



Maximizing ANSYS® FLUENT® Performance with InfiniBand and HPC-X™ MPI

ANSYS FLUENT

Computational Fluid Dynamics (CFD) enables engineers to study the dynamics of things that flow and to analyze qualitative and quantitative physical phenomena, toward improving engineering design. CFD brings together several different disciplines including fluid dynamics, mathematical theory of partial differential systems, computational geometry, numerical analysis, computer science, and more.

ANSYS FLUENT is a leading CFD application, widely used in almost every industry sector and manufactured product.

InfiniBand In-Network Computing

The latest revolution in High Performance Computing (HPC) and Artificial Intelligence (AI) is In-Network Computing. In-Network Computing is the result of a collaborative industry and academia effort to reach scalable performance by taking a holistic system-level approach toward fundamental performance improvements.

The latest generations of smart interconnects offload both the network functions from the CPU and the data algorithms managed within the network, allowing users to run algorithms while the data is being transferred within the system interconnect, rather than waiting for the data to reach the CPU. This technology, referred to as In-Network Computing, is the leading approach to achieve performance and scalability for HPC and AI scalable platforms. In-Network Computing transforms the data center interconnect into a “distributed CPU” and “distributed memory,” to overcome performance walls and enabling faster and more scalable data analysis.

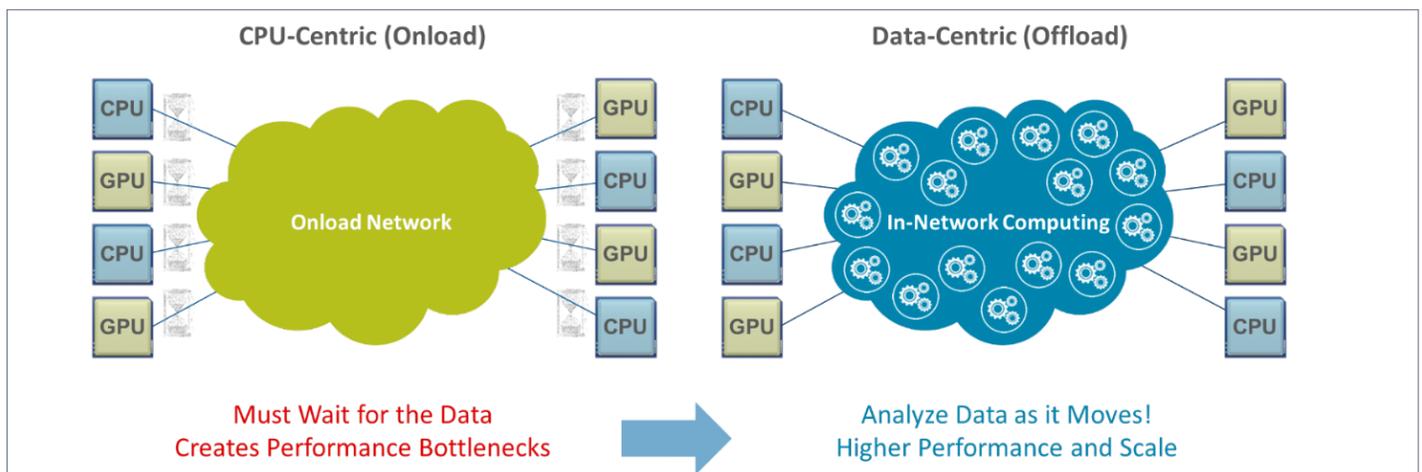


Figure 1: In-Network Computing

InfiniBand In-Network Computing technology includes several elements - Scalable Hierarchical Aggregation and Reduction Protocol (SHARP)™— a technology, which received the R&D100 award and enables the execution of data reduction algorithms on network devices instead of on host-based processors; Smart Tag Matching, rendezvous protocols, and more. These technologies are in use at several of the recently deployed large-scale supercomputers around the world, including the top TOP500 platforms.

HPC-X MPI Suite

Mellanox HPC-X is an accelerated MPI implementation based on the open source OpenMPI. This fully-featured and tested MPI both, is optimized for InfiniBand, RoCE and supports other interconnect options. Mellanox HPC-X takes advantage of In-Network Computing capabilities to maximize application performance.

Unified Communication X (UCX) is an open source framework developed by the UCX consortium, a collaboration between the industry, laboratories and academia. UCX serves as the MPI point-to-point accelerated engine in HPC-X.

Hierarchical Collectives (HCOLL) comprises a collective acceleration engines library that implements SHARP technology and other enhanced algorithms to accelerate application performance.

More information about Mellanox HPC-X can be found on www.mellanox.com

FLUENT Performance with InfiniBand and HPC-X

The performance benchmarks were done using the HPC Advisory Council cluster center resources via the HPE ProLiant DL360 Gen9 “Hercules” cluster:

- Dual-Socket 16-Core Intel E5-2697A v4 @ 2.60 GHz CPUs
- Memory: 256GB memory, DDR4 2400 MHz
- Mellanox ConnectX-5 EDR 100Gb/s InfiniBand Adapters
- Mellanox Switch-IB2 SB7800 36-port EDR 100Gb/s InfiniBand Switch
- OS: RHEL 7.4, MLNX_OFED 4.3

The following charts illustrate four of the well-known FLUENT benchmarks. The blue-colored bars show the performance rating per input file, while the red line shows scalability. Results illustrate a high maximum absolute value per input file along with close to perfect scalability. Doubling the amount of nodes results in a 2x performance improvement.

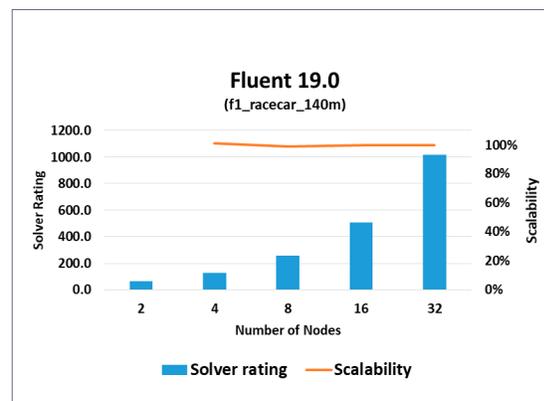
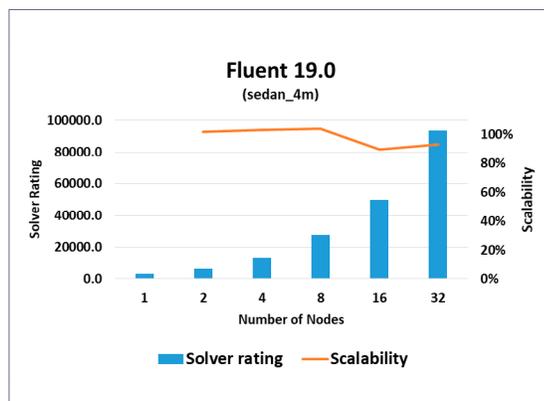
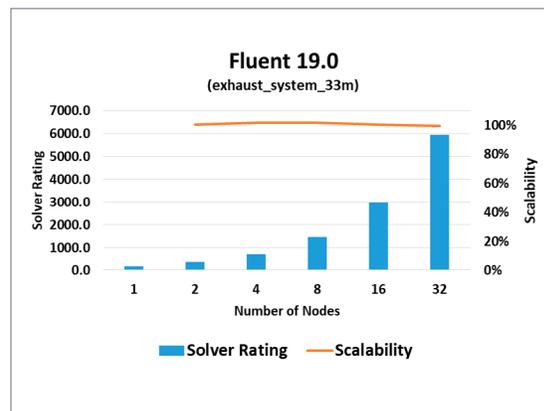
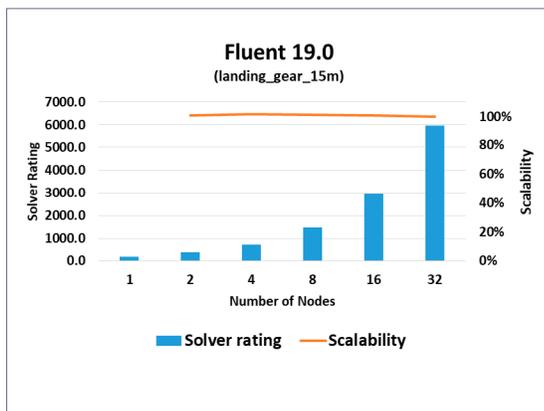


Figure 2: ANSYS FLUENT Benchmarks

Maximizing Performance and Return of Investment

HPC clusters today impose high performance demands and high scalability on networks. As one of the leading CFD applications, ANSYS FLUENT demonstrated upon testing to scale maximally when used in conjunction with Mellanox InfiniBand Interconnect and to accelerate by using HPC-X using In-Network computing hardware.

Maximize the performance of your CFD application by leveraging ANSYS FLUENT with Mellanox's Interconnect accelerated solutions and get the best return on investment.

Resources

- Mellanox Website: <http://www.mellanox.com>
- ANSYS FLUENT: <https://www.ansys.com/products/fluids/ansys-fluent>
- Mellanox HPC-X: http://www.mellanox.com/page/hpcx_overview
- ANSYS FLUENT Benchmarking: <https://www.ansys.com/solutions/solutions-by-role/it-professionals/platform-support/benchmarks-overview/ansys-fluent-benchmarks>