

VMware Cloud™ on AWS

Total Cost of Ownership (TCO)

An Analysis for SAP Landscapes

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Civatree

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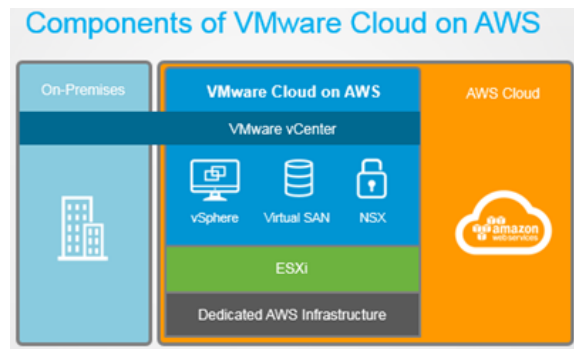
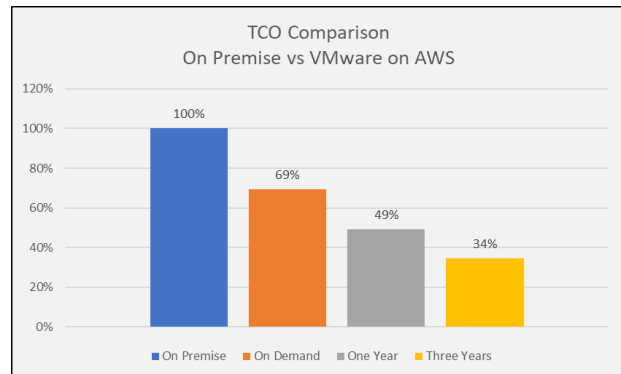
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VMware Cloud™ on AWS Total Cost of Ownership (TCO)

Executive Summary

Discover how moving your SAP workloads to VMware Cloud on AWS can lower your Total Cost of Ownership (TCO) by 10% for on-demand instances and over 50% for three-year reserved instances.



VMware Cloud on AWS runs directly on physical hardware, integrating with both an existing on-premise VMware environment and AWS services for a seamless hybrid environment.

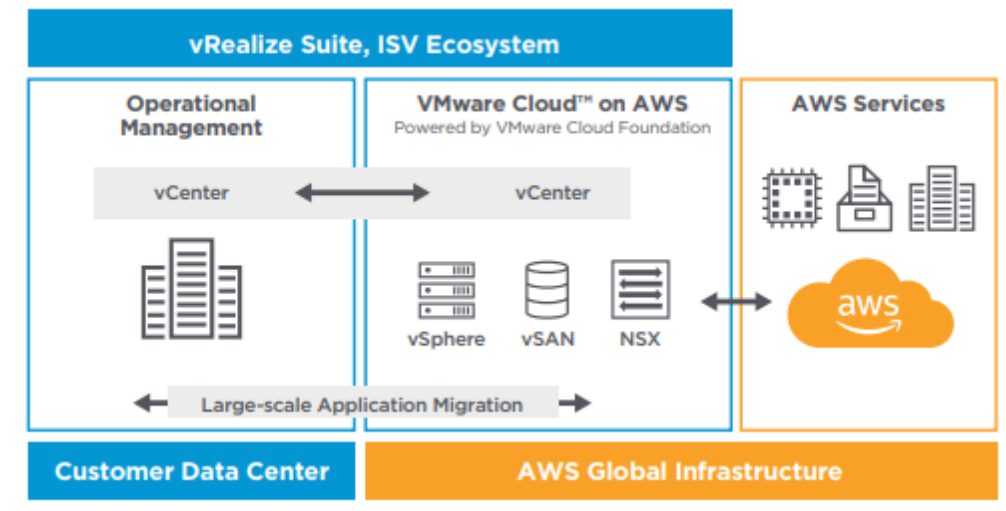
In this paper, data will be presented to show the TCO of running SAP on VMware Cloud on AWS. Several crucial operational points key to a successful cloud-based implementation will also be discussed.

Additionally, important elements related to Cloud Computing, and the many features VMware provides for contributing to the reduction of TCO will be presented.

Other important topics that will be addressed include: the design, security, complexity and business risk associated with migrating SAP workloads to VMware Cloud on AWS.

What is VMware Cloud on AWS?

In short, VMware Cloud on AWS is a cloud version of an existing on-premise VMware environment running vSphere. This leverages the well-known features of VMware and the flexibility to modernize both appl provided by AWS cloud services. VMware Cloud runs on physical hardware hosted by AWS and integrates with all the other cloud services and functionality that AWS provides. VMware Cloud on AWS integrates on-premise environments with AWS Services for a complete SAP hybrid cloud solution.



VMware Cloud on AWS is powered by VMware Cloud Foundation™, the unified VMware SDDC platform that integrates VMware vSphere®, VMware Virtual SAN™ and VMware NSX™ virtualization technologies. This service is optimized to run on a dedicated, elastic, bare-metal Amazon Web Services (AWS) infrastructure and is delivered, sold, and supported by VMware and its partners.

Pioneered by VMware and partnered with AWS, SDDC extends the virtualization concepts, abstraction, pooling and automation to all data center resources and services. The architecture enables a fully automated, near zero-downtime infrastructure for any application or hardware. This enables a flexible, scalable and agile environment allowing improved agility and efficiency along with a secure environment with high speed networking and response times.

Why run SAP on VMware Cloud?

SAP environments are a critical component of a company's business operations. Maintaining a highly available SAP solution is often seen as an expensive addition to the IT budget but making the decision to run non-HA can often be more costly in the long run. Similar decisions are made to having redundant disaster recovery environments. These expenses can be greatly reduced in a hybrid cloud solution utilizing VMware Cloud on AWS.

Agility is key to a competitive edge in today's business environment. The ability to quickly provision new systems with little to no acquisition costs can help avoid project bottlenecks associated with procuring hardware. Business processes such as year or quarter end that can consume a high amount of resources may cause environments to be oversized. The ability to quickly scale environments up and down can reduce these costs. A hybrid cloud solution encompassing VMware Cloud on AWS can be integral to future-proofing an SAP landscape.

VMware offers SAP next-generation technology platforms through a broad range of private, hybrid, and multi-cloud deployment architectures, enabling customers to rapidly transform their SAP landscapes to run in a virtualized software defined data center environment.

Key VMware offerings for SAP are:

- Multi and Hybrid Cloud for SAP HANA®
- Hyper-converged Architectures for SAP HANA
- SAP HANA Virtualization
- SAP Automation

SAP landscapes and data workloads on VMware virtualization software provide the simplicity, efficiency, and agility customers demand for their most mission-critical enterprise workloads. Customers are enabled to transform and virtualize their entire workloads whether they be transactional or analytical.

VMware on AWS provides a seamless extension of your on-premise virtualized environment to AWS, utilizing existing familiarity with tools for both on premise and the cloud. It provides automated and simplified migration using VMware vSphere® vMotion® across on premise and cloud and allows established on-premise enterprise security, governance, and operational policies.

SAP TCO Considerations

For all SAP NetWeaver® and SAP Business Suite products, SAP recommends at minimum a three-tier landscape consisting of a development, quality control, and production environments to segregate development, testing and business operations.

The total cost of ownership (TCO) for the environment includes two broad categories:

- Capital expenditures (CAPEX) – Infrastructure and Licenses.
- Operational expenses (OPEX) – Administration and Operations

The TCO values reflect the quality-asset utilization and the efficiency of operations against the ROI.

There are various models for calculating TCO, and the common goal of all TCO models is to split the total costs into blocks to identify the cost drivers within the system landscape. The Gartner model calculates TCO in four broad categories detailed below:

Cost Category	SAP Application Activities
Availability and Downtime	Planned and unplanned downtime Users affected Business Impact
Operations	SAP maintenance Support Deployment Maintenance Process and planning Upgrades Energy consumption
Administration	Asset management Firmware upgrades Procurement training (IS, end user)
Infrastructure	Hardware Additional software management supplies

Source: Kagermann, Henning, Prof. – SAP Press book SAP-Solutions

Analysis Methodology

The focus of this whitepaper is to do a detailed comparative TCO analysis for an SAP landscape running on VMware Cloud on AWS against on-premise data center. Use case scenarios will be utilized to explain the advantages and cost benefits of extending the on-premise VMware environments to AWS.

For TCO analysis the below option is considered for comparison with an equivalent on premise

On-premise Environment	VMC on AWS Host	AWS Region
<p>VMware Cloud Foundation on Premise recommended a standard 4 node cluster as a minimum to support N+1 for a business critical application (SAP)</p> <p>Host Configuration:</p> <ul style="list-style-type: none"> • CPU <ul style="list-style-type: none"> ○ 2 Sockets ○ 18 cores per socket • Memory <ul style="list-style-type: none"> ○ 512GB RAM • Storage <ul style="list-style-type: none"> ○ 15TB SSD 	<p>VMware Cloud on AWS recommended standard 4 node cluster as a minimum to support N+1 for a business critical application (SAP)</p> <p>Host Configuration</p> <ul style="list-style-type: none"> • CPU <ul style="list-style-type: none"> ○ 2 Sockets ○ 18 cores per socket • Memory <ul style="list-style-type: none"> ○ 512GB RAM • Storage <ul style="list-style-type: none"> ○ 15.2TB RAW SSD 	<p>US Oregon</p>

The total cost for an on-premise environment is amortized for a 3-year period for cost analysis.

VMware Cloud™ on AWS Total Cost of Ownership (TCO)

On Premise vs VMC on AWS Costs (for 3 years)

Cost Category	On-premise*($\text{\$}$)	VMC on AWS ($\text{\$}$ **)		
		Pay on Demand	1-year Subscription	3-year Subscription
Server Hardware	986,979.00	879,654.67	623,844.00	437,464.00
Network Hardware	149,775.00			
Storage	131,110.00			
Personnel	2,592.00			
Total Cost	1,270,456.00	879,654.67	623,844.00	437,464.00
TCO Savings for VMC on AWS		~30%	~50%	~65%

*On-premise cost calculated based on AWS TCO estimation for a virtualized environment

** Average per month cost ($\text{\$}$) of VMC on AWS subscriptions is as below

- Pay on demand - 24,435.84
- 1-year subscription - 17,329.00
- 3-year subscription – 12151.78

The above pricing information is used for analysis of all use cases discussed in this whitepaper and the TCO advantages are explained with amortized costs / month for a 3-year period.

What's in?

This cost analysis includes

- Infrastructure related TCO of running an SAP landscape on VMC on AWS
- On-premise infrastructure cost including the cost to operate the data center for a period of 3 years.
- Infrastructure administrator expense for administering the on premise hardware
- Hardware maintenance cost considered at 15% of server cost / year
- 25% discount for on premise server costs and 50% for per GB storage cost

What's out?

This cost analysis excludes

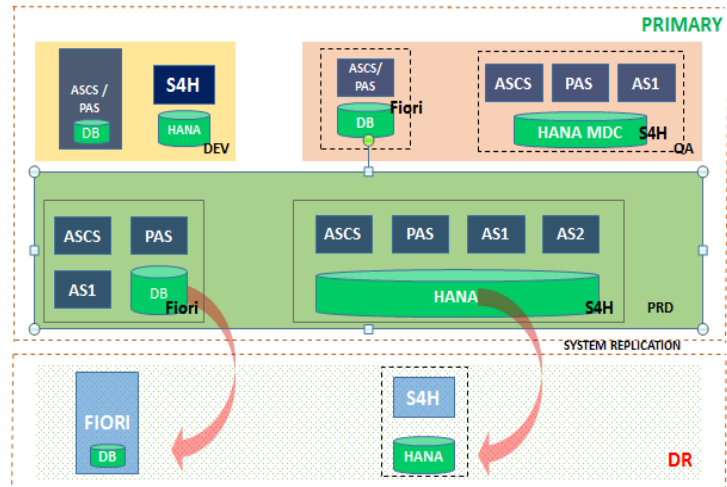
- Application expenses and business impact during maintenance and downtime
- Software licenses
- Hybrid cloud discounts for existing VMware customers
- Additional datacenter maintenance costs and facilities cost is not included in the total cost for on premise
- AWS data egress fees for transfer between on premise and AWS

SAP on VMware Cloud Use Cases

SAP Landscape

The first use case will examine an SAP environment deployed with a 3-system landscape model for a detailed TCO analysis for every use case scenario to run VMware Cloud on AWS (VMC on AWS).

- 3 tier deployment model considered for QA and PROD
- 2 tier deployment model is considered for Fiori DEV and DR systems



Use Cases

Customers running SAP on premise typically encounter the following challenges: performance bottlenecks due to capacity limitations, underutilization of resources, and scalability limitations to meet future growth.

The below use case scenarios are used to map each scenario to a deployment pattern to compare the cost benefits of running the application on VMC on AWS against an On-premise data center.

- SAP Non-production systems
- High availability
- Disaster recovery environment
- Upgrade / Test landscape
- Scale out instances

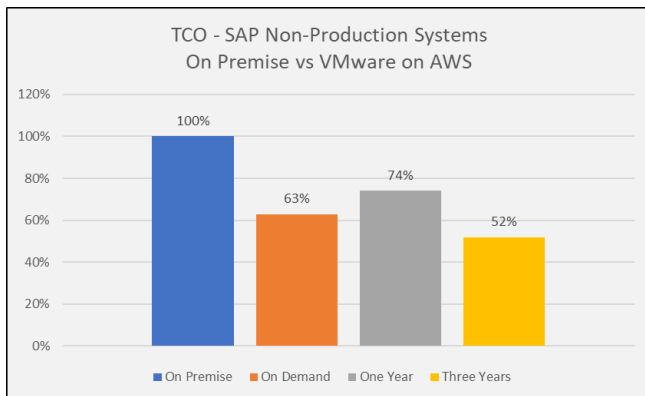
SAP Non-production systems

When considering extending your SAP on VMware environment to AWS Cloud, a decision will have to be made on migrating the non-production environment to leverage the advantages of cloud architecture.

Scenario assumptions:

- Reduced service availability is acceptable for non-production environments
- QA environment to be a replica of the production environment
- Compute resources for On-premise consisting of:
 - SAP Systems - S4 HANA and Fiori
 - 8 VMs (64 cores, 512 GB RAM, 5 TB SSD storage)
 - 3 VM's for Development system
 - 5 VM's for QA environment

TCO Analysis



Deployment Option	On-premise (\$)	VMC on AWS (\$)		
		Pay on Demand*	1-year Subscription	3-year Subscription
Amortised Cost / month	23401.00	14727.85	17,329.00	12151.78
TCO Savings for VMC on AWS		37.06%	25.94%	48.07%

*Service availability of 220 days / year considered for Pay on demand instances

VMware Cloud™ on AWS Total Cost of Ownership (TCO)

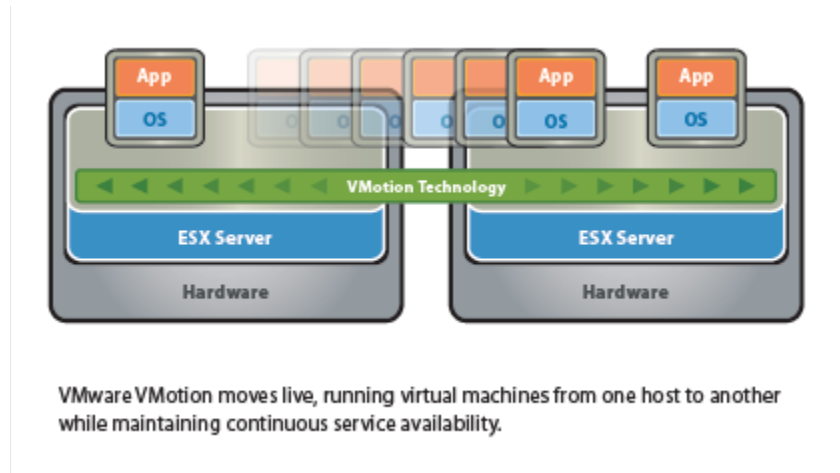
Why VMC on AWS

In addition to subscription cost benefits, flexible usage of systems using the below additional features of VMC on AWS systems enhances the TCO savings for non-production.

1. **Improved asset quality utilization** – Optimization of system availability by using vMotion for rapid migration of the environment from on premise to VMC on AWS.
2. **Cloud Automation** – Leverage cloud automation using vRealize™ to provision and control new and existing infrastructure, reduce operational cost by replacing time-consuming, manual processes and gain additional cost savings through automated reclamation of inactive resources. The vRealize tool allows the customer to achieve additional TCO benefits by pre-defining the service uptime policies for these environments to completely automate the system management.

High availability

Some customers require their critical SAP systems to be available 24x7 to meet business requirements. A down time of even a few minutes could result in huge financial implications and data loss.



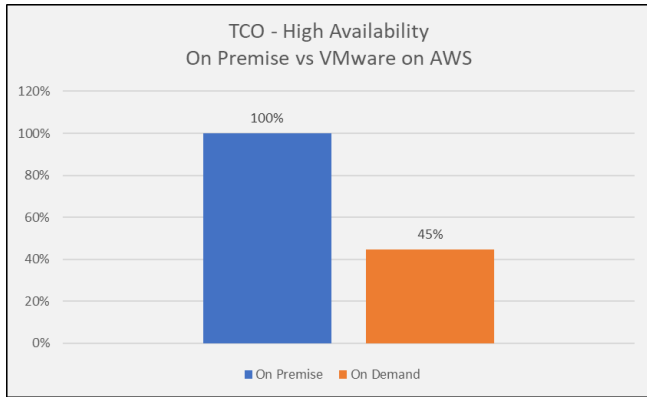
SAP high availability deployed on premise is generally based on usage of a cluster infrastructure to secure for single points of failure in the architecture such as the SAP ASCS and database. This implies a higher infrastructure investment, operational costs and increased administration effort. The native capabilities of VMware help reduce the impact of both planned and unplanned downtime.

Scenario assumptions

- SPOF configuration for SAP ASCS instance
- SAP ERS instance
- Compute resources for on-premise consisting of:
 - 2 Failover clusters for ASCS/ERS (16 cores and 96 GB RAM)
- The VMC on AWS cost for HA is for pay on demand subscription Service uptime of 24 hours for the failover node / failover incident
- 7 failover incidents considered / month

VMware Cloud™ on AWS Total Cost of Ownership (TCO)

TCO Analysis



Deployment Option	On-premise (\$)	VMC on AWS (\$)
Amortised Cost / month	8,403.42	3748.91
TCO Savings for VMC on AWS		55.39%

Month #	# of failover incidents	On-premise Cost	VMC on AWS cost	TCO Savings for VMC on AWS
1	7	8,403.42	5,623.36	33.08%
2	3	8,403.42	2,410.01	71.32%
3	0	8,403.42	0	100%
4	10	8,403.42	8,033.38	4.4%
5	2	8,403.42	1,606.68	80.88%
6	6	8,403.42	4,820.03	42.64%
Average TCO savings for 6 months		50,420.52	22,493.46	55.39%

Why VMC on AWS?

Achieve High availability on VMC on AWS for critical SAP instances with VMware® vMotion™.

By enabling seamless bi-directional application migration between your on-premise data center and the AWS Cloud zero downtime and continuous service availability can be achieved. This results in extreme level of TCO reduction with negligible additional investment and zero disruption to business operations during system maintenance activities.

During times of service disruption with any of the servers running SAP, the affected server is automatically migrated to AWS and the service is restored with no disruption to the end user. This server could be migrated back to the on-premise environment once the underlying issue is resolved. Looking at an example – if there is an issue with an on-premise server (primary) and the affected host is migrated to AWS till the issue with the primary host is resolved. Once issue is resolved the host is migrated from AWS back to the primary. Considering the total time to resolve the issue with primary is approximately 24 hours, subscription cost for this duration would be the only factor contributing to TCO and this is periodic.

*VMware vMotion is included in VMware Infrastructure 3 Enterprise.

Disaster Recovery Environment

Customers who are looking to secure their mission critical applications with a disaster recovery site at a remote location could explore alternative deployment models like hosting their DR site on the cloud. For existing VMware customers this would be advantageous to deploy their DR on AWS.

For a complex, mission critical application like SAP it is extremely important to analyze the options to setup a cost-effective, consistent DR. In this use case scenario disaster recovery environment for mission critical SAP production environments is considered for the below use case scenarios to analyze the TCO for an SAP landscape

DR using Database Options

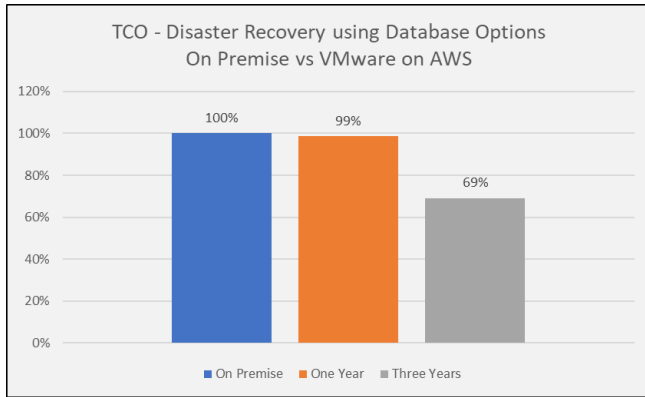
The supported database options for SAP are: HANA, Oracle, Sybase ASE, IBM DB2, MS SQL and MaxDB. All the databases support a native HA/DR setup. The advantages of using native DR features are data consistency, product support and scope for reduction of RPO and RTO based on the type of DR (active with continuous log shipping and replay/ passive based on backup restore).

Scenario Assumptions

- Remote DR site for SAP and Database
- Continuous log shipping and replay to DR site
- Compute resource for On-premise consisting of:
 - 4 servers (80 Core, 512 GB RAM and 15 TB storage)

VMware Cloud™ on AWS Total Cost of Ownership (TCO)

TCO Analysis



Deployment Option	On-premise* (\$)	VMC on AWS (\$)	
		1-year Subscription	3-year Subscription
Amortised cost / month	17,572.64	17,329.00	12,151.78
TCO Savings for VMC on AWS		1.3%	30.84%

Why VMC on AWS?

TCO could be optimized further using the below features of VMC on AWS

- **Higher capacity** – The infrastructure on AWS is of very high capacity compared to the on premise hardware and could be used to run additional applications
- Using an active DR site only for Database, while using VMware DR features for SAP application servers which could reduce the number of hosts for subscription

DR using Database backup / restore

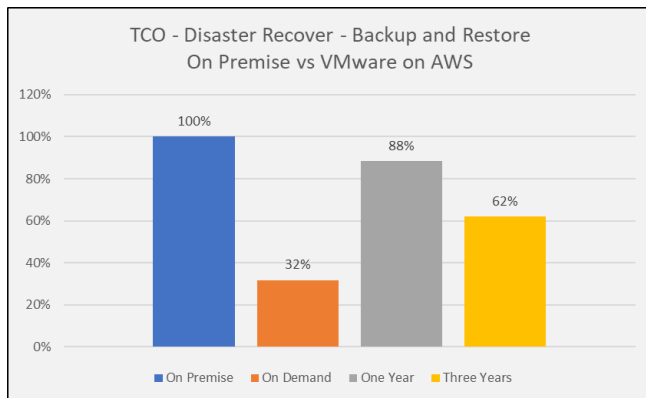
Business continuity plans based on backup / restore would mean the DR is a passive environment with high RPO and RTO based on backup frequency and restoration of database and operations in the target site, respectively.

In this scenario, it is not necessary for the servers at the DR site to be up and running all the time. This would translate to reduced power consumption resulting in a reduced cost of operations, but still requires upfront investment for DR hardware.

Scenario Assumptions

- Operational costs (power consumption) for servers, excluded in the DR costs for On-premise passive DR setup.
- For VMC on AWS
 - Amazon S3 standard storage is considered for backup storage
 - A DR requirement of 6 times / year is considered for cost calculations
 - Backup storage of 60 TB considered
 - Data restoration charges from a near line storage as applicable on AWS
 - For 1 year and 3-year subscriptions passive storage is not considered

TCO Analysis



Deployment Option	On-premise (\$)	VMC on AWS (\$)		
		Pay on Demand	1-year Subscription	3-year Subscription
Amortised Cost / month	19,632.86	6,233.15	17,329.00	12,151.78
TCO Savings for VMC on AWS		62.3%	2.6%	31.75%

VMware Cloud™ on AWS Total Cost of Ownership (TCO)

Why VMC on AWS?

VMC on AWS provides a distinct advantage to host a passive DR site using backup / restore in terms of TCO reduction, which are

- The subscription cost for hosting the DR site is only for the service uptime of the actual DR systems (pay as you go)
- Amazon S3 could be used as low-cost storage to store the database backup against expensive disk storage

DR using VMware DRS

VMC on AWS enables organizations to simplify, accelerate and modernize their existing disaster recovery solutions by enhancing their existing VMware-based DR solutions with AWS Cloud-based disaster recovery as a service (DRaaS) capabilities. By combining the trusted and proven VMware DR technologies such as VMware Site Recovery Manager (SRM) and vSphere Replication organizations can realize the benefits of cost reduction, operational simplification and faster time to protection for disaster recovery and DR testing.

Upgrade / Test landscape

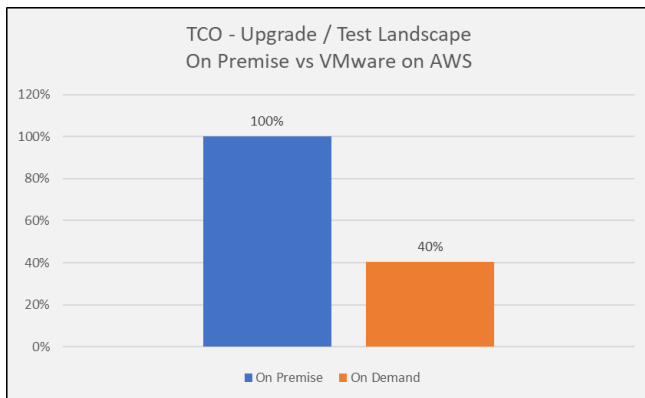
Running SAP on premise during a project, teams often requires additional capacity to test, sandbox or load test new solutions. It is costly to add additional temporary capacity, not to mention the complex and challenging to meet project timelines.

One of the primary advantages of moving to a cloud-based environment is the rapid deployment of an SAP environment based on periodic demand and project requirements. Smaller customers not willing to invest in a permanent test or a typical n+1 landscape could consider deploying a temporary load / simulation environment on the cloud on demand.

Scenario assumptions:

- A test environment equivalent to production
- System with a short-term service uptime – 3 weeks considered for cost calculation
- Compute resources:
 - 6 Virtual Servers (80 cores, 512 GB RAM and 10 TB storage)
 - Pay on demand instances for VMC on AWS
- 5 cycles of project / temp landscape considered per year

TCO Analysis



Deployment Option	On-premise (\$)	VMC on AWS (\$)
		Pay on Demand
Amortized Cost / month	17,396.44	7029.20

VMware Cloud™ on AWS Total Cost of Ownership (TCO)

Below table explains how TCO benefits are realized for a project / temp landscape setup with VMC on AWS for a period of 12 months

Month #	Requirement of test landscapes	On-premise Cost	VMC on AWS cost	TCO Savings for VMC on AWS
1	Yes	17,396.44	16,870.09	3%
2	No	17,396.44	0	100%
3	No	17,396.44	0	100%
4	Yes	17,396.44	16,870.09	3%
5	Yes	17,396.44	16,870.09	3%
6	No	17,396.44	0	100%
7	Yes	17,396.44	16,870.09	3%
8	No	17,396.44	0	100%
9	No	17,396.44	0	100%
10	Yes	17,396.44	0	100%
11	Yes	17,396.44	16,870.09	3%
12	No	17,396.44	0	100%
Average TCO savings for 12 months		208,757.28	84,350.45	60%

Why VMC on AWS?

Leverage VMC on AWS features to commission additional temporary servers on-demand for temporary requirements such as a maintenance landscape (n+1) for critical upgrade projects or a separate environment for periodic performance testing. Increased testing and separation of sustainment and project landscapes reduces TCO to a large extent.

Consider a requirement to build a new test environment for performance testing as part of a new version upgrade or roll out. Typical expectations for load testing are to validate the performance expectations of a production environment through user load simulation equivalent to production. Sizing another system to production is a daunting task. If the cost and environment are temporary these costs can be budgeted to the project.

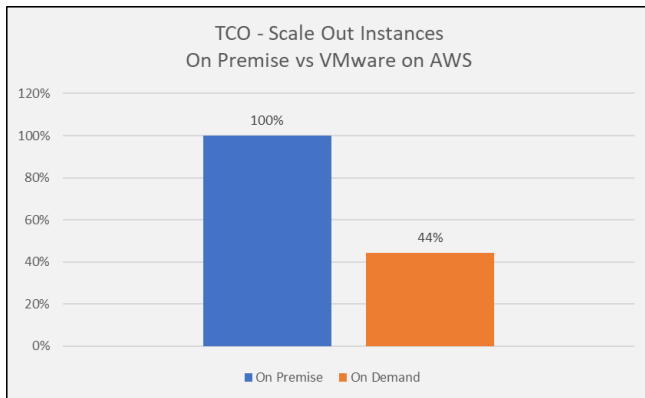
Scale out Instances

Not every customer would require their SAP system to be running at a peak capacity all the time and it would also not be viable to invest upfront to meet a periodic peak load. Month end processing and year end processing are typical periodic requirements when there would be a surge in the number of concurrent users and the amount of data, they are processing.

Scenario assumptions

- Scale out instance equivalent of SAP app servers considered
- Compute resources:
 - 2 Servers (8 cores, 64 GB RAM and 1 TB storage)
 - Pay on demand instances on VMC on AWS
- Service uptime of 24 hours for 7 days

TCO Analysis



Deployment Option	On-premise (\$)	VMC on AWS (\$)
		Pay on Demand
Amortized Cost / month	6338.67	2811.68
TCO Savings for VMC on AWS		55.64%

Below table explains how TCO benefits are realized for scale out instances' setup with VMC on AWS for a period of 12 months

VMware Cloud™ on AWS Total Cost of Ownership (TCO)

Month #	Requirement of Scale out instance	On-premise Cost	VMC on AWS cost	TCO Savings for VMC on AWS
1	Yes	6338.67	5623.36	11.28%
2	No	6338.67	0	100%
3	Yes	6338.67	5623.36	11.28%
4	No	6338.67	0	100%
5	No	6338.67	0	100%
6	Yes	6338.67	5623.36	11.28%
7	No	6338.67	0	100%
8	No	6338.67	0	100%
9	Yes	6338.67	5623.36	11.28%
10	No	6338.67	0	100%
11	Yes	6338.67	5623.36	11.28%
12	Yes	6338.67	5623.36	11.28%
Average TCO savings for 12 months		76064.04	33740.16	55.64%

Why VMC on AWS?

VMC on AWS offers flexibility to scale on demand and this could be achieved using VMware features like vMotion and vRealize automation.

In this use case scenario, considering a surge in load for a period of 2 weeks, an SAP scale out deployment with instances equivalent to existing application server instances to meet additional load for the period provides extends TCO advantages of running such an environment on VMC on AWS than on premise.

With VMC on AWS leverage the global footprint of AWS to deploy additional instances on AWS EC2 bare metal infrastructure to meet any growing business demand. This enables meeting any operational demand with no locked investment.

Conclusion

VMware Cloud on AWS affords great flexibility managing SAP workloads in a hybrid cloud environment. It provides the framework for a cost-conscious high availability solution. Disaster recovery no longer requires redundant hardware taking up valuable space in a data center as VMware Cloud on AWS can supply DR resources on-demand. The on-demand cost savings mean IT management can justify more robust DR solutions which better meet business requirements.

Technology changes rapidly and it is imperative for companies to be able to utilize it to their advantage and maintain a competitive edge. VMware Cloud on AWS utilizes existing vSphere technology and combines it with AWS cloud services to provide an agile solution ready for scale out or provisioning of temporary project environments at a manageable cost.

This paper has shown that clearly, there is monetary value in running SAP workloads in a hybrid VMware Cloud on AWS environment, but a TCO study alone does not reflect the additional value in flexibility, agility, and familiarity the product supplies.