SIAM CHAMNAN KIT

DevOps series

DevOps
Development
Deployment

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สยามชำนาญกิจ
SIAM CHAMNAN KIT

SHU HA RI
SOFTWARE DEVELOPMENT SCHOOL

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Somkiat Puisungnoen

Somkiat | Home

Somkiat Puisungnoen

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When did you work at Opendream?

••• 22 Pending Items

Intro

Software Craftsmanship

Software Practitioner at สยามชำนาญกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Post | Photo/Video | Live Video | Life Event

What's on your mind?

Public | Post

Somkiat Puisungnoen

15 mins · Bangkok ·

Java and Bigdata

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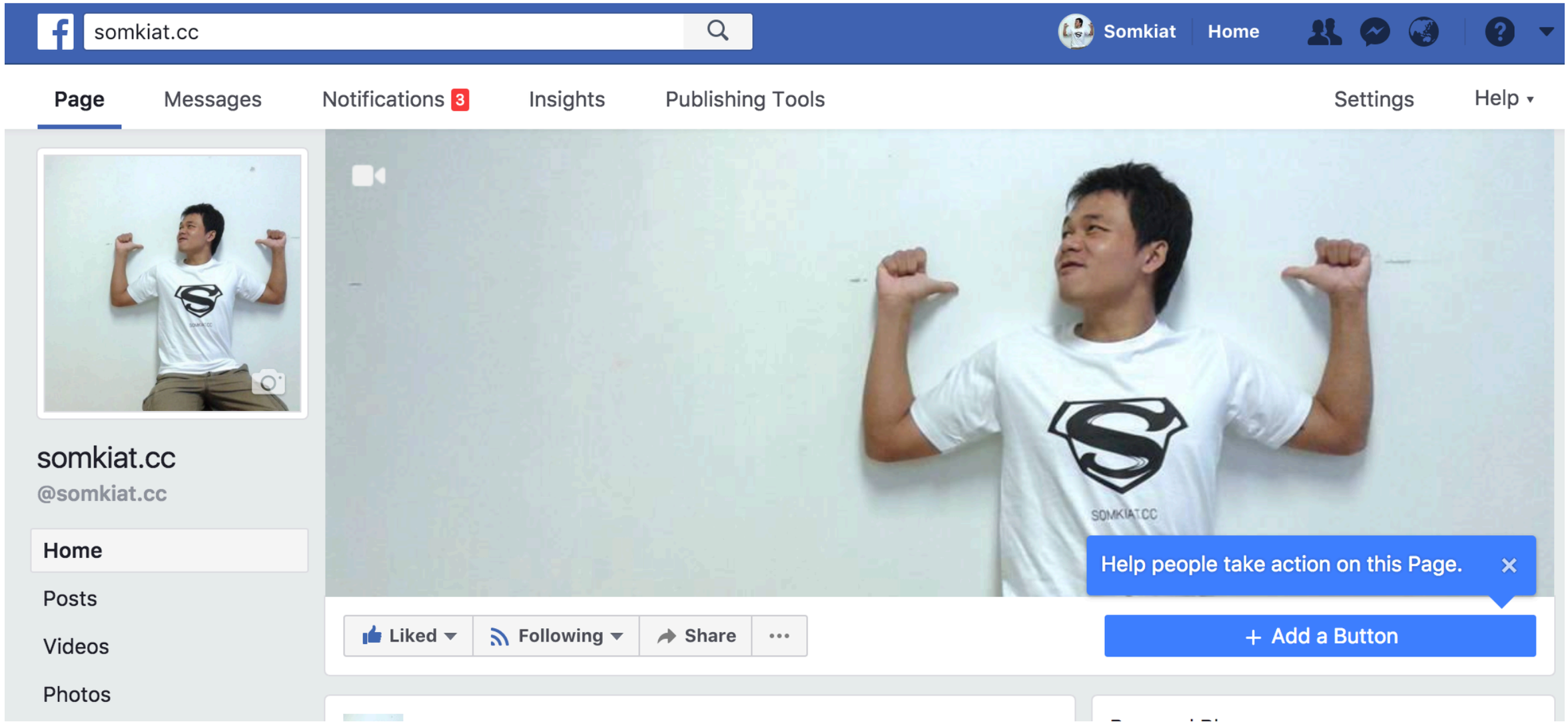

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https://github.com/up1/course-devops-workshop

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Section 1

1. Introduction to DevOps
2. DevOps workflow
3. DevOps tools
4. DevOps team topologies
5. Version Control System with Git
6. Manage containers with Docker
7. Docker image, container, Dockerfile, compose

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Section 2

1. Introduction to Kubernetes
2. K8s foundation (Pods, Deployment, Service)
3. K8s command with kubectl
4. Writing K8s manifest files
5. Introduction to Helm to manage K8s

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Section 3

1. Continuous Integration and Delivery (CI/CD)
2. CI/CD principles
3. Design your pipeline
4. Working with Jenkins
5. Create your pipeline
6. Pipeline as a Code
7. Scalable Jenkins with Master/slave

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DevOps

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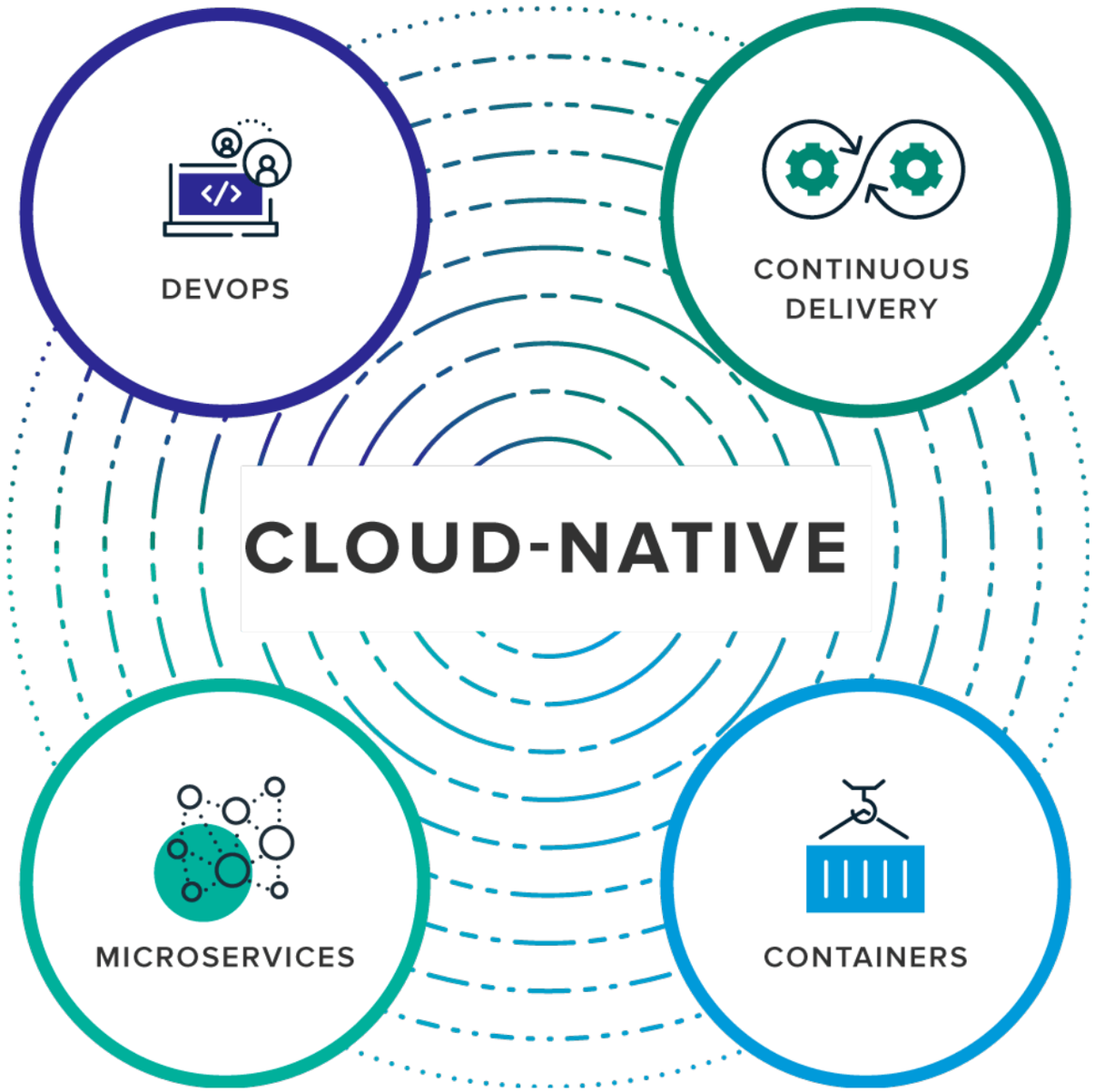
Cloud Native Application



https://pivotal.io/cloud-native

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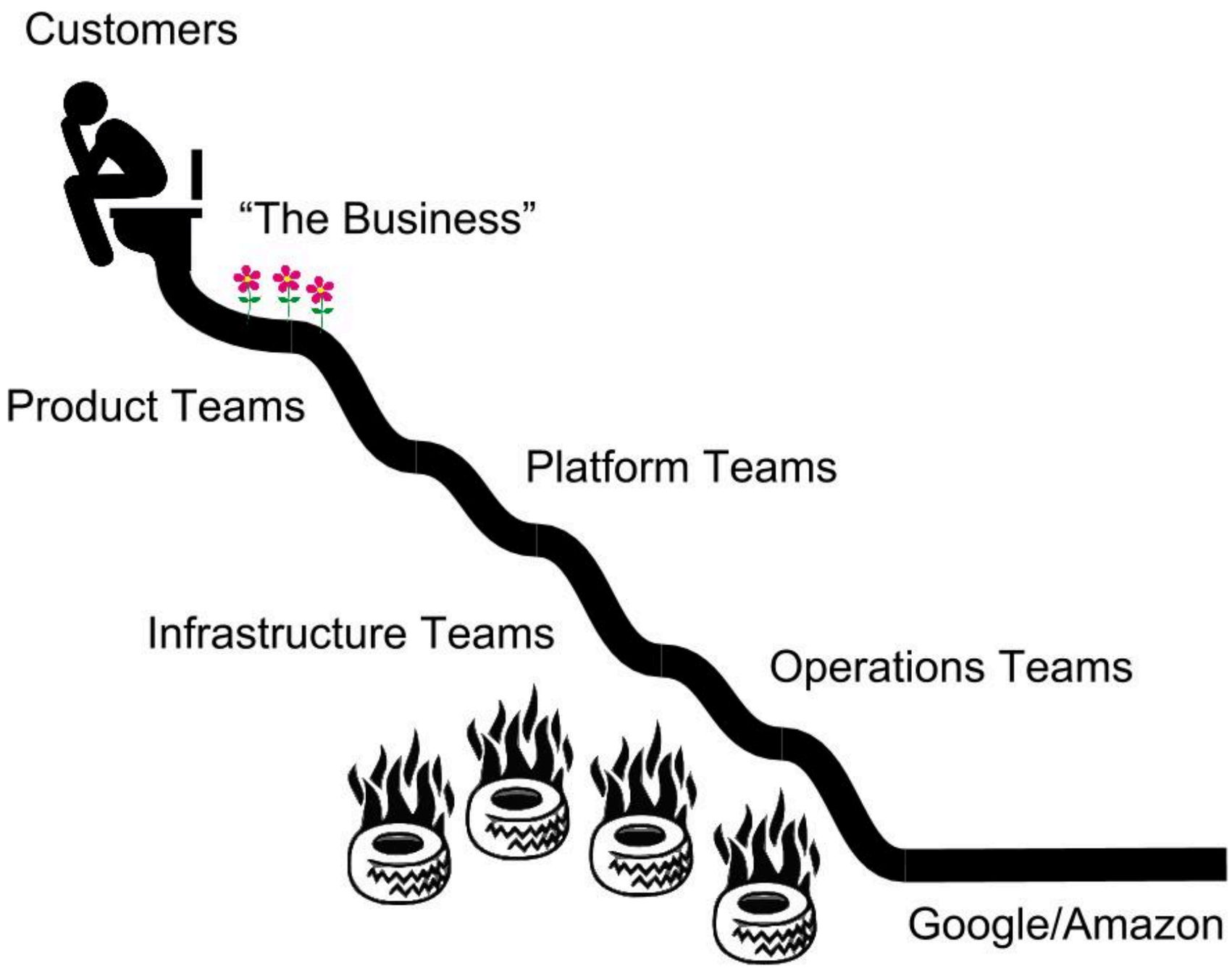
SDLC



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Silo madness

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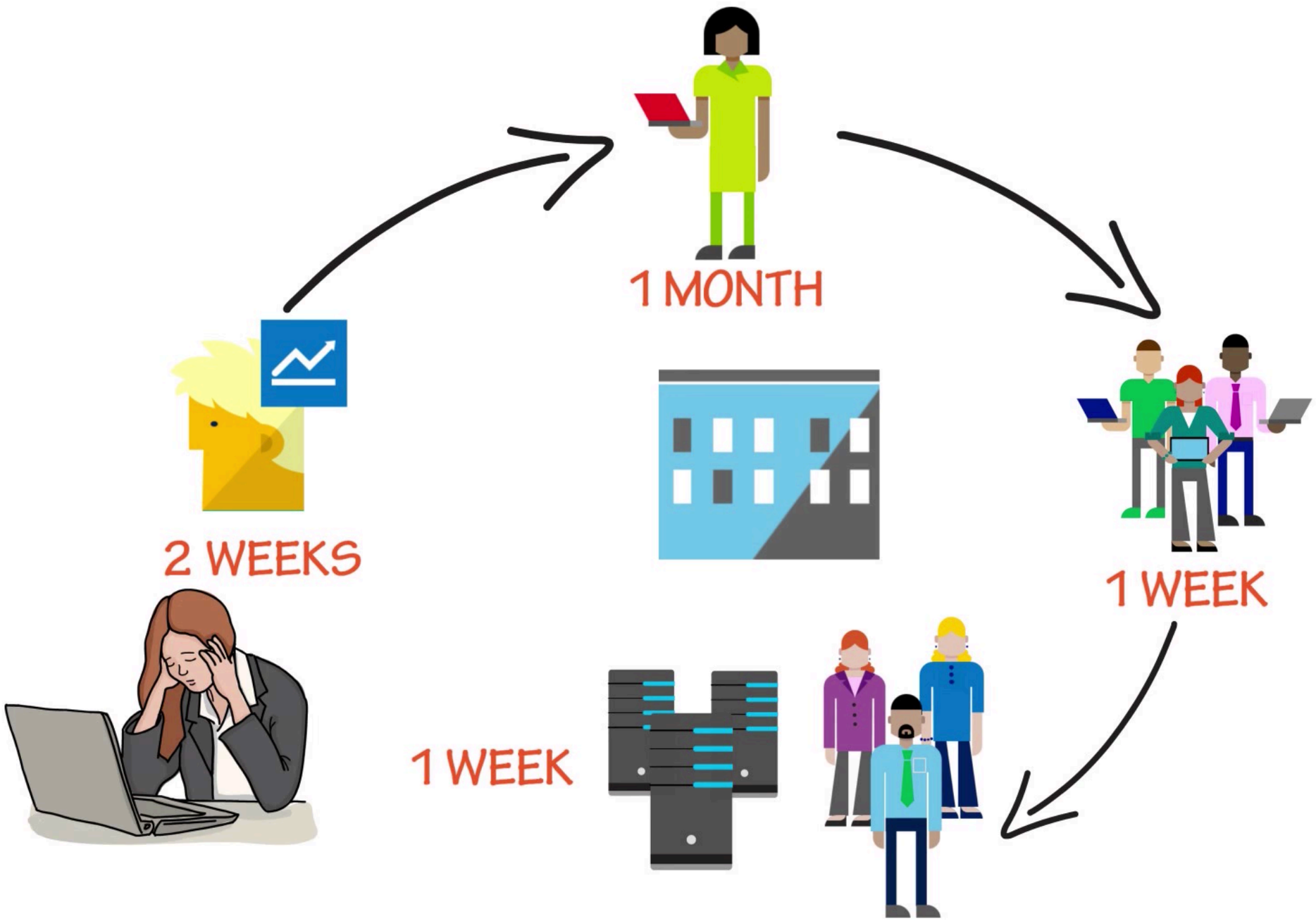
SDLC



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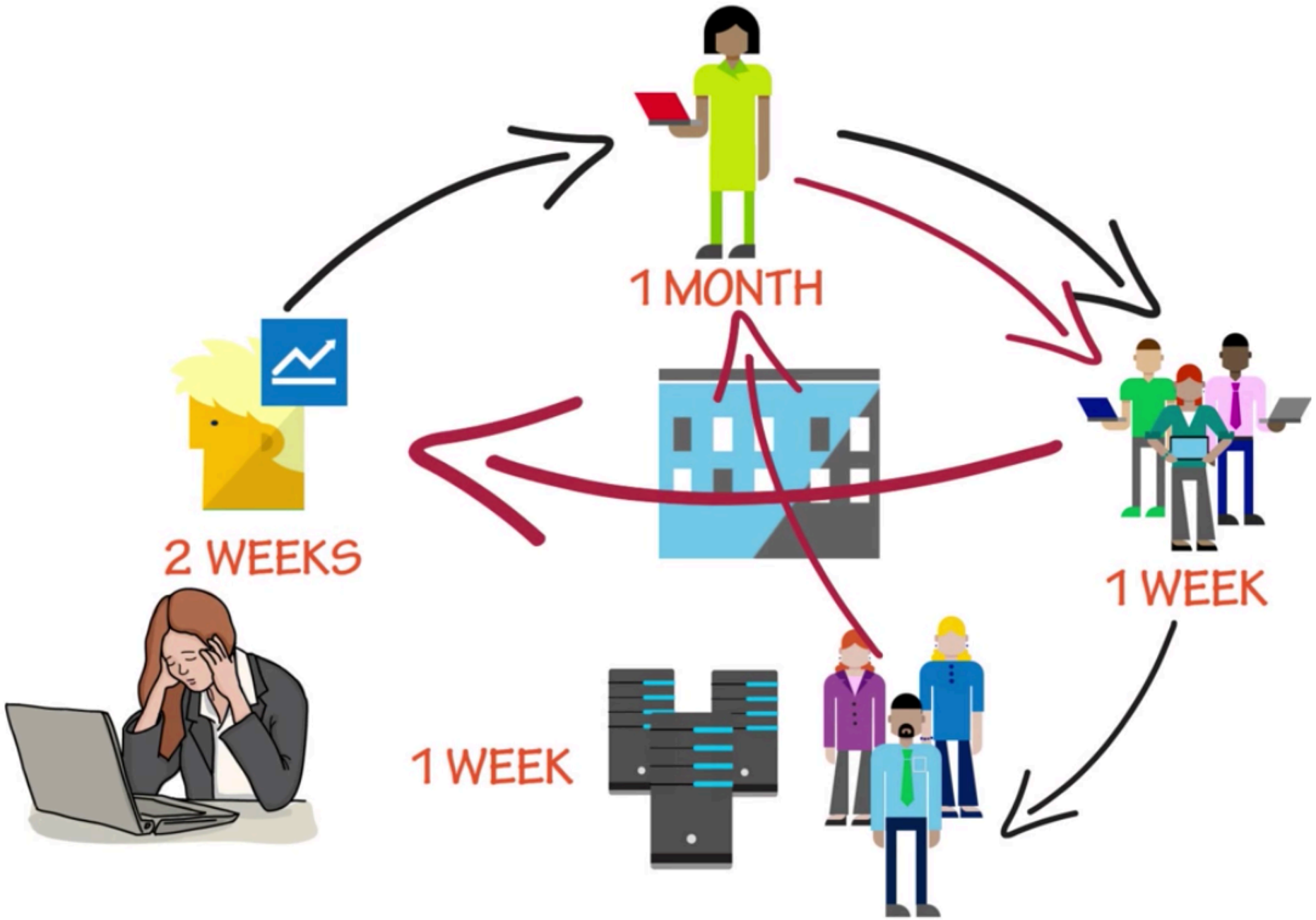
SDLC



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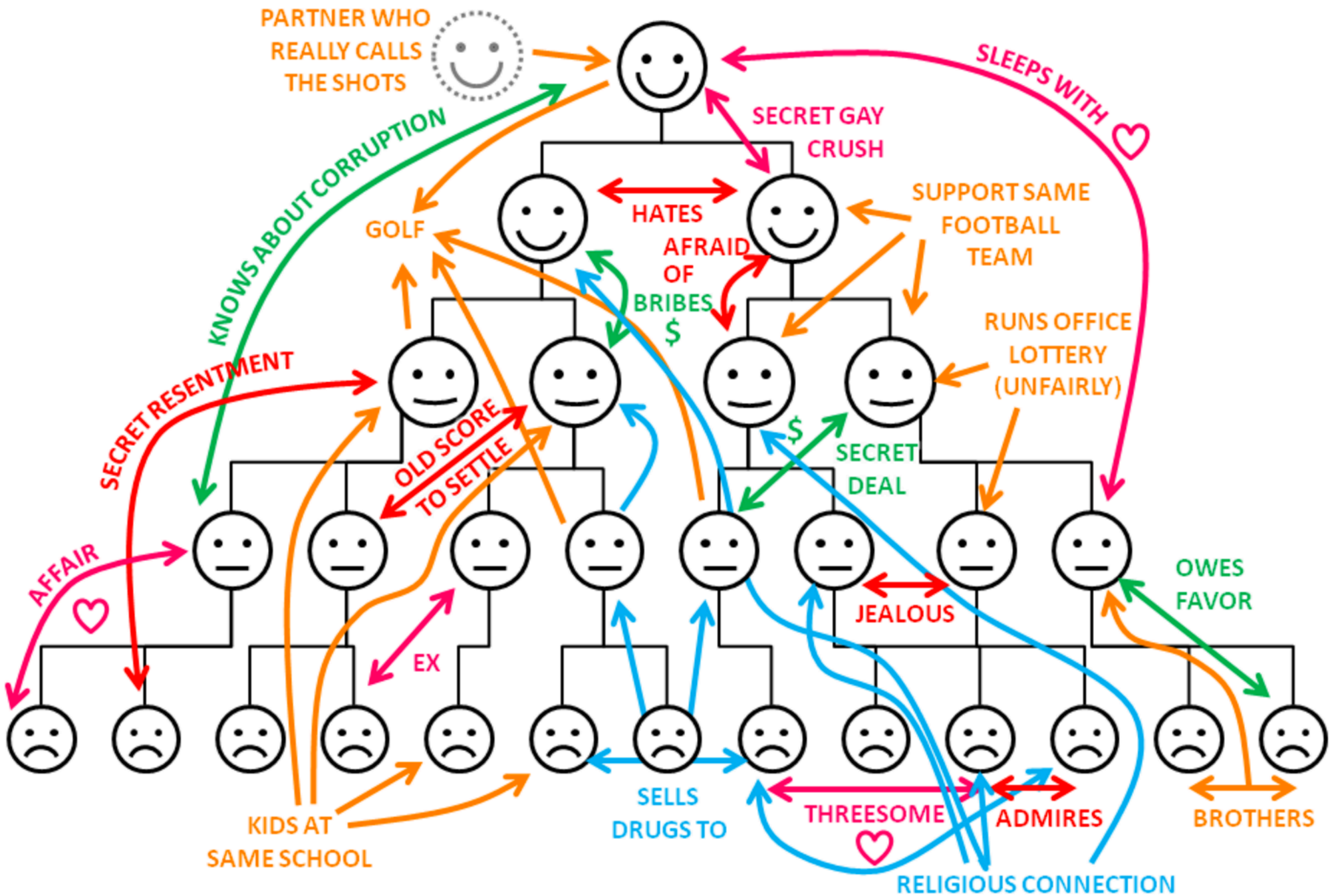
Organization !!



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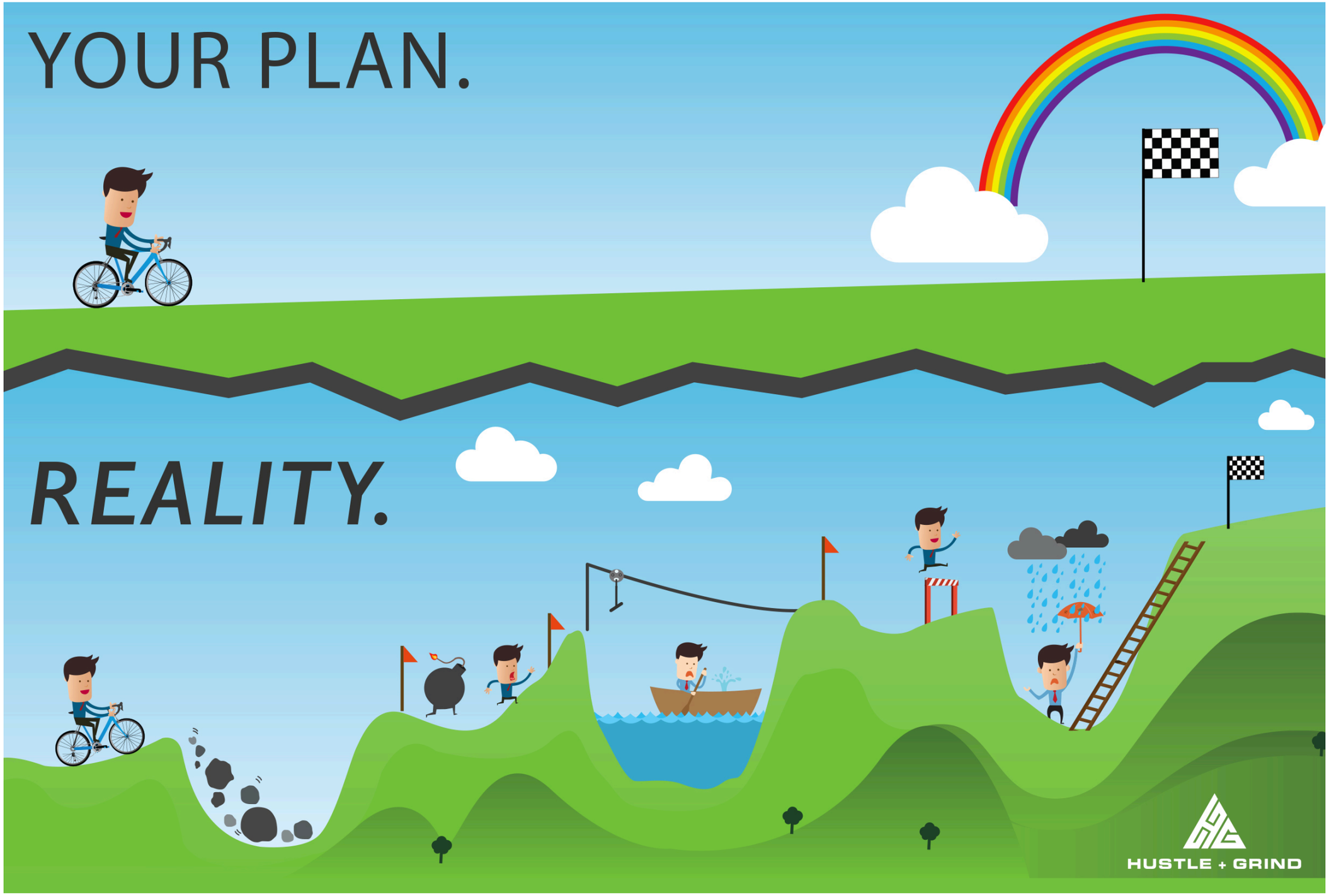
Plan vs Reality



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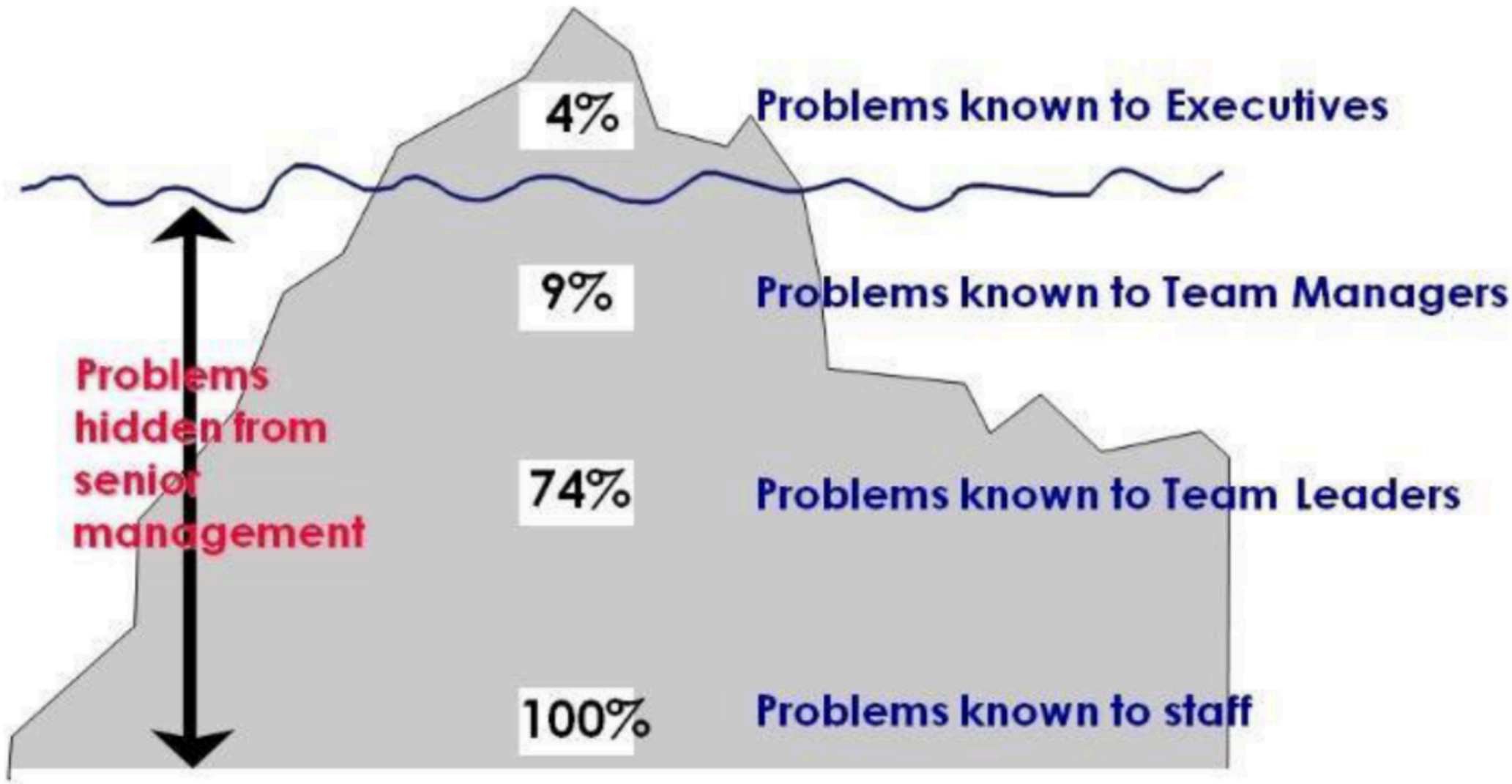
The iceberg of ignorance



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Consequence of inefficient

Grow Fat

Code base grows. All the things slow down.

Age

Your code base will become a jurassic park introducing new tech becomes hard

Ownership

Who is responsible for which part and more important: who has the pager

Economies of Scale

The bigger the team the more they interrupt each other

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Consequence of inefficient

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Consequence of inefficient

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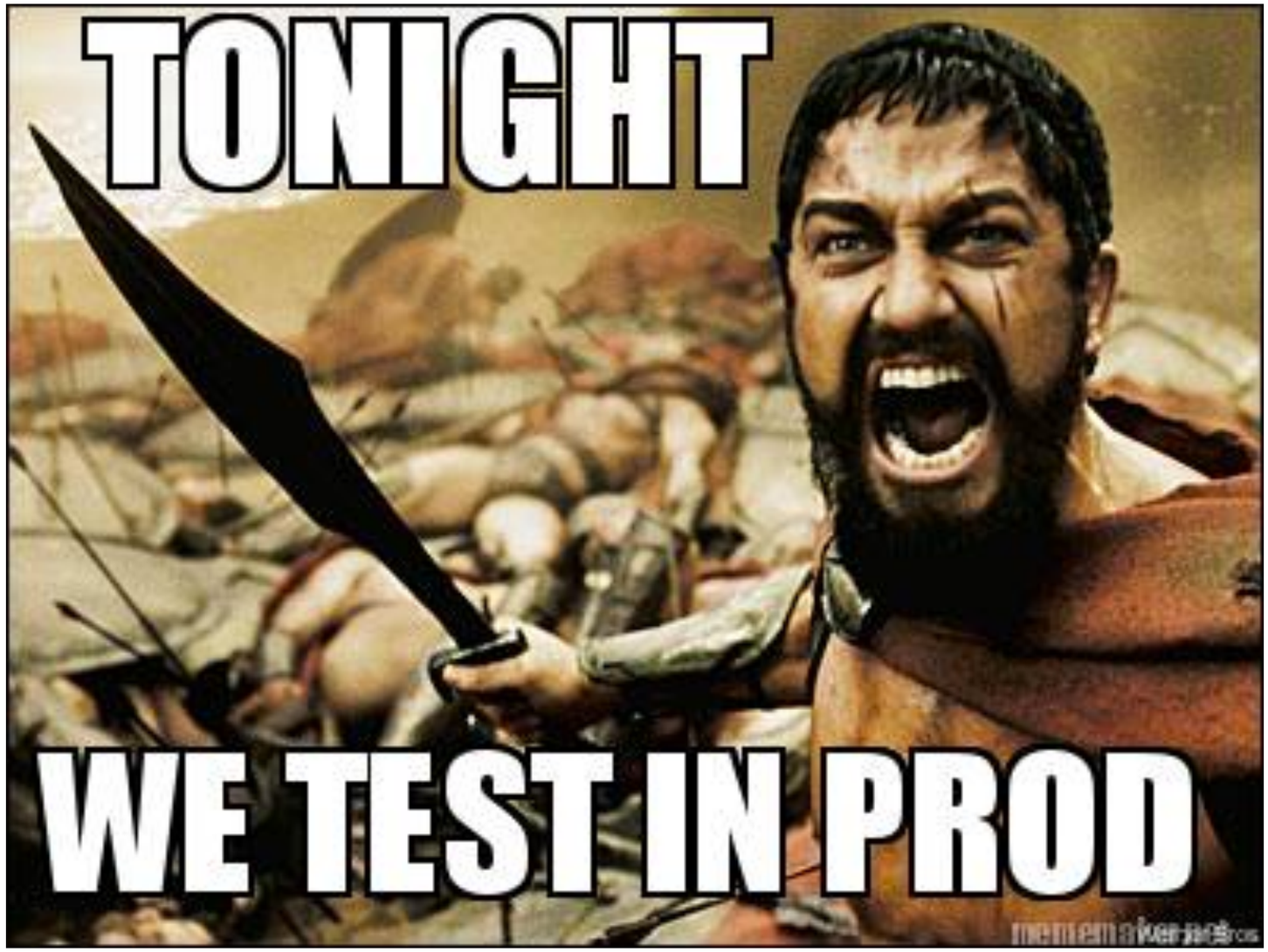
Consequence of inefficient



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Consequence of inefficient

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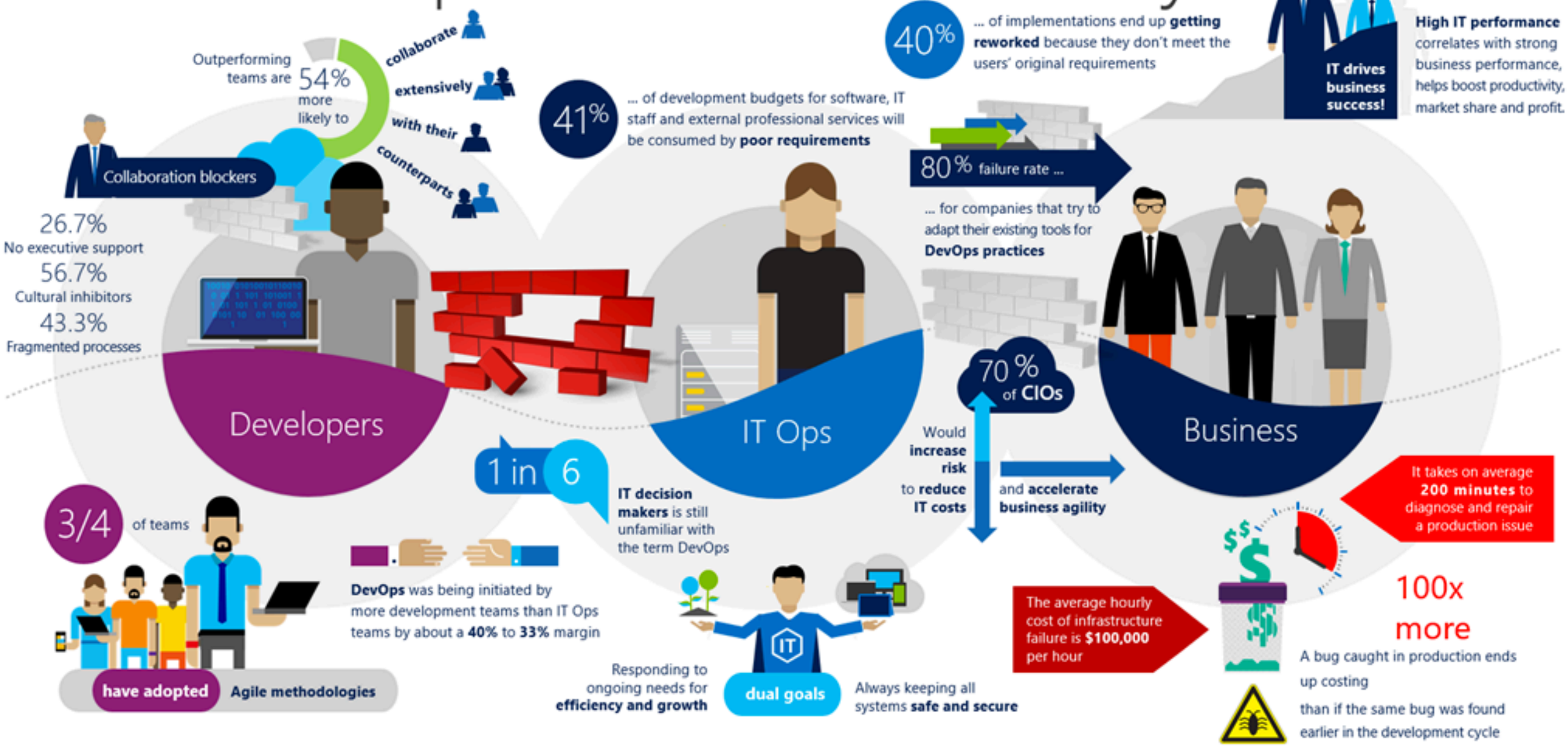
The consequences of inefficiency



https://channel9.msdn.com/Series/DevOps-Fundamentals

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Development vs Operations

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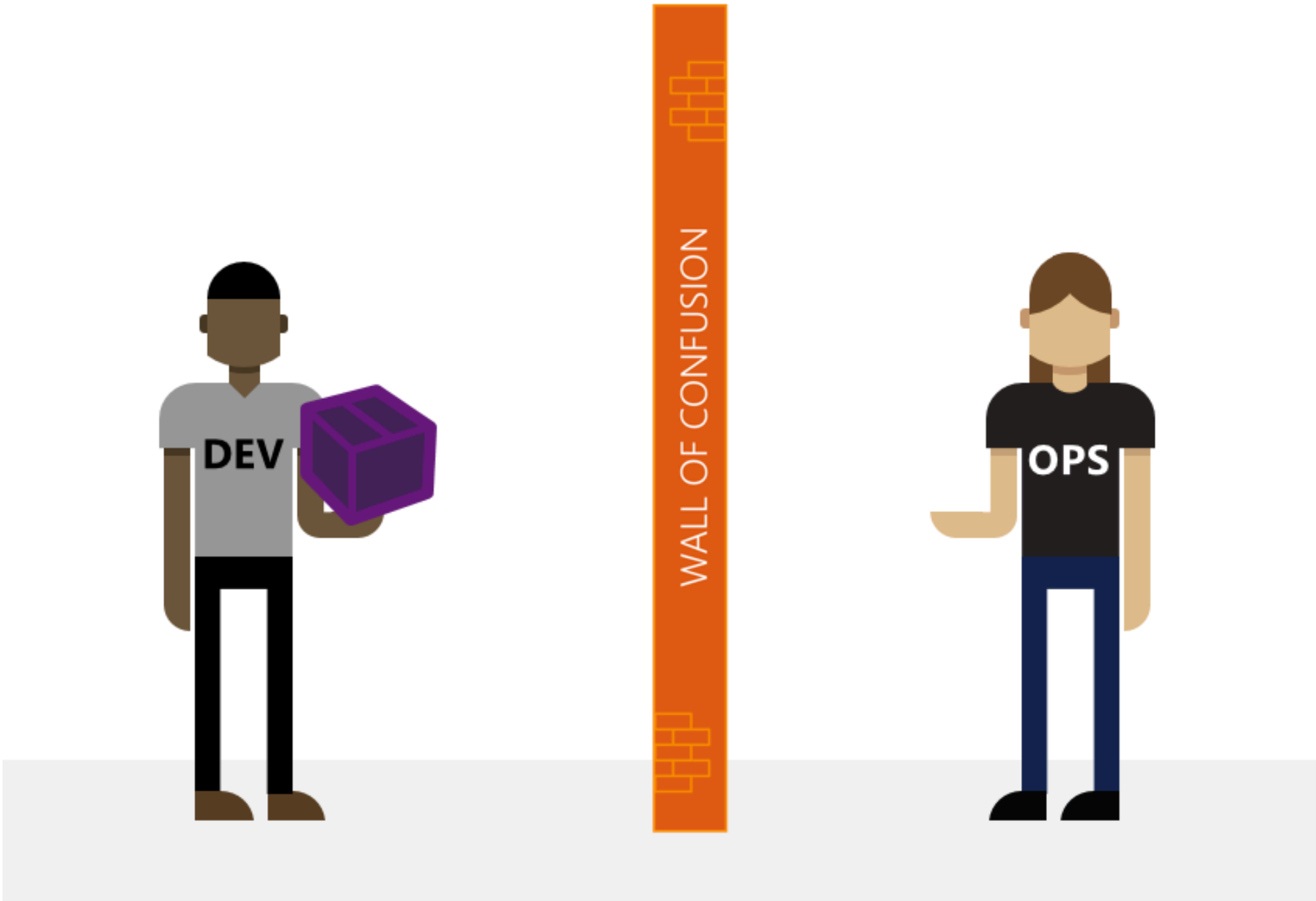

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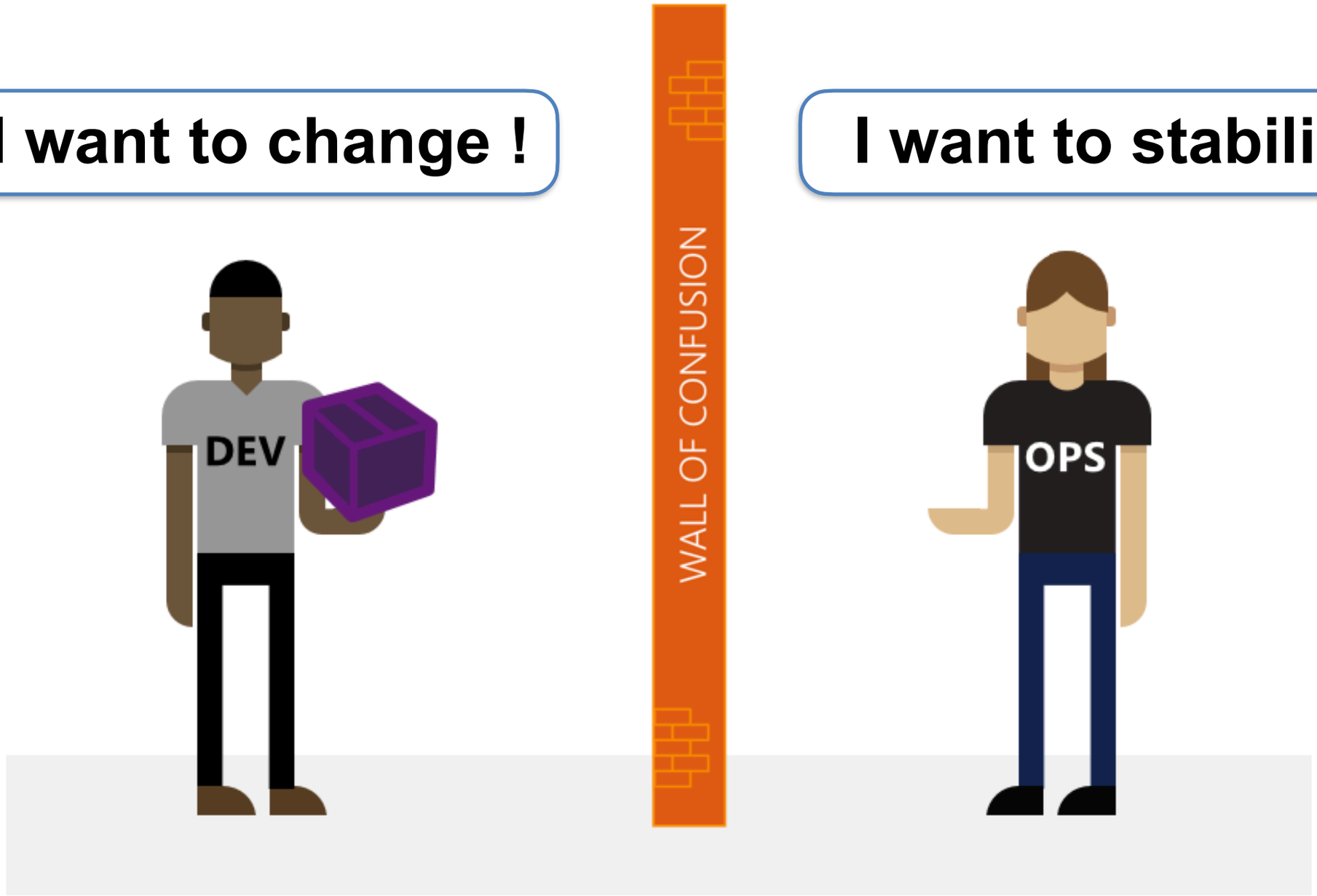
I want to change !

I want to stability !



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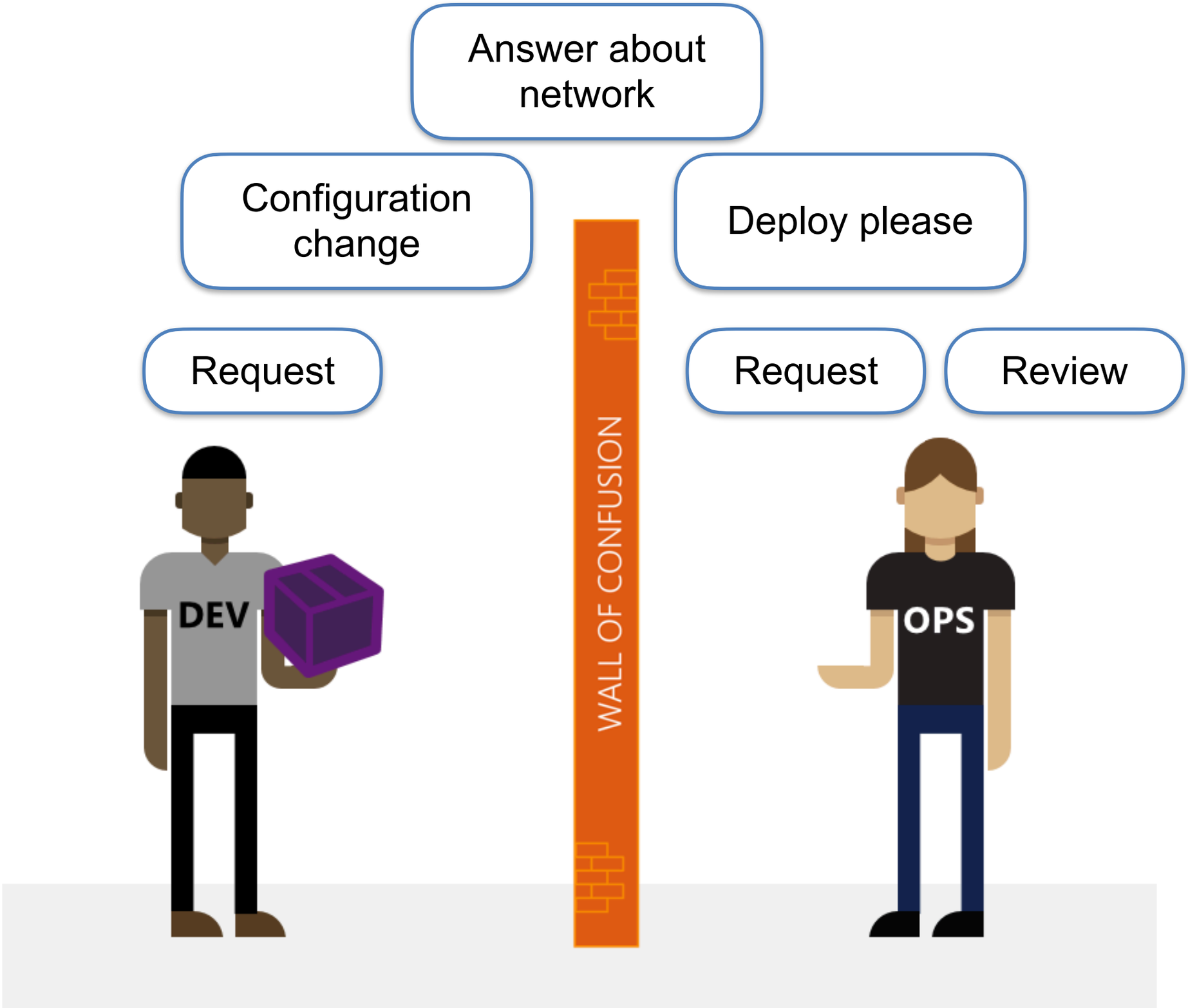

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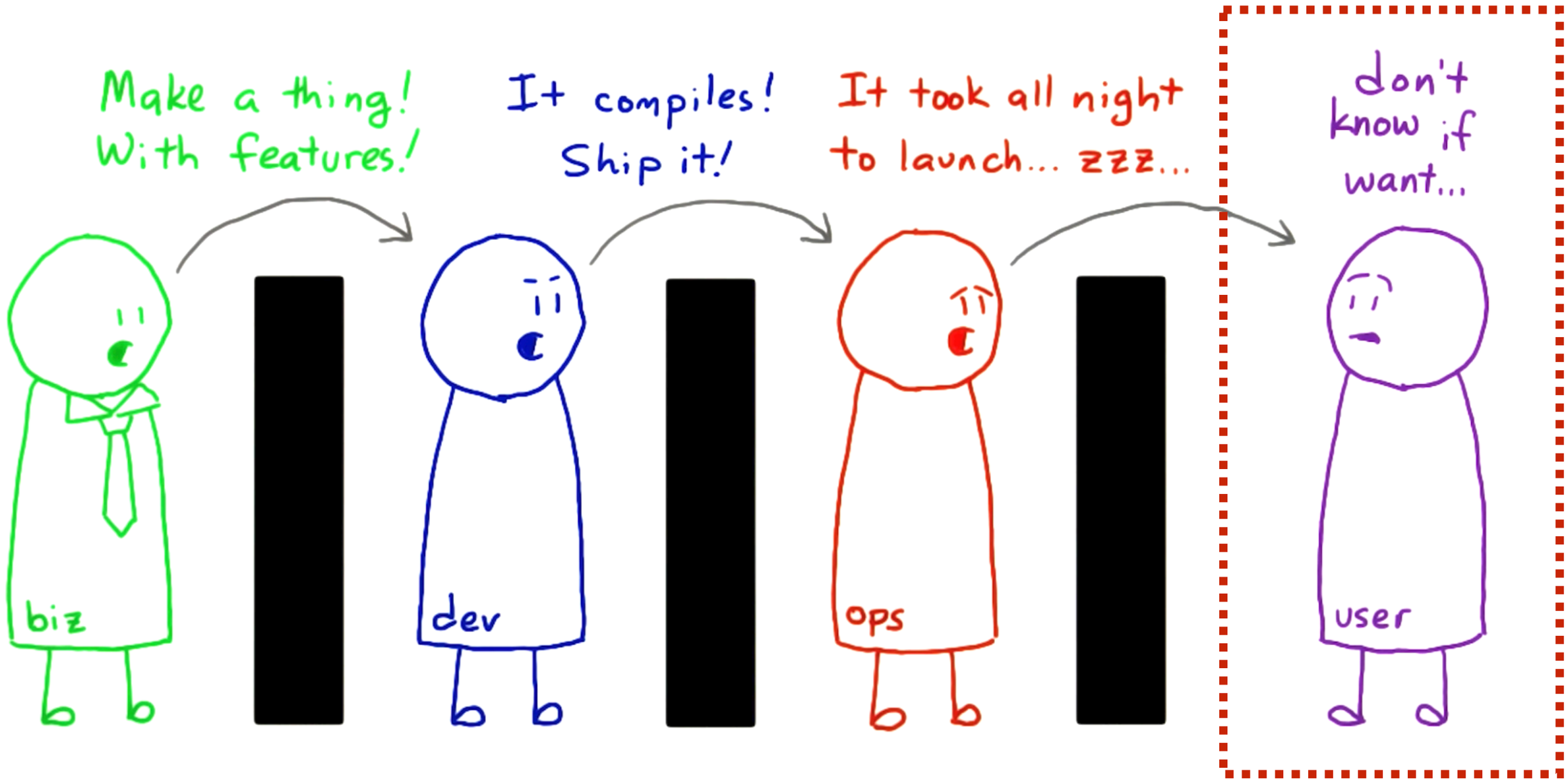
Result ?



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Problems ?

Deadline Driven Development

Delayed project/product deliver

Bad quality

Low customer satisfaction

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Rise of DevOps

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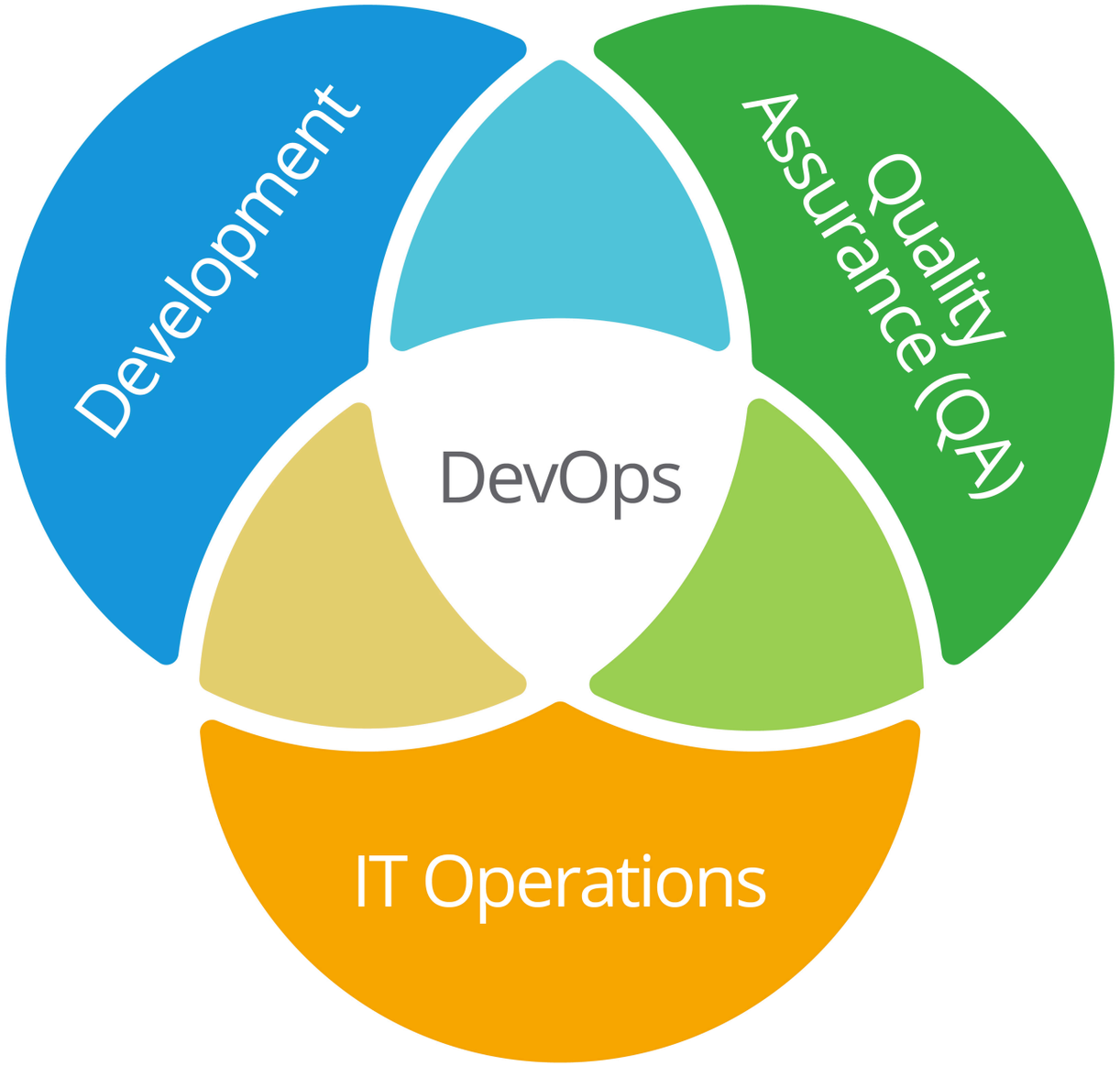
DevOps



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Devops isn't any single person's job.

It's everyone's job.

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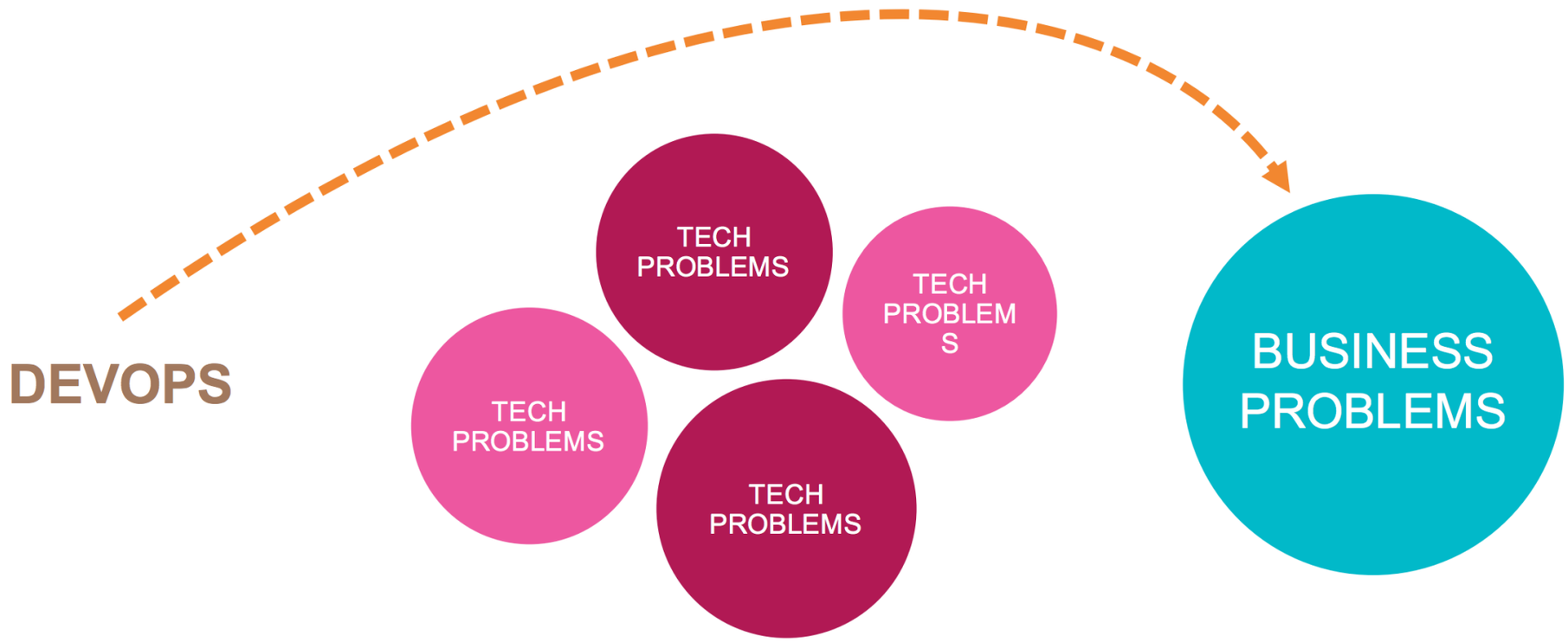
DevOps

Solve **business** problem first



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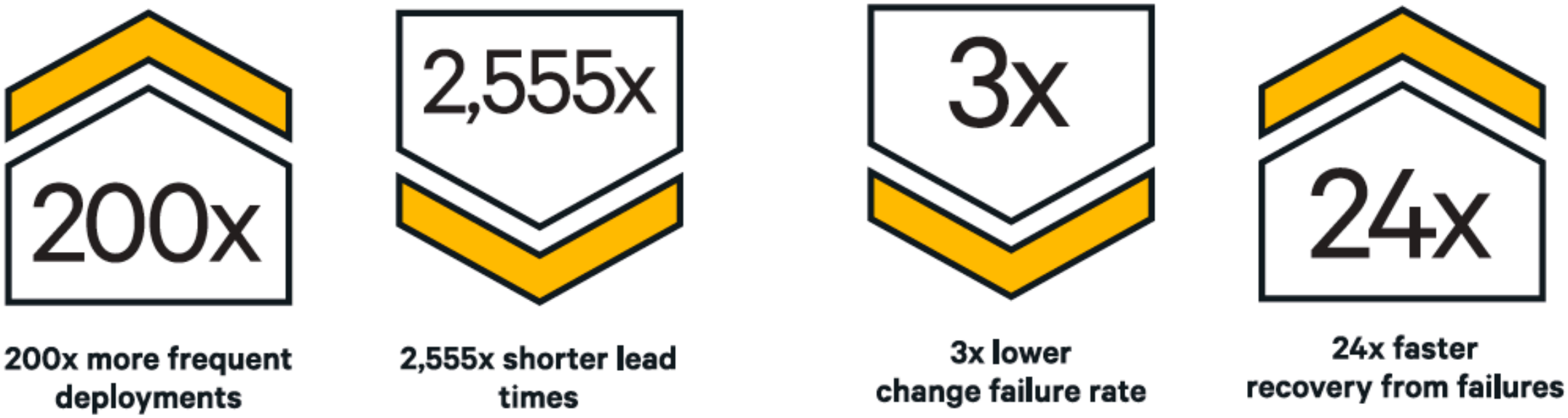
State of DevOps Report

High-performing teams deploy more frequently and have much faster lead times.

They make changes with fewer failures, and recover faster from failures.



https://puppet.com/resources/whitepaper/state-of-devops-report

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What is DevOps ?

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DevOps is not …

Certification

Role

Set of tools

Prescriptive process

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What is DevOps ?

"**DevOps** is development and operations collaboration"

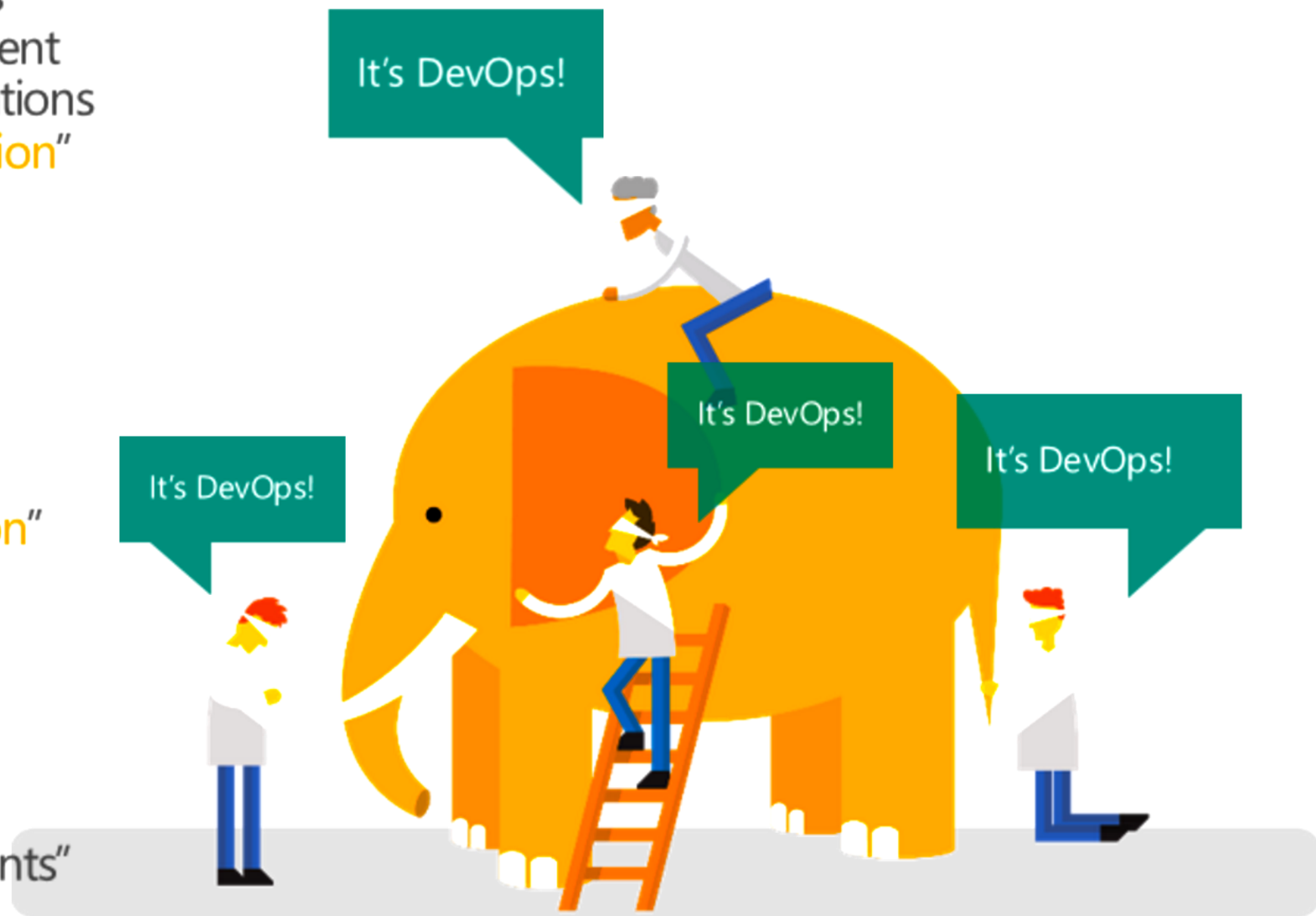
"**DevOps** is treating your infrastructure as code"

"**DevOps** is using automation"

"**DevOps** is feature switches"

"**DevOps** is small deployments"

"Kanban for Ops?"



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What is DevOps ?

DevOps is a **set of practices** intended to **reduce the time** between committing a change to a system and the change being placed into normal production, while ensuring **high quality**

https://en.wikipedia.org/wiki/DevOps#Definitions_and_history

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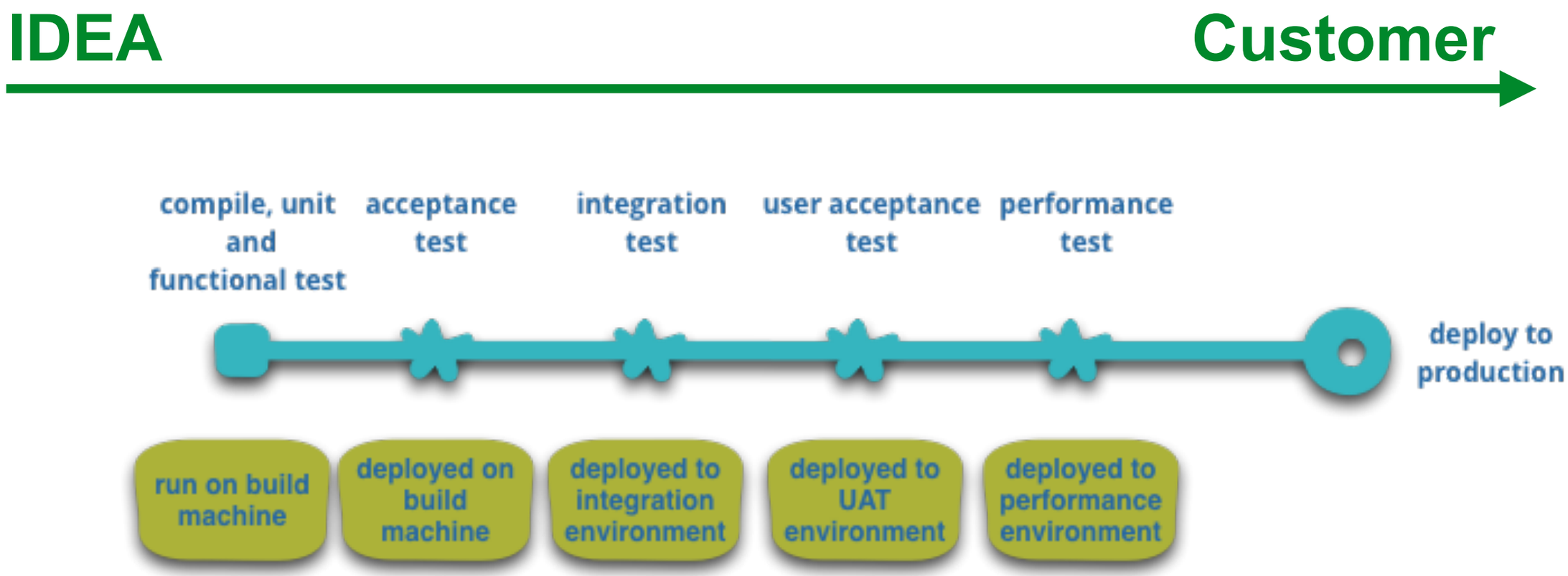
Goals of DevOps

Improve the delivery of value
for Customer and Business



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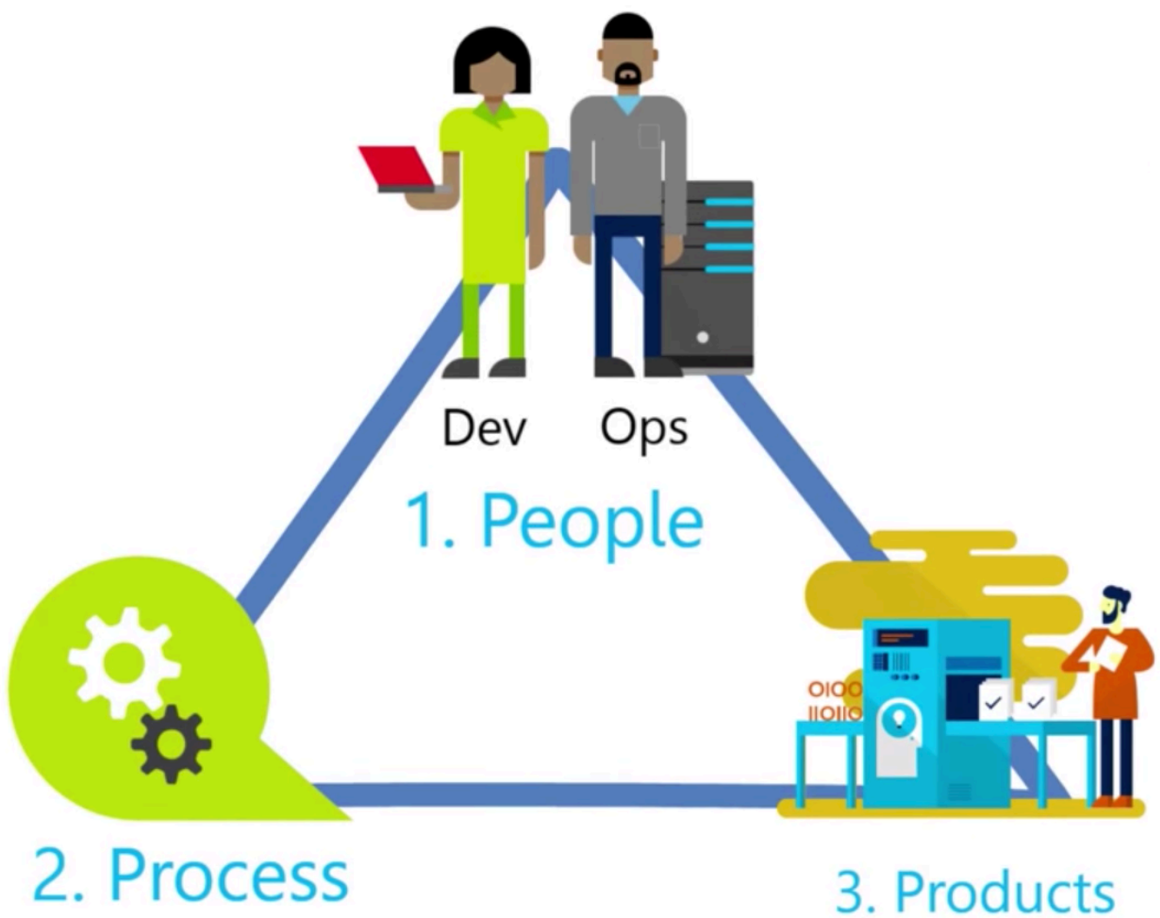
Goals of DevOps

Enable the **continuous delivery** of value to customer and business



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Continuous Delivery

The more often to deploy

Small change

Automate it

Reduce **TTR** (Time to Repair/Recovery)

Learn and repeat

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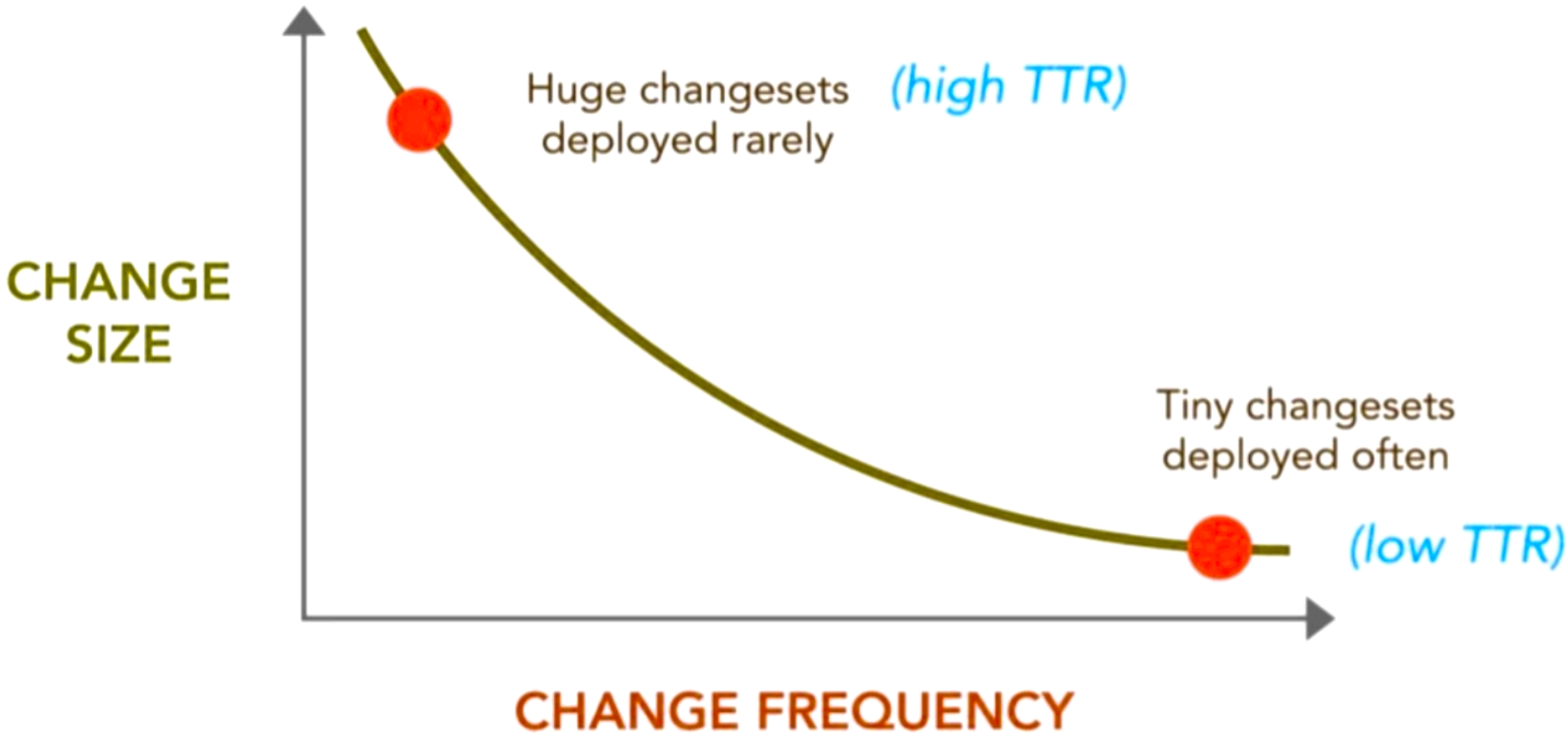
Continuous Delivery



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DevOps Three Ways

1. Flow of work
2. Feedback process
3. Environment and culture

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1. Flow of work

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2. Feedback process/loop

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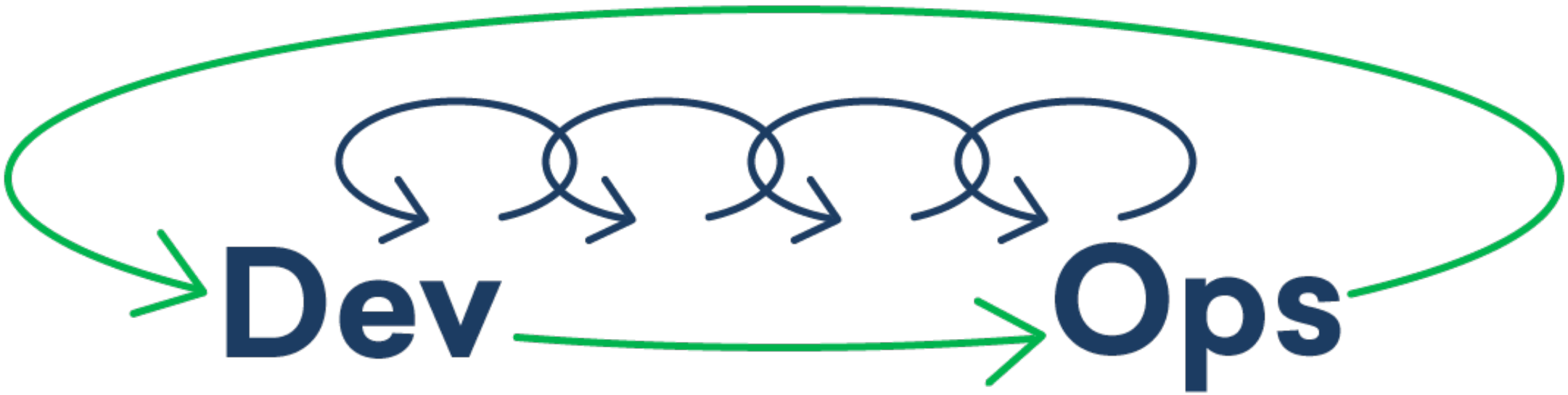
3. Environment and culture



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CALMS Framework

Culture

Automation

Lean

Measurement

Sharing

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DevOps is all about Human problems

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DevOps Metrics

Lead time for changes

Change failure rate

Deployment frequency

Mean time to recovery (MTTR)

Design for Recovery from failure

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DevOps Tools

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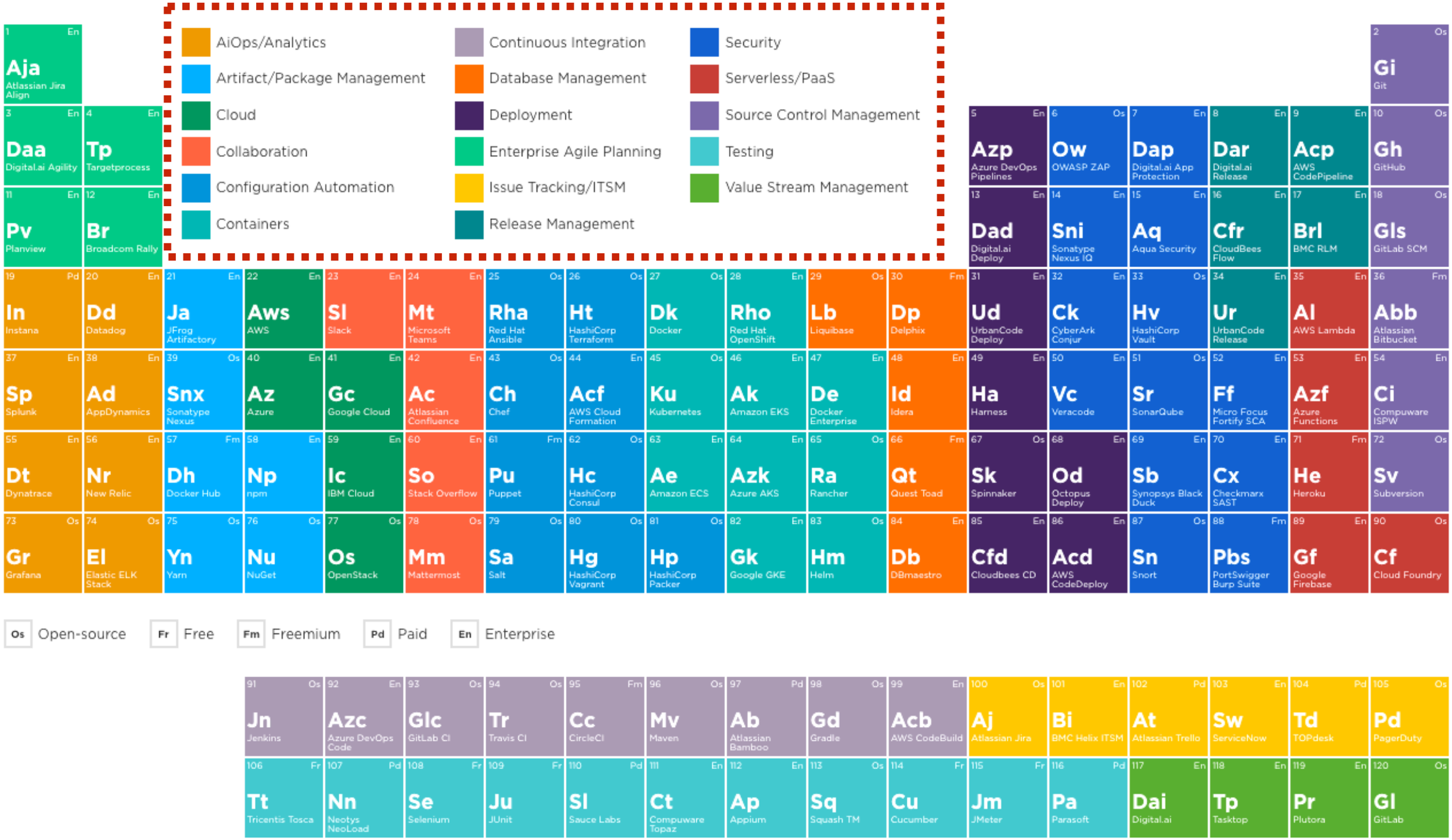

https://digital.ai/periodic-table-of-devops-tools

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- AiOps/Analytics
- Artifact/Package Management
- Cloud
- Collaboration
- Configuration Automation
- Containers
- Continuous Integration
- Database Management
- Deployment
- Enterprise Agile Planning
- Issue Tracking/ITSM
- Release Management
- Security
- Serverless/PaaS
- Source Control Management
- Testing
- Value Stream Management

https://digital.ai/periodic-table-of-devops-tools

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Workshop

Design your delivery process

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Continuous Integration
Continuous Delivery

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Why CI/CD ?

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The cost of integration

1. Merging the code
2. Duplicate changes
3. Test again again !!
4. Fixing bugs
5. Impact on stability

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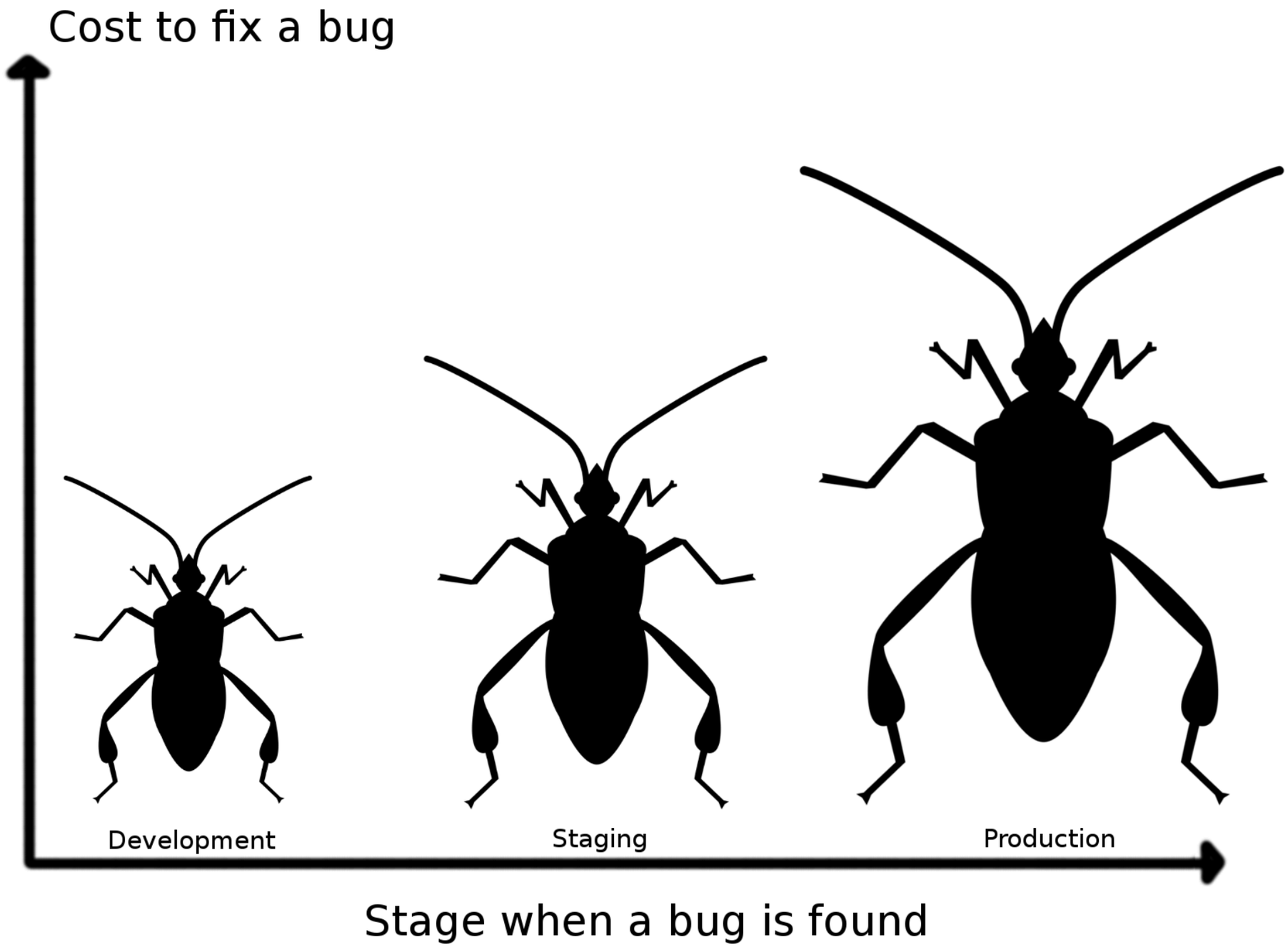
The cost of integration



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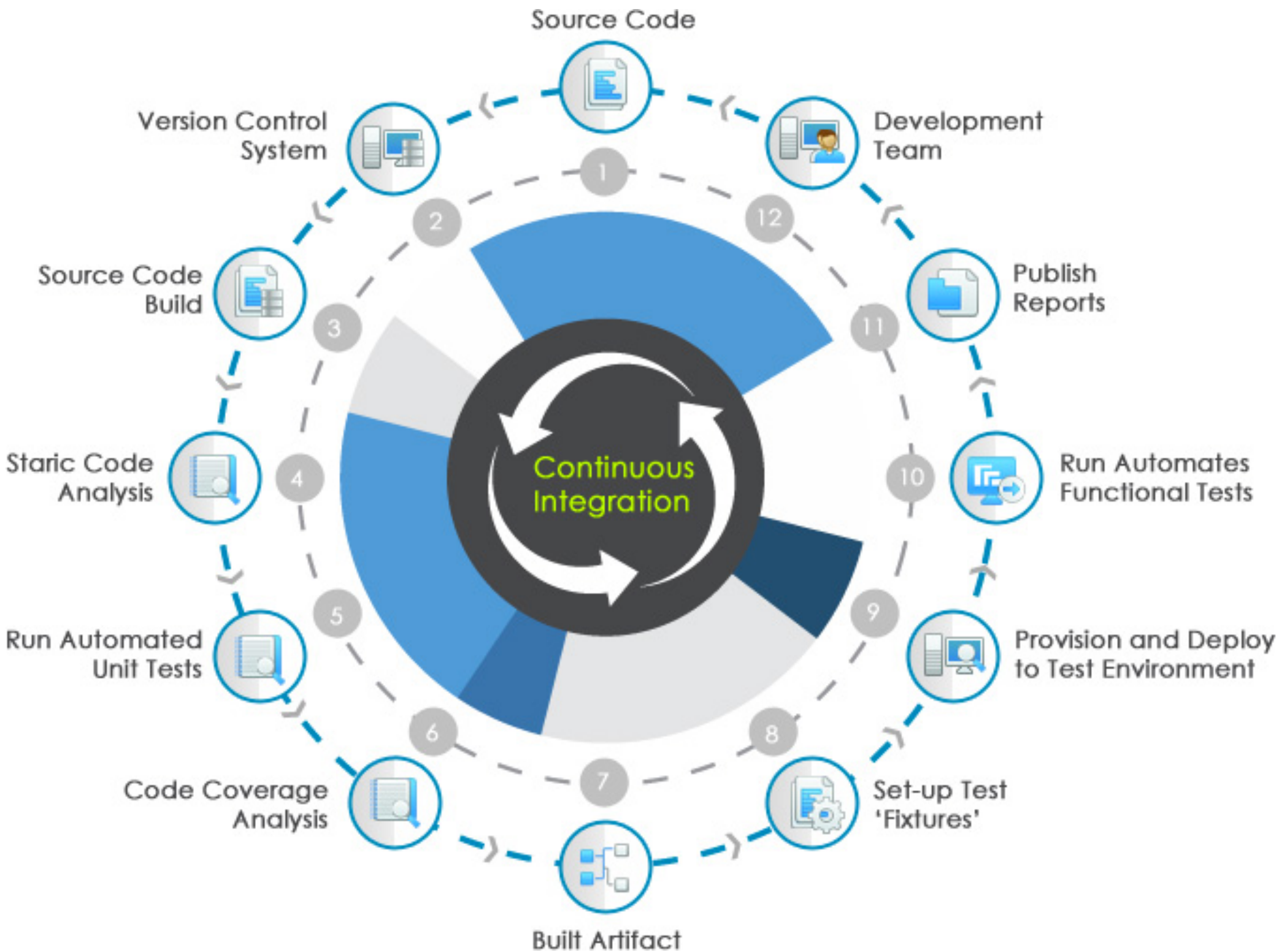

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Jenkins

Bamboo

TeamCity

go™

Visual Studio
Team Foundation Server

Hudson

Travis

wercker

circleci

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CI is about what people do not about what tools they use

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Continuous Integration

Discipline to **integrate frequently**

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Continuous Integration

Strive to make **small change**

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Continuous Integration

Strive for **fast feedback**

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Practices of Continuous Integration

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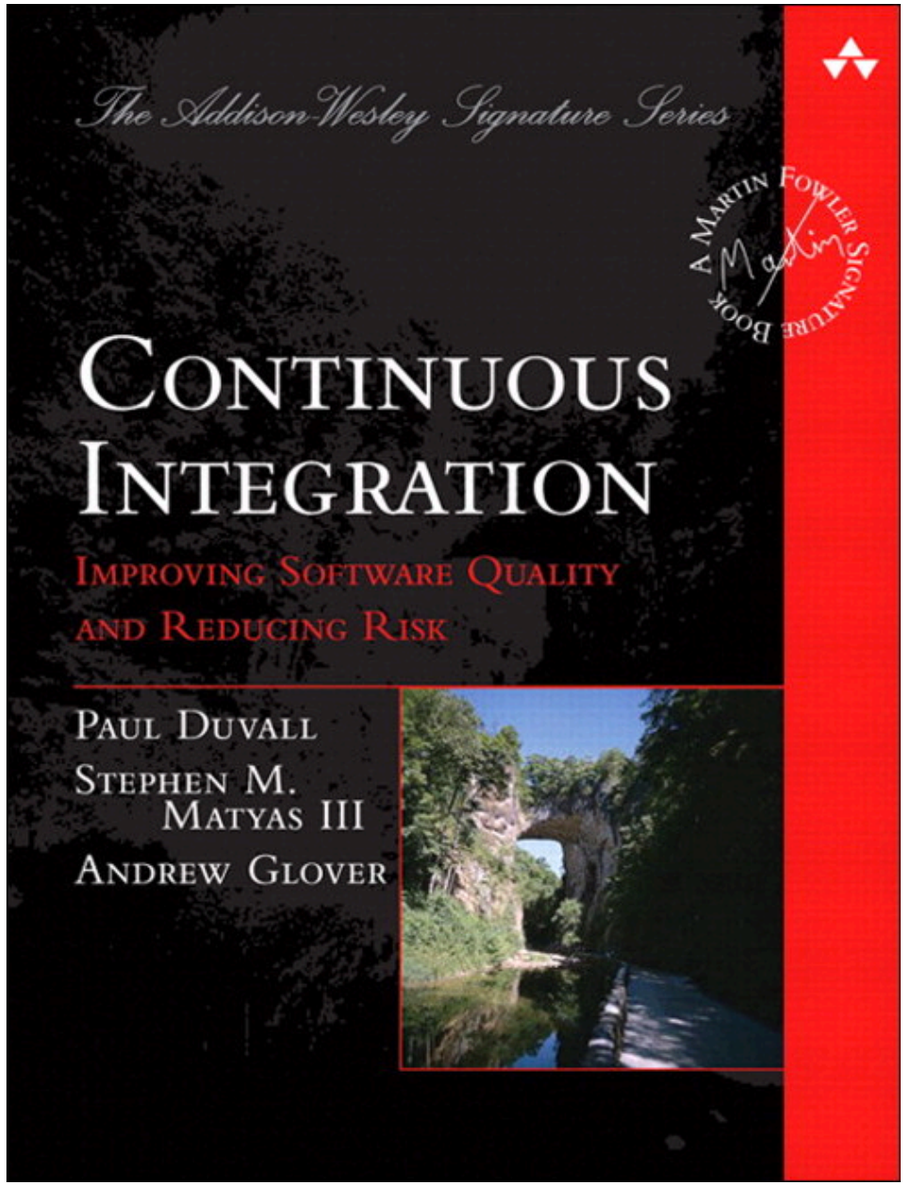
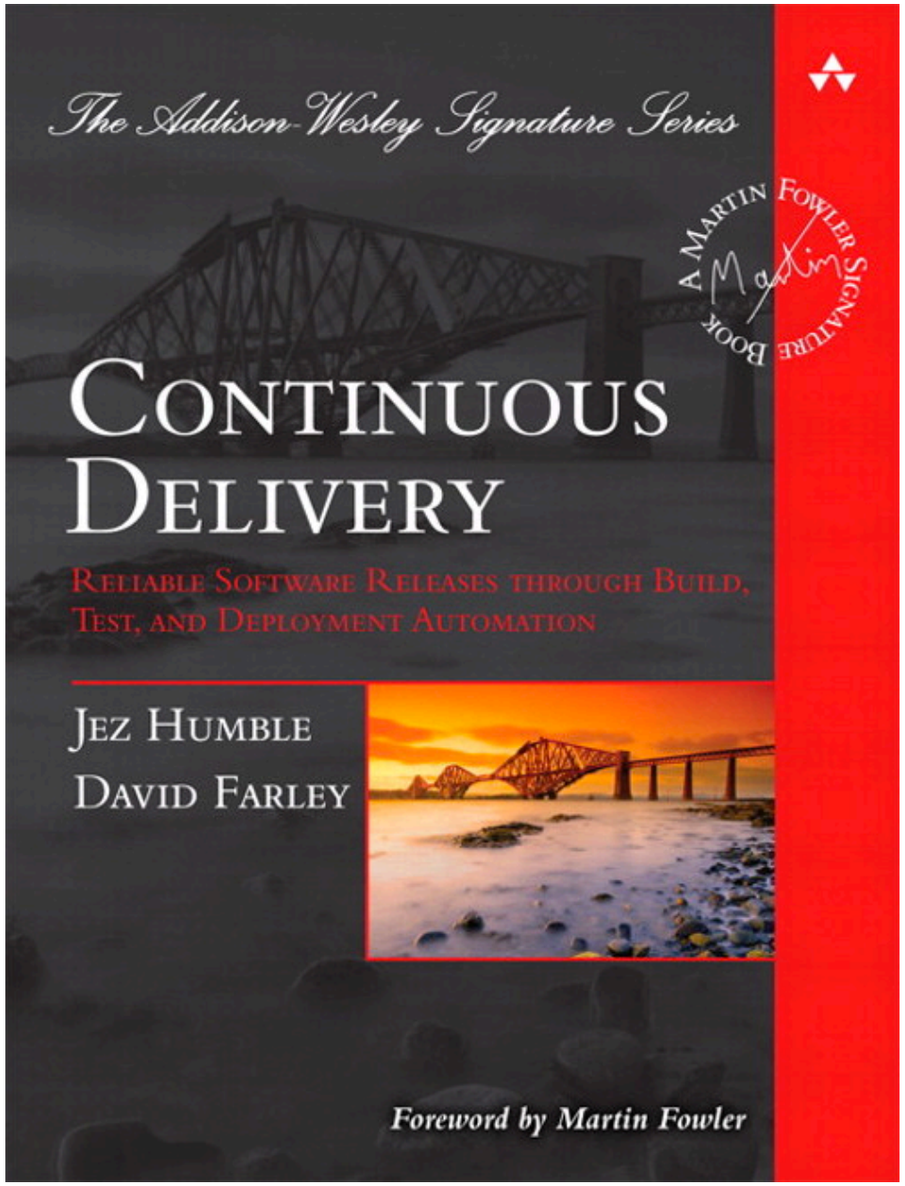
Improve quality and reduce risk





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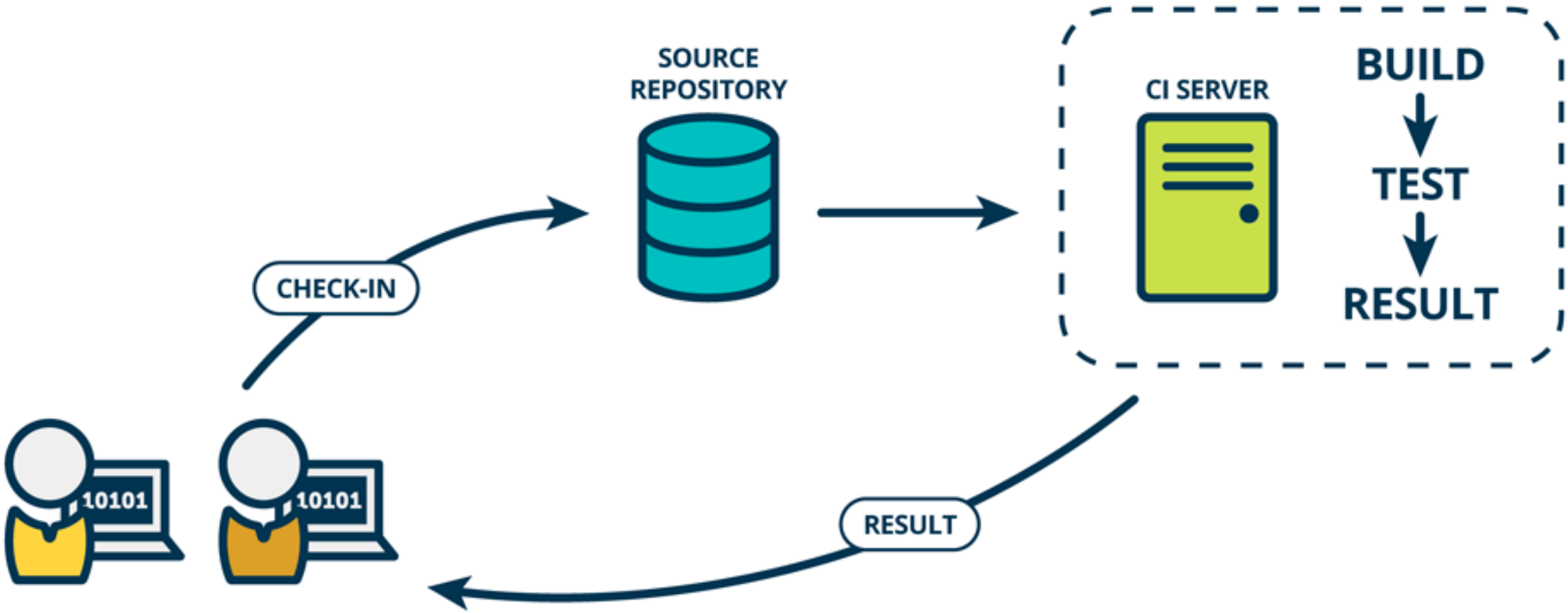
Continuous Integration



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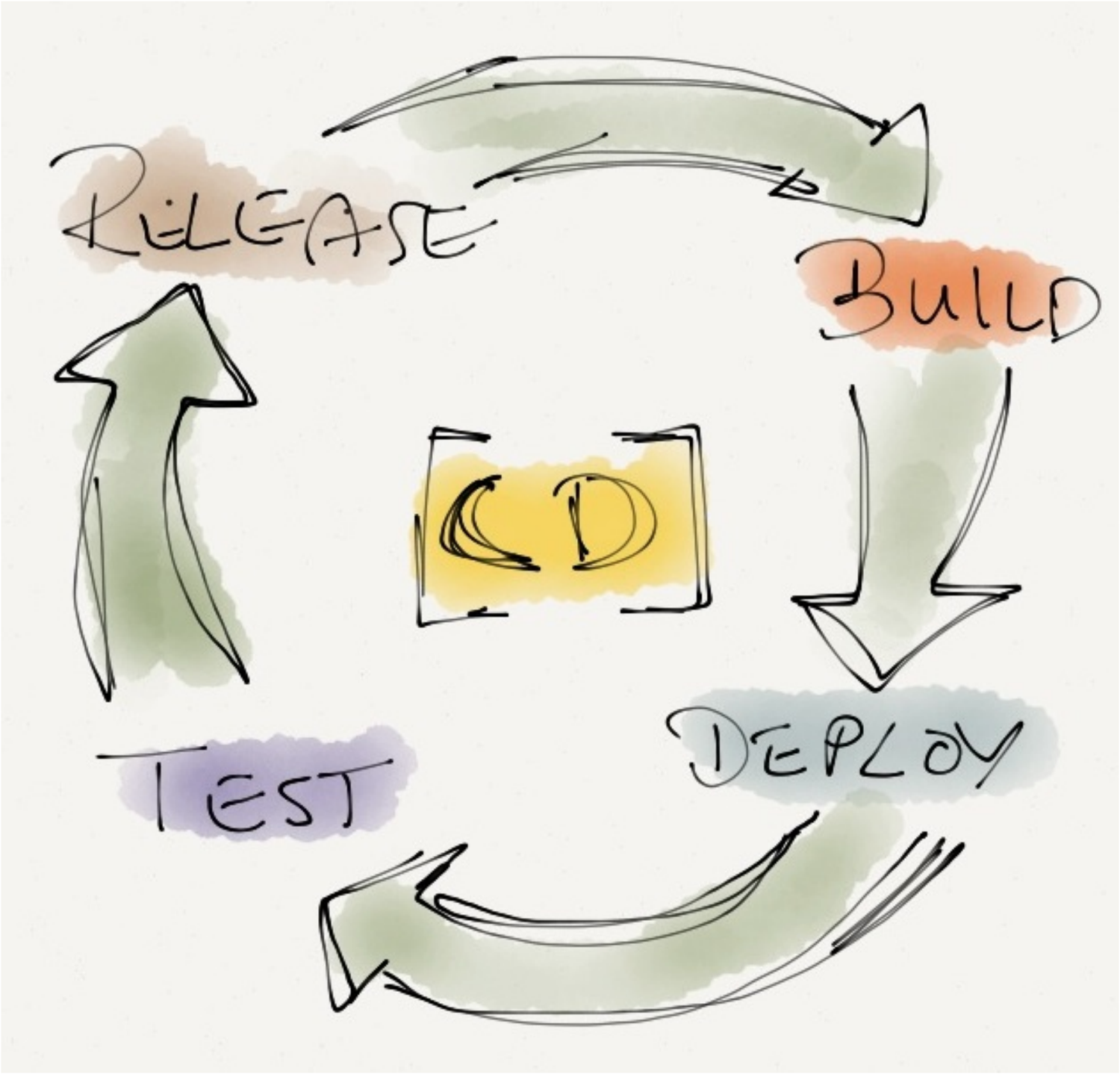
CD ?



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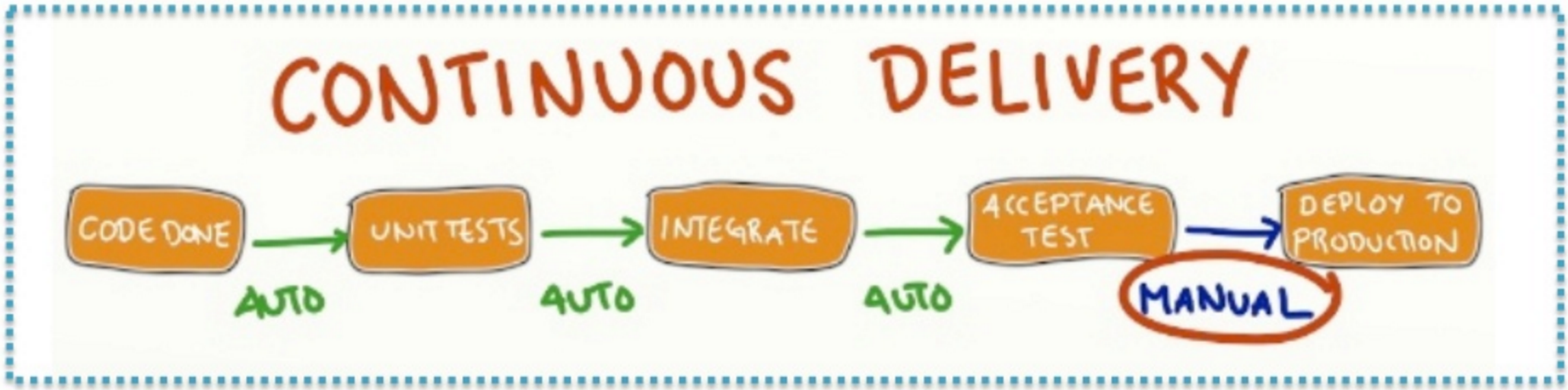
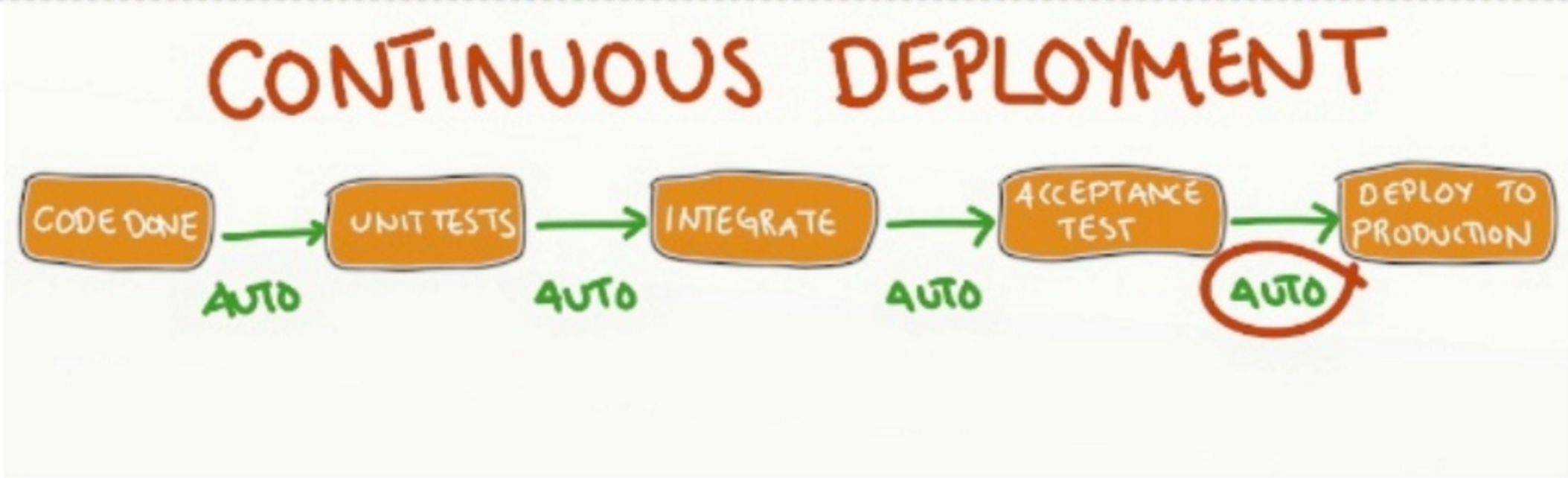
CD ?





http://blog.crisp.se/2013/02/05/yassalsundman/continuous-delivery-vs-continuous-deployment

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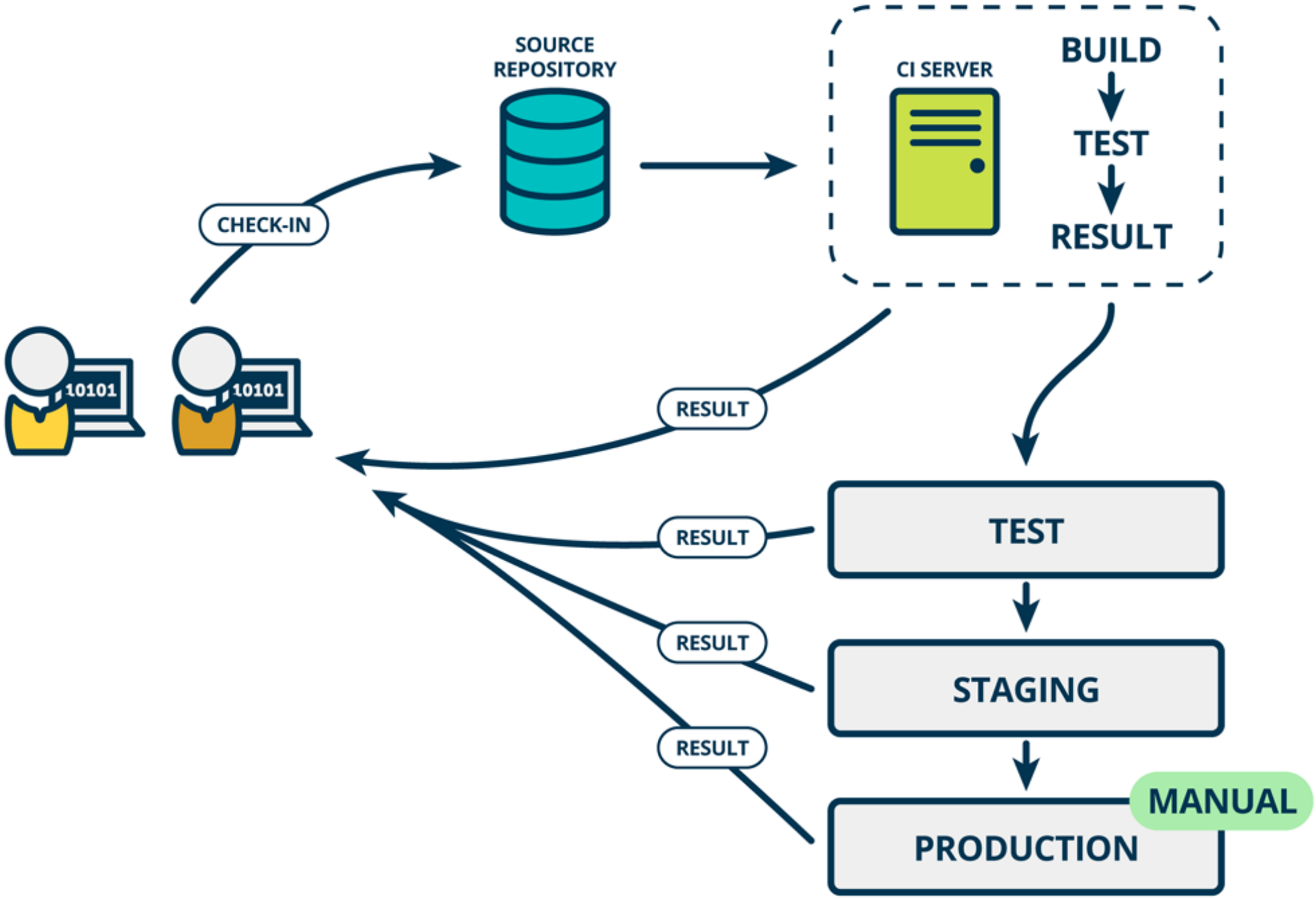
Continuous Delivery



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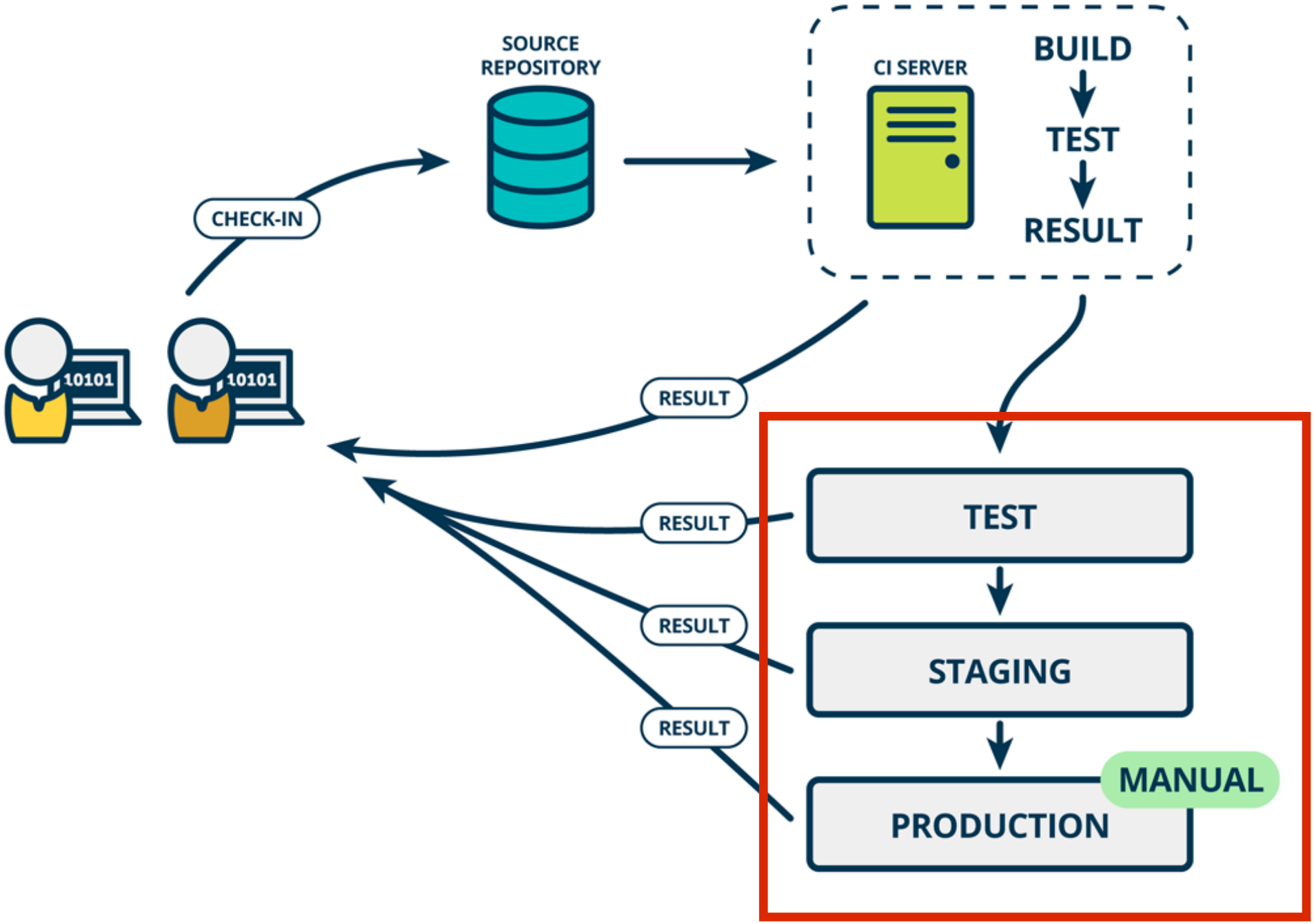
Rise of DevOps



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Continuous Integration

is a Software development **practices**

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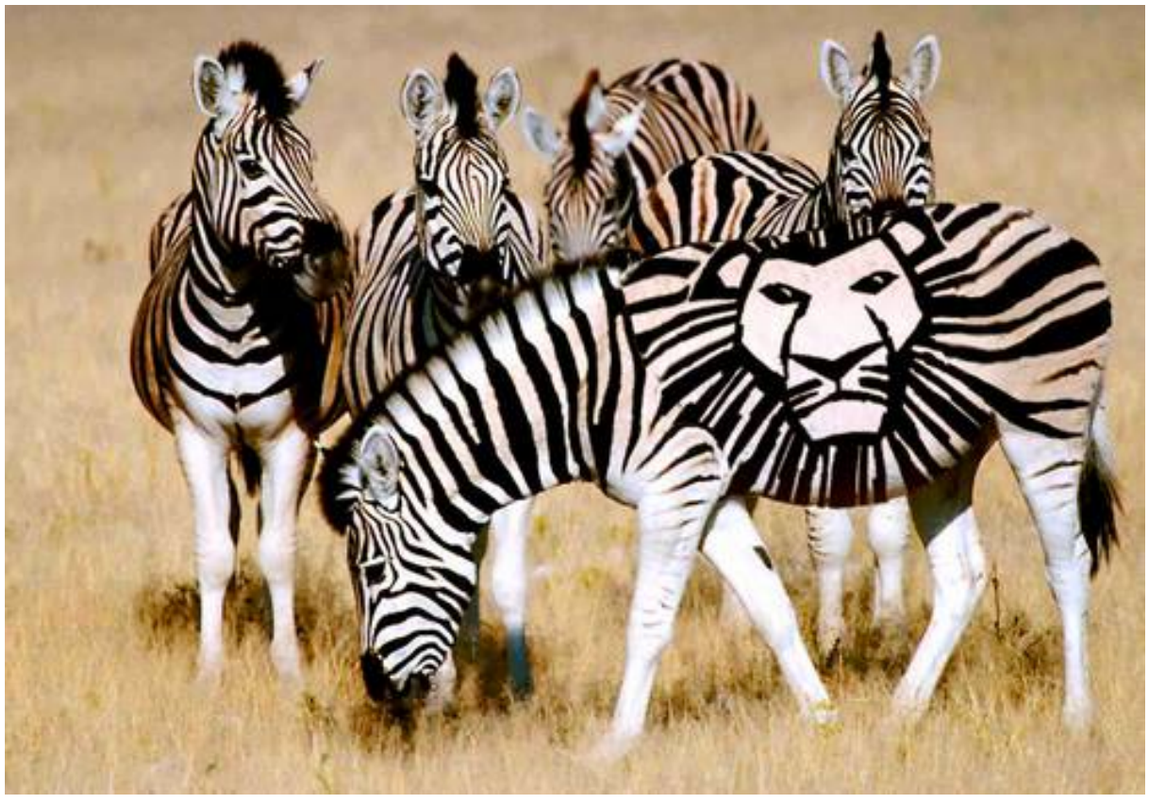
Practice 1

Maintain a single source repository

In general, you should store in source control everything you need to build anything



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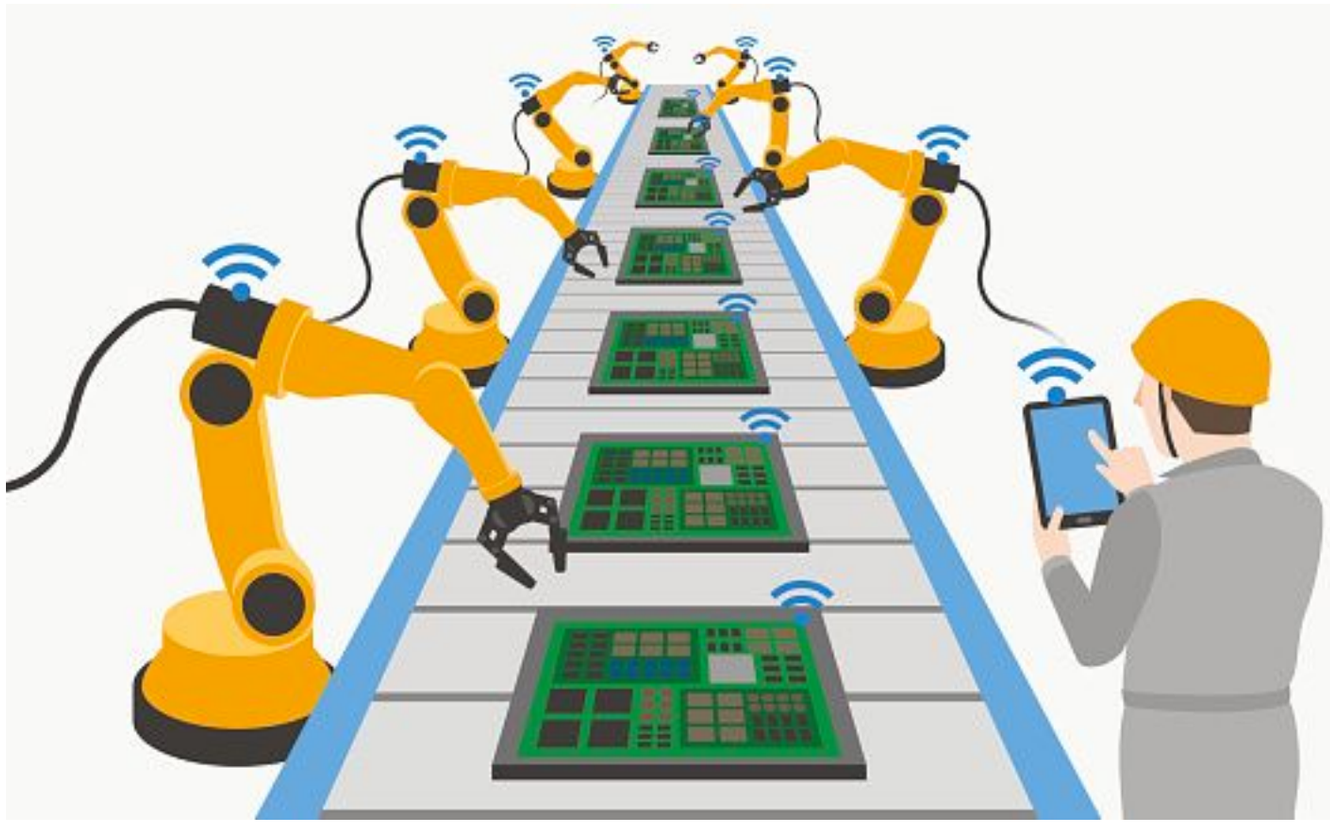
Practice 2

Automated the build

Automated environment for builds



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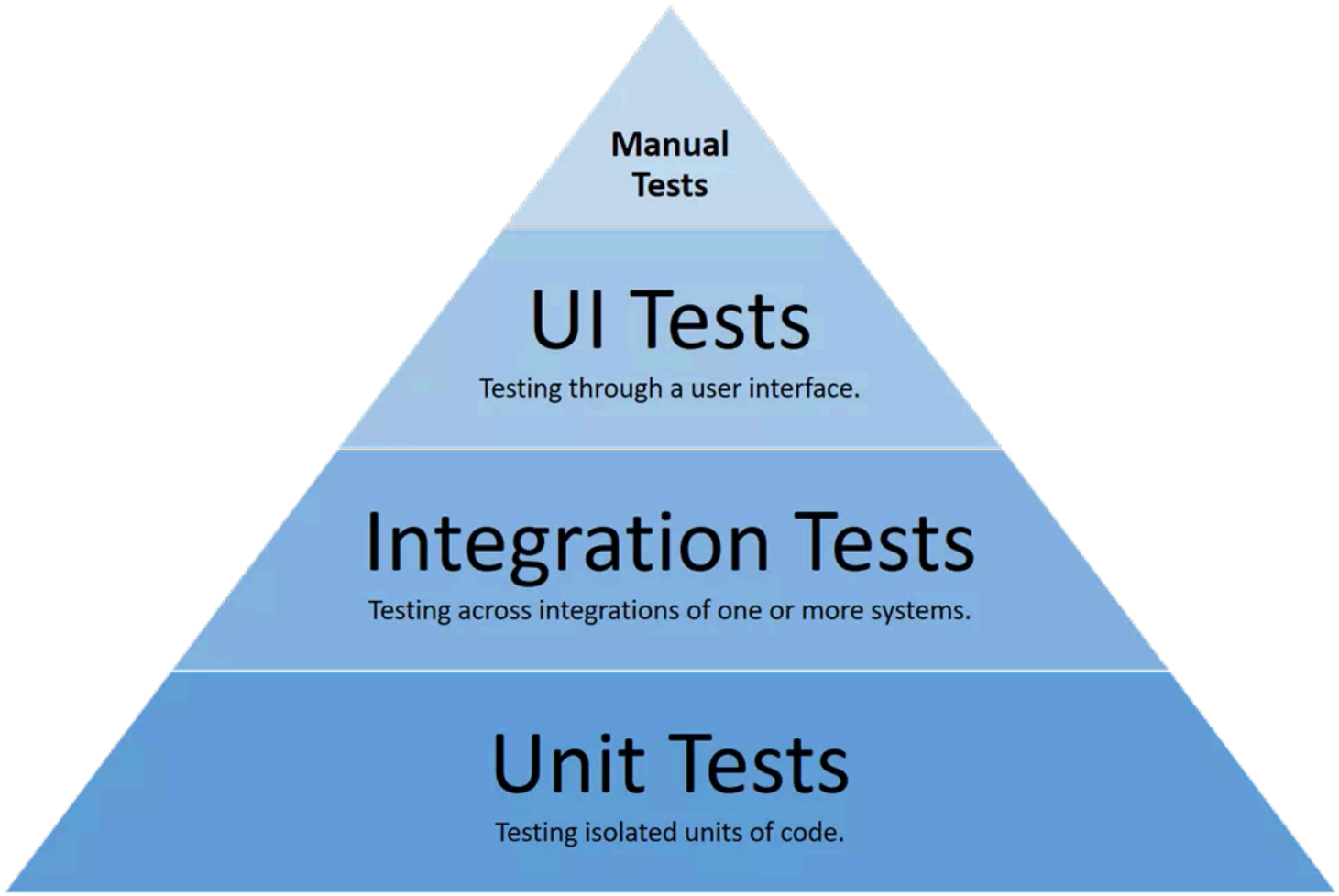
Practice 3

Make your build **self-testing**

Build process => compile, linking and **testing**



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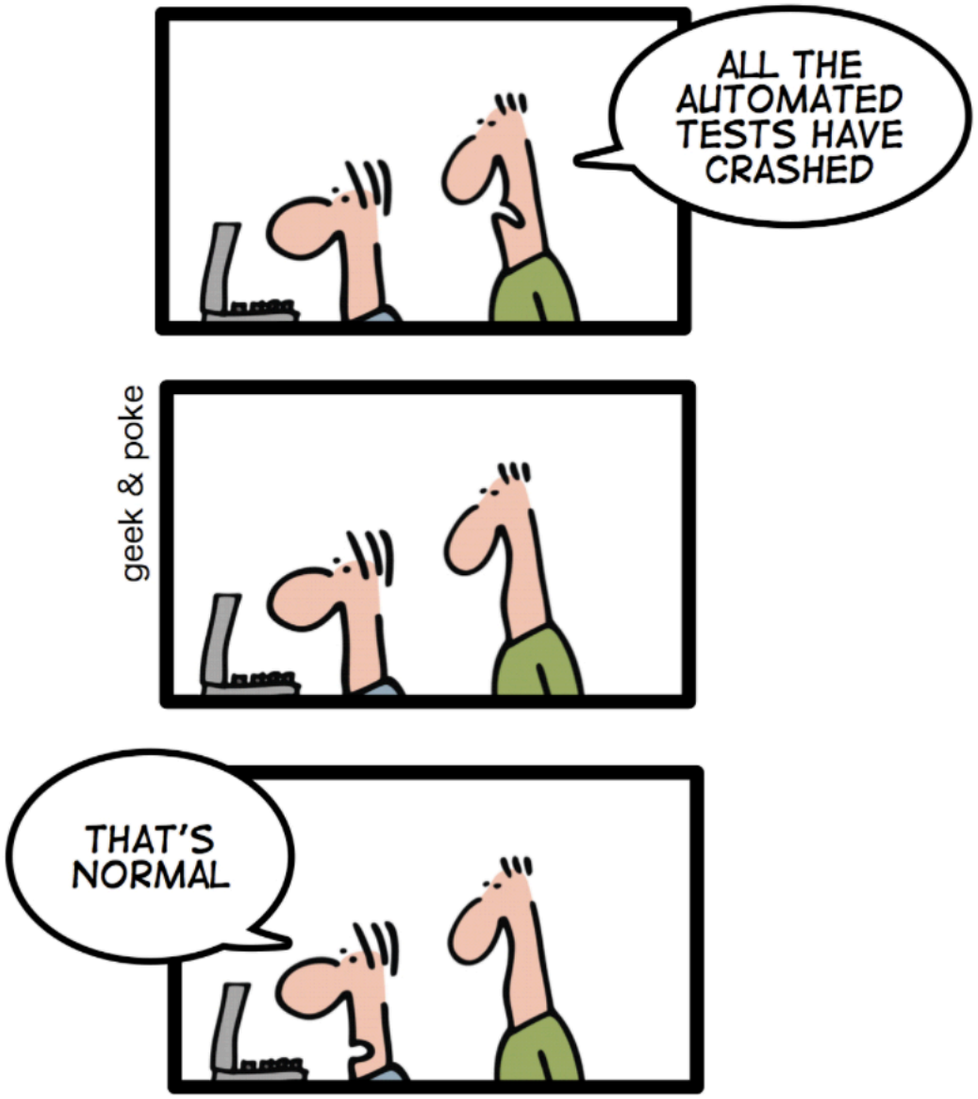
TODAY: CONTINUOUS INTEGRATION GIVES YOU THE COMFORTING FEELING TO KNOW THAT EVERYTHING IS NORMAL



http://geekandpoke.typepad.com/

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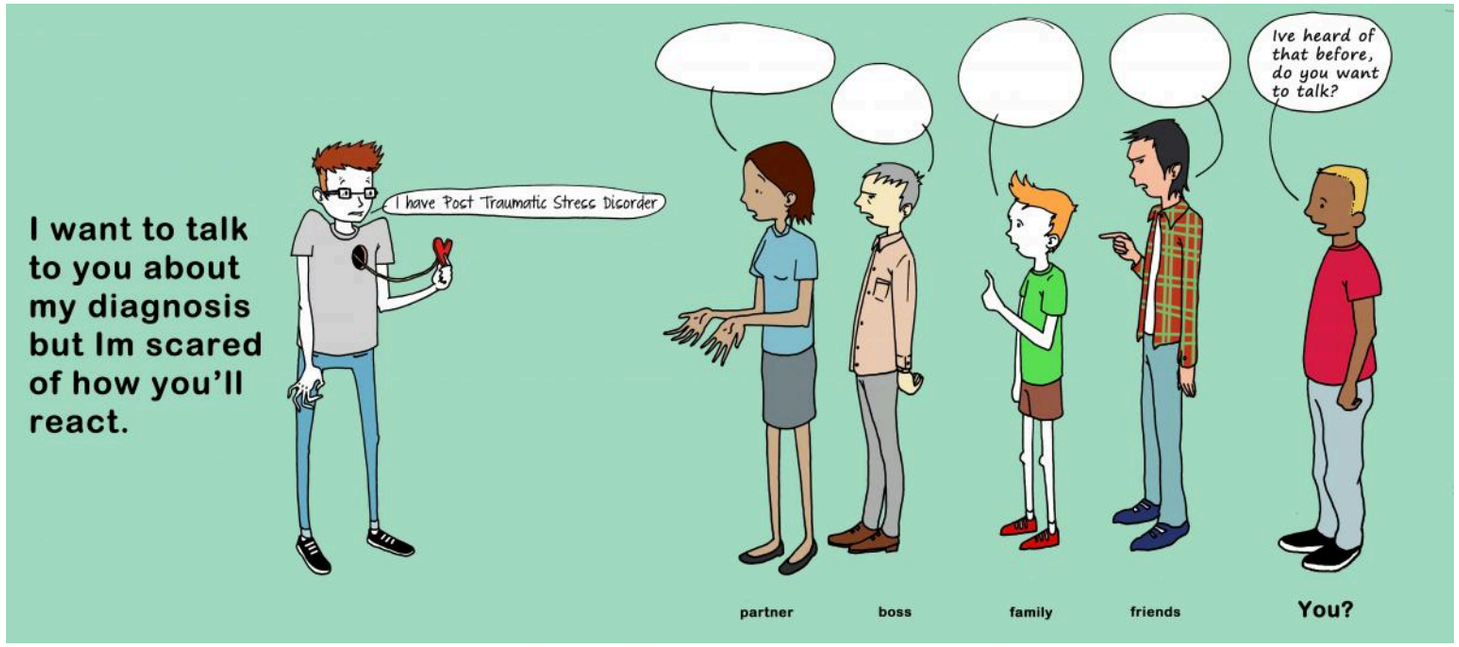
Practice 4

Everyone **commits** to the mainline everyday

Integration is about **communication**

Integration allows developers to **tell** other developers



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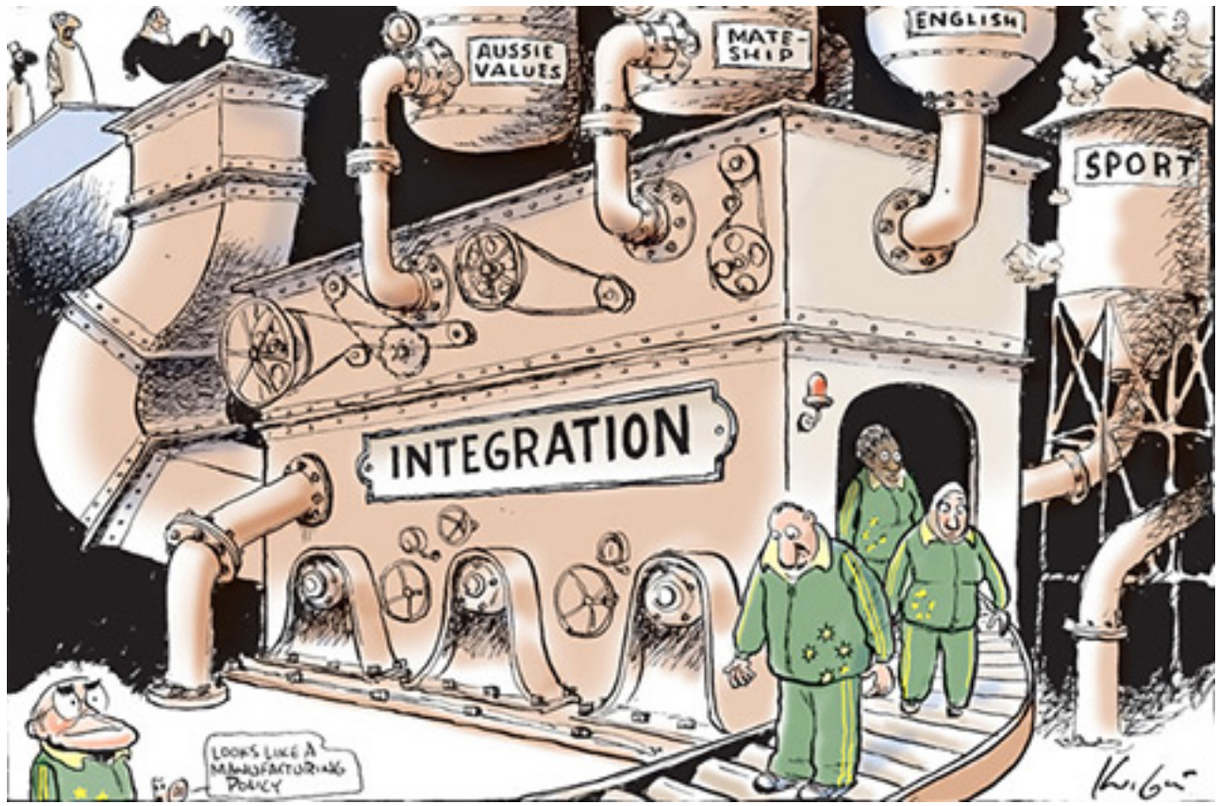
Practice 5

Every commits should build the mainline on an **Integration machine**



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Nightly build is not enough for Continuous Integration

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Practice 6

Fix broken builds **immediately**

“Nobody has a higher priority task than fixing the build”

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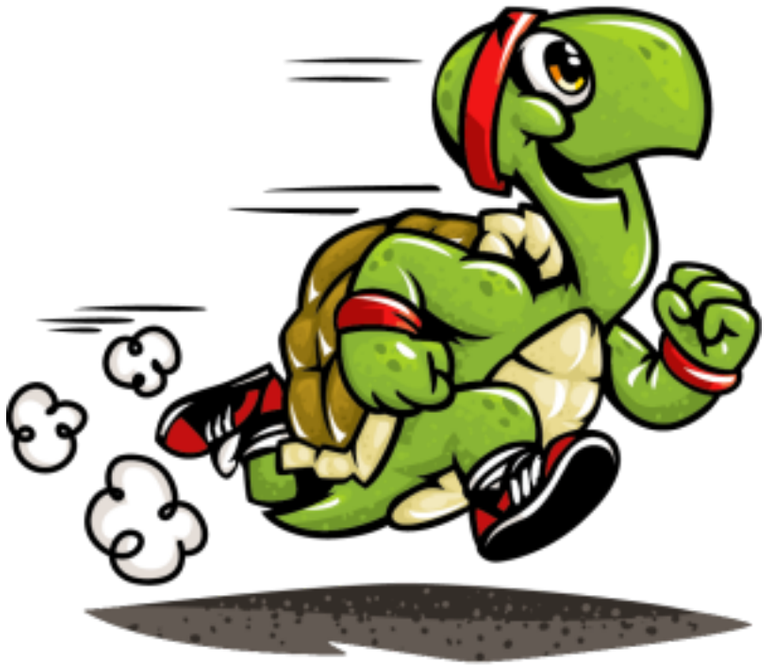
Practice 7

Keep the build **fast**

Continuous Integration is to provide rapid feedback



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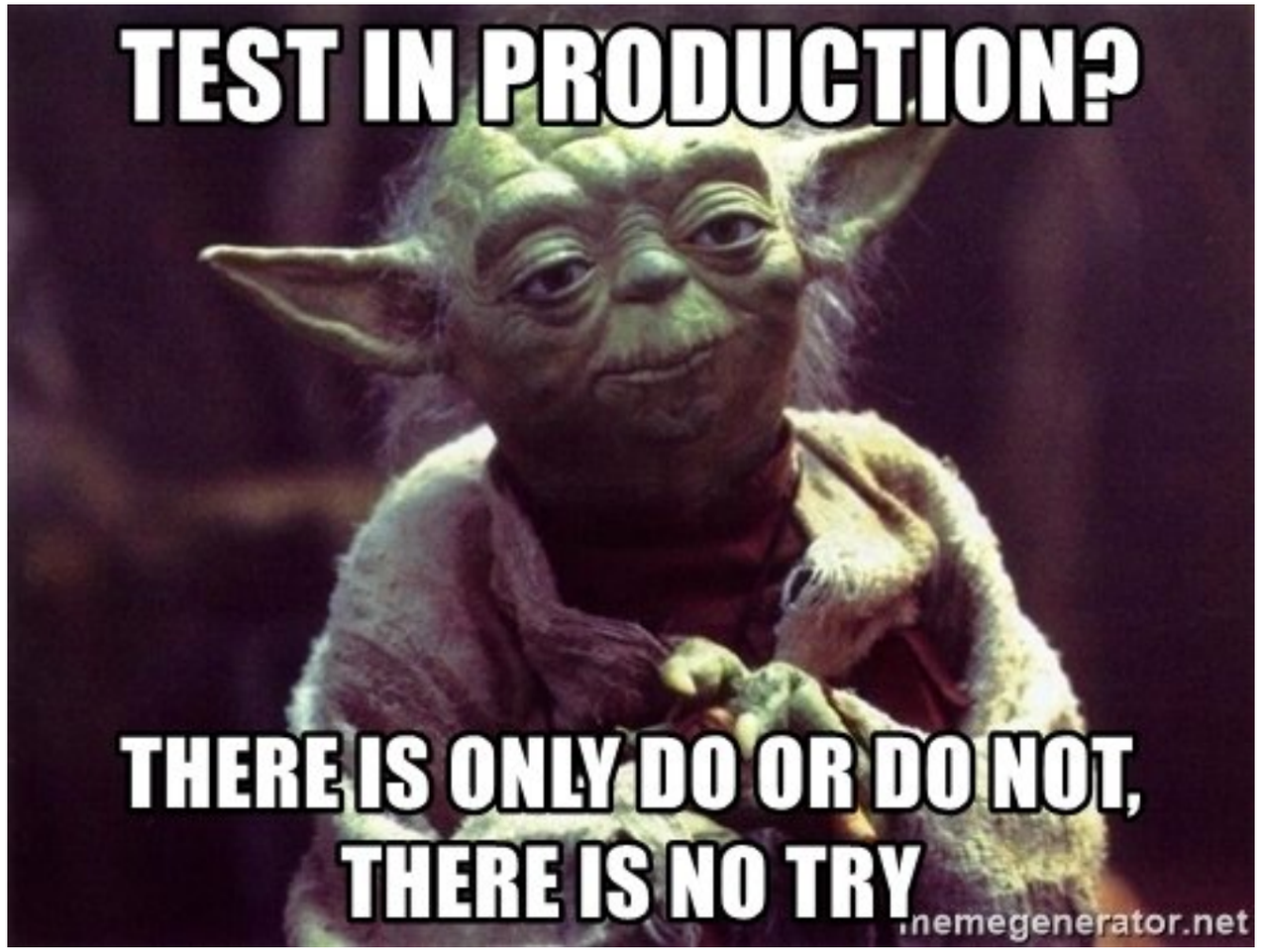
Practice 8

Test in clone of the **Production** environment



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Practice 9

Make it easy for anyone to get
the latest executable

Make sure well known place where people can find

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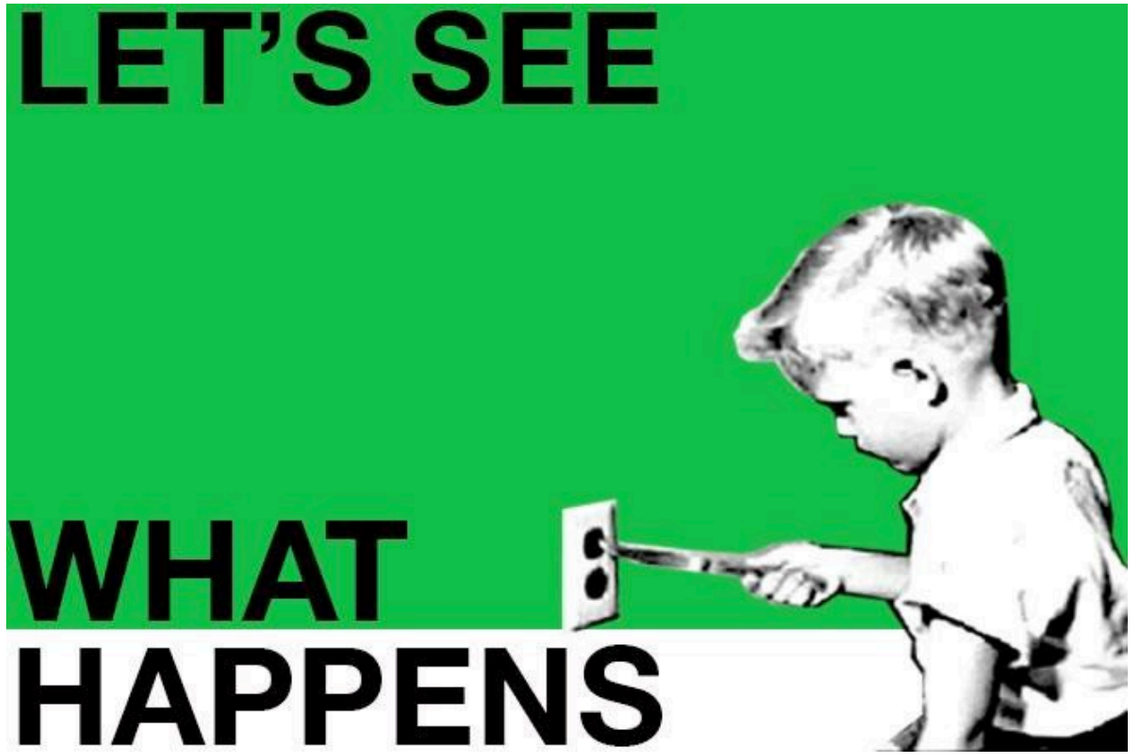
Practice 10

Everyone can see what's happening

Easier to see the state of the system and changes

Show the good information



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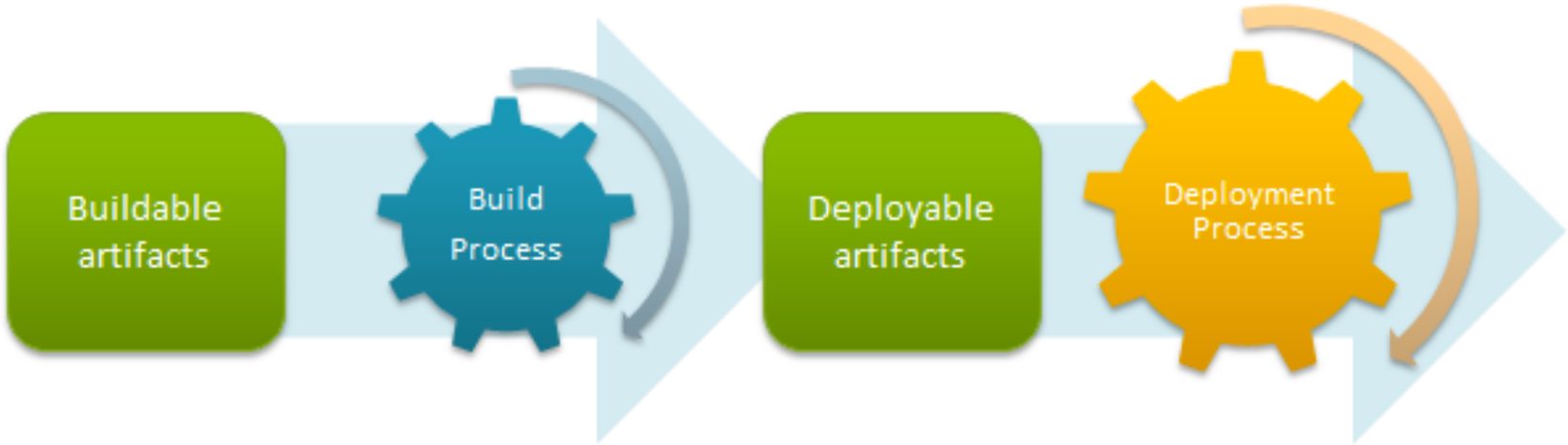
Practice 11

Automated deployment



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Practice 11

Automated deployment

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Continuous Delivery

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Continuous Delivery

Use version control for all production artifacts
Automate your deployment process
Implement continuous integration (CI)
Use trunk-based development methods
Implement test automation
Support test data management
Integrate security into software development process

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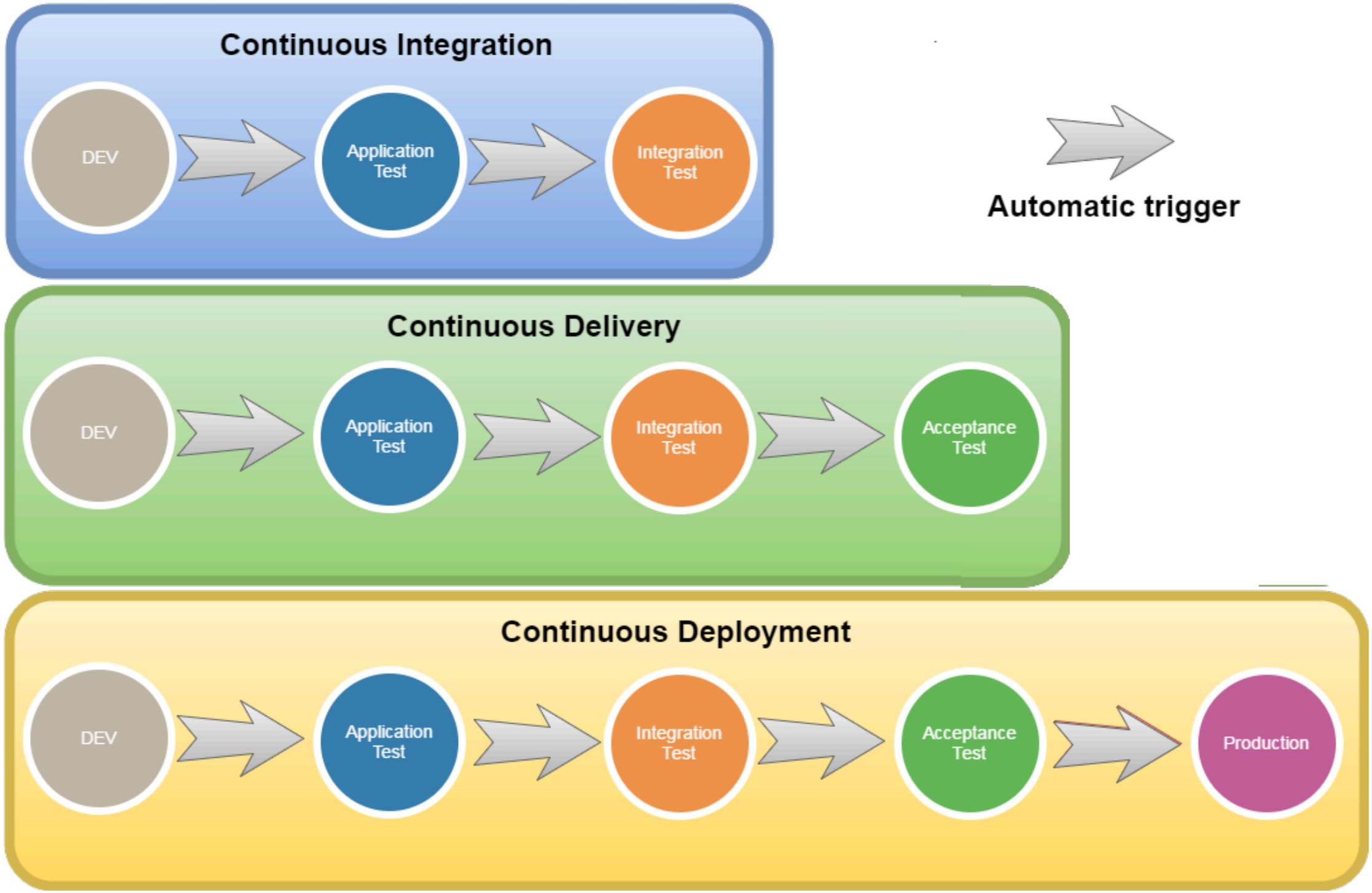

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How to achieve the CI ?

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1. Use good version control

Local

Centralize

Distributed

VSS =

JUST SAY NO!

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2. Choose Branch strategy

Main only

Development isolation

Feature isolation

Release isolation

Service and Release isolation

Service, Hotfix and Release isolation

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Main only

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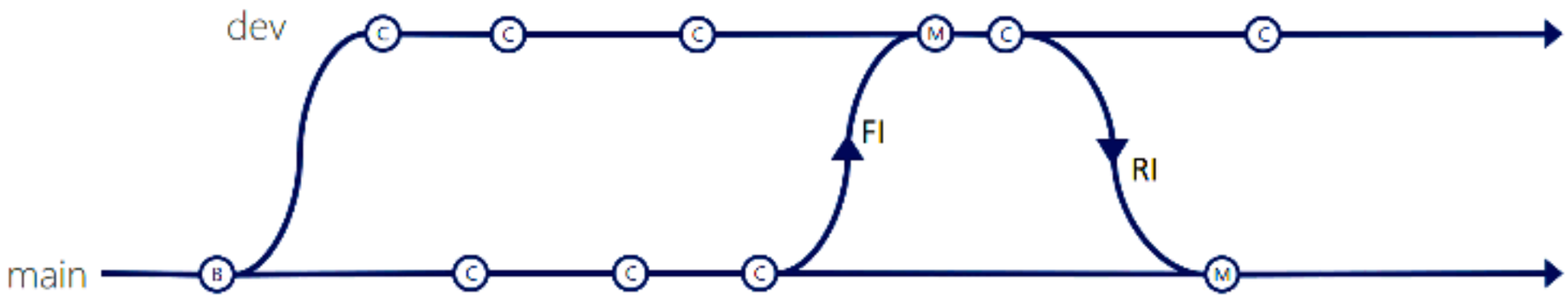
Development isolation



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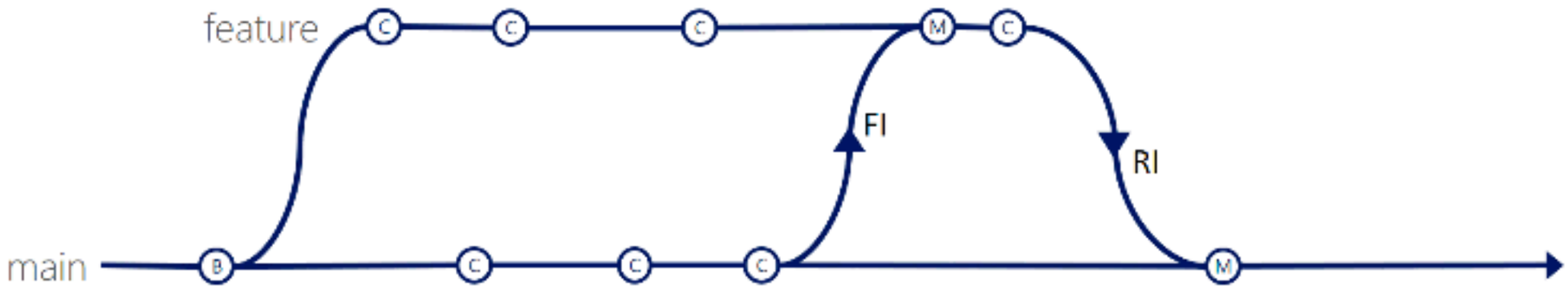
Feature isolation



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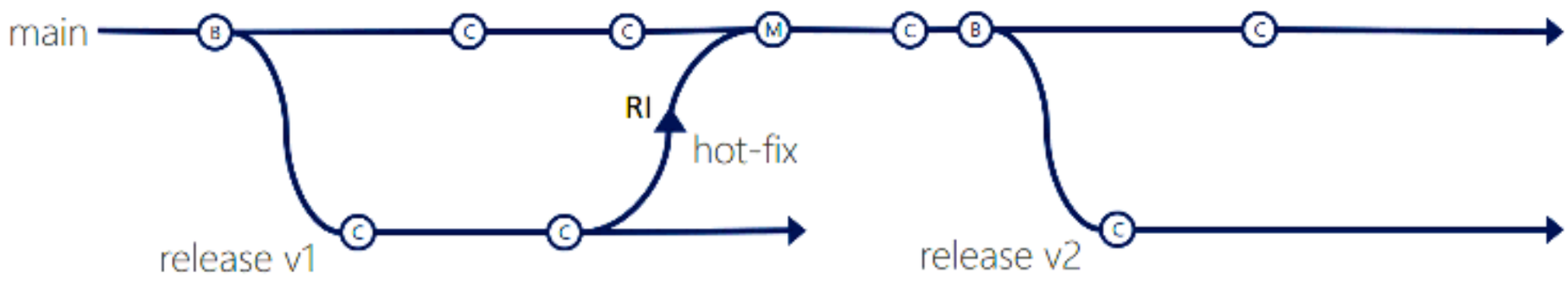
Release isolation



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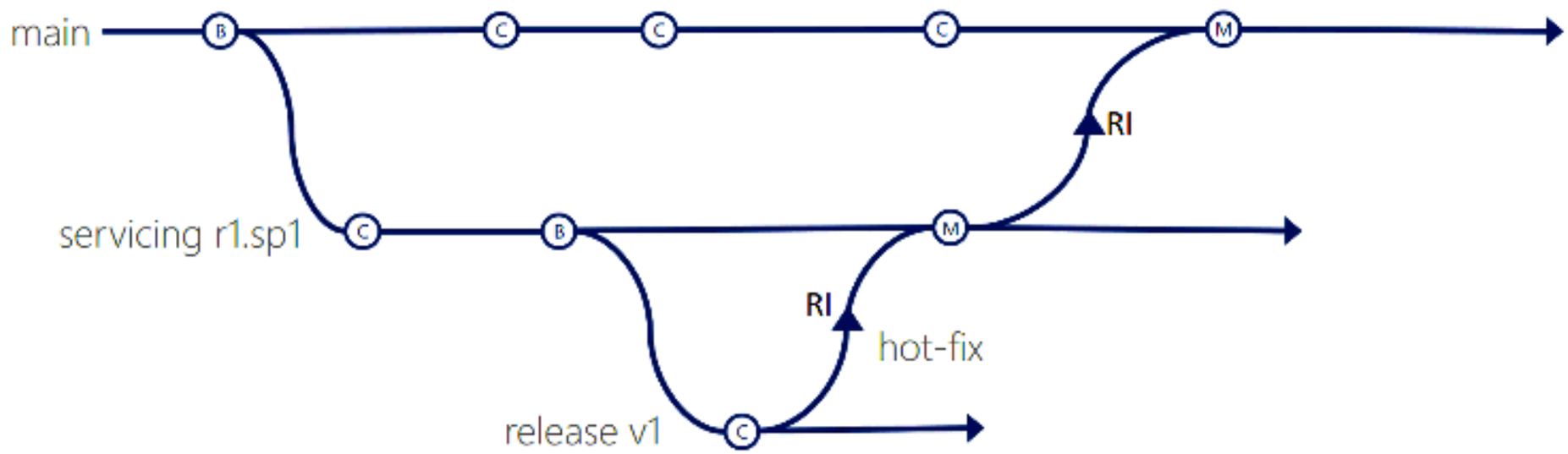
Service and Release isolation



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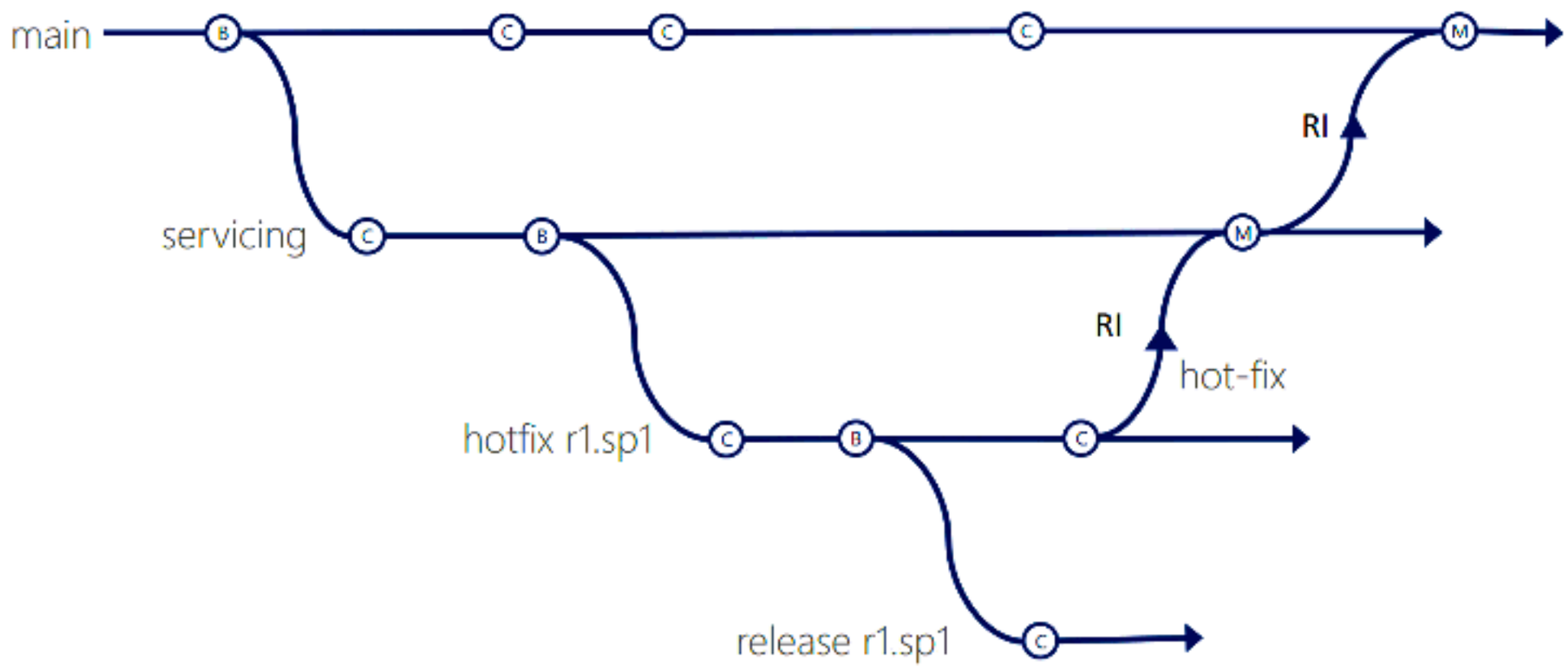
Service, Hotfix, Release isolation



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Validate, Validate and Validate

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Suggestion

Keeping branches short-lived, merge conflicts are keep to as few as possible

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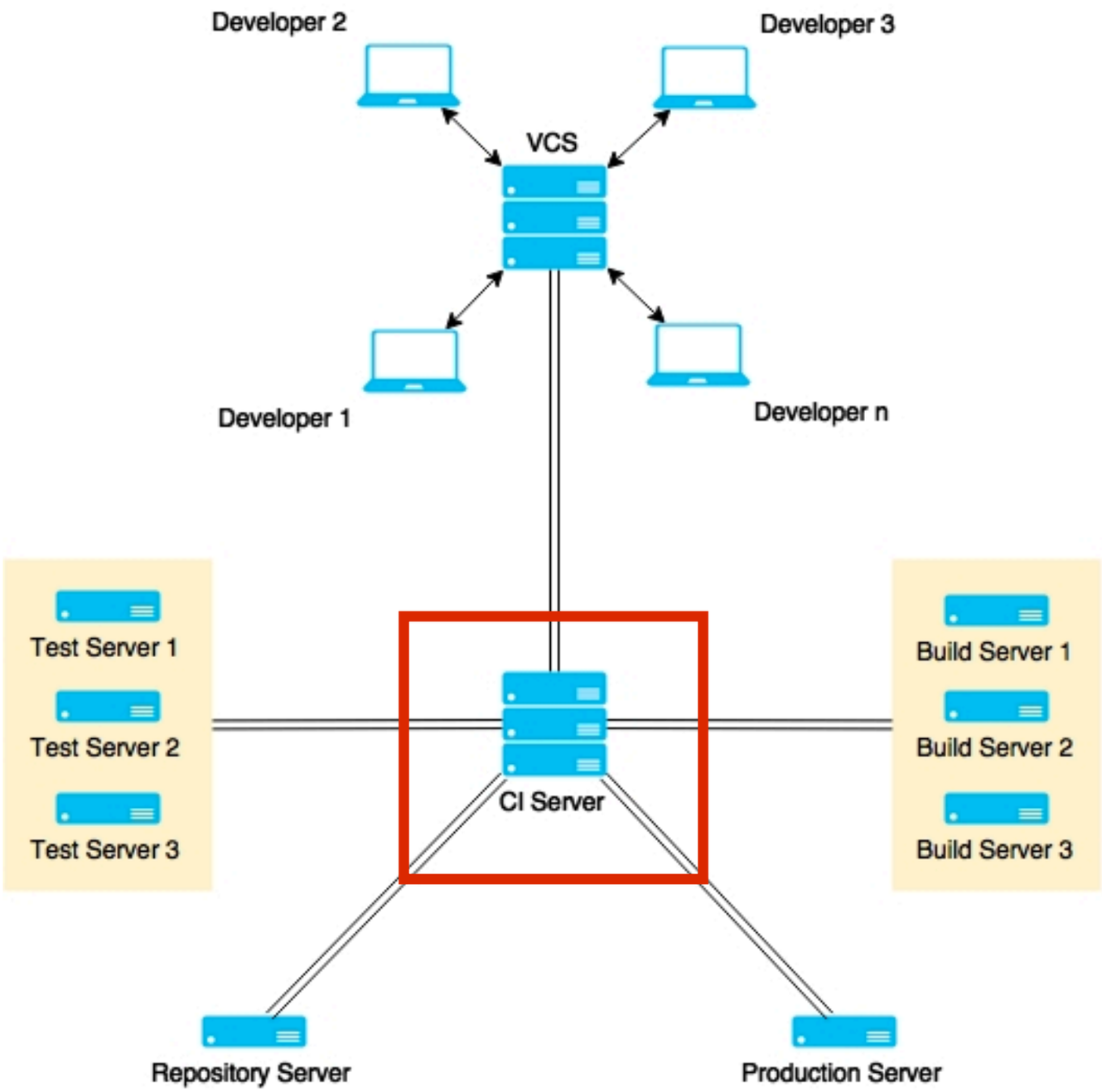
3. Use good CI tool



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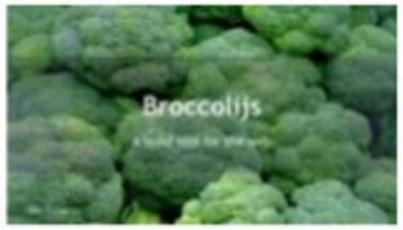
4. Use good build tool

- Javascript
  - Gulp, Grunt, Brocolli



- C#/.NET
  - Nant, MSBuild

- Java/JVM
  - Ant, Maven, Gradle, SBT, Leiningen

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More …

Use static code analysis

Automated testing

Automated deployment

People discipline/habit

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“Behind every successful agile project, there is a **Continuous Integration Server**”

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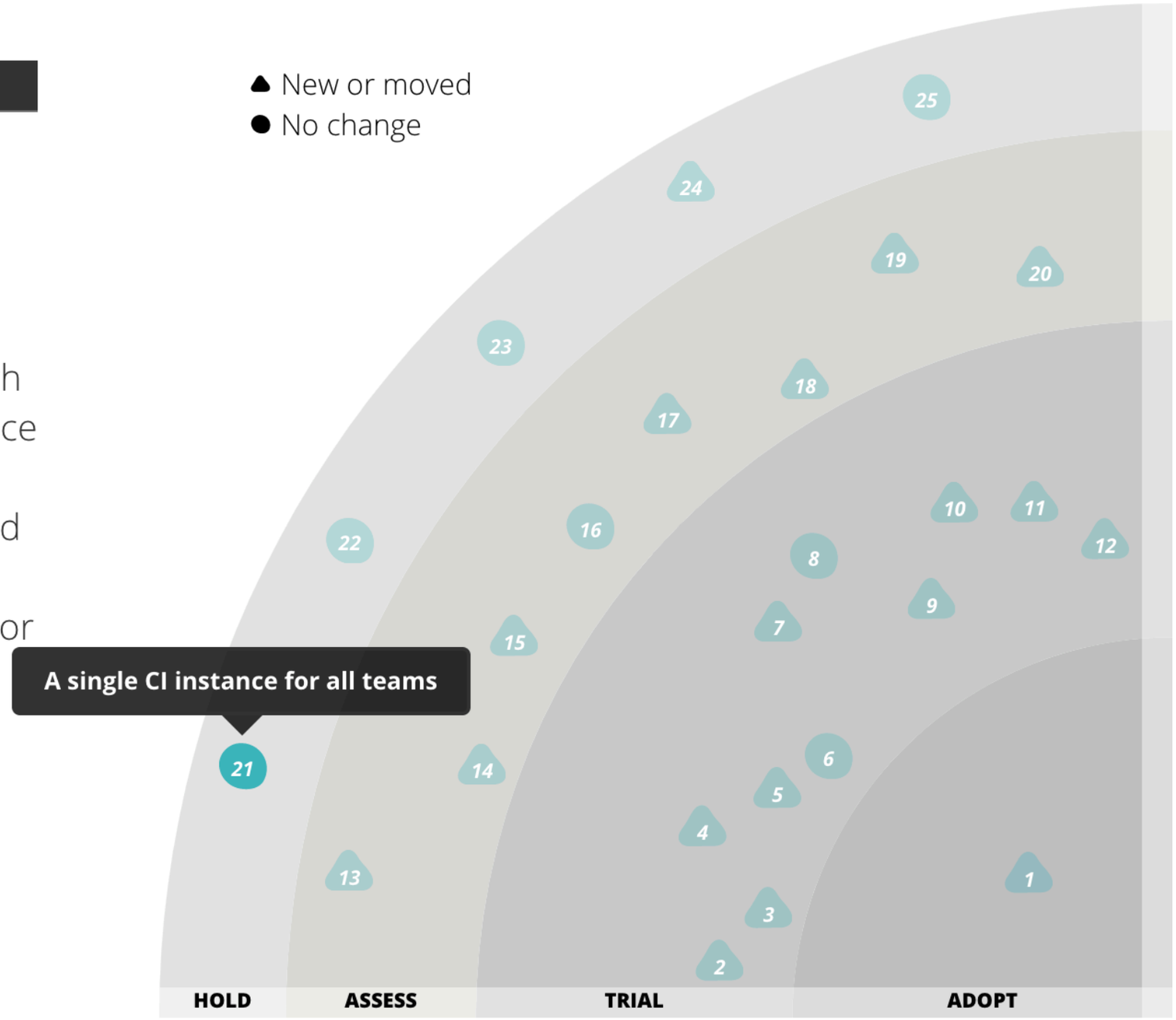
Anti-pattern for CI Server

HOLD ?

21. A single CI instance for all teams

We're compelled to caution, again, against creating **a single CI instance for all teams**. While it's a nice idea in theory to consolidate and centralize Continuous Integration (CI) infrastructure, in reality we do not see enough maturity in the tools and products in this space to achieve the desired outcome. Software delivery teams which must use the centralized CI offering regularly have long delays depending on a central team to perform minor configuration tasks, or to troubleshoot problems in the shared infrastructure and tooling. At this stage, we continue to recommend that organizations limit their centralized investment to establishing patterns, guidelines and support for delivery teams to operate their own CI infrastructure.



https://www.thoughtworks.com/radar/techniques

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Let’s start with CI/CD

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Application and framework to manage and monitor the executable of **repeated tasks**

Jenkins

https://jenkins.io/

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Centralize Continuous Integration Server

Jenkins

https://jenkins.io/

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Why Jenkins ?

Easy !!

Extensible

Scalable

Opensource

Large community

Lot of plugins

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Who use Jenkins ?

We thank the following organizations for their major commitments to support the Jenkins project.

Microsoft cloudbees OSL OPEN SOURCE LAB

rackspace redhat

We thank the following organizations for their support of the Jenkins project through free and/or open source licensing programs.

Atlassian Datadog JFrog Mac Cloud PagerDuty XMission

https://jenkins.io/

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Download Jenkins

https://jenkins.io/

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Use Long Term Support (LTS)

Getting started with Jenkins

The Jenkins project produces two release lines, LTS and weekly. Depending on your organization's needs, one may be preferred over the other.

Both release lines are distributed as `.war` files, native packages, installers, and Docker containers.

Long-term Support (LTS)

LTS (Long-Term Support) releases are chosen every 12 weeks from the stream of regular releases as the stable release for that time period. Learn more…

Changelog | Upgrade Guide | Past Releases

Deploy Jenkins 2.46.3

Deploy to Azure

Download Jenkins 2.46.3 for:

- Docker
- FreeBSD

Weekly

A new release is produced weekly to deliver bug fixes and features to users and plugin developers.

Changelog | Past Releases

Download Jenkins 2.65 for:

- Arch Linux
- Docker
- FreeBSD
- Gentoo

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Start Jenkins

$java -jar jenkins.war

Default port of server is **8080**

```
org.eclipse.jetty.server.AbstractConnector doStart
ector@3e2fc448{HTTP/1.1,[http/1.1]}{0.0.0.0:8080}
org.eclipse.jetty.server.Server doStart
```

```
winstone.Logger logInternal
ngine v4.0 running: controlPort=disabled
jenkins.InitReactorRunner$1 onAttained
tion
jenkins.InitReactorRunner$1 onAttained

jenkins.InitReactorRunner$1 onAttained
```


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Change port of Jenkins

$java -jar jenkins.war **--httpPort=<port>**

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Open in browser

http://localhost:8080

Getting Started

Unlock Jenkins

To ensure Jenkins is securely set up by the administrator, a password has been written to the log (not sure where to find it?) and this file on the server:

`/Users/somkiat/data/slide/ci-cd/swpark/software/keep/secrets/initialAdminPassword`

Please copy the password from either location and paste it below.

Administrator password

Continue

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Copy password from console

```
*************************************************************
*************************************************************
*************************************************************

Jenkins initial setup is required. An admin user has been creat
.
Please use the following password to proceed to installation:

a4b3a5231b8048419192d0c5afd3fce8

This may also be found at: /Users/somkiat/data/slide/ci-cd/swpa
itialAdminPassword

*************************************************************
*************************************************************
*************************************************************
```


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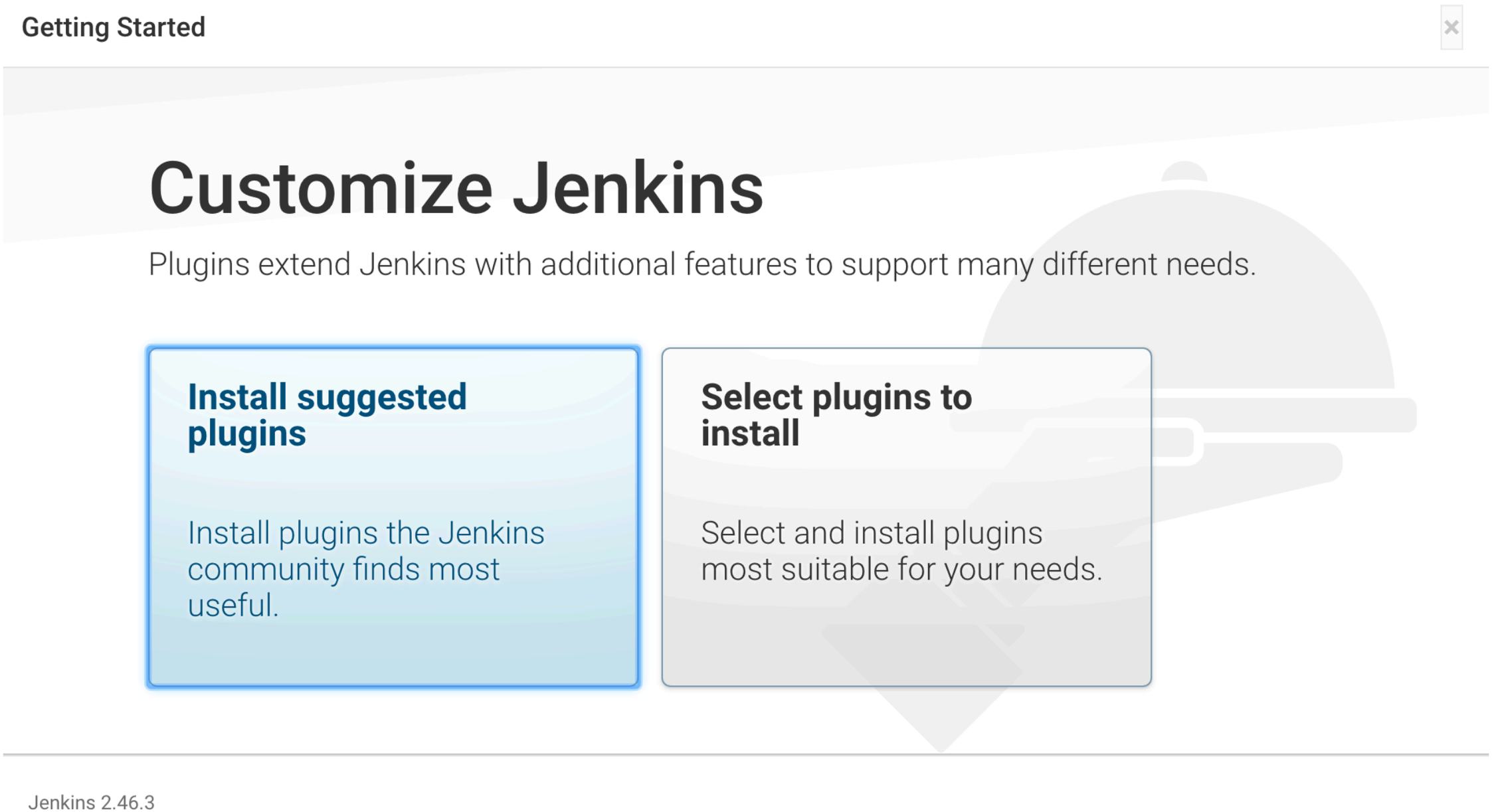
Customize plugins



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Waiting

Getting Started

Getting Started

Folders Plugin	OWASP Markup Formatter Plugin	build timeout plugin	Credentials Binding Plugin
Timestamper	Workspace Cleanup Plugin	Ant Plugin	Gradle Plugin
Pipeline	GitHub Organization Folder Plugin	Pipeline: Stage View Plugin	Git plugin
Subversion Plug-in	SSH Slaves plugin	Matrix Authorization Strategy Plugin	PAM Authentication plugin
LDAP Plugin	Email Extension Plugin	Mailer Plugin	

** - required dependency

Jenkins 2.46.3

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Success

Getting Started

Installation Failures

Some plugins failed to install properly, you may retry installing them or continue with

✔ Folders Plugin	✔ OWASP Markup Formatter Plugin	✔ build timeout plugin	✔ Credentials Binding Plugin
✔ Timestamper	✔ Workspace Cleanup Plugin	✔ Ant Plugin	✔ Gradle Plugin
✔ Pipeline	✔ GitHub Organization Folder Plugin	✔ Pipeline: Stage View Plugin	✔ Git plugin
✔ Subversion Plug-in	✔ SSH Slaves plugin	✔ Matrix Authorization Strategy Plugin	✔ PAM Authentication plugin
✔ LDAP Plugin	✔ Email Extension Plugin	✔ Mailer Plugin	

Jenkins 2.46.3

Continue Retry

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Create a new user

Getting Started

Create First Admin User

Username:

Password:

Confirm password:

Full name:

E-mail address:

Jenkins 2.46.3

Continue as admin

Save and Finish

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Ready to use

Getting Started

Jenkins is ready!

Your Jenkins setup is complete.

Start using Jenkins

Jenkins 2.46.3

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Welcome to Jenkins

Jenkins

search

somkiat | log out

Jenkins

ENABLE AUTO REFRESH

New Item

People

Build History

Manage Jenkins

My Views

Credentials

add description

Welcome to Jenkins!

Please **create new jobs** to get started.

Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

Page generated: Jun 14, 2017 2:08:57 PM ICT REST API Jenkins ver. 2.46.3

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About Jenkins's HOME

Default of **JENKINS_HOME** is

<path of user>/.jenkins

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About Jenkins's HOME

Data in JENKINS_HOME

```
/Users/somkiat/.jenkins
├── config.xml
├── failed-boot-attempts.txt
├── hudson.model.UpdateCenter.xml
├── jenkins.CLI.xml
├── jenkins.install.UpgradeWizard.state
├── jobs
├── logs
├── nodeMonitors.xml
├── nodes
├── plugins
├── queue.xml
├── queue.xml.bak
├── secret.key
├── secret.key.not-so-secret
├── secrets
├── updates
├── userContent
├── users
└── war
```


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About Jenkins's HOME

File and Folder name	Description
config.xml	All about configuration
jobs	Keep all jobs/project
plugins	Keep all plugins
nodes	Keep all nodes
logs	Keep all logs

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Change Jenkins’s HOME

For Windows

set JENKINS_HOME=<your path>

For Linux/Mac

export JENKINS_HOME=<your path>

try to restart Jenkins …

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Disable Jenkins’s security

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Set useSecurity=false

<JENKINS HOME>/config.xml

```
<?xml version='1.0' encoding='UTF-8'?>
<hudson>
  <disabledAdministrativeMonitors/>
  <version>2.89.3</version>
  <numExecutors>2</numExecutors>
  <mode>NORMAL</mode>
  <useSecurity>false</useSecurity>
  <authorizationStrategy class="hudson.secu
nceLoggedInAuthorizationStrategy">
    <denyAnonymousReadAccess>true</denyAno
  </authorizationStrategy>
```


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Learn to use Jenkins in the right way

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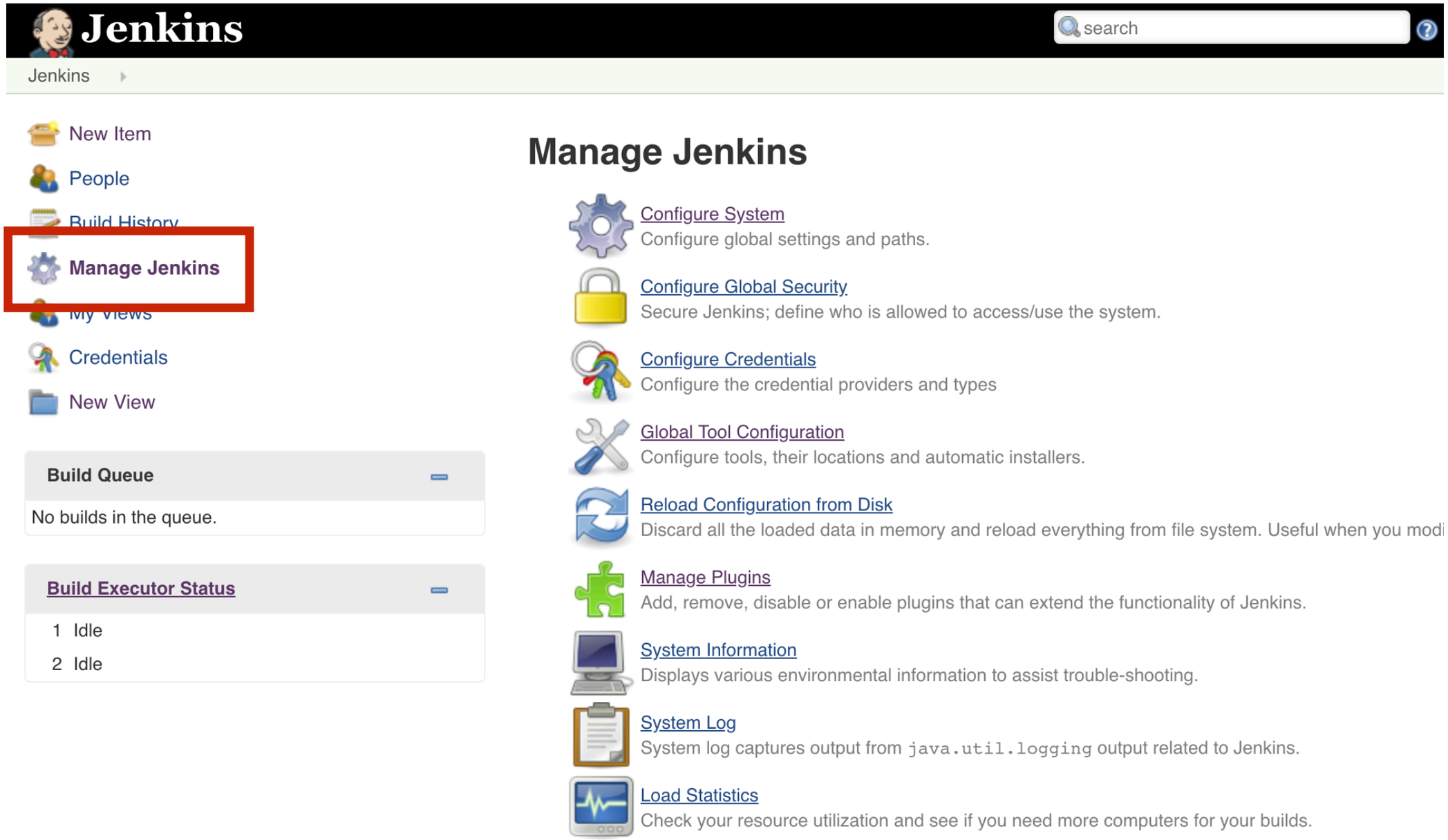
Manage Jenkins

For Administrator to config anything in Jenkins



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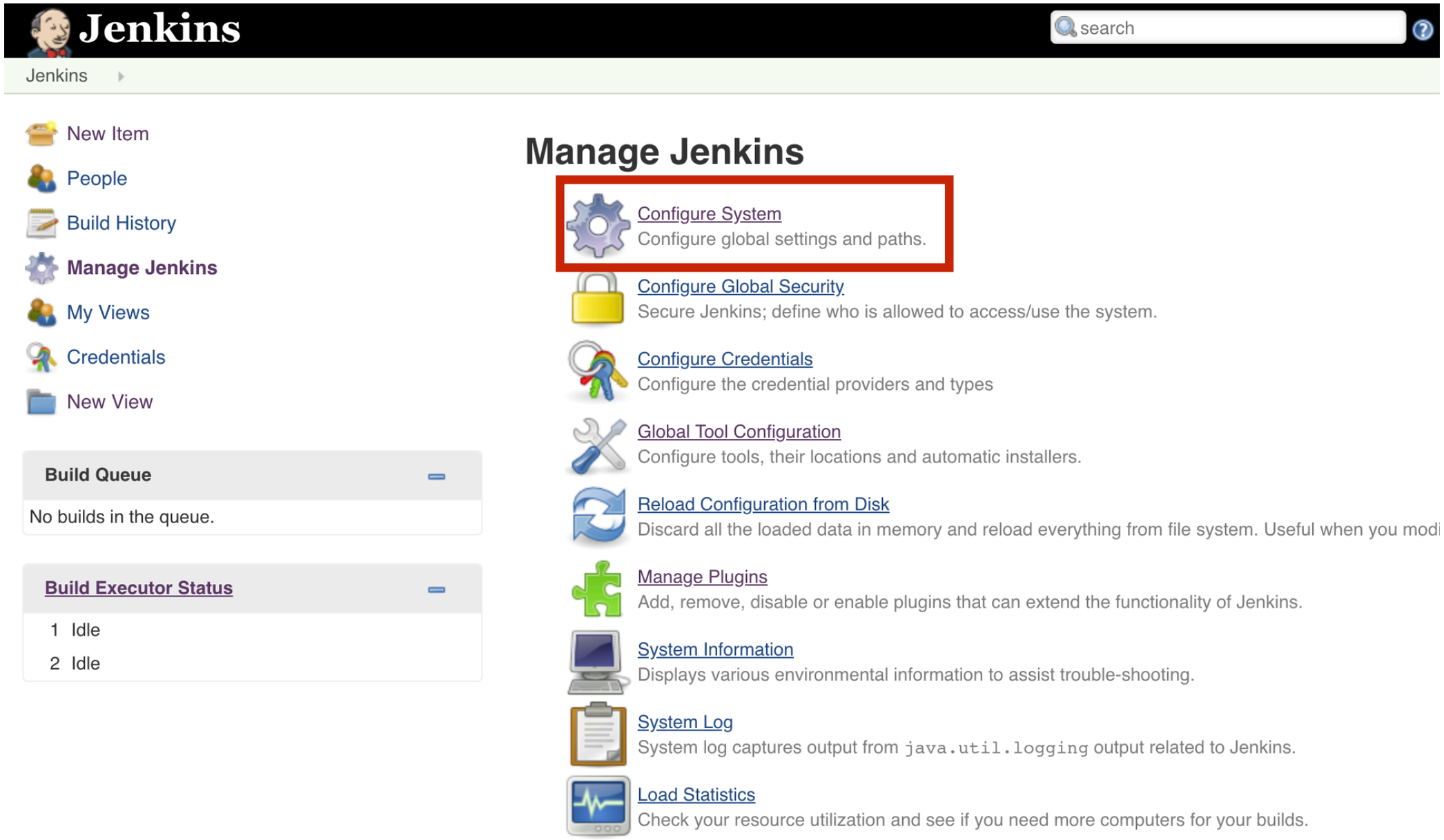
Configure System

Global setting and paths



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Configure System

JENKINS Home

# of executors

Label name of node

Environment variables

Email notification

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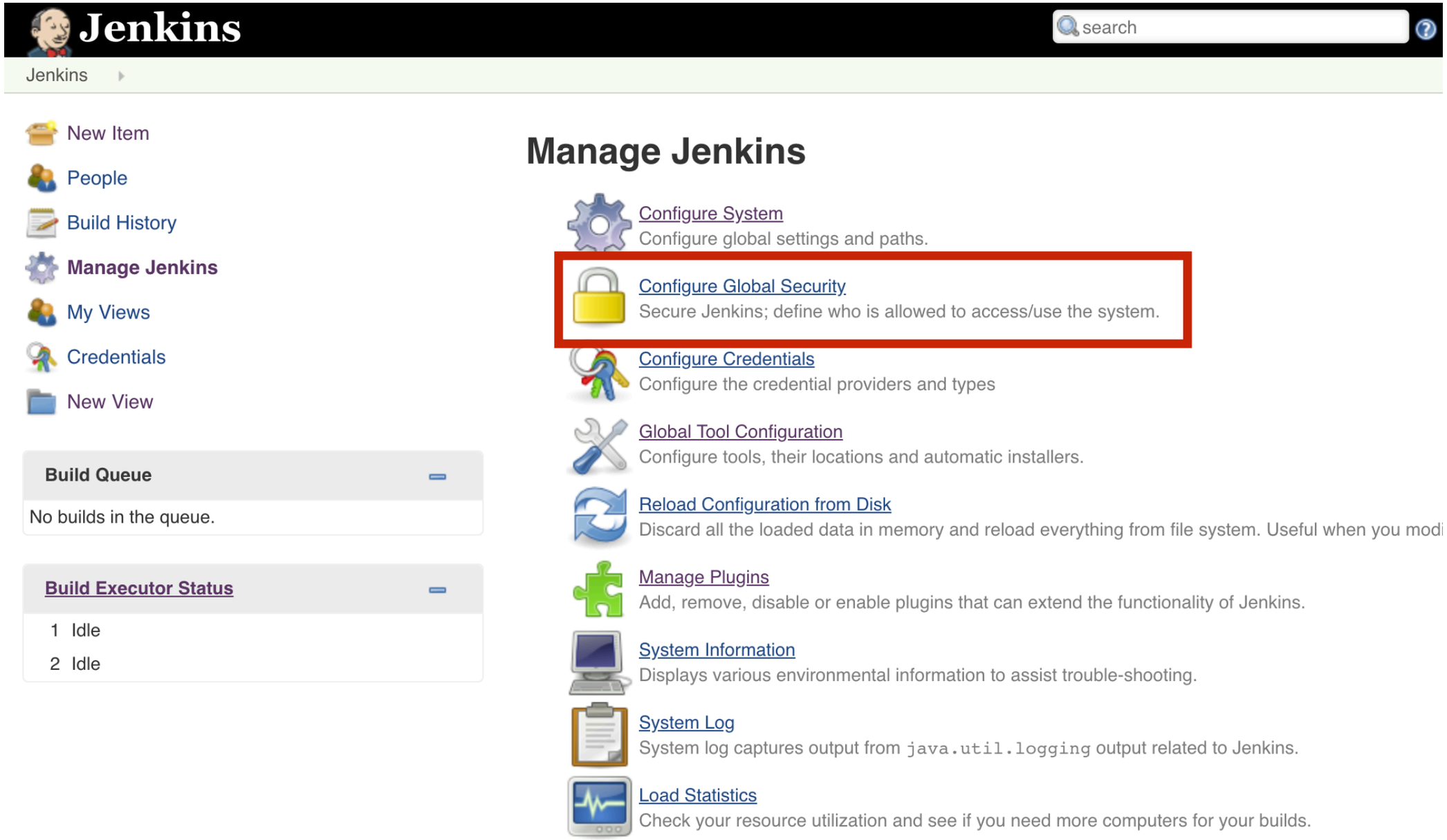
Configure Global Security

Setting for secure Jenkins



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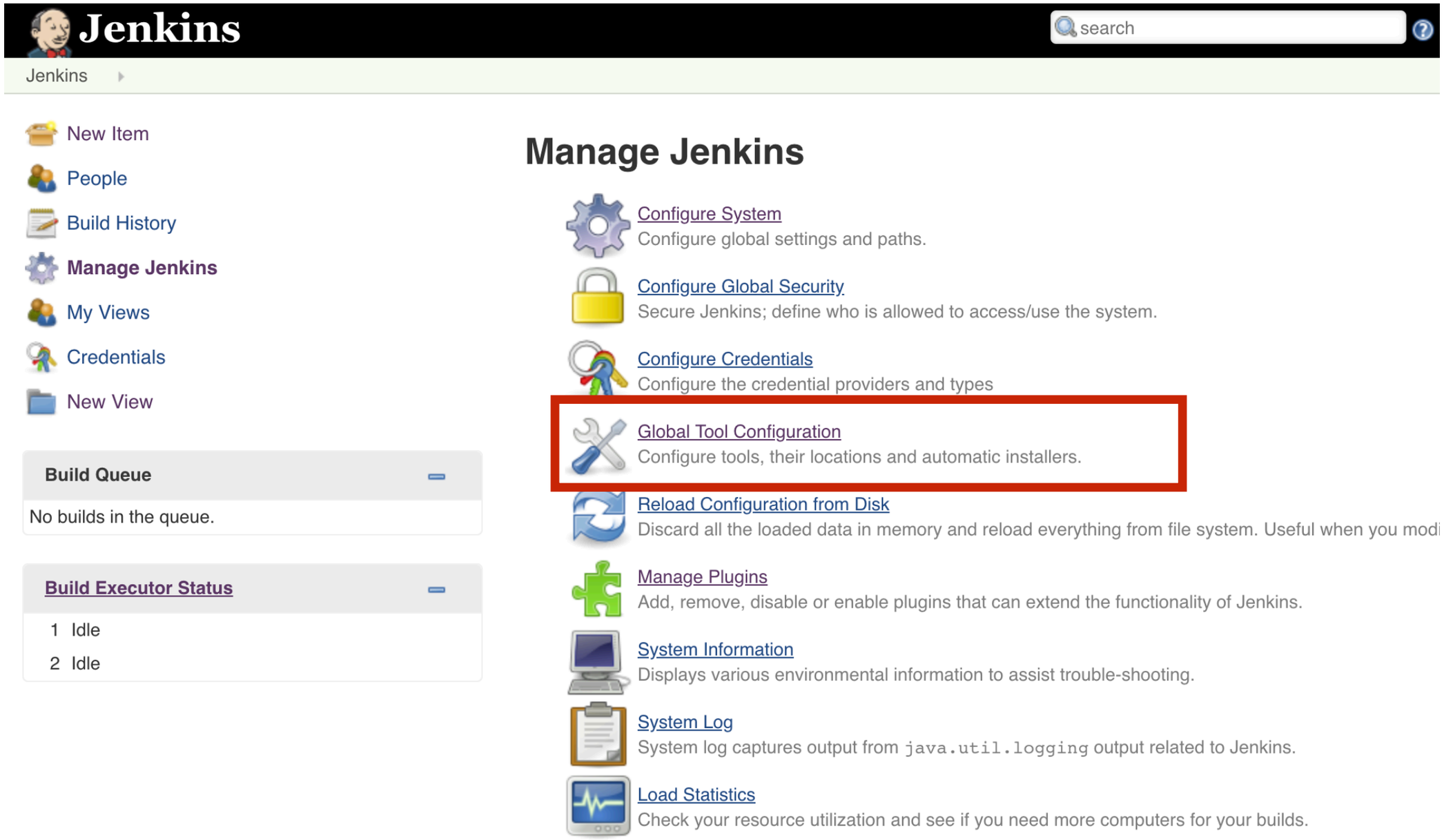
Global Tool Configuration

Config tools, location and automatic installers



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Global Tool Configuration

Apache Maven

JDK (Java Development Kit)

Git

Gradle

Docker

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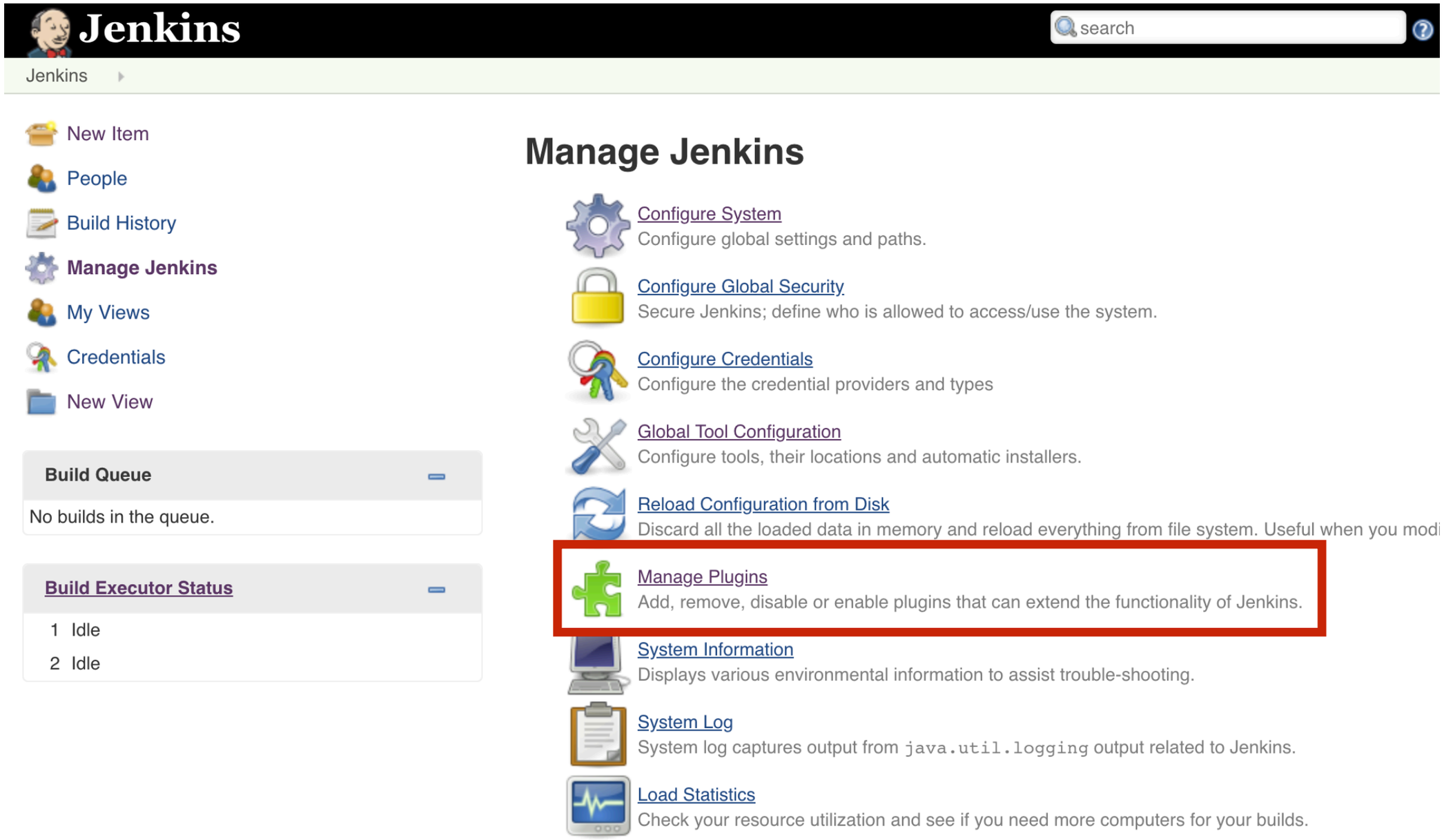
Manage Plugins

Add, remove, enable/disable plugins



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Manage Plugins

Add, remove, enable/disable plugins

Filter:

Updates | Available | Installed | Advanced

Install	Name ↓	Version	Installed
		No updates	

Update information obtained: 14 hr ago **Check now**

Select: All, None

This page lists updates to the plugins you currently use.

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Manage Plugins

Filter plugins

Filter:

Updates | Available | Installed | Advanced

Install	Name ↓	Version	Installed
		No updates	

Update information obtained: 14 hr ago **Check now**

Select: All, None

This page lists updates to the plugins you currently use.

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Finds Jenkins's plugin

https://plugins.jenkins.io/

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Try to install a first plugin

Choose Available tab and select a plugin

Filter:

Updates | **Available** | Installed | Advanced

Install ↓	Name	Version
.NET Development		
☐	CCM Plug-in This plug-in generates the trend report for CCM, an open source static code analysis program.	3.1
☐	FxCop Runner plugin	1.1
☐	MSBuild Plugin	1.27
☐	MSTest plugin Generates test reports for MSTest.	0.19
☐	MSTestRunner plugin	1.3.0
☐	NAnt Plugin	1.4.3
☐	NCover plugin	0.3
☐	PowerShell plugin	1.3
☐	Violation Comments to Bitbucket Server Plugin Finds violations reported by code analyzers and comments Bitbucket Server (or Stash) pull requests (or commits) with them.	1.50
☐	Violations plugin	0.7.11

Install without restart | Download now and install after restart | Update information obtained: 9 hr 37 min ago | Check now

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Manage Nodes

Add, remove, status of nodes

Jenkins

search | Somkiat Puisungnoen | log out

Jenkins ▸ Nodes ▸ ENABLE AUTO REFRESH

- Back to Dashboard
- Manage Jenkins
- New Node
- Configure

S	Name ↓	Architecture	Clock Difference	Free Disk Space	Free Swap Space	Free Temp Space	Response Time
	master	Mac OS X (x86_64)	In sync	5.73 GB	463.00 MB	5.73 GB	0ms
	Data obtained	36 min	36 min	36 min	36 min	36 min	36 min

Refresh status

Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

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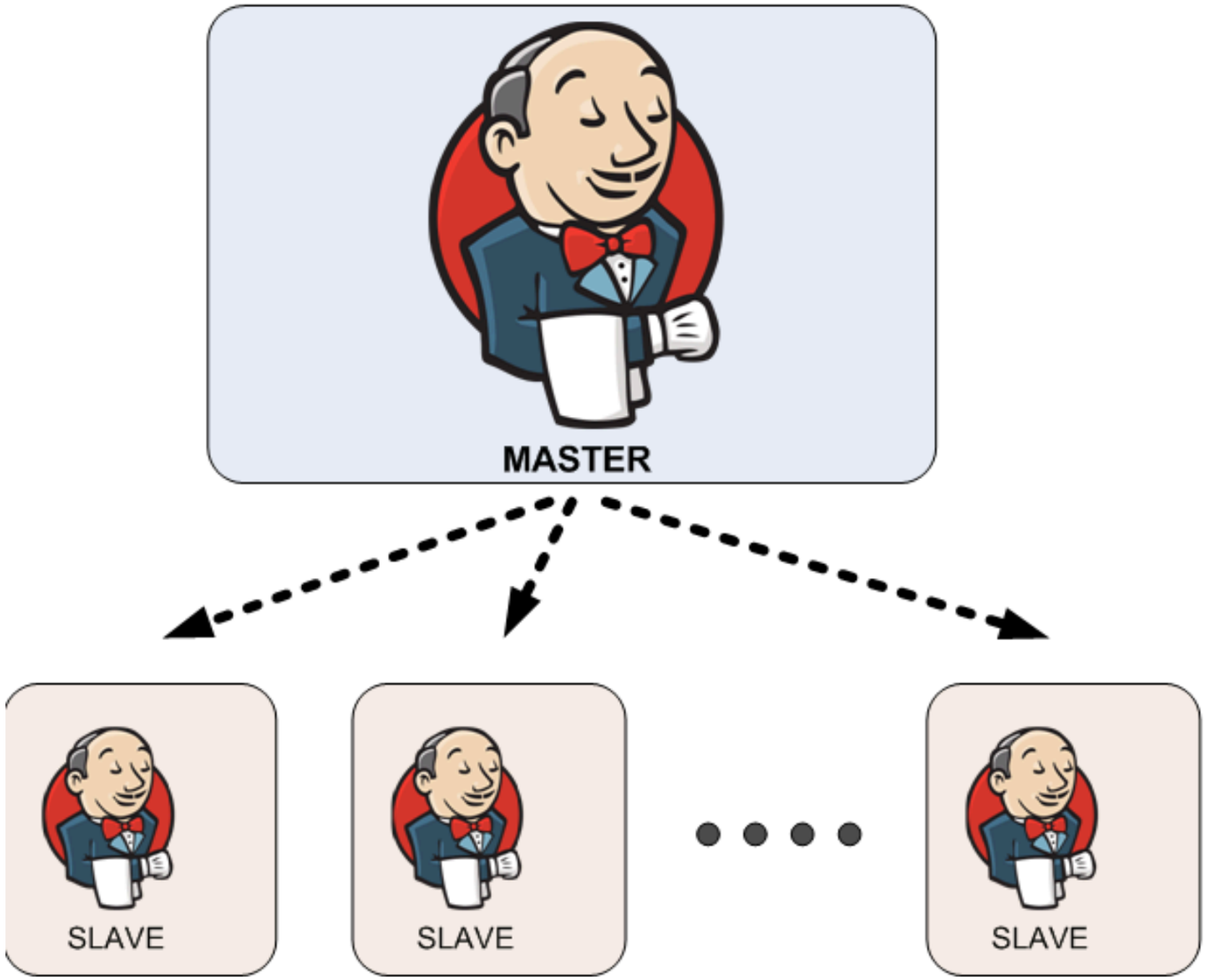
Manage Nodes

Master-slave concept to scale Jenkins



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Create a first Job

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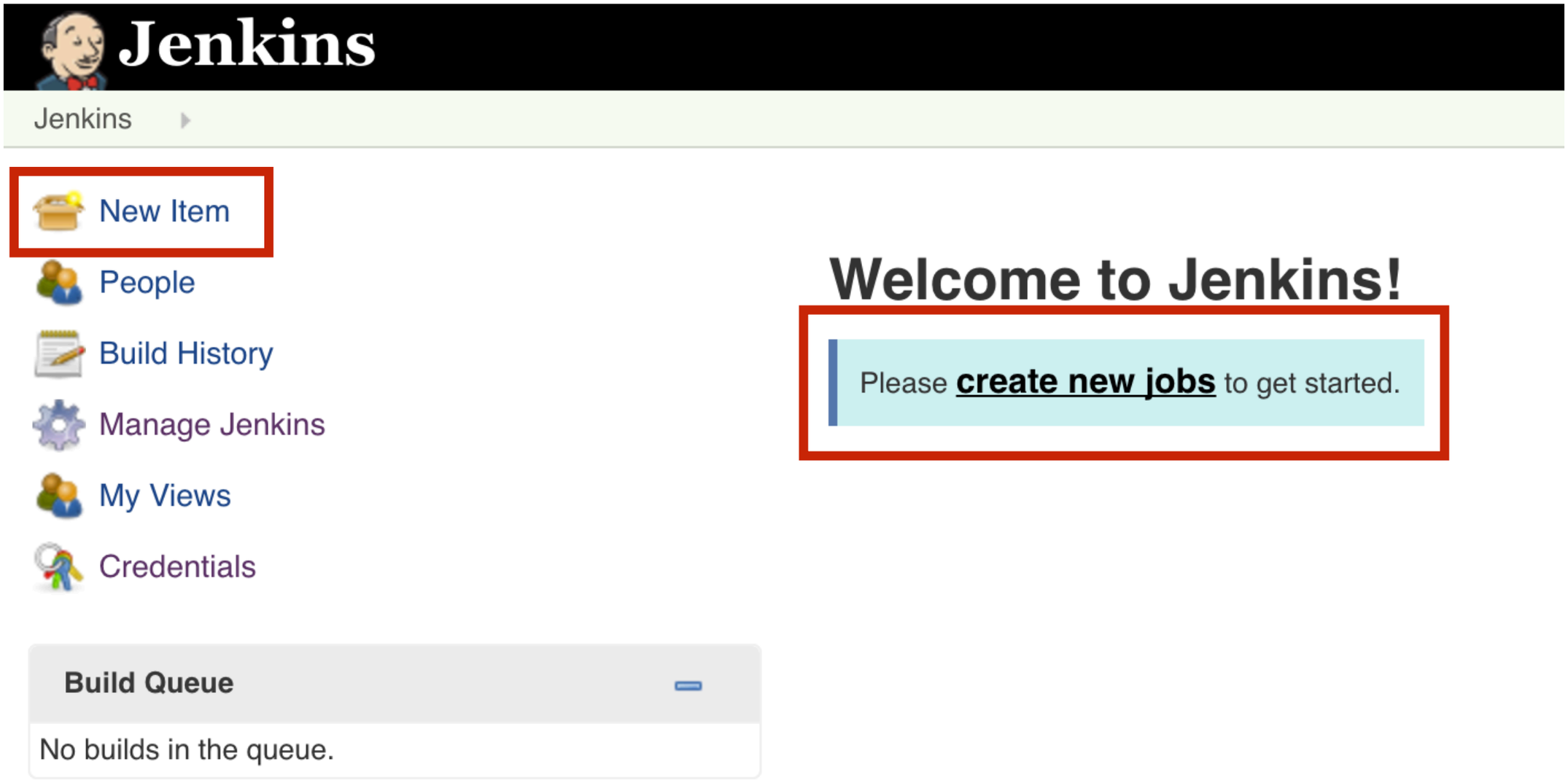
1. Create a new job



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2. Fill in a job name

Enter an item name

hello

» *Required field*

Freestyle project

This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Pipeline

Orchestrates long-running activities that can span multiple build slaves. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

External Job

This type of job allows you to record the execution of a process run outside Jenkins, even on a remote machine. This is designed so that you can use Jenkins as a dashboard of your existing automation system.

Multi-configuration project

Suitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

OK

older

reates a container that stores nested items in it. Useful for grouping things together. Unlike view, which is just a filter, a folder creates a separate namespace, so you can have multiple things of the same name as long as they are in different folders.

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3. Choose type of job

Enter an item name

hello

» *Required field*

Freestyle project

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Enter an item name

hello

» *Required field*

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OK

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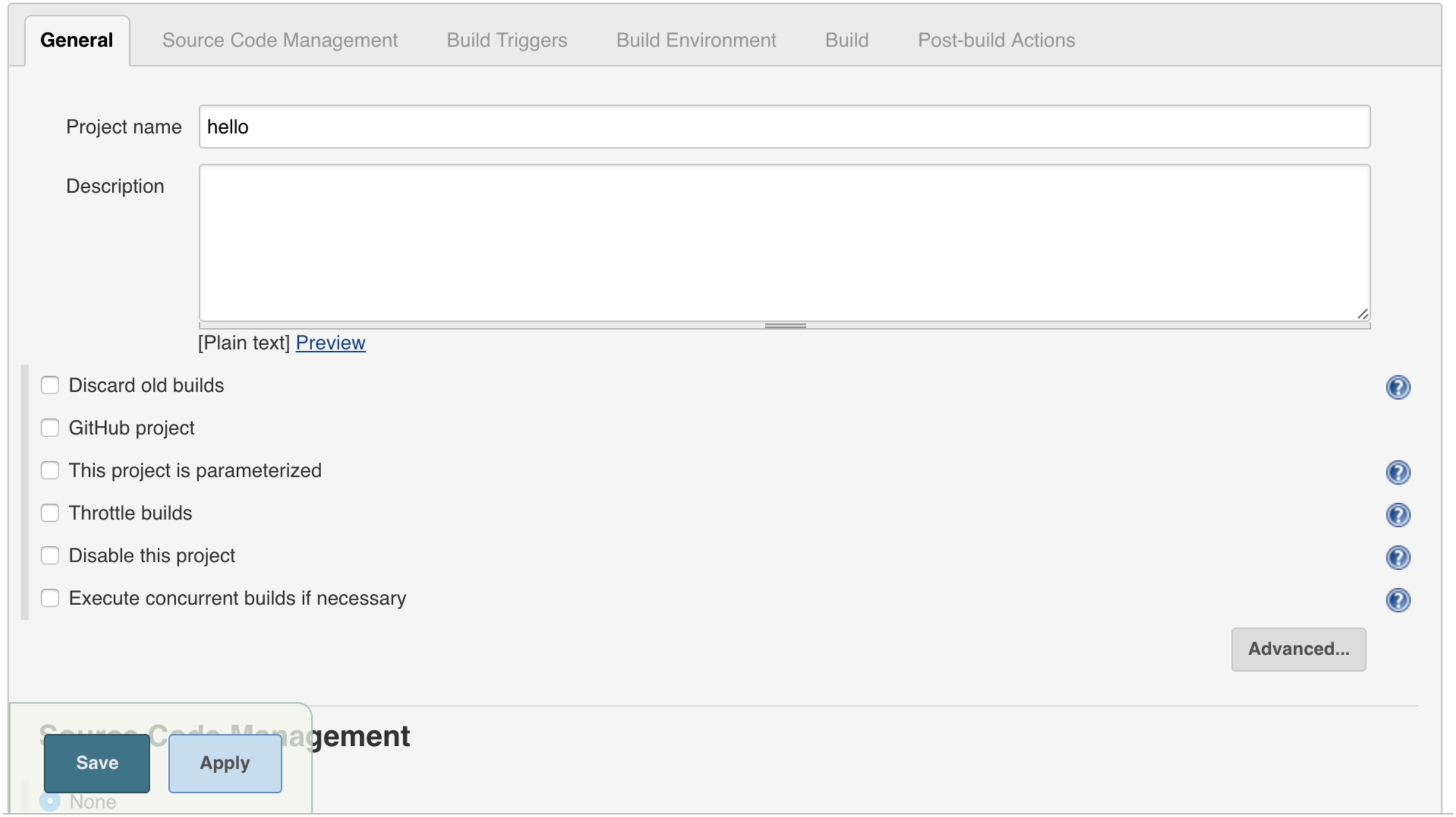
4. General section



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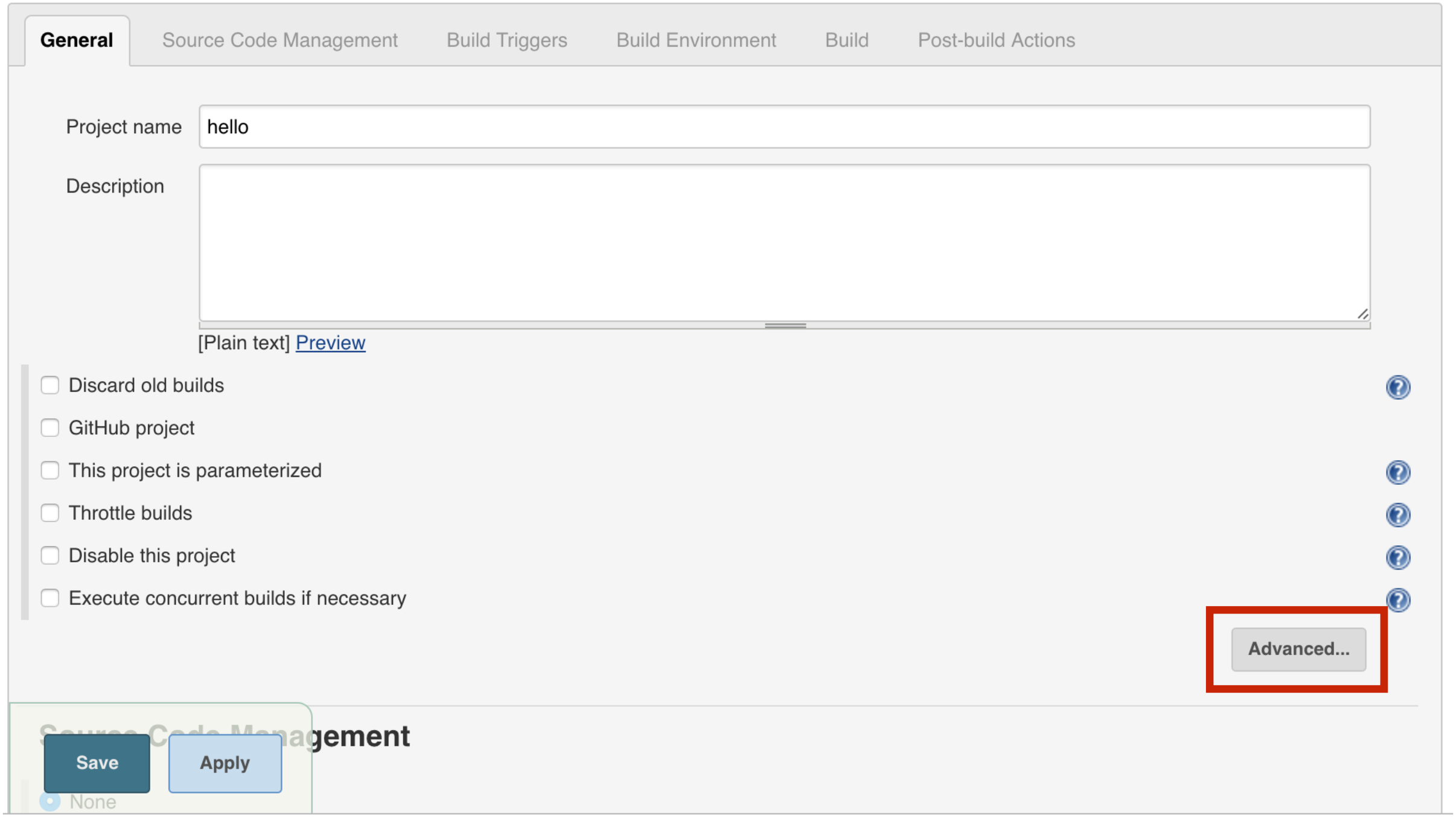
4.1 Advanced options



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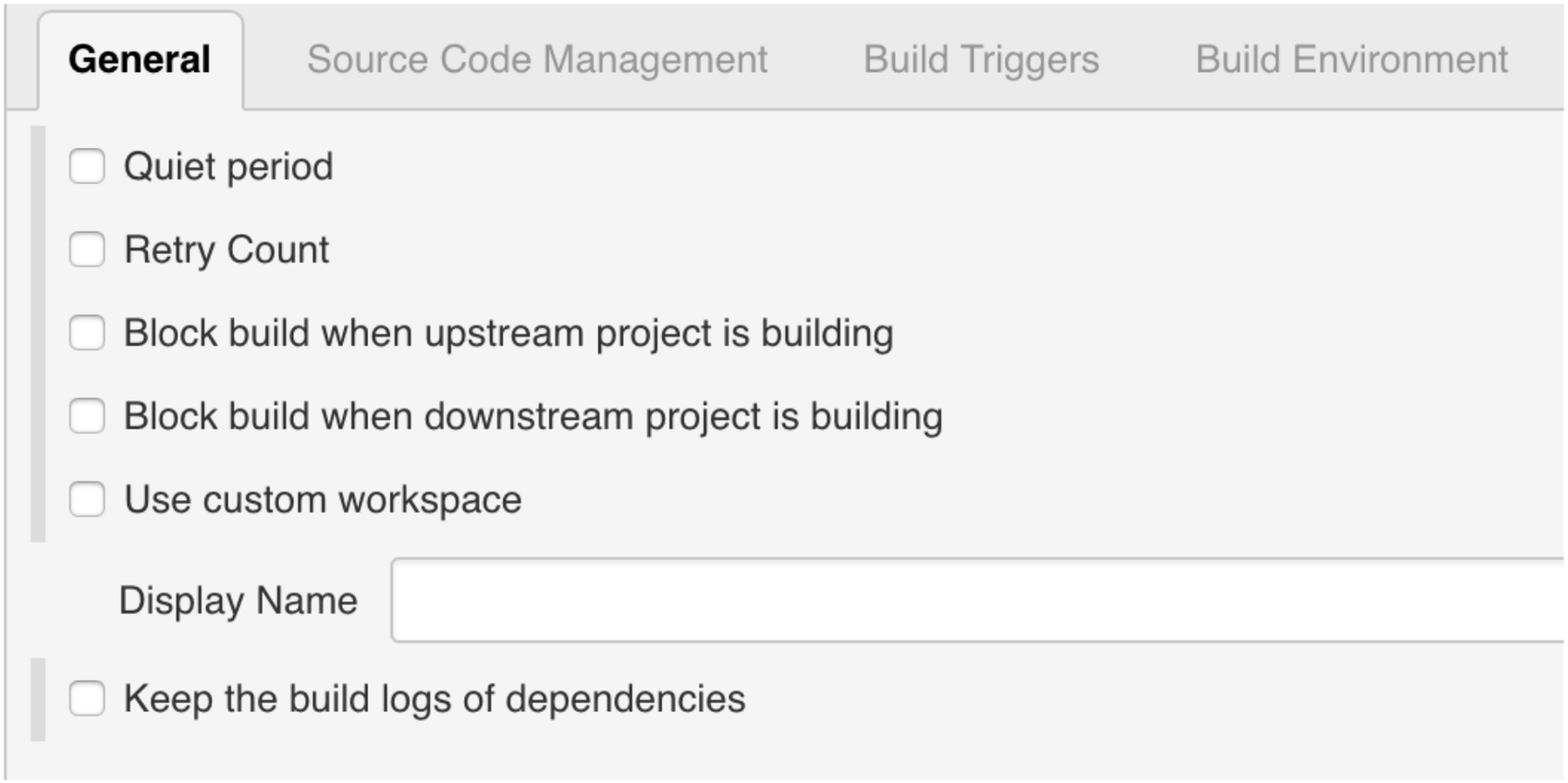
4.1 Advanced options



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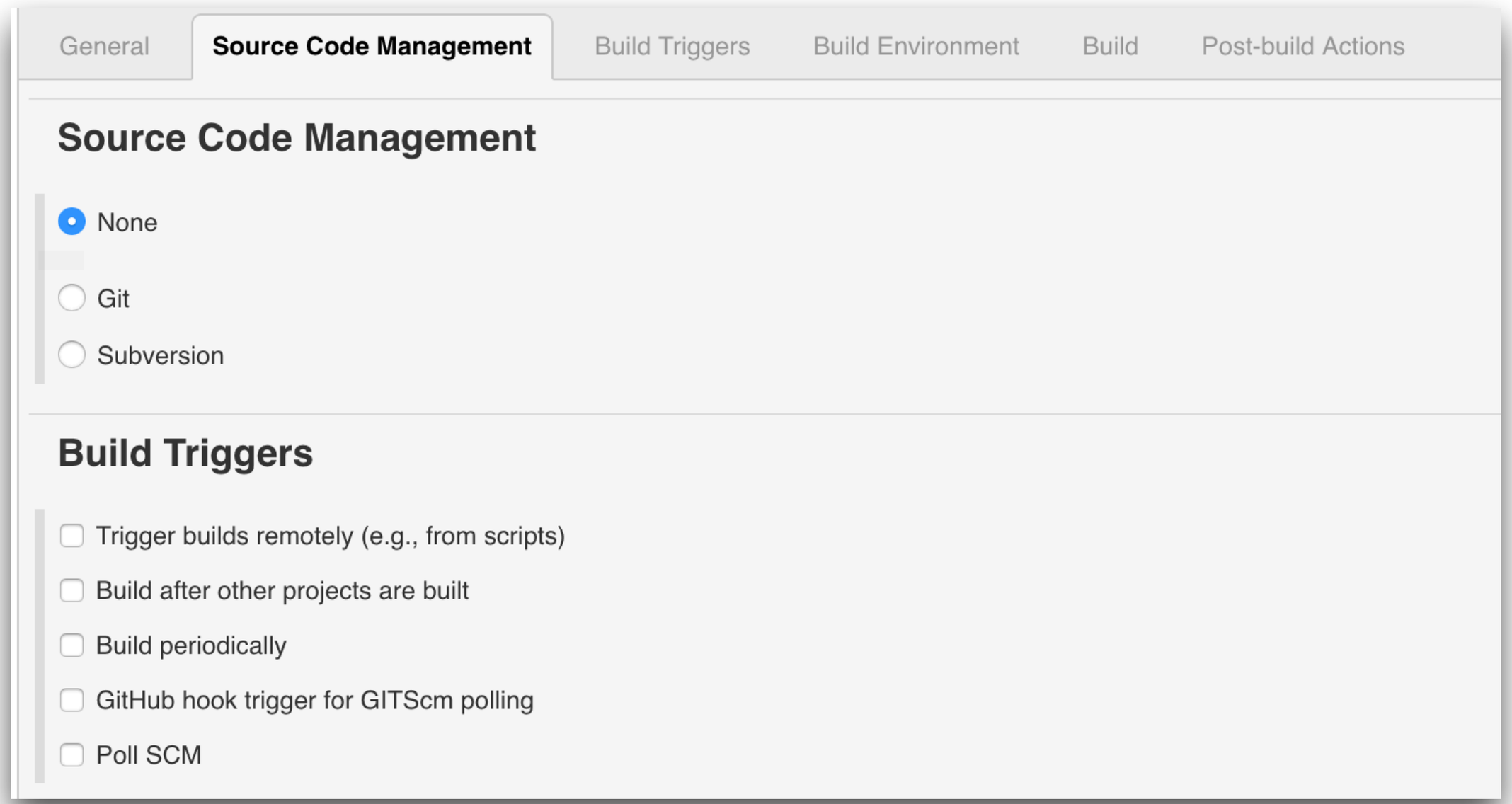
5. Source code management

By default is Git and Subversion



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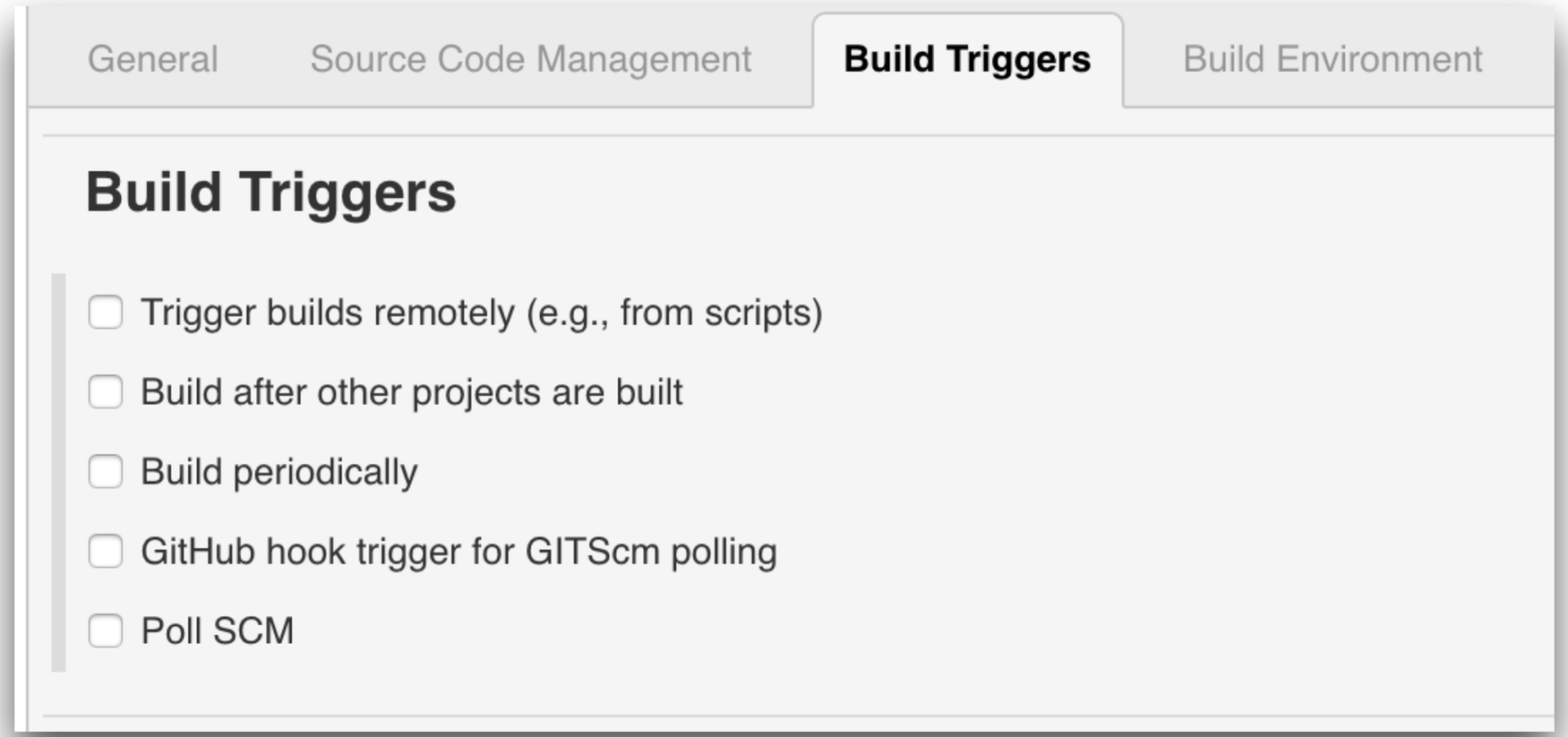
6. Build trigger

When to run this job



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6.1 Periodically

General | Source Code Management | **Build Triggers** | Build Environment | Build | Post-build Actions

Build Triggers

- [ ] Trigger builds remotely (e.g., from scripts)
- [ ] Build after other projects are built
- [x] Build periodically

Schedule

```
H 23 * * *
```

⚠ No schedules so will never run

- [ ] GitHub hook trigger for GITScm polling
- [ ] Poll SCM

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6.2 Poll SCM

Poll SCM

Schedule

No schedules so will only run due to SCM changes if triggered by a post-commit hook

This field follows the syntax of cron (with minor differences). Specifically, each line consists of 5 fields separated by TAB or whitespace:

```
MINUTE HOUR DOM MONTH DOW
```

MINUTE	Minutes within the hour (0–59)
HOUR	The hour of the day (0–23)
DOM	The day of the month (1–31)
MONTH	The month (1–12)
DOW	The day of the week (0–7) where 0 and 7 are Sunday.

To specify multiple values for one field, the following operators are available. In the order of precedence,

- `*` specifies all valid values
- `M-N` specifies a range of values
- `M-N/X` or `*/X` steps by intervals of X through the specified range or whole valid range
- `A,B,...,Z` enumerates multiple values

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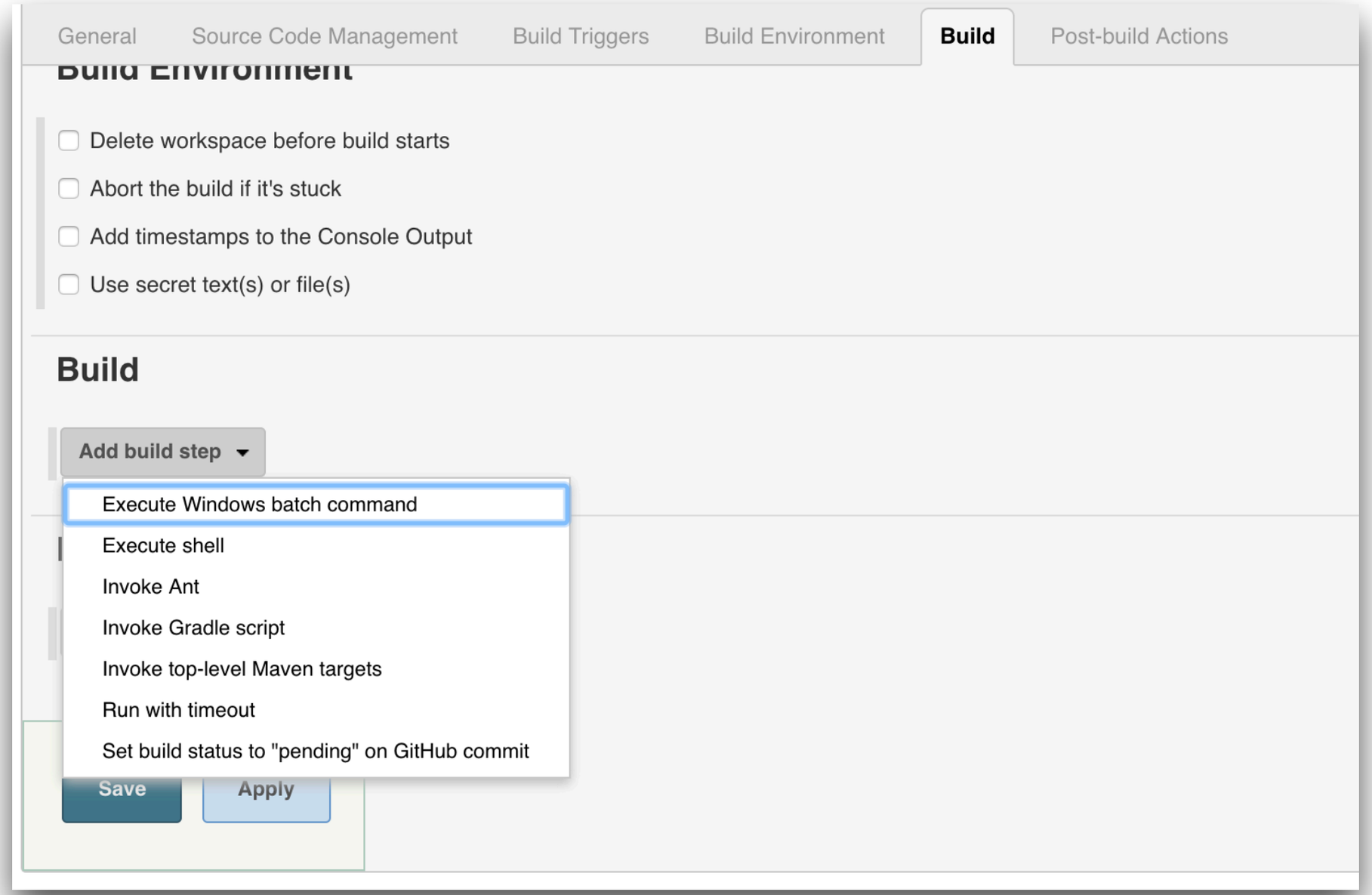
7. Add build step

What to run this job



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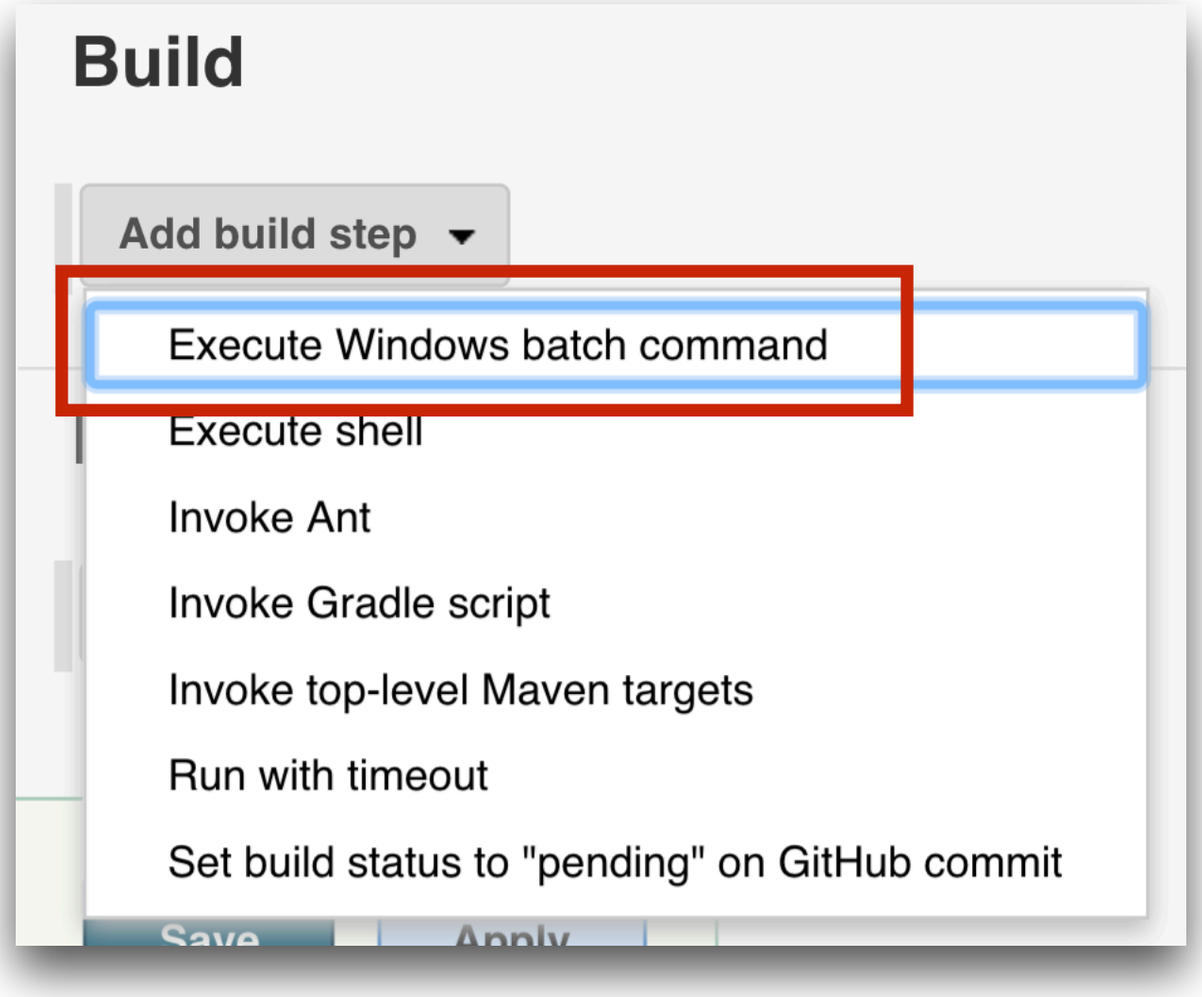
7.1 For Windows



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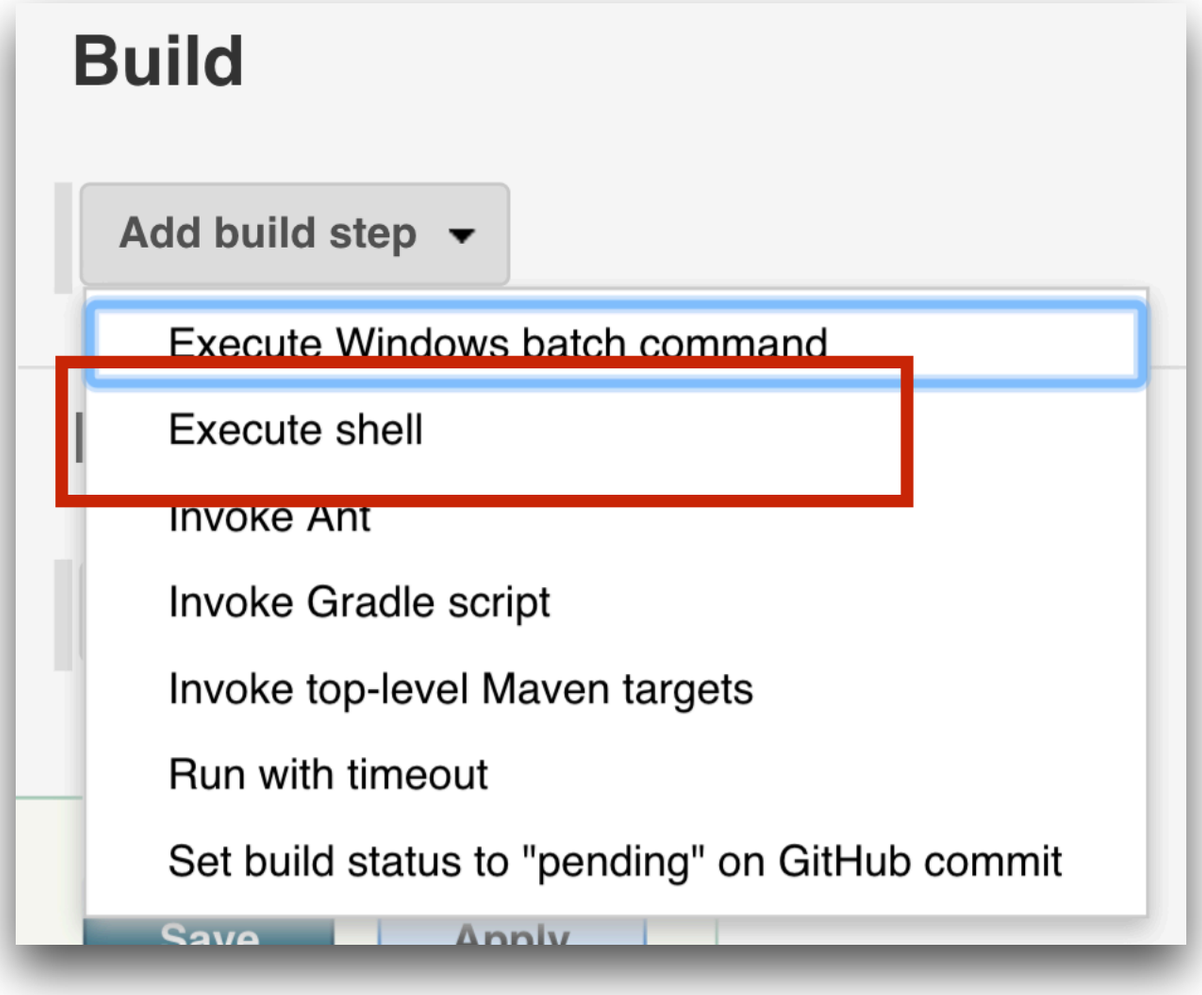
7.2 For Linux/Mac



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8. Post build actions

Generate reports

Send email

Run other jobs/projects

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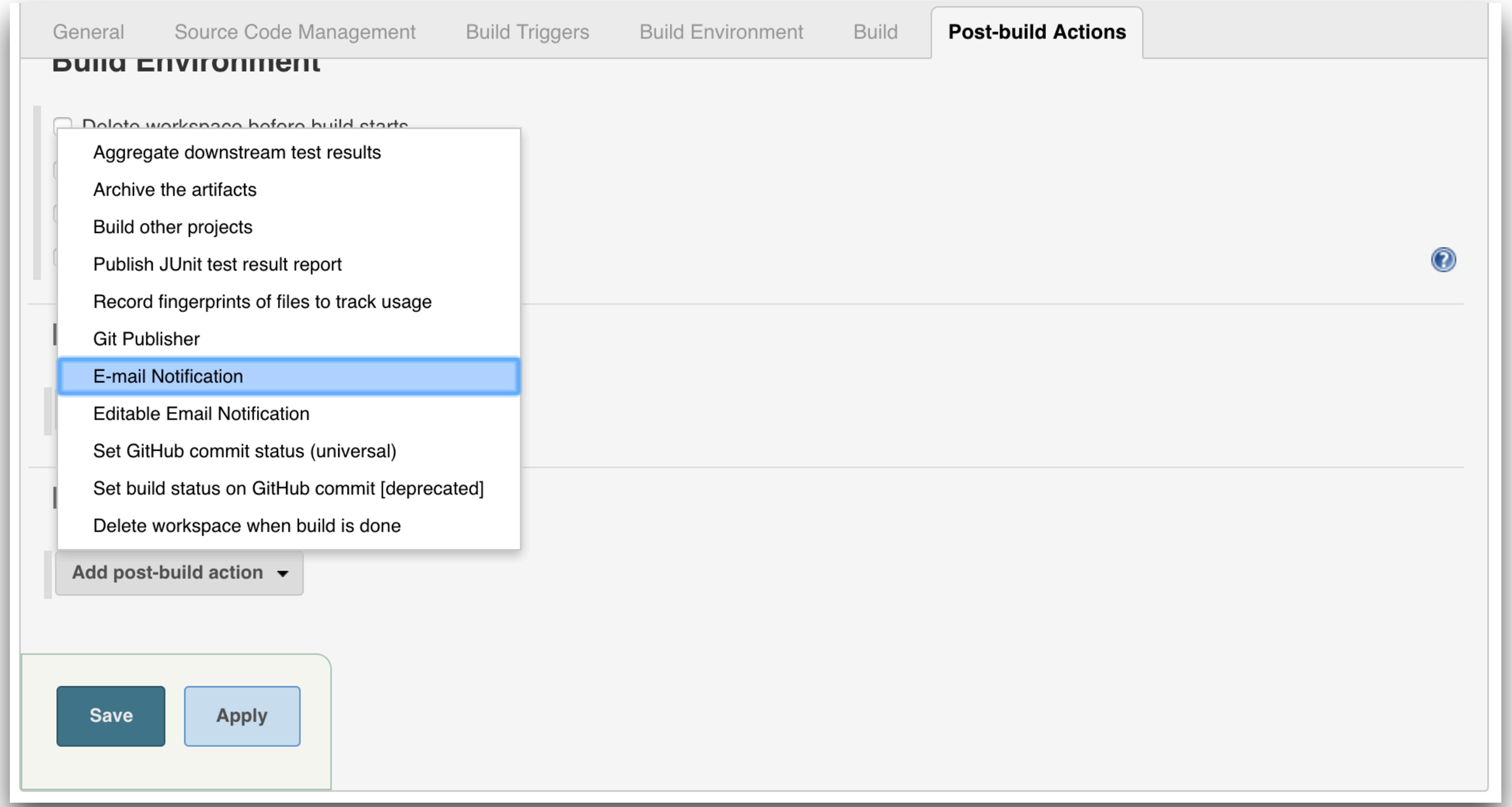
8. Post build actions



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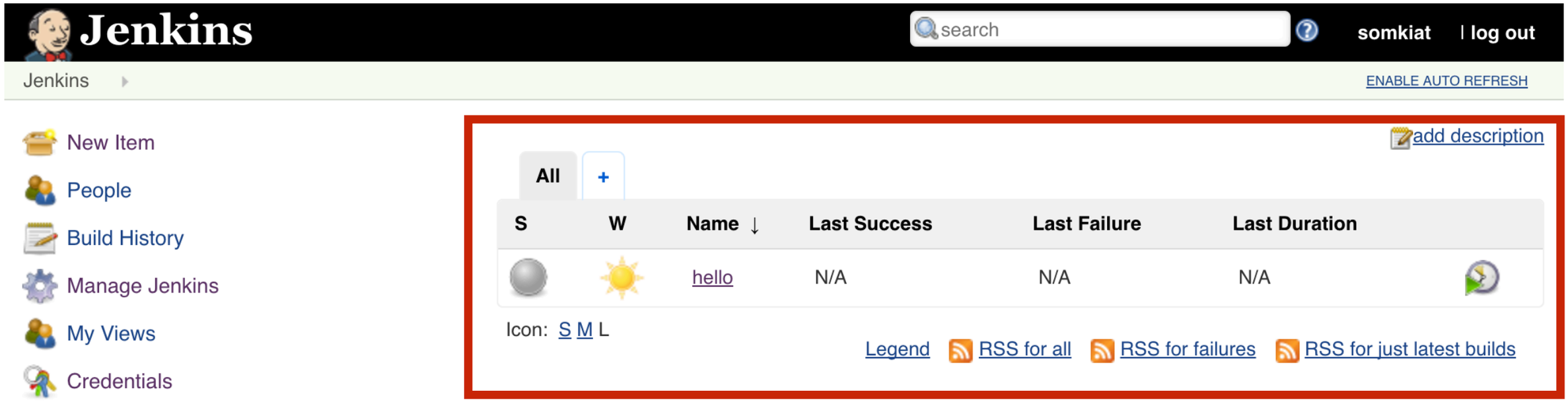
9. Run your job

Manual and Scheduler run



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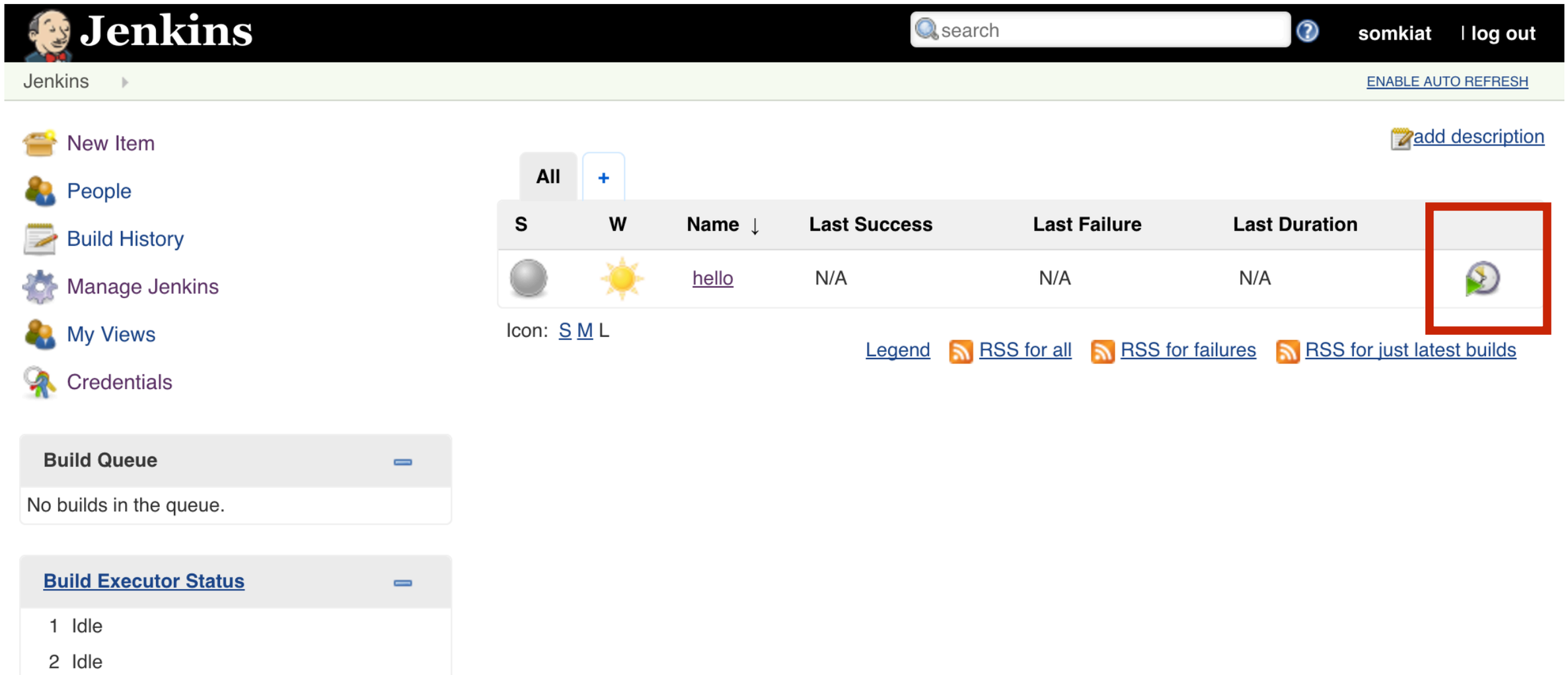
9. Run your job

Start build your job



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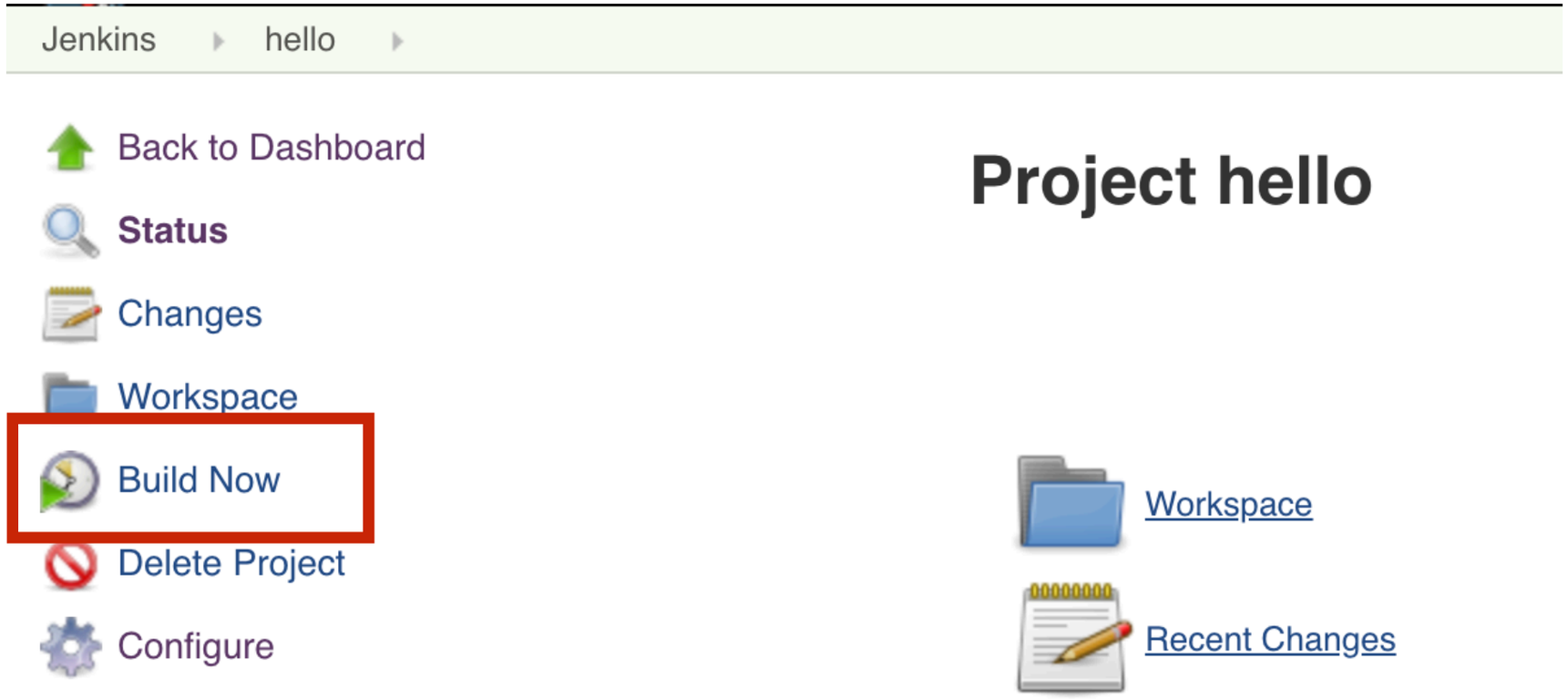
9. Run your job

Start build your job



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9. Run your job

See your job's output

Jenkins ▸ hello ▸ #1

- Back to Project
- Status
- Changes
- **Console Output**
  - View as plain text
- Edit Build Information
- Delete Build
- Next Build

Console Output

```
Started by user Somkiat Puisungnoen
Building in workspace /Users/somkiat/Downloads/set/workspace/hello
Finished: SUCCESS
```


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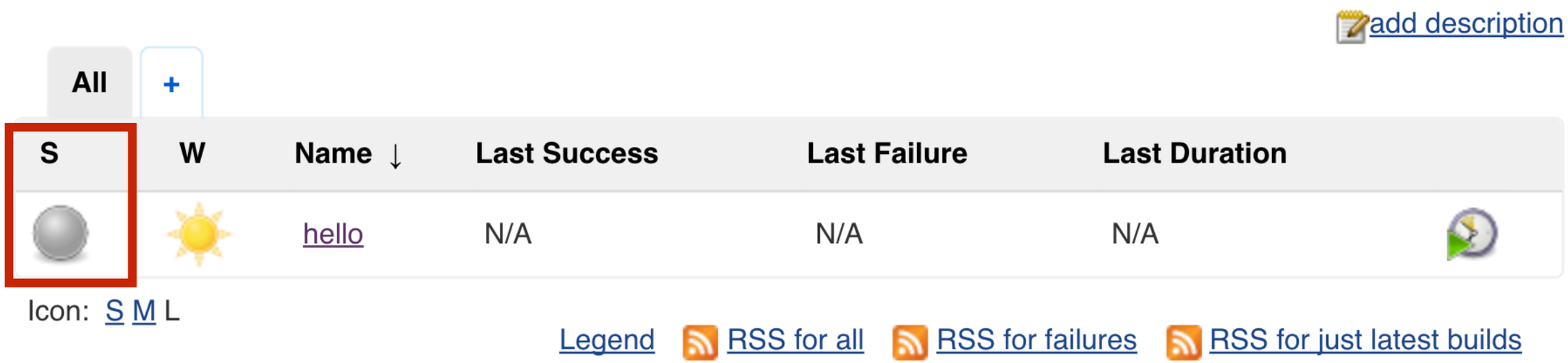
10. See job's status

By default is Blue, Red and Gray



Blue = build success

Red = build failure

Gray = disabled/never executed

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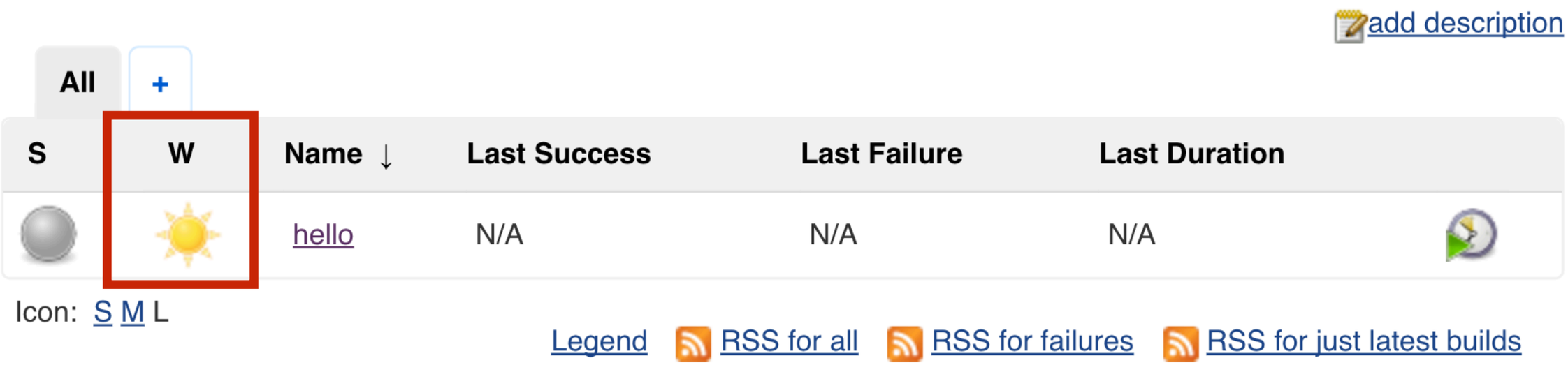
11. See job's health



Sunny = 100% success rate
Cloudy = 60% success rate
Raining = 40% success rate

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Let’s workshop

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Jenkins driven by Plugins !!

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Working with Pipeline as a Code

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Pipeline as a Code

Declarative Pipeline

Scripted Pipeline

https://jenkins.io/doc/book/pipeline/

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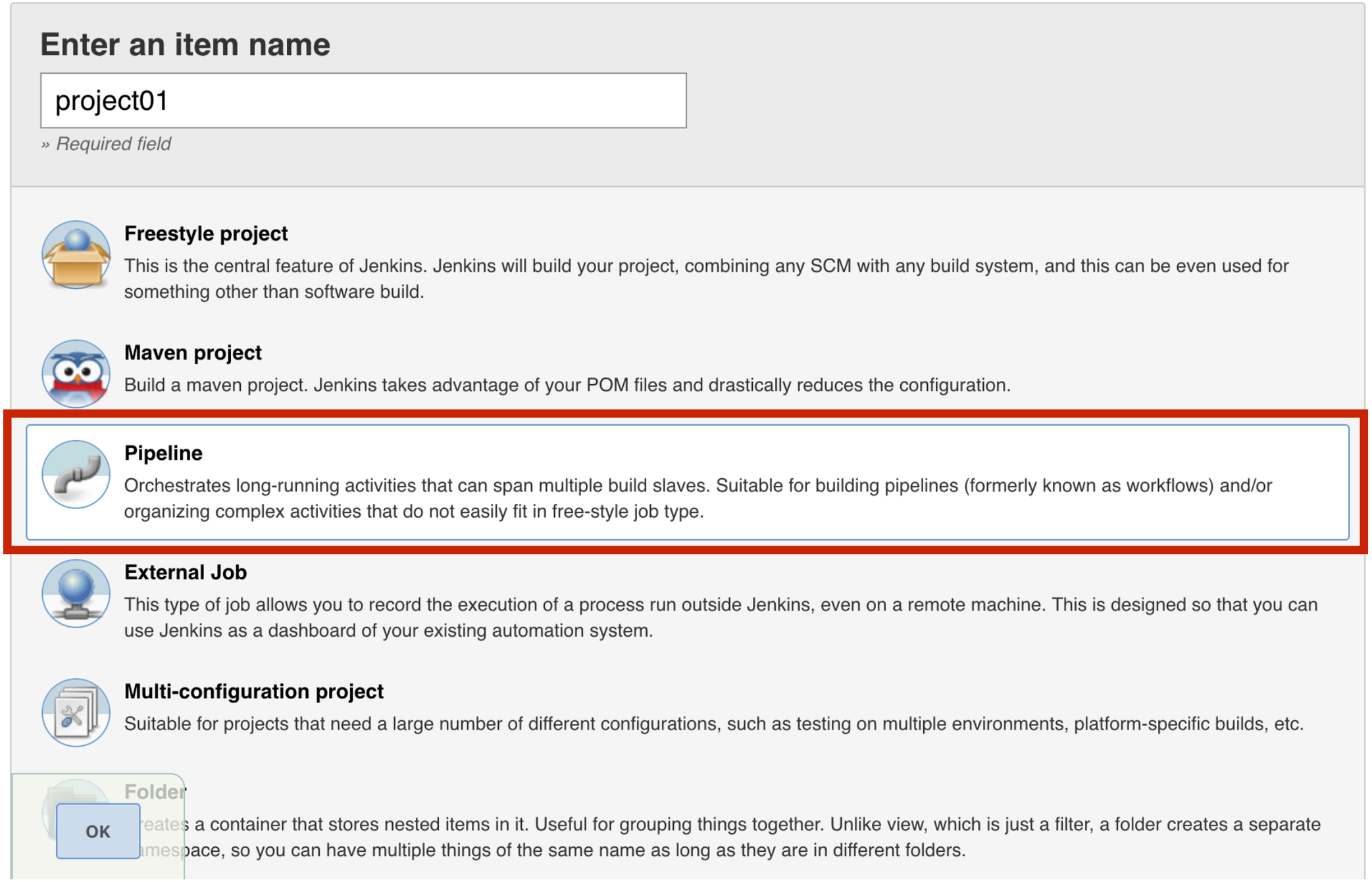
Create a new job with pipeline



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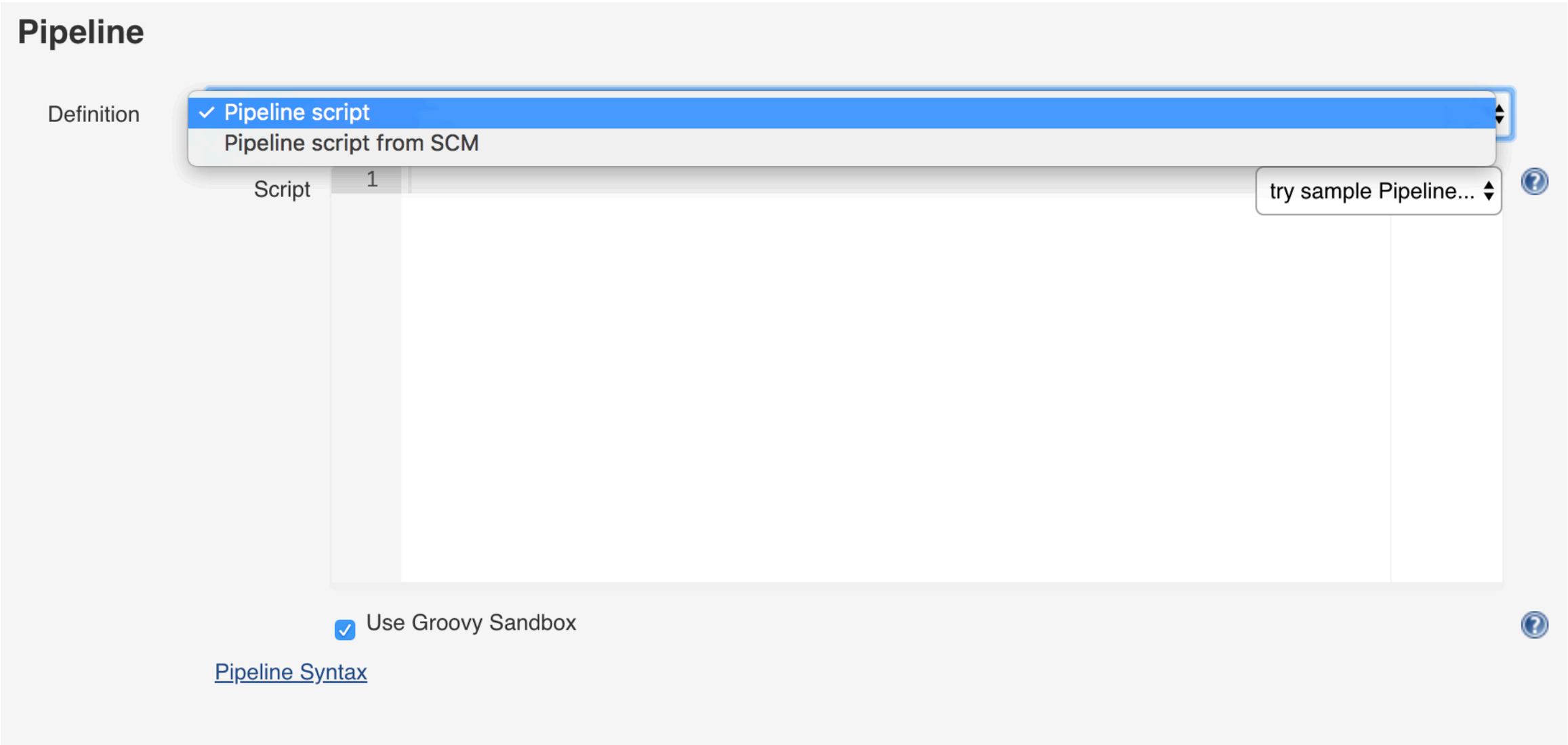
Write your pipeline

Pipeline script or from .Jenkinsfile



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Pipeline syntax

Jenkins

search

Jenkins ▸ xxxx ▸ Pipeline Syntax

- Back
- **Snippet Generator**
- Declarative Directive Generator
- Declarative Online Documentation
- Steps Reference
- Global Variables Reference
- Online Documentation
- IntelliJ IDEA GDSL

Overview

This **Snippet Generator** will help you learn the Pipeline Script code which can be used to define various steps. Pick a step you are interested in from the list, configure it, click **Generate Pipeline Script**, and you will see a Pipeline Script statement that would call the step with that configuration. You may copy and paste the whole statement into your script, or pick up just the options you care about. (Most parameters are optional and can be omitted in your script, leaving them at default values.)

Steps

Sample Step: archiveArtifacts: Archive the artifacts

Files to archive

Advanced...

Generate Pipeline Script

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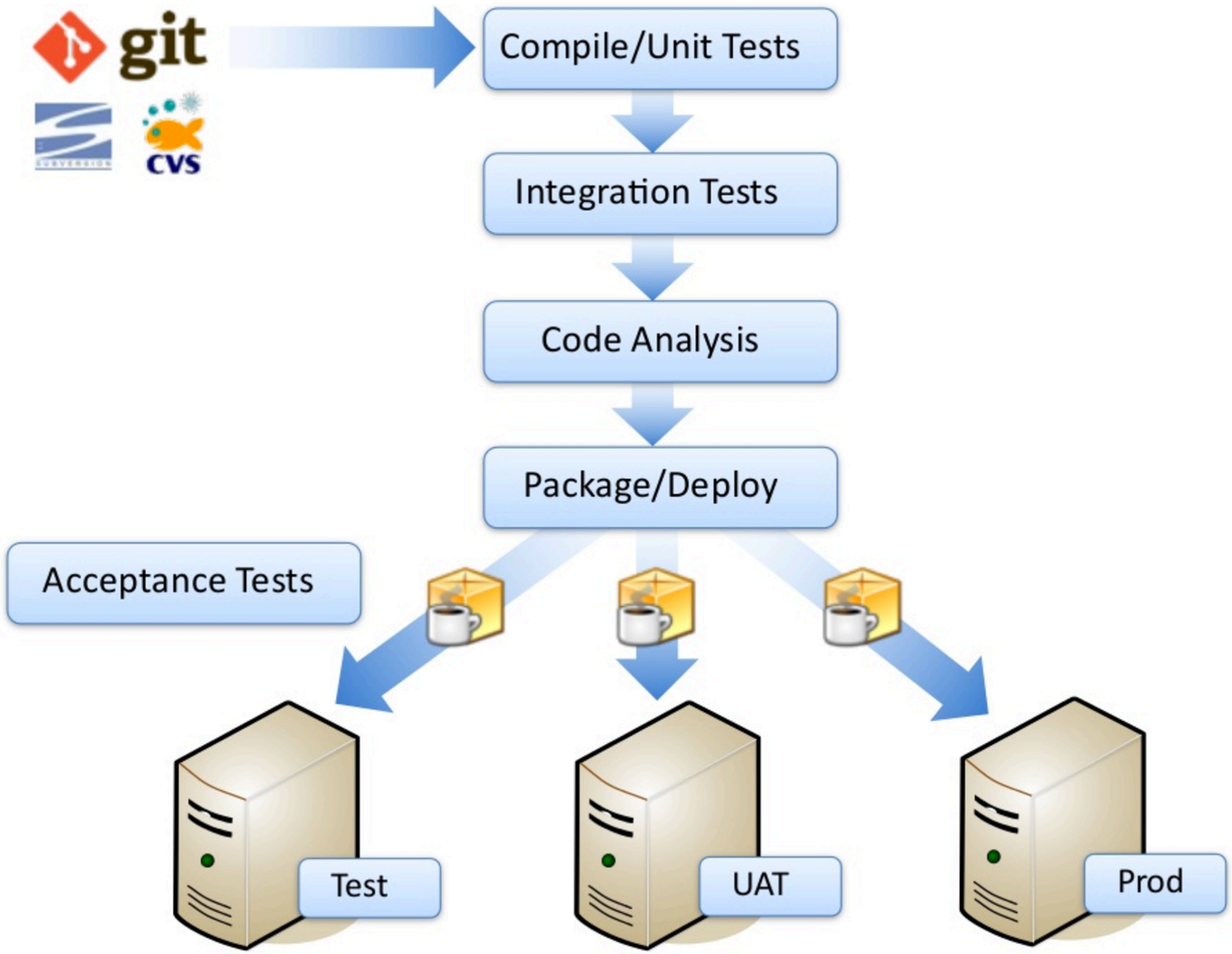
Build pipeline



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Create pipeline as code

```
node {
    stage('Pullcode') {
        git 'https://github.com/up1/workshop-java-web-tdd.git'
    }
    stage('Testing') {
        sh "mvn clean test"
        junit 'target/surefire-reports/*.xml'
    }
    stage('Package') {
        sh "mvn package"
    }
    stage('Code coverage') {
        cobertura autoUpdateHealth: false, autoUpdateStability: false
    }
}
```


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Result

	Declarative: Checkout SCM	Pullcode	Testing	Package	Code coverage	Declarative: Post Actions
Average stage times: (Average full run time: ~33s)	2s	1s	7s	15s	55ms	33ms
#18 Feb 08 00:34 — 5 commits	2s	1s	7s	15s	55ms	33ms
#17 Feb 08 00:33 — No Changes						

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Jenkinsfile

```
pipeline {
     agent any
     stages {
       stage('Pullcode') {
         steps {
             git 'https://github.com/up1/workshop-java-web-tdd.git'
         }
       }
       stage('Testing') {
          steps {
            sh "mvn clean test"
            junit 'target/surefire-reports/*.xml'
          }
        }
```


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Jenkinsfile

```
stage('Package') {
  steps {
    sh "mvn package"
  }
}
stage('Code coverage') {
  steps {
      cobertura autoUpdateHealth: false, autoUpdateStability: fa
    }
  }
}
post {
  always {
      junit 'target/surefire-reports/*.xml'
  }
}
```


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Jenkins Best Practices

https://wiki.jenkins.io/display/JENKINS/Jenkins+Best+Practices

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Jenkins Best Practices

Always secure Jenkins

In large system, don’t build on the master

Backup JENKINS_HOME regularly

Limit project name to the sane character set

https://wiki.jenkins.io/display/JENKINS/Administering+Jenkins

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Jenkins Best Practices

Always config your job to generate report
Archive unused jobs before removing them
Setting difference job for each branch
Prevent resource collisions in job (parallel)
Fail fast

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Version Control System

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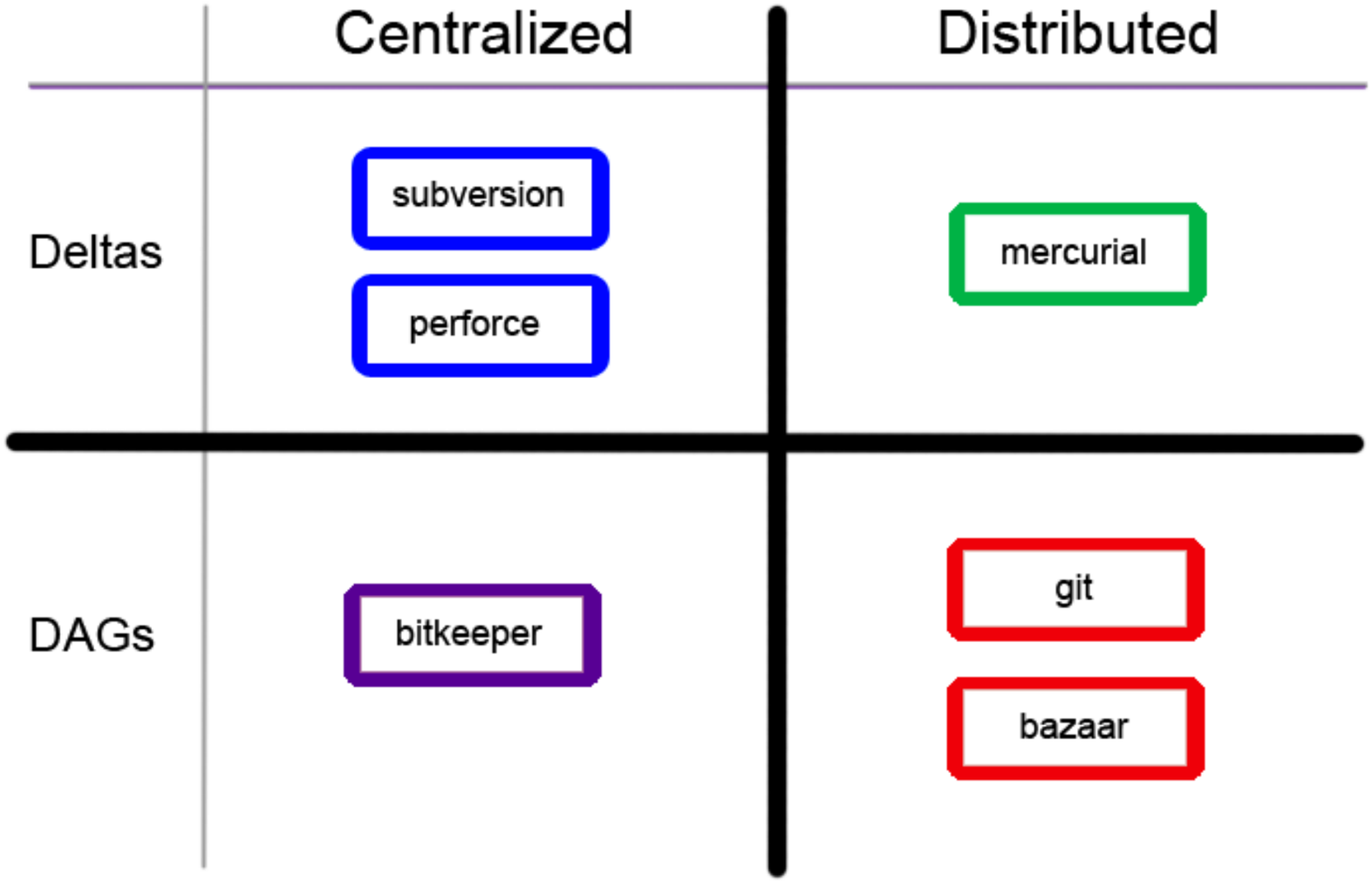
Version Control System



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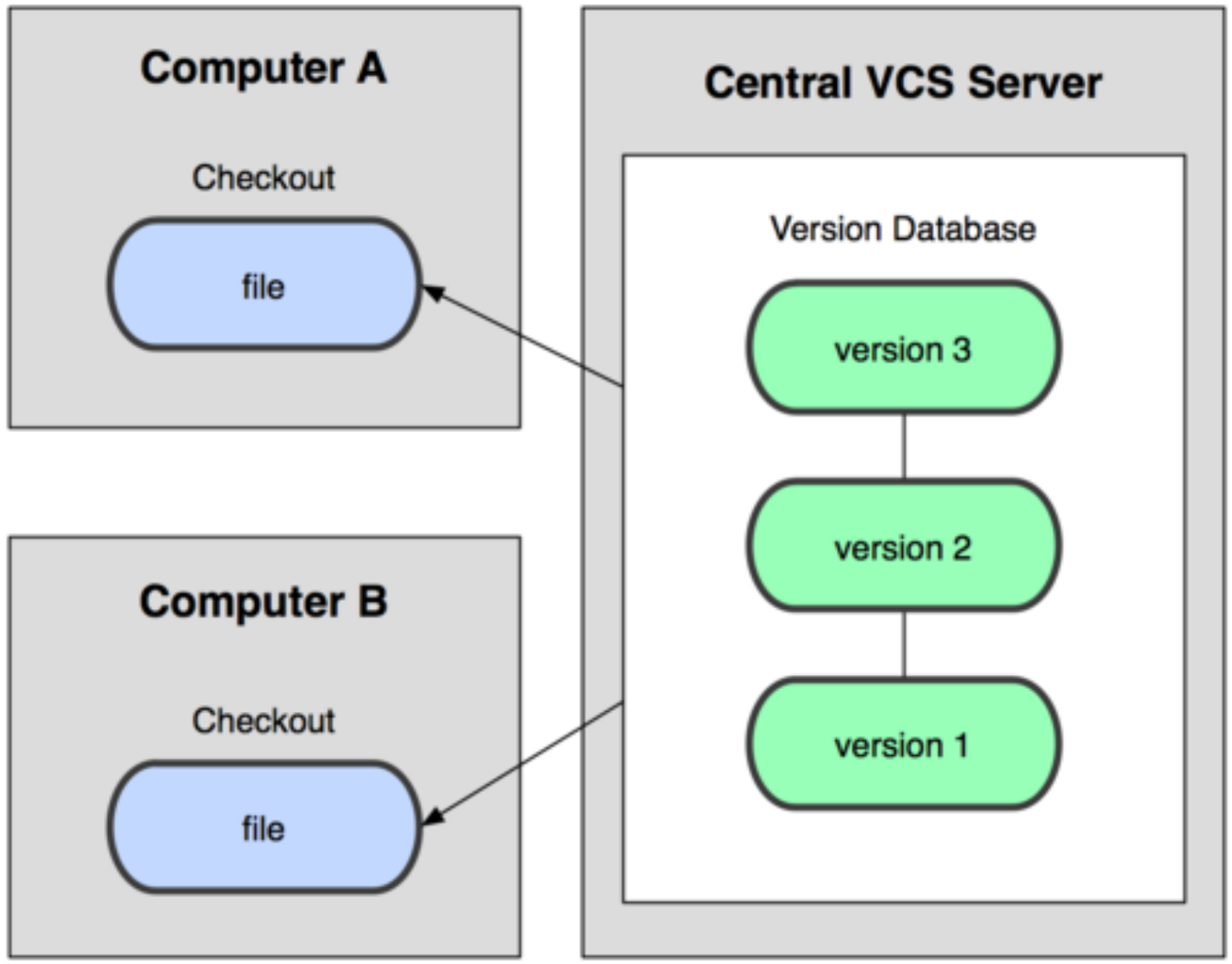
Centralize



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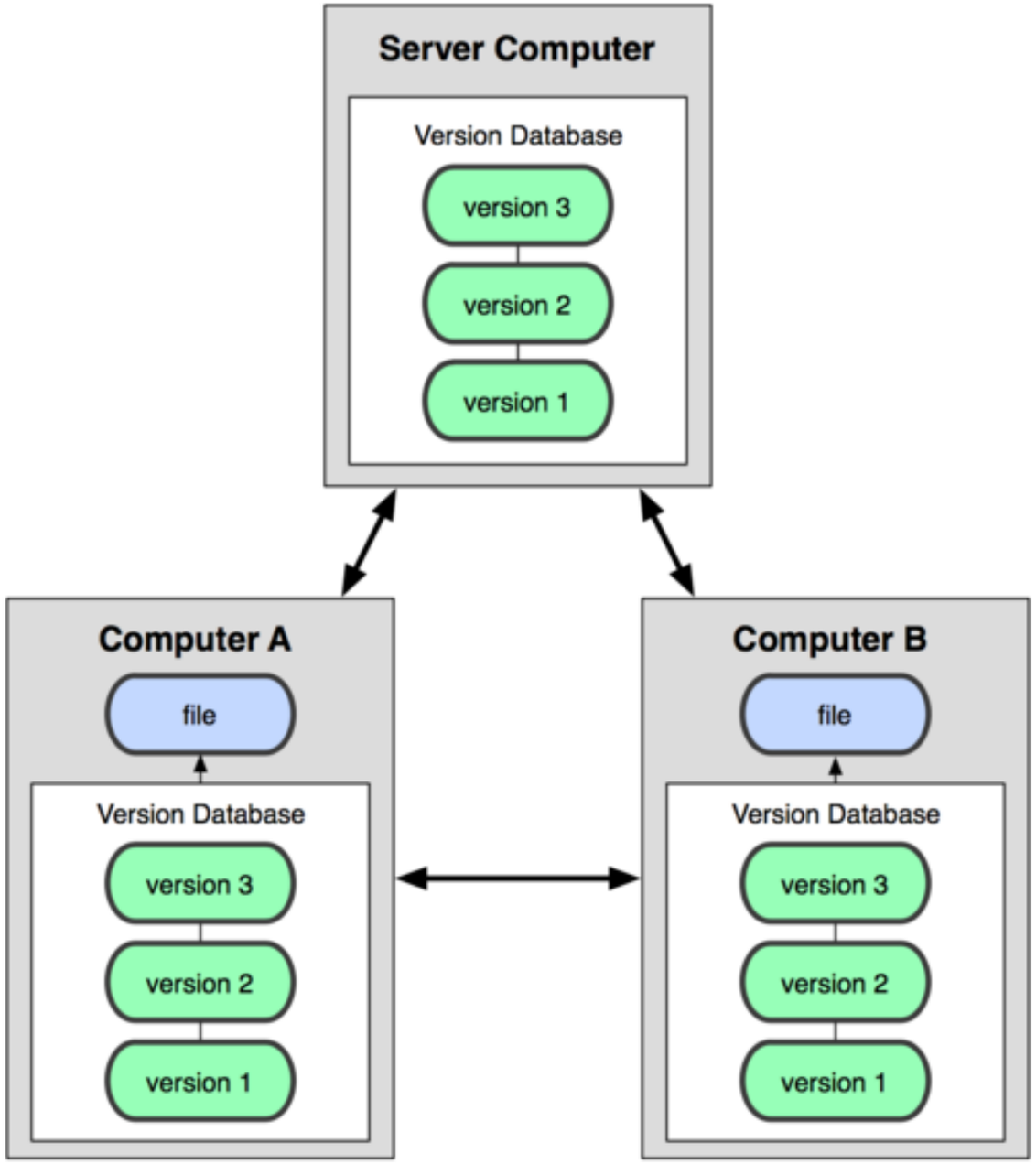
Decentralize



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Goals of Git

Speed

Simple

Support many parallel branches

Fully distributed

Handle large project

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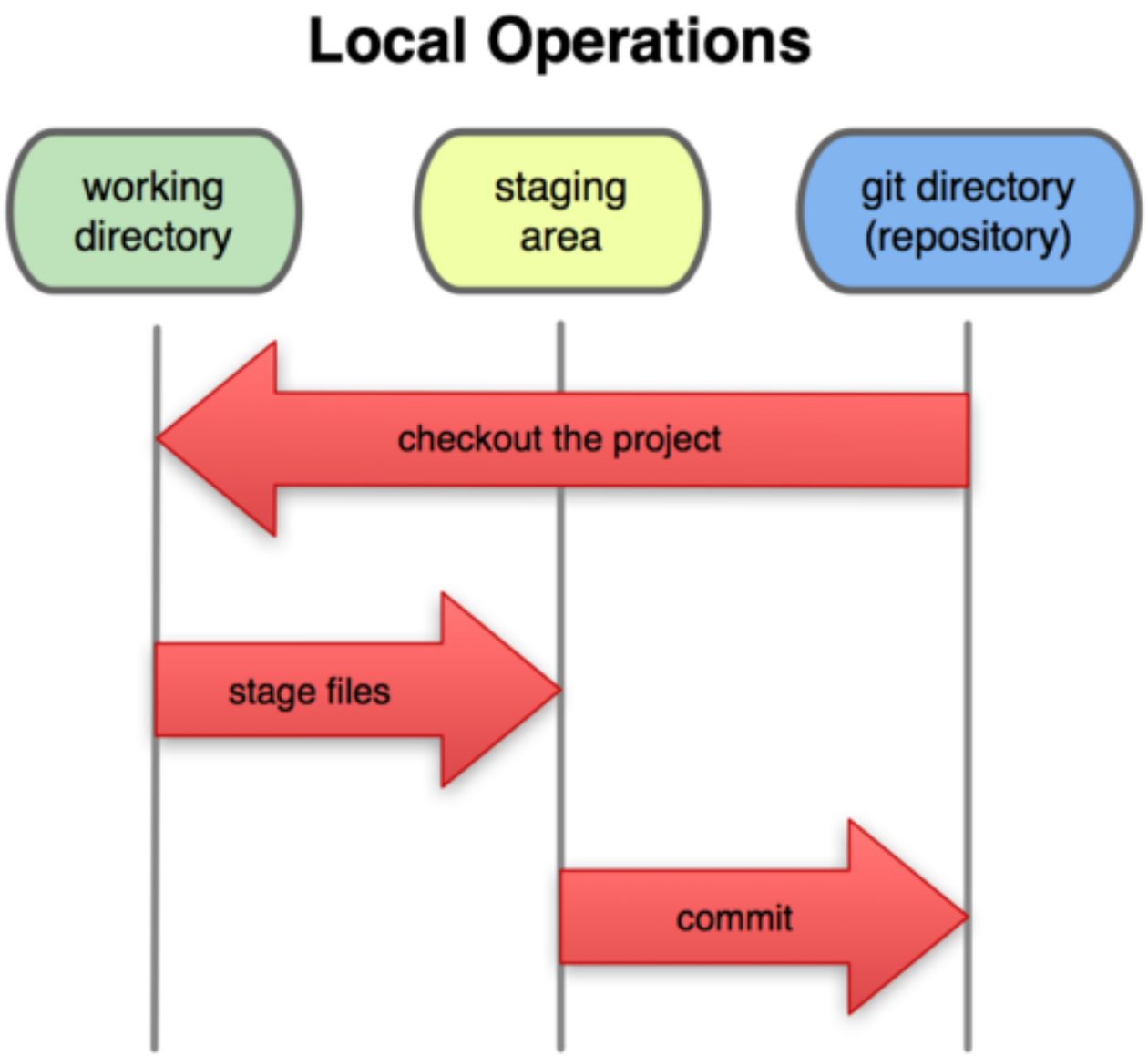
Git Workflow



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Installation

https://git-scm.com/

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Life cycle of file status

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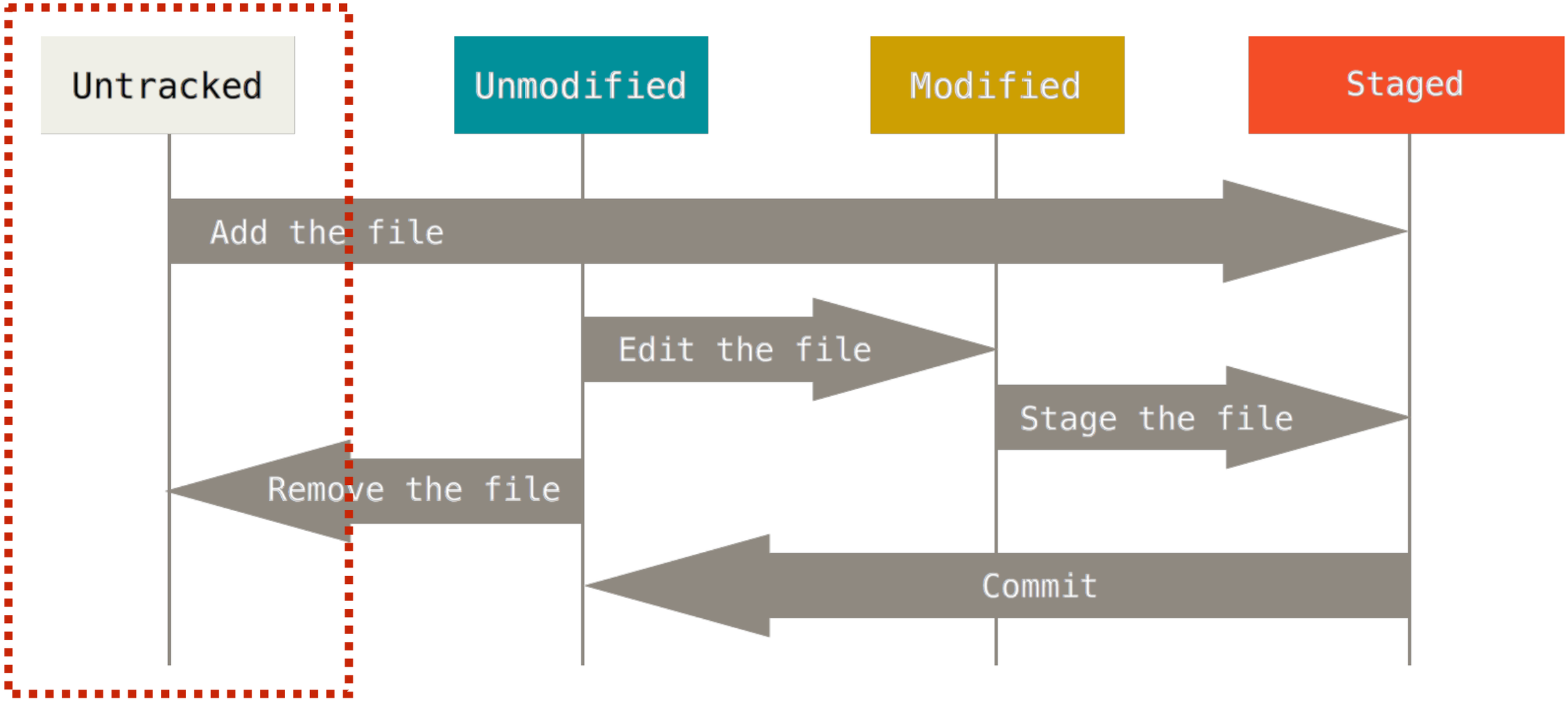
Create new file

$touch *README*



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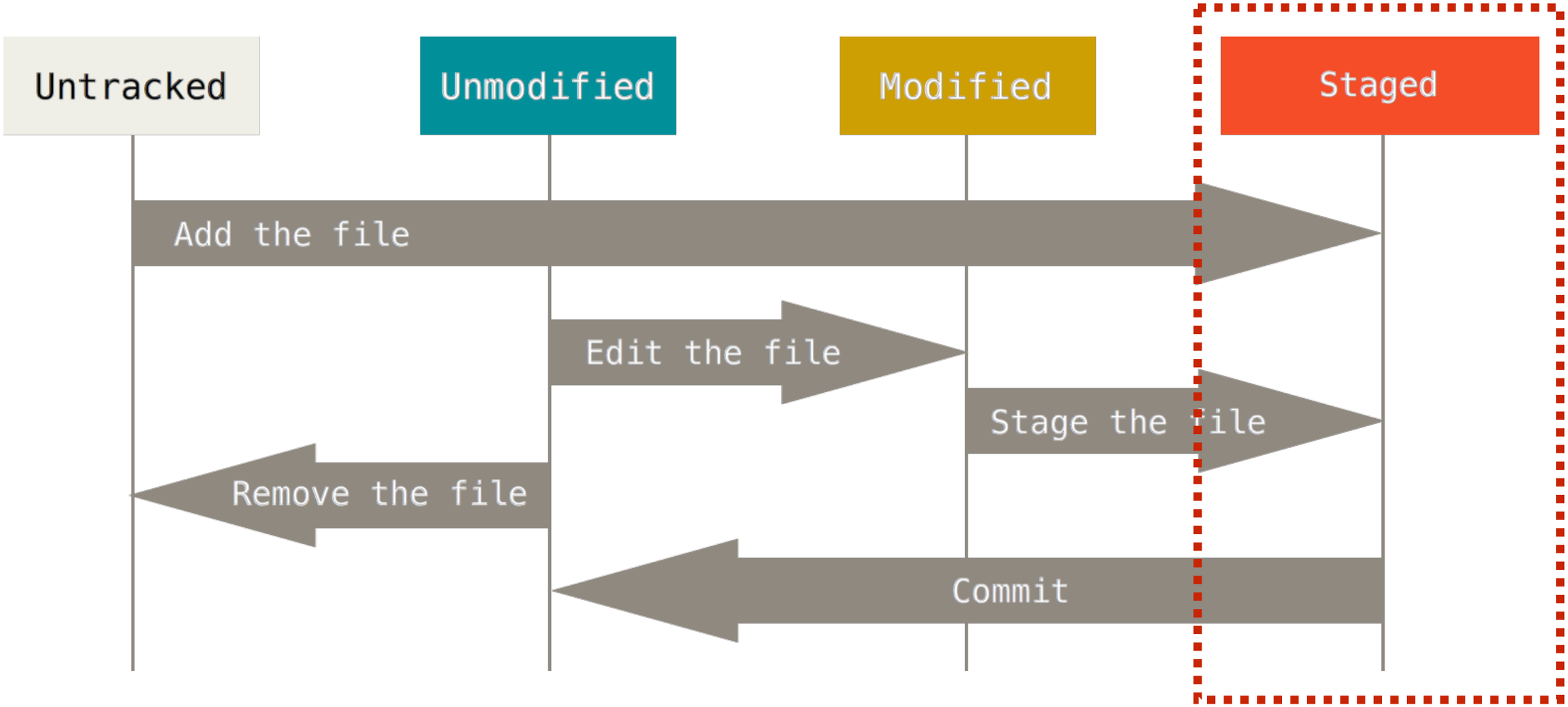
Add file to staged

$git add *README*



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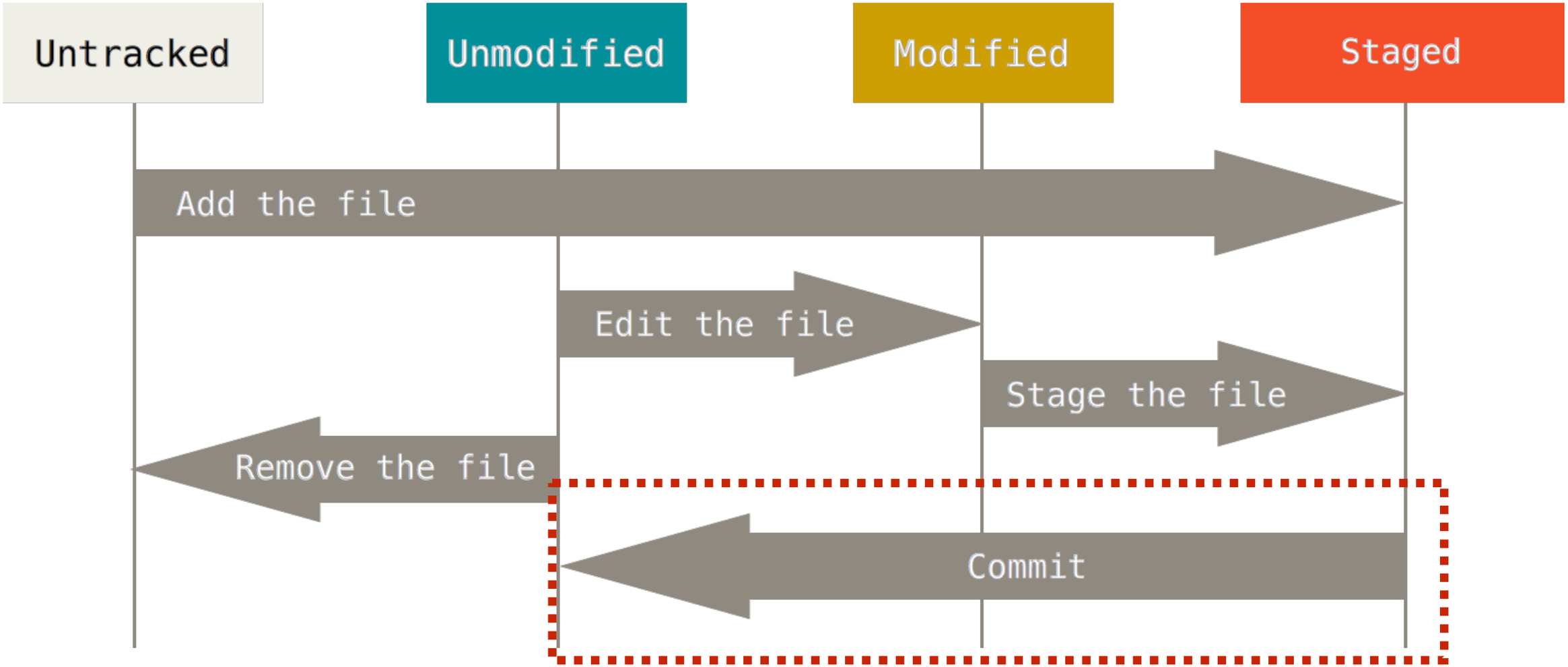
Commit your changes …

$git commit -m *“your message”*



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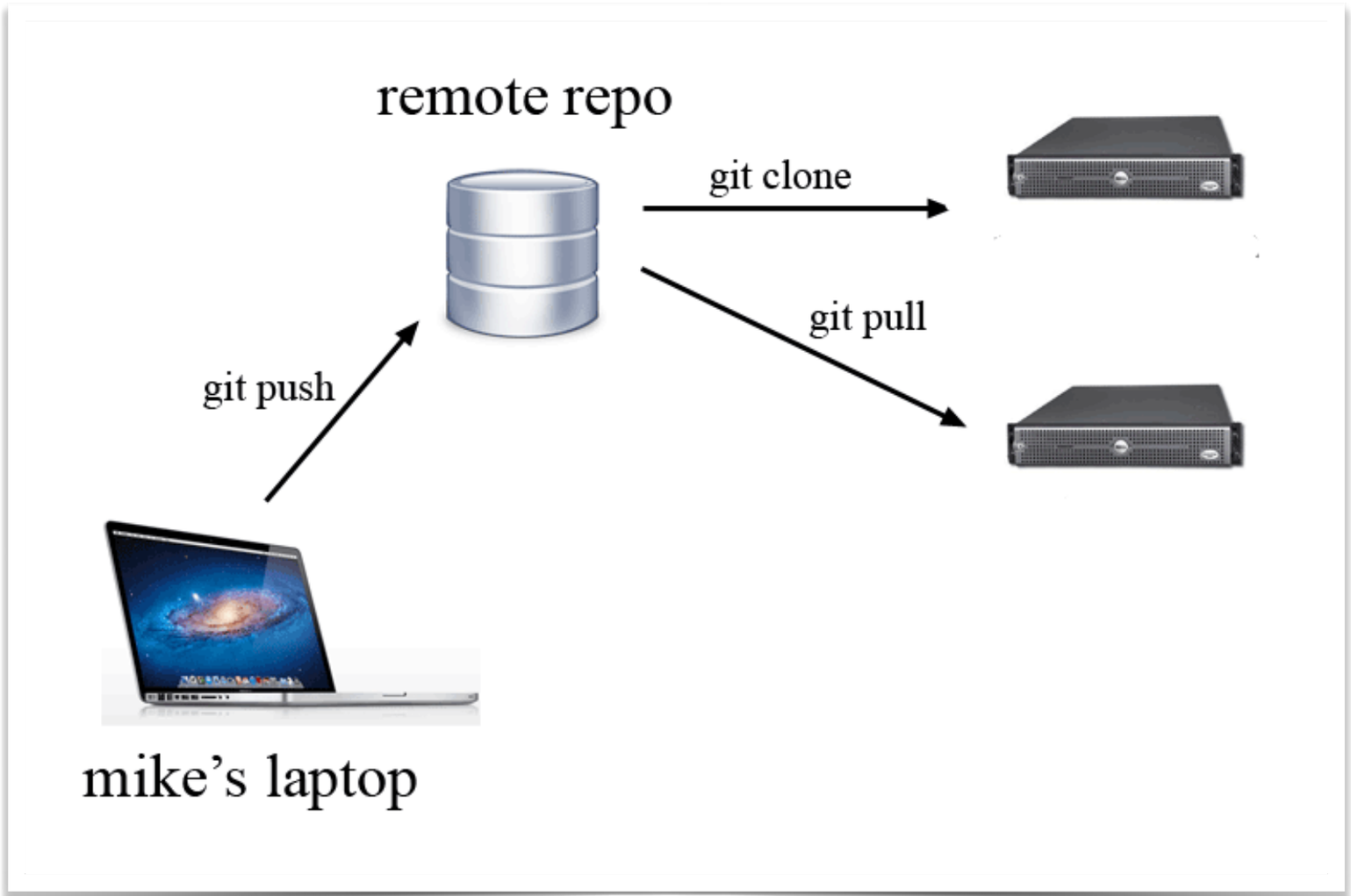
Push local's changes to remote

$git push



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Working with branch

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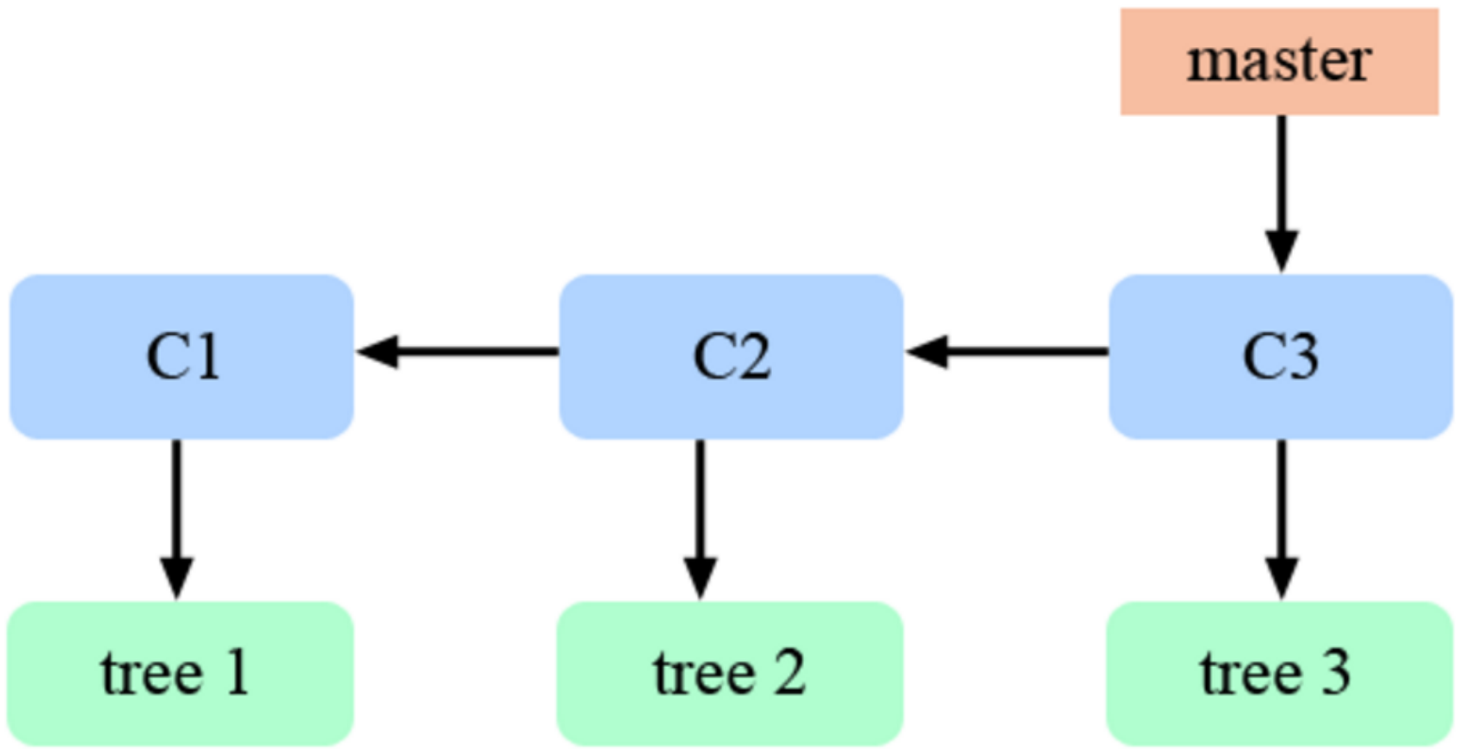
Each branch points to a commit



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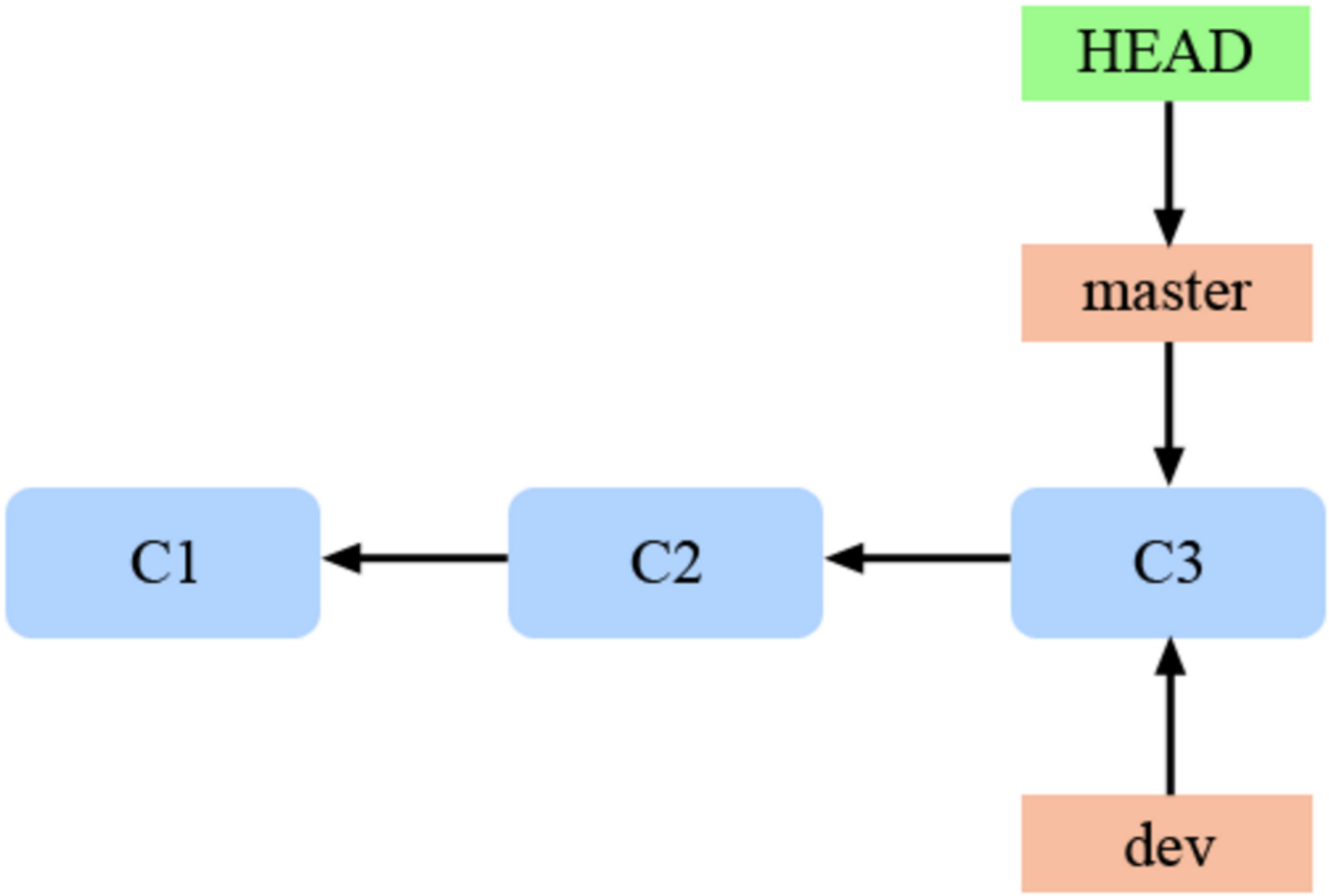
Create new branch

$git branch <branch name>



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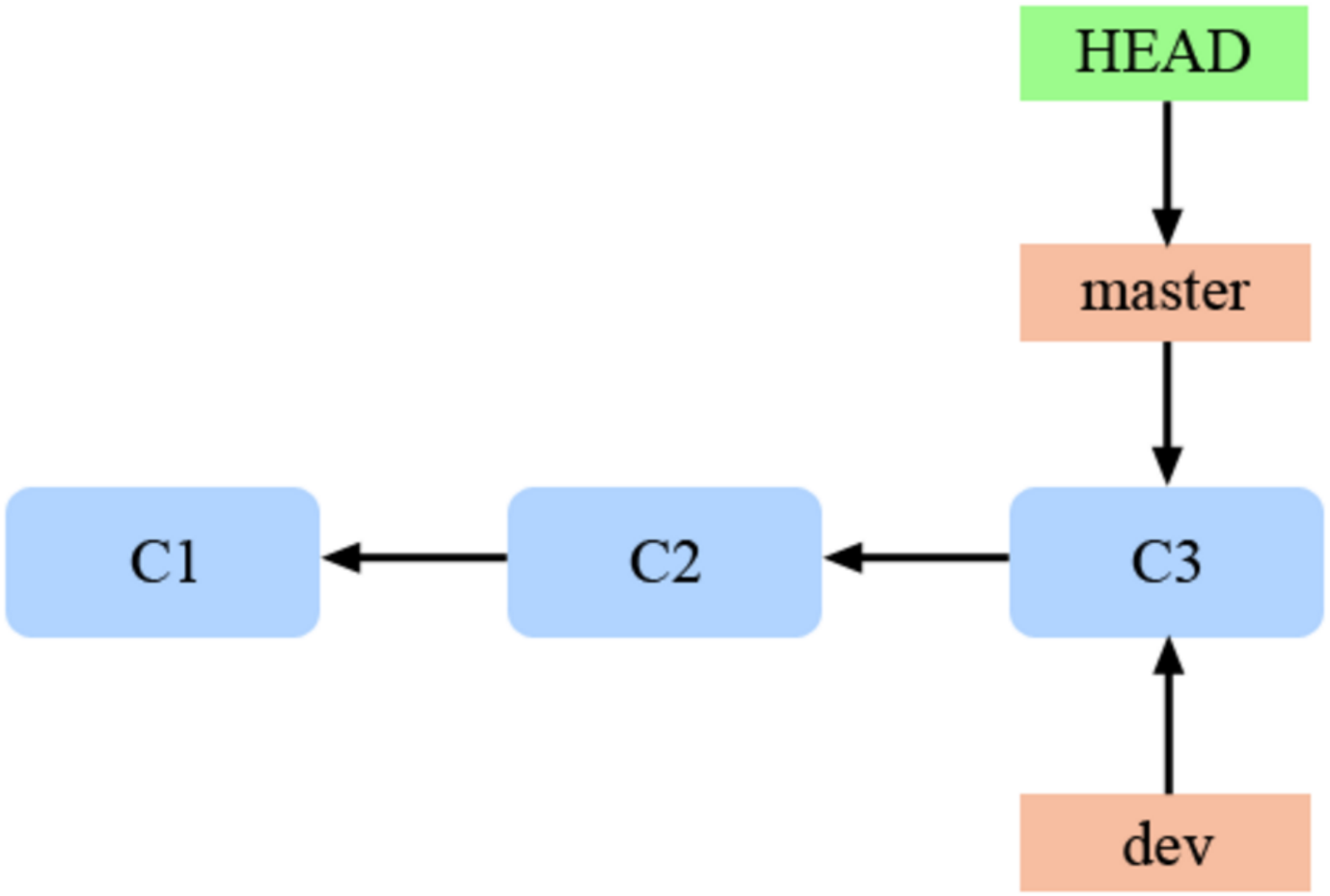
Switch branch

$git switch <branch name>



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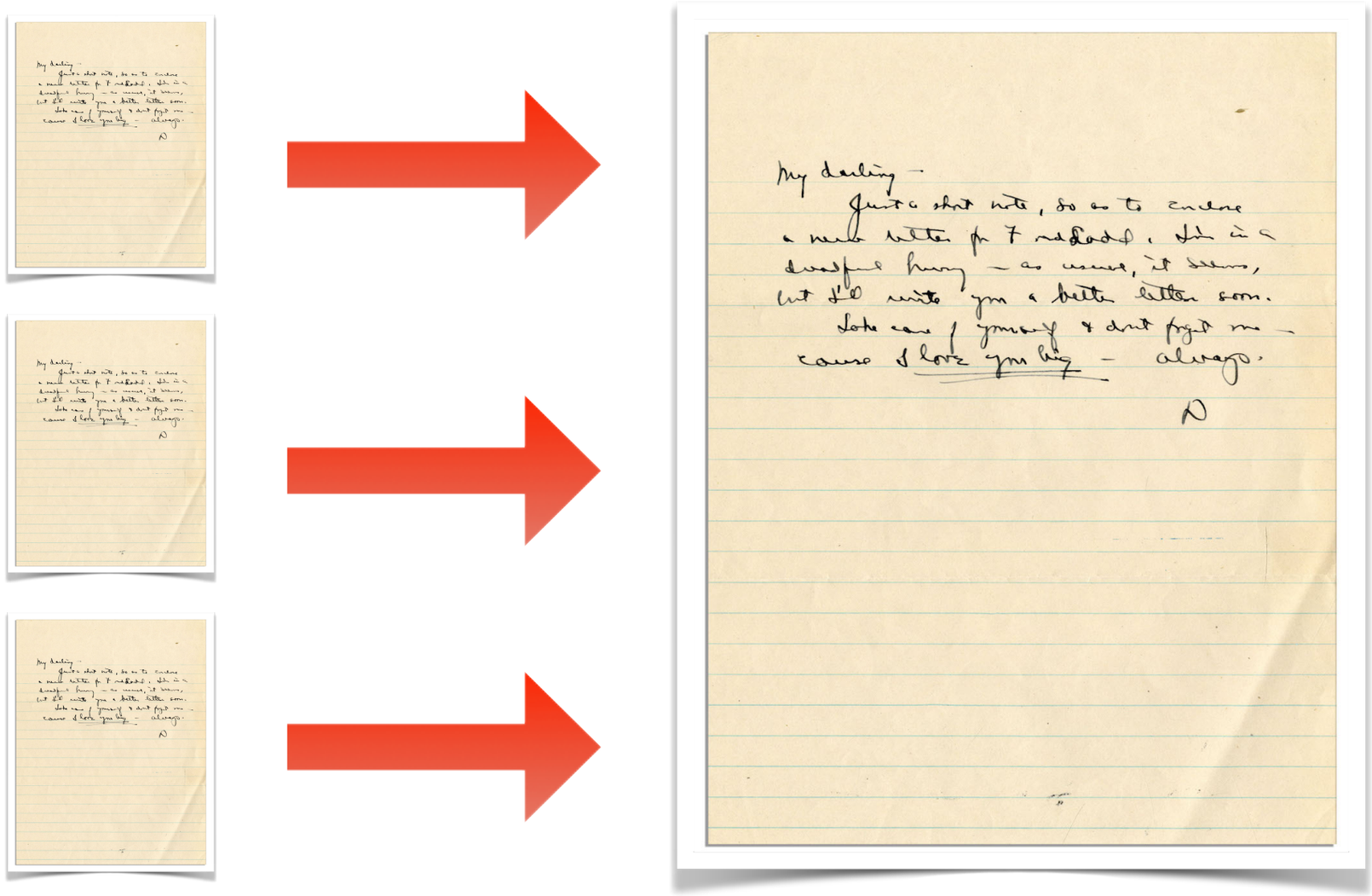
All branch become one

$git merge



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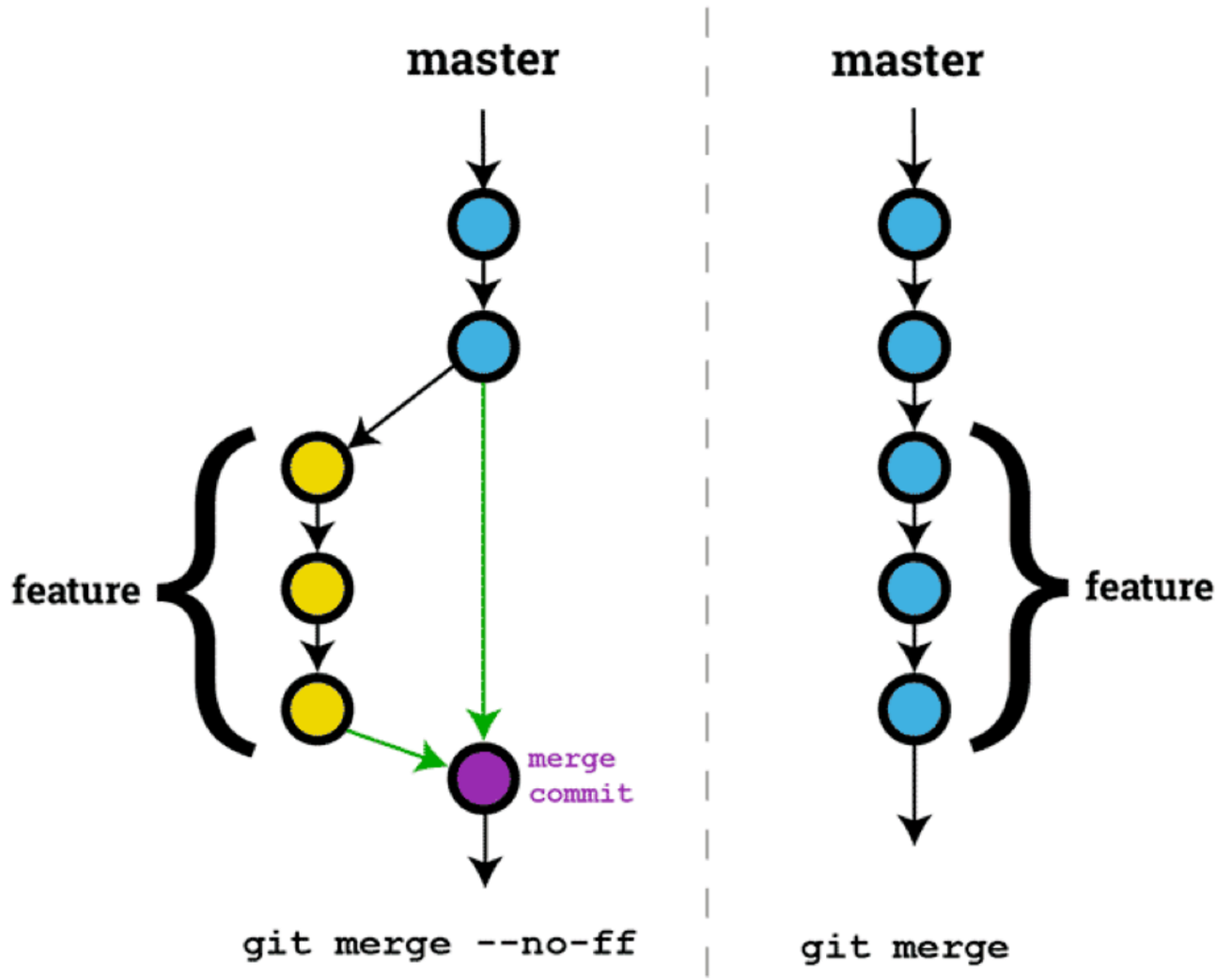
Merge vs Rebase



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Avoid merge conflict !!

Small change and commit

Early merge

Single Responsibility Principle

Communication is a key

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Commit message

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Update

TODO

fixed bug

add feature

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“Added a user object to the database.
currently only has a name and email.
no authentication yet ”

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“Fixed the bug that would add something to everything. Turn to not add something to everything”

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Workshop

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Working with containers

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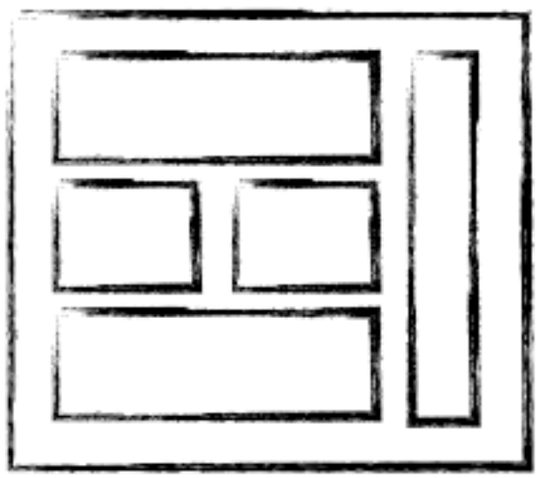
Why docker ?

Software industry has changed !!



MONOLITHIC/LAYERED

MICRO SERVICES

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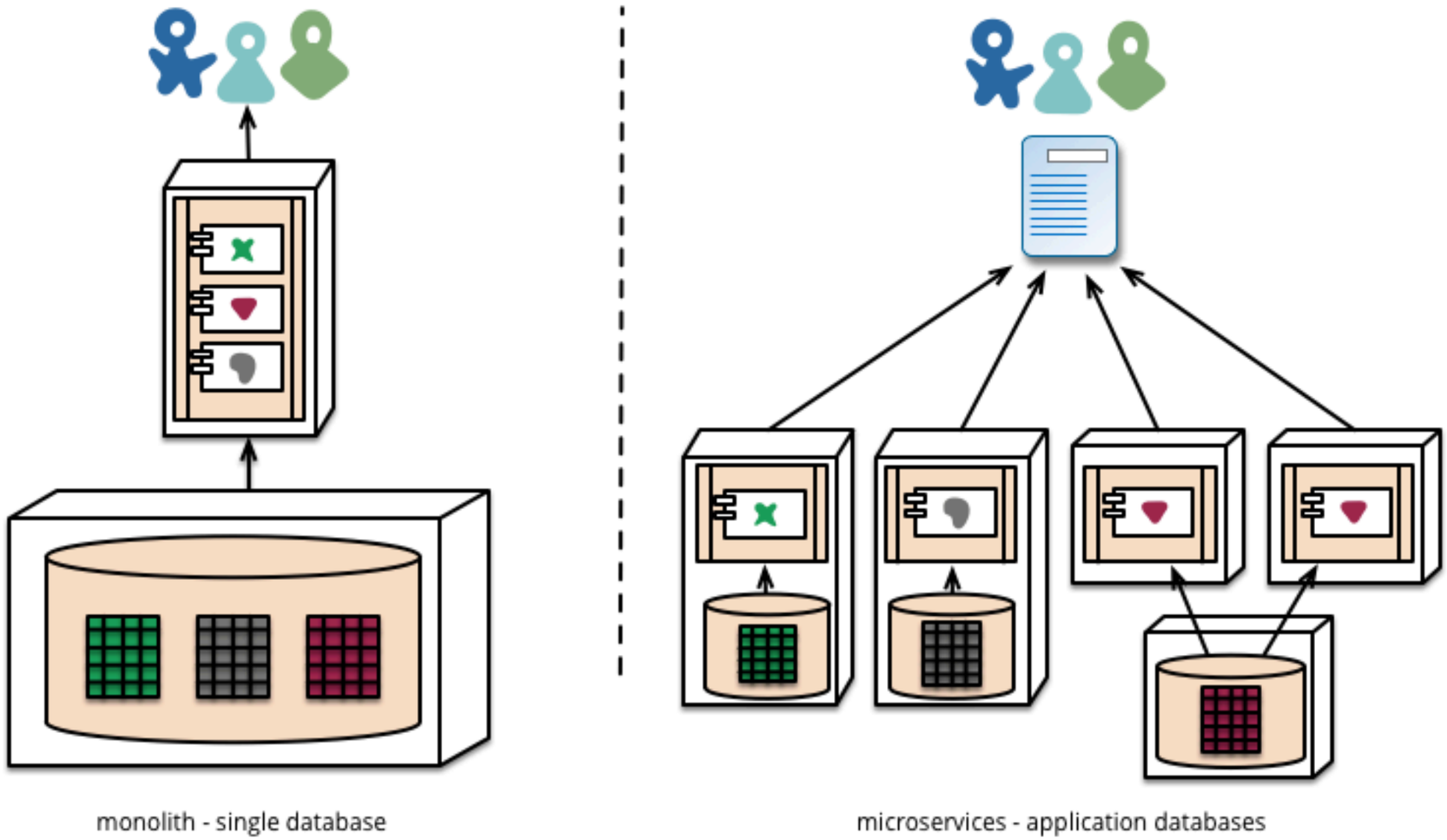
Microservice architecture



https://martinfowler.com/articles/microservices.html

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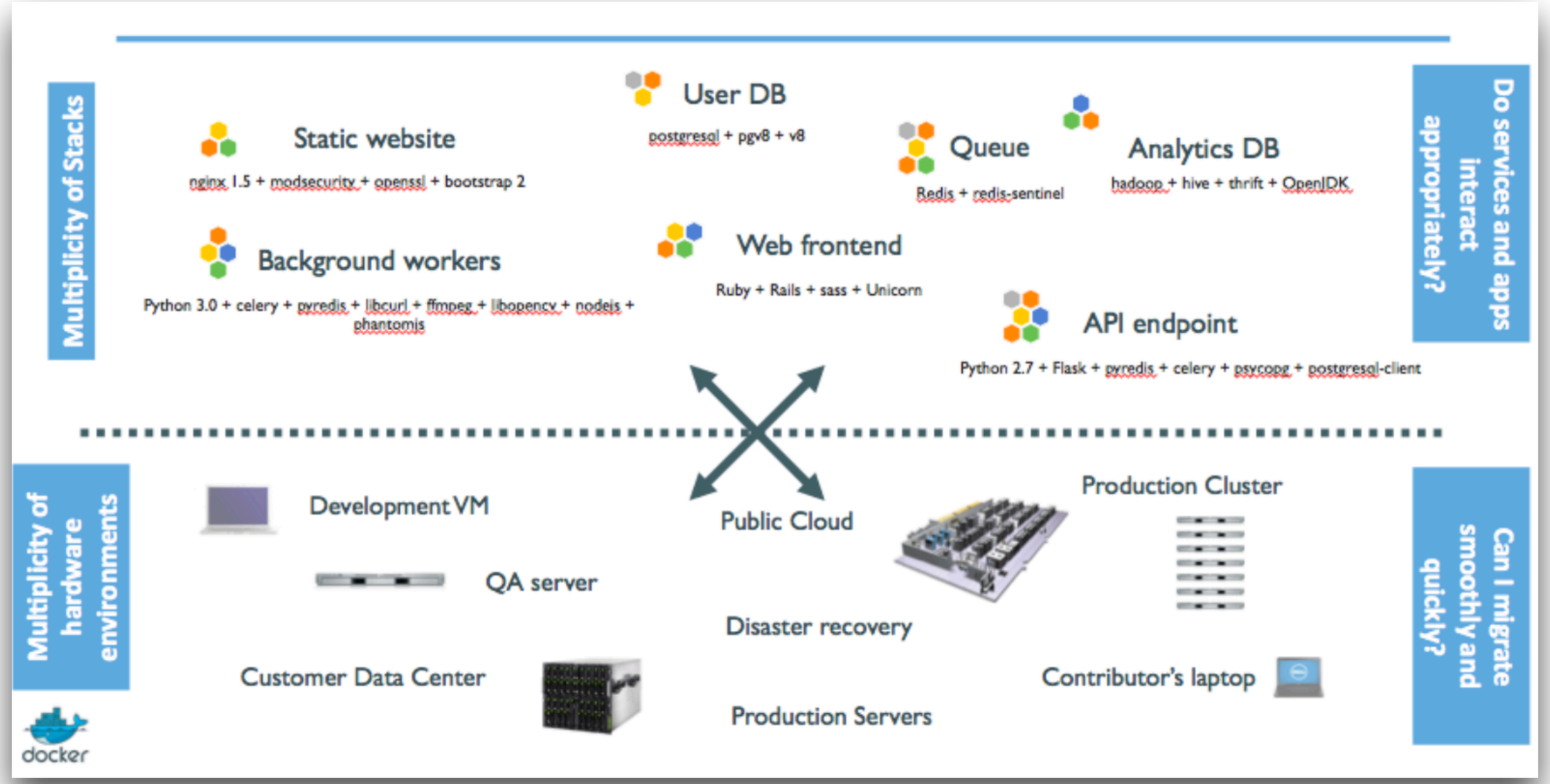
Why docker ?

We have problem !!



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Problem ?

	Developmen t VM	QA Server	Single Prod Server	Onsite Cluster	Public Cloud	Contributor' s laptop	Customer Servers
Static website	?	?	?	?	?	?	?
Web frontend	?	?	?	?	?	?	?
Background workers	?	?	?	?	?	?	?
User DB	?	?	?	?	?	?	?
Analytics DB	?	?	?	?	?	?	?
Queue	?	?	?	?	?	?	?

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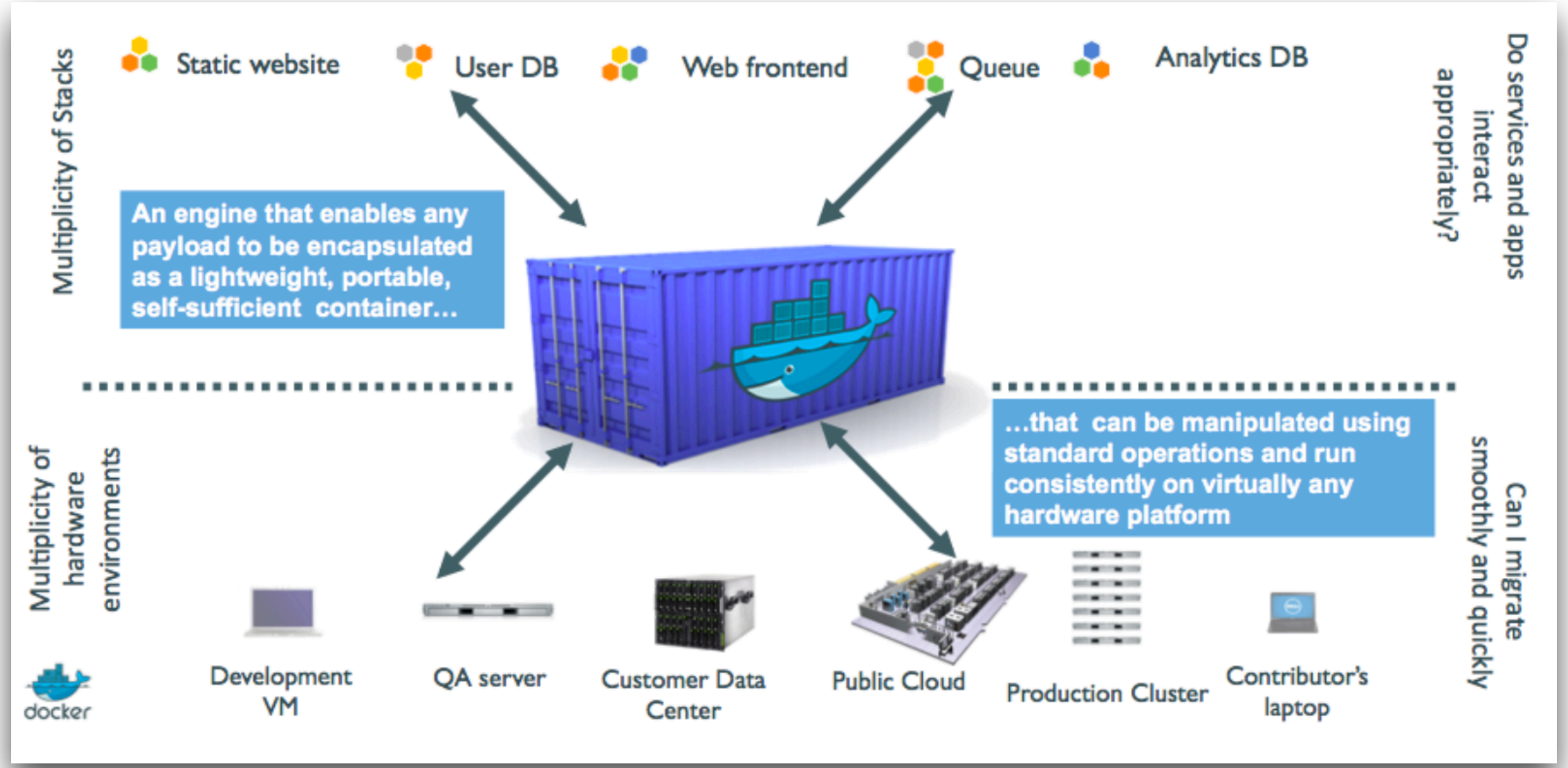
Solution ?



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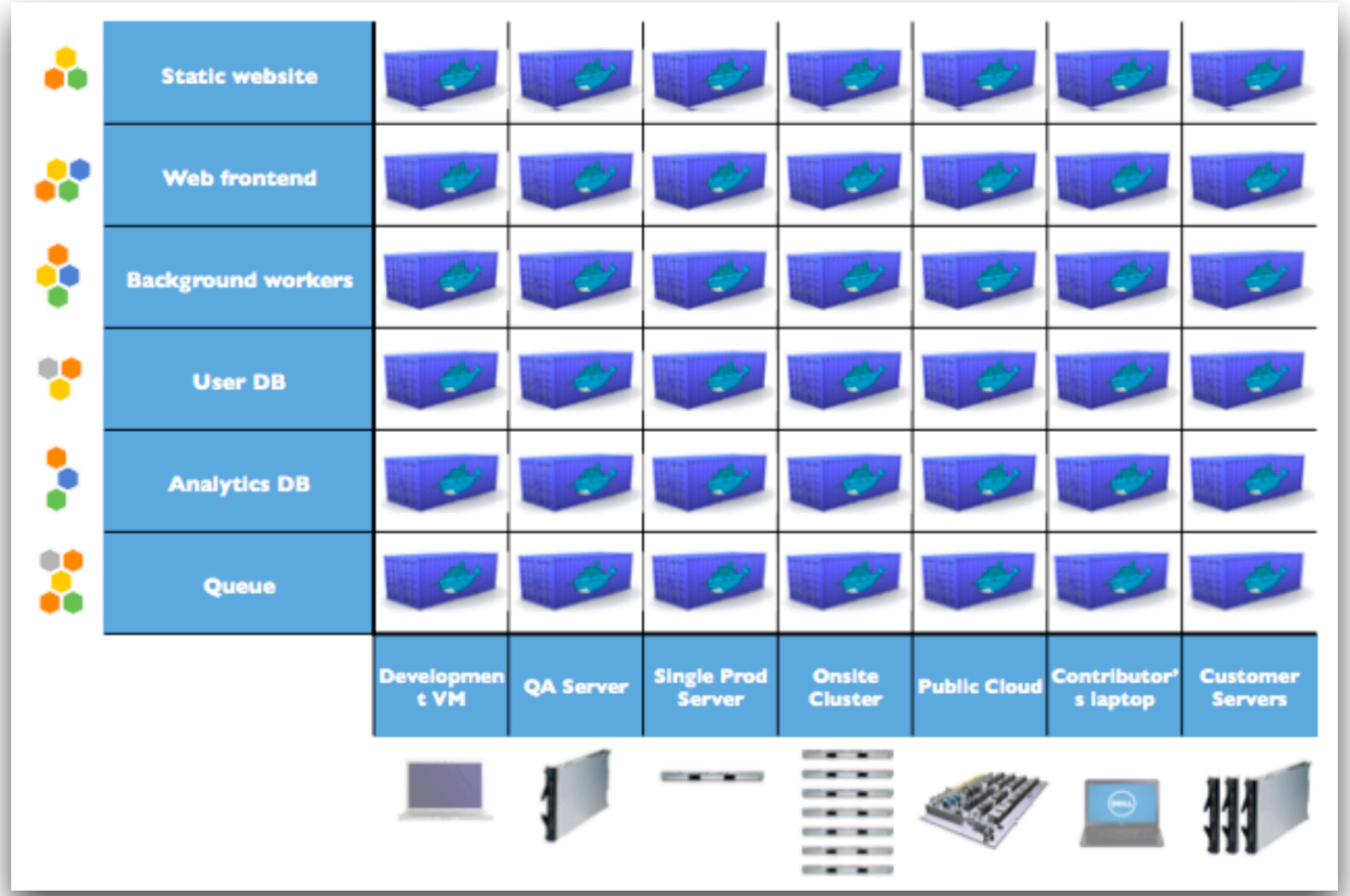
Solution ?



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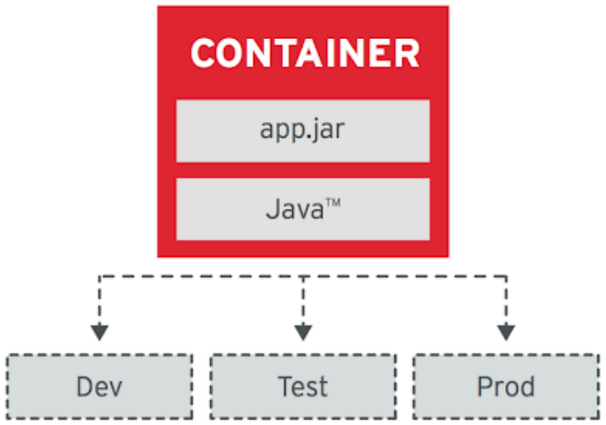
Container Design Principles

Image Immutability Principle

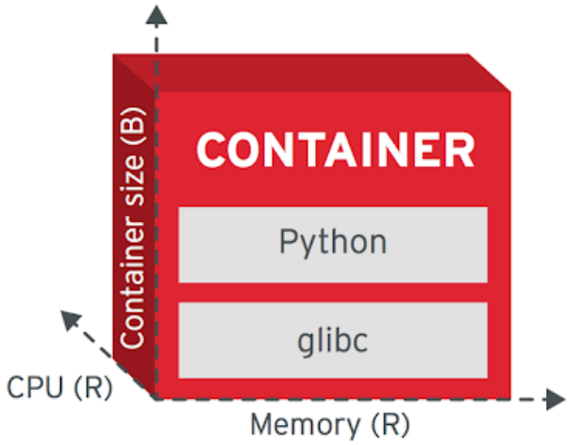


High Observability Principle

Process Disposability Principle

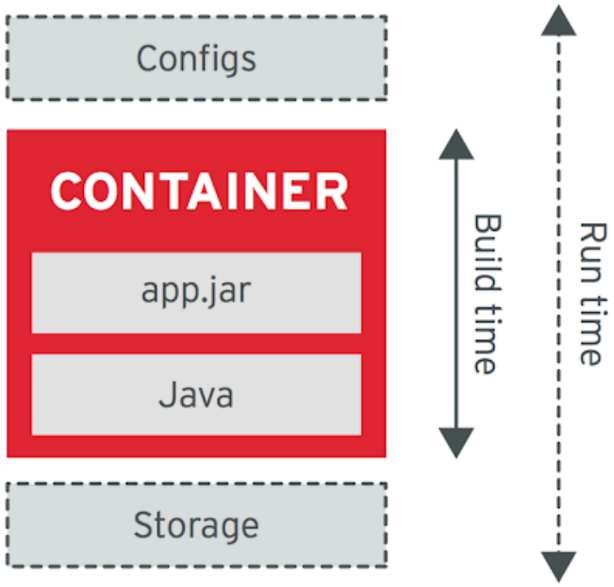
Lifecycle Conformance Principle

Runtime Confinement Principle



Single Concern Principle

Self-Containment Principle



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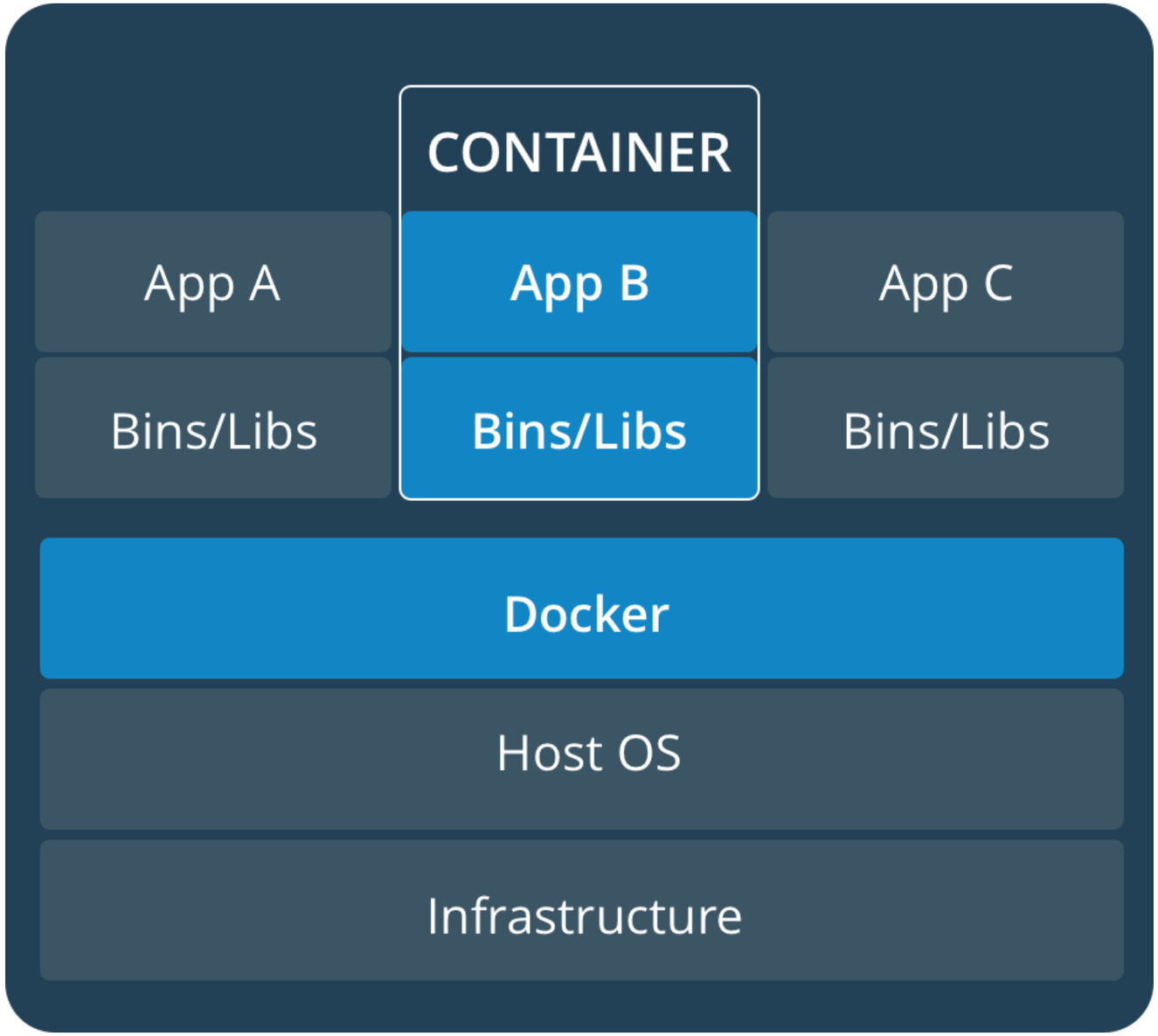
Container with Docker



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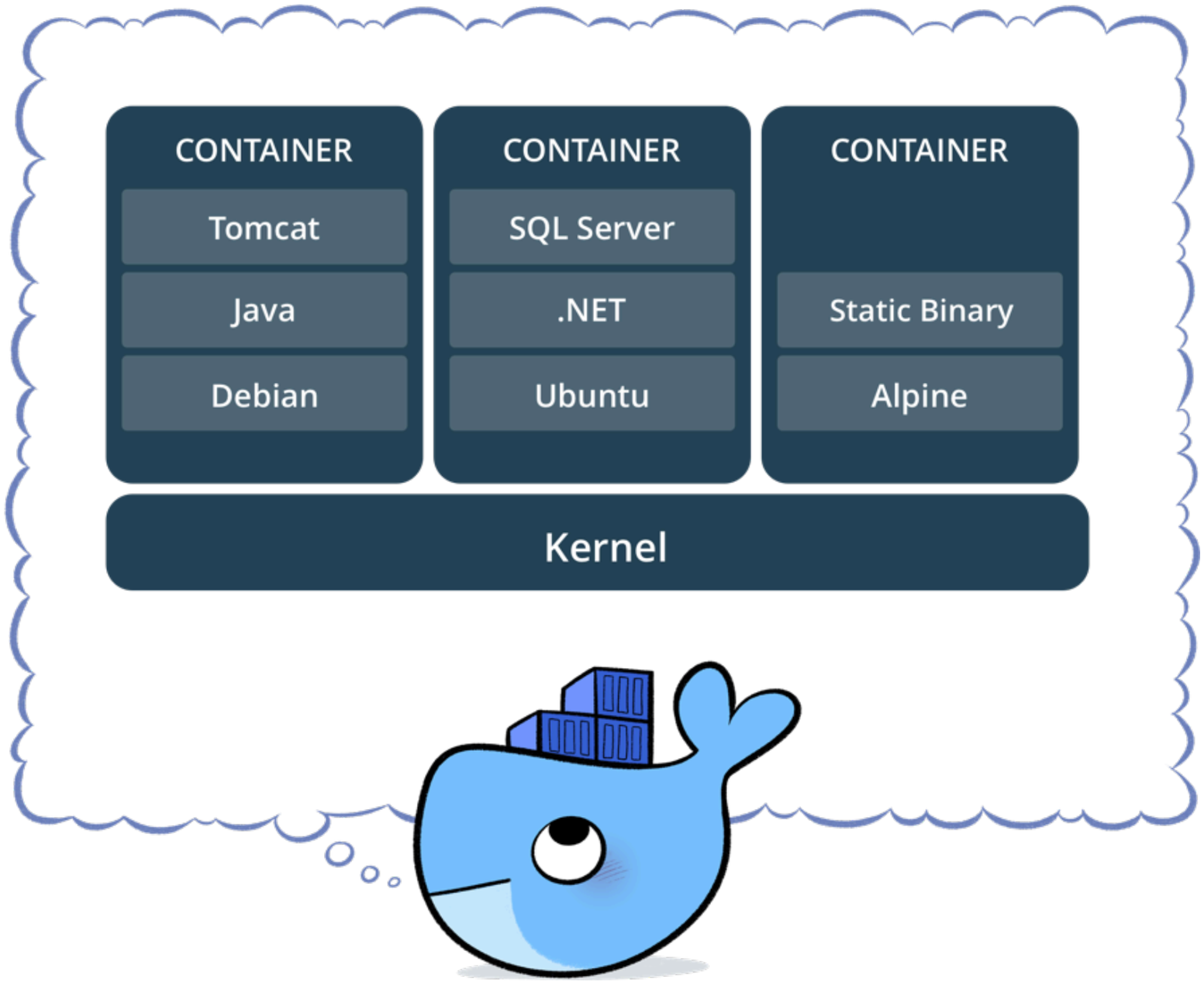
Container with Docker



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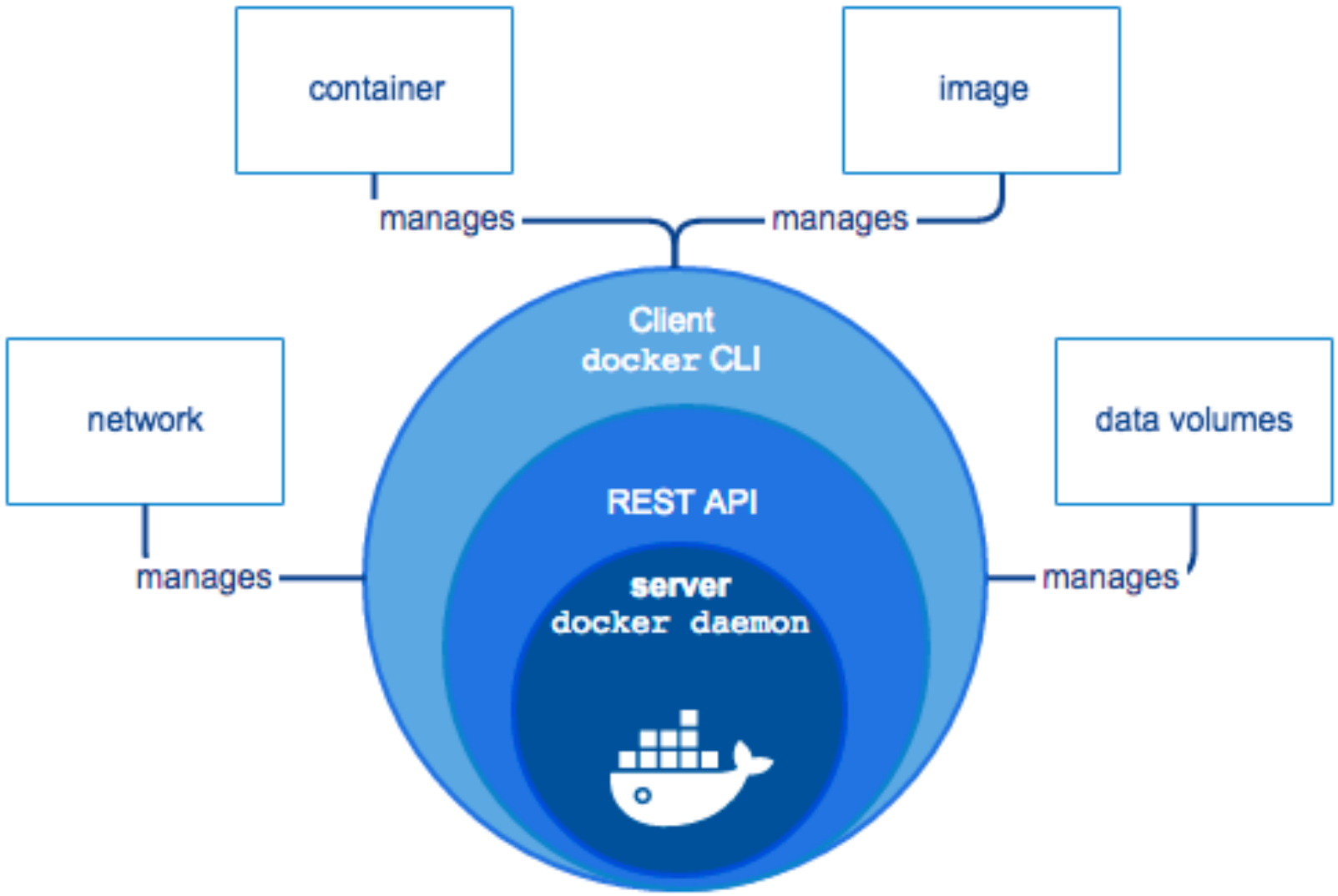
Basic of Docker



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Basic of Docker

Image
Container
Dockerfile
Registry
Volume and network

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Image vs Container

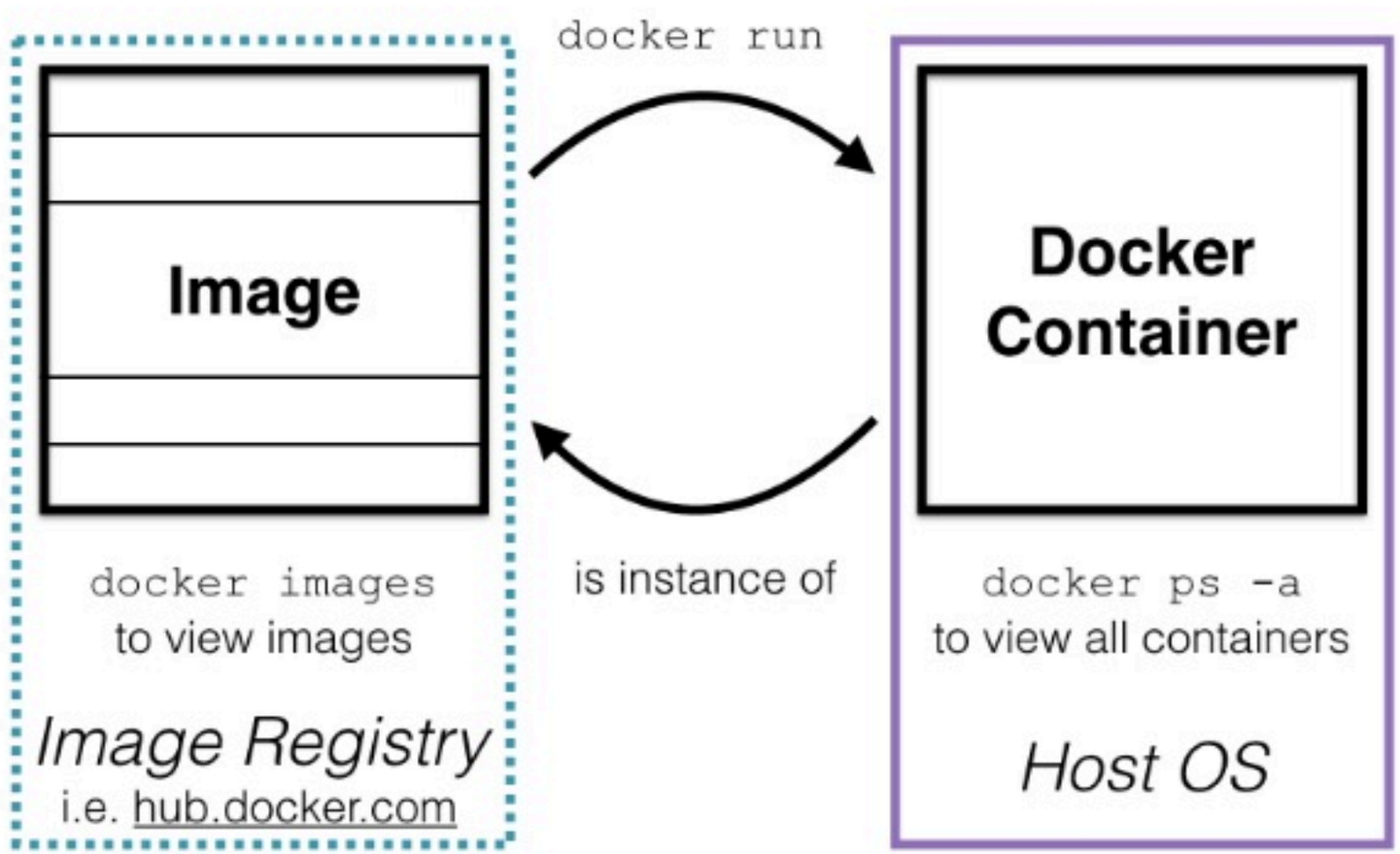

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Image vs Container

Image like template/blueprint
Containers are created from image

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Docker image

Collection of files and some meta data
Made of **layers**
Each layer can add/change/remove files
Image can share layers
Read-only file system

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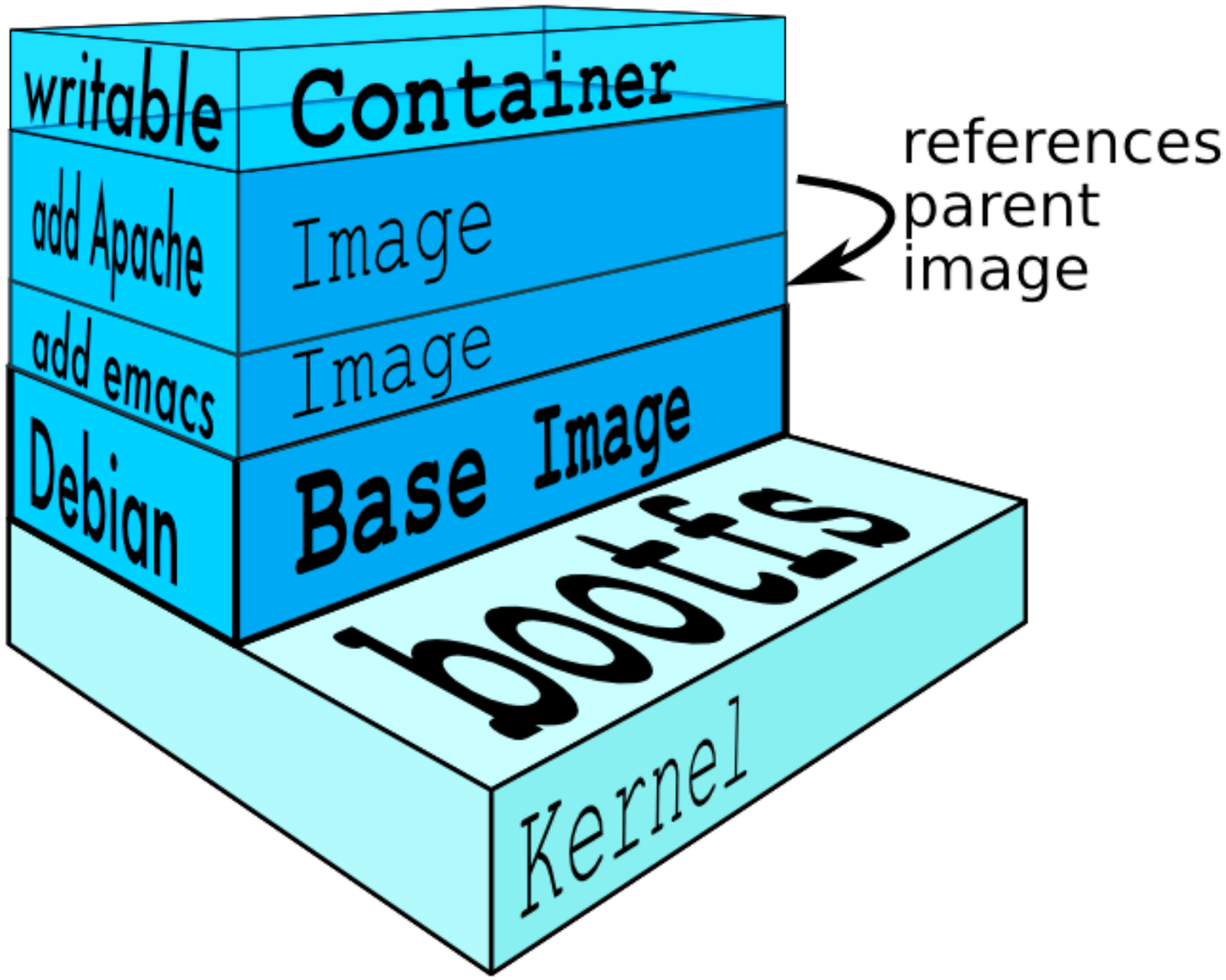
Docker image layer



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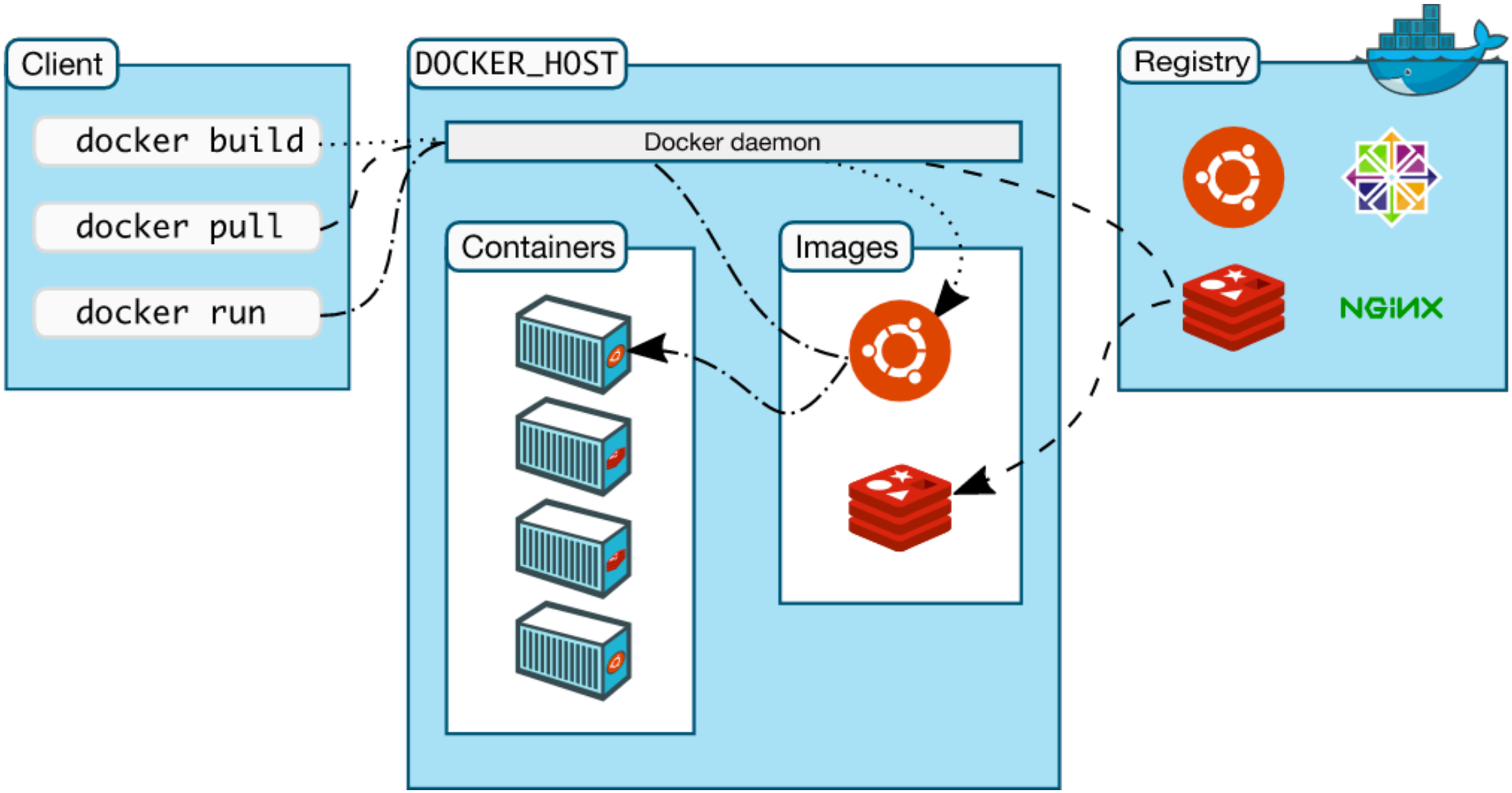
How docker works ?



https://docs.docker.com/get-started/overview/

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Docker commands

Manage image
Manage container
Manage system

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Management commands

$docker image <commmand>
$docker container <commmand>
$docker system <commmand>

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Working with Nginx

OFFICIAL REPOSITORY

nginx ☆

Last pushed: 20 days ago

Repo Info | Tags

Short Description

Official build of Nginx.

Docker Pull Command

```
docker pull nginx
```

Full Description

Supported tags and respective `Dockerfile` links

- `1.11.10`, `mainline`, `1`, `1.11`, `latest` (*mainline/jessie/Dockerfile*)
- `1.11.10-alpine`, `mainline-alpine`, `1-alpine`, `1.11-alpine`, `alpine` (*mainline/alpine/Dockerfile*)
- `1.10.3`, `stable`, `1.10` (*stable/jessie/Dockerfile*)
- `1.10.3-alpine`, `stable-alpine`, `1.10-alpine` (*stable/alpine/Dockerfile*)

https://hub.docker.com/_/nginx/

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Pull image

$docker image pull nginx:latest

```
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
693502eb7dfb: Pull complete
6decb850d2bc: Pull complete
c3e19f087ed6: Pull complete
Digest: sha256:52a189e49c0c797cfc5cbfe578c68c225d160fb13a42954144b29af3fe4fe335
Status: Downloaded newer image for nginx:latest
```


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Pull image

$docker image pull nginx:latest

Tag

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Image and Tag

Image can have **tags**
Tags define image variants
Default of tag is **:latest**

:latest tag can be updated frequently !!

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Docker container

Foreground
Background
Interactive

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Run with foreground

$docker container run nginx

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Run with background

$docker container run **-d** nginx

-d = --detach

Run container in background and print container ID

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Run with interactive

$docker container run **-it** nginx bash

-i = --interactive

-t = --tty

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Access to container

$docker container run -it
$docker container exec -it

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Create Image from Dockerfile

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Dockerfile

Build recipe for a Docker image
Contain series of instructions
Use **$docker image build** command

https://docs.docker.com/engine/reference/builder/

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Example

```
FROM ubuntu
RUN apt-get update
RUN apt-get install -y wget
```


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Build image from Dockerfile

$docker image build -t first_image .

```
Sending build context to Docker daemon 2.048 kB
Step 1/3 : FROM ubuntu
 ---> 0ef2e08ed3fa
Step 2/3 : RUN apt-get update
 ---> Running in 6c598d2946b7
Get:1 http://archive.ubuntu.com/ubuntu xenial InR
Get:2 http://archive.ubuntu.com/ubuntu xenial-upc
Get:3 http://archive.ubuntu.com/ubuntu xenial-sec
Get:4 http://archive.ubuntu.com/ubuntu xenial/mai
Get:5 http://archive.ubuntu.com/ubuntu xenial/res
```


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History of image

Show all layers of image

$docker image history <image name>

```
IMAGE               CREATED             CREATED BY                                      SIZE
1813d5ecf658        4 minutes ago       /bin/sh -c apt-get install -y wget              7.35 MB
2930e9a322d6        5 minutes ago       /bin/sh -c apt-get update                       40.1 MB
0ef2e08ed3fa        3 weeks ago         /bin/sh -c #(nop)  CMD ["/bin/bash"]            0 B
<missing>           3 weeks ago         /bin/sh -c mkdir -p /run/systemd && echo '...   7 B
<missing>           3 weeks ago         /bin/sh -c sed -i 's/^#\s*\(deb.*universe\...   1.9 kB
<missing>           3 weeks ago         /bin/sh -c rm -rf /var/lib/apt/lists/*          0 B
<missing>           3 weeks ago         /bin/sh -c set -xe   && echo '#!/bin/sh' >...   745 B
<missing>           3 weeks ago         /bin/sh -c #(nop) ADD file:efb254bc677d66d...   130 MB
```


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Working with Docker compose

https://docs.docker.com/compose/

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Mutilple containers app!!

Difficult to create and manage !!

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Mutilple containers app!!

Build images from Dockerfile
Pull images from Hub/private/cache
Configuration and create containers
Start and stop containers
Stream their logs

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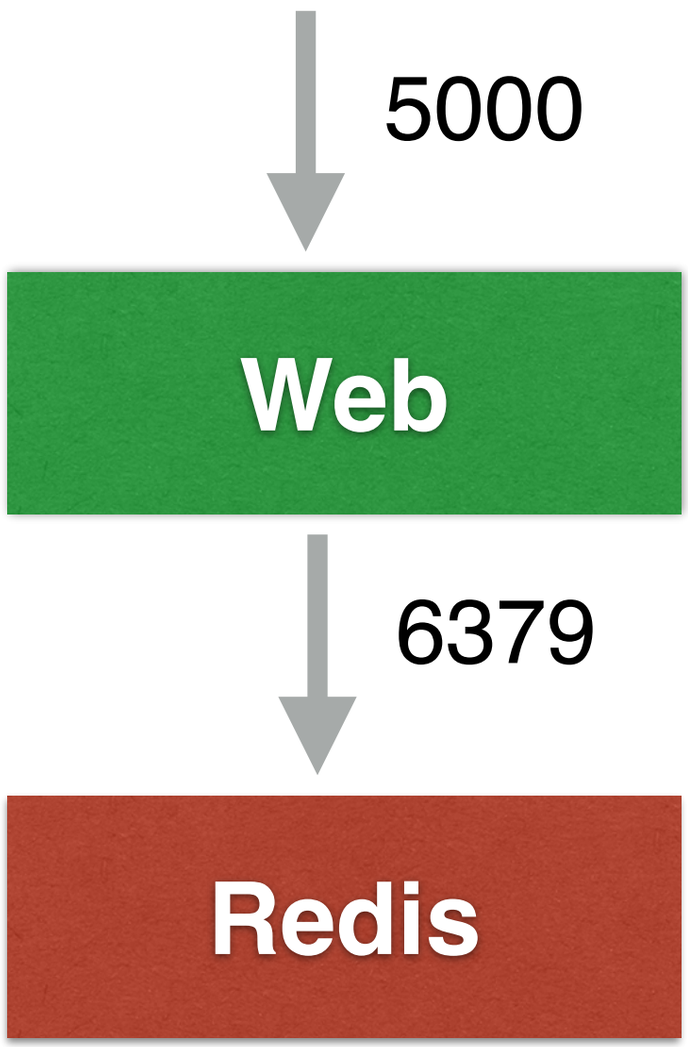
Mutilple containers app!!




```
$docker pull redis:latest
$docker build -t web .
$docker run -d --name db redis
  redis-server --appendonly yes
```

```
$docker run -d --name web --link
db:db -p 5000:5000 -e
REDIS_HOST=db  -v $(pwd):/code
web
```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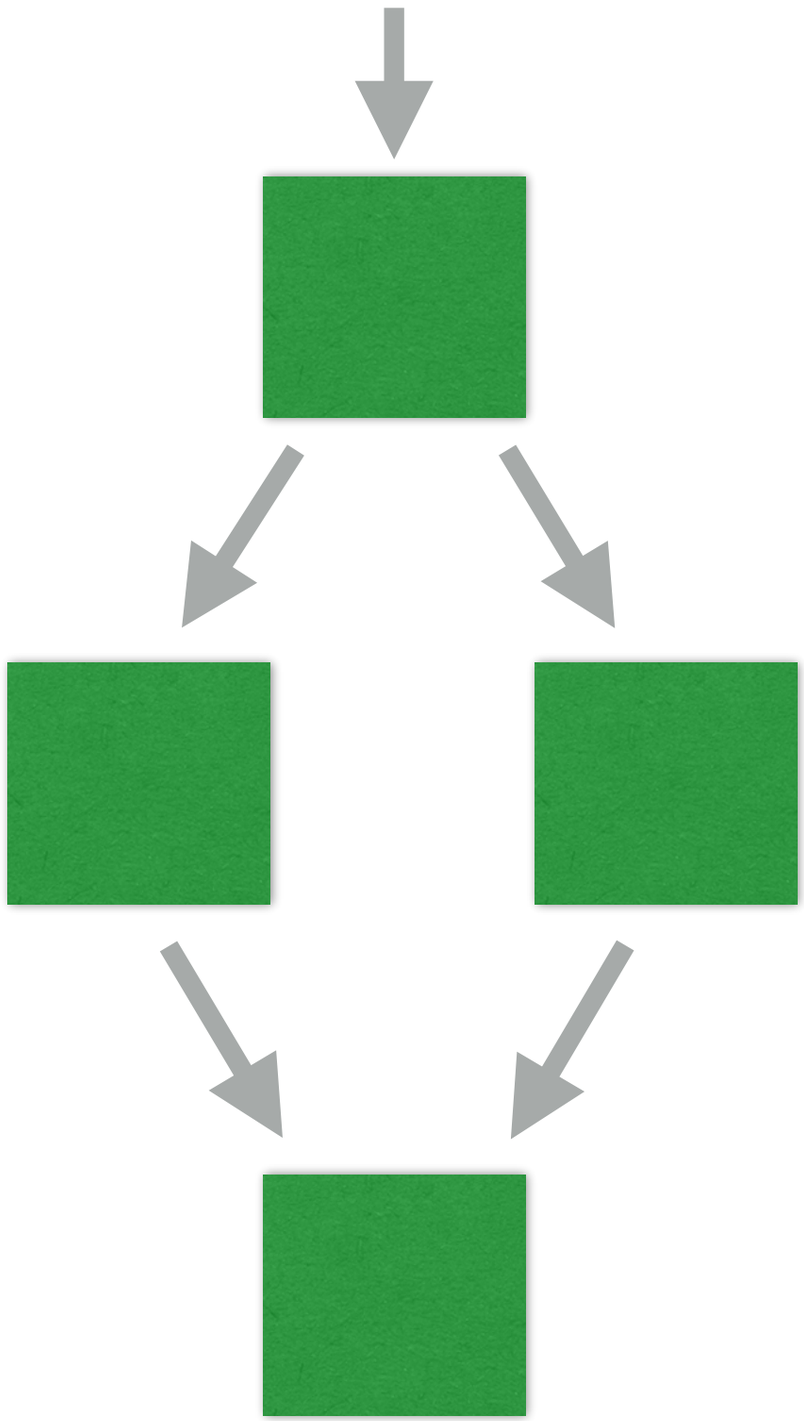
Mutilple containers app!!



$docker pull

$docker build

$docker build

$docker build

$docker run

$docker run

$docker run

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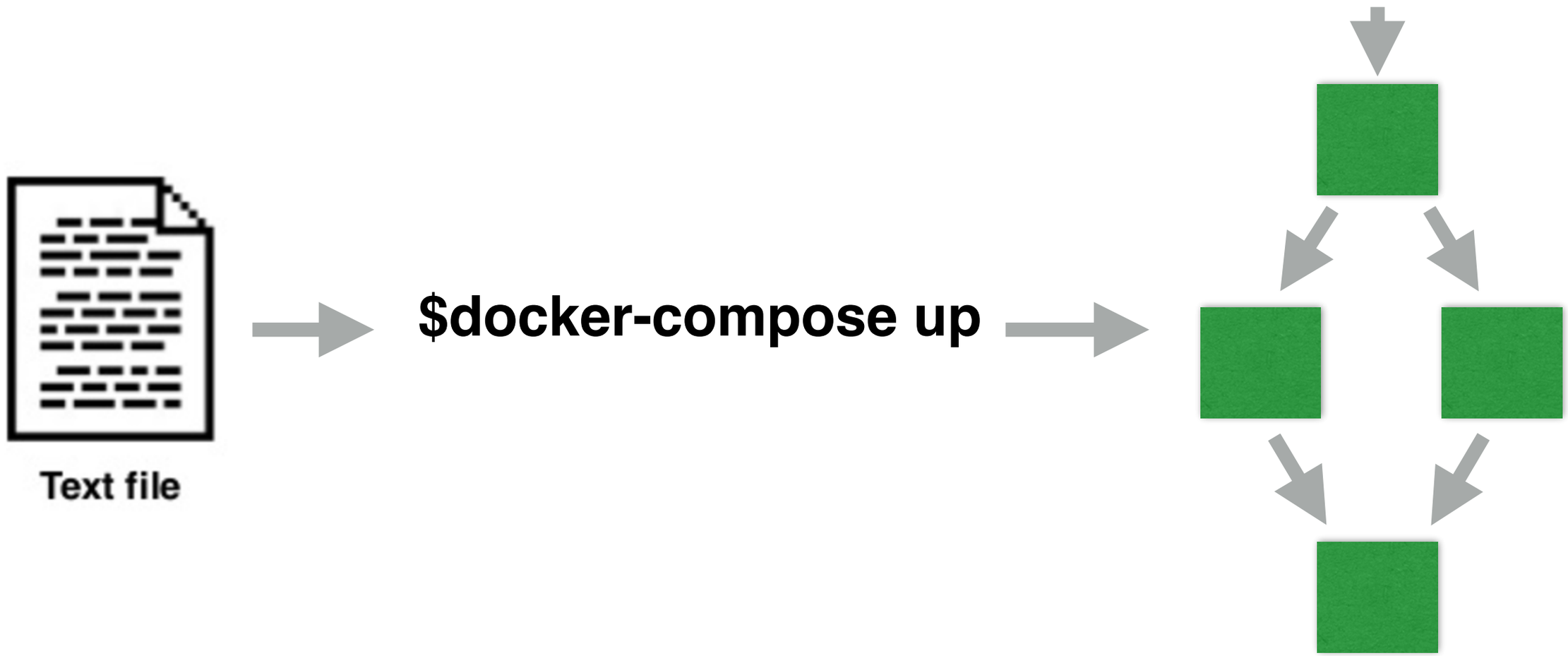
Docker compose

Running app in one command-line
Configuration in YAML file



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docker-compose.yml

```yaml
version: '3'
services:
  web:
    container_name: web
    build: .
    ports:
      - 80:5000
    environment:
      - REDIS_HOST=redis

  redis:
    container_name: redis
    image: redis
```


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Build and run

```
$docker-compose build
$docker-compose up -d
$docker-compose logs --follow
$docker-compose ps
$docker-compose down
```


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Working with

kubernetes

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Why we need Kubernetes ?

Managing containers for production is challenging

Need something to manage beyond a container engine !!

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Key capabilities was missing

Using multiple containers with shared resources
Monitoring running containers
Handling dead containers
Moving containers so utilization improves

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Key capabilities was missing

Autoscaling container instances to handle load
Making the container services easily accessible

Handling dead Connecting containers to a variety of external data sources

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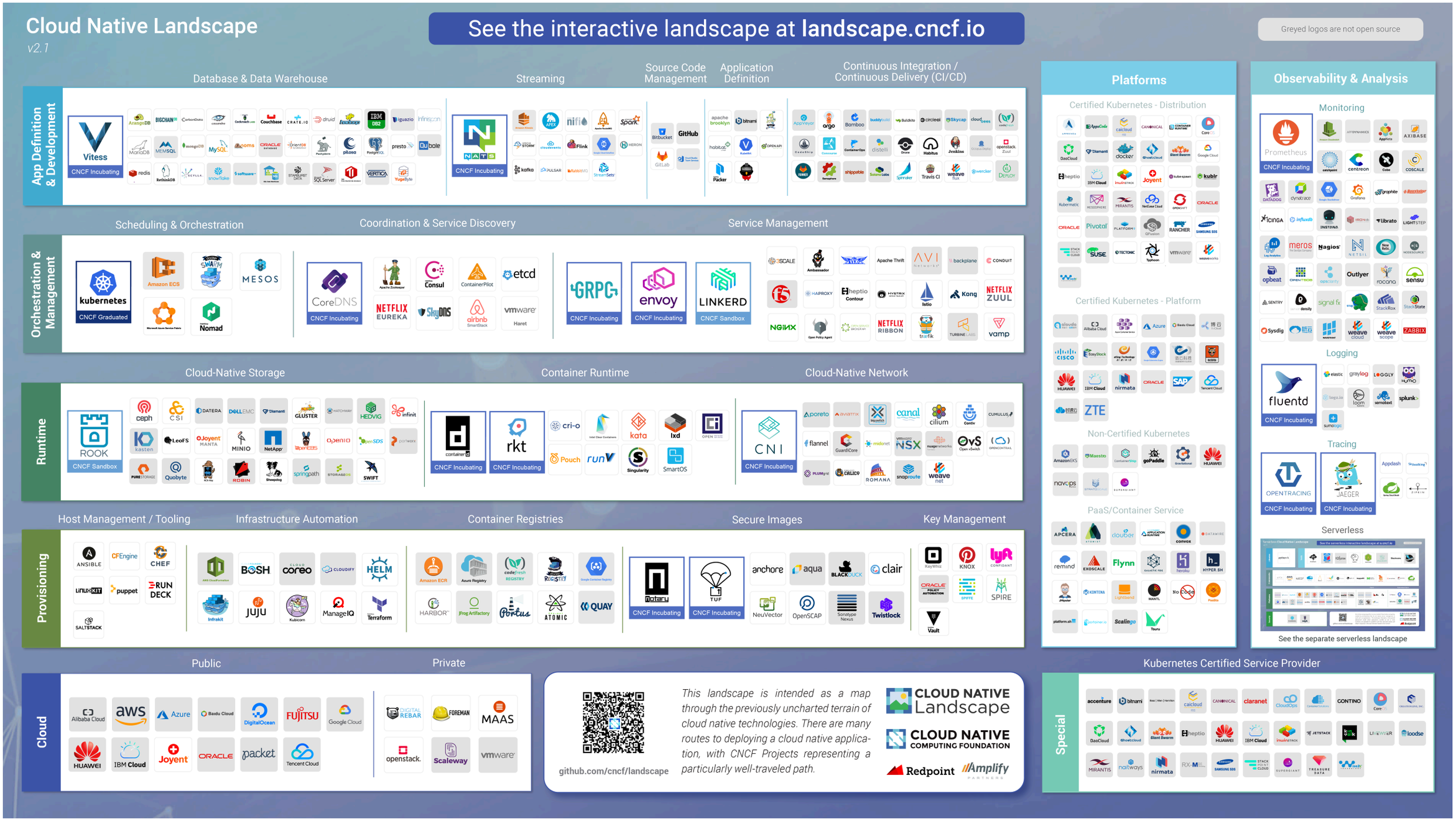
Cloud Native Landscape



https://github.com/cncf/landscape

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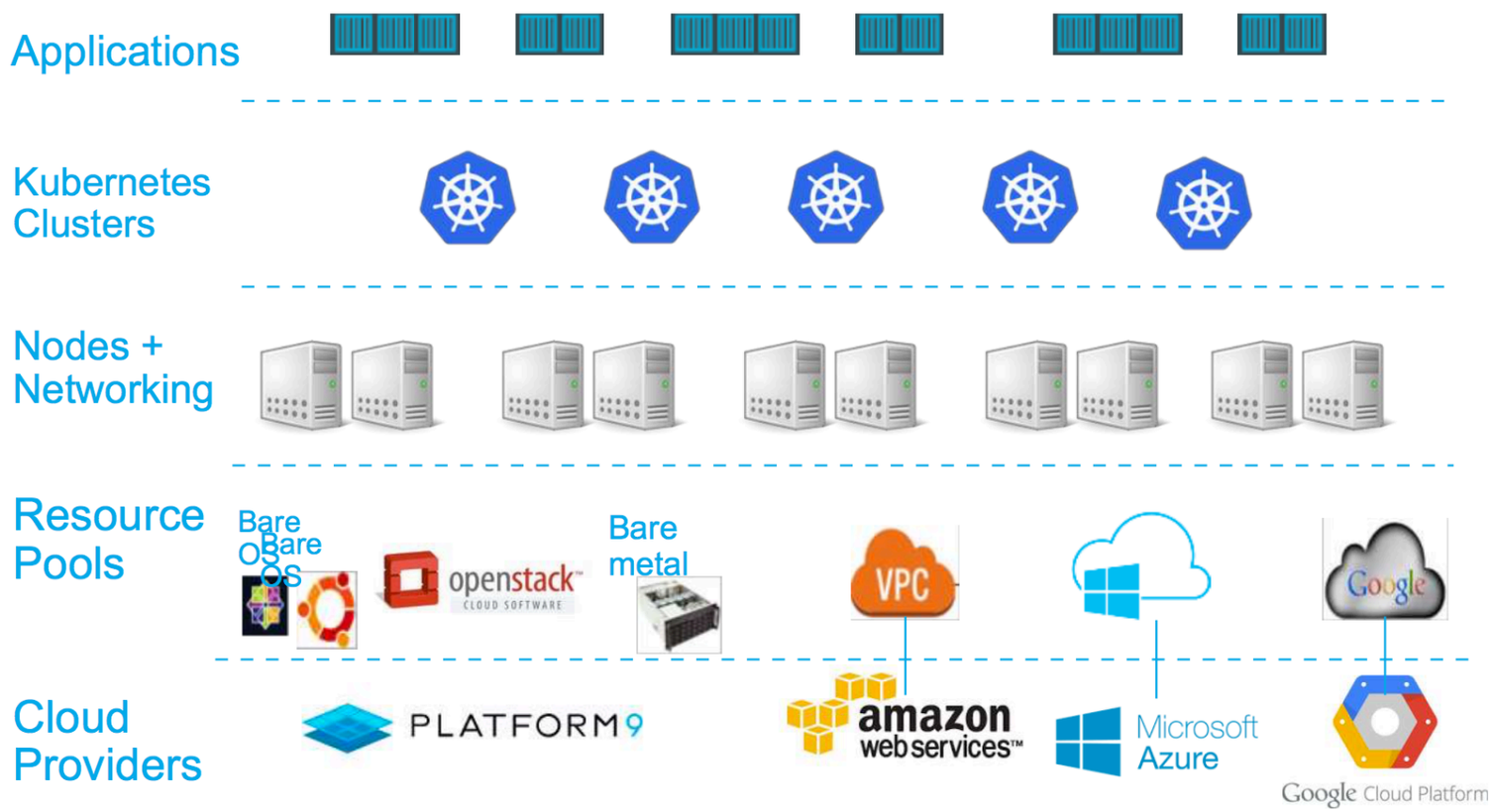
Write once, run anywhere

Eliminate infrastructure lock-in
Use containers
Provides management for containers



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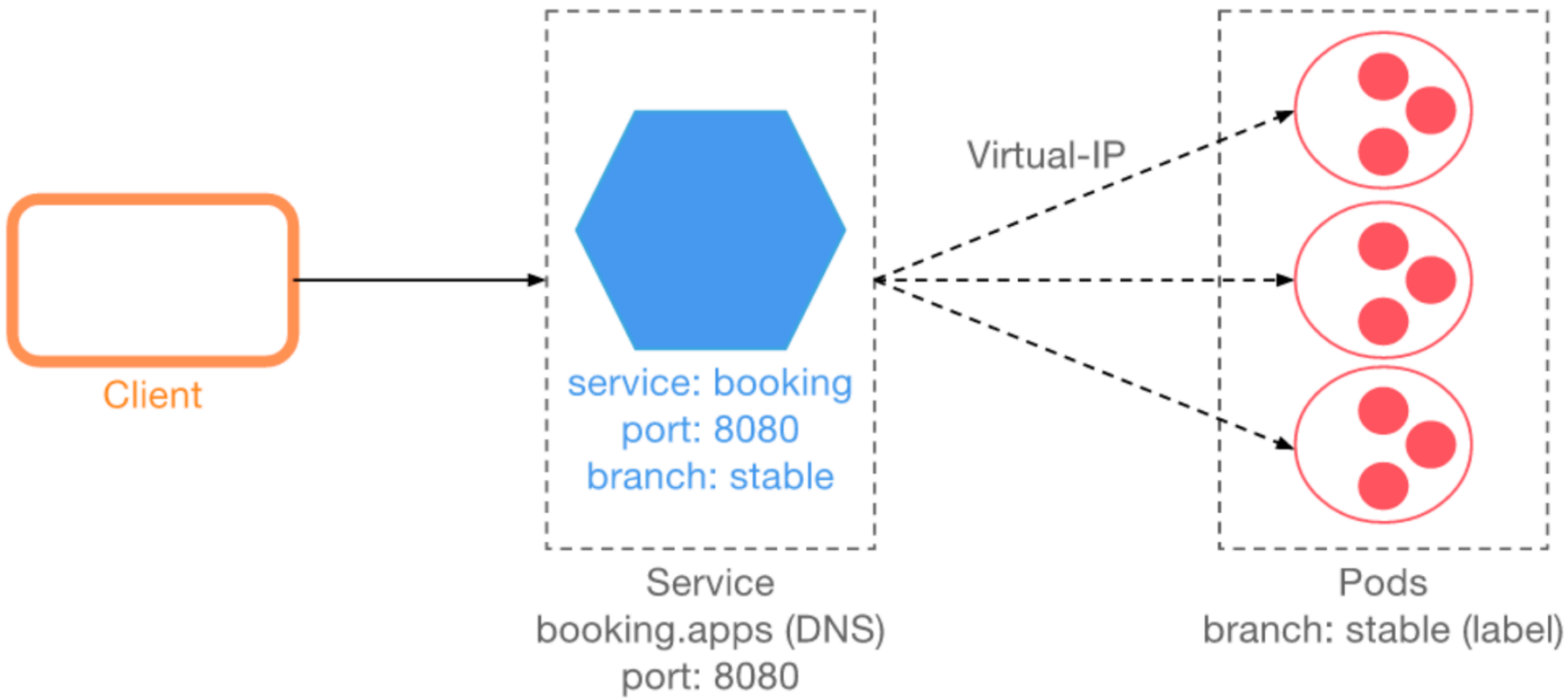
Modular app design

Container/Image boundary similar to class
How to use/manage a collection of container ?



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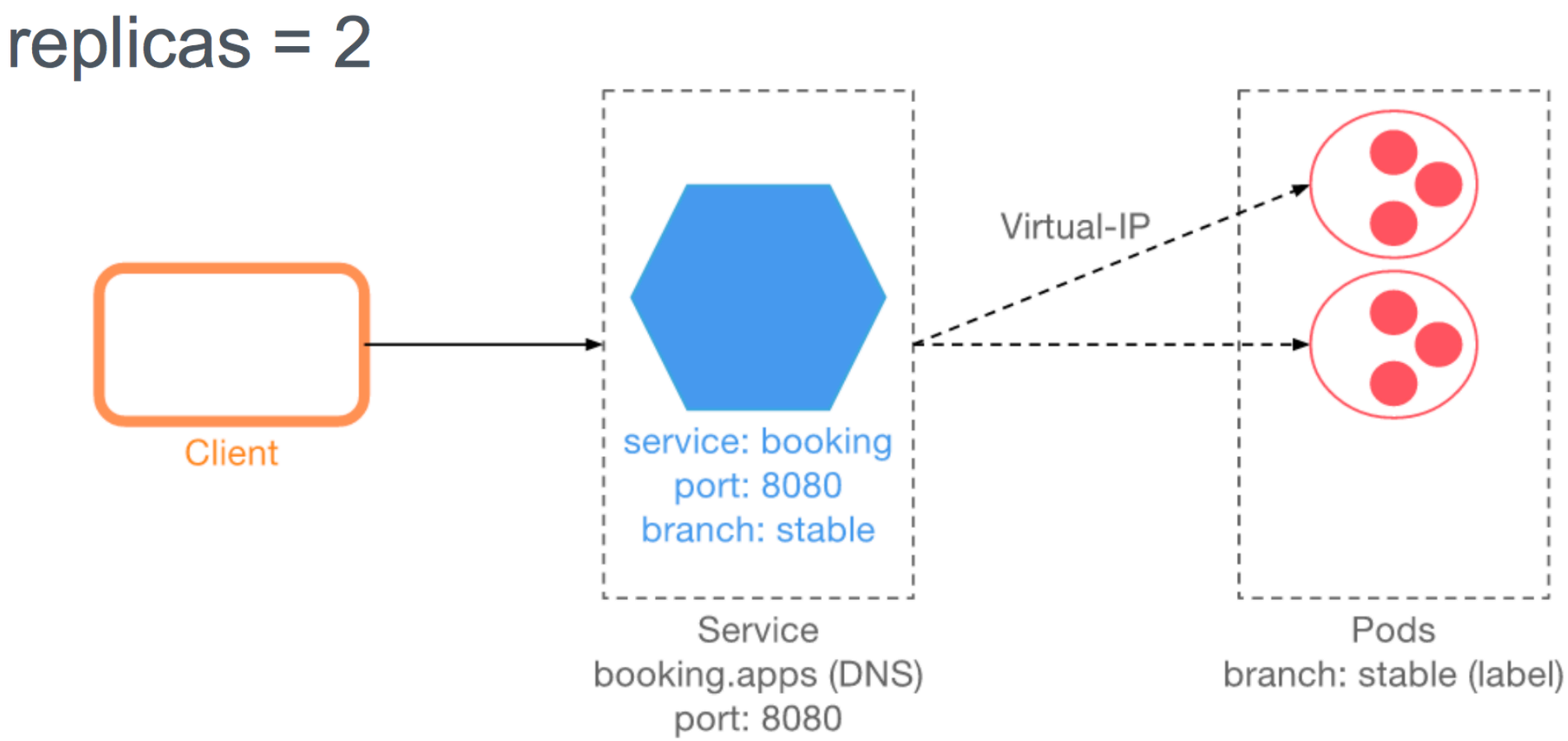
Fault-tolerant by design

Design for failure



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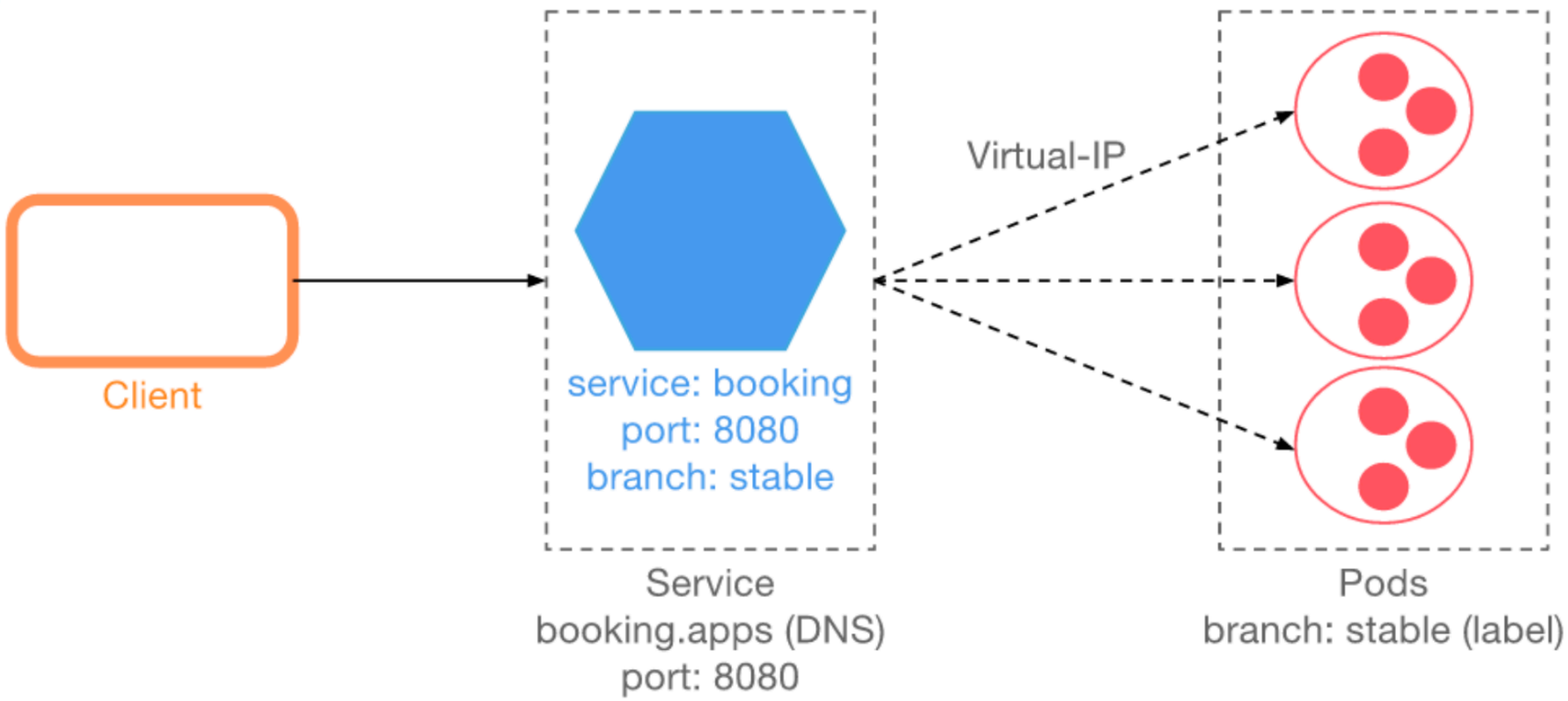
Fault-tolerant by design

Design for failure

replicas = 3



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Deployment, not infrastructure

Software deployment is hard
Infrastructure provisioning/re-provisioning
Configuration networking and load balance
Redundancy (scale-out)
Lifecycle management (Software update)

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K8s support for deployment

Scale-out service
Rolling update for new version
Rollback to a previous version
Pause and resume a deployment
Horizontal auto-scaling
Canary deployment

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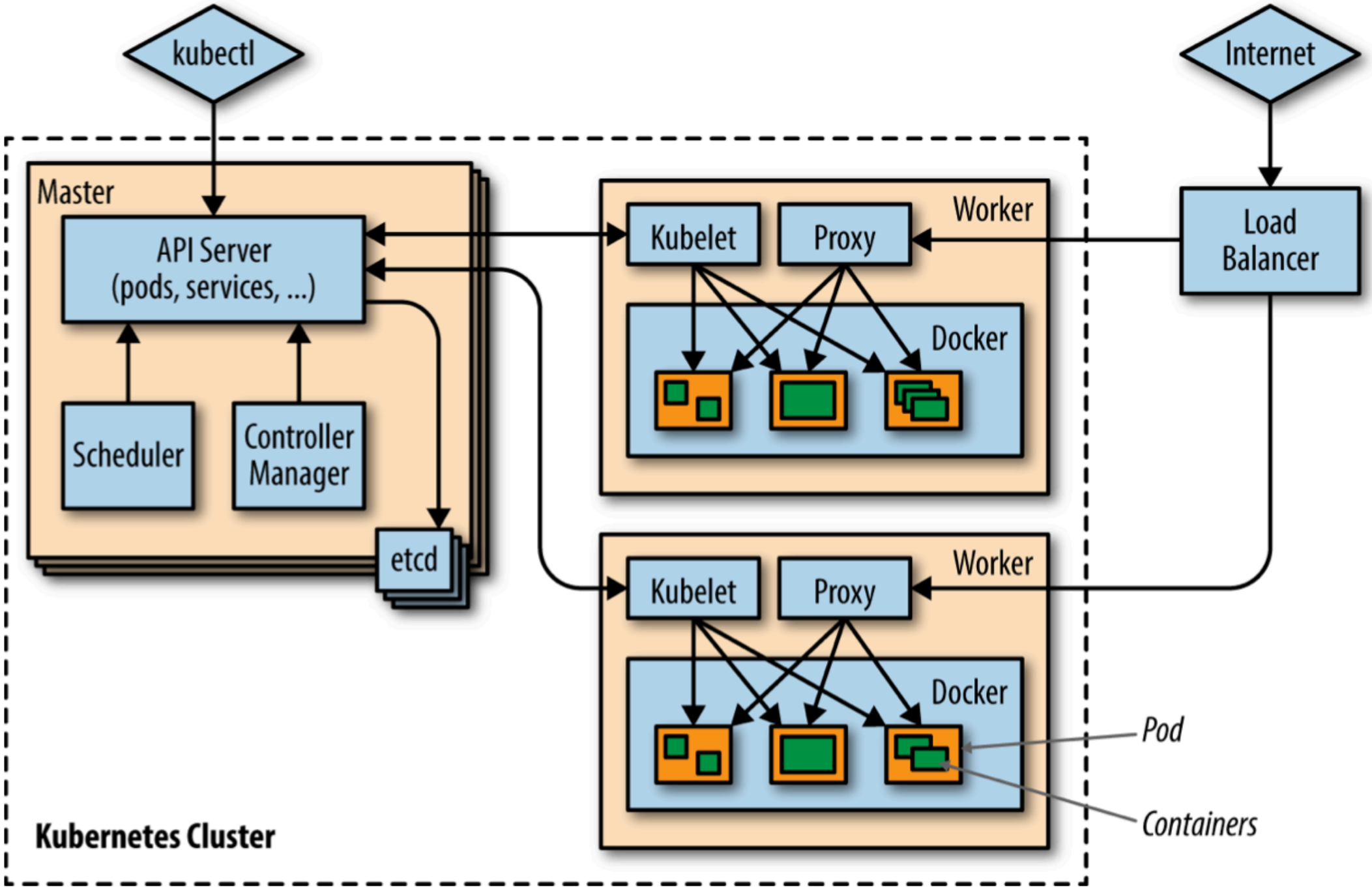
Kubernetes Architecture



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K8s components

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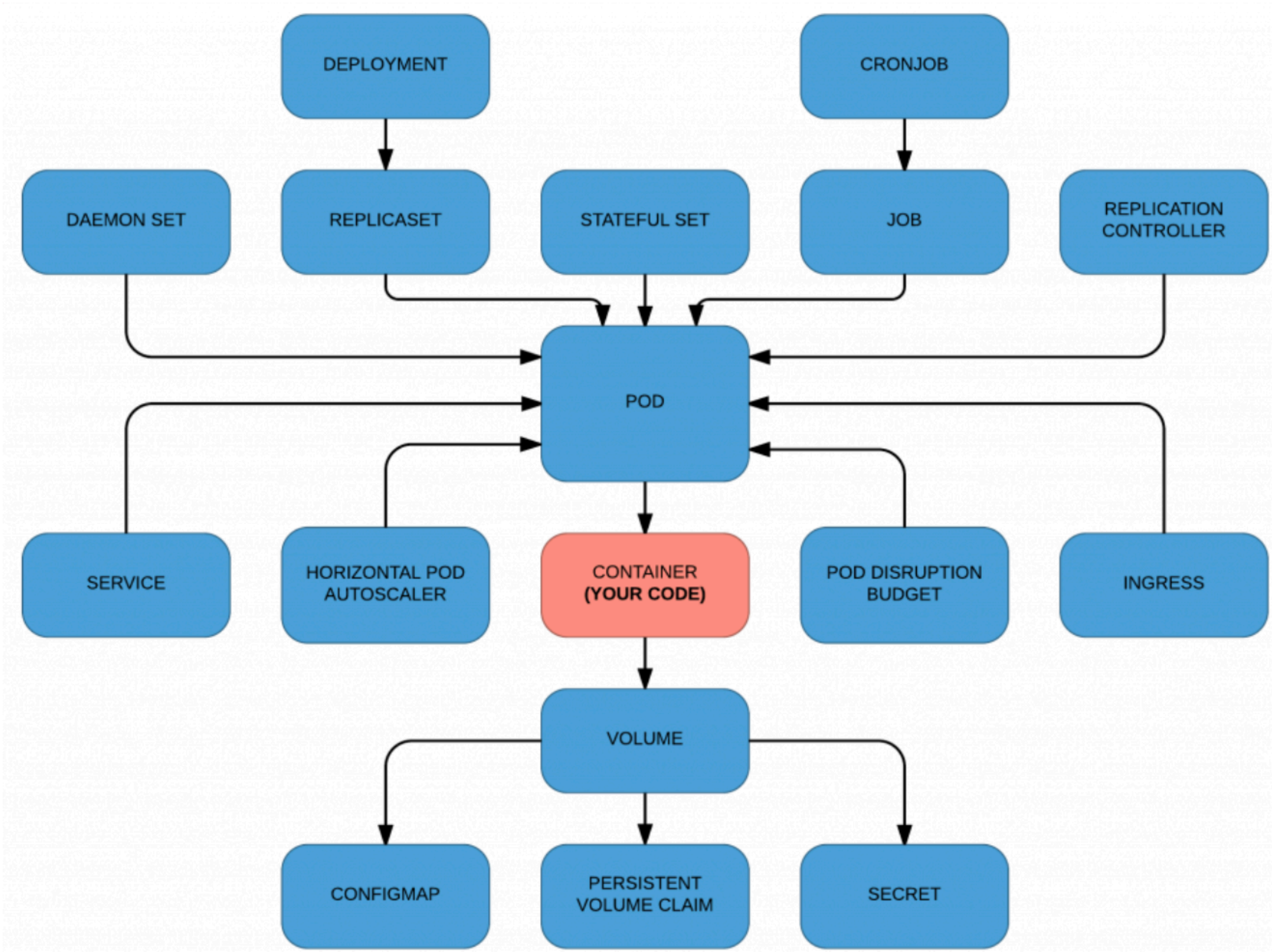

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K8s components

Pods
Services
Deployments
ConfigMap and Secret
Volumes
StatefulSets

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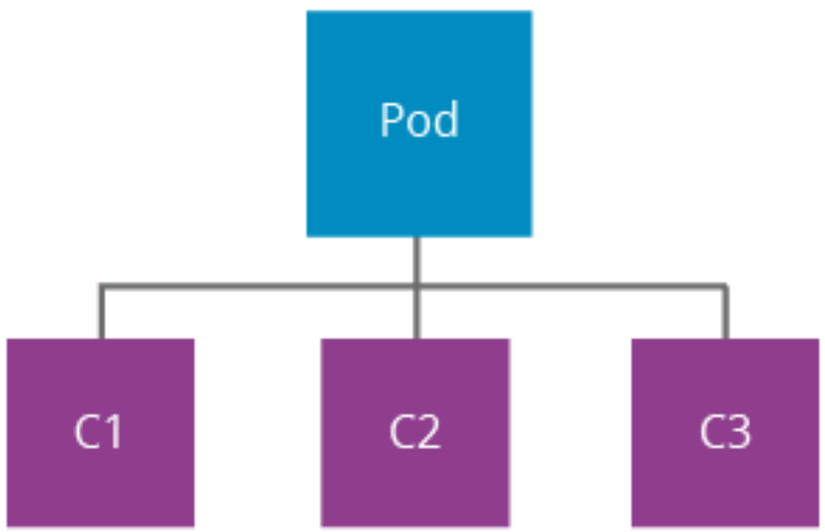
Pods

Small group of co-located containers
Optionally shared volume between containers
Basic deployment unit in Kubernetes



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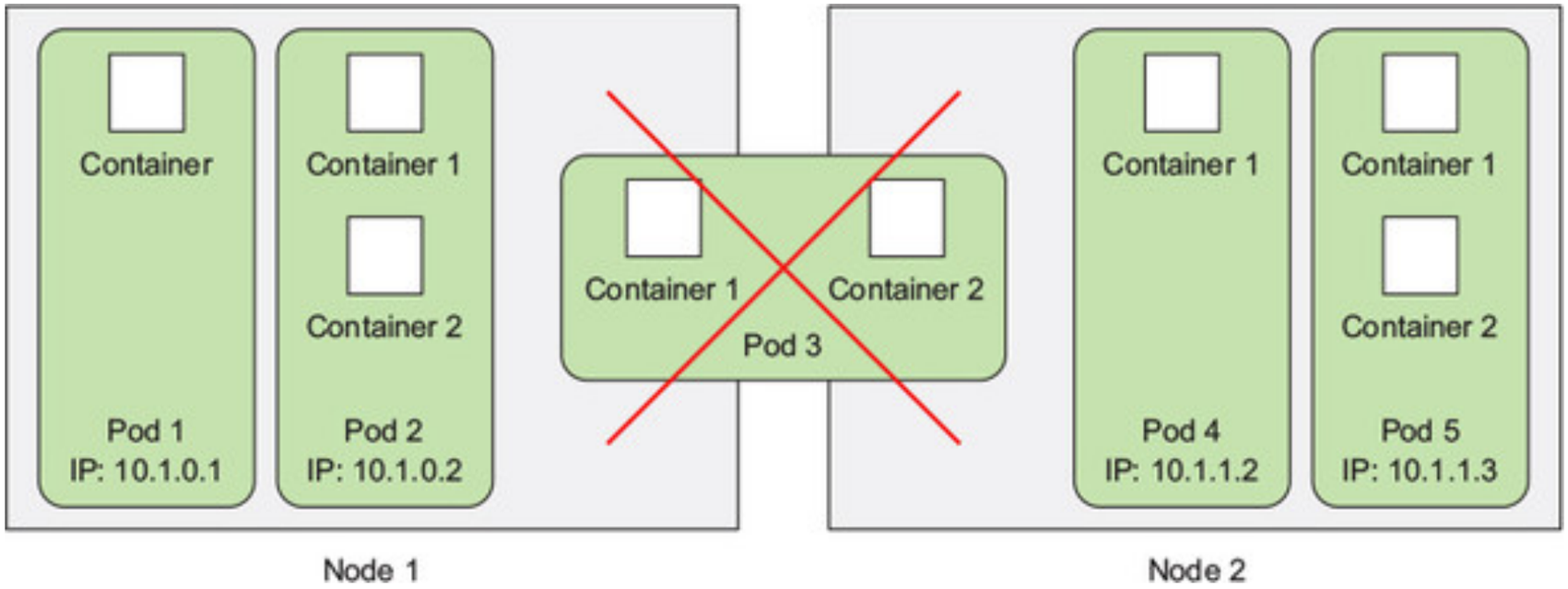
Pods

1 pods = 1 container
1 pods = N containers



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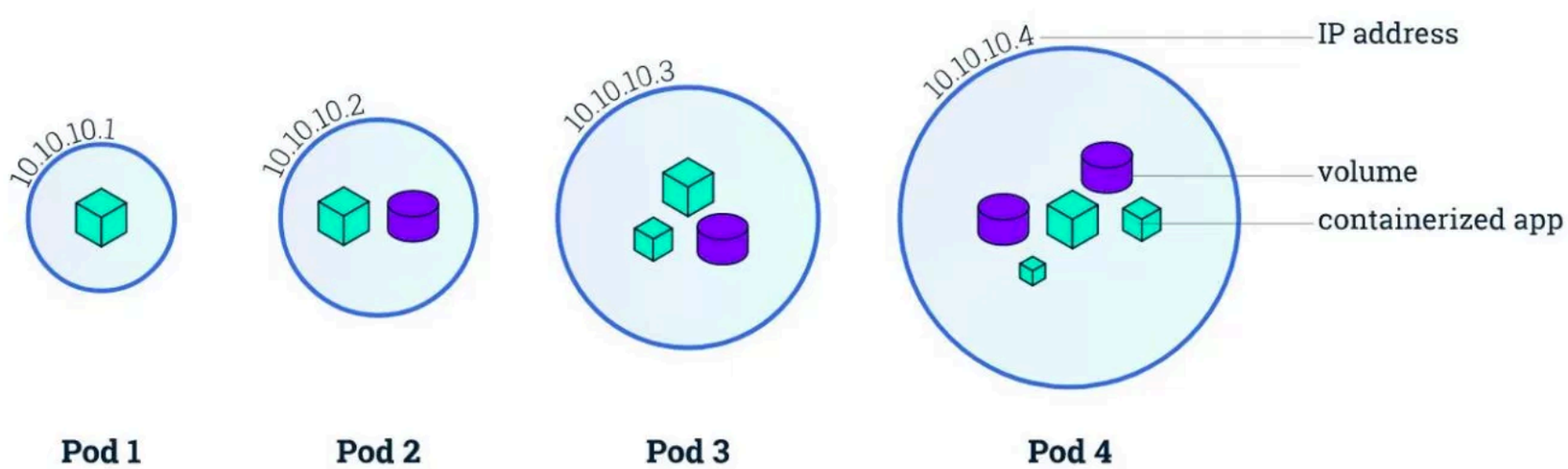
All containers in same Pods

Share process ID
Share network interface
Share Hostname/IP/Port
Share Unix Time Sharing (UTS)



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Pods Life Cycle

Phase	Description
Pending	Accepted by kubernetes but container not created yet
Running	Pods bound to the node, all containers created and at least one container is running/starting/ restarting
Successed	Containers exited with status 0
Failed	All containers exit and at least one exited with non-zero status
Unknow	State of Pods can’t be determined due to communication issues with its node

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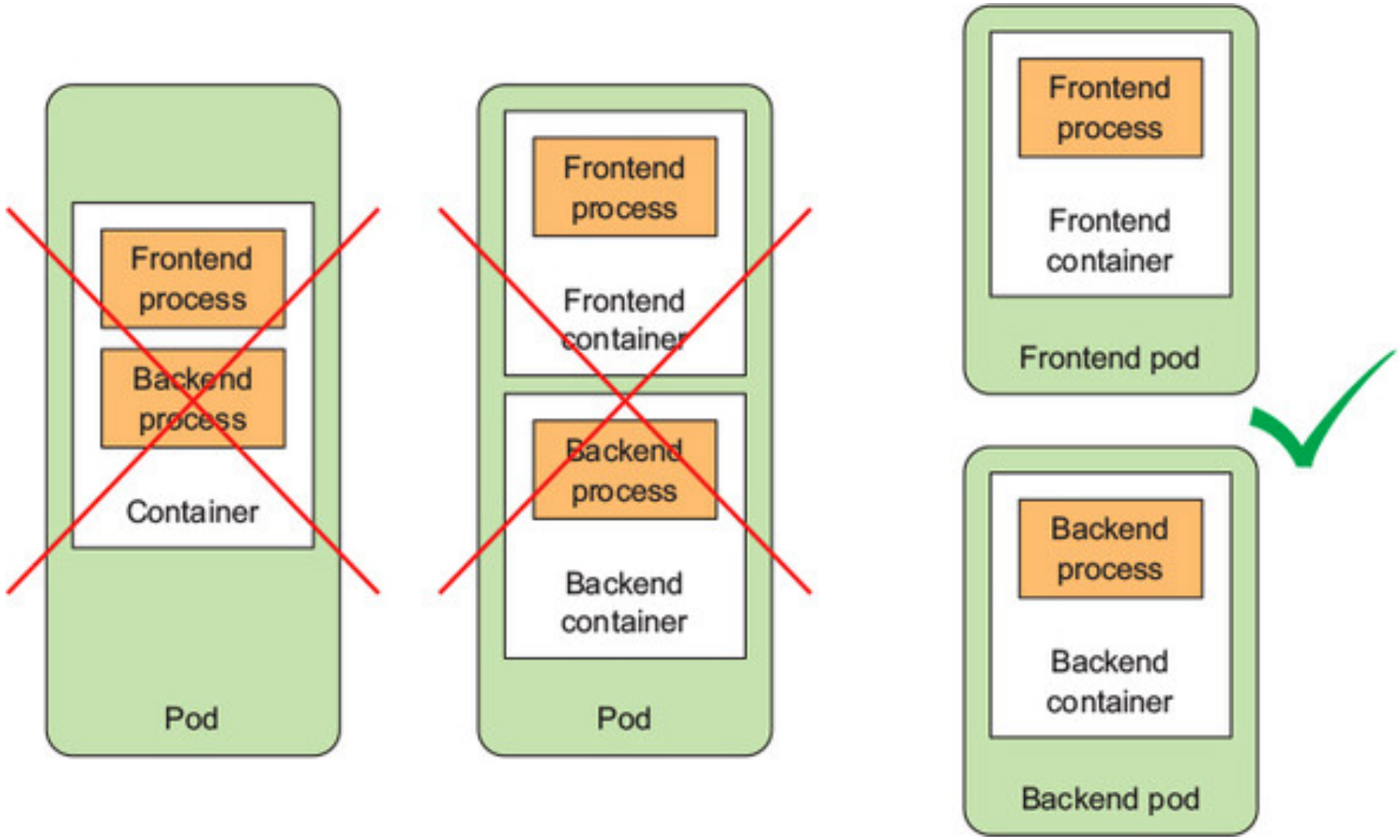
Organize container across Pods

Split multi-tiers app into multiple pods



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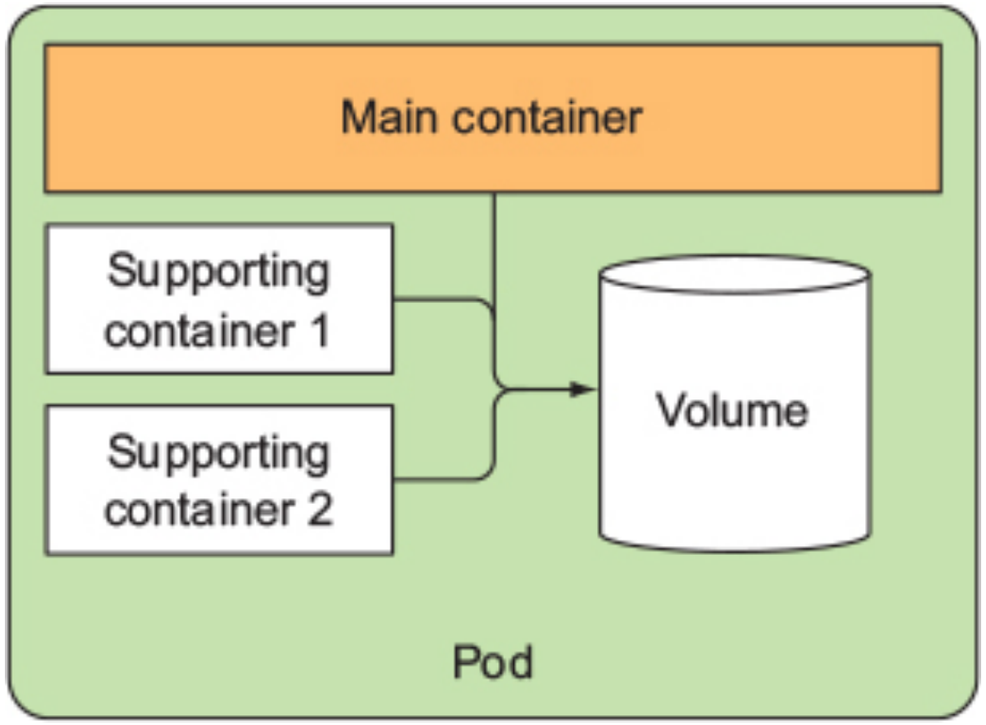
Organize container across Pods

When to use multiple containers in a pods



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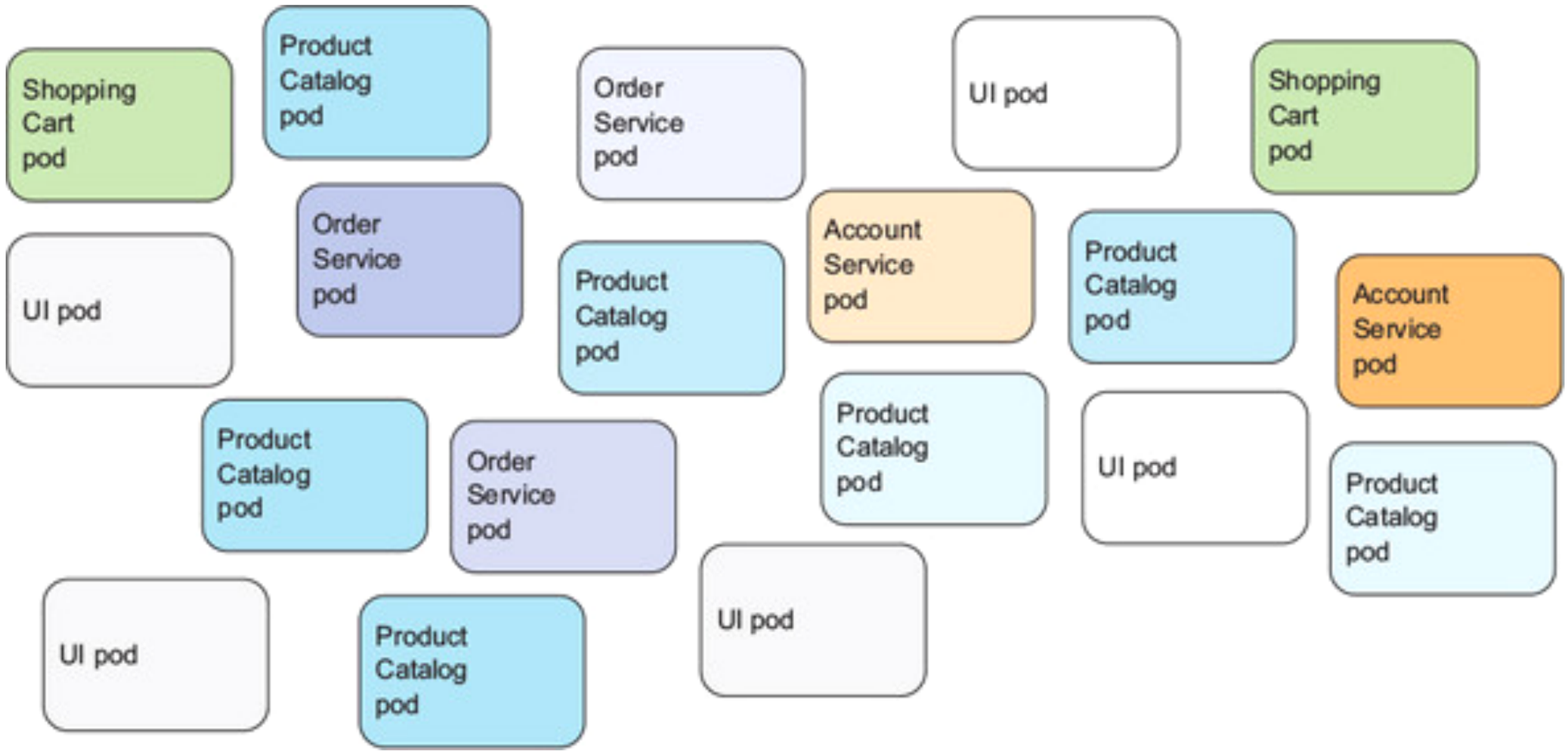
Organize pods with Labels



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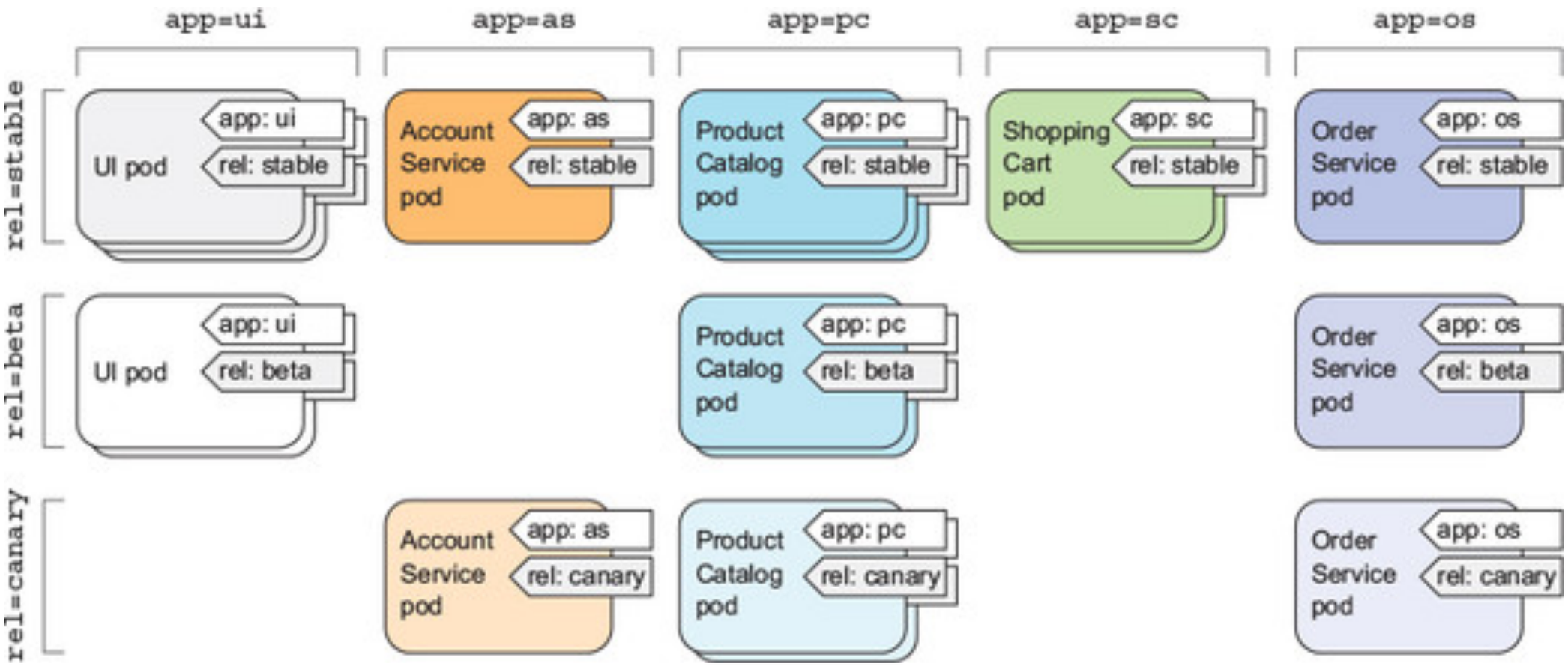
Organize pods with Labels



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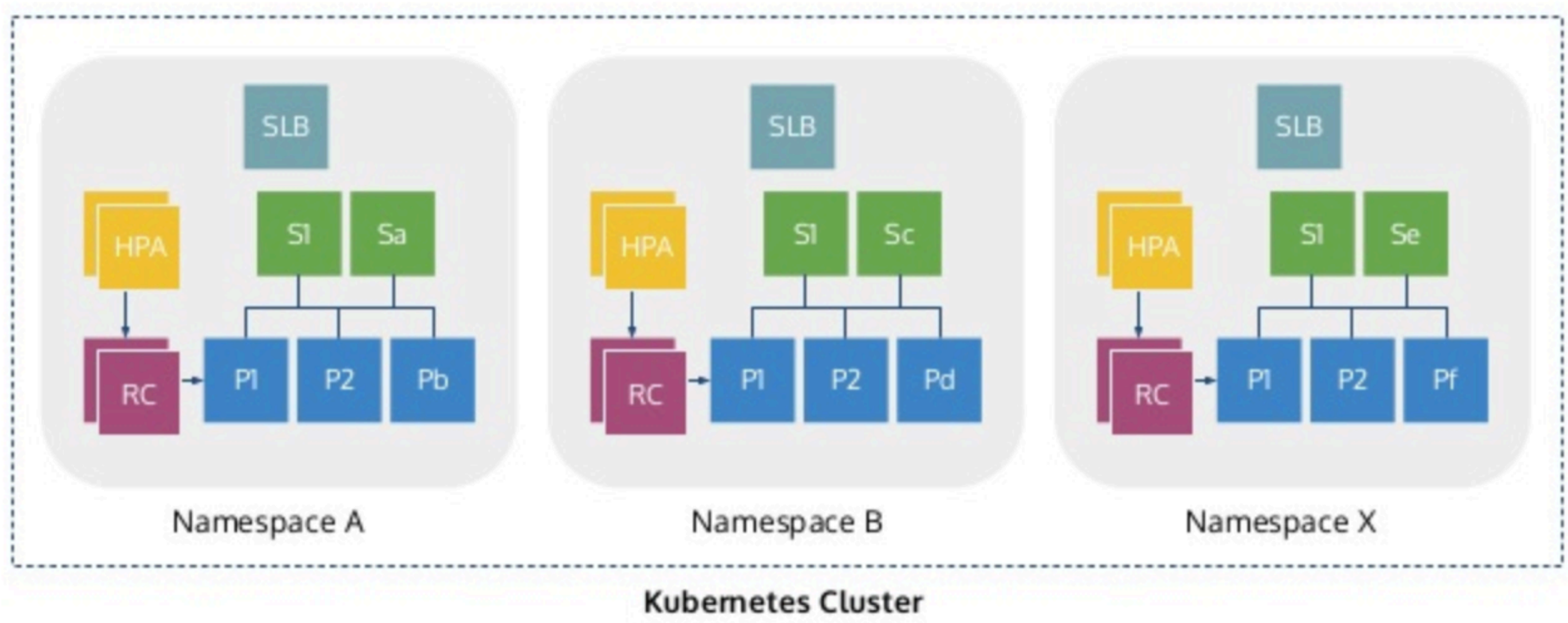
Pods Namespaces

Allow different teams to use the same cluster



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Services discovery and Load balancing

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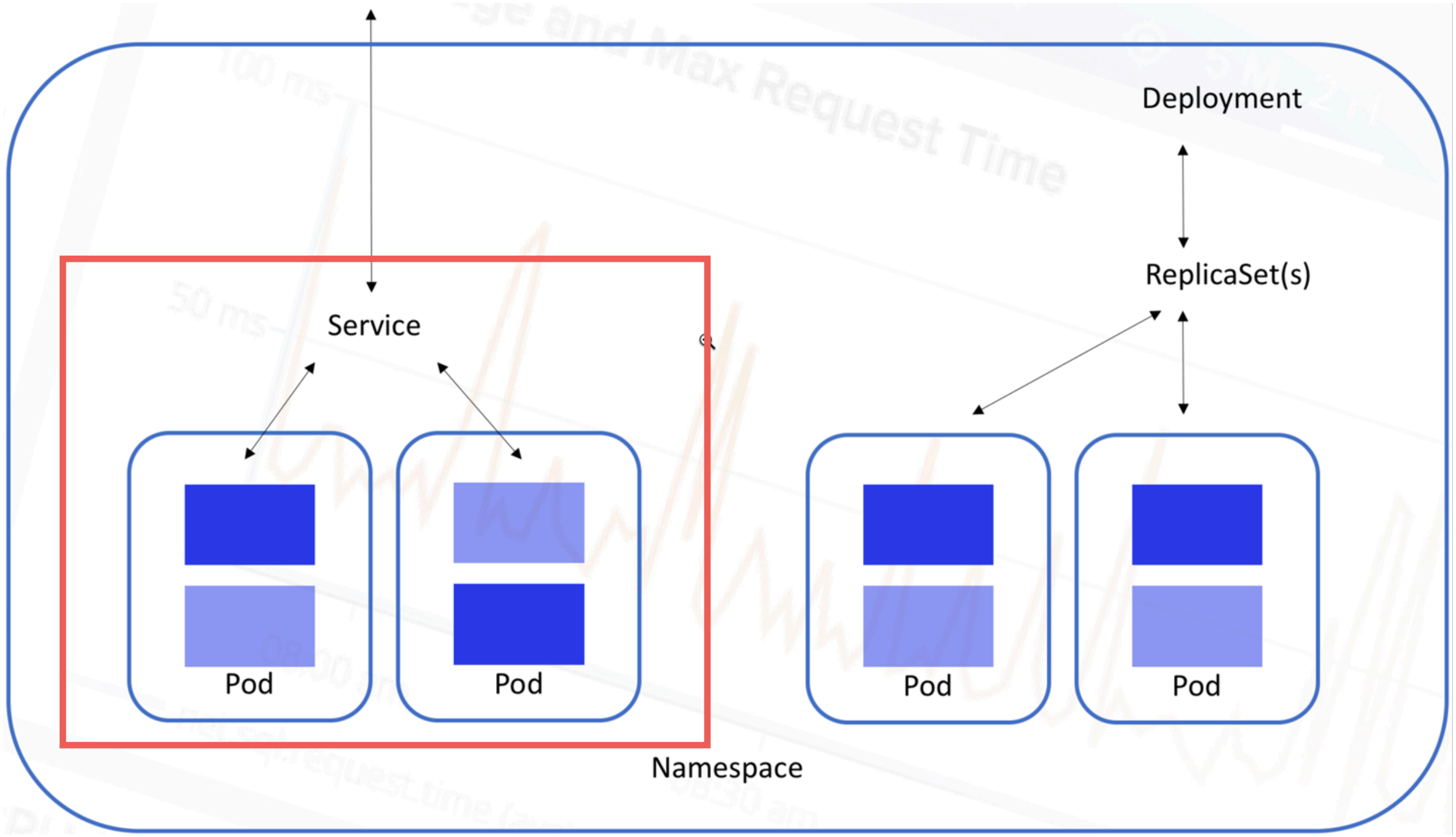
Services



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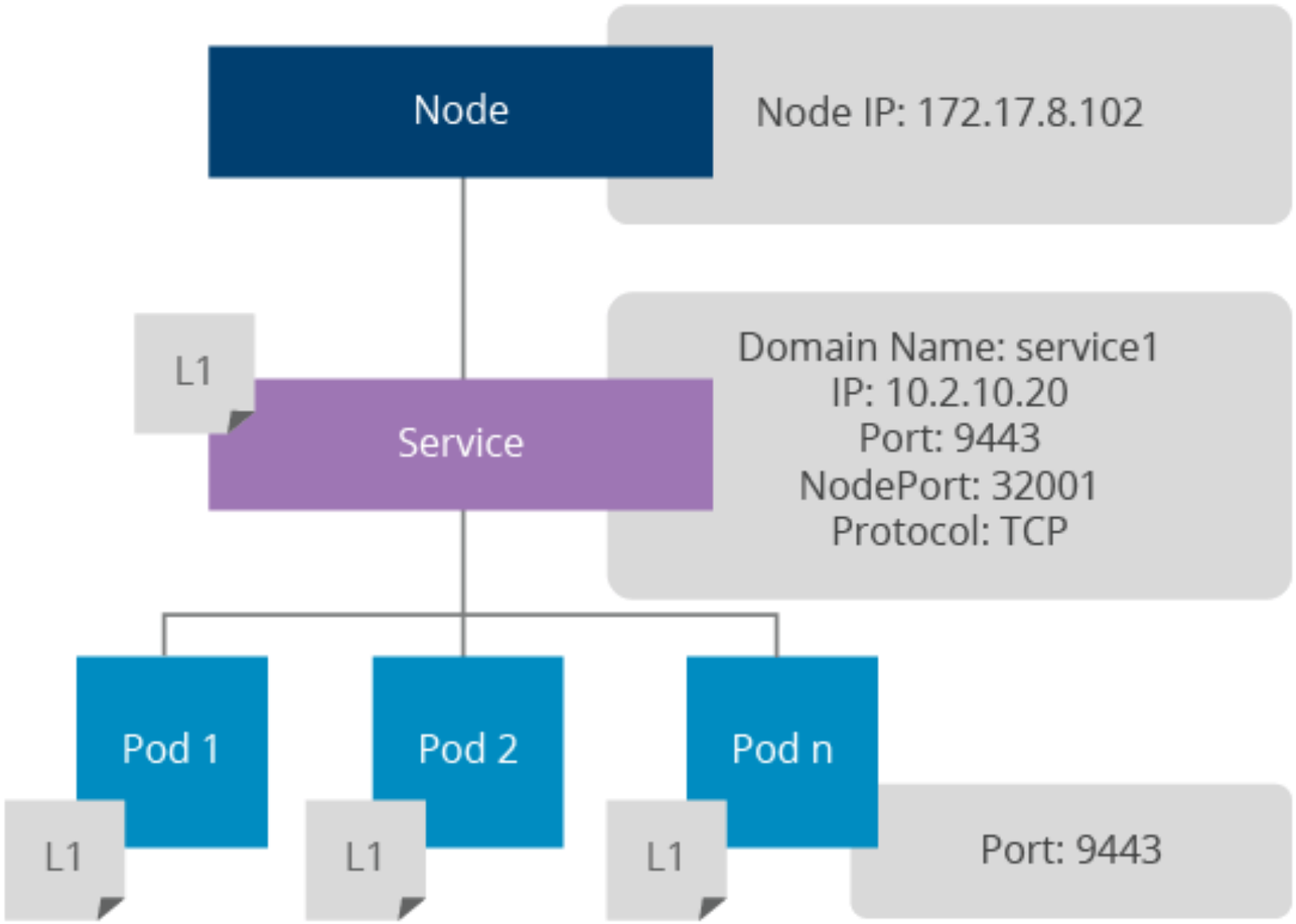
Services



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Services

Independent from Pods
Abstraction layer of Pods
Provide load balance
Expose access Pods/Load balance
Find Pods by label selector

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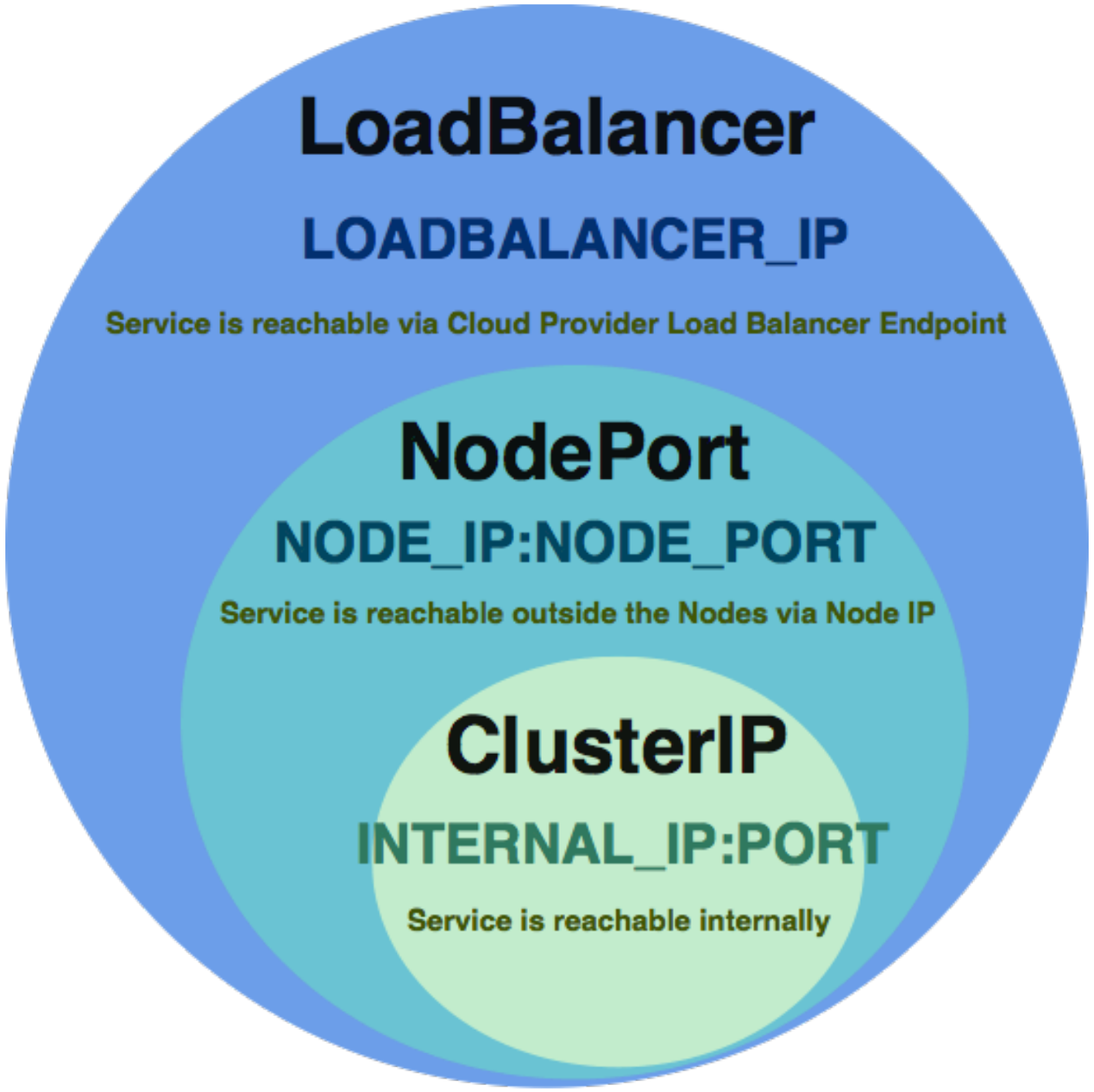
3 types of services



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Deployment and ReplicaSet (RS)

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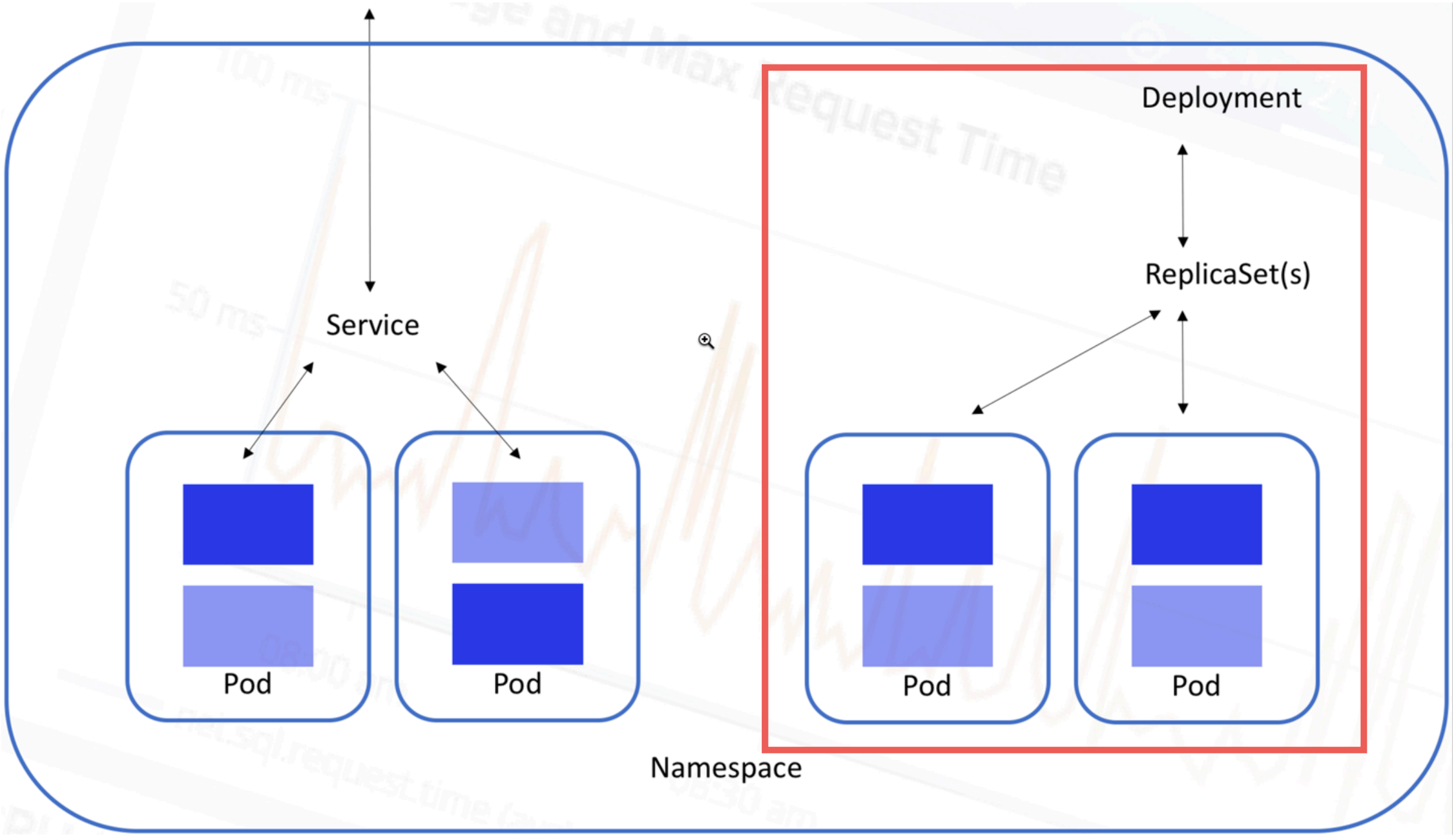
Deployment and ReplicaSet



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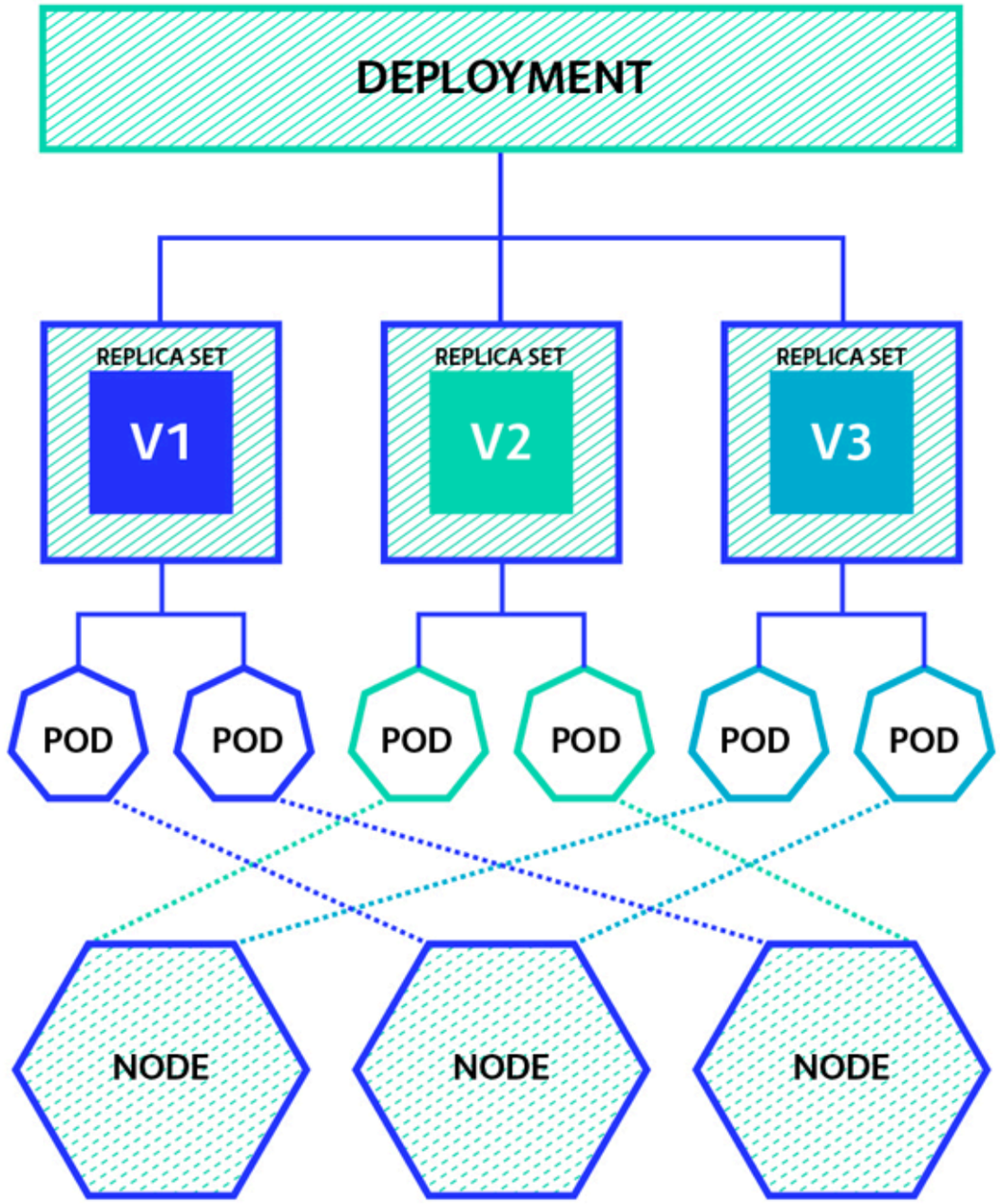
Deployment and ReplicaSet



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Deployment and ReplicaSet

Next-generation of Replication Controller
Provide function to maintain versioning of Pods
Update new version (Rollout)
Revert to old version (Rollback)
Scale a deployment
Pause/Resume process

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Ingress network

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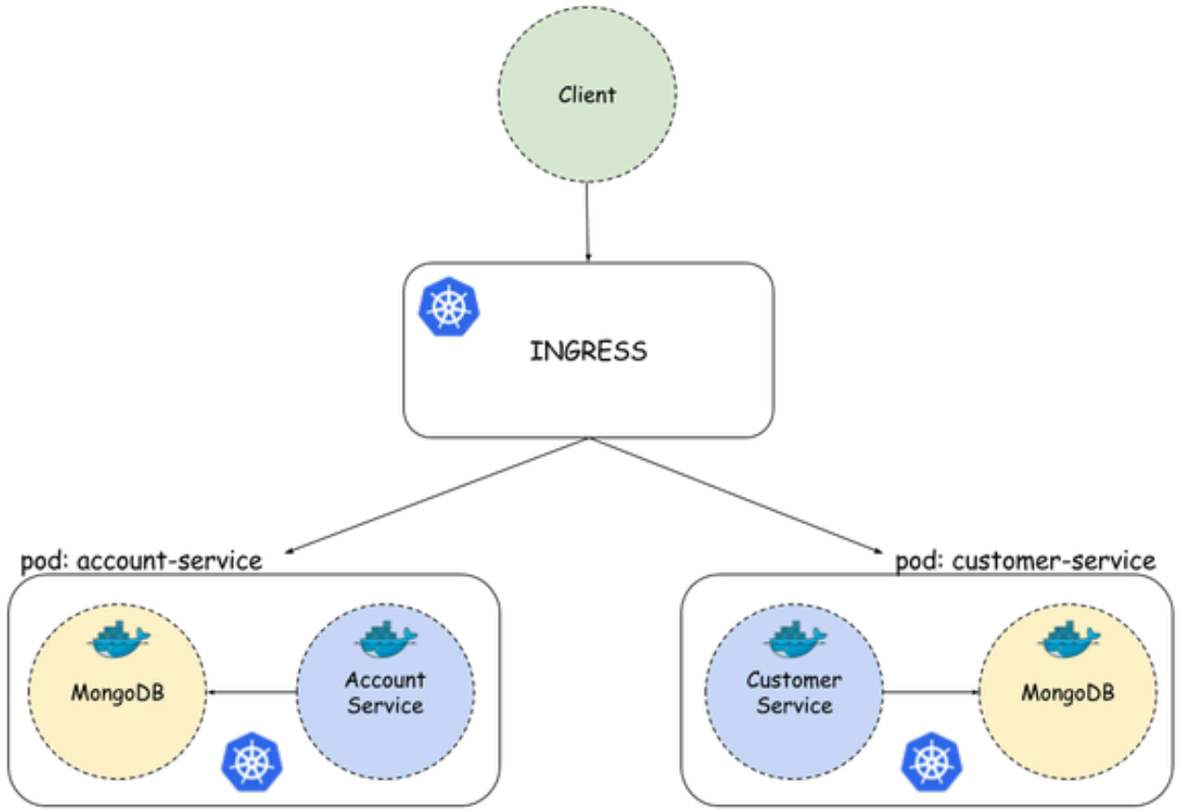
Ingress Network

How to handle multiple services in same port ?
How to limit protocol to access ?



https://kubernetes.io/docs/concepts/services-networking/ingress/

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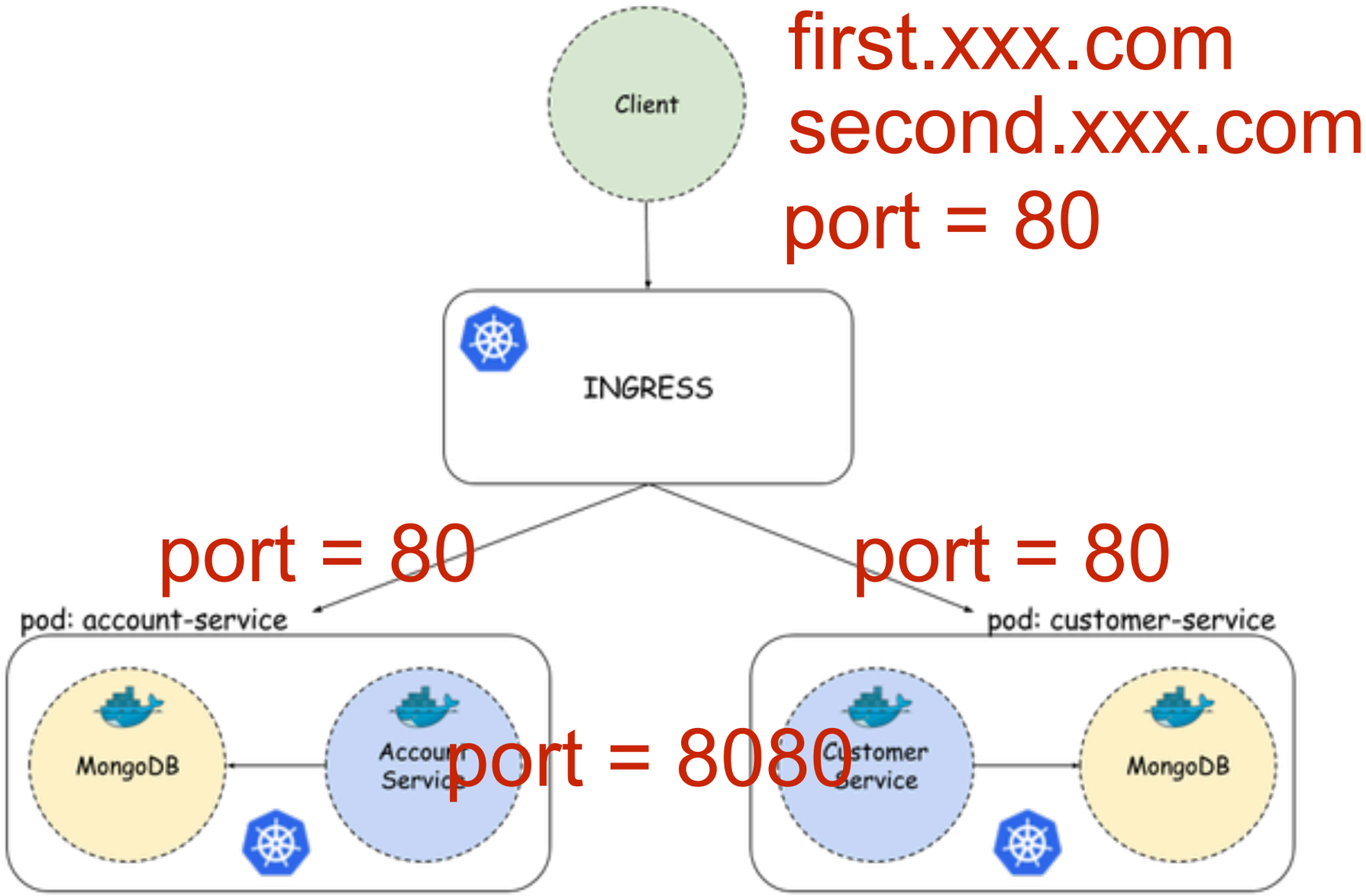
Ingress Network



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StatefulSet

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StatefulSet

Bringing the concept of ReplicaSets to **stateful** Pods
Enable running Pods in **cluster** mode
Ideal for deploy **highly** available database **workload**

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StatefulSet

Stable, unique network identifiers
Stable, persistent storage
Ordered, graceful deployment and scaling
Ordered, graceful deletion and termination

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Key concepts

Pods are created sequentially
Pods are terminated in LiFo (Last in, First out)

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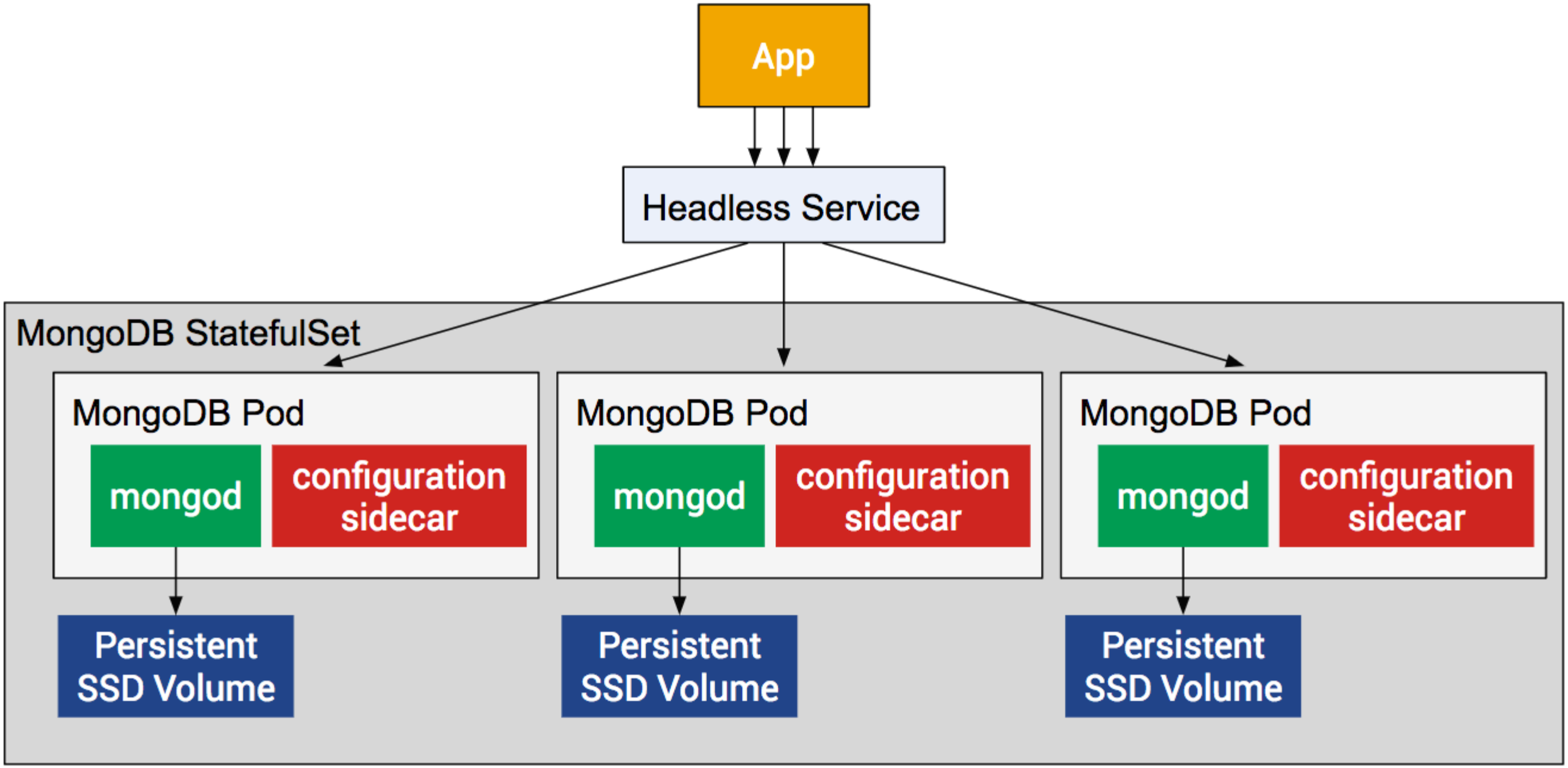
StatefulSet



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Workshop

kubernetes

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Working with Helm

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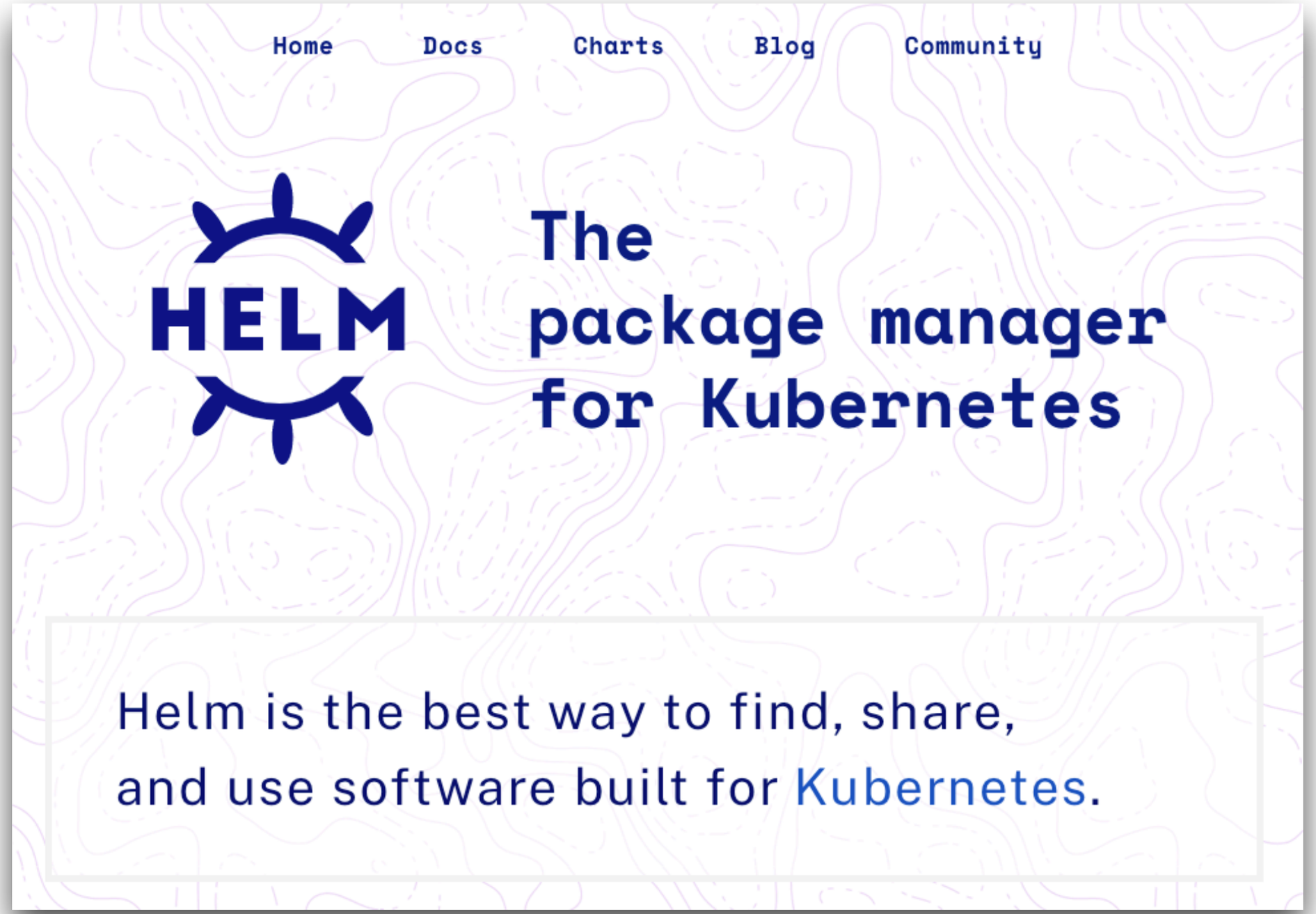
Helm ?



https://helm.sh/

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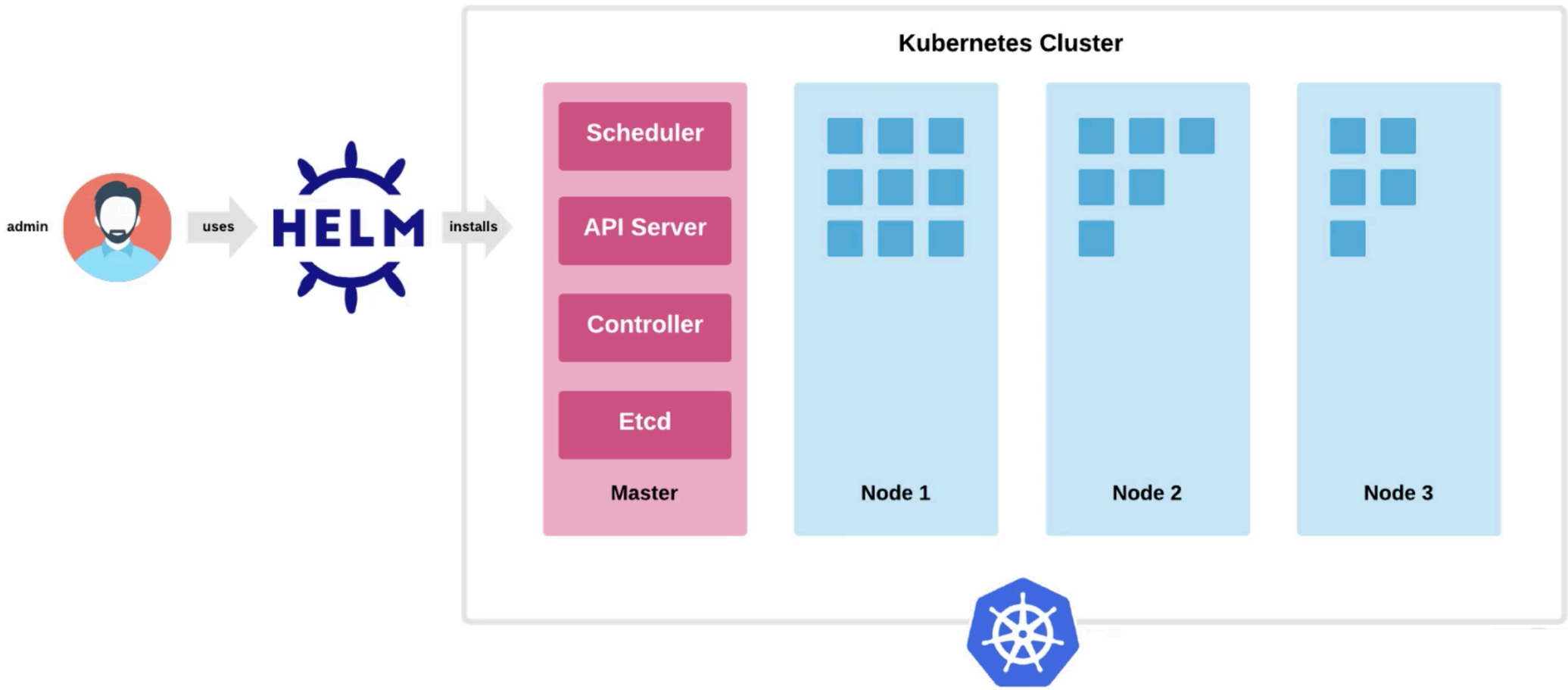
Package manager for K8s



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Why Helm ?

Hard to manage multiple K8s configurations

Hard to deploy multiple K8s configurations

Hard to share and reuse K8s configurations

Hard to parameterise and support multiple environments

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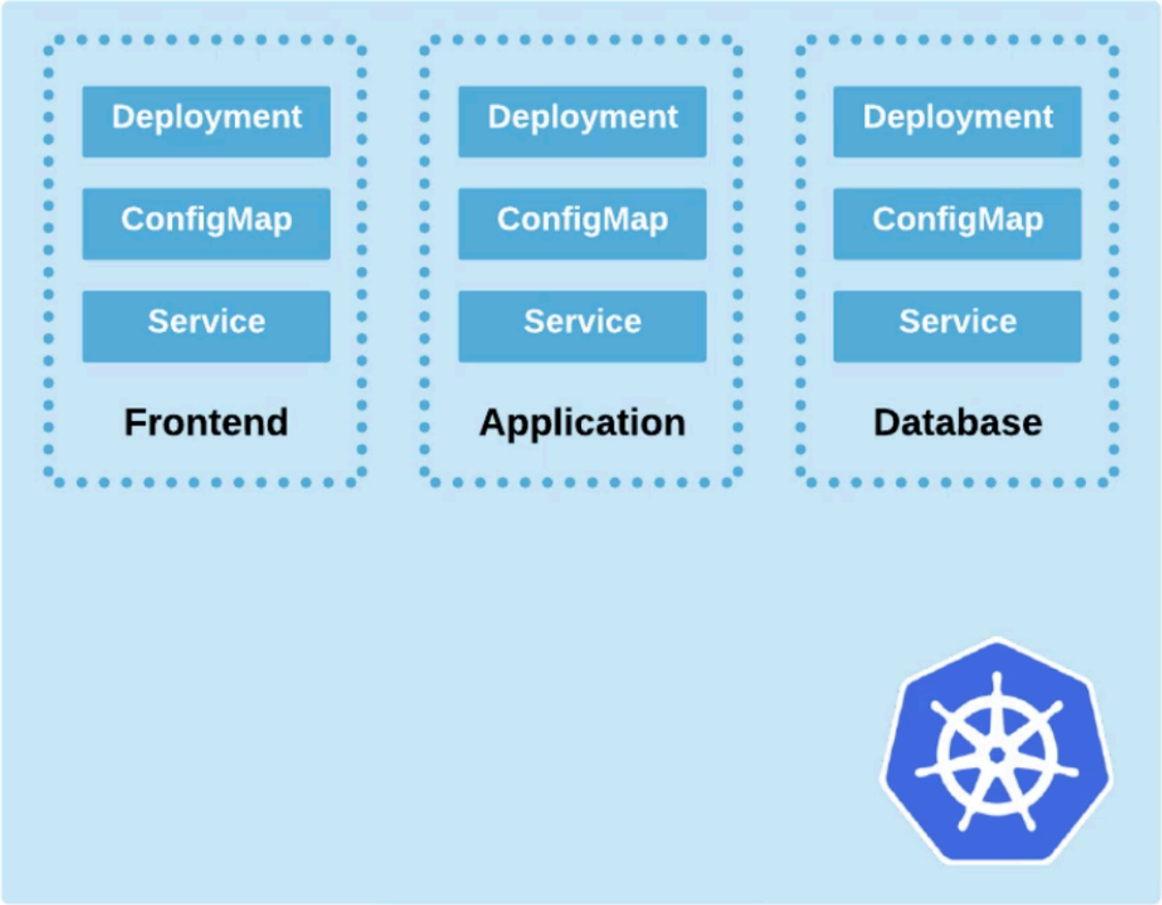
K8s resources



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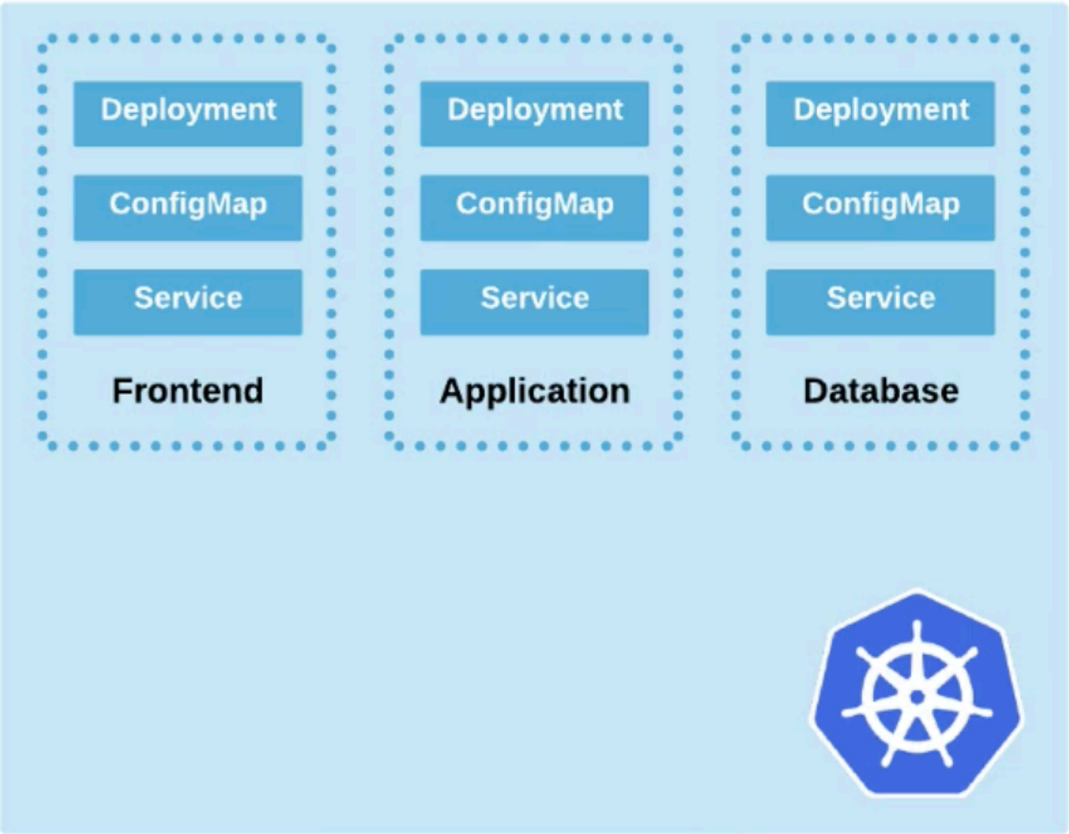
K8s resources




```
~/demo: kubectl apply -f
~/demo: kubectl apply -f
~/demo: kubectl apply -f

~/demo: kubectl apply -f
~/demo: kubectl apply -f
~/demo: kubectl apply -f

~/demo: kubectl apply -f
~/demo: kubectl apply -f
~/demo: kubectl apply -f
```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Why Helm ?

Hard to manage app releases
(rollout, rollback, history)

Hard to define deployment life cycle
Hard to validate release state after deployment

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Helm make it easy to start Using K8s with real application

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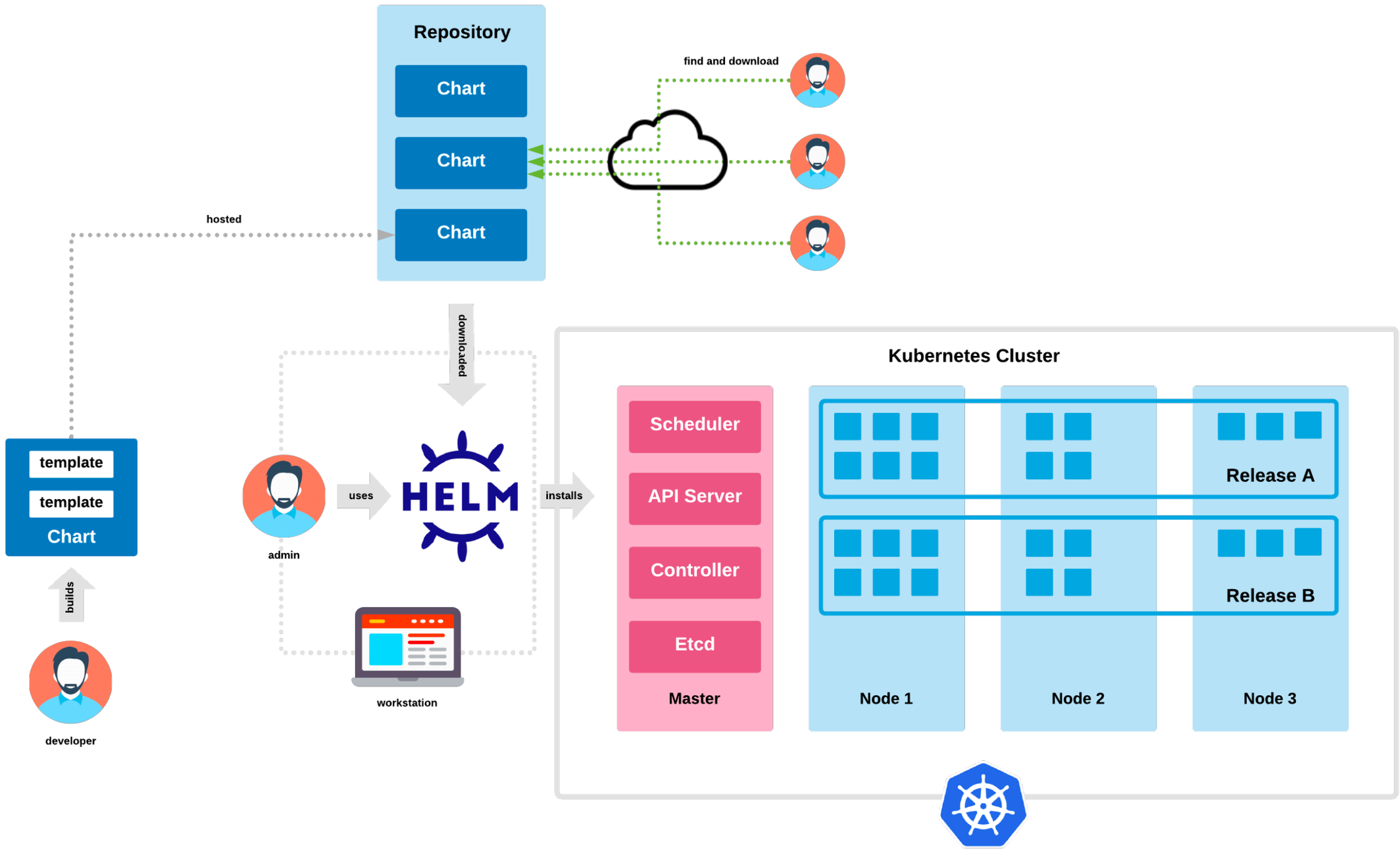
Welcome to Helm



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What Helm ?

Helm is a **Package Manager** for Kubernetes

Package multiple K8s resources into a single logical deployment unit

Called “**Chart**”

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What Helm ?

Helm is a **Deployment management** for Kubernetes

Repeat deployment
Management dependencies (reuse/share)
Manage multiple configurations
Update/rollback and test application deployments

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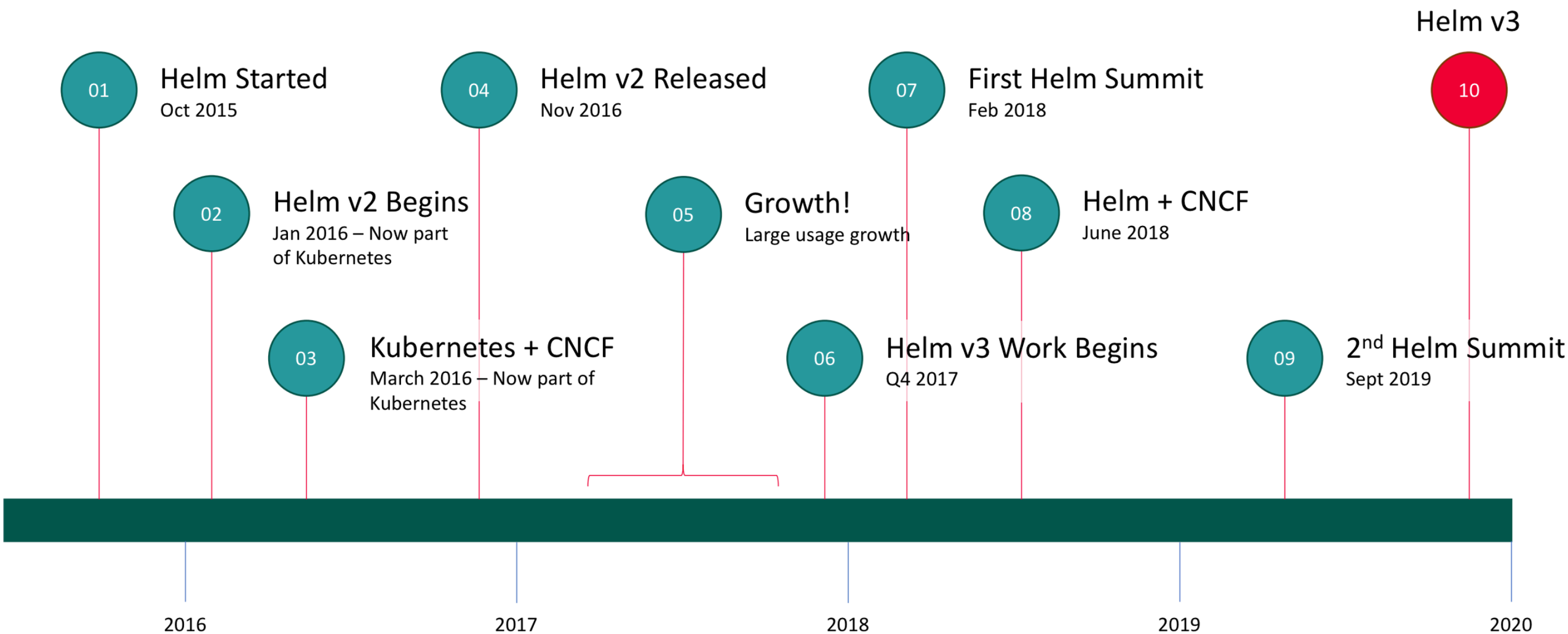
Helm History



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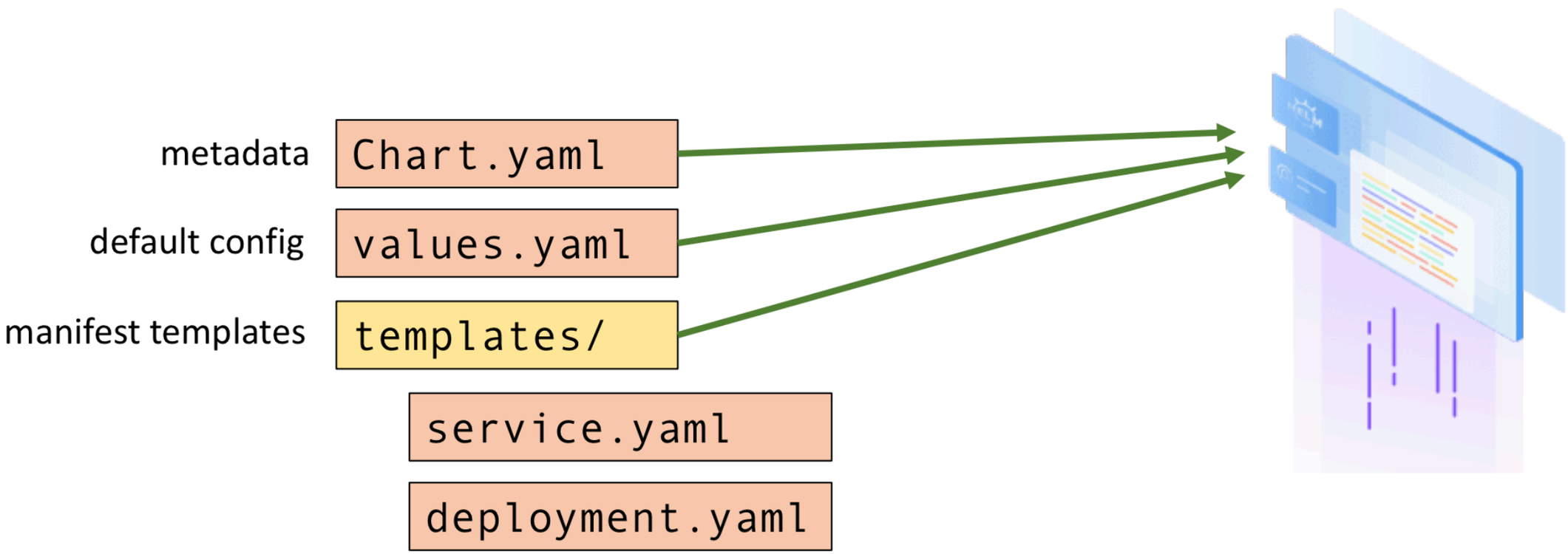
Helm Charts

Helm packages are referred to as **"Charts"**
Collections of files at well-known locations



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Helm Vocabulary

Chart

A package; bundle of K8s resources

Release

A chart instance is loaded into K8s

Same chart can be installed several times into the same cluster; each will have it’s own Release

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Helm Vocabulary

Repository

A repository of published Charts

Template

K8s configuration file mixed with Go/Sprig template

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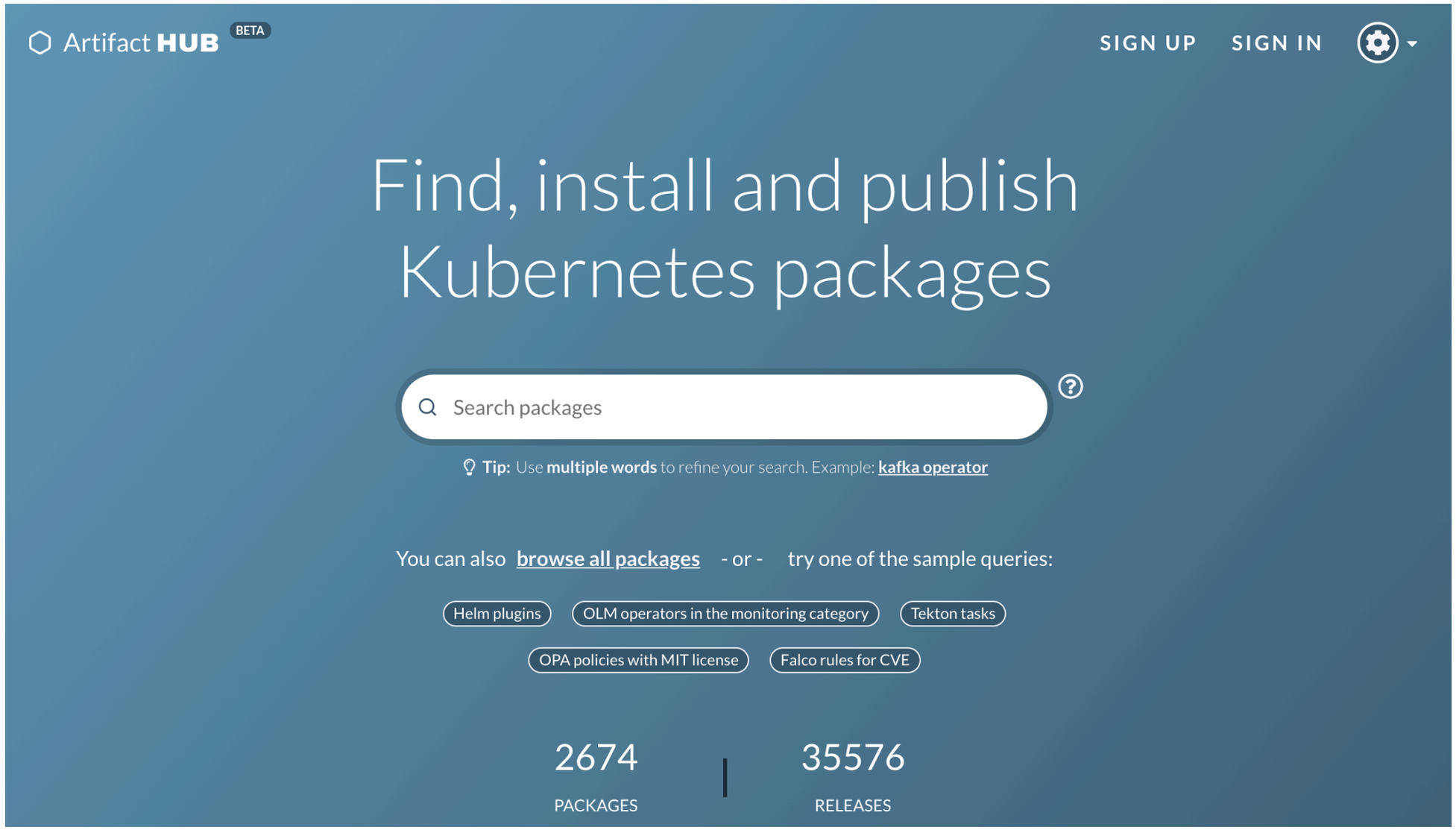
Artifact Hub



https://artifacthub.io/

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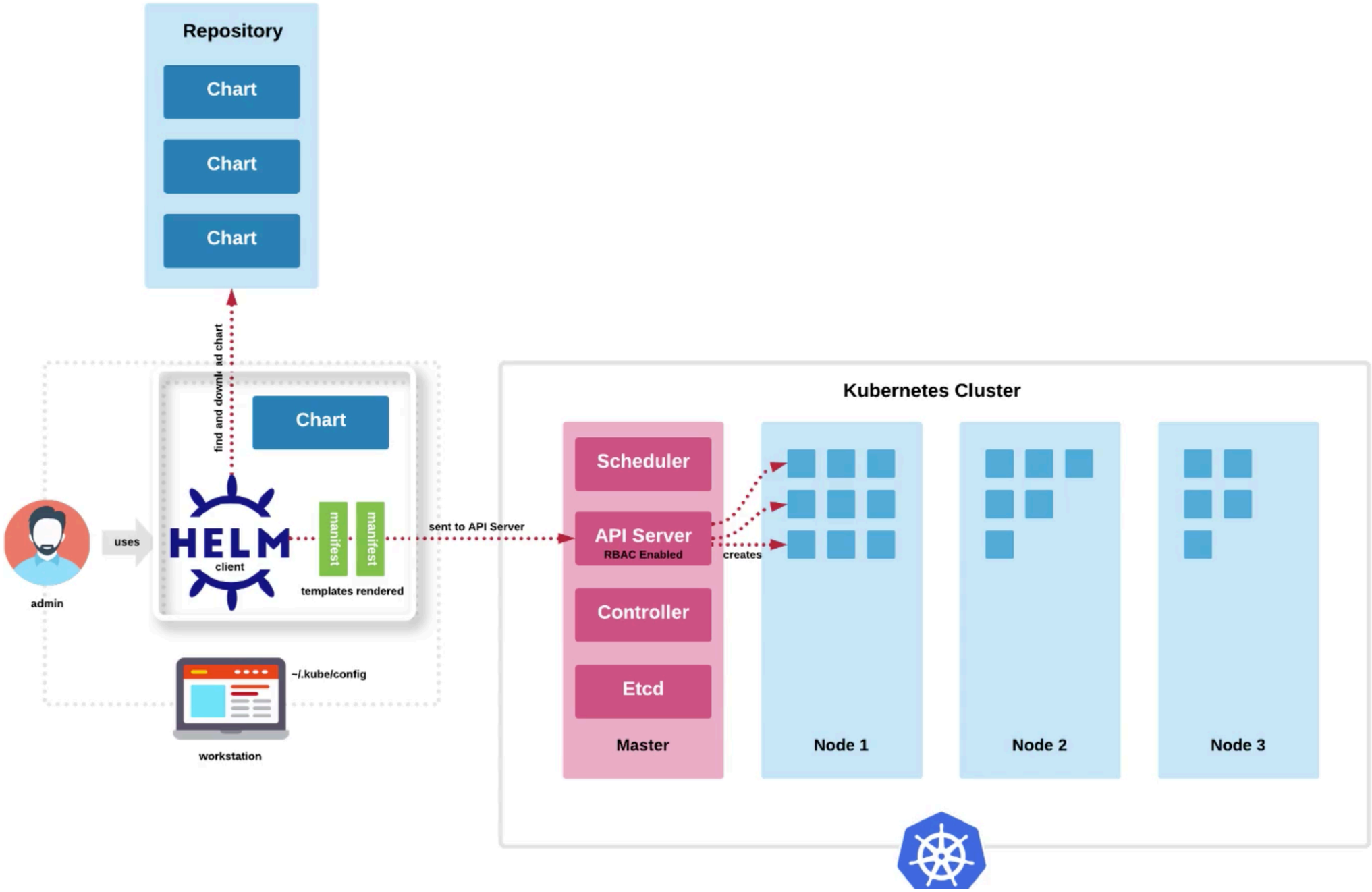
Helm Architecture



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Helm’s Core Values

Install resource in K8s should be easy

Teams should be able to collaborate

Release should be reproducible

Packages should be sharable

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Helm Tips

Create Chart for each (micro)service;
keep it in same Git repository

Learn and practice Go Template language
(and Sprig template library)

Use Helm hooks to control release flow

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Helm Tips

Use helm test to validate releases

Manage environments with multiple Values files

Do not commit secrets into GitHub

Follow community Helm best practices and conventions

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Helm commands

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Helm chart management

$helm search hub [KEYWORD]

$helm search repo [KEYWORD]

$helm pull [CHART]

$helm install [NAME] [CHART]

$helm upgrade [RELEASE] [CHART]

$helm rollback [RELEASE] [REVISION]

$helm uninstall [RELEASE]

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Helm repository management

$helm repo add [NAME] [URL]

$helm repo list

$helm repo remove [NAME]

$helm repo update

$helm repo index [DIR]

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Helm release management

$helm status [RELEASE]

$helm list

$helm history [RELEASE]

$helm get manifest [RELEASE]

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Helm chart management

$helm create [NAME]

$helm template [NAME] [CHART]

$helm package [CHART]

$helm lint [CHART]

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Create a chart

$helm create myapp

```
myapp
├── Chart.yaml
├── charts
├── templates
│   ├── NOTES.txt
│   ├── _helpers.tpl
│   ├── deployment.yaml
│   ├── hpa.yaml
│   ├── ingress.yaml
│   ├── service.yaml
│   ├── serviceaccount.yaml
│   └── tests
│       └── test-connection.yaml
└── values.yaml
```


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Install a chart

$helm install [NAME] [CHART]

From a chart directory

$helm install demo **./myapp**

From a remote chart directory

$helm install demo **myrepo/myapp**

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Custom values

You can pass the values files or key-value pairs from command line

Use a values files

$helm install demo ./myapp **-f custom.yaml**

Use a key-value pairs

$helm install demo ./myapp **--set key=value**

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Check status

$helm status demo

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Upgrade a release

Create a new revision of your release
Update template sources or config values

$helm upgrade demo ./myapp --set image.tag=1.1.1

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Rollback a release

Helm tracks every revision made on release
You can revert back to a working version

$helm rollback demo <revision>

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Remove a release

$helm delete demo

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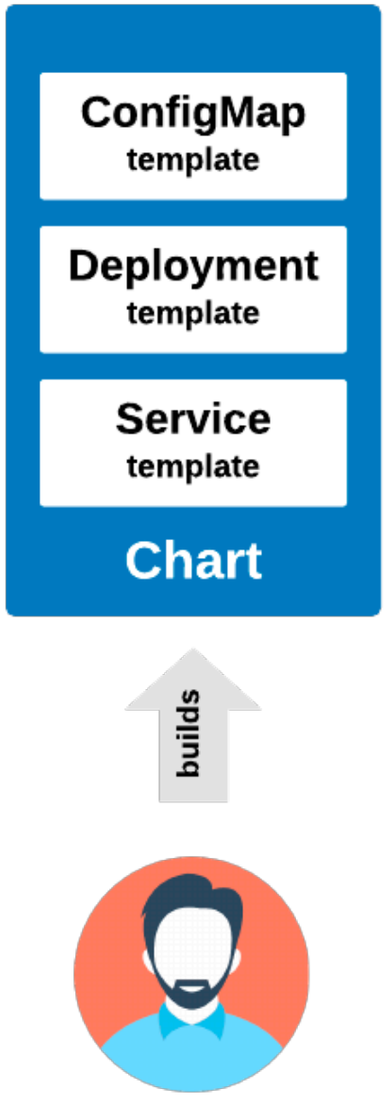
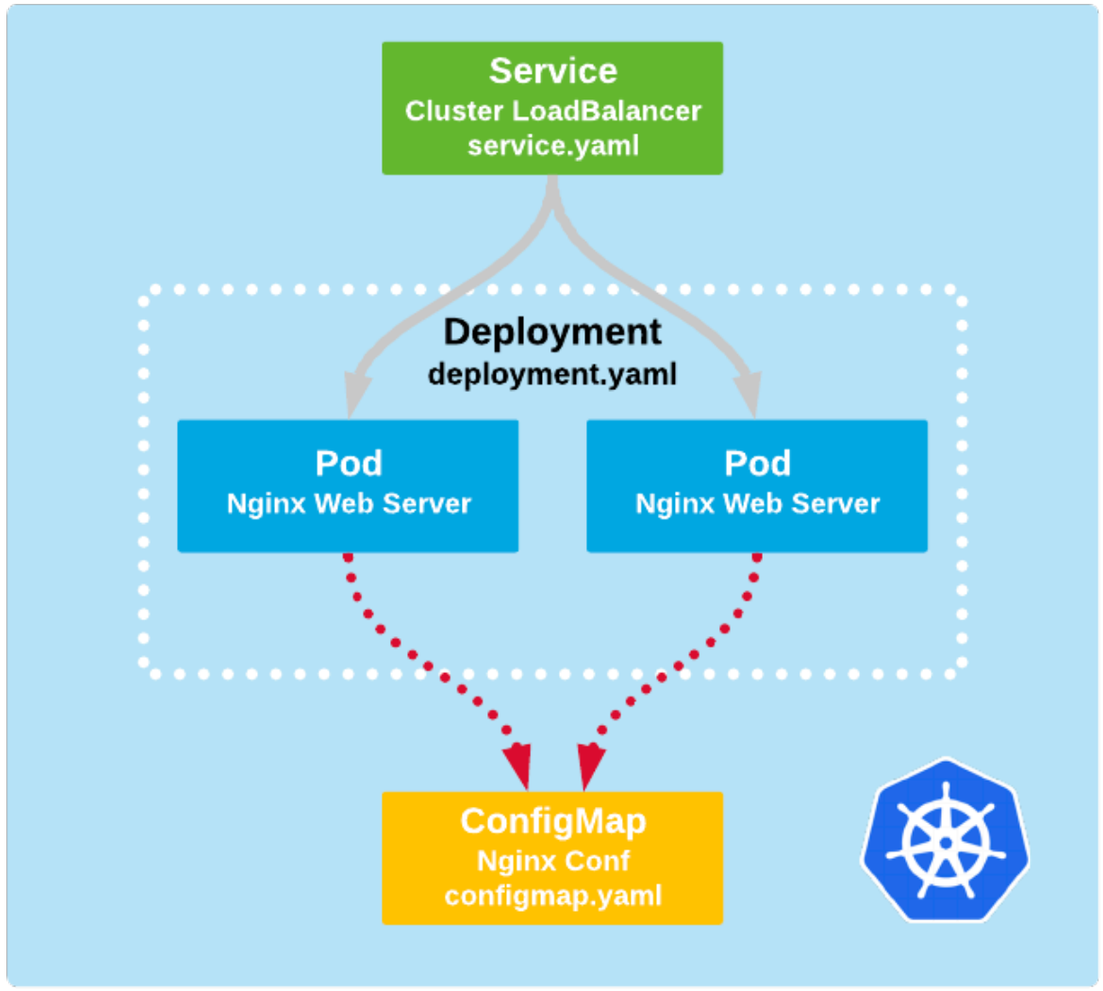
Helm Demo





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Workshop

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