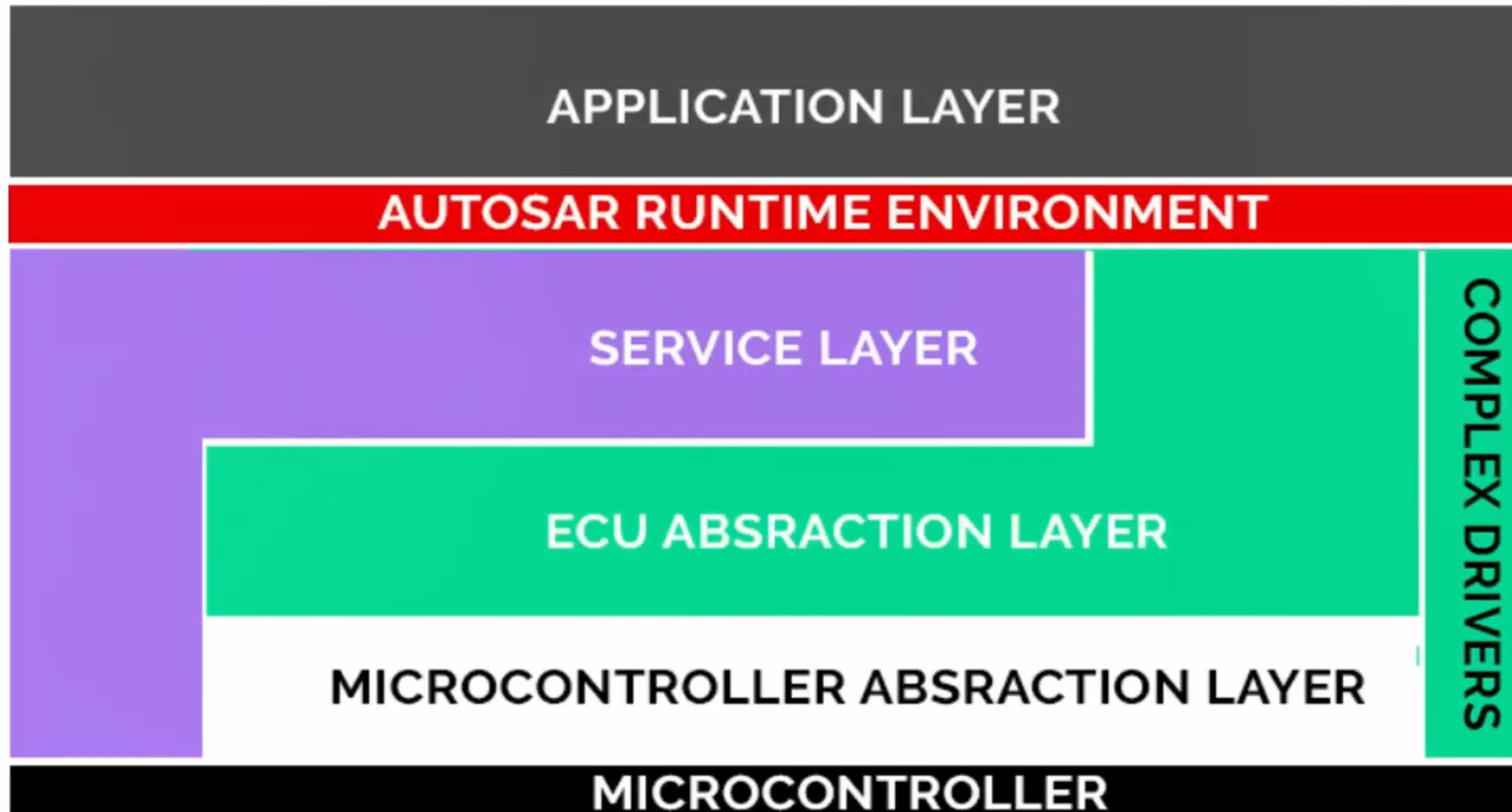


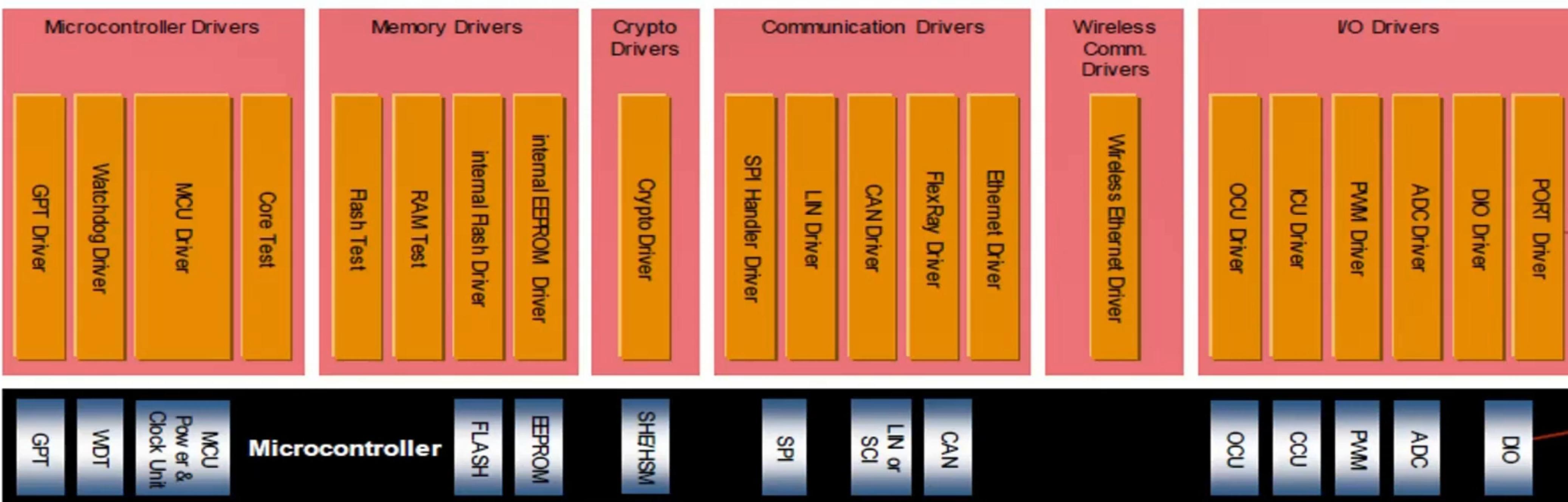
MICROCONTROLLER ABSTARCTION LAYER(MCAL)

AUTOSAR ARCHITECTURE



What is MCAL?

MCAL is a software module that directly accesses on-chip MCU peripheral modules and external devices that are mapped to memory, and makes the upper software layer independent of the MCU



The Microcontroller Abstraction layer consist of the following module groups

1. Microcontroller Drivers
2. Communication Drivers
3. Memory Drivers
4. I/O Drivers
5. Crypto Drivers
6. Wireless Communication Drivers

MICROCONTROLLER DRIVERS

- Drivers for Internal Peripherals functions with direct microcontroller access (Ex : Core Test)
- Internal Peripherals functions:
 - **WDG** -> Watch Dog Driver (Initialize WDG and Mode Settings)
 - **GPT** -> General Purpose Timer (Performs Timer Count)
 - **MCU** -> Microcontroller Unit (Initializes Clock and Power Mode Settings)



MEMORY DRIVERS

- Drivers for On-chipped Memory devices (Internal Flash and Internal EEPROM)
- Memory Mapped external Devices(Ex : external flash)
- Internal drivers are used to access internal peripherals located in microcontroller peripherals like Internal EEPROM, ADC,etc.
- External drivers are used to access external peripherals located outside the microcontroller like external Flash, EEPROM, Watchdog, etc.
- The internal driver lies in MCAL layer whereas the external driver lies in the ECU abstraction layer
- **FLS Driver:** FLS (Flash) Driver initializes FLS and reads/writes to FLS memory.

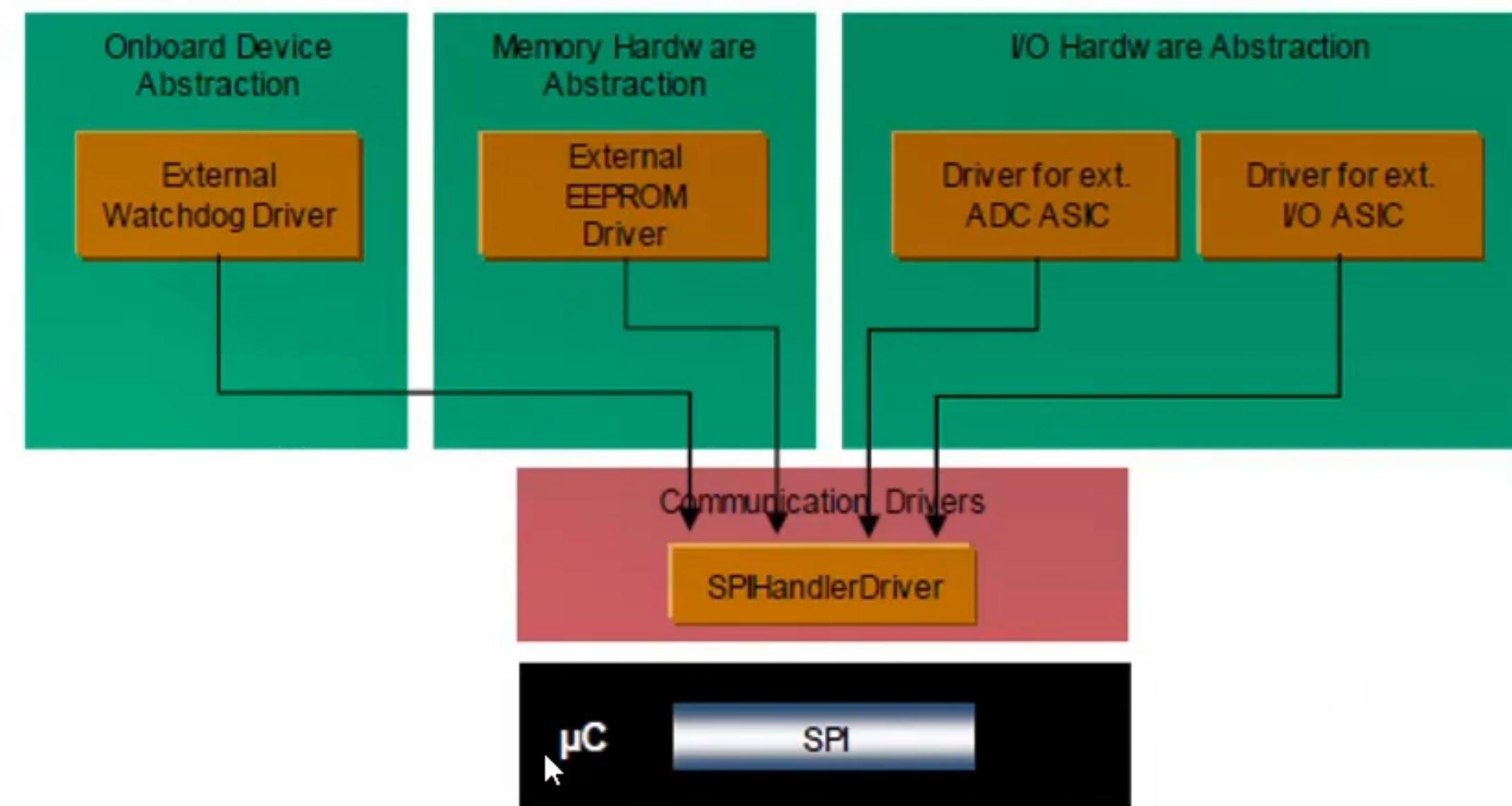
Communication Drivers

- Drivers for ECU Onboard(SPI) and Vehicle Communication(CAN).
- It is part of Data Link layer
- **SPI**: Serial Peripheral Interface Driver. on-chip clock serial function that initializes SPI, performs SPI input/output and SPI I/O buffer settings.
- **LIN**: Local Interconnected Network Driver initializes LIN and performs LIN input/output.
- **CAN**: Controller Area Network Driver that initializes CAN and performs CAN input/output.
- **FlexRay** : FlexRay device driver initializes FlexRay and performs FlexRay input/output.
- **Ethernet**: Ethernet device driver initializes Ethernet Driver and performs Ethernet Driver input/output.

SPI HANDLER DRIVER

The SPI Handler Driver allows concurrent access of several clients to one or more SPI busses.

Example:

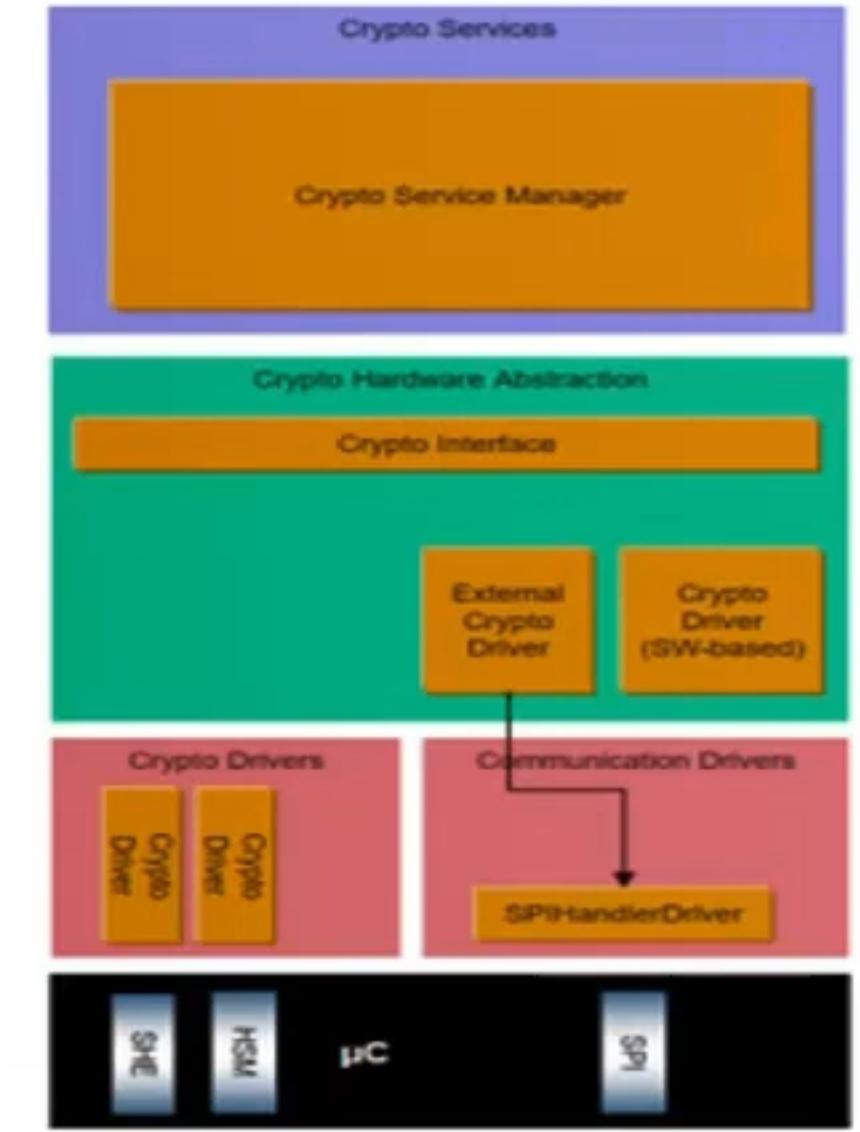


I/O DRIVERS

- Drivers for Analog and Digital I/O (e.g.: ADC,PWM,DIO)
- **ICU**: Input Capture Unit Driver and using on chip MCU timer and Initialize ICU. It also measures PWM Waveforms .
- **PWM**: PWM (Pulse Width Modulation) is a device driver using on-chip MCU timer. It initializes PWM and sends PWM waveforms as output.
- **ADC**: ADC (Analog Digital Converter) is a device driver for on-chip ADC. It initializes ADC, starts/stops AD conversion, sets AD conversion result buffer and reads AD conversion results.
- **DIO** : DIO (Digital Input/Output) is an MCU port device driver that performs port signal (input/output)
- **PORT**: PORT Driver is a MCU port device driver that performs MCU pin settings (I/O, shared functions)

CRYPTO DRIVER

- Drivers for on-chip crypto devices like SHE or HSM.
- HSM : Hardware Security Module
- SHE : Security Hardware Extension
- It implements a generic interface for synchronous and asynchronous cryptographic primitives.
- It also supports key storage, key configuration, and key management for cryptographic services.



WIRELESS COMMUNICATION DRIVER

- Drivers for wireless network systems (in-vehicle or off-board communication)
- The Wireless Ethernet driver provides communications access to the radio for wireless communications.

