Version Control with Git

Version Control, Git, GitHub, Branching and Pull Requests

In case of fire.

- → 1. git commit
- 2. git push
- 3. leave building

SoftUni Team Technical Trainers







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Source Control Systems

Version Control System

Software Configuration Management (SCM)

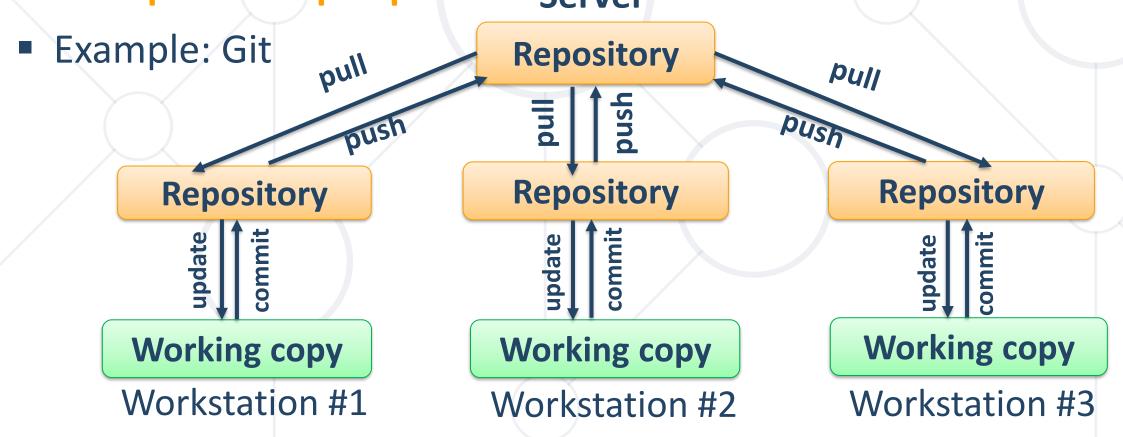


- Version Control System ≈ Source Control System
 - Tool for managing the changes during the development
 - A repository keeps the source code and other project assets
 - Keeps a full history of all changes during the time
 - Change log shows who, when and why changed what
 - Solves conflicts on concurrent changes
 - Allows reverting of old versions
- Popular source control systems
 - Git distributed source control (hierarchical)
 - Subversion (SVN) central repository (centralized)

Distributed Version Control (DVC)



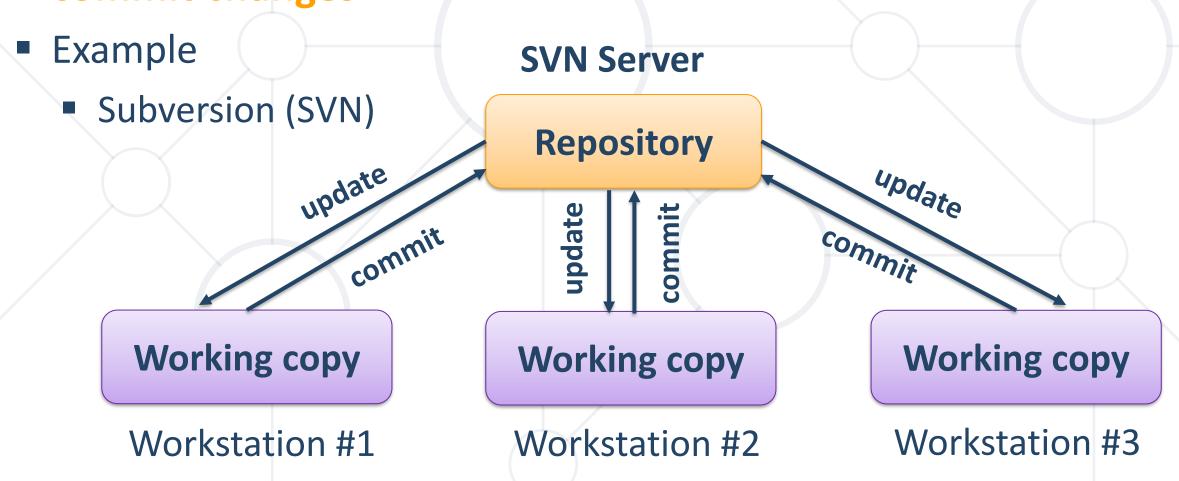
- Unlike a CVC system, a DVC doesn't have a single point of failure
- Developers clone repositories on their DVC workstations, creating multiple backup copies
 Server



Centralized Version Control (CVC)



 A CVC system relies on a central server where developers commit changes





What is Git?







- The most popular source control in the world
- Free open-source software
- Works with local and remote repositories
- Runs on Linux, Mac OS and Windows

GitHub

- Social network for developers
- Free project hosting site with Git repository



Vocabulary



- Repo (repository)
 - Holds the project in a remote server
- Branch
 - Parallel development path (separate version of the project)
- Merge branches
 - Merge two versions of the same projects

Clone

- Download a local copy of the remote project
- Commit
 - Saves a set of changes locally
- Pull
 - Take and merge the changes from the Remote

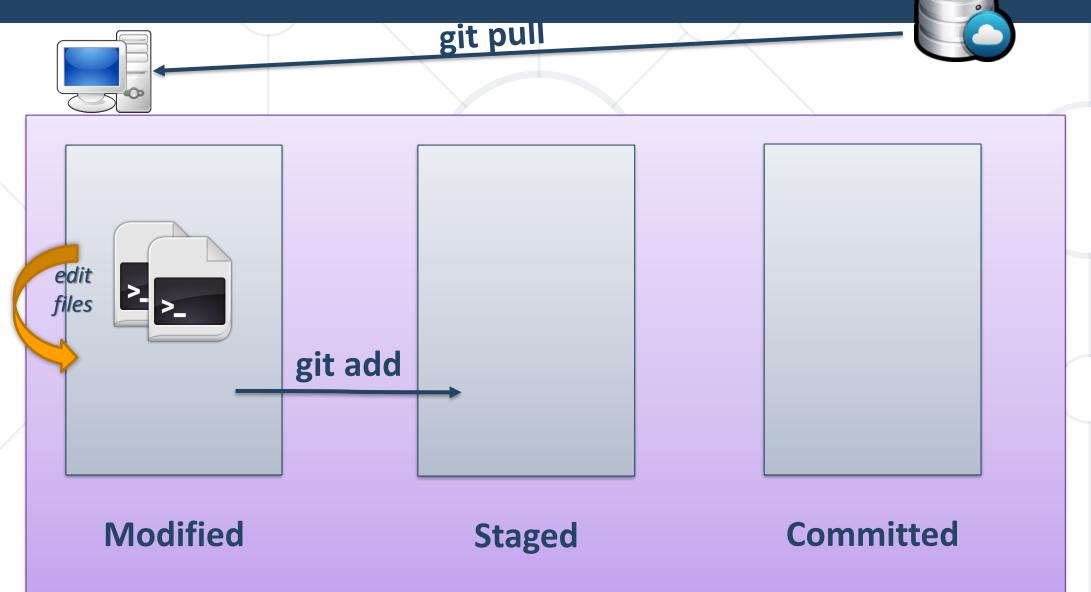
Push

Send local changes to the Remote



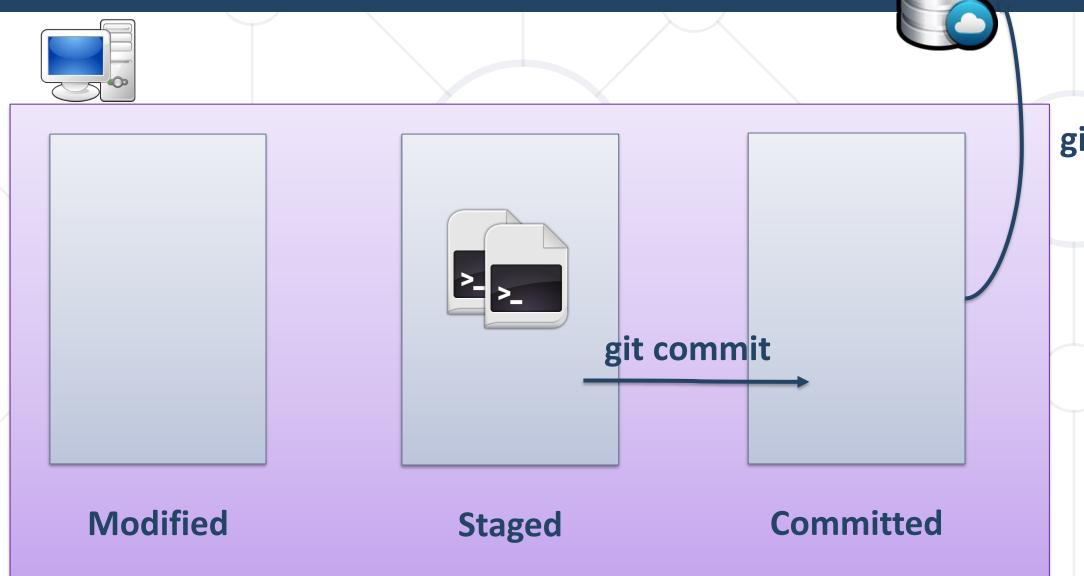
Git Workflow





Git Workflow





git push



What is GitHub?





- Platform and cloud-based service, based on Git
- World's most used source code host
- Used for software development and version control
 - Free for open-source projects and small private projects
 - Paid plans for private repositories with advanced features
- GitHub Desktop
 - Enables interacting with GitHub using a GUI instead of the command line or a web browser



GitHub Features



- Access control
- Bug tracking (Issue tracker)
- Continuous Integration (Actions)
- Wiki pages (Documentation)
- Software feature request
- Task management
- Project board (Kanban style)
- Etc.



Basic Git Commands

Clone → Modify → Add → Commit → Push

Basic Git Commands



Clone an existing Git repository

```
git clone [remote url]
```

Fetch and merge the latest changes from the remote repository

```
git pull
```

Prepare (add / select) files for a commit

```
git add [filename] ("git add ." adds everything)
```

Commit to the local repository

```
git commit -m "[your message here]"
```

Basic Git Commands



Check the status of your local repository (see the local changes)

```
git status
```

Create a new local repository (in the current directory)

```
git init
```

Create a remote (assign a short name for remote Git URL)

```
git remote add [remote name] [remote url]
```

Push to a remote (send changes to the remote repository)

```
git push [remote name] [local name]
```



Live Demo

Using Git Commands



Git Conflict

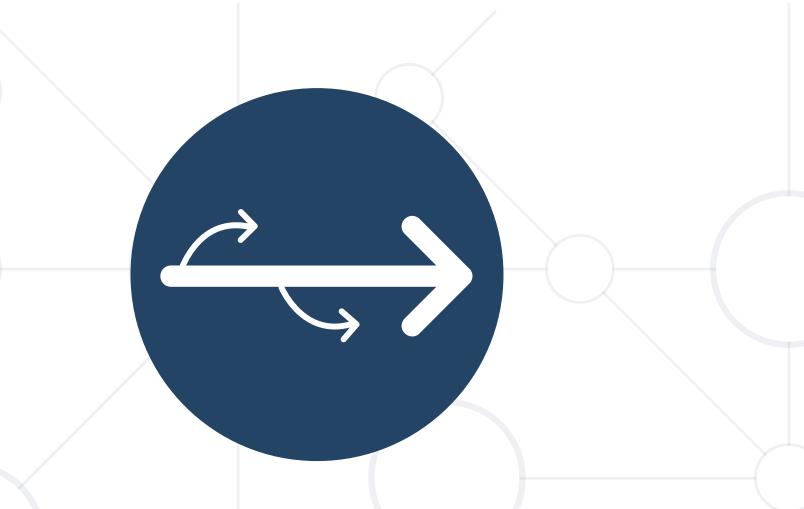


- Conflicts generally arise when two or more people change the same file simultaneously
 - Or if a developer deletes a file while another developer is modifying it
- In these cases, Git cannot automatically determine what is correct
- Conflicts only affect the developer conducting the merge
- The rest of the team is unaware of the conflict



Live Demo

Git Conflict Scenario



Branching Concepts & Branching in Git

Creating and Merging Branches

What is Branching?



- Branches allow you to work on different parts of a project without impacting the main / master branch
 - Serve as an abstraction for the edit / stage / commit process
- Represent a way to request a brand new working directory, staging area, and project history
 - Any new commits are recorded in the history for the current branch
 - Without impacting the main branch until it's decided to integrate the changes
- You can switch between branches and work on different projects without them interfering with each other



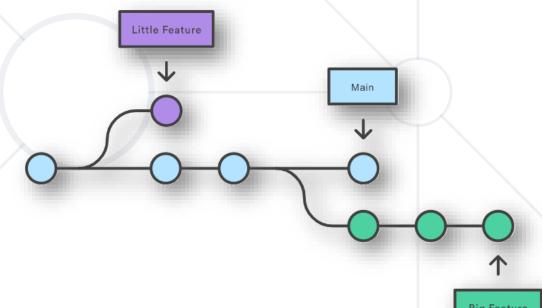
Branches == Built-In Feature of Git



- Branching is available in most version control systems
 - In some version control systems, it can be an expensive operation in both time and disk space
- In Git, branches are a part of the everyday

development process

 Git branches are an effective pointer to a snapshot of a developer's changes





Live Demo

Git Branches



View / Switch / Delete Branches

Local vs. Remote Branches



Local branch

- Branch in your local Git repo
- Changes tracked only locally

Remote branch

- Branch inside the remote repository (e.g. in GitHub)
- Upstream branch
 - Remote branch, connected to your local branch
 - When you push changes, they are sent to the upstream branch



Create a new local branch

```
git branch {branch-name}
```

Switch to certain existing branch

```
git switch {branch-name}
```

```
git checkout {branch-name}
```

Create a new branch and switch to it

```
git checkout -b {branch-name}
```



List all local and remote branches

```
git branch --all
git branch -a
```

List local together with the last commit message

```
git branch --verbose
git branch -vv
```

List all local and remote branches with the last commit message

```
git branch --all --verbose
git branch -a -vv
```



List local branches

```
git branch
```

Push to a new upstream (in a new remote branch)

```
git push --set-upstream origin {branch-name}
```

```
git push -u origin {branch-name}
```

Merge another branch in the active branch

```
git merge {branch-name}
```



Delete a local branch

```
git branch -d {branch-name}
```

Delete a remote branch

```
git push origin -d {branch-name}
```

Reapply commits on top of another base tip

```
git rebase {base-branch-name}
```

• Include specific commits without merging the entire branch

```
git cherry-pick {branch-name}
```

Git Squash



- Combining multiple commits into a single commit
- Useful for cleaning up commit history before merging a feature branch into the main branch
 - Makes commit history simpler and more understandable
- Usually applied during use of other commands, e.g.
 - git rebase
 - git merge
- Rewrites history and must be used with caution!



Branching Strategies

Strategy Simple Branch

What is a Branching Strategy?





- A strategy that programmers adopt while writing, merging and deploying code when using a VCS
- It is essentially a set of rules that developers can follow to stimulate how they interact with a shared codebase
- It enables teams to work in parallel to achieve faster releases and fewer conflicts
 - By creating a clear process when making changes to source control



Purposes of Branching Strategy



- Enhance productivity by ensuring proper coordination among developers
- Help organize a series of planned, structured releases
- Map a clear path when making changes to software through to production
- Maintain a bug-free code
- Enable parallel development

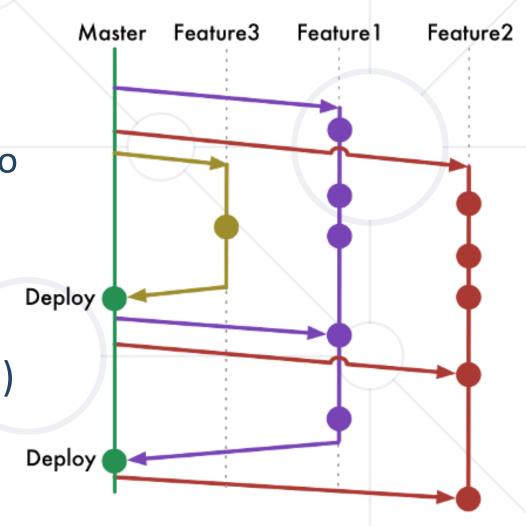


Common Git Branching Strategies

Trunk-Based Development



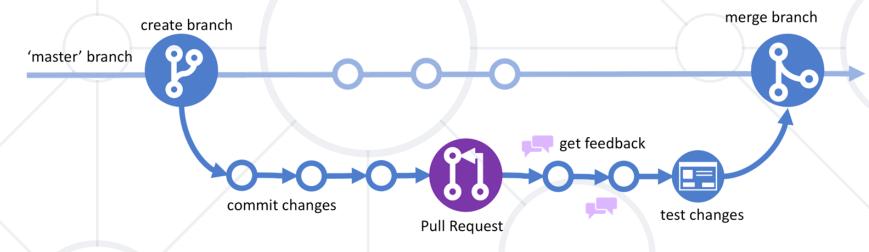
- Trunk-based development
 - "No branches" strategy
 - Developers integrate their changes into a shared trunk at least once a day
- Make smaller changes more frequently and commit directly into the trunk (without the use of branches)
 - This shared trunk should be ready for release anytime
- This strategy is suited to more senior developers



GitHub Flow



- GitHub Flow
 - Lightweight and flexible development workflow



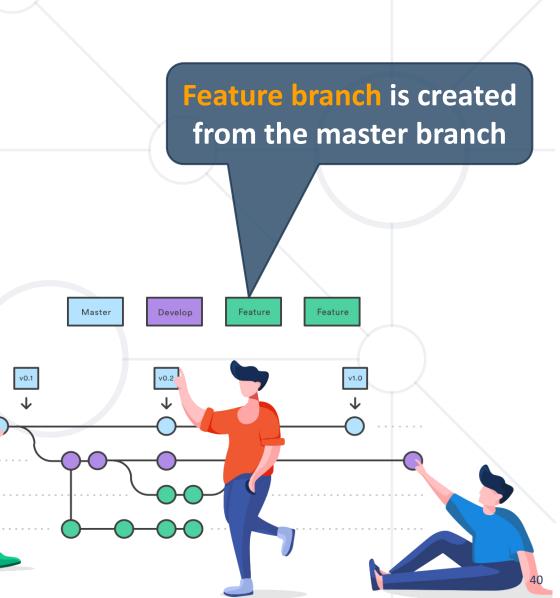
- Each feature is implemented in its own branch
- Keep the master code in a constant deployable state
- Before merging, each branch comes through a Pull Request and code review, then the changes are tested and integrated

GitFlow



GitFlow

- Enables parallel development
- Devs can work separately from the master branch on features
- This strategy contains separate and straightforward branches for specific purposes
 - Ideal to handle multiple versions of the product



GitFlow Branches



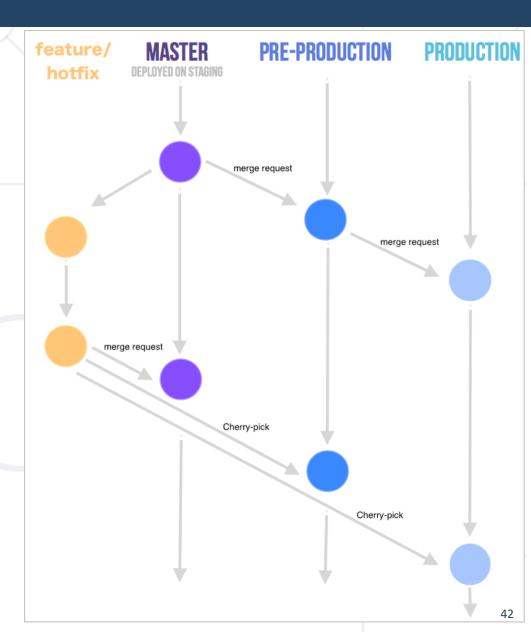
- Master (main)
 - Holds the active production code
- Release
 - Help prepare a new production release
- Hotfix
 - Hotfix branches arise from a bug that has been discovered and must be resolved
- Develop
- Feature
 - Develop new features

GitLab Flow



GitLab Flow

- Combines feature-driven development and feature branching with issue tracking
- Each feature is implemented in its own branch
- Developers work with the main branch right away
- The main branch is deployed to production (manually or auto)



Best Branching Strategy for Your Team



Product type and its release method	Team size	Collaboration maturity	Applicable mainstream b ranch mode
All	Small team	High	Trunk-based Dev
Products that support continuous de ployment and release	Middle	Moderate	GitHub-Flow and Trunk- based Dev
Products with a definite release wind ow and a periodic version release ca dence	Middle	Moderate	Git-Flow and GitLab-Flow w with release branch
Basic platform products	Middle	Moderate	GitLab-Flow
Products demanding product quality and have a long maintenance cycle f or released versions	Large	Moderate	Git-Flow

No Standard for "Branching Strategy"



- Different organizations use different branching strategies for each different team / project
 - There is no "best branching strategy"
 - How to use branches highly depends on
 - The team
 - The project under development





Pull Requests in GitHub

Show Changes You've Pushed

Pull Requests in GitHub



- Pull requests
 - A mechanism for developers to notify their team members that they have completed a feature
- The pull request is more than just a notification—it's a code review process, including discussions on the proposed feature
- If there are any problems with the changes, teammates can post feedback in the pull request
- This activity is tracked directly inside of the pull request

Pull Requests

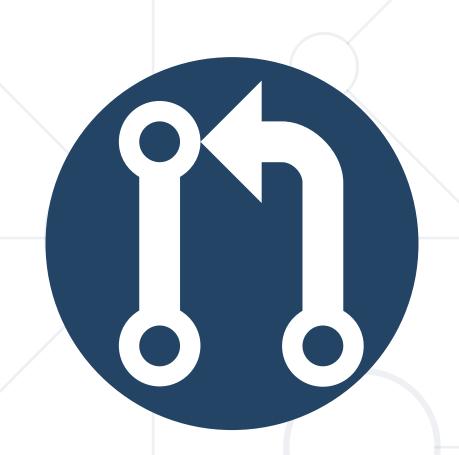


- Pull requests let you tell others about changes you want to push to a branch in a repository on GitHub
- Once a pull request is opened, you can discuss and review the potential changes with collaborators
- You can create pull requests on GitHub.com, in GitHub
 Desktop or in other GitHub tools

Branch Protection Rules



- You can create a <u>branch protection rule</u> in a repo
 - Can be created for
 - A specific branch
 - All branches
 - Any branch that matches a name pattern you specify with fnmatch syntax
- For example, you can create a branch protection rule to prevent contributors from merging to a branch without an approved pull request



The Pull Request Process

Notify Team for a Completed Feature

Pull Request: The Process









Senior Developer

Create a feature branch

Make and commit changes

Open a pull request

Resolve merge conflicts

Request a review

Discussion Give feedback / comment

Approve and merge



Live Demo

Creating a Pull Request



Forking a Repository in GitHub



- Fork == personal copy of another user's repository in your own
 GitHub account
- Allows to make changes without impacting the original project
- A forked repo remains connected to the original
 - Enabling updates and contributions via pull requests
- Often used for
 - Open-source contributions
 - Exploring and modifying existing codebases

Steps to Fork a Repository



- Navigate to the repository on GitHub
- Click the [Fork] button (top-right corner)
 - GitHub creates a copy under your account
- Clone your fork to your local machine
- Make and commit your changes
- Push the changes to your fork
- Create a Pull Request to propose changes to the original repository

Fork vs. Branch



	Fork	Branch
Definition	A fork creates a personal copy of an entire repo under your GitHub account	A branch is separate line of a development within the same repo
Location	Exists as a separate repository under your GitHub account	Stays within the same repository
Ownership	You own the forked repo and can modify it freely	The repo owner controls all branches
Use Case	Used when you don't have direct write access	Used when you have write access
Visibility	Changes remain in your fork until you submit a PR	Changes remain in the same repo and can be merged easily
Merging	You must open a PR to merge changes in the original repo	Changes can be merged directly into the main branch by the repo owner or by submitting a PR by the person who is making the changes

Summary



- Git == distributed source control system
- GitHub == platform and cloud-based service, based on Git
- Branch == a new separate version of the main repository
- Build your branching strategy from several main concepts
- Pull requests let you tell others about changes you've pushed to a branch in a repository on GitHub
- Conflicts may appear when merging branches
- Forking == a way to create your own copy of a repo to contribute without affecting the original





Questions?



















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