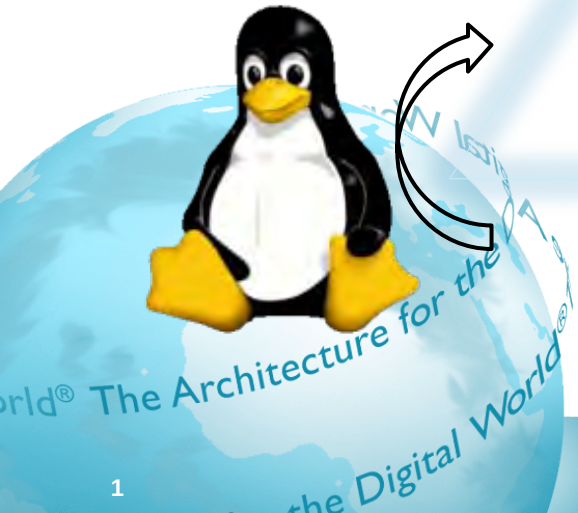


ARM Update

David Brash

Linaro Connect, Hong Kong

ARM's market presence

- 30 billion+ ARM processors shipped
  - 8 billion ARM-based chips in 2011, 30% CAGR over last 5 years
- Mobile devices still the largest market
  - embedded and enterprise the fastest growing
- Unrivalled partner ecosystem serving 850+ processor licenses

Mobile	15%	4.5bn in 2011
Embedded	70%	1.8bn in 2011
Enterprise	30%	1.3bn in 2011
Home	10%	0.3bn in 2011

Energy Efficiency Underlies It All

Efficiency is a requirement for a connected world

ARM activities

CoreSight™
Debug & Trace IP by ARM

- Virtual Platforms
- Early-access Hardware
- Code Generation
- Debug Tools
- Performance Analysis

Enabling the Design Flow

Early software development a critical factor

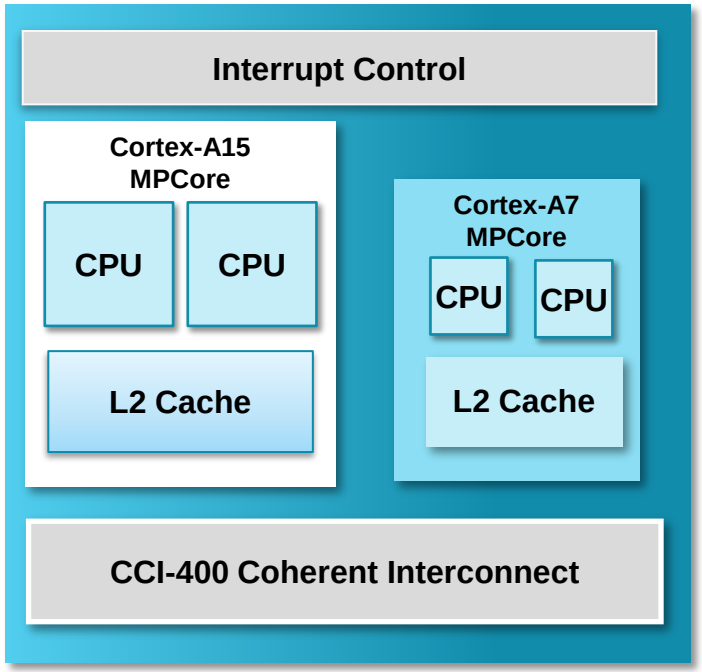
Initial Software Creation	RTL simulation	FPGA and Silicon	Final Product
			
Fast Models	VSTREAM virtual debug interface	DSTREAM debug and trace targeting Development boards	Streamline perf. analyzer

GNU tools / ARM Development Studio 5 (DS-5)

Cortex-A15/7 big.LITTLE Processing

- Uses the right processor for the right job
- Up to 70% energy savings on common workloads
- Flexible and transparent to apps – importance of seamless software handover

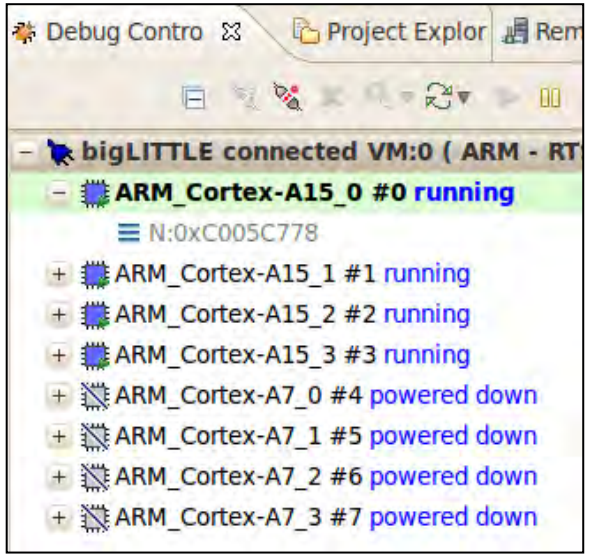
big



LITTLE

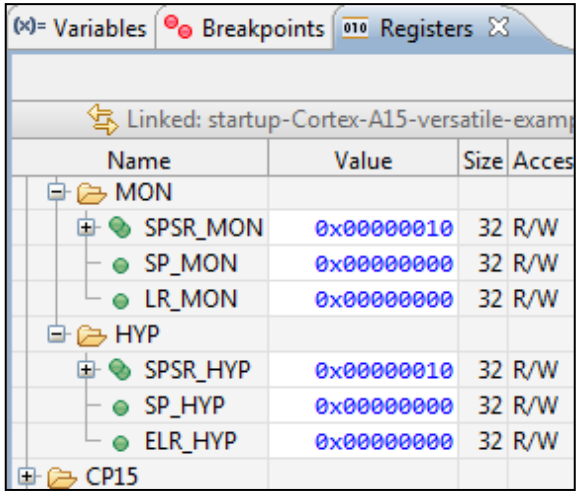
DS-5 Debugger and {V,D}STREAM

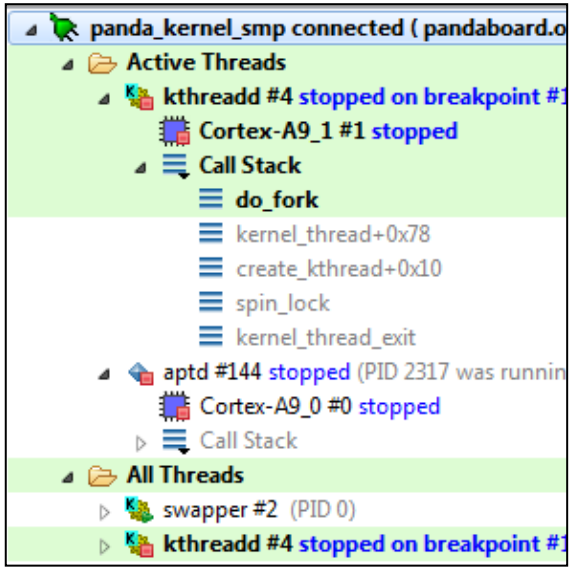
Debug tools that fully utilize and support all the latest technologies on Cortex-A processors



Development of switching software on big.LITTLE targets & models

***Upper Layer* software development on Cortex-A7 & A15**

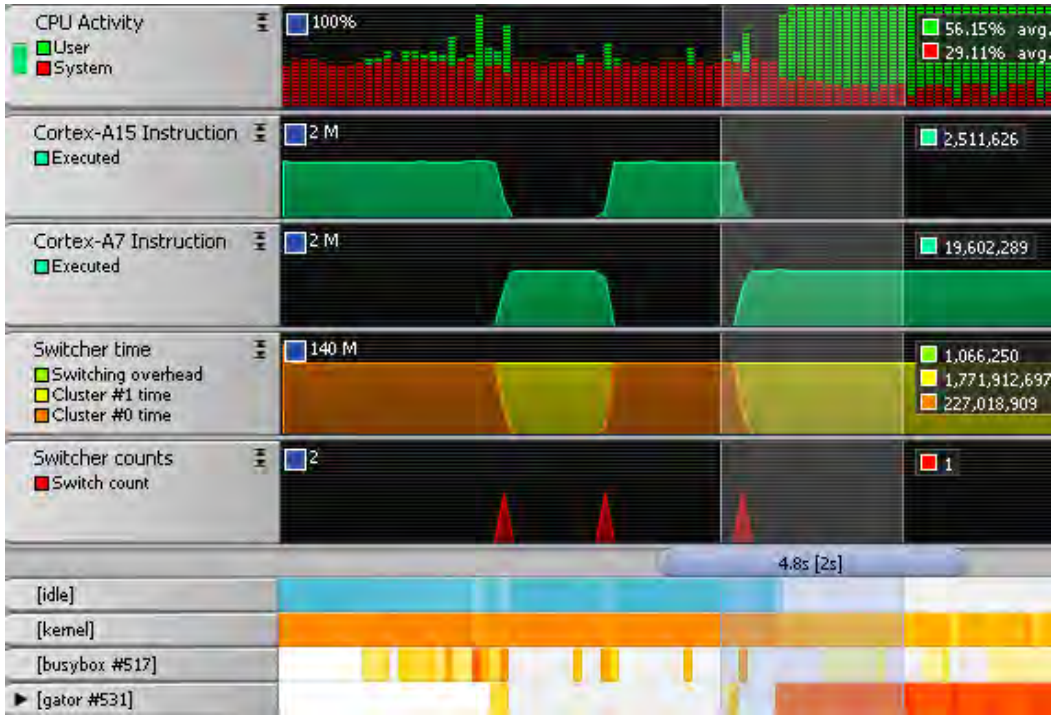




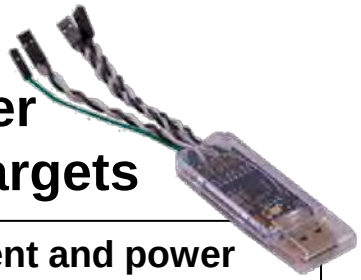
Assisted kernel and driver debug on Linux UP and SMP targets

ARM Tools for big.LITTLE Systems

Debug and optimize your big.LITTLE software *now!*



- **Fast Model of a Cortex-A15 + A7 big.LITTLE system**
- **Migration code developed and demonstrated on this model using DS-5**
- **Monitor thread migration between processors and clusters**
- **Correlate power on hardware targets**

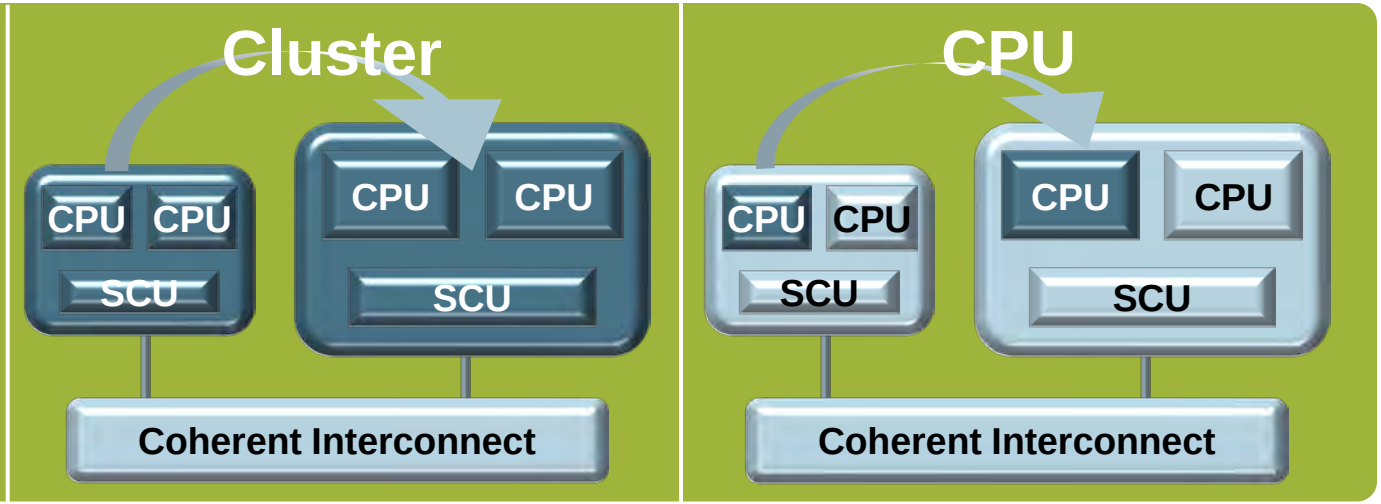


Monitor voltage, current and power on up to three power rails

big.LITTLE Approaches

Migration

Reusing existing power management strategies for switching

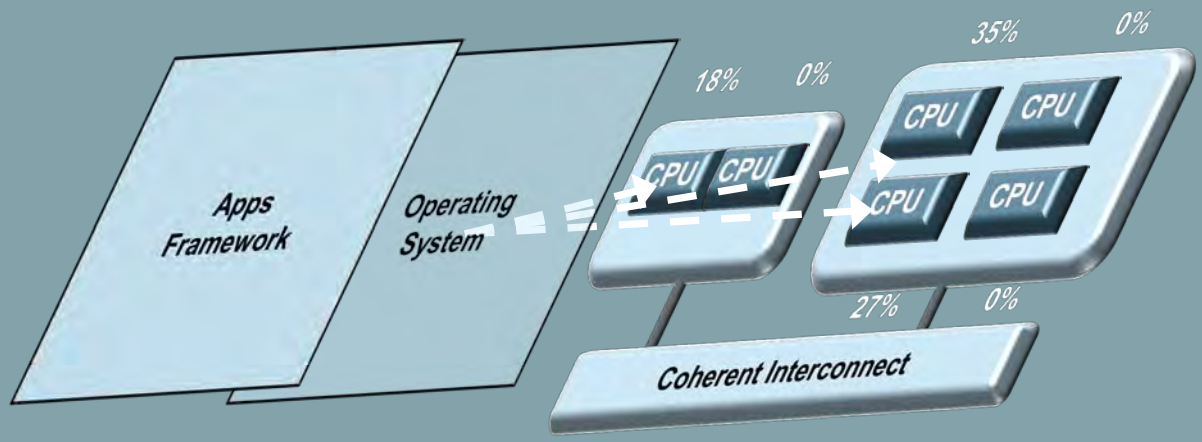


Common Hardware platform. Multiple Software Strategies

MP

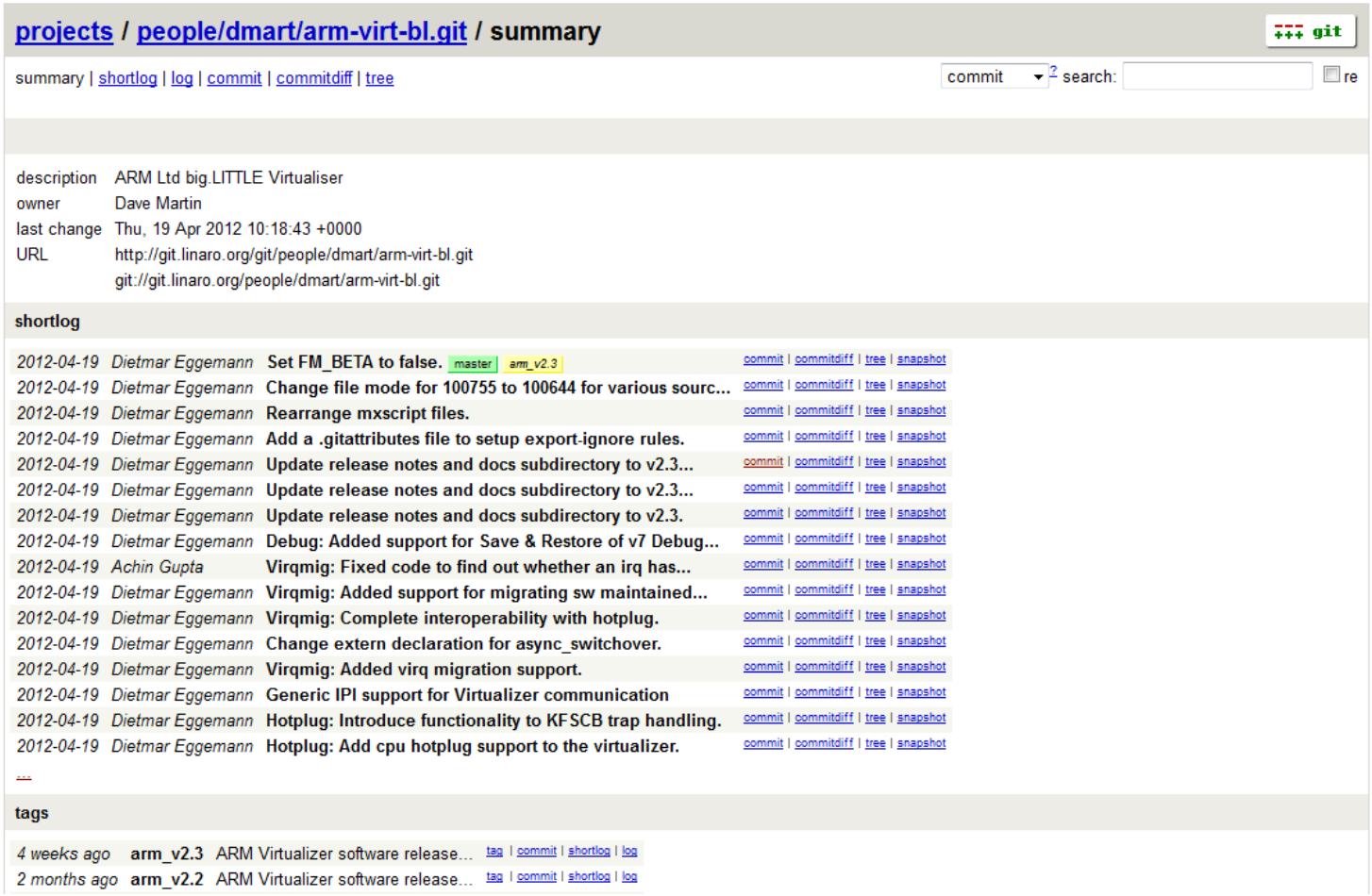
OS scales through all CPUs in the system

All clusters may be in simultaneous use



Virtualiser software

- Nico's article: **http://lwn.net/Articles/481055/**
- Example code available through Linaro



projects / people/dmart/arm-virt-bl.git / summary

git

summary | shortlog | log | commit | commitdiff | tree

commit search: re

description	ARM Ltd big.LITTLE Virtualiser
owner	Dave Martin
last change	Thu, 19 Apr 2012 10:18:43 +0000
URL	http://git.linaro.org/git/people/dmart/arm-virt-bl.git git://git.linaro.org/people/dmart/arm-virt-bl.git

shortlog

2012-04-19	Dietmar Eggemann	Set FM_BETA to false. master arm_v2.3	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Change file mode for 100755 to 100644 for various sourc...	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Rearrange mxscript files.	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Add a .gitattributes file to setup export-ignore rules.	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Update release notes and docs subdirectory to v2.3...	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Update release notes and docs subdirectory to v2.3...	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Update release notes and docs subdirectory to v2.3.	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Debug: Added support for Save & Restore of v7 Debug...	commit | commitdiff | tree | snapshot
2012-04-19	Achin Gupta	Virqmig: Fixed code to find out whether an irq has...	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Virqmig: Added support for migrating sw maintained...	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Virqmig: Complete interoperability with hotplug.	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Change extern declaration for async_switchover.	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Virqmig: Added virq migration support.	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Generic IPI support for Virtualizer communication	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Hotplug: Introduce functionality to KFSCB trap handling.	commit | commitdiff | tree | snapshot
2012-04-19	Dietmar Eggemann	Hotplug: Add cpu hotplug support to the virtualizer.	commit | commitdiff | tree | snapshot

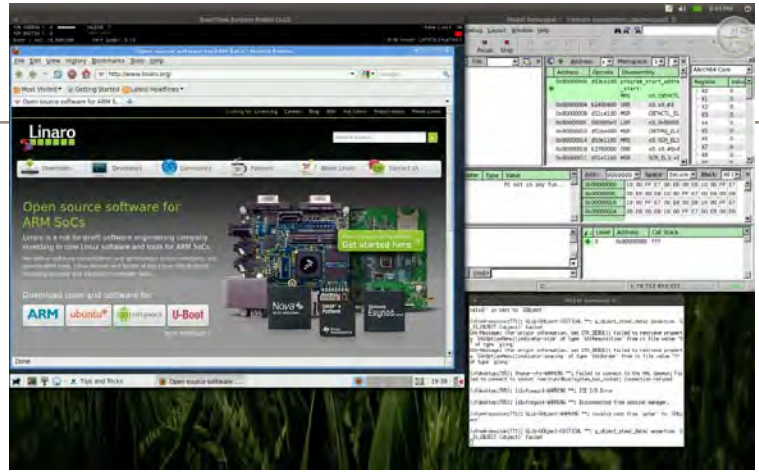
...

tags

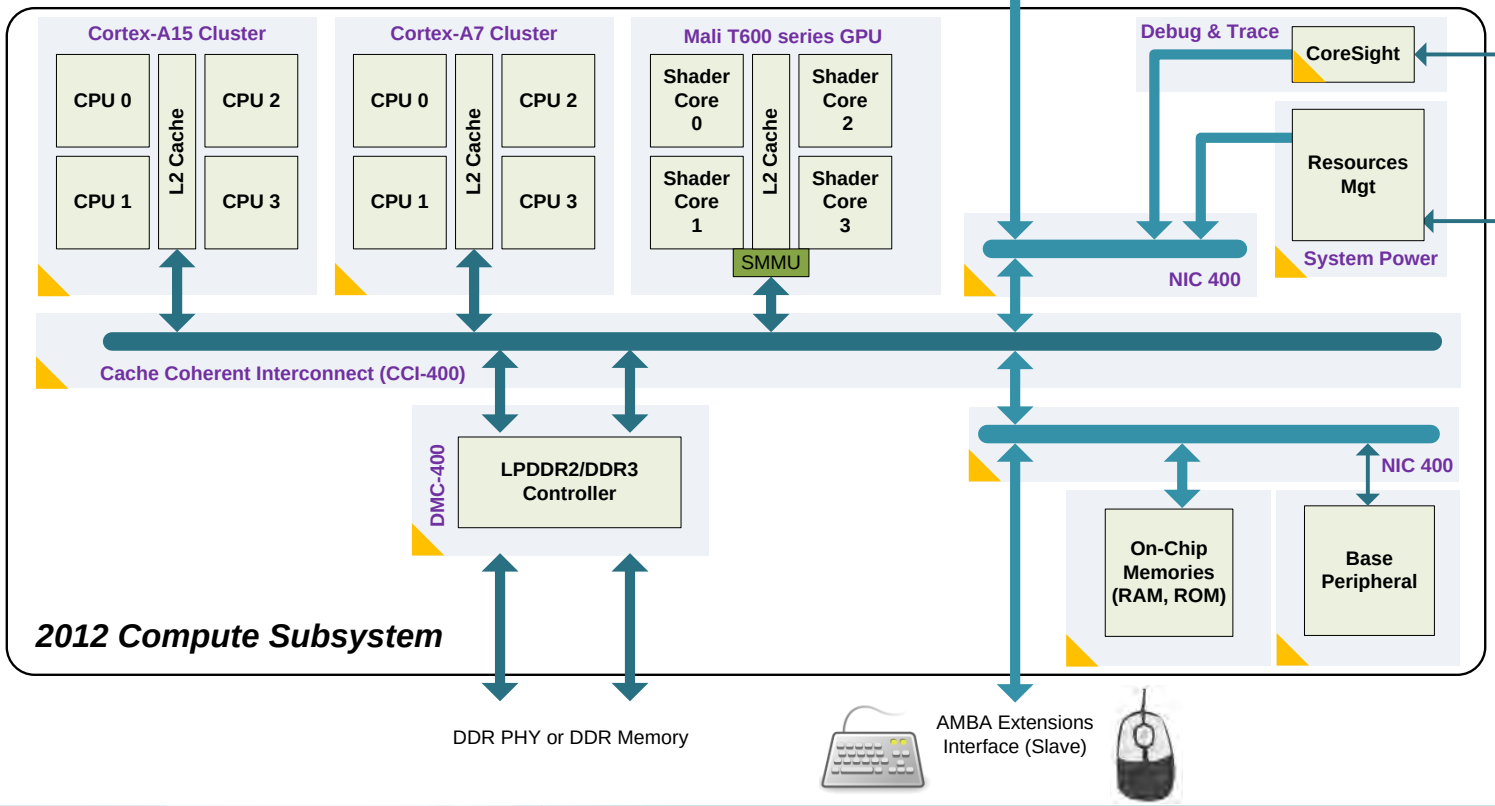
4 weeks ago	arm_v2.3	ARM Virtualizer software release...	tag | commit | shortlog | log
2 months ago	arm_v2.2	ARM Virtualizer software release...	tag | commit | shortlog | log

Platform models

- A hierarchy of models
  - Align ARM platform recommendations and associated software development/ contributions to the community
  - Used for big.LITTLE, key for ARMv8



AMBA Extensions Interface (Master)



JTAG & Trace

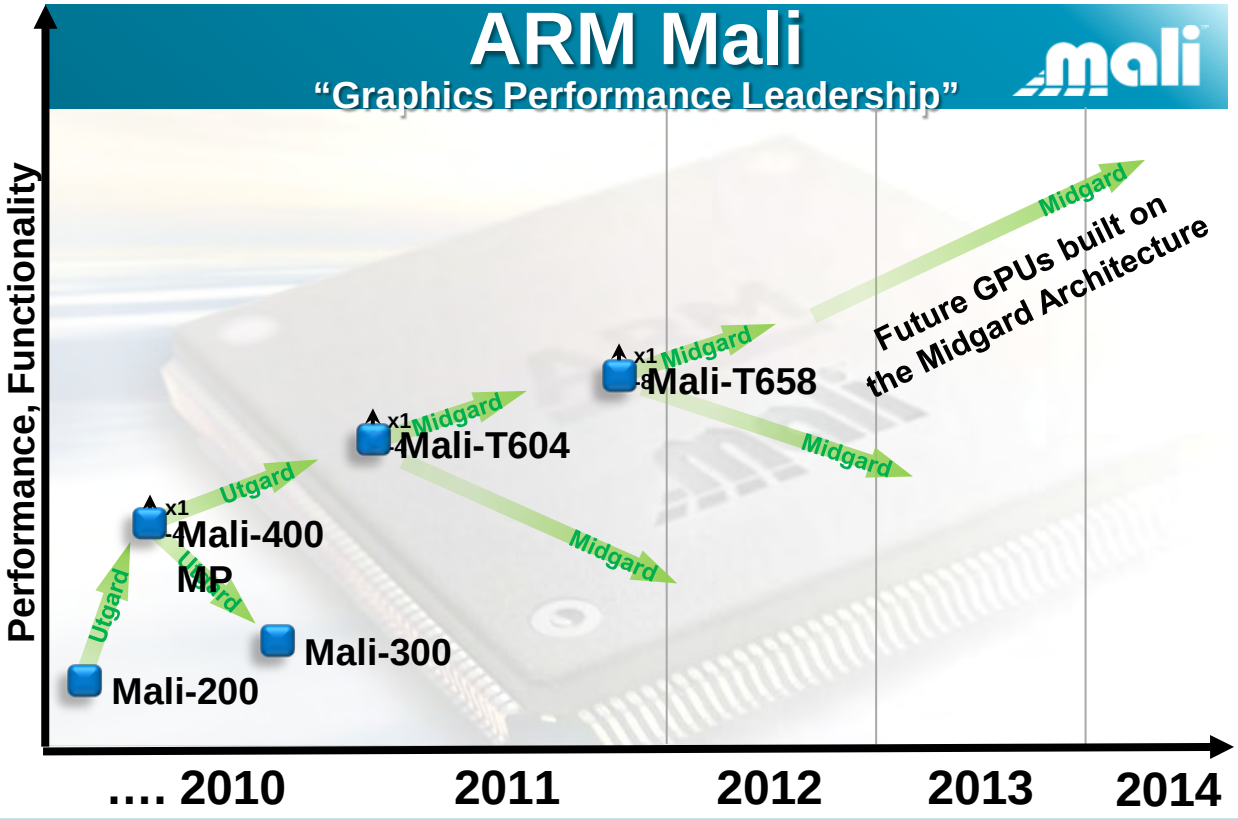
PMIC/ APB Bus

DDR PHY or DDR Memory

AMBA Extensions Interface (Slave)

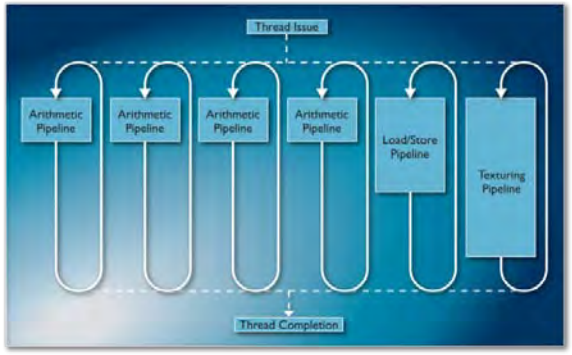
Mali Midgard architecture - introduction

- A native 64-bit GPU architecture – “ARMv8 ready”
- GPU Compute
- Extensive API support
  - **Graphics APIs:** Microsoft DirectX® 11, Khronos OpenGL® ES and OpenVG™
  - **Compute APIs:** Khronos OpenCL™, Google® Renderscript™, Microsoft DirectCompute®



Multicore Mali-T658 GPU

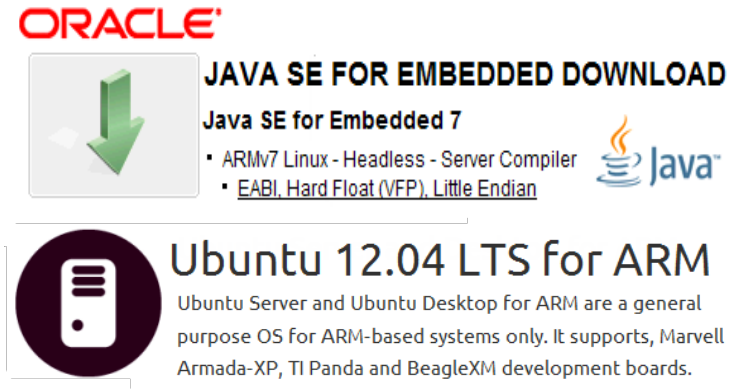
- **Up to 10x graphics performance** of Mali-400 MP
  - **4x GPU compute performance** compared to Mali-T604
- Mali 400 & Mali-T6XX aligned around a common X11 and kernel infrastructure.
- Selected Linux DDK components are open-sourced:
  - Mali kernel Device Driver (GPLv2).
  - Linux X11 Display Drivers and Android Gralloc
  - Functionally identical to commercial code
  - ARM maintaining in Linaro GIT tree and published on the Mali Developer Portal.
- Base driver, ESSL compiler, EGL, GLES, OpenCL & VG drivers provided under a commercial license.
- ARM and Linaro working on a Mali profiling solution
  - Event visibility through perf, ARM's Streamline ...



mali™ Visual Computing by ARM

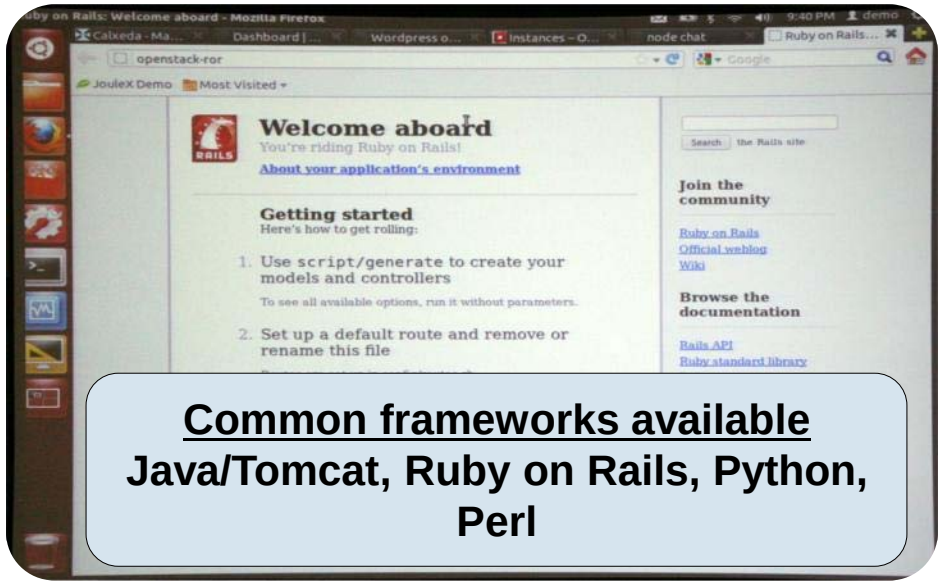
Server Progress – Ecosystem Highlights

- **Oct'11**: Oracle demonstrated C2 JIT running on ARM
  - 20-40% performance uplift vs existing C1 JIT on ARM
- **Oct'11**: First release of Ubuntu server Linux for ARM
- **Oct'11:** Applied Micro announce ARMv8 based X-Gene device, support for up to 128 processors @ up to 3GHz per processor.
- **Nov'11**: HP announce Calxeda-based Redstone development platform and formation of Lab to explore optimized Hyperscale applications
- **Nov'11**: Calxeda announce EnergyCore
- **Nov'11**: nVidia announce Tegra (Quad core Cortex-A9) + CUDA GPGPU software development platform to pursue HPC market
- **Dec'11:** Oracle announce Server C2 JIT on ARM
- **Apr'12:** Ubuntu release 12.04LTS server for ARM implementing new Hard Float ABI
- **May'12:** First public demo of Calxeda server with 12.04LTS, MAAS, JuJu, OpenStack, node.js, RoR etc…

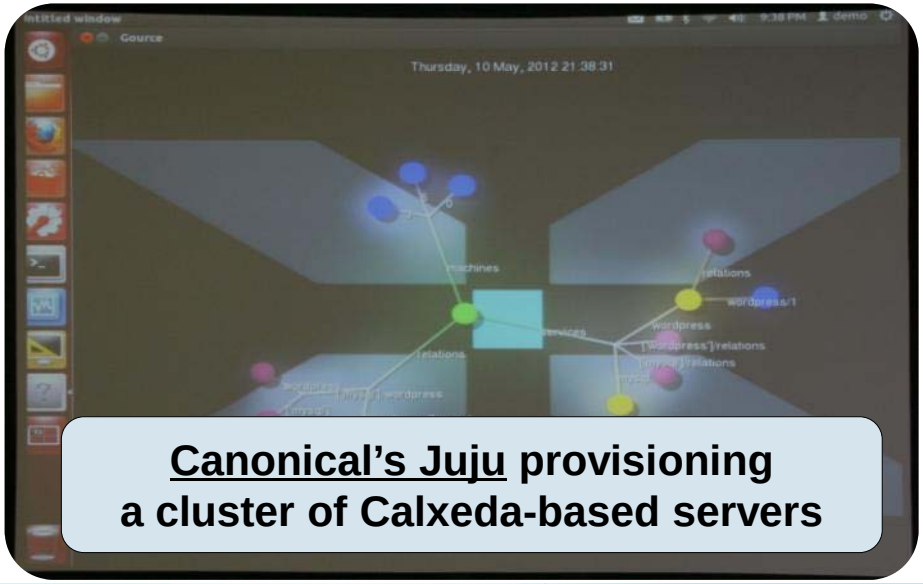


Calxeda EnergyCore + Ubuntu 12.04LTS @ UDS

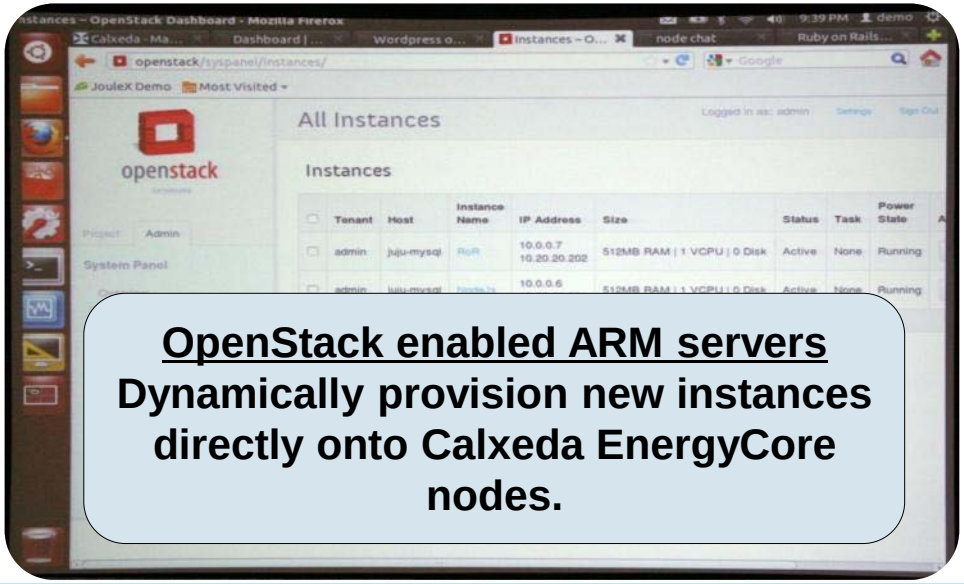
LAMP stack running Calxeda.com
Linux + Apache + MySQL + PHP



Common frameworks available
Java/Tomcat, Ruby on Rails, Python, Perl



Canonical's Juju provisioning a cluster of Calxeda-based servers



OpenStack enabled ARM servers
Dynamically provision new instances directly onto Calxeda EnergyCore nodes.

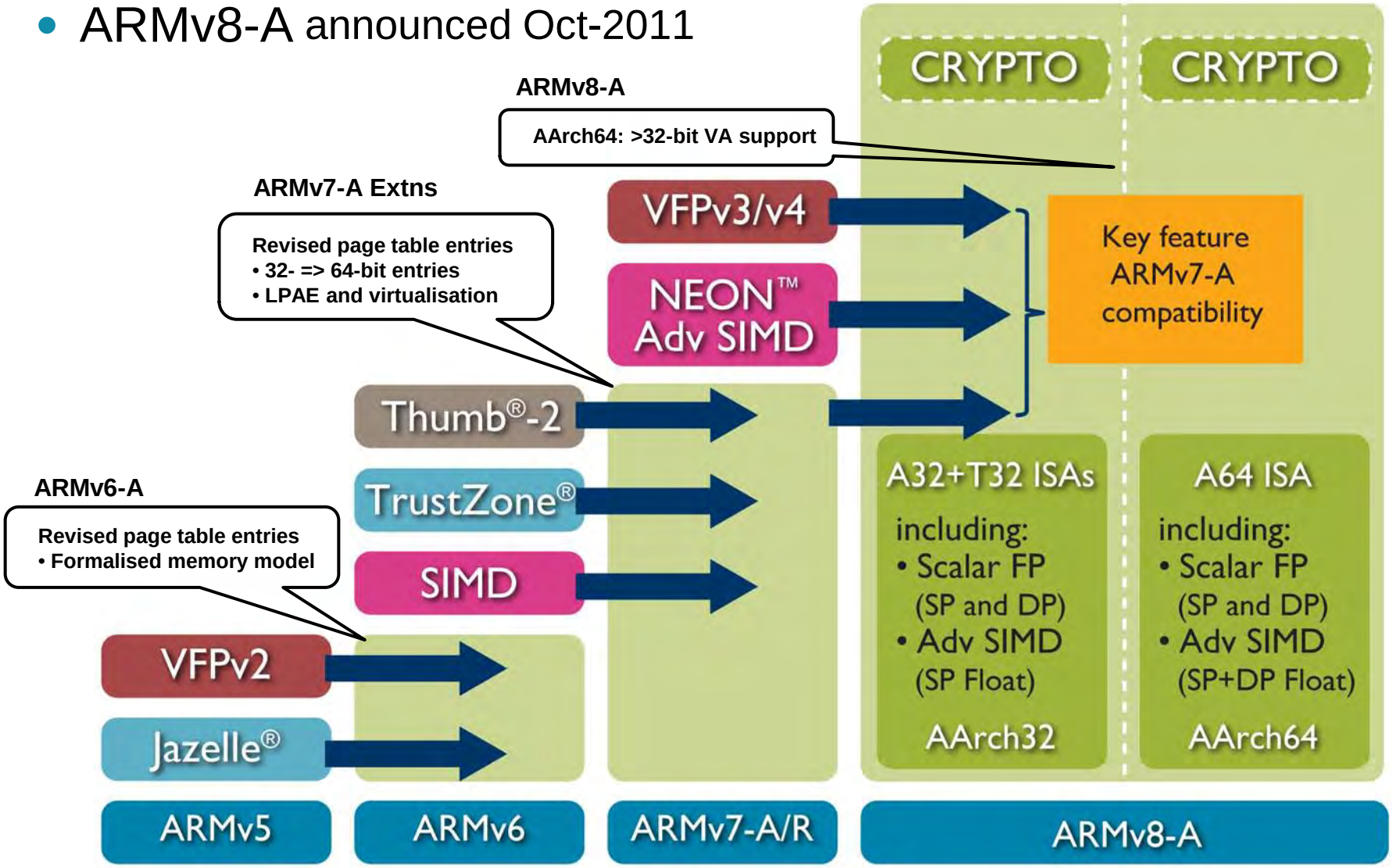
Calxeda EnergyCore + Ubuntu 12.04LTS @ UDS

Thanks to Linaro, Canonical and the open source community…

IT JUST WORKS!

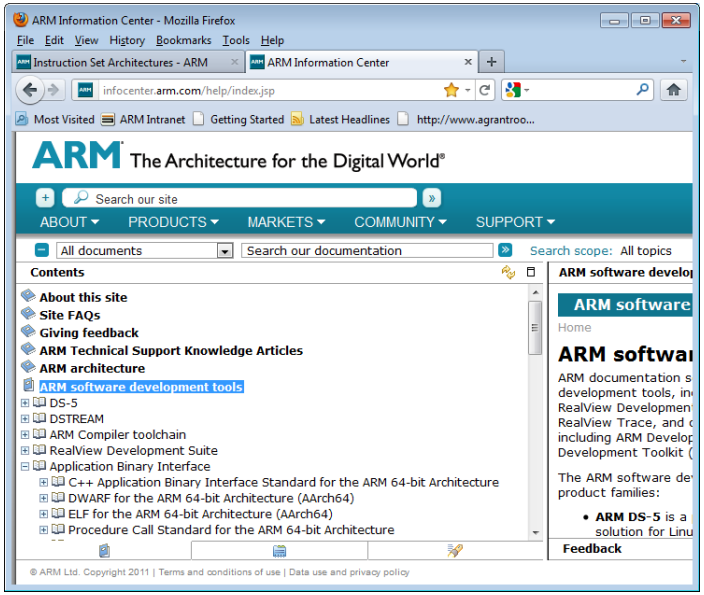
ARMv7-A => ARMv8-A development

- ARMv8-A announced Oct-2011



ARMv8-A Public information

- **ARM.com/architecture**
  - TechCon talk – architecture overview
  - Instruction Set Overview
    - All new instructions including assembler syntax
  - AArch64 ABI documents



- NEW!!!
  - Gcc for AArch64 public review
  - **svn://gcc.gnu.org/gcc/branches/ARM/aarch64-branch**

ARMv8, Linaro and the community

- From the Techcon announcement (Oct-11):
  - *2012 – ARM will start upstreaming open-source materials*
  - *ARM working with architectural partners & on its own implementations*

- **Goals: upstream/review 2012, adopted/maintained 2013:**
  - AArch64 tools support via gnu.org
  - AArch64 Linux kernel support via kernel.org

- Alignment of ARMv8 efforts with ARMv7 developments
  - Linaro's current development programs as appropriate
  - Key technology areas
    - KVM, UEFI, ...
  - GNU tools and Linux distributions

Mali and ARMv8

- Midgard memory system alignment - today
  - Mali-T604/Mali-T658 and LPAE physical address space
    - Cortex-A15 and Mali-T604 page table format
  - System I/O coherency with ACE/ACE-Lite and CCI-400

- Multiple simultaneous address spaces supported
  - Mali GPUs run many threads in parallel
  - Independent processes may execute on GPU simultaneously
  - Seamless process transitions ensures maximum utilization/efficiency

- Midgard architecture built for 64-bit addresses

mali™ Visual Computing by ARM

Readying 64-bit Server Ecosystem

- ARM focused on enabling choice at all stages of the ecosystem.
  - Silicon partners
  - Operating systems
  - Hypervisors
  - Optimized application stacks and tools

- Partnering with semiconductor licensees to create 64-bit ecosystem momentum

ARM 64-bit S/W Development Board from Applied Micro

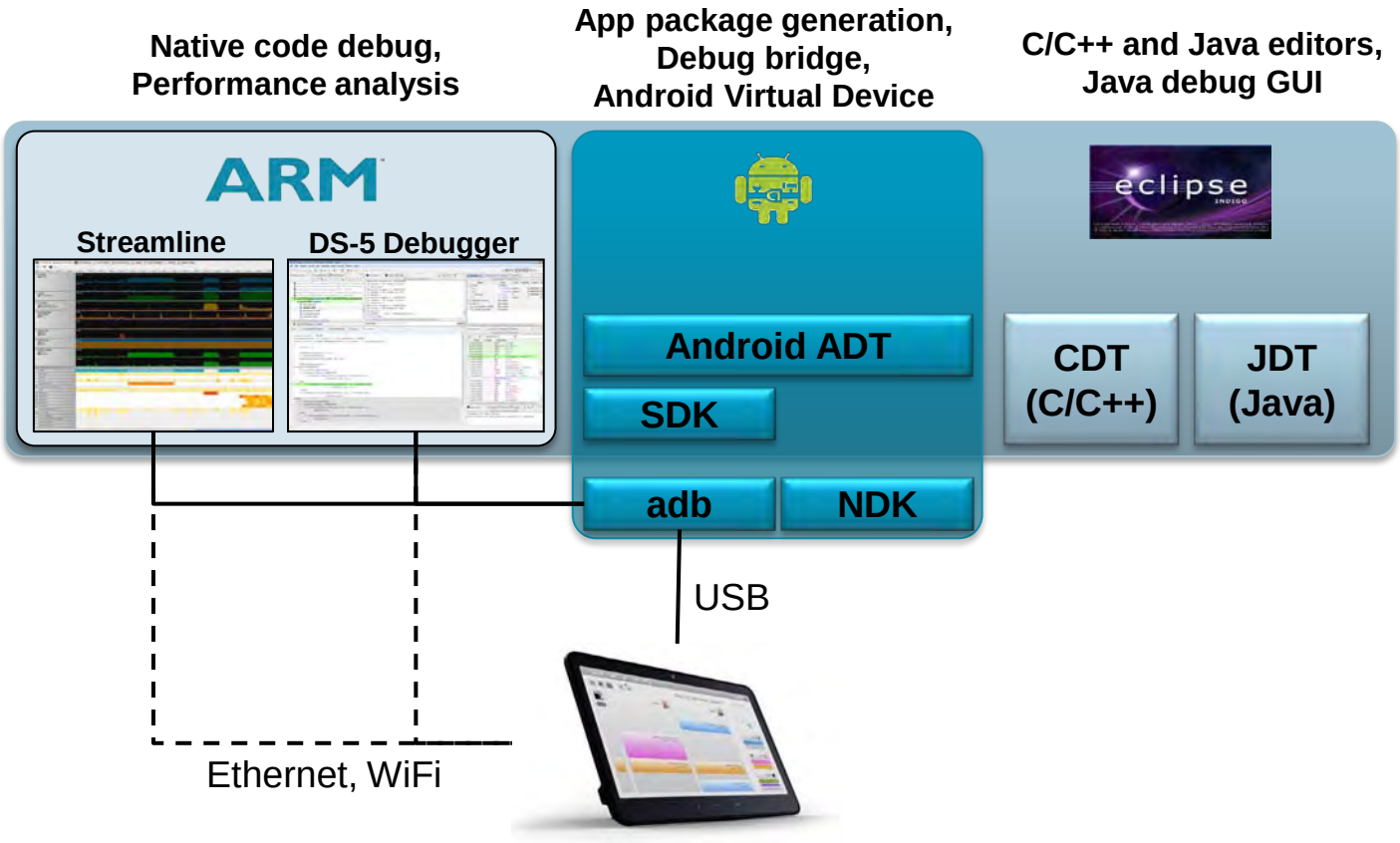
AArch32 / ARMv7 today ... AArch64 / ARMv8 ???

DS-5 Community Edition

A free toolkit for the Android apps community

- **Graphical Android native debugger**
- **Feature-limited Streamline**

- **Free for everyone!**
- **Make Android native development in C/C++ as easy as Java development**
- **Integrated with Android SDK & NDK**



Thank you

5 Billion connected by ARM Powered Devices enabling a connected life.