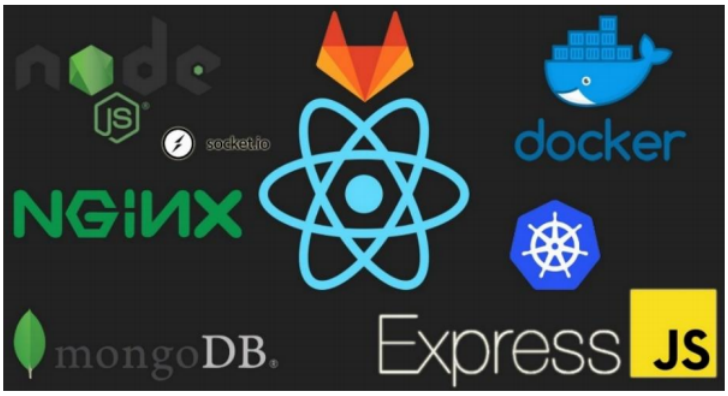
DevOps Final Project



--Ravi Kumar Pilla
--Dinakara Sai Santosh Burugupalli
--Priyam Mukund Modi

Introduction

Application Features – Twitter Clone / Chatter

- Token based authentication for user Sign in and Sign up
- Web application where user can tweet and see the recent tweet from all other users.
- Integrated News API on the home page for latest updates
- Tweets include photo, username, tweet body, comments and likes on a particular post.
- User can comment and like the tweet and view tweets posted by others
- Ability to delete offensive tweets before any user can see them
- Tweets are stored in a database, so they never get lost
- Ability to deploy front-end as a PWA so that it can run on devices
- All the tweets are store to the backend database, which will help the user find their past tweets.
- Redis-json as the middle layer.
- React and material UI for frontend development
- Session Based user management using cookies

Application Deployment

- Terraform to provision infrastructure
- Kubernetes cluster on AWS
- Logging using ELK stack
- Monitoring using Prometheus
- Continuous Integration to Docker Hub (A new image is created and deployed to docker hub)
- Ingress Controller using NGINX
- Application scaling based on number of clients

About various Technologies

Frontend Technologies

- React: https://react-cn.github.io/react/downloads.html
- React Native: https://reactnative.dev/
- Command to create react native project- npx react-native init {Application Name}

Backend Technologies

- Node Js: https://nodejs.org/en/download/
- Mongo DB: MongoDB_Download_Link
- Redis Server: https://redis.io/download

Server Technologie

- Docker CLI: https://docs.docker.com/docker-for-mac/install/
- Kubernetes: https://kubernetes.io/docs/tasks/tools/install-kubectl/
- EKS: https://minikube.sigs.k8s.io/docs/start/
- Helm Chart: https://helm.sh/docs/helm/helm_pull/
- AWS CLI: https://awscli.amazonaws.com/AWSCLIV2.msi

Final Project – Twitter Application

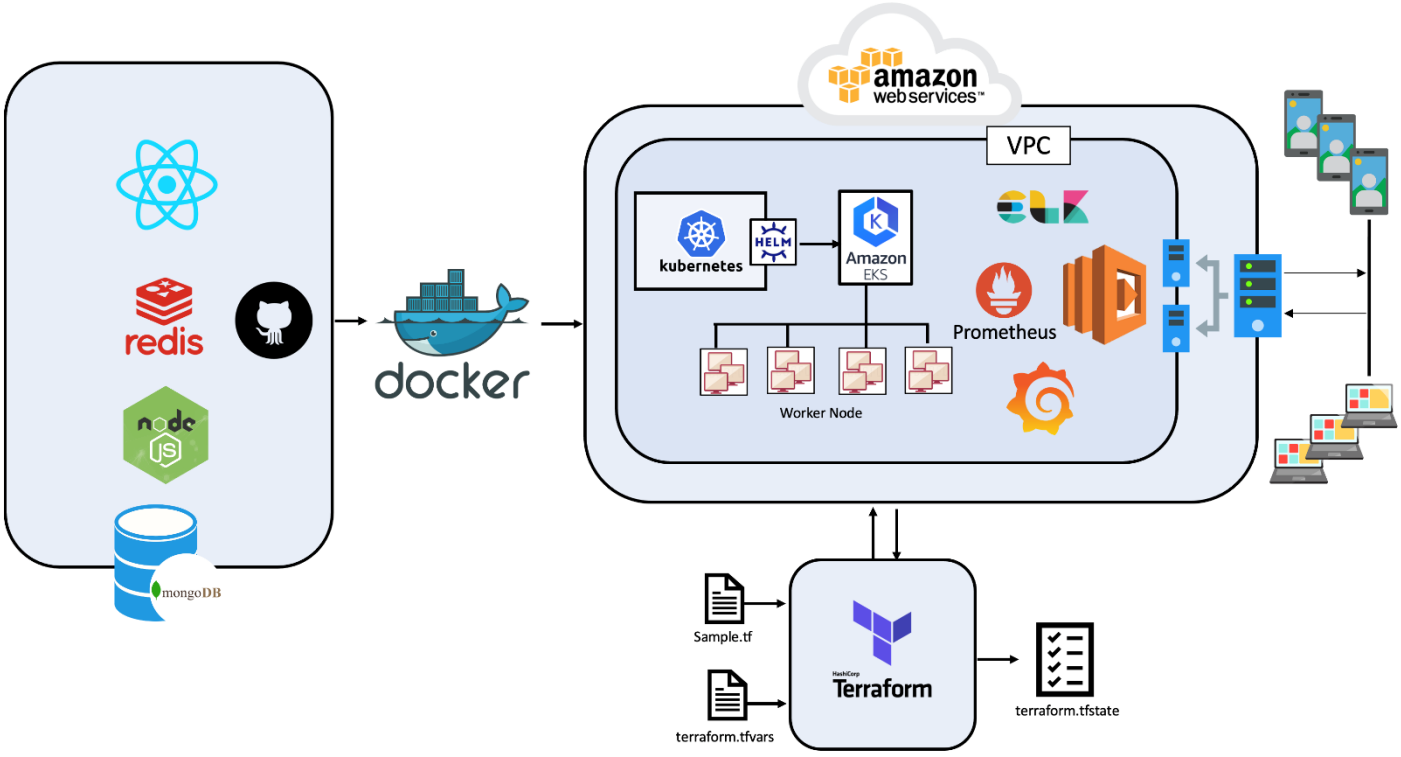
- Prometheus: https://prometheus.io/download/
- Terraform: https://www.terraform.io/downloads.html

Logging Technologies

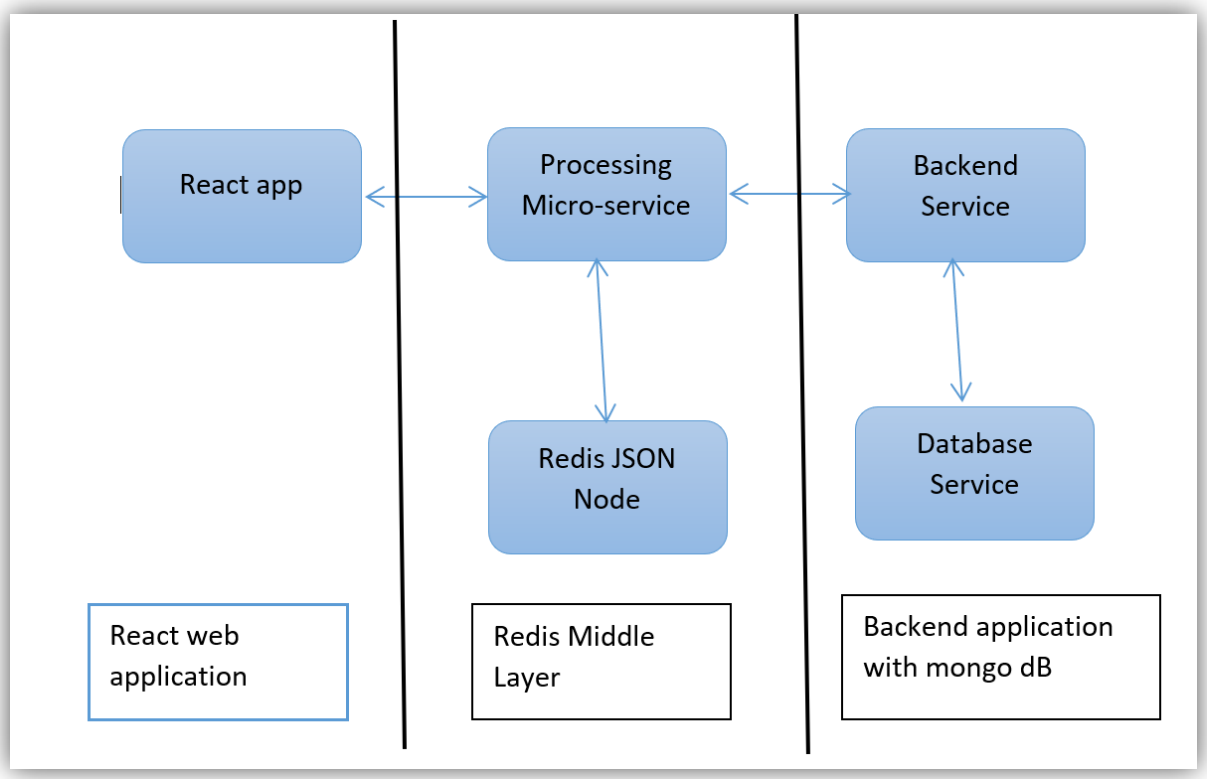
- ELK Stack

Project Architecture

- The Front end is created in the React, Redis JSON is working as the middleware for the system.
- All the requests are clustered in the middleware and after every interval it is transferred to the backend i.e., Node server.
- The Node server relates to the MongoDB for saving and fetching user data.
- All the layers are separately containerized in the Docker Container.
- The Docker containers are further deployed as the Kubernetes pods.
- The Kubernetes pods are deployed on the AWS EKS using the Terraform.
- The Prometheus server is connected to the AWS to track down the request load on the server
- Metrics are displayed using Grafana dashboard
- All the incoming requests from the client are load balanced on the AWS using the ELB service of the AWS.
- Pod autoscaling based on number of client requests. And custom metrics using service monitor and Prometheus client.
- Continuous Integration using GitHub Operations and Docker
- Developed helm chart to deploy application at a faster pace

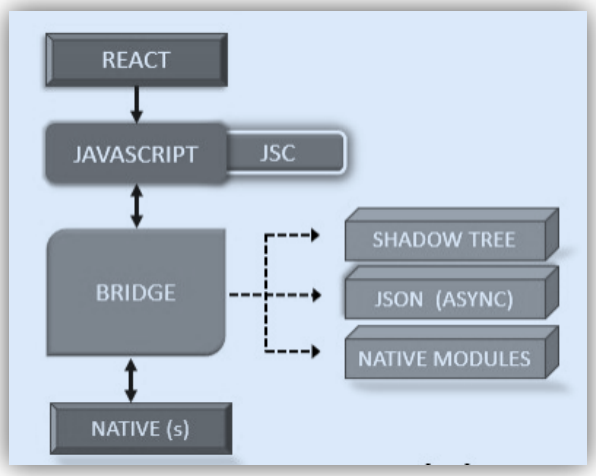


Application architecture



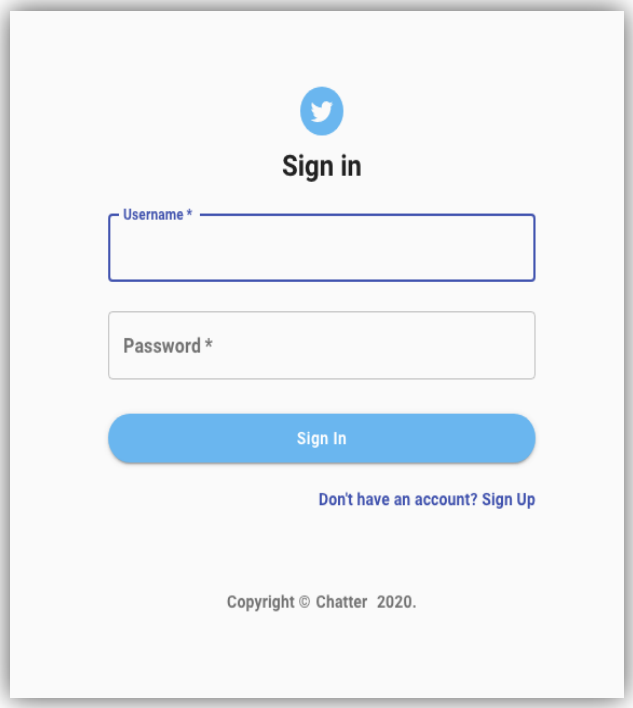
1. **Frontend**

The frontend application is created in React, which enables the application to run on both Mobile and webapp.



Login Page

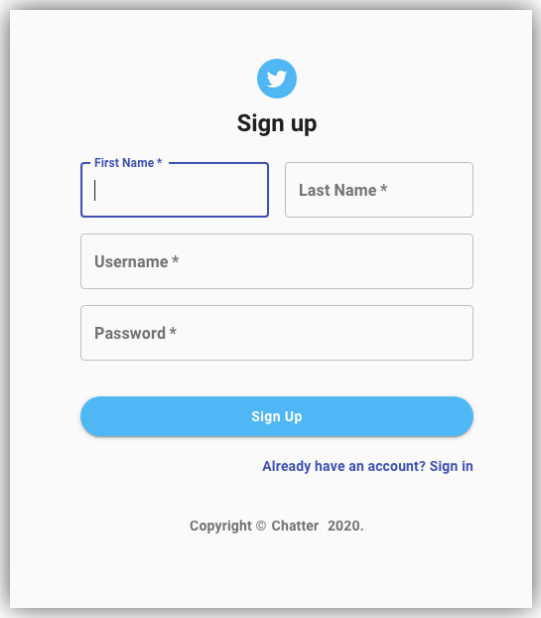
User can login to the existing account.



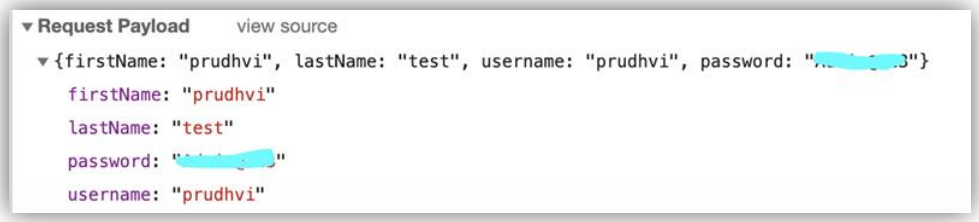

```
// SignIn function definition
export default function SignIn({ changeActiveRoute, history }) {
  const classes = useStyles();

  // State for username and password
  const [username, setUserName] = useState("");
  const [password, setPassword] = useState("");

  // State to show auth failed/succeeded
  const [isUserEntryValid, setIsUserEntryValid] = useState(true);

  // Authenticate a user using API endpoint
  const authenticateUser = async (e) => {
    try {
      setIsUserEntryValid(true);
      e.preventDefault();

      // post api call trigger to verify user identity
      const userRequest = {
        username: username,
        password: password,
      };

      const userInfoReceived = await authenticateUserInfo(userRequest);
      userInfoReceived.displayName = userInfoReceived.firstName
        .concat(" ")
        .concat(userInfoReceived.lastName);

      // Set session for user
      setSessionCookie(userInfoReceived);
      history.push("/home");
    } catch (error) {
      console.log(error);
      setIsUserEntryValid(false);
    }
  };
```

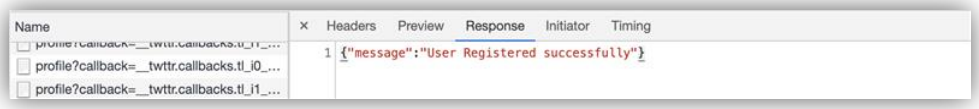
Registration Page

Create a new user just by entering Name and Email ID.
Password field on the Login and Registration page is Token based authentication.

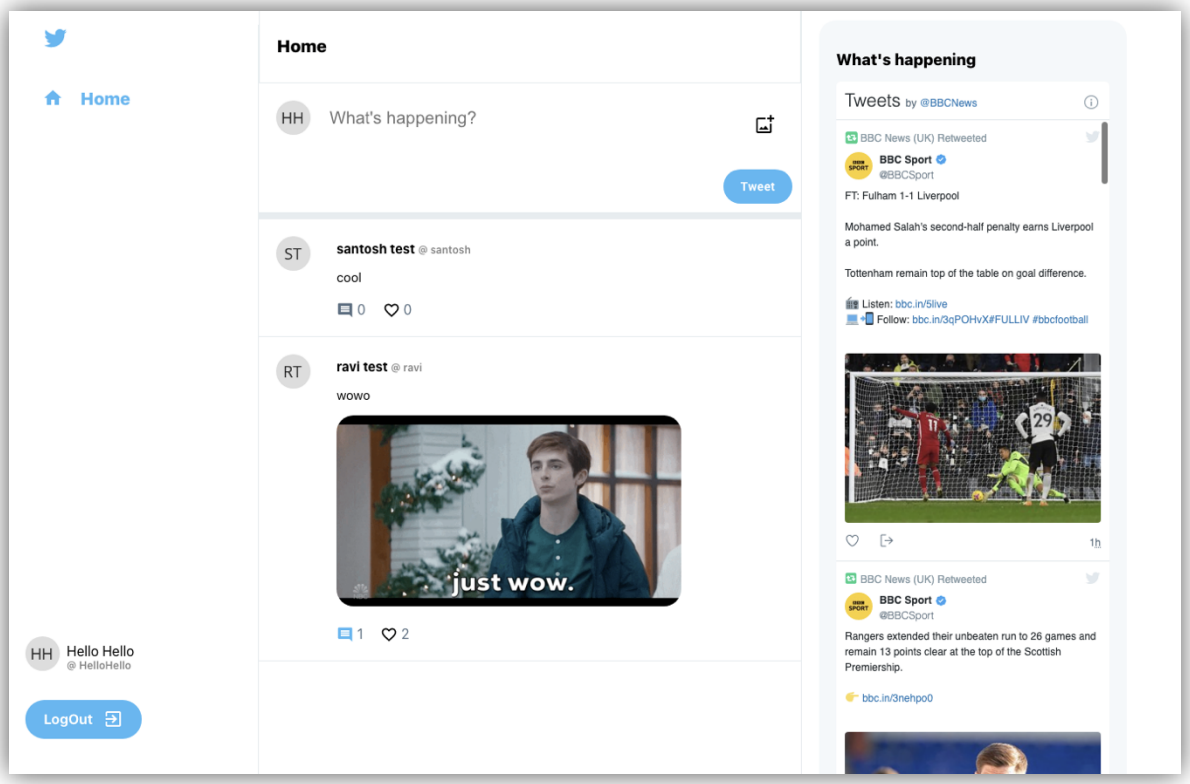



```
// Function to register a user using Register API
const registerUser = async (e) => {
  try {
    setIsUserEntryValid(true);
    e.preventDefault();

    // post api call trigger to register user
    const userRequest = {
      firstName: firstName,
      lastName: lastName,
      username: username,
      password: password,
    };

    // register API call
    await registerUserInfo(userRequest);
    // move to login screen
    changeActiveRoute();
  } catch (error) {
    console.log(error);
    setIsUserEntryValid(false);
  }
};
```


Request Payload
view source
{firstName: "prudhvi", lastName: "test", username: "prudhvi", password: "[redacted]"}
firstName: "prudhvi"
lastName: "test"
password: "[redacted]"
username: "prudhvi"


Name
Headers
Preview
Response
Initiator
Timing
profile?callback=__twttr.callbacks.tl_i0_...
profile?callback=__twttr.callbacks.tl_i1_...
1 {"message":"User Registered successfully"}

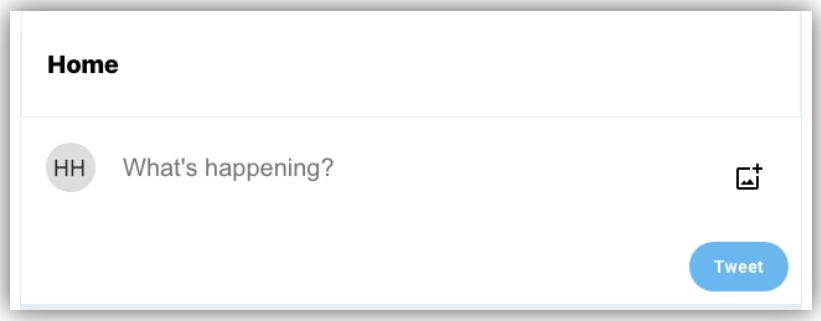
Home Page


Home
Home
HH
What's happening?
Tweet
ST
santosh test @ santosh
cool
0
0
RT
ravi test @ ravi
wowo
just wow.
1
2
HH
Hello Hello
@ HelloHello
LogOut
What's happening
Tweets by @BBCNews
BBC News (UK) Retweeted
BBC Sport
@BBCSport
FT: Fulham 1-1 Liverpool
Mohamed Salah's second-half penalty earns Liverpool a point.
Tottenham remain top of the table on goal difference.
Listen: bbc.in/5live
Follow: bbc.in/3qPOHvX#FULLIV #bbcfootball
1h
BBC News (UK) Retweeted
BBC Sport
@BBCSport
Rangers extended their unbeaten run to 26 games and remain 13 points clear at the top of the Scottish Premiership.
bbc.in/3nehpo0

21 lines (20 sloc) | 488 Bytes

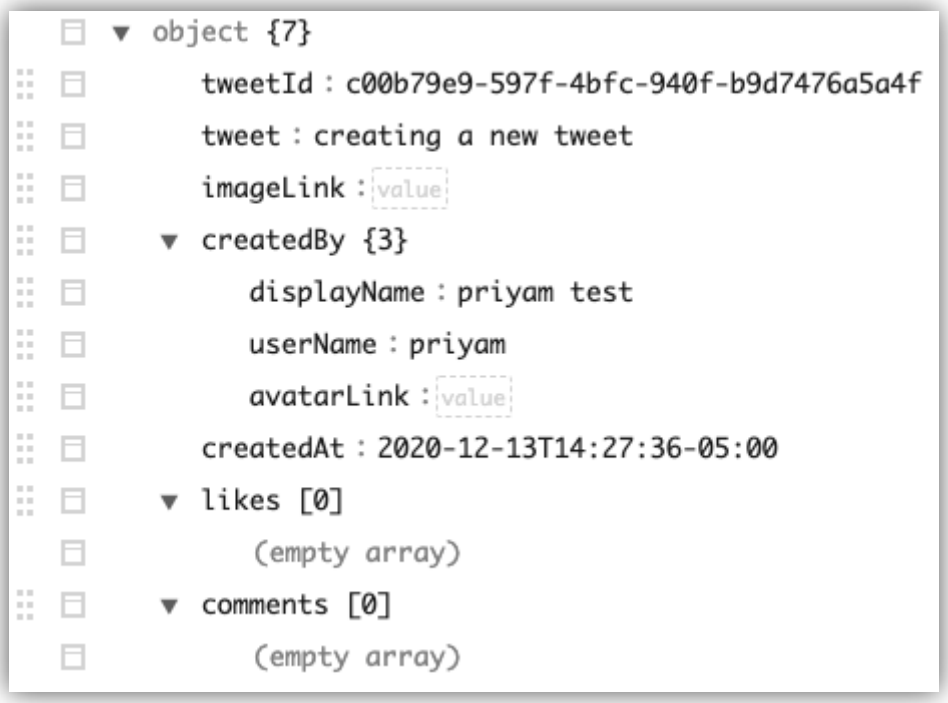
```
/**
 * Component Responsible to hold all the 3 major
 * components Sidebar, Feed, Widgets
 */
import React from "react";
import Feed from "../Feed/Feed";
import Sidebar from "../Sidebar/Sidebar";
import Widgets from "../Widgets/Widgets";
import "../../App.css";
// Home function definition
function Home({ userInfo }) {
  return (
    <div className="app">
      <Sidebar userInfo={userInfo} />
      <Feed userInfo={userInfo} />
      <Widgets />
    </div>
  );
}

export default Home;
```

- User can Tweet what is happening around.

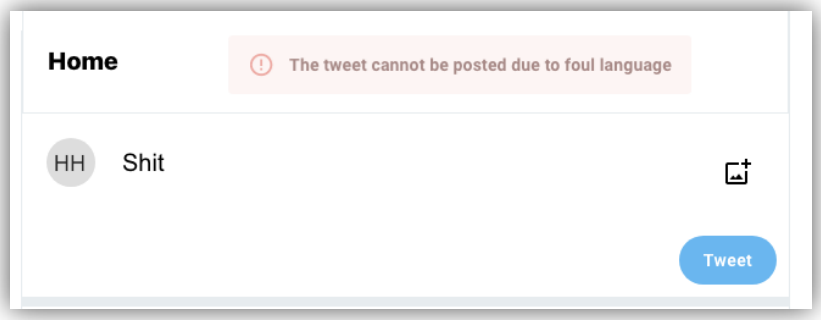


Request for Creating Tweet

Response for Creating Tweet



- User will not be able to post abuse words.

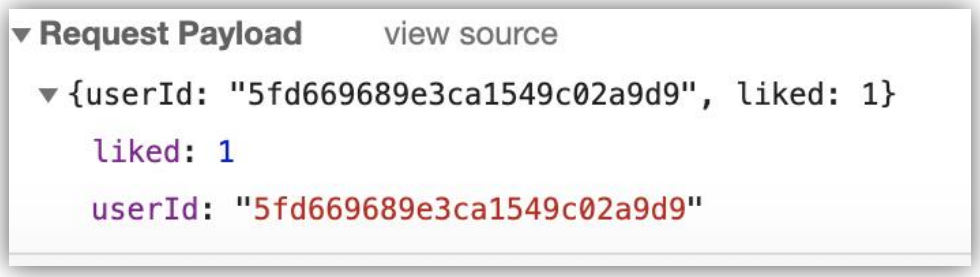


- User can like any of the tweets and can also comment on tweets.

JSON Request for likes

JSON Request for likes on tweet

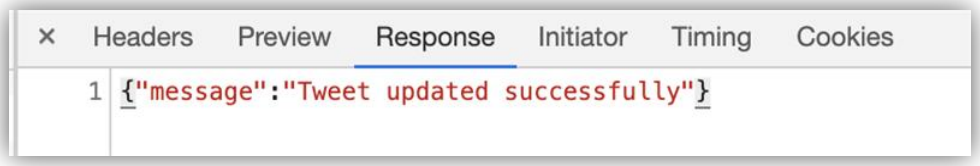
After User click on the Like Button it will add to the backend



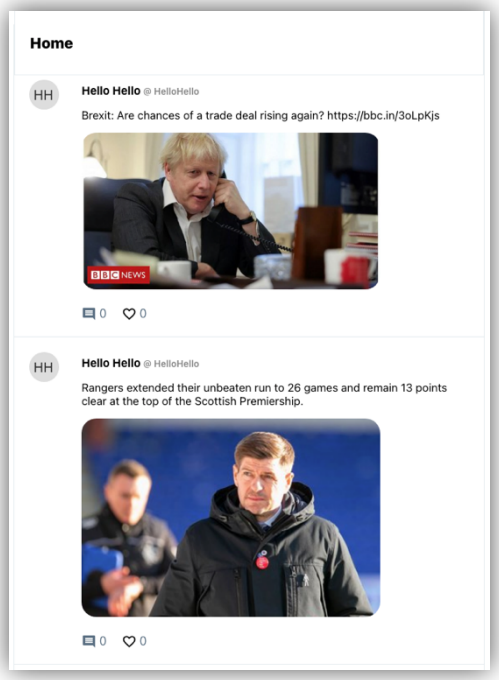
Comment Request to Get Comments from the backend

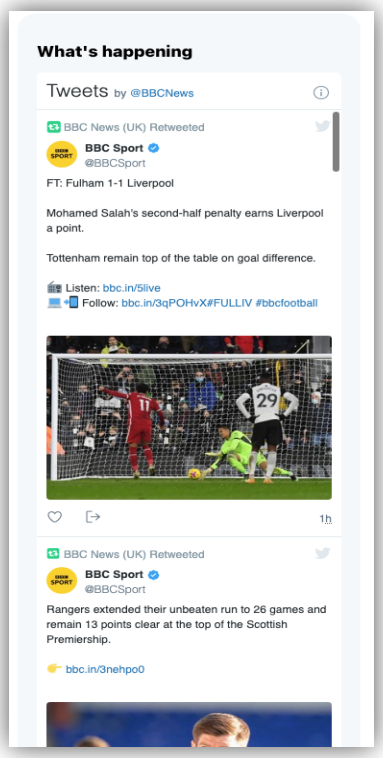
Adding Comment Request

Response from backend after request are submitted



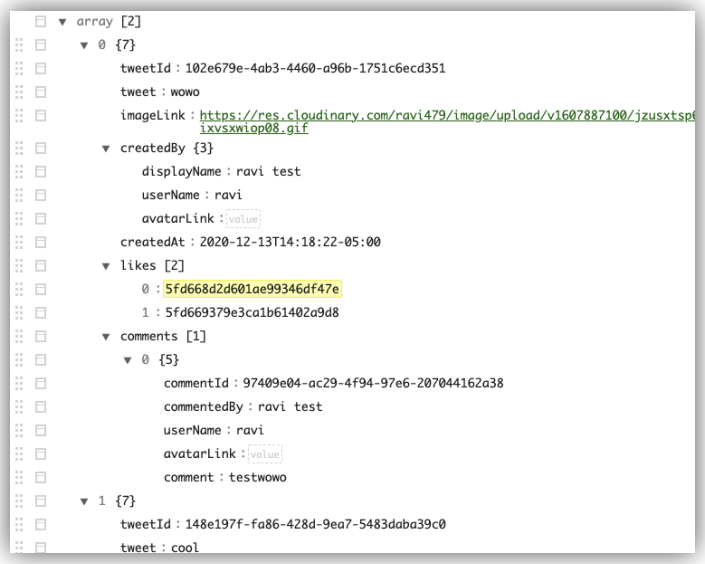
- Included BBC News API to show the recent news.
- Logout from the account.





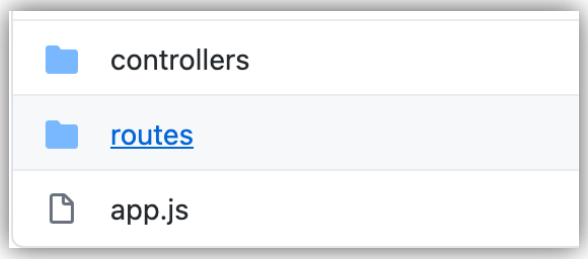
Get All Tweets Request

JSON Data



2. Redis Server

The Redis server will act as the middleware for the application. All the request from the frontend will be forwarded to the Redis server and it will as the queuing part.



The Set interval method is used to queue the api calls and after every 6000ms it will be pushed to the backend server.

```
setInterval(clearCache, 1000 * 60 * cacheTimeOut);

// Function used to clear cache after every cacheTimeOut minutes and calls the main backend to
// update the records
function clearCache() {
  // get the values from cache
  client.lrange(myKey, 0, -1, function (err, reply) {
    if (!err) {
      const tweets = reply.map(JSON.parse);
      if (tweets && tweets.length > 0) {
        // call the node server to dump the data
        fetch(`${baseUrl}/tweets`, {
          method: "POST",
          body: JSON.stringify(tasks),
          headers: { "Content-Type": "application/json" },
        })
          .then((res) => res.json())
          .then((json) => console.log(json));
      }
    }
  });
```

Redis Server Code

```
const express = require("express"),
  app = express(),
  bodyParser = require("body-parser"),
  port = process.env.PORT || 3000,
  cors = require("cors");
// enable cors
app.use(cors());

//Adding body parser for handling request and response objects.
app.use(
  bodyParser.urlencoded({
    extended: true,
  })
);
app.use(bodyParser.json({ limit: "50mb" }));
app.use(
  bodyParser.urlencoded({
    limit: "50mb",
    extended: true,
    parameterLimit: 50000,
  })
);

//Initialize app
let initApp = require("./api/app");
initApp(app);

app.listen(port);
console.log(`ChatterApp Redis server started on: ${port}`);
```

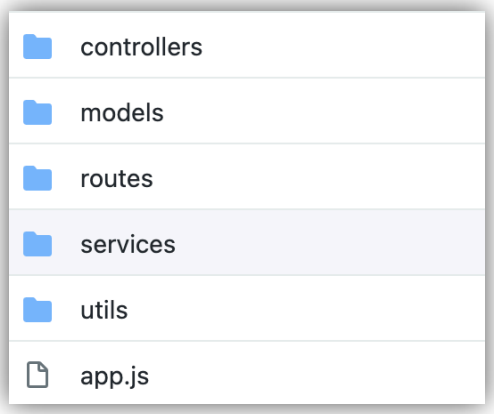
3. Backend

The backend of the application relates to the Redis Server, where all the request is gathered and further it is transported to the backend Node JS server.

Server Code:

```
const utilConstants = require("./api/utils/Constants");
const express = require("express"),
  app = express(),
  port = process.env.PORT || utilConstants.PORT,
  mongoose = require("mongoose"), //created model loading here
  bodyParser = require("body-parser");
const cors = require("cors");
const jwt = require('./api/utils/jwt');
const errorHandler = require("./api/utils/error_handler");

// Mongo Atlas
const uri = utilConstants.MONGODB_URL;
mongoose.connect(uri, {
  useNewUrlParser: true,
  useUnifiedTopology: true,
  useFindAndModify: false,
  useCreateIndex: true,
  promiseLibrary: global.Promise,
})
.then(() => {
  console.log("MongoDB Connected…")
})
.catch(err => console.log(err))

// enable cors
app.use(cors());
app.use(jwt());
app.use(errorHandler);
//Adding body parser for handling request and response objects.
app.use(
  bodyParser.urlencoded({
    extended: true,
  })
);
app.use(bodyParser.json({ limit: "50mb" }));
app.use(
  bodyParser.urlencoded({
    limit: "50mb",
    extended: true,
    parameterLimit: 50000,
  })
);


//Initialize app
let initApp = require("./api/app");
initApp(app);

app.listen(port);
console.log("ChatterApp RESTful API server started on: " + port);
```

Server API folder Structure

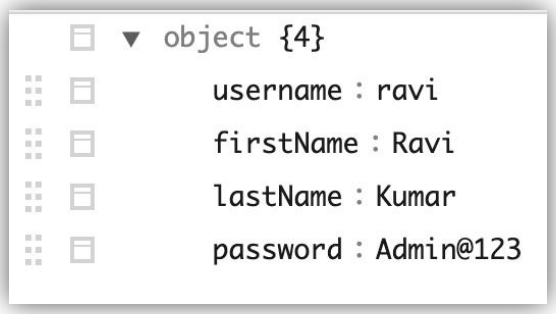


The Server Controllers API contains the Tweet methods which are responsible for creating and displaying tweets, adding comments to the tweet, adding like to the tweet and User controller methods which are responsible for creating a new user or fetching the existing user details.

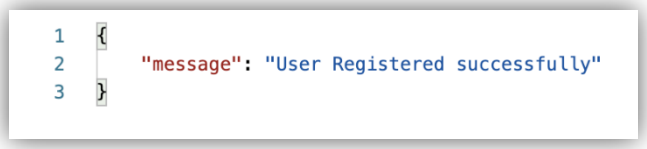
The Server Model API contains the Schema of the tweet and user data.

The Route services API contains the routes throw which the data will be communicated between frontend and backend.

We have created the following endpoint for the backend communication –
Create User: Post method - http://localhost:3000/v1/register



If the user is successfully created, the server will respond with the success message.



If there is some issue while creating the user, the server will respond with the failure message.

User Login: Post Method - http://localhost:3000/v1/authenticate

If the credentials provided are correct, the server will respond with the success message as follow


```
{
    "username": "ravi123",
    "firstName": "ravi",
    "lastName": "test1",
    "createdDate": "2020-12-06T03:34:54.186Z",
    "id": "5fcc515e6b3aed35842e3d59",
    "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.
        eyJzdWIiOiI1ZmNjNTE1ZTZiM2FlZDM1ODQyZTNkNTkiLCJpYXQiOjE2MDcyMjc5NDQsImV4cCI6MTYwNzgzMjc0NH0.
        GEqHgUcHNK8YjZjsI-qaDSWYVnn4Z2nxEi50o2MapVA"
}
```


If the credentials provided are not correct, the server will respond with the failure message


```
{
    "message": "Invalid username or password"
}
```


Creating Tweet: Post method - http://localhost:3000/v1/tweets

The parameters used for the creating tweets are as below –
TweetID – uuid
CreatedBy – Name of the user who created the tweet
CreatedAt – TimeStamp


```
{
    "tweetId": "3",
    "tweet": "Some tweet description from frontend3",
    "createdBy": {
        "userName": "username from frontend",
        "avatarLink": "user image link from frontend"
    },
    "createdAt":"TimeStamp from frontend",
    "imageLink":"Link of Any image for the tweet"
}
```


If the entered data validated and the tweet is stored in the database, the server will acknowledge using the below success message.

```
{
    "tweetId": "3",
    "tweet": "Some tweet description from frontend3",
    "imageLink": "Link of Any image for the tweet",
    "createdBy": {
        "userName": "username from frontend",
        "avatarLink": "user image link from frontend"
    },
    "createdAt": "timeStamp from frontend",
    "likes": [],
    "comments": []
}
```

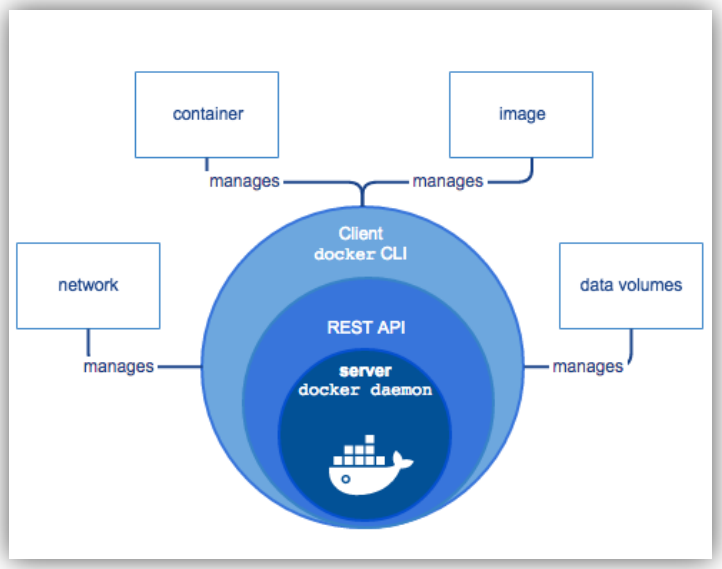

If it fails, the server will acknowledge with the below error message


```
{
    "message": "Invalid Token"
}
```


4. Infrastructure

Docker

- Docker is an open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly.
- With Docker, you can manage your infrastructure in the same ways you manage your applications.
- By taking advantage of Docker's methodologies for shipping, testing, and deploying code quickly, you can significantly reduce the delay between writing code and running it in production.



All of the microservices will containerized as a separate container
Create a separate docker files for frontend, middleware, and Backend.

- Docker file for React Application

2 lines (2 sloc) | 43 Bytes

```
1  FROM nginx
2  COPY build /usr/share/nginx/html
```

- Docker file for Redis Server

7 lines (7 sloc) | 118 Bytes

```
1  FROM node:14-slim
2  WORKDIR /usr/src/app
3  COPY ./package.json ./
4  RUN npm install
5  COPY . .
6  EXPOSE 3000
7  CMD [ "server.js" ]
```

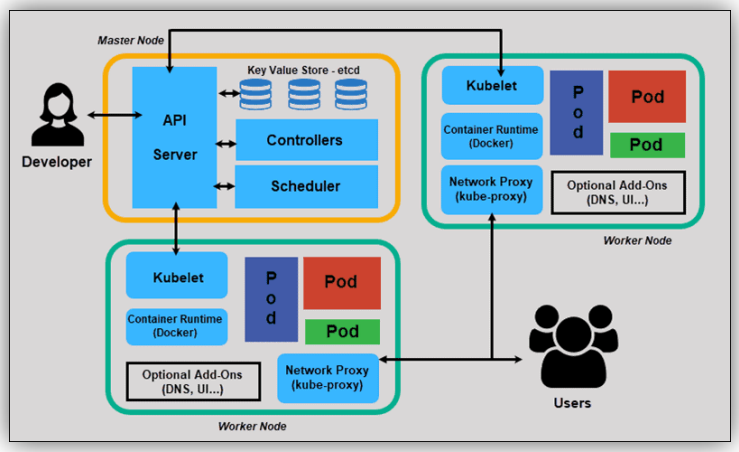
- Docker file for the Node Server

7 lines (7 sloc) | 118 Bytes

```
1  FROM node:14-slim
2  WORKDIR /usr/src/app
3  COPY ./package.json ./
4  RUN npm install
5  COPY . .
6  EXPOSE 3000
7  CMD [ "server.js" ]
```

Kubernetes

- Kubernetes is a portable, extensible, open-source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation. It has a large, rapidly growing
- ecosystem. Kubernetes services, support, and tools are widely available.



- In Kubernetes, we can expose the services publicly by choosing the type Load Balancer. That will create a public IP address for each service.

- But we want to reduce the number of IP addresses to make some saving and we want to map a URL like mycompany.com/login and mycompany.com/products to the right. Well, this could be done through Kubernetes Ingress resources.

- Kubernetes API does not provide an implementation for an ingress controller. So, we need to install it ourselves.

Many ingress controllers are supported for Kubernetes:

1. Nginx Controller
2. HAProxy Ingress, Contour, Citrix Ingress Controller
3. API Gateways like Traffic, Kong and Ambassador
4. Service mesh like Istio
5. Cloud managed ingress controllers like Application Gateway Ingress Controller (AGIC), AWS ALB Ingress Controller, Ingress GCE

The first part will start by configuring Ingress:

1. Installing an ingress controller (NGINX) into Kubernetes.
2. Deploying different applications/services.
3. Configuring ingress to route traffic depending on the URL.
4. Configure SSL/TLS using Cert Manager

```
csye7220-vm@ubuntu:~/chatter$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
mongo-f7d8b86bd-8pwwv               1/1     Running   0          87m
nginx-ddfcd8464-bqb9z               1/1     Running   0          86m
twitter-backend-5899fcf9c4-9gqwt    1/1     Running   0          87m
twitter-backend-5899fcf9c4-tknm4    1/1     Running   0          87m
twitter-redis-5587855cc7-j85ff      1/1     Running   0          86m
twitter-redis-5587855cc7-lj45j      1/1     Running   0          86m
twitter-redis-node-78f9cc978f-92ndp 1/1     Running   0          87m
csye7220-vm@ubuntu:~/chatter$
```

Helm Chart

- Helm is a package Manager for Kubernetes. Package managers (like yum and APT) are a big reason many of the popular Linux distributions are as successful as they are.
- They provide a standard, opinionated way to install, configure, upgrade, and run an application in a matter of minutes.
- The packages themselves are open source, and anyone can contribute to them.

- Helm is made of two components:

- A server called Tiller, which runs inside your Kubernetes cluster and a client called helm that runs on your local machine.

- A package is called a chart to keep with the maritime theme.

- With the Helm client, you can browse package repositories and deploy those Charts on your Kubernetes cluster.

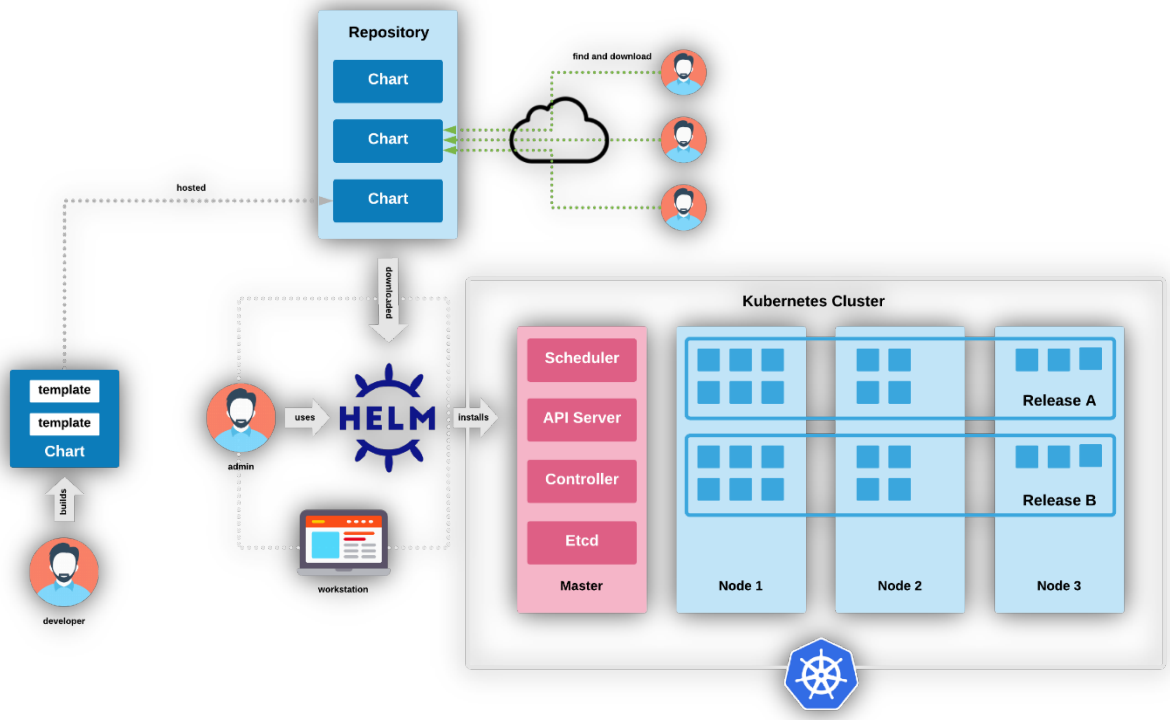
- Helm will pull the Chart and talking to Tiller will create a *release* (an instance of a Chart).

Structure of a Chart

A Chart is easy to demystify; it is an archive of a set of Kubernetes resource manifests that make up a distributed application.

```
.
├── Chart.yaml
├── README.md
├── templates
│   ├── NOTES.txt
│   ├── _helpers.tpl
│   ├── configmap.yaml
│   ├── deployment.yaml
│   ├── pvc.yaml
│   ├── secrets.yaml
│   └── svc.yaml
└── values.yaml
```

- Chart.yaml, contains some metadata about the Chart, such as its name, version, keywords.
- values.yaml, contains keys and values that are used to generate the release in your Cluster. These values are replaced in the resource manifests.
- configMap.yaml, contains database configuration.
- secrets.yaml, database passwords are stored in secret file.

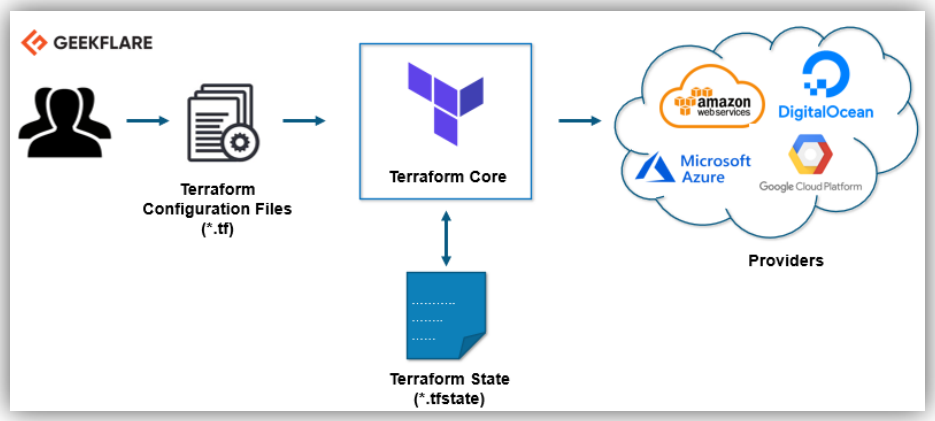


Commands to Run:

- Check all the values in the Helm chart are correct –
- *helm lint ./twitterhelmchart*
- Dry Run (Check everything is running well without deploying actual services) –
- *helm install --dry-run --debug ./twitterhelmchart --generate-name*
- Run the Helm chart - *helm install example ./twitterhelmchart/ --set service.type=NodePort*

Terraform

- Terraform is a tool for building, changing, and versioning infrastructure safely and efficiently.
- Terraform can manage existing and popular service providers as well as custom in-house solutions.
- Configuration files describe to Terraform the components needed to run a single application or your entire datacenter.
- Terraform generates an execution plan describing what it will do to reach the desired state, and then executes it to build the described infrastructure.
- As the configuration changes, terraform can determine what changed and create incremental execution plans which can be applied.



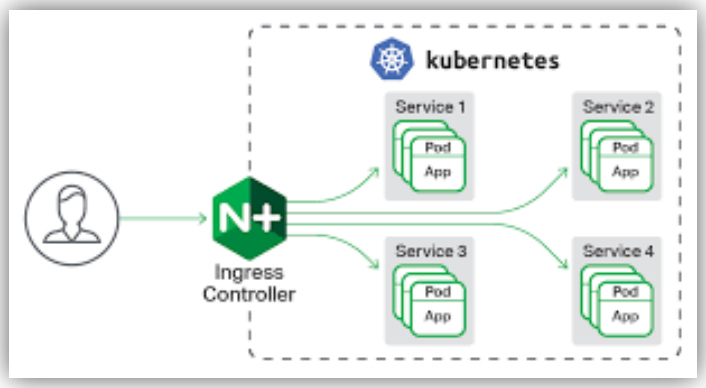
Ingress Controller

Kubernetes ingress is a collection of routing rules that govern how external users access services running in a Kubernetes cluster? However, in real-world Kubernetes deployments, there are frequently additional considerations beyond routing for managing ingress. We'll discuss these requirements in more detail below.

Ingress in Kubernetes

In Kubernetes, there are three general approaches to exposing your application.
Using a Kubernetes service of type Node Port, which exposes the application on a port across each of your nodes.

Use a Kubernetes service of type Load Balancer, which creates an external load balancer that points to a Kubernetes service in your cluster
Use a Kubernetes Ingress Resource

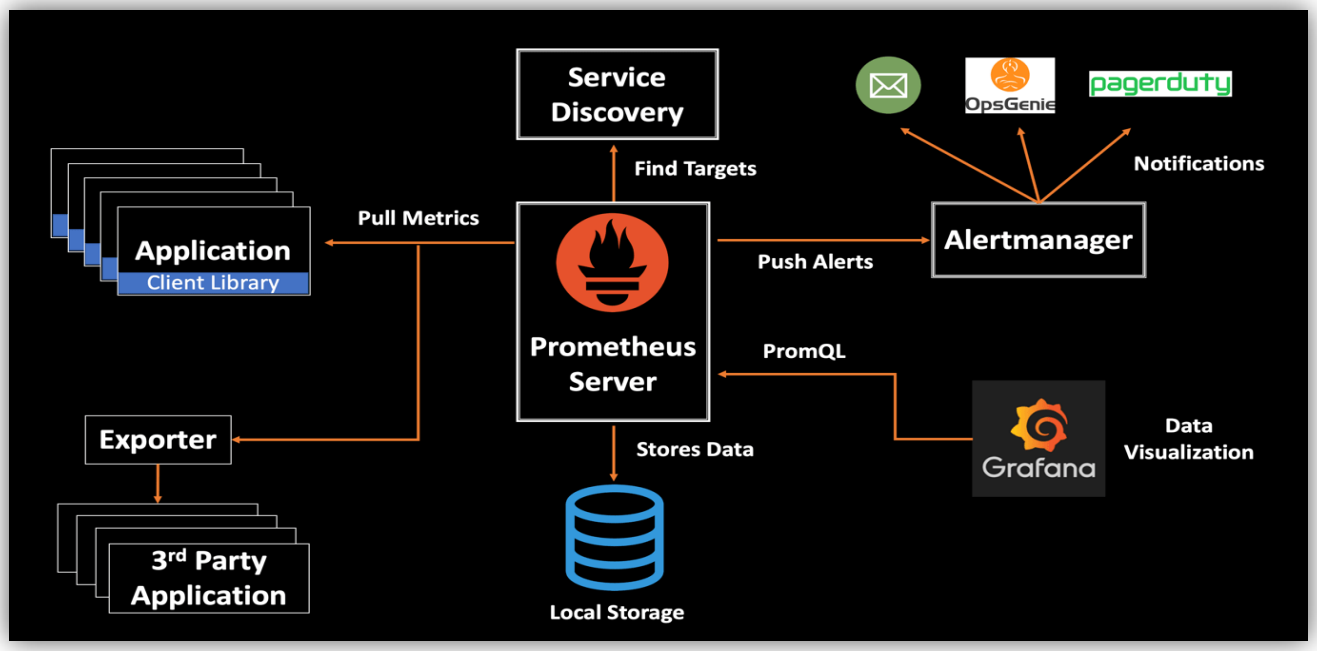


Ingress resource Configuration

```
apiVersion: networking.k8s.io/v1beta1
kind: Ingress
metadata:
  name: ingress-node-sample-helloworld
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
    nginx.ingress.kubernetes.io/enable-cors: "true"
    kubernetes.io/ingress.class: nginx
spec:
  rules:
    # Uncomment the below to only allow traffic from this domain and route based on it
    # - host: my-host # your domain name with A record pointing to the nginx-ingress-controller IP
    - http:
        paths:
        - path: / # Everything on this path will be redirected to the rewrite-target
          backend:
            serviceName: nginx # the exposed svc name and port
            servicePort: 80
        - path: /auth # Everything on this path will be redirected to the rewrite-target
          backend:
            serviceName: nginx # the exposed svc name and port
            servicePort: 80
        - path: /home
          backend:
            serviceName: nginx
            servicePort: 80
```

Prometheus Server

Prometheus is an open-source system monitoring and alerting toolkit originally built at SoundCloud. Since its inception in 2012, many companies and organizations have adopted Prometheus, and the project has a very active developer and user community.



Prometheus Service yaml file

15 lines (15 sloc) | 290 Bytes

```yaml
apiVersion: v1
kind: Service
metadata:
  name: prometheus-service
  namespace: monitoring
  annotations:
      prometheus.io/scrape: 'true'
      prometheus.io/port:   '9090'
spec:
  selector:
    app: prometheus-server
  type: LoadBalancer
  ports:
    - port: 80
      targetPort: 9090
```

Prometheus Dashboard

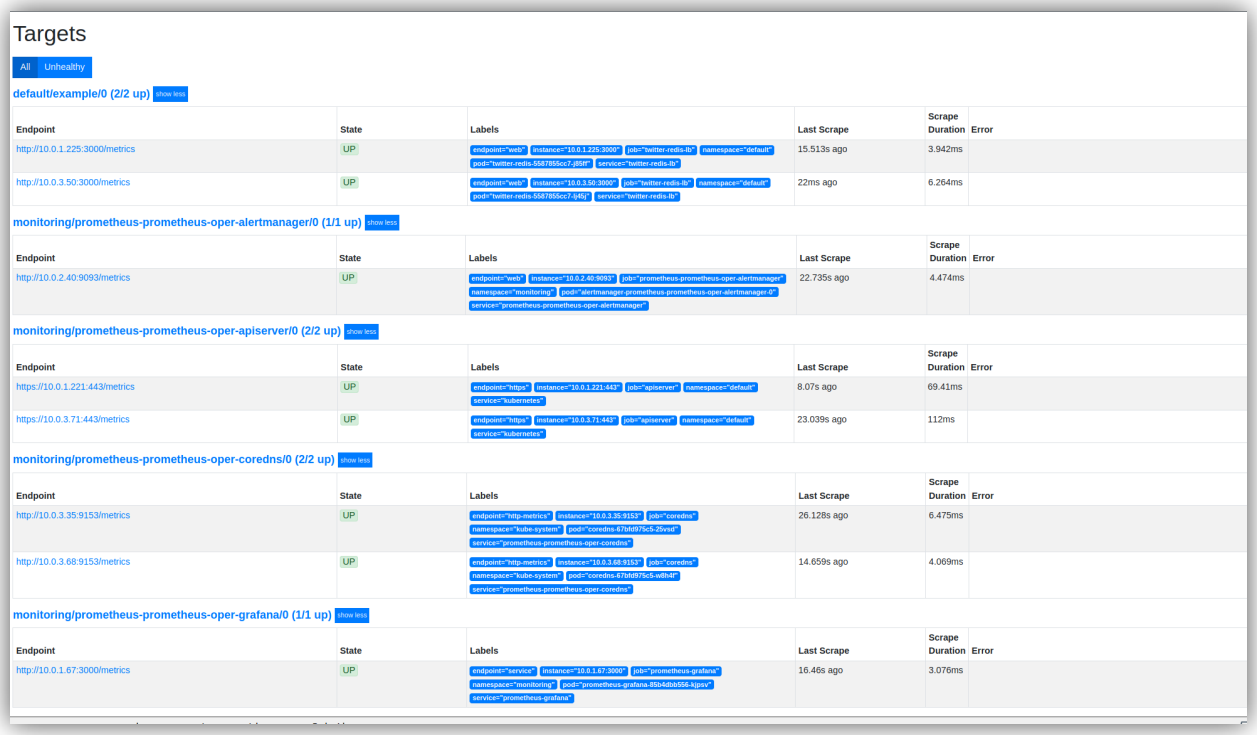
```
csye7220-vm@ubuntu:~/chatter/infrastructure/kubernetes$ kubectl get pods --namespace monitoring
NAME                                                     READY   STATUS    RESTARTS   AGE
alertmanager-prometheus-prometheus-oper-alertmanager-0   2/2     Running   0          78m
prometheus-grafana-85b4dbb556-kjpsv                      2/2     Running   0          78m
prometheus-kube-state-metrics-6df5d44568-r2qhp           1/1     Running   0          78m
prometheus-prometheus-node-exporter-2t4z5                1/1     Running   0          78m
prometheus-prometheus-node-exporter-p7xwl                1/1     Running   0          78m
prometheus-prometheus-node-exporter-tw9cp                1/1     Running   0          78m
prometheus-prometheus-oper-operator-85cc758cdb-wqmlm     2/2     Running   0          78m
prometheus-prometheus-prometheus-oper-prometheus-0       3/3     Running   1          78m
csye7220-vm@ubuntu:~/chatter/infrastructure/kubernetes$
```

```
csye7220-vm@ubuntu:~/chatter/infrastructure/kubernetes$ kubectl get all
NAME                 TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
service/kubernetes   ClusterIP   172.20.0.1   <none>        443/TCP   83m

NAME                                                                REFERENCE          TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
horizontalpodautoscaler.autoscaling/nginx   Deployment/nginx   1%/5%     1         10        1          50m
```

```
csye7220-vm@ubuntu:~/chatter/infrastructure/kubernetes$ kubectl get ingress
NAME                          HOSTS   ADDRESS   PORTS   AGE
ingress-node-sample-helloworld   *                 80      8s
csye7220-vm@ubuntu:~/chatter/infrastructure/kubernetes$
```

Prometheus using Custom Metrics

Example is the custom metric, and I have also enabled metrics server to get started.



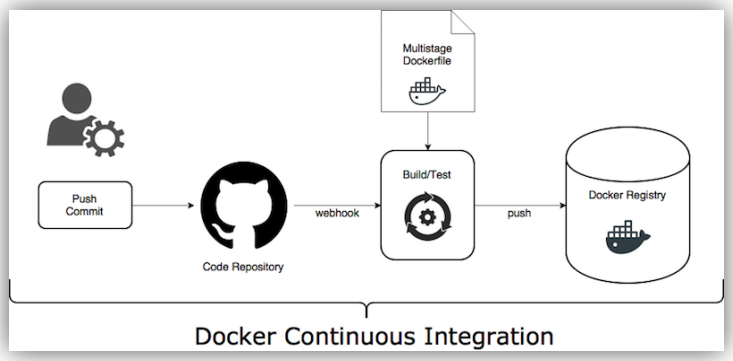
```
# HELP my_application:nodejs_heap_space_size_available_bytes Process heap space size available from Node.js in bytes.
# TYPE my_application:nodejs_heap_space_size_available_bytes gauge
my_application:nodejs_heap_space_size_available_bytes{space="read_only"} 0
my_application:nodejs_heap_space_size_available_bytes{space="new"} 133352
my_application:nodejs_heap_space_size_available_bytes{space="old"} 360328
my_application:nodejs_heap_space_size_available_bytes{space="code"} 18752
my_application:nodejs_heap_space_size_available_bytes{space="map"} 70768
my_application:nodejs_heap_space_size_available_bytes{space="large_object"} 0
my_application:nodejs_heap_space_size_available_bytes{space="code_large_object"} 0
my_application:nodejs_heap_space_size_available_bytes{space="new_large_object"} 1047424

# HELP my_application:nodejs_version_info Node.js version info.
# TYPE my_application:nodejs_version_info gauge
my_application:nodejs_version_info{version="v14.15.1",major="14",minor="15",patch="1"} 1

# HELP my_application:nodejs_gc_duration_seconds Garbage collection duration by kind, one of major, minor, incremental or weakcb.
# TYPE my_application:nodejs_gc_duration_seconds histogram
my_application:nodejs_gc_duration_seconds_bucket{le="0.001",kind="minor"} 67
my_application:nodejs_gc_duration_seconds_bucket{le="0.01",kind="minor"} 69
my_application:nodejs_gc_duration_seconds_bucket{le="0.1",kind="minor"} 69
my_application:nodejs_gc_duration_seconds_bucket{le="1",kind="minor"} 69
my_application:nodejs_gc_duration_seconds_bucket{le="2",kind="minor"} 69
my_application:nodejs_gc_duration_seconds_bucket{le="5",kind="minor"} 69
my_application:nodejs_gc_duration_seconds_bucket{le="+Inf",kind="minor"} 69
my_application:nodejs_gc_duration_seconds_sum{kind="minor"} 0.03412943200000001
my_application:nodejs_gc_duration_seconds_count{kind="minor"} 69
my_application:nodejs_gc_duration_seconds_bucket{le="0.001",kind="incremental"} 4
my_application:nodejs_gc_duration_seconds_bucket{le="0.01",kind="incremental"} 6
my_application:nodejs_gc_duration_seconds_bucket{le="0.1",kind="incremental"} 6
my_application:nodejs_gc_duration_seconds_bucket{le="1",kind="incremental"} 6
my_application:nodejs_gc_duration_seconds_bucket{le="2",kind="incremental"} 6
my_application:nodejs_gc_duration_seconds_bucket{le="5",kind="incremental"} 6
my_application:nodejs_gc_duration_seconds_bucket{le="+Inf",kind="incremental"} 6
my_application:nodejs_gc_duration_seconds_sum{kind="incremental"} 0.013808233
my_application:nodejs_gc_duration_seconds_count{kind="incremental"} 6
my_application:nodejs_gc_duration_seconds_bucket{le="0.001",kind="major"} 0
my_application:nodejs_gc_duration_seconds_bucket{le="0.01",kind="major"} 3
my_application:nodejs_gc_duration_seconds_bucket{le="0.1",kind="major"} 3
my_application:nodejs_gc_duration_seconds_bucket{le="1",kind="major"} 3
my_application:nodejs_gc_duration_seconds_bucket{le="2",kind="major"} 3
my_application:nodejs_gc_duration_seconds_bucket{le="5",kind="major"} 3
my_application:nodejs_gc_duration_seconds_bucket{le="+Inf",kind="major"} 3
my_application:nodejs_gc_duration_seconds_sum{kind="major"} 0.012880494999999999
my_application:nodejs_gc_duration_seconds_count{kind="major"} 3

# HELP my_application:hello_duration Duration of HTTP requests in ms
# TYPE my_application:hello_duration histogram

# HELP get_tweets_route To get all the tweets
# TYPE get_tweets_route counter
get_tweets_route 11

# HELP metric_name metric_help
# TYPE metric_name counter
metric_name 0
```

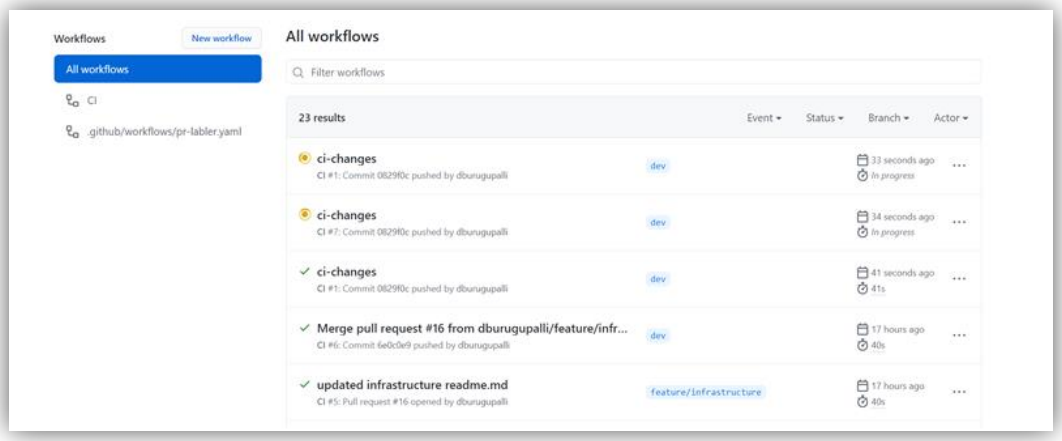
Service Discovery

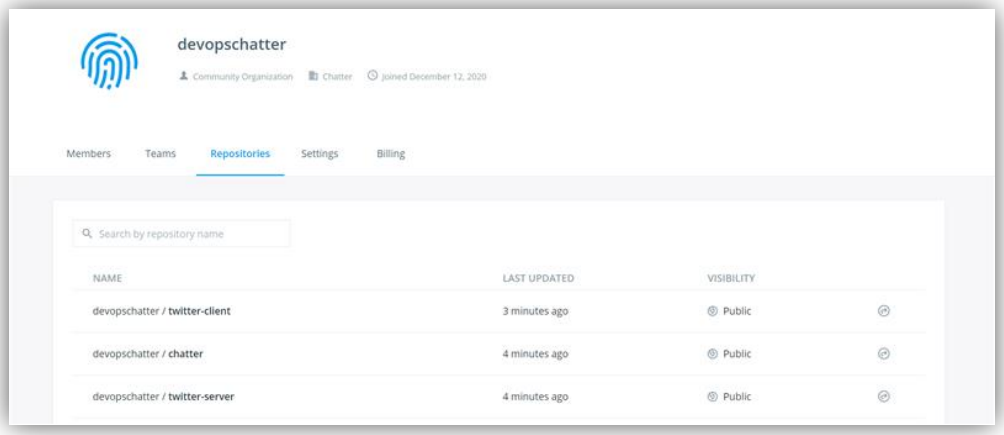
- default/example/0 (2/13 active targets)
- monitoring/prometheus-prometheus-oper-alertmanager/0 (1/16 active targets)
- monitoring/prometheus-prometheus-oper-apiserver/0 (2/13 active targets)
- monitoring/prometheus-prometheus-oper-coredns/0 (2/25 active targets)
- monitoring/prometheus-prometheus-oper-grafana/0 (1/16 active targets)
- monitoring/prometheus-prometheus-oper-kube-controller-manager/0 (0/25 active targets)
- monitoring/prometheus-prometheus-oper-kube-etcd/0 (0/25 active targets)
- monitoring/prometheus-prometheus-oper-kube-proxy/0 (3/25 active targets)
- monitoring/prometheus-prometheus-oper-kube-scheduler/0 (0/25 active targets)
- monitoring/prometheus-prometheus-oper-kube-state-metrics/0 (1/16 active targets)
- monitoring/prometheus-prometheus-oper-kubelet/0 (3/25 active targets)
- monitoring/prometheus-prometheus-oper-kubelet/1 (3/25 active targets)
- monitoring/prometheus-prometheus-oper-kubelet/2 (3/25 active targets)
- monitoring/prometheus-prometheus-oper-kubelet/3 (3/25 active targets)
- monitoring/prometheus-prometheus-oper-node-exporter/0 (3/16 active targets)
- monitoring/prometheus-prometheus-oper-operator/0 (1/16 active targets)
- monitoring/prometheus-prometheus-oper-prometheus/0 (1/16 active targets)

Continuous Integration using GitHub actions

Continuous Integration (CI) is a development practice where developers integrate code into a shared repository frequently, preferably several times a day. Each integration can then be verified by an automated build and automated tests. While automated testing is not strictly part of CI it is typically implied.



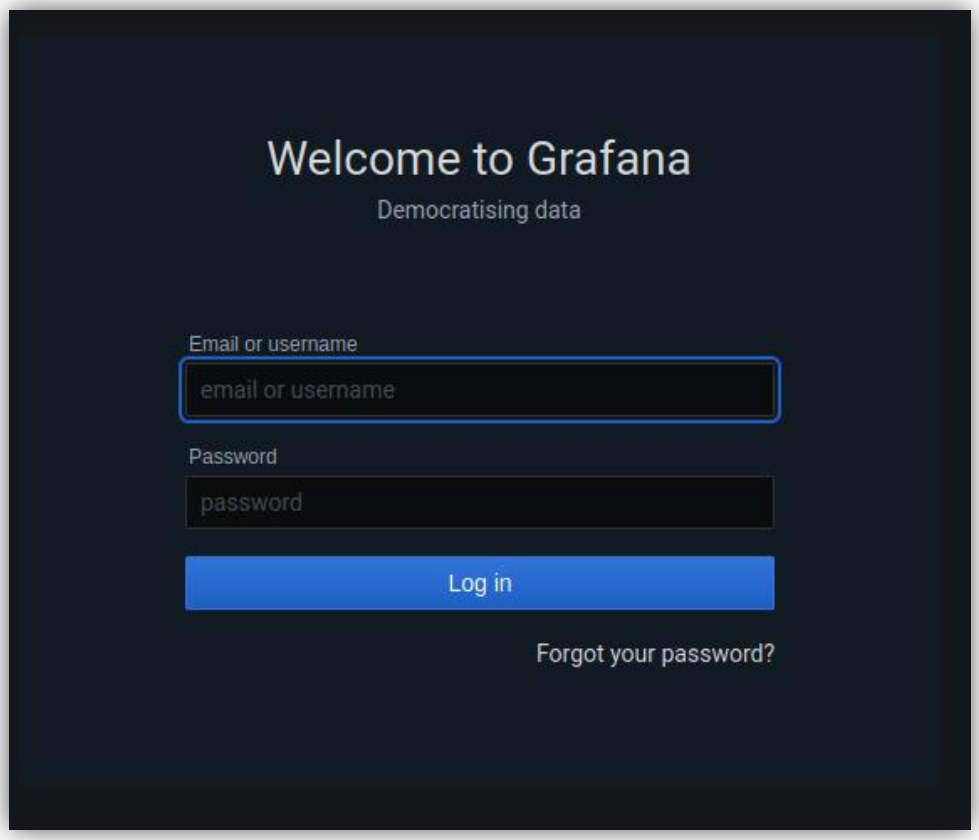


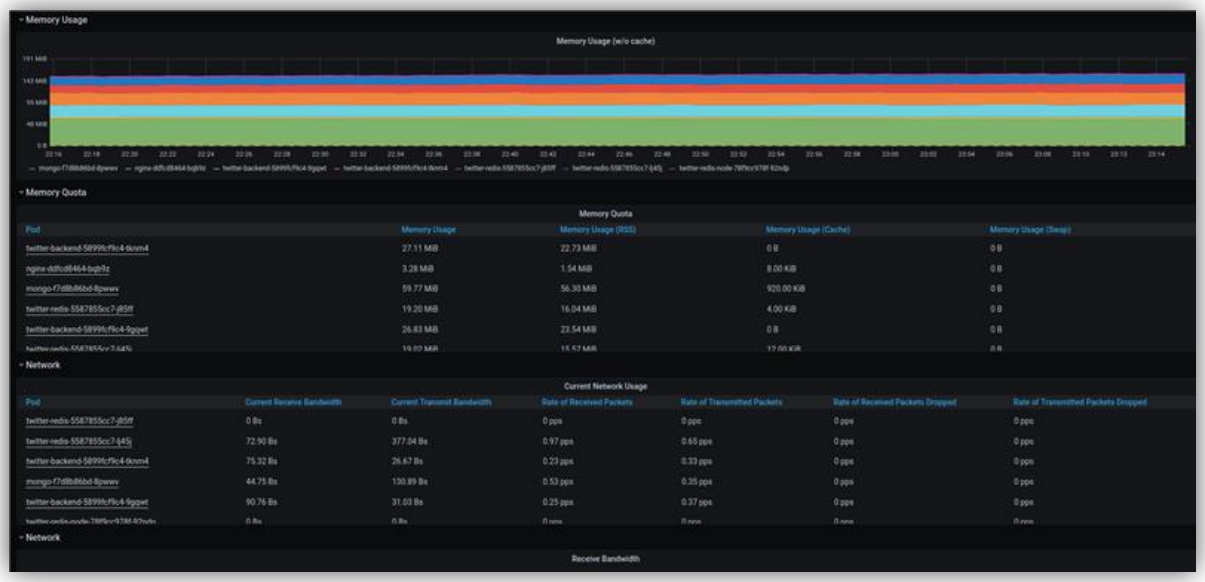


Designing Monitoring dashboard Grafana

Grafana is an open-source visualization tool that can be used on top of a variety of different data stores but is most commonly used together with Graphite, InfluxDB, Prometheus, Elasticsearch and Logz.io. As it so happens, Grafana began as a fork of Kibana, trying to supply support for metrics (a.k.a. monitoring) that Kibana (at the time) did not provide much if any such support for.

Essentially, Grafana is a feature-rich replacement for Graphite-web, which helps users to easily create and edit dashboards. It contains a unique Graphite target parser that enables easy metric and function editing. Users can create comprehensive charts with smart axis formats (such as lines and points) as a result of Grafana's fast, client-side rendering — even over long ranges of time — that uses Flot as a default option.




Memory Usage
Memory Usage (w/o cache)
Memory Quota
Memory Quota
Pod
Memory Usage
Memory Usage (RSS)
Memory Usage (Cache)
Memory Usage (Swap)
twitter-backend-5899fcf9c4-tknm4
27.11 MiB
22.73 MiB
0 B
0 B
nginx-ddfcd8464-bqb9z
3.28 MiB
1.54 MiB
8.00 KiB
0 B
mongo-f7d8b86bd-8pwwv
59.77 MiB
56.30 MiB
920.00 KiB
0 B
twitter-redis-5587855cc7-j85ff
19.20 MiB
16.04 MiB
4.00 KiB
0 B
twitter-backend-5899fcf9c4-9ggwt
26.83 MiB
23.54 MiB
0 B
0 B
Network
Current Network Usage
Pod
Current Receive Bandwidth
Current Transmit Bandwidth
Rate of Received Packets
Rate of Transmitted Packets
Rate of Received Packets Dropped
Rate of Transmitted Packets Dropped
twitter-redis-5587855cc7-j85ff
0 Bs
0 Bs
0 pps
0 pps
0 pps
0 pps
twitter-redis-5587855cc7-lj45j
72.90 Bs
377.04 Bs
0.97 pps
0.65 pps
0 pps
0 pps
twitter-backend-5899fcf9c4-tknm4
75.32 Bs
26.67 Bs
0.23 pps
0.33 pps
0 pps
0 pps
mongo-f7d8b86bd-8pwwv
44.75 Bs
130.89 Bs
0.53 pps
0.35 pps
0 pps
0 pps
twitter-backend-5899fcf9c4-9ggwt
90.76 Bs
31.03 Bs
0.25 pps
0.37 pps
0 pps
0 pps
Network
Receive Bandwidth


25
20
15
10
5
0
06:30
07:00
07:30
08:00
08:30
09:00
09:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
get_tweets_route{endpoint="web", instance="10.0.1.225:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-j85ff", service="twitter-redis-lb"}
get_tweets_route{endpoint="web", instance="10.0.1.8:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-gl8bq", service="twitter-redis-lb"}
get_tweets_route{endpoint="web", instance="10.0.3.253:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-gzzj5", service="twitter-redis-lb"}
get_tweets_route{endpoint="web", instance="10.0.3.50:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-lj45j", service="twitter-redis-lb"}


25
20
15
10
5
0
06:30
07:00
07:30
08:00
08:30
09:00
09:30
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
get_tweets_route{endpoint="web", instance="10.0.1.225:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-j85ff", service="twitter-redis-lb"}
get_tweets_route{endpoint="web", instance="10.0.1.8:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-gl8bq", service="twitter-redis-lb"}
get_tweets_route{endpoint="web", instance="10.0.3.253:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-gzzj5", service="twitter-redis-lb"}
get_tweets_route{endpoint="web", instance="10.0.3.50:3000", job="twitter-redis-lb", namespace="default", pod="twitter-redis-5587855cc7-lj45j", service="twitter-redis-lb"}

Logging using ELK stack

Elastic Search, Logstash and Kibana

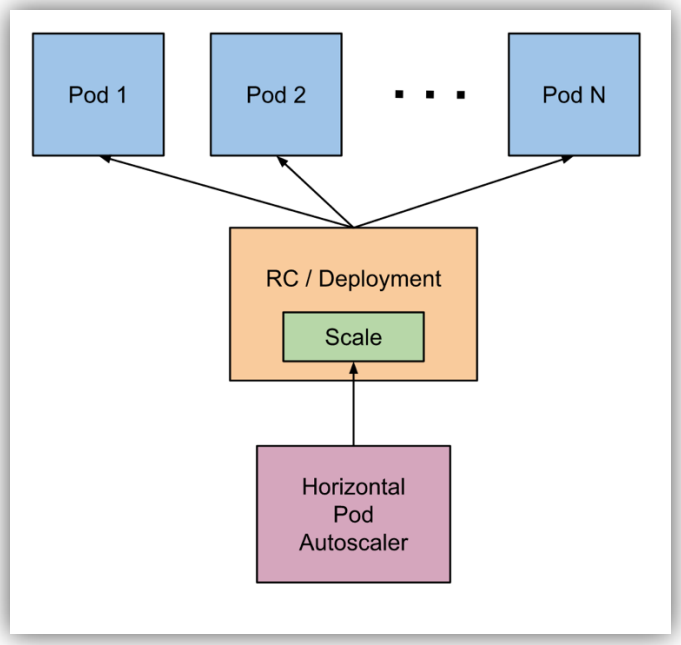
Elastic Search is analysis and search engine and Logstash is a server-side data processing pipeline that ingests the data from multiple sources simultaneously, transforms and sends it to a stash like
Elastic search, Kibana lets the users visualize the charts and graphs in elastic search

```
csye7220-vm@ubuntu:~/chatter/infrastructure/efk$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
elasticsearch-856f49d4b4-tmwvs      1/1     Running   0          54s
kibana-584b78d8bd-jq657             1/1     Running   0          52s
logstash-7f8f44cfd8-h4jc4           1/1     Running   0          49s
mongo-f7d8b86bd-8pwwv               1/1     Running   0          3h16m
nginx-ddfcd8464-bqb9z               1/1     Running   0          3h16m
twitter-backend-5899fcf9c4-9gqwt    1/1     Running   0          3h16m
twitter-backend-5899fcf9c4-tknm4    1/1     Running   0          3h16m
twitter-redis-5587855cc7-j85ff      1/1     Running   0          3h16m
twitter-redis-5587855cc7-lj45j      1/1     Running   0          3h16m
twitter-redis-node-78f9cc978f-92ndp 1/1     Running   0          3h16m
```

Kibana logging dashboard

HPA

The Horizontal Pod Autoscaler automatically scales the number of Pods in a replication controller, deployment, replica set or stateful set based on observed CPU utilization (or, with custom metrics support, on some other application-provided metrics). Note that Horizontal Pod Autoscaling does not apply to objects that can't be scaled, for example, DaemonSets.




```yaml
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: nginx
spec:
  scaleTargetRef:
    apiVersion: apps/v1
    kind: Deployment
    name: nginx
  minReplicas: 1
  maxReplicas: 10
  targetCPUUtilizationPercentage: 5
```

```
csye7220-vm@ubuntu:~/chatter/infrastructure/efk$ kubectl get hpa
NAME    REFERENCE          TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
nginx   Deployment/nginx   1%/5%     1         10        1          4h46m
csye7220-vm@ubuntu:~/chatter/infrastructure/efk$
```