Introduction to Embedded System

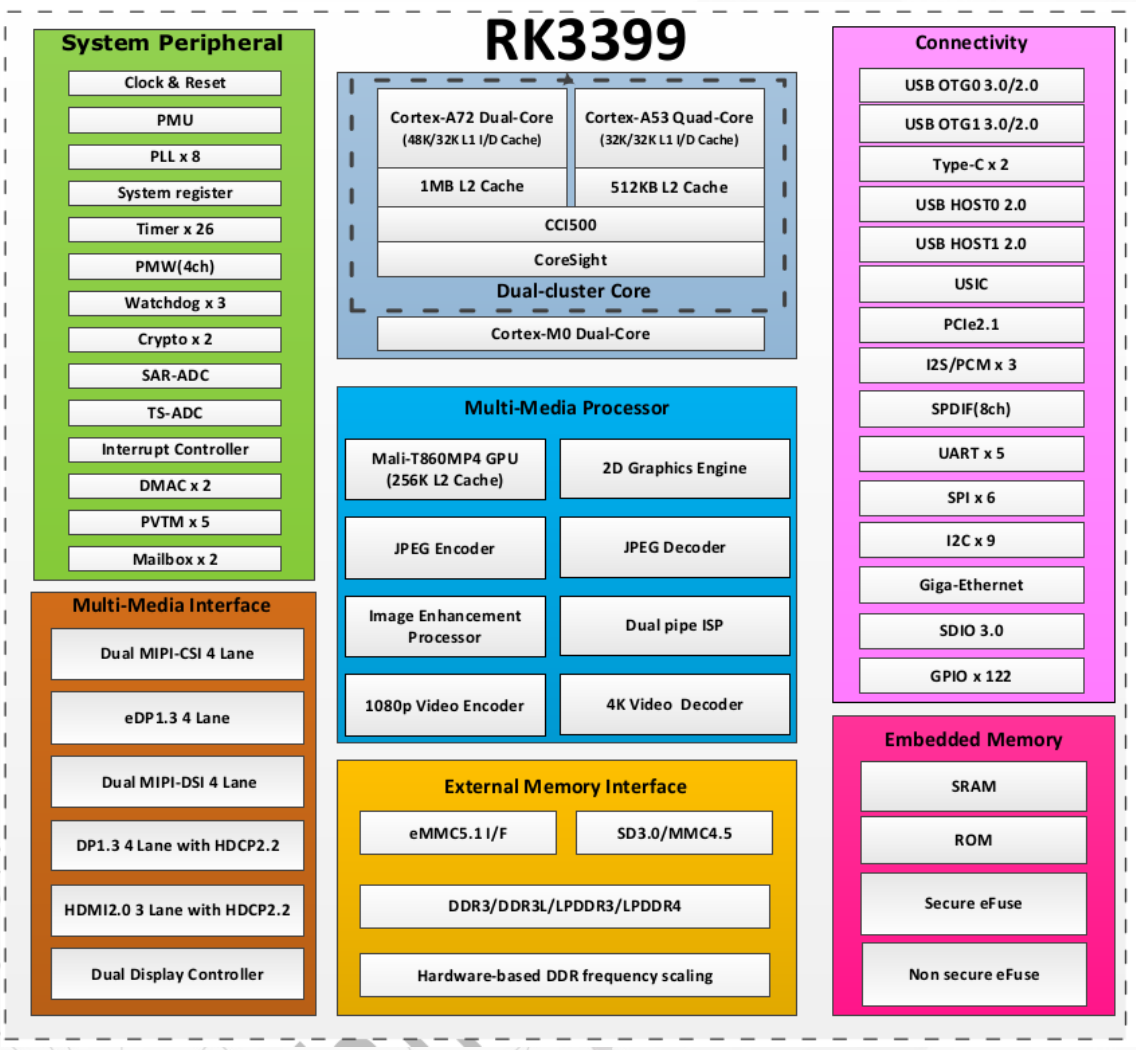
Embedded System

- 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



SOC – System On Chip

- Processor

  → ARM, X86, MIPS ….

- RAM

  → 8MB ~ 4 GB

- Storagee

  → Nand, Nor flash

  → SD/MMC/eMMc

- System Bus

  → AMBA, AHB, APB, AXI ...

SOC – System On Chip

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

Embedded Linux ?

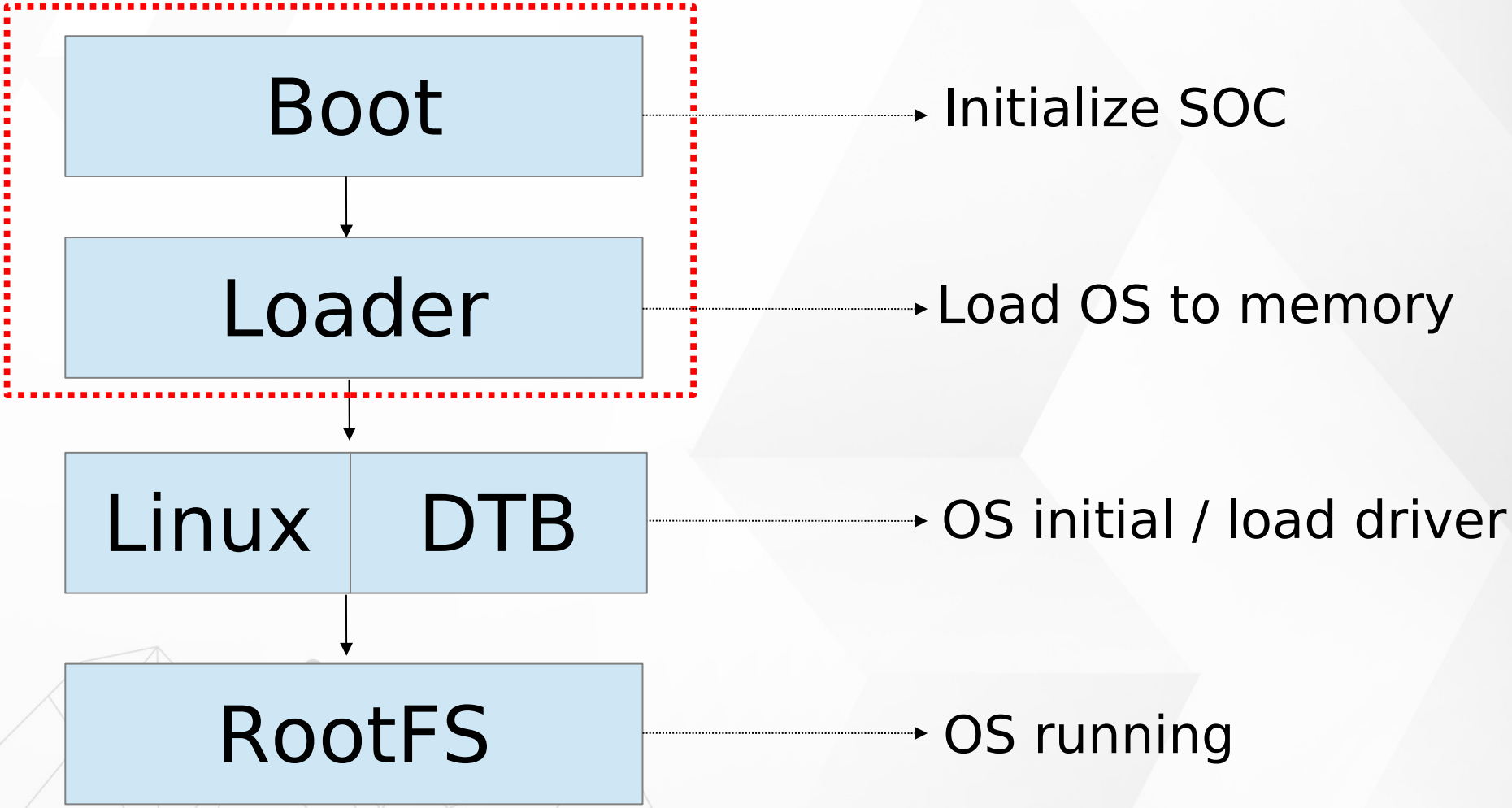
Embedded Linux is the usage of the Linux kernel and various open-source components in **embedded systems** (from Free Electrons)

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

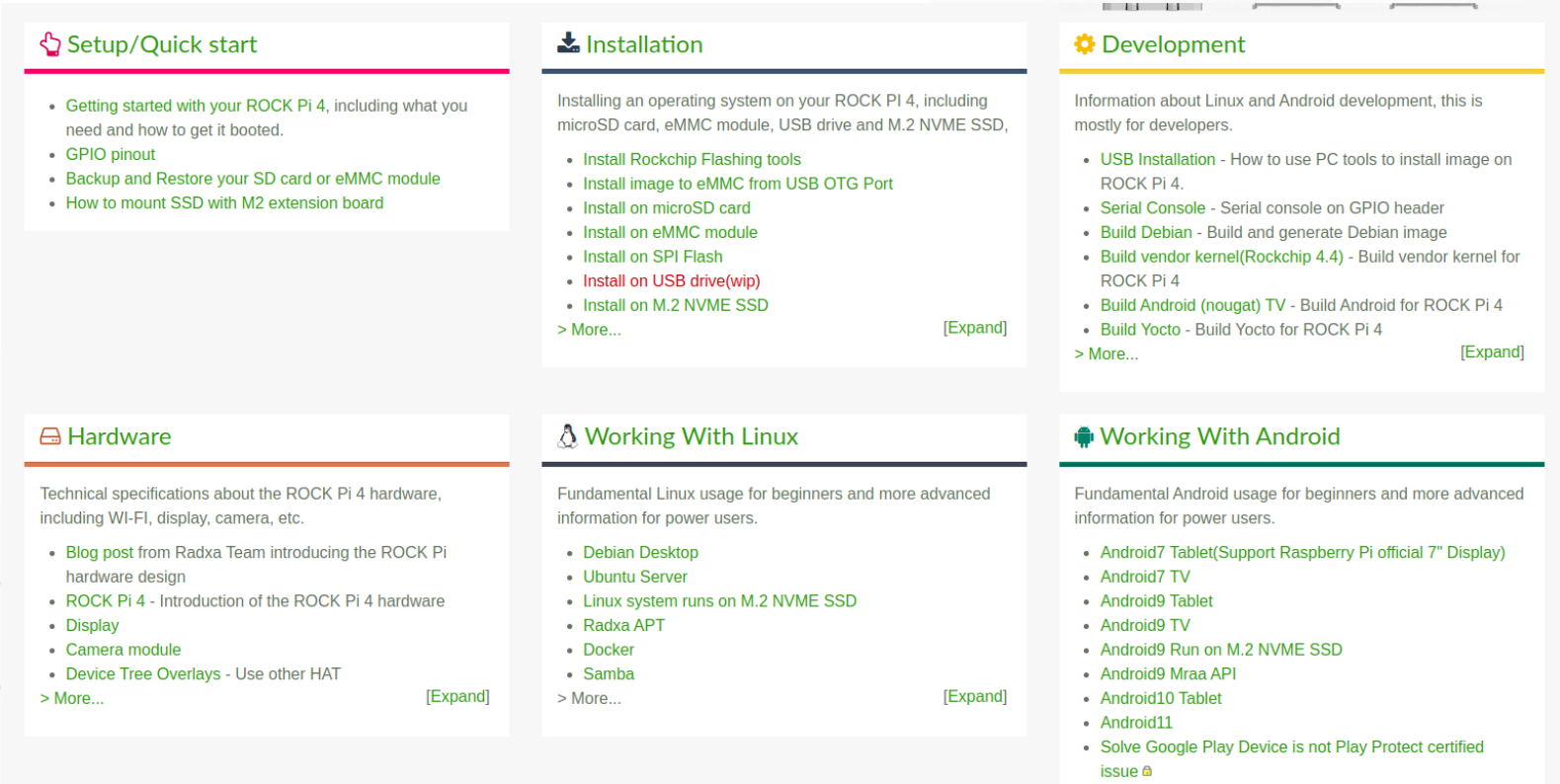
- Host PC (Linux)
- Toolchain
- BSP (Board Support Package)
- Target Board EVB (RockPi4)

BSP

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

RK3399 Debian BSP (1)

- RK3399 Debian BSP
  - https://wiki.radxa.com/Rockpi4



Setup/Quick start

- Getting started with your ROCK Pi 4, including what you need and how to get it booted.
- GPIO pinout
- Backup and Restore your SD card or eMMC module
- How to mount SSD with M2 extension board

Installation

Installing an operating system on your ROCK PI 4, including microSD card, eMMC module, USB drive and M.2 NVME SSD,

- Install Rockchip Flashing tools
- Install image to eMMC from USB OTG Port
- Install on microSD card
- Install on eMMC module
- Install on SPI Flash
- Install on USB drive(wip)
- Install on M.2 NVME SSD

> More... [Expand]

Development

Information about Linux and Android development, this is mostly for developers.

- USB Installation - How to use PC tools to install image on ROCK Pi 4.
- Serial Console - Serial console on GPIO header
- Build Debian - Build and generate Debian image
- Build vendor kernel(Rockchip 4.4) - Build vendor kernel for ROCK Pi 4
- Build Android (nougat) TV - Build Android for ROCK Pi 4
- Build Yocto - Build Yocto for ROCK Pi 4

> More... [Expand]

Hardware

Technical specifications about the ROCK Pi 4 hardware, including WI-FI, display, camera, etc.

- Blog post from Radxa Team introducing the ROCK Pi hardware design
- ROCK Pi 4 - Introduction of the ROCK Pi 4 hardware
- Display
- Camera module
- Device Tree Overlays - Use other HAT

> More... [Expand]

Working With Linux

Fundamental Linux usage for beginners and more advanced information for power users.

- Debian Desktop
- Ubuntu Server
- Linux system runs on M.2 NVME SSD
- Radxa APT
- Docker
- Samba

> More... [Expand]

Working With Android

Fundamental Android usage for beginners and more advanced information for power users.

- Android7 Tablet(Support Raspberry Pi official 7" Display)
- Android7 TV
- Android9 Tablet
- Android9 TV
- Android9 Run on M.2 NVME SSD
- Android9 Mraa API
- Android10 Tablet
- Android11
- Solve Google Play Device is not Play Protect certified issue

RK3399 Debian BSP (2)

- Boot-Loader
  - RKBin, U-Boot
- Kernel
  - Linux Kernel source
- Rootfs
  - Debian File System
- Tool-Chain
  - Compile tool

Cross Compilation

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

Cross Compilation