



Dell EMC™ PowerEdge™ R840



Finish Monte Carlo simulations 4.5x as fast



Achieve 54% less statistical error in Monte Carlo methods



Make projections 1.2x further into the future

## Get more power for your CPU-intensive workloads

A Dell EMC PowerEdge R840 server with Intel Xeon Platinum processors and Intel NVMe SSDs completed Monte Carlo workloads faster than a PowerEdge R820 server, while also increasing statistical precision and simulation scope

Whether your company deals in data analytics, IT, or finance, chances are you'll need to run computation-intensive workloads to keep up with the competition. These workloads are getting more complex and massive each year, and you need a powerful solution to handle them. New servers from Dell EMC could give your business just the boost it needs.

At Principled Technologies, we tested a Dell EMC PowerEdge R840 server, powered by top-of-the-line Intel® Xeon® Platinum 8180M processors and Intel SSD DC P4500 NVMe drives. We compared this solution to one based on the PowerEdge R820 using Monte Carlo simulations—a type of computation-intensive workload used in scientific fields such as climate science, physics, and engineering, among others.

In our tests, the new PowerEdge R840 completed Monte Carlo work faster than the older model. When controlling for time, the PowerEdge R840 also achieved less statistical error and increased the scope of its simulations.

## Testing compute power with Monte Carlo methods

We assessed the computational performance of each server solution with a workload that employs Monte Carlo simulations: algorithms that use random sampling to compute possible outcomes of a given problem.

Because Monte Carlo simulations require a massive number of iterations, they benefit greatly from modern computational power. Before the rise of digital electronic computing, many complex calculations required scores of people taking hours to solve problems by hand. Now, scientists can perform complex work—such as Monte Carlo simulations—in a fraction of the time.

Monte Carlo methods have become widespread in mathematics, where they find use in numerical integration, optimization, and inverse problems. Monte Carlo methods are also used in molecular modeling, fluid dynamics, artificial intelligence, and more.

Our tests applied Monte Carlo in a financial context, where the methods are used to calculate risk and uncertainty for potential investments.

### New processor innovations mean more power for your workloads

Monte Carlo simulations put stress on a server's processor. The Dell EMC PowerEdge R840 we tested supports the most powerful model of Intel Xeon Scalable processor available—the Intel Xeon Platinum 8180M—meaning you'll reap the benefits of the very best Intel has to offer.

Monte Carlo algorithms must run thousands, even millions of times before researchers can obtain meaningful data. With 112 cores consisting of 224 hyperthreads available on its processors, the PowerEdge R840 ran many more concurrent simulations than the 12th generation server, whose processors total only 32 cores containing 64 hyperthreads.

The Intel Xeon Platinum 8180M processor boasts Intel Advanced Vector Extensions 512 (Intel AVX-512), a set of instructions that allow each core in the PowerEdge R840 to operate on chunks of data up to 512 bits at a time for certain bulk operations—compared to 256 bits for the processors in the PowerEdge R820.

We ran two instances of the Monte Carlo simulation on each available processor thread: 448 instances at a time on the PowerEdge R840, and 128 instances on the PowerEdge R820. The new solution's improved performance could enable your company to do more important work, faster.



### Monte Carlo workload

Based on code from researchers associated with Oxford and Columbia universities, the workload uses Monte Carlo methods to estimate the valuation of European swaptions. To learn more, visit <https://software.intel.com/en-us/code-samples/intel-c-compiler/application-domains/finance/Monte-Carlo>



### The Dell EMC PowerEdge R840: More compute power for data analytics

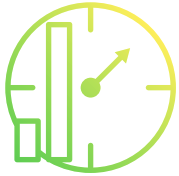
Data analytics is becoming more CPU-intensive every day. The R840 handles these workloads well, with up to 6 TB of memory and space for 24 NVMe drives. These features could benefit your data analytics applications.

## Our results

We ran three main tests. First, we determined the rate at which each solution could complete Monte Carlo simulations. Next, we ran simulations on each solution for a fixed amount of time, and measured the statistical error for each set. Finally, we measured the simulation scope each solution could handle—that is, how far into the future each solution could simulate in a comparable amount of time.

### Finish CPU-intensive workloads faster

The Dell EMC PowerEdge R840 solution processed Monte Carlo simulations 3.5 times faster than the older server. If the Monte Carlo workload is representative of your company's own work, this means you could potentially finish 4.5 times as much work in the same amount of time. This could enable your business to find solutions quickly while making space to do more of the same work.



Finished Monte Carlo simulations  
4.5x as fast

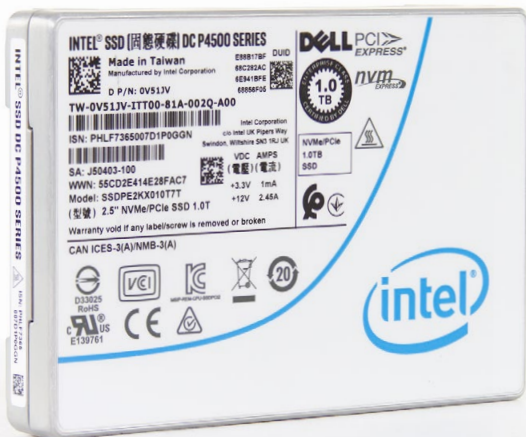
### Average simulations completed per minute (millions)

Dell EMC PowerEdge R840

247.4

Dell EMC PowerEdge R820

53.9



### Fast NVMe drives from Intel

The Dell EMC PowerEdge R840 we tested came equipped with six Intel DC P4500 NVMe SSDs. These NVMe drives operate at microsecond-level latency and are optimized for read-intensive workloads. Intel DC P4500 drives also offer end-to-end data protection, which protects against silent data corruption and issues arising from sudden power loss.

## Intel Xeon Processor Scalable Family

If you want to get the most business value out of your compute-intensive workloads, powerful processors are key.

The Intel Xeon Scalable processor series has many improvements over the older-generation Intel Xeon E5-4600 series that came with our 12th generation server.

The new Scalable processors now have 28 cores—20 more than the older processors, allowing for higher performance and better scalability. The new processors also have six memory channels and 1.5 TB of maximum memory per socket (compared to four memory channels and 384 GB of per-socket memory in the older generation). These increases provide more parallelization and memory resources for memory-intensive workloads.



### Reduce statistical error

Monte Carlo methods work by taking random samples to determine the most likely outcomes for a given situation. For these workloads, error decreases as the number of simulations increase. For example, to decrease error by a factor of 10, one would have to run the simulation 100 times.

Because the Dell EMC PowerEdge R840 can complete more simulations in the same time compared to the PowerEdge R820, those simulations had 54 percent less statistical error than the set that ran on the older server.



Achieve 54% less statistical error

#### Monte Carlo statistical error

Lower is better

Dell EMC PowerEdge R840

0.0033

Dell EMC PowerEdge R820

0.0072

### Increase your simulation scope

The Monte Carlo algorithm calculates an estimate for the value of a large-scale investment some number of years into the future. To obtain estimates further out, the server must perform lengthier calculations. Because the newer server can do a greater volume of work in the same time, the Dell EMC PowerEdge R840 was able to project more than twice as far into the future. With the PowerEdge R840, your organization would be able to assess value over a longer period of time, helping you make better decisions about investments.



Make projections 1.2x further into the future

#### Years projected ahead

Dell EMC PowerEdge R840

11

Dell EMC PowerEdge R820

5



## Conclusion

In the information age, your business operations need to be fast—especially if you work in a fast-paced industry like finance. When your operations hinge on older servers, your more technologically advanced competitors could gain the upper hand.

In our tests, a solution comprised of the Dell EMC PowerEdge R840, Intel Xeon Platinum 8180M processors, and Intel SSD DC P4500 NVMe drives finished Monte Carlo simulations 4.5 times as fast as a 12th generation Dell EMC PowerEdge R820 with Intel Xeon E5-4650 processors. The newer solution's speed led to two ancillary effects that could stand to improve your business: Within a comparable amount of time, the PowerEdge R840 solution ran Monte Carlo simulations 1.2 times further into the future with a 54 percent reduction in statistical error.

Read the science behind this report at <http://facts.pt/8aj6sg> ►



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