Ubuntu on ARM

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Agenda

- Why ARM?
- ARM Architecture Primer
- Board Bring Up
- Ubuntu on ARM
- Native Building
- Applications
- Release Cycle
- Questions

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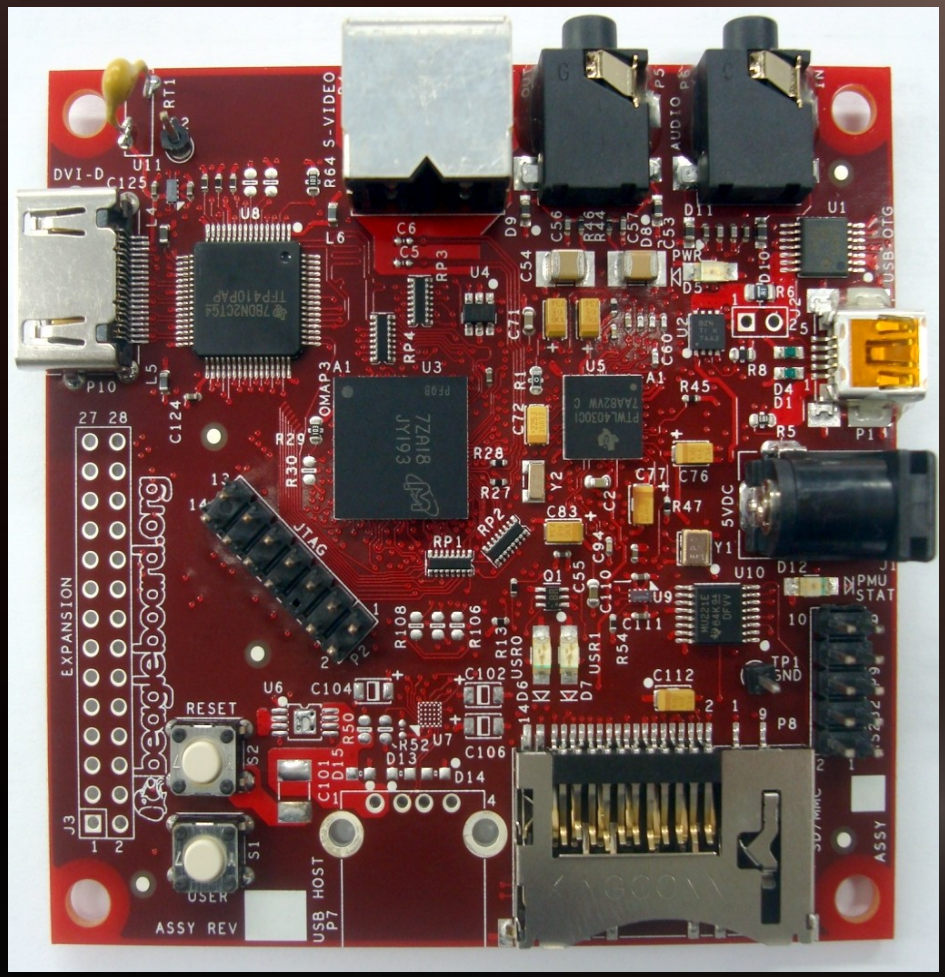
Why ARM



- Very low power consumption
  - Day to multi-day battery life
- Smaller designs
- Lighter weight
- Cooler
- Simple Design

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Why ARM?

- With the advent of ARMv7 Cortex A8 and Cortex A9 devices there will be devices that can use Ubuntu Linux for ARM.
  - Computers: Notebooks – Netbooks – Servers
  - Smart Phones (Nokia N900, Apple iPhones)
  - Home Entertainment: Televisions with Internet access (Sony devices and others)
  - Automotive Entertainment

ARM Architecture

- 32-bit reduced instruction set computer (RISC) processor
- developed by ARM Holdings
- ARM == Advanced RISC Machine || Acorn RISC Machine
- The ARM architecture is the most widely used 32-bit processor family
  - 98% of all mobile phones use at least one processor

ARM Background

- In 2009, ARM processors accounted for 90% of all embedded 32-bit RISC processors
- ARM processors are used in: PDAs, mobile phones, digital media, music players, hand-held game consoles, calculators, hard drives and routers
- The ARM architecture is licensable:
  - Apple Inc., Atmel, Broadcom, Cirrus Logic, Digital Equipment Corporation, Freescale, Intel, LG, Marvell, NEC, NVIDIA, NXP, Oki, Qualcomm, Samsung, Sharp, ST Microelectronics, Symbios Logic, Texas Instruments, VLSI Technology, Yamaha ...

ARM Background

- ARM processors are developed by ARM and by ARM licensees
- Prominent examples of ARM processor families include the ARM7, ARM9, ARM11 and Cortex
- Examples of ARM processors developed by major licensees include:
  - Freescale's i.MX
  - Marvell (formerly Intel) Xscale & Dove
  - NVIDIA's Tegra
  - Qualcomm's Snapdragon
  - Texas Instruments OMAP

Types of ARM Processors

- Most devices have multiple ARM processors
  - Application Processor
    - general-purpose CPU with a memory-management unit (MMU) capable of supporting a high-level operating system
  - Baseband Processor
    - performs the basic communications functions required to connect to a cellular network.
    - contains a CPU that supervises the baseband functions, using a DSP or hard-wired logic

Types of ARM Processors (cont)

- Mobile Multimedia Processor (MMP)
  - coprocessor that offloads multimedia functions from the host processor
  - Examples include: audio & video processing, (camera) image processing, and 2D/3D/vector-graphics acceleration

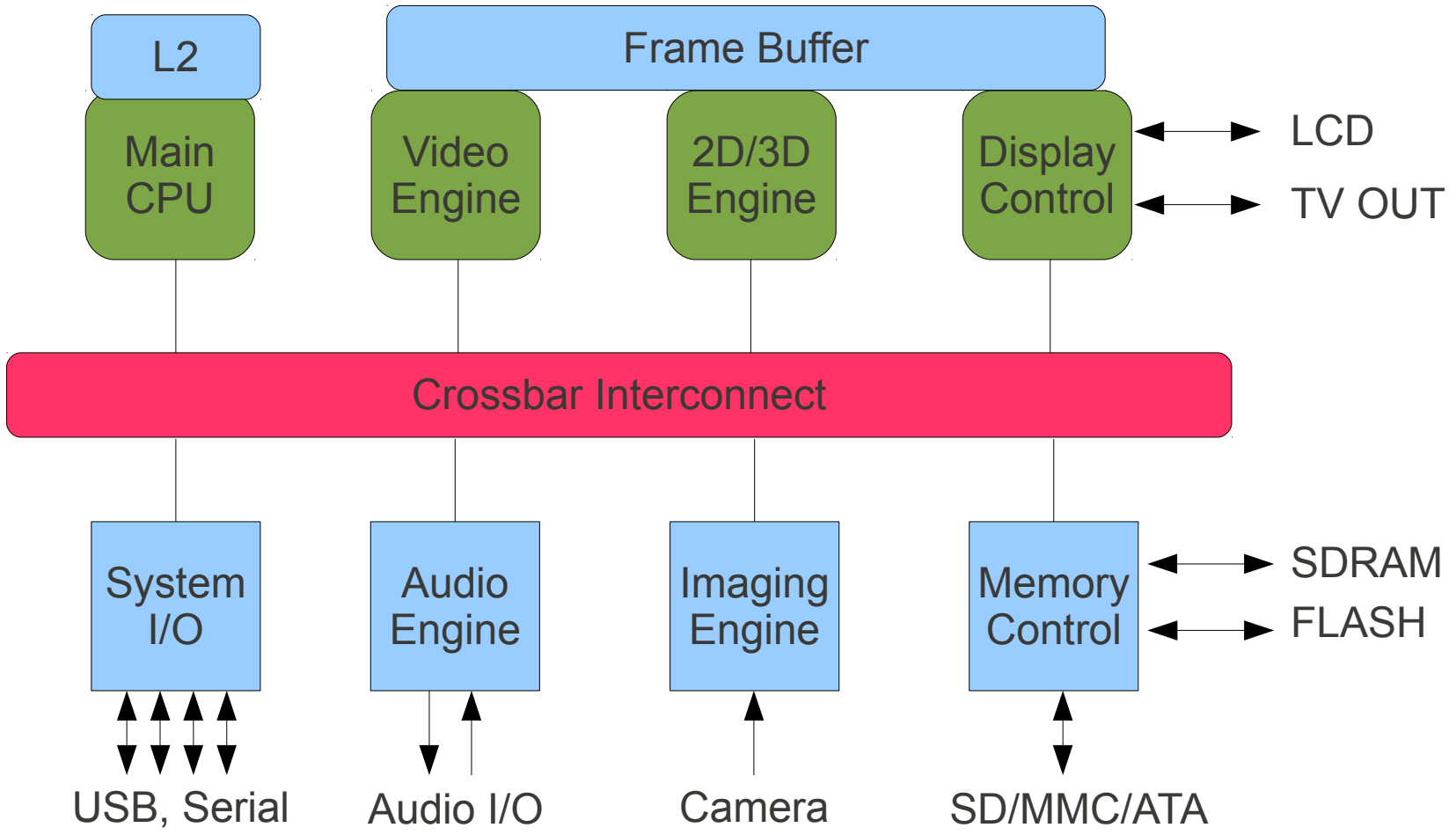
ARM in the Past

- ARMv1 – ARMv3
  - Obsolete: Not powerful enough to run Linux
- ARMv4
  - Some very limited Linux BSP's and some level of support in Debian without X. Heavily used in the embedded space with RTOS's
- ARMv5-ARMv6
  - Powerful enough for phones and some smart phones, Limited Linux, and other RTOS's used.

ARM of Today

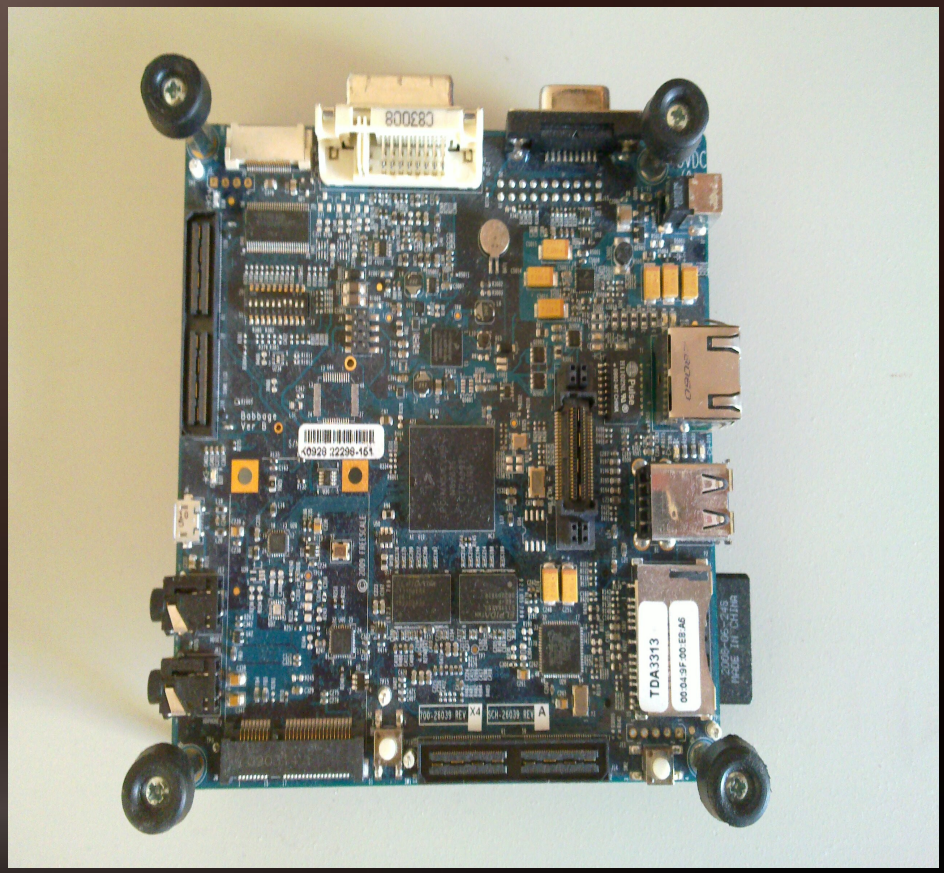
- ARMv7
  - Powerful enough for smart phones and general purpose computing, Desktop, Note/Netbooks, and low power servers.
  - Need a well supported general purpose operating system to support use cases.

Generic Mobile Processor



ARM Fun Facts

- ARM Designs are called “System on Chip” or SoC
- ARM does not have BIOS
- Currently requires a custom kernel per SoC
- Uboot & Redboot are typical bootloaders
- No PCI bus or bridges (North or South)



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ARM Board Bring Up

- Involves 3 steps
  - Receive BSP from SoC Vendor
  - Merge/Forward/Backport SoC specific patch delta into the Ubuntu kernel tree
  - Test/Bug Fix/
- Wash, rinse, repeat
- Work with SoC vendor on upstreaming patches

Challenges with ARM Bring Up

- No BIOS to do board set up
- This leads SoC vendors to do board set up in various “nonstandard ways”
- Long term solution is **Device Tree**
  - Device tree uses a config table that is passed to the kernel at boot time
- CPU feature sets are often broken in early silicon
  - Find workaround in the kernel
  - Or respin the silicon

Ubuntu Architectures

- Ubuntu Supported
  - Amd64
  - **Armel**
  - I386
- Community Supported
  - Powerpc
  - Sparc
  - Ia64

Ubuntu on ARM

- Started 18 months ago, supporting one System on Chip (SoC): Freescale iMX51
- 12 months ago expanded to two SoC's: Freescale iMX51 and Marvell dove.
- Releasing this month supporting three SoC's: Freescale iMX51, Marvell Dove, and Texas Instruments OMAP 3530 and beyond.

Ubuntu Flavours built for ARM

- Gnome Desktop – built for the first two releases of ARM, available in this release but not as an image.
- Netbook – Build for the first time for this release. Both 2D and 3D versions.
  - 2D uses the enlightenment foundation libraries
  - 3D requires Open GL accelerated drivers installed and working
- Server images built but not tested.
- Community supplied Kubuntu Netbook Remix.

Native Building

- All versions of Ubuntu are native built, it's a “feature” of the Ubuntu build system
  - Derived from the Debian build system that works the same way
    - Many .deb packages are very hard to use cross compilation on, they either self generate code or have tests that have to be run on the actual hardware
  - In order to build an architecture you need actual hardware for that architecture

Compilation Issues

- Tool chain issues for the 10.04 release we are compiling ARMv7 with Thumb 2
  - ARMv7 is new
  - Thumb 2 is new
    - Applications with ARM Assembly code have needed touch ups.
- Ubuntu contains a mix of ARMv7 code and Thumb 2 this can cause issues.
  - For a function return ARMv4 would be “MOV pc lr”, it not safe in a mixed ARM/Thumb 2 code base so “BX lr” is preferred

Application Choices

- Most ARMv7 platforms to date have ~256M of RAM and no fast IO for hard disks.
  - Easy to run out of RAM if using in a desktop context
  - Slow Swap
- Currently most ARMv7 images use a non-accelerated frame buffer. This leads to some issues.
  - Slow scrolling
  - Slow screen update
  - No 3D

Release Cycle – Ubuntu on ARM

- Releases take place every six months with the rest of Ubuntu
- Developer releases:
  - Ideal for fast moving projects or developers, not always well tested but early cutting edge release, OMAP this cycle will be a developers release.
- Standard releases:
  - Maintained with security patches for 18 months Free
- Long Term Supported releases:
  - No ARM release has achieved LTS status yet, perhaps by next LTS cycle

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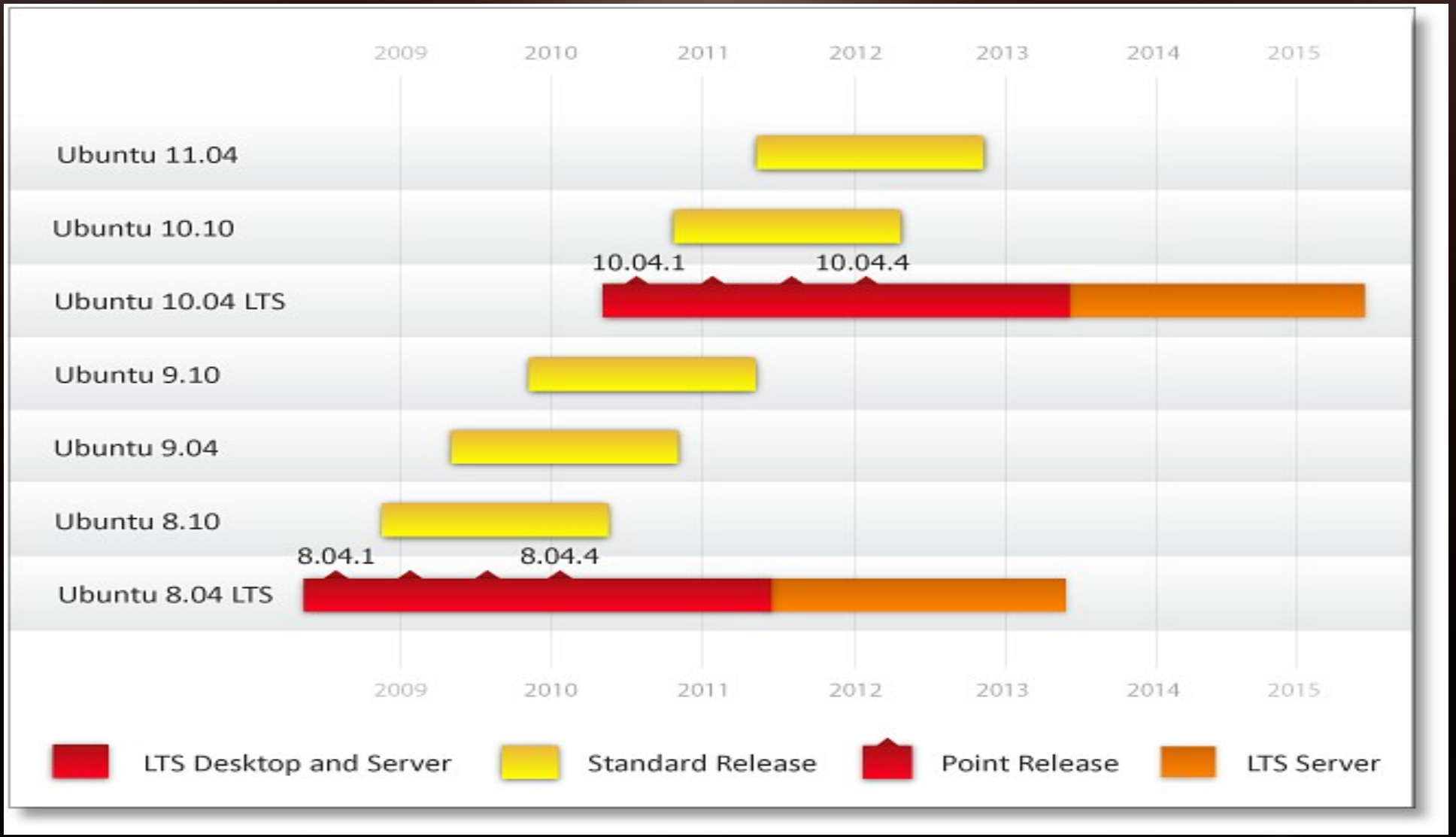

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Refereces

- https://wiki.ubuntu.com/
- https://wiki.ubuntu.com/ARM/
- https://wiki.ubuntu.com/ARM/Thumb2PortingHowto

Questions?