Collaboration: Key to Delivery During Market Disruption

Simon Segars
CEO, ARM
The Face of Computing in the 20th Century
The Face of Computing Has Changed
Embedded Computing in the 20th Century

Apollo Guidance Computer

61 cm x 32 cm x 17 cm
2 MHz clock source
~72 KB ROM, 8 KB RAM
55 watts active power
32 kg (70 lbs)

Source: NASA
Photo with permission: Freescale Semiconductor
### Today: Cypress PSoC® 4 at 130nm

- Cortex-M0 CPU at 40nm
- Cypress PSoC® 4

### 1960s: Apollo Guidance Computer

#### Cypress
- 16 MHz
- 2 KB SRAM
- 8-16 KB Flash
- 25 µW Active Power
- 1.5mg
- 1.48mm x 1.58mm
- ARM Cortex-M0

#### Apollo GC
- 2 MHz
- 2 KB RAM
- 36KB ROM
- 55W Active Power
- 30kg
- 61cm x 32cm x 17cm
- Lots of dual 3-input NOR gate modules
Still Out of this World

- Raspberry Pi based “Astro Pi” project
- School children’s experiments to run in space
- Astronaut Tim Peake & UK space organizations
- Joins international Space Station (ISS) in 2016
Hardware Without Software
Typical Process Design Rules

SemiCo report “SoC Silicon and Software Design Cost Analysis”, 2013

http://semico.com/content/soc-silicon-and-software-design-cost-analysis-how-rising-costs-impact-soc-design-starts

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**Compound Average Node Complexity Increase**

70%

180nm → 16/14nm

**Compound Average Node Cost Increase**

53%

28nm → 7nm

**Software Design Cost Increase CAGR**

69%

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1 SemiCo report “SoC Silicon and Software Design Cost Analysis”, 2013
Mobile, IoT and Cloud Disrupting Infrastructure

- Mobile and IoT stressing network and data access
- Cloud pace sets rapid software and services evolution
- Increasing demand for intelligence at the network edge
- Evolving scale-out architectures from data center to network edge
Software Sets Product and Services Innovation Rate

“Software eats the world”
- Mark Andreesen

Source: Adrian Cockcroft, Flowcon November 2013
A Framework for Collaboration
Linaro Addressing Multiple Vertical Markets

Digital Home - LHG
- OSS for the digital home
  - W3C EME Secure
  - Media playback for RDK and Android
  - Middleware and user-space stack
  - DRM, DLNA, CVP-2, HTML5
  - LSK kernel version for STB/IPTV
  - Common media frameworks
- Support members, ARM and Google Android development

Mobile - LMG
- OSS for mobile devices
  - Android 64 bit, “L”
  - big.LITTLE power management
  - QEMU based Android development
  - 64-bit Chromium browser
- Support members, ARM and Google Android development

Networking - LNG
- OSS for networking
  - Real Time Support
  - Virtualization
  - Core isolation
  - OpenDataPlane (ODP)
  - Big-endian legacy support
- ODP cross-platform support for SoC accelerators

Enterprise - LEG
- OSS for ARM servers
  - UEFI/ACPI
  - KVM/Xen
  - ARMv8 optimization
  - OpenJDK, Hadoop, OpenStack
- Reduces fragmentation, cost, accelerates time to market
Building Value Today From Core Linux into Key Distributions

- Linaro has delivered a high quality upstream kernel enabling key commercial software
- Continuous Integration and Validation of new patches via LAVA

Linaro Automated Validation Architecture (LAVA)

- Executed near 550,000 jobs since launch
- Total of 150 devices in LAVA production
- 40 distinct ARM device types
- Coverage of all ARM cores A5, A9, A15, big.LITTLE, A53, A57, A53/A57 (FastModel)
- Thousands of jobs submitted and run daily by the CI, QA, Kernel, TCWG, etc. groups within Linaro

- Significantly reducing cost and building a foundation of software quality
Collaborating for Success in Mobile

- Direct collaboration between Linaro and ARM on Android L
- Linaro made significant contributions to key open source projects enabling the Android L Developer Preview SDK
  - OpenSSL, QEMU
- Linaro hosting latest AOSP builds for the ARM Juno Platform in LAVA
Past 12 Months: Growing Availability of Silicon Solutions

- **ThunderX**: announces server intent
- **Qualcomm**: 16FinFET Network Processor
- **Cavium**: availability
- **EZchip**: 100 core Cortex-A53
- **Hisilicon**: announces MPSoc
- **Xilinx**: 32 core Cortex-A57
- **Freescale**: Seattle based boards
- **APplied Micro**: Sampling Helix-2
- **QorIQ LS2**
Past 12 Months: Advances in Open Source Software

- OpenSSL support for AArch64
- OpenStack cloud for development
- ODP L.0 integration
- CRC optimization upstreamed
- ODP 1.1
- OpenVSwitch
- NGINX
- AArch64 support available
- Kernel upstreamed
- VM migration and IO virt support upstreamed
- ACPI upstreamed
- CentOS 7 announces AArch64 support
- Oracle JDK AArch64 early access
- SUSE SLES 12 partner program
- Server 15.04
- Ubuntu development preview 7.1
- Debian 15.04
- Red Hat
- Mainline release
- CentOS 7 announces AArch64 support
- Release for AArch64
- AArch64 support
- Fedora
- FreeBSD AArch64 support
Past 12 Months: Real Products and Deployments

Top 5 HPC technologies to watch

- GIGABYTE® Server-on-chip platform
- Synology NAS
- PEGATRON announce platforms
- OPNFV developer platform for ARM
- University of Utah
- SC14
- Netgear
- Cisco
- CRAY
- National Laboratories
- PayPal
- Ericsson
- DataCentred
- Linaro
- HP ProLiant availability
- ARM endorsement
Opportunity in Embedded

- Make the Linux kernel fit for purpose in Cortex-A Linux based IoT/embedded systems
  - Power management
  - Minimal footprint
  - Embedded UI

- Reference IoT client and IoT gateway implementations

DragonBoard™ 410c

The HiKey Board

https://www.96boards.org
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DragonBoard™ 410c

The HiKey Board

http://community.arm.com/docs/DOC-9977
Hundreds of Cortex-A Processor Based Embedded Platforms

http://community.arm.com/docs/DOC-9977
Expanding Role: Increasing Capabilities

Implementation  Stabilize  Validate  Upstream

ACPI

OpenJDK

Hadoop

Ceph

OpenStack
Thought Leadership: Influencing Communities

Define Create
Implementation
Stabilize
Validate
Upstream

Energy Aware Scheduler
Secure Media Integration
Successful Collaborative Engineering

2010

- MOBILE
- ARM
- IBM
- freescale
- ST ERICSSON
- Texas INSTRUMENTS

4x segments

5x members

10x engineers

2015

- MOBILE
- SERVER
- NETWORKING
- DIGITAL HOME

- ARM
- Alibaba.com
- Allwinner Technology
- AMD
- apm applied micro
- ATAP Advanced Technology and Projects
- Cisco
- Comcast
- Enea
- Facebook
- Freescale
- Cavium
- IBM
- The Linux Foundation
- Mediatek
- Microsoft
- NVIDIA
- NXP
- open source
- Texas Instruments
- Wind
- ZTE

Engineers
Increasing Collaboration Through Linaro

- Build a stronger software foundation for the Linux community
- Open Source Software breadth enables more innovation across markets
- Adoption of open source projects in enterprise deployments is increasing

We are committed to increasing our investment in Linaro
We are all Linaro
Thank You