Git & GitHub

Including project management

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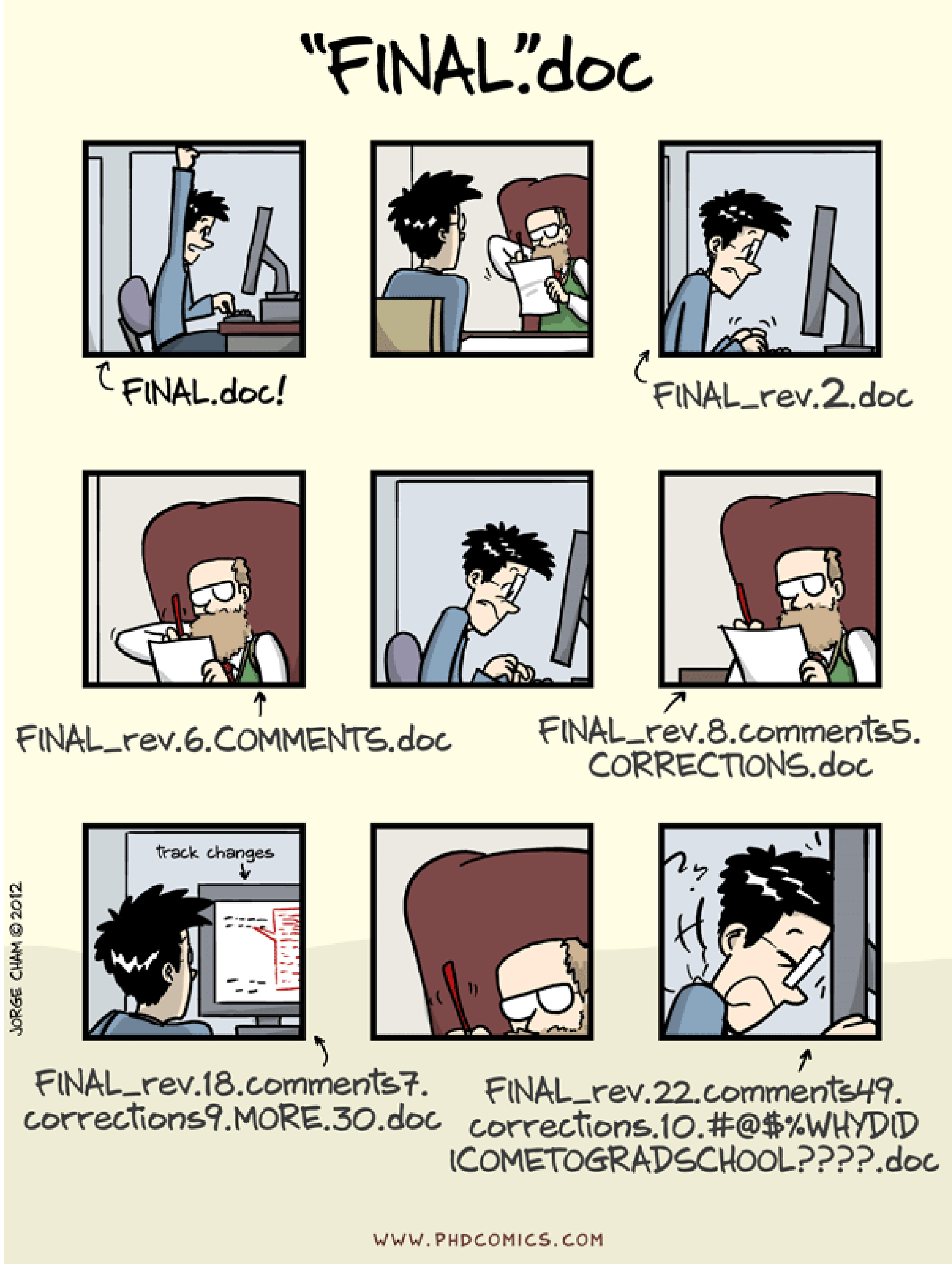


Learning objectives

What are versions?

Basic Git and GitHub terminologies

Have a GitHub user account

Markdown styling of the text

Git commands: add, commit, diff, branch, checkout, merge, log

Git issue, project, pull request

Introduction

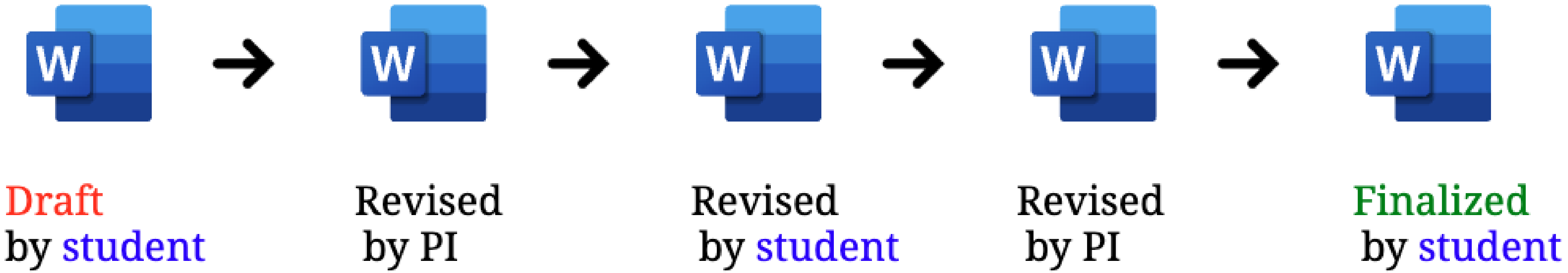
Name

Designation

Research group & Institution

Experience with Git and/ or GitHub

A general example of manuscript revision

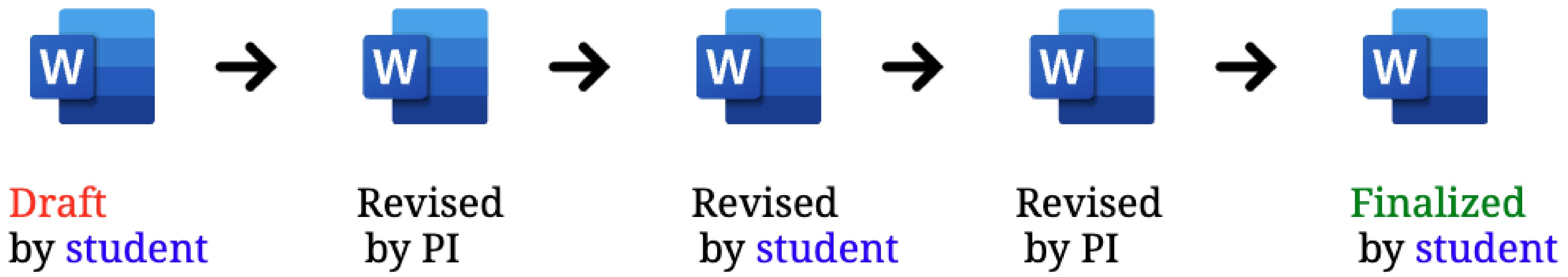


A general example of manuscript revision

Draft by student → Revised by PI → Revised by student → Revised by PI → Finalized by student

What would you call these files?

A general example of manuscript revision



What would you call these files?

Versions?

How would you store different versions?

- manuscript_**FA**.docx
- manuscript_**FA_LA**.docx
- manuscript_**FA_LA_FA**.docx
- manuscript_**FA_LA_FA_LA**.docx
- manuscript_**final**.docx

How would you store different versions?

- manuscript**_FA**.docx
- manuscript**_FA_LA**.docx
- manuscript**_FA_LA_FA**.docx
- manuscript**_FA_LA_FA_LA**.docx
- manuscript**_final**.docx

- manuscript**_20221001**.docx
- manuscript**_20221224**.docx
- manuscript**_20230107**.docx
- manuscript**_20230201**.docx
- manuscript**_final**.docx

How would you store different versions?

- manuscript_**FA**.docx
- manuscript_**FA_LA**.docx
- manuscript_**FA_LA_FA**.docx
- manuscript_**FA_LA_FA_LA**.docx
- manuscript_**final**.docx

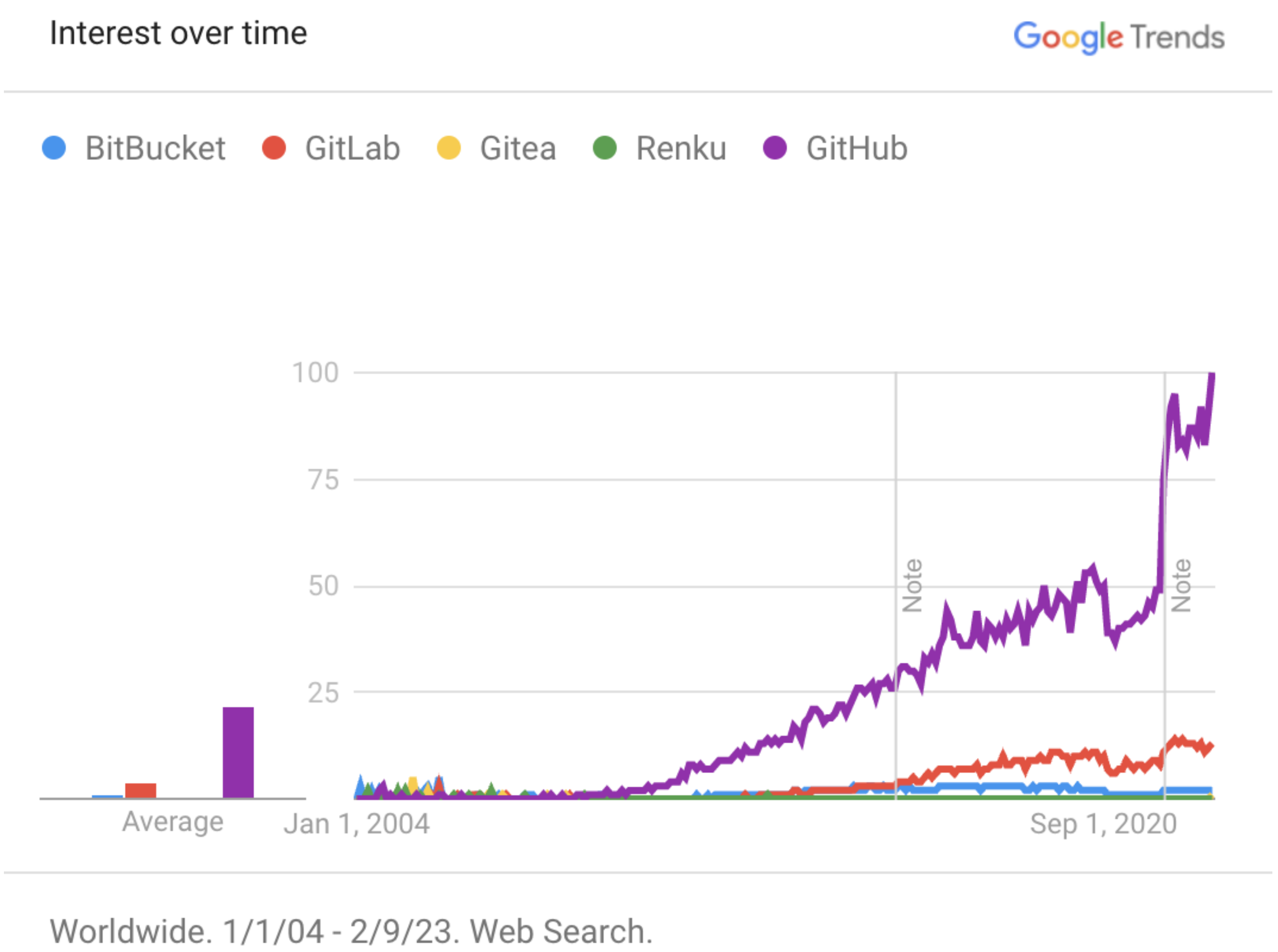
- manuscript_**20221001**.docx
- manuscript_**20221224**.docx
- manuscript_**20230107**.docx
- manuscript_**20230201**.docx
- manuscript_**final**.docx

Does anyone store files differently?

Version control

File	"commit message"	version/commit ID
manuscript.docx	"first draft"	ac3eveta
manuscript.docx	"revision 1"	a23eveta
manuscript.docx	"revision 2"	cc3eveta
manuscript.docx	"updated figures"	dc3edeta
manuscript.docx	"removed table"	zc9aveta
manuscript.docx	"line numbering"	tc5eveta
manuscript.docx	"bioRxiv submission"	yc8evata
manuscript.docx	"published"	zz33eeta

How to host these versions?



Terminologies

Organization	shared account
Username	your identity
Repository	folder
Issues	track bugs, request features, discuss
Branch	separate line of development
Fork	server-side copy of Repository
Pull request	proposal to merge changes

Exercise 1

1. Create a username on https://github.com
2. Check if you belong to any organization
3. Create a new **public** Repository with your username
4. Go to your home page: https://github.com**/username**
5. Take a screenshot

Writing style on GitHub: Markdown

~~~~
# This is heading 1

## This is heading 2

`code`

```r
R code
```
~~~~

Writing style on GitHub: Markdown

Bold   __Bold__

Italics   _Italics_

~Strikeout~

> quote

Writing style on GitHub: Markdown

This is a list

- Item 1
- Item 2
- Item 3

This is a numbered list

1. Item 1
2. Item 2
3. Item 3

Writing style on GitHub: Markdown

This is a task list

- [ ] Item 1
- [ ] Item 2
- [ ] Item 3

[this is a link](https://github.com)

Writing style on GitHub: Markdown

Making a table

```
| Column 1 | Column 2 | Column 3 |
|--------------|---------------|--------------|
| row 1 a | row 1 b | row 1 c |
| row 2 a | row 2 b | row 2 c |
```

Exercise 2

1. Create a file: **README.md** in your username Repository
2. Write your introduction into sections: Background, Research project, Affiliation, Education
3. In the Education section, make a table of your studies with university and year
4. Save your README.md file with a proper commit message
5. Go to your home page: https://github.com/**username**
6. Compare it with previously taken screenshot

Exercise 3

1. Create an issue in your repository:
   https://github.com/username/repository/issues/new
2. Give it a title: updating README file
3. Write a description: what else you would like to update in the README file
4. Assign it to yourself, add relevant labels and type

Exercise 4

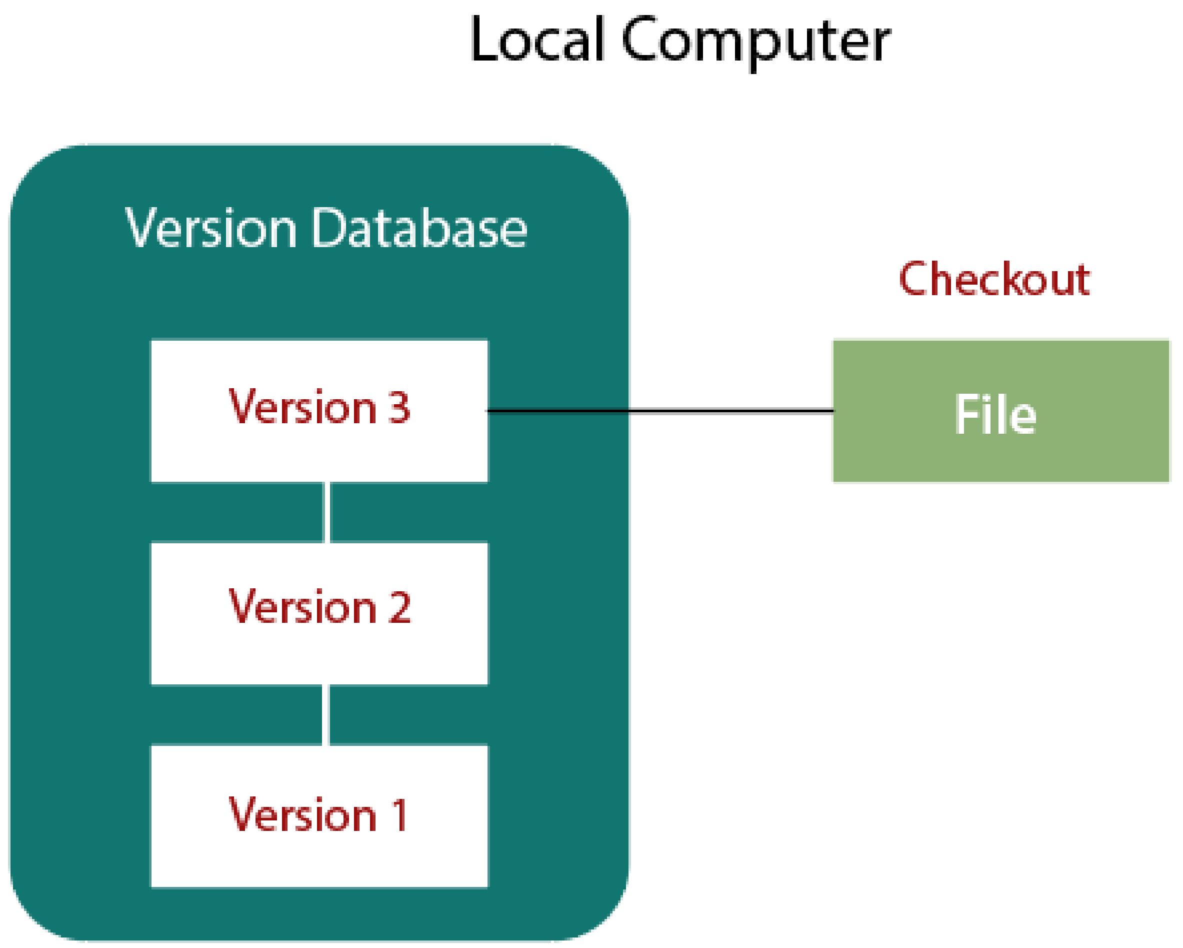
1. Go to https://github.com/DQBM-SIB/intro_git_github
2. Fork this repository under your username
3. Create a branch with your first name
4. In your named branch, edit README file of this repo and add your GitHub username
5. Create a pull request for original repository DQBM-SIB/intro_git_github in main branch with appropriate message
6. After pull requests are merged, check different commit messages

Exercise 5

1. Go to https://github.com/DQBM-SIB/intro_git_github
2. Click on Projects
3. Execute three projects in groups

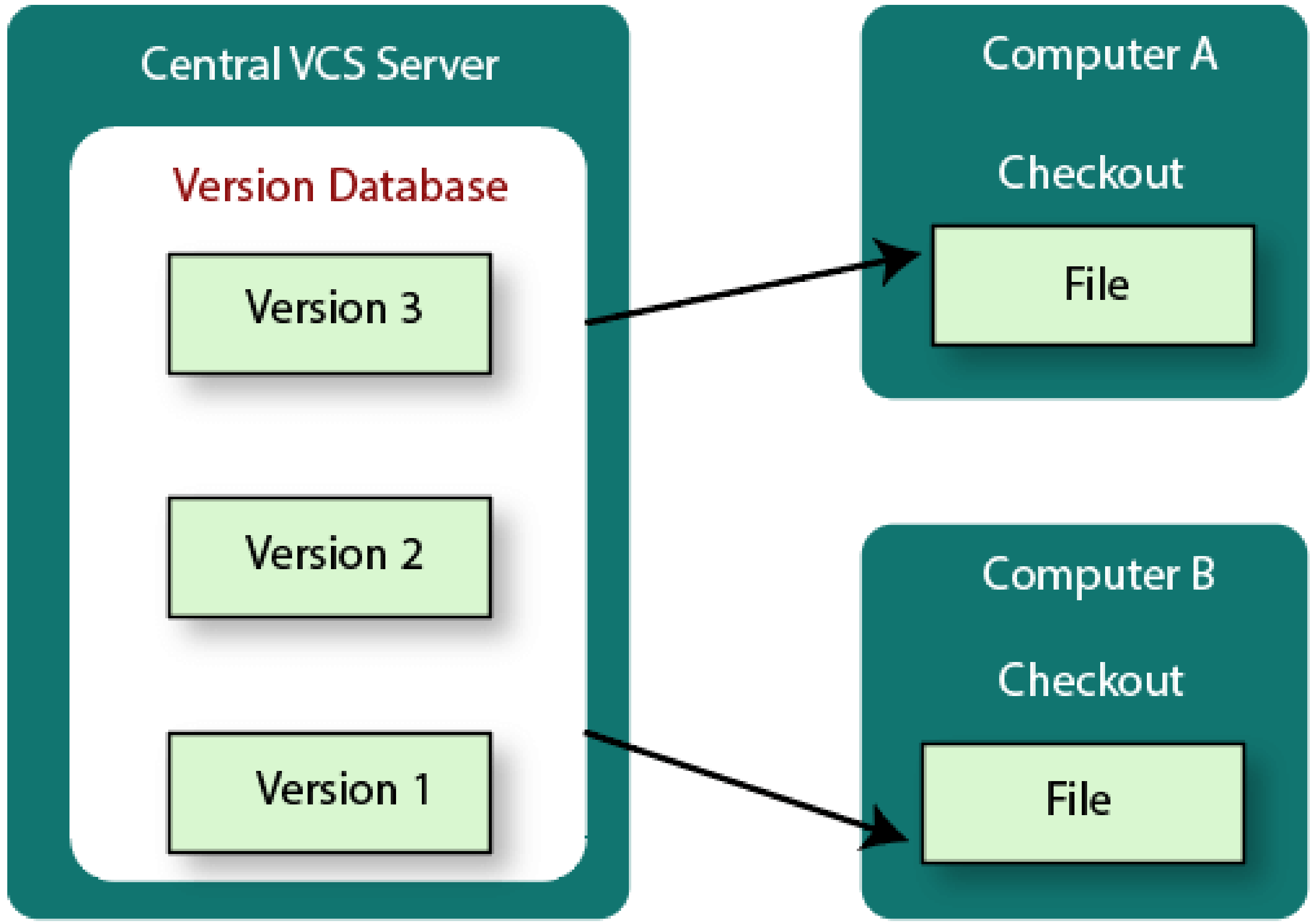
Overview of Version Control System

Local



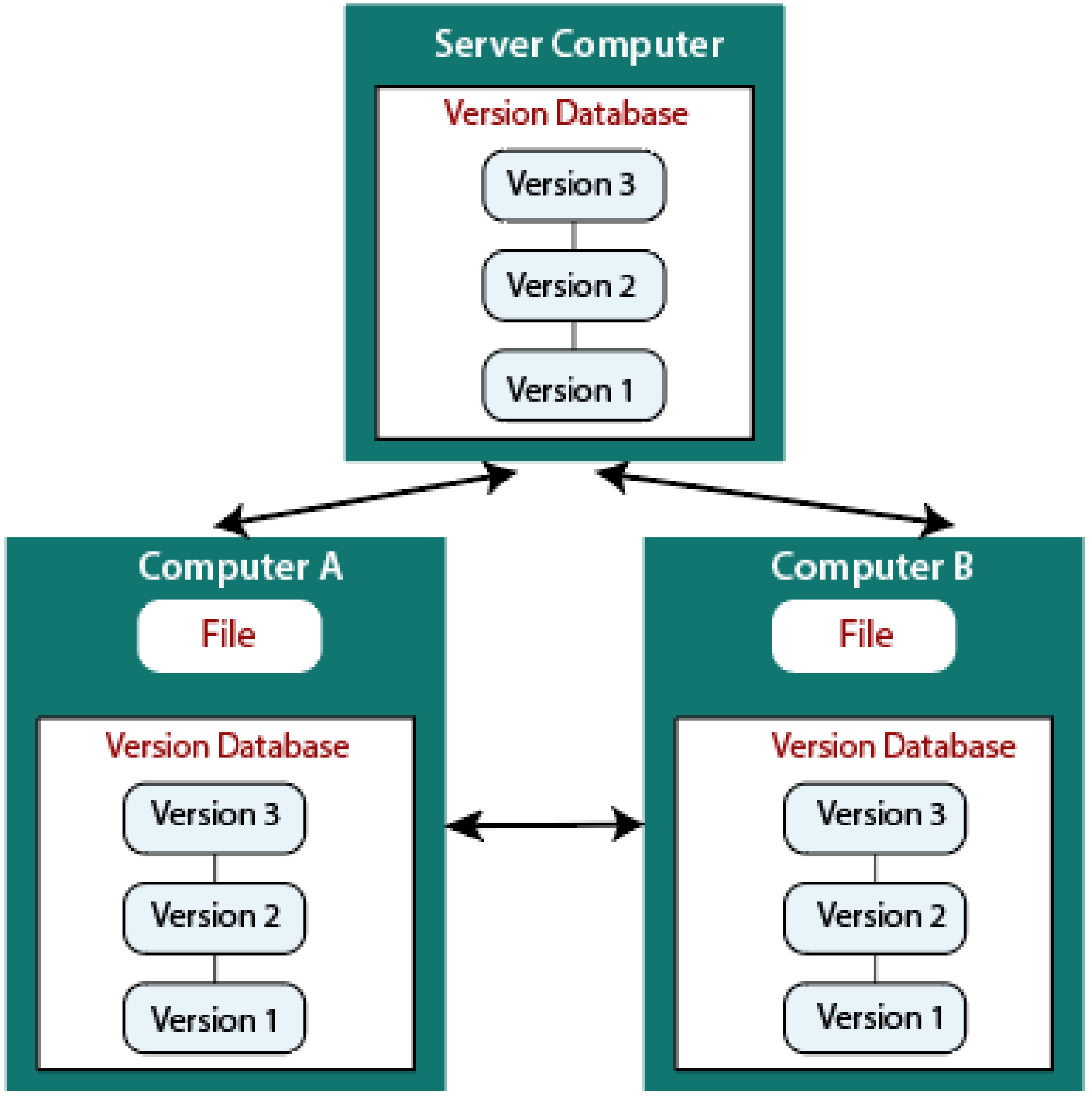
Overview of Version Control System

Central

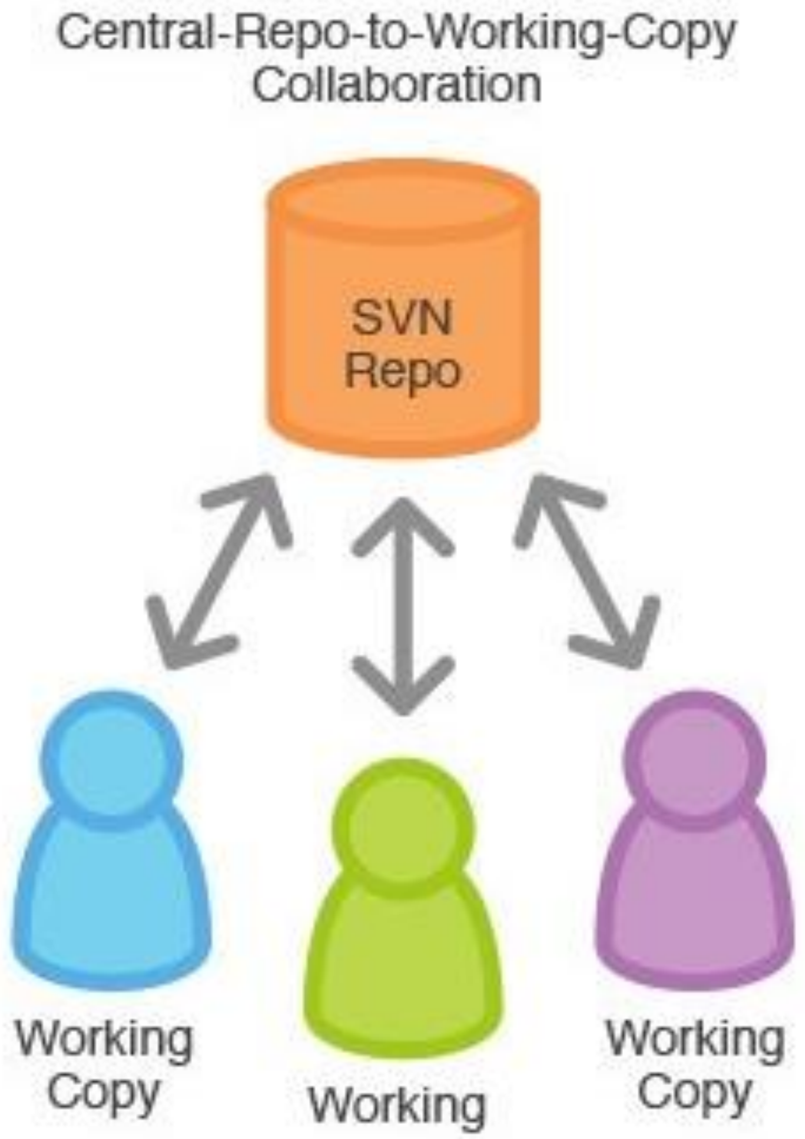


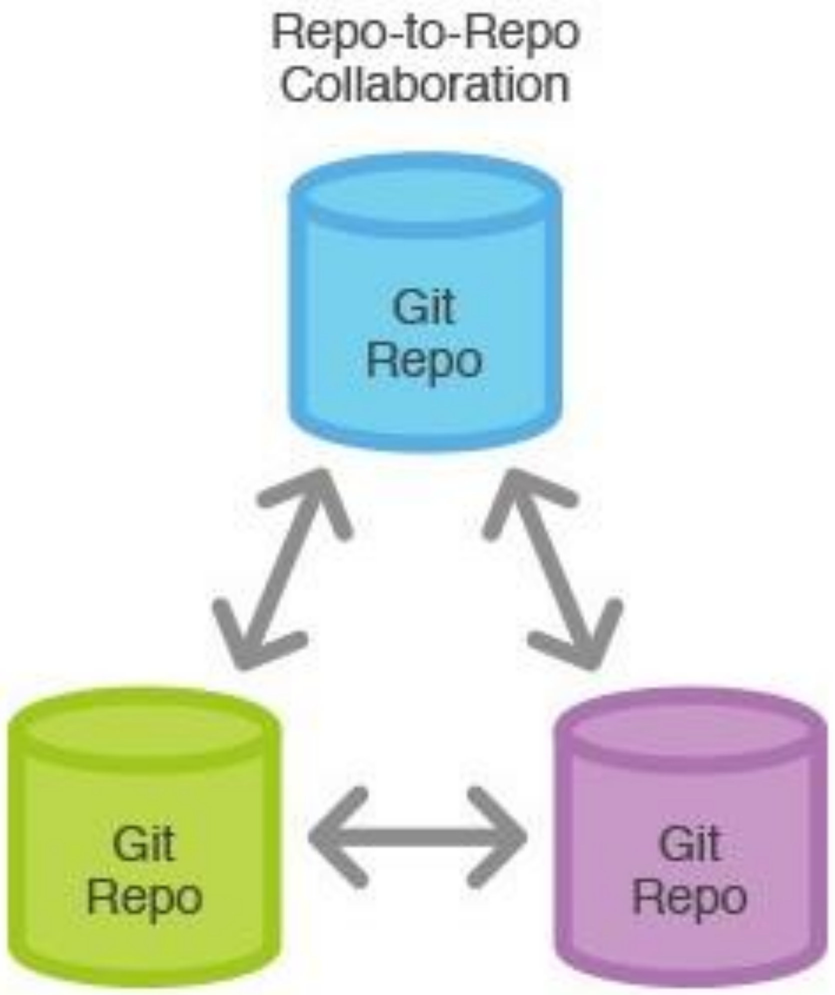
Overview of Version Control System

Distributed



The two main VCS

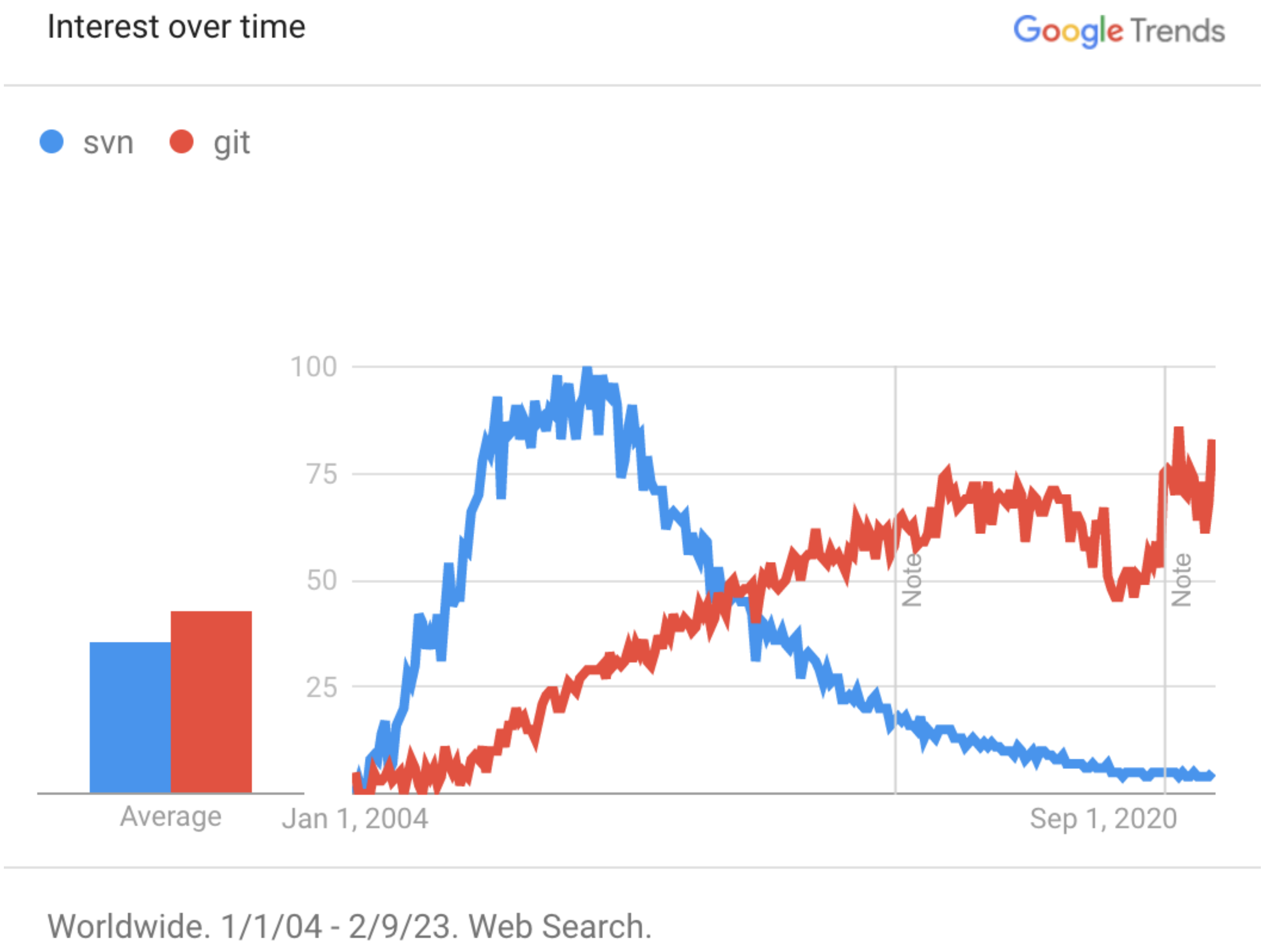




Git is more trending than svn

svn: 2000

git: 2005



Quiz 1-3

Getting started with git

Is git installed in your system?

```
$ git config --global user.name "Your Name"
$ git config --global user.email "Your email address"
```

git commands

- add
- am
- annex
- annex-shell
- annotate
- apply
- archimport
- archive
- bisect
- blame
- branch
- bundle
- cat-file
- check-attr
- check-ignore
- check-mailmap
- checkout
- checkout-index
- check-ref-format
- cherry
- cherry-pick
- citool
- clean
- clone
- column
- commit
- commit-graph
- commit-tree
- config
- count-objects
- credential
- credential-cache
- credential-store
- cvsexportcommit
- cvsimport
- cvsserver
- daemon
- describe
- diff
- diff-files
- diff-index
- difftool
- diff-tree
- fast-export
- fast-import
- fat
- fetch
- fetch-pack
- filter-branch
- fmt-merge-msg
- for-each-ref
- format-patch
- fsck
- gc
- get-tar-commit-id
- gitk
- gitweb
- grep
- gui
- hash-object
- help
- http-backend
- imap-send
- index-pack
- init
- instaweb
- interpret-trailers
- lfs
- log
- ls-files
- ls-remote
- ls-tree
- mailinfo
- mailsplit
- media
- merge
- merge-base
- merge-file
- merge-index
- merge-one-file
- mergetool
- merge-tree
- mktag
- mktree
- multi-pack-index
- mv
- name-rev
- notes
- p4
- pack-objects
- pack-redundant
- pack-refs
- patch-id
- prune
- prune-packed
- pull
- push
- quiltimport
- range-diff
- read-tree
- rebase
- reflog
- remote
- remote-gcrypt
- remote-tor-annex
- repack
- replace
- request-pull
- rerere
- reset
- restore
- revert
- rev-list
- rev-parse
- rm
- send-email
- send-pack
- sh-i18n
- shortlog
- show
- show-branch
- show-index
- show-ref
- sh-setup
- sparse-checkout
- stash
- status
- stripspace
- submodule
- svn
- switch
- symbolic-ref
- tag
- unpack-file
- unpack-objects
- update-index
- update-ref
- update-server-info
- var
- verify-commit
- verify-pack
- verify-tag
- whatchanged
- worktree
- write-tree

git commands

add	citool	diff-tree	index-pack	multi-pack-index	repack	**status**
am	clean	fast-export	**init**	mv	replace	stripspace
annex	**clone**	fast-import	instaweb	name-rev	request-pull	submodule
annex-shell	column	fat	interpret-trailers	notes	rerere	svn
annotate	**commit**	fetch	lfs	p4	**reset**	switch
apply	commit-graph	fetch-pack	**log**	pack-objects	restore	symbolic-ref
archimport	commit-tree	filter-branch	ls-files	pack-redundant	revert	tag
archive	config	fmt-merge-msg	ls-remote	pack-refs	rev-list	unpack-file
bisect	count-objects	for-each-ref	ls-tree	patch-id	rev-parse	unpack-objects
blame	credential	format-patch	mailinfo	prune	rm	update-index
branch	credential-cache	fsck	mailsplit	prune-packed	send-email	update-ref
bundle	credential-store	gc	media	**pull**	send-pack	update-server-info
cat-file	cvsexportcommit	get-tar-commit-id	**merge**	**push**	sh-i18n	var
check-attr	cvsimport	gitk	merge-base	quiltimport	shortlog	verify-commit
check-ignore	cvsserver	gitweb	merge-file	range-diff	show	verify-pack
check-mailmap	daemon	grep	merge-index	read-tree	show-branch	verify-tag
checkout	describe	gui	merge-one-file	rebase	show-index	whatchanged
checkout-index	**diff**	hash-object	mergetool	reflog	show-ref	worktree
check-ref-format	diff-files	**help**	merge-tree	**remote**	sh-setup	write-tree
cherry	diff-index	http-backend	mktag	remote-gcrypt	sparse-checkout	
cherry-pick	difftool	imap-send	mktree	remote-tor-annex	stash	

Creating a Repository

Make a directory

```
$ cd ~/Downloads
$ mkdir planets
$ cd planets
```

Creating a Repository

Initialize git

```
$ git init
```

Creating a Repository

View git repository

```
$ ls -a
```

Tracking changes in a git repository

Make a file with planet names

```
$ nano planets.txt
```

Tracking changes in a git repository

Add planet names

```
Mercury
Venus
Earth
Mars
Jupiter
Saturn
Uranus
Neptune
```

Tracking changes in a git repository

Close the file

```
ctrl + x --> press Y --> press Enter
```

Tracking changes in a git repository

Check status of the repository

```
$ git status
```

Tracking changes in a git repository

Add changes to git

```
$ git add --all
```

Tracking changes in a git repository

Check status of the repository again

```
$ git status
```

Tracking changes in a git repository

Commit changes to git

```
$ git commit –m “added planets list”
```

Tracking changes in a git repository

Check status of the repository again

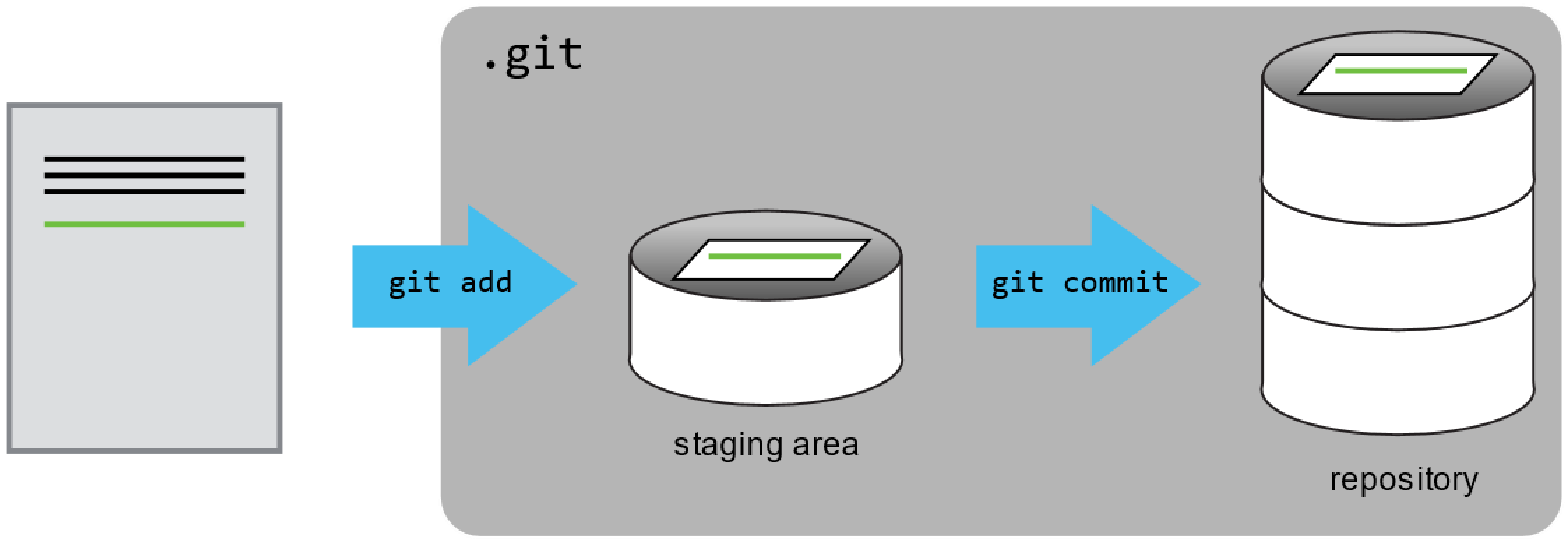
```
$ git status
```

Tracking changes in a git repository

Check log of your activity

```
$ git log
```

Recap

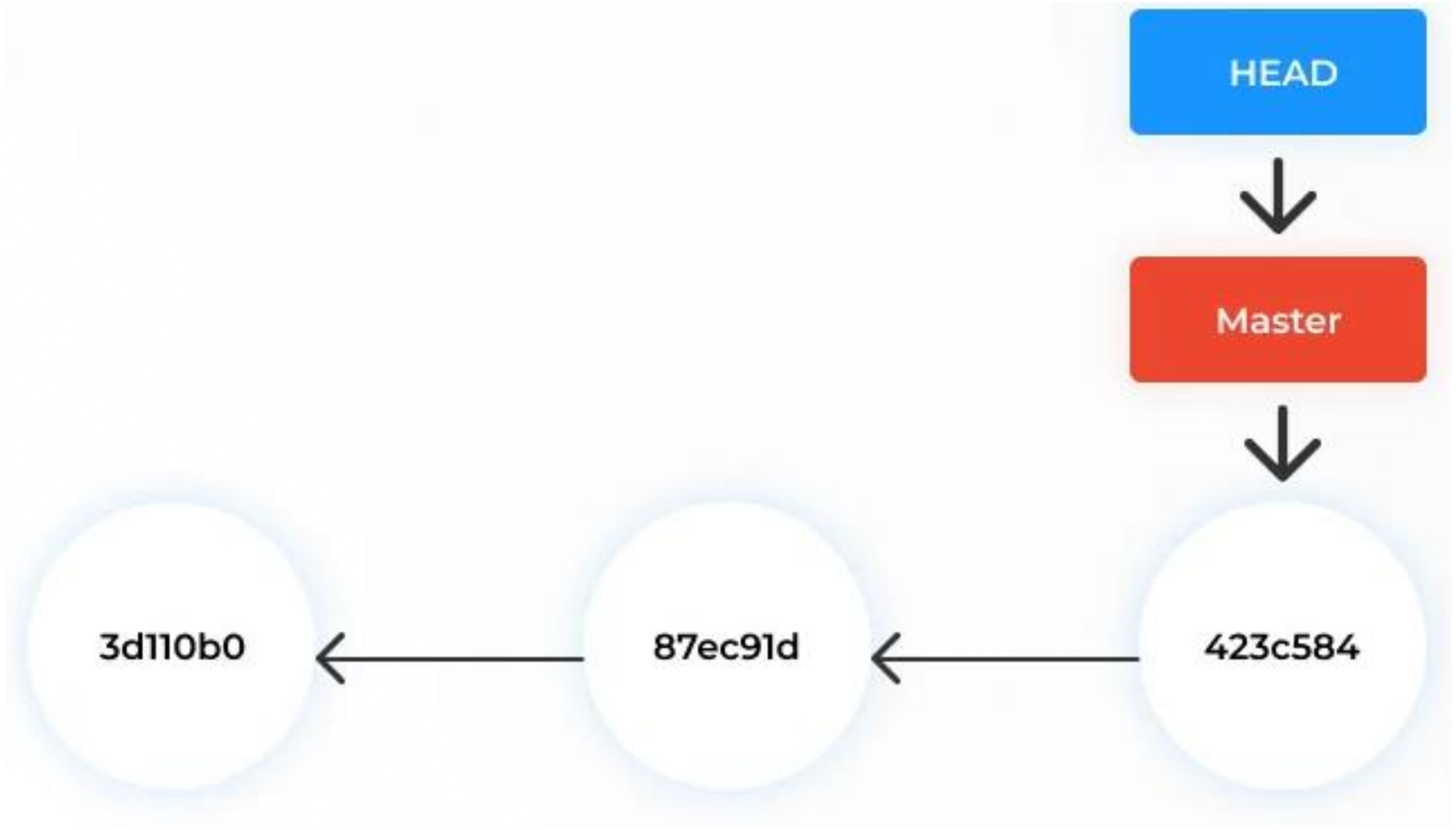


Exercise 6

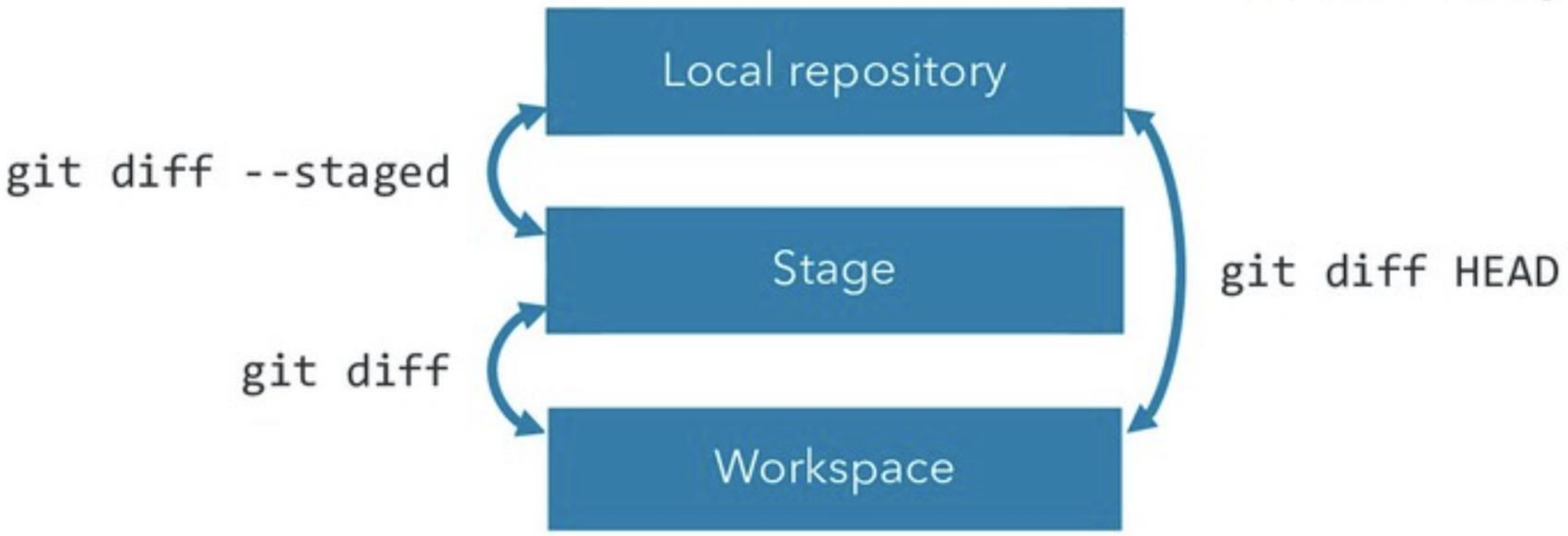
1. Make a directory, naming it as your GitHub user name 1 (ex.: dktanwar1)
2. Initiate this directory as a git repository
3. Make a file: README.md
4. Write a brief introduction about yourself
5. Add the file to git
6. commit the changes with a meaningful message
7. Make a new file: education.md
8. List your education history
9. Add the file to git and commit the changes with a meaningful message
10. Copy content of education.md at the end of README.md
11. Add the changes to git and commit the changes with a message
12. Delete the file education.md
13. Add the changes to git and commit the changes with a message
14. Check the log of your git activity

Quiz 4-9

HEAD



git diff

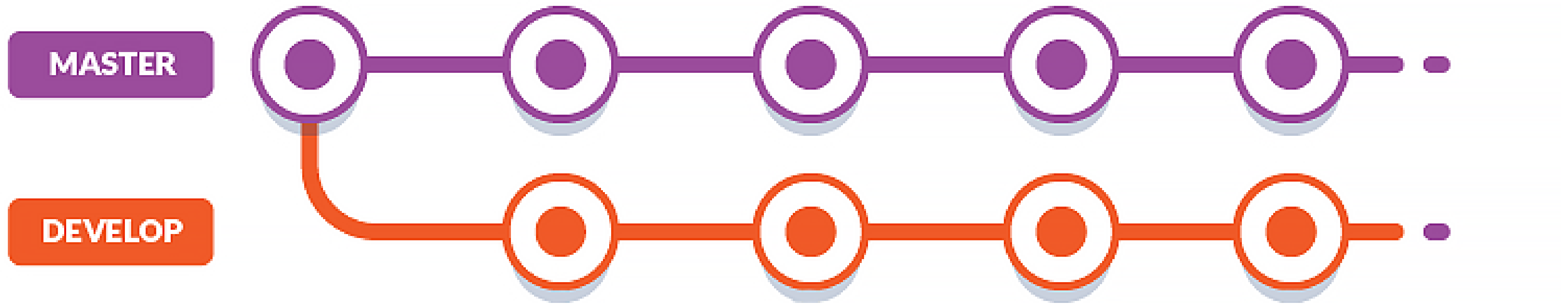

Local repository
Stage
Workspace
git diff --staged
git diff
git diff HEAD

git diff

Diffing is a function that takes two input data sets and outputs the changes between them

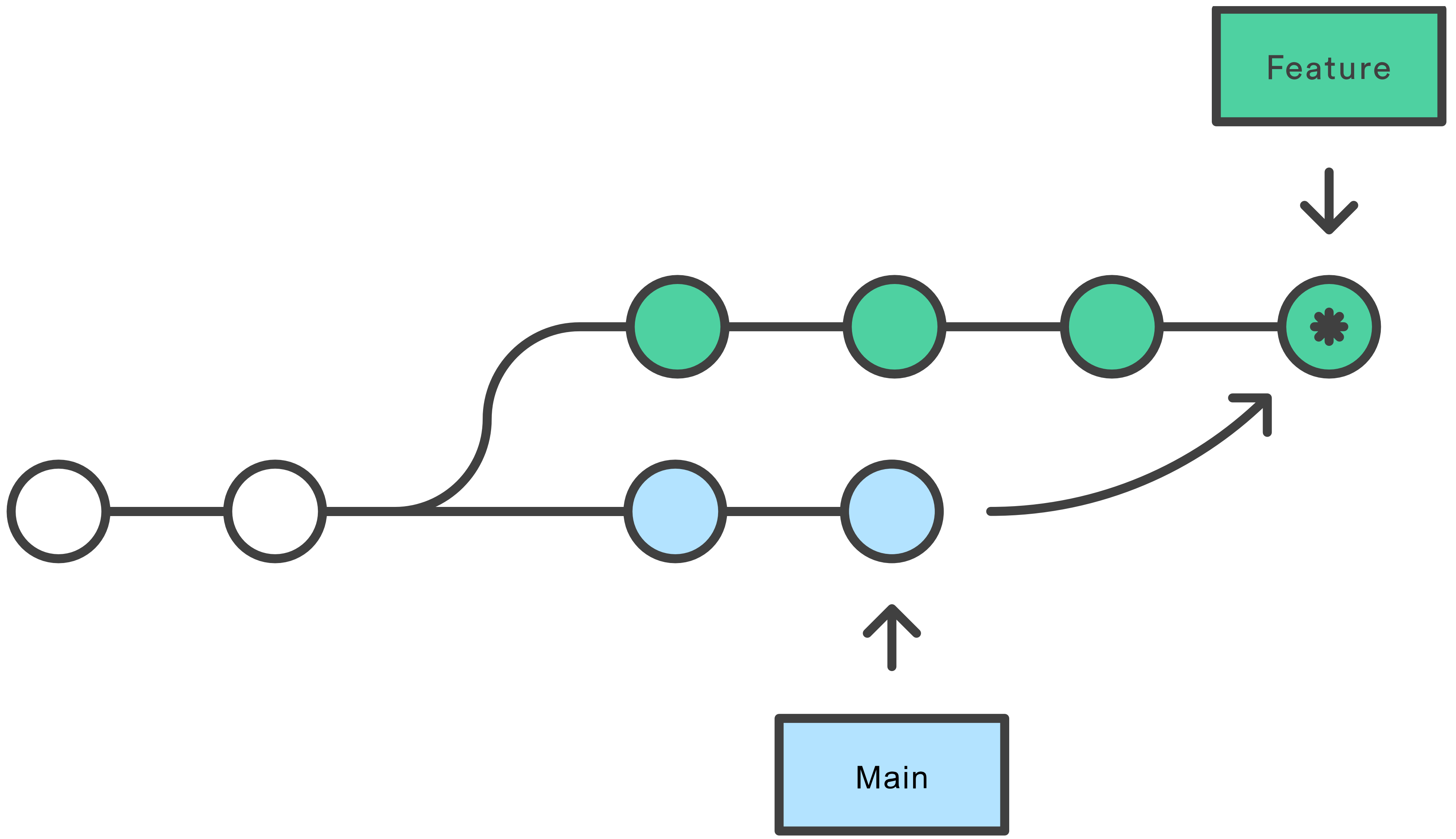
1. Open README.md file and add your hobbies
2. Run git diff
3. Run git diff --staged
4. Run git diff on 2 different commits

git branch and git checkout

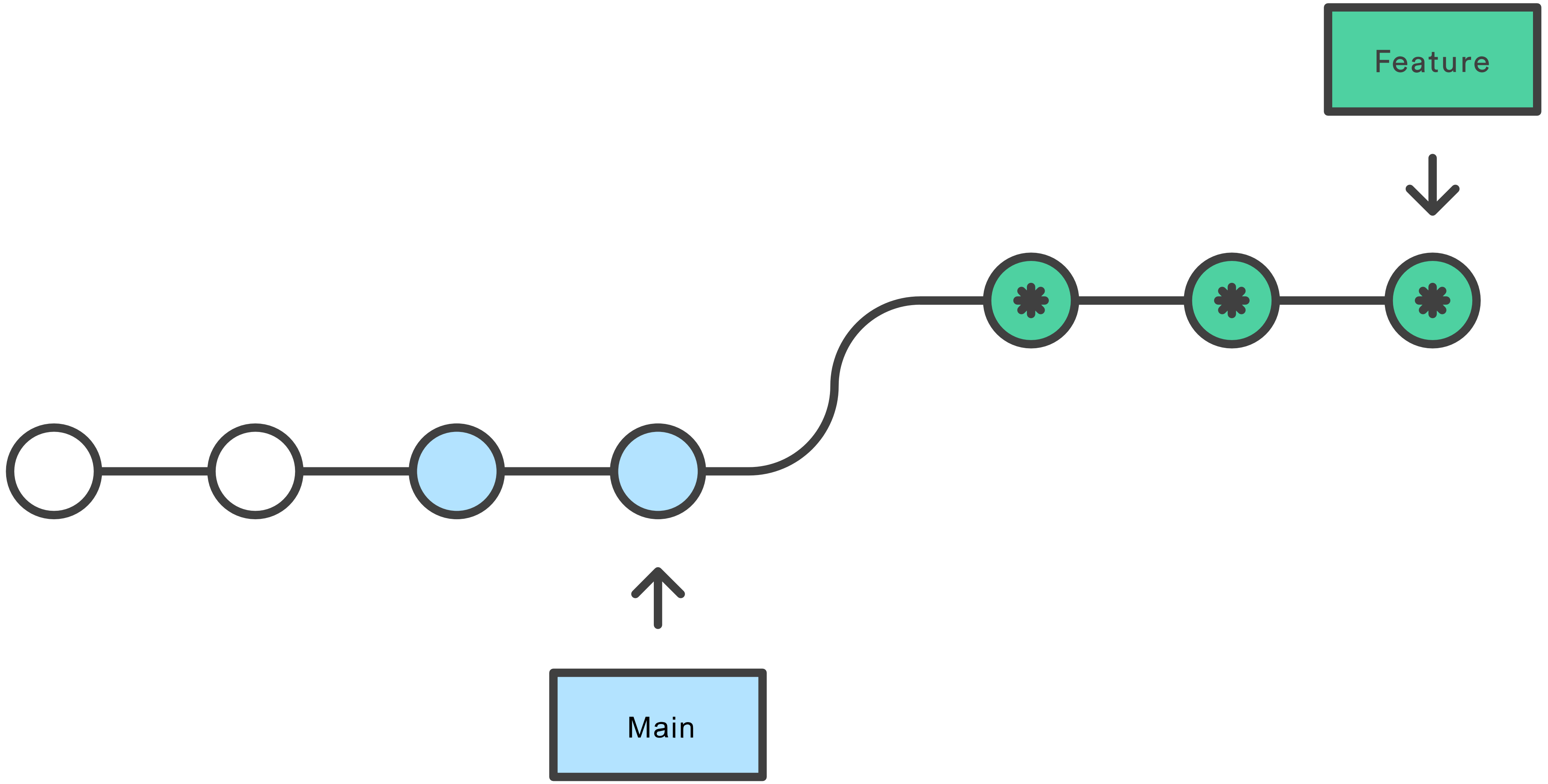


1. Run git branch to check on which branch you are in.
2. Make a new branch called dev
3. Go to the dev branch

git checkout and git merge



git checkout and git merge



git checkout and git merge

1. Make a new file hobbies.md, add it, and commit it
2. Go to the main branch
3. Check for the file hobbies.md
4. Merge dev with main

Exploring git history

How do you check history of your commits?

```
$ git log
$ git log --oneline
```

Go to the content of specific commit.

```
$ git checkout a499ea4
```

Ignore files in git

1. Make a folder called test
2. In the test folder, creates files: test1.txt, test2.txt, test3.txt
3. Check status
4. Make a file, .gitignore and write test/
5. Check status

git reset

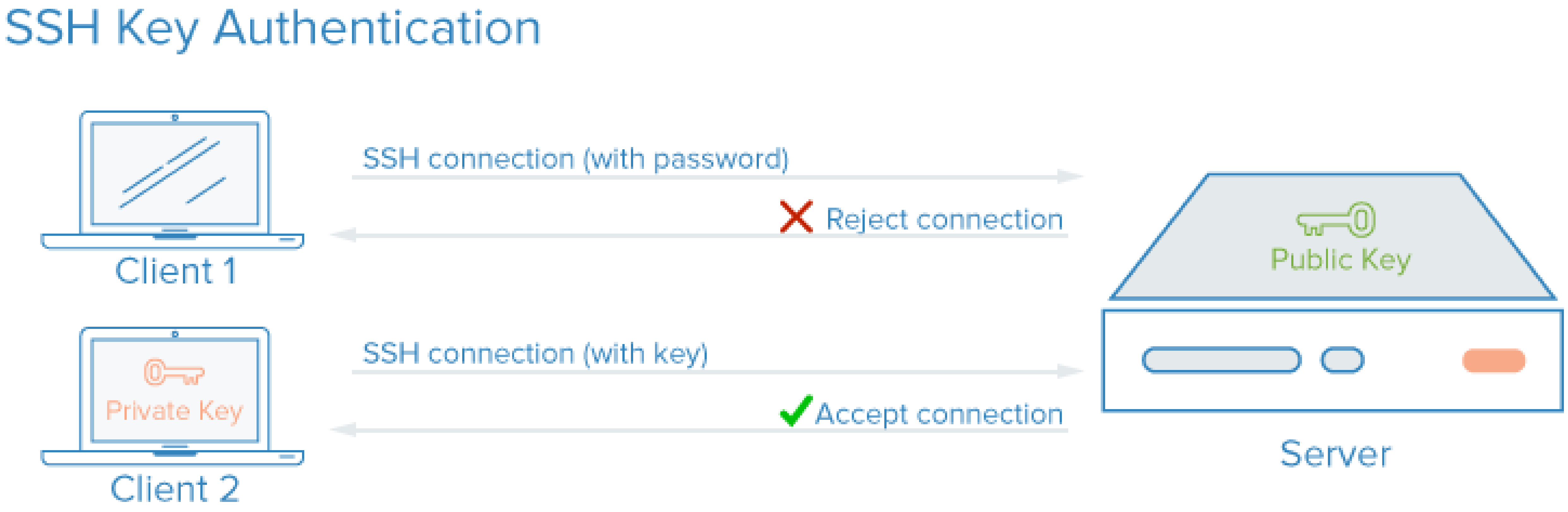
1. Make a file called animal.md (touch animal.md)
2. Check status
3. Add file (git add animal.md)
4. Remove file from adding (git reset animal.md)
5. Add file again, and then commit it
6. Remove file from commit (git reset --soft HEAD~1)
7. Repeat step 5
8. Remove file completely (git reset --hard HEAD~1)

Quiz 10-16

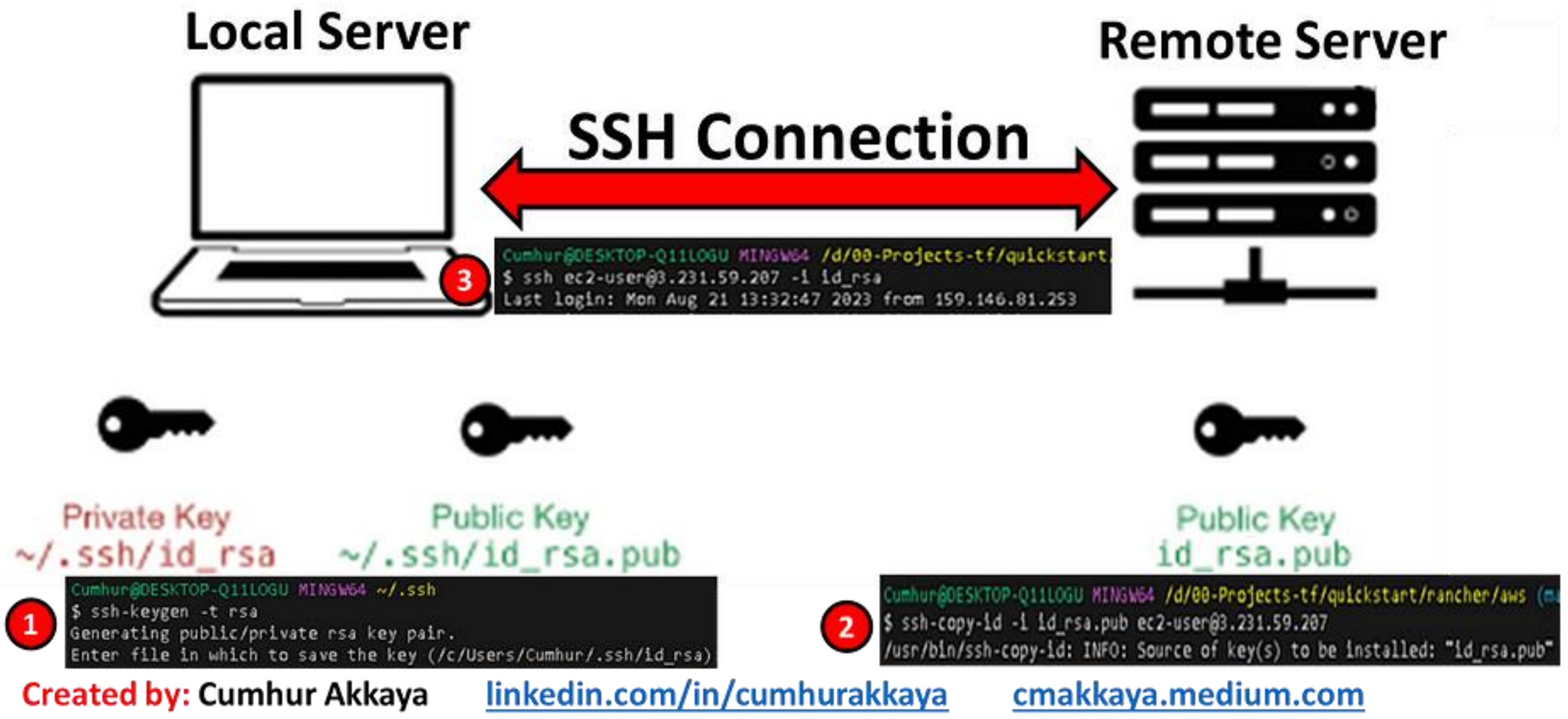
Exercise 7

1. Go to the directory of your GitHub user name1 (ex.: dktanwar1)
2. Open README.md file and add links to your professional profiles (LinkedIn?)
3. Use diff command to compare current state of repo with HEAD
4. Add the file to git and compare changes of local repo (git database) with staged changes
5. Commit the change.
6. Compare the first commit of your git repo with the last commit
7. Make a new branch and give it your first name
8. Check how many branches you have and then go to your name branch
9. Make a new file: test.md and write your favorite color in it
10. Add and commit the changes with a message
11. Go back to main branch and check if test.md file is there. If not, merge the your name branch with main branch
12. Make a new file: test2.md and ignore this file from git

ssh key


SSH Key Authentication
SSH connection (with password)
Reject connection
Client 1
Private Key
Client 2
SSH connection (with key)
Accept connection
Public Key
Server

ssh key



```
Cumhur@DESKTOP-Q11LOGU MINGW64 /d/00-Projects-tf/quickstart
$ ssh ec2-user@3.231.59.207 -i id_rsa
Last login: Mon Aug 21 13:32:47 2023 from 159.146.81.253
```

```
Cumhur@DESKTOP-Q11LOGU MINGW64 ~/.ssh
$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/c/Users/Cumhur/.ssh/id_rsa)
```

```
Cumhur@DESKTOP-Q11LOGU MINGW64 /d/00-Projects-tf/quickstart/rancher/aws (m
$ ssh-copy-id -i id_rsa.pub ec2-user@3.231.59.207
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "id_rsa.pub"
```

ssh key setup

1. Check if key exists
```
ls -al ~/.ssh
```
2. Generate the key
```
ssh-keygen
```
3. Check again
```
ls -al ~/.ssh
```
4. Copy the public key
```
cat ~/.ssh/id*.pub
```
5. Add the public key to your GitHub account

Final exercise

https://github.com/DQBM-SIB/intro_git_github

File: final_exercise.md

Applications of git & GitHub

- Version control of files
- Access to all the changes made
- Collaboration across the world
- Everything remains at the same place: Issue, Wiki, and Commits
- Working in parallel
- **Genomic Data Science:** Version controlled reproducible data analysis

Thank you!

Please provide the course feedback!