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OPENSHIFT

Build your applications thinking on zero-downtime upgrades

OpenShift Meetup
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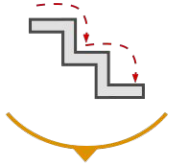
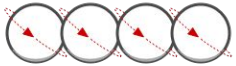
Introduction

Evolution of IT

Development Process

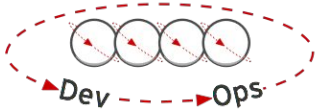
Waterfall





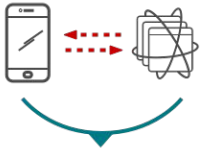
Agile

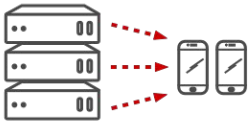
DevOps



Application Architecture

Monolithic





N-Tier

Microservices

Deployment & Packaging

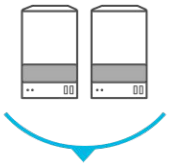
Physical Servers

Virtual Servers

Containers

Application Infrastructure

Datacenter



Hosted

Cloud

Build your applications thinking in zero-downtime upgrades

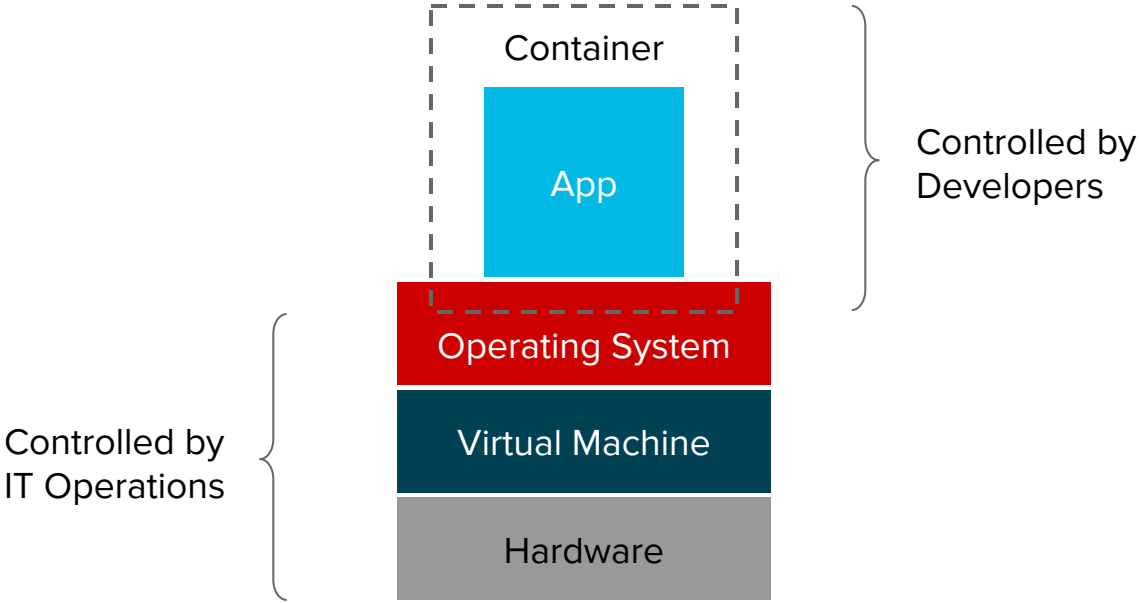
WHAT ARE CONTAINERS?

It depends who you ask

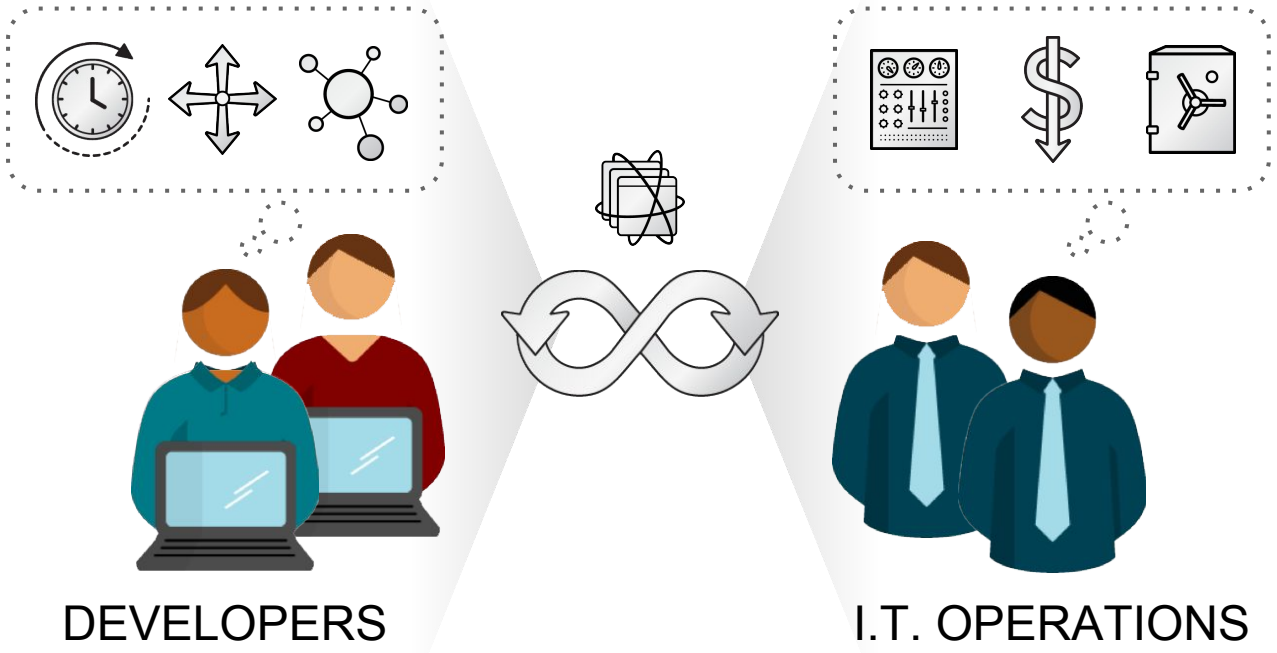
- Sandboxed application processes on a shared Linux OS kernel
- Simpler, lighter, and denser than virtual machines
- Portable across different environments

- Package my application and all of its dependencies
- Deploy to any environment in seconds and enable CI/CD
- Easily access and share containerized components

CLEAR BOUNDARIES



COMMON LANGUAGE



Docker is an open-source container packaging format and runtime that packages and run applications in “containers,” allowing them to be portable among systems running Linux.

Kubernetes is an open-source system for automating deployment, operations, and scaling of containerized applications across multiple hosts

kubernetes

But you need more

Multi-tenancy	Teams and Collaboration
Routing & Load Balancing	Quota Management
CI/CD Pipelines	Image Build Automation
Role-based Authorization	Container Isolation
Capacity Management	Vulnerability Scanning
Infrastructure Visibility	Chargeback

The industry's most secure and comprehensive enterprise-grade container platform based on industry standards, Docker and Kubernetes.

To take full advantage of the platform one needs to know how it works

Workload types

- **ReplicaSets →DeploymentConfig/Deployments**
- StatefulSets (a.k.a PetSets)
- DaemonSets
- Jobs
- CronJobs
- more to come???

DeploymentConfig

A deployment configuration consists of the following key parts:

- A **replication controller template** which describes the application to be deployed.
- The default **replica count** for the deployment.
- A **deployment strategy** which will be used to execute the deployment.
- A set of **triggers** which cause deployments to be created automatically.

Deployment strategies

- Recreate
- Rolling
- Custom

Recreate Deployment Strategy

Recreate Strategy for Deployment

A recreate deployment removes instances of the previous version of an application and replaces them with instances of the new version of the application.

The Recreate strategy has basic rollout behavior and supports lifecycle hooks for injecting code into the deployment process

When to use a Recreate Strategy

- When you must run migrations or other data transformations before your new code starts.
- When you do not support having new and old versions of your application code running at the same time.
- When you want to use a RWO volume, which is not supported being shared between multiple replicas.

Definition of a Recreate Strategy

```
strategy:
  type: Recreate
  recreateParams:
    timeoutSeconds:
    pre: {}
    mid: {}
    post: {}
```

Workflow of a Recreate Strategy

1. Execute any **pre** lifecycle hook.
2. **Scale down** the previous deployment to zero.
3. Execute any **mid** lifecycle hook.
4. **Scale up** the new deployment.
5. Execute any **post** lifecycle hook.

Demo - Recreate Strategy (Code)

Execute a recreate deployment of an application with 3 instances

```
oc new-project recreatedemo

oc create -f
https://raw.githubusercontent.com/jorgemoralespou/zerodowntime-talk/master/demos/recreatedemo.yaml

oc tag deployment-example:v2 deployment-example:latest && oc logs -f dc/deployment-example
```

Allow for Zero downtime?

Rolling Deployment Strategy

Rolling Strategy for Deployment

A rolling deployment slowly replaces instances of the previous version of an application with instances of the new version of the application. A rolling deployment typically waits for new pods to become ready via a readiness check before scaling down the old components. If a significant issue occurs, the rolling deployment can be aborted.

All rolling deployments in OpenShift Origin are canary deployments; a new version (the canary) is tested before all of the old instances are replaced.

When to use Rolling Strategy

- When you want to take no downtime during an application update.
- When your application supports having old code and new code running at the same time.

Definition of a Rolling Strategy

```
strategy:
  type: Rolling
  rollingParams:
    timeoutSeconds:
    intervalSeconds:
    updatePeriodSeconds:
    maxSurge: ""
    maxUnavailable: ""
    pre: {}
    post: {}
```

Workflow of a Rolling Strategy

1. Execute any **pre** lifecycle hook.
2. **Scale up** the **new** replication controller based on the surge count.
3. **Scale down** the **old** replication controller based on the max unavailable count.
4. **Repeat this scaling** until the new replication controller has reached the desired replica count and the old replication controller has been scaled to zero.
5. Execute any **post** lifecycle hook.

Demo - Rolling Strategy (Code)

Execute a Rolling deployment of an application with 3 instances

```
oc new-project rollingdemo

oc create -f
https://raw.githubusercontent.com/jorgemoralespou/zerodowntime-talk/master/demos/rollingdemo.yaml

oc tag deployment-example:v2 deployment-example:latest && oc logs -f dc/deployment-example
```

Allow for Zero downtime?

Custom Deployment Strategy

Custom Strategy for Deployment

The Custom strategy allows you to provide your own deployment behavior.

When to use Custom Strategy

- When the default strategies does not work for you
- When you want to alter how a default strategy works

Definition of a Custom Strategy

```
strategy:
  type: Custom
  customParams:
    Image: “”
    command:
    environment:
```

Alternative - Custom behaviour of default strategies

```
strategy:
  type: Rolling
  customParams:
    Image: “”
    command: “/bin/sh -c openshift-deploy --until=50%; echo
Halfway there; openshift-deploy; echo Complete”
    environment:
```

Demo - Custom strategy (Code)

Execute a Custom Rolling deployment of an application with 4 instances showing a message half way through

```
oc new-project customdemo

oc create -f
https://raw.githubusercontent.com/jorgemoralespou/zerodowntime-talk/master/demos/customdemo.yaml

oc tag deployment-example:v2 deployment-example:latest && oc logs -f dc/deployment-example
```

Allow for Zero downtime?

What's the problem now?

When a container starts it’s not when the application is ready for getting requests.

Health checks

- Know when the application is ready to accept requests (**readinessProbe**).
- Know if the application is healthy (**livenessProbe**)

HTTP Check

The kubelet uses a web hook to determine the healthiness of the container. The check is deemed successful if the hook returns with 200 or 399

A HTTP check is ideal for complex applications that can return with a 200 status when completely initialized.

```
httpGet:
  path: /healthz
  port: 8080
initialDelaySeconds: 15
periodSeconds: 1
timeoutSeconds: 1
failureThreashold: 3
sucessThreshold: 1
```

Container execution Check

The kubelet executes a command inside the container. Exiting the check with status 0 is considered a success.

When health should be checked using a script or command

```
exec:
   command:
   - cat
   - /tmp/health
 initialDelaySeconds: 15
 periodSeconds: 1
 timeoutSeconds: 1
 failureThreashold: 3
 sucessThreshold: 1
```

TCP socket Check

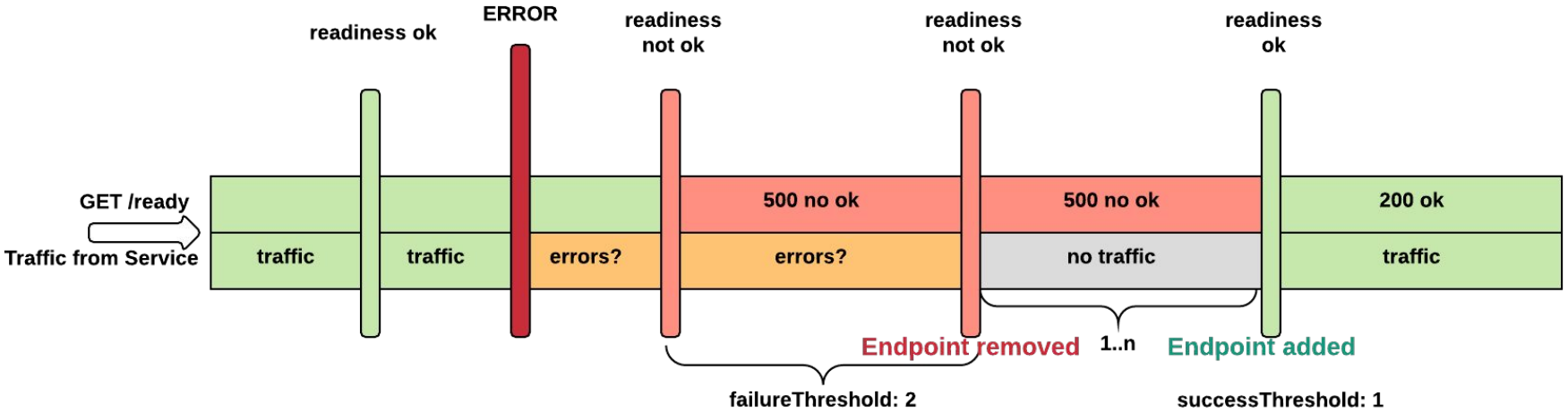
The kubelet attempts to open a socket to the container. The container is only considered healthy if the check can establish a connection.

A TCP socket check is ideal for applications that do not start listening until initialization is complete.

```
tcpSocket:
  port: 8080
initialDelaySeconds: 15
periodSeconds: 1
timeoutSeconds: 1
failureThreashold: 3
sucessThreshold: 1
```

Readiness Probe

A readiness probe determines if a container is ready to service requests. If the readiness probe fails a container, the endpoints controller ensures the container has its IP address removed from the endpoints of all services.



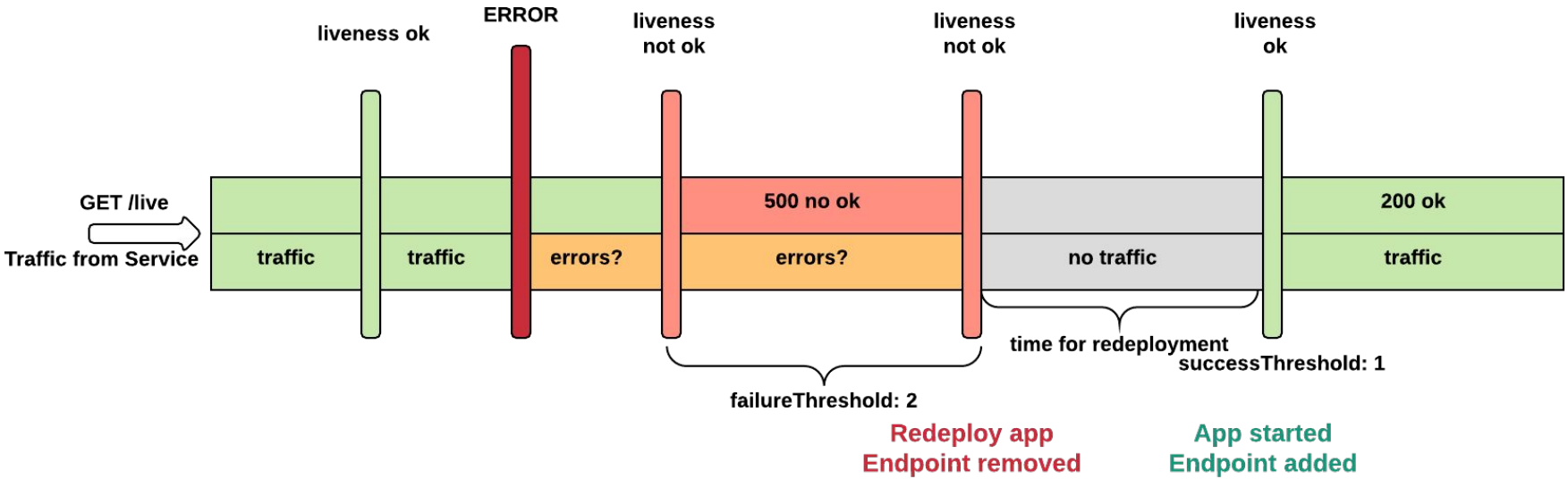
Demo - Readiness Probe (Code)

Switch readiness result OK/NOOK

```
oc new-project probesdemo

oc create -f
https://raw.githubusercontent.com/jorgemoralespou/zerodowntime-talk/master/demos/probesdemo.yaml

curl http://probesdemo-probesdemo.apps.lcup/ws/unsetready
curl http://probesdemo-probesdemo.apps.lcup/ws/setready
```

Liveness Probe

A liveness probe checks if the container in which it is configured is still running. If the liveness probe fails, the kubelet kills the container, which will be subjected to its restart policy.



Demo - Liveness Probe (Code)

Switch Liveness resultNOOK

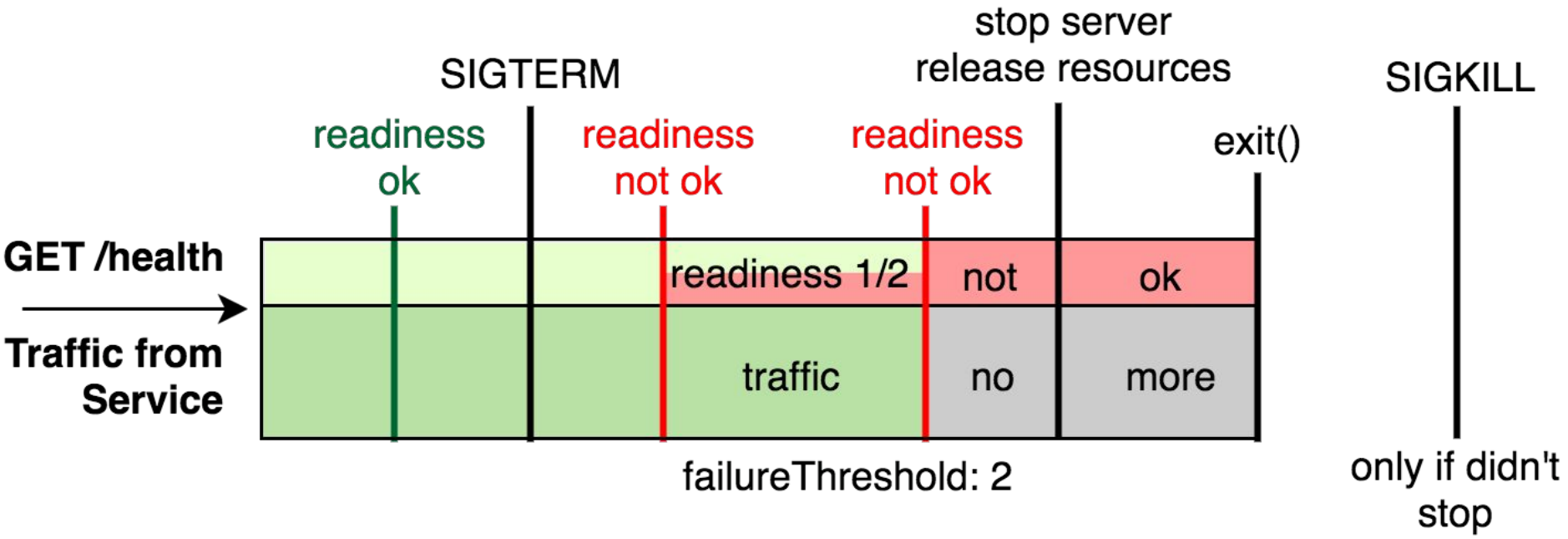
```
oc new-project probesdemo

oc create -f
https://raw.githubusercontent.com/jorgemoralespou/zerodowntime-talk/master/demos/probesdemo.yaml
```

curl http://probesdemo-probesdemo.apps.lcup/ws/unsetlive

What else?

Don’t kill you clients

- On shutdown, OpenShift Origin will send a TERM signal to the processes in the container.
- Application code, on receiving SIGTERM, should stop accepting new connections (The application code should then wait until all open connections are closed before exiting).
- After the graceful termination period expires, a process that has not exited will be sent the KILL signal, which immediately ends the process. (terminationGracePeriodSeconds defaults to 30 seconds).


stop server
release resources
SIGTERM
SIGKILL
readiness
ok
readiness
not ok
readiness
not ok
exit()
GET /health
Traffic from
Service
readiness 1/2
not
ok
traffic
no
more
failureThreshold: 2
only if didn't
stop

Make sure signals get to the process. Use **exec**

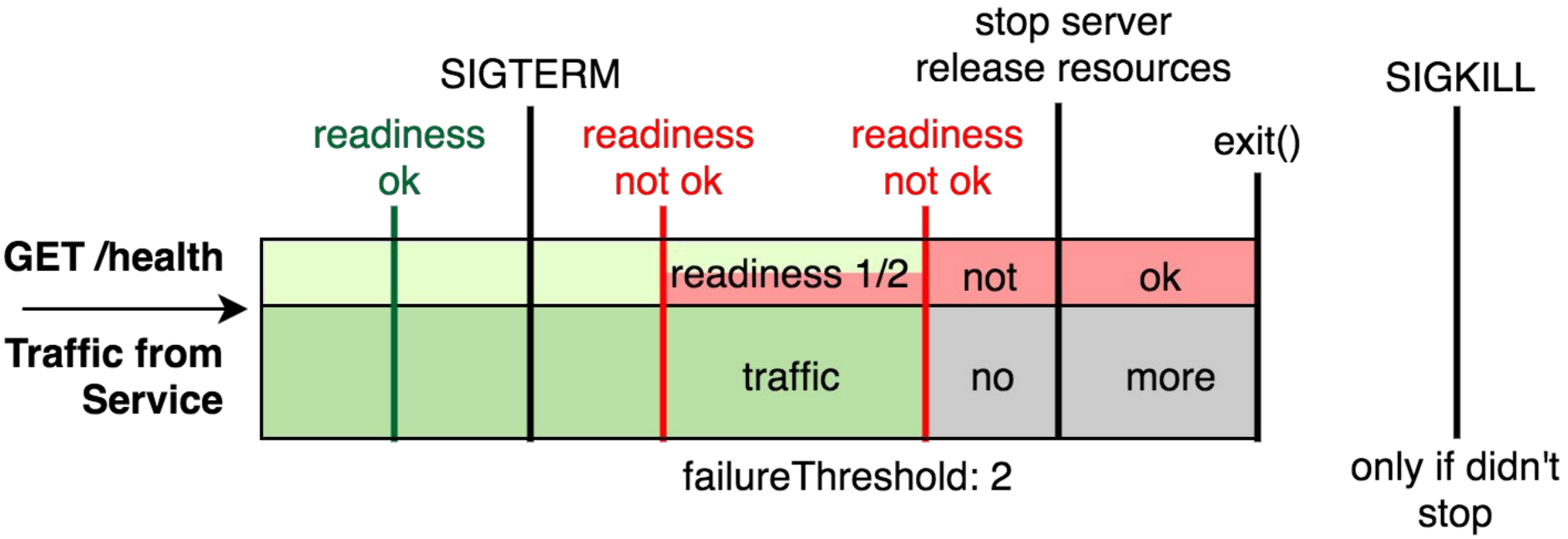
Demo - Propagate signal

Enter the container and kill 1

```
oc new-project probesdemo

oc create -f
https://raw.githubusercontent.com/jorgemoralespou/zerodowntime-talk/master/demos/probesdemo.yaml

oc rsh <pod>
kill 1
```

Allow for Zero downtime?

But deployments make it even better

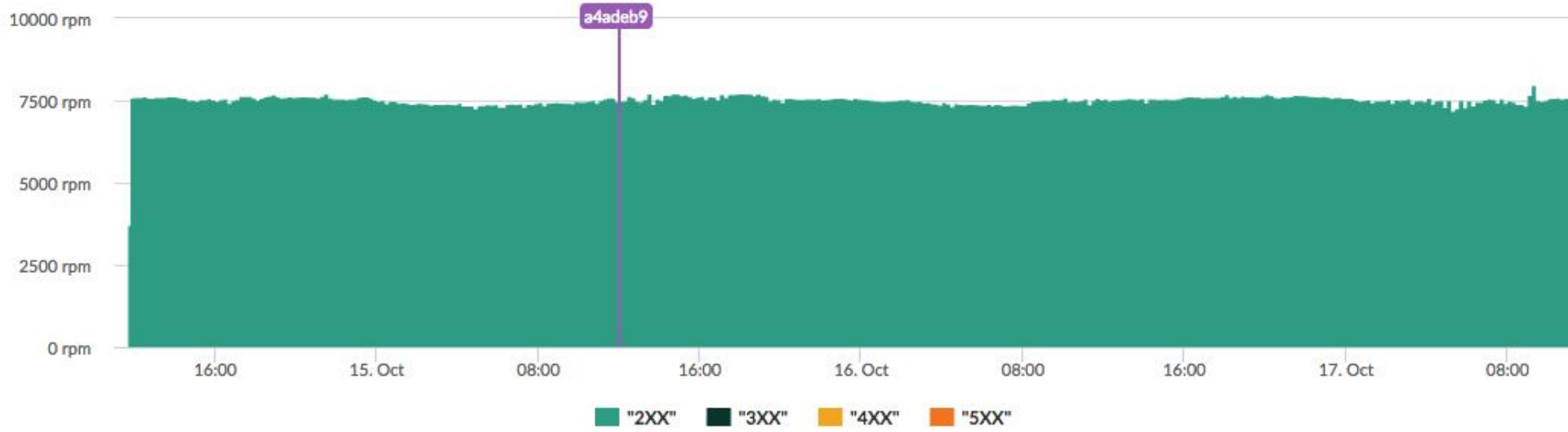

stop server
release resources
SIGTERM
SIGKILL
readiness
ok
readiness
not ok
readiness
not ok
exit()
GET /health
Traffic from
Service
readiness 1/2
not
ok
traffic
no
more
failureThreshold: 2
only if didn't
stop

Demo - Zerodowntime (Code)

Deploy a new version of the application

```
oc new-project zerodowntimedemo
oc create -f
https://raw.githubusercontent.com/jorgemoralespou/zerodowntime-talk/master/demos/probesdemo.yaml

# Start load tool validating HTTP status code=200 at http://probesdemo-zerodowntimedemo.apps.lcup/

# Make a code change in local checkout directory
oc start-build bc/probesdemo  --from-dir=. --follow

# Redeploy lastest application again
oc deploy probesdemo --latest --follow
```

Result graph



Allow for Zero downtime?

But what if?

My application upgrade needs change the database?

- If the change can be backwards compatible
  - Predeployment hook to update the database
  - Blue/Green Deployment - A/B Deployments
  - Pipelines orchestrated deployment (a.k.a Continuous Delivery Deployments)
- If the change can not be backwards compatible
  - No Zero-Downtime possible (with CAVEATS, but that’s for another meetup)

Allow for Zero downtime?

Remember

Checklist

- Use the appropriate strategy
  - Make sure it allows for rolling update
- Use healthchecks.
  - Make sure to use correct timing configuration
- Propagate the signals to your process
  - Make sure the application or server does Graceful Shutdown
- If there is data involved try to make updates backwards compatible
- Test under load
  - Rollover
  - Rollback
- Automate if there is configuration change involved. Use pipelines to orchestrate the update (rollover, test, rollback if error)

Resources

https://github.com/jorgemoralespou/zerodowntime-talk

And if you wonder how I did run my openshift cluster?

https://github.com/openshift-evangelists/oc-cluster-wrapper

Questions???

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Thank you

It’s beer and pizza time!!!