- ICU Driver
- PWM Driver
- ADC Driver
- DIO Driver
- PORT Driver

Crypto Drivers

- Crypto Driver

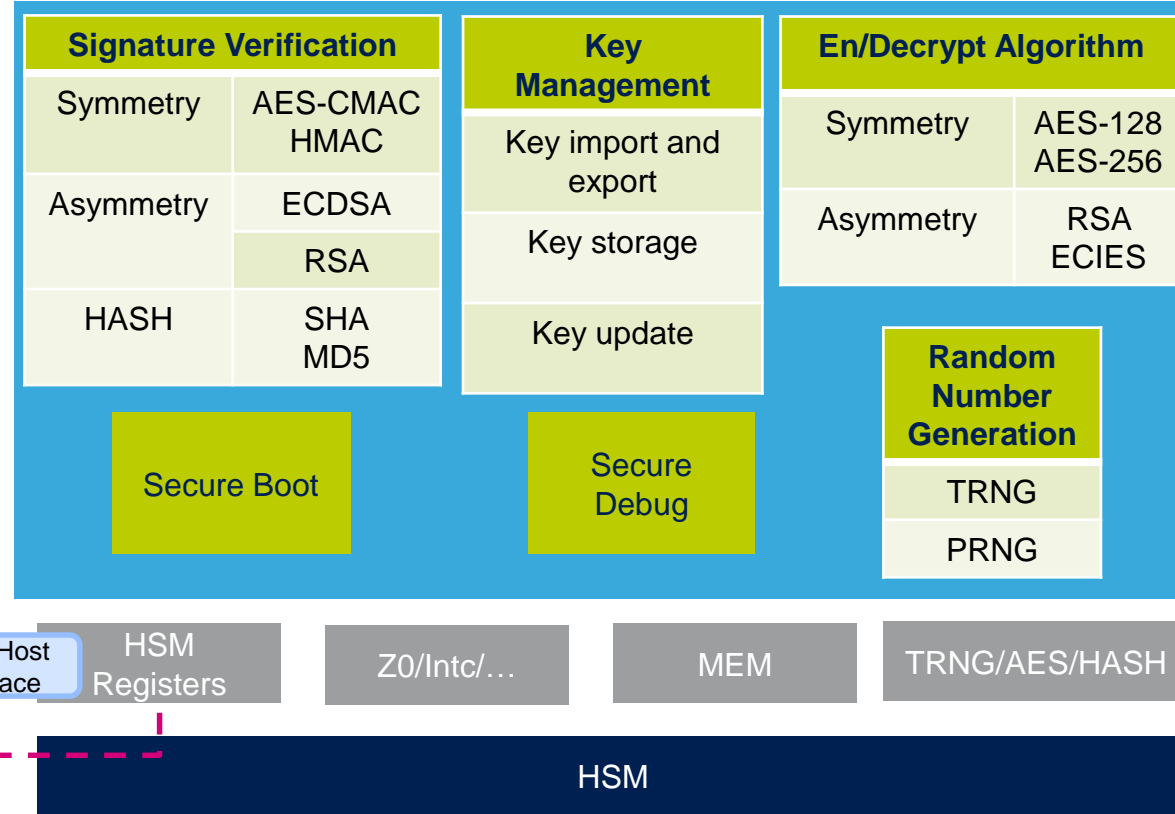
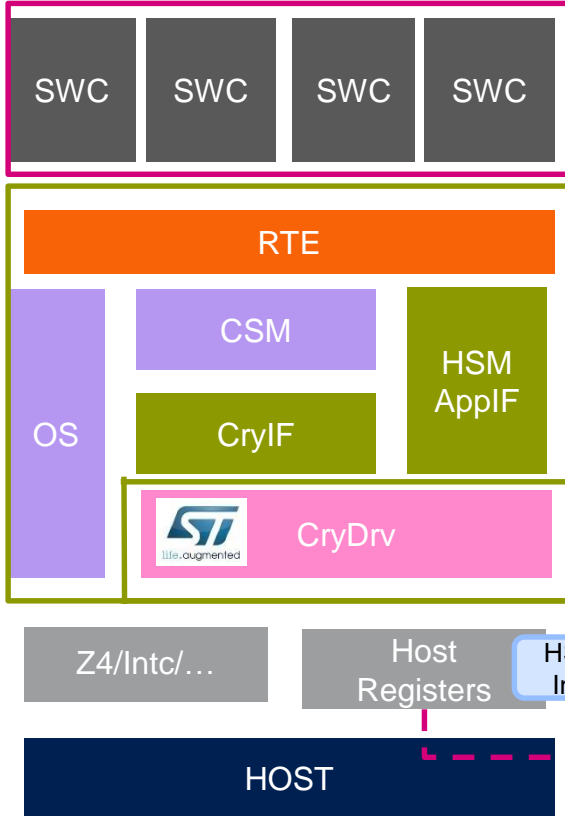
Complex Driver

- EMMC Driver
- OSPI Driver
- STDBY Driver

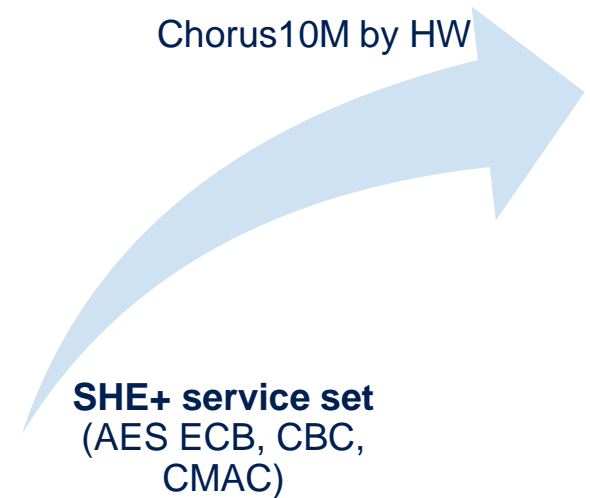
This horizontal bar contains several icons and logos. From left to right: a GPT icon, a WDT icon, an MCU Power & Clock Unit icon, the ST logo with 'life.augmented' text, the Chorus logo, a FLASH icon, an EEPROM icon, an Ethernet icon, a FlexRay icon, a CAN icon, a LIN icon, an SPI icon, an ICU icon, a PWM icon, an ADC icon, a DIO icon, a PORT icon, a SHE/HSM icon, an EMMC icon, an OSPI icon, and a Low Power icon.

HSM SW Platform Architecture

CUSTOMER



Support for asymmetric cryptography (RSA, ECC, PKCS) and HASH algorithms (SHA256)
Chorus10M by HW



SHE+ service set (AES ECB, CBC, CMAC)

3rd PARTIES



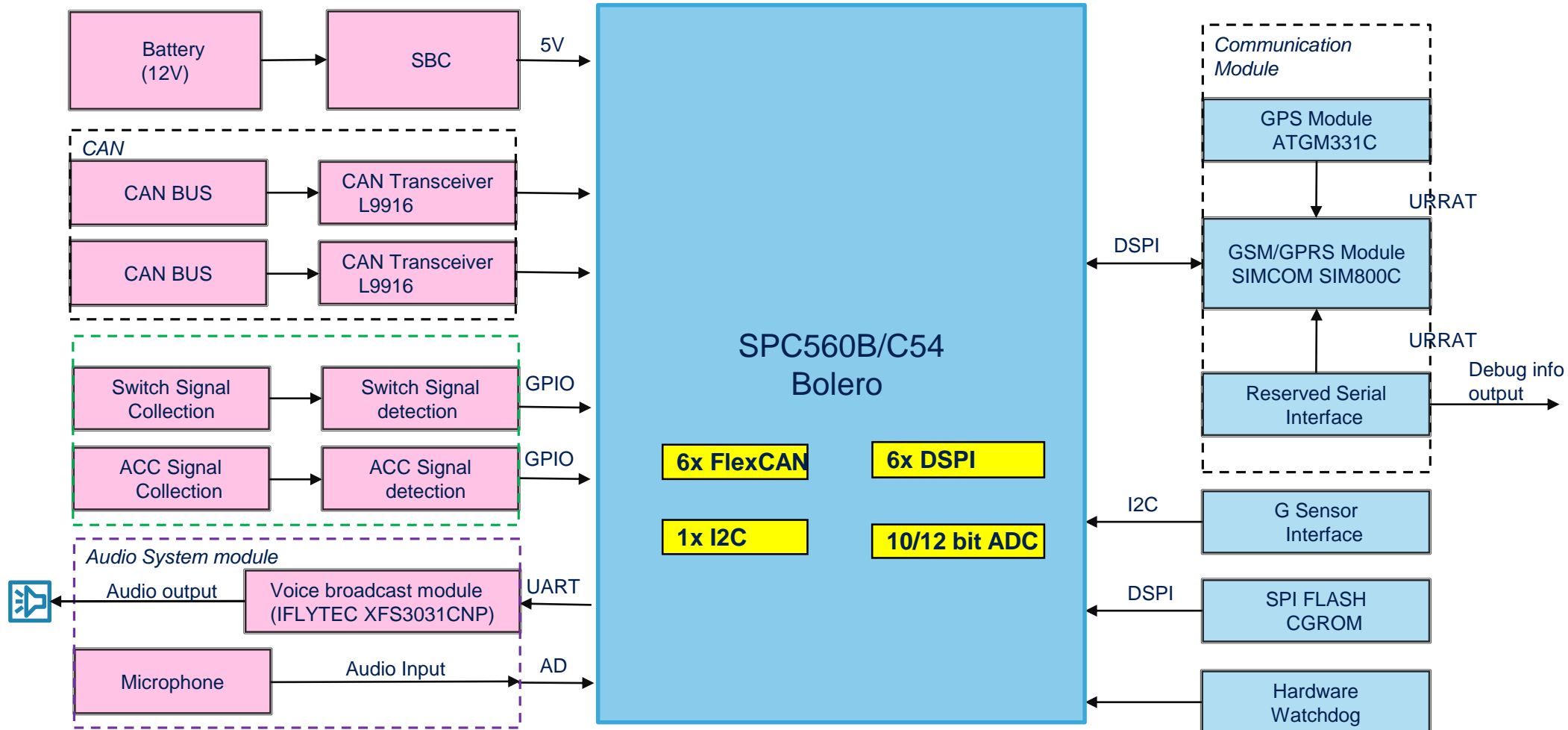
Proven Solution In MP

T-Box Solution

19

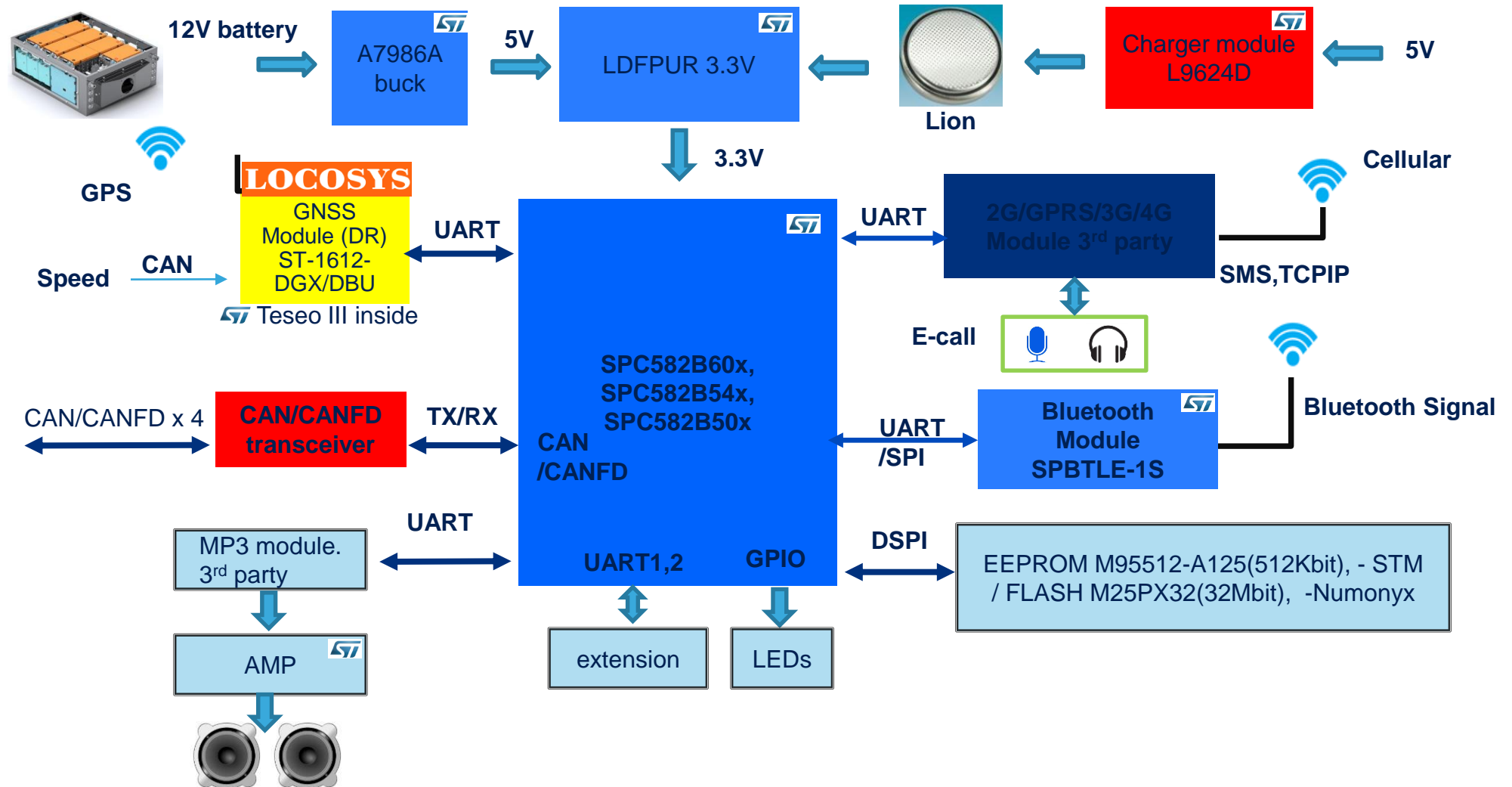
Key MCU Features

- 6 CAN interfaces, platform scale
- 12bit ADC : diagnostic function
- eDMA to support SPI, high speed communication
- with external memory interface

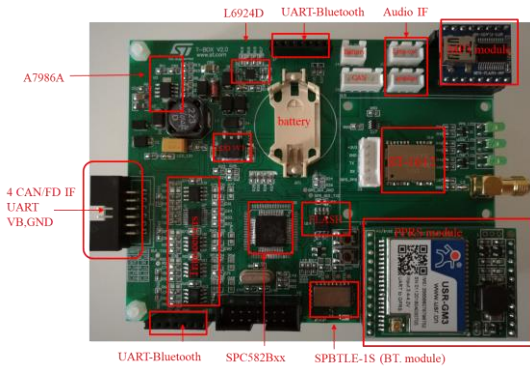


ST Low end T-Box Solutions

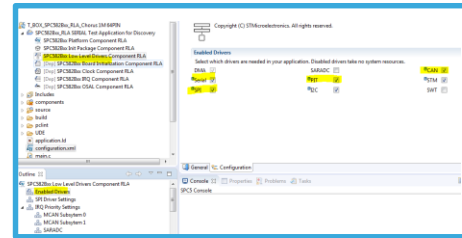
(stand-alone : SPC582Bxx)



ST Low End T-box solutions (stand-alone : SPC582Bxx)



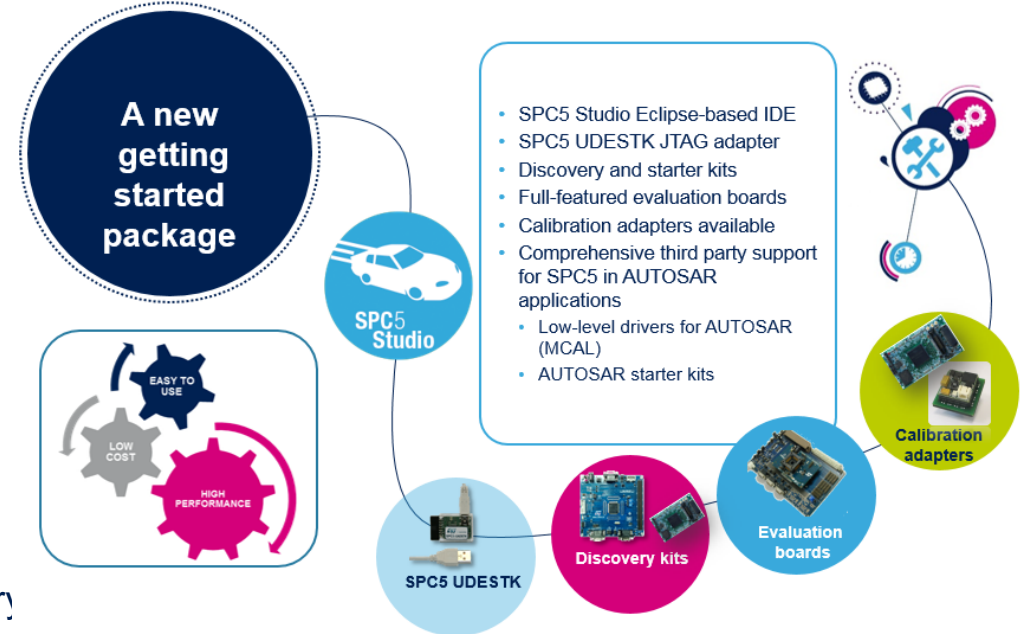
Evaluation board



Configurable LLDs

Advantages:

- AEC-Q100 qualified
- Comprehensive new generation ASIL-B safety concept
- High performance e200z2 single core
- 1088 KB (1024 KB code flash + 64 KB data flash) on-chip flash memory
- 96 KB on-chip general-purpose SRAM
- Multi-channel direct memory access controller (eDMA) with 16 channels
- 6 LINFlexD modules
- 4 deserial serial peripheral interface (DSPI) modules
- 7 MCAN interfaces with advanced shared memory scheme and ISO CAN FD support
- More cost efficient solution



Customer support materials:

- Cost efficient Software & development tools
- SPC5 Studio configurable LLDs
- Reference software
- Evaluation board
- Documents



