Miscellaneous

Software Engineering II
WS 2017/18

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Enterprise Platform and Integration Concepts

Hasso Plattner Institut
IT Systems Engineering | Universität Potsdam

Pre- and Post-Commit Reviews

- Two different concepts of when to do reviews
  - Conceptually before or after change is in the repository
  - Repository can be varied
    - Git, Mercurial, Perforce, Bazaar
    - Stack of papers
  - Pre-commit the more controlling approach
    - Suitable for trunk-based development

- Pull Requests and PR comments are implementation of post-commit reviews
  - Depending on specifics of implementation concepts can have similarities

Introductory Exercise

Everyone passed \o/

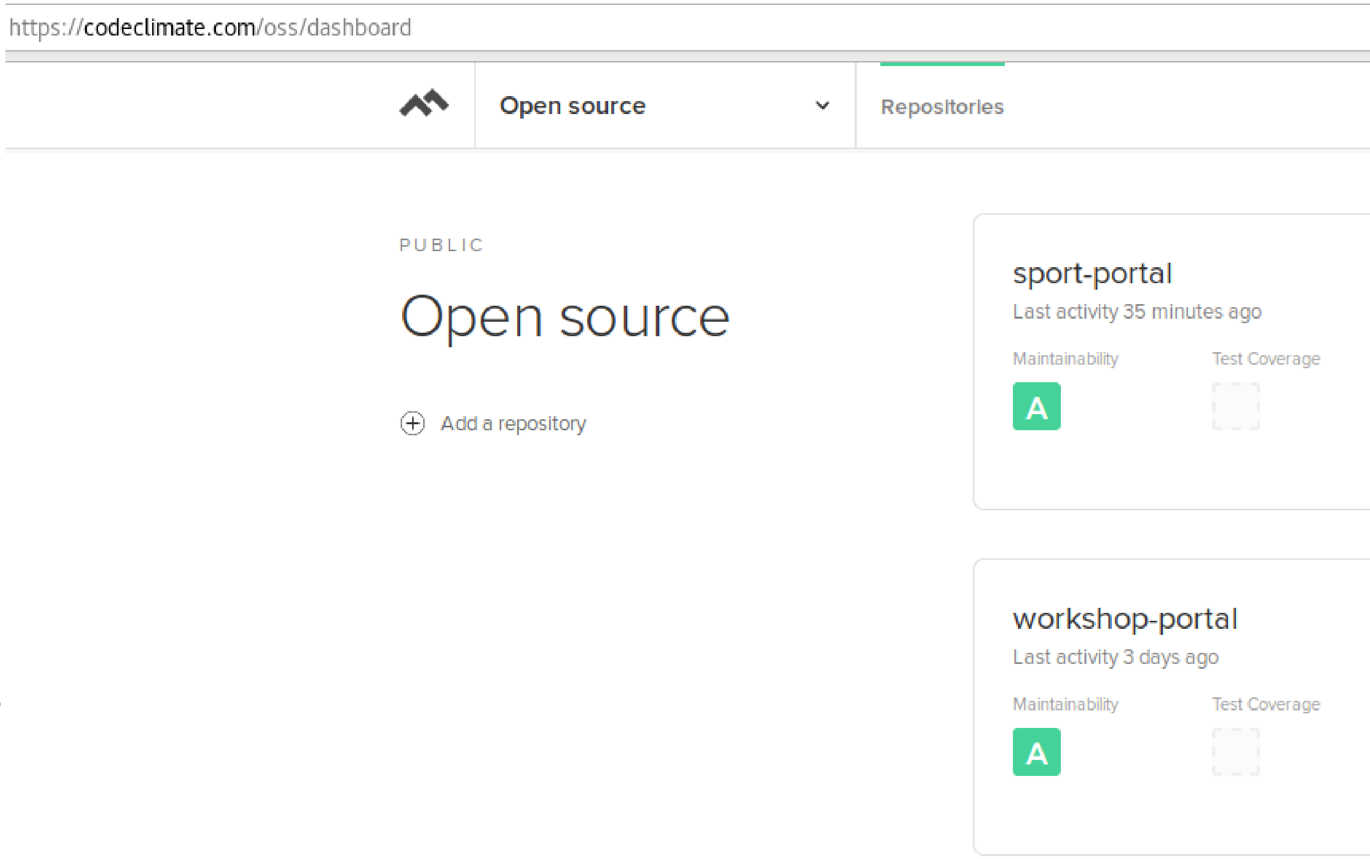
- Good job!
- Pretty young idea
- Keeps evolving (e.g. using GitHub classroom)
- Thanks for giving us feedback, helps us improve the exercise

CodeClimate & Code Linters

Should be possible to dismiss issues

- You are all admins of the repo and have all of the rights
- Might help to add the repository to CC: codeclimate.com/oss/dashboard
- If dismissing a lot of issues, change config
- Do not let the linters slow you down!

- Ask if you need any credentials!


https://codeclimate.com/oss/dashboard

PUBLIC

Open source

sport-portal
Last activity 35 minutes ago
Maintainability A
Test Coverage

workshop-portal
Last activity 3 days ago
Maintainability A
Test Coverage

Application Deployment

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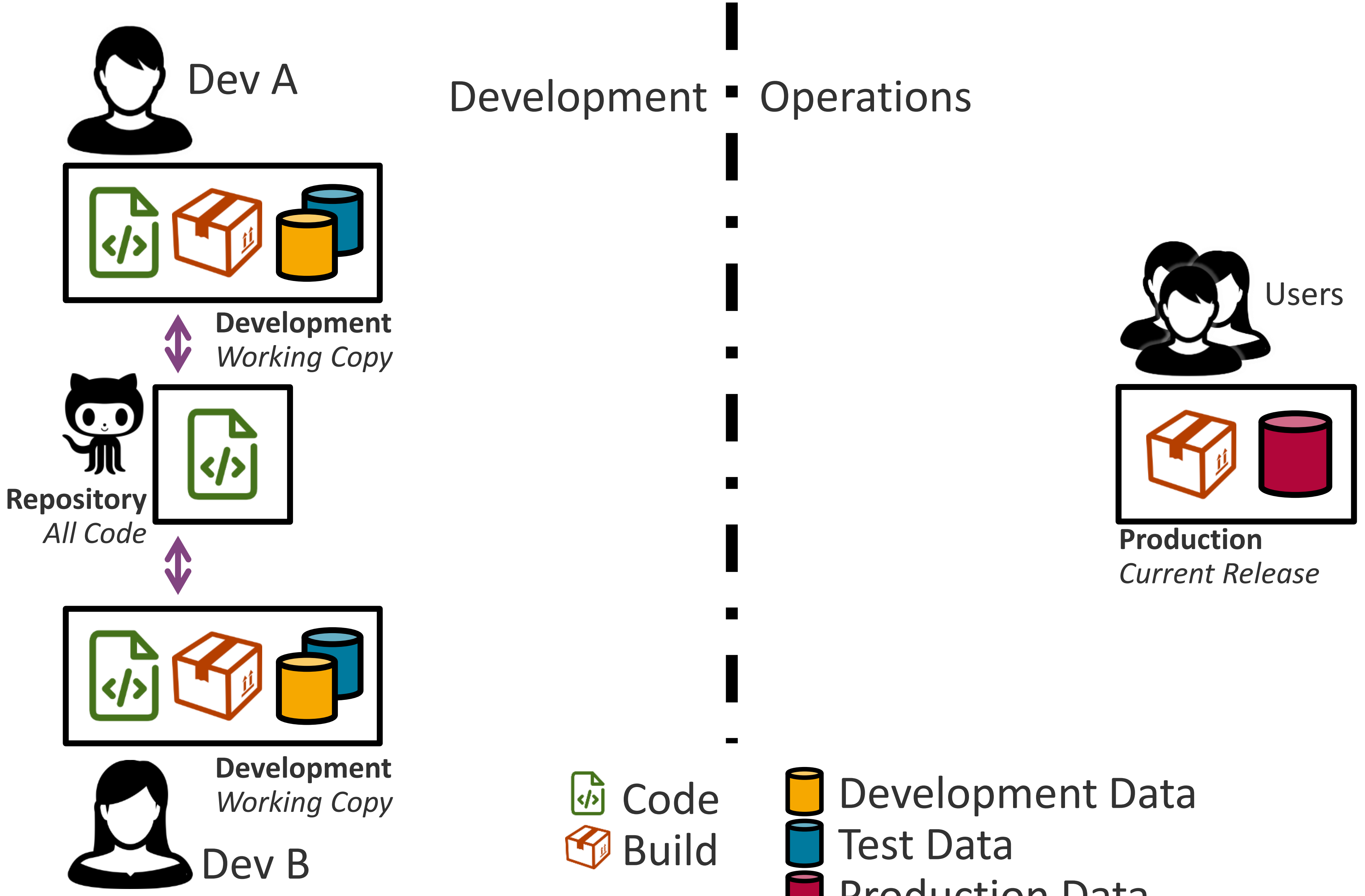
Agenda

Development vs. Operations



Code
Build

🟨 Development Data
🟦 Test Data
🟥 Production Data

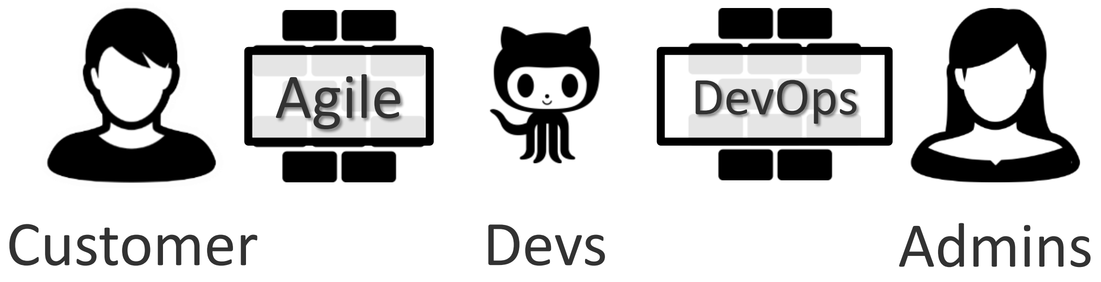
Development & Operations

Problems

- Software needs to be operated
  - Developers vs. Admins
- Short deployment cycles
- Maintain quality standards

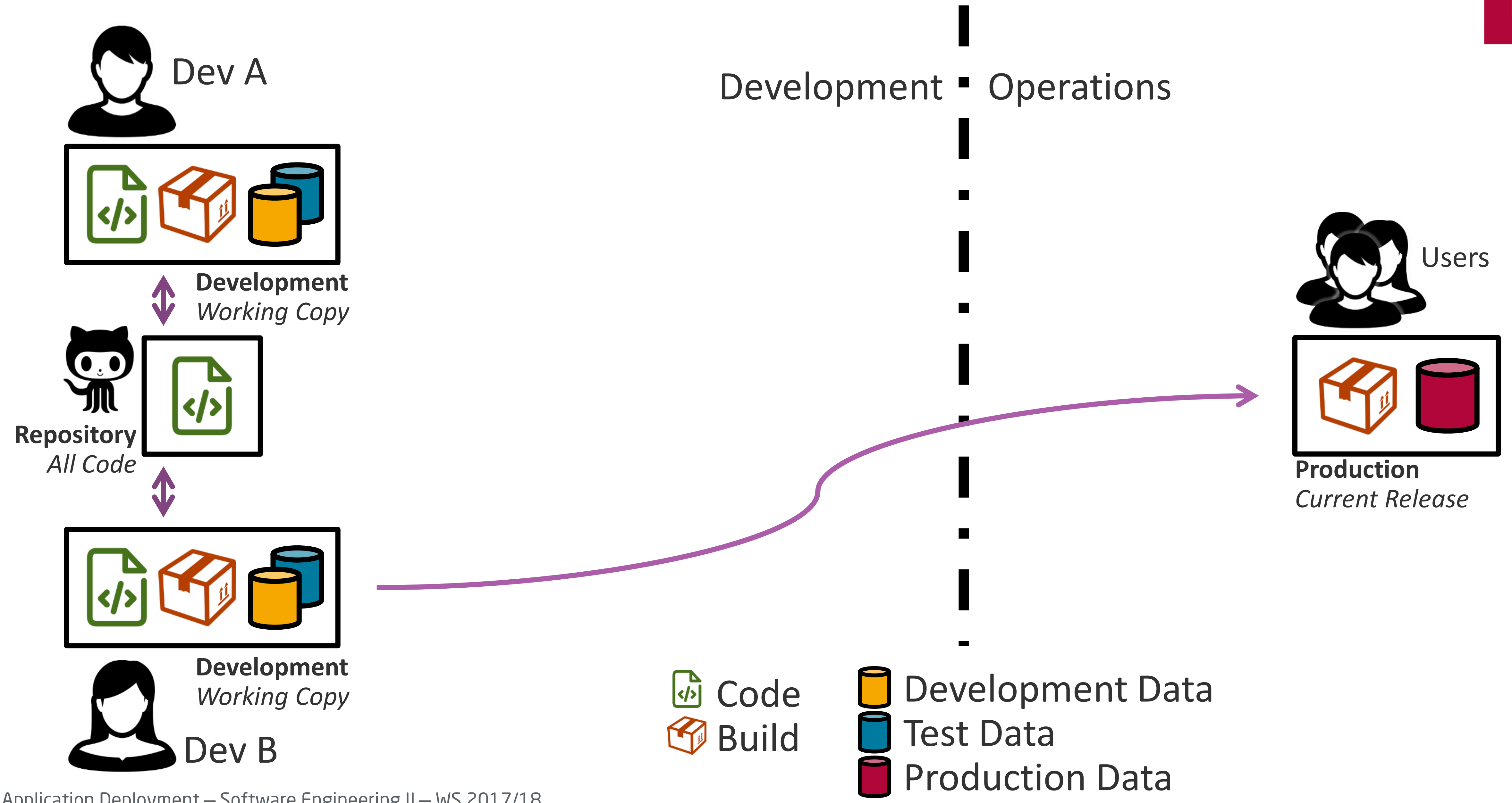
DevOps

- Formalized process for deployment
- Focus on communication, collaboration, and integration between Dev and Ops



“Agile for deployment”

Not DevOps


Dev A
Development
Working Copy
Repository
All Code
Development
Working Copy
Dev B
Development
Operations
Users
Production
Current Release
Code
Build
Development Data
Test Data
Production Data

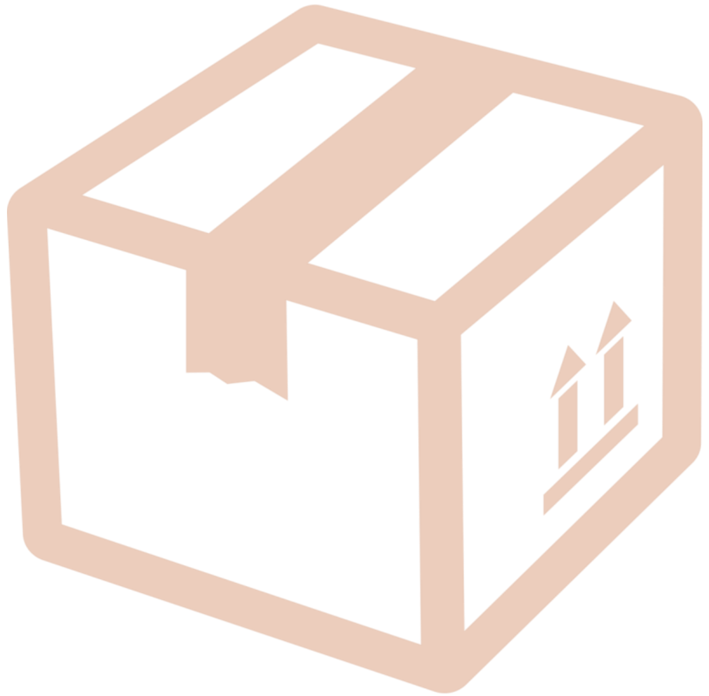
Terminology

Release

- Planned state of the application
- Set of requirements
- Examples
  - Next big version with new shiny features
  - Urgent hotfix
  - Anything in-between

Version

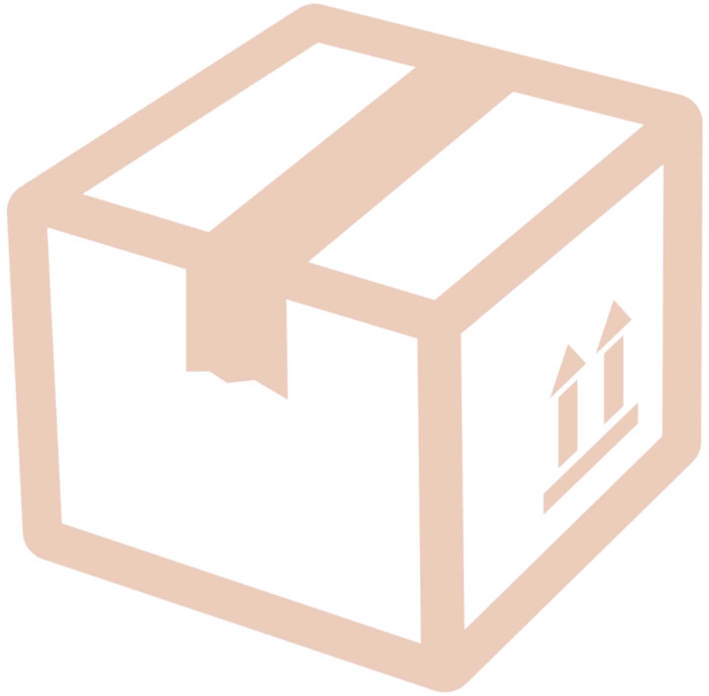
- Could be anything
- A release has a version number



Terminology

Build

- Attempt to implement a release
  - Snapshot of application
- Often the output of the build tool
  - Not: the build script/tool/process
- Version number is
  “<Release Number>.<Build Number>”



Terminology

Environment

- A system on which the application can be deployed and used

To promote

- To deploy a build on the next environment

To release

- To promote a build to production
- Thereby finishing the release

Overview of Environments

Development
managed by developers

Development
- Where the developers work
- One per developer (if possible)

Integration
- Runs all tests
- A try-out version

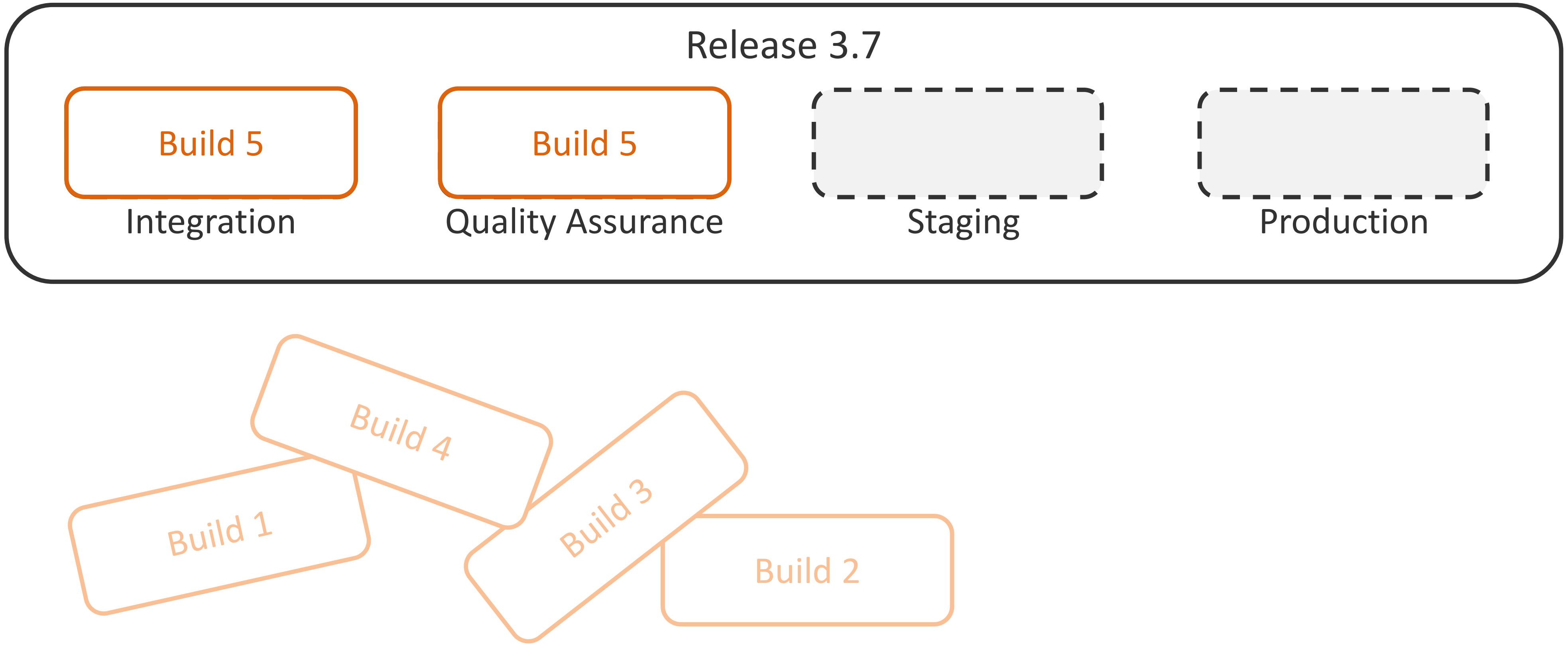
Quality Assurance
- Professional manual testing

Operations
managed by admins

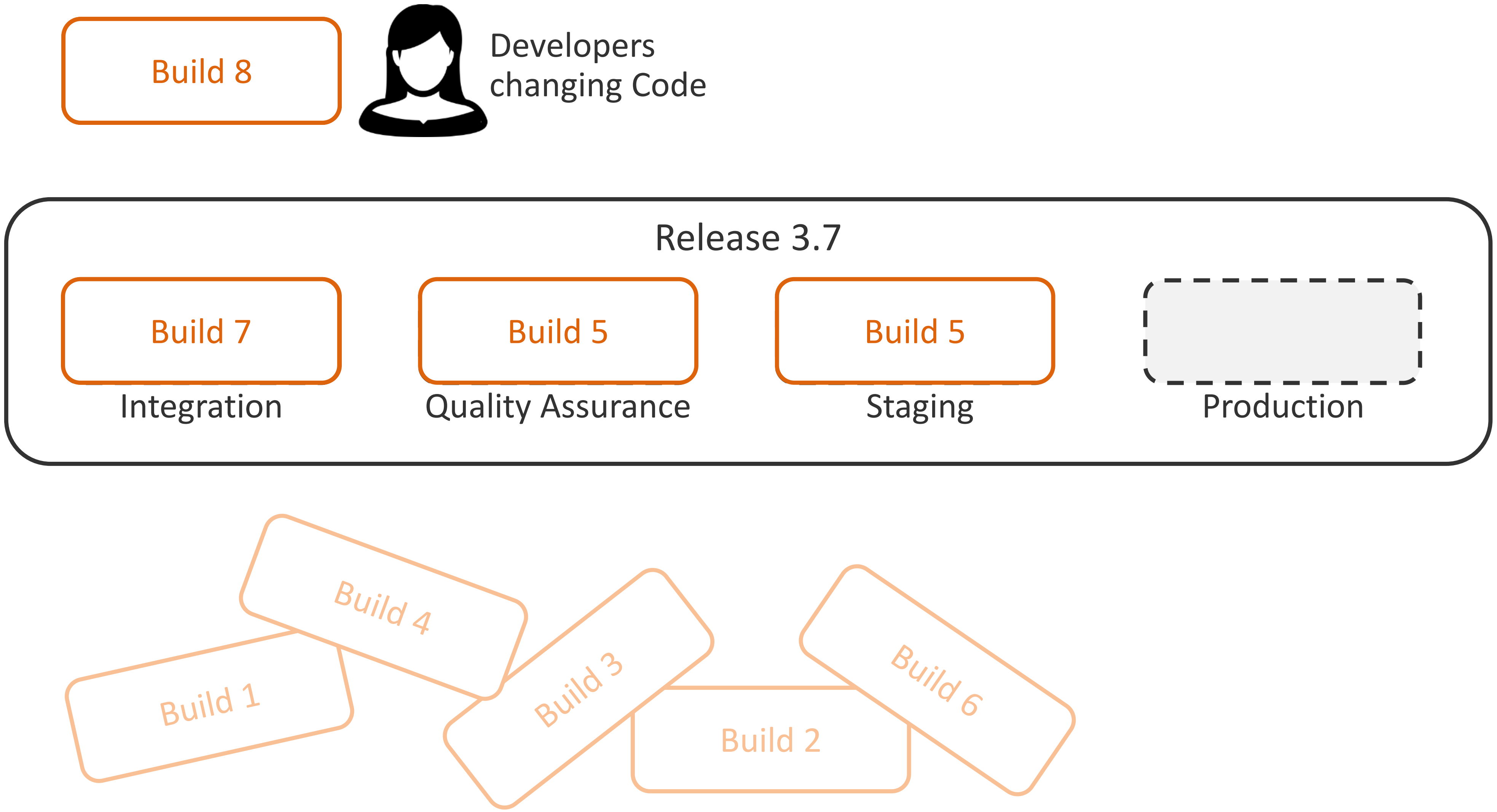
Staging
- Clone of production system
- Final rehearsal

Production
- The live system
- Failures are expensive here

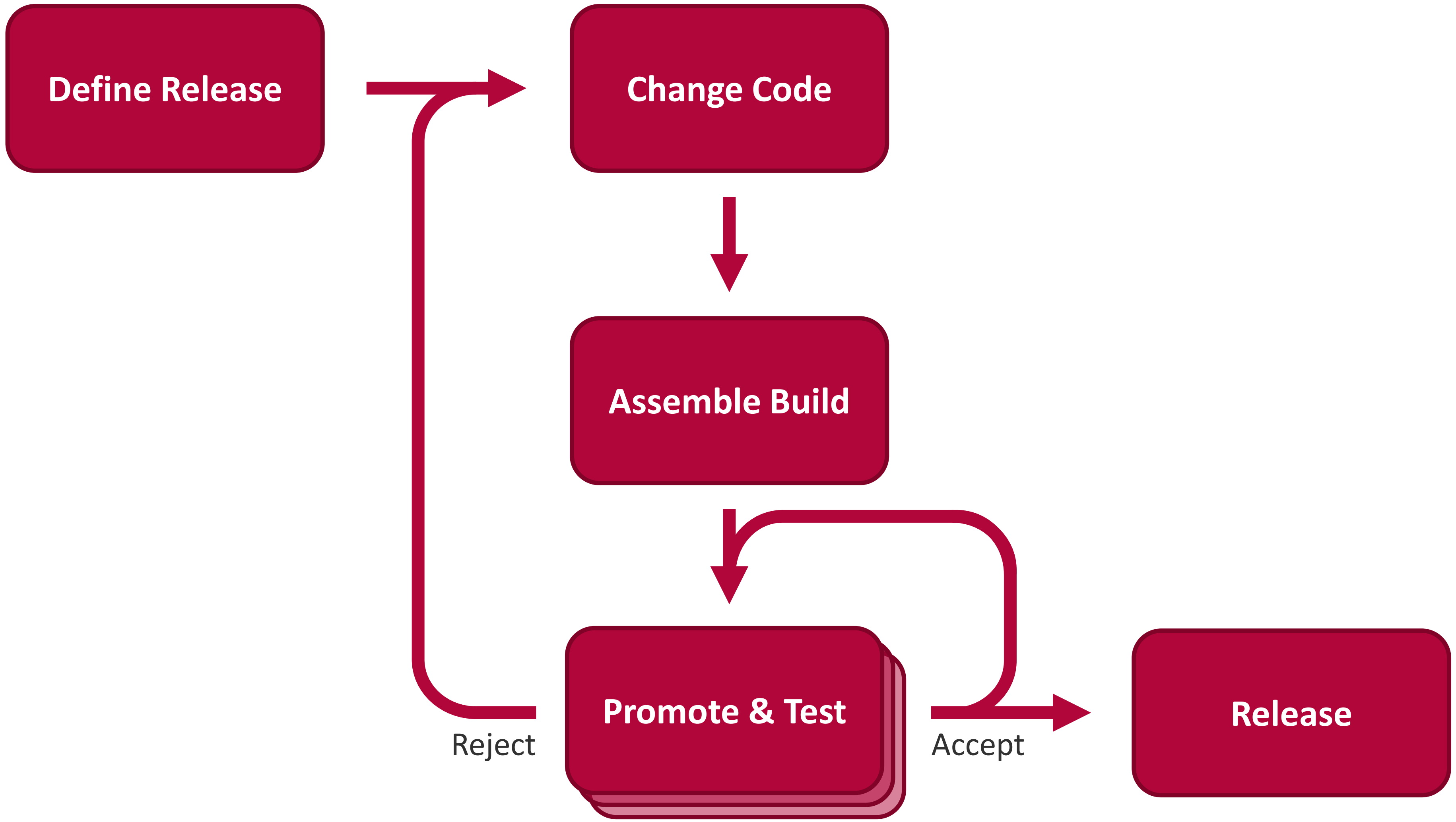
Example


Release 3.7
Build 5
Integration
Build 5
Quality Assurance
Staging
Production
Build 4
Build 1
Build 3
Build 2

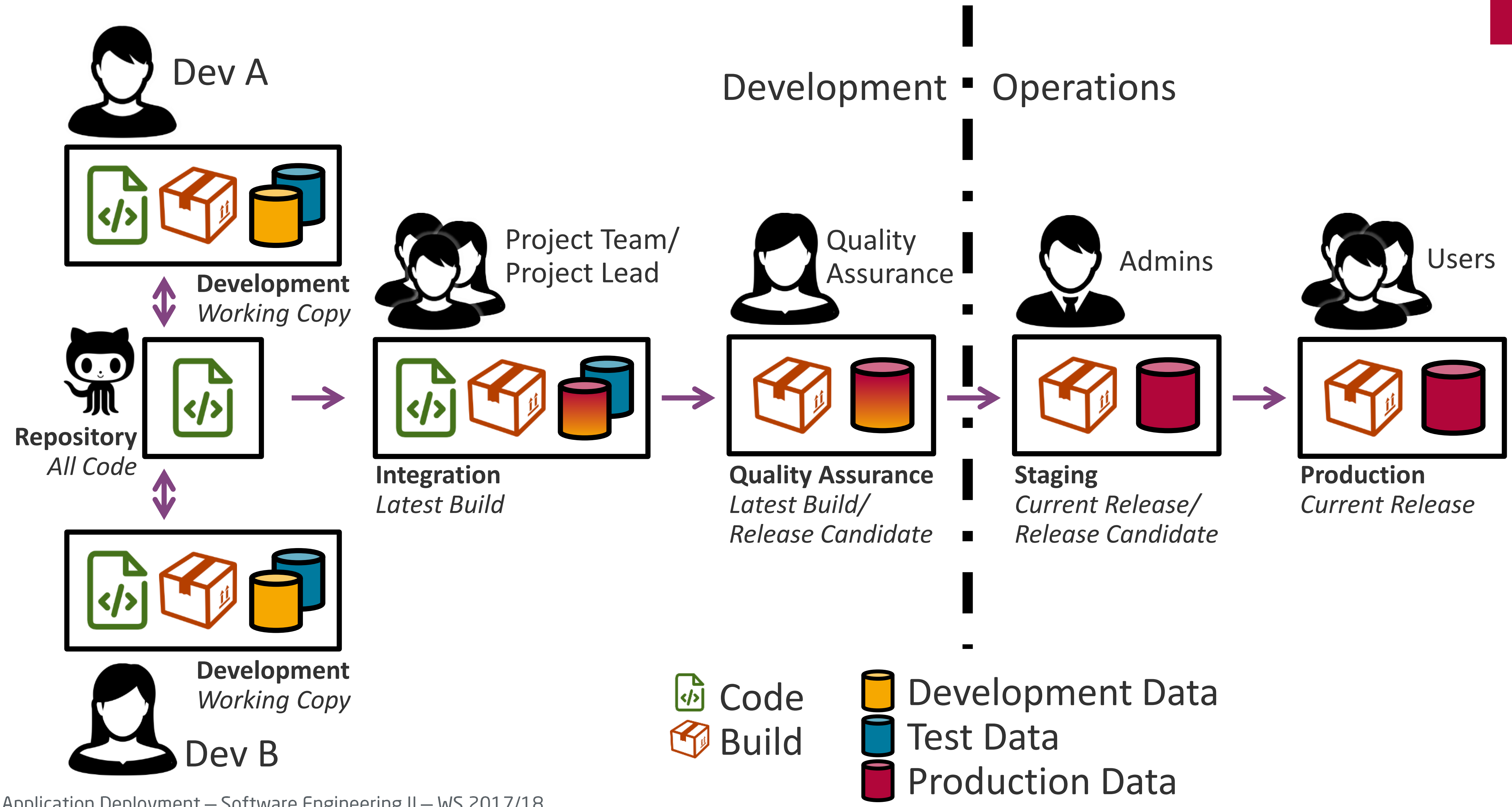
Example


Build 8
Developers changing Code
Release 3.7
Build 7
Integration
Build 5
Quality Assurance
Build 5
Staging
Production
Build 4
Build 1
Build 3
Build 2
Build 6

Workflow


Define Release
Change Code
Assemble Build
Promote & Test
Reject
Accept
Release

DevOps



Dev A
Development
Working Copy
Repository
All Code
Development
Working Copy
Dev B
Project Team/
Project Lead
Integration
Latest Build
Development
Operations
Quality
Assurance
Quality Assurance
Latest Build/
Release Candidate
Admins
Staging
Current Release/
Release Candidate
Users
Production
Current Release
Code
Build
Development Data
Test Data
Production Data

Implications

Builds are immutable

- If changed, previous testing was pointless

➔ Even the smallest change has to go through all environments

Many systems required

- Each environment has to be maintained
- Automation?

$\Big\}$ Remainder of this lecture

Deployment overhead

- Manual steps are potential for human failure
- Automation?

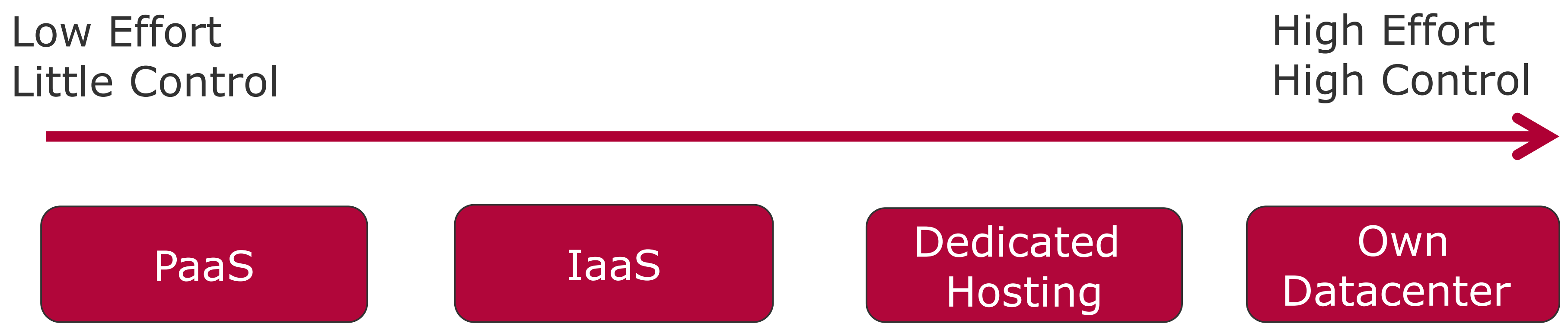
Agenda

1. DevOps
2. Application Hosting Options
3. Automating Environment Setup
4. Deployment Scripting
5. Application Monitoring
6. Continuous Deployment and Scrum

Application Hosting Options

Choice of hosting options is driven by a variety of parameters

- Initial setup effort, cost, and required expertise
- Operational costs and effort
- Targeted service level agreements (SLAs)
- Legal considerations (data privacy, liability, etc.)



Platform as a Service (Paas)

Providers deliver OS, execution environment, database, web server, monitoring, etc.

Advantages

- Minimal effort and knowledge required for setup
- Only platform development knowledge (e.g. Python, Ruby) needed, no need for hardware / OS maintenance
- Possibility to scale up quickly and easily

Disadvantages

- Usually fixed environment with little variation points
- Provider SLA targets might differ from yours, e.g. downtime, response times
- Limited technical support

Examples: Heroku, Azure Compute, Google App Engine

Infrastructure as a Service (IaaS)

Providers deliver virtual private servers (VPS) with requested configuration
Setup of execution environment, database servers, etc. is up to customers

Advantages

- Flexibility regarding execution environment
- Avoid management of underlying hardware
- Dynamic on-demand scaling of resources

Disadvantages

- Server administration know-how and efforts required
- It’s still a VM: Potential performance drops, Disk I/O, etc.

Examples: Amazon EC2, Google Compute Engine, Rackspace Cloud, DigitalOcean

Dedicated Hosting

Providers allocate *dedicated* hardware, classical approach

Advantages

- Complete control over server, down to bare metal, full power always available
- No virtualization-related performance issues
- More control over network configuration
- Dedicated SLAs

Disadvantages (compared to Iaas)

- No easy scaling of resources
- Administration efforts for servers, e.g. monitor disk failures

Examples: Hetzner, OVH, Rackspace, Host Europe

Own datacenter

You host your own servers

Advantages

- Complete control over data, security, operations, network etc.
- Custom designed servers possible
- Add cabinets in available space with low cost

Disadvantages

- Huge upfront costs, e.g. space, cooling, fiber, hardware
- Expanding the space of the datacenter is expensive
- Provide around the clock support, monitoring, personnel, etc.
- Not feasible for small companies

Examples: Google, Facebook

Agenda

Setting up an Environment

Main challenges in preparing infrastructure:

- Minimize the effort required to repeatedly setup identical execution environments
- Without relying on “administration gurus”

Solutions:

- *DevOps*, i.e. a strong collaboration between the development and the operations team
- A strong bias towards automation

Where to Start With "Deploying"?

- Hosted solutions aren't always feasible for initial experiments
- Maintaining local installs of server stacks in different versions can get cumbersome *(e.g. XAMPP, WAMP, LAMP)*
- Development vs. production environment differences result in *"it works on my machine"* problems
- Don't want to force all developers to use same development environment (e.g. choice of OS)

Possible solution: VirtualBox + Vagrant (https://www.vagrantup.com/)

- "Deploy" to a virtual machine on your local OS for development

http://code.tutsplus.com/tutorials/vagrant-what-why-and-how--net-26500

Agenda

Next Step: Automate VM Configuration

Virtualization software provides a VM.

Provisioning tools configure it, e.g. install required software.

Why not provision manually?

- Error prone, repetitive tasks
- Documentation has to be kept up-to-date
- Explicit knowledge transfer required if Admin changes

One provisioning tool example: Chef (http://chef.io, https://github.com/chef/chef)

- Formalize software install and configuration state into *recipes*
- Recipes (e.g. for rails4) are shared (https://supermarket.chef.io/cookbooks)
- Ensure software is installed based on dependencies
- Ensure that files, packages, and services are in the prescribed state

Common alternative: Puppet (https://puppetlabs.com/)

Provisioning Summary

Create your VM, e.g. describe it with Vagrant.

Using provisioning tools, you can:

- Define the required packages for all required servers
- Install and configure necessary services
- Create the directory structure for your application
- Create custom configuration files (e.g., database.yml)

Not touched here but also possible:

- Use templates to create different files based on variables
- Environments (staging vs. production)
- Central management of configuration files that are automatically transferred to clients

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Environment is set – How to deploy?

Necessary steps after the server is configured:

- Checkout code changes
- Update your dependencies (i.e. gems)
- Run database migrations, restart application servers
- Optional: Restart index servers, setup new Cron jobs, etc.

Remember: Automation!

- Easiest: Travis CI supports deploying to many hosting providers (http://docs.travis-ci.com/user/deployment/)
  - Deploy after all the tests pass
- Alternative: Capistrano (https://github.com/capistrano/capistrano)
  - Prepares the server for deployment (possibly using provisioning tools)
  - Deploy the application as updates are made

Deployment with Travis CI

Travis Continuous Integration and Deployment Workflow:

1. **`before_install`**
2. **`install`**
3. **`before_script`**
4. **`script`**
5. **`after_success`** **or** **`after_failure`**
6. **`after_script`**
7. **`before_deploy`**
8. **`deploy`**
9. **`after_deploy`**

tests are run

optional steps

A non-zero exit-status is these phases means the build is marked as *failed.* The build is *not* deployed to the hosting provider.

Otherwise it is deployed in the deploy step.

- A custom `after_success` step can be used to deploy to own servers (http://docs.travis-ci.com/user/deployment/custom/)

http://docs.travis-ci.com/user/build-lifecycle/

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Monitoring your servers and application

Keep an eye on server health and applications:

- Get alerts when components fail or exceed predefined thresholds
- Examples:
  - Uptime Robot—HTTP GET / ping every 5 mins (https://uptimerobot.com/)
  - Nagios—Monitor infrastructure, down to switches and services (http://nagios.org)

Monitor application errors and performance bottlenecks:

- Monitor errors that happen at runtime, discovered by users
- Notifications upon application errors, slow downs
- Good idea: Protocols for error fixing!
- Examples:
  - Errbit—Collect and organize errors (https://github.com/errbit/errbit)
  - New Relic—Performance monitoring, response times, SQL (http://newrelic.com/)

Agenda

Deploying 50 times a day? Continuous Delivery

Advantages:

- Users get a sense of "something happening" frequently, shorter feedback loop
- Business value of features immediately present
- Deploy scripts used often, less likely to contain errors
- Reduced amount of code changes per release → faster fixes, less downtime

Prerequisites/Disadvantages:

- Only feasible with extensive set of *good* tests
- Tests / deployment need to run fast *(Continuous Integration)*
- Additional training for developers *(DevOps)* required
- May not be feasible for applications that require planning or long-term support (e.g. operating systems)

Discussion:
Operating systems feature both CD (rolling releases) and classical approaches (LTS releases)

Continuous Deployment vs. Scrum

How do 50 deployments a day fit into Scrums notion of Sprints?

Some ideas (let’s discuss):

- Intermediate Reviews for individual stories by the PO
  - At sprint review, each finished story is already running in production
  - Review meetings become shorter, more of a high level overview
- Get faster feedback from stakeholders for next Scrum meeting
- Deploying to staging or testing systems becomes part of the definition of done
- Acceptance of features not only based on PO approval but stakeholder approval?
  - A/B testing?
- "Working software is the primary measure of progress"—*Agile Manifesto*
  - Is software that is not deployed *working*? *(DevOps)*

Summary

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Conclusion: Automate everything!

https://github.com/narkoz/hacker-scripts ;-)

Image Credits

- thenounproject.com
  - Box designed by Mourad Mokrane
  - Bricks designed by Trammie Anderson