

Facing the Reality: What's new in the L4Re Operating System

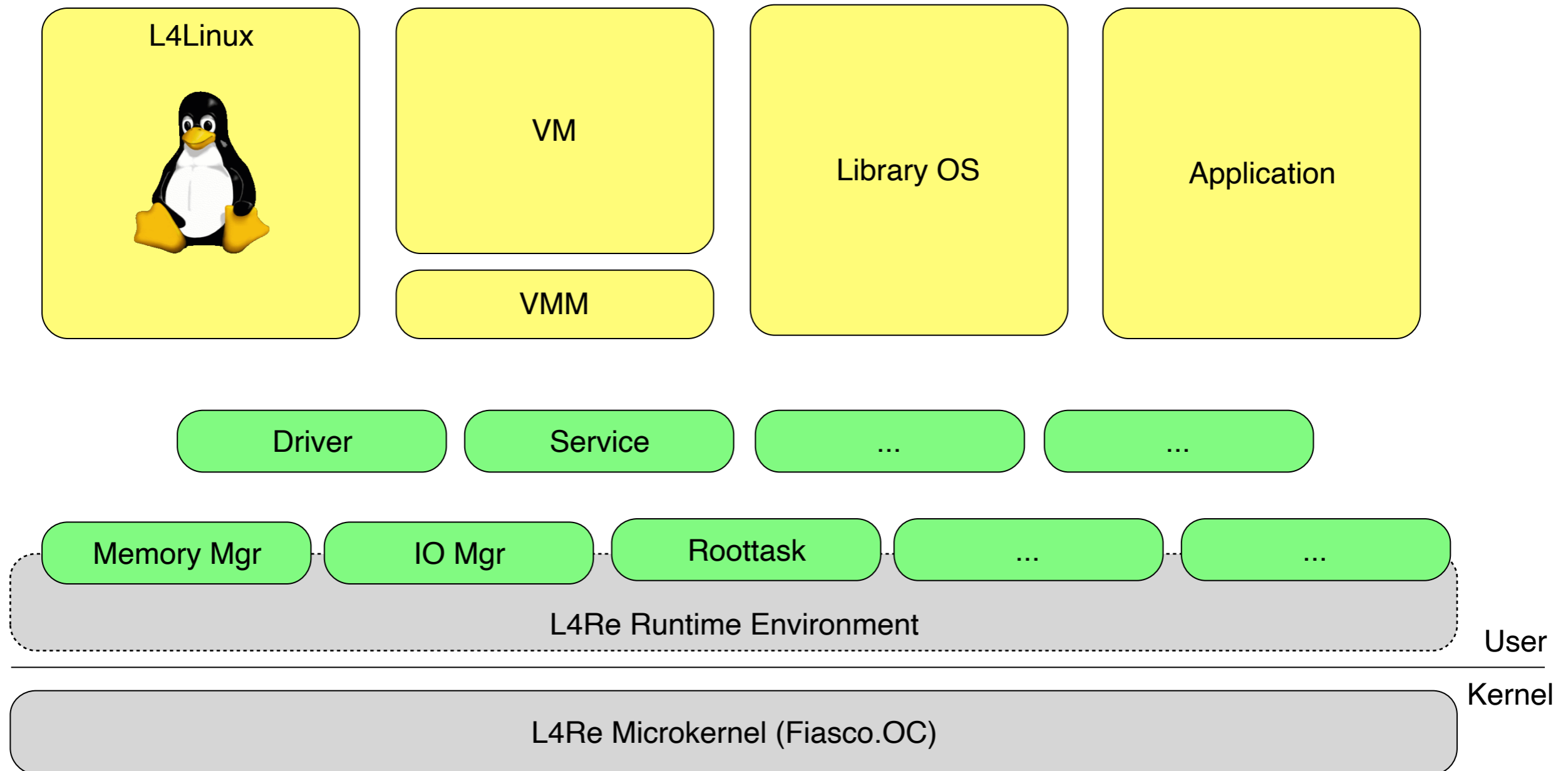
Matthias Lange, Kernkonzept GmbH, FOSDEM '15



- Spin-off from TU Dresden
- Founded by core developers
- www.kernkonzept.com



L4Re Microkernel System



L4Re Key Features

- Set of building blocks
 - Lots of contrib packages!
- Highly modular
- Broad platform support
- Virtualization
- User/Kernel co-design
- Dynamic + static setups



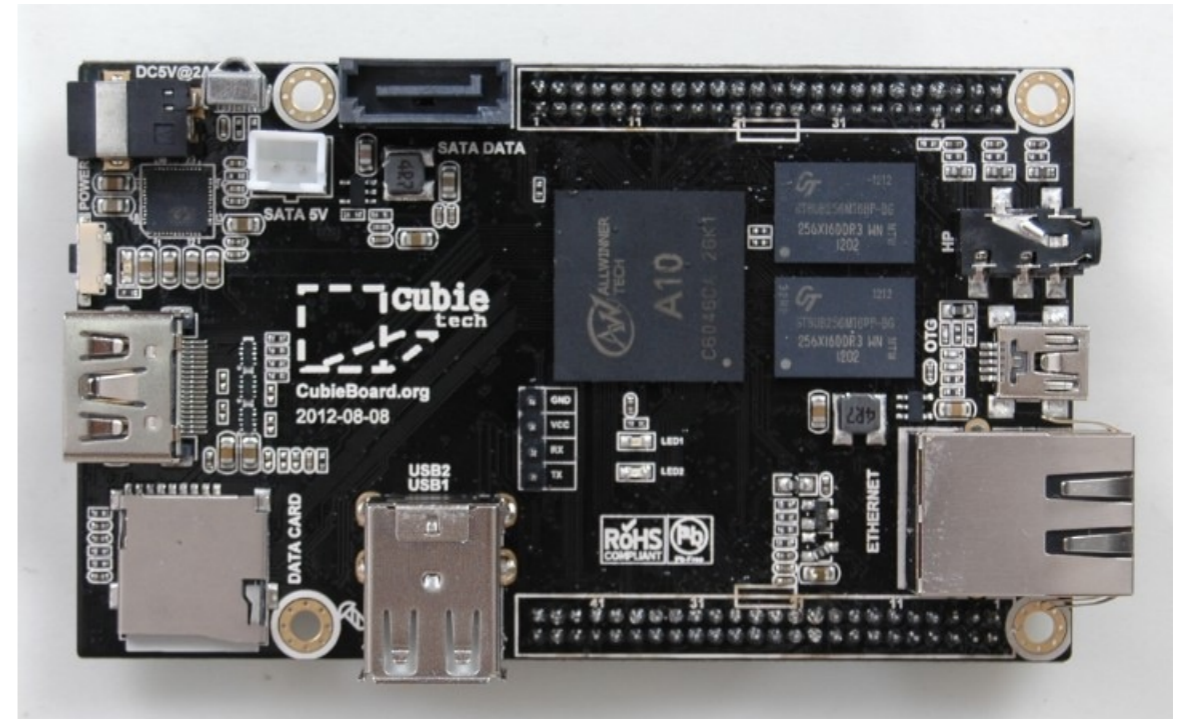


What's new in L4Re

L4Re Microkernel Updates

ARM Support

- ARM hardware assisted virtualization support
- Allwinner SoC (sunxi) support
- Omap5 support



X86 Support

- Suspend/Resume (S3)
- Can be booted on UEFI platforms
- SMEP



Tools Support

- clang/LLVM support work in progress
- gcc 5 is work in progress
- Tools support is "continuous integration" effort



L4Re Runtime Environment Updates

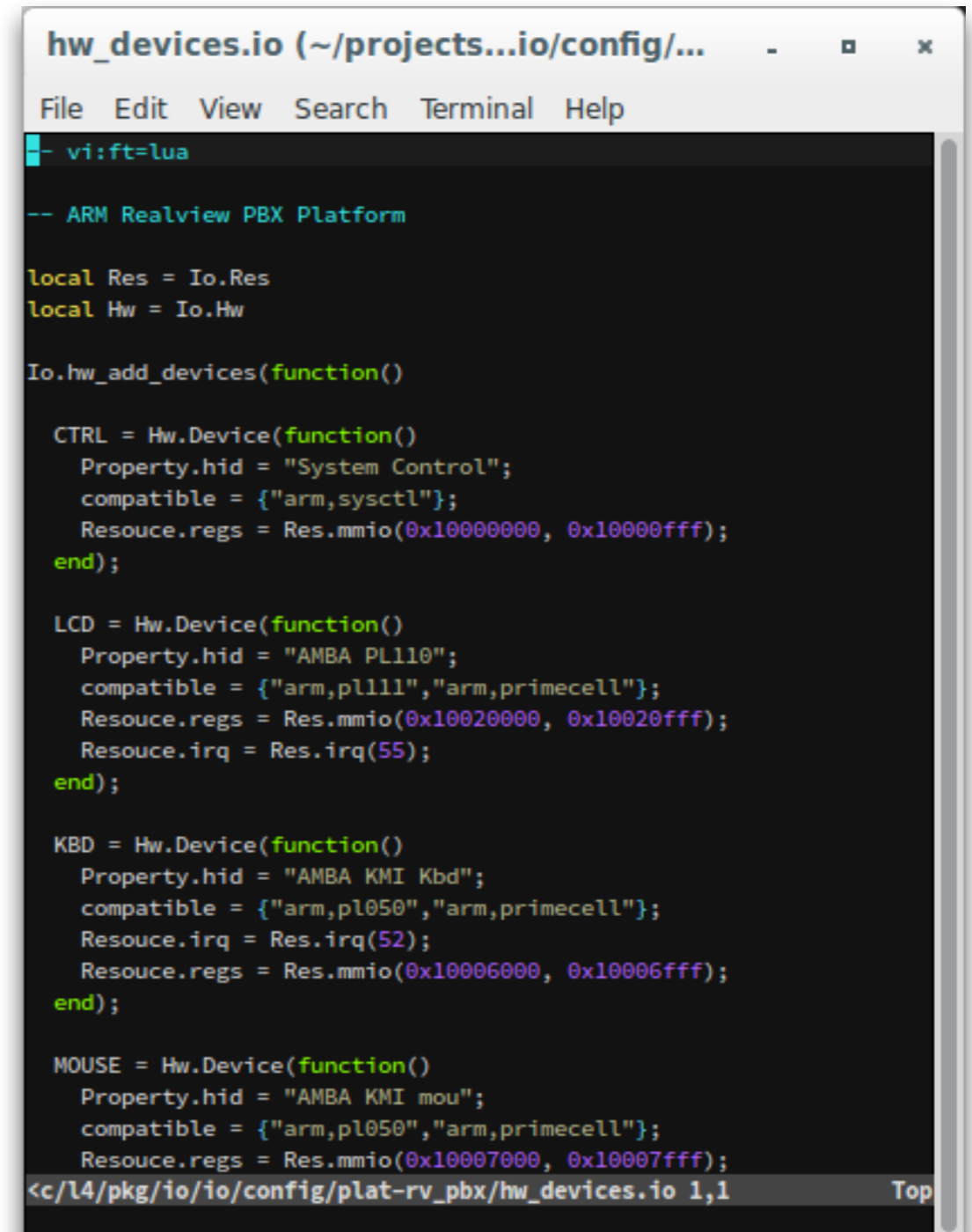
Suspend/Resume

- User space side implemented by io
 - Inhibitor locks
- ACPI events
- Works with L4Linux



IO Manager

- Transition to lua as configuration language
- Refinement of the GPIO multiplexing API
 - GPIO pin as device resource
- GPIO drivers for BCM2835 & OMAP3-5
 - Configured via device tree



```
hw_devices.io (~/.projects...io/config/... - ▢ x
File Edit View Search Terminal Help
- vi:ft=lua

-- ARM Realview PBX Platform

local Res = Io.Res
local Hw = Io.Hw

Io.hw_add_devices(function()

  CTRL = Hw.Device(function()
    Property.hid = "System Control";
    compatible = {"arm,sysctl"};
    Resouce.regs = Res.mmio(0x10000000, 0x10000fff);
  end);

  LCD = Hw.Device(function()
    Property.hid = "AMBA PL110";
    compatible = {"arm,pl111","arm,primecell"};
    Resouce.regs = Res.mmio(0x10020000, 0x10020fff);
    Resouce.irq = Res.irq(55);
  end);

  KBD = Hw.Device(function()
    Property.hid = "AMBA KMI Kbd";
    compatible = {"arm,pl050","arm,primecell"};
    Resouce.irq = Res.irq(52);
    Resouce.regs = Res.mmio(0x10006000, 0x10006fff);
  end);

  MOUSE = Hw.Device(function()
    Property.hid = "AMBA KMI mou";
    compatible = {"arm,pl050","arm,primecell"};
    Resouce.regs = Res.mmio(0x10007000, 0x10007fff);
  end);
end);

<c/l4/pkg/io/io/config/plat-rv_pbx/hw_devices.io 1,1 Top
```

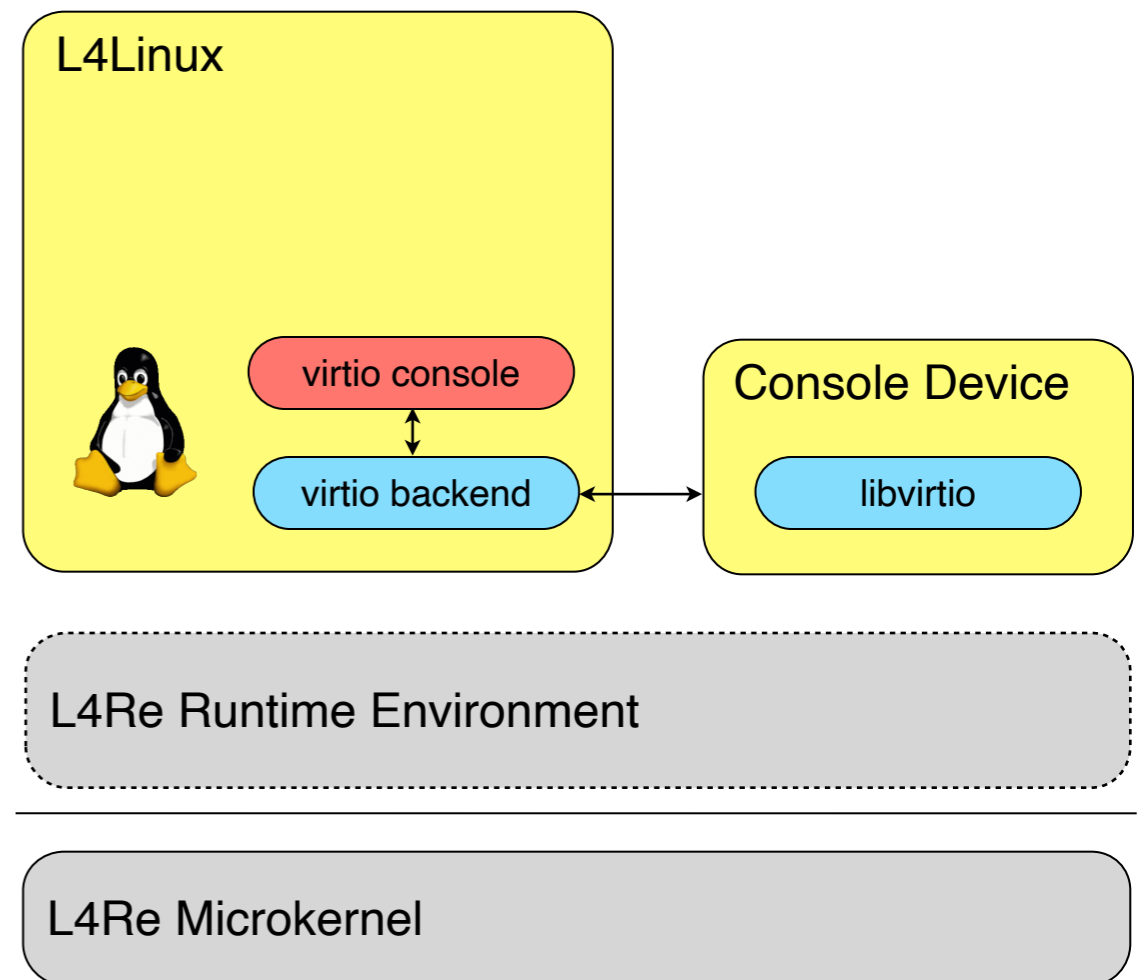
Stack Protector

- Terminator canary
- Prints error message if compromised



Virtio - Work in Progress

- Library with virtio primitives
 - Queues
 - Rings
 - MMIO interface
- Allows implementation of virtio host side



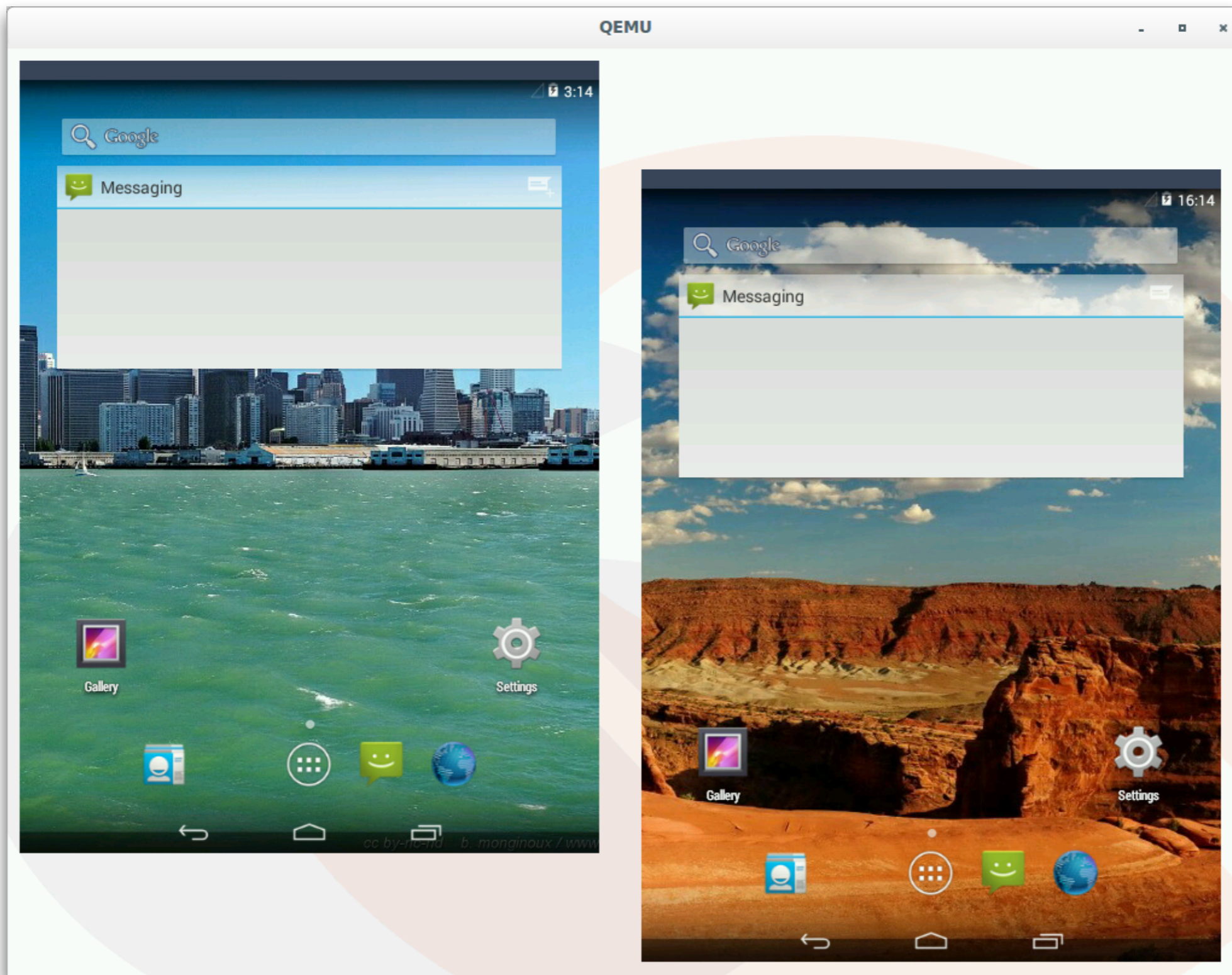
L4Re Virtualization Update

L4Linux

- version 3.18, continuous update
- virtio-l4 backend
- Filesystem server
- Framebuffer server

L4Android

- updated to 4.4.4
- Lollipop is work in progress
- Technology demo available

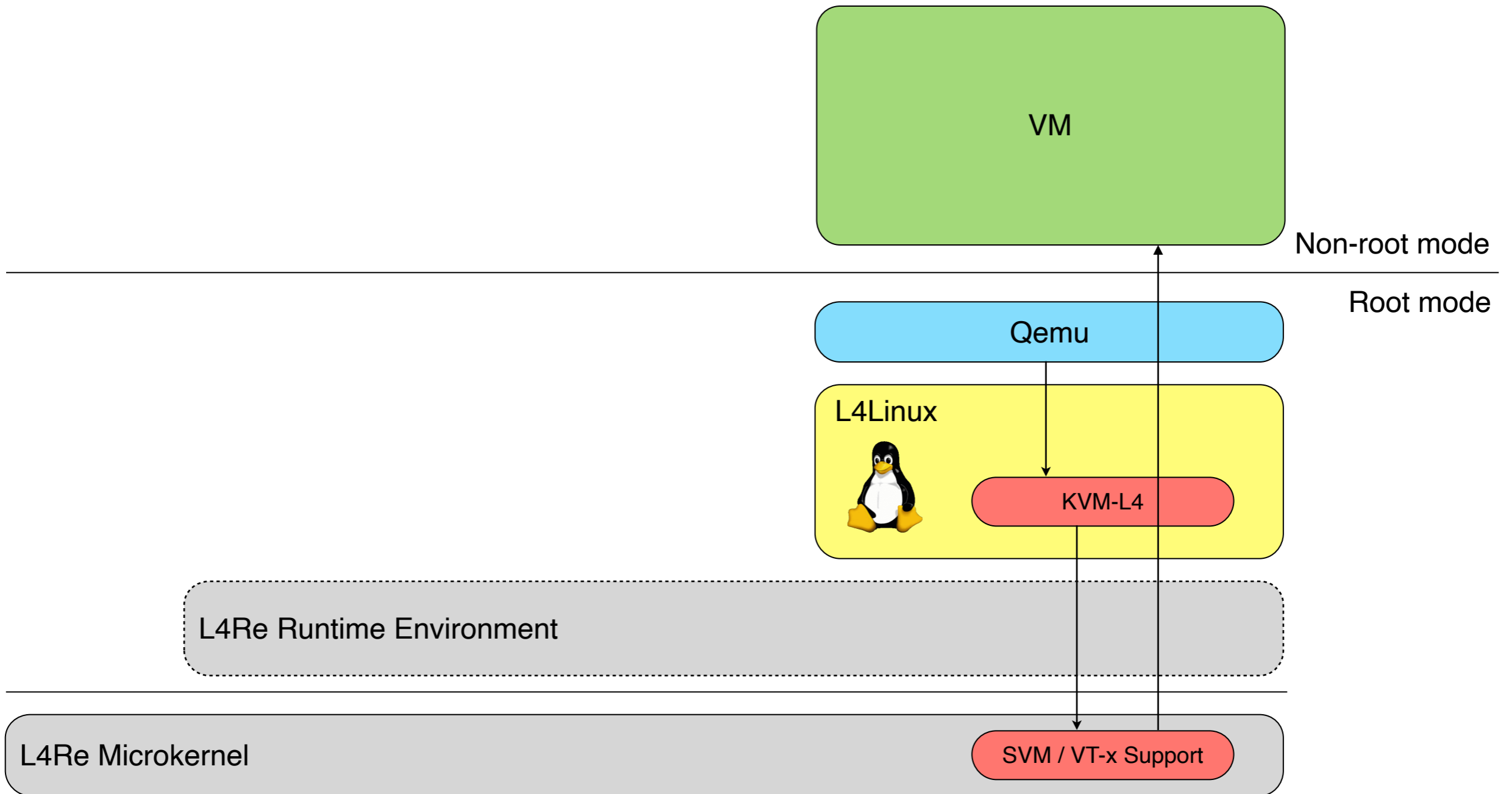


L4Android Screenshot

L4KVM

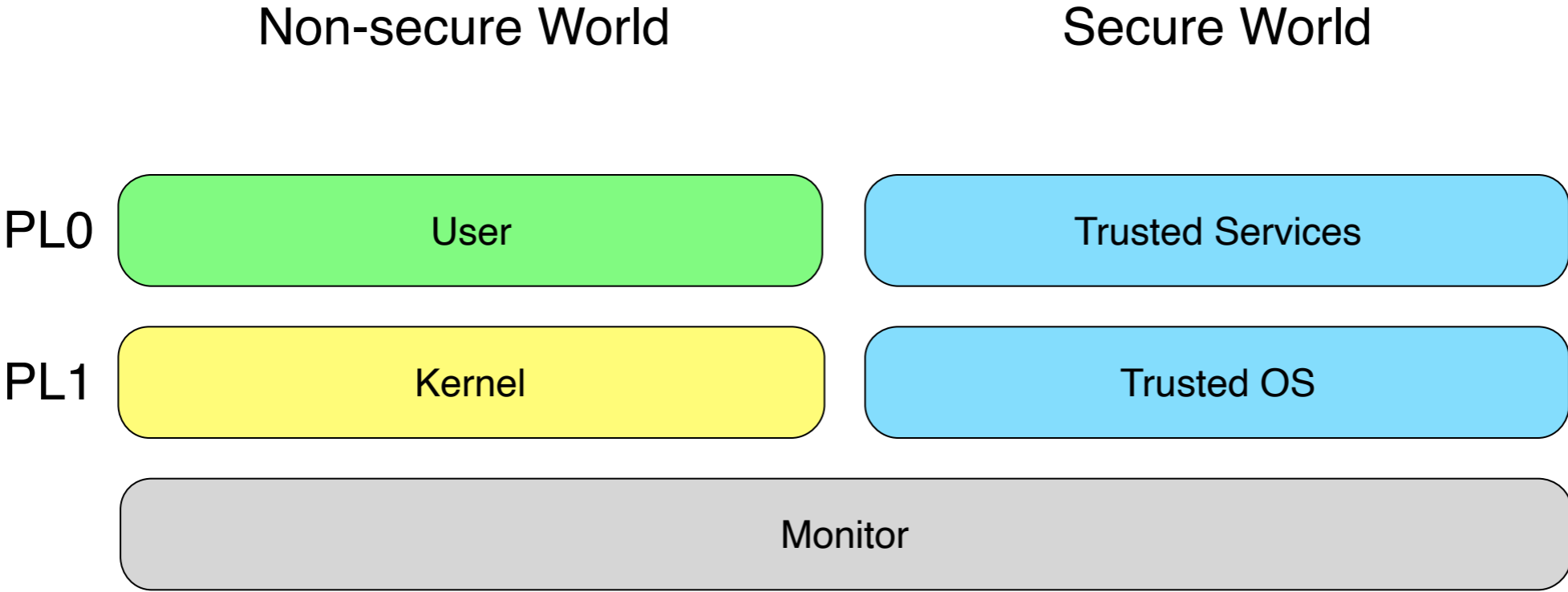
- Feature-rich VMM (read: runs Windows)
- Use KVM from within L4Linux
- X86 support
 - SVM and VT-x
 - 32/64bit
 - Nested paging



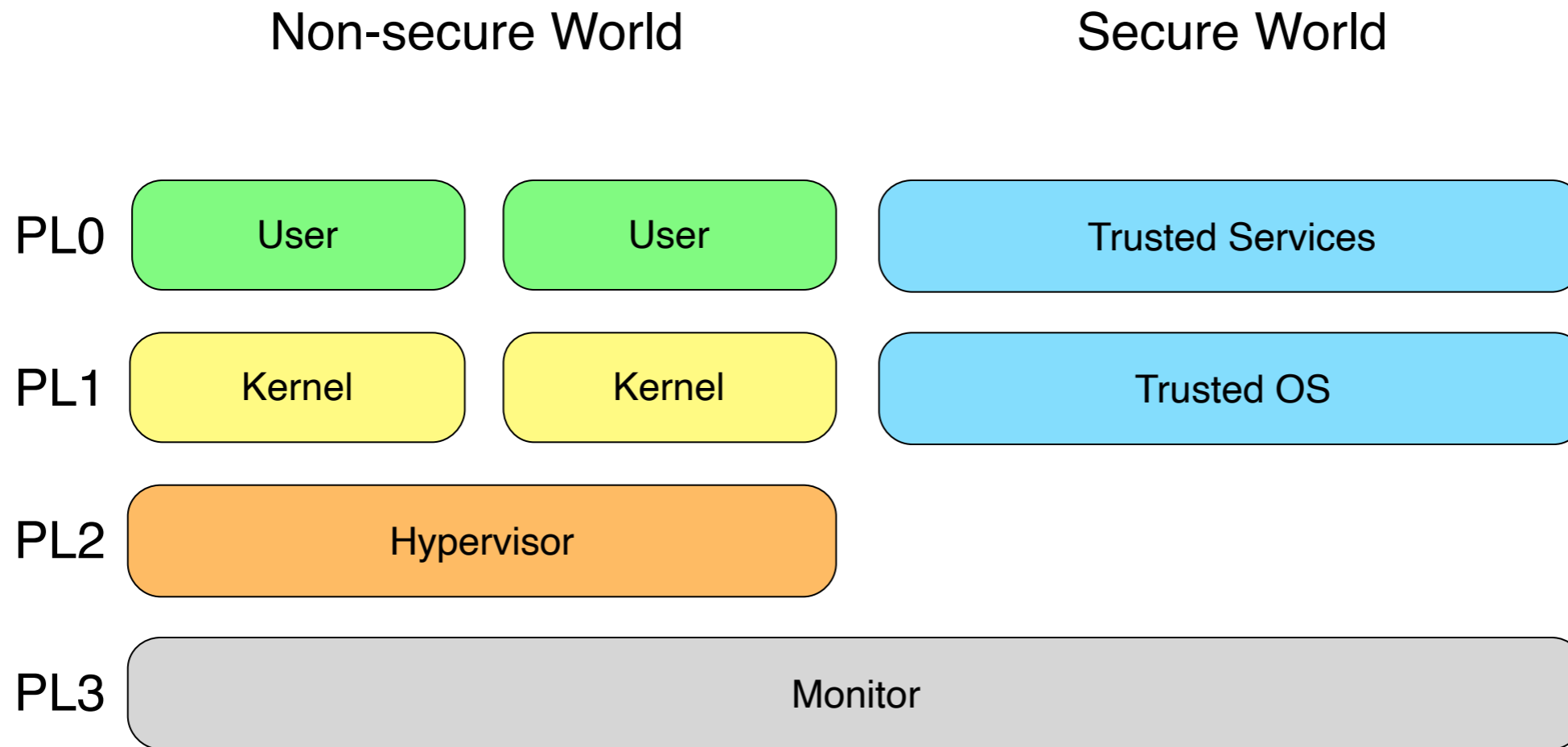


L4KVM Architecture

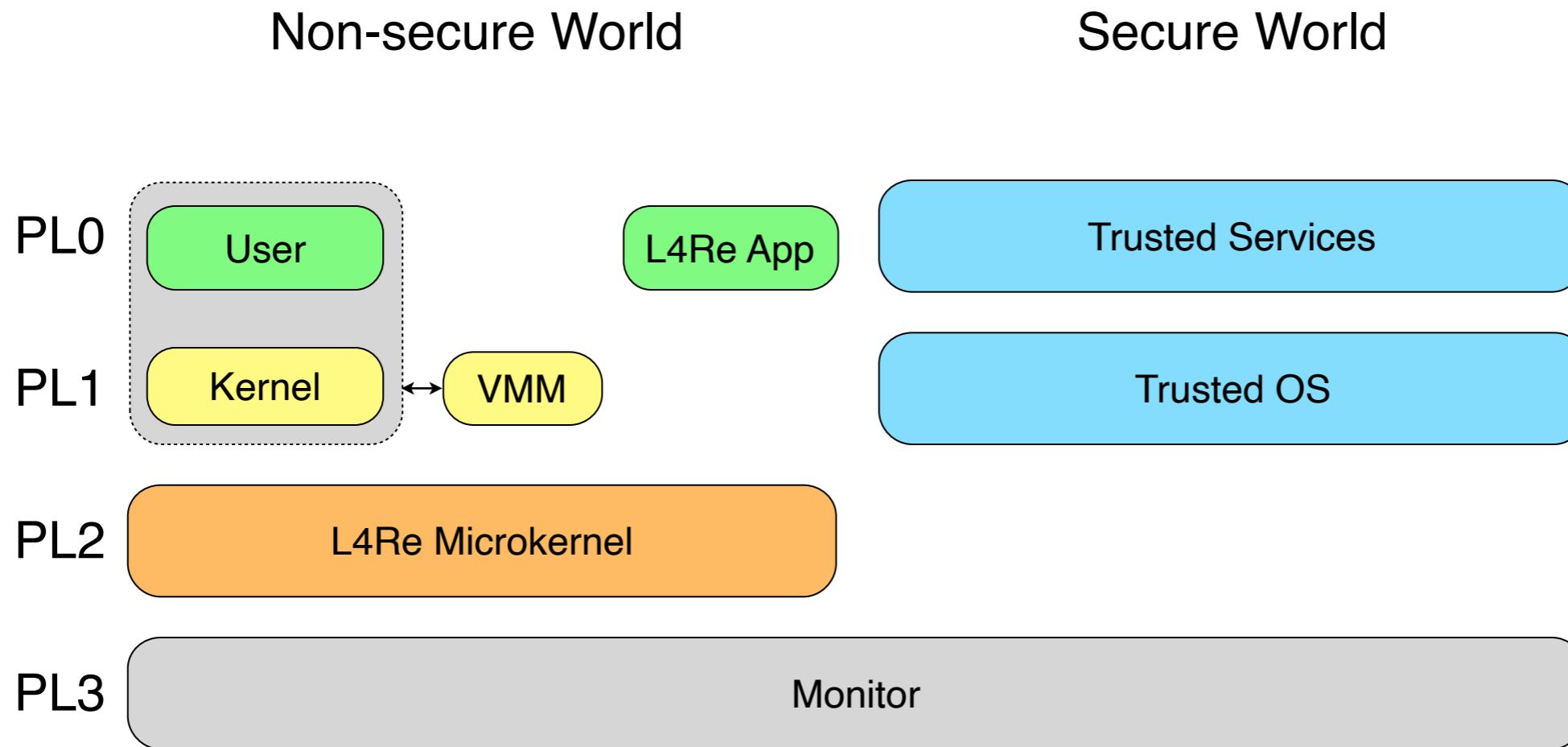
ARM Hardware Assisted Virtualization



ARM Hardware Assisted Virtualization



ARM Hardware Assisted Virtualization



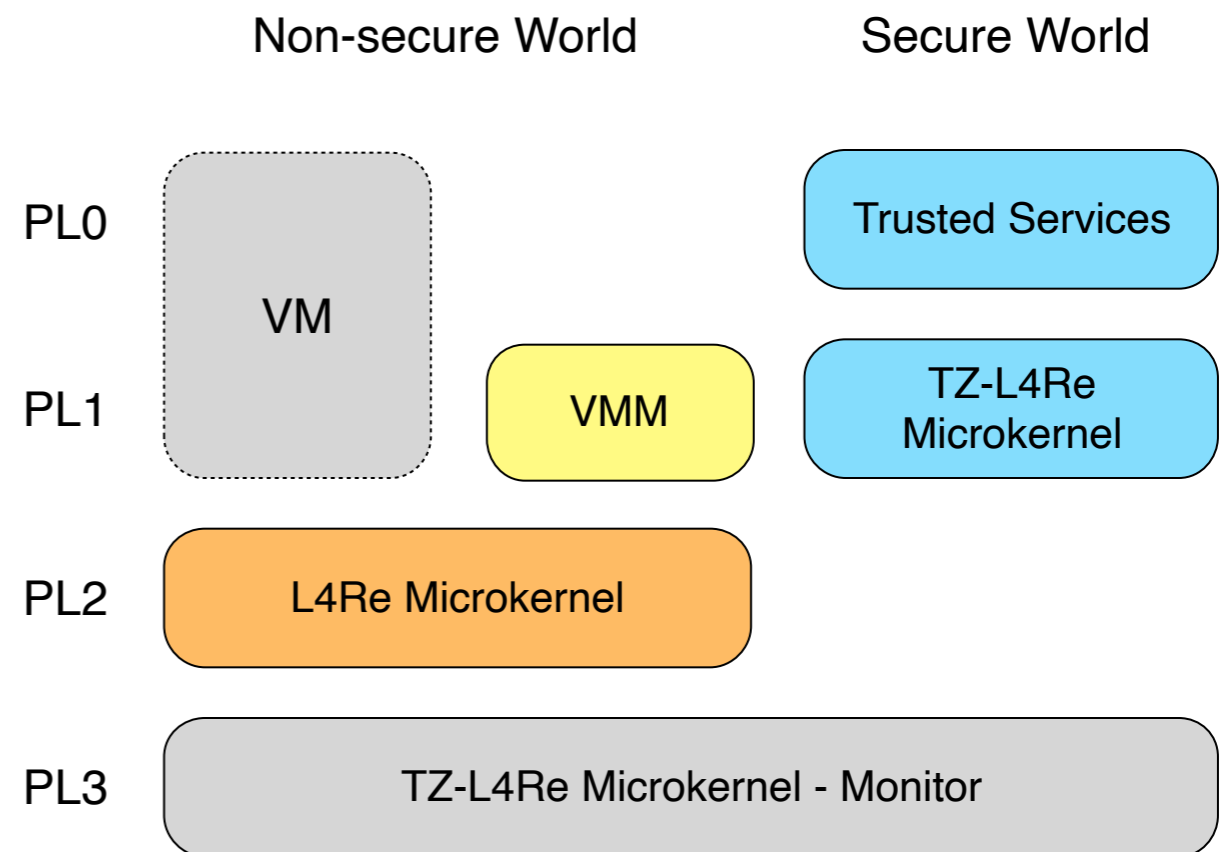
Problem: Booting

- Secure Software installed
 - OS typically boots in Non-secure PL1
 - How to get to PL2?
- No Secure Software
 - Boots in secure mode
 - Hyp mode only in Non-secure world

Solution: Booting

- Support on secure side required

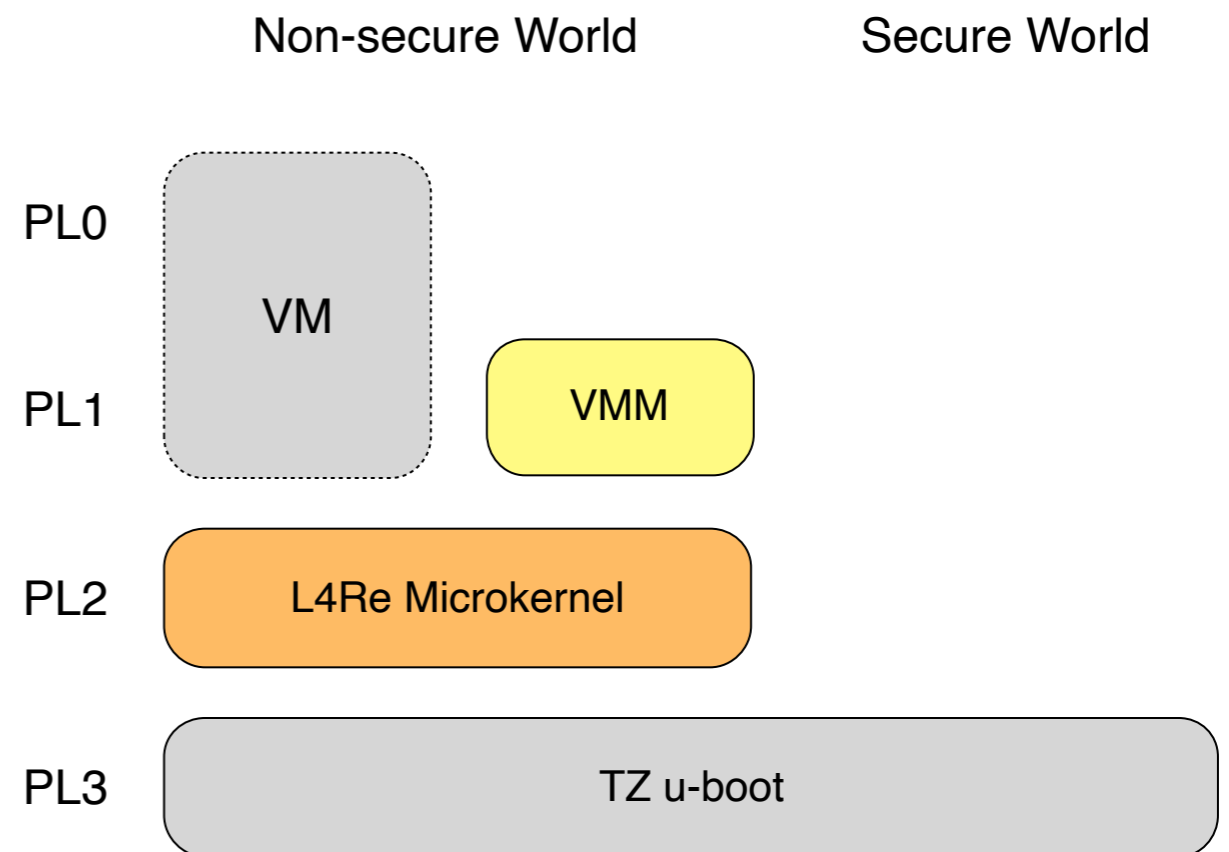
- Secure side switches to PL2



Solution: Booting

- Support on secure side required

- Launch in Non-secure PL2 mode



ARM Hardware Assisted Virtualization

- Supported by L4Re Microkernel
 - Tested with Exynos5 and OMAP5
 - Platform boot is the key!
- VMM in package vmm

REALITY-CHECK

L4Re Microkernel

- EFI ✓
- Tools ✓
 - Minimal required gcc version 4.5
 - clang still work in progress
 - continuous effort (e.g. compiler blacklist)

L4Re Userland

- Power management 

Virtualization

- ARM ✓
- L4KVM ✓
- L4Linux 64bit - still experimental
- L4Android ✓



Outlook

L4Re Microkernel - Interesting Topics

- ARM64
- IOMMU
- Both require user space support
- Towards more static configurations

L4Re Userland

- RPC framework
- Native AHCI driver
- Lua 5.3
 - Real integers and bit operators
- Application debugging
- Extend tool support: clang and GCC 5

L4Linux

- Use device tree support on ARM
 - Shall help device enablement

Resources

- www.kernkonzept.com
- l4re.org
- Talk with us



T H A N K

Y O U