Seminar 3

Python for Data Analysis

Agenda

Standard Library

Python Modules

Import Statements

Install python Packages

Data Analysis Packages

Pandas

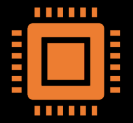
Matplotlib

Standard Library

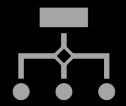
- Built-in Python
  - Every Python session has access to everything we've learned
  - The built-ins are general purpose building blocks: "primitive" data, control flow statements, basic operators, etc

- every Python installation also comes with special functions, methods, data types, operators to address specific types of problems
- Not imported by default

Python Modules

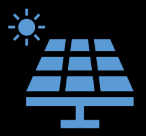


any .py file can also be referred to as a "Python module"



modules can be imported using one of four styles of import syntax. here's one of them

the list of modules already accessible to any vanilla Python installation because they are in the stdlib are listed online at https://docs.python.org/3/library/ ⇢

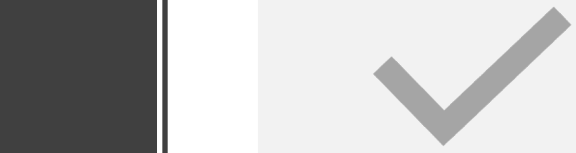


importing a module makes its code definitions accessible in whatever environment they are being imported to

Anatomy of import syntax 1

if import syntax is:

```
import module_name
```



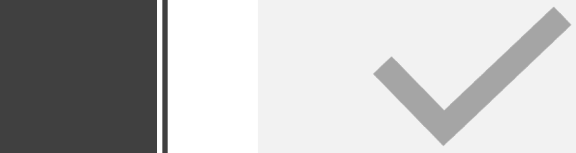
then call syntax is:

```
module_name.member_name
```

Anatomy of import syntax 2

if import syntax is:

```
import module_name as alias
```



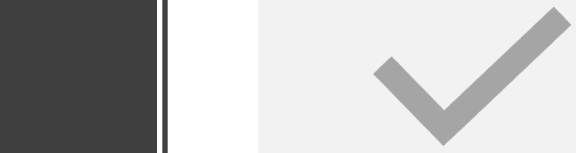
then call syntax is:

```
alias.member_name
```

Anatomy of import syntax 3

if import syntax is:

```
from module_name import member_name
```



then call syntax is:

```
member_name
```

stdlib greatest hits

datetime

random.seed, random.random

os.path.exists, os.path.join, os.path.abspath

csv.reader, csv.DictReader

csv.writer

json.loads, json.dumps

Exercise
Get your feet wet

- In the Python interpreter, try using the 3 different styles of import syntax to import the following **functions**, and call them properly based on the type of import syntax you used.
  - random.random
  - os.getcwd

You will need to exit and re-enter your python session to clear your prior import syntax each time.

Introducing our data analysis packages

Pandas

- used for processing tabular data
- core data type is the DataFrame
- port of R's DataFrame paradigm

Matplotlib

- used to generate charts such as histograms or box plots from Python data structures
- port of MATLAB's charting functionalilty

Pandas

DataFrame

Series

Python attributes

DataFrame indexing

Query DataFrames with Boolean series

Create a pandas dataframe

var_name = pd.convenience_method(path_as_string)

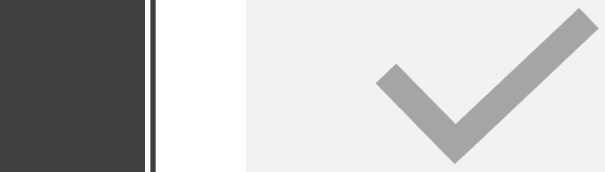
read_csv

read_table

read_json

read_excel

read_html



a two dimensional data structure representing tabular data

has *columns* and *rows*

each column's data is of the same *data type*

use a convenience function against a file on disk

- pd.read_csv, for CSV data
- pd.read_table, for general reading of tabular data, including .tsv files
- pd.read_json for JSON data
- pd.read_excel for Excel files, particularly useful for excel files with many sheets
- pd.read_html for reading HTML <table>s

Creating a pandas dataframe inline

- var_name = pd.DataFrame(data=data_castable_to_dataframe)
- var_name = pd.DataFrame(data=data_castable_to_dataframe, columns=list_of_column_names)

Attributes

Python attributes

- instances of more complex data types have **attributes** associated with them
- they are accessible using the dot notation like variable_name.attribute_name
- these are not callable - in practical terms to us at this point, this means they don't need the parentheses () after them - and simply return the static data that attribute refers to

DataFrame attributes

- DataFrames are one case of a data type that has attributes associated with them
- three interesting ones for us are
  - DataFrame.columns
  - DataFrame.shape
  - DataFrame.values

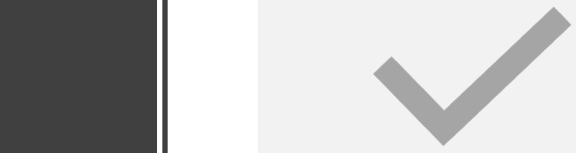
Series

Attributes:

series.name

series.dtype

series.shape



is effectively the one-dimensional representation of a DataFrame axis - for example one row, or one column.

Exercise
Get your feet wet

- Load the data as a pandas DataFrame.
  - HINT: Use a convenience method to pull the data into a DataFrame from a file path!
- Describe the data in the DataFrame using the describe() method.
- Select just row 5 from the DataFrame. Now how about the value from row 5, column 2. How about selecting a whole column by its label?
- Use the groupby() method against a categorial column in your data.

Applying custom logic cellwise

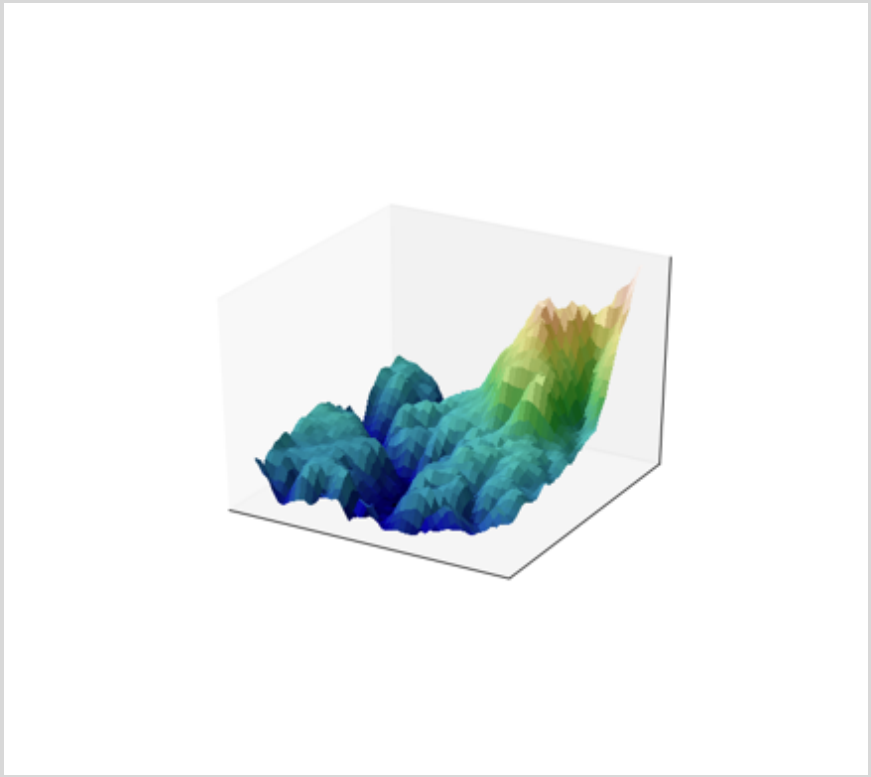
- Write a program that prints the numbers from 1 to 100. But for multiples of three print “Fizz” instead of the number and for the multiples of five print “Buzz”. For numbers which are multiples of both three and five print “FizzBuzz”

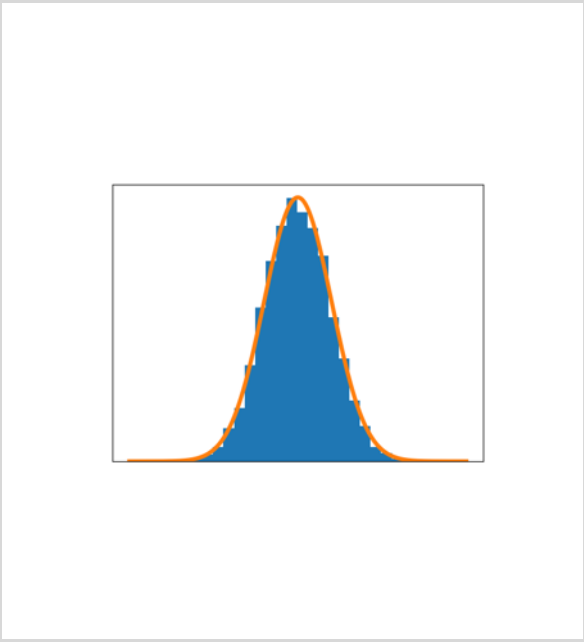
Exercise
Get your feet wet

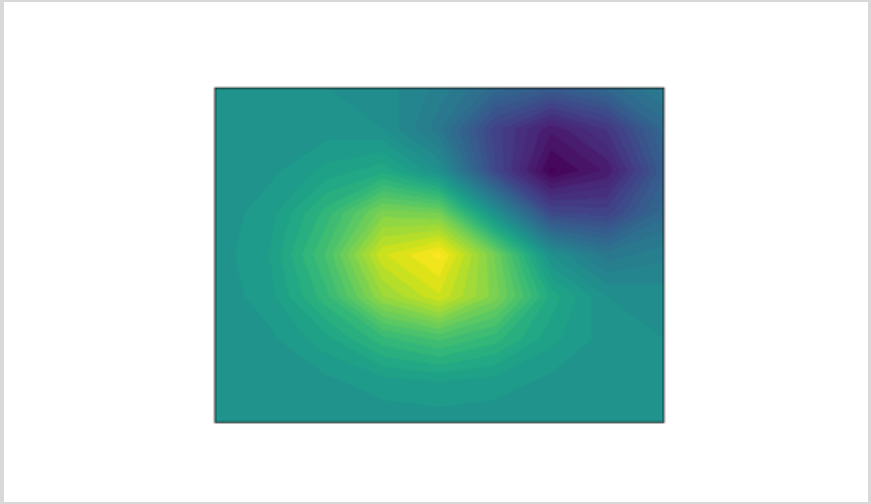
- Using the chipotle.tsv file from Canvas, answer the following questions. (HINT: What convenience method works on .tsvs?)
- What is the number of observations in this dataset?
  - HINT: (1) and (2) can be answered with the same DataFrame attribute!
- What is the number of columns in the dataset?
- What are the names of all the columns of this dataset?
- What was the most ordered item?
  - HINT: Consider a groupby with an aggregation!
  - HINT: You will need to add up the quantity field across items of the same item_name and look at the results. There is an aggregation method called sum().
- How many times was a Veggie Salad Bowl ordered?

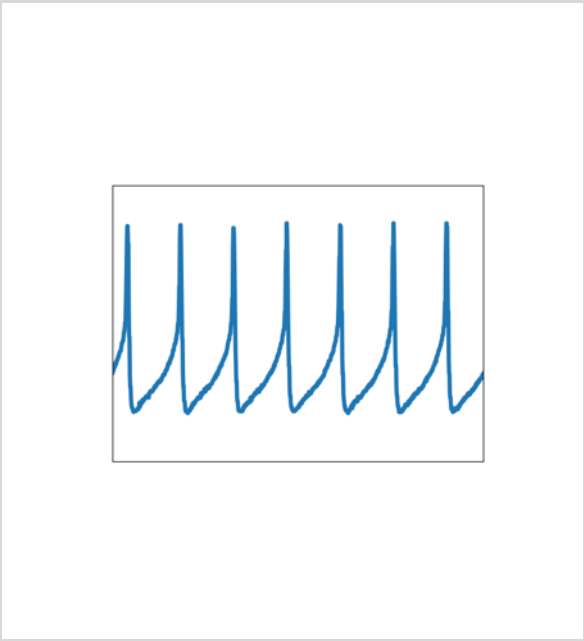
Matplotlib: Visualization with Python

- a comprehensive library for creating static, animated, and interactive visualizations in Python.



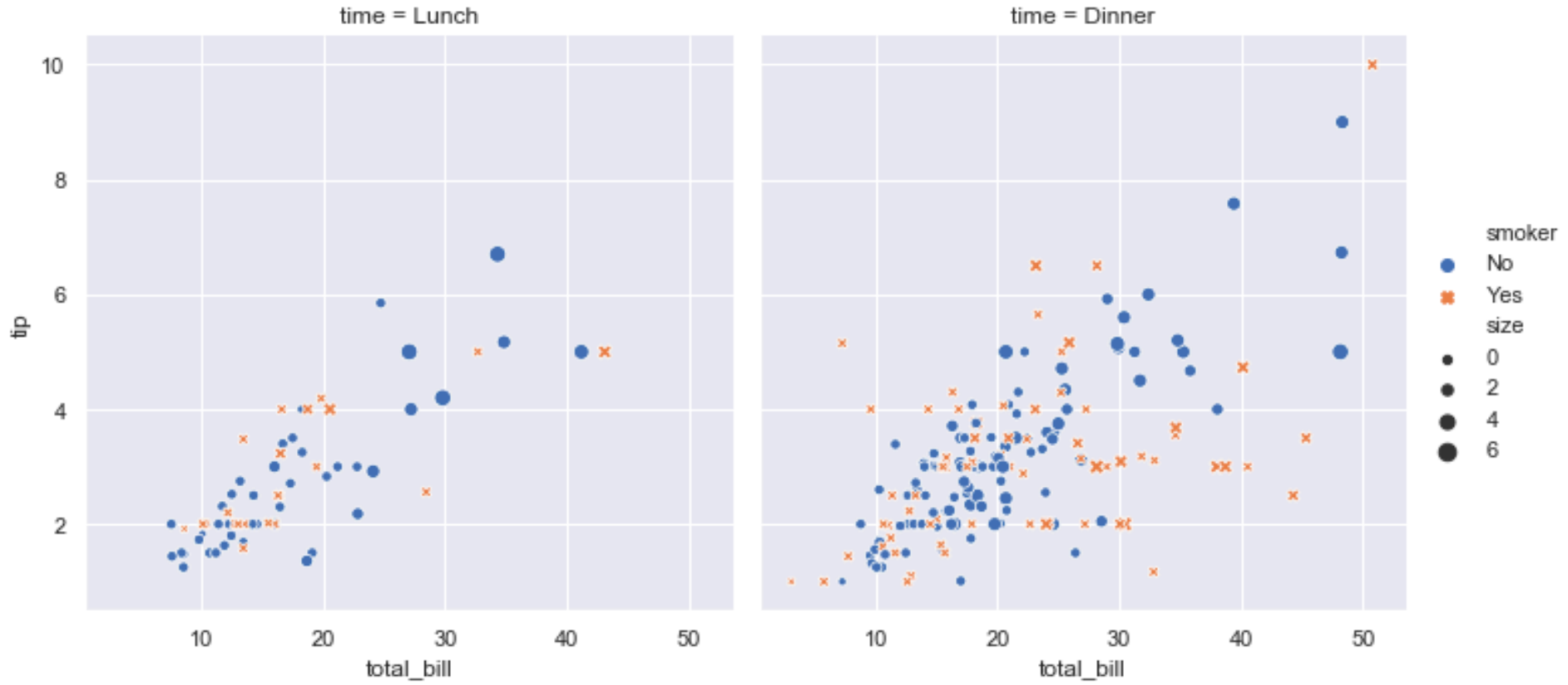




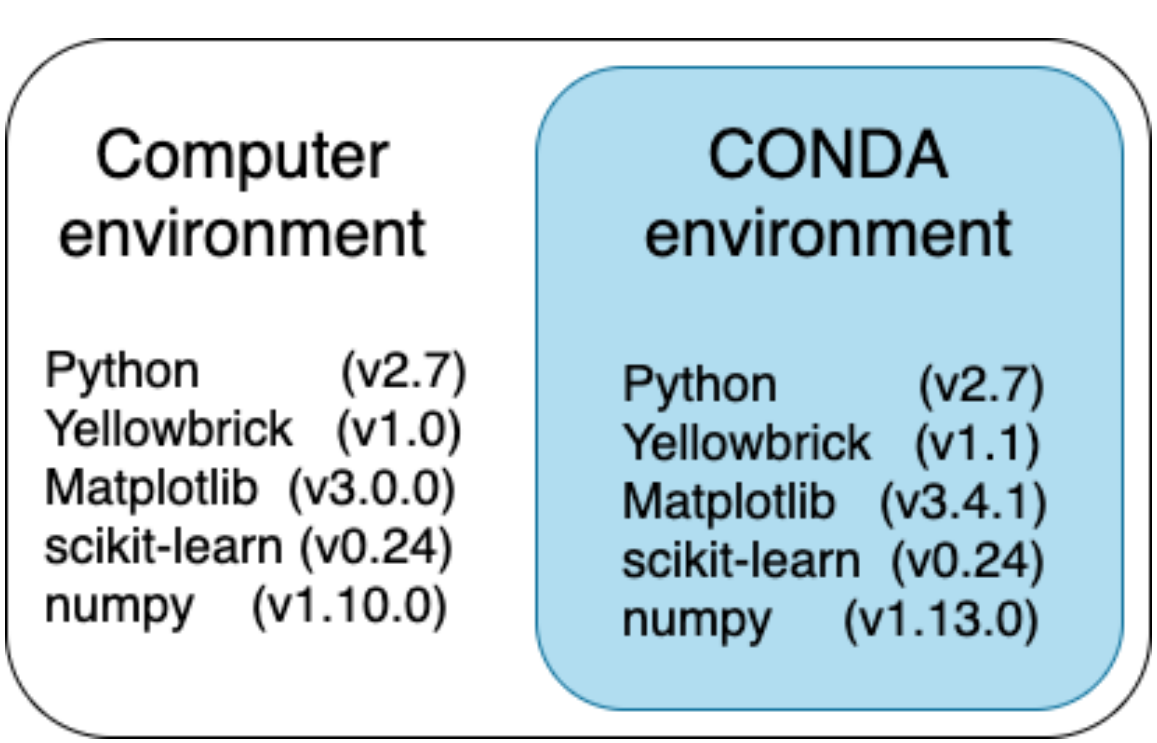


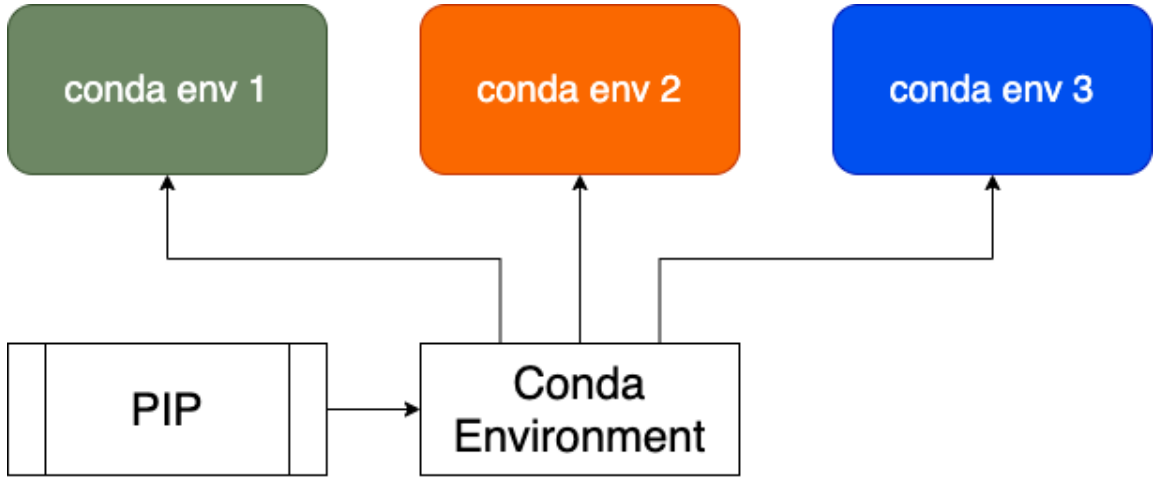
Seaborn: statistical data visualization

A Python data visualization library based on matplotlib. It provides a high-level interface for drawing attractive and informative statistical graphics

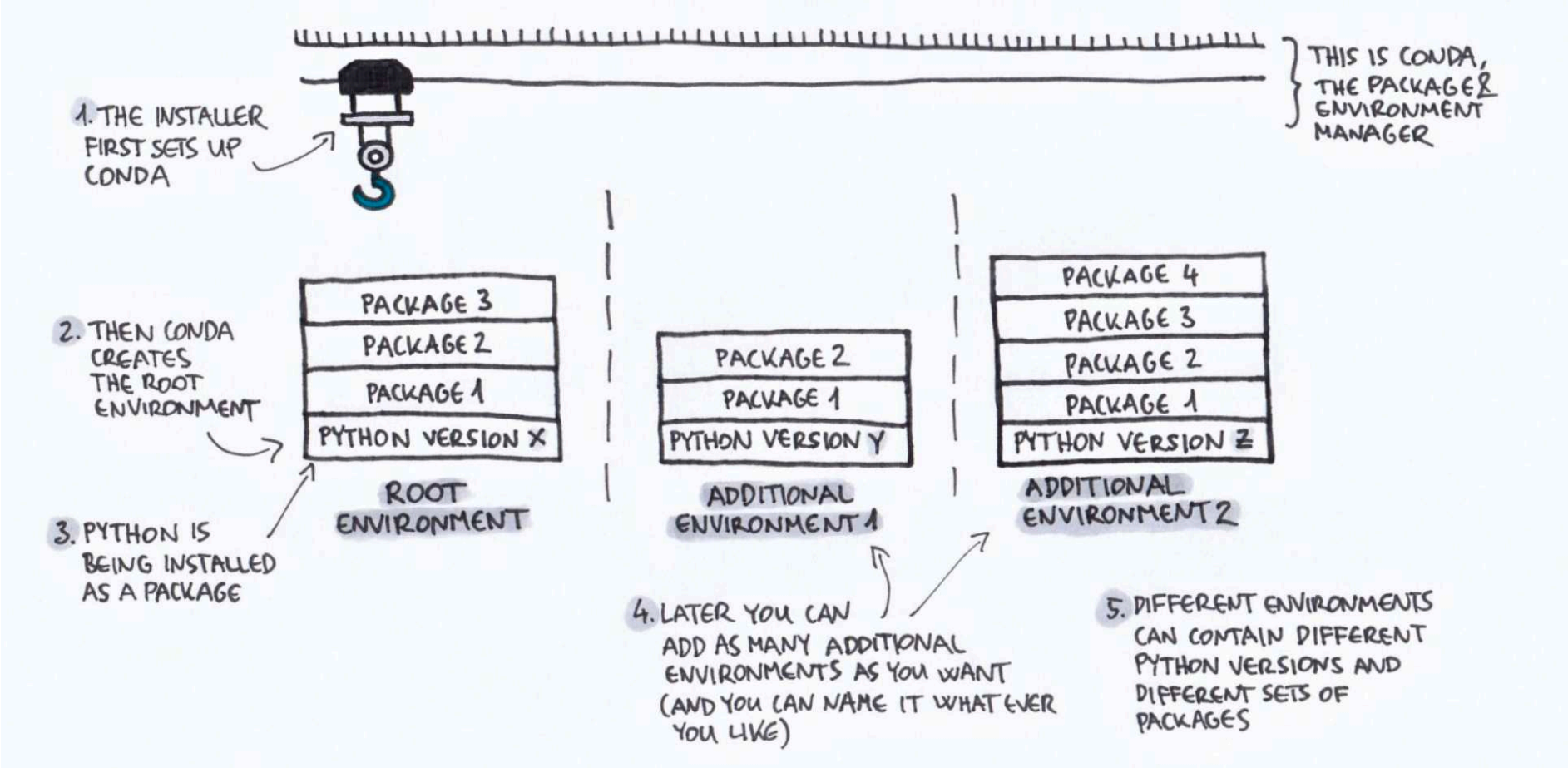


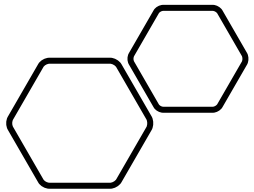
Virtual Environments





Virtual Environments





Collaboration

Why do we need Version Control Systems?

Version Control System

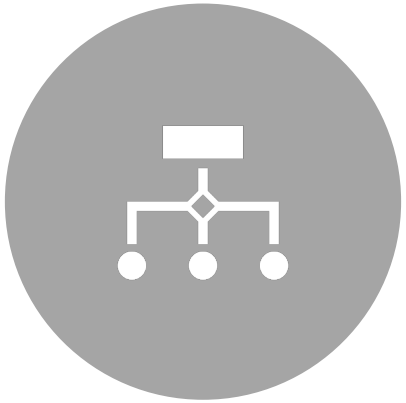
WHAT IS IT?

WHY DO WE NEED IT?

HOW DO WE USE IT?

What is a Version Control System?

IT IS A CATEGORY OF SOFTWARE THAT HELPS YOU MANAGE FILES OVER TIME.



IT TRACKS EVERY MODIFICATION TO THE FILES

IF MISTAKES ARE MADE OR IF FILES ARE DELETED, THEY CAN BE RESTORED TO THEIR PREVIOUS STATE.

GIT – How do we use Version Control?

Git is a Popular Version Control System

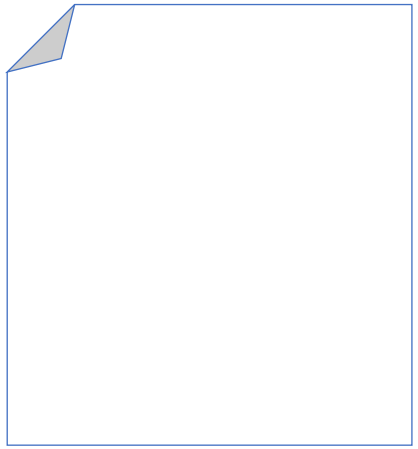
- Repository - A location where files are stored

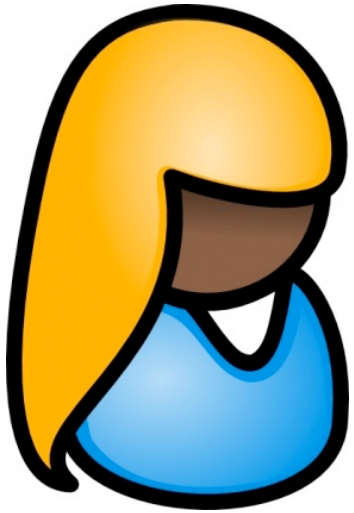
Git Commands

- git init – Initialize a git repositiory (repo)
- git clone – Copy a remote repo
- git status – Show the current state of the repository
- git add – Add changes to a staging area
- git commit – Save changes
- git branch – Create a copy of a repo
- git checkout – Switch between different copies of a repo
- git merge – Combine changes from different copies of a repo
- git push – Send file changes to another remote repo (GITHUB)
- git pull – Retrieve file changes from a remote repo (GITHUB)

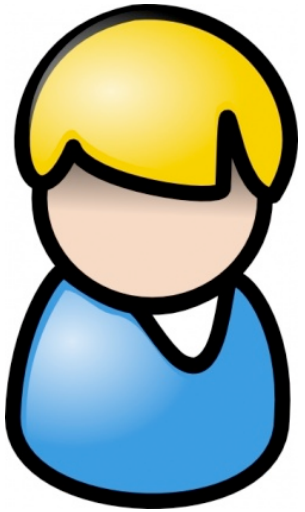
Git and Github

You must work with people

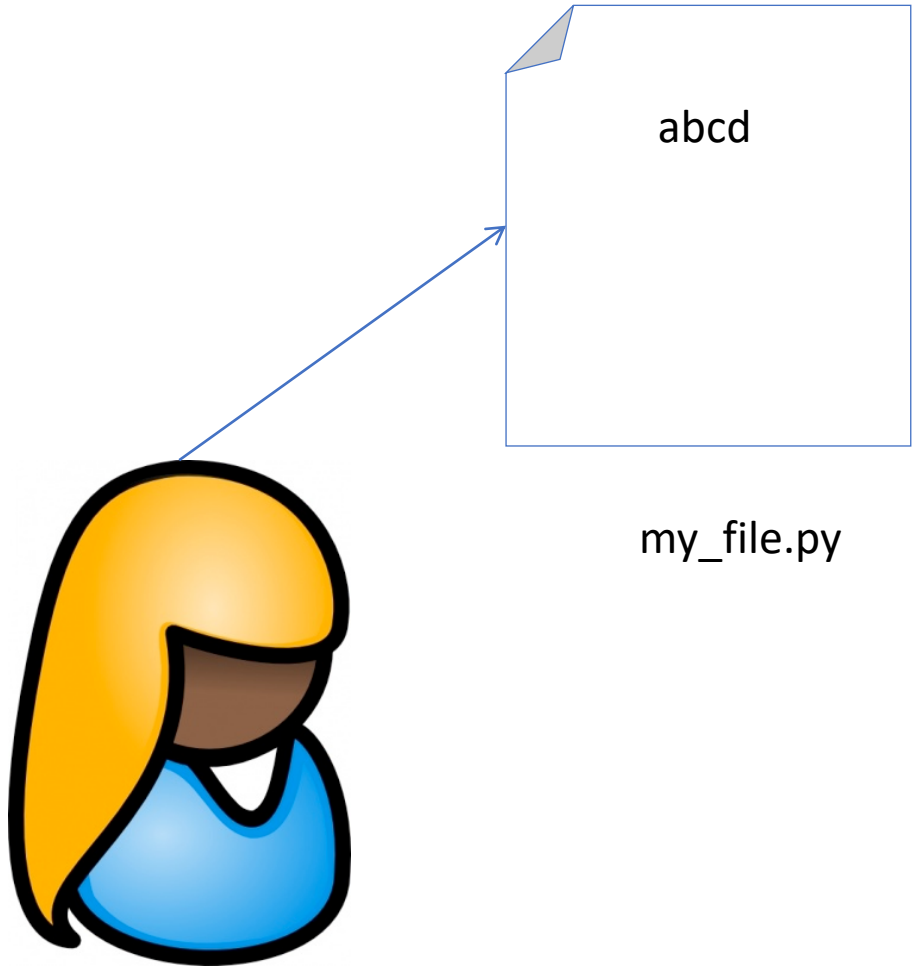


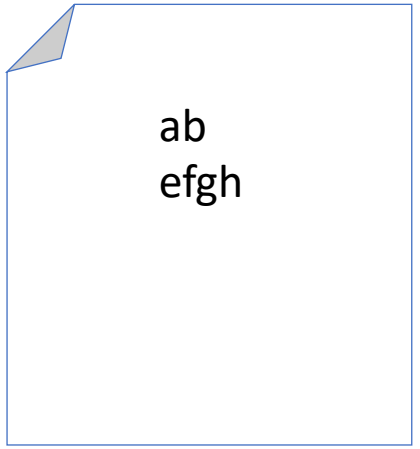


Hello, my name is Sally

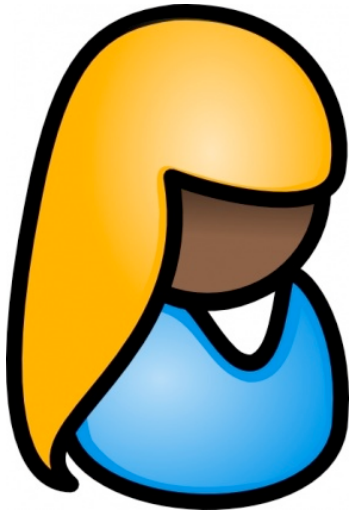


Hello, my name is Bob


abcd
my_file.py
Hello, my name is Sally
Hello, my name is Bob



my_file_bob.py



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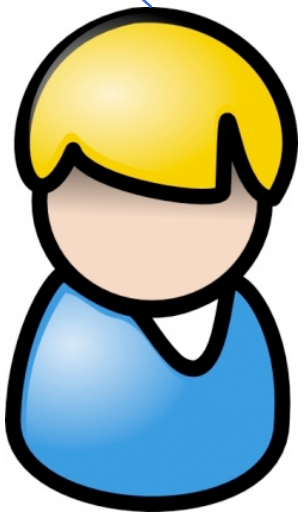
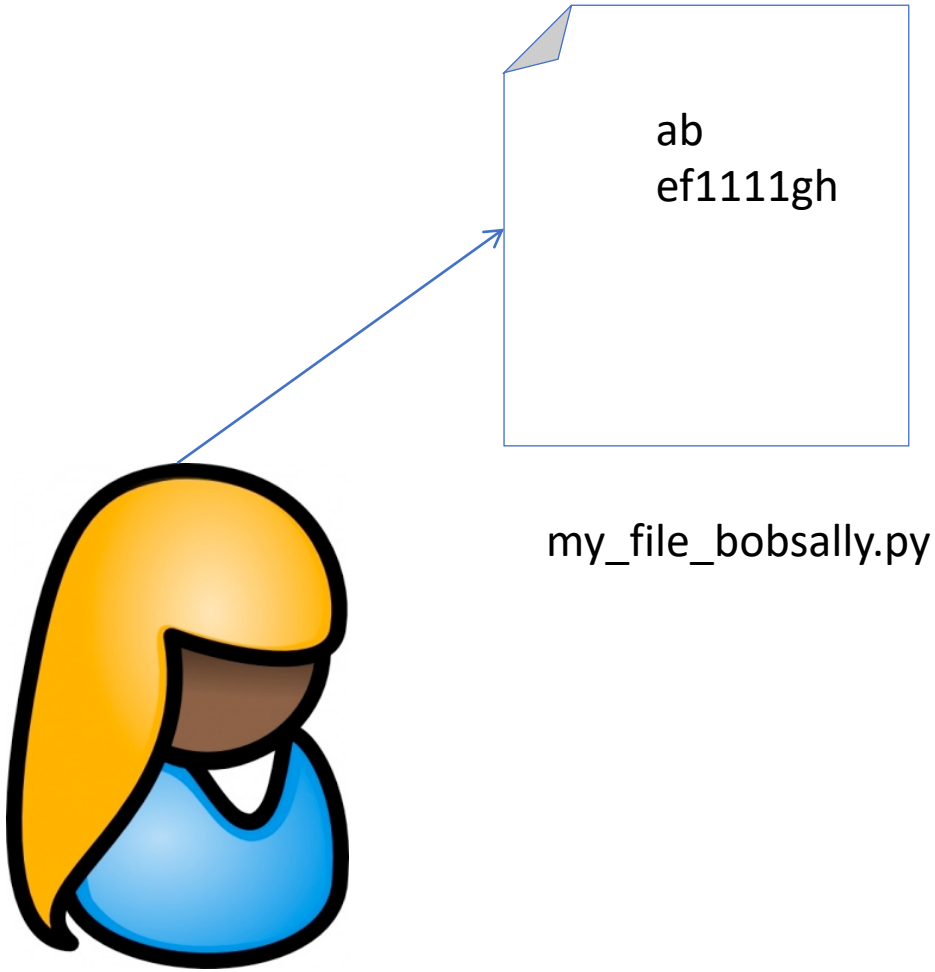
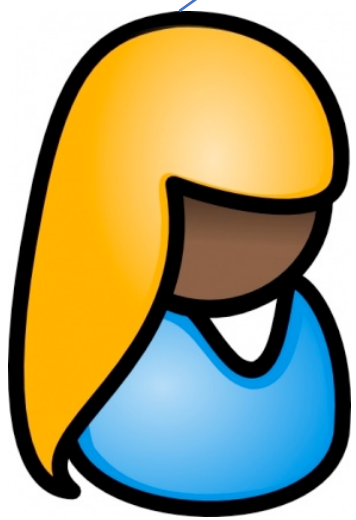


Hello, my name is Bob


ab
ef1111gh
my_file_bobsally.py
Hello, my name is Sally
Hello, my name is Bob



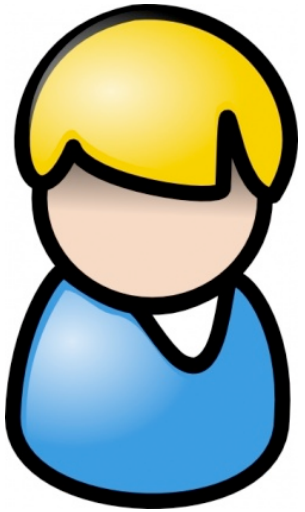
Hello, my name is Sally

ab
ef1111gh

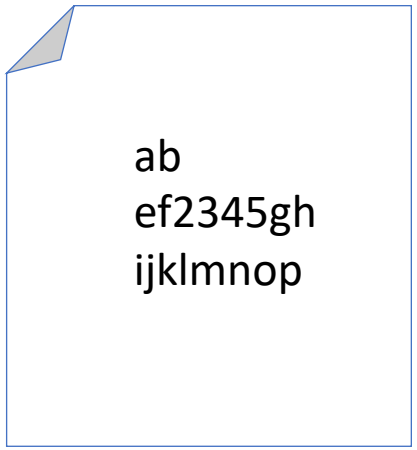
my_file_bobsally.py

ab
ef2345gh
ijklmnop

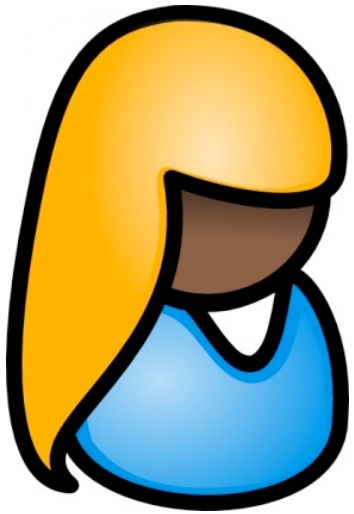
my_file_bob_2.py



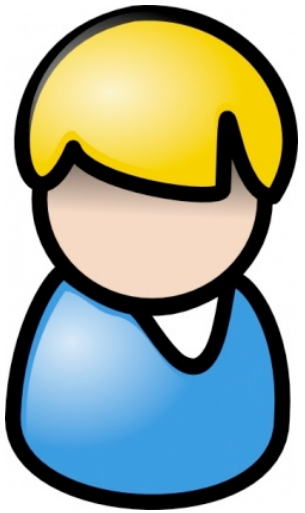
Hello, my name is Bob



my_file_bob2_FINAL.py

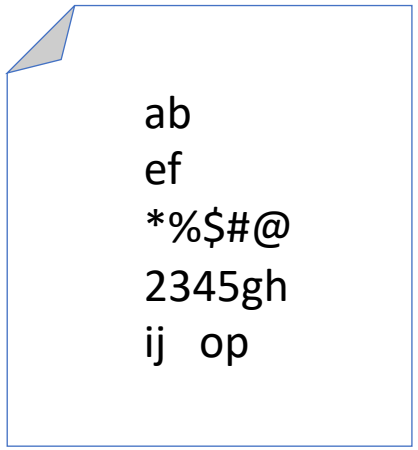


Hello, my name is Sally

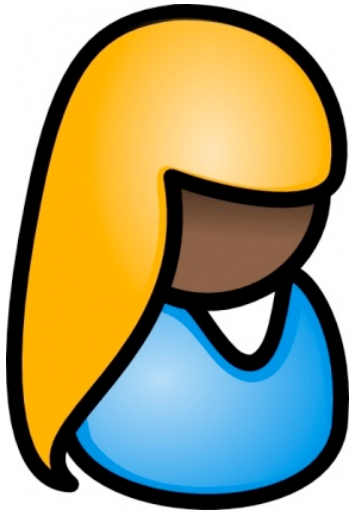


Hello, my name is Bob

CHAOS



my_file_bob2_FINALFINAL.py



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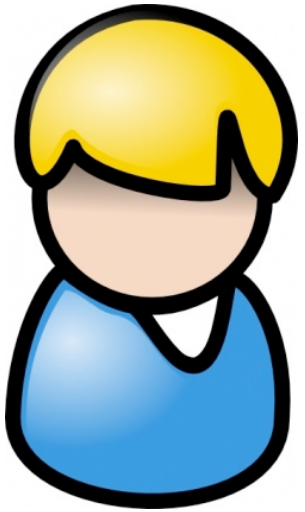
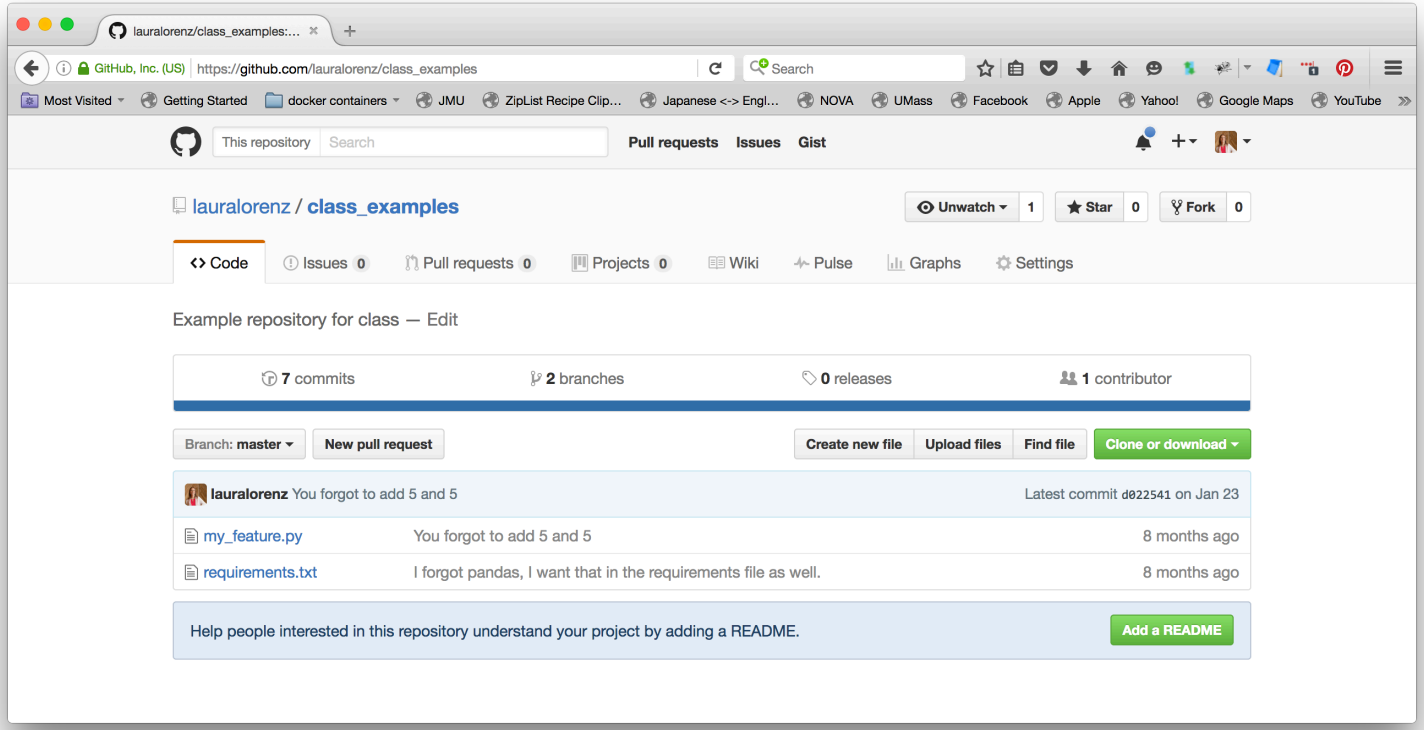
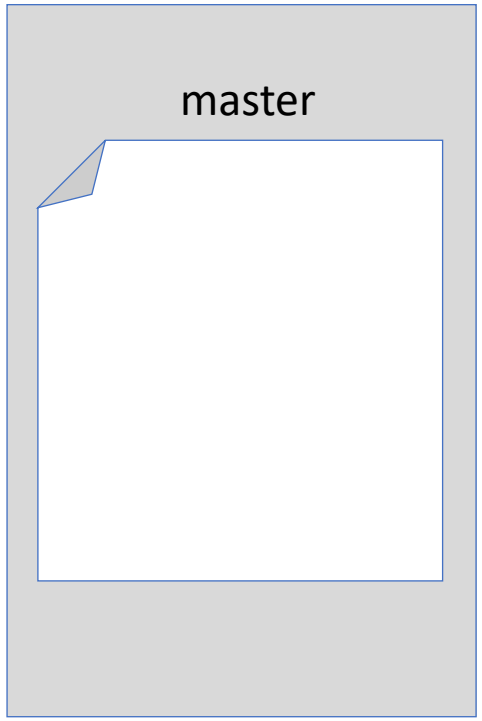


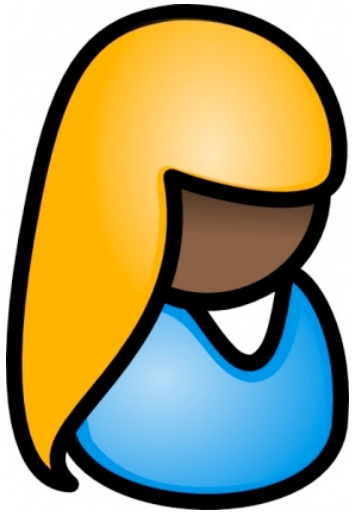
Hello, my name is Bob

Git and Github



It can be better





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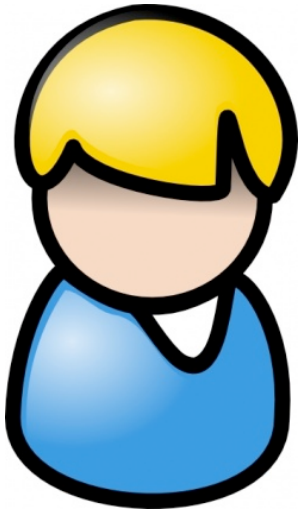
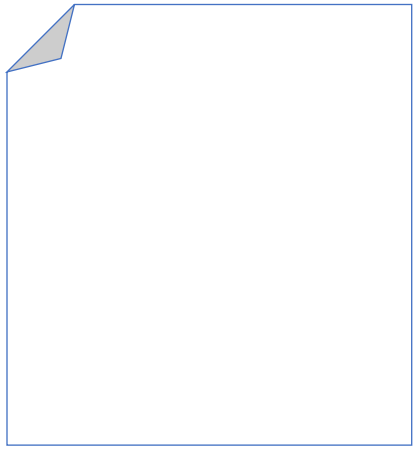


Hello, my name is Bob

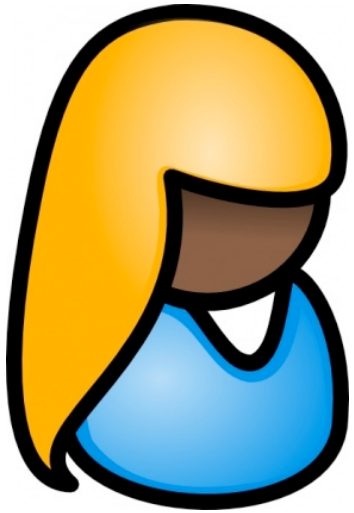


branch

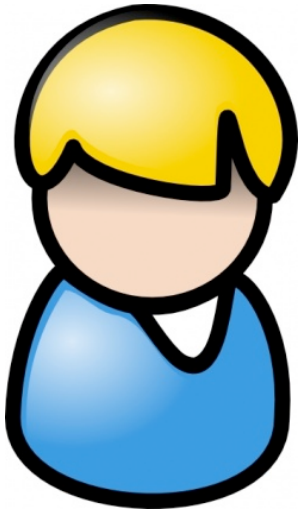
sallys_branch

master

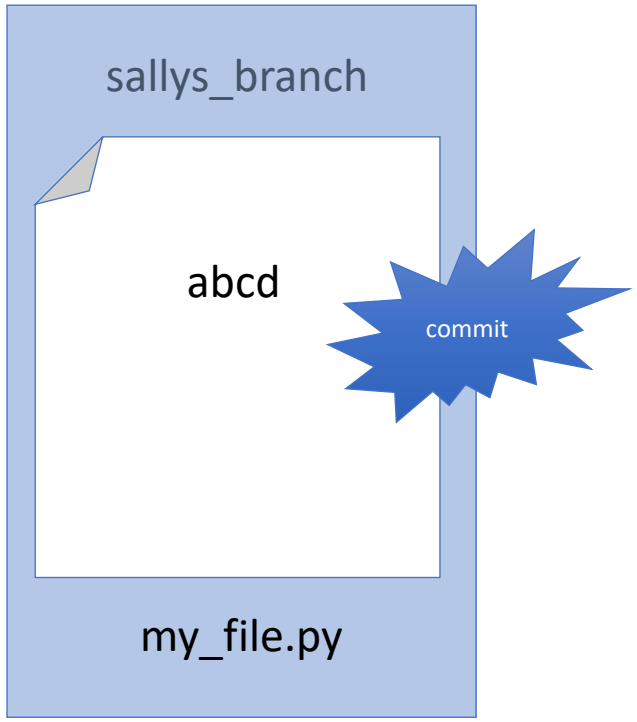
my_file.py

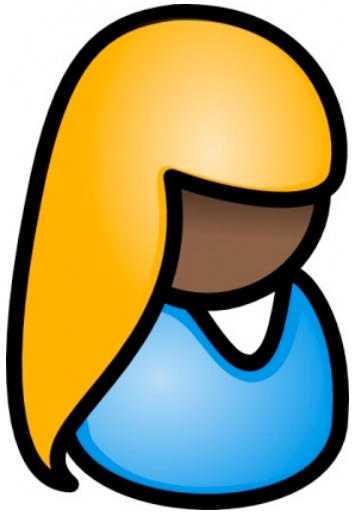


Hello, my name is Sally

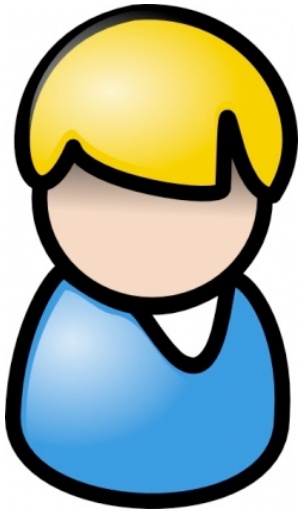


Hello, my name is Bob

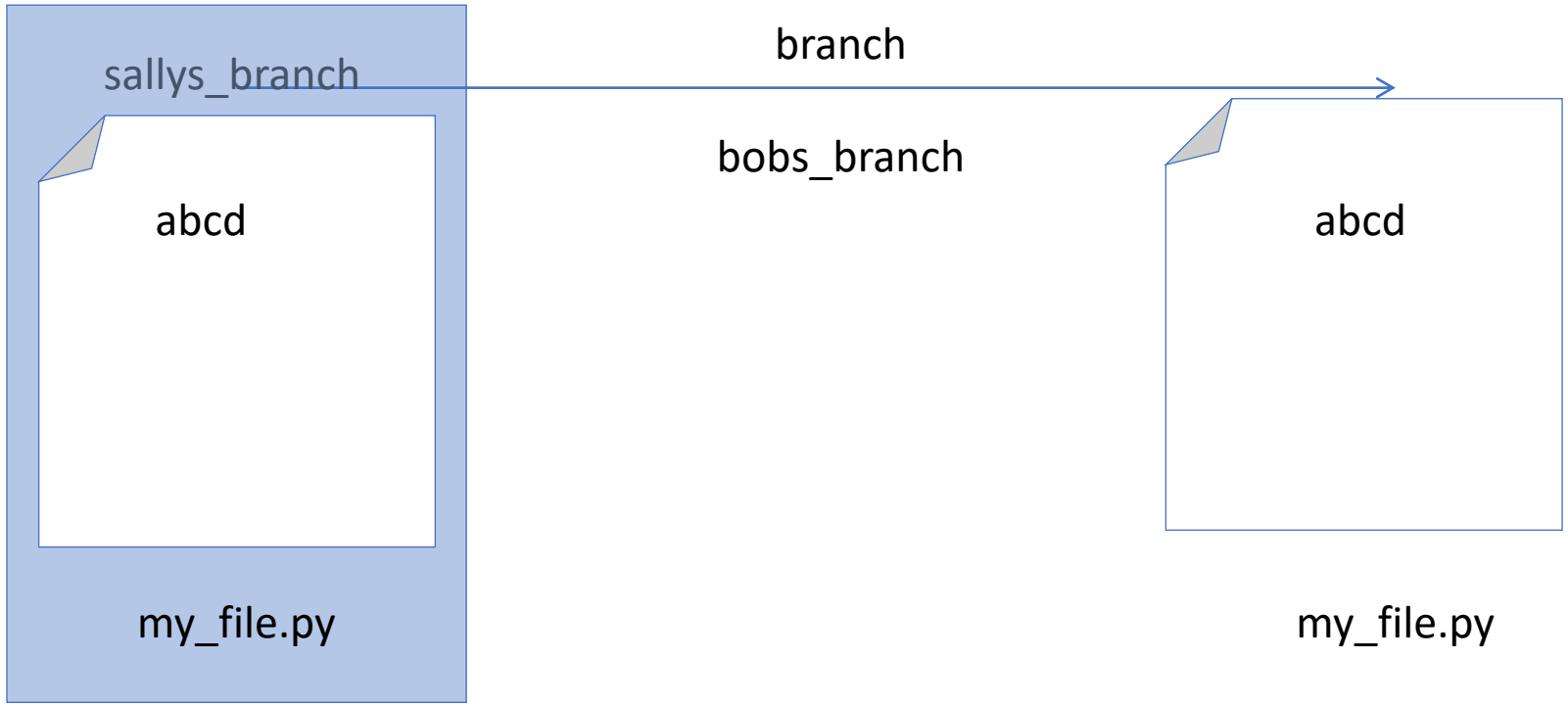


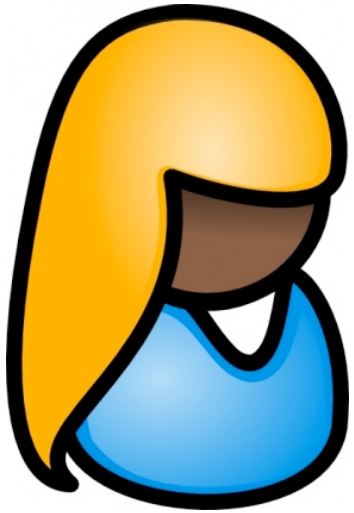


Hello, my name is Sally



Hello, my name is Bob





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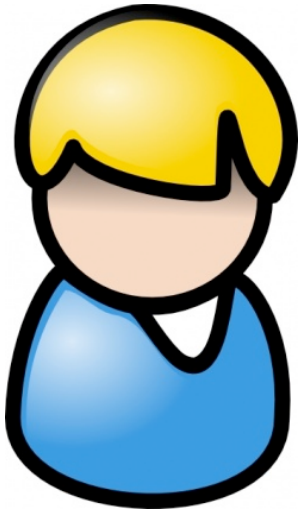

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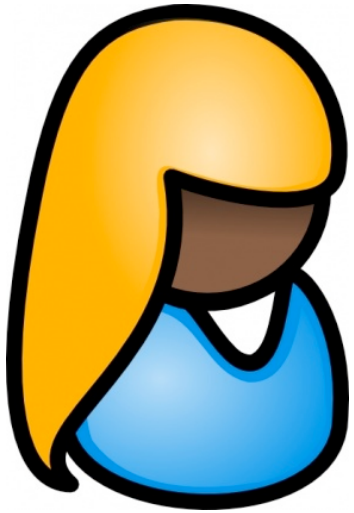

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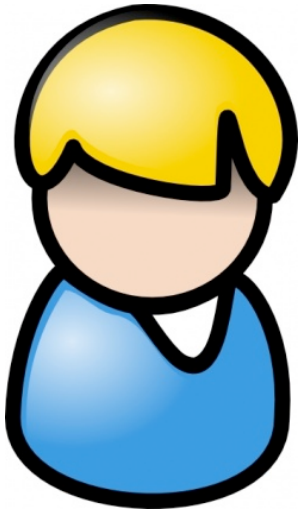

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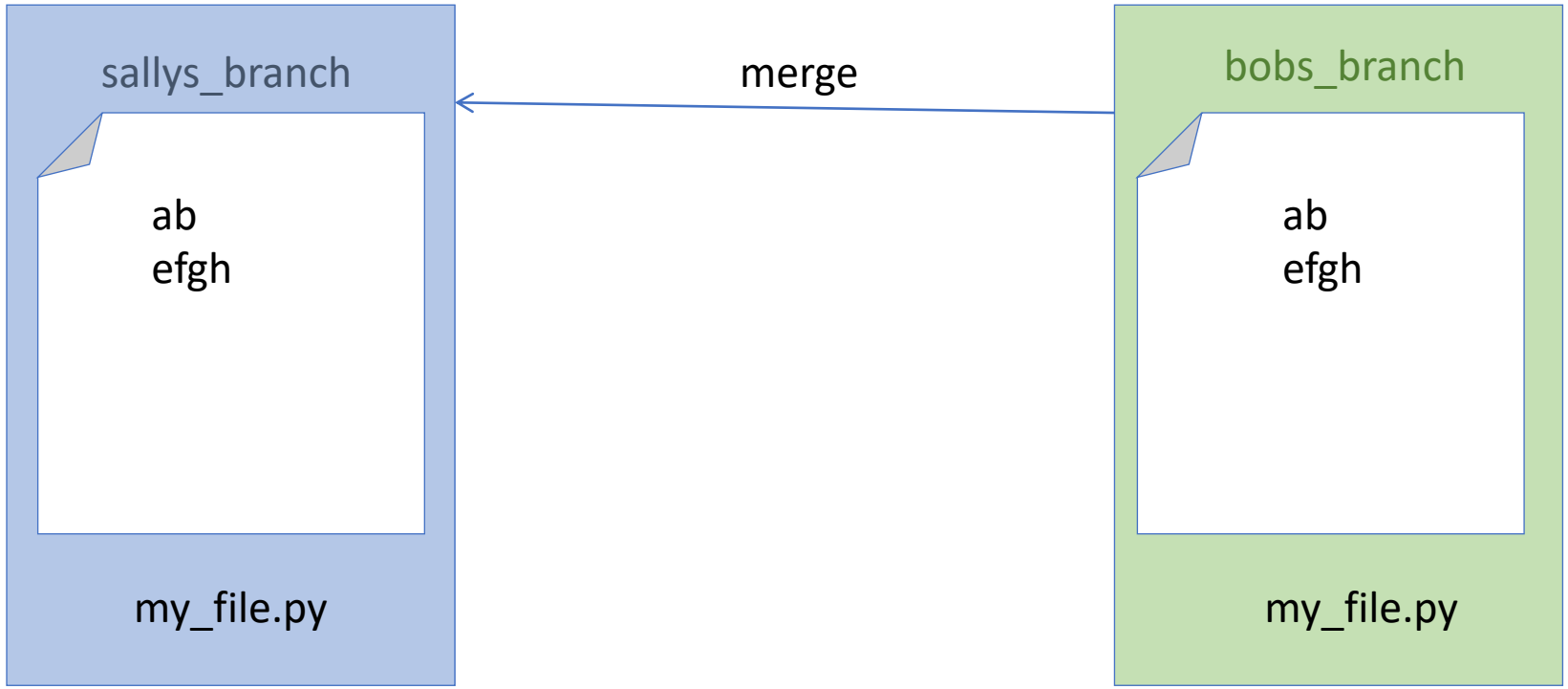

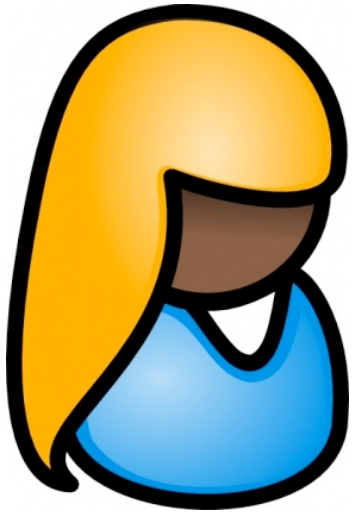

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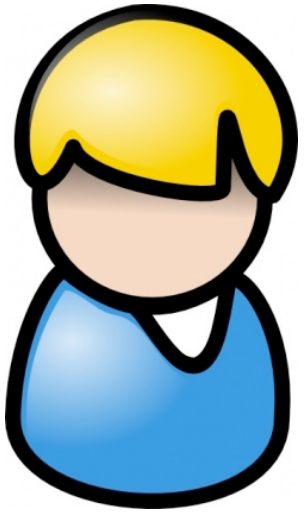

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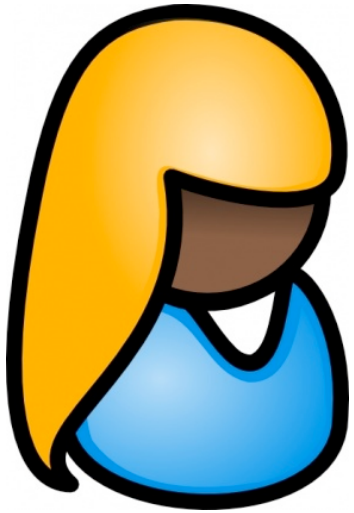

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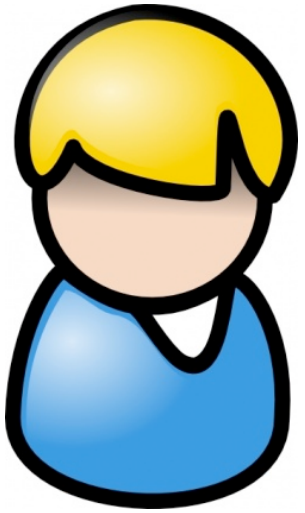

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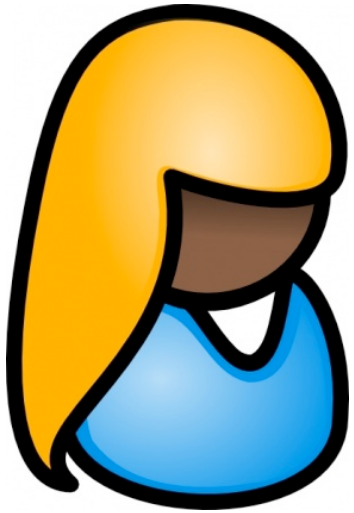

Hello, my name is Sally

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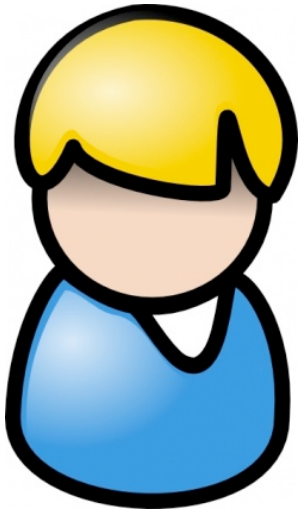

Hello, my name is Bob

MERGE CONFLICT

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my_file.py

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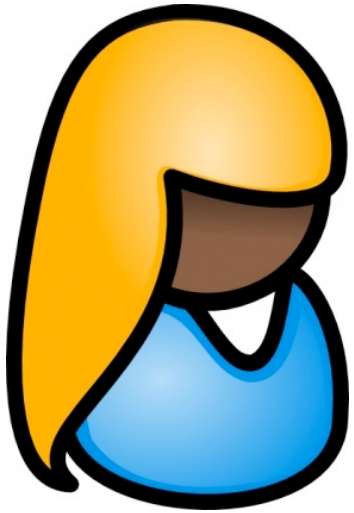
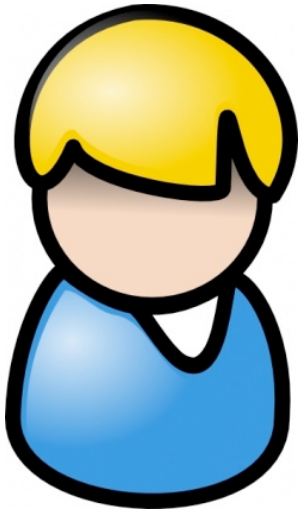
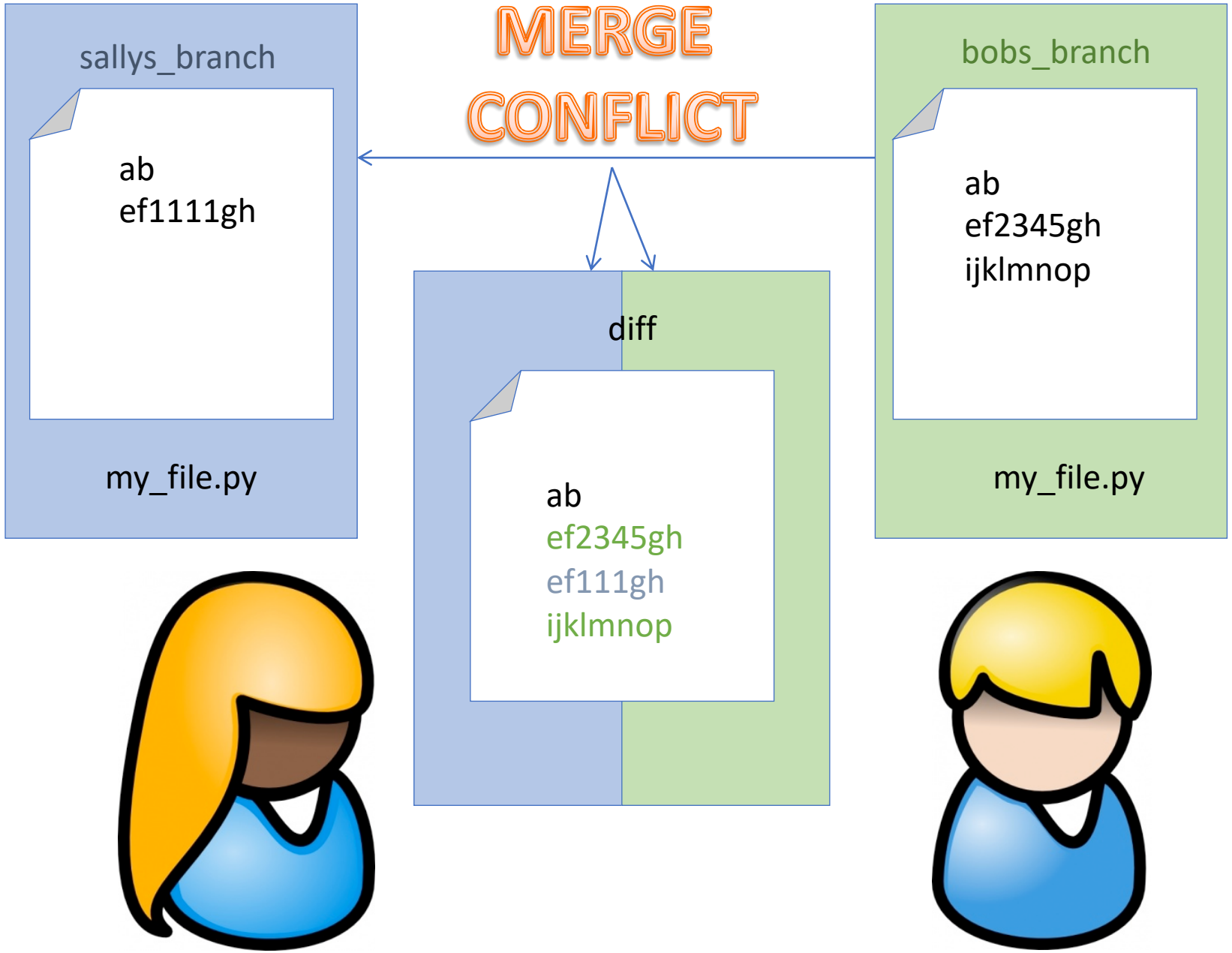


Hello, my name is Sally



Hello, my name is Bob


MERGE CONFLICT
sallys_branch
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my_file.py
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Hello, my name is Sally
Hello, my name is Bob

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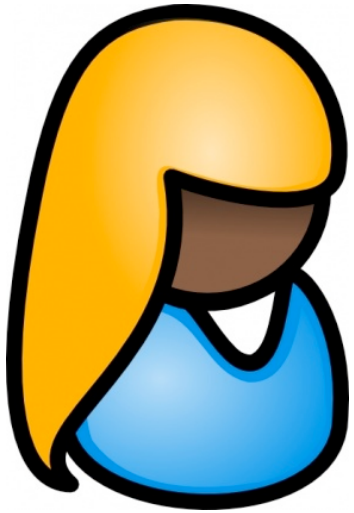

Hello, my name is Sally

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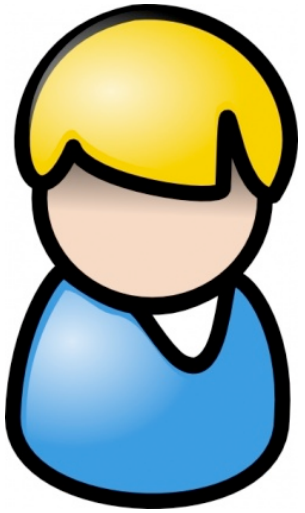
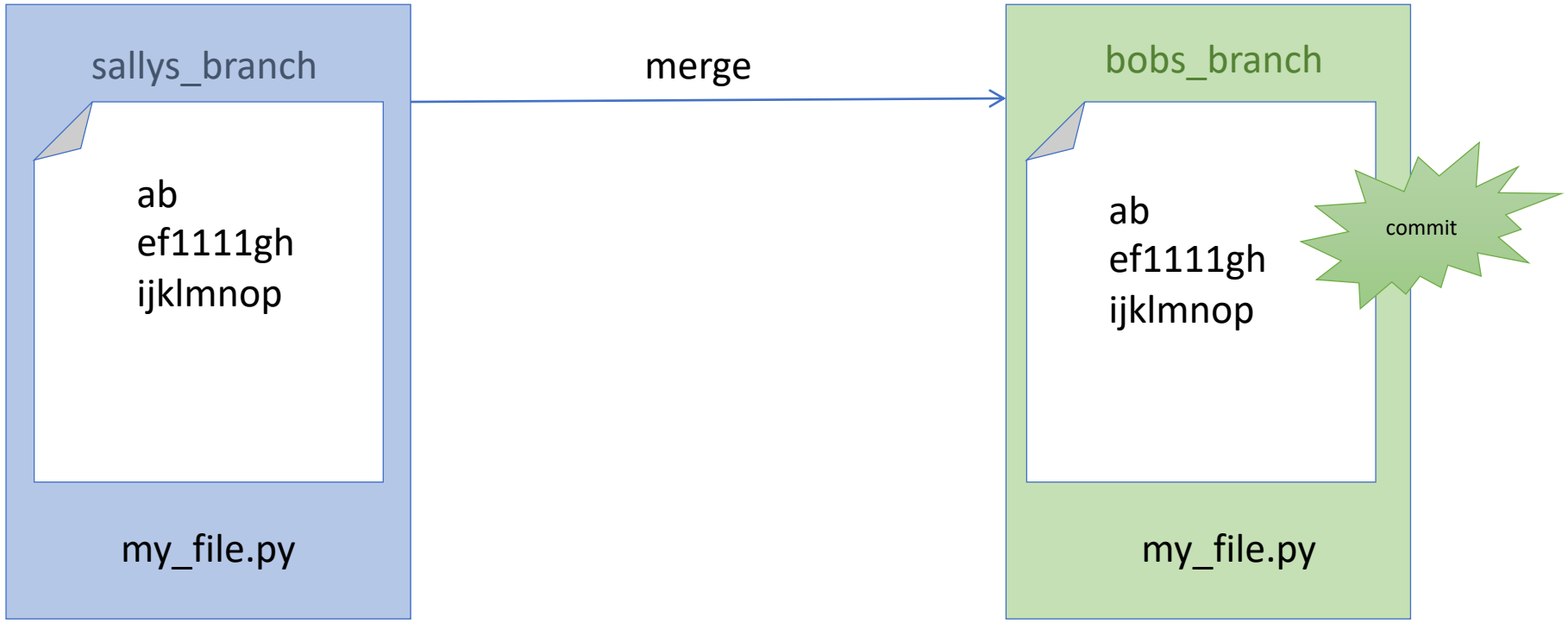
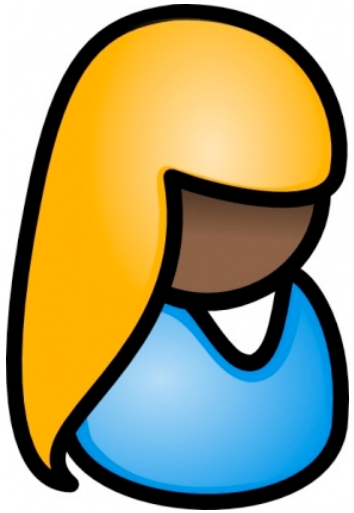
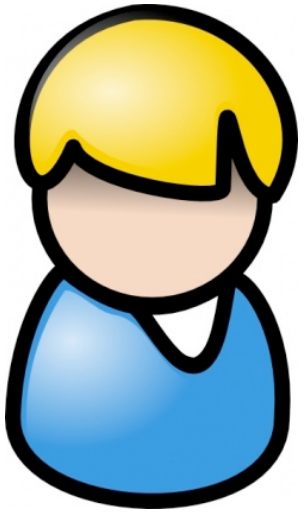


Hello, my name is Bob

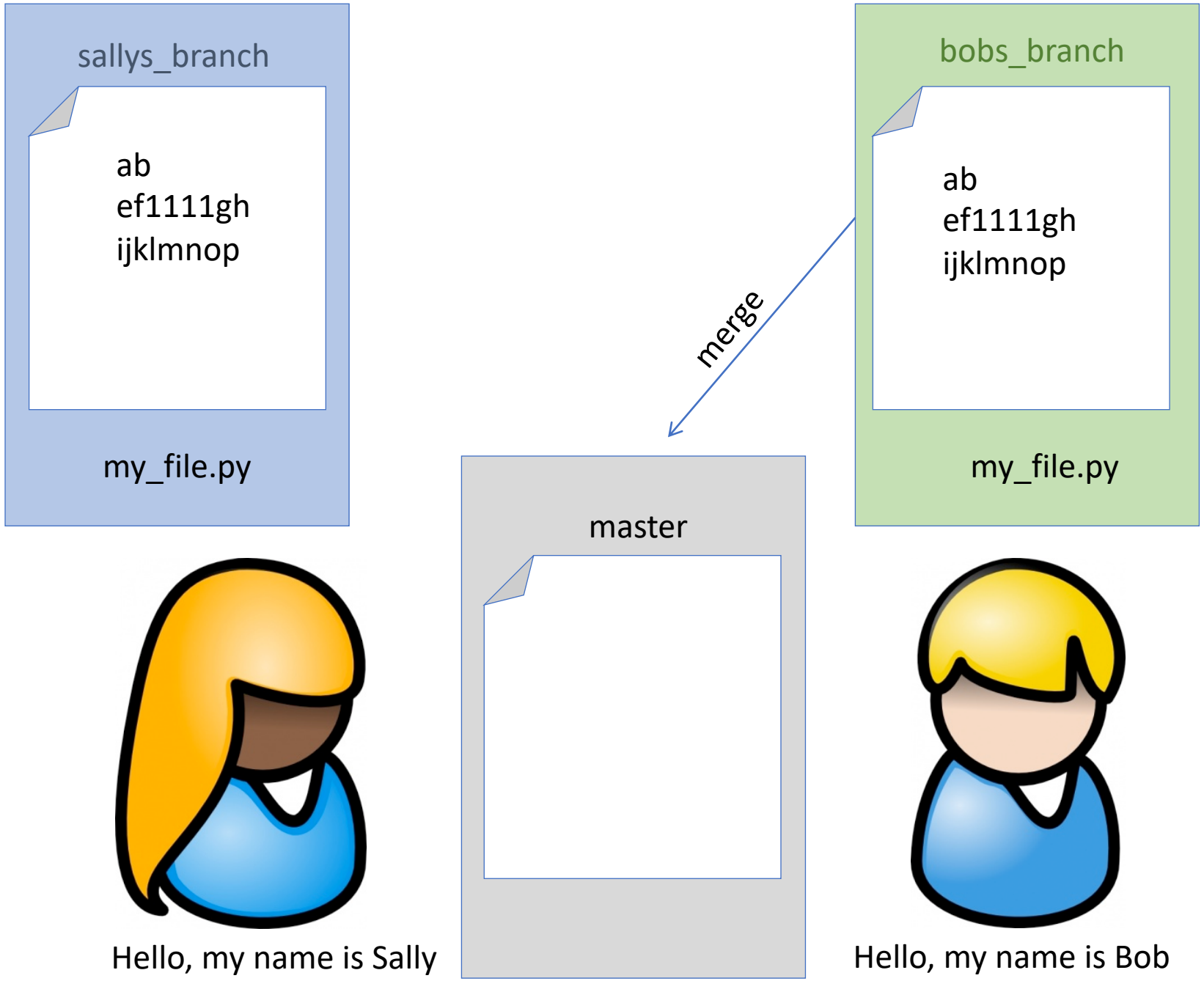




Hello, my name is Sally



Hello, my name is Bob


sallys_branch
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bobs_branch
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Hello, my name is Sally
Hello, my name is Bob

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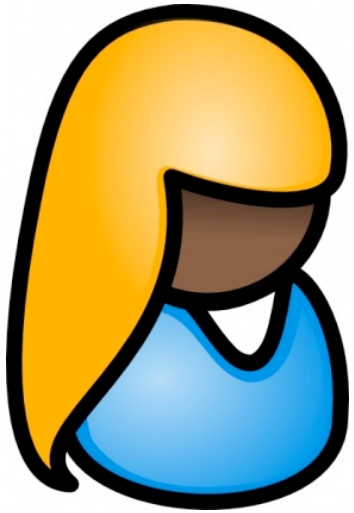

Hello, my name is Sally

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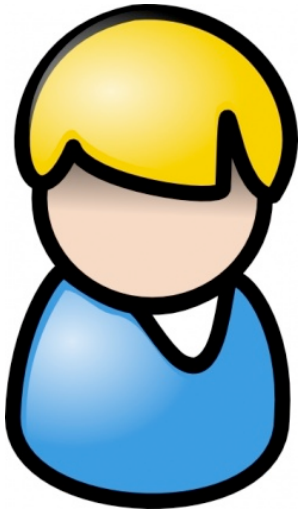

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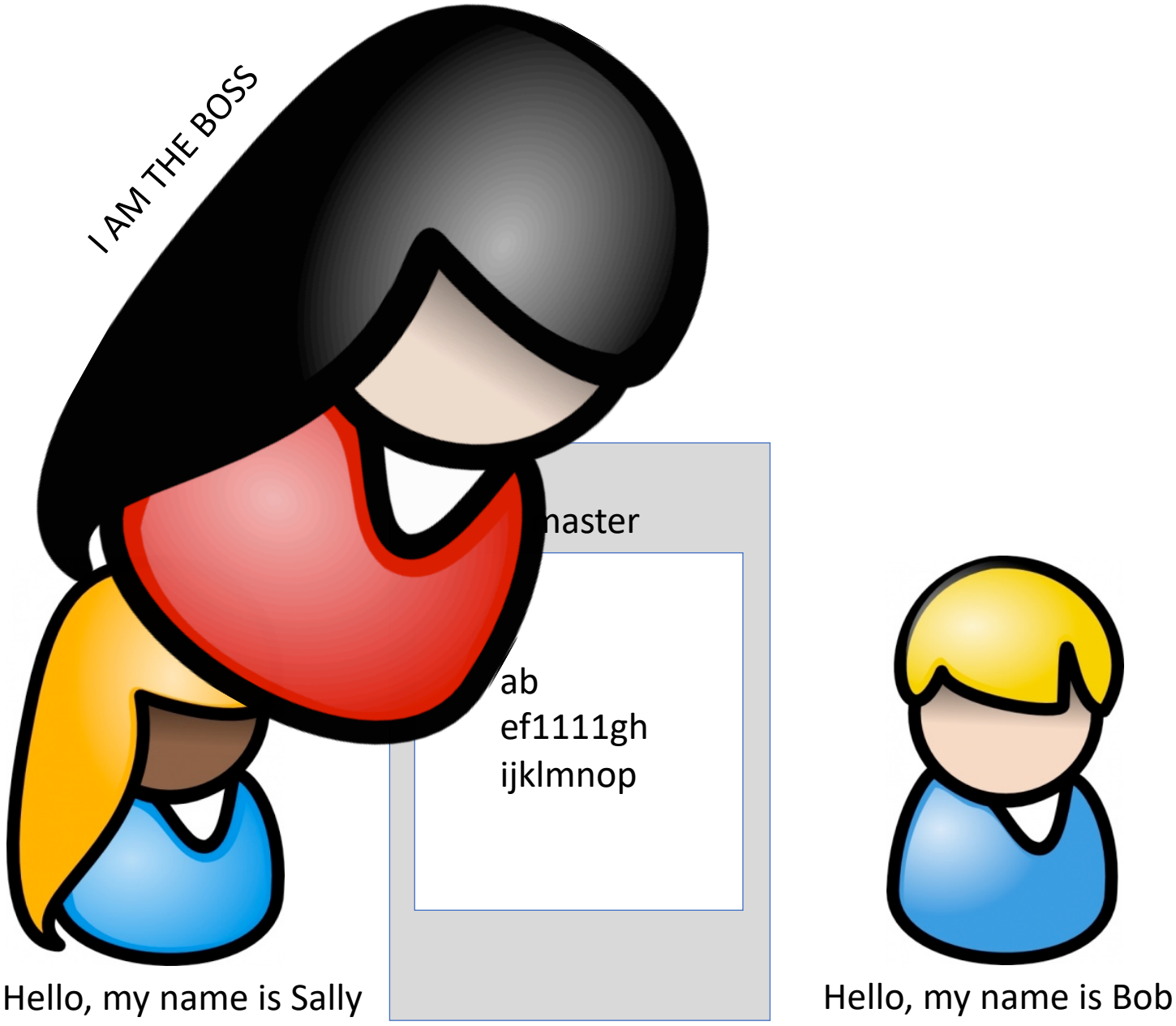
I AM THE BOSS
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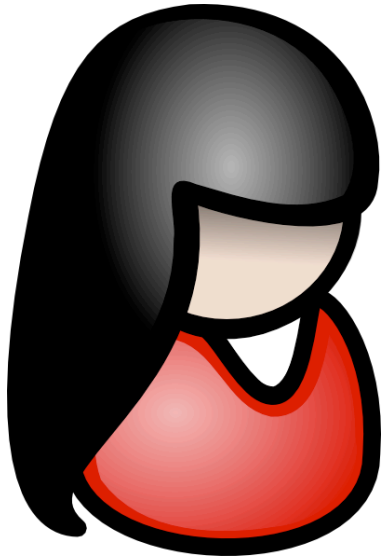
Hello, my name is Sally
Hello, my name is Bob



I AM THE BOSS

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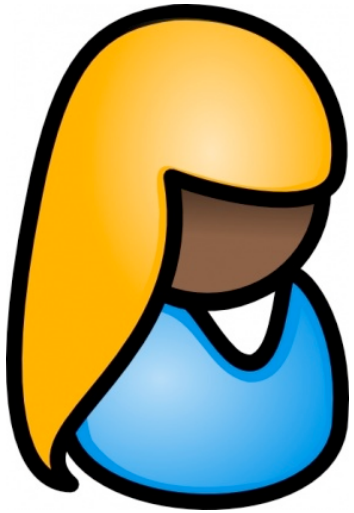

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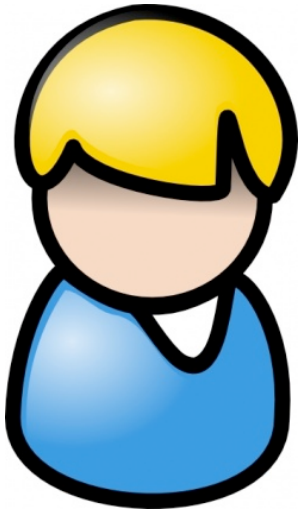
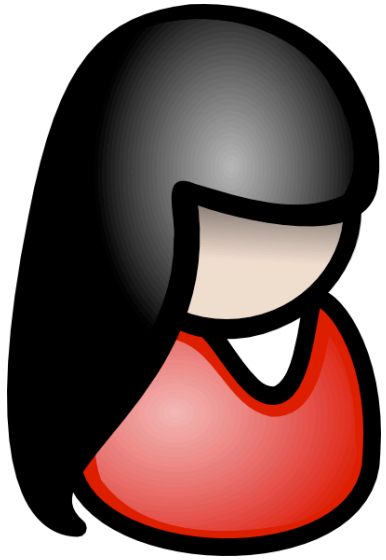


Hello, my name is Bob



I AM THE BOSS

BOSS_branch

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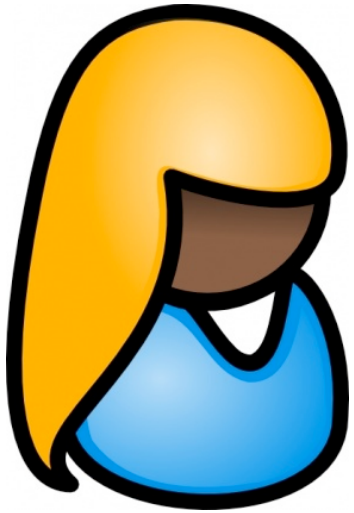

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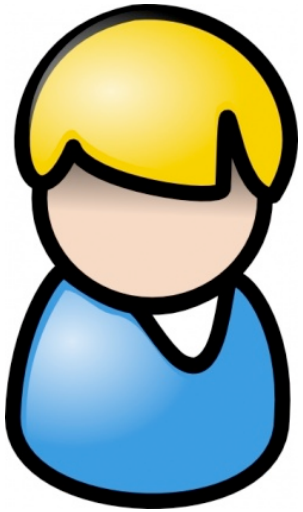

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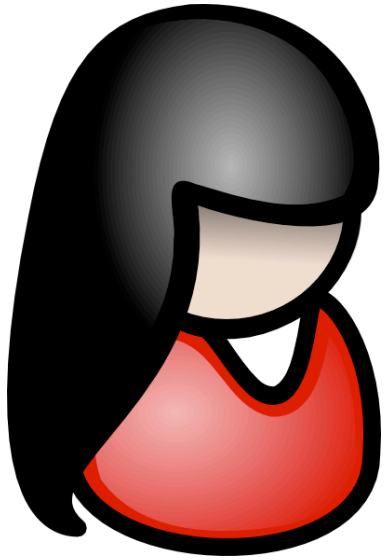

I AM THE BOSS

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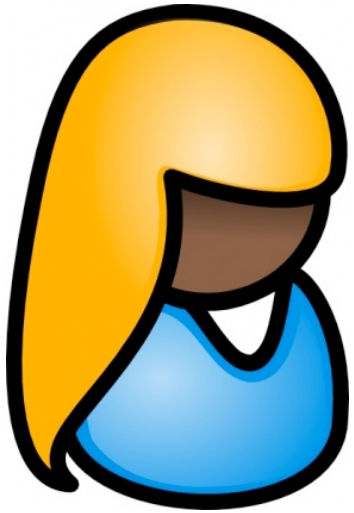

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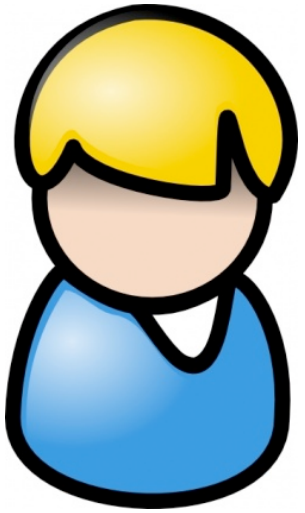

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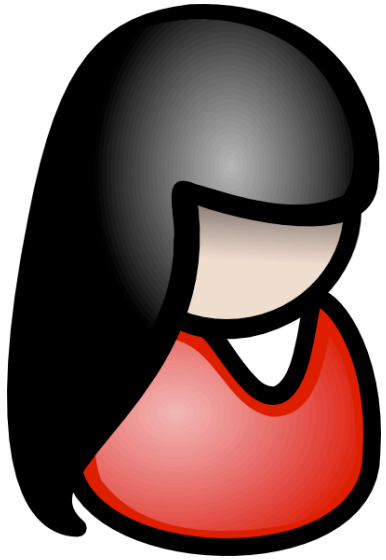

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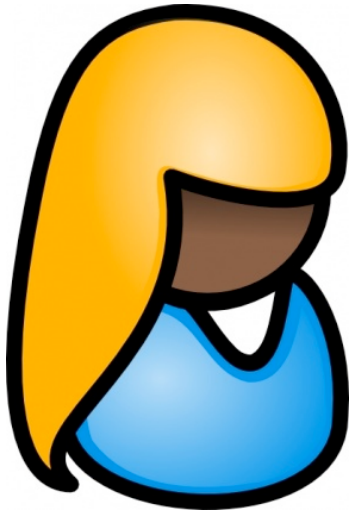

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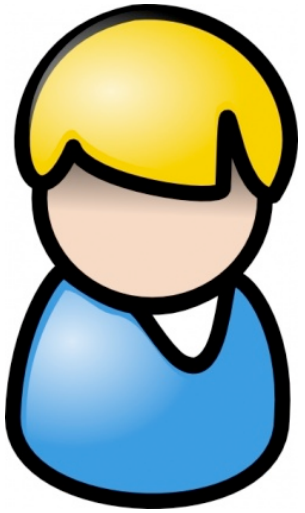

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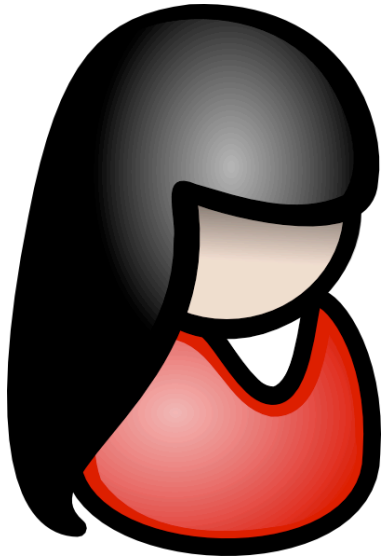

I AM THE BOSS

boss: + *%$#@
- 1111
+ 2345
- jklm
bob: + ijklmnop
sally: + 1111
bob: - cd
+ efgh
sally: + abcd

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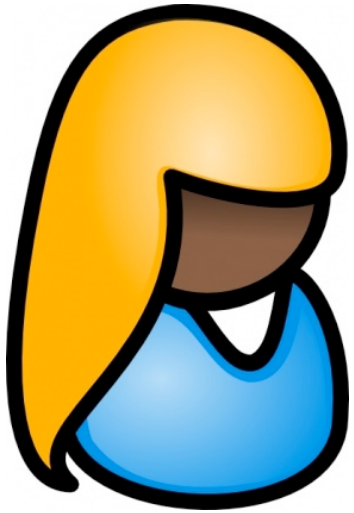
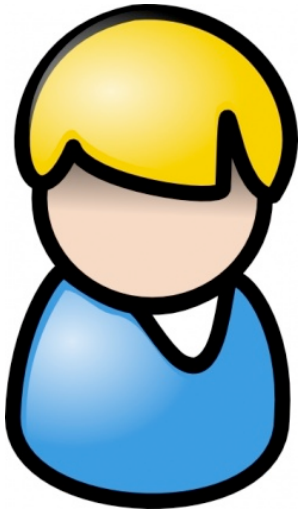


Hello, my name is Sally



Hello, my name is Bob

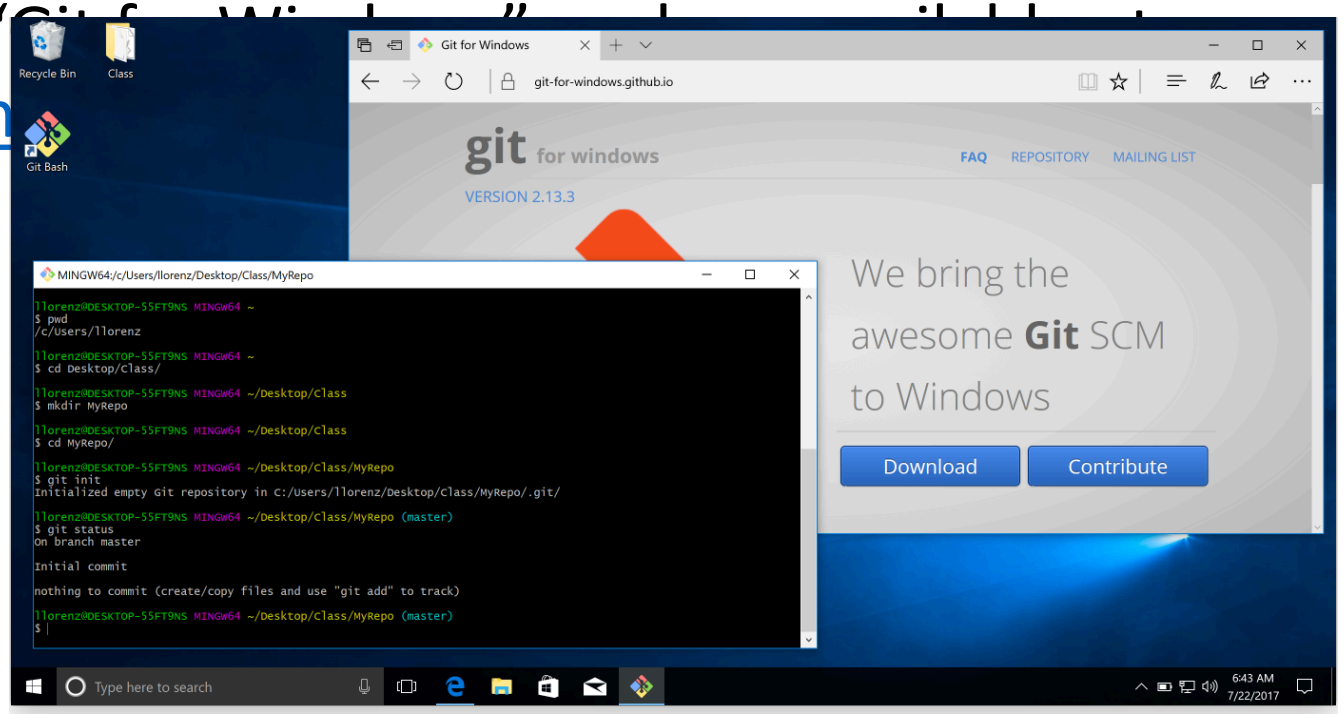
Using Git

Installation: Mac OS

- git is already preinstalled on your system, so you can use it from your normal command line application, Terminal, as depicted in the following slides.

Installation: Windows

- The easiest way to to install a bash emulator that has git installed like Git BASH (part of the "Git for Windows" package available at h



There are also plugins for individual terminal applications (Powershell, Command Prompt) to configure using git from them directly. There is also a desktop application available called Github Desktop that will install git, but we will exclusively be learning how to use the command line, not the desktop app.

GIT

git init

or,

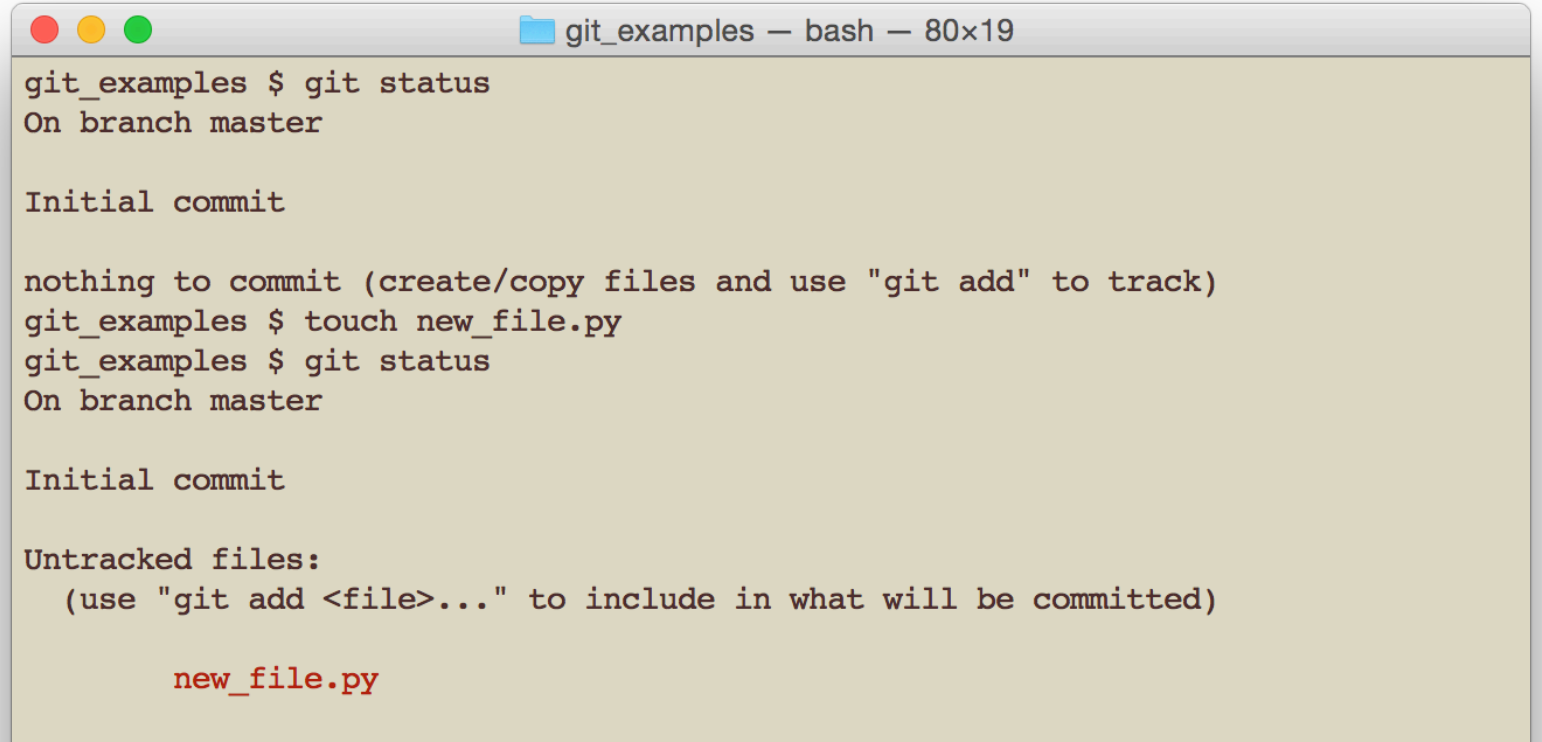
“let’s get started!”

GIT

git status

or,

“what does git know about right now?”

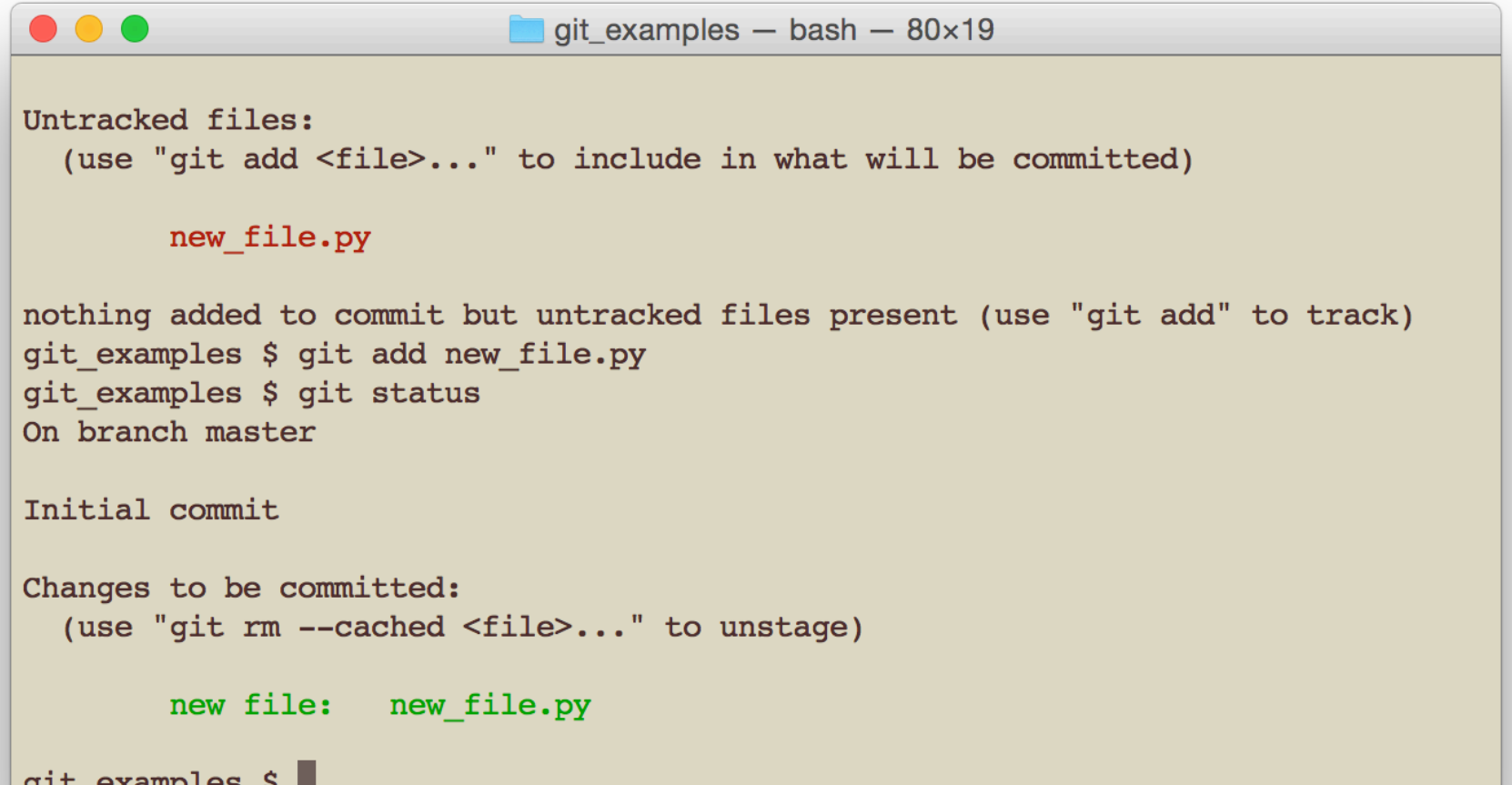


GIT

git add

or,

“git, start tracking this file (or these new file changes)!!”

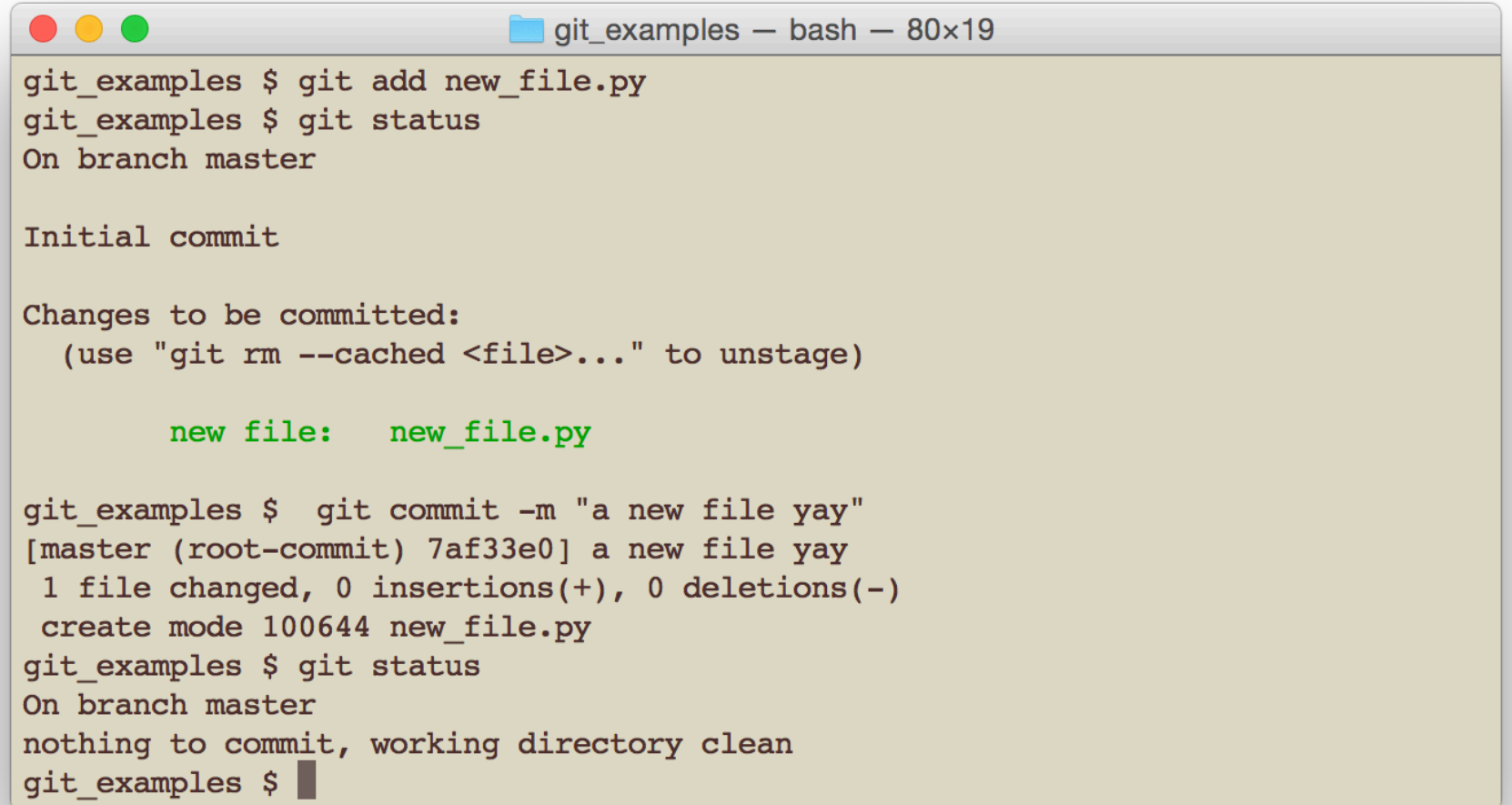


GIT

git commit

or,

“git, checkpoint everything I’ve added to the stage”

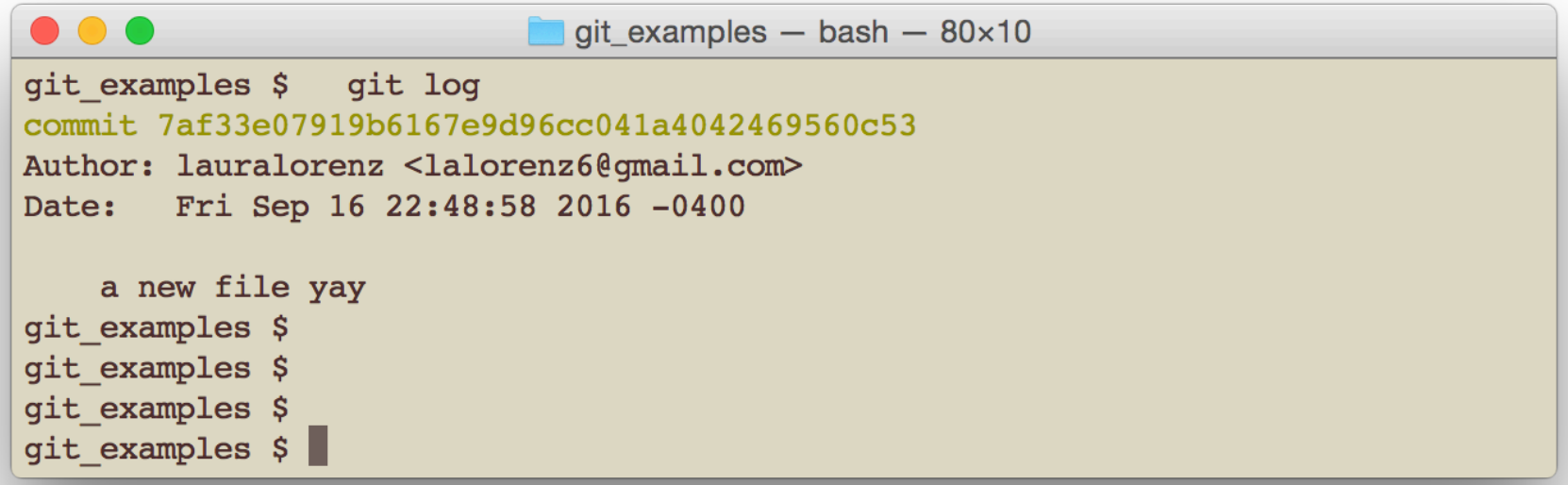


GIT

git log

or,

“what did I do before again?”

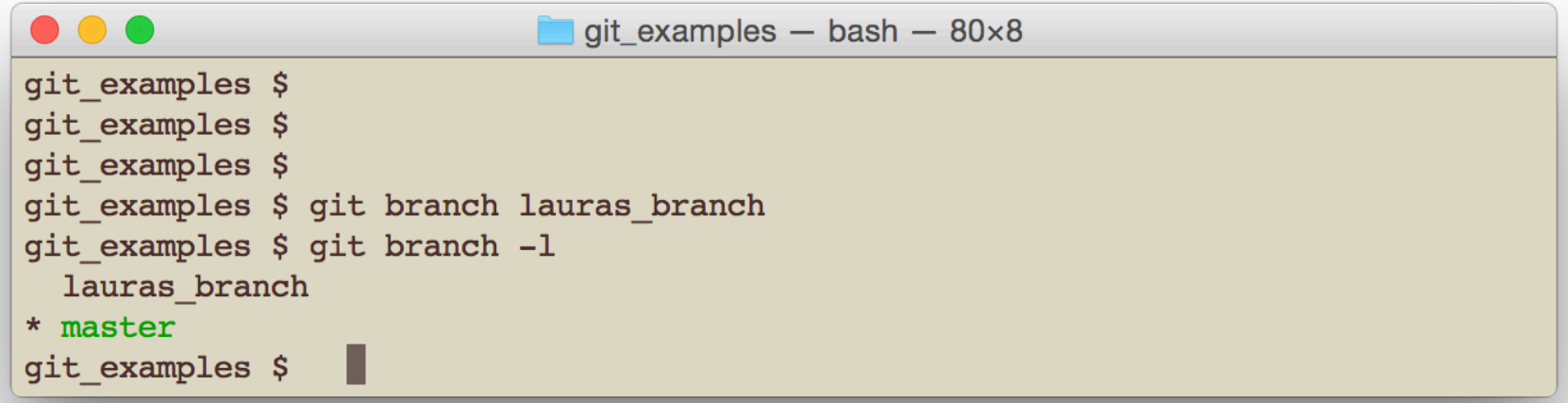


GIT

git branch

or,

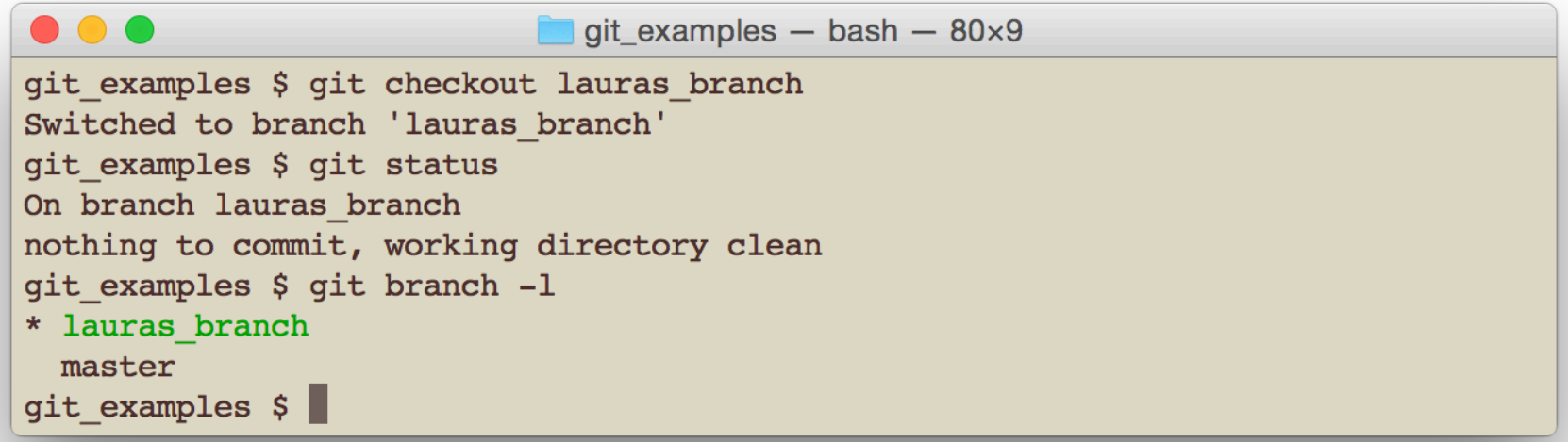
“start a new branch with space for me to work on stuff separate from everyone else”



GIT

git checkout

or,
“let me switch to this branch now”

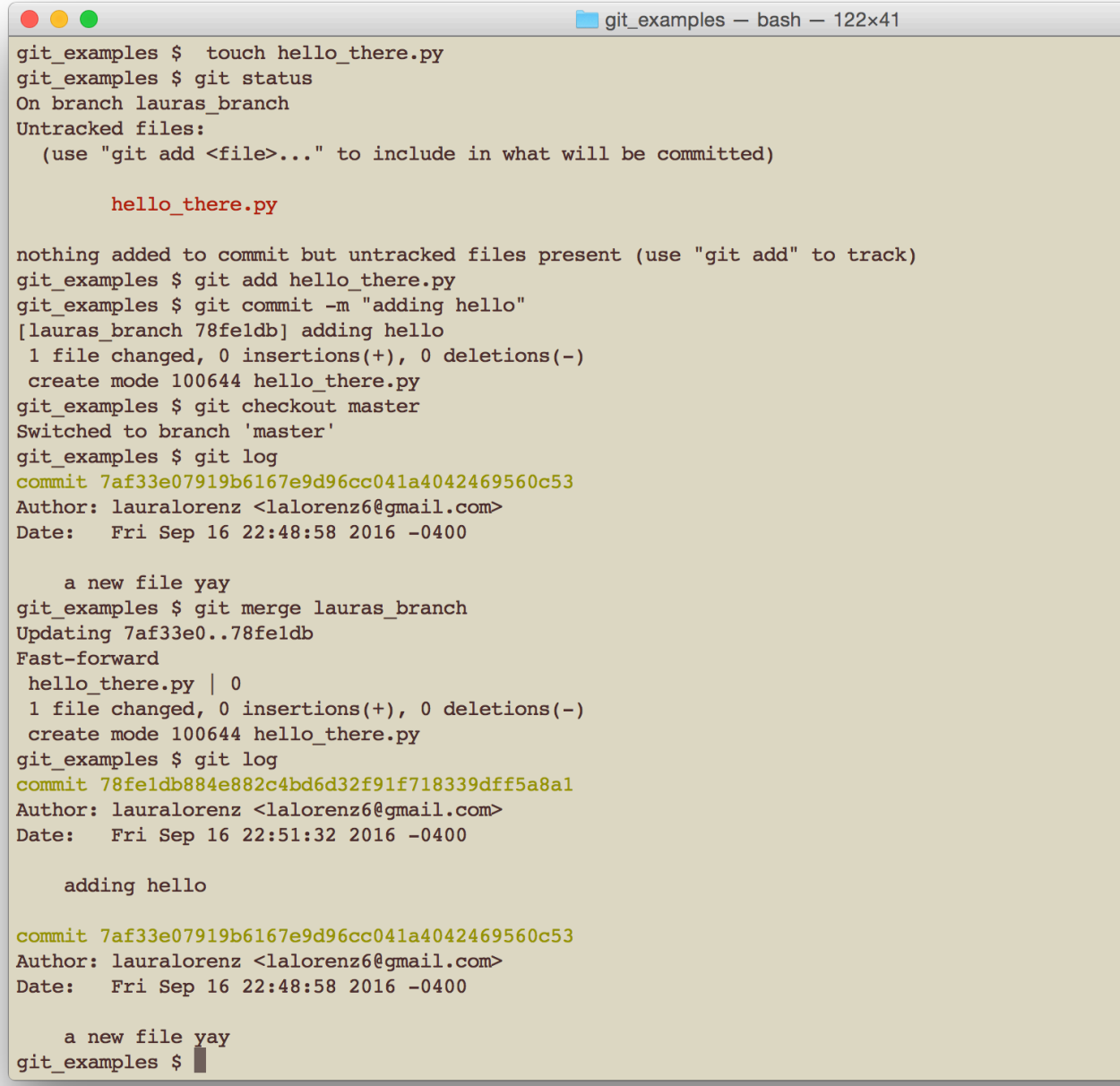


GIT

git merge

or,

“pull in all the commits from this other branch to the branch I am on”



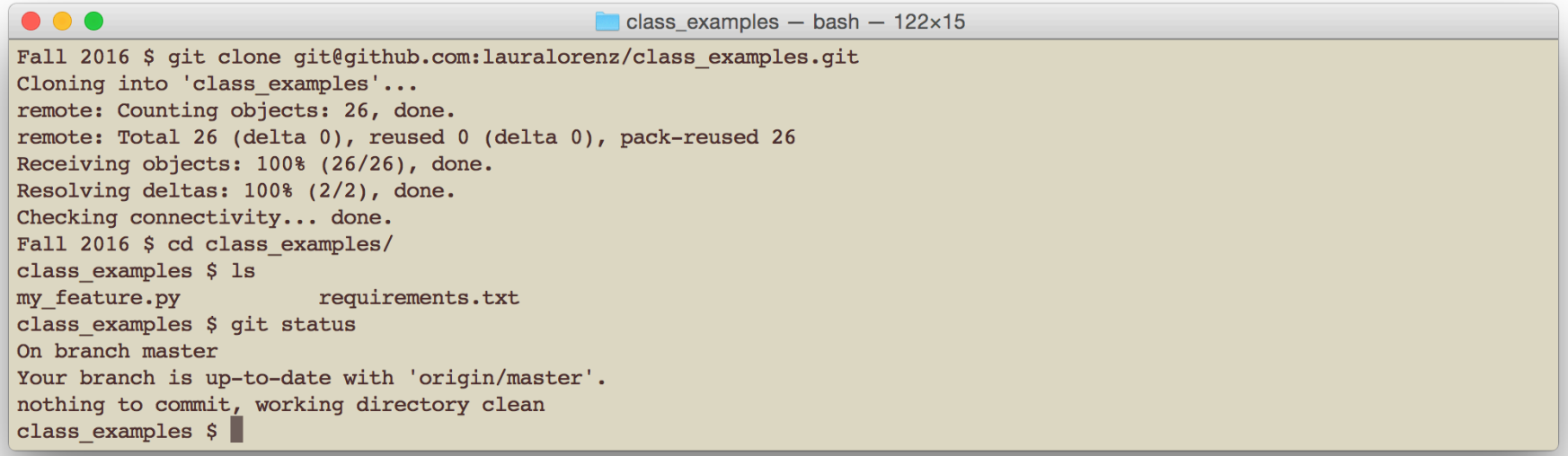
Sharing your code to Github

GITHUB!

git clone

or,

“copy this git repository on the Internet to my local disk”

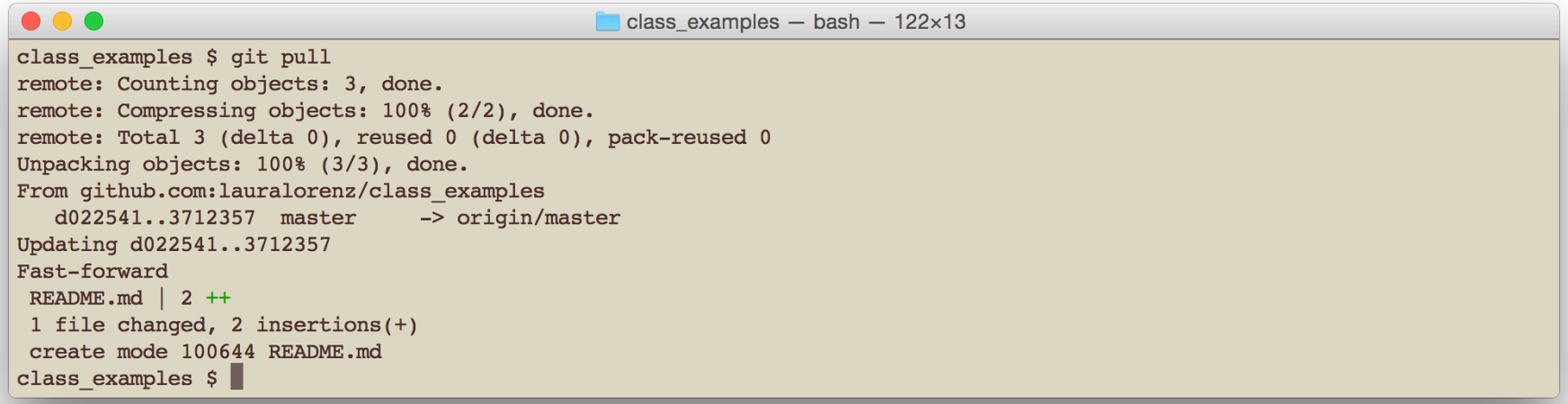


GITHUB!

git pull

or,

“update the local repository with any changes on the Internet for it”

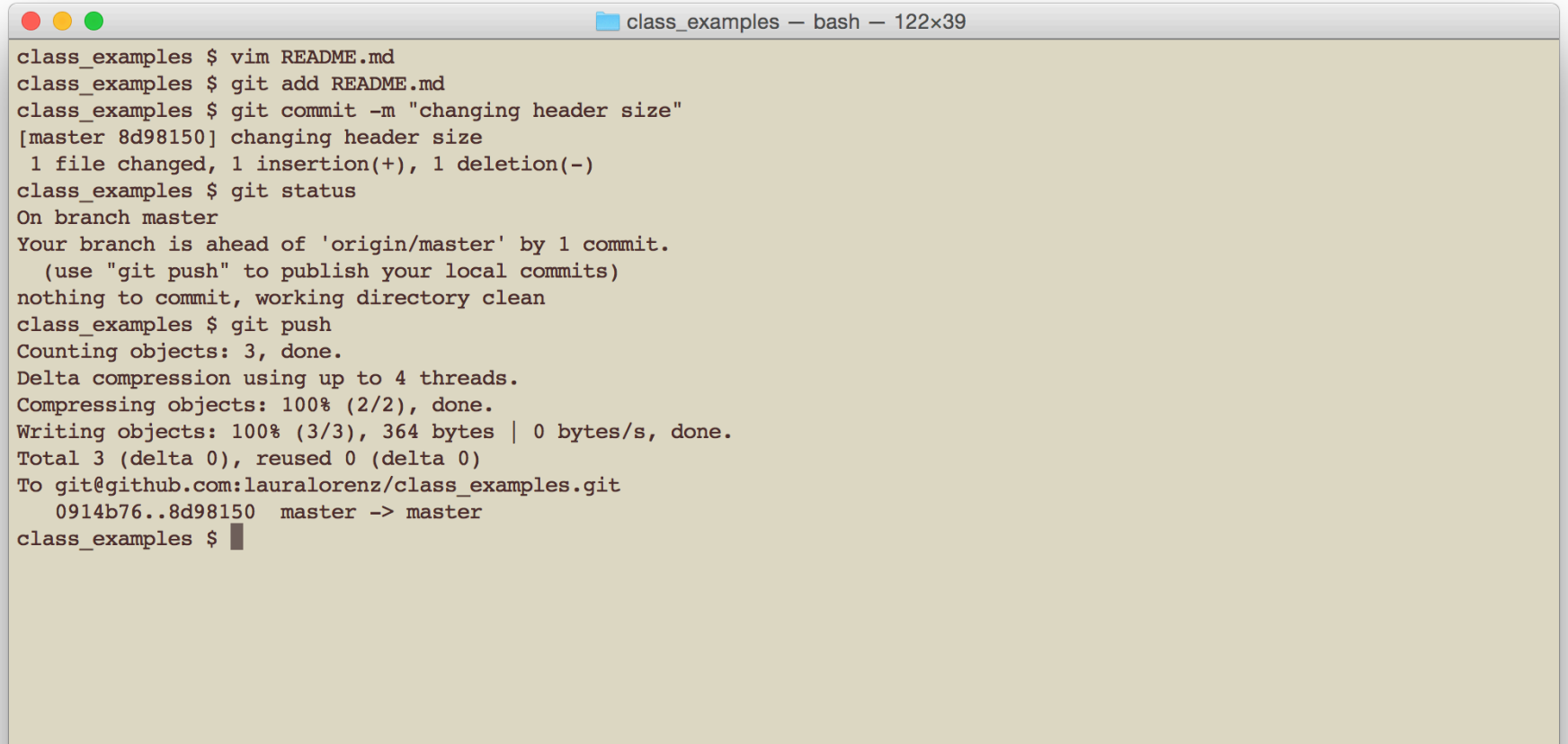


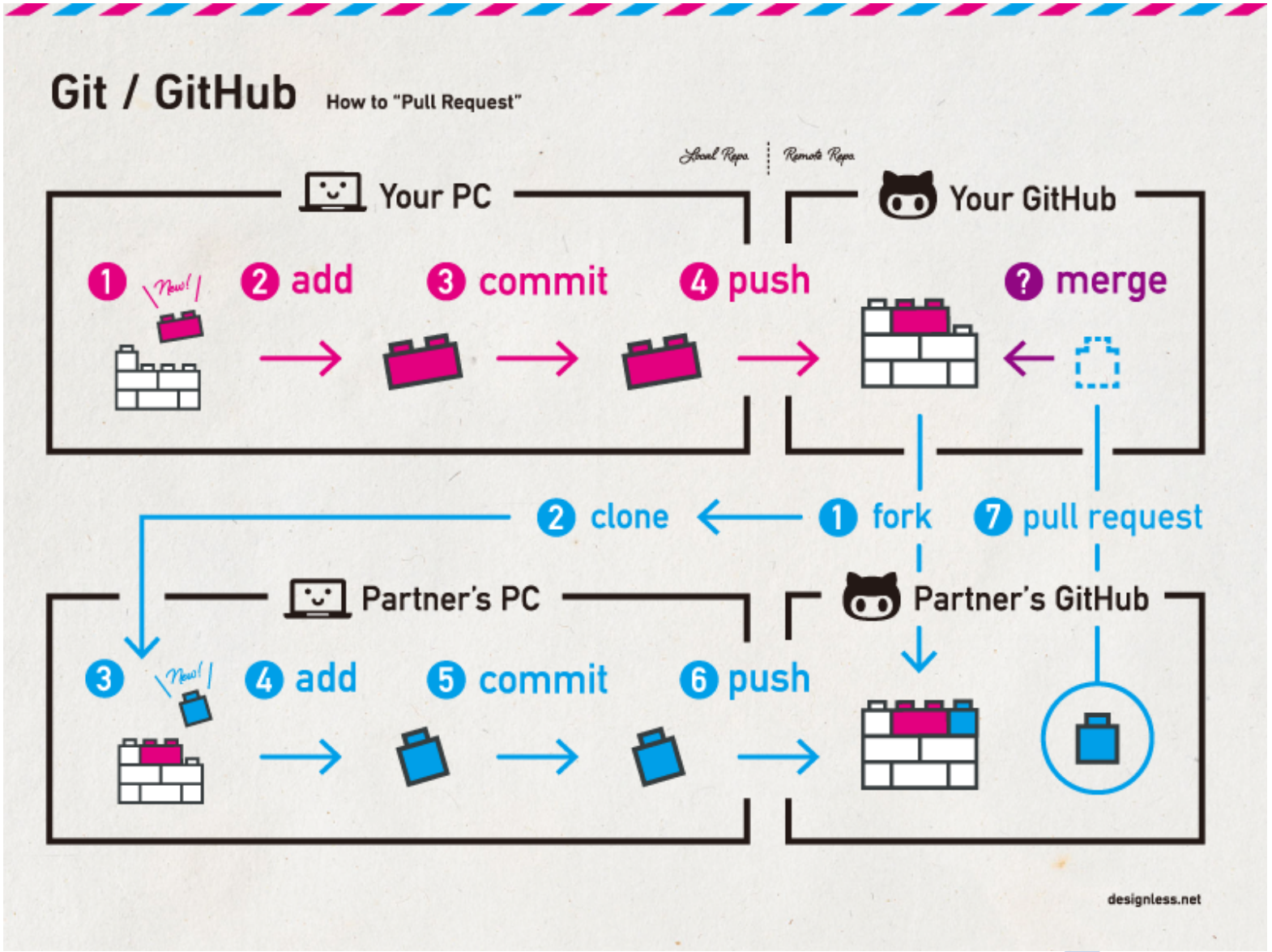
GITHUB!

git push

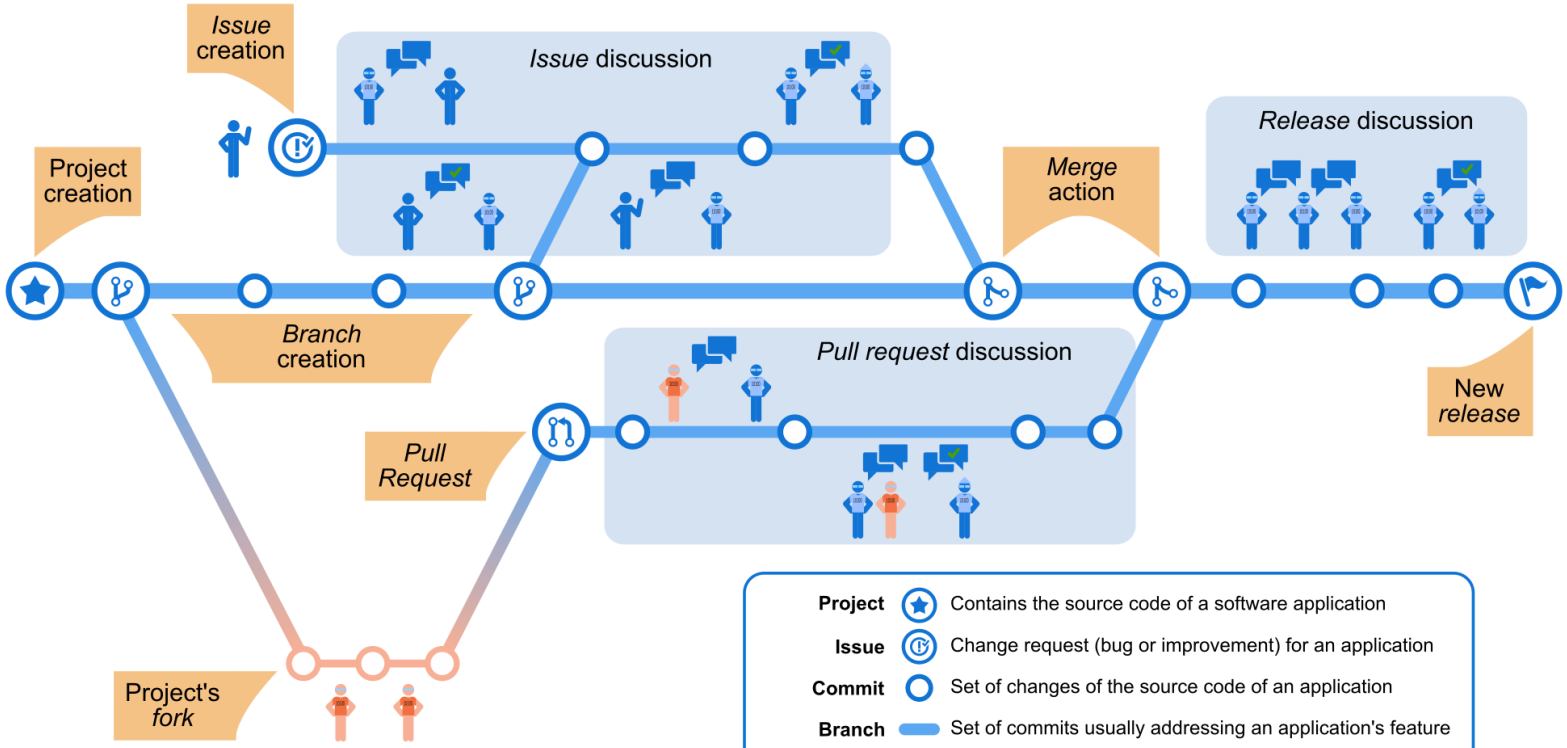
or,

“update the remote repository with any changes I made”




Git / GitHub
How to "Pull Request"
Local Repo.
Remote Repo.
Your PC
Your GitHub
1 New!
2 add
3 commit
4 push
? merge
2 clone
1 fork
7 pull request
Partner's PC
Partner's GitHub
3 New!
4 add
5 commit
6 push
designless.net

How GitHub projects are developed?
Where are the main discussion points?



Project	Contains the source code of a software application
Issue	Change request (bug or improvement) for an application
Commit	Set of changes of the source code of an application
Branch	Set of commits usually addressing an application's feature
Fork	Creation of a new branch
Pull Request	Request to join two branches
Merge	Action of joining two branches
Release	Publication of a new version of an application

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