Scaling Fisher Price Architecture with Kubernetes

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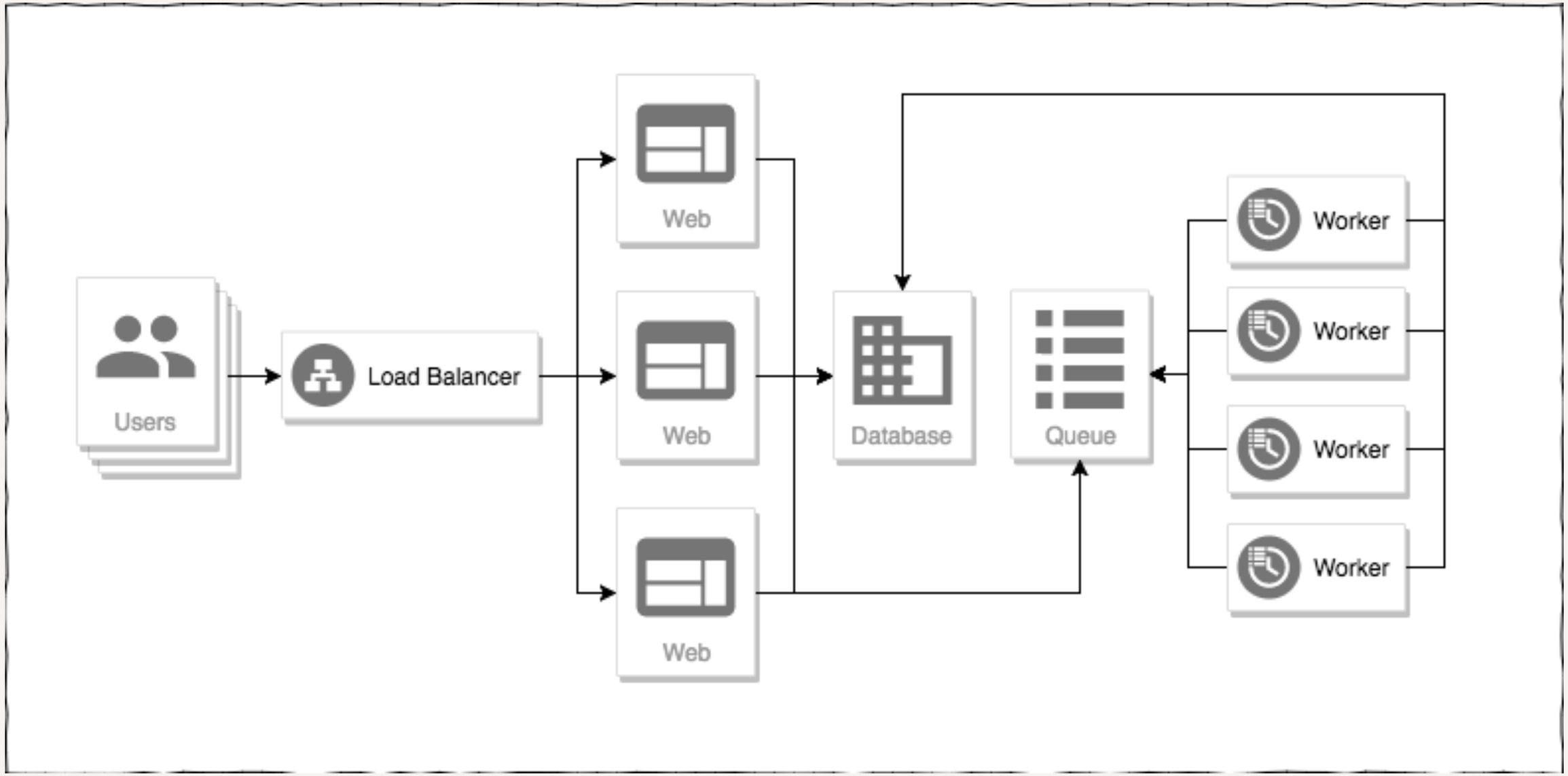
Mavenlink Integrations

- Connects third party APIs with Mavenlink
- For example,
  - A company might want to use **Jira** for *development tasks* and **Mavenlink** for *accounting*, *project planning* and *client collaboration*.
  - Mavenlink Integrations lets them *sync* **Jira** and **Mavenlink** so that data flows between both systems.


Users
Load Balancer
Web
Web
Web
Database
Queue
Worker
Worker
Worker
Worker

HEROKU

Pros

- Dead simple to get started
- Easy deploys
- Some monitoring

Cons

- Resource utilization and cost
- Hard to scale queue based workloads
- Less control over the underlying hardware
- Visibility


HEROKU

Why?

- Flexibility
- Better resource usage and scaling
- Cheaper!

Mavenlink ❤ Kubernetes

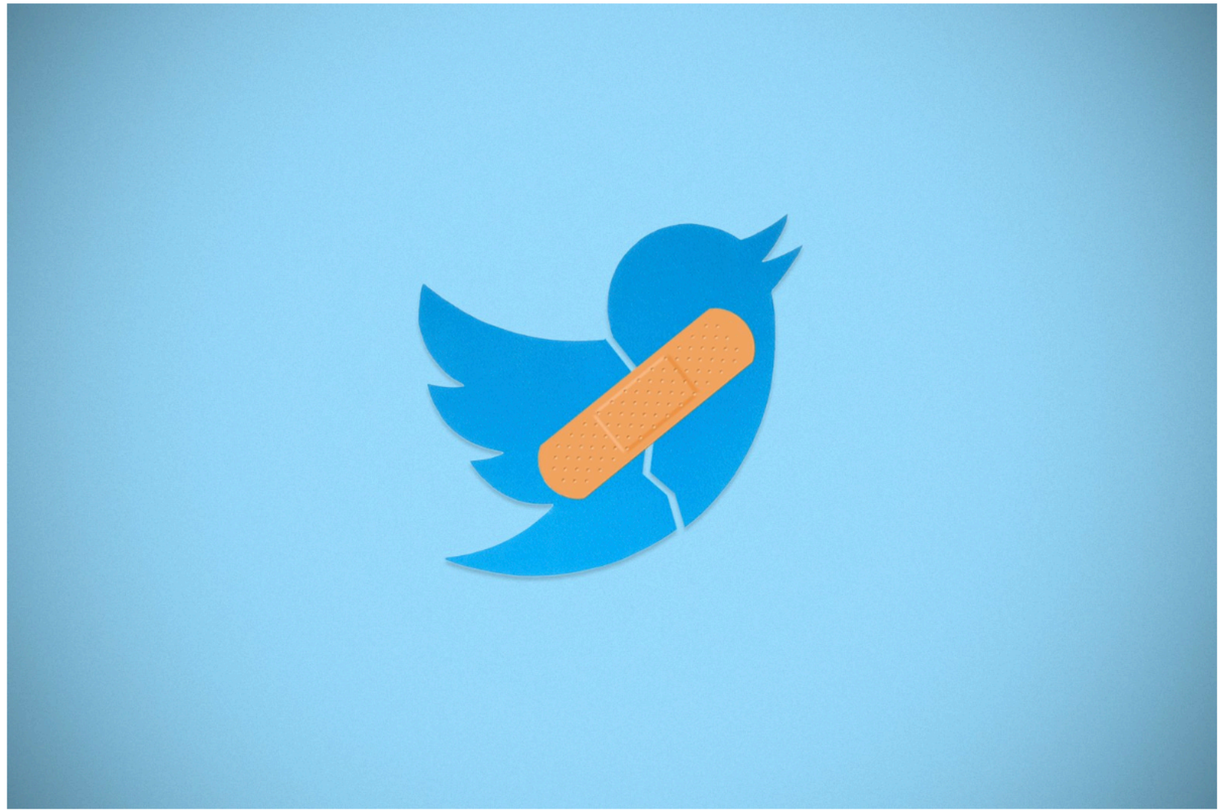
- Two production applications fully deployed
- Background workers for primary application
- Kubernetes workstations
- Instastage

What's the deal with Fisher Price?

“Just an Ass-Backward Tech Company”: How Twitter Lost the Internet War

Twitter faces more challenges than most technology companies: ISIS terrorists, trolls, bots, and Donald Trump. But its last line of defense, the company’s head of trust and safety, Del Harvey, isn’t making things easier. “Del overcomplicates things . . . and you can see that in the way some of these things are handled publicly.”

BY MAYA KOSOFF | FEBRUARY 19, 2018 6:00 PM



Dare Obasanjo
@Carnage4Life

Follow

Twitter blames their poor handling of abuse on Ruby on Rails? What's next blaming verifying Nazis on MySQL? Way to insult our intelligence.
vanityfair.com/news/2018/02/h …

> At the same time, her defenders say, Harvey has been forced to clean up a mess that Twitter should have fixed years ago. Twitter's backend was initially built on Ruby on Rails, a rudimentary web-application framework that made it nearly impossible to find a technical solution to the harassment problem. If Twitter's co-founders had

4:57 PM - 19 Feb 2018

1,010 Retweets **1,912** Likes

Michael Hartl ⛱️ @mhartl · Feb 19

Replying to @dhh @tobi

OK, the 5th edition of the Ruby on @RailsTutorial will now be subtitled "Learn Rudimentary Web Development with Rails"

2 2 47

DHH
@dhh

Follow

Maybe we can forward the question to @tobi 😄? How's the Fisher-Price infrastructure holding back your $13B public company?

> **April Joyner** @aprjoy
> Twitter's failure on this issue is not a joke, but 😂 at "blaming verifying Nazis on MySQL."
>
> Also, I wonder what @dhh thinks of the claim that @rails is "Fisher-Price…

6:58 PM - 19 Feb 2018

75 Retweets **372** Likes


shopify

Rails isn't the problem...

...how we're using and deploying it might be.

What we'll cover

- A traditional "production" Rails application
- What is Kubernetes and how can it help me scale my application?
- Advanced Kubernetes Concepts

A disclaimer

Lets look at a traditional Rails application...

We'll discuss

- Developing
- Shipping it to *production*

Let's identify some common *scaling* problems

Developing

Setting up your development environment

Probably went something like this...

- Install packages
- Install languages, frameworks, and tools
- Install dependencies
- Install services (mySQL, Postgres, Redis, ElasticSearch, etc...)

What about replicating this to all of your other developers machines?

Problem 1

Managing an applications dependencies across development machines is difficult

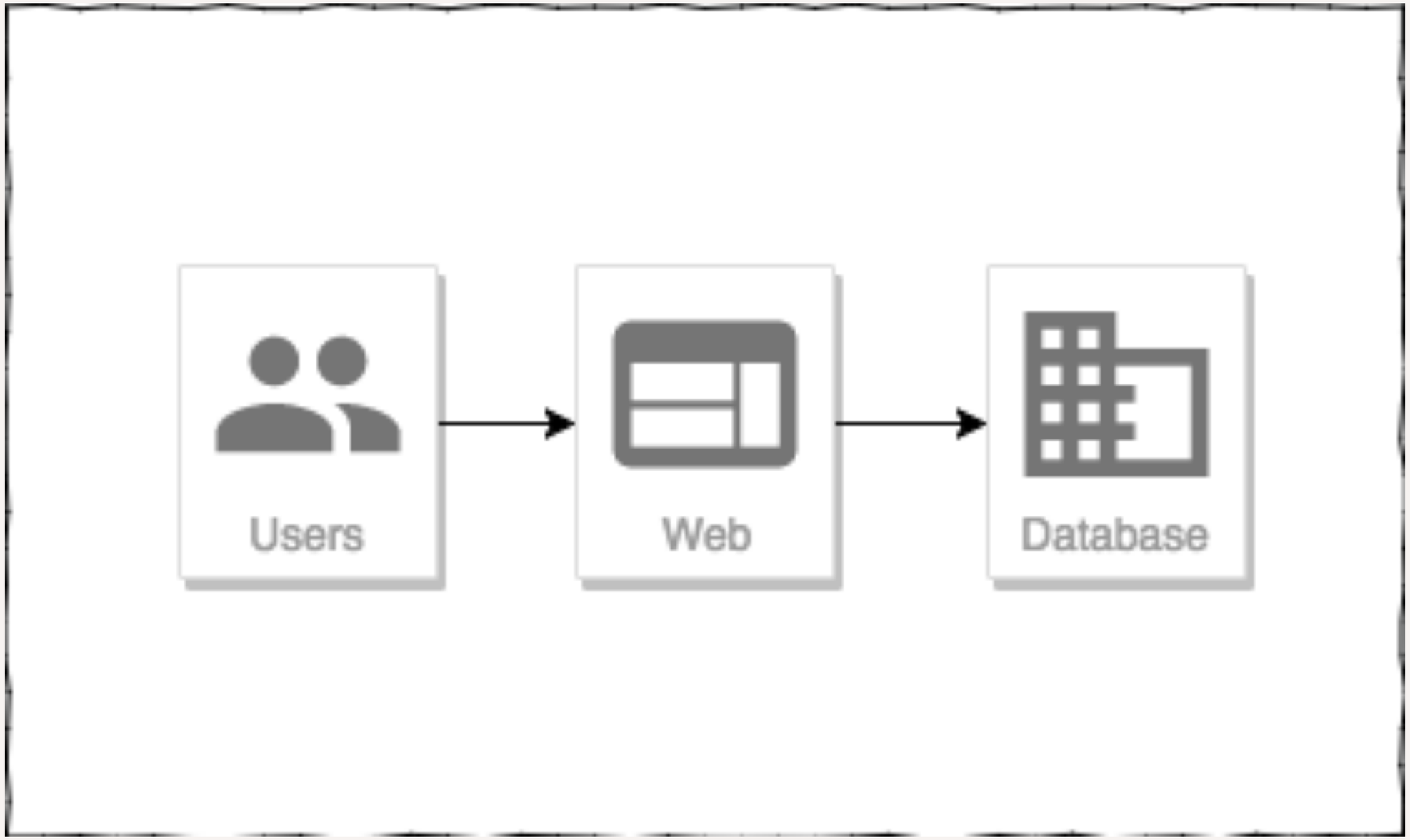
Shipping it to production

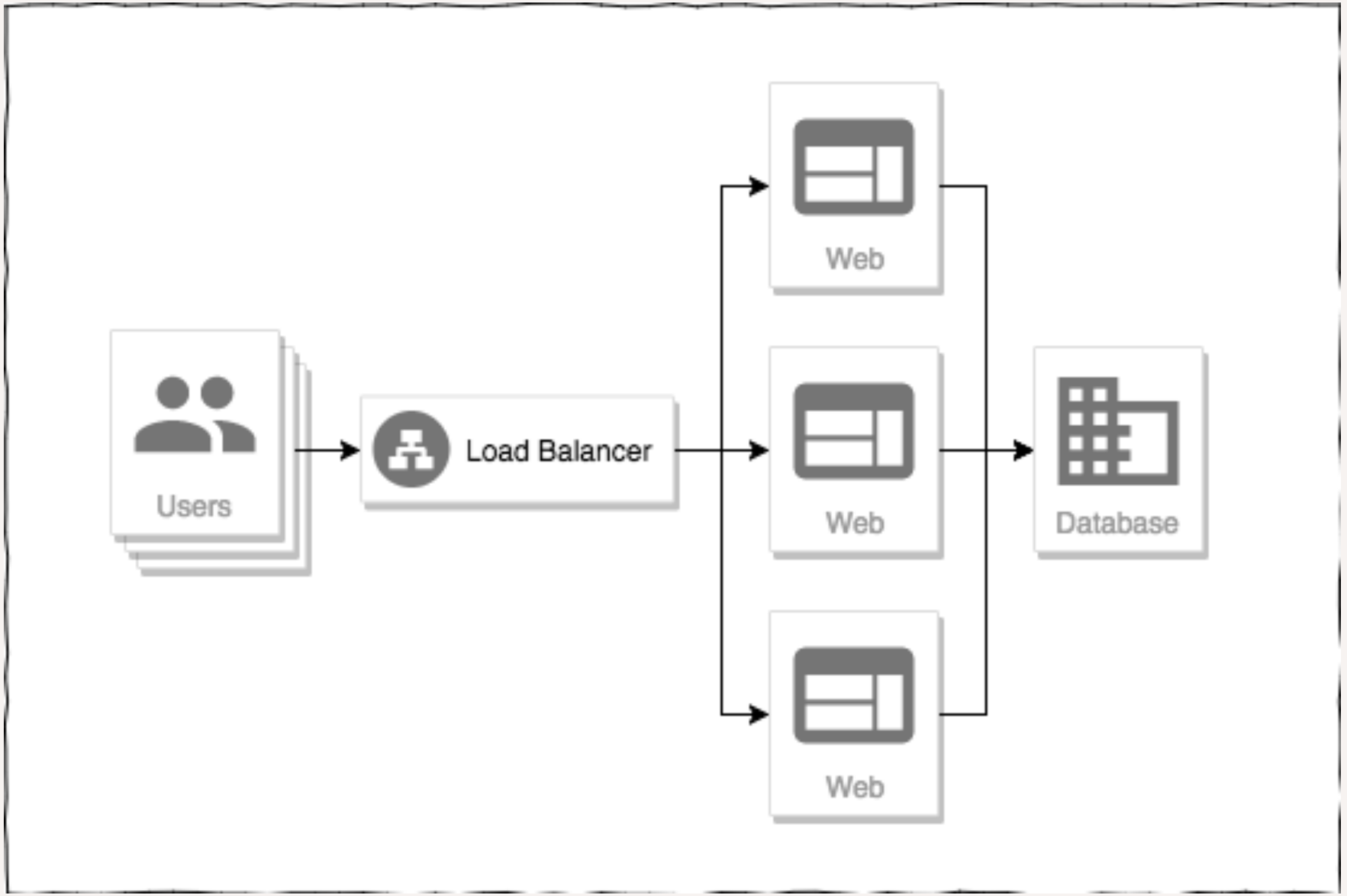
- Need a database
- Need some servers to run my application

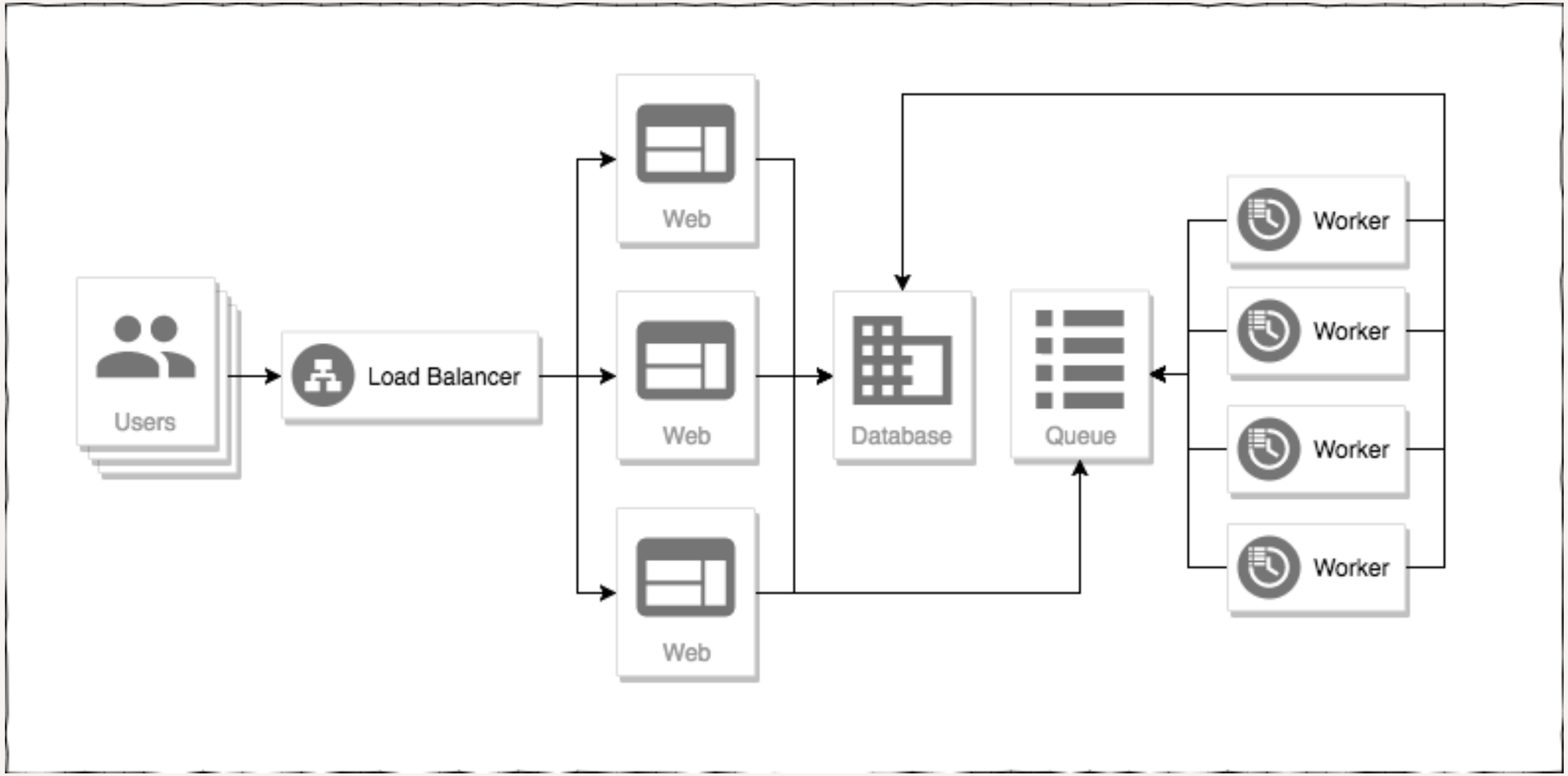
Options

- Roll your own servers
- Use Heroku
- Use a cloud service provider

Lets go with a cloud provider for this example...


Users
Web
Database


Users
Load Balancer
Web
Web
Web
Database


Users
Load Balancer
Web
Web
Web
Database
Queue
Worker
Worker
Worker
Worker

This quickly becomes quite the chore!

- Maintaining server inventory
- Maintaining deploy and development tooling
- Monitoring
- Rollbacks
- Backups

More problems!

Problem 2

Keeping development, staging, and production environments the same

Problem 3

Scaling inventory with demand

Problem 4

Utilization and cost

Problem 5

What if I need to deploy and manage more services?

There has to be a better way

Lets start by discussing containers

What's a container anyway?

A container image is a *lightweight*, **stand-alone**, *executable package* of a piece of software that includes everything needed to run it.

Containers *run anywhere* and have everything they need to run


docker

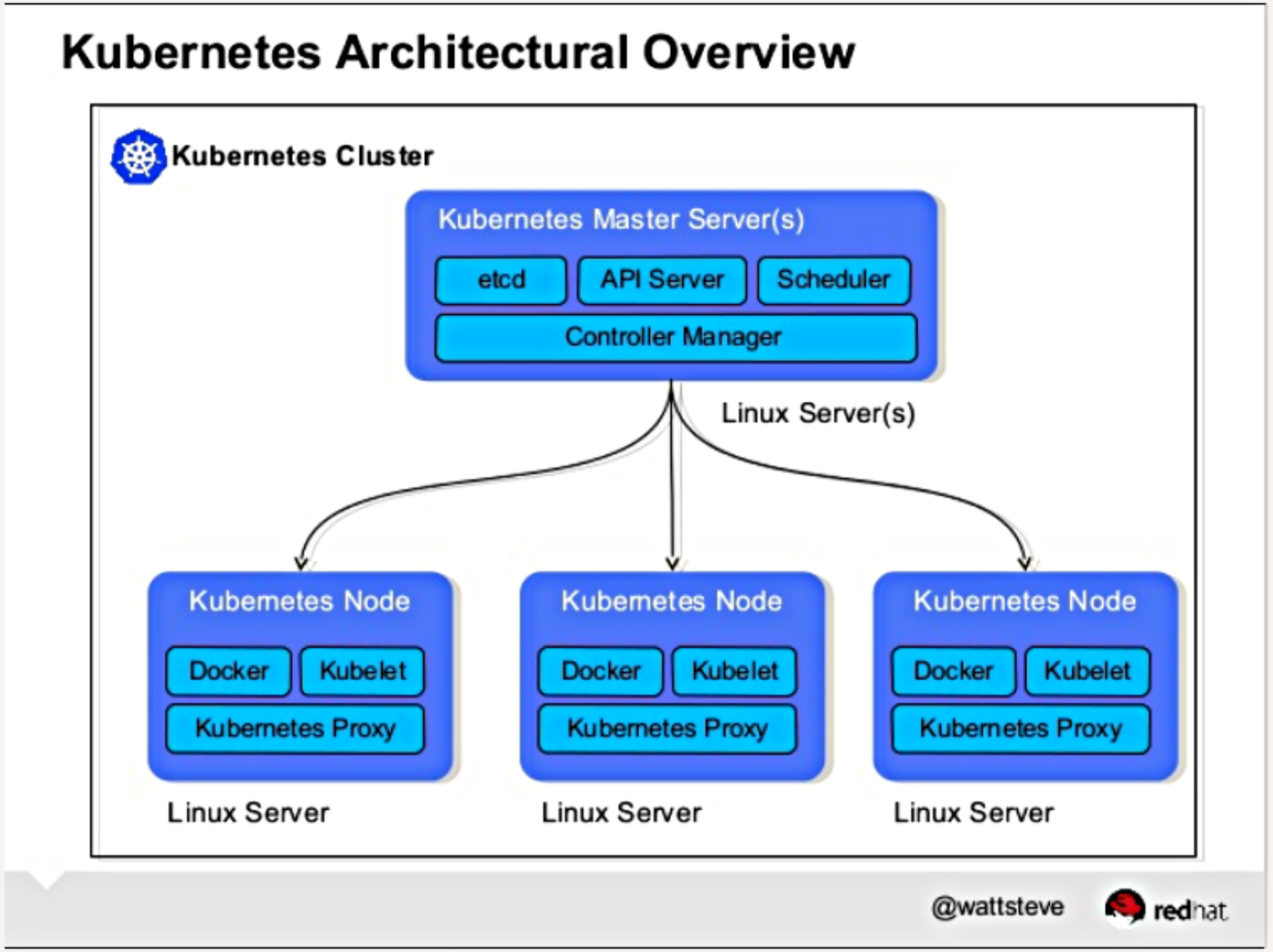
This solves #1 and #2

But now that I've got a container, how do I deploy and manage them?

What is Kubernetes?

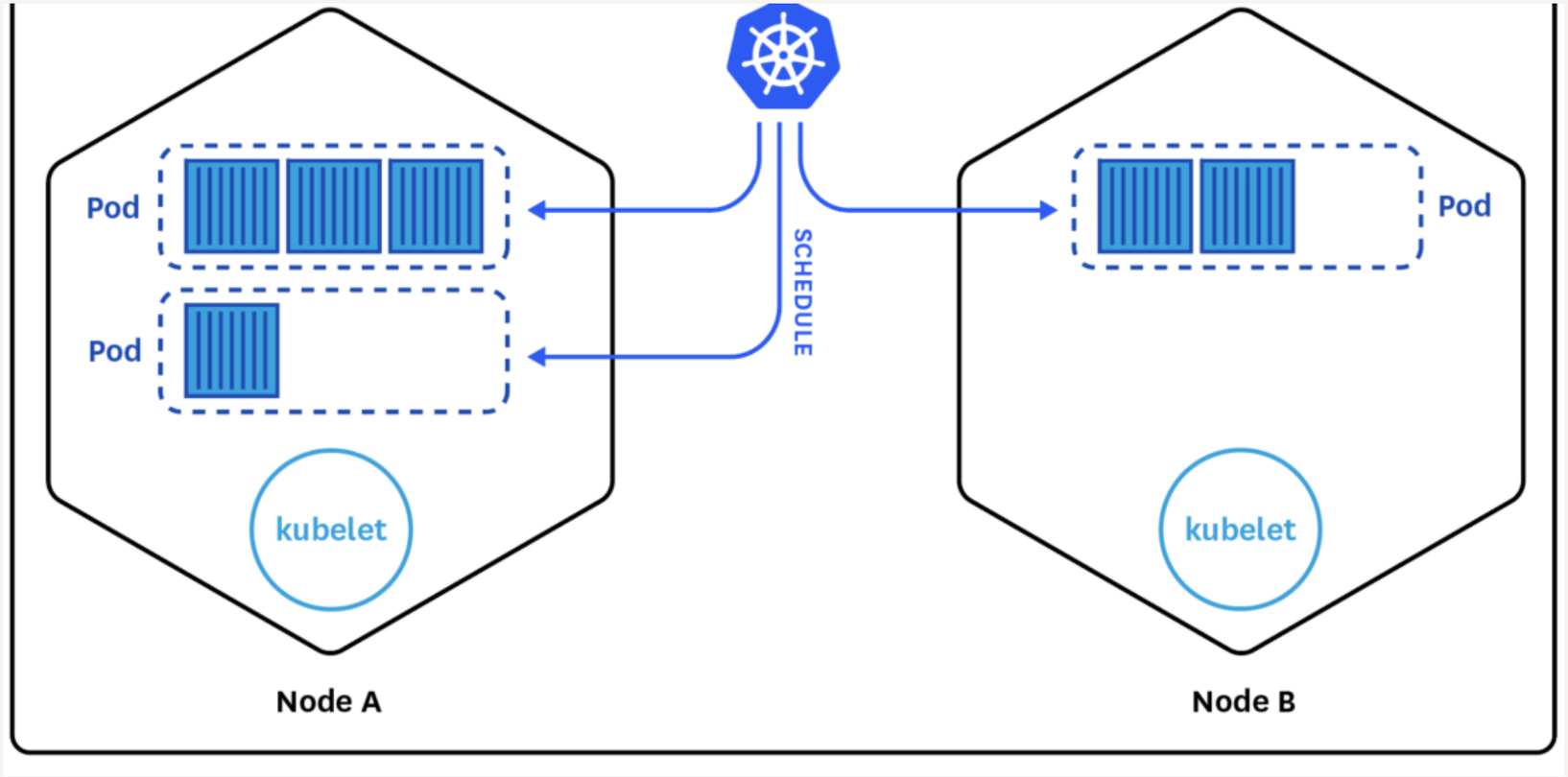
Kubernetes is a portable, extensible open-source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation[1].

[1] What is Kubernetes?, kubernetes.io.



Kubernetes Architectural Overview (by Steve Watt, Red Hat).

Scheduling



Unsourced 😔

What do I like about Kubernetes?

- Abstractions for thinking about infrastructure
- Don't have to know **too** much about the underlying hardware
- Trivial scaling
- Very, very, flexible!

How do I get my Rails application on Kubernetes?

1) Spin up a cluster!


amazon
web services


Microsoft Azure


Google Cloud Platform

2) Containerize it!

```
FROM ruby:2.5

USER root
RUN apt-get update && apt-get install -qq -y build-essential nodejs libpq-dev --fix-missing --no-install-recommends

RUN mkdir -p /app
WORKDIR /app

COPY Gemfile Gemfile
COPY Gemfile.lock Gemfile.lock

USER app
RUN RAILS_ENV=production bundle install --jobs=4 --retry=3 --deployment

ENV RAILS_ENV=production

COPY . .

USER root
RUN chown -R app. /app

USER app
CMD ["bundle","exec","rails s"]
```

3) Put it on Kubernetes

We're going to write some *manifests* that describe what our application should look like

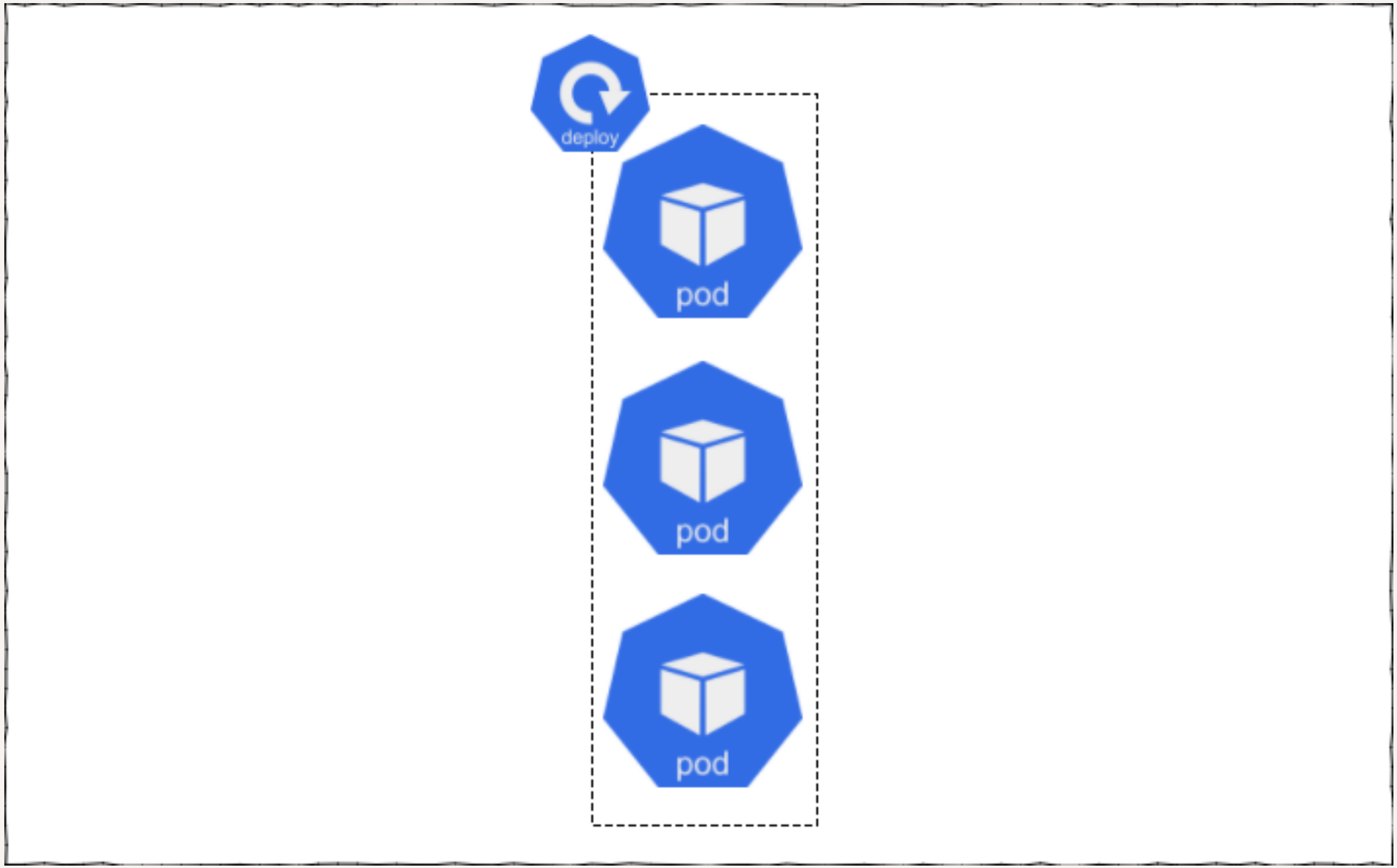
Deployment

A deployment declares your desired state of an application, usually as a series of pods and how they should be managed

Pod

A pod (as in a pod of whales or pea pod) is a group of one or more containers (such as Docker containers), with shared storage/network, and a specification for how to run the containers.

In laymans terms, pods are units of works or *replicas* of an application. And deployment describes how to configure them.


deploy
pod
pod
pod

```yaml
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  name: rails
spec:
  replicas: 3
  template:
    metadata:
      name: rails-pod
      labels:
        service: rails-web
    spec:
      containers:
      - name: rails-container
        image: rails:latest
      restartPolicy: Always
```

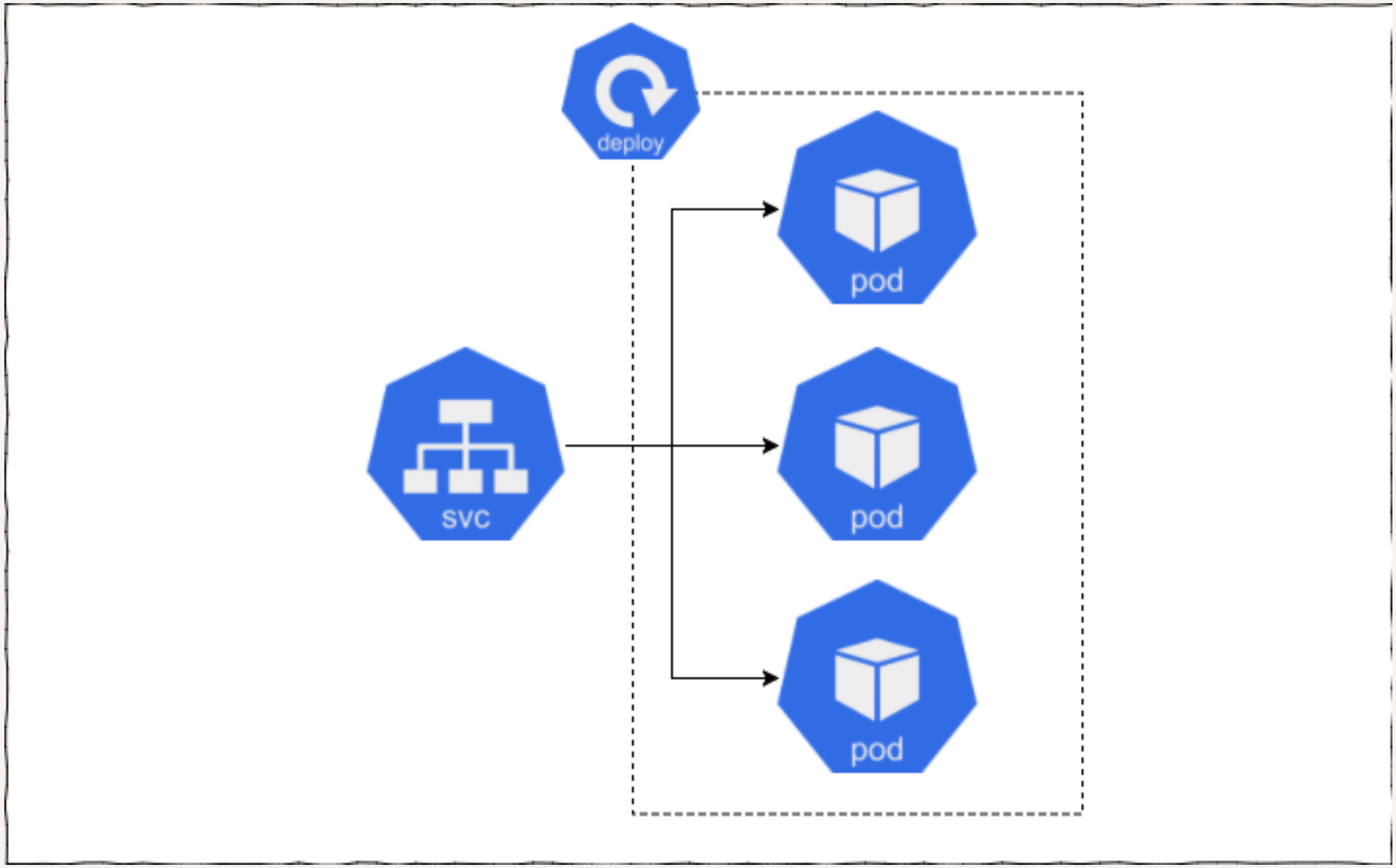
What can I do with a deployment?

```yaml
# How much resources should we allocate to this pod?
resources:
  requests:
    memory: 1Gi
    cpu: 200m
  limits:
    cpu: 1
    memory: 2Gi
```

```
# Environment variables that the pod should have access to
env:
  - name: MY_FAVORITE_COLOR
  value: blue
  - name: SUPER_TOP_SECRET_USERNAME
  valueFrom:
    secretKeyRef:
      name: secret-token
      key: username
```

Service

A service allows other things to access your deployment with a predictable host.

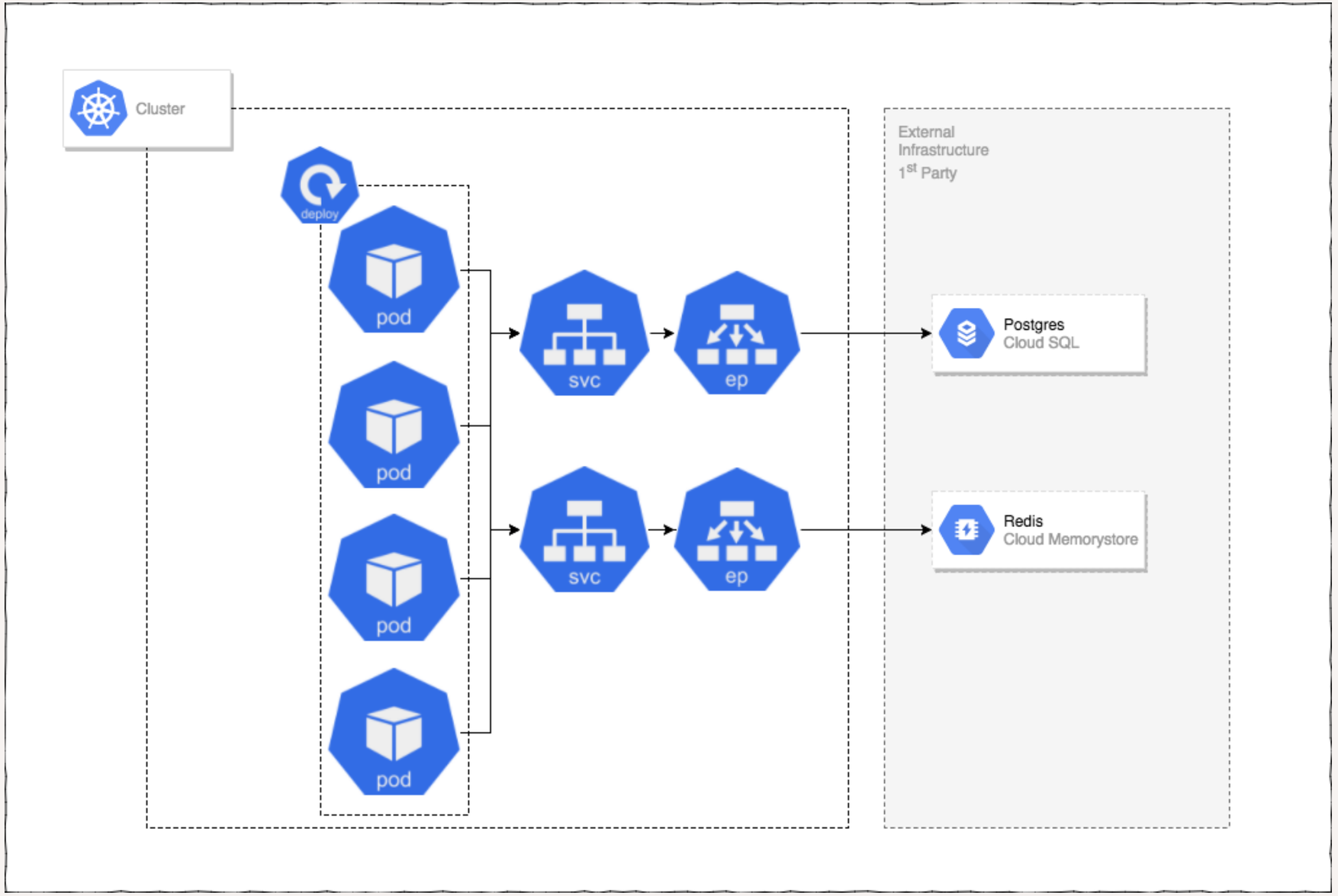

deploy
pod
svc
pod
pod

```yaml
apiVersion: v1
kind: Service
metadata:
  labels:
    service: rails
  name: rails-service
spec:
  type: NodePort
  ports:
  - name: rails-port
    port: 3000
    protocol: TCP
    targetPort: 3000
    nodePort: 30000
  selector:
    service: rails-web
```

This becomes a human readable (and predictable) host

rails-service.default.svc.cluster.local

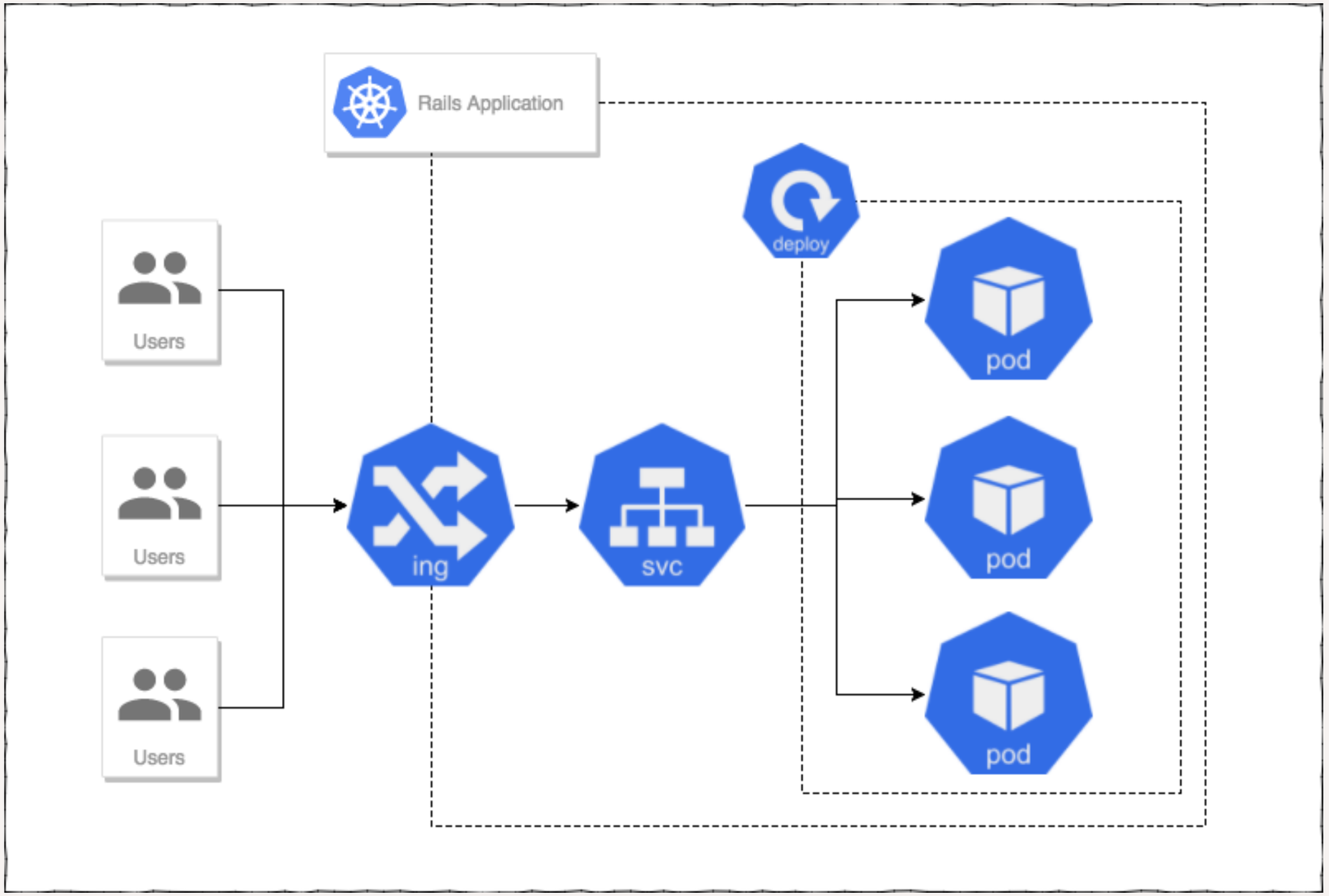
What about talking to external services?


Cluster
deploy
pod
pod
pod
pod
svc
ep
svc
ep
External
Infrastructure
1st Party
Postgres
Cloud SQL
Redis
Cloud Memorystore

Ingress

Allows traffic to a given hostname, to route to the correct service

In some cases, like GKE, this even spins up a load balancer for you!


Rails Application
deploy
Users
Users
Users
ing
svc
pod
pod
pod

```yaml
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: rails-web-ingress
spec:
  tls:
    - secretName: my-tls-cert
  rules:
    - host: my-rad-rails-app.com
      http:
        paths:
          - backend:
              serviceName: rails-web-service
              servicePort: rails-port
            path: /*
```

So lets circle back to some of our scaling problems

- Utilization and cost
- Scaling inventory with demand
- What if I need to deploy and manage more services?

Scaling inventory with demand

Lets define inventory

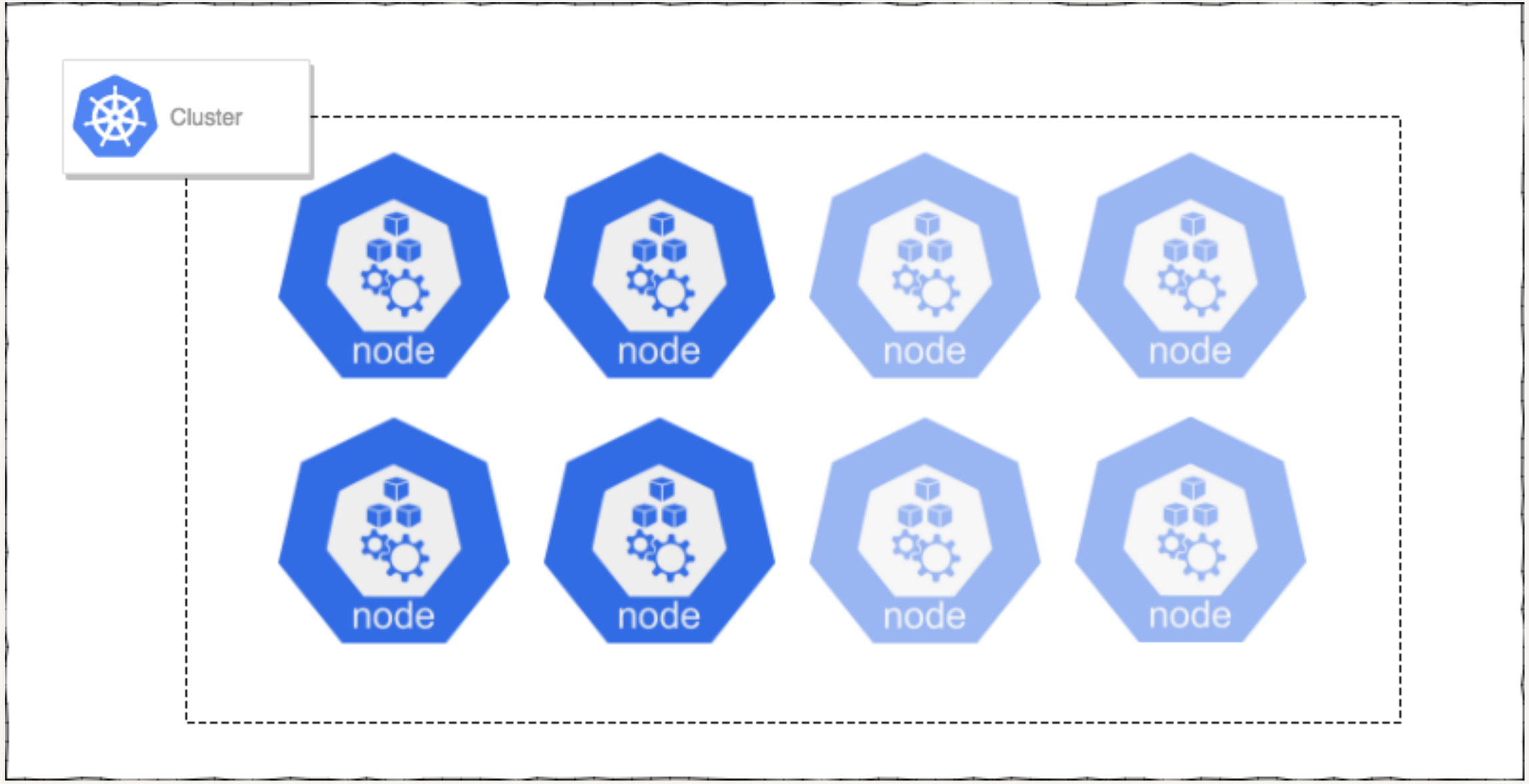
- Servers to run our code on
- Copies of our application

This is often called Horizontal Scaling

Servers to run our code on

Just add more nodes!

Node can be any mixture of machines


Cluster
node
node
node
node
node
node
node
node

Node Autoscaler

Scaling copies of our application

```
replicas: 3 -> 4
```

It's that easy!

Utilization and cost

Remember resource requests from before?

```yaml
# How much resources should we allocate to this pod?
resources:
  requests:
    memory: 1Gi
    cpu: 200m
  limits:
    cpu: 1
    memory: 2Gi
```

Utilization and cost

- Nodes are total *cluster* capacity
- Replicas are total *application* capacity
- These can be tweaked to find the right level of utilization

What if I need to deploy and manage more services?

A new service needs

- A docker image
- A deployment
- A service

You can then

- Deploy it separately
- Pass its service url to the Rails App
- Send requests

Since its just a *service*, you can route traffic from inside the cluster without worrying about Ingress

You could also try using gRPC!

Advanced

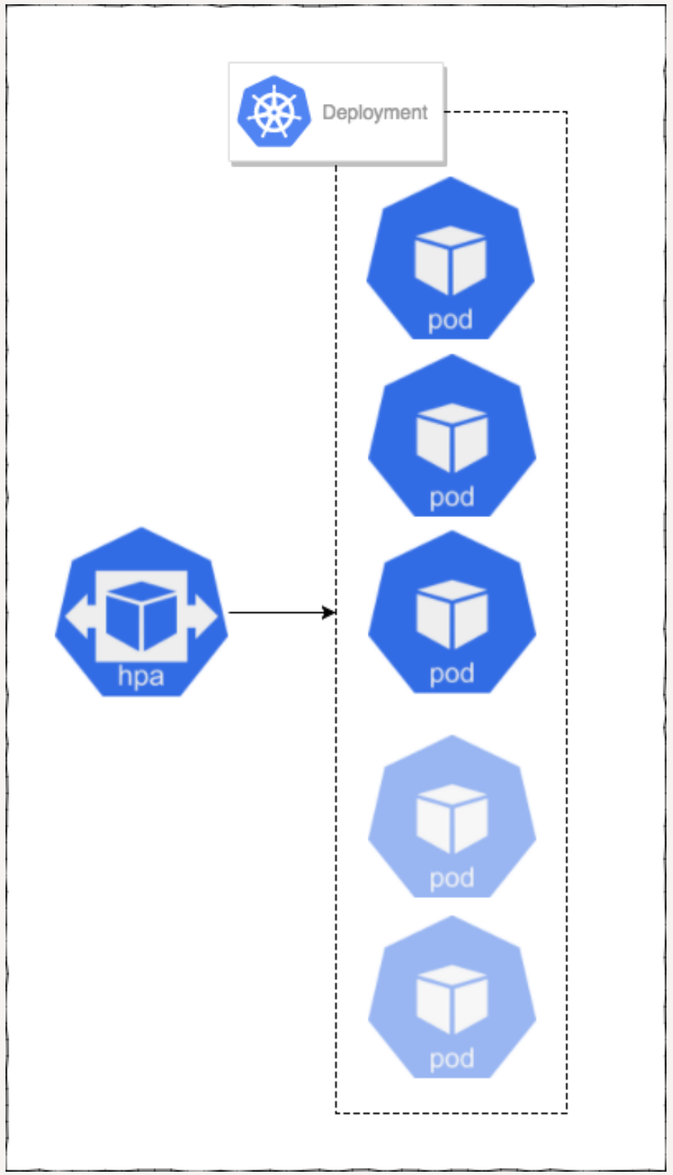
So this is cool and all, but show me the good stuff!

Autoscaling

We already know we can autoscale nodes, but what about pods?

Horizontal Pod Autoscaler

The Horizontal Pod Autoscaler automatically scales the number of pods in a replication controller, deployment or replica set based on observed CPU utilization.


Deployment
pod
pod
hpa
pod
pod
pod

```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
  name: rails-hpa
spec:
  maxReplicas: 5
  minReplicas: 3
  scaleTargetRef:
    apiVersion: extensions/v1beta1
    kind: Deployment
    name: rails-web
  targetCPUUtilizationPercentage: 50
```

But thats not always the right thing to scale on...

Custom Metrics

Kubernetes allows you to *extend* its API

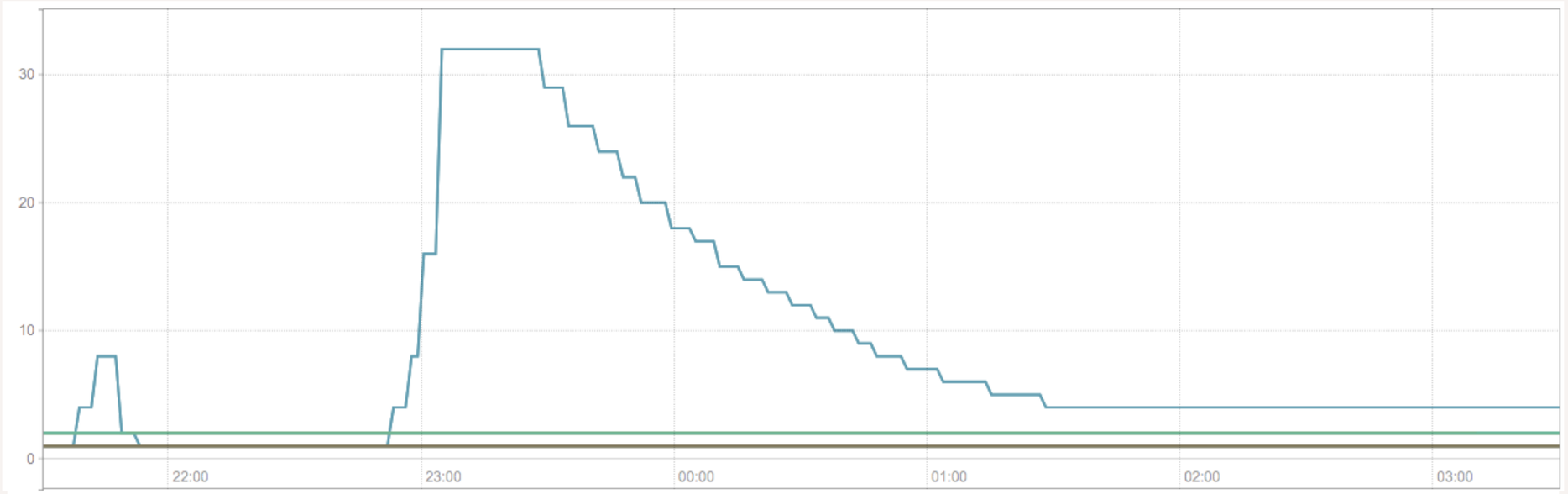
For us,

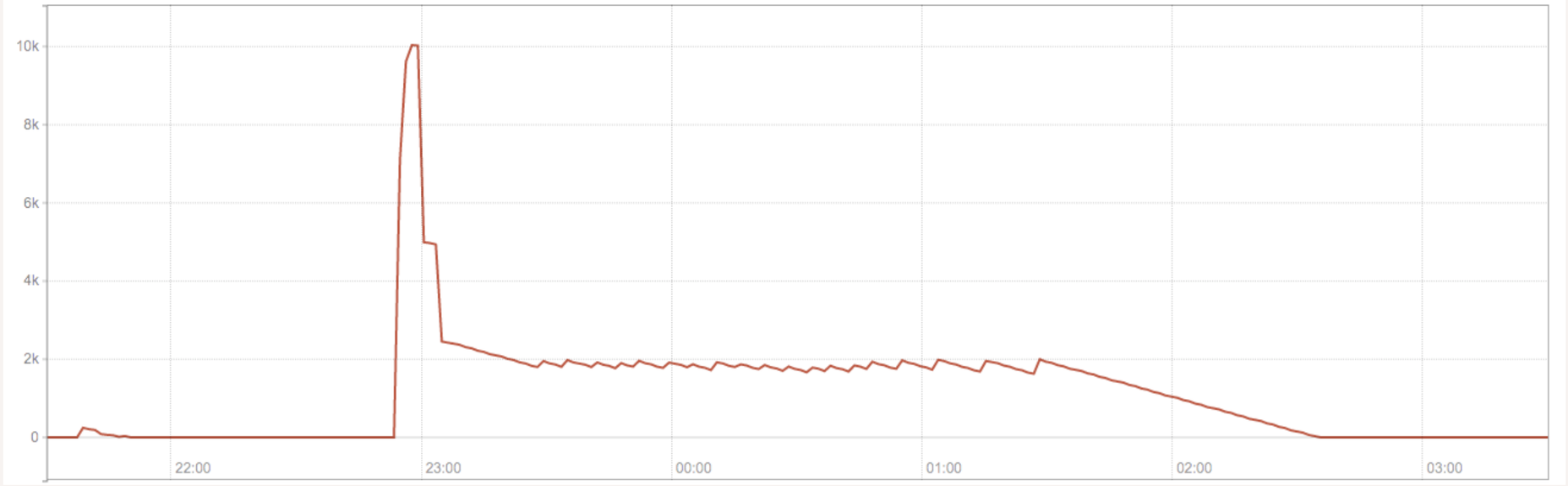
- Scaling our jobs on the `jobs_per_worker` ratio in the queue
- Scaling our web server on the `http_requests` per minute

Lets look at queues

We need to,

- Collect metrics
- Expose those metrics to Kubernetes
- Have our HPA point at those metrics


30
20
10
0
22:00
23:00
00:00
01:00
02:00
03:00


10k
8k
6k
4k
2k
0
22:00
23:00
00:00
01:00
02:00
03:00

Custom Resource Definitions

Lets think about a worker/queue setup

For every queue,

- I need a worker pool
- I want that worker pool to autoscale

Kubernetes lets us define *custom* resources to create *new* abstractions

You need to...

- Define a CustomResourceDefinition
- Implement the controller that says "what do I do to fulfill this resource"

```yaml
apiVersion: customResources/v1
kind: Queue
metadata:
 name: jira-queue
spec:
 name: jira
 min: 1
 max: 10
 metric: jobs_per_worker
```

The possibilities are endless

- A `Database` resource that spins up a database in cluster for you
- A `Staging` resource, the configures a staging app with dns behind company firewall

This to me is the true power of Kubernetes

Summing up

Kubernetes faciliates..

- Thinking of infrastructure as code
- Scaling manually and automatically with ease
- Building our own abstractions

How can I learn more?

- noobernetes.io
- Tutorials - Kubernetes
- Getting started with Kubernetes as an Application Developer
- The Childrens Illustrated Guide to Kubernetes

Fin