4-28-2023

Infrastructure-as-Code: Automating the Deployment on AWS using Terraform

Srikar Pratap

CIS693 – MASTER'S PROJECT

Introduction:

In my master's project, I used Terraform to create a scalable infrastructure on Amazon Web Services (AWS) for my personal website. Terraform is an open-source infrastructure-as-code (IAC) tool that allows you to create, manage and provision infrastructure resources, such as virtual machines, storage accounts, networks, and more, across multiple cloud providers and on-premises data centers using a declarative configuration language. A scalable infrastructure is important because it enables a system or application to handle increasing amounts of traffic or workload without experiencing performance issues or downtime. It ensures that the system remains responsive, available, and reliable as an organization grows or its user base expands. Amazon Web Services (AWS) is a comprehensive cloud computing platform offered by Amazon. It provides a broad range of cloud-based services, including compute, storage, networking, database, analytics, machine learning, security and more. These services are designed to help organizations of all size to build, deploy and scale applications and infrastructure in the cloud with ease and flexibility. This project highlights the benefits of Infrastructure as Code and the power of Terraform with AWS for automating infrastructure deployment.

Background:

For my personal website, I've leveraged a variety of Amazon Web Services (AWS) to ensure optimal performance, security, and reliability. Here are the key AWS tools that I've used and how they contribute to the functionality of my website:

Elastic Cloud Compute (EC2): I've utilized EC2 as my web server to handle all computational tasks required for my website.
Virtual Private Cloud (VPC): To manage traffic and ensure security, I've implemented VPC to regulate access to my website.
Simple Storage Service (S3): All the files needed for my website have been uploaded to S3 buckets, which helps ensure that my site is always accessible and running smoothly.
Route53: This service allowed me to register a domain for my personal website, making it easier for visitors to find and access.
Elastic Load Balancer (ELB): To manage traffic and optimize performance, I've integrated ELB with my web servers, effectively distributing traffic across multiple instances.
Terraform: As my preferred infrastructure-as-code tool, I've utilized Terraform to deploy all of the aforementioned AWS services, streamlining the process and ensuring consistency across environments.

Methodology:

To create the necessary cloud infrastructure to host my personal website, I followed a specific methodology that involved utilizing Terraform to streamline the deployment process. Here are the steps I took:

First, I created an AWS account and generated an access key for authentication purposes. I then used this key to connect Terraform with my AWS account.

To validate my Terraform and AWS configurations were working properly, I created an EC2 instance using Terraform.

I created four separate modules - compute, networking, storage, and database - to handle different aspects of the infrastructure. Within each module, I defined various AWS services and settings using Terraform.

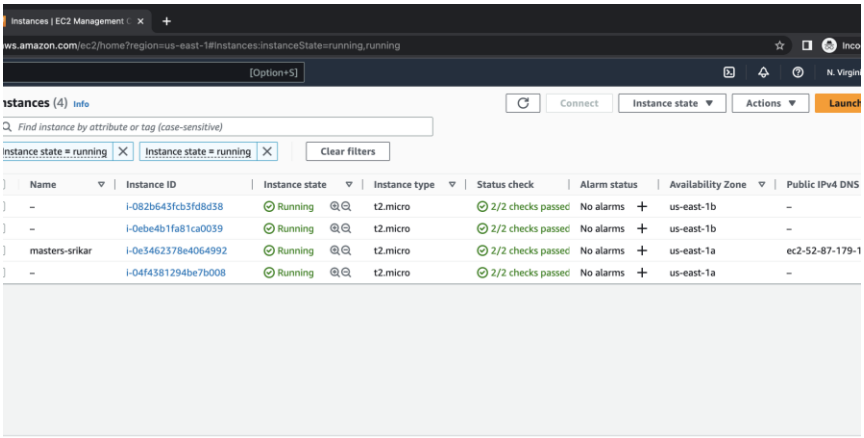
I started by deploying the networking module, which defined subnets, route tables, and other necessary networking components. Once this was set up, I used the VPC ID from the networking module to deploy other services such as autoscaling and elastic load balancing. I then created a DNS record for my website using Route53 and linked it to my load balancer. All the files needed for my website were uploaded to S3. Finally, I created a "main.tf" file that called all the separate modules I had created. This allowed me to deploy the entire infrastructure in a single Terraform deployment.

To ensure security, I defined all sensitive information in a "dev.tfvars" file and referenced it during deployment.

The deployment process involved running the following commands:

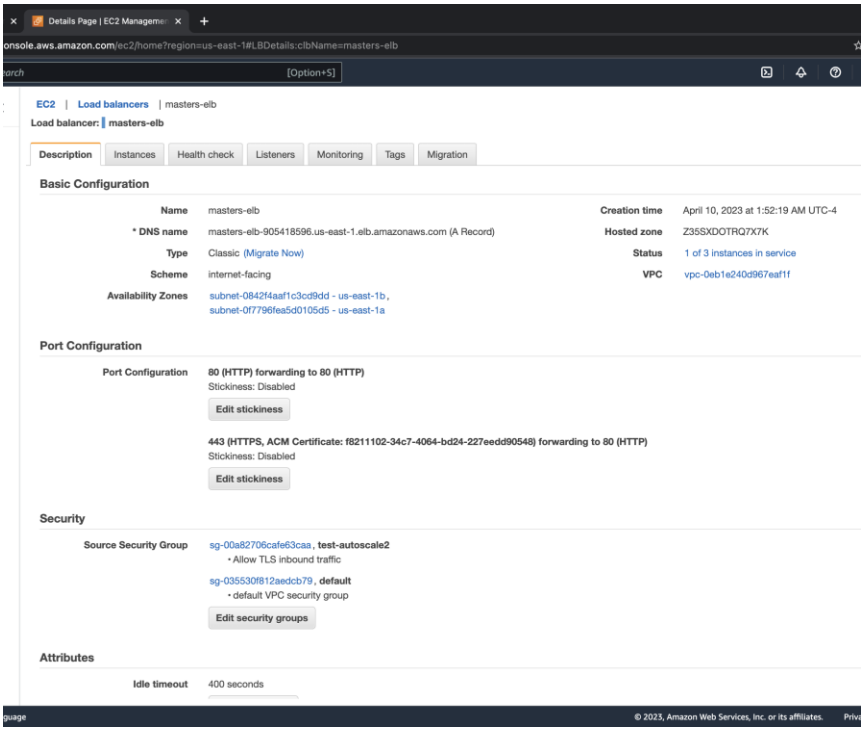
terraform init
terraform plan -var-file dev.tfvars
terraform apply -var-file dev.tfvars
By following this methodology, I was able to efficiently and securely deploy all the cloud services needed to host my personal website.

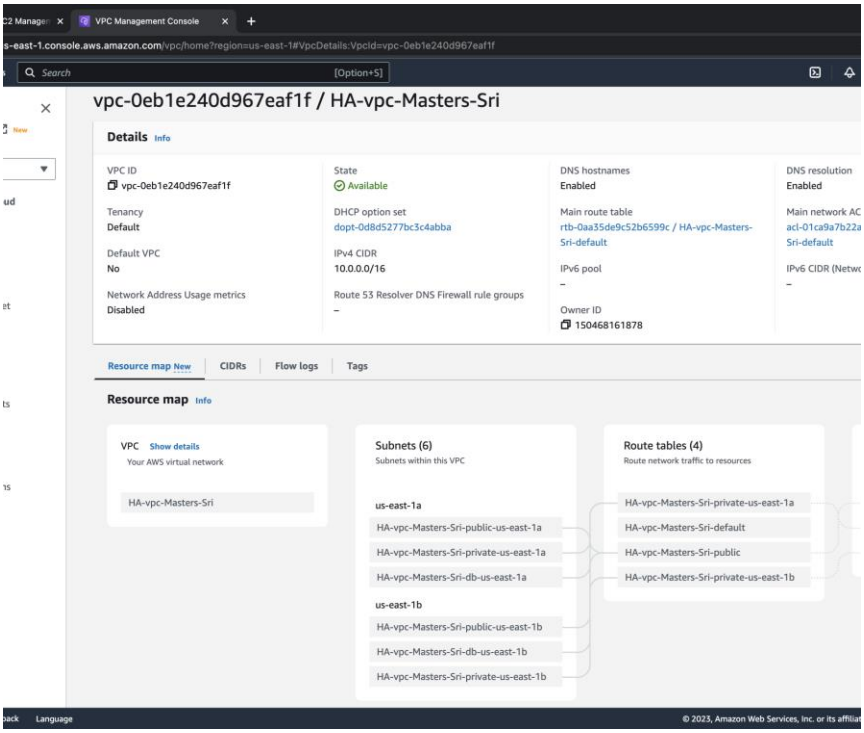
Outcomes:

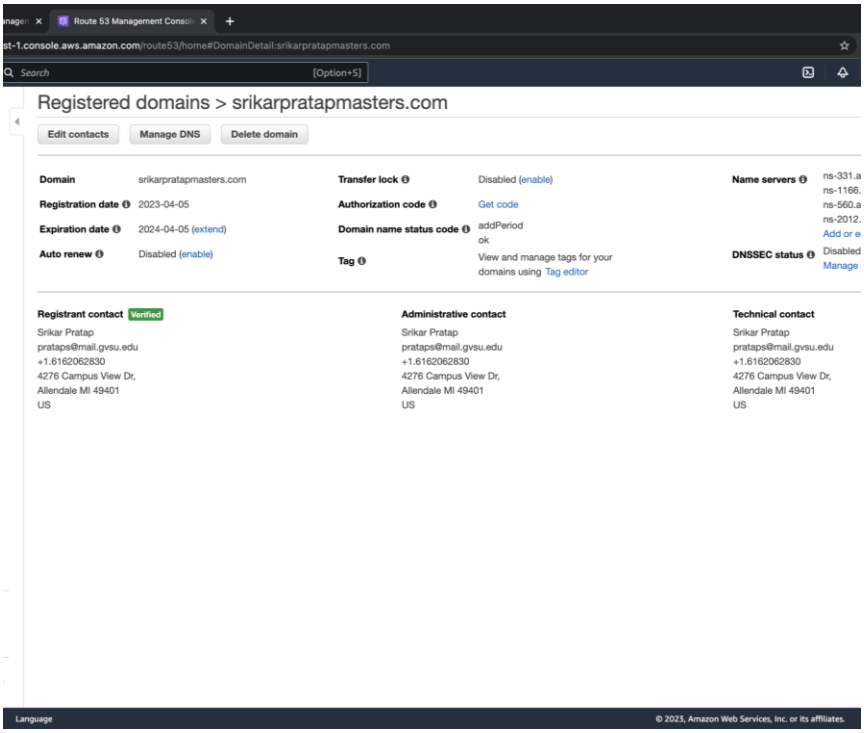


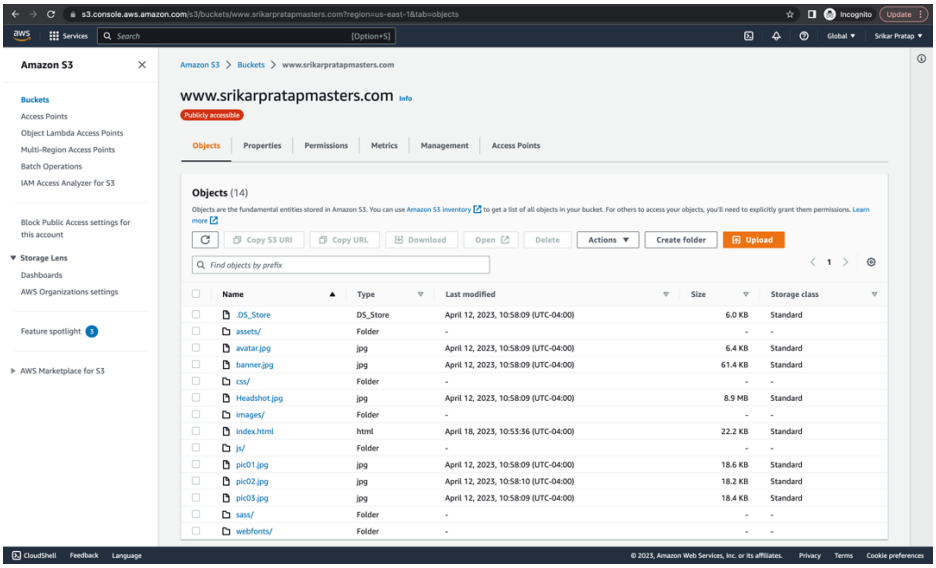
=

elect an instance




VPC Management Console
s-east-1.console.aws.amazon.com/vpc/home?region=us-east-1#VpcDetails:VpcId=vpc-0eb1e240d967eaf1f
Search
[Option+S]
vpc-0eb1e240d967eaf1f / HA-vpc-Masters-Sri
Details Info
VPC ID
vpc-0eb1e240d967eaf1f
State
Available
DNS hostnames
Enabled
DNS resolution
Enabled
Tenancy
Default
DHCP option set
dopt-0d8d5277bc3c4abba
Main route table
rtb-0aa35de9c52b6599c / HA-vpc-Masters-Sri-default
Default VPC
No
IPv4 CIDR
10.0.0.0/16
IPv6 pool
–
Network Address Usage metrics
Disabled
Route 53 Resolver DNS Firewall rule groups
–
Owner ID
150468161878
Resource map New
CIDRs
Flow logs
Tags
Resource map Info
VPC Show details
Your AWS virtual network
HA-vpc-Masters-Sri
Subnets (6)
Subnets within this VPC
us-east-1a
HA-vpc-Masters-Sri-public-us-east-1a
HA-vpc-Masters-Sri-private-us-east-1a
HA-vpc-Masters-Sri-db-us-east-1a
us-east-1b
HA-vpc-Masters-Sri-public-us-east-1b
HA-vpc-Masters-Sri-db-us-east-1b
HA-vpc-Masters-Sri-private-us-east-1b
Route tables (4)
Route network traffic to resources
HA-vpc-Masters-Sri-private-us-east-1a
HA-vpc-Masters-Sri-default
HA-vpc-Masters-Sri-public
HA-vpc-Masters-Sri-private-us-east-1b
Language
© 2023, Amazon Web Services, Inc. or its affiliat


Route 53 Management Console
st-1.console.aws.amazon.com/route53/home#DomainDetail:srikarpratapmasters.com
Search
[Option+S]
Registered domains > srikarpratapmasters.com
Edit contacts
Manage DNS
Delete domain
Domain
srikarpratapmasters.com
Registration date
2023-04-05
Expiration date
2024-04-05 (extend)
Auto renew
Disabled (enable)
Transfer lock
Disabled (enable)
Authorization code
Get code
Domain name status code
addPeriod
ok
Tag
View and manage tags for your domains using Tag editor
Name servers
ns-331.a
ns-1166.
ns-560.a
ns-2012.
Add or e
DNSSEC status
Disabled
Manage
Registrant contact
Verified
Srikar Pratap
prataps@mail.gvsu.edu
+1.6162062830
4276 Campus View Dr,
Allendale MI 49401
US
Administrative contact
Srikar Pratap
prataps@mail.gvsu.edu
+1.6162062830
4276 Campus View Dr,
Allendale MI 49401
US
Technical contact
Srikar Pratap
prataps@mail.gvsu.edu
+1.6162062830
4276 Campus View Dr,
Allendale MI 49401
US
Language
© 2023, Amazon Web Services, Inc. or its affiliates.



Reflection:

Upon completing this project, I am pleased to report that everything went smoothly, and I was able to gain new skills and knowledge along the way. However, there were a few challenging phases during the project that required me to seek help.

One particular hurdle I encountered was related to hosting my personal website. Fortunately, I was able to reach out to Dr. Erik Fredericks for guidance and support. Thanks to his expertise and advice, I was able to navigate the issue successfully and complete the project as planned.

Overall, I found this project to be a valuable learning experience that helped me expand my understanding of cloud infrastructure and the benefits it can offer. I look forward to applying this newfound knowledge in future projects and endeavors.

Summary:

- The master's project involved using Terraform to create a scalable infrastructure for their personal website on Amazon Web Services (AWS).
- Terraform is an infrastructure-as-code tool that enables the creation and management of infrastructure resources across multiple cloud providers and on-premises data centers. The project highlighted the benefits of Infrastructure as Code and the power of Terraform with AWS for automating infrastructure deployment.
- Created four modules for computing, networking, storage, and database services, and then used a "main.tf" file to call all the modules and deploy the entire infrastructure in a single Terraform deployment.
- Also defined secured information in a "dev.tfvars" file and used Terraform commands such as "init", "plan", and "apply" during deployment.

References:

[1] Terraform Documentation – “https://developer.hashicorp.com/terraform/docs”
[2] AWS Documentation – “https://docs.aws.amazon.com/”
[3] AWS and Terraform – “https://developer.hashicorp.com/terraform/tutorials/aws-get-started”