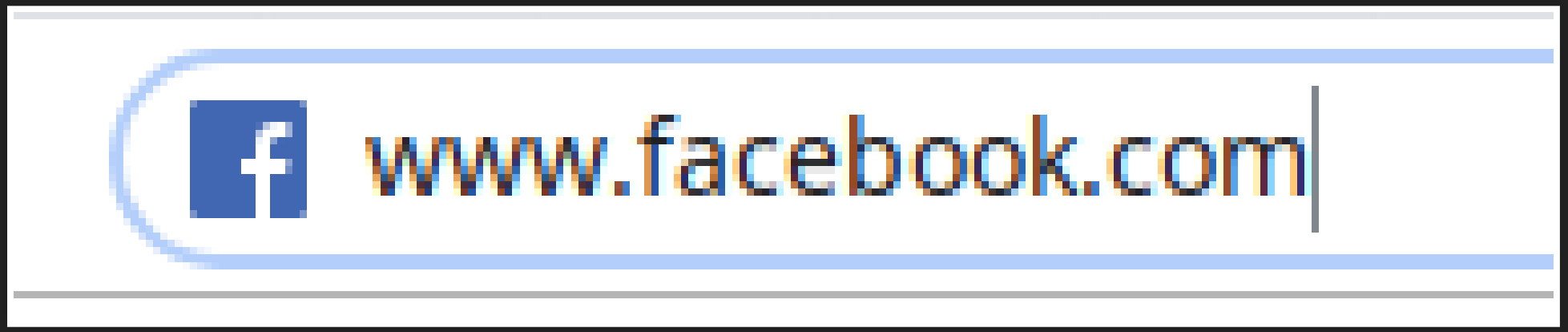
HTTP, REST API, JSON & THE WEB (ALSO REGEXES)

What happens when you press enter?



1. Browser -> DNS: what's the IP of facebook.com?

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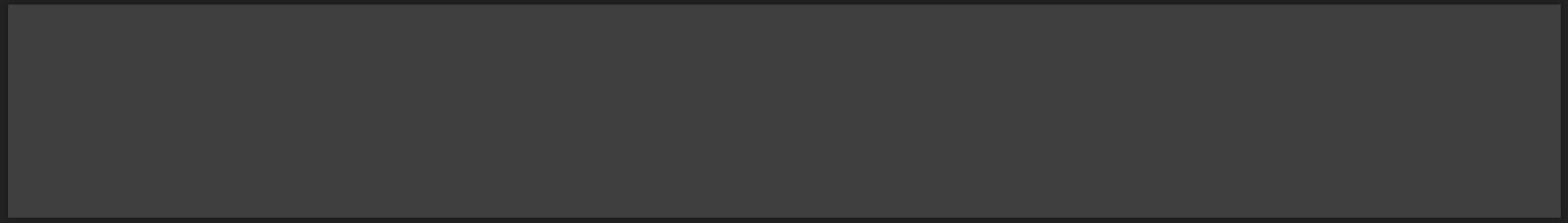
3. Browser -> 4.4.4.4: send HTTP request
4. 4.4.4.4 -> Browser: send HTTP response

HTTP request

HTTP request



HTTP request

```
GET
```

HTTP request

```
GET /
```

HTTP request

```
GET / HTTP/1.1
```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
Accept-Language: en

```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
Accept-Language: en
Accept-Encoding: gzip
```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
Accept-Language: en
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```

HTTP response

HTTP request

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GET / HTTP/1.1
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HTTP response

```

```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
Accept-Language: en
Accept-Encoding: gzip
```

HTTP response

```
HTTP/1.1 200 OK
```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
Accept-Language: en
Accept-Encoding: gzip
```

HTTP response

```
HTTP/1.1 200 OK
Content-Length: 29769
```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
Accept-Language: en
Accept-Encoding: gzip
```

HTTP response

```
HTTP/1.1 200 OK
Content-Length: 29769
Content-Type: text/html
```

HTTP request

```
GET / HTTP/1.1
Host: www.facebook.com
Accept-Language: en
Accept-Encoding: gzip
```

HTTP response

```
HTTP/1.1 200 OK
Content-Length: 29769
Content-Type: text/html

<html>...</html>
```

HTTP methods

HTTP methods

1. GET - read data

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2. POST - update/insert data

HTTP methods

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3. DELETE - delete data

HTTP methods

1. GET - read data
2. POST - update/insert data
3. DELETE - delete data
4. PUT, PATCH, HEAD, OPTIONS, ...

Passing data to server

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Params in URL (usually for GET)

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Params in URL (usually for GET)

```
GET /page?param1=a&param2=b
```

Passing data to server

Params in URL (usually for GET)

```
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```

Data in body (usually for POST)

Passing data to server

Params in URL (usually for GET)

```
GET /page?param1=a&param2=b
```

Data in body (usually for POST)

```
POST /page
...

hello
```

HTTP status codes

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- 2xx - everything is fine

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- 3xx - redirection

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HTTP status codes

- 2xx - everything is fine
- 3xx - redirection
- 4xx - client error
- 5xx - server error

- 403 - forbidden
- 404 - not found
- 500 - internal server error
- 418 - I'm a teapot ☕

API (APPLICATION PROGRAMMING INTERFACE)

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- interface for using code

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- Operate on resources using HTTP requests

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- interface for using code
- simplifies usage of complex code
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REST API

- Idea: represent data as resources (URLs)
- Operate on resources using HTTP requests
- Intention of requests is given by HTTP method

Example: provide access to a database of users

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Endpoint: /users

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- GET /users/1 - download user with ID 1

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Endpoint: /users

- GET /users - download all users
- GET /users/1 - download user with ID 1
- POST /users - create new user
- DELETE /users - delete user with ID 1

How is the data transferred?

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- Char. encoding: typically UTF-8

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- URL encoding: /hello world -> /hello%20world

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- Char. encoding: typically UTF-8
- URL encoding: /hello world -> /hello%20world
- Data format: historically XML, nowadays JSON

JSON (example)

```
{
  "course": "SPJA",
  "teacher": "Kuba Beránek",
  "year": 2018,
  "attendants": ["Martin Novák", "František Dobrota"]
}
```

JSON (data types)

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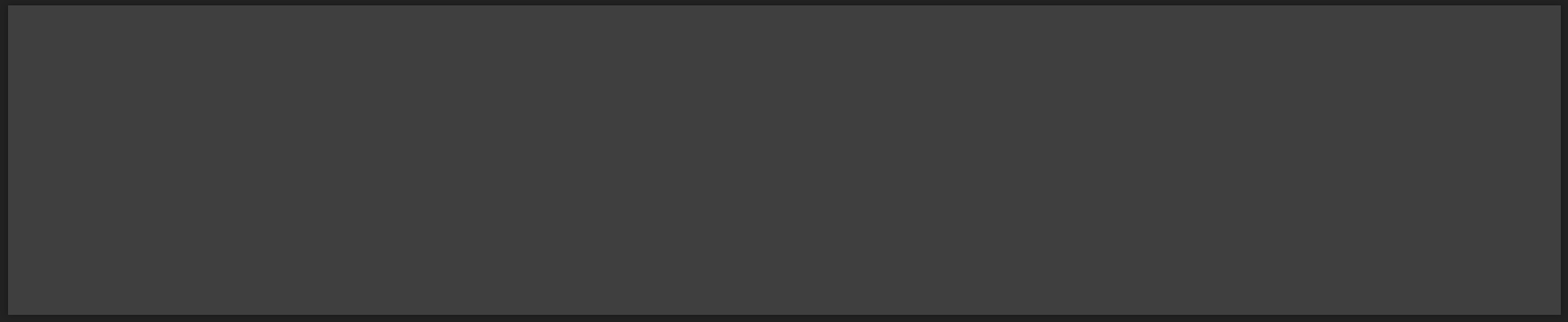

JSON (data types)

```
1
```

JSON (data types)

```
1
"hello"
```

JSON (data types)

```
1
"hello"
true
```

JSON (data types)

```
1
"hello"
true
null
```

JSON (data types)

```
1
"hello"
true
null
[1, 2, ["3", 4, true]]
```

JSON (data types)

```
1
"hello"
true
null
[1, 2, ["3", 4, true]]
{"name": "James", "children": [...]}
```

requests library

```
$ pip install requests
```

Generated request

requests library

```
$ pip install requests
```

```
import requests, json
```

Generated request

```
```

requests library

```
$ pip install requests
```

```
import requests, json
res = requests.post(
```

Generated request

```
POST
```

requests library

```
$ pip install requests
```

```
import requests, json
res = requests.post("github.com/users",
```

Generated request

```
POST /users HTTP/1.1
Host: github.com
```

requests library

```
$ pip install requests
```

```
import requests, json
res = requests.post("github.com/users",
  headers={"Content-Type": "application/json"},
```

Generated request

```
POST /users HTTP/1.1
Host: github.com
Content-Type: application/json
```

requests library

```
$ pip install requests
```

```
import requests, json
res = requests.post("github.com/users",
  headers={"Content-Type": "application/json"},
  data=json.dumps({"param": 1})
)
```

Generated request

```
POST /users HTTP/1.1
Host: github.com
Content-Type: application/json

{"param": 1}
```

requests library

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$ pip install requests
```

```
import requests, json
res = requests.post("github.com/users",
  headers={"Content-Type": "application/json"},
  data=json.dumps({"param": 1})
)
res.content  # raw binary data
```

Generated request

```
POST /users HTTP/1.1
Host: github.com
Content-Type: application/json

{"param": 1}
```

requests library

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$ pip install requests
```

```
import requests, json
res = requests.post("github.com/users",
  headers={"Content-Type": "application/json"},
  data=json.dumps({"param": 1})
)
res.content  # raw binary data
res.json     # parsed JSON data
```

Generated request

```
POST /users HTTP/1.1
Host: github.com
Content-Type: application/json

{"param": 1}
```

requests library

```
$ pip install requests
```

```
import requests, json
res = requests.post("github.com/users",
  headers={"Content-Type": "application/json"},
  data=json.dumps({"param": 1})
)
res.content  # raw binary data
res.json     # parsed JSON data
res.text     # text data
```

Generated request

```
POST /users HTTP/1.1
Host: github.com
Content-Type: application/json

{"param": 1}
```

OAuth client

```
$ pip install oauth2
```

```
client = create_client()
res, data = client.request("github.com/api",
  method="POST", headers=...)
assert res['status'] == 200
```

REGULAR EXPRESSIONS

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standardized language for searching and manipulating text

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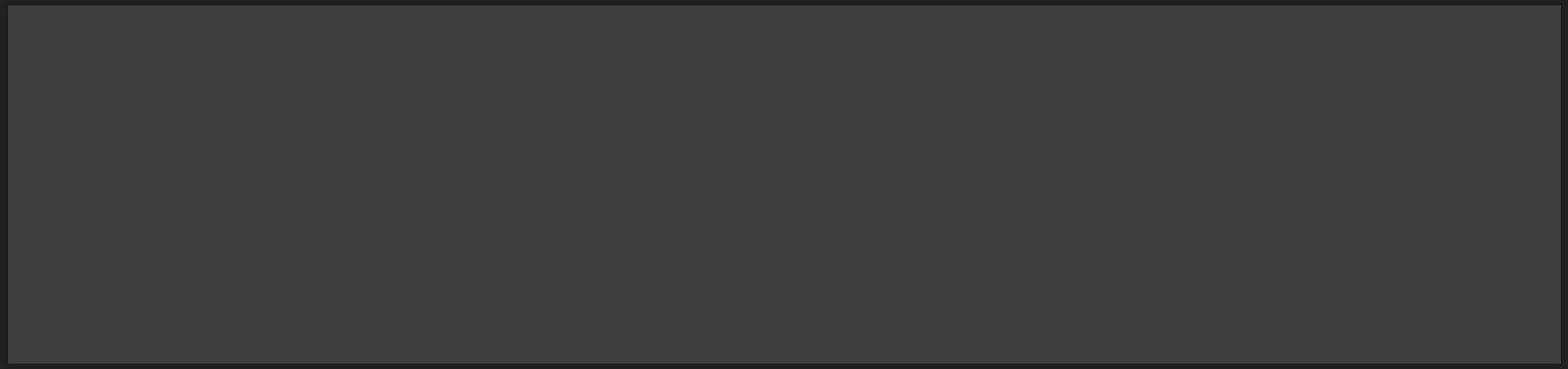
standardized language for searching and manipulating text

```
(?:\w|-)*@(?:\w|-)\.\w{2-4}
```

Regex intro (https://regex101.com/)

```
abc          match literal characters 'abc'
.            match anything
\s           match whitespace
\d           match digit (1, 2, etc.)
[abc]        match any character from the brackets (a, b or c)
\d*          match digit 0 or more times
\d+          match digit 1 or more times
\d{1,3}      match digit between 1-3 times
(x.*)        capture text inside the parantheses
a|b          match a or b
(A|B)*       match repeated As and Bs
```



```
1) Vepřo knedlo zelo 115,-
```

```
(\d)\)\s*(.*?)\s*(\d+),-
```

```

```

```
1) Vepřo knedlo zelo 115,-
```

```
(\d)\)\s*(.*?)\s*(\d+),-
```

```
(\d)   zaznamenej číslici (ID jídla)
```

```
1) Vepřo knedlo zelo 115,-
```

```
(\d)\)\s*(.*?)\s*(\d+),-
```

```
(\d)   zaznamenej číslici (ID jídla)
\)     následovanou znakem konce závorky ')'
```

```
1) Vepřo knedlo zelo 115,-
```

```
(\d)\)\s*(.*?)\s*(\d+),-
```

```
(\d)   zaznamenej číslici (ID jídla)
\)     následovanou znakem konce závorky ')'
\s*    ignoruj mezery
```

```
1) Vepřo knedlo zelo 115,-
```

```
(\d)\)\s*(.*?)\s*(\d+),-
```

```
(\d)   zaznamenej číslici (ID jídla)
\)     následovanou znakem konce závorky ')'
\s*    ignoruj mezery
(.*?)  zaznamenej cokoliv, co najdeš (název jídla)
```

```
1) Vepřo knedlo zelo_115,-
```

```
(\d)\)\s*(.*?)\s*(\d+),-
```

```
(\d)   zaznamenej číslici (ID jídla)
\)     následovanou znakem konce závorky ')'
\s*    ignoruj mezery
(.*?)  zaznamenej cokoliv, co najdeš (název jídla)
\s*    ignoruj mezery
```

```
1) Vepřo knedlo zelo 115,-
```

```
(\d)\)\s*(.*?)\s*(\d+),-
```

```
(\d)   zaznamenej číslici (ID jídla)
\)     následovanou znakem konce závorky ')'
\s*    ignoruj mezery
(.*?)  zaznamenej cokoliv, co najdeš (název jídla)
\s*    ignoruj mezery
(\d+)  zaznamenej sekvenci číslic (cena)
```

```
1) Vepřo knedlo zelo 115,-
```

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(\d)\)\s*(.*?)\s*(\d+),-
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```
(\d)   zaznamenej číslici (ID jídla)
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\s*    ignoruj mezery
(.*?)  zaznamenej cokoliv, co najdeš (název jídla)
\s*    ignoruj mezery
(\d+)  zaznamenej sekvenci číslic (cena)
,-     následovanou znaky ',-'
```

Regex in Python

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```
import re
```

Regex in Python

```
import re
regex = re.compile('param="([\w/.]+)"')
```

Regex in Python

```
import re
regex = re.compile('param="([\w/.]+)"')
matches = regex.findall('param="images/data.jpg"')
```

Regex in Python

```
import re
regex = re.compile('param="([\w/.]+)"')
matches = regex.findall('param="images/data.jpg"')
# ['images/data.jpg']
```