CS553 Cloud computing - Homework 3

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Configuration 1

160k core cpu requires 5000 d3.8xlarge instances and 128TB memory requires 500 d3.8xlarge instances. Because of this difference, I assumed we needed 500 instances not 5000, thus 16k cores.

AWS

EC2:

For EC2 instance, there was no 5 year reservation option, so I calculated the price for 5 year using the rates of 3 year reservation.

▼ **Other purchasing options**

Standard Reserved Instances

Learn about Standard Reserved Instances.

Reservation term

- 1 year
- 3 year

Payment Options

- No upfront
- Partial upfront
- All upfront

Upfront: 0.00

Monthly: 1260.02/Month

Estimate date: February 27, 2024

Estimate summary Info

Upfront cost	Monthly cost	Total 12 months cost
0.00 USD	630,011.90 USD	7,560,142.80 USD Includes upfront cost

Getting Started with AWS

Get started for free

Contact Sales

My Estimate

Duplicate | Delete | Move to | Create group | Add support | Add service

Find resources

1

Service Name	Status	Upfront cost	Monthly cost	Description	Region	Config Summary
Amazon EC2	-	0.00 USD	630,011.90 USD	-	US East (Ohio)	Tenancy (Shared Ins...

S3

The calculations below exclude Free Tier discounts.

S3 Standard storage

48000

Unit

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 lifecycling 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.

PUT, COPY, POST requests to S3 Standard

S3 Standard Average Object Size

Used to calculate number of objects which affects cost of moving data into S3 Standard. You can find the average object size of your existing S3 data using S3 Storage Lens in the S3 Console.

Value

16

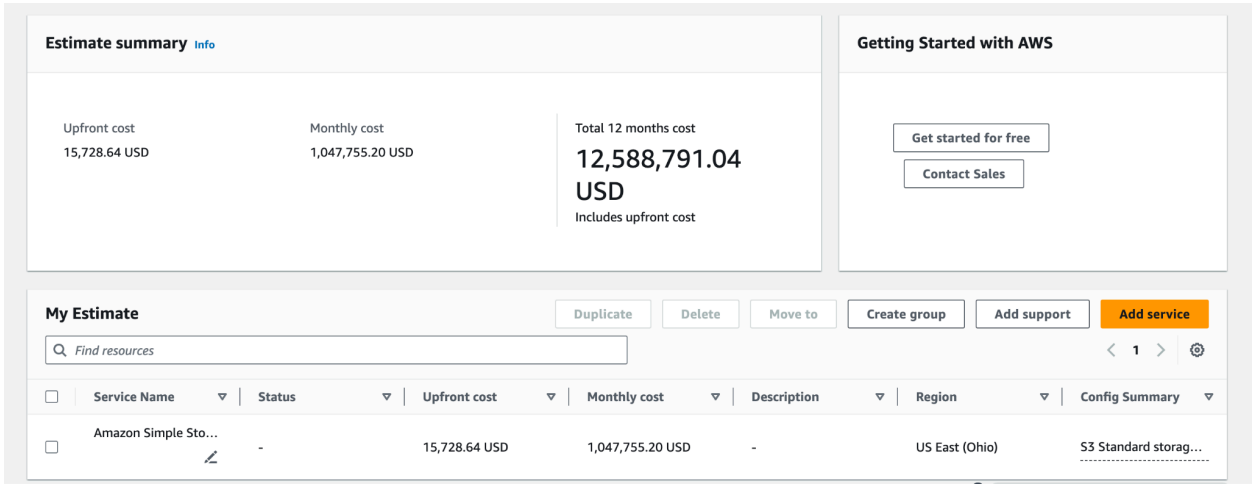
Unit

MB

PUT, COPY, POST, LIST requests to S3 Standard

Ongoing monthly number of PUT, COPY, POST or LIST requests

3000000000



Private Cloud

Server

THINKMATE

READY TO BUY?
1-800-371-1212

RAX XS4-21S1-10G

My System February 26th, 9:39 pm EST

Thinkmate Config ID 705513

Configured Price: **$10,503.71**

Selection Summary	
Motherboard	Intel® C621 Chipset - 14x SATA3 - 1x M.2 NVMe - Dual Intel® 1-Gigabit Ethernet (RJ45)
Processor	2 x Intel® Xeon® Gold 6242 Processor 16-Core 2.8GHz 22MB Cache (150W)
Memory	4 x 64GB PC4-25600 3200MHz DDR4 ECC RDIMM
Chassis	Thinkmate® RAX-1304 1U Chassis - 4x Hot-Swap 3.5" SATA/SAS3 - 750W 1+1 Redundant Power
Hard Drive	1TB SATA 6.0Gb/s 7200RPM - 3.5" - Ultrastar™ DC HA210 (512n)
Network Adapter	Broadcom NetXtreme 1-Gigabit Ethernet Network Adapter - PCIe 2.0 x1 - 2x RJ45
Server Management	Thinkmate® Update Manager (OOB Management Package)
Cables	AC Power Cord (North America), C13, NEMA 5-15P, 2.1m CAB-AC
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
Operating System	No Operating System
Warranty	Thinkmate® 3 Year Advanced Parts Replacement Warranty (Zone 0)

Tech Specs	
Motherboard	
North Bridge	Intel C621
Memory Technology	DDR4 ECC Registered
Memory Slots	12x 288-pin DIMM sockets
Expansion Slots	1x PCI-E 3.0 x32 Left Riser Slot PCI-E 3.0 x16 Right Riser Slot 1x PCI-E 3.0 x16 for Add-On-Module (AOM)
Graphics Controller	Aspeed AST2500 BMC
Network Controller(s)	Dual LAN with GbE from C621
On-Board Interfaces	Intel® C621 controller for 14 SATA3 (6 Gbps) ports; RAID 0,1,5,10
USB 3.0 Ports	6x USB 3.0 ports (4 rear + 2 via headers)
VGA Ports	1x VGA port
Processor	
Product Line	Xeon Scalable 2nd Gen
Socket	LGA3647
Clock Speed	2.80 GHz
Cores/Threads	16C / 32T
Intel Virtualization Technology	Yes
Intel Hyper-Threading	Yes

TDP Wattage	150W
Memory	
Technology	DDR4
Type	288-pin DIMM
Capacity	4 x 64 GB
Speed	3200 MHz
Error Checking	ECC
Signal Processing	Registered
Chassis	
Form Factor	1U Rackmount
Color	Black
Watts	750W
External Drive Bays	4x 3.5" Hot swap SAS/SATA
Cooling Fans	4 x 40x56mm counter-rotation PWM fans
Dimensions (WxHxD)	25.6" (650mm) x 17.2" (437mm) x 1.7" (43mm)
AC Input	700W with Input 100 - 140Vac 750W with Input 200 - 240Vac
Hard Drive	
Storage Capacity	1TB
Interface	6.0Gb/s Serial ATA
Rotational Speed	7,200RPM
Cache	128MB
Format	512n
Network Adapter	
Speed	1Gb Ethernet
Connector	RJ45
Interface	PCI Express 2.1 x1
Cable Medium	Copper

Quotation Date: February 27th, 2024, 12:19 AM EST. All prices subject to change.

Configured Price: **$10,503.71**

READY TO BUY?
1-800-371-1212

CONFIGURATION ID
705513

THINKMATE

Storage

THINKMATE

READY TO BUY?
1-800-371-1212

RAX XS4-21S1-10G

My System February 27th, 12:41 am EST

Thinkmate Config ID 705515

Configured Price: **$10,503.71**

Selection Summary	
Motherboard	Intel® C621 Chipset - 14x SATA3 - 1x M.2 NVMe - Dual Intel® 1-Gigabit Ethernet (RJ45)
Processor	2 x Intel® Xeon® Gold 6242 Processor 16-Core 2.8GHz 22MB Cache (150W)
Memory	4 x 64GB PC4-25600 3200MHz DDR4 ECC RDIMM
Chassis	Thinkmate® RAX-1304 1U Chassis - 4x Hot-Swap 3.5" SATA/SAS3 - 750W 1+1 Redundant Power
Hard Drive	1TB SATA 6.0Gb/s 7200RPM - 3.5" - Ultrastar™ DC HA210 (512n)
Network Adapter	Broadcom NetXtreme 1-Gigabit Ethernet Network Adapter - PCIe 2.0 x1 - 2x RJ45
Server Management	Thinkmate® Update Manager (OOB Management Package)
Cables	AC Power Cord (North America), C13, NEMA 5-15P, 2.1m CAB-AC
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
Operating System	No Operating System
Warranty	Thinkmate® 3 Year Advanced Parts Replacement Warranty (Zone 0)

Tech Specs	
Motherboard	
North Bridge	Intel C621
Memory Technology	DDR4 ECC Registered
Memory Slots	12x 288-pin DIMM sockets
Expansion Slots	1x PCI-E 3.0 x32 Left Riser Slot PCI-E 3.0 x16 Right Riser Slot 1x PCI-E 3.0 x16 for Add-On-Module (AOM)
Graphics Controller	Aspeed AST2500 BMC
Network Controller(s)	Dual LAN with GbE from C621
On-Board Interfaces	Intel® C621 controller for 14 SATA3 (6 Gbps) ports; RAID 0,1,5,10
USB 3.0 Ports	6x USB 3.0 ports (4 rear + 2 via headers)
VGA Ports	1x VGA port
Processor	
Product Line	Xeon Scalable 2nd Gen
Socket	LGA3647
Clock Speed	2.80 GHz
Cores/Threads	16C / 32T
Intel Virtualization Technology	Yes
Intel Hyper-Threading	Yes

TDP Wattage	150W
Memory	
Technology	DDR4
Type	288-pin DIMM
Capacity	4 x 64 GB
Speed	3200 MHz
Error Checking	ECC
Signal Processing	Registered
Chassis	
Form Factor	1U Rackmount
Color	Black
Watts	750W
External Drive Bays	4x 3.5" Hot swap SAS/SATA
Cooling Fans	4 x 40x56mm counter-rotation PWM fans
Dimensions (WxHxD)	25.6" (650mm) x 17.2" (437mm) x 1.7" (43mm)
AC Input	700W with Input 100 - 140Vac 750W with Input 200 - 240Vac
Hard Drive	
Storage Capacity	1TB
Interface	6.0Gb/s Serial ATA
Rotational Speed	7,200RPM
Cache	128MB
Format	512n
Network Adapter	
Speed	1Gb Ethernet
Connector	RJ45
Interface	PCI Express 2.1 x1
Cable Medium	Copper

Quotation Date: February 27th, 2024, 12:54 PM EST. All prices subject to change.

Configured Price: **$10,503.71**

READY TO BUY?
1-800-371-1212

CONFIGURATION ID
705515

THINKMATE

Network

For network topology, I used 4 level3 high-performance switches with 12 downlink ports that are connected to lower level switches each can transfer up to 10Gbps and 3 uplink ports with 100Gbps connected to the internet. For lower level switches that connect to the servers, I used 48 downlink ports each 1Gbps and 4 uplink ports with 10Gbps achieving a total of 400Gbps upstream.

Electric Power

I calculated the electric consumption as the worst case scenario, meaning all the hardware to work on full power. I used a rate of 11.94 cents/kWh in Illinois https://www.eia.gov/electricity/state/.

Component	Rated power consumption	Quantity	hourly	5 years

RAX XS4-21S1-10G	750Wx2	500	$89.55	$3,922,290.00
QuickShip SuperStorage Server 6049P-E1CR36L	1200Wx2	303	$86.83	$3,803,154.00
Catalyst 9200L 48-port PoE+ 4x10G uplink Switch, Network Essentials	125W	11	$0.16	$7,008.00
Dell Networking S4112T, 12 x 10GBaseT, 3 x 100GbE QSFP28, IO to fan, 2 x AC PSU, OS10	180W	4	$0.09	$3,942.00
Rack Mount Fan - 4 Fans Server Cooling System - 1U	24W	11	$0.03	$1,314.00
Total				$7,737,708.00

Total cost

	Description	Price per Item	Quantity	Total Price
Compute Servers	RAX XS4-21S1-10G	$10,503.71	500	$5,251,855.00
Network Switches	Catalyst 9200L 48-port PoE+ 4x10G uplink Switch, Network Essentials	$2,995.00	11	$32,945.00
	Dell Networking S4112T, 12 x 10GBaseT, 3 x 100GbE QSFP28, IO to fan, 2 x AC PSU, OS10	$6,916.00	4	$27,664.00
Network Cables	C9200-STACK-KIT=	$456.00	11	$5,016.00
Racks	48U 151SW Data Center Rack 600mm x 1200mm	$1,700.00	11	$18,700.00
Storage Servers	QuickShip SuperStorage Server 6049P-E1CR36L	$25,656.71	303	$7,773,983.13
Electric Power	Refer to above table	$7,737,708.00	1	$7,737,708.00
Cooling	Rack Mount Fan - 4 Fans Server Cooling System - 1U	$98.00	11	$1078.00
Administration	System administrator in Illinois	$389,849.00	2	$779,698.00
TOTAL				$21,628,647.13

Configuration 2

AWS

m5	$5.069
m5d	$5.966
m5dn	$7.181
m5n	$6.283
m5zn	$4.36
m4	$2.42
mac2	$0.65
mac2-m2	$0.878
mac2-m2pro	$1.56
mac1	$1.083

The hourly rate of mac1.metal instance is $1.083. The total number of hours that we have to lease this instance is:

1000 users X 40 hours/week X 48 week X 5 years = 9,600,000 hours.

So the total cost will be:

$1.083 /hours * 9,600,000 hours = $10,396,800.

Private Cloud

Mac-mini

Mac mini

Quantity: 999

$1,497,501.00

Pay 0% APR for 12 months: $124,791.75/mo.

Hide product details ^ Remove

Hardware

- Apple M2 with 8-core CPU, 10-core GPU, 16-core Neural Engine
- 24GB 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

Network

For network topology, it is similar to configuration 1's network structure, but needs switches that can handle more bandwidth since the requirement is 10Gbps for each of the mac mini.
level2: 48*10GE down speed
level3: 480 Gbps capacity

Electric Power

I calculated the electric consumption as the worst case scenario, meaning all the hardware to work on full power. I used a rate of 11.94 cents/kWh in Illinois https://www.eia.gov/electricity/state/.

Component	Rated power consumption	Quantity	hourly	5 years
Mac mini M2	50W	1000	$5.97	$261,486.00
S6730-H48X6C	274W	21	$0.69	$30,222.00
C9500-24Y4C-A	650W	4	$0.31	$13,578.00
Rack Mount Fan - 4 Fans Server Cooling System - 1U	24W	22	$0.06	$2,628.00
Total				$307,914.00

	Description	Price per Item	Quantity	Total Price
Compute Servers	Mac mini M2	$1,499.00	1000	$1,499,000.00
Network Switches	S6730-H48X6C	$2,984.00	21	$62,664.00
	C9500-24Y4C-A	$8,173.00	4	$32,692.00
Network Cables	40G QSFP+ to 4xSFP+ Breakout DAC	$28.99	25	$724.75
	10Gtek SFP+ DAC Twinax Cable	$17.99	1000	$17,990.00
Racks	48U 151SW Data Center Rack 600mm x 1200mm	$1,700.00	1	$1,700.00
	5U HyperShelf for 16 Apple Mac Mini	$599.99	63	$37,799.37
Electric Power	Refer to above table	$307,914.00	1000	$307,914.00
Cooling	Rack Mount Fan - 4 Fans Server Cooling System - 1U	$98.00	22	$2156.00
Administration	System administrator in Illinois	$389,849.00	2	$779,698.00
TOTAL				$2,742,338.12

	Configuration 1	Configuration 2
Public Cloud (including EC2 and S3) Cost over 5 years	$100,744,669.20	$10,396,800.00
Private Cloud cost over 5 years	$21,628,647.13	$2,742,338.12

Configuration 3

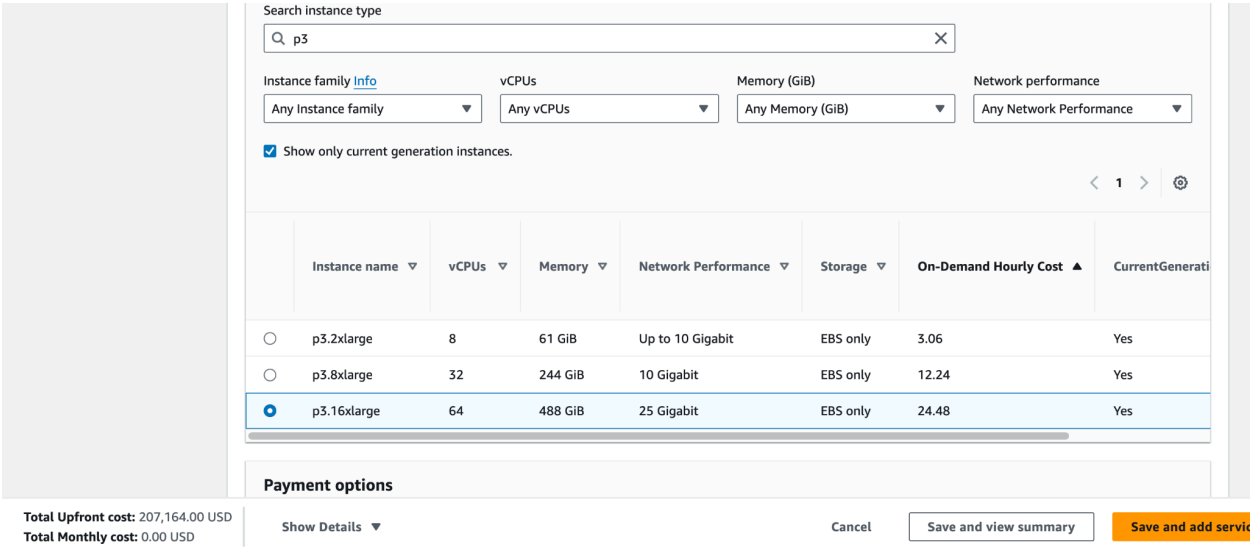
AWS

For AWS, I decided to use p3.16xlarge instance which has 8 GPUs - Tesla V100. Each V100 GPU can generate 50.2 MH/s of Ravencoin (RVN) according to this benchmark.

If reserve the instance paying with all upfront, the 3 year lease will cost $207,164.00. Let's say we lease it for 5 years with the same rate, then the 5 year cost will be $345,273.33. With $10,000,000.00 funding, we can lease 28 instances for 5 years.

As for revenue from mining, a single instance with 8 Tesla V100 GPUs would generate 401.6MH/s which translates to $0.2891. So 28 instances would make around $8.1 per hour.

Therefore over 5 years, the total income will be $14,773.01 if we omit the coin's price change and the reward rate.



Private Cloud

A single server setup

Motherboard: TB360-BTC PRO 2.0 Core $89.00
GPUs: 8xASUS Dual GeForce RTX™ 4060 OC Edition 8x$284.67
CPU: Intel BX80677I57600 7th Gen $89.00
RAM: Crucial Pro RAM 64GB $217.99
Power Supply: ROG Thor 1200W Platinum II 2x$278.99
Storage: SAMSUNG 870 EVO SATA SSD 500GB $52.99

Electric Power

I used a rate of 11.94 cents/kWh in Illinois https://www.eia.gov/electricity/state/.

Component	Rated power consumption	Quantity	hourly	5 years
Server	1500W	800	$143.28	$6,275,664.00
S6730-H48X6C	274W	17	$0.56	$24,528.00
C9500-24Y4C-A	650W	2	$0.16	$7,008.00
Rack Mount Fan - 4 Fans Server Cooling System - 1U	2.4W	6400	$1.83	$80,154.00
Total				$6,387,354.00

	Description	Price per Item	Quantity	Total Price
Compute Servers	See above.	$3284.32	800	$2,627,456.00
Network Switches	S6730-H48X6C	$2,984.00	17	$50,728.00
	C9500-24Y4C-A	$8,173.00	2	$16,346.00
Network Cables	40G QSFP+ to 4xSFP+ Breakout DAC	$28.99	35	$1,014.65
	10Gtek SFP+ DAC Twinax Cable	$17.99	800	$14,392.00
Racks	Mining Case 8 GPU Stackable	$59.99	800	$47,992.00
Electric Power	Refer to above table	$307,914.00	1000	$6,387,354.00
Cooling	Corsair SP120 Elite	$14.99	6400	$95,936.00
Administration	System administrator in Illinois	$389,849.00	2	$779,698.00
TOTAL				$10,020,916.65

According to this benchmark NVIDIA RTX4060 can generate around 17.92 MH/s.

From revenue from mining with the above setup, a single server with 8 RTX4060 GPUs would generate 143.36MH/s which translates to $0.1252. So 800 instances would make around $100.16 per hour. Therefore over 5 years, the total income will be $4,387,008.00 if we omit the coin's price change and the reward rate.

Configuration 3	Investment	Revenue	Profit
Public Cloud Mining Profit over 5 years	$9,667,653.24	$14,773.01	-$9,652,880.23
Private Cloud Mining Profit over 5 years	$10,020,916.65	$4,387,008.00	-$5,633,908,65