



# **Source Code Management / Version Control System**

# Version Control System



- Version control is a system that allows the software team to manage changes to the source code over time
- This software tool makes it easier for developers to collaborate on different projects separating their tasks through branches
- It also gives the possibility to turn back to earlier versions for comparing and fixing the mistakes if needed
- Version Control Systems (VCS) also known as SCM (Source Code Management) or RCS (Revision Control System) are software tools for keeping track of changes to the source code over time

# Benefits



- **Long-term change history**
  - The changes made by developers, including the creating, modification, and deletion of files over the years, can be seen in history
  - It will allow going back to the previous version for analyzing bugs and fixing problems
- **Branching and merging**
  - Branching helps work in an independent manner and not interfere with each other's work
  - Merging brings the works together and allows seeing if there are conflicts between those works
- **Traceability**
  - Ability to trace each change and connect it to project management and bug tracking software, as well as to annotate each change with a message describing the purpose of the change
- **Synchronization**
  - The up-to-date codes can be fetched from the repository
- **Backup and Restore**
  - Files are saved at any time and restored from the last saved one
- **Undoing**
  - You can undo both the last known version and the last one created a long time ago
- **Branching and Merging**
  - Changes are made on a branch and after being approved, they can be merged with the master branch



# Types



# Local Version Control System

- Local VCSs were created to prevent issues like confusing the directories and accidentally writing or copying to the wrong file
- It is a simple database that keeps all the changes to files under revision control
- One of the most popular VCS tools was a system called Revision Control System (RCS), which is still distributed today, although being an earlier version control system
- It allows users to make their revisions of a document, commit changes, and merge them. RCS was originally developed for programs but is also useful for text documents or configuration files that are frequently revised



# Centralized Version Control System

- In centralized systems, all the versioned files, as well as a number of clients that check out files from that central place, are included in a single server
- For many years, this has been the standard for version control
- Centralized Version Control Systems are CVS, Subversion, and Perforce

# Distributed Version Control System



- In Distributed Version Control Systems (DVCS), clients fully mirror the repository, including its full history
- If the server that these systems were collaborating with dies, the client repositories can be copied back up to the server to restore it
- Distributed Version Control Systems are Git, Mercurial, Bazaar or Darcs



# Git



# What is Git ?



- Git is a distributed revision control and source code management system
- Git was initially designed and developed by Linus Torvalds for Linux kernel development
- Git is a free software distributed under the terms of the GNU General Public License version 2

# History



- The Linux kernel is an open source software project of very large scope
- From 1991–2002, changes to the software were passed around as patches and archived files
- In 2002, the Linux kernel project began using a proprietary DVCS called BitKeeper
- In 2005, the relationship with BitKeeper broken down and tool's free-of-charge status was revoked
- tool's free-of-charge status was revoked (and in particular Linus Torvalds) to develop their own tool based on some of the lessons they learned while using BitKeeper
- Some of the goals of the new system were
  - Speed
  - Simple design
  - Strong support for non-linear development (thousands of parallel branches)
  - Fully distributed
  - Able to handle large projects like the Linux kernel efficiently (speed and data size)

# Characteristics



- Strong support for non-linear development
- Distributed development
- Compatibility with existent systems and protocols
- Efficient handling of large projects
- Cryptographic authentication of history
- Toolkit-based design
- Pluggable merge strategies

# Advantages



- Free and open source
- Fast and small
- Implicit backup
- Security
- No need of powerful hardware
- Easier branching



# Basic Workflow



- The git init command is used to generate a new, empty Git repository or to reinitialize an existing one
- With the help of this command, a .git subdirectory is created, which includes the metadata, like subdirectories for objects and template files, needed for generating a new Git repository

# git config



- The git config command is a function that sets configuration variables
- It controls git look and operation
- Levels
  - **Local (--local)**
    - When no configuration option is passed git config writes to a local level, by default
    - The repository of the .git directory has a file that stores local configuration values
  - **Global (--global)**
    - The application of the global level configuration includes the operating system user
    - Global configuration values can be found in a file placed in a user's home directory
  - **System (--system)**
    - The System-level configuration includes all users on an operating system and all repositories
    - System-level configuration file is located in a git config file of the system root path

# git add



- The git add is a command, which adds changes in the working directory to the staging area
- With the help of this command, you tell Git that you want to add updates to a certain file in the next commit
- But in order to record changes, you need to run git commit too
- In combination with the commands mentioned above, git status command is also needed to see which state the working directory and the staging area are in





- The git commit command saves all currently staged changes of the project
- Commits are created to capture the current state of a project
- Committed snapshots are considered safe versions of a project because Git asks before changing them
- Before running git commit command, git add command is used to promote changes to the project that will be then stored in a commit
- **Working of commit**
  - Git snapshots are committed to the local repository
  - Git creates an opportunity to gather the commits in the local repository, rather than making a change and commit it immediately to the central repository
  - This has many advantages splitting up a feature into commits, grouping the related commits, and cleaning up local history before committing it to the central repository
  - This also gives the developers an opportunity to work in an isolated manner

# git log



- The git log command shows committed snapshots
- It is used for listing and filtering the project history, and searching for particular changes
- The git log only works on the committed history in comparison with git status controlling the working directory and the staging area



# Branching

# Branching



- Branching allows developers to branch out from the original code base and work separately
- Allows another line of development
- A way to write code without affecting the rest of your team
- Generally used for feature development
- Once confirmed the feature is working you can merge the branch in the master branch and release the build to customers
- **Why is it required ?**
  - So that you can work independently
  - There will not be any conflicts with main code
  - You can keep unstable code separated from stable code
  - You can manage different features keeping away the main line code and there wont be any impact of the features on the main code

# git branch



- The git branch command creates, lists and deletes branches
- It doesn't allow switching between branches or putting a forked history back together again
- Git branches are a pointer to a snapshot of the changes you have made
- A new branch is created to encapsulate the changes when you want to fix bugs or add new features
- This helps you to clean up the future's history before merging it
- Git branches are an essential part of everyday workflow
- Git does not copy files from one directory to another, it stores the branch as a reference to a commit