OPERATING SYSTEM OTA UPDATE

SERVER A

SERVER B
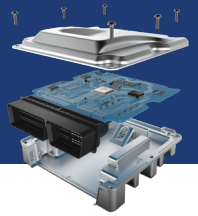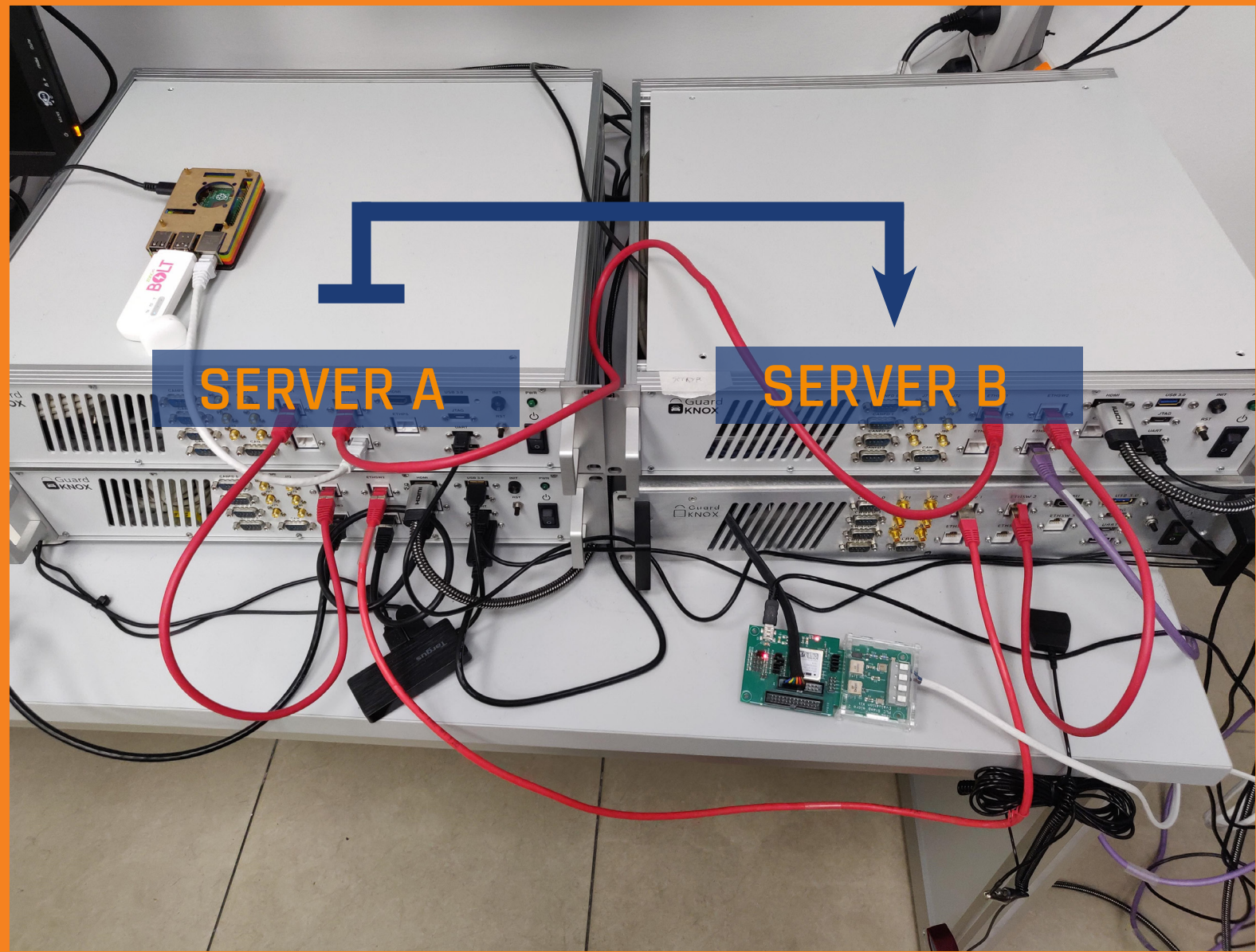
Server B pulls a complete virtual machine (vm) from Server A as an update via ethernet and authenticates it

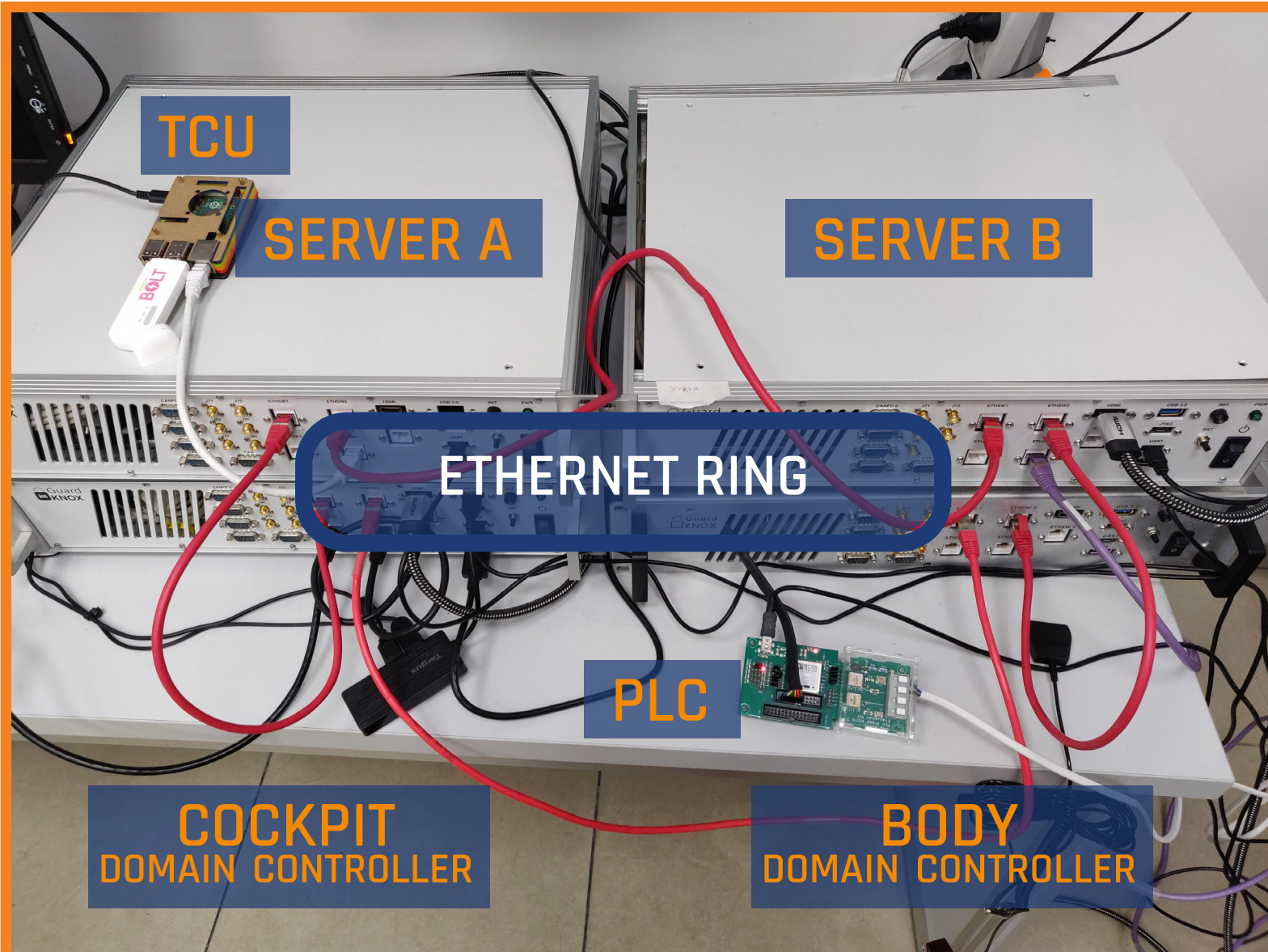Server B replaces the virtual machine and boots it

Server A runs pikeos as hypervisor (safety and security)

Server B runs xen as hypervisor (open source)

GUARD KNOX

FAIL OPERATIONAL ETHERNET BACKBONE

TCU

SERVER A

SERVER B

ETHERNET RING

PLC

COCKPIT
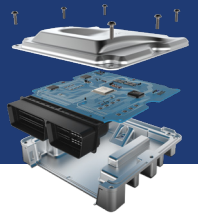DOMAIN CONTROLLER

BODY
DOMAIN CONTROLLER

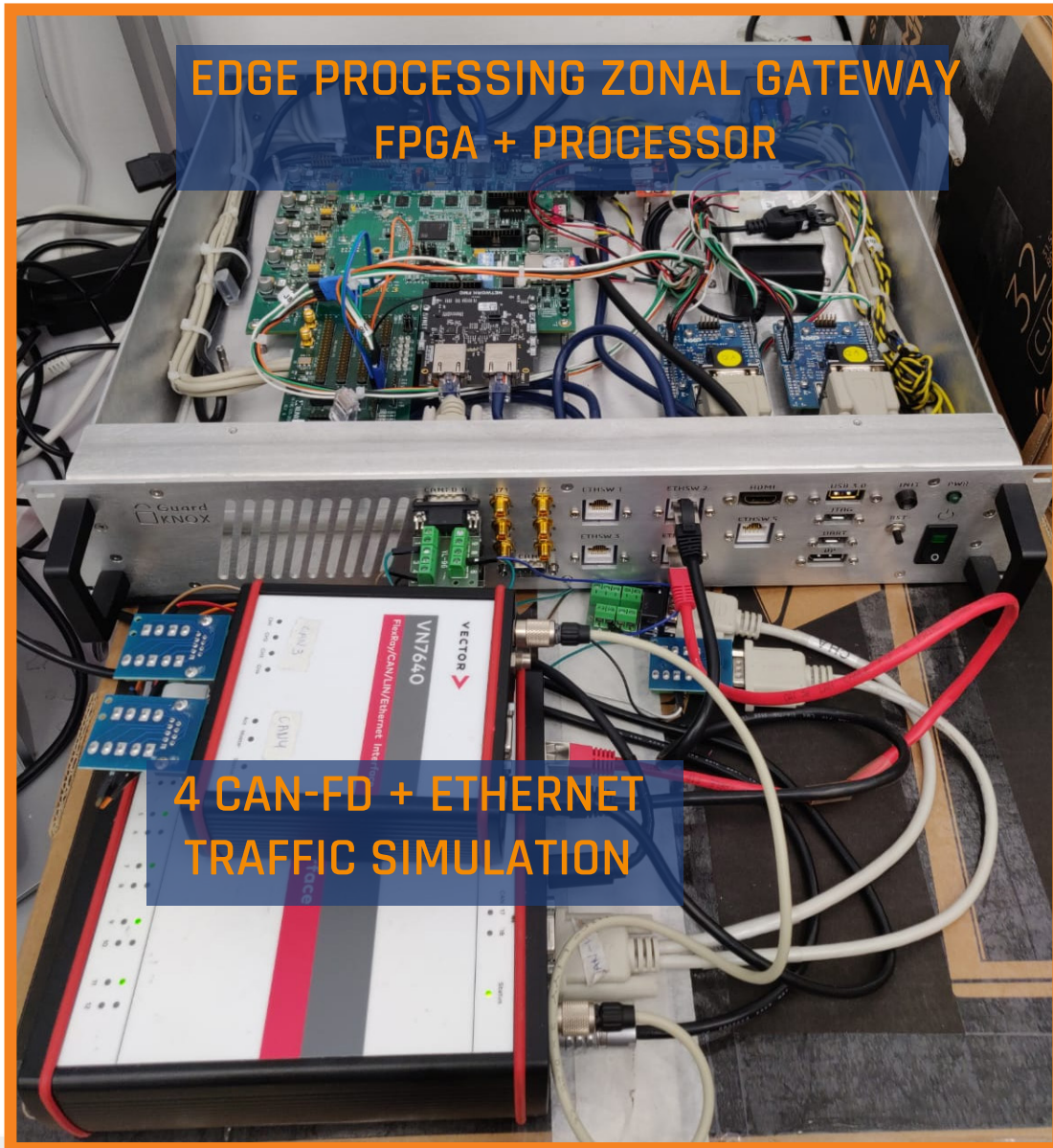Ring configuration of 3 high-performance platforms and telematics control unit (tcu) attachment

All connected via ethernet

Can break the modular ring at any point without affecting the network (fail operational automatic convergence)

GUARD KNOX

HARDWARE PROTOCOL DATA UNIT (PDU) ROUTING

EDGE PROCESSING ZONAL GATEWAY
FPGA + PROCESSOR

4 CAN-FD + ETHERNET
TRAFFIC SIMULATION

Zonal gateway with edge processing capability

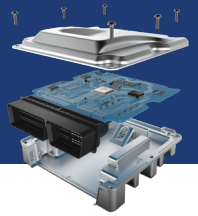PDU routing in hardware (FPGA) independent of processor

4 can-fd + 2 ethernet interfaces with traffic generated using vector
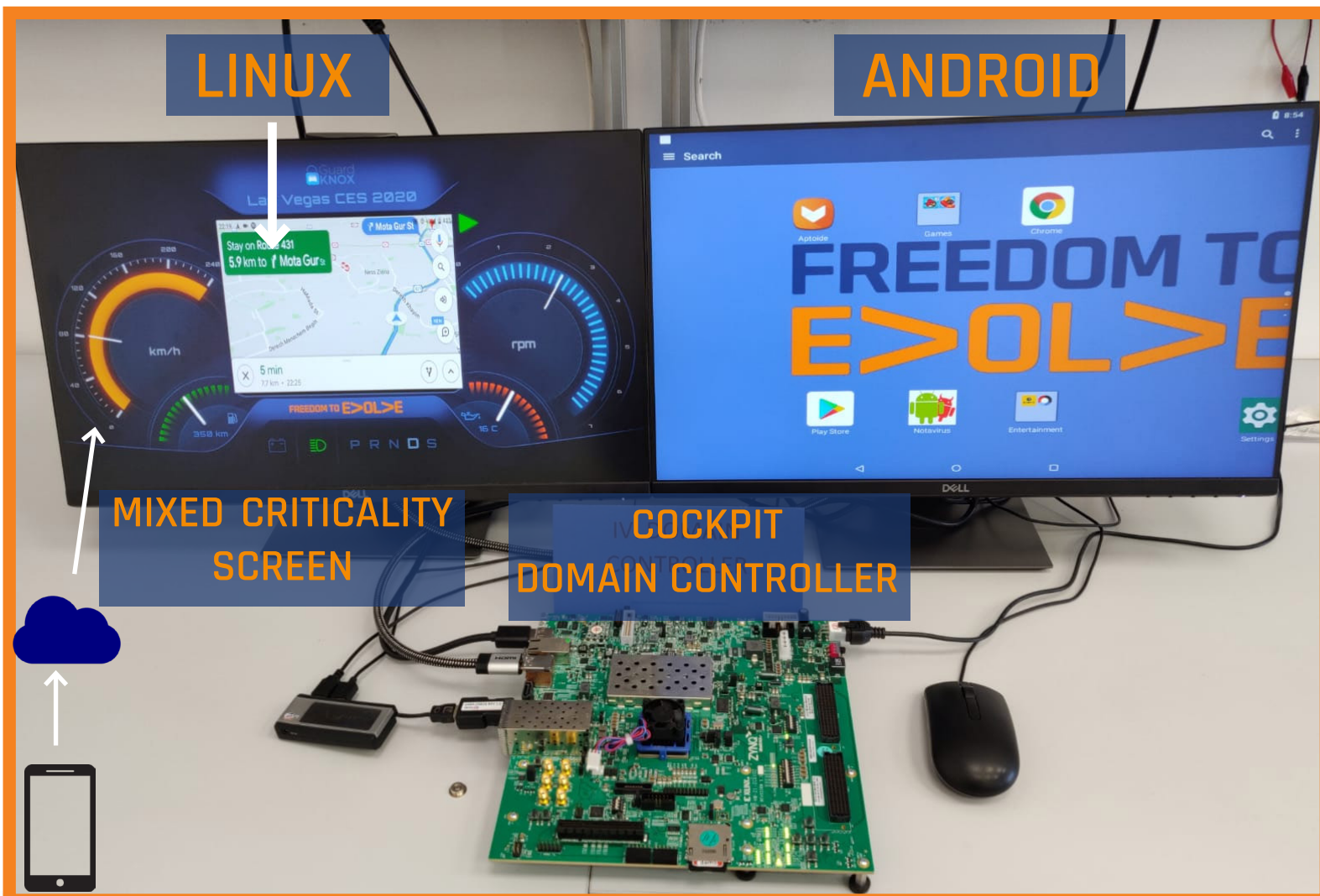
Processing latency is ~1 microsecond

Ethernet may be switched

Updatable

FREEDOM TO EVOLVE

MIXED CRITICALITY INSTRUMENT CLUSTER UPDATE

LINUX

ANDROID

MIXED CRITICALITY SCREEN
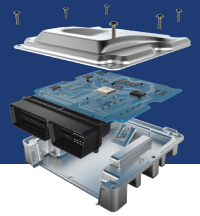
COCKPIT DOMAIN CONTROLLER

Cockpit domain controller is a single SoC mixed criticality ecu

Android (dedicated screen) and linux (segment of instrument cluster screen) on hypervisor

Instrument cluster + linux screen: mixed criticality (linux is the non-safety critical and dials are safety critical)

Phone app can communicate with the cockpit domain controller through the tcu over the ethernet backbone

Safe and secure update of the instrument cluster faceplate
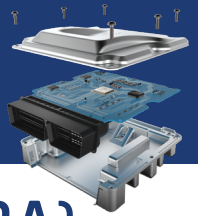
FREEDOM TO EVOLVE

MICROSERVICES UPDATE

LINUX

ANDROID

MIXED CRITICALITY SCREEN

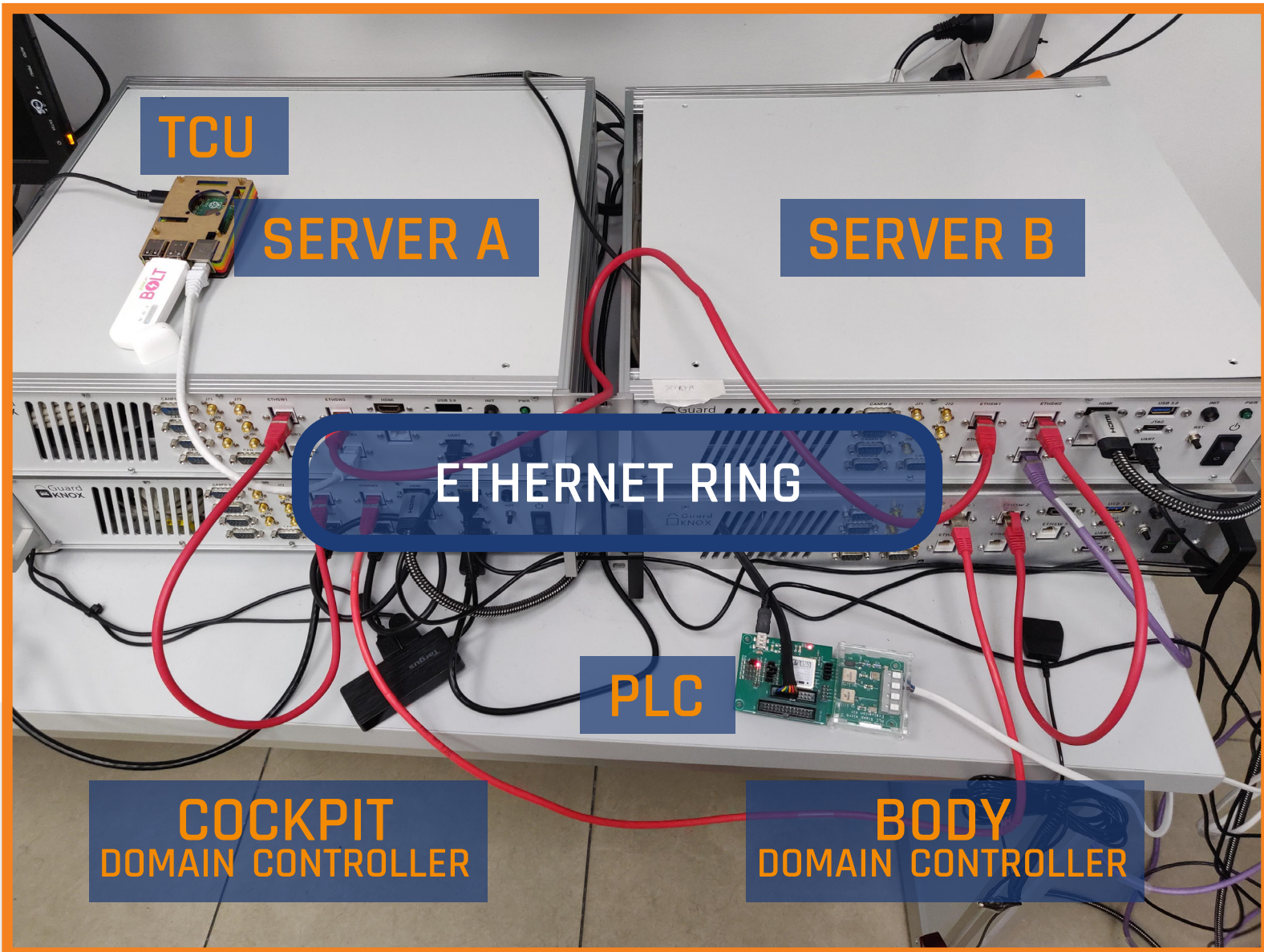**COCKPIT DOMAIN CONTROLLER**

Linux virtual machine pulls container (or a micro-service) from Server A

The application is replaced on the mixed criticality screen (the middle of the instrument cluster

# SERVICE-ORIENTED ARCHITECTURE (SOA)
PLUG AND PLAY DEMO

TCU

SERVER A

SERVER B

ETHERNET RING

PLC

COCKPIT
DOMAIN CONTROLLER

BODY
DOMAIN CONTROLLER

When tcu is connected -> tcu will publish a wifi hotspot service -> wifi hotspot button appears on android screen in cockpit domain controller

When tcu is disconnected -> tcu no longer publishes a wifi hotspot service -> wifi hotspot button disappears on android screen in cockpit domain controller
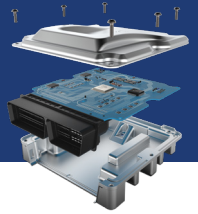
HARDWARE OVER THE AIR UPDATE

TCU

SERVER A

SERVER B

ETHERNET RING

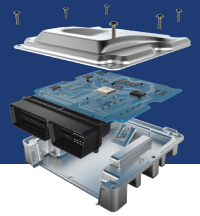PLC

COCKPIT
DOMAIN CONTROLLER

BODY
DOMAIN CONTROLLER
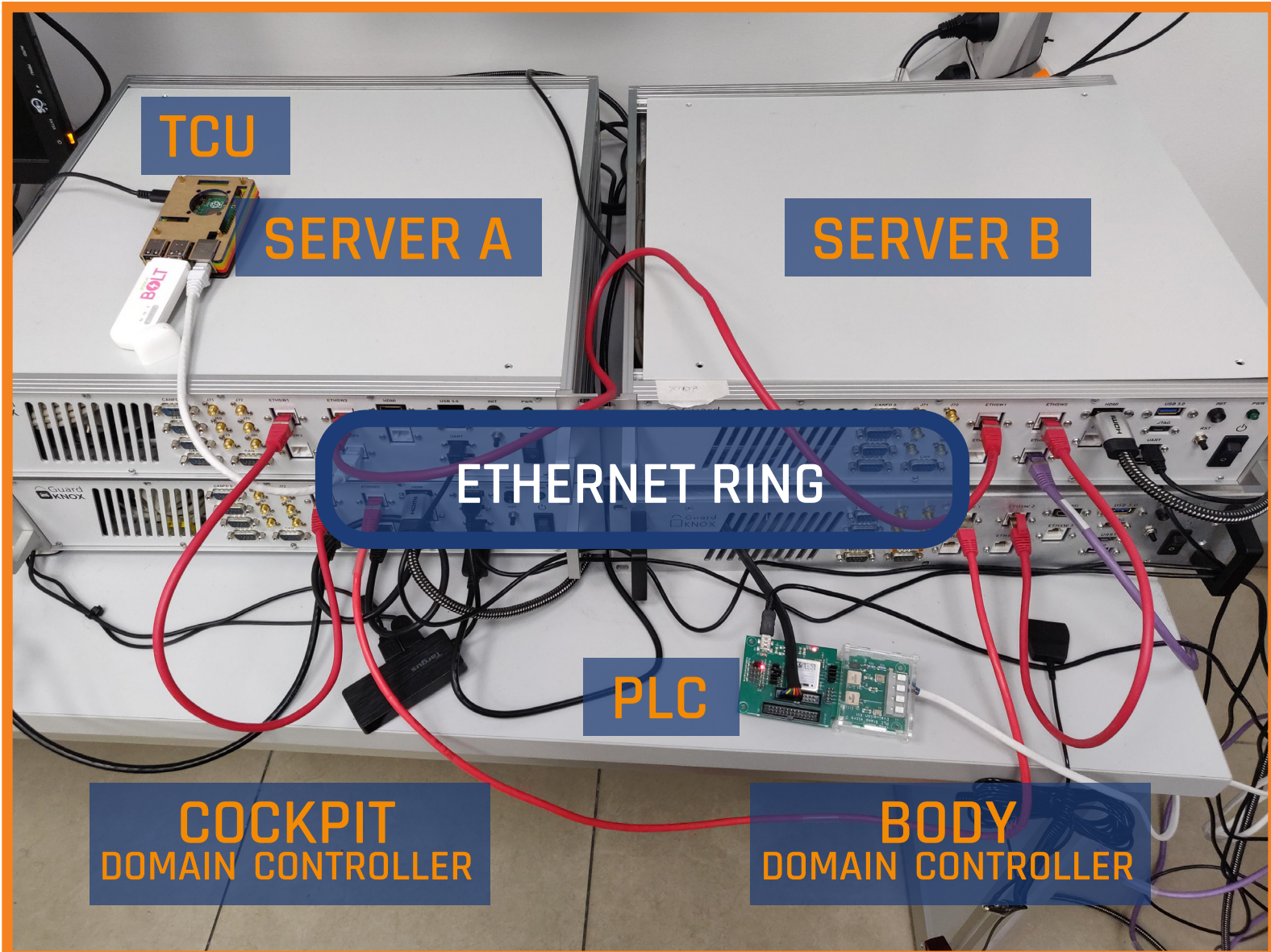
HOTA UPDATE

Server B pulls new fpga configuration image from Server A

Server B reboots with new adas functionality (sobel derivative image filter)

GLOSSARY OF TERMS

VM = Virtual Machine

OTA = Over The Air

HOTA = Hardware Over The Air

OS = Operating System

TCU = Telematics Control Unit

PLC = Powerline Communications

FPGA = Field Programmable Gate Array

SoC = System On Chip

= Ethernet Ring