



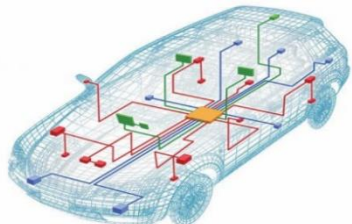

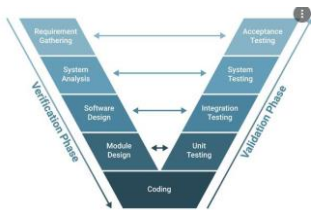
*Create, Embed, Empower*

# Automotive Competencies

# Crevavi – Company Overview

A R&D company, founded in 2011

Global footprint

Automotive	EV / Autonomous	SW Functional Safety
		
Automotive ECU software	Inverter, OBC, DCDC BMS	ISO26262 compliance



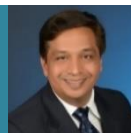
## Company strengths

Number of developers

75+

Lab facilities

3+



**Sachin Shivapur**  
Co-founder and CEO  
25 years experience



**Ravi Kishore Attili**  
Co-founder and US Head  
25 years experience



**Shriram Kathavate**  
Cofounder and CTO  
23 years experience

HW Test benches

3+

Locations

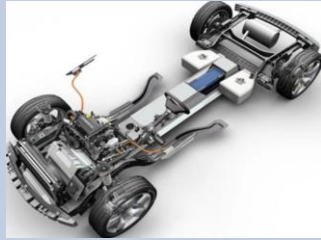
5+

- 250+ Man years of Automotive ECU SW and HW experience
- HV EV ECU – Traction Inverter , DCDC, Battery Management (BMS), OBC
- R&D for Automotive Electronics
- Functional safety (ISO26262)
- Development partners of major silicon vendors
- World-wide presence: India, Germany and USA

Automotive software competencies



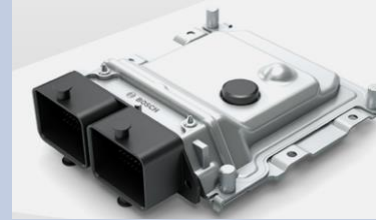
# Automotive Core competencies



HV Inverter for e-Motor  
HV On-Board Charger  
Battery Management System  
HV DC-DC Converter  
Super-Capacitor cell balancing ECU



Immobilizer  
Secure boot  
Secure Programming  
Bootloaders  
OEM specific flash loaders



Drive Train ECU  
Instrument Cluster  
Telematics ECU  
Zone/Domain Controller  
Chassis and Body Control ECU



IC Engine ECU  
Fuel Injection, ignition  
Angle/Time Driver  
High-pressure pump control

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# Key ECU Projects executed

# ADAS: Real-time Object detection: using Jetson Nano

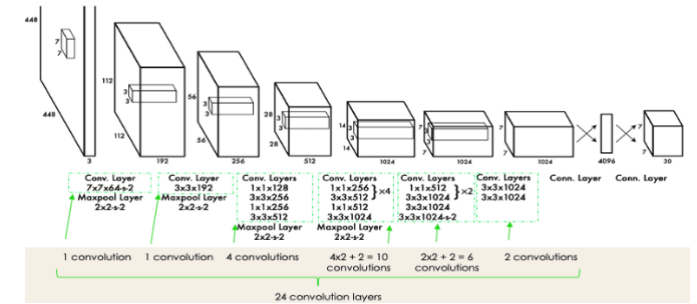
- **Project:** Implement Yolo algorithm on Jetson Nano for real-time object detection

- **Project content:**

- Use the JetPack L4T BSP as base platform
- create pipeline and capture frames from the MIPI-CSI CSI camera using Gstreamer multimedia framework
- Integration of Yolo (You Only Look Once) CNN real-time object detection algorithm
- Integration of Pytorch tensor library for deep learning for Yolo algorithm
- Use the bounding boxes augmentation for object detection provided by Yolo
- Use the computing power of CUDA processors to render the image with minimal lag

- **Customer Benefits :**

- Optimize high compute loads on NVIDIA platforms starting from Nano
  - quad-core 64-bit ARM CPU, a 128-core integrated NVIDIA GPU
- Validation of algorithms
- Performance and memory optimization for underlying hardware architecture



# SW Defined Vehicle: SOA architecture for Body ECU

- **Project content:** Design SOA architecture for Body ECU components compliant to SOA
- **Details:**
  - Decode system requirements for Body ECU (Immobilizer, Climate, Alarm, Doors)
  - Design **SOA** architecture
    - SOA interaction within Body domain
    - SOA integration with Powertrain, Chassis, Cockpit domains and other Zonal ECUs
  - Arrive at safety goals following ISO26262 standard
    - For crash scenarios
    - Automatic door lock scenarios
  - SOA interaction between Zonal and HPC (high performance computing domains)
  - **S2S (Signal to signal – Adaptive AUTOSAR)** design for communication across ECUs
  - **Ethernet to CAN** gateway interaction for SOA
- **Customer Benefits**
  - Leverage on SDV platform design experience
  - Leverage on SOA architecture definition for Zonal and HPC computing domains for SDV

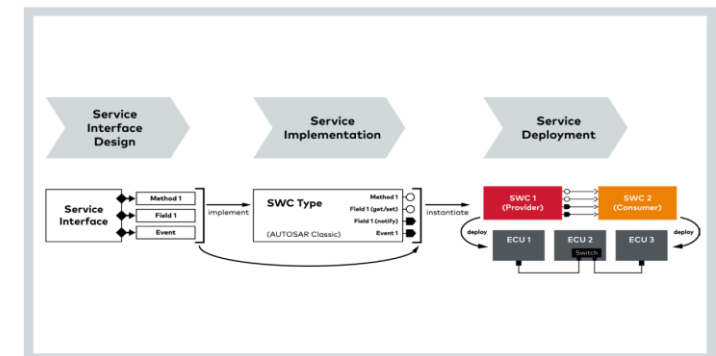
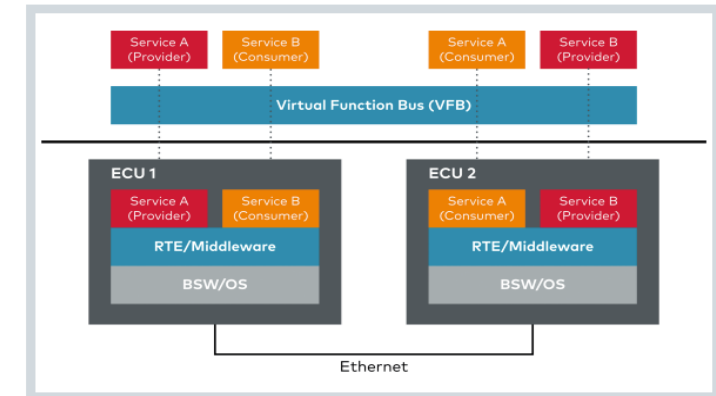
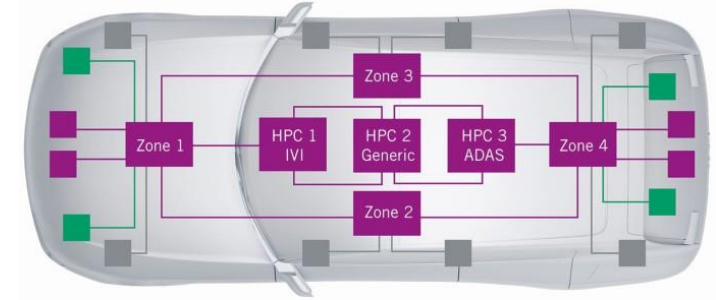
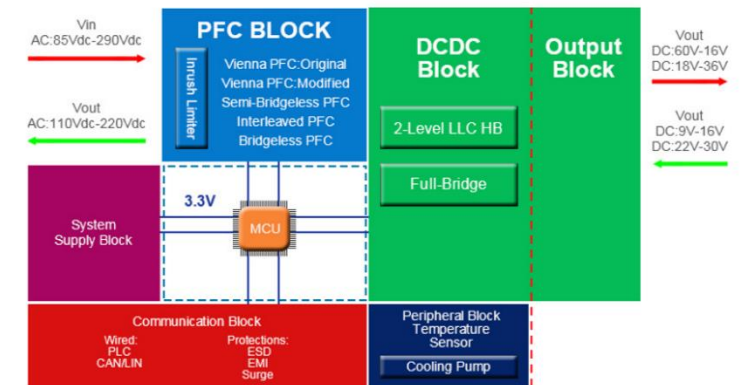


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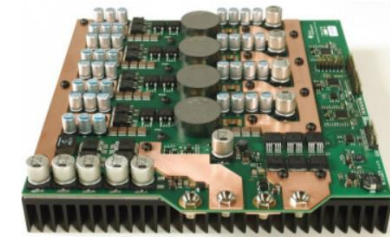
# E-Mobility: SW development for HV On-board Charger ECU

- **Project content:** CPU load reduction for AUTOSAR BSW stack on Multicore, Mixed ASIL ECU
- **Details:**
  - Entire Configuration analysis of **AUTOSAR BSW** and MCAL stack
  - Analysis of high frequency function calls and stacks
  - Profiling of start up, shutdown, communication (CAN-FD, LIN and **Ethernet**), OS Applications, spinlocks, memory and watchdog stacks
  - Validate and measurement of CPU loads reduction and memory optimization
  - Verify NVM(D-Flash), wakeup, **Ethernet**, **SOMEIP** configuration for SOP
  - Write and validate microcontroller functional safety drivers to be compliant with **ISO26262**
  - Achieve **ASIL-D** safety concept
    - FCCU configuration, CRC, Memory error management and reporting of events
  - Validate multi-core, mixed-ASIL functionality
    - Memory and core partitioning
- **ECU HW**
  - **ST SPC58 Chorus** family
  - e200z4 triple core:32-bit Power Architecture technology CPU

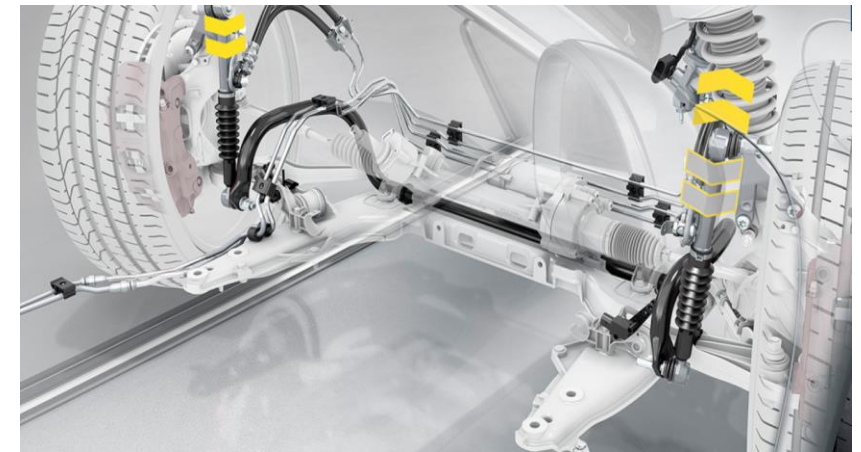


# E-Mobility: DCDC and SCAP ECU for Anti-roll ECU

- **Ask from Indian Supplier**
  - Operate in BOT model + Manage project timelines and deliverables
  - Deliver series grade project for a Japanese Tier1 for **HV EV DCDC** and Super-capacitor ECU
  - Handle UK OEM interactions
- **Project: Configure AUTOSAR BSW stack for Anti-roll ECU (DCDC and Super Capacitor ECU)**
- **Project work carried out:**
  - Configuration and integration of Vector AUTOSAR BSW stack and Bootloader
  - Develop **Complex Drivers**
  - **Cell-balancing Complex Driver for Super Capacitors**
  - End-to-end system testing for series production
- **Customer Benefits :**
  - Demonstrated End-to-end systems' competency in HV DCDC converter SW
  - Provided entire ECU SW architecting as a consultancy to Tier1 and OEMs
  - Own entire validation responsibility for series production



Super Capacitors on the ECU

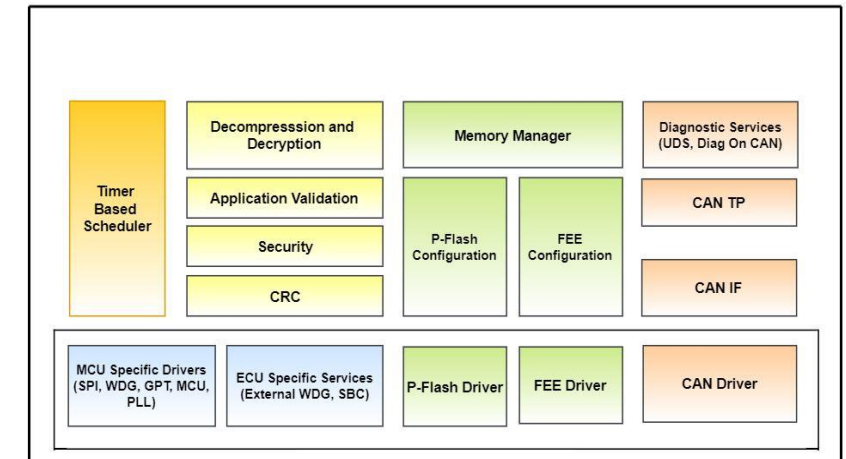


Anti-roll System



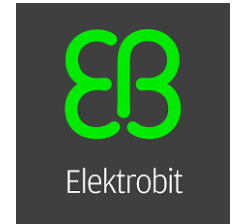
# Migrate TCU platform from NXP to Infineon AURIX for American Tier1

- **Ask from German Supplier (Partner)**
  - Bid for the TCU (Transmission control Unit) project and win against competitors
  - Own end-to-end execution of project
  - Handle Japanese OEM interactions on behalf of American Tier1
- **Project: Develop Generic Bootloaders for Transmission control system ECUs**
- **Project work carried out:**
  - Integration of legacy SW, middle-ware, AUTOSAR select layers and MCAL(IO)
  - Development of Generic bootloader
  - Development of state-of-the-art security algorithms
  - Handle OEM interactions
- **Customer Benefits :**
  - Develop robust platform ECU for scalability
  - Upto 50% reduction in TTM and TCC (total cost of ownership)
  - Offload Tier1s with OEM interactions
  - Meet stringent SOP requirements of global OEMs(Japanese, European and US)

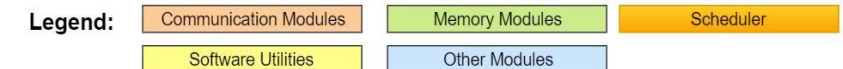
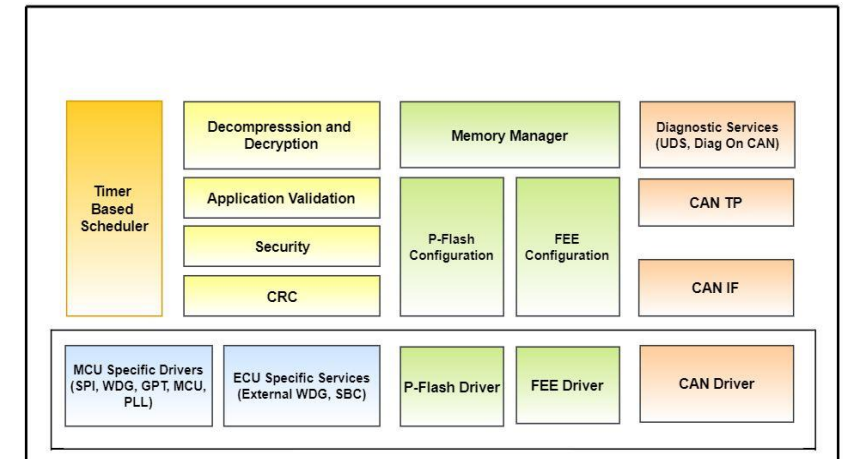


# Flash Bootloaders (FBL) for Aurix TC2XX

- **Project: Develop Generic Bootloaders for Transmission control system ECUs**
  - End-to-end responsibility from concept to production
  - MCAL stack using EB Tresos
  - Vector CAN Stack (CAN Driver, CANIF, CANSMB) using DAVINCI Configurator tool
  - Compliance to ISO 14229-1 and ISO 15765-2 (UDS on CAN)
  - Develop flashing using XCP protocol
  - Support for ODX flash specifications



- **Customer Benefits :**
  - Develop platform for scalability
  - Pragmatic implementation of 3<sup>rd</sup> party IP to save royalty costs
  - Upto 50% reduction in TTM
  - Upto 50% reduction in total cost of ownership



# Telematics and ADAS platform with Intel

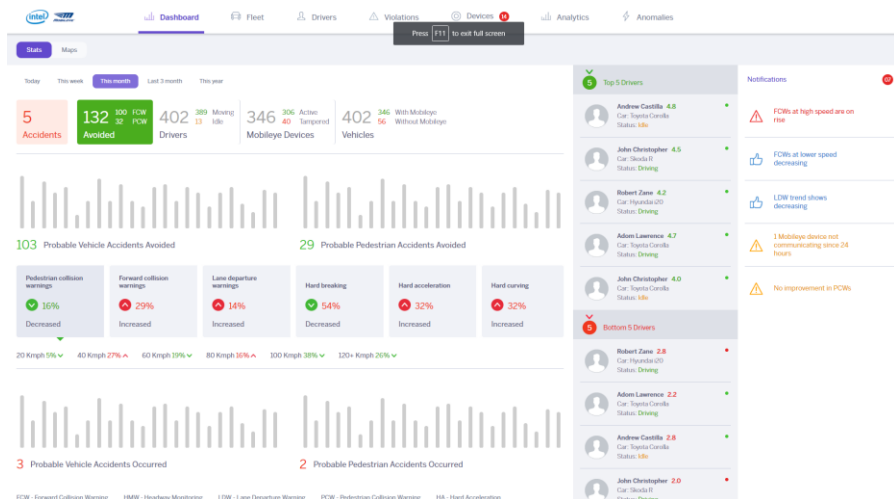


## Project Content:

- Linux based platform co-developed with Intel
- OBDII, GSM communication on Intel Atom
- Fleet Management System (FMS) on cloud
- Interface with ADAS processor for ADAS event recognition
- Connects to cloud via cellular modem
- Integrated GNSS for tag and trace
- OBDII connection using UDS protocol

## Customer Benefits :

- Ready platform for FMS, Telematics and ADAS
- Retrofit and factory fit option



Predictive Vehicle health



ADAS Events



Driver Authentication



Driver Monitoring



Driver monitoring & Authentication & Event recording



Mobileye CAS



Car Dashcam with event Recording



Rear Parking Camera



Centralized Processing Unit

1. Multiple Camera inputs
2. GPS & Accelerometer
3. 3G/4G/WIFI
4. CAS Events
5. Vehicle OBD



# Immobilizer ECU for Indian Tier1

- **Ask from an Indian Supplier**
  - Bag the project from the European OEM. Win the bid against competitors
  - Deliver a generic platform immobilizer ECU
- **Project:** Develop the entire ECU SW for a renowned European sports bikes manufacturer
- **Project content:**
  - Develop bootloader and UDS diagnostics stack
  - Key authentication with key transponder, Pairing with Immobilizer and Engine ECU
  - State-of-the-art encryption and decryption algorithms as defined by German supplier
- **Customer Benefits :**
  - Leverage on Immobilizer domain knowhow
  - Meet demanding TTM timelines
  - Bootloader with state-of-the-art security algorithms



# Instrument Cluster ECU

- **Project:** Develop IO drivers for Renesas RH850 controller
- **Challenge:** Deliver ECU software in 5 months from scratch using newly launched controller
- **Project content:**
  - Develop AUTOSAR like ADC, PWM, I2C, RTC, WDT, SOUND, DMA drivers
  - Compliance to SW layered architecture of AUTOSAR
  - Portable across Renesas RH850 family
- **Customer Benefits :**
  - RH850 controller know-how to meet demanding TTM targets
  - Instrument cluster domain know
  - Platform development for scalability



# Powertrain ECU software

- **20 years of automotive powertrain ECU software development**
  - TPU and PCP co-processor programming for time critical applications like injection and ignition
  - End power-stage control and diagnosis of actuators
  - CAN, UDS, KWP, LIN communication protocols development
  - Layered SW architecture development on the lines of AUTOSAR standards
- **Quality process\methodology**
  - ASPICE process compliance
  - FMEA and 8D analysis
  - ISO26262 compliance
  - DevOPs / CICD
- **Customer Benefits**
  - SW development for highest ASIL ISO2626 applications
  - Multicore Mixed ASIL
  - Time critical applications requiring complex timing waveform generation



# Thank You for your time

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**Sachin Shivapur**

Co-Founder & CEO

Germany: +49-160-1479 707

[sachin.shivapur@crevavi.com](mailto:sachin.shivapur@crevavi.com)

**Shriram Kathavate**

Co-founder & CTO

India: +91-9880167217

[Shriram.Kathavate@crevavi.com](mailto:Shriram.Kathavate@crevavi.com)

[WWW.MOBILITY.CREVAVI.COM](http://WWW.MOBILITY.CREVAVI.COM)

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