Don’t Take a Lemon for an Apple

Why pure price comparison alone is not leading to a good choice of a cloud provider and what is required to make a solid and sound decision.
Why you should read this

Performance of cloud services differ as do their prices. Therefore a truthful comparison of cloud services for a specific need is not straight-forward. Even recent studies from market analysts\(^1\) show only a part of the full picture which might lead to wrong sourcing decisions for cloud buyers. Bringing transparency to the cloud market is the mission of ASCAMSO. That is why we provide this booklet to

- prepare understanding what you need to consider for a fair cloud service comparison
- unveil indications that a simple price-based comparison is not sufficient for sound purchase decisions
- introduce you to the ASCAMSO initiatives to make the adoption of cloud services more efficient and more convenient

For now, we focus on Infrastructure-as-a-Service and cloud services like compute instances (virtual machines, VMs) along with their components like CPU, RAM, storage and network.

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\(^1\) s. CloudSpectator, Gartner or others
Introduction

Virtualization technology enabled the provisioning of compute resources as services. Instant and easy deployment of new capacities at time when they are needed is the promise of today’s cloud infrastructures.

Yet, as a downside, comes the intransparency of your resource configuration. You receive a virtual environment which reports components such as CPU cores, size of RAM and storage – but as you have no insight about the hardware which runs your instance, there is no easy proof of the tangible performance you can expect. In addition, you do not know how many other – foreign – instances run on the same hardware as yours and how their load demand will be at any given point in time. Indeed, research in recent years shows repeatedly, that the performance of cloud offers differ as do their prices.

To overcome that uncertainty, we conducted an extensive testing of more than 2,500 test runs at ten providers in the course of 2014. Some of our key findings are presented in this paper. Therefrom we derive some consequences for cloud service procurement:

We found that CPU performance of cloud instances differs to a large extent across providers, even though the number of cores indicate similar performance levels. Adding the cost perspective showed that cloud service consumers can end up paying three times the money for a comparable amount of computing capacity.

So if you are a buyer of cloud services, you should test the purchased services to get transparency about the product you buy from your provider. Benchmarking of cloud services from scratch causes high effort to deliver solid results: You need to identify suitable benchmarks for shared environments, find a mechanism to execute tests as well as collect and analyse results. Or you may decide to use the free ASCAMSO platform benchmarking service, which provides this for you.

Also price comparison is not as easy as it might look at first sight: Different CPU, RAM or storage sizes or obligational features complicate comparison. Even more factors have to be considered: Bundled instances or component-based pricing, Data centre location, traffic pricing, billing models, operating systems, discounts, their application conditions, so on and so forth. ASCAMSO’s mission is to resolve these worries for you. We are working to give you the tools you need for a proper assessment of your infrastructure needs and find the right partner to put them into operation.

If you are a provider of cloud services, our assessment tools can help you to get a clear picture of your strengths and weaknesses to improve your services and serve your customers with a higher and more reliable service quality.

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2 Compare e.g. Cunha et al. (2013), Gilliam et al. (2013), Silva et al. (2013)
Findings of our study

Equal number of cores – diverse performance
Looking at the available CPU capacity in a VM, our tests revealed a large spread among providers. Figure 1 to 3 show a ranking of several providers by measured performance under Linux and Windows. As we can see, for 2-core Linux VMs the best provider delivers three times more capacity than the provider with the weakest performance (Figure 1). For 8-core Linux VMs this factor increases up to 3.7 (see Figure 3).

Based on our observations, it would be necessary to purchase an 8-core system from Provider 2 while it would be enough to take a 2-core machine from Provider 6 to get almost the same compute capacity. While the latter is available for 0.15 EUR/h, you would need to pay 0.4 EUR/h for an 8-core machine to Provider 2.

Besides this, the comparison also showed an anomaly at the Windows VMs of Provider 3. At the time of our tests, this offer has been new to the market and most probably over time this impressive lead will decrease with more customers sharing the available underlying hardware resources. But for a certain time frame you could make a very good deal in deploying Windows services with Provider 3. Being aware of such insights you would be able to optimize purchasing according to your needs.
Figure 1 Provider performance comparison @ 2 cores 8 GB

Figure 2 Provider performance comparison @ 4 cores 16 GB RAM

Figure 3 Provider performance comparison @ 8 cores 32 GB RAM
Towards an appropriate price comparison

The previous observations have unveiled relevant differences in capacity and quality. But a comparison of technical performance is only one side of the medal. It needs to be completed by a price comparison to enable a judgment about the economics of an offering.

As a user of cloud resources, you are interested in the amount of work that a CPU is able to process in a certain amount of time. Thus, for applications depending on compute power, we want to rather know the price for the performance we receive instead of just an hourly rate. To combine quality and the price information we define a certain amount of operations to complete (so called MASC).

By doing so, we are able to determine how much time a VM would need to compute this pile of operations and thus how much cost would occur for a certain amount of work – so we arrive at a “performance price”. Using this performance price, we can calculate and compare the cost for delivered computing performance and arrive at a fair comparison of the cloud service benefit.

Figure 4 to 6 show different rankings for a 2-core, 4-core and 8-core basket. On the left panel, the hourly price determines the order of providers while on the right panel, we sorted by the price per work executed. As you see, the order is quite different. For example, Provider 6 charges the second highest hourly price, but results as second best in the cost-efficient ranking (Figure 4). Or when buying a 4-core machine, you would chose provider 4 based on hourly price as the best offer, while in fact, it only has average cost efficiency (Figure 5). Similar changes in the order can be perceived in the third diagram.

Depending on your use case, you may end up paying more choosing a provider with a lower hourly rate because you might have to switch to a higher machine class to receive the capacity required or your processing might take longer. However, picking the expensive ones is no winning strategy either, as the results for Provider 1 show.

To conclude, hourly prices do not seem to be a reasonable criteria when selecting an offer in the cloud. A performance price which gives the price per delivered computing performance comes closer to a fair comparison.
Figure 4 Provider comparison on EUR/h and performance price (EUR/MASC) – 2-cores 8GB RAM

Figure 5 Provider comparison on EUR/h and performance price (EUR/MASC) – 4-cores 16 GB RAM

Figure 6 Provider comparison on EUR/h and performance price (EUR/MASC) – 8-cores 32 GB RAM
Relaxed today, stressed tomorrow – reliability of performance

During our test, we not only realized differences in the total capacity delivered. Looking at time series, providers diverge in delivering a steady and reliable level of capacity. The variance of performance hence is another quality measure to take into consideration when deciding for cloud services.

Figure 7 shows two products of two different providers. Both products have an expectation value of about 800 ASCs. While Product A oscillates within a corridor of 7.5% around its expectation value, Product B is sometimes above the max values of Provider A, but quite often the capacity breaks down and hence a reliable supply of computing power is missing. If such a breakdown happens during a critical phase when the system is under load, the aftermath might be very expensive. A major reason for large variances in performance reliability might be an exaggerated overprovisioning rate or inferior VM allocation within a datacentre. As a consequence, if it is a traceable characteristic of a provider, as a consumer, you might want to change to a more reliable infrastructure service.

In our sample, the best case shows a variation of 5% while the worst case reaches 45% with diverse results across baskets. To quantify the effect of this uncertainty as a risk on the price and make it conveniently applicable for purchase decision support, we will conduct further analyses of this phenomenon in future.

![Figure 7 Stability as quality criteria](image.png)
Summary and conclusions

The previous chapters showed that the purchase unit “core” does not address the need of a corporate buyer. The analysis of similar offerings realized remarkable capacity deltas between providers. To make a sound purchase decision from the technical perspective a capacity based selection approach should be considered.

The ASCAMSO platform provides tools which allow to assess capacity of cloud services but also on premise hardware. This enables a simple comparison of capacity demand as well as capacity supply. The toolset can be used free of charge @ www.ascamso.com/beta.

We also discussed the effect of capacity on price comparison. Assuming the need for steady computer power, i.e. mathematical problems such as portfolio calculation or formulas, capacity will have an impact on usage duration. Therefore comparison on price per hour base does not help to find a reasonable purchase decision.

Further on, the measuring showed that provided capacities are not necessarily stable over time. Depending on the provider, capacity may vary between a few neglectable percentage points up to almost a fourth of the capacity. This so called “performance stability” might have an impact on the suitability of providers for certain use cases.

We can wrap up the following recommendations for every cloud service consumer:

- **Be clear about your demand.** The answer to the question of an optimal provider will have many answers depending on your use cases. Search the free ASCAMSO knowledge base to learn to distinguish between several use cases and the corresponding demand.

- **Don’t underestimate impact of technical performance.** Technical performance will strongly impact your demand for resources. Cheap hourly rates on poor VMs might increase organisational effort and increase the number of required VMs. Use the free and simple ASCAMSO benchmarking solutions to gain insights of your demand and the provided offerings.

- **VM based hourly pricing is not a valid comparison base.** Not only is the “performance price” an important achievement to compare cloud offerings on a more qualitative base. Cloud offerings come with many obligations and add-ons, which all may strongly influence the overall pricing, e.g. traffic. ASCAMSO has created the Open Tariff Modell to overcome this complexity and allow comparisons on effective price base.

- **There is more than performance and pricing.** With growing cloud expertise in your organization qualities like support centre ticket integration, automated accessibility or network management capabilities will also gain importance. To get an overview of the complete provider capabilities you may use the ASCAMSO rating profiles to search and select for the best fit to your organisations requirements.

- **The Cloud brings flexibility.** Adopting the cloud goes beyond outsourcing with decisions on one or few providers. Open your mind to the market. Integration limitations are about to fade as more and more providers integrate common libraries to interact with their clients. Only flexible organizations will be able to realize the benefits and savings on flexible markets.

We do believe in a future where hybrid cloud models will be part of each corporate infrastructure because this is for sure the most effective way to trim your IT operating expenses. ASCAMSO is prepared to support you with knowledge, tools and insight on your journey to a cloudified enterprise.
Appendix - measurement approach and Bibliography

This study focuses on measurement and comparison of CPU capacity among providers, though the ASCAMSO platform which we used to assess CPU performance is also able to measure other components. But the CPU measurement is very suitable as an introductory showcase. To conduct such a performance measurement easily, the ASCAMSO platform offers software agents to install and run tests on a cloud instance. These ASCAMSO satellites are simple to install and you can use them yourself to measure your instances. You can even combine them to execute coordinated test scenarios across larger deployments. Visit www.ascamso.com/beta to learn more.

How does the ASCAMSO platform measure CPU performance?

To measure the CPU capacity available to a VM, we use a benchmark which consists of a fixed amount of operations\(^3\). A CPU which needs less time to execute these operations has a higher capacity to process operations and hence provides a higher performance. So when we measure the time the CPU needs to process these operations, we receive the number of operations per second, the CPU is able to perform\(^4\).

![Figure 8: Sequence of continuous CPU benchmarking](image)

We measure this metric in a unit called ASC. To give you a reference for this dimension: the capacity of a standard Intel i7 Quad Core with 4 GB RAM, which is the typical size of a modern laptop, has a capacity of around 1200 ASC (measured on Windows OS).

Our continuous measurement process conducts pulsed tests during a run period, i.e. the satellite executes and measures a quick capacity test and then pauses again for a defined interval before the next test is executed. Over time, we receive a series of capacity measurements which indicate the capacity available to the specific cloud instance and enables us to compute an expected value for the capacity.

How did we analyze the results?

Some providers offer pre-configured instance sizes (“t-shirt sizes”, i.e. XS, L, XL and so on) while others allow a free choice of quantities for each component like CPU and RAM. Thus, we needed to normalize VM sizes to allow an appropriate performance comparison. We have identified and named the following combinations of RAM and cores as categories or baskets. We assigned T-Shirt products of providers into the closest matching basket to enable comparability within homogenous classes. For component-based providers, we configured VMs according to the basket specification.

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\(^3\) For this study, we used the Fast Fourier Transform of the SciMark2 benchmark suite. Other benchmark operations are possible and have been conducted in other contexts as well.

\(^4\) For multi-core VMs, we ran two threads per core to assess the capacity of all cores and combine the delivered results. Providing two threads per core makes it most likely that no core will be spared from the test.
These are the baskets we analyzed:

- Standard [01C-004GB] small
- Standard [02C-008GB] medium
- Standard [04C-016GB] large
- Standard [08C-032GB] x-large
- Standard [16C-064GB] xx-large
- High-Mem [01C-008GB] small
- High-Mem [02C-016GB] medium
- High-Mem [04C-032GB] large
- High-Mem [08C-064GB] x-large
- High-Mem [16C-128GB] xx-large

When did we measure?
In the course of 2014, we approached the providers as standard customers without informing them about our actions. We purchased VMs of different size and configuration as well under Linux and Windows and executed several test series. As of today we have conducted over 2300 test runs with more than 10 providers.

Bibliography


Contact

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