Can a Private Cloud be as Cost-Effective as the Public Cloud?

An Evaluator Group TCO Analysis Comparing AWS and Dell EMC Enterprise Hybrid Cloud on VxRail

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Can a Private Cloud be as cost-Effective as the Public Cloud?
Amazon Web Services (AWS) was one of the originators of the hyper-scale model, creating their own scale-out storage infrastructure that’s helped popularize the concept of “commodity hardware”. They also developed a sophisticated software stack to turn this capacity and scalability into a product that would make money.

What public cloud providers like Amazon are doing is selling “self-service IT” to remote customers. As a product, it must be easy to use and easy to pay for, so this cloud software stack supports a “services delivery” model and features consumption-based pricing. But in addition to providing self-service for users, this cloud infrastructure has to automate the whole process for their IT teams in order to manage the scale of the environment and to optimize the entire infrastructure stack. For these Infrastructure-as-a-Service providers, resource efficiency is a key driver of profitability.

All of this makes sense to IT organizations that face the same challenges, albeit on a smaller scale. They have to make IT more agile - make it easier, cheaper and faster – and make it self-service for the user. But how do enterprises get that automation and services delivery to make their infrastructures efficient? And, is it cost-effective, compared with using the public cloud?

In this report we examine the costs of running an enterprise-level environment in the public cloud versus running it on-site with a private cloud infrastructure. We’ll compare Dell EMC’s Enterprise Hybrid Cloud (EHC) solution, running on a VxRail cluster supporting from 500 to 2500 VMs, with a comparable number of server instances running in Amazon Web Services.

**Private Cloud**

Dell EMC Enterprise Hybrid Cloud is an Infrastructure-as-a-Service platform that companies can use to create a hybrid cloud solution combining the on-site infrastructure, automation and services delivery of a private cloud with public cloud resources as needed. This report will focus primarily on the private cloud aspect of EHC, which is comprised of three layers.

The physical infrastructure foundation for Dell EMC Enterprise Hybrid Cloud can be either a converged or a hyper-converged infrastructure (HCI). In this analysis, that foundation is provided by a Dell EMC VxRail cluster described in the next section. Running on that is an integrated software stack from VMware, which provides a self-service portal that drives workload provisioning, resource management and consumption-based costing. The top layer is the Enterprise Hybrid Cloud platform, developed by Dell EMC. This software has predefined workflows, for functions like data protection and security, that enable cloud implementations to scale out to multiple instances in multiple data centers while maintaining the value that benefits both end users and IT organizations.

For internal users, EHC provides access to applications and traditional IT services through a service catalog. This dashboard lets them select the resources they need at the appropriate service levels, while managing cost, security, reliability and performance. They can choose from hundreds of software
programs and platforms or create their own application stacks configured for a specific use case, like data analytics, software development, VDI, etc.

The service catalog lets users set up what they need, quickly, and keep track of how much resources they consume – the way AWS does in the public cloud. They can also decommission server instances and return resources to the common pool when no longer needed.

In addition to accelerating the delivery of applications and services for end users, the service catalog reduces IT’s workload, and simplifies the management of infrastructure for IT organizations across multiple sites. It facilitates the monitoring of health and performance and measures the value of IT services delivered, enabling accurate charge-back to user departments. Like the hyper-scalers, a private cloud lets enterprise IT organizations crank up their efficiency level, enabling fewer administrators to handle more infrastructure – and more internal users.

**EHC Infrastructure**

In this comparison we used the VxRail P470F hyperconverged appliance in an n+1 cluster for high availability. Also included is a pair of Connectrix VDX-6740B switches, cables and SFPs, providing two 10GbE ports for each node. The five-node baseline supported 500 VMs, with each additional node supporting 200 more VMs. We allocated 2 vCPUs, 4GB of memory and 100GB of flash storage for each VM. The configuration for VxRail P470F nodes is as follows:

- 2 x Intel E5-2699 2.2GHz 22-core CPUs
- 768GB RAM
- 12 x 1.92TB SSD drives – primary storage
- 4 x 800GB SSD – cache
- 4 x 10GbE NICs

For the TCO comparison we calculated a cost per month using a 3-year simple amortization with no interest. We assumed that companies could easily add in the cost of capital from internal sources or through a commercially available lease. Facilities costs were estimated at $100 per month for each node of the VxRail cluster that forms the foundation of the Enterprise Hybrid Cloud infrastructure.

Administration includes the “care and feeding” tasks associated with any IT infrastructure, but also the cloud admin time required to manage the VMware and EHC software layers described above, providing an “IT-as-a-Service” experience to end users. It was estimated that this combined EHC infrastructure would require 2 hours per week. Administrative costs were estimated with the following formula:

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\text{Hourly cost of a fully burdened employee ($150,000 per year or$75 per hour) \times 2 hours per week \times 52 weeks \times 3 years}
\]
The calculation for this TCO model combined the purchase price (discounted “street price” estimates, not list prices) for the VxRail hardware and the switches, the EHC and VMware software, plus implementation services, maintenance and ongoing administrative overhead. The cost line items for this baseline, 500-VM, 5-node* configuration were as follows:

- 5 x VxRail P-Series all-flash appliances (P470F) plus switches $413,196
- EHC software subscription for 3 years, including upgrades 122,306
- VMware software licenses – vSphere, vRealize Suite, NSX 113,763
- Implementation services for hardware and software 76,844
- Prepaid hardware and software support for 3 years 215,779
- Prepaid facilities costs for 3 years (power, cooling, rack space) 18,000
- IT administrator time 23,500

$ 983,387

Dividing this total by 36 months and by 500 VMs gives us the monthly cost of $54.63 per VM (see graph). To scale the infrastructure we add more nodes, each of which can support an additional 200 VMs at an incremental cost of $20.60 per VM ($148,354 per expansion node / 36 months / 200 VMs). If we add ten more nodes to scale out to support 2500 VMs, that monthly cost of $54.63 is reduced to $27.54 per VM.

* Although each node can support 200 VMs, a conservative baseline configuration of 5 nodes was used, to accommodate clustering minimums and failover.

The Cloud Infrastructure

Traditional IT applications are designed to be connected to dedicated resources. They expect storage capacity, CPU cores and memory to be available all the time. This means that a cloud infrastructure comparable to on-site infrastructure needs to be 100% utilized and dedicated. AWS Elastic Compute Cloud (EC2) is offered in many different varieties of compute instances, providing different combinations of resources, different utilization profiles, different storage options, etc. For this comparison, we chose the following EC2 configuration:

**Compute**

The “T2.medium” ECS instance, 100% utilized, was chosen, supplying 2 vCPUs and 4 GB of memory per instance. T2 instances provide moderate baseline I/O but can burst to higher performance for short periods. This balances the performance over the day for workloads that
have variable use patterns. T2.medium is a very conservative choice for AWS instances, when compared with the capabilities of the all-flash HCI infrastructure supporting Enterprise Hybrid Cloud in this model.

Storage
“EBS General Purpose SSD (gp2)” was chosen, with 100GB capacity per instance (VM), providing 300 IOPS per 100GB of allocated storage, with the ability to burst IOPS for occasional load spikes.

Snapshots
Data protection requirements vary by application so we chose to leave this out to ensure an equivalent comparison.

Data Transferred
AWS tracks the amount of data transferred into and out of the ECS instance from the internet. For this model we estimated that each instance would generate the following amount of data movement each month:

- 10GB of data transferred in
- 30GB of data transferred out

Load Balancing
One elastic load balancer was provided for every 10 EC2 instances, supporting 10GB of data per instance.

VPN Service
One VPN connection was added to secure communication between the on-premises infrastructure and the public cloud.

Financing
For this TCO comparison, we included the following three financing options from AWS, each represented in graph below.

“On-Demand” refers to buying compute, storage and data transfers as needed. It requires the least commitment but charges the highest cost per VM.

“1 year, No Upfront” is like On-Demand, charging for services consumed each month, but with a one-year commitment.

“3 year All Upfront, Reserved” charges the accumulated cost for three years at the beginning of the term.
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Results and Analysis

The graph below shows the average monthly cost per VM for a private cloud infrastructure using Dell EMC EHC running on VxRail and three different pricing options for AWS at multiple VM levels.

On the left side of the graph, we can see the cost comparisons at the 500-VM level. This cost of $54.63 per VM was calculated earlier in the report. At this initial level, the public cloud options are less than the that of a private cloud. But as we scale the infrastructure out, the EHC + VxRail solution gets more and more economical.

At 1700 VMs the cost curve for the private cloud crosses that of the public cloud. At 2500 VMs the EHC solution is 11% less than the AWS 3 year reserved, all up front option and 37% less than the AWS 1 year reserved no upfront option. The On-Demand comparison is even more dramatic, where the Dell EMC Enterprise Hybrid Cloud is 47% less than AWS. And, as discussed in the section below, there’s a caveat to this comparison. The cost of the private cloud solution includes integrated public cloud connectivity as well.
Conclusions

Economics at Scale

The graph shows that the cost of the private cloud infrastructure actually comes down, substantially, as the environment grows, reflecting some economies of scale. The incremental cost of adding each node ($20.60 per VM) is less than half that of the baseline 5-node cluster (see calculation above).

One-time costs associated with implementation are spread across more nodes, along with the cost of administering the cluster which doesn’t increase as nodes are added. This is due in part to the single point of management that the hybrid cloud platform offers.

While the cost of the VMware software stack is tied to node count, the cost of the Enterprise Hybrid Cloud value added software is fixed for the cluster. There is a single price for the base system subscription that includes any upgrades needed. So as the infrastructure scales, this cost is also spread across more nodes, reducing the cost per VM.

Economics of Hyperconverged

The HCI foundation of this private cloud solution is designed with the same basic principles as infrastructures supporting public clouds like AWS. Scale-out architectures can grow easily, and the ability to use industry-standard server hardware and commodity storage devices allows them to leverage some of the hyper-scalers’ economics as well. This allows VxRail (and vSAN) to focus development resources on software, and leave the platform innovation to the server OEMs (and Intel), instead of building those costs into the product. The result is a system that’s powerful enough to support a private cloud but is still economical.

As CPU technology advances, compute power and VM density increase proportionally. Coupled with similar developments in solid-state technology (such as 3D NAND flash), each generation of HCI products provides more high-performance storage capacity, lower overall latency and the ability to support more VMs. In this way VxRail can “ride the hardware innovation curve”, delivering more resources for less money and helping to further drive down costs.

In this report we’ve shown that the private cloud model enterprises are adopting to improve IT agility can, in fact, be more economical than the public cloud. This can help support the choice to deploy a private cloud instead of using the public cloud. But the cloud isn’t an “either-or” decision for most companies. There are real benefits to using a public cloud for some workloads in some situations and there are real benefits to running certain applications on-site. The Hybrid Cloud model is a way to get the best of both worlds.
Why Hybrid Cloud may be Best Solution

“Lift and shift”, the process of converting software running on-site and moving the stack into the cloud is hard - and not even possible for some applications. Also, compliance and governance requirements make on-site infrastructure something many enterprises must still have. That said, the public cloud can provide a good target for disaster recovery or a common platform for development between multiple sites. In many scenarios, companies are making the determination that they need both a private and a public cloud - a hybrid cloud solution.

In addition to private cloud functionality, the Enterprise Hybrid Cloud software stack (with VMware components) provides connectivity to multiple public cloud service providers, including AWS. This means companies can easily support test and development with cloud-based infrastructure and then move applications on-site for production, to accommodate security, compliance and provide long-term cost savings. They can also use the public cloud as an overflow resource pool, an off-site repository or for anything they would consider running in AWS. By integrating the public cloud with the private cloud, a hybrid cloud provides the flexibility many companies need to deploy as much cloud as they need, where they need it.

About Dell EMC Enterprise Hybrid Cloud

Dell EMC Enterprise Hybrid Cloud simplifies IT operations for enterprises of all sizes by delivering the agility of a combined private and public cloud. It accelerates business outcomes by enabling an IT-as-a-Service environment for enterprise applications through a self-service catalog. A true hybrid cloud platform, Enterprise Hybrid Cloud delivers automated Infrastructure-as-a-Service across private and public clouds with greater speed, scalability and agility, while reducing costs and minimizing risks. Based on hundreds of thousands of engineering hours, it combines hyper-converged infrastructure, software, engineered workflows, services and single contact support to deliver a turnkey hybrid cloud platform. This allows IT organizations to focus on delivering value-added services rather than building and maintaining a cloud platform.

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