

Logging and monitoring Kubernetes Cluster using EFK and Prometheus

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Steps describing how to enable logging and monitoring kubernetes cluster using EFK(Elasticsearch Fluentbit Kibana) and Prometheus respectively.

Prerequisite

- Up and running kubernetes cluster.
- We will be using Helm charts, hence helm chart must be available.

Preface

- These steps are validated against kubernetes cluster on VirtualBox, with minimal hardware, hence running Elasticsearch in minimalistic setup.
- Since I'm using VirtualBox, will be using persistent volume of type local.
- Using [stable/elasticsearch](#) repository instead of elasticsearch official from [here](#)
- Validated against elasticsearch version [6.7.2](#)

Setup EFK stack.

- Update Helm repository.

```
$ helm repo update
```

- We will be running 2 master node (though Ideally quorum would be an odd number), 1 client(coordinator) node and 1 data node. Coordinator node does not require volume, thus we need 3 PV. Create directories for 3 PVs.

```
$ sudo mkdir -p /opt/kubernetes/data/elasticsearch/es0
$ sudo mkdir -p /opt/kubernetes/data/elasticsearch/es1
$ sudo mkdir -p /opt/kubernetes/data/elasticsearch/es2
```



Since I've one worker node cluster, creating all the es nodes in same worker node hence 3 directories in the same server.

- Change permission of the directories

```
$ sudo chmod -R g+w /opt/kubernetes/data
```

- Create a persistent volume and storage class to bind the pvs. from below yaml file, using command `kubectl apply -f <file-name>.yaml`

```
# Source: efk-stack/templates/storage.yaml
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: efk-stack-local-storage
  namespace: logging
  labels:
    app: efk-stack
    chart: efk-stack-0.1.0
    release: efk-stack
    heritage: Tiller
provisioner: kubernetes.io/no-provisioner
volumeBindingMode: Immediate
#volumeBindingMode: WaitForFirstConsumer
# Supported policies: Delete, Retain
reclaimPolicy: Delete

---

apiVersion: v1
kind: PersistentVolume
metadata:
  name: efk-stack-pv-0
  namespace: logging
  labels:
    app: efk-stack
    chart: efk-stack-0.1.0
    release: efk-stack
    heritage: Tiller
```

```

spec:
  capacity:
    storage: 4Gi
  # volumeMode field requires BlockVolume Alpha feature gate to be enabled.
  volumeMode: Filesystem
  accessModes:
  - ReadWriteOnce
  persistentVolumeReclaimPolicy: Delete
  storageClassName: efk-stack-local-storage
  local:
    path: /opt/kubernetes/data/elasticsearch/es0
  nodeAffinity:
    required:
      nodeSelectorTerms:
      - matchExpressions:
        - key: disk-available
          operator: In
          values:
            - "true"
  ---

apiVersion: v1
kind: PersistentVolume
metadata:
  name: efk-stack-pv-1
  namespace: logging
  labels:
    app: efk-stack
    chart: efk-stack-0.1.0
    release: efk-stack
    heritage: Tiller
spec:
  capacity:
    storage: 4Gi
  # volumeMode field requires BlockVolume Alpha feature gate to be enabled.
  volumeMode: Filesystem
  accessModes:
  - ReadWriteOnce
  persistentVolumeReclaimPolicy: Delete
  storageClassName: efk-stack-local-storage
  local:
    path: /opt/kubernetes/data/elasticsearch/es1
  nodeAffinity:
    required:
      nodeSelectorTerms:
      - matchExpressions:
        - key: disk-available
          operator: In
          values:
            - "true"

```

```

---
apiVersion: v1
kind: PersistentVolume
metadata:
  name: efk-stack-pv-2
  namespace: logging
  labels:
    app: efk-stack
    chart: efk-stack-0.1.0
    release: efk-stack
    heritage: Tiller
spec:
  capacity:
    storage: 4Gi
  # volumeMode field requires BlockVolume Alpha feature gate to be enabled.
  volumeMode: Filesystem
  accessModes:
    - ReadWriteOnce
  persistentVolumeReclaimPolicy: Delete
  storageClassName: efk-stack-local-storage
  local:
    path: /opt/kubernetes/data/elasticsearch/es2
  nodeAffinity:
    required:
      nodeSelectorTerms:
        - matchExpressions:
            - key: disk-available
              operator: In
              values:
                - "true"

```



PV cannot be deleted before PVCs are deleted, PVCs need to be deleted manually.

- Download elasticsearch charts and extract.

```
$ helm fetch stable/elasticsearch --untar
```

- change directory

```
$ cd elasticsearch
```

- Open values.yaml and update values as described below.
 - Make sure image name is `docker.elastic.co/elasticsearch/elasticsearch-oss` if you want to use opensourced version.
 - update elasticsearch tag to `6.7.2`

```
image:
  repository: "docker.elastic.co/elasticsearch/elasticsearch-oss"
  tag: "6.7.2"
  pullPolicy: "IfNotPresent"
```

- Change **client** and **data** node replica count to 1

```
client:
  name: client
  replicas: 1
  serviceType: ClusterIP
```

- (Optional) Comment out CPU count both for **client**, **master** and **data** node

```
resources:
  limits:
    # cpu: "1"
    # memory: "1024Mi"
  requests:
    cpu: "25m"
    memory: "512Mi"
```



This is inline to my hardware constarint, if there is enough CPU you can leave as is.

- Change Master replica count to 2.

```
master:
  name: master
  exposeHttp: false
  replicas: 2
  heapSize: "512m"
```

- On **data** and **master** node section update disk size to 4Gi as we have created pv with 4Gi and uncomment storageClassName and provide the stoage class name we created earlier.

```
persistence:
  enabled: true
  accessMode: ReadWriteOnce
  name: data
  size: "4Gi"
  storageClass: "efk-stack-local-storage"
```

- Create elasticsearch cluster using helm command.

```
$ helm install . --name efk-stack-elastic --namespace logging --debug
```

Verification

- Wait until 4 Pods comes up and state changes to Ready.

```
$ kubectl get po -n logging
```

- Create a busybox pod from below yaml

```
apiVersion: v1
kind: Pod
metadata:
  name: busybox
  namespace: default
spec:
  containers:
  - name: busybox
    image: busybox
    command:
      - sleep
      - "3600"
    imagePullPolicy: IfNotPresent
  restartPolicy: Always
```

- Now execute below command to verify elastic search is up and running.

```
$ kubectl exec busybox -- wget http://efk-stack-elastic-elasticsearch-
client.logging:9200 \
-O - \
-S
```

output:

```
Connecting to efk-stack-elastic-elasticsearch-client.logging:9200 (10.111.238.225:9200)
HTTP/1.1 200 OK
content-type: application/json; charset=UTF-8
content-length: 539

- 100% |*****| 539 0:00:00 ETA

{
  "name" : "efk-stack-elastic-elasticsearch-client-cf8579b94-zjxxr",
  "cluster_name" : "elasticsearch",
  "cluster_uuid" : "1n-mUFcJT4C-XPrjb98HHg",
  "version" : {
    "number" : "6.7.2",
    "build_flavor" : "oss",
    "build_type" : "docker",
    "build_hash" : "56c6e48",
    "build_date" : "2019-04-29T09:05:50.290371Z",
    "build_snapshot" : false,
    "lucene_version" : "7.7.0",
    "minimum_wire_compatibility_version" : "5.6.0",
    "minimum_index_compatibility_version" : "5.0.0"
  },
  "tagline" : "You Know, for Search"
}
```

Setup elasticsearch curator

- Download curator

```
$ helm fetch stable/elasticsearch-curator --untar
```

- change directory.

```
cd elasticsearch-curator/
```

- Add elasticsearch client service as host at `confiMaps` → `config.yml` → `hosts` as shown below in `values.yaml`

```
config_yaml: |-
  ---
  client:
    hosts:
      - efk-stack-elastic-elasticsearch-client
    port: 9200
```

- Install curator using below command.

```
$ helm install . --name efk-stack-curator --namespace logging
```

Setup Fluentbit

- Download Fluentbit

```
$ helm fetch stable/fluent-bit --untar
```

- change directory.

```
$ cd fluent-bit/
```

- Add elasticsearch client service as host at **backend** → **es** → **host** and **forward** type to **es** as shown below in values.yaml


```

backend:
  type: es
  forward:
    host: fluentd
    port: 24284
    tls: "off"
    tls_verify: "on"
    tls_debug: 1
    shared_key:
  es:
    host: efk-stack-elastic-elasticsearch-client
    port: 9200
    # Elastic Index Name
    index: kubernetes_cluster
    type: flb_type
    logstash_prefix: kubernetes_cluster
    replace_dots: "On"
    time_key: "@timestamp"
    # Optional username credential for Elastic X-Pack access
    http_user:
    # Password for user defined in HTTP_User
    http_passwd:
    # Optional TLS encryption to ElasticSearch instance
    tls: "off"
    tls_verify: "on"
    # TLS certificate for the Elastic (in PEM format). Use if tls=on and
    # tls_verify=on.
    tls_ca: ""
    # TLS debugging levels = 1-4
    tls_debug: 1

```

- Install fluentbit using below command.

```
$ helm install . --name efk-stack-fluent-bit --namespace logging
```

Verification

Execute below command to check if fluentbit is successfully started. Ready value should be 1

```
$ kubectl get ds -n logging
```

output

| NAME | DESIRED | CURRENT | READY | UP-TO-DATE | AVAILABLE | NODE |
|----------------------|---------|---------|-------|------------|-----------|--------|
| SELECTOR | AGE | | | | | |
| efk-stack-fluent-bit | 1 | 1 | 1 | 1 | 1 | <none> |
| 14s | | | | | | |

Setup Kibana

- Download kibana

```
$ helm fetch stable/kibana --untar
```

- change directory.

```
$ cd kibana/
```

- Add elasticsearch client service as host at `files` → `kibana.yml` → `elasticsearch.hosts` and service type `NodePort` as shown below in values.yaml

```
files:
  kibana.yml:
    ## Default Kibana configuration from kibana-docker.
    server.name: kibana
    server.host: "0"
    ## For kibana < 6.6, use elasticsearch.url instead
    elasticsearch.hosts: http://efk-stack-elastic-elasticsearch-client:9200
```

- Install kibana

```
$ helm install . --name efk-stack-kibana --namespace logging
```

- Get the Kibana URL by executing below command

```
export KIBANA_NODE_PORT=$(kubectl get --namespace logging \
  -o jsonpath="{.spec.ports[0].nodePort}" services efk-stack-kibana)
export KIBANA_NODE_IP=$(kubectl get nodes --namespace logging \
  -o jsonpath="{.items[0].status.addresses[0].address}")
echo http://$KIBANA_NODE_IP:$KIBANA_NODE_PORT
```

Configure Kibana UI.

- Open the url obtained in previous section in a browser. Since its fresh installation page will be automatically redirected to management tab to create index Patterns. Add index pattern **kubernetes*** and click next.

Create index pattern

Kibana uses index patterns to retrieve data from Elasticsearch indices for things like visualizations.

☐ Include system indices

Step 1 of 2: Define index pattern

Index pattern

kubernetes*

You can use a * as a wildcard in your index pattern.
You can't use spaces or the characters \, /, ?, *, <, >, |.

> Next step

✓ Success! Your index pattern matches 1 index.
kubernetes_cluster-2019.05.19

Rows per page: 10

- Select time filter field as **@timestamp** and click **create index pattern**

Create index pattern

Kibana uses index patterns to retrieve data from Elasticsearch indices for things like visualizations.

☐ Include system indices

Step 2 of 2: Configure settings

You've defined **kubernetes*** as your index pattern. Now you can specify some settings before we create it.

Time Filter field name Refresh

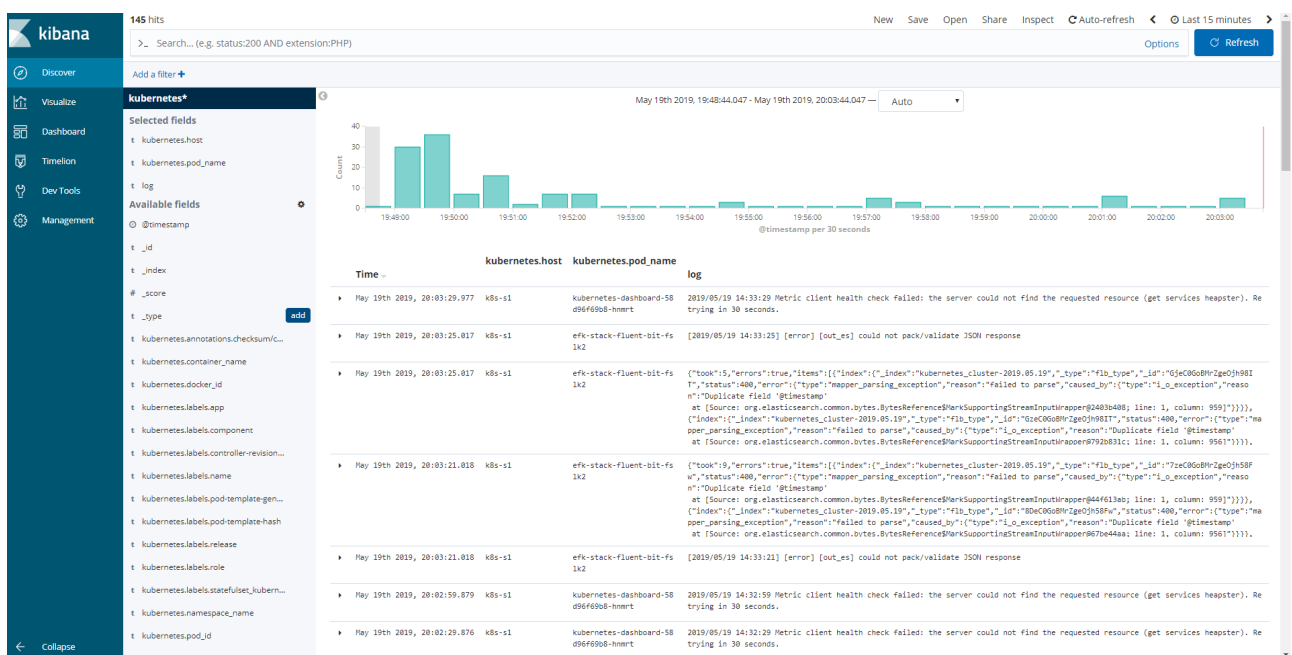
@timestamp

The Time Filter will use this field to filter your data by time.
You can choose not to have a time field, but you will not be able to narrow down your data by a time range.

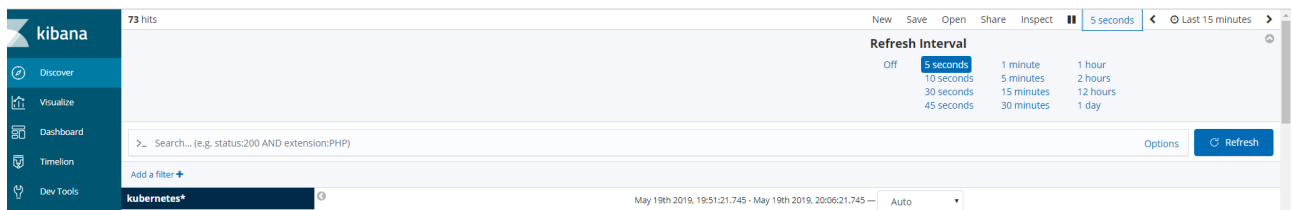
> Show advanced options

< Back Create index pattern

- Now select **discovery** menu from side nav menu, already logs will start appearing., Now you can add/remove columns to display from Available fields by hovering on field and clicking add button, remove columns can be done by unselecting the fields from selected fields.



- Log refresh rate and duration to show can be managed by selecting the **Auto refresh** button on top right corner and similarly the duration of the logs to display can be configured on date menu adjacent to **Auto refresh button**.



Setup Prometheus

- Download Prometheus operator

```
$ helm fetch stable/prometheus-operator --untar
```

- change directory.

```
$ cd prometheus-operator/
```

- Install prometheus operator

```
$ helm install . --name prometheus --namespace monitoring
```

- Edit grafana service from cluster ip to node port

```
$ kubectl edit svc -n monitoring prometheus-grafana
```

- Get the grafana url by executing below command.

```
export GRAFANA_NODE_PORT=$(kubectl get --namespace monitoring \
-o jsonpath="{.spec.ports[0].nodePort}" services prometheus-grafana)
export GRAFANA_NODE_IP=$(kubectl get nodes --namespace monitoring \
-o jsonpath="{.items[0].status.addresses[0].address}")
echo http://$GRAFANA_NODE_IP:$GRAFANA_NODE_PORT
```



Default username/password is admin/prom-operator

TODO

- Add Steps to enable spring boot logs as fields in FluentBit before sending to Elasticsearch.

- Add Steps to enable spring boot metrics to be fetch by Prometheus using annotations.