

CS553 Cloud Computing

Project report

By

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Introduction:-

In this project we need to build a private cloud and compare the cost with available public cloud. We have to make an analysis in between public and private cloud for the instances mentioned below.

m4.10xlarge, m3.large, m3.2xlarge, c3.8xlarge, g2.2xlarge, r3.4xlarge, i2.8xlarge, d2.8xlarge

To build a private cloud the following hardware components are considered processor, storage, memory, motherboard, Cooling System, network adapter, server chassis, network switch, rack, UPS, firewall. The private cloud is built for each instance by considering the compatibility components from the public cloud instances. For private cloud the following are the instances considered.

Private_m4.10xlarge, Private_m3.large, Private_m3.2xlarge, Private_c3.8xlarge, Private_g2.2xlarge, Private_r3.4xlarge, Private_i2.8xlarge, Private_d2.8xlarge

The cost calculation is done for 5 years to all the 8 instances mentioned above.

Private Cloud:-

1.Private m4.10xlarge:-

Type	Name	Amt(\$)
processor	2 Intel xenon E5 2676 v3(12 cores)	3600
Memory	Crucial 32GB (2 x 16GB) 288-Pin DDR4 SDRAM ECC DDR4 2133 (PC4 17000) Server Memory Model CT2K16G4RFD4213 + Crucial 128GB (4 x 32GB) 288-Pin DDR4 SDRAM ECC Registered DDR4 2133 (PC4 17000) Server Memory Model CT4K32G4RFD4213	1347.89
Storage	Seagate Constellation ES ST1000NM0011 1TB 7200 RPM 64MB Cache SATA 6.0Gb/s 3.5" Enterprise Hard Drive Bare Drive	74.79
mother board	ASUS ATX DDR4 3000 (O.C.) Motherboard X99-DELUXE	285.05
Cooling System	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel E10G41AT2 AT2 Server Adapter 10Gbps PCI Express 2.0 x8 1 x RJ45	329.99

Server chassis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99
Network Switch	ZyXEL GS1900 GS1900-48 Managed 48-port GbE Smart Managed Switch	342.99
Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99
Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		37466.83

Table: 1.1 Breakup of hardware components

GFLOPS = No.of cores*ipc*Processor Speed= 12*16*2.4*2
=921.6

GFLOPS	Instances	Hardware cost	System power cost	Cooling cost	Administrator	Total cost	cost/hr	cost/hr/gflops
1	1	37466.83	8407.1	2522.1	500000	548396	12.52046	0.0135
10	1	37466.83	8407.1	2522.1	500000	548396	12.52046	0.0135
100	1	37466.83	8407.1	2522.1	500000	548396	12.52046	0.0135
1000	2	74933.66	16814.2	5044.2	500000	596792.1	13.62539	0.0073
10000	11	412135.1	92478.1	27743.1	500000	1032356	23.56978	0.0023
100000	108	4046418	907966.8	272386.8	500000	5726771	130.7482	0.0013
1000000	1085	40651511	9121703.5	2736479	1000000	53509693	1221.682	0.0012

Table: 1.2 Breakup of cost/hr/gflop

2. Private m3.large:-

Type	Name	Amt(\$)
processor	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz LGA 2011 115W BX80635E52670V2 Server Processor	1559.99
storage	Transcend mSATA 32GB SATA III MLC Internal Solid State Drive (SSD) MSA370 (TS32GMSA370)	38.99
Memory	HyperX FURY 8GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Memory Model HX316C10FB/8	34.99
mother board	ASUS ROG RAMPAGE IV BLACK EDITION LGA 2011 Intel X79 SATA 6Gb/s USB 3.0 Extended ATX Intel Gaming Motherboard	374.99
Cooling cost	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel EXPI9301CTBLK 10/ 100/ 1000Mbps PCI-Express Network Adapter	27.99
Server chassis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99
Network Switch	NETGEAR ProSAFE 24-Port Gigabit Rackmount Web Managed (Plus) Switch (JGS524E) - Lifetime Warranty	168.86
Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99
Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		33691.93

Table: 2.1 Breakup of hardware components

GFLOPS=No.of cores*ipc*Processor Speed=10*8*2.5*1
=200

GFLOPS	Instances	Hardware cost	System power cost	Cooling cost	Administrator	Total cost	cost/hr	cost/hr/gflops
1	1	33691.93	8407.1	2522.1	500000	544621.13	12.43427	0.062
10	1	33691.93	8407.1	2522.1	500000	544621.13	12.43427	0.062
100	1	33691.93	8407.1	2522.1	500000	544621.13	12.43427	0.062
1000	5	168459.65	42035.5	12610.5	500000	723105.65	16.50926	0.0165
10000	50	1684596.5	420355	126105	500000	2731056.5	62.35289	0.0062
100000	500	16845965	4203550	1261050	500000	22810565	520.7892	0.0052
1000000	5000	168459650	42035500	12610500	2500000	225605650	5150.814	0.0051

Table: 2.2 Breakup of cost/hr/gflop

3. Private m3.2xlarge:-

Type	Name	Amt(\$)
processor	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz LGA 2011 115W BX80635E52670V2 Server Processor	1559.99
storage	Intel DC S3500 Series 2.5" 160GB SATA III MLC Internal Solid State Drive (SSD) SSDSC2BB160G401	159.99
Memory	G.SKILL Ripjaws X Series 32GB (4 x 8GB) 240-Pin DDR3 SDRAM DDR3 2133 (PC3 17000) Desktop Memory Model F3-2133C9Q-32GXH	164.99
mother board	ASUS ROG RAMPAGE IV BLACK EDITION LGA 2011 Intel X79 SATA 6Gb/s USB 3.0 Extended ATX Intel Gaming Motherboard	374.99
Cooling cost	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel EXPI9301CTBLK 10/ 100/ 1000Mbps PCI-Express Network Adapter	27.99
Server chassis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99

Network Switch	NETGEAR ProSAFE 24-Port Gigabit Rackmount Web Managed (Plus) Switch (JGS524E) - Lifetime Warranty	168.86
Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99
Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		33942.93

Table: 3.1 Breakup of hardware components

GFLOPS=No.of cores*ipc*Processor Speed=10*8*2.5*1
=200

GFLOP S	Instanc es	Hardware cost	System power cost	Cooling cost	Administrat or	Total cost	cost/hr	cost/hr/gflo ps
1	1	33942.93	8407.1	2522.1	500000	544872. 1	12.44	0.0622
10	1	33942.93	8407.1	2522.1	500000	544872. 1	12.44	0.0622
100	1	33942.93	8407.1	2522.1	500000	544872. 1	12.44	0.0622
1000	5	169714.65	42035.5	12610.5	500000	724360. 7	16.537 91	0.0165
10000	50	1697146.5	420355	126105	500000	274360 7	62.639 42	0.0062
10000 0	500	16971465	420355 0	126105 0	500000	229360 65	523.65 45	0.0052
10000 00	5000	16971465 0	420355 00	126105 00	2500000	2.27E+0 8	5179.4 67	0.0051

Table: 3.2 Breakup of cost/hr/gflop

4. Private c3.8xlarge:-

Type	Name	Amt(\$)
processor	2 Intel Xeon E5-2680 v2 Ivy Bridge-EP 2.8 GHz 25MB L3 Cache LGA 2011 115W BX80635E52680V2 Server Processor	3533.98
storage	SAMSUNG 840 EVO 2.5" 750GB SATA III TLC Internal Solid State Drive (SSD) MZ-7TE750BW	449.99
Memory	G.SKILL Ripjaws Z Series 64GB (8 x 8GB) 240-Pin DDR3 SDRAM DDR3 2133 (PC3 17000) Desktop Memory Model F3-17000CL11Q2-64GBZLD	364.99
mother board	ASRock EP2C602-2TS6/D16 SSI EEB Server Motherboard Dual LGA 2011 Intel C602 DDR3 1600/1333/1066	619.99
Cooling cost	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel E10G41AT2 AT2 Server Adapter 10Gbps PCI Express 2.0 x8 1 x RJ45	329.99
Server chasis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99
Network Switch	NETGEAR ProSAFE 24-Port Gigabit Rackmount Web Managed (Plus) Switch (JGS524E) - Lifetime Warranty	168.86
Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99
Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		36953.92

Table: 4.1 Breakup of hardware components

$$\begin{aligned}\text{GFLOPS} &= \text{No.of cores} * \text{ipc} * \text{Processor Speed} \\ &= 10 * 8 * 2.8 * 2 \\ &= 448\end{aligned}$$

GFLOPS	Instances	Hardware cost	System power cost	Cooling cost	Administrator	Total cost	cost/hr	cost/hr/gflops
1	1	36953.92	8407.1	2522.1	500000	547883.12	12.50875	0.027
10	1	36953.92	8407.1	2522.1	500000	547883.12	12.50875	0.027
100	1	36953.92	8407.1	2522.1	500000	547883.12	12.50875	0.027
1000	2	73907.84	16814.2	5044.2	500000	595766.24	13.60197	0.0151
10000	23	849940.16	193363.3	58008.3	500000	1601311.76	36.55963	0.0035
100000	224	8277678.08	1883190	564950.4	500000	11225818.88	256.2972	0.0025
1000000	2233	82518103.36	18773054	5631849	1500000	108423006.96	2475.411	0.0024

Table: 4.2 Breakup of cost/hr/gflop

5. Private g2.2xlarge:-

Type	Name	Amt(\$)
processor	HP SL230s Gen8 Intel Xeon E5-2670 Sandy Bridge-EP 2.6GHz (Turbo Boost up to 3.3GHz) 2MB L2 Cache 20MB L3 Cache LGA 2011 115W 654408-B21 Server Processor Kit	1349.95
storage	VisionTek GoDrive 2.5" 60GB SATA III MLC Internal Solid State Drive (SSD) 900510	58.99
Memory	G.SKILL Ripjaws X Series 16GB (2 x 8GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model F3-1600C9D-16GXM	67.99
mother board	ASUS ROG RAMPAGE IV BLACK EDITION LGA 2011 Intel X79 SATA 6Gb/s USB 3.0 Extended ATX Intel Gaming Motherboard	374.99
Cooling cost	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel EXPI9301CTBLK 10/ 100/ 1000Mbps PCI-Express Network Adapter	27.99
Server chasis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99
Network Switch	NETGEAR ProSAFE 24-Port Gigabit Rackmount Web Managed (Plus) Switch (JGS524E) - Lifetime Warranty	168.86
Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99

Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		33534.89

Table:5.1 Breakup of hardware components

GFLOPS=No.of cores*ipc*Processor Speed
=8*8*2.6*1
=166.4

GFLOPS	Instances	Hardware cost	System power cost	Cooling cost	Administrator	Total cost	cost/hr	cost/hr/gflops
1	1	33534.89	8937.2	2081.86	500000	544553.95	12.43274	0.074
10	1	33534.89	8937.2	2081.86	500000	544553.95	12.43274	0.074
100	1	33534.89	8937.2	2081.86	500000	544553.95	12.43274	0.074
1000	6	201209.34	53623.2	12491.16	500000	767323.7	17.51881	0.0175
10000	61	2045628.3	545169.2	126993.5	500000	3217790.95	73.46555	0.0072
100000	601	20154469	5371257	1251198	500000	27276923.95	622.7608	0.0062
1000000	6010	201544689	53712572	12511979	3000000	270769239.5	6181.946	0.0061

Table:5.2 Breakup of cost/hr/gflop

6. Private r3.4xlarge:-

Type	Name	Amt(\$)
processor	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz LGA 2011 115W BX80635E52670V2 Server Processor	1559.99
storage	HP 320 GB Internal Solid State Drive 600279-B21	913.45

Memory	CORSAIR Vengeance 64GB (8 x 8GB) 240-Pin DDR3 SDRAM DDR3 1866 (PC3 14900) Desktop Memory Model CMZ64GX3M8A1866C9(390.99) + Approved Memory 32GB (2 x 16GB) 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model AM160D3DR4RLPN/32G-A (356.99) + Kingston 2GB 240-Pin DDR3 SDRAM DDR3 1600 (PC3 12800) Desktop Memory Model KVR16N11S6/2 (11.99) + Kingston 24GB (3 x 8GB) 240-Pin DDR3 SDRAM DDR3 1333 Desktop Memory Model KVR13N9K3/24(125.55)	885.52
mother board	ASUS ROG RAMPAGE IV BLACK EDITION LGA 2011 Intel X79 SATA 6Gb/s USB 3.0 Extended ATX Intel Gaming Motherboard	374.99
Cooling cost	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel EXPI9301CTBLK 10/ 100/ 1000Mbps PCI-Express Network Adapter	27.99
Server chasis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99
Network Switch	NETGEAR ProSAFE 24-Port Gigabit Rackmount Web Managed (Plus) Switch (JGS524E) - Lifetime Warranty	168.86
Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99
Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		35416.88

Table:6.1 Breakup of hardware components

GFLOPS=No.of cores*ipc*Processor Speed
=8*8*2.5
=160

GFLOP S	Instanc es	Hardwar e cost	System power cost	Cooling cost	Administrat or	Total cost	cost/hr	cost/hr/gflo ps
1	1	35416.88	8937.2	2081.86	500000	546435.9	12.47571	0.077
10	1	35416.88	8937.2	2081.86	500000	546435.9	12.47571	0.077
100	1	35416.88	8937.2	2081.86	500000	546435.9	12.47571	0.077
1000	7	247918.16	62560.4	14573.02	500000	825051.6	18.83679	0.0168
10000	63	2231263.4	563043.6	131157.2	500000	3425464	78.20695	0.00758

100000	625	2213555 0	558575 0	130116 3	500000	295224 63	674.028 8	0.00674
100000 0	6250	2213555 00	558575 00	130116 25	3000000	2.93E+0 8	6694.62 6	0.00669

Table:6.2 Breakup of cost/hr/gflop

7. Private i2.8xlarge:-

Type	Name	Amt(\$)
processor	2 Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz LGA 2011 115W BX80635E52670V2 Server Processor	3117.98
storage	SAMSUNG 850 EVO 2.5" 2 TB SATA III 3-D Vertical Internal Solid State Drive (SSD) MZ-75E2T0B/AM + SAMSUNG 850 EVO 2.5" 2 TB SATA III 3-D Vertical Internal Solid State Drive (SSD) MZ-75E2T0B/AM + SAMSUNG 850 EVO 2.5" 2 TB SATA III 3-D Vertical Internal Solid State Drive (SSD) MZ-75E2T0B/AM + Intel 750 Series 2.5" 400GB PCI-Express 3.0 x4 MLC Internal Solid State Drive (SSD) SSDPE2MW400G4X1	2158.99
Memory	CORSAIR Vengeance 64GB (8 x 8GB) 240-Pin DDR3 SDRAM DDR3 1866 (PC3 14900) Desktop Memory Model CMZ64GX3M8A1866C9	390.99
mother board	ASRock EP2C602-2TS6/D16 SSI EEB Server Motherboard Dual LGA 2011 Intel C602 DDR3 1600/1333/1066	619.99
Cooling cost	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel E10G41AT2 AT2 Server Adapter 10Gbps PCI Express 2.0 x8 1 x RJ45	329.99
Server chasis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99
NetworkK Switch	NETGEAR ProSAFE 24-Port Gigabit Rackmount Web Managed (Plus) Switch (JGS524E) - Lifetime Warranty	168.86
Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99
Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		38272.92

Table:7.1 Breakup of hardware components

$$\begin{aligned}\text{GFLOPS} &= \text{No. of cores} * \text{ipc} * \text{Processor Speed} \\ &= 10 * 8 * 2.5 * 2 \\ &= 400\end{aligned}$$

GFLOPS	Instances	Hardware cost	System power cost	Cooling cost	Administrator	Total cost	cost/hr	cost/hr/gflops
1	1	38272.92	8407.1	2522.1	500000	549202.1	12.53886	0.0313
10	1	38272.92	8407.1	2522.1	500000	549202.1	12.53886	0.0313
100	1	38272.92	8407.1	2522.1	500000	549202.1	12.53886	0.0313
1000	3	114818.8	25221.3	7566.3	500000	647606.4	14.78553	0.0123
10000	25	956823	210177.5	63052.5	500000	1730053	39.49893	0.00394
100000	250	9568230	2101775	630525	500000	12800530	292.2495	0.00292
1000000	2500	95682300	21017750	6305250	1500000	1.25E+08	2842.587	0.00284

Table:7.2 Breakup of cost/hr/gflop

8. Private d2.8xlarge:-

Type	Name	Amt(\$)
processor	2 Intel xenon E5 2676 v3(12 cores)	3600
storage	LaCie 48TB 8big Thunderbolt 2 Rack Series RAID	4599
Memory	CORSAIR Vengeance 64GB (8 x 8GB) 240-Pin DDR3 SDRAM DDR3 1866 (PC3 14900) Desktop Memory Model CMZ64GX3M8A1866C9	390.99
mother board	ASRock EP2C602-2TS6/D16 SSI EEB Server Motherboard Dual LGA 2011 Intel C602 DDR3 1600/1333/1066	619.99
Cooling cost	Cooler Master Sleeve Bearing 120mm Silent Fan for Computer Cases, CPU Coolers, and Radiators (Value 4-Pack)	11.99
network adapter	Intel E10G41AT2 AT2 Server Adapter 10Gbps PCI Express 2.0 x8 1 x RJ45	329.99
Server chasis	iStarUSA 3U Stylish Zinc-Coated Steel Rackmount Server Chassis Front-mounted ATX Power Supply (D-300-PFS)	99.99
NetworkK Switch	NETGEAR ProSAFE 24-Port Gigabit Rackmount Web Managed (Plus) Switch (JGS524E) - Lifetime Warranty	168.86

Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	329.99
UPS	OPTI-UPS ES1500C-RM 1400 VA 980 Watts 8 Outlets Line Interactive Rackmount UPS w/ AVR	234.99
Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809.16
Total		41194.92

Table:8.1 Breakup of hardware components

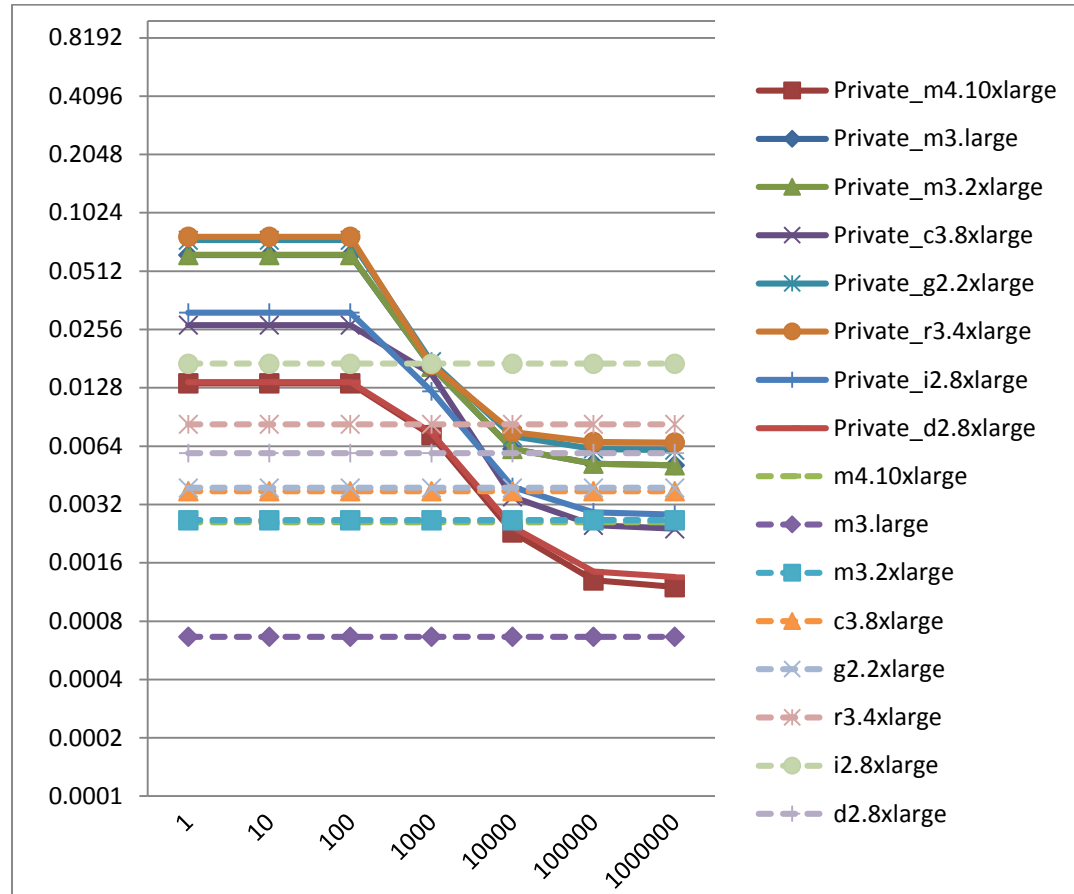
GFLOPS=No.of cores*ipc*Processor Speed
=12*16*2.4*2
=921.6

GFLOPS	Instances	Hardware cost	System power cost	Cooling cost	Administrator	Total cost	cost/hr	cost/hr/gflops
1	1	41194.92	9567.8	2845.4	500000	553608.1	12.63945	0.0137
10	1	41194.92	9567.8	2845.4	500000	553608.1	12.63945	0.0137
100	1	41194.92	9567.8	2845.4	500000	553608.1	12.63945	0.0137
1000	2	82389.84	19135.6	5690.8	500000	607216.2	13.86338	0.00752
10000	11	453144.1	105245.8	31299.4	500000	1089689	24.87875	0.00245
100000	108	4449051	1033322	307303.2	500000	6289677	143.5999	0.00144
1000000	1085	44696488	10381063	3087259	1000000	59164810	1350.795	0.00135

Table:8.2 Breakup of cost/hr/gflop

COMPARING THE COSTS OF PUBLIC CLOUD AND PRIVATE CLOUD SCALING FROM 1 GFLOPS TO 1PFLOPS

Cost calculation from 1GFLOPS to 1PFLOPS



X axis is Performance is GFLOPS

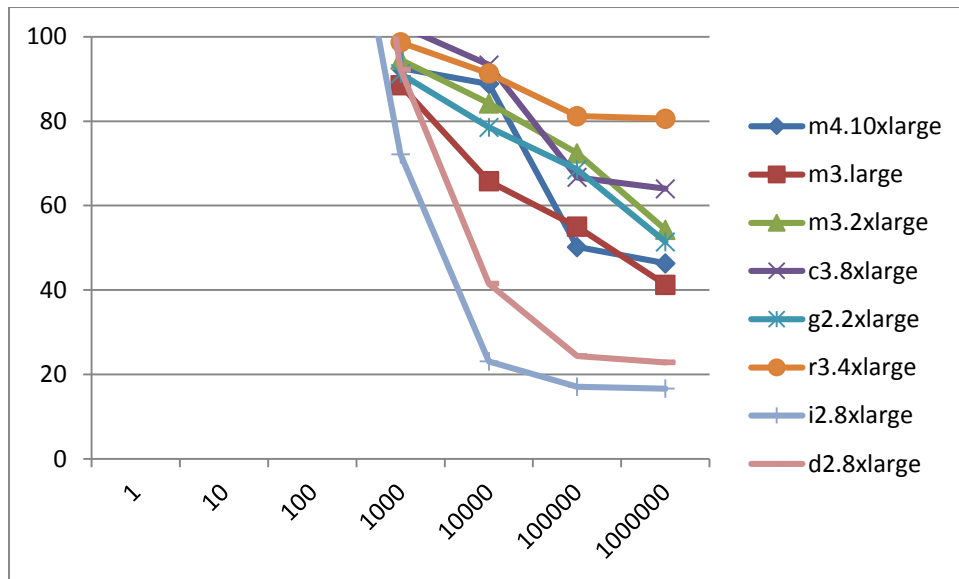
Y-axis is cost/hr/gflops in \$

The above graph shows 16 different lines in which both private and public are included. For public we could notice that the graph is a straight line which means the rate will be constant for any instances. Lines for the public cloud are denoted by dotted lines.

For private cloud we could see the curved lines in which the cost initially is high and decreases if GFLOPS increases. This is because we are building a private cloud in which many factors has to be calculated as mentioned in the above tables.

From the above graph we can notice that private cloud instances are costlier than the public cloud, but as GFLOPS increases the private cloud cost decreases and more affordable than public cloud for some instances.

Performance Utilization graph:-



X axis is Performance is GFLOPS

Y-axis is percentage utilization

The above graph is the utilization of private cloud over public cloud. From the graph we could notice that the percentage utilization decreases as we scale from 1GFLOPS to 1PFLOPS.

From the above two graphs, it is better to use public cloud instance if it is for small scale computing and for large scale computing it's better to choose private cloud.