CH05 Terraform & EKS I

Objectives

- **Kubernetes & EKS Overview**
- **Make a EKS Clsuter with Terraform**
- **Concept about making a EKS Cluster for production with Terraform**

Preparation

Kubernetes Client

- https://kubernetes.io/docs/tasks/tools/install-kubectl/

AWS IAM Authenticator

- https://github.com/kubernetes-sigs/aws-iam-authenticator
  - AWS EKS access permission integrates with AWS IAM
  - heptio-authenticator-aws needs to be installed in the client side

Key Pair

- In order to access worker node through ssh protocol, please create a key pair in example region US West (Oregon) us-west-2

Practice - Part 1

- `$ git clone https://github.com/getamis/vishwakarma.git`
- `$ cd examples/eks_worker`
- `$ terraform init`
- `$ terraform plan`

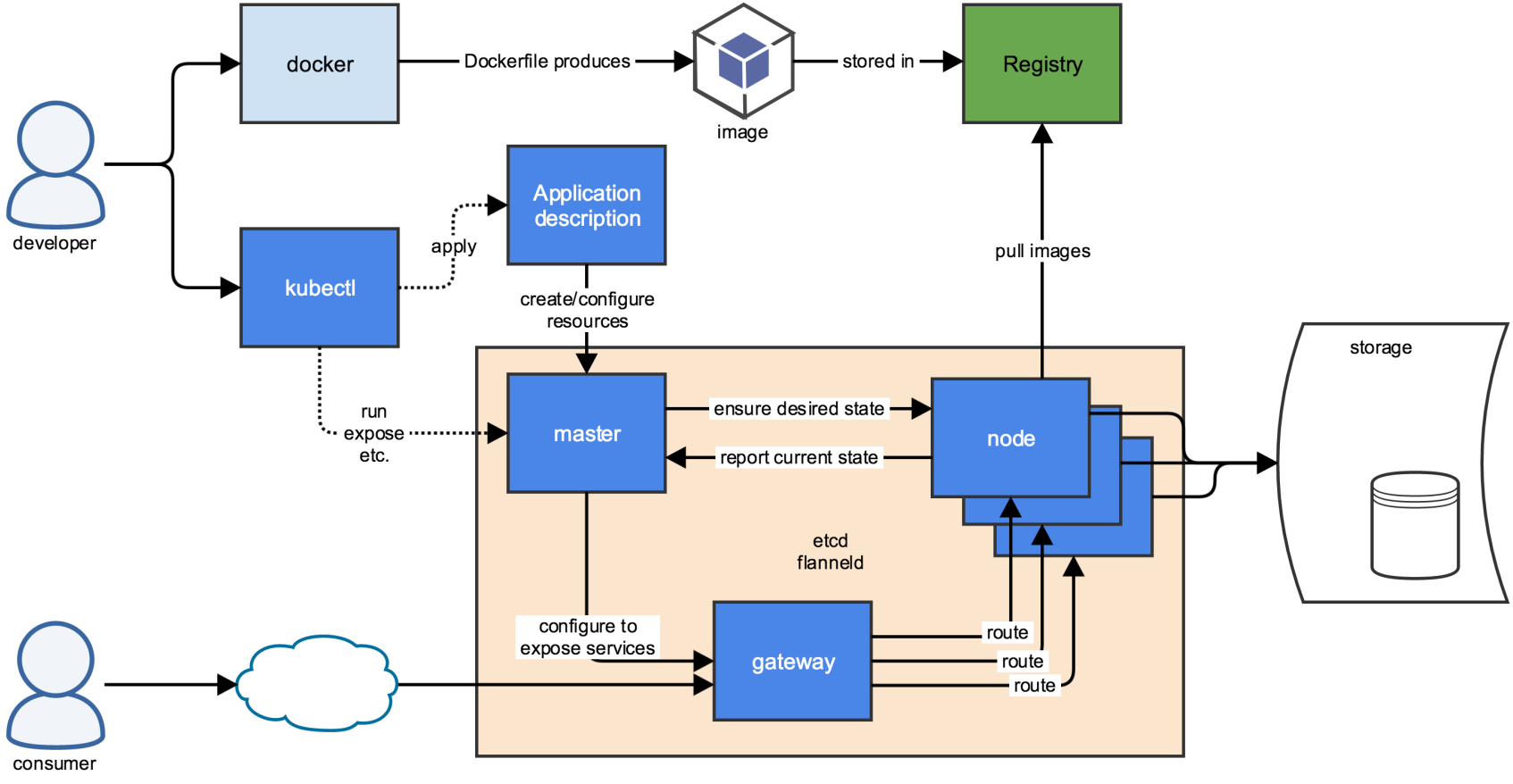
```
# need to input the key pair name
var.key_pair_name
  The key pair name for access bastion ec2
Enter a value:
```

- `devopsdays-workshop`
- `$ terraform apply`

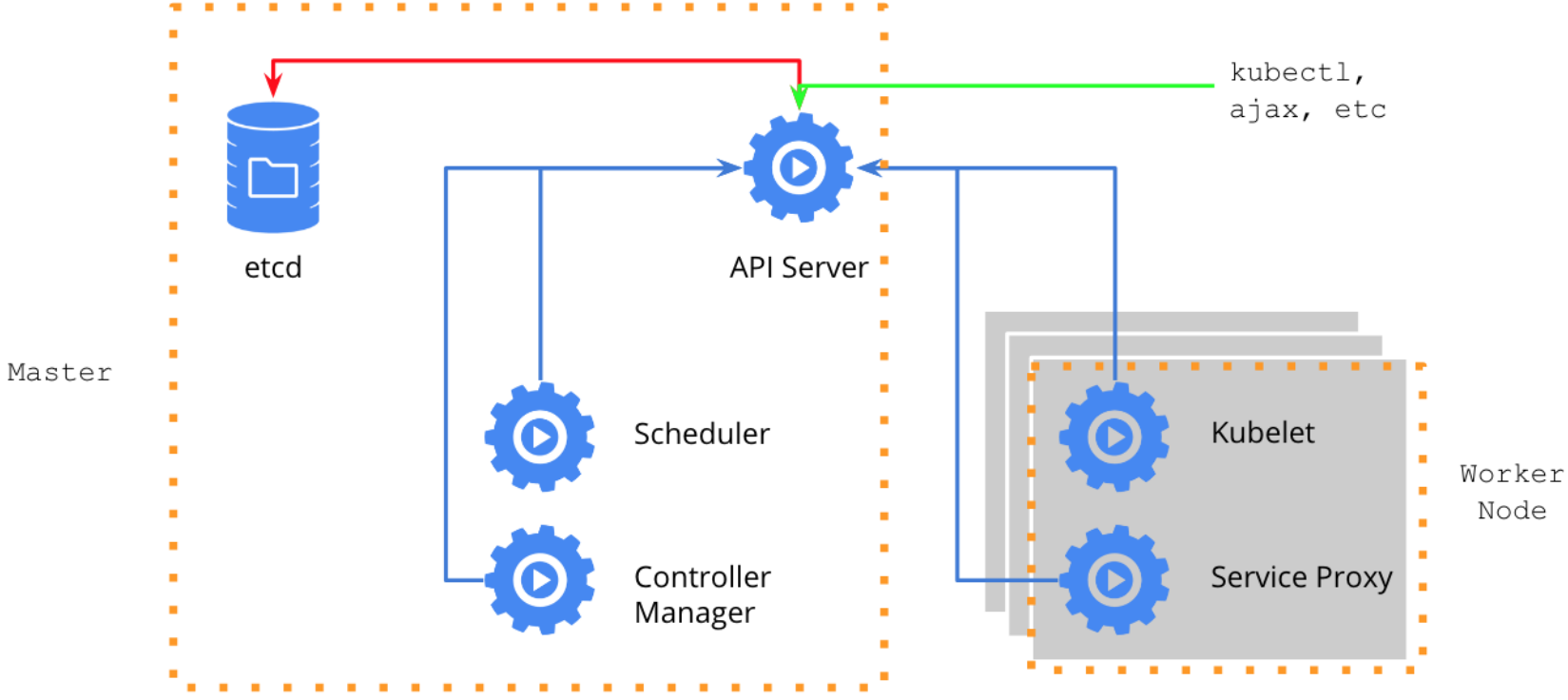
Kubernetes

- Open Source
- Container Automation Framework
- Container Orchestrator
- Open API Based on Google’s experiences

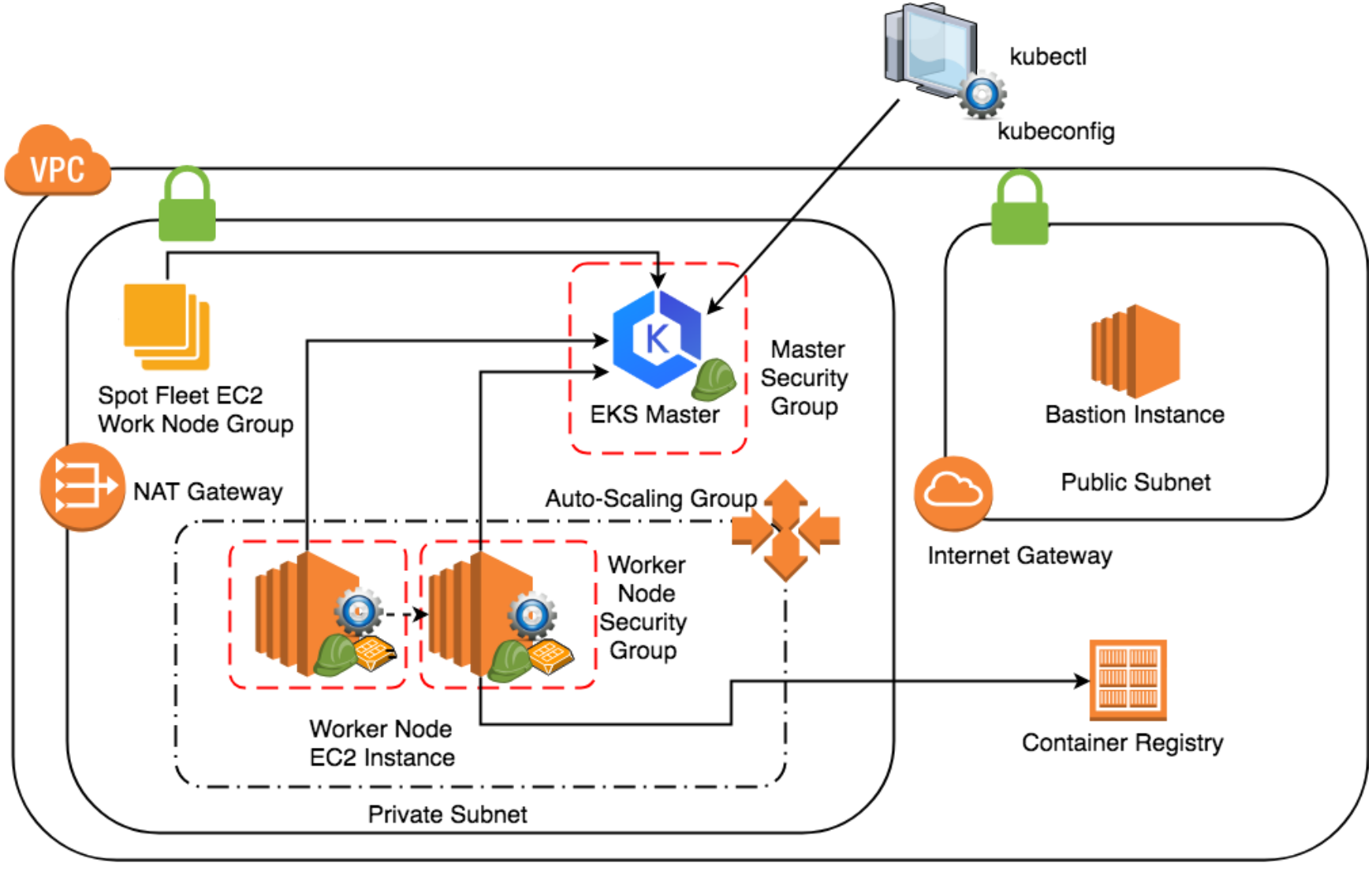
Kubernetes Overview



Kubernetes Architecture



Vishwakarma EKS Cluster



Vishwakarma

- repo: GitHub - getamis/vishwakarma

Modules

- path: `vishwakarma/aws`
- Terraform modules :
  - network
  - container_linux
  - eks

- **Directories:**

```
├── container_linux
├── eks
│   ├── ignition
│   │   └── resources
│   │       ├── dropins
│   │       ├── kubernetes
│   │       ├── services
│   │       └── sysctl.d
│   ├── master
│   │   └── resources
│   ├── worker-asg
│   ├── worker-commonw
│   └── worker-spot
└── network
```

Vishwakarma aws & eks modules

- **aws/network**
  - One AWS VPC includes private and public subnet
  - One EC2 instance called bastion hosts in public subnet, can access the resource hosting in the private subnet.
- **aws/eks/master**
  - Create the AWS EKS cluster
- **aws/eks/worker-asg**
  - Create a AWS auto-scaling group with CoreOS container linux and leverage ignition to provision
  - Register to EKS cluster automatically
- **aws/eks/worker-spot**

Terraform resource dependencies

- multiple resources and how to reference the attributes of other resources to configure subsequent resources.

```
resource "aws_instance" "example" {
  ami           = "ami-2757f631"
  instance_type = "t2.micro"
}
resource "aws_eip" "ip" {
  instance = "${aws_instance.example.id}"
}
```

Terraform implicit Dependencies dependencies

- Terraform can automatically infer when one resource depends on another.
- Terraform uses this dependency information to determine the correct order in which to create the different resources.
- https://www.terraform.io/intro/getting-started/dependencies.html

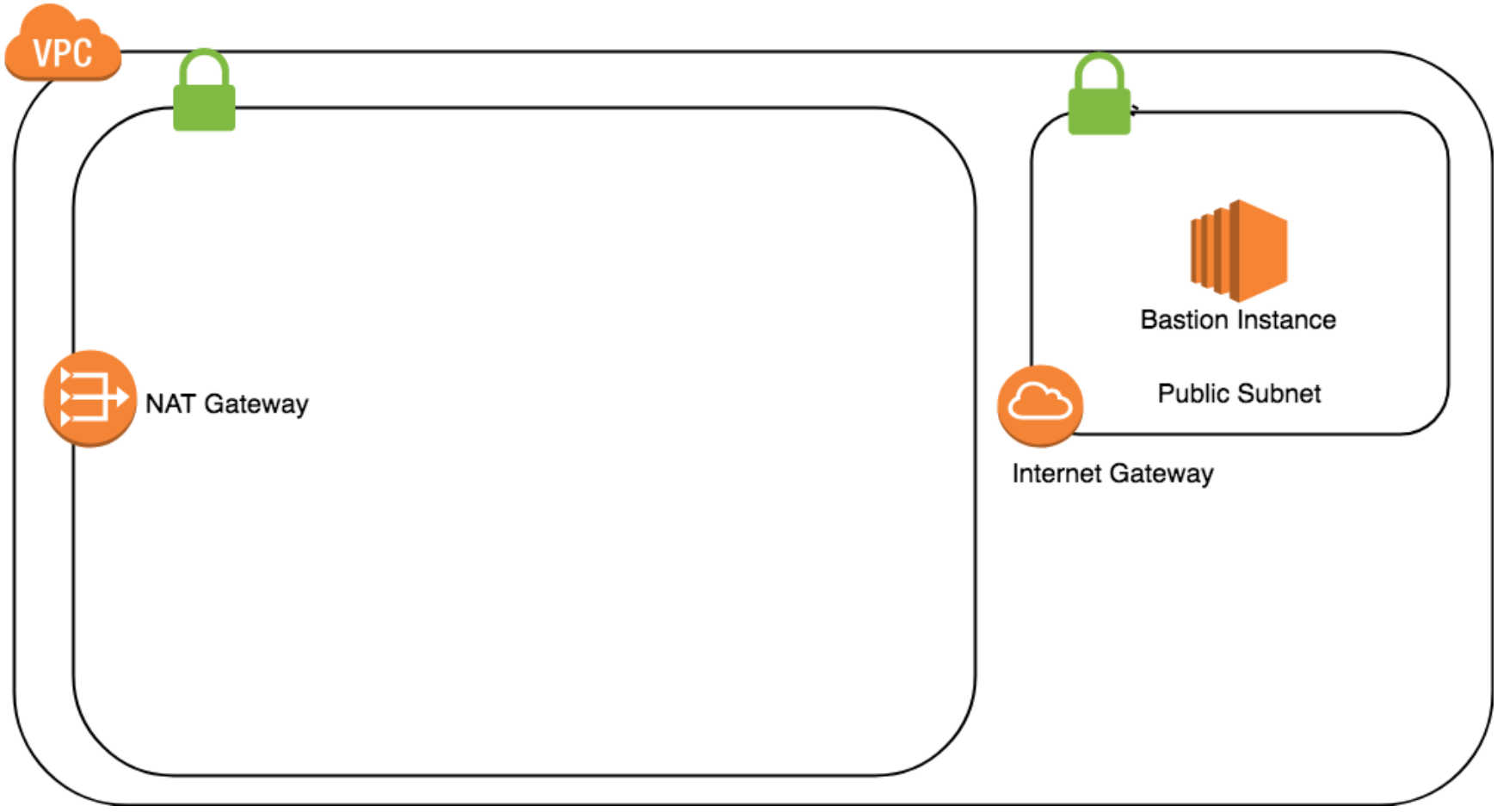
Example

- File: examples/eks_worker/main.tf
- Simple expression of dependencies

```
workers_asg
        └──> master
        │       └──> network
        └──> worker-asg
                └──> worker-common
```

- `terraform graph`

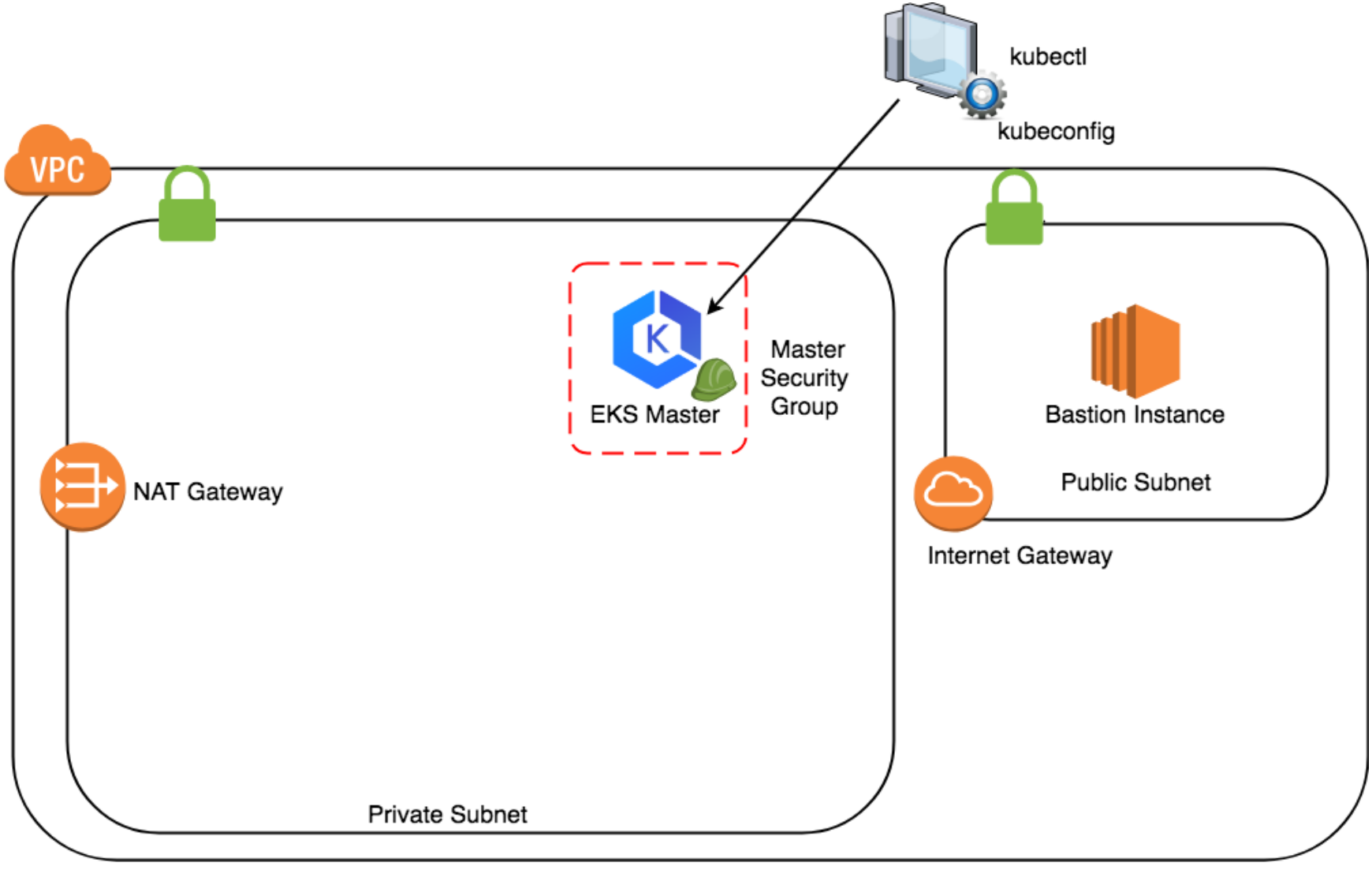
EKS Cluster Network



EKS Cluster Network Details

- module: aws/network
- One VPC
  - One public Subnet
  - One private Subnet
  - One internet gateway
  - One NAT gateway
  - setup the subnet routing to route external traffic through the gateways:
  - One bastion is a `jump server`
    - https://docs.aws.amazon.com/quickstart/latest/linux-bastion/architecture.html

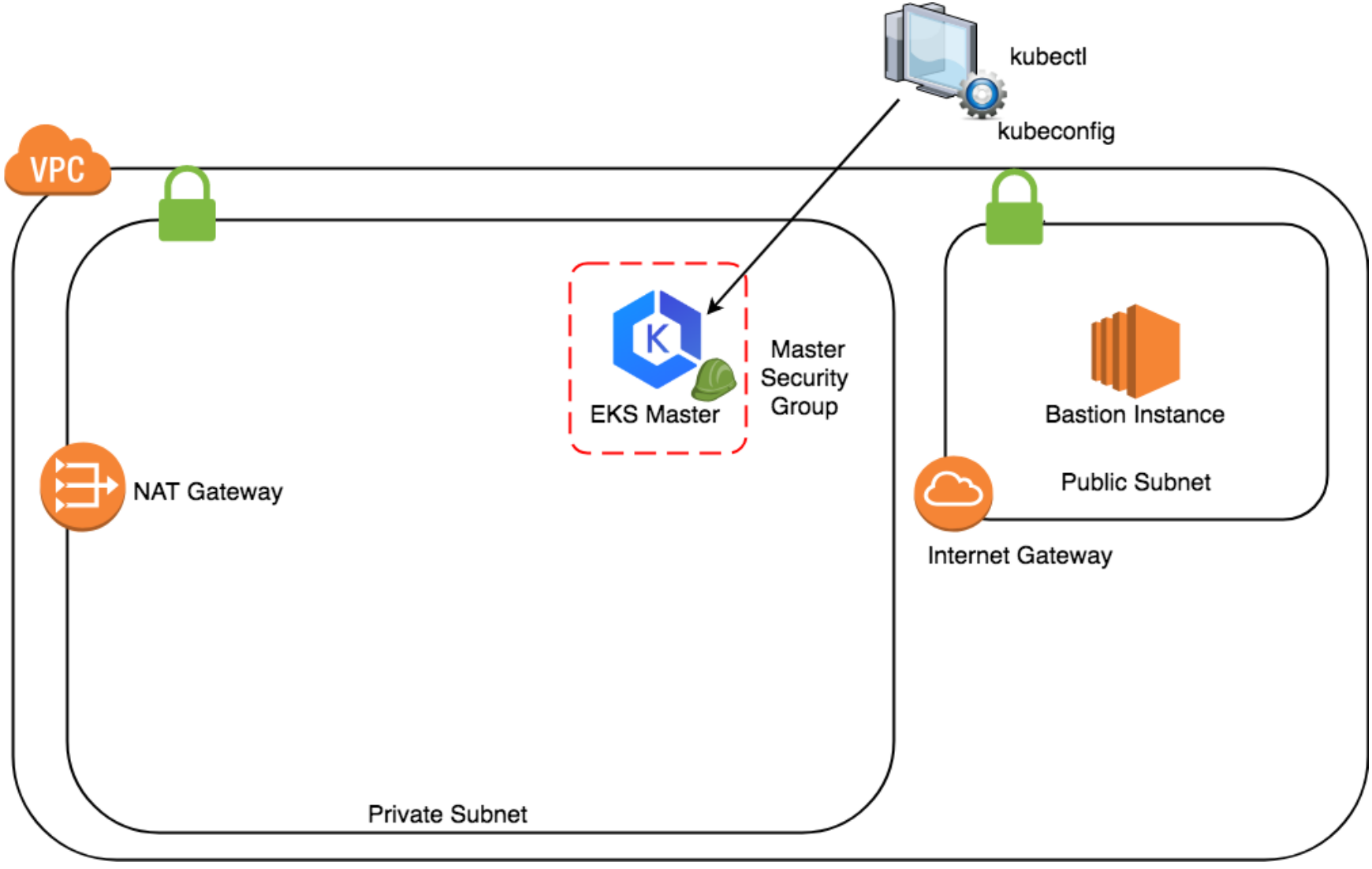
EKS Cluster Master



EKS Cluster Master Details

- module: aws/eks/master
- This is where the EKS service comes into play.
- Expected
  - IAM Role
  - Security Group
  - EKS Master
  - kubeconfig

EKS Cluster Master



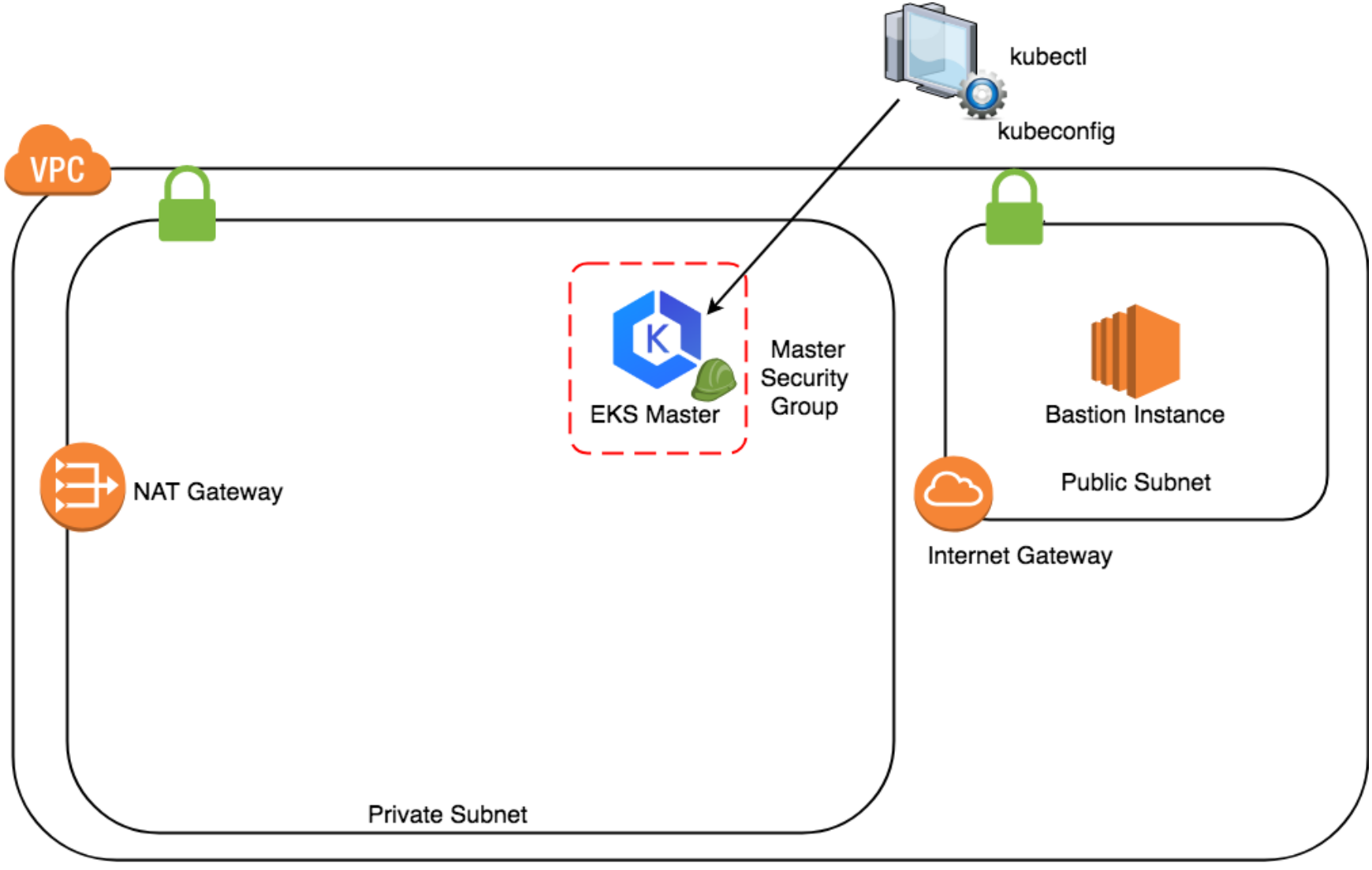
EKS Cluster Master Permission

- **File: aws/eks/master/role-eks.tf**
- **Purpose:**
    - **Give the suitable permission for access EKS Service And Create EKS Cluster**

EKS Cluster Master Permission - IAM Roles

- File: aws/eks/master/role-eks.tf
- Action:
  - Create IAM Role `AWSServiceRoleForAmazonEKS`
  - Uses the following IAM policies:
    - `AmazonEKSServicePolicy`
    - `AmazonEKSClusterPolicy`
- Terraform Resources
  - `aws_iam_role`
  - `aws_iam_policy_document`
  - `aws_iam_role_policy_attachment`

EKS Cluster Master



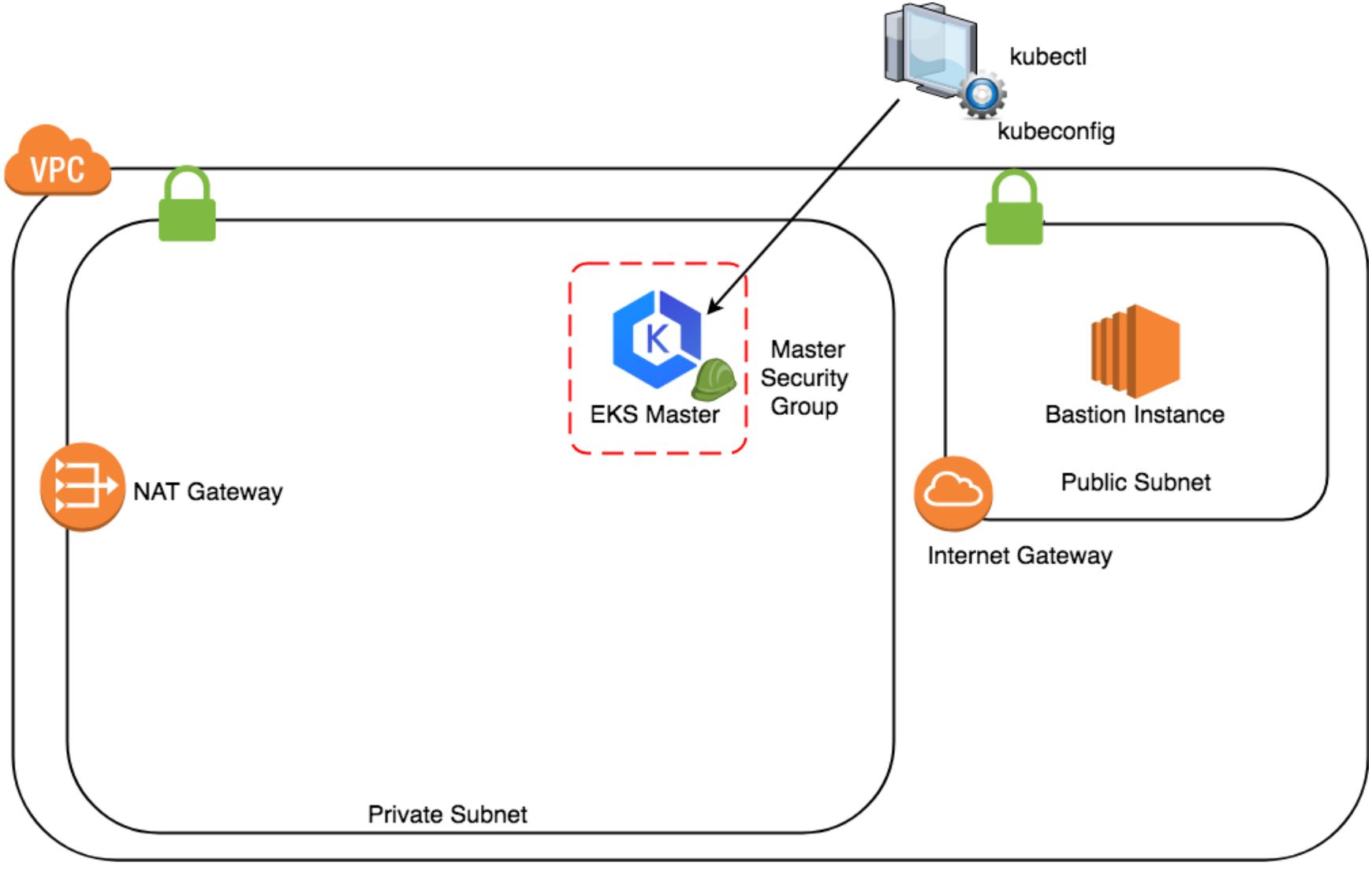
EKS Cluster Master Firewall

- **File: aws/eks/master/security-group-eks.tf**
-
- **Purpose:**
    - **Cluster communication with worker nodes**
    - **Allow instances in VPC to communicate with the cluster API Server**

EKS Cluster Master Firewall - Security Group

- File: aws/eks/master/security-group-eks.tf
- Action:
  - AWS Security Group
    - `eks_cluster_egress`
    - `eks_cluster_ingress_https`
- Terraform Resources
  - `aws_security_group`
  - `aws_security_group_rule`

EKS Cluster Master



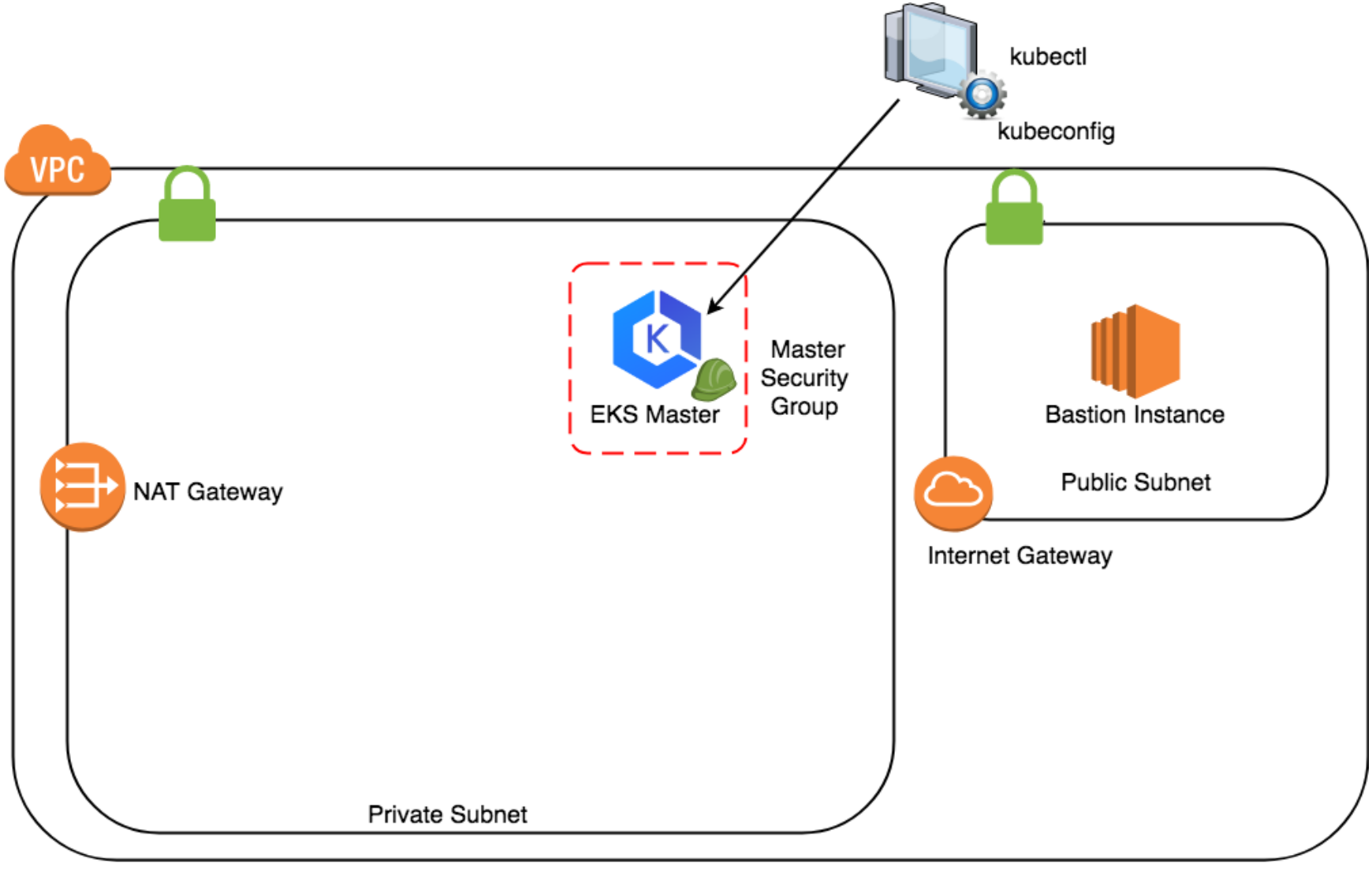
EKS Cluster Master

- **File: aws/eks/master/cluster.tf**
- **Purpose:**
    - **Create Cluster Master with EKS Service**

EKS Cluster Master - Create Master

- File aws/eks/master/cluster.tf
- Action:
  - Create Cluster Master with EKS Service
- Terraform Resources
  - `aws_eks_cluster`
  - Notice: `depends_on`

EKS Cluster Master



Obtaining kubectl Configuration

- **File: aws/eks/master/s3-kubeconfig.tf**
- **Purpose:**
  - **Generate the kubeconfig file for kubectl**
  - **Save the kubeconfig in AWS S3 for using in future**

Obtaining kubectl Configuration

- File: aws/eks/master/s3-kubeconfig.tf
- Action:
  - render kubeconfig with data from eks
  - create S3 bucket for saving the kubeconfig
- Terraform Resources
  - `template_file`
  - `local_file`
  - `aws_s3_bucket`
  - `aws_s3_bucket_object`

Kubernetes Configuration to Join Worker Nodes

- **File:** aws/eks/master/aws-auth-cm.tf
- **Purpose:**
    - **Allow worker nodes to join the cluster via AWS IAM role authentication.**

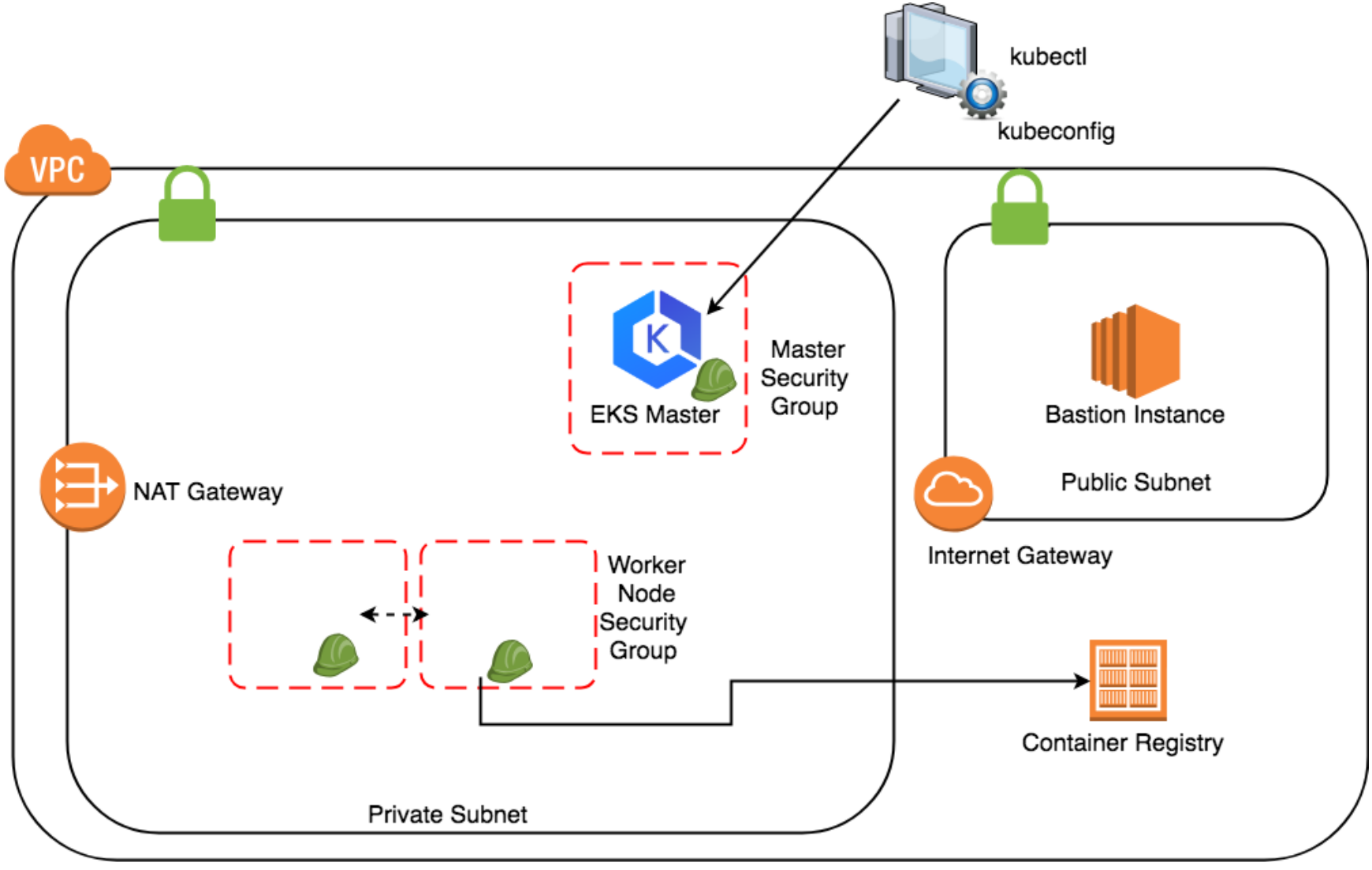
Kubernetes Configuration to Join Worker Nodes

- File: aws/eks/master/aws-auth-cm.tf
- Action:
  - To output an example IAM Role authentication ConfigMap from your Terraform configuration
  - Kubectl apply the ConfigMap
- Terraform Resources
  - `template_file`
  - `local_file`
  - `null_resource`

EKS Cluster Worker Nodes

- wroker-asg
  - Initailization of EC2 Instance (AMI)
  - Preparation for added into Kubernetes Cluster
- worker-common
  - Permission
  - Firewall

EKS Cluster Worker Node Common



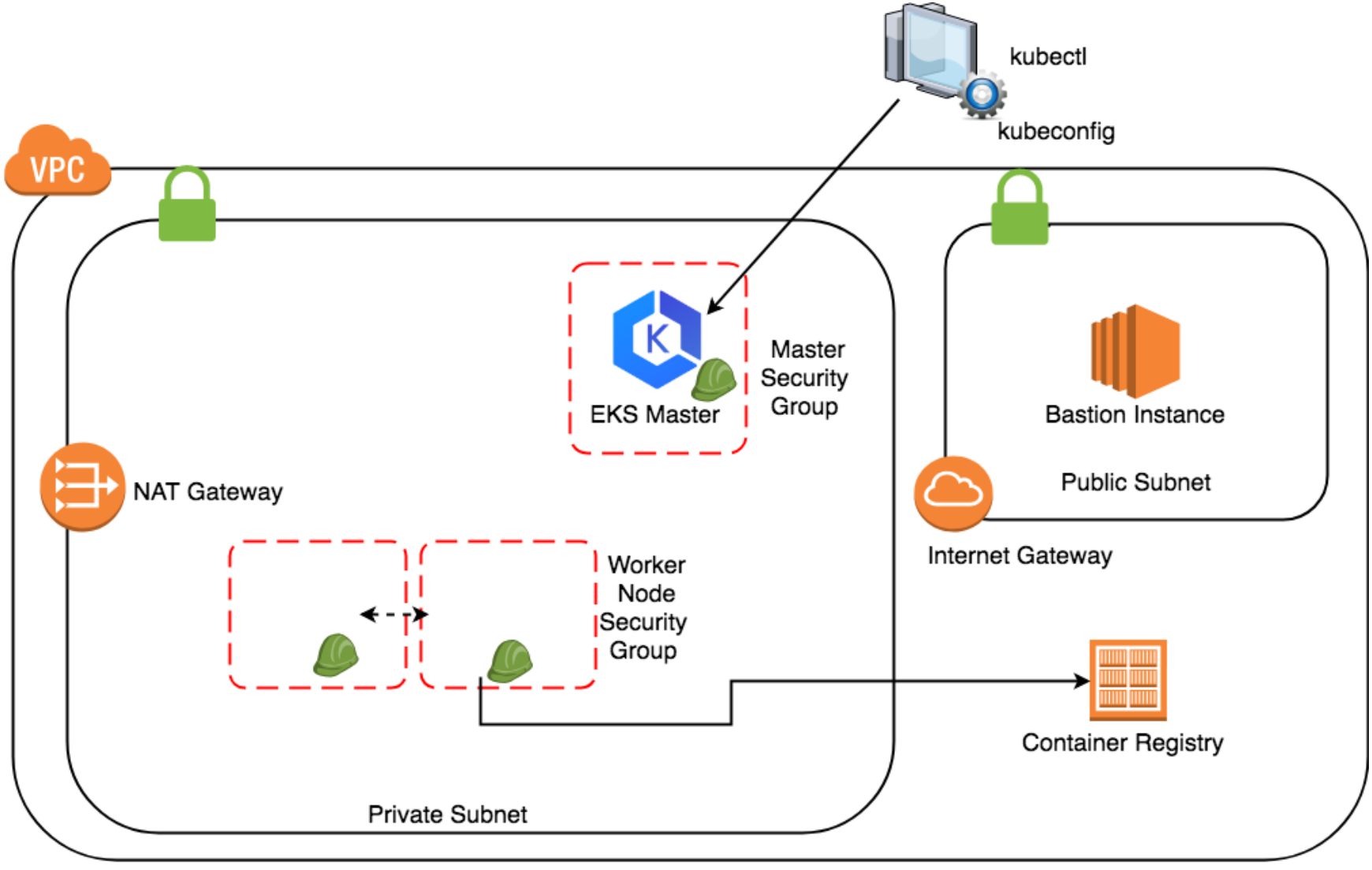
Worker Node Permission - IAM Role and Instance Profile

- File: aws/eks/worker-common/role.tf
- Purpose:
  - IAM role and policy to allow the worker nodes to manage or retrieve data from other AWS services.
    - Network
    - ContainerRegistry
  - It is used to allow worker nodes to join the cluster.

Worker Node Permission - IAM Role and Instance Profile

- File: aws/eks/worker-common/role.tf
- Action:
  - Create IAM Role `EKSWorkerAssumeRole`
  - Policy
    - `AmazonEKSWorkerNodePolicy`
    - `AmazonEKS_CNI_Policy`
    - `AmazonEC2ContainerRegistryReadOnly`
    - `s3:GetObject`

EKS Cluster Worker Node Common



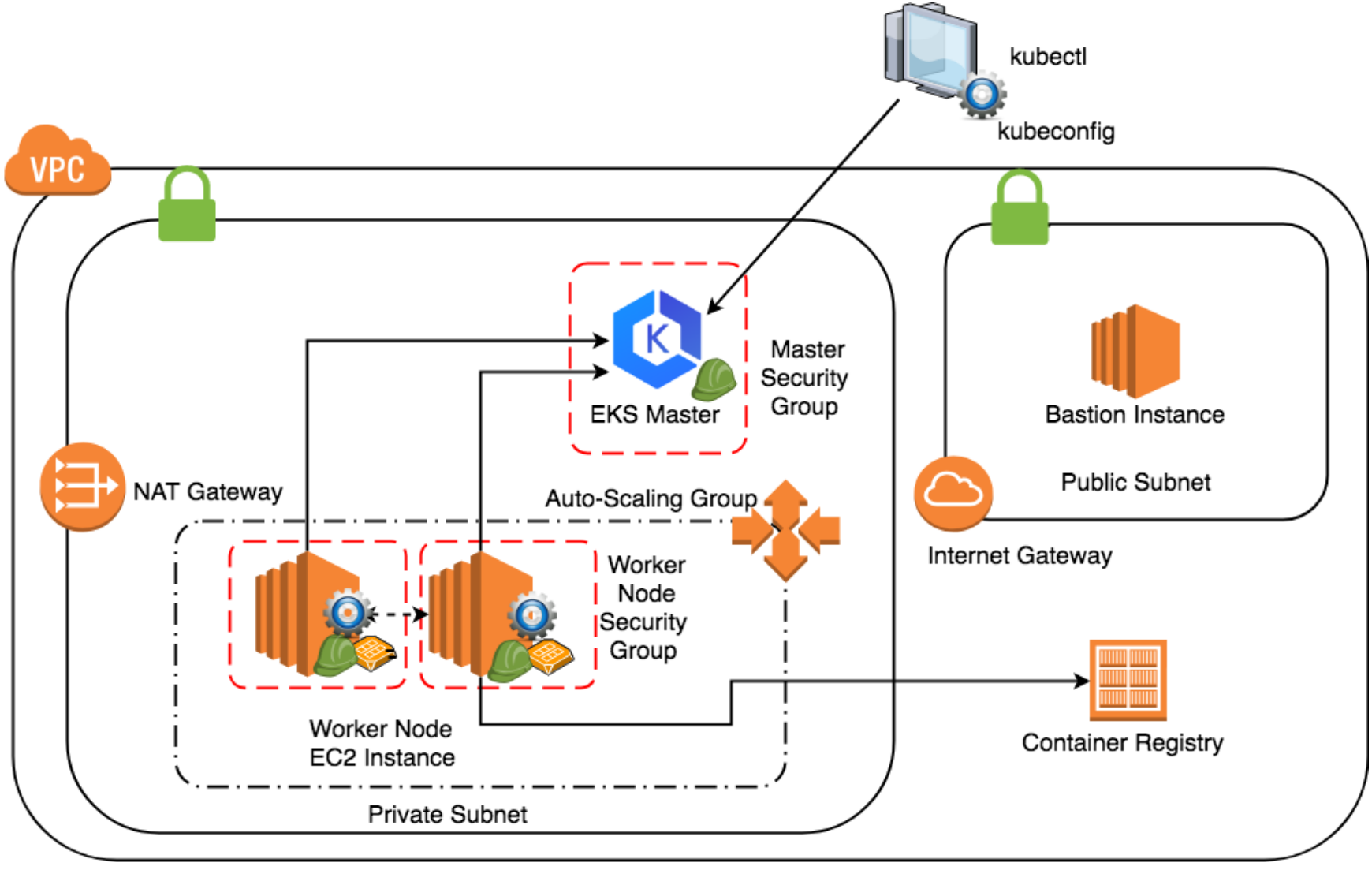
Worker Node Filewall

- **File: aws/eks/master/security-group-worker.tf**
- **Purpose:**
  - **Controls networking access to the Kubernetes worker nodes.**

Worker Node Filewall - Security Group

- File: aws/eks/master/security-group-worker.tf
- Purpose:
  - Controls networking access to the Kubernetes worker nodes.
- Action:
  - AWS Security Group
    - `workers_egress_internet`
    - `workers_ingress_self`
    - `workers_ingress_cluster`
    - `workers_ingress_ssh`
    - `worker_ingress_lb`
      - Kubernetes NodePort

EKS Cluster Worker Node AutoScaling Group



Worker Node AutoScaling Group

- File: aws/eks/worker-asg/asg.tf
- Purpose:
  - This setup utilizes an EC2 AutoScaling Group (ASG) rather than manually working with EC2 instances.
  - This offers flexibility to scale up and down the worker nodes on demand.

Amazon Machine Image

- First, let us create a data source to fetch the latest Amazon Machine Image (AMI) that Amazon provides with an EKS compatible Kubernetes baked in.
- aws/eks/worker-asg/asg.tf
    - `image_id = "${coalesce(var.ec2_ami, module.worker_common.coreos_ami_id)}"`

AMI with Terraform module

- `module.worker_common.coreos_ami_id`
  - File: aws/eks/worker-common/ami.tf
  - `module.container_linux`
    - try to get latest version of coreos, if needed

AutoScaling Launch Configuration

- aws/eks/worker-asg/asg.tf
  - `aws_autoscaling_group`
    - `aws_launch_configuration`

```
resource "aws_launch_configuration" "workers" {
......
  user_data            = "${module.worker_common.ign_conf

......
}
```

User Data - ignition

- Ignition is a new provisioning utility designed specifically for CoreOS Container Linux.
- https://coreos.com/ignition/docs/latest/
- File: aws/eks/worker-common/ignition.tf
- File: aws/eks/ignition
    - locksmithd
    - docker
    - ca
    - heptio_authenticator_aws
    - kubelet

User Data - ignition - utilities

- File: aws/eks/worker-common/ignition.tf

```
data "ignition_config" "main" {
  files = ["${compact(list(
    module.ignition_worker.max_user_watches_id,
    module.ignition_worker.ntp_dropin_id,
    module.ignition_worker.client_ca_file_id,
    module.ignition_worker.kubeconfig_id,
    module.ignition_worker.kubelet_env_id,
   ))}"
  ]

  systemd = [
    "${module.ignition_worker.locksmithd_service_id}",
    "${module.ignition_worker.docker_dropin_id}",
    "${module.ignition_worker.update_ca_certificates_drop
    "${module.ignition_worker.heptio_authenticator_aws_id
    "${module.ignition_worker.kubelet_service_id}",
  ]
}
```

Practice - Part 2

- `$ export KUBECONFIG=.terraform/kubeconfig`
- `$ kubectl cluster-info`
- `$ kubectl get node`

Key Takeaways

- **Kubernetes & EKS Overview**
  - Kubernetes Architecture Concept
  - EKS Master
  - EKS WorkNode
- **Make a EKS Clsuter with Terraform**
  - AWS EKS Service
  - Other Service ...
- **Concept about making a EKS Cluster for production with Terraform**
  - Terraform module & resource dependencies
  - Network & Firewall
  - Instances & Utilities