

CS 553 Cloud Computing – HW3

Configuration 1

Private Cloud Config and cost:

CALCULATIONS:

Computer Servers:

Your Order

| Product | Unit Price | Quantity | Subtotal |
|--|-----------------------------------|-----------------------------------|-----------------|
|  HDX XN24-32S3 (My System February 22nd, 11:50 pm EST) Thinkmate Config ID 704443 | \$17,058.00 | <input type="text" value="2000"/> | \$34,116,000.00 |
| <input type="checkbox"/> Remove | | | |
| <small>2U 2-Node - Intel® C621A Chipset - 24x NVMe/SATA + 2x M.2 - 2200W 1+1 Redundant 4 x Intel® Xeon® Silver 4316 Processor 20-Core 2.3GHz 30MB Cache (150W) 8 x 16GB PC4-25600 3200MHz DDR4 ECC RDIMM 8 x No DC Persistent Memory Currently Selected 4 x 240GB Solidigm SSD D3-S4520 Series 2.5" SATA 6.0Gb/s Solid State Drive 4 x 960GB Solidigm SSD D3-S4520 Series 2.5" SATA 6.0Gb/s Solid State Drive 2 x 3.84TB Solidigm SSD D3-S4520 Series 2.5" SATA 6.0Gb/s Solid State Drive 2 x Broadcom NetXtreme 100-Gigabit Ethernet Network Adapter P2100G - PCIe 4.0 x16 - 2x QSFP56 2 x Intel i350-AM4 Ethernet Adapter - Gigabit Ethernet 4x RJ45 - AIOM OCP 3.0 PCIe 2.1 x4 2 x Thinkmate® Update Manager (OOB Management Package) 2 x No Operating System Thinkmate® ISO 9001 Certified Assembly, Testing, and Quality Control Thinkmate® 3 Year Advanced Parts Replacement Warranty (Zone 0)</small> | | | |
| Reconfigure | Add A Spares Kit | | |
| | | Update | \$34,116,000.00 |
| Ship To Country | Shipping Estimate | | |

COST OF ONE HDX SERVER = 17,058 USD

COST OF 2000 TO MEET CONFIG REQUIREMENTS = 17,058 X 2000 = 34,116,000 USD

Network Switches:

For a data center a Fat Tree Network has 3 main layers:

1. Core Layer
2. Aggregation Layer
3. Leaf Layer

The chosen number of ports = 32 ports

Now to calculate the number of switches at each level for 2182 servers (2000 compute servers and 182 storage servers)

Leaf switches: 2182 servers (16 hosts per switch) = 136 Leaf switches

Each leaf switch connects to 16 aggregation switches and 16 servers.

Aggregation switches: = 68 Aggregation switches

Each aggregation switch connects to both core switches for redundancy and load balancing.

Core switches: = 2 Core switches

Total Number of Switches required = $136 + 68 + 2 = 206$ switches

The switch I have chosen is the [NVIDIA MSN3700-CS2F Spectrum-2 100GbE 1U Open Ethernet Switch](#)

Shopping Cart

| Product | Price | Quantity | Total |
|---|-------------|----------|----------------|
|  NVIDIA MSN3700-CS2F Spectrum-2 100GbE 1U Open Ethernet Switch Remove | \$25,714.12 | 206 | \$5,297,108.72 |

Special instructions for seller

Subtotal \$5,297,108.72
Shipping & taxes calculated at checkout

[Update Cart](#) [Check Out](#)

COST OF BUYING 206 SWITCHES FOR SERVER ARCHITECTURE = 5,297,108.72 USD

Network Cables:

To connect to the outside world (if needed)

Total cables for the core layer: $2 \text{ switches} \times 1 \text{ cable/switch} = 2 \text{ cables.}$

Each aggregation switch connects to both core switches. Therefore, each aggregation switch requires 2 cables.

Total cables for the aggregation layer: $68 \text{ switches} \times 2 \text{ cables/switch} = 136 \text{ cables.}$

Each edge switch connects to 16 aggregation switches. Therefore, each edge switch requires 16 cables.

Total cables for the edge layer: $136 \text{ switches} \times 16 \text{ cables/switch} = 2176 \text{ cables.}$

Each server connects to one port on an edge switch. Therefore, the total number of cables for the servers is also 2182.

Total number of cables = $2182 + 2176 + 136 + 2 = 4496$ cables

Network Cable that I chose is [**Mellanox MFA1A00-C030 Compatible 100G QSFP28 Active Optical Cable**](#)

30m (98ft) Mellanox MFA1A00-C030 Compatible 100G QSFP28 Active Optical Cable #120551 

≤3.5W | 7.5mm | Fiber

US\$217.00

FS P/N: Q28-AO30 103 Sold | 42 Reviews | 4 Questions

Length: ⓘ

0.5m(2ft) 1m(3ft) 2m(7ft) 3m(10ft) 5m(16ft) 7m(23ft)
10m(33ft) 15m(49ft) 20m(66ft) 25m(82ft) 30m(98ft)

Compatible Brands: ⓘ

Cisco Juniper Arista Brocade HW Dell Mellanox
Extreme Generic More + Customized

Click to open expanded view



110 In U.S. Warehouse, Get It By Feb 28, 2024 ⓘ
25 In Global Warehouse, Get It By Mar 4, 2024 ⓘ
[See more warehouse availability](#)

Deliver to New York, 10010
Free Shipping via UPS Ground®

Test Support ⓘ
5-Year Warranty | 30-Day Returns | 30-Day Exchange ⓘ

— 4496 + [Add to Cart](#)

Cart

| Item | Availability | Price | Qty | Item Total |  |
|--|--|------------|----------|----------------|---|
|  30m (98ft) Mellanox MFA1A00-C030 Compatible 100G QSFP28 Active Optical... FS P/N: Q28-AO30 #120551 |  110 In U.S. Warehouse  Get It By Wed, Feb 28, 2024 if you order within 20hr 17min | US\$217.00 | — 4496 + | US\$975,632.00 | |

[Sign in](#) to save this Cart, view Saved Cart or email this Cart. [Remove All](#)

COST OF BUYING 4496 ETHERNET CABLES FOR SERVER ARCHITECTURE = 975,632 USD

Racks:

Rack details from Amazon: [4-Post 42U Mobile Open Frame Server Rack](#)

Height of each compute server = 2U

Height of Rack = 42 U

Number of Servers per Rack = 21

Total number of Compute Servers = 2000

Total number of Racks = $2000 / 21 = 96$ (approx. rounded up)

Cost of one Rack = 274.99

COST OF RACKS FOR ALL THE COMPUTE SERVERS = $274.99 \times 96 = 26399.04$ USD

Height of each storage server = 2U

Height of Rack = 42 U

Total number of Storage Servers = 182

Total number of Racks = $182 / 21 = 9$ (approx. rounded up)

COST OF RACKS FOR ALL THE STORAGE SERVERS = $274.99 \times 9 = 2474.91$ USD

Height of each switch = 1U

Height of Rack = 42 U

Total number of Switches = 206 Switches

Total number of Racks = $206 / 42 = 5$ Racks

COST OF RACKS FOR ALL THE SWITCHES = $274.99 \times 5 = 1,374.95$ USD

COST OF ALL THE RACKS = $26,399.04 + 2,374.91 + 1,374.95 = 30,148.9$ USD

Shopping Cart

| | | Price |
|---|--|--|
|  | <p>StarTech.com 4-Post 42U Mobile Open Frame Server Rack, 19in Network Rack with Wheels, Rolling Rack for Computer/AV/Data/IT</p> <p>\$295.99</p> <p>In Stock</p> <p>Eligible for FREE Shipping</p> <p><input type="checkbox"/> This is a gift Learn more</p> <p>Size: 42U</p> <p>Pattern: Rack</p> | |
| StarTech.com | <input type="button" value="110"/> Delete Save for later Compare with similar items Share | Subtotal (110 items): \$32,558.90 |

Storage Servers:

Your Order

| Product | Unit Price | Quantity | Subtotal |
|---|------------|--|----------------|
|  STX-JB JE12-0220-SH (My System February 24th, 7:54 pm EST) Thinkmate Config ID 704871 | \$8,926.00 | <input type="text" value="182"/> <input type="checkbox"/> Remove | \$1,624,532.00 |

Thinkmate® STX-2312 2U Chassis - 12x 3.5" SATA3/SAS3 - 12Gb/s SAS Dual Expander - 550W 1+1 Redundant Power
12 x 22TB SATA 6.0Gb/s 7200RPM - 3.5" - Ultrastar™ DC HC570 (512e/4Kn)
I have an existing Host Server or Adapter
Thinkmate® ISO 9001 Certified Assembly, Testing, and Quality Control
Thinkmate® 3 Year Advanced Parts Replacement Warranty (Zone 0)

[Reconfigure](#) [Add A Spares Kit](#) [Update](#) **\$1,624,532.00**

COST OF ONE JBD STORAGE SERVER = 8,926 USD

COST OF 182 TO MEET CONFIG REQUIRMENTS = $8,926 \times 182 = 1,624,532$ USD

Electric Power:

Power cost per kilo watt in Chicago = 0.15 USD/hour

Estimated Watt per compute server = 1542 Watt

Total Watt for compute cloud = $1542 \times 2000 = 3084000$ Watt = 3084 kW

COST OF ELECTRIC POWER FOR COMPUTE SERVERS PER HOUR = $3084 \times 0.15 = 462.6$ USD

Watt per storage server = 682 Watt

Total Watt for storage cloud = $682 \times 182 = 124.124$ kW

COST OF ELECTRIC POWER FOR STORAGE SERVERS PER HOUR = $124.124 \times 0.15 = 18.6186$ USD

Watt per switch = 500 Watt

Total Watt for all switches = $500 \times 206 = 103,000$ Watts = 103 Kw

COST OF ELECTRIC POWER FOR SWITCHES PER HOUR = $103 \times 0.15 = 15.45$ USD

TOTAL COST OF ELECTRIC POWER FOR 1 HOUR = $462.6 + 18.6186 + 15.45 = 496.6686$ USD

TOTAL COST OF ELECTRIC POWER FOR 5 YEARS = $496.6686 \times 24 \times 365 \times 5 = 21,754,084.68$ USD

Cooling:

Same as the power consumptions,
TOTAL COST OF COOLING FOR 5 YEARS = 21,754,084.68 USD

Administration:

Using reference of salary from [Glassdoor](#)

Cost of administrator for 1 year for 500 servers = 93,000 USD
For 2000 servers 4 administrators are needed

COST OF 4 ADMINISTRATORS FOR 5 YEAR PERIOD FOR 2000 SERVERS = 93,000 X 4
X 5 = 1,860,000 USD

Public Cloud Config and cost:

Reserved Instance Pricing for EC2:

Details of the instance(I used Dedicated Instance to maintain security)

Number of instances
Please specify the total number of instances that you need each month.
5000

EC2 Instances (1)
Based on your inputs, this is the lowest-cost EC2 instance: **d3.8xlarge**
Chosen instance: **d3.8xlarge** | Family: **d3** | 32vCPU | 256 GiB Memory

Search instance type

Instance family [Info](#) vCPUs Memory (GiB) Network performance
Any Instance family 32 Any Memory (GiB) Any Network Performance

Show only current generation instances.

| Instance name | vCPUs | Memory | Network Performance | Storage | On-Demand Hourly Cost | CurrentGe |
|---------------|-------|---------|---------------------|---------------|-----------------------|-----------|
| d3.8xlarge | 32 | 256 GiB | 25 Gigabit | 24 x 2000 HDD | 4.39507 | Yes |

Pricing per month for the 3 year term (As there is no 5 year)(Screenshots from AWS calculator)

5000 Reserved instances x 0.000000 USD upfront cost = 0.000000 USD

Reservation instances (upfront): 0.000000 USD

5000 instances x 730 hours in a month = 3650000 Reserved instance hours per month

3650000 Reserved instance hours per month x 1.898670 USD = 6930145.500000 USD

Dedicated Per Region Fee: 730 hours x 2 USD = 1460.000000 USD

Normalized Reserved instances (monthly): 6931605.500000 USD

RESERVE INSTANCE PRICING FOR D3.X8 LARGE MONTHLY = 6,931,605.5 USD

RESERVE INSTANCE PRICING FOR A 5-YEAR PERIOD = 6931605.5 X 60 = 415,896,330 USD

| | Description | Price per Item | Quantity | Total Price |
|-------------------------|--------------------|-----------------------|-----------------|--------------------|
| Compute Servers | Refer Above | 17,058 | 2000 | 34,116,000.00 |
| Network Switches | Refer Above | 25,714.12 | 206 | 5,297,108.72 |
| Network Cables | Refer Above | 217 | 4496 | 975,632.00 |
| Rack | Refer Above | 274.99 | 110 | 30,148.90 |
| Storage Servers | Refer Above | 8,926 | 182 | 1,624,532.00 |
| Electric Power | Refer Above | | | 21,754,084.68 |
| Cooling | Refer Above | | | 21,754,084.68 |
| Administration | Refer Above | | | 1,860,000.00 |
| TOTAL | | | | 85,817,207.88 |

Standard Pricing for S3:

Details of the storage

▼ S3 Standard [Info](#)

The calculations below exclude Free Tier discounts.

| | |
|---------------------|--------------|
| S3 Standard storage | Unit |
| 48000 | TB per month |

How will data be moved into S3 Standard?
Automatically calculates PUT, COPY, POST costs for moving data into S3 Standard initially. To compare the cost of current storage in S3 Standard to lifecycle this data to another storage class, you can specify that your storage is already stored in S3 Standard while selecting Lifecycle under the new storage class to capture the upfront cost of moving your data.

The specified amount of data is already stored in S3 Standard

Cost of the storage without data transfer costs (read and write)

Unit conversions

S3 Standard storage: 48000 TB per month x 1024 GB in a TB = 49152000 GB per month

Pricing calculations

Tiered price for: 49,152,000 GB

51,200 GB x 0.023 USD = 1,177.60 USD

460,800 GB x 0.022 USD = 10,137.60 USD

48,640,000 GB x 0.021 USD = 1,021,440.00 USD

Total tier cost: 1,177.60 USD + 10,137.60 USD + 1,021,440.00 USD = 1,032,755.20 USD (S3 Standard storage cost)

S3 Standard cost (monthly): 1,032,755.20 USD

S3 Standard cost (upfront): 0.00 USD

COST OF STORAGE S3 BUCKET PER MONTH = 1,032,755.20 USD

Details of the Data Transfer Costs

▼ Data Transfer [Info](#)

Inbound Data Transfer

Enter the data you expect to transfer into US East (Ohio)

Data transfer from

Internet (free)

Enter Amount

4000

Data amount

TB per month

[Add inbound data transfer](#)

Outbound Data Transfer

Enter the data you expect to transfer out of US East (Ohio)

Data transfer to

Internet (0.05 USD - 0.09 USD per GB)

Enter Amount

4000

Data amount

TB per month

[Add outbound data transfer](#)

Cost of Data Transfer (Read and Write)

Unit conversions

Inbound:

Internet: 4000 TB per month x 1024 GB in a TB = 4096000 GB per month

Outbound:

Internet: 4000 TB per month x 1024 GB in a TB = 4096000 GB per month

Pricing calculations

Inbound:

Internet: 4096000 GB x 0 USD per GB = 0.00 USD

Outbound:

Internet: Tiered pricing for 4096000 GB:

10240 GB x 0.09 USD per GB = 921.60 USD

40960 GB x 0.085 USD per GB = 3481.60 USD

102400 GB x 0.07 USD per GB = 7168.00 USD

3942400 GB x 0.05 USD per GB = 197120.00 USD

Data Transfer cost (monthly): 208,691.20 USD

COST OF DATA TRANSFER PER MONTH = 208,691.20 USD

TOTAL COST OF BOTH STORAGE AND DATA TRANSFER PER MONTH=

1,032,755.20 + 208,691.20

= 1,241,446.4 USD

TOTAL COST OF BOTH STORAGE AND DATA TRANSFER FOR 5 YEARS=

1,241,446.4 X 60

= 74,486,784 USD

Total Cost of Public Cloud For 5-year period:

COST OF EC2 + COST OF STORAGE (S3 AND DATA TRANSFER) = 415,896,330 + 74,486,784

= 490,383,114 USD

Configuration 2

Private Cloud Config and cost:

Computer Servers:



Mac mini

Quantity:
1

\$1,299.00

Pay 0% APR for 12 months:

\$108.25/mo.

[Hide product details ^](#)

[Remove](#)

Hardware

- Apple M2 with 8-core CPU, 10-core GPU, 16-core Neural Engine
- 16GB unified memory
- 1TB SSD storage
- 10 Gigabit Ethernet
- Two Thunderbolt 4 ports, HDMI port, two USB-A ports, headphone jack
- Accessory Kit

Software

- Photos, iMovie, GarageBand
- Pages, Numbers, Keynote
- macOS

COST OF ONE MAC MINI MACHINE = 1,299 USD

COST OF 1000 TO MEET CONFIG REQUIREMENTS = 1,299 X 1000 = 1299000 USD

Network Switches:

Number of Servers = 1000

Since no specific Network Architecture was mentioned in the configuration. I am assuming a basic architecture where all the switches are connected with n servers and one core switch. This is typically referred to as star server architecture.

I chose a **NETGEAR 48-Port 10G Ethernet Smart Switch (XS748T) - Managed, with 4 x 10**

Gigabit SFP+

Number of ports = 48 ports

If each switch is connected to 47 servers and last port is connected to a central switch. Then the total number of switches required is $1000/47 = 22$ switches + 1 central switch

Cost of one switch = 4169.99 USD

Cost of 23 switches = $23 \times 4169.99 = 95909.77$ USD

Shopping Cart

| Price |
|---|
| NETGEAR 48-Port 10G Ethernet Smart Switch (XS748T) - Managed, with 4 x 10 Gigabit SFP+, Desktop or Rackmount, and Limited Lifeti... \$4,169.99 |
|  Only 5 left in stock (more on the way). Eligible for FREE Shipping & FREE Returns <input type="button" value="View details"/> <input type="checkbox"/> This is a gift Learn more Style: 44 Port 10G 4xSFP+ |
| 23 Delete Save for later Compare with similar items Share |
| <small>Cable Matters 10Gbps Snagless Long Shielded Cat6A Ethernet Cable... was removed from Shopping Cart.</small> |
| Subtotal (23 items): \$95,909.77 |

Network Cables:

Network Cable I chose was **Cable Matters 10Gbps Snagless Long Shielded Cat6A**, that is compatible with both the net gear switch mentioned above and the mac mini servers.

Since each switch is connected to 47 servers, and there are 22 switches, the total number of connections from switches to servers is $22 \text{ switches} * 47 \text{ servers/switch} = 1034$ connections.

Since there are 22 switches (excluding the central switch), there are 22 connections between switches and the central switch.

Total cables needed = $1034 + 22 = 1056$ cables

Cost of 1 cable: 17.99 USD

COST OF PURCHASING 1056 CABLES = $1056 \times 17.99 = 18,997.44$ USD

Shopping Cart

Price



Cable Matters 10Gbps Snagless Long Shielded Cat6A Ethernet Cable
50 ft (SSTP, SFTP Shielded Ethernet Cable, Shielded Cat6 Cable, Cat 6

\$17.99

In Stock

Eligible for FREE Shipping & [FREE Returns](#)

This is a gift [Learn more](#)

Size: 50 ft

Color: Black

Qty: 1 ▾

| Delete

| Save for later

| Compare with similar items

| Share

Subtotal (1 item): \$17.99

Racks:

[Hypershelf Link](#)

Rack details from Amazon: [4-Post 42U Mobile Open Frame Server Rack](#)

Number of Mac Mini = 1000

Number of Mac Mini one Hypershelf can store = 16

Number of Hypershelfs needed = $62.5 = 63$ Hypershelfs

Cost of one Hypershelf = 599.99

Cost of 63 Hypershelf = $599.99 \times 63 = 6,299.37$

Height of one Hypershelf = 5U

Height of Rack 1 = 42 U

Number of Hypershelf per Rack = 8

Total number of Racks needed = $7.87 = 8$

Cost of one Rack = 274.99

Cost of 8 Racks = $274.99 \times 8 = 2199.92$ USD

Shopping Cart

| | Price |
|---|-----------------|
|  StarTech.com 4-Post 42U Mobile Open Frame Server Rack, 19in Network Rack with Wheels, Rolling Rack for Computer/AV/Data/IT \$295.99 | \$295.99 |
| In Stock Eligible for FREE Shipping <input type="checkbox"/> This is a gift Learn more Size: 42U Pattern: Rack Qty: 8 <input type="button" value="▼"/> Delete Save for later Compare with similar items Share | |
| Subtotal (8 items): \$2,367.92 | |

THERE WAS AN OFFER BUT IT IS NOT THERE ANYMORE WHEN I TOOK THIS SCREENSHOT

TOTAL COST OF RACKS NEEDED FOR COMPUTE RESOURCES = 2,199.92 USD + 6,299.37 = 8499.29 USD

16 OF THE SWITCHES CAN BE FITTED INTO THE REMAINING SPACES OF THE 8 RACKS. TO ACCOMMODATE THE 7 SWITCHES I BOUGHT ONE [RACK OF 7 U](#)

Shopping Cart

| | Price |
|--|--|
|  Procraft 7U 12" Deep Equipment Rack 7 Space - Made in the USA - With Rack Screws \$115.00 | \$115.00 |
| | Subtotal (1 item): \$115.00 <input type="button" value="Proceed to checkout"/> |
| Subtotal (1 item): \$115.00 | |

TOTAL COST OF RACKS = 8,614.29 USD

Storage Servers:

NO STORAGE SERVERS ARE REQUIRED AS THERE IS NO DISTRIBUTED STORAGE MENTIONED

Electric Power:

Power cost per kilo watt in Chicago = 0.15 USD/hour

Estimated Watt per compute server = 150 Watt

Total Watt for compute cloud = 150 X 1000 = 150000 Watt = 150 kW

COST OF ELECTRIC POWER FOR COMPUTE SERVERS PER HOUR = 150 X 0.15

= 22.5 USD

Watt per switch = 548 Watt

Total Watt for all switches = $548 \times 23 = 12,604$ Watt = 12.6 kW

COST OF ELECTRIC POWER FOR SWITCHES PER HOUR = 12.6×0.15
= 1.89 USD

TOTAL COST OF ELECTRIC POWER FOR 1 HOUR = $22.5 + 1.89 = 24.39$ USD

TOTAL COST OF ELECTRIC POWER FOR 5 YEARS = $24.39 \times 24 \times 365 \times 5$
= 1,068,282 USD

Cooling:

Same as the power consumptions,

TOTAL COST OF COOLING FOR 5 YEARS = 1,068,282 USD

Administration:

Using reference of salary from [Glassdoor](#)

Cost of Mac OS administrator for 1 year for 500 servers = 106,000 USD

For 1000 servers 2 administrators are needed

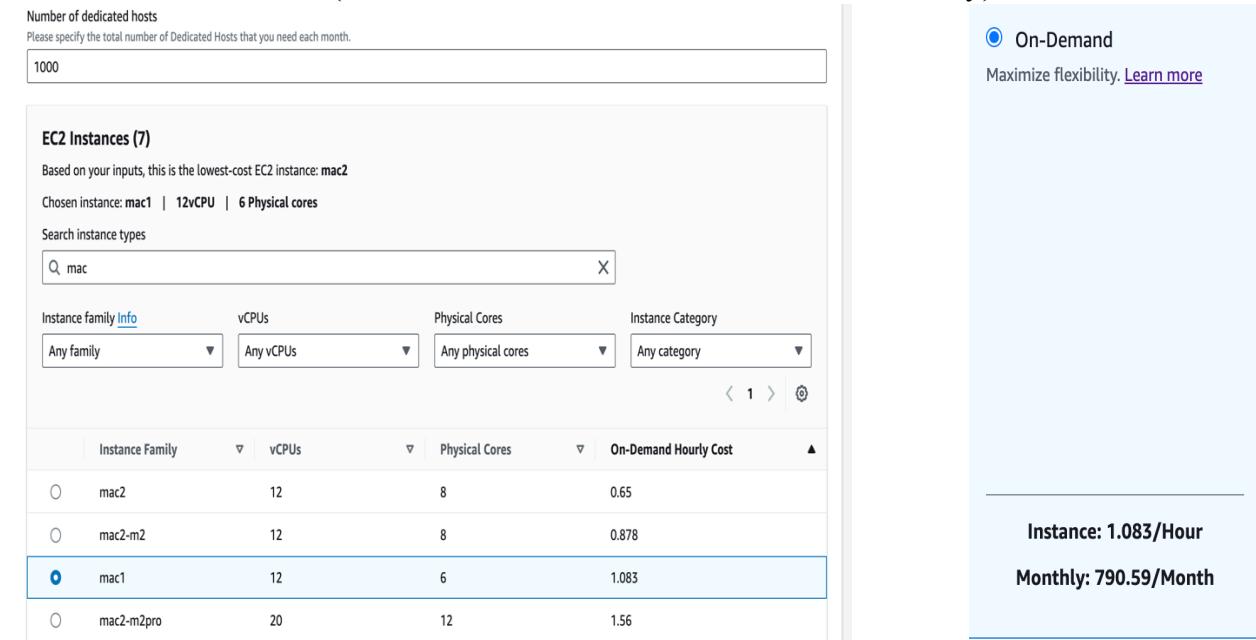
COST OF 4 ADMINISTRATORS FOR 5 YEAR PERIOD FOR 2000 SERVERS = $106,000 \times 2 \times 5 = 1,060,000$ USD

| | Description | Price per Item | Quantity | Total Price |
|------------------|-------------|----------------|----------|---------------------|
| Compute Servers | Refer Above | 1,299 | 1000 | 1,299,000 |
| Network Switches | Refer Above | 4169.99 | 23 | 95,909.77 |
| Network Cables | Refer Above | 17.99 | 1056 | 2,199.92 |
| Rack | Refer Above | 274.99, 115 | 8,1 | 8,614.29 |
| Storage Servers | Refer Above | 0 | 0 | 0 |
| Electric Power | Refer Above | | | 1,068,282 |
| Cooling | Refer Above | | | 1,068,282 |
| Administration | Refer Above | | | 1,060,000 |
| TOTAL | | | | 4,602,287.98 |

Public Cloud Config and cost:

Reserved Instance Pricing for EC2:

Details of the instance (I used Dedicated Instance to maintain security)



Number of dedicated hosts
Please specify the total number of Dedicated Hosts that you need each month.
1000

On-Demand
Maximize flexibility. [Learn more](#)

EC2 Instances (7)
Based on your inputs, this is the lowest-cost EC2 instance: mac2
Chosen instance: mac1 | 12vCPU | 6 Physical cores
Search instance types
Q mac X

| Instance family | vCPUs | Physical Cores | Instance Category |
|-----------------|-----------|--------------------|-------------------|
| Any family | Any vCPUs | Any physical cores | Any category |

Instance: 1.083/Hour
Monthly: 790.59/Month

| Instance Family | vCPUs | Physical Cores | On-Demand Hourly Cost |
|-----------------|-----------|----------------|-----------------------|
| mac2 | 12 | 8 | 0.65 |
| mac2-m2 | 12 | 8 | 0.878 |
| mac1 | 12 | 6 | 1.083 |
| mac2-m2pro | 20 | 12 | 1.56 |

Pricing for 5-year term for on demand pricing:

Employees work 40 hours/week and 48 weeks/year. So,

Hours per year = $40 \times 48 = 1920$ Hours

Hours for 5-year term: $1920 \times 5 = 9,600$ Hours

Per instance per hour pricing: 1.083 USD

Number of Instances = 1000

So,

TOTAL COST TO RESERVE MAC1 FOR A 5 YEAR TERM FOR 1K EMPLOYEES

=1.083 X 9600 X 1000 = 10,396,800 USD

Reserved Pricing for EBS:

Details of the EBS Storage

▼ Amazon Elastic Block Store (EBS) - optional [Info](#)

Storage per instance

Storage for each EC2 instance
Choose EBS volume storage type.

General Purpose SSD (gp2)

Storage amount Unit

▼ Show calculations

Unit conversions

Storage amount: 1 TB x 1024 GB in a TB = 1024 GB

Pricing Details for EBS:

Storage amount: 1 TB x 1024 GB in a TB = 1024 GB

Number of Dedicated Hosts: 1000 Hosts

Reservation Cost for General Purpose SSD per GB per instance per month= 0.10 USD

$$\begin{aligned}\mathbf{EBS \, STORAGE \, COST \, PER \, MONTH} &= 1024 \times 1000 \times 0.1 \\ &= 102,400 \text{ USD}\end{aligned}$$

$$\begin{aligned}\mathbf{EBS \, STORAGE \, COST \, FOR \, 5\text{-YEAR \, TERM}} &= 102,400 \times 60 \\ &= 6,144,000 \text{ USD}\end{aligned}$$

Total Cost of Public Cloud For 5-year period:

$$\begin{aligned}\mathbf{COST \, OF \, EC2 \, (Mac1) + COST \, OF \, STORAGE \, (EBS)} &= 10,396,800 + 6,144,000 \\ &= 16,540,800 \text{ USD}\end{aligned}$$

Configuration 3

Private Cloud Config and cost:

Computer Servers:

Your Order

| Product | Unit Price | Quantity | Subtotal |
|---|------------------------|--------------------------------|-------------|
|  GPX XS12-24S3-10GPU (My System February 26th, 3:52 pm EST) Thinkmate Config ID 705399 | \$32,018.00 | <input type="text" value="1"/> | \$32,018.00 |
| 4U GPU Server - 12x 3.5" SATA/SAS - 10x GPUs Dual Root - Dual 10-Gigabit Ethernet - 2200W 2+1 Redundant 2 x Intel® Xeon® Silver 4310 Processor 12-Core 2.1GHz 18MB Cache (1.20W) 16 x 8GB PC4-25600 3200MHz DDR4 ECC RDIMM 240GB Micron 5400 PRO Series 2.5" SATA 6.0Gb/s Solid State Drive 8 x NVIDIA® RTX A5000 - 24GB GDDR6 - PCIe 4.0x16 - Active Cooling (4xDP) Broadcom NetXtreme 1-Gigabit Ethernet Network Adapter - PCIe 2.0 x1 - 2x RJ45 3 x IEC320 C14 to C19 Power Cable - 14AWG - 250V/15A - 4ft / 1.2M (TAA Compliant) No Operating System Thinkmate® ISO 9001 Certified Assembly, Testing, and Quality Control Thinkmate® 3 Year Advanced Parts Replacement Warranty (Zone 0) | | | |
| Reconfigure Add A Spares Kit | | | |
| | Update | | \$32,018.00 |

Cost one 1 GPU intensive server (above) = 32,018.00 USD

COST OF 145 GPU INTENSIVE SERVERS = 32,018.00 X 145 = 4,642,610 USD

Network Switches:

Basic architecture where all the switches are connected with n servers and one core switch. This is typically referred to as star server architecture.

I chose a [24-Port Gigabit Ethernet Unmanaged Switch](#) which supports 1gbps ethernet speed.

Number of ports = 24 ports

If each switch is connected to 21 servers and last port is connected to a central switch, with 2 ports left empty for future connections. Then the total number of switches required is $145/21 = 7$ switches + 1 central switch

Cost of one switch = 129.99 USD (DISCOUNT !!)

COST OF BUYING 8 SWITCHES = 129.99 X 8 = 1,039.92 USD

MY CART (1 Item)

NETGEAR 24-Port Gigabit Unmanaged Switch (JGS524)



IN STOCK

1 | +

\$159.99

\$129.99

REMOVE

Network Cables:

Network Cable I chose was **CAT 5e Ethernet Patch Cable, RJ45 Computer Network Cord**

Since each switch is connected to 21 servers, 2 ports left empty and there are 7 switches, the total number of connections from switches to servers is 7 switches * 21 servers/switch = 210 connections.

Since there are 7 switches (excluding the central switch), there are 7 connections between switches and the central switch.

Total cables needed = $147 + 7 = 154$ cables

Cost of 1 cable: 19.99 USD

COST OF PURCHASING 220 CABLES = $154 \times 19.99 = 3,078.46$ USD

Shopping Cart

Price

CableCreation 10 Feet (5-Pack) CAT 5e Ethernet Patch Cable, RJ45 Computer Network Cord, Cat5/Cat5e/Cat6 LAN Cable UTP

\$19.99



In Stock

Eligible for FREE Shipping & FREE Returns

This is a gift [Learn more](#)

Color: Blue

Size: 10 Feet

Qty: 1

[Delete](#)

[Save for later](#)

[Compare with similar items](#)

[Share](#)

Subtotal (1 item): **\$19.99**

Racks:

Rack details from Amazon: [4-Post 42U Mobile Open Frame Server Rack](#)

Height of each GPU compute server = 4U

Height of Rack = 42 U

Number of Servers per Rack = 10

Total number of Compute Servers = 145

Total number of Racks = $200/10 = 15$ (approx. rounded up)

Cost of one Rack = 274.99

COST OF RACKS FOR ALL THE COMPUTE SERVERS = $274.99 \times 15 = 4,124.85$ USD

SINCE THE THERE IS EXTRA SPACE IN THE 15 RACKS BOUGHT FOR THE SERVERS THE SWITCHES CAN BE FITTED WITHIN THESE RACKS ITSELF.

Shopping Cart

Price



StarTech.com 4-Post 42U Mobile Open Frame Server Rack, 19in Network Rack with Wheels, Rolling Rack for Computer/AV/Data/IT...

\$295.99

In Stock

Eligible for FREE Shipping

This is a gift [Learn more](#)

Size: 42U

Pattern: Rack

15

[Delete](#)

[Save for later](#)

[Compare with similar items](#)

[Share](#)

CableCreation 10 Feet (5-Pack) CAT 5e Ethernet Patch Cable, RJ45... was removed from Shopping Cart.

Subtotal (15 items): \$4,439.85

Storage Servers:

NO STORAGE SERVERS ARE REQUIRED AS THERE IS NO DISTRIBUTED STORAGE MENTIONED

Electric Power:

Power cost per kilo watt in Chicago = 0.15 USD/hour

Estimated Watt per compute server = 2823.4 Watt

Total Watt for compute cloud = $2823.4 \times 145 = 409,393$ Watt = 408.393 kW/hour

COST OF ELECTRIC POWER FOR COMPUTE SERVERS PER HOUR =

Watt per switch = 30 Watts

Total Watt for all switches = $30 \times 11 = 330$ Watts = 0.33 Kw/hour

Servers and Switches consume 24×409.00 Kw (leaving area for flexibility) = 9,816 Kw per day

I am choosing solar panels to meet power needs as it would be more efficient than paying the power costs due to the high wattage of each server.

I chose this high efficiency Solar Panel

One Solar Panel produces per day (assuming 10 hours of sunlight): 4 Kw.

Number of Solar Panels needed to accommodate needs = 2,454 panels

Cost of one panel = 796.99 USD

COST OF BUYING 2,454 PANELS = $2,454 \times 796.99 = 1,889,555.46$ USD

Shopping Cart

| | Price |
|--|-----------------|
|  Renogy 400W Portable Solar Panel Foldable Monocrystalline Solar Blanket, Huge Power Solar Panel, Sunpower Solar Cells 23.7% High... <small>Only 14 left in stock (more on the way). Eligible for FREE Shipping & FREE Returns. <input type="checkbox"/> This is a gift Learn more</small> <small>Style: 400W</small> | \$796.69 |
| <small>StarTech.com 4-Post 42U Mobile Open Frame Server Rack, 19in Netw... was removed from Shopping Cart.</small> | |
| Subtotal (1 item): \$796.69 | |

Cooling:

Same as the power consumptions,

Power Consumption for a single day = 9,816 Kw/per day

TOTAL COST OF COOLING FOR 5 YEARS = $9,816 \times 30 \times 12 \times 5 \times 0.15 = 2,650,320$ USD

Administration:

Using reference of salary from [Glassdoor](#)

Cost of administrator for 1 year for 500 servers = 93,000 USD

For less than 500 servers 1 administrators is needed

COST OF 1 ADMINISTRATORS FOR 5 YEAR PERIOD FOR 2000 SERVERS = 93,000 X 1
X 5 = 465,000 USD

Calculating the profit

Server GPU architecture = **NVIDIA® RTX A5000 - 24GB GDDR6 - PCIe 4.0 x16 - Active Cooling (4xDP)**

Each server has 8 of the above GPU

[Hash rate of the RTX A5000 for mining Raven Coin](#) = 45.1

| Hashrate | Power consumption | Pool fee | Currency | Electricity costs | |
|---------------------|-------------------|-------------------------------|------------------------------|--------------------------------------|-----------|
| 45.1 | MH/s | 0 W | 0 % | USD | Calculate |
| PERIOD | EST. REWARD | EST. INCOME | COSTS | EST. PROFIT | |
| Last 1h | 1.20024315 RVN | 0.0305 USD 0.00000054 BTC | -0.00 USD -0.00000000 BTC | 0.0305 USD 0.00000054 BTC | |
| Last 24h | 32.18815954 RVN | 0.8333 USD 0.00001469 BTC | -0.00 USD -0.00000000 BTC | 0.8333 USD 0.00001469 BTC | |
| Last 7 days | 239.72639915 RVN | 5.6627 USD 0.00009983 BTC | -0.00 USD -0.00000000 BTC | 5.6627 USD 0.00009983 BTC | |
| Current daily | 27.55744415 RVN | 0.7031 USD 0.00001240 BTC | -0.00 USD -0.00000000 BTC | 0.7031 USD 0.00001240 BTC | |
| Current for 7 days | 192.90210905 RVN | 4.9217 USD 0.00008677 BTC | -0.00 USD -0.00000000 BTC | 4.9217 USD 0.00008677 BTC | |
| Current for 30 days | 826.72332450 RVN | 21.0930 USD 0.00037187 BTC | -0.00 USD -0.00000000 BTC | 21.0930 USD 0.00037187 BTC | |

Profit from a single GPU for one day = 0.7031

Profit from 1 year from a single GPU = 0.7031 X 365 = 256.6315 USD

Number of GPUs in one server = 8

Profit from 1 year from a single server = 256.6315 X 8 = 2053.052 USD

Profit from 5 years from a single server = 2053.052 X 5 = 10,265.26 USD

Profit from 5 years from 145 servers = 10,265.26 X 145 = 1,488,462.7 USD

Total Profit made including expenses = 1,488,462.7 - 9,655,728.69 = -8167265.99 USD

| | Description | Price per Item | Quantity | Total Price |
|-------------------------|--------------------|----------------|------------|--------------|
| Compute Servers | Refer Above | 32,018.00 | 145 | 4,642,610 |
| Network Switches | Refer Above | 129.99 | 8 | 1,039.92 |
| Network Cables | Refer Above | 19.99 | 154 | 3,078.46 |
| Rack | Refer Above | 274.99 | 15 | 4,124.85 |
| Storage Servers | Refer Above | N/A | N/A | N/A |
| Electric Power | Refer Above | 796.99 | 2,454 | 1,889,555.46 |
| Cooling | Refer Above | | | 2,650,320 |
| Administration | Refer Above | | | 465,000 |
| TOTAL | | | | 9,655,728.69 |

Public Cloud Config and cost:

Number of instances
Please specify the total number of Instances that you need each month.

189

EC2 Instances (1)
Based on your inputs, this is the lowest-cost EC2 instance: **p3.2xlarge**
Chosen instance: **p3.2xlarge** | Family: **p3** | 8vCPU | 61 GiB Memory

Search instance type

X

| Instance family Info | vCPUs | Memory (GiB) | Network performance |
|--------------------------------------|-----------|------------------|-------------------------|
| Any Instance family | Any vCPUs | Any Memory (GiB) | Any Network Performance |

Show only current generation instances.

1

| Instance name | vCPUs | Memory | Network Performance | Storage | On-Demand Hourly Cost | CurrentGenera |
|---------------|-------|--------|---------------------|----------|-----------------------|---------------|
| p3.2xlarge | 8 | 61 GiB | Up to 10 Gigabit | EBS only | 3.06 | Yes |

● Spot Instances
Minimize cost by leveraging EC2's spare capacity. Recommended for fault tolerant and interruption tolerant applications. [Learn more](#)

The historical average discount for p3.2xlarge is 61%

Assume percentage discount for my estimate
61

Actual spot instance pricing varies
With spot instances, you pay the spot price that's in effect for the time period your instance is running

Instance: 3.06/Hour
Monthly:

▼ Show calculations

Unit conversions

Spot discount: $61/100 = 0.61$

Pricing calculations

189 instances x 3.06 USD On Demand hourly cost x 730 hours in a month = 422188.200000 USD

422188.200000 USD - (422188.200000 USD x 0.61) = 164653.398000 USD

Spot instances (monthly): 164653.398000 USD

Cost of spotting 189 instances for 1 month = 164,653.398 USD

▼ Amazon Elastic Block Store (EBS) - optional [Info](#)



Calculating EBS snapshots

[Learn more](#) on how EBS snapshot prices are calculated.

Storage for each EC2 instance
Choose EBS volume storage type.

General Purpose SSD (gp2)

Storage amount

100

Unit

GB

Snapshot Frequency

No snapshot storage

▼ Show calculations

137,970 total EC2 hours / 730 hours in a month = 189.00 instance months

100 GB x 189.00 instance months x 0.10 USD = 1,890.00 USD (EBS Storage Cost)

EBS Storage Cost: 1,890.00 USD

Amazon Elastic Block Store (EBS) total cost (monthly): 1,890.00 USD

Total cost of spotting 189 instances for 1 month (including EBS) = 166,543.40

COST OF SPOTTING 189 INSTANCES FOR 5 YEARS=166,543.40 X 60 = 9,992,604 USD

Under the budget of 10 M

Instance Specs:

Instance Details

| Compute | Value |
|----------------------------|-----------------------------------|
| vCPUs | 8 |
| Memory (GiB) | 61.0 |
| Memory per vCPU (GiB) | 7.62 |
| Physical Processor | Intel Xeon E5-2686 v4 (Broadwell) |
| Clock Speed (GHz) | 2.3 |
| CPU Architecture | x86_64 |
| GPU | 1 |
| GPU Architecture | nvidia tesla v100 |
| Video Memory (GiB) | 16 |
| GPU Compute Capability (?) | 7.0 |
| FPGA | 0 |

GPU architecture = Nvidia tesla v100

[Hash rate for mining Raven Coin for this GPU](#) = 48.15 MH/s

Using the Raven Coin Calculator to Calculate monthly gain.

| Hashrate | Power consumption | | Pool fee | | Currency | Electricity costs | | | |
|---------------------|-------------------|--------------------|----------|-------------------------------|----------|------------------------------|------|--------------------------------------|-----------|
| 48.15 | MH/s | 0 | W | 0 | % | USD | 0.15 | USD/kWh | Calculate |
| PERIOD | | EST. REWARD | | EST. INCOME | | COSTS | | EST. PROFIT | |
| Last 1h | | 1.41893847 RVN | | 0.0367 USD 0.00000067 BTC | | -0.00 USD -0.00000000 BTC | | 0.0367 USD 0.00000067 BTC | |
| Last 24h | | 34.94922242 RVN | | 0.8897 USD 0.00001630 BTC | | -0.00 USD -0.00000000 BTC | | 0.8897 USD 0.00001630 BTC | |
| Last 7 days | | 259.58410629 RVN | | 6.0167 USD 0.00011023 BTC | | -0.00 USD -0.00000000 BTC | | 6.0167 USD 0.00011023 BTC | |
| Current daily | | 34.92862662 RVN | | 0.9045 USD 0.00001657 BTC | | -0.00 USD -0.00000000 BTC | | 0.9045 USD 0.00001657 BTC | |
| Current for 7 days | | 244.50038633 RVN | | 6.3318 USD 0.00011600 BTC | | -0.00 USD -0.00000000 BTC | | 6.3318 USD 0.00011600 BTC | |
| Current for 30 days | | 1047.85879858 RVN | | 27.1362 USD 0.00049713 BTC | | -0.00 USD -0.00000000 BTC | | 27.1362 USD 0.00049713 BTC | |

Monthly Gain in USD from mining raven coin for 1 of the above instance = 27.1362 USD
 Gain in USD over a 5-year period for 1 of the above instance = 27.1362 X 60
 = 1628.172 USD

GAIN IN USD OVER A 5 YEAR PERIOD FOR 189 OF THE ABOVE INSTANCE = 1628.172 X 189 = 307,724.508 USD

TOTAL PROFIT OVER 5 YEARS = 307,724.508 - 9,992,604 = -9684879.492 USD

TABLES

| | Configuration 1 | Configuration 2 |
|---|------------------------|-----------------------|
| Public Cloud (including EC2 and S3) Cost over 5 years | 490,383,114 USD | 16,540,800 USD |
| Private Cloud cost over 5 years | 85,817,207.88 USD | 4,602,287.98 USD |

| | |
|--|------------------|
| | Configuration 3 |
| Public Cloud Mining Profit over 5 years | -9684879.492 USD |
| Private Cloud Mining Profit over 5 years | -8167265.99 USD |

Rent from Amazon or Buy Private?

Config 1

In this case, renting resources from the public cloud over a five-year period is substantially more expensive than purchasing a private cloud infrastructure, by about \$404.57 million.

Config 2

In this case, renting resources from the public cloud over a five-year period is substantially more expensive than purchasing a private cloud infrastructure, by about \$11.94 million.

Config 3

In this particular scenario, during a five-year period, both the public and private cloud mining endeavors incur losses. But if I had to pick one, I would go with the private venture because the loss was almost \$1,517,613.502 USD less.