White Paper

Intel® Xeon® Scalable Processors
Intel® Optane™ Persistent Memory

Intel® Processor Selection for Ansys Mechanical and Fluent Workloads

Processor and Processor Family Recommendations for Dedicated and Mixed Ansys/HPC Workloads

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Executive Summary

Selecting the correct Intel processor family and processor model number to run Ansys® Fluent® and Ansys® Mechanical® workloads is a critical design decision that directly impacts the cost and benefits of Computer Aided Engineering (CAE) efforts.

To assist customers, Intel collaborated with Ansys[1] and with MVConcept[2] to measure the performance of select Intel Xeon Scalable processor families using both single and multi-node Ansys Fluent and Ansys Mechanical official benchmarks spanning a range of size regimes and solvers.[3,4] The performance results reflect the complex relationship between computational efficiency, processor core count, core frequency and memory bandwidth.

Ansys workloads have both memory bandwidth and compute intensive requirements which can vary for many reasons, including dataset size and the solver utilized. High performance requires balancing the efficiency of the processor core against the bandwidth of the memory subsystem. Given the one process per core nature of Ansys workloads and core-utilization basis for Ansys licenses, performance per core is the key metric in benchmark analysis as it reflects the expected performance in the field, but only in situations where there is sufficient memory bandwidth to keep the computational units on the processor cores supplied with data and running efficiently.

This white paper presents and evaluates the performance behavior of 2nd Generation Intel Xeon Scalable processors from the Intel Xeon Gold 62xx and Intel Xeon Platinum 92xx families of processors. Specifically, the following observations can be made based on the performance of Intel Xeon Scalable 6254, 6248R, and 9242 processors on official Ansys Mechanical 2020 R1 and Fluent 2020 R1 benchmarks:

- Both the Intel Xeon Gold 62xx and Intel Xeon Platinum 92xx processor families deliver balanced performance on both Ansys Fluent and Mechanical workloads.
- For applications such as Ansys Fluent ***where memory bandwidth regions tend to dominate performance***, the benchmark results demonstrated that the 12 memory channels per socket of the Intel Xeon Platinum 92xx processor family means more cores can be utilized to deliver nearly 2x the performance. Overall, tests confirm that all of the Intel Xeon Scalable Processor families deliver higher performance when faster memory DIMM modules are installed in the compute node.
- For applications such as Ansys Mechanical where ***compute regions tend to dominate performance***, the benchmarks show that processors with high processor base clock rates and high maximum turbo frequency performed

best on the Ansys Mechanical benchmarks. As observed in this white paper the Intel 92xx family of Intel Xeon Scalable processors delivered the highest single node performance relative to the other Intel Xeon Scalable processors tested.

- The performance of the storage subsystem is very important. Use of Intel® Optane™ NVMe SSDs can reduce the amount of DRAM needed for out-of-core Ansys Mechanical solvers while not impacting the application runtime. It also has up to 56% performance advantages over 3D NAND NVMe SSD used in the same scenario.

Processor family recommendations

The benchmark results confirm that both the Intel Xeon Gold 62xx and Intel Xeon Platinum 92xx processor families deliver balanced performance on both Ansys Fluent and Mechanical workloads. Performance depends mainly on the number of cores utilized, but a slight drop in per core computational efficiency discussed in section 3.2 indicates that the Intel Xeon Gold 6248 might be approaching the limits of the 6 memory channel per socket Intel Xeon Gold memory subsystem.

The single node Ansys Fluent analysis (section 3.2) and Ansys Mechanical single node benchmark analysis (section 5.2) show that the 12 memory channels and high processor core count of the Intel Xeon 92xx processor family can speed up Ansys Fluent workloads by 2x or more (section 3.2) and Ansys Mechanical workloads by up to 1.8x (section 5.2) compared to the Intel Xeon Gold 62xx family.

The multi node analysis for Ansys Fluent in section 4 and Ansys Mechanical in section 5 confirms that building clusters with either processor family is a good solution as both processors balance computation and memory bandwidth so performance is dictated by the number of processes per node. The higher core count of the Intel Xeon 92xx family of processors delivers both scalability and high performance (sections 4.2 and 6.2) on all workloads.

Those who run mixed HPC and Ansys workloads on their clusters need to consider the requirements of the other applications as discussed in section 9. A general recommendation is to purchase the number of cores that best map to the overall workload mix. While beyond the scope of this white paper, recent HPC benchmarks highlight the superiority of the latest Intel Xeon Scalable 92xx family of processors on numerous HPC workloads due to their high core counts and 12-memory channels per socket design.[5,6] Performance improvements can be as much as 2.25x.[7]

Following are observations on how to specify the number of cores to achieve best performance:

- Utilizing all the cores on a high-core count processor may lower the computational efficiency of the core as individual Ansys processes (one per core) can become starved for data on memory bandwidth dominated regions of the Ansys application.
- Running with too few cores wastes compute capability even though it increases the memory bandwidth per core. In the extreme, the highest memory bandwidth per core is achieved when running one core per socket or NUMA domain, but modern Intel memory systems are fast enough that running a single Ansys process per socket cannot fully utilize all the available memory bandwidth. Where appropriate, this white paper reports the best performance obtained per node along with number of cores utilized on the nodes.
- For the Intel Xeon Gold 62xx processor family, experience has shown the overall performance sweet spot for Ansys Mechanical workloads seems to be when running between 16 to 48 physical cores per dual socket node. For Ansys Fluent, the number is 32 to 48 physical cores per dual socket node.
- The greater core count and 12 memory channel per socket features of the Intel Xeon Platinum 92xx family of processors increases the performance sweet spot to 64+ processes per node.

Ansys Fluent is a multiphysics computational fluid dynamics (CFD) software commonly used to model flow dynamics and related physical phenomena.

Ansys Mechanical is a comprehensive finite element analysis (FEA) package that allows modeling of complex materials, large assemblies, and mechanical systems that exhibit both linear and nonlinear behavior.

Both packages are used by thousands of companies around the world as an integral part of their product design and optimization process.

1. Benchmark results reflect a complex performance envelope

In collaboration with Intel and Ansys, MVConcept of Montreal, Canada benchmarked the performance of the Ansys Fluent and Ansys Mechanical applications over a number of different system configurations and BIOS settings.

A total of 3,250 Ansys Fluent and 4,778 Ansys Mechanical benchmark tests were performed using datasets from the official Ansys Fluent 2020 R1[8] and Ansys Mechanical 2020 R1[9] benchmark suites. Ansys provides these benchmark suites to their hardware and HPC partners for their use in performance benchmarking and to provide comprehensive performance data for comparative purposes.

Results in this white paper are reported in terms of the Ansys Solver Rating, which is defined as the number of benchmarks that can be run on a given machine (in sequence) in a 24 hour period.[10] A higher value represents better expected performance on actual Ansys workloads in the field. Unless otherwise indicated, all results are reported as factors of performance improvement (e.g. 2.4x).

The various analyses presented in this white paper are based on these results, which encompass a wide range of problem sizes and solvers that reflect the expected performance for customers in the field. As expected, the benchmark data demonstrates that both Ansys Fluent and Mechanical workloads stress the underlying hardware in a variety of ways where performance is affected by system memory bandwidth, number of cores utilized, CPU frequency, and the per core computational efficiency when processing both vector and serial code.

2. Systems evaluated

The following systems were used in the evaluation. All benchmarks on all systems were performed with turbo mode enabled and hyperthreading disabled. This was done in the BIOS. Unless otherwise indicated, the default memory DIMM frequency shown in the following table was utilized.

HARDWARE			
System	Intel	Intel	Intel
Processor	Intel Xeon Platinum 9242	Intel Xeon Gold 6248R	Intel Xeon Gold 6254
Cores per socket	48	24	18
Sockets per motherboard	2	2	2
Processor Base Frequency (GHz)	2.3	3	3.1
Max Turbo Frequency (GHz)	3.8	4	4
Memory channels per socket	12	6	6
Memory (GB)	768	768	768
Memory Frequency (GHz)	2933	2933	2933
Interconnect	Intel® Omni-Path Architecture	Mellanox InfiniBand HDR	Mellanox InfiniBand HDR
SOFTWARE			
Operating System	CentOS Linux 7.7		
Compiler	Intel® C++ compiler version 2019 update 3		
MPI	Intel®MPI 2018u3 as packaged with Ansys Mechanical and Fluent		

Table 2-1: System descriptions

3. Ansys Fluent single node performance

Ansys Fluent is a multiphysics computational fluid dynamics (CFD) software that can model flow, turbulence, heat transfer, reactions, and more. It is known for its ability to accurately solve a wide range of fluid flow problems from airflow over an electric vehicle to combustion in a gas turbine.[11]

To reflect the variety of dataset sizes used by customers, benchmark results were obtained on four official Ansys datasets: the small *aircraft_wing_2m*, the medium sized *landing_gear_15m*, a large *f1_racecar_140m* dataset, plus the extra-large *open_racecar_280m* dataset.

3.1 Methodology and results

The Ansys Fluent Solver Rating was measured for four datasets and used to compare three different dual socket systems. All runs were performed when the system was in a clean state.[12] All physical cores in the processors on the dual socket motherboard were utilized.

The Ansys Fluent Core Solver Rating relative to the performance of the Intel Xeon Gold 6254 is reported for each processor and dataset in the following table.

ANSYS FLUENT CORE SOLVER RATING RELATIVE TO THE INTEL XEON GOLD 6254 (A higher relative Core Solver Rating indicates faster relative performance)			
	9242	6248R	6254
Aircraft_wing_2m	2.4	1.3	1.0
Landing_gear_15m	2.8	1.3	1.0
F1_racecar_140m	2.7	1.2	1.0
Open_racecar_280m	2.8	1.2	1.0

Table 3-1: Ansys Fluent Core Solver Rating relative to the Intel Xeon Gold 6254 processor for various datasets

3.2 Analysis

These results indicate that both the Intel Xeon Gold 62xx and Intel Xeon Platinum 92xx family of processors nicely balance the memory and compute requirements of Ansys Fluent workloads.

Looking only at core count, we see in the following table the expected performance improvement that the other two processors should deliver compared to the Intel Xeon Gold 6254 simply because they have more cores.

EXPECTED PERFORMANCE GAIN RELATIVE TO THE INTEL XEON GOLD 6254 BASED PURELY ON CORE COUNT			
	9242	6248R	6254
System core count	96	48	36
Expected performance gain purely based on core count	2.67	1.33	1.00

Table 3-2: Expected performance gain relative to the Intel Xeon Gold 6254 processor based purely on core count

Factoring out this expected performance improvement from the benchmark results demonstrate that most of the performance difference can be attributed purely to core count as shown in the table below.

MEASURED PERFORMANCE UPSIDE RELATIVE TO EXPECTED PERFORMANCE			
	9242	6248R	6254
Aircraft_wing_2m	-9%	-3%	0%
Landing_gear_15m	4%	-4%	0%
F1_racecar_140m	1%	-6%	0%
Open_racecar_280m	4%	-7%	0%

Table 3-3: Measured performance upside relative to expected performance

The green highlighted cells indicate that the Intel Xeon Platinum 9242 can deliver higher than expected performance so long as there is sufficient work for the cores. This is consistent with architectural improvements in the Intel Xeon Platinum 92xx family of processors. The *aircraft_wing_2m* dataset appears to be too small to keep all the Intel Xeon Platinum 9242 processor cores running at full efficiency. The greater core count of the Intel Xeon Gold 6248R clearly delivers increased performance across all datasets relative to the Intel Xeon Gold 6254, but the preceding table indicates there might be a slight decline in the efficiency as the 24 cores per processor (48 per node) approach the limits of the memory subsystem.

Overall, all the processors appeared to have sufficient memory bandwidth to keep all the cores active and running efficiently on Ansys Fluent workloads. The 12 channel per socket design of the Intel Xeon 9242 is able to provide data to all 96 cores in the dual socket system. Similarly, the 6 memory channel design of the Intel Xeon Gold 62xx processors can support both 36 and even 48 cores in a 2S motherboard configuration on Ansys Fluent workloads.

4. Ansys Fluent multi-node performance

Many Ansys Fluent workloads require the use of a computational cluster for the timely generation of results.

The single node results from section 3 translate well to distributed runs on a cluster as CFD problems tend to scale well both across the cores inside a node and across the nodes in a distributed environment. Cluster-based workloads are a common use case where all the physical cores in the computational node are utilized – meaning each core of each multi-core processor are assigned to run a single Ansys process. The main caveat is that the problem size must be sufficient to give each of the cores enough work.

4.1 Methodology and scaling results

Benchmark results were obtained for the same datasets used in the single node evaluation.

A small 16 node Intel Xeon Platinum 9242 cluster was used to evaluate the performance of the latest Intel Xeon 92xx technology. For comparison, a four node Intel Xeon Gold 6254 cluster was also used to evaluate the performance when running 32 Ansys processes per node. These latter results reflect the performance customers might see on their current Intel Xeon Gold clusters.

Scaling proved to be good on both cluster configurations with Ansys Fluent exhibiting nearly linear scaling across all nodes as shown in Figures 4-1 and 4-2.

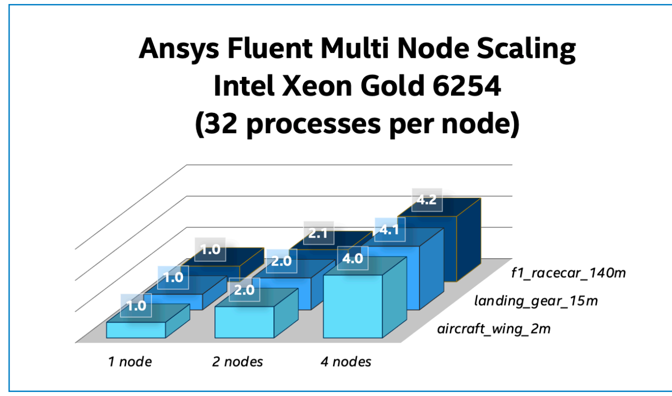

Figure 4-1: Ansys Fluent multi-node scaling on the Intel Xeon Gold 6254 processor for various datasets when running 32 processes per node

The need to provide the processor cores with sufficient work is highlighted on the Intel Xeon Platinum 9242 where the reported scaling is lower on the smaller *aircraft_wing_2m* dataset and higher on the larger datasets. The f1_racecar_140m dataset in particular reflects excellent, nearly linear scaling across all tested cluster configurations.

The minor performance variations in the results depicted in the figure are expected as cluster performance can be affected by the fabric and communications overhead.

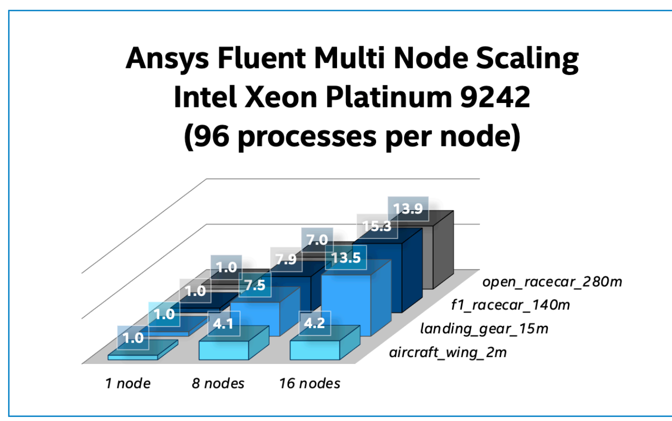

Figure 4-2: Ansys Fluent multi-node scaling on the Intel Xeon Platinum 9242 processor for various datasets when running 96 processes per node

5. Ansys Mechanical best single-node performance

Ansys Mechanical is a multiphysics finite element analysis (FEA) software for structural analysis that encompasses

ANSYS MECHANICAL BEST CORE SOLVER RATING RELATIVE TO INTEL XEON GOLD 6254 (Higher reflects a higher Core Solver Rating)							
CPU	Cores per 2S node	V20cg-2		V20ln-1		V20sp-5	
		Best Core Solver Rating	Cores utilized	Best Core Solver Rating	Cores utilized	Best Core Solver Rating	Cores utilized
9242	96	1.7	88	1.8	92	1.5	92
6248R	48	1.3	40	1.1	44	1.1	44
6254	36	1.0	32	1.0	32	1.0	32

Table 5-1: Ansys Mechanical best Core Solver Rating relative to the Intel Xeon Gold 6254 processor

linear dynamics, nonlinear dynamics, contact capacities to evaluate the interactions of multiple parts, thermal analysis, fatigue analysis, and more.

The very nature of FEA computations makes them popular candidates to run on single, dedicated, high-performance computational nodes. Customers also use clusters to perform FEA analysis as will be discussed in section 6.

The Ansys Mechanical V20 benchmarks were chosen for this report as they were large enough to explore the memory bandwidth vs. compute performance relationship while still fitting into a single computational node. Various solver types were explored with the V20cg-2, V20ln-1 and V20sp-5 benchmark runs reported as representative of each solver type. More information can be found on the Ansys[13] and Intel[14] websites.

The sparse direct solver is a popular choice in the field. For this reason, the performance of the V20sp-5 sparse solver is particularly important.

5.1 Methodology and results

The best Core Solver Rating was determined using a dual socket computational node for each of the processors tested by running increasing numbers of Ansys Mechanical processes and recording the best core Solver Rating when using the fewest cores.

Table 5-1 lists the number of cores per dual socket (2S) node that delivered the best performance for each Intel Xeon Scalable processor tested relative to the Intel Xeon Gold 6254.

5.2 Analysis

The Ansys Mechanical benchmarks demonstrate that the number of cores and the frequency at which they run provide the greatest benefit in terms of Core Solver Rating. The ability to achieve faster performance simply by increasing the number of Ansys Mechanical processes per node reflects the balanced nature of the memory subsystem in the Intel Xeon Gold 62xx and Intel Xeon Platinum 92xx processor families.

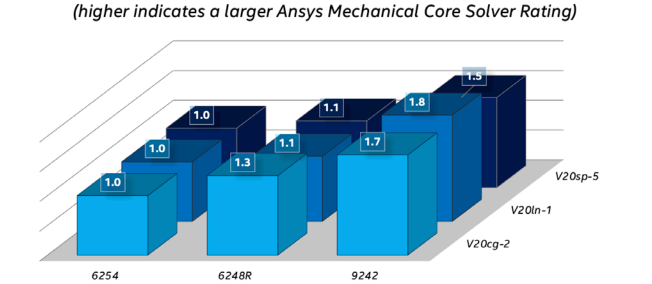

Figure 5-1: Speedup relative to an Intel Xeon Gold 6254 processor for various processors and datasets

The following figure shows that the number of processes used to achieve the best core solver rating does depend on the workload. Specifically, the best Ansys Core Solver Rating was achieved when 83% of the cores were utilized on the V20cg-2 benchmark. The 40 Ansys Mechanical processes on the Intel Xeon Gold 6248R were able to achieve a higher Core Solver Rating than the 36 processes running on the Intel Xeon Gold 6254 computational node.

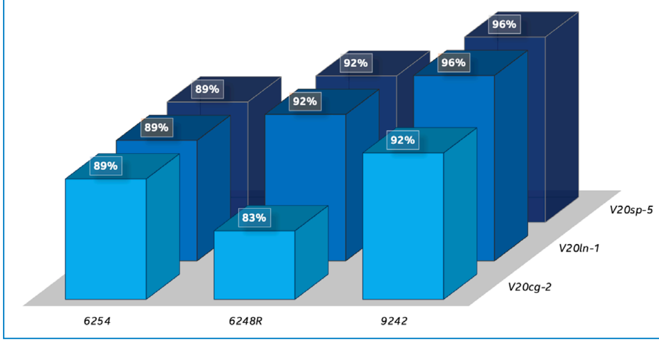

Figure 5-2: Percentage of total processor cores used on a 2S node to obtain best Core Solver Rating for various processors and datasets

Overall, these results, along with the Ansys Fluent results in section 3, demonstrate the balanced nature of the core count and memory subsystem of both the Intel Xeon Gold 62xx and Intel Xeon Platinum 92xx family of processors. The varying core counts used to achieve best performance reflect the complex nature of the Ansys Mechanical workloads, and how different solvers can place more demands on the memory subsystem or the computational cores.

6. Ansys Mechanical multi-node performance

Some customers choose to run Ansys Mechanical in a cluster environment. Typically, some of the cores in the computational nodes are not used in these distributed environments.

6.1 Methodology and scaling results

Figures 6-1 and 6-2 report the Ansys Mechanical Core Solver Rating for a sparse solver when processing two large degree of freedom Ansys Mechanical V20 datasets on an Intel Xeon Platinum 9242 cluster. The best of three runs Core Solver Rating is reported for runs with 64 and 88 processes per node (PPN) on 2, 4, and 8, and 16 nodes.

The scaling behavior (Figure 6-1) illustrates the multi-node performance improvement compared to a single node for each dataset. The single-node performance was assumed to

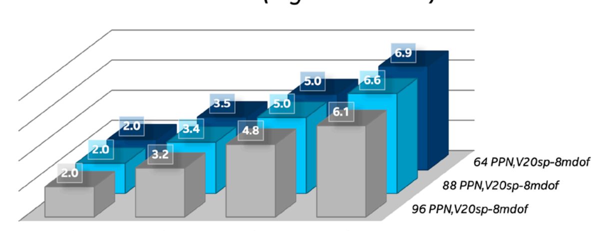

Figure 6-1: Ansys Mechanical multi-node scaling on the V20sp-8mdof dataset when running on an Intel Xeon Platinum 9242 processor-based cluster using various processes per node

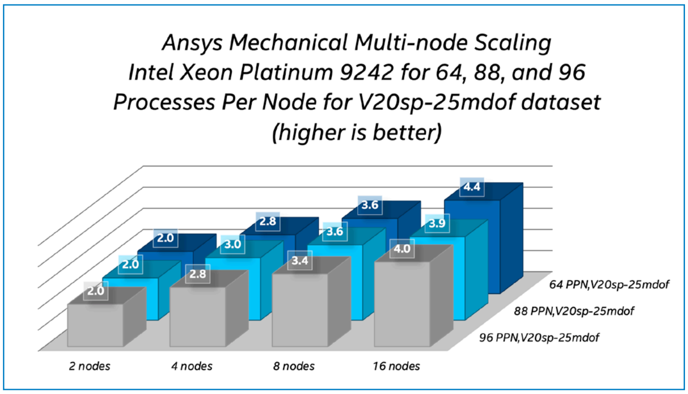

Figure 6-2: Ansys Mechanical multi-node scaling on the V20sp-25mdof dataset when running on an Intel Xeon Platinum 9242 processor-based cluster using various processes per node

be half that of the 2 node cluster results. Results from both clusters (shown above) clearly demonstrate that running Ansys Mechanical on a cluster does provide a performance improvement on these large degree of freedom datasets.

The minor performance variations depicted in the results in both figures are expected as cluster performance can be affected by the fabric and communications overhead. As with the Ansys Mechanical single node benchmark results of the previous section, the number of Ansys processes per node can vary according to dataset and solver.

7. Effect of turbo mode

When not limited by memory bandwidth, the performance of the processing core is influenced by the clock rate at which the core can run. Essentially a higher clock rate equates to more operations performed per unit time, which means the entire application runs faster.

Tables 7-2 and 7-2 report the Core Solver Rating improvement that can be achieved when running with Turbo mode enabled and disabled in the BIOS.

The conclusion is simple. Turbo mode should be enabled as it helps each processor core speed through computational dominated regions of the Ansys Fluent and Mechanical workloads.

8. Effect of DIMM speed

DIMM speed has an impact on the Ansys Fluent and Mechanical performance. Intuitively this makes sense as faster memory is an easy way to increase the memory bandwidth per node ratio.

To test the effect of DIMM speed, the memory frequency was changed in the BIOS and the Ansys Core Solver Rating measured. The memory frequency was only decreased from the default 2933 frequency as the experiment was not intended to measure the effects of overclocking the memory.

The beneficial effect of higher memory speed can be clearly seen in the following Ansys Fluent and Ansys Mechanical benchmark results, which report performance as a

ANSYS FLUENT INTEL XEON GOLD 6254 36 PROCESSES (a higher ratio reflects a higher Core Solver Rating)	
	Performance improvement Turbo On vs Off
aircraft_wing_2m	7%
landing_gear_15m	4%
f1_racecar_140m	11%
open_racecar_280m	4%

Table 7-1: Turbo mode performance improvement measured using ANSYS Fluent on an Intel Xeon Gold 6254 processor-based system using 36 processes per node

ANSYS FLUENT INTEL XEON PLATINUM 9242 96 PROCESSES (A higher ratio reflects a higher Core Solver Rating)	
	Performance improvement Turbo On vs Off
aircraft_wing_2m	12%
landing_gear_15m	16%
f1_racecar_140m	6%
open_racecar_280m	15%

Table 7-2: Turbo mode performance improvement measured using ANSYS Fluent on an Intel Xeon Platinum 9242 system using 96 processes per node

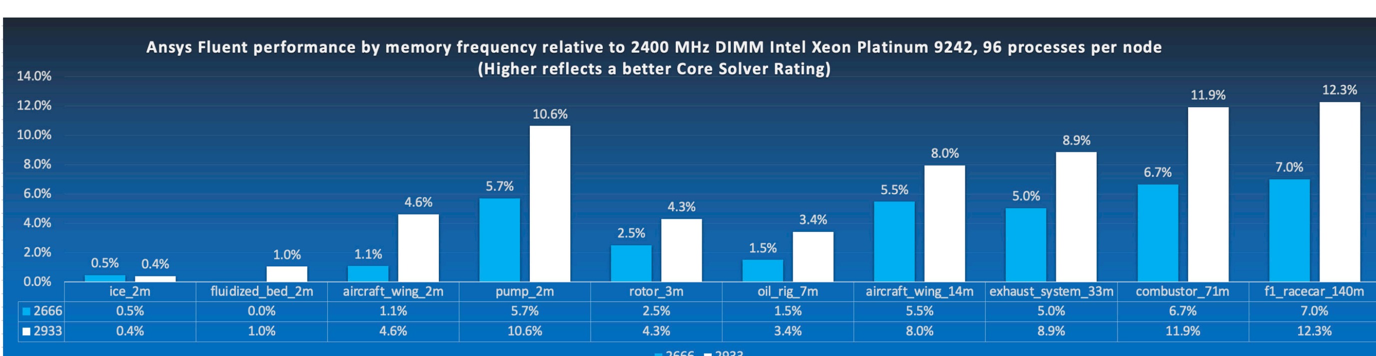

Figure 8-1: Ansys Fluent performance by memory frequency relative to 2400 MHz DIMM performance on an Intel Xeon Platinum 9242 processor-based system running 96 processes per node

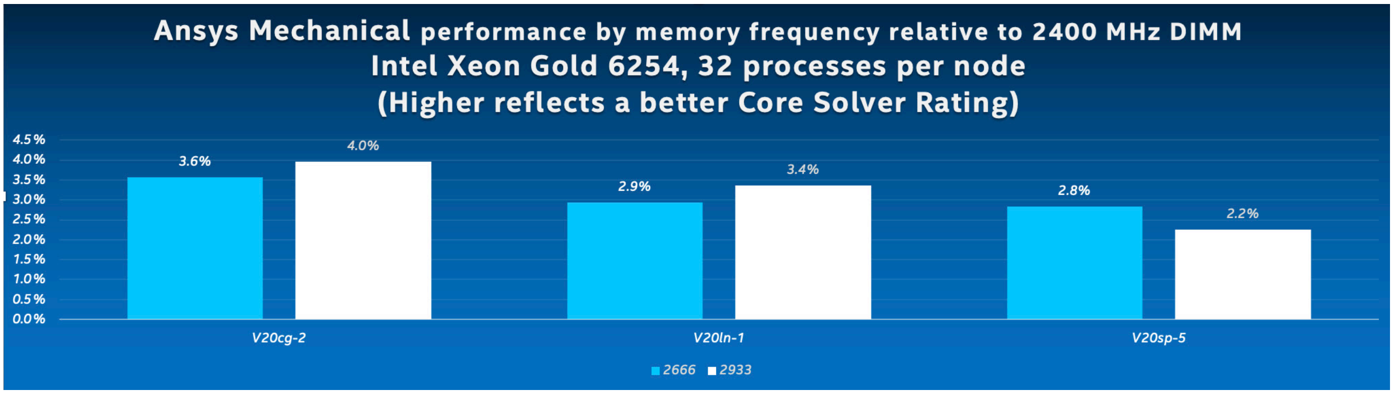

Figure 8-2: Ansys Mechanical performance by memory frequency relative to 2400 MHz DIMM performance on an Intel Xeon Gold 6254 processor-based node running 32 processes per node

percentage increase over the lowest memory frequency (e.g., the slowest performing memory).

The results are clear: The fastest memory results in the highest Core Solver Rating for both Ansys Fluent and Mechanical workloads. In most cases, the highest speed memory can deliver more data to each core per unit of time. This means each core spends less time waiting for data and more time computing. In general, faster memory is best.

9. The impact of the storage system on Ansys workloads

Ansys workloads are complex. They stress all aspects of the computer including the storage subsystem. For this reason, NVMe storage is recommended for all Ansys workloads, but particularly for Ansys Mechanical workloads.

The most significant impact of the storage system performance is observed when running out of core solvers. These solvers reflect an important Ansys Mechanical workload as customers tend to run out of memory as model size increases regardless of the processing power of the CPU.

Benchmarks were performed using a variety of out of core Ansys Mechanical solvers. All of them demonstrated a performance improvement when using Intel Optane SSDs compared to NAND NVMe SSDs. However sparse solvers are the most aggressive on the I/O and so bring more benefits for users. Hence the cg-100mdof, sp-8mdof and sp-25mdof benchmarks are indicative of the importance of out-of-core solvers. For this reason, we report the performance of the popular PCG and sparse solver for Ansys Mechanical workloads on an Intel Xeon Gold 6254 system using the following configurations:

- 1x NAND NVMe: One Intel P4610 3D NAND NVMe SSD 1.6TB was installed in a U.2 slot
- 1x Optane SSD: One Intel P4800X Optane SSD 750GB was installed in a U.2 slot
- 3x NAND NVMe: Three Intel P4610 3D NAND NVMe SSD 1.6TB were installed in three U.2 slots
- 3x Optane SSD: Three Intel P4800X Optane SSD 375GB were installed in three U.2 slots

For these runs, approximately 700GB of scratch is required, which matches the Intel Optane SSD product family. In comparison, the lowest capacity of the P4610 3D NAND SSD is 1.6TB, which leaves the remaining capacity unused.

A software RAID was used to combine both the 3x NAND and Intel Optane storage devices into a single volume via an Intel VROC RAID with MDADM IMSM RAID container. This provides extra performance optimizations for both configurations comparing to default Linux MDRAID implementation.

The out of core Ansys Mechanical Core Solver Rating was recorded for each of the runs and reported in the following table as a speedup compared to the out of core performance of the solver when using a single NVMe NAND SSD device.

These results indicate that the highest performance is achieved when utilizing multiple devices, regardless if they were NAND NVMe or Optane SSDs. However, Intel Optane SSDs clearly delivered the highest performance.

When compared to the price of DDR4 DRAM, provisioning a system with Intel Optane devices can be considered as a cost saving measure. For example, a customer can purchase a system with 192GB DDR4 DRAM and Intel Optane SSDs rather than a system containing system 768GB of DDR4 DRAM. The extra capacity of the Intel Optane SSDs compensates for the difference in DDR4 DRAM capacity when running out of core solvers.

Provisioning a system with Intel Optane devices also provides greater reliability while also delivering a cost savings compared to NAND NVMe devices.

For given capacity, the cost of multiple smaller Optane SSDs is the same as the single Optane SSD up to 1.5TB target

ANSYS MECHANICAL SPEEDUP BY SOLVER RELATIVE TO 1X NAND				
	1x NAND	1x Optane SSD	3x NAND	3x Optane SSD
V20cg-100	1	1.5	1.34	1.56
V20sp-8	1	1.27	1.31	1.31
V20sp-25	1	1.21	1.33	1.37

Table 9-1: Ansys Mechanical speedup by Core Solver Rating relative to a 1x NAND NVMe configuration

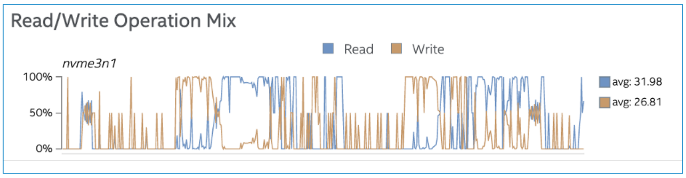

Figure 9-1: Example percentage read write operation mix for an Ansys Mechanical out of core solver

scratch capacity. Given the flat price per GB for Optane technology there is no cost difference to provision with the smaller Intel Optane devices. NAND SSDs typically are also priced at a flat cost per GB. However, the smallest P4610 SSD capacity is 1.6TB. Thus, the cost of 3x NAND SSDs is higher because it costs more to purchase the extra capacity.

As seen in the Operation mix chart above, the Ansys P4610 family of NAND devices is rated at 3 DWPD (drive writes per day) while the Intel Optane P4800X family of devices is rated at 60 DWPD. Purchasing larger NAND devices does not compensate for the 20x greater DWPD rating of the Intel Optane SSDs.

10. Processor family selection for mixed HPC/AI/ Ansys workloads

Just like Ansys workloads, higher memory bandwidth and core count is critical to performance for many HPC and AI workloads.

While the analysis is outside the scope of this white paper, Intel has published performance benchmarks (shown below) that are consistent with the findings in this white paper. The Intel results demonstrate that the 12 memory channel per socket Intel Xeon Platinum processors outperform 6 memory channel products on a wide range of industry standard benchmarks as well as common HPC workloads by as much as 2.25x. Increased memory bandwidth clearly helps performance as processor cores that are starved for data simply cannot deliver performance.

For more information

Performance leadership of the Intel Xeon Platinum 92xx processor family: https://www.intel.com/content/www/us/en/benchmarks/server/xeon-scalable/platinum-9200-performance.html

Free Ansys HPC Benchmark program: https://www.ansys.com/free-hpc-benchmark

Ansys HPC Cluster Appliance Program: https://www.ansys.com/hpc-cluster-appliance

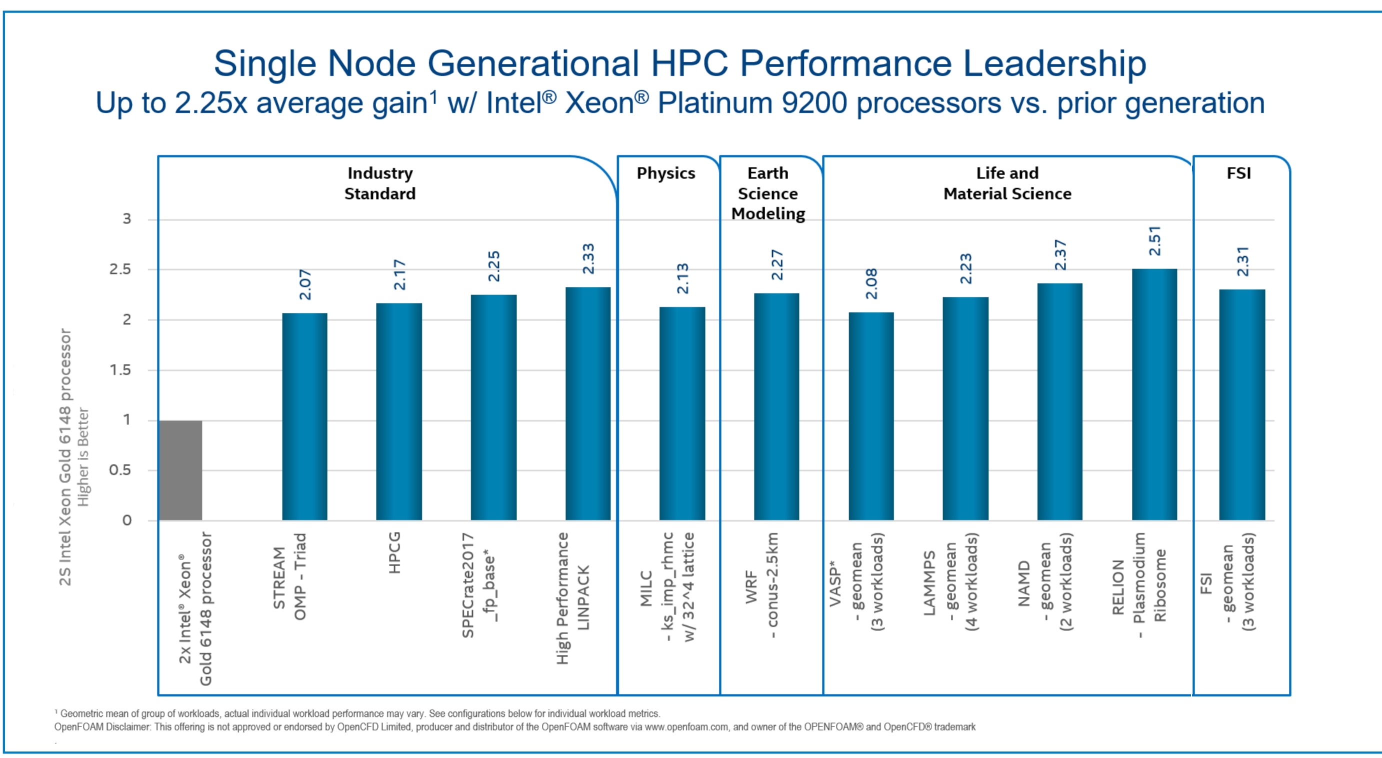

Figure 10-1: Performance improvement of Intel Xeon Platinum 9200 processors over previous generation Intel processors

Endnotes

1. https://www.ansys.com/
2. https://mvconceptusa.com/
3. https://www.ansys.com/solutions/solutions-by-role/it-professionals/platform-support/benchmarks-overview/ansys-fluent-benchmarks/
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