Introduction to Embedded System

Embedded System
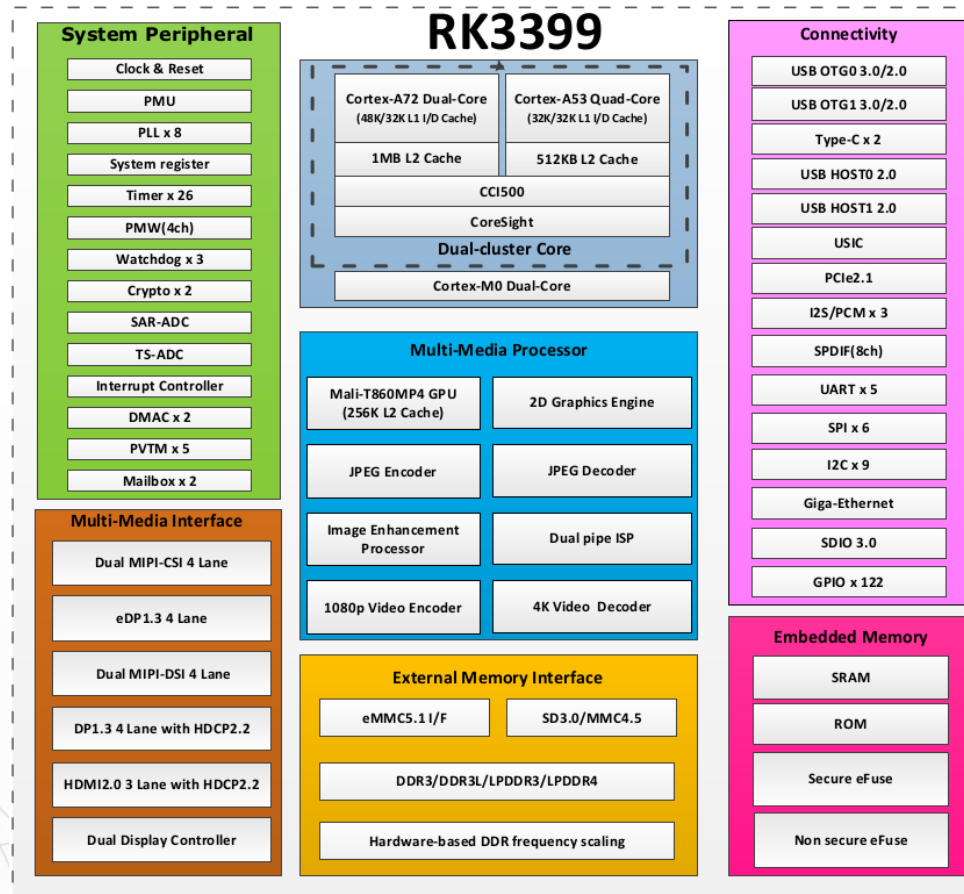
- An embedded system

  – combination of computer hardware and software

  – specifically designed for a particular function

- Applications

  – Mobile phone

  – Digital camera

  – Smart TV

  – Navigation system

Feature

- Designed to do some specific task

  - Low power

  - Small size

  - Special operating ranges

  - Low cost

- Install OS ?

SOC RK3399

Component of embedded system

- Processor
  - → ARM, X86, MIPS ….
- RAM
  - → 8MB ~ 2 GB
- Storagee
  - → Nand, Nor flash
  - → SD/MMC/eMMc
- System Bus
  - → AMBA, AHB, APB, AXI …

Component of embedded system

- Communication
    - I2C, I2S, USB, PCI/PCIe …
- Media system
    - JPEG, H.264 ..
- System component
    - DMA, RTC ..
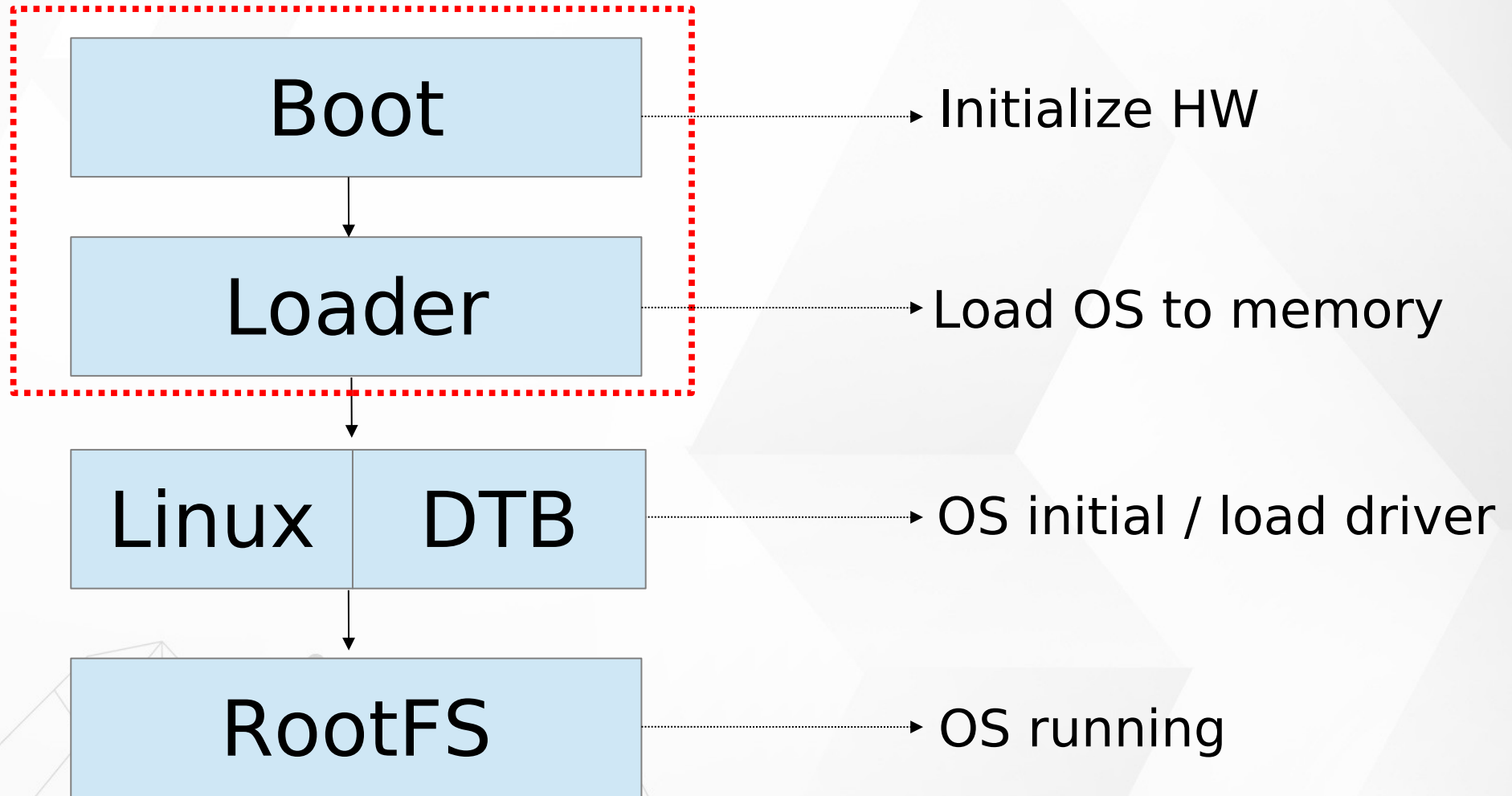
Embedded Linux ?

Embedded Linux is the usage of the
Linux kernel and various
open-source components in
embedded systems
(from Free Electrons)

Advantages

- Re-use components

- Quickly design and develop complicated products

- No need to re-develop components

  → TCP/IP stack, USB stack, PCI stack …

- Allow you modify components

Embedded Linux System Booting

Boot	⋯⋯▸ Initialize HW
Loader	⋯⋯▸ Load OS to memory
Linux	DTB	⋯⋯▸ OS initial / load driver
RootFS	⋯⋯▸ OS running

Embedded Linux System Software components

- Cross-compilation toolchain

- Bootloader

- Linux Kernel, DeviceTree

- Rootfs

- C library

- Libraries and applications

- BSP (Board Support Package)

Develop Environment
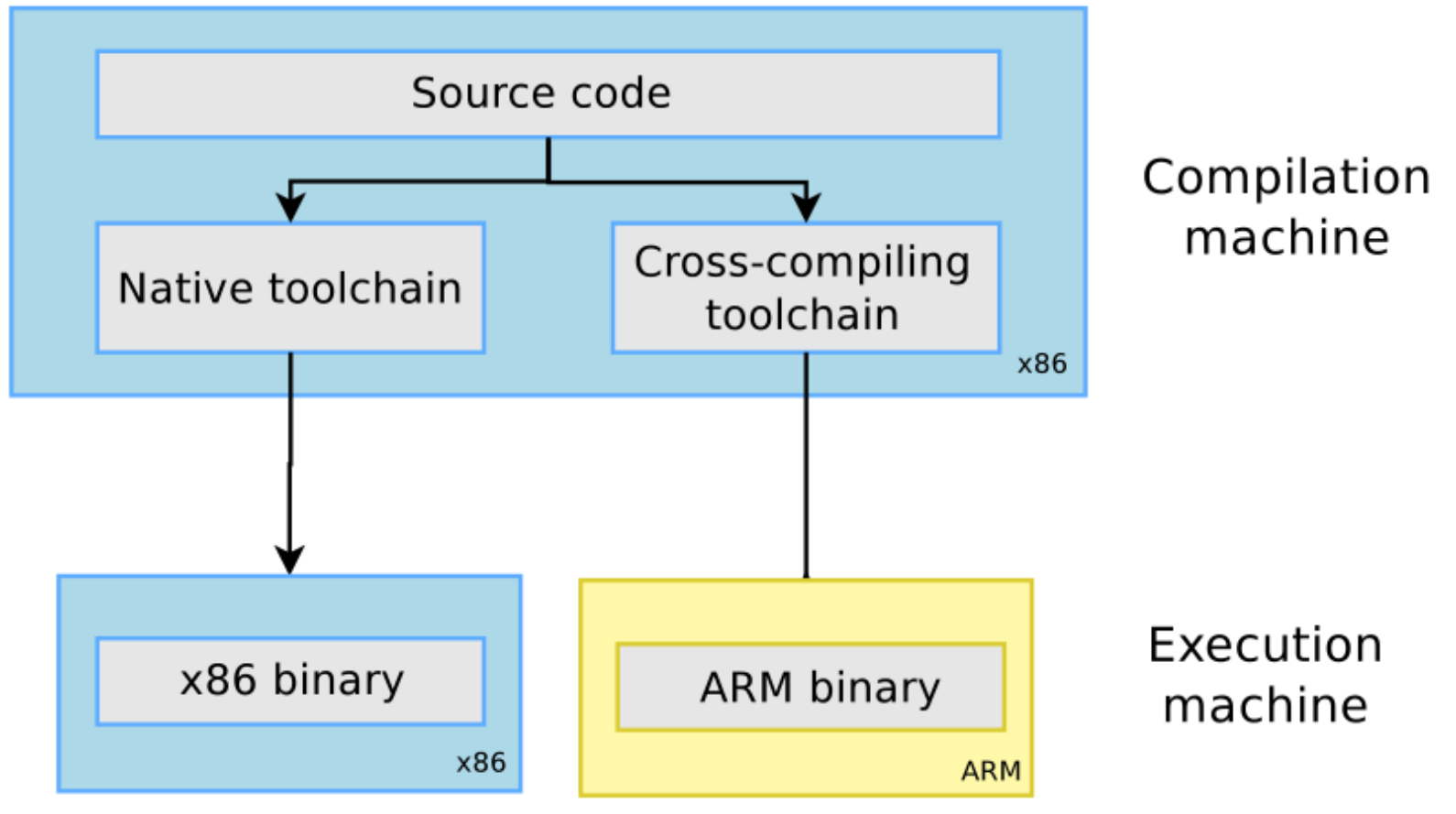
Develop Environment

- Host PC

- Toolchain

- Target EVB (RockPi4)

- BSP

BSP

- Board Support Package
- From chip vendor
  - Distribution
    - Bootloader
    - Linux kernel
    - Device driver
    - Rootfs

Cross Compilation toolchain

Setup References - 1

Debian Image :
  https://github.com/radxa/rock-pi-images-released/releases

Image Write Tool :
  https://www.balena.io/etcher/

Install Image to SD Card :
  https://wiki.radxa.com/Rockpi4/install/microSD

Setup References - 2

Debug Port :
　https://wiki.radxa.com/Rockpi4/dev/serial-console

Linaro ToolChain :
　https://releases.linaro.org/components/toolchain/binaries/7.3-2018.05/aarch64-linux-gnu/gcc-linaro-7.3.1-2018.05-x86_64_aarch64-linux-gnu.tar.xz

Install Package :
　sudo apt-get install libncurses5 libncurses5-dev build-essential libssl-dev mtools bc python dosfstools liblz4-tool

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Setup References - 3

u-boot :　　　　　https://wiki.radxa.com/Rockpi4/dev/u-boot

Linux Kernel :　　https://wiki.radxa.com/Rockpi4/dev/kernel-4.4

Debian :　　　　　https://wiki.radxa.com/Rockpi4/dev/Debian

RockPi4 WiKi :　　https://wiki.radxa.com/Rockpi4

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