X-Gene® in High Performance Computing
Rob Reiner
Director of Marketing
rreiner@apm.com
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X-Gene Driving ARM in Data Centers

**OCTOBER 2009**
Dedicated processor team begins 64b development

2009

**APRIL 2012**
X-Gene FPGA release enables ecosystem partners

2012

**OCTOBER 2014**
HP’s m400 product launch

2014

**OCTOBER 2014**
X-Gene 2 wins ARM TechCon “Best in Show”

2014

**NOVEMBER 2015**
X-Gene 3 Announced

2015

**2H’2016**
Platform Announcements

2016

**MARCH 2010**
World’s 1st ARMv8 Server Architecture Licensee

2010

**MARCH 2013**
X-Gene silicon samples to customers

2013

**SPRING 2014**
X-Gene 2 samples to customers

2014

**Spring/Summer 2015**
Cirrascale RM1905D Announced

2015

**NOVEMBER 2015**
E4 RK003 Announced

2015

**Eurotech Aurora Hive Announced**

2015

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**Target Customer Types**

- OEM
- ODM
- Networking
  - Hyperscale
  - HPC

**Target Deployments**

- Mainstream Web Tier
- Search
- Memcache
- Storage
- Enterprise
## ARM Platforms Powered by X-Gene

### Data Center
- HP ProLiant m400
- Tier 1 China Hyperscale end users
- ODM Platforms

### Storage
- Gigabyte R120-P30 & MP30
- HPE StoreVirtual3200 Enterprise Storage Platform
- Wistron X5 OCP Platform
- Mudan Storage Platform

### Networking
- Kontron SYMKLOUD T4010
- Tier1 Datacenter Switch
- Programmable PCIE Accelerator Card

### High-Performance Computing
- E4 ARKA RK003
- Cirrascale RM2916
- NVIDIA
- Eurotech Aurora “Hive”
X-Gene + GPU: Solid Platform for GPU-Optimized Apps

Application Workload Profile

ARM: Applied Micro X-GENE CPU, X86: Xeon E5-2697, X86*: E5-2687W @ 3.10GHz

Source: nVidia
X-GENE & X86 NVIDIA K40 BENCHMARK : HPCG

Source: APM, Nvidia

X-Gene: Applied Micro Gigabyte MP30 Platform 8-core @ 2.4GHz, 32GB DDR3-1600, Ubuntu 15.04
X86: Xeon E5-2680v2 10C/20T @2.8GHz Turbo/HT Enabled, 64GB DDR3-1600, CentOS 6.6, Xeon E5-2697v2 12C/24T @2.7GHz CUDA 6.5
X-Gene + GPU: Solid Platform for GPU-Optimized Apps

HPCG

Source: nVidia

X-Gene: AppliedMicro X-Gene 1 ARM CPU
x86: Xeon™ E5-2697v2 CPU
K20: nVidia Tesla K20 GPU
E4 Arka HPC Platform based on X-Gene

E4 ARKA series the first ARMv8 platforms dedicated to HPC

**E4 RK003**

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<th>FEATURES</th>
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<tbody>
<tr>
<td>Form Factor</td>
<td>2U</td>
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<tr>
<td>CPU</td>
<td>1x APM X-Gene 8 cores</td>
</tr>
<tr>
<td>GPU up to</td>
<td>2x NVIDIA Kepler® K20, K40, K80</td>
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<tr>
<td>Memory</td>
<td>Up to 128 GB RAM DDR3</td>
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<tr>
<td>Network</td>
<td>2x 10 GbE SFP+, 1x Infiniband FDR QSFP</td>
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<tr>
<td>Storage</td>
<td>4x SATA 3.0</td>
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<tr>
<td>Expansion slots</td>
<td>2x PCI-E 3.0 x8 (in x16)</td>
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![LAMMPS Benchmark](chart.png)

Source: E4
X-Gene HPC Platforms

Eurotech Aurora Hive

- **Most dense** architecture in the market
  - 1.5 PFlop/s DP peak per rack
  - 5 Pflop/s SP peak per rack
- **Highest energy efficiency.**
  - At system level > 6 GFlops / Watt sustained
  - At datacenter level with PUE of 1.05
- **Distinctive flexibility.** Direct hot water cooled with no constraints for the choice of components:
  - Intel or ARM CPU
  - NVIDIA or AMD accelerators
  - Intel coprocessors
  - Any other PCIe card
- **Direct hot water cooling** of all components
- **First and only** system with multiple direct hot water cooled GPGPUs
X-Gene® 3

- Third Generation ARMv8 Processor
- Quantum Jump in ARM Server Landscape
- 6x the performance versus current X-Gene family
- 8 64-bit DDR4 Memory Controllers with ECC
- 1TB Memory per Socket
- 30% Lower Power per Core
- Addresses mainstream work-loads used by Tier 1 hyperscale datacenter customers
- Targets data analytics, HPC, machine learning, web/caching servers, web search

Sampling Q1 2017
X-Gene® 3 Overview

Processor Subsystem
- 32 ARM™ v8 64-bit CPU cores at up to 3 GHz
- 32 KB I-cache/D-cache
- Shared 256 KB L2 cache per 2 cores

Memory
- 32 MB globally shared L3 cache
- Eight DDR4-2667 channels with ECC and RAS
- Up to 16 DIMMs and 1TB/socket

System Resources
- GICv3 Interrupt Controller
- Full IO Virtualization
- Enterprise server-class RAS

Connectivity
- 42 lanes of PCIe Gen 3 with 8 controllers
- 4 x SATA Gen 3 ports
- 2 x USB 2.0 ports
- 1 x RGMII port

Functionality
- ARM SBSA Level 3
  - EL3, secure memory and secure boot support
- Advanced Power Management with ACPI/PSCI
- Full SBBR compliance with UEFI

Performance
- SPECint_rate ~550; TDP: 125W
Conclusion

• X-Gene 1/X-Gene 2 are in production today
  – Wide Range of HPC Platforms and Deployments

• Higher Performance/$ and Performance/Watt reduces the overall TCO

• X-Gene 1 and X-Gene 2 pave the way for Third Generation X-Gene 3

• X-Gene 3 Delivers Quantum Jump in ARM Server Landscape