



DevOps series

DevOps Development Deployment





Somkiat Puisungnoen

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Intro

Software Craftsmanship

Software Practitioner at สยามชานาญกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Somkiat Puisungnoen 15 mins · Bangkok · ...

Java and Bigdata

 DevOps

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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



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



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



**[https://github.com/up1/
course-devops-workshop](https://github.com/up1/course-devops-workshop)**



Software Delivery

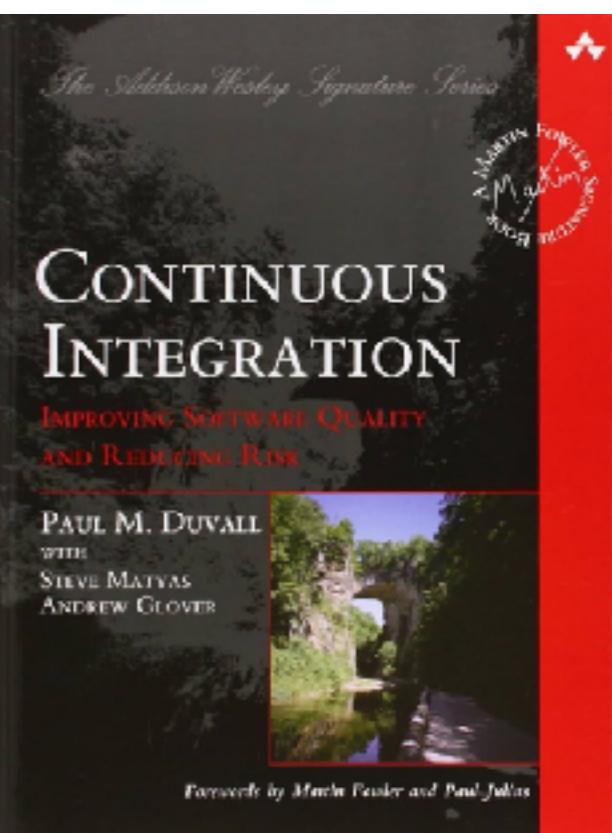
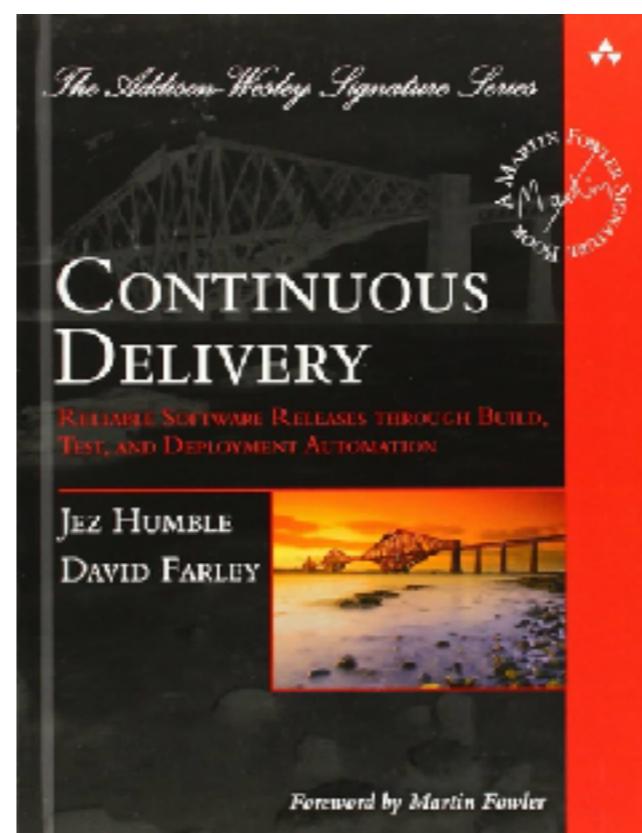
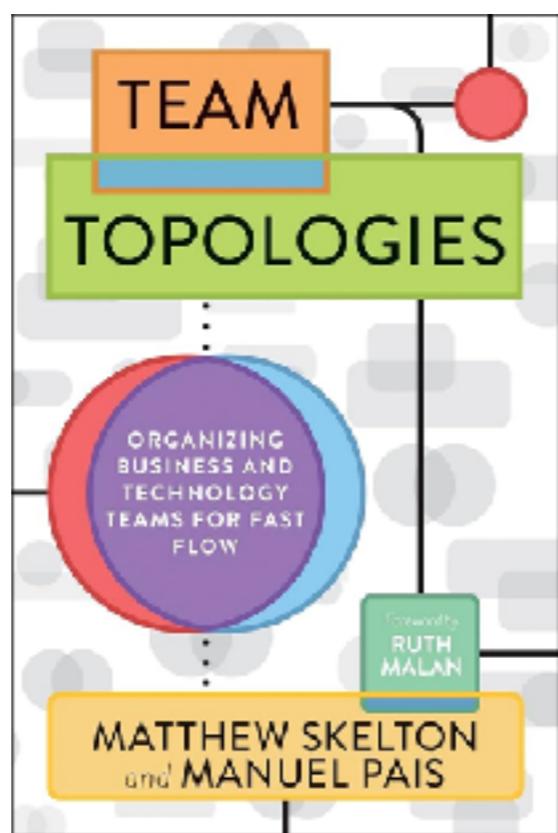
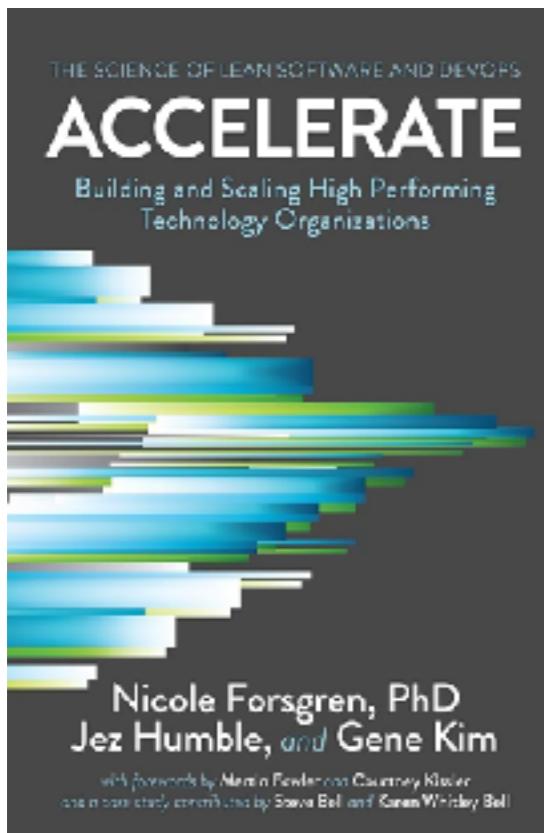
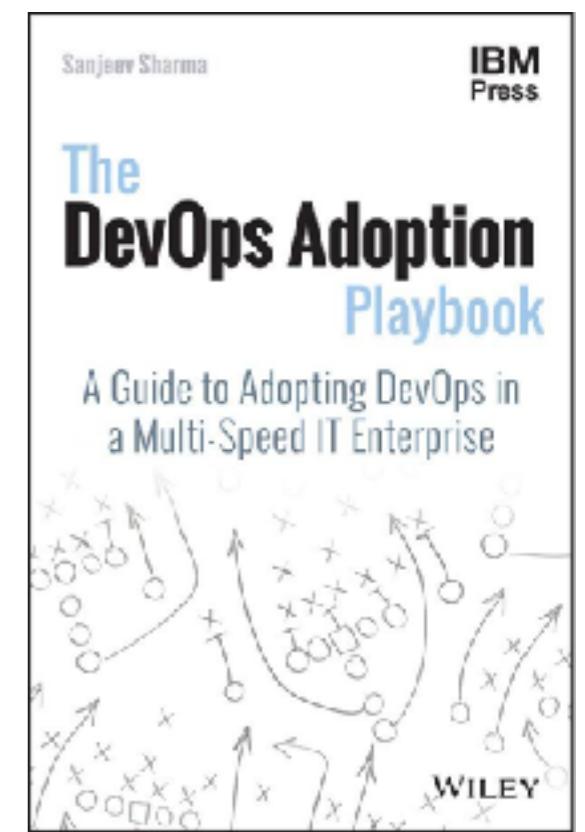
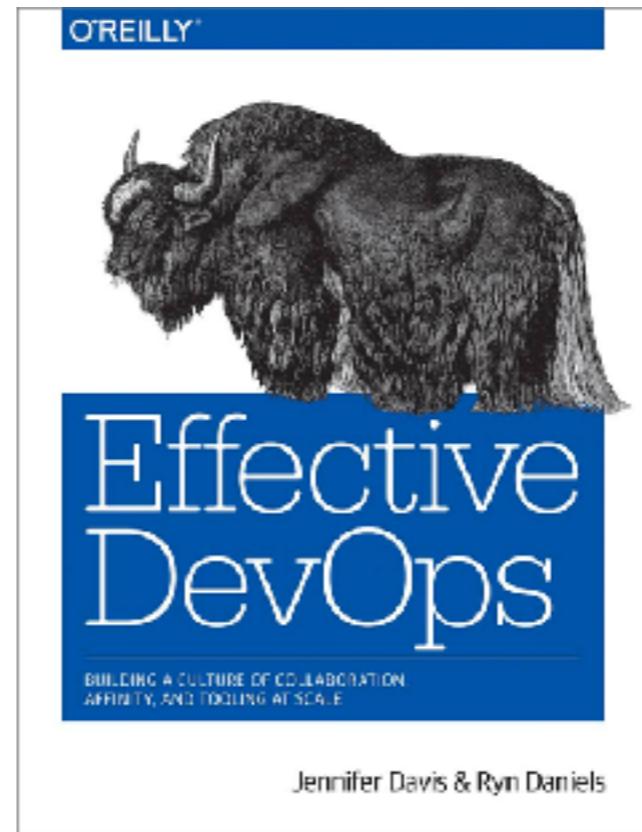
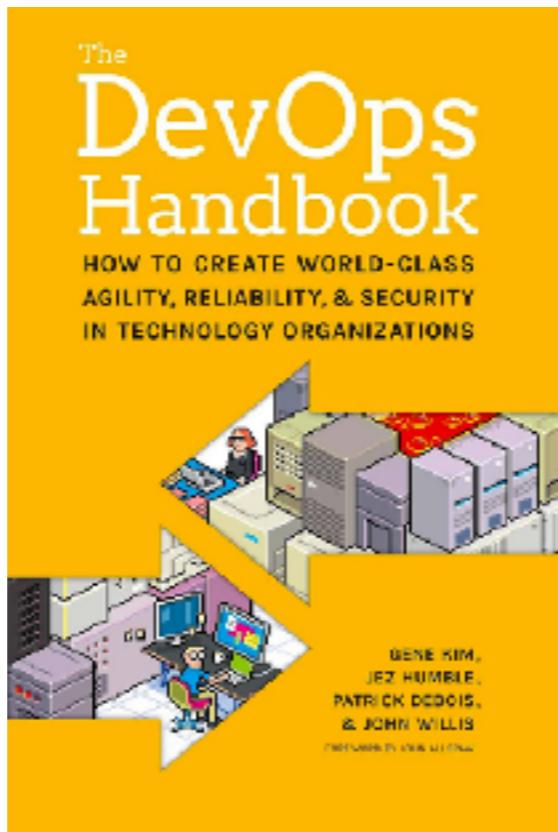
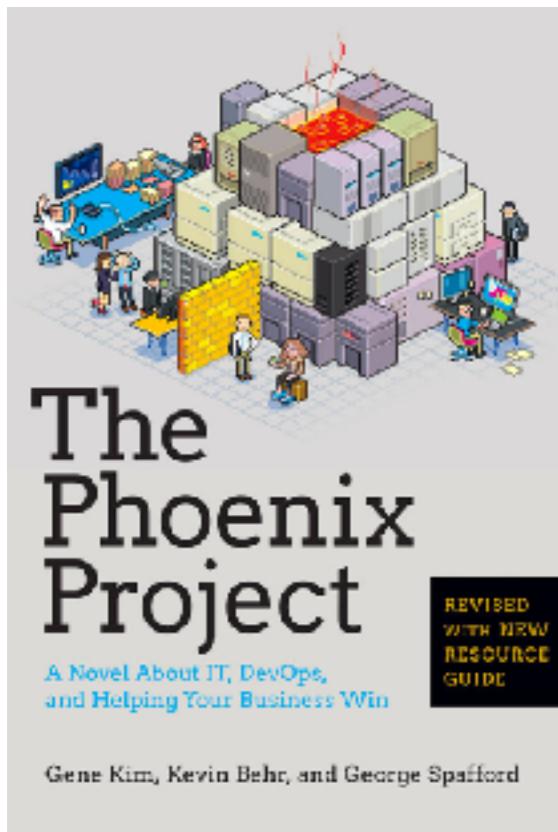


Quantity vs Quality ?

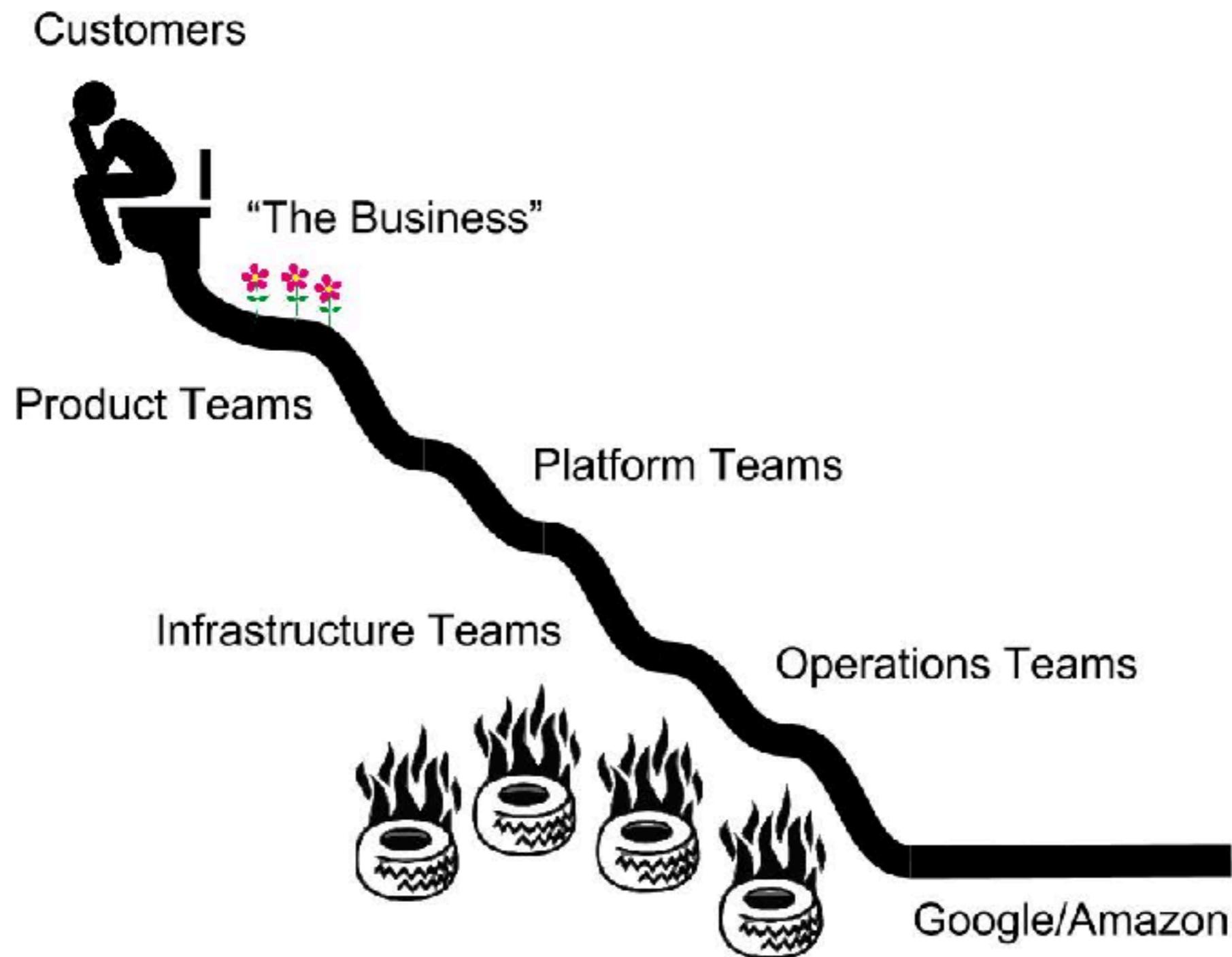


DevOps foundation

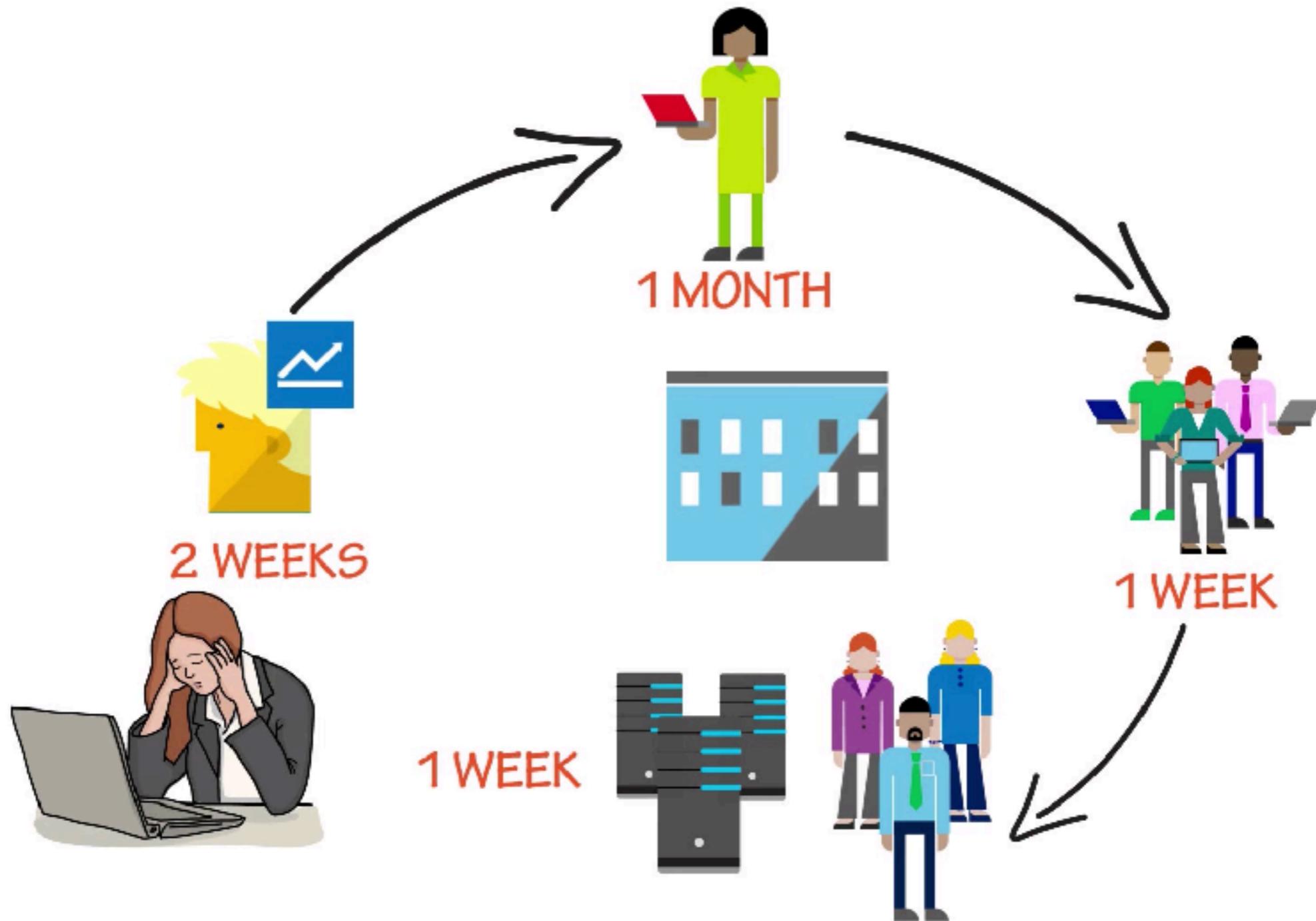




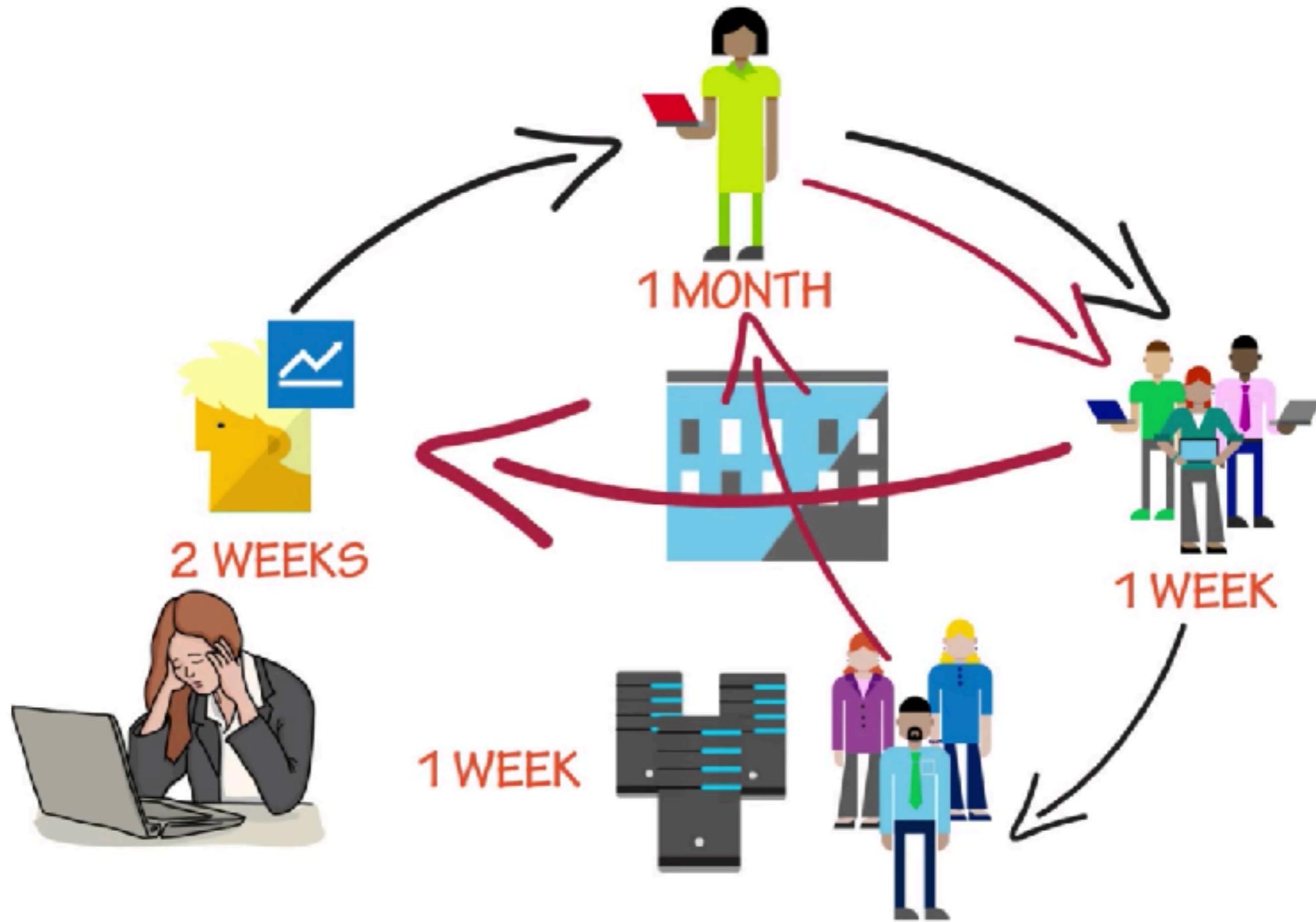
SDLC



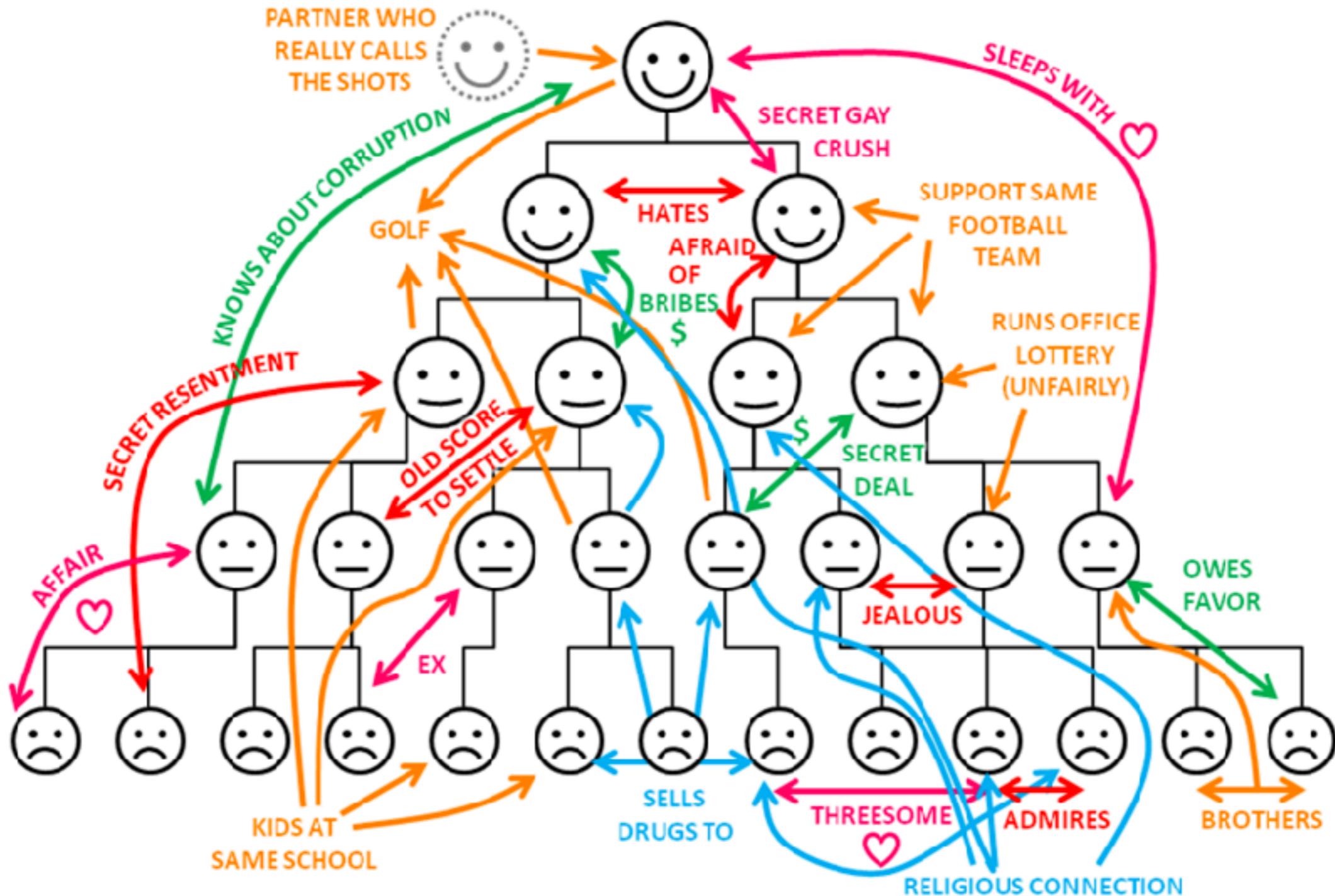
SDLC



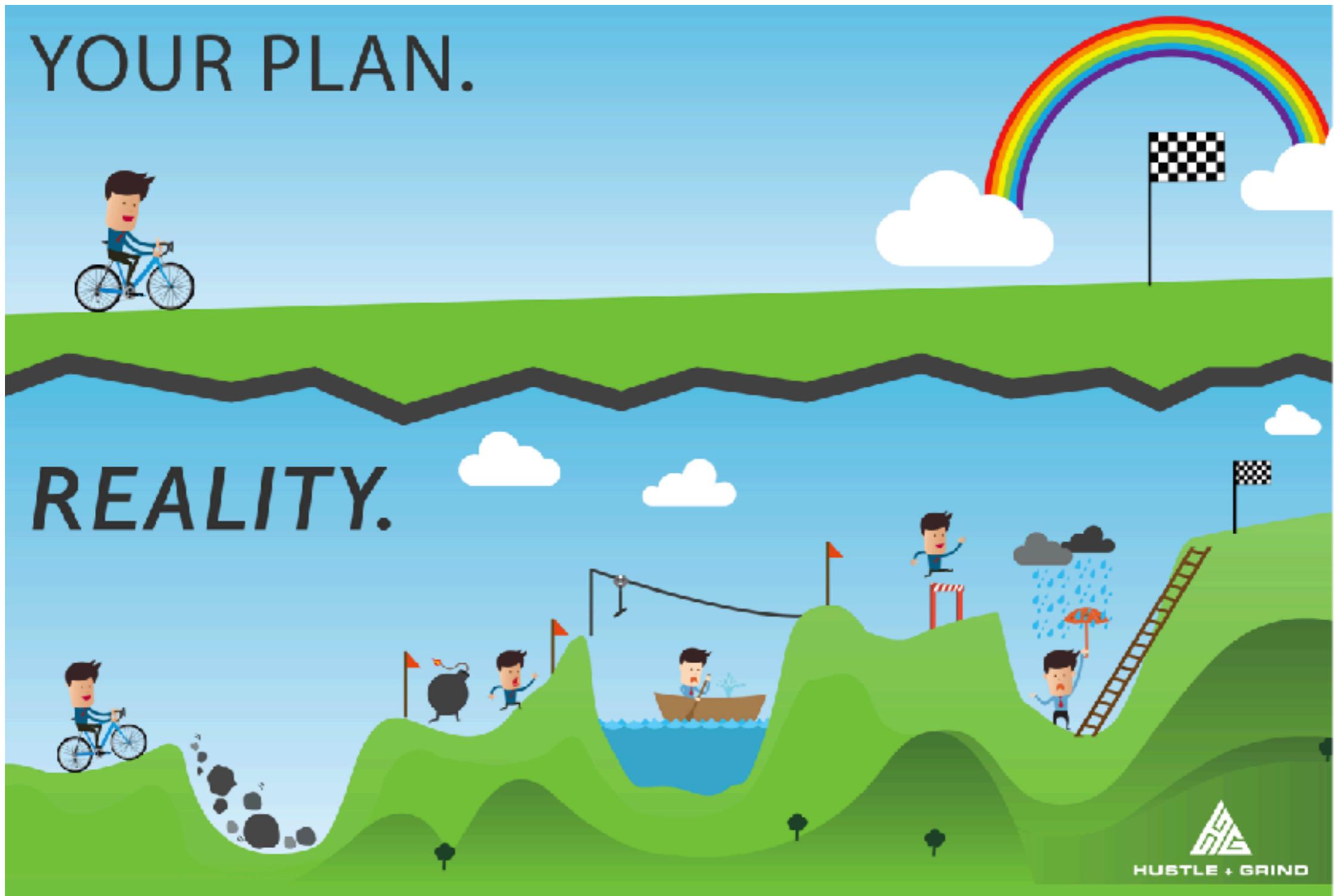
SDLC



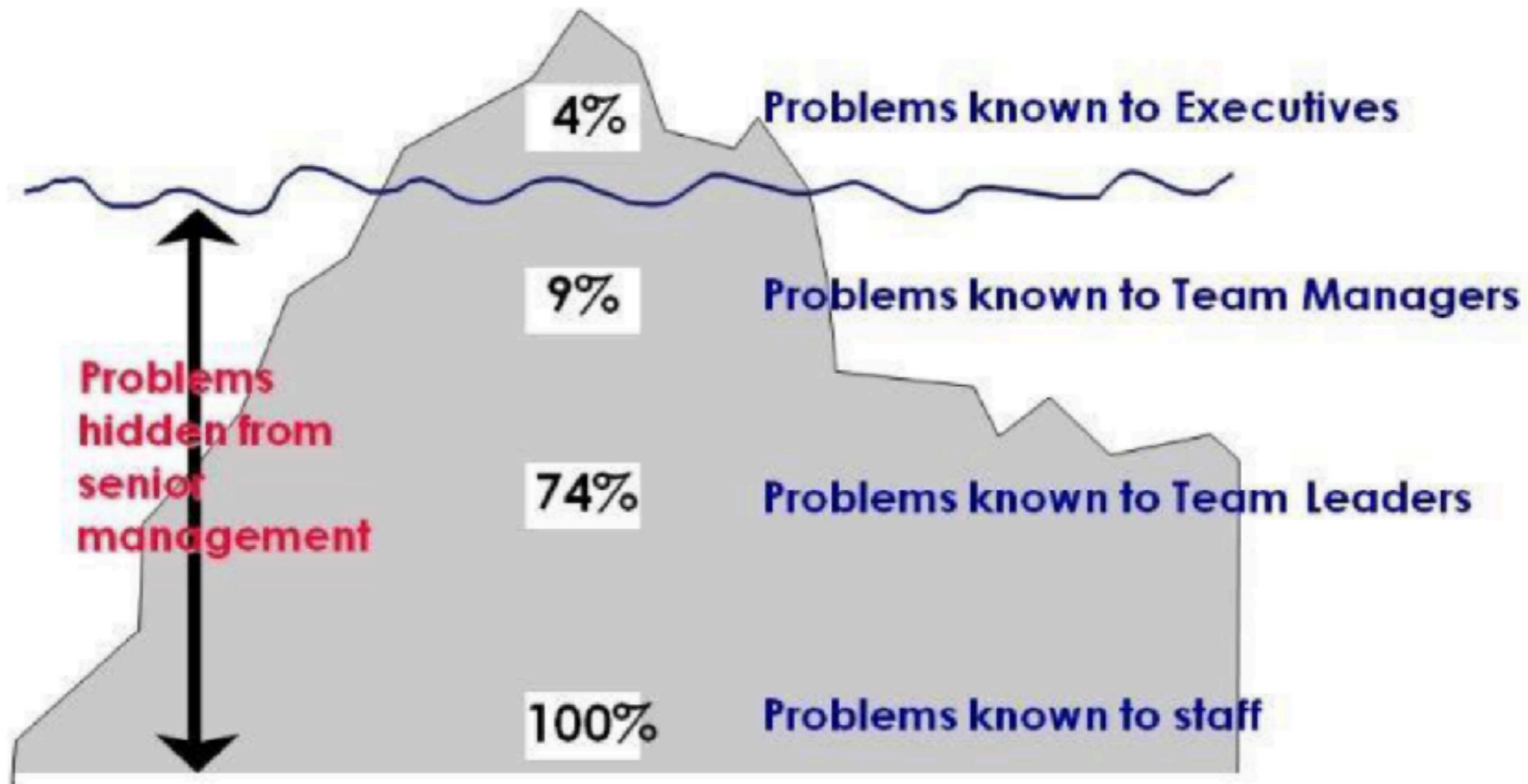
Organization !!



Plan vs Reality



The iceberg of ignorance



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



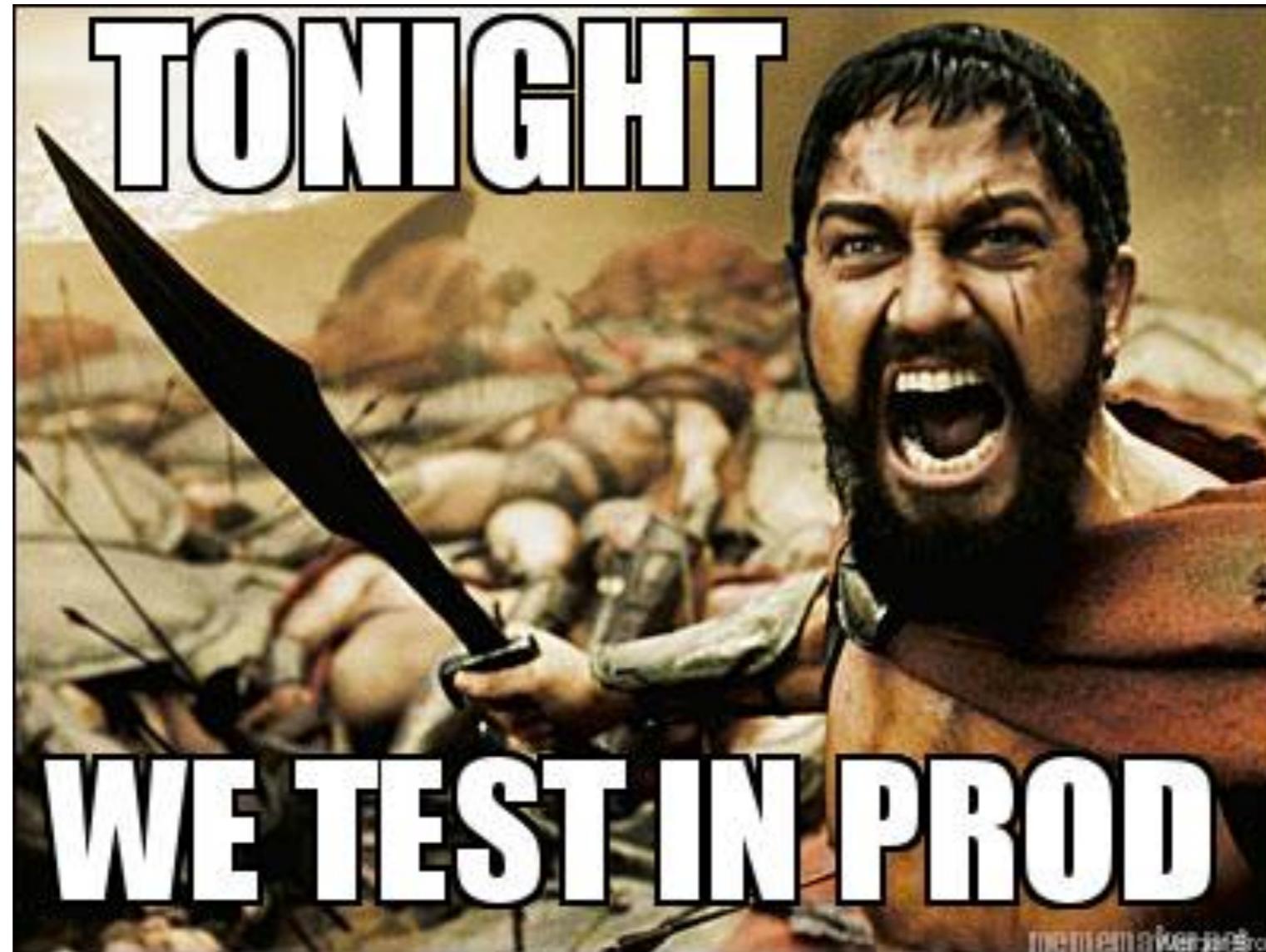
Consequence of inefficient



Consequence of inefficient



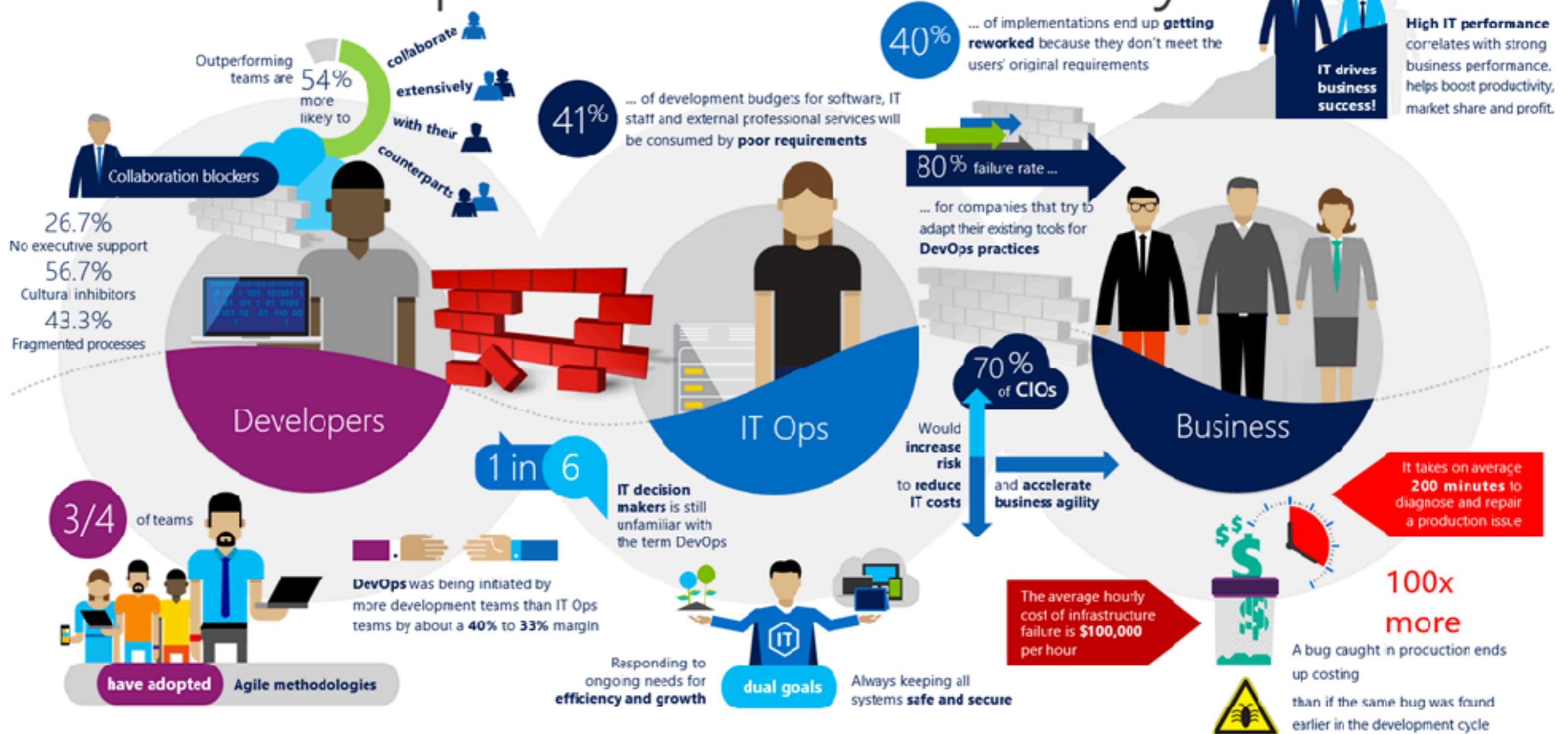
Consequence of inefficient



Consequence of inefficient

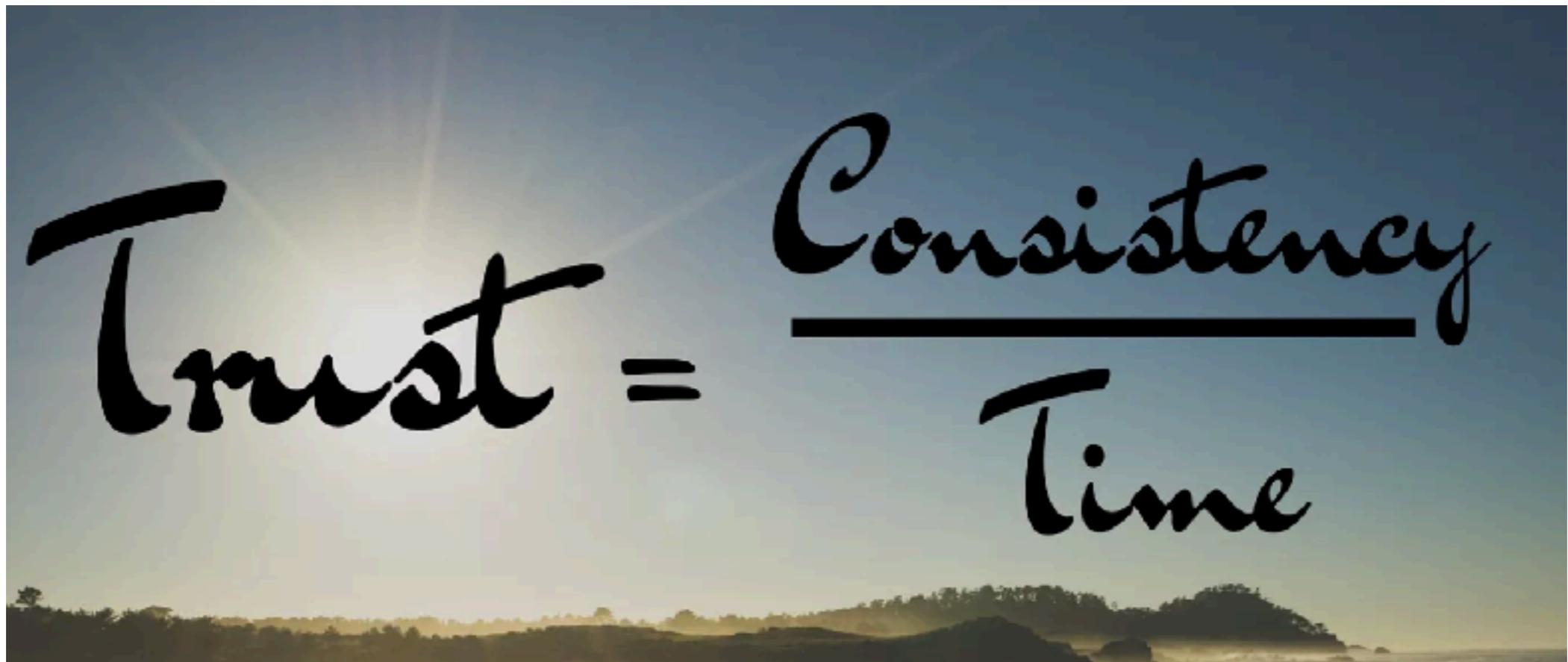


The consequences of inefficiency



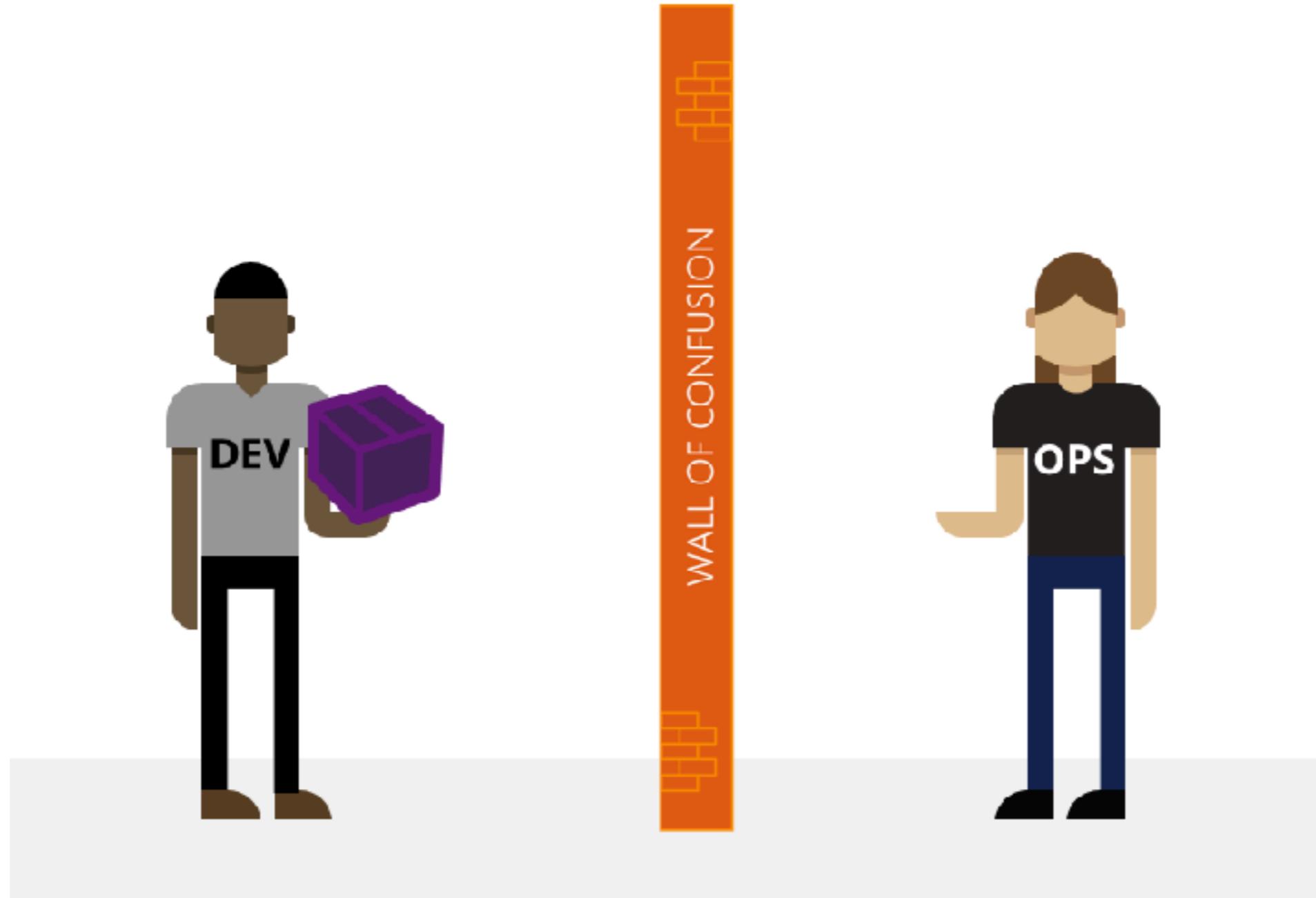
<https://channel9.msdn.com/Series/DevOps-Fundamentals>



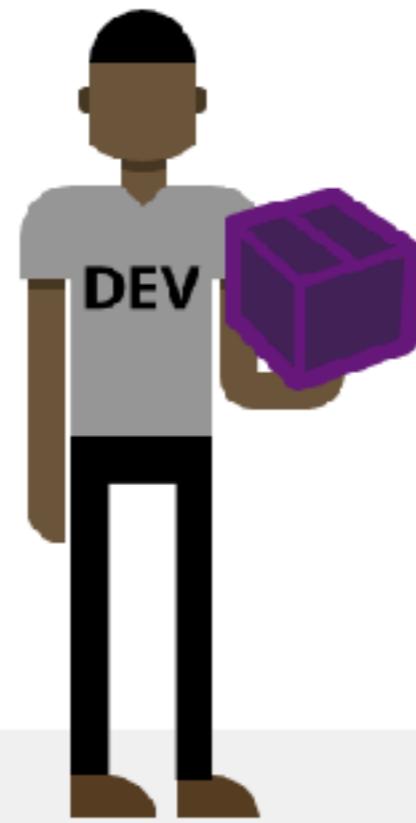


Development vs Operations



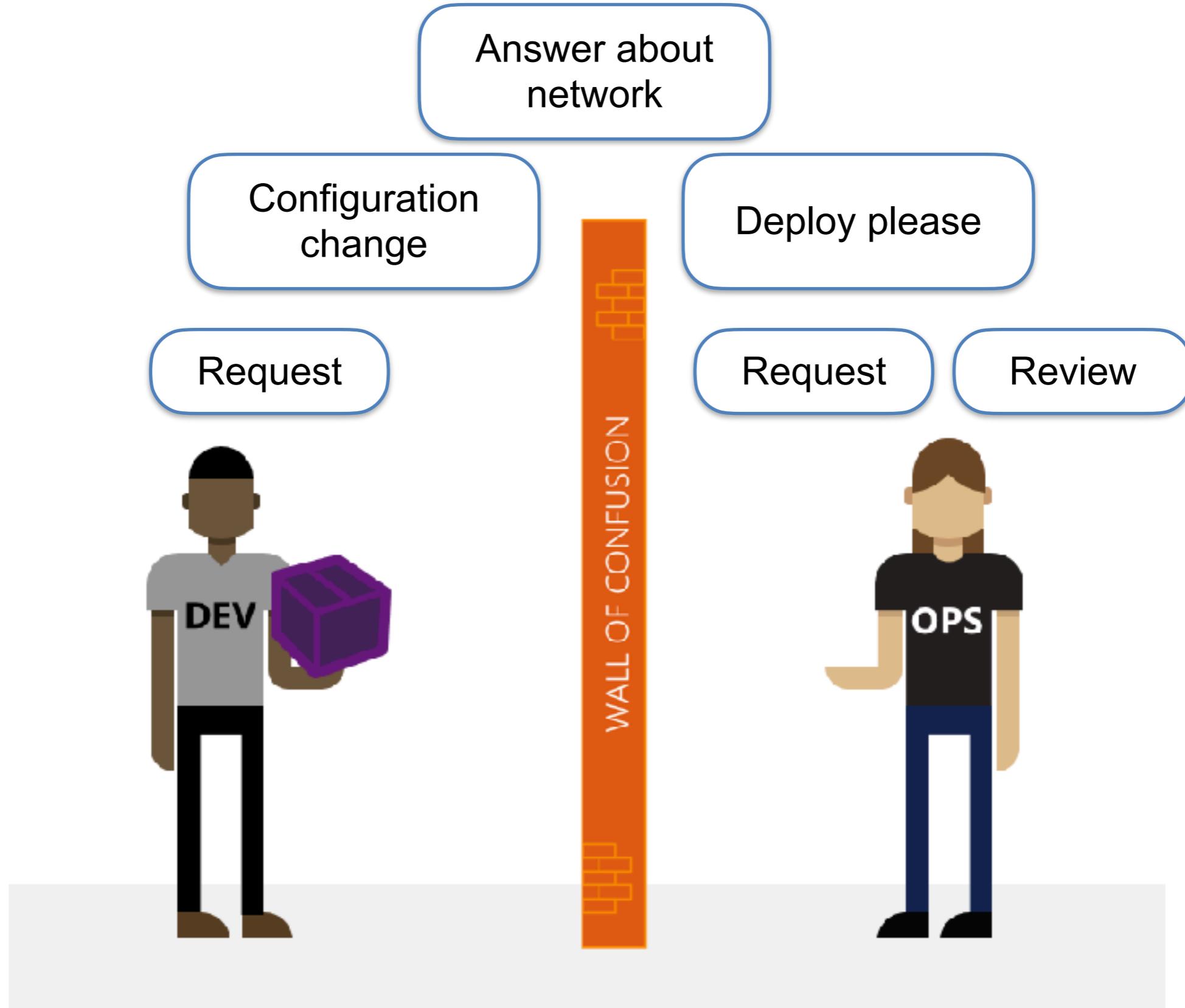


I want to change !

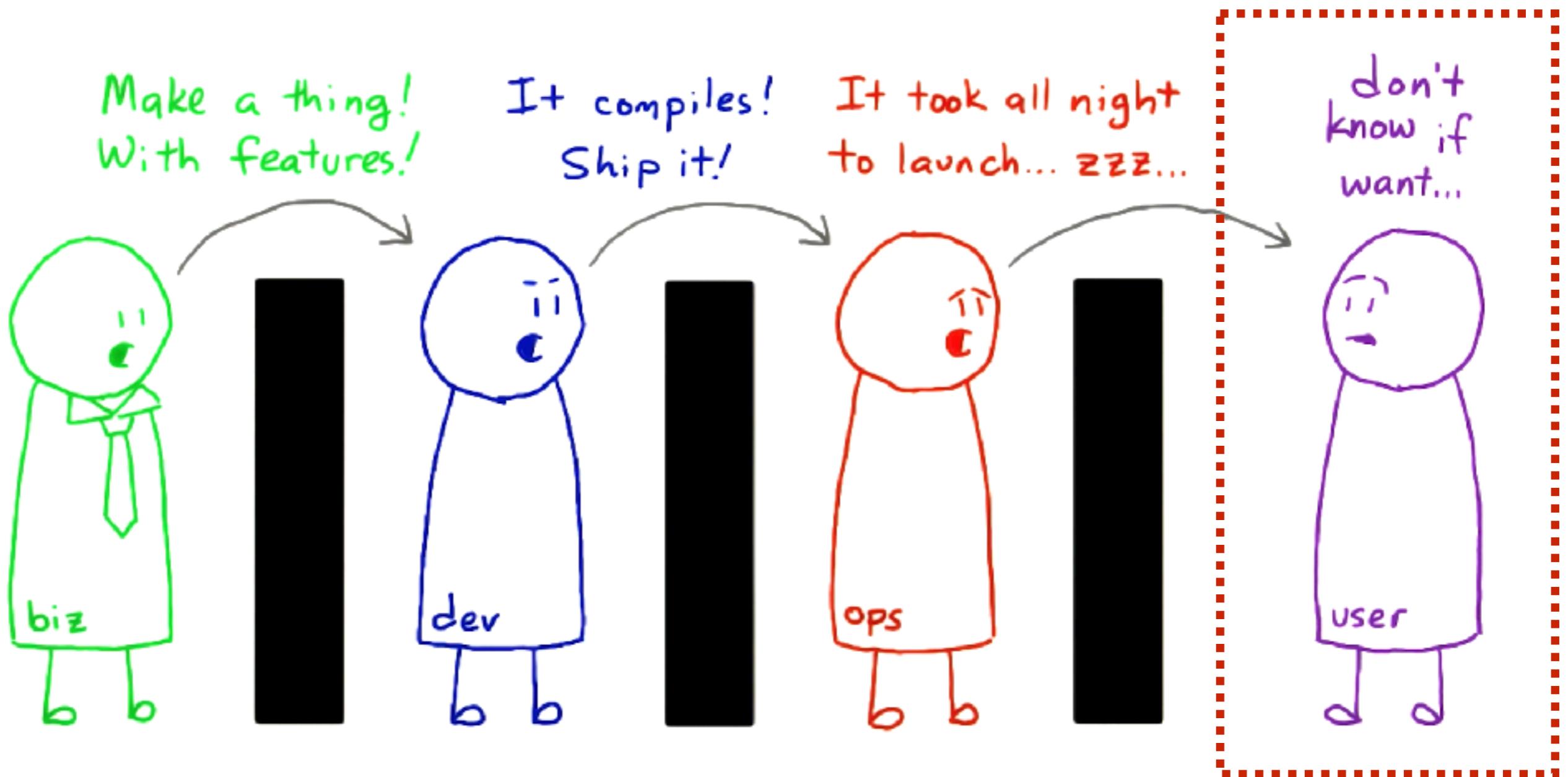


I want to stability !





Result ?



Problems ?

Deadline Driven Development

Delayed project/product deliver

Bad quality

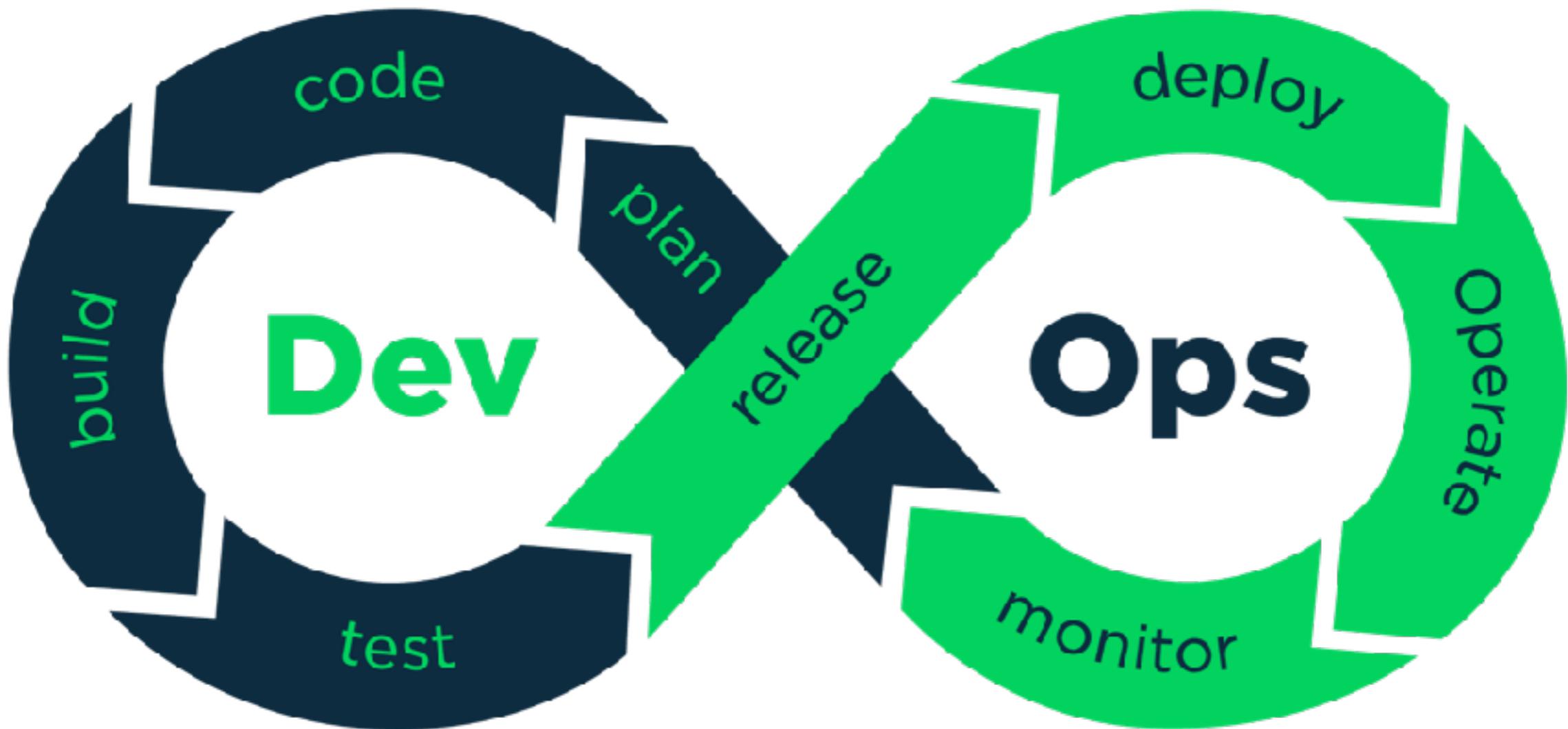
Low customer satisfaction



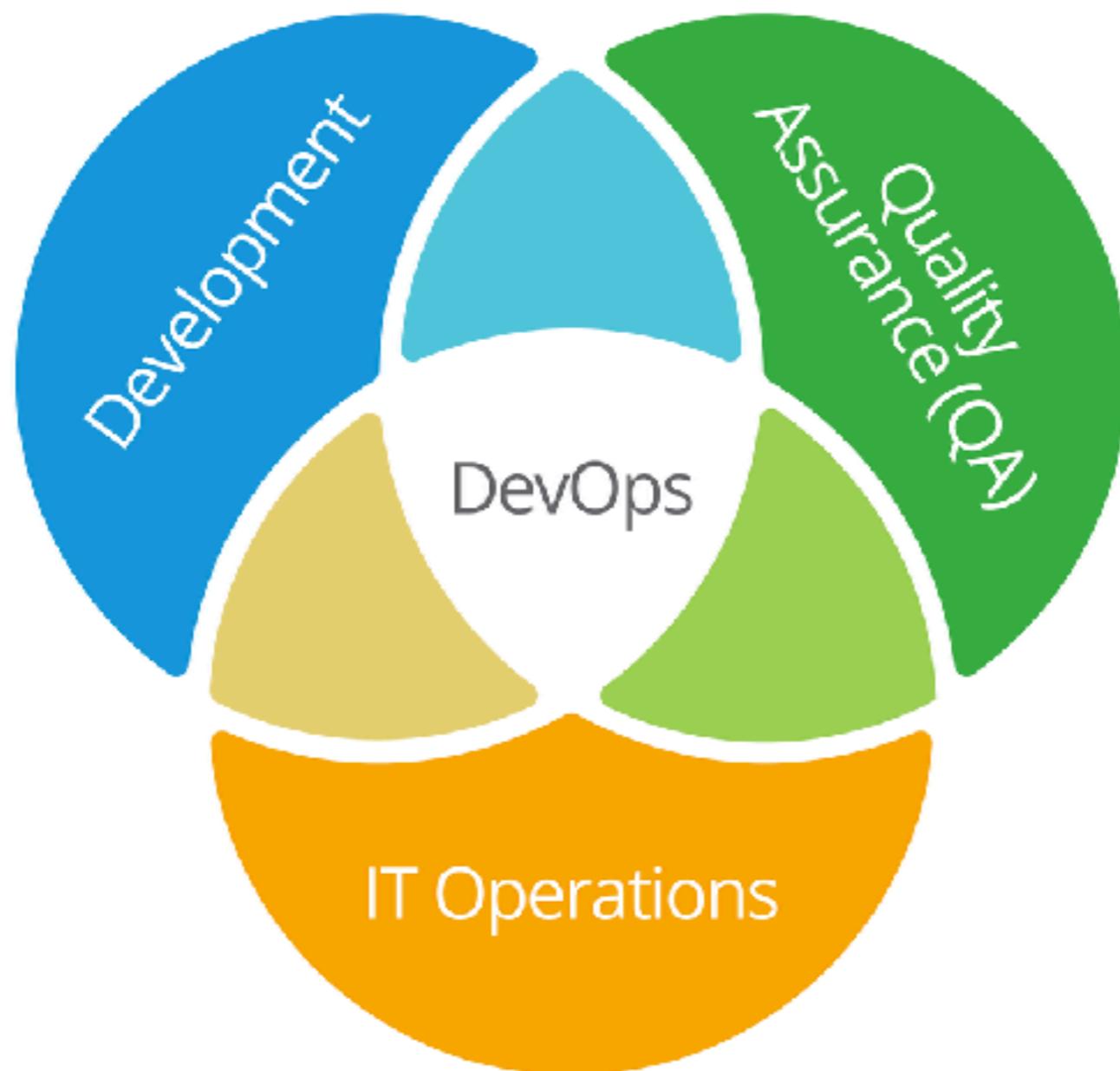
Rise of DevOps



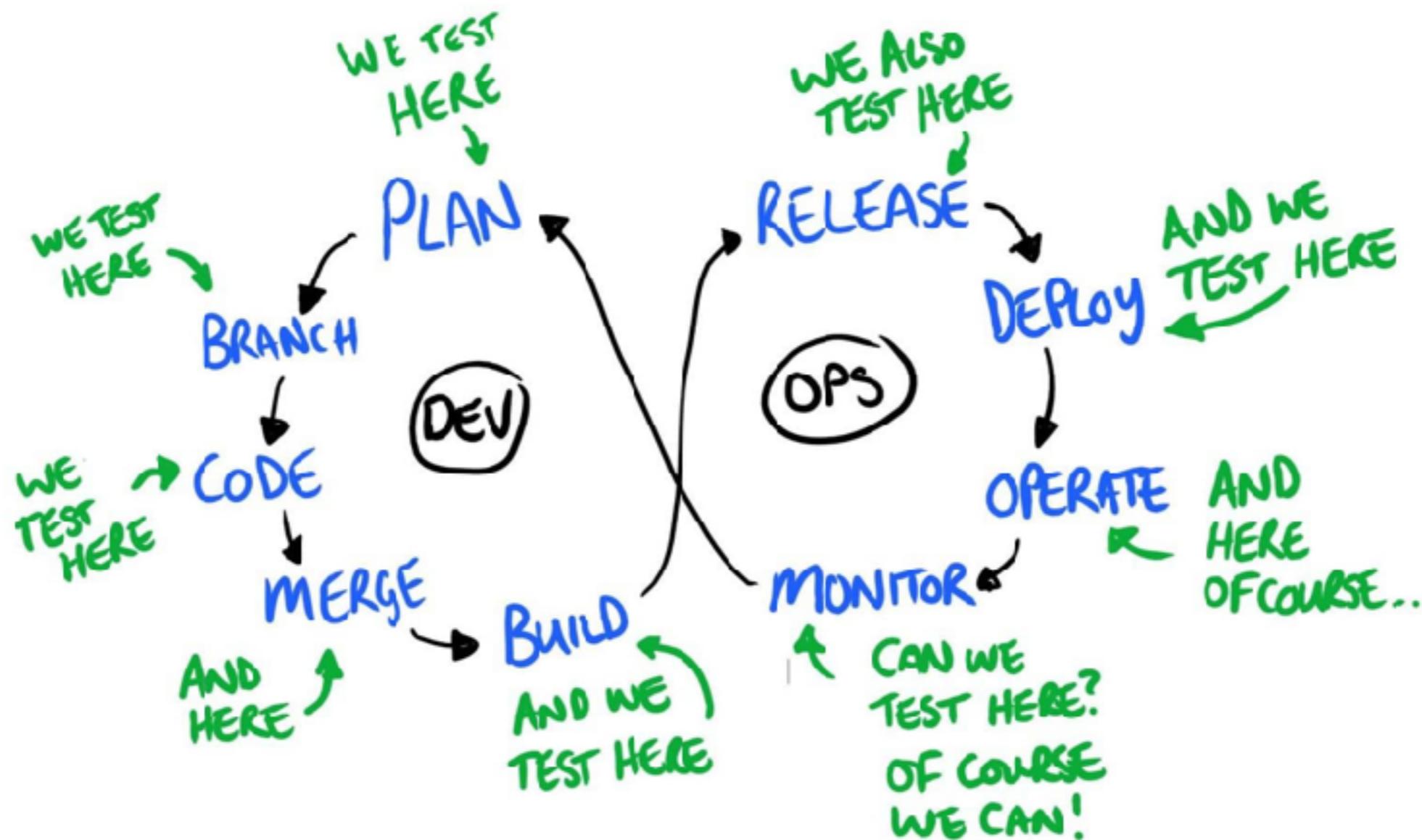
DevOps



DevOps



DevOps with Quality



<https://danashby.co.uk/2016/10/19/continuous-testing-in-devops/>

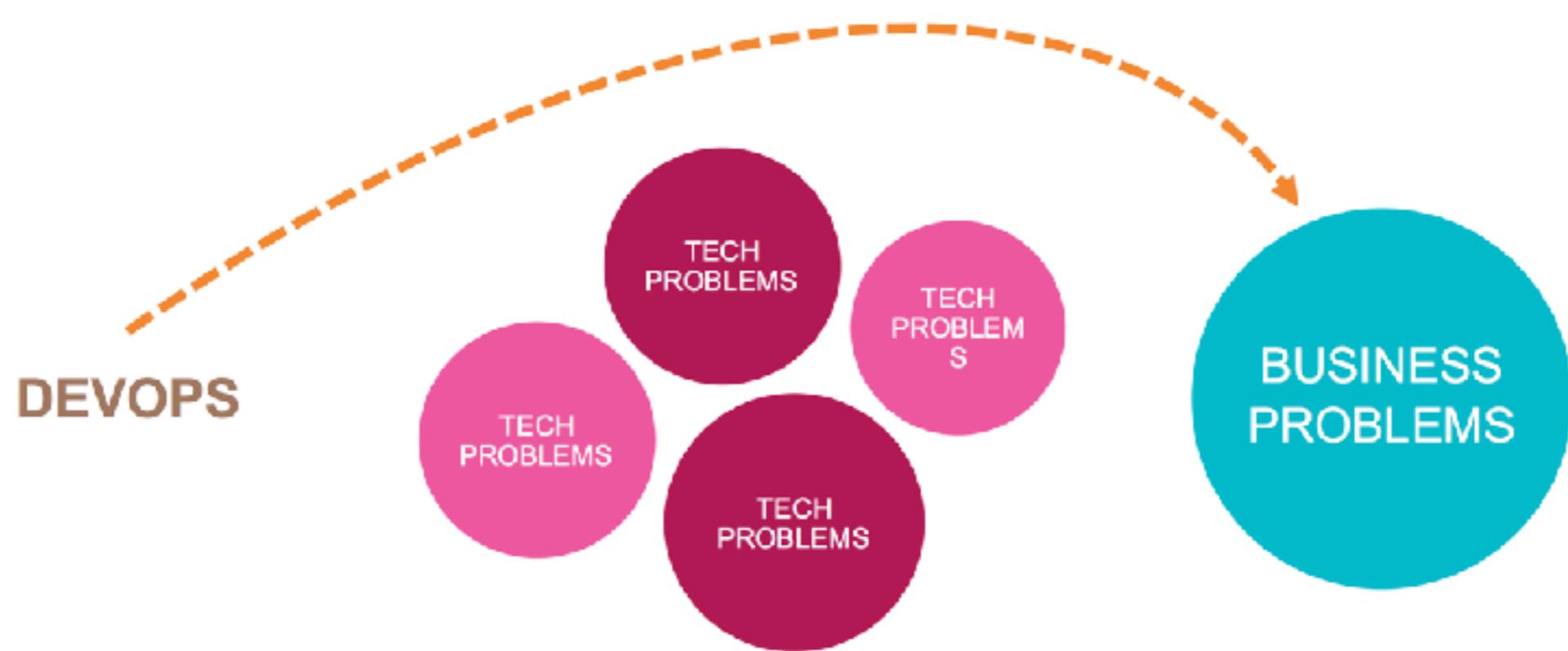


**Devops isn't any single person's job.
It's everyone's job.**

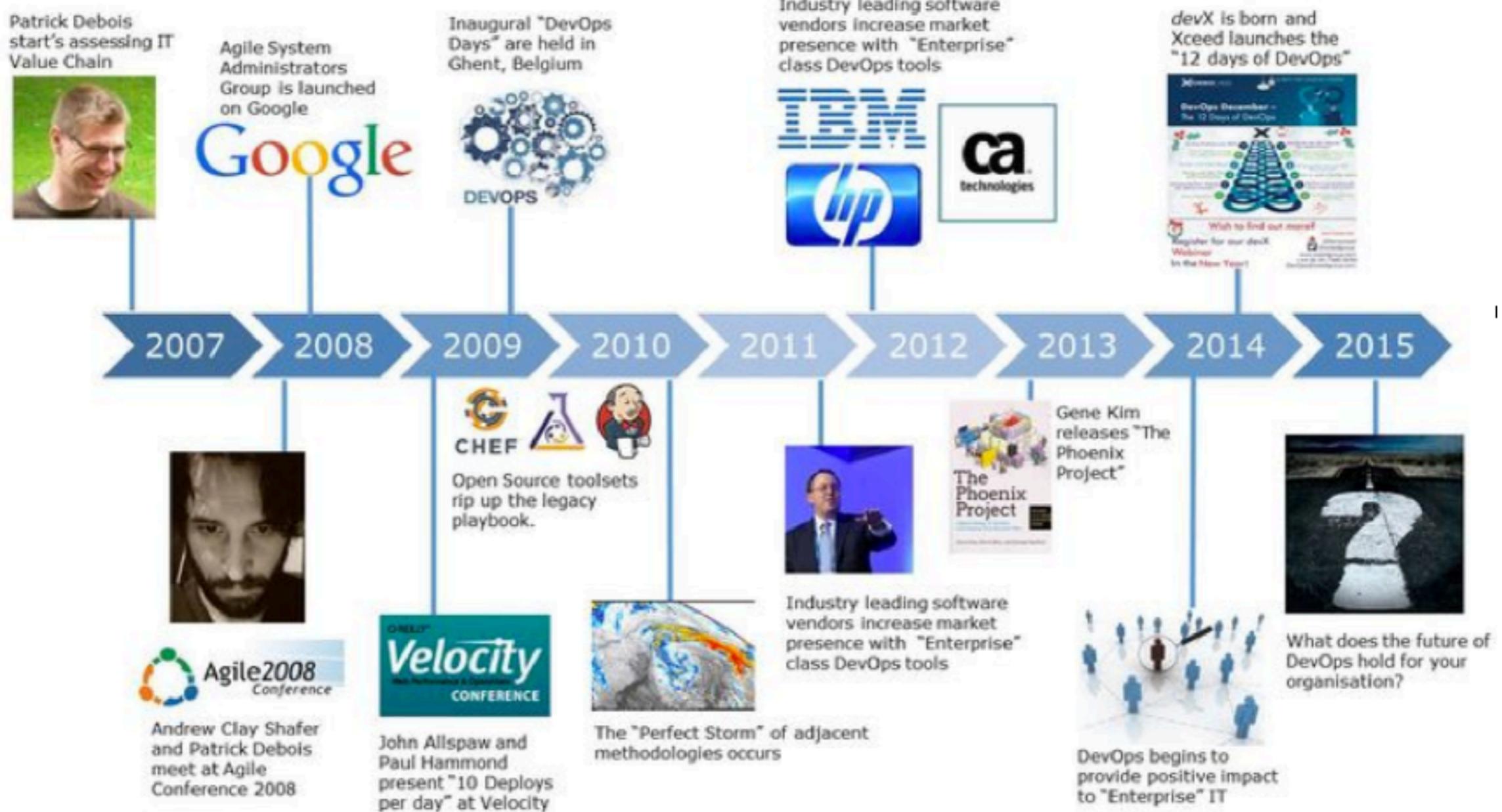


DevOps

Solve business problem first



History of DevOps



State of DevOps Report

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



200x more frequent deployments



2,555x shorter lead times

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



3x lower change failure rate



24x faster recovery from failures

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



What is DevOps ?



DevOps is not ...

Certification

Role

Set of tools

Prescriptive process

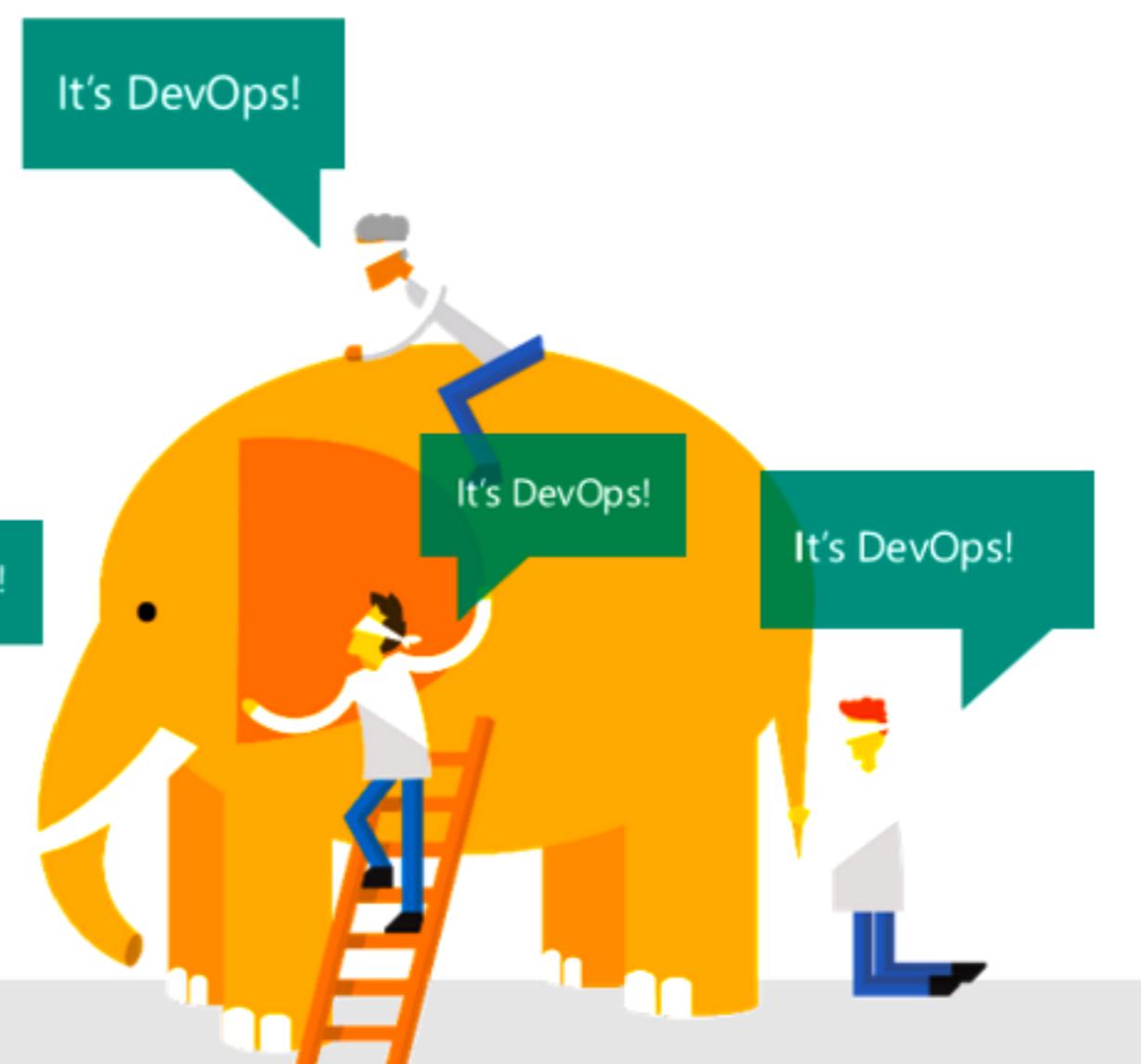


What is DevOps ?

“DevOps is development and operations collaboration”

“DevOps is using automation”

“DevOps is small deployments”



“DevOps is treating your infrastructure as code”

“DevOps is feature switches”

“Kanban for Ops?”



What is DevOps ?

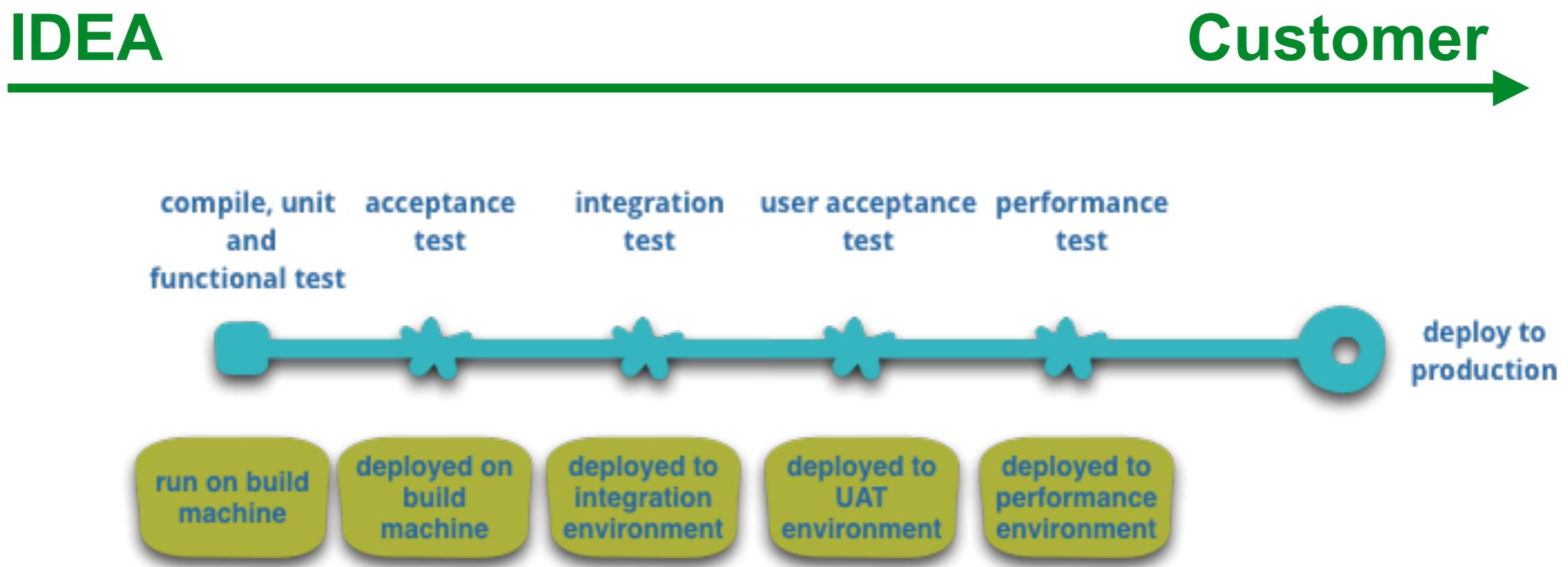
DevOps is a set of practices intended to reduce the time between committing a change to a system and the change being placed into normal production, while ensuring high quality

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



Goals of DevOps

**Improve the delivery of value
for Customer and Business**



Goals of DevOps

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



Continuous Delivery

The more often to deploy

Small change

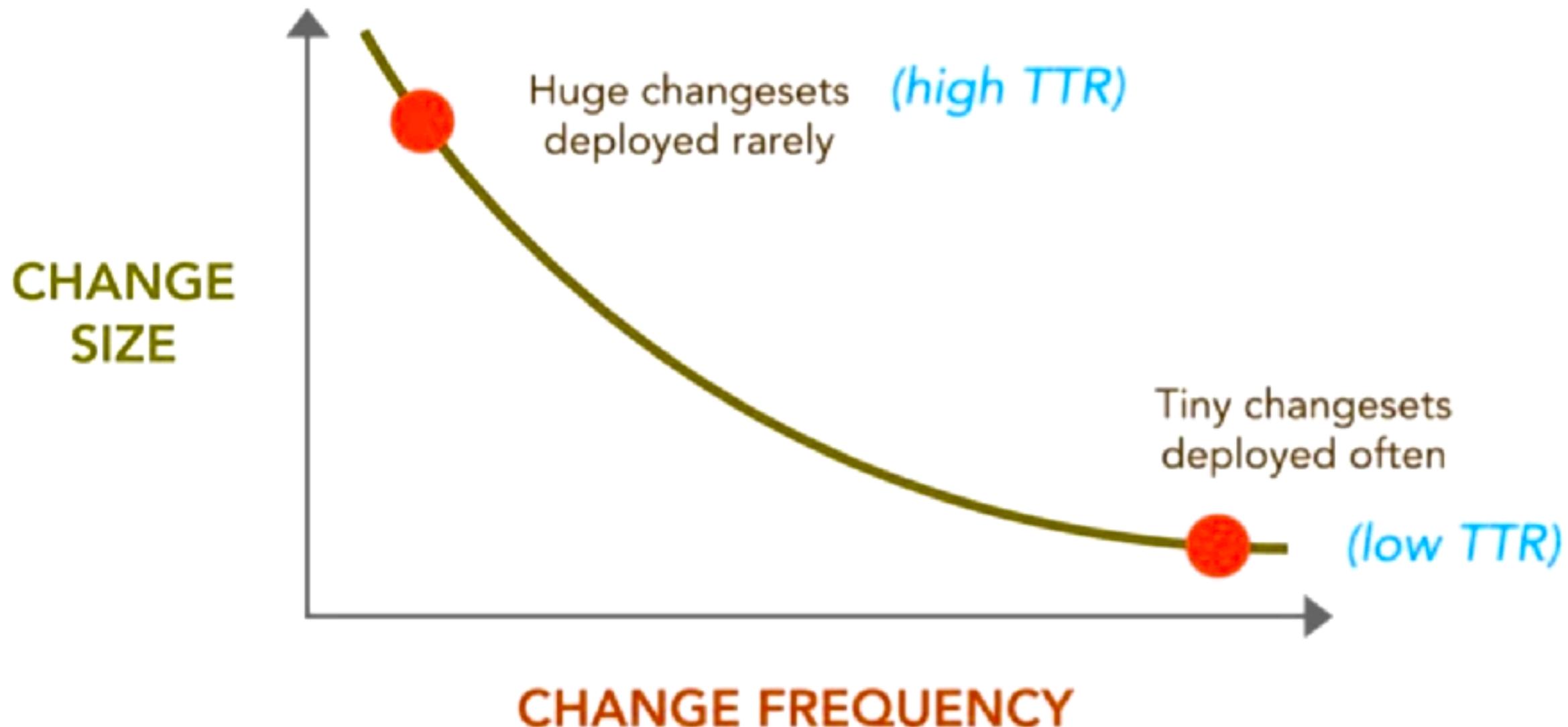
Automate it

Reduce TTR (Time to Repair/Recovery)

Learn and repeat



Continuous Delivery



DevOps Three Ways

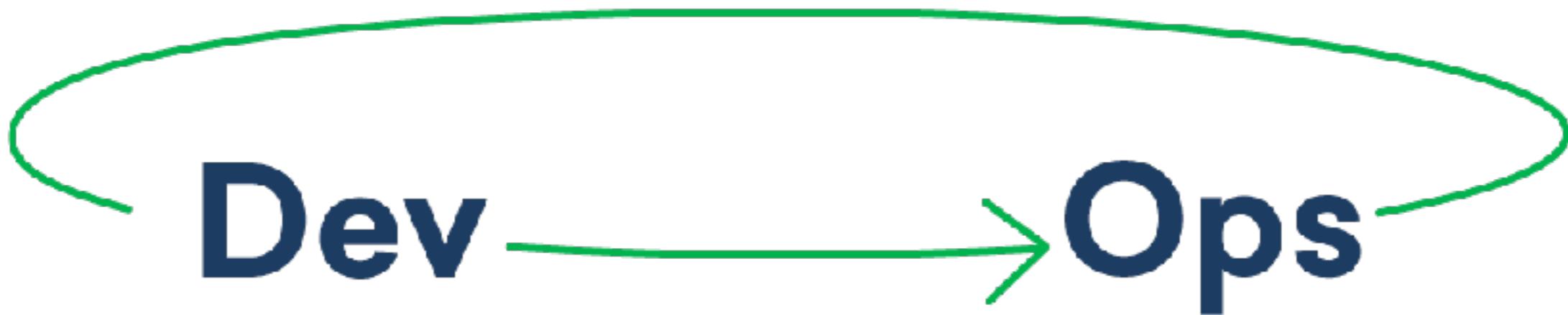
1. Flow of work
2. Feedback process
3. Environment and culture



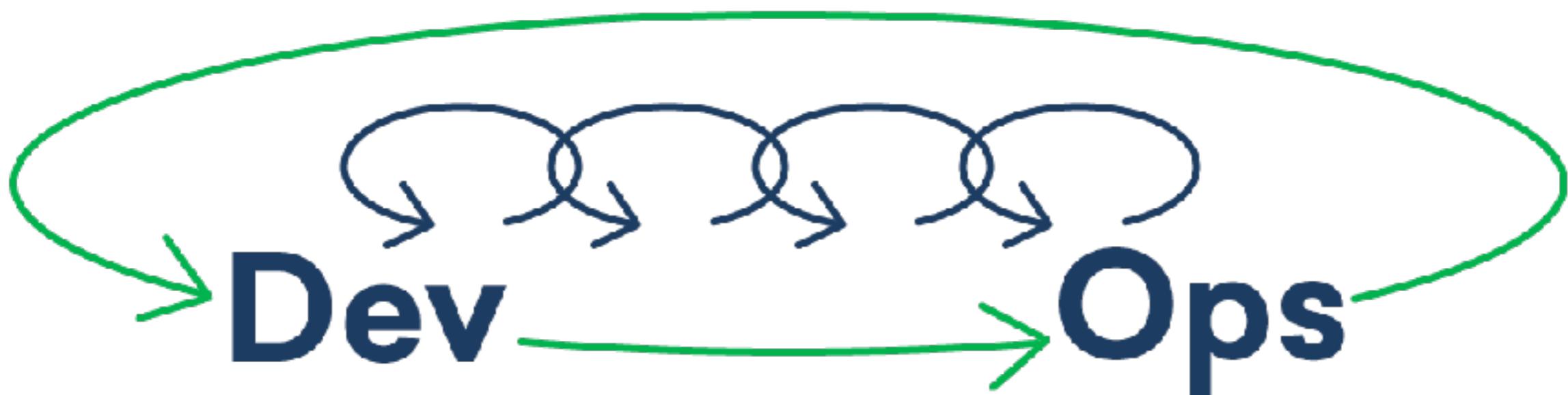
1. Flow of work



2. Feedback process/loop



3. Environment and culture



CALMS Framework

Culture
Automation
Lean
Measurement
Sharing



DevOps is all about **Human** problems



DevOps Metrics

Lead time for changes

Change failure rate

Deployment frequency

Mean time to recovery (MTTR)



Software Delivery Performance

Aspect of Software delivery performance	Elite	High	Medium	Low
Change lead time For the primary application or service you work on, what is your lead time for changes (i.e., how long does it take to go from code committed to code successfully running in production)?	Less than one day	Between one day and one week	Between one week and one month	Between one week and one month
Deployment frequency For the primary application or service you work on, how often does your organization deploy code to production or release it to end users?	On-demand (multiple deploys per day)	Between once per day and once per week	Between once per week and once per month	Between once per week and once per month
Change failure rate For the primary application or service you work on, what percentage of changes to production or released to users result in degraded service (e.g., lead to service impairment or service outage) and subsequently require remediation (e.g., require a hotfix, rollback, fix forward, patch)?	5%	10%	15%	64%
Failed deployment recovery time For the primary application or service you work on, how long does it generally take to restore service after a change to production or release to users results in degraded service (for example, lead to service impairment or service outage) and subsequently require remediation (for example, require a hotfix, rollback, fix forward, or patch)?	Less than one hour	Less than one day	Between one day and one week	Between one month and six months
Percentage of respondents	18%	31%	33%	17%

<https://cloud.google.com/blog/products/devops-sre/announcing-the-2023-state-of-devops-report>



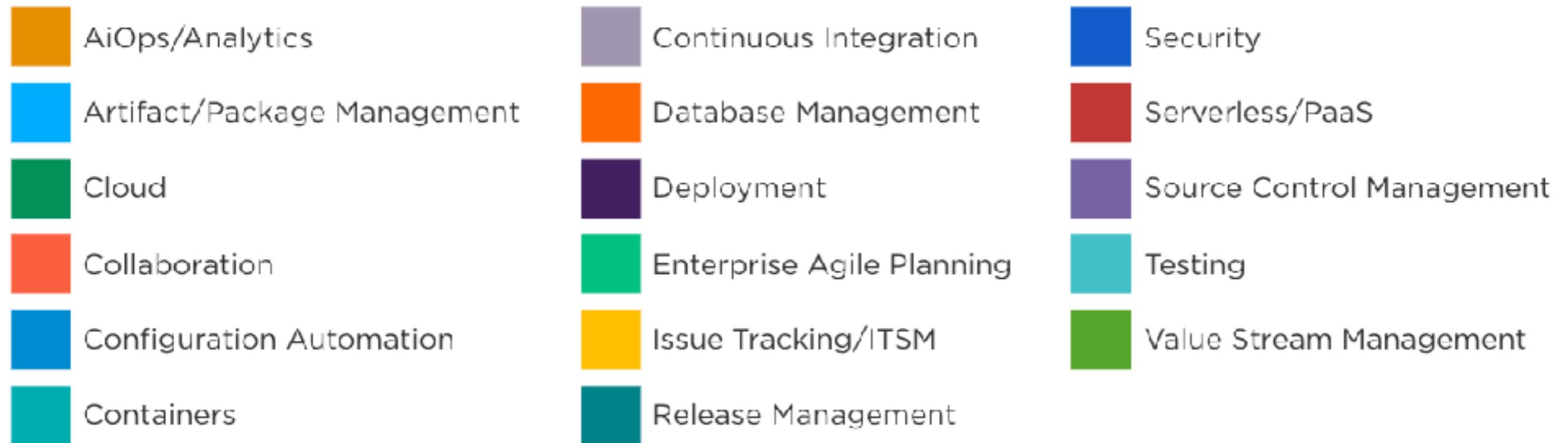
DevOps Tools



St	Oc	Wd	en	Re	Oc	Wd	Oc	Wd	Fr	Wd	Oc	Wd	Pd	Wd	Cs	Wd	Wd	en	Wd	Oc	TOI	en	Wd	Pd	Wd	en	Wd	Pd	Wd	Cs
Jn	Azc	Glc			Tr	Cc		Mv		Ab	Gd		Acb		Aj		Bi		At		Sw		Td		Pd					
Junkin	Acme DevOps Code	GitLab CI			Travel CI	CircleCI		Power		Allianz Bamboo	Scalr		AvS CookBuild		Allianz Jira		EMC Helix ITSM		Allianz Triflu		ServiceNow		TOPJunk		Player Duty					

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





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



Workshop

Design your delivery process



DevOps with Security

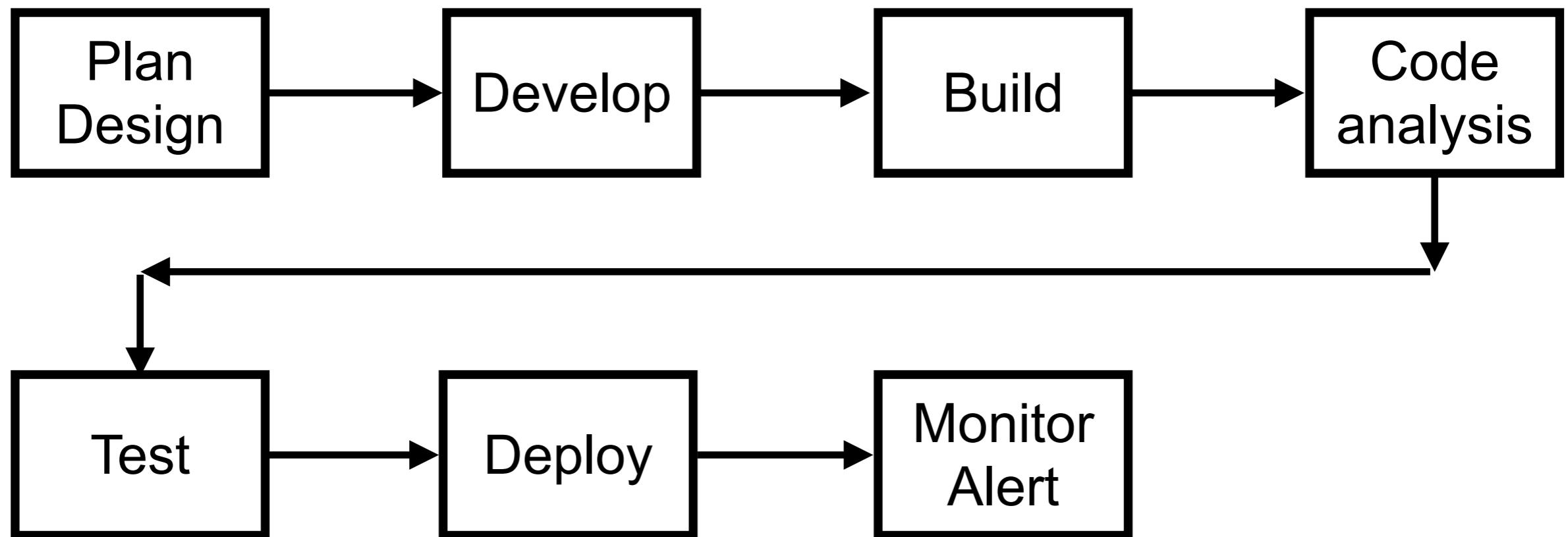


DevSecOps

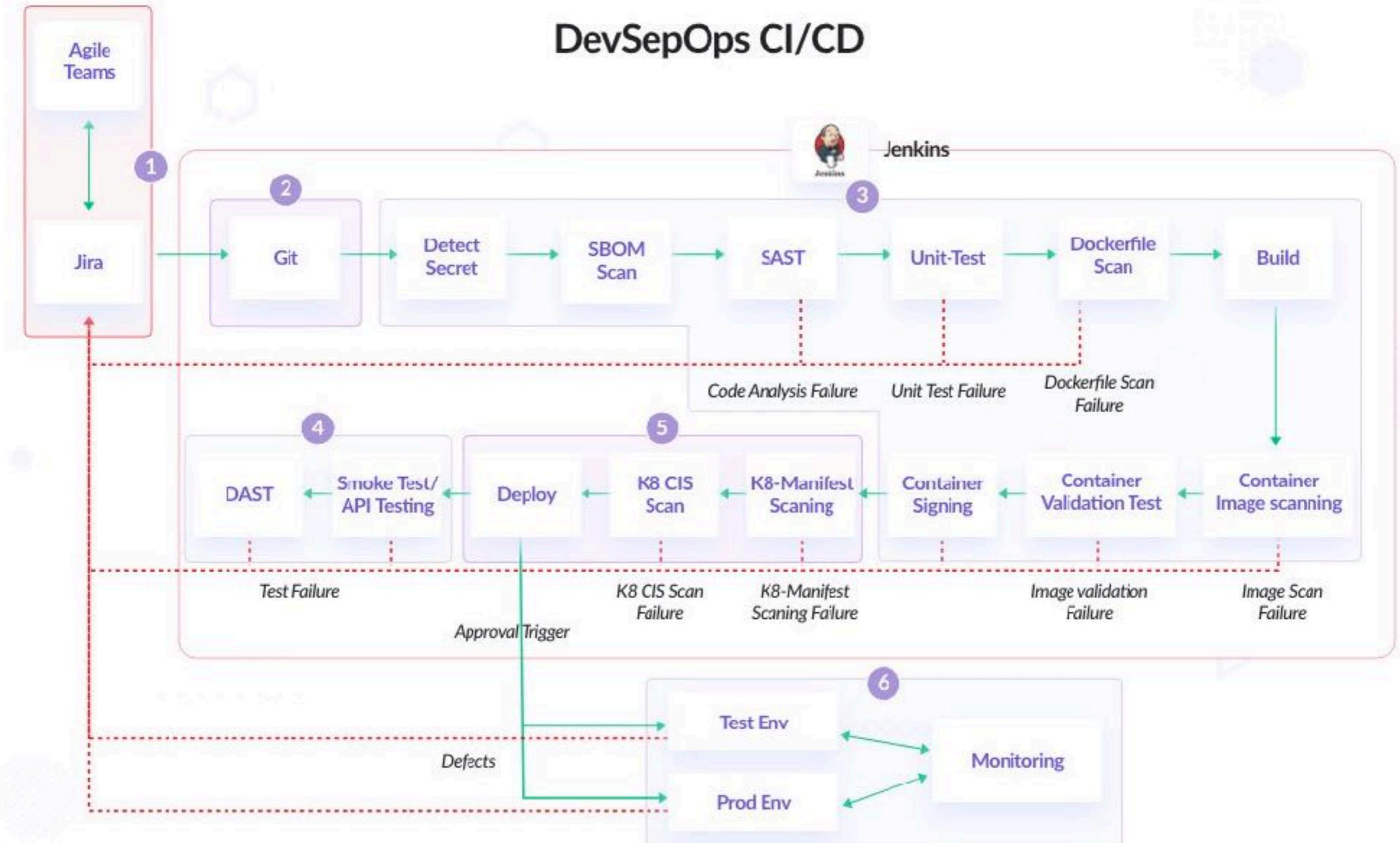
Security in software development life cycle
Finds vulnerability and bugs at an earlier stage of development



DevSecOps Pipeline



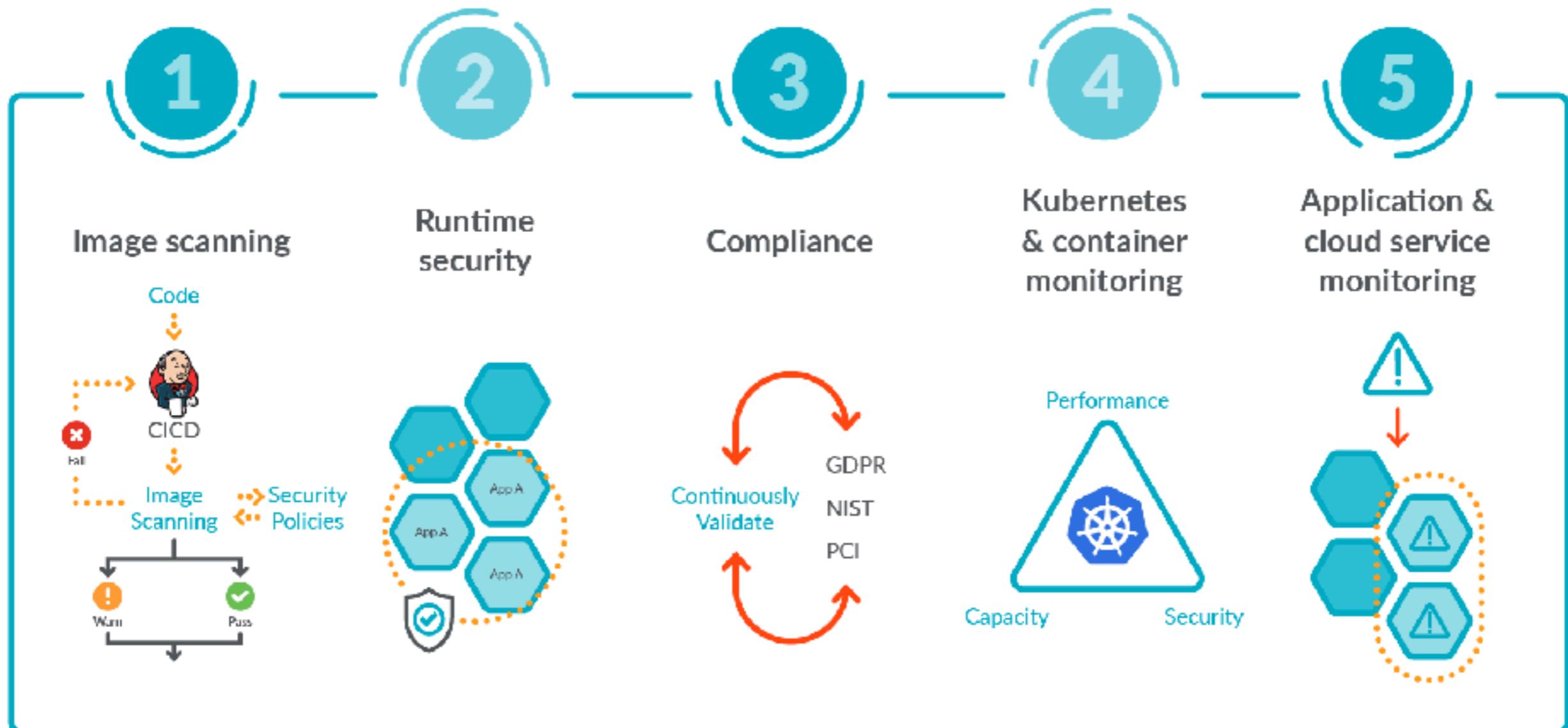
DevSepOps CI/CD



<https://www.infracloud.io/blogs/implement-devsecops-secure-ci-cd-pipeline/>



Five Essential Workflows for Secure DevOps



<https://sysdig.com/blog/image-scanning-best-practices/>



Plan and Design

Threat modeling



https://owasp.org/www-community/Threat_Modeling



Plan and Design

Secure Software Development Life Cycle (SSDLC)



<https://snyk.io/learn/secure-sdlc/>



Develop

Shift left security in development phase
SonarLint
Pre-commit hooks
Setup protected branch
Signed git commit with GPG key

https://docs.gitlab.com/ee/user/project/repository/gpg_signed_commits/



Build and Code analysis

Scan code for vulnerabilities and secrets

SonarQube

Dependency check

Detect code lead to a memory leak

Scan docker image

Signing and verify a docker image



Container !!

How to identify malware in a container ?



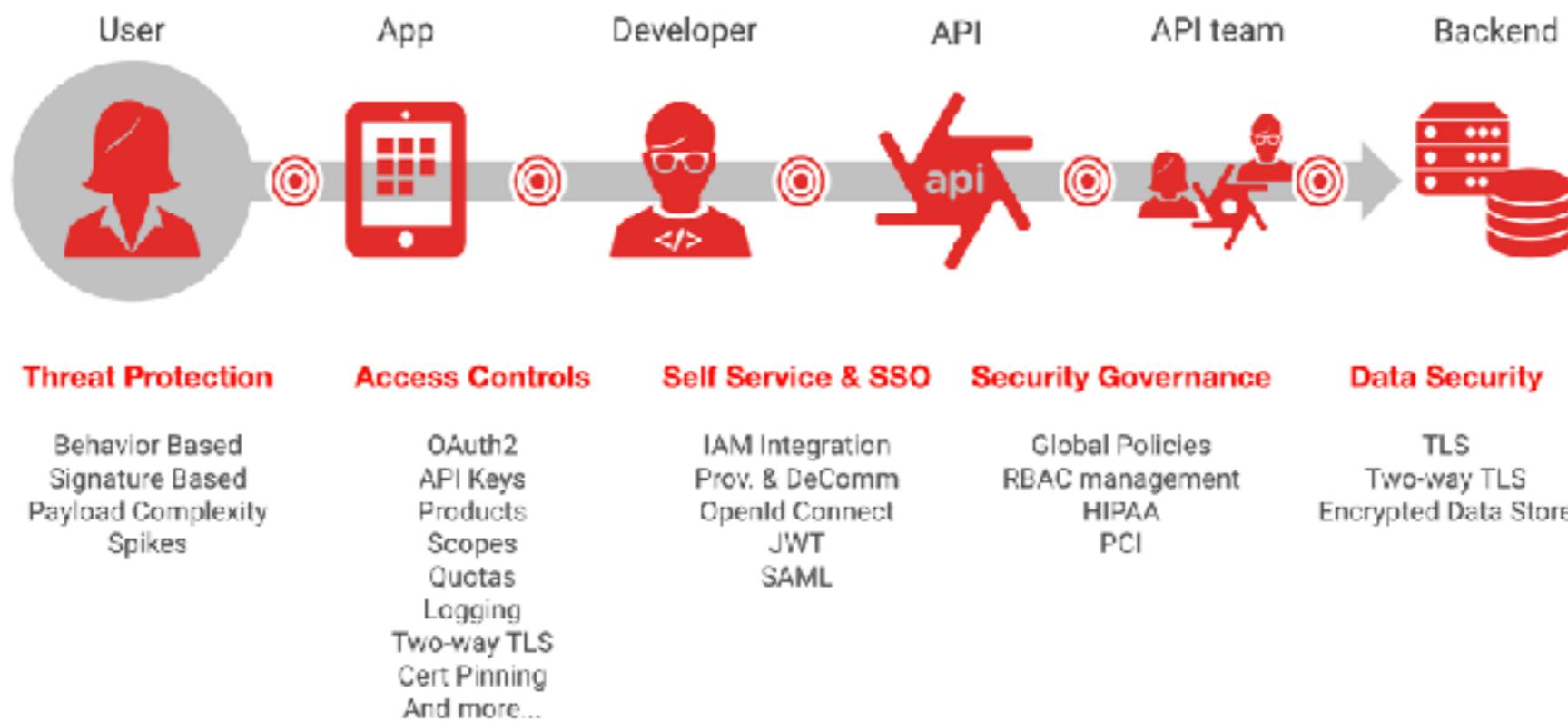
Docker
scout

<https://snyk.io/learn/docker-security-scanning/>



OWASP Top 10

Web API Mobile



<https://owasp.org/Top10/>



DevOps

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Docker Security Top 10

OWASP/Docker-Security



Getting a handle on container security

81 9

Contributors

0 14

Issues

★ 571

Stars

0 122

Forks



<https://github.com/OWASP/Docker-Security>



DevOps

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Scan for secret and credential

Detect-secret
Gitleaks

```
$detect-secrets scan test_data/ --all-files
```

<https://github.com/Yelp/detect-secrets>



Deployment

Static scan of k8s manifest file

Pre-deploy policy check k8s manifest file

IaC scanning (terrascan, terratest)



Continuous Integration Continuous Delivery



Why CI/CD ?

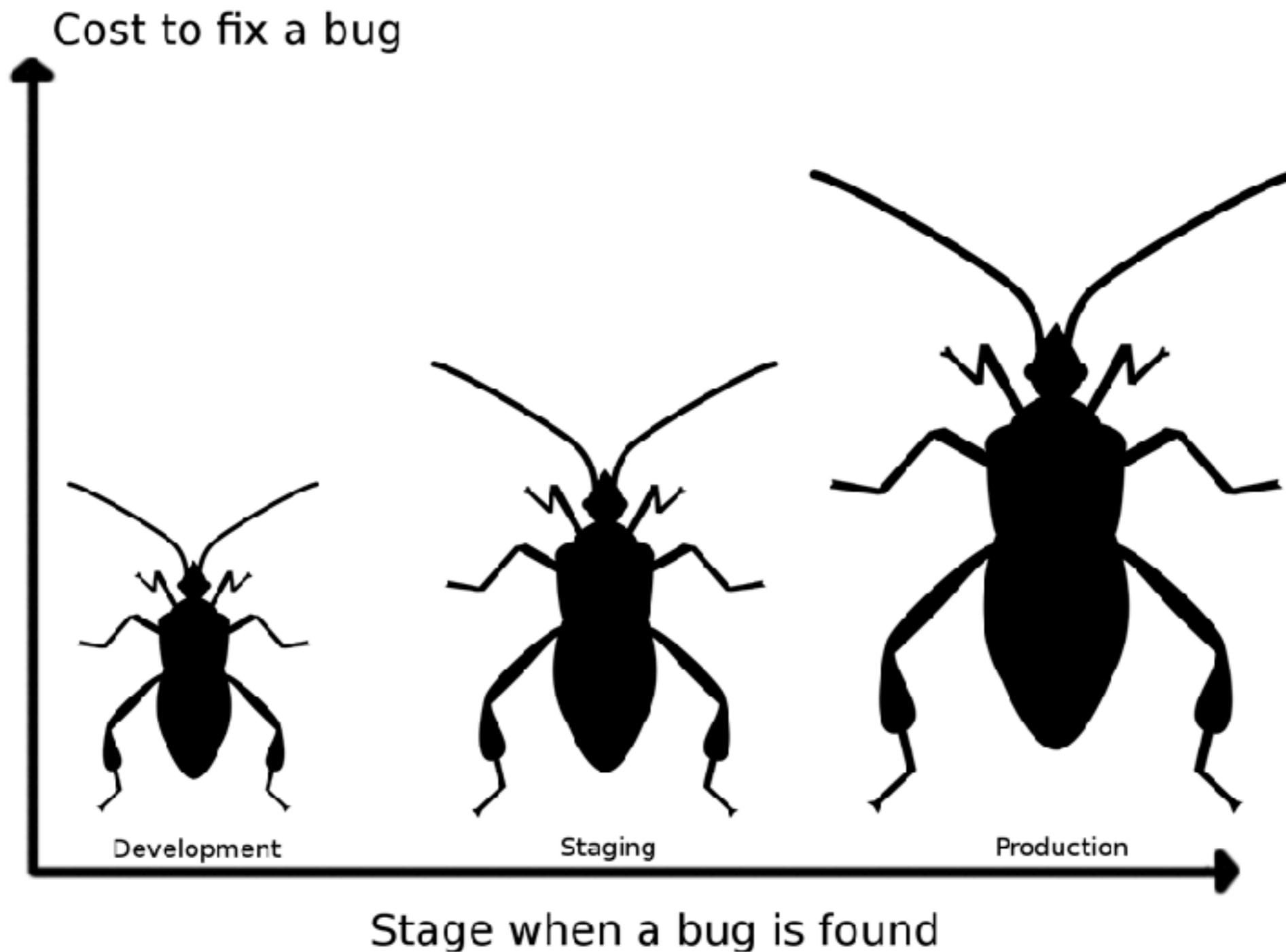


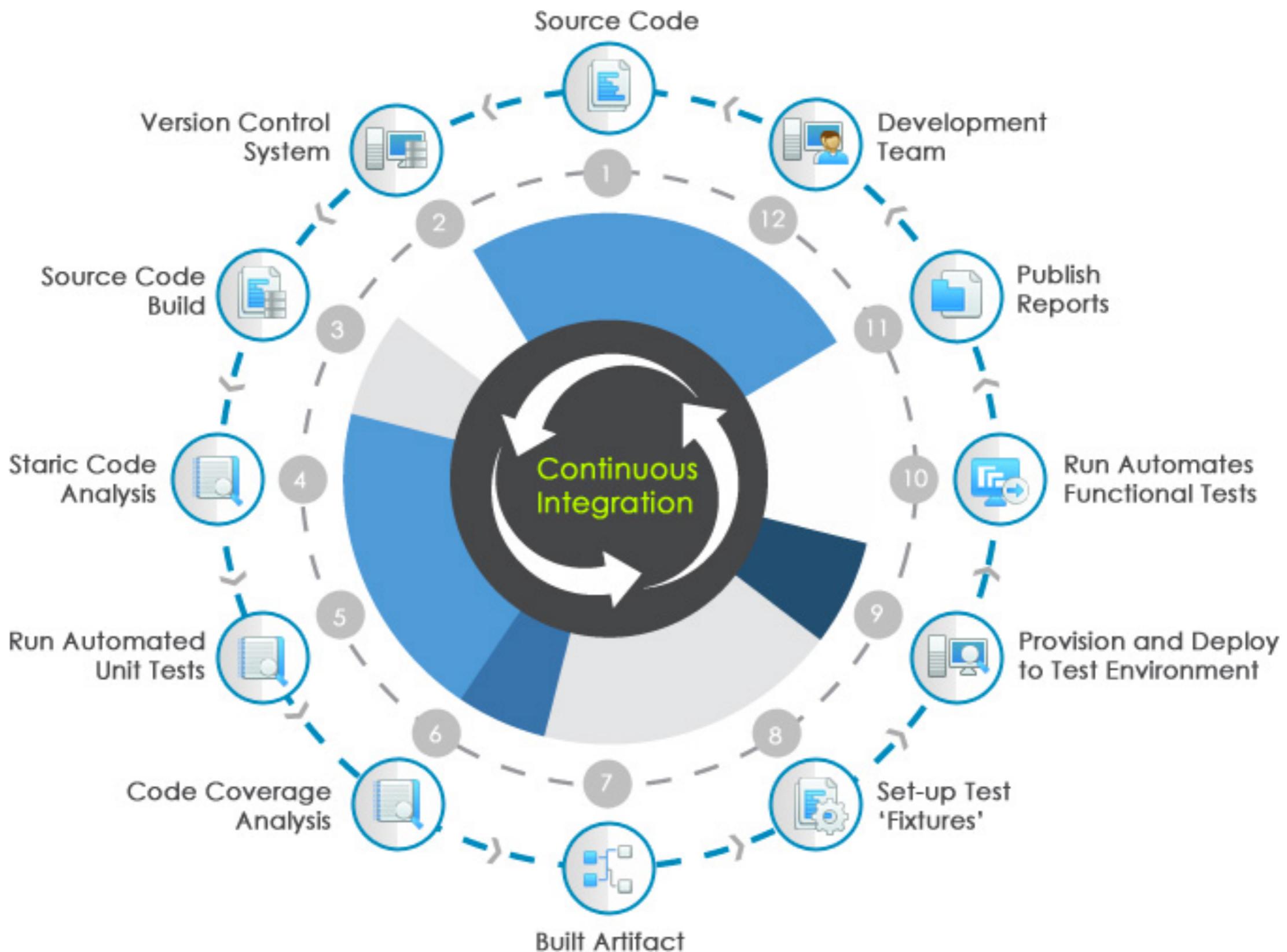
The cost of integration

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



The cost of integration







Jenkins

Bamboo



TeamCity

> goTM



Hudson





Jenkins

Bamboo

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



Visual Studio



Team Foundation Server

Hudson



Travis

wercker

circleci



Continuous Integration

Discipline to integrate frequently



Continuous Integration

Strive to make **small change**



Continuous Integration

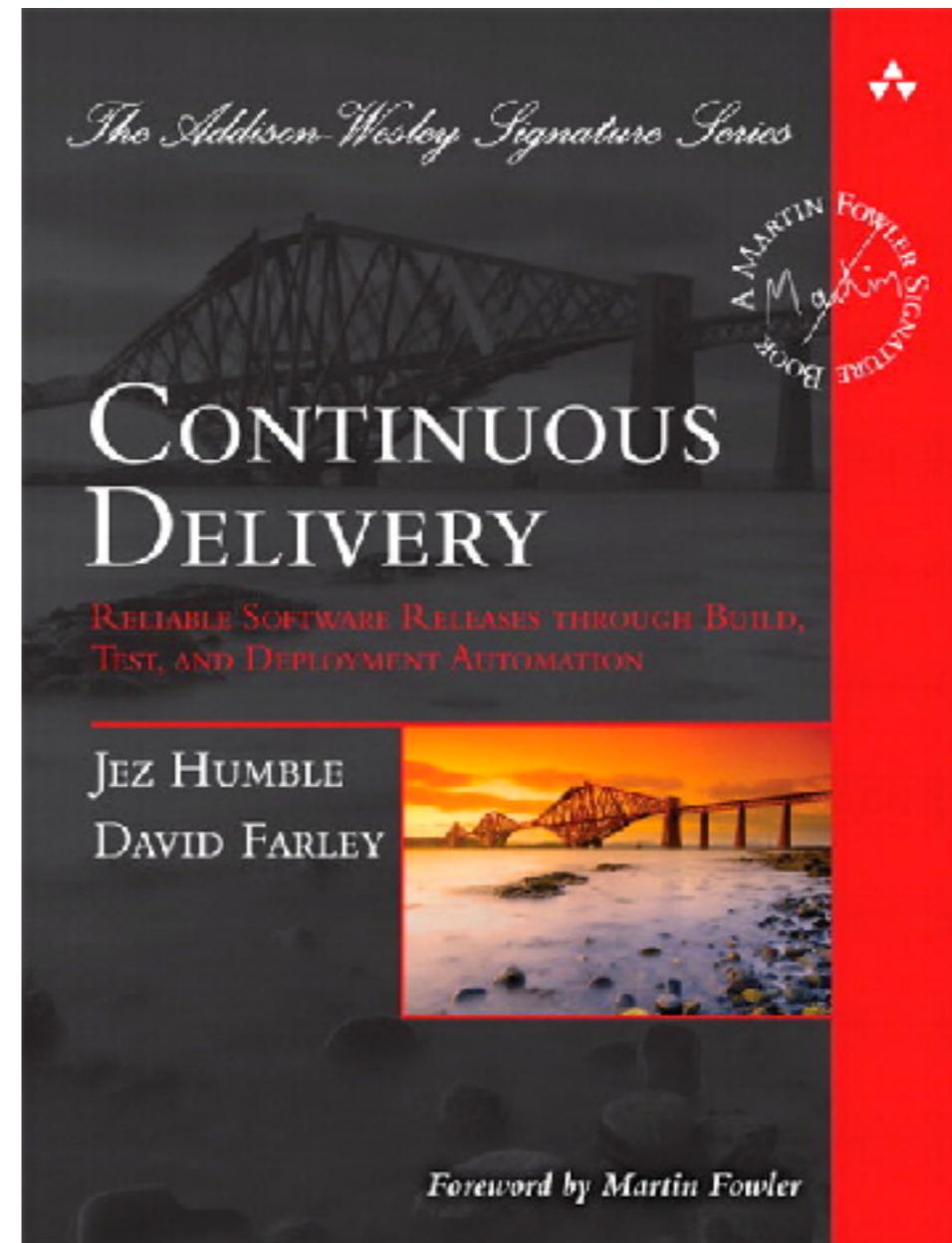
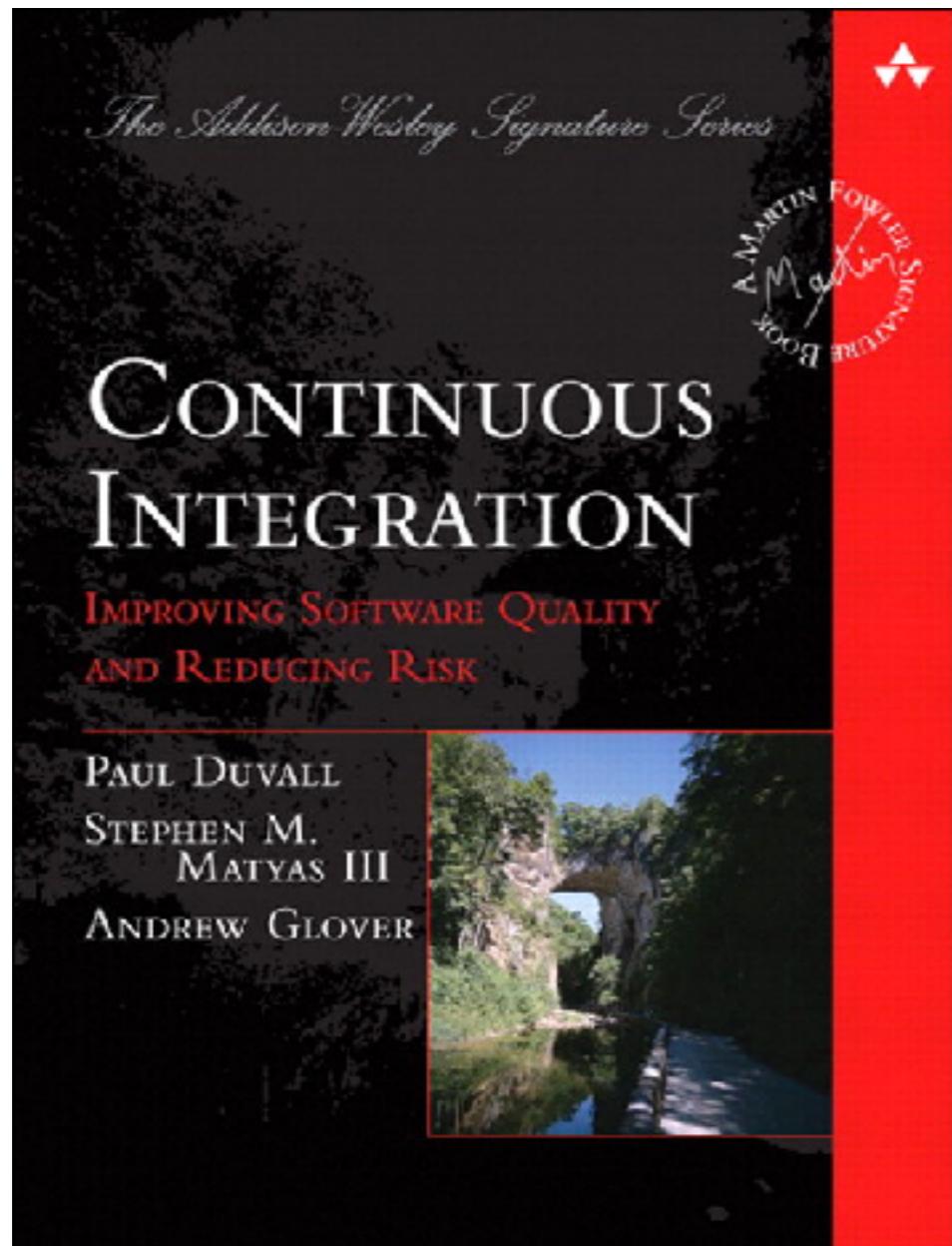
Strive for **fast feedback**



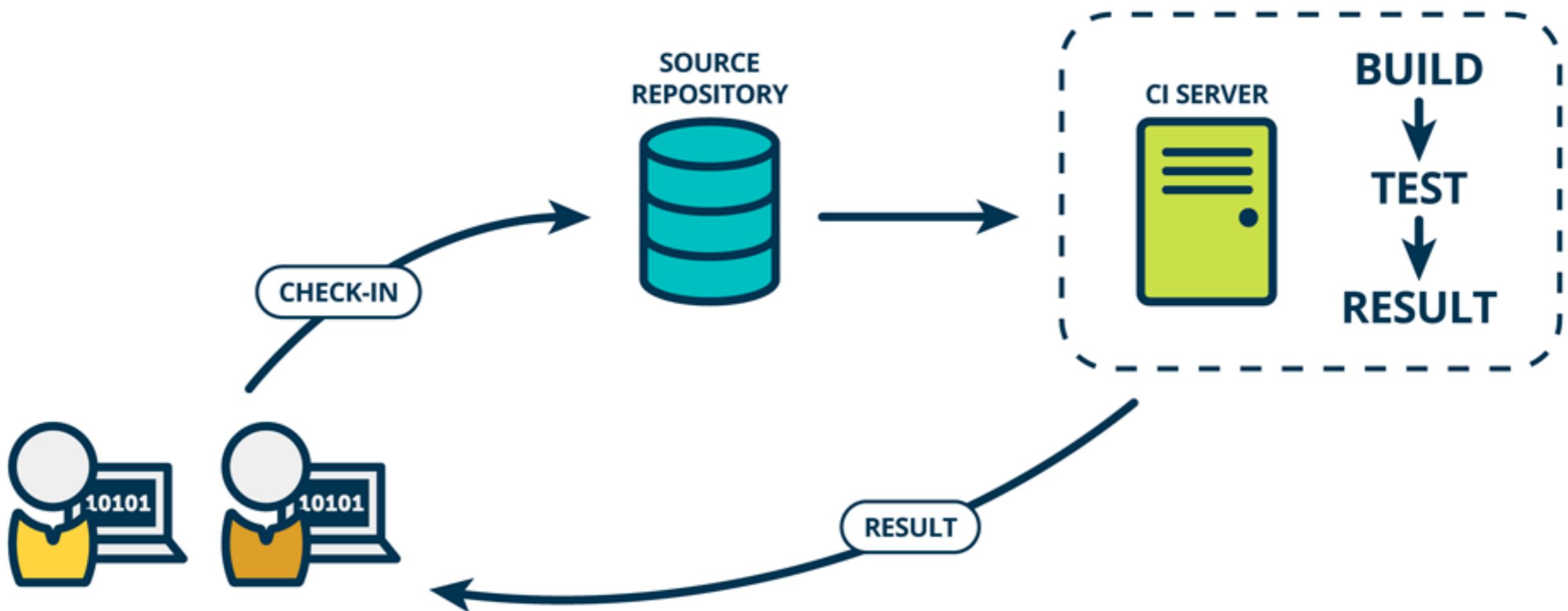
Practices of Continuous Integration



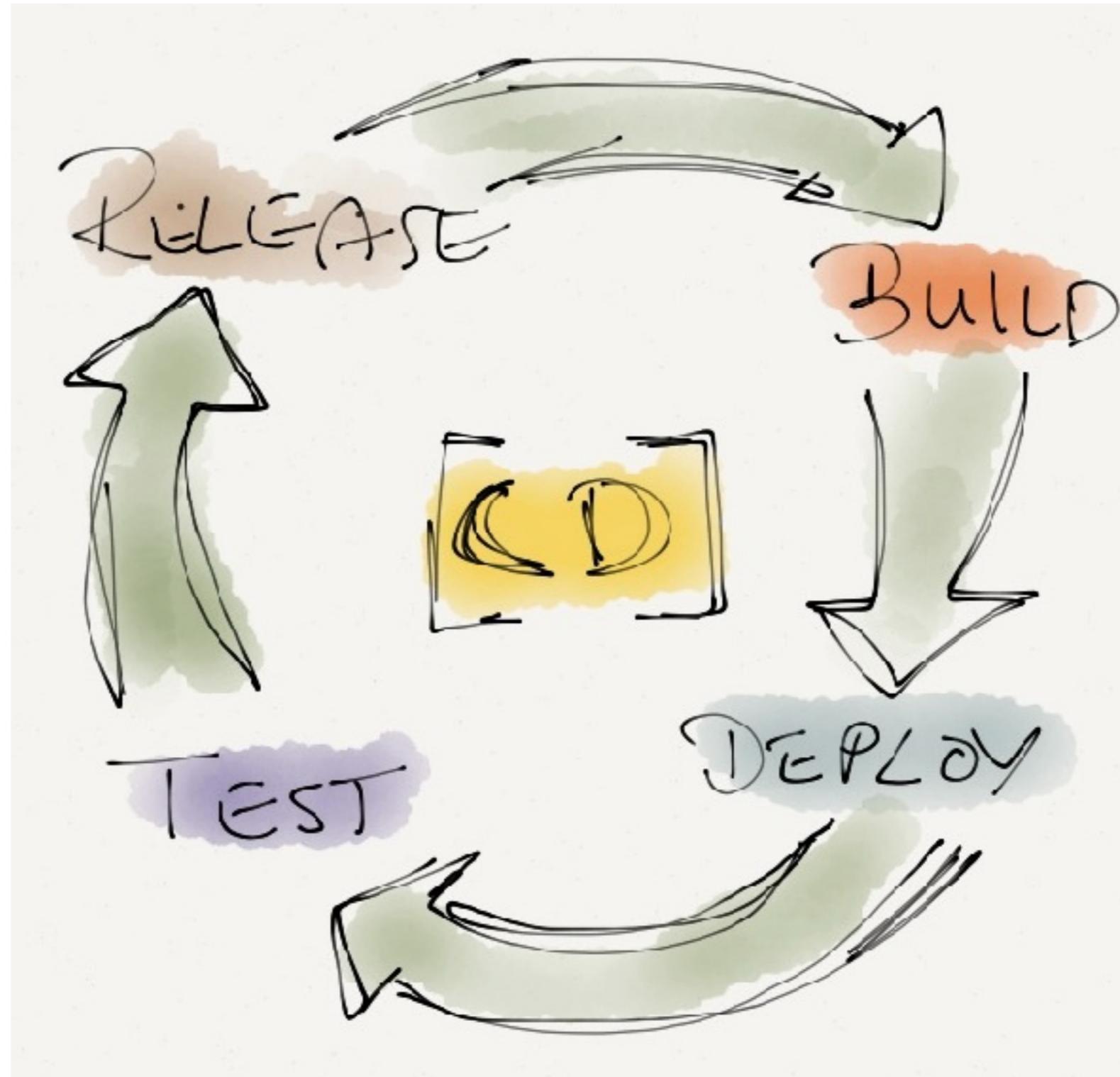
Improve quality and reduce risk



Continuous Integration



CD ?



CD ?

CONTINUOUS DELIVERY



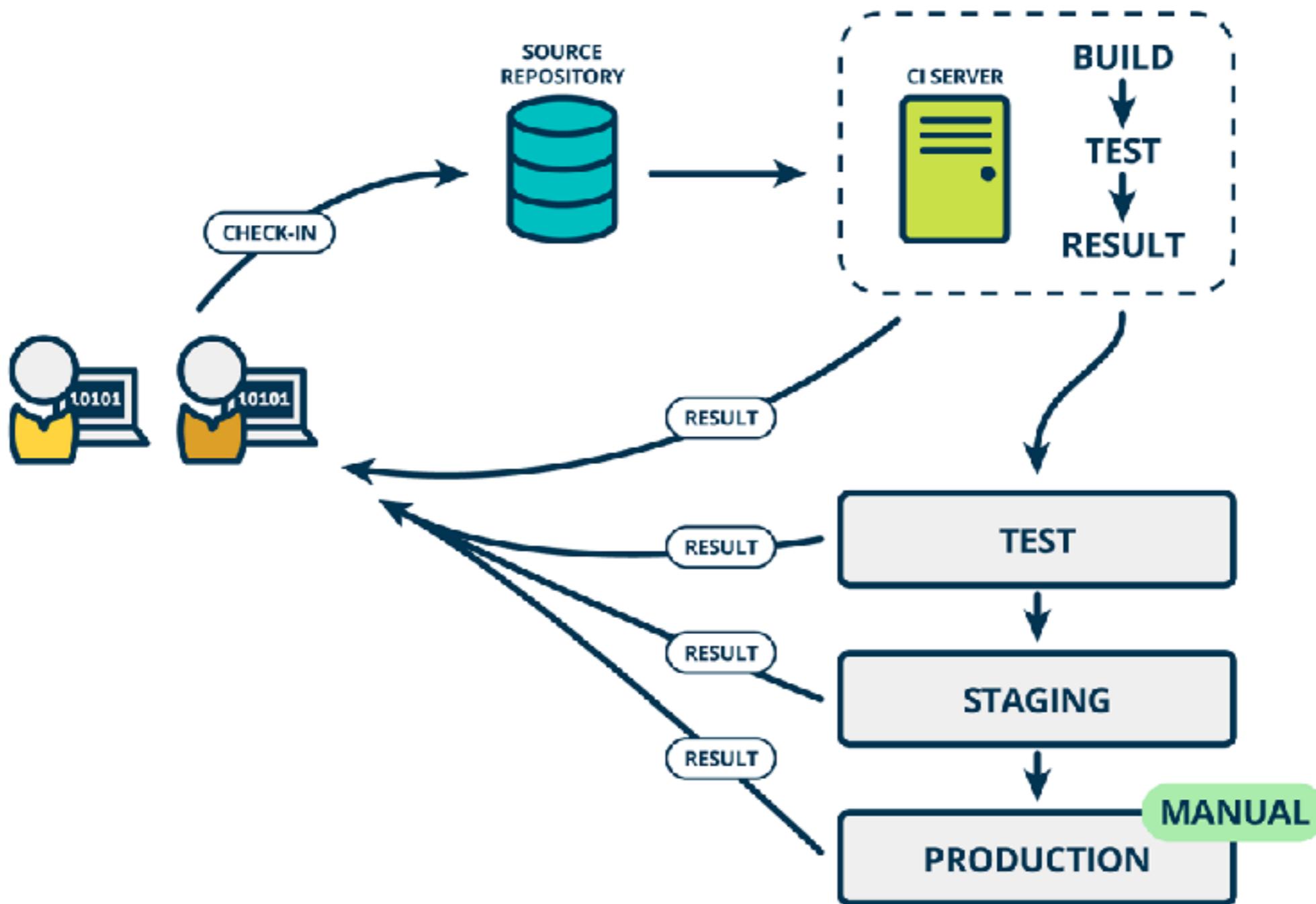
CONTINUOUS DEPLOYMENT



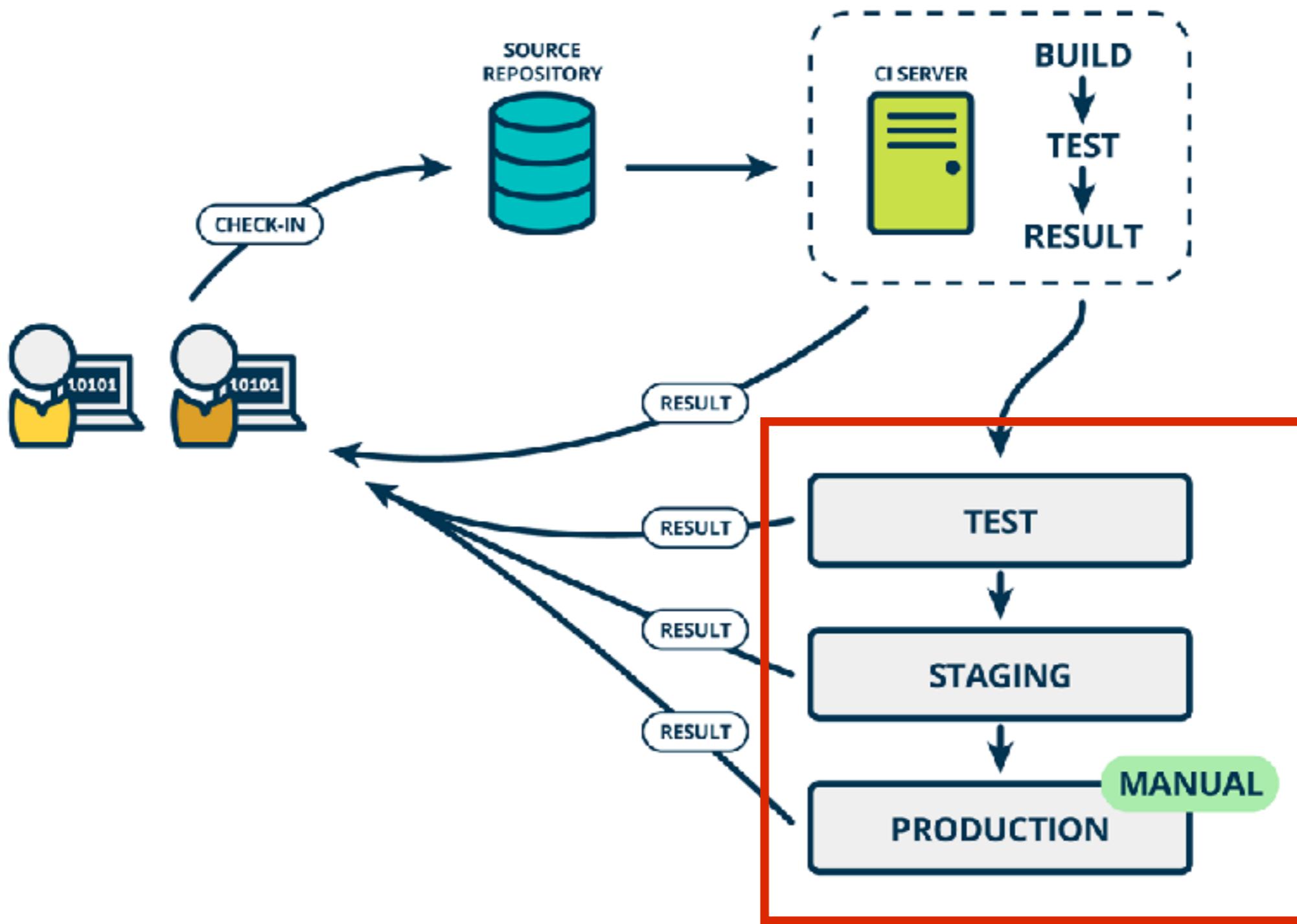
<http://blog.crisp.se/2013/02/05/yassalsundman/continuous-delivery-vs-continuous-deployment>



Continuous Delivery



Rise of DevOps



Continuous Integration

is a Software development practices



Practice 1

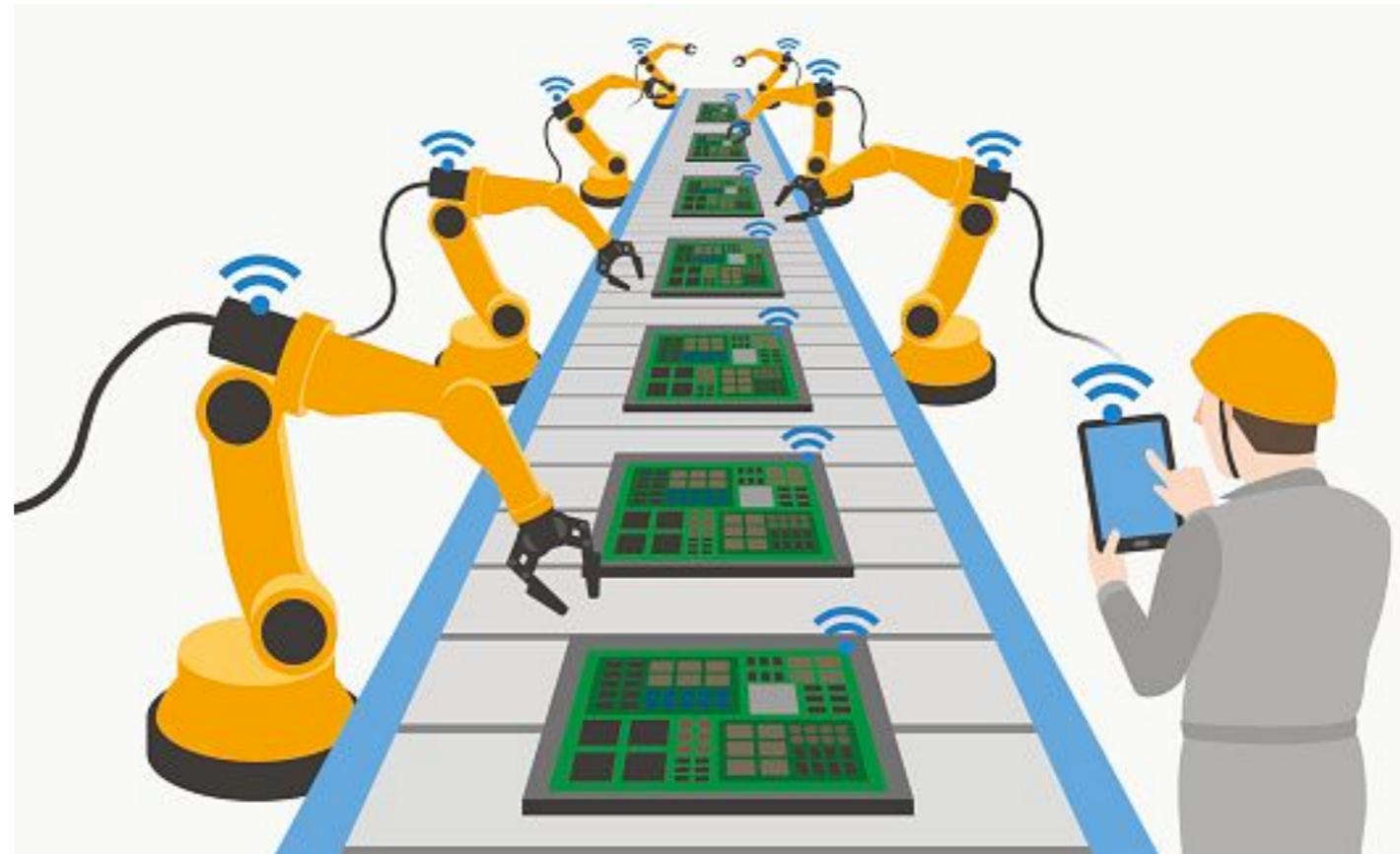
Maintain a single source repository

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



Practice 2

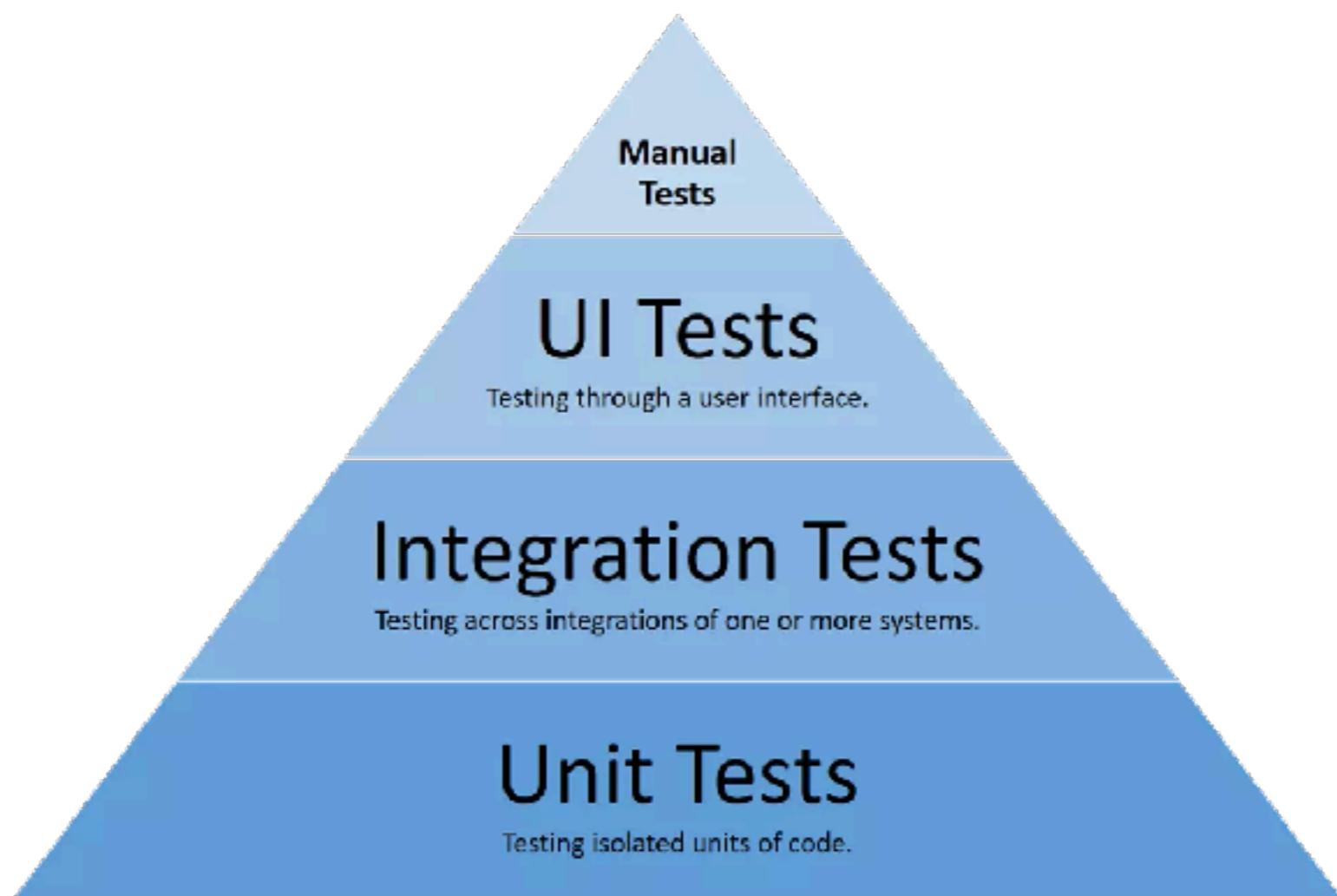
Automated the build
Automated environment for builds



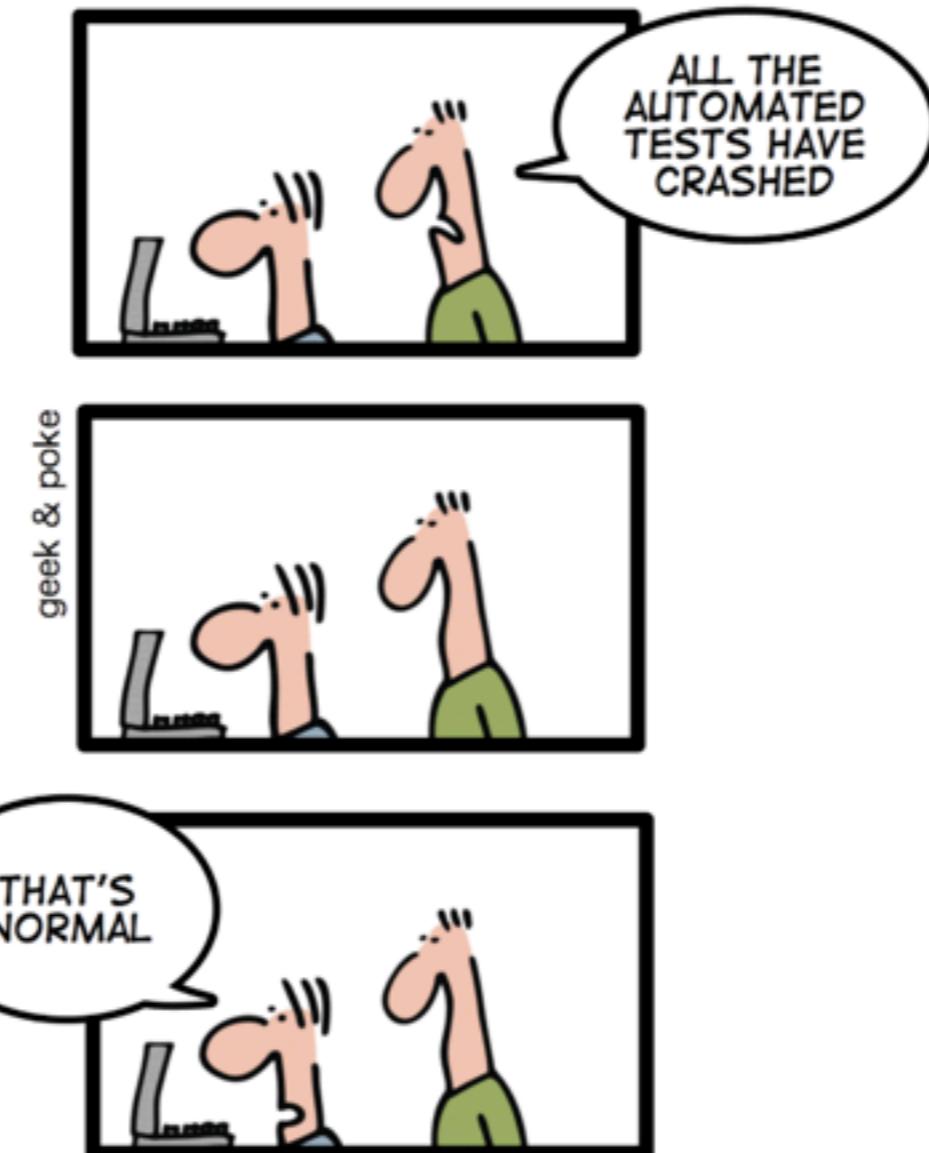
Practice 3

Make your build **self-testing**

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



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



<http://geekandpoke.typepad.com/>

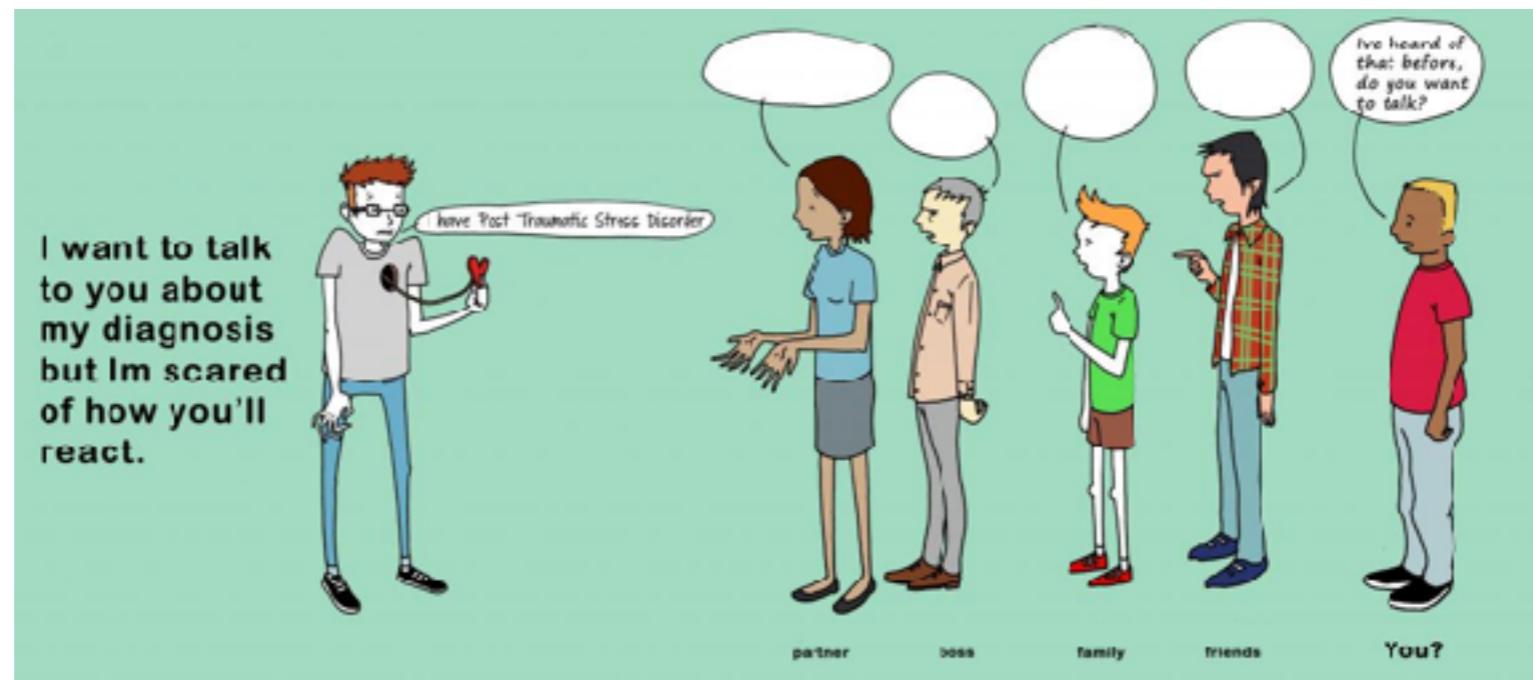


Practice 4

Everyone commits to the mainline everyday

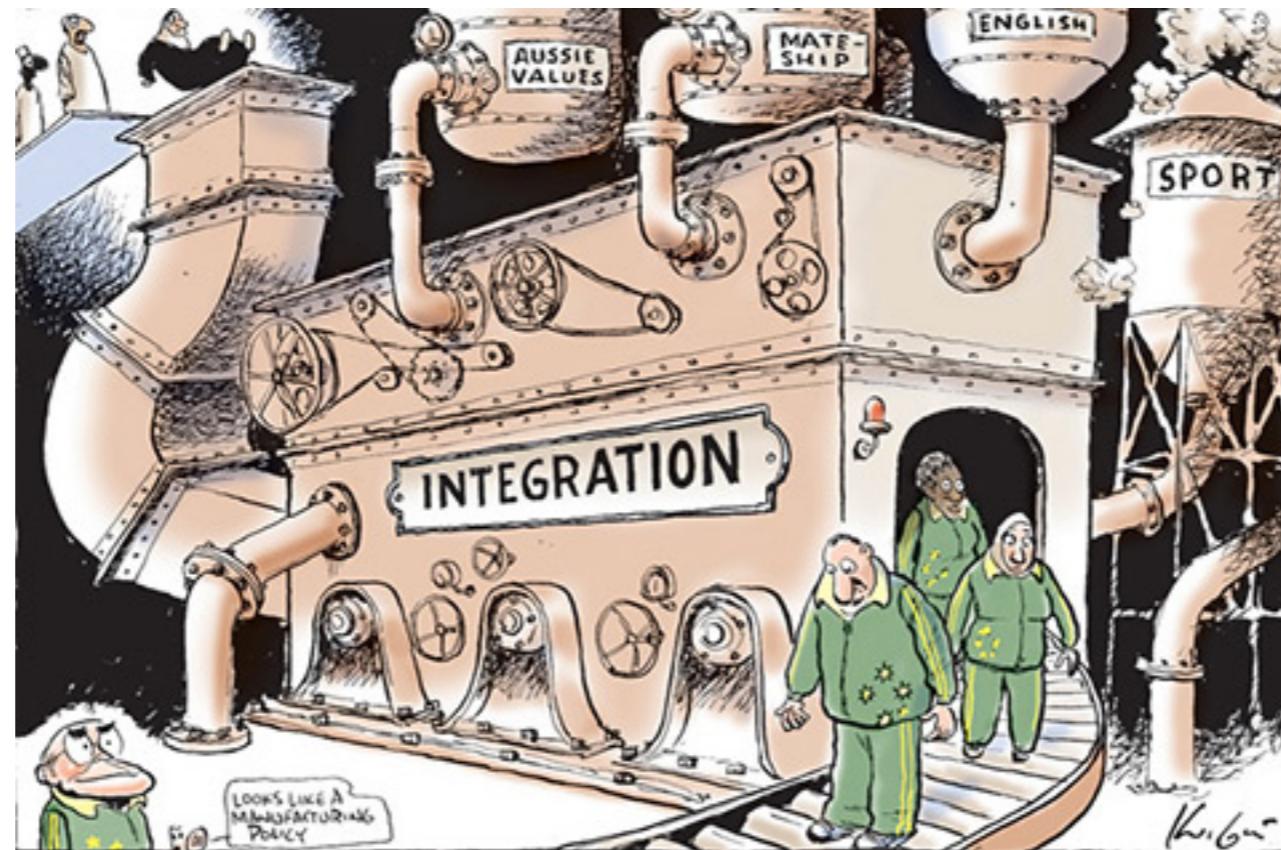
Integration is about communication

Integration allows developers to tell other developers



Practice 5

Every commits should build the mainline on an
Integration machine



Nightly build is not enough for Continuous Integration



Practice 6

Fix broken builds immediately

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



Practice 7

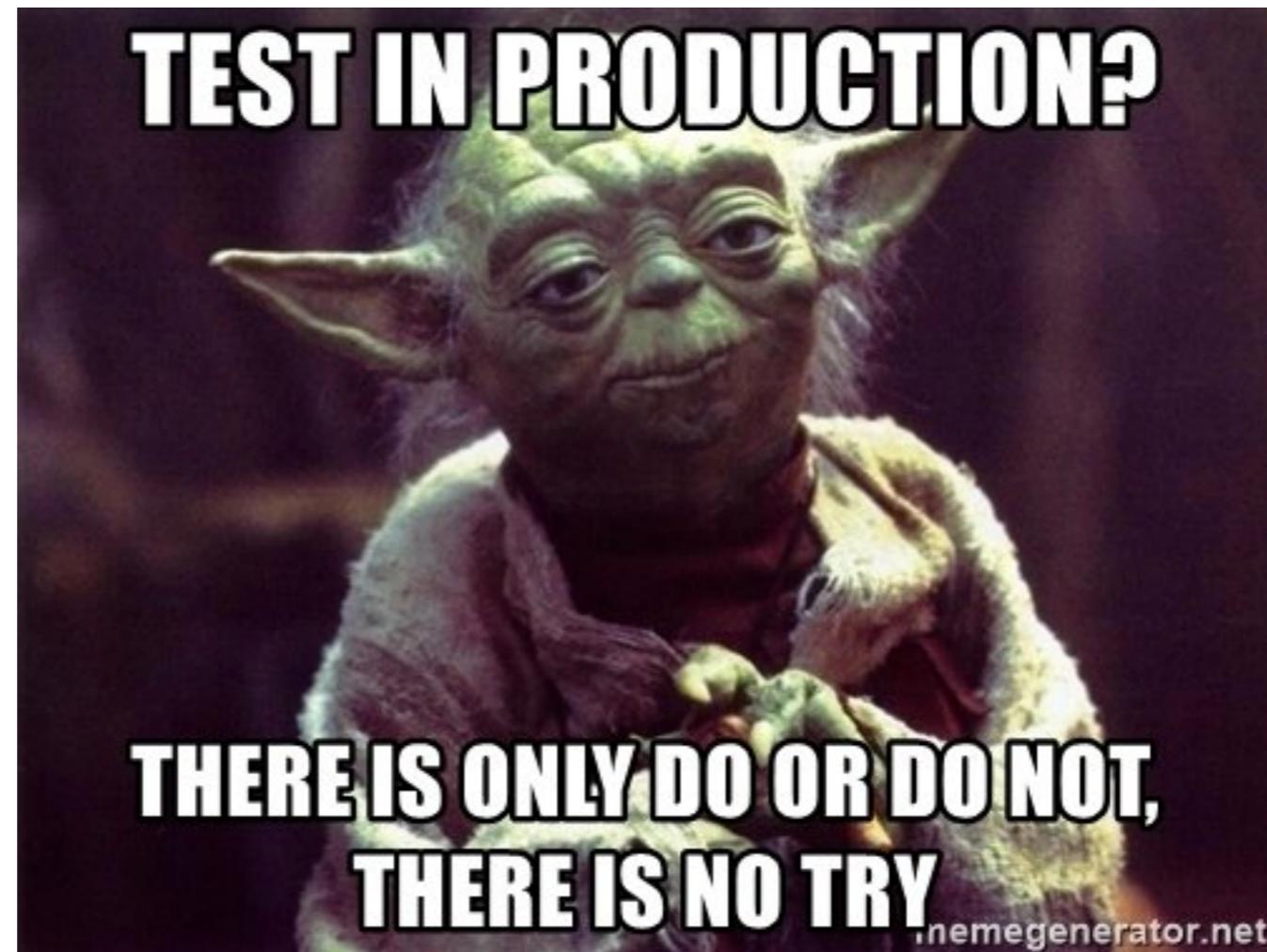
Keep the build **fast**

Continuous Integration is to provide rapid feedback



Practice 8

Test in clone of the **Production** environment



Practice 9

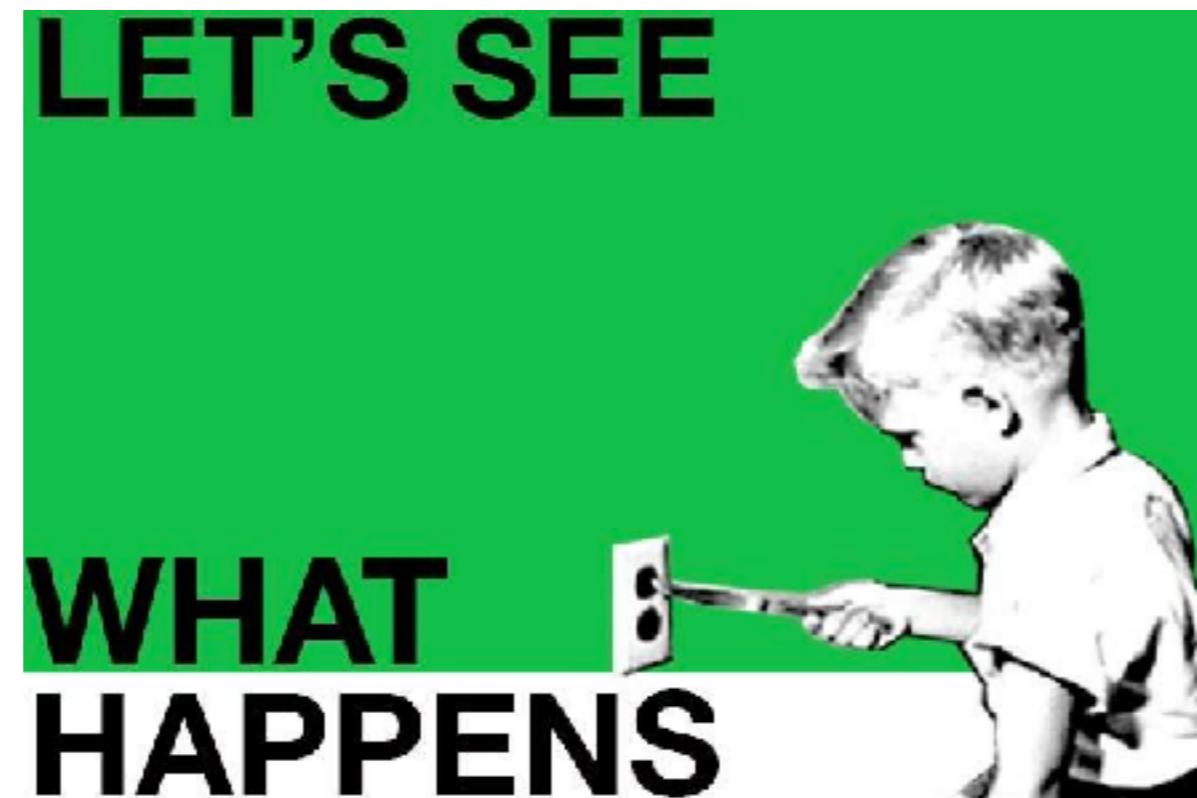
Make it easy for anyone to get
the latest executable

Make sure well known place where people can find



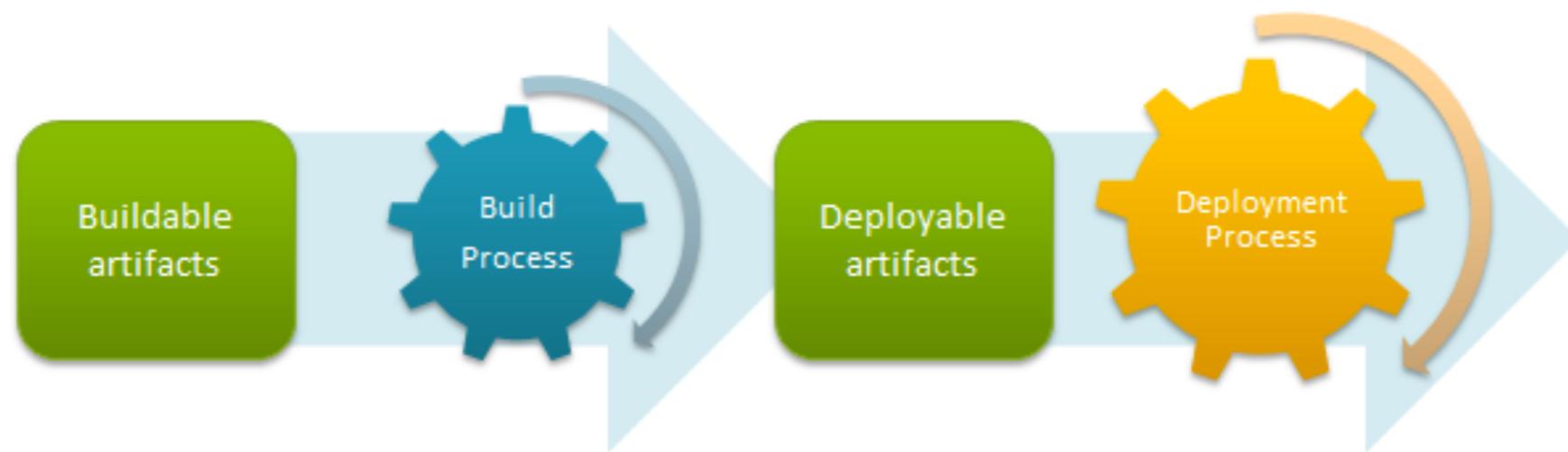
Practice 10

Everyone can see what's happening
Easier to see the state of the system and changes
Show the good information



Practice 11

Automated deployment



Continuous Delivery



Continuous Delivery

Use version control for all production artifacts

Automate your deployment process

Implement continuous integration (CI)

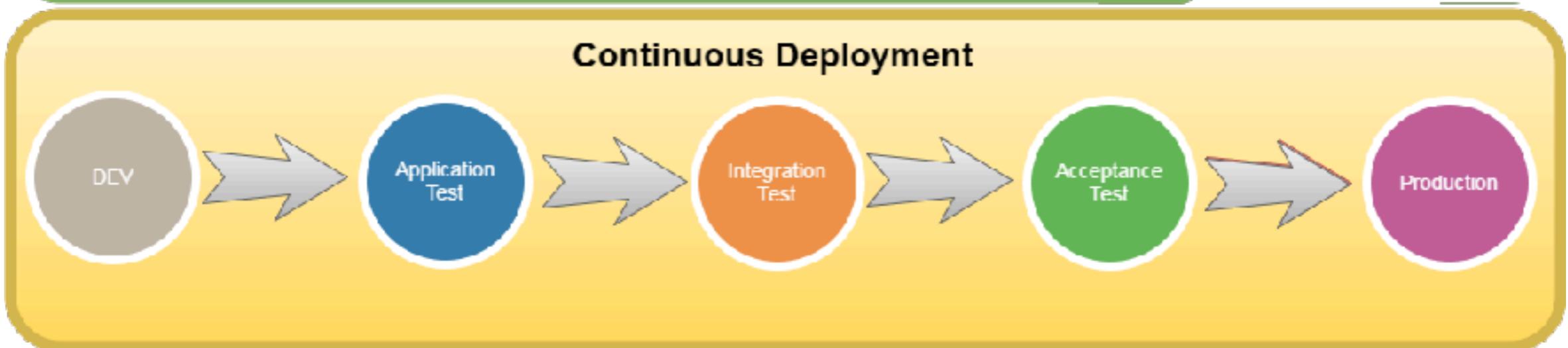
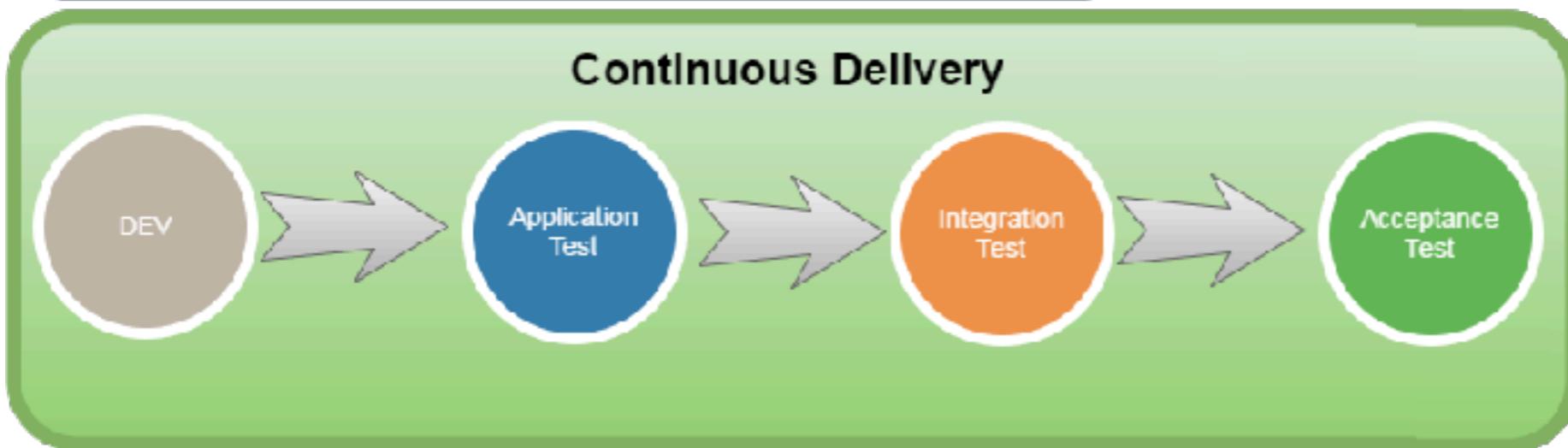
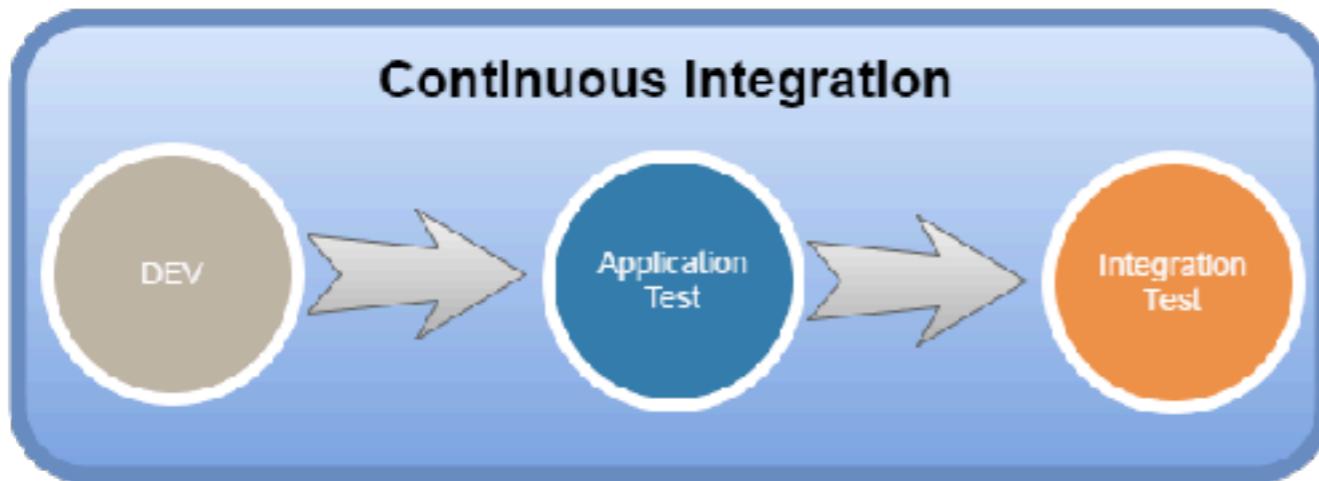
Use trunk-based development methods

Implement test automation

Support test data management

Integrate security into software development process





How to achieve the CI ?



1. Use good version control

Local
Centralize
Distributed



VSS = A brown粪便 emoji with three white wavy lines above it, representing steam or smoke.

JUST SAY NO!



2. Choose Branch strategy

Main only

Development isolation

Feature isolation

Release isolation

Service and Release isolation

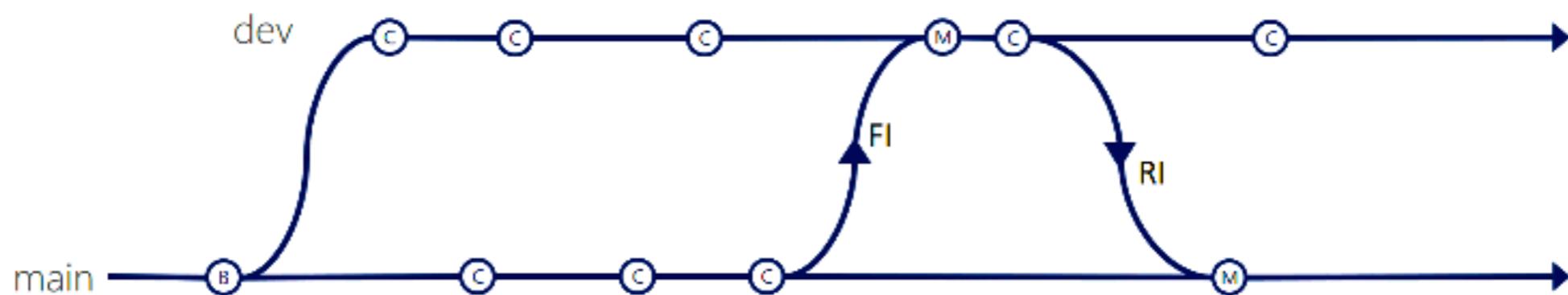
Service, Hotfix and Release isolation



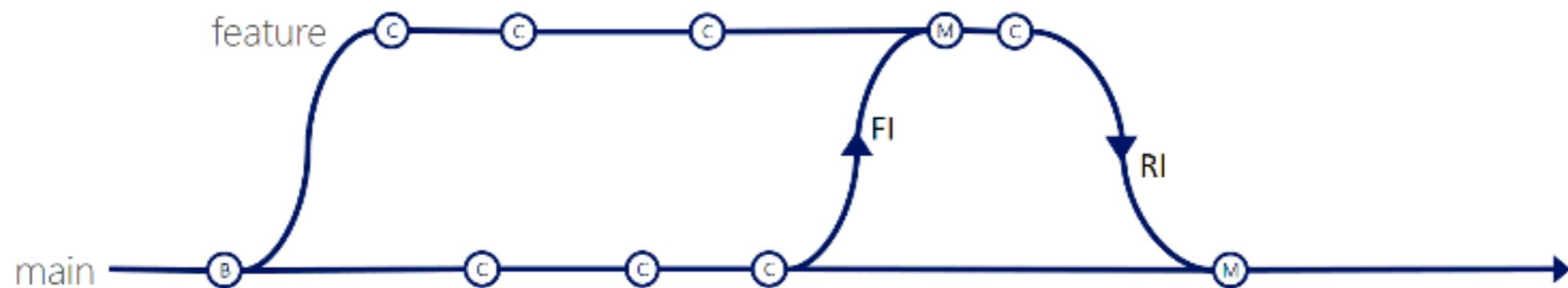
Main only



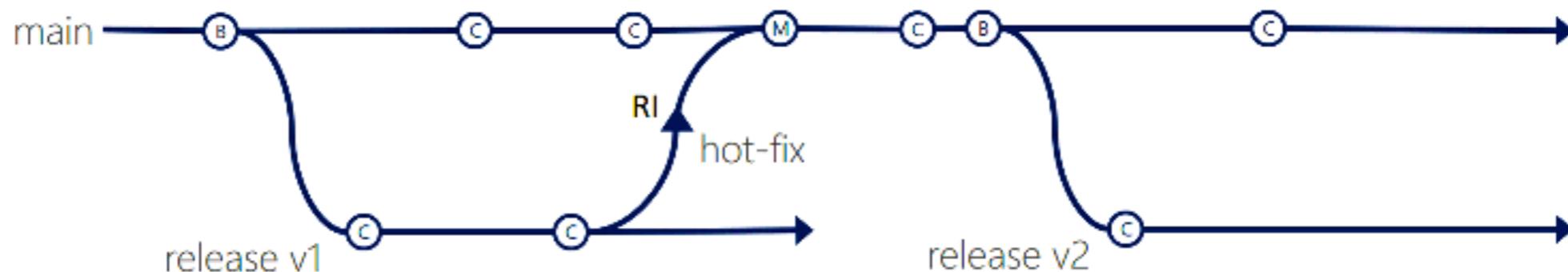
Development isolation



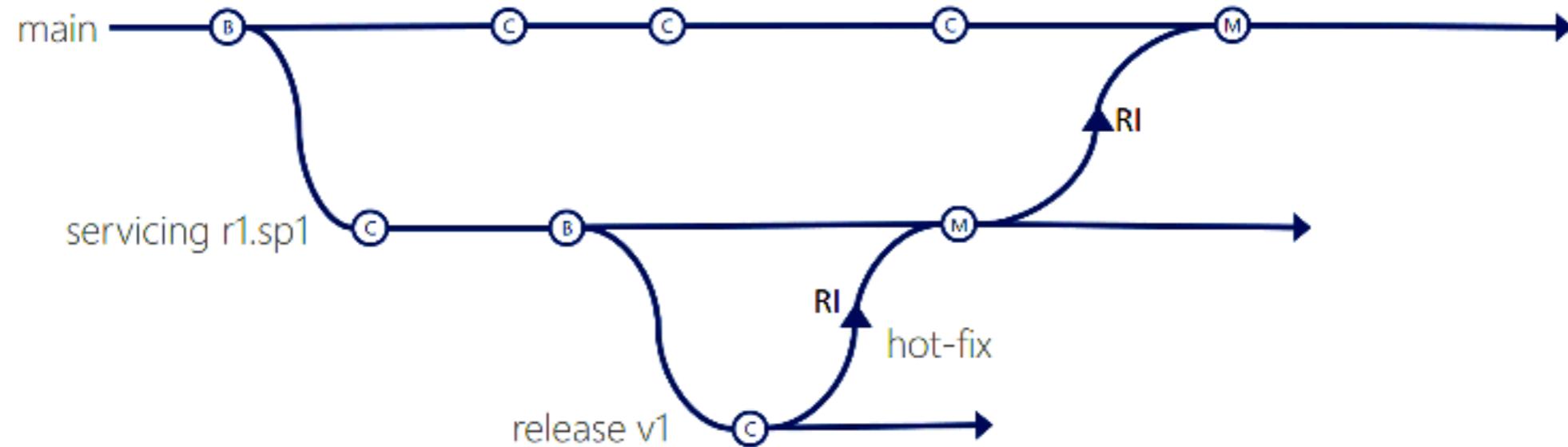
Feature isolation



Release isolation



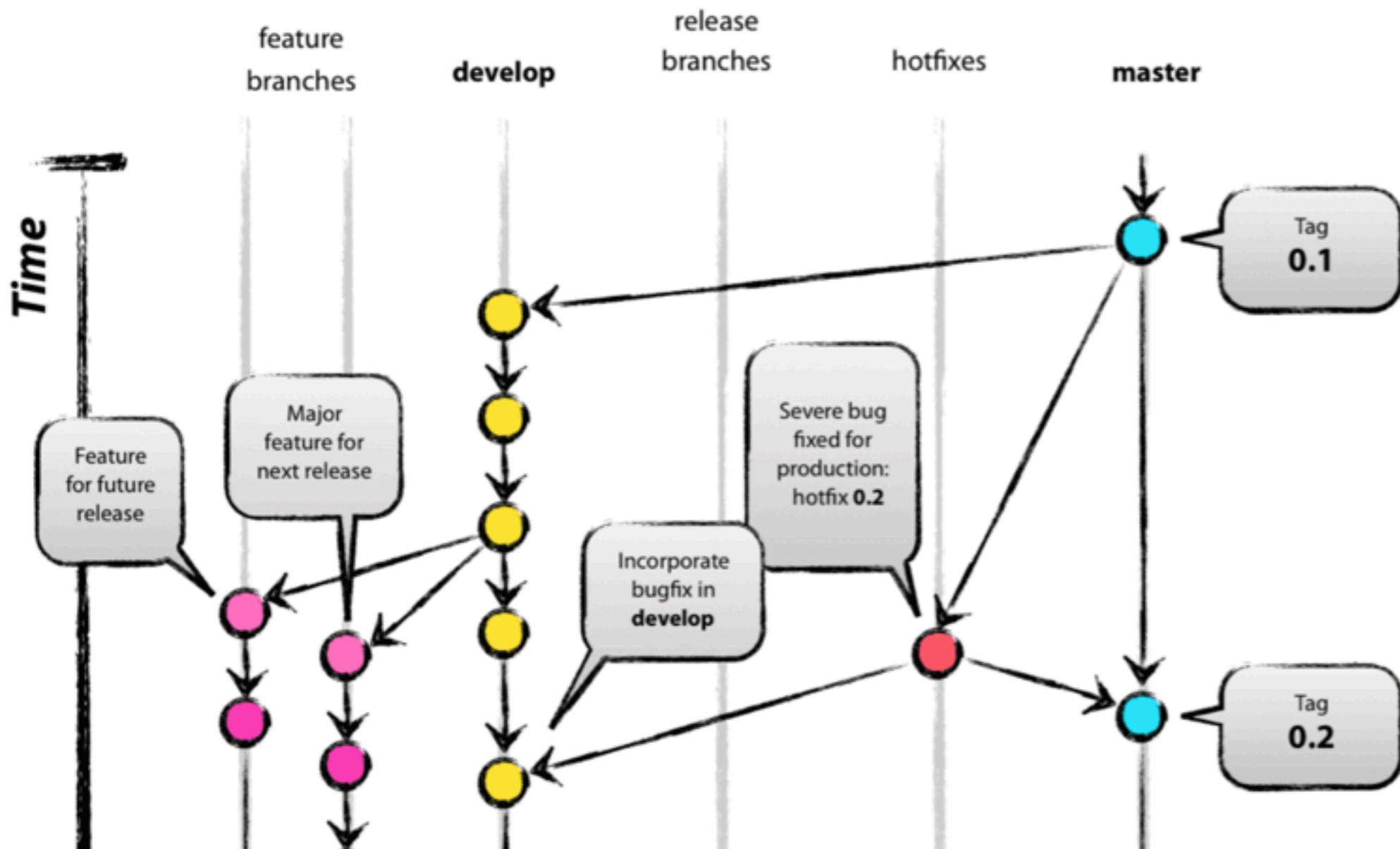
Service and Release isolation



Service, Hotfix, Release isolation



Git Branch Model



<https://nvie.com/posts/a-successful-git-branching-model/>



Validate, Validate and Validate

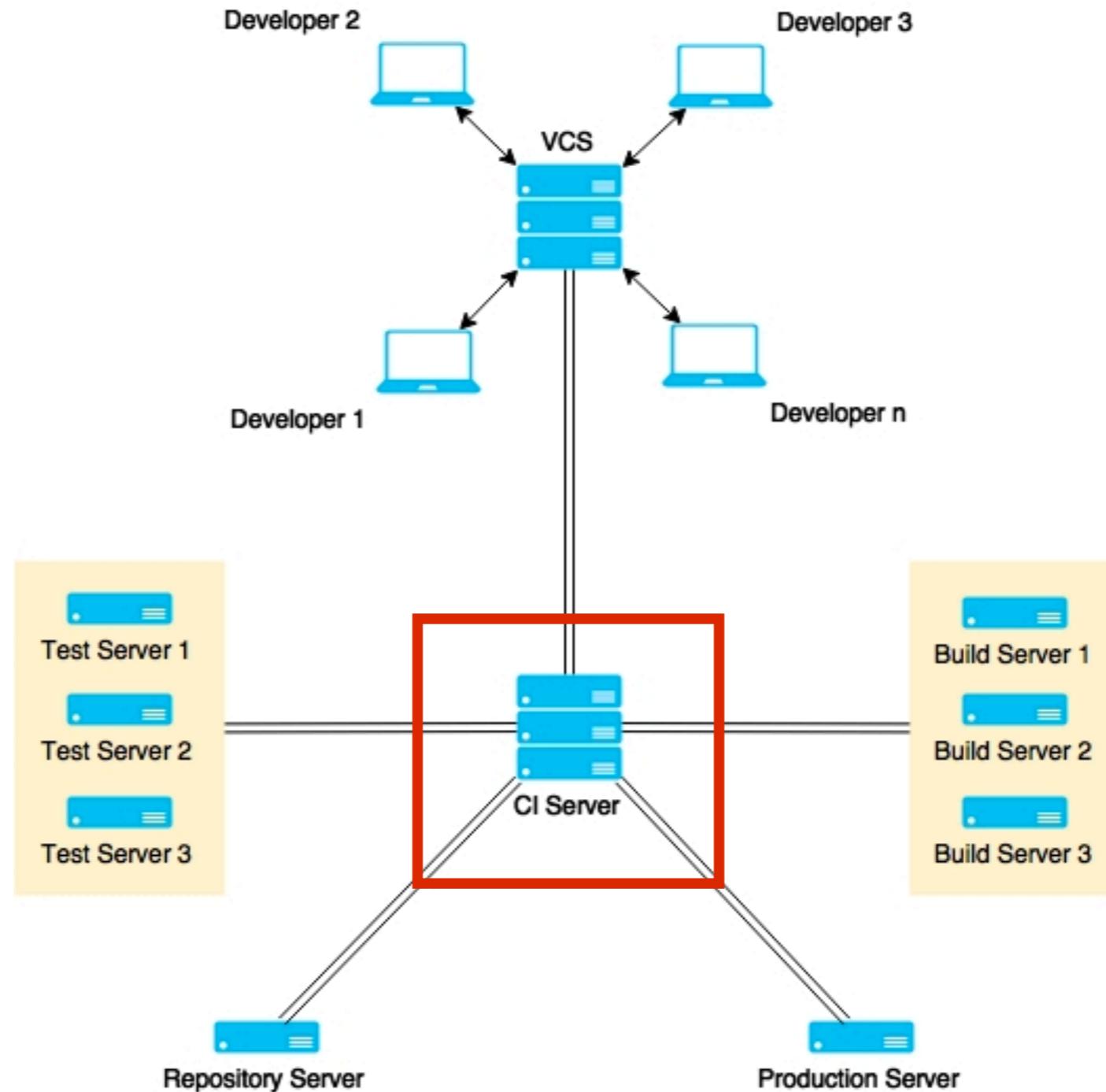


Suggestion

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



3. Use good CI tool





Jenkins

Bamboo



TeamCity

> goTM



Hudson



4. Use good build tool

- Javascript
 - Gulp, Grunt, Brocolli



- C#/.NET
 - Nant, MSBuild



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



sbt gradle



More ...

Use static code analysis
Automated testing
Automated deployment
People discipline/habit



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



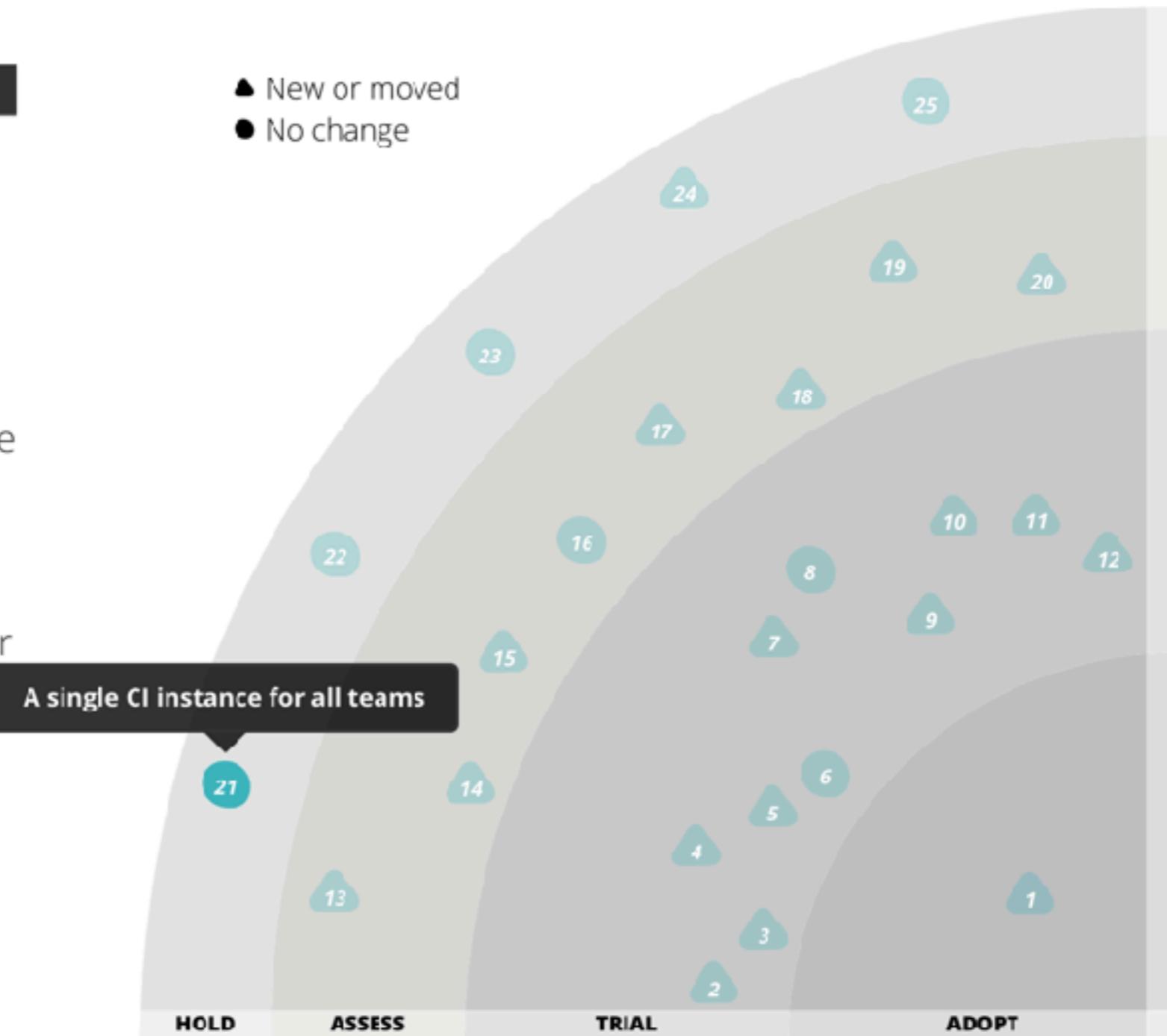
Anti-pattern for CI Server

● 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.

- ▲ New or moved
- No change



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



Let's start with CI/CD



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



Jenkins

<https://jenkins.io/>



Centralize Continuous Integration Server



Jenkins

<https://jenkins.io/>



Why Jenkins ?

Easy !!

Extensible

Scalable

Opensource

Large community

Lot of plugins



Who use Jenkins ?

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



Microsoft



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/>



Download Jenkins



The Jenkins website homepage. At the top is a dark navigation bar with links: Blog, Documentation, Plugins, Use-cases ▾, Participate, Sub-projects ▾, and Resources ▾. The main title "Jenkins" is in large, bold, black font. Below it is the tagline "Build great things at any scale". A descriptive paragraph follows: "The leading open source automation server, Jenkins provides hundreds of plugins to support building, deploying and automating any project." At the bottom right are two buttons: "Documentation" (white background) and "Download" (red background).

<https://jenkins.io/>



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



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
Engine v4.0 running: controlPort=disabled
jenkins.InitReactorRunner$1 onAttained
:ion
jenkins.InitReactorRunner$1 onAttained
jenkins.InitReactorRunner$1 onAttained
```



Change port of Jenkins

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



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



Copy password from console

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

Jenkins initial setup is required. An admin user has been created.

Please use the following password to proceed to installation:

a4b3a5231b8048419192d0c5afd3fce8

This may also be found at: /Users/somkiat/data/slide/ci-cd/swp/initialAdminPassword

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



Customize plugins

Getting Started



Customize Jenkins

Plugins extend Jenkins with additional features to support many different needs.

Install suggested plugins

Install plugins the Jenkins community finds most useful.

Select plugins to install

Select and install plugins most suitable for your needs.

Jenkins 2.46.3



DevOps

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Waiting

Getting Started

Getting Started

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

** - required dependency

Jenkins 2.46.3



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](#)



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](#)



Ready to use

Getting Started

Jenkins is ready!

Your Jenkins setup is complete.

[Start using Jenkins](#)

Jenkins 2.46.3



Welcome to Jenkins

Jenkins  somkiat | log out

ENABLE AUTO REFRESH

New Item  add description 

People 

Build History 

Manage Jenkins 

My Views 

Credentials 

Build Queue  -
No builds in the queue.

Build Executor Status  -
1 Idle
2 Idle

Please [create new jobs](#) to get started.

Page generated: Jun 14, 2017 2:08:57 PM ICT [REST API](#) [Jenkins ver. 2.46.3](#)



About Jenkins's HOME

Default of **JENKINS_HOME** is
`<path of user>/jenkins`



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
```



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



Change Jenkins's HOME

For Windows

```
set JENKINS_HOME=<your path>
```

For Linux/Mac

```
export JENKINS_HOME=<your path>
```

try to restart Jenkins ...



Disable Jenkins's security



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.security.LoggedInAuthorizationStrategy">
        <denyAnonymousReadAccess>true</denyAnonymousReadAccess>
    </authorizationStrategy>
```



Learn to use Jenkins in the right way



Manage Jenkins

For Administrator to config anything in Jenkins

Jenkins

New Item

People

Build History

Manage Jenkins

My views

Credentials

New View

Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

search

Manage Jenkins

- [Configure System](#)
Configure global settings and paths.
- [Configure Global Security](#)
Secure Jenkins; define who is allowed to access/use the system.
- [Configure Credentials](#)
Configure the credential providers and types
- [Global Tool Configuration](#)
Configure tools, their locations and automatic installers.
- [Reload Configuration from Disk](#)
Discard all the loaded data in memory and reload everything from file system. Useful when you modify configuration files.
- [Manage Plugins](#)
Add, remove, disable or enable plugins that can extend the functionality of Jenkins.
- [System Information](#)
Displays various environmental information to assist trouble-shooting.
- [System Log](#)
System log captures output from java.util.logging output related to Jenkins.
- [Load Statistics](#)
Check your resource utilization and see if you need more computers for your builds.



Configure System

Global setting and paths

Jenkins  

New Item 

People 

Build History 

Manage Jenkins 

My Views 

Credentials 

New View 

Build Queue 
No builds in the queue.

Build Executor Status 
1 Idle
2 Idle

Manage Jenkins

-  [Configure System](#)
Configure global settings and paths.
-  [Configure Global Security](#)
Secure Jenkins; define who is allowed to access/use the system.
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Displays various environmental information to assist trouble-shooting.
-  [System Log](#)
System log captures output from java.util.logging output related to Jenkins.
-  [Load Statistics](#)
Check your resource utilization and see if you need more computers for your builds.



Configure System

JENKINS Home

of executors

Label name of node

Environment variables

Email notification



Configure Global Security

Setting for secure Jenkins

The screenshot shows the Jenkins Manage Jenkins interface. On the left, there's a sidebar with links like 'New Item', 'People', 'Build History', 'Manage Jenkins', 'My Views', 'Credentials', and 'New View'. Below that are two sections: 'Build Queue' (empty) and 'Build Executor Status' (2 Idle). The main area is titled 'Manage Jenkins' and contains several configuration options: 'Configure System' (purple gear icon), 'Configure Global Security' (yellow padlock icon, highlighted with a red box), 'Configure Credentials' (key icon), 'Global Tool Configuration' (wrench icon), 'Reload Configuration from Disk' (refresh icon), 'Manage Plugins' (green puzzle piece icon), 'System Information' (monitor icon), 'System Log' (clipboard icon), and 'Load Statistics' (blue graph icon). The 'Configure Global Security' link is described as 'Secure Jenkins: define who is allowed to access/use the system.'

Manage Jenkins

- [Configure System](#)
Configure global settings and paths.
- Configure Global Security**
Secure Jenkins: define who is allowed to access/use the system.
- [Configure Credentials](#)
Configure the credential providers and types
- [Global Tool Configuration](#)
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Add, remove, disable or enable plugins that can extend the functionality of Jenkins.
- [System Information](#)
Displays various environmental information to assist trouble-shooting.
- [System Log](#)
System log captures output from `java.util.logging` related to Jenkins.
- [Load Statistics](#)
Check your resource utilization and see if you need more computers for your builds.



Global Tool Configuration

Config tools, location and automatic installers

The screenshot shows the Jenkins Manage Jenkins interface. On the left, there's a sidebar with links like New Item, People, Build History, Manage Jenkins (which is selected), My Views, Credentials, and New View. Below that are sections for Build Queue (empty) and Build Executor Status (2 Idle). The main area is titled "Manage Jenkins" and lists several configuration options: Configure System, Configure Global Security, Configure Credentials, Global Tool Configuration (which is highlighted with a red box), Reload Configuration from Disk, Manage Plugins, System Information, System Log, and Load Statistics.

Link	Description
Configure System	Configure global settings and paths.
Configure Global Security	Secure Jenkins; define who is allowed to access/use the system.
Configure Credentials	Configure the credential providers and types
Global Tool Configuration	Configure tools, their locations and automatic installers.
Reload Configuration from Disk	Discard all the loaded data in memory and reload everything from file system. Useful when you modify configuration files.
Manage Plugins	Add, remove, disable or enable plugins that can extend the functionality of Jenkins.
System Information	Displays various environmental information to assist trouble-shooting.
System Log	System log captures output from <code>java.util.logging</code> related to Jenkins.
Load Statistics	Check your resource utilization and see if you need more computers for your builds.



Global Tool Configuration

Apache Maven
JDK (Java Development Kit)
Git
Gradle
Docker



Manage Plugins

Add, remove, enable/disable plugins

The screenshot shows the Jenkins Manage Jenkins interface. On the left, there's a sidebar with links like New Item, People, Build History, Manage Jenkins (which is selected and highlighted in blue), My Views, Credentials, and New View. Below that are sections for Build Queue (empty) and Build Executor Status (2 Idle). The main content area is titled "Manage Jenkins" and lists several configuration options: Configure System, Configure Global Security, Configure Credentials, Global Tool Configuration, Reload Configuration from Disk, Manage Plugins (which is highlighted with a red box), System Information, System Log, and Load Statistics.

Manage Jenkins

- [Configure System](#)
Configure global settings and paths.
- [Configure Global Security](#)
Secure Jenkins: define who is allowed to access/use the system.
- [Configure Credentials](#)
Configure the credential providers and types
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- [Manage Plugins](#)
Add, remove, disable or enable plugins that can extend the functionality of Jenkins.
- [System Information](#)
Displays various environmental information to assist trouble-shooting.
- [System Log](#)
System log captures output from `java.util.logging` related to Jenkins.
- [Load Statistics](#)
Check your resource utilization and see if you need more computers for your builds.



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.



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.



Finds Jenkins's plugin

Plugins Index

Discover the 1000+ community contributed Jenkins plugins to support building, deploying and automating any project.

Browse ▶ Find plugins...

<https://plugins.jenkins.io/>



Try to install a first plugin

Choose Available tab and select a plugin

The screenshot shows a plugin management interface with a top navigation bar featuring tabs: Updates, Available (highlighted with a red box), Installed, and Advanced. Below the navigation is a search bar labeled 'Filter:' with a magnifying glass icon. The main content area displays a table of available plugins under the heading '.NET Development'. The table has columns for Name and Version. Plugins listed include CCM Plug-in, FxCop Runner plugin, MSBuild Plugin, MSTest plugin, MSTestRunner plugin, NAnt Plugin, NCover.plugin, PowerShell plugin, Violation Comments to Bitbucket Server Plugin, and Violations plugin. Each plugin entry includes a checkbox and a brief description. At the bottom of the page, a red box highlights the bottom navigation bar which contains three buttons: 'Install without restart', 'Download now and install after restart' (highlighted with a red box), and 'Check now'. A status message 'Update information obtained: 9 hr 37 min ago' is also visible.

Name	Version
CCM Plug-in	3.1
FxCop Runner plugin	1.1
MSBuild Plugin	1.27
MSTest plugin	0.19
Generates test reports for MSTest.	
MSTestRunner plugin	1.3.0
NAnt Plugin	1.4.3
NCover.plugin	0.3
PowerShell plugin	1.3
Violation Comments to Bitbucket Server Plugin	1.50
Finds violations reported by code analyzers and comments Bitbucket Server (or Stash) pull requests (or commits) with them.	
Violations plugin	0.7.11

Install without restart Download now and install after restart Check now

Update information obtained: 9 hr 37 min ago



Manage Nodes

Add, remove, status of nodes

Jenkins

Jenkins > Nodes >

ENABLE AUTO REFRESH

Back to Dashboard

Manage Jenkins

New Node

Configure

Build Queue

No builds in the queue.

Build Executor Status

1 Idle

2 Idle

search

S Name ↓ Architecture Clock Difference Free Disk Space Free Swap Space Free Temp Space Response Time

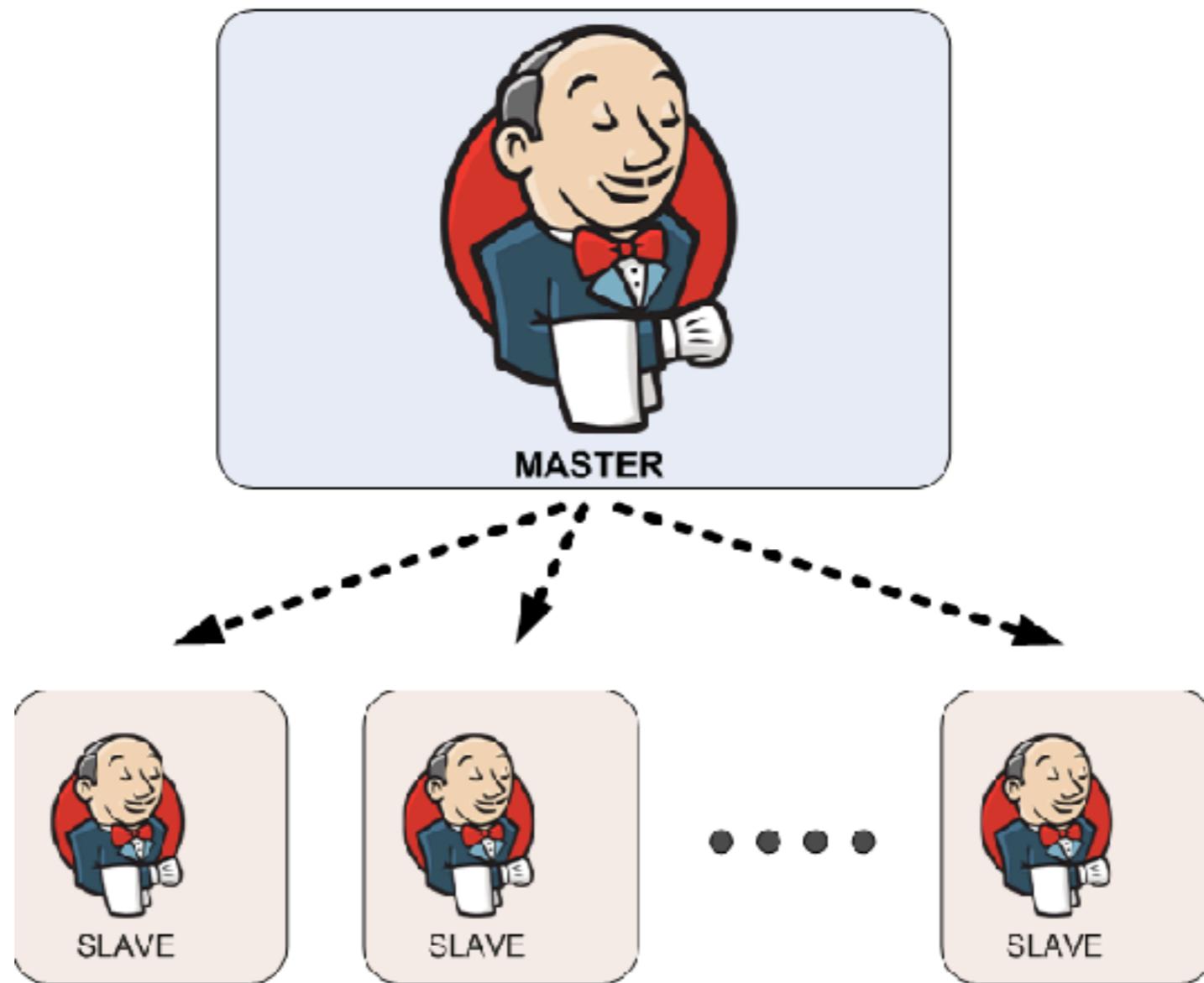
S	Name ↓	Architecture	Clock Difference	Free Disk Space	Free Swap Space	Free Temp Space	Response Time
	master	Mac OS X (x86_64)	In sync	5.73 GB	463.00 MB	5.73 GB	0ms
	Data obtained	36 min	36 min	36 min	36 min	36 min	36 min

Refresh status



Manage Nodes

Master-slave concept to scale Jenkins



Create a first Job



1. Create a new job

The screenshot shows the Jenkins dashboard. At the top left is the Jenkins logo. Below it is a navigation bar with the word "Jenkins" and a dropdown arrow. The main content area has a "Welcome to Jenkins!" message in large bold letters. Below it is a teal box containing the text "Please create new jobs to get started." A red box highlights the "New Item" button in the sidebar, which has a icon of a briefcase with a dollar sign. Other sidebar items include "People", "Build History", "Manage Jenkins", "My Views", and "Credentials". A "Build Queue" section at the bottom shows "No builds in the queue.".



2. Fill in a job name

Enter an item name

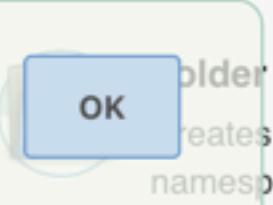
» Required field

 **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.

 **Folder**
Creates 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.



3. Choose type of job

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

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External Job

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Creates 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.



3. Choose type of job

Enter an item name

hello

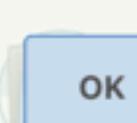
» Required field

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Folder
 creates 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.



4. General section

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

Project name: hello

Description:

[Plain text] [Preview](#)

Discard old builds ?
 GitHub project ?
 This project is parameterized ?
 Throttle builds ?
 Disable this project ?
 Execute concurrent builds if necessary ?

[Advanced...](#)

Source Code Management

Save Apply

None



4.1 Advanced options

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

Project name: hello

Description:

[Plain text] [Preview](#)

Discard old builds [?](#)

GitHub project [?](#)

This project is parameterized [?](#)

Throttle builds [?](#)

Disable this project [?](#)

Execute concurrent builds if necessary [?](#)

[Advanced...](#)

Source Code Management

Save Apply

None



4.1 Advanced options

The screenshot shows the 'General' tab selected in a Jenkins build configuration. The tab bar also includes 'Source Code Management', 'Build Triggers', and 'Build Environment'. The 'General' tab contains the following configuration:

- Quiet period
- Retry Count
- Block build when upstream project is building
- Block build when downstream project is building
- Use custom workspace

Below these options is a 'Display Name' field with an empty input box. At the bottom of the section is another checkbox:

- Keep the build logs of dependencies



5. Source code management

By default is Git and Subversion

The screenshot shows a software interface for managing build configurations. At the top, there is a navigation bar with tabs: General, Source Code Management (which is currently selected), Build Triggers, Build Environment, Build, and Post-build Actions. The 'Source Code Management' tab is highlighted with a thicker border.

Source Code Management

Under the 'Source Code Management' tab, there is a list of options:

- None
- Git
- Subversion

Build Triggers

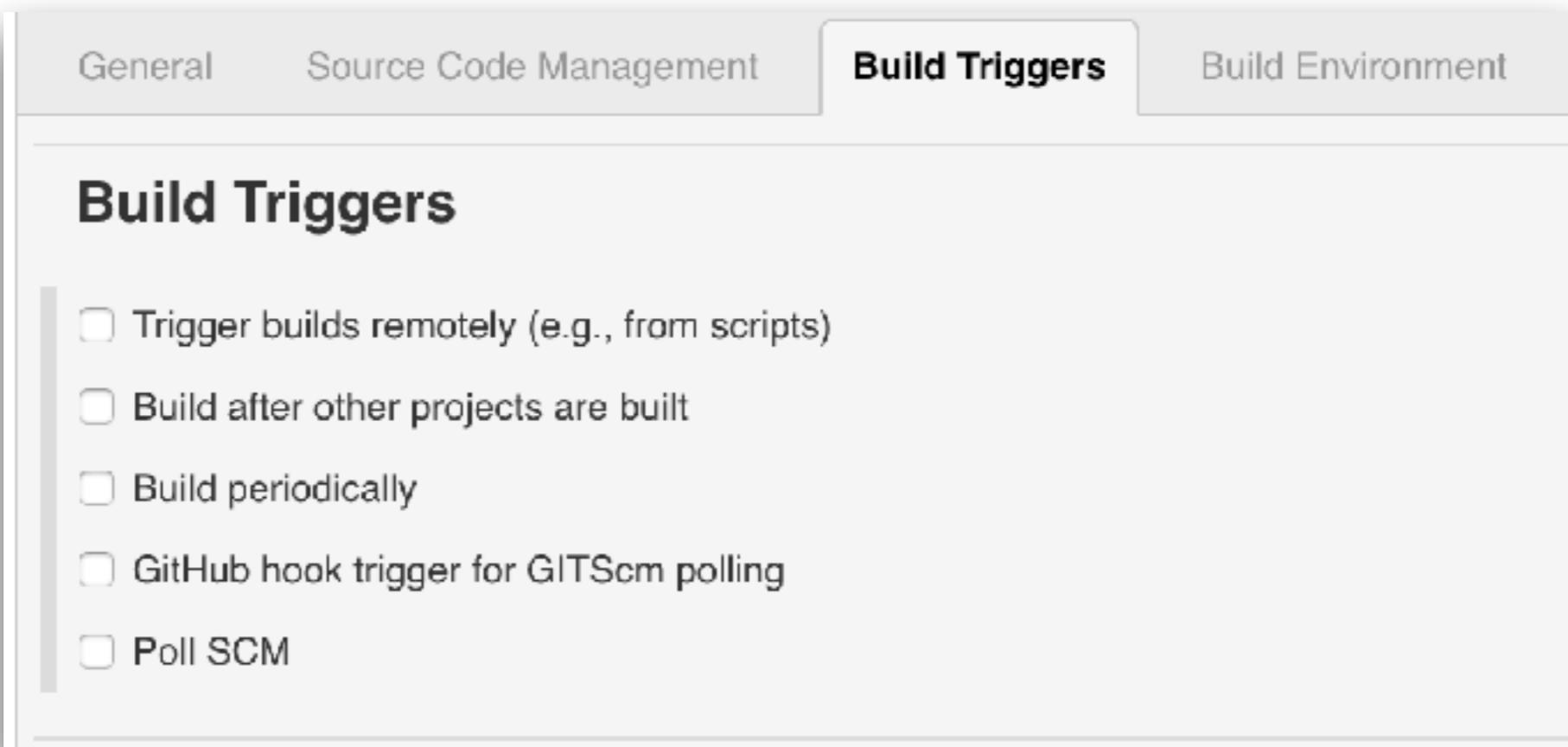
Under the 'Build Triggers' tab, there is a list of trigger types:

- Trigger builds remotely (e.g., from scripts)
- Build after other projects are built
- Build periodically
- GitHub hook trigger for GITScm polling
- Poll SCM



6. Build trigger

When to run this job



The screenshot shows a software interface for managing build triggers. At the top, there are four tabs: 'General', 'Source Code Management', 'Build Triggers', and 'Build Environment'. The 'Build Triggers' tab is currently active, indicated by a dark background and bold text. Below the tabs, the title 'Build Triggers' is displayed in a large, bold font. To the left of the main content area, there is a vertical gray sidebar. The main content area contains a list of five options, each preceded by an empty checkbox:

- Trigger builds remotely (e.g., from scripts)
- Build after other projects are built
- Build periodically
- GitHub hook trigger for GITScm polling
- Poll SCM



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 ?
 Build periodically ?

Schedule ?

H 23 * * *

⚠ **No schedules so will never run**

GitHub hook trigger for GITScm polling ?
 Poll SCM ?



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



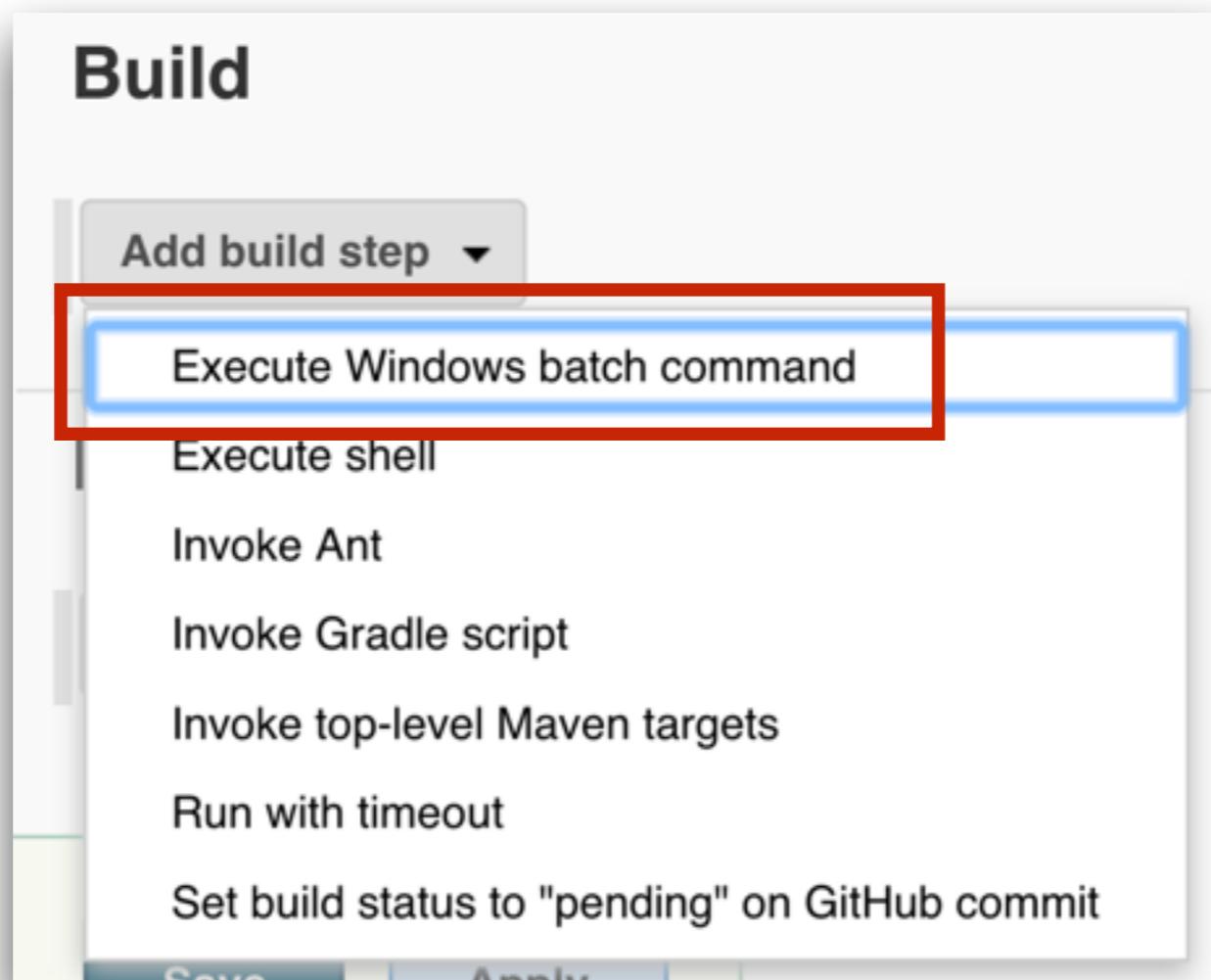
7. Add build step

What to run this job

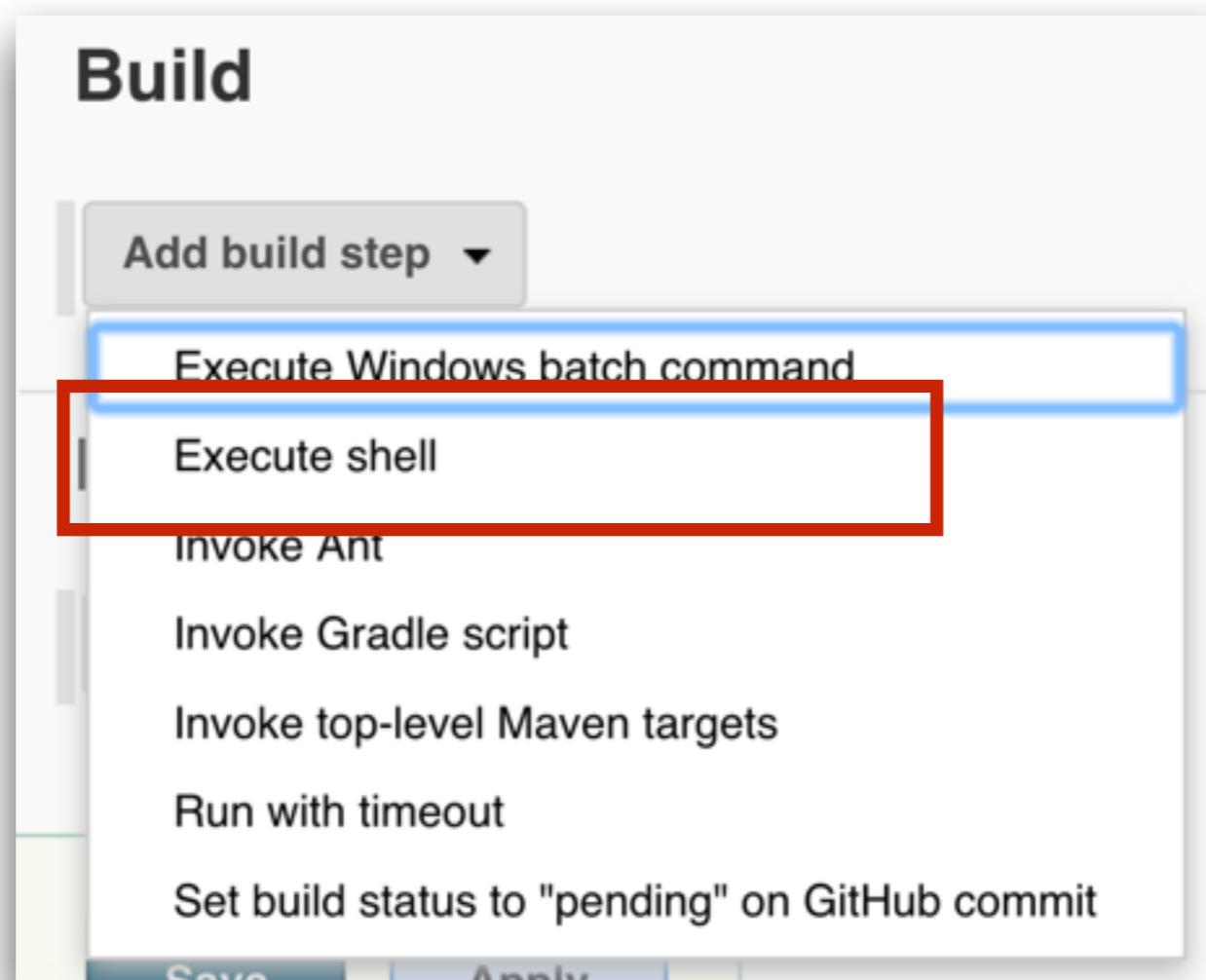
The screenshot shows a Jenkins job configuration interface. The top navigation bar includes tabs for General, Source Code Management, Build Triggers, Build Environment, **Build**, and Post-build Actions. The **Build** tab is active. Below the tabs is a section titled **BUILD ENVIRONMENT** containing four checkboxes: Delete workspace before build starts, Abort the build if it's stuck, Add timestamps to the Console Output, and Use secret text(s) or file(s). Under the **Build** tab, there is a sub-section with a dropdown menu labeled "Add build step". The menu lists several options: Execute Windows batch command (which is highlighted with a blue border), Execute shell, Invoke Ant, Invoke Gradle script, Invoke top-level Maven targets, Run with timeout, and Set build status to "pending" on GitHub commit. At the bottom of the "Add build step" panel are two buttons: "Save" and "Apply".



7.1 For Windows



7.2 For Linux/Mac



8. Post build actions

Generate reports

Send email

Run other jobs/projects



8. Post build actions

The screenshot shows the 'Post-build Actions' tab selected in a Jenkins configuration interface. A dropdown menu is open, listing various actions:

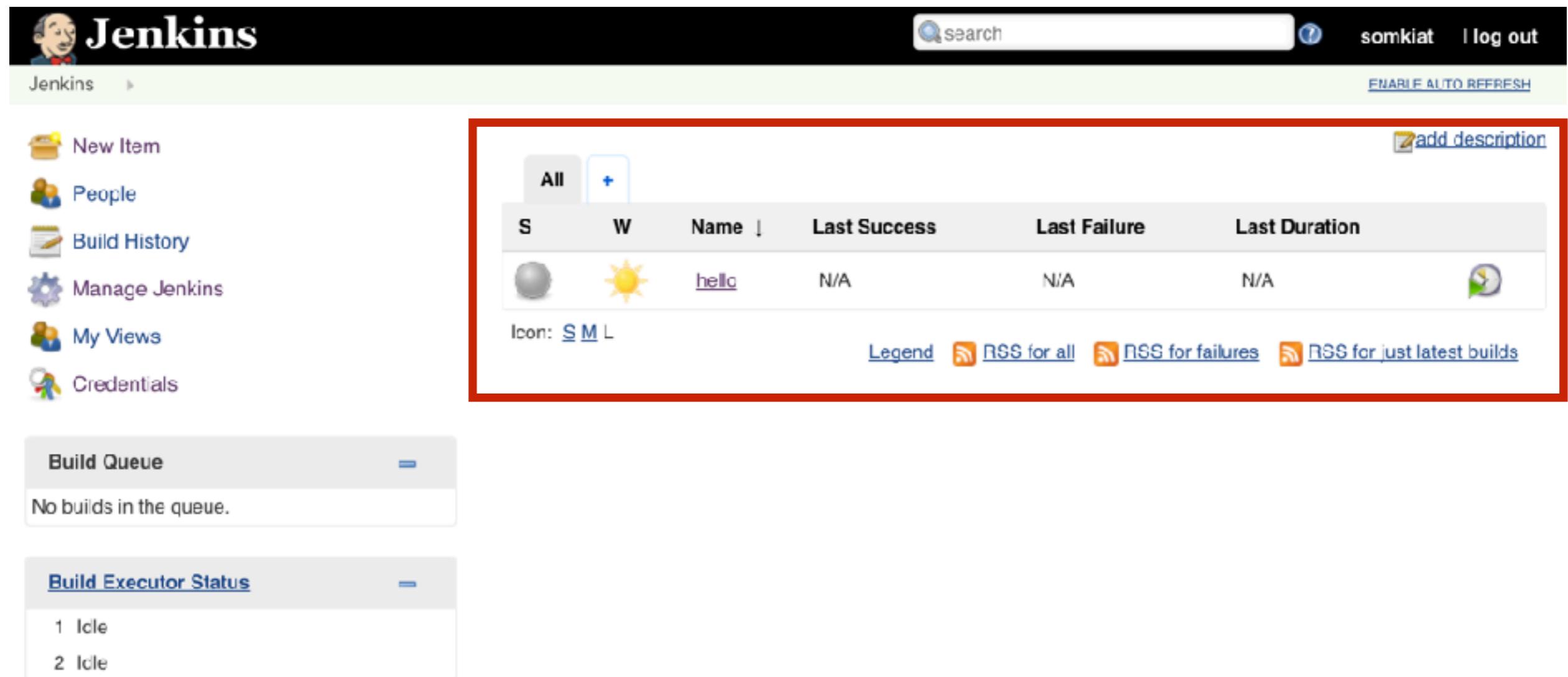
- Aggregate downstream test results
- Archive the artifacts
- Build other projects
- Publish JUnit test result report
- Record fingerprints of files to track usage
- Git Publisher
- E-mail Notification** (highlighted with a blue background)
- Editable Email Notification
- Set GitHub commit status (universal)
- Set build status on GitHub commit [deprecated]
- Delete workspace when build is done

Below the dropdown is a button labeled "Add post-build action ▾". At the bottom right of the main panel are "Save" and "Apply" buttons.



9. Run your job

Manual and Scheduler run



The screenshot shows the Jenkins dashboard with a red box highlighting the main job list area. The job 'hello' is listed with a yellow sun icon, indicating it is successful. The dashboard also includes sections for Build Queue and Build Executor Status.

S	W	Name	Last Success	Last Failure	Last Duration
		hello	N/A	N/A	

Icon: [S](#) [M](#) [L](#)

Legend: [RSS for all](#) [RSS for failures](#) [RSS for just latest builds](#)

Build Queue
No builds in the queue.

Build Executor Status
1 Idle
2 Idle



9. Run your job

Start build your job

The screenshot shows the Jenkins dashboard with the following details:

- Left sidebar:** Includes links for New Item, People, Build History, Manage Jenkins, My Views, and Credentials.
- Top navigation bar:** Features a search bar, user information for somkiat, and log out options.
- Job Overview:** A table displays a single job entry:
 - Name:** hello
 - Last Success:** N/A
 - Last Failure:** N/A
 - Last Duration:** N/A
- Icon Legend:** Shows S (Grey), M (Yellow), and L (Green) with the text "Icon: S M L".
- RSS Feeds:** Options for RSS feeds: RSS for all, RSS for failures, and RSS for just latest builds.
- Build Queue:** A section stating "No builds in the queue."
- Build Executor Status:** A section showing 1 Idle and 2 Idle executors.



9. Run your job

Start build your job

The screenshot shows the Jenkins interface for a project named "hello". The top navigation bar shows "Jenkins" and "hello". The main content area has a title "Project hello". On the left, there is a sidebar with several options: "Back to Dashboard", "Status", "Changes", "Workspace", "Build Now", "Delete Project", and "Configure". The "Build Now" button is highlighted with a red box. To the right, there are two links: "Workspace" and "Recent Changes".

Jenkins ➤ hello ➤

Project hello

Back to Dashboard

Status

Changes

Workspace

Build Now

Delete Project

Configure

Workspace

Recent Changes



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

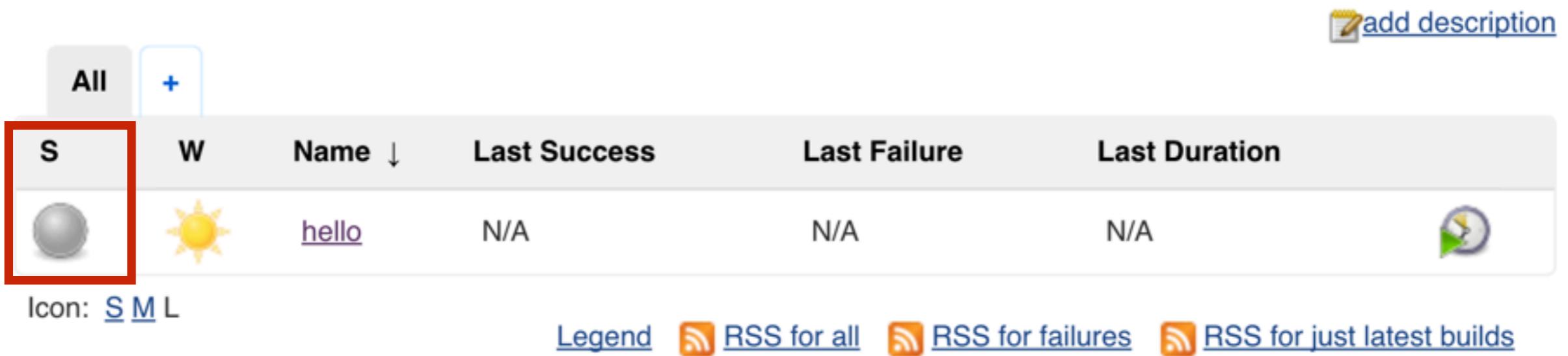
Console Output

Started by user [Somkiat Puisungnoen](#)
Building in workspace /Users/somkiat/Downloads/set/workspace/hello
Finished: SUCCESS



10. See job's status

By default is **Blue**, **Red** and **Gray**



The screenshot shows a Jenkins dashboard with a single job listed:

S	W	Name ↓	Last Success	Last Failure	Last Duration
		hello	N/A	N/A	

Icon: [S](#) [M](#) [L](#)

Legend:  [RSS for all](#)  [RSS for failures](#)  [RSS for just latest builds](#)

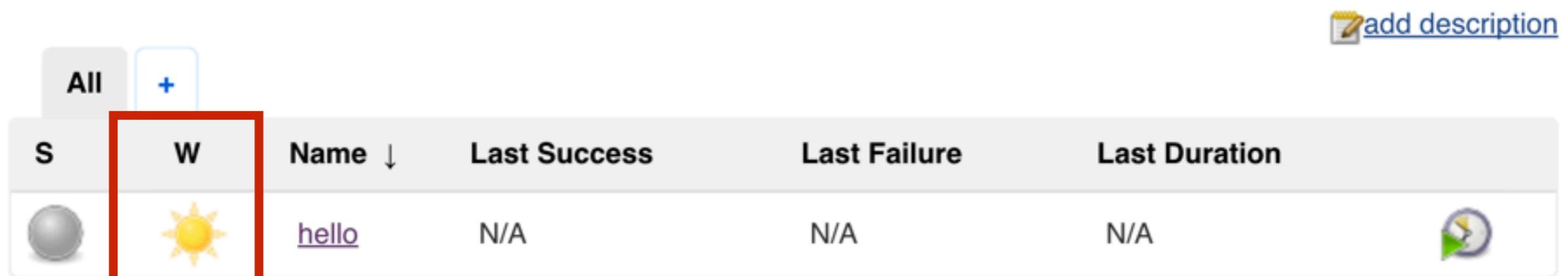
Blue = build success

Red = build failure

Gray = disabled/never executed



11. See job's health



A screenshot of a Jenkins job health dashboard. At the top, there are buttons for 'All' and '+'. To the right is a blue 'add description' button with a pencil icon. Below this is a table with columns: 'Name' (sorted by success), 'Last Success', 'Last Failure', and 'Last Duration'. The first row shows a job named 'hello' with a status of 'W' (Warning). The 'Last Success' column shows 'N/A', 'Last Failure' shows 'N/A', and 'Last Duration' shows 'N/A'. The job icon is a sun, which is highlighted with a red box. Below the table, there are links for 'Icon: S M L' and three RSS feed links: 'RSS for all', 'RSS for failures', and 'RSS for just latest builds'. The 'RSS for all' link has an orange icon, while the others have grey icons.

S	W	Name ↓	Last Success	Last Failure	Last Duration
		hello	N/A	N/A	N/A

Icon: [S](#) [M](#) [L](#)

[Legend](#) [RSS for all](#) [RSS for failures](#) [RSS for just latest builds](#)

Sunny = 100% success rate

Cloudy = 60% success rate

Raining = 40% success rate



Let's workshop



Jenkins driven by Plugins !!



Working with Pipeline as a Code



Pipeline as a Code

Declarative Pipeline

Scripted Pipeline

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



Create a new job with pipeline

Enter an item name
project01 » Required field

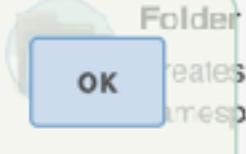
Freestyle project
 This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Maven project
 Build a maven project. Jenkins takes advantage of your POM files and drastically reduces the configuration.

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.

Folder
 Creates 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.



Write your pipeline

Pipeline script or from .Jenkinsfile

Pipeline

Definition

- Pipeline script
- Pipeline script from SCM

Script 1 try sample Pipeline... ?

Use Groovy Sandbox ?

[Pipeline Syntax](#)



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

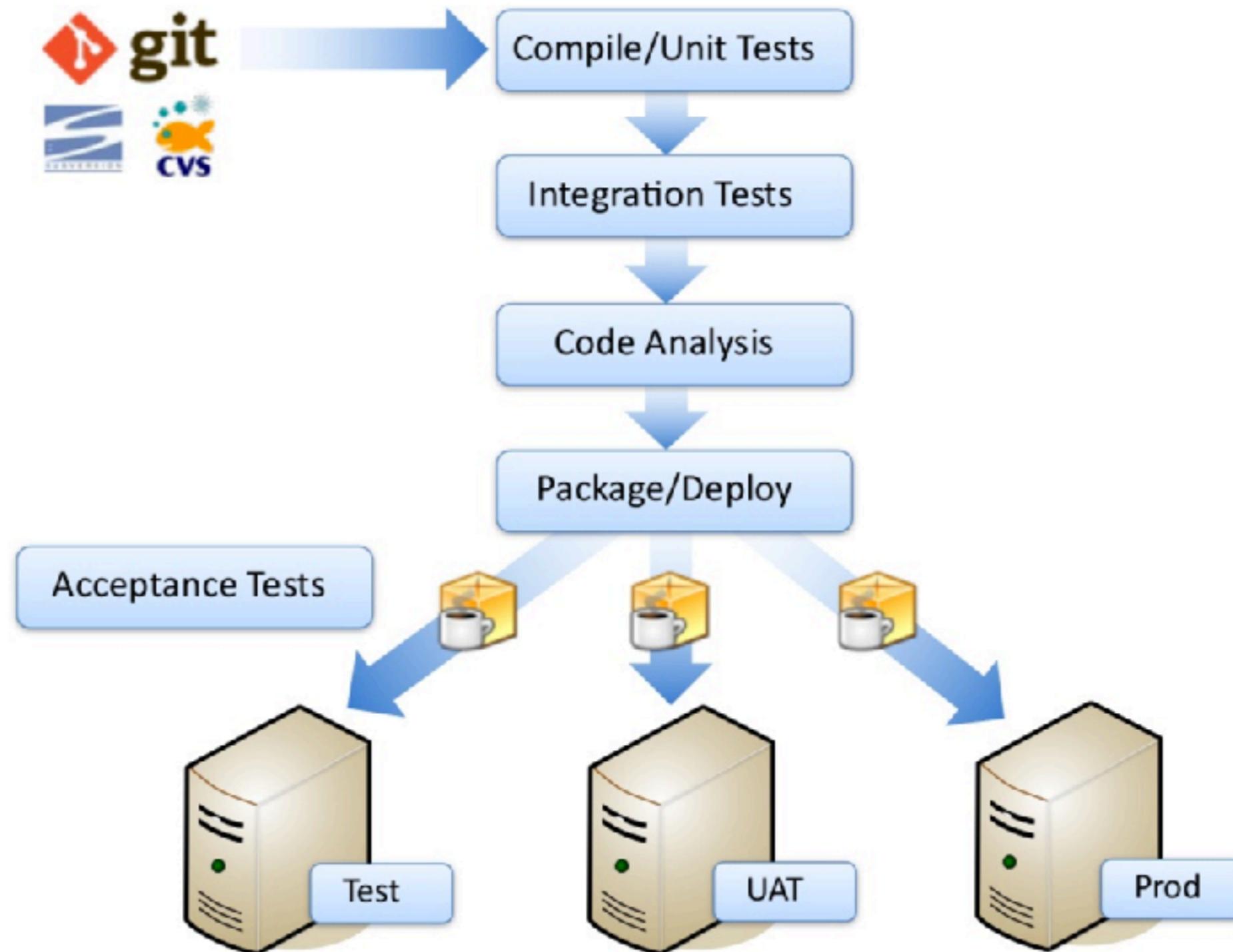
Files to archive

Advanced...

Generate Pipeline Script



Build pipeline

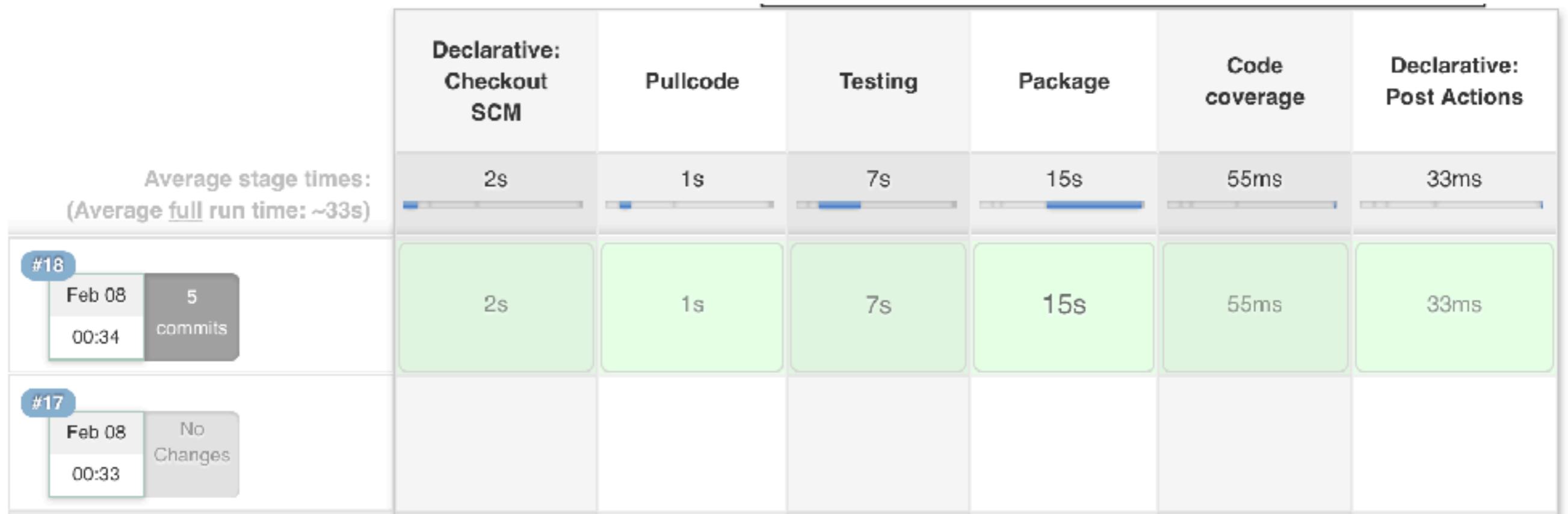


Create pipeline as code

```
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  
    }  
}
```



Result



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'  
            }  
        }  
    }  
}
```



Jenkinsfile

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



Jenkins Best Practices

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



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>



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)

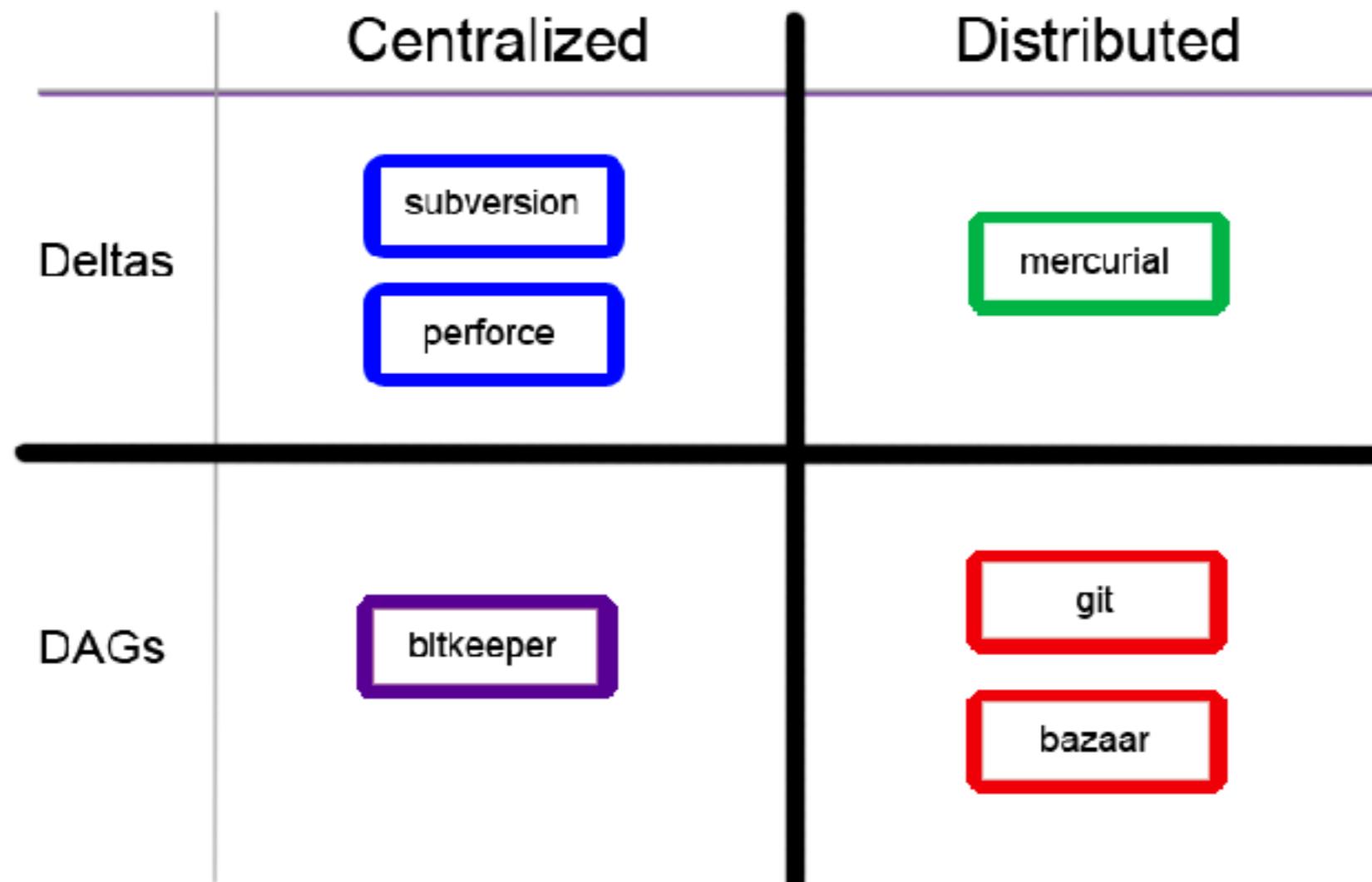
Fail fast



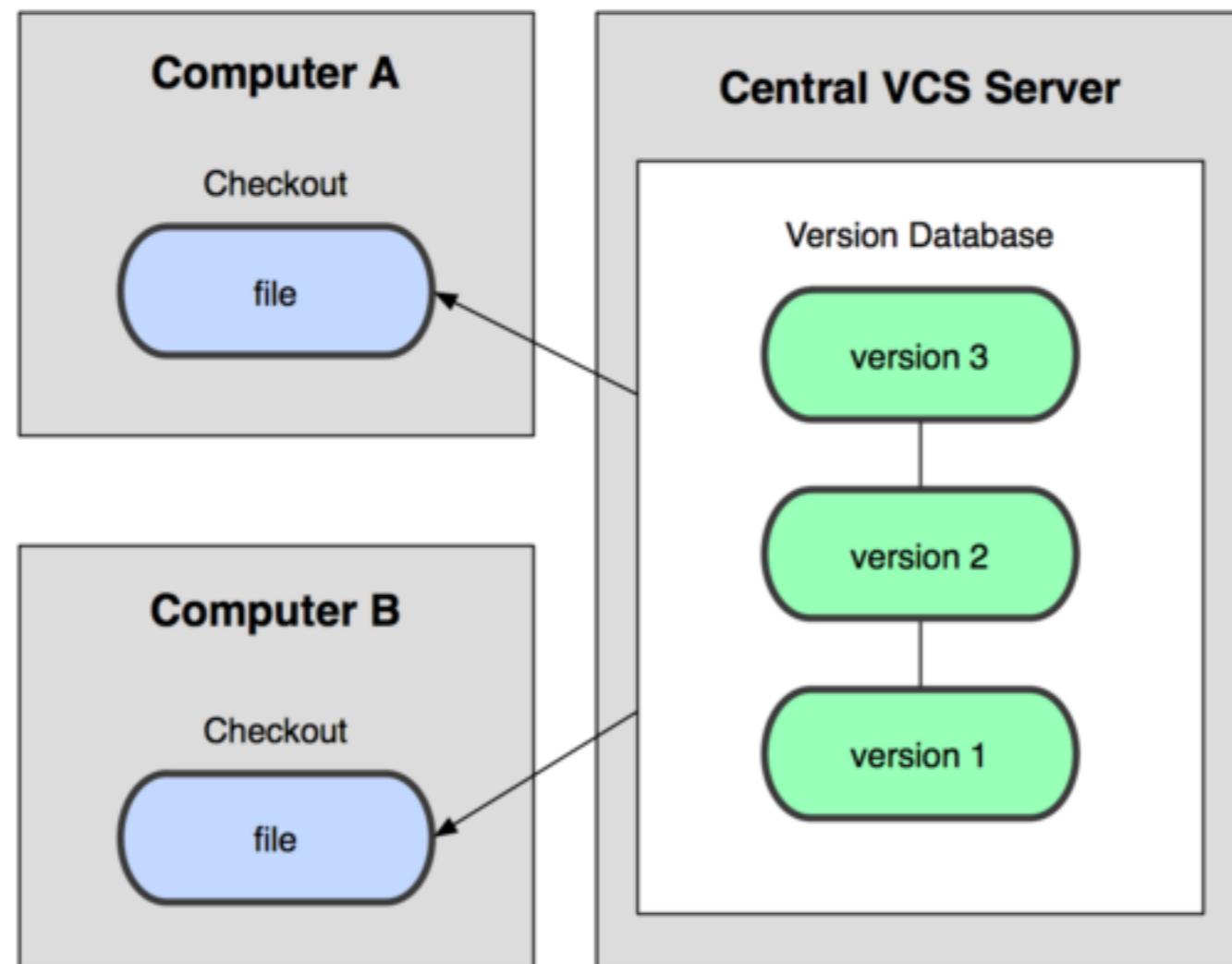
Version Control System



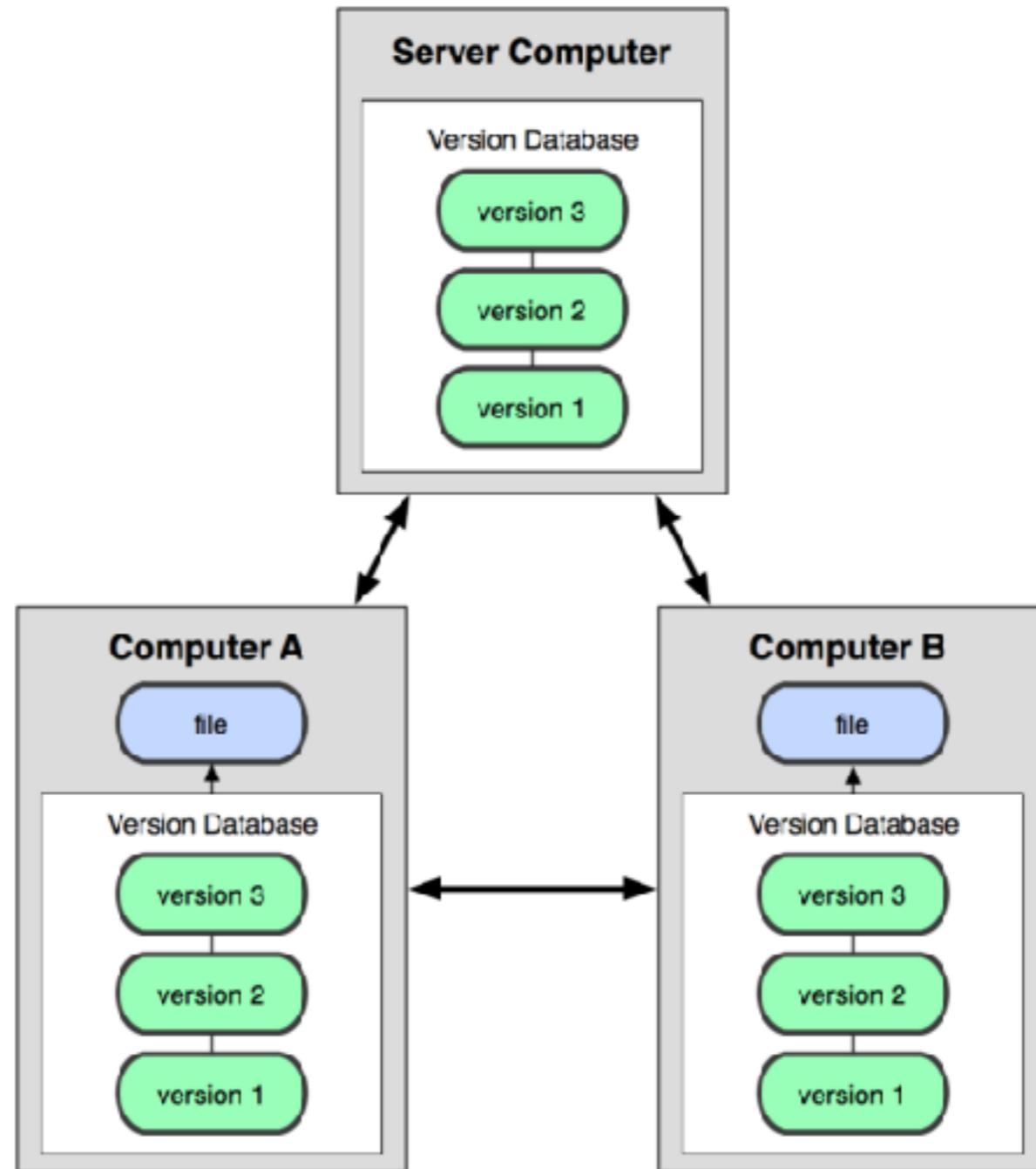
Version Control System



Centralize



Decentralize



Goals of Git

Speed

Simple

Support many parallel branches

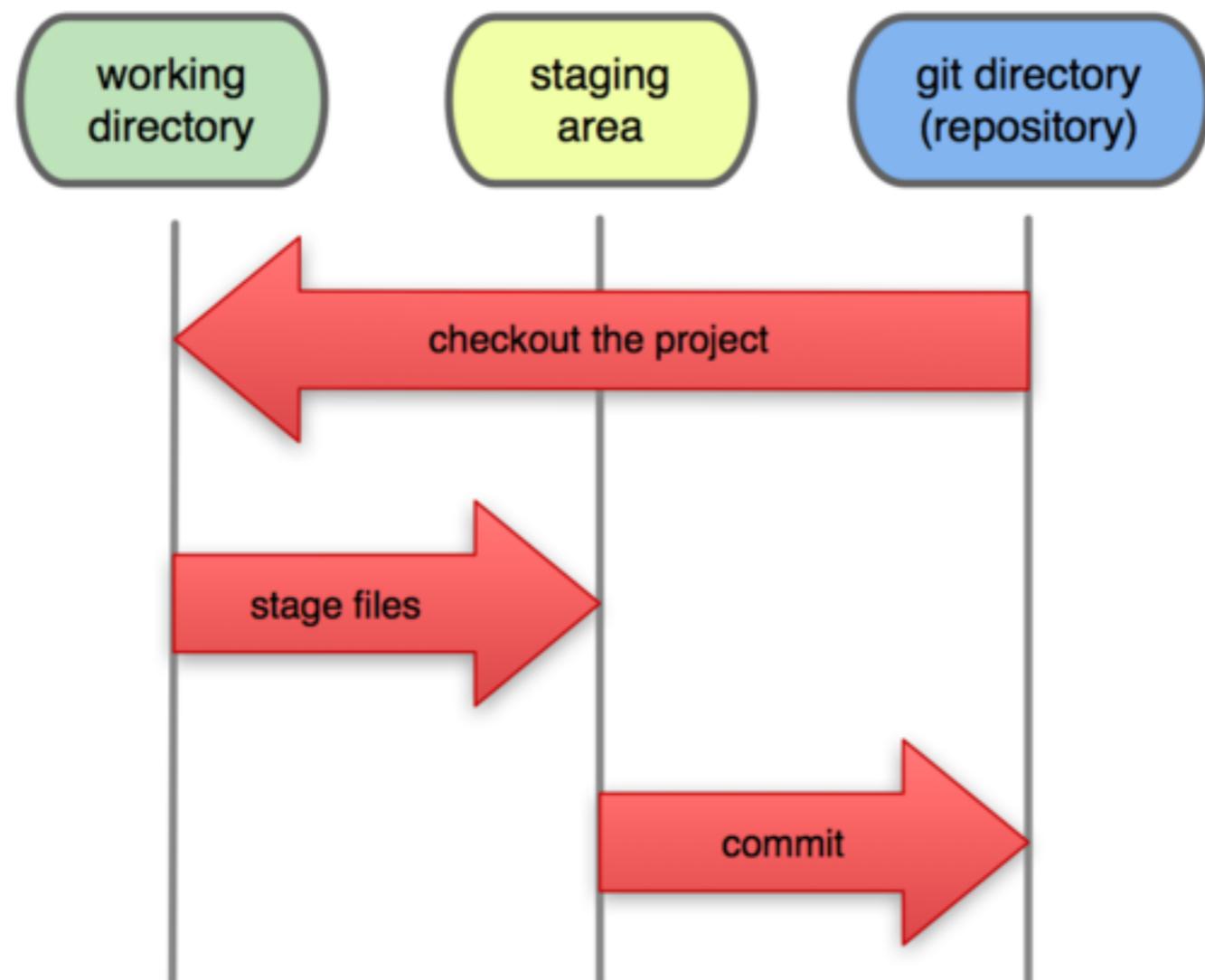
Fully distributed

Handle large project



Git Workflow

Local Operations



Installation

The screenshot shows the official Git website (<https://git-scm.com/>). At the top, the Git logo and tagline "git --everything-is-local" are displayed. A search bar is located in the top right. Below the header, a brief introduction states: "Git is a **free and open source** distributed version control system designed to handle everything from small to very large projects with speed and efficiency." To the right of this text is a diagram illustrating Git's distributed nature, showing multiple repositories connected by red lines on a grid background. Below the introduction, there are five main navigation links: "About" (with a gear icon), "Documentation" (with a book icon), "Downloads" (with a download arrow icon), "Community" (with a speech bubble icon), and a large "Latest source Release" section featuring the version "2.30.0" and a "Download 2.27.0 for Mac" button.

git --everything-is-local

Search entire site...

Git is a **free and open source** distributed version control system designed to handle everything from small to very large projects with speed and efficiency.

Git is **easy to learn** and has a **tiny footprint with lightning fast performance**. It outclasses SCM tools like Subversion, CVS, Perforce, and ClearCase with features like **cheap local branching**, convenient **staging areas**, and **multiple workflows**.

About
The advantages of Git compared to other source control systems.

Documentation
Command reference pages, Pro Git book content, videos and other material.

Downloads
GUI clients and binary releases for all major platforms.

Community
Get involved! Bug reporting, mailing list, chat, development and more.

Latest source Release
2.30.0
Release Notes (2020-12-27)
Download 2.27.0 for Mac

<https://git-scm.com/>

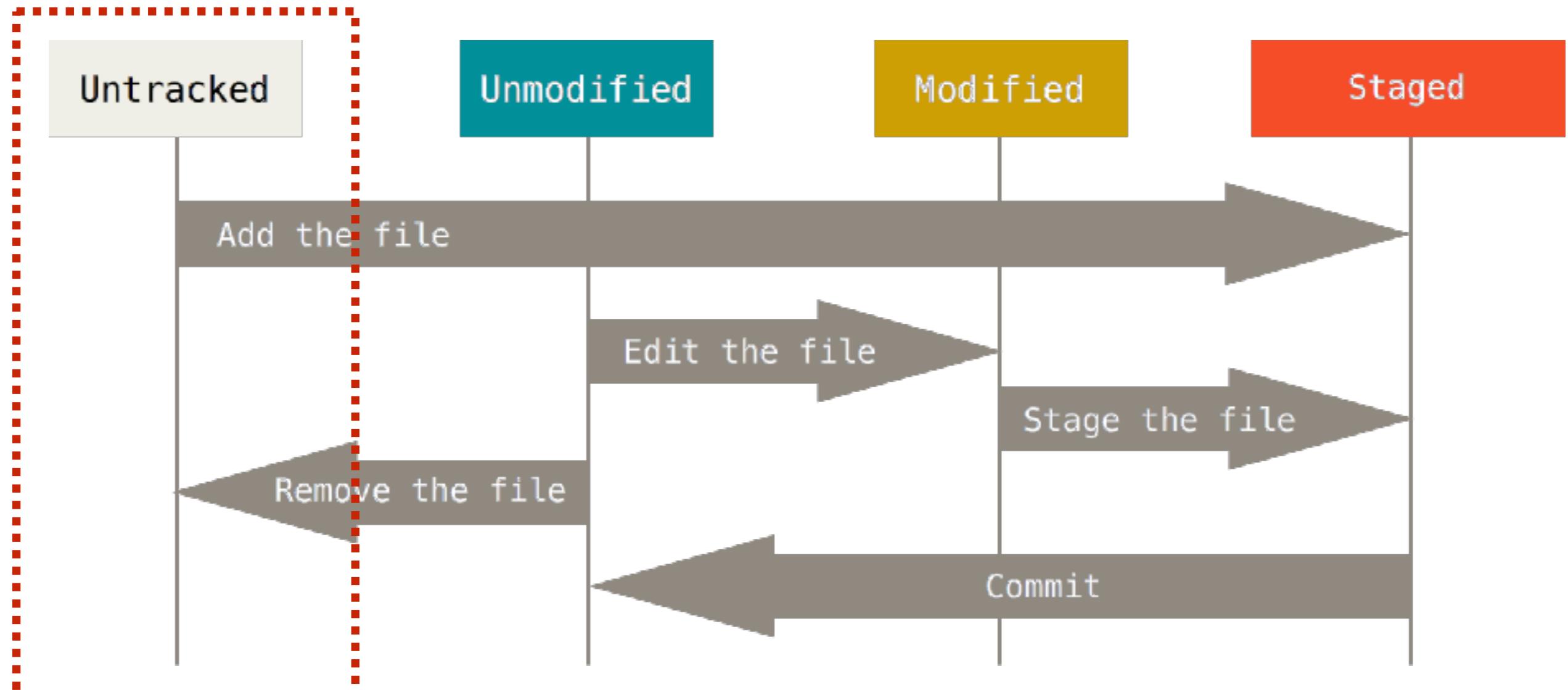


Life cycle of file status



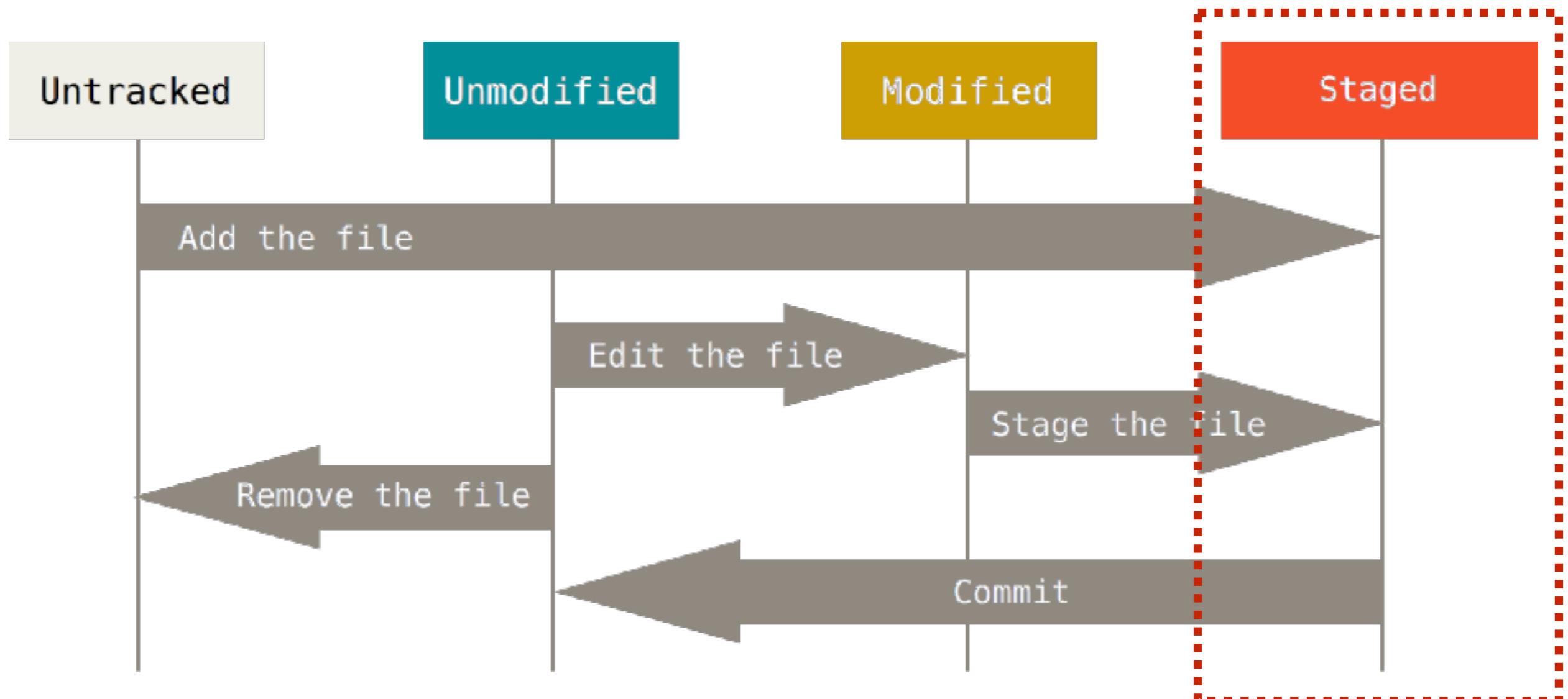
Create new file

\$touch *README*



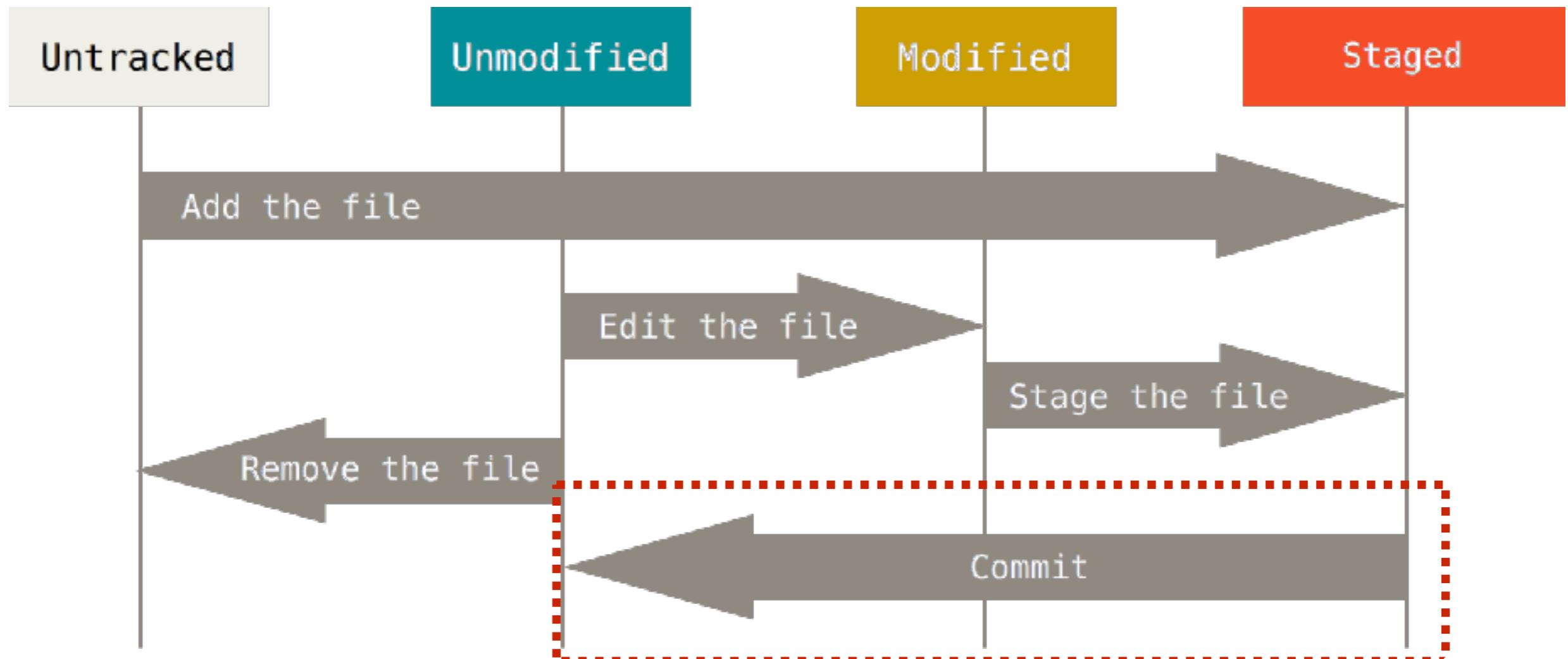
Add file to staged

\$git add *README*



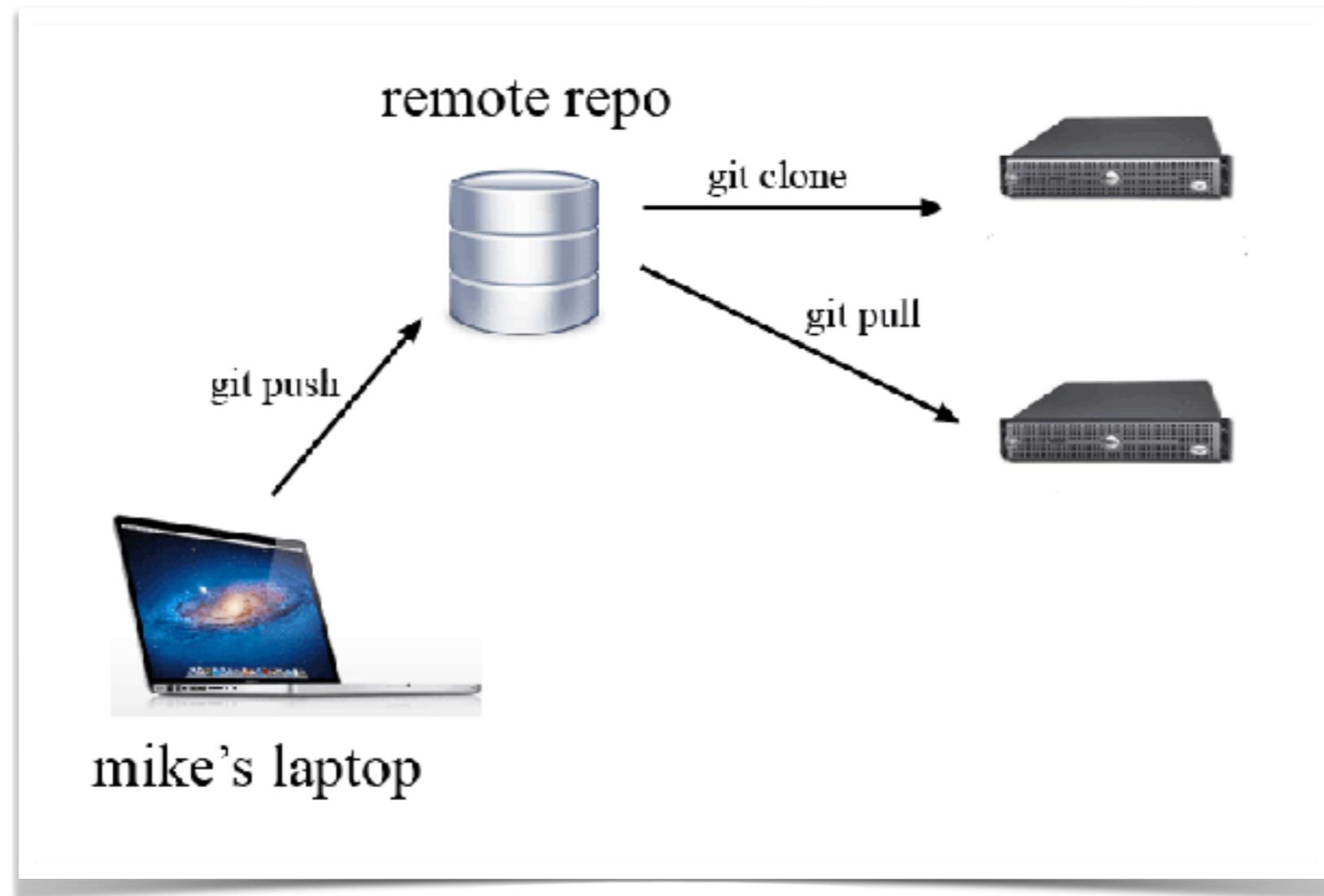
Commit your changes ...

`$git commit -m “your message”`



Push local's changes to remote

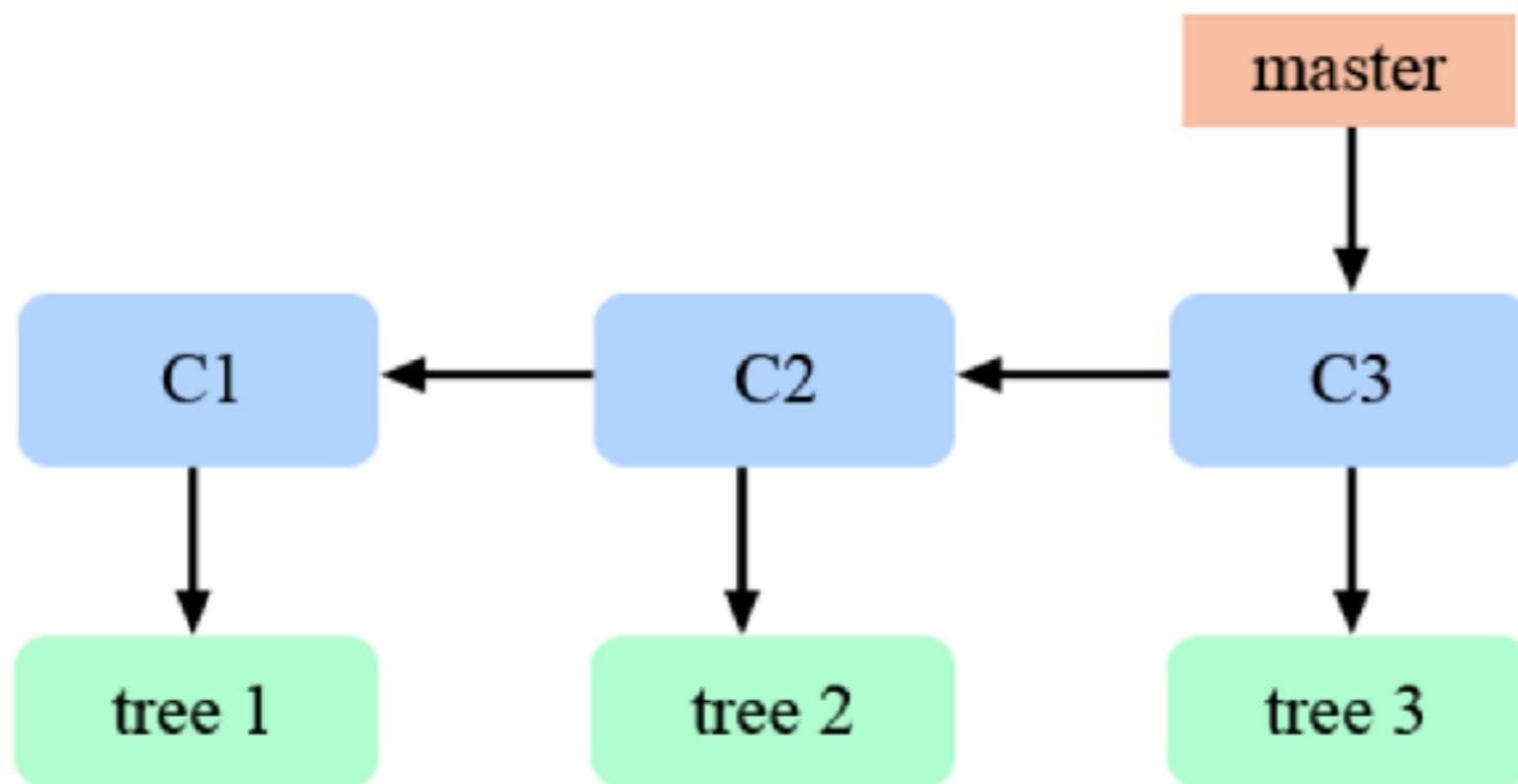
\$git push



Working with branch

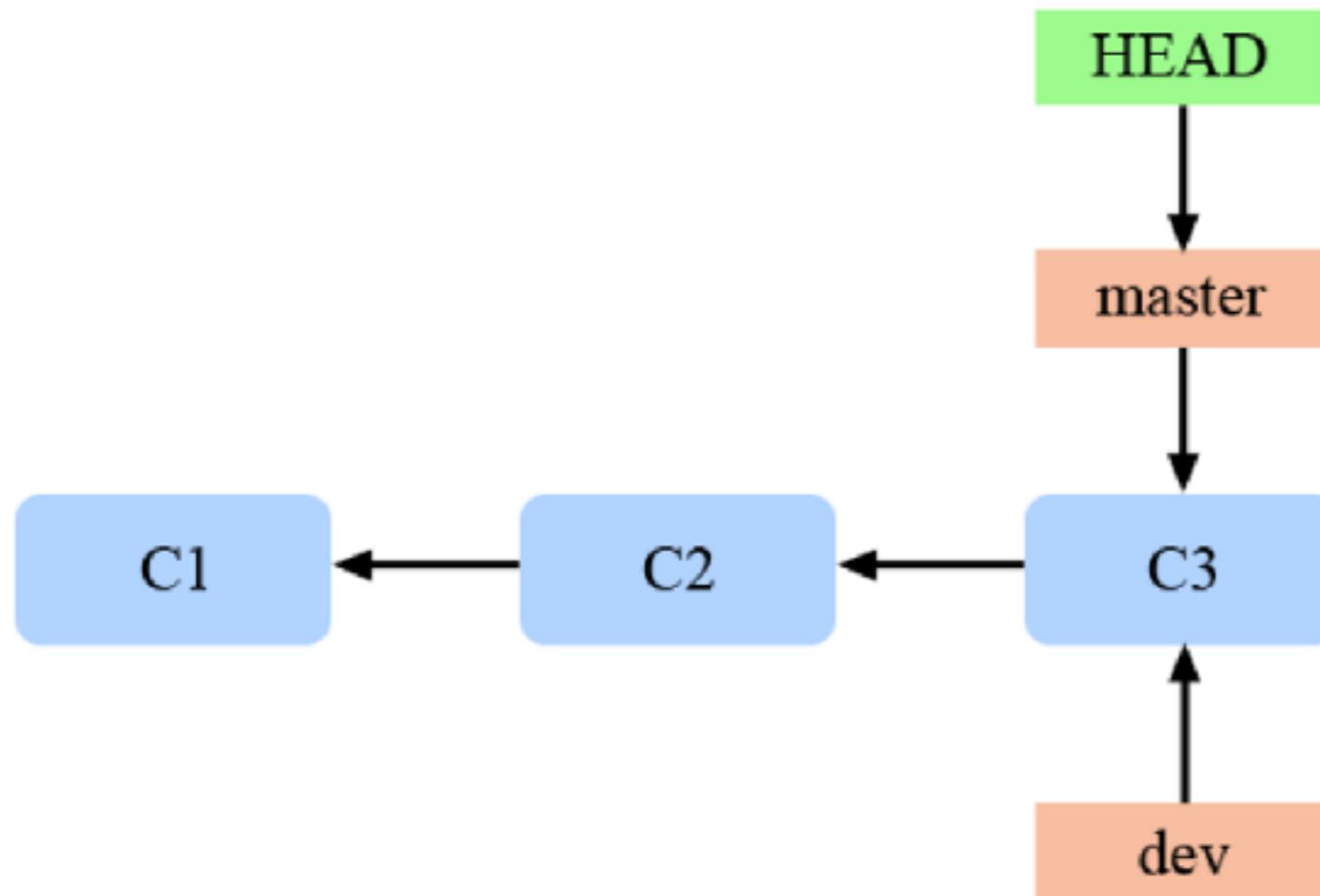


Each branch points to a commit



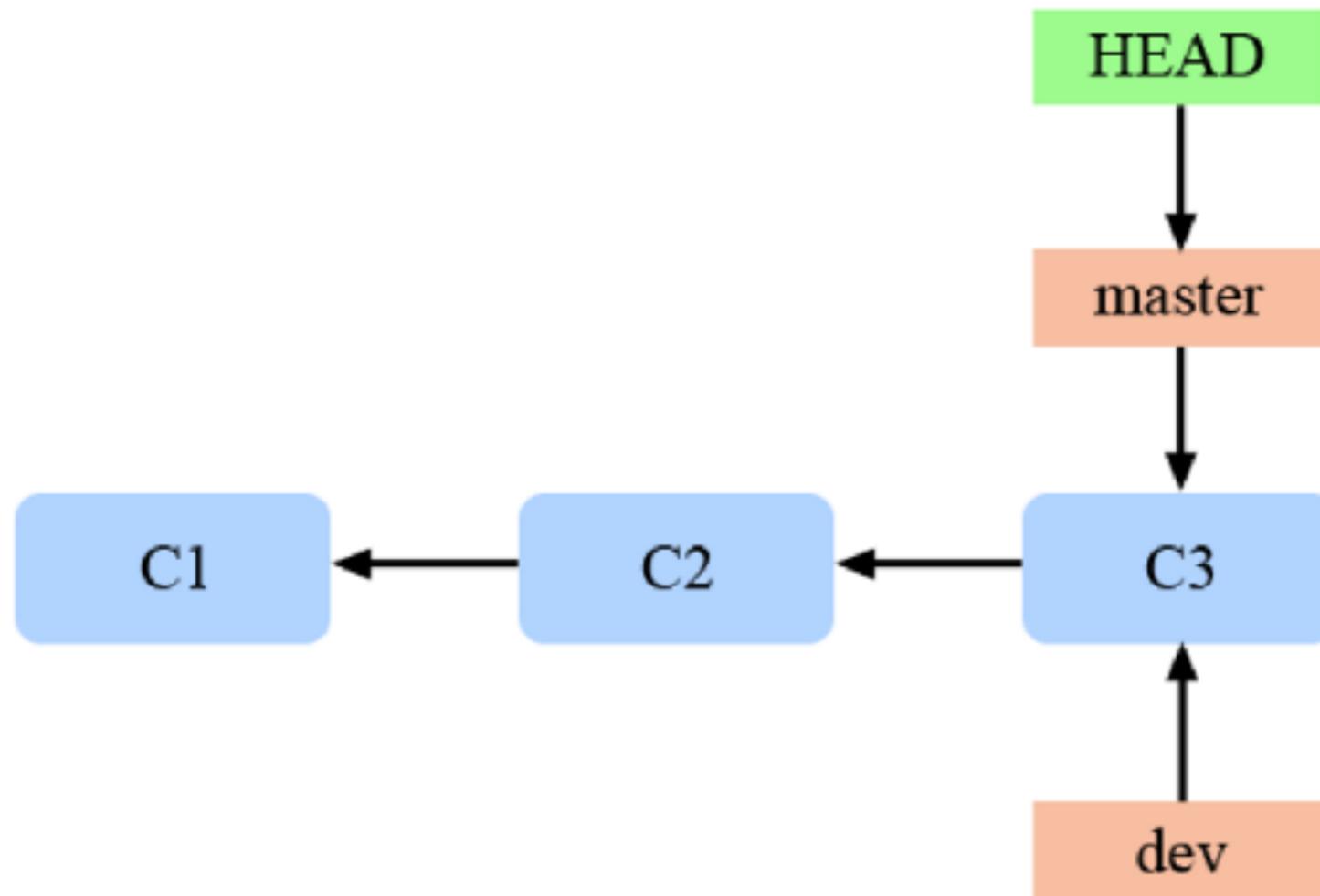
Create new branch

\$git branch <branch name>



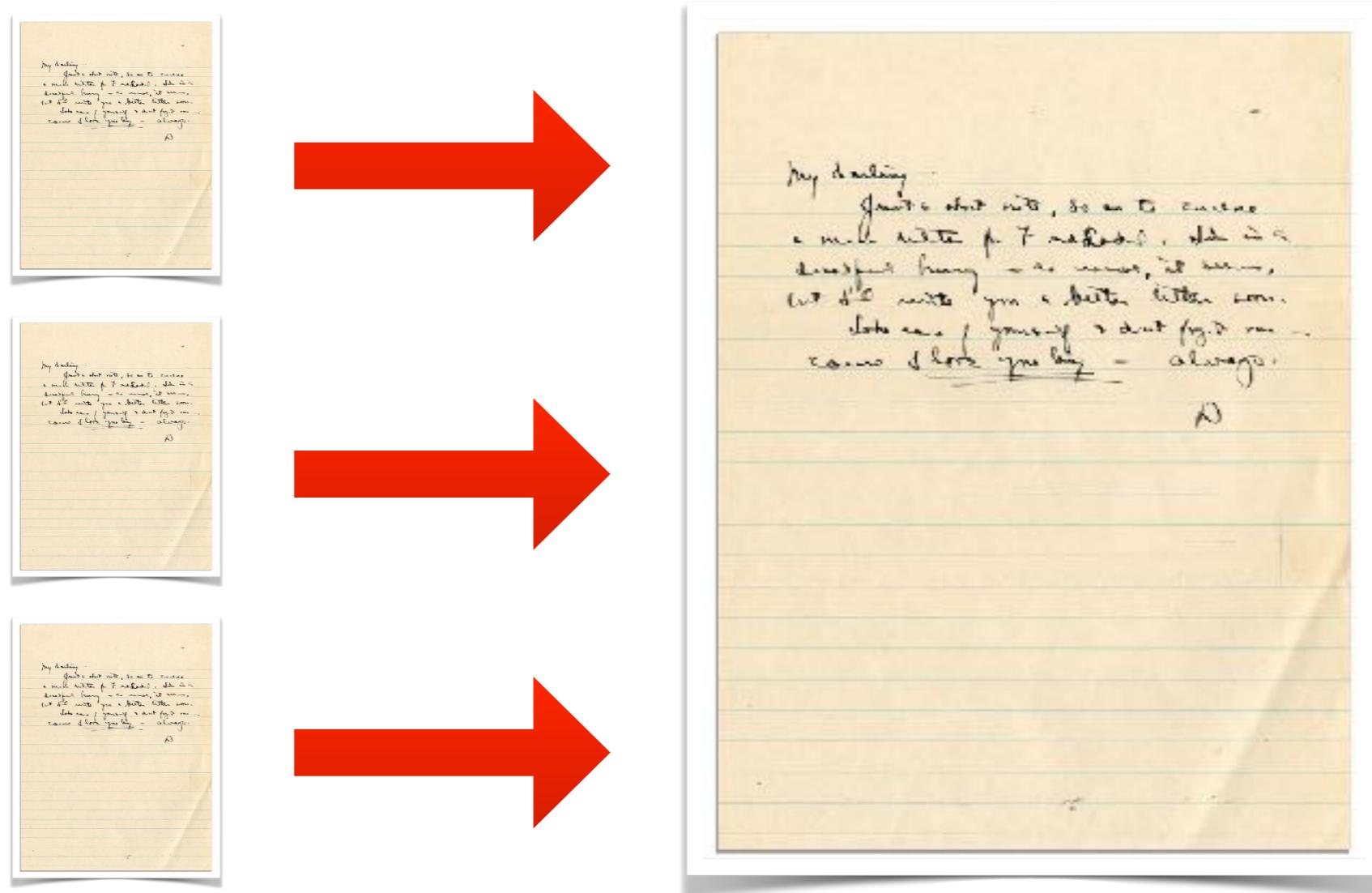
Switch branch

\$git switch <branch name>

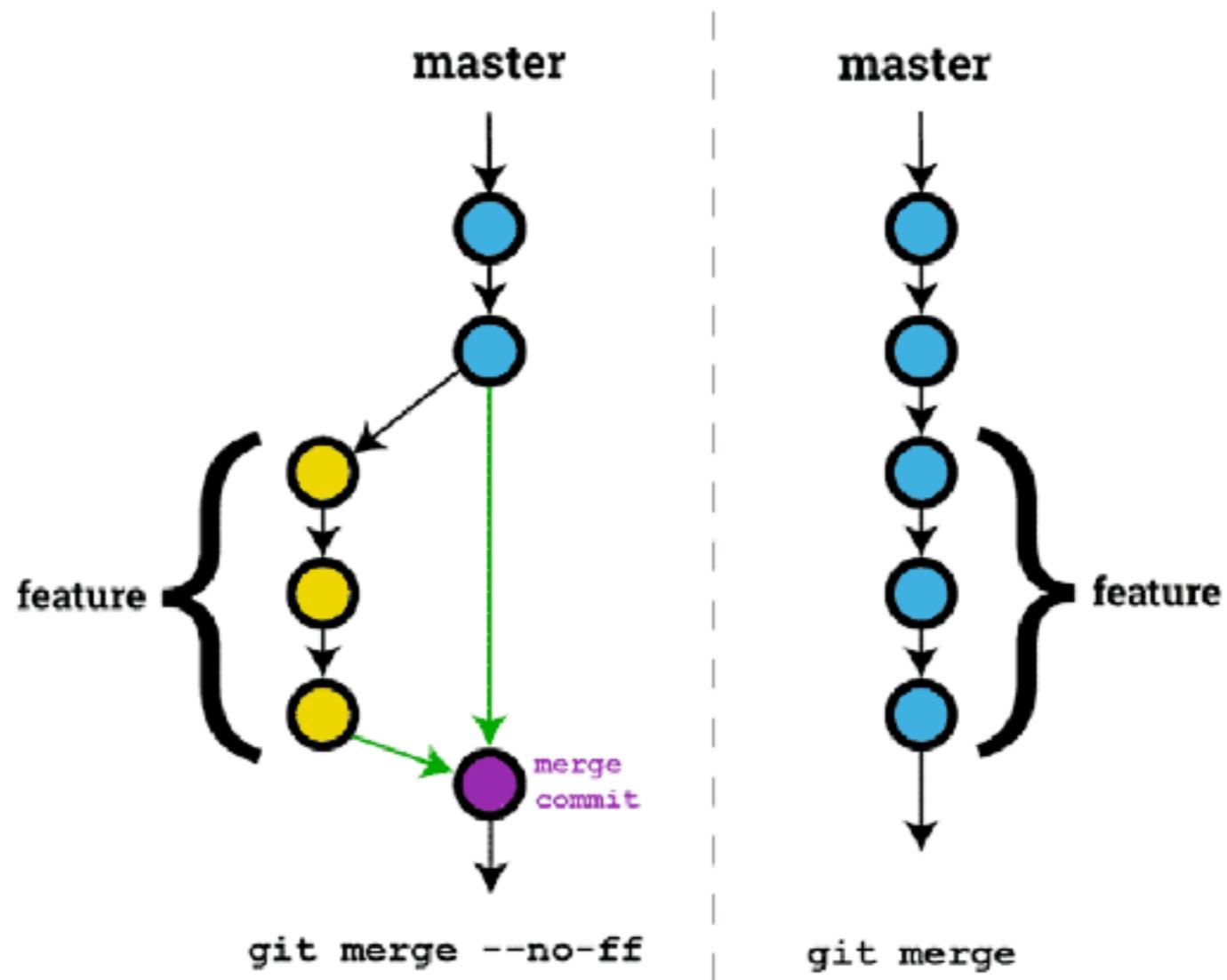


All branch become one

\$git merge



Merge vs Rebase



**BRANCHED FROM MASTER 3
WEEKS AGO**



**MERGED BACK WITHOUT
ANY CONFLICTS**



Avoid merge conflict !!

Small change and commit

Early merge

Single Responsibility Principle

Communication is a key



Commit message



Update
TODO
fixed bug
add feature



Commit Message Format ?

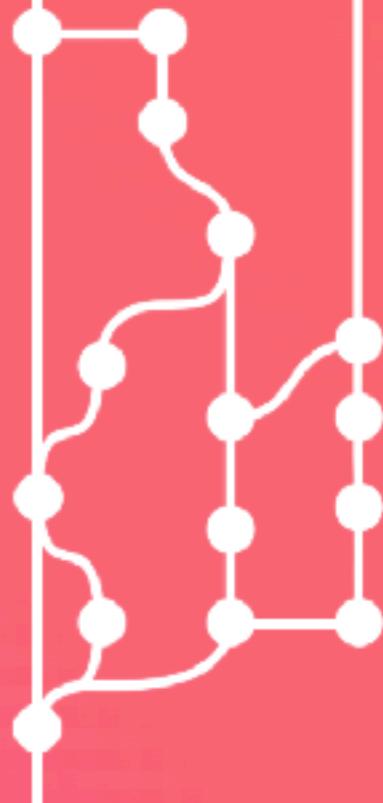
Conventional Commits

A specification for adding human and machine readable meaning to commit messages

Quick Summary

Full Specification

Contribute



<https://www.conventionalcommits.org/>



DevOps

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



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



Workshop

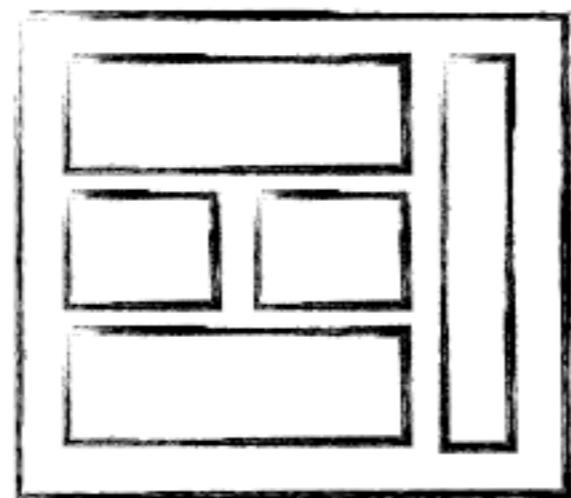


Manage containers



Why docker ?

Software industry has changed !!



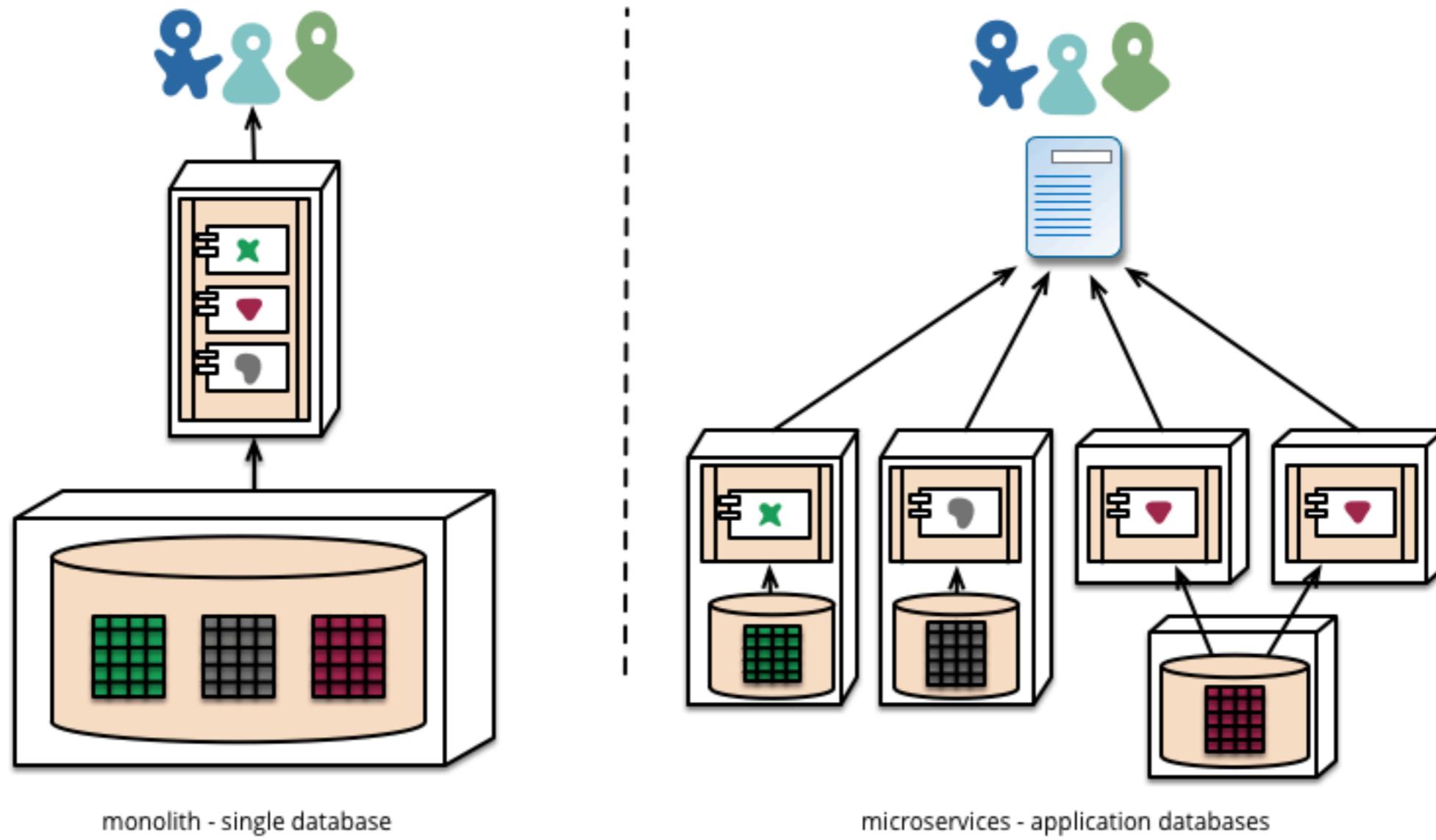
MONOLITHIC/LAYERED



MICRO SERVICES



Microservice architecture

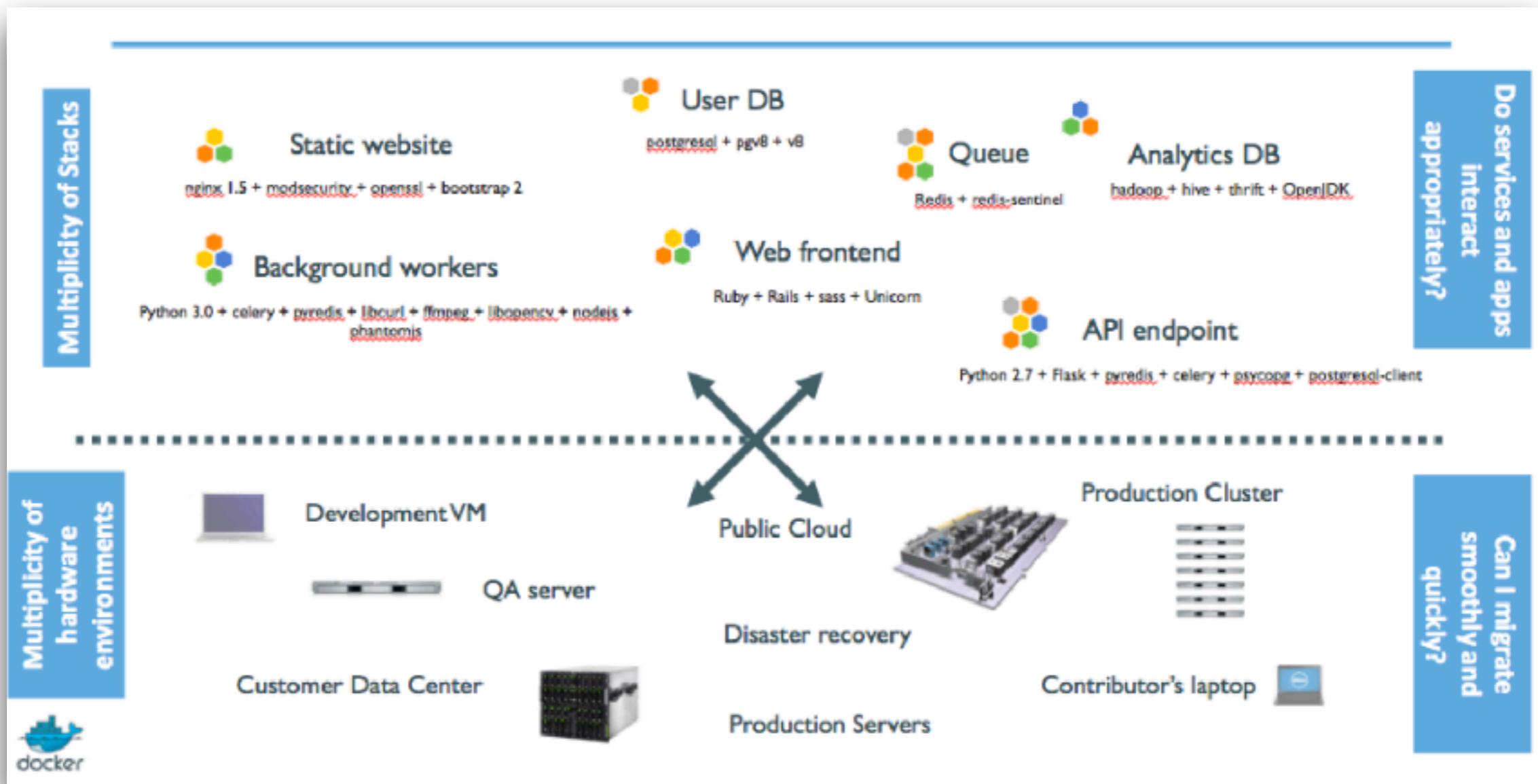


<https://martinfowler.com/articles/microservices.html>



Why docker ?

We have problem !!

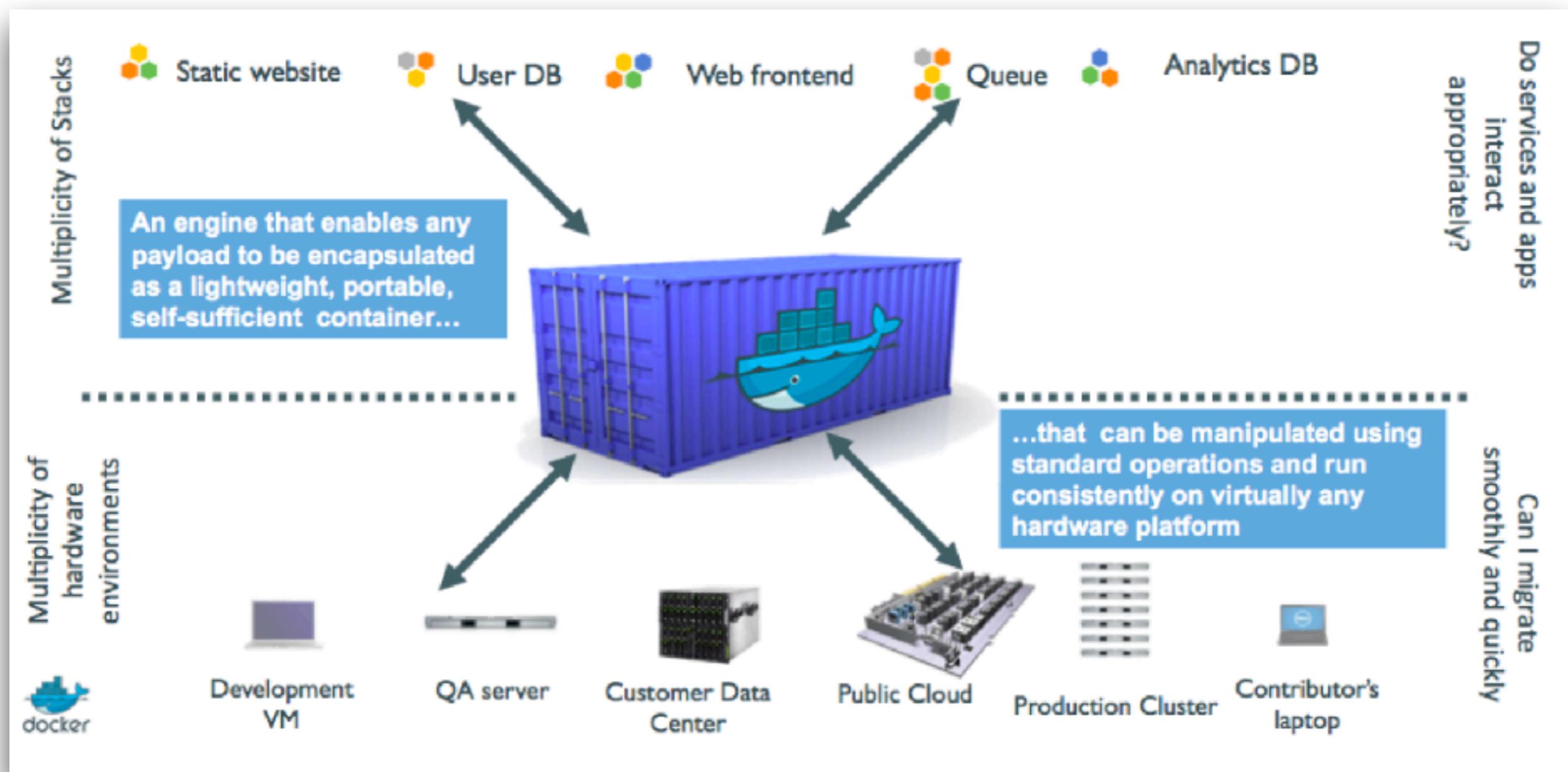


Problem ?

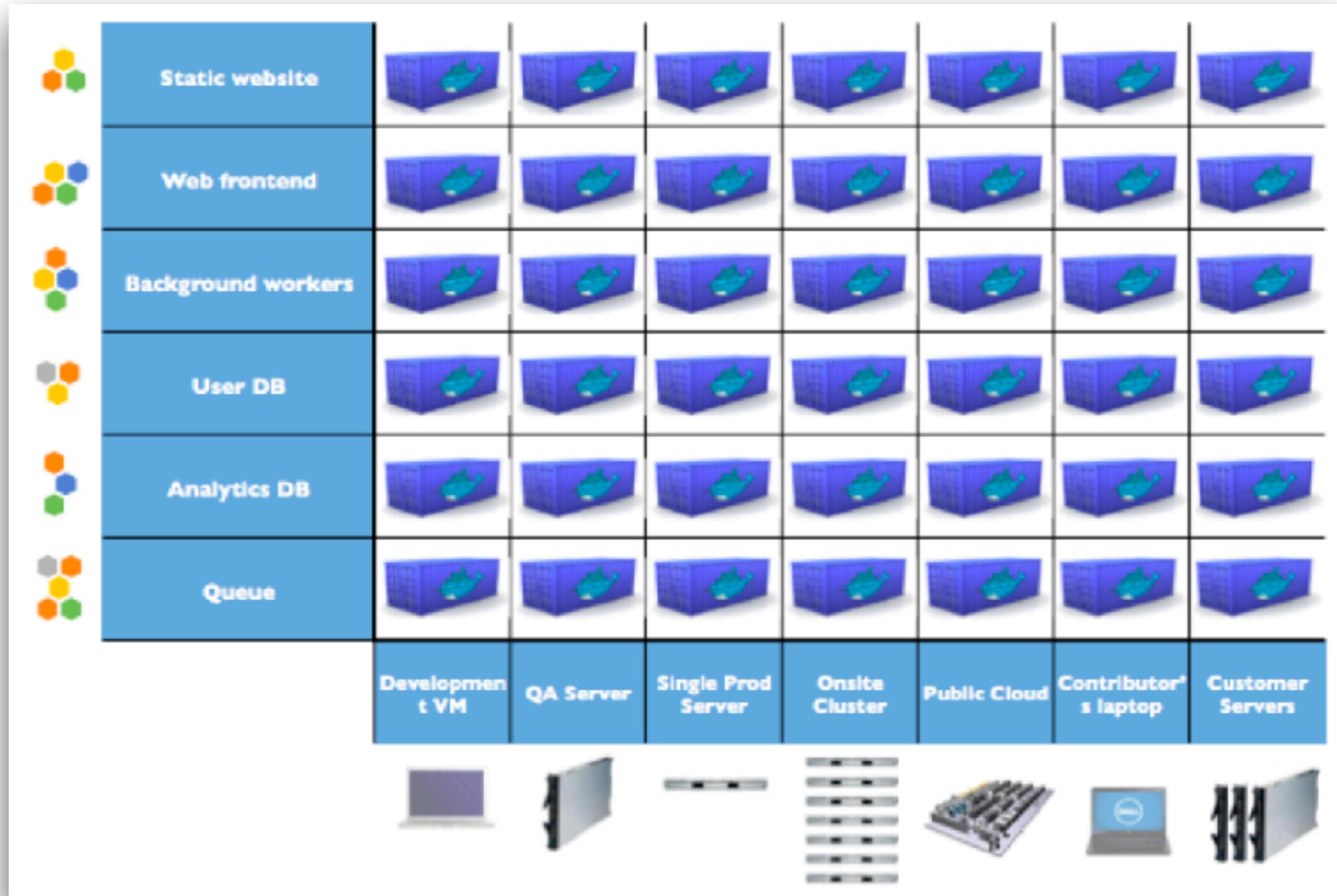
	Static website	?	?	?	?	?	?	?
	Web frontend	?	?	?	?	?	?	?
	Background workers	?	?	?	?	?	?	?
	User DB	?	?	?	?	?	?	?
	Analytics DB	?	?	?	?	?	?	?
	Queue	?	?	?	?	?	?	?
	Development VM	QA Server	Single Prod Server	Onsite Cluster	Public Cloud	Contributor's laptop	Customer Servers	
								



Solution ?

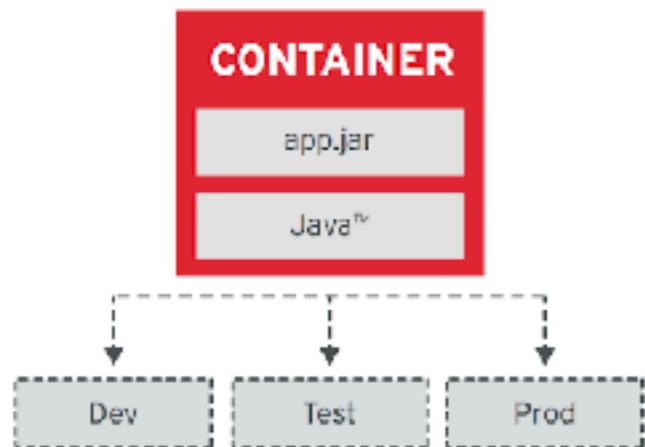


Solution ?

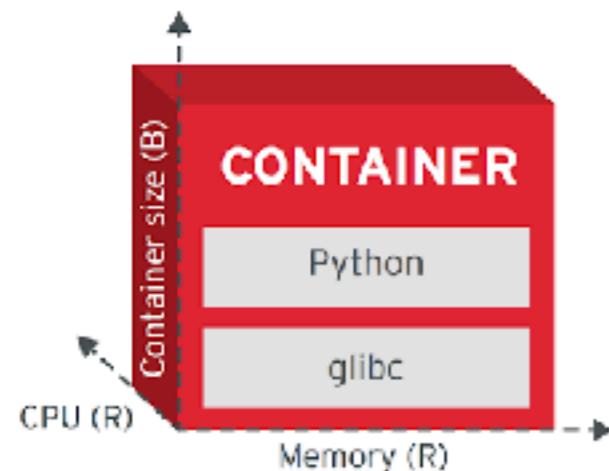


Container Design Principles

Image Immutability Principle



Runtime Confinement Principle



High Observability Principle



Lifecycle Conformance Principle



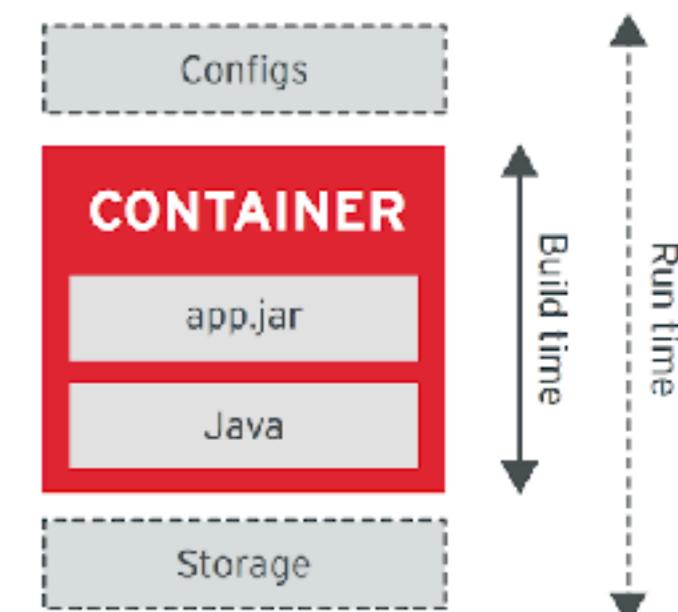
Single Concern Principle



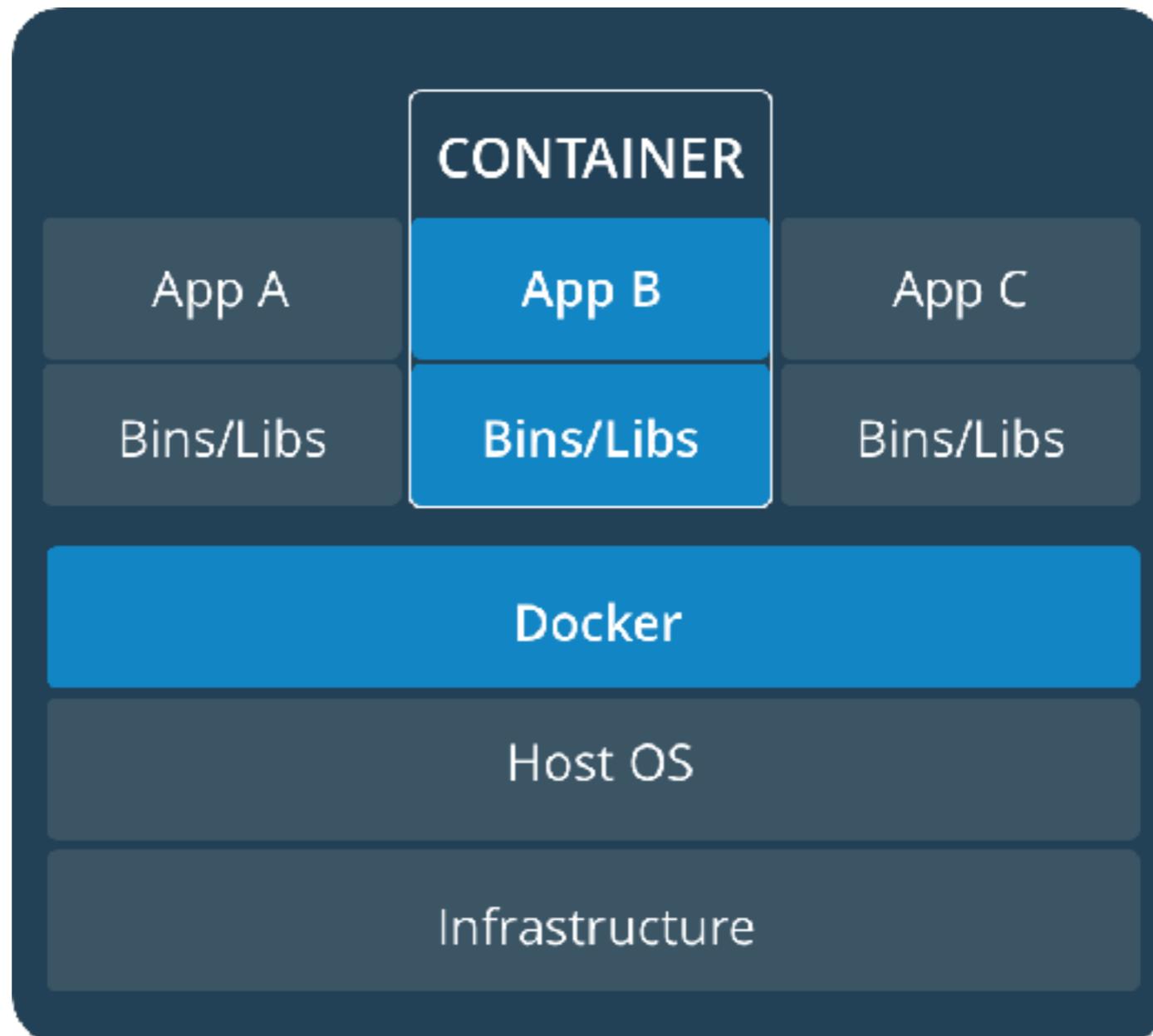
Process Disposability Principle



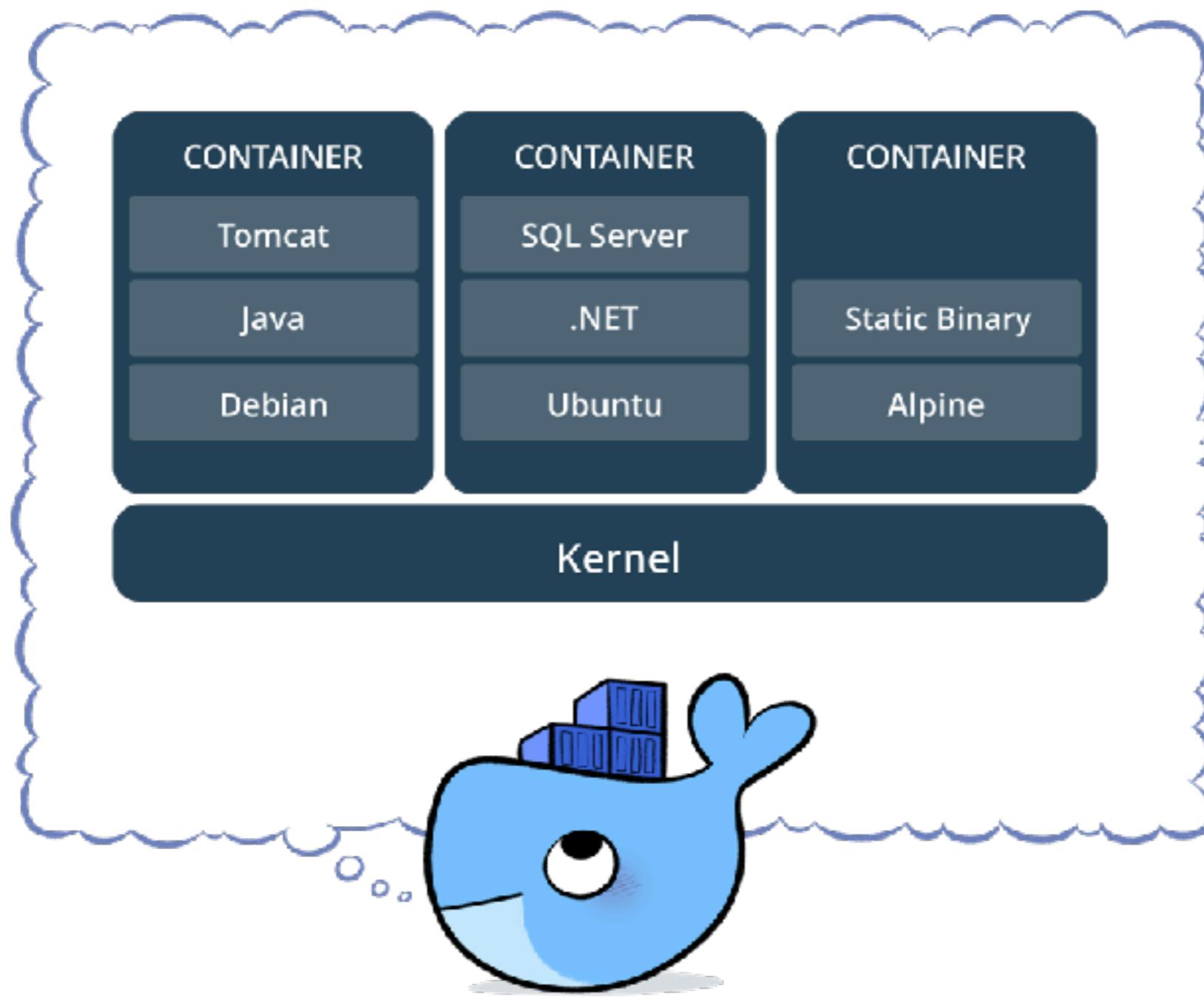
Self-Containment Principle



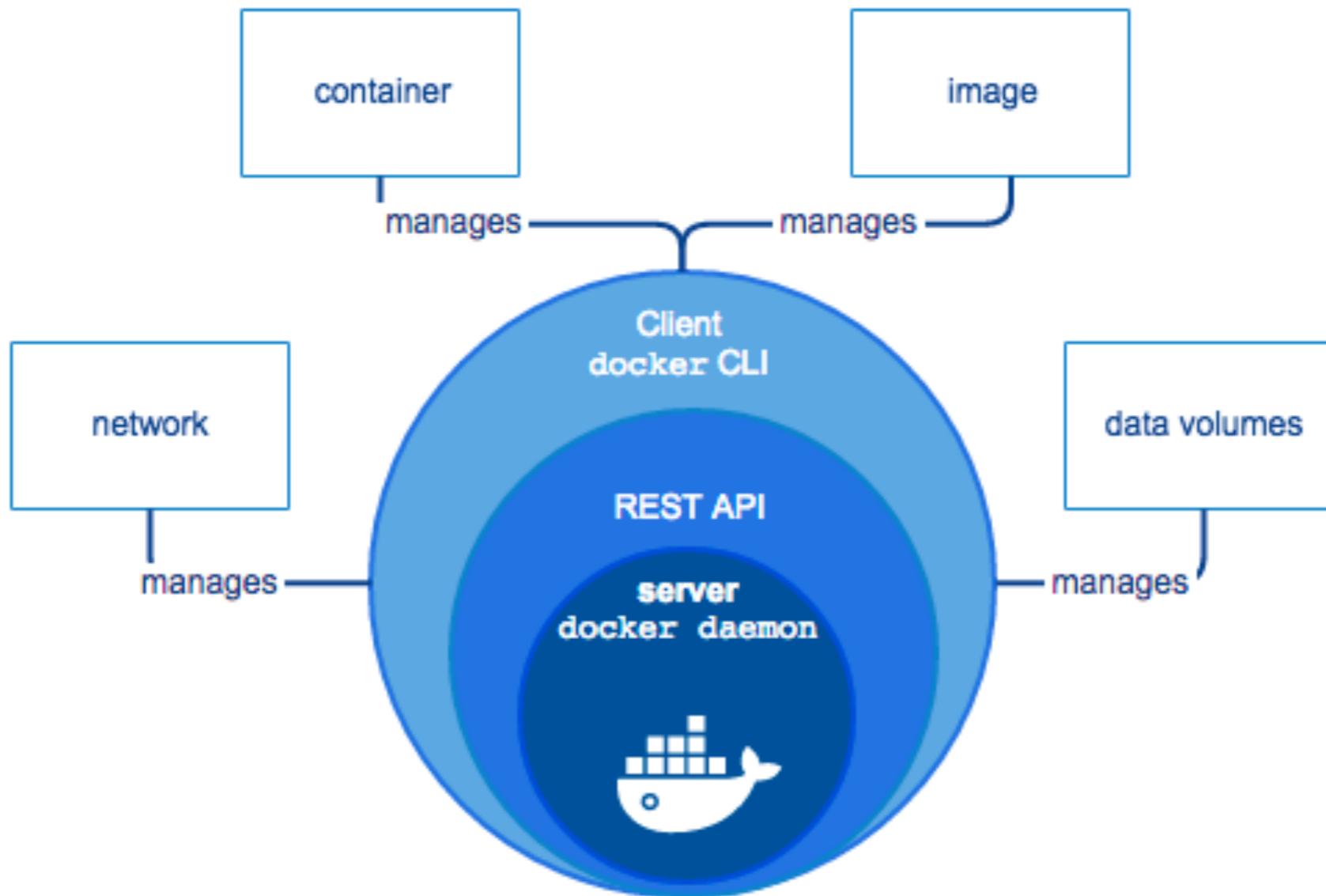
Container with Docker



Container with Docker



Basic of Docker



Basic of Docker

**Image
Container
Dockerfile
Registry
Volume and network**



Image vs Container

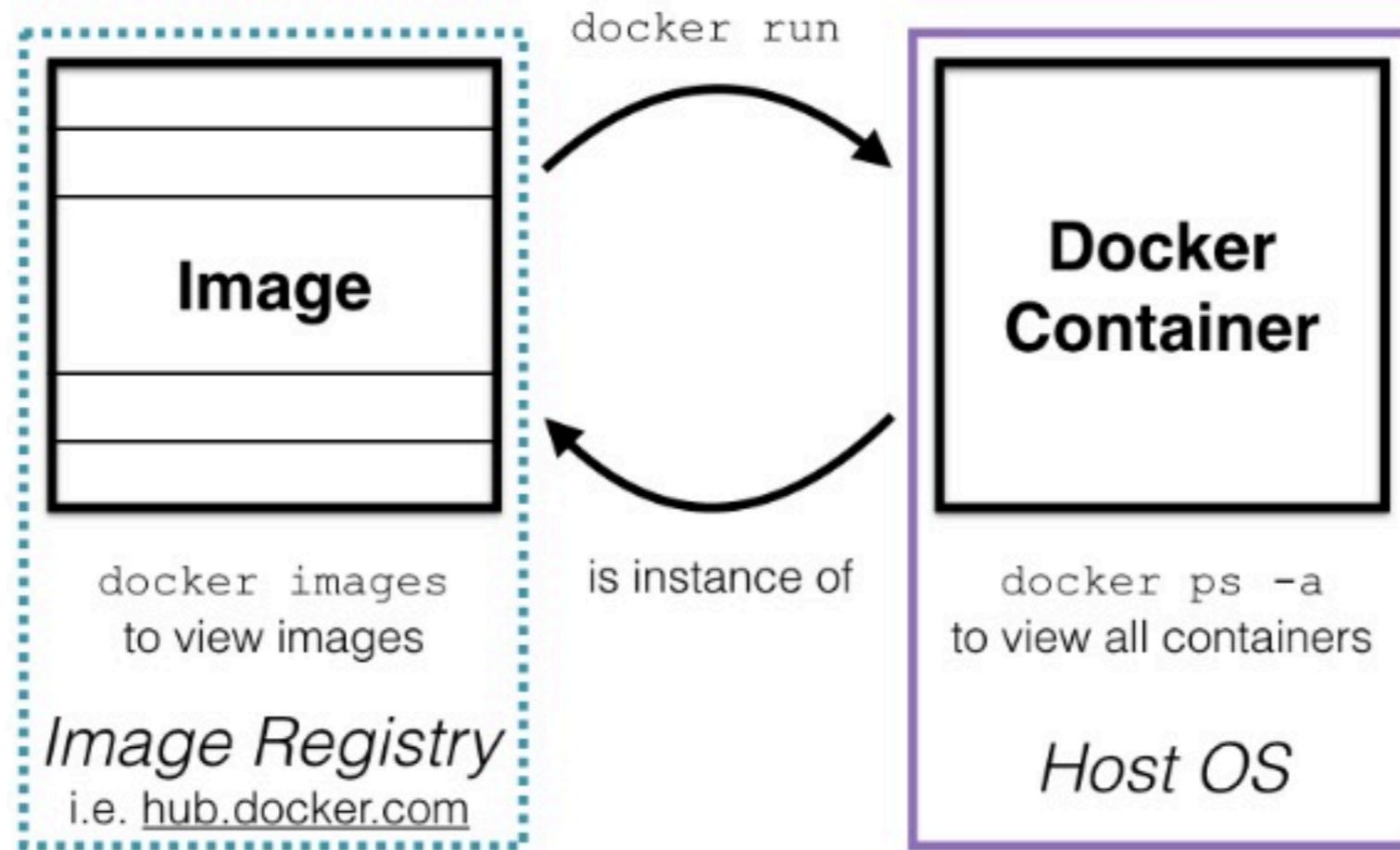


Image vs Container

Image like template/blueprint
Containers are created from image



Docker image

Collection of files and some meta data

Made of **layers**

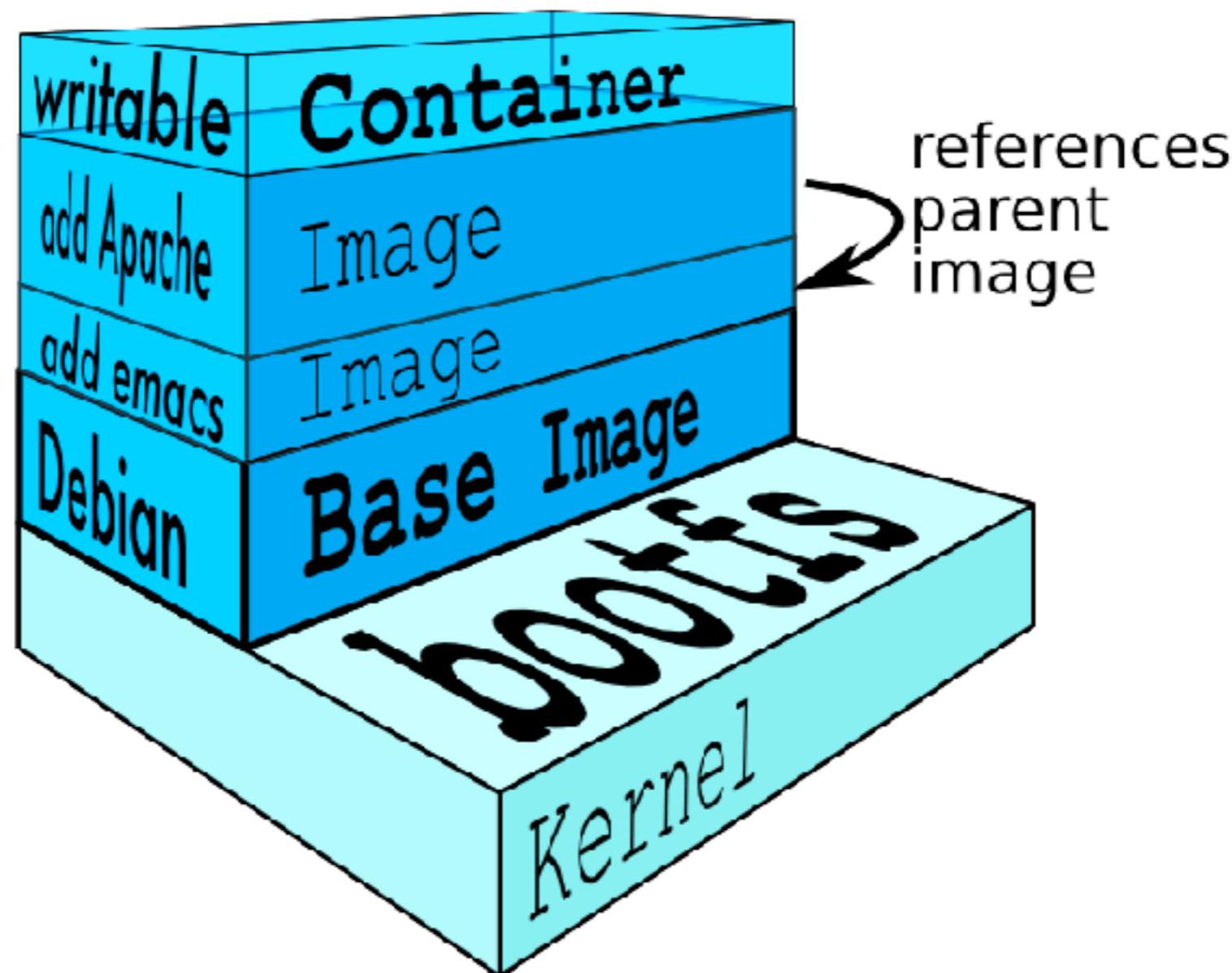
Each layer can add/change/remove files

Image can share layers

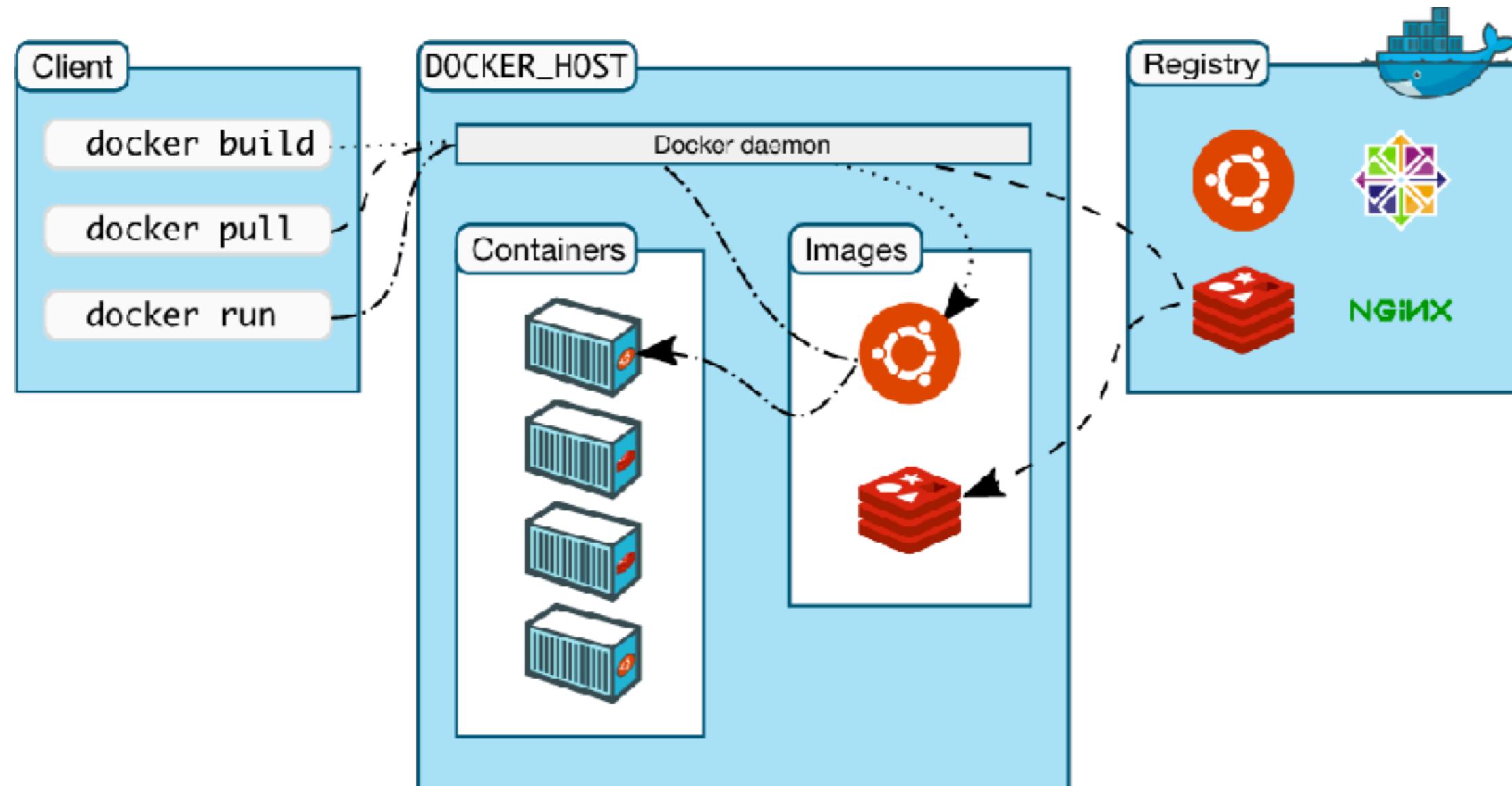
Read-only file system



Docker image layer



How docker works ?



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



Docker commands

Manage image
Manage container
Manage system



Management commands

```
$docker image <command>  
$docker container <command>  
$docker system <command>
```



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/



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: sha256:52a189e49c0c797cf5cbfe578c68c225d160fb13a42954144b29af3fe4fe335
Status: Downloaded newer image for nginx:latest
```



Pull image

```
$ docker image pull nginx:latest
```



Tag



Image and Tag

Image can have **tags**

Tags define image variants

Default of tag is **:latest**

:latest tag can be updated frequently !!



Docker container

Foreground
Background
Interactive



Run with foreground

```
$ docker container run nginx
```



Run with background

```
$ docker container run -d nginx
```

-d = --detach

Run container in background and print container ID



Run with interactive

\$ docker container run -it nginx bash

-i = --interactive

-t = --tty



Access to container

\$docker container **run -it**

\$docker container **exec -it**



Create Image from Dockerfile



Dockerfile

Build recipe for a Docker image

Contain series of instructions

Use **\$docker image build** command

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



Example

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



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 InRelease
Get:2 http://archive.ubuntu.com/ubuntu xenial-updates InRelease
Get:3 http://archive.ubuntu.com/ubuntu xenial-security InRelease
Get:4 http://archive.ubuntu.com/ubuntu xenial/main Sources
Get:5 http://archive.ubuntu.com/ubuntu xenial/restricted Sources
```



History of image

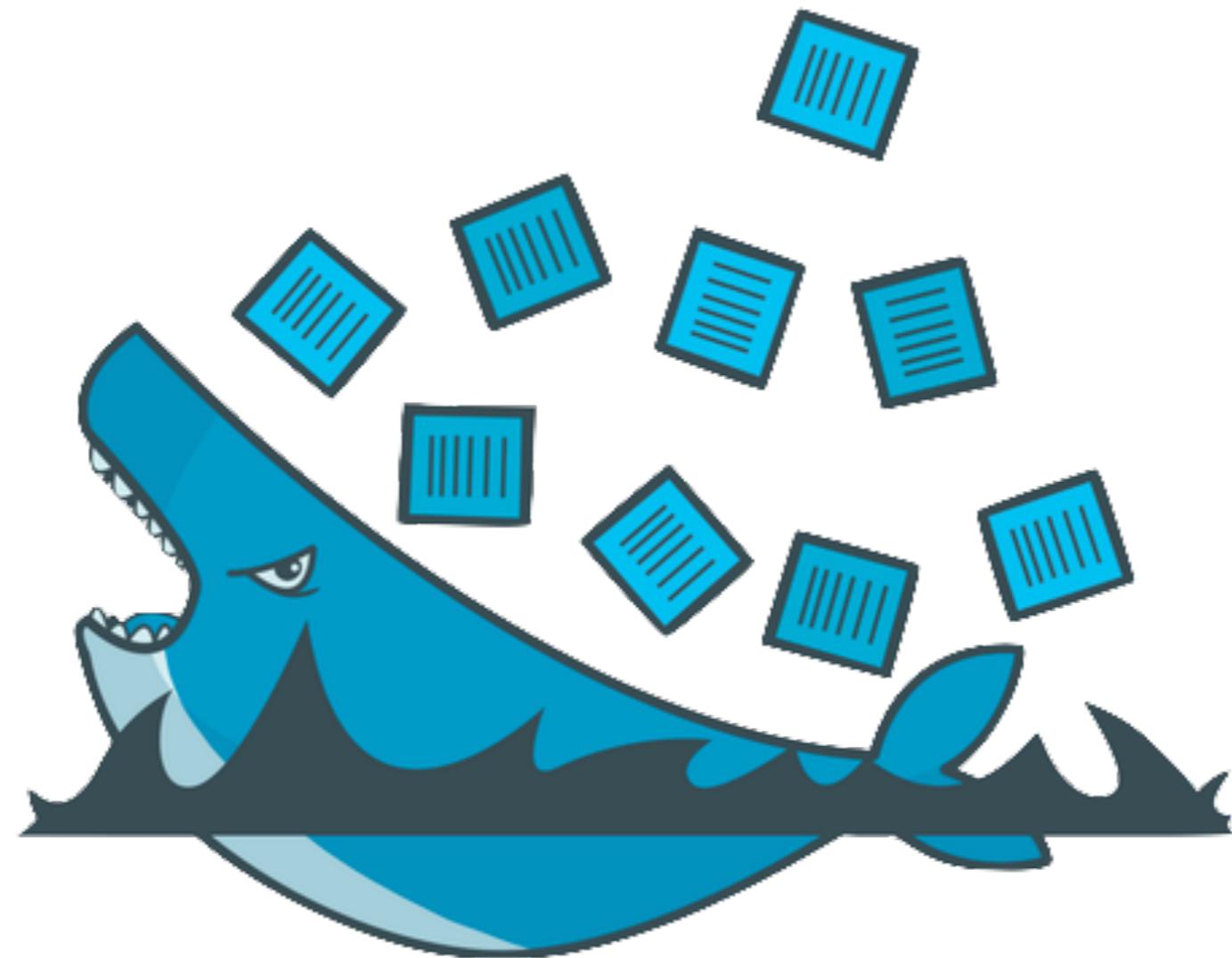
Show all layers of image

\$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\ ...)/.../g'	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' >.../etc/init.d/docker	745 B
<missing>	3 weeks ago	/bin/sh -c #(nop) ADD file:efb254bc677d66d.../etc/init.d/docker	130 MB



Workshop



Working with Docker compose

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



Mutilple containers app!!

Difficult to create and manage !!

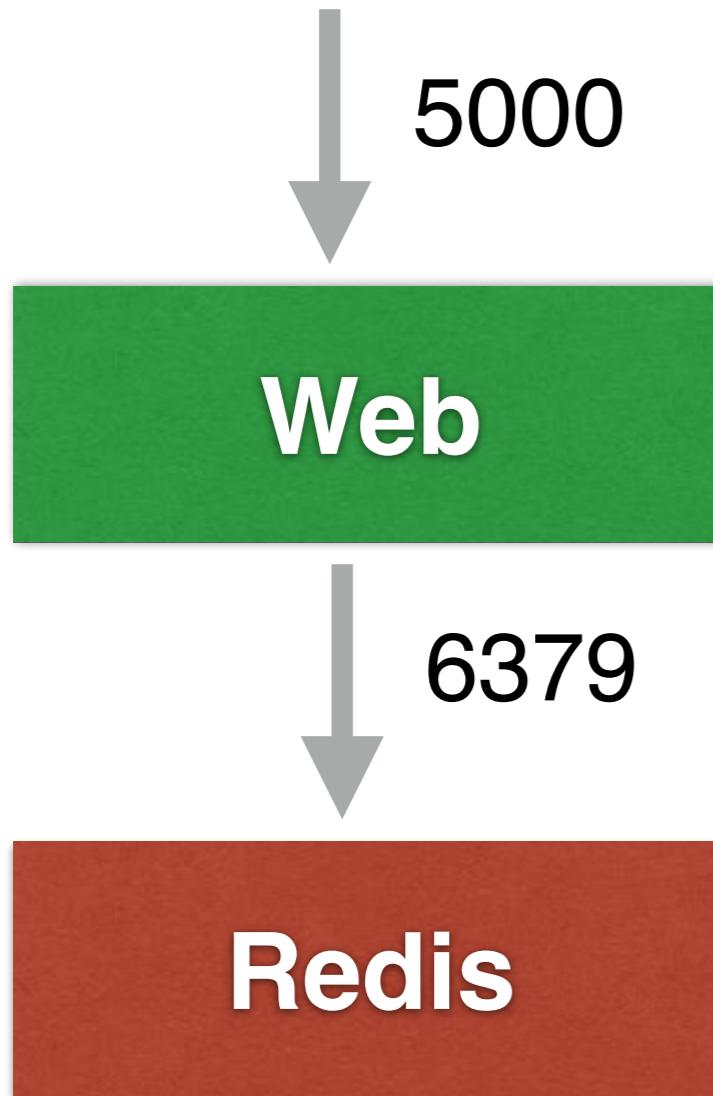


Mutilple containers app!!

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



Mutilple containers app!!



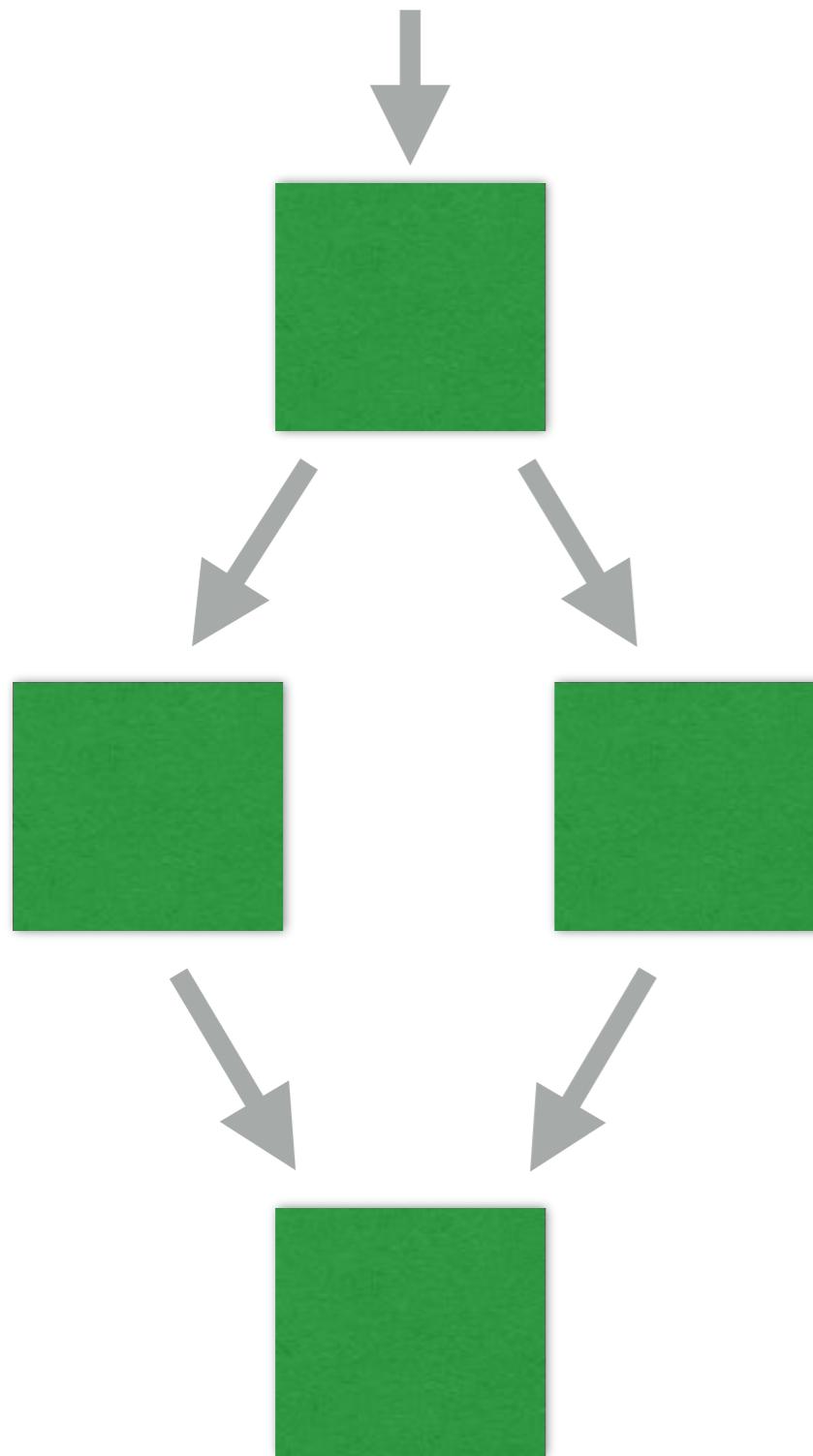
```
$docker pull redis:latest  
$docker build -t web .
```

```
$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
```



Mutilple containers app!!



\$docker pull

\$docker build

\$docker build

\$docker build

\$docker run

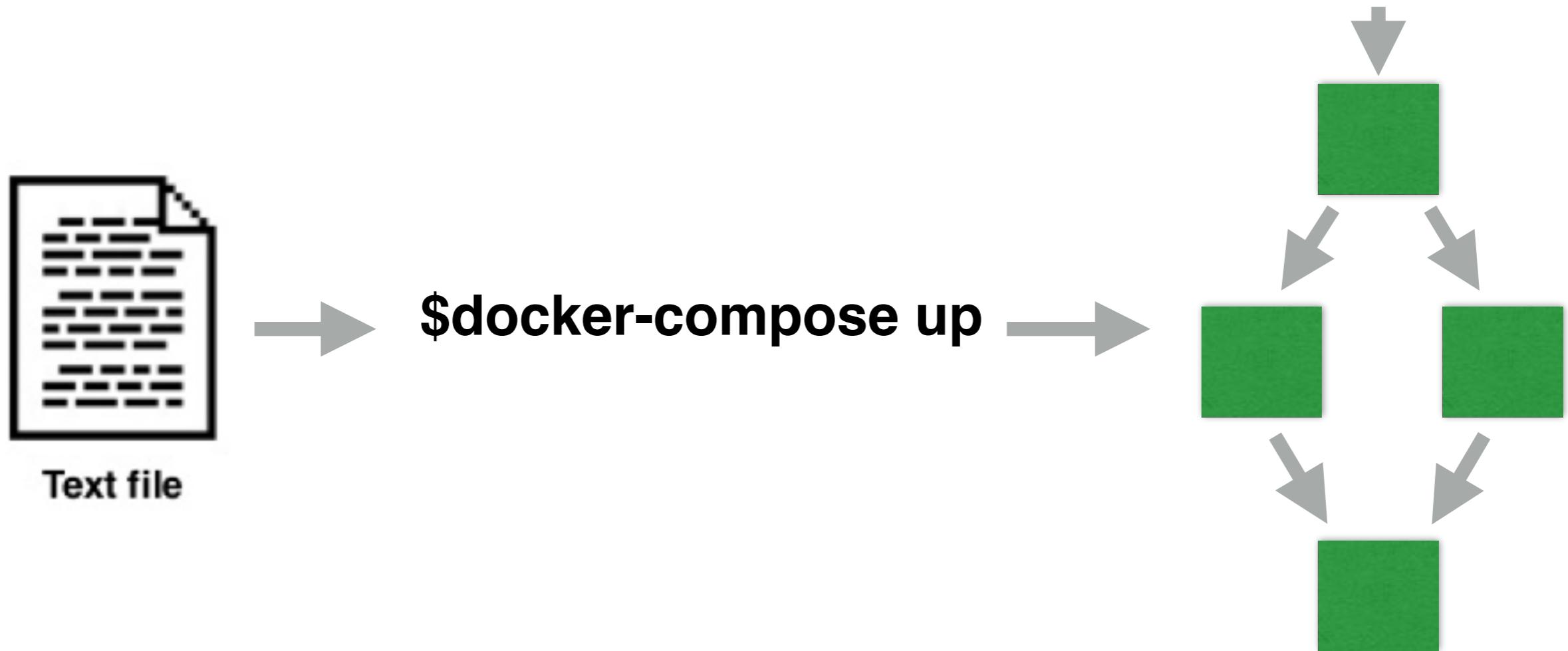
\$docker run

\$docker run



Docker compose

Running app in one command-line
Configuration in YAML file



docker-compose.yml

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



Build and run

\$docker-compose build

\$docker-compose up -d

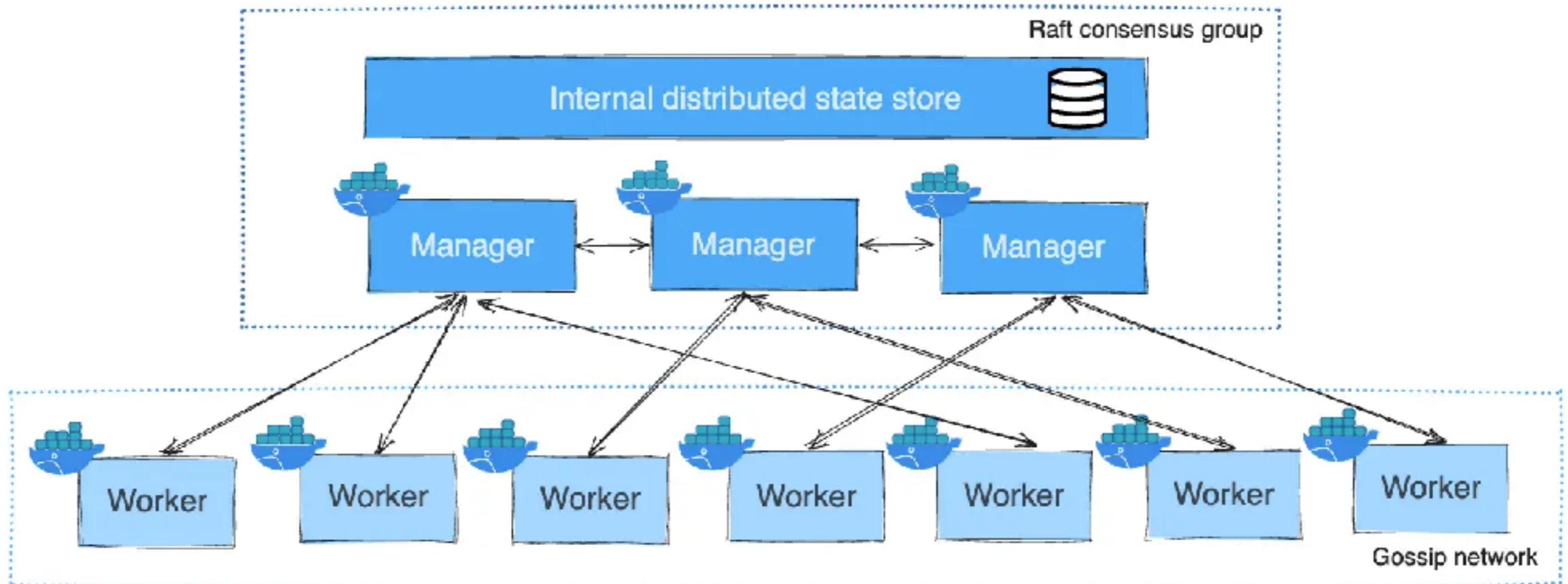
\$docker-compose logs --follow

\$docker-compose ps

\$docker-compose down



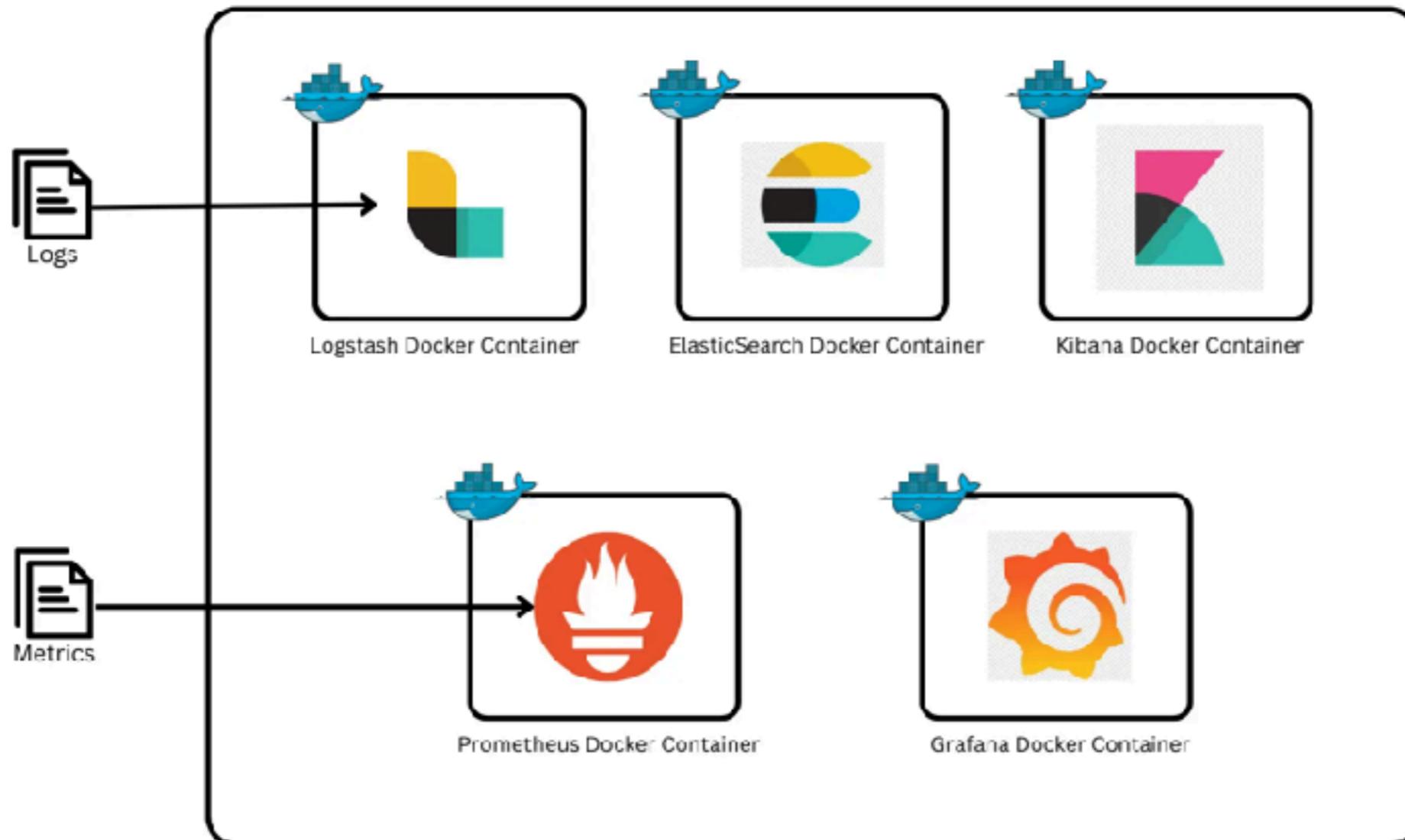
Docker Swarm



<https://docs.docker.com/engine/swarm/how-swarm-mode-works/nodes/>



Monitoring with Docker



Workshop



Introduction to k8s



kubernetes



Why we need Kubernetes ?

Managing containers for production is challenging

Need something to manage beyond a container engine !!





Key capabilities was missing

Using multiple containers with shared resources

- Monitoring running containers

- Handling dead containers

- Moving containers so utilization improves



Key capabilities was missing

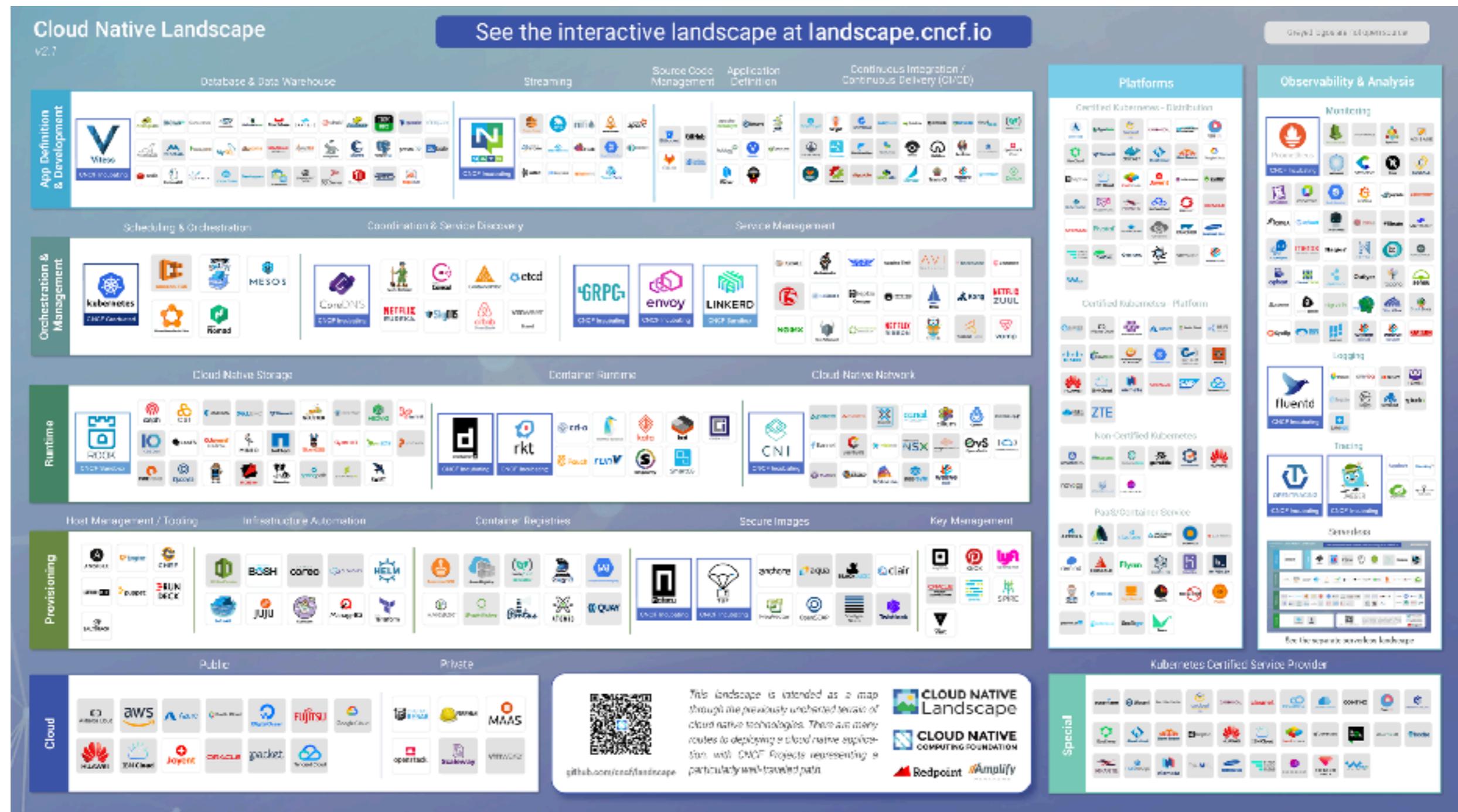
Autoscaling container instances to handle load

Making the container services easily accessible

Handling dead Connecting containers to a variety of
external data sources



Cloud Native Landscape



<https://github.com/cncf/landscape>

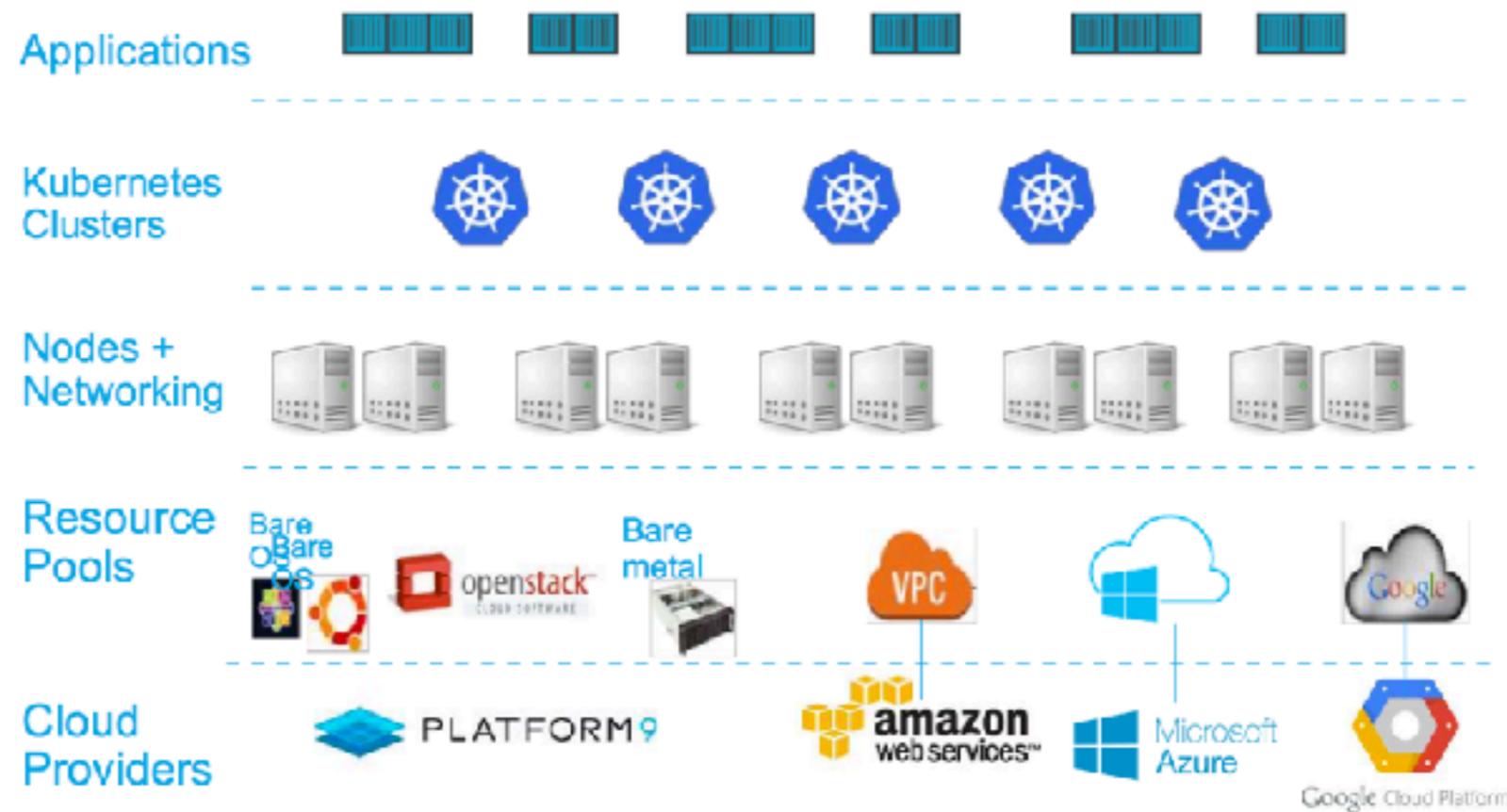


Write once, run anywhere

Eliminate infrastructure lock-in

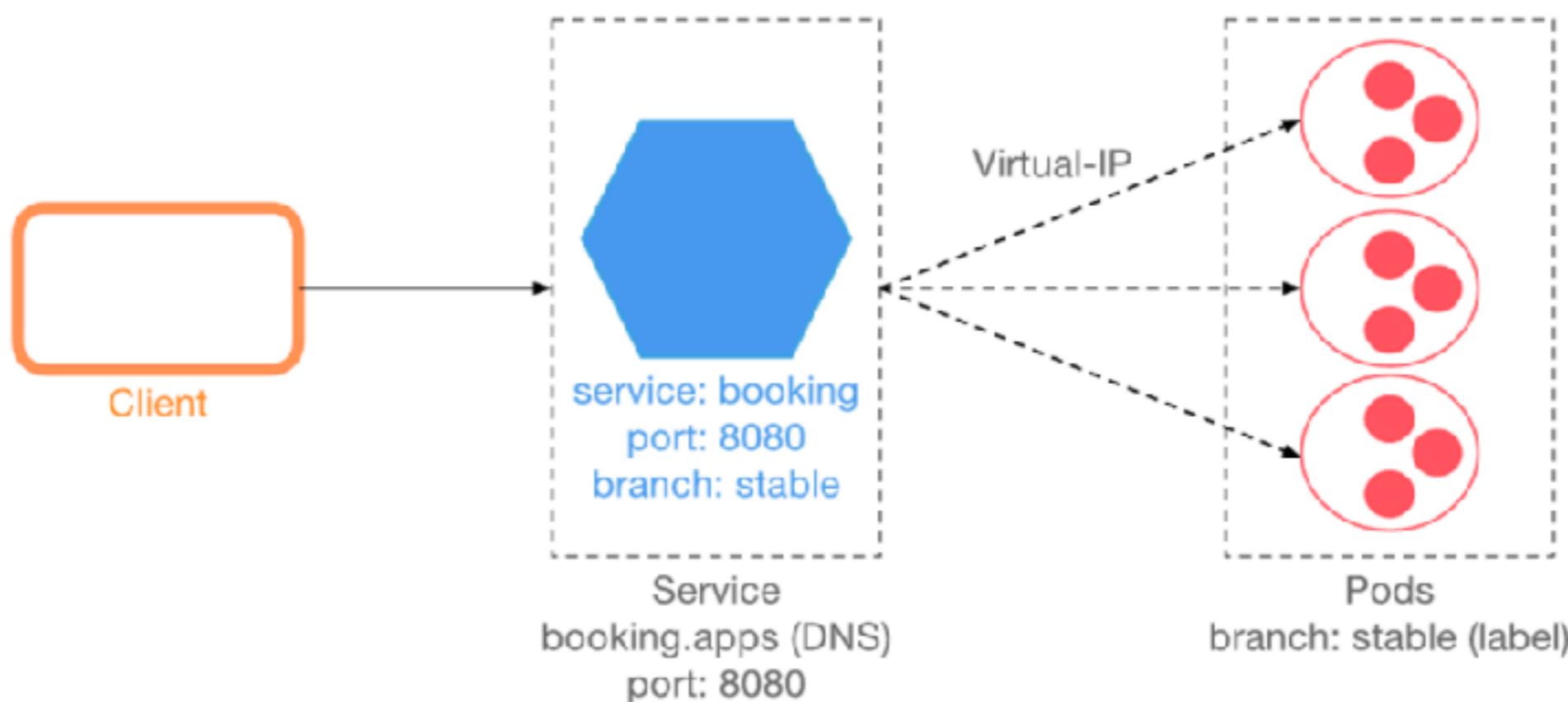
Use containers

Provides management for containers



Modular app design

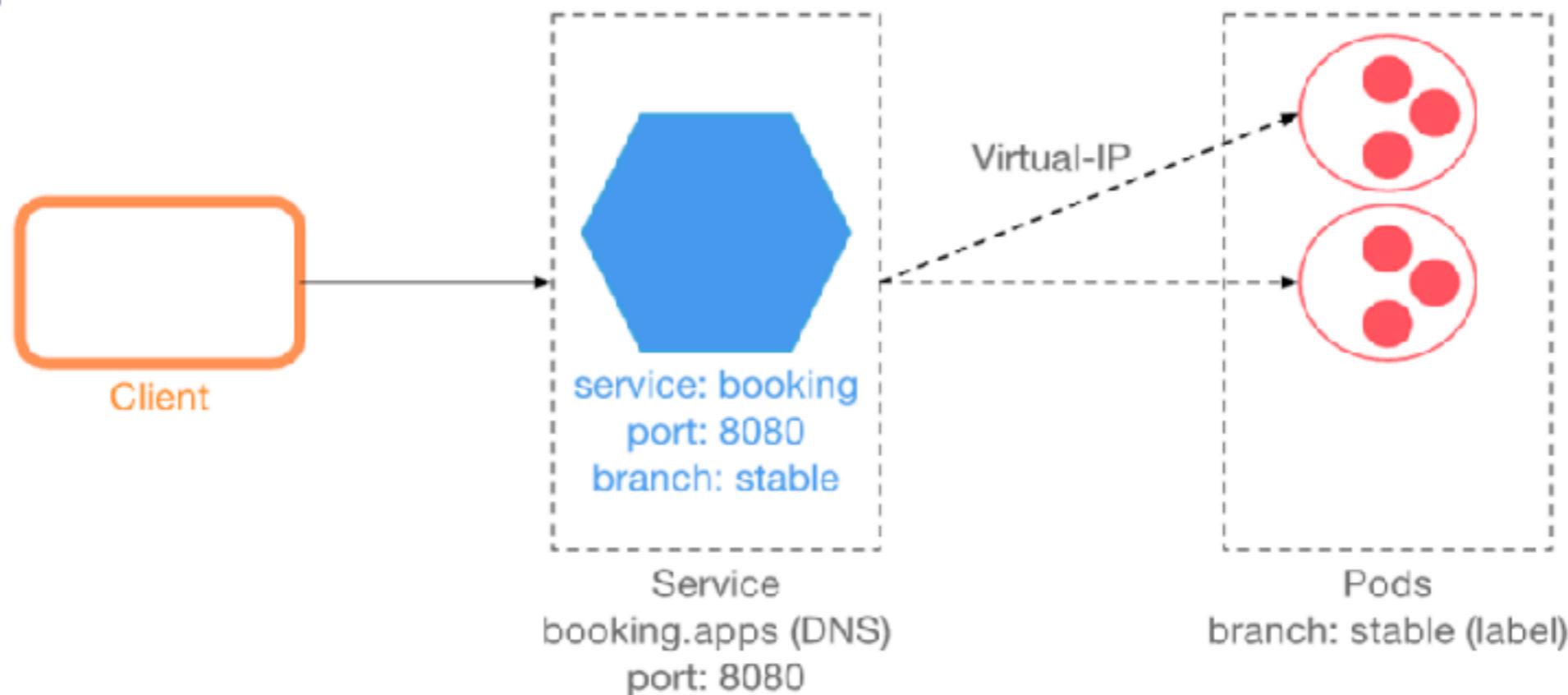
Container/Image boundary similar to class
How to use/manage a collection of container ?



Fault-tolerant by design

Design for failure

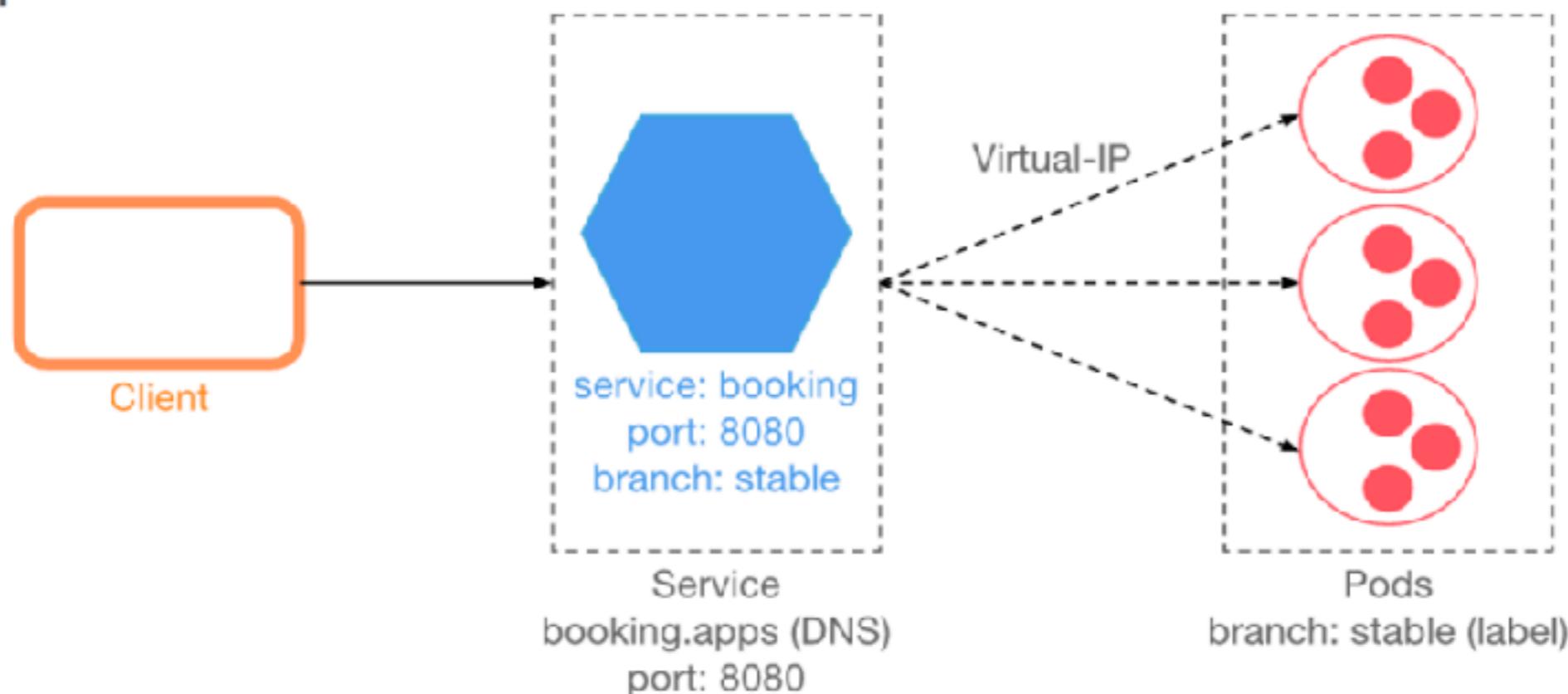
replicas = 2



Fault-tolerant by design

Design for failure

replicas = 3



Deployment, not infrastructure

Software deployment is hard

Infrastructure provisioning/re-provisioning

Configuration networking and load balance

Redundancy (scale-out)

Lifecycle management (Software update)



K8s support for deployment

Scale-out service

Rolling update for new version

Rollback to a previous version

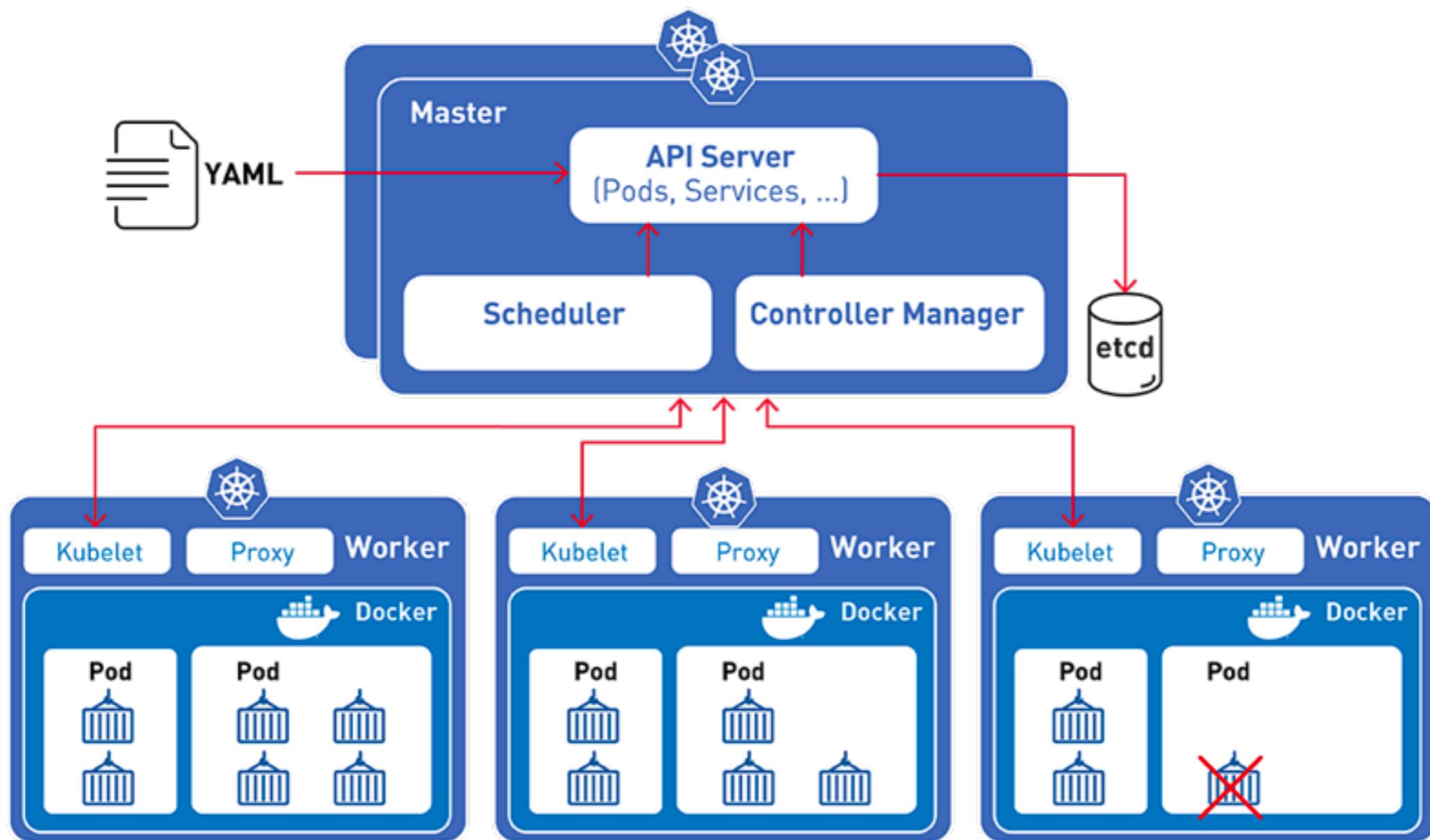
Pause and resume a deployment

Horizontal auto-scaling

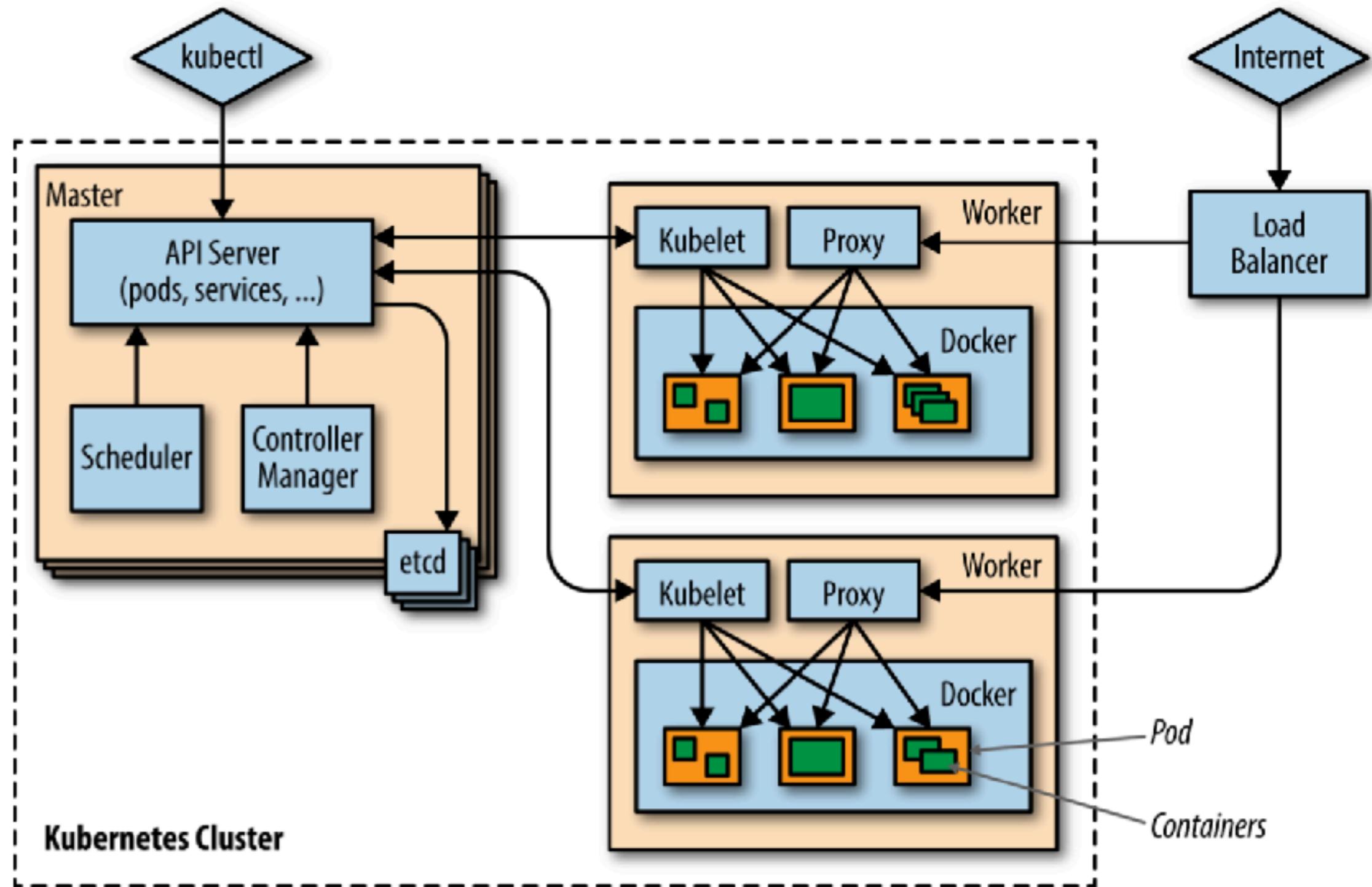
Canary deployment



Kubernetes

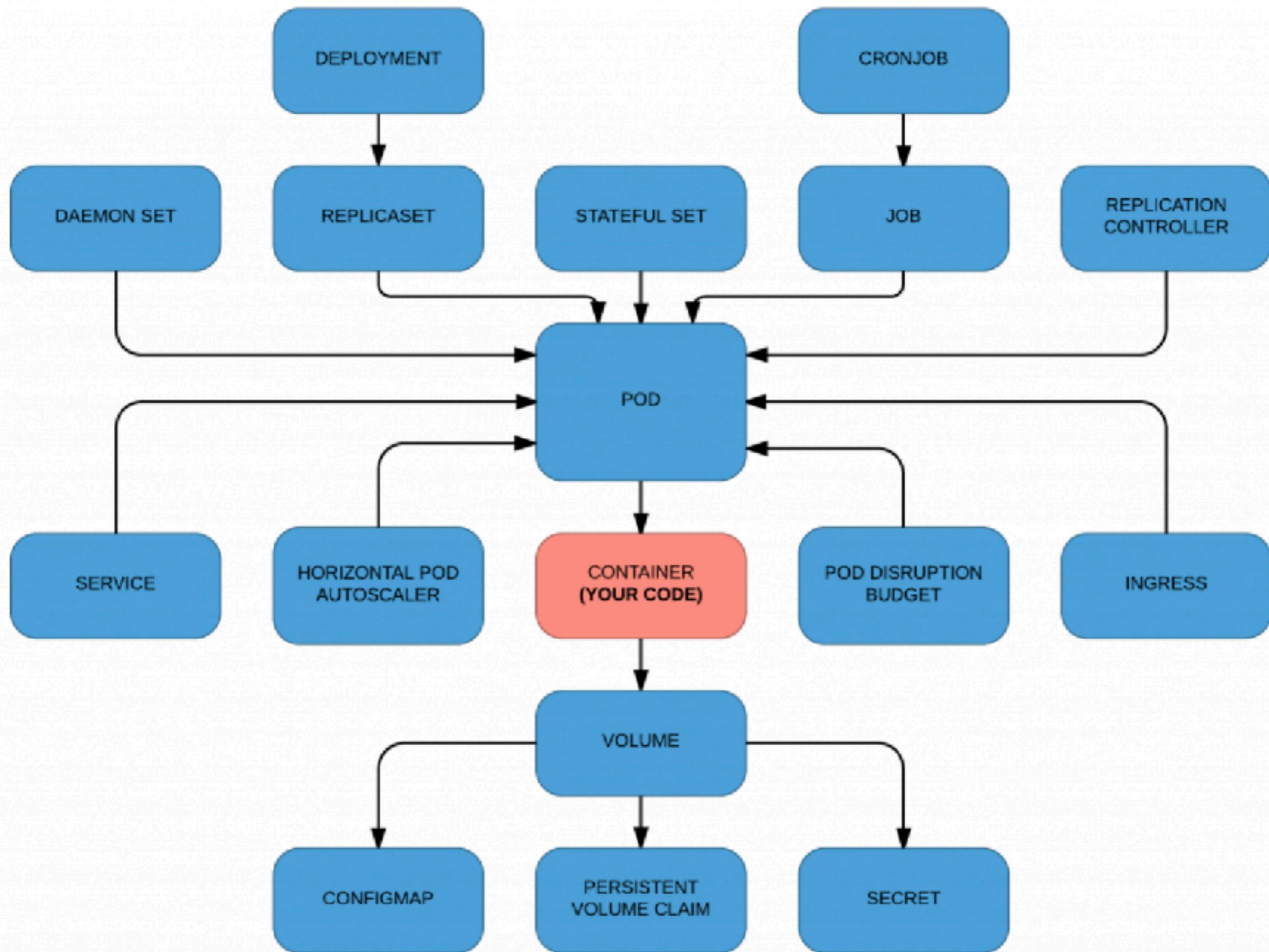


Kubernetes Architecture



K8s components





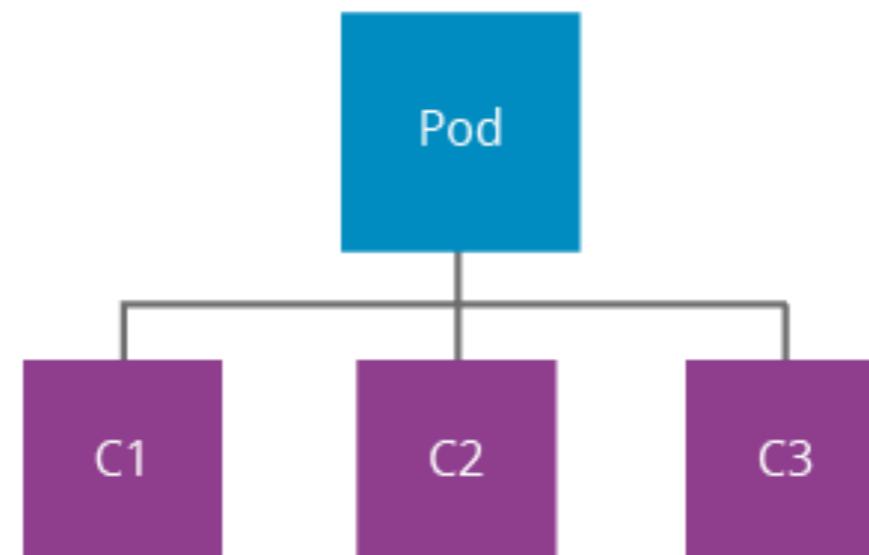
K8s components

Pods
Services
Deployments
ConfigMap and Secret
Volumes
StatefulSets



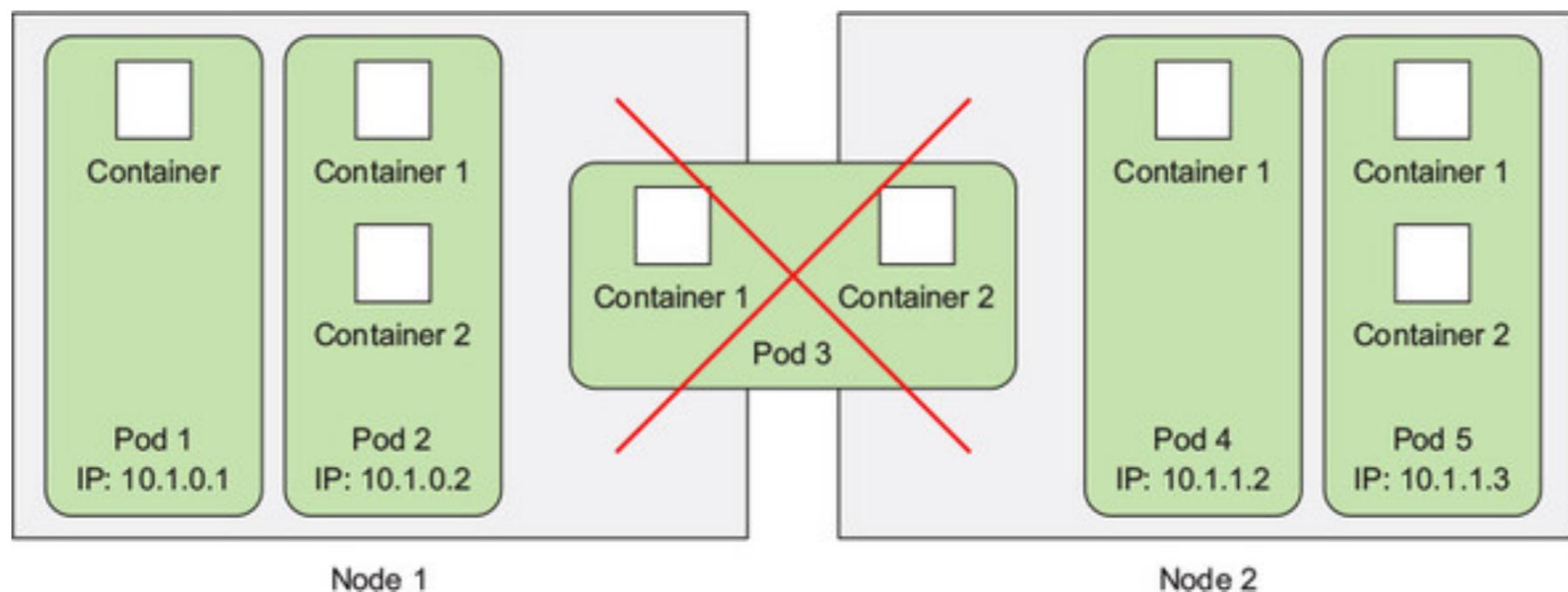
Pods

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



Pods

1 pods = 1 container
1 pods = N containers



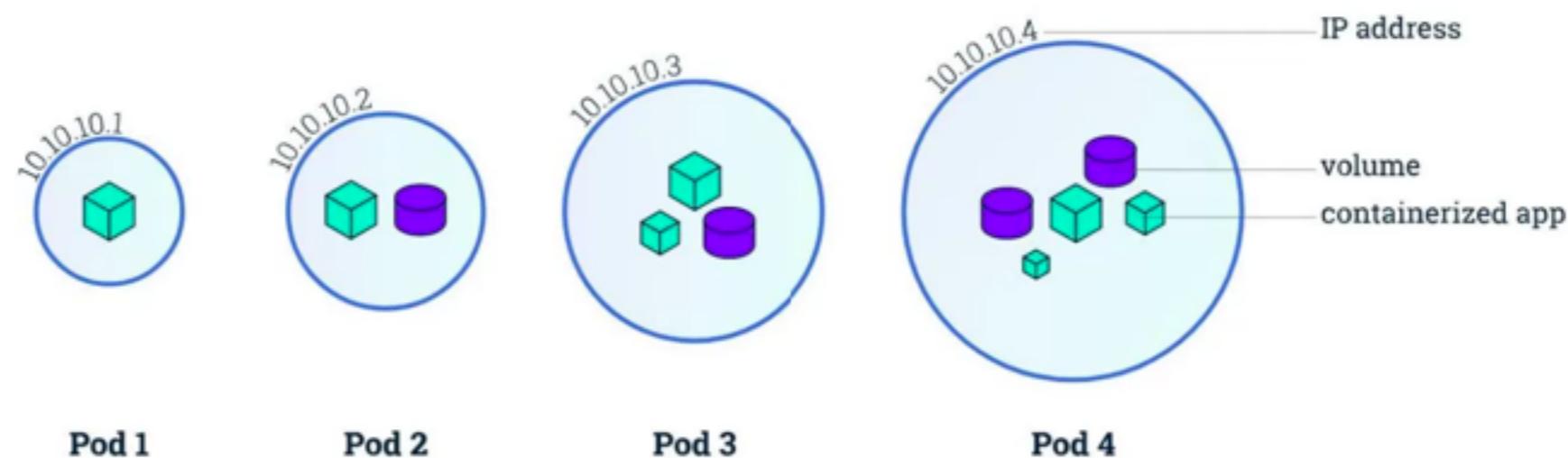
All containers in same Pods

Share process ID

Share network interface

Share Hostname/IP/Port

Share Unix Time Sharing (UTS)



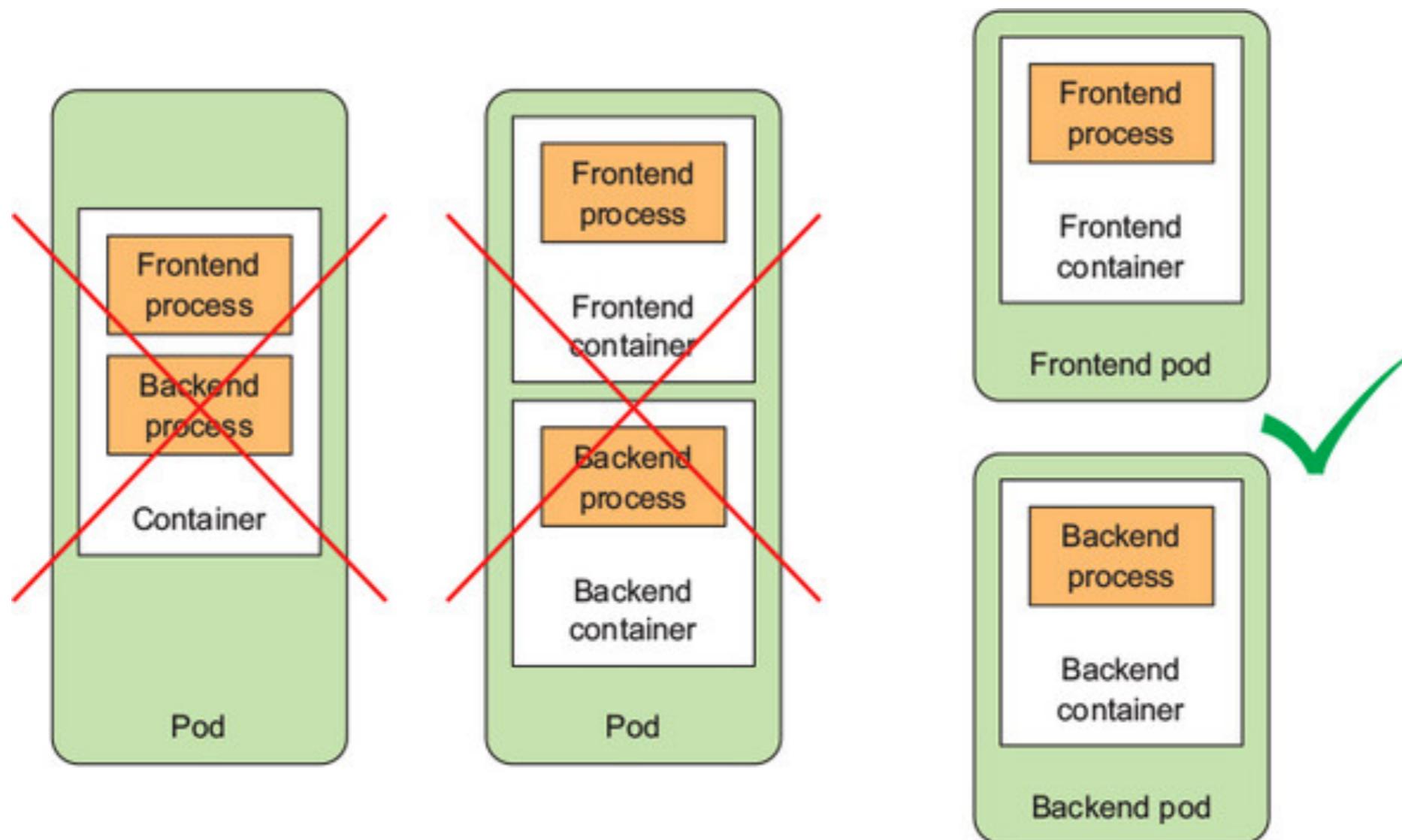
Pods Life Cycle

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/start/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



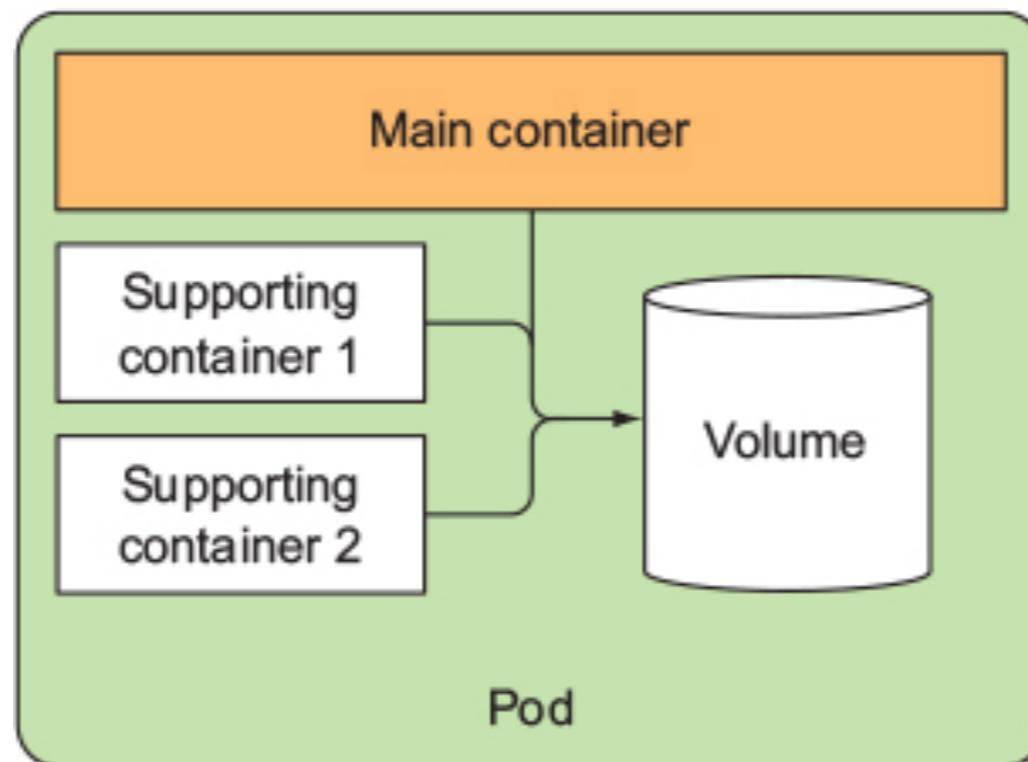
Organize container across Pods

Split multi-tiers app into multiple pods

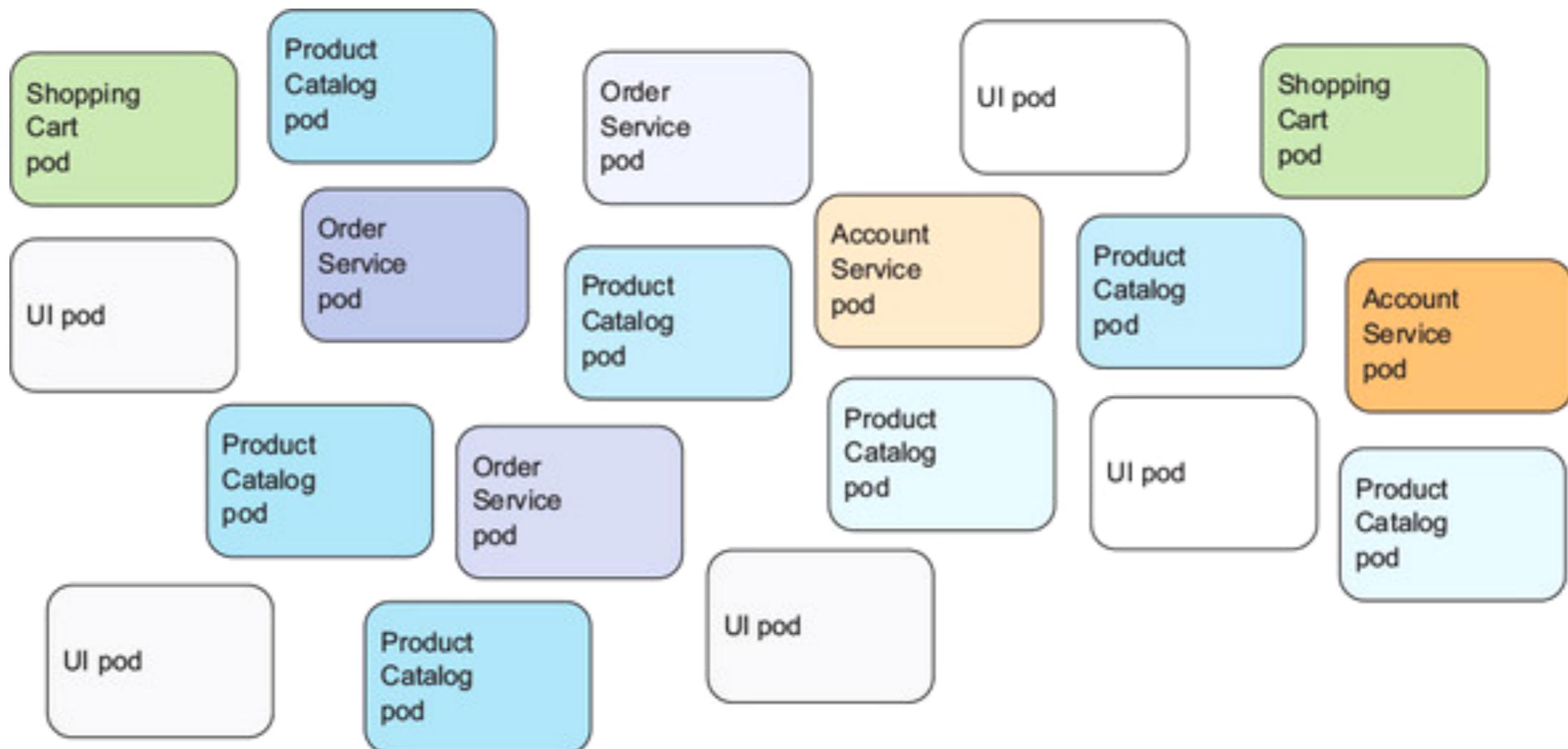


Organize container across Pods

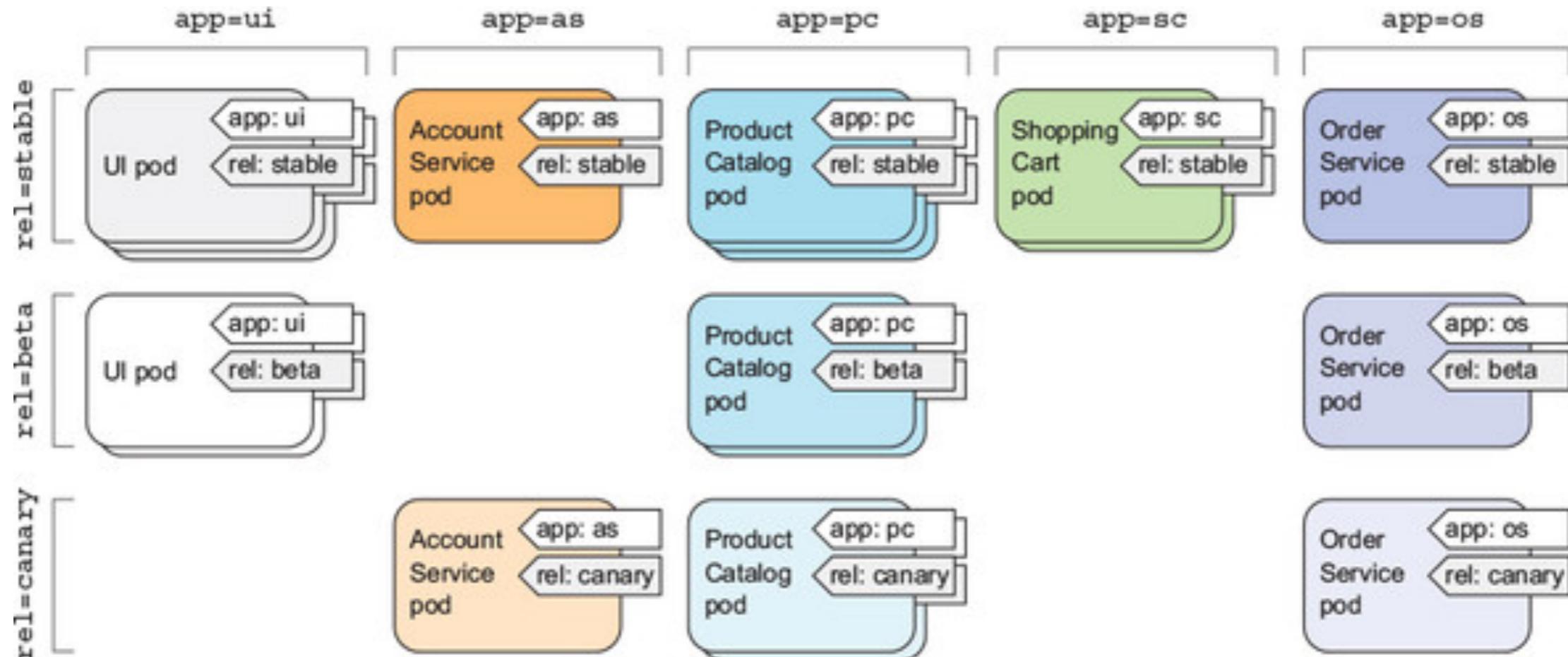
When to use multiple containers in a pods



Organize pods with Labels

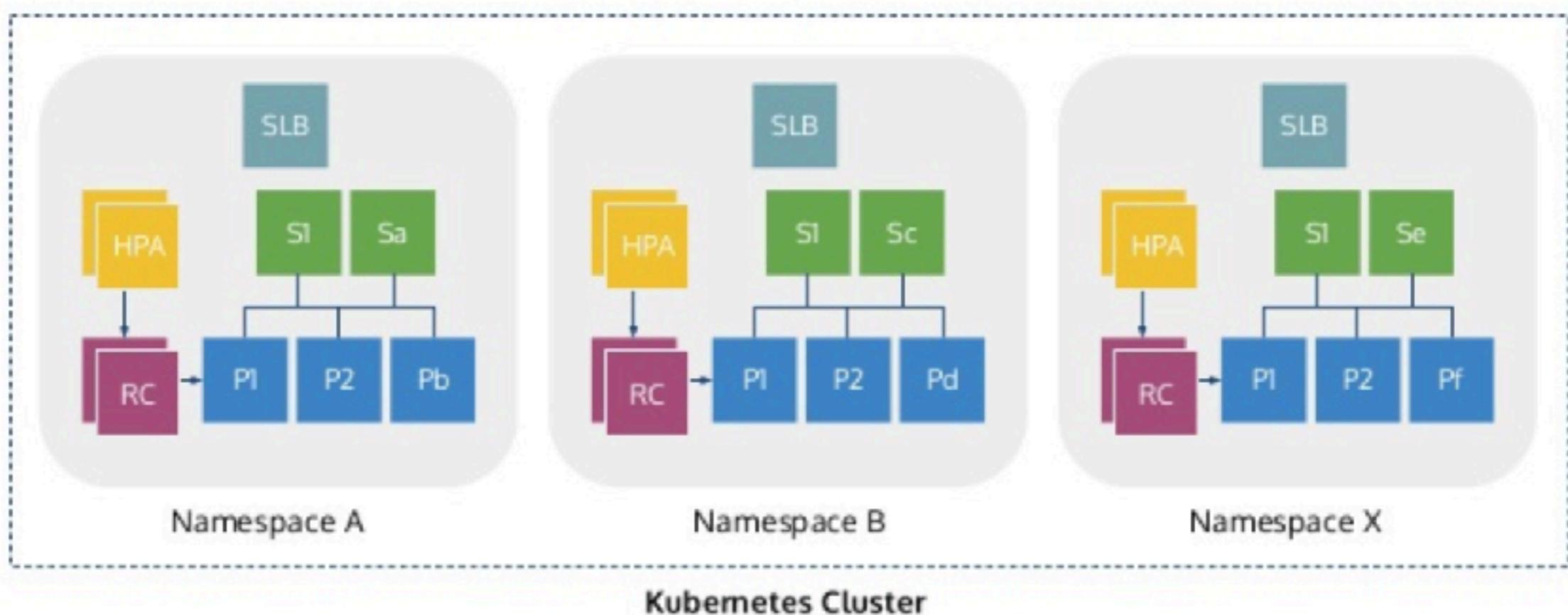


Organize pods with Labels



Pods Namespaces

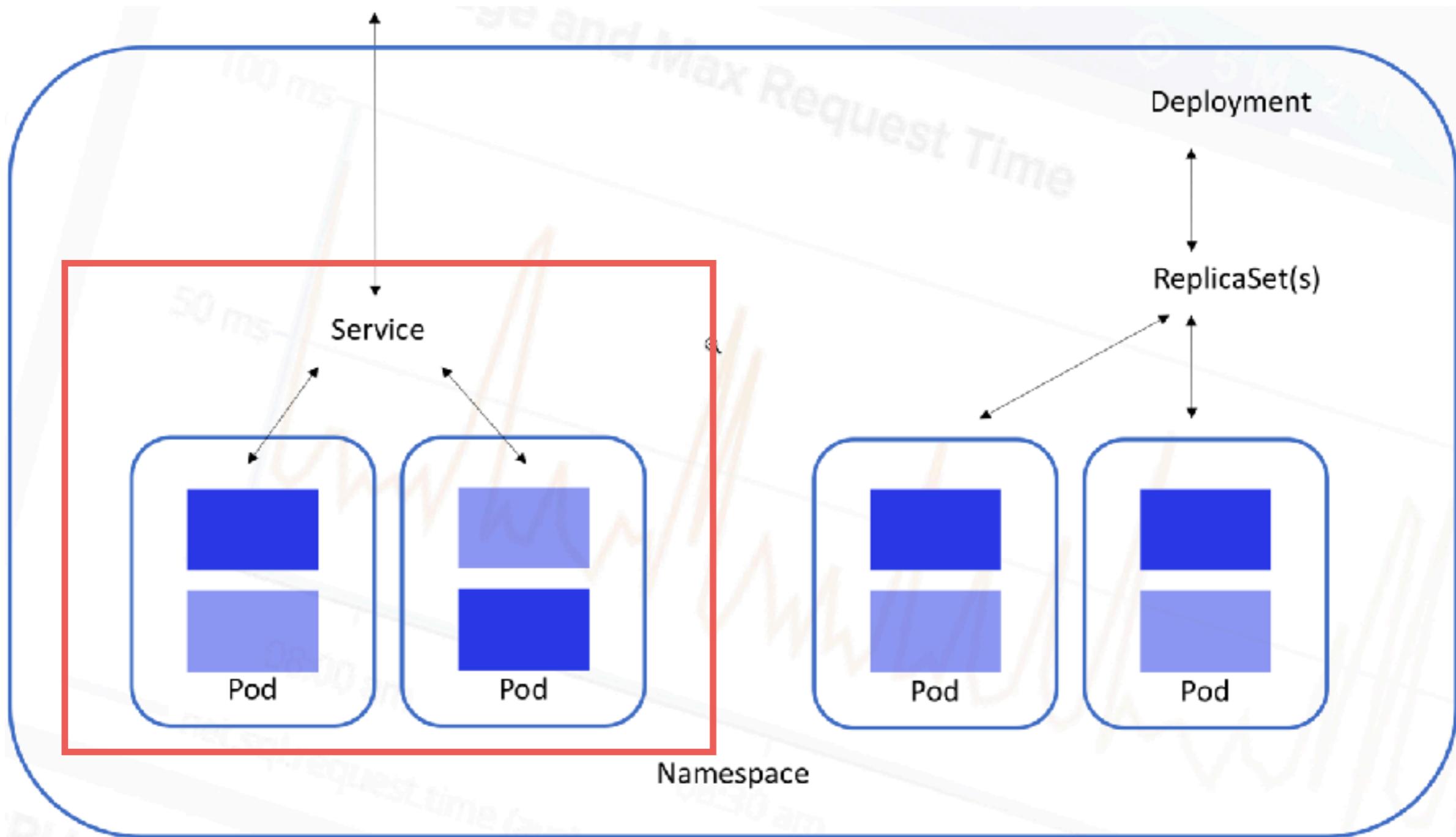
Allow different teams to use the same cluster



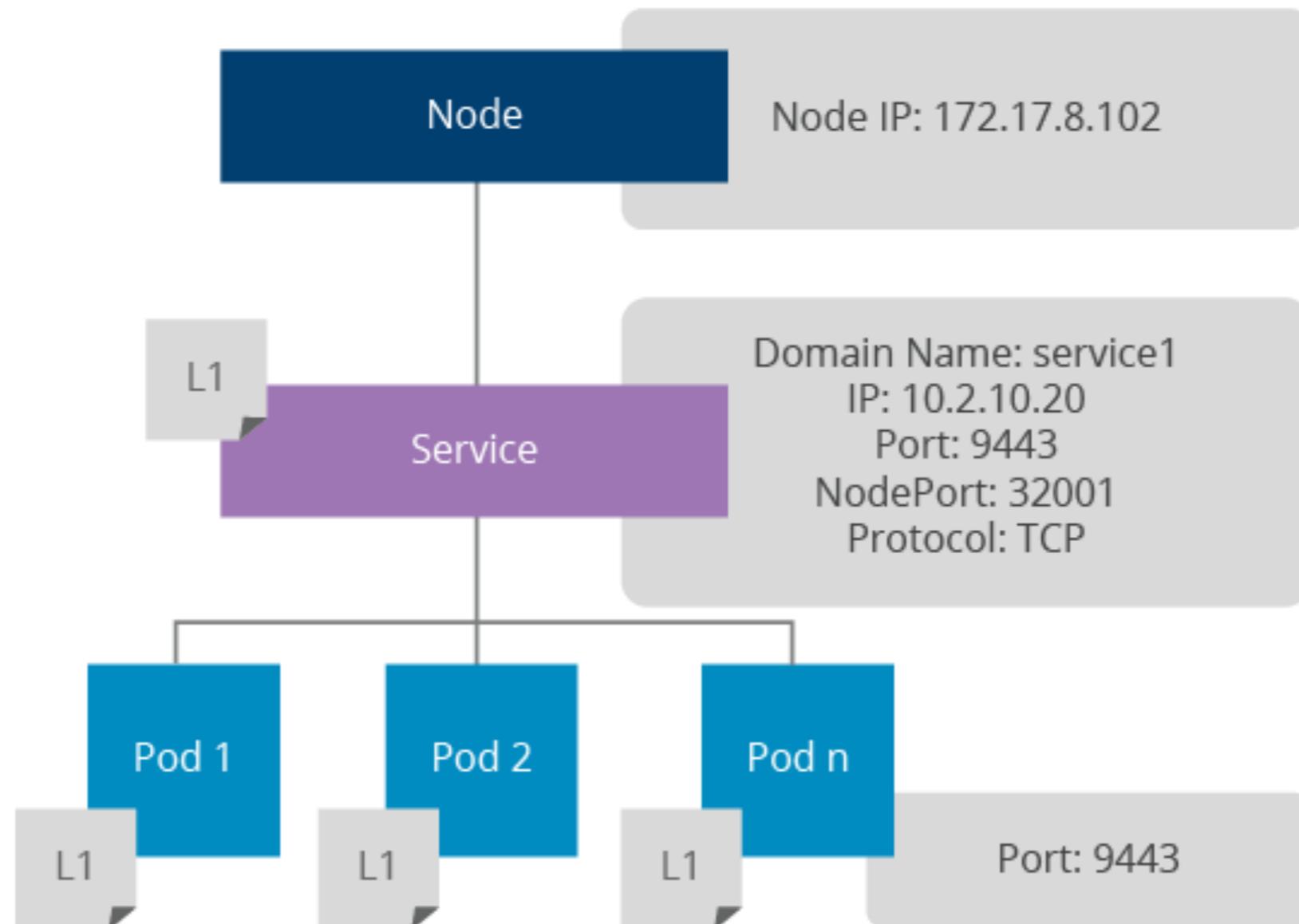
Services discovery and Load balancing



Services



Services

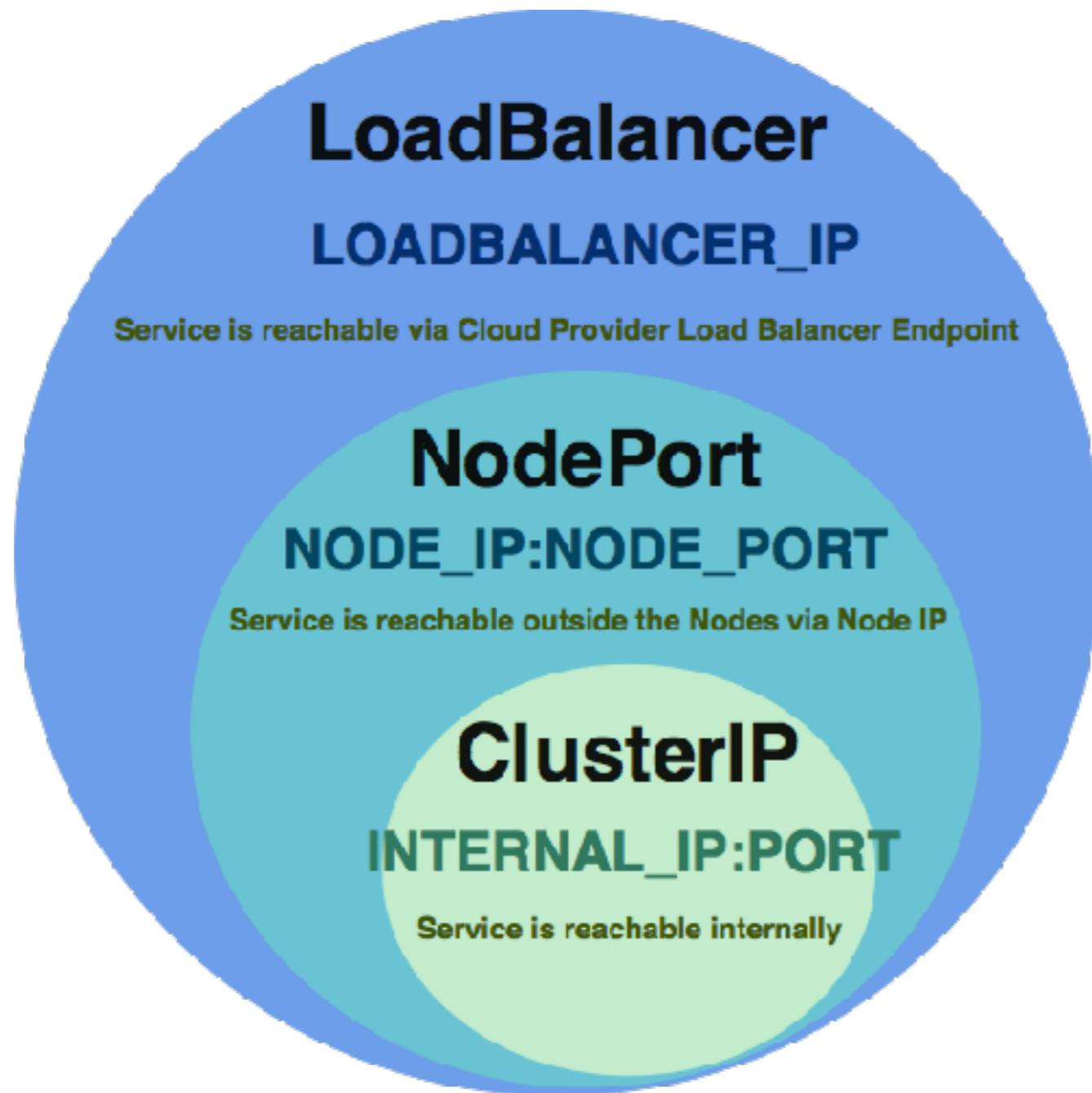


Services

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



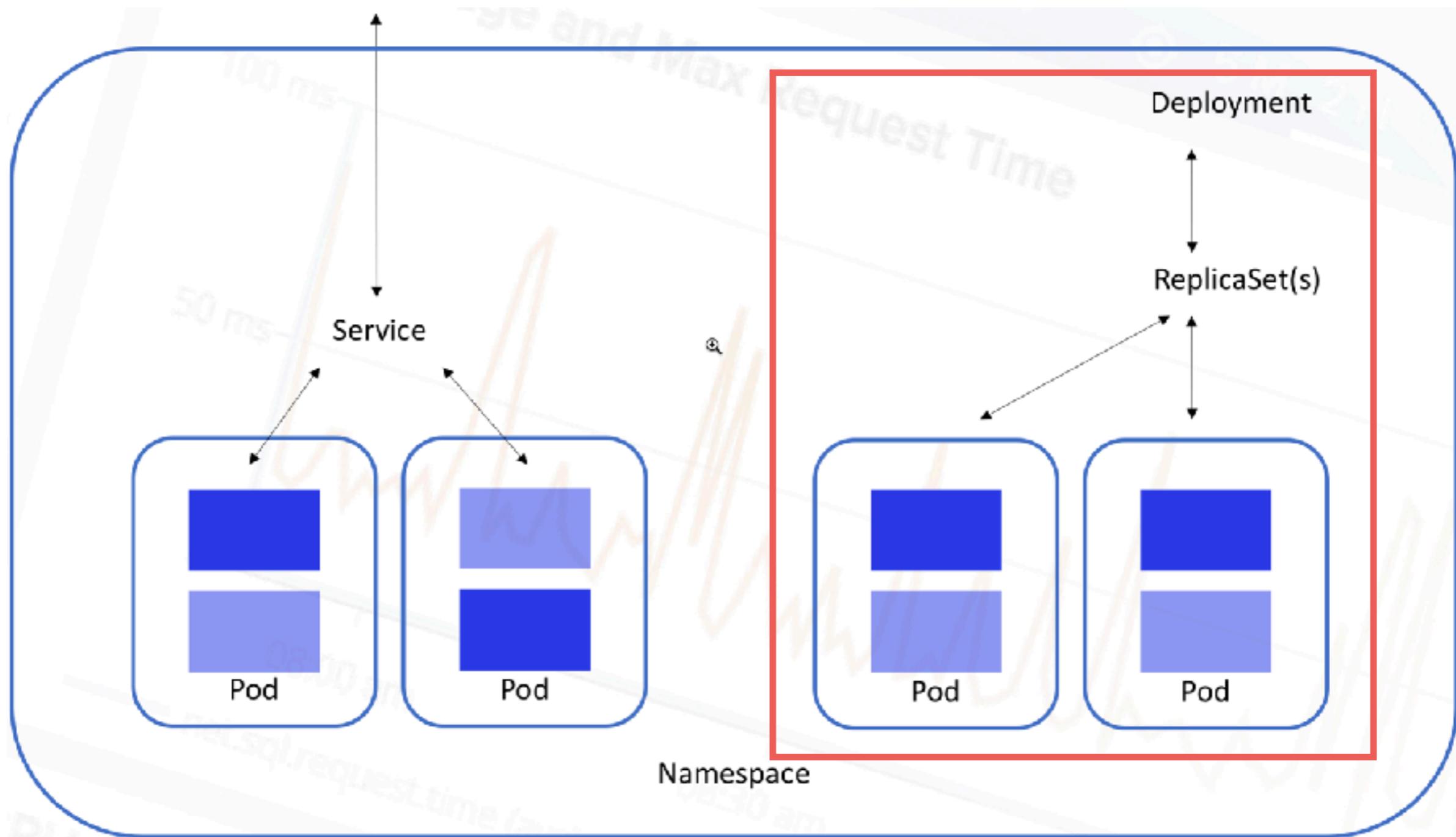
3 types of services



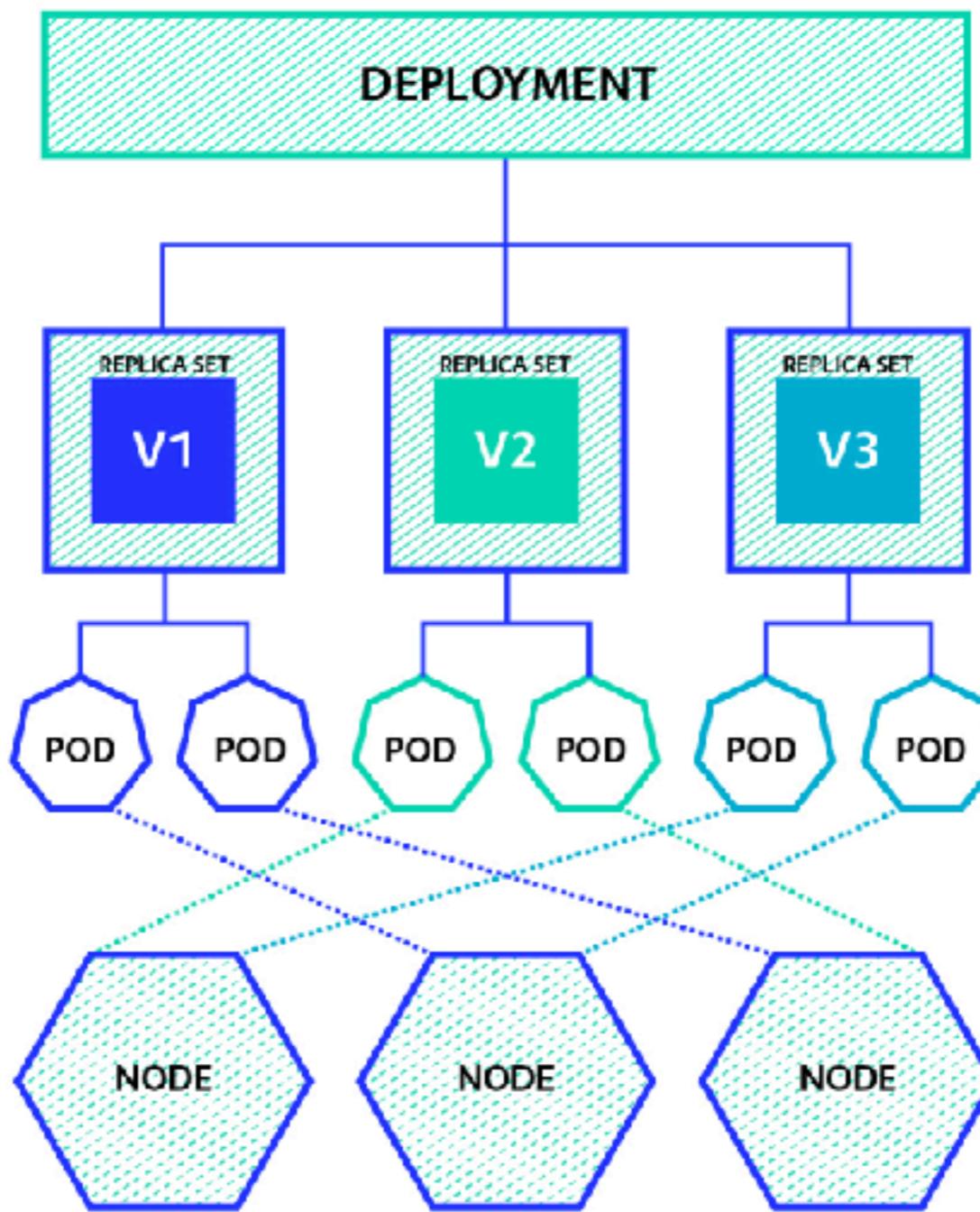
Deployment and ReplicaSet (RS)



Deployment and ReplicaSet



Deployment and ReplicaSet



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

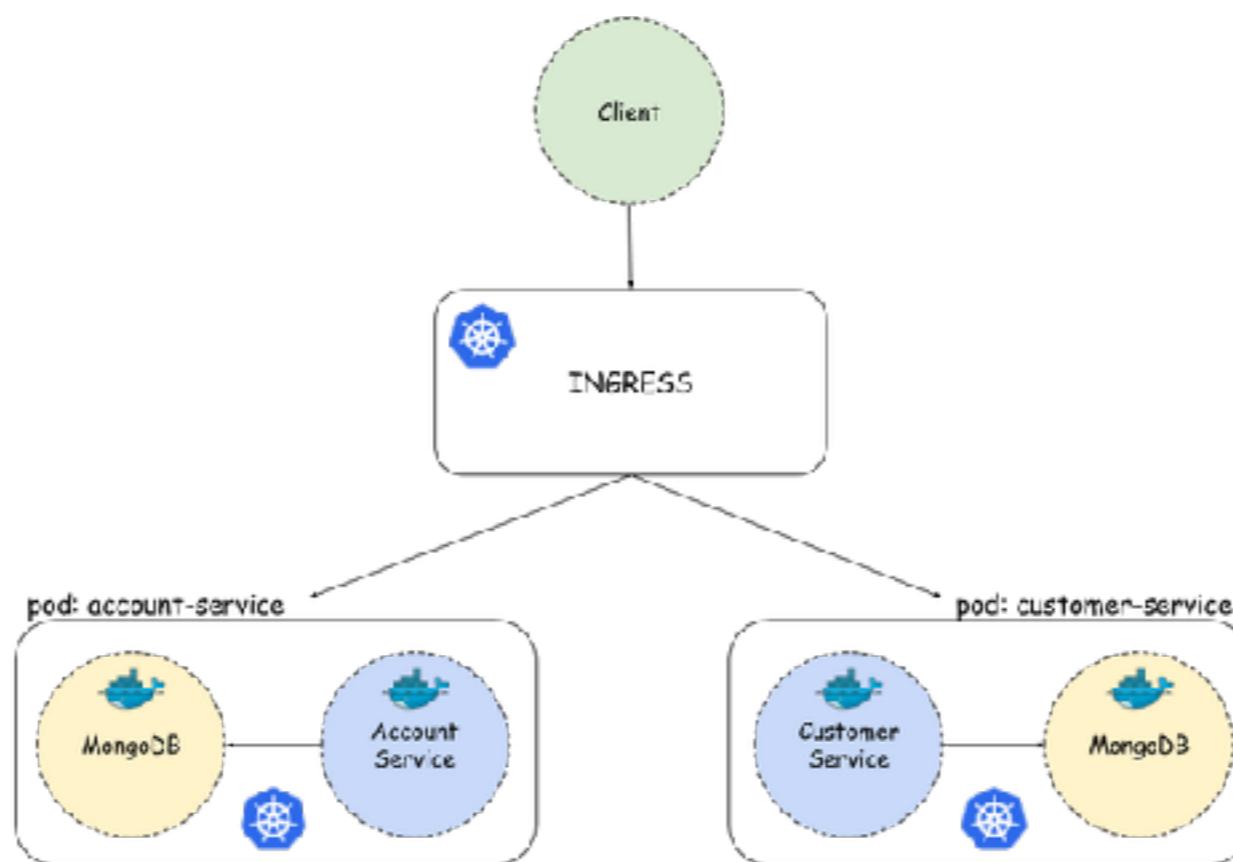


Ingress network



Ingress Network

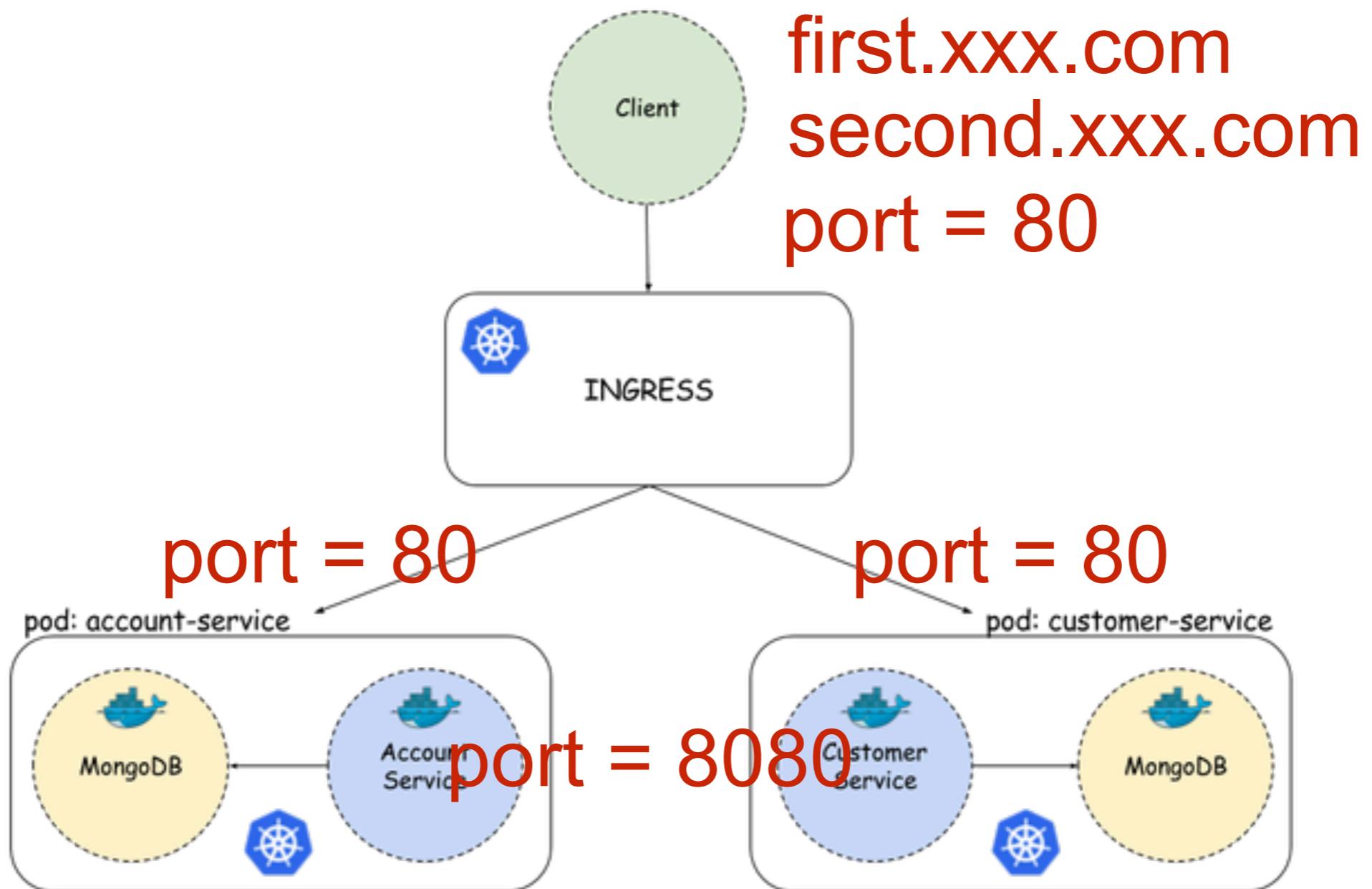
How to handle multiple services in same port ?
How to limit protocol to access ?



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



Ingress Network



StatefulSet



StatefulSet

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



StatefulSet

Stable, unique network identifiers

Stable, persistent storage

Ordered, graceful deployment and scaling

Ordered, graceful deletion and termination



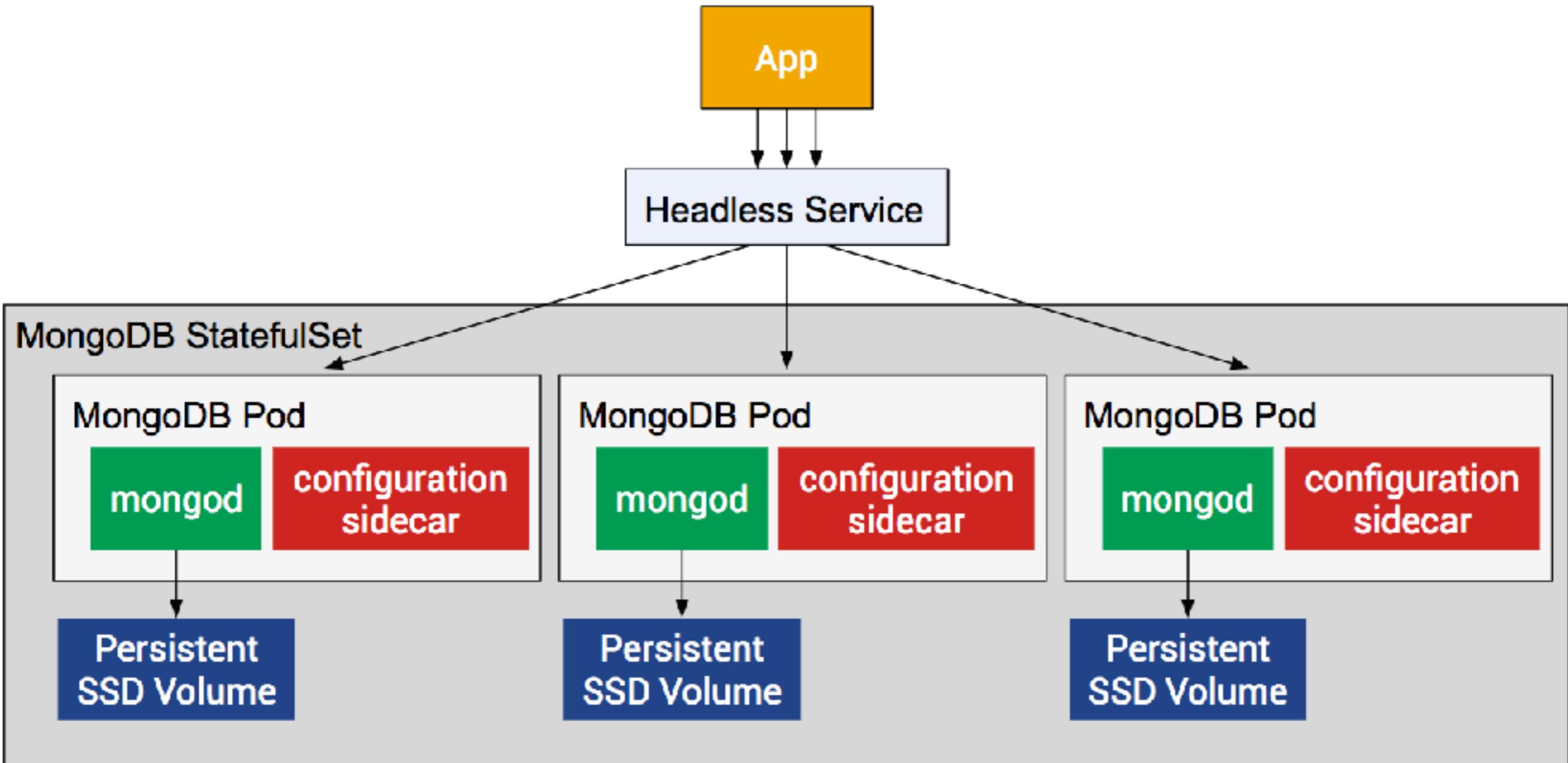
Key concepts

Pods are created sequentially

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



StatefulSet



Workshop



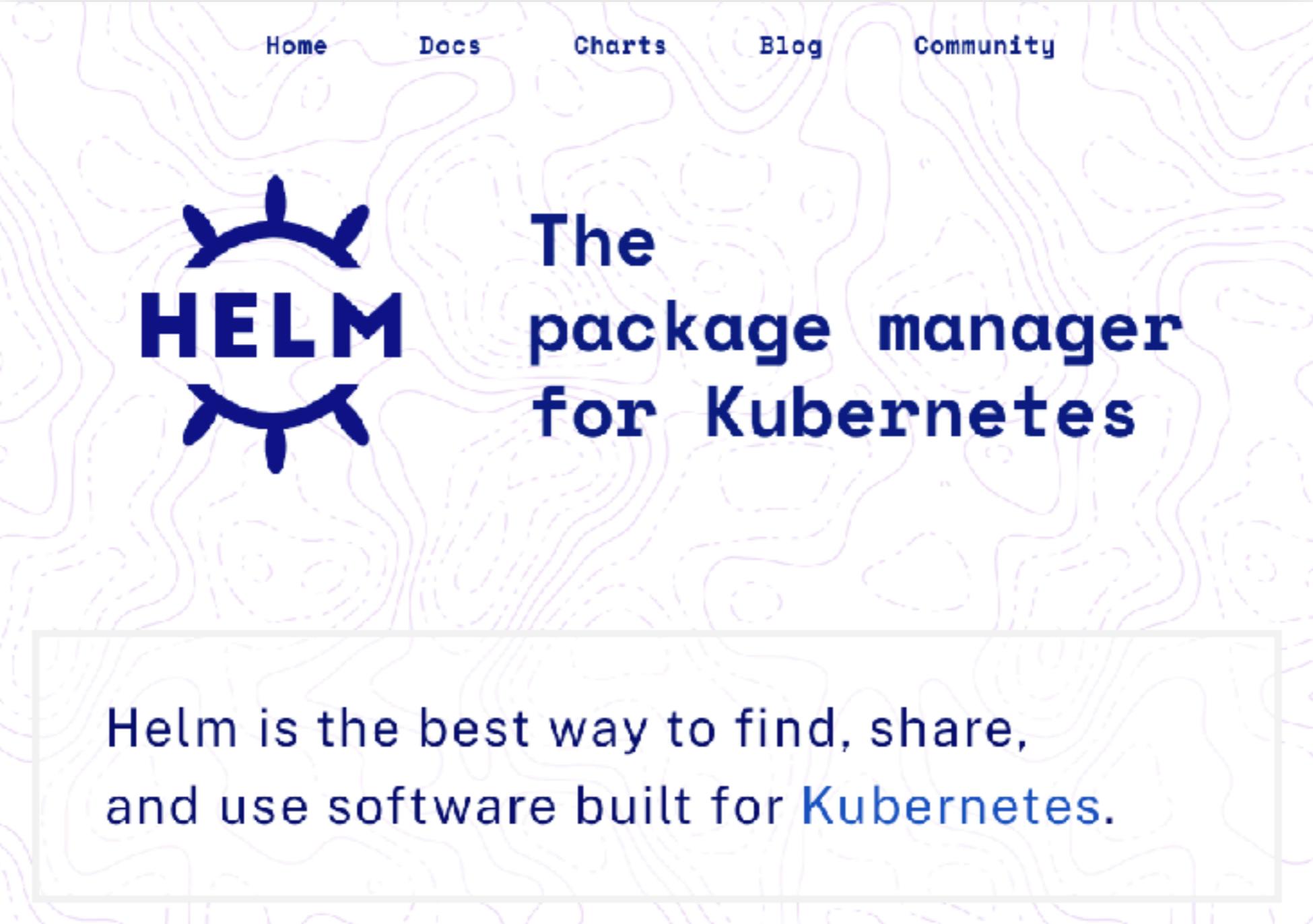
kubernetes



Working with Helm



Helm ?

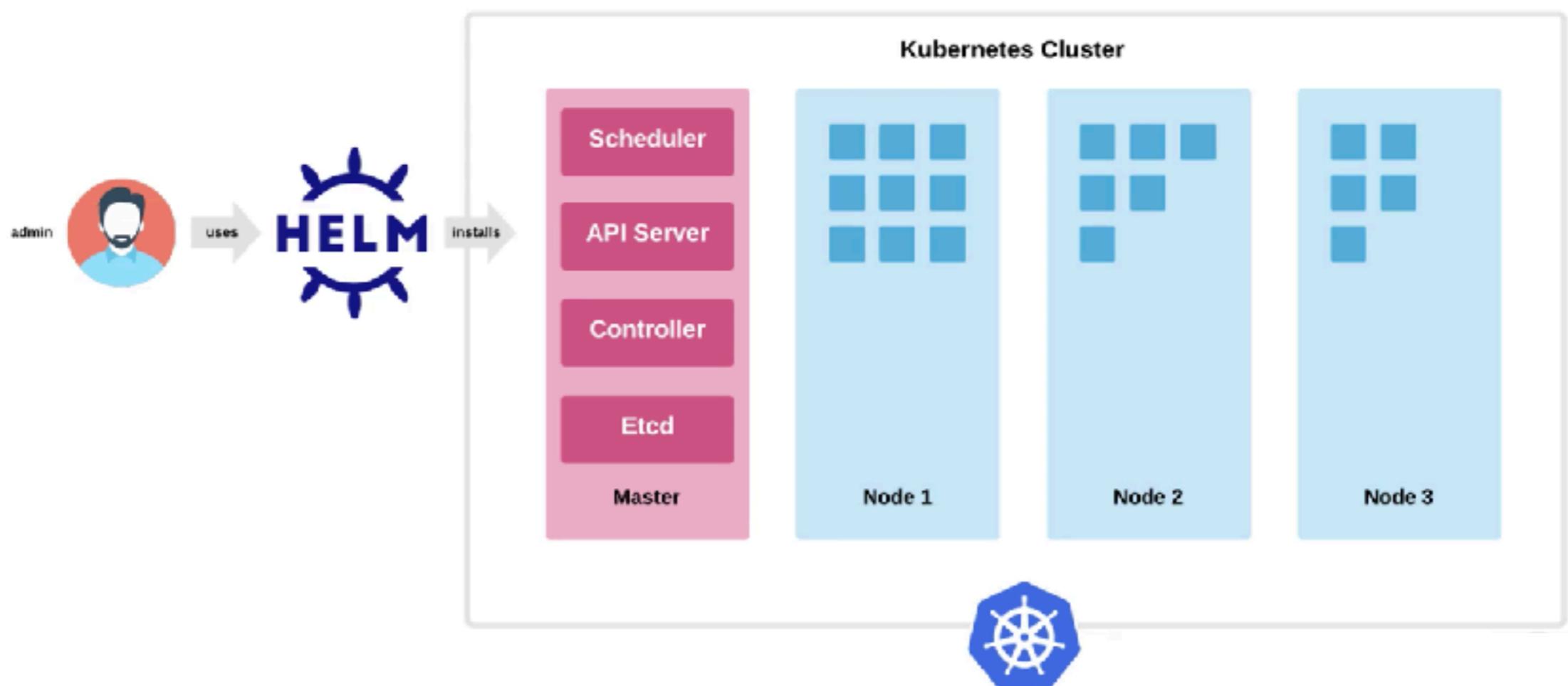


The screenshot shows the Helm project's website. At the top, there is a navigation bar with links for Home, Docs, Charts, Blog, and Community. Below the navigation bar is the Helm logo, which consists of the word "HELM" in a bold, sans-serif font inside a circular emblem that looks like a stylized sun or gear. To the right of the logo, the text "The package manager for Kubernetes" is displayed in a large, bold, dark blue font. At the bottom of the page, within a white rectangular box with a thin gray border, is the text "Helm is the best way to find, share, and use software built for Kubernetes." in a dark blue font.

<https://helm.sh/>



Package manager for K8s

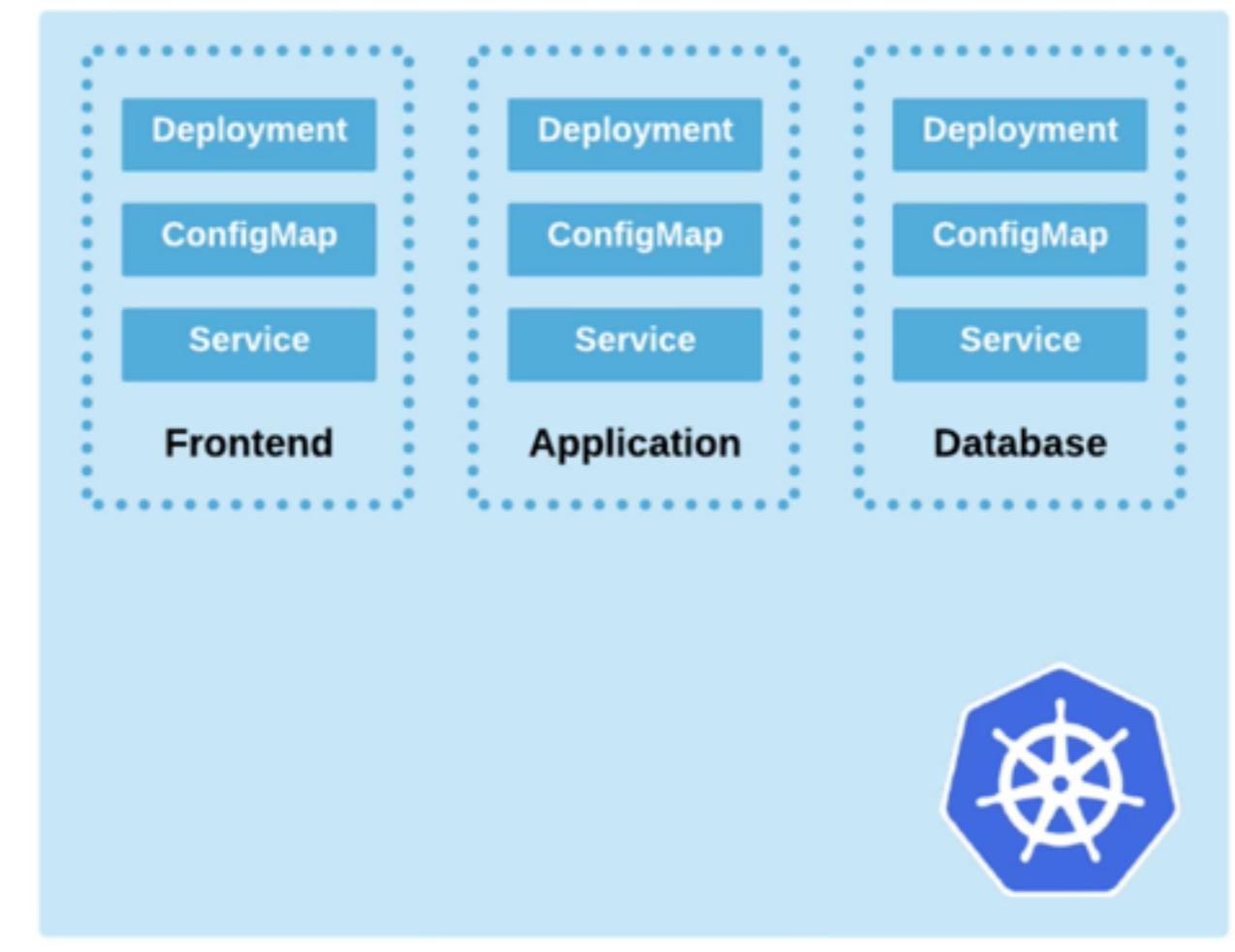


Why Helm ?

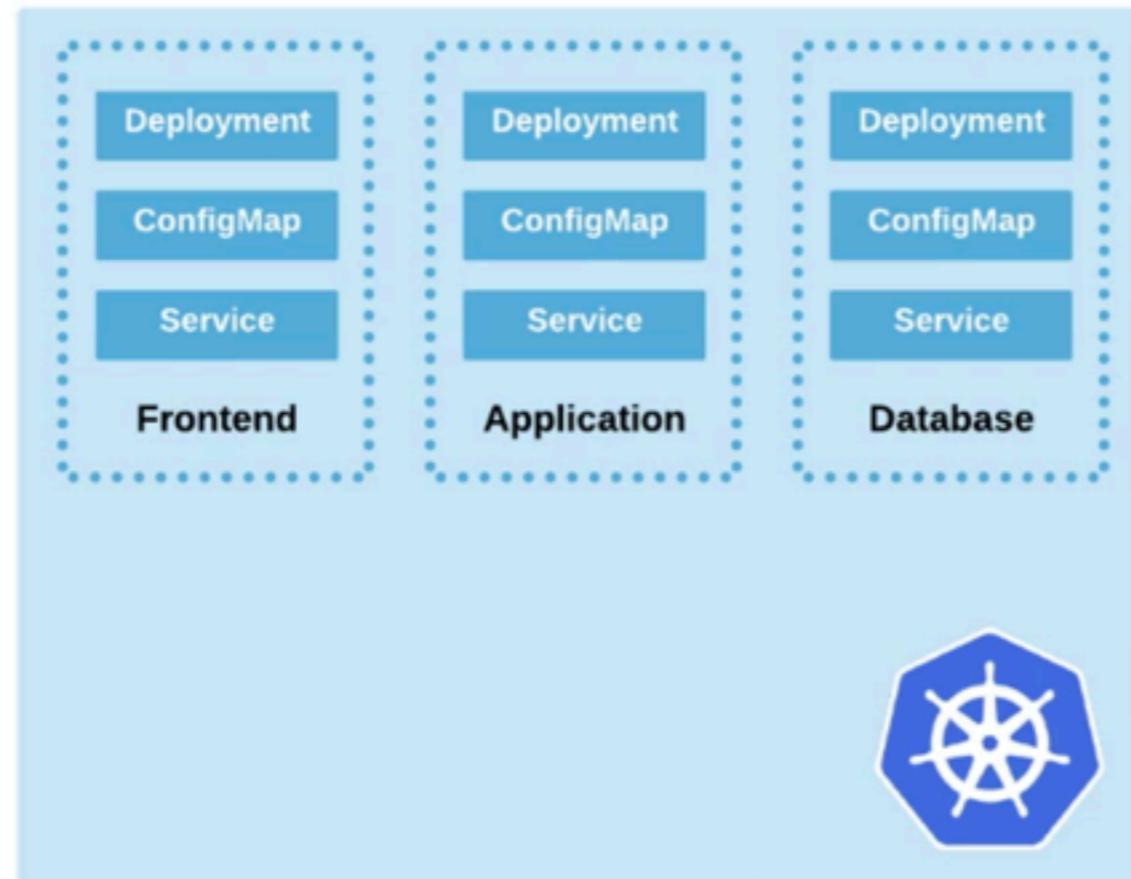
Hard to manage multiple K8s configurations
Hard to deploy multiple K8s configurations
Hard to share and reuse K8s configurations
Hard to parameterise and support multiple environments



K8s resources



K8s resources



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



Why Helm ?

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

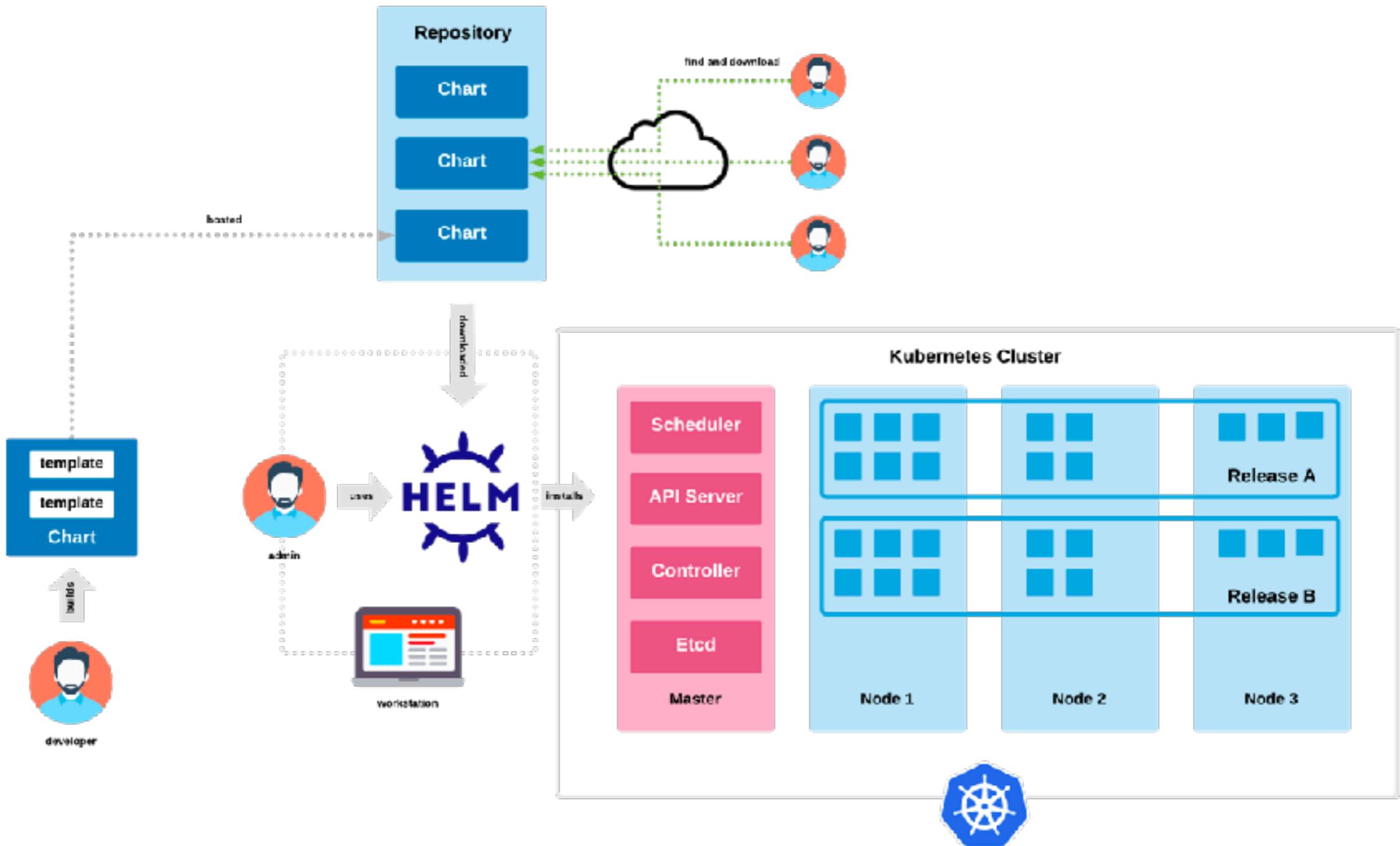
Hard to define deployment life cycle
Hard to validate release state after deployment



Helm make it easy to start Using K8s with real application



Welcome to Helm



What Helm ?

Helm is a **Package Manager** for Kubernetes

Package multiple K8s resources into a single logical deployment unit

Called “**Chart**”



What Helm ?

Helm is a **Deployment management** for Kubernetes

Repeat deployment

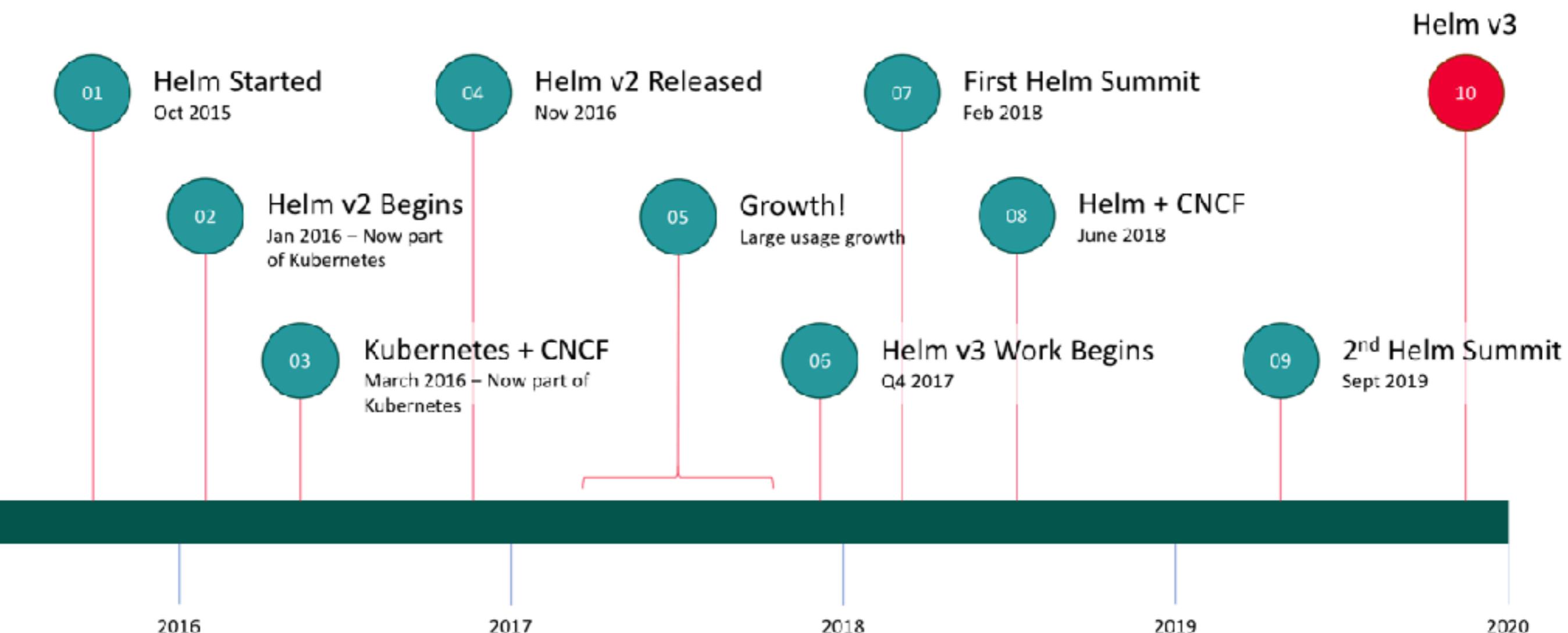
Management dependencies (reuse/share)

Manage multiple configurations

Update/rollback and test application deployments

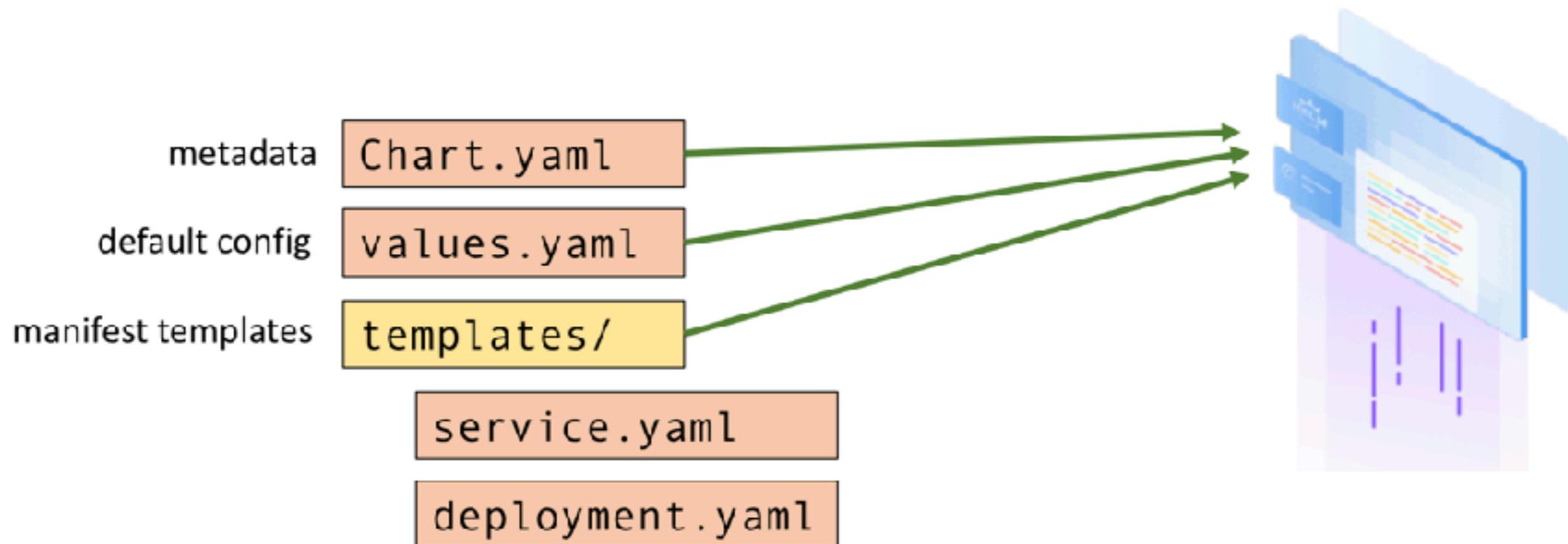


Helm History



Helm Charts

Helm packages are referred to as “Charts”
Collections of files at well-known locations



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



Helm Vocabulary

Repository

A repository of published Charts

Template

K8s configuration file mixed with Go/Sprig template



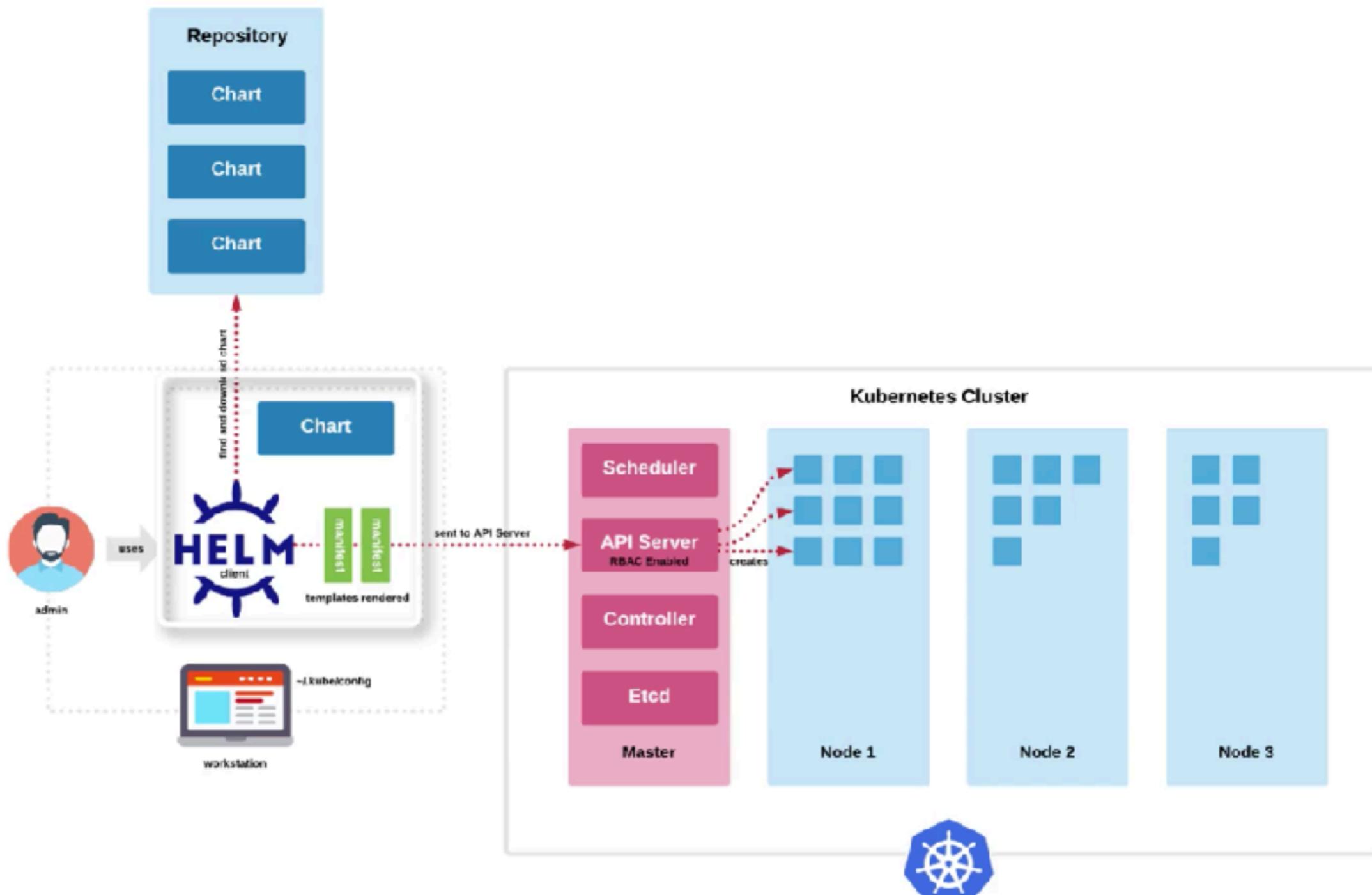
Artifact Hub

The screenshot shows the homepage of Artifact Hub. At the top left is the logo "Artifact HUB" with a beta badge. Top right features "SIGN UP" and "SIGN IN" buttons, along with a user icon. The main heading "Find, install and publish Kubernetes packages" is centered. Below it is a search bar with placeholder "Search packages" and a help icon. A tip below the search bar says "Tip: Use multiple words to refine your search. Example: kafka operator". Below the search area, there's a section for "sample queries" with links like "browse all packages", "Helm plugins", "OLM operators in the monitoring category", "Tekton Tasks", "QPA policies with MIT license", and "False rules for CVE". At the bottom, two large numbers are displayed: "2674 PACKAGES" and "35576 RELEASES".

<https://artifacthub.io/>



Helm Architecture



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



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



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



Helm commands



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]



Helm repository management

\$helm repo add [NAME] [URL]

\$helm repo list

\$helm repo remove [NAME]

\$helm repo update

\$helm repo index [DIR]



Helm release management

\$helm status [RELEASE]

\$helm list

\$helm history [RELEASE]

\$helm get manifest [RELEASE]



Helm chart management

\$helm create [NAME]

\$helm template [NAME] [CHART]

\$helm package [CHART]

\$helm lint [CHART]

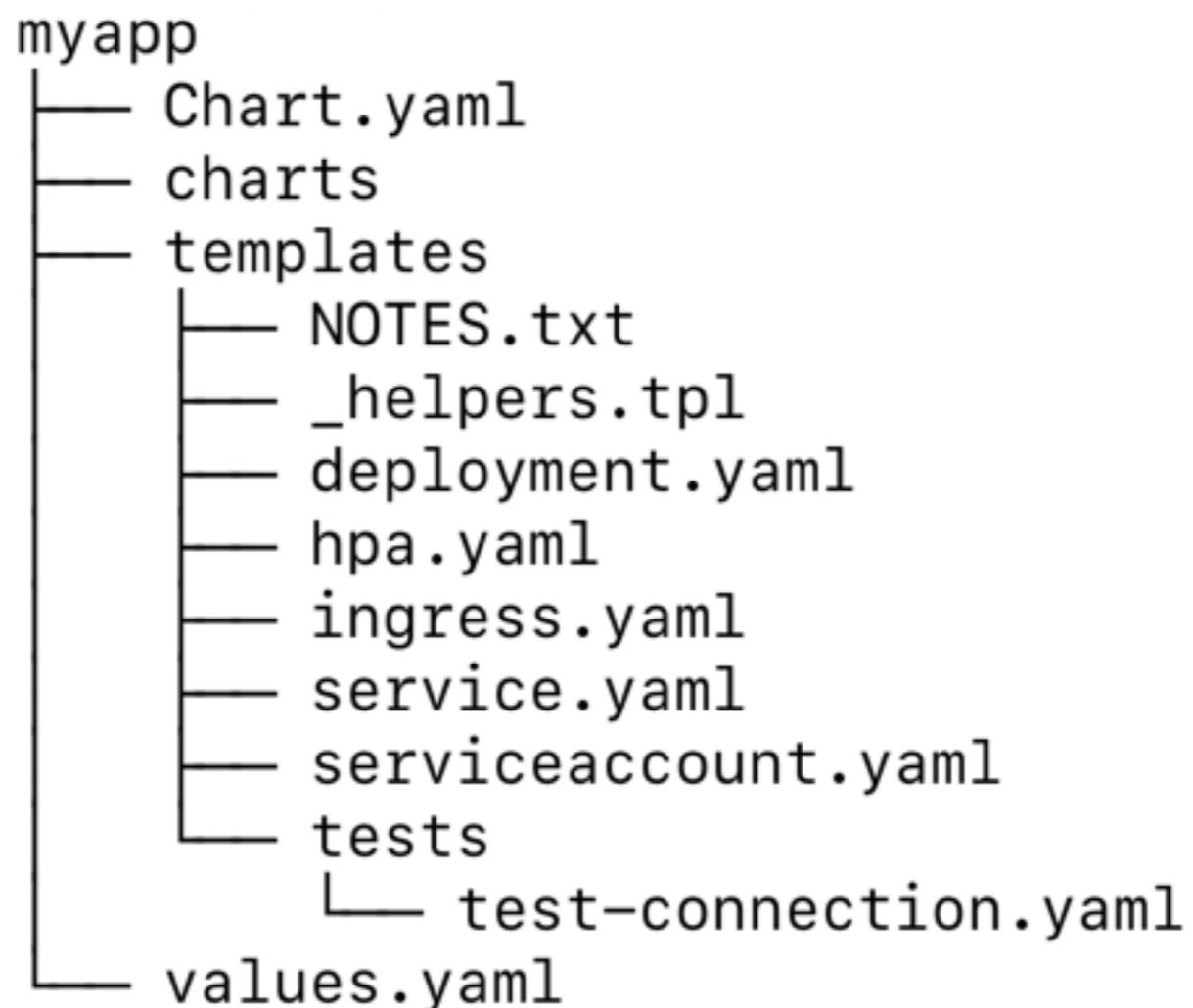


Hello Helm



Create a chart

```
$ helm create myapp
```



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`



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
```



Check status

\$helm status demo



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
```



Rollback a release

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

\$helm rollback demo <revision>

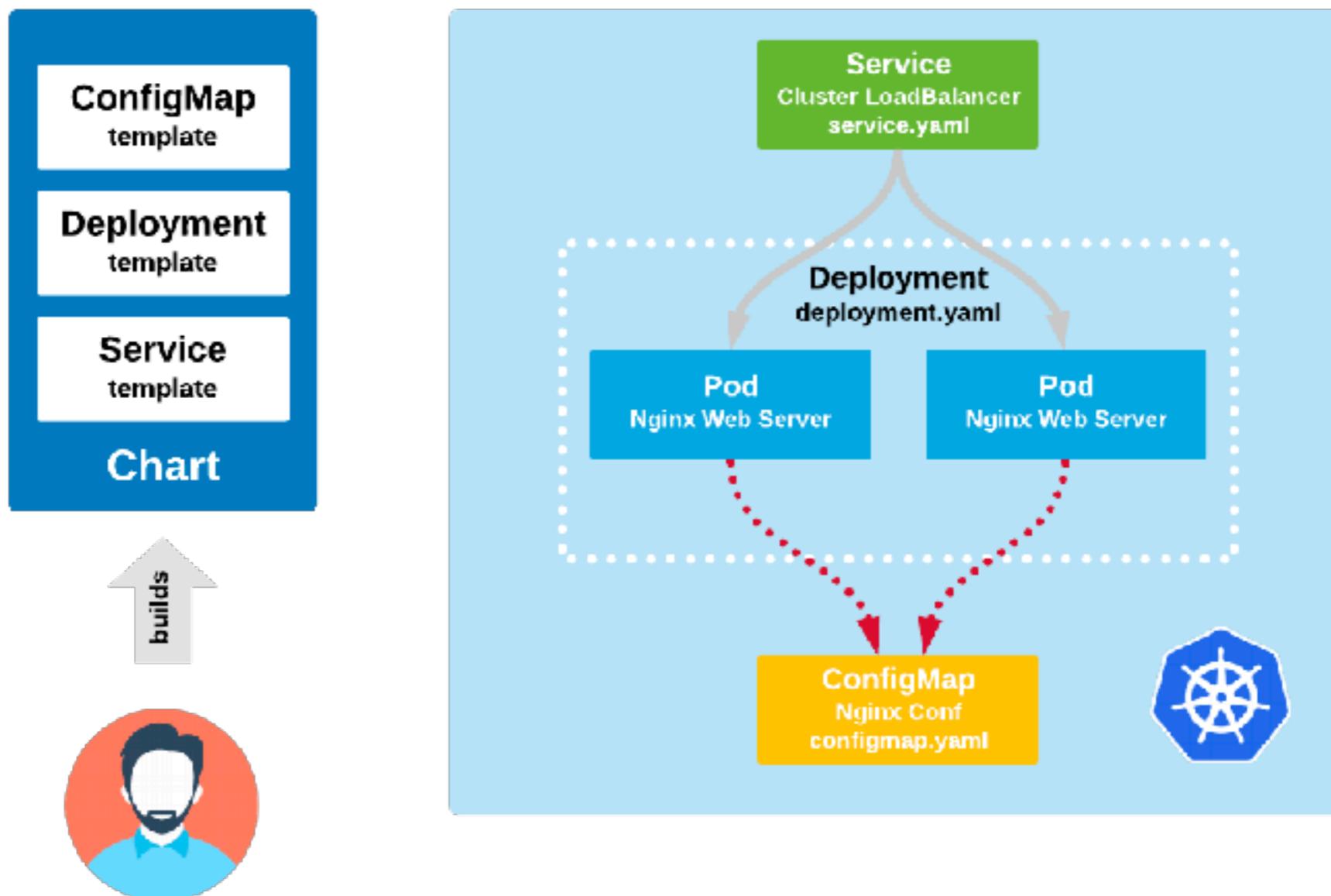


Remove a release

```
$helm delete demo
```



Helm Demo



Workshop

