Electronic Architecture for next Electrical Vehicle Generation

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Automotive Mechatronics a more than 30 years story
Pollux: Virtual target vehicle Architecture

Key technological innovation

- Affordable embedded fail safe concepts
- Smart sensors
- Mechatronis actuators
- Power systems
- New multicore
- Li-Ion cells
- Supercap monitoring
- Functionnal domain partitioning
- AUTOSAR multicore compliant
- Determinsitic in vehicle network (Ethernet EV)
- HW / SW and system integration
- Test cases and demonstrators
ARTEMIS Pollux Overview

a Pan-European Cooperation
10 European Countries

35 Partners
33 M€
POLLUX - Traction E-Motor Control

- Dual Core Technologies: ST Micro / Infineon
- Simulated model of traction E-Motor Control
- Demonstrators:
  - FIAT 500 Hybrid
  - PSA E/E Architecture HIL Test Bench
POLLUX - HMI

› Reconfigurable Displays
› Active Force Feedback Pedal for Eco-Driving
› Steer-by-Wire Maneuver Assistant system with Joystick
› Demonstrators: Th!nk car and Duracar
› Partners: CONTINENTAL, ZEM, SINTEF, Duracar
POLLUX - BMS & Charging Remote Control on Smart Phone

› Vehicle-to-Grid Simulation
› Energy management
› Charge Remote Control
› New look & feel for EV Interface driving
› Partners : CONTINENTAL, AKKA, GPT, FICOSA, ACIA
POLLUX - Final Demonstrators

DURACAR: Haptic Pedal
CITY MOTION: HMI
FIAT 500 Hybrid

TH!NK: X-by-Wire
PSA: EEA Architecture HIL test Bench
CONTINENTAL: Remote Charge Control
Continental Automotive
All Electric Vehicle - Zero Emission

- Brake Control Unit
- Accelerator Force Feedback Pedal
- HMI (Human Machine Interface)
- Li-Ion High Voltage Energy Storage
- Inverter, DC/DC Converter
- Electric Vehicle Controller
- Electrical Machine
- Electric Water Pump
- Electric Vacuum Pump
- Electric Machine
- Conti eContact Tires
Next Step: prediction based Energy Management
From Torque to predictive Energy Management

Shift from torque management to energy management
Managing vehicle and drivetrain diversity
Powertrain supervisor concept

- Driver demand acquisition
- Energy management
- Powertain management
- Electrical system management
- Thermal management

Vehicle communication
Pedals

Thermal control actuators
Plug in hybrid Charging interface

EMS CAN
Hybrid CAN
EMS
- Torque realization
- Combustion control

TCU

Hybrid drivetrain
Multi Core SW Architecture
A Major Trend

Helps to Resolve Contradicting Requirements

- Increasing performance requirements
  ⇒ classical approach: operating frequency increase

- Reduction of power dissipation Pd
  ⇒ classical approach: operating frequency reduction

MultiCore is the new Market Standard
Multi Core SW Architecture: SOP 2014

- **Low**
  - ~120Mhz
  - 1.5 M
- **Mid**
  - ~180Mhz
  - 2.5M
- **High**
  - ~200Mhz
  - 4M
- **Ultra High**
  - ~240Mhz
  - 6M

**Performance**
- Single Core
- Dual Core
- Multi Core

**Complexity**
- Crossbar
- Core
- Local RAM
- Peripherals incl. GTM
- Program Flash
- System RAM
- Prog Flash

*Continental*
BU Hybrid Electric Vehicle
Power Electronics Roadmap

- **Power Density (peak current, 10 s)**
  - Inverter: 215 Arms DCDC: 120 A Volume: 8.3 ltr
  - Inverter: 200 Arms DCDC: 180 A Volume: 7 ltr
  - Inverter: 305 Arms DCDC: 240 A Volume: 7 ltr Weight: 11 kg
  - Inverter: 450 Arms DCDC: 250 A Volume: 5.8 ltr Weight: 8 kg

- **Year**: 2008 Gen 1.0
- **Year**: 2009 Gen 1.5
- **Year**: 2011 Gen 2.0
- **Year**: 2015 Gen 2.8

Increasing Power density, Increasing Modularity, additional variants
Ethernet for Automotive Applications.
Roadmap at BMW

Specification, testing, maintenance

Reuse, scalability, maturity, quality

camera für assist systems

2008
Ethernet for fast flashing

2013
IP & Ethernet subsystem

2020
Highly integrated, efficient E/E architecture

Continental
Key Trends for 2020 PSA EE_Architecture

3 keys factors for evolutions with new Functionalities & Technologies

- **HYBRIDATION:**
  - *Micro Hybridation:* Optimization of existing solutions: Performance/Cost and Regenerative Braking (Battery Li-ion / Ultra-Capacitors)
  - *Mild Hybridation:* Introducing 48V Technology with new traction machine
  - *Full Hybridation:* Introducing Plug-in & Autonomous optimization (Batt Li-ion)

- **ADVANCED DRIVING ASSISTANCE (ADAS):**
  - Parking Assistance: interaction between several functions (limited Safety)
  - Driving Assistance: introducing Radar & Lidar Technologies
  - Autonomous Driving Assistance with centralized supervisor (high level of Dependability & Reliability)

- **CONNECTED CARS:**
  - Connectivity for services (Telediagnostic, Teleservices, Teleassistance)
  - Car To X communication for Safety, Cleaning up and Infotainment
  - Vehicle to Grid (V2G) for Smart Grid connection (Plugged Vehicle)
Automated Driving Continental Automotive Roadmap
Aeronautics and Automotive strategic agenda

... meet in Midi Pyrenees...
Thank you for your Attention!