

Introduction to Embedded System



Embedded System

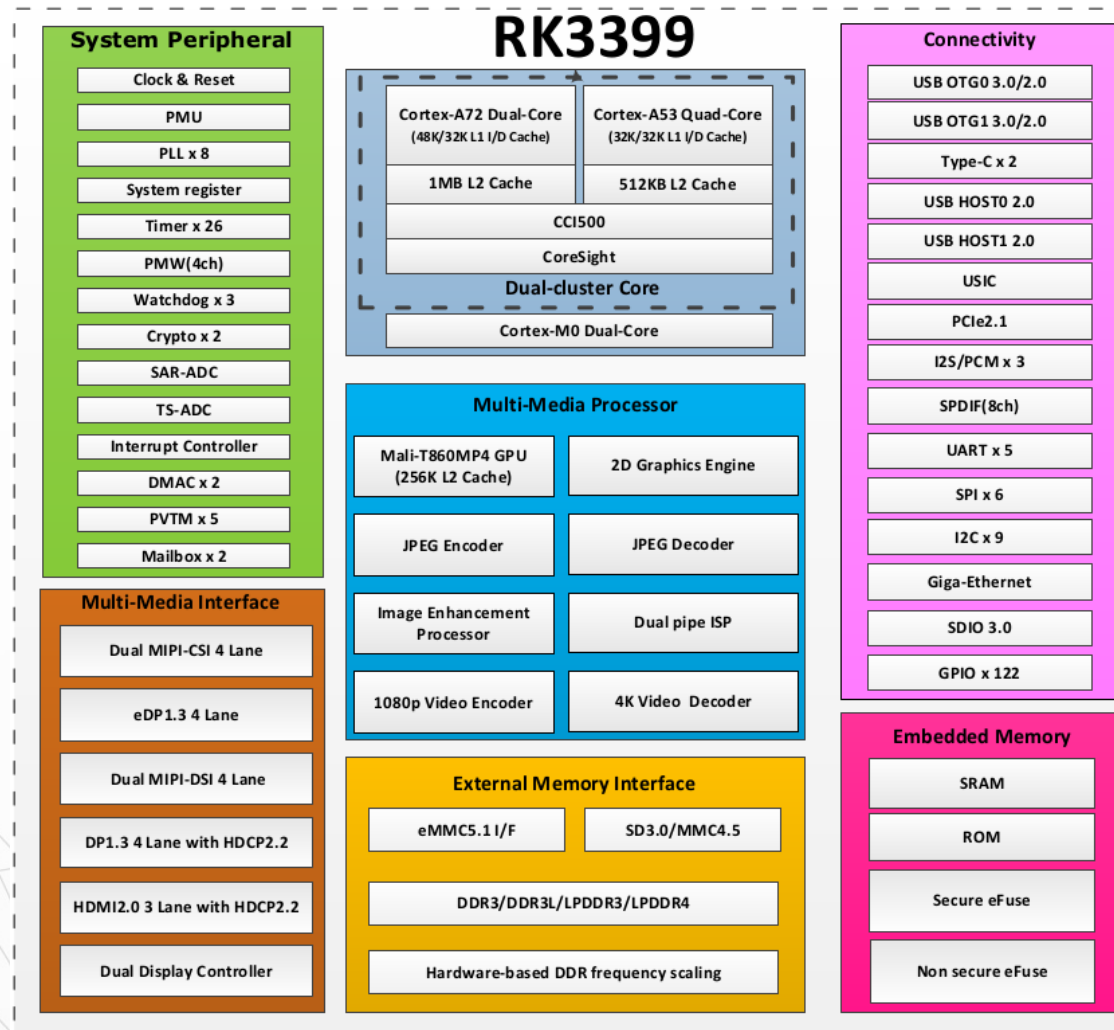
- An embedded system
 - combination of computer hardware and software
 - specifically designed for a particular function
- Applications
 - Mobile phone
 - Digital camera
 - Smart TV
 - Navigation system



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 ~ 4 GB
- Storageee
 - 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 ?

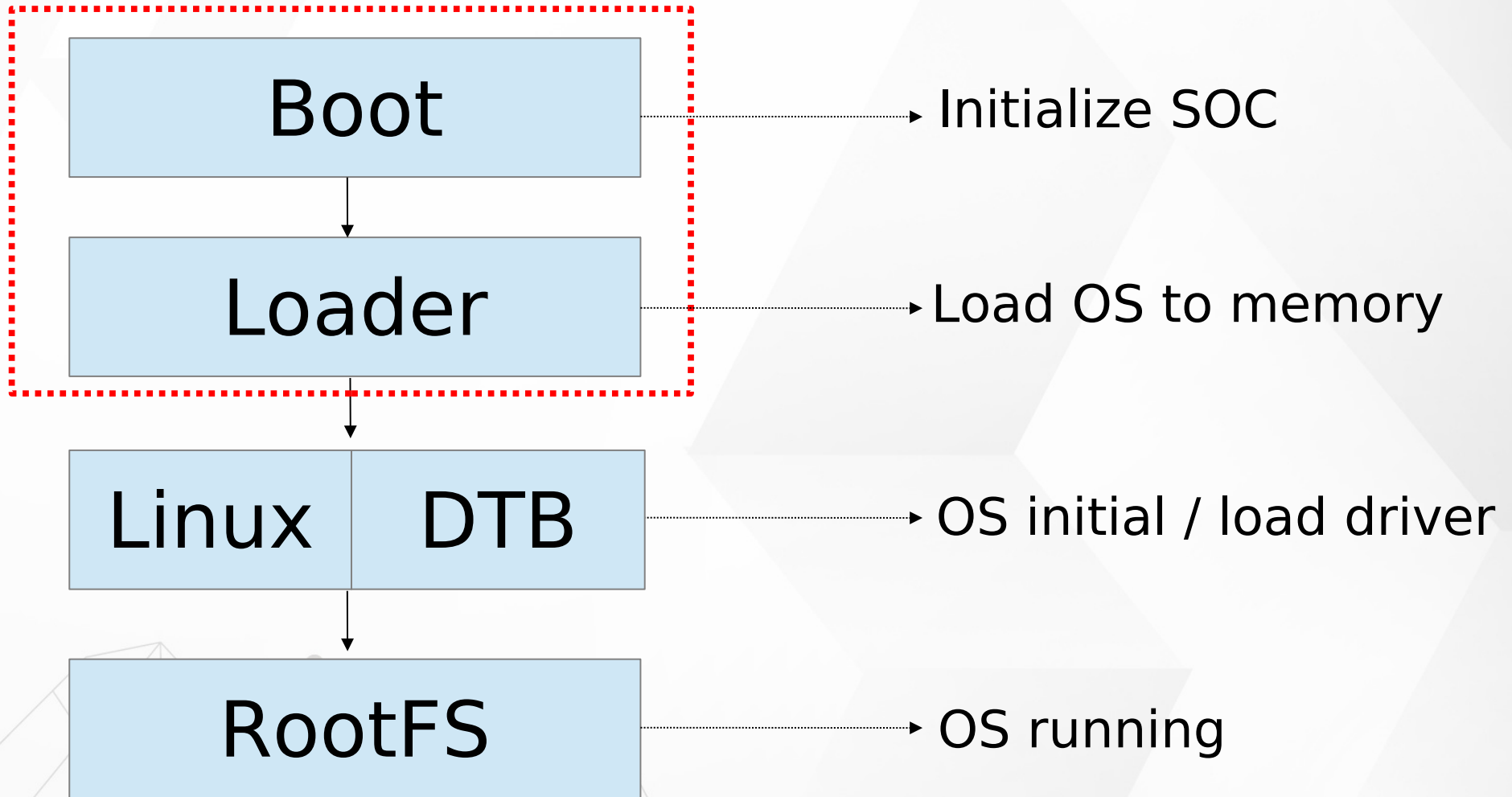
Embedded Linux is the usage of the
Linux kernel and various
open-source components in
embedded systems
(from Free Electrons)



Linux 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 Booting





Software Components

- Cross-compilation Toolchain
- Boot-loader
- Linux Kernel, DeviceTree
- RootFS
- C library
- Libraries and applications
- BSP (Board Support Package)

Develop Environment



Develop Environment

- Host PC (Linux)
- Toolchain
- Target Board EVB (RockPi4)
- BSP (Board Support Package)

BSP

- Board Support Package
- From chip vendor
 - Distribution
 - Bootloader
 - Linux Kernel
 - Device Driver
 - Rootfs

RK3399 BSP (1)

- RK3399 Debian BSP
 - <https://wiki.radxa.com/Rockpi4/dev/Debian>
- build
 - Auto build script file
- U-boot
 - Second bootloader

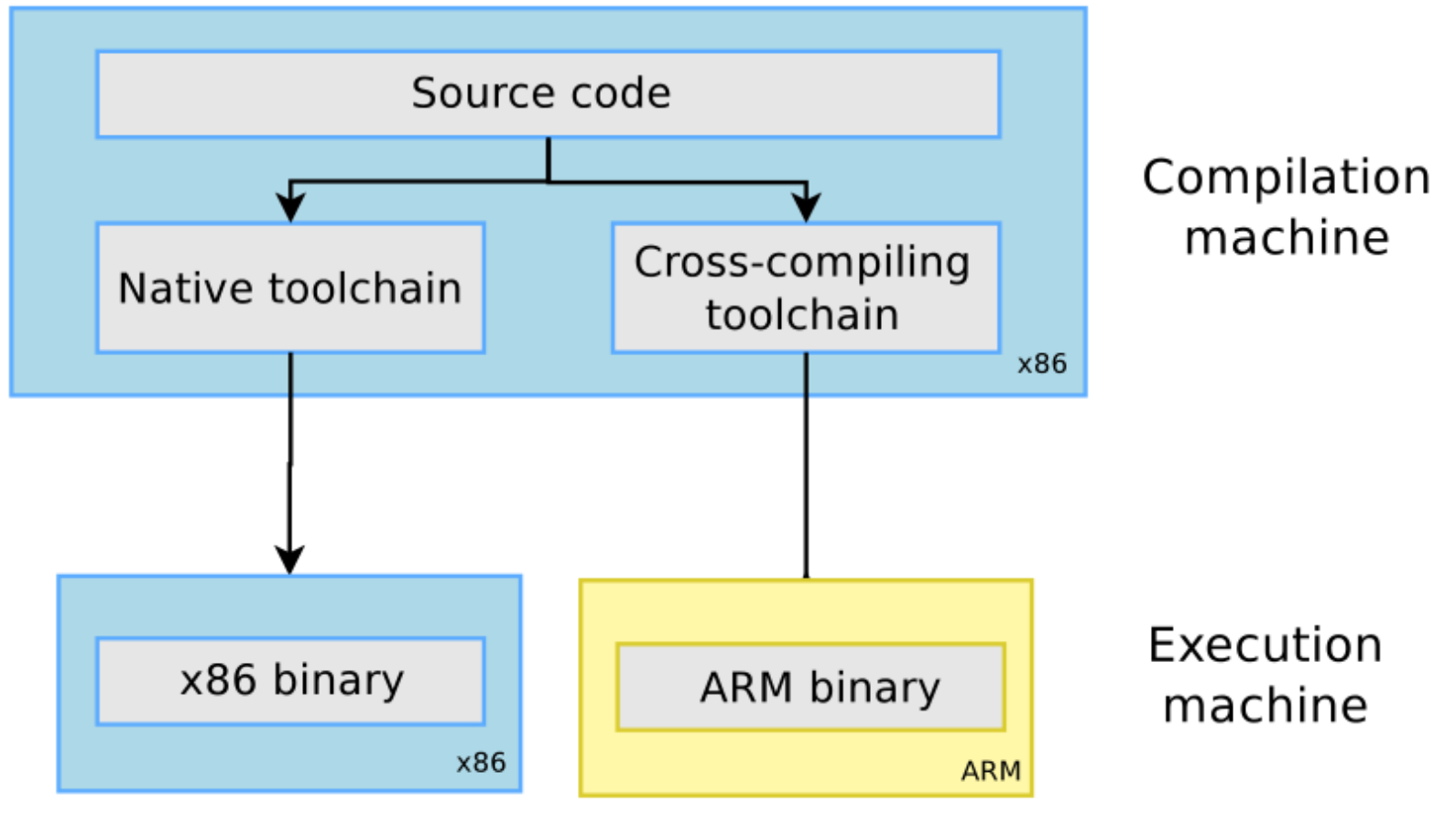
RK3399 BSP (2)

- Kernel
 - Linux Kernel source
- Rootfs
 - Debian File System
- Rkbin
 - Pre-build Image
- Tool-Chain
 - Compile tool

Cross Compilation

- Native Environment
 - Host x86PC (Linux)
 - gcc
- Cross-Compile
 - aarch64-linux-gnu-gcc

Cross Compilation





Setup References - 1

- Debian Image :
 - <https://github.com/radxa/rock-pi-images-released/releases>
 - rockpi4b_debian_buster_xfce4_arm64_20210824_0233-gpt.img.gz
- 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`



Setup References - 3

- **RockPi4 WiKi :**
 - <https://wiki.radxa.com/Rockpi4>
- **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>