Elektrobit
Driving the future of software

Elektrobit

Driving the future of software

Architecting…

the experiences inside and outside the connected vehicle in a safe manner.

Leading…

innovation and creating differentiating solutions for the automated car.

Facilitating…

automotive-grade software partnerships for the entire vehicle life cycle.

Enabling…

knowledgeable development, testing, and business teams.

Elektrobit

Technical competencies

EB's technical core competencies are the development of automotive-grade (software) products and engineering services.

Global presence

Development and business offices in Austria, China, Finland, France, Germany, India, Israel, Japan, Romania, South Korea, and USA.

Employees

More than 3400 employees* worldwide. Spans three continents and eleven countries.

Continental AG

Wholly owned, independent subsidiary of Continental AG.

Consistent growth

In 2018: +35 %

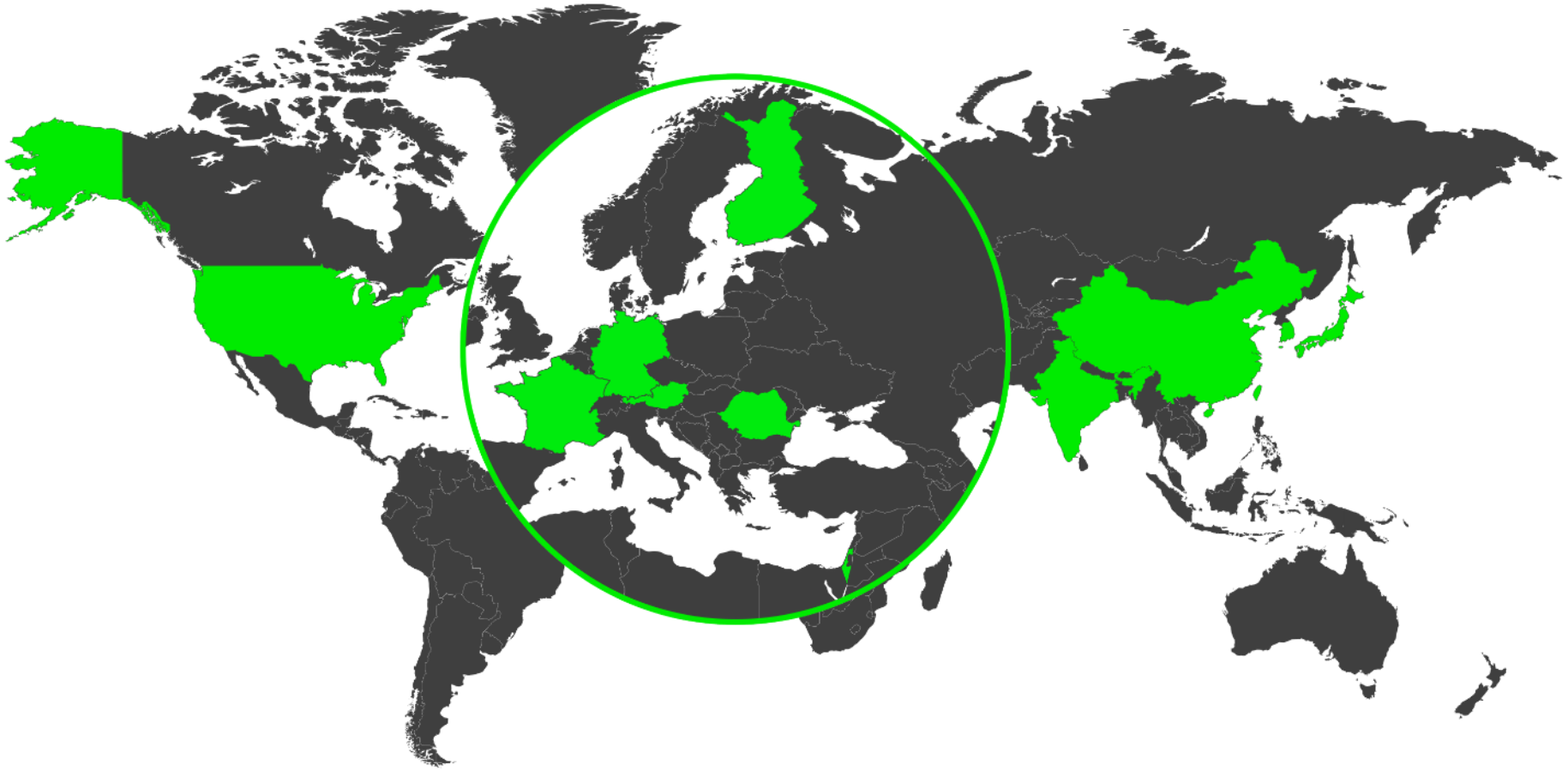
100+ million

Over 100 million vehicles on the road and one billion embedded devices.

*December 2019, incl. Argus, excl. e.solutions.

Global footprint

Elektrobit



Elektrobit (EB) – Locations

- Tokyo . Nagoya | **Japan**
- Seoul | **Korea**
- Beijing . Shanghai | **China**
- Bengaluru | **India**
- Tel Aviv | **Israel**
- Oulu | **Finland**
- Brasov . Timisoara | **Romania**
- Wien | **Austria**
- Berlin . Böblingen . Braunschweig . Erlangen . Ingolstadt . Radolfzell . München . Ulm | **Germany**
- Paris (Carrières-sur-Seine) | **France**
- Seattle . Silicon Valley . Detroit | **USA**

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Elektrobit

Mobility for an enriched life

Our software is the foundation for our customers‘ innovations

Elektrobit

Delivering unique experiences year after year

07

Global software integrator for Ford SYNC

08

e.solutions is formed, a **joint venture between EB and Audi** AEV

10

Strategic partnership centered around **ADAS development**

12

AUTOSAR 4.0 on the road across all BMW car lines

14

Connected navigation solution for China and Japan

16

Touchscreen HMI for snow groomers

17

Integration of automotive **cyber security pioneer Argus**

18

Measurement technology for automated driving test fleets

19

Vehicle infrastructure architecture and HMI development platform for VW's electric ID. family

20

HMI system for cockpit and infotainment for the VISION-S concept vehicle

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Driving technology further — products & solutions

Automated driving

- Measurement technology for test and validation
- Cloud-based data management
- Electronic horizon solution
- Highly accurate vehicle positioning

Vehicle infrastructure

- Products and solutions based on the AUTOSAR standard
- Single- & multi-core OS
- Functional safety OS
- Embedded security
- Automotive communication networks, e.g. Ethernet

Connected vehicle

- Toolchain to enable software updates over the air
- Intelligent remote analytics tool
- Scalable backend
- Cybersecurity solutions plus modular add-ons by Argus

User experience

- User interface development tools and services
- Augmented reality solutions
- Voice assistants integration (e.g. Amazon Alexa, Google Assistant ...)
- Cockpit system solutions (e.g. services for Android …)
- UX concept and design development

Elektrobit Consulting

- Agile and lean development methodology and transformation
- Future-proof software architecture and strategy guidance
- Functional safety and security consulting

Engineering services

- Comprehensive verification & validation portfolio
- Development and integration of software
- System architecture design and HW development
- Software maintenance & application life cycle management

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We are your independent software partner

Acting as a neutral party, we offer independent software and manage software integration with OEM and third-party software suppliers.

EB delivers independency of services thanks to:

- Full autonomy in business and project execution
- Confidentiality – also to Continental – as a key commitment
- Separated IT infrastructure

Common approach on demand

If customers demand a common approach, we will be able to generate additional value by bundling the development, application, and industrialization expertise of Elektrobit and Continental.

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Innovation through collaboration

Worldwide partner ecosystem of cutting-edge technology companies

Leading innovation in renowned consortia and organizations

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Argus - The Global Leader in Automotive Cyber Security

ONE-STOP SHOP

MULTI-LAYERED SOLUTIONS

Prevent | Understand | Respond

TRUSTED ADVISORY SERVICES

100 000 Research Hours

53 Granted & Pending Patents

WORLDWIDE PRESENCE

6 Offices Worldwide

AUTOMOTIVE & CYBER EXCELLENCE

Cyber:
Embedded software, Mobile communication, Critical infrastructure, IT & Networks

Automotive:
Senior executives: GM, FCA, Daimler
Over three decades in automotive, Electrical engineering

PARTNERING WITH INDUSTRY LEADERS

Continental, Elektrobit, Ericsson, Magna, Qualcomm, Infineon, Intel, Check Point, NXP, ST Micro, Wind River, Singtel, T-Systems

WORKING WITH WORLD'S MAJOR OEMS & TIER 1s

Awarded production projects - multiple SOPs in 2020

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EB in China

Elektrobit

Focusing on local market

Offices in Shanghai and Beijing

Elektrobit Automotive Software (Shanghai) Ltd., established since April, 2012 and has branch office in Beijing

Dedicated and experienced local team

Consists of 120 passionate employees and engineering teams whose dedicated to providing flexible and innovative solutions and engineering services for areas of：

- car infrastructure
- connectivity & security
- automated driving
- user experience

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Recognition

Recognized as a TASE by Chinese government

In 2019, Elektrobit Automotive Software (Shanghai) Ltd., received the **Technology Advanced Service Enterprise (TASE)** status, a significant business recognition by the Chinese government.

With this achievement EB continues to grow in China, not only in terms of business but also as a major provider of advanced technology services.

技术先进型服务企业
证 书

企业名称：伊必汽车软件（上海）有限公司　证书编号：20193100000059
发证时间：2019 年 12 月 12 日　有 效 期：三年
批准机关：
上海市科学技术委员会　上海市商务委员会　上海市财政局　国家税务总局上海市税务局　上海市发展和改革委员会

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Experience and proven in local and global customer projects

Local

SAIC MOTOR
BRILLIANCE
FAW
HUAWEI
NAVINFO
CHANGAN
GEELY
Baidu 百度 | apollo
PATAC
星宇股份 XINGYU CO.,LTD.
WELTMEISTER 威马汽车
CHERY
Great Wall
ADAYO 华阳通用
HSAE 航盛
SEMDRIVE 芯驰科技
CATARC
Longhorn

JV

一汽-大众 FAW-VOLKSWAGEN
东风汽车有限公司 DONGFENG MOTOR COMPANY LIMITED
NISSAN

Global

TESLA
Ford
GARMIN
SIEMENS
Continental
Valeo
FUJITSU TEN

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Our innovations

Paving the way for latest in-car infrastructures

Reliable, scalable, and efficient AUTOSAR solutions

- Classic and Adaptive AUTOSAR basic software, tooling, and services
- Single- and multi-core operating systems
- Functional safety supporting ISO 26262 and certified up to ASIL-D
- Embedded security you can rely on
- Latest communication technology such as automotive Ethernet

Benefits

- Broad range of automotive real-time applications for a fast time to market
- Smooth integration on latest microcontrollers
- Extensive global partner ecosystem
- Efficient, reliable comprehensive tooling ecosystem
- Tools to leverage the most innovative functions while keeping your efforts, resources, and budget in check

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Driving the car of the future

ADAS and automated driving products & solutions

- ADTF development environment
- Hardware and software for data logging and replay
- Hardware-in-the-Loop simulation solution
- Cloud-based validation toolchain
- Electronic horizon for map-based functions
- Engineering services for up to level 5 of automated driving

Benefits

- Comprehensive offering and interlocking products and solutions
- Broad experience of ADAS software development, integration, and industrialization
- Dedicated training, professional consulting, and experienced support with short response times

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Offering your customers the greatest user experience

Human machine interface (HMI) solutions

- All-in-one HMI development toolchain to build holistic user interfaces, for automotive or non-automotive applications
- Augmented reality framework to extend the user experience
- Development of complete systems from concept phase to mass production
- Integration of voice assistants (e.g. Amazon Alexa, Google Assistant, ...)
- Android ecosystem for automotive usage

Benefits

- Trusted partner in building industry-leading HMI with 20+ years of experience
- Reliable automotive-grade HMI development toolchain (EB GUIDE) used within +50 million cars, chosen by 9 out of 10 OEMs
- Full-scale capability from hardware and software up to UX design
- Fast development and innovation cycle
- One-stop shop for all HMI tooling and engineering with support by a global team of highly qualified HMI experts

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From embedded software to cloud services

Automotive cloud computing solutions

- Complete toolchain for secure soft- and firmware updates over the air
- Scalable, modular, and agnostic back-end solution for fleet, software, and campaign management
- Intelligent remote analytics tool for car data and user behavior insights
- State-of-the-art security and privacy solutions for connected cars

Benefits

- Quality through continuous deployment using micro services and DevOps
- Cost-efficient through scalability
- Unique combination of two decades of embedded experience with the latest cloud computing skills

© Elektrobit (EB) 2020

We enable you to manage challenging automotive projects

Consulting by experts

- Lean development methodology and transformation
- Future-proof software architectures and guidance
- Functional safety and security consulting
- Dedicated training courses, from agile to scrum to safety

Benefits

- Shorter delivery times
- Increased component re-use
- Increased quality and maturity of software
- Reduced risk and greater transparency
- Efficient execution of safety-critical projects

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Support from prototype to start of production and beyond

Verification and validation

Comprehensive verification and validation services for embedded systems, automated driving, connected solutions, and user experience solutions.

System integration

Integration of production-ready in-vehicle software and hardware solutions in all relevant platforms, managing complex projects on a global scale.

System maintenance

Taking responsibility for maintaining, managing the life cycle, and extending your features, from writing specifications to coordinating suppliers.

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Case studies

Revolutionized vehicle infrastructure architecture

The challenge

Volkswagen has been forging ahead with its all-electric fully networked vehicles of the ID. family. They are set to make use of the full potential of connectivity with the internet as well as over-the-air updates and upgrades.

Constraints:

- With the ID. family, Volkswagen is introducing a completely new IT vehicle architecture.
- Cars contain up to 100 ECUs and literally three or four kilometers of electrical wiring connecting them all. Interior space has reached its limits.
- Enabling this requires more computing power and new dynamic systems like Linux and Adaptive AUTOSAR.

The solution

EB's new vehicle infrastructure architecture forms the basis for software-defined cars. The architecture and software design of EB's new “Software Platform” moves away from purely static, individual ECUs and additionally incorporates centralized ECUs. EB's “Software Platform” for high-performance computing (HPC) enables the usage of the maximum computing power of hardware.

Benefits:

- This new central ECU architecture, combined with state-of-the-art EB middleware, ensures vastly increased vehicle operating efficiency – built on a robust software platform that can be updated and improved over the life cycle of the vehicle.
- It also allows for enhanced car safety and security – enabling simple integration of newer hardware and software in the future.

EB’s added value

VW's new electric compact ID. will start rolling off the line in 2020. Further models – ID. CROZZ, ID. BUZZ, and ID. VIZZION – will follow. EB's software ensures that vehicles are safer and more reliable while also enabling the convenient use of innovative cloud-based services.

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Global software integration for Ford

The challenge

Ford, with over 6.5 million SYNC equipped cars on the road, was looking for a partner to help adding new Applications (such as 911 assist and Vehicle Health Report) on top of the SYNC platform. (SYNC is a fully integrated, voice activated in-car communication and entertainment system)

Constraints:

- Must work seamlessly with SYNC across the globe
- Must accommodate a variety of suppliers, developers and logistic processes

The solution

EB has become a key software integrator ensuring interoperability between 3rd party developed applications and the rest of the systems in the SYNC environment.

Benefits:

- 3rd party application integration allows Ford to differentiate

EB's added value

EB's experience in the automotive software domain enables Ford to have the versatility of working with a variety of 3rd party vendors and keep a high bar of excellence.

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Driver assistance software implementation for Daimler

The challenge

Daimler was searching for a software partner to build a strategic alliance with the best expertise in software development starting from the first software concept and lasting throughout the entire life cycle.

Constraints:

- Having the partner take over functions and implementation models, software implementation, module testing, and integration testing
- Smoothly integrating Daimler's standards by maintaining functionalities, time lines, and quality at the same high level

The solution

In 2010, EB took on the development environment in a smooth transition. Due to constant, continuous optimizations, EB provided innovation and variant handling, ensuring efficiency in time, costs, and quality.

- More than 650 version releases, with 200 series approvals, were delivered on schedule between 2010 to 2017.
- With the help of EB, Daimler is able to focus on driver assistance algorithm development, self-driving vehicles, and their core competence of building innovative cars.

Software implementation from smart to S-Class

EB's added value

Our software factory allowed us to provide "continuous integration", which enables innovation and variant handling on an on-going basis, including complexity management.

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OSEK- and AUTOSAR-compliant standard core for BMW

Challenge

In 2001, BMW began putting standard software-in-series production. The Standard Core included up to 56 basic software modules. BMW was looking for someone to take over the integration of BMW modules substituting selected standard modules.

Constraints:

- Develop majority of basic software modules since 1997
- Fully integrate various Standard Core versions and BMW AUTOSAR Core on a great variety of platforms.

Solution

EB's experience with both OSEK and AUTOSAR software development which made integrations efficient.

Benefits:

- EB has partnered with BMW since 1997 and its expertise in ECU software development has helped BMW to efficiently realize project-specific integrations of the BMW Standard Core.

EB's added value

EB has experience with both OSEK and AUTOSAR software development. EB has a demonstrated ability to manage large/global projects.

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HMI development with Audi

Challenge

Audi needed to develop a truly modular Infotainment system so that the solution could be used for any of their lines of vehicles. Audi was looking for a partner with deep understanding of automotive user interfaces.

Constraints:

- Must function well across all variants of the vehicles
- Must be modular for customization
- A partner must be capable of managing complex global projects with various features, display variants, and over 1,400 different user dialogs.

Solution

Audi chose to partner with EB to instantiate the solution and make it extensible.

Benefits:

- EB has a deep understanding of Automotive User Interfaces and by leveraging EB GUIDE, EB's integrated HMI development tool, EB created a highly reusable, but modular solution.

EB's added value

Elektrobit offers EB GUIDE, an integrated HMI development tool which allows to model multimodal user interfaces. EB GUIDE helped manage the scope and complexity of the project.

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Global map compilation for leading OEMs

The challenge

Leading OEMs including Audi, Bentley, Daimler, Porsche, SKODA, Tesla and VW all over the world need navigation maps for diverse regions. They are looking for a partner who goes “above and beyond” by providing value-added services such as updating map data, which helps them to reduce additional costs on software updates down the line.

Constraints:

- These projects require the transformation of large amounts of data on a limited timeline.

The solution

To streamline and accelerate map development, the EB China team works in conjunction with EB’s global map testing and navigation software teams to deliver high-quality maps enabled with automatic, manual and bench testing functions as well as map data solutions for all brands across different regions within a strict timeline.

Benefits:

- EB’s China and Germany team upgraded its map compilation tools and increased the bandwidth of its servers, and established automatic data synchronization between servers across the globe to save time and ensure the smooth transfer of massive amounts of data.

EB’s added value

This highly integrated approach has increased efficiencies and resulted in significant cost savings for OEMs.

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EB goes the extra mile for new EV automaker WM Motor

The challenge

About six years ago, Weltmeister (WM) Motor was seeking a basic software development and integration partner for its first smart and fully electric SUV – the EX5.

Constraints:

- WM Motor's project schedule was extremely compressed, and because the EX5 is its first mass production model, the scope and requirements of the project were very commanding

The solution

EB developed and integrated basic software for most of the ECUs associated with the vehicle's CAN and LIN communication, supporting diagnostics, and AUTOSAR network management.

In addition, EB supplied an OSEK Bootloader to support the over-the-air (OTA) updates, which was designed at the very beginning, of the EX5.

Benefits:

- By utilizing some of the EB tresos product line features, EB provided WM Motor with safe and reliable mass-production-ready software, and customization of basic software applicable to WM Motor's specific requirements

WELTMEISTER
威马汽车

EB's added value

EB was flexible and able to meet WM Motor's evolving needs. These included working closely with Tier 1 suppliers involved in the project, creating documentation, user manuals and training materials, and eagerly helped to troubleshoot and solve any potential problems to ensure that the EX5 becomes production-ready.

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EB chosen as partner by Baidu to enable safe autonomous driving for Apollo

The challenge

The Apollo Computing Unit (ACU), an autonomous driving in-vehicle computing platform for mass production, is one of the most important products of Baidu Apollo.

Constraints:

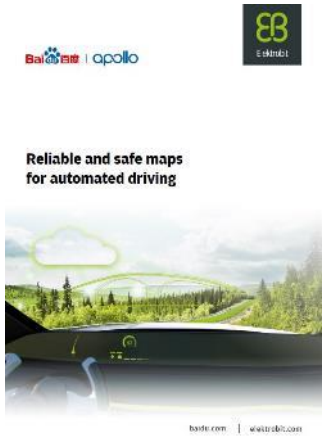
- Baidu Apollo is looking for a partner whose capable to provide automotive infrastructure software which adhers to the highest quality and safety standards for the Baidu ACU-Advanced Automated Valet Parking project

The solution

EB provided EB tresos automotive basic software products to the Baidu ACU-Advanced Automated Valet Parking project.

Benefits:

- EB tresos enables the development of AUTOSAR standard-compliant software for automotive electronic control units (ECUs) with the highest levels of functional safety, up to ISO 26262 ASIL D



EB and Baidu Apollo joint whitepaper

EB’s added value

EB’s industry-leading software will allow car manufacturers and suppliers using ACU to expedite the market introduction of safe systems for Automated Valet Parking. EB is an important strategic partner and plays an integral role in Baidu Apollo’s ongoing efforts to accelerate the intelligent transformation of the automotive industry.

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AUTOSAR Adaptive: Where HPC Meets Automotive - EB corbos

Elektrobit

Agenda

- EB Classic AutoSAR Solution
- The EB corbos product line
- EB corbos Studio
- EB corbos AdaptiveCore
- EB corbos Linux
- EB corbos Hypervisor
- EB core
- EB software architecture on S32G

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EB Classic AutoSAR Solution

Elektrobit

About AUTOSAR (**AUT**omotive **O**pen **S**ystem **AR**chitecture)

Main goal

- Standardized layer between application software and the hardware of an electronic control unit (ECU).

Benefit

- Software is largely independent from any chosen microcontroller and OEM, making it reusable for several individual ECU systems.

AUTOSAR consortium

- EB is one of the founding members and an active premium partner.

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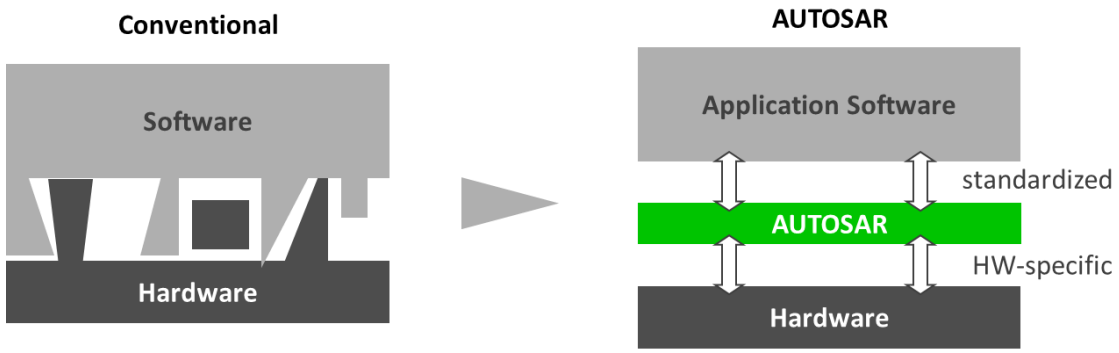
Software architecture of real-time ECUs

AUTOSAR is designed for real-time ECUs, which

- Closely interact with hardware (e. g. sensors, actuators)
- Are connected to the in-vehicle network (e. g. CAN, Ethernet)
- Are based on uCs with limited resources (e. g. computing power, memory, ..)



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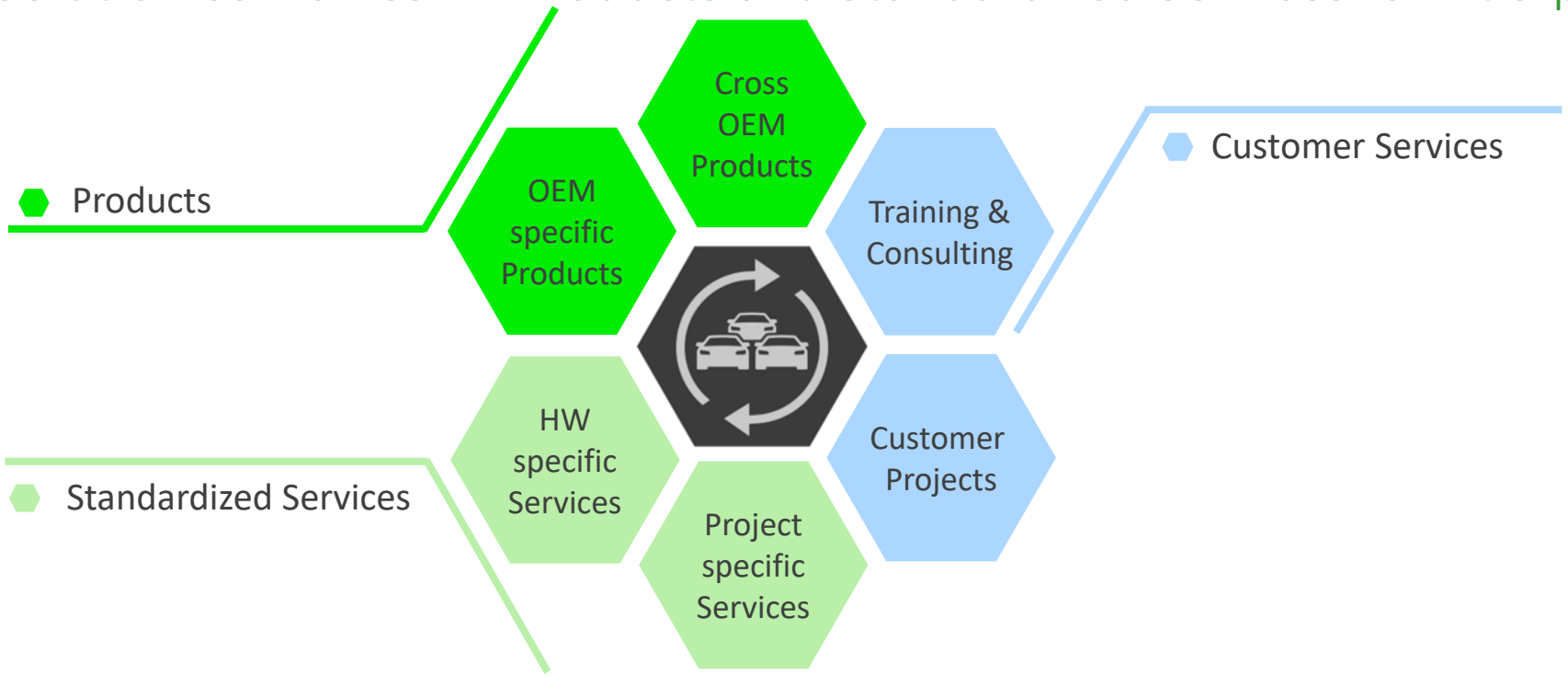
EB tresos Solution Overview

To meet dedicated OEM platform needs and individual Tier1 life cycles
the EB tresos Solution combines EB Products and Standardized Services for ECU projects.



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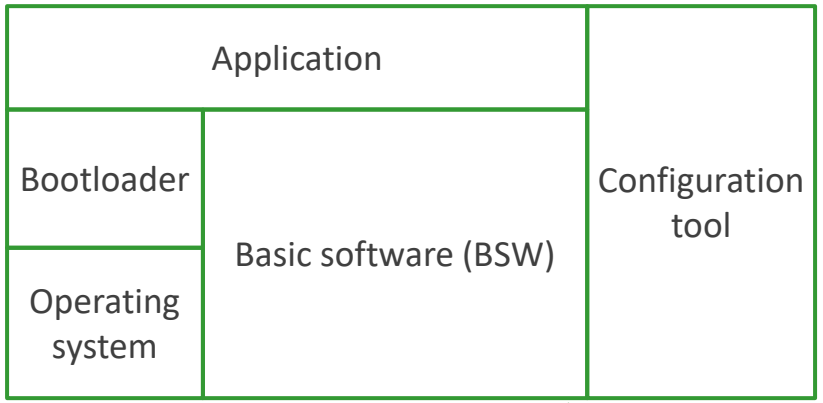
EB's Classic AUTOSAR product line in a nutshell



EB tresos Bootloader
Update of the application software according to OEM-specific requirements

EB tresos AutoCore OS
Single-core and multi-core real-time operating system

EB tresos Safety OS
Robust and protected single-core and multi-core safety operating system

EB tresos AutoCore
Implementation of AUTOSAR-compliant basic software for automotive ECUs

EB tresos WinCore
Windows-based AutoCore platform

EB tresos OsekCore
OSEK-/VDX-compliant ECU

EB tresos Safety
Safety products based on the ISO 26262 and IEC 61508 standards, up to ASIL D/SIL3

EB tresos Studio
ECU basic software configuration and integration in one single environment

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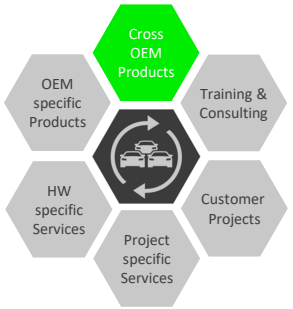
Cross OEM Products



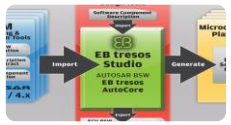
The basis of all our offerings

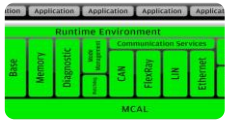
We provide efficient and scalable products for ECU projects

Cross OEM Products

- Tools
- Target SW

EB tresos Studio
- Single configurator for all BSW
- AUTOSAR standard compliant
- Interoperability and flexibility





EB tresos AutoCore Generic
AUTOSAR 4
- All stacks available
- Ethernet & Efficient COM

EB tresos Safety Components
- E2E, TimeE, Rte, OS
- Freedom from Interference
- ASIL D & SIL 3 certified

EB tresos AutoCore OS & MCAL
- Single- and Multi-core OS
- MCALs for communication stack
- 3rd Party MCALs

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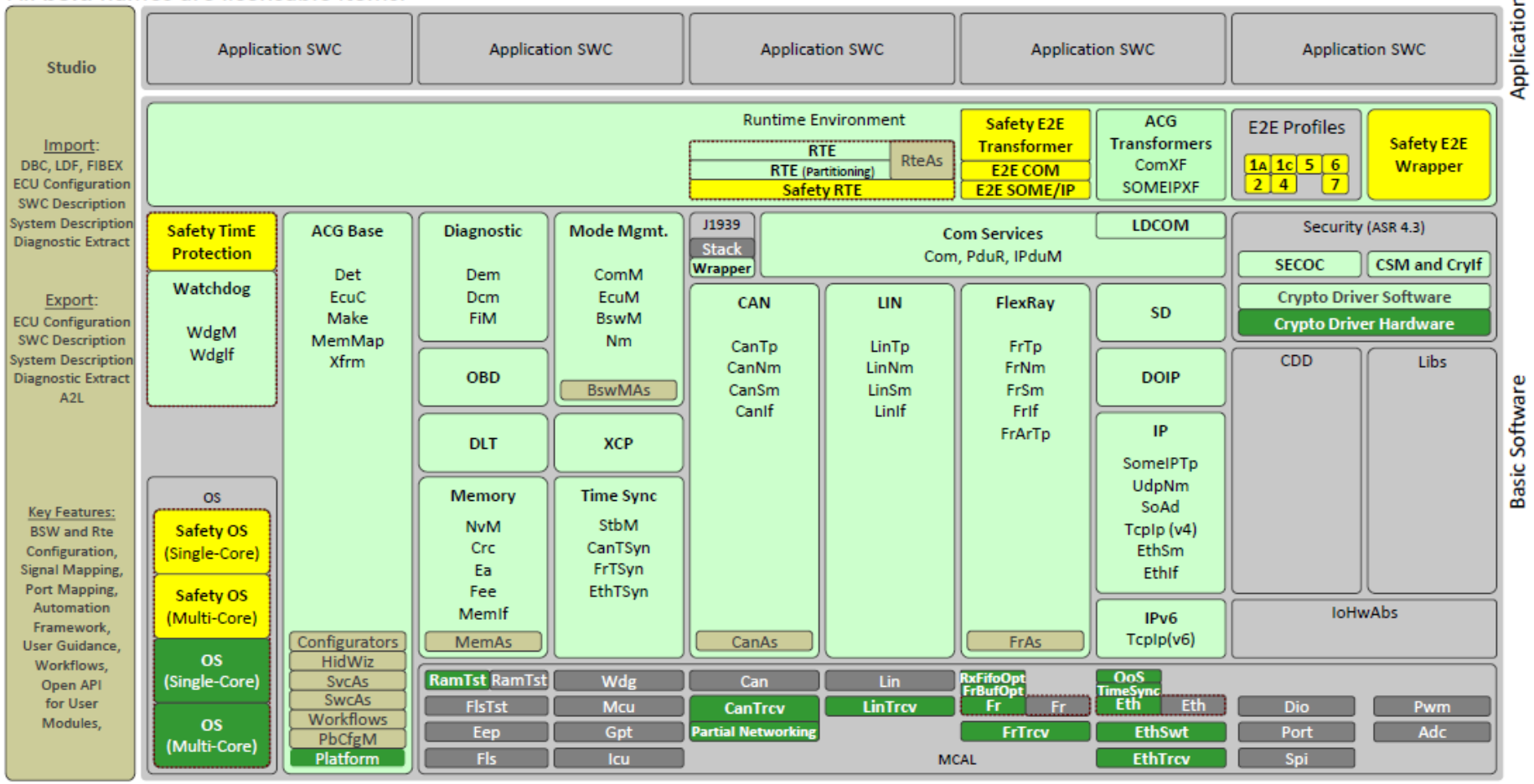
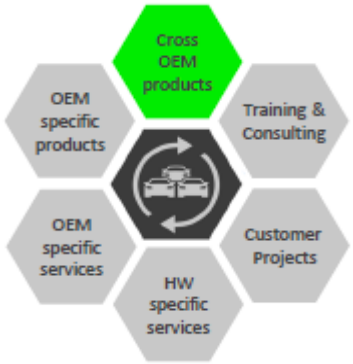
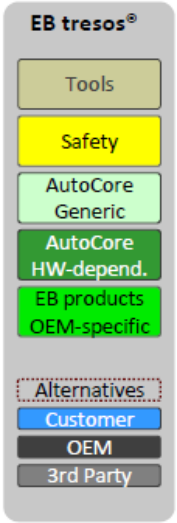
Classic Autosar Architecture

based on EB tresos AutoCore8

All **bold** names are licensable items.







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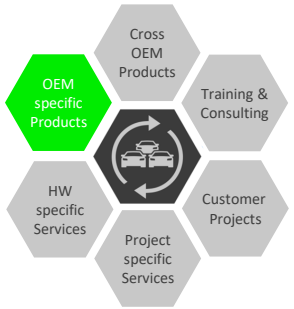
OEM specific Products



Achieving OEM specific needs

We implement car manufacturers' software requirements that are not covered by AUTOSAR.

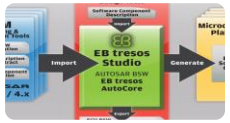
OEM specific Products

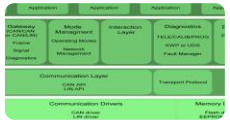
Tools

Target SW

Tools for OEM

- Tooling add-ons which are needed for specific OEMs but are not covered in the standard product





Modules for OEM

- Covering OEM requirements which are not covered by AUTOSAR
- E.g. for VWAG, Volvo, Audi, …

EB tresos Bootloader

- OEM specific bootloaders / -updaters
- Update & secure OTA infrastructure
- Supporting AUTOSAR

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EB is a trusted industry partner

	SP2021	Star3	Multiple Platforms	P33a/[SUV]	NEA2020	SPA	D8u	Global B	Atlantis	19PF	FNOS	
ACG8 (Tool+BSW)												Cross-OEM products
Safety E2E												
Safety TimE												
Safety Rte												
Operating system												
Tools for OEM												OEM-specific products
Modules for OEM[1]	V: OEM	V: OEM	V: EB/OEM	V: OEM	V: EB	V: EB	V: EB	V:EB	V: EB	V: EB	V: EB	
Bootloader												
HW-specific services												
SU Application												Project-spec. services
SU Bootloader												

1) Modules provided by vendor (V:) , i.e., OEM, EB, or third party, EB provides license for integrated modules into EB tresos Studio

In development | EB license | EB service | OEM provision

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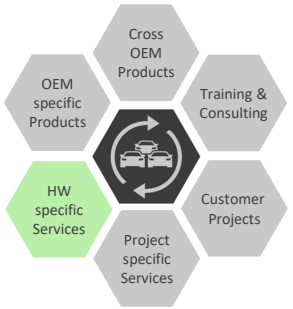
HW specific Services



Standard service packages for specific microcontroller platforms

HW specific Services

IP

Integration Package
- Integration of 3rd party modules (e.g. MCALs) into EB tresos framework

QP

Qualification Package
- Execution of EB module tests and integration tests on a dedicated uC (including MCALs)

Porting

Porting
- Porting of hw-dependent EB products (OS, ACM..) to dedicated uC platforms

A modular integration and test strategy

Our approach to reach quality goals in customer projects efficiently. Therefore we offer standardized packages for different integration and test scopes (uC and OEM specific) which fit seamless into the integration & test strategies of our customers.

- Tests on „Module Level“ / „Stack Level“
  - >14k Tests performed for each ACG releases
  - Tests are re-performed for releases on a dedicated platform (depending on the ordered packages)
- Analysis of Compiler warnings
- Static code analysis for the Product releases
  - Static Polyspace analysis – to detect violations of MISRA guidelines
  - HIS code complexity metrics – to reduce code complexity and improve testability
  - Bounds checking GCC – arrays are instrumented to detect buffer overruns
  - Dynamic Polyspace analysis – to analyze the code regarding specific classes of errors
- Verification criteria depending on quality level of the releases (E.g.: “RfM”)
- Quality metrics and test results reviewed before each release (Q-Record) and document within Q-statement

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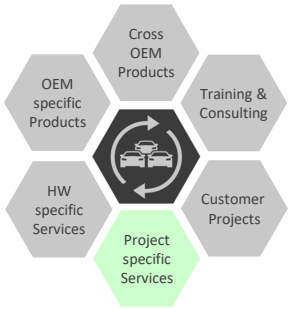
Project specific services



Tailor-made services for each use case

Project specific Services

- **Startup**
  - Startup Package
    - Integration and pre-configuration considering project-specific input
- **Update**
  - Update Package
    - Update of Project Integration Package considering newer versions

We put our customers in a position to set up and run ECU projects for all leading car manufacturers

Providing a pre-integration for an easy project start, based on:

- EB Products and Services (BSW, uC specific SW and <OEM> BSW) integrated with project-specific EcuExtract and application stubs on a dedicated HW (Eval board or project hardware)
- Containing generic start-up concepts / Diagnostic / Communication based on AUTOSAR
- Compile tests to detect incompatibilities of OEM's provision for the target platform
- Pre-Integration of an Application and a Bootloader based on Project specific extracts
- Automatic configuration checks
- Perform Acceptance tests based on
  - OEM specific Test-Suite (according to availability)
  - EB developed Test-Suite (e.g. EB tresos ITA)

1) OEM approval/acceptance tests are already included in Cross-OEM product license (for available EB tresos Solution platforms)

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Localization Plan for Classic AUTOSAR Platform Service

Platform Service:

- OS porting
- OS qualification & safety approval
- ACM platform porting and integration
- ACM Qualification
- MCAL integration
- Bootloader development
- OEM Specific module development

Employees

More than 3400 employees* worldwide.
Spans three continents and eleven countries.

Global presence

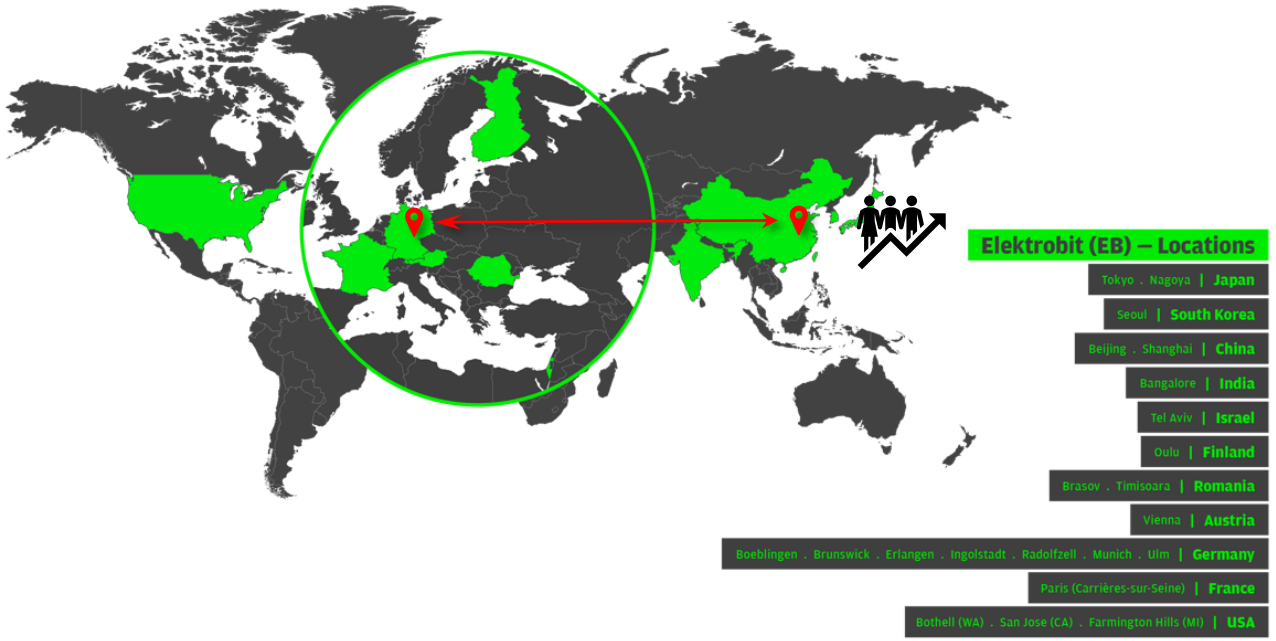
Development and business offices in Austria, China, Finland, France, Germany, India, Israel, Japan, Romania and USA.

Bootloader development

ACM platform porting and integration

OS Porting
MCAL integration
OEM Specific module development for local OEM

ACM Qualification
OS qualification & safety approval



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Classic AutoSAR Platform Support

Current:

- ACM Platform Integration
- Support for EB AUTOSAR BSW configuration
  - CAN/LIN/FlexRay/Ethernet stack
  - Safety TimE Protection/Safety OS (Single/Multi-Core)/Safety RTE/Safety E2E
  - Time Sync/LDCOM/Mode Management/XCP…etc
- Support for SWC- and CDD- Integration
- Support for OEM specific modules
  - OEM specific Modules: Covering OEM requirements red by AUTOSAR
  - OEM specific Modules: Local OEM Specific requirements analysis
- Bootloader
  - Support for Bootloader integration
  - explain the bootloader's download mechanism
  - Bootloader development
- Issue analysis
- Q&A on generic AUTOSAR topics
- Q&A on EB products

Ongoing:

- OEM specific modules development for local OEM
- ACM platform/OS porting
- MCAL integration
- ACM qualification
- OS qualification & safety approval

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The EB corbos product line

Elektrobit

EB corbos

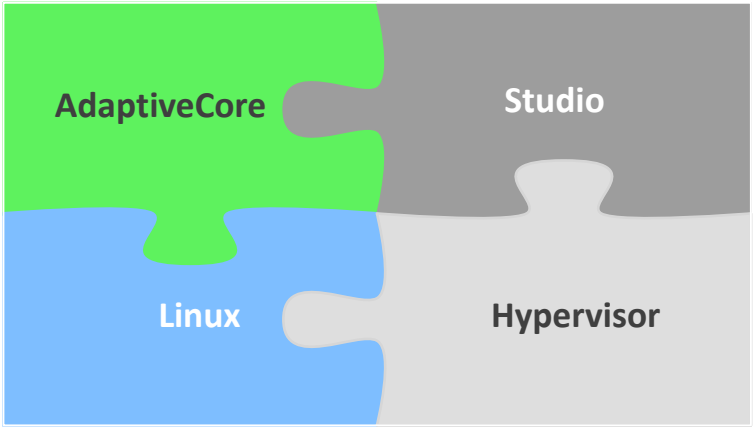
A product line bringing AUTOSAR Adaptive on the road

Content Information

- EB corbos
  - EB corbos Hypervisor
  - EB corbos Linux
  - EB corbos AdaptiveCore
  - EB corbos Studio
- Build environment and access to source code included
- Reference applications based on AUTOSAR Adaptive

Supported Platform

- Lead platforms
  - EB corbos: Renesas R-Car M3 & H3
- Supported platforms
  - EB corbos: NXP S32G
  - Intel Denverton only EB corbos Linux
- Further portings on request
  - Please inquire



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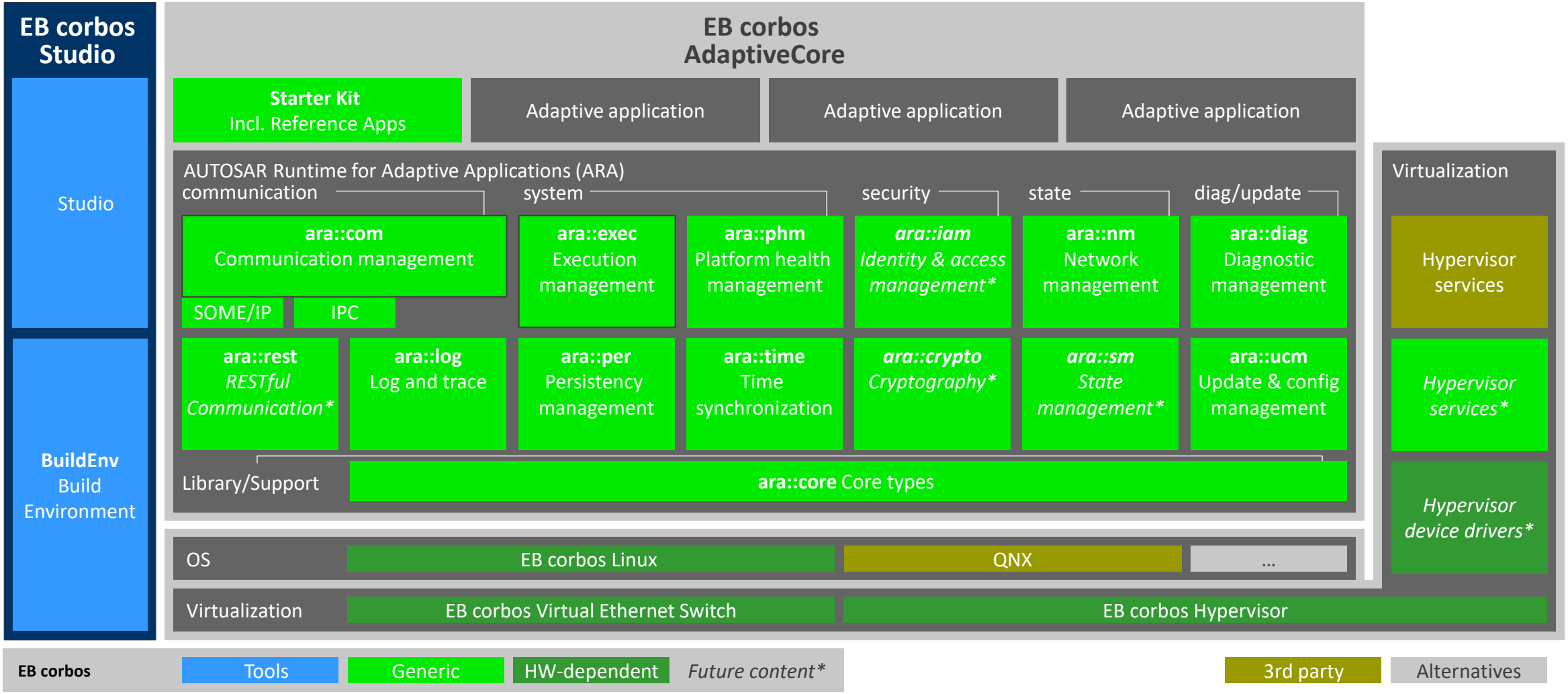
EB corbos



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EB corbos Studio

Elektrobit

EB corbos Studio

Objective

EB corbos Studio is an integrated development environment for EB corbos products.

EB corbos Studio supports:

- **Application Development**

  Develop applications according the AUTOSAR Adaptive Platform.

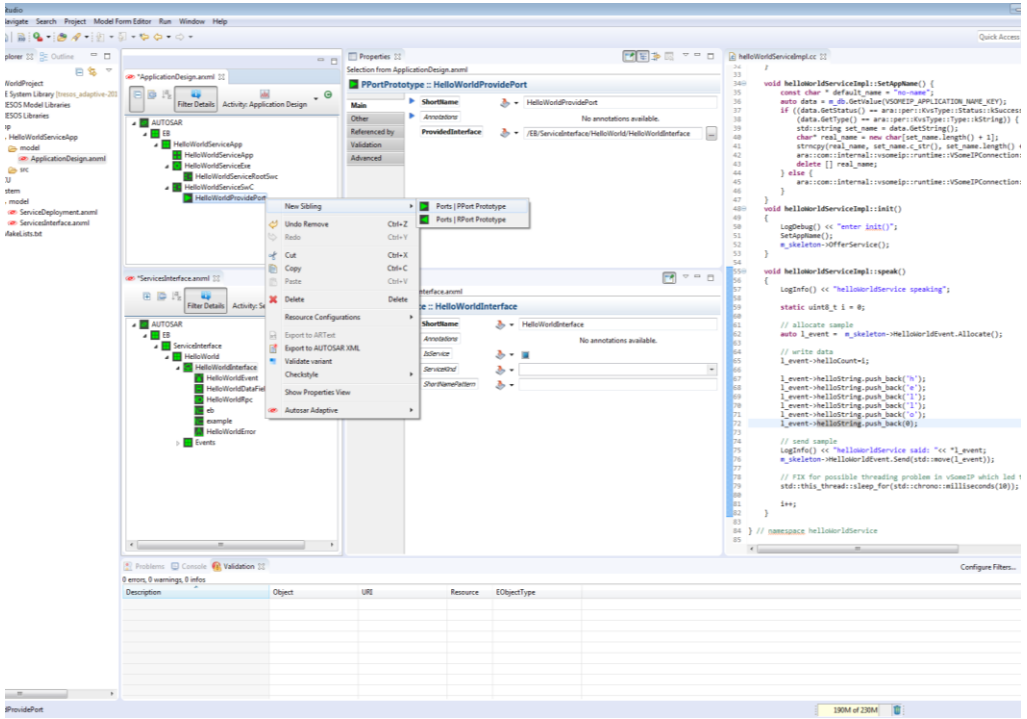
- **Integration**

  Integrate Software Components with EB corbos AdaptiveCore and other products of the EB corbos product line.

Supported meta models:
AUTOSAR adaptive R19-03 specification

Functionality provided in EB corbos AdaptiveCore

- Meta Model R19-03 support
- UI improvements
- Maintenance Updates



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EB corbos AdaptiveCore

Elektrobit

BuildEnv and Starter Kit

Objective

BuildEnv enables application and platform module development and integration according to AUTOSAR Adaptive Platform.

Supports command-line usage and usage via EB corbos Studio GUI.

Based on:

AUTOSAR adaptive R19-03 specification

Functionality provided in EB corbos AdaptiveCore 2

- Enablement for QNX build target
- Application development
  - Build, deploy, test and debug in target.
- Platform develpoment
  - Build, integrate and deploy to target.
- Execute code generators
- Build EB corbos Linux images
  - Add custom layers
  - Build YoctoSDK
- EB corbos Starter Kit 2
  - RefApps for
    - ara::com events,methods,bitfields
    - ara::time time synchronization between applications

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EB corbos Linux

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Linux for vehicle server ECUs

The car of tomorrow becomes a smart device

Linux is everywhere

DFS Deutsche Flugsicherung

NYSE

esa

DEUTSCHE BÖRSE CLOUD EXCHANGE

Connected security built-in: Whole internet runs on Linux from Cloud to Smartphone

The strength of Linux

- **Core community values**: **Security** **Efficiency**
- **Innovation power**
  - In 8 weeks of development for Linux kernel v4.19:

    Linux is highly professional and improving constantly
    - 80% contributors from big players: Google, Microsoft, Intel, Red Hat, IBM, SUSE, Renesas, ARM, Oracle, NXP, Facebook, etc…
    - 1,710 different contributors, 253 first-time, 307,000 lines added
- **Short time-to-market**
  - Academic R&D development frequently on Linux desktop distributions
  - Fast prototyping due to availability of trained professionals and well-known technology

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EB Linux: the safe and secure OS for car makers

- For the vehicle
  - Configured for the car
  - Available for the vehicle lifecycle
    - Concept, development, operation
- Secure
  - Configured for security
  - Security maintained for the full vehicle lifecycle
  - 21434 compliance

- For the OEM
  - Accelerate Time to market
  - Familiar Developer experience
  - respect OEM IP
  - ASPICE, requirements tracing, POSIX
- Safe
  - (A)SIL evidences and safety concept
  - 26262/61508

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EB corbos Linux

Automotive tailored and container based Linux platform

EB corbos Linux

- Designed with security as priority
- Leverage full HCP hardware performance, real time capable
- Long-term automotive lifecycle operations
  - Security maintenance
  - Option for new features in the field
- Functional Safety
- Based on well-proven implementations, open source

EB corbos Linux is optimized for the automotive use case.

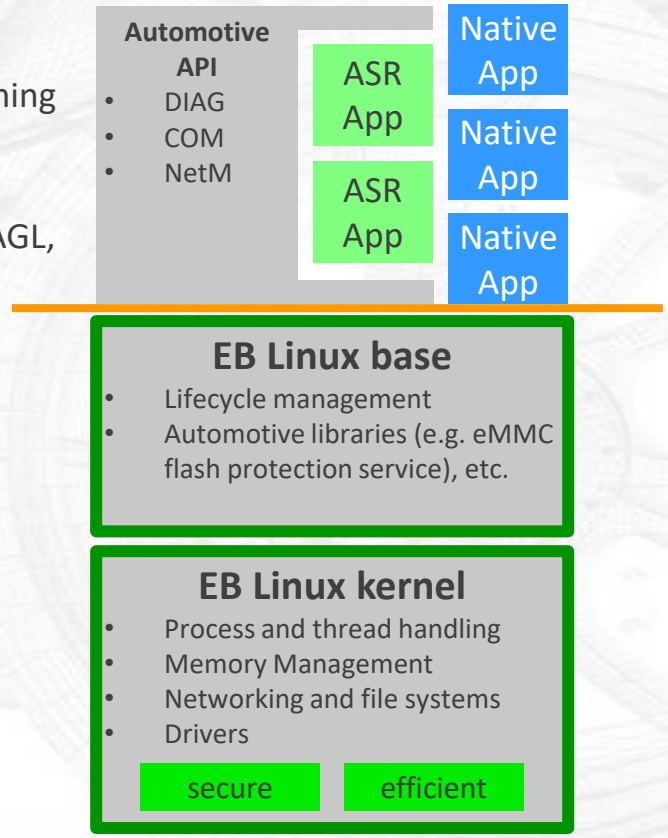
	EB corbos Linux	Enterprise | Desktop Linux
Number of packages	150 debug, <50 for production	3.500 – 50.000
Maintainability	Complete decoupling of base OS from application	Tight coupling, upgrades risky, application rework needed
Security over car lifetime	Proactive security maintenance, upgrade strategy	Typical car life cycle not covered
Functional Safety	Available (selected Hardware)	Not available

Applications
Sensor fusion, cruise control, anything

Automotive grade APIs
Adaptive AUTOSAR, Java, GENIVI, AGL, OpenCL, etc.

System Management
start/stop/suspend/OTA
container management

POSIX runtime
filesystems, processes, network, real-time



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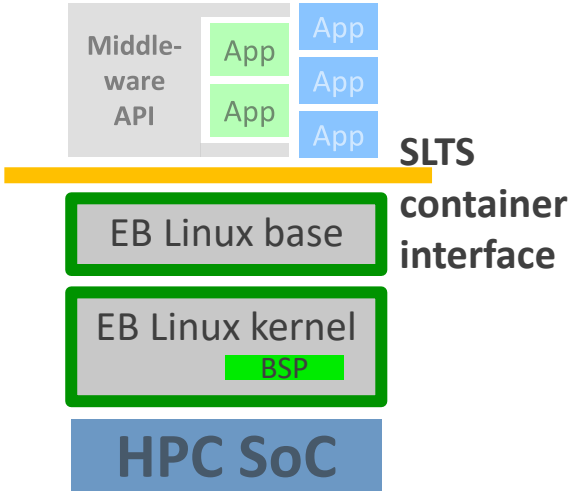
EB Linux: Technology for the car

Feature set

- (A)SIL functional safety enabled
- Real time
- Security & isolation
- Fast boot
- flash protection
- secure boot
- A/B update
- End to end protection (TLS/dTLS)
- Firewall
- SLTS enablement

On board



Off board

- Smooth developer experience
  - simple git access
  - debugging and performance tuning tools
  - standard experience (like yocto)

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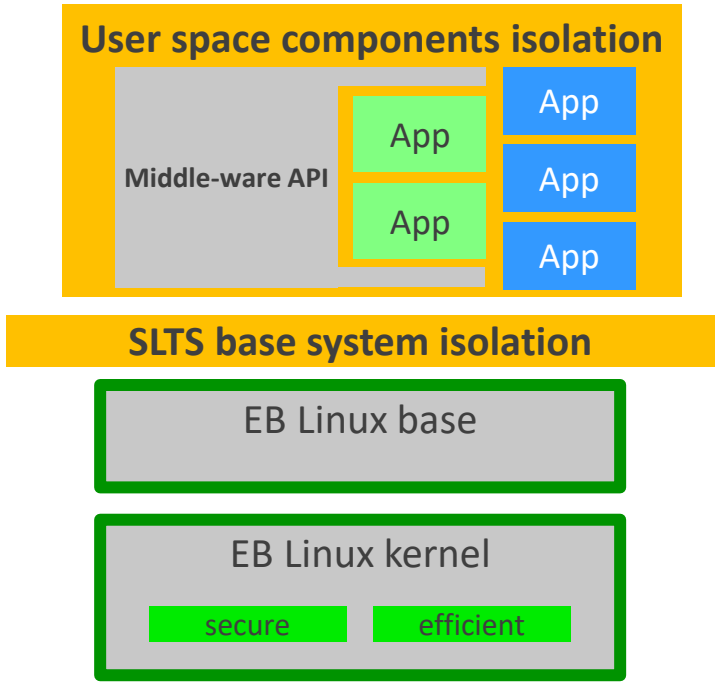
Our Partners and Cooperations

EB corbos Linux: container based

Key to efficient yet secure long term security

Containers details

- Strictly confined at all levels
  - RAM, CPU, disk, network
    (Linux namespaces, individual r/w micro-partitions, containers proper are r/o)
  - Shared resources possible
- Tamper proof
  - Verified on disk format, r/m partition
  - Individual persistent storage on r/w partition
- Independently updatable
  - No file level unpacking -> MMC flash protection
  - Atomic updates (no overwriting, A/B enabled)
- Backwards compatible on EB Linux for the full vehicle lifespan



Containers isolate

- User space from base system
- User space components from each other

Container isolation

- Enables Base system upgrades in 6 and 12 years
- Simplifies addition of functionality post SOP

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EB Linux Quality

- POC (proof of concept)
  - validates the feasibility of technologies and gives insight into the actual effort to possibly provide the technology as part of the product.
- RFP (Ready for Prototype)
  - code stream delivers beta quality technology, it receives regular feature additions and bug fixes.
- RFD (Ready for development)
  - code stream is only available to large development projects aiming at a custome Tier 1 / OEM board/ECU. RFD code is considered mostly feature complete. The priority are non-breaking changes only, and a focus on bug fixes and maturity.
- RFM (Ready for Manufacturing)
  - code stream is made available to manufacturing projects that approach homologation. It is free from blocker bugs and matches the quality requirements of all OEM/Tier1 projects it is provided to. Security maintenance is available and recommended for RFM code streams.

Quality statement

Purpose

The purpose of this quality statement is to document the quality level of the corresponding release. The quality level indicates the proper range of application this release is intended for.

References

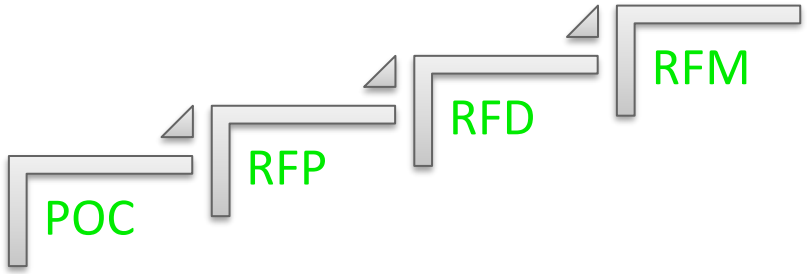
Reference ID	Version / Date	Title
Quality Level documentation	0.3 / 11.06.2019	Quality Level Documentation for EB corbos Linux

Release Information

Release full name	EB corbos Linux 1.8
Target hardware	QEMU_x86, Renesas M3, Intel Denverton
Release date	18.07.2019
Unique identifier of the release	EB corbos - EB corbos Linux - 1.8 - Qemu_x86 & M3

Release content

Content Name	Version	SEooC
EB corbos Linux	1.8	no



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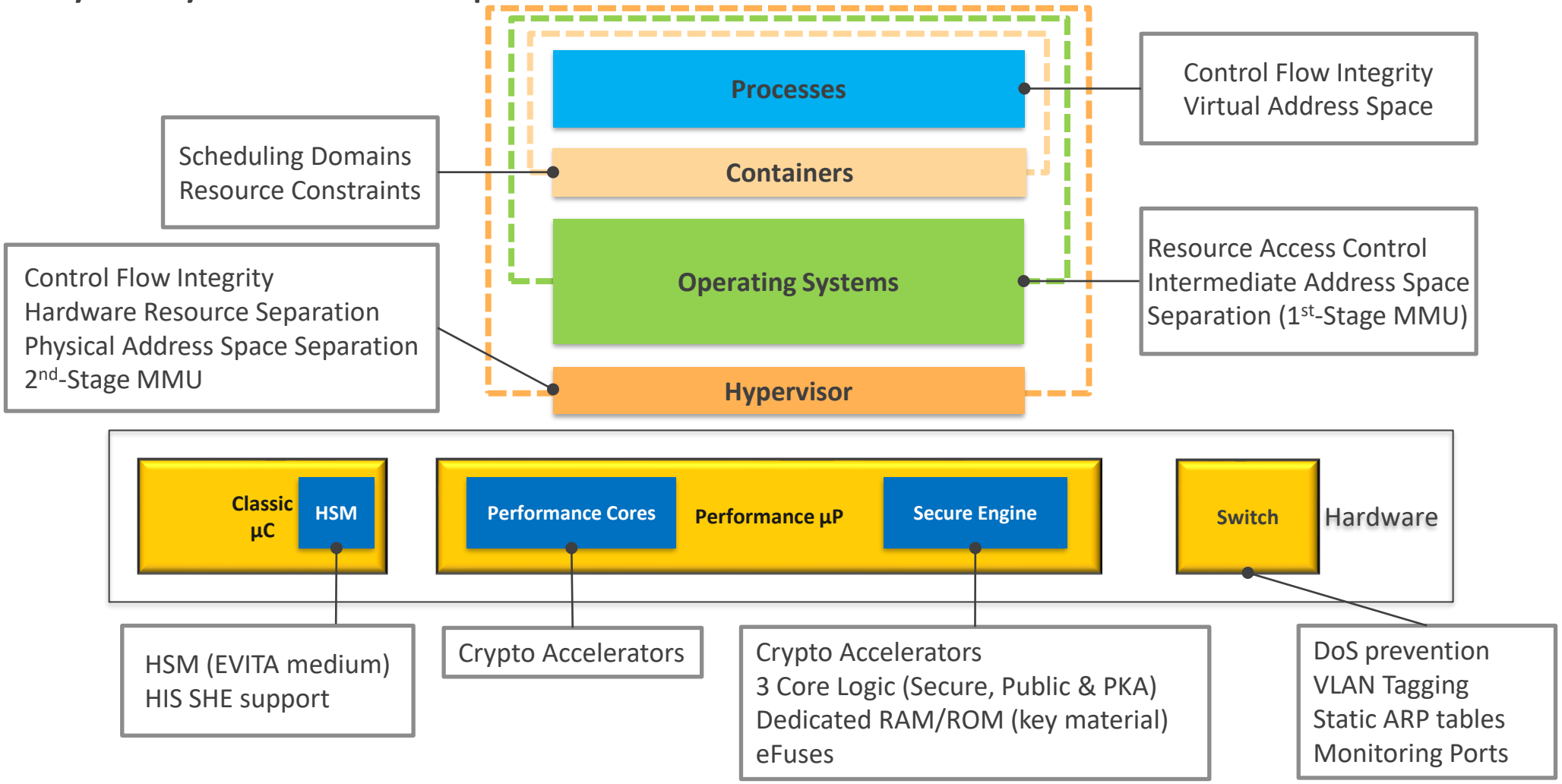
Security Layer Concept



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Basic platform security

Secure boot

Chain of trust ensures authenticity & integrity

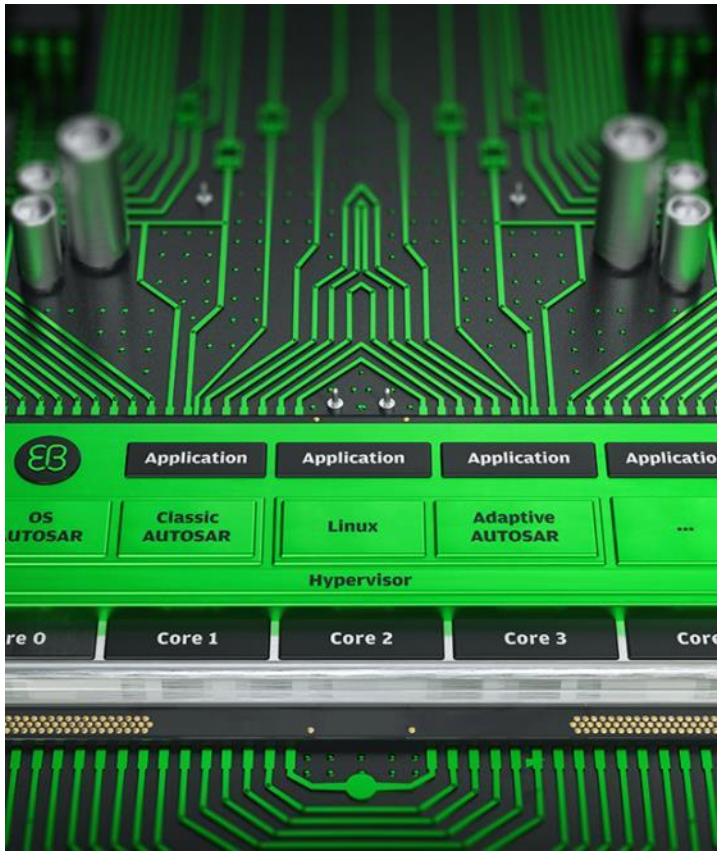
Hardware root key (eFuse) → Verify → Bootloader I → Verify → Bootloader II → Verify → ...

Secure boot features
- Roll-back protection
- Revocation

ASLR

Address space layout randomization
- Makes exploitation of vulnerabilities harder
- performance neutral

Application Load Cycles n n+1 n+2



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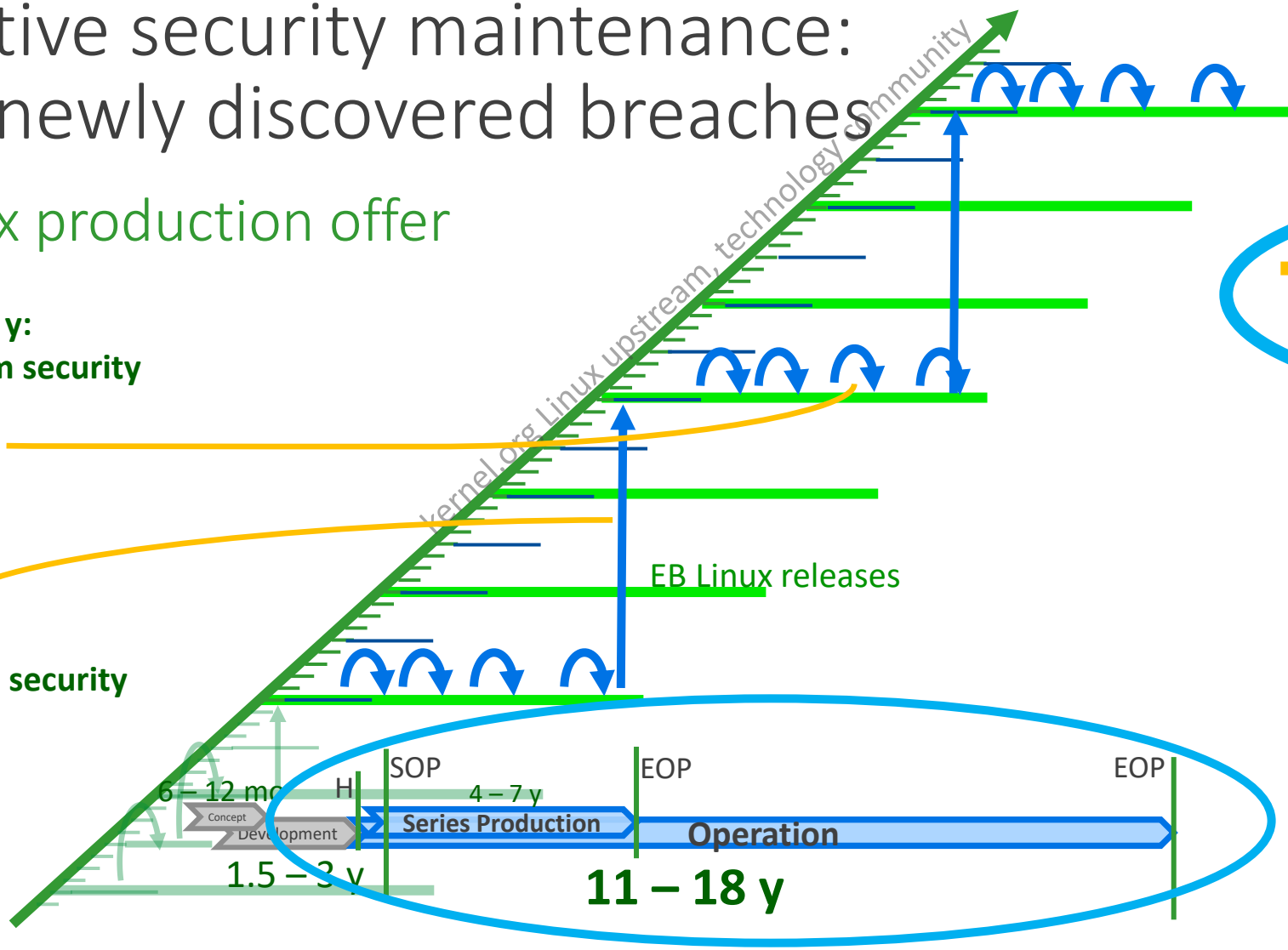
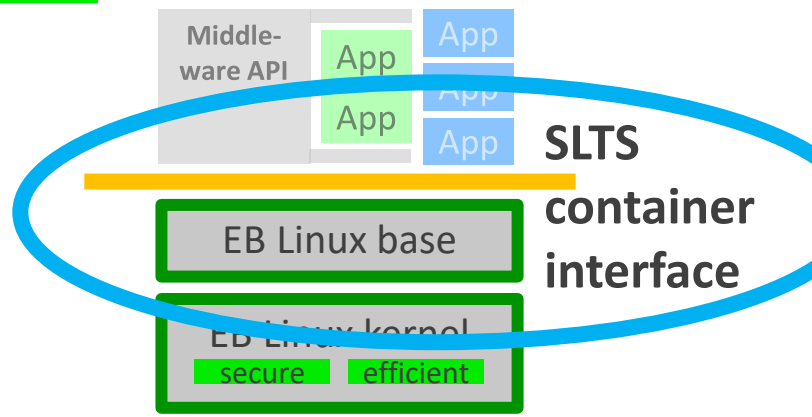
Proactive security maintenance: close newly discovered breaches

EB Linux production offer

For 6 + 1 y:
long term security updates

Up to 18y:
super long term security upgrades





SLTS container interface

- selected subset of the binary compatible Linux kernel system calls
- stable container set up description
- compatible with all future EB Linux releases
- seamless upgrades

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EB corbos Hypervisor

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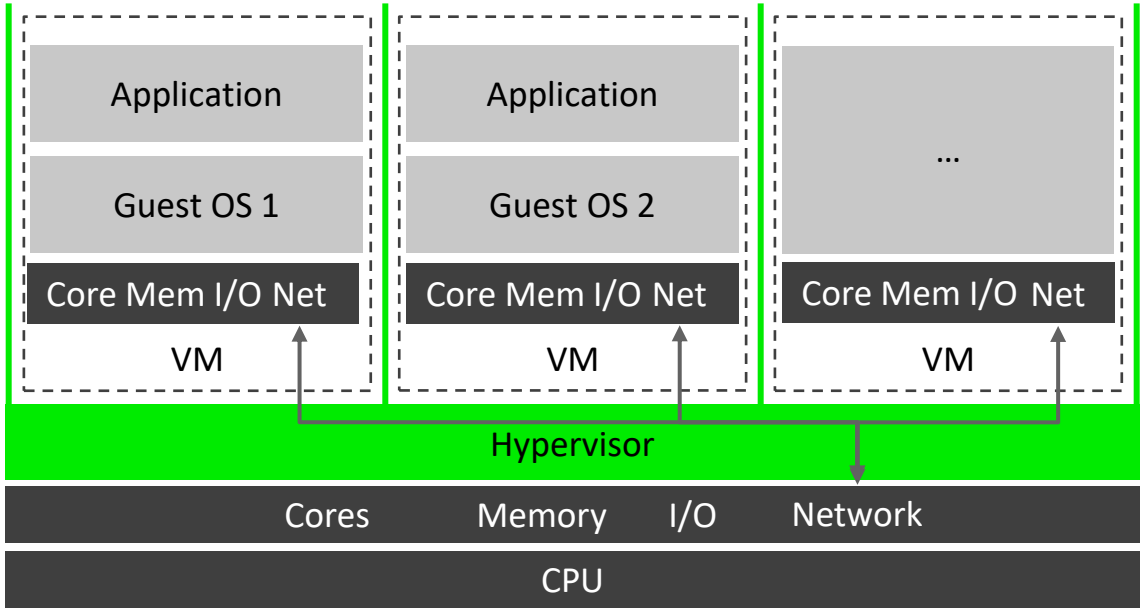
EB corbos Hypervisor



The EB corbos Hypervisor

- creates and executes virtual machines (VMs) for multiple guest OS or native applications
- uses hardware virtualization features of the CPU
- offers communication services for inter-VM communication
- ensures spatial and temporal isolation between virtual machines

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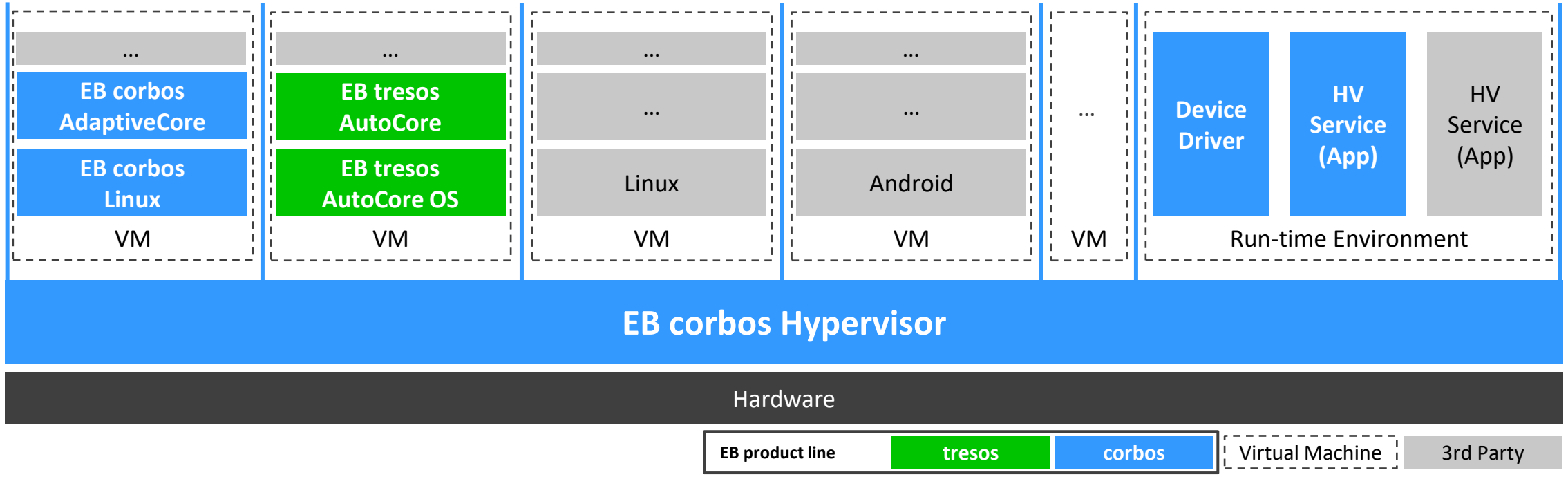
EB corbos Hypervisor - Architecture



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EB corbos Hypervisor components - Overview

Microkernel[1]

- Small embedded type-1 hypervisor
- Provides spatial and temporal isolation
- Supports virtual machines and native L4Re applications
- Hardware-assisted virtualization and para-virtualization

Runtime Environment[1]

- User-level environment
- Low-level OS services (memory management, program loading, IO abstraction)
- Libraries: C library, C++ library, pthreads
- POSIX-based programming/runtime environment.

[1]) Based on L4Re from KERNKONZEPT

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Microkernel

General Features

- Support for
  - ARM-v7 (32Bit) and ARM-v8 (64Bit)
  - Intel IA32 (32 and 64 Bit)
- Virtual machines using hardware virtualization
  - ARM VE
  - Intel VT-x
- Real-time capability
- Multiple OS on one CPU core (scheduling)
- High-performance inter-VM communication
- Native applications on top of microkernel
- Virtual networking between VMs
- ASIL-D on separation (freedom from interference)

Security Features

- Capability model providing access control to kernel objects
- Protection against side-channel attacks possible (cache flushing etc.)
- Support for firewall architectures

Infotainment Features

- GPU virtualization possible
  - Via OpenGL multiplexing
  - Via native virtualizing drivers (from GPU vendor)
- Peripheral virtualization
- Support for proprietary OSes

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EB core

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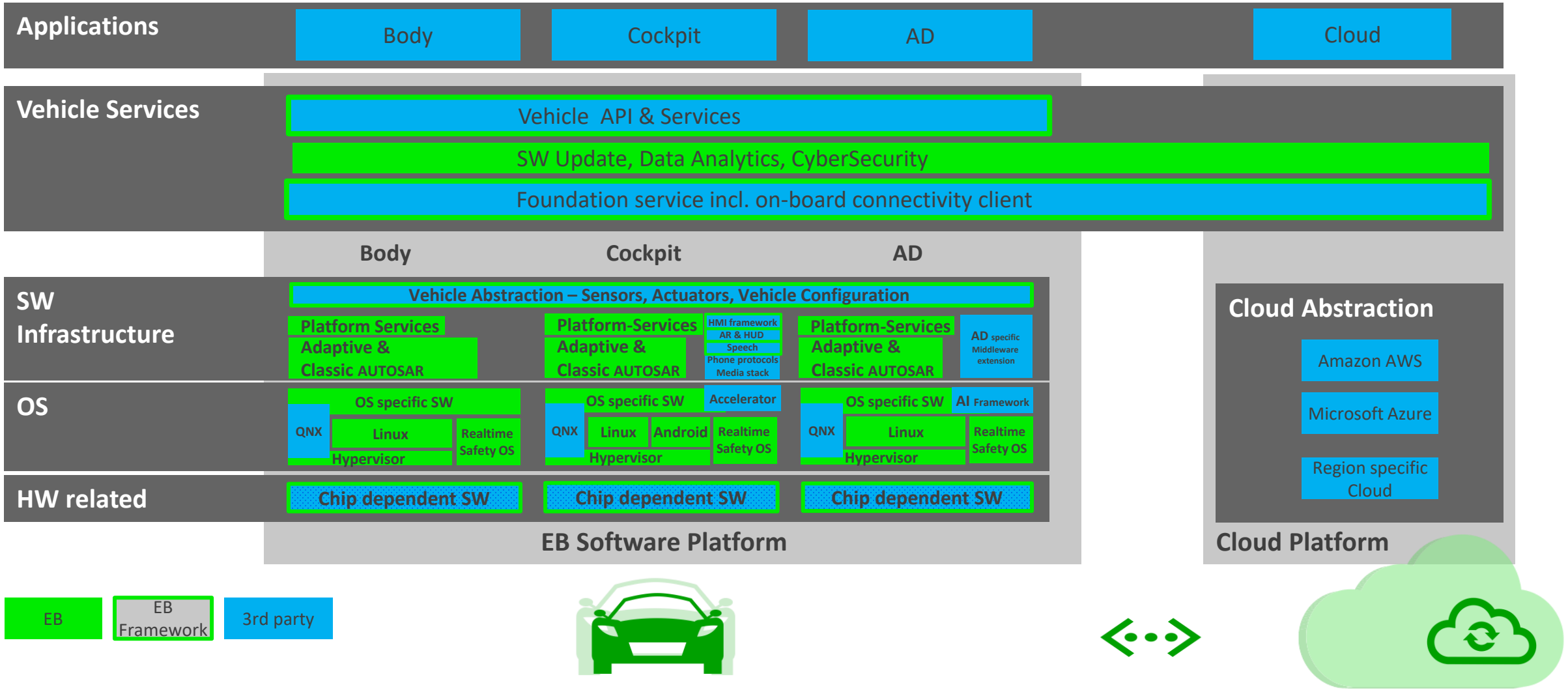
EB Software Platform



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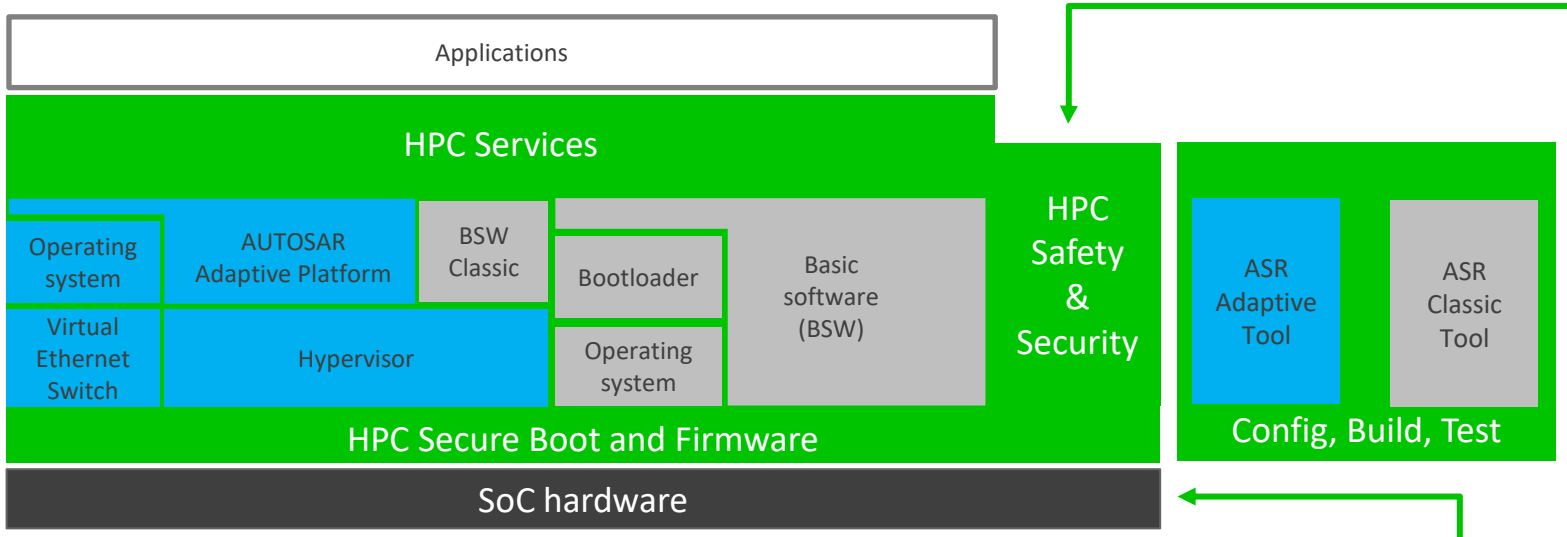
Software Platform EB core - Vision

Safe and Secure Middleware for High Performance Computer



HPC Safety and Security concept utilizing SoC hardware features

Common configuration concept for HPCs
Common Build and Test Environment for HPCs

Ported, Integrated and tested on selected SoC eval boards

HPC system startup and integration of tresos and corbos
Firmware to support SoC features

Software modules and system configurations to fulfil High Performance Computer requirements
Platform Health Management, Suspend to Ram, Power Managment
Software Flashing for all HPC software parts and applications
Reference Applications for HPC use cases of corbos and tresos

EB core | EB corbos | EB tresos

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NXP S32G SW Architecture

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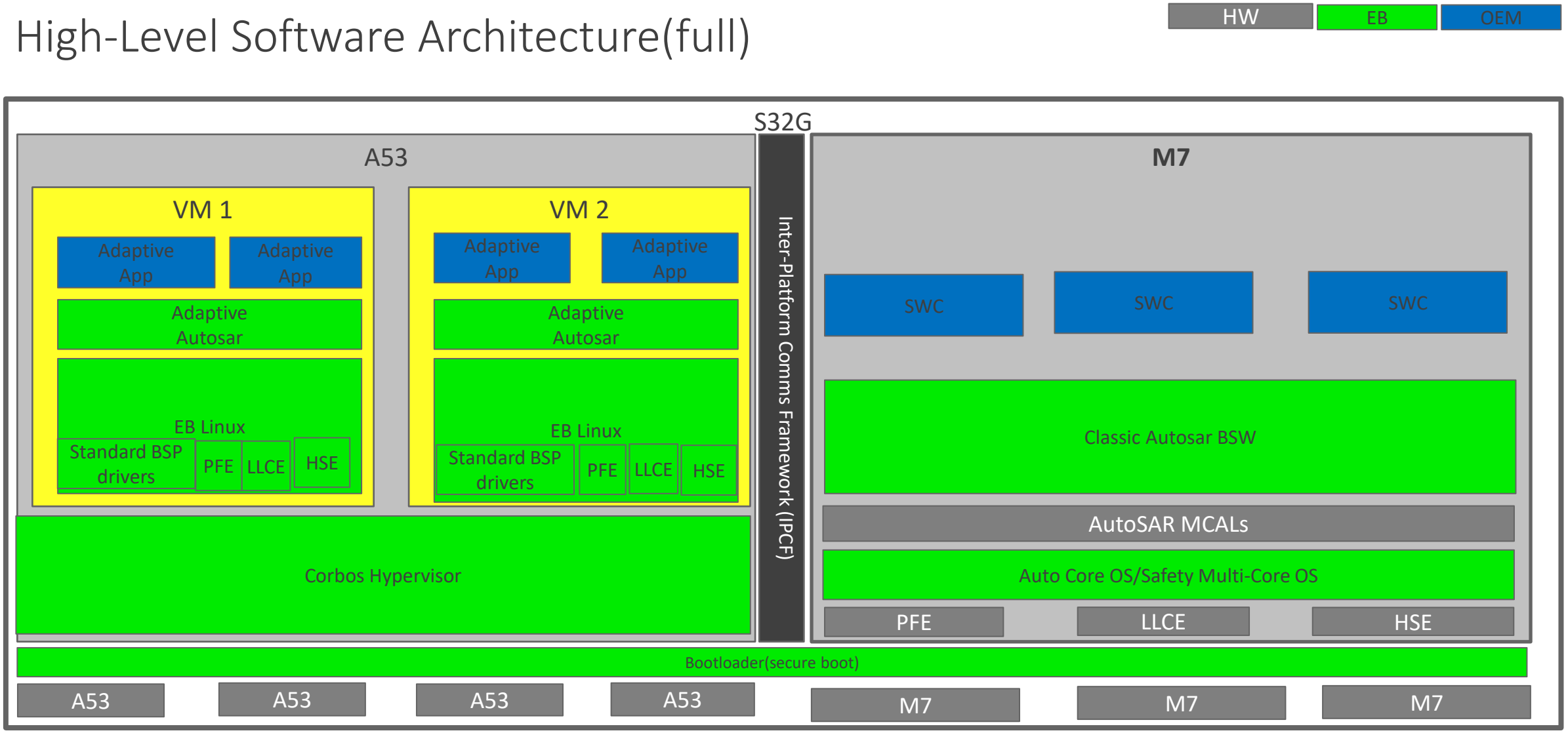
High-Level Software Architecture(full)



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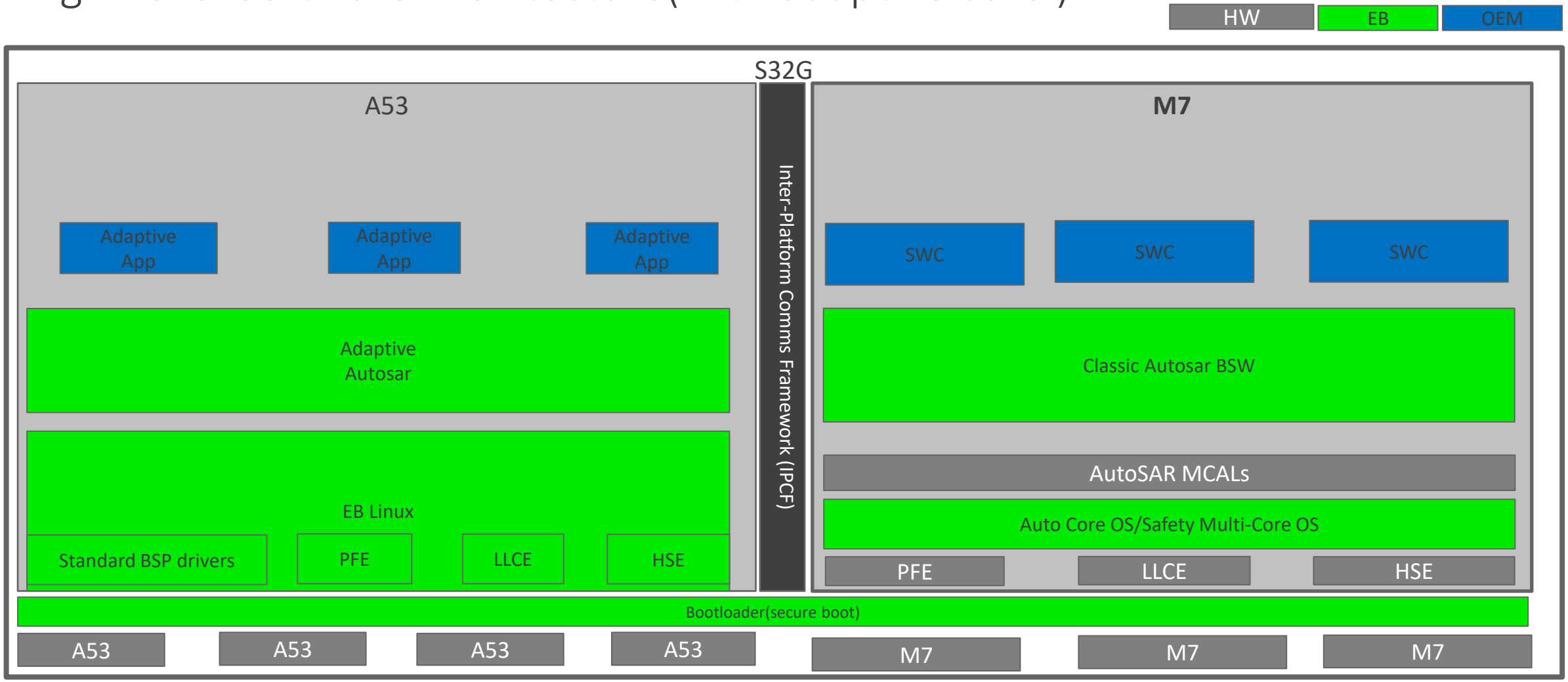
High-Level Software Architecture(with adaptive core)



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[1] Subject to change

Timeline EB core NXP S32G POC[1] Product deliveries

V 0.1

Cortex-M7

- EB tresos AutoCore OS
- EB tresos AutoCore ACG/ACM
- EB tresos Virtual Eth driver

Remarks

- EB tresos DevDrop was delivered

CW 50/2019 ✓

V 0.2

V 0.2a

Cortex-M7

- EB tresos AutoCore OS
- EB tresos AutoCore ACG/ACM
- EB tresos Virtual Eth driver

Cortex-A53

- EB corbos Linux 2 without HV

Remarks

- DevDrop available in CW 04

CW 04/2020 ✓

V 0.2b

Cortex-M7

- EB tresos AutoCore OS
- EB tresos AutoCore ACG/ACM
- EB tresos Virtual Eth driver

Cortex-A53

- EB corbos Hypervisor
- EB corbos Linux 2
- VirtIO Bridge

Remarks

- Booting from eMMC is functional
- VM Hub with EB Linux

CW11/ 2020 ✓

V 0.3

Cortex-M7

- EB tresos AutoCore OS
- EB tresos AutoCore ACG/ACM
- EB tresos Virtual Eth driver

Cortex-A53

- EB corbos Hypervisor
- EB corbos Linux 2
- EB corbos ADG 2
- VirtIO Bridge

Remarks

- Customer will take care about the PFE / LLCE setup

June 2020

V 1.0

Cortex-M7

- EB tresos AutoCore OS
- EB tresos AutoCore ACG/ACM
- EB corbos Virtual Eth Switch

Cortex-A53

- EB corbos Hypervisor
- EB corbos Linux 2
- EB corbos ADG 2
- VirtIO Bridge

Preconditions

- PFE setup was successful
- Provision of the PFE HIF documentation from NXP
- Extended NDA with NXP available

Remarks

- Missing NDA for PFE HIF usage → Possible delay in development for Virtual Eth Switch

Q3 / 2020

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Ethernet connection product Line

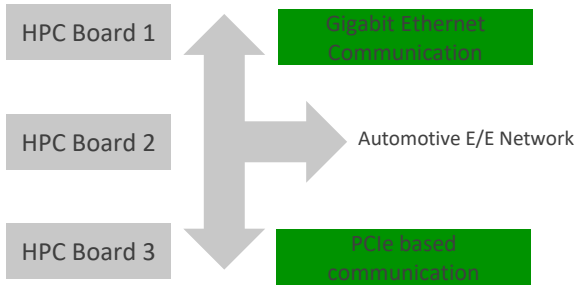
Elektrobit

Solution Proposal

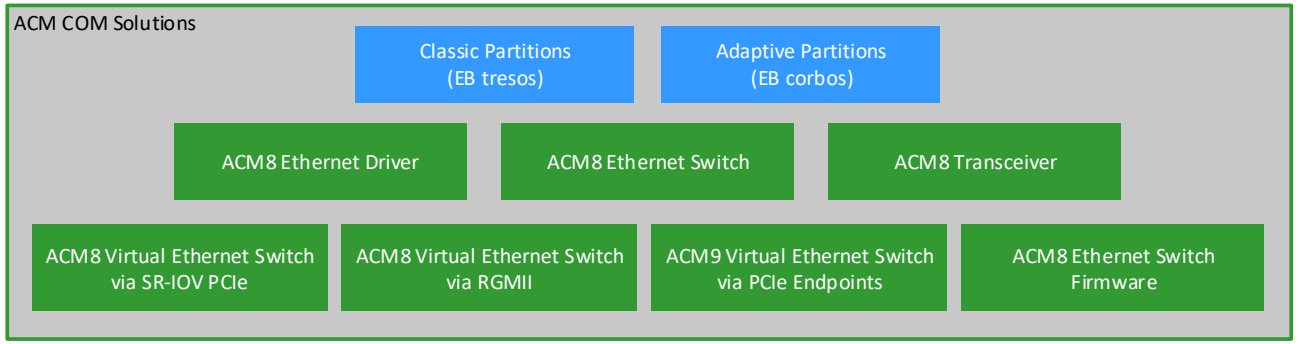
Scalable Inter-HPC communication

- EB's GBit Ethernet products
  - robust and production proven
  - versatile combinations possible (e.g., virtualization based on RGMII)
  - Powerful offloading possibilities (e.g., via Switch Firmware, hardware accelerators)
- In development
  - PCIe Multi-Gbit Switch connectivity, Based on SR-IOV
- Roadmap
  - Full PCIe inter-SOC connectivity

Requirement:



Proposed Solution:



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EB OTA solution

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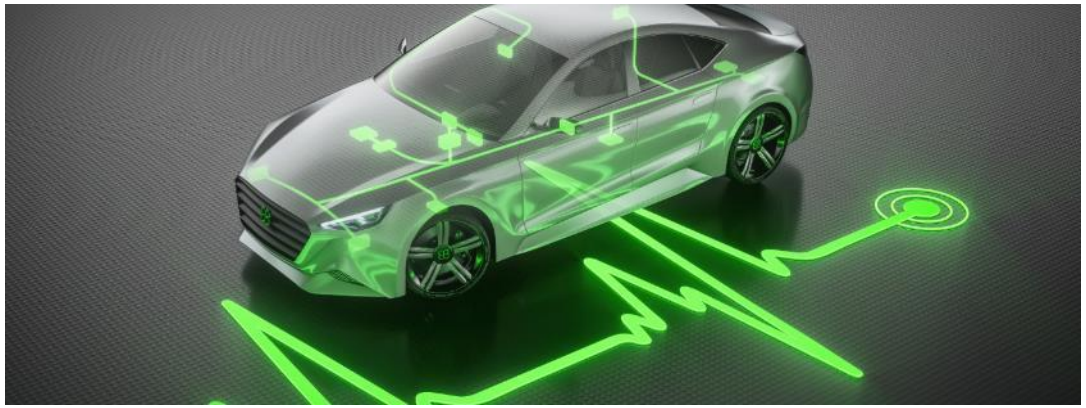
EB cadian product line at a glance



EB cadian Analytics

Remote analytics tool to gain valuable insights from the fleet on the road, and as a powerful basis for updates.

EB cadian Sync

Secure software updates over the air.

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ARGUS

Modular solutions for maximum flexibility

High level overview of EB cadian

On-board components

- EB cadian Sync components
- Lifespan protection components
- EB cadian Analytics components

Backend services

- EB cadian Sync services
- Lifespan protection services
- EB cadian Analytics services

Foundation service including on-board connectivity client

Portal

Update UI
Security UI
Analytics UI
Foundation UI

Argus service/component

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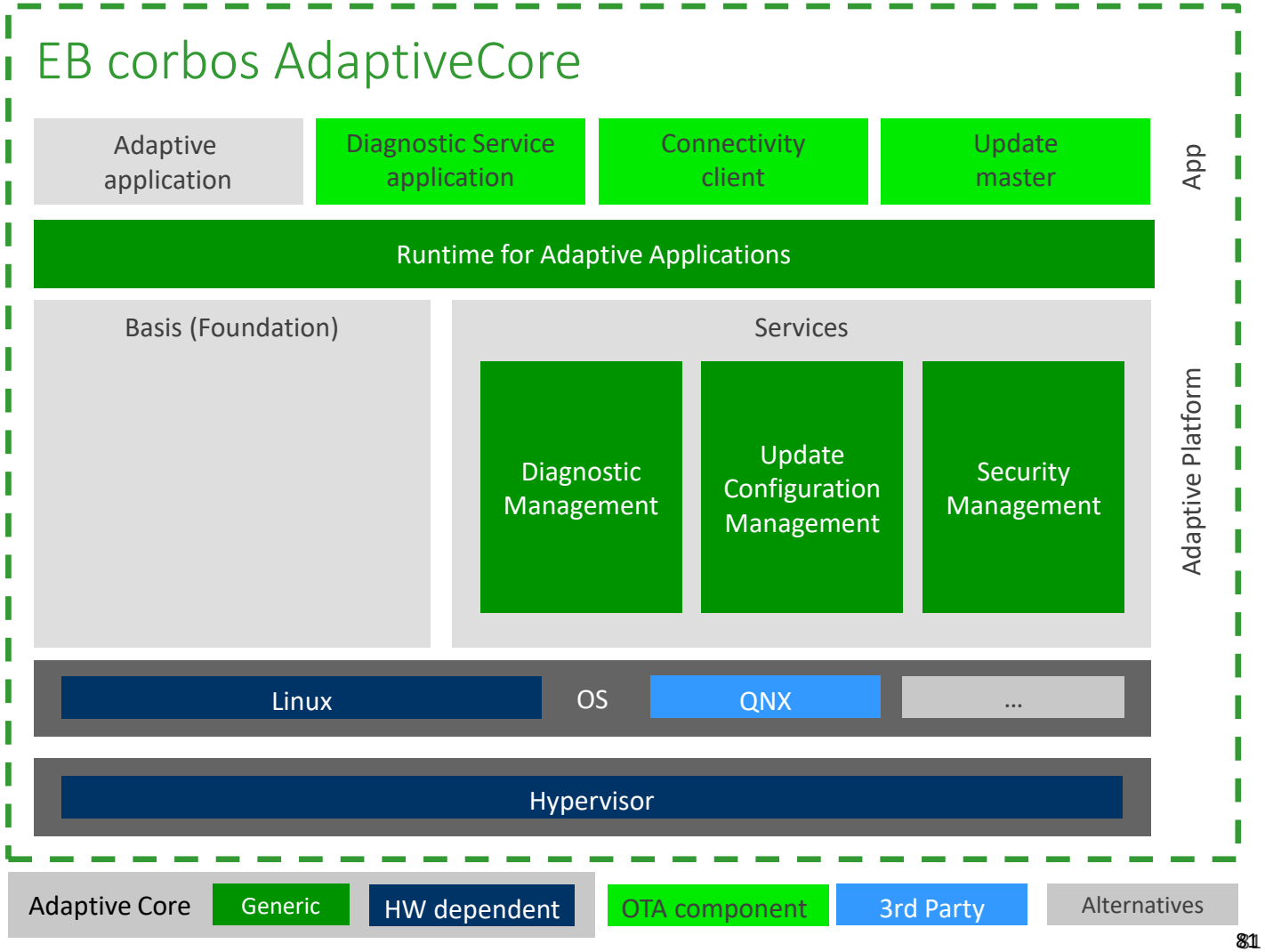
Software updates over the air in AdaptiveCore

EB corbos

- Update capability the Adaptive AUTOSAR is provided by services in the Adaptive platform
- On application level, the Connectivity client to enable backend communication and the Update master as central update manager are required



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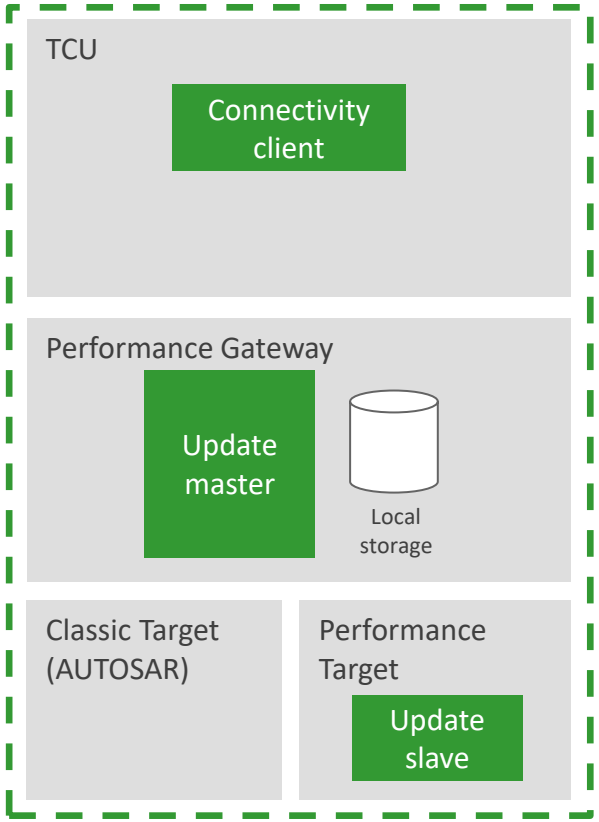
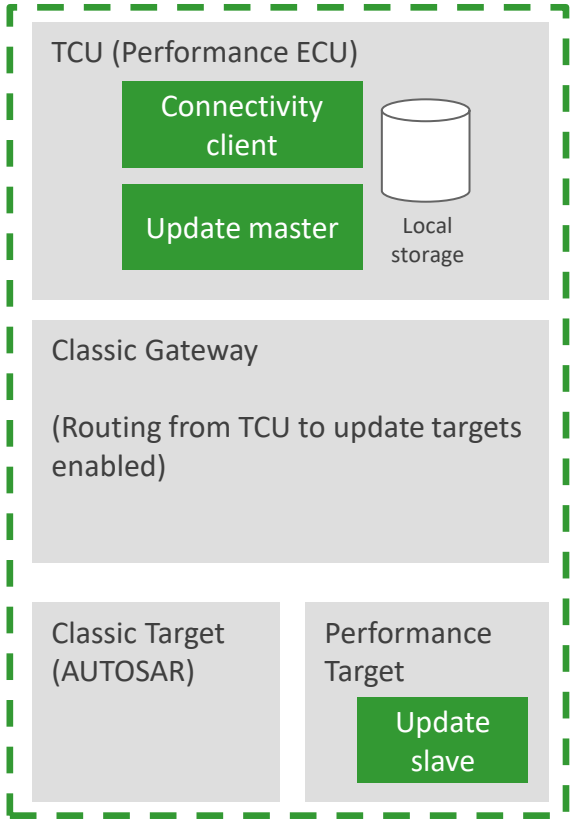
Examples for allocation of OTA components

Allocation flexibility allows us to adjust our solution to your system architecture.





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saleschina@elektrobit.com
www.elektrobit.cn

Backup

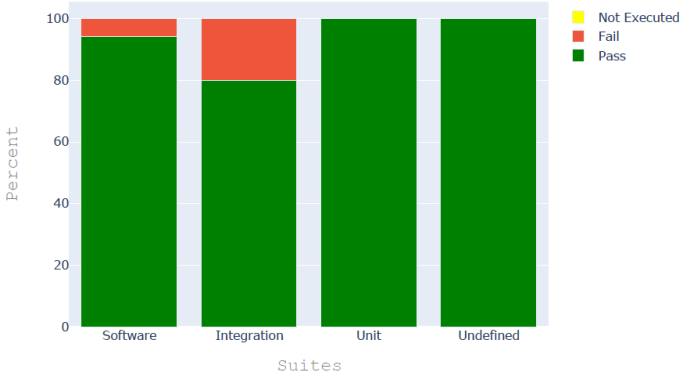
Example Continues Integration Validation

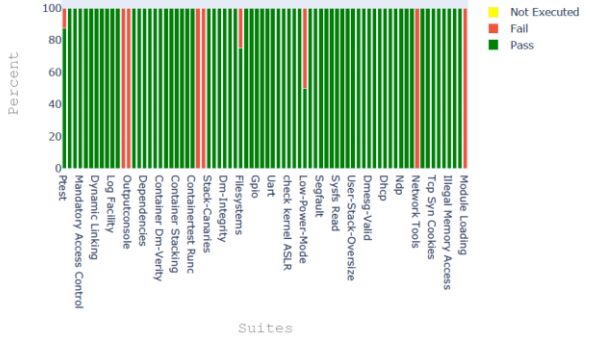
Test Type

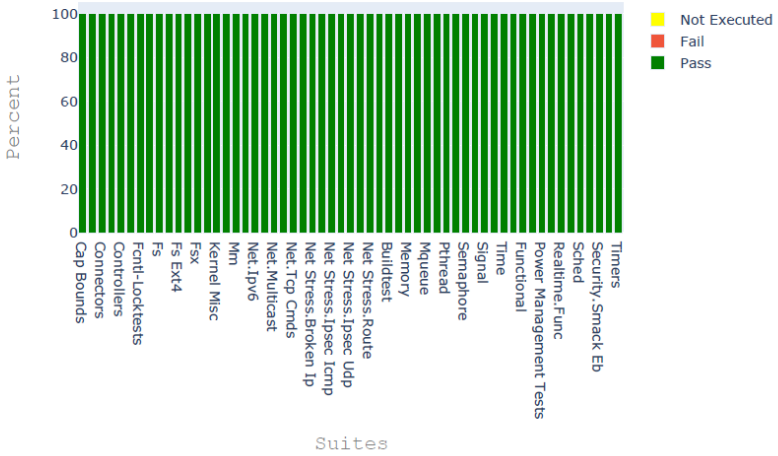
- Software test
- Integration test
- Unit test
- Undefined test

Summary	Pass	Fail	Not Executed	Total	Percent Pass
Software Tests	189	12	0	201	94.03%
Integration Tests	8	3	0	11	72.73%
Unit Tests	147	0	0	147	100.00%
Undefined Tests	3423	0	0	3423	100.00%

Table 3.2. Test types summary







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Example Continues Integration Component Test

GCC test

Summary	Ex-pected passes	Unex-pected failures	Expect-ed fail-ures	Unre-solved test-cases	Unsup-ported tests	Total	Percent Pass
g++	100327	9524	496	446	5120	110347	90.92%
gcc	68376	25561	289	7797	2654	94226	72.57%

glibc test

Summary	Ex-pected passes	Unex-pected failures	Expect-ed fail-ures	Unex-pected passes	Unsup-ported tests	Total	Percent Pass
glibc	4420	1484	17	2	39	5923	74.62%

Table 4.2. Overall glibc test results

Binutils

Summary	Ex-pected passes	Unex-pected failures	Expect-ed fail-ures	Unre-solved test-cases	Unsup-ported tests	Total	Percent Pass
binutils	1781	0	57	13	177	3284	54.23%

Other test

Ptest	Passes	Failures	Total	Percent Pass
acl	380	0	380	100.00%
attr	146	0	146	100.00%
busybox	626	0	626	100.00%
e2fsprogs	355	0	355	100.00%
jq	7	0	7	100.00%
libseccomp	8063	0	8063	100.00%
systemd	157	33	190	82.63%
zlib-intel	1	0	1	100.00%

Table 4.4. Packages tested with ptest overall test results

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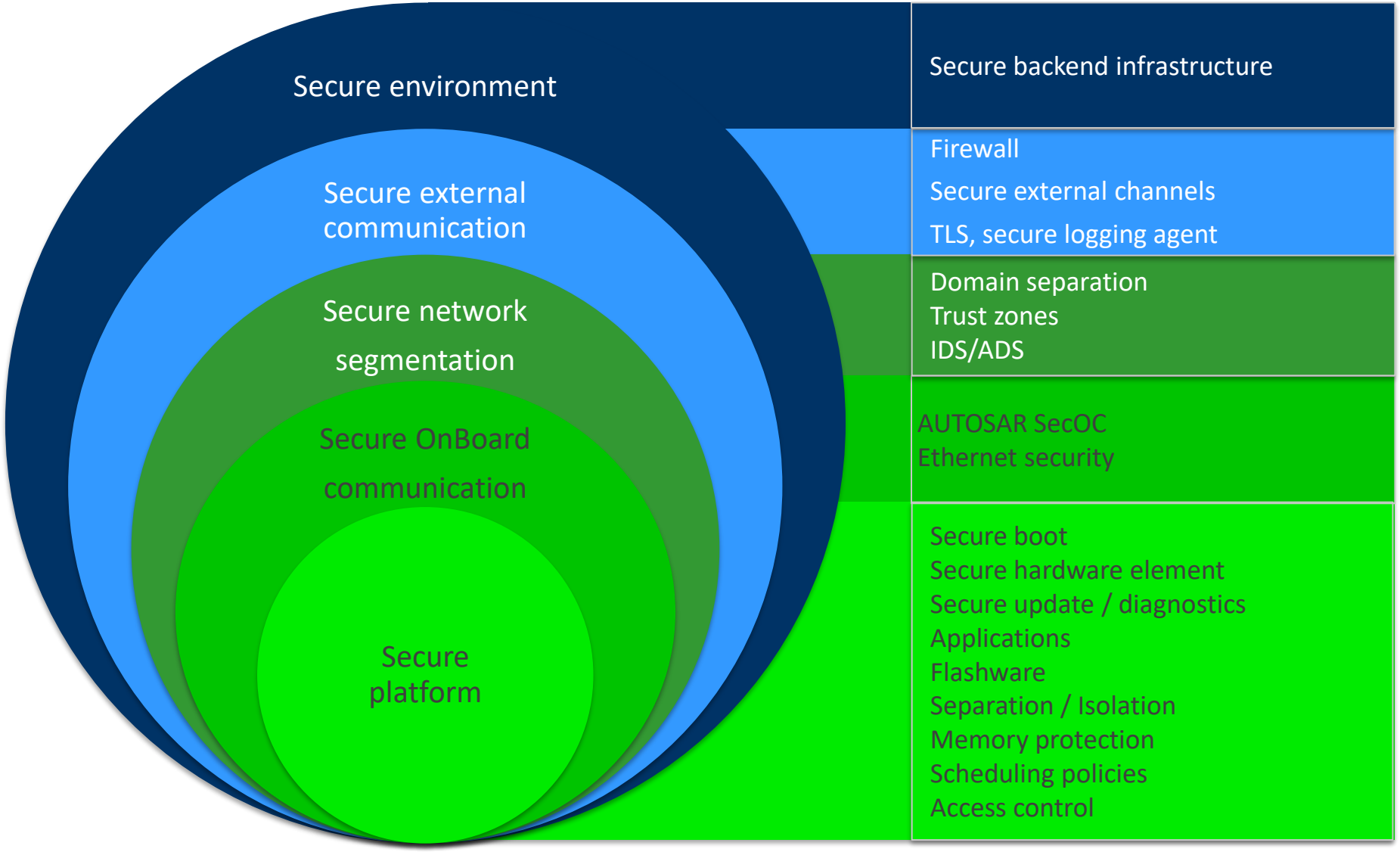
EB‘s holistic Security approach for HPC



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