Tooling for Java EE applications PA165

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Maven

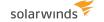
Git Basics

Git Branching

Pull requests

Branching Strategies

Continuous Integration



Maven

Git Basic

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Building java applications

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- ▶ Motivation aka Why should we care, let's have bash script with bunch of javac commands
- Brief look into history
 - Make
 - Ant (with Ivy)
 - Maven
 - Gradle



Build tools - history overview

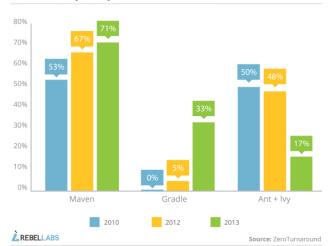
THE EVOLUTION OF BUILD TOOLS: 1977 - 2013 (AND BEYOND)





Build tools - popularity

Build Tools Popularity - Late 2010 to Mid 2013





Desired properties of quality build tool

- How steep is learning curve
- Time required for build
- Complexity of build script (creation, maintenance)
- Extensibility and flexibility (plugins)
- Build environment consistency
- Extra features (docs, deployment, etc...)
- Integration with developer tools (IDEs, CI servers,...)



Maven basics

- Software project management and comprehension tool
 - Describes how software project is built
 - Describes software project dependencies
- Developed by Apache Software Foundation
- Created 2004, current version 3.5.0 (Apr 2017)
- Written in Java
- XML configured



Maven characteristics

- Consistency across projects, standardized build environment
- Lot of implicit functionality (mvn clean is standardized)
- Inheritance via parent poms
- Dependency management, transitive dependencies
- Convention over configuration
 - ▶ If mvn conventions are followed then it's easy, if not, it can become very complicated
- Centered around managing entire projects lifecycle



- XML definition of a project
- Defines:
 - Project information
 - Name
 - Company allegiance
 - Docs
 - Test coverage
 - Version
 - Parent relation
 - **Dependencies**
 - Plugins to be used
 - Build steps



- Dependency management
 - Scope
 - compile (default)
 - provided
 - test
 - Library versions
- Versioning
 - SNAPSHOTs
 - Deployment of stable versions into repository
 - Central Maven repository
 - Company proxy Artifactory, Nexus



Mayen - Features

- **Packaging**
 - ▶ jar (default)
 - war
 - ear
 - pom
- Archetypes
 - Ability to quickly setup template projects
 - Way of standardization of company guidelines and frequently used patterns



Maven - Plugins

- Standardized shared functionality execution
- All work in Maven is done by plugins
- Build plugins (project consolidation)
- Reporting plugins (tests, site, docs)
- Each plugin can have several goals (e.g. mvn jetty:run)
- Standard plugins https://maven.apache.org/plugins/
 - mvn clean
 - mvn package
 - mvn install
 - mvn deploy



Maven - Lifecycle

- Clearly defined process for project build and distribution
- Consisting of phases
 - ▶ Phase consists of plugin goals
- 3 built-in lifecycles
 - default (validate, compile, test, package, verify, install, deploy)
 - Each phase triggers all previous (eg. mvn test executes validate and compile before test)
 - clean
 - site
- Customizable (defining own lifecycles)



Maven - Best practices

- ► Single artifact per pom.xml
- Using recommended layouts
- Versions for plugins and dependencies to be kept in parent mgmt section
- Put all artifacts into target folder (follow conventions)
- Use dependency plugin to analyze goals to identify issues
- Follow conventions (e.g. directory structure)
- Do not make Maven act like Ant



Maven - Demo



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Git Basics

Git Branching

Pull requests

Branching Strategies

Continuous Integration



Version control

- Motivation
- History
 - One file at a time
 - Centralized (CVS, Subversion)
 - Distributed (Git, Mercurial)



► Created in 2005 by Linus Torvalds

- described by himself as "stupid content tracker"
- Originally created for linux kernel development
- Inspired by BitKeeper, aiming to be performant and free
- CVS taken as example of what not to do
- git no exact meaning
 - random three-letter combination that is pronounceable, and not actually used by any common UNIX command. The fact that it is a mispronunciation of "get"may or may not be relevant.
 - "global information tracker": you're in a good mood, and it actually works for you. Angels sing, and a light suddenly fills the room.
 - "g*dd*mn idiotic truckload of sh*t": when it breaks
 - https://github.com/git/git/blob/master/README.md



Git characteristics

- Strong support for non-linear development
 - Rapid branching and merging
 - ► Tools for visualisation and navigation in development history
 - Lightweight branches
- Distributed development
 - Each developer has full history
 - Prevents data loss
 - Subteams can share reposities without access to central repository
 - No need to have access to central repository all the time
 - Changes are committed locally and then pushed to central repository



Git characteristics

- Variety of protocols supported
 - HTTP/HTTPS
 - ▶ FTP
 - SSH
- Efficient handling of large projects
 - Fast (when applying patches)
 - Scalable
 - Fetching version history from locally stored repository is faster then from remote
- Allows various workflows
 - Centralized (enterprise companies)
 - Hierarchical (Linux kernel)
 - Distributed (open source projects, pull requests)



Git Basics - commands

git init

Initializes empty local repository

git status

Shows current file differences between HEAD commit and current working copy

git add <filename>

- Adds a file/directory into commit checklist
- -A (all files not versioned, or not ignored), -u (only updated files already under version control)

git commit -m <message>

Records working copy changes into repository



Git Basics - commands

git log

- Shows latest commits for local repository
- --oneline (condensed view), --graph (includes branches)

git diff

Shows code difference between HEAD commit and current working copy

git checkout / git reset

Removes local uncommitted changes

git reset --soft HEAD 1 / --hard <commithash>

Reverts working copy to given commit (soft keeps changes as to be committed, hard removes them completely)

git tag

 Annotates current version of local repository with tag (such as version)



Git Basics - commands

git clone

Clones remote repository into local repository and fetches latest changes

git push

- Pushes local committed changes into remote repository
- --tags Pushes tags into remote repository
- Cleanup local commits before push using amend or rebase

.gitignore

File for specifying files not to be tracked under version control (binary files, log files, temporary build files, etc.)

.gitattributes

- ► File for specifying attributes to apply for certain paths
- Used for example for specifying line endings

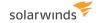


Git Basics - Demo



Contents

Git Branching



- A branch represents an independent line of development.
- Lightweight implementation of branching Git stores a branch as a reference to a commit.
- Keeps history as a tree, where each commit is a node in the tree, and has one or more parents.
- History is extrapolated through the commit relationships.
- It's a good practice to spawn a new branch to encapsulate your changes no matter how big the changes are.



Git Branching - Local Branches

Non-tracking local branches

- Exist on user's machine.
- Not associated with any other branch.
- User needs to specify upstream branch when running push or pull commands.

Tracking local branches

- Exist on user's machine.
- Tracking branch is a branch that has a direct relationship to another branch
- Local tracking branches in most cases track a remote tracking branch.
- Allow user to run git pull and git push without specifying which upstream branch to use.



Git Branching - remote-tracking branches

Remote

Remote connection (bookmark) into other repository.

Remote branch

Branch on a remote location.

Remote-tracking branch

- Local cache for what the remote repositories contain.
- (remote)/(branch)
 - origin/master
 - origin/test-branch

Note:

"origin" and "master" are not special.



Git Branching - merge

- Way of putting a forked history back together again.
- Non-destructive operation.
- All the operations always **merge into the current** branch.
- Git has **several distinct algorithms** to accomplish the merge.

Note:

git pull command effectively runs git fetch and git merge.



Git Branching - merge

3-Way Merge

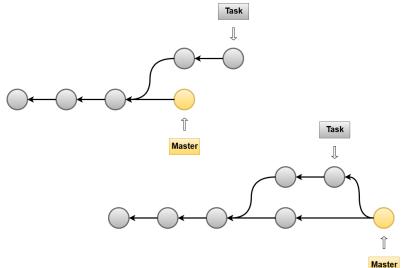
- Creates merge commit that ties together the histories of both branches.
- Merge commit as a symbolic joining of the two branches.
- Original context is maintained.

Fast-Forward Merge

- Requires linear path from the current branch tip to the target branch.
- Usually facilitated through rebasing suitable for small tasks and fixes.
- Context of the affected commits as part of an earlier feature branch is lost.

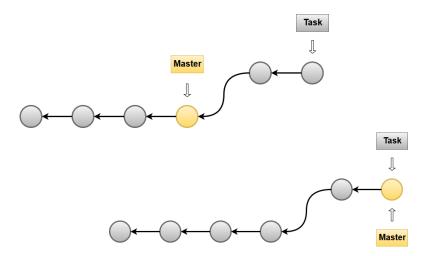


Git Branching - 3-way merge





Git Branching - fast-forward merge



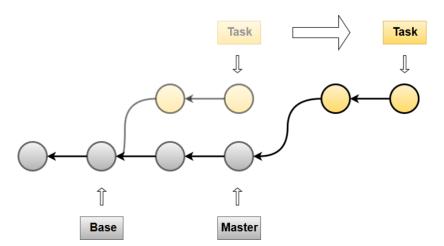


Git Branching - rebase

- Process of moving or combining a sequence of commits to a new base commit – alternative to merge.
- Makes the branch appear as if you'd created it from a different commit.
- ▶ Git takes changes from your branch and **replays them** on top of the destination branch.
- Result branch looks the same but it's composed of entirely new commits.
- Do not rebase commits that exist outside your repository (unless you have a good reason to do so).



Git Branching - rebase





Rebase helps to maintain a linear project history – that allows an easier investigation of regression issues.

Workflow example:

- 1. User creates the new task branch from master and starts working in it.
- 2. There is an active development on a master branch.
- 3. User wants to get the latest updates from master to task hranch
- 4. User performs regular rebase operation to move his commits on top of latest master commits.
- 5. User is done with his task and performs the final rebase and merge to master.
- 6. Git is able to apply fast-forward algorithm for the merge.



Git Branching - rebase

Interactive rebase

- Allows user to alter individual commits in the process of rebasing.
- Support for powerful history rewriting features.
- Useful for history cleanup: reword, edit, squash, fixup
- Always amend commits that have not been pushed yet to avoid confusion.



- Conflicts may occur during merge and rebase operations.
- Use the suitable merge strategy to avoid conflicts.
- When the conflict occurs:
 - Abort the merge with.
 - ► Work through the conflict and continue.
- Visualize and resolve conflict in merge tool.

Note:

▶ Rebase has an option to **skip/bypass** conflicting commit.



git branch

List all of the branches in your repository.

git branch < new-branch-name >

Create a new branch called < new-branch-name >.

git branch -d <existing-branch-name>

Delete the existing branch, safely. Use –D to force it.

git checkout <existing-branch-name>

Navigate between the existing branches.

```
git checkout -b < new-branch-name >
<remote>/<branch-name>
```

- Create and checkout a new local tracking branch.
- Or simply use the previous command if there is only one remote-tracking branch called <existing-branch-name>. This applies to Git 1.6.6+.

git remote

List the connections to remote repositories. Use -v to get URIs

git remote add <remote-name> <url>

Add a new connection to a remote repository.

git remote rm < remote-name >

Remove the connection to a remote repository.

git fetch < remote-name >

Fetch all of the branches from the remote repository.

git pull <remote-name>

Fetch the remote's copy of the current branch and merge it into the local copy.

Push the specified branch to remote repository



Git Branching - commands

git merge <existing-branch-name>

Merge the specified branch into current one and let Git to choose an algorithm.

git merge --no-ff <existing-branch-name>

Merge the specified branch into current one and generate merge commit.

git merge --ff-only <existing-branch-name>

Merge the specified branch into current one and refuse to merge when fast-forward is not possible.

git checkout task git rebase master

Move the entire task branch to begin on the tip of the master branch, effectively incorporating all of the new commits in master.



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Git Basics

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Branching Strategies

Continuous Integration



- Mechanism for a developer to notify coworkers.
- Not a Git feature, functionality provided by e.g. Bitbucket or GitHub.
- ▶ Interface for **discussing proposed changes** before integrating them into the official project code base.
- 4 pieces of information:
 - source repository
 - source branch
 - destination repository
 - destination branch



Pull Requests - workflow

- 1. Developer **creates task/feature** branch.
- Once done with coding the developer pushes his dedicated local branch to public repository.
- Developer creates pull request (it's good idea to rebase local branch).
- 4. Team members **review the code** and provide feedback.
- 5. Once approved the project maintainer **merges the changes** to target branch.



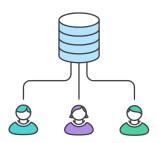
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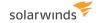
Branching Strategies



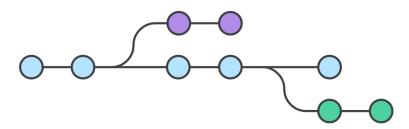
Centralized Workflow

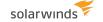
- Master branch only.
- Easier transition to Git.
- Users don't need to change their workflow.





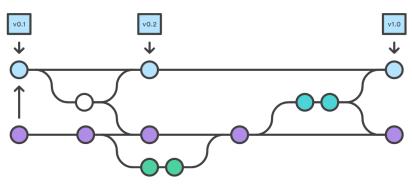
- ► Feature development isolated in feature branches pull request for discussing the changes.
- ▶ Master branch should always hold stable code.





Gitflow Workflow

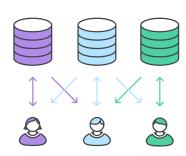
- ▶ Strict branching model designed around the project release.
 - ▶ The master branch stores the official release history.
 - The develop branch serves as an integration branch for features.

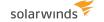




Forking Workflow

- ► Forks of the repository need to be created.
- Each user has a personal public repository.
- Project maintainer integrates the changes into official repository via pull requests.
- official repository = public repository of project maintainer.





Tools Overview

- ► GitHub, Bitbucket, GitLab etc.
- Feature overview:
 - Git repository management.
 - Access control.
 - Branch permissions.
 - Pull requests with code reviews and comments.
 - Code aware search.
 - Git Large File Storage (LFS).
 - 3rd party integrations (Jira, CI server etc.)



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Continuous Integration

- ▶ Definition by Martin Fowler:
 - "Continuous Integration is a software development practice where members of a team integrate their work frequently, usually each person integrates at least daily - leading to multiple integrations per day. Each integration is verified by an automated build (including test) to detect integration errors as quickly as possible."
- ▶ Team of developers integrate and test their code early and often.
- Reduce the risk of seeing "integration hell".
- Automated testing is a key part of Continuous Integration.
- Address the conflicts and issues early.
- ► Get fast feedback on code changes.



- Maintain a Single Source Repository.
- Automate the Build
- Make Your Build Self-Testing
- 4. Everyone Commits To the Mainline Every Day
- Every Commit Should Build the Mainline on an Integration Machine
- 6. Fix Broken Builds Immediately
- 7. Keep the Build Fast
- 8. Test in a Clone of the Production Environment
- Make it Easy for Anyone to Get the Latest Executable
- 10. Everyone can see what's happening
- 11. Automate Deployment



Builds fails too often.

- Developers are not able to verify the code before commit.
- Test engineers are waiting too long to get new version.
- Single step of build pipeline cannot be repeated.
- Number of muted tests is growing.
- It's hard to identify source of the issue single build contains a lot of changes.



Improvements

- Automate everything that can be automated (build, environment preparation, tests etc.).
- Let developers to run all validation steps locally.
- Isolate each build step and make it standalone.
- Split monolithic build into smaller build configurations.
- Execute some of the build steps in parallel (e.g. tests and package preparation).
- Scale build configurations: Fast/Common/Nightly



Continuous Delivery and Deployment

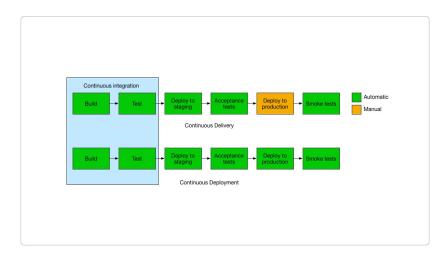
Continuous Delivery

- Definition by Martin Fowler:
 - "Continuous Delivery is a software development discipline where you build software in such a way that the software can be released to production at any time." by Martin Fowler
- Exists on top of Continues Integration.
- Deployment and release process automated.
- Every change can be deployed to production but you may choose not to do it because of business priorities.

Continuous Deployment

- Sometimes confused with Continuous Delivery but goes one step further.
- Every change that passes all stages of the production pipeline is released to customers.







TOOIS OVERVIEW

- Jenkins
- TeamCity
- GitLab CI/CD
- Bamboo
- Bitbucket Pipelines



- Git Documentation
- Martin Fowler's web
- Atlassian Git Tutorial
- Atlassian Documentation
- ZeroTurnaround web



Questions?

