**CS553 Project**

**Understanding the Cost of Cloud Computing**

Cloud computing, one of the scalable infrastructure for computing available today is catered by means of service. Amazon being one of the companies who provide these services tend to follow a on demand pricing business model. This project aims at comparing amazon on demand cloud service against the cost to set up a private infrastructure.

The report is formed in such a way that comparison between the two infrastructure options are evident. For the cloud computing setup, we have considered three configurations described in the following format.

Configuration Details

Amazon Public cloud setup cost estimation

Private cloud setup cost estimation

And finally, at the end we will compare all three configurations to showcase which is better and why

**Setup 1**

Configuration

|  |  |
| --- | --- |
| Config 1 | Description |
| Compute Servers | 32 k cores |
| Memory | 256 TB |
| Disk | 50 PB HDD |
| Network | 10 Gb/sec |
| Distributed storage (100GB/sec throughput) | 100 PB |

*Table 1: configuration 1 specification*

Amazon public on demand cloud computing cost

Instance chosen: d2.8xlarge

Each instance configuration:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **vCPU** | **Mem(GiB)** | **HDD(GB)** | **cost** |
| **D2.xlarge** | **36** | **244** | **24\*2000** | **$5.52/Hour** |

36 cores, 244 GiB of Memory and 24\* 2000 HDD at the cost of $5.52 per hour

For the configuration mentioned in the above table. The required instances are computing below

CPU

32K cores

1 d2 instance CPU’s = 36 vCPU

vCPU to cores = vCPU

= 36 cores

Instances required for 32 K core = 32000/36

= 889 d2.8xlarge instances --------> a

Memory

256TB in GB = 262,144 GB

1 d2 instance Disk capacity = 244 GiB

244 GiB in GB = 244\* 1.074 = 262.06 GB

Instances required for 256TB = 262,144 /262.06

= 1,001 d2.8xlarge instances --------> b

Disk

50PB in GB = 52,428,800 GB

1 d2 instance Disk capacity = 48,000 GB

Instances required for 50PB = 52,428,800/48000

= 1,093 d2.8xlarge instances --------> c

Total number of d2.8xlarge instances required = max ( a, b, c)

= 1,093 instances

Distributed Storage

S3 standard storage pricing per month = $0.021 per GB

100 PB in GB = 104,857,600 GB

Storage cost for 5 years = 0.021 \* 104,857,600 \* 12 \* 5

= $ 132,120,576

Total Cost calculation

1 D2.8xlarge instance cost

36 cores, 244 GiB of Memory and 24\* 2000 HDD at the cost of $5.52 per hour

1,093 instances cost per hour = 5.52 \* 1,093

= $ 6033.36

1,093 instances cost for 5 years = $9,814.56 \* 24 \* 365 \* 5

= $ 264,261,168

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

= $ 132,120,576 + $ 264,261,168

= $ 396,381,744

Cost break down

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Description | Price | Quantity | Total Price for 5 years |
| Compute Servers | D2.8xlarge | $ 5.52/hr | 1,093 | $264,261,168 |
| Distributed Storage | S3 | $ 0.021/GB |  | $132,120,576 |
| Total | N/A | N/A | N/A | $ 396,381,744 |

Private Cloud setup cost estimation

Each rack used: Iris 2482



Cost breakdown

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Description | Price per Item | Quantity | Total Price |
| Compute Servers | Iris 2482 | $ 16,903.53 | 1,000 | $ 16,903,530 |
| Network Switches | Dell Z9000 switches | $ 862.62 | 71 | $ 61,246.02 |
| Network Cables | Dell Networking Cable,40GbE (QSFP+) to 4 x 10GbE SFP+ | $ 720 | 256 | $ 184,320 |
| Network Cables | Dell Networking, Cable, QSFP+ to QSFP+, 40GbE | $ 590 | 992 | $ 585,280 |
| Storage Servers | STX-CL XE72-2460 | $ 43,934 | 237 | $ 10,412,358 |
| Electric Power | 1200W (compute nodes)+ 1200W(cooling) over 5 years | N/A | N/A | $ 12,614,400 |
| Cooling | Cooler master v1200 | $ 303 | 1,000 | $ 303,000 |
| Administration | 1 per 1000 nodes over 5 years | $ 500,000 | 1 | $ 500,000 |
| TOTAL | N/A | N/A | N/A | $ 41,564,134.02 |

**Setup 2**

Configuration

|  |  |
| --- | --- |
| Config 1 | Description |
| Compute Servers | 1 Million \* 2 cores |
| Memory | 1 Million \* 15 GB RAM |
| Disk | 1 Million \* 32 GB SSD |
| Network | 1 Million \* 1GB/sec |
| Distributed storage (10GB/sec throughput) | 10 PB |

*Table 2: configuration 2 specification*

Amazon public on demand cloud computing cost

Instance chosen: r3.large

Each instance configuration:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **vCPU** | **Mem(GiB)** | **HDD/SSD(GB)** | **cost** |
| **R3.large** | **2** | **15** | **1\*32SSD** | **$0.166/Hour** |

For the configuration mentioned in table 2. The required instances are computed below

Instances Required

For the configuration mentioned in first table

CPU

2 million cores

1 r3.large instance CPU’s = 2 vCPU

vCPU to cores = vCPU

= 1 core

Instances required for 2Million core = 2,000,000/2

= 1,000,000 r3.large instances --------> a

Memory

15 Million GB

1 r3.large instance Disk capacity = 15 GiB

15 GiB in GB = 15 \* 1.074 = 16.11 GB

Instances required for 15 Million GB = 15000000/16.11

= 931,099 r3.large instances --------> b

Disk

32 Million GB

1 r3.large instance Disk capacity = 32 GB

Instances required for 32 Million GB = 32000000/32

= 1,000,000 r3.large instances --------> c

Total number of r3.large instances required = max ( a, b, c)

= 1,000,000 instances

2.Distributed Storage

S3 standard storage pricing per month = $0.021 per GB

10 PB in GB = 10485760 GB

Storage cost for 5 years = 0.021 \* 10485760 \* 12 \* 5

= $ 13,212,057.6

3.Cost calculation

1 r3.large instance cost 0.166/hr

1,000,000 instances cost per hour = 0.166 \* 1,000,000

= $166,000

1,000,000 instances cost for 5 years = $166,000\* 24 \* 365 \* 5

= $7,270,800,000

Total cost = distributed storage cost + r3.large instance cost

= $13,212,057.6 + $7,270,800,000

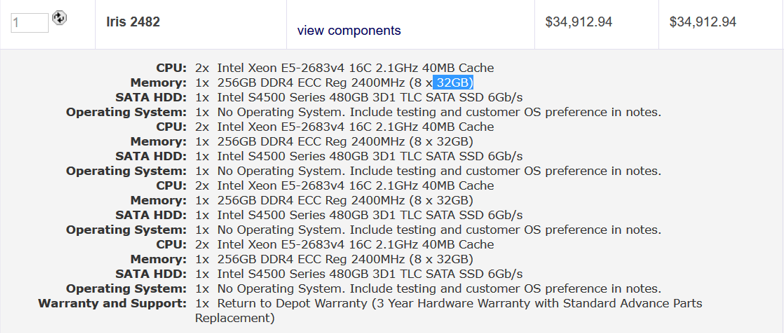
= $ 7,284,012,057.6

Cost break down

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Description | Price | Quantity | Total Price for 5 years |
| Compute Servers | R3.large | $ 0.166/hr | 1,000,000 | $7,270,800,000 |
| Distributed Storage | S3 | $ 0.021/GB |  | $13,212,057.6 |
| Total | N/A | N/A | N/A | $7,284,012,057.6 |

Private Cloud setup cost estimation

Each rack used: Iris 2482



Cost break down

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Description | Price per Item | Quantity | Total Price |
| Compute Servers | Iris 2482 | $ 34,912.94 | 16,667 | $ 581,893,970.98 |
| Network Switches | Dell Z9000 switches | $ 862.62 | 1,565 | $ 1,350,000.3 |
| Network Cables | Dell Networking Cable,40GbE (QSFP+) to 4 x 10GbE SFP+ | $ 720 | 16,688 | $ 12,015,360 |
| Network Cables | Dell Networking, Cable, QSFP+ to QSFP+, 40GbE | $ 590 | 16,688 | $ 9,845,920 |
| Storage Servers | STX-CL XE72-2460 | $ 43,934 | 24 | $ 1,054,416 |
| Electric Power | 1200W (compute nodes)+ 1200W(cooling) over 5 years | N/A | N/A | $ 210,244,204.8 |
| Cooling | Cooler master v1200 | $ 303 | 16,667 | $ 5,050,101 |
| Administration | 1 per 1000 nodes over 5 years | $ 500,000 | 17 | $ 8,500,000 |
| TOTAL | N/A | N/A | N/A | $ 829,953,973.08 |