Arm HPC processor A64FX advantages in Oil & Gas application

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Agenda

- Arm HPC processor A64FX inside #1 HPC system Fugaku
- Technical Information of A64FX
- Memory intensive benchmark on A64FX
- A64FX Ecosystem
- Take away

Arm HPC processor A64FX inside #1 system Fugaku

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A64FX system has Vector instruction and High Bandwidth Memory to solve grand challenge problems.

These feature would contribute performance on Oil & Gas application

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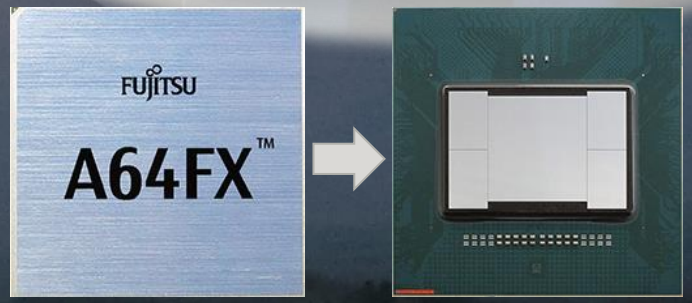
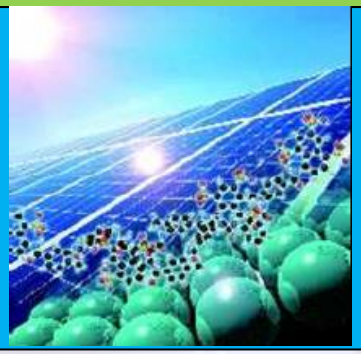


Applications in Fugaku and their speedup from K

https://www.mext.go.jp/content/20200116-mext_jyohoka01-000004148_2.pdf

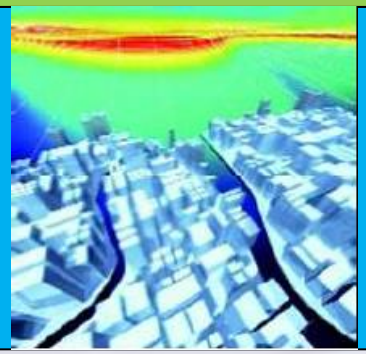
Health and longevity	
GENESIS	Genomon
131x	23x

Energy issue	
NTChem	Adventure
70x	63x

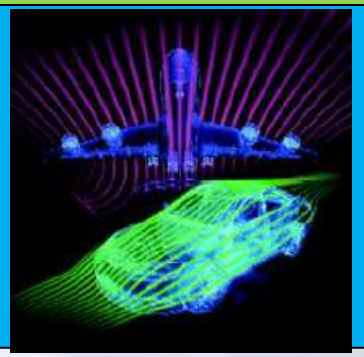


Basic science
LQCD
38x

Disaster prevention & Environment	
GAMERA	NICAM+LETKF
63x	127x



Industrial competitiveness	
RSDFT	FFB
38x	51x



Target region
Application
Speed up

image

Technical Information of A64FX

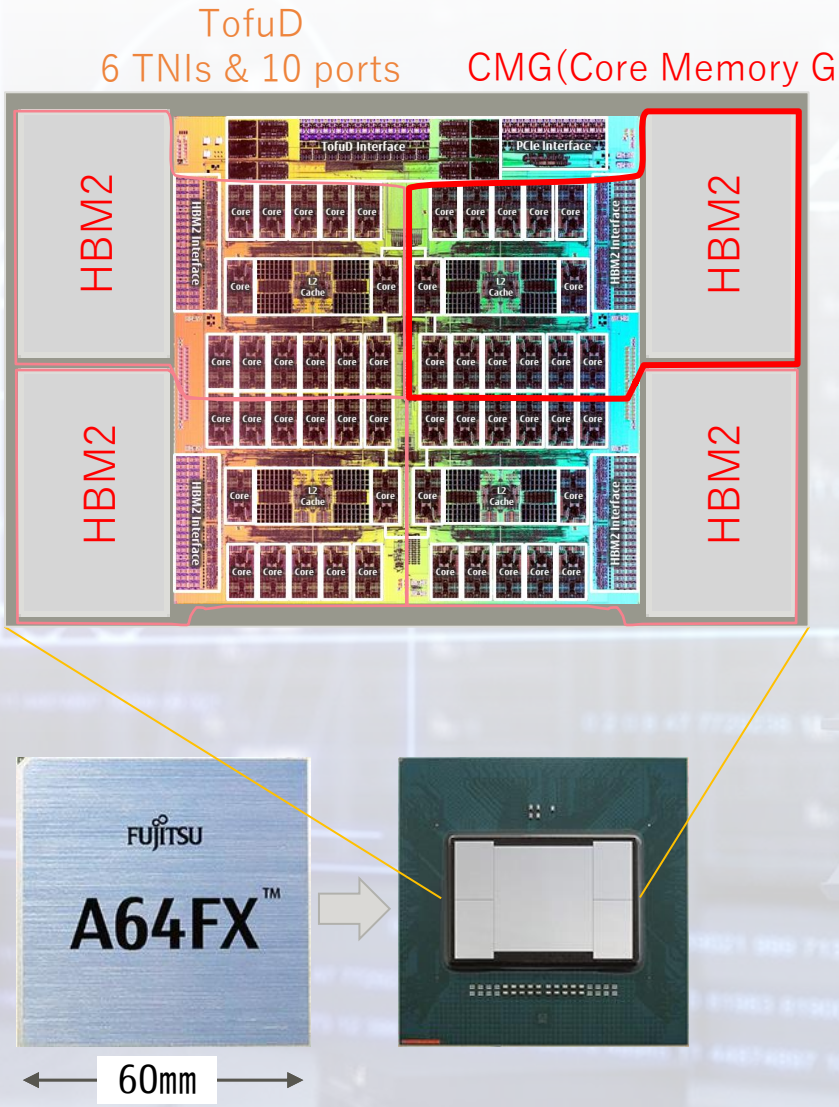
Architecture Features

- Armv8.2-A (AArch64 only)
- SVE 512-bit wide SIMD x 2 pipeline per core
- 48 computing cores (+ 4 assistant cores*)
  All 52 cores are identical
- Frequency 1.8GHz, 2.0GHz, 2.2GHz*
- 2.7 / 3.0 / 3.3 TFLOPS (Double presision)
- L1I$ size: 3MiB (64KiB x 48 computing core)
- L1D$ size: 3MiB (64KiB x 48 computing core)
- L2 cache size: 32MiB (8MiB x 4 CMG**)
- HBM2 32GiB (1024GiB/s)
- PCIe Gen3 16 lanes
- TofuD* 6D Mesh/Torus,
  28Gbps x 2 lanes x 10 ports

7nm Fin FET

- 8,786M transistors
- 594 package signal pins

* 2.2GHz, Assistant cores and TofuD are only for Fugaku and FX1000
** CMG: Core Memory Group

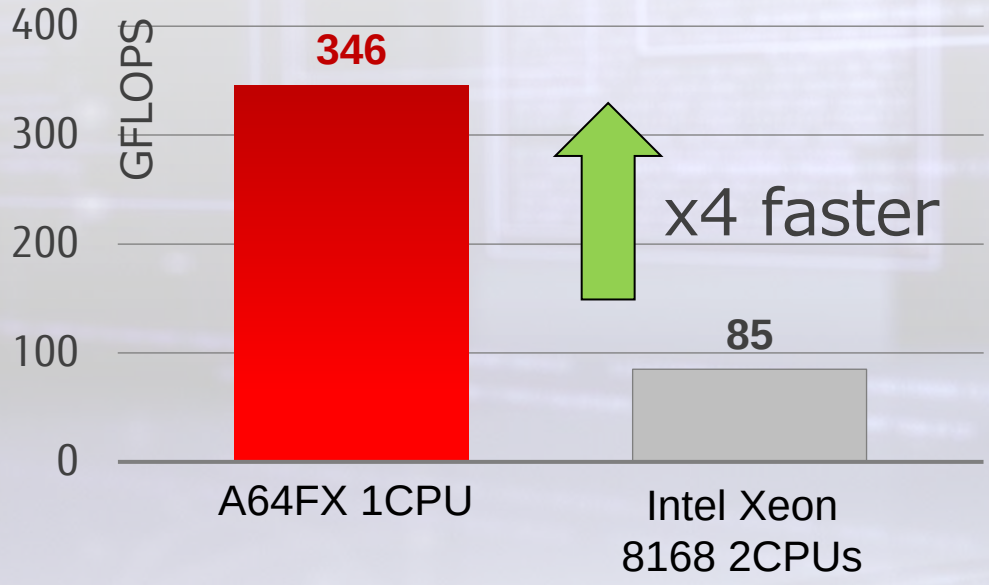


Memory intensive benchmark on A64FX

- HBM(High Bandwidth Memory) contributes A64FX performance advantage
- We expect A64FX contributes time to solution for Oil & Gas applications

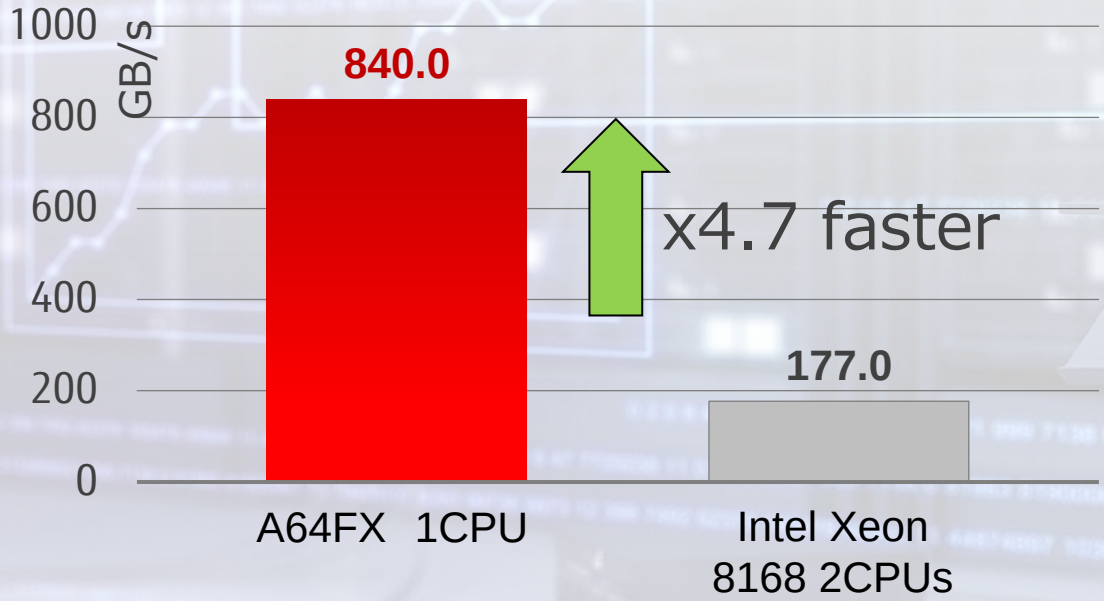
Himeno Benchmark:

Stencil calculation to solve Poisson's equation by Jacobi method



Stream Triad:

The benchmark to measure memory B/W for simple vector kernels



A64FX Ecosystem (hardware/software)

- De facto software could be available on A64FX
- Today, A64FX users in Oil & Gas share their experience.
  (Note: Their environment might be different from others)

Open-source benchmark/applications / in house codes for Oil & Gas

Gcc/llvm other open-source libraries

Fujitsu compiler/library | Arm compiler/library | HPE compiler/library

Red Hat RHEL/SUSE linux SUSE

FX1000/FX700 server

Hewlett Packard Enterprise Apollo80 server

Others

A64FX processor

Others

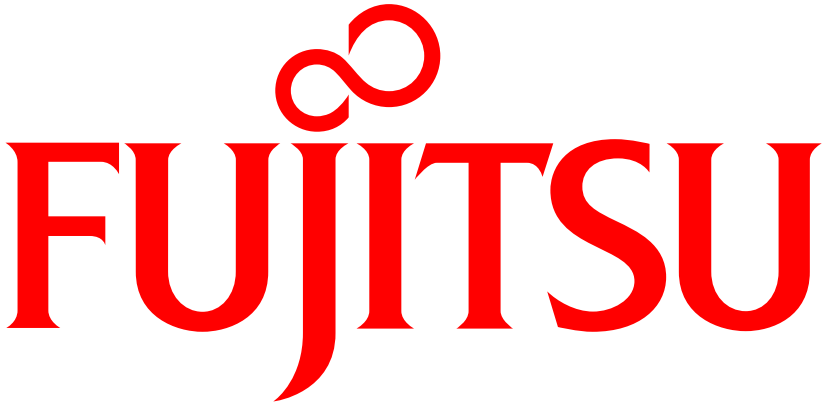
arm Arm architecture

Take away

- A64FX shows high performance with stream/stencil benchmark performance in addition to LINPACK/HPCG by SVE/HBM.
- A64FX users could prove A64FX advantage in their PoC and share such experience today.
- I hope participant of this webinar could find similar use case with your business/research.
- Please contact us for your A64FX evaluation.

reference

- hoshiya.takayuk@fujitsu.com
- A64FX/Fugaku
  https://www.fujitsu.com/global/products/computing/servers/supercomputer/a64fx/
  https://www.fujitsu.com/global/about/innovation/fugaku/
  https://www.r-ccs.riken.jp/en/fugaku/
- Eco system / OSS application porting, tuning
  https://github.com/fujitsu/oss-patches-for-a64fx
  https://github.com/fujitsu/oss-patches-for-a64fx/tree/master/Spack
- Reference for Apollo80
  will be introduced in HPE session



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