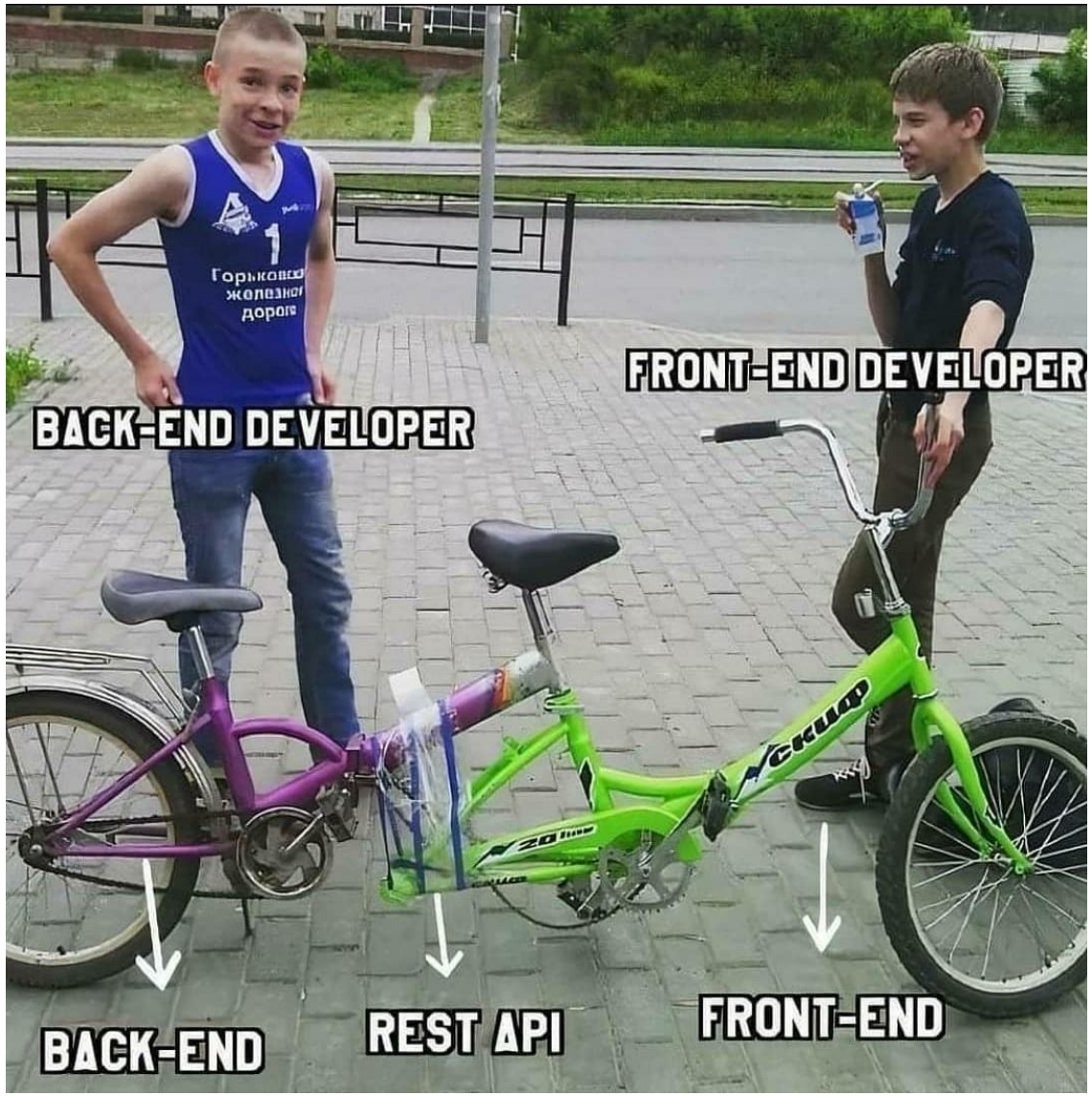

BACK-END DEVELOPER
FRONT-END DEVELOPER
BACK-END
REST API
FRONT-END


I'M THE CLIENT
GOOD
BAD
DO WHAT I SAY NOW!
memegenerator.net

Module 2-9

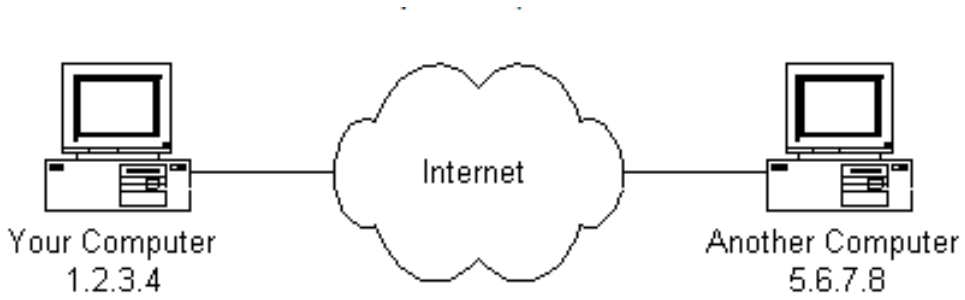
HTTP and Web APIs

Objectives

- Explain the purpose of: IP Addresses, DNS, Ports, HTTP, TLS
- Identify and explain the purpose of the main components of HTTP
- Explain the steps of a typical HTTP request between a web browser and a server
- Explain what a GET request is used for
- Recognize that a 2xx Status Code indicates "success"
- Make an HTTP GET request using Postman and inspect the result
- Explain what JSON is and how to use it in a Java program
- Make an HTTP GET request to a RESTful web service using Java and process the response

What is the Internet?

- **Global network of computers**
- Each has a unique address (IP Address – Internet Protocol)
- IPv4 (32 – bit)
  nnn.nnn.nnn.nnn -- nnn must be a number between 0 – 255
  Ex. -- `198.185.159.145`
- IPv6 (128 – bit)
  8 groups of 4 hexadecimal digits, groups are separated by colons



Anatomy of a URL

Here is a URL that uses an IP number:

https://**127.0.0.1**:**3000**

- **protocol:** others - http, ftp
- **ip address:** This is the unique address of a machine on a network.
- **port**: Number allocated for a specific type of service.

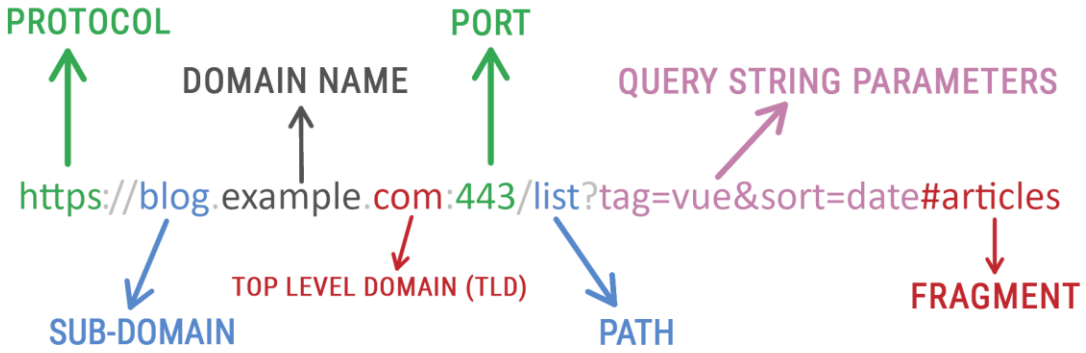
Anatomy of a URL

Here is another URL that uses hostnames, this is certainly easier to remember than a bunch of numbers.

https://skynet.**wecomeinpeace.com**

- host name: A physical name assigned to your machine.
- **domain name**: Defines a specific “region of control” on the internet, also, .com is referred to as the top-level domain name.

The above URL is an example of a fully qualified domain name (FQDN).



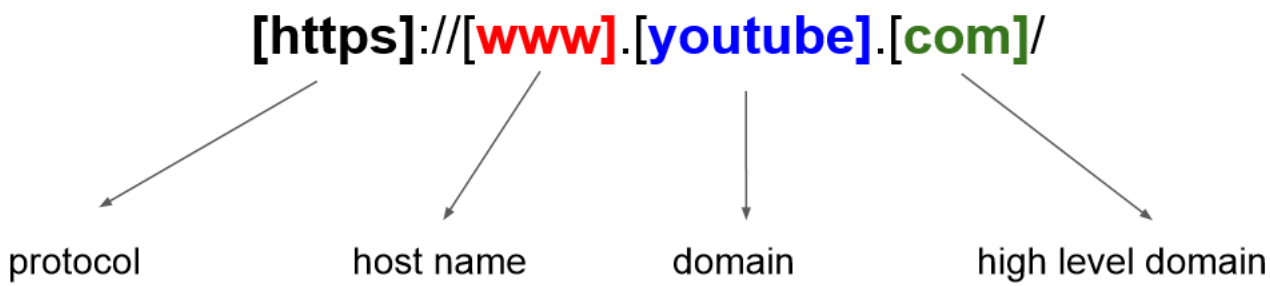
DNS

- DNS is an acronym for Domain Name System.
- A DNS server is responsible for converting a URL containing human readable domain names (second example) to one containing an IP address (first example)

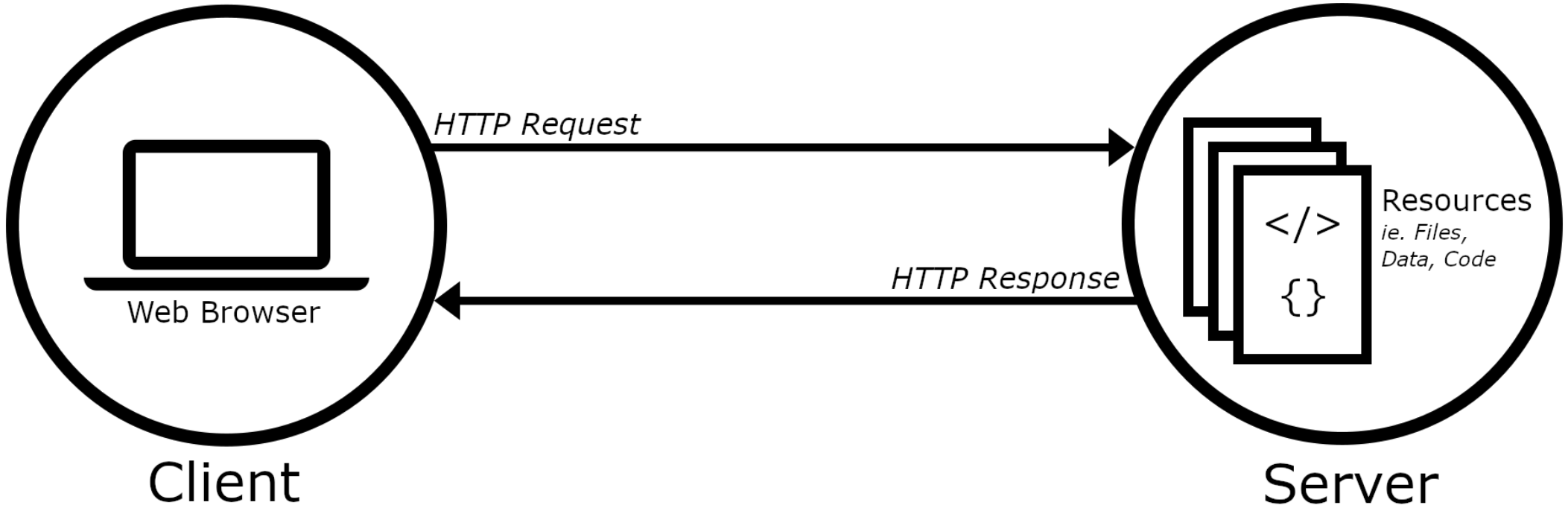
WWW

Because I’m sure you’ve wondered…

- On a URL the appearance of www has no bearing on the means by which we are communicating with another machine on the network (the protocol is still http or https).
- www is simply a hostname:



HTTP


HTTP Request
HTTP Response
Web Browser
Client
Resources
ie. Files,
Data, Code
</>
{}
Server

HTTP request

- **Request message has several elements:**
  - **An HTTP method (GET, PUT, POST, DELETE)**
  - **Path to resource**
  - **Headers**
  - **Message body**

HTTP response

- **Request message has several elements:**
  - **A status-line**
  - **Zero or more headers**
  - **Empty line**
  - **Message body (optional)**

HTTP methods

- **GET**
- **POST**
- **PUT**
- **DELETE**

Example

A simple form using the default `application/x-www-form-urlencoded` content type:

```
POST /test HTTP/1.1
Host: foo.example
Content-Type: application/x-www-form-urlencoded
Content-Length: 27

field1=value1&field2=value2
```

A form using the `multipart/form-data` content type:

```
POST /test HTTP/1.1
Host: foo.example
Content-Type: multipart/form-data;boundary="boundary"

--boundary
Content-Disposition: form-data; name="field1"

value1
--boundary
Content-Disposition: form-data; name="field2"; filename="example.txt"

value2
--boundary--
```

HTTP status codes

Code Range	Description
100-199	Information Responses
200-299	Successful Responses
300-399	Redirection Messages
400-499	Client Error Responses
500-599	Server Error Responses

HTTP Status Codes

This page is created from HTTP status code information found at ietf.org and Wikipedia. Click on the **category heading** or the **status code** link to read more.

1xx Informational

100 Continue
101 Switching Protocols
102 Processing (WebDAV)

2xx Success

★ 200 OK
★ 201 Created
202 Accepted
203 Non-Authoritative Information
★ 204 No Content
205 Reset Content
206 Partial Content
207 Multi-Status (WebDAV)
208 Already Reported (WebDAV)
226 IM Used

3xx Redirection

300 Multiple Choices
301 Moved Permanently
302 Found
303 See Other
★ 304 Not Modified
305 Use Proxy
306 (Unused)
307 Temporary Redirect
308 Permanent Redirect (experimental)

4xx Client Error

★ 400 Bad Request
★ 401 Unauthorized
402 Payment Required
★ 403 Forbidden
★ 404 Not Found
405 Method Not Allowed
406 Not Acceptable
407 Proxy Authentication Required
408 Request Timeout
★ 409 Conflict
410 Gone
411 Length Required
412 Precondition Failed
413 Request Entity Too Large
414 Request-URI Too Long
415 Unsupported Media Type
416 Requested Range Not Satisfiable
417 Expectation Failed
418 I'm a teapot (RFC 2324)
420 Enhance Your Calm (Twitter)
422 Unprocessable Entity (WebDAV)
423 Locked (WebDAV)
424 Failed Dependency (WebDAV)
425 Reserved for WebDAV
426 Upgrade Required
428 Precondition Required
429 Too Many Requests
431 Request Header Fields Too Large
444 No Response (Nginx)
449 Retry With (Microsoft)
450 Blocked by Windows Parental Controls (Microsoft)
451 Unavailable For Legal Reasons
499 Client Closed Request (Nginx)

5xx Server Error

★ 500 Internal Server Error
501 Not Implemented
502 Bad Gateway
503 Service Unavailable
504 Gateway Timeout
505 HTTP Version Not Supported
506 Variant Also Negotiates (Experimental)
507 Insufficient Storage (WebDAV)
508 Loop Detected (WebDAV)
509 Bandwidth Limit Exceeded (Apache)
510 Not Extended
511 Network Authentication Required
598 Network read timeout error
599 Network connect timeout error

★ **"Top 10"** HTTP Status Code. More REST service-specific information is contained in the entry.

Web service

- Web server – hardware and software to display content
  - Hardware is computer where software and data files are stored
  - Software provides controls on how files are accessed
    - HTTP server
    - Other protocols – FTP, UDP, SNMP, SFTP, available but not for web content.

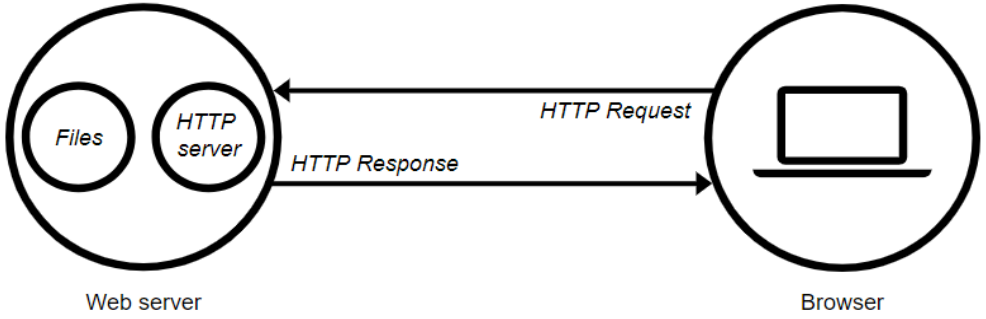


Image - Web Server

Web service

- piece of software that makes itself available over the internet and uses a standardized XML messaging system.

  XML – is used to encode all communications to a web service
- Self contained, modular, distributed, dynamic applications

  Built on top of open standards such as TCP/IP, HTTP, Java, HTML and XML
- A collection of open protocols and standards used for exchanging data between applications or systems.

What is an API?

- A set of functions and/or procedures designed to interact with an external system.
- Modern cloud architecture relies heavily on API’s.
- Consuming an API means interacting with an API’s code to product a desired result.

APIs as a source of data

- We have explored various ways of obtaining data, starting from having Java read a text file, to building a sophisticated relational database like PostgreSQL.
- APIs could potentially be yet another source of data for other applications to consume.

Request Types to an API

Recall that a REST controller can be configured to handle various types of requests. Let's review them:

- **GET**: Ideally suited to retrieve all the records from a REST endpoint.
- **GET** (with path variable): We can configure path variables (i.e. puppy/1) to retrieve a single record of data.
- **POST**: Ideally suited for inserting new data into the data source.
- **PUT**: Ideally suited for updating an existing record within a data source.
- **DELETE**: Ideally suited for removing an existing record from the data source.

Our focus today will be on GETs, in particular how we consume them in Java.

Possible Responses from API

Once a request is made, the REST server can respond with specific status codes:

- **200**: All's well, the request was successful.
- **4XX**: The client (you or your application) has not structured the request correctly. Common examples of these are 400 Bad Request and 401 Unauthorized Request.
- **5XX**: The server has encountered some kind of error. The most common of these is the 500 Internal Server Error message

Postman!

JSON

- JavaScript Object Notation
- Lightweight format for storing and transporting data
- Often used when data is sent from server to a web page
- “self – describing” and easy to understand
- Not language-specific (can be generated or read in any language)

Making a GET request through Java

The RestTemplate class provides the means with which we can make a request to an API. Here is an example call:

```
private static final String API_BASE_URL = "http://helpful-site/v1/api/data";
 private static RestTemplate restTemplate = new RestTemplate();
MyObj myobj = restTemplate.getForObject(API_BASE_URL, MyObj.class);
```

Note that we can specify the return type of the API call with the second parameter (MyObj.class). Alternatively, if you are getting an array of objects back, we can write the following:

```
MyObj [ ] myobj = restTemplate.getForObject(API_BASE_URL, MyObj[ ].class);
```

Serialize vs. Deserialize

- When we convert our data from a JSON string into an object, we are deserializing.
- We won’t cover this today, but the opposite of this is to serialize, which converts the object into a byte stream.

Let’s code!