Version Control

ITI - Day 1

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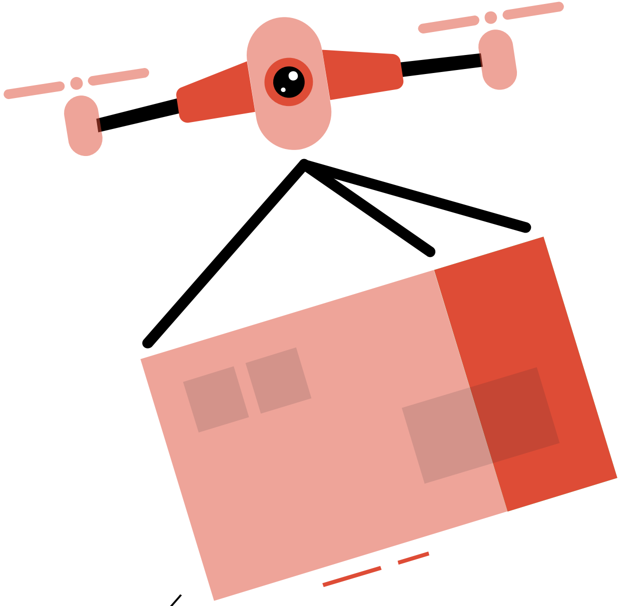
Introduction To VCS

What it is, use cases
and advantages



What is version control?

Version control, also known as source control, is the practice of tracking and managing changes to software code.

Version control software keeps track of every modification to the code in a special kind of database. If a mistake is made, developers can turn back the clock and compare earlier versions of the code to help fix the mistake.

Why use Version Control ?

1. Helps teams collaborate around the world
2. Accelerates product delivery
3. You can version and backup your code
4. Keeping Track of All the Modifications Made to the Code
5. Working on a new features without affecting the working code

Version Control Features

1. Synchronization
2. Backup & Restore
3. Short-term undo
4. Long-term undo
5. Track Changes
6. Track Ownership
7. Sandboxing
8. Branching and merging

Version Control Terminologies

Repository
Or Repo

Server

Client

Working Copy

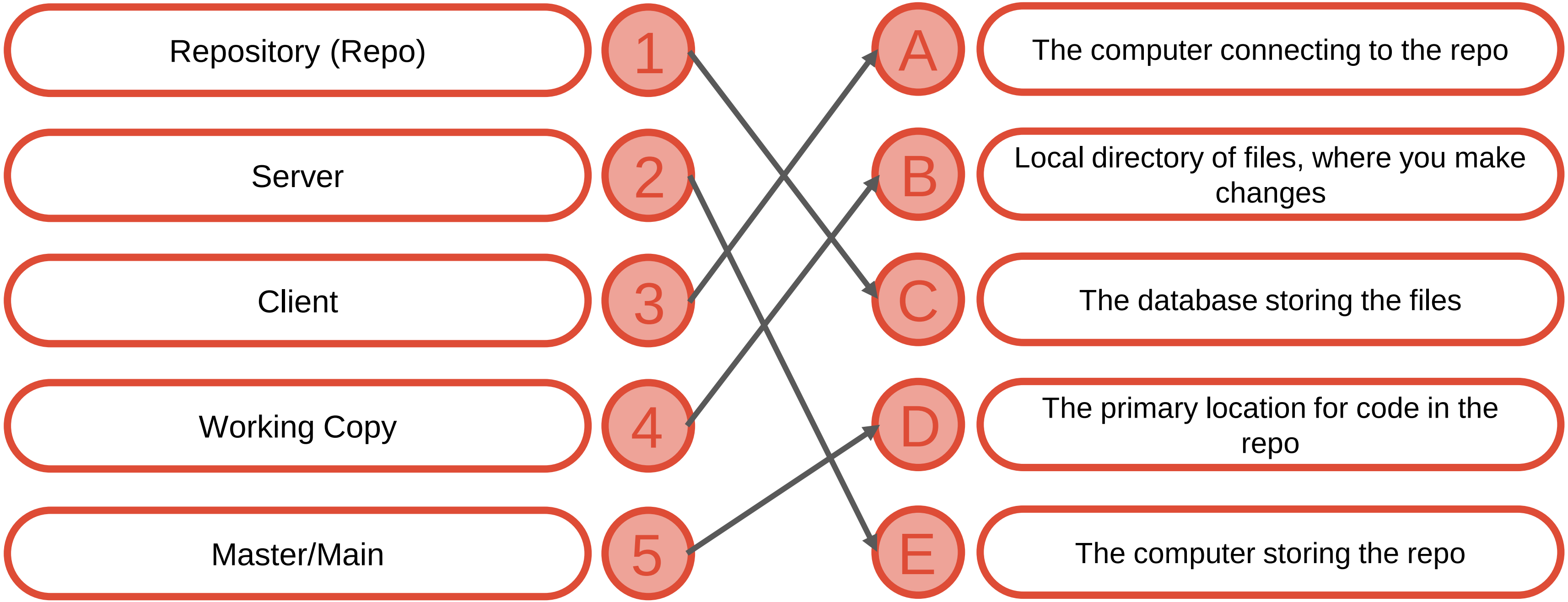
Master/Main

Match The VCS Terminologies

1. Repository (Repo)
2. Server
3. Client
4. Working Copy
5. Master/Main

A. The computer connecting to the repo
B. Local directory of files, where you make changes
C. The database storing the files
D. The primary location for code in the repo
E. The computer storing the repo

The VCS Terminologies Solution



Repository (Repo)
1

Server
2

Client
3

Working Copy
4

Master/Main
5

A
The computer connecting to the repo

B
Local directory of files, where you make changes

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The database storing the files

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The primary location for code in the repo

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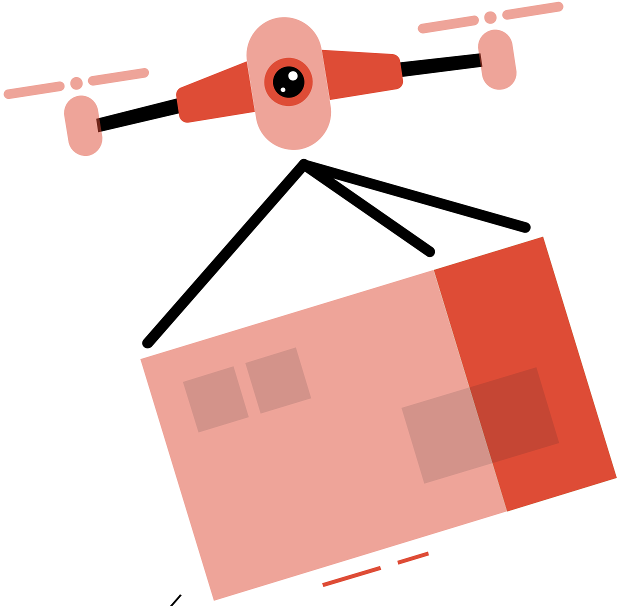
Centralized VCS

The structure of
the centralized VCS

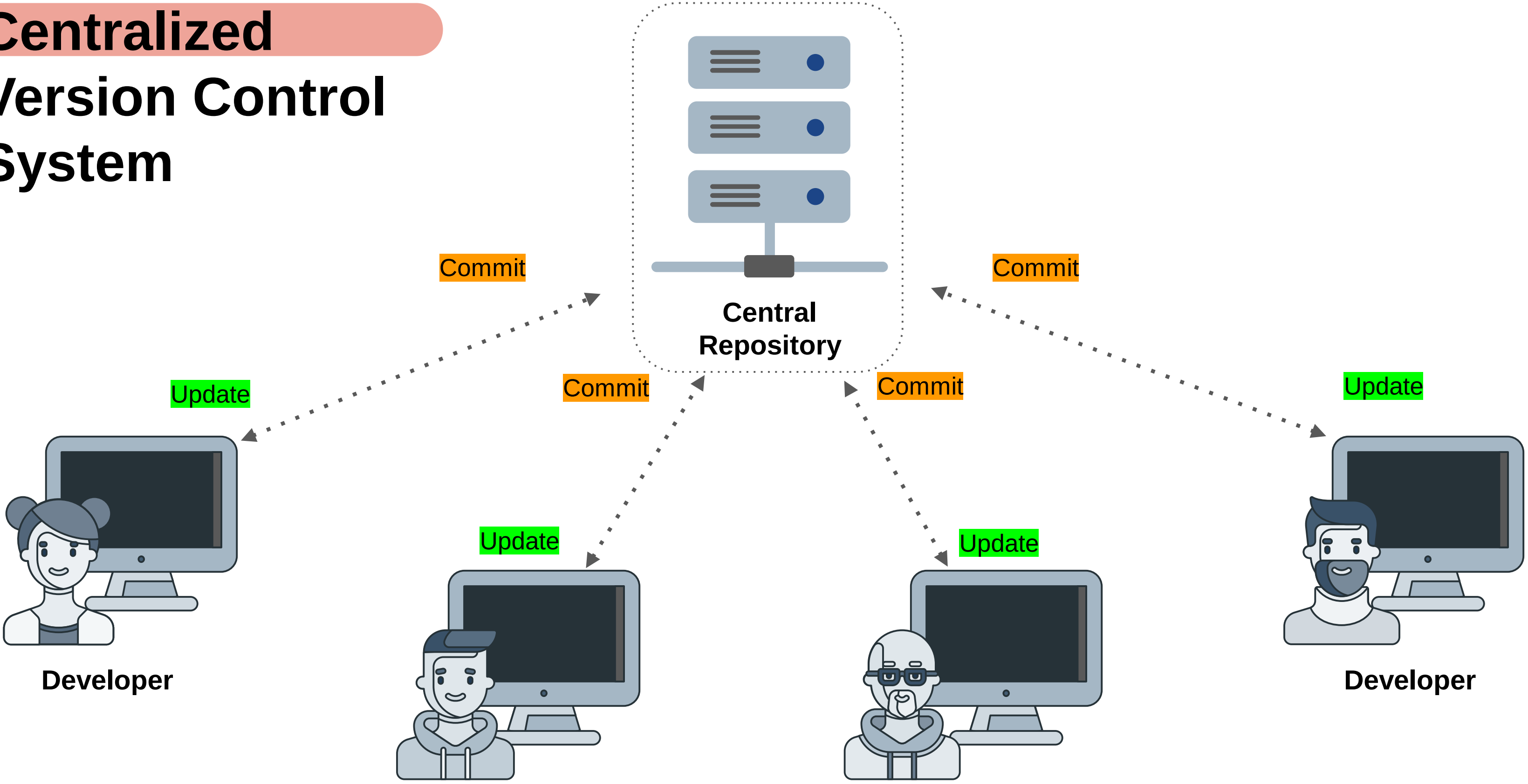


Centralized VCS

Centralized version control systems are based on the idea that there is a single “central” copy of your project on a server, and programmers will “commit” their changes to this central copy.

“Committing” a change simply means recording the change in the central system. Other programmers can then see this change. They can also pull down the change, and the version control tool will automatically update the contents of any files that were changed.

Centralized Version Control System



Commit

Central Repository

Commit

Update

Commit

Commit

Update

Update

Update

Developer

Developer

Developer

Developer

Disadvantages

- If the main server goes down, developers can’t save versioned changes.
- Need internet connection to commit the changes.
- If the central database is corrupted, the entire history could be lost.

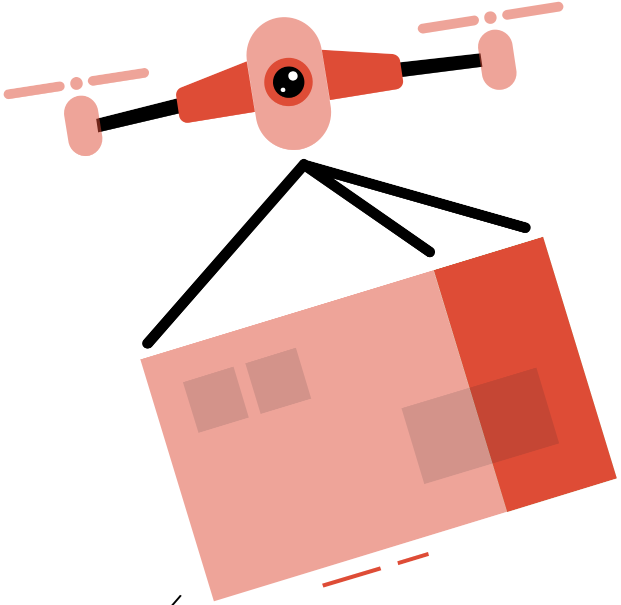
Centralized VCS Examples

Concurrent
Version System

Subversion

Distributed VCS

The structure of
the distributed VCS

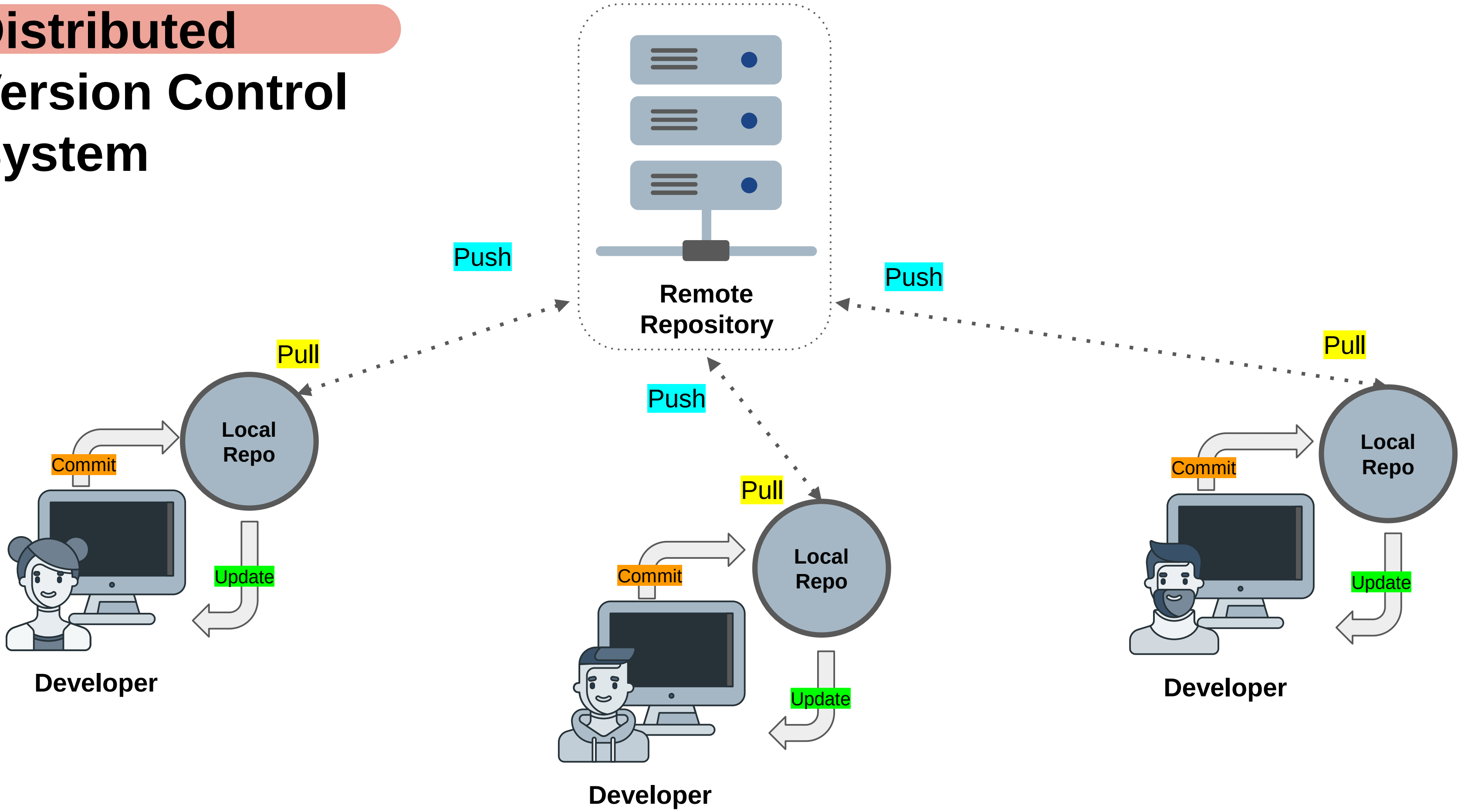


Distributed VCS

These systems do not necessarily rely on a central server to store all the versions of a project's files. Instead, every developer "clones" a copy of a repository and has the full history of the project on their own hard drive.

The act of getting new changes from a repository is usually called "pulling", and the act of moving your own changes to a repository is called "pushing". In both cases, you move changesets (changes to files groups as coherent wholes), not single-file diffs.

Distributed Version Control System


Remote Repository
Push
Push
Push
Pull
Pull
Pull
Local Repo
Local Repo
Local Repo
Commit
Commit
Commit
Update
Update
Update
Developer
Developer
Developer

Advantages

- Performing actions other than pushing and pulling changesets is extremely fast because the tool only needs to access the hard drive, not a remote server.

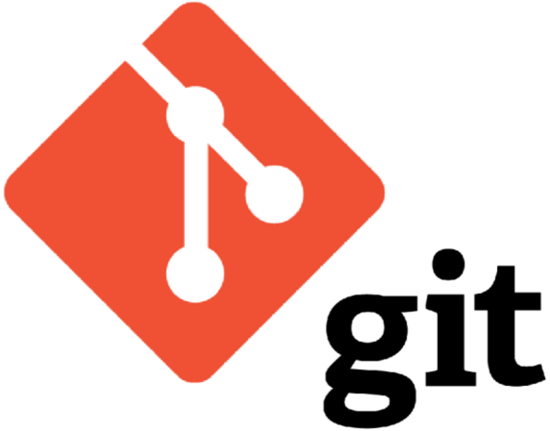
- Committing new changesets can be done locally without anyone else seeing them. Once you have a group of changesets ready, you can push all of them at once.

Advantages - Cont'd

- Everything but pushing and pulling can be done without an internet connection. So you can work on a plane, and you won’t be forced to commit several bugfixes as one big changeset.

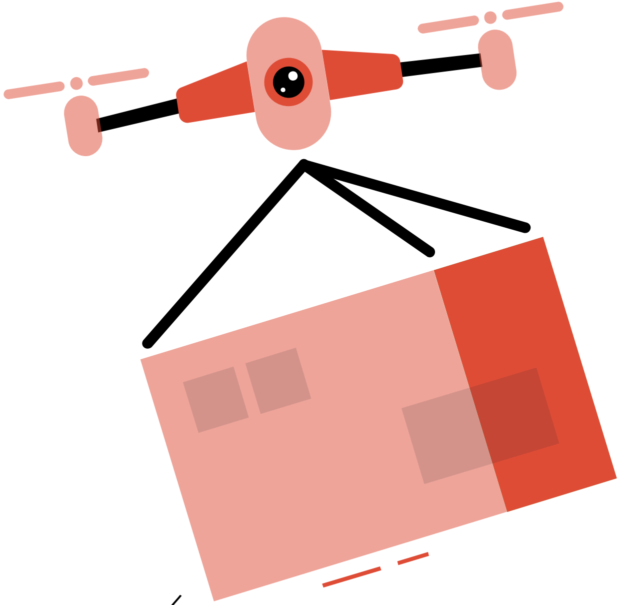
- Since each programmer has a full copy of the project repository, they can share changes with one or two other people at a time if they want to get some feedback before showing the changes to everyone.

Distributed VCS Examples



Git & GitHub

History, advantages
and hands-on



Git History

2002

Linux kernel project began using BitKeeper

2005

Linux kernel project stopped using BitKeeper

2005

Linus Torvalds started working on a new DVCS called Git

The Goals of Git

- Simple design
- Speed
- Fully distributed
- Able to handle large projects like the Linux kernel efficiently
- Strong support for non-linear development

Every Operation is Local

- Most operations in Git only need local files and resources to operate, generally no information needed from another computer on your network.

- For example: to browse the history of the project, Git doesn’t need to go out to the server to get the history and display it for you, it simply reads it directly from your local database.

Git Integrity

- The Git Version Control System uses SHA-1 checksums on the contents of all change commits. In fact, the checksum is used as commit identifier and commonly referred to as "the SHA". Git's checksums include metadata about the commit including the author, date, and the previous commit's SHA.

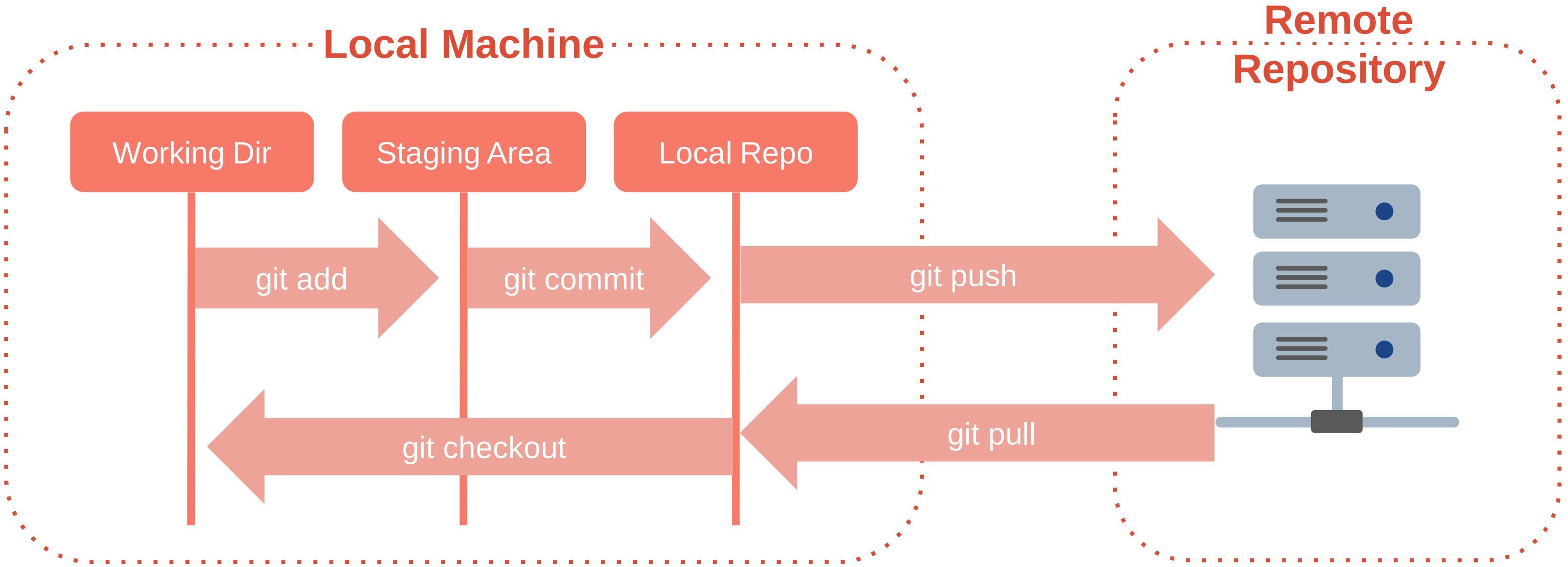
- Git assures the integrity of the data being stored by using checksums as identifiers. If someone were to try to alter a commit or its meta data, it would change the SHA used to identify it. It would become a different commit.

The Three Git States

Git has three main states that your files can reside in:

- **Modified** means that you have changed the file but have not committed it to your database yet.
- **Committed** means that the data is safely stored in your local database.
- **Staged** means that you have marked a modified file in its current version to go into your next commit snapshot.

The Three Git States



Local Machine

Working Dir

Staging Area

Local Repo

git add

git commit

git checkout

Remote Repository

git push

git pull

First Time Git Setup

- The first thing you should do when you install Git is to set your user name and email address.
- This is important because every Git commit uses this information, and it’s immutably baked into commits you start creating.

```
git config --global user.name “your name”
git config --global user.email “your e-mail”
```

- You can also set your default editor and colorize the output:

```
git config --global core.editor vi
git config --global color.ui true
```

Git SSH Keys

SSH keys come in pairs, public key that gets shared with services like GitHub and a private key that is stored only on your computer. If the keys match, you’re granted access.

- Generate a new SSH key pairs

```
ssh-keygen -t ed25519 -C "your e-mail"
```

- Copy the public key to your GitHub account

```
cat ~/.ssh/id_ed25519.pub
```

Starting a Repo

- `mkdir pyhton_project`

  Make a directory

- `cd python_project`

  Change directory to the above directory

- `git init`

  Initialize an empty Git repository

- `ls -a`

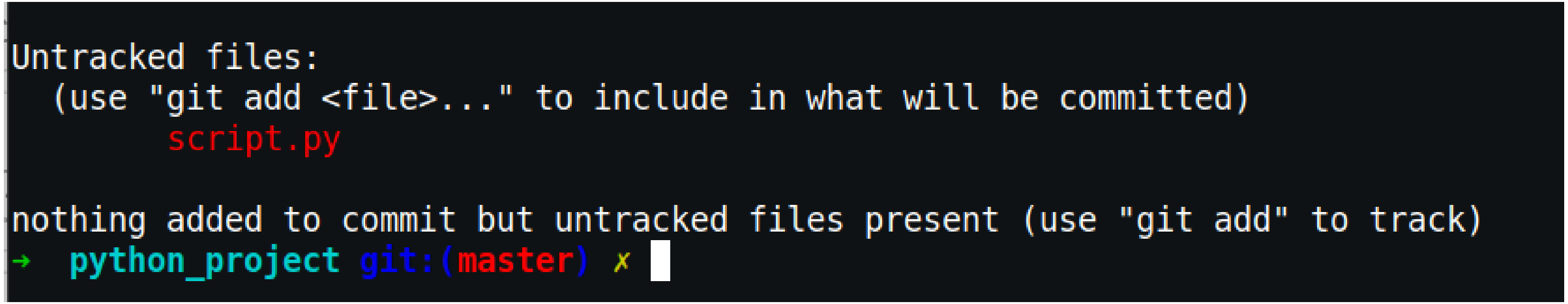
  List all the files & dir and the hidden files & dir

Create a New File

- touch script.py

  Create a new file called script.py

- git status



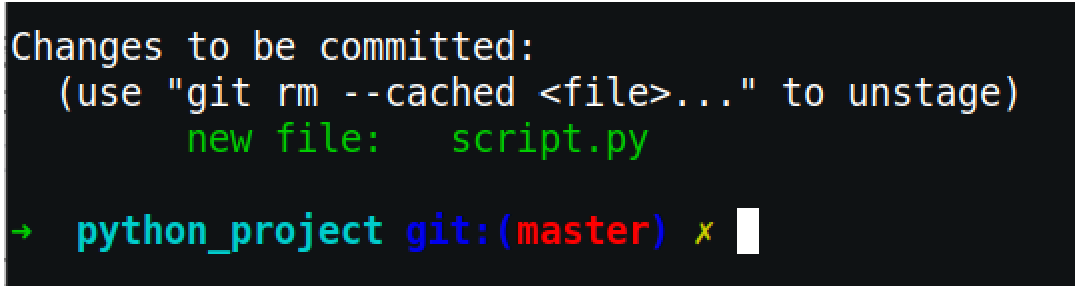
```
Untracked files:
  (use "git add <file>..." to include in what will be committed)
        script.py

nothing added to commit but untracked files present (use "git add" to track)
➜  python_project git:(master) ✗ 
```

Add to Staging Area

- git add script.py

  Staging the script.py file

- git status



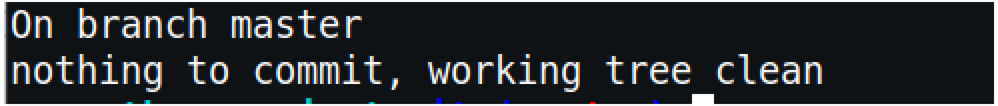
```
Changes to be committed:
  (use "git rm --cached <file>..." to unstage)
        new file:   script.py

→  python_project git:(master) ✗
```

Commit changes

- git commit -m “the first commit”

  Commit the changes

- git status



```
On branch master
nothing to commit, working tree clean
```

Amend to a Commit

- git commit --amend -m “your new msg”

  Maybe you forgot to add a file

  The above command will amend

  the added change to the last commit

Add & Commit

- `git commit -a -m “the first commit”`

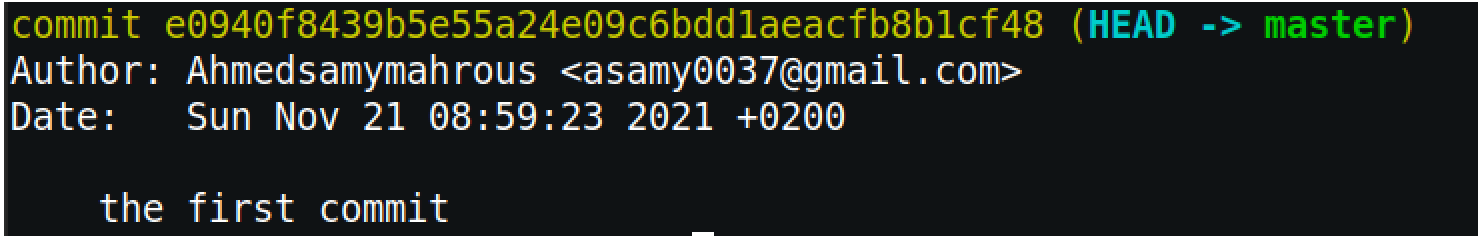
  Add the changes & commit the changes in one line

But , notice that this command doesn’t add new files

It only works with the changes that made inside the files itself

Git Logs

- git log



```
commit e0940f8439b5e55a24e09c6bdd1aeacfb8b1cf48 (HEAD -> master)
Author: Ahmedsamymahrous <asamy0037@gmail.com>
Date:   Sun Nov 21 08:59:23 2021 +0200

    the first commit
```

Git Diff

- git diff

  Show the unstaged differences since the last commit

- git diff --staged

  Show the staged differences since the last commit

Unstaging changes

- `git reset HEAD script.py`

  To unstage the changes

- `git restore --staged script.py`

  To unstage the changes

Undoing a Comment

- git reset --soft HEAD^

  Delete the last commit and git back to the staging area

- git reset --soft HEAD^^

  Delete the last 2 commits and git back to the staging area

- git reset --hard HEAD^

  Delete the commit and the change from staging area and delete from working copy

Add / Remove Remote Repo

- git remote add origin https://github.com/Ahmedsamymahrous/any_repo

  To add a remote repository

- git remote -v

  To list the remote repositories

Push / Pull Remote Repo

- git push origin master

  To push the local changes to the remote repo

- git pull origin master

  To get the changes that made by others

Clone a Remote Repo

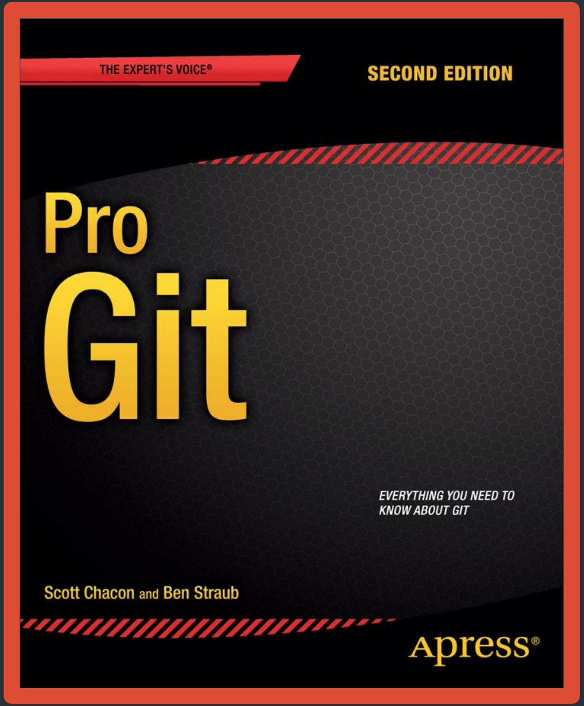
- Git clone https://github.com/****/*****

  To clone the entire repository to your local machine in a new directory

Lab 1

- Install Git.
- Create an account on GitHub.
- Accept my contribution invitation from Gmail, and clone the repository to your computer.
- Edit the repo by adding new file including your name and email, and push the changes.
- Create a new local repo and a remote repo on GitHub, then make a file contains your full name, then push it to the remote repo, and send an invitation to me (ahmedibrahem22322@gmail.com).

RESOURCES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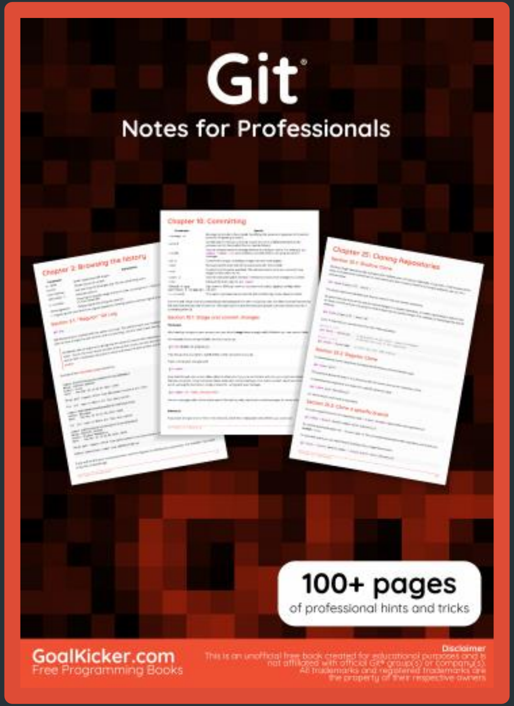
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Thanks!

Do you have any questions?