Dictionaries, JSON, and Pip

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Maintaining Two Lists

```
acronyms =     ['LOL',              'IDK',          'TBH']
translations = ['laugh out loud', "I don't know", 'to be honest']

del acronyms[0]
del translations[0]

print(acronyms)
print(translations)
```

If we add or delete from one list...
We have to do the same thing in the other list.

```
['IDK', 'TBH']
["I don't know", 'to be honest']
```

A Dictionary Maps Keys to Values

```
acronyms = {'LOL': 'laugh out loud',
            'IDK': "I don't know",
            'TBH': 'to be honest'}
```

key *assign to* *value*

Key	Value
'LOL'	'laugh out loud'
'IDK'	"I don't know"
'TBH'	'to be honest'

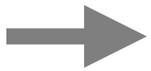
These would be the keys and values stored in the dictionary.

Each item is known as a "key-value pair".

A Dictionary Maps Keys to Values

```
acronyms = {'LOL': 'laugh out loud',
            'IDK': "I don't know",
            'TBH': 'to be honest'}

print(acronyms['LOL'])
```

*To look up a **value** in a dictionary, we send in a **key**. (Instead of an index in a list.)*



```
laugh out loud
```

Dictionaries Can Hold Anything

Dictionaries, like lists, can hold anything you want: numbers, strings, a mix of both, and other objects.

Dictionary of strings to strings

```
acronyms = {'LOL': 'laugh out loud', 'IDK': "I don't know"}
```

Dictionary of strings to numbers

```
menu = {'Soup': 5, 'Salad': 6}
```

A menu item's name is the key, and its price is the value.

Dictionary of anything

```
my_dict = {10: 'hello', 2: 6.5}
```

Creating a Dictionary and Adding Values

Create an empty dictionary:

```
acronyms = {}
```

Adding new dictionary items:

```
acronyms['LOL'] = 'laugh out loud'
acronyms['IDK'] = "I don't know"
acronyms['TBH'] = 'to be honest'
print(acronyms)
```

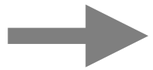
Notice our 3 key-value pairs are there, but order is random in a dictionary.

```
{'IDK': "I don't know", 'LOL': 'laugh out loud',
'TBH': 'to be honest'}
```

Updating Values in Our Dictionary

Our current dictionary:

```
print(acronyms)
```



```
{'IDK': "I don't know",
 'LOL': 'laugh out loud',
 'TBH': 'to be honest'}
```

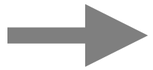
Let's update the value for TBH:

```
acronyms['TBH'] = 'honestly'
```

A value is updated the same way a value is added.

Looking up the same value:

```
print(acronyms['TBH'])
```



```
honestly
```

Removing Dictionary Items

You can delete an item from a dictionary by looking up its key

```
acronyms = {'LOL': 'laugh out loud',
            'IDK': "I don't know",
            'TBH': 'to be honest'}

del acronyms['LOL']

print(acronyms)
```

*To delete a **value** in a dictionary, we send in a **key** just like when we look up a value.*

```
{'IDK': "I don't know", 'TBH': 'to be honest'}
```

Get an Item that Might Not Be There

Trying to access a key that doesn't exist will cause an error

```
definition = acronyms['BTW']
```

```
KeyError: 'BTW'
```

If you want to get a word in the dictionary, use `get()`

```
# Get a value that might not be there
definition = acronyms.get('BTW')
print(definition)
```

Using `get()` *won't crash your program.*

```
None
```

None *is a type that represents the absence of a value.*

None Type

None means the absence of a value, and evaluates to False in a conditional.

```
acronyms = {'LOL': 'laugh out loud', 'IDK': "I don't know"}
definition = acronyms.get('BTW')

if definition:
    print(definition)
else:
    print("Key doesn't exist")
```

definition *equals* None *because the key doesn't exist*

False *because* definition *is* None

So this is run

```
Key doesn't exist
```

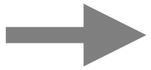
Using a Dictionary to Translate a Sentence

```
acronyms = {'LOL': 'laugh out loud',
            'IDK': "I don't know",
            'TBH': 'to be honest'}

sentence = 'IDK' + ' what happened ' + 'TBH'
translation = acronyms.get('IDK') +' what happened '+ acronyms.get('TBH')
```

Look up the value of each acronym in the acronyms *dictionary*

Using a Dictionary to Translate a Sentence

```
acronyms = {'LOL': 'laugh out loud',
            'IDK': "I don't know",
            'TBH': 'to be honest'}

sentence = 'IDK' + ' what happened ' + 'TBH'
translation = acronyms.get('IDK') +' what happened '+ acronyms.get('TBH')

print('sentence:', sentence)
print('translation:', translation)
```



```
IDK what happened TBH
I don't know what happened to be honest
```

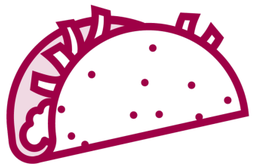
Combining Lists and Dictionaries

Breakfast, Lunch, and Dinner Lists

Let's say we have three separate menu lists: Breakfast, Lunch, Dinner...

```
breakfast = ['Egg Sandwich','Bagel','Coffee']
```

```
lunch = ['BLT','PB&J','Turkey Sandwich']
```



```
dinner = ['Soup','Salad','Spaghetti','Taco']
```

How would we combine these into one list?

A List of Lists

You can have a container of containers - **menus** is a list of lists.

```
menus = [ ['Egg Sandwich','Bagel','Coffee'],
          ['BLT','PB&J','Turkey Sandwich'],
          ['Soup','Salad','Spaghetti','Taco'] ]

print('Breakfast Menu:\t', menus[0])
print('Lunch Menu:\t',     menus[1])
print('Dinner Menu:\t',    menus[2])
```

1st list
2nd list
3rd list

```
Breakfast Menu:  ['Egg Sandwich', 'Bagel', 'Coffee']
Lunch Menu:      ['BLT', 'PB&J', 'Turkey Sandwich']
Dinner Menu:     ['Soup', 'Salad', 'Spaghetti', 'Taco']
```

Getting an Item from a Two-dimensional List

You can use get two indexes to get an individual item

How would you get this item?

```
menus = [ ['Egg Sandwich','Bagel','Coffee'],
          ['BLT','PB&J','Turkey Sandwich'],
          ['Soup','Salad','Spaghetti','Taco'] ]

print(menus[0])
```

1st list

```
['Egg Sandwich', 'Bagel', 'Coffee']
```

A good start! Now we just need to get the second item in this list.

Getting an Item from a Two-dimensional List

You can use get two indexes to get an individual item

How would you get this item?

```
menus = [ ['Egg Sandwich','Bagel','Coffee'],
          ['BLT','PB&J','Turkey Sandwich'],
          ['Soup','Salad','Spaghetti','Taco'] ]

print(menus[0][1])
```

The list at index 0 in the outer list, the item at index 1 in the inner list

```
Bagel
```

A Dictionary of Lists

We could also use a dictionary for our menus with keys for Breakfast, Lunch and Dinner

```
menus = { 'Breakfast': ['Egg Sandwich','Bagel','Coffee'],
          'Lunch':     ['BLT','PB&J','Turkey Sandwich'],
          'Dinner':    ['Soup','Salad','Spaghetti','Taco'] }

print('Breakfast Menu:\t', menus['Breakfast'])
print('Lunch Menu:\t',     menus['Lunch'])
print('Dinner Menu:\t',    menus['Dinner'])
```

Using the keys to access each list

```
Breakfast Menu:  ['Egg Sandwich', 'Bagel', 'Coffee']
Lunch Menu:      ['BLT', 'PB&J', 'Turkey Sandwich']
Dinner Menu:     ['Soup', 'Salad', 'Spaghetti', 'Taco']
```

A Dictionary of Lists

We could also use a dictionary for our menus with keys for Breakfast, Lunch and Dinner

```
menus = { 'Breakfast': ['Egg Sandwich','Bagel','Coffee'],
          'Lunch':     ['BLT','PB&J','Turkey Sandwich'],
          'Dinner':    ['Soup','Salad','Spaghetti','Taco'] }

print('Breakfast Menu:\t', menus['Breakfast'])
print('Lunch Menu:\t',     menus['Lunch'])
print('Dinner Menu:\t',    menus['Dinner'])
```

What if we had a lot more menus, is there better way to print each one?

```
Breakfast Menu:  ['Egg Sandwich', 'Bagel', 'Coffee']
Lunch Menu:      ['BLT', 'PB&J', 'Turkey Sandwich']
Dinner Menu:     ['Soup', 'Salad', 'Spaghetti', 'Taco']
```

Printing the Dictionary Menu Items

```
menus = { 'Breakfast': ['Egg Sandwich','Bagel','Coffee'],
          'Lunch':     ['BLT','PB&J','Turkey Sandwich'],
          'Dinner':    ['Soup','Salad','Spaghetti','Taco'] }

for item in menus:
    print(item)
```

*This defaults to just returning the keys in a dictionary... Which is **not** what we want.*

```
Breakfast
Lunch
Dinner
```

Using a Dictionary's Key and Value in a `for` Loop

```
menus = { 'Breakfast': ['Egg Sandwich','Bagel','Coffee'],
          'Lunch':     ['BLT','PB&J','Turkey Sandwich'],
          'Dinner':    ['Soup','Salad','Spaghetti','Taco'] }

for name, menu in menus.items():
    print(name, ':', menu)
```

Now the loop has access to both the key and the value here.

```
Breakfast :  ['Egg Sandwich', 'Bagel', 'Coffee']
Lunch :      ['BLT', 'PB&J', 'Turkey Sandwich']
Dinner :     ['Soup', 'Salad', 'Spaghetti', 'Taco']
```

Using Dictionaries to Represent Objects

Let's say we have a person and we want to represent their attributes, such as their name, age, and city they're from.

We could use a dictionary where the attributes are saved as key, value pairs.

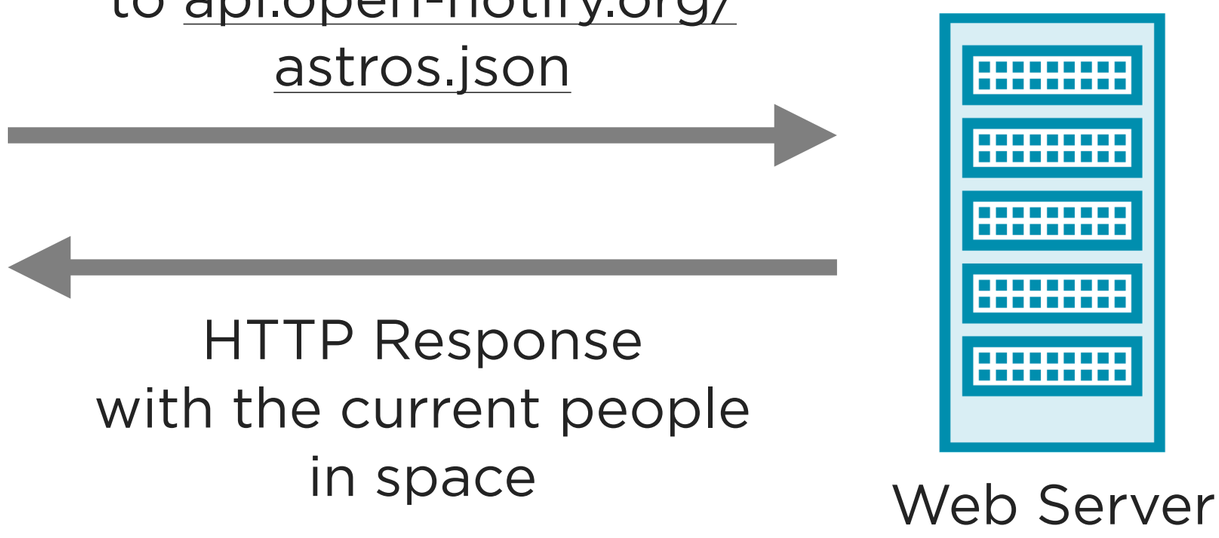
```
person = {'name': 'Sarah Smith',
          'city': "Orlando",
          'age': '100'}

print(person.get('name'), 'is', person.get('age'), 'years old.')
```

```
Sarah Smith is 100 years old.
```

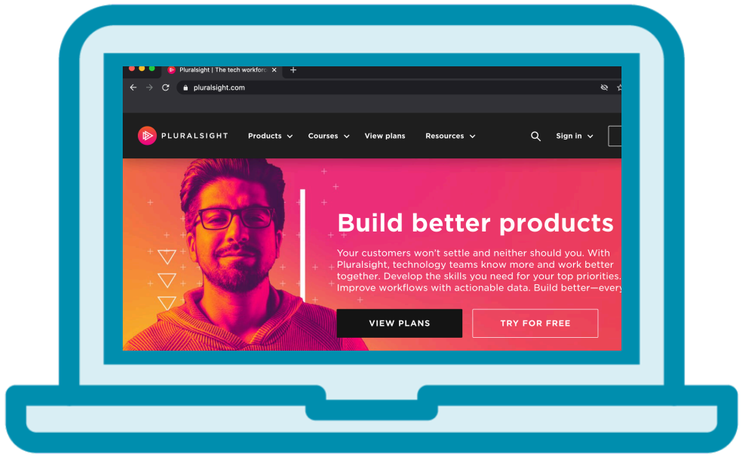
Reading JSON and Installing Packages with Pip

We Want a Program that Lists the Current People in Space

```
>>> python3 space_people.py

The people currently
in space are:

Sergey Ryzhikov
Kate Rubins
Sergey Kud-Sverchkov
Mike Hopkins
Victor Glover
Shannon Walker
Soichi Noguchi
```



HTTP Request



Your Computer

HTTP Request
pluralsight.com

HTTP Response

HTML can be returned and displayed as a web page in your browser

Web Server

Some Websites Return Raw Data

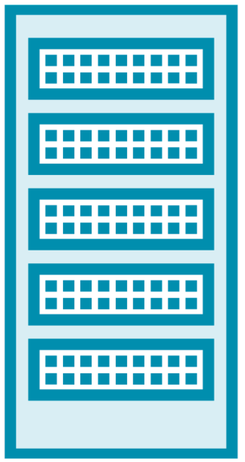
Usually the raw data is returned under the API (Application Programming Interface) for the website such as api.twitter.com

Your Computer

HTTP Request

HTTP Response

JSON data is returned and different applications can do different things with it



Web Server

JSON Data

A common use of JSON is to exchange data to/from a web server.

```
json = {
    "number":4,
    "students":
        [
            {"name":"Sarah Holderness", "email":"sarah@example.com"},
            {"name":"Harry Potter", "email":"harry@example.com"},
            {"name":"Hermione Granger", "email":"hermione@example.com"},
            {"name":"Ron Weasley", "email":"ron@example.com"}
        ]
}
```

JSON format can be a mix of lists and dictionaries like we've seen before

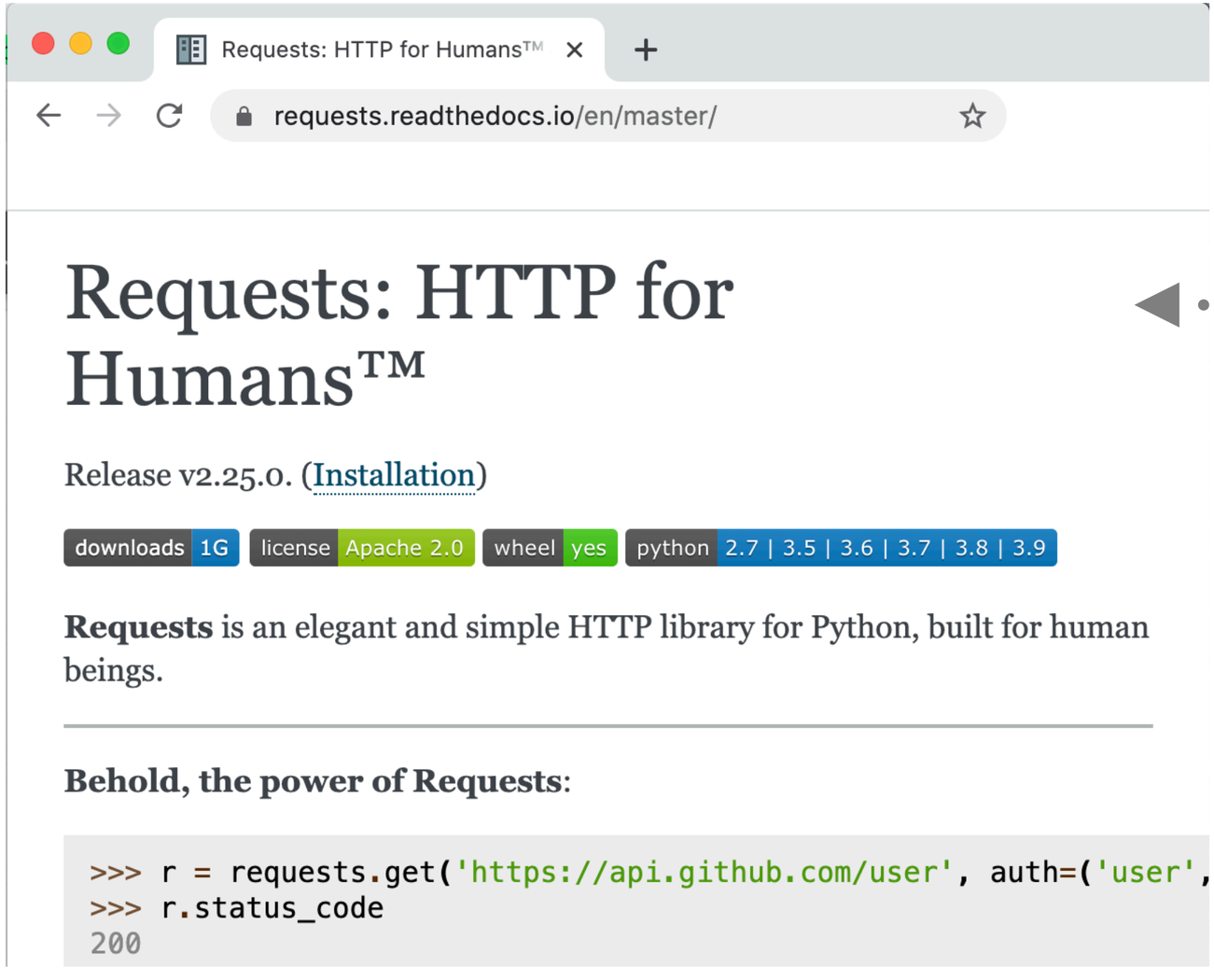
JSON - JavaScript Object Notation

JSON started in JavaScript but now can be used in any programming language, including Python

```
json = {
    "number":4,
    "students":
        [
            {"name":"Sarah Holderness", "email":"sarah@example.com"},
            {"name":"Harry Potter", "email":"harry@example.com"},
            {"name":"Hermione Granger", "email":"hermione@example.com"},
            {"name":"Ron Weasley", "email":"ron@example.com"}
        ]
}
```

How Do We Do an HTTP Request in Python?

If you do a web search for "Python http request" the first result should be for the requests library.



The requests library allows us to do an http request.

However, requests is not installed with Python so we need to install it ourselves.

Ensure PIP is Installed

pip is used to install any package from the Python Package Index

If Python 3 is installed the command `pip3` *should work on a Mac or* `pip` *on Windows. (Otherwise add* `pip` *to the Path.)*

```
<<< pip3 --version

pip 20.2.3 from /Library/Frameworks/Python.framework/
Versions/3.9/lib/python3.9/site-packages/pip (python 3.9)
```

Installing the Requests Package

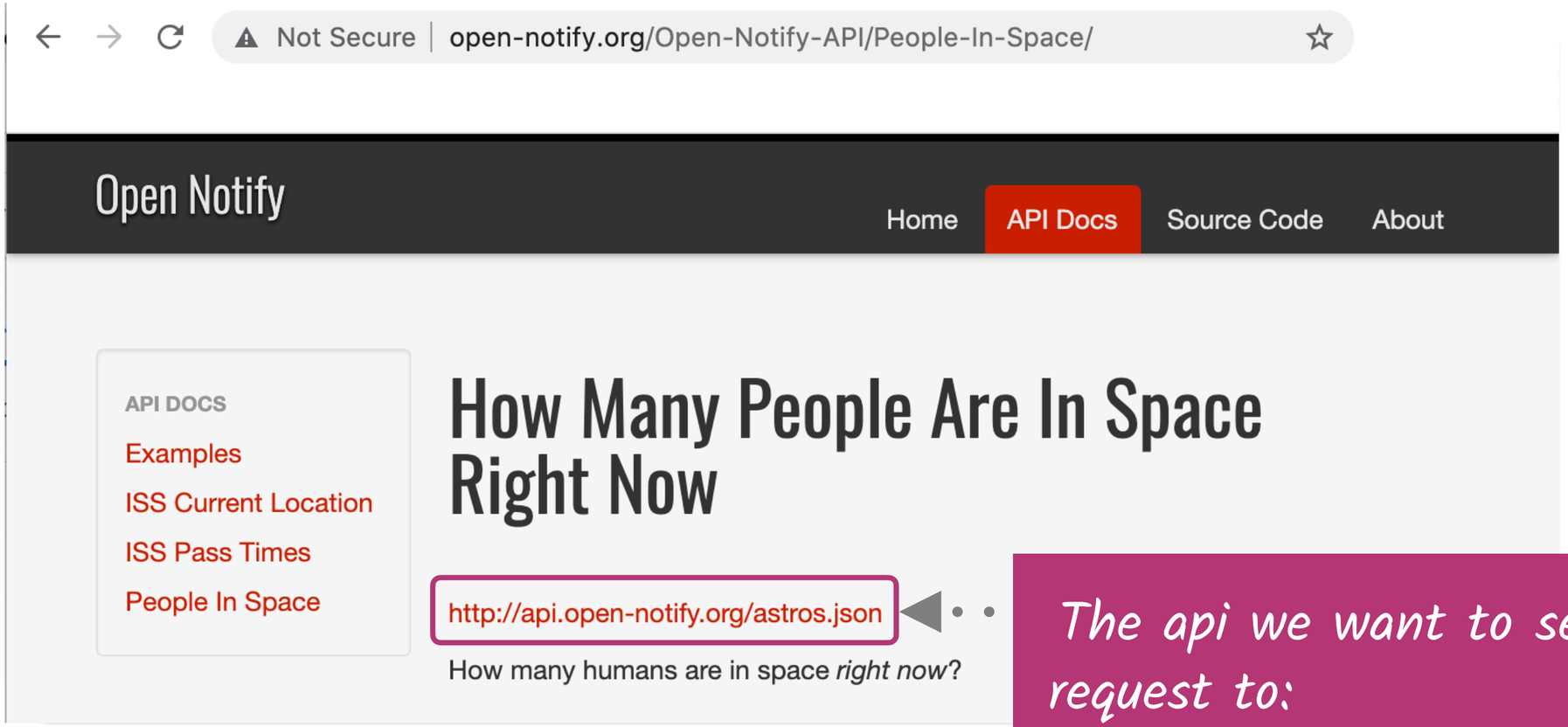
```
<<< pip3 requests

Collecting requests
...
Successfully installed requests-2.25.0
```

You will need an internet connection since the packages are downloaded from the internet.

Now that the `requests` *package is installed, we can use it in a program!*

Where Do We Want to Request Data From?

open-notify.org - This API returns the current number of people in space. When known it also returns the names and spacecraft those people are on.



The api we want to send http the request to:
api.open-notify.org/astros.json

How many humans are in space *right now* in JSON?

Making a request to http://api.open-notify.org/astros.json, will return the following JSON format.

```
{
    "message": "success",
    "number": NUMBER_OF_PEOPLE_IN_SPACE,
    "people": [
      {"name": NAME, "craft": SPACECRAFT_NAME},
      ...
    ]
}
```

How Do We Do an HTTP Request in Python?

```
import requests
```

First, we import the requests module

How Do We Do an HTTP Request in Python?

```
import requests

response = requests.get('http://api.open-notify.org/astros.json')
```

Then we call `requests.get()` *and pass in our http address:* api.open-notify.org/astros.json

How Do We Get JSON from the Response?

```
import requests

response = requests.get('http://api.open-notify.org/astros.json')
json  = response.json()
```

Call `response.json()` *to decode the JSON from the response.*

Now We Can Print the JSON Data

```
import requests

response = requests.get('http://api.open-notify.org/astros.json')
json  = response.json()
print(json)
```

json *stores the JSON as a dictionary*

```
{
    'message': 'success',
    'number': 7,
    'people': [
        {'craft': 'ISS', 'name': 'Sergey Ryzhikov'},
        {'craft': 'ISS', 'name': 'Kate Rubins'},
        …
}
```

How Do We Print the Names of the People in Space?

```
json  =
```

```
{
    'message': 'success',
    'number': 7,
    'people': [
        {'craft': 'ISS', 'name': 'Sergey Ryzhikov'},
        {'craft': 'ISS', 'name': 'Kate Rubins'},
        …
}
```

How do we get this list of people?

```
json['people']
```

We can use the `people` *key.*
Now let's print this list.

Printing the People in Space

```
import requests

response = requests.get('http://api.open-notify.org/astros.json')
json  = response.json()

for person in json['people']:
    print(person)
```

We can use a loop to print each item in this list.

```
{'craft': 'ISS', 'name': 'Sergey Ryzhikov'}
{'craft': 'ISS', 'name': 'Kate Rubins'}
{'craft': 'ISS', 'name': 'Sergey Kud-Sverchkov'}
...
```

Each item is a dictionary, but we just want the name part.

Printing the People in Space

```
import requests

response = requests.get('http://api.open-notify.org/astros.json')
json  = response.json()

for person in json['people']:
    print(person['name'])
```

We can use the key 'name' key to get just the name.

```
Sergey Ryzhikov
Kate Rubins
Sergey Kud-Sverchkov
...
```

Great! We're able to print the names of the people in space.

Final Touch: Adding a Heading

```
import requests

response = requests.get('http://api.open-notify.org/astros.json')
json  = response.json()

print('The people currently in space are:')
for person in json['people']:
    print(person['name'])
```

Print a heading for clarity.

```
The people currently in space are:
Sergey Ryzhikov
Kate Rubins
Sergey Kud-Sverchkov
...
```