CS553: Cloud Computing

Understanding the Cost of Computing in the Cloud

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Introduction:

The basic purpose for this written project is to understand and compare the cost of Public and Private Cloud. Given Amazon EC2 instances are taken for computing public cloud cost. We need to predict which type of instances are better under certain circumstance for each instance type. I have made some assumption while calculating the cost of private cloud.

We need to decide which type of cloud is better for those circumstances and when it is better to own the Cloud environment and when it is better to rent the same.

Following eight tables of eight different instances are given which demonstrates the hardware and cost details of that particular instance.

For calculating the cost of each category components are searched from newegg.com site.

I chose best possible component for the particular instance to satisfy the needs of that instance for e.g. CPU, Memory, Hard disk, Network adaptor and switch etc.

While calculating the cost of private cloud I have considered 5 years cost for each hardware attributes well as administrative cost.

Number of GFLOPS and instances are calculated.

Points Considered:

The configuration given by Amazon instances is considered for searching the Hardware components for those instances.

Cost of computing hardware is calculated by cost of hardwares taken.

Network cost is calculated according to the cost of Network switch which we have selected with respect to number of instances.
The network cost is calculated by selecting number of switches for number of instances and then multiplying by the cost of network switch.

Admin cost I have selected is 90000 per annum and hence I have calculated its cost for 5 years which is 450000.
I have assumed that one Administrator can monitor 1000 number of instances and hence cost of admin is calculated accordingly.

Amazon EC2 G2.2X large instance provides GPU so we have taken GPU configuration for this type of instances

Electricity cost is calculated using Watts required by the component.
Average price in illinois is 6.987 cents.
Here also I have calculated the electricity cost keeping 5 years of span in the mind.
After calculating the power cost cooling cost is calculated which is exactly 1/3 of the Electricity cost.

According to the configuration of the instance some type of instances requires Racks to setup the environment so best suitable racks are selected and cost for the same is considered while calculating the total cost.

Total cost is calculated by adding all the costs that we have calculated so far and then cost / hour is calculated.
Cost / Hour is calculated by dividing the total cost by 5 years and 24 hours.
Then I have calculated Cost / Hour / GFLOP by dividing the cost / hour calculated above.

Instance	Gflops
m4.10xlarge	768
m3.large	20
m3.2xlarge	80
c3.8xlarge	358.4
g2.2xlarge	83.2
r3.4xlarge	160
i2.8xlarge	320
d2.8xlarge	691.2

m4.10xlarge Instance:

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2676 V3 2.40ghz Sr1y5 30mb 12 cores 24	2	1800.00	3600.00
Memory	Crucial 128GB (4 x 32GB) 288-Pin DDR4 SDRAM ECC DDR4 2133 (PC4 17000) Server Memory Model CT4K32G4LFQ4213 + Crucial 32GB (2 x 16GB) DDR3 1866 (PC3 14900) ECC Registered Memory For Mac Pro Systems Model CT2K16G3R186DM	1	1401.98	1401.98
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	Intel X520-T2 10G 4-Port PCI-E Low Profile Ethernet Network Adapter	1	396.00	396.00
Network Switch	HP 3800-48G-4XG Managed L4 Switch – 48 Ethernet Ports	1	5500.00	5500.00
Motherboard	ASRock EP2C602-4L/D16 SSI EEB Server Motherboard Dual LGA 2011 Intel C602 DDR3 1600/1333/1066	1	309.99	309.99

GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	12256.96	5500	921.25	307.08	450000	468985.29	10.7074	0.0139419
10	1	12256.96	5500	921.25	307.08	450000	468985.29	10.7074	0.0139419
100	1	12256.96	5500	921.25	307.08	450000	468985.29	10.7074	0.0139419
1000	2	19013.92	5500	1842.5	614.17	450000	476970.59	10.8897	0.0070896
10000	14	100097.44	5500	12897.5	4299.17	450000	572794.11	13.0775	0.0012163
100000	131	901661.76	16500	120683.75	40227.92	450000	1529073.43	34.9103	0.0003470
1000000	1303	8958318.88	154000	1200388.75	400129.58	900000	11612837.21	265.1333	0.0002649

m3.large Instance :

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	1	1559.99	1559.99
Memory	Crucial 8GB (2 x 4GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model CT2KIT51264BA160BJ	1	29.99	29.99
SSD	Transcend mSATA 32GB SATA III MLC Internal Solid State Drive (SSD) MSA370 (TS32GMSA370)	1	38.99	38.99
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	SYBA SY-PEX24028 Dual Port Gigabit Ethernet Network Adapter 10/ 100/ 1000Mbps PCI-Express 2 x RJ45	1	34.99	34.99
Network Switch	HP 2530-48G-PoE+-2SFP+ Managed Switch - 48 PoE+ Ethernet Ports & 2 10/1 Gigabit Ethernet SFP+ Port	1	1500.00	1500.00
Motherboard	SUPERMICRO X9SRA Single Socket R (LGA 2011) E5 ATX Workstation/Server Motherboard DDR3 1600 12*USB, 2* PCI-E 3.0 *16	1	271.99	271.99

GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	4484.94	5500	1521.15	507.05	450000	462013.14	10.5482	0.52741
10	1	4484.94	5500	1521.15	507.05	450000	462013.14	10.5482	0.52741
100	5	16424.7	5500	7605.75	2535.25	450000	482065.7	11.0061	0.110061
1000	50	152247	11000	76057.5	25352.5	450000	714657	16.3164	0.0163164
10000	500	1508970	60500	760575	253525	450000	3033570	69.2596	0.00692596
100000	5000	15082200	577500	7605750	2535250	2250000	28050700	640.4269	0.00640427
1000000	50000	150810000	5731000	76057500	25352500	22500000	280451000	6402.9909	0.00640299

m3.2xlarge Instance :

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	1	1559.99	1559.99
Memory	Crucial 32GB (2 x 16GB) DDR3 1866 (PC3 14900) ECC Registered Memory For Mac Pro Systems Model CT2K16G3R186DM	1	231.99	231.99
SSD	Intel 80 GB Internal SSD - 2.5" - SATA 3Gb/s	2	89.00	178.00
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	SYBA SY-PEX24028 Dual Port Gigabit Ethernet Network Adapter 10/ 100/ 1000Mbps PCI-Express 2 x RJ45	1	34.99	34.99
Network Switch	HP 2530-48G-PoE+-2SFP+ Managed Switch - 48 PoE+ Ethernet Ports & 2 10/1 Gigabit Ethernet SFP+ Port	1	1500.00	1500.00
Motherboard	SUPERMICRO X9SRA Single Socket R (LGA 2011) E5 ATX Workstation/Server Motherboard DDR3 1600 12*USB, 2* PCI-E 3.0 *16	1	271.99	271.99

GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	4825.95	1500	1521.15	507.05	450000	458354.15	10.4647	0.1310588
10	1	4825.95	1500	1521.15	507.05	450000	458354.15	10.4647	0.131058
100	2	7182.91	1500	3042.3	1014.1	450000	462739.31	10.5648	0.06603
1000	13	44737.35	1500	19774.95	6591.65	450000	522603.95	11.9316	0.0114727
10000	125	420243.75	4500	190143.75	63381.25	450000	1128268.75	25.7596	0.0025760
100000	1250	4197937.5	40500	1901437.5	633812.5	900000	7673687.5	175.1983	0.001751983
1000000	12500	59932875	391500	19014375	6338125	5850000	91526875	2089.6547	0.0020896547

c3.8xlarge Instance :

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2680 v2 Ivy Bridge-EP 2.8 GHz LGA 2011 115W BX80635E52680V2 Server Processor	2	1769.99	3539.98
Memory	Crucial 64GB (2 x 32GB) 240-Pin DDR3 SDRAM ECC DDR3 1866 (PC3 14900) Server Memory Model CT2K32G3ELSDQ4186D	1	599.99	599.99
SSD	HP ioDrive IO Accelerator for ProLiant Servers 320 GB Internal SSD - PCI Express x4	2	762.00	1524.00
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	Intel X520-T2 10G 4-Port PCI-E Low Profile Ethernet Network Adapter	1	396.00	396.00
Network Switch	HP 3800-48G-4XG Managed L4 Switch - 48 Ethernet Ports & 4 10Gb Ethernet Ports	1	5500.00	5500.00
Motherboard	SUPERMICRO X9SRA Single Socket R (LGA 2011) E5 ATX Workstation/Server Motherboard DDR3 1600 12xUSB, 2x PCI-E 3.0 x16	1	271.99	271.99

GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	12880.95	5500	921.25	307.08	450000	469609.28	10.7217	0.02991546
10	1	12880.95	5500	921.25	307.08	450000	469609.28	10.7217	0.02991546
100	1	12880.95	5500	921.25	307.08	450000	469609.28	10.7217	0.02991546
1000	3	27642.85	5500	2763.75	921.25	450000	486827.85	11.1148	0.01033743
10000	28	212166.6	5500	25795	8598.33	450000	702059.93	16.0288	0.00159726
100000	280	2099666	33000	257950	85983.33	450000	2926599.33	66.8173	0.00066583
1000000	2791	20924731.45	324500	2571208.75	857069.58	1350000	26027509.78	594.2354	0.00059406

g2.2xlarge Instance :

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2670 Sandy Bridge-EP 2.6GHz (3.3GHz Turbo Boost) 20MB L3 Cache LGA 2011 115W BX80621E52670 Server Processor	1	584.54	584.54
Memory	Crucial 16GB (2 x 8GB) 240-Pin DDR3 SDRAM ECC Unbuffered DDR3 1600 (PC3 12800) Server Memory Model CT2KIT102472BD160B	1	97.99	97.99
GPU	HP Quadro NVS 510 C2J98AT 2GB DDR3 PCI Express 2.0 x16 2GB Graphics	1	399.89	399.89
SSD	Mushkin Enhanced Atlas Series 60GB Mini-SATA (mSATA) MLC Internal Solid State Drive (SSD) MKNSSDAT60GB-V : $55.39	1	55.39	55.39
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	SYBA SY-PEX24028 Dual Port Gigabit Ethernet Network Adapter 10/ 100/ 1000Mbps PCI-Express 2 x RJ45	1	34.99	34.99
Network Switch	HP 2530-48G-PoE+-2SFP+ Managed Switch - 48 PoE+ Ethernet Ports & 2 10/1 Gigabit Ethernet SFP+ Port	1	1500.00	1500.00
Motherboard	ASRock EP2C602-4L/D16 SSI EEB Server Motherboard Dual LGA 2011 Intel C602 DDR3 1600/1333/1066	1	309.99	309.99

GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	4031.78	1500	1521.15	507.05	450000	457559.98	10.4466	0.12556009
10	1	4031.78	1500	1521.15	507.05	450000	457559.98	10.4466	0.12556009
100	1	4031.78	1500	1521.15	507.05	450000	457559.98	10.4466	0.12556009
1000	13	34413.14	1500	19774.95	6591.65	450000	512279.74	11.6959	0.01081352
10000	121	310845.38	4500	184059.15	61353.05	450000	1010757.58	23.0767	0.00229227
100000	1202	3082199.56	39000	1828422.3	609474.1	900000	6459095.96	147.4679	0.00147458
1000000	12020	30808495.6	376500	18284223	6094741	5850000	61413959.6	1402.1452	0.00140205

r3.4xlarge Instance :

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	1	1559.99	1559.99
Memory	Crucial 128GB (4 x 32GB) 288-Pin DDR4 SDRAM ECC DDR4 2133 (PC4 17000) Server Memory Model CT4K32G4LFQ4213	1	1169.99	1169.99
SSD	HP ioDrive IO Accelerator for ProLiant Servers 320 GB Internal SSD - PCI Express x4	1	762.00	762.00
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	SYBA SY-PEX24028 Dual Port Gigabit Ethernet Network Adapter 10/ 100/ 1000Mbps PCI-Express 2 x RJ45	1	34.99	34.99
Network Switch	HP 2530-48G-PoE+-2SFP+ Managed Switch - 48 PoE+ Ethernet Ports & 2 10/1 Gigabit Ethernet SFP+ Port	1	1500.00	1500.00
Motherboard	SUPERMICRO X9SRA Single Socket R (LGA 2011) E5 ATX Workstation/Server Motherboard DDR3 1600 12*USB, 2* PCI-E 3.0 *16	1	271.99	271.99

GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	6347.95	1500	1521.15	507.05	450000	459876.15	10.4995	0.06562188
10	1	6347.95	1500	1521.15	507.05	450000	459876.15	10.4995	0.06562188
100	1	6347.95	1500	1521.15	507.05	450000	459876.15	10.4995	0.06562188
1000	7	35435.65	1500	10648.05	3549.35	450000	501133.05	11.4414	0.01021554
10000	63	398420.85	3000	95832.45	31944.15	450000	979197.45	22.3561	0.00221787
100000	625	3050968.75	21000	950718.75	316906.25	450000	4789593.75	109.3515	0.00109352
1000000	6250	30496187.5	196500	9507187.5	3169062.5	3150000	46518937.5	1062.0762	0.00106208

i2.8xlarge Instance :

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz 25MB L3 Cache LGA 2011 115W BX80635E52670V2 Server Processor	2	1559.99	3119.98
Memory	Crucial 128GB (4 x 32GB) 288-Pin DDR4 SDRAM ECC DDR4 2133 (PC4 17000) Server Memory Model CT4K32G4LFQ4213	2	1169.99	2339.98
SSD	Intel SSD DC S3500 Series 2.5" 800GB SATA III MLC Internal Solid State Drive (SSD) SSDSC2BB800G401 – OEM	8	871.58	6972.64
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	Intel X520-T2 10G 4-Port PCI-E Low Profile Ethernet Network Adapter	1	396.00	396.00
Network Switch	HP 3800-48G-4XG Managed L4 Switch – 48 Ethernet Ports	1	5500.00	5500.00
Motherboard	ASRock EP2C602-4L/D16 SSI EEB Server Motherboard Dual LGA 2011 Intel C602 DDR3 1600/1333/1066	1	309.99	309.99

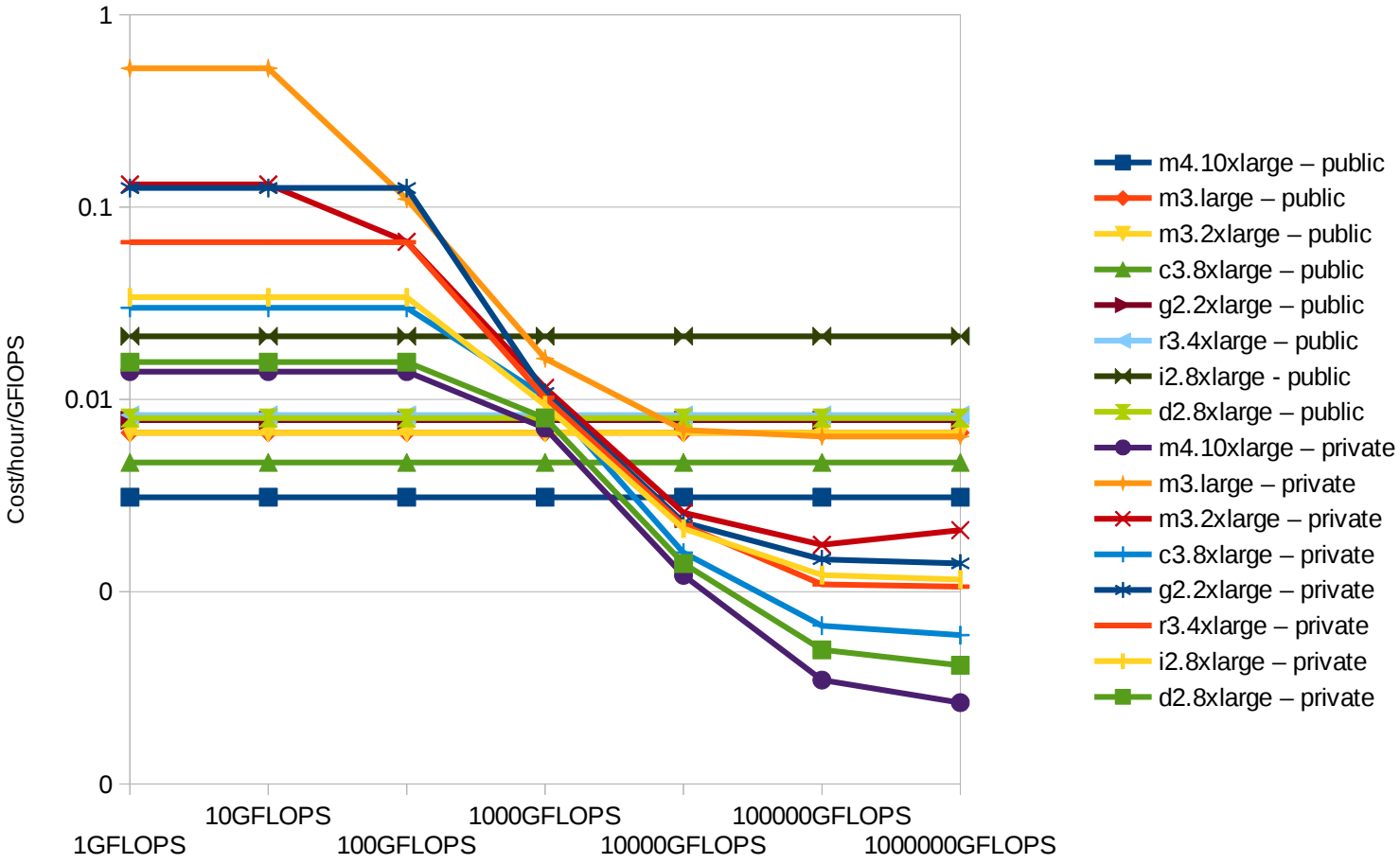
GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	19687.58	5500	921.25	307.08	450000	476415.91	10.8771	0.03399094
10	1	19687.58	5500	921.25	307.08	450000	476415.91	10.8771	0.03399094
100	1	19687.58	5500	921.25	307.08	450000	476415.91	10.8771	0.03399094
1000	4	62250.32	5500	3685	1228.33	450000	522663.65	11.9330	0.00932266
10000	32	459502.56	5500	29480	9826.67	450000	954309.23	21.7879	0.00212772
100000	313	4479212.54	38500	288351.25	96117.08	450000	5352180.87	122.1960	0.00122000
1000000	3125	44699187.5	363000	2878906.25	959635.42	1800000	50700729.17	1157.5509	0.00115755

d2.8xlarge Instance :

Component	Details	Quantity	Unit Cost	Total Cost
CPU	Intel Xeon E5-2676 V3 2.40ghz Sr1y5 30mb 12 cores 24	2	1800.00	3600.00
Memory	Crucial 128GB (4 x 32GB) 288-Pin DDR4 SDRAM ECC DDR4 2133 (PC4 17000) Server Memory Model CT4K32G4LFQ4213	2	1169.99	2339.98
SSD	Seagate Enterprise ST2000NM0033 2TB 7.2k RPM 3.5" SATA-6GB/s HDD	24	115.00	2760.00
RACK	Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)	1	1048.99	1048.99
Network Adapter	Intel X520-T2 10G 4-Port PCI-E Low Profile Ethernet Network Adapter	1	396.00	396.00
Network Switch	HP 3800-48G-4XG Managed L4 Switch – 48 Ethernet Ports	1	5500.00	5500.00
Motherboard	ASRock EP2C602-4L/D16 SSI EEB Server Motherboard Dual LGA 2011 Intel C602 DDR3 1600/1333/1066	1	309.99	309.99

GFlops	Instance Require	Cost of Computing hardware	Network Cost	Electricity Cost	Cooling Cost	Administration Cost	Total Cost	Cost / Hour	Cost / Hour / GFLOP
1	1	15954.96	5500	921.25	307.08	450000	472683.29	10.7919	0.015613281
10	1	15954.96	5500	921.25	307.08	450000	472683.29	10.7919	0.015613281
100	1	15954.96	5500	921.25	307.08	450000	472683.29	10.7919	0.015613281
1000	2	26409.92	5500	1842.5	614.17	450000	484366.59	11.0586	0.007999566
10000	15	162324.4	5500	13818.75	4606.25	450000	636249.4	14.5262	0.001401061
100000	145	1537969.2	22000	133581.25	44527.08	450000	2188077.53	49.9561	0.000498445
1000000	1447	15298827.12	170500	1333048.75	444349.58	900000	18146725.45	414.3088	0.000414240

Plot 1: Comparison between AMAZON EC2 Public Instances cost and Private Cloud equivalent instance types cost, from 1GFlop to 1PFlop.



Observations from the above graph:

The axis of the graph is taken as follows:

X-axis - Number of GFlops

Y-axis - cost/hour/GFlops

The graph shows that using private cloud for small compute power costs more than public amazon instance. But for large compute power private cloud costs less over an amortization period of 5 years.

When to choose public cloud and when to choose private cloud.

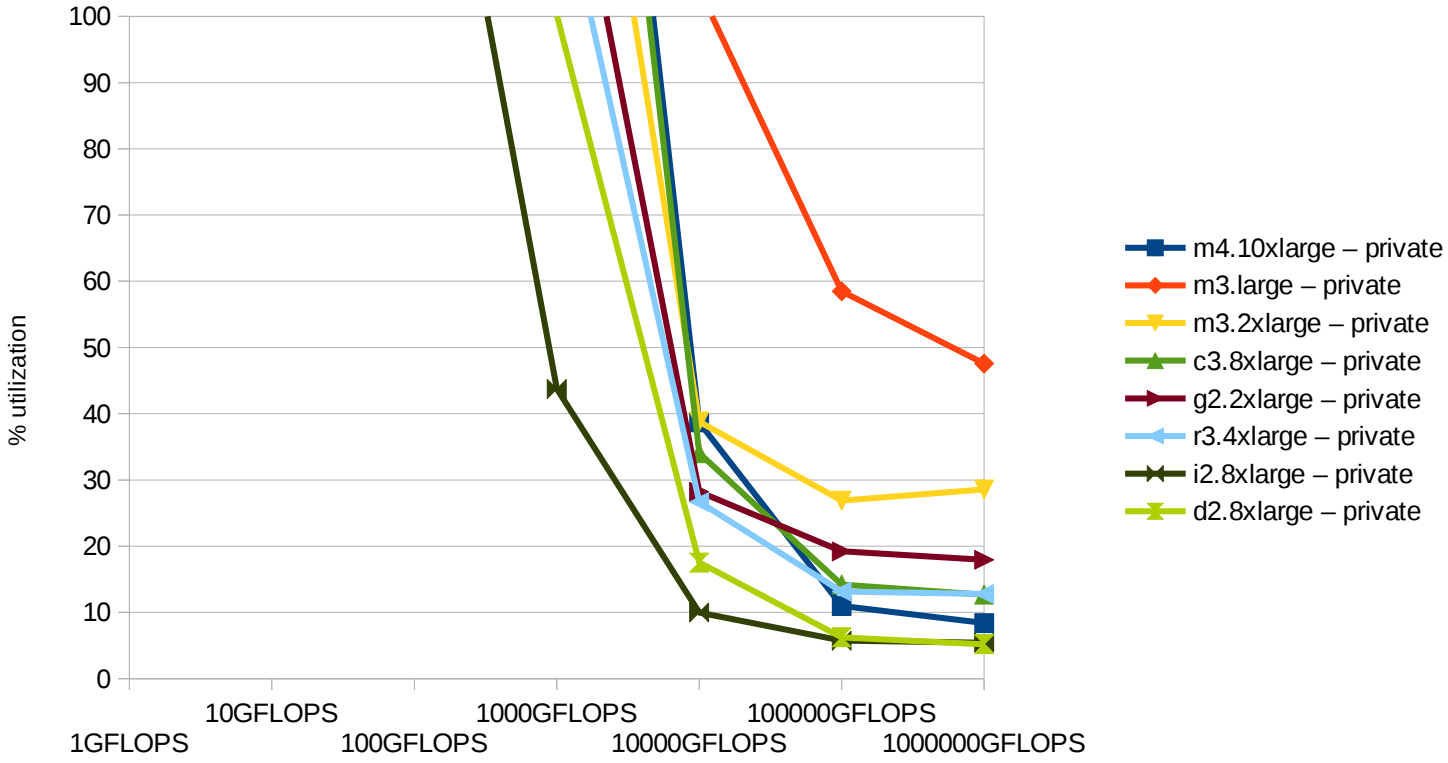
1. If you have a small requirement for short amount of time choose to go for Amazon EC2.
2. If you have small requirement for short amount then also choose for Amazon EC2.
3. If you have small requirement for long amount of time then also choose Amazon EC2
4. If you have large requirement for long amount of time then choose private cloud.

The cost of private cloud decreases for large compute power because of the following points:

The cost of administration does not increase linearly with the compute power. It remains constant for 1000 instances.
So, as we increase the compute power over a period of time, the system administration cost gets amortized causing the cost of private cloud to decrease.

Plot 2: Needed utilization of private cloud from 1 GFLOP to 1 PFLOP for different private instance types.

$$\% \text{ utilization} = \frac{\text{cost/hour/Gflops of private}}{\text{cost/hour/Gflops of public}} * 100$$



Observations from the above graph:

The axis of the graph is taken as follows:

X-axis - Number of GFlops

Y-axis – Percentage Utilization

The graph has been calculated as follows:

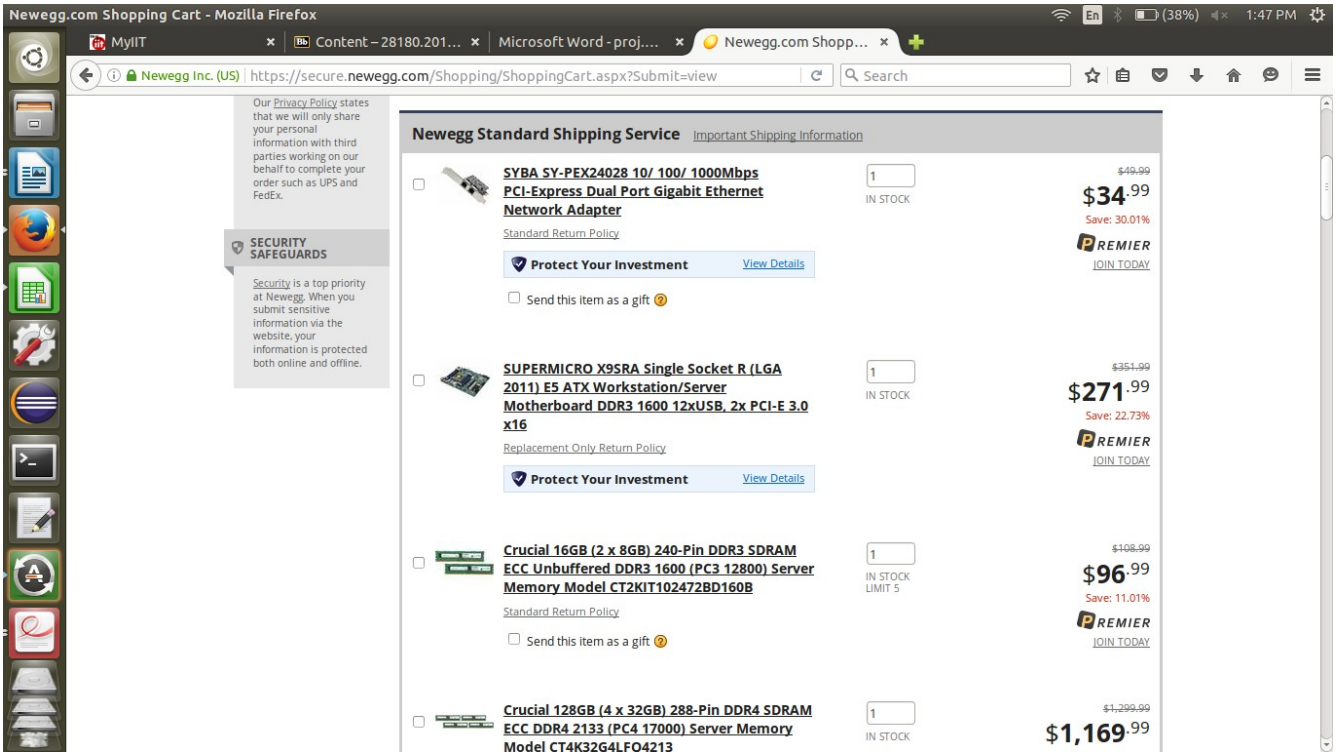
I have taken the utilization of the private cloud at break-even point as 100%.
Then as the cost of the private cloud decreases, I have calculated the decrease in the percentage utilization of the private cloud.

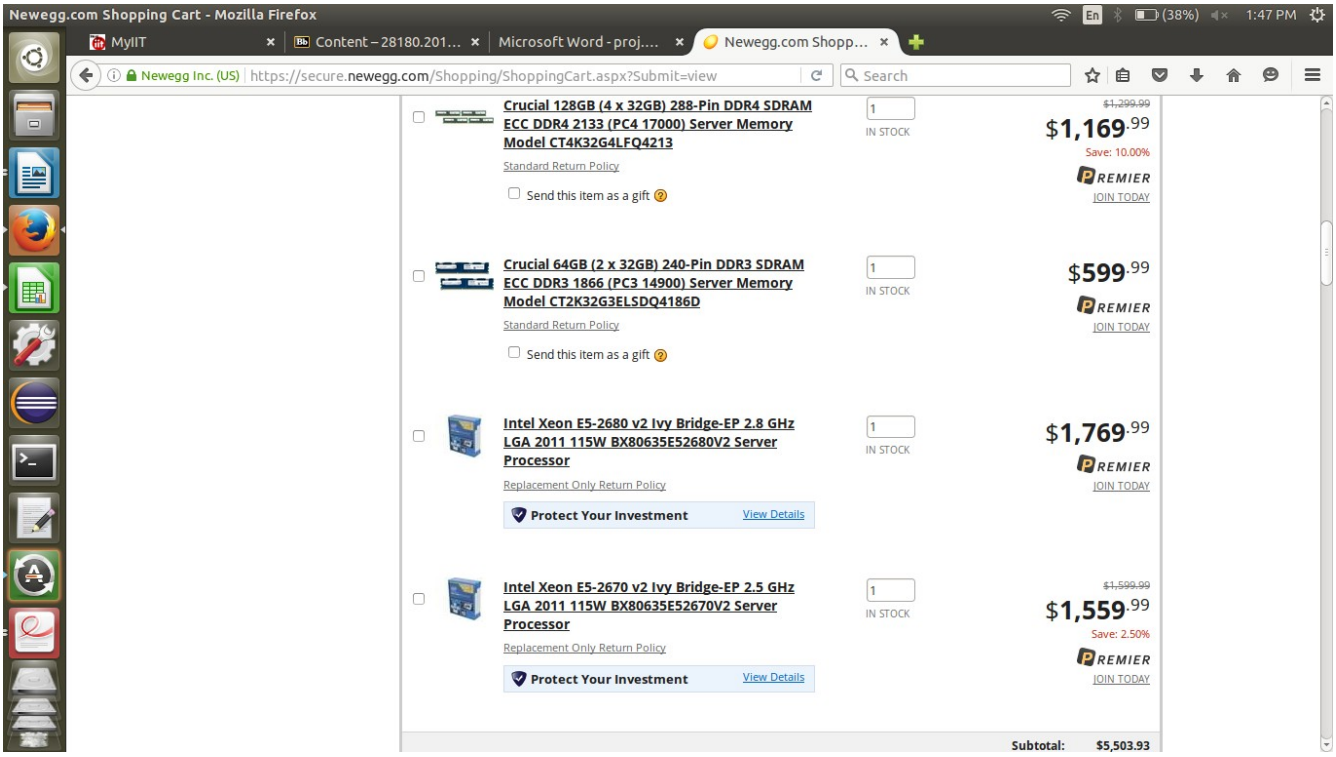
From the above graph I conclude the following:

The graph gives the idea of utilization of the private instances.
Thus it shows the utilization that needs to be achieved to break even points.
It shows that at higher compute power (higher GFlops) the utilization of private instances drops.
Hence, it shows that if very high GFlops is needed over a large period of time, one should opt for private cloud as it has low cost.
This goes in sync with the result that we obtain from plot1.
As for large number of GFLOPS, private cloud is more cost effective even for less % utilization and hence I suggest use of private cloud instead of public cloud under this circumstances.

APPENDIX:

SCREENSHOTS:

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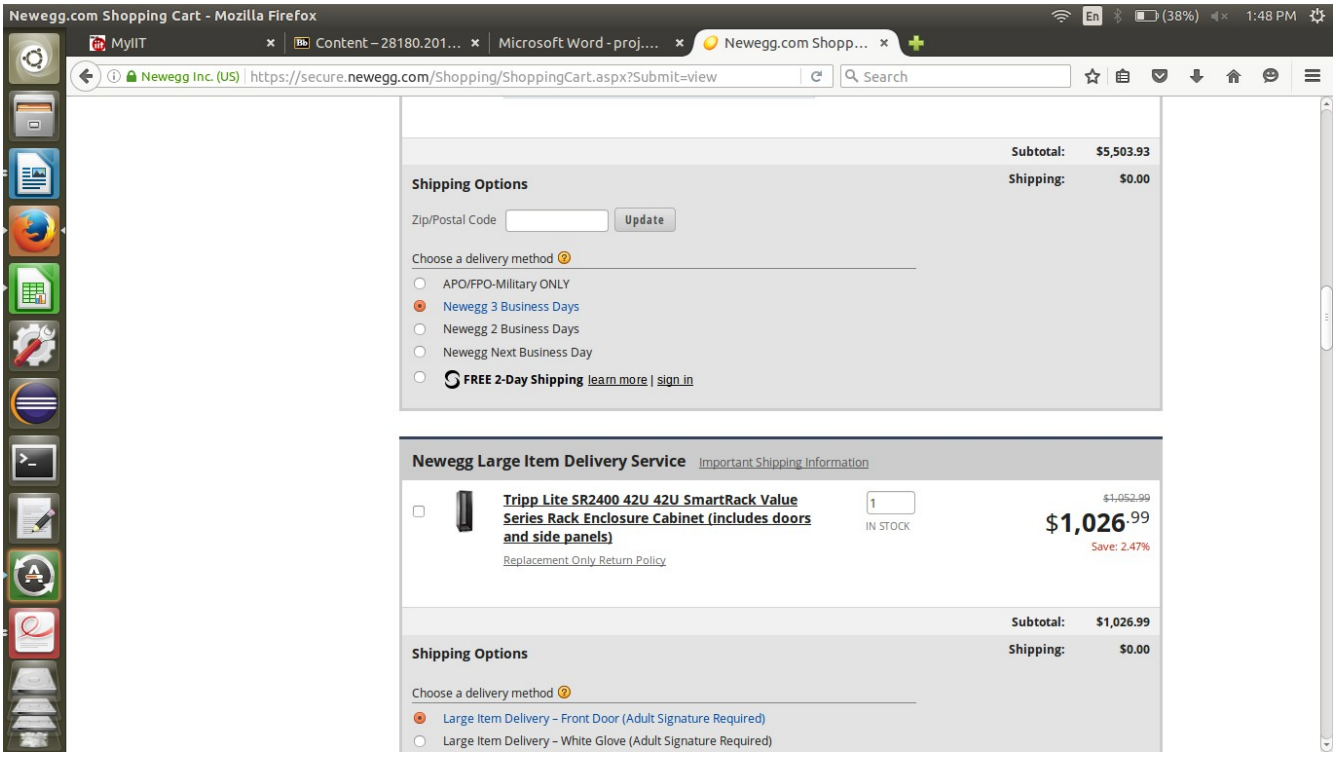
MyIIT
Content – 28180.201...
Microsoft Word - proj....
Newegg.com Shopp...
Newegg Inc. (US) https://secure.newegg.com/Shopping/ShoppingCart.aspx?Submit=view
Search
Crucial 128GB (4 x 32GB) 288-Pin DDR4 SDRAM ECC DDR4 2133 (PC4 17000) Server Memory Model CT4K32G4LFQ4213
Standard Return Policy
Send this item as a gift
IN STOCK
$1,299.99
$1,169.99
Save: 10.00%
PREMIER
JOIN TODAY
Crucial 64GB (2 x 32GB) 240-Pin DDR3 SDRAM ECC DDR3 1866 (PC3 14900) Server Memory Model CT2K32G3ELSDQ4186D
Standard Return Policy
Send this item as a gift
IN STOCK
$599.99
PREMIER
JOIN TODAY
Intel Xeon E5-2680 v2 Ivy Bridge-EP 2.8 GHz LGA 2011 115W BX80635E52680V2 Server Processor
Replacement Only Return Policy
Protect Your Investment
View Details
IN STOCK
$1,769.99
PREMIER
JOIN TODAY
Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz LGA 2011 115W BX80635E52670V2 Server Processor
Replacement Only Return Policy
Protect Your Investment
View Details
IN STOCK
$1,599.99
$1,559.99
Save: 2.50%
PREMIER
JOIN TODAY
Subtotal: $5,503.93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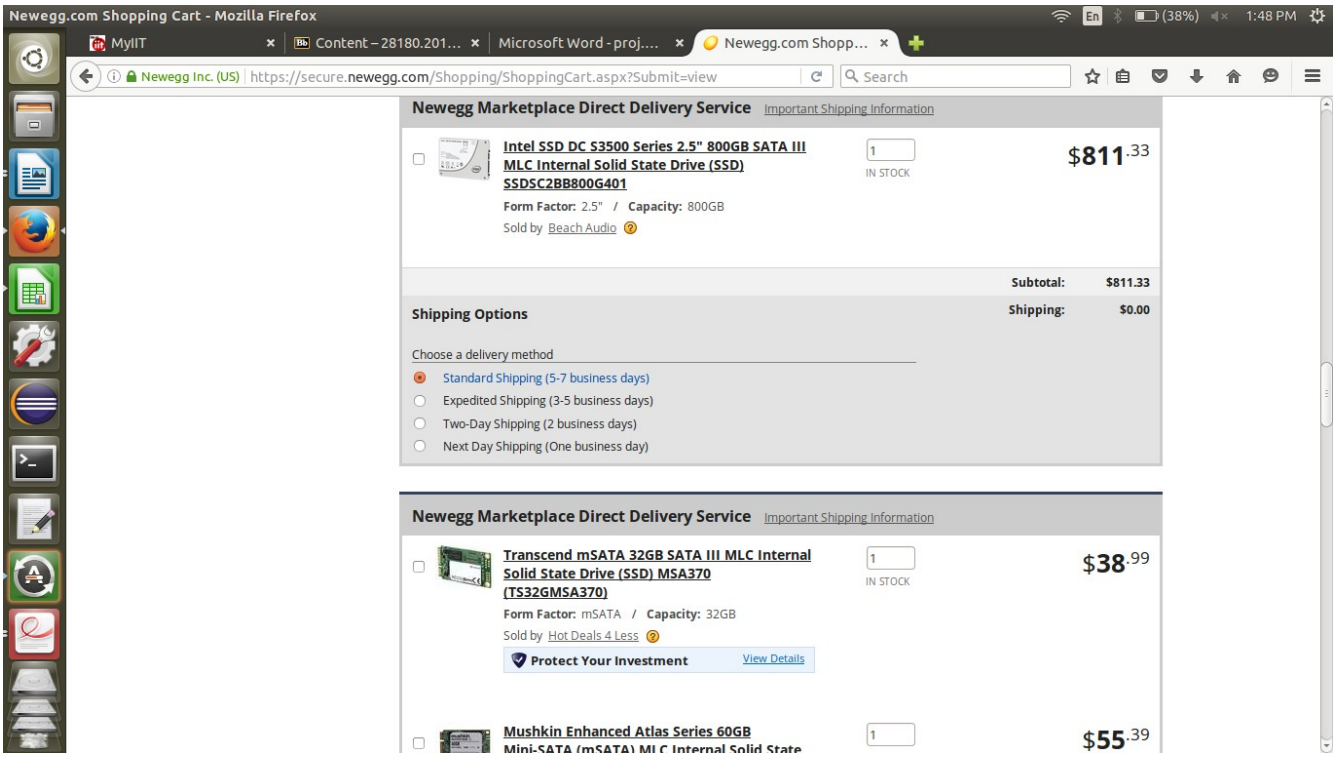
Important Shipping Information
Tripp Lite SR2400 42U 42U SmartRack Value Series Rack Enclosure Cabinet (includes doors and side panels)
Replacement Only Return Policy
IN STOCK
$1,052.99
$1,026.99
Save: 2.47%
Subtotal: $1,026.99
Shipping Options
Shipping: $0.00
Choose a delivery method
Large Item Delivery – Front Door (Adult Signature Required)
Large Item Delivery – White Glove (Adult Signature Required)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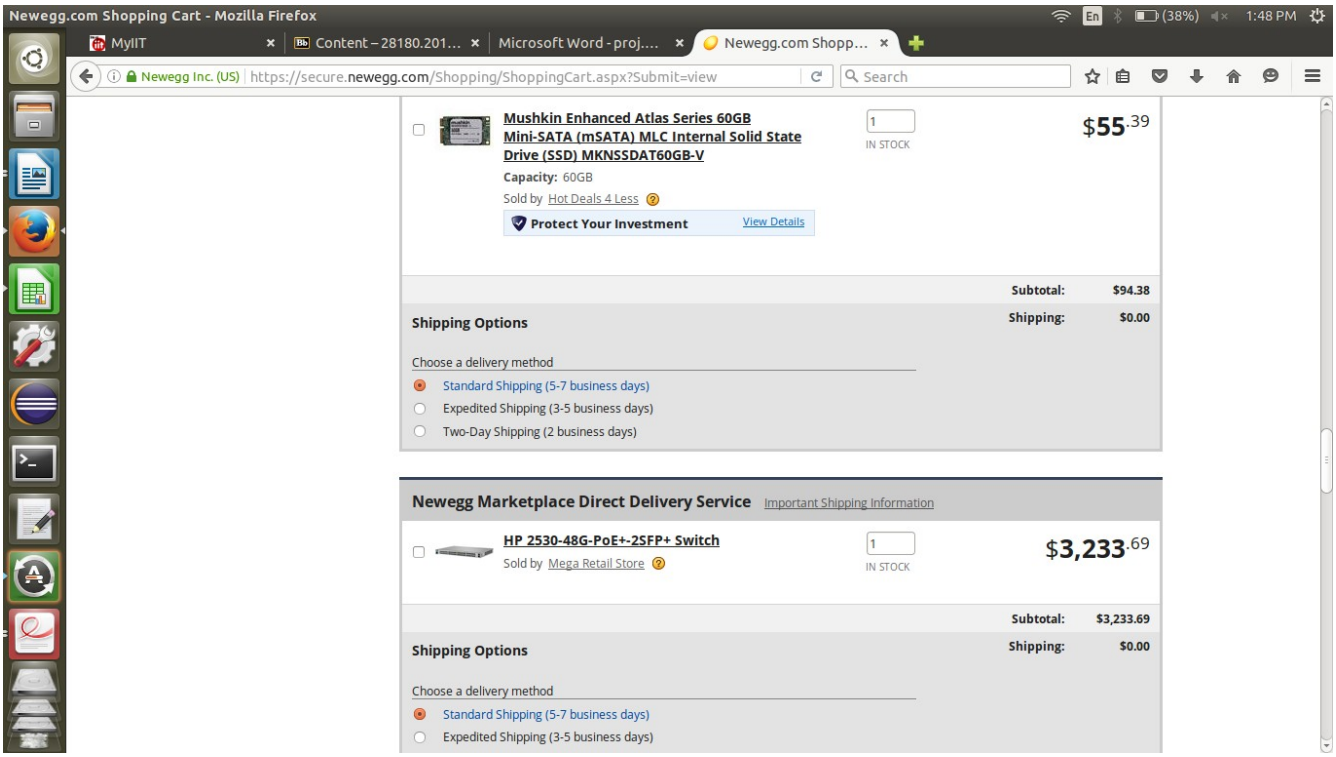
Important Shipping Information
Intel SSD DC S3500 Series 2.5" 800GB SATA III MLC Internal Solid State Drive (SSD) SSDSC2BB800G401
IN STOCK
$811.33
Form Factor: 2.5" / Capacity: 800GB
Sold by Beach Audio
Subtotal: $811.33
Shipping Options
Shipping: $0.00
Choose a delivery method
Standard Shipping (5-7 business days)
Expedited Shipping (3-5 business days)
Two-Day Shipping (2 business days)
Next Day Shipping (One business day)
Newegg Marketplace Direct Delivery Service
Important Shipping Information
Transcend mSATA 32GB SATA III MLC Internal Solid State Drive (SSD) MSA370 (TS32GMSA370)
IN STOCK
$38.99
Form Factor: mSATA / Capacity: 32GB
Sold by Hot Deals 4 Less
Protect Your Investment
View Details
Mushkin Enhanced Atlas Series 60GB
$55.39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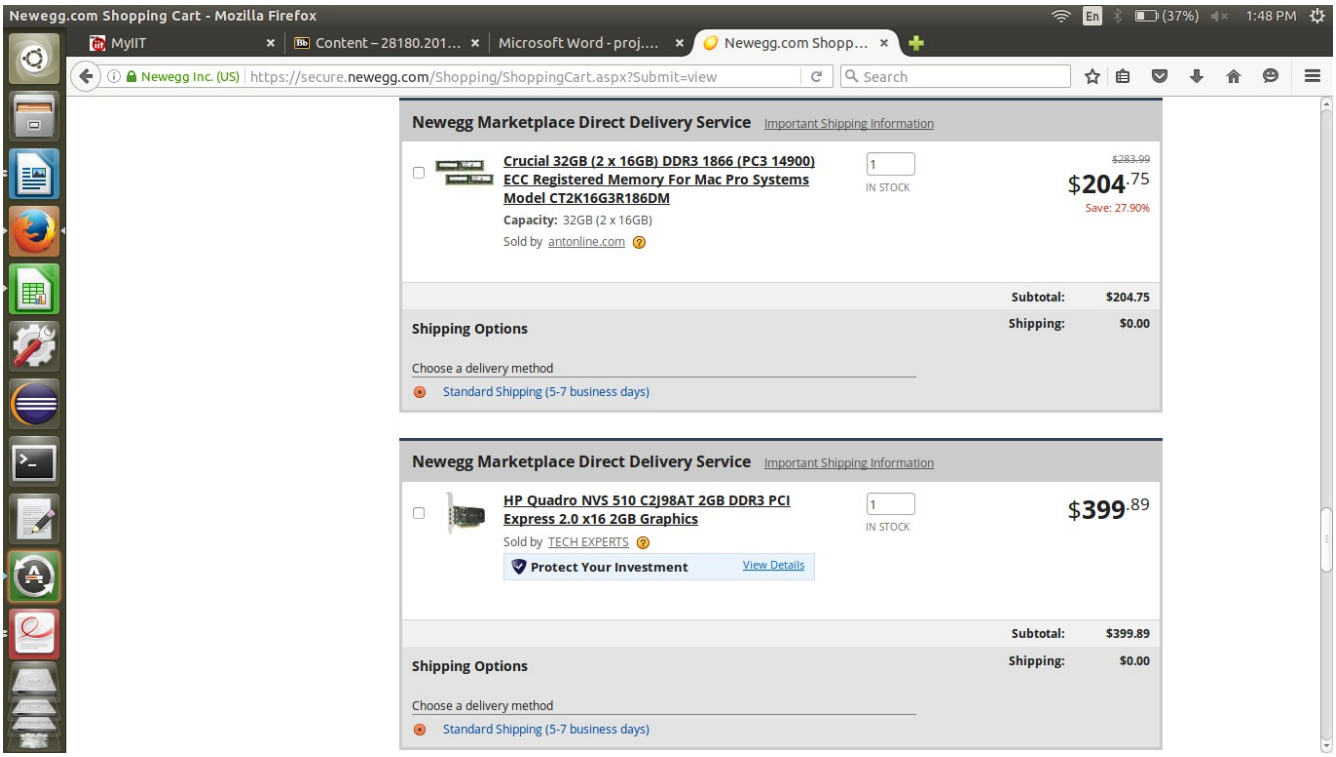
Search
Mushkin Enhanced Atlas Series 60GB Mini-SATA (mSATA) MLC Internal Solid State Drive (SSD) MKNSSDAT60GB-V
IN STOCK
$55.39
Capacity: 60GB
Sold by Hot Deals 4 Less
Protect Your Investment
View Details
Subtotal: $94.38
Shipping Options
Shipping: $0.00
Choose a delivery method
Standard Shipping (5-7 business days)
Expedited Shipping (3-5 business days)
Two-Day Shipping (2 business days)
Newegg Marketplace Direct Delivery Service
Important Shipping Information
HP 2530-48G-PoE+-2SFP+ Switch
Sold by Mega Retail Store
IN STOCK
$3,233.69
Subtotal: $3,233.69
Shipping Options
Shipping: $0.00
Choose a delivery method
Standard Shipping (5-7 business days)
Expedited Shipping (3-5 business days)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Important Shipping Information
Crucial 32GB (2 x 16GB) DDR3 1866 (PC3 14900) ECC Registered Memory For Mac Pro Systems Model CT2K16G3R186DM
Capacity: 32GB (2 x 16GB)
Sold by antonline.com
IN STOCK
$283.99
$204.75
Save: 27.90%
Subtotal: $204.75
Shipping Options
Shipping: $0.00
Choose a delivery method
Standard Shipping (5-7 business days)
Newegg Marketplace Direct Delivery Service
Important Shipping Information
HP Quadro NVS 510 C2J98AT 2GB DDR3 PCI Express 2.0 x16 2GB Graphics
Sold by TECH EXPERTS
Protect Your Investment
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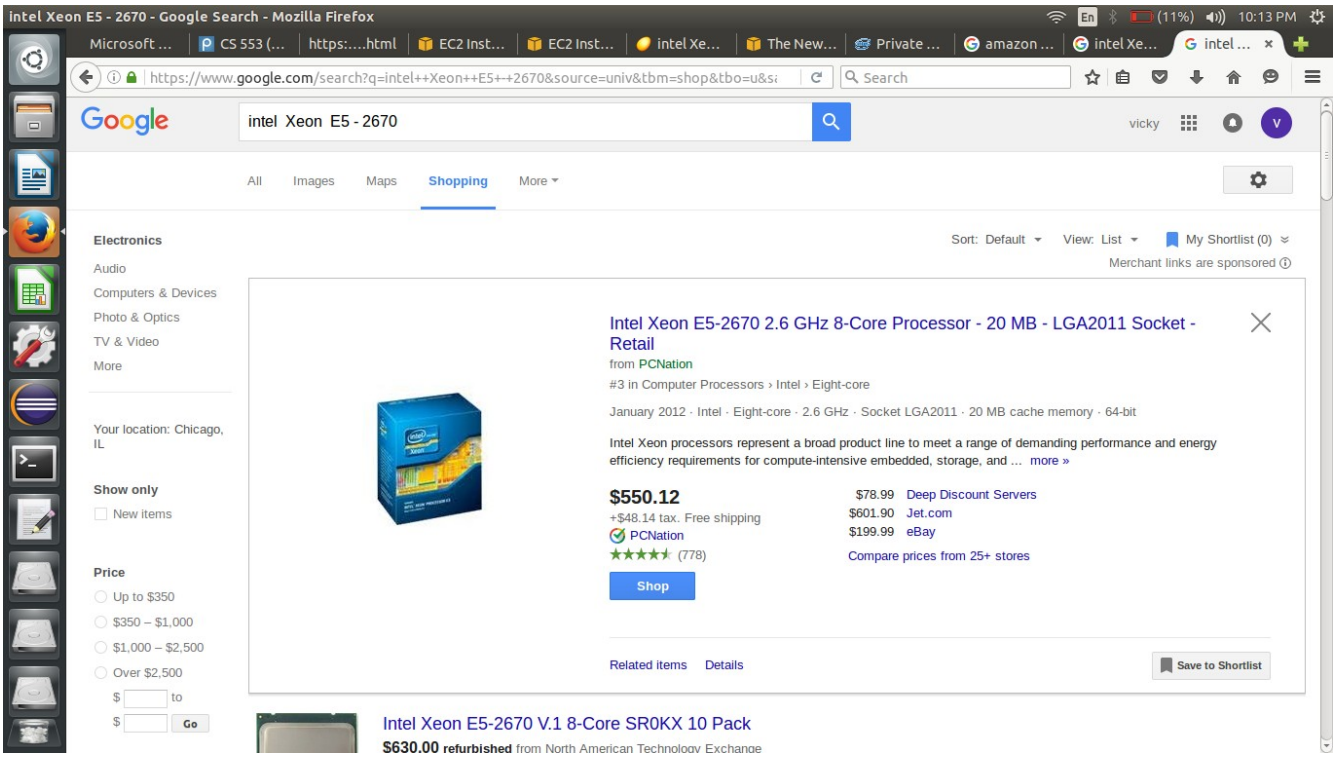
IN STOCK
$399.89
Subtotal: $399.89
Shipping Options
Shipping: $0.00
Choose a delivery method
Standard Shipping (5-7 business days)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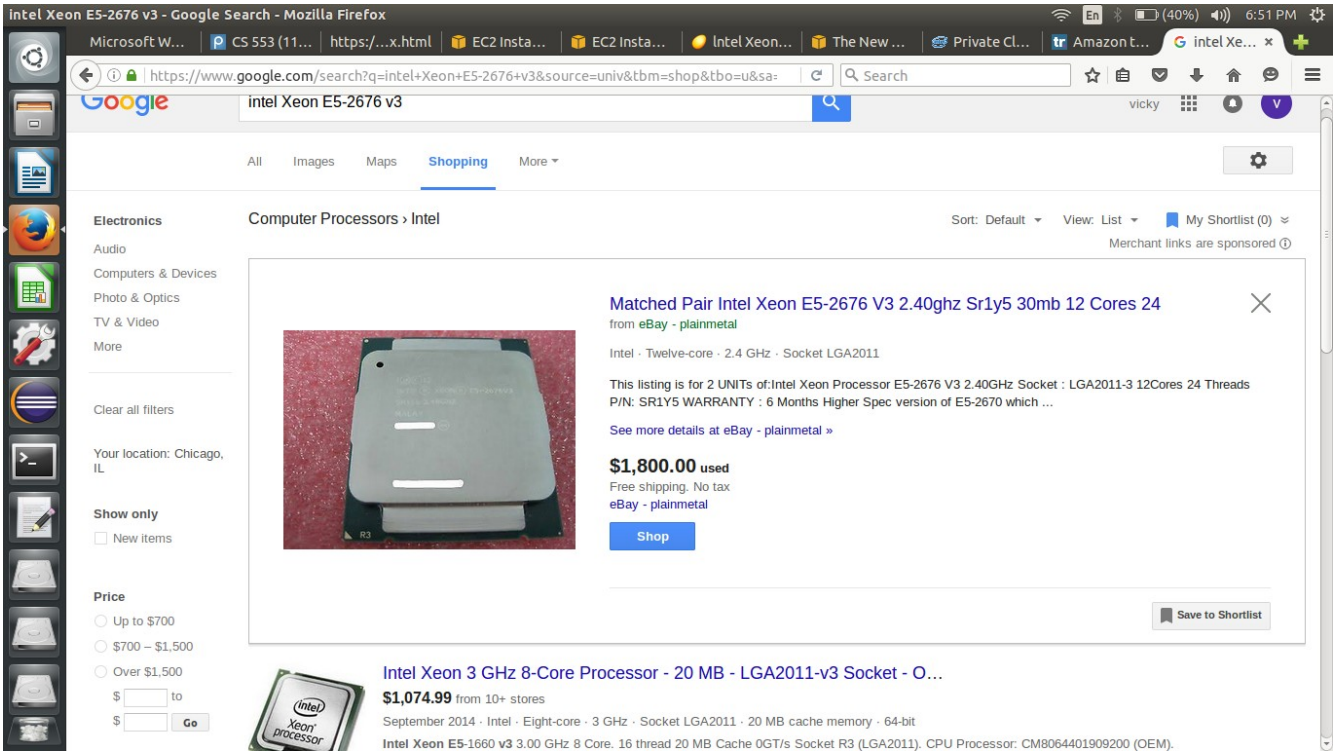
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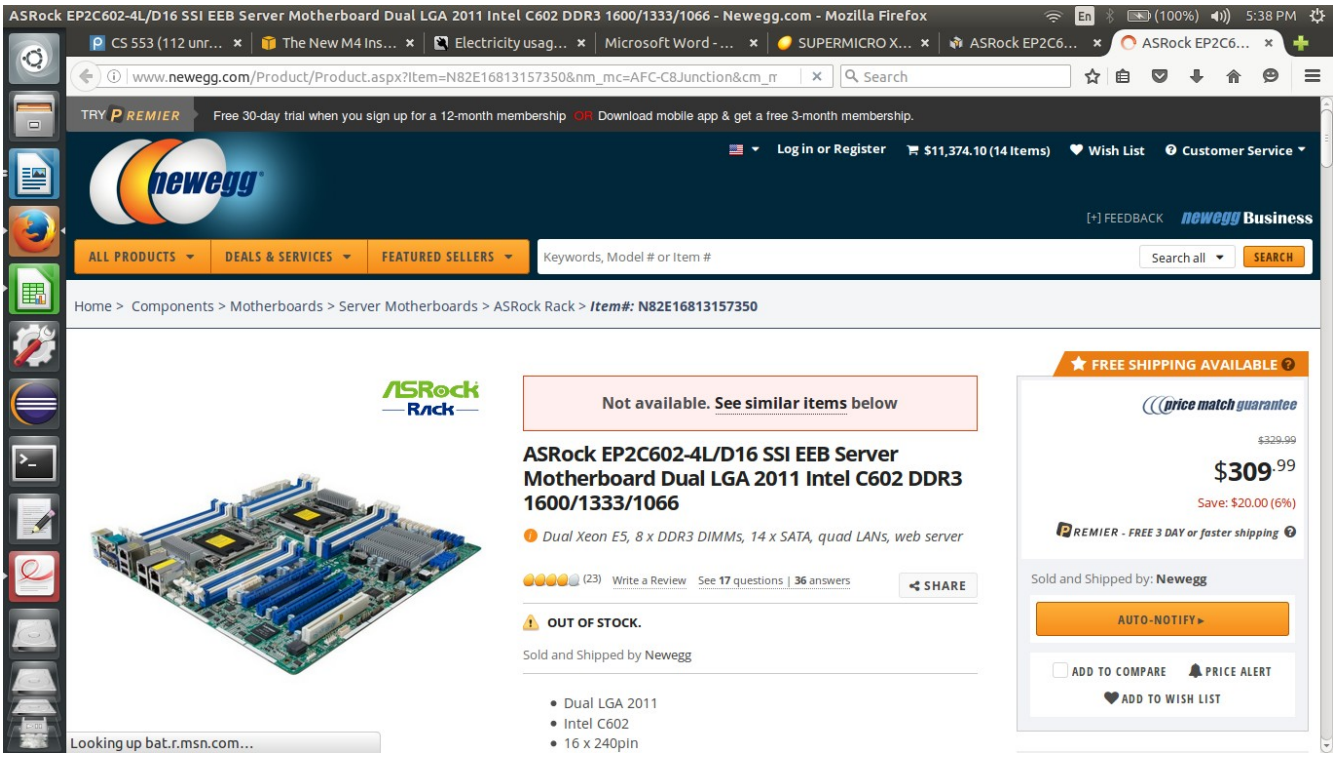
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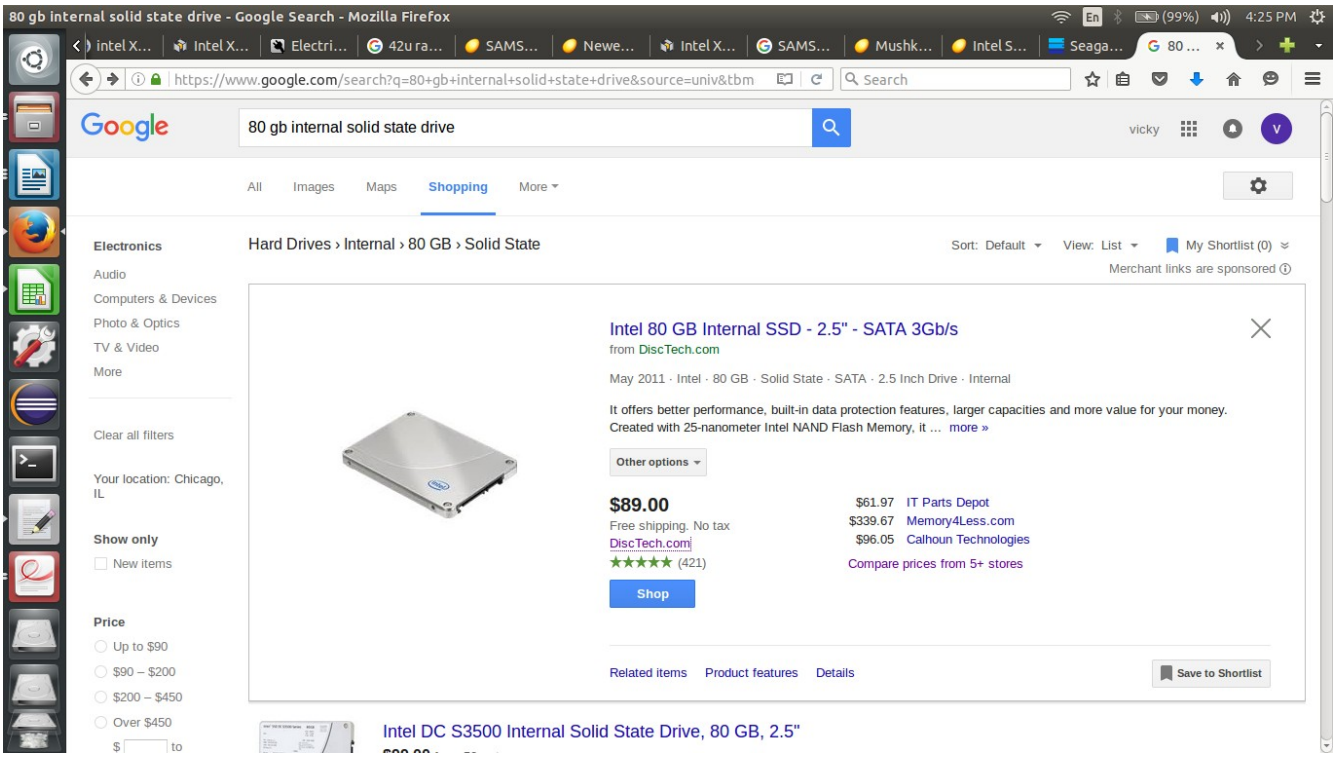
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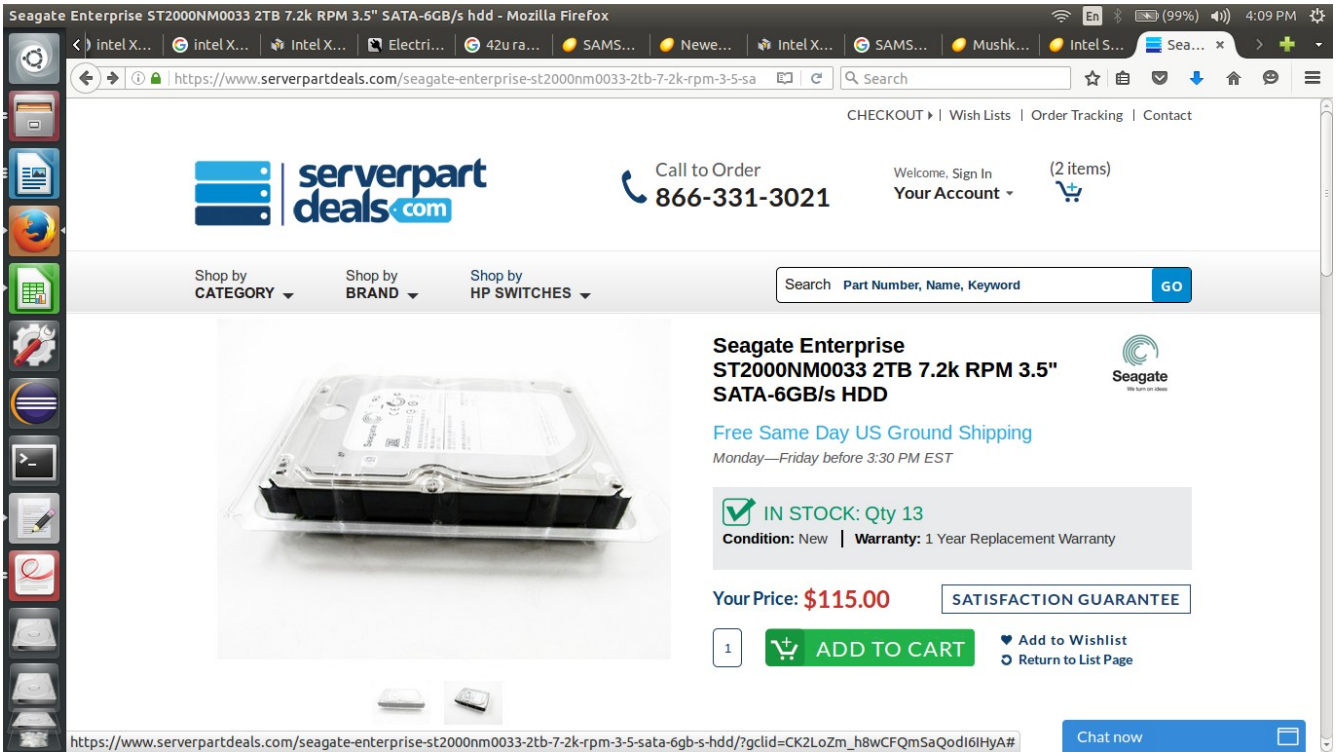
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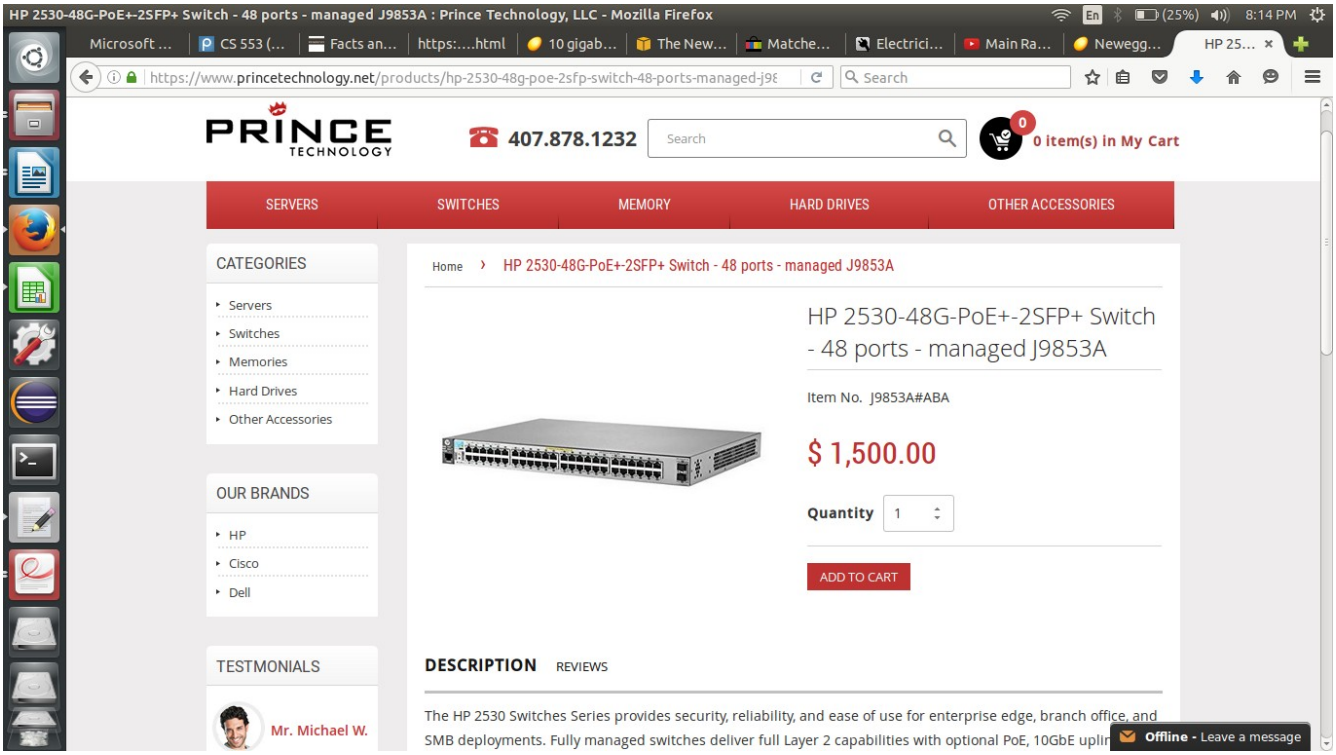
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