Standard P1935

Introduction & Implementation

陳奐廷

Outline

- Testbed architecture
- Testbed actions
- Testbed apis
- Testbed implementation
- Testbed usage

Architecture

Edge/Fog Orchestrator

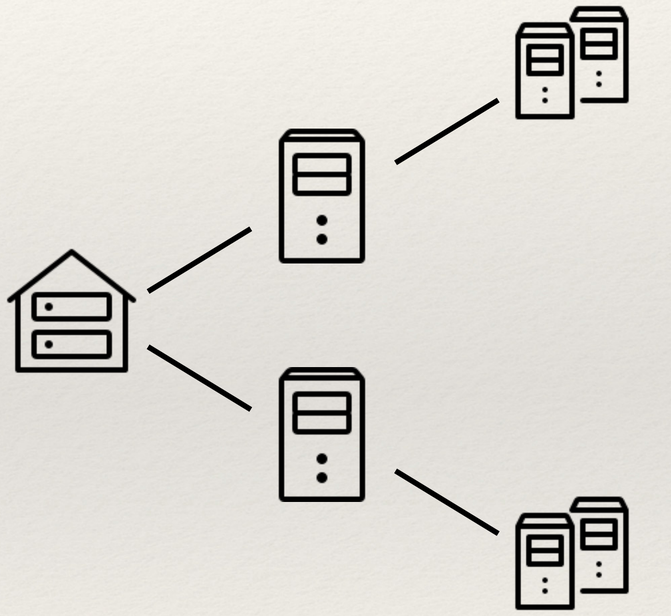
An orchestrator of the whole Edge/Fog system

Control Node

Manage the related compute nodes

Compute Node

An entity that is able to handle the computing tasks on its own



Architecture

Edge/Fog Orchestrator

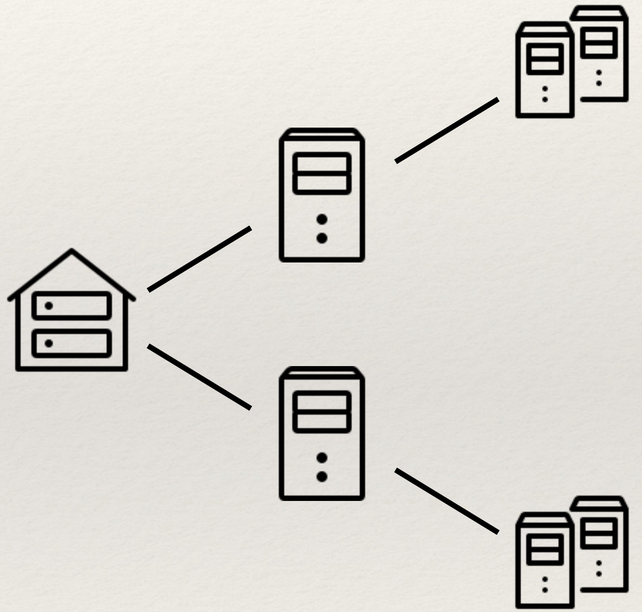
python™ mongoDB.

Control Node

kubernetes

Compute Node

kubernetes



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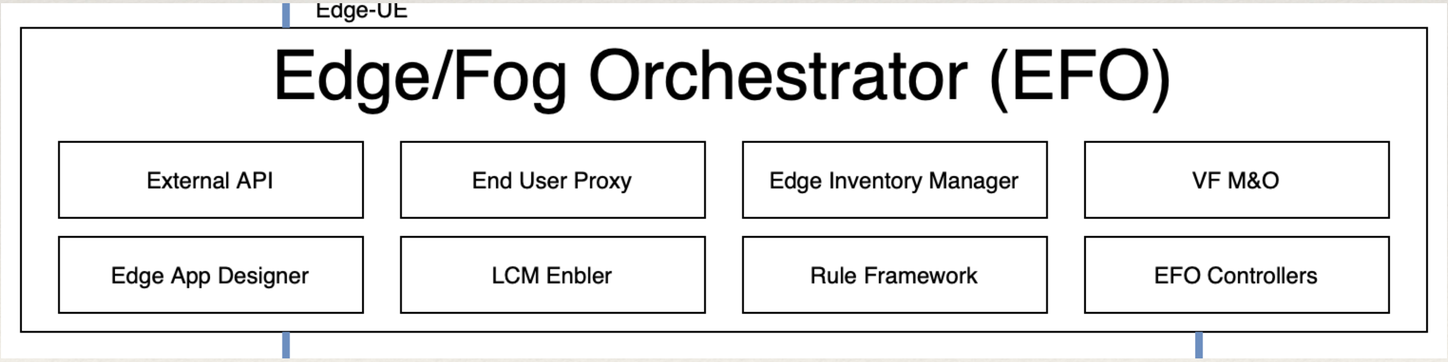

Architecture

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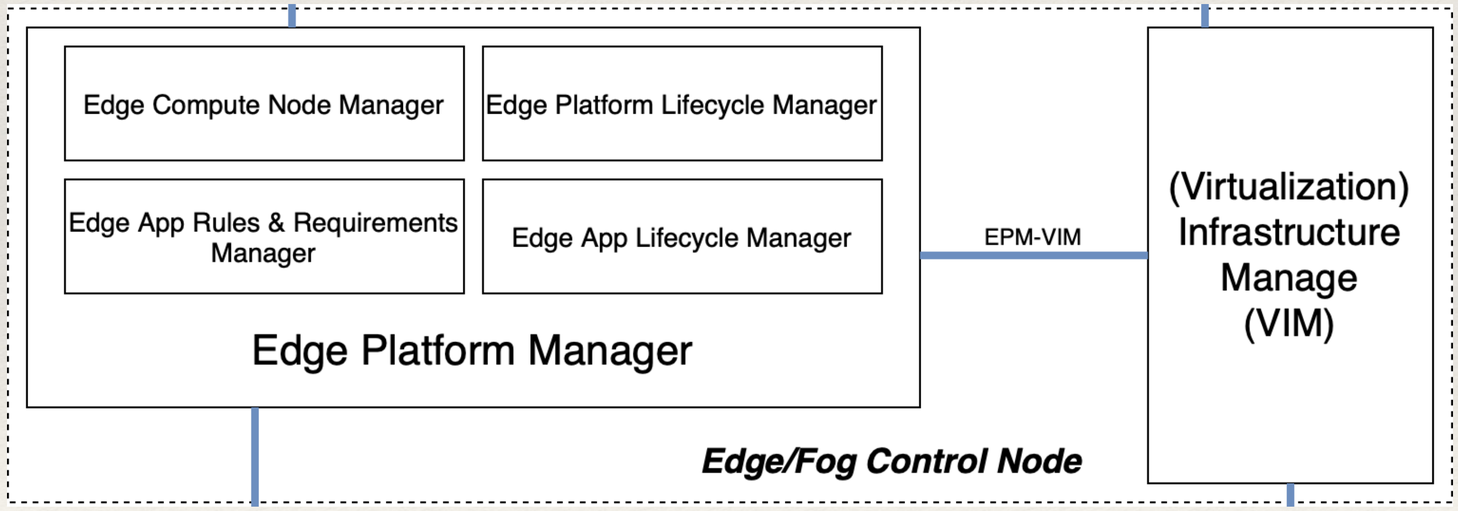

Architecture

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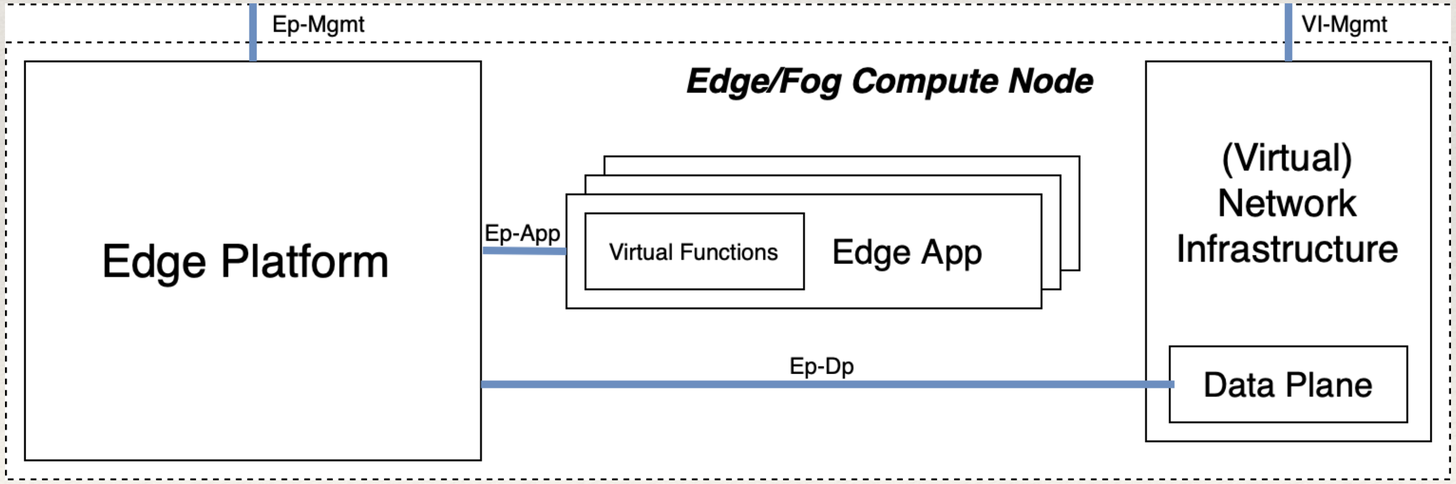


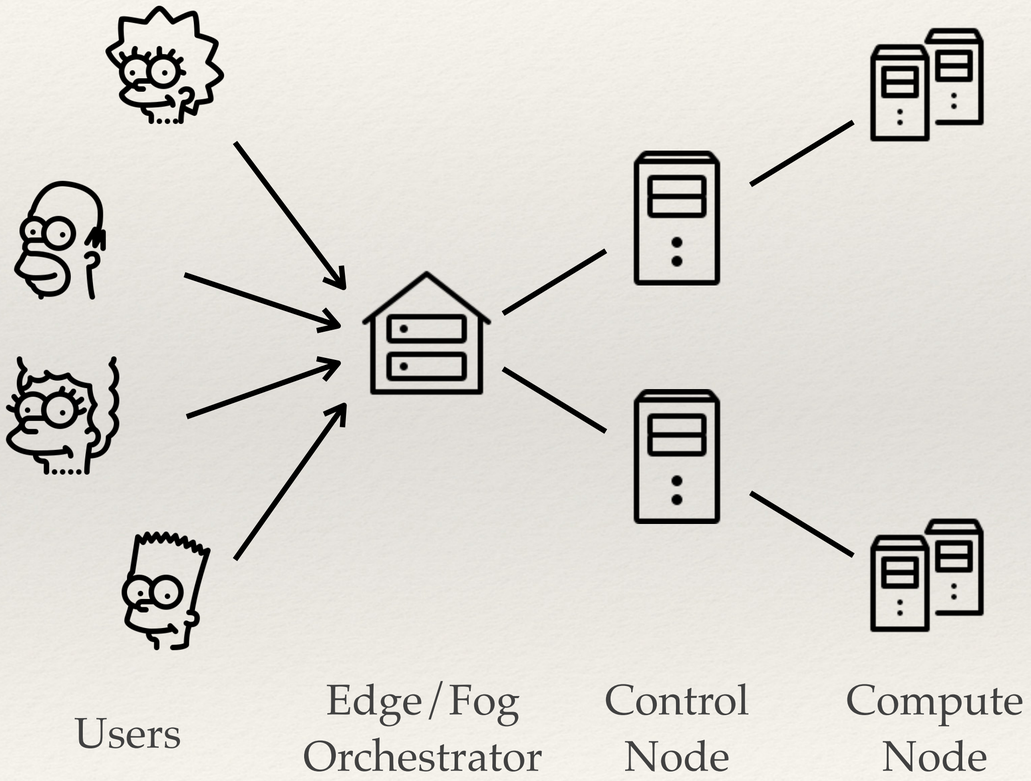
Users

Infrastructure Owner

Edge Service Provider

Edge Service Operator

End User

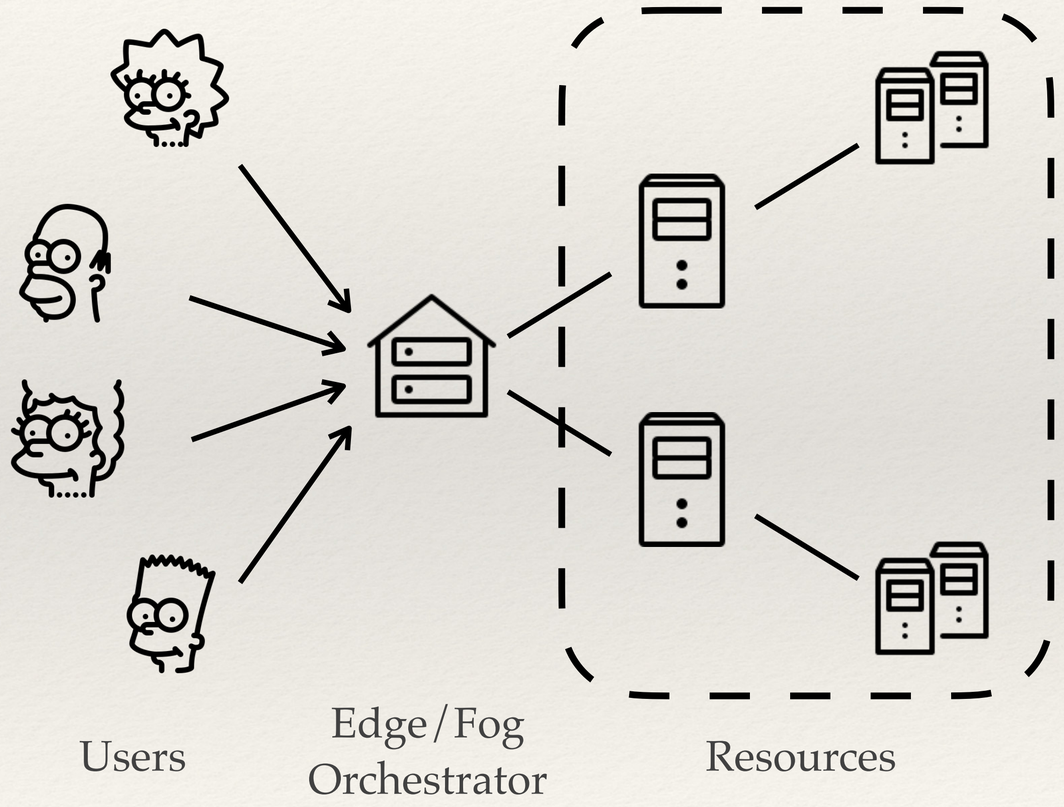


Actions

- Resource management
- Application management

Actions

- Resources
  - Physical machine
  - Virtual machine



Actions

- Applications
  - Run in container (Kubernetes)
  - Configured by manifest

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: helloworld
  labels:
    app: helloworld
spec:
  replicas: 1
  selector:
    matchLabels:
      app: helloworld
  template:
    metadata:
      labels:
        app: helloworld
    spec:
      containers:
      - name: helloworld
        image: dingyiyi0226/demoapp
        ports:
        - containerPort: 5678
```

Actions

- Resource Management
  - Creation 
  - Query/Discovery 
  - Reconfiguration 
  - Deletion 
- Application Management
  - Onboarding 
  - Instantiation 
  - Context Creation/Deletion 
  - Reconfiguration 
  - Termination 

 Infrastructure Owner  Edge Service Provider  Edge Service Operator  End User

REST APIs

- Resource Management

list_clusters	**GET** /api/clusters
create_cluster	**POST** /api/clusters
delete_cluster	**DELETE** /api/clusters/<clusterName>
list_nodes	**GET** /api/clusters/<clusterName>/nodes
create_node	**POST** /api/clusters/<clusterName>/nodes
list_machines	**GET** /api/machines
create_machine	**POST** /api/machines
delete_machine	**DELETE** /api/machines/<machineName>
create_vm	**POST** /api/vms

- Application Management

list_manifests	**GET** /api/manifests
create_manifest	**POST** /api/manifests
delete_manifest	**DELETE** /api/manifests/<manifestID>
patch_manifest	**PATCH** /api/manifests/<manifestID>
list_apps	**GET** /api/apps
create_app	**POST** /api/apps
delete_app	**DELETE** /api/apps/<appID>
post_app_contexts	**POST** /api/apps/<appID>/contexts
list_services	**GET** /api/services

See API.md for more information

Application Lifecycle

1. Service provider uploads the manifest

   POST /api/manifests

2. Service operator authorizes and distributes the manifest

   POST /api/apps

3. Service operator manages the application

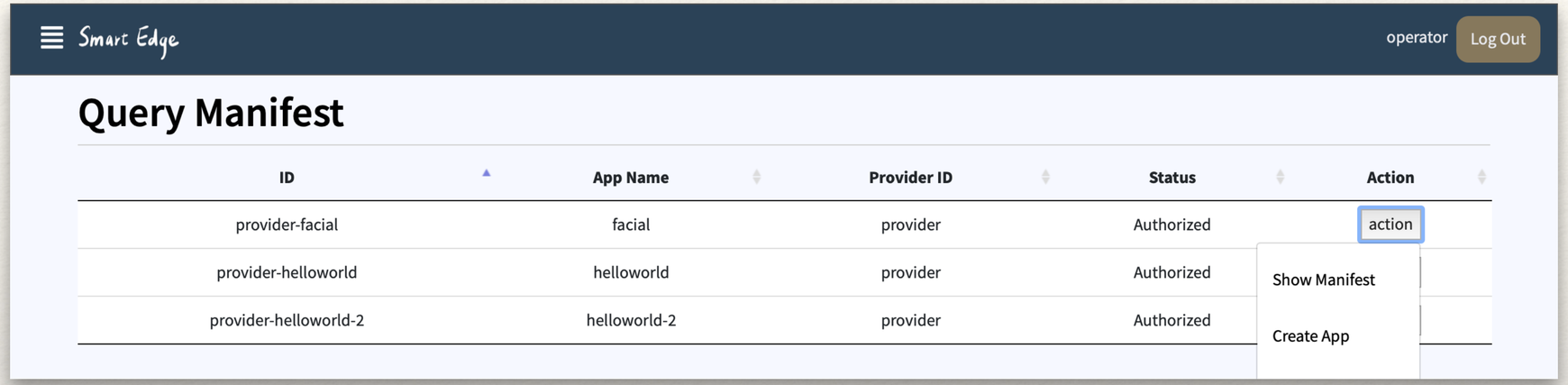
   GET /api/apps/<appID>/instantiate

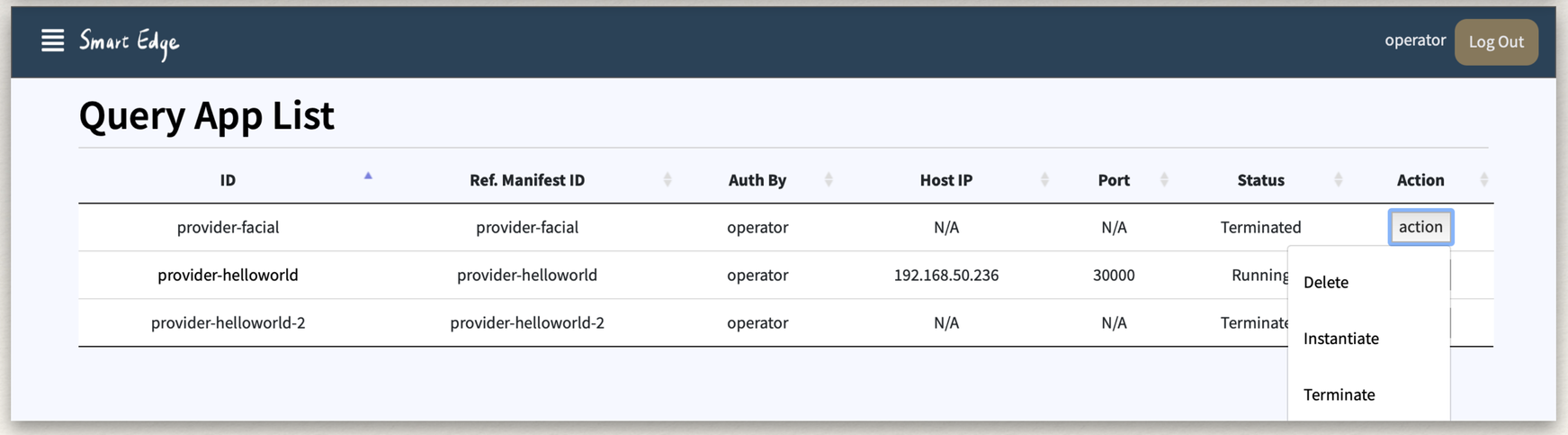
   GET /api/apps/<appID>/terminate

   DELETE /api/apps/<appID>

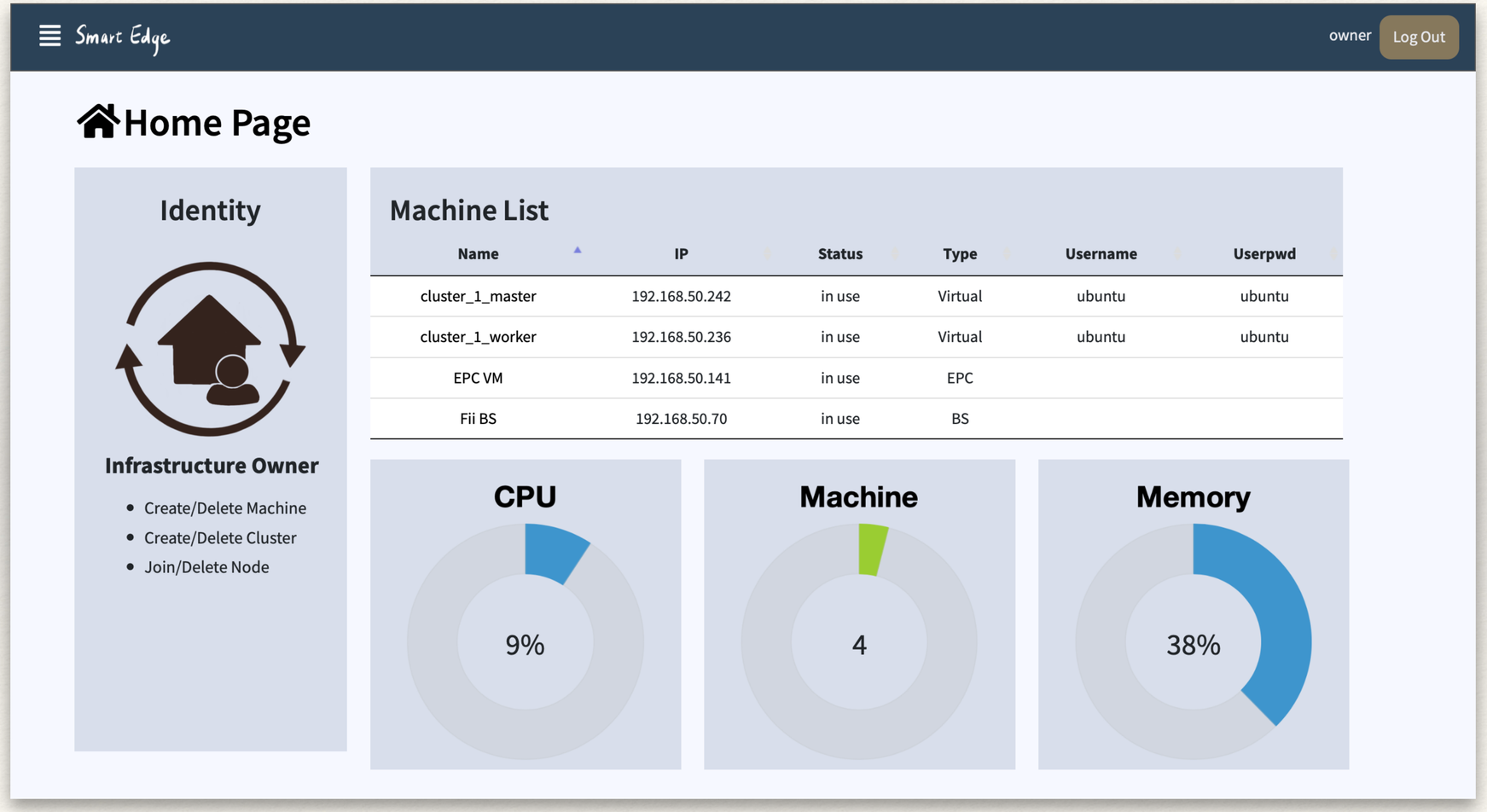
See Actions.md, API.md, and demo videos (on NAS) for more information

User Interface





User Interface



Testbed Location

- Server IP

  140.112.187.109, 192.168.50.166

- Path

  /home/1935/standard-p1935

- Github

  dingyiyi0226/standard-p1935

System Structure

- API Server

  Flask. Expose the api

- EFO

  The core system

- Database

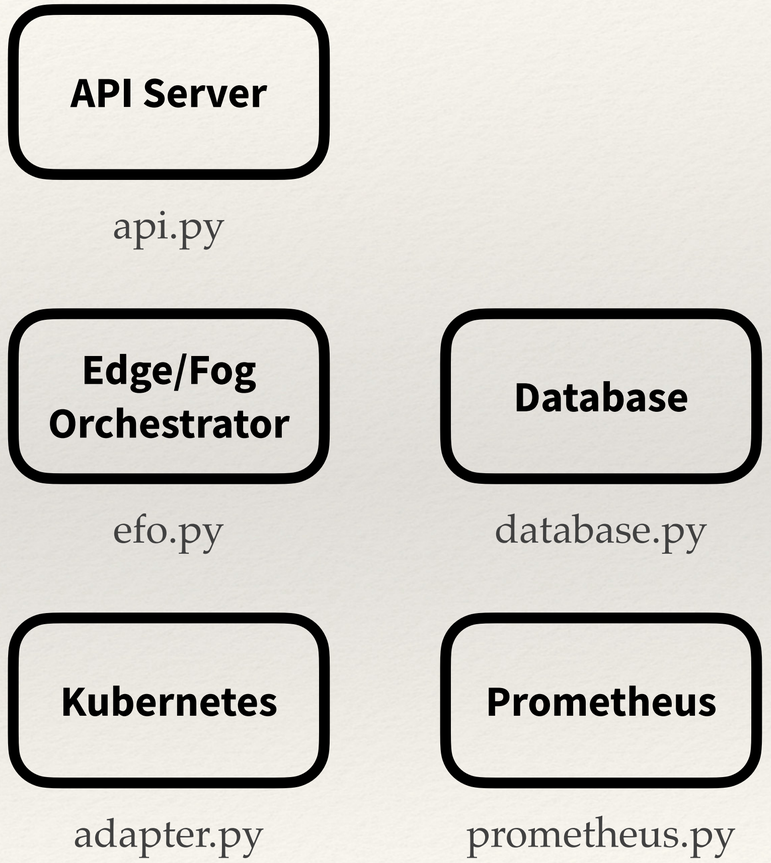
  MongoDB. Store the manifests, apps, and nodes information

- Prometheus

  Prometheus-operator. Monitor nodes and retrieve real time information

- Kubernetes

  Kubernetes-python-client. Communicate with the kubernetes clusters



System Installation

- Install python 3.7 with requirements

  pip install -r requirements.txt

- Install MongoDB

- Add users in database

  mongo < init_db.js

Start the system

- (optional) Switch the user to wmnlab (for VM related)

  su - wmnlab

- Activate the python environment

  conda activate 1935env

- Start the system in development/production mode

  ./run_dev.sh or ./run_prod.sh

- Go to http://192.168.50.166:5000 in browser

Login Accounts

Name	Password	Identity
provider	prov	Service provider
operator	oper	Service operator
enduser	end	End User
owner	own	Infrastructure owner

Defined in init_db.js

Common Errors

- Starting script errors, address already in use

  Kill the process or change the port in the starting script

- Package not found error

  Activate the python environment

- Other errors

  Check the VM/Kubernetes/MongoDB status

Conclusions

- Testbed introduction
- Testbed RESTful APIs
- Testbed Implementation and UI
- Testbed usage