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CLOUD VS. ON-PREMISES COSTS

The Critical Factors Every Exec Needs to Consider

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It's a million dollar question: should your company keep its technology on-premises or move it to the cloud? Executives are in the hot seat to grow their businesses, get new products to market, save money, increase revenues, and stay technologically competitive, all while catering to more savvy, more demanding customers.

Anyone who has done their research has heard the cloud is the single solution that addresses all these issues. But even if you can articulate the pros and cons of the cloud, convincing yourself and your business to take that step requires hard numbers to support your argument.

And that's where it gets tough. Finding cost-comparison data is difficult because pricing technology solutions is an incredibly complicated task. Further, comparing such disparate models as cloud versus on-premises yourself may seem insurmountable. This paper calculates quantifiable answers with as much parity as possible, shedding light on factors that are critical to making an informed decision.

THE GROUND RULES

Setting up a sound analysis requires some ground rules about how to evaluate your options:

- **Simplify** – The best way to solve any complex problem is to simplify and weed through the noise. Therefore, we will specifically call out where we have simplified our analysis and why.
- **Apples-to-apples** – Because things can be done so much differently in the cloud versus on-premises, especially when it gets to PaaS and SaaS solutions, this rule ensures that we strive to compare the same type of solution between cloud and on-premises.

ADVANTAGES OF THE CLOUD

Time to Implementation
Provisioning an Azure IaaS server takes about 15 minutes to have a fully functioning server, complete with OS installed and configured, versus several days for on-premises as the server needs to be ordered, shipped, installed, and configured.

Net Present Value
That $2,000 capital expenditure could be put to better use investing and earning interest, for example. Thus, that $2,000 capital expense technically costs you more than $2,000 because that money could have been invested and earning interest over the three-year lifecycle of the system.

Tax Implications
The hardware bought as a capital expense must be depreciated over time, while cloud solutions are considered operational expenses that are deducted as costs.

Flexibility
If, in a year's time, you discover you no longer need the server, you simply turn it off and no longer pay for it in the cloud scenario. With on-premises you are literally stuck with the server; you can try to recoup some of the capital expense by selling it, but remember you will pay taxes on that income.

Ongoing Costs
If the lifecycle for the hardware is three years, then technically the costs to migrate the system to something new should be accounted for in the total cost of the on-premises solution. In the cloud, if Microsoft needs to upgrade its servers, it's not your problem.

Reliability
Microsoft guarantees 99.9% uptime versus with on-premises you probably don't have a guarantee at all.

Security
Microsoft assumes breach within its security infrastructure, meaning the company is constantly, actively looking for breaches in security. Microsoft's team of experts dedicate 100% of their time to testing their own system security by constantly running "red team/blue team" white-hat hackers. That means one team is actively trying to look for penetration points (hack the system), while the other team actively looks to stop them. For a fair analysis, compare the security measures employed by Microsoft to the expertise of your IT team in keeping your on-premises system secure.

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- **Reality** – We insert reality checks as needed to ensure we are not comparing unrealistic scenarios.
- **"Favor" On-premises** – Though it's not a new solution, the cloud continues to be a scary and daunting proposition to many executives, so it's not uncommon to face numerous objections. Anticipating that, we perform our analysis the same way someone skeptical of the cloud might approach it, by making assumptions that "handicap" the cloud and favor on-premises solutions.

SIMPLIFYING ASSUMPTIONS

These assumptions simplify the cost analysis and favor on-premises. They also ignore many of the cloud's purported advantages, just as is often done in organizations when cloud solutions are being evaluated. The advantages of cloud will be addressed only after we examine a cost comparison.

ASSUMPTIONS

What is being compared and how?

On-premises solution vs. a single cloud environment, Microsoft Cloud (Azure)

- All calculations in monthly cost comparisons, where 1 month = 744 hours
- On-premises costs will be rounded down and cloud costs will be rounded up for the sake of simplicity and to handicap the cloud

Configuration

Whether on-premises or in the cloud:

- 1 client computer
- 1 network switch
- Firewall
- Internet connection

Factors not compared

- Cost of setup and configuration – These costs will be roughly equivalent, regardless of the solution. We assume you will either do these in-house or pay an IT professional to configure them.
- Tax implications (capital expenses versus operating expenses) – Tax implications don't apply in all situations. Ignoring tax implications works in favor of an on-premises solution.
- Time to implement – Comparison is omitted to favor on-premises solutions. Cloud implementation actually takes as little as 15 minutes, whereas on-premises implementations are highly variable and can take multiple days.
- Maintenance issues and maintenance fees – On-premises maintenance issues and fees vary. Cloud solutions are off-premises, so there are no maintenance issues or fees.

FIRST SCENARIO:
Single Server On-premises vs. IaaS

What are the costs of running a single server on-premises versus in the cloud in an Infrastructure as a Service (IaaS) model?

On-Premises Solution

After eliminating the elements covered in our simplifying assumptions, the costs involved with an on-premises, single server solution can be broken down into:

- Cost of server hardware
- Power consumption
- Space

Cost of Server Hardware

Costs of servers vary wildly, from about $1,000 to $30,000, depending upon their configuration. We chose a Dell R320, with a nominal cost of $2,000, which, would equal **$55 per month.** [$2,000 / 36 months = $55.56, so we round down the monthly cost of this server to $55.] We will ignore that we would likely need a separate network switch and battery backup for this, additional costs, and assume that these factors are included in our real estate (space) costs.

Power Consumption

In terms of power consumption, we aren't blind to reliability; our Dell R320 is configured with dual 350W power supplies. Calculating the kWh consumed by these power supplies, we use RapidTables' Watts to kWh Calculator with 700W and 744 hours to arrive at 520.8 kWh consumed per month. We round this down to 520 kWh, but we must account for the fact that this is maximum energy consumption.

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At 520 kWh consumed, essentially the power supplies are running flat out, which means that the processors are pegged 24/7. Reality? Not likely. So, we will assume that, on average, our power supplies are pulling 30% of their maximum power rating and that includes the fact that power supplies are only about 80% efficient. In other words, if a power supply needs to deliver 100W and is 80% efficient, it will actually burn 120-125W. 520 · .30 = 156 kWh.

"IN A FULLY REALISTIC SCENARIO, THE CLOUD IS APPROXIMATELY 30% CHEAPER THAN ON-PREMISES."

However, we must also insert reality in terms of Power Usage Effectiveness (PUE). PUE is the measure of how effectively power is delivered to servers versus being used to power heating and cooling systems, etc. An Uptime Institute survey says that PUE averages about 1.7. So, 156 · 1.7 = 265.2, which we will round down to 265.

Finally, we must convert this to dollars. The U.S. Energy Information Administration website indicates that the commercial price per kWh in the United States averages about 11 cents. So, 265 · $.11 = $29.15, which we will round down to **$29 per month for power consumption.**

Space

Whether the on-premises server is located in a closet or in a data center, there is cost associated with its location. To simplify, we will simply assume a cost of $10 per square foot per month, based on data from Digital Reality Trust. We will assume that this cost includes having the server take up space, the network, battery backup, and we'll hypothetically say it runs in a data center that provides all of that for $10 per square foot per month. The Dell R320 is approximately 2' wide by 4' long, so 8 square feet, gives us $10 · 8 = **$80 per month for space.**

So on-premises, you have a server in a data center for which you are effectively paying $55 (capital) + $29 (power) + $80 (space) = **$164 per month.**

Cloud Solution

Cloud cost calculations are simple in comparison to on-premises. A roughly equivalent server in Microsoft Azure IaaS, a D2 SSD 2 cores 7 GB RAM 100 GB disk, will cost somewhere between $193.44 per month to $208.32 per month depending on the data center. We will simplify this to $200 per month. This includes the server, power consumption, and space.

Initial Analysis

Through simple math, $200 (cloud) / $164 (on-premises), we can calculate that cloud is approximately 20% more expensive than on-premises for this single server scenario, but critical factors, namely the advantages of the cloud, were not included in that analysis. It is left to the reader to decide if they are worth that extra 20%.

SECOND SCENARIO:
Multiple Servers On-premises vs. IaaS

The first scenario, with only one server occupying an eight-square-foot space, may be too simple, so we performed a second analysis where we consider the costs of an entire rack of servers in that space.

On-Premises Solution

The costs for on-premises were already calculated. All we need to add now is a 42U rack unit, which will cost about $1,000. $1,000 / 36 months = $27.78 per month, which we will round down to $27/month.

So, for the on-premises solution, we have (assuming we maximize the use of the rack with 42 1U servers):

$27 (rack)
+ 42 · $55 (capital)
+ 42 · $29 (power)
+ $80 (space)

$3,635 per month

In today's world you would likely have fewer servers and run a few big host servers that run 42 virtual machines, but those few big servers are going to have bigger power supplies, run at a higher power consumption percentage, and you need to pay for the virtualization software, added complexity, etc. So, to keep it simple, let's say that this scenario and that alternative scenario are roughly the same cost per month.

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Cloud Solution
42 · $200 = $8,400 per month

Initial Analysis
The calculation is $8,400 / $3,635 = 2.31. Said another way, it is roughly 230% more costly to run cloud than on-premises. The cloud appears to be far more expensive than on-premises, but that is only because, for the purposes of simplification, this assessment overlooked some critical factors.

FINAL GAME-CHANGING FACTORS TO CONSIDER

So far, we've done everything we can to favor an on-premises solution, but injecting a final dose of reality paints a different picture in a cost comparison.

Management Software Adds to On-premises Costs
First, with 42 servers to manage, you are probably going to need something to view and manage them with.

In Azure, management software giving you a single pane of glass to monitor and manage your servers is included. In addition, this management software allows you to schedule and automate tasks, such as stopping and starting servers, backup VM's, provision systems, send emails, etc.

For all of that, remember apples-to-apples, you are easily looking at spending at least $2,000 in software. So, add another $55 of capital software expenses per month.

What about Load Balancing Costs?
With 42 servers, you are going to need load balancing. It is highly likely that you have some web servers and other types of servers that need load balancing.

CLOUD VS. ON-PREMISES AT A GLANCE

	Cloud Solution	On-premises Solution
Time to implementation	15 minutes	Varies – could take multiple days to order, ship, install and configure
Net present value	Not applicable	$2,000 capital expense depreciates over time
Tax implications	Operating expenses – deducted as costs	Capital expenses
Flexibility	Scales with needs	Scaling up requires additional equipment. Cannot reduce costs if scaling down is needed.
Ongoing costs	Pay as you go. If servers are not needed, there is no cost.	Cost of maintenance, upgrades, energy usage and hardware replacement after typical 3-year lifecycle
Reliability	Microsoft guarantees 99.9% uptime	No guarantee
Security	Manned 24/7 by Microsoft's team of specialists dedicated solely to security	Typically provided by a single or few employees who are not 100% dedicated to security and possibly not trained in security

For redundancy, you will need at least 2 load balancers. Add another capital expense of at least $10,000 or $275 per month. You've already filled up your rack with servers, so add another $27 for a second rack and another $80 per month for the space for that rack. To simplify, we will not include any costs for the additional power consumption of these load balancers.

2 · $27 (racks)
+ $55 (software capital)
+ $275 (load balancing capital)
+ $2,310 (server capital)
+ $1,218 (power)
+ 2 · $80 (space)

$4,072 per month

Now the cloud is only twice as expensive as on-premises.

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Storage Costs Can Be Significant
With 42 servers in the mix, the odds of being able to run them all with local storage is unlikely. In today's modern IT world, you need shared storage. On-premises, this is handled by a SAN while in Azure, this is handled by a storage account.

Cloud Storage Costs
We can provision a 1,000 GB (1 TB) storage account for $0.10 per GB. No, that decimal is not in the wrong place. What's more, this $0.10 buys us GRS storage (Globally Redundant Storage). What is GRS? GRS essentially means that each GB of data is actually stored 3 times locally and 3 times globally.

So, essentially, each transaction is written to 3 storage nodes in the local data center and then are also written to another data center where it is also written to 3 storage nodes in that data center. $0.10 per GB to effectively have 6 copies of your data at all times with geographic separation included.

1,000 · $0.10 = $100 per month

So, for the cloud we have:

$8,400 (servers)
+ $100 (storage)

$8,500 per month

On-premises Costs
To get an apples-to-apples comparison, we are going to need 2 SANS in separate geographic locations with dedicated high-speed network connections between them. We will need 3 TBs of storage for each SAN giving us a total capacity of 6 TB. Overkill?

OK, we will knock this down to 4 TB total, 2 TB for each SAN so that each has a "live" copy and a backup copy. But how do you calculate out the costs for a SAN? While we could assume away IT resources being equivalent between cloud and on-premises for something as simple as servers, we can't make that same assumption for SANs and still claim realism. Typical things that go into a SAN pricing would be the enterprise SAN arrays and software, backup systems, high speed network to connect them, 2-4 technician's salaries, power consumption, space, etc.

Let's simplify this. Doing some research reveals that SAN costs per GB per month typically fall in the range of $5-$15 per GB with some people claiming they have been charged by internal IT up to $30 per GB. Let's stack the deck in favor of on-premises. Let's say that, for today only, you can have a geo-redundant SAN with power, space, and management costs included for the low, low price of a mere $2 per GB per month, twice as low as any estimation of storage price that you will likely find out there today.

4,000 GB · $2 = $8,000 per month

So, now we have:

$8,000 (storage)
+ $54 (racks)
+ $55 (software)
+ $275 (load balancing)
+ $2,310 (servers)
+ $1,218 (power)
+ $160 (space)

$12,072 per month

Let's give on-premises yet another break, we'll call it $12,000 even. $8,500 / $12,000 = .708 or that now, **in a fully realistic scenario,** cloud is approximately 30% cheaper than on-premises. This cost comparison, combined with the benefits of the cloud, demonstrates the value of cloud as a long-term solution to support the future needs of your organization.

CONCLUSION

Calculating hard-dollar cost comparisons between cloud IaaS versus on-premises infrastructure is complex, even with simplifying assumptions, and is dependent upon the specific solution being deployed. While it varies wildly depending upon the specifics of the system being deployed, for midmarket/enterprise businesses, **cloud-based solutions represent a potential cost savings of 30%** (despite all conceivable advantages being given to on-premises).

These hard-dollar cost savings do not factor in the litany of other cloud advantages cited in this paper. The majority of this cost savings is accounted for by storage costs, which are at least an order of magnitude less expensive in the cloud versus on-premises. Whatever your next move, now you can evaluate the critical factors that many overlook when making a decision.

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