Programming with Python

Key Takeaways

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Introduction to Python

- Python is one of many **programming languages**
- The basic programming concepts are similar across the different languages

Benefits of Python

- **Simple syntax**
- **Easy to setup**
- **Large ecosystem**: many libraries, large community
- **Flexible**: You're not limited to language specifics

- Python is one of the **most popular and widely used languages**

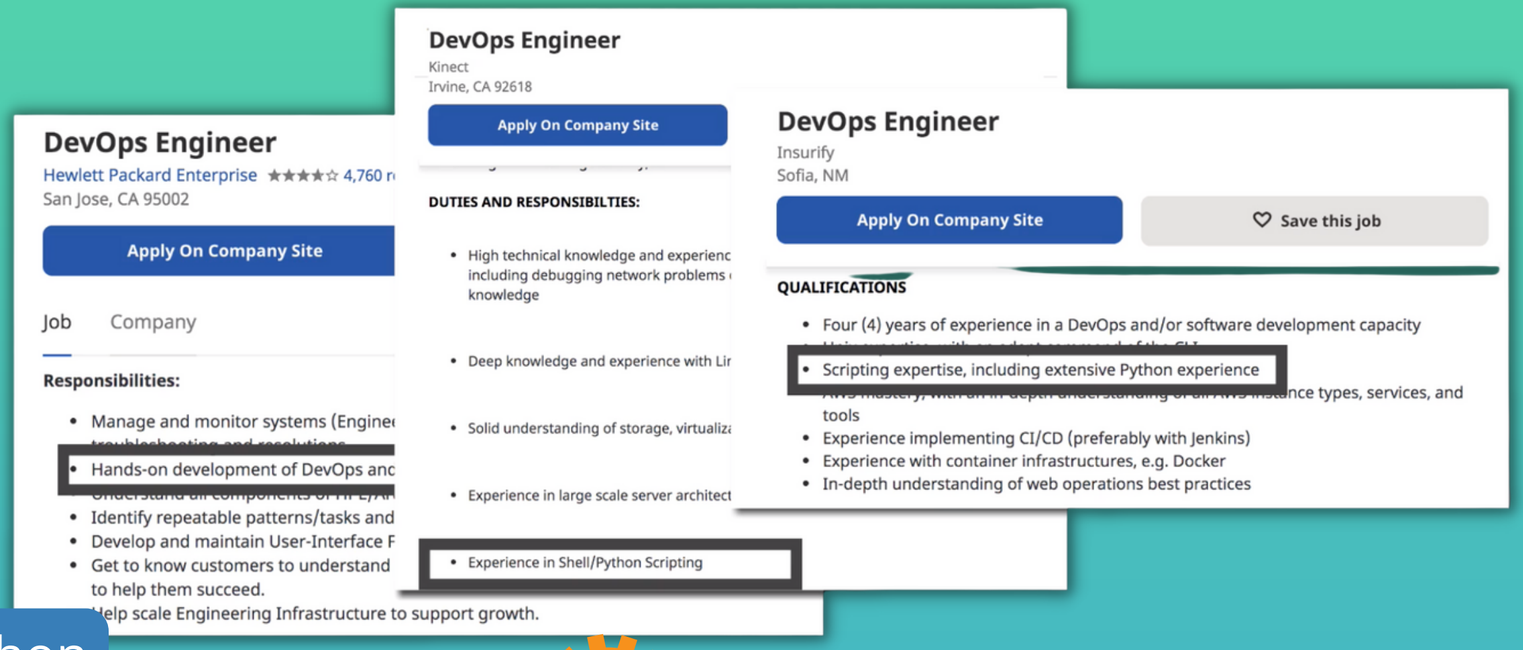
- Better alternatives for Mobile, Game & Desktop Development

What Python is used for

- Web Development
- Data Science, Machine Learning, Artificial Intelligence
- Web Scraping
- **Automation**: Automate DevOps tasks and general tasks

Why Python as a DevOps Engineer

- Knowing programming in general and Python in particular, makes you much **more valuable as a DevOps engineer**



DevOps tasks to automate with Python

- System Health Checks
- Monitoring Tasks
- Backup Tasks
- Custom Ansible Modules
- Data Visualization
- Managing Cron
- CI/CD related Tasks (update Jira ticket after Jenkins build, trigger Jenkins job on specific events)
- Cleanup Tasks

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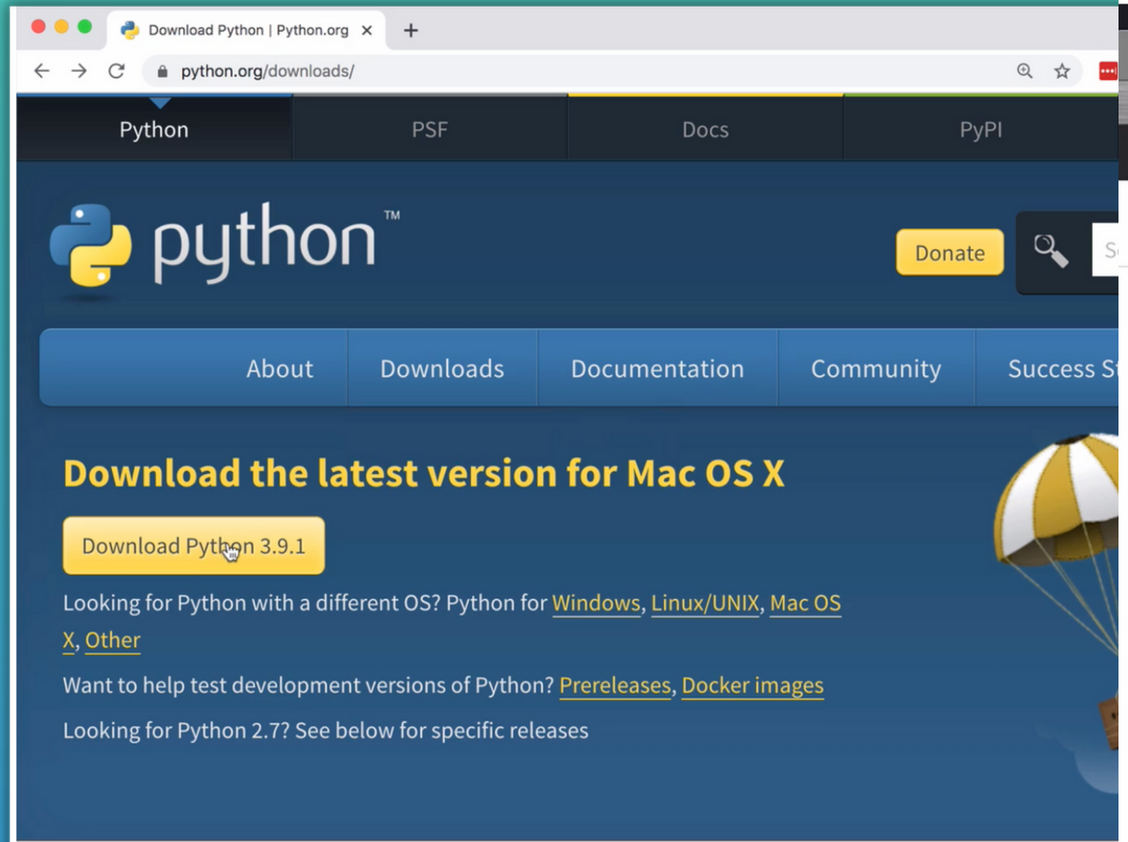
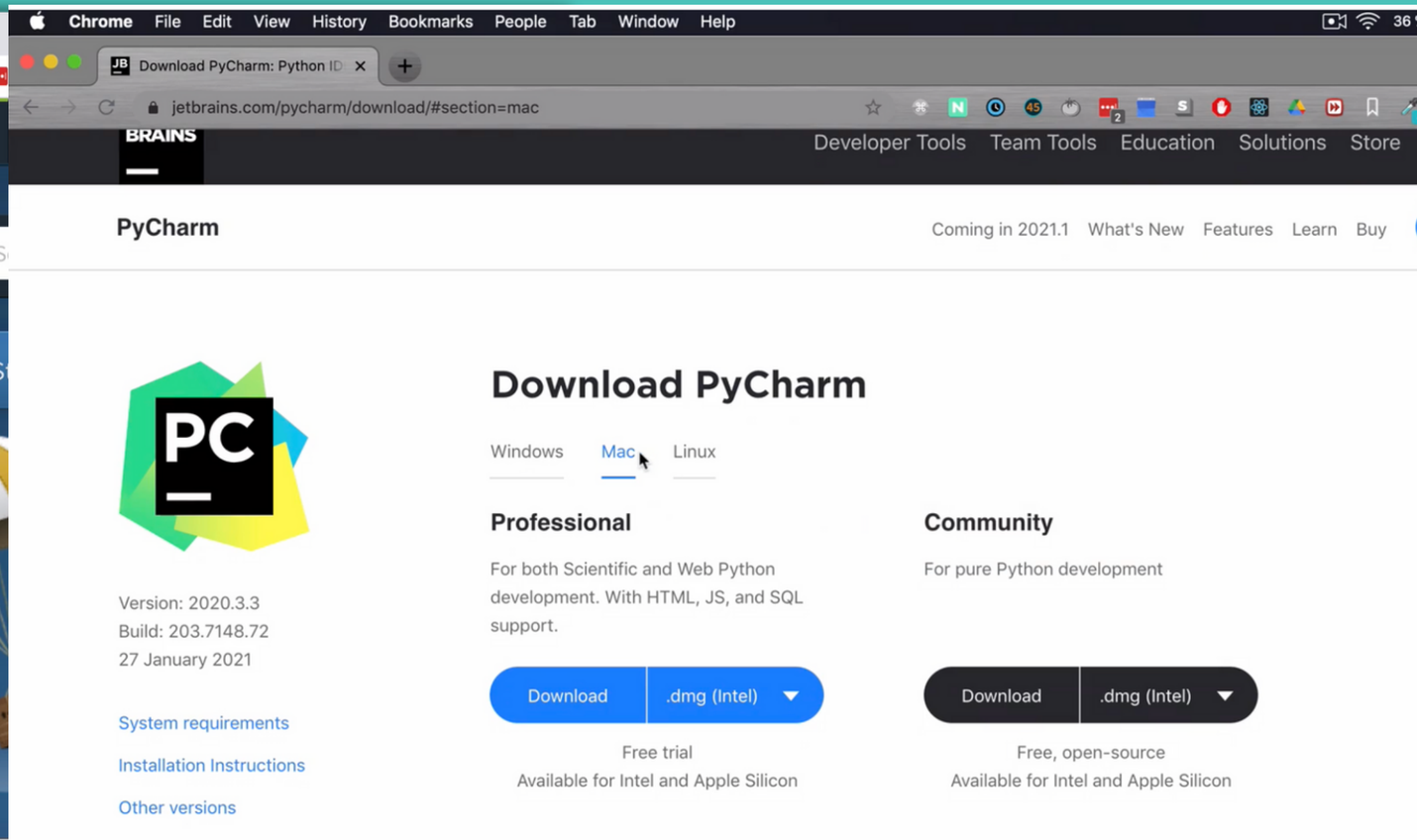
Get Started - Local Setup

- For writing a Python program you need 2 things installed

1) Install Python version

2) Download Code Editor, like PyCharm or Visual Studio Code





Core Programming Concepts - 1

Variables

- Variables are **containers for storing data values**

```
score = 5
```

```
name = "James"
```

- For repetitive values that need to be reused multiples times in different places in your code

Built-in Data Types

- Variables can store data of different types
- **Different types can do different things**
- **Strings** and **numbers** are most basic data types

```
"James"
```

```
10
```

Text Type:	`str`
Numeric Types:	`int`, `float`, `compl`
Sequence Types:	`list`, `tuple`, `rang`
Mapping Type:	`dict`
Set Types:	`set`, `frozenset`
Boolean Type:	`bool`

Comments

- For additional **textual description** to explain code
- Comments start with a **#**. Python will ignore it
- Usually code should be easily understandable (for example use descriptive variable names!) without comments, so don't overuse it!

```
#This is a comment
print("Hello, World!")

print("Hello, World!") #This is a comment
```

Core Programming Concepts - 2

Functions

- Function is a block of code to **perform a single, related action**
- It only **runs when it is "called"**
- For repetitive code blocks that need to be reused multiple times in different places in your code
- Functions can pass data (**parameters**) into a function
- A function can **return** data as a result of its execution

Core Programming Concepts - 3

Conditional - if/else Statements

- **Control logical flow of the program**: What to do under which condition
- **Logical conditions**:
  - Equals: `a == b`
  - Not Equals: `a != b`
  - Less than: `a < b`
  - Less than or equal to: `a <= b`
  - Greater than: `a > b`
  - Greater than or equal to: `a >= b`

```
tom = 200
anna = 33

if anna > tom:
  print("anna has a higher score than tom")
elif tom == anna:
  print("anna and tom have an equal score")
else:
  print("tom has a higher score than anna")
```

Evalutes to **false**

Evalutes to **false**

Else block will be executed

Boolean Data Type

- Boolean represent one of two values: **True** or **False**
- When you compare two values, the expression is evaluated and Python returns the boolean result

```
print(10 > 9)   => True
print(10 == 9)  => False
print(10 < 9)   => False
```

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Core Programming Concepts - 4

Built-in Functions

- Creators and developers of Python continuously create **functions for the most common use cases**
- So you can use these, instead of writing it yourself
- For example, accepting user input with "input"

Accepting User Input

- In Python we can **ask the user for input**
- Here the input is saved into variable "user_input":

```
user_input = input("Hey, enter a number of days and I will convert it to hours")
```

Error Handling

- To **protect code** from bad user input or programming errors
- Instead of letting an error crash the program, **write code to handle the error** when it happens
- In below example, if user doesn't enter a number, it will crash when we do the calculation. So we would need to handle this case, for example with if/else statement

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Core Programming Concepts - 5

Lists

- Are used to **store multiple items** in a single variable
- Can contain different data types
- Items are **indexed**, the first item has index [0]
- List items are ordered and **allow duplicate values**

```
friends = ["tim", "sara", "john"]
```

- You can loop through the list items by using a "for loop"

```
friends = ["tim", "sara", "john"]
for friend in friends:
  print(friend)
```

Loops

- Allows us to **execute a statement multiple times**
- Different types of Loops

For Loop:

- Logic that should repeat FOR a specific number of times or **FOR a set of values**

While Loop:

- For logic that should **repeat as long as a certain condition is true**, like WHILE a user is shopping, we will keep the shopping cart active

```
count = 0
while (count < 9):
   print 'The count is:', count
   count = count + 1

print "Good bye!"
```

Core Programming Concepts - 6

Sets

- Similar to list, as you can store multiple items in a set
- Difference: You **can NOT have duplicate values** and it's **unindexed**
- Good to keep track of lists that must have unique values, like student ids in a university database

```
studentIds = [3441, 1661, 7845]
```

- You can also loop through a set

Dictionaries

- More complex data structure that groups multiple simple data types together
- Stores data values in **key:value pairs**
- Duplicates are not allowed

```
aPerson = {
  "name": "Sara",
  "languages": ["python", "javascript"],
  "age": 29
}
print(aPerson)
```

Modules - 1

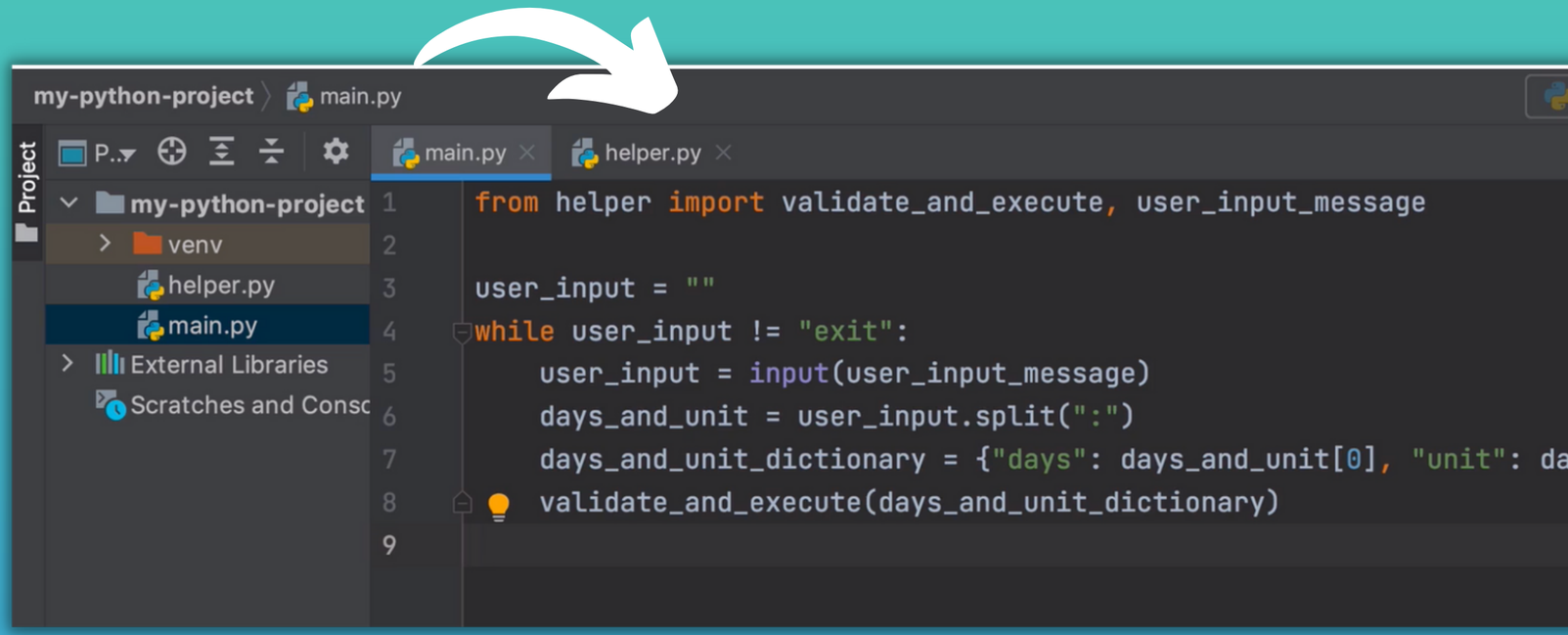
- A module allows you to **logically organize your Python code**, so it should contain related code
- Grouping related code into a module **makes the code easier to understand and use**

Create a Module

- It's just a .py file consisting of Python code. For example *helper.py*

Use a Module

- To use the module, we need to **import** it



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Modules - 2

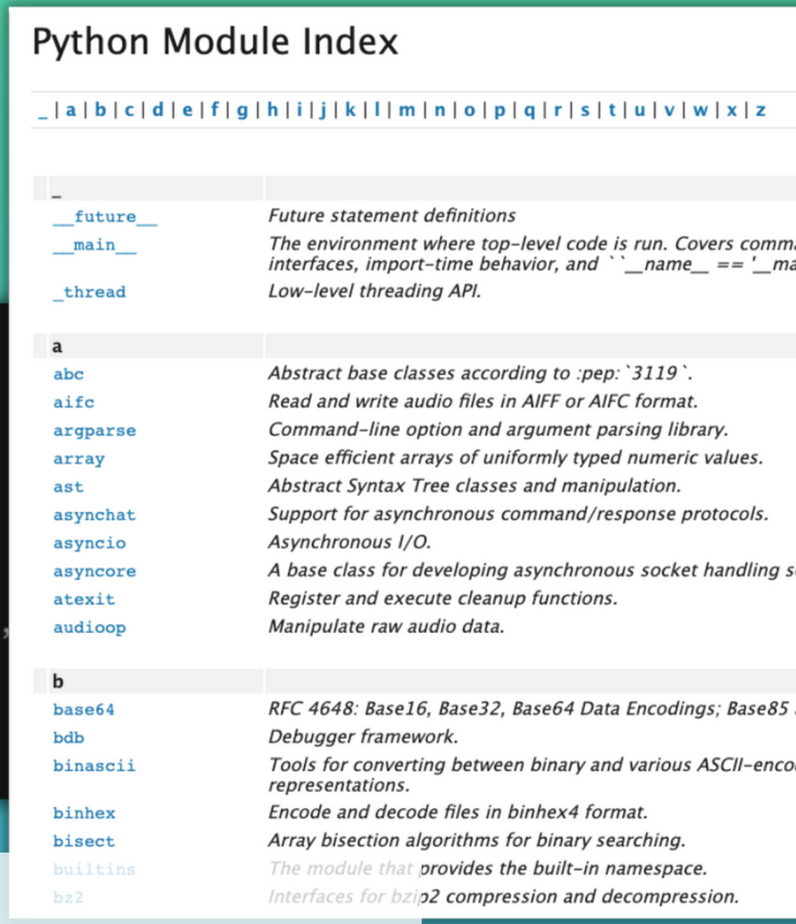
- You can also use **existing modules**
- Many useful ones, for example datetime module which have many different functions that make it **easier for you to work with dates and times!**

```
from datetime import datetime, timezone

now = datetime.now()

datetime.datetime(2018, 10, 7, 12, 27, 25,

obj.astimezone(timezone.utc)
```



Built-In vs Third-Party

- Python comes only with a set of built-in modules
- Many more available, which are NOT part of the Python installation
- You need to install these **third-party packages**
- For example you may need specific ones for writing a web application or a machine learning app

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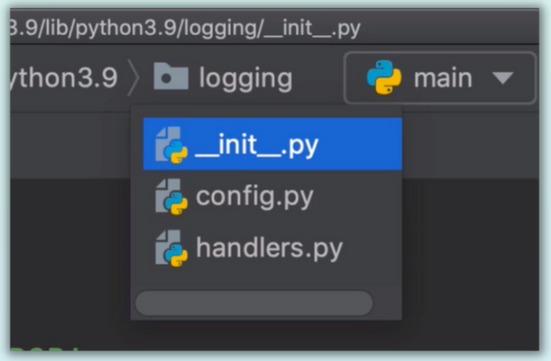
Packages, PyPI and pip

Package

- **Module =** Any Python file is a module
- **Package =** A collection of Python modules
- Package must include an __init__.py file
- This file distinguishes a package from a directory

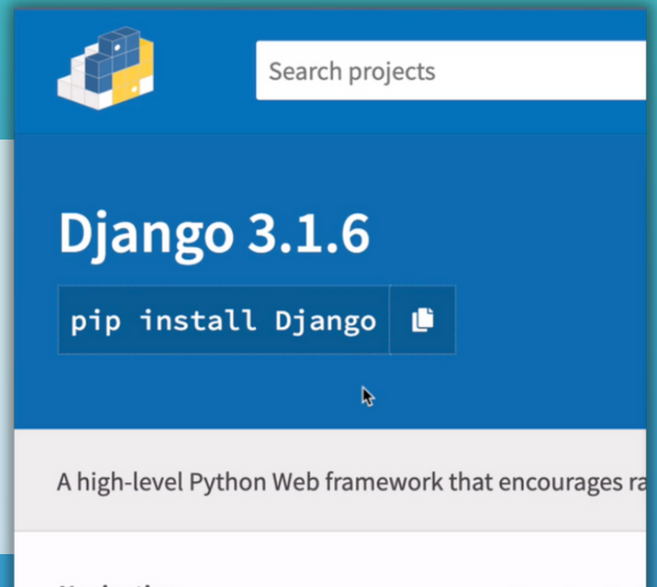


PyPI - Find Packages

- **Repository for third-party Python packages**
- People can publish their packages to this repository
- So it becomes **available for everyone to use**
- Large Community means, many people are creating useful modules and make them available for others

pip

- **Package installer** for Python
- Used to **install packages** from the Python Package Index , but also other indexes



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Object-oriented Programming - 1

- Python is a object oriented programming language
- Almost everything in Python is an object, with its properties (or also called attributes) and methods (functions that belong to the object)

Class

- Like a object constructor or a **blueprint for creating objects**

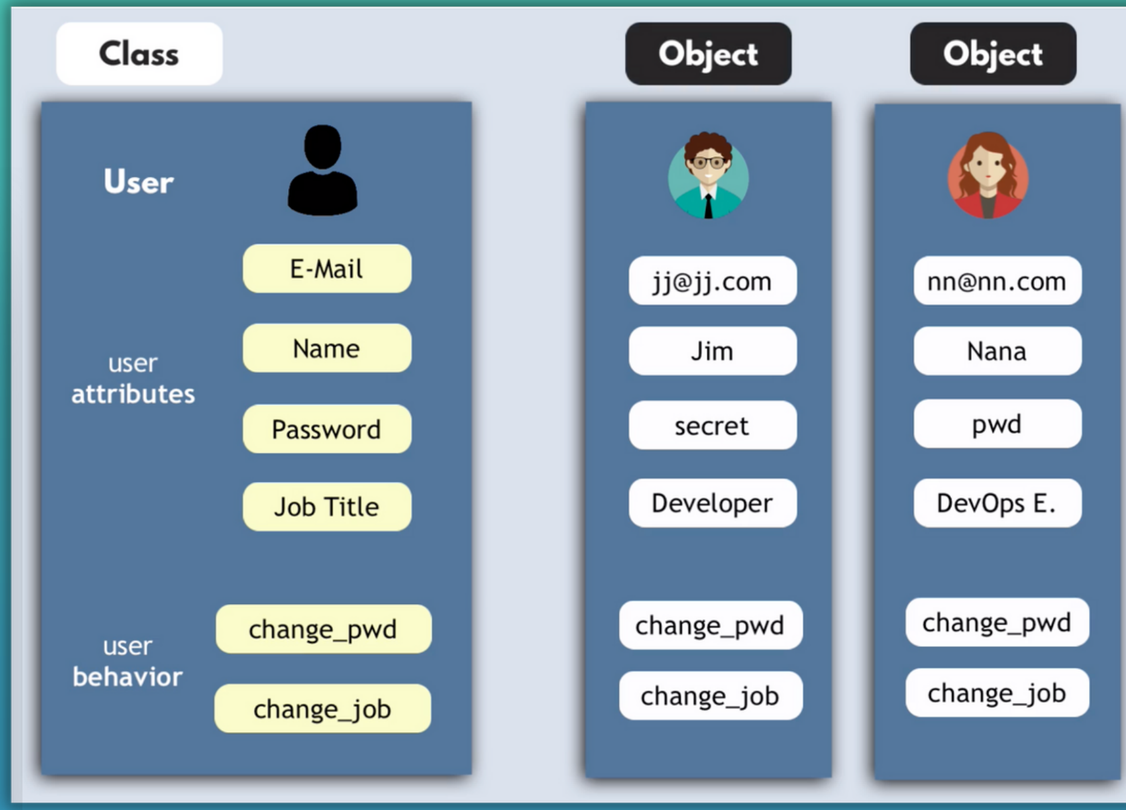
Object

- Object is a unique **instance** of that class

```python
class Person:
  def __init__(self, name, age):
    self.name = name
    self.age = age

p1 = Person("Jim", 32)

print(p1.name)
print(p1.age)
```



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Object-oriented Programming - 2

- All classes have a function called __init__(), which is always **executed when the class is being initiated.**
- Use the __init__() function to **assign values** to object properties, or other operations that are necessary to do when the object is being created

```
class Person:
  def __init__(self, name, age):
    self.name = name
    self.age = age

p1 = Person("Jim", 32)

print(p1.name)
print(p1.age)
```

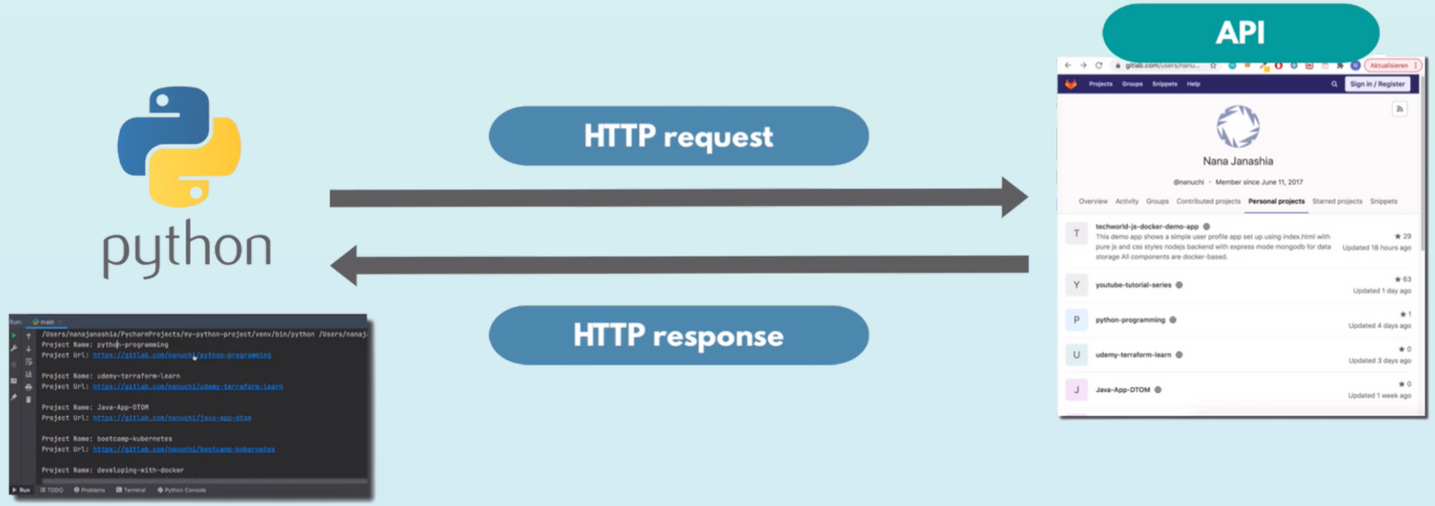
API Requests - 1

Application Programming Interface (API)

- API is code layer of an application that **lets other applications talk to it**.
- So it's used as a **communication interface** between that app (e.g. Gitlab) and any other apps that want to talk to it.

HTTP Request and Response

- To communicate, the app (python app) must send an "**API request**" to GitLab, like "Hey GitLab, give me a list of repositories for user xx" and GitLab will respond with the reply ("**API response**").



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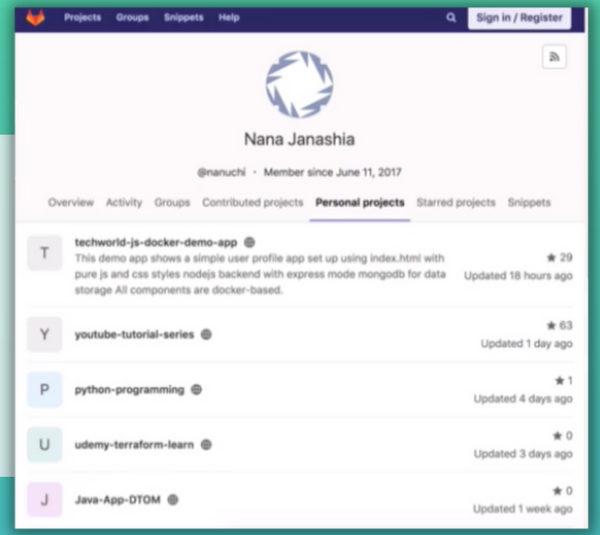
API Requests - 2

JSON

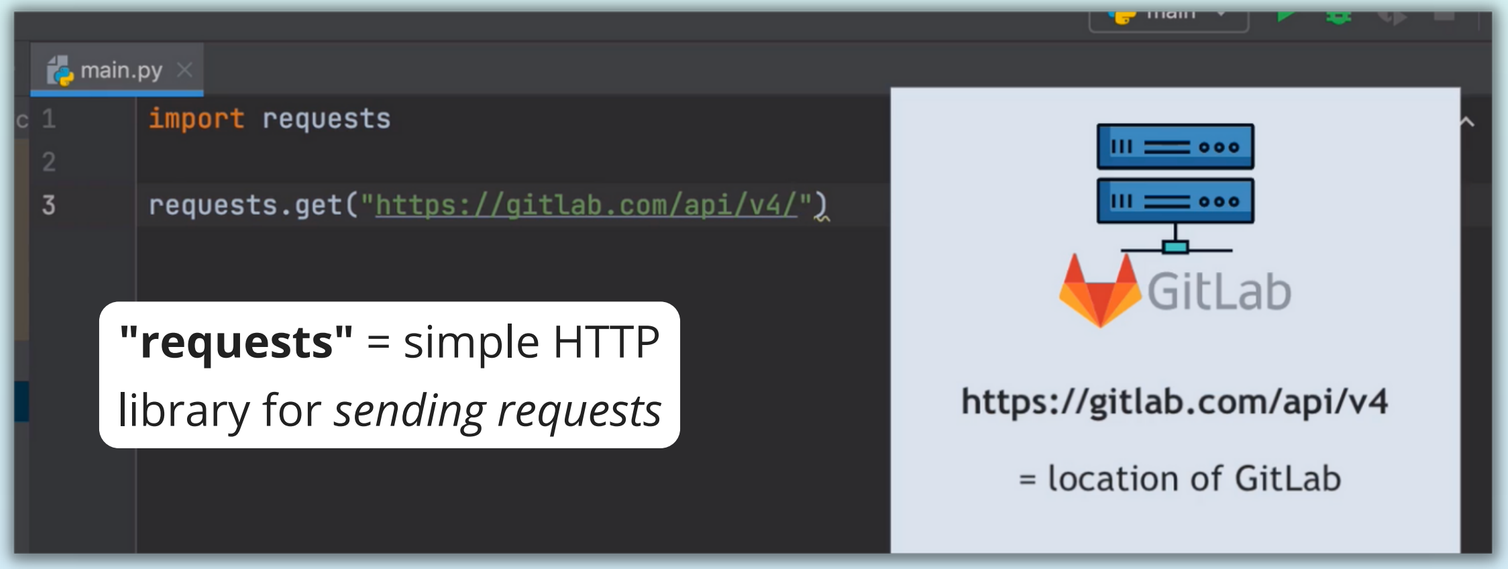
- Lightweight **format for transporting data**
- Often used to send data over the web

Request in JSON →

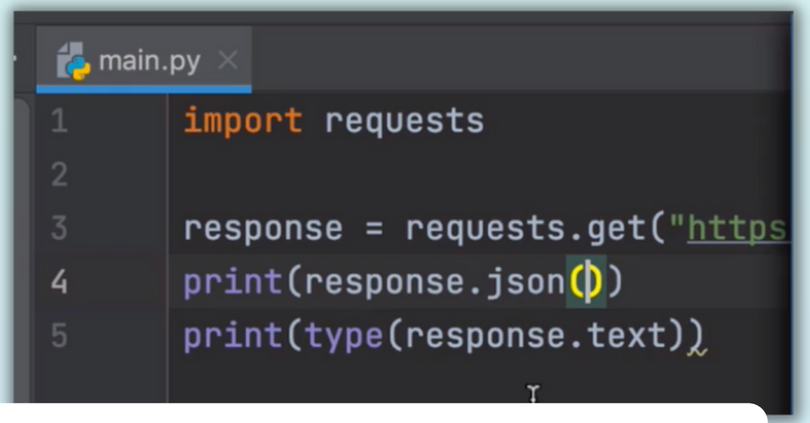
← Response in JSON



How to do it in Python code?



"requests" = simple HTTP library for *sending requests*



"json()" = function converts the data from json into Python data type

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API Requests - 3

Authenticate

- **Many web services require authentication** to access for example personal data, like private repositories of users etc.
- For that the service (GitLab for example) must request validation that it’s the user herself requesting the private information, and not some other user, who is not authorized to see that information.
- So in the request, application (python program) must **send credentials** too, which API will validate.
- There are **different authentication types**

Basic Authentication

```
requests.get('https://gitlab.com/api/v4/jim/repositories', auth=('user', 'pass')
```

Best Practices - 1

Naming Conventions for Variables and Function Names:

- Use **descriptive variable names**!
- Use lowercase and underscores to separate words
- Class file should be lowercase, whereas the class name itself should start with an uppercase. Examples: user.py file, but class User
- Constants are usually defined on a module level and written in all capital letters with underscores separating words. Examples: MAX_OVERFLOW and TOTAL

Comments:

- **Don’t overuse comments**! The program itself with descriptive variable and function names should already be very descriptive.
- Only use comments, when it adds more information. Example: a + b, bad would be to write a comment here: # here I add a plus b

Best Practices - 2

- Use Spaces for Indentation

Functions:

- **DRY - Don’t Repeat Yourself** - a general principle of software development intended for reducing repetition. Whenever you code something more than once you can actually create a function for the logic or a variable for the value.
- Functions should be small and encapsulate one single functionality. If your function needs many parameters, you probably include too much logic and the function should rather be splitted. With this approach you will also have no problem in naming the function and it’s easier to reason about the program.

Official Style Guides for Python: https://www.python.org/dev/peps/pep-0008/