

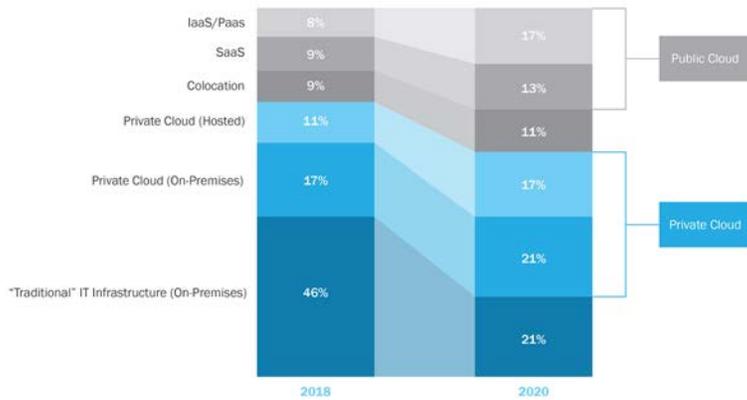
NAVIGATING THE HYBRID CLOUD

>> A guide to distributing workloads to achieve the best price, performance, and security.



Technology, meet Humanity.
opus:interactive

Cloud Based IT is becoming the 'new normal'



451 Research - HCTS 2018

HYBRID IS THE NEW NORM.

Right sizing and distributing workloads across a hybrid environment makes all the difference for performance, cost, security, and scale. But not every cloud is the right cloud.

In a recent 451 Research survey, 20% of companies surveyed reported that cost drove them to move one or more of their workloads from public clouds to private clouds. Similarly, IDC reported that 53% of enterprises were – or were considering – bringing their workloads back on premises. Top reasons for cloud “repatriation” include performance/availability issues, data sovereignty, regulation changes, on-prem and private cloud environment improvements, and high costs.

Enterprises are increasingly adopting a hybrid approach that includes public cloud, private cloud, colocation, and on-prem infrastructure. A study by Forrester showed that organizations are deploying between one and three of each type of cloud platform on average (i.e., hosted private cloud, internal private cloud, and public cloud).

To provide visibility into how each cloud service performs across the hybrid mix, Opus Interactive commissioned third-party, Cloud Spectator, to test and compare the OpusCloud, Azure, and AWS.

The OpusCloud is housed inside Tier III datacenters located in Stack Infrastructure in Oregon, and Iron Mountain’s FISMA High facility in Virginia. Results of the third-party testing revealed Opus’ Eastern US VM performance was superior in all measured VM performance dimensions and achieved **top price-performance values in five of six of the performance criteria**. Opus’ Western US VM performance was superior across all measured VM performance dimensions.

“The careful planning and advanced technology used in development of its OpusCloud platform positions Opus as a world class Cloud Service Provider capable of meeting the demands of business and enterprise clients already working within or considering migration to the cloud sphere.”

- Cloud Spectator



SAVE ENERGY - SAVE MONEY. Energy costs and efficiency matter. An optimized workload that operates on efficient equipment housed inside of a low PUE facility located in an area with low power costs saves energy and delivers cost savings.

FINDING YOUR HYBRID MIX

Infrastructure is complex. Legacy systems that worked within on-prem, cloud, or colocation environments are being replaced by new systems that disperse workloads across a mix of hybrid and multi-cloud networks.

Understanding which environments are best for streaming, collection, compute, and storage workloads can make all the difference for cost and performance. And, ensuring that you can connect, map, manage, and monitor your multi-cloud and hybrid environment involves key considerations:

- **Existing infrastructure and workload requirements.** Conduct a thorough audit of utilized resources and where they are currently being housed. Take note of existing workflow issues, equipment leases, software licenses, and hours needed to monitor and manage the existing infrastructure and network. Define what resources or processes need to improve.
- **Security and compliance.** Consider what sensitive data and processes are in your environment and what levels of security and compliance are needed. Some of your data may need to be secured with HIPAA, PCI-DSS, or FedRAMP compliance. Who needs access and to what extent? Access can be as light as an on-prem location for your equipment, or as stringent as FedRAMP-High compliance inside of FISMA-High Secure facilities with grid-redundancy.
- **Facilities.** Every datacenter is different. Understand how they differ and how those differences will impact price, performance, security, and reliability for your organization. When selecting a facility, consider interconnected facilities and global access, PUE, renewables, grid redundancy, hyperscale network access, security, certifications, network proximity, and geographic location.
- **Hybrid cloud monitoring & management.** In a multi-cloud environment, your business only performs as well as what you can see. Invest in management tools that provide comprehensive visibility to ensure your resources are working optimally and properly interacting with other applications and services.



TIPS FOR CONTROLLING HIDDEN CLOUD COSTS:

- **Keep some workloads on-prem.** Performance-intensive applications such as video editing are not suited to the cloud, nor are other types of software that require high-performance desktop computers (such as those used for graphic design).
- **Factor in applicable egress fees.** If your business involves transferring large amounts of data, be aware that while transferring data to the cloud is free, outbound data transfers over the basic monthly allowance are charged on a per GB basis with many providers.
- **Factor in applicable support costs.** When weighing options, look closely at tiered pricing plans and details like overage and support plans. Consider current and possible future expansion.
- **Consider uptime and SLAs.** Not all SLA's are the same. Make sure that the service provider you are choosing has an SLA that matches the uptime requirements of your application, without costing you more money. When does the SLA kick in? How many nines of availability are they offering? What's the time to resolution and response time? And, what support and escalation options are available?
- **Avoid vendor lock in.** Build your applications and/or data formats to allow easy transfer/conversion of information into other systems, vs. models that lock you into any specific vendor.
- **Invest in business continuity.** Outages happen. Adopt a backup and disaster recovery strategy to protect your servers, data, and environment.

FINDING YOUR HYBRID MIX (contd.)

There is no shortage of providers and solutions. Understanding your needs and the benefits of each is key.

A hybrid mix distributes your workloads between on-prem, colocation, private cloud, public cloud, and multicloud solutions. Use the public cloud for high-volume websites and applications that need to be distributed across many continents and have large unpredictable spikes in traffic, and the private cloud (or other on-premises infrastructure) for sensitive, business-critical operations like financial systems.

Public cloud benefits:

- **Lower costs**—no need to purchase hardware or software. Pay only for the service you use
- **No maintenance**—your service provider completes maintenance
- **Near-unlimited scalability**—on-demand resources are available
- **High reliability**—vast network of servers and availability zones ensures against failure

Private cloud benefits:

Hardware, data storage and network is dedicated to a single organization and can be architected to assure high levels of security and performance

- **More flexibility**—your organization can customize its cloud environment to meet specific business needs
- **Improved security**—resources are not shared, so higher levels of control and security eliminate “noisy neighbor” impacts
- **High scalability**—generally as scalable and efficient as public cloud

Hybrid cloud benefits:

Allows data and applications to move between private and public clouds for greater flexibility and more deployment options

- **Control**—you can maintain a private infrastructure for sensitive assets
- **Flexibility**—you can take advantage of additional resources in the public cloud as needed
- **Cost-effectiveness**—with the ability to scale to the public cloud
- **Ease**—transitioning to the cloud doesn't have to be overwhelming because you can migrate gradually—phasing in workloads over time



ABOUT OPUSCLOUD

Launched in 2005, OpusCloud is a robust private cloud offering built on HPE's award winning server and storage hardware combined with VMware's compute, storage, and networking virtualization solutions.

The OpusCloud is HIPAA and PCI-DSS compliant, and offers an architecture you can trust, engineered from the ground up for high-performance, incredible flexibility and extreme resilience - housed inside of state-of-the-art facilities.



What differentiates OpusCloud from Azure and AWS? Cloud Spectator identified the primary drivers for Opus' strong performance as threefold:

- 1. Impressive CPU and Memory performance**
- 2. Superb storage random read and write performance**
- 3. Excellent Price-Performance results**

OpusCloud is available as single virtual machines (VMs), multiple VMs, or entire virtual datacenters, giving you the flexibility to build and scale as needed.

Benefits include:

- Faster application deployment
- Greatly improved performance
- Streamlined operations made possible through integrated automation
- An innovative IT infrastructure that's easier to manage and less costly to own
- A better user experience with fast response times and continuous availability that users need to do their jobs

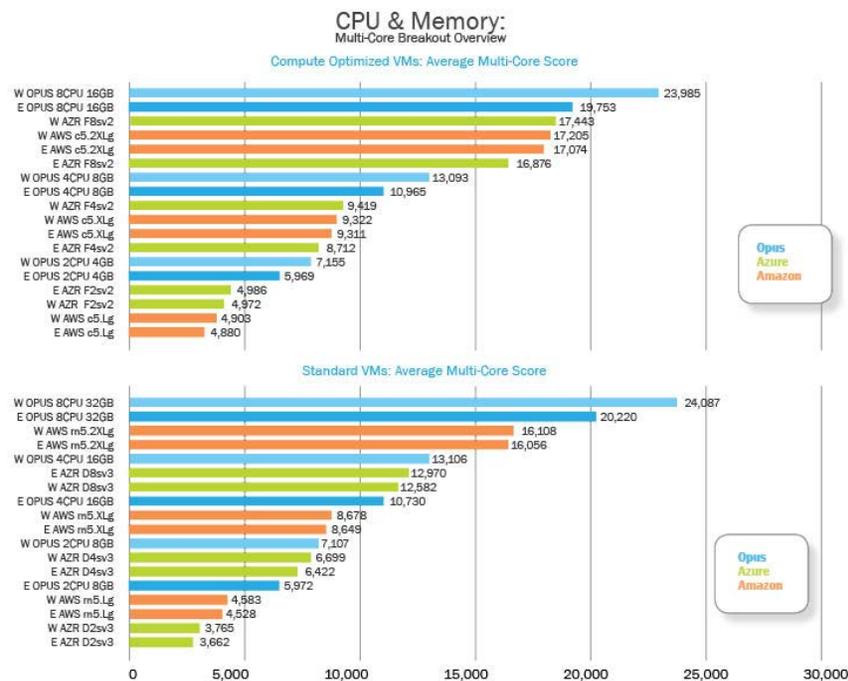


CPU

Most enterprise production scenarios utilize multi-core VMs. In the third-party testing, **Opus VMs outperformed AWS and Azure VMs in each size class.**

Opus VMs displayed excellent performance value in all observed performance dimensions. Opus' CPU multi-core performance was exceptional, with performance advantages reaching a maximum of 95% in 4 vCPU standard class, and achieving an average performance advantage of 56% across all tested VMs.

- Opus' compute-optimized, 2, 4 and 8 vCPU VMs outperformed rival offerings in both classes, including Amazons current c5 and m5 VMs as well as Azure's Fsv2 and Dsv3 series machines.
- Opus Interactive's offerings were dominant, particularly in their multi-core performance, with smaller machines occasionally outperforming rival VMs configured with double the available resources e.g. vCPU and RAM. Additionally, Opus achieved the highest performance gains within the test group when switching from single-core to multi-core workloads. This may indicate Opus' use of advanced underlying optimization approaches.

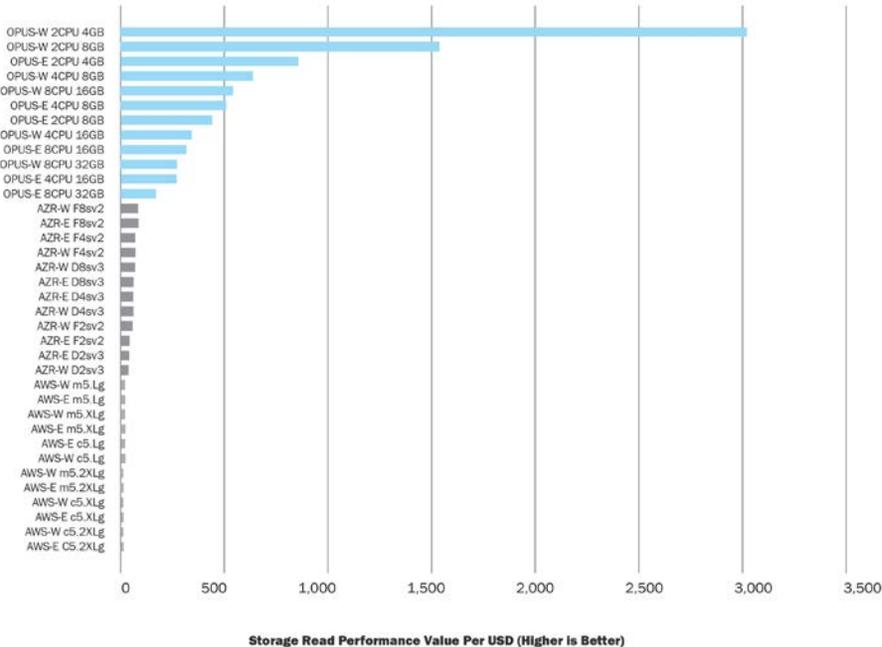


STORAGE

Storage performance for how fast your applications can read and write the data is critical to overall performance. Opus' read speed was impressive, **exceeding 165,000 IOPs (input/output operations per second)**, while write speeds peaked at ~18,500 IOPs. The third-party findings recorded OpusCloud with a raw read performance advantage of **up to 172x faster at maximum than AWS and Azure**. Opus VMs also outperformed write speeds for both hyperscale solutions.

- Opus Interactive's read performance exceeded Amazon Web Service's EBS and Azure's Premium LRS for each size and both classes of VMs. Read performance displayed performance gains ranging from ~7x to over 127x depending on VM matchups.
- For random 4K write performance, Opus continued to achieve the highest raw scores, outpacing rival offerings by a minimum of 69% within the 8 vCPU compute-optimized category and peaking at over 123x faster among 2 vCPU offerings.

Price Performance
Storage: Read
ALL VMS: STORAGE READ PERFORMANCE PER DOLLAR





PRICE-PERFORMANCE

Price-Performance, measures overall value of performance divided by operating costs. Opus' computational and storage **price-performance values were universally superior in the compute-optimized category**, with 2, 4, and 8 vCPU offerings taking the top three spots for CPU value. Additionally, each standard VM offered by Opus displayed the highest in price-performance value in their respective size classes. Storage read and write values showed similar, if not more pronounced dominance, from Opus' block storage as contrasted with AWS'S EBS and Azure's Premium LRS options. **Opus achieved unrivaled performance and value among the latest offerings from two of the largest Cloud IaaS providers – AWS and Azure.**

- Opus' standard and compute-optimized VMs achieved the highest price-performance value for each test performed, often by a significant margin.
- Opus VMs garnered the highest price-performance value primarily due to impressive compute performance, indicative of tuned virtualization technology and superior hardware or implementation.
- While other providers may have had lower pricing for certain VMs, those machines were unable to deliver equally-adjusted performance, resulting in lower calculated price-performance value.



SOLUTIONS EXAMINED

AMAZON AWS
MICROSOFT AZURE
OPUSCLOUD

LOCATION

OREGON
NORTHERN VIRGINIA

DURATION OF THIS STUDY

48 TOTAL HOURS ON
2 DIFFERENT SETS OF
VIRTUAL MACHINES -
EACH TESTING FOR 24
HOURS.

To view the full Cloud Spectator report,
contact sales@opusinteractive.com.

CONCLUSION

Navigating the hybrid cloud space is complex. Performance in the industry cannot be assumed to be equal or even similar. When examining processor and memory bandwidth performance, tiered providers such as AWS and Azure have varying performance depending on the family/series of the VM, despite having equivalent amounts of vCPUs and similar amounts of memory.

In order to achieve the amount of IOPs performance that your application needs on the AWS and Azure you are required to buy larger VMs than you need. With OpusCloud you can right size your VM and maximize your budget by right-sizing your workload.

About Opus Interactive

Founded in 1996, Opus Interactive has earned a reputation for custom hybrid cloud solutions that fit unique requirements for security, scalability, cost, and future growth needs of its customers. An accredited member of the International Managed Services Provider Alliance, the Company operates from Tier III+ data centers located in Hillsboro, Portland, Dallas, and Northern Virginia. Through close partnerships with industry-leaders and a commitment to customer satisfaction, Opus offers Hybrid Cloud & IaaS (with IaaS, Object Storage, and Virtual Desktop Infrastructure), Enterprise Colocation, IT Services, Network Connectivity, DRaaS & Backup, and Hybrid Cloud Monitoring & Management.

Opus Interactive is a woman and minority-owned enterprise that has worked closely with VMware and HPE partnership programs since 2005. With past performance that includes more than 20 years of proven results and current compliance with PCI-DSS, HIPAA, and SSAE 18 SOC 2, Opus helps customers reduce cost and optimize resources using efficient operations. For more information please visit opusinteractive.com.

About Cloud Spectator

Cloud Spectator is a cloud analyst agency focused on cloud Infrastructure-as-a-Service (IaaS) performance. The company actively monitors several of the largest IaaS providers in the world, comparing VM performance (i.e., CPU, RAM, disk, internal network, and workloads) and pricing to achieve transparency in the cloud market. The company helps cloud providers understand their market position and helps business make intelligent decisions in selecting cloud providers and lowering total cost of ownership. The firm was founded in early 2011 and is located in Boston, MA.

For questions about this report, to request a custom report, or if you have general inquiries about our products and services, please contact Cloud Spectator at +1 (617) 300-0711 or contact@cloudspectator.com.



What you get when you choose Opus Interactive as your hybrid cloud and colocation provider.

At Opus Interactive we appreciate the fact that you have a choice of service providers. We are also confident that if you choose us as your hybrid cloud provider, you'll discover a number of reasons why you made the right choice.

✓ OUR CUSTOMIZED APPROACH

We understand that each customer has unique needs. So, beginning with initial contact we work with you to understand your business requirements and goals and then design solutions that deliver.

✓ OUR DEDICATED EXPERTISE

Our team of experts is committed to working closely with customers in order to engage the best innovative technology to solve problems and drive business success.

✓ OUR CERTIFICATIONS

Opus Interactive is experienced in the programs, systems, and technologies that businesses depend on the most. We're a proud member of world-renowned IT organizations and have invested the time and energy to offer you business-critical compliance requirements, including SAS70/SSAE 16, PCI-DSS and HIPAA.

✓ OUR PARTNERSHIPS

We're proud to be associated with leading companies that are known for quality and reliability. We believe that the very best solutions require the best technology, including both hardware and software products and services that have been tried and tested.

✓ OUR PREMIUM FACILITIES

Opus Interactive combines class leading hosting facilities with our own highly resilient network offering the perfect environment for your IT infrastructure. Connect your on-premises network and securely deliver your workloads to AWS Direct Connect and Azure ExpressRoute with our low-latency private connection.

✓ OUR CUSTOMER COMMITMENT

From CEO to support technician, our team is made up of experts in cloud and colocation services who are dedicated to delivering what you need, when you need it.

Hybrid Cloud & IaaS • Enterprise Colocation • IT Services • Network Connectivity •
DRaaS & Backup • Hybrid Cloud Monitoring & Management



23+
YEARS

600+
CUSTOMERS

6
NETWORK
FACILITIES*

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* Facilities include: Stack Infrastructure Oregon, Tata Communications Oregon, Iron Mountain Virginia (FISMA High), Databank Texas, Pittock Internet Exchange - Network Only, EdgeConnex - Network only.