



Software Technology 06

DevOps Toolchain

DevOps

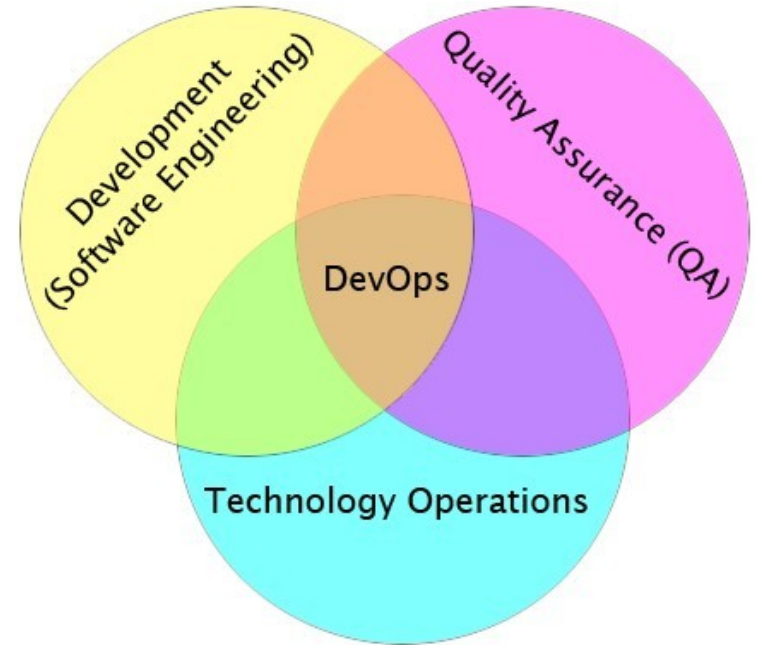
– *Development & Operations*

Collaboration of developers and other IT professionals to automate software delivery and infrastructure changes.

- Traditionally:
 - Developers change
 - Testers reduce risk
 - Operations stabilize processes

Contradicting goals

+ Agile methodologies → DevOps is **cultural change**

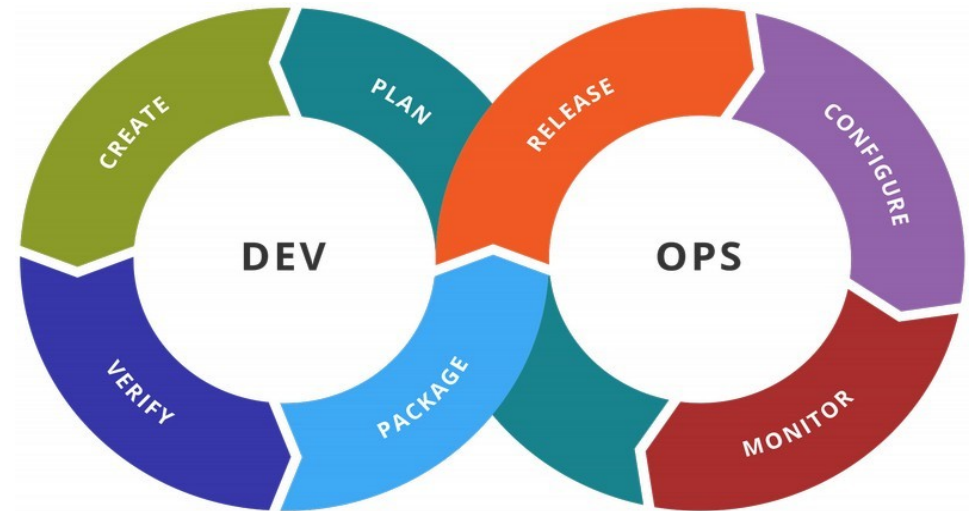


DevOps Goals

- Improve:
 - Time-to-Market
 - Feedback loop delay
 - Commit-to-Deploy (bugfix, new feature)
 - Quality
 - Efficiency
- Very frequent releases
- Fully automated release and deployment pipeline
- **Continuous Integration (CI)**
- **Continuous Delivery (& Continuous Deployment)**

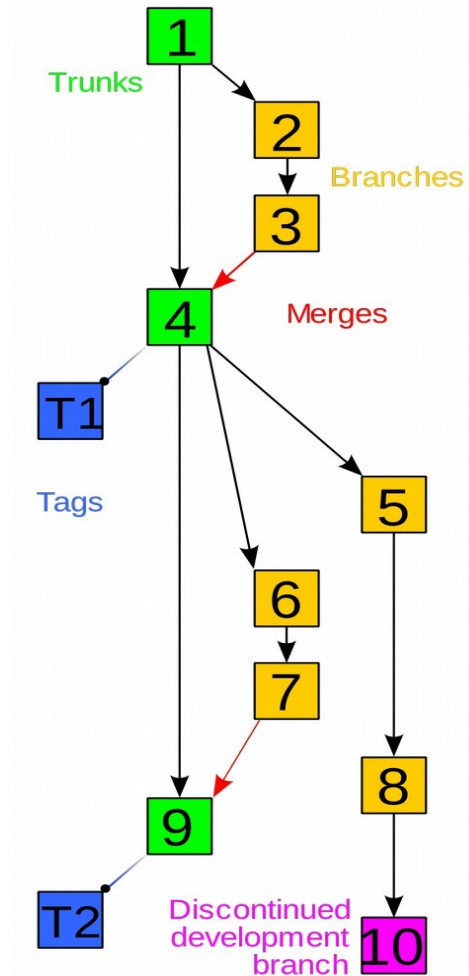
DevOps Pipeline

- Code & Review
- Build (CI & status)
- Test
- Package (Artifact Repository, Staging environment)
- Release
- Configure (Infrastructure as Code)
- Monitor (Errors, Performance, Statistics, UX)



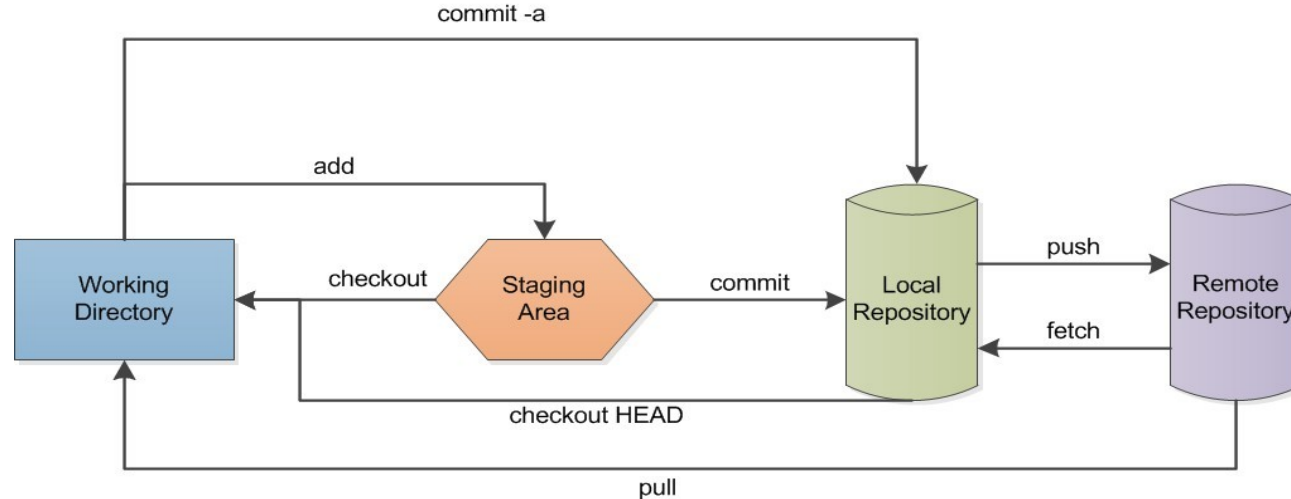
Code & Review

- Version Control Systems (VCS)
 - Organization:
 - Centralized (Subversion (SVN))
 - Distributed (Git, Mercurial, Bazaar)
 - Workflow
 - Branching
 - Merging (Integrating)
 - Tags (Releases)



Code & Review

- Distributed VCS (Git) operations



`commit -a`: Directly commit modified and deleted files into the local repository (*no new files!*)

`add`: Add a file to the staging area.

`checkout`: Get a file from the staging area.

`checkout HEAD`: Get a file from the local repository

`commit`: Commit files from the staging area to the local repository

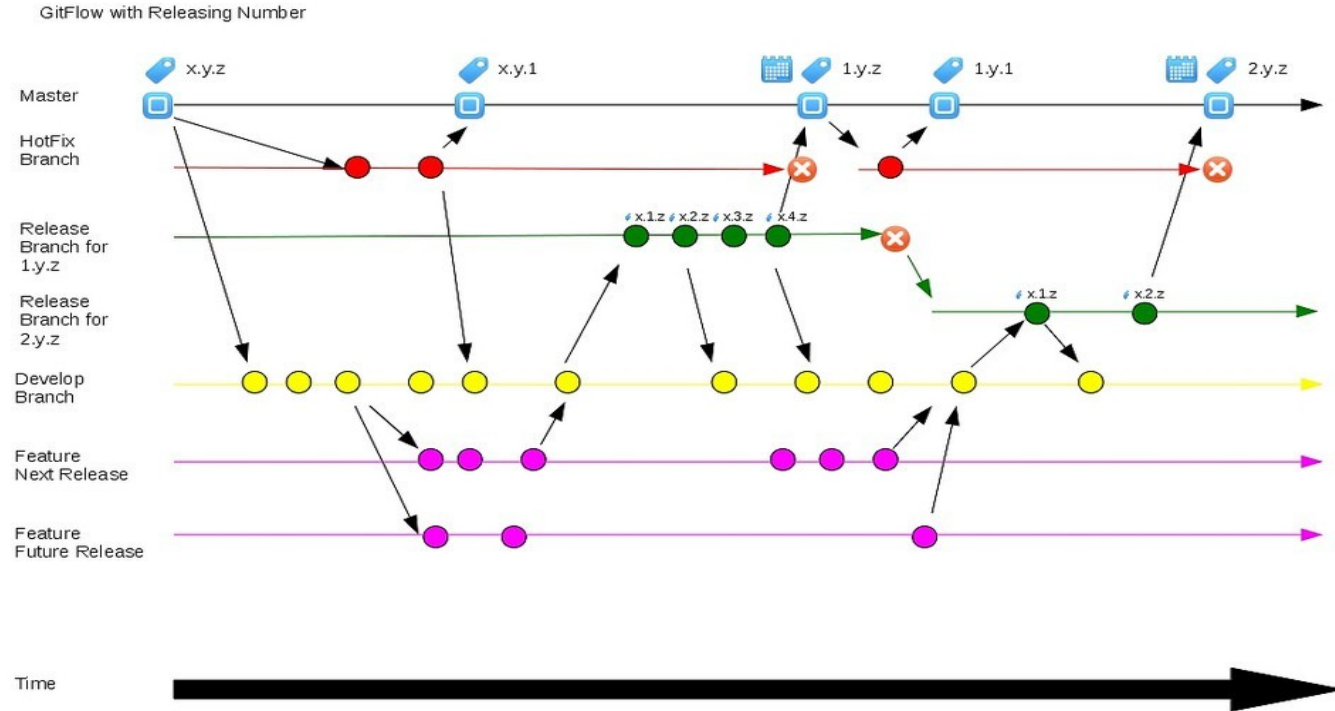
`push`: Send files to the remote repository

`fetch`: Get files from the remote repository

`pull`: Get files from the remote repository and put a copy in the working directory

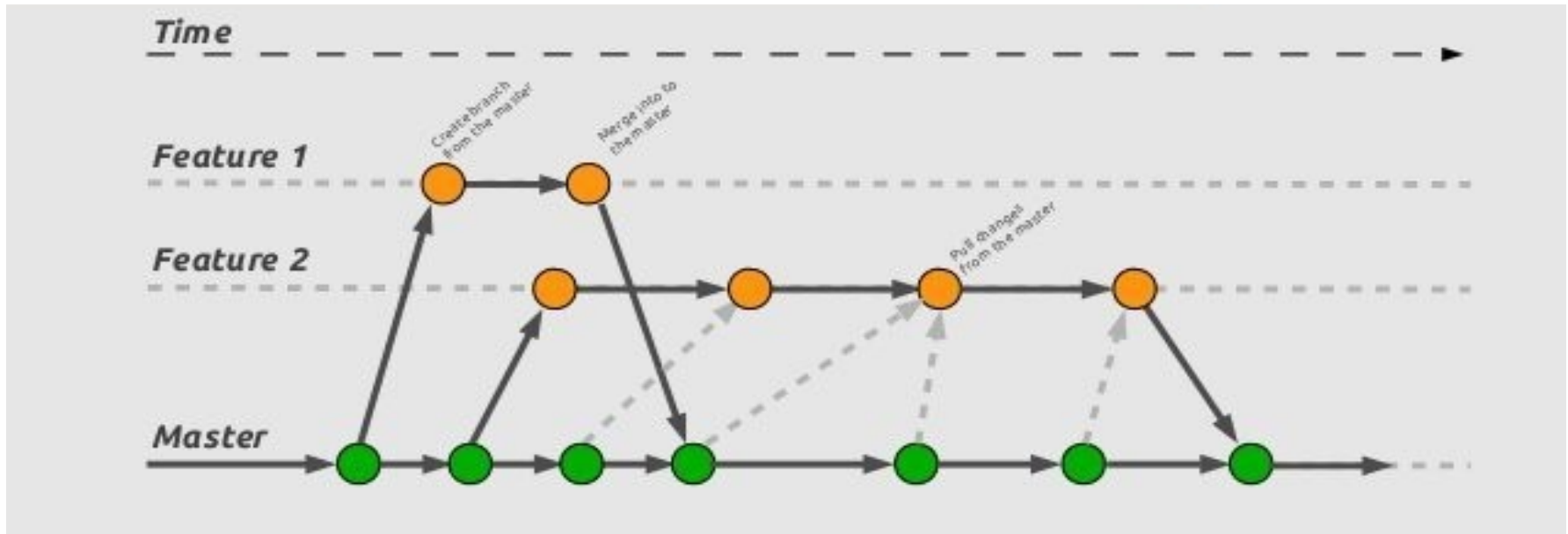
Code & Review

- VCS Branching (Old School)



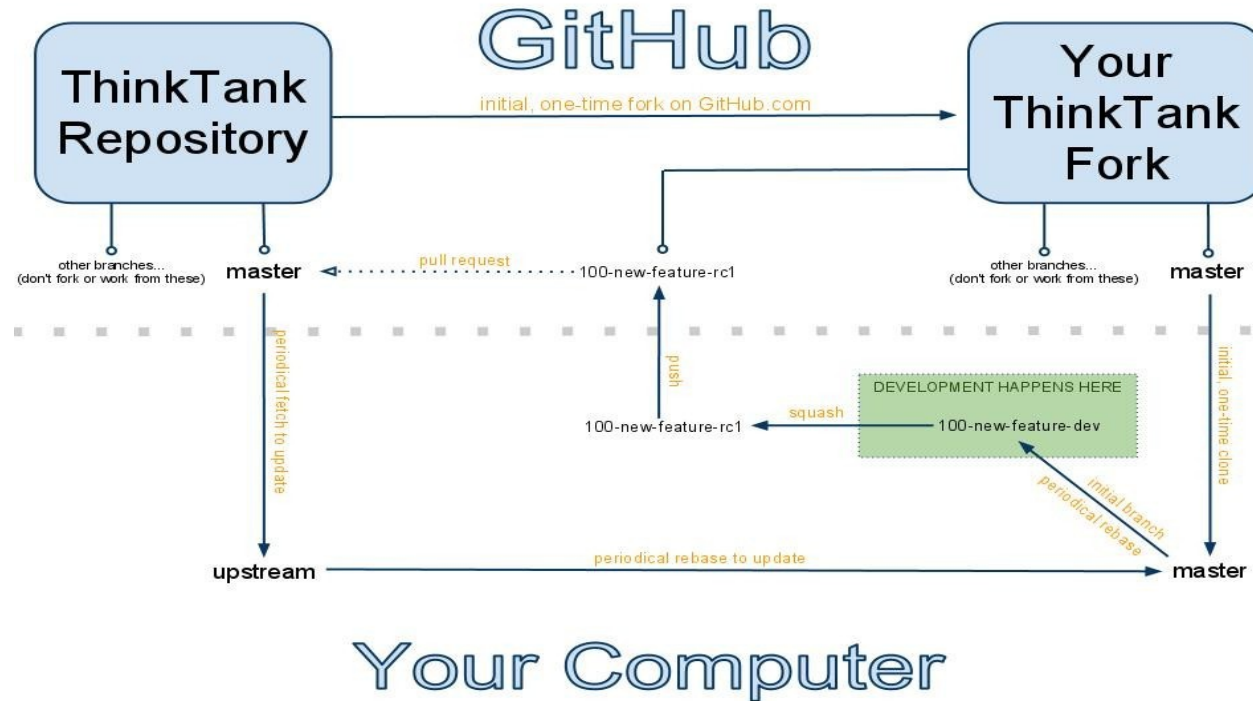
Code & Review

- VCS Branching (the CI way: no develop branch!)



Code & Review

- Merging tools (Github Pull Requests)

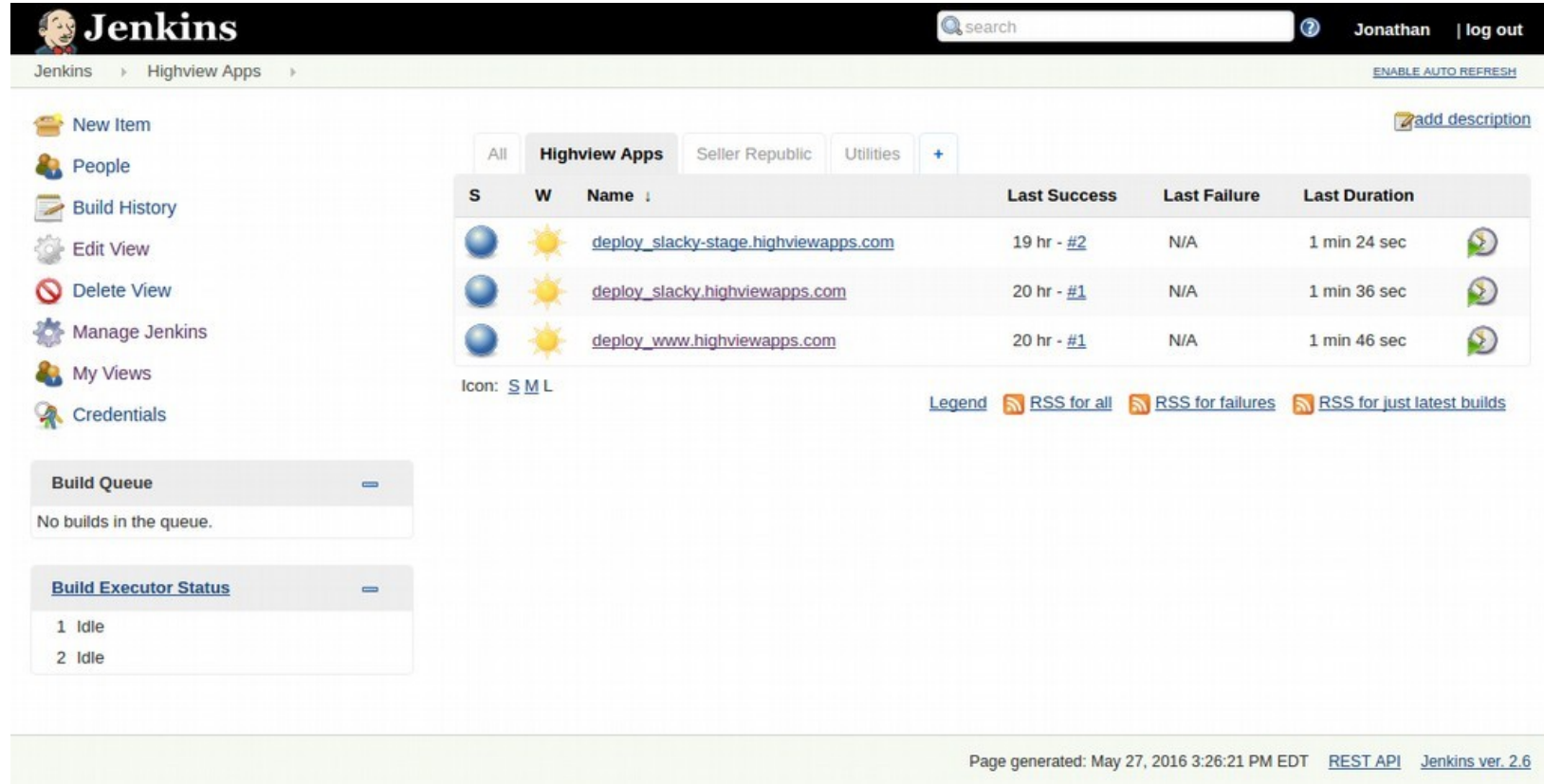


Build, Test, Package







- CI Practices
 - Central Code Repository (can be multiple)
 - Automated Build
 - Automated Tests
 - Almost like production testing (Staging or Preprod)
 - Not much branches (everyone is close to trunk / master → short round-trip)
 - Every commit is Built and Tested
 - Automate deployment into Artifact Repository
 - Results: Build Dashboard

Build, Test, Package

- CI Tools (Jenkins)



The screenshot displays the Jenkins web interface. At the top, the Jenkins logo and name are visible, along with a search bar and user information (Jonathan | log out). Below the header, the breadcrumb navigation shows 'Jenkins > Highview Apps >'. The left sidebar contains a list of navigation links: New Item, People, Build History, Edit View, Delete View, Manage Jenkins, My Views, and Credentials. The main content area shows a list of builds for the 'Highview Apps' job. The table has columns for Status (S), Weather (W), Name, Last Success, Last Failure, and Last Duration. Three builds are listed, all with a status of 'Success' (blue sphere) and a weather icon of a sun. The builds are for 'deploy_slack-stage.highviewapps.com', 'deploy_slack.highviewapps.com', and 'deploy_www.highviewapps.com'. Below the table, there are links for 'Legend', 'RSS for all', 'RSS for failures', and 'RSS for just latest builds'. On the left side of the main content area, there are two sections: 'Build Queue' (showing 'No builds in the queue.') and 'Build Executor Status' (showing '1 Idle' and '2 Idle'). At the bottom of the page, the footer indicates 'Page generated: May 27, 2016 3:26:21 PM EDT', 'REST API', and 'Jenkins ver. 2.6'.

S	W	Name ↓	Last Success	Last Failure	Last Duration
		deploy_slack-stage.highviewapps.com	19 hr - #2	N/A	1 min 24 sec
		deploy_slack.highviewapps.com	20 hr - #1	N/A	1 min 36 sec
		deploy_www.highviewapps.com	20 hr - #1	N/A	1 min 46 sec

Build, Test, Package

- *“Earlier it is caught, cheaper to fix”*
- Testing frameworks (JUnit, Mockito, GTest...)
- Build tools (command line)
 - Ant, Maven, Gradle (Ivy, Nexus = Artifact or Binary Repositories)
 - Make (autotools), Ninja, CMake (Cross IDE, Cross Platform)

Build, Test, Package

- Matrix Builds = lot of build artifacts according to different categories
 - Debug / ReleaseWithDebug / Release (+Obfuscation)
 - Free / Commercial / With-extra-feature
 - Release per branch
 - Per platform builds
 - Special builds
 - Coverage
 - Memory checking
 - Thread checking

Project Matrix Project Plugin Demo

Configuration Matrix	IE	Safari	Chrome	Firefox	Opera
DEV					
Test					
QA					
Stage					
Production					



Disk Usage

Job	615 KB
All builds	615 KB
Locked builds	-
All workspaces	204 KB
Slave workspaces	204 KB
Non-slave workspaces	-

Build, Test, Package



- *“Earlier it is caught, cheaper to fix”*
- Compiler Errors, Warnings, Warning Levels
- Other verification
 - Coding Convention Enforcement (clang-format, pep8)
 - Code Metrics
 - Static Code Analysis
 - example: SonarQube, Lint, clang-format, clang-tidy, clang, Eclipse, FindBugs, PMD, pep8, Pylint, PyCharm
- Coverage
- Profiling (Profiling or Sampling)

Build, Test, Package

Version 6.x - Mon, 26 Jul 2010 13:58 - profile [Nemo rules](#)

Lines of code

162,306 ▲

325,036 lines ▲

87,758 statements ▲

1,060 files

Classes

1,447

103 packages

14,271 methods ▲

+1,262 accessors

Comments

26.6%

58,891 lines ▲

59.1% docu. API

5,418 undocu. API

1,164 commented LOCs

Duplications

7.1%

22,998 lines ▼

566 blocks ▲

174 files ▲

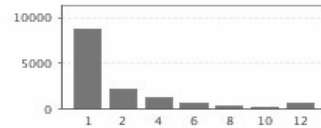
Complexity

3.1 / method

30.9 / class

42.2 / file

Total: 44,773 ▲



● Methods ○ Classes

Events

All ▼

2010-07-26	Version	6.x
2009-06-07	Version	6.0.x
2009-02-15	Alert	Orange !

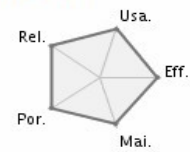
Key : org.apache.tomcat

Language : java

Alerts feed

Rules compliance

83.7%



Violations

10,072 ▲

⚠ Blocker 0

⚠ Critical 0

⚠ Major 8,794 ▲

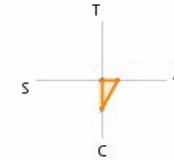
⚠ Minor 65

⚠ Info 1,213 ■

Alerts : Duplicated lines (%) > 5.

SIG Maintain. Model

(A)nalsability -
(C)hangeability 0
(S)tability -
(T)estability -



Tags

356

0 mandatory

356 optional

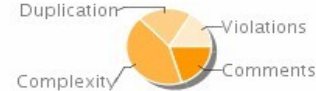


Technical Debt

11.0%

\$ 341,563 ▲

683 man days ▲



No information available on coverage

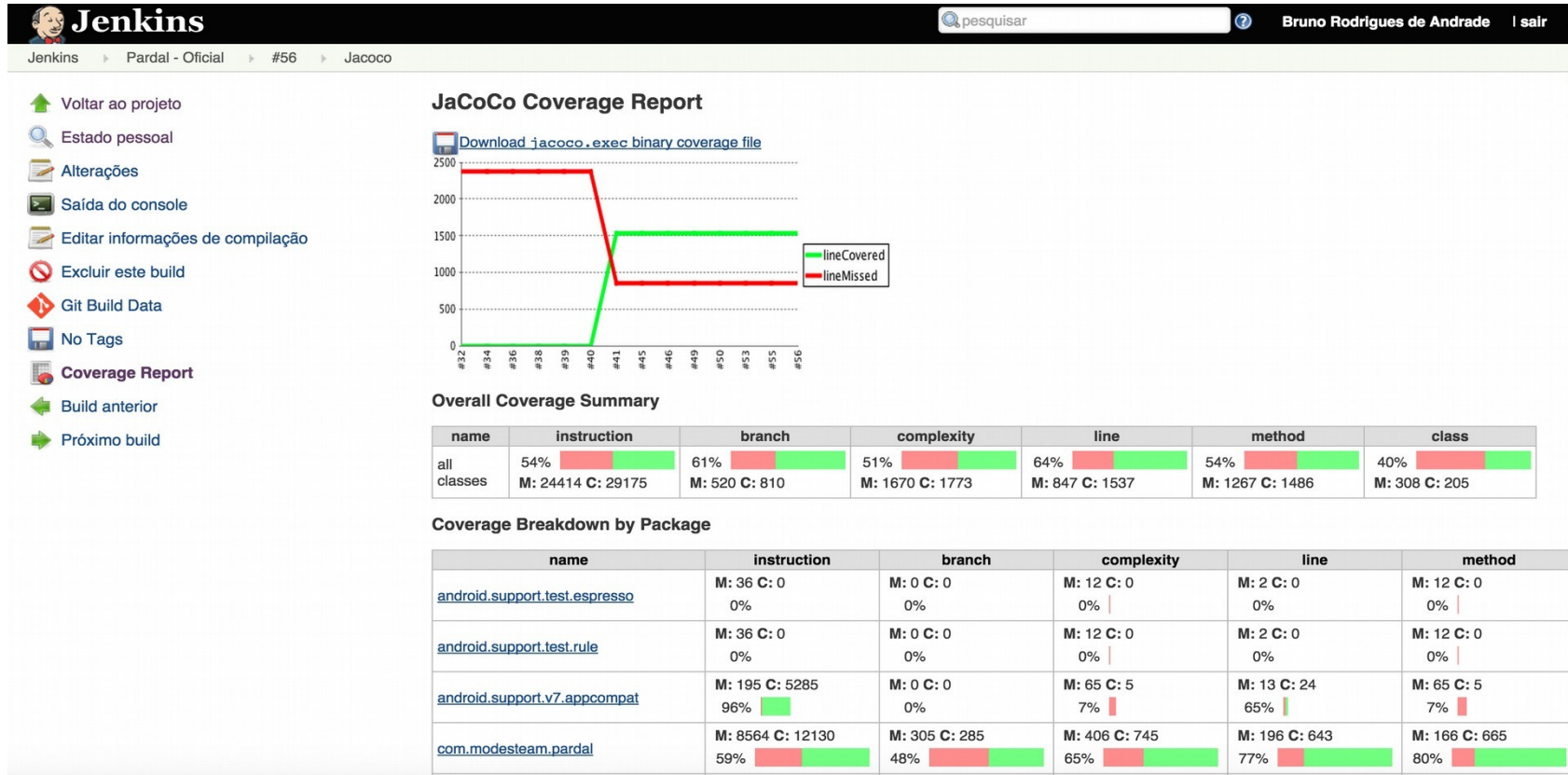
No information available on design

Build, Test, Package

The screenshot shows the CodeChecker web interface. The top bar is blue with the 'CodeChecker' logo. Below it, there's a 'List of runs' tab showing 'xercesxtu_novisitfunc'. The main area is titled 'Bug Overview' for 'BMPattern.cpp @ Line 181'. On the left, a sidebar shows a tree of bug categories: Critical, High, Medium, Low, Style, and Unspecified. Under 'Unspecified', 'Line 181: core.DivideZero' is selected, showing a 'Result: Division by zero'. The main panel displays the source code of 'BMPattern.cpp' with annotations. Blue arrows point from the bug report to the relevant code lines. Annotations include: 'Entered call from constructor for 'BMPattern'', 'Loop body executed 0 times', 'Entering loop body', and 'Division by zero' at line 181. The code snippet shows the initialization of patternLen, allocation of fShiftTable, and a loop that calculates the difference between patternLen and k-1, leading to a division by zero at line 181.

```
156 //
157 void BMPattern::initialize() {
158     Entered call from constructor for 'BMPattern'
159     const XMLSize_t t patternLen = XMLString::stringLen(fPattern);
160     XMLCh* lowercasePattern = 0;
161     fShiftTable = (XMLSize_t*) fMemoryManager->allocate(fShiftTableLen*sizeof(XMLSiz
162     if (fIgnoreCase) {
163         fUppercasePattern = XMLString::replicate(fPattern, fMemoryManager);
164         lowercasePattern = XMLString::replicate(fPattern, fMemoryManager);
165         XMLString::upperCase(fUppercasePattern);
166         XMLString::lowerCase(lowercasePattern);
167     }
168     ArrayJanitor<XMLCh> janLowercase(lowercasePattern, fMemoryManager);
169     for (unsigned int i=0; i< fShiftTableLen; i++)
170         Loop body executed 0 times
171         fShiftTable[i] = patternLen;
172     for (unsigned int k=0; k< patternLen; k++) {
173         Entering loop body
174         XMLCh ch = fPattern[k];
175         XMLSize_t diff = patternLen - k - 1;
176         int index = ch % fShiftTableLen;
177         Division by zero
178     }
179 }
```


Build, Test, Package



Release & Configure

- Deployment scalability → Virtualization
 - Full (KVM, Xen, QEMU, VirtualBox)
 - OS-Level (Docker, LXC / LXD, OpenVZ) - Containerization
- Infrastructure as Code
 - Declarative (functional) vs Imperative (procedural)
 - Push or Pull (towards controller server)
 - Continuous Configuration Automation (CCA) (Chef, Puppet, Vagrant, Ansible)

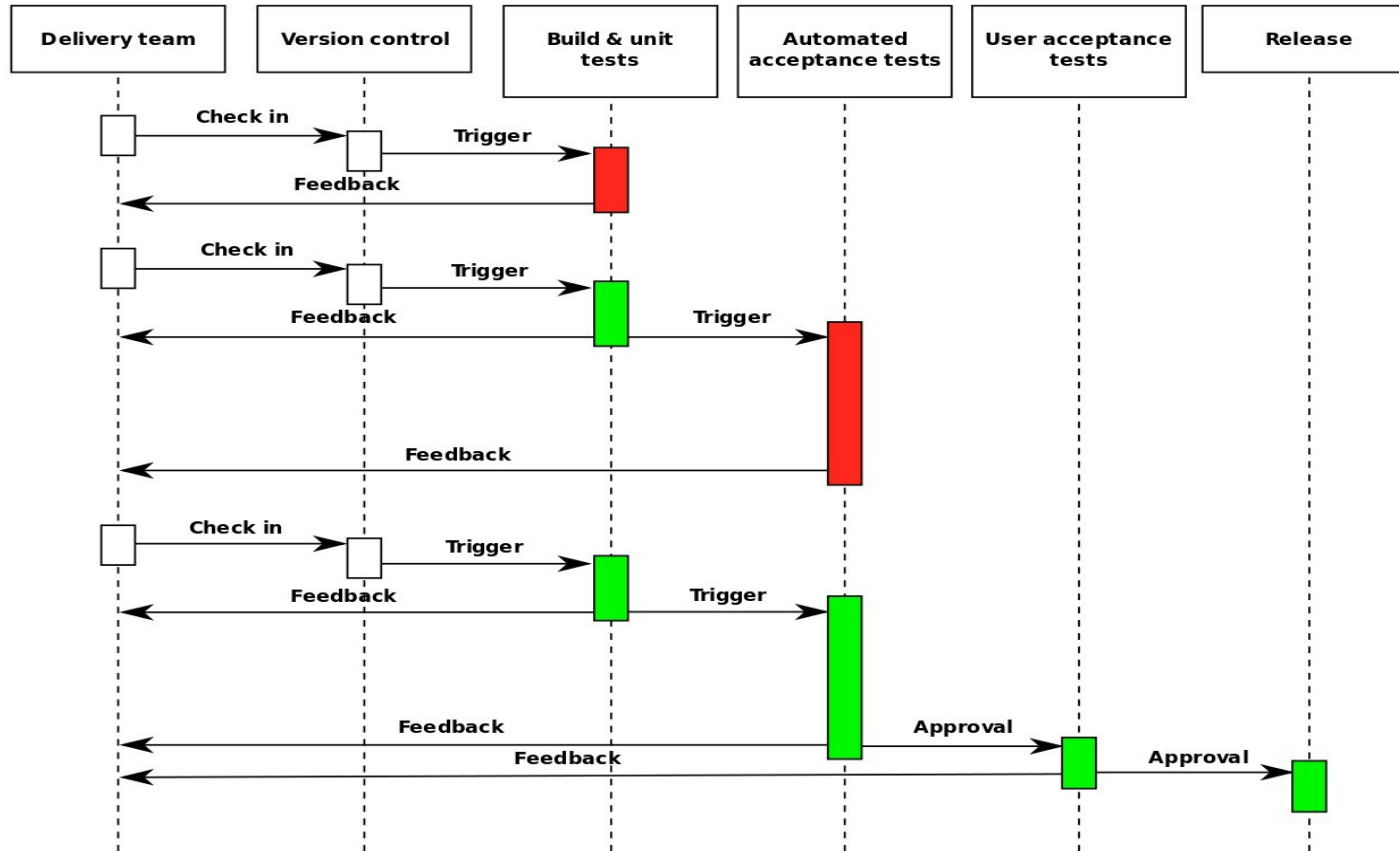
Monitor

- Application Performance Monitoring
 - Not Profiling
 - General usage statistics
 - UX Monitoring
 - Command chain analysis
 - Time measurement
 - System component monitoring
 - Measure critical times (loading, waiting for network...)
 - Micro measure time spent in subsystems

Monitor

- Application Performance Monitoring
 - Extensive Logging
 - Log levels
 - Log types
 - Log modules
 - Structured Logging
 - Live / Real-time Dashboards
- Monit, Nessus, Kibana (ELK Stack)...

Continuous Delivery



PERIODIC TABLE OF DEVOPS TOOLS (V3)

PERIODIC TABLE OF DEVOPS TOOLS (V3)																																			
1 Os GI GitLab																		2 En Sp Splunk																	
3 Fm Gh GitHub		4 En Dt Datical																5 En XLr XebiaLabs XL Release		6 Fm Aws AWS		7 Pd Az Azure		8 En Gc Google Cloud		9 Fm Op OpenShift		10 Fm Sg Sumo Logic							
11 Os Sv Subversion		12 En Db DBMaestro																13 Os Dk Docker		14 En Ur UrbanCode Release		15 Pd Af Azure Functions		16 Pd Ld Lambda		17 Fm Ic IBM Cloud		18 Os Fd Fluentd							
19 En Cw ISPW		20 En Dp Delphix		21 Os Jn Jenkins		22 Fm Cs Codeship		23 Os Fn FitNesse		24 Fr Ju JUnit		25 Fr Ka Karma		26 Fm Su SoapUI		27 En Ch Chef		28 Fr Tf Terraform		29 En XLd XebiaLabs XL Deploy		30 En Ud UrbanCode Deploy		31 Os Ku Kubernetes		32 Fm Cc CA CD Director		33 En Pr Plutora Release		34 Pd Al Alibaba Cloud		35 Os Os OpenStack		36 Os Ps Prometheus	
37 Pd At Artifactory		38 Fm Rg Redgate		39 Pd Ba Bamboo		40 Fm Vs VSTS		41 Fr Se Selenium		42 Fr Jm JMeter		43 Os Ja Jasmine		44 Pd Sl Sauce Labs		45 En An Ansible		46 Os Ru Rudder		47 En Oc Octopus Deploy		48 Os Go GoCD		49 Os Ms Mesos		50 Pd Gke GKE		51 Fm Om OpenMake		52 Pd Cp AWS CodePipeline		53 Pd Cy Cloud Foundry		54 En It ITRS	
55 Pd Nx Nexus		56 Os Fw Flyway		57 Os Tr Travis CI		58 Fm Tc TeamCity		59 Os Ga Gatling		60 Fr Tn TestNG		61 Fm Tt Tricentis Tosca		62 Pd Pe Perfecto		63 En Pu Puppet		64 Os Pa Packer		65 Fm Cd AWS CodeDeploy		66 En Ec ElectricCloud		67 Os Ra Rancher		68 Pd Aks AKS		69 Os Rk Rkt		70 Os Sp Spinnaker		71 Pd Ir Iron.io		72 Pd Mg Moogsoft	
73 Fm Bb BitBucket		74 En Pf Perforce		75 Fm Cr Circle CI		76 Pd Cb AWS CodeBuild		77 Fr Cu Cucumber		78 Os Mc Mocha		79 Os Lo Locust.io		80 En Mf Micro Focus UFT		81 Os Sa Salt		82 Os Ce CFEngine		83 En Eb ElasticBox		84 En Ca CA Automic		85 En De Docker Enterprise		86 Pd Ae AWS ECS		87 Fm Cf Codefresh		88 Os Hm Helm		89 Os Aw Apache OpenWhisk		90 Os Ls Logstash	

Os

Open Source

Fr

Free

Fm

Freemium

Pd

Paid

En

Enterprise

Source Control Mgmt.

Database Automation

Continuous Integration

Testing

Configuration

Deployment

Containers

Release Orchestration

Cloud

AIOps

Analytics

Monitoring

Security

Collaboration

Os	Open Source	Source Control Mgmt.	Deployment	Analytics
Fr	Free	Database Automation	Containers	Monitoring
Fm	Freemium	Continuous Integration	Release Orchestration	Security
Pd	Paid	Testing	Cloud	Collaboration
En	Enterprise	Configuration	AI/Ops	



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106 En Sw ServiceNow	107 Pd Jr Jira	108 Fm Tl Trello	109 Fm Sk Slack	110 Fm St Stride	111 En Cn CollabNet VersionOne	112 En Ry Remedy	113 En Ac Agile Central	114 Pd Og OpsGenie	115 Pd Pd Pagerduty	116 Os Sn Snort	117 Fm Tw Tripwire	118 En Ck CyberArk	119 En Vc Veracode	120 En Ff Fortify SCA