HS06 Benchmark for an ARM Server

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Motivation

ARM CPUs promise low power consumption

Typically, with x86 systems spend investment cost again on power over 3-4 years

Large power consumption triggers large infrastructure costs

Can we (HEP computing) rely on ARM CPUs to save power and infrastructure cost?

New product: Calxeda ARM SoC for server, available in Boston Viridis

Calxeda quad-core ARM SoC

Calxeda EnergyCore™ SoC with ARM Cortex-A9

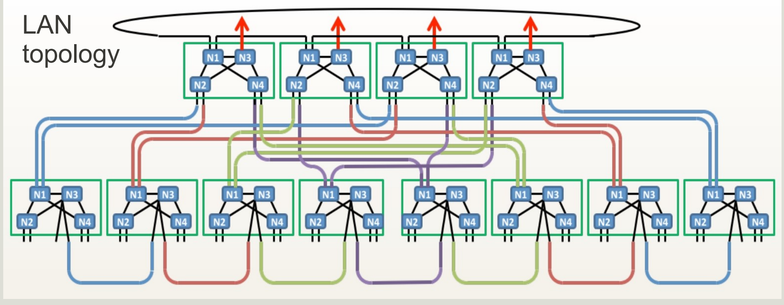
Typical tablet or smartphone CPU: 32bit, 1.1 GHz, FPU, GPU

But: 4 GB RAM, 4 x SATA disk, 2 x 10 GBE LAN, distributed layer-2 10 GBE switch

Server card contains four complete server nodes

Boston Viridis system board

10 GBE LAN between all nodes and to outside



Sufficient for I/O needs of HEP applications

Power distribution, system management

Boston Viridis 2U enclosure

Up to 48 servers on 12 cards, 24 disks

Power supply (300 W), 10 GBE LAN ports

HEPSPEC 2006 Benchmark

Collection of all C++ programs from CPU 2006 [1], one job per core, average execution times

SPEC CPU 2006 V1.1, spec2k6-2.23 scripts

Ubuntu 12.04 LTS armhf [2] on remote server provided by Boston Limited, UK

On ARM, need to compile CPU 2006 toolset [3]

Need gcc 4.4 to compile all benchmark programs, use package manager to get necessary software

gcc options: -O3 -fPIC -pthread -mtune=cortex-a9 -mfpu=vfpv3 or -mfpu=neon

[1] twiki.cern.ch/twiki/bin/view/FIOgroup/TsiBenchHEPSPEC
[2] www.ubuntu.com/download/arm
[3] code.google.com/p/mycodespot/wiki/RunningSPEC2006

HEPSPEC 2006 Results

-mfpu=neon: 10.3
-mfpu=vfpv3: 10.4

For comparison (32bit HS06 on 64bit OS):

HP dc7900 i7-2600k: 95

IBM HS22 E5620: 130

IBM HS22 E5645: 179

IBM HS23 E5-2670: 339

DELL C6145 AMD 6378: 558 [4]

[4] w3.hepix.org/benchmarks/doku.php?id=bench:results_sl6_x86_64_gcc_445)

Power efficiency

Compare power consumption to HS06 values

	HS06	power [W]	HS06/W
Calxeda/Viridis	10.4	~5	2.1
HP dc7900 i7	95	~150	0.63
HS22 E5620	130	~250	0.52
HS22 E5645	179	~250	0.72
HS23 E5-2670	339	~360	0.94
DELL C6145	558	~600	0.93

Power consumption values are estimates

Observations

Power efficiency advantage for ARM by factor 2-4

480 HS06 in 2U enclosure possible (1.1 GHz SoC)

Calxeda EnergyCore SoC with 1.4 GHz (~13 HS06?)

1 GB/core, would need multithreading in applications

ARM A15 (PAE) and A53/A57 (64bit) in 2014/15

Cost of ARM servers not yet competetive (€/HS06)

Ubuntu (and now Fedora) Linux OS available

No port of HEP or experiment software attempted, but “should be straightforward”

Running SPEC 2006 somewhat cumbersome

Dedicated optimization for FPU or GPU?

Conclusions

Large power and possibly cost savings potential with ARM based servers

Linux (Ubuntu, Fedora) established on ARM

Should invest in HEP and experiment software ports

Ability to use different CPU architectures puts pressure on vendors

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