GIT AND GITHUB

What is Git

Git is a distributed version control system (VCS) used for tracking changes in computer files and coordinating work on those files among multiple people. It's especially popular in software development for managing source code.

Common Git Terminology:

- **Repository (Repo)**: A collection of files and their version history. This can be local (on your machine) or remote (on a server).
- **Commit**: A snapshot of your changes at a particular point in time. Commits allow you to save the state of the project and later revert back if needed.
- **Branch**: A separate line of development. The "main" branch (often called main or master) is where the stable version of the project lives.
- **Merge**: Combining changes from different branches.
- **Clone**: A copy of a remote repository on your local machine.
- **Push**: Uploading your changes to a remote repository.
- **Pull**: Downloading changes from a remote repository to your local machine.

In summary, Git is a powerful tool that helps developers track, manage, and collaborate on code changes effectively.

Why Git

Git offers several advantages that make it a popular and essential tool for developers and teams working on software projects. Here's why **Git** is widely used:

1. Version Control:

- **Track Changes**: Git allows you to track every change made to a project over time. This means you can see who changed what and why, with a detailed history.
- **Revert to Previous States**: If something goes wrong, you can easily revert to a previous version of your project, reducing the risk of errors or losing important work.

2. Collaboration:

- **Multiple Contributors**: Git makes it easy for multiple developers to work on the same project at the same time without conflicting with each other's work. Changes are tracked and can be merged together smoothly.
- **Branching and Merging**: Developers can create separate branches to work on new features, bug fixes, or experiments without affecting the main codebase. These branches can be merged back when the work is complete, ensuring clean and organized development.

3. Distributed System:

- **Local Repositories**: Every developer has a full copy of the repository on their machine, including the project's history. This means they can work offline and still have full access to the project's history and functionality.

- **No Single Point of Failure**: Since the full history is stored on each developer's machine, there's no risk of losing the project if the central server goes down. You can push changes to a central server or a cloud-based repository when you're online.

4. Efficiency and Speed:

- **Fast Operations**: Git is designed to be fast. Since most operations (like committing changes or viewing history) are done locally, they are incredibly quick.
- **Large Projects**: Git is highly optimized for handling large codebases, making it scalable for both small and massive projects.

5. Branching and Experimentation:

- **Isolated Development**: With Git, developers can create isolated environments (branches) to experiment or work on features without affecting the stable version of the project. Once the feature is ready, it can be merged back into the main project.
- **Testing and Debugging**: Git allows easy testing of new code by using separate branches for features or fixes, ensuring that bugs don't reach the production version of the code.

6. Open Source and Free:

- **Cost-Effective**: Git is open-source and free to use, making it accessible to individuals, teams, and organizations of all sizes.
- **Widespread Adoption**: Being open-source, Git is widely supported by many platforms (e.g., GitHub, GitLab, Bitbucket), making it easy to integrate with other tools and services.

7. Remote Repositories:

- **Backup and Sharing**: Remote Git repositories (e.g., on GitHub or GitLab) allow for backup, sharing, and collaboration on code. Developers can push their changes to these platforms and pull others' updates to stay in sync.
- **Code Reviews**: Remote repositories often integrate with features like pull requests, which facilitate code reviews and quality control before changes are merged into the main project.

8. Security:

- **History and Integrity**: Git uses cryptographic hashing (SHA-1) to ensure the integrity of the project's history, making it difficult for anyone to tamper with the commit history.
- **Access Control**: Platforms like GitHub or GitLab offer access control mechanisms to manage who can view, modify, or contribute to repositories.

9. Flexibility:

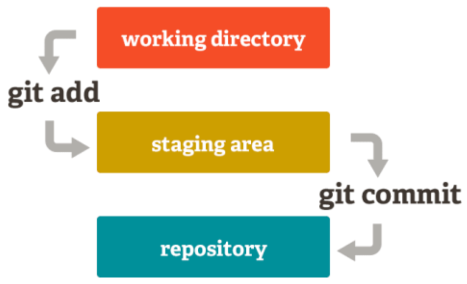
- **Works with Any File Type**: While Git is often associated with source code, it can be used to track changes for almost any type of file (documents, images, etc.).
- **Works Across Platforms**: Git works on Windows, macOS, and Linux, making it compatible with different operating systems.

10. Integration with Other Tools:

- **CI/CD**: Git integrates well with Continuous Integration and Continuous Deployment (CI/CD) tools, automating testing, building, and deploying code when changes are made.

- **IDE Support**: Most popular Integrated Development Environments (IDEs) and text editors (e.g., Visual Studio Code, IntelliJ, Sublime Text) offer Git integration, allowing developers to perform Git operations from within their development environment.

Git Stages



In Git, the concept of **staging** refers to the process of preparing changes in your working directory before committing them to the repository. Git uses a **staging area** (also called the **index**) to hold changes that are about to be committed. Here's a breakdown of the different "stages" in the Git workflow:

1. Untracked (Unstaged) Changes

When you make changes to files in your working directory, Git considers them **untracked** or **unstaged**. These changes haven't been added to the staging area, so they won't be included in the next commit until you explicitly stage them.

- **Untracked file**: A file that Git isn't yet aware of, meaning it hasn't been added to the repository yet.
- **Unstaged changes**: Changes to files that Git is aware of but haven't been staged for commit.

Example: After modifying a file, it will be in the **unstaged** state until you explicitly stage it.

2. Staging Area

The **staging area** (also called the **index**) is where you prepare changes before committing them. The staging area allows you to control which changes will be included in the next commit. When you **stage** a file, you are telling Git that you want those changes to be part of the next commit.

You can add files or parts of files to the staging area using git add.

Common Git Commands for Staging:

- **Stage a specific file**:

bash

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```
git add <file_name>
```

- **Stage all changed files (including new, modified, and deleted files)**:

bash

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```
git add .
```

or

bash

Copy code

```
git add -A
```

- **Stage a specific part of a file** (interactive staging):

bash

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```
git add -p <file_name>
```

After staging the file, it moves from the **unstaged** state to the **staged** state.

3. Committed

Once you've staged your changes, you commit them to the local repository using git commit. This is when your changes are officially saved in the repository's history.

- **Commit changes**:

bash

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```
git commit -m "Your commit message"
```

After a commit, the changes in the staged area are saved as a new commit, and the files move from the **staged** state to the **committed** state

Basic git commands

Here's a list of **basic Git commands** that every developer should know for working with Git repositories:

1. Setting Up Git

- **Configure your username and email:**

bash

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```
git config --global user.name "Your Name"

git config --global user.email "your.email@example.com"
```

2. Creating a Repository

- **Initialize a new Git repository in the current directory:**

bash

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```
git init
```

- **Clone an existing remote repository to your local machine:**

bash

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git clone <repository_url>

Example:

bash

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git clone https://github.com/user/repository.git

3. Checking Repository Status

- **Check the status of files in the working directory (modified, untracked, etc.):**

bash

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git status

4. Staging and Committing Changes

- **Stage a file for commit (add changes to the staging area):**

bash

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git add <file_name>

To stage all modified files:

git add .

- **Commit the staged changes with a message:**

git commit -m "Commit message"

5. Viewing Changes

- **View the changes made to files since the last commit:**

git diff

- **View the commit history:**

git log

To see a simplified view of the commit history (one line per commit):

bash

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git log –oneline

Git Branches

In Git, **branches** are a powerful feature that allows you to work on different versions of your project simultaneously, isolating different features or fixes. Each branch represents an independent line of development. Here's an overview of Git branches:

- **Branches** in Git allow you to diverge from the main line of development (usually the main or master branch) and work independently without affecting the main codebase.
- Once your work on a branch is complete, you can merge it back into the main branch, which is typically used for production-ready code.

Basic Concepts of Branching

- **Default Branch**: The default branch in a Git repository is often called main (formerly master). It's the central branch where the code is considered stable.
- **Branching**: When you create a branch, you essentially create a copy of your project at a specific point in history. You can then make changes in that branch without affecting other branches.
- **Merging**: Once you've made changes in a branch, you can merge those changes back into another branch (typically the main branch).

Git Branching Workflow

1. **Create a new branch** from the main branch.
2. **Switch to** the new branch to work on it.
3. Make changes in the branch (e.g., add features, fix bugs).
4. **Commit** the changes to the branch.
5. Once the work is done, **merge the branch** back into the main branch.
6. Optionally, **delete the branch** after merging.

Git Branch Commands

1. **View Branches**
   - To list all branches (local branches):

```
git branch
```

   - To list both local and remote branches:

```
git branch -a
```

2. **Create a New Branch**
   - To create a new branch but **stay on the current branch**:

```
git branch <branch_name>
```

   - To create and immediately **switch to** the new branch:

```
git checkout -b <branch_name>
```

   - Alternatively, with Git 2.23 and later, you can use:

bash

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```
git switch -c <branch_name>
```

3. **Switch Between Branches**

- To switch to an existing branch:

bash

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```
git checkout <branch_name>
```

- Or, with Git 2.23 and later, use:

bash

Copy code

```
git switch <branch_name>
```

4. **Delete a Branch**
   - To delete a **local branch**:

bash

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```
git branch -d <branch_name>
```

- Use -D (uppercase) if the branch has unmerged changes and you want to force delete it:

bash

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```
git branch -D <branch_name>
```

5. **Merge Branches**
   - To merge a branch into the current branch:

bash

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```
git merge <branch_name>
```

6. **Rename a Branch**
   - To rename the current branch:

bash

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```
git branch -m <new_branch_name>
```

7. **Track a Remote Branch**
   - To create a local branch that tracks a remote branch:

bash

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```
git checkout --track origin/<remote_branch_name>
```

Or, with Git 2.23 and later:

bash

Copy code

```
git switch --track origin/<remote_branch_name>
```

Branch Merging and Conflict Resolution

- **Fast-Forward Merge**: If the branch being merged is directly ahead of the current branch (no divergent commits), Git performs a fast-forward merge.
  - **Example**: git merge <branch_name>.
- **Three-Way Merge**: If the branches have diverged (commits on both branches), Git will attempt to merge the changes.
  - If there are conflicting changes, Git will ask you to resolve conflicts manually. After resolving conflicts:

bash

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```
git add <resolved_file>
git commit
```

- **Merge Conflicts**: When you merge two branches, Git tries to automatically combine the changes. However, if both branches modify the same part of a file differently, it results in a conflict. You'll need to:

1. Open the conflicted file.
2. Look for the conflict markers (<<<<<<<, =======, >>>>>>>).
3. Edit the file to resolve the conflict.
4. Add and commit the resolved file.

Feature Branching

A common Git workflow involves using **feature branches** to work on new features or fixes. The general flow is:

1. **Start from the main branch** (often main or master):

bash

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```
git checkout main
```

2. **Create a new feature branch**:

bash

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```
git checkout -b feature/new-feature
```

3. **Make changes**, commit them, and push the feature branch to the remote repository:

bash

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git commit -m "Add new feature"

git push origin feature/new-feature

4. **Create a pull request** (on platforms like GitHub, GitLab, or Bitbucket) to merge the feature branch into the main branch.
5. Once the feature branch is merged, **delete** the feature branch:

bash

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git branch -d feature/new-feature

Git Rebase

Git rebase is a command used in Git to **reapply commits** from one branch onto another. It is often used to make the history of a branch linear and cleaner by integrating changes from one branch (usually main or master) into a feature branch, or by moving commits to the top of another branch's history.

Unlike git merge, which creates a new merge commit when combining branches, git rebase rewrites the commit history by "replaying" commits from one branch onto another.

Why Use Git Rebase?

- **Clean History**: Rebase is often used to keep the project history linear, which makes it easier to understand and read. It avoids the clutter of unnecessary merge commits.
- **Incorporating Changes**: It allows you to incorporate changes from a main branch into a feature branch without creating a merge commit.
- **Avoiding Merge Commits**: When working in a feature branch, rebasing allows you to add your changes on top of the main branch without creating a merge commit every time.

How Git Rebase Works

Rebasing works by "replaying" commits from the feature branch onto the latest commit of the base branch. This is how it differs from merging, which brings in the changes from one branch to another without altering the history.

Here’s a step-by-step breakdown of how git rebase works:

1. **Check out the feature branch**:

bash

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git checkout feature-branch

2. **Rebase the feature branch onto the main branch**:

bash

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git rebase main

This command moves the commits of feature-branch onto the tip of main. It essentially "replays" each commit from feature-branch on top of main and creates new commit hashes for those rebased commits.

Git Rebase Commands

1. **Rebase onto Another Branch**:
   - To rebase a feature branch onto main:

bash

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git checkout feature-branch

git rebase main

2. **Interactive Rebase**:
   - With interactive rebase, you can reorder, squash, edit, or delete commits. It’s useful when you want to clean up your commit history before pushing changes.

bash

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git rebase -i HEAD~n

This will open an editor showing the last n commits, and you can specify actions like pick, reword, squash, etc.

3. **Abort a Rebase**:
   - If something goes wrong during a rebase (e.g., conflicts), you can abort the rebase and return to the state before the rebase began:

git rebase --abort

4. **Continue a Rebase After Resolving Conflicts**:
   - After resolving conflicts during a rebase, use the following command to continue:

git rebase --continue

5. **Skip a Commit During Rebase**:
   - If you decide to skip a commit (for example, when it’s irrelevant or has issues), you can use:

git rebase --skip

6. **Rebase a Remote Branch**:
   - To rebase a remote branch, fetch the changes first and then perform the rebase:

git fetch origin

git rebase origin/main

Git Rebase vs. Git Merge

Feature	Git Merge	Git Rebase
Commit History	Keeps the history as it is, with merge commits.	Rewrites the history to create a linear history.
Merge Commit	Creates a merge commit.	Does not create a merge commit.
Use Case	When you want to preserve the history, including the context of merging branches.	When you want a clean, linear history without merge commits.
Conflicts	Resolves conflicts once during the merge.	Conflicts may need to be resolved multiple times during the rebase.
Resulting History	May show multiple branches merging over time.	Results in a linear history with no merge commits.

Git Stash

Git stash is a useful command in Git that allows you to temporarily save changes in your working directory that you're not yet ready to commit. This is helpful when you need to switch to another branch or task without committing incomplete work. You can then retrieve your stashed changes later and continue working on them.

Why Use Git Stash?

- **Temporary Storage**: Stashing allows you to save your current progress without committing unfinished work, letting you switch to another branch or task.
- **Work on Something Else**: If you're in the middle of a task but need to quickly switch to another branch to address an urgent issue, you can stash your current changes and pop them later.
- **Keep a Clean Working Directory**: You can stash local changes without committing them, which helps you keep your Git history clean.

Git Stash Commands

1. **Stash Your Changes**:
    - To stash all your local modifications (including staged and unstaged changes):

bash

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```
git stash
```

2. **Stash Changes with a Message**:
    - You can provide a description for the stash to remind yourself of what changes were stashed:

bash

Copy code

```
git stash save "message describing changes"
```

3. **List Stashed Changes**:
    - To see a list of all stashes you've made:

```
git stash list
```

   - This will display a list of stashes, like:

less

Copy code

```
stash@{0}: WIP on feature-branch: abc1234 Add new feature
stash@{1}: WIP on main: def5678 Fix bug in main
```

4. **Apply Stashed Changes**:
    - To apply the most recent stash (i.e., bring the changes back into your working directory):

```
git stash apply
```

   - To apply a specific stash (for example, stash@{1}):

```
git stash apply stash@{1}
```

5. **Pop the Stashed Changes**:
    - git stash pop applies the most recent stash and removes it from the stash list. This is useful when you want to apply and then delete the stash in one step:

```
git stash pop
```

6. **Drop a Specific Stash**:
    - If you no longer need a particular stash, you can remove it with:

```
git stash drop stash@{1}
```

7. **Clear All Stashes**:
    - To remove all stashes (be cautious, as this is irreversible):

bash

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```
git stash clear
```

8. **Stash Only Unstaged Changes**:
    - If you only want to stash **unstaged changes** (and leave staged changes intact), use the -k or --keep-index flag:

bash

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```
git stash -k
```

9. **Stash Only Staged Changes**:
   - To stash only **staged changes** (and leave unstaged changes intact), use the --staged flag:

bash

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```
git stash –staged
```

Git Stash and Merge Conflicts

When you apply or pop a stash, sometimes you may encounter merge conflicts if the changes in the stash conflict with changes in your current working directory. Git will notify you of the conflicts, and you'll need to resolve them manually before committing the changes.

1. **Resolve Conflicts**: If there are conflicts after applying a stash, Git will mark the conflicted files. Open the files and resolve the conflicts.
2. **Stage and Commit the Resolved Files**: After resolving the conflicts, stage the files:

```
git add <resolved_file>
```

3. **Commit the Changes**: Commit the resolved files:

```
git commit -m "Resolved merge conflicts after stash pop"
```

Advanced Stash Options

1. **Stashing Part of a File**:
   - You can stash specific parts of a file using git add -p to select the changes you want to stash. After staging the selected changes, you can run:

```
git stash
```

2. **Create a Stash from a Specific Commit**:
   - You can also create a stash based on the differences between the current commit and a previous commit:

bash

Copy code

```
git stash push -m "message" commit_hash
```

What is a Central Repository

A **central repository** in the context of Git (and version control systems in general) refers to a **shared, centralized storage location** where the official and authoritative version of a project's code is stored. This repository serves as the main hub where all contributors push their changes and pull updates from.

In Git, a central repository is typically hosted on a remote server or platform (like GitHub, GitLab, Bitbucket, or a self-hosted server), and it serves as the **single source of truth** for the project's history. It allows multiple developers to collaborate on the same project by sharing changes and ensuring everyone works with the latest version of the code.

Key Concepts of a Central Repository

1. **Remote Repository**: The central repository is often referred to as the **remote repository** in Git. The remote repository is where all contributors push their changes (commits), and from where they pull changes made by others.
2. **Collaboration**: Multiple developers can clone the repository, make changes locally, and then push those changes back to the central repository. This makes it easy for teams to collaborate on projects and ensure that all changes are tracked in a central location.
3. **Shared Access**: All contributors (developers, testers, managers, etc.) typically have access to the central repository. They can update the repository by pushing new commits, while also pulling the latest changes from other team members.
4. **Branching and Merging**: Developers usually work on separate branches (for new features or bug fixes) and, once their work is complete, they merge their changes back into the main branch (often called main or master). The central repository holds the full project history, including all branches and merges.

Key Characteristics of a Central Repository in Git

- **GitHub/GitLab/Bitbucket**: Most central repositories today are hosted on popular platforms such as GitHub, GitLab, or Bitbucket. These platforms allow for easy collaboration, access control, and even integration with CI/CD pipelines.
- **Push and Pull**: Developers interact with the central repository by:
  - **Pushing** their local changes to the central repository using git push.
  - **Pulling** changes from the central repository to synchronize their local copy with the latest code using git pull.
- **Single Source of Truth**: The central repository is considered the most up-to-date and official version of the project. It stores all the commits, branches, and tags related to the project.
- **Access Control**: Central repositories often implement user permissions and access control mechanisms. For example, only authorized contributors may have permission to push to the central repository, while others may have read-only access.

How Does a Central Repository Work in Git

1. **Clone**: A developer clones the central repository to create a local copy of the project. The clone is an exact replica of the central repository, including all branches, commits, and history.

bash

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```
git clone <repository-url>
```

2. **Work Locally**: The developer makes changes to their local copy of the project. These changes might include adding new features, fixing bugs, or making other modifications.
3. **Commit**: The developer commits their changes locally to their own repository.

bash

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```
git add <file>

git commit -m "Description of changes"
```

4. **Push**: Once the changes are committed locally, the developer pushes their changes to the central repository.

bash

Copy code

```
git push origin <branch-name>
```

5. **Pull**: Other developers can then pull the latest changes from the central repository to keep their local copies up to date.

```
git pull origin <branch-name>
```

Advantages of Using a Central Repository

1. **Collaboration**: It enables multiple developers to work on the same project simultaneously. Changes made by different developers can be merged together, allowing for parallel development of features and bug fixes.
2. **Backup and Security**: The central repository acts as a backup of the project's codebase. If anything happens to a developer's local copy (e.g., a hard drive failure), they can retrieve the latest version of the code from the central repository.
3. **Version Control**: It provides version control, ensuring that every change made to the project is tracked and that developers can revert to previous versions if needed.
4. **Code Reviews and Pull Requests**: Many platforms hosting central repositories (such as GitHub) support features like pull requests or merge requests. These features allow developers to review and approve each other's code before it is merged into the main codebase, promoting code quality and collaboration.
5. **Continuous Integration/Continuous Deployment (CI/CD)**: Central repositories often integrate with CI/CD tools, allowing for automated testing, building, and deployment when changes are pushed to the repository.

Central Repository Workflow Example

1. **Clone the Central Repository**:

bash

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```
git clone https://github.com/username/project.git
```

2. **Create a Branch for New Work** (e.g., a new feature or bug fix):

bash

Copy code

```
git checkout -b feature-branch
```

3. **Make Changes Locally**:
   - Edit files, add new features, fix bugs.
4. **Stage and Commit Changes**:

bash

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```
git add .

git commit -m "Implemented new feature"
```

5. **Push Changes to the Central Repository**:

```
git push origin feature-branch
```

6. **Create a Pull Request** (on GitHub or GitLab) to merge your changes into the main branch.
7. **Merge the Pull Request**: After review and approval, the changes are merged into the main branch.
8. **Pull Latest Changes**: Before starting new work, developers pull the latest changes from the central repository to ensure they have the most up-to-date code.

```
git pull origin main
```

Git vs GitHub

Git and GitHub are often mentioned together, but they serve different purposes in the world of version control and collaboration. Here's a breakdown of the differences:

Key Differences Between Git and GitHub

Feature	**Git**	**GitHub**
Type	Version control system (VCS)	Cloud-based hosting platform for Git repositories
Purpose	Tracks changes in files locally	Hosts Git repositories remotely and provides collaboration tools
Local or Remote	Operates locally on your machine	Operates remotely, accessible over the internet
Storage	Stores repositories locally in the .git directory	Stores repositories on GitHub’s servers

Feature	**Git**	**GitHub**
Usage	Used for version control, managing commits, branches, etc.	Used for storing repositories online, collaboration, code reviews, issue tracking
Collaboration	No collaboration features on its own; only version control	Provides collaboration features like pull requests, code reviews, issues, and team management
Requires Internet	Works offline (local operations)	Requires an internet connection to push/pull code to/from GitHub
Installation	Git needs to be installed locally on your machine	GitHub is a web service and requires no installation, though you need Git installed to interact with it
Popular Commands	git commit, git push, git pull, git merge	GitHub-specific features include pull requests, GitHub Actions, GitHub Pages

How They Work Together

- **Git** is the version control tool you use locally on your machine to manage your project.
- **GitHub** is the platform where you can **store your Git repositories remotely** and collaborate with others.

Here's how you typically use Git and GitHub together:

1. **Initialize a Git Repository Locally**:

```
git init
```

2. **Make Changes and Commit**:
   - Work locally in your project and commit changes using Git.

```
git add .

git commit -m "Initial commit"
```

3. **Push to GitHub**:
   - You push your commits to a GitHub repository, where it's stored remotely.

```
git remote add origin https://github.com/username/repository.git

git push -u origin main
```

4. **Collaborate Using GitHub**:
   - Other team members can **fork** the repository, make changes, and then **open pull requests** for you to review and merge their changes.
5. **Pull Changes from GitHub**:
   - To get updates from others, you **pull** changes from the GitHub repository.

```
git pull origin main
```

Git Tags

Git tags are a powerful feature in Git that allows you to mark specific points in your project's history as important. Tags are commonly used to mark release versions, significant milestones, or important commits that you want to reference or archive.

Unlike branches (which move as new commits are added), tags are static references to specific commits. Once a tag is created, it doesn't change unless explicitly deleted or modified.

Types of Tags in Git

There are two types of tags in Git:

1. **Lightweight tags**
2. **Annotated tags**

1. Lightweight Tags

- A **lightweight tag** is essentially a pointer to a specific commit, like a branch, but it doesn't have any additional metadata (e.g., tag message, author, date).
- It's just a simple reference to a commit.

When to Use:

- For temporary markers or if you don't need to store additional information about the tag.
- They are faster to create and lighter in terms of storage, but they lack important metadata.

Creating a Lightweight Tag:

```
git tag <tag-name>
```

Example:

```
git tag v1.0
```

This creates a tag named v1.0 that points to the current commit.

2. Annotated Tags

- An **annotated tag** is more robust. It stores not only the commit it points to but also metadata like:
  - The **tagger's name and email** (based on your Git configuration).
  - The **date** when the tag was created.
  - A **message** (similar to a commit message) describing the tag.
- Annotated tags are typically used to mark release points (like v1.0, v2.0), and the information they store makes them more useful for tracking significant events in the project's history.

When to Use:

- When you need to keep a record of the tag's creation, like for releases or important milestones.

- For creating tags that need to be shared or referenced by others.

Creating an Annotated Tag:

```
git tag -a <tag-name> -m "Your tag message"
```

Example:

```
git tag -a v1.0 -m "First official release"
```

This creates an annotated tag v1.0 with the message "First official release".

Viewing Tags

- To list all tags in the repository:

```
git tag
```

This will display all tags in the repository in alphabetical order.

- To list tags with a specific pattern (e.g., all tags starting with v):

```
git tag -l "v*"
```

- To view the details of an annotated tag, you can use:

```
git show <tag-name>
```

Example:

```
git show v1.0
```

This will show the tag information, including the commit it points to, the message, and metadata about the tag.

Checking Out Tags

You can check out the code at a specific tag, but be aware that checking out a tag will put you in a **detached HEAD state**, meaning you're not on any branch.

- To check out a tag:

  ```
  git checkout <tag-name>
  ```

Example:

```
    git checkout v1.0
```

If you want to make changes and commit them, it's advisable to create a new branch after checking out the tag:

```
    git checkout -b <new-branch-name> v1.0
```

Pushing Tags to Remote Repositories

By default, when you push changes to a remote repository, **tags are not pushed** automatically. You need to push them explicitly.

- To push a single tag to the remote repository:

  ```
  git push origin <tag-name>
  ```

Example:

```
git push origin v1.0
```

- To push all tags to the remote repository:

```
git push --tags
```

This command will push all tags that you've created locally but haven't yet pushed to the remote repository.

Deleting Tags

If you no longer need a tag, you can delete it locally or remotely.

- **Delete a local tag**:

```
git tag -d <tag-name>
```

Example:

```
git tag -d v1.0
```

- **Delete a remote tag**: Deleting a tag from the remote repository requires you to use the git push command with the --delete option:

```
git push origin --delete tag <tag-name>
```

Example:

```
git push origin --delete tag v1.0
```

Tagging Best Practices

- **Use annotated tags for official releases**: Annotated tags store valuable information like the tagger's name, email, and a message, making them more useful for historical tracking.
- **Use lightweight tags for temporary or personal markers**: Lightweight tags can be useful for marking certain commits that don't need to be shared or referenced in a broader sense.
- **Push tags to the remote repository**: Remember to push your tags to the remote repository so that collaborators can access them. Tags are a great way to mark releases for your team and the community.

Example Workflow for Using Git Tags

1. **Create a Tag for a Release**: After finishing development on a new feature or fixing a bug, you might want to mark the current state of the code as a release.
   - Create an annotated tag:

```
git tag -a v1.0 -m "Initial release of the project"
```

2. **Push the Tag to the Remote Repository**: Push the new release tag to GitHub (or other remote platforms):

```
git push origin v1.0
```

3. **Check Out a Tag for Review or Deployment**: If you want to see the code at the point of v1.0 (e.g., for a deployment), you can check out the tag:

```
git checkout v1.0
```

4. **View the Tag Details**: You can always view the tag details later with:

```
git show v1.0
```

All Basic to Advance GIT and GITHUB Commands

Basic Git Commands

1. git config

- **Purpose**: Configure Git settings such as username and email.
- **Example**:

```
git config --global user.name "John Doe"
git config --global user.email "johndoe@example.com"
```

2. git init

- **Purpose**: Initialize a new Git repository in the current directory.
- **Example**:

```
git init
```

3. git clone

- **Purpose**: Clone a repository from GitHub or any remote source.
- **Example**:

```
git clone https://github.com/user/repo.git
```

4. git status

- **Purpose**: Show the current state of the repository, including changes to be committed and untracked files.
- **Example**:

```
git status
```

5. git add

- **Purpose**: Add changes in the working directory to the staging area.
- **Example**:

```
git add file.txt
git add .  # Adds all files
```

6. git commit

- **Purpose**: Record the changes made to the repository with a commit message.
- **Example**:

```
git commit -m "Added new feature"
```

7. git push

- **Purpose**: Push local changes to a remote repository.
- **Example**:

```
git push origin main
```

8. git pull

- **Purpose**: Fetch and merge changes from a remote repository to your local repository.
- **Example**:

```
git pull origin main
```

9. git log

- **Purpose**: View the commit history of the repository.
- **Example**:

```
git log
```

10. git branch

- **Purpose**: List, create, or delete branches.
- **Example**:
  - List branches:

```
git branch
```

  - Create a new branch:

```
git branch new-feature
```

  - Delete a branch:

```
git branch -d old-feature
```

Intermediate Git Commands

11. git checkout

- **Purpose**: Switch to another branch or restore a file.
- **Example**:
  - Switch to a branch:

```
git checkout new-feature
```

  - Create and switch to a new branch:

```
git checkout -b new-feature
```

12. git merge

- **Purpose**: Merge the changes of one branch into another.
- **Example**:

```
git checkout main
git merge new-feature
```

13. git rebase

- **Purpose**: Reapply commits on top of another base tip to create a linear history.
- **Example**:

```
git checkout new-feature
git rebase main
```

14. git fetch

- **Purpose**: Fetch changes from the remote repository but do not merge them.
- **Example**:

```
git fetch origin
```

15. git reset

- **Purpose**: Undo changes in the working directory or staging area.
- **Example**:
  - Unstage a file:

```
git reset file.txt
```

  - Reset to a previous commit:

```
git reset --hard HEAD~1
```

16. git diff

- **Purpose**: Show the differences between files, commits, or branches.
- **Example**:

```
git diff
git diff main..feature-branch
```

17. git tag

- **Purpose**: Mark a specific commit with a tag (often used for release versions).
- **Example**:

```
git tag v1.0
git tag v1.0.1 123abc  # Tagging a specific commit
```

18. git stash

- **Purpose**: Stash changes temporarily to clean the working directory.
- **Example**:

```
git stash
git stash pop  # Apply the most recent stash
```

Advanced Git Commands

19. git cherry-pick

- **Purpose**: Apply a commit from another branch to the current branch.
- **Example**:

```
git cherry-pick <commit-hash>
```

20. git revert

- **Purpose**: Create a new commit that undoes the changes from a previous commit.
- **Example**:

```
git revert <commit-hash>
```

21. git clean

- **Purpose**: Remove untracked files or directories.
- **Example**:

```
git clean -fd  # Remove untracked files and directories
```

22. git reflog

- **Purpose**: View the history of the HEAD reference.
- **Example**:

```
git reflog
```

23. git blame

- **Purpose**: View line-by-line information about who last modified each line of a file.
- **Example**:

```
git blame file.txt
```

24. git config --list

- **Purpose**: View the current configuration settings for Git.
- **Example**:

```
git config --list
```

25. git ls-tree

- **Purpose**: Show the contents of a tree object (often used to inspect a commit).
- **Example**:

```
git ls-tree HEAD
```

26. git submodule

- **Purpose**: Manage submodules (repositories within repositories).

- **Example**:
    - Initialize a submodule:

```
git submodule init
```

- Update submodules:

```
git submodule update
```

GitHub Commands (GitHub CLI)

The GitHub CLI (gh) allows interaction with GitHub repositories directly from the command line.

1. gh auth login

- **Purpose**: Authenticate to GitHub from the command line.
- **Example**:

```
gh auth login
```

2. gh repo clone

- **Purpose**: Clone a GitHub repository to your local machine.
- **Example**:

```
gh repo clone user/repo
```

3. gh repo create

- **Purpose**: Create a new repository on GitHub from the command line.
- **Example**:

```
gh repo create my-new-repo --public
```

4. gh pr create

- **Purpose**: Create a pull request from the command line.
- **Example**:

```
gh pr create --base main --head feature-branch --title "Add new feature" --body "This PR adds a new
feature."
```

5. gh pr merge

- **Purpose**: Merge a pull request.
- **Example**:

```
gh pr merge 123 --merge
```

6. gh issue list

- **Purpose**: List issues in a repository.
- **Example**:

```
gh issue list
```

7. gh issue create

- **Purpose**: Create an issue in a GitHub repository.
- **Example**:

```
gh issue create --title "Bug found in login feature" --body "Steps to reproduce..."
```

8. gh gist create

- **Purpose**: Create a GitHub Gist to share code or text snippets.
- **Example**:

```
gh gist create file.txt --public
```

9. gh release create

- **Purpose**: Create a release on GitHub.
- **Example**:

```
gh release create v1.0.0 file.zip --title "Version 1.0" --notes "Initial release"
```

10. gh repo view

- **Purpose**: View the details of a GitHub repository.
- **Example**:

```
gh repo view user/repo
```

GitHub Collaboration & Workflow

1. gh pr status

- **Purpose**: Check the status of pull requests for the current repository.
- **Example**:

```
gh pr status
```

2. gh pr checks

- **Purpose**: View the status of checks (e.g., CI/CD pipelines) for a pull request.
- **Example**:

```
gh pr checks 123
```

3. gh pr review

- **Purpose**: Review a pull request (approve, request changes, or comment).
- **Example**:

```
gh pr review 123 --approve
```

REFERENCES:

Here are some useful references and resources to help you dive deeper into **Git** and **GitHub**:

Official Documentation:

1. **Git Official Website**:
   - https://git-scm.com/
   - The official site provides comprehensive documentation for all aspects of Git, including installation, configuration, and advanced usage.
2. **Git Documentation**:
   - https://git-scm.com/doc
   - This is the complete guide to using Git, covering basic concepts, commands, and advanced workflows.
3. **GitHub Official Website**:
   - https://github.com/
   - GitHub's main site offers access to repositories, documentation, and learning resources to get started with version control.
4. **GitHub Docs**:
   - https://docs.github.com/en/github
   - GitHub's official documentation covers everything from setting up your account to advanced workflows, CI/CD, and integrations.

Learning Resources:

1. **Pro Git Book (Free Online Version)**:
   - https://git-scm.com/book/en/v2
   - The **Pro Git** book, written by Scott Chacon and Ben Straub, is an excellent resource for mastering Git. It's available for free online and covers Git from basic concepts to advanced workflows.
2. **GitHub Learning Lab**:
   - https://lab.github.com/
   - GitHub's Learning Lab provides hands-on interactive tutorials to help you learn Git and GitHub at your own pace, from beginner to advanced topics.
3. **Udemy Courses:**
   - Git and GitHub Courses on Udemy
   - Udemy offers a variety of courses for Git and GitHub users at different skill levels, with practical exercises and examples.

Books on Git and GitHub:

1. **"Pro Git" by Scott Chacon & Ben Straub**:
   - https://git-scm.com/book/en/v2
   - A widely-recommended and comprehensive book on Git that covers everything from basic commands to advanced techniques like branching and merging.
2. **"Git Pocket Guide" by Richard E. Silverman**:
   - This concise reference book is ideal for both beginners and advanced users, offering practical insights into Git commands and workflows.
3. **"GitHub Essentials" by Achilleas Pipinellis**:
   - A book focused specifically on using GitHub for version control, collaboration, and workflow management. It is a good companion to understanding GitHub's ecosystem.

Tools and Integrations:

1. **GitHub Actions**:
   - https://github.com/features/actions
   - GitHub Actions allows you to automate workflows, CI/CD pipelines, and other repetitive tasks directly within your GitHub repository.
2. **Git with GitHub for CI/CD**:
   - https://www.atlassian.com/git/tutorials/comparing-workflows
   - Learn how to integrate Git with popular CI/CD tools like Jenkins, Travis CI, CircleCI, and more to automate the build, test, and deployment process.
3. **GitKraken (GUI for Git)**:
   - https://www.gitkraken.com/
   - GitKraken is a popular Git GUI client that simplifies Git's workflow with an intuitive visual interface, ideal for users who prefer graphical tools over the command line.