

Subsystems

- **S1.** BCM (Body Control Module) responsible for functionalities related to the car body: access control for windows and doors, diagnostic interface, Heating Ventilation and Air Conditioning (HVAC)
- **S2.** Dashboard Instrument Cluster is the main information source for the driver, providing details on driving and mechanical condition
- **S3.** Engine ECU responsible with the ignition, traction control, fuel economy, reduced CO2 emissions
- **S4.** Chassis ECU responsible for braking, stability control, steering, safety related tasks for vehicle driving
- S5. Firewall/IDS protects the in-vehicle network from potential attacks coming over the less secure Android based infotainment unit S6. Infotainment Unit offers various modern applications and connectivity with user-held devices, e.g., mobile phone or tablets
- **S7.** RF (Radio Frequency) Receiver links the wireless devices, e.g., the key fob, with the BCM unit
- **S8.** TPMS (Tire Pressure Monitoring System) prevents accidents and improves on fuel consumption by warning the driver of improperly inflated tires
- **S9.** OBD (On-board diagnostics) Port enables the connection of an external diagnosis tool which communicates with the in-vehicle ECUs
- **\$10.** Rain-light sensor sends information to automatic windshield wipers and automatic light control systems
- **\$11.** Accelerator pedal provides information regarding the pedal position **\$12.** Smartphone an indispensable gadget that connects to the outside

Communication Interfaces

- **C1.** CAN (Controller Area Network) a broadcast bus up to 125kbps (low-speed) and up to 1Mbps (high-speed)
- **C2.** LIN (Local Interconnect Network) a low-cost serial communication protocol for speeds up to 20Kbps
- **C3.** USART (universal synchronous/asynchronous receiver-transmitter) a serial communication employed for short distance communication up to 38.4Kbps in our model
- C4. GPIO (General-Purpose Input/Output) communication lines used for various I/O operations
 - C5. RF (Radio Frequency) a wireless communication channel **C6.** FlexRay a high-speed network with data rates up to 10MBit/s

Electronic Control Units (ECU)

- **E1.** MC9S12DG128, 16bit, 50MHz, Flash: 128KB, EEPROM: 2 KB SRAM: 8KB, LIN: 1 ch. CAN: 2 ch. IIC, 2xSCI, 2xSPI, SAE J1850
- E2. MC9S12XF512, 16bit, 50MHz, Flash: 512KB, EEPROM: 2 KB SRAM: 32KB, FlexRay: 2 ch. CAN: 1 ch. IIC, 2xSCI, 2xSPI
- E3. MSP430F2274, 16bit, 16MHz, Flash: 32KB, RAM: 1KB, GPIO: 32, IIC, USART, SPI
- **E4.** Quad-Core Cortex A9, 1.6GHz, 1GB RAM, 0.98GB ROM Android 4.4.4 WiFi 802.11b/g/n Bluetooth CAN, USB, GPS