TxCR
TEXAS CYBER RANGE

Annual Cost Estimation

Purpose:
This documentation details the total annual cost estimation for the Texas Cyber Range. It contains cost estimations for on a yearly and semesterly basis, along with the methodology behind the calculations used to determine costs.

Section 1: TLDR

The annual cost estimation for the Texas Cyber Range is **$207,060.**

Cost	Amount
Total VM Cost per Year	$157,692.00
Student Worker Cost per Year	$45,000.00
Electricity Cost per Year	$4,368.00

Common Virtual Services Comparison (at 500 VMs)

Service	Amount
Texas Cyber Range	$207,060.00
AWS	$683,724.00
Azure	$582,576.12

- AWS cost estimation was determined using AWS's most comparable service which is 8 GB RAM, 4 vCPUs, and 70 GB SSD $1,367.40 for 1 VM per year
- Azure cost estimation was determined using Azure's most comparable service which is 8 GB RAM, 4 CPU core, and 64 GB SSD $1,201.20 for 1 VM per year
- **NOTE:** *AWS and Azure have reduced prices when purchased in bulk (those totals are seen in the table above). AWS and Azure also require separate storage purchases (included in totals above).*

Section 2: Hardware

The Texas Cyber Range proudly offers the capacity to host 500 concurrent virtual machines (VMs) powered by XCP-ng. The following hardware resources below are available on the Cyber Range. While not all resources will be utilized, the majority of them will be employed to guarantee an exceptional user experience. Adequate reserves of resources will also be maintained to cater to periods of high demand.

Hardware Specification Totals:

- 4.5 TB RAM
- 35 TB SSD
- 504 Core CPUs
- 1 Gbps bandwidth

Section 3: VM Specifications

The primary objective of the Texas Cyber Range is to deliver a competitive and high-quality virtualization experience to the esteemed students and faculty of Texas A&M University. To achieve this, we aim to provide the maximum possible specifications within the constraints of our current hardware capabilities. Customers will have the flexibility to request specific VM specifications, including vCPUs, RAM, and SSD storage, with an allowance of up to 70 GB of free SSD. Beyond this threshold, customers will incur storage costs at a monthly rate of $0.45 per 10 GB of SSD. For instance, if a customer utilizes 90 GB of SSD, the monthly cost will amount to $40.50. In addition, as part of our commitment to supporting the academic community, we will offer a standard VM to Texas A&M students free of charge. The standard VM will include the following specifications and users will have the option to select either a Linux or an unlicensed Windows operating system. Below are the standard VM specifications provided by the Texas Cyber Range:

Standard Linux TxCR Range Specifications:

- 4 vCPUs
- 8 GB RAM
  70 GB SSD
- Ubuntu, Kali, or unlicensed Windows OS

Section 4: Cost Methodology

The Texas Cyber Range VMs will account for vCPU, RAM, with up to 70 GB of free SSD. An additional charge will be applied at a monthly rate.

Annual cost per single VM is $414.12.

Cost	Amount
Single VM Cost per Year	$315.36
Student Worker Cost per VM per Year	$90.00
Electricity Cost per VM per Year	$8.76

Rates per hour:

- vCPU = $0.003
- RAM = $0.003

Rates per month:

- SSD over 80GB = $0.45 per 10 GB
- Student Worker Fee = $7.50
- Electricity Fee = $0.73

The pricing structure for vCPUs and RAM rates was carefully established by analyzing the rates offered by industry competitors such as AWS and Azure. Our aim was to strike a balance between competitive pricing and providing reduced rates specifically tailored for academic use. The agreed-upon hourly rates mentioned above were determined by current members of the Texas Cyber Range, keeping academic usage in mind.

In terms of storage, each VM on the Texas Cyber Range will be allocated up to 80 GB of SSD space free of charge. If a customer requires additional storage beyond this limit, they will incur storage costs at a rate of $0.45 per 10 GB of SSD. For instance, if a customer requests 90 GB of SSD, the additional cost will amount to $40.50 per month.

The Student Worker Fee has been calculated based on the assumption of a staff consisting of 10 student workers, each working 10 hours per week for 30 weeks, at a

pay rate of $15 per hour. The total annual cost of student worker labor amounts to $45,000, which is distributed across 500 VMs over 12 months, resulting in a fee of $7.50 per VM per month.

To account for electricity consumption, the Electricity Fee has been determined using the standard rate of $0.50 per kilowatt-hour (kWh) for 8760 hours in a year. This cost is then divided by the total capacity of 500 VMs over 12 months, resulting in a fee of $0.73 per VM.

Section 5: Conclusion

The Texas Cyber Range has conducted a comprehensive evaluation of multiple factors to ensure that our pricing structure remains highly competitive. Our goal is to prioritize the specific needs and affordability of our academic users, particularly the students and faculty at Texas A&M University. Our utmost priority is to provide an exceptional virtualization environment that empowers students and faculty with the necessary resources to enhance their educational pursuits.

The .txt file here contains the TxCR script used to determine the costs of the Texas Cyber Range. This script was developed using python3, please feel free to use the script in your interpreter of choice.