

UNDERSTANDING THE COST OF CLOUD COMPUTING

Team 14

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Configuration 1:

Hadoop/Spark Cluster with 256K-cores, 2PB memory, 400PB HDD, and 25Gb/s Ethernet Fat-Tree network (each VM should be equivalent to the d2.8xlarge instance); in addition to the compute resources, a 800PB distributed storage shared across the entire cloud should be procured, with enough capacity for 800GB/sec throughput (for pricing comparison, see S3)

Configuration 2:

Support 1M virtual machines (VM) where each VM requires 2-core, 16GB RAM, 75GB NVMe storage, and 10Gb/s Fat-Tree network (each VM should be equivalent to the r5d.large instances); in addition to the compute resources, a 10PB distributed storage shared across the entire cloud should be procured, with enough capacity for 100GB/sec throughput (for pricing comparison, see S3)

Configuration 3:

Support deep learning with 1 exaflop of double precision performance (hint: each VM should be equivalent to p3.16xlarge instances; you will want to use the NVIDIA V100 GPUs (8 GPUs per node), and allocate 8-cores per GPU (64-cores per node) with 8GB of memory per core (512GB per node); the network to use is at least 3Gb/s per GPU (25Gb/s should work), and should be organized in a Fat-Tree network; in addition to the compute resources, a 1PB distributed storage shared across the entire cloud should be procured, with enough capacity for 10GB/sec throughput (for pricing comparison, see S3)

ASSUMPTIONS:

- Assume a 5 year amortization cost
- Assume 1 system administrator is needed for every 1000 servers.
 - System administrator salary = \$100,000 per year
- Assume power costs \$0.15 per KWH, Cooling Cost= ¼ of Electricity cost(<https://www.coolitsystems.com/data-center-cooling-power-myths-busted/>)
- *Note: AWS uses (base 1024) 1GB = 1,073,741,824 bytes.*

Configuration 1:

Hadoop/Spark Cluster with 256K-cores, 2PB memory, 400PB HDD, and 25Gb/s Ethernet Fat-Tree network (each VM should be equivalent to the d2.8xlarge instance); in addition to the compute resources, a 800PB distributed storage shared across the entire cloud should be procured, with enough capacity for 800GB/sec throughput (for pricing comparison, see S3)

Configuration 1:

	Description
Compute Servers	256k cores
Memory	2PB
Disk	400PB HDD
Network	25GB/s
Distributed storage	800 PB

Public Cloud(AWS) :

Instance Chosen: d2.8xlarge instance

- 2.4 GHz Intel Xeon E5-2676 v3 Processor
- vCpu: 36
- Storage: 24*2000 HDD GB
- Memory: 244GiB

Each Instance Configuration

Instance	vCPU	ECU	memory(GiB)	Instance Storage (GB)	Processor	Linux/ UNIX usage
d2.8xlarge	36	116	244	24*2000HDD	Intel Xeon E5-2673 v3	\$ 5.52 per hour

Instance calculation

CPU:

256k cores required

One d2.8xlarge instance CPU's = 36 vCPU's

1VCPU = 1 core

Hence 36 cores.

Instances required for 256k = $256000/36$

=7,111 (d2.8xlarge instances)

Memory:

2 PB in Gb = $2 \times 1024 \times 1024 = 2,097,152$ GB

1 d2.8xlarge instance memory= 244 GiB

1 Gib= 1.074 GB

244GiB= 262.06Gb

Instances required for 2 PB= $2,097,152 / 262.06$

= 8002 (d2.8x large instances)

Disk:

400 PB in HDD = $400 \times 1024 \times 1024 = 419,430,400$

1 d2.8xlarge instance disk capacity= 48000GB

Instances required for 400PB= $419,430,400/48000$

=8738 (d2.8xlarge instances)

No of instances to be considered= $\max(7111, 8002, 8738)$

Cost -**1. d2.8xlarge instance cost**

1d2.8xlarge instance= \$ 5.52 per hour

Estimation of cost of one instance for 5 years

= $5 \times 365 \times 24 \times 5.52 = \241776

Price of 8738 instances for 5 years = $8738 \times 241776 = \$2,112,638,688$

2. Distributed storage cost -

Cost of 800 PB distributed storage shared across the entire cloud S3(standard):

S3(standard storage) pricing per month = \$0.021 per GB (month)

800 PB in Gb= $800 \times 1024 \times 1024$

= 838,860,800 Gb

Storage cost for 5 years= $5 \times 12 \times 0.021 \times 838,860,800$ = **\$1,056,964,608**

Total Cost= d2.8xlarge instance cost + distributed storage cost

= \$2,112,638,688+\$1,056,964,608= **\$3,169,603,296**

Configuration 2:

Support 1M virtual machines (VM) where each VM requires 2-core, 16GB RAM, 75GB NVMe storage, and 10Gb/s Fat-Tree network (each VM should be equivalent to the r5d.large instances); in addition to the compute resources, a 10PB distributed storage shared across the entire cloud should be procured, with enough capacity for 100GB/sec throughput (for pricing comparison, see S3)

Configuration 2:

	Description
Compute Servers	1Million* 2 cores
Memory	1 Million * 16GB RAM
Disk	1 Million * 75GB NVMe
Network	1 Million * 10GB/s
Distributed storage	10 PB

Public Cloud(AWS) :

Instance Chosen: r5d.large instance

Up to 3.1 GHz Intel Xeon Platinum Processor

vCpu: 2

Storage: 1 x 75 NVMe SSD GiB

Memory: 16 GiB

Each Instance Configuration

Instance	vCPU	ECU	memory(GiB)	Instance Storage (GB)	Processor	Linux/ UNIX usage
r5d.large	2	10	16	1 x 75 NVMe SSD	Intel xeon platinum	\$ 0.144per hour

Instance calculation

CPU:

Required 2 Million cores

1 r5d.large instance CPU's = 2 vCPU

1 vCPU =1 core

Hence 2 cores

Instances required for 2Million cores = $2,000,000/2$

=1,000,000 (r5d.large instances)

Memory:

16Million GB

1 r5d.large instance memory= 16 GiB

1 Gib= 1.074 GB

16GiB= 17.184GB

Instances required for 16 Million Gb= $16,000,000 / 17.184$

= 931098 (r5d.large instances)

Disk:

75 Million Gb

1 r5d.large instance disk capacity= 75 GB

Instances required for 400PB= $75 \text{ Million} / 75$

= 1,000,000 (r5d.large instances)

No of instances to be considered= $\max(1M, 931098, 1M)$

=1M (r5d.large instances)

Cost -

1. r5d.large instance costs

1r5d.large instance= \$ 0.144 per hour

Estimation cost of one instance for 5years

$$=4 \times 365 \times 24 \times 0.144 + 366 \times 24 \times 0.144 (\text{leap year}) = 6310.656$$

Price of 1M instances for 5 years = $1\text{M} \times 6310.656 =$ **\$6,310,656,000**

2. Distributed storage cost:

Cost of 10 PB distributed storage shared across the entire cloud S3(standard):

S3(standard storage) pricing per month=\$0.021 per GB (month)

10 PB in Gb= $10 \times 1024 \times 1024$

$$=10,485,760 \text{ Gb}$$

Storage cost for 5 years= $5 \times 12 \times 0.021 \times 10,485,760 =$ **\$13,212,057**

Total Cost= r5d.large instance cost + distributed storage cost

$$= \$6,310,656,000 + \$13,212,057 = \textbf{\$6,323,868,057}$$

Configuration 3:

Support deep learning with 1 exaflop of double precision performance (hint: each VM should be equivalent to p3.16xlarge instances; you will want to use the NVIDIA V100 GPUs (8 GPUs per node), and allocate 8-cores per GPU (64-cores per node) with 8GB of memory per core (512GB per node); the network to use is at least **3Gb/s** per GPU (**25Gb/s** should work), and should be organized in a Fat-Tree network; in addition to the compute resources, a 1PB distributed storage shared across the entire cloud should be procured, with enough capacity for 10GB/sec throughput (for pricing comparison, see S3)

Configuration 3

	Description
Compute Servers	1Exaflop double precision
NVIDIA V100 GPU's	8 GPUs per node(64 cores per node)
Memory	8GB/core(512GB/node)
Network	3Gb/s per GPU (25Gb/s should work)

Distributed storage	1 PB
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Instance	GPUs per node	vCPU	ECU	memory(GiB)	Precision(double)/GPU	Linux/ UNIX usage
p3.16xlarge	8	64	201	488	125 TF	\$ 24.48per hour

Instance Calculation

1 exaflop= 10^{18} floating operations per sec

1 Teraflop = 10^{12} floating operations per sec

1 GPU = 125 TF

= 125×10^{12}

1 instance = 8 GPU

= 8x 125 TF

= 1000 TF

Number of instances = $10^{18} / 1000\text{TF}$

= 1000 (p3.16xlarge instances)

Cost:

1p3.16xlarge instance cost is \$24.48 per hour

Estimation for 5 years and 1000 instances

= $1000 \times 5 \times 365 \times 24 \times 24.48$

= \$1,072,224,000

Distributed storage cost:

Cost of 1 PB distributed storage shared across the entire cloud S3(standard):

S3(standard storage) pricing per month=\$0.021 per GB (month)

1 PB in Gb= $1 \times 1024 \times 1024$

=1,048,576 Gb

Storage cost for 5 years= $5 \times 12 \times 0.021 \times 1,048,576 = \$1,321,205.76$

Total Cost= p3.16xlarge instance cost + distributed storage cost

$$= \$1,072,224,000 + \$1,321,205.76 = \$1,073,545,205.76$$

PRIVATE CLOUD

Configuration 1:

	Description	Price per item	Quantity	Total Price
Compute servers	HDX XT24-5260V4-SAS3 CPU:processor 8x Eight core Intel® Xeon® Processor E5-2620 v4 2.10GHz 20MB Cache (85W) Memory:32 x 16GB PC4-21300 2666MHz DDR4 ECC RDIMM Hard Drive:(20 x 3.84TB)+(4 x 7.68TB) Intel® SSD D3-S4510 Series 2.5" SATA 6.0Gb/s Solid State Drive Network card:4 x Mellanox 25-Gigabit Ethernet Adapter ConnectX®-4 Lx EN MCX4111A (1x SFP28)	\$39,944.00	4000	\$159,776,000.00
Network Switches	Mellanox MSN3800-CS2FO Spectrum-2 Based 100GbE 2U Open Ethernet switch with ONIE 64 QSFP28 Ports 2 Power Supplies (AC) x86 CPU Standard Depth P2C Airflow Rail Kit	\$50,963.00	125	\$6,370,375
Network Cables	Mellanox MCP1600-C001E30N Passive Copper Cable Ethernet 100GbE QSFP28 1m Black 30AWG CA-N	\$85.00	4000 * 2(computing) + 484 * 2(storage) = 8968	\$762,280.00
Racks	Great Lakes ES-Series GL910ES-2442MS	\$3132.00	4000/48(computing)+484/48(storage) = .94	\$294,408.00
Storage Servers	Thinkmate® STX-4244 4U Chassis - 1.69PB 4U-106 12G SAS JBOD (106 x 16TB SAS Drives) - 2000W Redundant Power	\$59,995	484	\$29,037,580
Electric Power	0.15 per KWH	\$687.6	5x365x24	\$30,116,880
Cooling	¼ of electric power	\$171.9	5x365x24	\$7,529,220
Administration	IT	\$100,000x5	5	\$2,500,000
TOTAL	N/A	N/A	N/A	\$236,386,743

Calculating the power Consumption:

Assumptions

- When used at full capacity, the maximum power consumption is 12.5 watts per port in switch. So total watts = 64 ports * 12.5 = 800 Watts.
- Servers on average use 800 - 1200 watts per hour, So assuming 1000 watts for servers.

Component	Total Devices	Power(W)	Total Power	Electricity consumption(kW)
Computer server	4000	1000	4000000	4000
Network switches	125	800	100,000	100
Storage server	484	1000	484000	484
total	N/A	N/A	N/A	4584

Cost of Electricity per hour = Total Electricity consumption in (kW) x Cost of electricity

$$= 4584 \times 0.15 = \text{\$687.6}$$

Configuration 2:

	Description	Price per item	Quantity	Total Price
Compute servers	RAX XT10-21S1-10G CPU: Memory: Hard Drive: Network card:	\$17,443.00	50,000 (1M/20)	\$872,150,000
Network Switches	Mellanox MSN3800-CS2FO Spectrum-2 Based 100GbE 2U Open Ethernet switch with ONIE 64 QSFP28 Ports 2 Power Supplies (AC) x86 CPU Standard Depth P2C Airflow Rail Kit	\$50,963.00	50,000/32 = 1563(computing) + 1(storage) = 1564	\$79,706,132
Network Cables	Mellanox MCP1600-C001E30N Passive Copper Cable Ethernet 100GbE QSFP28 1m Black 30AWG CA-N	\$85.00	50,000 * 2 = 100,000(Computing) + 18 * 2 = 36(Storage)	\$8,503,060
Racks	Great Lakes ES-Series GL910ES-2442MS	\$3132.00	50,000/48(computing) + 2(for storage) = 1042 + 2 = 1044	\$3,269,808
Storage Servers	STX-NS XE36-24S1-10G	\$26763.00	10,000/576 = 17.36	\$481,734
Electric Power	0.15 per KWH	\$7736.4	5x365x24	\$338,854,320

Cooling	¼ of electric power	\$1934.1	5x365x24	\$84,713,580
Administration	IT Admin	\$100,000x5(5y ears)	50	\$25,000,000
TOTAL	N/A	N/A	N/A	\$1,412,678,634

Calculating the power Consumption

Assumptions

- When used at full capacity, the maximum power consumption is 12.5 watts per port in switch. So total watts = 64 ports * 12.5 = 800 Watts.
- Servers on average use 800 - 1200 watts per hour, So assuming 1000 watts for servers.

Component	Total Devices	Power(W)	Total Power(W)	Electricity consumption(kWH)
Compute server	50000	1000	50,000,000	50000
Network switches	1564	800	1,251,200	1251.2
Storage server	325	1000	325000	325
total	N/A	N/A	N/A	51,576.2

Cost of Electricity per hour = Total Electricity consumption in (kW) x Cost of electricity

= 51,576.2x 0.15 = **\$7736.4**

Configuration 3:

	Description	Price per item	Quantity	Total Price
Compute	GPX QT8-22E2-8GPU CPU:2 x AMD EPYC 7502 Processor 32-core 2.50GHz	\$73,642.00	1000	\$7,364,200.00

servers	128MB Cache (180W) Memory: 16 x 32GB PC4-23400 2933MHz DDR4 ECC RDIMM Hard drive: 1.0TB SATA 6.0Gb/s 7200RPM - 2.5" - Seagate Exos 7E2000 Series (512e) Co-processors: 8 x NVIDIA® TeslaTM V100 GPU Computing Accelerator - 16GB HBM2 - PCIe 3.0 x16 - Passive Cooling			
Network Switches	Mellanox MSN3800-CS2FO Spectrum-2 Based 100GbE 2U Open Ethernet switch with ONIE 64 QSFP28 Ports 2 Power Supplies (AC) x86 CPU Standard Depth P2C Airflow Rail Kit	\$50,963.00	$(1000/32) + 1 = 33$	\$1,681,779.00
Network Cables	Mellanox MCP1600-C001E30N Passive Copper Cable Ethernet 100GbE QSFP28 1m Black 30AWG CA-N	\$85.00	$1000 * 2 + 1 * 2 = 2002$	\$170,170.00
Racks	Great Lakes ES-Series GL910ES-2442MS	\$3132.00	$1001/48 = 21$	\$65,772
Storage Servers	Thinkmate® STX-4244 4U Chassis - 90x Hot-Swap 3.5" SATA/SAS - 12Gb/s SAS Dual Expander - 1000W Redundant Power	\$40,258.00	1	\$40,258
Electric Power	0.15 per KWH	\$154.11	5x365x24	\$6,750,018
Cooling	¼ of electric power	\$38.5275	5x365x24	\$1,687,504.5
Administration	IT Admin	\$100,000x5	1	\$500,000
TOTAL	N/A	N/A	N/A	\$18,193,929.5

Calculating the power Consumption:

Assumptions

- When used at full capacity, the maximum power consumption is 12.5 watts per port in switch. So total watts = 64 ports * 12.5 = 800 Watts.
- Servers on average use 800 - 1200 watts per hour, So assuming 1000 watts for servers.

Component	Total Devices	Power(W)	Total Power	Electricity consumption(kWH)
Computer server	1000	1000	100000	1000
Network switches	33	800	26400	26.4
Storage server	1	1000	1000	1

total	N/A	N/A	N/A	1027.4
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Cost of Electricity per hour = Total Electricity consumption in (kW) x Cost of electricity

$$= 1027.4 \times 0.15 = \$154.11$$

CONCLUSION:

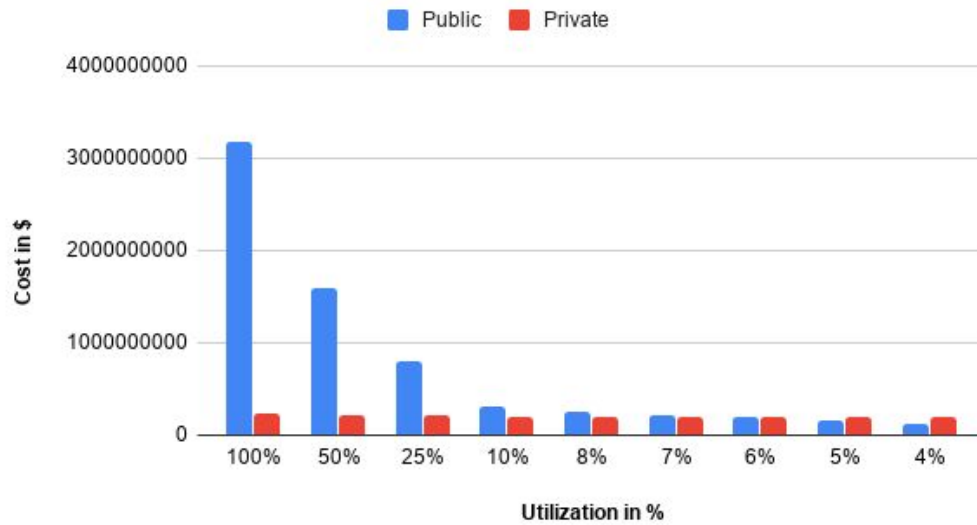
Configuration 1:

Utilization(%)	Public	Private
100%	\$3,169,603,296	\$236,386,743
50%	\$1,584,801,648	\$217,563,693
25%	\$792,400,824	\$208,152,168
10%	\$316,960,329.6	\$202,505,253
8%	\$253,568,263.68	\$201,752,331
7%	\$221,872,230.72	\$201,375,870
6%	\$190,176,197.76	\$200,999,409
5%	\$158,480,164.8	\$200,622,948
4%	\$126,784,131.84	\$200,246,487

Above table compares the costs of public and private cloud based on utilization.

Threshold value = 6%

Configuration 1



The above graph shows the comparison between AWS and private cloud. The blue bar indicates AWS cost and the red bar is the private cloud.

We can clearly see that the utilization of 6% both cost almost the same(private costs more), with the reduction of utilization percentage, the cost of AWS cloud reduces.

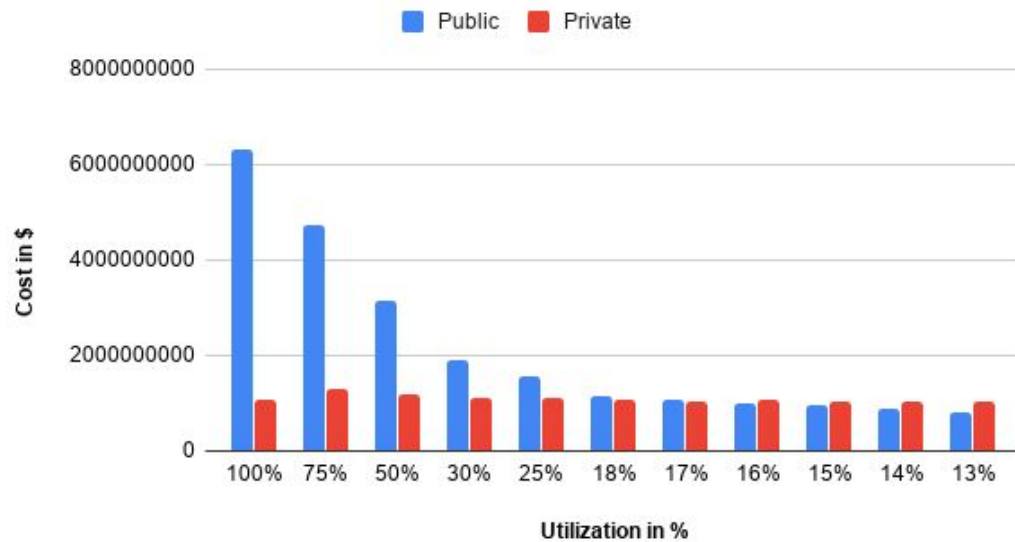
Configuration 2:

Utilization(%)	Public	Private
100%	\$6,323,868,057	\$1,073,545,205.76
75%	\$4,742,901,042.75	\$1,306,786,659
50%	\$3,161,934,028.5	\$1,200,894,684
30%	\$1,897,160,417.1	\$1,116,181,104
25%	\$1,580,967,014.25	\$1,095,002,709
18%	\$1,138,296,250.26	\$1,065,352,956
17%	\$1,075,057,569.69	\$1,046,715,968.57
16%	\$1,011,818,889.12	\$1,056,881,598
15%	\$948,580,208.55	\$1,052,645,919
14%	\$885,341,527.98	\$1,048,410,240

13%	\$822,102,847.41	\$1,044,174,561
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Above table compares the costs of public and private cloud based on utilization.
Threshold value = 16%

Configuration 2



The above graph shows the comparison between AWS and private cloud. The blue bar indicates AWS cost and the red bar is the private cloud.

We can clearly see that the utilization of 16% both cost almost the same(private costs more), with the reduction of utilization percentage, the cost of AWS cloud reduces.

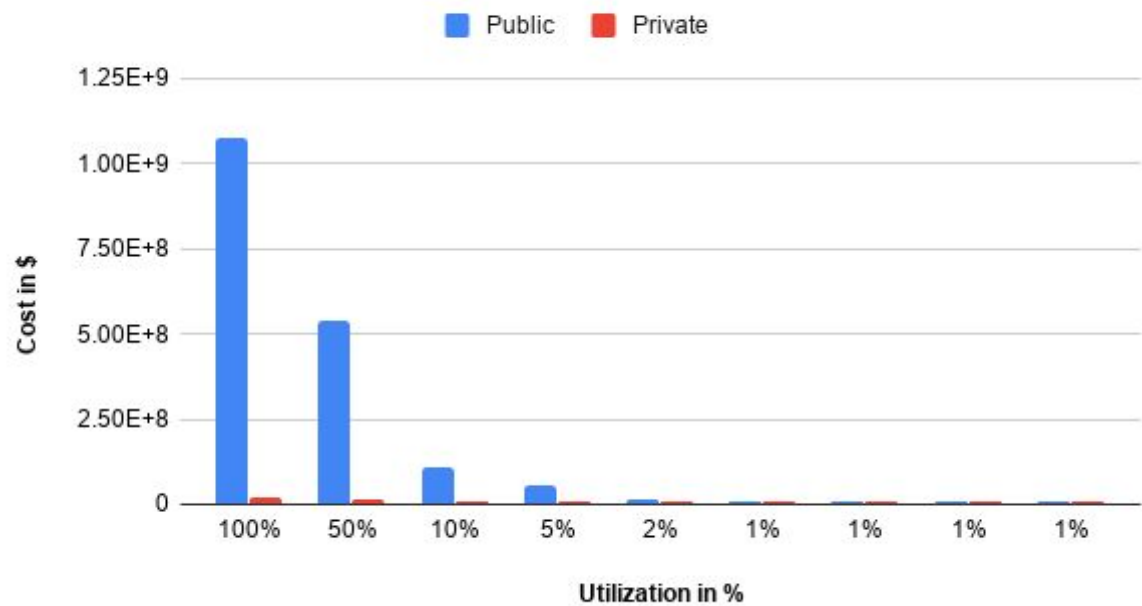
Configuration 3:

Utilization(%)	Public	Private
100%	\$1,073,545,205.76	\$18,193,929.5
50%	\$536,772,602.88	\$13,975,168.25
10%	\$107,354,520	\$10,600,159
5%	\$53,677,260	\$10,178,283
1.5%	\$16,103,178	\$9,882,969
1%	\$10,735,452	\$9,840,782
0.9%	\$9,661,906	\$9,832,344

0.8%	\$8,588,361	\$9,823,907
0.7%	\$7,514,816	\$9,815,469

Above table compares the costs of public and private cloud based on utilization.
Threshold value = 0.9%

Configuration 3

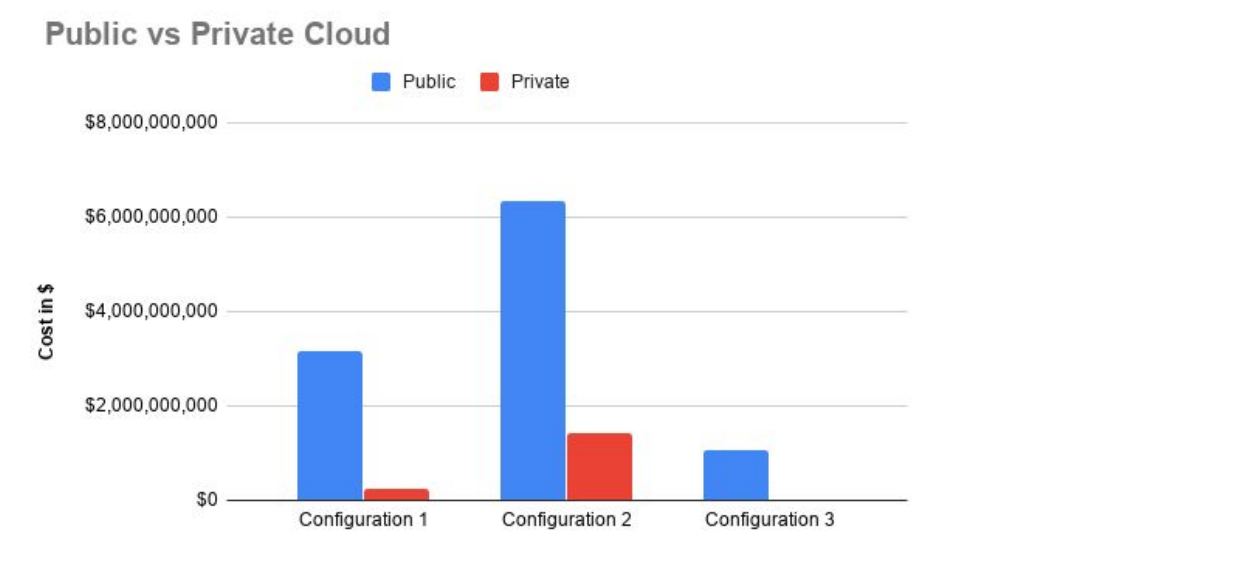


(#Note: the graph isn't representing less than one percentage values. For better understanding 1% 0.9% 0.8% 0.7%)

The above graph shows the comparison between AWS and private cloud. The blue bar indicates AWS cost and the red bar is the private cloud.

We can clearly see that the utilization of 0.9% both cost almost the same(private costs more), with the reduction of utilization percentage, the cost of AWS cloud reduces.

comparing the 3 configurations between the public and private cloud; your cost of power, cooling, and administration should be to cover 5 years of costs:



The above graph shows the comparison between AWS and private cloud costs of 3 Configurations for 5 years. The blue bar indicates AWS cost and the red bar is the private cloud.

	Configuration 1	Configuration 2	Configuration 3
Public Cloud (including EC2 and S3) Cost over 5 years, 24/7 operation, with 100% usage	\$3,169,603,296	\$6,323,868,057	\$1,073,545,205.76
Private Cloud cost over 5 years, 24/7 operation, with 100% usage	\$236,386,743	\$1,412,678,634	\$18,193,929.5
What utilization must be achieved with the private cloud to make the private cloud option more attractive than the public cloud?	6%	16%	0.9%

Table 2: Summary table comparing the 3 configurations between the public and private cloud; your cost of power, cooling, and administration should be to cover 5 years of costs

The cost described in the above table is 100% usage. The price of the infrastructure and the components remain the same. The only variable cost will be power consumption cost.

If the utilization of private cloud for these specific configurations is less than the threshold value(in percent), we should prefer public cloud over private cloud.

In conclusion, it is better to go with the private cloud setup than renting public cloud with the assumption of 100% utilization over a period of 5 years

Storage server:

4/13/2020

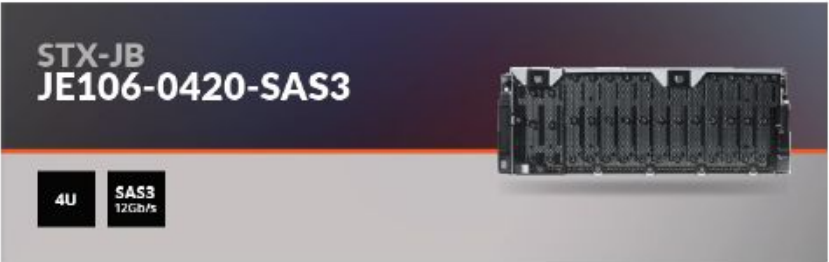
THINKMATE

READY TO BUY?
800-371-1212

STX-JB JE106-0420-SAS3

My System April 13th, 8:02 pm EDT

Thinkmate Config ID 422176



Configured Price: \$59,995.00

Selection Summary	
Chassis	Thinkmate® STX-4244 4U Chassis - 1.69PB 4U-106 12G SAS JBOD (106 x 16TB SAS Drives) - 2000W Redundant Power
Tech Specs	
Chassis	
Product Type	4U Rackmount
Color	Black
Watts	2000W
Internal Drive Bays	Supports up to 106 6Gb/s SATA and 12Gb/s SAS drives
Dimensions (WxHxD)	Height (with top cover): 176.4mm / 6.95 in Width (without ears and rails): 441mm / 17.4 in Depth (with handles, without cables): 1139mm / 44.8 in

Quotation Date: April 13th, 2020, 08:04 PM EDT. All prices subject to change.

Configured Price: \$59,995.00

READY TO BUY?
800-371-1212

CONFIGURATION ID
422176

THINKMATE

Thinkmate is a world-class provider of custom computer and server equipment since 1986. Our business was formed around assisting our customers in planning, budgeting, and implementing complete solutions. We provide a broad range of customized server, storage and cluster solutions to governments, universities, corporations and high performance computing markets. Our commitment to superior customer service and cutting edge technology has kept us the number one white box server solutions provider for nearly twenty years.

Configuration 2:

Compute server:

THINKMATE

READY TO BUY?
800-371-1212

RAX XT10-21S1-10G

My System April 12th, 3:33 am EDT
Thinkmate Config ID 421786



Configured Price: \$17,443.00

Selection Summary		
Motherboard	Intel® C622 Chipset - 14x SATA3 + 4x U.2 - 1x M.2 - Dual Intel® 10-Gigabit Ethernet (RJ45) - IPMI 2.0 with LAN	
Processor	2 x Intel® Xeon® Gold 6248 Processor 20-Core 2.5GHz 28MB Cache (150W)	
Memory	12 x 32GB PC4-23400 2933MHz DDR4 ECC RDIMM	
Chassis	Thinkmate® RAX-1210 1U Chassis - 10x Hot-Swap 2.5" SAS/SATA/NVMe - 700/750W Redundant Power	
U.2 NVMe Drive	1.5TB Intel® Optane™ SSD DC P4800X Series U.2 PCIe 3.0 x4 NVMe Solid State Drive	
Optical Drive	No Optical Drive Support	
Network Card	2 x Mellanox 100Gb/s EDR InfiniBand Adapter ConnectX®-5 VPI (1x QSFP28) - PCIe 3.0 x16	
Riser Cards	Thinkmate® 1U Riser Card - Left Side WIO - 2x PCIe 3.0 x16	
	Thinkmate® 1U Riser Card - Right Side WIO - 1x PCIe 3.0 x8	
Server Management	Thinkmate® Update Manager (OOB Management Package)	
Operating System	Ubuntu Linux 18.04 LTS Server Edition (No Media) (Community Support) (64-bit)	
Warranty	3 Year Advanced Parts Replacement Warranty	

Storage server:

THINKMATE

800-371-1212

STX-NS XE36-24S1-10G

My System April 12th, 9:36 pm EDT

Thinkmate Config ID 421894



Configured Price: **\$26,763.00**

Selection Summary

Motherboard	Intel® C622 Chipset - 10x SATA3 - 2x M.2 - Dual Intel® 10-Gigabit Ethernet (RJ45) - IPMI 2.0 with LAN
Processor	2 x Intel® Xeon® Silver 4112 Processor 4-core 2.60GHz 8.25MB Cache (85W)
Memory	4 x 8GB PC4-23400 2933MHz DDR4 ECC RDIMM
Chassis	Thinkmate® STX-4336 4U Chassis - 36x Hot-Swap 3.5" SAS - 12Gb/s SAS Single Expander - 1200W Redundant Power
3.5"/2.5" Boot Drive	2 x 240GB Intel® SSD D3-S4610 Series 2.5" SATA 6.0Gb/s Solid State Drive
Storage Drive	36 x 16.0TB SAS 3.0 12.0Gb/s 7200RPM - 3.5" - Seagate Exos X16 Series FastFormat™ (512e/4Kn)
Controller Card	Broadcom MegaRAID 9480-8i8e SATA/SAS/NVMe 12Gb/s PCIe 3.1 8-Port RAID Controller with 4GB Cache
Battery Backup	CacheVault Flash Cache Protection Module for 9460/9480 Series (CVPM05)
Network Card	2 x Mellanox 50-Gigabit Ethernet Adapter ConnectX®-4 EN MCX413A (1x QSFP28)
Server Management	Thinkmate® Update Manager (OOB Management Package)
Operating System	ThinkNAS™ DirectorProPlus v2.5 - 36-Drive License
Warranty	3 Year Advanced Parts Replacement Warranty

Configuration 3:

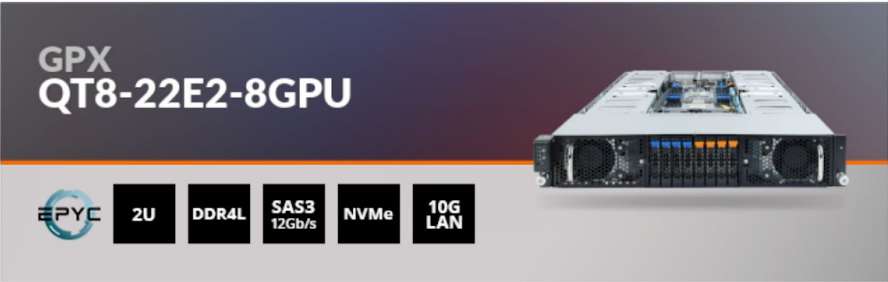
Compute server

THINKMATE

READY TO BUY?
800-371-1212

GPX QT8-22E2-8GPU

My System April 13th, 4:03 pm EDT
Thinkmate Config ID 422101



Configured Price: **\$73,642.00**

Selection Summary	
Barebone	AMD EPYC™ 7002 Series - 2U GPU Server - 4x Hot-Swap 2.5" SAS3 - 4x Hot-Swap NVMe - Dual 10-Gigabit RJ45 - 2200W Redundant Power
Processor	2 x AMD EPYC™ 7502 Processor 32-core 2.50GHz 128MB Cache (180W)
Memory	16 x 32GB PC4-23400 2933MHz DDR4 ECC RDIMM
Hard Drive	1.0TB SATA 6.0Gb/s 7200RPM - 2.5" - Seagate Exos 7E2000 Series (512e)
GPU Accelerator	8 x NVIDIA® Tesla™ V100 GPU Computing Accelerator - 16GB HBM2 - PCIe 3.0 x16 - Passive Cooling
Network Card	Mellanox 25-Gigabit Ethernet Adapter ConnectX®-4 Lx EN MCX4111A (1x SFP28)
Cables	2 x IEC320 C19 to NEMA 5-15P Power Cable, 14AWG, 125V/15A, Black - 3ft (TAA Compliant)
Operating System	Ubuntu Linux 18.04 LTS Server Edition (No Media) (Community Support) (64-bit)
Warranty	3 Year Depot Warranty (Return for Repair)

Storage Server

4/13/2020

THINKMATE

READY TO BUY?
800-371-1212

STX-JB JE90-0420-SAS3

My System April 13th, 10:29 pm EDT

Thinkmate Config ID 422230



Configured Price: \$40,258.00

Selection Summary

Chassis	Thinkmate® STX-4244 4U Chassis - 90x Hot-Swap 3.5" SATA/SAS - 12Gb/s SAS Dual Expander - 1000W Redundant Power
Storage Drive	90 x 12TB SAS 3.0 12.0Gb/s 7200RPM - 3.5" - Ultrastar™ DC HC520 (512e)
Controller Card	I have an existing Host Server or Adapter
Warranty	3 Year Depot Warranty (Return for Repair)

Tech Specs

Chassis	
Product Type	4U Rackmount
Color	Black
Watts	1000W
External Drive Bays	90 x 3.5" SAS3 12Gb/s Hot-swap drives (6 rows with 15 drive per row)
Cooling Fans	5 x 80mm high speed low vibration Hot-swappable Fans
Storage Drive	
Storage Capacity	90 x 12.0TB
Interface	12.0Gb/s SAS
Rotational Speed	7200RPM
Cache	256MB
Format	512e

Quotation Date: April 13th, 2020, 10:33 PM EDT. All prices subject to change.

Configured Price: \$40,258.00

READY TO BUY?
800-371-1212

CONFIGURATION ID
422230

Racks:

Great Lakes GL910ES-2442MS: ES-Series 48U x 24"W x 42"D Server Enclosure

The Great Lakes ES-Series GL910ES-2442MS is a 48U server rack enclosure with mesh contour front and rear doors.

Dimensions: 91.00"H x 24.00"W x 42.00"D (40"D Usable)

Rack Spaces: 48 RMU, 19" EIA 310-D Compliant

Stock Colors: Black (optional white and custom colors available)

Weight Capacity: 2000 lbs. on levelers or bolted to floor, 1800 lbs. on casters

UL Listed: UL60950-1 Standard for IT & Communications Equipment, Cabinet Enclosures and Rack Systems

Compliance: RoHS compliant

Included:

- Enclosure frame with two pairs of black powder coated, universal 19" M6 mounting rails (with RMU markings) and package of M6 hardware; includes two pairs of PDU mounting brackets with six holes each
- One set of 4 adjustable levelers (2.50"H)
- Solid Top Panel
- Mesh contour front door with easy-latch locking handle
- Mesh contour rear door with easy-latch locking handle
- Pair of solid lift-off side panels with lock and finger release



Great Lakes

Price: ~~\$3,614.00~~

NOW: \$3,132.00

Save: \$482.00

Need help configuring your rack?
Click here



Network switch:

Mellanox MSN3800-CS2FO Spectrum-2 Based 100GbE 2U Open Ethernet switch with ONIE 64 QSFP28 Ports 2 Power Supplies (AC) x86 CPU Standard Depth P2C Airflow Rail Kit

MPN: MSN3800-CS2FO

Condition: New



Availability: **Limited**
MSRP: **\$50,963.00**

Condition: **New**
Technology: **Ethernet**
Connector Type: **QSFP28**
Max Speed: **100GbE**
Max Ports: **64x100GbE**
Operating System: **ONIE/Bare Metal**
Product Brief: [Download MSN3800-CS2FO](#)

Recommended Support:

None

Quantity: 1

Add to Cart

Get a Quote

Network cable:


Ships same day

Mellanox MCP1600-C001E30N Passive Copper Cable Ethernet 100GbE QSFP28 1m Black 30AWG CA-N

MPN: MCP1600-C001E30N

Condition: New

Mellanox MCP1600-C001E30N Passive Copper Cable ETH 100GbE 100Gb/s QSFP28 1m Black 30AWG CA-N



Availability:

Ships same day

Price:

\$85.00

Condition:

New

Technology:

Ethernet

Max Speed:

100GbE

Material:

Copper

Connector Type:

QSFP28

Passive/Active:

Passive

Length:

2.0m and under

ECCN:

EAR99

Product Brief:

[Download MCP1600-C001E30N](#)

Quantity:

▼

1

▲

Add to Cart

Get a Quote

(Racks, Network Switches, Network Cables are common for all 3 configurations)