

ECU Module Software Development & Testing

ECU Software: DE has the expertise in developing embedded Module software for the following Electronic control modules

Modules:

- **Instrument clusters**
- **Body**
- **Climate**

Instrument Cluster

Instrument Cluster – Features

- **Telltale**

ABS, Airbag (RIL), EPATS, Brake, Charge System, High Beams On, Left Turn Signal, Right Turn Signal, Hazard, Oil Pressure, Seat Belt, Check Engine (MIL), Speed Control Active, TPMS, Tow Haul, Wait to Start, 4x4 High, 4x4 Low, RTT Display RED Telltale (Warning), RTT Display AMBER Telltale (Caution), ..

- **Chimes**

Airbag Secondary Warning, Headlamps ON Reminder Chime, Key In Ignition Reminder, Left Turn / Right Turn Signal Tic-Toc, Hazard Tic Toc, Turn Signal Minder Chime, Message Center Warning Chime, Over Speed Warning, Park Brake Warning, Seat Belt Warning, Beltminder Warning, General Warning Chime, Turn Signal Minder, ...

- **Warnings and RTT**

Powertrain Malfunction / Reduced Power, Check Fuel Cap, Check Transmission, Door Ajar, Electronic Throttle Control Fault (ETC), Engine Coolant Over Temperature, Low Fuel, Traction Control Active, Water in Fuel, Oil Pressure,

- Illumination, Calibration, Engineering Test Mode
- Drive Position (EPRNDL)

DE Reusable Component based Prototype Solution

- Reduce the time for IC product development
- IC mostly have common specifications for OEM's with some up-gradations

- Fix platforms for line of products
- Fixing the platform brings in reusable board support packages and reduce time to market for the product
- To avoid repetitive effort, reusable platform independent packages are built
- Packages are task specific ready to use modules. Its behavior is configurable based on the Program needs
- Packages are built for most of the features to reduce the implementation time
- Package implements the core functionality and allows feature applications to handle inputs processing and program specific conditions
- Adaptability for developing clusters on different scale,
- Simple cluster to a complex cluster based on different vehicle segment
- Stepper driven to a TFT based cluster
- Addition of safety features like night vision, parking aid assistance...

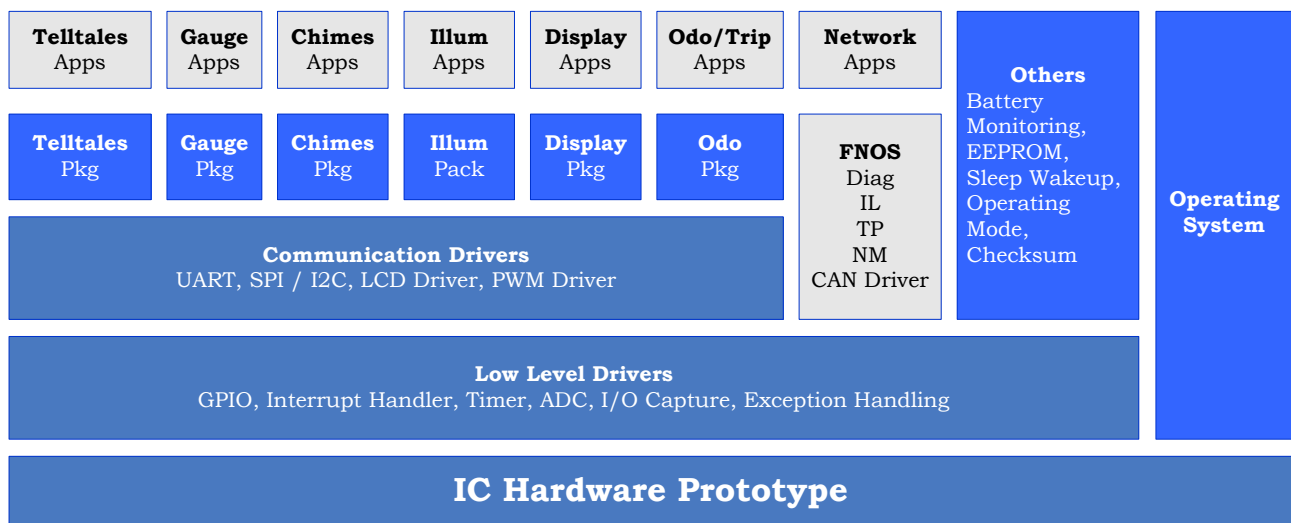
This calls for standardizing architecture to build IC Product

- Instrument Cluster mostly have common functionality for OEM's with up-gradations. To avoid repetitive effort, reusable platform independent packages are to be built which are adaptive for developing clusters for different vehicle segments.
- We propose to build a Standard IC Architecture based on 3 layers as detailed below,
 - Specific to platform
 - Low level drivers (BSP's)
 - Communication drivers with standard API's
 - Hardware specific interfaces of OS
 - **Configurable and Reusable Packages**
 - **Standard configuration parameters**
 - **Standard API's for application**
 - Application specific to customer specification built using the API's provided by packages

Architecture will support to configure the build, specific to a program by selecting required packages. This flexibility allow to customize the IC's for different vehicle segments and also migration to different platforms

IC – DE deliverables

- DE shall provide platform independent software component packages for the prototype development
- DE shall provide the communication drivers and BSP for the identified platforms with standard API's
- DE can provide the application development services
- DE can provide Hardware development prototyping service



Audio and Multimedia

Body Electronics / Climate Control:

BCM:

The BCM is one of the key and smart ECUs in the vehicle and performs following functionalities

Electrical Energy Management: Process information regarding the alternator through ECM, calculates maximum allowable current consumption of the climatic loads and sends a message to DIM to display certain symbols and messages. It communicates with BMS over LIN, to control regenerative charging and takes care of diagnostics implementation and car configurations.

Climate control: Includes air condition system control, heater control and blower fan control functionalities

Locking System: Includes Door locks, Central Locking and Remote Control functionalities

Exterior Lights / Interior Lights : Exterior Light functions include general functionality and bulb failure warning, Dipped/Main Beam Head Lights, Position Lights, Front Fog Light / Rear Fog Light, Stop Light / Emergency Brake Light, Reversing Light, Turn Indication / Hazard indication, Approach Light / Home Safe light and Auxiliary.

Visibility: The visibility function area contains the functionality related to visibility aspects of the car user like windscreen, headlamp cleaning and windscreen defroster through LIN. Also implements CAN communication and part II diagnostic requirement for visibility.

Driver Information: Driver Information system shall include Distance, Vehicle Speed, Fuel Level, Washer Fluid Level and Brake Fluid Level Indications.

Vehicle Dynamics: Vehicle Dynamic functions include

- AirBag
- Active Yaw Control
- Cruise Control and CADS System
- Collision Mitigation by Braking (CMbB)
- Engine Management: Either Clutch Switch Clutch TOT Switch (digital) and/or Clutch Pedal Sensor (analogue) is connected to CEM
- Engine Off Time

- Theft and Access Protection and Immobilizer control.

Tools Used:

- MATLAB/Simulink/Stateflow, RTW (Auto Code Generation), Volcano (OSEK based Network Management), BDM (Trace 32), Freescale Code Warrior (Compiler), Vector CANoe / LIN. Proprietary RTOS
- Unit Testing and Model Code Integration Testing (MCIT) (MxVDev)
- Configuration management (DOORS, CM Synergy)

Body Electronics / Climate Control:

HVAC:

Climate Control is the Drivers impression of the cabin environment and level of comfort related to the temperature and humidity. Climate Controls offer automatic and manual front and rear temperature controls that operate the Heating, Ventilation and Air Conditioning System (HVAC). HVAC systems can also provide reduce air infiltration, and maintain pressure relationships between spaces. Combining our domain knowledge with advanced development tools and hardware/software standardization, we are committed to delivering innovations that meet the market demands for reduced cost, high consumer perceived quality, improved occupant comfort, new Human Machine Interface (HMI) solutions and rapid development.

HVAC Software Product contains features like,

- Auxiliary Blower/Air Intake Control based on LIN Protocol
- Front/Auxiliary Temperature control
- HMI design based on Digital Control/CAN
- Voice Recognition application (synchronize with manual/Touch Screen Control)
- Dimming control
- LED driver
- Global Diagnostic Implementation (Ford Vehicle)
- Front Panel Diagnostic (Nissan Vehicle)
- I/O Control Module (Hardware dependent Module)
- Remote Display
- EOL (End of Line)
- Manual /Automatic Air Intake control
- Front/Auxiliary Blower Algorithm
- Implementation HMI state matrix algorithm (Different states Air Zone e.g. Single Zone, Dual Zone etc around 160 states)

Software Environment and Software Tools:

- Lauterbach Trace32 development tools, Freescale Microcontrollers, IAR Embedded workbench, CodeWarrior development tools
- RTOS, FNOS, AUTOSAR, QAC with MISRA compliance,
- Manual and Automated Testing using RTRT/NUNIT (Freeware), CANoe, LabVIEW, MATLAB
- CCP tools