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Performance Analysis of IBM POWER8 Processors

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What is IBM POWER8 and what is so special there?

The Power8 processor is available under *OpenPOWER license*.
Every core is able to execute instructions from 8 different software threads in real *Simultaneous Multi-Threading* (8SMT).
Every socket can be connected to 8 memory modules using fast memory lanes, providing sustainable bandwidth over *190 GB/s* per socket. The Power8 can operate in both little and big endian mode.
Competing Intel server/HPC architecture with similar parameters is *Intel Haswell-EP*.

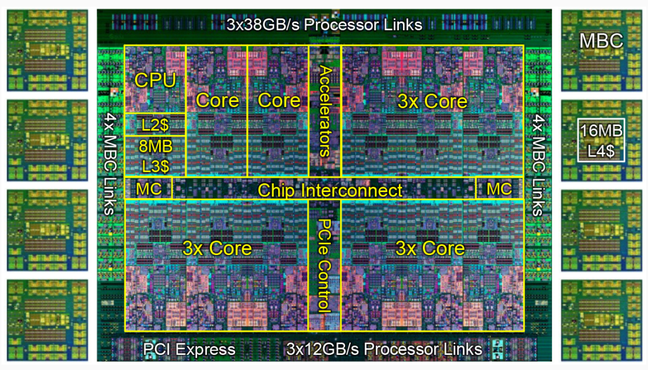


Fig. 1: IBM Power8 CPU die, labeled[1]

Can you compare them?

	IBM Power8 8247-21L	Intel Xeon E5-2680 v3 Haswell-EP
Lithography	22 nm	22 nm
Launch date	Q2'14	Q3'14
Cores	10	**12**
Threads	**80**	24
L1 data cache	**64 kB**	32 kB
L2 cache (core)	**512 kB**	256 kB
L3 cache (sum)	**80 MB**	30 MB
L4 cache	**128 MB**	-
Bandwidth [GB/s]	**192**	68
Vector unit [b]	2×128 (VSX)	256 (AVX2)
Frequency [GHz]	**3.425**	2.5
Performance [GFLOPS]	**548**	480

Is it better than Intel Haswell-EP processors?

It depends on what you measure. Memory performance is significantly better. Single Power8 socket could provide higher sustainable bandwidth than two Intel Xeon sockets.

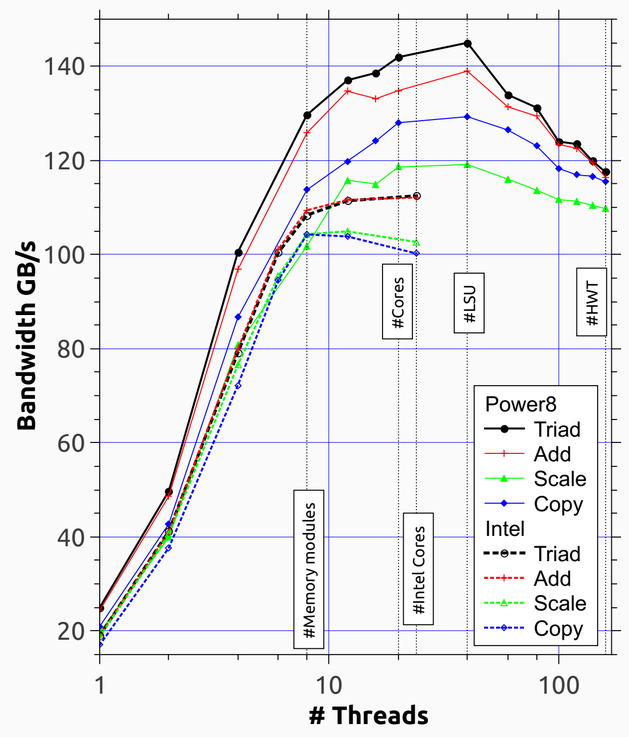
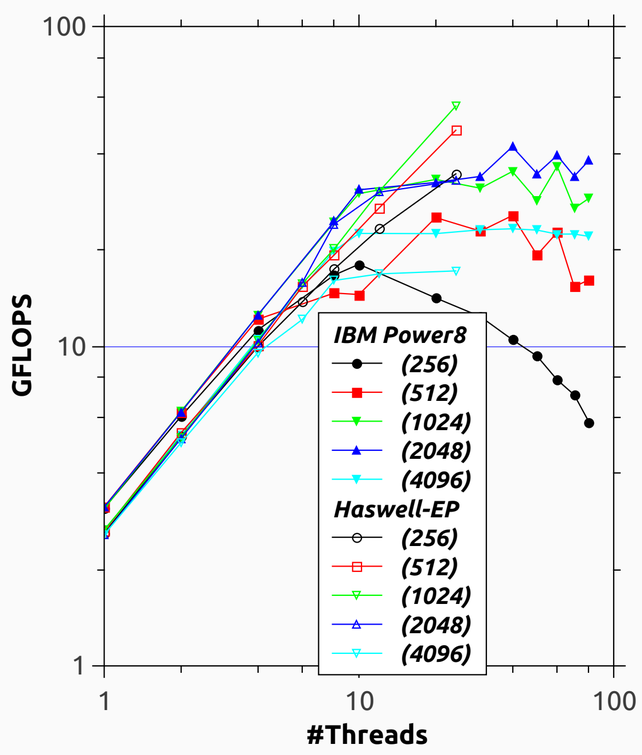


Fig. 3: STREAM: Memory bandwidth performance

So how fast is it? For which workloads?

As mentioned above, memory bandwidth is exceptional. Another performed test was matrix multiplication using different algorithms. Power8 showed better performance than Haswell-EP for single single-thread tasks. Even ATLAS performed better than MKL.
Similar results were achieved with Steady State Heat distribution on 2D plane, but results for smaller matrices are comparable with Intel.
In more complex algorithms, such as N-body simulation, Intel Compiler is able to make use of more of the vector potential and provide significantly better performance.
Certainly, this is not a processor you would by to your laptop. Or to your home server.
It is targeting supercomputing, cloud and big data workload. The memory characteristics were proven by the tests, which means this processor is suitable for *memory bound problems*.



So what? Intel has a Skylake! And Phi!

Yes. Current results show that the performance is comparable in some cases, which is not world-changing. It is a long time since the introduction of Power8 and Intel did a great job with 14 nm in Skylake. But Skylake architecture still do not provide appropriate processors for server segment.
The Intel Xeon Phi is exact opposite the the Power8 processor. It is using massive parallelism, but with significantly less memory and caches. Therefore it is more suitable for compute-bound workloads.
The next generation *Power9* processor is just around the corner and during next year it will build up new *supercomputers Summit and Sierra*, aiming high in the TOP 500 list of supercomputers[3].

Can I try that out?

Yes! There is *Open Power HUB*[2], where is Red Hat with IBM Linux Technology Center providing access to Power8 hardware.

Sources:

[1] http://www.extremetech.com/computing/181102-ibm-power8-openpower-x86-server-monopoly
[2] http://fit-rhlab.rhcloud.com/powerlinux-openpower-development-hosting/
[3] http://wccftech.com/nvidia-volta-gpus-ibm-power9-cpus-deliver-300-petaflops-performance-2017-summit-sierra-supercomputers/