Software testing in CI/CD pipelines

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Buzzword Bingo - Rules

1	2	3
Take a Bingo card	Every time you recognize a highlighted buzzword, mark it on your card	If you completed a row, column or diagonal, come over and choose a Giveaway

Agenda

- Concepts - Software testing in CI/CD pipelines
- Our goals for today
- Sample app
- Container platform
- CI/CD pipelines
- Integration testing
- End-2-End testing
- What's next?
- Recap

Concepts – Software testing

- Software tests influencing your company
- Software testing has various aspects
  - Technical aspect
  - Business aspect

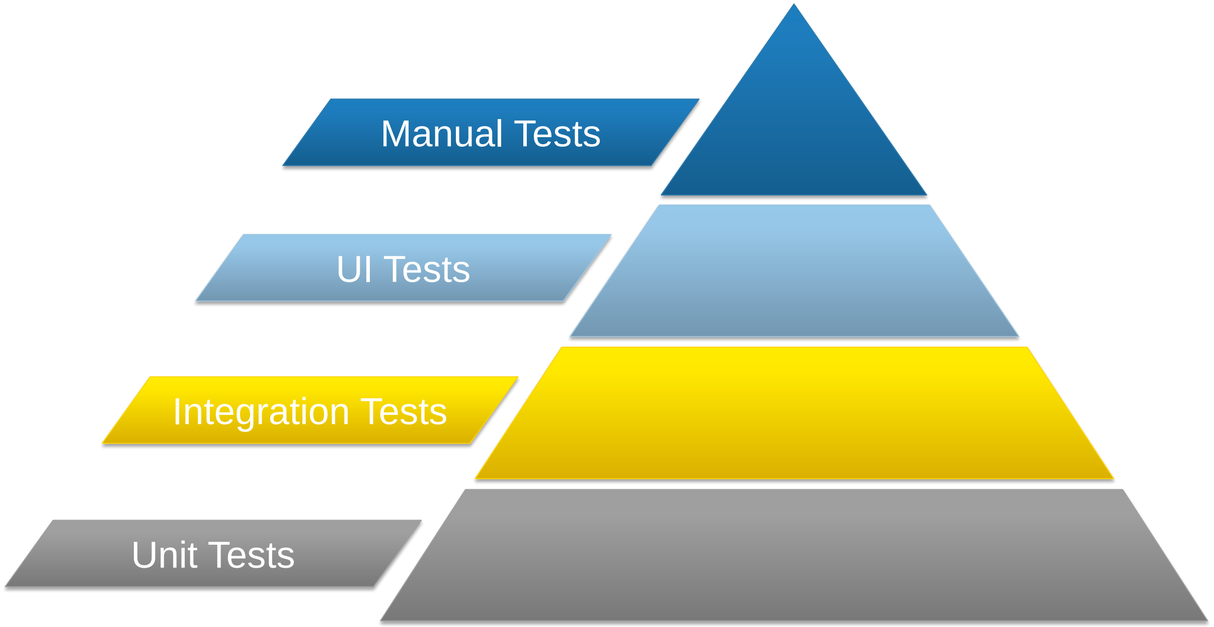
Concepts – Software testing - Technical perspective

- Ensures that your software works as expected
- Provides information about the quality of the software
- Helps identifying bugs
- Eases software changes

Concepts – Software testing – Business perspective

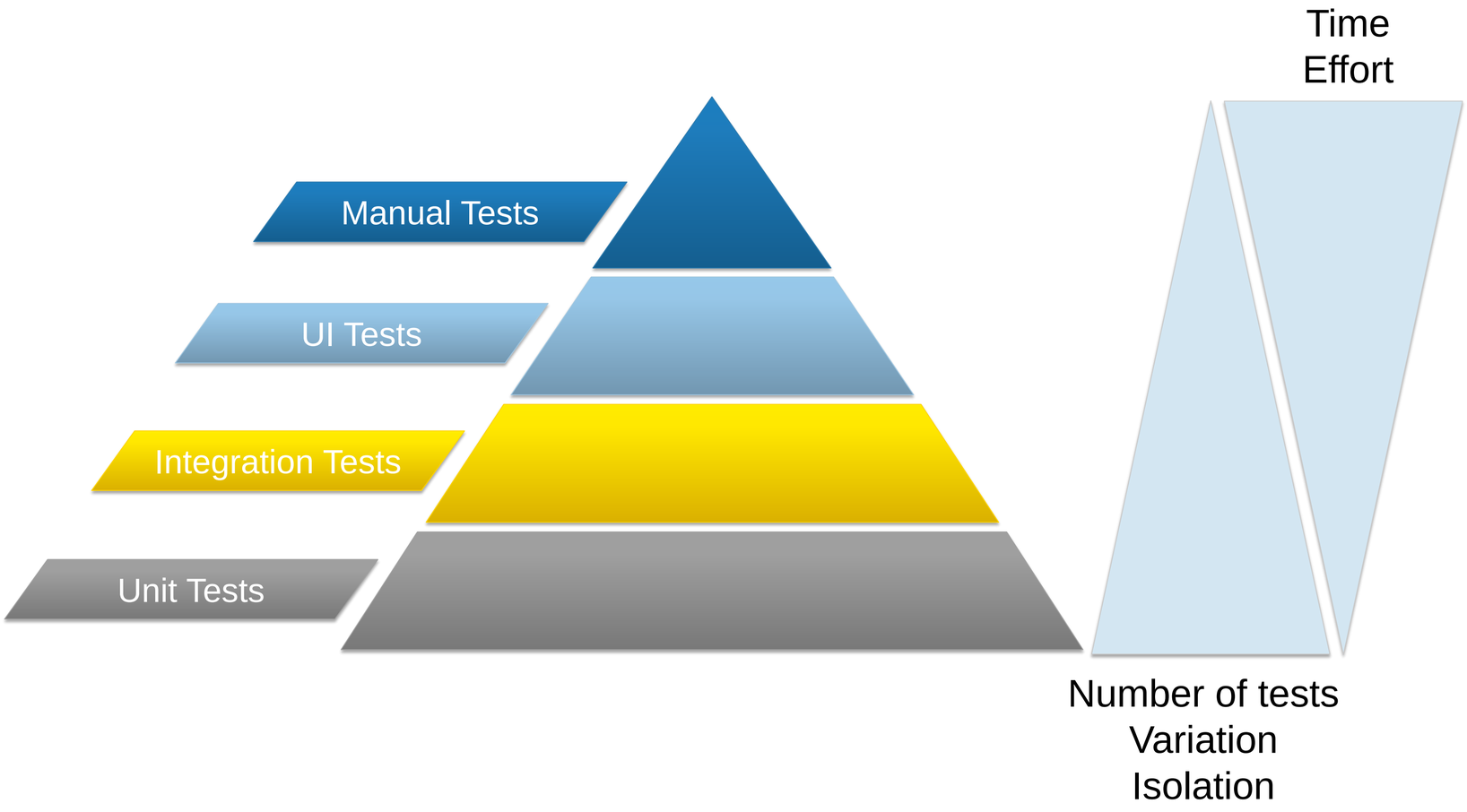
- Ensures stable revenue streams
- Increases customer satisfaction
- Lowers costs for development

Concepts – Software testing

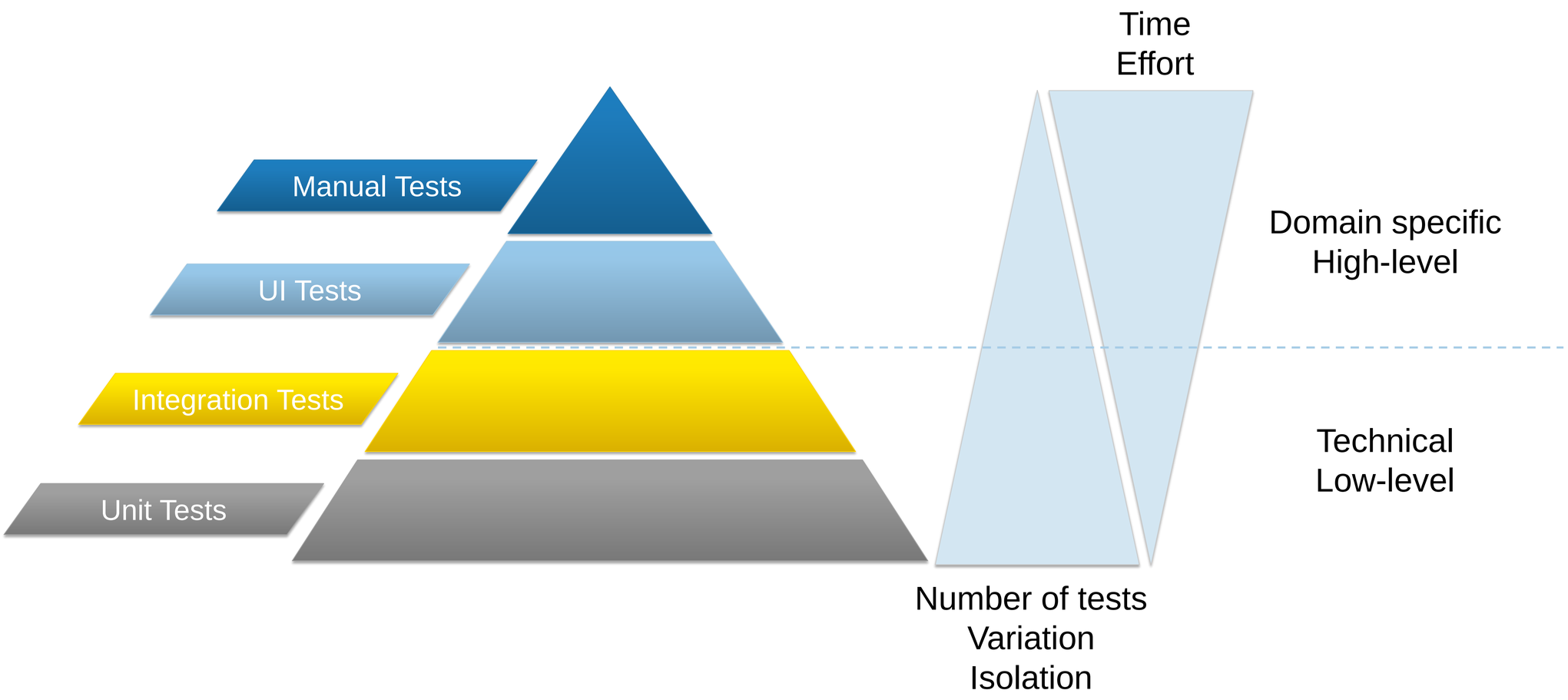


Test Pyramid

Concepts – Software testing



Concepts – Software testing



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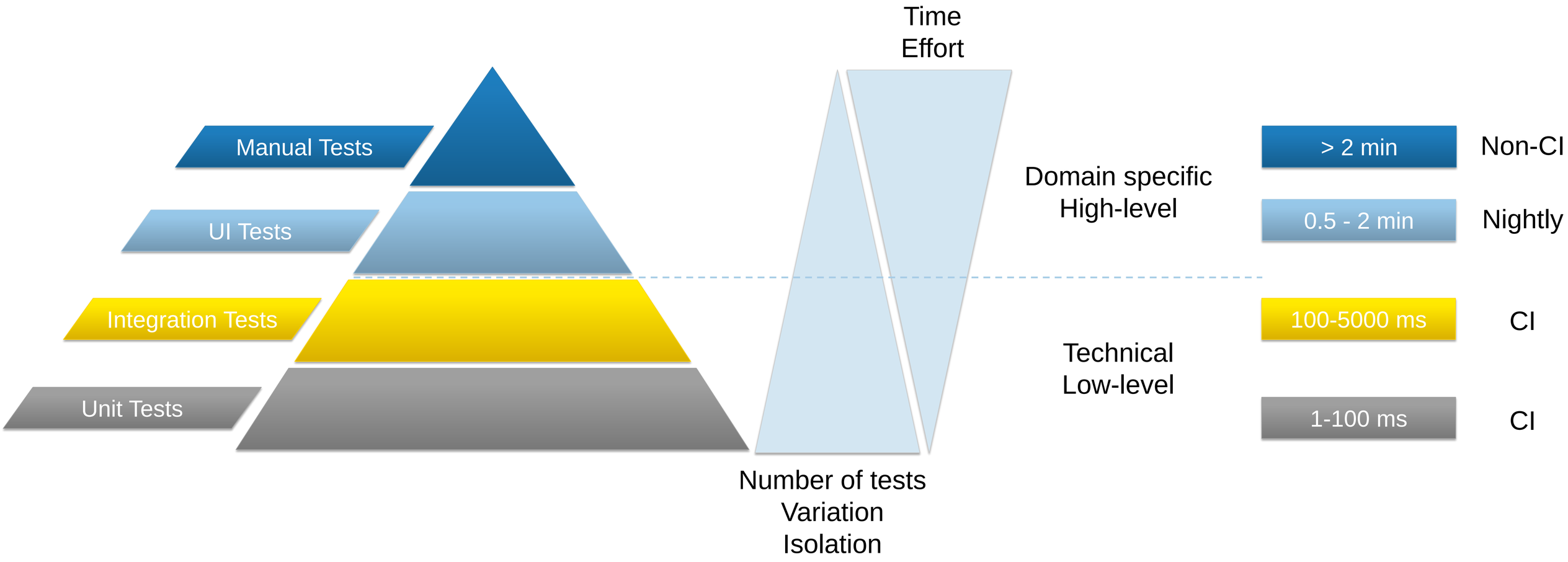
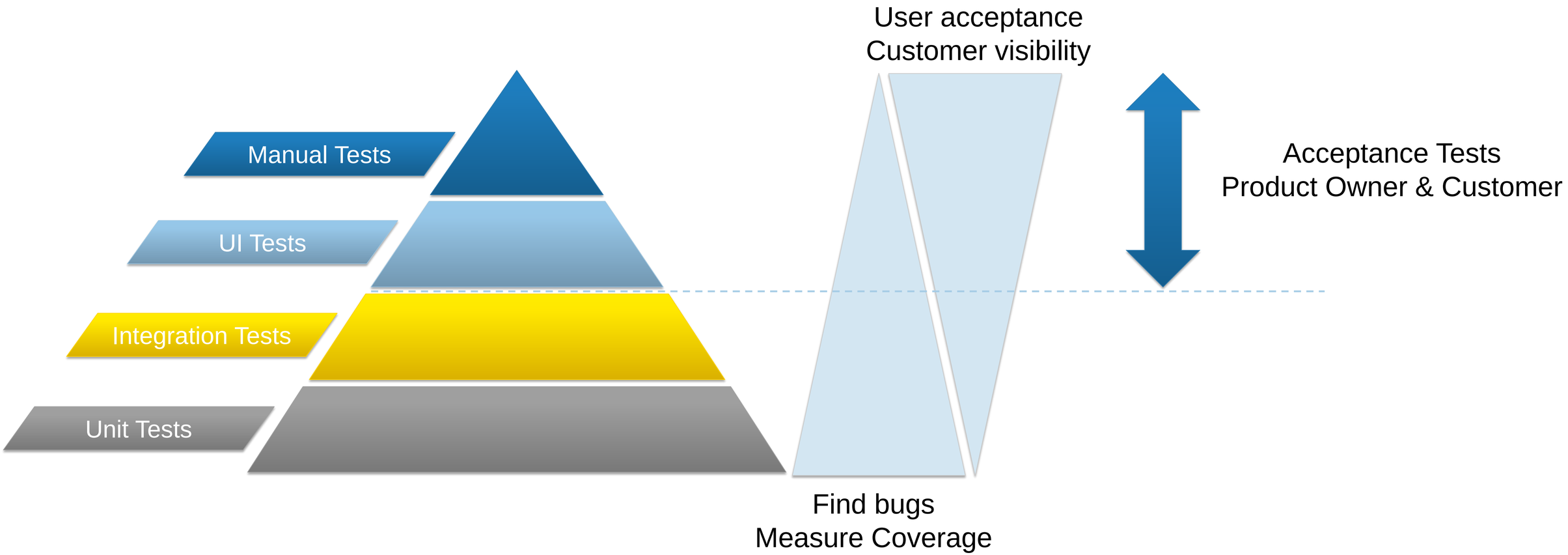
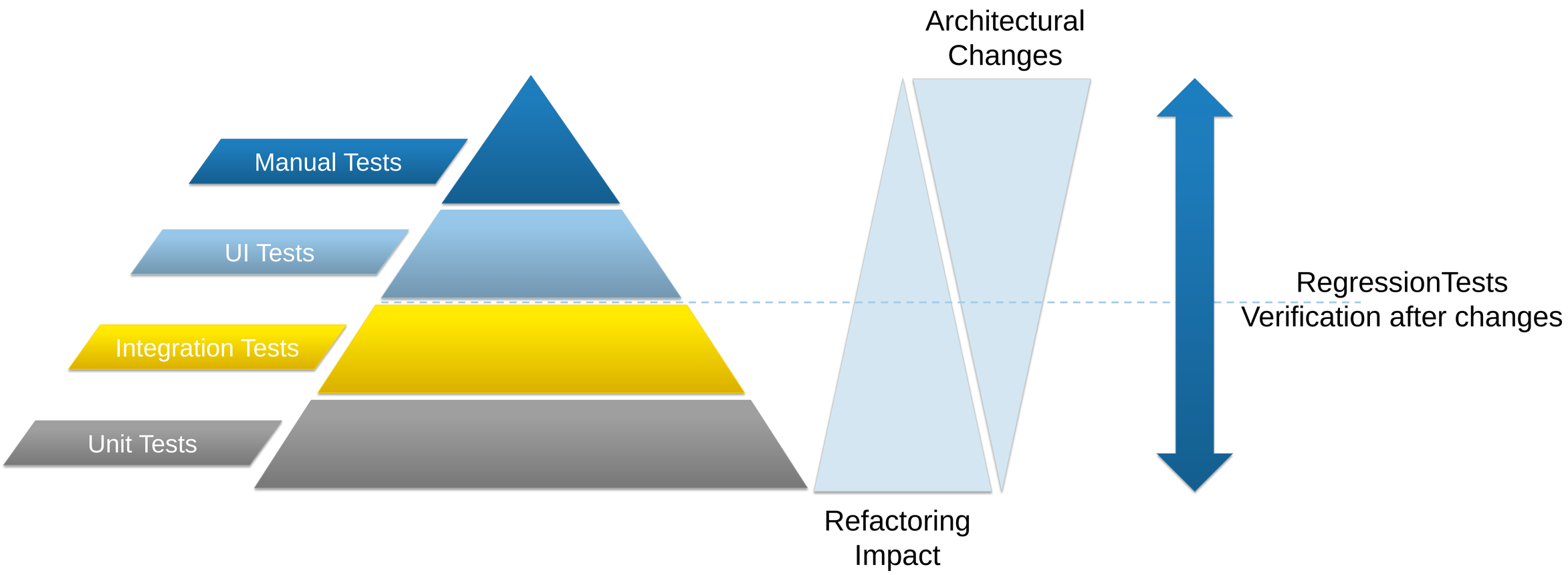


Concepts – Software testing

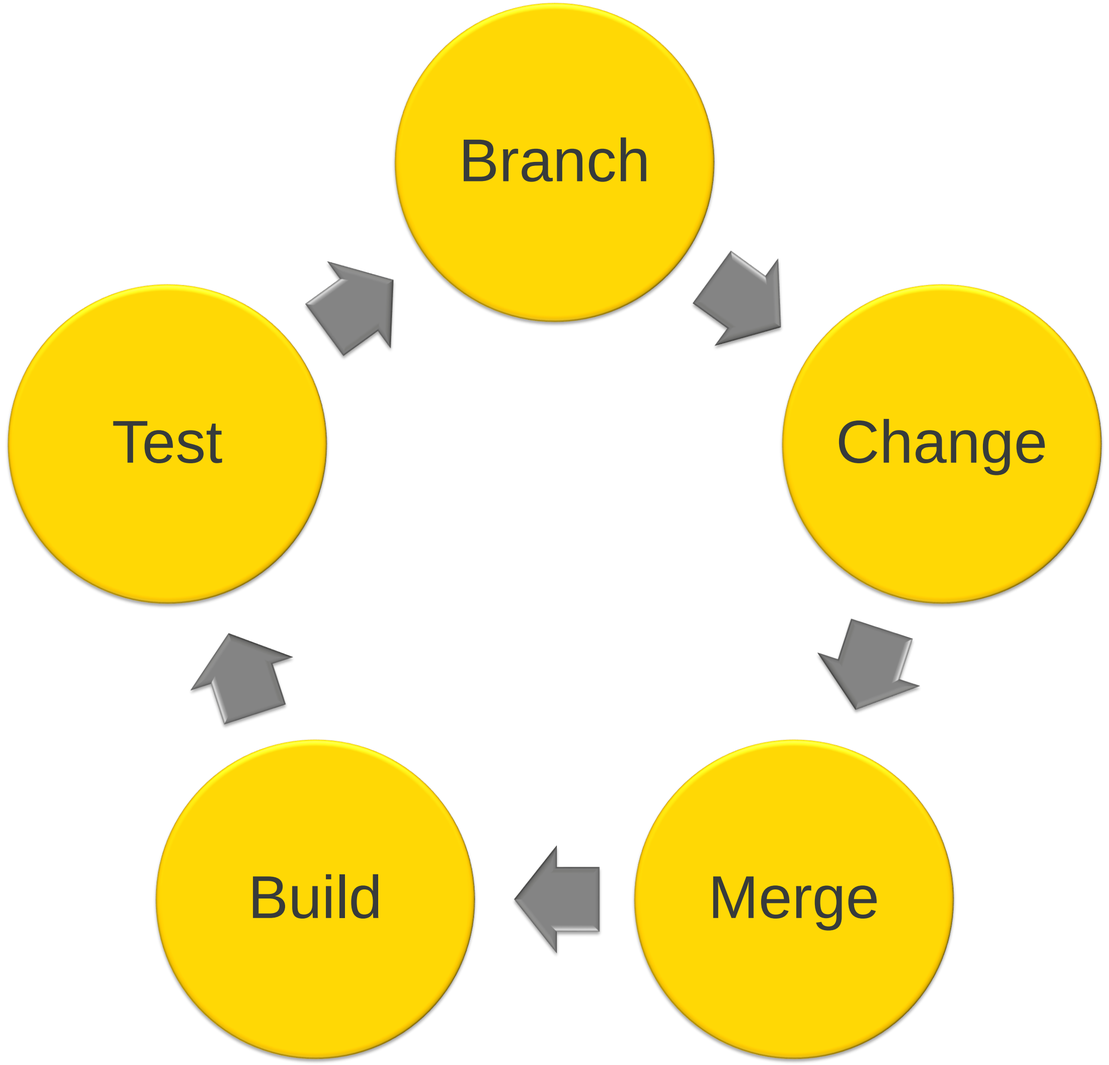


Concepts – Software testing



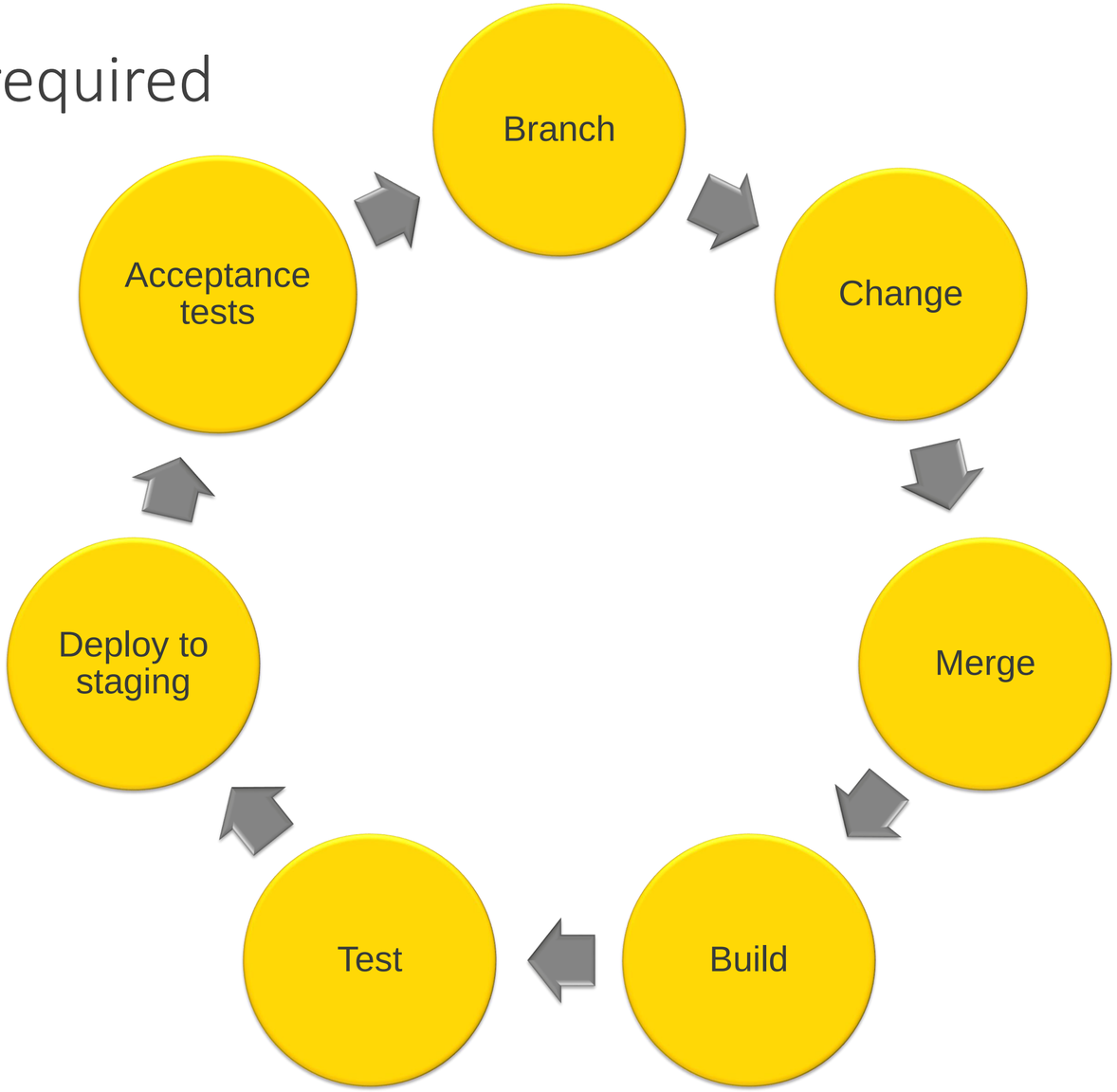
Concepts – CI – Continuous integration

- Born from extreme programming
- Merge your code early and often
- Build your code automated after change
- Test your code automated after change
- Goal
  - Early feedback on changes
  - Reduce merge conflicts



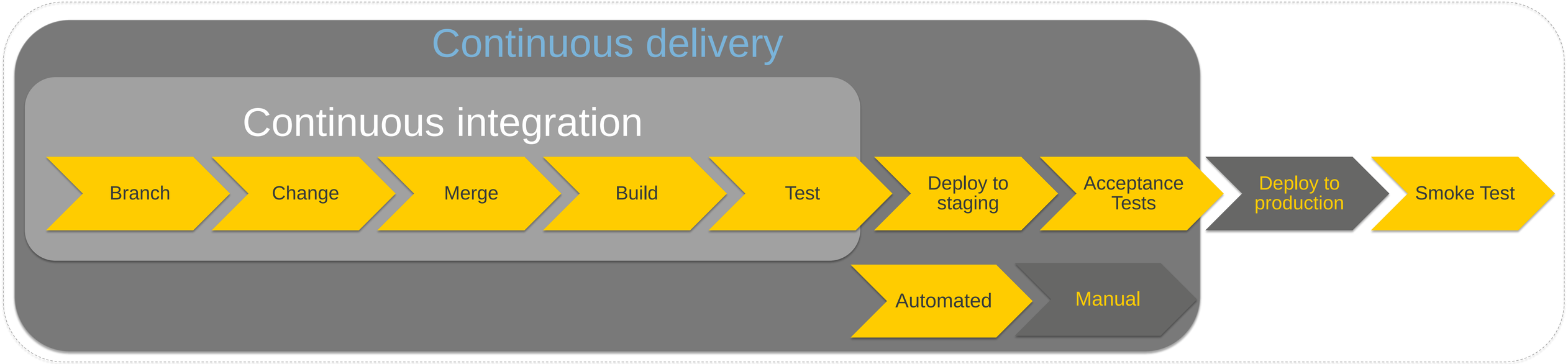
Concepts – CD – Continuous delivery

- Release your software whenever it's required
- Extends continuous integration by
  - Deployment into a staging environment
  - Acceptance tests

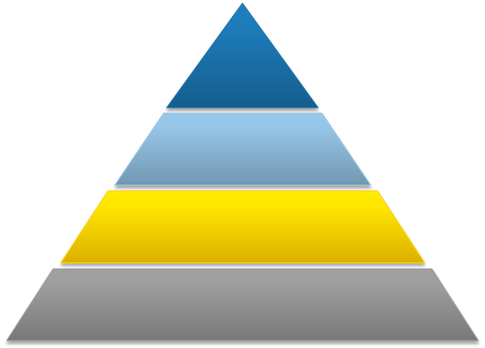


Concepts – CI/CD pipelines

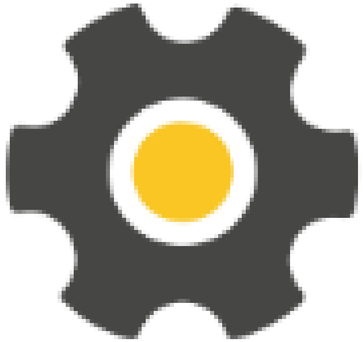
- Automate everything from code change to pre production
- Increase visibility of issues while building, testing, deploying your product
- Allows fast feedback loops
- Empowers you to deliver continuously
- Enables continuous deployment

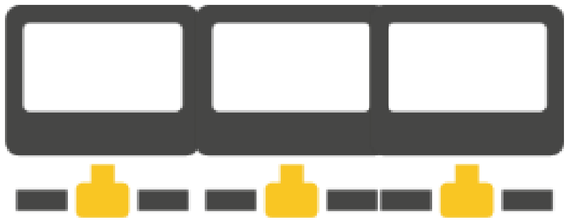


Concepts



Software testing in CI/CD pipelines



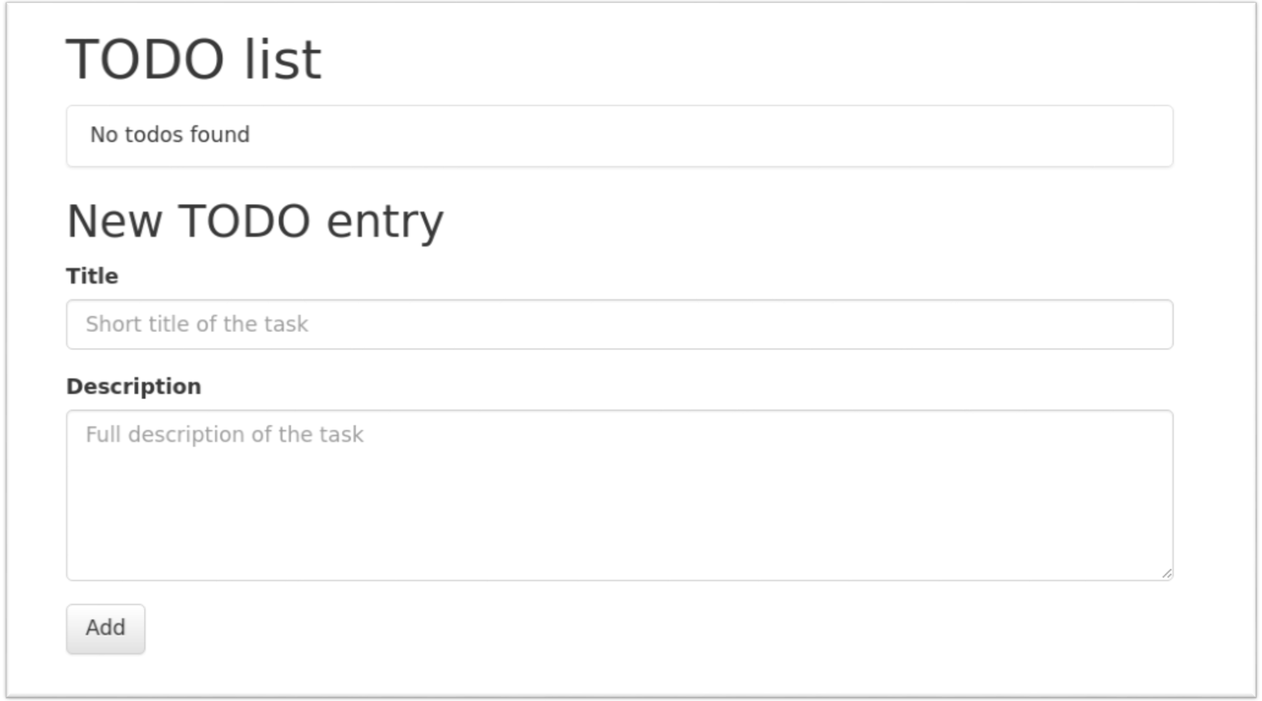


Our goals for today

1. Take a sample app
2. Create a multi stage environment on a container platform
3. Build the app
4. Create a pipeline to deploy the app
5. Add integration tests to the pipeline
6. Add End-2-End tests to the pipeline

Sample app

- Todo list app
- Located in a git service (GOGS)
- Small GUI
- Small REST API



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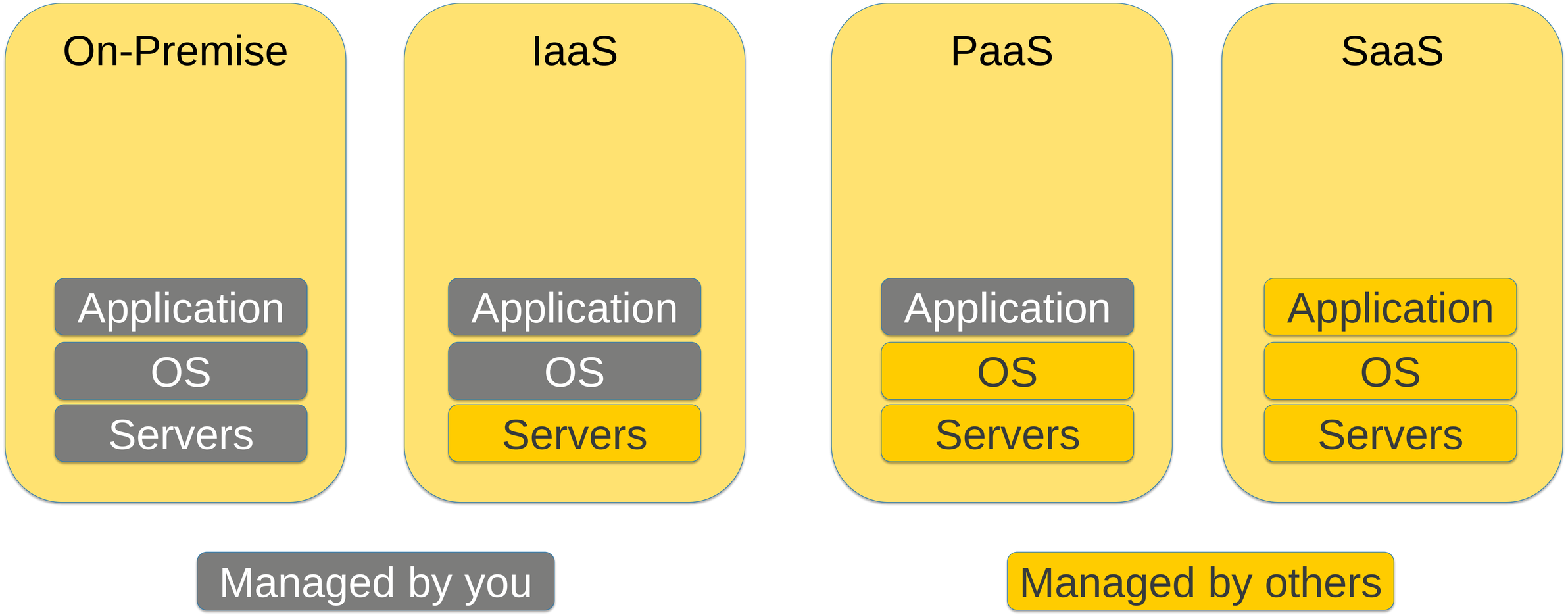
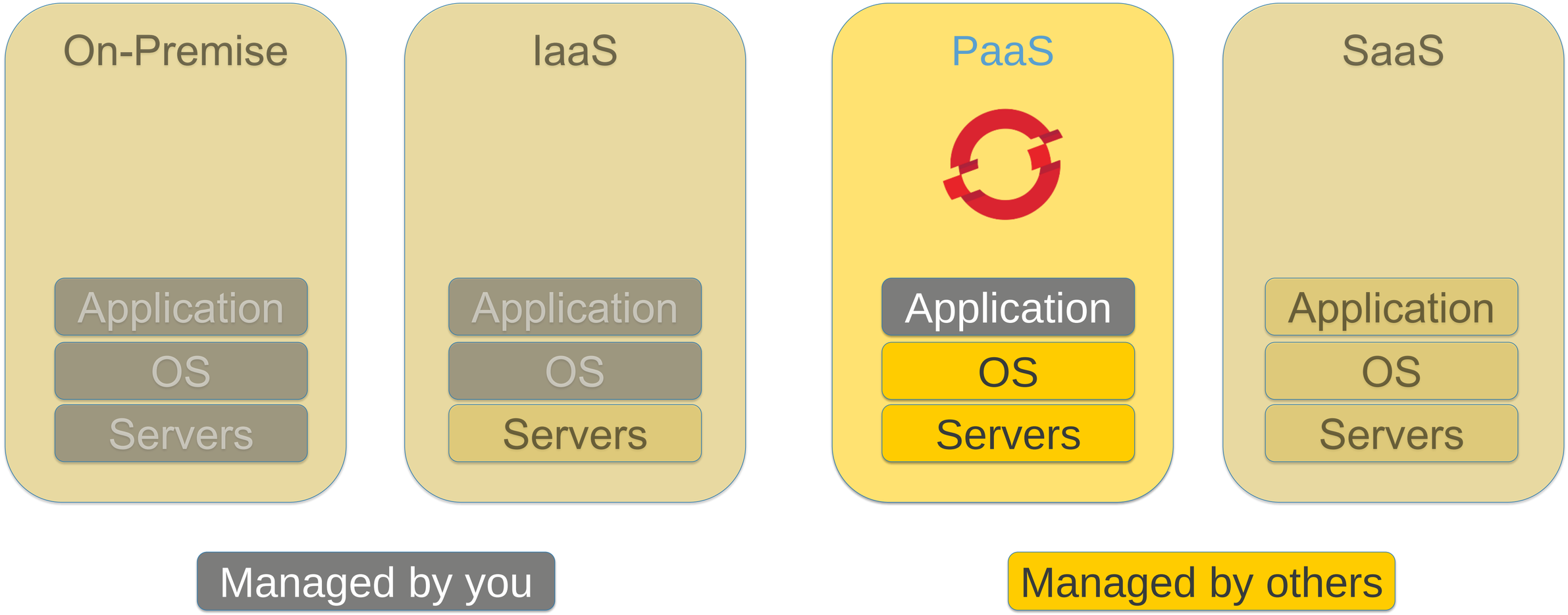
Container platform



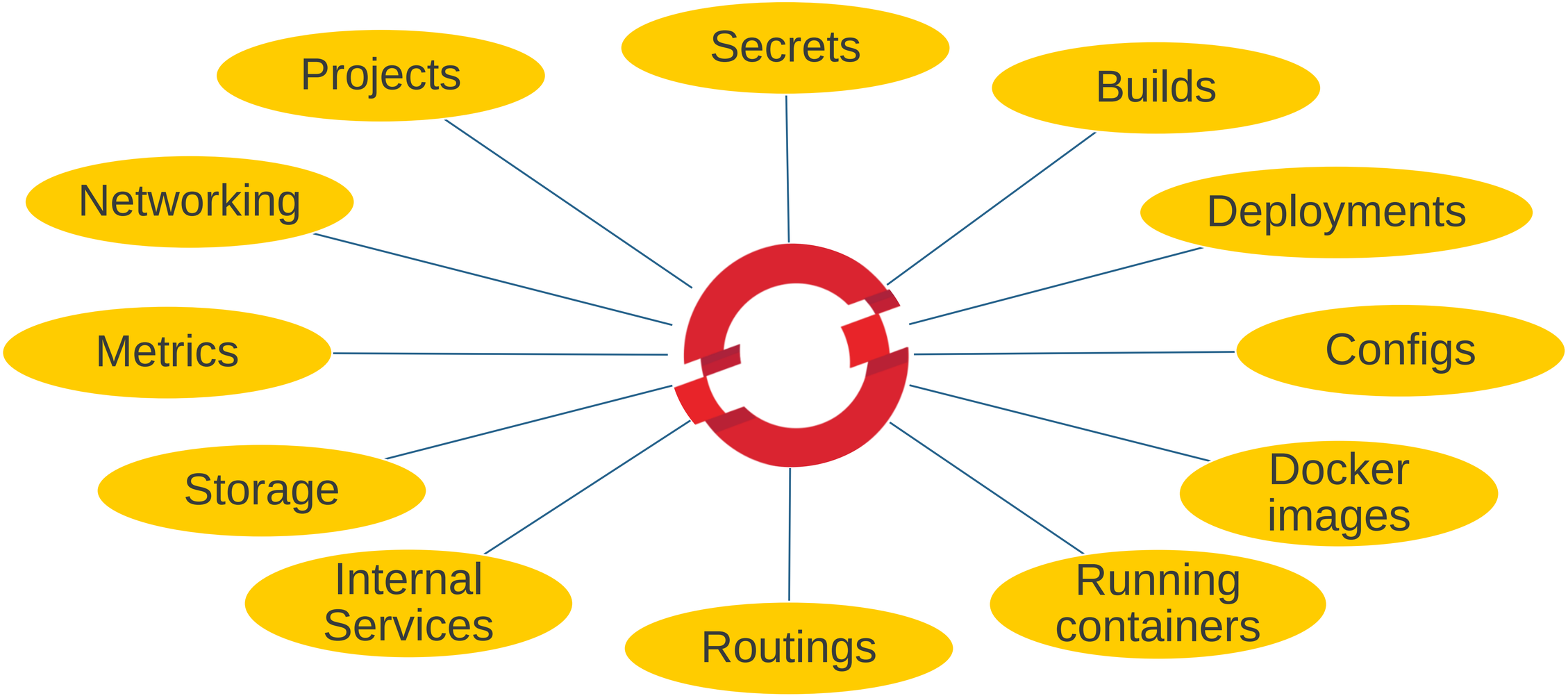
Container platform



Container platform - OpenShift

- Developed and maintained by RedHat since 2011
- Open source container platform *OKD* (Apache Licence 2.0)
- Professional support options
- Public OpenShift cloud available
- Based on Kubernetes
- Uses Docker containers
- Additional platform specific features

Container platform - OpenShift



Mission

Create a multi stage environment on a container platform

Let’s code!

Our goals for today

1. Take a sample app ✓
2. Create a multi stage environment on a container platform ✓
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Classic vs. Modern

CI/CD pipelines – Classic

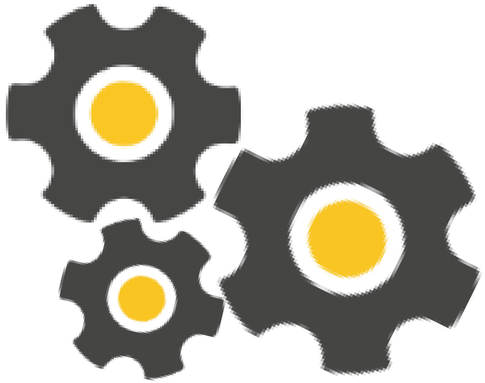
- Jenkins installed on a VM or bare metal
- Create a job
  - By yourself
  - Via admin
  - Via a business process
- Maybe adapt to a predefined pipeline
- Shared resources / workers

CI/CD pipelines – Modern

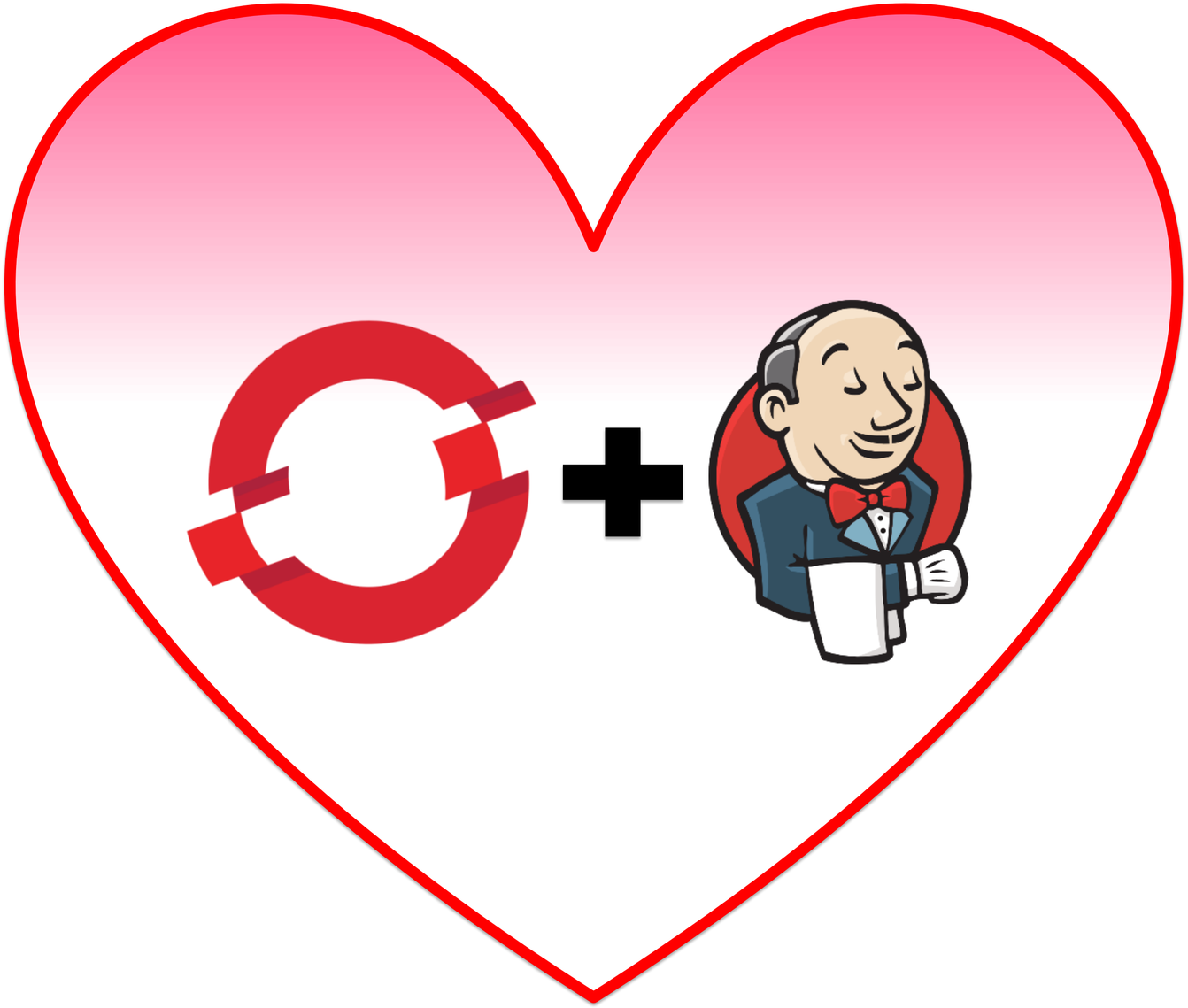
- Define your individual pipeline
- Bind it to your source control
- Deploy the pipeline to your Jenkins
- Get some coffee

CI/CD pipelines – Modern

- The modern life cycle has to be enabled by software
  - Configuration as code
- Various software solutions on the market
  - Travis CI
  - GitLab CI
  - OpenShift with Jenkins
  - etc.
- Provide a configurable platform to specify build pipelines

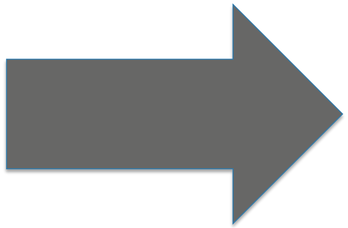


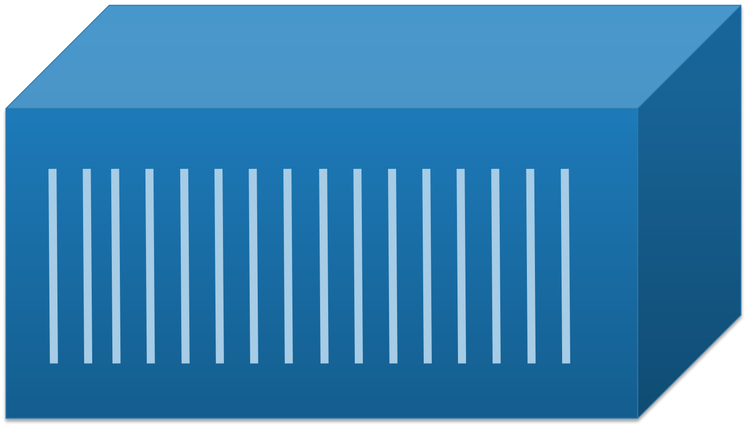
CI/CD pipelines – Jenkins and OpenShift



CI/CD pipelines – Build the software

- What we have: Source code
- What we want: A deployable artefact
- How do we come from Source code to a deployable artefact?





CI/CD pipelines – Build the software – Jenkins

- We need a Jenkins file to define the pipeline
- Build a Jenkins containing the Jenkins file
- To build software, you need a build config
- Jenkins and build configuration stored in the git repository

```
node{

    checkout scm


}
```

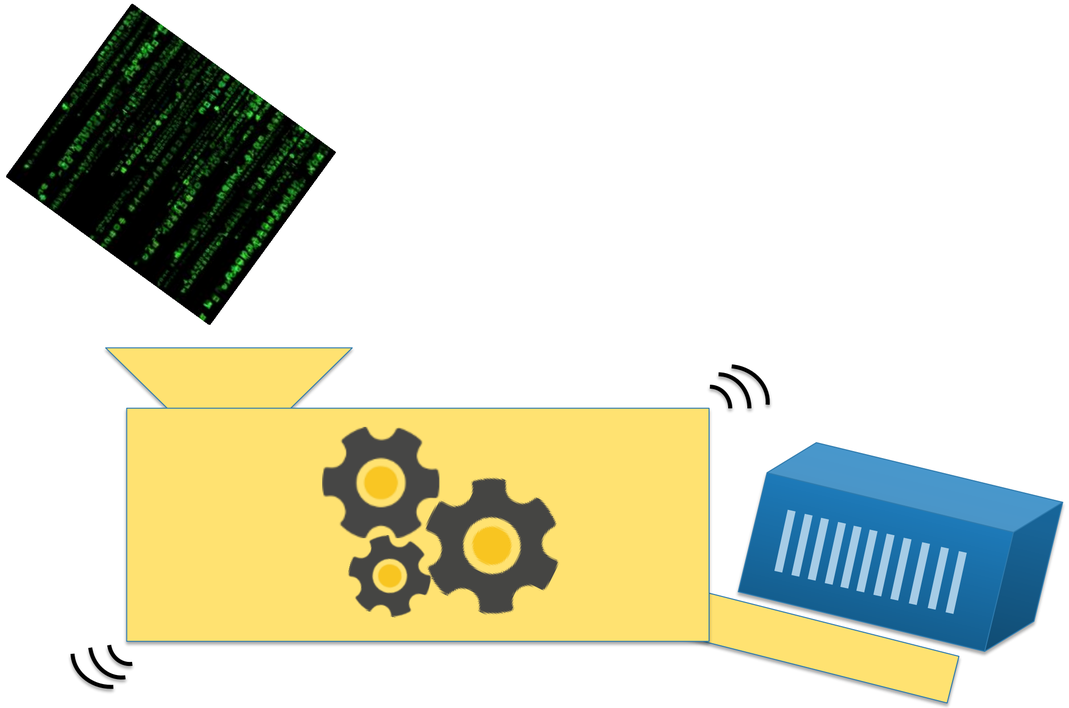
+

```yaml
- apiVersion: v1
  kind: BuildConfig
  metadata:
    labels:
      build: ${APPLICATION_NAME}-pipeline
      component: backend
      app: ${APPLICATION_NAME}
    name: ${APPLICATION_NAME}-pipeline
  spec:
    failedBuildsHistoryLimit: 5
    runPolicy: Serial
    source:
      git:
        uri: ${INFRASTRUCTURE_REPOSITORY_URL}
      sourceSecret:
        name: gitlab-ssh
      type: Git
    strategy:
      jenkinsPipelineStrategy:
        jenkinsfilePath: infra/jenkins/Jenkinsfile
      type: Source
```

=

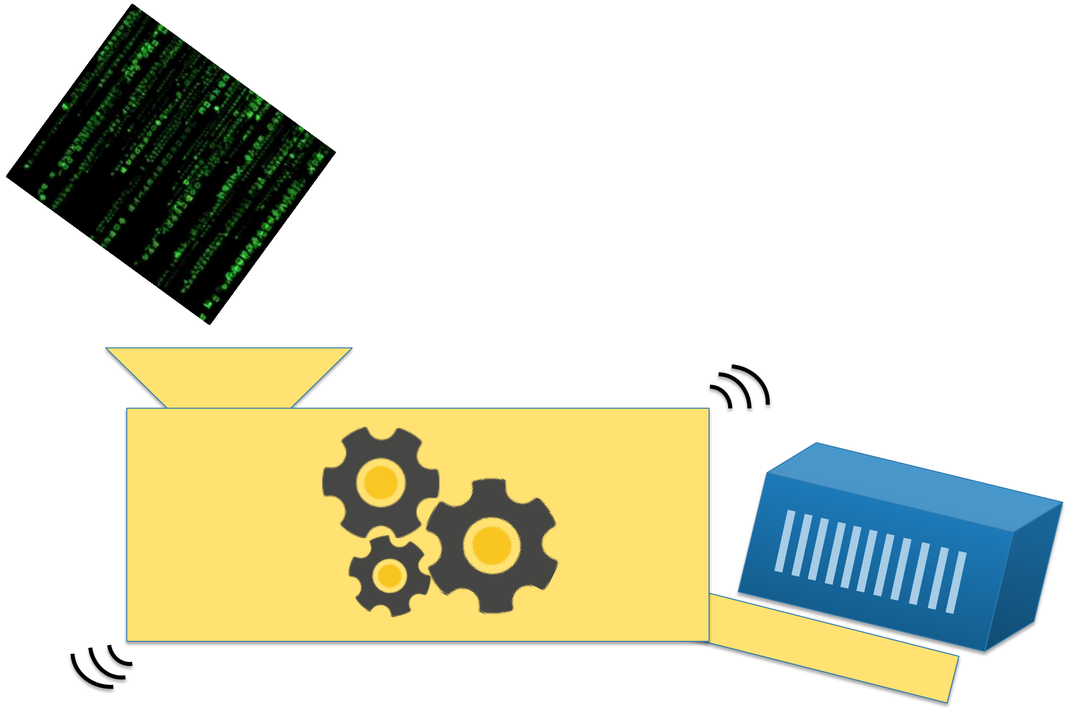
CI/CD pipelines – Build the software – S2I

- We're going to use Source to Image (S2I)
- OpenShift feature
- S2I defines an interface to build software
- Used via build config



CI/CD pipelines – Build the software – S2I

- S2I images contain a build environment
- S2I creates a deployable Docker image containing the app
- Image is pushed to the registry into an image stream
- Available for many technologies and ready to use



CI/CD pipelines – Build the software – S2I

Mission

Build the app

Jenkins! Please serve the app!

Our goals for today

1. Take a sample app ✓
2. Create a multi stage environment on a container platform ✓
3. Build the app ✓
4. Create a pipeline to deploy the app
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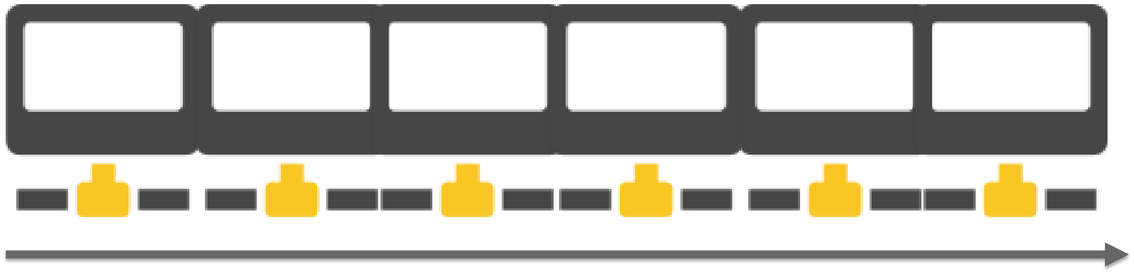
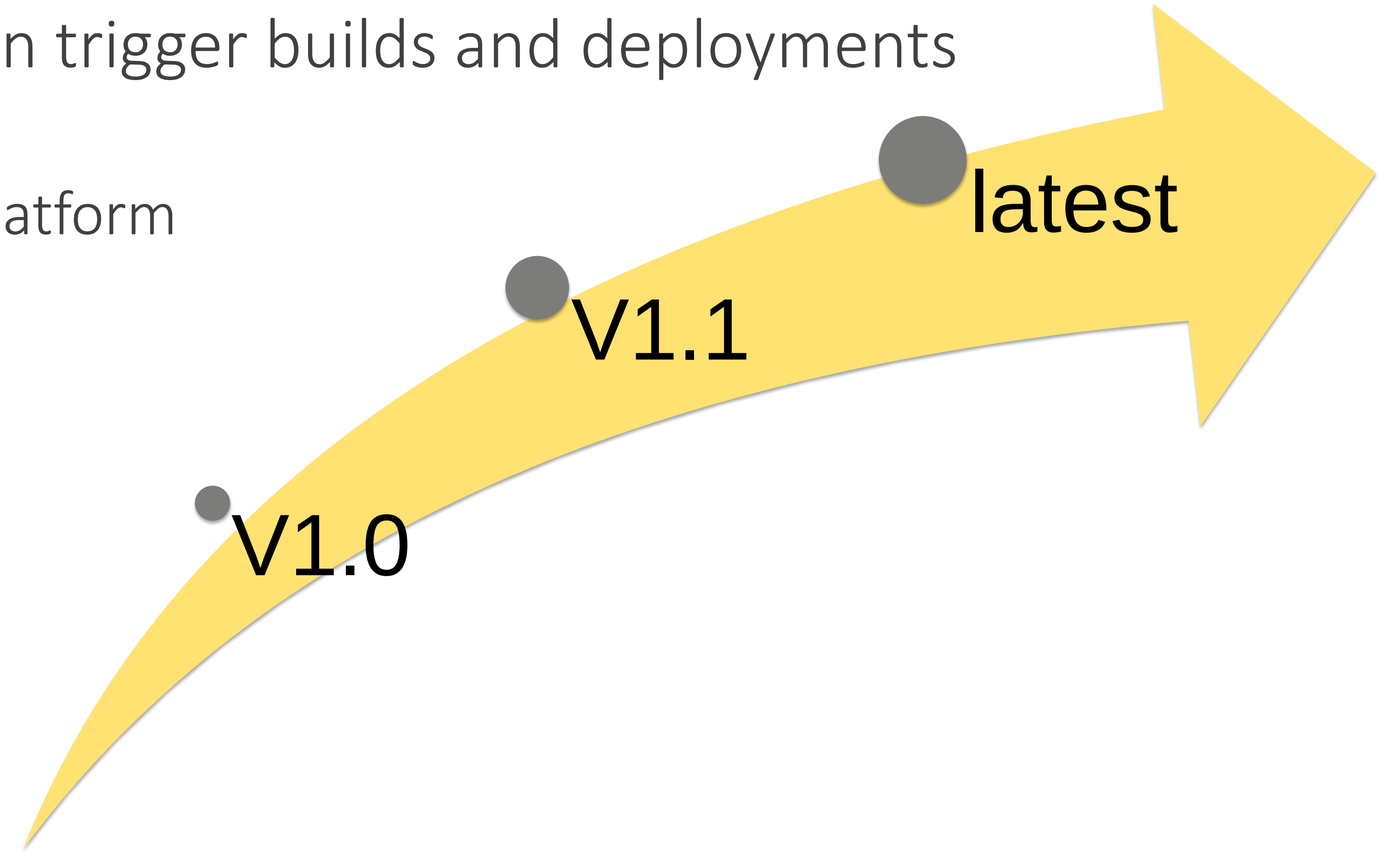
CI/CD pipelines – The pipeline

- We have
  - A Jenkins file
  - A deployable immutable artefact
- We need
  - To deploy the artefact - Deployment config
  - To transport the artefact between stages - Image streams



CI/CD pipelines – The pipeline – Image streams

- Same idea as for a Docker registry
- … with some additions
- Image streams contain Docker images identified by tags
- Changes on image streams can trigger builds and deployments
- Image streams can refer to
  - The registry of the container platform
  - Other image streams
  - External registries



Mission

Create a pipeline to deploy the app

The deployment is strong with this one.

Our goals for today

1. Take a sample app ✓
2. Create a multi stage environment on a container platform ✓
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4. Create a pipeline to deploy the app ✓
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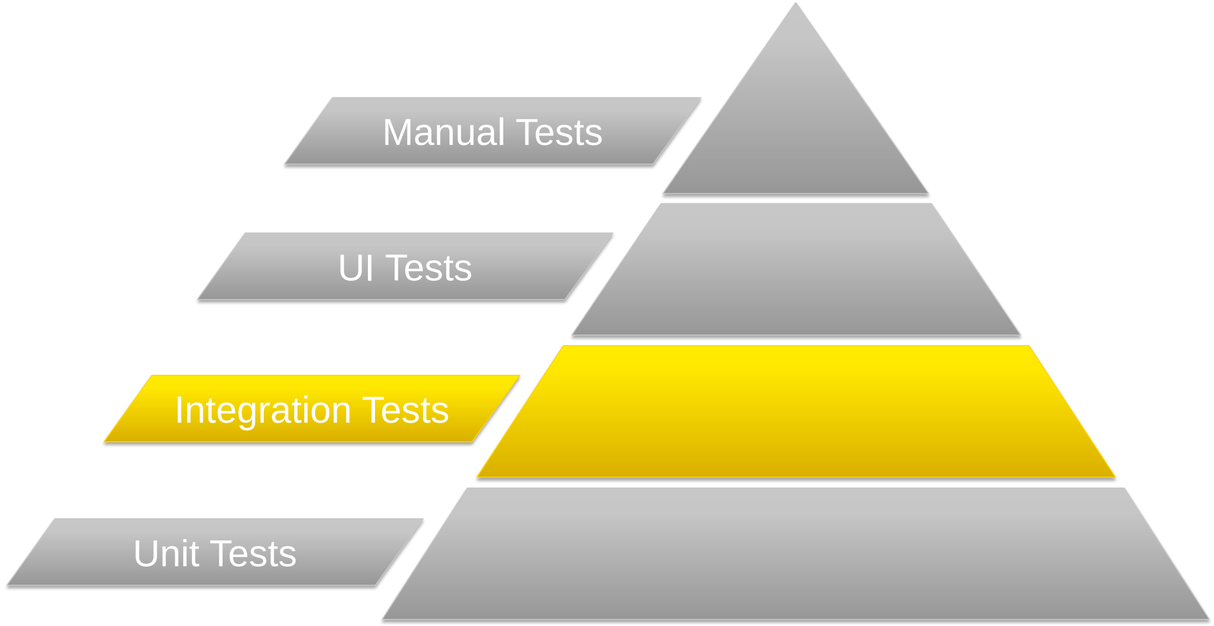
Integration testing

- Tests the communication between software components
- The system under test (SUT) is tested as a black box
- Software required to provide endpoints to communicate with
- CITRUS



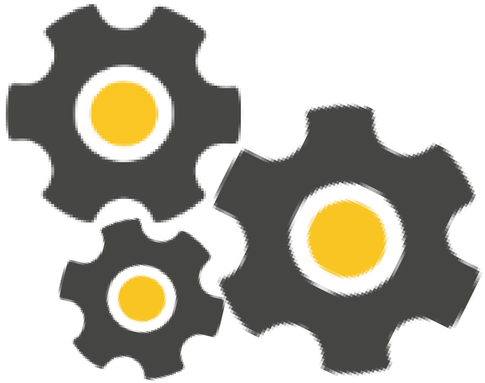
Integration testing with CITRUS

Citrus is
an **open-source** framework for **automated integration testing** of **messaging interfaces** in enterprise applications.

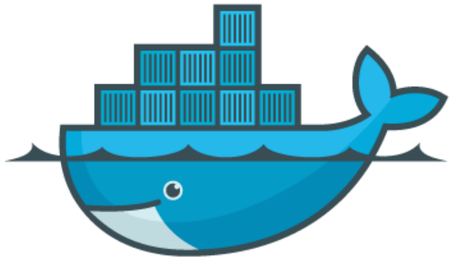
citrusframework.org

Integration testing with CITRUS

- Based on the Spring Framework
- Integrates with common build tools
  - Maven
  - Gradle
  - Ant
- Therefore tests are easily executable with Jenkins
- Rich Java- and XML-DSL
- No mocks – only real messages over the wire



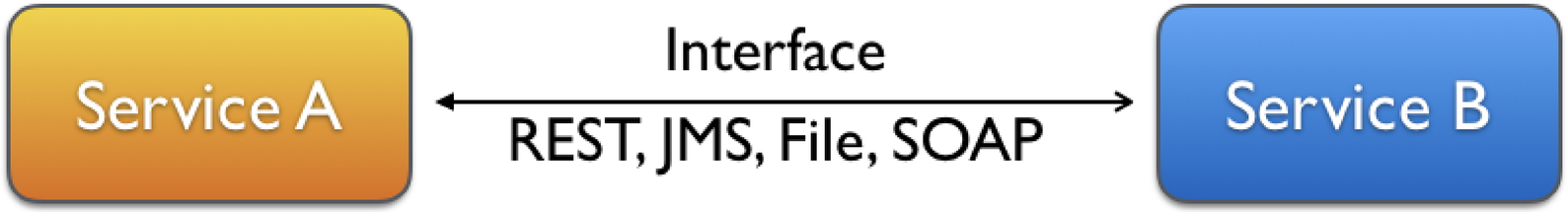
Integration testing with CITRUS



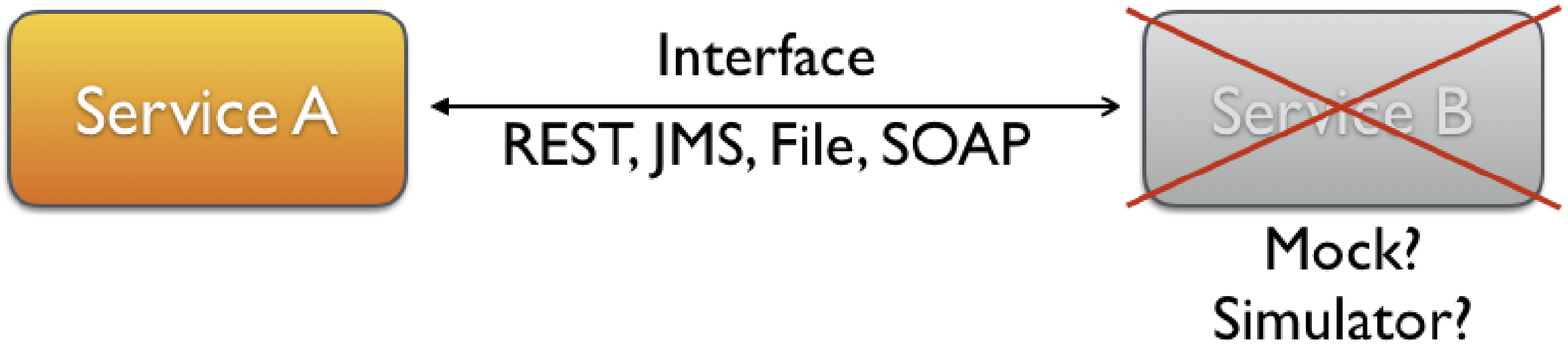
Integration testing with CITRUS

Endpoint	Description
citrus-http	HTTP client and server
citrus-jms	JMS consumer and producer
citrus-ws	SOAP WebServices client and server
citrus-mail	Mail client and server
citrus-docker	Docker client
citrus-camel	Apache Camel components
citrus-kubernetes	Kubernetes client
citrus-selenium	Selenium browser
citrus-ftp	FTP client and server
citrus-vertx	Vert.x consumer and producer
citrus-ssh	SSH client and server
citrus-jdbc	JDBC server simulation
...	...

Integration testing with CITRUS



Integration testing with CITRUS



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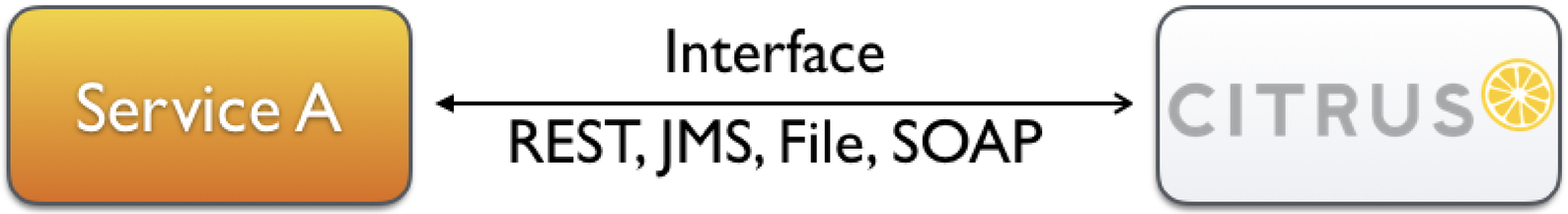

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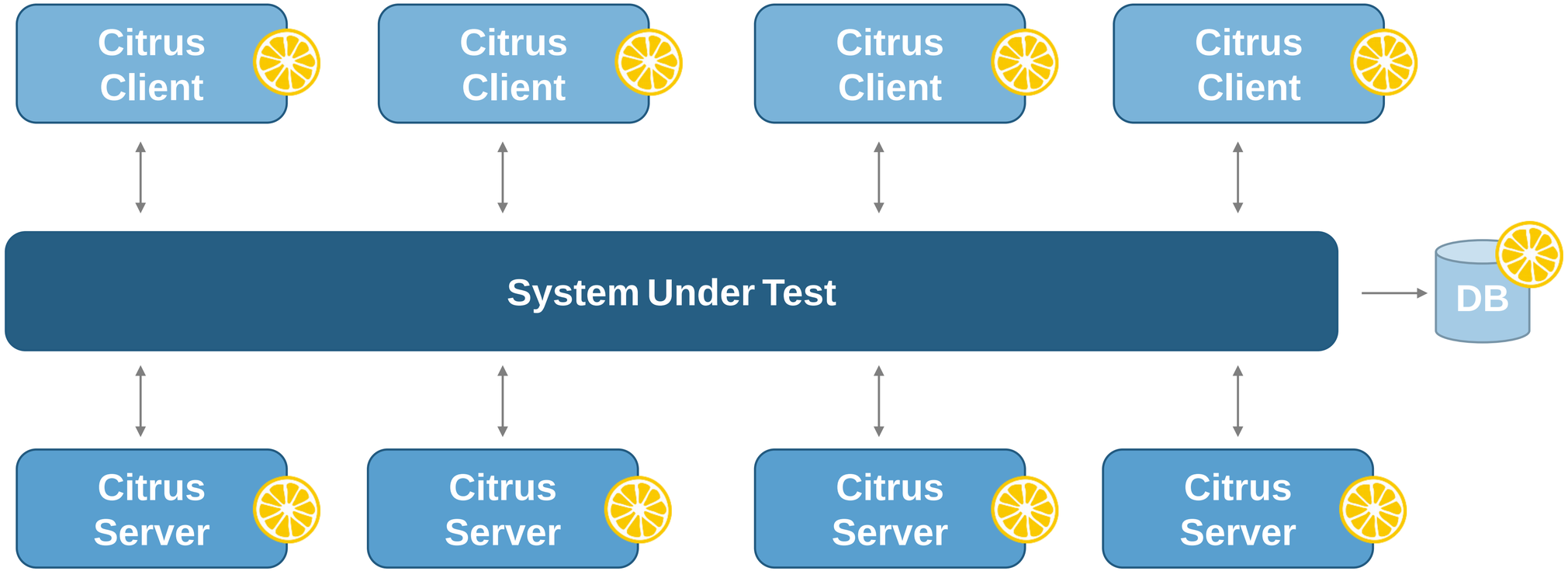

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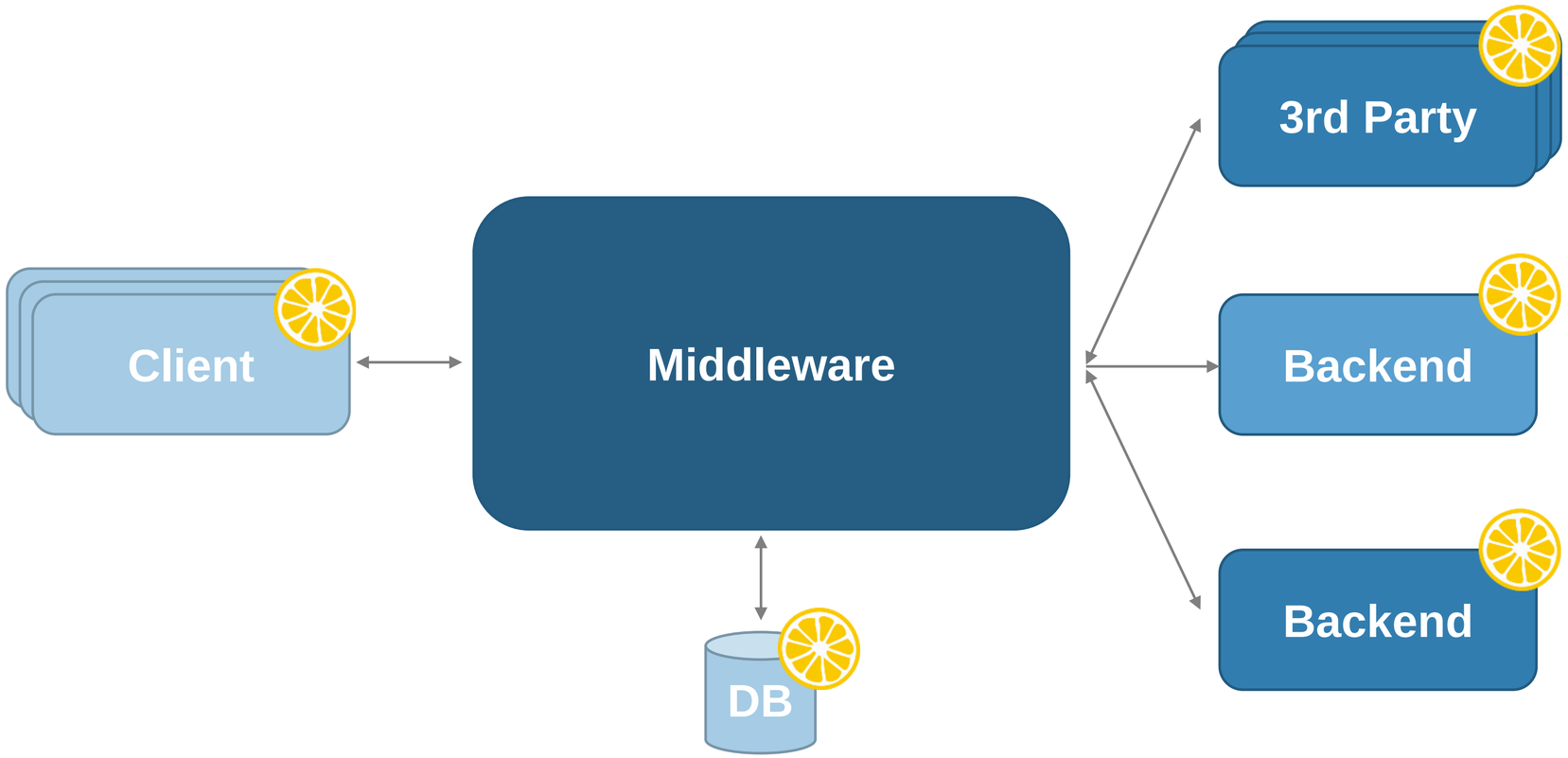

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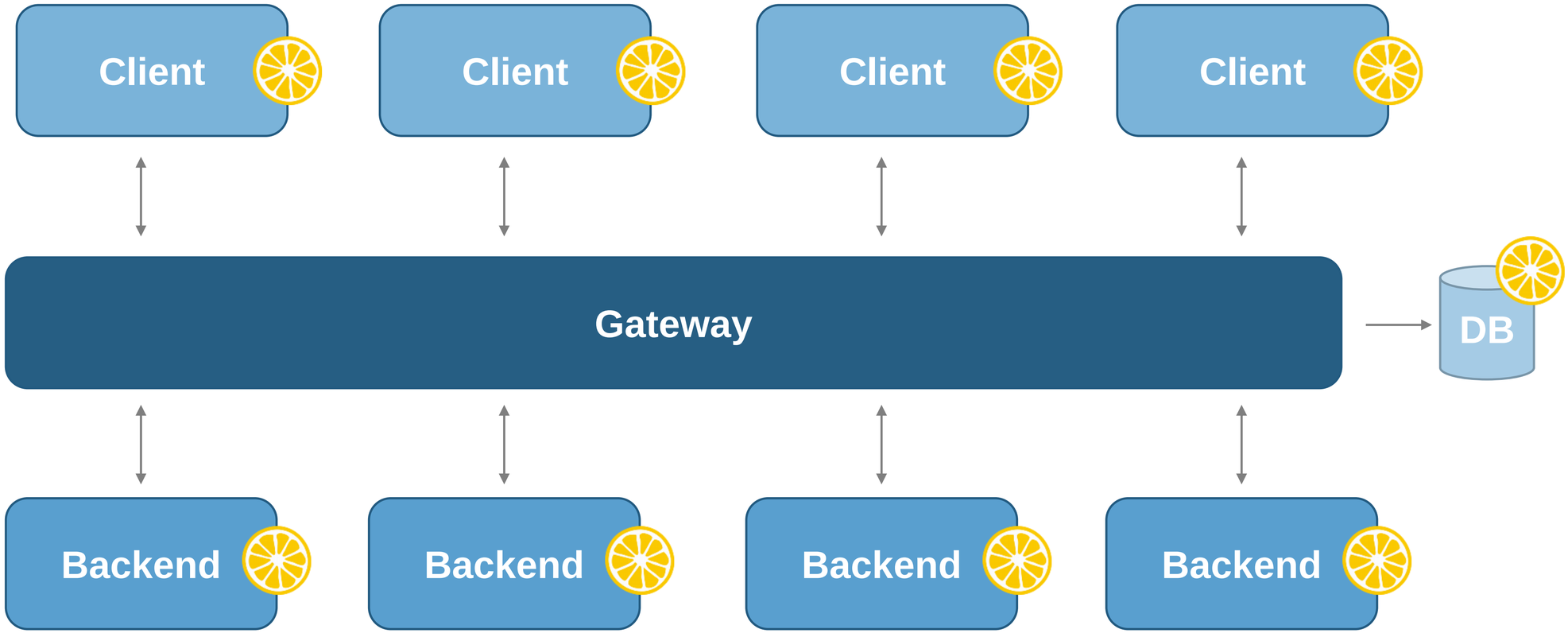

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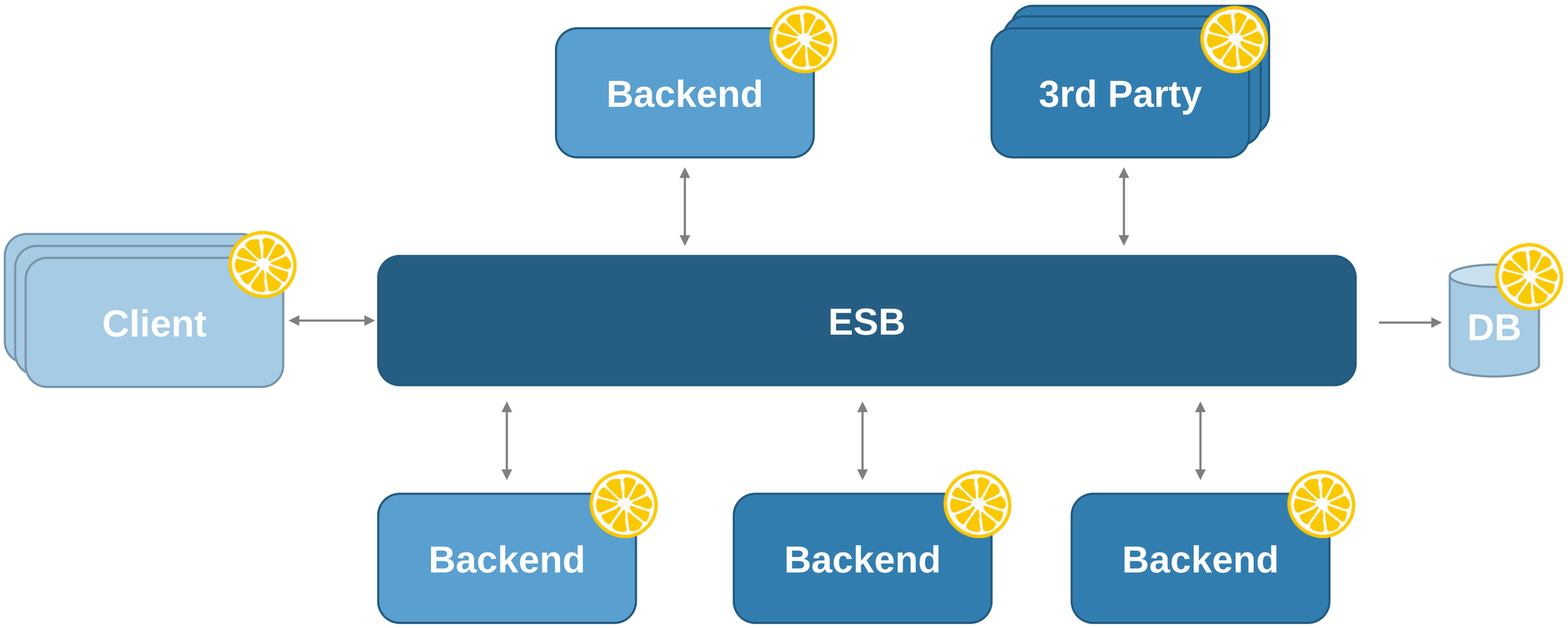

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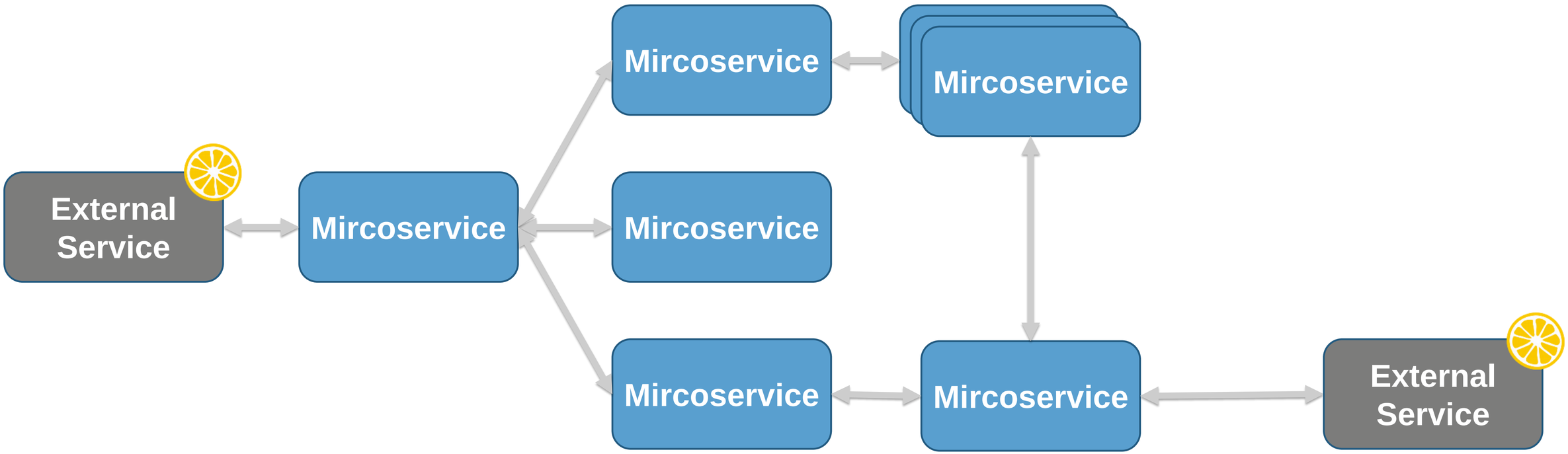

Mission

Add integration tests to the pipeline

Let’s add some juicy tests

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2. Create a multi stage environment on a container platform ✓
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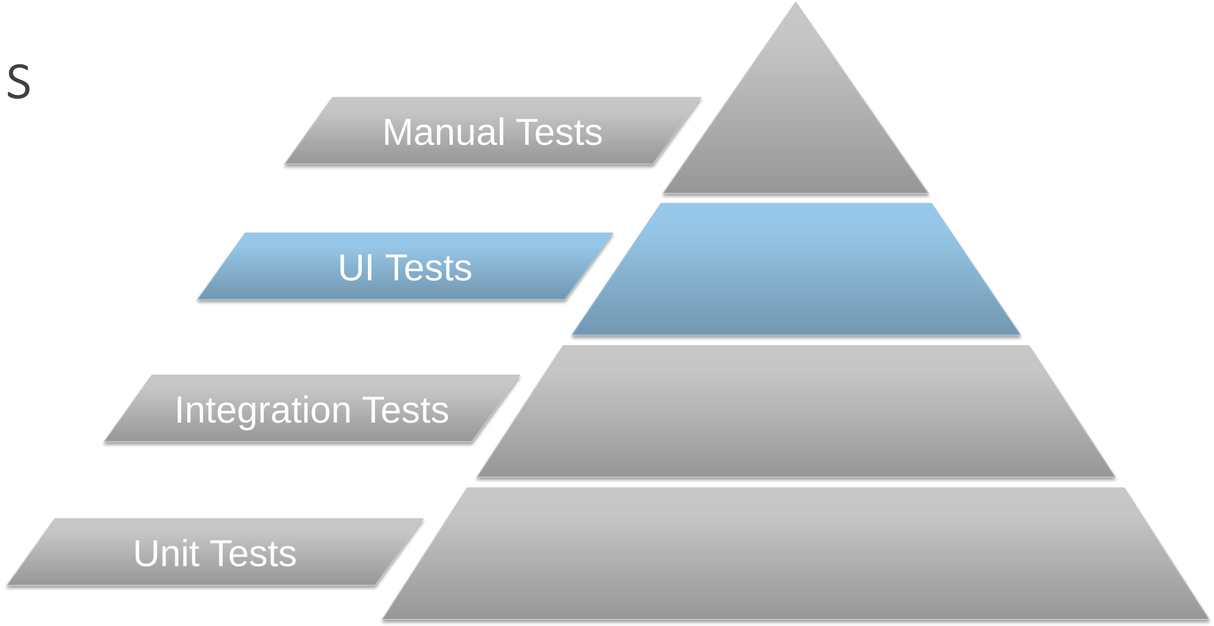
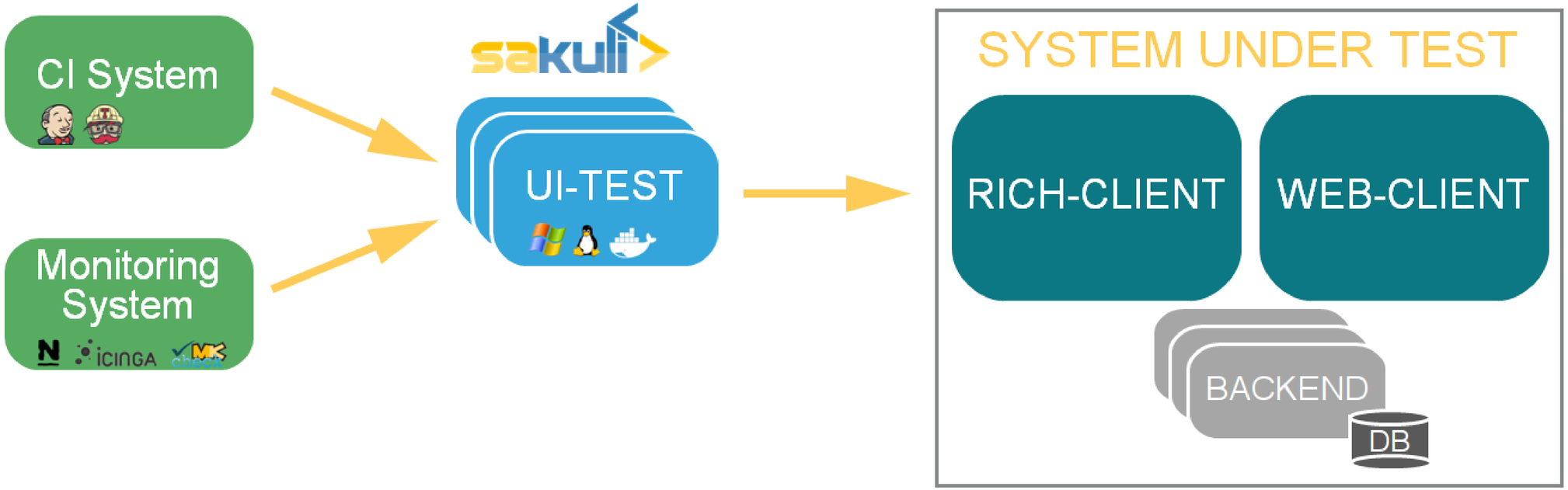
End-2-End testing

- Tests the whole application from end to end
- Tests the system from a user perspective
- Ensures that the critical paths of the application are working
- Includes desktop checks as well as browser checks
  - Important for fat client tests
  - Important for hybrid applications
- sakuli



End-2-End testing with sakuli



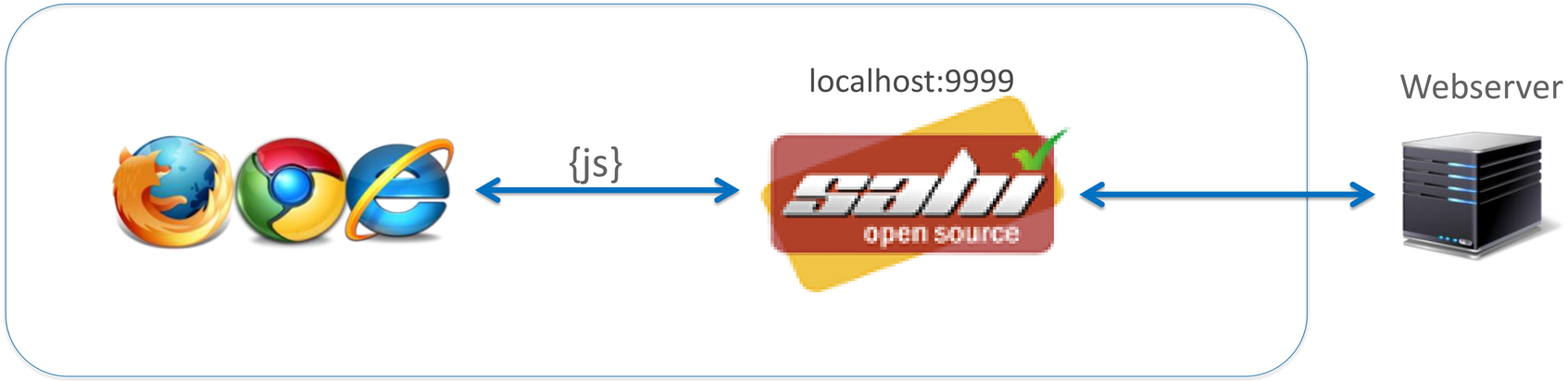
End-2-End testing with sakuli

- The idea of Sakuli: Combine two frameworks
- Combine their strengths
- Eliminate their weaknesses
- Unify the API
- Make it executable and scalable in cloud environments
- Run it on every platform
- Provide native integration of monitoring systems

End-2-End testing with sakuli

Web testing tool (sahi.co.in, seleniumhq.org)
method based DOM access:

```
_assertContainsText ("Logged in as: Sakuli", _div("user_field"));
_click(_span("Loaded Run Tabels"));
_assertExists(_table("cross_table_fixed"));
_assertExists(_cell("testing allowed", _rightOf(_span("Name")), _under(_cell("Action")));
```

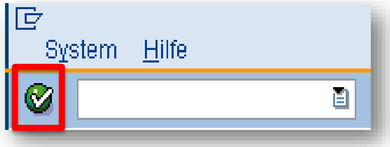


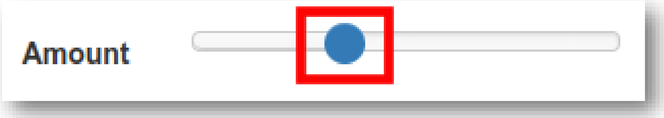

```
<table>
 <tbody>
  <tr>

<td>Alice</td>
   <td>Bob</td>
  </tr>
 </tbody>
</table>
```

End-2-End testing with sakuli

Visual automation tool (sikuli.org)

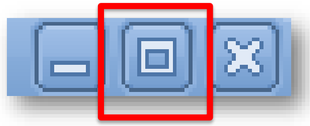
image identification, mouse & keyboard interaction:

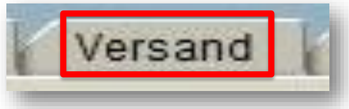


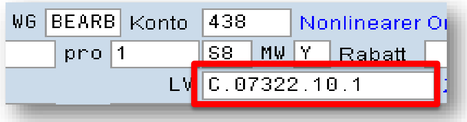



```
screen.find("sap_ok").click();
screen.find("sap_ok").right(40).click().type("2223");
```


```
var bubble = new Region().waitForImage("bubble.png", 20);
bubble.dragAndDropTo(bubble.left(35)).highlight();
```







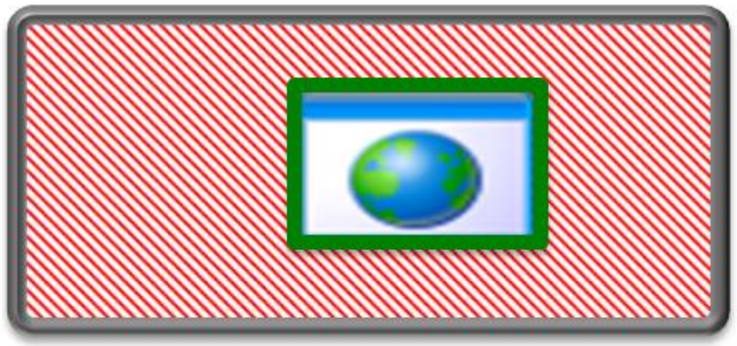
End-2-End testing with sakuli

Sikuli

- ✔ **universal**, complete screen
- ✘ **(more) resource intensiv**
- ✘ needs a "unlocked" screen

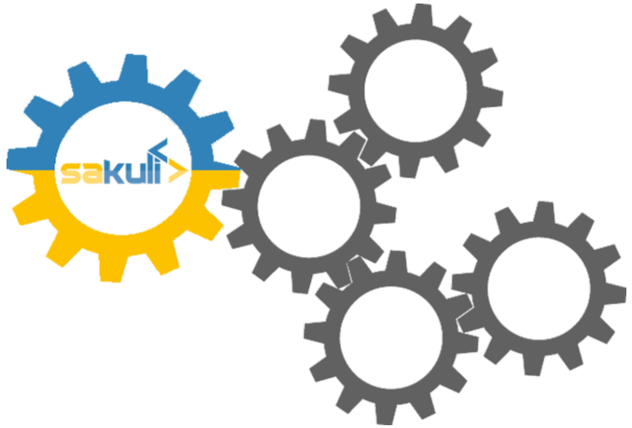
Sahi / Selenium

- ✘ limited on **web,**
  (no Flash, Java applets...)
- ✔ **fast through DOM navigation**
- ✔ **easy to write and stabilize**
  (Controller + Recorder)



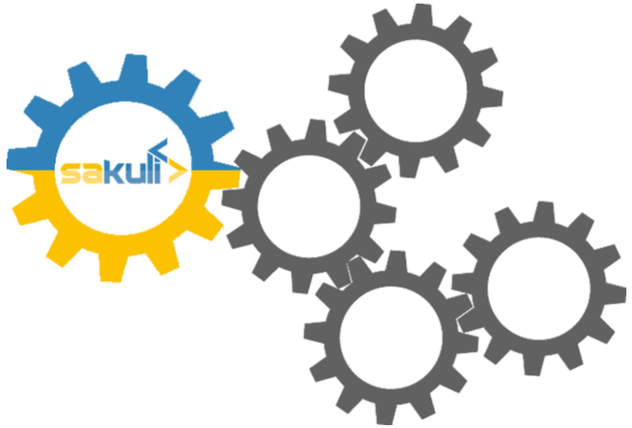
End-2-End testing with sakuli

- Various ways to execute Sakuli tests
  - Native installation
  - Maven dependency
  - Docker container



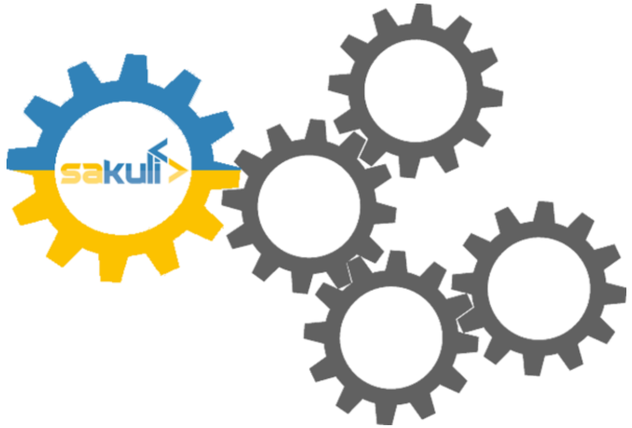
End-2-End testing with sakuli – Native Execution

- Supports all end user platforms: Windows, Linux, Mac
- Installable on the end user client
- Easy JavaScript based API syntax
- Execution of test scripts without compile process



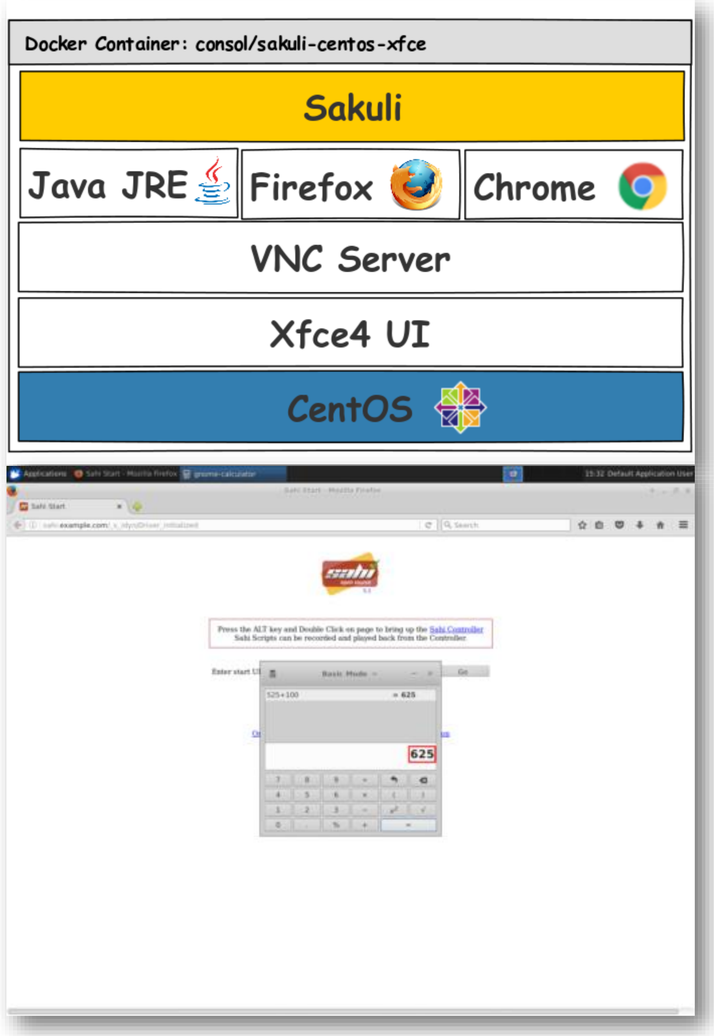
End-2-End testing with sakuli – Maven Execution

- Java Syntax, Maven Dependency
- Easy integration in maven build cycle
- Support through well known Java IDEs
- Optional: Integrate Selenium as Web-Testing-Engine



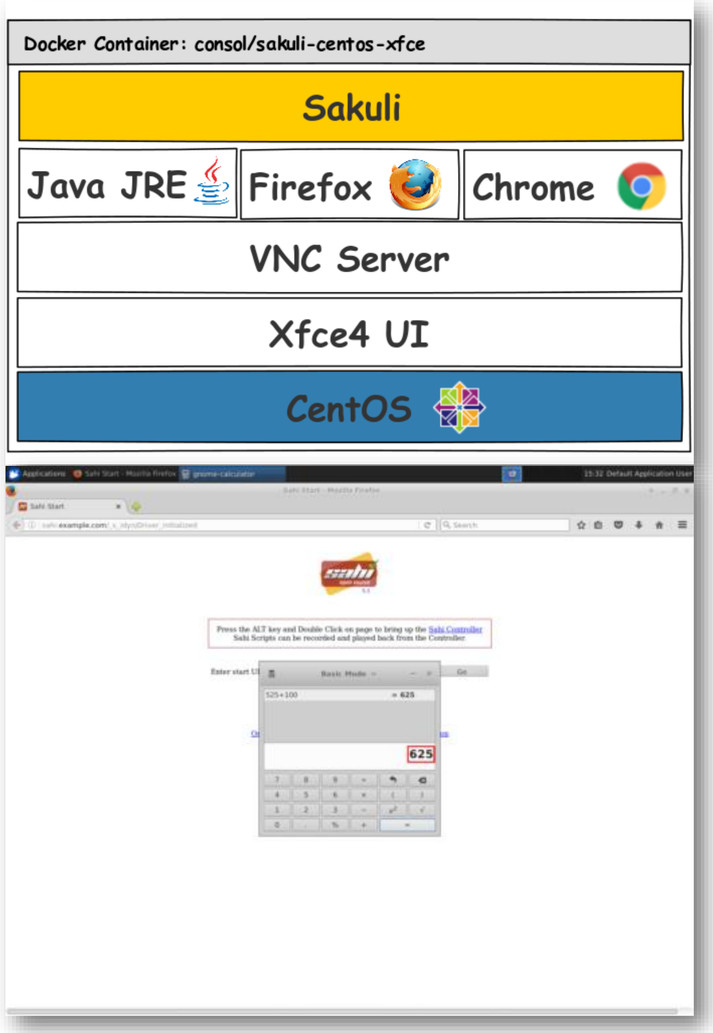
End-2-End testing with sakuli – Containerized Execution

- Supported Container platforms:
  - Docker Compose
  - Kubernetes
  - OpenShift
- Ready to use E2E environment
- Allows Java and JavaScript syntax



End-2-End testing with sakuli – Containerized Execution

- Tests with
  - a real desktop
  - a real browser
  - a native client
- Easy integration for running headless UI tests
- Scalable environment leveraging container technology



Mission

Add End-2-End tests to the pipeline

Start up your containers, gentleman!

Our goals for today

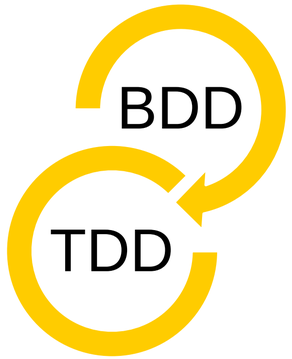
1. Take a sample app ✓
2. Create a multi stage environment on a container platform ✓
3. Build the app ✓
4. Create a pipeline to deploy the app ✓
5. Add integration tests to the pipeline ✓
6. Add End-2-End tests to the pipeline ✓

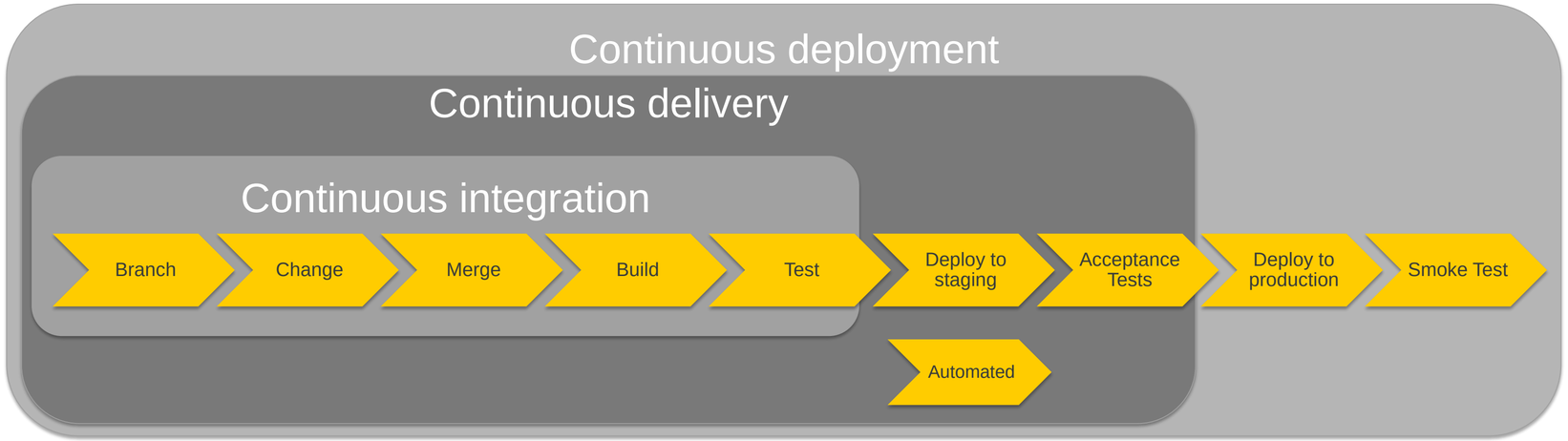
What’s next

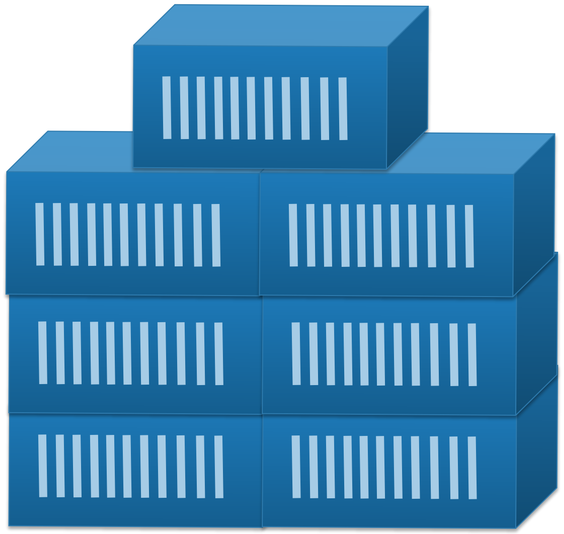
- Add monitoring – Open Monitoring Distribution (OMD)
- Add notifications on test errors/warnings
- Create issues for findings automatically

What’s next

- Improve your tests with BDD
- Scale your tests with the cloud
- Extend continuous delivery to continuous deployment

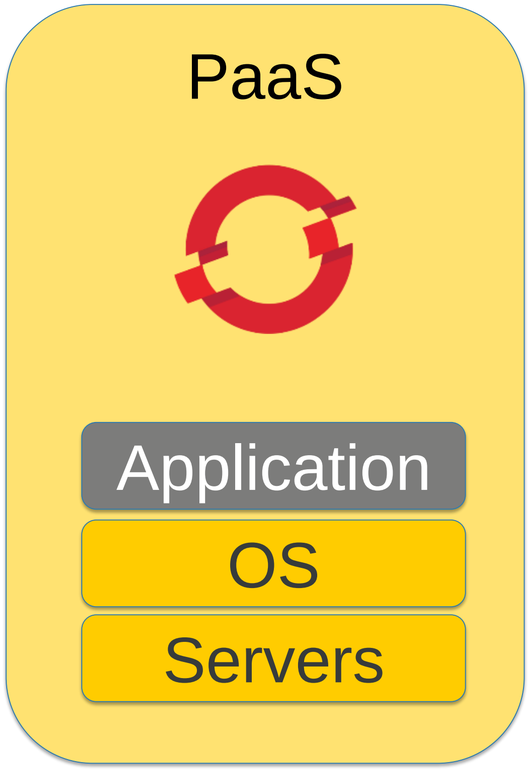


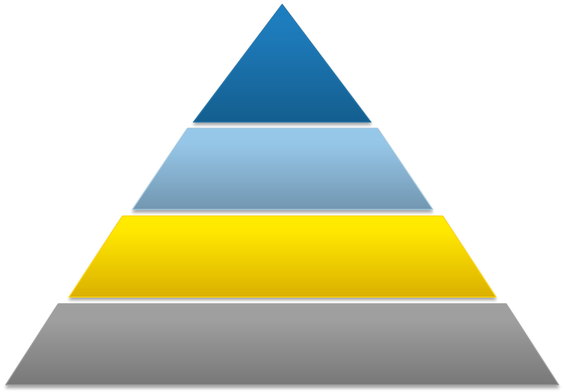


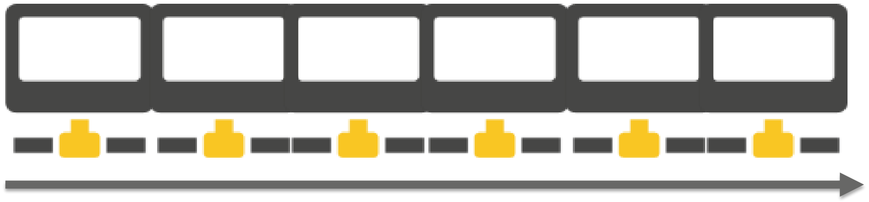


Recap

- The concepts of CI/CD pipelines
- The concepts of testing software
- The differences between various *aaS attempts
- Various OpenShift concepts like BC, DC, IS, S2I

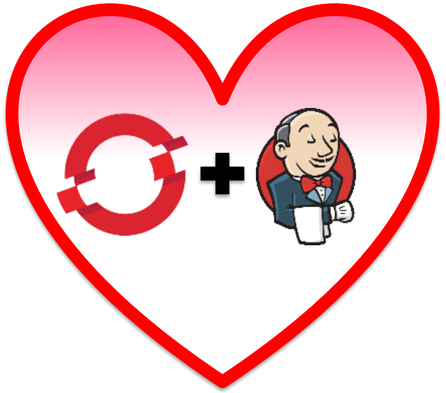






Recap

- How to create CI/CD pipelines with OpenShift and Jenkins
- How to use the Citrus integration testing framework
- How to use the Sakuli End-2-End testing framework
- You can use everything, parts or nothing!



Questions?

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Thank you!