Cloud Computing

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Cloud

- Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned.

- Services are dynamically provisioned and presented as one or more unified computing resources based on **service-level agreements (SLA)** established through negotiation between the service provider and consumers.

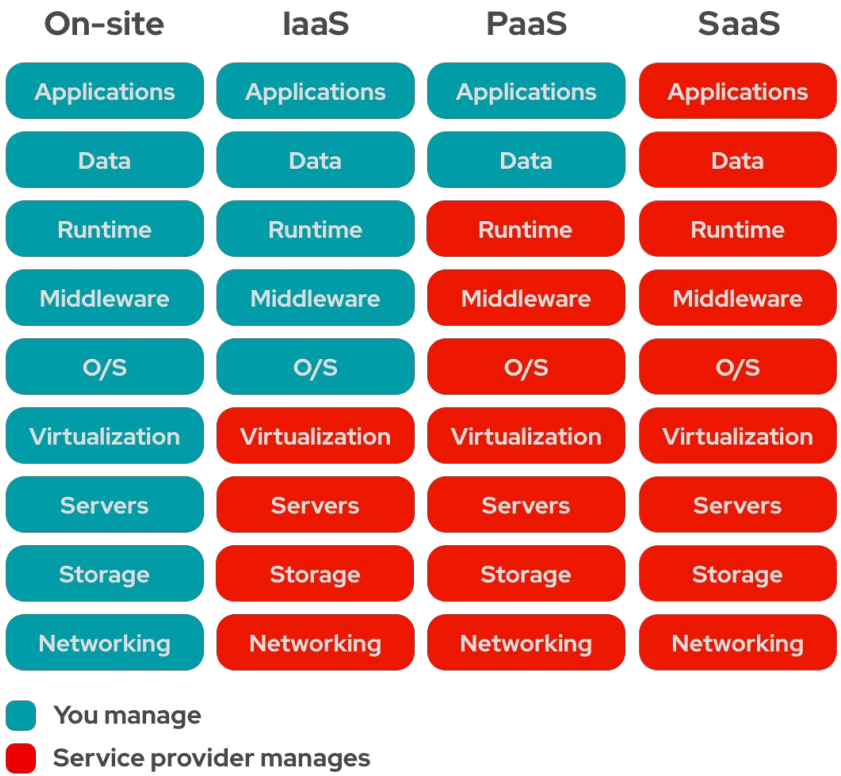
Types of Cloud Computing

- **Private clouds:** cloud environments solely dedicated to a single end user or group
- **Public clouds:** ran off-premises services.
- **Hybrid clouds:** IT environment created from multiple environments connected LANs,WANs and/or VPNs. Contains at least one private cloud and at least one public cloud
- **Multiclouds:** are a cloud approach made up of more than 1 cloud service, from more than 1 cloud vendor—public or private. All hybrid clouds are multiclouds, but not all multiclouds are hybrid clouds. Multiclouds become hybrid clouds when multiple clouds are connected by some form of integration or orchestration.

Cloud computing Services

Cloud services are infrastructure, platforms, or software that are hosted by third-party providers and made available to users through the internet. There are three main types of as-a-Service solutions: IaaS, PaaS, and SaaS.

Cloud computing Services



MISCONCEPTIONS ABOUT PERFORMANCE IN CLOUD

1. VM performance is the same from CSP to CSP. => differences in the underlying hardware, architecture, and performance tuning lead to entirely different results from the same terms such as vCPUs
2. For performance, you get what you pay for. => When it comes to additional services such as support, security, geographical location, and managed services on CSPs, this may be true; however, regarding performance, there is no always correlation between price and performance.
3. Resource contention, known colloquially as the Noisy Neighbor Effect, is not a concern with most providers. => With a lack of understanding of other users' activities, resource-hogging applications can affect the performance of other VMs on the host machine.
4. If Noisy Neighbor is a concern, then performance is too unpredictable. => Performance throttling to deliver a consistent user experience regardless of the actual user load on the physical machine.

Price-Performance Analysis of the Top 10 Public IaaS Providers

- Measures and ranks CSPs using a performance and price-performance methodology specifically for the purpose of measuring cloud environments.
  - **Performance Index** is calculated by indexing the individual performance scores achieved by each VM category (categorized as Small, Medium, Large and Extra Large) on a scale of 0-100 with 100 as the highest possible score.
  - **Variability** is calculated as the average coefficient of variation (CV), which is the standard deviation expressed as a percentage of the mean performance for the VM categories of each CSP. Higher CV correlates to more fluctuation in performance

https://cloudspectator.com/wp-content/uploads/2019/10/US-Top-10-2017-Report-Final.pdf

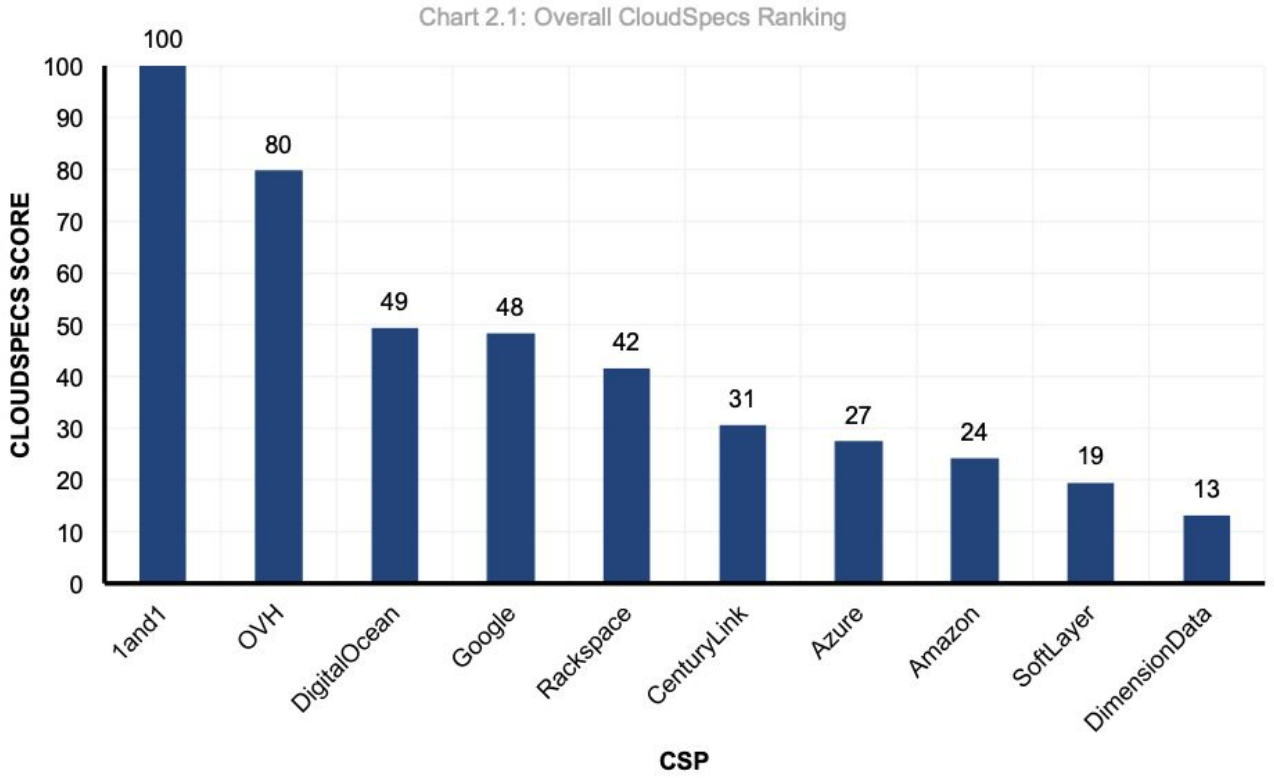
PRICE-PERFORMANCE SETUP

- Two aspects:

  (i) **VM Performance:** tests the CPU and memory on the virtual machine;

  (ii) **Block Storage Performance:** two storage scenarios were run to capture performance data: Type 1 and Type 2. In both scenarios, random and sequential IOPS were recorded as the indicator of performance over a test period of 60 seconds. Type 1 used a large file size with a small block size, while Type 2 used a small file size with a large block size.

PRICE-PERFORMANCE KEY FINDINGS



Index performance scores and variability percentage

Table 2.1: Performance and Variability of CSPs Over 24 Hours

	VM		Block Disk	
	Performance Index	Variability	Performance Index	Variability
1&1	94	6%	49	21%
Amazon*	75	1%	17	49%
Azure	92	2%	18	2%
CenturyLink	83	8%	11	28%
DigitalOcean	60	16%	48	9%
Dimension Data	89	3%	11	55%
Google	67	1%	50	3%
OVH	96	4%	33	2%
Rackspace	95	5%	90	12%
SoftLayer	79	4%	20	4%

*Amazon's disk variability is artificially high due to an initial burst period that lasted until the volume ran out of I/O credits.

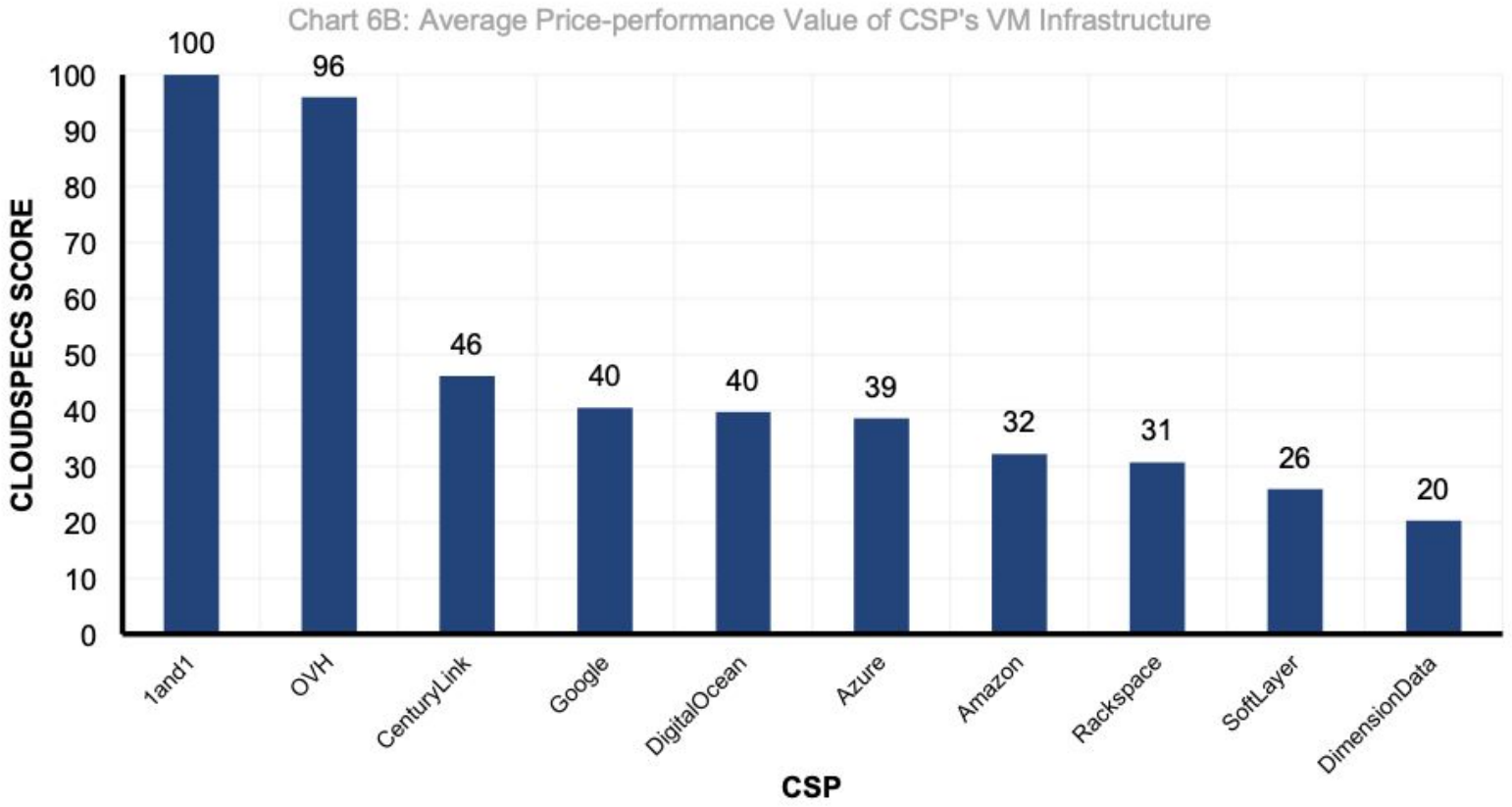
PRICE-PERFORMANCE KEY FINDINGS

Formulas (Price-Performance Value):

- *price-performance_value = [VM performance score] / [VM cost]*
- *best_VM_value = max{price-performance_values}*
- *Score^{TM} = 100*price-performance_value / best_VM_value*

- Value, defined as the ratio of price and performance varies by 7.7x across the compared IaaS providers.
- 1&1 achieves the highest CloudSpecs Score^{TM} in the Top 10 cloud IaaS providers ranking. This is due to strong VM performance and the most inexpensive packaged pricing.
- Rackspace have achieved above-average performance for VM environments, the price-performance value achieved by those types of providers were lower due to higher costs

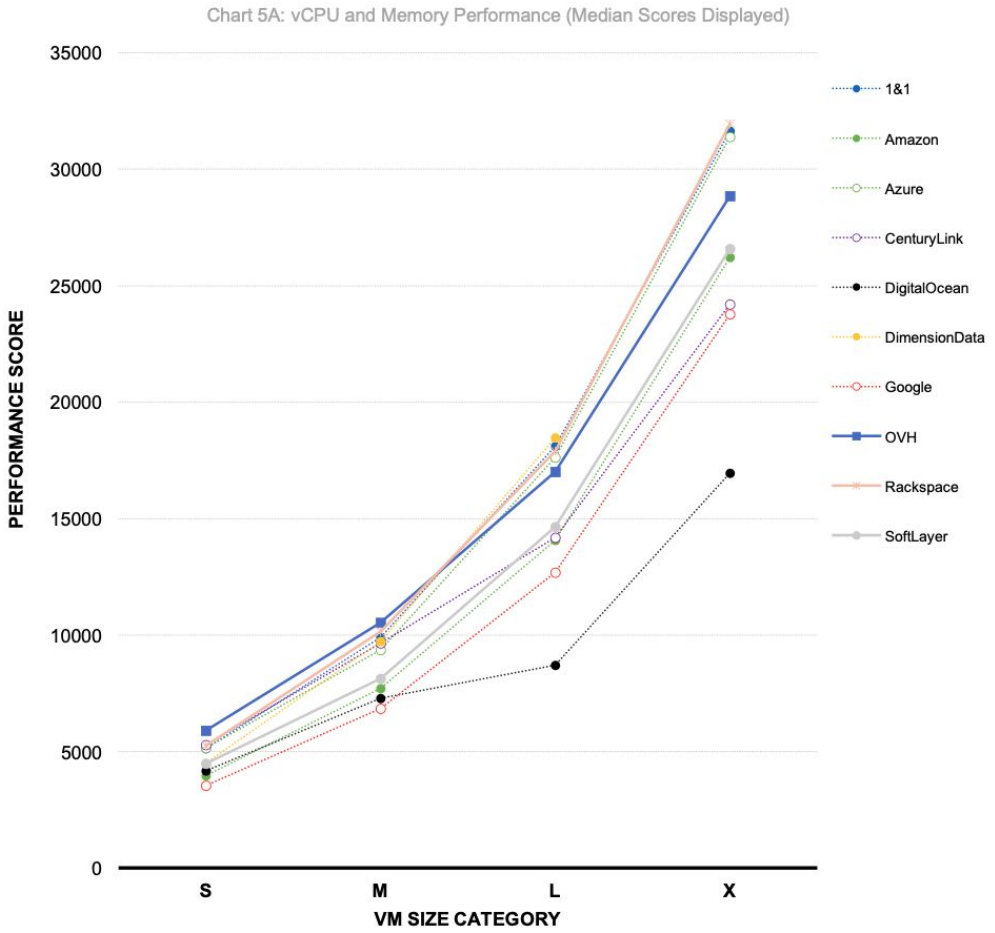
VM Performance: VCPU AND MEMORY VALUE



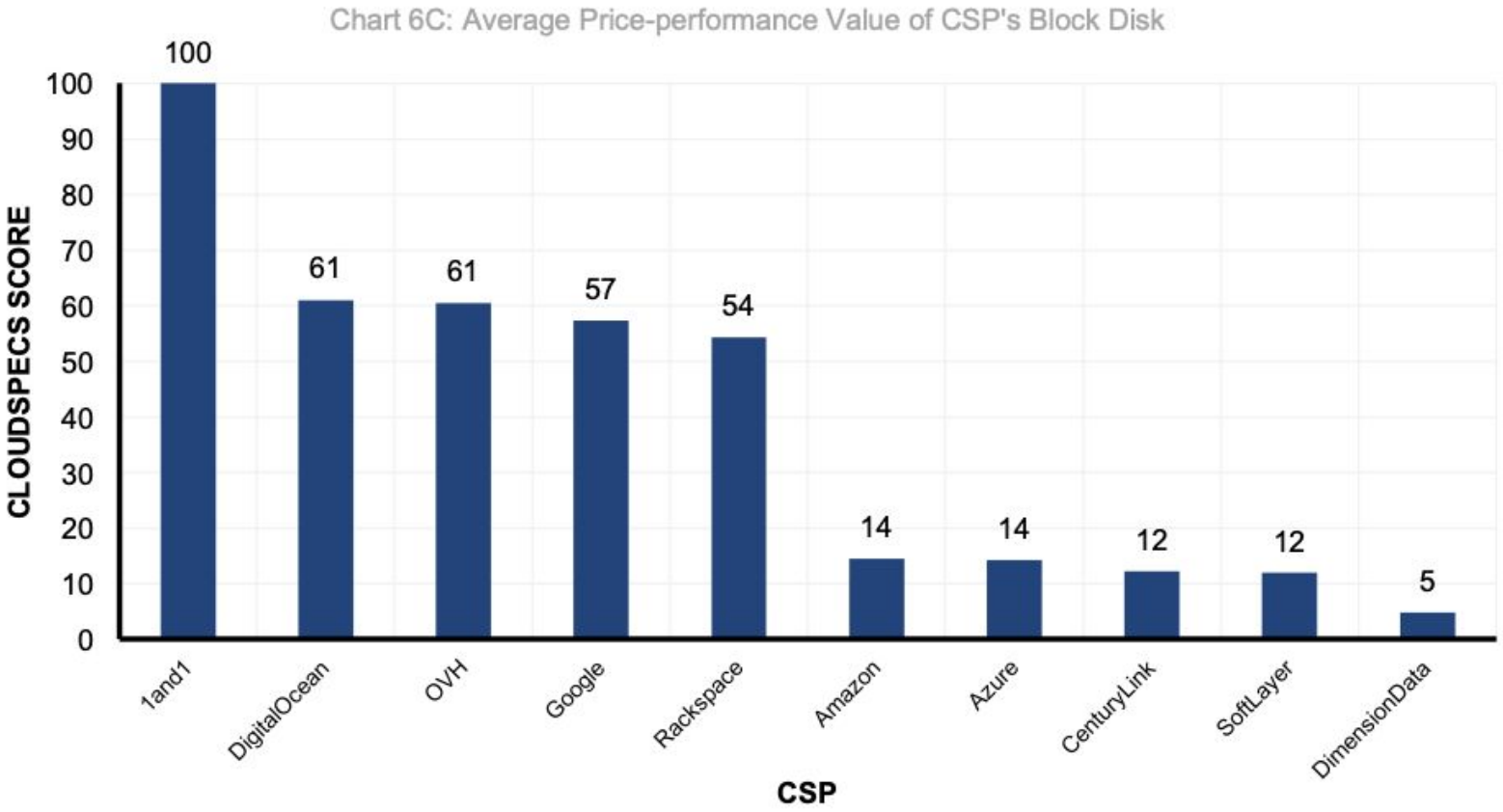
VM Performance: VCPU AND MEMORY PERFORMANCE

The Small VM category exhibits a difference of 1.7x between the highest and lowest-performing CSP VMs.

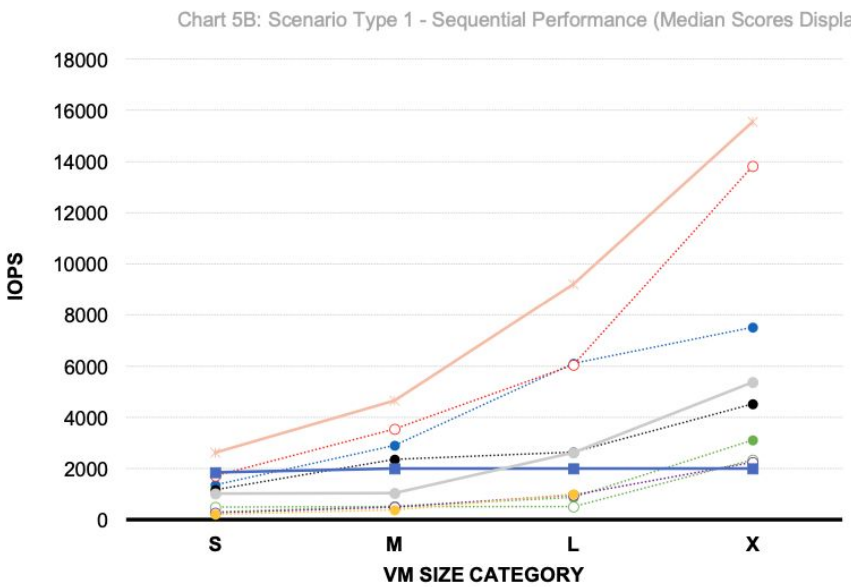
The Extra Large VM category exhibits a difference of 1.9x between the highest and lowest- performing CSP VMs.

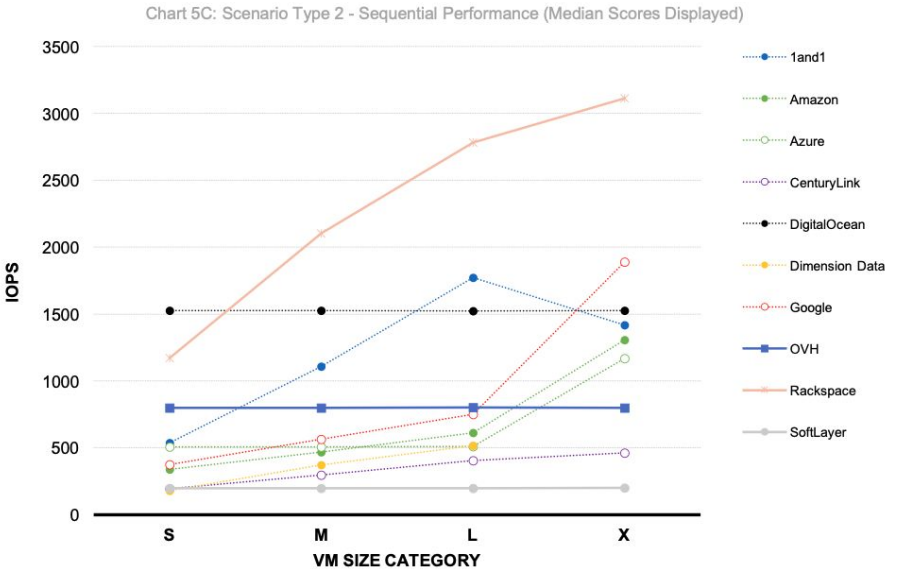


BLOCK STORAGE VALUE



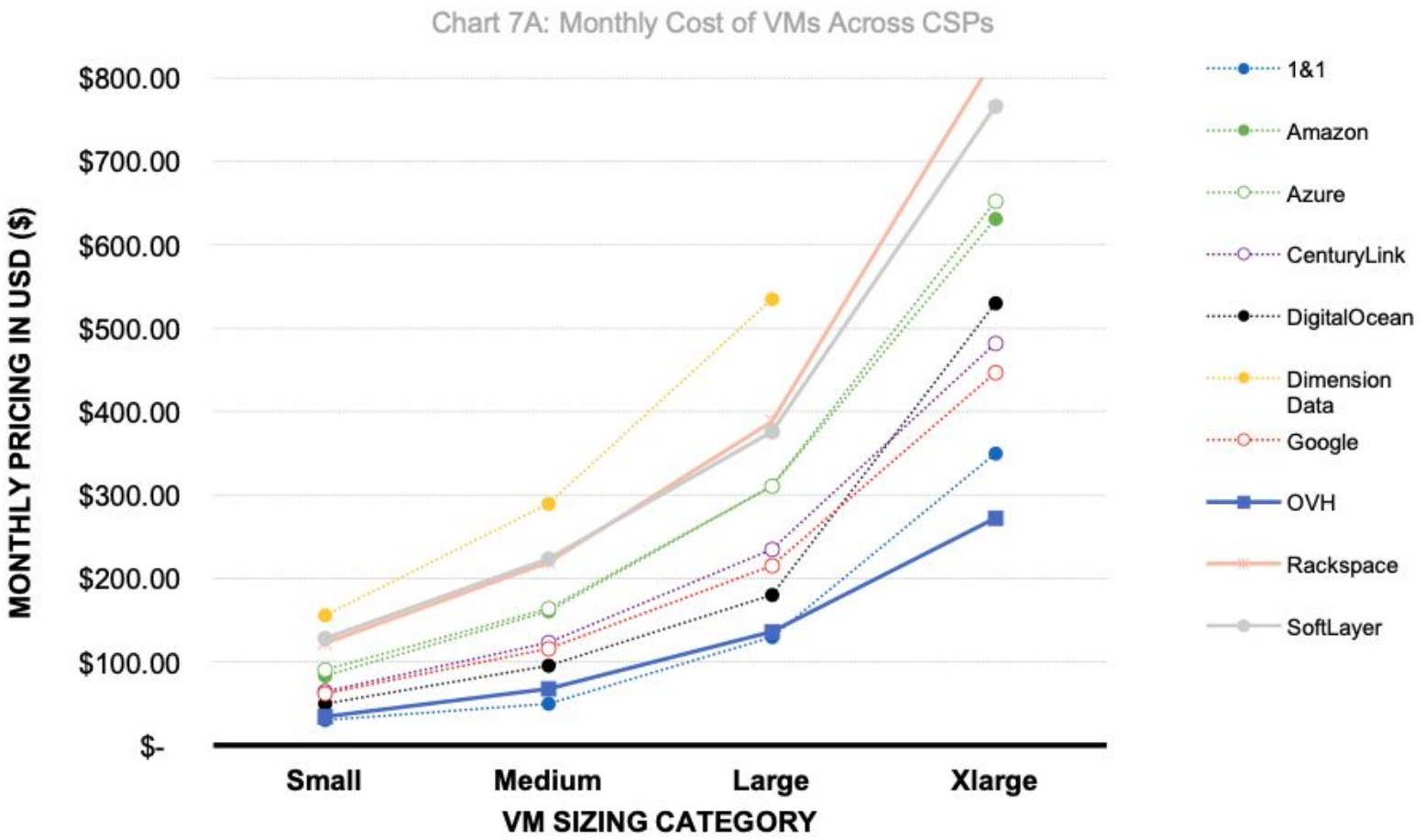
BLOCK STORAGE PERFORMANCE



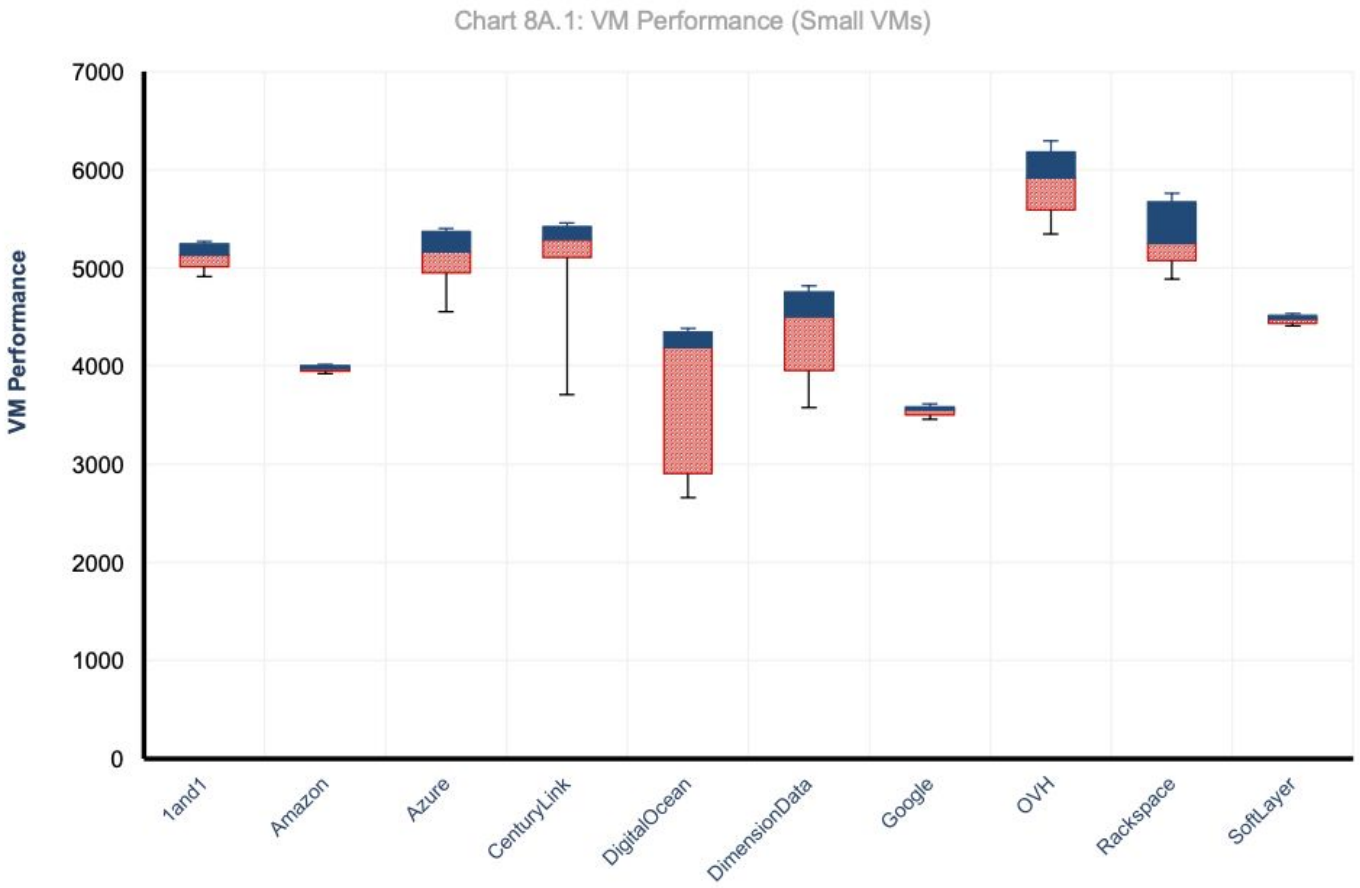


- Block storage is not created equally across CSPs in regards to hardware, architecture, or performance. A difference of more than 18x can exist between highest and lowest-performing block storage offerings across CSPs.

OVERALL PRICING



Performance and Variance



Cloud Computing Cost Analysis

Cloud computing allows your business to generate more revenue by making your employees more productive. It makes your business run more efficiently which will allow you to scale effortlessly.

You don’t have to set up any infrastructure which means no hardware costs, reduced software expenses, and cheaper maintenance.

Is Cloud Computing Really Cheaper?

It depends on your specific requirements and circumstances. How much you’ll pay for cloud computing depends on your unique cloud implementation and, to some extent, on the period of time you’ll use to measure costs.

Simple example. Your business installed on-site infrastructure 4 years ago at a cost of $50,000. Discounted over time, this infrastructure will cost you $10,000 per year for five years. You also employ a systems administrator at $3,000 per month.
This means your infrastructure costs for the next year will be $46,000.

Feature comparison: https://ilyas-it83.github.io/CloudComparer/

Lab Exercise: Cloud Computing Cost Analysis (Expenses Breakdown)

Your company needs to deploy a service. Your task is to make a decision if your company should use own on-site infrastructure/dedicated solution or a cloud solution. Your company needs to use the service for M months.

The service requires 64 servers (each server 8core, 32GB RAM) & 512TB.

Lab Exercise: Cloud Computing Cost Analysis (Expenses Breakdown)

To calculate the cost you can use the following simple formulas:

Own (month cost)

(Storage + Servers) + (sysadmin + energy cost (PUE=2.0)) * M

Rent (month cost) (Use at least two different cloud providers)

(S3 x volume + EC2 (m4.x2large)) * M

Lab Exercise: Cloud Computing Cost Analysis (Expenses Breakdown)

You can extend the formulas with additional terms. In the formulas, the price for internet, energy, networking devices is missing. Extend the formula to obtain more realistic scenario.

PUE stands for Power Usage Effectiveness - is a metric representing the ratio of total amount of energy used by a computer data center facility to the energy delivered to computing equipment. It is used to determine the energy efficiency of a data center.

PUE = Total facility power / IT equipment energy

Expected Deliverables

You need to provide an expenses breakdown based on your analysis and write a small report where you provide the following information:

1) Total Cost in both cases

2) M, the number of months after which having own infrastructure is cheaper

3) Clearly specify your assumptions (which aspects in the formula are not taken in consideration) in your analysis and specify a source on how you obtained the other data.