When Does Colocation Become Competitive With The Public Cloud?

PLEXXI WHITE PAPER

colovore

KSC
KING STAR COMPUTER
Rackmount Server Specialist

Piston
CLOUD COMPUTING

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Affinity Networking for Data Centers and Clouds

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EXECUTIVE SUMMARY

Public cloud computing has revolutionized IT by facilitating the rapid deployment of computing resources while reducing the capital expenditure needed to do so. This has made services such as Amazon EC2 very attractive to not only newer, smaller companies without lease financing options, but also corporate departments with limited capital budgets. Slow bureaucracy can be bypassed to quickly add new compute resources with a corporate credit card.

These parallel business processes, created for the sake of speed, often have unexpected consequences. Organizations can be unpleasantly surprised when they realize public cloud costs can grow faster than revenues, or suddenly become a major cost center.

IT teams need to know when the public cloud makes financial sense versus doing it themselves. The assumptions of the past no longer apply. IT vendors have responded robustly by significantly expanding their leasing services. Flexible, favorable financing terms are increasingly available to small and medium businesses, and as a result, the competitive advantage of the public cloud has diminished significantly.

This paper shows that for constant, non-bursty loads, Amazon EC2 can become cost prohibitive with a deployment of as little as 129 cores, or seventeen (17) Amazon EC2 m3.2xlarge instances (a $7,644 monthly spend), when compared to a typical modern architecture using:

- OpenStack-based private cloud
- Modern server equipment
- Affinity-driven networking gear
- Purpose-built high density colocation

While 129 cores is not an absolute figure, it represents a point at which the benefits of the public cloud should start to be investigated. This white paper identifies other factors to consider in an IT strategy besides cost. Speed of scalability, tooling, application modifications, budgetary control, operational procedures, and competitive pressures need to be considered. Useful strategies to quantify these often-intangible costs are included in the analysis.

This paper's real world case study also shows that a single server cabinet deployment can save up to $388K or 44% over a typical 36 month equipment cycle when compared to Amazon.

CASE STUDY: AMAZON EC2 VS IN-HOUSE PRIVATE CLOUD

This case study explores the key assumption that current public cloud infrastructure offerings are cheaper than in-house application hosting.

AIM

After receiving extensive customer feedback and analyzing anecdotal accounts of unexpectedly high public cloud costs, the participants in this paper decided to evaluate this solution with private cloud alternatives.

The primary aim of our case study is to determine the point at which a private cloud alternative becomes both financially and operationally viable with leased equipment when compared to steady state Amazon EC2 VM deployments providing equivalent compute resources.

A secondary aim was to easily illustrate how Amazon EC2 VM instances and cores, intangible concepts, equate to more tangible items found in a datacenter, such as quantities of servers, racks of equipment, and kilowatts of power consumed

PARTICIPANTS

This case study was funded by leading cloud infrastructure hardware, software and services companies based in the San Francisco Bay Area. The participants actively help organizations in a range of industries including medical sciences, gaming, service providers and government organizations to build their private clouds.

Piston

Piston makes software that automates the orchestration of an entire private cloud environment on commodity servers. Companies building web, mobile, and Big Data applications use Piston's secure and cost-effective Amazon Web Services (AWS)-like capabilities to bring new products to market faster.

Plexxi

Plexxi makes datacenter networking intuitive, flexible, and scalable. Our platform combines three mature networking technologies–photonic switching, merchant Ethernet, and SDN control–to deliver networks that are flat, cost effective, and simple to manage. Plexxi architectures reduce capital and operations expense by making more efficient use of deployed hardware assets. Eliminating aggregation reduces the number of switch ports needed to scale, and cabling is reduced dramatically compared to leaf spine, by about 90%. In addition, overall management complexity is reduced by leveraging an SDN controller architecture, meaning there are fewer points of management, and a more consolidated provisioning and configuration interface

Colovore

Colovore is the Bay Area's leading provider of high-density colocation services. Located in Santa Clara, CA, Colovore's modern data center features wall-to-wall power densities of 20 kW per rack, providing significant reductions in TCO for our customers while also ensuring long-term IT scalability. Our facility features 9 MW of power, in just 24,000 square feet, and operates with a PUE range of 1.1 - 1.3. In addition to colocation services, Colovore also features a range of managed network and IT services to make the daily life of IT professionals better.

King Star Computer

King Star Computer (KSC) specializes in building rack mount server systems to provide computing solutions for High Performance Computing (HPC), Cloud Computing, Petabyte Storage, Enterprise IT, Big Data and more. KSC servers, storage and workstations are built with quality, performance and value in mind.

KSC's expertise in customized solutions allows customers to select from over 100 types of optimized server platforms, ranging from individual deployments to large scale server farms.

Located in Sunnyvale, CA and operating since 1990, KSC's proximity, expertise and flexibility facilitates building servers for both in-house use and installations on a customer premise. KSC provides Silicon Valley's best value and service.

METHOD

The participants created a scalable private cloud environment against which Amazon EC2 m3.2xlarge VM instances were compared. This instance type was selected as it was the largest general purpose VM on offer.

Comments from the participant's Silicon Valley customers' indicated that separate Amazon EC2 expense reports often proliferate uncontrolled in software development and DevOps teams using short term higher cost AWS instances. It is for this reason that Northern California, Amazon EC2 non-dedicated on-demand pricing was used in this study.

To this end, the participants installed:

- Nine (9) King Star Twin Two servers, with two (2) nodes per chassis, as the base platform
- Piston OpenStack private cloud software for cloud orchestration and management
- Plexxi's affinity-driven Switch2 switches to provide network interconnectivity
- Colovore's water-cooled high-density cabinets for colocation infrastructure

Details of cost, compute resources and other related data can be found in the appendix.

Each King Star system provided roughly the same performance as six (6) Amazon EC2 m3.2xlarge VM instances. In total, the private cloud provided an equivalent of 54 Amazon instances.

RESULTS

The data collected confirmed what had been reported by our customers. The public cloud was the cheaper alternative to launch a small scale application as there were few underlying fixed costs, and variable costs increased in smaller increments.

As compute resource requirements increased the comparative advantage of a public cloud solution declined and became less economical than a self-hosted solution after deploying as few as seventeen (17) Amazon EC2 m3.2xlarge instances.

The private cloud hardware was only consuming 3.8kW of power at this cross-over point.

The results are summarized in Table 1, "Cost Comparison of Amazon vs Private Cloud".

Chart 1, "Cost Growth Comparison of Amazon vs Private Cloud Instances" shows how the rate of increase of cost in the public cloud greatly exceeds that of the private cloud.

This is equally visible in Chart 2, "Cost Growth Comparison of Amazon vs Private Cloud Cores", where the instances are converted to equivalent CPU cores.

Analysis of the lifetime cost of deploying the case study's 54 Amazon EC2 m3.2xlarge instance equivalents illustrates a stark difference between private and public cloud deployments. Table 2, "Lifetime Cost Comparison of Amazon vs Private Cloud" shows that over a 36-month period, the private cloud environment can save over $388K versus Amazon, a 44% savings!

The significance of these results will be examined in the conclusion.

NO. OF AMAZON VM INSTANCES (M3.2XLARGE)	PROCESSOR CORES	AMAZON MONTHLY COST (M3.2XLARGE INSTANCE)	PRIVATE CLOUD MONTHLY COST	PRIVATE CLOUD KW OF POWER CONSUMED
0	0	$0.00	$4,871.17	-
4	32	$1,798.72	$5,121.17	1.80
8	64	$3,597.44	$5,770.83	2.30
12	96	$5,396.16	$6,170.49	2.80
16	128	$7,194.88	$7,219.82	3.80
17	**129**	**$7,644.56**	**$7,219.82**	**3.80**
24	192	$10,792.32	$8,269.14	4.80
32	256	$14,389.76	$9,968.12	6.30
40	320	$17,987.20	$11,417.11	7.80
48	384	$21,584.64	$12,466.43	8.80
54	432	$24,282.72	$13,515.75	9.80

Table 1 - Cost Comparison of Amazon vs Private Cloud

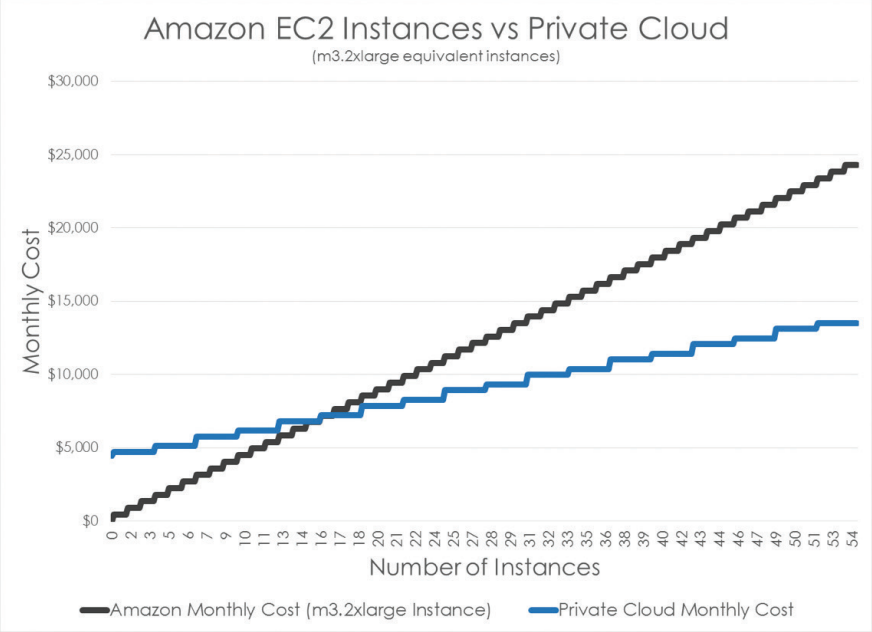

Chart 1 - Cost Growth Comparison of Amazon vs Private Cloud Instances

CONCLUSION

Our case study shows that for constant, non-bursty loads, applications can be initially hosted cheaply in the public cloud. This cost advantage deteriorates rapidly with self-hosted private cloud solutions becoming cost competitive at a seventeen (17) Amazon EC2 m3.2xlarge instance cross-over point.

This implies that companies currently operating fewer than seventeen (17) Amazon EC2 m3.2xlarge instances, with business growth projections of steadily increasing workloads, will benefit from open-source based private cloud solutions.

This cross-over point occurs with less than one physical server chassis deployed, consuming less than 2 kilowatts of colocation power.

A 10 kilowatt colocation cabinet of servers can support up to 54 private cloud instances equivalent the Amazon EC2 m3.2xlarge saving over $388K over the server lease's lifetime.

Running OpenStack in a data center offers additional savings opportunities allowing you to:

- **Consolidate Credit Cards:** A proliferation of expense reports for public cloud spending can be greatly reduced.
- **Lower Bandwidth Costs:** EC2 costs start at ~$40 / Mbps. Internet ISPs are currently charging under $3 / Mbps for low commitment levels.
- **Improve Application Performance:** Make performance more predictable by having more resource control.
- **Lower Data Storage Costs:** EC2 storage costs start at ~$30 per TB per month. Equivalent single disk storage can be purchased for a ~$30 one-time charge.

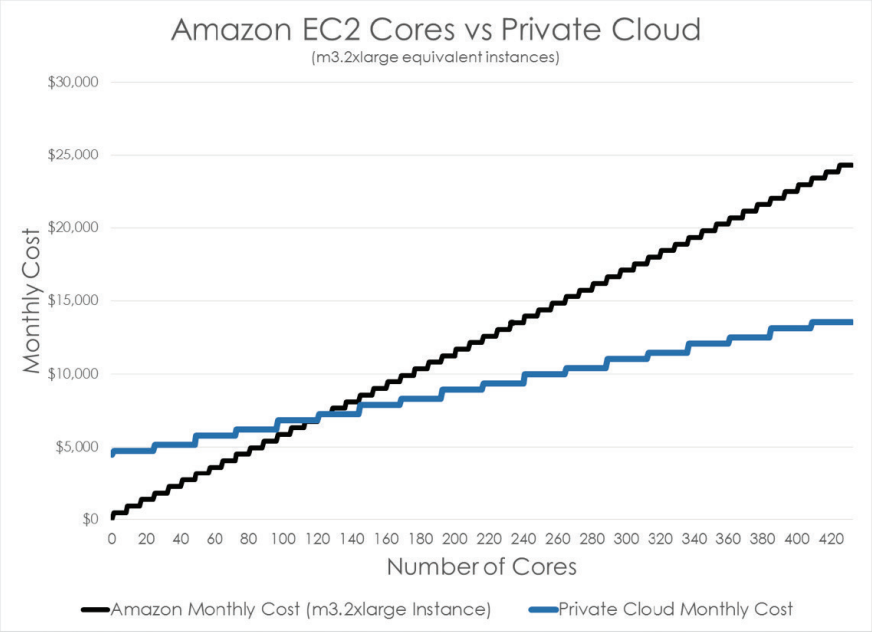

Chart 2 - Cost Growth Comparison of Amazon vs Private Cloud Instances

SERVICE	54 INSTANCES, 36 MONTHS COST	SAVINGS VS AMAZON EC2	%SAVINGS VS AMAZON EC2
Private Cloud	$486,567.13	$387,610.80	44%
Amazon	$874,177.92	N/A	N/A

Table 2 - Lifetime Cost Comparison of Amazon vs Private Cloud

Of course there is more to the private versus public cloud than just cost. Factors to consider when switching can include:

- Speed of scalability
- Tooling
- Application modifications
- Budgetary control
- New operational procedures
- Competitive pressures
- Long term contract delays
- Training and hiring

This white paper shows that the steady state private cloud savings are significant, and become a cost effective alternative when compared to small EC2 deployments. The OpEx savings can be applied to DevOps, IT Ops and Application Development teams to migrate, partially or fully, to the new paradigm. The remainder of the savings can then be applied to where the business needs it most.

APPENDIX – CASE STUDY DETAILS

The following sections provide details regarding the equipment and services used in comparing Amazon EC2 to a self-hosted private cloud alternative.

The private cloud consisted of:

- Nine (9) King Star Twin Two servers, with two (2) nodes per chassis, as the base platform
- Piston's Piston OpenStack private cloud software for cloud orchestration and management
- Plexxi's affinity-driven Switch2 switches to provide network interconnectivity
- Colovore's water cooled high density cabinets for colocation infrastructure

Costs, assumptions and the rationale used are provided in each subsection.

REFERENCE: AMAZON EC2 VM (DEDICATED INSTANCE)

The Amazon EC2 m3.2xlarge VM was selected as it was the largest general purpose VM on offer. Smaller VMs had proportional capabilities and equally proportional pricing.

FEATURE	EC2 M3.2XLARGE
vCPUs	8
RAM (GB)	30
SSD Storage (GB)	160
CPU / Speed (Ghz)	2.6Ghz
Monthly Cost	$449.68

REFERENCE: KING STAR TWIN TWO SERVERS

The King Star Twin Two server was selected as it was a commonly deployed server platform with Colovore high density colocation customers. The units used had the following characteristics at constant load throughout the month:

FEATURE	KING STAR TWIN TWO SERVER NODE	3 X AMAZON EC2 M3.2XLARGE
vCPUs	24	24
RAM (GB)	96	90
SSD Storage (GB)	480	480
Hard Disk Storage	2,000	0
CPU / Speed (Ghz)	2.4	2.6
Monthly Cost (36 Month Lease, 10% Annual Interest)	$107.99	$1,349.04

REFERENCE: PLEXXI NETWORK UNITS

The Amazon EC2 m3.2xlarge VM was selected as it was the largest general purpose VM on offer. Smaller VMs had proportional capabilities and equally proportional pricing.

FEATURE	PLEXXI SWITCH2S UNIT
High density 10G/40G	Up to 72 10G
LightRail interfaces	4 x 120 Gbps per switch
Linux based SDN controller	1 controller per 250 switches
Standard L2 / L3 support	LAG, OSPF, BGP, VLANs, etc.
Monthly Maintenance Cost	$1,754.00
Monthly Cost (36 Month Lease, 10% Annual Interest)	$2,001.39

REFERENCE: PISTON OPENSTACK PRIVATE CLOUD DEPLOYMENT

The Amazon EC2 m3.2xlarge VM was selected as it was the largest general purpose VM on offer. Smaller VMs had proportional capabilities and equally proportional pricing.

FEATURE	PISTON OPENSTACK
Compute	KVM+VMS
Storage	Ceph with storage profiling and management
Service Orchestration	Moxie RTE
Hyperconverged	Compute, Storage, Networking, Management on each node
Monthly Cost / Server	$291.67

REFERENCE: COLOVORE HIGH DENSITY COLOCATION

A single Colovore rack, capable of supporting up to 17.3 kW of power, was provided to house the private cloud environment.

FEATURE	COLOVORE CABINET
Cabinet	48" x 24" x 45RU
Max Power / Cabinet	20kW
Cross Connects	Included
8x5 Remote Hands	Included
Monthly Cost (@ 10kW of Load)	$2,500.00

REFERENCE: SUPPORTING HARDWARE

In all cases below, pricing is based on a 36 month lease with a 10% annual interest rate.

DEVICE	MONTHLY COST
King Star Boot Node	$66.46