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Boost Electrification and Digitalization market with ST's NEV CC total solution

Gavin Fu

NEV Competence Center & PTS BU | Marketing

What we did in the past

Benchmarking

- Automotive market was dominated by global Tier 1 customers.
- Silicon design was led by global Tier 1 customers in all traditional Body, Powertrain, safety and Chassis applications.
- Local tier 1 benchmark global Tier 1 system design and use same silicon solutions.

WW standard

- Local Tier 1 customers competence is stronger and stronger, especially in engine management market and Alternator regulator market.
- Co-developed dedicated local devices L9177A, L9779, L9788 U-chip CN6 compliance EMS Solution.
- Co-developed dedicated local AR devices L9916, L9918


Door zone


Lighting

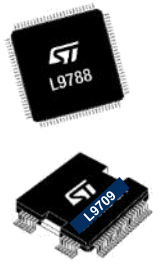

Braking

Airbag


Motorcycle


AR


EMS



2005 to 2010

2011 to 2018

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Fast evolution of automotive market

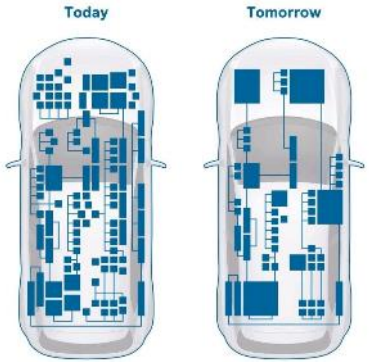
New Customers database

Before: Traditional global Tier 1 (Bosch Conti)

Now: Car makers, traditional local tier1, Industrial players, Mobile phone players, IoT players

Bigger customer data base with different design concept and various technical requirement.

New system architecture



New system architecture required new product proposal, new system proposal and new knowhow to support this new market

Software Defined Vehicle (SDV)

Software is the core enabler for key automotive innovations in connectively, autonomous driving, electrification and thus increasingly becomes a differentiating factor

Faster than traditional Tier 1

Lead market trend:

Fast market evolution with more advanced requirement than the W.W.

Shorter design cycle:

New devices design cycle requirement is 1.5 Years, required NEV CC deeply involved in SPEC definition, silicon validation and system validation

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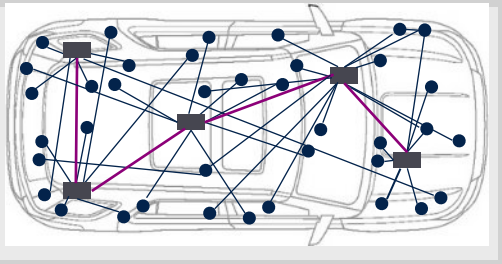
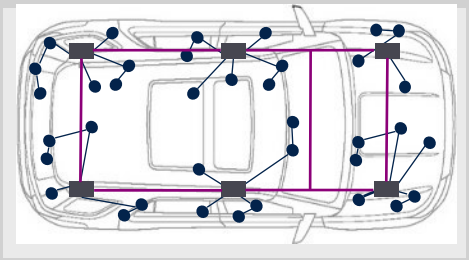
Creation of NEV CC and Team Mission

Domain



Zone



Keep leading position on all conventional domain & Expand our footprint in new automotive market trends

(Electrification, Digitalization)

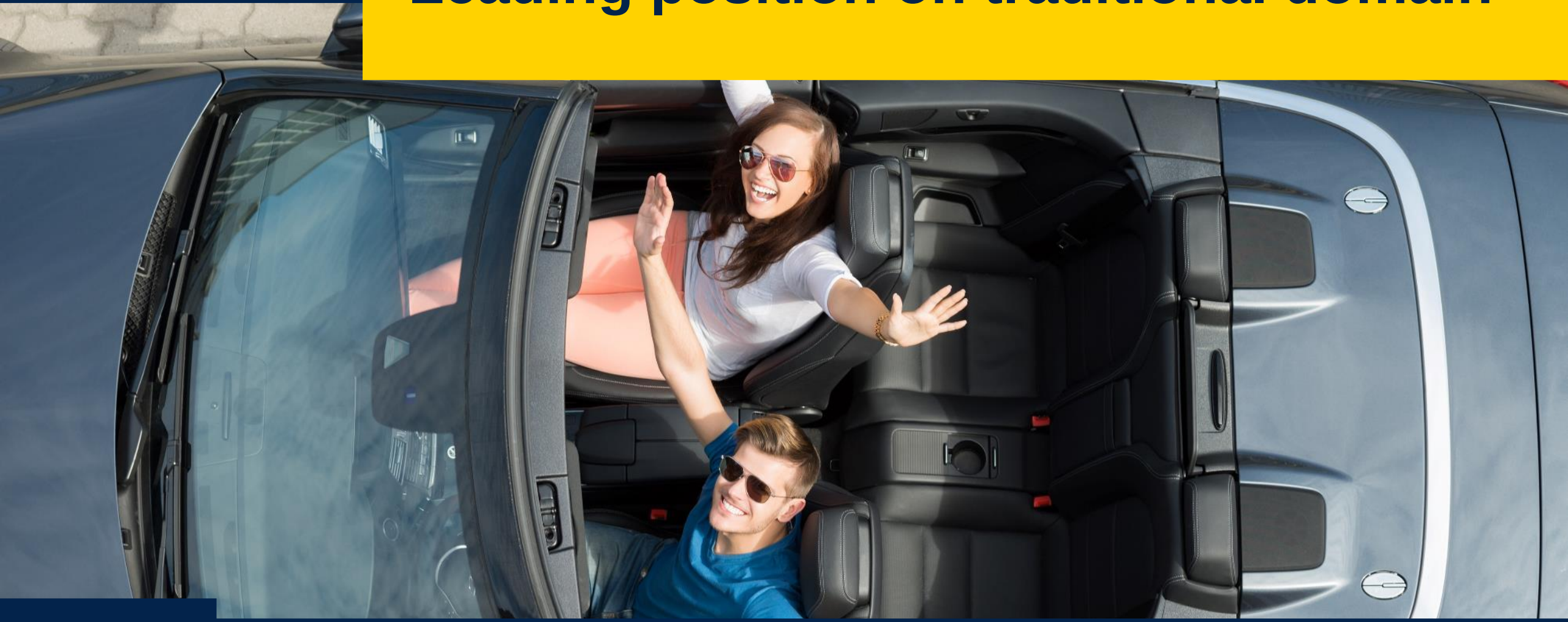
New architecture trend

(Domain, Zone)

Through…

- ***NSP*** (New Solution Proposal) helping shorten customer development cycle.
- ***NPP*** (New Product Proposal) development targeting local customer needs.

Leading position on traditional domain



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ST: 全球多元化汽车半导体领导者 超过30年的经验

覆盖所有汽车应用


Powertrain for ICE


Body & Convenience


Chassis and Safety


Electro-mobility


ADAS


Mobility Service

37% of ST revenue

市场份额 (on SAM) **>10%**

2019 **>$3.61B**

2018 **+1.5%** Y-o-Y

$3.55B
ADG 营业额

#1

- 发动机控制
- 24 GHz 毫米波雷达
- ADAS Safety
- 车载互联
- Car Audio 功率放大器
- GNSS 全球卫星定位系统
- 智能功率器件
- SiC

ST引领汽车应用市场

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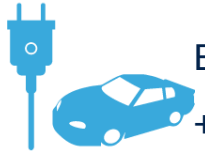
Source: Strategy Analytics, ST

ADG leading automotive gateway market secure MCU for in-vehicle networking & FOTA

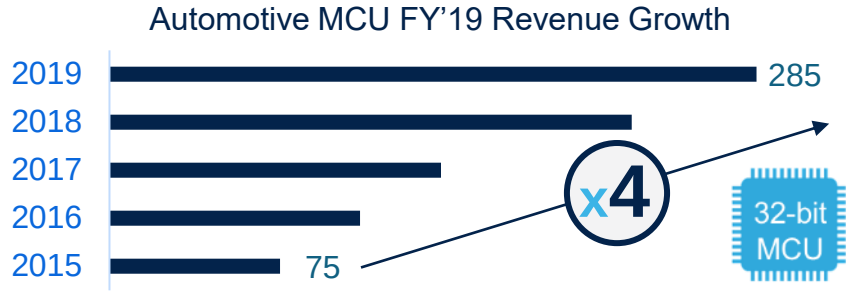
1st Automotive Gateway supplier

FY'19 Driven by:


ADAS
+46%

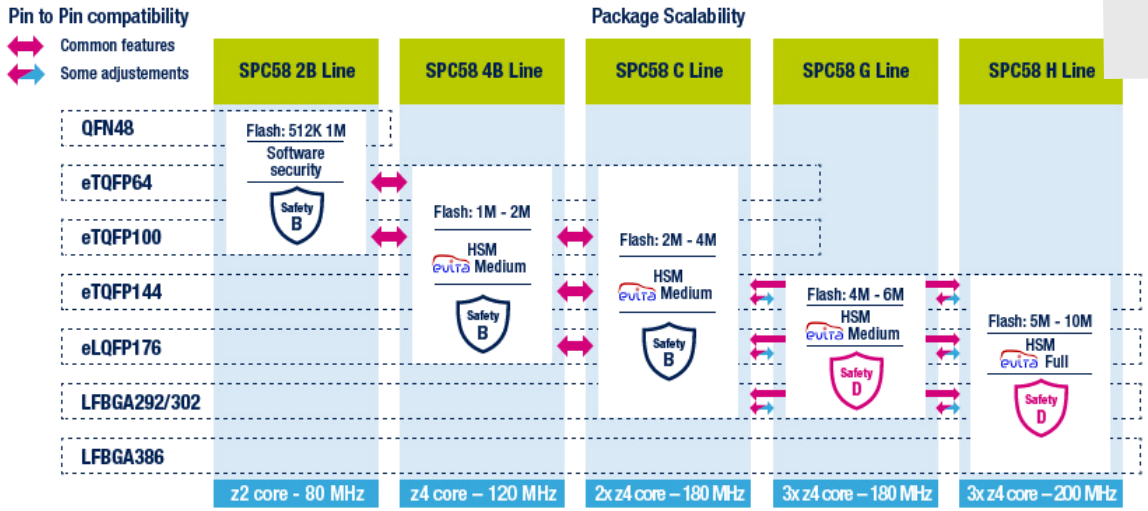

EVs
+43%


Body & Gateway
+26%

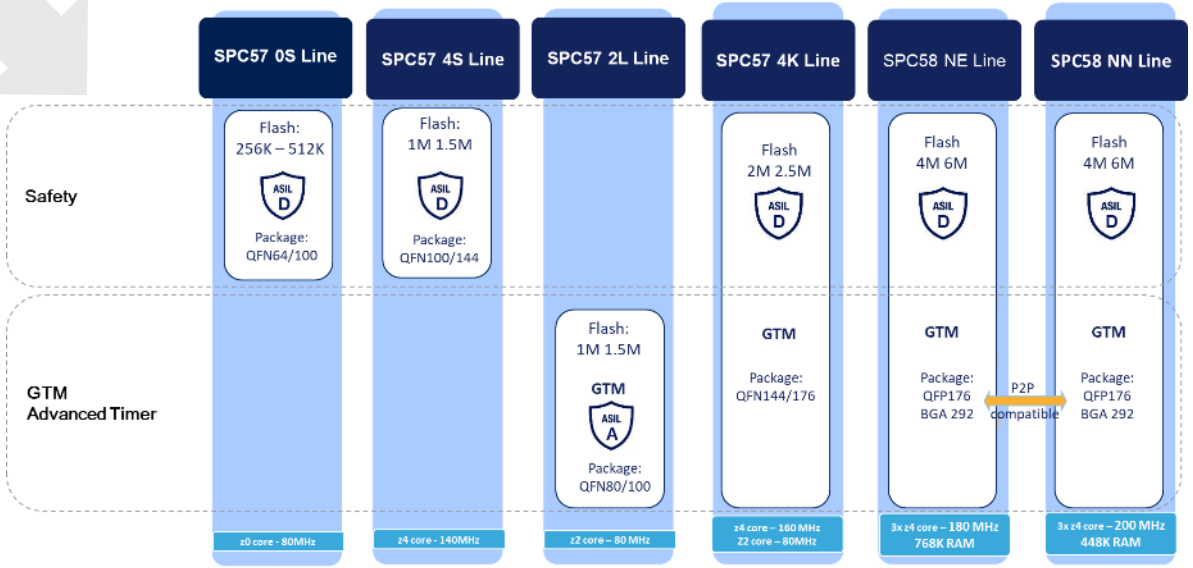


Comprehensive Product Portfolio for General Purpose and New Generation Product Families

SPC5 Chorus Series: Full Scalable & General Purpose



High Performance MCUs: Advanced Safety & Timer



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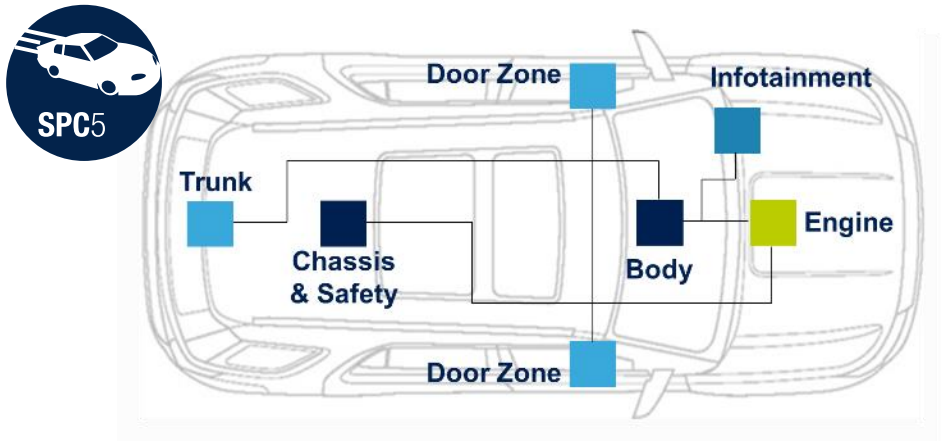
Stellar: driving new architectures

Enabled by ST with FD-SOI 28nm and embedded phase-change memory (PCM)

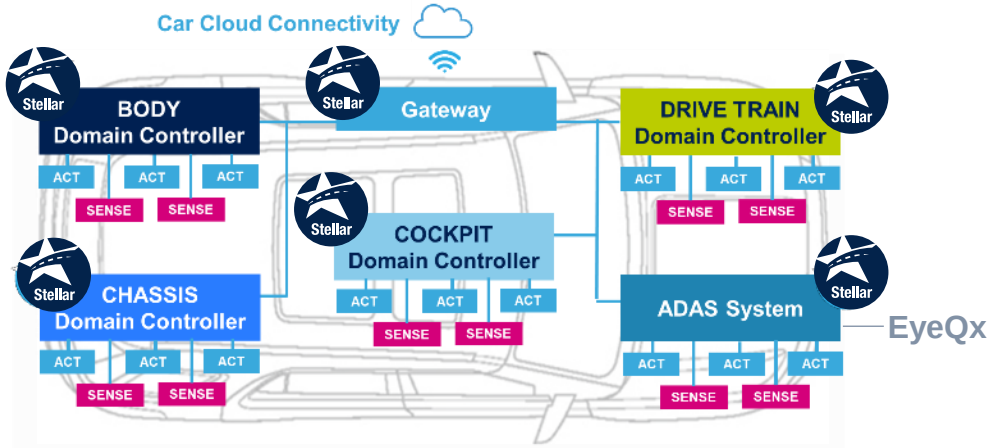
Distributed Architecture: 9k DMIPS per Car



x10

Car
Computational
Power

Integrated Real-time Domain Architecture: 90k DMIPs per Car



2017 — **202X**

10x more computing power
from 9K DMIPS to 90+ TFLOPS

Defragmentation of main computing units
100 ECUs/Car in 5 main domains

Faster in-vehicle and off-vehicle
data exchange

Enhancing safety and security level

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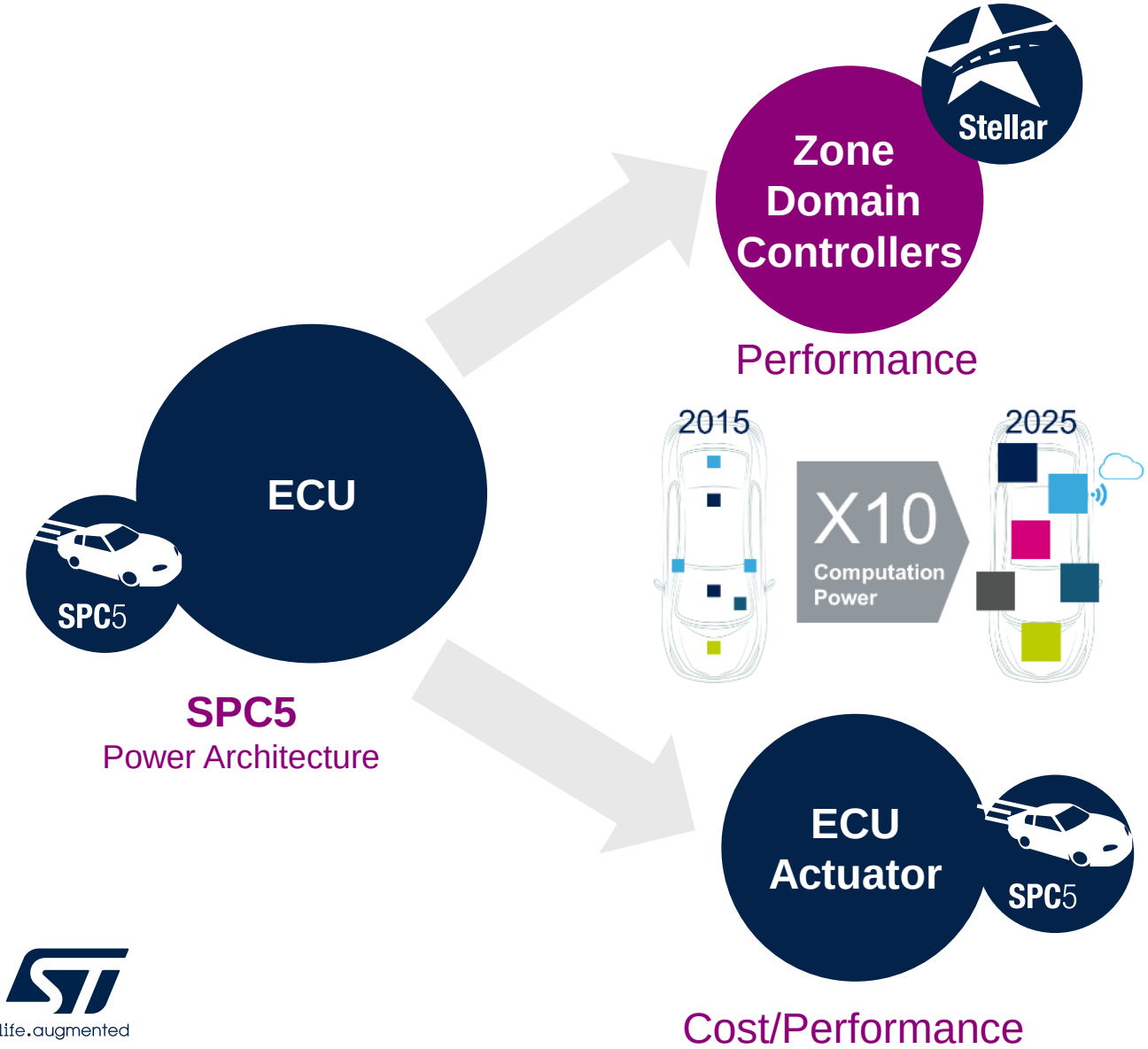
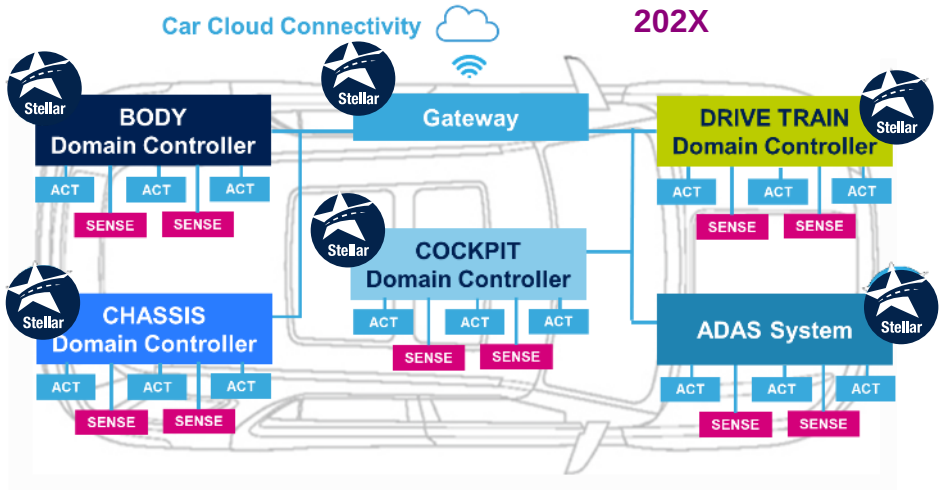
Microcontrollers roadmap evolution



Stellar Arm R52 28nmFDSOI PCM for High end



SPC5 Power Architecture Flash NVM for Single ECUs

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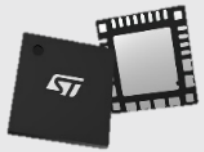
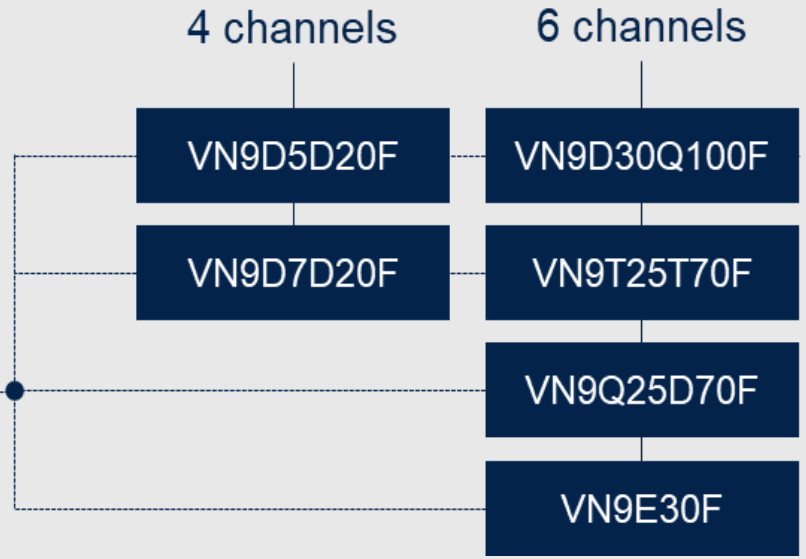
M09 SPI high-side drivers the best ever SPI HSDs with advanced digital features

… first family in the world of HSDs with Digital Current Sense



QFN32L
6x6



Program Status:

- PQC: Q4.2020…Q4.2022

High Integration to achieve smallest PCB and fewest external component:

- High channel count (up to 6) in small 36mm² footprint (QFN 6x6)
- Low Microcontroller I/O employment, no Microcontroller Analog channels required.

Best Current sense accuracy:

- Less than 7% Digital Current Sense accuracy at Nominal Load, no need of application level calibration.

Easiest Software Design:

- Device integrate PWM engine with fully autonomous and sampled diagnostic.

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10

M0-9 SPI for BCM optimization front and rear corner lights with two devices only

VN9D7D20F

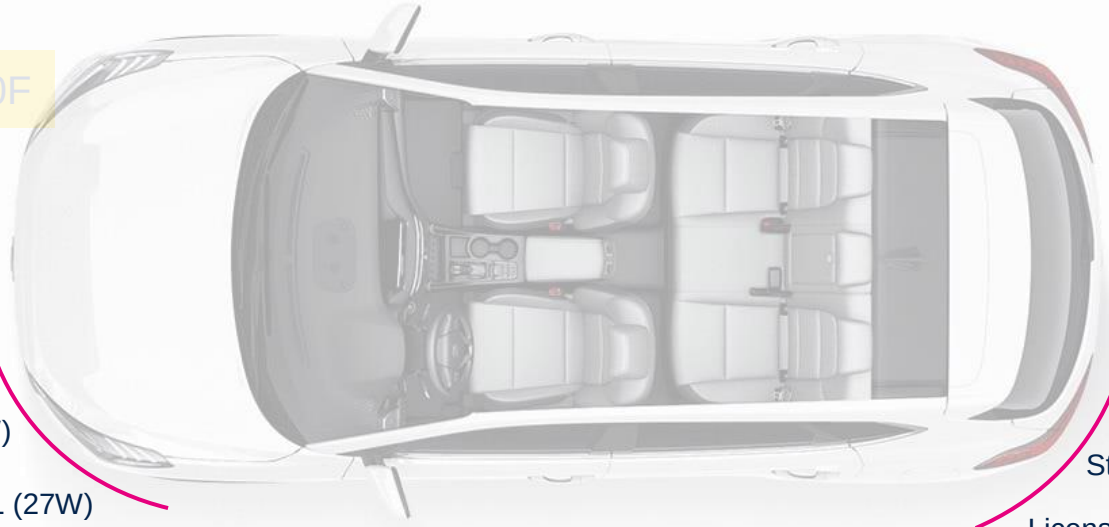
VN9D5D20F

High Beam (65W)

Low Beam (55W)

Turn indicator (21W)

DRL (27W)



VN9D30Q100F

VN9T25T70F

VN9Q25D70F

DRL(10W)

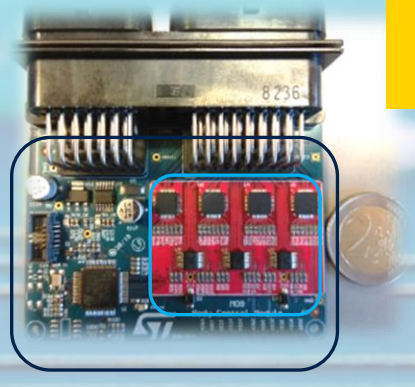
Reverse light (21W)

Turn indicator (21W)

Fog light (21W)

Stop light (27W)

License plate light (10W)



32 channels PCB driven by seven M0-9 devices only.
Based on a real partitioning from one of the main Tier1

Full PCB: 80x120 mm

Power Area: 30x44 mm

VIPower M0-9 SPI Competitive advantages

-55% PCB Power-Area vs Parallel Smart Power

-30% external components

Up to **25%** Microcontroller Workload reduction

-66% Microcontroller I/O and ADC

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NPP & NSP for Electrification & Digitalization market

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Localized co-development product

Chinese Customers

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Marketing strategy

Tailored to China Leading Customer Requirement and Cross Fertilize to ASIA and Worldwide market

L9779 引擎
SOP: 2013

L9915B
SOP 2015
PVO: 1M$

L9916
发电机调节器
SOP 2016

L9788
引擎控制
SOP 2017

L9177A
SOP 2016

L9918
LIN调节器
SOP 2019

L9501
on board charger
SOP 2022

GaN + Drive -- OBC/ DCDC
on board charger
SOP 2024

PMIC
智能驾驶
SOP 2021

L9788+
EMS+/PDCU
SOP 2022

系统基础芯片
Under evaluation

L9502
主驱逆变器
SOP 2021

L996y
12V 锂电池

Lidar
GaN + Predriver
SOP 2021

L9963T
SOP: 2019

L9963
电池管理系统
SOP 2019

L996x 16cell
电池管理系统
SOP 2022

HV flyback GaN converter
主驱逆变器
SOP 2023

PMIC
智能驾驶
SOP 2023

2011： traditional application

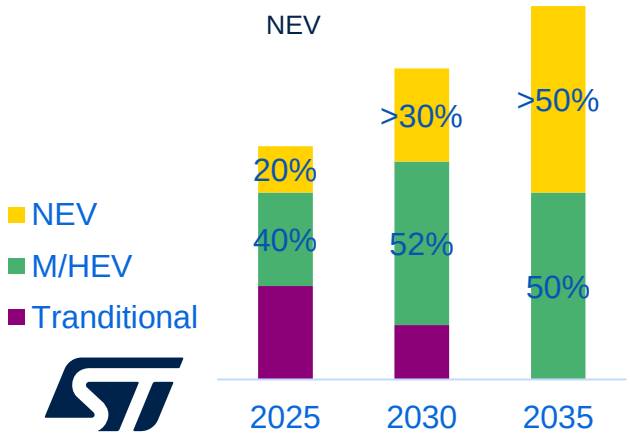
2017： Electrification & Digitalization

From division drive to region drive

More powerful Uchip for next-gen platforms

Fast market evolution

Electrification is the strategy direction in China. Government pushing to have more M/HEV and NEV



L9788+

To support this fast evolution market, upgrading L9788 with higher current output capability and optimized features for coming Electrification market

GDI

GDI market share keep increasing, which need more powerful Micro and Uchip

EMS+TCU

PDCU

Powertrain domain control unit to cover VCU, BMS, Traction in EV

EMS+VCU

Cost effective solution to have EMS ECU and VCU together for hybrid vehicle

EMS+…

To gain market share in other Powertrain market by combing ECUs into EMS ECU.

Upgraded L9788 with more powerful features for coming Electrification market.

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Electrification Digitalization

新能源创新中心技术团队

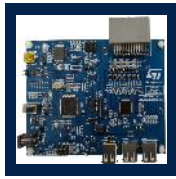
2019

整车、动力域控制器
- SPC57, L9788 dual chip solution
- ASIL D
- IDH cooperation

在线刷新
- OTA with 3rd party
- Embedded Hardware Security Module (eHSM)

智能终端
- GB/T32960 compliant
- ASIL-B safety concept
- Scalable CAN-FD interfaces

2020



电池管理系统
- ±2mV in whole temp range
- Up to 434 cells
- ASIL-D ready

3KW 充电机
- Single MCU solution for two Power stages
- GB QCT895 compliant

逆变器
- Total solution with SiC
- ASIL D ready
- Software Resolver

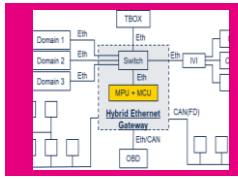
空调压缩机
- Optimized Motor control library
- Efficiency >97%@2.0KW

OLED
- All in one OLED taillight
- Digitalized，communicational and Personality-oriented

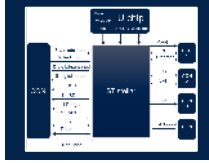
直流变换器
- Full digital Single MCU solution
- High efficiency with SiC MOSFET
- ASIL-C

2021

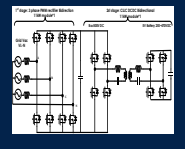
智能电气分配盒
- Efuse
- PowerPC



智能网关
- MPU + MCU solution
- Multiple network
- Protocol translation
- Security



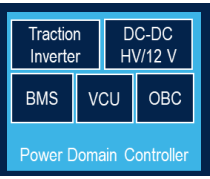
动力域
- VCU + BMS combo
- STELLAR P
- New U chip NPP



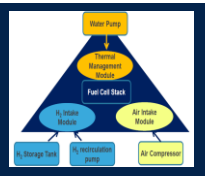
11/22KW 充电机
- 3 phase bidirectional PFC + CLLC DCDC
- STELLAR E1

数字钥匙
- POC project with compliance to CCC 2.0
SPC582B +ST33-A +ST25

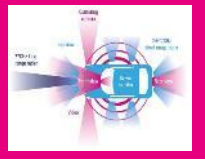
2022 ~ Later



多合一动力域控制器
- STELLAR E/P, SiC, New SBC, Gate driver
- Real-time Virtualization



燃料电池
- AFE
- Thermal management
- A/C compressor



智能驾驶电源与外设
- Automotive Processor
- PMIC
- GNSS, Radar, MEMS

2020

电动助力转向
- Target Autonomous Driving through steering redundant function
- ASIL D

- 新能源创新中心为您提供**系统解决方案**，包括硬件原理图、Layout设计、底层软件、复杂驱动、功能安全、系统验证报告等。

NEV
Competence Center
Digitalization

Digital rear lighting solution

Strategic Partnerships

Leading Over The Air Service Provider

Leading OLED Display Supplier

NEV Competence Center

AUTOSAR

- *BSW on MCU & MPU*
- *Software utilities (drivers, flashers)*
- *System Design Kit*
- *Partners*

Top 7 Chinese carmakers are considering adopting an ST Solution

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NEV
Competence Center
Electrification

Traction inverter solution

Our Advantages:

- Software Resolver → ***25%*** Cost saving
- Gate driver and SiC MOSFET Module Compatibility → ***Efficiency***
- Model-Based Design base on MATLAB→ ***Time to market***
- System Functional Safety Ready → ***Safer***

Our Support & Offer:

- ASIL C — ***System Functional Safety***
- ***System Design Kit***
- ***Partners***
- ***System Validation Report***

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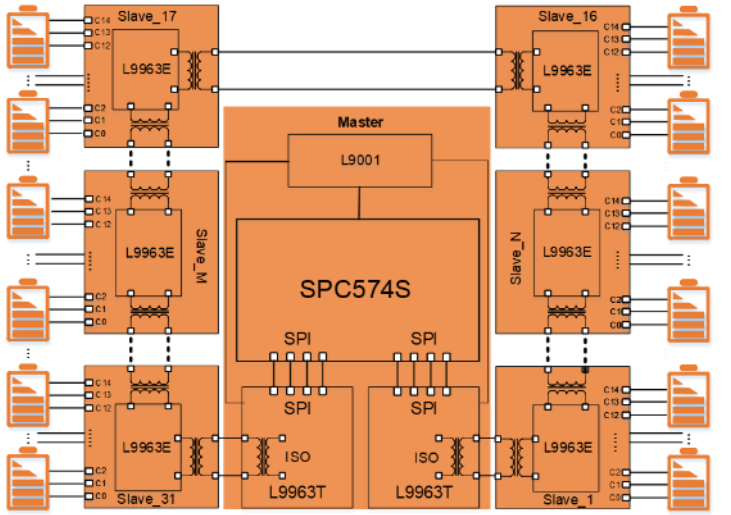
NEV
Competence Center
Electrification

ASIL Ready

Battery management system

Outline

- Automotive BMS must be able to meet critical features such as voltage, temperature and current monitoring, battery state of charge (SoC) and cell balancing of lithium-ion (Li-ion) batteries.



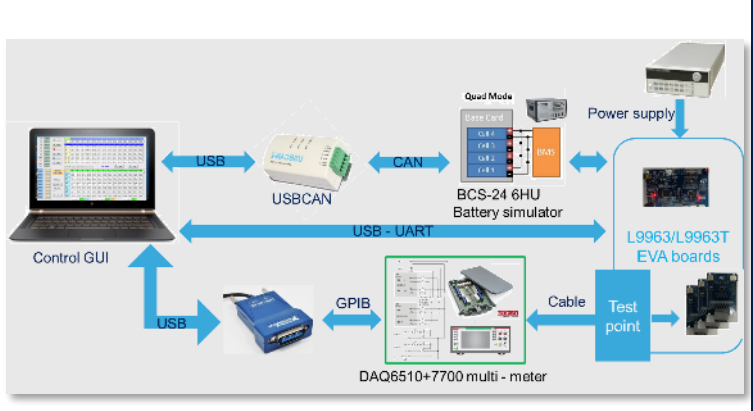
Technical Highlight

- Advanced voltage measurement for up to 434 cells
- High precision with maximum error of ±2mV in whole operating temp range
- Intelligent diagnostics, Function Safety and Robustness
- Easy connection, quick evaluation and low-cost demonstration kit

Function	Product group	ST product
MCU	APG	SPC574S
AFE	APG	L9963E L9963T
Power	APG	L9001

Supporting Package

- Easy connection, quick evaluation and low-cost demonstration kit
- Evaluation GUI
- Reference code on SPC5Studio
- Application notes
- Databrief / Datasheet
- Safety manual
- FMEDA / DFA



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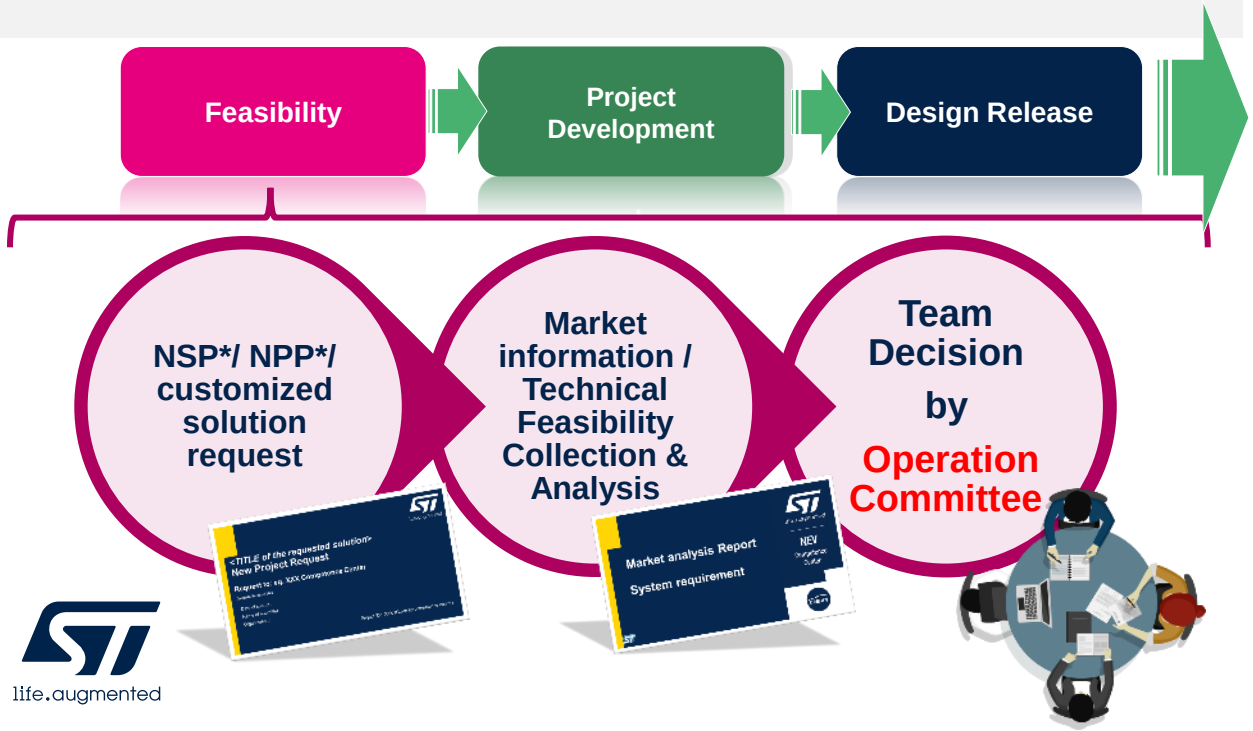
*NSP: New solution proposal
*NPP: New product proposal

Successful story with NEV Competence Center system solution development

NEV Competence Center Vision

Leverage
- ST wide & strong **Product Portfolio**
- Strong **Software & System** knowhow in ST GCSA
- ST system solution & support

Key Objective
- Improving AP customer project **Time to Market**



✓ User Friendly Design Kit
✓ Provide Support & Consultation Throughout Customer Project Development Cycle

Business Opportunity Engagement
- Provide reference design kit, document and test report
- Competitor solution / component benchmark
- Application scenario evaluation in system
- Training & workshop

Design IN
- Low level driver / CDD development
- MCAL customization
- Hardware design & debug
- Application specific algorithms development
- System software development
- System safety analyze

DV & PV
- EMC performance optimization
- Joint bench test
- Data log analyze
- System safety assessment consultant

To Ensure SOP on time

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NEV Competence Center

- **Time to market**

  Develop & supporting complete system solution helping customer to shorten development cycle-time.

- **Quality & Safety**

  Support system level functional safety, complex driver compliant to AUTOSAR.

- **Customization**

  Support customized Solution and Product development.

- **Easy to Use**

  Provide product & solution training enhancing IDH and distribution system technical knowhow & competency

Thank you

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