Assignment - 3

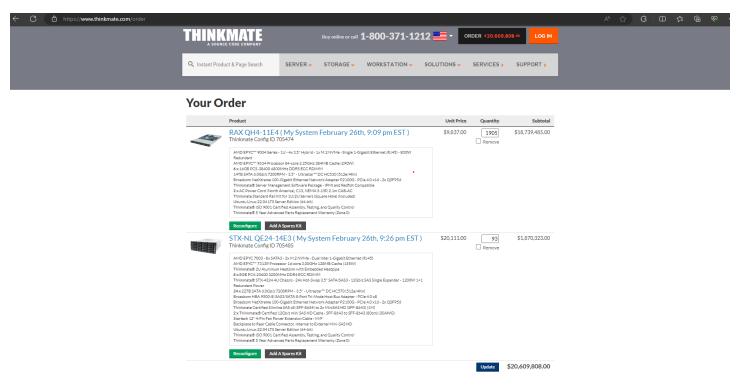
Name: - Pranav Murali

CWID: - A20555824

Configuration 1: Hadoop/Spark Cluster with 160K-cores, 128TB memory, 24PB HDD, and 100Gb/s Ethernet Fat-Tree network (each VM should be equivalent to the d3.8xlarge instance); in addition to the compute resources, a 48PB distributed storage shared across the entire cloud should be procured, with the expectation that 48PB of data will be read and written to S3 every year from outside of Amazon with enough capacity for 1GB/sec throughput (for pricing comparison, see S3 Standard). For EC2, you must use the reserved instance pricing with a standard 5-year term.

Private Cloud:-

Compute server and Storage Server



Switches

Cart



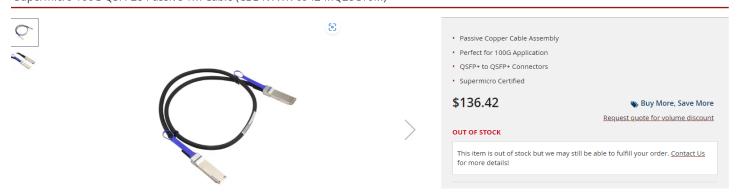
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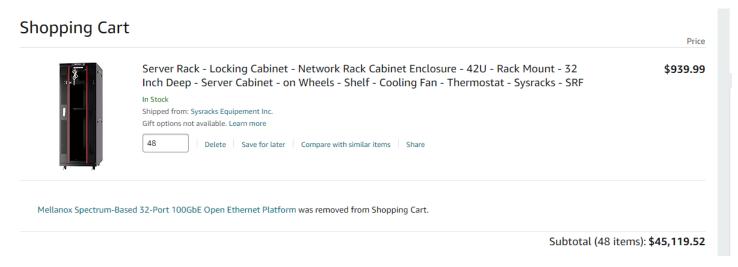


Cables

Supermicro 100G QSFP28 Passive 1m Cable (CBL-NTWK-0942-MQ28C10M)



Racks



Total cores = 84*1905 = 160,020 cores

Power consumption for 1 server = 486.4 Watts/hr

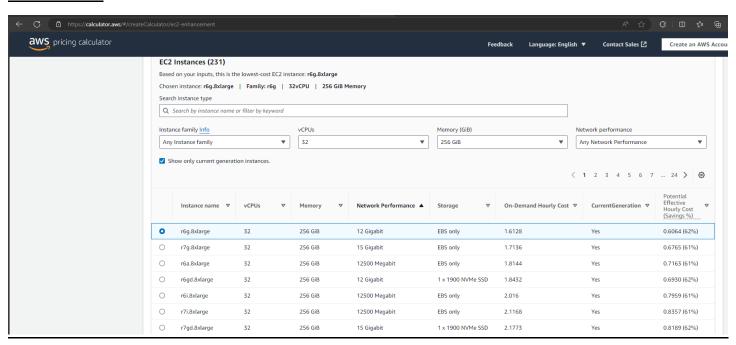
Cost per hour for 1905 servers = 138.98 USD (assuming rate = 0.15 kWh) For 5 years 138.98*24*365*5= 6,087,324.00

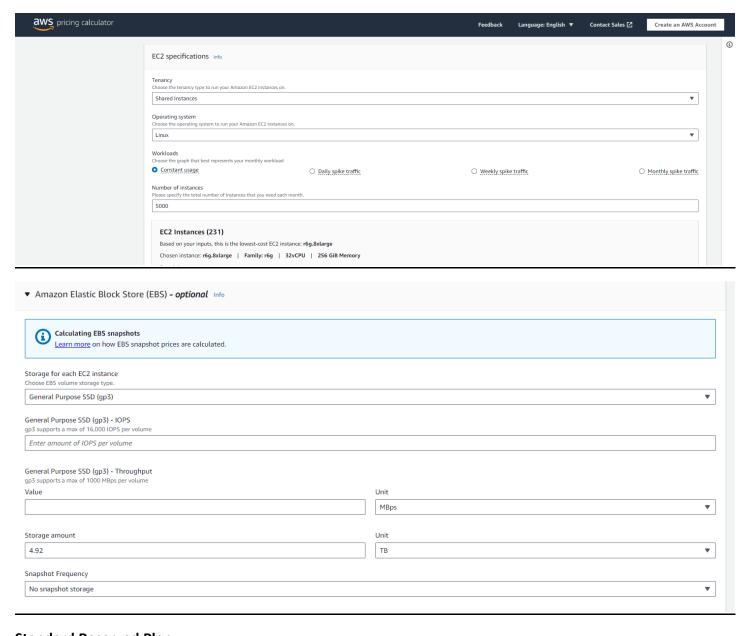
JBOD storage – 1 unit power consumption = 150.0 Watts/hr

Cost per hour for 93 JBOD = 2.09 USD For 5 years 2.09*24*365*5= 91,542.00

	Description	Price per item	Quantity	Total Price (5 years)
Computer Servers	RAX QH4-11E4	\$ 9837.00	1905	\$ 18,739,485.00
Network Switches	Mellanox MSN4600-CS2FC Spectrum-3 Ethernet Switch, 64 x 100 Gigabit Ethernet Expansion Slot, 100GBase-X, Rail-mountable, Rack-mountable	\$ 25,046.49	30	\$751,394.70
	Mellanox Spectrum-Based 32-Port 100GbE Open Ethernet Platform	\$ 4,560.00	3	\$13,680.00
Network cables	Supermicro 100G QSFP28 Passive 1m Cable (CBL-NTWK-0942-MQ28C10M)	\$ 136.42	2333	\$ 318,267.86
Racks	Server Rack - Locking Cabinet - Network Rack Cabinet Enclosure - 42U - Rack Mount - 32 Inch Deep - Server Cabinet - on Wheels - Shelf - Cooling Fan - Thermostat - Sy racks - SRF	\$ 939.99	48	\$ 45,119.52
Storage Servers	STX-NL QE24-14E3	\$ 20,111.00	93	\$ 1,870,323.00
Electric Power				\$ 6,178,566.00
Cooling				\$ 6,178,566.00
Administration	Require 1 admin for each 1000 servers	\$ 100,000.00	2	\$ 200,000.00
Total				\$ 34,296,001.00

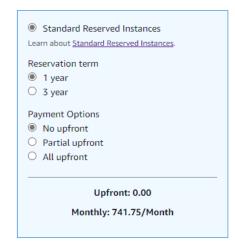
Public Cloud: -

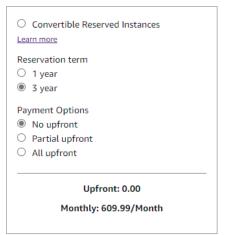




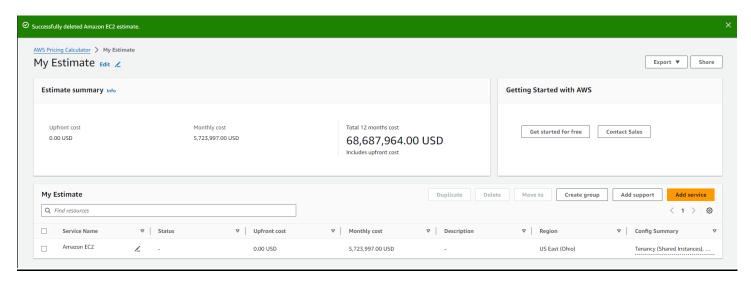
Standard Reserved Plan

▼ Other purchasing options

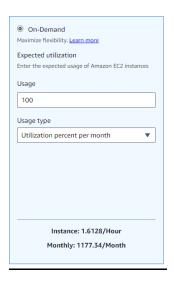




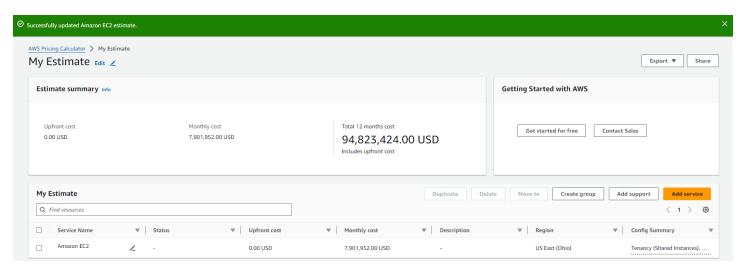
EC2 Instance



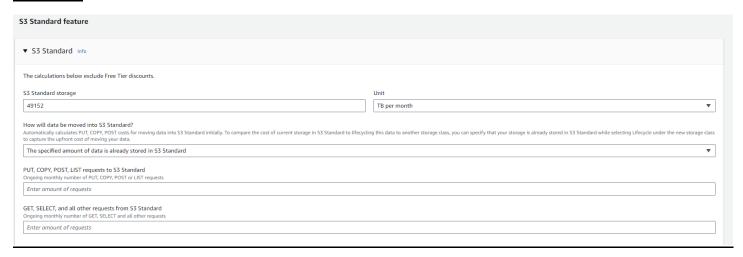
On-Demand Plan

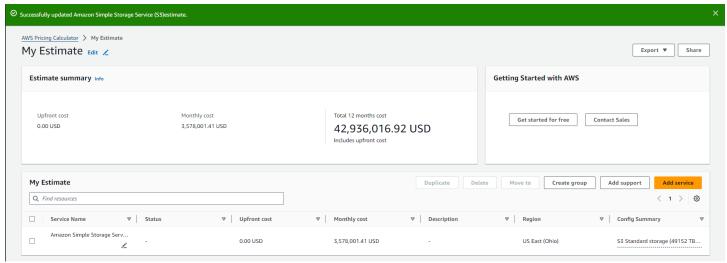


EC 2 Instance



S3 Storage





S3 Storage for 1 year = \$ 42,936,016.92

S3 Storage for 5 years = \$ 214,680,084.00

Standard Reserved Cost for 1 year= \$ 68,687,964.00

Standard Reserved Cost for 5 years = \$ 343,439,824.00

On-Demand Cost for 1 year = \$ 94,823,424.00

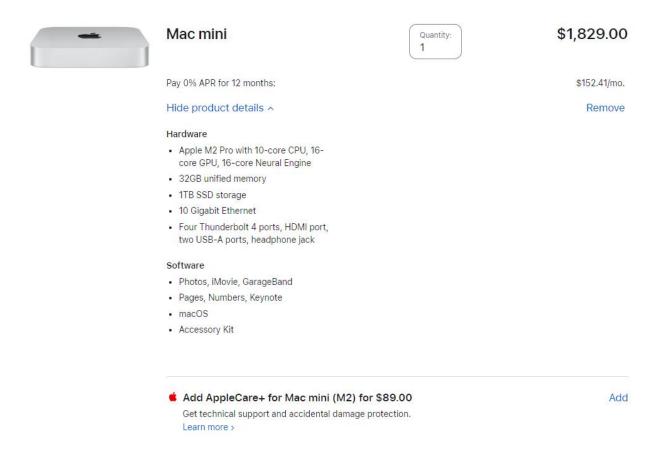
On-Demand Cost for 5 years = \$ 474,117,120

Conclusion

Public Cloud for 5 Years	
Standard Reserved cost	\$ 558,119,908.00
On-Demand cost	\$ 688,797,204.00
Private Cloud for 5 Years	\$ 34,296,001.00

Configuration 2: Support 1K application developers who are designing MacOS and iPad OS applications. They require a MacOS system with 6 cores (3GHz), 32GB RAM, 1TB storage, and a 10Gb/s network (Amazon has mac1.metal instances that have everything you need except the 1TB storage, which you can provision through EBS). The developers work 40 hours/week, 48 weeks/year (they get 4 weeks of vacation per year). You must use on-demand EC2 pricing as developers are expected to provision their systems at the beginning of each working day, and release their systems at the end of each working day.

Private Cloud:-



For 1000 developers 1829*1000 = \$ 1,829,000.00

The maximum power consumption for each Mac is 185 Watt/hr

For 1000 developers the power consumption is 185 kw/hr

The developers work 40 hours a week and 48 weeks a year = 40*48*185= 355,200 kw/hr

Assuming 0.15 USD per kilowatt = \$ 53,280.00

A mini mac will be ideal for a long time. When it is in ideal state it consumes 7 watt/hr, so for 1000 Macs it is 7kw/hr

The total ideal hours where the developers wont be working is 6840 hours = 6840*7= 47,880 kw/hr

The total amount of \$ 60,462 for 1 year

For 5 years it is \$ 302,310

Switches

Cart



Cables

Shopping Cart



Subtotal (1 item): \$11.95

Racks

Shopping Cart

Price Server Rack - Locking Cabinet - Network Rack Cabinet Enclosure - 42U - Rack Mount - 32 \$939.99 Inch Deep - Server Cabinet - on Wheels - Shelf - Cooling Fan - Thermostat - Sysracks - SRF In Stock Shipped from: Sysracks Equipement Inc. Gift options not available. Learn more 48 Delete Save for later Compare with similar items Share Mellanox Spectrum-Based 32-Port 100GbE Open Ethernet Platform was removed from Shopping Cart. Subtotal (48 items): \$45,119.52

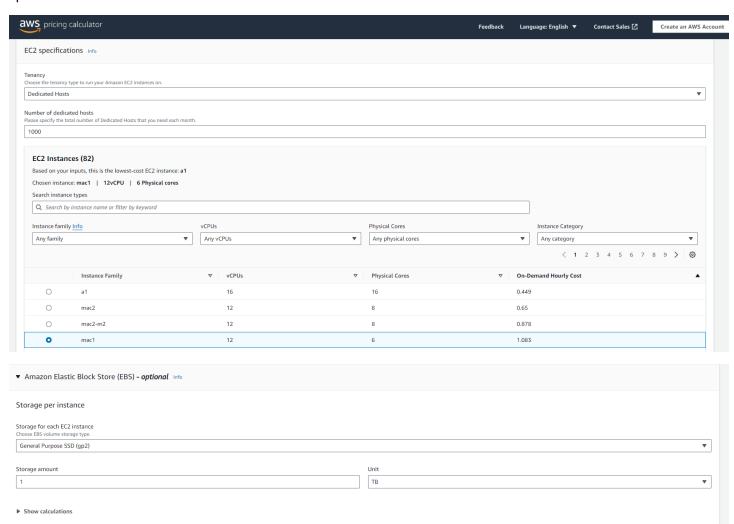
	Description	Price per item	Quantity	Total Price (5 years)
Computer Servers	Mac mini	\$ 1829.00	1000	\$ 1,829,000.00
Network Switches	Mellanox MSN4600-CS2FC Spectrum-3 Ethernet Switch, 64 x 100 Gigabit Ethernet Expansion Slot, 100GBase-X, Rail-mountable, Rack-mountable	\$ 25,046.49	16	\$ 400,743.84
Network cables	FiberCablesDirect - 1M OM3 LC LC Fiber Patch Cable 10Gb Duplex 50/125 LC to LC Multimode Jumper 1 Meter (3.28ft) Length	\$ 11.95	1050	\$ 12,547.5

	Options: 0.5M-300M 1g 10g 40g dplx mmf 10gbase sfp+ Aqua ofnr lommf lc-lc			
Racks	Server Rack - Locking Cabinet - Network Rack Cabinet Enclosure - 42U - Rack Mount - 32 Inch Deep - Server Cabinet - on Wheels - Shelf - Cooling Fan - Thermostat - Sy racks - SRF	\$ 939.99	21	\$ 19,739.79
Storage Servers	N/A			
Electric Power				\$ 60,462.00
Cooling				\$ 60,462.00
Administration	Require 1 admin for each 500 mac	\$ 200,000.00	2	\$ 400,000.00
Total				\$ 2,782,953.00

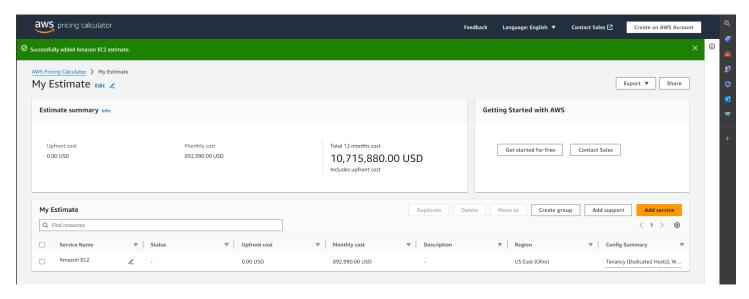
For 5 years the total amount will be \$ 3,266,649.00

Public Cloud

Specifications



EC2 Instance



This is the total cost for 1 year with continuous work.



As the configuration states that there are 1000 developers working 40 hours a week and 48 weeks a year, we can calculate = 40*48*1.083 = 779.76*1000 = \$779760

For every one person using this instance over a week will be charged around 43.32 \$

For a single person using this instance for a whole year will be \$ 2079.36

The team of thousand developers working on it for 5 years will be charged \$ 10,396,800 just for the compute instance

For storage of 1TB we will be considering the General Purpose SSD (gp3) - Storage EBS from AWS

This storage costs around \$ 0.08 GB / Month

This storage will be charged \$ 983,040.00 for 1000 developers for one year

Over a tenure of 5 years the total charge for the above-listed storage will be \$4,915,200.00

The combined cost of these cloud instances and storage will be \$ 15,312,000.00

Private Cloud for 5 years	\$ 3,266,649.00
Public Cloud for 5 years	\$ 15,312,000.00

Configuration 3: Ethereum crypto currency mining; you have an investor who has \$10M to buy hardware 2 | CS553 H W 4 to mine Raven Coin RVN (and pay for maintance / sys admin, power, and cooling), or rent resources from Amazon EC2 to mine Raven Coin. Configure the best hardware you can from ThinkMate. For buying hardware solution, make sure to leave funds to pay for power, cooling, and system administrator. Raven Coin mining can be done on any compute hardware (CPUs or GPUs), but you will likely find that its most profitable to mine using GPUs. Since Ethereum mining is compute intensive, your processor, memory, hard drive, and network requirements are minimal (4-cores, 8GB RAM, 100GB HDD, and 1Gb/sec network). Identify the best Amazon instance (you must use Spot Instances to make sure you get the best hardware for the cheapest price); although spot pricing fluctuates over time, you can assume the spot price will remain fixed for the duration of your evaluation. For the purchase of the hardware scenario, you are free to locate the hardware in any state in the USA (for a full list of average electricity cost by state, see

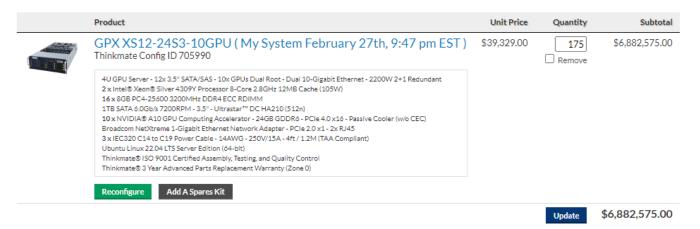
https://www.chooseenergy.com/electricity-rates-by-state/); since this will be a business venture, use the business electricity rates. If electricity is too expensive to make a profit, invest part of the \$1M in solar power (solar panels), and estimate the amount of energy you can extract. For an overview of various GPUs and their respective hash rates (the higher the hash rates, the more Raven Coin that can be mined), see https://whattomine.com (Kapow); this online resource has an even more exhaustive list of GPUs and their hash rate;

https://www.betterhash.net/mining/gpu/?page=1. Once you have a hashrate, you can estimate how much money can be made mining Ethereum by using an online caluclator such as

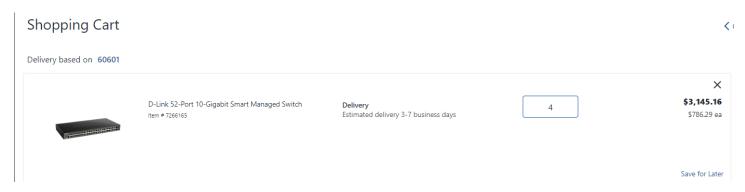
https://www.cryptocompare.com/mining/calculator/eth?HashingPower=0&HashingUnit=M H%2Fs&Powe rConsumption=0&CostPerkWh=0&MiningPoolFee=1. The mining calculator gives an instantanous mining number, although in reality the amount of coin that can be mined would vary based on many factors (hash rate, hash difficulty, fees, etc). The profit similarly can vary based on the Raven Coin pricing, which can vary wildly. When computing the mining coins and expected profit, you can use the caluclator above to compute it for a 5 year period, assuming the mining continues at the same rate, and the price remains at the same level. Your task is to compute the amount of profit that is expected after \$10M is invested in buying hardware and running it for 5-years, vs. renting the hardware from Amazon. Its possible that the profits you make will be less than the original investment (especially with the Amazon scenario).

Private Cloud

Your Order

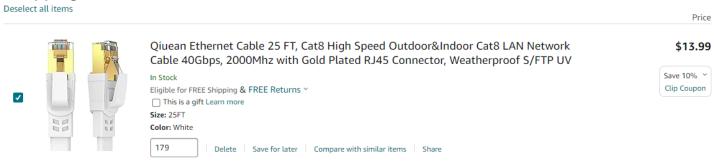


Switches



Cables

Shopping Cart



Subtotal (179 items): \$2,504.21

Racks

Shopping Cart

Deselect all items Price



Sysracks - Server Rack - Locking Cabinet - Network Rack - Av Cabinet - 42 U - Rack Mount - Free Standing Network Rack- Server Cabinet - Caster Leveler - Rack Shelf - C... In Stock

Shipped from: Sysracks Equipement Inc. Gift options not available. Learn more

Delete Save for later Compare with similar items Share

Qiuean Ethernet Cable 25 FT, Cat8 High Speed Outdoor&Indoor Cat8... was removed from Shopping Cart.

Subtotal (5 items): \$4,799.95

\$959.99

	Description	Price per item	Quantity	Total Price (5 years)
Computer Servers	GPX XS12-24S3-10GPU	\$ 35,334.00	175	\$ 6,882,572.00
Network Switches	D-Link 52-Port 10-Gigabit Smart Managed Switch	\$ 786.29	4	\$ 3,145.16
Network cables	Qiuean Ethernet Cable 25 FT, Cat8 High Speed Outdoor&Indoor Cat8 LAN Network Cable 40Gbps, 2000Mhz with Gold Plated RJ45 Connector, Weatherproof S/FTP UV Resistant for Router/Gaming/Modem (25)	\$ 13.99	179	\$ 2,504.21
Racks	Sysracks - Server Rack - Locking Cabinet - Network Rack - Av Cabinet - 42 U - Rack Mount - Free Standing Network Rack- Server Cabinet - Caster Leveler - Rack Shelf	\$ 959.99	5	\$ 4,799.95
Storage Servers	N/A			
Electric Power	Chicago – \$ 0.063 kw/hr			\$ 1,346,601.00
Cooling				\$ 1,346,601.00
Administration	Require 1 admin for each 100 servers	\$ 100,000.00	2	\$ 200,000.00
Total				\$ 9,633,100.16

Total power consumption of 1 server = 2788.6 w/hr

Cost of Total power consumption for 1 year = \$1538.97

Total cost for 5 years = \$ 7694.86

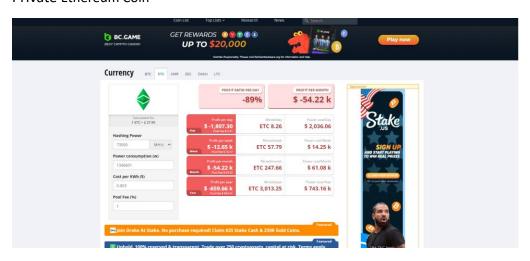
Total cost for 5 years with cooling = \$ 15,389.72

Total for 175 servers = \$ 1,346,601

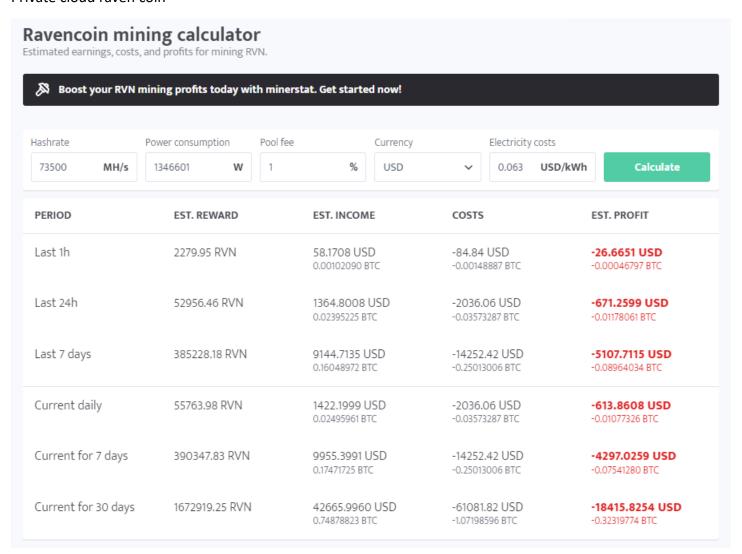
Total for 175 servers with cooling = \$ 2,693,201

Total hash rate for 175 machines with 10 gpu = 73500

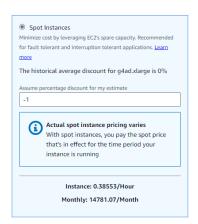
Private Ethereum Coin

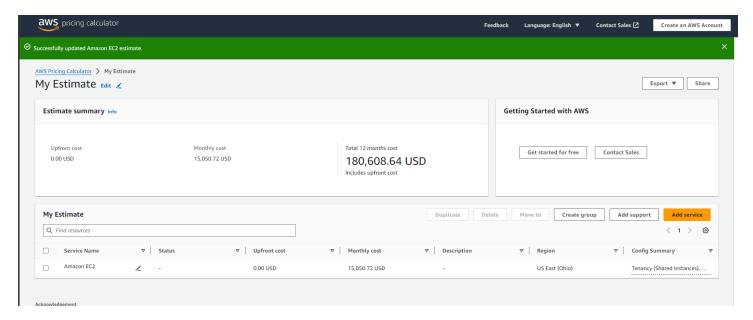


Private cloud raven coin



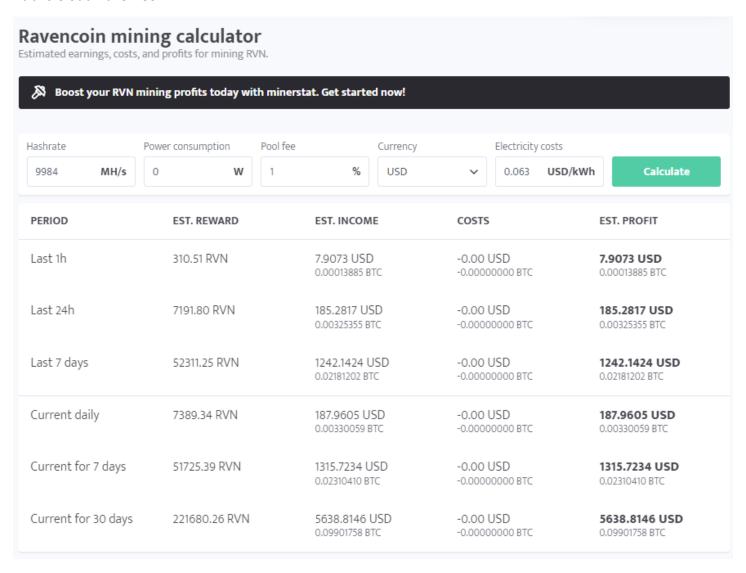
Public Cloud

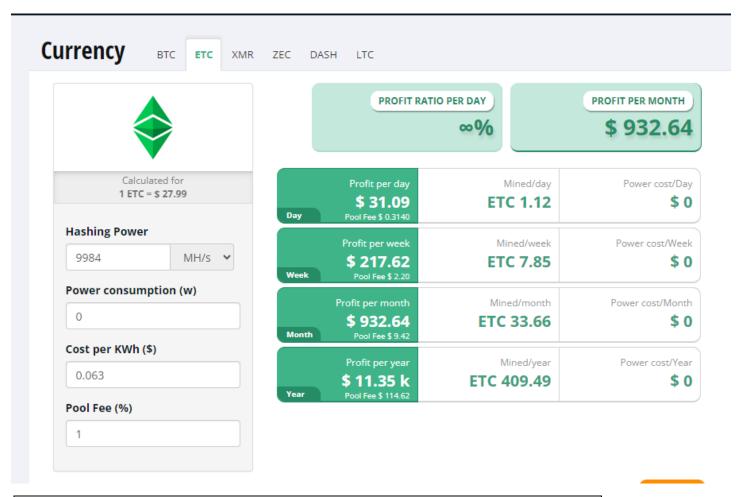




AWS total hash rate for 52 machines each with 4 GPUs - 9,984

Public Cloud Raven Coin





Private Cloud - 175 instances for 5 year	\$ 9,633,100.16
Etherium profit for 5 year	\$ -3,298,300.00
Raven coin profit for 5 year	\$ -1,104,900.00
AWS - 52 systems 1 year investment	\$ 180,608.64
AWS - 52 systems 5 year investment	\$ 903,040.00
Etherium profit for 5 year	\$ 56,750.00
Raven coin profit for 5 year	\$ 338,280.00

Conclusion: -

In the context of the initial setup tailored for Hadoop and Spark use cases, opting for a private cloud infrastructure proves advantageous over a 5-year period. This choice promises a more economical initial investment coupled with favorable returns.

Considering the second configuration, the utilization of a private cloud not only ensures enhanced performance but also allows for further optimization through the incorporation of superior servers. Conversely, deploying instances in a public cloud would incur substantial costs.

Examining the third configuration, investing in mining rigs during a bear market appears financially unfavorable. However, embracing a public cloud-based solution becomes a prudent choice as it mitigates losses, especially when compared to the higher operational costs associated with a private cloud, even in a region like Louisiana with relatively low power consumption rates at 0.063\$/kWh.

	Public Cloud		Private Cloud	
Configuration 1	Shared - \$ 558,119,908.00		\$ 34,296,001.00	
	On-demand - \$ 688,797,204.00			
Configuration 2	\$ 15,312,000.00		\$ 3,266,649.00	
Configuration 3	\$ 180,608.64	Profit	\$ 9,633,100.16	Profit
Etherium		\$ 56,750.00		\$ -3,298,300.00
Raven		\$ 338,280.00		\$ -1,104,900.00