Xen Dom0-less

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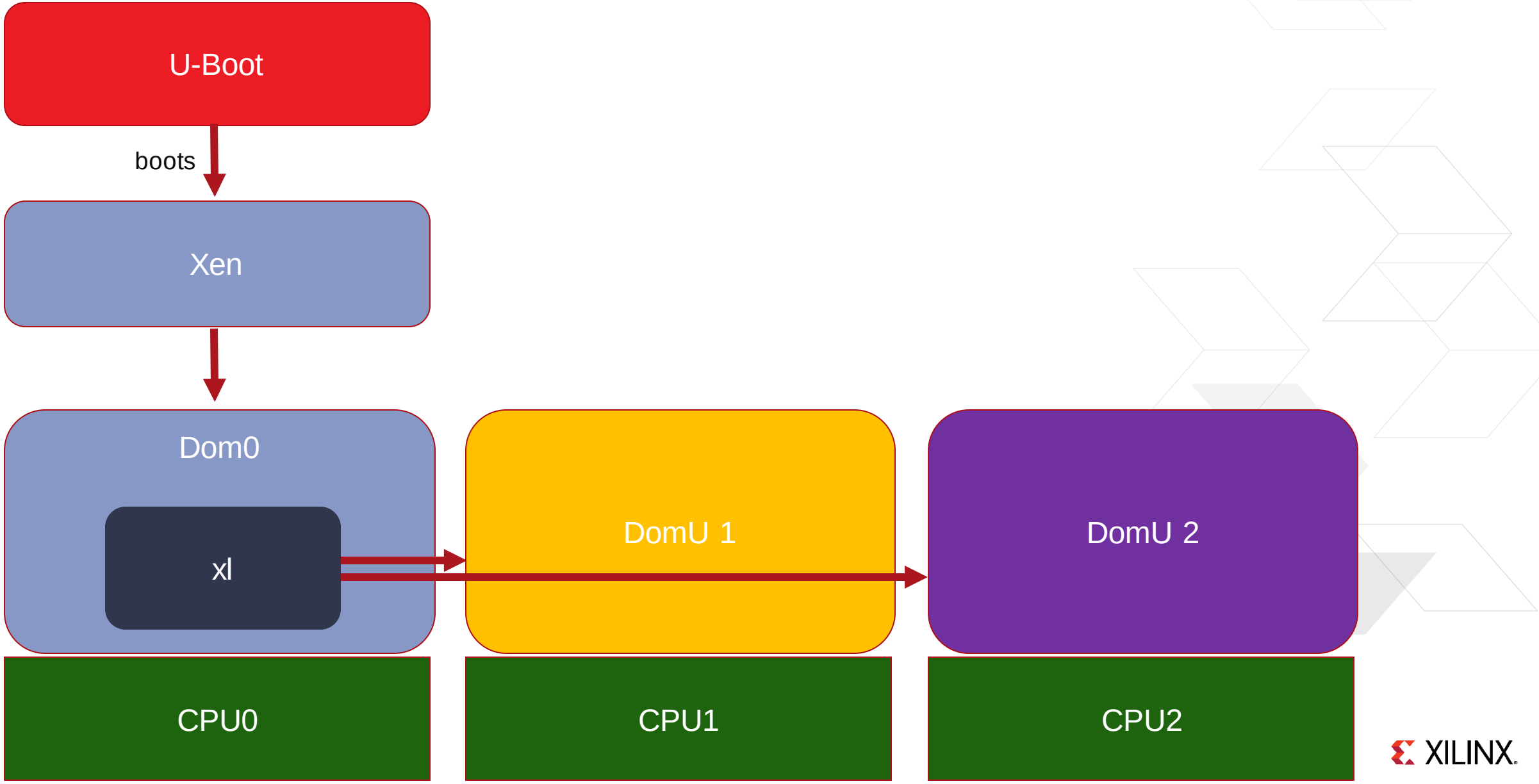
XILINX.

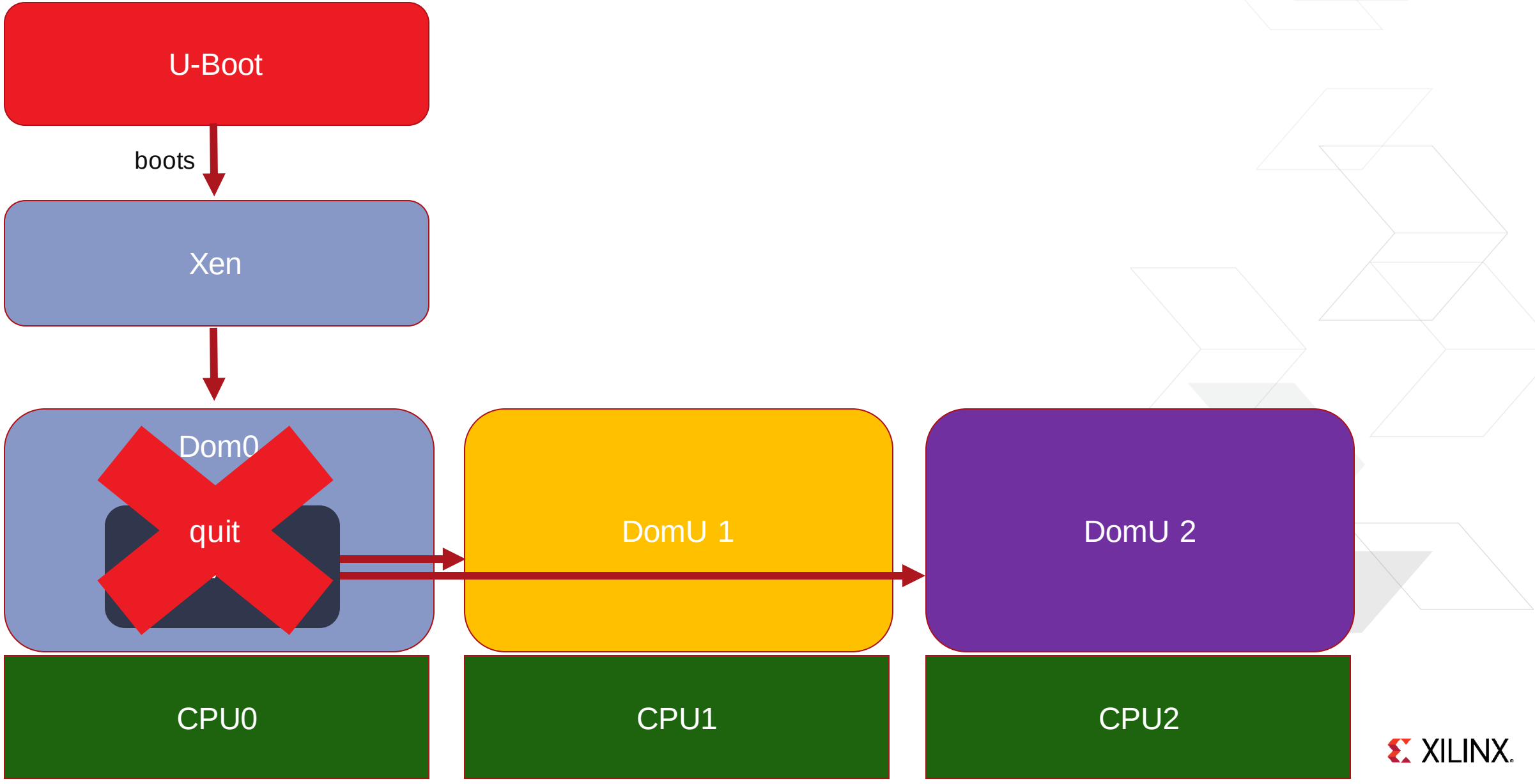
Traditional Xen System Configuration and Boot



The problem

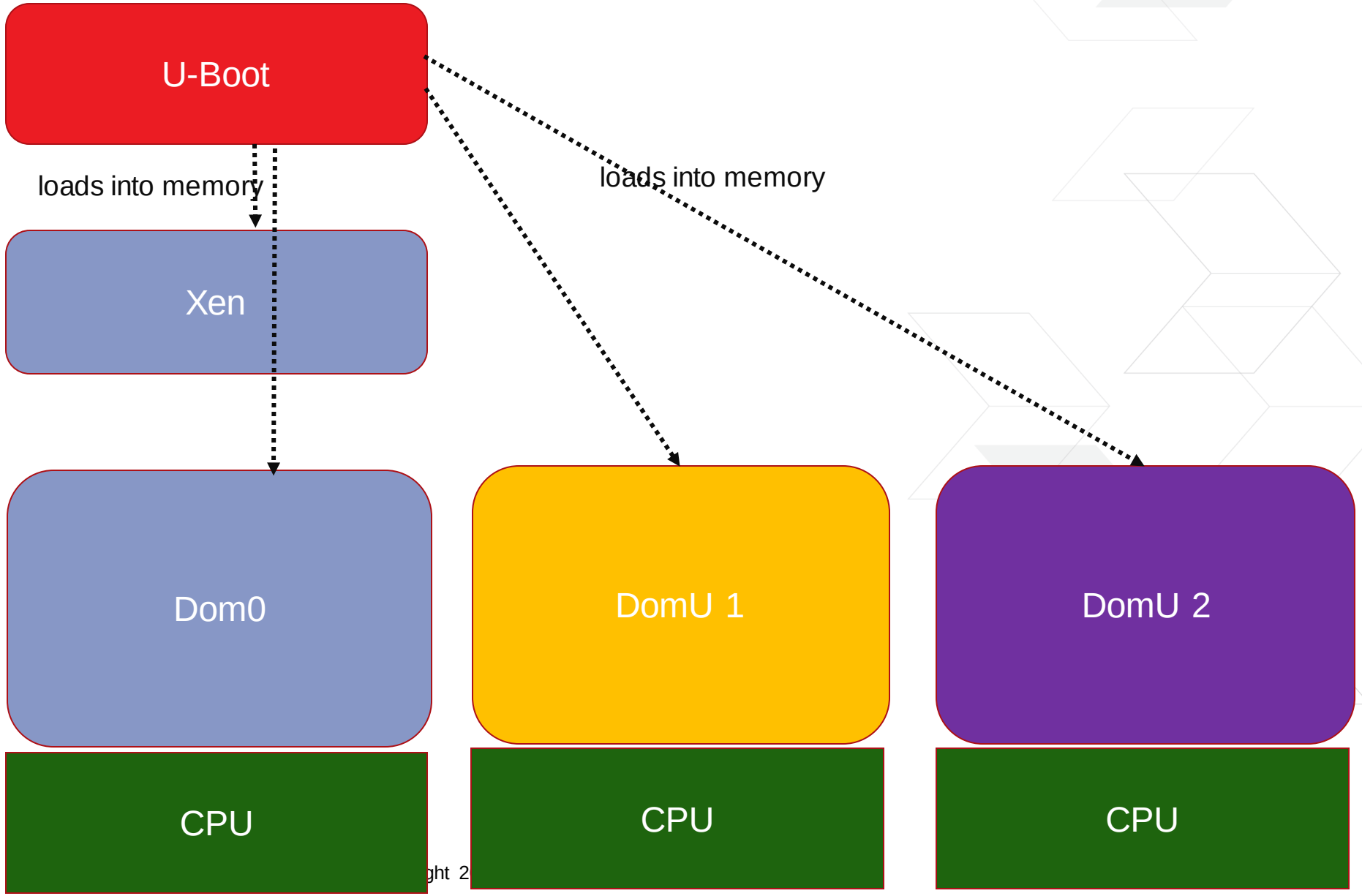
- Boot Time
  - total > xen + dom0_kernel + dom0_user
- Safety Certifications
  - Dom0 doesn’t have to be Linux but it typically is
  - non-Linux Dom0
  - exit Dom0 after boot
- Complexity
  - build-time complexity
    - Yocto rootfs build
  - runtime flexibility
    - Monitoring
    - VMs restart

Traditional Xen System Configuration and Boot

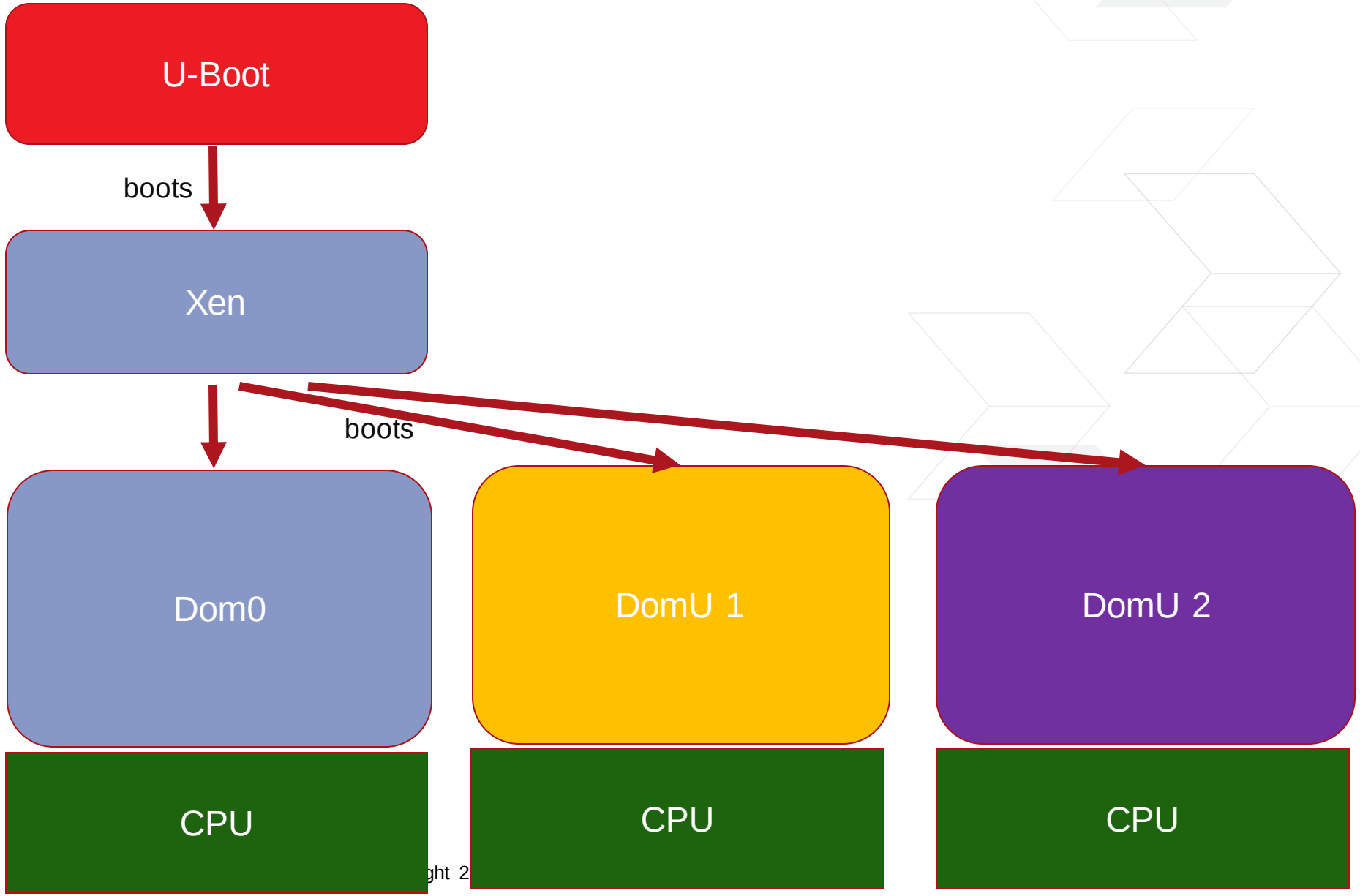


Dom0-less

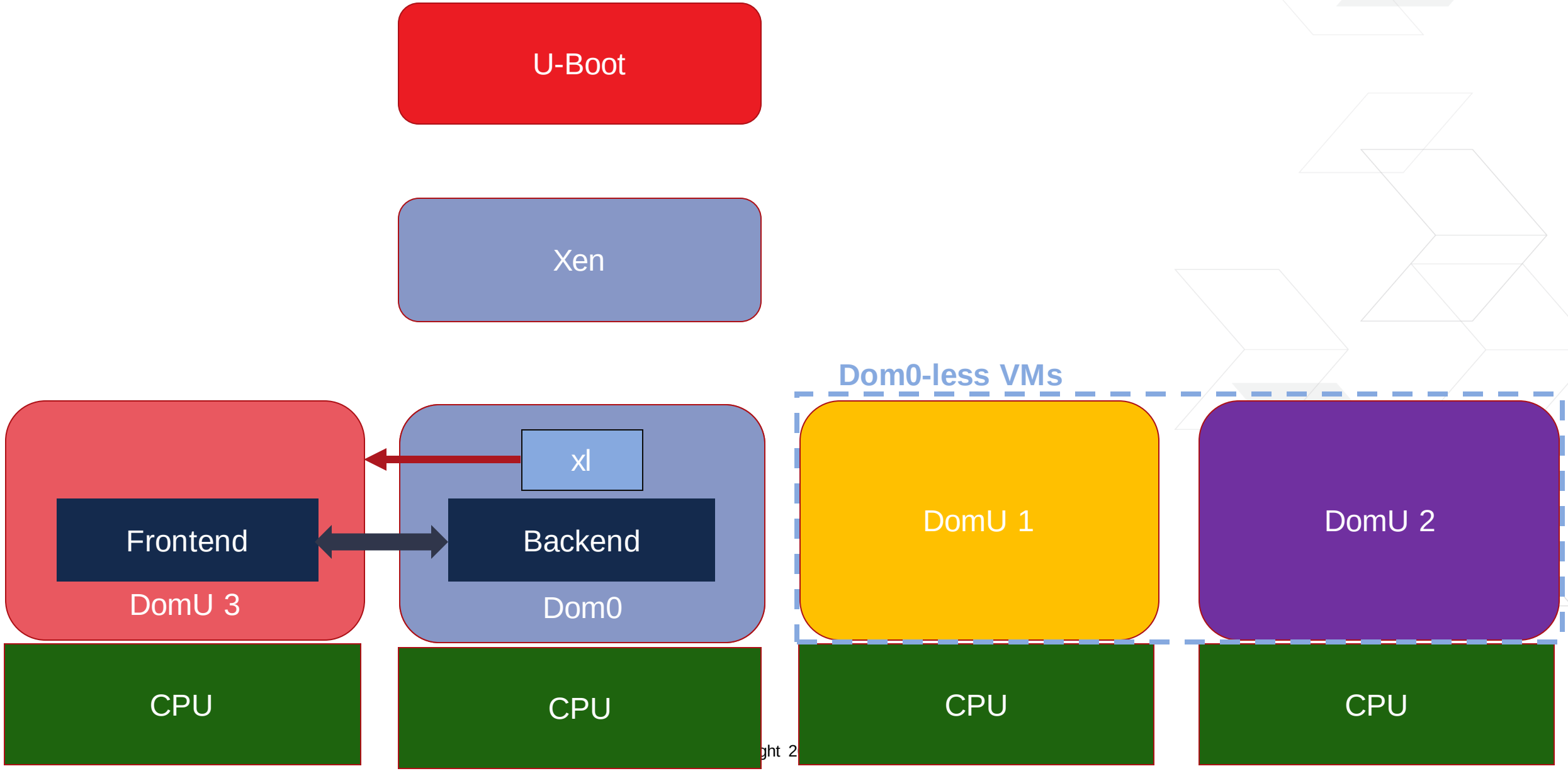
Dom0-less System Configuration and Boot



Dom0-less System Configuration and Boot



Dom0-less System Configuration and Boot



U-Boot + Device Tree protocol

> Load all the required binaries via U-Boot commands

```
tftpb 0x4000000  dom0less/mpsoc.dtb
tftpb 0x80000    dom0less/Image-dom0
tftpb 0x5000000  dom0less/uXen
tftpb 0xd000000  dom0less/dom0-ramdisk.cpio.uboot

tftpb 0xa000000  dom0less/Image-domU
tftpb 0xb000000  dom0less/domU-ramdisk.cpio

bootm 0x5000000  0xd000000  0x4000000
```

U-Boot + Device Tree protocol

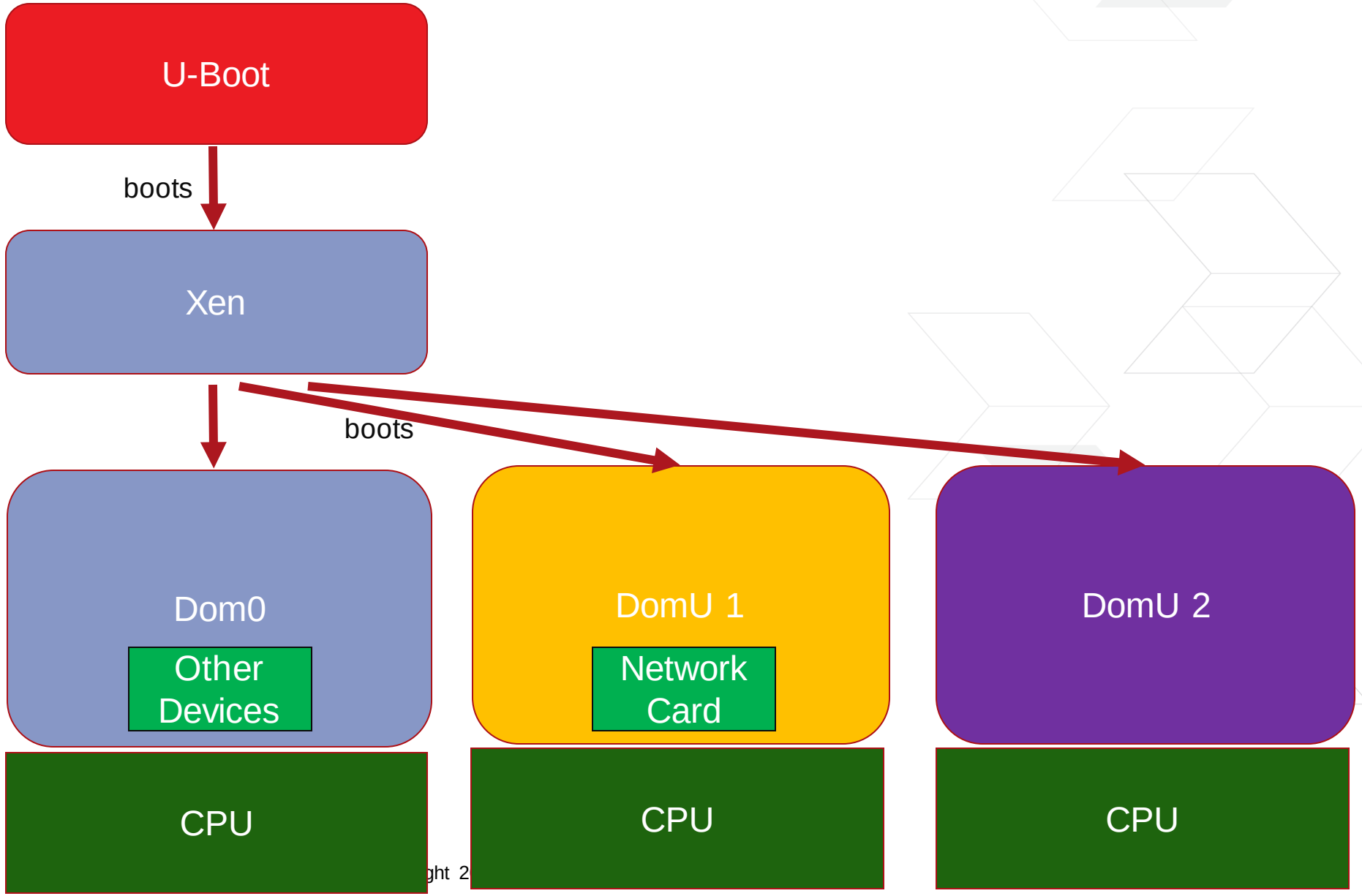
> Advertise and configure Dom0-less VMs via Device Tree

```
domU1 {
        compatible = "xen,domain";
        memory = <0x20000>;
        cpus = 1;
        vpl011;

        module@a000000 {
                compatible = "multiboot,kernel", "multiboot,module";
                reg = <0xa000000  0xffffff>;
                bootargs = "console=ttyAMA0";
        };

        module@b0000000 {
                compatible = "multiboot,ramdisk", "multiboot,module";
                reg = <0xb000000  0xffffff>;
        };
};
```

Dom0-less Device Assignment



Dom0-less Device Assignment

> Configured via a nested device tree snippet

```
domU1 {
        […]

        module@a000000 {
                compatible = "multiboot,kernel", "multiboot,module";
                reg = <0xa000000  0xffffff>;
                bootargs = "console=ttyAMA0";
        };

        module@b0000000 {
                compatible = "multiboot,ramdisk", "multiboot,module";
                reg = <0xb000000  0xffffff>;
        };

        module@c000000 {
                compatible = "multiboot,device-tree", "multiboot,module";
                reg = <0xc000000  0xffffff>;
        };
};
```

Dom0-less Device Assignment

- Configured via a nested device tree snippet
  - the device tree node of the device to assign
  - same as for regular DomUs
  - Special properties:
    - **interrupts**: interrupts to remap
    - **interrupt-parent**: special reference to GIC parent (65000)
    - **xen,path**: path to the device node in the main DT
    - **xen,reg**: memory to remap

```
/dts-v1/;

/ {
        #address-cells = <0x2>;
        #size-cells = <0x1>;

        passthrough {
                compatible = "simple-bus";
                ranges;
                #address-cells = <0x2>;
                #size-cells = <0x1>;

                ethernet@ff0e0000 {
                        compatible = "cdns,zynqmp-gem";
                        status = "okay";
                        interrupt-parent = <0xfde8>;
                        interrupts = <0x0 0x3f 0x4 0x0 0x3f 0x4>;
                        xen,path = "/amba/ethernet@ff0e0000";
                        xen,reg = <0x0 0xff0e0000 0x1000 0x0 0xff0e0000>;
                        reg = <0x0 0xff0e0000 0x1000>;
                        clock-names = "pclk", "hclk", "tx_clk", "rx_clk";
                        #address-cells = <0x1>;
                        #size-cells = <0x0>;
[...]
```

Dom0-less Pros & Cons

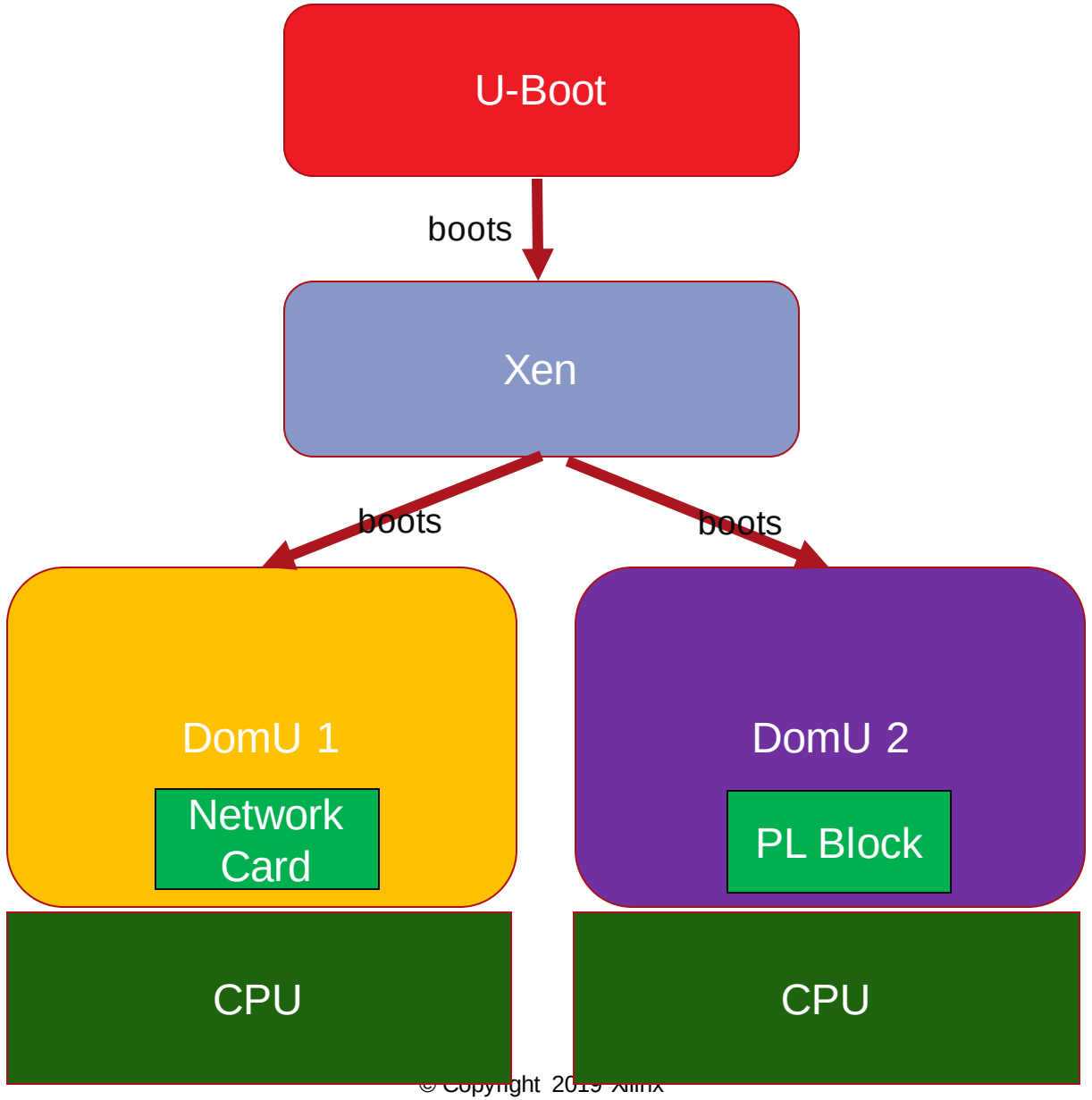
Pros:

- Much **faster** startup times
  - total ~= xen + domU
- Enable true Dom0-less configurations
  - Excellent for small systems
  - Easier to certify
- Lower Complexity
  - No need for the Xen tools
  - Does not require Yocto, just cross-build Xen
  - No need for Xen support in Dom0-less VMs, no need for CONFIG_XEN

Cons:

- No monitoring and restarting DomUs without Dom0
- No PV frontends/backends without Dom0

True Dom0-less

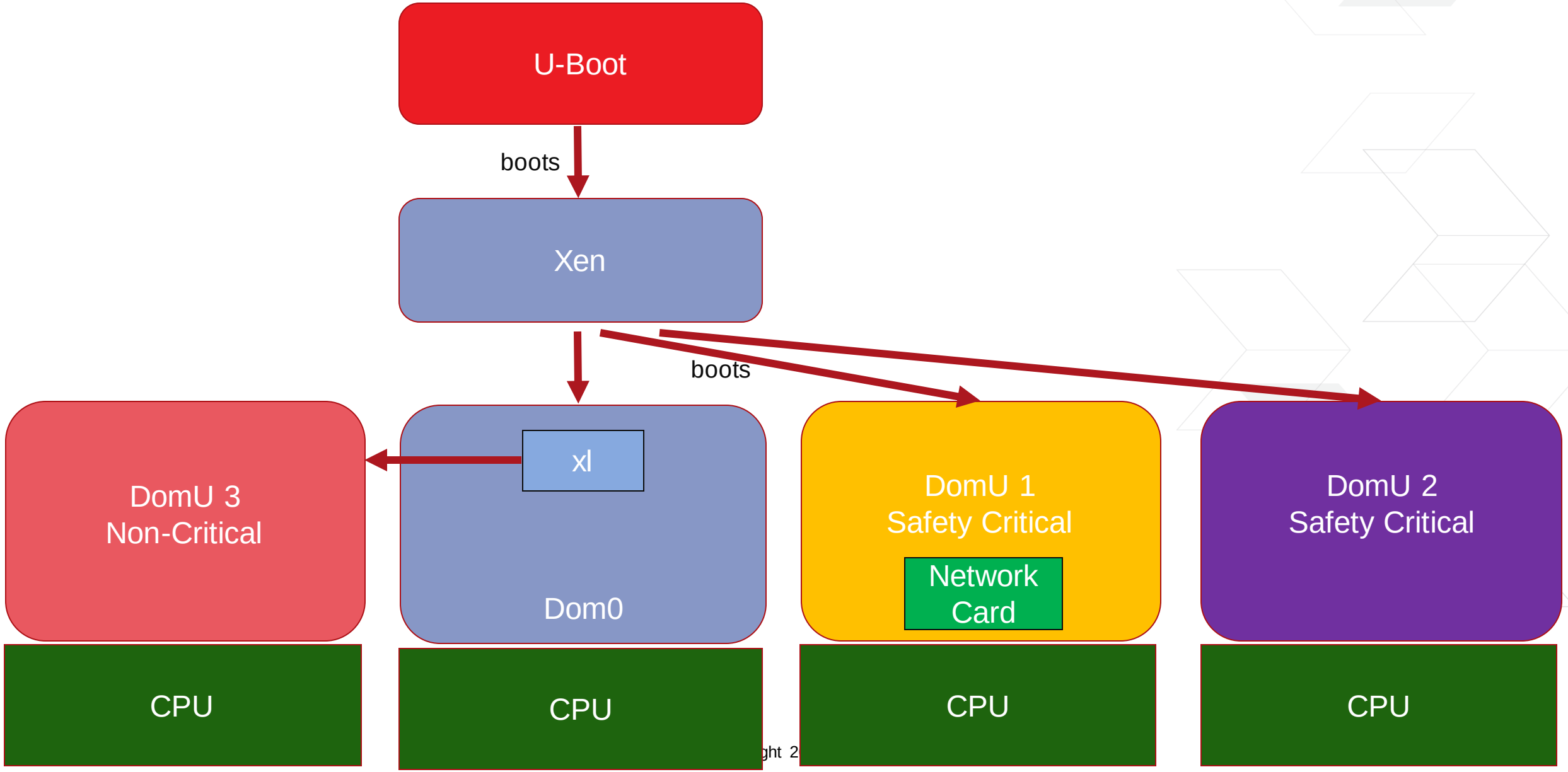


Status & TODO

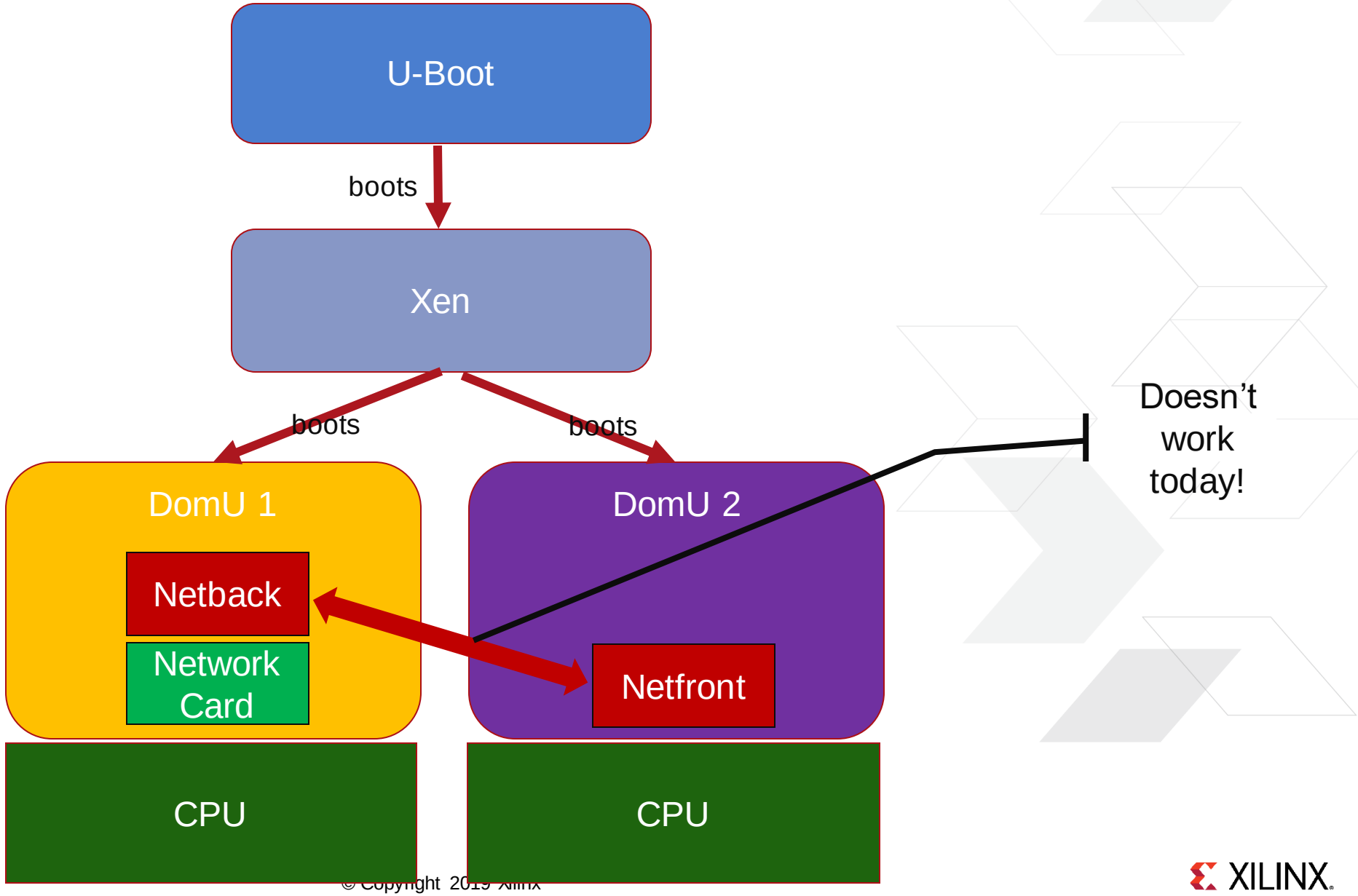
- DONE
  - basic Dom0-less booting upstream in Xen 4.12
  - device assignment implemented and sent to the list (not upstream)

- TODO
  - True Dom0-less
  - Shared memory and interrupts for VM-to-VM communications
  - PV frontends/backends drivers for Dom0-less VMs

Dom0-less and safety critical applications

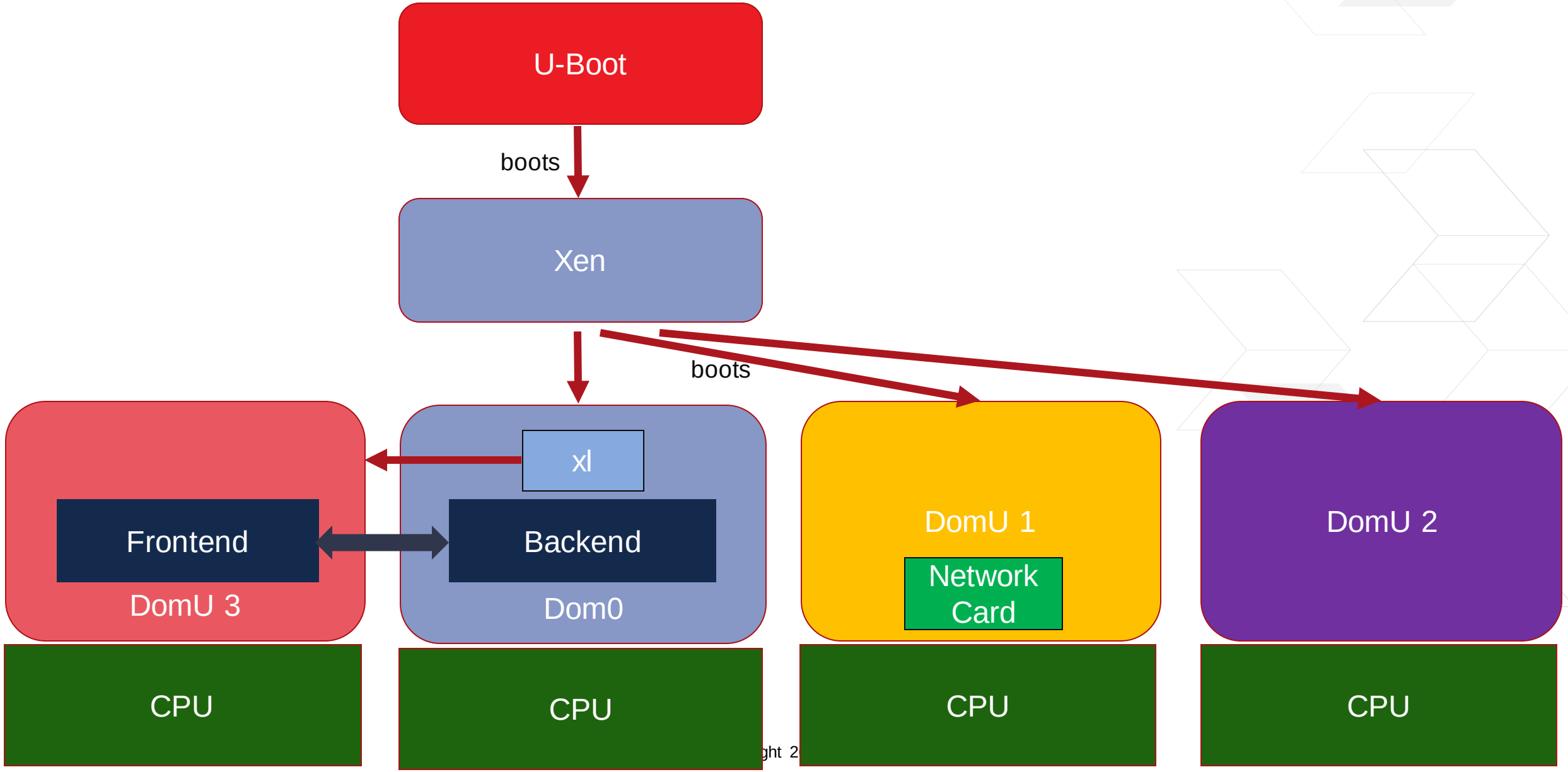


Dom0-less and PV drivers

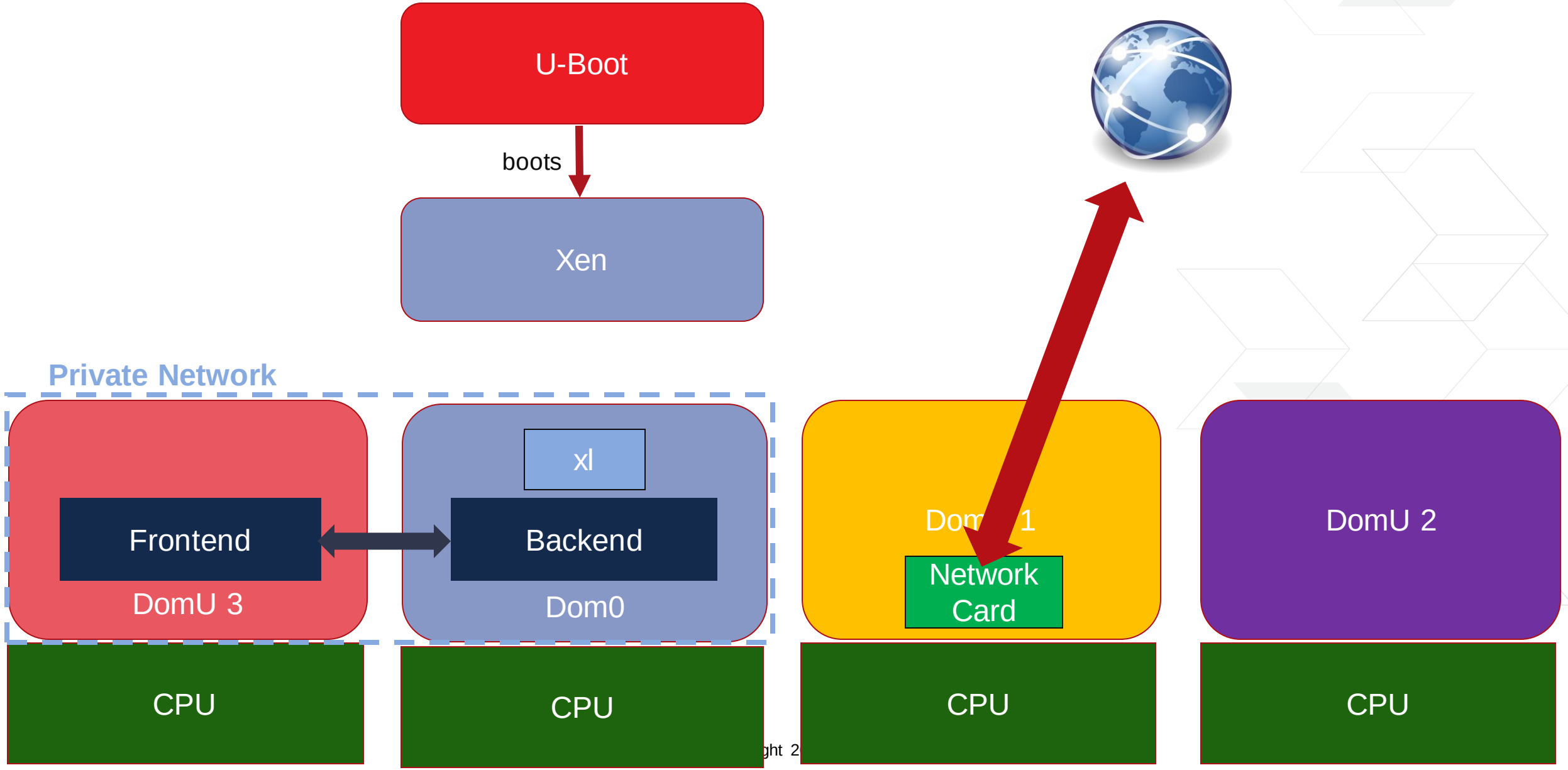


Demo

Dom0-less and PVCalls



Dom0-less and PVCalls



Questions?

Adaptable.
Intelligent.