สยามชำนาญกิจ
SIAM CHAMNAN KIT

# 守破離

## Shu Ha Ri

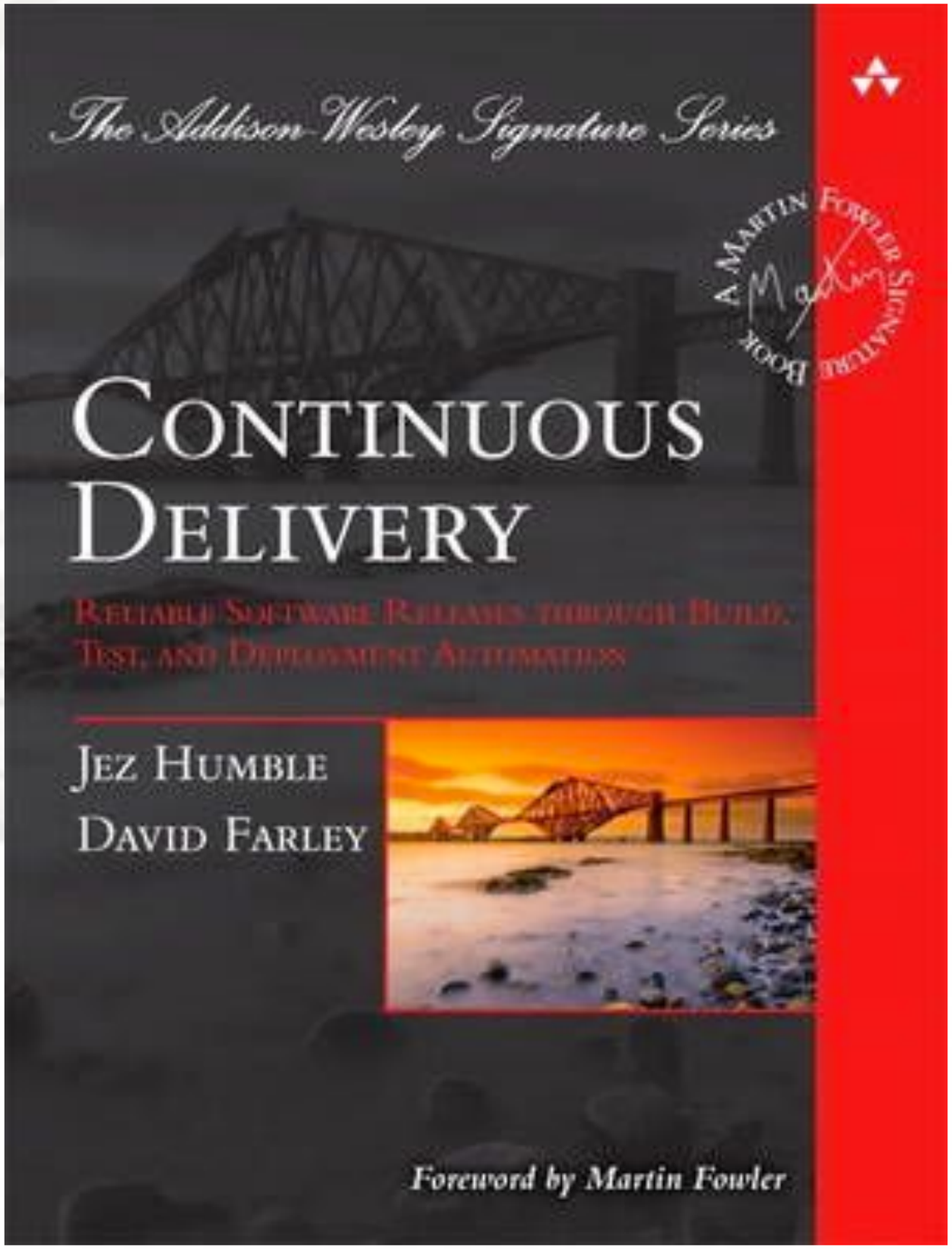
## SEAL


## We Love Bug

# Continuous Delivery

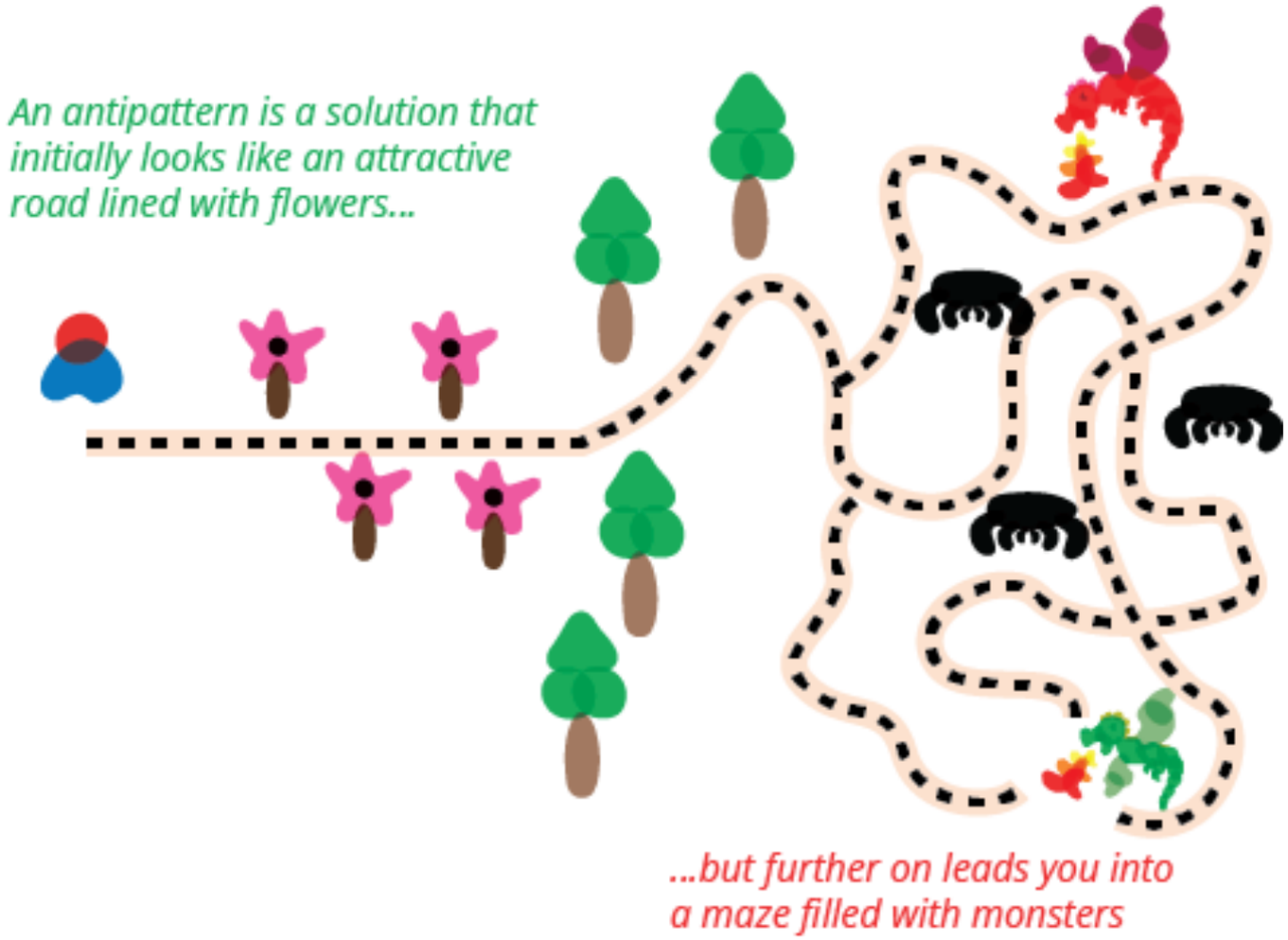
Reliable Software Releases Through Build , Test and Deployment Automation

# Continuous Delivery



# The Problem of Delivering Software

# Some Common Release Antipatterns




"An antipattern is just like a pattern, except that instead of a solution it gives something that looks superficially like a solution but isn't one."
-- Andrew Koenig

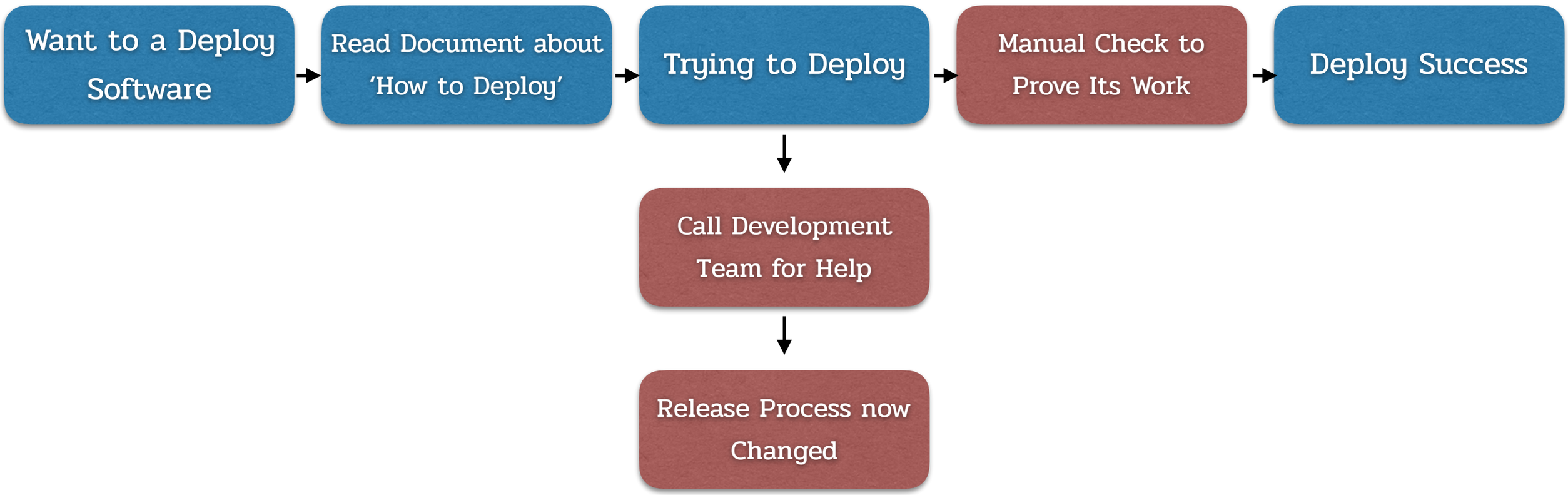
Source: https://martinfowler.com/bliki/AntiPattern.html

# Some Common Release Antipatterns

- Deploying Software Manually
- Deploying to a Production-like Environment Only after Development Is Complete
- Manual Configuration Management of Production Environments

# Antipatterns : Deploying Software Manually

expected time : 15 mins




actual time : > 1 hours

# Antipatterns : Deploying Software Manually

Automated Deployment

Detect errors fast

Repeatable

Fast

Reduce documentation

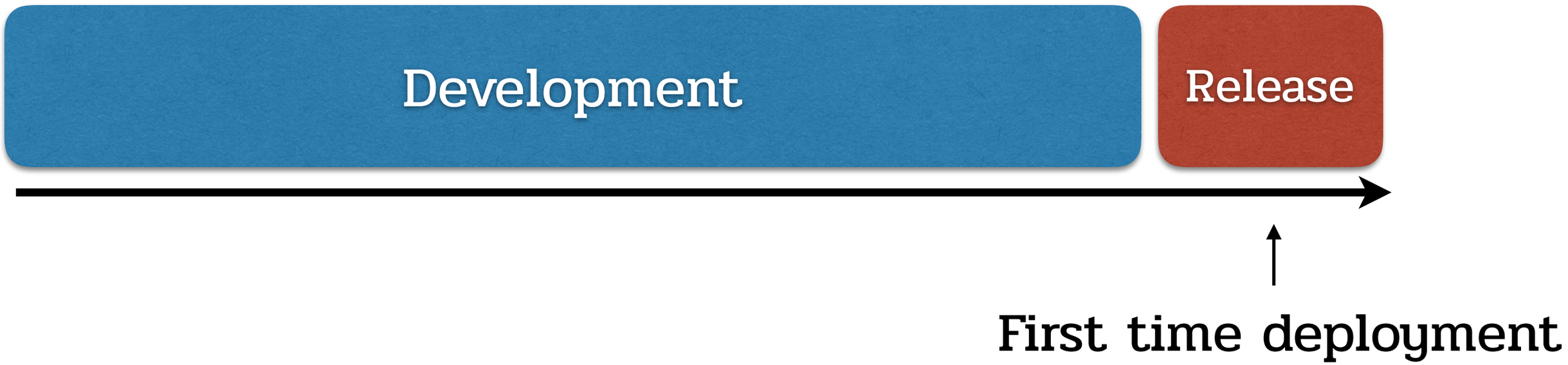
No human errors

Cheap

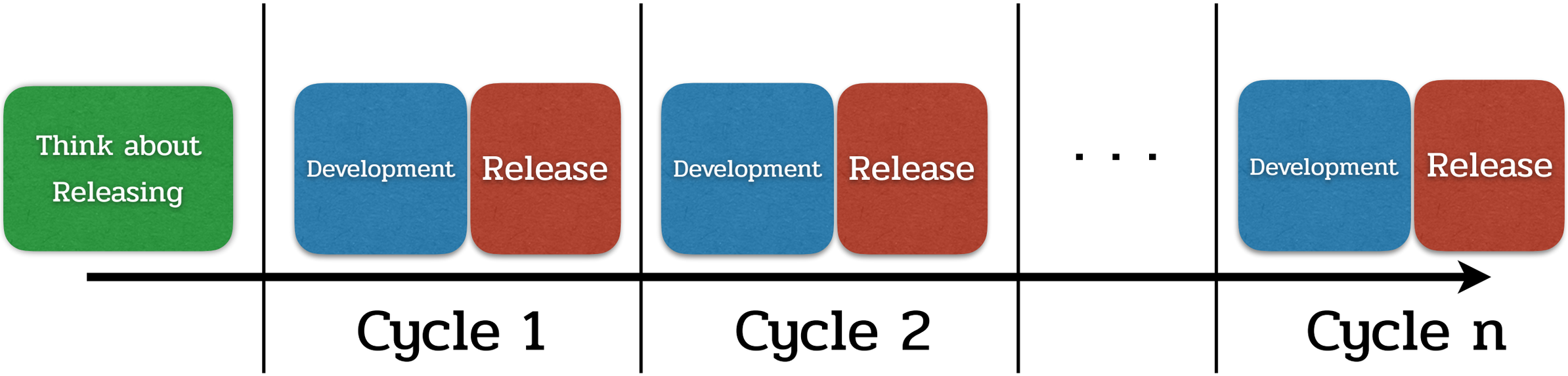
Just press the ‘Deploy’ button

## Antipatterns : Deploying to a Production-like Environment Only after Development Is Complete

In this pattern, the first time the software is deployed to a production-like environment is once most of the development work is done—at least, “done” as defined by the development team.



# Antipatterns : Deploying to a Production-like Environment Only after Development Is Complete



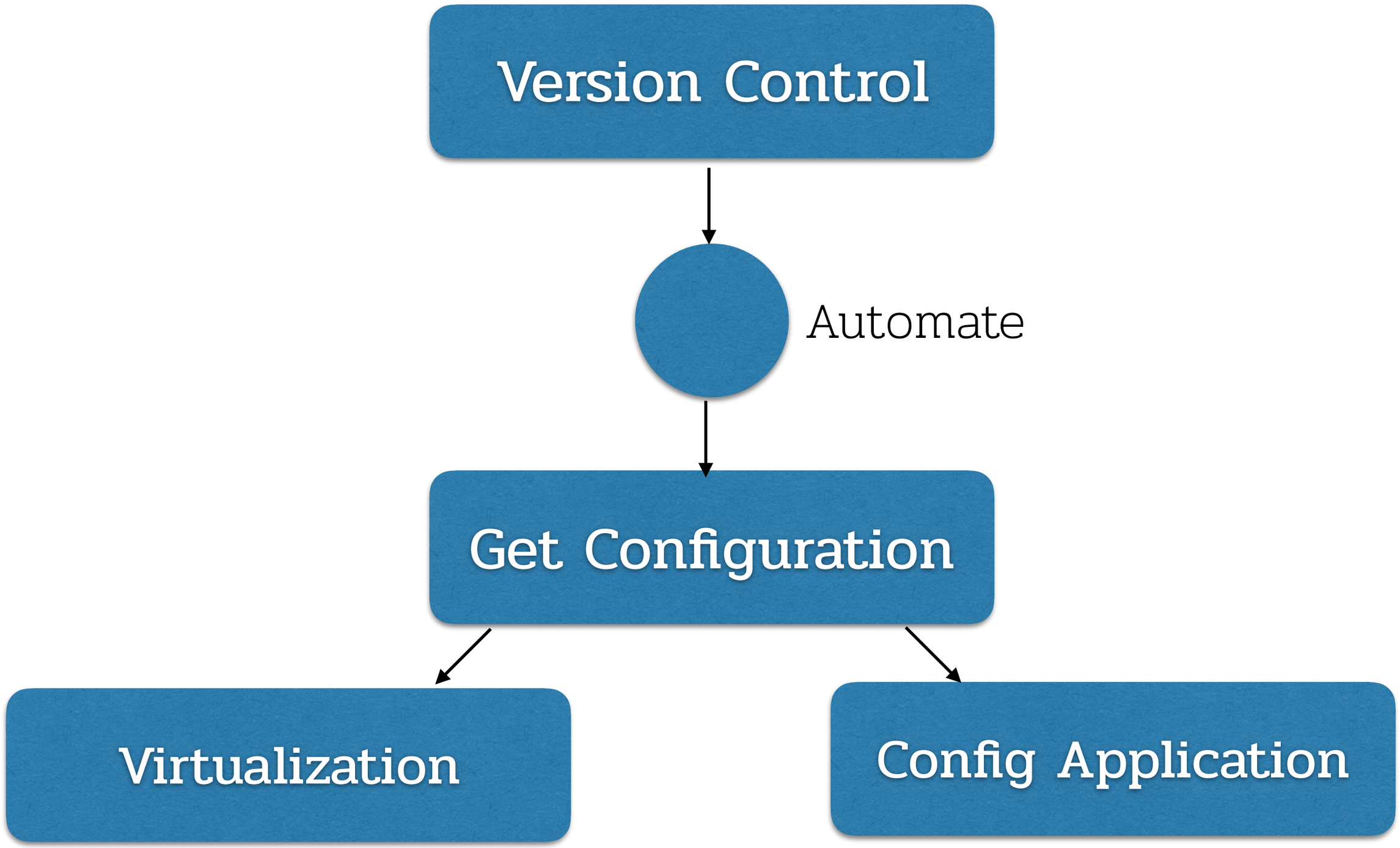
# Antipatterns : Manual Configuration Management of Production Environments


Staging fine but production fail

Get different of some environments

Unable rollback the config

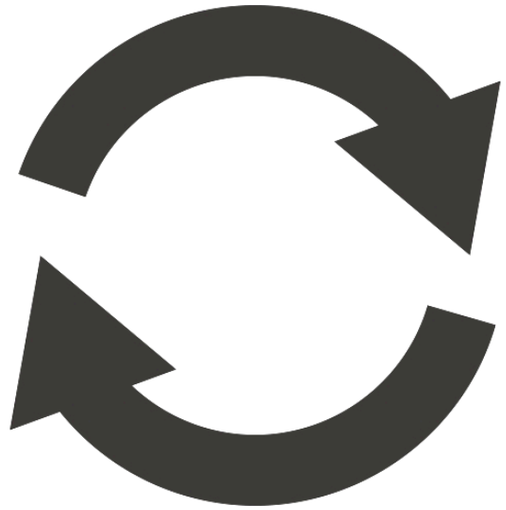
# Antipatterns : Manual Configuration Management of Production Environments



# How do we achieve our goal

"low cycle time and high quality"

Automate



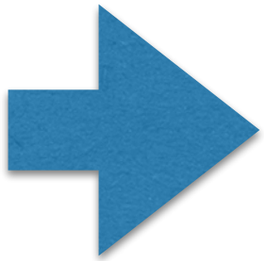
Frequency Feedback

# How to achieve the Feedback Criteria

- Every Change Should Trigger the Feedback Process
- The Feedback Must Be Received as Soon as Possible
- The Delivery Team Must Receive Feedback and Then Act on It

# What Are The Benefits ?

Create release process
repeatable,
reliable
and predictable



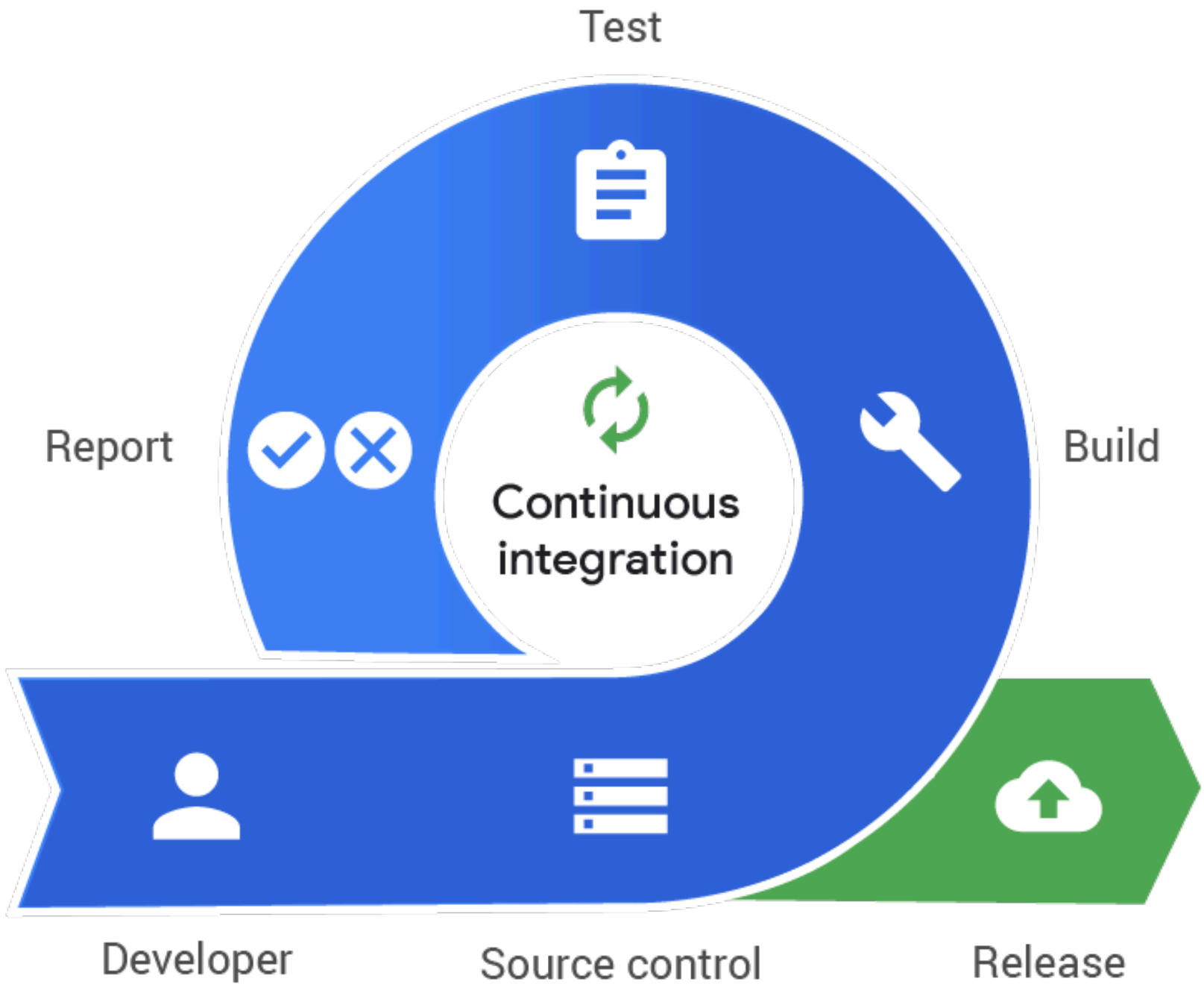
- Empowering Team
- Reducing Errors
- Lower Stress
- Deployment Flexibility

# The Release Candidate


**Figure 1.2** *Traditional view of release candidates*

"A change to your code may or may not be releasable. "

# Every Check-in Leads to a Potential Release



# Principles of Software Delivery

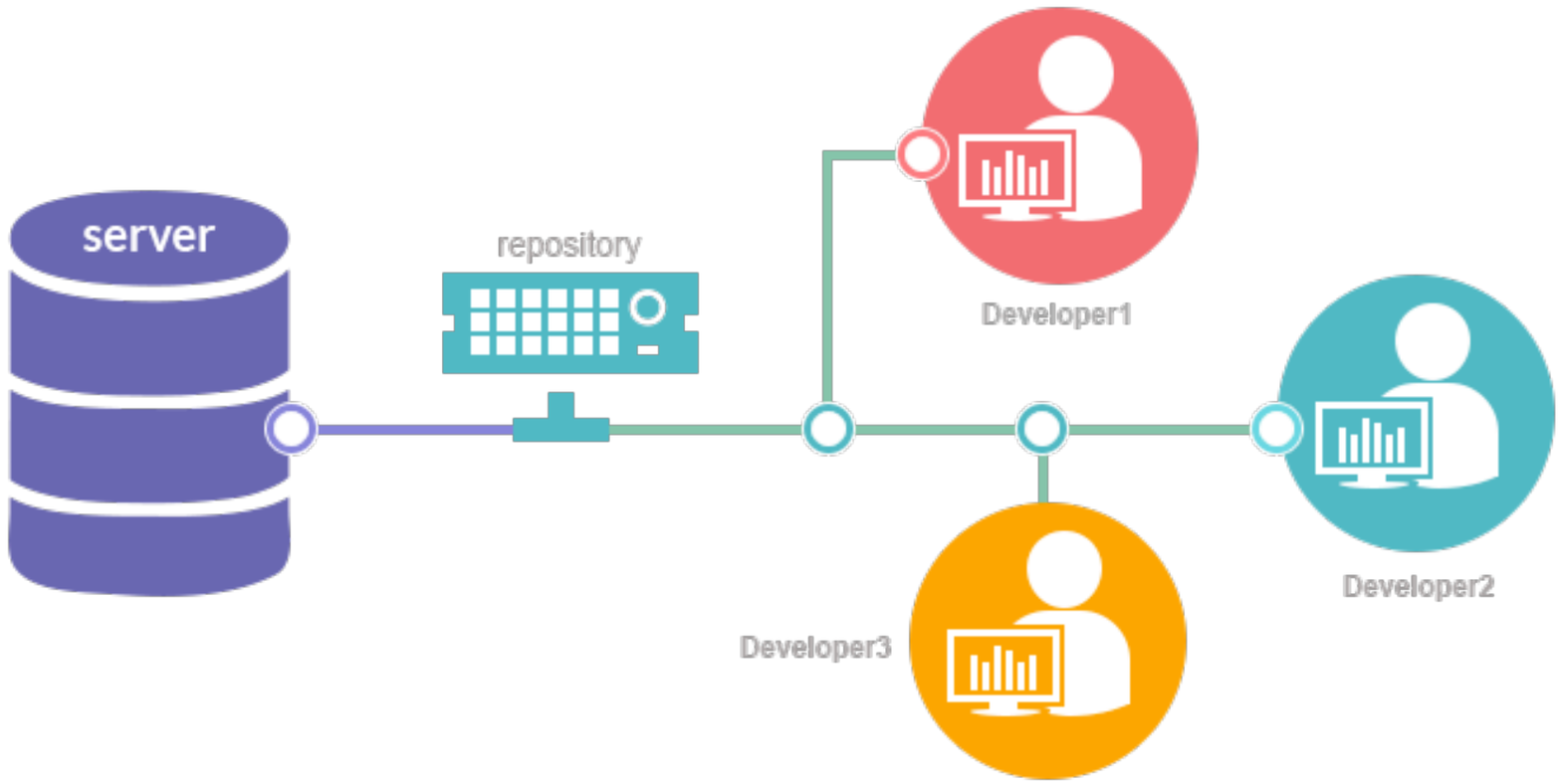
- Create a Repeatable, Reliable Process for Releasing Software
- Automate Almost Everything
- Keep Everything in Version Control
- If It Hurts, Do It More Frequently, and Bring the Pain Forward
- Build Quality In
- Done Means Released
- Everybody Is Responsible for the Delivery Process
- Continuous Improvement

# Configuration Management

# Good configuration management can answer the quest below

- Can I exactly reproduce any of my environment with version configuration?
- Can I easily make change and deploy it to my environment?
- Can I trace back to see exactly what the change was, who made it and when?
- Can I satisfy all of the compliance regulations that I am subject to?
- It is easy for every member of the team to get the information that to make a change?
- Dose the strategy get the way of efficient delivery, leading to increased cycle time and reduced feedback?

# Using Version Control




- Keep Absolutely Everything in Version Control
- Check In Regularly to Trunk
- Use Meaningful Commit Messages

# Managing Dependencies

## — Managing External Libraries

Keep copies libraries on repository that version suited with our application

## — Managing Component

Split smallest of application into component for efficient development process

# Managing Software Configuration

- Configuration and Flexibility
- Types of Configuration
- Managing Application Configuration
- Managing Configuration across Applications
- Principles of Managing Application Configuration

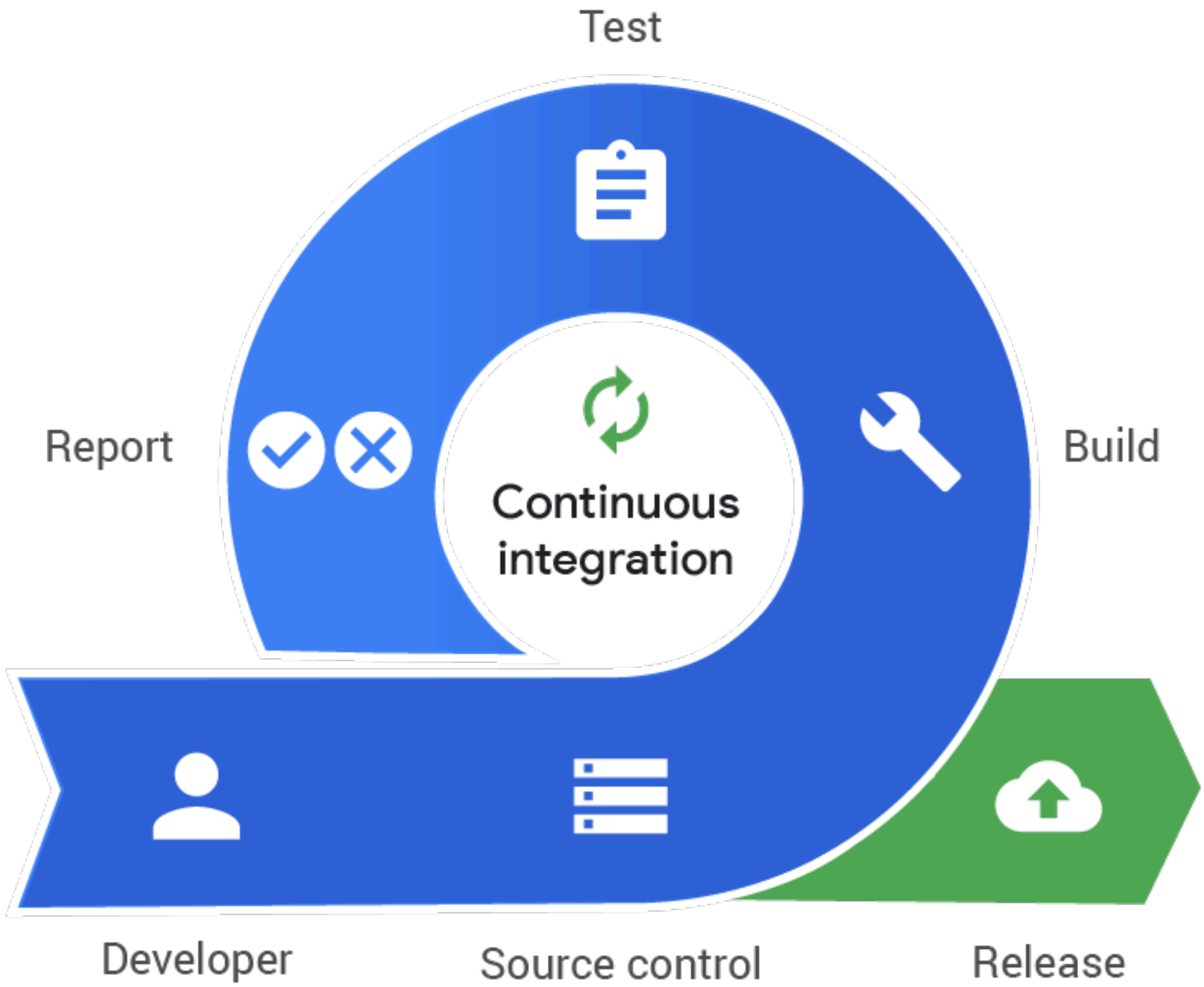
# Managing Your Environments

- **Tools to Manage Environments**
  - ex. Puppet , CfEngine
  - Virtualization

- **Managing the Change Process**
  - Any change can be break
  - Test process like code frequent

# Continuous Integration

# Continuous Integration



# Implementing Continuous Integration

- What You Need Before You Start
- A Basic Continuous Integration System
- Prerequisites for Continuous Integration
- Using Continuous Integration Software
- Essential Practices

# What You Need Before You Start

1. Version Control
2. An Automate Build
3. Agreement of the Team

# A Basic Continuous Integration System

1. Work with rest of team to fix the build failure
2. Update your code from repository after your task finished and tested
3. Run build and test on your machine to confirm its still work
4. If local build and test passes , check your code into version control
5. Wait for your CI tool to run the build with your changes.
6. If it fails, stop what you’re doing and fix the problem immediately —go to step 3.
7. If the build passes, rejoice and move on to your next task.

# Prerequisites for Continuous Integration

- Check In Regularly
- Create a Comprehensive Automated Test Suite
- Keep the Build and Test Process Short
- Managing Your Development Workspace

# Using Continuous Integration Software

- **Basic Operation**
  1. Execute simple workflow
  2. Provide a view of result

- **Bell and Whistels**
  - Show anyone about current status
  - Use like indicator of problem
  - Then keep the build green

# Essential Practices

- Don’t Check In on a Broken Build
- Always Run All Commit Tests Locally before Committing
- Wait for Commit Tests to Pass before Moving On
- Never Go Home on a Broken Build
- Always Be Prepared to Revert to the Provision Revision
- Time-Box Fixing before Reverting
- Don’t Comment Out Failing Tests
- Take Responsibility the Result form Your Changes
- Test-Driven Development

# Suggested Practices

- **Extreme Programming Development Practices**
  - TDD , Share Code Ownership , Refactor

- **Failing a Build for Architectural Breaches**
- Failing the Build for Slow Tests
- Failing the Build for Warnings and Code Style Breaches

** Failing Build need to have strategy for closing the gap **

# Implementing a Testing Strategy

What does

# CONT. DEL. say about TEST STRATEGY

> TESTING IS A CROSSFUNCTIONAL ACTIVITY THAT INVOLVES THE WHOLE TEAM, AND SHOULD BE DONE CONTINUOUSLY FROM THE BEGINNING OF THE PROJECT.

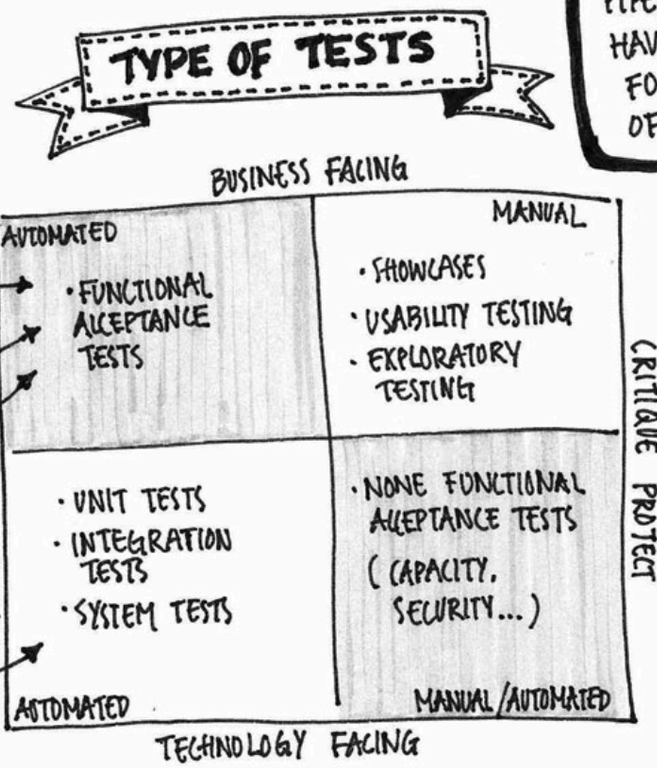


? NOT MUCH INFORMATION REGARDING THIS TYPE OF TESTS IN THE BOOK.

INTEGRATION TEST - TEST THAT ENSURE THAT EACH INDEPENDENT PART OF YOUR APPLICATION WORKS CORRECTLY WITH THE SERVICES IT DEPENDS ON.

WILL FORM PART OF YOUR REGRESSION TEST SUITE

UNIT TEST
COMPONENT TEST
DEPLOYMENT TEST




YOUR DEPLOYMENT PIPELINE SHOULD HAVE ALL THESE FOUR TYPE OF TESTS.

**REGRESSION TEST?** NOT MENTIONED IN THE DIAGRAM. THEY ARE CROSSCUTTING CATEGORY.


Source: Nhan Ngo, a QA engineer at Spotify,

# Type of Tests

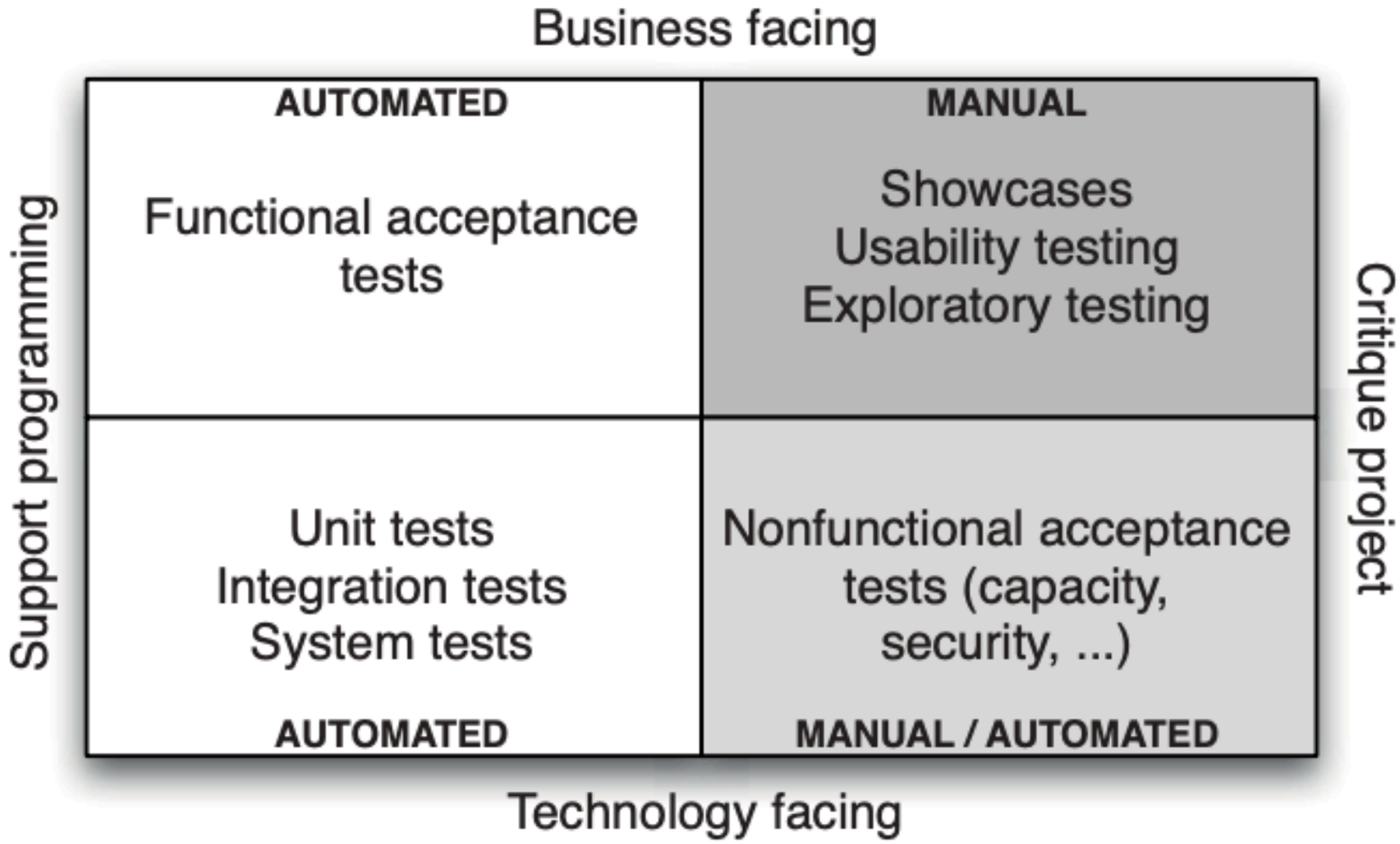



**Figure 4.1** *Testing quadrant diagram, due to Brian Marick, based on ideas that were "in the air" at the time*

# Real-Life Situations and Strategies

## New Project

- Important to start writing automate acceptance tests from the very beginning

- Choose technology , Testing tools

- Strict the process

# Real-Life Situations and Strategies

## Mid Project

- Automate testing the most common , most important and high value use cases

- Identify with customer where is real business value

- Specify and clearly the objective of you tests

# Real-Life Situations and Strategies

## From Legacy System To Automation Deployment

- First create **automated build** process (Continuous Integration - XP)
- First create **automated deploy** process (Continuous Integration - XP)
- Create **automate test suite** from documents or member of team (Continuous Integration - XP); ใช้ Agile Testing Quadant-Brian Merick และ Automation Test Pyramid-Mike Cohn
- **Automated deployment** with **automate test suite** to save a lot of effort on manual testing (ให้รู้ผลเร็วขึ้น ละข้อผิดพลาดจากคน)
- Explain about value of automate regression testing to unwilling customer
- Identify high-value uses of features
- Test the code that you change

# Anatomy of the Deployment Pipeline

# Basic Deployment Pipeline

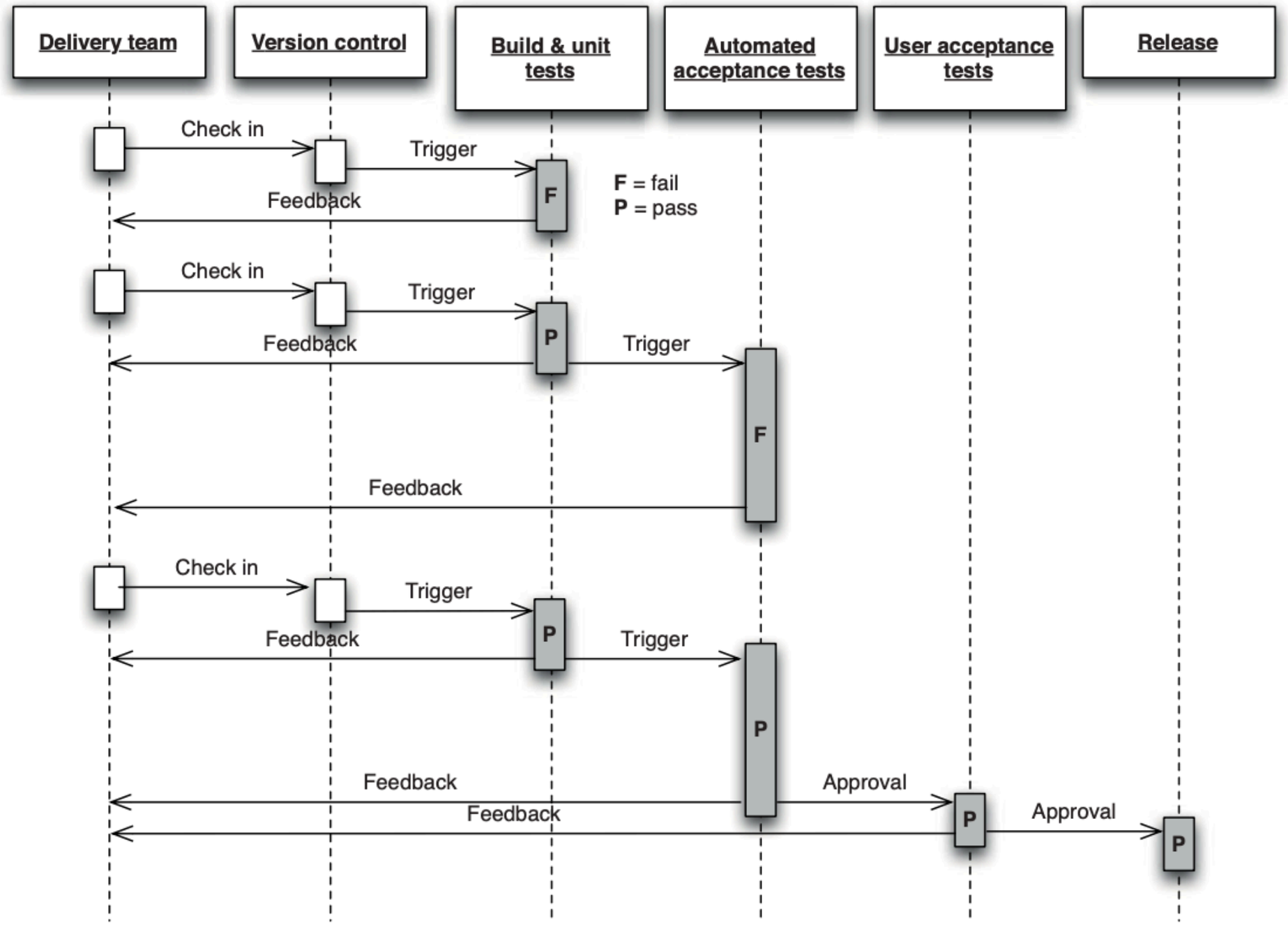



**Figure 5.2** *Changes moving through the deployment pipeline*

# Basic Deployment Pipeline

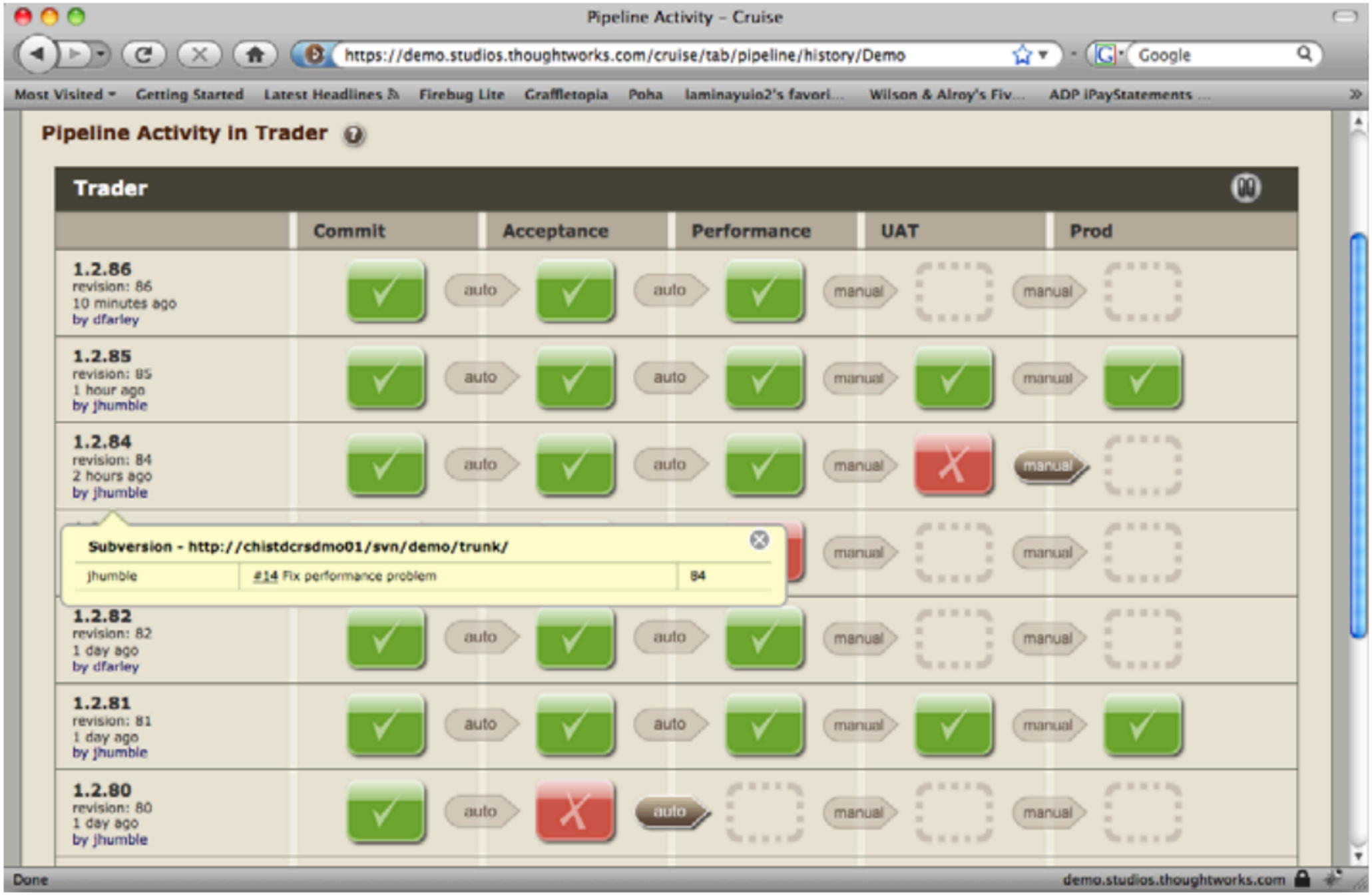
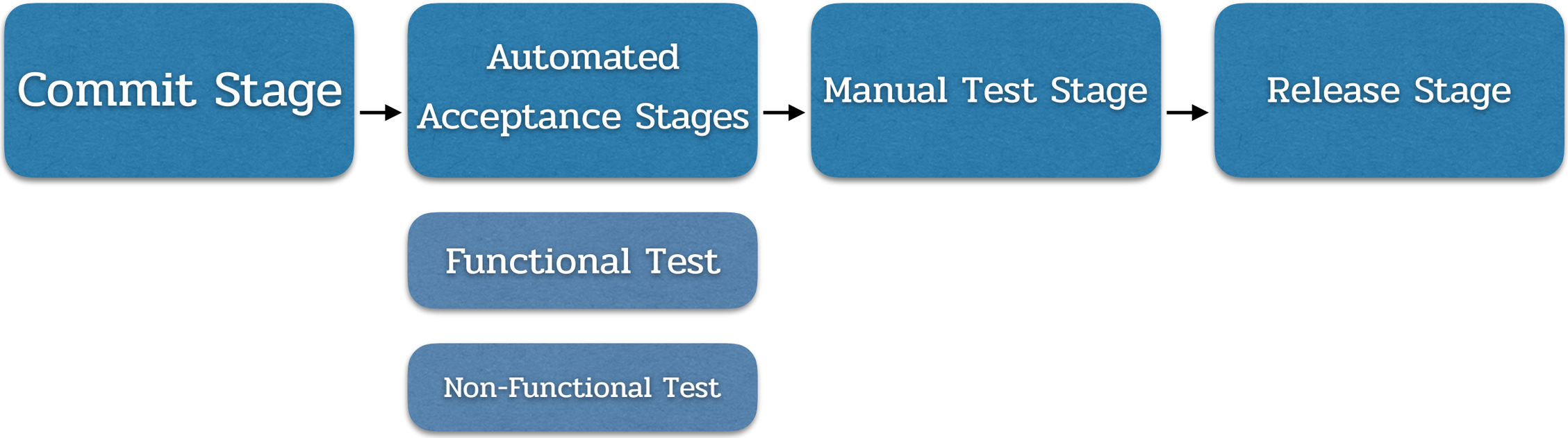



**Figure 5.5** *Go showing which changes have passed which stages*

# Stage of Testing in Releasing Process



# Stage of Testing in Releasing Process

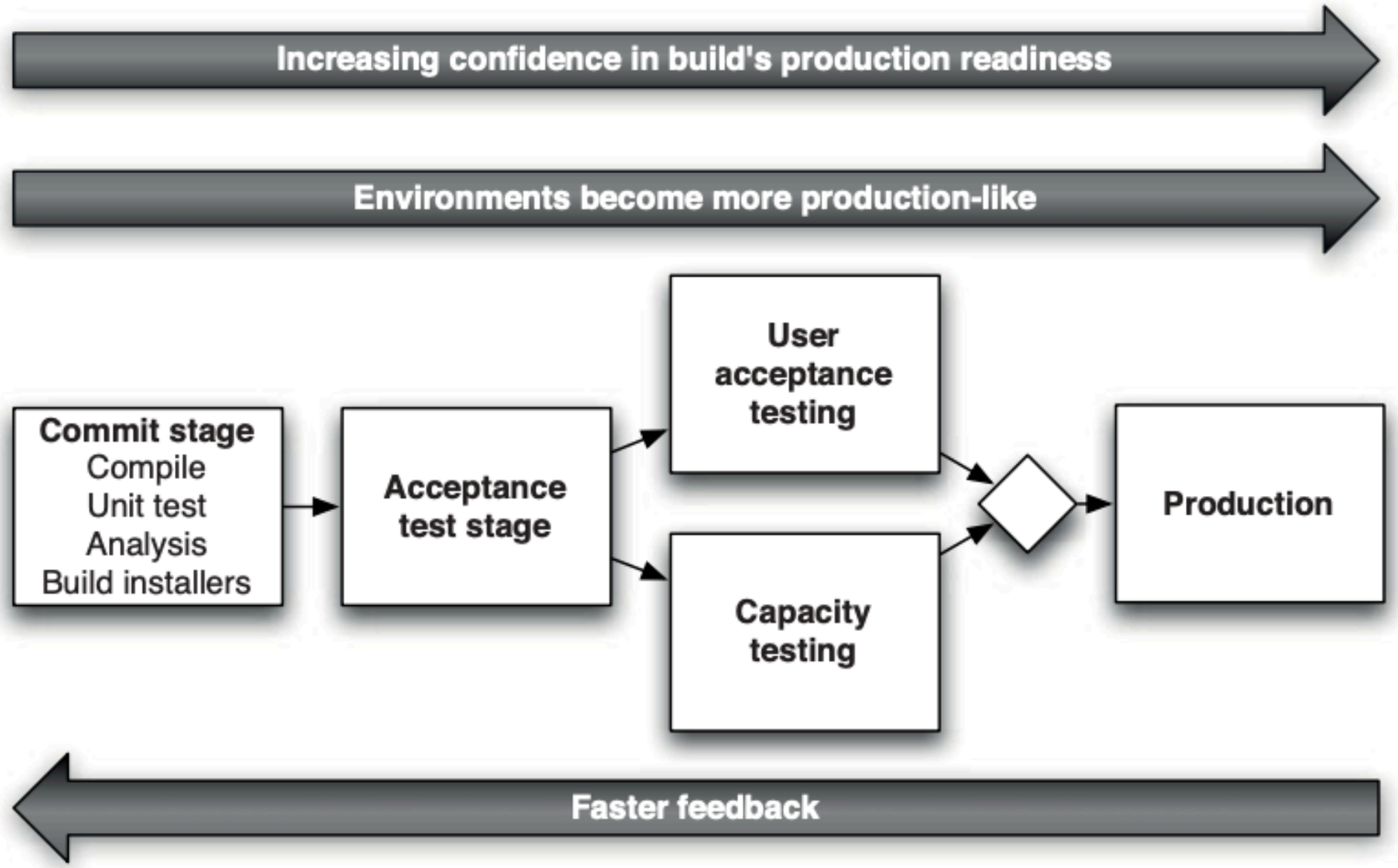



**Figure 5.3** *Trade-offs in the deployment pipeline*

# Basic Deployment Pipeline

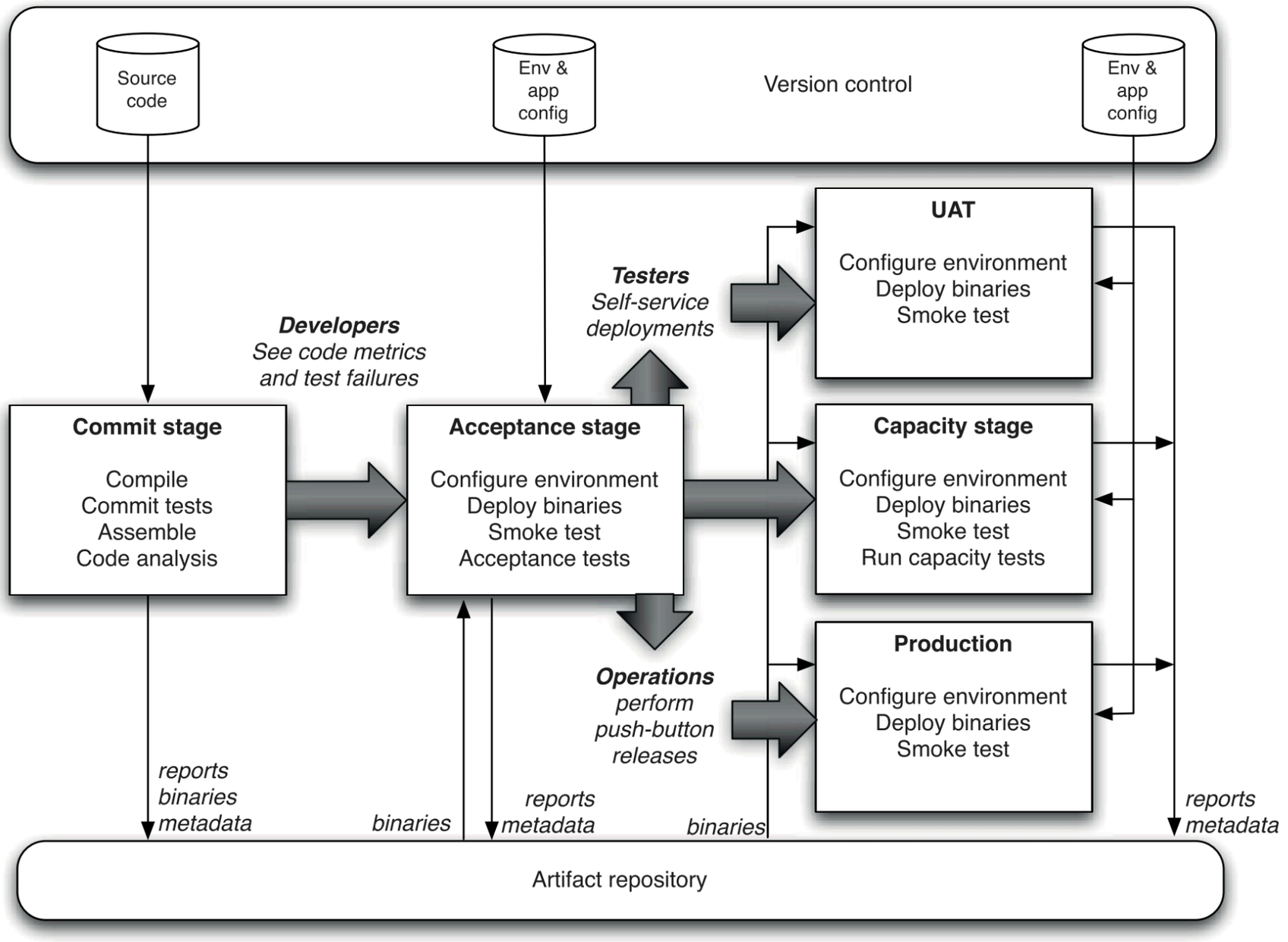



**Figure 5.4** *Basic deployment pipeline*

# Basic Deployment Pipeline

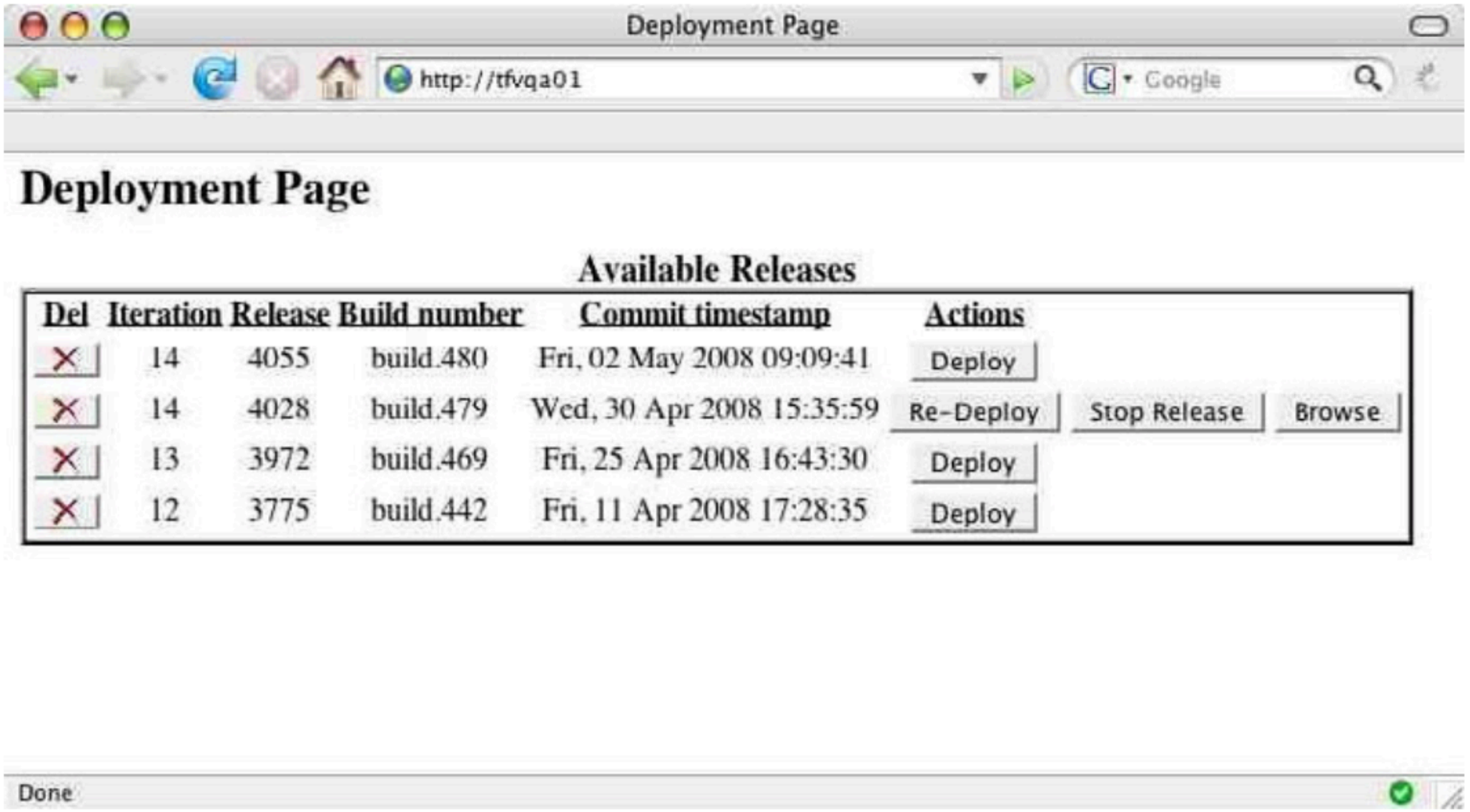



**Figure 5.7** *Example deployment page*

# Deployment Pipeline Practices

- Only Build Your Binaries Once
- Deploy the Same Way to Every Environment
- Smoke-Test Your Deployments
- Deploy Into a Copy of Production
- Each Change Should Propagate through Pipeline Instantly
- If any Part of the Pipeline Fails , Stop the Line

# Topic size 48

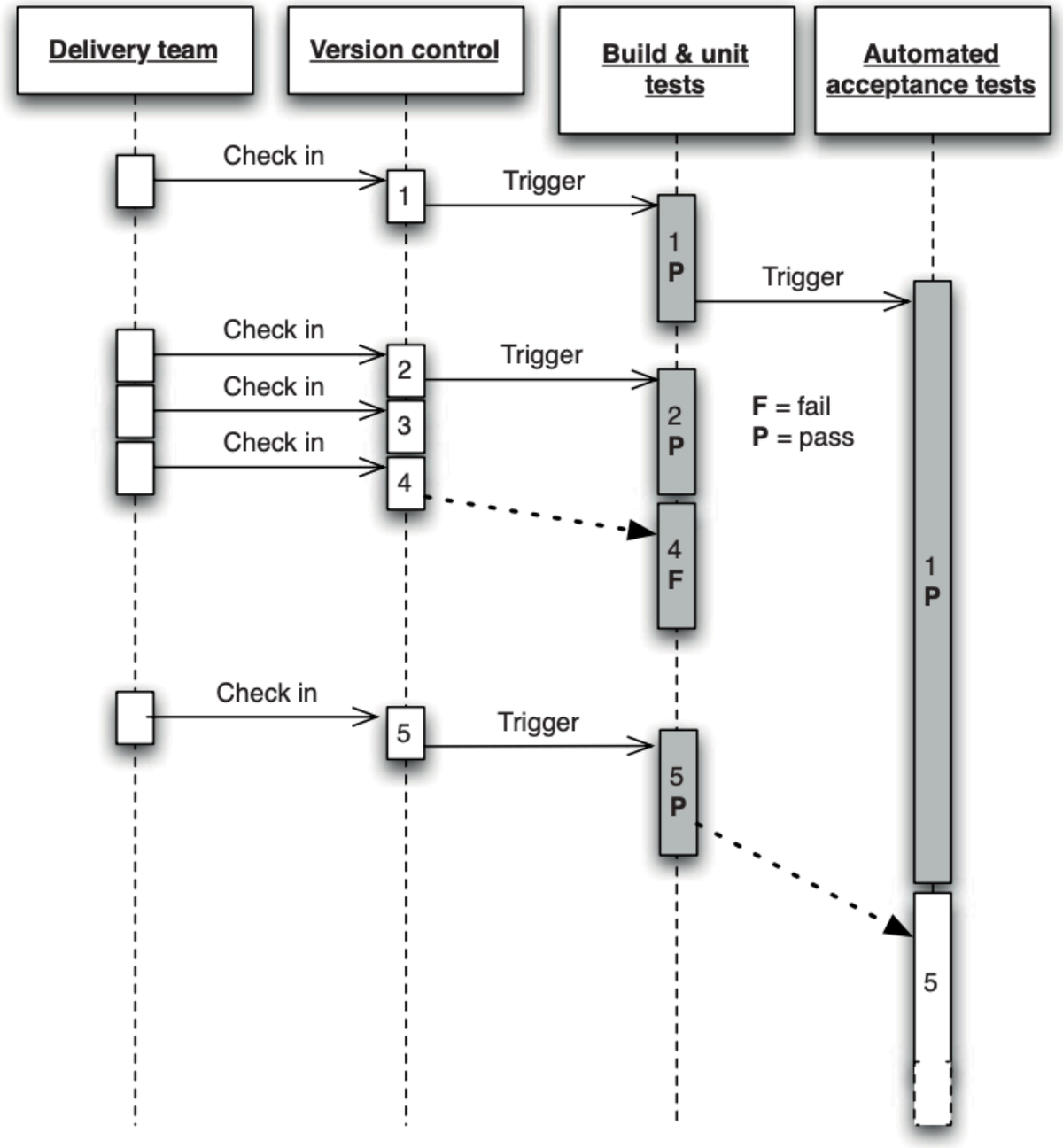



**Figure 5.6** *Scheduling stages in a pipeline*

# Basic Deployment Pipeline

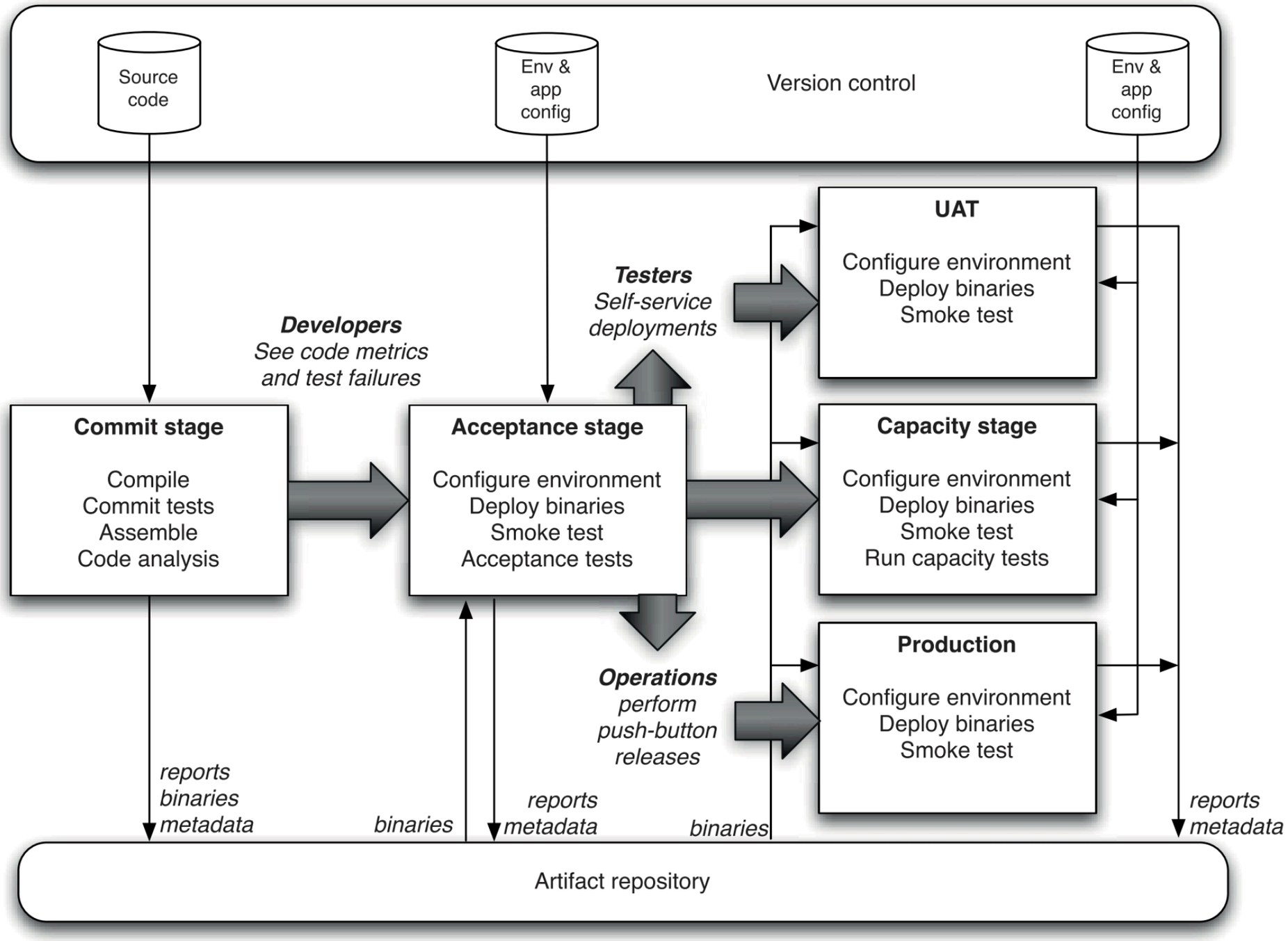



**Figure 5.4** *Basic deployment pipeline*

# Preparing to Release

- Automating Deployment and Release
- Backing Out Changes
- Building on Success

# Implementing a Deployment Pipeline

1. Model your value stream and create a walking skeleton
2. Automating the Build and Deployment Process
3. Automating the Unit Tests and Code Analysis
4. Automating Acceptance Test
5. Automating Release
6. Evolving Your Pipeline

# Metrics

Feedback is hearth of any software delivery process , use metrics to improve not only the cycle time.

# Metrics

- Automated test coverage
- Properties of the codebase such as the amount of duplication, cyclomatic complexity, efferent and afferent coupling, style problems, and so on
- Number of defects
- Velocity
- Number of commits to the version control system per day
- Number of builds per day
- Number of build failures per day
- Duration of build, including automated tests

# Build and Deployment Scripting

# An Overview of Build Tools

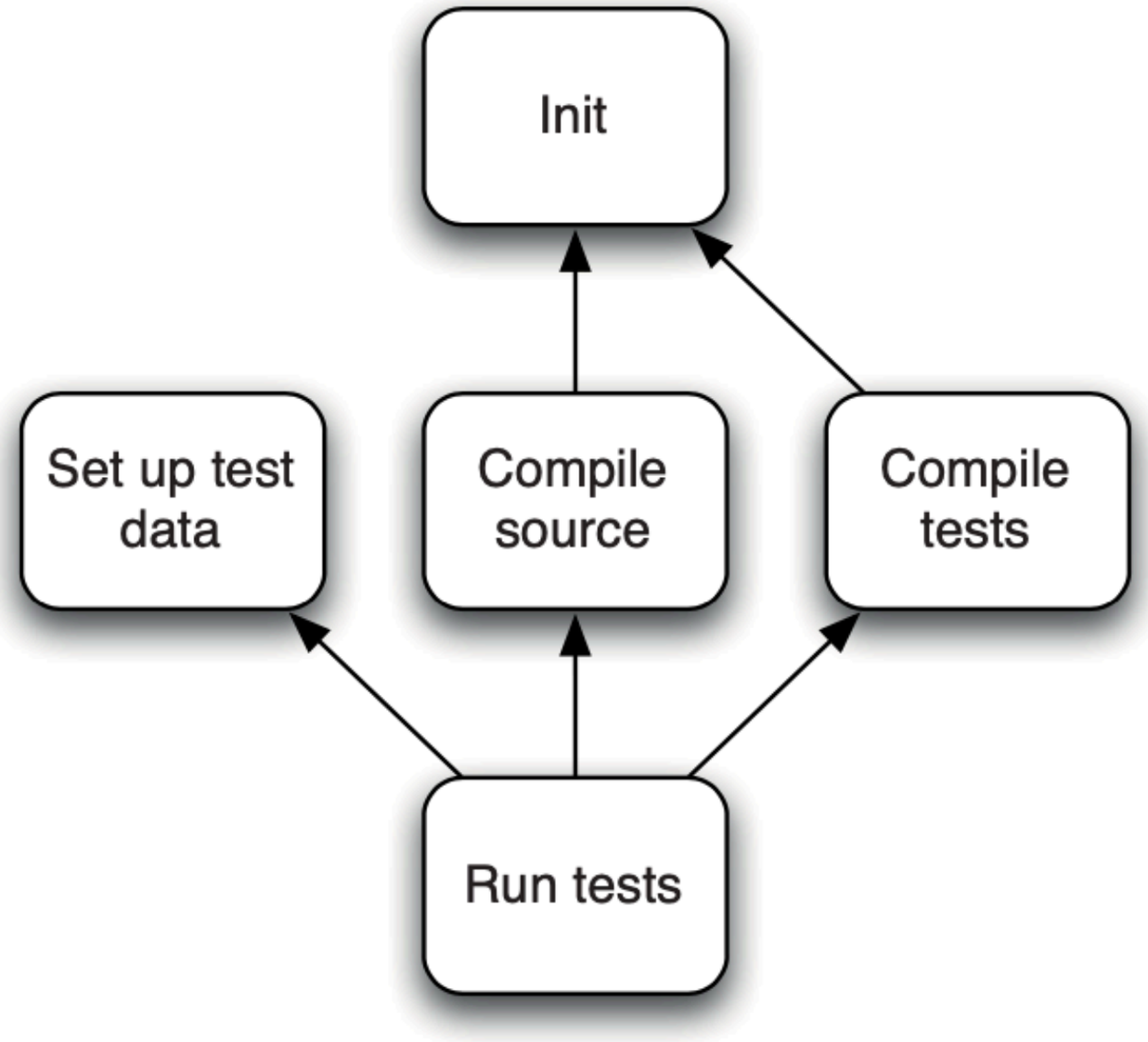



**Figure 6.1** *A simple build dependency network*

# Principles and Practices of Build and Deployment Scripting

- Create a Script for Each Stage in Your Deployment Pipeline
- Use an Appropriate Technology to Deploy Your Application
- Use the Same Scripts to Deploy to Every Environment
- Use Your Operating System's Packing Tools
- Ensure the Deployment Process Is Idempotent
- Evolve Your Deployment System Incrementally

# Project Structure for Applications That Target the JVM

- Project Layout
- Managing Source Code
- Managing Tests
- Managing Build Output
- Managing Libraries

# Project Structure for Applications That Target the JVM

```
/[project-name]
  README.txt
  LICENSE.txt
  /src
    /main
      /java        Java source code for your project
      /scala       If you use other languages, they go at the same level
      /resources   Resources for your project
      /filters     Resource filter files
      /assembly    Assembly descriptors
      /config      Configuration files
      /webapp      Web application resources
    /test
      /java        Test sources
      /resources   Test resources
      /filters     Test resource filters
    /site          Source for your project website
    /doc           Any other documentation
  /lib
    /runtime       Libraries your project needs at run time
    /test          Libraries required to run tests
    /build         Libraries required to build your project
```

# Deploying and Testing Layers

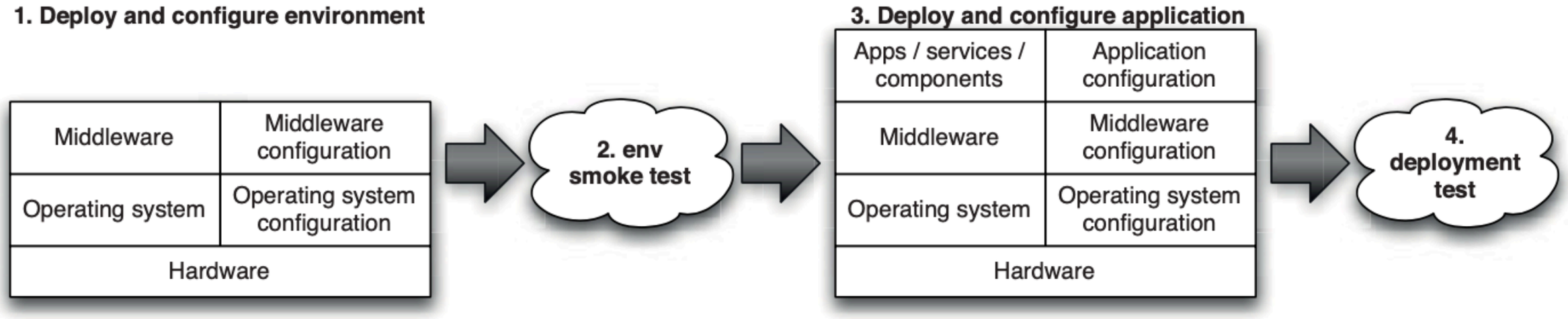



**Figure 6.3** *Deployment testing layers*

# Tips and Tricks

- Always Use Relative Paths
- Eliminate Manual Steps
- Build In Traceability from Binaries to Version Control
- Test Target Should Not Fail The Build
- Constrain Your Application with Integrated Smoke Tests
- .NET Tips a Tricks ( Clean before Build )

# The Commit Stage

# The Commit Stage

- Compiling Code and Run Test
- Create the Binary File for Later Stages
- Performing any Analysis
- Creating any Other Artifacts
- Provide Rapid Feedback

# The Commit Stage

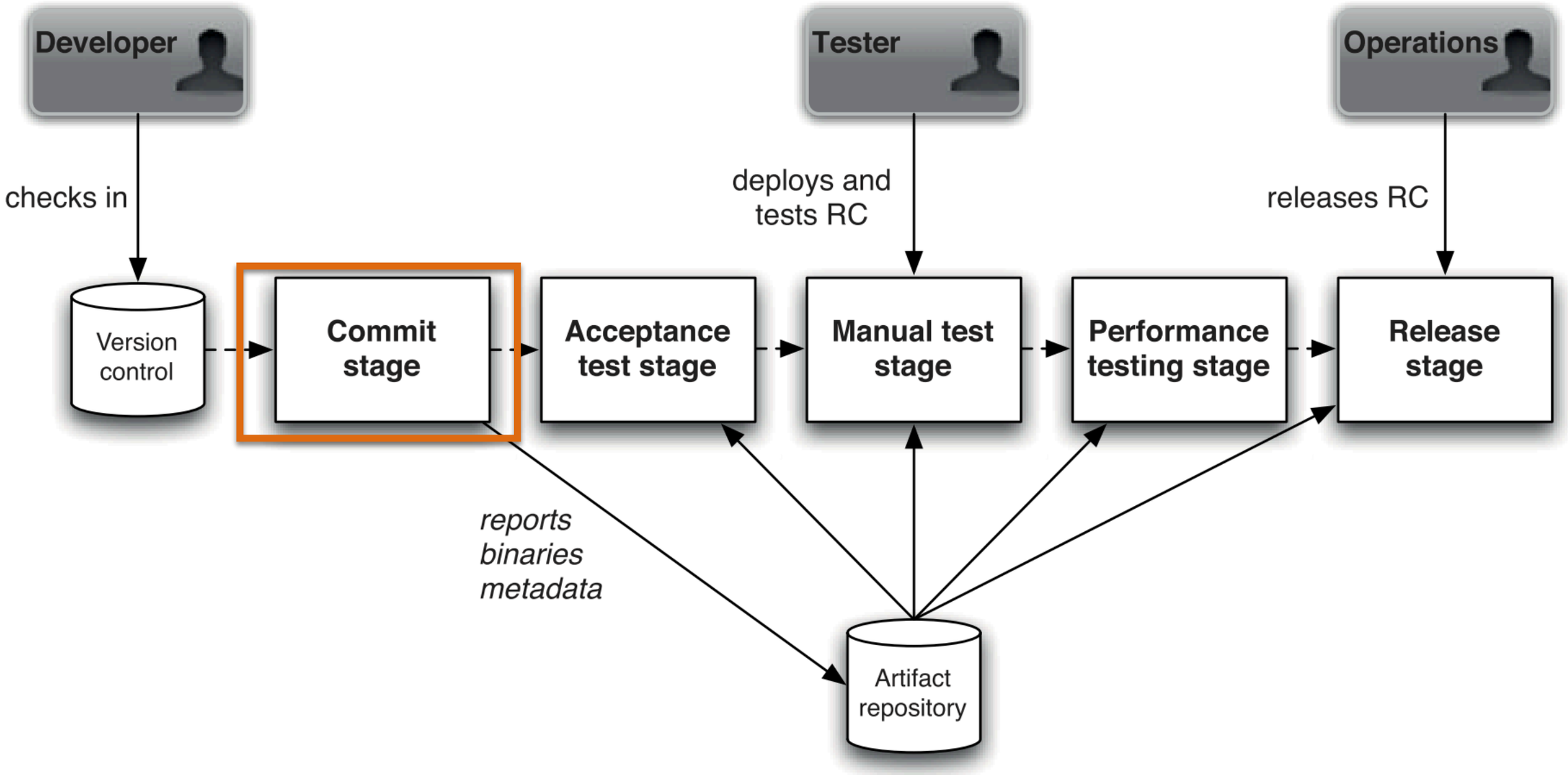



**Figure 7.2** *The role of the artifact repository*

# The Commit Stage

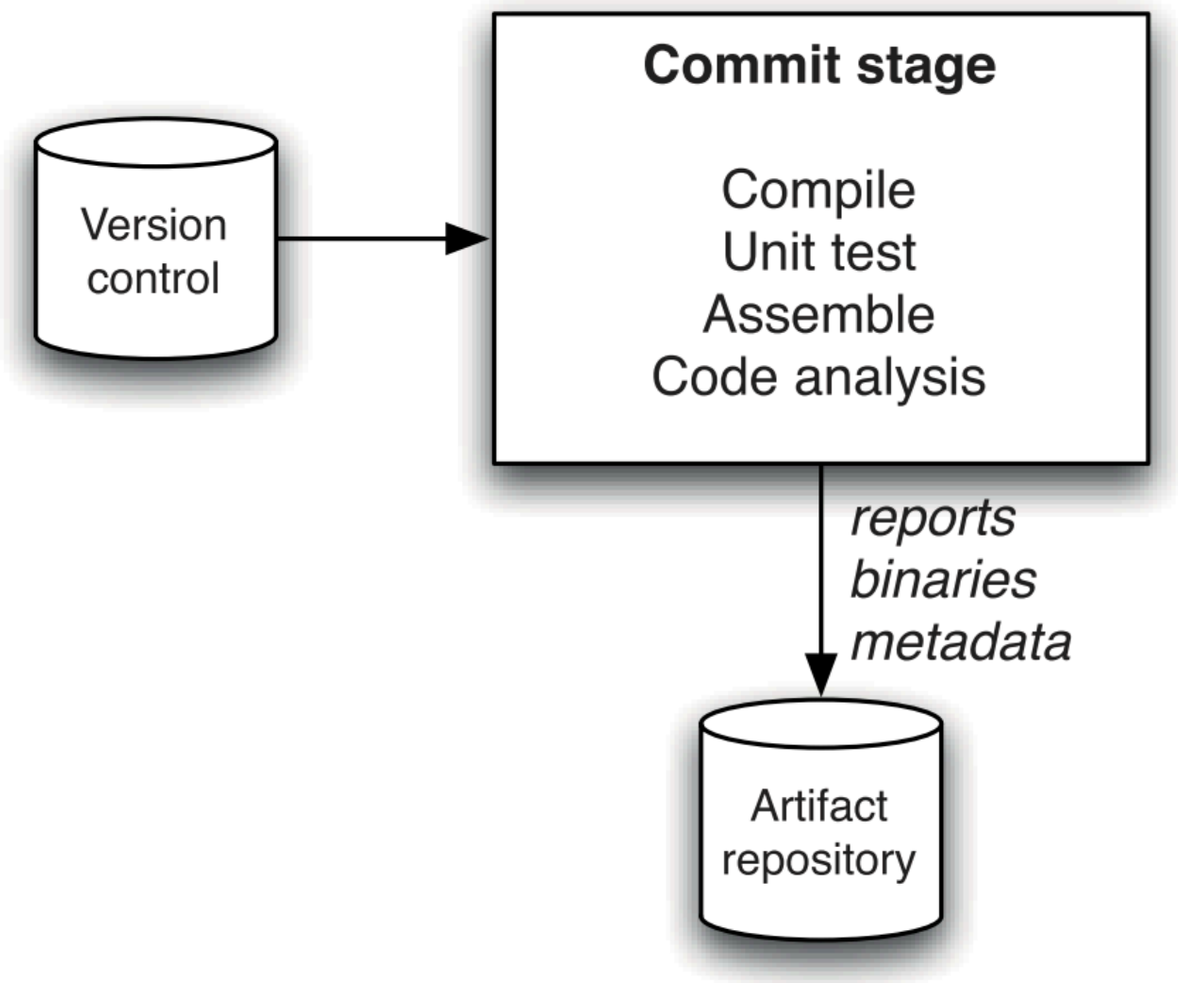



**Figure 7.1** *The commit stage*

# Commit Stage Principles and Practices

- What Should Break the Commit Stage ?
- Tend the Commit Stage Carefully
- Give Developers Ownership
- Use a Build Master for Very Large Teams

# The Artifact Repository

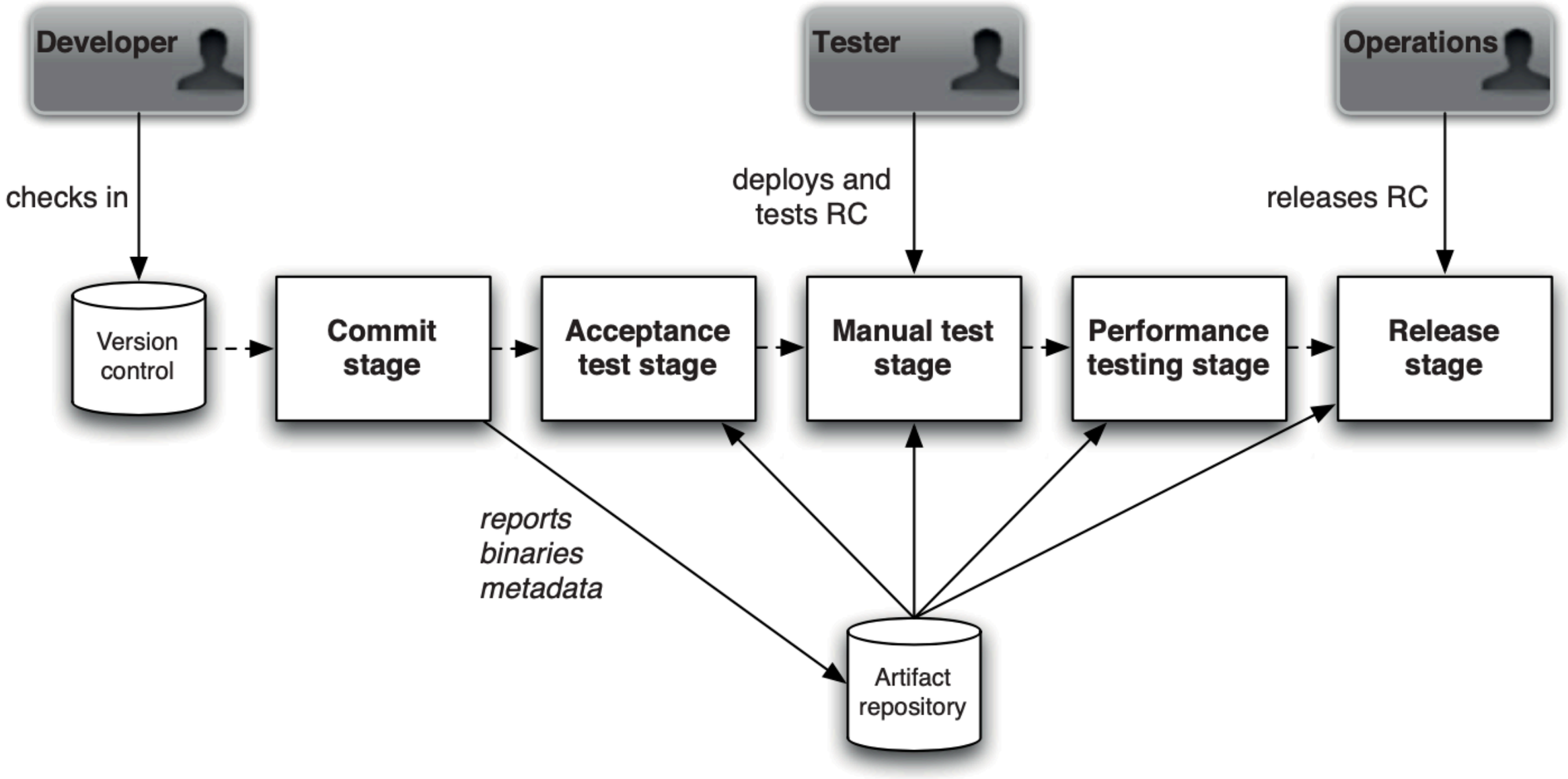



**Figure 7.2** *The role of the artifact repository*

# Test Automation Pyramid

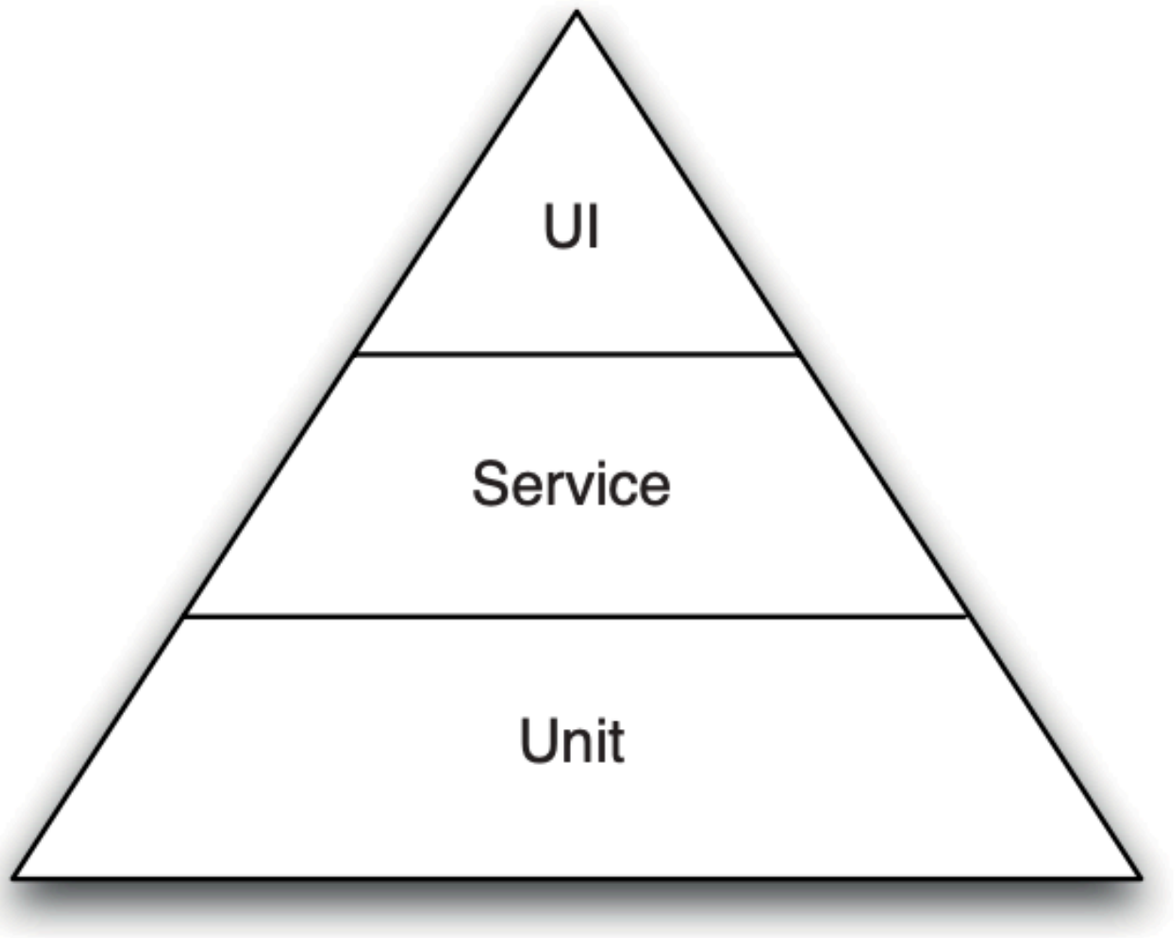



**Figure 7.3** *Test automation pyramid (Cohn, 2009, Chapter 15)*

# Commit Test Suite Principles and Practices

- Avoid the User Interface
- Use Dependency Injection
- Avoid the Database
- Avoid Asynchrony in Unit Tests
- Using Test Doubles
- Minimizing Stage in Tests
- Faking Time
- Brute Force

# Automate Acceptance Testing

# Acceptance Testing

"Once you have automate acceptance test in place, you are testing the **business acceptance criteria** of your application, that is, **validating** that it provides **users** with valuable **functionality**."

# Acceptance Test Stage

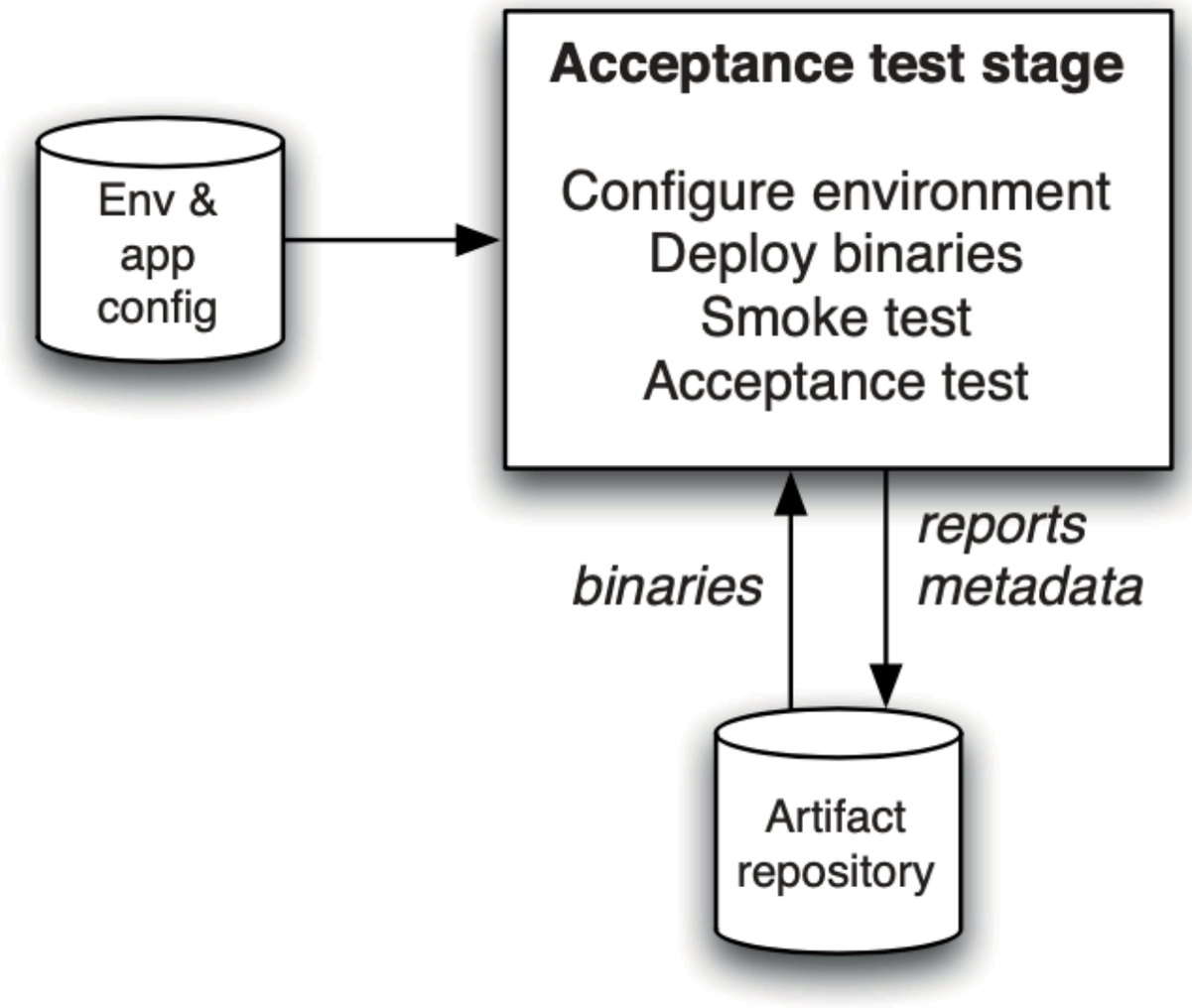
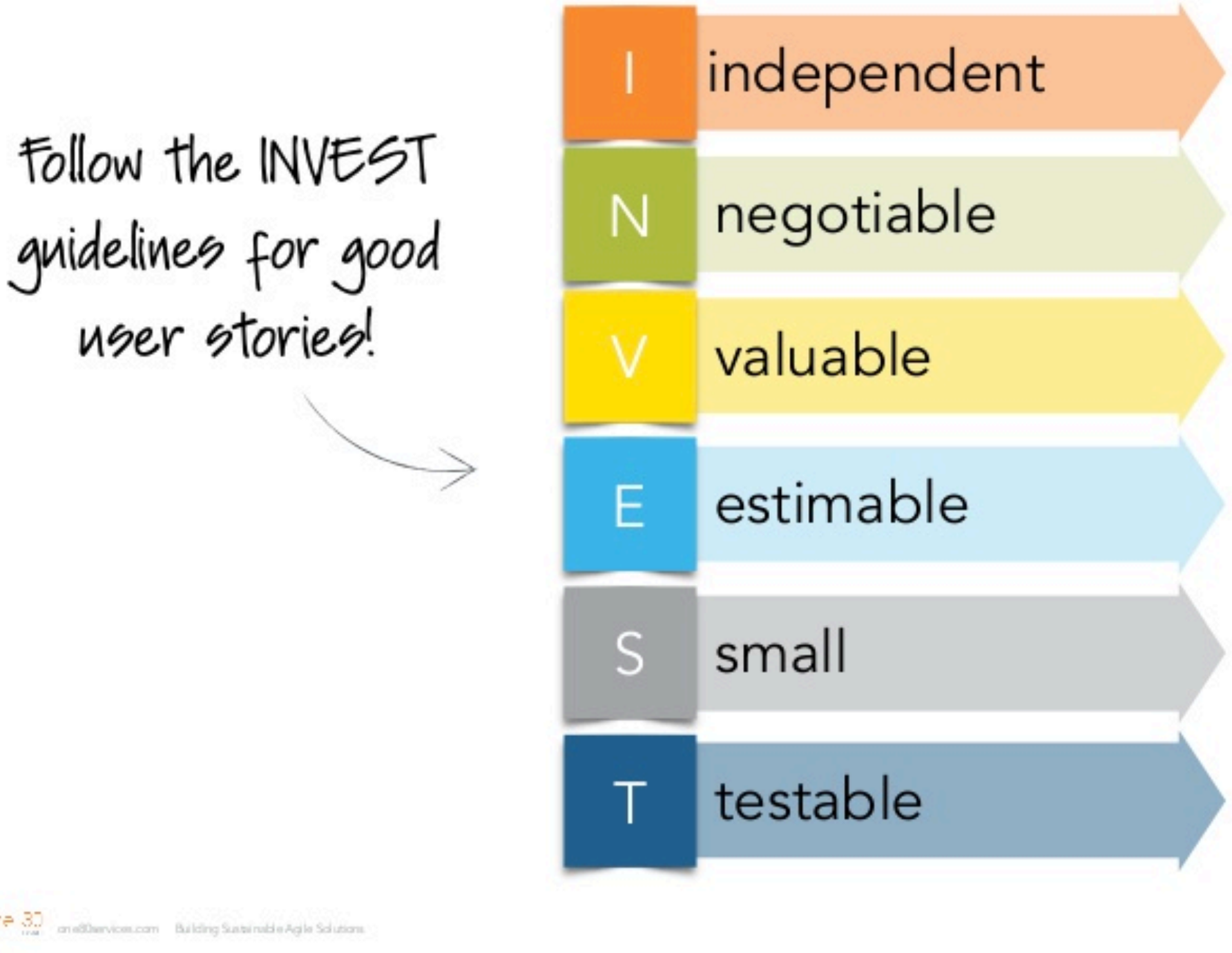



**Figure 8.1** *The acceptance test stage*

# How to Create Maintainable Acceptance Test Suites



# How to Create Maintainable Acceptance Test Suites

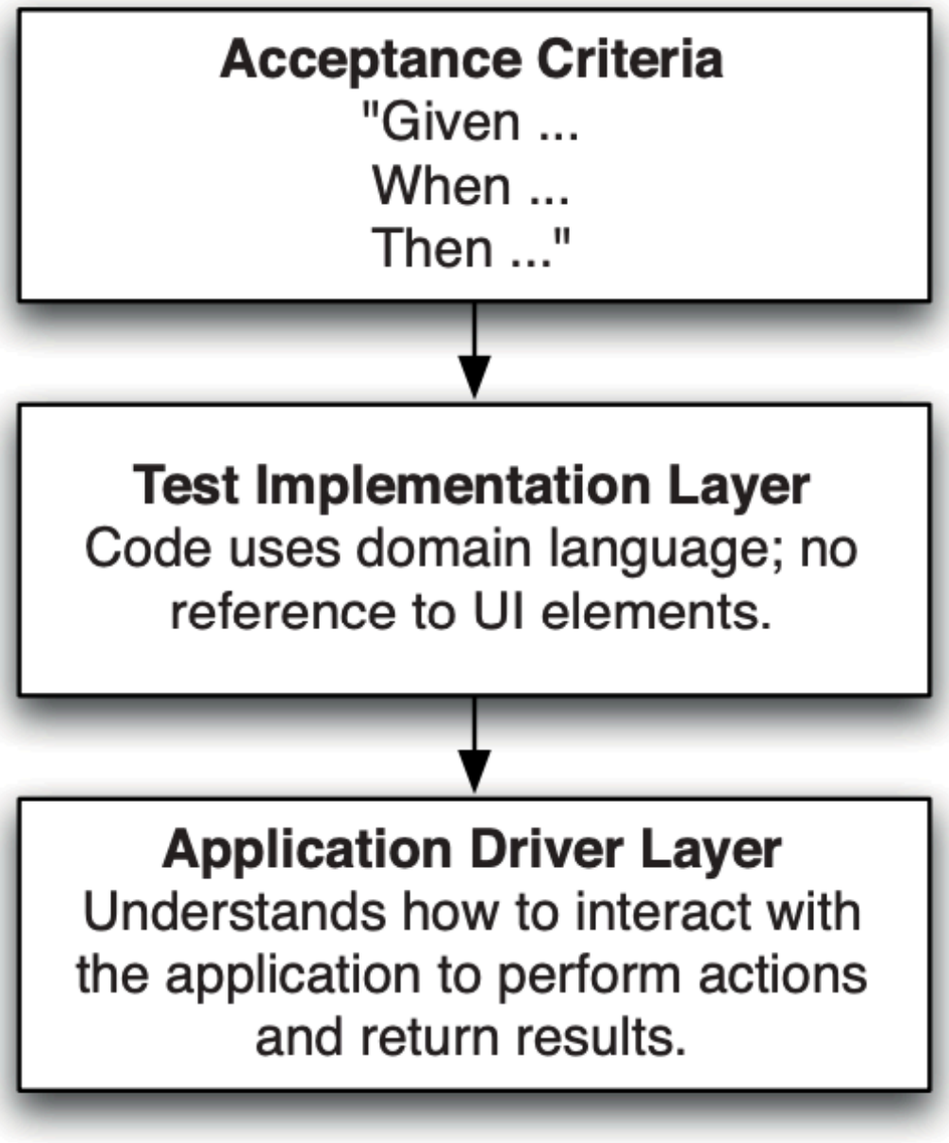



**Figure 8.2** *Layers in acceptance tests*

# Creating Acceptance Tests

1. Tester and BA working with customer to define acceptance criteria for requirements
2. Tester and BA working with developer to create automated acceptance tests
3. Tester and BA Perform manual test ( Exploratory , Acceptance , Showcase )

# Acceptance Criteria as Executable Specifications

```
Feature: Placing an order

  Scenario: User order should debit account correctly
  Given there is an instrument called bond
  And there is a user called Dave with 50 dollars in his account
  When I log in as Dave
  And I select the instrument bond
  And I place an order to buy 4 at 10 dollars each
  And the order is successful
  Then I have 10 dollars left in my account
```

# Implementing Acceptance Tests

- Minimize the states in acceptance tests
- Process boundaries , encapsulation and testing
- Managing asynchrony and timeouts
- Using test double
- Keeping acceptance tests green
- Deployment test
- Refactor common task

# Testing Nonfunctional Requirements

# Performance and Throughput

**Performance** is a measure of the time taken to process a single transaction, and can be measured either in isolation or under load.

**Throughput** is the number of transactions a system can process in a given timespan. It is always limited by some bottleneck in the system **( Capacity )**

# Programming for Capacity

The point of the capacity testing stage is to tell us whether we have a problem, so that we can go on to fix it. Don’t guess

# Strategy is Address Capacity Problems

1. Decide upon an architecture for your application
2. Understand and use patterns and avoid antipatterns
3. Keep team working within architecture but can apply appropriate
4. Pay attention to data structures and algorithms
5. Be extremely careful about threading
6. Establish automate test for capacity
7. Use profiling for attempt to fix problems
8. Wherever you can use real-world capacity measures

# Measuring Capacity

Scalability testing.

Longevity testing.

Throughput testing.

Load testing.

# Automating Capacity Testing

During development, what we need is the ability to assert that our application will achieve the capacity required by the customer.

# Automating Capacity Testing

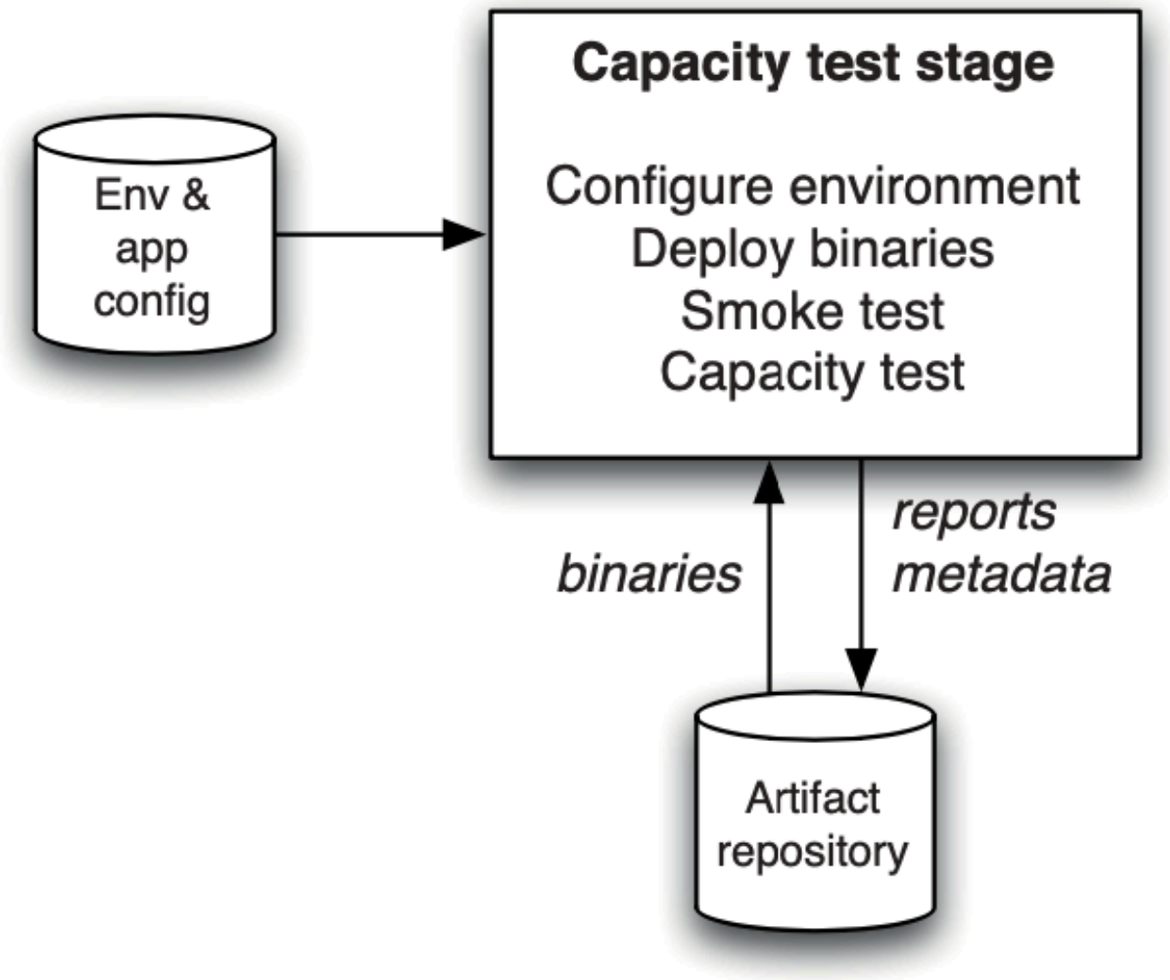



**Figure 9.7** *The capacity test stage of the deployment pipeline*

# Additional Benefits of a Capacity Test System

- Detecting and debugging memory leaks
- Tuning application configuration parameters
- Tuning third-party application configuration, such as operating system, application server, and database configuration
- Measuring the scalability of the application over different hardware configurations

# Deploying and Releasing Applications

# Creating a Release Strategy

The point of their discussions should be working out a common understanding concerning the deployment and maintenance of the application throughout its lifecycle.

# Creating a Release Strategy

- Parties in charge of deployment in environment and release
- Plan for implement deployment pipeline
- Requirements for monitoring the application
- Description of the integration
- A disaster recovery plan
- The steps about back out the deployment

# Modeling Your Release Process and Promoting Builds

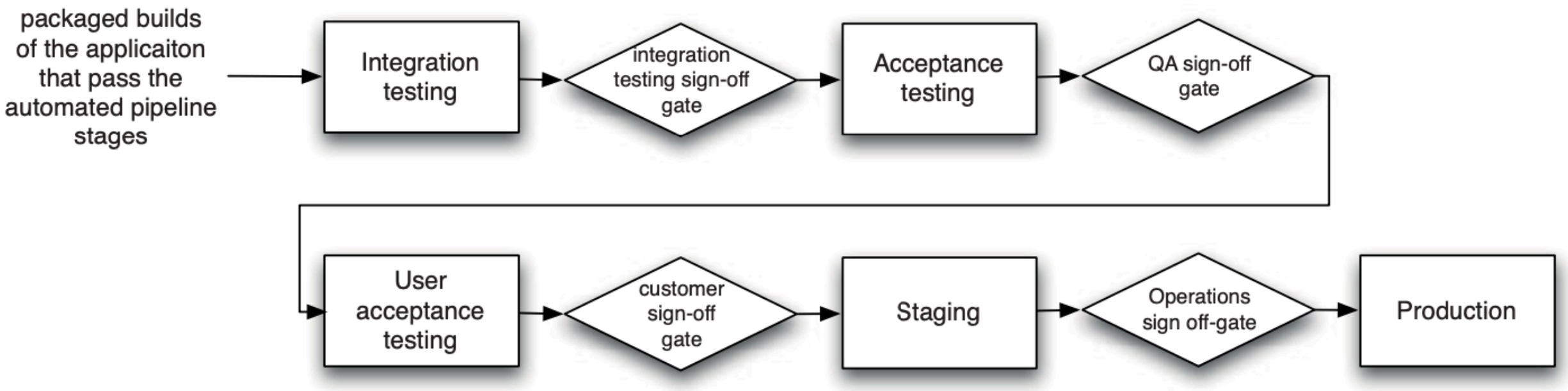


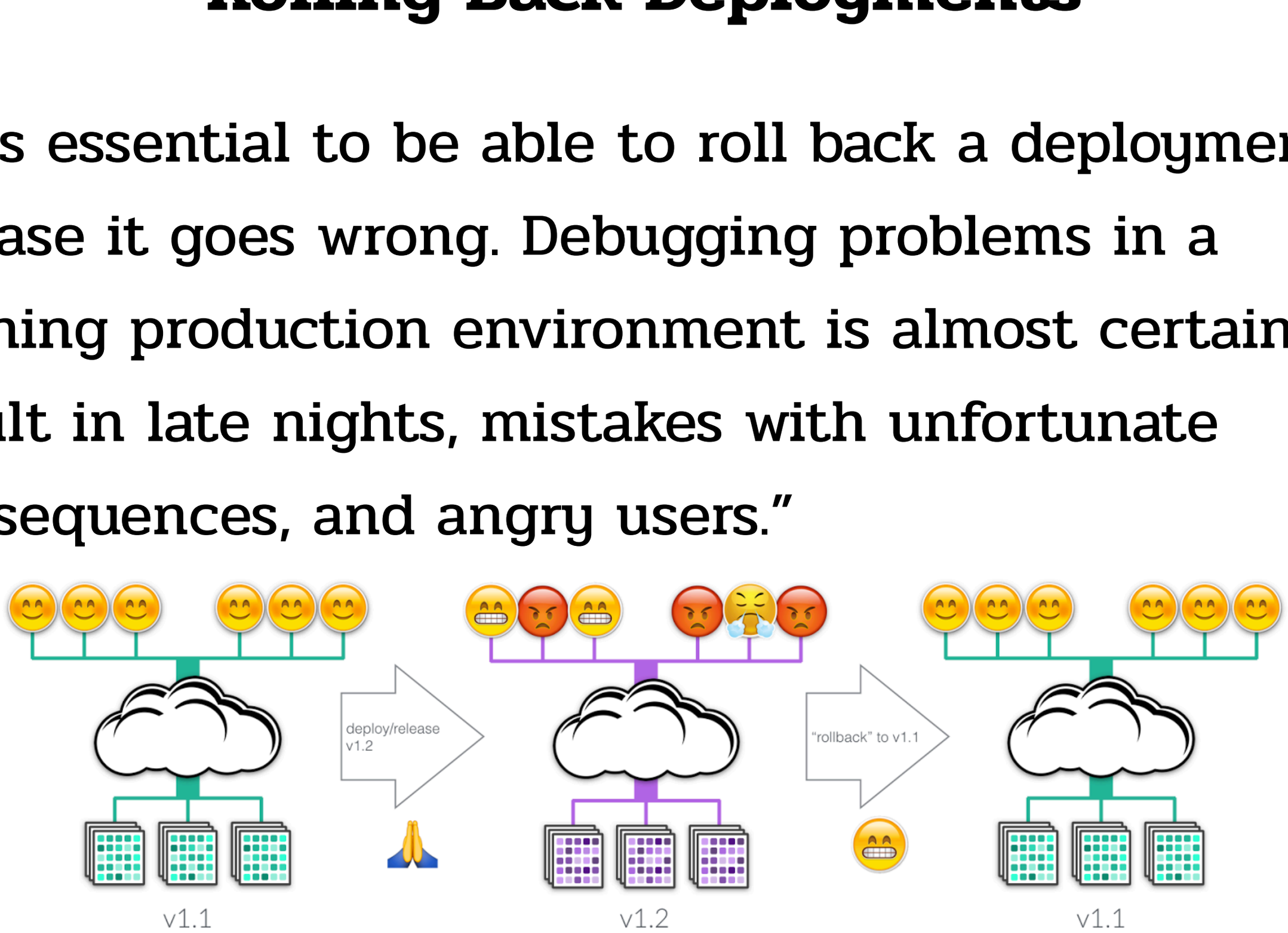

**Figure 10.1** *An example test and release process diagram*

# Deployments to Staging Environments

"You should have started to put your staging environment together at the beginning of your project."

# Rolling Back Deployments

"It is essential to be able to roll back a deployment in case it goes wrong. Debugging problems in a running production environment is almost certain to result in late nights, mistakes with unfortunate consequences, and angry users."



# Blue-Green Deployments

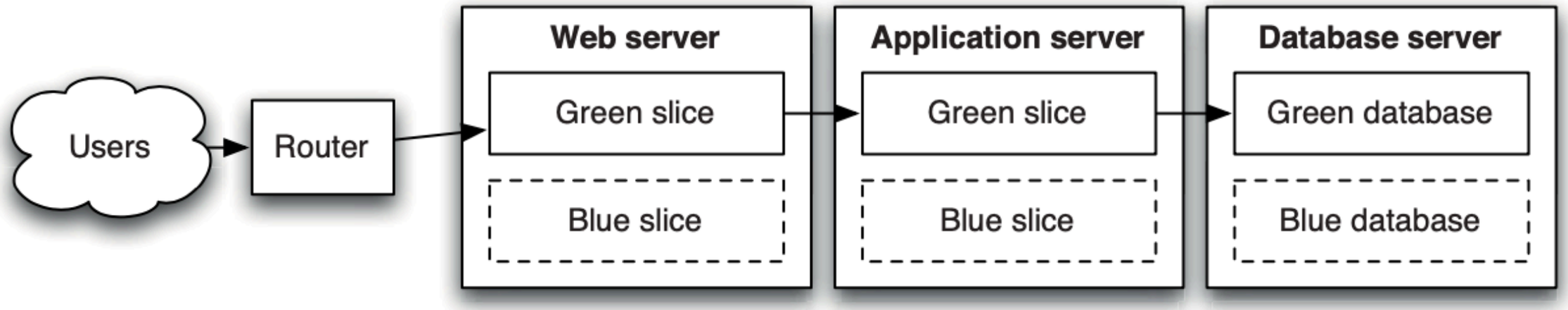



**Figure 10.2** *Blue-green deployments*

# Canary Releasing

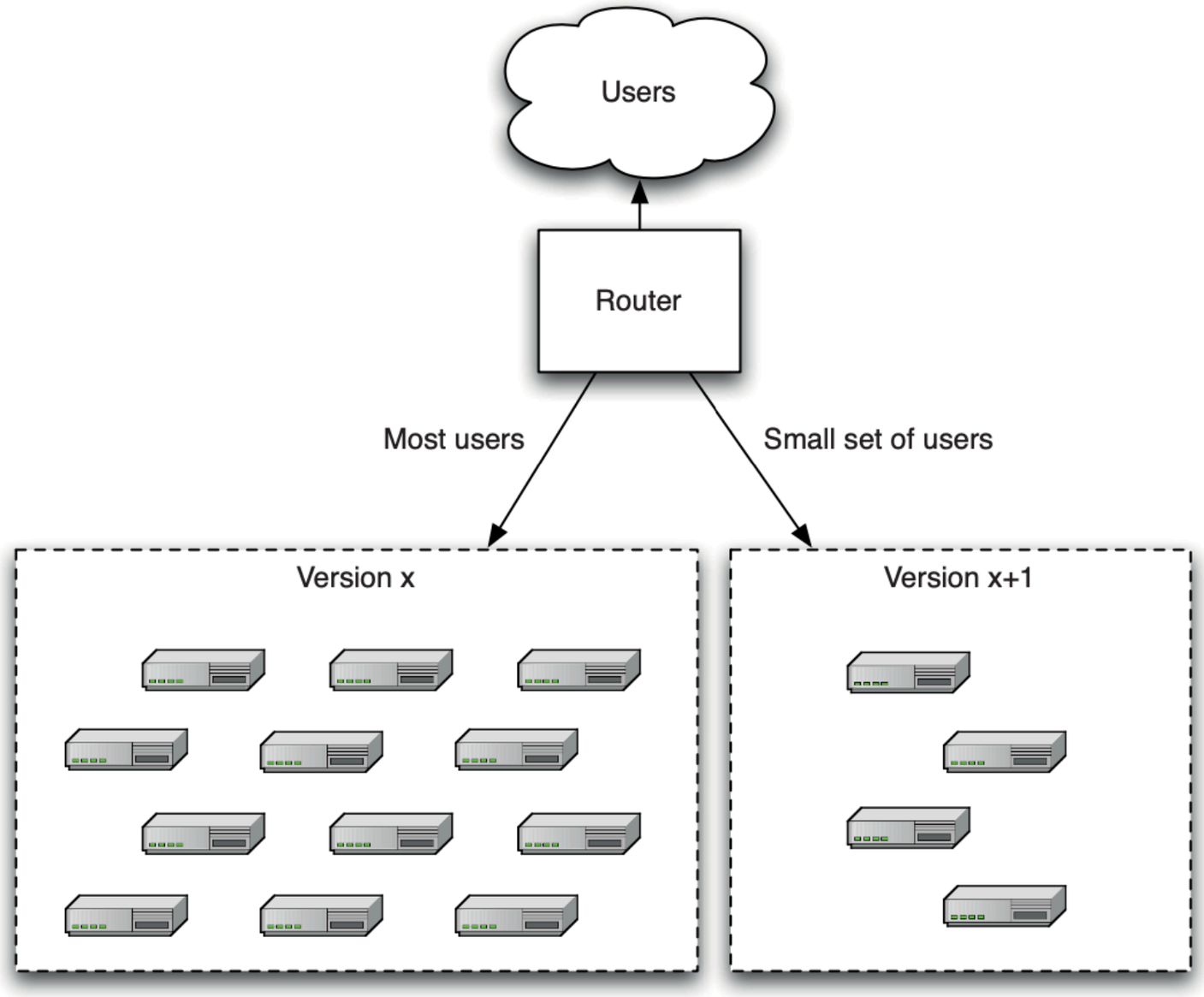
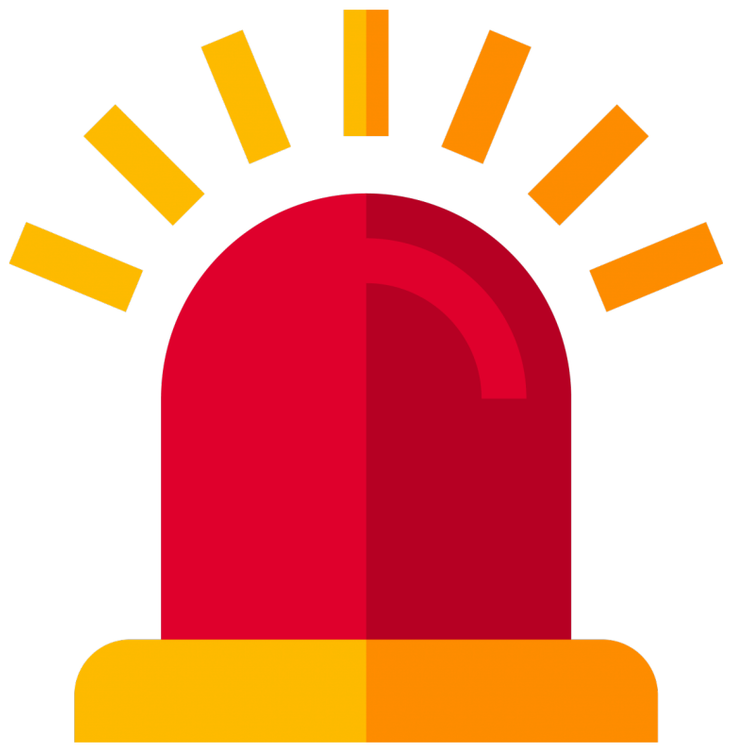



**Figure 10.3** *Canary releasing*

# Emergency Fixes

“Emergency fixes have to go through the same build, deploy, test, and release process as any other change. ”

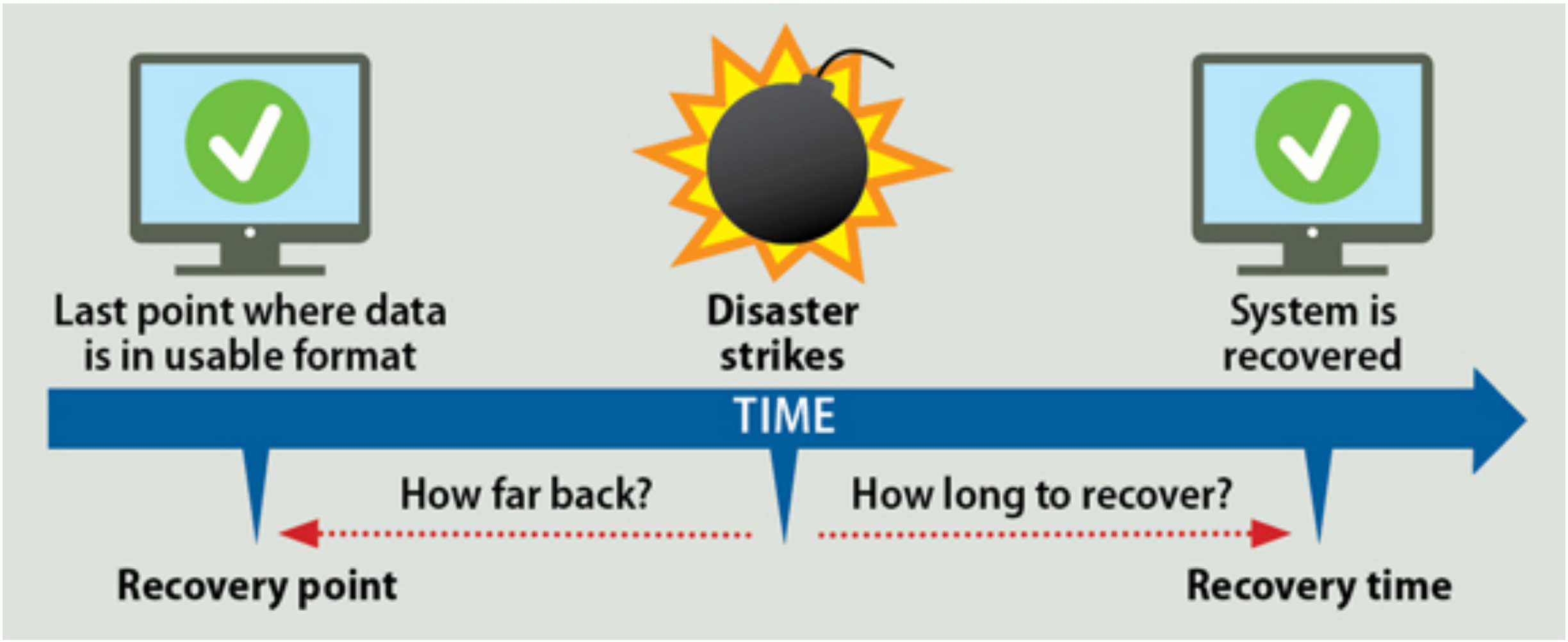


# Managing Infrastructure and Environments

# Understanding the Needs of the Operation Team

- Documentation and Auditing
- Alters for Abnormal Events
- IT Service Continuity Planning
- Use the Technology the Operations Team Is Familiar With

# Recovery Point Objective & Recovery Time Objective



# Modeling and Managing Infrastructure

- How will we provision our infrastructure?

- How will we deploy and configure the various bits of software that form part of our infrastructure?

- How do we manage our infrastructure once it is provisioned and configured?

# Virtualization

"Virtualization provides a way to amplify the benefits of the techniques, already described in this chapter, for automating the provisioning of servers and environments"

# Virtualization

Benefits :

- **Fast Response to Change Requirement**

  Can be provisioned new machine in seconds , no cost

- **Consolidation**

  More efficient at team service and hardware

- **Standardizing Hardware**

  No longer distinct hardware configuration

- **Easier-To-Maintain Baselines**

  Application stack maintain in a image

# Monitoring Infrastructure and Applications

- To find out how much revenue
- Detecting something goes wrong
- Historical data for planning

# Collecting Data

Hardware : Voltages , Temperatures

Operating System : Memory Usage , Disk Space , I/O

Middleware : Database Connection Pool

Application : Number of Transactions

# Creating Dashboards

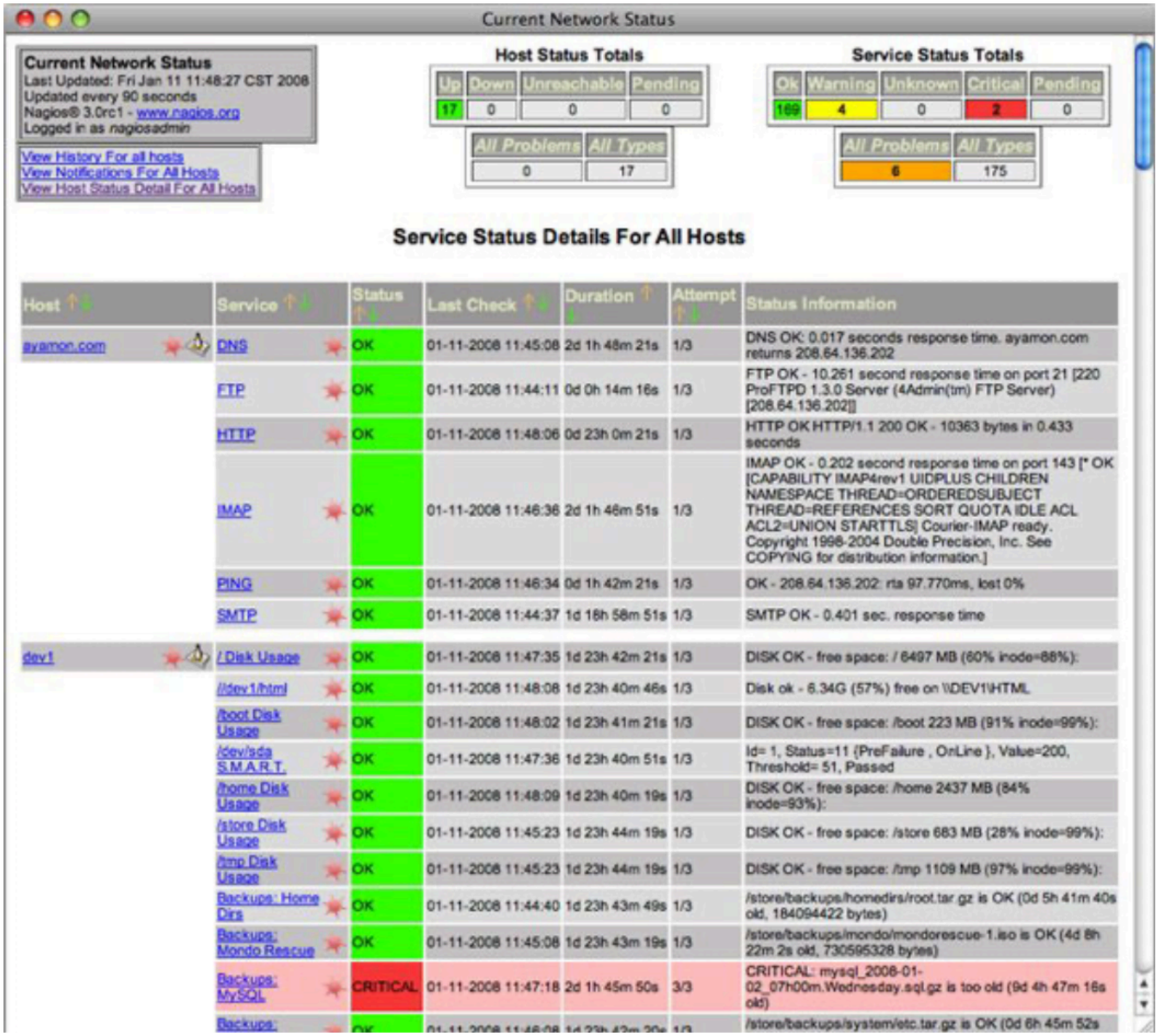
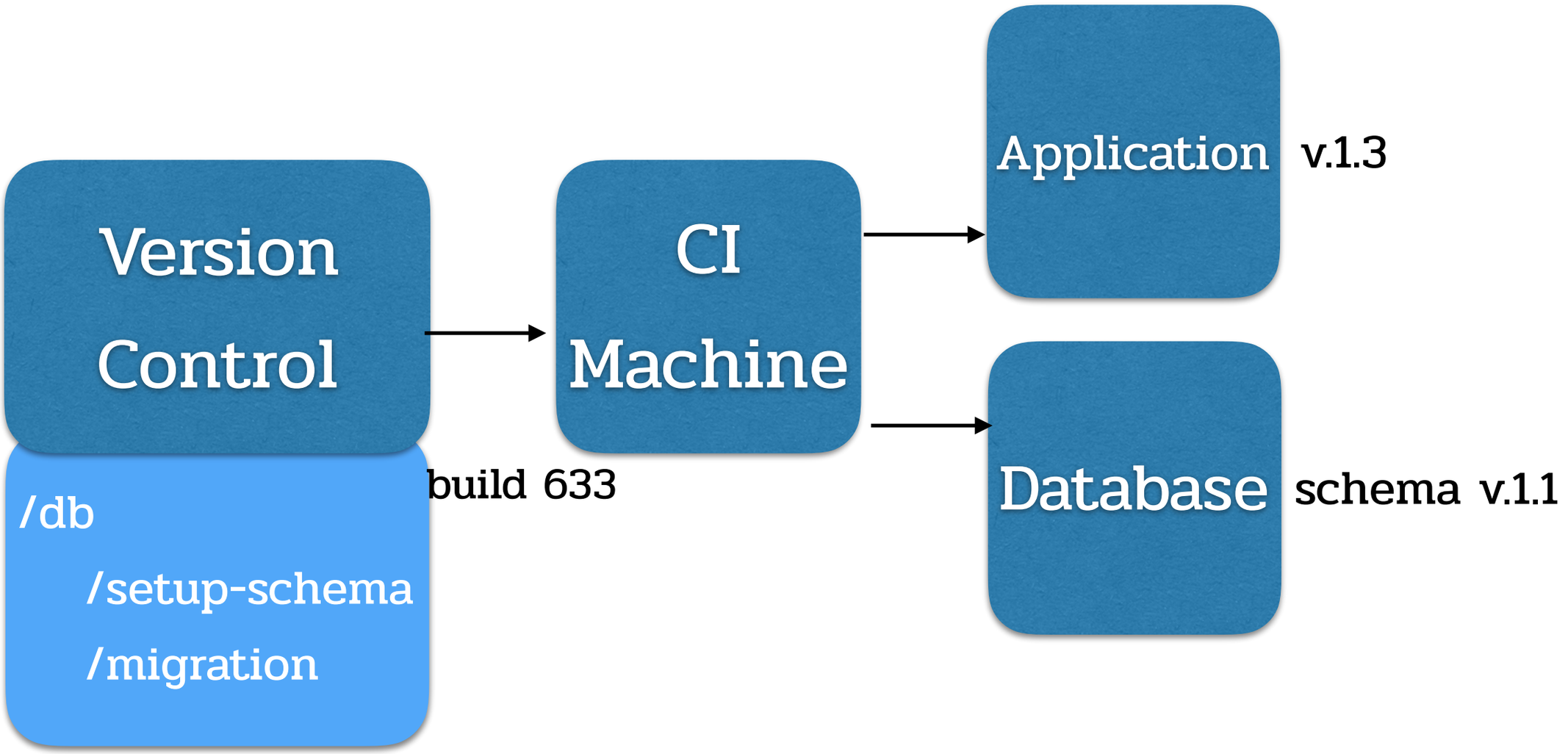



**Figure 11.10** *Nagios screenshot*

# Managing Data

# Database Scripting



# Incremental Change: Versioning Your Database

## 1_create_inital_database.sql

```
CREATE TABLE customer (
  id    BIGINT GENERATED BY DEFAULT AS IDENTITY (START WITH 1) PRIMARY KEY,
  firstname  VARCHAR(255)
  lastname  VARCHAR(255)
);
```

## 2_add_customer_date_of_birth.sql

```
ALTER TABLE customer ADD COLUMN dateofbirth DATETIME;

--//@UNDO

ALTER TABLE customer DROP COLUMN dateofbirth;
```

# Decoupling Application Deployment from Database Migration

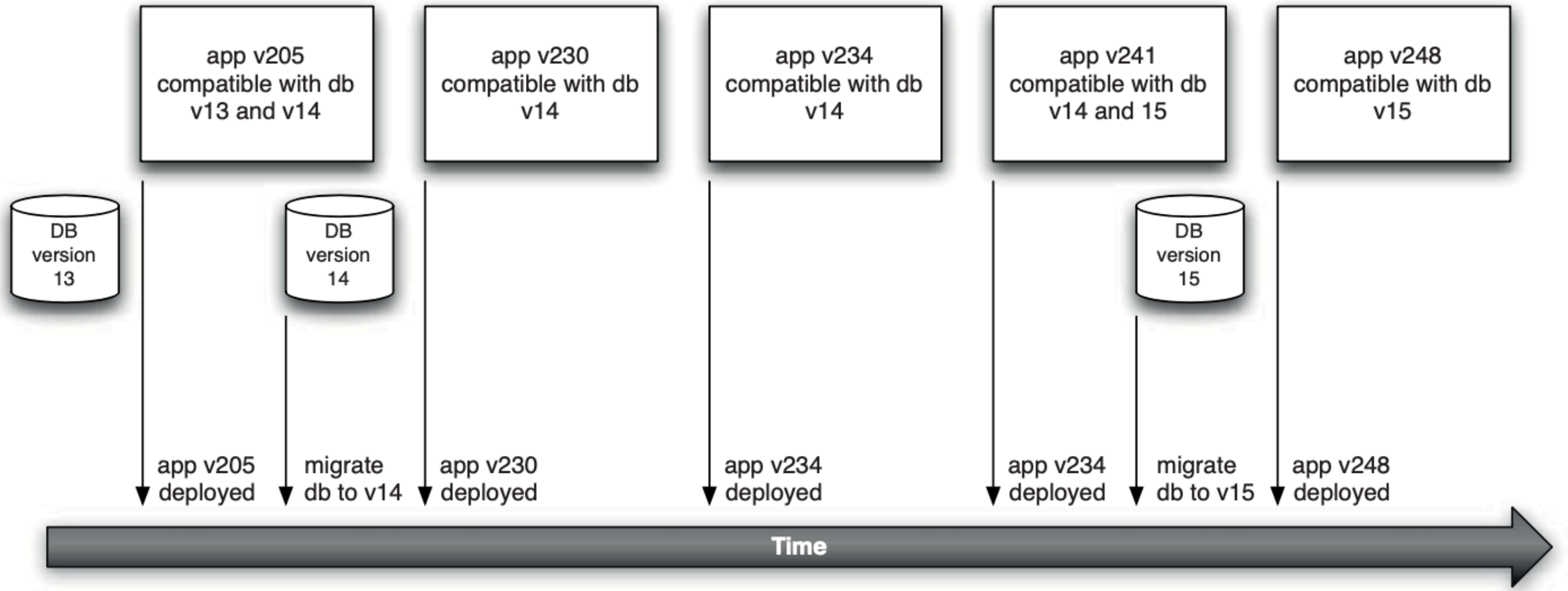
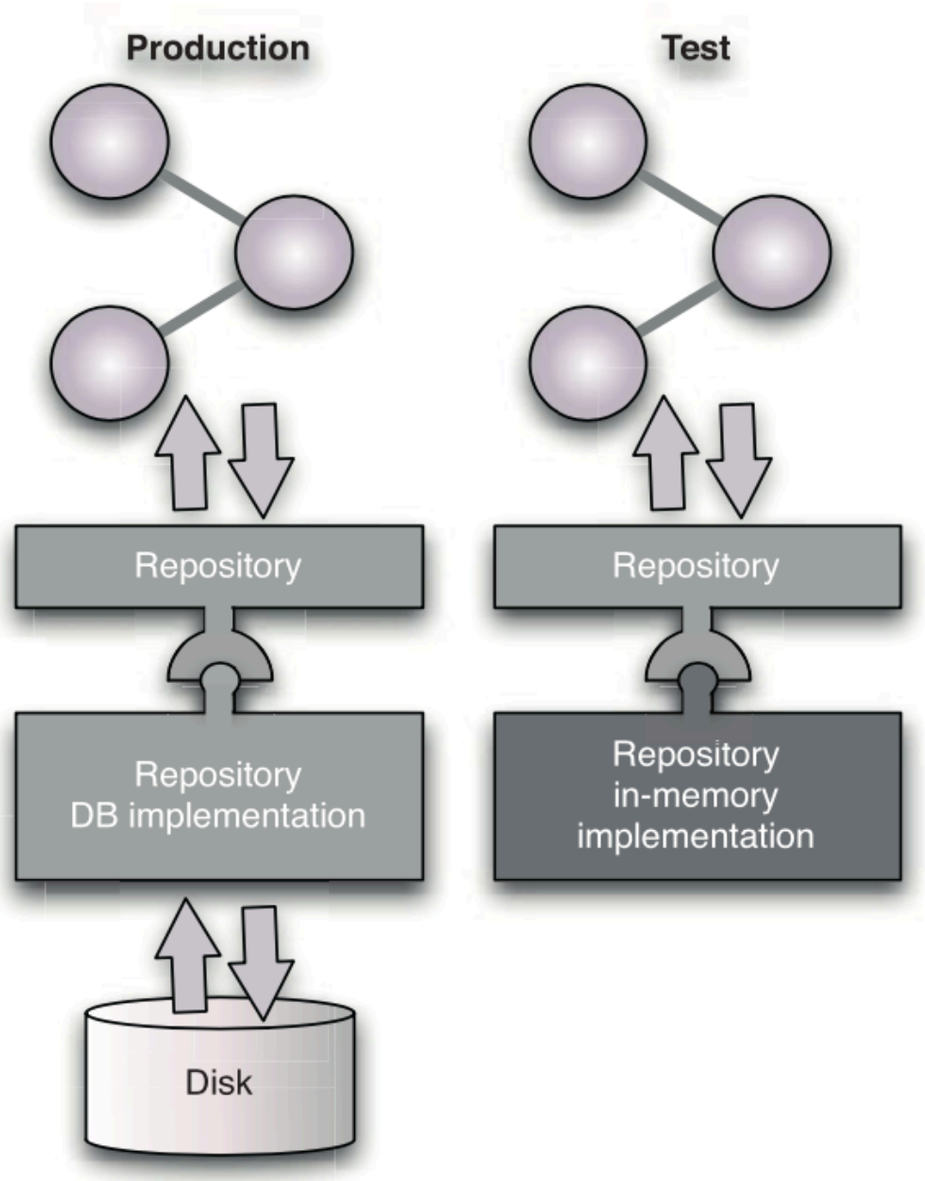



**Figure 12.1** *Decoupling database migration from application deployment*

# Managing Test Data

- Faking the Database for Unit Test
- Managing the Coupling between Tests and Data
- Test Isolation
- Setup and Tear Down
- Coherent Test Scenarios

# Managing Test Data : Faking the Database for Unit Test




- Don't run test against a real database
- Replace with a test double
- Still possible to use fake database

**Figure 12.2** *Abstracting database access*

# Data Management and the Deployment Pipeline

- **Data in Commit Stage Tests**

  - Use test double , Avoid elaborate data setup

- **Data in Acceptance Tests**

  - Test-specific , Test reference , Application Reference

- **Data in Capacity Tests**

  - Scale acceptance test with data

- **Data in Other The Stages**

  - Specific data for specific objective

# Managing Components and Dependencies

# Keeping Your Application Releaseable

- Hide new functionality until it is finished.
- Make all changes incrementally as a series of small changes, each of which is releasable.
- Use branch by abstraction to make large-scale changes to the codebase.
- Use components to decouple parts of your application that change at different rates.

# Dependencies : Libraries and Components

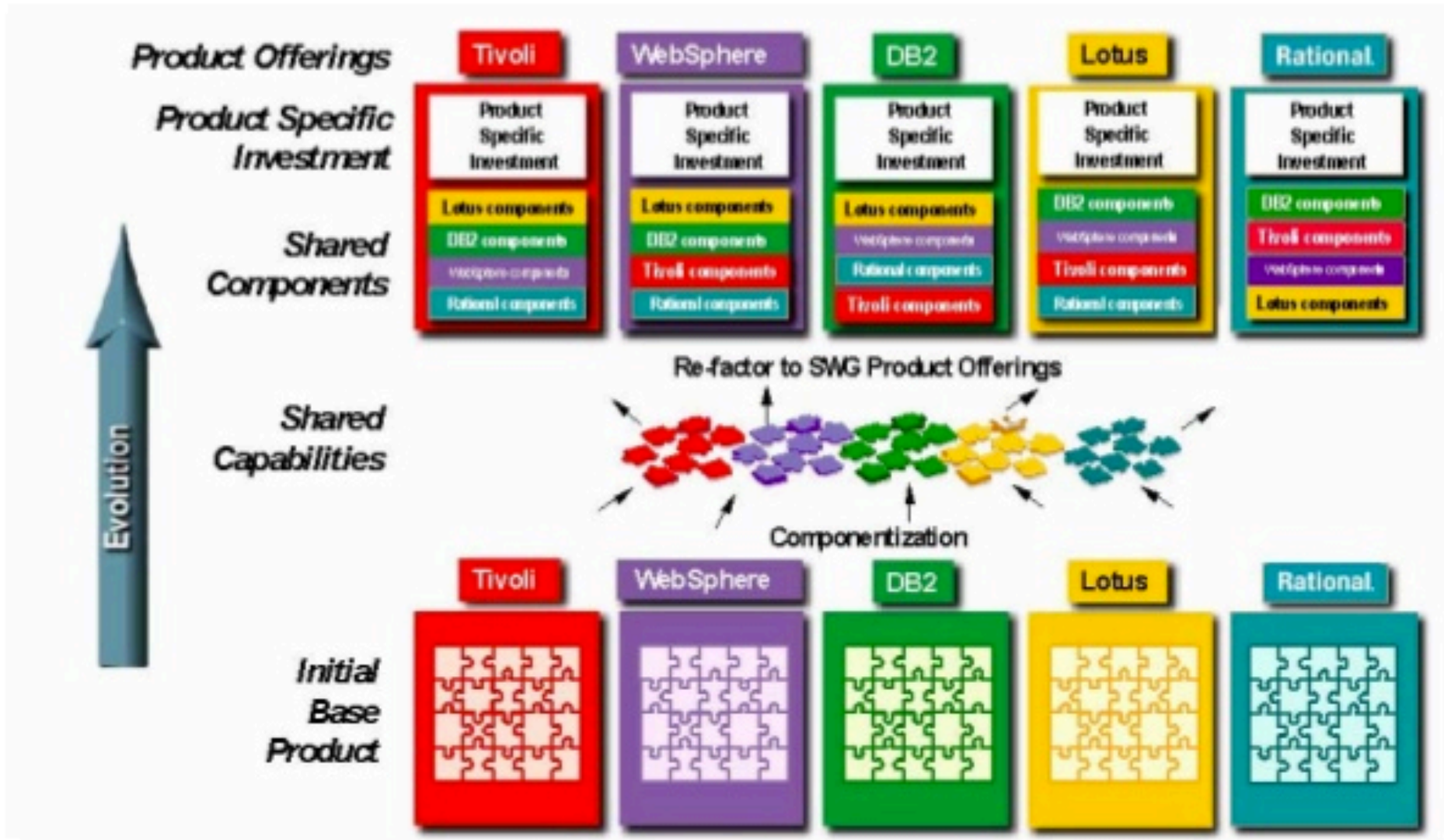
## Libraries

- Out of control
- Rarely update

## Components

- Organization controlled
- Frequently update

# How to Divide a Codebase into Components




Source: The Benefits of an Open Service Oriented Architecture in the Enterprise - Craig Hayman, IBM Software Group

# The Integration Pipeline

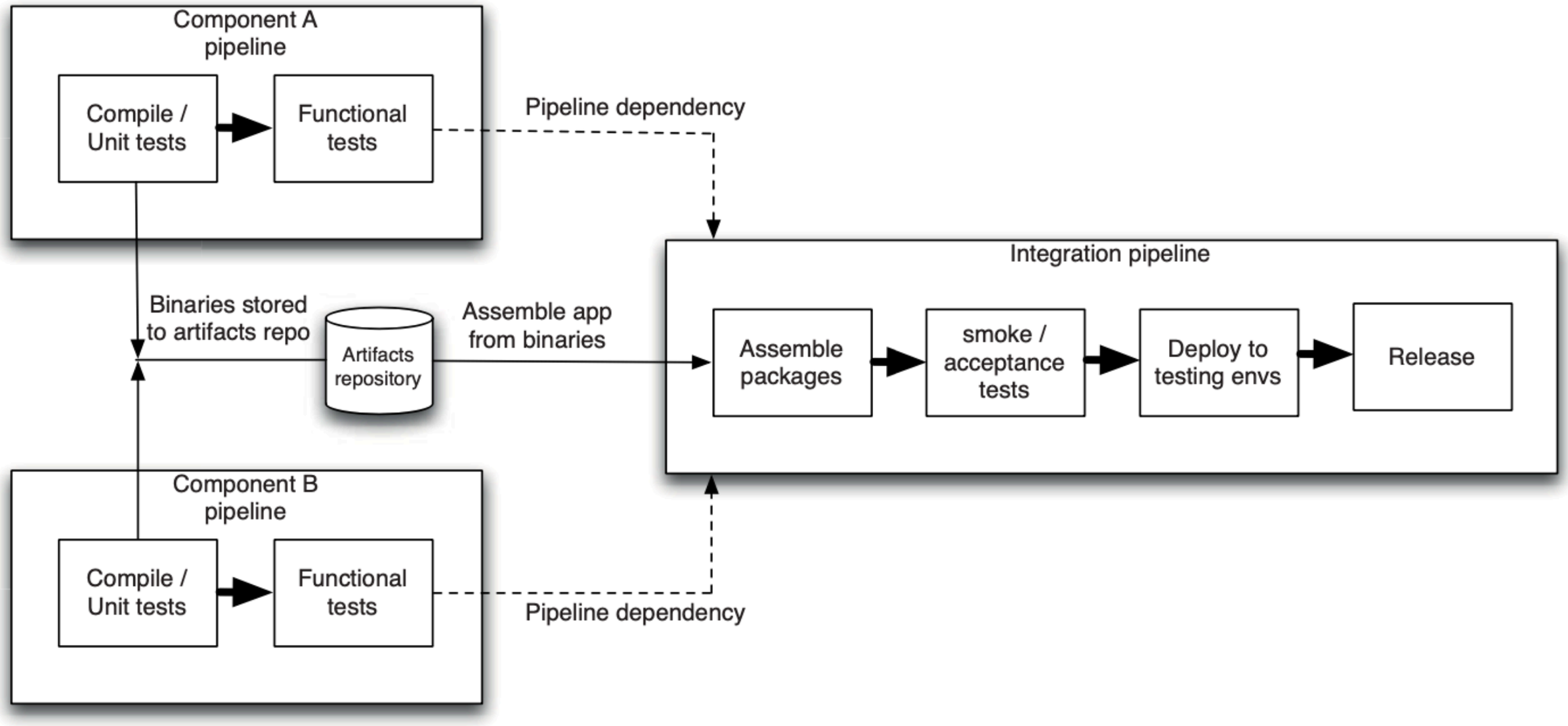



**Figure 13.1** *Integration pipeline*

# Building Dependency Graphs

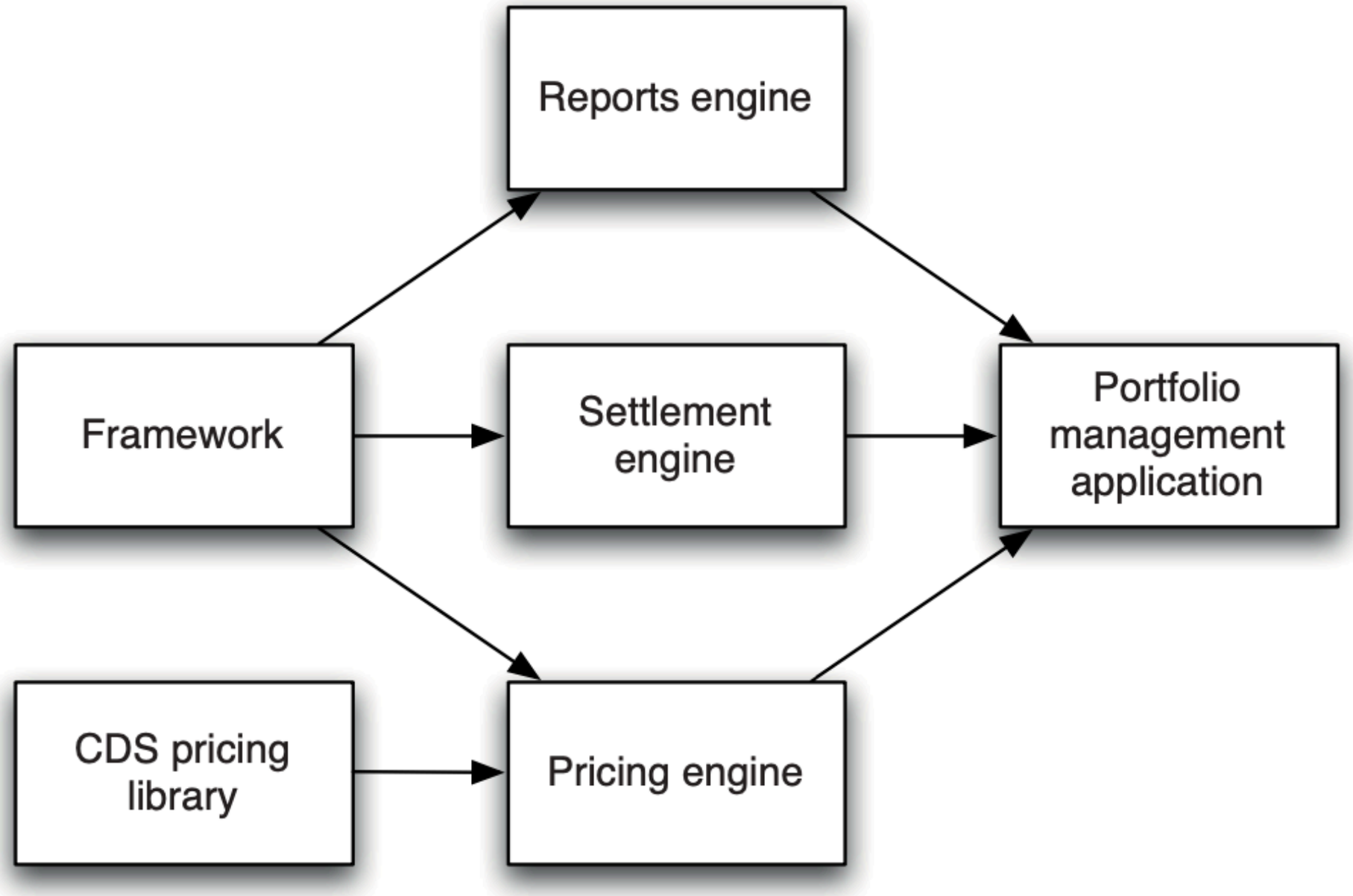



**Figure 13.2** *A dependency graph*

# Pipelining Dependency Graphs

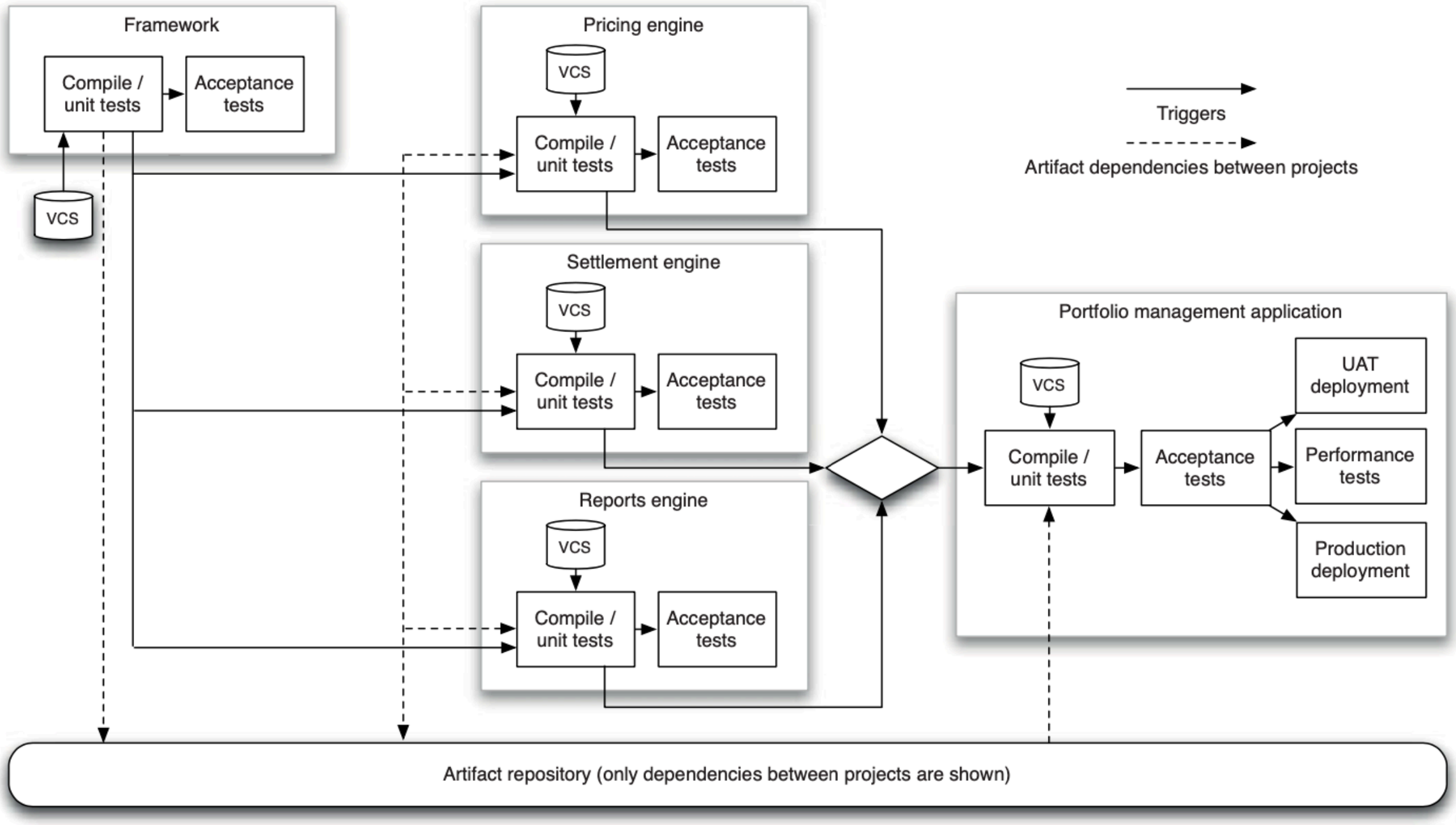



**Figure 13.3** *Component pipeline*

# Pipelining Dependency Graphs

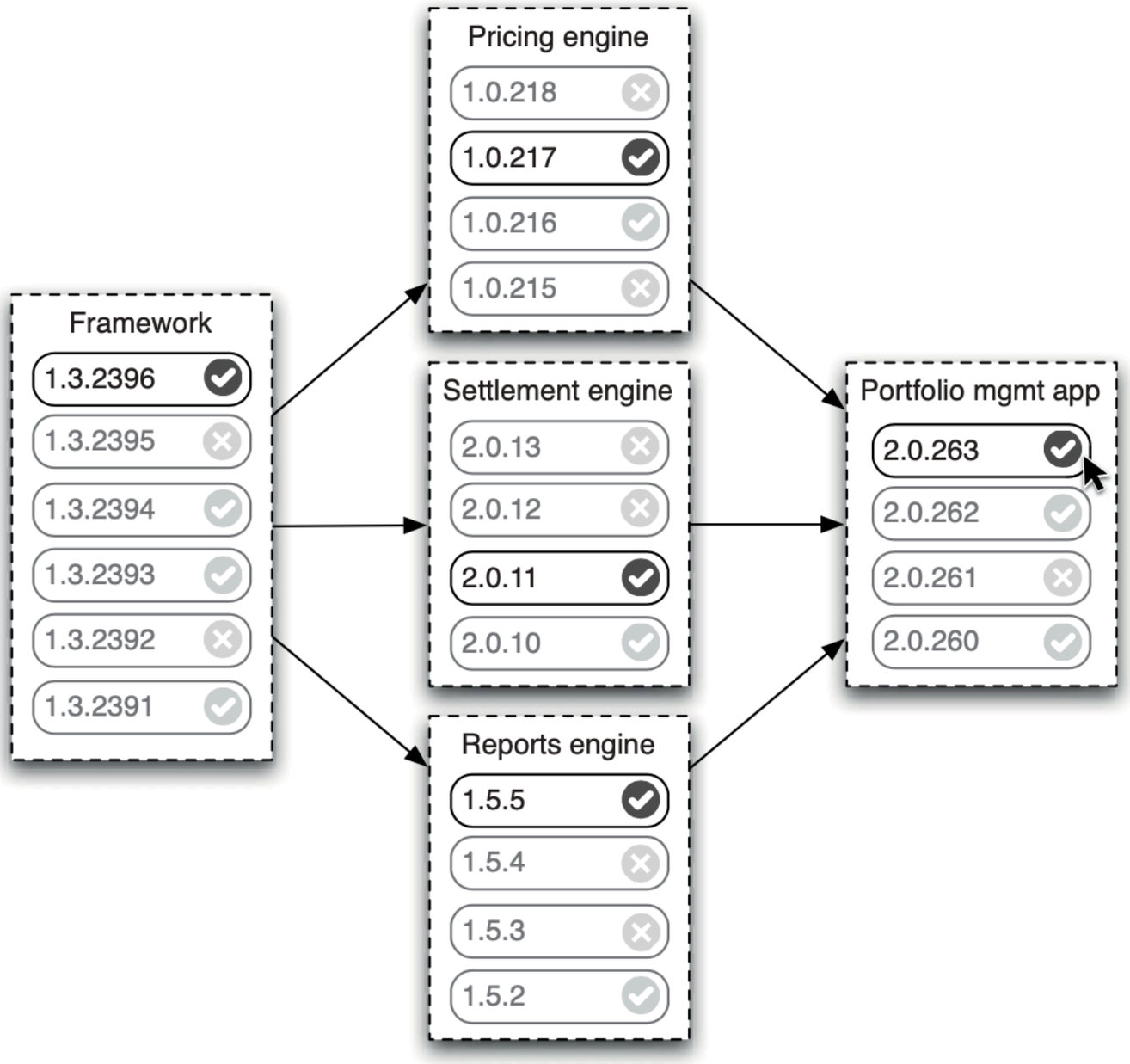



**Figure 13.4** *Visualizing upstream dependencies*

# Pipelining Dependency Graphs

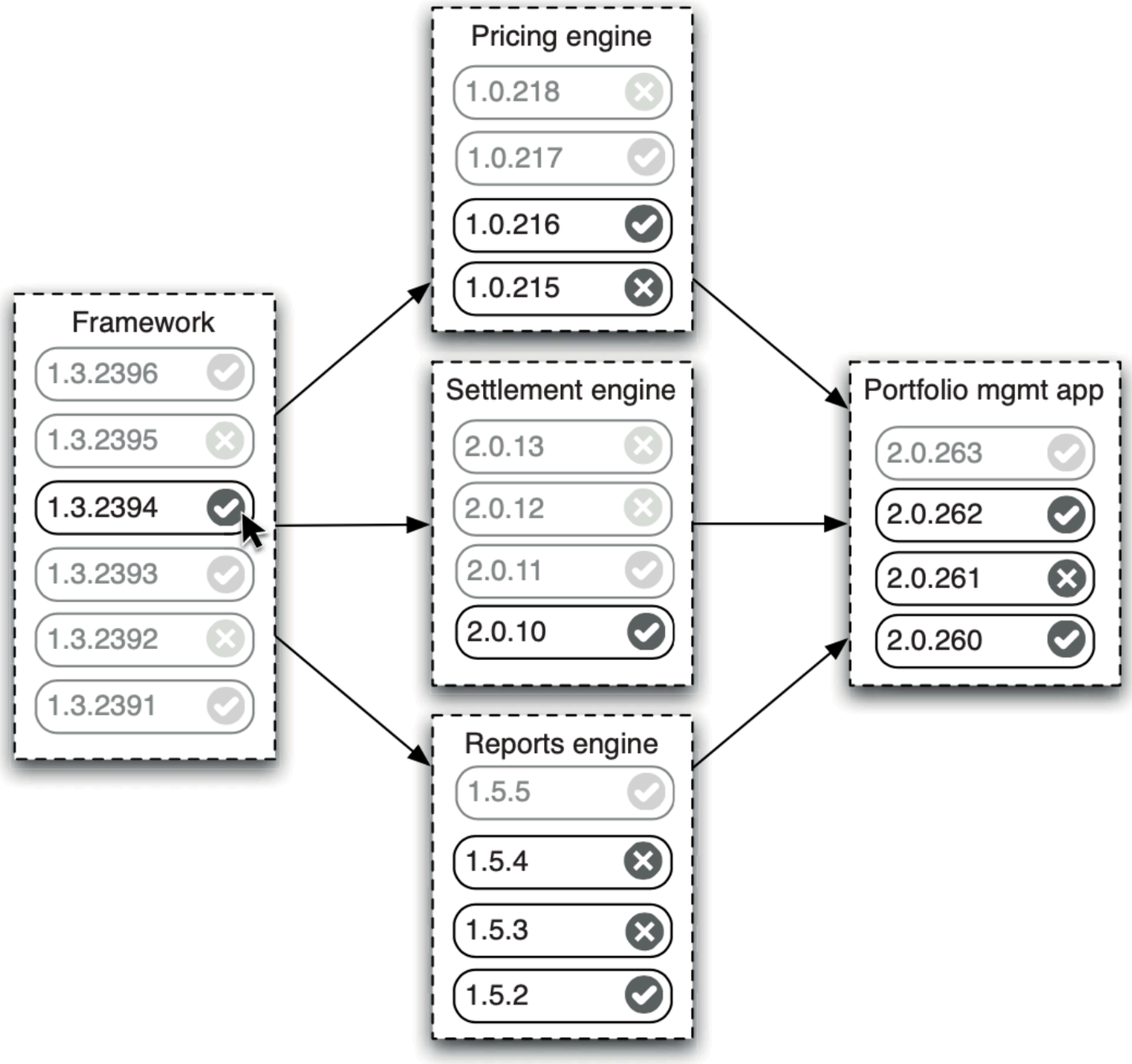



**Figure 13.5** *Visualizing downstream dependencies*

# Pipelining Dependency Graphs

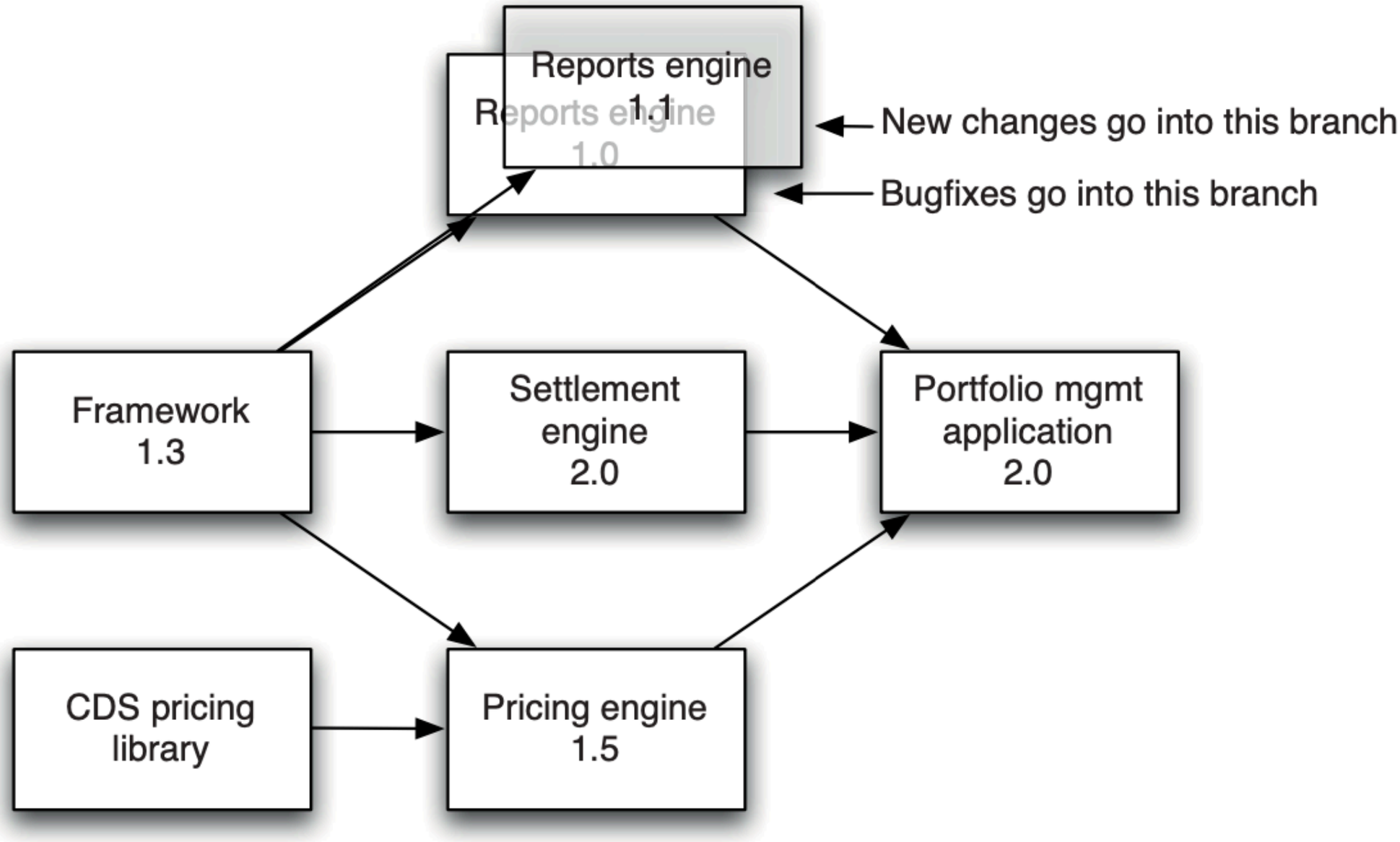



**Figure 13.6** *Branching components*

# When Should We Trigger Builds? : Cautious Optimism

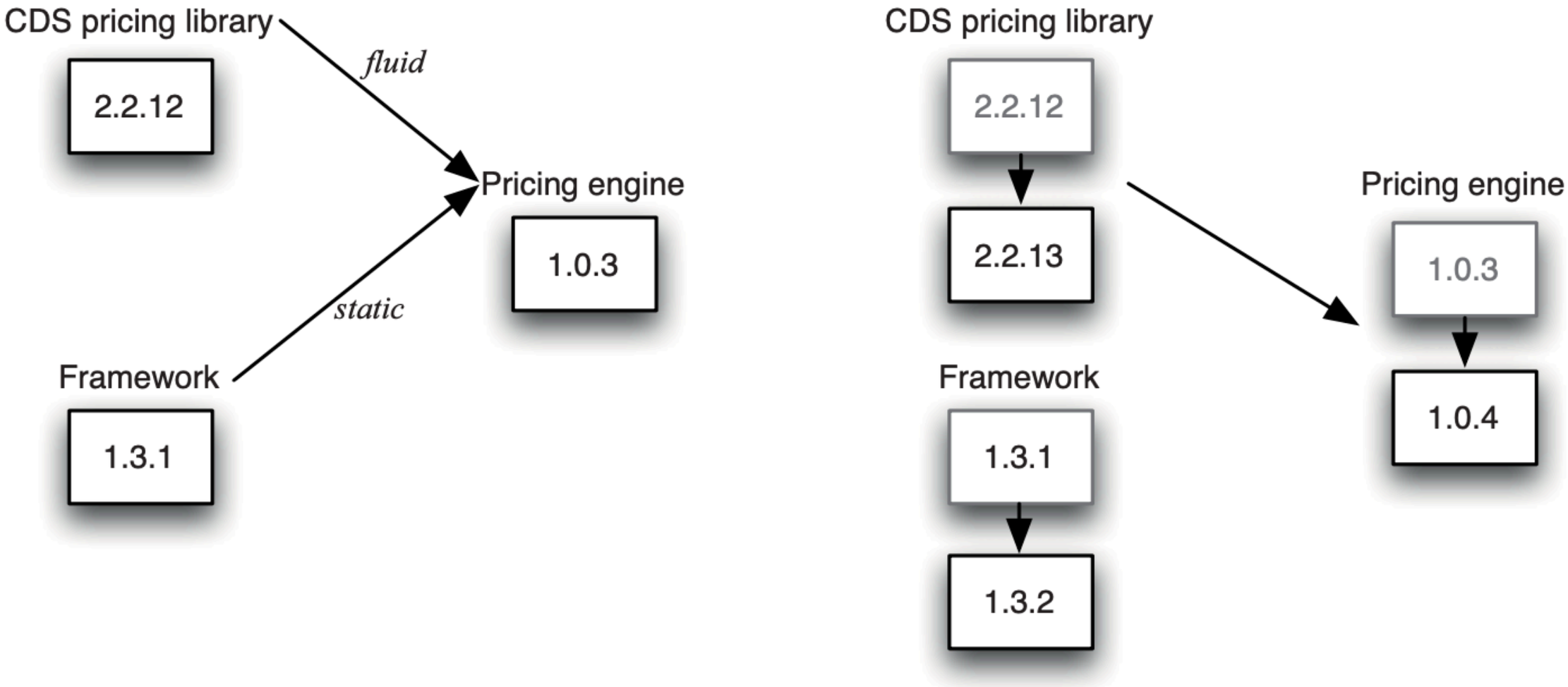



**Figure 13.7** *Cautious optimism triggering*

# When Should We Trigger Builds? : Circular Dependencies

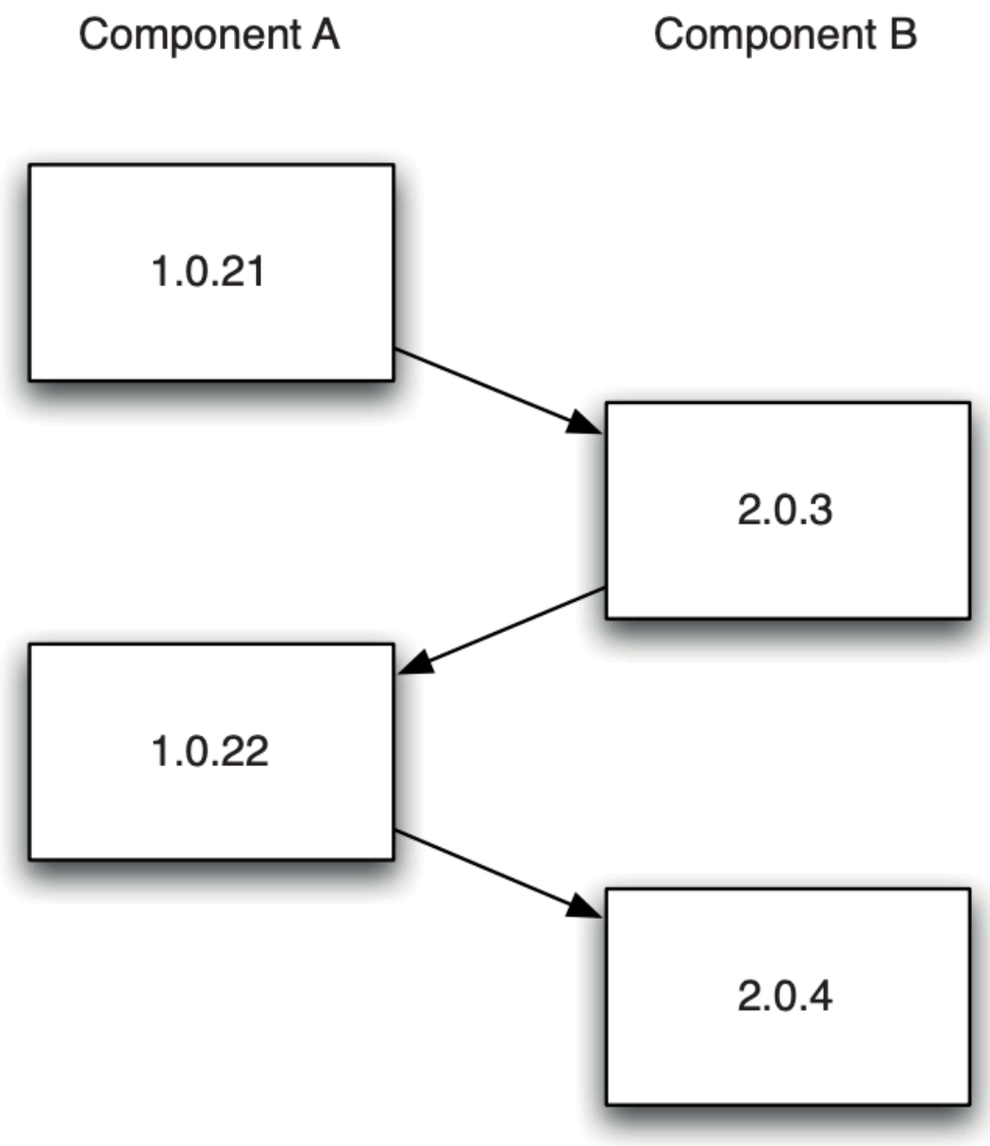



**Figure 13.8** *Circular dependency build ladder*

# Advanced Version Control

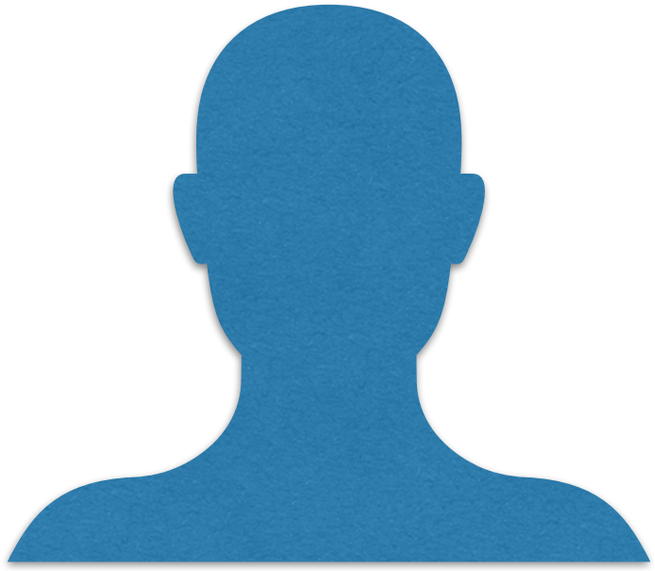
# Branching and Merging

It’ acceptable when we branching when . . . .

- Releasing
- Refactoring
- Creating the large change

# Branching and Merging

“We are branching for delay the pain of merging and conflict and got extremely pain in the end”



# Branches , Steams and Continuous Integration

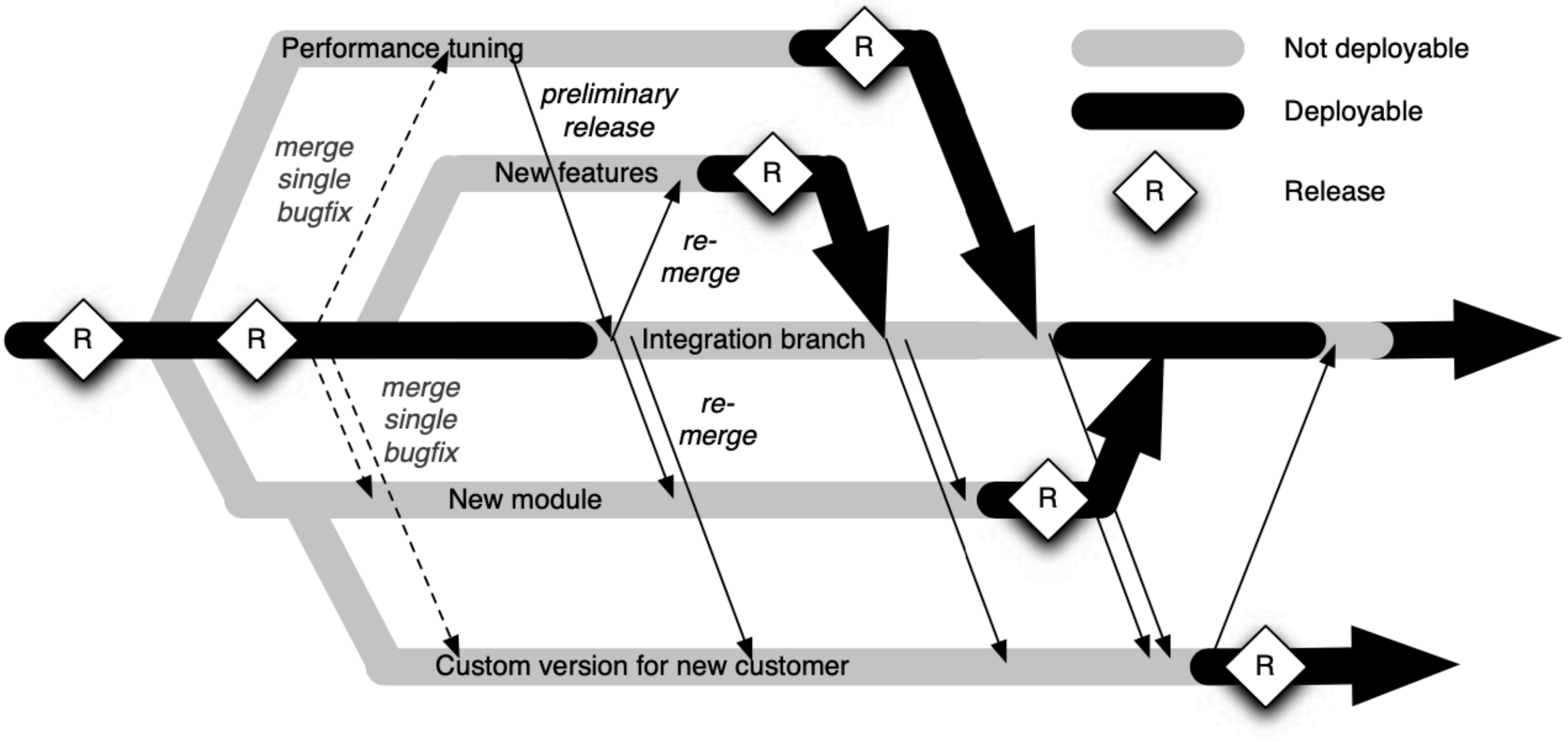



**Figure 14.1** *A typical example of poorly controlled branching*

# Branch for Release

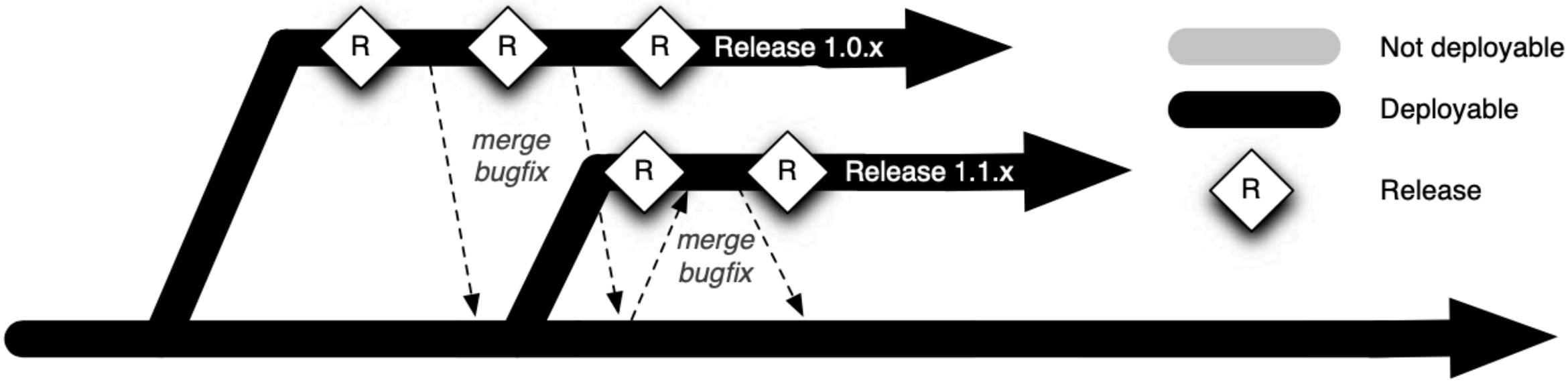
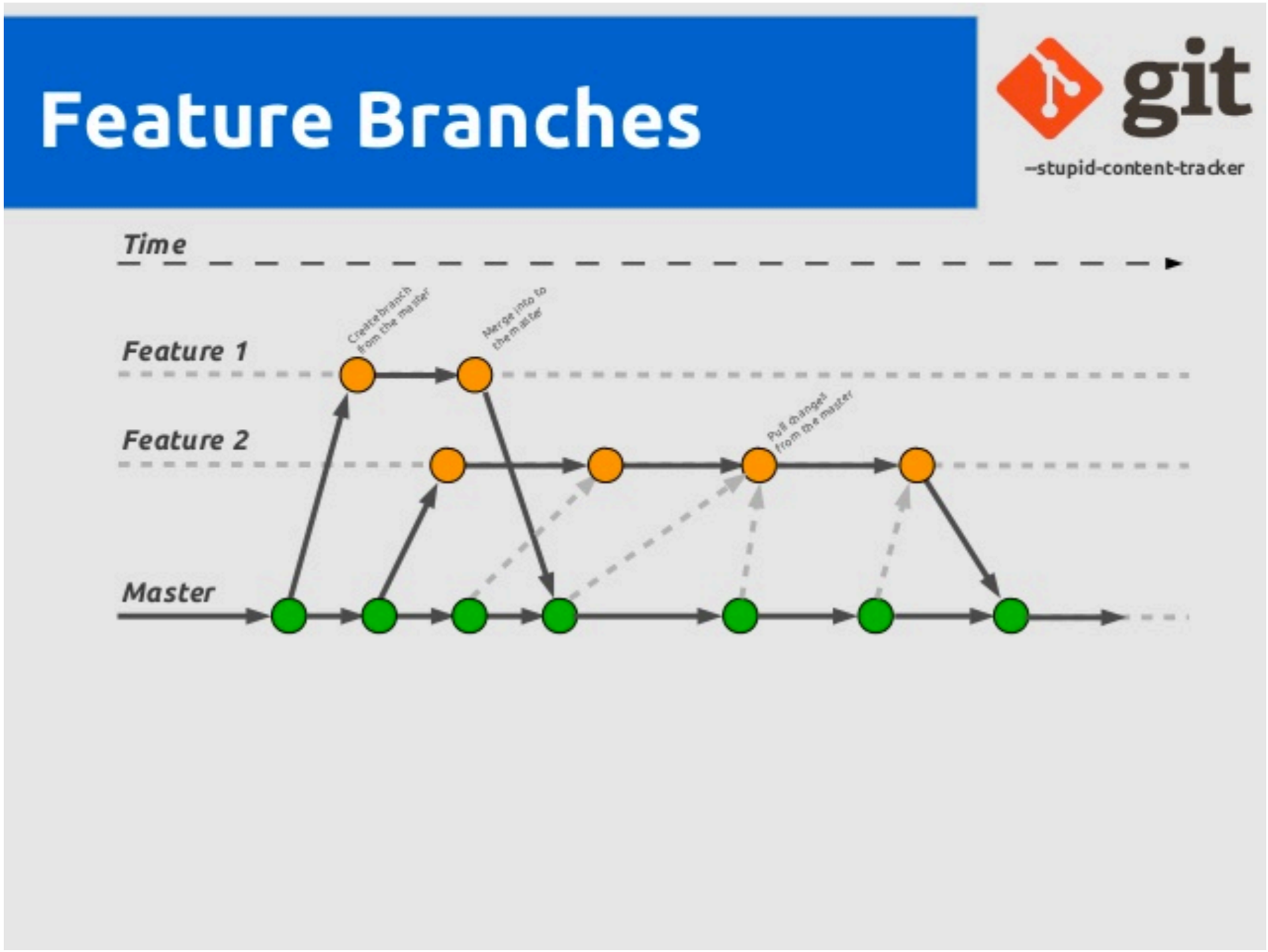



**Figure 14.2** *Release branching strategy*

# Branch by Feature




Source: Git Branching Model : Harun Yardımcı, Software & Product Development Manager @ eBay Turkey

# Branch by Team

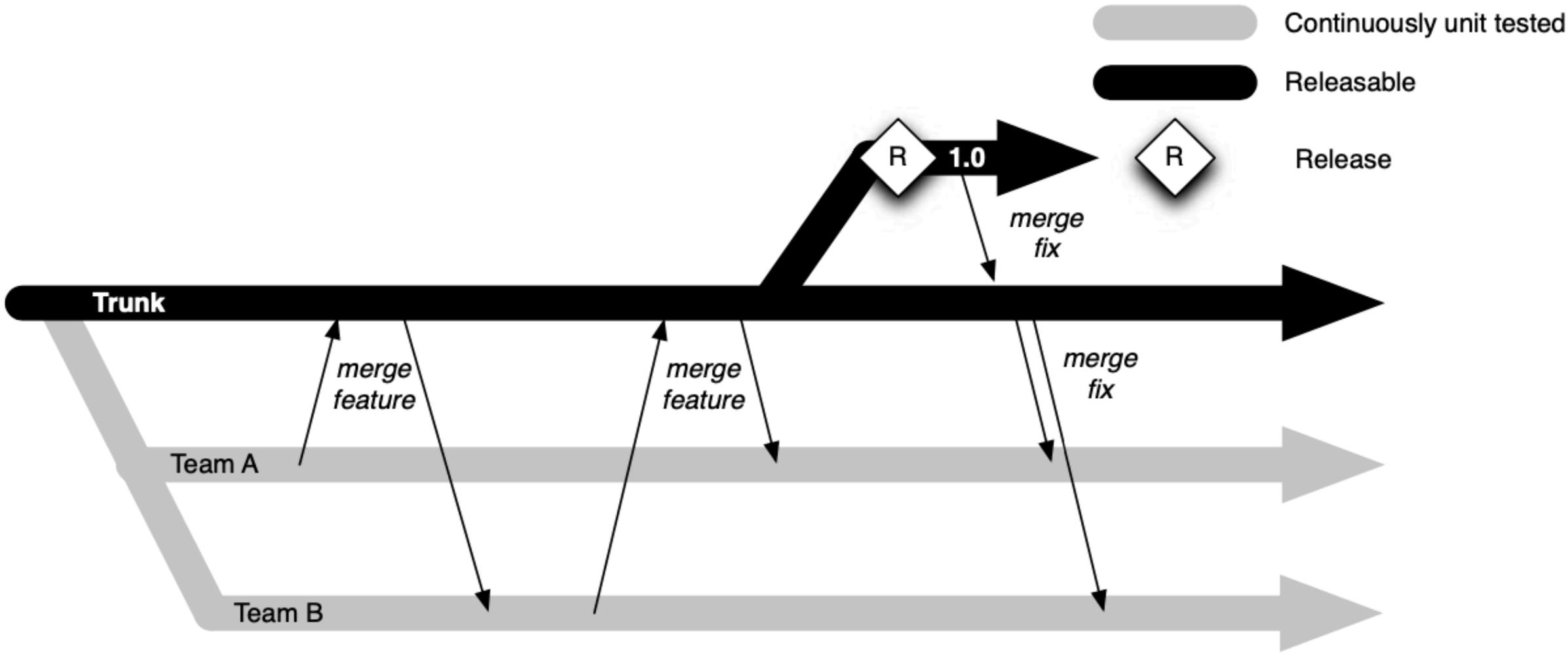



**Figure 14.7** *Branch by team*

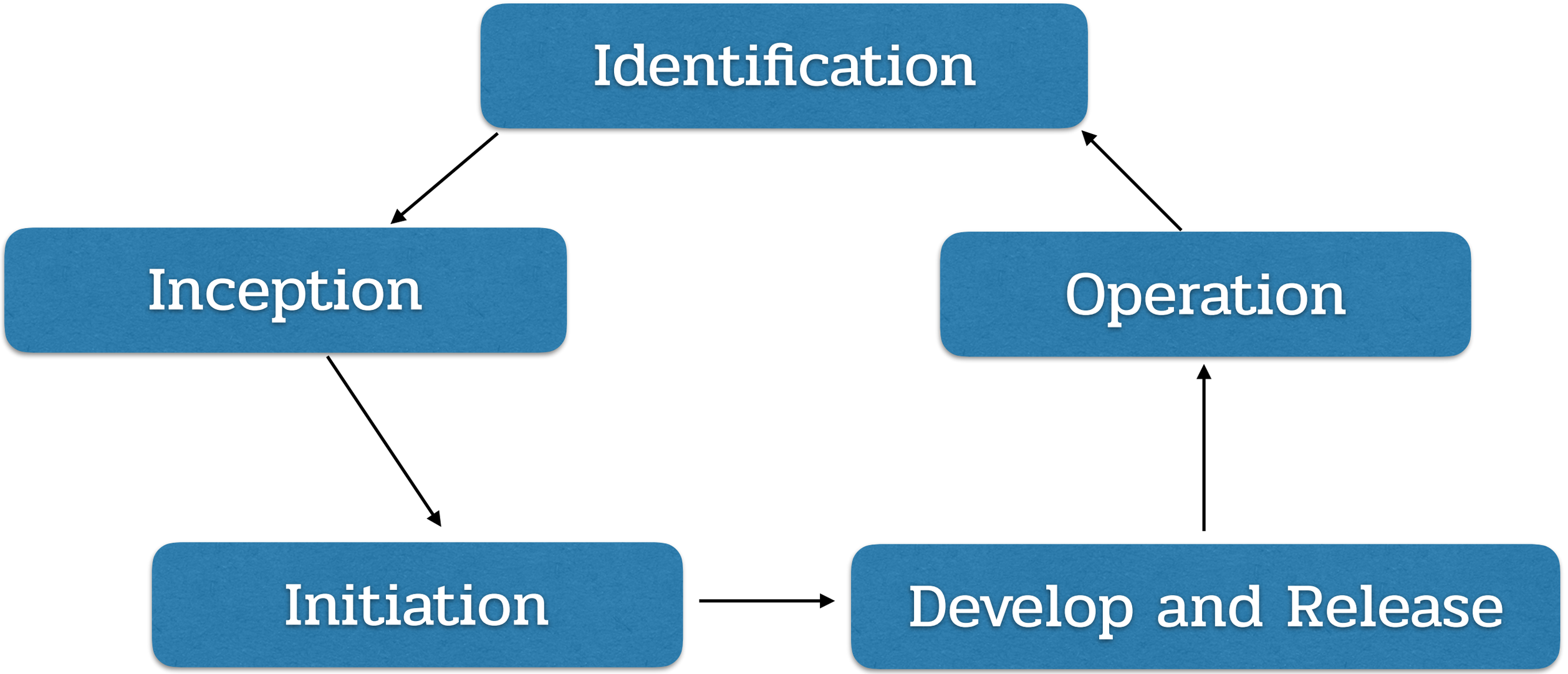
# Managing Continuous Delivery

# A Maturity Model for Configuration and Release Management

| Practice | Build management and continuous integration | Environments and deployment | Release management and compliance | Testing | Data management | Configuration management |
|---|---|---|---|---|---|---|
| **Level 3 - Optimizing:** Focus on process improvement | Teams regularly meet to discuss integration problems and resolve them with automation, faster feedback, and better visibility. | All environments managed effectively. Provisioning fully automated. Virtualization used if applicable. | Operations and delivery teams regularly collaborate to manage risks and reduce cycle time. | Production rollbacks rare. Defects found and fixed immediately. | Release to release feedback loop of database performance and deployment process. | Regular validation that CM policy supports effective collaboration, rapid development, and auditable change management processes. |
| **Level 2 - Quantitatively managed:** Process measured and controlled | Build metrics gathered, made visible, and acted on. Builds are not left broken. | Orchestrated deployments managed. Release and rollback processes tested. | Environment and application health monitored and proactively managed. Cycle time monitored. | Quality metrics and trends tracked. Non functional requirements defined and measured. | Database upgrades and rollbacks tested with every deployment. Database performance monitored and optimized. | Developers check in to mainline at least once a day. Branching only used for releases. |
| **Level 1 - Consistent:** Automated processes applied across whole application lifecycle | Automated build and test cycle every time a change is committed. Dependencies managed. Re-use of scripts and tools. | Fully automated, self-service push-button process for deploying software. Same process to deploy to every environment. | Change management and approvals processes defined and enforced. Regulatory and compliance conditions met. | Automated unit and acceptance tests, the latter written with testers. Testing part of development process. | Database changes performed automatically as part of deployment process. | Libraries and dependencies managed. Version control usage policies determined by change management process. |
| **Level 0 – Repeatable:** Process documented and partly automated | Regular automated build and testing. Any build can be re-created from source control using automated process. | Automated deployment to some environments. Creation of new environments is cheap. All configuration externalized / versioned | Painful and infrequent, but reliable, releases. Limited traceability from requirements to release. | Automated tests written as part of story development. | Changes to databases done with automated scripts versioned with application. | Version control in use for everything required to recreate software: source code, configuration, build and deploy scripts, data migrations. |
| **Level -1 – Regressive:** processes unrepeatable, poorly controlled, and reactive | Manual processes for building software. No management of artifacts and reports. | Manual process for deploying software. Environment-specific binaries. Environments provisioned manually. | Infrequent and unreliable releases. | Manual testing after development. | Data migrations unversioned and performed manually. | Version control either not used, or check-ins happen infrequently. |

**Figure 15.1** *Maturity model*

# Project Lifecycle



# Project Lifecycle

Identification

- Business Objective
- Requirement Gathering
- Business Cases

# Project Lifecycle

Inception

- Release Strategy
- Testing Strategy
- Description Development Lifecycle
- Deliverables living Documents

# Project Lifecycle

Initation

- Project's Infrastructure
- Setting Up Project
- Setup Working Agreement
- Try to Working with Tools and Architecture

# Project Lifecycle

Develop and Release

- Make Your Software Always Working
- Showcase Testing
- Deploy Every Iterations

# Project Lifecycle


- First Release is not Last
- Series of Maintenance
- Discover user needs

# Common Delivery Problems

- Infrequent or Buggy Deployments
- Poor Application Quality
- Poorly Managed Continuous Integration
- Poor Configuration Management

# Compliance and Auditing

- Automation over Documentation
- Enforcing Traceability
- Working in Silos
- Change Management