

Understanding the Cost of Computing in the Cloud

Cloud is best known for its low cost and all time available resources. In this project, I have calculated the cost of computing in cloud by comparing with the cost of computing by buying the infrastructure instead. The results of the comparison are shown below.

Computing the Cost per TFlops per hour in \$ for the 8 amazon instances

To determine the cost of compute of the eight amazon instances I have calculated the performance of the instance's CPU in Gflops then converted to TFlops and divided the price of the instance (one-hour granularity) by the flops determined in flops/second.

Gflops the processors produces are calculated using the **theoretical peak performance formula** given below

$$\text{GFlops} = (\text{CPU speed in GHz}) \times (\text{number of CPU cores}) \times (\text{CPU instruction per cycle})$$

Instance Type	Cost per hour (\$)	Gflops	Cost per TFlops per hour (\$)
m4.10xlarge	2.394	$2.4 \times 20 \times 32 = 1536$	1.559
m3.large	0.133	$2.5 \times 1 \times 16 = 40$	3.325
m3.2xlarge	0.532	$2.5 \times 4 \times 16 = 160$	3.325
c3.8xlarge	1.680	$2.8 \times 16 \times 16 = 717$	2.343
g2.2xlarge	0.650	$2.6 \times 4 \times 16 = 167$	3.892
r3.4xlarge	1.33	$2.5 \times 8 \times 16 = 320$	4.156
i2.8xlarge	6.82	$2.5 \times 16 \times 16 = 640$	10.656
d2.8xlarge	5.52	$2.4 \times 18 \times 32 = 1383$	3.991

The **CPU instruction per cycle** (IPC) for the processor with AVX (Ivy Bridge/Sandy Bridge) instruction set is 16 and for AVX2(Haswell) instruction set is 32 for a Single Precision Operations performed. The flops calculated is for **Single Precision Operations**.

Private Cloud Infrastructure Cost

In order to build equivalent infrastructure as per the public cloud instances the resources are bought almost equivalent to the resources used in the AWS instances as provided by the Amazon website. The 8 amazon instance type instances are as mentioned above while calculating the theoretical flops of processor.

The cost of the private cloud is **amortized for the span of 5 years**; the hardware resources are one-time investment whereas other costs are amortized. The electricity cost and cooling costs as well as the admin cost are as per the current rates in Chicago, IL (April 2016).

A datacenter is built with similar resources provided by AWS, when building datacenter one must take care of **Land Cost, Power, Cooling, Human Resource, Maintenance** etc. The resources should have replacement when some resources go down. Such common costs are calculated based on the number of nodes that run on the datacenter to provide equivalent computing capacity of public cloud.

The datacenter cost is termed as Private Cloud cost in this paper and the term Amazon cloud and Public cloud are used interchangeably. The resources are bought in order to meet the computing capacity of the instance type. Similar configuration of the instance are bought. The configuration of the resource used in public (Amazon) cloud is available in their website. The information about resources bought are provided at the end of this paper as appendix.

Electricity Rate – 15.3 cents per kwh is considered – current rate in Chicago (2016). For cooling the power required is calculated as per electricity rate. Total Cooling cost is slightly less than power cost.

The cost breakdown of each type of instance if resources are bought i.e. equivalent private cloud cost for each instance type of amazon is as shown below

m4.10xlarge

Resource	Hardware Model/Name	Cost
CPU	Intel Xeon E5-2620 v3 Haswell 2.4 GHz 6 x 256KB L2 Cache 15MB L3 Cache LGA 2011-3 85W BX80644E52620V3 Server Processor	1719.96
RAM	G. SKILL Value Series 32GB (4 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Desktop Memory Model F4-2133C15Q-32GNT G.SKILL Aegis 64GB (4 x 16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory Model F4-2133C15Q-64GIS	619.97
SDD	Refurbished: Crucial M550 2.5" 256GB SATA 6Gb/s MLC Internal Solid State Drive (SSD) CT256M550SSD1 - CERTIFIED REFURBISHED	79.99
Network	StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter	226.99
Switch	D-Link 10-Port 10-Gigabit Ethernet Smart Managed Switch	865.41
Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Haswell Processor	2278.48
Cooling	Cost of Cooling for 5 years per node	2269.8
Other	Switch to connect switches + Cable + Maintenance	2500
Total		412060.6

m3.large

Resource	Hardware Model/Name	Cost
CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	1559.99
RAM	HyperX FURY 8GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/8	34.99
SDD	MyDigitalSSD 32GB Super Boot Drive 42mm SATA III (6G) M.2 2242 NGFF SSD - MDM242-SB-032	29.99
Network	TP-LINK TG-3468 Network Adapter 10/ 100/ 1000Mbps PCI-Express 1 x RJ45	11.99
Switch	D-Link 52-Port Gigabit Web Smart Switch including 4 SFP ports	374.99
Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Ivy Bridge Processor	770.66
Cooling	Cost of Cooling for 5 years per node	767.73
Other	Switch to connect switches + Cable + Maintenance	2500
Total		407550.34

m3.2xlarge

Resource	Hardware Model/Name	Cost

CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	1559.99
RAM	G.SKILL Value Series 32GB (4 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Desktop Memory Model F4-2133C15Q-32GNT	239.98
SDD	Intel DC S3500 80 GB 2.5" Internal Solid State Drive	339.98
Network	TP-LINK TG-3468 Network Adapter 10/ 100/ 1000Mbps PCI-Express 1 x RJ45	11.99
Switch	D-Link 52-Port Gigabit Web Smart Switch including 4 SFP ports	374.99
Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Ivy Bridge Processor	770.66
Cooling	Cost of Cooling for 5 years per node	767.73
Other	Switch to connect switches + Cable + Maintenance	2500
Total		407550.34

c3.8xlarge

Resource	Hardware Model/Name	Cost
CPU	Intel Xeon E5-2680 v2 Ivy Bridge-EP 2.8 GHz 25MB L3 Cache LGA 2011 115W BX80635E52680V2 Server Processor	3533.98
RAM	G.SKILL Ripjaws Z Series 64GB (8 x 8GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model F3-12800CL10Q2-64GBZL	249.99
SDD	Mushkin Enhanced Atlas Vital M.2 2280 120GB SATA III MLC Internal Solid State Drive (SSD) MKNSSDAV120GB-D8 Mushkin Enhanced Atlas Vital M.2 2280 480GB SATA III MLC Internal Solid State Drive (SSD) MKNSSDAV480GB-D8	224.98
Network	StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter	226.99
Switch	D-Link 10-Port 10-Gigabit Ethernet Smart Managed Switch	865.41
Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Ivy Bridge Processor	1541.32
Cooling	Cost of Cooling for 5 years per node	1535.46
Other	Switch to connect switches + Cable + Maintenance	2500
Total		412178.13

g2.2xlarge

Resource	Hardware Model/Name	Cost
CPU	Intel Xeon E5-2670 Sandy Bridge-EP 2.6GHz (3.3GHz Turbo Boost) 20MB L3 Cache LGA 2011 115W BX80621E52670 Server Processor	575
GPU	NVIDIA® Quadro® K5000 for Mac VCQK5000MAC-PB 4GB 256-bit GDDR5 PCI Express 2.0 x16 SLI Supported Workstation Video Card	1836.78
RAM	G.SKILL Ripjaws X Series 16GB (2 x 8GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model F3-12800CL10D-16GBXL	55.99
SDD	Biwin® 60GB MLC SATA III 6Gb/s NGFF,M.2 2242 SSD Solid State Drive	32.99
Network	TP-LINK TG-3468 Network Adapter 10/ 100/ 1000Mbps PCI-Express 1 x RJ45	11.99
Switch	D-Link 52-Port Gigabit Web Smart Switch including 4 SFP ports	374.99

Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Sandy Bridge Processor	770.66
Cooling	Cost of Cooling for 5 years per node	767.73
Other	Switch to connect switches + Cable + Maintenance	2500
Total		408426.13

r3.4xlarge

Resource	Hardware Model/Name	Cost
CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	1559.99
RAM	G.SKILL Ripjaws 4 Series 64GB (8 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRB	509.98
SDD	Intel 320 Series 2.5" 160GB SATA II MLC Internal Solid State Drive (SSD) SSDSA2CW160G310	170
Network	TP-LINK TG-3468 Network Adapter 10/ 100/ 1000Mbps PCI-Express 1 x RJ45	11.99
Switch	D-Link 52-Port Gigabit Web Smart Switch including 4 SFP ports	374.99
Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Ivy Bridge Processor	770.66
Cooling	Cost of Cooling for 5 years per node	767.73
Other	Switch to connect switches + Cable + Maintenance	2500
Total		408165.34

i2.8xlarge

Resource	Hardware Model/Name	Cost
CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	3533.98
RAM	G.SKILL Ripjaws 4 Series 64GB (8 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRB	1019.96
SDD	Intel DC S3610 2.5" 400GB SATA III MLC Internal Solid State Drive (SSD) SSDSC2BX400G401 - OEM	3014.96
	SAMSUNG 850 PRO 2.5" 2 TB SATA III 3-D Vertical Internal Solid State Drive (SSD) MZ-7KE2T0BW	
Network	StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter	226.99
Switch	D-Link 10-Port 10-Gigabit Ethernet Smart Managed Switch	865.41
Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Ivy Bridge Processor	1541.32
Cooling	Cost of Cooling for 5 years per node	1535.46
Other	Switch to connect switches + Cable + Maintenance	2500
Total		415738.08

d2.8xlarge

Resource	Hardware Model/Name	Cost

CPU	Intel Xeon E5-2620 v3 Haswell 2.4 GHz 6 x 256KB L2 Cache 15MB L3 Cache LGA 2011-3 85W BX80644E52620V3 Server Processor	1289.97
RAM	G. SKILL Ripjaws 4 Series 64GB (8 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRB G.SKILL Ripjaws Z Series 64GB (8 x 8GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model F3-12800CL10Q2-64GBZL	1024.96
SDD	WD Blue 6TB Desktop Hard Disk Drive - 5400 RPM SATA 6Gb/s 64MB Cache 3.5 Inch - WD60EZRL WD Blue 4TB Desktop Hard Disk Drive - 5400 RPM SATA 6Gb/s 64MB Cache 3.5 Inch - WD40EZRL WD Blue 3TB Desktop Hard Disk Drive - 5400 RPM SATA 6Gb/s 64MB Cache 3.5 Inch - WD30EZRL	1619.9
Network	StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter	226.99
Switch	D-Link 10-Port 10-Gigabit Ethernet Smart Managed Switch	865.41
Rack	For overall racks in the datacenter	1500
Admin	Cost of admin for 5 years	400000
Power	Cost for 5 years to run one node of Haswell Processor	1708.86
Cooling	Cost of Cooling for 5 years per node	1702.35
Other	Switch to connect switches + Cable + Maintenance	2500
Total		412438.44

The cost calculated above are per node for 5 years' cost providing the equivalent computing capacity of the public cloud.

Cost per Tflops per hour in \$

PRIVATE CLOUD

Instance Type	GFlops	10GFlops	100GFlops	1TFlops	10TFlops	100TFlops	1PFlops
m4.10xlarge	6.12485	6.12485	6.12485	6.12485	0.87498	0.09280	0.00939
m3.large	232.6201	232.6201	77.5400	9.30480	0.93048	0.09304	0.00930
m3.2xlarge	58.15501	58.15501	58.15501	8.30786	0.92309	0.09304	0.00930
c3.8xlarge	13.12477	13.12477	13.12477	6.56238	0.93748	0.09375	0.00940
g2.2xlarge	55.83711	55.83711	55.83711	9.30619	0.93062	0.09321	0.00932
r3.4xlarge	29.12139	29.12139	29.12139	7.28034	0.91004	0.09304	0.00932
i2.8xlarge	14.83084	14.83084	14.83084	7.41542	0.92693	0.09446	0.00948
d2.8xlarge	6.80868	6.80868	6.80868	6.80868	0.85108	0.09327	0.00940

The costs calculated for 5 years are converted to per hour per Tflops. The conversion is done by dividing the cost by 43800 hours and theoretical flops - calculated at the beginning of each instance type. Theoretical flops are converted to Tflops before dividing.

In order to scale from 1Gflops to 1PFlops, more instances of same kind are run. Since many nodes run together to provide the required computing capacity, the cost of the hardware resources increases as per the number of instances but one-time resources cost (Major portion of investment) remains same.

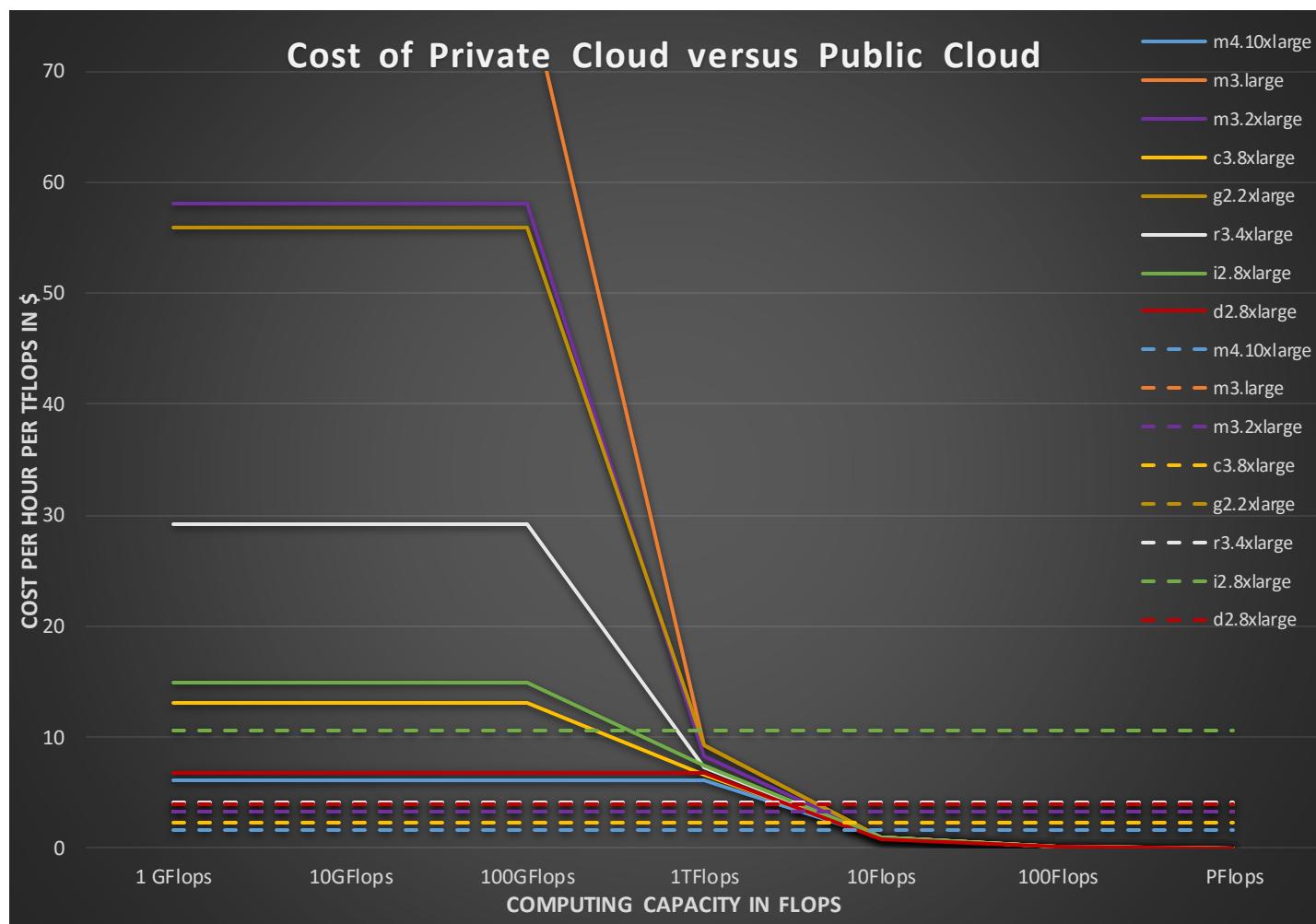
The computing capacity is scaled exponentially, even though the cost to run many nodes is increasing the **cost per hour per flops is decreasing** as the flops (number being divided) is more (exponential increase). The cost at **large scales** (Greater than 1Tflops or 10 Tflops) are **almost same** for all the instance types. At **lower capacity** the cost **varies too much** across the types of instances.

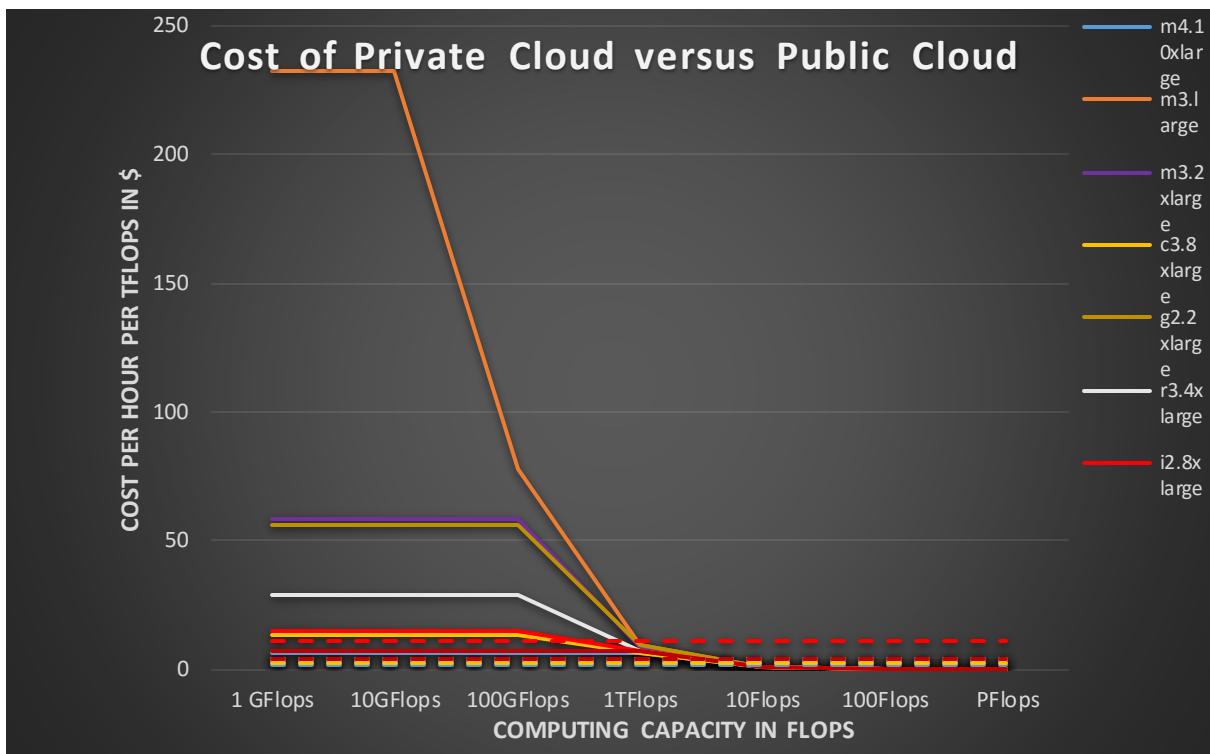
PUBLIC CLOUD

Instance Type	GFlops	10GFlops	100GFlops	1TFlops	10TFlops	100TFlops	1PFlops
m4.10xlarge	1.559	1.559	1.559	1.559	1.559	1.559	1.559
m3.large	3.325	3.325	3.325	3.325	3.325	3.325	3.325
m3.2xlarge	3.325	3.325	3.325	3.325	3.325	3.325	3.325
c3.8xlarge	2.343	2.343	2.343	2.343	2.343	2.343	2.343
g2.2xlarge	3.892	3.892	3.892	3.892	3.892	3.892	3.892
r3.4xlarge	4.156	4.156	4.156	4.156	4.156	4.156	4.156
i2.8xlarge	10.656	10.656	10.656	10.656	10.656	10.656	10.656
d2.8xlarge	3.991	3.991	3.991	3.991	3.991	3.991	3.991

Cost per hour per Tflops for the public cloud remain same irrespective of the computing capacity as the **cost is same**. It is the instance type that we request for and computing capacity for that instance type is managed by the public cloud. We **only pay the per hour price**. For comparison the cost per Tflops per hour is tabulated.

PLOT #1





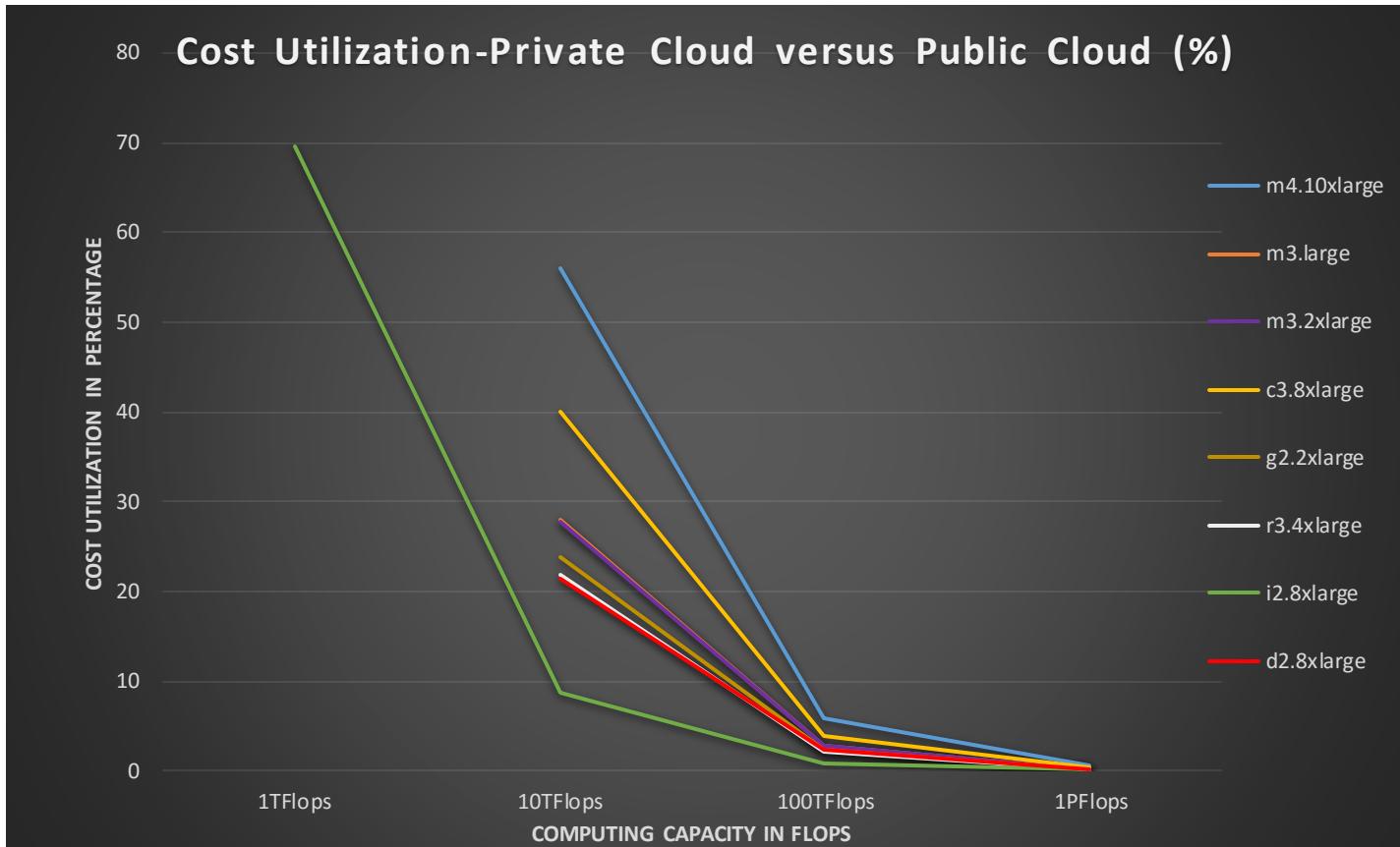
This plot is same as above – complete scale is captured here, whereas in the above plot to make sense out of data the scale is reduced to where lines are clearly visible. There is no change in the values.

As per the plot till 1 Tflops the cost of private cloud plotted as the line is higher and almost same but for higher capacities the cost reduces with increase in computing capacity. The cost of public cloud plotted as dashed line is same throughout across all computing capacities. The cost of private cloud is way too costly for lesser computing capacities but the cost of private cloud drops drastically for larger capacities especially for 10Tflops capacity and continue reducing for increase in computing capacity. The cost of private cloud is **minimum for the Pflops** capacity and is almost **same for all the instance** types (8) mentioned.

Utilization of Private versus Public in percentage

Instance Type	1TFlops	10TFlops	100TFlops	1PFlops
m4.10xlarge	100	56.12	5.95	0.60
m3.large	100	27.98	2.79	0.27
m3.2xlarge	100	27.76	2.79	0.27
c3.8xlarge	100	40.01	4.00	0.40
g2.2xlarge	100	23.91	2.39	0.23
r3.4xlarge	100	21.89	2.23	0.22
i2.8xlarge	69.58	10.70	8.86	0.08
d2.8xlarge	100	21.32	2.33	0.23

PLOT #2



The cost utilization can be calculated by dividing the private cloud cost by public cloud cost for those ranges where the public cloud costs more than private. The ratio as percentage is plotted against the computing capacity.

The utilization is 100 percent for costs of private more than public cloud. As the cost of private cloud decreases the utilization decreases. At lower capacity the utilization is more say 10 Flops but there is a sudden decrease in utilization either from 100 at 1Tflops or 10 Tflops and further the decrease in utilization is such that utilization is similar across all instance type. At larger scales especially 1Pflops the cost utilization is same for all the instance types.

Conclusion

- The cost of computing in cloud at large scale (Computing capacities greater than Tflops or 10 Tflops) is actually costly than buying the resource.
- Lower scales the public cloud is best and utilization is 100%
- Large Scale the utilization is less than 1%, buying the infrastructure is better.
- Large Scale the private cloud costs almost same irrespective of the computing capacity of system.

APPENDIX

Shopping cart of the items purchased in order to setup datacenter is listed. References for the power cost, cooling admin etc. is added in the file containing the shopping cart.

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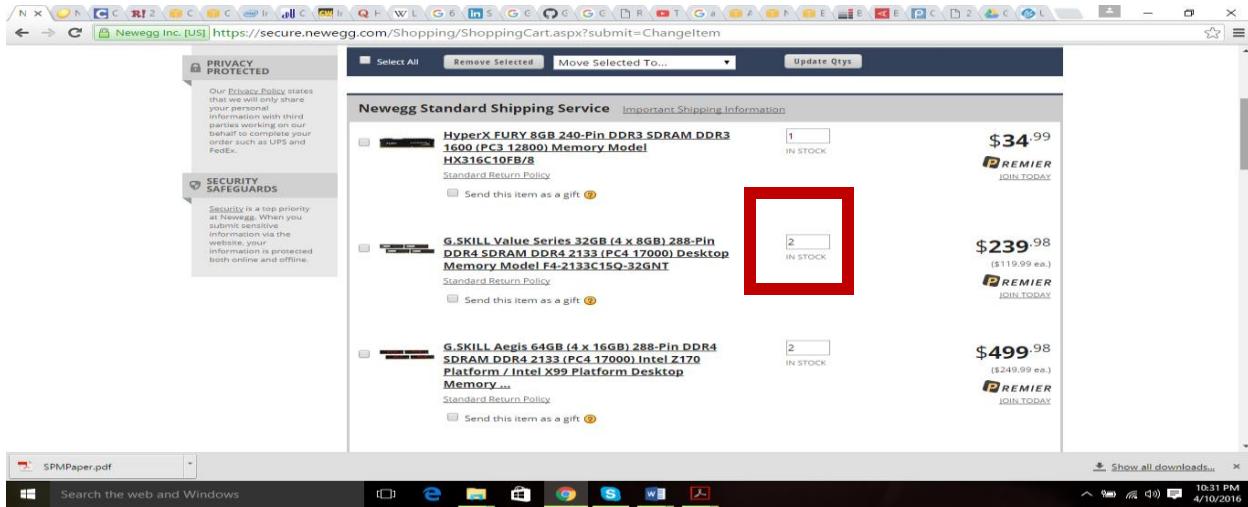
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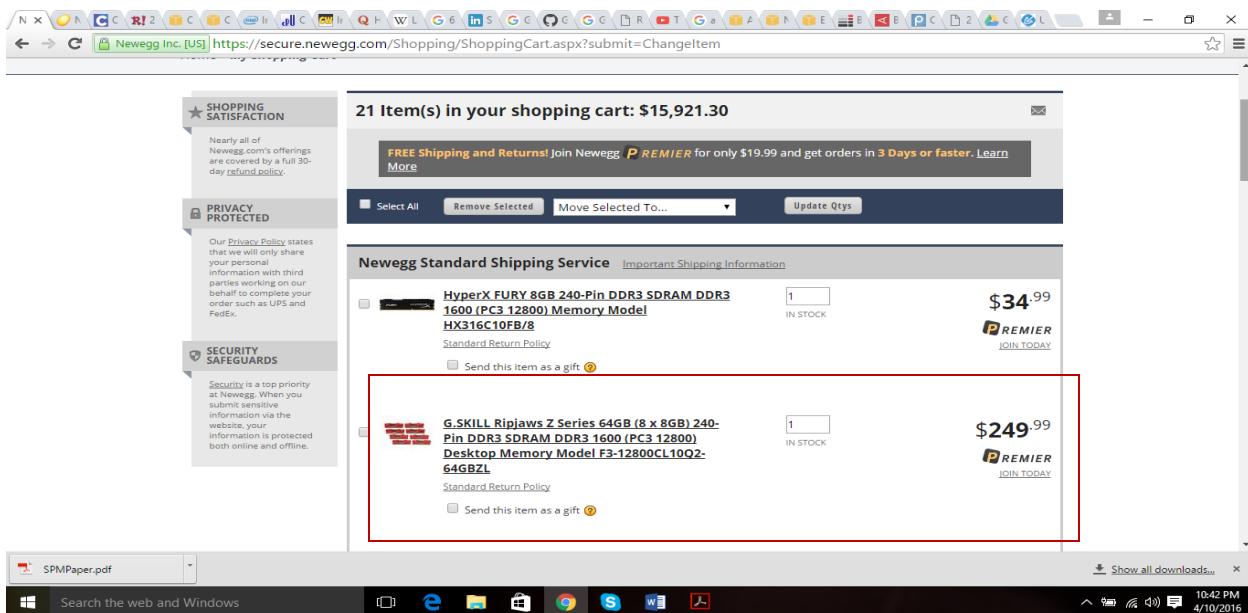
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Standard Return Policy
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\$239.98 (\$119.99 ea.) **Premier** JOIN TODAY

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G.Skill Ripjaws Z Series 64GB (8x8GB) 240-Pin DDR3 SDRAM DDR3 2133 (PC3 17000) Desktop Memory Model F3-2133C10Q2-64GZM Standard Return Policy <input type="checkbox"/> Send this item as a gift	1 IN STOCK	\$259.99 JOIN TODAY
G.Skill Value Series 32GB (4x8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Desktop Memory Model F4-2133C15Q-32GNT Standard Return Policy <input type="checkbox"/> Send this item as a gift	2 IN STOCK	\$239.98 (\$119.99 ea.) JOIN TODAY
G.Skill Ripjaws 4 Series 64GB (8x8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRB Standard Return Policy <input type="checkbox"/> Send this item as a gift	6 IN STOCK	\$1,529.94 (\$254.99 ea.) JOIN TODAY
G.Skill Ripjaws 4 Series 64GB (8x8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRR Standard Return Policy <input type="checkbox"/> Send this item as a gift	3 IN STOCK	\$764.97 (\$254.99 ea.) JOIN TODAY

SSD Shopping

M4.10xlarge

Newegg.com | EC2 Product | Nagada S | RAID Perform | Convert Mbp | W/Solid-state | SSD Ranking | Azure Virtual | https://www.s... | 5:50 PM | 4/11/2016

Newegg Inc. [US] | https://secure.newegg.com/Shopping/ShoppingCart.aspx?Submit=view

G.Skill Ripjaws 4 Series 64GB (8x8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRR Standard Return Policy <input type="checkbox"/> Send this item as a gift	3 IN STOCK	\$764.97 (\$254.99 ea.) JOIN TODAY
G.Skill Aegis 64GB (4x16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory ... Standard Return Policy <input type="checkbox"/> Send this item as a gift	2 IN STOCK	\$499.98 (\$249.99 ea.) JOIN TODAY
Refurbished: Crucial M550 2.5' 256GB SATA 6Gb/s MLC Internal Solid State Drive (SSD) CT256M550SSD1 - CERTIFIED REFURBISHED Standard Return Policy <input type="checkbox"/> Send this item as a gift	1 IN STOCK	\$449.99 \$79.99 Save: 33.34% JOIN TODAY
Intel DC S3610 2.5" 400GB SATA III MLC Internal Solid State Drive (SSD) SSDS2BX400G401 - OEM Standard Return Policy <input type="checkbox"/> Send this item as a gift	1 IN STOCK	\$499.99 \$314.99 Save: 37.00% JOIN TODAY

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Choose a delivery method

- APO/FPO-Military ONLY
- Newegg 3 Business Days
- Newegg 2 Business Days
- Newegg Next Business Day

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MyDigitalSSD 32GB Super Boot Drive 42mm SATA III (6G) M.2 2242 NGFF SSD - MDM242-SB- **\$29.99**
IN STOCK

Capacity: 32GB
Sold by [MyDigitalDiscount](#)

Shipping Options

Choose a delivery method

- Standard Shipping (5-7 business days)
- Expedited Shipping (3-5 business days)
- Two-Day Shipping (2 business days)
- Next Day Shipping (One business day)

Subtotal: \$29.99
Shipping: \$0.00

M3.2xlarge

Newegg.com Shopping C EC2 Product Details - Ami Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?Submit=view

Shipping Options

Zip/Postal Code **Shipping:** \$0.00

Choose a delivery method

- APO/FPO-Military ONLY
- Newegg 3 Business Days
- Newegg 2 Business Days
- Newegg Next Business Day

FREE 2-Day Shipping [learn more](#) | [sign in](#)

Newegg Marketplace Direct Delivery Service [Important Shipping Information](#)

Intel DC S3500 80 GB 2.5" Internal Solid State Drive **\$339.98**
IN STOCK

Form Factor: 2.5" / Capacity: 80GB
Sold by [ETopSell](#)

Shipping Options

Choose a delivery method

- Standard Shipping (5-7 business days)

Subtotal: \$339.98
Shipping: \$0.00

C3.8xlarge

Newegg.com Shopping C EC2 Product Details - Ami Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?submit=ChangeItem

Newegg Marketplace Direct Delivery Service [Important Shipping Information](#)

Mushkin Enhanced Atlas Vital M.2 2280 120GB SATA III MLC Internal Solid State Drive (SSD) **\$59.99**
IN STOCK

Form Factor: M.2 / Capacity: 120GB
Sold by [PlatinumMicro.com](#)

Protect Your Investment [View Details](#)

Mushkin Enhanced Atlas Vital M.2 2280 480GB SATA III MLC Internal Solid State Drive (SSD) **\$164.99**
IN STOCK

Form Factor: M.2 / Capacity: 480GB
Sold by [PlatinumMicro.com](#)

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Shipping Options

Choose a delivery method

- Standard Shipping (5-7 business days)
- Expedited Shipping (3-5 business days)
- Two-Day Shipping (2 business days)
- Next Day Shipping (One business day)

Subtotal: \$224.98
Shipping: \$0.00

G2.2xlarge

Newegg.com Shopping C EC2 Product Details - Am Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?submit=ChangeItem

G.SKILL Ripjaws 4 Series 64GB (4 x 16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRR
IN STOCK \$764.97 (\$254.99 ea.) PREMIER JOIN TODAY

G.SKILL Aegis 64GB (4 x 16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory
IN STOCK \$499.98 (\$249.99 ea.) PREMIER JOIN TODAY

Biwin® 60GB MLC SATA III 6Gb/s NGFF M.2 2242 SSD Solid State Drive
Form Factor: M.2 / Capacity: 64GB / Out-of-Box Ready
IN STOCK \$32.99 PREMIER JOIN TODAY

Sold by Windisk

Intel Xeon E5-2680 v2 Ivy Bridge-EP 2.8 GHz LGA 2011 115W BX80635E52680V2 Server Processor
Replacements Only Return Policy
Protect Your Investment View Details \$3,533.98 (\$8,539.98 Save: 0.17% (\$1,766.99 ea.) PREMIER JOIN TODAY

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Shipping Options
Choose a delivery method
Standard Shipping (5-7 business days)

Newegg Marketplace Direct Delivery Service Important Shipping Information

Intel 320 Series 2.5" 160GB SATA II MLC Internal Solid State Drive (SSD)
SSUSA2CW160G310
Form Factor: 2.5" / Capacity: 160GB
Sold by E.O.L. Tech Inc. \$170.00 (\$25.00 ea.)

Intel Xeon E5-2670 Sandy Bridge-EP 2.6GHz (3.3GHz Turbo Boost) LGA 2011 115W BX80621E52670 Server Processor
Sold by E.O.L. Tech Inc. \$575.00

Subtotal: \$745.00
Shipping: \$0.00

Shipping Options
Choose a delivery method
Standard Shipping (5-7 business days)

Credit Card Statement Credit*: -\$25.00 7:04 PM 4/11/2016

Get \$25 Back!

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I2.8xlarge

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Mushkin Enhanced Atlas Vital M.2 2280 480GB SATA III MLC Internal Solid State Drive (SSD)
MKNSSDAV480GB-D8
Form Factor: M.2 / Capacity: 480GB
Sold by Mushkin Electronics \$164.99

SAMSUNG 850 PRO 2.5" 2 TB SATA III 3-D Vertical Internal Solid State Drive (SSD) MZ-ZKE2T0BW
Form Factor: 2.5" / Capacity: 2 TB
Sold by PlatinumMicro.com \$2,699.97 (\$899.99 ea.)

Subtotal: \$2,864.96
Shipping: \$0.00

Shipping Options
Choose a delivery method
Standard Shipping (5-7 business days)
Expedited Shipping (3-5 business days)
Two-Day Shipping (2 business days)
Next Day Shipping (One business day)

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EC2 Product Details - Ami

Bang Bang Bollywood

Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?submit=ChangeItem

G.Skill Ripjaws 4 Series 64GB (8x8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRR

\$764.97
(\$24.99 ea.)
IN STOCK

Premier Join Today

G.Skill Aegis 64GB (4x16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory

\$499.98
(\$24.99 ea.)
IN STOCK

Premier Join Today

Intel DC S3610 2.5" 400GB SATA III MLC Internal Solid State Drive (SSD) SSDSC2BX400G401 - OEM

\$314.99
Save: 37.00%
IN STOCK

Premier Join Today

Biwin® 60GB MLC SATA III 6Gb/s NGFF M.2 2242 SSD Solid State Drive

\$32.99
IN STOCK

Premier Join Today

Intel Xeon E5-2680 v2 Ivy Bridge-EP 2.8 GHz

\$3,539.98
IN STOCK

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D2.8xlarge

Newegg.com Shopping Cart

EC2 Product Details - Ami

Bang Bang Bollywood

Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?Submit=view

WD Blue 6TB Desktop Hard Disk Drive - \$400
RPM SATA 6Gb/s 64MB Cache 3.5 Inch - WD60EZRX

\$1,069.95
Save: 26.21%
(\$213.99 ea.)
IN STOCK LIMIT 5

Premier Join Today

WD Blue 4TB Desktop Hard Disk Drive - \$400
RPM SATA 6Gb/s 64MB Cache 3.5 Inch - WD40EZRX

\$359.97
Save: 29.41%
(\$119.99 ea.)
IN STOCK LIMIT 3

Premier Join Today

WD Blue 3TB Desktop Hard Disk Drive - \$400
RPM SATA 6Gb/s 64MB Cache 3.5 Inch - WD30EZRX

\$189.98
Save: 20.84%
(\$54.99 ea.)
IN STOCK

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Network Shopping

M4.10xlarge

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69 item(s) in your shopping cart: \$34,401.84

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Select All Remove Selected Move Selected To... Update Qty

Newegg Standard Shipping Service Important Shipping Information

StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter

\$226.99
Save: 1.30%
IN STOCK

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M3.large

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StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter
Standard Return Policy
Send this item as a gift

TP-LINK TG-3468 10/ 100/ 1000Mbps PCI-Express Network Adapter
45/1 Return Policy
Protect Your Investment View Details
Send this item as a gift

HyperX FURY RGB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/R
Standard Return Policy
Send this item as a gift

G.Skill Ripjaws X Series 16GB (2 x 8GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model F3-12800CL10D-16GBX4
Standard Return Policy
Send this item as a gift

M3.2xlarge

Newegg Standard Shipping Service Important Shipping Information

StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter
Standard Return Policy
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TP-LINK TG-3468 10/ 100/ 1000Mbps PCI-Express Network Adapter
45/1 Return Policy
Protect Your Investment View Details
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HyperX FURY RGB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/R
Standard Return Policy
Send this item as a gift

G.Skill Ripjaws X Series 16GB (2 x 8GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model F3-12800CL10D-16GBX4
Standard Return Policy
Send this item as a gift

C3.8xlarge

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ALL PRODUCTS DEALS & SERVICES FEATURED SELLERS Keywords, Model # or item #

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71 Item(s) in your shopping cart: \$34,698.82

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StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter
Standard Return Policy
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G2.2xlarge

Newegg Standard Shipping Service Important Shipping Information

StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter
Standard Return Policy

TP-LINK TG-3468 10/100/1000Mbps PCI-Express Network Adapter
45/1 Return Policy

HyperX FURY 8GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/8
Standard Return Policy

\$907.96
\$35.97
\$34.99

R3.4xlarg

Newegg Standard Shipping Service Important Shipping Information

StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter
Standard Return Policy

TP-LINK TG-3468 10/100/1000Mbps PCI-Express Network Adapter
45/1 Return Policy

HyperX FURY 8GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/8
Standard Return Policy

\$907.96
\$35.97
\$34.99

12.8xlarge

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ALL PRODUCTS DEALS & SERVICES FEATURED SELLERS

Keywords, Model # or Item #

5 Item(s) in your shopping cart: \$35,133.09

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StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter
Standard Return Policy

TP-LINK TG-3468 10/100/1000Mbps PCI-Express Network Adapter
45/1 Return Policy

HyperX FURY 8GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/8
Standard Return Policy

\$907.96
\$35.97
\$34.99

D2.8xlarge

Newegg.com EC2 Product Justin Bieber RAID Performer Convert Mbr Solid-state SSD Ranking Azure Virtual http://www... Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?submit=ChangeItem TRY P PREMIER Free 30-day trial when you sign up for a 12-month membership OR Download mobile app & get a free 3-month membership. My Account \$35,133.09 (75 Items) Wish List Customer Service ALL PRODUCTS DEALS & SERVICES FEATURED SELLERS Keywords, Model # or Item # Search all SEARCH Home > My Shopping Cart

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SECURITY SAFEGUARDS
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75 Item(s) in your shopping cart: \$35,133.09

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Select All Remove Selected Move Selected To... Update Qnts

Newegg Standard Shipping Service Important Shipping Information

StarTech.com PCI Express 10 Gigabit Ethernet Fiber Network Card w/ Open SFP+ - PCIe x4 10Gb NIC SFP+ Adapter
Standard Return Policy
Send this item as a gift

\$649.96
\$907.96
Save: 13.0% (\$226.99 ea.)
P PREMIER JOIN TODAY

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SWITCH

Newegg EC2 Pr Mark R RAID P Convert W Solid- SSD Ra Azure http:// HP JGS Super W 10 Gig Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?submit=ChangeItem Zip/Postal Code Update Choose a delivery method APO/FPO/Military ONLY Newegg 3 Business Days Newegg 2 Business Days Newegg Next Business Day FREE 2-Day Shipping learn more | sign in

Newegg Marketplace Direct Delivery Service Important Shipping Information

D-Link 10-Port 10-Gigabit Ethernet Smart Managed Switch Sold by PC Rush
Subtotal: \$3,436.24 (\$829.00 ea.)
Shipping Options Standard Shipping (5-7 business days)
Expedited Shipping (3-5 business days)
Two-Day Shipping (2 business days)

Newegg Marketplace Direct Delivery Service Important Shipping Information

Mushkin Enhanced Atlas Vital M.2 2280 120GB Subtotal: \$60.99

Windows Search the web and Windows 10:08 PM 4/11/2016

Newegg EC2 Pr Mark R RAID P Convert W Solid- SSD Ra Azure http:// HP JGS Super W 10 Gig Newegg Inc. [US] https://secure.newegg.com/Shopping/ShoppingCart.aspx?submit=ChangeItem SECURITY SAFEGUARDS Security is a top priority as we keep your sensitive information via the secure connection. Your information is protected both online and offline.

TP-LINK TG-3468 10/ 100/ 1000Mbps PCI-Express Network Adapter
45/1 Return Policy
Protect Your Investment View Details
Send this item as a gift

D-Link 52-Port Gigabit Web Smart Switch including 4 SFP ports
Standard Return Policy
Protect Your Investment View Details
1.00x + \$0.00 UP TO + 1500

HyperX FURY 8GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/8
Standard Return Policy
Send this item as a gift

G.Skill Ripjaws X Series 16GB (2 x 8GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model GS-16GBK1600C10D
Standard Return Policy
Send this item as a gift

Windows Search the web and Windows 10:08 PM 4/11/2016

Motherboard

M4.10xlarge (2)

The screenshot shows a Newegg shopping cart with two items:

- G.Skill Aegis 64GB (4 x 16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory**: \$499.98 (IN STOCK)
- Supermicro X9SRA Server Motherboard - Intel C602 Chipset - Socket R LGA-2011 - Bulk Pack**: \$292.99 (IN STOCK)

Both items have a "PREMIER JOIN TODAY" button.

M3.large (1)

The screenshot shows a Newegg shopping cart with one item:

- G.Skill Ripjaws 4 Series 64GB (8 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRR**: \$499.98 (IN STOCK)

This item has a "PREMIER JOIN TODAY" button.

M3.2xlarge

The screenshot shows a Newegg shopping cart with three items:

- Supermicro X9SRA Server Motherboard - Intel C602 Chipset - Socket R LGA-2011 - Bulk Pack**: \$292.99 (IN STOCK)
- Open Box: SUPERMICRO MBD-X10DAI-O Extended ATX Xeon Server Motherboard Dual LGA 2011 Intel C612**: \$585.98 (IN STOCK LIMIT 5)
- Refurbished: Crucial M550 2.5" 256GB SATA 6Gb/s MLC Internal Solid State Drive (SSD) CT256M550SSD1 - CERTIFIED REFURBISHED**: \$64.99 (IN STOCK LIMIT 5)

Items 2 and 3 have "PREMIER JOIN TODAY" buttons.

C3.8xlarge

G2.2xlarge

Item Description	Quantity	Price
G.Skill Ripjaws 4 Series 64GB (8 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRB	6	\$1,499.94
G.Skill Ripjaws 4 Series 64GB (8 x 8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRR	2	\$499.98
G.Skill Aegis 64GB (4 x 16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory	2	\$499.98
SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	1	\$364.99

G2.2xlarge

Item Description	Quantity	Price
G.Skill Aegis 64GB (4 x 16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory	2	\$499.98
SUPERMICRO X9SRA Single Socket R (LGA 2011) E5 ATX Workstation/Server Motherboard DDR3 1600 12xUSB, 2x PCI-E 3.0 x16	1	\$271.99
SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	1	\$364.99
Supermicro X9SRA Server Motherboard - Intel C602 Chipset - Socket R LGA-2011 - Bulk Pack	1	\$292.99

R3.4xlarge

Item Description	Quantity	Price
SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	1	\$364.99
Supermicro X9SRA Server Motherboard - Intel C602 Chipset - Socket R LGA-2011 - Bulk Pack	1	\$292.99
Open Box: SUPERMICRO MBD-X10DAI-O Extended ATX Xeon Server Motherboard Dual LGA 2011 Intel C612	2	\$585.98
Open Box: SUPERMICRO MBD-X10SRA-O ATX Server Motherboard LGA 2011 Intel C612	1	\$204.59
Open Box: SUPERMICRO MBD-X10SRA-F-O ATX Server Motherboard Single Socket R (LGA 2011) Intel C612	1	\$238.99

I2.8xlarge

D2.8xlarge

Item Description	Price	Stock Status	Save (%)
Open Box: SUPERMICRO MBD-X10DAL-I-O ATX Server Motherboard Dual LGA 2011 Intel C612	\$239.99	In Stock Limit 5	Save: 12.73%
Refurbished: Crucial M550 2.5" 256GB SATA 6Gb/s MLC Internal Solid State Drive (SSD) CT256M550SSD1 - CERTIFIED REFURBISHED	\$64.99	In Stock Limit 5	Save: 45.84%
Intel DC S3610 2.5" 400GB SATA III MLC Internal Solid State Drive (SSD) SSDS2BX400G401 - OEM	\$314.99	In Stock	Save: 17.00%
Biwin® 60GB MLC SATA III 6Gb/s NGFF M.2 2242 SSD Solid State Drive Form Factor: M.2 / Capacity: 64GB / Option: Single Drive Sold by Windisk	\$32.99	In Stock	Save: 45.00%

D2.8xlarge

Item Description	Price	Stock Status	Save (%)
Supermicro X9SRA Server Motherboard - Intel C602 Chipset - Socket R LGA-2011 - Bulk Pack	\$292.99	In Stock	Save: 0.00%
Open Box: SUPERMICRO MBD-X10DAI-O Extended ATX Xeon Server Motherboard Dual LGA 2011 Intel C612	\$585.98	In Stock Limit 5	Save: 5.00% (\$292.99 ea.)
Open Box: SUPERMICRO MBD-X10DRL-I ATX Server Motherboard Dual LGA 2011 R3 Intel C612	\$247.99	In Stock Limit 5	Save: 6.00% (\$292.99 ea.)
Open Box: SUPERMICRO MBD-X10SRA-O ATX Server Motherboard LGA 2011 Intel C612	\$204.59	In Stock	Save: 5.97%

+ Main Switch

Item Description	Price	Stock Status	Save (%)
G.Skill Ripjaws 4 Series 64GB (8x8GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Memory Kit Model F4-2133C15Q2-64GRR	\$499.98	In Stock	(\$249.99 ea.)
G.Skill Aegis 64GB (4x16GB) 288-Pin DDR4 SDRAM DDR4 2133 (PC4 17000) Intel Z170 Platform / Intel X99 Platform Desktop Memory ...	\$499.98	In Stock	(\$249.99 ea.)
Open Box: ASUS Z9PA-U8 ATX Server Motherboard LGA 2011 DDR3 1600/1333/1066	\$229.99	In Stock	Save: 20.69%
Open Box: SUPERMICRO X9SRA Single Socket R (LGA 2011) E5 ATX Workstation/Server Motherboard DDR3 1600 12xUSB, 2x PCI-E 3.0 x16	\$271.99	In Stock	Save: 22.73%
SUPERMICRO MBD-X9DBD-I-O Extended ATX	\$389.99		

The screenshot shows a Microsoft Edge browser window with a shopping cart on the Newegg website. The cart contains the following items:

- TP-LINK TG-3468 10/ 100/ 1000Mbps PCI-Express Network Adapter**: \$47.96, In Stock Limit 5
- NETGEAR ProSAFE 52-Port Stackable Smart Managed Switch (GS752TXS) - Lifetime Warranty**: \$1,316.99, In Stock
- D-Link 52-Port Gigabit Web Smart Switch including 4 SFP ports**: \$1,499.96, In Stock
- HyperX FURY 8GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/8**: \$34.99, In Stock Limit 5

The total price for the cart is \$1,803.90.

Electricity

The 15.3 cents per kWh that Chicago households paid for electricity in February 2016 was 14.2 percent higher than the nationwide average cost of 13.4 cents per kWh. With the exception of February 2014, when Chicago area electricity costs were comparable to the national average, prices have exceeded the national average by 19.5 percent or more in the previous four years (2012-2015) in February. (See [chart 2](#).)

Chart 2. Average prices for electricity, Chicago-Gary-Kenosha and the United States, 2012-2016 (as of February)



http://www.bls.gov/regions/midwest/news-release/averageenergyprices_chicago.htm

Data Center Operation Administrator Salary in Chicago, IL

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Data Center Operation Administrator in Chicago, IL	\$80,000
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In USD as of Apr 17, 2016

Average Data Center Operation Administrator salaries for job postings in Chicago, IL are 20% higher than average Data Center Operation Administrator salaries for job postings nationwide.

National Salary Trend from Indeed.com

— Data Center Operation Administrator

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Blade server

From Wikipedia, the free encyclopedia

A **blade server** is a stripped down server computer with a modular design optimized to minimize the use of physical space and energy. Whereas a standard **rack-mount** server can function with (at least) a power cord and network cable, blade servers have many components removed to save space, minimize power consumption and other considerations, while still having all the functional components to be considered a computer.^[1] Unlike a rack-mount server, a blade server needs a blade enclosure. A **blade enclosure**, which can hold multiple blade servers, provides services such as power, cooling, networking, various interconnects and management. Together, blades and the blade enclosure form a blade system (although **BladeSystem** from **Hewlett-Packard** is a specific product name). Different blade providers have differing principles regarding what to include in the blade itself, and in the blade system altogether.

In a **standard** server-rack configuration, one rack unit or **1U**—19 inches (480 mm) wide and 1.75 inches (44 mm) tall—defines the minimum possible size of any equipment. The principal benefit and justification of blade computing relates to lifting this restriction so as to reduce size requirements. The most common computer rack **form-factor** is **42U** high, which limits the number of discrete computer devices directly mountable in a rack to 42 components. Blades do not have this limitation. As of 2014, densities of up to 180 servers per blade system (or **1440 servers per rack**) are achievable with blade systems.^[2]

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Cost of cooling and power cost

Every 3,000 Watts (approximately 25 amps at 120 volts) requires 10,200 BTU of sensible cooling. If you're using conventional CRAC units with humidification, set them for 72F Return Air. This will require about one ton of total machine capacity. These are very "round numbers" but should give you a good guideline.

https://www.vmguru.com/2011/06/how-to-calculate-electrical-costs-for-cooling-and-power-consumption/

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Operating Hours * Watt Usage per hour

$$\frac{1000}{kWh * Electricity Costs per kWh}$$

Operating Hours = 365 Days * 24 hours a day = 8760 Hours per year

Watt Usage per hour = 307 Watt

Electricity Costs per kWh = € 0,18

So if we fill in the formula for the energy consumption costs you will get that this server will cost € 484,08 per year.

$$\frac{(365 * 24) * 8760 * 307}{1000} = 2689,32 \text{ kWh} * € 0,18 = € 484,08$$

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Cooling cost calculation

For calculating the cooling cost to keep the equipment in normal operating conditions, I almost use the same formula where we translate the BTU/h to Watts needed so we get the correct costs associated with cooling the heat the server emits for a year.

$$\frac{(\text{Operating Hours} * \text{BTU per hour}) * 0,293}{1000} = \text{kWh} * \text{Electricity Costs per kWh}$$

Operating Hours = 365 Days * 24 hours a day = 8760 Hours per year

BTU per hour = 1047 BTU

1000 BTU/h is approximately 293W

Electricity Costs per kWh = € 0,18

$$\frac{(8760 * 1047) * 0,293}{1000} = 2687,31 \text{ kWh} * € 0,18 = € 483,72$$

To calculate the total electrical cost associated with running the server for one year 24x7 in the data center we add the Energy Cost to the Cooling Cost to get the Total Electrical cost for the server.

Operating the HP DL380 server in the example for a year will cost € 484,08 + € 483,66 = € 967,74. If you can virtualize the running workload on it you will save almost 1000 Euro a year per server. Of course when you virtualize this server and other servers on a heavier physical server which runs ESXi server you often use heavier equipment under the hypervisor which consumes more energy but I will elaborate more on that subject in a future blog post.

Power Calculators

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