Our mission: LEADING COLLABORATION IN THE ARM ECOSYSTEM
2009

Smarter technology efficiently connecting the digital world

4 Billion chips
$500M revenue

<1% Cortex® >2Bn

Intelligent Processors by ARM®

2014

Shaping the Connected World

12 Billion chips
$1.2Bn revenue
Predictions from HKG15

- 64 bit ARMv8
- ARM Server Ecosystem
- ODP - the road to adoption
- 96Boards ecosystem impact
ARM Server Ecosystem

- Linaro CoLo facility in Austin
  - APM X-Gene, AMD Seattle & HP Moonshot hardware
  - ARM64 testing and validation
    - Examples - node.js, LLVM & OpenStack
    - Debian builders for ARM64
  - Go port to ARM64

- OVH.com (Europe) deployed Cavium Thunder-X
  - OVH Summit (Sept 24th)
A cross-industry initiative

- ODP v1.3 released last month
- Egress Traffic Manager API design sprint
  ○ 27 architects from 15 companies participated
- ODP-DPDK
  ○ ODP applications on top of DPDK with negligible overhead & full portability across ODP implementations
- Active participation in the OPNFV DPACC Project
HiKey - LeMaker version
Qualcomm DragonBoard 410c
○ 80 Boards for Linaro engineers donated by Qualcomm
More coming ...
Arrow Electronics
○ Linaro Connect sponsors
Coming in Q4

- **AMD HuskyBoard**
  - 96Boards EE
  - Quad Cortex-A57
  - GBit Ethernet
  - SATA/eSATA
  - x16 PCIe G3
  - SO-DIMMs up to 16GB
Difficult questions
Why join Linaro when the output is free?

$55Bn

$1.35Bn

$?Bn

ARM

Partnership
The ARM Partnership must invest together in Open Source software

- Leverage shared resources
- Higher quality deliverables on ARM
- Faster upstreaming leads to improved quality, faster upgrades and less maintenance
- APIs and interfaces need to cater for innovation and differentiation
Membership also brings value

- Open source is not free software - it’s a business model
- Working within Linaro benefits our members
  - Help members collaborate on common needs
  - Provide early member access to new work
  - Member engineers work in Linaro with open source maintainers and experts
- Linaro members lead rather than follow
Is Linaro going to turn into a Professional Services company?

No, collaborative engineering is our core value

- Benefiting members first, and the whole ARM ecosystem

But, part of Linaro work is Professional Services

- Landing teams and special member projects
- This will continue at less than 20% of our business
- It is a member benefit, not our core value
Is Linaro just for Silicon Vendors?

No …

- Distributions benefit from working with SoC vendors and end users
- End users influence SoC Vendors and distributions to meet their product and market needs
- For these companies, Linaro is the place to collaborate with the ARM ecosystem
When will Linaro be finished?

The ARM ecosystem is now a “first class citizen” in open source - why do we need Linaro any more?

The ARM ecosystem is built on innovation

- SoC development & innovation is moving faster than ever
- The need to collaborate on common software is growing not reducing

We project to double in size over the next 5 years
Can we/members do more upstream?

- Key in the open source business model is to work upstream
- Changing business models takes a lot of time
- Simplistically, to deliver a product needs
  - A kernel build at a given point in time
  - Support for vendor SoC features that are not upstream
  - Support for 3rd party and value add proprietary code
  - Productize, test, QA and delivery
- Goals - start with upstream kernel, minimize out of tree code, and manage the value add
Year 6

- Core engineering
- Segment Groups
- Global development & use of ARM technology
- Scaling to larger projects
Linaro IoT & Embedded Group - LITE

- Open source on “small” devices
  - Cortex-A - Linux
    - Small memory
    - Small power sources
    - Embedded UI
  - Cortex-M - mbed OS
- Connection to the Cloud
Global Use of ARM Technology

- The ARM ecosystem now spans the globe
- Major companies in US, Europe and Asia
- Linaro must enable collaboration across the world, including growing open source contribution and participation from major Chinese companies and ARM licensees
Introduction

● Executive VP
Greater China

郭晶
Jill Guo
Scaling

- **Lead Projects**
  - Tackle big problems that need the ecosystem working together
  - Member engineers to achieve member goals in collaborative projects
Examples

- ARM kernel collaboration
- Power management
- ODP
- Open source security platform
- Reference platform*

* In TSC discussion
Demonstrations

● 96Boards
  ○ DragonBoard 410c and Freedreno
  ○ HiKey - OctaCore A53 & Sensors I/O Board
  ○ Solr search engine

● LEG Big Data
Dragonboard 410c

- Ubuntu
- Freedreno Open Source GPU Linux driver
HiKey

- Debian 8
- Arduino package
- Linaro Sensors Board
Enterprise Prototyping on 96Boards

- Low cost 96Boards CE can be used for prototyping enterprise solutions such as data analytics
- The demo implements a web crawler and a search engine running a web service interface
  - Nutch, Hadoop, SoLR, Lucene, Jetty
  - OpenJDK (1.8) from LEG
  - Debian 8
Enterprise Prototyping on 96Boards

- Hadoop jobs
- Indexing
- Lucene
- Query
- Response
- Apache Solr
- MapReduce
- HDFS
- OpenJDK 1.8
- Debian 8 jessie

96Boards
Linaro Enterprise Group Demo

ARM 64-bit Servers

Distributed Big Data machine learning

hadoop

H2O.ai
Cluster Set-up

- Six AMD Seattle 8-core nodes in Austin CoLo
- ~146GB data set
  - file parsing
  - model building
- Total of 48 Cortex-A57 cores
Performance scales linearly

**File parsing vs memory**

- 32GB
- 64GB

**Model building vs memory**

- 32GB
- 64GB
External IO is the Limiting Factor

File parsing vs Network

Performance ratio vs 1 node

Nodes

1GigE

10GigE
Summary

- Performance scales linearly with the number of nodes
- H2O performs in-memory, DDR plays a role when the per-node-distributed data is bigger than RAM space
- LAN is the dimensioning factor for a distributed system → FABRIC is key
Thank you