From Containers to Kubernetes Operators

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elastic

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Community Engineer

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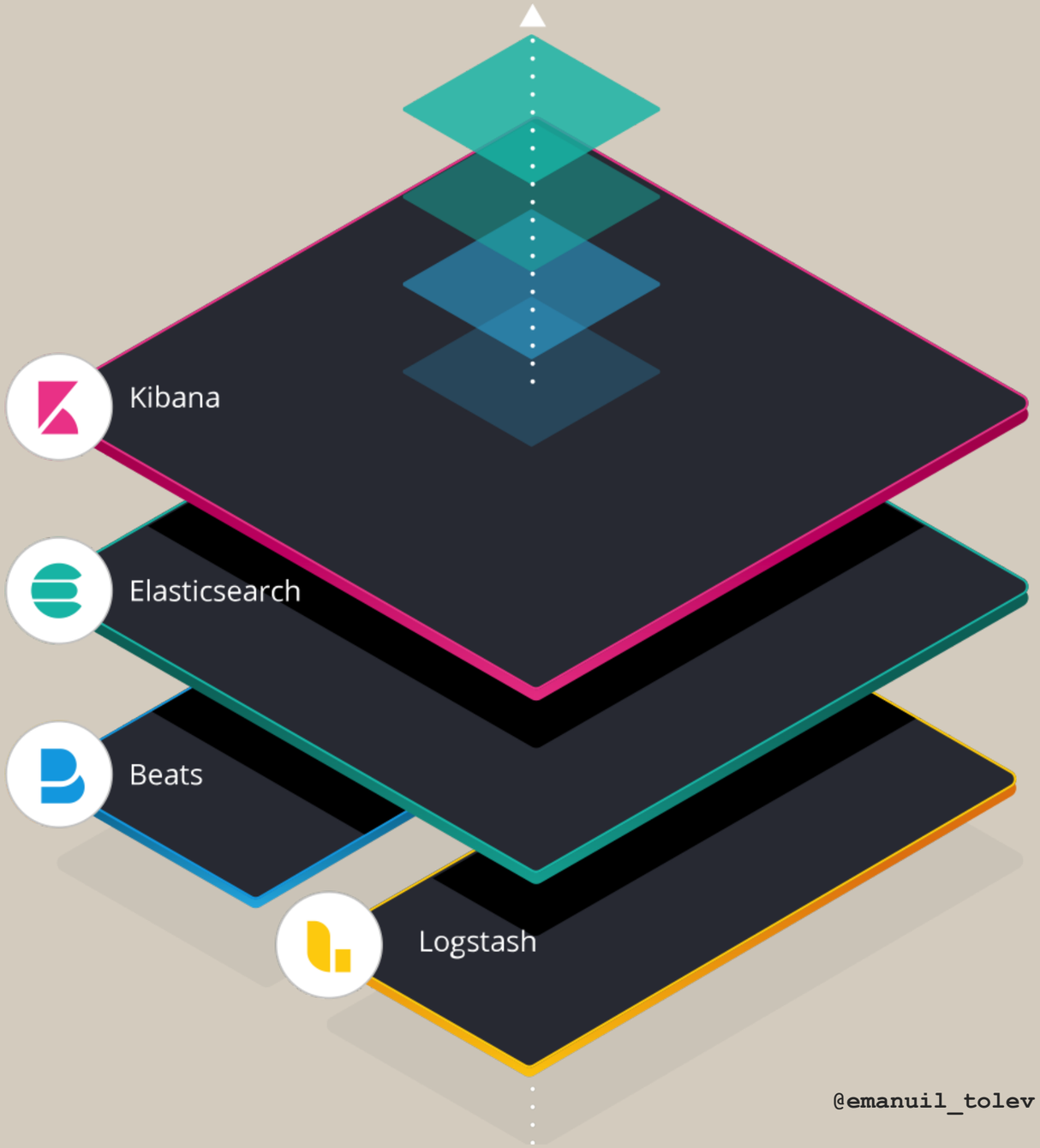

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Agenda - Elastic's journey through

Docker images
Helm Chart
Kubernetes Operator

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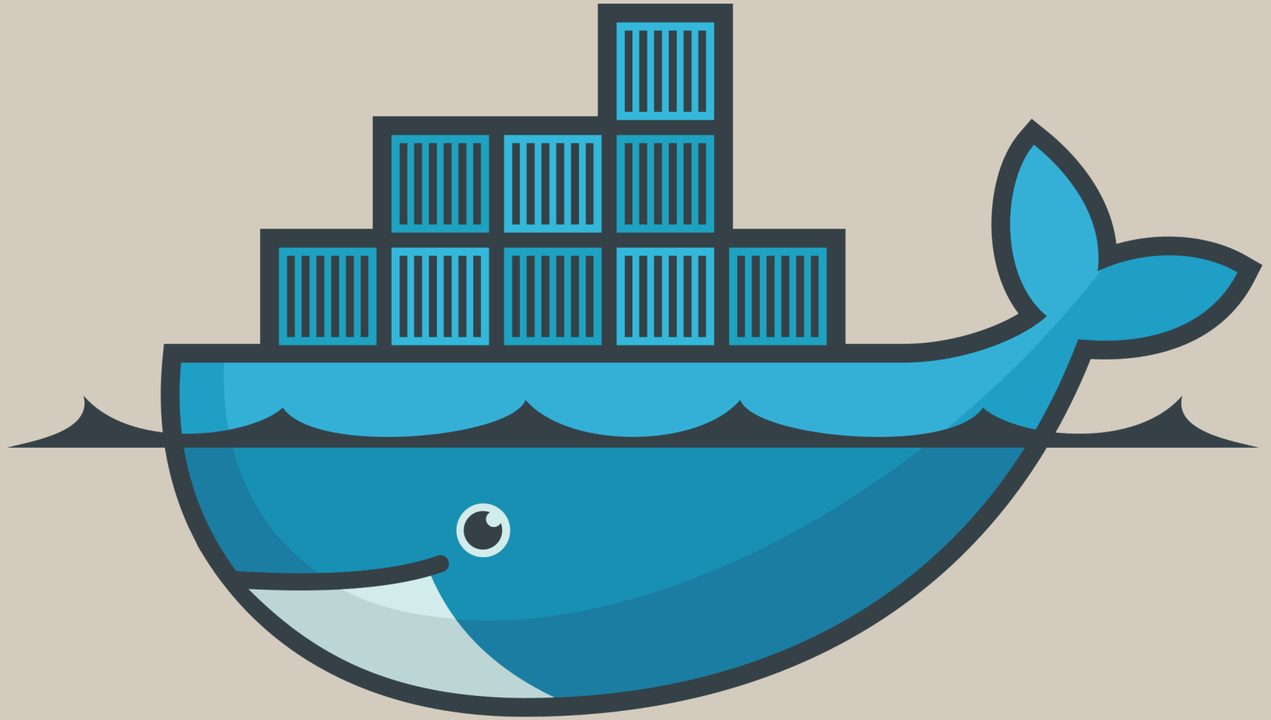

docker

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HD

Containers are the new ZIP format to distribute software

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One of many…

RPM, DEB, TAR.GZ, MSI
Ansible, Chef, Puppet

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…but not without issues

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Fallacy
root and chmod 777

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:-p sed s/🐍/🐳/g #Docker

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The container runs Elasticsearch as user elasticsearch using uid:gid 1000:0.

https://www.elastic.co/guide/en/elasticsearch/reference/current/docker.html

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bluepuma77 commented on 4 Mar

Bug description

Starting elasticsearch:5.2.2 results in `Failed to created node environment`. This has been covered in #21, the recommendation was to set user permissions on the host system.

```
docker run --rm -v /tmp/elastic:/usr/share/elasticsearch/data docker.elastic.co/elasticsear
# breaks
```

I prefer simple fire & forget docker containers which don't need any preparation on the host system. Would it be an option to check the Elasticsearch image from Docker, that runs fine, without setting any permissions before, and replicate that behaviour in new `elasticsearch-docker`?

```
docker run --rm -v /tmp/elastic:/usr/share/elasticsearch/data elasticsearch:5.2.2
# runs
```

```
docker run --rm -v /tmp/elastic:/usr/share/elasticsea
# breaks
```

I prefer simple fire & forget docker containers which don't n
Would it be an option to check the Elasticsearch image from
any permissions before, and replicate that behaviour in new

```
docker run --rm -v /tmp/elastic:/usr/share/elasticsea
# runs
```

Fallacy
:latest

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akes data easy to explore.

Copy and paste to pull this image

```
docker pull elasticsearch
```

View Available Tags

No :latest, what about :7 and :7.7?

Exact only: 7.7.1

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The base image diversity and size debate

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Common base image since 5.4+

CentOS 7

Similar setup

Shared layers - ultimately much better for size across components

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Kubernetes is the answer. What was the question?

— **https://twitter.com/charlesfitz/status/1068203930683752448**

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…lots of it

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Fun with YAML

http://www.yamllint.com

```
ports:
  - 80:80
  - 20*60(1):20*60(0)=1220 * 60
  - 54:3 == 234
```

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Fun with YAML

https://docs.docker.com/compose/compose-file/#short-syntax-1

```yaml
ports:
  - "80:80"
  - 73200
```

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Building on existing Kubernetes primitives like StatefulSet, Service, Deployment,…

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Elastic Helm Charts

Elasticsearch, Kibana, Filebeat, Metricbeat, APM Server, Logstash

https://github.com/elastic/helm-charts

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Tested on GKE

Default storage pd-ssd (network attached)

Kubernetes >=1.10 supports Local PersistentVolumes for increased performance

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Un-Opinionated

Expose environment variables & mount secrets

Multiple upgrade strategies

Minikube Example

https://github.com/elastic/helm-charts/tree/master/elasticsearch/examples/minikube

```
helm repo add elastic https://helm.elastic.co

helm install --name elasticsearch elastic/elasticsearch [--set imageTag=7.7.1]

minikube addons enable default-storageclass
minikube addons enable storage-provisioner
cd examples/minikube
make
```

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```yaml
---
# Permit co-located instances for solitary minikube virtual machines
antiAffinity: "soft"

# Shrink default JVM heap
esJavaOpts: "-Xmx128m -Xms128m"

# Allocate smaller chunks of memory per pod
resources:
  requests:
    cpu: "100m"
    memory: "512M"
  limits:
    cpu: "1000m"
    memory: "512M"

# Request smaller persistent volumes
volumeClaimTemplate:
  accessModes: [ "ReadWriteOnce" ]
  storageClassName: "standard"
  resources:
    requests:
      storage: 100M
```

OPERATOR FRAMEWORK

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Custom Resource (CR)

CRD == type definition (class)

CR == instance (object)

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Custom Resource Definition (CRD)

Think: Elasticsearch, Kibana, APM

Contrast: Built-in resources like Pods, Services, Secrets, StatefulSets,…

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Custom Controller

Brings CRDs to "life" (reconciliation loop)

Upgrades, secrets, certificate management,…

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Elastic Operator

Elasticsearch, Kibana, APM Server

https://github.com/elastic/cloud-on-k8s

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Golang 1.13

Kubebuilder 2

SDK for building Kubernetes APIs using CRDs

Kustomize

Generate patched CRDs for specific flavors

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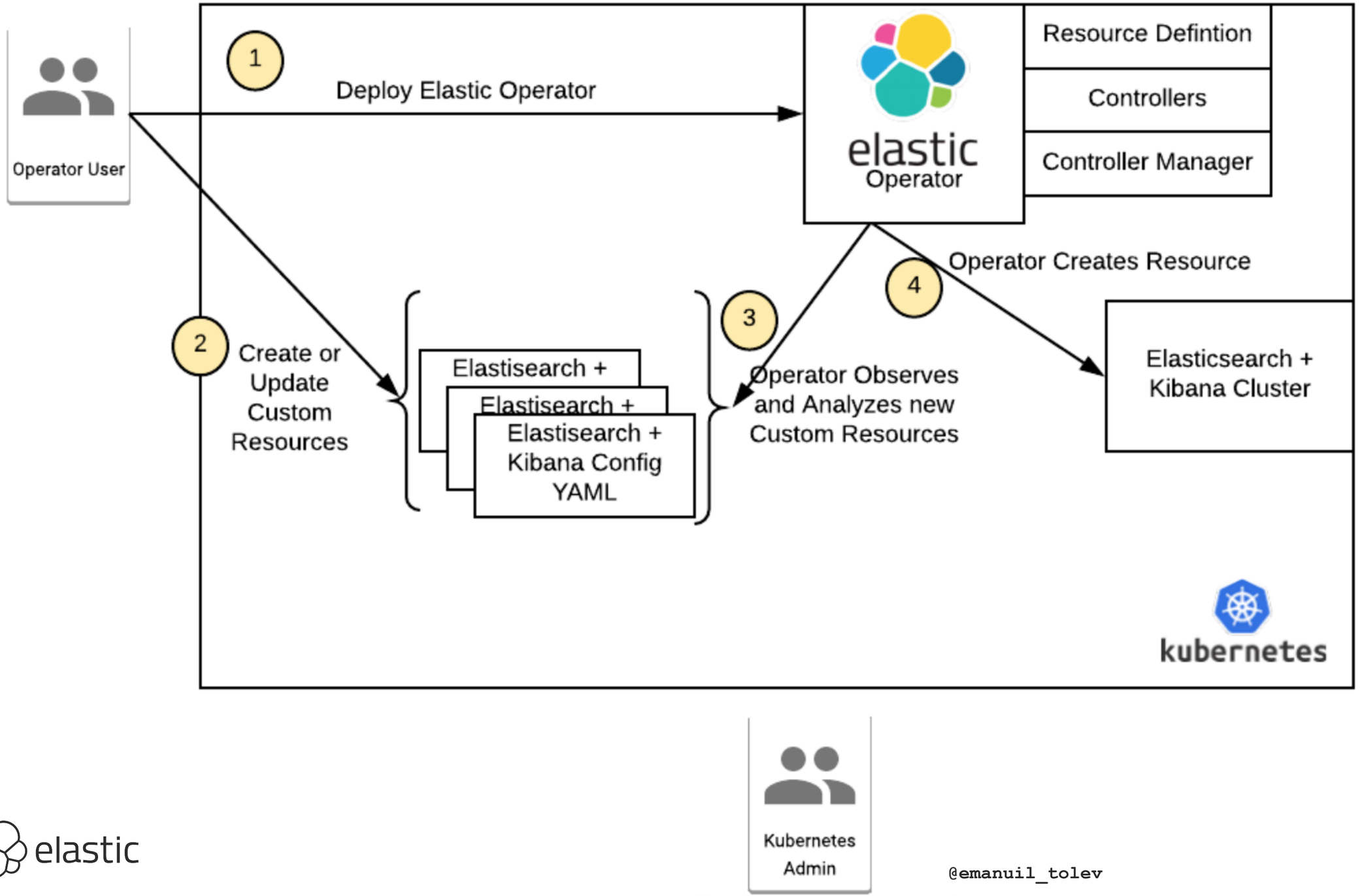

Kubernetes Admin

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Opinionated

Encode best practices & operational knowledge
Built-in certificate management, security,…

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Example Opinions

Scale down: Drain nodes first

Upgrade: Disable shard allocation

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You Can Still Shoot Yourself in the Foot

Configure 0 replicas and do an upgrade for example

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Running on Minikube

```
minikube config set memory 16384
minikube config set cpus 4
minikube start
```

Running on Minikube

```
# Set up the entire operator: configs, deployment practices, monitoring, in one command
kubectl apply -f https://download.elastic.co/downloads/eck/1.1.2/all-in-one.yaml

# Monitor logs
kubectl -n elastic-system logs -f statefulset.apps/elastic-operator

# And this is where you come in - the configs you write
kubectl apply -f apm_es_kibana.yaml
```

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```yaml
---
apiVersion: elasticsearch.k8s.elastic.co/v1
kind: Elasticsearch
metadata:
  name: elasticsearch-sample
spec:
  version: 7.7.1
  nodes:
  - nodeCount: 1
    podTemplate:
      spec:
        containers:
          - name: elasticsearch
            resources:
              limits:
                memory: 2Gi
    volumeClaimTemplates:
    - metadata:
        name: data
      spec:
        accessModes:
        - ReadWriteOnce
        resources:
          requests:
            storage: 2Gi
```

```yaml
---
apiVersion: apm.k8s.elastic.co/v1
kind: ApmServer
metadata:
  name: apm-server-sample
spec:
  version: 7.7.1
  nodeCount: 1
  elasticsearchRef:
    name: "elasticsearch-sample"
```

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```yaml
---
apiVersion: kibana.k8s.elastic.co/v1
kind: Kibana
metadata:
  name: kibana-sample
spec:
  version: 7.7.1
  nodeCount: 1
  elasticsearchRef:
    name: "elasticsearch-sample"
```

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Running on Minikube

```
# Check status
kubectl get elasticsearch,kibana,apmserver

# Expose Kibana
kubectl port-forward service/kibana-sample-kb-http 5601

# Get the credentials
echo `kubectl get secret elasticsearch-sample-es-elastic-user
     -o=jsonpath='{.data.elastic}' | base64 --decode`
```

Changes

Instance size / number, version,…

```
kubectl apply -f apm_es_kibana.yaml
```

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Support

GKE (Google Cloud)

EKS (AWS)

AKS (Azure)

OpenShift (Redhat)

StatefulSets

Rolling Upgrades with Volume reuse

"Standard" way to run stateful workloads — stable network ID, stable data volume that is re-attachable during rolling upgrades

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Deployment

CRDs require cluster admin level permissions to install

Privileged Containers — Elasticsearch host kernel settings like **vm.max_map_count**

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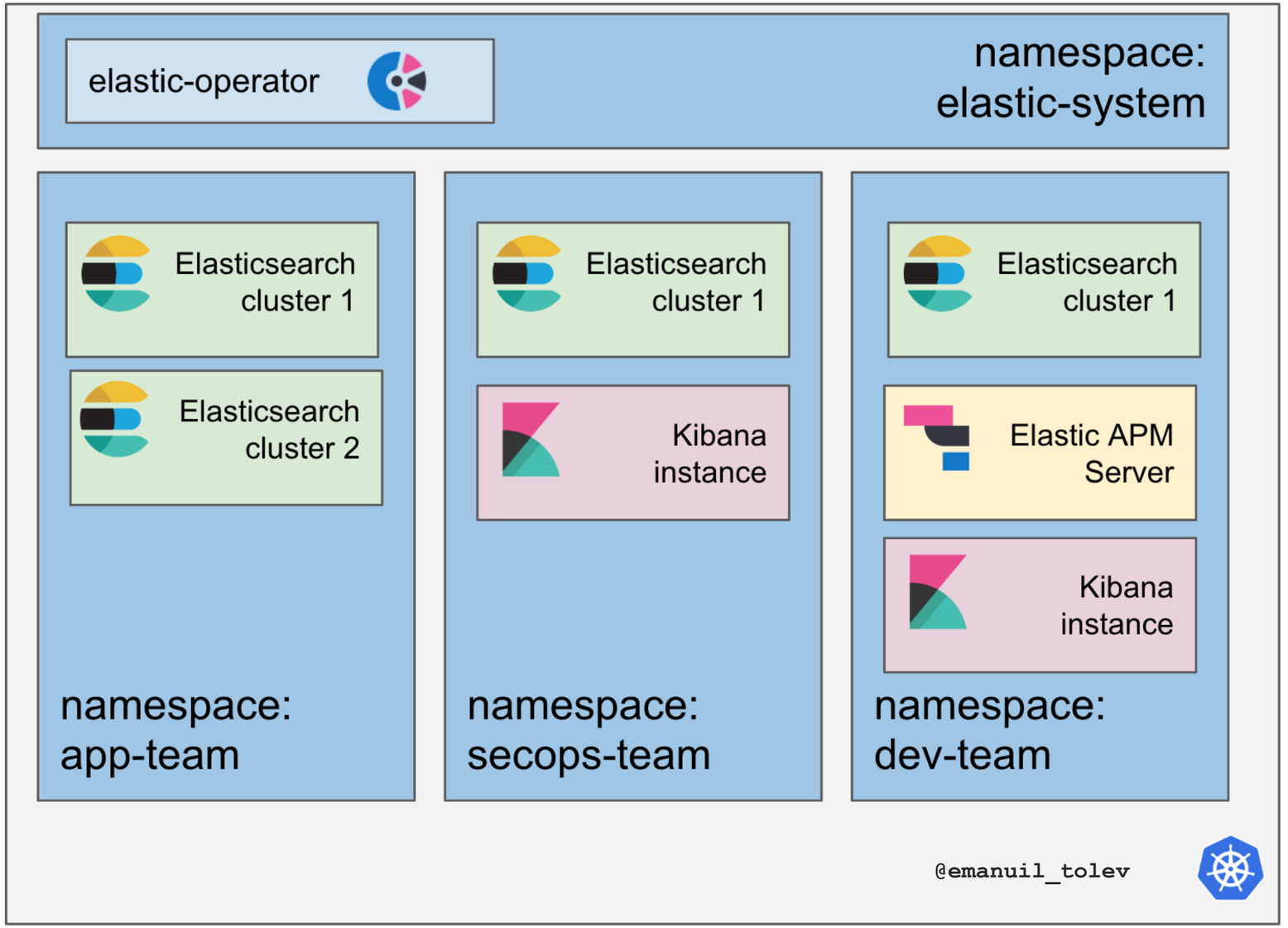
Global Namespace



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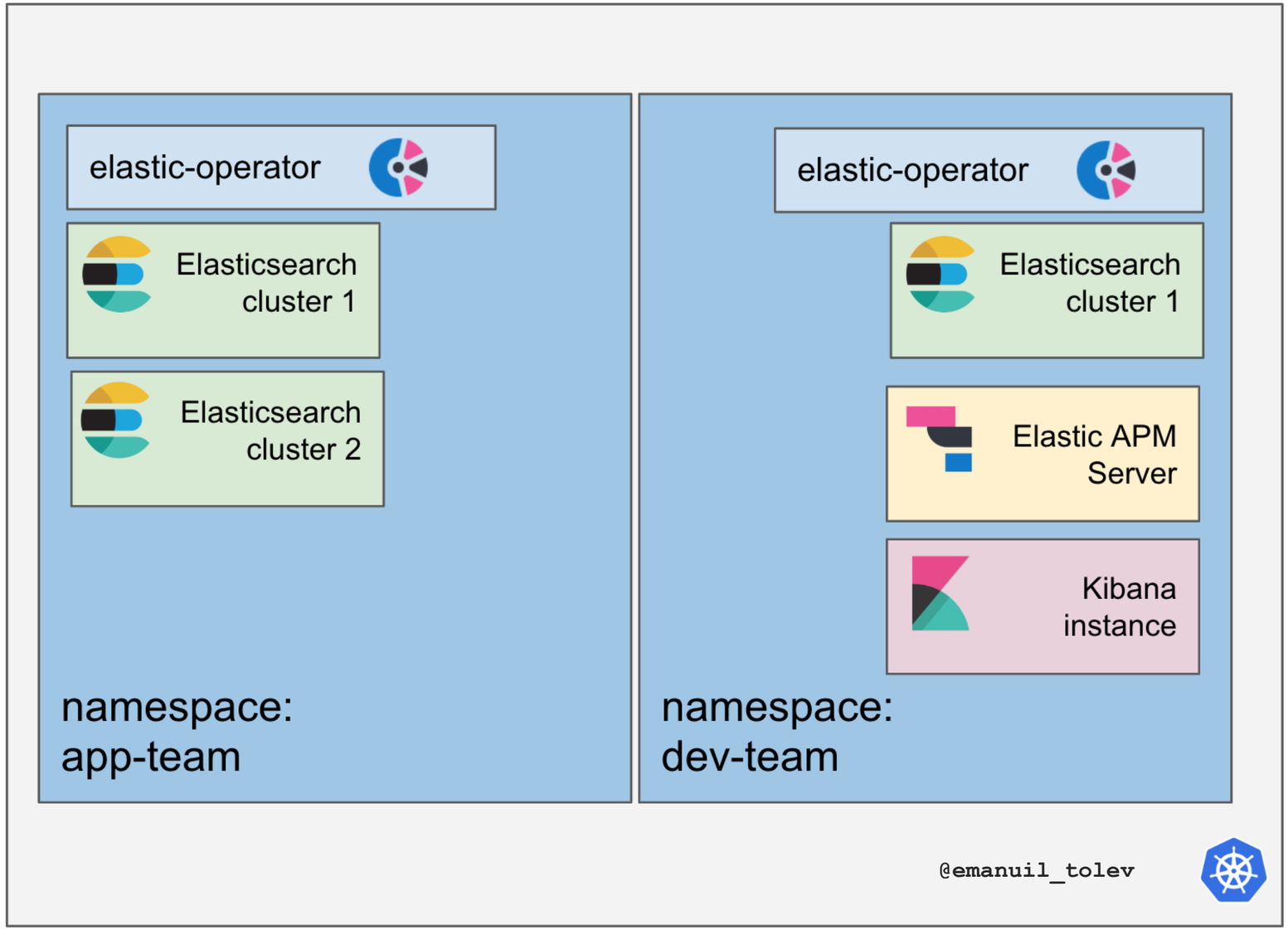
Single Namespace



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Couchbase Operator

provided by Couchbase

The Couchbase Autonomous Operator allows users to easily deploy, manage, and maint

Crunchy PostgreSQL Enterprise

provided by CrunchyData.com

A Postgres Operator from Crunchydata.com

Dynatrace OneAgent

provided by Dynatrace LLC

Install full-stack monitoring of Kubernetes clusters with the Dynatrace OneAgent.

Eclipse Che

provided by Eclipse Foundation

A Kube-native development solution that delivers porta

Elastic Cloud on Kubernetes

provided by Elastic

Run Elasticsearch, Kibana and the APM Server on Kubernetes and OpenShift

EnMasse

provided by EnMasse

EnMasse provides messaging as a managed service on Kubernetes

etcd

provided by CNCF

Create and maintain highly-available etcd clusters on Kubernetes

Event Streams Topic

provided by IBM

An operator for managing Topics for Event Streams on IBM Cloud

Ext Postgres Operator

provided by movetokube.com

Manage databases and roles in external PostgreSQL server or

Falco Operator

provided by Sysdig

Falco is a behavioral activity monitor designed to detect

Federator.ai

provided by ProphetStor Data Services, Inc.

Federator.ai Operator provides

FfDL Operator

provided by IBM

Fabric for Deep Learning - an operating system fabric for

Conclusion

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"Containers are disrupting the industry!"

"Can I run Elasticsearch on Docker or Kubernetes?"

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"Should I run Elasticsearch on Docker or Kubernetes?"

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Effective collaboration and solving production problems

Remember why you're doing all this

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Helm Charts vs Operator

Where to next?

- Deeper look at the operator: https://www.elastic.co/blog/introducing-elastic-cloud-on-kubernetes-the-elasticsearch-operator-and-beyond
- The source code: https://github.com/elastic/cloud-on-k8s
- The slides: https://noti.st/emanuil-tolev/CqvknF/from-containers-to-kubernetes-operators

Elastic interest?

community.elastic.co
free lunch info sessions, ping me

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Questions & Discussion

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