Total Cost of Ownership (TCO) Comparison

This report includes a total cost of ownership (TCO) comparison between running your application in an on‑premises or colocation infrastructure and AWS. The on‑premises/colocation infrastructure is based on the description you provided in the online tool. The AWS infrastructure is an approximation of the infrastructure you described. These calculations use third‑party estimates and assumptions. This calculator provides an estimate of usage charges for AWS services based on certain information you provide. Your monthly charges will be based on your actual usage of AWS services and may vary from the estimates the calculator has provided.

AWS Total Cost of Ownership (TCO) Calculator

On-Premises vs. AWS Summary

You could save **60%** a year by moving your infrastructure to AWS.

Your three year total savings would be $ 6,813,186.

3 Years Cost Breakdown
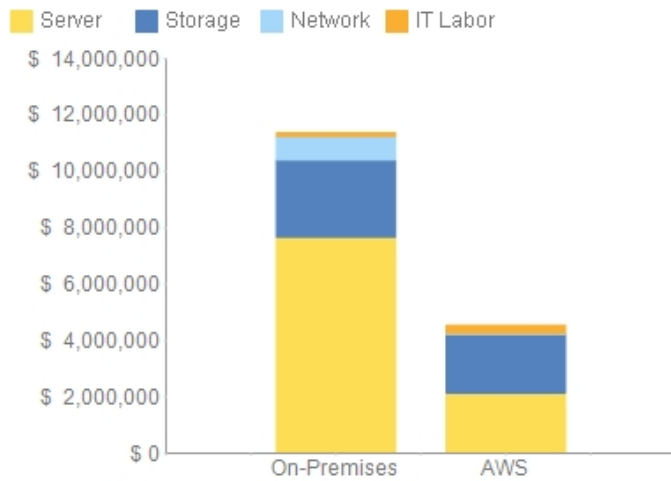
	3 Yr. Total Cost of Ownership	
	On-Premises	**AWS**
Server	$ 7,678,026	$ 2,149,716
Storage	$ 2,741,636	$ 2,078,198
Network	$ 835,562	$ 36,559
IT-Labor	$ 109,350	$ 286,915
Total	$ 11,364,574	$ 4,551,389

AWS cost includes business level support

Environment Details

Currency: United States Dollar

Your Physical environment

Environment: Physical

# Servers	# Cores	Memory (GB)	OS	Server Utilization (%)	Optimize by
10	32	128	Linux	100%	RAM
10	32	128	Linux	100%	RAM
200	32	64	Linux	100%	RAM

Storage (TB)

SAN	NAS	Object
1,000	500	200

Bandwidth (Mbps)

Pipe Size	Peak/Average Ratio
1,000	3

Your AWS environment : US East (N. Virginia)

Closest AWS Instances

# Instances	Instance	vCPU	RAM (GiB)	Optimize by	Instance Type
10	db.m4.10xlarge	40	160	RAM	3 Yr. Partial Upfront RI
10	db.m4.10xlarge	40	160	RAM	3 Yr. Partial Upfront RI
200	m4.4xlarge	16	64	RAM	3 Yr. Partial Upfront RI

EC2 Instance Mapping Criteria

Optimize by	Description
CPU	Option matches by VCPU count and then finds the lowest priced EC2 instance from the available choices
RAM	Option matches by RAM size and then finds the lowest priced EC2 instance from the available choices
Storage IO	Option matches by I/O requirements and then finds the lowest priced EC2 instance from the available choices

Cost Breakdown

Your On-Premises Cost Breakdown

Server
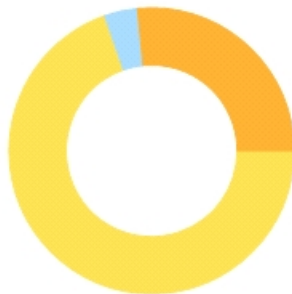
- Hardware : $ 5,348,706 [69%]
- Software : $ 288,840 [4%]
- Overhead : $ 2,040,480 [27%]

Storage
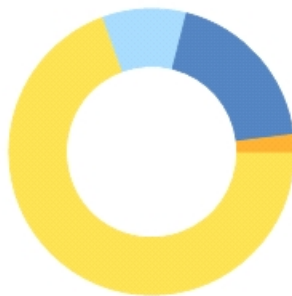
- Raw Capacity : $ 1,904,640 [69%]
- Backup : $ 524,400 [19%]
- Overhead : $ 260,123 [9%]
- Admin : $ 52,473 [2%]

Network

- Bandwidth : $ 60,000 [4%]
- Gear : $ 775,562 [46%]
- Admin : $ 835,562 [50%]

Your AWS Cost Breakdown

Compute EC2

- 3 Yr Partial Upfront RI : $ 2,258,450 [100%]
- On Demand : $ 0 [0%]

Storage

- EBS : $ 907,663 [45%]
- S3 : $ 31,467 [2%]
- S3IA : $ 5,724 [0%]
- EFS : $ 1,057,536 [53%]

EBS

- IOPS : $ 0 [0%]
- EBS Volumes : $ 829,440 [98%]
- Snapshot : $ 17,510 [2%]

Server

Input

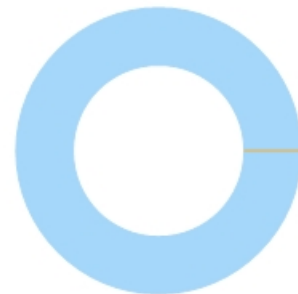| On-Premises Server Configuration							
App Name	# of Processors /Server	# of Cores /Processor	# of Servers	Memory (GB)	Host OS	Server Utilization (%)	Optimize By ?
Oracle SE	4	8	10	128	Linux	1	RAM
Others	4	8	10	128	Linux	1	RAM
Linux	4	8	200	64	Linux	1	RAM

Modified Assumption	
Parameter	Value
4 procs and 8 cores	
VMware License cost ($)	
Metered Power cost/kWH	
Cost to operate a rack/mo	

Output

On-Premises - Server Costs

Server Hardware Costs

Server Hardware Costs							
# Servers	# of Cores	RAM (GB)	Units (U)	Power (KW)	Unit Cost	Unit Discount	Total Cost
10	32	128	40	7.5	$ 18,075	25%	$ 135,563
10	32	128	40	7.5	$ 18,075	25%	$ 135,563
200	32	64	800	150	$ 17,723	25%	$ 2,658,450
220			880	165.0			$ 2,929,575

Total Server Hardware cost	$	2,929,575
Server Hardware Maintenance cost for 3 Yrs. (@15%/Yr.)	$	1,318,309
Total number of Racks required (1 Rack=42U, 28U occupied by servers, 4U by ToR switches and PDUs)		32
Total Peak power consumed (kW)		165.0

Rack Infrastructure Costs

AWS - EC2 Costs

EC2 Instance Costs (3 Yr.) – On-Demand and Reserved Instances

3 Yr. Partial Upfront Reserved Instances			
AWS Instance	Upfront	Hourly	Total Costs
db.m4.10xlarge	$ -	$ -	$ -
db.m4.10xlarge	$ 10,512	$ 1.78	$ 574,186
m4.4xlarge	$ 4,205	$ 0.16	$ 1,684,264
Total Cost:			$ 2,258,450

Total costs = (upfront cost + hourly cost*8,784 hours/yr.*3 years)* # of instances (Applied to the whole term whether or not you're using the Reserved Instance)

On-Demand			
AWS Instance	Upfront	Hourly	Total Costs
db.m4.10xlarge	0	0	$ -
db.m4.10xlarge	0	7.004	$ 1,845,694

Rack Chassis with PDU (@$3500/rack) cost	$	59,200
PDUs, dual 280V per rack (@$540 each, 2/rack for HA) cost	$	29,440
Top of Rack Switch (48-port 10/100/1G, $5,000 each, 2/rack for high availability)	$	320,000
Rack and Stack one-time deployment cost ($250/server)	$	55,000
Provision for spare servers for 3 Yrs. (@5% spare capacity/Yr.)	$	637,183
Total Rack costs (rack infrastructure and server hardware)	**$**	**5,348,706**

Server Software Costs (Host OS)

Total number of Windows licenses required		0
Windows license list price (unit cost for 2 licenses)	$	6,155
Windows license discounted price (unit cost for 2 licenses)	$	4,616
Windows licenses cost	$	-
Windows Software Assurance cost (3 Yrs.)	$	-
Windows Licenses and Software Assurance (3 Yrs.)	**$**	**-**

MySQL

MySql Edition		Open Source
MySql License List Price (per 2 cores)	$	-
MySql License Price After Discount	$	-
MySql Standard Ed. Licenses Required		10
MySql Standard Cost	$	-

Oracle

Number of Standard Edition One Licenses Required		20
License Cost	$	116,000
Total Oracle Cost	$	144,420
Total 3-Year Database Software License Cost	$	144,420
Total Server Costs (Hardware and Software) - 3 Yr.	**$**	**5,637,546**

Facilities Costs (data center space, power and cooling) - On-Premises

Total Power consumed by servers (kW)		165.0
Metered cost per kWH	$	0.10
Estimated power cost/month	$	11,880.00
Monthly cost to operate a rack	$	1,400.00
Total rack costs/month	$	44,800.00
Total monthly Facilities costs	$	56,680.00
Facilities costs - On-Premises (3 Yr.)	**$**	**2,040,480**

m4.4xlarge	0	0.8	$ 4,216,320
Total Cost:			**$ 6,062,014**

> Total costs = (hourly cost*8,784 hours*3 years*utilization)* # of instances (Hourly usage fee charged for each hour you use the instance)

Lowest Priced Instance

Instance	Cost	Type
db.m4.10xlarge	$ -	3 Yr. Partial Upfront RI
db.m4.10xlarge	$ 574,186	3 Yr. Partial Upfront RI
m4.4xlarge	$ 1,684,264	3 Yr. Partial Upfront RI
Total Cost:	**$ 2,258,450**	

EC2 Costs (3 Yr.)   **$ 2,258,450**

EC2 Reserved Instances discounts (if Applicable)

EC2 Reserved Instances

AWS Instance	Pricing model	# Instances	Upfront fee	Total cost
db.m4.10xlarge	3 Yr. Partial Upfront RI	10	$ -	$ -
db.m4.10xlarge	3 Yr. Partial Upfront RI	10	$ 10,512	$ 574,186
m4.4xlarge	3 Yr. Partial Upfront RI	200	$ 4,205	$ 1,684,264
Total fee				**$ 2,258,450**

Discount Tier Applicable	10%
AWS Business Support (EC2)	**$ 117,111**

Server cost break-down

Server cost break-down		
Category	**Cost**	**% of Total Cost**
Hardware	$ 5,348,706	69%
Software	$ 288,840	4%
Operating Costs (3 Yrs.)	$ 2,040,480	27%
Total	$ 7,678,026	100%

Total server cost, including operational cost (3 Yr.)　　**$　7,678,026**

EC2 Costs (3 Yr.) after discount　　**$　2,149,716**

Storage

Input

On-Premises Storage Configuration				
Storage Type	**Raw Storage Capacity (TB)**	**Max IOPS for Application**	**Backup % / Month**	**Disk Type**
Object	200	0	0	
NAS	500	0	0	
SAN	1000	0	0	
Modified Assumption				

Parameter	Value
Object	
NAS	
SAN	
Number of TB in a rack	

Output

On-Premises - Storage Costs

Only raw capacity specified, no IO requirements; use HDD by default
SAN Cost

Starting capacity/raw capacity (TB) user provided		1,000
Starting capacity/raw capacity (GB)		1,024,000
Capacity after OS Penalty (~7%, capacity OS recognizes) (GB)		921,600
Usable capacity based on RAID (RAID 10 assumed) configuration (GB)		184,320
$/raw GB purchase price	$	1.50
Discounted $/raw purchase price (50% storage hardware discount applied)	$	0.75
Acquisition Cost of SAN storage	**$**	**768,000**

SSD used based on user input
NAS Costs

Starting capacity/raw capacity (TB)		500
Starting capacity/raw capacity (GB)		512,000
Capacity after Penalty (RAID,OS,Utilization,Redundancy) (GB)		97,920
$/raw GB purchase price	$	4.00
Discounted $/raw purchase price (50% storage hardware discount applied	$	2.00
Acquisition Cost of NAS storage	**$**	**1,024,000.00**

Object Storage Cost

AWS - Storage Costs

EBS Storage - Only Standard EBS used with no IOPS requirements

EBS Costs - Equivalent to On-Premises SAN environment

Starting capacity (GB)		184,320
Equivalent EBS storage volume		General Purpose (SSD)
Number of EBS volumes required		185
EBS volumes cost/month	$	23,040.00
Initial snapshot cost(one-time)	$	17,510.40
EBS incremental snapshots cost/month	$	-
Total EBS cost /month	$	23,040
EBS Costs (3 Yr) - no IOPS	$	846,950
EBS Costs (3 Yr.)	**$**	**907,663**
AWS Business Support (EBS)	**$**	**60,713**

EFS Costs -Equivalent to on-premises NAS Storage

Capacity required (GB)		97,920
Price per GB Per Month		0
Total Cost Per Month		29,376
EFS Costs (3 Yr.)	**$**	**1,057,536**
AWS Business Support (EFS)	**$**	**75,808**

S3 Costs -Equivalent to on-premises Object Storage

Starting capacity/raw capacity (TB)			200
Starting capacity/raw capacity (GB)			204,800
Capacity after OS Penalty (~7%, capacity OS recognizes) (GB)			184,320
Usable capacity based on RAID (RAID 10 assumed) configuration (GB)			36,864
$/raw GB purchase price	$		1.10
Discounted $/raw purchase price (50% storage hardware discount applied)	$		0.55
Acquisition Cost of Object storage	$		**112,640**

Storage backup cost

Total amount of storage to be backed up (TB)		1,000.00
Total amount of storage to be backed up (GB)		1,024,000
Type of Tape Library used		LTO-6
Max uncompressed speed (MB/s) for Tape Library		160
Max uncompressed speed - TB/day		13.18
Backup Window Time(hr.)		8
TBs processed/drive for backup window		4.39
Number of Tape drives required		228
Tape Library price/drive	$	2,300
Backup cost (3 Yr.)	$	**524,400**

Storage Overhead (data center space, power, cooling, storage administrator)

Typical TB managed by storage admin/Yr.		1000
Storage Admin Costs (3 Yr.)	$	**52,473**

Inter-site networking bandwidth

Estimated GBs inter-site networking traffic per month		605,127
Inter-site networking bandwidth Cost per month	$	3,026
Inter-site networking bandwidth Costs (3 Yr.)	$	**108,922.85**

Amount of TBs hosted by a single rack (TB)		1000
Number of racks required		3
Monthly cost to operate a rack	$	1,400
Total data center space, power, cooling costs (3 Yr.)	$	**151,200**

Storage cost break-down

Storage cost break-down

Storage (GB)	27,648

S3 Standard storage cost	
Tier	Cost
First 50 TB / month	$ 815.62
Next 450 TB / month	$ -
Over 500 TB / month	$ -

Total Monthly S3 costs	$	**815.62**
S3 Costs (3 Yr.)	$	**31,467**
AWS Business Support (S3)	$	**2,105**

Standard – Infrequent Access Costs -Equivalent to on-premises Object Storage

Storage (GB)	9,216

Standard – Infrequent Access Standard storage cost	
Tier	Cost
Cost per Gig/Month	$ 0.0125
Cost to retrieve(GB)	$ 0.01
Cost per 1000 PUT requests	$ 0.01
Cost per 10,000 GET/LIST requests	$ 0.01
Lifecycle cost per 1000 objects	$ 0.01

Standard – Infrequent Access Costs (3 Yr.)	$	**5,723.86**
AWS Business Support (Standard – Infrequent Access)	$	**382.86**
Total AWS Storage Costs (3 Yr.) including support	$	**2,078,198**
Total AWS Storage Costs (3 Yr.)	**$**	**2,078,198.43**

Category	Cost	% of Total Cost
Raw Capacity (Incl. IOPS)	$ 1,904,640	69%
Backup	$ 524,400	19%
Overhead (excl. storage admin)	$ 260,123	9%
Storage Admin	$ 52,473	2%
Total	$ 2,741,636	100%

Total Storage Costs (3 Yr.)   **$ 2,741,636**

Network

Input

Data Center Bandwidth (Mbit/s)	1000
Peak/Average Ratio	3

Modified Assumption	
Parameter	**Value**

Network overhead as % of Hardware costs (%)

Output

| **On-Premises - Networking Costs** | **AWS - Data Transfer Costs** |

Networking Hardware and Software Costs

Network overhead cost as a % of server hardware acquisition cost	10%
Network hardware and software cost	$ 534,870.63
Network hardware and software maintenance/Yr.	15%
Maintenance cost (3 Yr.)	$ 240,691.78
Total Network Hardware and Software costs (3 Yr.)	$ **775,562**

Bandwidth Costs (On-Premises)

Size of Network Pipe (Mbps)	1000
Peak/Avg. Ratio	3
Average Bandwidth	333
On-premises Bandwith costs/Mbps	$ 5.00
Bandwith costs/month	$ 1,666.67
Avg. data transferred per month (TB)- Inbound + Outbound	103
Avg. data transferred per month (TB)- North/South	20.6
Avg. data transferred per month (TB) - Outbound	10.3
On-premises Bandwith costs/Mbps	$ 5.00
Bandwith costs/month	$ 1,666.67
Bandwith costs - On-Premises (3 Yr.)	$ **60,000.00**

Network Admin Costs

Network admin effort as % of total IT admin effort	8%
Avg. burdened salary for your Network Admin	$ 13,500
IT labor cost (1 Yr.)	$ -
Network admin costs (1 Yr.)	$ -

AWS - Data Transfer Costs

| Monthly Data Transfer Out (TB) | | | 10.3 |

Data Transfer Costs			
	US East (N. Virginia)	**Tier (GB)**	**Monthly Cost**
First 1 GB per month	$ -	1	$ -
Up to 10 TB per Month	$ 0.09	10240	$ 921.60
Next 40 TB per Month	$ 0.09	306	$ 26.00
Next 100 TB per Month	$ 0.07	0	$ -
Over 350 TB per Month	$ 0.05	0	$ -

Total monthly data transfer costs	$	947.60
AWS Business Support (data transfer)	$	2445.4
Data Transfer Costs (3 Yr.)	$	**36,559**

Network admin costs (3 Yrs.)	$	-
Total Networking Costs (3 Yr.)	$	**835,562**

IT Labor

Input

Provide average salary for your data center staff	$ 13500
Provide Number of VMs per Admin	100

Modified Assumption	
Parameter	**Value**
On-Premises Server Admin Ratio	13500

Output

On-Premises- IT Labor Costs

Number of VMs managed by an Admin		100
Avg. burdened salary for your IT Admin	$	13,500
Number of VMs in your current environment		220
Admin effort required for your current environment		220%
Total IT Admin Costs -based on number of VMs/Servers (1 Yr.)	$	29,700
Total IT Admin Costs -based on number of VMs/Servers (3 Yr.)	**$**	**89,100**

Database Admin Costs

Number of Databases managed by an Admin		40
Avg. burdened salary for your IT Admin	$	13,500
Colo On-Call Labor Cost		0
Number of Databases in your current environment		20
Admin effort required for your current environment		50%
3-Year IT DBA Labor costs	**$**	**89,100**

AWS - IT Labor Costs

EC2 Admin Costs

# of EC2 instances managed by an admin		400
Avg. burdened salary for your IT Admin	$	13,500
# of EC2 instances in your environment		200
Admin effort required for your current environment		50%
IT labor costs (1 Yr.)	$	6,750
IT labor costs (3 Yr.)	$	20,250

RDS Admin Cost

# of RDS instances managed by an admin		100
Avg. burdened salary for your IT Admin	$	13,500
# of RDS instances in your environment		20
Admin effort required for your current environment		20%
IT labor costs (3 Yr.)		8,100
Total IT Admin Costs -based on number of VMs / Servers (3 Yr.)	**$**	**28,350**

AWS SUPPORT

Modified Assumption	
Parameter	**Value**
AWS Server Admin Ratio	
AWS support Included	Y
1 Yr. or 3 Yr. Reserved Instances	3

AWS - Support Costs

Monthly EC2 Spend	$	32,808.25
Monthly EBS Spend	$	23,526.40
Monthly S3 Spend	$	815.62
Monthly S3IA Spend	$	815.62
Monthly Data Transfer Spend	$	947.60
Total AWS Spend - Month	**$**	**87,622.23**

Support Costs - All Services	
Business Level Support	**Cost**
10% of monthly AWS usage for the first $0 - $10K	$ 1,000.00
7% of monthly AWS usage for the first $0 - $10K	$ 4,900.00
5% of monthly AWS usage for the first $0 - $10K	$ 381.11
3% of monthly AWS usage for the first $0 - $10K	$ -

AWS Support for all services - Month	**$**	**6,281.11**
AWS Support for all services (3 Yr.)	**$**	**226,120.01**
EC2 Reserved Instances Upfront cost after discount	**$**	**851,508**

Support Costs - Reserved Instances	
Business Level Support	**Cost**
10% of monthly AWS usage for the first $0–$10K	$ 1,000.00
7% of monthly AWS usage from $10K–$80K	$ 4,900.00
5% of monthly AWS usage from $80K–$250K	$ 8,500.00
3% of monthly AWS usage over $250K	$ 18,045.24

AWS Reserved Instance Support cost (One-Time)	**$**	**32,445.24**
Total AWS Support (Business)	**$**	**258,565**

METHODOLOGY

The AWS TCO calculator uses the following methodology when calculating on-premises, colocation, and AWS costs.

Our methodology defines Total Cost of Ownership (TCO) as below –

TCO = Acquisition Costs + Operational Costs

Operational costs include labor cost to manage the data center operations as well as overhead cost associated with running the data center equipment. A standard 3 year time frame is used for our calculations as the useful life for the data center equipment.

The following graphic shows the major cost categories in on-premises and colocation environments

Diagram doesn't include every cost item in data center. E.g. software costs can include database, systems management, middle tier software costs. Facilities cost can include costs associated with upgrades, maintenance, building security, taxes etc. IT labor costs can include security admin and application admin costs.
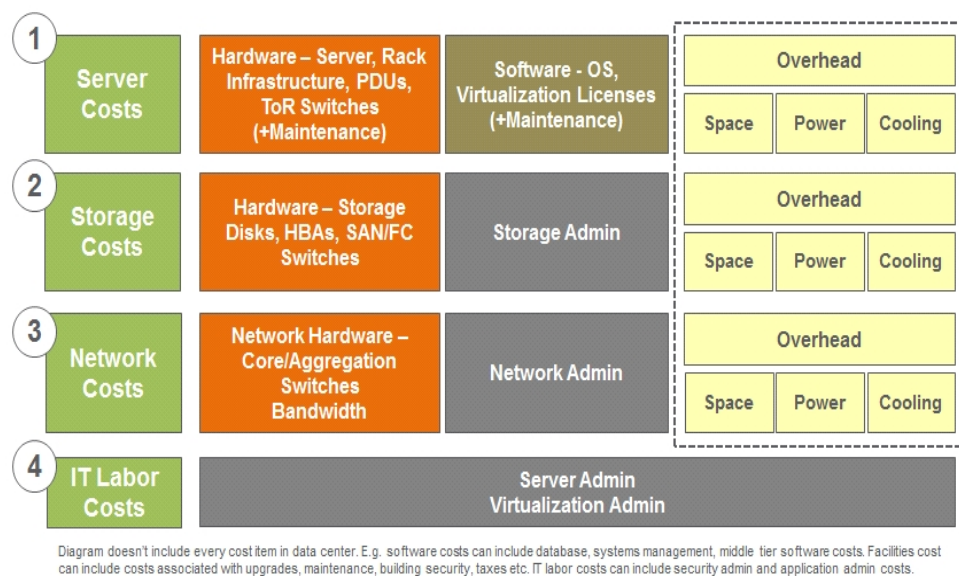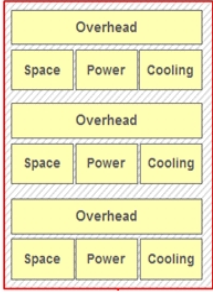
For On-Premises/Colocation, TCO = Server Costs + Storage Costs + Network Costs + IT Labor Costs

For on-premises and colocation environments, each of the major cost categories (server, storage, and network) include the cost of hardware, software (where applicable), and overhead costs. Overhead costs include the cost of data center floor space, and power and cooling required for data center equipment. For our calculations, a "standard rack" is considered to be the typical 19 inch rack that has a rack footprint of 28 sq. ft. (actual area covered by the rack) in the data center. Additionally, we assume average power density per rack to be 10kW in an on-premises data center and a cabinet to have a primary 20 amp, 120V single phase circuit and a redundant 20 amp, 120V circuit in a colocation environment. We use Uptime institute cost model to calculate overhead costs for on-premises and a publicly available price quote from a global colocation, interconnection, and managed IT infrastructure service provider for colocation environment.Since power and cooling expenses are billed on a monthly basis, we calculate our overhead costs on a monthly basis. We also use a "standard rack" as a common point for calculating overhead costs.

1 Server Costs — Hardware – Server, Rack Infrastructure, PDUs, ToR Switches (+Maintenance) — Software - OS, Virtualization Licenses (+Maintenance) — Overhead: Space, Power, Cooling

2 Storage Costs — Hardware – Storage Disks, HBAs, SAN/FC Switches — Storage Admin — Overhead: Space, Power, Cooling

3 Network Costs — Network Hardware – Core/Aggregation Switches Bandwidth — Network Admin — Overhead: Space, Power, Cooling

These costs are modeled on a $/rack/month basis
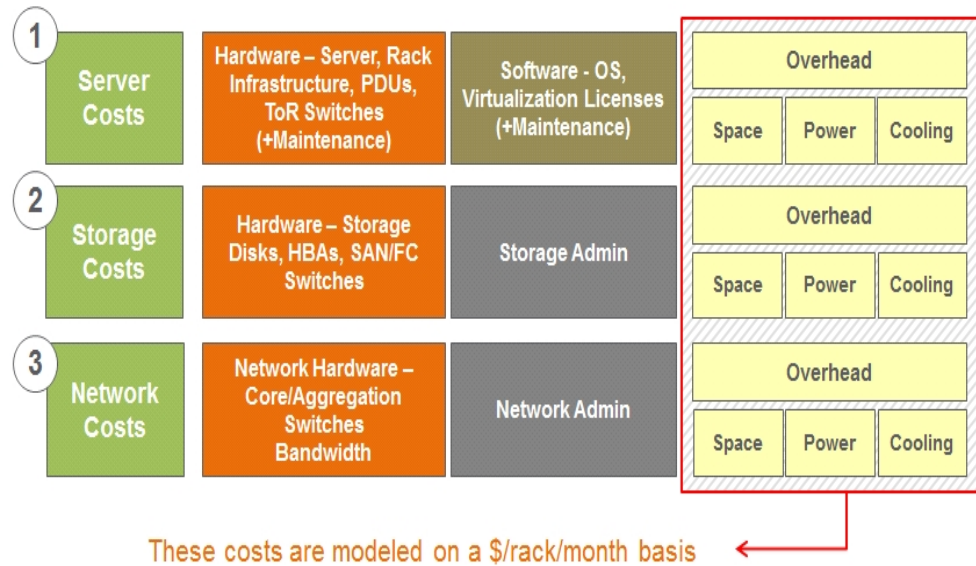
For On-Premises and Colocation environments, the $/rack/month is calculated differently -

These costs are modeled on a $/rack /month basis

On-Premises	Colocation

The Uptime Institute cost model uses two components -
• The **kW component** by desired level of functionality
  • Tier I : $11,500/kW of redundant UPS
  • Tier II: $12,500/kW of redundant UPS
  • Tier III: $23,000/kW of redundant UPS
  • Tier IV: $25,000/kW of redundant UPS
• **Computer room component** - $300/sq. ft. added in all cases
 	
Assumptions
• Tier III Data center with a 15 yr. useful life
• Standard rack occupies 28 Sq. Ft.
• Standard rack uses 10 kW of power
 	
$/rack /month = ($23,000/kWx10kW + $300x28)/(15*12) = $1,324
	• **Cabinet and Cage Pricing***
	  • $1,490 (monthly recurring charge)
	• **30-amp, 208v Single Phase***
	  • $730 (monthly recurring charge)
	• **20- amp, 208v Single Phase Redundant***
	  • $365 (monthly recurring charge)
	
	$/rack /month = $2,585

$/rack/month = $1,500	**$/rack/month = $2,500**
*Cost Model: Dollars per kW plus Dollars per Square Foot of Computer Floor, Uptime Institute	*Colocation service Provider

As shown above, the logic by which the overhead cost is calculated for on-premises and colocation environments is different. Most of the other cost categories are handled similarly between these environments. On the network side, a colocation environment incurs recurring bandwidth costs where as an on-premises environment also incurs network capital expense and network operation expense.

	On-Premises	Colocation
Overhead (Space, Power, Cooling)	Default Cost/Rack/month = $1,500 Power/cooling charged separately	Default Cost/Rack/month = $2,500 Power/cooling included in this cost
Server (excl. overhead)	Same	Same (unless HW is leased)
Storage (excl. overhead)	Same	Same (unless HW is leased)
Network (excl. overhead)	Flat Bandwidth charge; Network overhead	Tiered Bandwidth charge; no network overhead
IT Labor Costs	Same	Same

Finally, on AWS side overhead costs is included in the publicly listed prices and customers don't have to pay extra for space, power, and cooling as shown below.

|	Server & Network Hardware	OS + Virtualization Software	Data center /Colocation Floor Space	Power Cooling	Data Center Personnel	Storage Redundancy	Resource Mgmt. /SW Automation	Software Defined Networking
amazon web services	✔	✔	✔	✔	✔	✔	✔	✔
Hardware Vendor Offering	✔	✘	✘	✘	✘	✘	✘	✘

With AWS, we include AWS Business level support costs. AWS Business level support includes guidance on optimizing AWS products and configuration to meet your specific needs. Business level support provides discounts as your AWS usage grows

TCO Methodology for RDS

	On-Prem/Colo:	AWS: DB on EC2	AWS: RDS
Server Costs Hardware:	Server Costs: Commericial List prices, less expected discount, plus operational burden for power/ cooling/ floor space.	EC2 Pricing Follows Existing Methodology: Server requirements Mapped to EC2 based on RAM/CPU/Storage constraints	RDS Pricing for DB • User defined Single v Multi-AZ replication • RI used for comparison
Database Pricing:	Database Costs Compare Database Pricing to comparable edition (non-Enterprise)	DB Mapped to AWS Support & CloudWatch: + AWS Business Level Support + 2 CloudWatch Custom Metrics (2x: Query Analyzer, Replication)	DB Mapped to AWS Support: + AWS Business Level Support
Block Storage:	DB Storage (SAN/NAS) Follows Existing methodology NAS/SAN Raw storage penalized for OS, RAID 10, over provisioning, and h/w performance capacity requirements to convert to usable. Backup: Follows Existing TCO Methodology: Assume Tape Backup	Mapping SAN/NAS to EBS (current methodology): Backup: Initial backup to S3 (100%), then incremental snapshots based on input for backup/month.	Multi-AZ vs. Single AZ Deployment: If Production, Multi-AZ; otherwise single-AZ. Backup: Same as EC2 Scenario.
Labor:	Compute, Storage, Admin: Follow existing TCO methodology DBA: 1 DBA can manage up to 40 DBs, under 1 TB in size Colo only: 10% additional labor cost for 'on-call DBA' for emergency maintenance issues	DBA Labor Savings of 10%, as a result of decreased time spent security planning, and performing installation, upgrading, migrating. 1 DBA can then manage 45 DBs on EC2.	DBA: Labor savings of 60%, as a result of decreased time spent doing patch mgmt., managing backups, performance, troubleshooting, and storage provisioning. 1 DBA can manage 100 DBs on RDS, versus 40 on prem.

SharePoint Architecture

Amazon Web Services – Microsoft SharePoint Server 2016 on the AWS Cloud May 2016
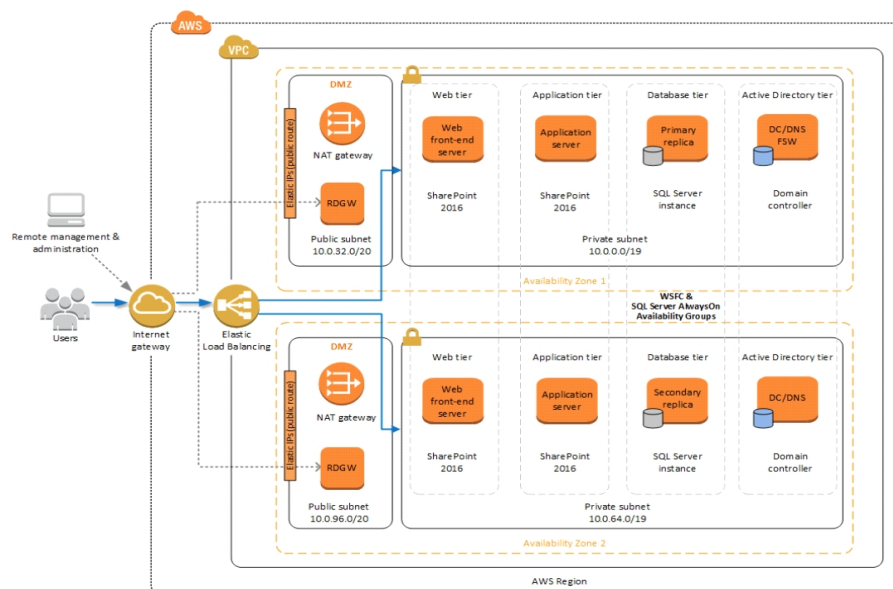
ASSUMPTIONS

The AWS TCO calculator makes the following assumptions for on-premises, co-location, and AWS environments.

On-Premises and Co-location Assumptions

1. Servers and Racks:

- On-premises and co-location server prices are based on Dell PowerEdge Rack servers and HP ProLiant Rack servers.

- Dell PowerEdge prices available here.

- HP ProLiant Rack servers prices available here.

- Servers can be physical or virtualized. Currently the tool supports VMware vSphere, KVM and Xen hypervisors.

- For virtualized environments, two virtualization host configurations are supported –

- Host 1 - 2 processors with 8 cores each and 96 GB RAM.

- Host 2 – 4 processors with 8 cores each and 256 GB RAM

- VM density is calculated based on the virtual RAM and virtual cores allocated to VMs.

- Server and rack hardware are discounted by 25% off the publicly available list prices.

- A "standard rack" is considered to be the typical 19 inch rack that has a rack footprint (actual area covered by the rack) in the data center as defined here. Standard rack assumed to consist of 42 rack units (42U).

- On average each rack is filled up to 75% of capacity (i.e. for a 42U rack, 32U is actually used)

- Dell PowerEdge Energy Smart 4620S Rack Enclosure used to hold data center equipment. A base price of $3,499 assumed as per the published price here.

- Every rack consists of two top of rack Switches (ToR) for Redundancy. Cisco Catalyst 2960 48 port switches used in calculations with the following configuration- 48 x 10/100/1000 - PoE+ 525Watt + 4 x SFP, LAN Base Layer 2. here.

- Every rack consists of 2 Power Distribution Units (PDU) for high-availability. APC Metered Rack PDU - power distribution strip used with a base price of $545 as per the published price here.

- A 15% hardware maintenance/year applied to the server and rack hardware.

- 5% of all server capacity assumed to be hot spare servers. A hot spare or hot standby is used as a failover mechanism to provide reliability and high-availability in data center environments.

2. Software

- VMware vSphere Enterprise Plus licenses assumed for customers using VMware environments. A base price of $3,495 per licenses and $874 for 1 year support and subscription assumed as per the published prices from VMware here.

- KVM is free software released under the GPL as described here. Vendors like RedHat offer KVM hypervisor under a subscription model that includes product access, all updates, and support. Details can be found here.

- Xen hypervisor is covered by the GNU general public license as described here and available for free. Vendors like Citrix offer a free and paid version of XenServer. Details can be found here.

- Software licenses and maintenance are discounted by 25% off the publicly available list prices.

- The Linux distributions used in our model are available for free as described here. Our model doesn't use the paid Linux distributions like SUSE Enterprise Linux and Red Hat Enterprise Linux.

3. Storage

- Our model assumes RAID 10 configurations for on-premises and colocation storage. RAID 10 details are

available here.

- Hard disk manufacturers measure drive capacity differently than operating systems. Hard disk manufacturers use a "base‑10" measure, whereas operating systems use a "base‑2" measure as described here. This mismatch causes a 7% penalty on the disk capacity.

- Raw capacity is defined as the disk capacity in the box or frame while usable capacity is the disk capacity after RAID protection and available for host allocation.

- Average Solid State Devices (SSD) and Hard Disk Drives (HDD) price per GB available here. Our model assumes higher prices as we include the price of Host Bus Adapters (HBA), Fiber Channel Adapters, Optical or Fiber Channel Cables and other storage equipment.

- A discount of 50% is applied by default to the SSD and HDD price per GB.

- The model assumes that a storage admin manages 1000 TB of data on an annual basis.

- The model assumes that a single storage rack contains 1000 TB of disks.

- The model assumes LTO‑5 tapes used for backups. Details available here.

- A base price of $1800/drive assumed for the cost of LTO‑5 drive taking tapes of up to 1.5 TB true (uncompressed) capacity as per the published price here.

4. Network

- The model assumes a 20% network overhead for on‑premises environments. The network overhead is calculated by taking a 20% overhead on server and rack hardware cost.

- For a colocation facility, no network overhead is assumed as colocation providers would bundle this cost in their prices.

- Traffic in the data center assumed to be both north‑south (between servers inside the data center and end points outside the data center) and east‑west (between components in the data center). Our model assumes 80% of all data center traffic is "east‑west".

- For on‑premises environment, Bandwidth costs also include cost of WAN Optimizers and MPLS VPN.

- Average colocation bandwidth pricing is tiered – our model assumes $30/Mbps at the lowest tier and $7/Mbps at the highest tier. More details can be found here.

- Average network admin effort is around 8% of total IT administration effort as per this report.

5. Power and Cooling

- Average Retail Price of Electricity in the US can be found here.

- The average cents per kilowatt‑hour in the US commercial segment for January 2014 was 10.34 cents.

- The model assumes a standard on‑premises/colocation PUE of 1.5 and a base kWh (kilo watt hour) price of 10 cents/hr. This gives us a total electricity charge of 15 cents per kWh (10*1.5).

6. Data Center Space

- The model assumes colocation providers charge a fixed $ per kW rate that covers the cost of all power and space contracted. Every rack assumed to have a primary and redundant power supply.

- The model assumes a separate charge for space, power and cooling for on‑premises environments.

7. IT Labor

- Average data center admin salaries by region available here.

AWS Assumptions

1. Compute

- Both On-Demand and 3 Yr. Reserved Instance types used for AWS compute.
- EC2 instances are matched with on-premises servers and VMs based on CPU, RAM, or storage I/O.
- The number of EC2 instances is the same as the physical servers or VMs on-premises meaning we don't apply any cost optimization on AWS side. In real-life situations, customers would change instance sizes up or down based on monitoring various AWS resource metrics like CPU utilization, free memory, or disk usage.
- Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Our model uses General purpose, Compute-optimized, Memory-optimized, and Storage-optimized instances.
- The model uses only the current generation of instances- General purpose (m3), Compute-optimized (c3), Memory-Optimized (R3), and Storage-optimized (I2).
- Current generation of instances provide faster, newer Intel Ivy Bridge processors, SSD-based instance storage, Higher performance Enhanced Networking, and advanced features such as support for HVM AMIs.
- The model assumes Reserved Instance volume discounts as described here.

2. Storage

- On-premises SAN and NAS storage systems are represented in AWS as EBS volumes.
- On-premises Object storage is represented in AWS as S3.
- S3 offers multiple storage classes – S3 Standard, RRS, and Glacier depending on how S3 handles data. Our model assumes S3 standard only.
- Model assumes RAID 0 for EBS volumes as described here.
- Multiple EBS volumes can be striped together to achieve up to 48,000 IOPS when attached to larger EC2 instances as described here.
- For backup, we use EBS snapshots to S3 for calculating backup costs on AWS.
- Backup%/month is the amount of data that changes every month. So a 50% number means that 50% of data changes every month and is backed up.
- Model calculates EBS-optimized instance cost separately, but doesn't add it to the total storage cost.

3. Network

- Model assumes publicly available Data Transfer OUT tiered rates From Amazon EC2 to Internet as described here.

4. IT Labor

- Model assumes that an IT admin can manage 400 EC2 instances.

5. AWS Support

- Model assumes Business-level support for AWS as described here.

SharePoint Assumptions

1. SharePoint Server 2016 on AWS

- The Amazon Web Services (AWS) cloud provides a suite of infrastructure services that enable you to deploy SharePoint Server 2016 securely, affordably, and with high availability.Running SharePoint Server on the AWS cloud gives you flexibility and agility, and you can fully customize and extend SharePoint for your business processes. This Quick Start implementation guide walks you through the steps to automatically deploy an enterprise SharePoint Server 2016 architecture in your own AWS account

2. Cost and Licenses

- You are responsible for the cost of the AWS services used while running this Quick Start reference deployment. There is no additional cost for using the Quick Start itself. The AWS CloudFormation template for the SharePoint Server 2016 Quick Start includes configuration parameters that you can customize, and some settings, such as the instance types and the number of instances, can greatly affect the cost of the deployment. AWS has published a whitepaper that shows how to estimate the cost of your SharePoint deployment. You have a wide array of options for building your SharePoint farm, and it's not possible to cover them all in that whitepaper or in this guide. The following table offers a model based on some key assumptions

3. Deploying Microsoft software on AWS

- Microsoft on AWS here.
- Secure Microsoft applications on AWS here.
- Microsoft Licensing Mobility here.
- MSDN on AWS here.

4. Microsoft SharePoint Server

- Configure SQL Server 2012 Always On Availability Groups for SharePoint 2013 here.
- Windows Server Failover Clustering and SQL Server AlwaysOn Availability Group here.

FAQ

1. What is the purpose of the AWS TCO calculator?

You can use the AWS TCO calculator to compare the cost of running your applications in an on-premises or colocation environment to AWS. The tool produces a detailed cost comparison with AWS based on the infrastructure details you provide.

2. What assumptions do you make?

We make several assumptions based on third party analyst and industry research as well as data from hundreds of AWS customers. Please refer to the Assumptions section of the TCO output page.

3. What is the difference between an on-premises data center and colocation facility?

An on-premises data center is a brick and mortar structure that contains all the required systems / facilities to house computing infrastructure running 24 x 7 x 365. An on-premises data center is owned and operated by the owners of the computing infrastructure. A colocation facility is usually offered by a provider that owns their own "data center" and rents out rack space and/or computing hardware. These environments have very different cost structures and your TCO for the same application would vary between these environments.

4. How are you calculating on-premises (or colocation) server infrastructure costs?

The calculator averages market rate pricing from multiple enterprise server vendors to determine an average price for a server based on CPU, RAM, and storage configuration. In addition, the tool adds licensing cost for Operating System and virtualization licenses as well as rack infrastructure costs. Rack infrastructure costs include cost of power distribution units, top of rack switches, rack chassis and one-time server deployment.

5. Do you apply any discount to on-premises (or colocation) server hardware, storage hardware, and software acquisition costs?

Yes, by default server hardware is discounted by 25%, Operating System and Virtualization licenses by 25% and storage hardware by 50%. These closely resemble industry standard pricing policy.

6. What types of storage are you using to compare?

On-premises Storage Area Network (SAN) and Network Attached Storage (NAS) are mapped to Amazon EBS, while on-premises object storage is mapped to Amazon S3. The amount of on-premises storage specified in the calculator input represents the amount of raw physical storage capacity purchased. AWS storage that is calculated is not equal to the amount of raw physical storage capacity, but rather a percentage of the storage that is actually utilized for on-premises data storage. Primary and secondary research indicates that this is ~50-60% of the raw physical storage purchased after taking into account RAID and Operating System overhead.

7. How are you calculating on-premises (or colocation) storage costs?

We are using industry standard pricing based on $ per raw GB purchase. We use a combination of Solid State Drives (SSD) and Hard Disk Drives (HDD); SSDs are used in case customers need higher IOPS for their on-premises/colocation environments. The tool uses RAID 10 configurations for on-premises and colocation storage. A discount of 50% is applied by default to the SSD and HDD price per GB.

8. How are you calculating on-premises network costs?

This is calculated as a percentage (20%) of server hardware acquisition cost. The network cost includes the cost for network interface cards, host bus adapters, core switches and other networking gear.

9. How are you calculating bandwidth costs?

We use a sampling of average market rates for data center telecom from major markets (typically measured in $/Mbps). Traffic in the data center is assumed to be both north-south (between servers inside the data center and end points outside the data center) and east-west (between components in the data center). We also assume a high percentage of data center traffic (~70-80%) to be "east-west".

10. What is the overhead cost? How are you calculating it for on-premises and colocation environments?

Overhead costs include the cost of data center floor space, and power and cooling required for data center equipment. It can also include other ongoing data center expenses such as maintenance and physical security. For the sake of simplicity, we only consider data space, power, and cooling when calculating overhead costs. The way overhead cost is calculated is different for on-premises and colocation environments. We leverage the publicly available Uptime institute's cost model to calculate overhead costs for on-premises data center and a price quote from a global colocation and interconnection infrastructure service provider for colocation environment. Since power and cooling expenses are billed on a monthly basis, we calculate our overhead costs on a monthly basis. We also use a "standard rack" as a common point for calculating overhead costs.

11. How do you calculate IT Labor costs?

You can specify the fully burdened cost of your IT admin resources. We leverage industry and third party analyst research for server: admin ratios. For physical environments, we assume one FTE IT admin per 100 physical servers or 250 virtual machines. We use these two variables and the rest of the inputs of the tool to calculate the percentage administrative cost. For storage, we assume a storage admin to manage 1 PB of storage annually and for network we assume network admin effort to be ~8% of the total IT admin effort.

12. How are the Amazon EC2 compute costs computed?

The tool automates the task of selecting the right AWS instance type based on the information you provide; you can input your physical or virtual infrastructure details and the tool will provide the equivalent AWS instance types that meet your requirements. The calculator uses current generation Amazon EC2 instances (except GPU instances) to calculate AWS compute costs. The tool also takes into account your on-premises usage/utilization rate. You can think of on-premises usage/utilization rate as the total desired uptime for your servers or VMs. For example, over a

3 year time-period, a 10% usage rate implies that your servers are running 10% of the time (or 3.6 months).

13. Why do you ask for usage/utilization rate?

If you don't need your on-premises VMs or physical servers up and running 24/7/365 you could save lot of money by powering off the VM/servers when not used. AWS provides multiple pricing models to optimize your spend for variable or steady-state workloads. The calculator will let you change the usage % (uptime) and automatically select the right AWS pricing model that will meet that uptime at the lowest price. If you don't know your usage/utilization rate, the tool defaults to 100% (which means that your servers/VMs are running 24/7/365).

14. Why can't I run calculations with previous generation Amazon EC2 instances?

We encourage you to use the latest generation of Amazon EC2 instances to get the best price for performance ratio. The calculator uses the current Amazon EC2 instances - M3, C3, R3, I2 and HS1 (and m1.small and t1.micro). You can find more details about the previous generation Amazon EC2 instances here.

15. Do you use S3 Reduced Redundancy Storage and Amazon Glacier?

No, currently the tool only uses S3 standard. For backup of EBS data, the tool uses EBS Snapshots to Amazon S3 charges.

16. Are data transfer costs included in the AWS storage cost?

No, all AWS data transfer costs are included under the network charges for AWS. The data transfer cost is calculated based on the EC2 data transfer out from Amazon EC2 to the internet. Since the calculator doesn't assume cross-AZ deployments, it doesn't calculate data transfer charges between Amazon EC2 instances in another Availability Zone in the same region.

17. What is the AWS server to admin ratio?

We have found a 400:1 Server to Admin ratio to be appropriate when running your apps on AWS. This is a conservative ratio based on AWS customer engagements. (Note: for on-premises we assume a 100:1 server admin ratio for physical servers and 250:1 ratio for virtual machines)

18. Why do you include AWS support costs?

We recommend all AWS customers use AWS Support to ensure a seamless experience leveraging AWS infrastructure services. We have created multiple tiers to fit your unique technical needs and budget. AWS Basic Support offers all AWS customers access to our Resource Center, Service Health Dashboard, Product FAQs, Discussion Forums, and Support for Health Checks – at no additional charge. Customers who desire a deeper level of support can subscribe to AWS Support at the Developer, Business, or Enterprise level. in our TCO model, we assume Business-level support costs