


GETTING REAL ABOUT PERFORMANCE IN THE CLOUD



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Technology

Performance counts in the cloud. You want servers that can handle your workloads without impeding user experience. But it isn't always easy to figure out how to obtain the best performance, given the various cloud performance specs thrown around by many vendors. IT infrastructure managers can be forgiven for being somewhat perplexed.

Challenge: *Optimize cost-performance for business workloads by making sense of the infrastructure performance specifications for cloud services.*

At stake: *Without fully understanding cloud performance, organizations risk overpaying, facing an opportunity cost from overprovisioning, or losing business due to underperforming infrastructure.*

Solution: *Profile the elements with the greatest impact on each application workload's performance, and match those elements to the relevant performance characteristics of cloud services, as provided by third-party benchmarks.*

Cloud performance has a direct impact on what you spend on compute resources, how you decide the right host for your workload, and how you choose to scale when the need arises. If a crush of business activity at the end of the month jams your database server with last-minute orders, you want that server to be highly responsive. Satisfying that need requires having a database server that can perform well under a heavy load. This makes perfect sense, but it's also where IT managers can misunderstand what really matters when it comes to performance in the cloud. What is it we want when we say we need "performance"? Adding processing capacity increases costs, as does adding speed. The faster you want it, the more it will cost.

It's not that the performance specs are wrong. It's just that performance is only relevant in the context of specific application workloads. Decisions

on performance should relate the meaningful system characteristics of the cloud services under consideration to the specific applications your organization intends to deploy to the cloud.

This paper initiates that conversation, using benchmarks from independent third parties to discuss cloud performance from the perspective of businesses seeking value for their application workloads.

Best Practice: Profile Your Performance Needs

As we've said, optimal cloud performance requirements will depend on your application workloads. The best practice is to look at specific performance characteristics for cloud infrastructure relative to the mix of requirements for your unique application.

For example, an ERP and general ledger system will require high levels of CPU use at certain peak periods, coupled with relatively high database server input/output (I/O). Such a system would be constrained by input/output operations per second (IOPS). In contrast, a graphically-rich system, such as a streaming server, may have intense CPU needs, use large volumes of network traffic, and tax physical memory — yet be quite light in IOPS.

To the extent possible, it's also important to incorporate future cloud infrastructure needs into your performance analysis. It's tempting to spec out cloud servers for an individual project in the near term, but this is not always the right approach. Ideally, you will work through how your cloud server requirements are likely to evolve over time. This might mean simply affirming that you don't know what the requirements will be. Even that insight implies a direction: It will point you toward cloud resources that auto-scale up and down or are flexible enough to adapt to whatever spectrum of need you identify for your near-future requirements.

Finding the Right Cloud Partner

The right cloud partner for your organization will emerge once you have profiled your cloud workloads. With cloud platforms offering a variety of performance characteristics, management capabilities, and configuration

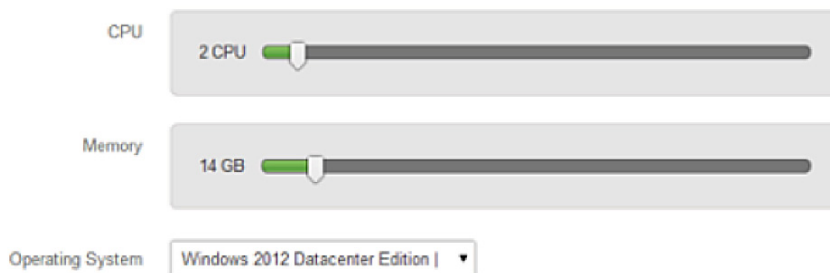


Figure 1 – CenturyLink Cloud's server configuration slider enables you to adjust CPU and memory levels to fit your workloads at any given time.

options, the service that works for company A might not be right for company B. Often, you will face a paradox of choices in cloud servers. The best fit could require a compromise, such as taking excess RAM to get the number of CPUs you require.

CenturyLink Cloud removes the need for this compromise with two flexible servers, Standard and Hyperscale.

CenturyLink Cloud mimics the way traditional servers are configured, so users can pick the amount of CPU and memory that makes sense, as well as the CPU SKU they want for a given performance level.

Figure 1 shows the administration controls that let you pick your preferred levels of CPU and memory — and change levels as evolving circumstances dictate.

If built-in data redundancy doesn't matter, but reliability and high performance does, you could select Hyperscale servers powered by Intel® Cloud Technology, which deliver scalability and secure handling of big data workloads. Hyperscale servers featuring Intel® Solid-State Drives (Intel® SSD) deliver the high-end flash storage these applications demand. CenturyLink Cloud's Standard server has the same CPU, RAM, OS, and configuration.

As Figure 2 shows, Hyperscale servers offer I/O performance that is three to five times higher than that of the standard server.¹ On the other hand, if you need strong, consistent performance but want daily storage snapshots and a SAN backbone, the Standard server would be better.

The results of valid performance tests can help you understand how best to scale an application. Should you add more capacity to a virtual machine (VM), or do you need to add VMs to the environment? That's a tough question to answer without understanding how the cloud platform will respond to capacity changes. Fortunately, scaling out doesn't always have to be your first response to the need for more capacity. CenturyLink's Hyperscale servers scale out and up, enabling you to add resources to a running VM. This is valuable because you can evaluate the change in performance before deciding if scaling out to new hardware is necessary. The results are simplified infrastructure and lower costs.

Recent reports commissioned by CenturyLink from the independent research firms Cloud Harmony and Cloud Spectator examined how well CenturyLink Cloud stacks up against other cloud players. Cloud Harmony measured the I/O profile for 16K and 64k blocks, which are relevant for workloads using Microsoft SQL Server databases. Those workloads should run on a cloud with persistent storage and high performance for the large blocks, but no charge for IOPs. This will result in predictable costs, with fewer resources needed to achieve optimal performance.

Summary Disk Scores: CenturyLink Cloud Standard vs. Hyperscale Servers

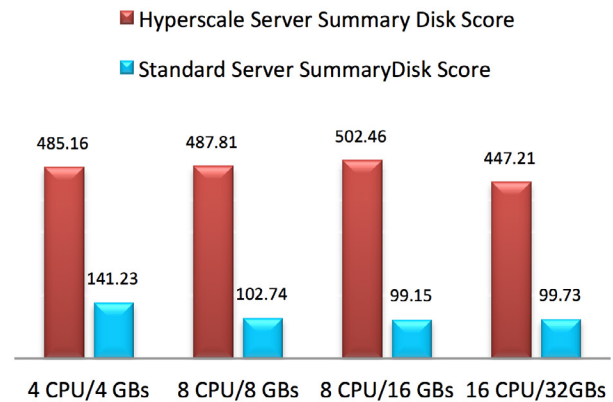


Figure 2 - Cloud Harmony Summary Disk Performance Benchmark, comparing CenturyLink standard servers to Hyperscale servers.

(The Summary Disk Performance Benchmark measures disk IOPS and IO consistency relative to a bare-metal baseline. The metric is derived 50% on IOPS and 50% on IO consistency. The summary metric is derived from 36 IO workload with a ratio of 80% reads and 20% writes.)

¹ Software and workloads used in performance tests related to Intel products may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Tests were performed on cloud-based servers with 2, 4, 8, and 16 cores. The CenturyLink Cloud standard server was powered by an Intel® Xeon® E5-2680 2.70GHz. The CenturyLink Hyperscale server was powered by an Intel® Xeon® E5-2650 v2 2.60GHz. Competitor servers ran Intel® Xeon® E5-2680 v2 2.80GHz and Intel® Xeon® E5-2670 2.60GHz processors. The reference system used in the research was a bare-metal (non-virtualized) Dell M610 PowerEdge server. This server had two Intel® X5650 2.66 GHz CPUs (12 cores total), 48 GB DDR3-10166 memory, and a Seagate SAS 2.0 10k RPM drive dedicated for testing.

Using benchmark tests over multi-day test periods, the research shows that CenturyLink's Hyperscale servers running on the most advanced Intel® Xeon® E5 2600 v2 processors outperform comparable offerings from competitors on CPU performance and disk read for 16K and 64K blocks. Table 1 summarizes the findings, including that CenturyLink Hyperscale offers a CPU performance advantage of between 136% and 211%, a 16K disk read advantage of between 319% and 343%, and a 64K disk read advantage of between 409% and 430%.²

CenturyLink Hyperscale vs. Competitors	2 Cores	4 Cores	8 Cores	16 Cores
CPU Performance: CenturyLink Performance Advantage	212%	167%	136%	136%
Disk Performance, Random 16K Blocks: CenturyLink Performance Advantage	319%	343%	329%	332%
Disk Performance, Random 64K Blocks: CenturyLink Performance Advantage	427%	430%	423%	409%

Table 1 – Summary of independent research comparing CenturyLink Hyperscale servers with comparably configured servers from cloud service competitors.³

The Performance-Cost Connection

Although the performance metrics shared in this paper only represent a snapshot in time, they can be extrapolated to help you think through your overall infrastructure needs and plan for spending in a predictable way. It's easy to overspend by overprovisioning. By right-sizing your workload, you can avoid over-provisioning. Alternatively, on some workloads, it might make sense to use a premium instance to get faster results, paying only for what you use and thereby likely reducing overall cost.

The Geekbench⁴ testing process enables you to measure server performance from different cloud providers using a common benchmark. The process allows you to compare costs of virtual machines that deliver a given level of performance. The research reveals that CenturyLink's Hyperscale servers save infrastructure managers money by delivering the same level of performance on lower-priced servers. For example, to attain a Geekbench score of 9,000, you could use the 8 vCPU server from a competing service or the 4 vCPU from CenturyLink.⁵ The CenturyLink 4 vCPU option offers a System Score of 9,538⁶ and is less expensive to use than the 8 vCPU server from the competitor.

² Cloud Harmony and Cloud Spectator independent research on CenturyLink Hyperscale server performance. Figures based on relative performance of CenturyLink Hyperscale server versus competitor average. <http://go.centurylinkcloud.com/CloudHarmonyReport>

³ Cloud Harmony and Cloud Spectator independent research on CenturyLink Hyperscale server performance. <http://go.centurylinkcloud.com/CloudHarmonyReport>.

⁴ <http://www.primatelabs.com/geekbench/>

⁵ Cloud Harmony and Cloud Spectator independent research on CenturyLink Hyperscale server performance. <http://go.centurylinkcloud.com/CloudHarmonyReport>

Competitive services enable you to scale your vCPUs up and down as required. But with CenturyLink, you can use the simple “slider” shown in Figure 1 to modify your CPU and memory levels at will. With most competitors, you have to spin up a new server instance with the higher vCPU levels while spinning down the existing instance. For administrators, this is more complex, time consuming, and error-prone.

Conclusion: Making the Right Call on Cloud Performance

To gain confidence in planning your cloud infrastructure, it’s important to profile the detailed requirements of your application workload, understanding where and when you need performance — and measuring performance along all the dimensions that matter.

Performance in the cloud goes beyond just CPU and RAM. It’s also about the speed of disk reads for different block sizes. It’s about integer processing, as found on the most advanced Intel® processors. It’s about systems that run, stay up, and are elastic, scaling up and down in response to demand. And, of course, it’s about cost. From a self-profile, you can move to selecting the right cloud partner for your specific workloads.

To help you make the right call on cloud performance, two independent research firms tested CenturyLink Cloud servers against comparable offerings from other major cloud providers. The data reveal that CenturyLink Cloud’s Hyperscale SSD server powered by Intel® Cloud Technology delivers consistently higher levels of performance for CPU, disk read, and integer processing across multiple CPU and vCPU configurations.⁷ In addition, CenturyLink Cloud’s ability to adjust CPU and memory levels on the fly, without spinning server instances up or down, enables flexibility in deployment that ensures the right level of performance without overspending.

About CenturyLink Cloud

CenturyLink Cloud, from CenturyLink Technology Solutions, is the complete platform to easily manage your entire business application portfolio, from development to business-critical workloads. CenturyLink Cloud offers high-performance, scalable, self-service virtual machines across our global network of data centers, including Hyperscale servers powered by Intel® Cloud Technology for distributed workloads that require maximum performance.

And CenturyLink Cloud provides built-in automation, orchestration, and management tools for an IT-ready and developer-friendly platform that is flexible, scalable, cost effective, and highly manageable.

Further details can be found at www.centurylinktechnology.com/financial-services

⁶ Ibid

⁷ See Footnote 1 for configuration of test servers.

About CenturyLink Technology Solutions

CenturyLink Technology Solutions delivers innovative managed services for global businesses on virtual, dedicated, and colocation platforms. It is a global leader in cloud infrastructure and hosted IT solutions for enterprise customers. Parent company CenturyLink, Inc. is the third-largest telecommunications company in the United States, and empowers CenturyLink Technology Solutions with its high-quality advanced fiber optic network. Headquartered in Monroe, La., CenturyLink is an S&P 500 company and is included among the Fortune 500 list of America's largest corporations.

For more information, visit www.centurylink.com/technology.

About Intel

Headquartered in Santa Clara, Calif., Intel today has more than 100,000 employees in 63 countries and serves customers in more than 120 countries. Intel designs and manufactures a variety of essential technologies, including microprocessors and chipsets, and the additional hardware, software, and related services that together serve as the foundation for many of the world's computing devices.

Over the last decade, Intel has evolved from a company that largely serves the PC industry to a company that increasingly provides the vital intelligence inside all things computing. In fact, one-third of Intel's revenue is associated with products beyond the PC. Hardware and software products by Intel and subsidiaries such as McAfee power the majority of the world's data centers, connect hundreds of millions of cellular handsets, and help secure and protect computers, mobile devices, and corporate and government IT systems. Intel technologies are also inside intelligent systems, such as in automobiles, automated factories, and medical devices.

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