

PROJECT

Understanding the Cost of Computing in the Cloud

By

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1. Introduction:

This report is to understand the computing cost of public cloud vs private cloud. For public cloud EC2 instances of AWS are used. As per these instances, I tried to create the private cloud which has the configuration as same as EC2 instance. Computing capacity of each instance is measured in GFLOPS. Each VCPU of the instance is a hyper thread of the Intel Xeon Processor. Eight EC2 instances: m4.10xlarge, m3.large, m3.2xlarge, c3.8xlarge, g2.2xlarge, r3.4xlarge, i2.8xlarge, d2.8xlarge are compared with the private cloud instances m4.10xlarge.private, m3.large.private, m3.2xlarge.private, c3.8xlarge.private, g2.2xlarge.private, r3.4xlarge.private, i2.8xlarge.private, d2.8xlarge.private. To build the private from scratch, I consider following factors Chassis, Processor, Storage, Memory, Mother board, Network Switch, Network Adapter, Rack, System Admin, Cooling Power, System power, UPS and Firewall. Following table of Private instances with their cost of the instance is the amortized cost for 5 years.

2. Private Cloud Instances:

Instance : m4.10xlarge.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	2 * INTEL XEON E5-2676 V3 2.40GHz SR1Y5 30Mb 12 Cores	1500
3	Storage	Axiom AXHD5007235A36E 500GB 7200 RPM 64MB Cache SATA 6.0Gb/s 3.5" Internal Hard Drive	116
4	Memory	5 * 32GB (4Rx4) DDR4 2400 (PC4 19200) ECC Registered Memory 288-pin	1207.5
5	Mother Board	ASUS Z10PC-D8/SAS (ASMB8-iKVM) CEB Server Motherboard 2 x Socket R3 LGA 2011-3 Intel C612	450
6	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
7	Network Adapter	Intel X540T2 Ethernet Converged Network Adapter 100Mbps/1Gbps/10Gbps PCI Express 2.1 x8 2 x RJ45	445
8	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
9	System Admin	80,000*5	400000
10	Cooling Power	373.512	1308.394
11	System Power	1867.56	6541.968
12	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
13	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			444108.9

GFLOPS	Instance	cost/instance/hours
1	1	10.13947173
10	1	10.13947173
100	1	10.13947173
1000	2	5.069735863
10000	14	0.743114356
100000	131	0.104271334
1000000	1303	0.034897442

1. No. of Instance with Cost/instance/hours

The above instance is used for general purpose computing with high configuration in this type of instance. Following information gives idea about the instance and its configurations:

- This instance requires 40 vCPU. The processor chip for this instance has 12 cores only. So I take 2 chips per instance which provides 20 cores for creating 40 vCPU.
- All the components are considered to fit a single instance.
- The GFLOPS of this private instance is $20 \times 16 \times 2.4 = 768$ GFLOPS.
- The total amortized cost (5 yrs) = \$444,108.9
- The cost for a single instance single GFLOPS = \$10.17 per hour.

Instance : m3.large.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz	1560
3	Storage	Intel DC S3710 2.5" 400GB SATA III MLC Internal SSD	569
4	Memory	5*Kingston 16GB 240-Pin DDR3 SDRAM ECC Registered DDR3 1600 (PC3 12800) Server Memory Model KVR16LR11D4/16	500
5	Mother Board	SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	365
6	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
7	Network Adapter	Intel Ethernet Server Adapter I350-T2	130
8	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post ServerRack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
9	System Admin	80,000*5	400000
10	Cooling Power	279.64	979.85856
11	System Power	1398.2	4899.2928
12	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
13	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			441543.1514

GFLOPS	Instance	cost/instance/hours
1	1	10.08089387
10	1	10.08089387
100	5	2.016178773
1000	50	0.218563359
10000	500	0.041028565
100000	5000	0.023297784
1000000	50000	0.021525188

2. No. of Instance with Cost/instance/hours

The above instance is used for small and mid-size application computing. Following information gives idea about the instance and its configurations:

- This instance requires 2 vCPU. The processor chip for this instance has 10 cores which can be shared to create 10 instances.
- All the components are considered to fit a single instance.
- The GFLOPS of this private instance is $10 \times 8 \times 2.5 = 200$ GFLOPS. So, $200/10 = 20$ GFLOPS/instance.
- The total amortized cost (5 yrs) = \$441,543.1514
- The cost for a single instance single GFLOPS=\$10.08 per hour.

Instance : m3.2xlarge.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz	1560
3	Storage	Intel DC S3710 2.5" 400GB SATA III MLC Internal SSD	569
4	Memory	4*Kingston 16GB 240-Pin DDR3 SDRAM ECC Registered DDR3 1600 (PC3 12800) Server Memory Model KVR16LR11D4/16	400
5	Mother Board	SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	365
6	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
7	Network Adapter	Intel Ethernet Server Adapter I350-T2	130
8	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
9	System Admin	80,000*5	400000
10	Cooling Power	259.718	910.0519
11	System Power	1298.59	4550.259
12	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
13	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			441024.3

GFLOPS	Instance	cost/instance/hours
1	1	10.0690482
10	1	10.0690482
100	2	5.034524101
1000	13	0.866837335
10000	125	0.180397189
100000	1250	0.108608411
1000000	12500	0.101505536

3. No. of Instance with Cost/instance/hours

The above instance is used for small and mid-size application computing with more computing power. Following information gives idea about the instance and its configurations:

- This instance requires 8 vCPU. The processor chip for this instance has 10 cores which can be shared to create 2 instances.
- The components like memory, storage, chassis are considered to fit 2 instances.
- The GFLOPS of this private instance is $8 \times 8 \times 2.5 = 160$ GFLOPS. So, $160/2 = 80$ GFLOPS/instance.
- The total amortized cost (5 yrs) = \$441,024.3

The cost for a single instance single GFLOPS=\$10.069 per hour.

Instance : c3.8xlarge.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	2 * Intel Xeon E5-2680 v2 Ivy Bridge-EP 2.8 GHz 25MB L3 Cache LGA 2011 115W BX80635E52680V2 Server Processor	3540
3	Storage	2*Intel DC S3710 2.5" 400GB SATA III MLC Internal SSD	1138
4	Memory	4*Kingston 16GB 240-Pin DDR3 SDRAM ECC Registered DDR3 1600 (PC3 12800) Server Memory Model KVR16LR11D4/16	400
5	Mother Board	SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	365
6	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
7	Network Adapter	Intel X540T2 Ethernet Converged Network Adapter 100Mbps/1Gbps/10Gbps PCI Express 2.1 x8 2 x RJ45	445
8	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
9	System Admin	80k*5	400000
10	Cooling Power	320.49	1123
11	System Power	1602.45	5614.98
12	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
13	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			445,166

GFLOPS	Instance	cost/instance/hours
1	1	10.16360689
10	1	10.16360689
100	1	10.16360689
1000	3	3.584223328
10000	28	0.647950497
100000	280	0.331164049
1000000	2791	0.29952607

4. No. of Instance with Cost/instance/hours

The above instance is used for high speed computing to compute science and engineering applications. Following information gives idea about the instance and its configurations:

- This instance requires 32 vCPU. The processor chip for this instance has 10 cores only. So I take 2 chips per instance which provides 16 cores for creating 32 vCPU.
- All the components are considered to fit single instances.
- The GFLOPS of this private instance is $16 \times 8 \times 2.8 = 358.4$ GFLOPS.
- The total amortized cost (5 yrs) = \$445,166

The cost for a single instance single GFLOPS=\$10.16 per hour.

Instance : g2.2xlarge.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz	1560
3	GPU	NVIDIA® Quadro® K5000 for Mac VCQK5000MAC-PB 4GB 256-bit GDDR5 PCI Express 2.0 x16 SLI Supported Workstation Video Card	1836.78
4	Storage	ADATA Premier SP550 2.5" 120GB SATA III TLC Internal Solid State Drive (SSD) ASP550SS3-120GM-C	39
5	Memory	2*Kingston 16GB 240-Pin DDR3 SDRAM ECC Registered DDR3 1600 (PC3 12800) Server Memory Model KVR16LR11D4/16	200
6	Mother Board	SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	364
7	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
8	Network Adapter	Intel Ethernet Server Adapter I350-T2	130
9	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
10	System Admin	80k*5	400,000
11	Cooling Power	377.62	1323.18
12	System Power	1888.1	6615.902
13	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
14	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			444,608.86

GFLOPS	Instance	cost/instance/hours
1	1	10.15088728
10	1	10.15088728
100	1	10.15088728
1000	1	10.15088728
10000	5	2.126127985
100000	46	0.336549765
1000000	459	0.144218455

5. No. of Instance with Cost/instance/hours

The above instance is used for general purpose graphical applications. Following information gives idea about the instance and its configurations:

- This instance requires 8 vCPU. The processor chip for this instance has 10 cores which can be shared to create 2 instances with 8 vCPU per instance.
- The components like memory, storage, chassis are considered to fit 2 instances.
- The GFLOPS of this private instance is $8*8*2.6=166.4$ GFLOPS..
- The total amortized cost (5 yrs) = \$444,608.86

The cost for a single instance single GFLOPS=\$10.16 per hour.

Instance : r3.4xlarge.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz	1560
3	Storage	Intel DC S3710 2.5" 400GB SATA III MLC Internal SSD	569
4	Memory	8*Kingston 16GB 240-Pin DDR3 SDRAM ECC Registered DDR3 1600 (PC3 12800) Server Memory Model KVR16LR11D4/16	800
5	Mother Board	SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	365
6	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
7	Network Adapter	Intel Ethernet Server Adapter I350-T2	130
8	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
9	System Admin	80k*5	400,000
10	Cooling Power	277.3	971.6592
11	System Power	1386.5	4858.296
12	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
13	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			441,794

GFLOPS	Instance	cost/instance/hours
1	1	10.08661998
10	1	10.08661998
100	1	10.08661998
1000	7	1.627412545
10000	63	0.37550271
100000	625	0.234788603
1000000	6250	0.220582853

6. No. of Instance with Cost/instance/hours

The above instance is used for general purpose memory intensive applications. Following information gives idea about the instance and its configurations:

- This instance requires 16 vCPU. The processor chip for this instance has 10 cores which can be shared to create 1 instance.
- All the components are considered to fit single instances.
- The GFLOPS of this private instance is $8*8*2.5=160$ GFLOPS..
- The total amortized cost (5 yrs) = \$441,794

The cost for a single instance single GFLOPS=\$10.086 per hour.

Instance : i2.8xlarge.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	2 * Intel Xeon E5-2670 v2 Ivy Bridge-EP 2.5 GHz	3120
3	Storage	4*SAMSUNG 850 EVO 2.5" 2 TB SATA III 3-D Vertical Internal Solid State Drive (SSD) MZ-75E2T0B/AM	2410.92
4	Memory	8 * 32GB (4Rx4) DDR4 2400 (PC4 19200) ECC Registered Memory 288-pin	1932
5	Mother Board	SUPERMICRO MBD-X9DRD-IF-O Extended ATX Server Motherboard Dual LGA 2011 DDR3 1600	365
6	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
7	Network Adapter	Intel X540T2 Ethernet Converged Network Adapter 100Mbps/1Gbps/10Gbps PCI Express 2.1 x8 2 x RJ45	445
8	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
9	System Admin	80k*5	400,000
10	Cooling Power	364.068	1275.694
11	System Power	1820.34	6378.471
12	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
13	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			448,467.1

GFLOPS	Instance	cost/instance/hours
1	1	10.23897456
10	1	10.23897456
100	1	10.23897456
1000	4	2.83560127
10000	32	0.679140796
100000	313	0.402880929
1000000	3125	0.374517484

7. No. of Instance with Cost/instance/hours

The above instance is used get optimized storage with high GFLOPS for random IO operations. Following information gives idea about the instance and its configurations:

- This instance requires 32 vCPU. The processor chip for this instance has 10 cores only. So I take 2 chips per instance which provides 16 cores for creating 32 vCPU.
- All the components are considered to fit single instances.
- The GFLOPS of this private instance is $16*8*2.5=320$ GFLOPS.
- The total amortized cost (5 yrs) = \$448,467.1

The cost for a single instance single GFLOPS=\$10.238 per hour.

Instance : d2.8xlarge.private

Sr. No	Device	Details	Cost(5 yrs)
1	Chassis	SUPERMICRO SuperChassis CSE-825MTQ-R700LPB Black 2U Rackmount Server Case 700W Redundant	549
2	Processor	2 * INTEL XEON E5-2676 V3 2.40GHz SR1Y5 30Mb 12 Cores	1500
3	Storage	6*Seagate Enterprise ST8000NM0055 8TB 3.5" Internal Hard Drive	2202
4	Memory	8 * 32GB (4Rx4) DDR4 2400 (PC4 19200) ECC Registered Memory 288-pin	1932
5	Mother Board	ASUS Z10PC-D8/SAS (ASMB8-iKVM) CEB Server Motherboard 2 x Socket R3 LGA 2011-3 Intel C612	450
6	Network Switch	Cisco SG200-26FP 26-port Gigabit Full-PoE Smart Switch	462
7	Network Adapter	Intel X540T2 Ethernet Converged Network Adapter 100Mbps/1Gbps/10Gbps PCI Express 2.1 x8 2 x RJ45	445
8	Rack	StarTech.com 42U Adjustable Depth Open Frame 4 Post Server Rack Cabinet - Flat Pack w/ Casters, Levelers and Cable Management Hooks	230
9	System Admin	80k*5	400,000
10	Cooling Power	368.178	1290.096
11	System Power	1840.89	6450.479
12	UPS	APC Smart-UPS SMC1500-2U 1440 VA 900 Watts 6 Outlets UPS	490
13	Firewall	Meraki MX400 Security Appliance Bundle, 1 Gbps FW Throughput, 8xGbE & 2xGbE Ports w/ 5 Years Enterprise License	30809
Total			446,809.6

GFLOPS	Instance	cost/instance/hours
1	1	10.20113183
10	1	10.20113183
100	1	10.20113183
1000	2	5.2634606
10000	15	0.990740661
100000	145	0.401517284
1000000	1447	0.340328928

8. No. of Instance with Cost/instance/hours

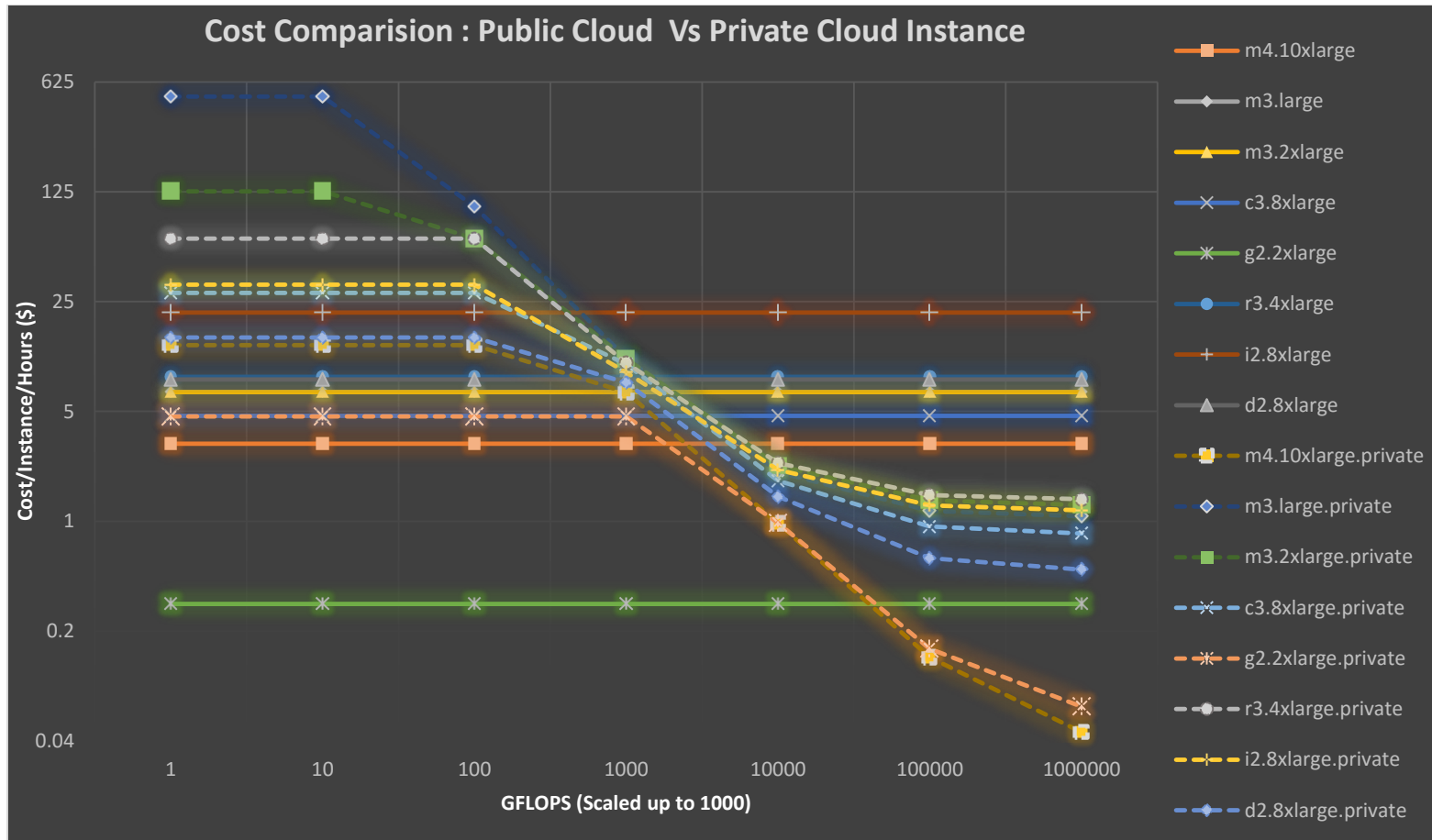
The above instance provides high local storage with high disk throughput performance for high storage applications. Following information gives idea about the instance and its configurations:

- This instance requires 36 vCPU. The processor chip for this instance has 12 cores only. So I take 2 chips per instance which provides 18 cores for creating 36 vCPU.
- All the components are considered to fit single instances.
- The GFLOPS of this private instance is $18 \times 16 \times 2.4 = 691.2$ GFLOPS.
- The total amortized cost (5 yrs) = \$446,809.6

The cost for a single instance single GFLOPS=\$10.201 per hour.

3. Cost Comparison: Public Cloud Vs Private Cloud Instances (Plot 1):

Instance Type	1 GFLOPS	10 GFLOPS	100 GFLOPS	1 TFLOPS	10 TFLOPS	100 TFLOPS	1 PFLOPS
m4.10xlarge	3.1171875	3.1171875	3.1171875	3.1171875	3.1171875	3.1171875	3.1171875
m3.large	6.65	6.65	6.65	6.65	6.65	6.65	6.65
m3.2xlarge	6.65	6.65	6.65	6.65	6.65	6.65	6.65
c3.8xlarge	4.6875	4.6875	4.6875	4.6875	4.6875	4.6875	4.6875
g2.2xlarge	0.2977281	0.29772811	0.297728106	0.2977281	0.29772811	0.29772811	0.2977281
r3.4xlarge	8.3125	8.3125	8.3125	8.3125	8.3125	8.3125	8.3125
i2.8xlarge	21.3125	21.3125	21.3125	21.3125	21.3125	21.3125	21.3125
d2.8xlarge	7.9861111	7.98611111	7.986111111	7.9861111	7.98611111	7.98611111	7.9861111
m4.10xlarge.private	13.2024371	13.20243714	13.20243714	6.60121857	0.96759682	0.135769967	0.0454394
m3.large.private	504.044693	504.0446933	100.8089387	10.928168	2.05142824	1.164889196	1.0762594
m3.2xlarge.private	125.863103	125.8631025	62.93155126	10.8354667	2.25496486	1.357605142	1.2688192
c3.8xlarge.private	28.3582782	28.35827815	28.35827815	10.0006231	1.80789759	0.924006832	0.8357312
g2.2xlarge.private	4.64954529	4.649545291	4.649545291	4.64954529	0.97385855	0.154154344	0.0660583
r3.4xlarge.private	63.0413749	63.04137489	63.04137489	10.1713284	2.34689194	1.467428767	1.3786428
i2.8xlarge.private	31.9967955	31.99679549	31.99679549	8.86125397	2.12231499	1.259002902	1.1703671
d2.8xlarge.private	14.7585819	14.75858193	14.75858193	7.61496036	1.43336322	0.580898848	0.492374

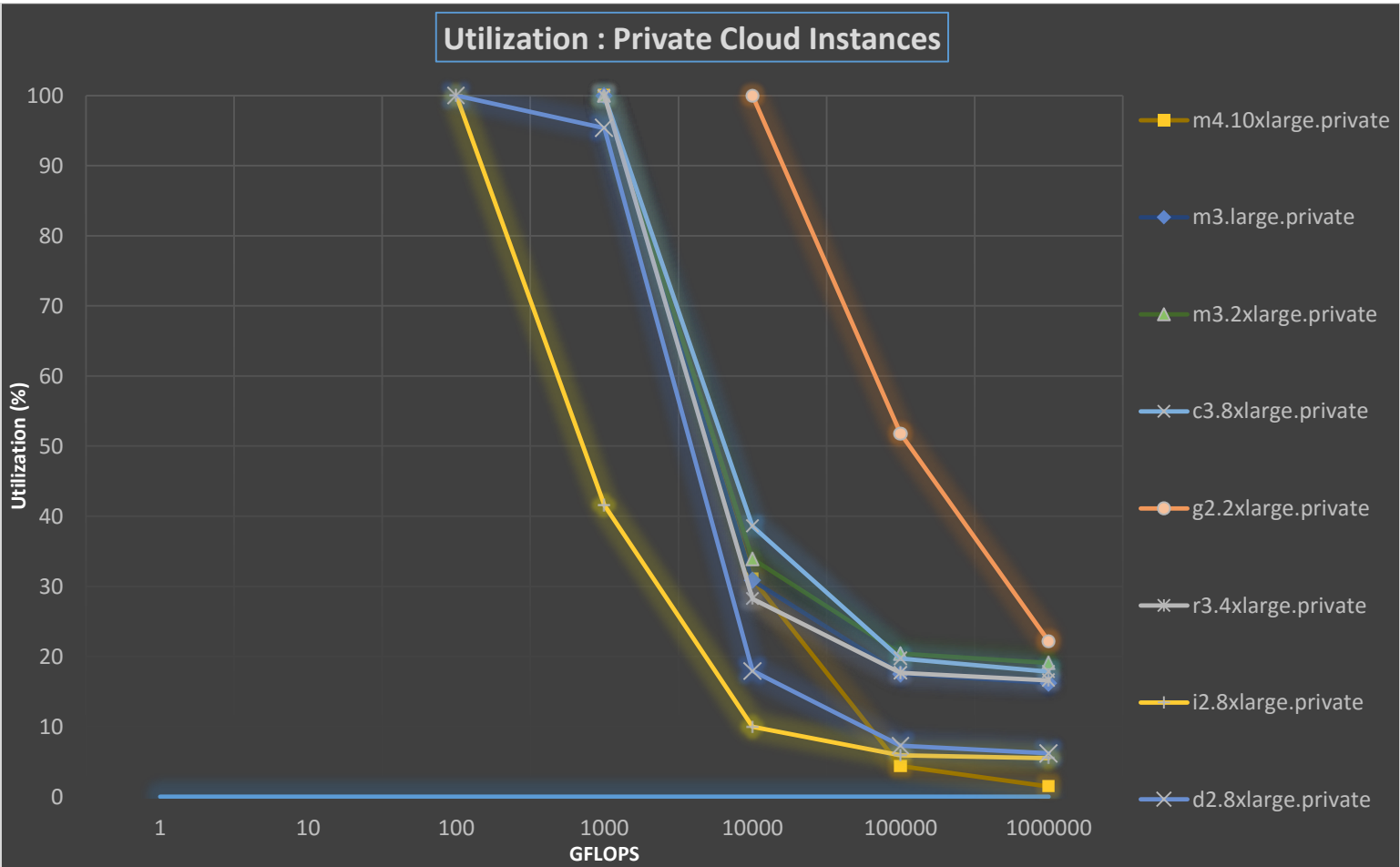


The above graph describes the comparison between Public instance (Amazon EC2) and Private instance with the cost per instance per hour in dollars for each of their 8 instances.

- The values are scaled to 1000 to visualize properly within the graph.
- The X-axis show the GFLOPS range and Y-axis show the cost/instance/hours (\$).
- It can be observed from the graph that private instances reach the break-even point around 1000 Gflops to 10000 Gflops range. After that point private instance provide cheaper rate than public instance.
- This happens because we have a direct proportion with the number of Gflops with the number of instances required to fulfill the Gflop requirement. In public cloud the cost per hour remains constant across instance but that is not the case with private cloud. The cost per hour for private cloud decreases as number of instances increase as administration cost and other fixed cost is amortized with the increase in number of instances.

4. Cost Utilization: Private Cloud Instances (Plot 2):

Instance Type	1 GFLOPS	10 GFLOPS	100 GFLOPS	1 TFLOPS	10 TFLOPS	100 TFLOPS	1 PFLOPS
m4.10xlarge.private				100	31.0406999	4.355527752	1.4577043
m3.large.private				100	30.8485449	17.51713077	16.184352
m3.2xlarge.private				100	33.909246	20.41511491	19.079988
c3.8xlarge.private				100	38.568482	19.71214575	17.828933
g2.2xlarge.private					100	51.7768869	22.187455
r3.4xlarge.private				100	28.2332865	17.6532784	16.585177
i2.8xlarge.private			100	41.577731	9.95807619	5.907344994	5.4914587
d2.8xlarge.private			100	95.352547	17.9482004	7.273863837	6.1653791




- The above graph shows the utilization of private cloud from 1GFLOPS to 1 PFLOPS. It depicts at what percent of private cloud gets used to break-even the cost.
- This values gives the clear visualization where the private cloud is advantageous over public cloud in terms of cost.
- m4.10xlarge.private, m3.large.private, m3.2xlarge.private, c3.8xlarge.private and r3.4xlarge.private instances break between 1000 to 10000 GFLOPS.
- At 10000 GFLOPS m4.10xlarge.private, m3.large.private, m3.2xlarge.private, c3.8xlarge.private and r3.4xlarge.private instances has 31.040%, 30.848%, 33.909%, 38.568% and 28.233% utilization respectively. This values depicts that this instances are cost effective over 10000 GFLOPS.
- g2.2xlarge.private instance is cost effective between 10TFLOPS to 100TFLOPS. At 100 TFLOPS instance is having the utilization percentage 51.776 %, which depicts that using this instance is cost effective if the work load uses more than 51.776 % of the instance's computing capacity.
- i2.8xlarge.private and d2.8xlarge.private instances are cost effective between 100 to 1000 GFLOPS. At 1000 GFLOPS instances are having utilization percentage 41.577 % and 95.352 % respectively, this value depict that these instances are cost effective over 1000 GFLOPS.

5. Screen Shot:

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