IBM Power System S822LC for High Performance Computing

Tackle new problems with NVIDIA Tesla P100 on the only architecture with CPU:GPU NVLink

Highlights

- Breakthrough performance for your GPU accelerated applications—to help realize faster time to insight
- Two POWER8® CPUs and 4 Tesla P100 with NVLink GPUs in a versatile 2U Linux server
- Unlock new possibilities with POWER8 with NVLink—the only architecture with NVIDIA NVLink Technology from CPU to GPU
- Designed for accelerated workloads in HPC, the enterprise datacenter, and accelerated cloud deployments

End users across domains consistently require increased system and application performance. GPU computing has delivered game-changing performance to address these needs—dramatic acceleration for a variety of HPC and enterprise applications.

System end-users, developers, and administrators need advancements in GPU performance, programmability, and in the ability to feed data to GPUs to unlock the next wave of accelerated computing.

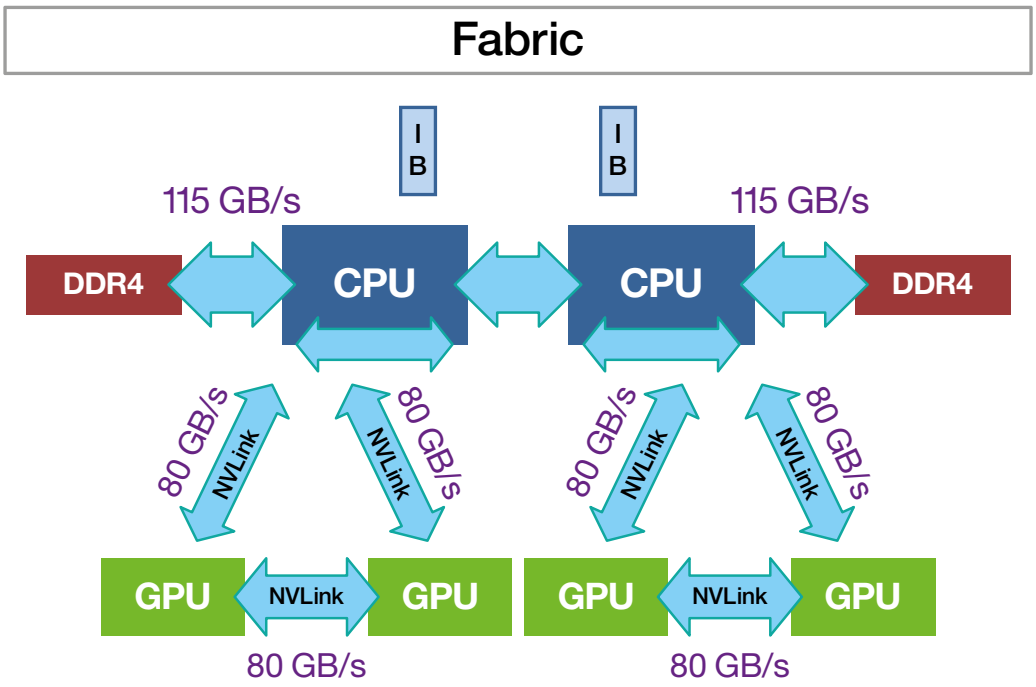
IBM® Power System S822LC for High Performance Computing pairs the strengths of the POWER8 CPU with 4 NVIDIA Tesla P100 GPUs. These best-in-class processors are tightly bound with NVIDIA NVLink Technology from CPU:GPU—to advance the performance, programmability, and accessibility of accelerated computing and resolve the PCI-E bottleneck.

This differentiated combination, with the only architecture delivering CPU:GPU NVLink, unlocks new potential for GPUs across industries.

IBM Power Systems LC Servers

IBM Power Systems™, with POWER8 technology, is a family of systems built innovatively to transform the power of big data & analytics, into competitive advantages in ways never before possible. Our new Linux scale-out systems embrace acceleration for the next generation of datacenter computing and provide differentiated performance, scalability, and low acquisition cost. The IBM Power System S822LC for High Performance Computing provides:

- 2x POWER8 CPUs, with 32 DIMM sockets delivered by 8 memory daughter cards for up 1 TB of memory
- A differentiated platform for GPU acceleration and superior I/O with CAPI
- POWER8 with NVLink Technology interconnecting the CPU to the GPU: faster link (80 GB/sec) to each of the 4 NVIDIA Tesla P100 GPUs delivering 2.8 times more bandwidth than PCI-E based GPUs[1]
- Incredible GPU:GPU communication: 2.5 times faster link (80 GB/sec) between adjacent Tesla P100 GPUs on the same socket
- Optional NVMe storage for exceptionally fast storage input/output (I/O)
- The robust features of a POWER8 server platform



The combination of NVLink and NVIDIA Tesla P100 GPUs delivers unprecedented performance across multiple workloads compared to x86 with Tesla K80 GPUs:

- 2.5 times more queries per hour running Kinetica "Filter by geographic area" queries[2]
- 1.9 times more GFLOPS based on running LatticeQCD[3]
- 2 times more "Base Pairs Aligned" per Second running SOAP3-dp with 2 instances per device.[4]
- 2.3 times better performance (57 percent reduction in execution time) running CPMD[5]
- 1.7 times better performance running the High Performance Conjugate Gradients (HPCG) Benchmark.[6]

IBM Power System S822LC for High Performance Computing at a glance

System configurations (8335-GTB)	
Microprocessors	Two 8-core 3.25 GHz POWER8 processor cards or two 10-core 2.86 GHz POWER8 processor cards
Level 2 (L2) cache	512 KB L2 cache per core
Level 3 (L3) cache	8 MB L3 cache per core
Level 4 (L4) cache	Up to 64 MB per socket
Memory Min/Max	4 GB, 8 GB, 16 GB, 32 GB DDR4 modules, 128 GB to 1 TB total memory
Processor to Memory Bandwidth	115 GB/sec per socket, 230 GB/sec per system (Max sustained memory bandwidth to L4 cache from SCM) 170 GB/sec per socket, 340 GB/sec per system (Max peak memory bandwidth to DIMMs from L4 cache)

IBM Power System S822LC for High Performance Computing at a glance	
Storage and input/output (I/O)	
Standard backplane	2 small form factor (SFF) bays for hard disk drive (HDD) or solid-state disk (SSD)
Media Bays	N/A
RAID Option	Software RAID
Adapter Slots	Three PCIe Gen3 slots: Two x16 plus one x8 PCIe Gen3; all CAPI enabled
I/O Bandwidth	64 GBps
GPU Accelerators	Up to 4 NVIDIA Tesla P100 with NVLink GPUs
Power, RAS, system software and physical characteristics and warranty	
Power Supply	200 V to 240 V
RAS Features	Processor instruction retry Selective dynamic firmware updates Chip kill memory ECC L2 cache, L3 cache Service processor with fault monitoring Hot-swappable disk bays Hot-plug and redundant power supplies and cooling fans (no power redundancy with GPU(s) installed)
Operating systems*	Linux on POWER
System dimensions	441.5 W x 86 H x 822 D mm
Warranty	3 year limited warranty; CRU (customer replaceable unit) for all other units (varies by country), next business day 9am to 5pm (excluding holidays), warranty service upgrades and maintenance are available.

Why IBM?

Architecting superior high performance computing (HPC) clusters requires a holistic approach that responds to performance at every level of the deployment.

IBM HPC solutions, built with IBM Power Systems, IBM Spectrum™ Computing, IBM Spectrum Storage™, and IBM Software technologies, provide an integrated platform to optimize your HPC workflows.

Only IBM provides a total HPC solution, including optimized, best-of-breed components at all levels of the stack. Comprehensive solutions ensure:

- Rapid deployment
- Clusters that deliver value immediately after acceptance

These clusters are built upon data-centric computing designs. Data-centric HPC minimizes data motion, enables compute capabilities across the system stack, and provides a modular, scalable architecture optimized for HPC.

For more information

To learn more about the IBM Power System S822LC for High Performance Computing please contact your IBM representative or IBM Business Partner, or visit the following website: **ibm.com**/systems/power/hardware/s822lc-hpc/

Additionally, IBM Global Financing provides numerous payment options to help you acquire the technology you need to grow your business. We provide full lifecycle management of IT products and services, from acquisition to disposition. For more information, visit: **ibm.com**/financing

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* See facts and features document for detailed OS level support. http://www.ibm.com/systems/power/hardware/reports/factsfeatures.html

[1] POWER8 with NVLink systems feature 80GB/sec of bidirectional bandwidth (40GB unidirectional) from CPU:GPU https://www.ibm.com/blogs/systems/ibm-power8-cpu-and-nvidia-pascal-gpu-speed-ahead-with-nvlink/
PCI-E x16. 3.0 bandwidth http://pcisig.com/aq?field_category_value[]=pci_express_3.0&keys=bit+rate

[2] All results running Kinetica "Filter by geographic area" queries on data set of 280 million simulated Tweets with 1 up to 80 concurrent query streams each with 0 think time. Systems: Power System S822LC for HPC; 20 cores (2 x 10c chips) / 160t, POWER8 with NVLink; 2.86 GHz, 256 GB memory, 2 x 1TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4xTesla P100 GPU; Ubuntu 16.04. Competitive stack: 2xE5- 2640 v4; 20 cores (2 x 10 chips) / 40 threads; Xeon E5-2640 v4; 2.4 GHz; 256 GB memory, 1 x 2TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4x Tesla K80 GPU, Ubuntu 16.04.

[3] All results are based on running LatticeQCD and reported in GFLOPS. Power System S822LC for HPC; 20 cores (2 x 10c chips) / 160 threads, POWER8 with NVLink; 2.86 GHz, 256 GB memory, 2 x 1TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4x Tesla P100 GPU; Ubuntu 16.04. Competitive stack: 2xE5-2640 v4; 20 cores (2 x 10 chips) / 40 threads; Xeon E5-2640 v4; 2.4 GHz; 256 GB memory, 1 x 2TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4xTesla K80 GPU, Ubuntu 16.04.

[4] All results based on running SOAP3-dp and reported in Millions of Base Pairs Aligned per Sec with 2 instances per device. Power System S822LC for HPC; 20 cores (2 x 10c chips) / 160t, POWER8 with NVLink; 2.86 GHz, 256 GB memory, 2 x 1TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4x Tesla P100 GPU; Ubuntu 16.04. Competitive stack: 2xE5-2640 v4; 20 cores (2 x 10 chips) / 40 threads; Xeon E5-2640 v4; 2.4 GHz; 256 GB memory, 1 x 2TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4x Tesla K80 GPU, Ubuntu 16.04.

[5] All results are based on running CPMD, a parallelized plane wave / pseudopotential implementation of Density Functional Theory. A Hybrid version of CPMD (e.g. MPI + OPENMP + GPU + streams) was implemented with runs are made for 128-Water Box, RANDOM initialization. Results are reported in Execution Time (seconds). Power System S822LC for HPC; 20 cores (2 x 10c chips) / 160t, POWER8 with NVLink; 2.86 GHz, 256 GB memory, 2 x 1TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 2x Tesla P100 GPU; Ubuntu 16.04. Competitive stack: 2xE5-2640 v4; 20 cores (2 x 10 chips) / 40 threads; Xeon E5-2640 v4; 2.4 GHz; 256 GB memory, 1 x 2TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 2x Tesla K80 GPU, Ubuntu 16.04

[6] All results are based on running High Performance Conjugate Gradients (HPCG) Benchmark, details at http://www.hpcg-benchmark.org/. Power System S822LC for HPC; 20 cores (2 x 10c chips) / 160 threads, POWER8; 2.86 GHz, 256 GB memory, 2 x 1TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4x Tesla P100 GPU; Ubuntu 16.04. Competitive stack: 2xE5-2640 v4; 20 cores (2 x 10 chips) / 40 threads; Xeon E5-2640 v4; 2.4 GHz; 256 GB memory, 1 x 2TB SATA 7.2K rpm HDD, 2-port 10 GbEth, 4xTesla K80 GPU, Ubuntu 16.04

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