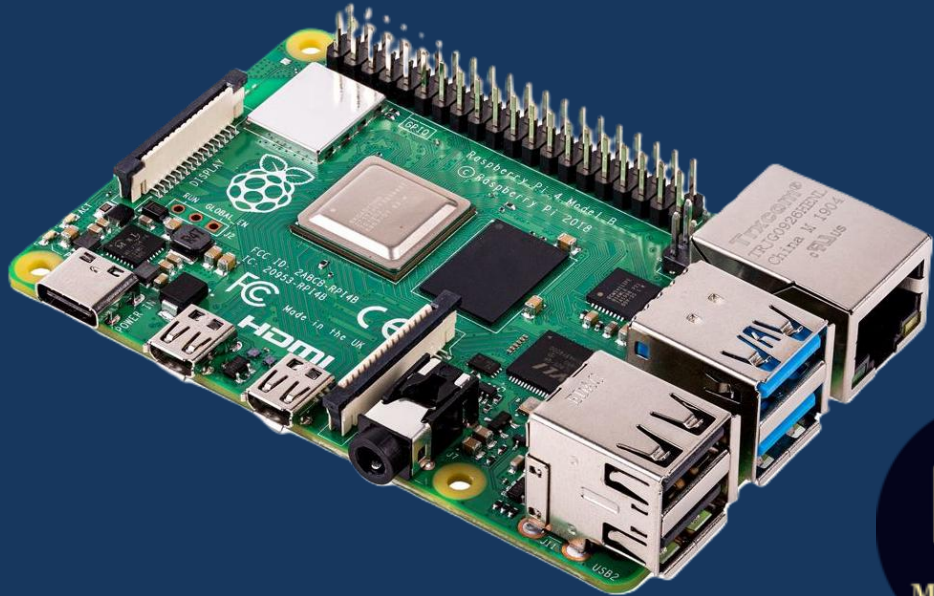


Linux Driver Development with Raspberry Pi



The diagram illustrates the layers of an operating system. It is divided into three main sections by two vertical dashed blue lines. The leftmost section is an orange rounded rectangle labeled 'User Space'. The middle section is a green rounded rectangle labeled 'Kernel', which contains a list of system services: Process Management, Memory Management, Device Drivers, File Systems, and Networking Stack. The rightmost section is a red rounded rectangle labeled 'Hardware', which lists physical components: CPU, RAM, GPIO, I2C, SPI, UART, and STORAGE. Below the first dashed line is the label 'Memory Boundary', and below the second is 'Hardware Abstraction Layer (HAL)'.

User Space

Kernel

- Process Management
- Memory Management
- Device Drivers
- File Systems
- Networking Stack

Hardware

CPU
RAM
GPIO
I2C
SPI
UART
STORAGE

Memory Boundary

Hardware Abstraction Layer
(HAL)

User Space

Programs
Python scripts,
C apps,
Terminal commands

Memory Boundary

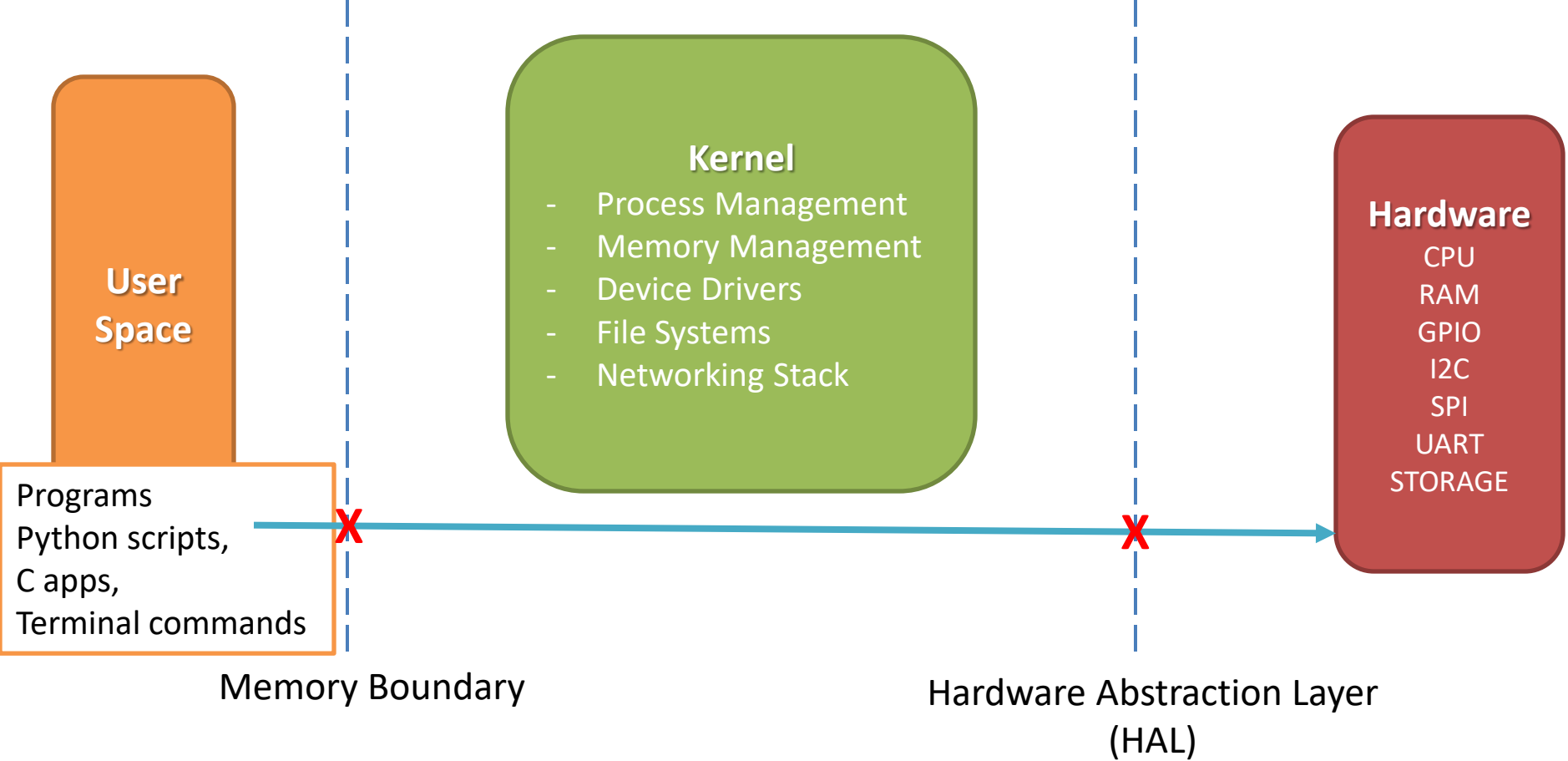
Kernel

- Process Management
- Memory Management
- Device Drivers
- File Systems
- Networking Stack

Hardware Abstraction Layer
(HAL)

Hardware

CPU
RAM
GPIO
I2C
SPI
UART
STORAGE



Unprivileged

User Space

- Desktop Apps
- C/Python etc. Programs
- Shell scripts
- Etc.

Privileged

Kernel

- Process Management
- Memory Management
- Device Drivers
- File Systems
- Networking Stack

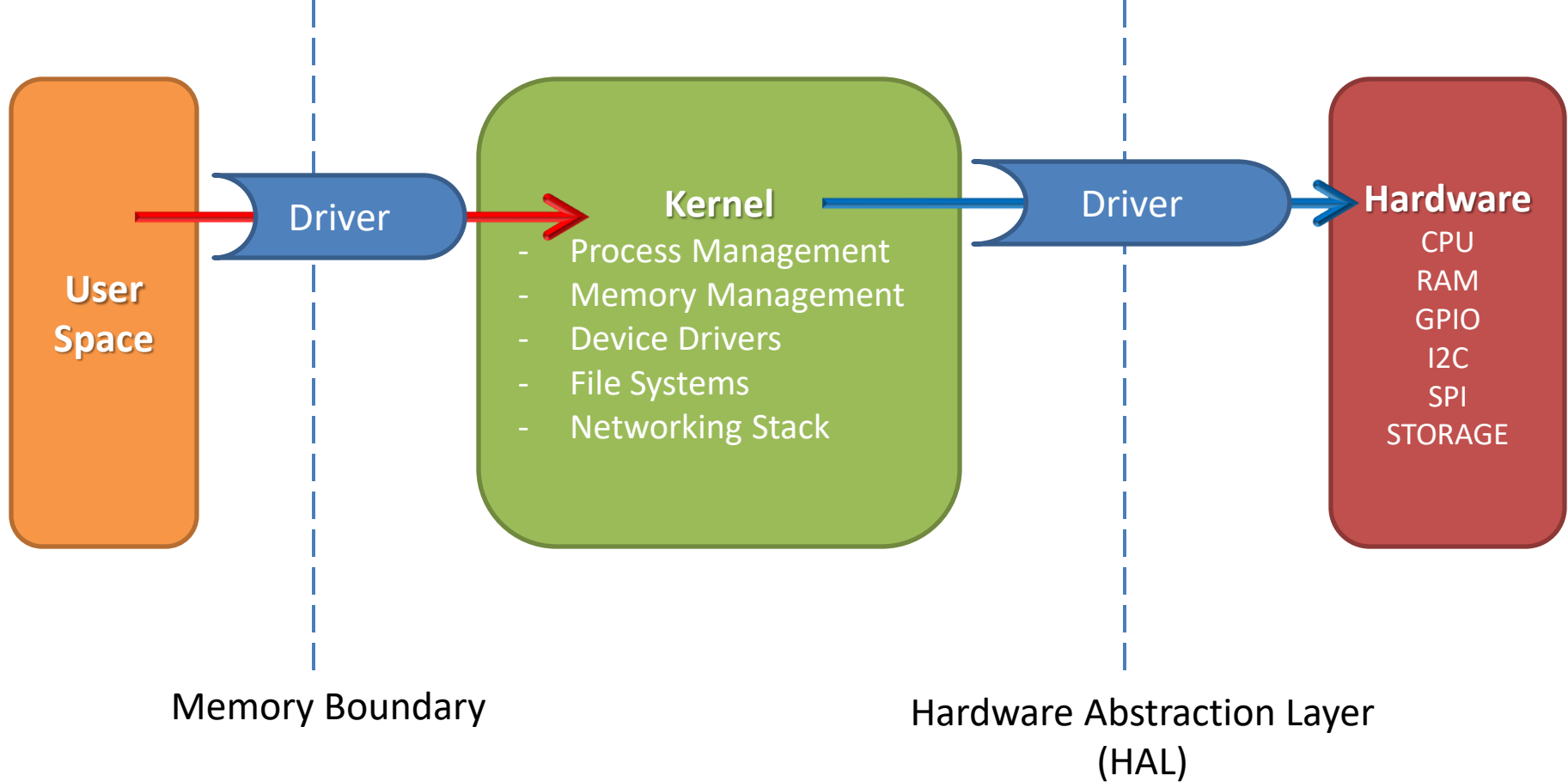
- Core OS runs.
- Kernel itself executes
- Device drivers run
- Interrupt handlers run
- Memory manager runs
- Etc..

Hardware

CPU
RAM
GPIO
I2C
SPI
STORAGE

Memory Boundary

Hardware Abstraction Layer
(HAL)



Only kernel space can directly interact with hardware (GPIO, I2C, SPI, etc).