Testing the New SOLIDWORKS Engine

SOLIDWORKS is currently beta testing a new engine. Historically, CAD application performance has relied entirely on the speed of a handful of high-frequency cores. However, like lots of professional software these days, SOLIDWORKS is being reworked to take better advantage of the latest GPUs. Therefore, now is a good time to compare performance of CPUs and GPUs across the current and upcoming engine, and demonstrate how a BOXX workstation is the best choice for your workflow.

These benchmarks provide an accurate representation of the performance comparisons between components by testing common tasks in SOLIDWORKS 2019 (Service Pack 2). They also give users a good idea of what performance will look like for three BOXX models designed specifically for running CAD software: the APEXX E2, APEXX S3, and APEXX X3.

Systems Configurations

BOXX Model	Intel® Core™ Processor Configurations		NVIDIA® GPUs Tested
APEXX E2	i7-9700k	1 core at 4.9GHz, 8 cores at 4.6GHz	Quadro P4000 (8GB) Quadro RTX 4000 (8GB) Quadro RTX 5000 (16GB) Quadro RTX 6000 (24GB)
	i9-9900K	2 cores at 5.0GHz, 8 cores at 4.7GHz	
APEXX S3	i7-9700K (OC)	8 cores at 5.1GHz	
	i9-9900K (OC)	8 cores at 5.0GHz	
APEXX X3	i9-9980XE	2 cores at 4.5GHz, 18 cores at 3.8GHz	
	i9-9980XE (OC)	4 cores at 4.5GHz, 18 at 4.4GHz	

To prevent bottlenecking, 64GB of DDR4-2666MHz memory was used, with a Samsung 970 Pro 500GB M.2 drive running Windows 10 (version 1809).

When only testing the processors, a Quadro RTX 6000 was used. All of the GPUs were tested with an overclocked 9700K.

All SOLIDWORKS settings were left on default values except for:

Level of detail: Off
Curvature generation: Always on
Large assembly mode: Off
Rotate about floor plane: On
Photoview360 enabled on startup
Enhanced performance (for some, this enables the beta graphics engine)

Assembly Used

The assembly used was a 2,200-part model of a BOXX rackmount chassis.

While this is a relatively complex model that would require the user to reduce visual quality in SOLIDWORK's current graphics engine to manipulate efficiently, many users have even larger models that may require faster GPUs to run at high settings to achieve 30-60fps in the new engine.

Benchmark

The benchmark used was a SOLIDWORKS macro script written in Visual Basic. It can be run with and without the rendering portion at the end. The script closes all currently open files, then runs the following steps 5 times (for accuracy):

1. Load the assembly
2. Open a separate part from the assembly and rebuild it
3. Rotate the model in the viewport for 1,000 frames
4. Render the assembly (if required)

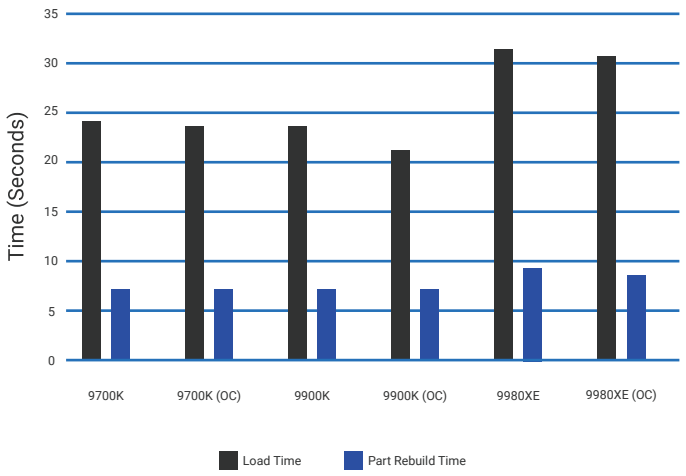
The macro then exports all the recorded times and the average frames per second of the rotation segment into an excel spreadsheet and averages the five runs.

The benchmark was run twice on each CPU configuration, and four times on each GPU configuration to test both in 1080p and 2160p. For each hardware configuration, the benchmark was run once in the old graphics engine (which is CPU-bound in terms of graphical performance), and then once in the beta engine (which is GPU-bound). This gives us a good idea of current and future performance, as the beta engine will be implemented in a future service pack of SOLIDWORKS.

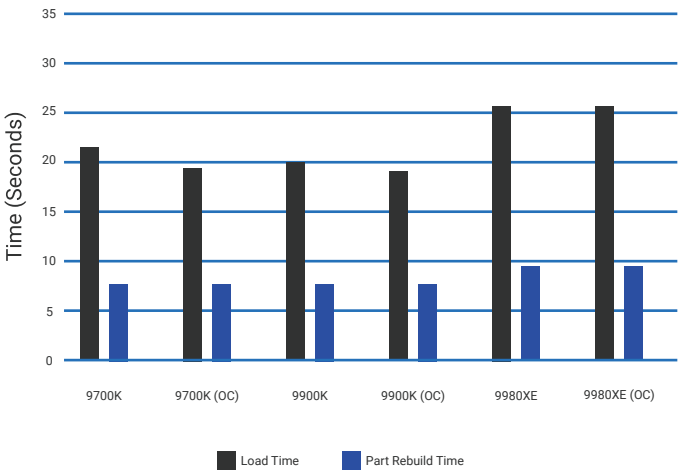
Results – CPU

Load and Rebuild Times - The overclocked 9700K and 9900K performed virtually identically in the new engine, and gave the best viewport performance out of all the configurations. This is not surprising, as SOLIDWORKS is designed to function best on a small number of cores at high frequency. In general, times did not change much for any of the CPUs tested across current and new engines, however load times were slightly higher for the overclocked 9980XE in the current engine, while they remained much the same in the new.

Load and Rebuild Times (Current Engine)



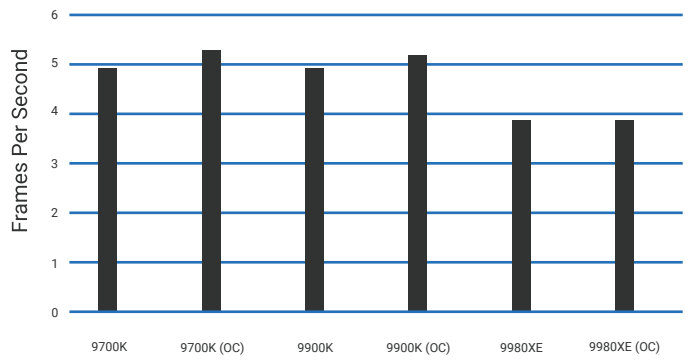
Load and Rebuild Times (Beta Engine)



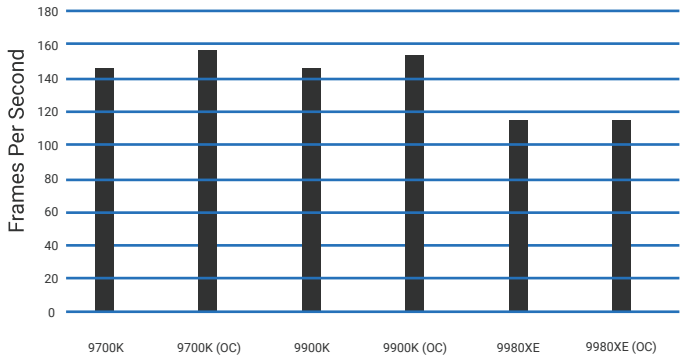
FPS

Frames per second evened out noticeably for all CPUs in the beta engine, while the current engine maintained an extremely low fps (<4 fps) with the 9980XE (stock and overclocked). This is of course due to the heavily CPU-bound nature of the current engine.

FPS (Current Engine)



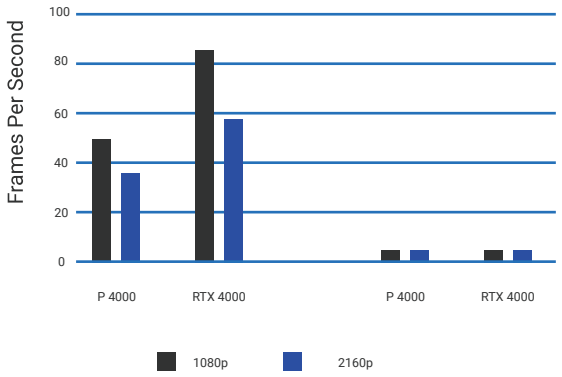
FPS (Beta Engine)



We saw no improvement in fps in the current engine among any of the GPUs. They all performed basically the same, achieving around 5 fps. Of course, we chose the same settings for the current engine and the beta to show the drastic difference in performance between the two versions. Realistically, if using the current engine, the user would trade some visual fidelity for a more workable model and get around 20–30 fps.

Comparing the older NVIDIA Quadro P4000 (Pascal architecture) and the newer Quadro RTX 4000 (Turing architecture) in the beta engine, we saw an increase of 38 fps with the RTX card at 1080p, as well as an increase of 23 fps at 2160p. The highest fps recorded was the RTX 6000 (163 fps at 1080p). The "worst" performing card was the P4000 with 48 fps at 1080p, which would still provide a very smooth and workable experience.

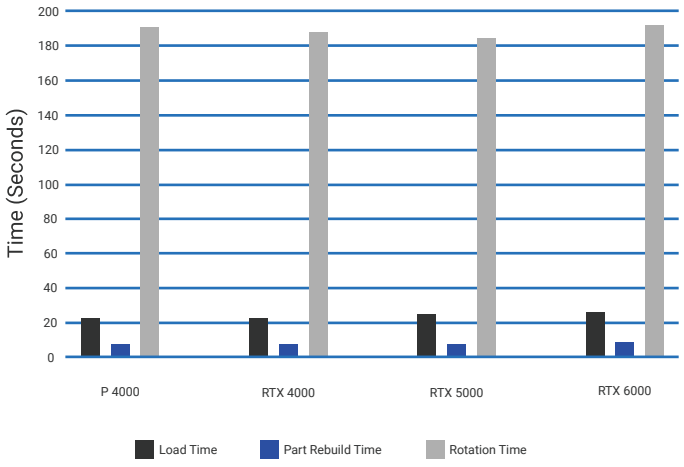
Pascal vs Turing



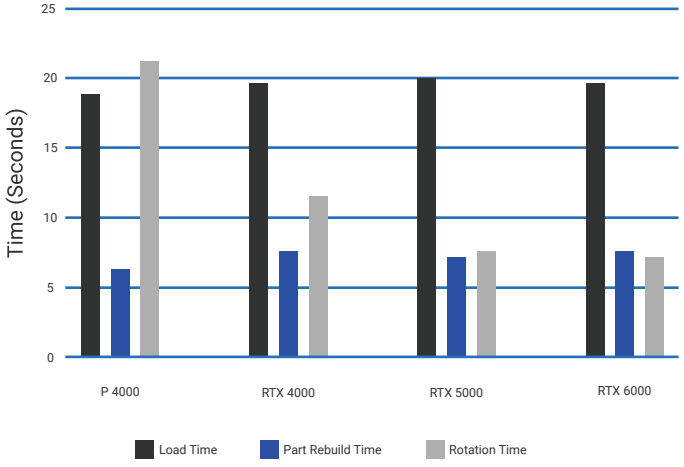
Load, Rebuild, and Rotation Times

The biggest takeaway between the two engines was the reduction in rotation time, averaging above three minutes in the current engine to ranging between 5–20 seconds in the beta engine.

Current Engine



Beta Engine



Recommendations

Regarding upcoming SOLIDWORKS releases, a single Quadro RTX 4000, P4000 or even P2000 should be sufficient for most users' basic needs. That said, the Quadro RTX 4000 falls right in the sweet spot when considering both price and performance. However, if your workflow includes extremely complex models, multiple displays, or you work in UHD (4K/8K), a multi-GPU setup with Quadro RTX cards would be beneficial.

Regardless of the processor, using a Quadro RTX 4000 (or higher) would also be beneficial if users want to utilize multiple monitors at once, and/or drive multiple CAD software instances at once. Of all the models we compared, the APEXX X3 has the highest GPU power budget (1,000 watts) to allow for the most high-end video cards in a single system.[1]

If you work with complex models at 2160p and want to maintain a comfortable 60 fps, an Intel® Core™ i7-9700K (nonover-clocked) combined with an NVIDIA Quadro RTX 4000 is a good solution. That can be found in the **APEXX E2**. However, it's also worth noting that the percent advantages of professionally overclocked processors (5–10%) translate relatively linearly to more time-consuming operations that users may be dealing with. For example, if you want to add the fastest load and rebuild times, you could upgrade to the overclocked **APEXX S3**, which offers more room for hard drives.

If you want a well-rounded system that provides fantastic load/rebuild times on top of blazing fast rendering, you can't go wrong with the **APEXX X3**. According to our tests, adding a Quadro RTX card (or two) to the mix will yield excellent results in the upcoming engine. In that case, you'll have a handful of high-frequency cores to build your models with, then plenty of cores to lean on when rendering. That's why they call it the multi-tasker.

[1] Read more about GPU power budgets **here**.