DATA SCIENCE CONSULTING
Session 1

January 23rd, 2023

The team with whom you will spend your session

Olivier AULIARD
Director of the course – Chief Data Scientist
olivier.auliard@capgemini.com

Ines EL KASMI
Data Scientist
ines.el-kasmi@capgemini.com

Fatima Zahra MJERREB
Consultant
fatima-zahra.mjerreb@capgemini.com

Guillaume REMONT
Consultant
guillaume.remont@capgemini.com

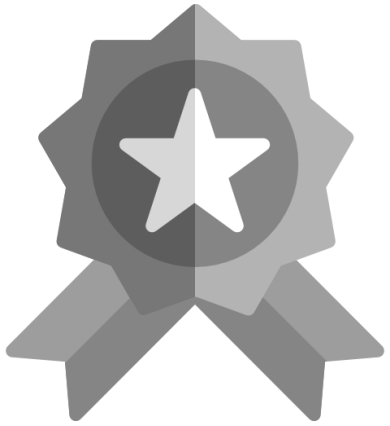
Thibault VENET
Data Scientist
thibault.venet@capgemini.com

Agenda

1. **Who are we?**
2. Course modalities
3. Analysis objectives & approach
4. Case presentation
5. Data collection
6. Html presentation & Selectors
7. Scraping with Selenium
8. Summary of the session

Capgemini Invent, a leader in digital & data transformation

Data Driven
Blending the power of data with strategy, creative, and technology expertise to shape the future of our clients



Leader on the market
has been positioned by Gartner Inc as a "Leader" in its 2022 Gartner Magic Quadrant for Data and Analytics Service providers

World class footprint
30 offices, + 11 000 consultants, coverage of more than 80% companies of CAC 40 and DAX 30 at CxO level

Our brand ecosystem

Capgemini invent

frog
Part of Capgemini Invent

Cambridge Consultants
Part of Capgemini Invent

SYNAPSE
A Cambridge Consultants Company

PURPOSE

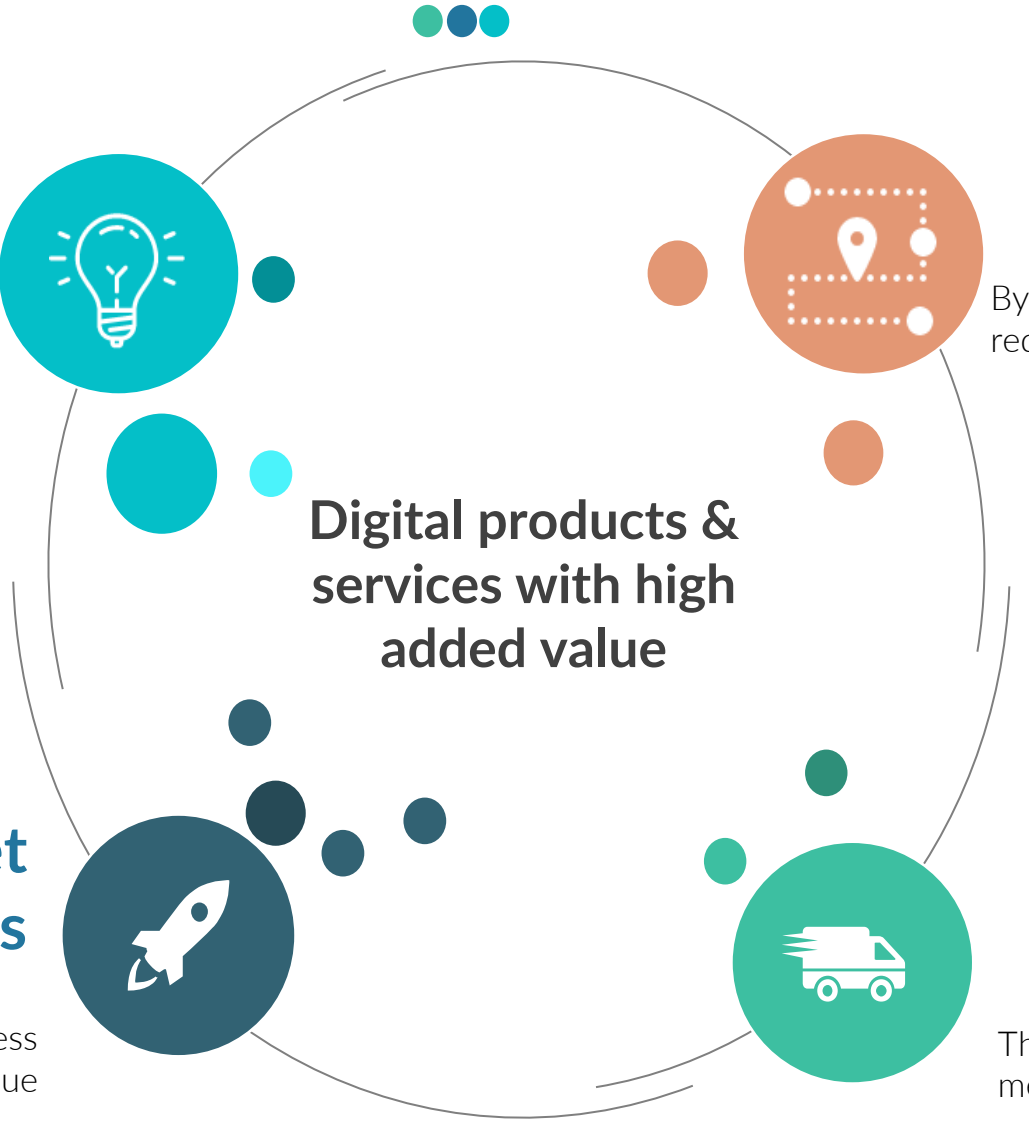
We are a hybrid consulting firm orchestrating business, data science, technologies, creative skills from vision to delivery

We stimulate ideation & disruptive vision

By helping you finding the unconventional ideas to hack your business

We provide end-to-end commitment & delivery

By involving & orchestrating the different required capabilities



We ensure go-to-market for your best ideas

From digital assets to business value

We innovate at startup speed for a fast delivery

Through proven agile and lean methodologies

Business expertise from projects with diverse clients

AIRBUS

GOUVERNEMENT
Liberté
Égalité
Fraternité

مكتب أبوظبي التنفيذي
ABU DHABI EXECUTIVE OFFICE

BNP PARIBAS

orange™

sodexo

RATP

eramet

SOCIETE GENERALE

SNCF

GROUPE BPCE

IPSEN
Innovation for patient care

ALLOCATIONS FAMILIALES

two-i
EMOTION RECOGNISER

Intermarché

pôle emploi

Grand Est
ALSACE CHAMPAGNE-ARDENNE LORRAINE

Roche

ars
Agence Régionale de Santé
Île-de-France

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

DIRECTION GÉNÉRALE DES FINANCES PUBLIQUES

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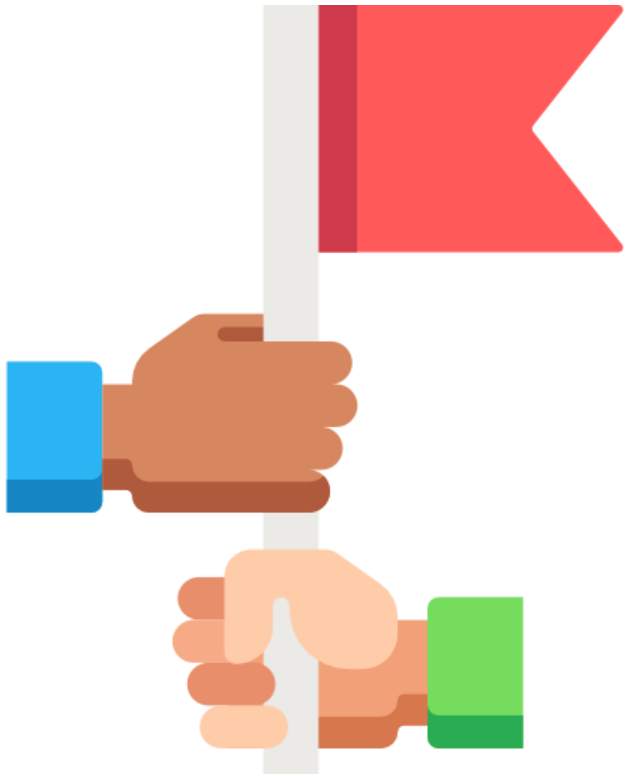
What are your expectations for this course?

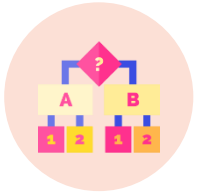


Go to **www.menti.com** and use the code **7147 4670**

Objectives of the case study

Handle a business problematic associated to data

Increase both knowledge and skills on these topics



Learn how to identify & implement the required analysis

Handle a data project from the beginning to the end

Understand the strategic & transformation stakes

Qualify and quantify the associated stakes

Grasp the consulting aspects

Learn how to manage these kinds of projects

Organization of the course

Content

- Each session focused on a **specific topic**
- **Balance** between theoretical explanations, brainstorming and hands-on applications
- **Tasks** to be prepared between sessions and to be presented in the beginning of the next session

Format

- **Weekly sessions on Monday afternoons** – from 2pm to 6pm
- **In Ecole Polytechnique & 147** (Capgemini offices) if the health conditions are met (virtual classes on Microsoft Teams otherwise)
- **Animation by Data Scientists & Consultants** from Capgemini Invent

Practical organization

- **Teamwork :** divided in groups of 5, each group with an assigned coach
- **Data Science tools** : Jupyter notebook on your local computer
- **The team is available via Teams** :
  - **Discuss** among yourselves
  - **Ask questions** to coaches
  - **Get access to all the questions & answers** – including from the other students & groups

Planning & key steps of the course

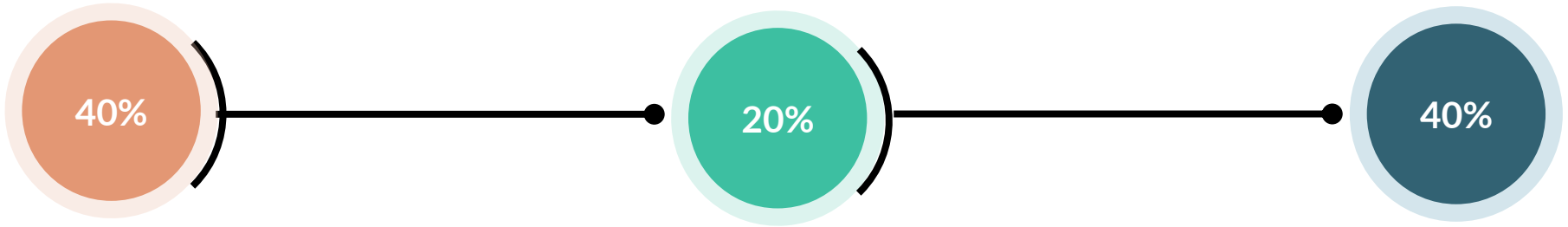
7 courses

Jan. 23	Jan. 30	Feb. 06	Feb. 13	Feb. 20	Mar. 06	Mar. 13
Session 1	Session 2	Session 3	Session 4	Session 5	Session 6	Session 7
Kick-off	Data Prep.	Embedding	Client meeting	Embedding	Sentiment Analysis	Final presentation Hackathon

Regular sessions: Synthetic status update on the progress made and foreseen objectives to be prepared

Committees: Complete pres. of the progress made, results; difficulties and foreseen next steps to be prepared

Evaluation



Homework

At each session you might have homework. We will ask you to send us your results and will evaluate them !

Intermediate restitution

At the 4th session, we will simulate a client meeting with intermediary results. It will be a presentation where you need to summarize what you've seen/done until then.

Final restitution

On the last day, you will make a final presentation that will enable you to present the business insights produced throughout from your data Project.

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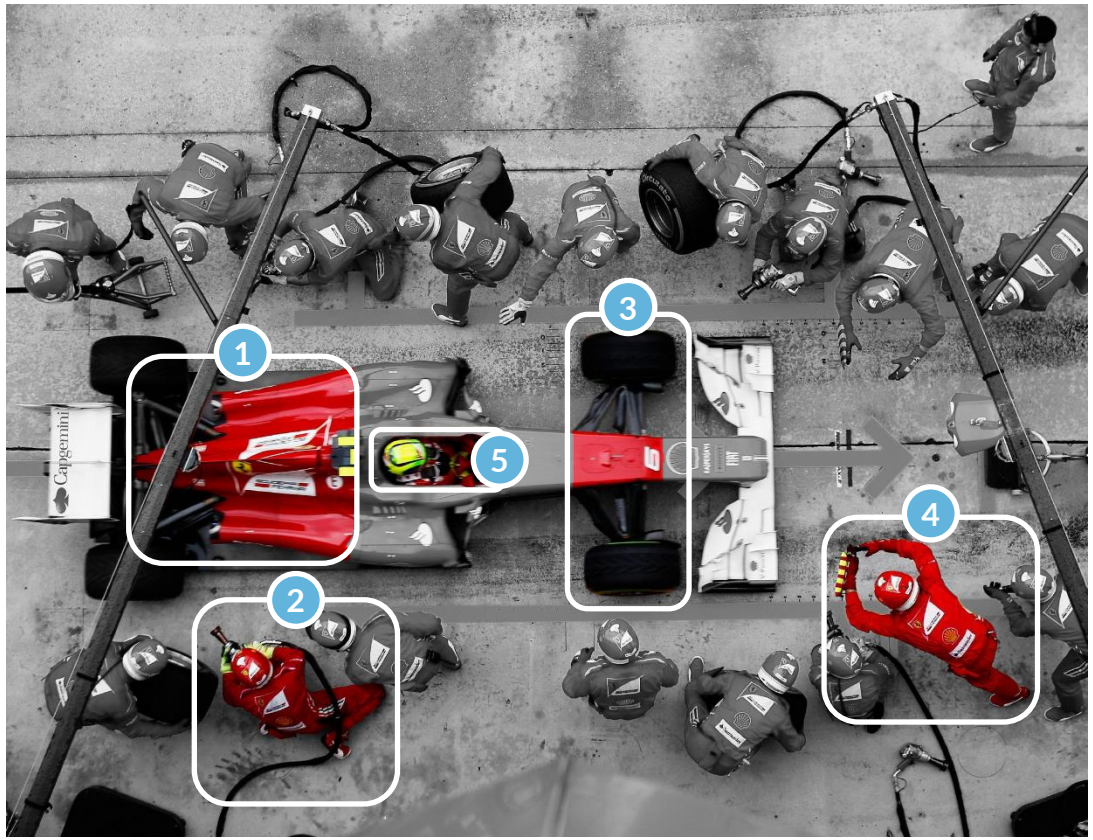
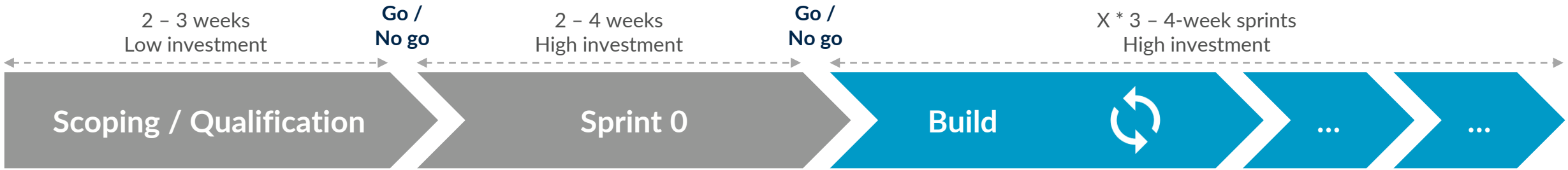
First of all … what is a data use case?



1. **Motor**
   Robust technical platforms
2. **Fuel**
   Comprehensive data sources
3. **Tires, wheel**
   Digital solutions & touchpoints
4. **Technical team**
   Advanced analytics capability
5. **Driver**
   Identified end-users

Typical approach for use case delivery projects

The operating model is based on a progressive approach to ensure the correct product delivery



Does the project bring sufficient **value** ?
Is it **feasible** ?

Is **everything ready** to launch the project?

Delivery of industrialized data products

PoC / PoV

If necessary, launch of a PoC / PoV to prove the project feasibility / value

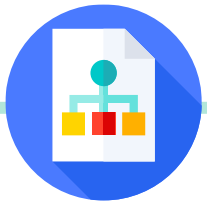
Zoom on Sprint 0

1 Business needs

- Elaborate a description of needs and matching features to respond
- Present the breakdown of features into user stories
- Design the prototype of the solution (if applicable)
- Process data and evaluate the algorithms & logic to be implemented

2 Data integration

- Confirm required & available data
- Identify data sources
- Define data to be ingested
- Build and initate data ingestion process



3 IT architecture

- Identify required elements for solution setup
- Adapt existing architecture to the target solution
- Define data ingestion architecture
- Ensure availability of necessary architecture models

4 Team

- Define competences to gather
- Ensure teams' availability (including Product Owner & Support)
- Define delivery model

5 Planification & project organisation

- Set up steering and delivery model : injection planning, sprint 1 planning
- Evaluate and prioritize features (business value & complexity)

Group constitution

5’

Divide the class into 7 balanced groups

The group should include different school backgrounds

The group should include a gender mix

Let’s create the groups!

7 Groups of 5 students : please, send your groups to fatima-zahra.mjerreb@capgemini.com

Group 1 ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx	**Group 2** ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx	**Group 3** ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx	**Group 4** ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx
Group 5 ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx	**Group 6** ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx	**Group 7** ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx ▪ Xxx	

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Focus of the case study : voice of customer

- Our client, a **French energy supplier**, is expecting an intensifying competition to retain customers in 2023 given the tense energy market, including but not limited to soaring energy prices.
- To differentiate itself from its competitors, it wants to **listen to customer feedback** to better understand and meet customer needs, expectations and identify the priority pain points to solve across their customer journey

Focus of the case study : voice of customer

As a **Data Science consultant**, you will have to assess the customer relationship strategy of a **French energy supplier** and provide recommendations on how to improve each stage of the **customer journey**

Use Natural Language Processing (NLP) approaches to listen to the Voice of the customer (VoC) and identify pain points across the entire customer journey

Analyse these results in light of the current tense energy market context, then propose data-driven opportunities that could benefit to both your client and its customers

Exercice 1

10’

What could be the main drivers for customers to switch to another energy providers ?

What could be the main drivers for customers to switch to another energy providers ?

Driver 1

Driver 2

Driver 3

Homework (due January 27th)

In group, conduct a preliminary analysis of the energy market trends and the main French B2C energy offers

The main objectives of this homework are to :

- Identify energy market trends that might lead to a higher churn rate (1 slide)
- Conduct a benchmark on B2C energy offers, to highlight the key characteristics a consumer might look for in an offer (4 slides max).

Do not aim to be completely exhaustive in your benchmark. The target analysis will focus on French B2C energy offers only, both on gas and electricity, of the top 5 energy suppliers in France. Your benchmark should be limited to a maximum of 5 differentiators and should highlight your methodology (what were your assumptions ? which characteristics did you choose for the comparison ? why ?) and your sources.

Please send the results of your benchmark in a PowerPoint File by **Friday 27th of Jan. evening** to *fatima-zahra.mjerreb@capgemini.com* and *guillaume.remont@capgemini.com*

If you have any questions, feel free to contact us by email.

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Data pipeline of a Nature Language Processing (NLP) project

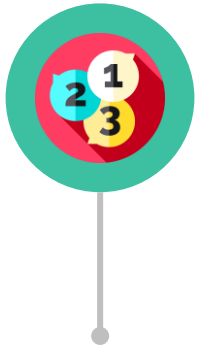
Subject of today's session

Data Collection

How to collect data automatically from the web?

Data Cleaning

How to clean and process textual data and clean the noise?

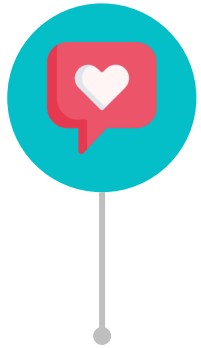


Word Embedding

How to encode text into meaningful numerical vectors?

Topic Extraction

How to extract the most representative topics in the data



Sentiment Analysis

How to detect and extract the sentiments expressed in textual data?

Application Programming Interfaces (API)

APIs enable interactions with applications

Several websites provide APIs for the purpose of data sharing

Few lines of code are needed to use them

The main advantage of using APIs is that they require less programming than scraping and are in general well documented

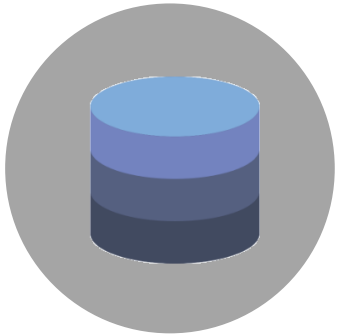
```python
from twython import Twython


CONSUMER_KEY= 'CRqjrVd0ZW5ADisG3KIW3ILZ0'
CONSUMER_SECRET= 'wIaRhn4NeENTal8eQkX4Ww3JbHRcTQfDa3A4ddb4WAffAIVEjr'
twitter = Twython(CONSUMER_KEY, CONSUMER_SECRET)


for status in twitter.search(q="data science")["statuses"]:
    user = status["user"]["screen_name"].encode('utf-8')
    text = status["text"].encode('utf-8')
    print(user, ":", text)


```

APIs provides structured data output

The output of an API is in general a JSON file which can be easily turned into a database

```json
{
    "menu": {
        "id": "file",
        "value": "File",
        "popup": {
            "menuitem": [
                { "value": "New", "onclick": "CreateNewDoc()" },
                { "value": "Open", "onclick": "OpenDoc()" },
                { "value": "Close", "onclick": "CloseDoc()" }
            ]
        }
    }
}
```

Data can be collected through several data channels

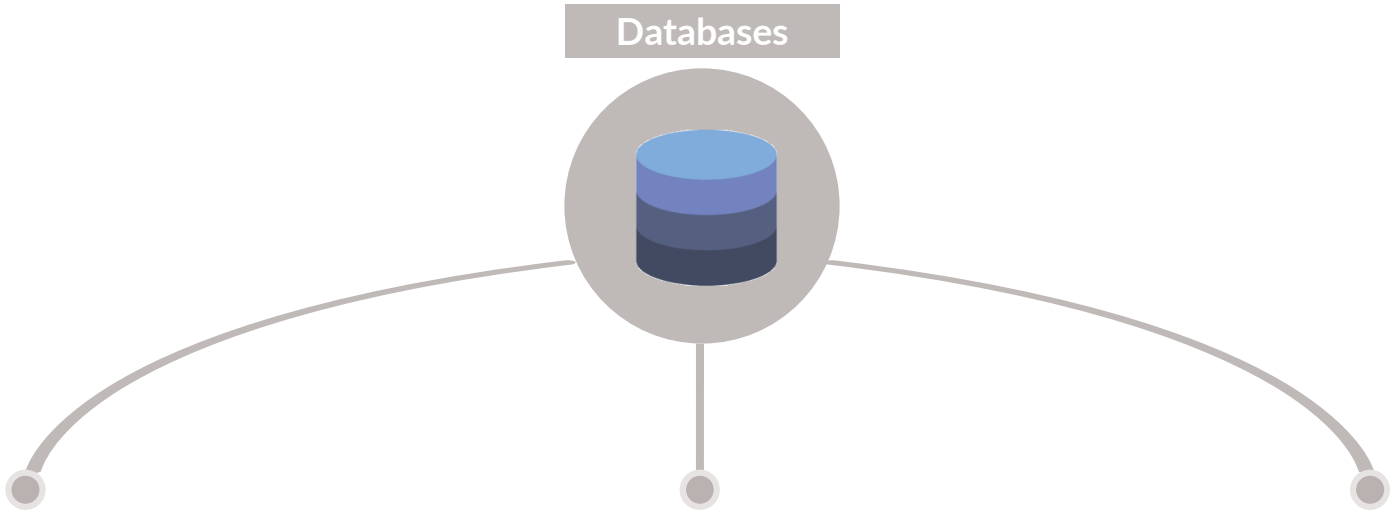


Databases

APIs

Web scraping

Collecting data from databases



Extracting data directly from databases

A user can retrieve data directly from certain type of databases by selecting and copying it through a user interface (*e.g. Excel files*)

Writing queries

Queries are written statements that describes and executes read and write operations on databases (*e.g. SQL queries*). In order to write such queries, the user needs to know how the database is structured

Using database connectors

Some data platforms provide connectors that facilitates extraction from databases stored into the platform (*e.g. Power BI provides connectors Azure DBs and Amazon DBs*)

Social networks have different policies concerning APIs

- No direct scraping unless authorized (fill in authorization form – 2 weeks for FB answer) : click here to see the terms
- APIs exist for app developers

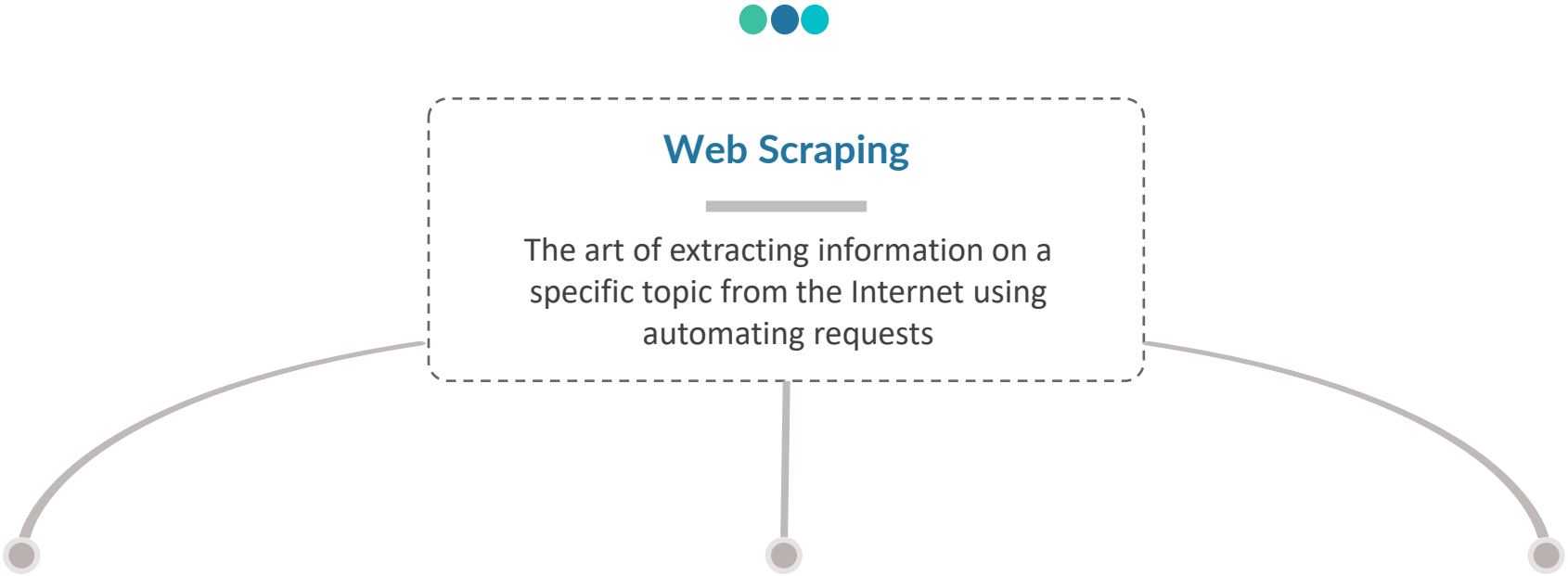
- Limited collection of the data (speed/volume is compared to what « human can reasonably produce »), it allows read & write operations on videos with a limited quota
- No personal data

- No direct scraping
- API with limited number of call by 15 min window

- Prohibition of scraping software
- APIs are for app development

- The free API is for “non-automated” apps, user authorization needed, Python/Ruby versions exists, 5000 calls per hour : it is being depreciated in favour of the new “Business version” (Instagram Graph API)
- Sensitive to user content/media (owned by users)

Web scraping enables information retrieval from the web



Why should we use web scraping?

- Market Price Analysis (*e.g. real-time competitiveness*)
- Market Intelligence (*e.g. competitive benchmarks*)
- Sentiment Analysis (*e.g. social listening*)

Which data are we looking for?

- Textual data available on websites (*e.g. articles, reviews, prices*)
- Metadata (*e.g. number of connections*)
- Social Media data (*e.g. tweets*)

What is the typical process?

- Crawl the web looking for needed information
- Centralize collected data and make it structured

Main tools used in web scraping

BeautifulSoup

HTML parser in Python, which transforms HTML code into a tree object usable with Python to extract content like text, images' URLs…

Scrapy

Python package combining a crawler AND a parser.

Selenium

Tool allowing to automate web browsers, mainly used in scraping to get data which is written in JavaScript through AJAX requests.

RVest

HTML parser like BeautifulSoup, but for R. Great documentation online.

Selenium

In this course we will focus on **Selenium** mainly

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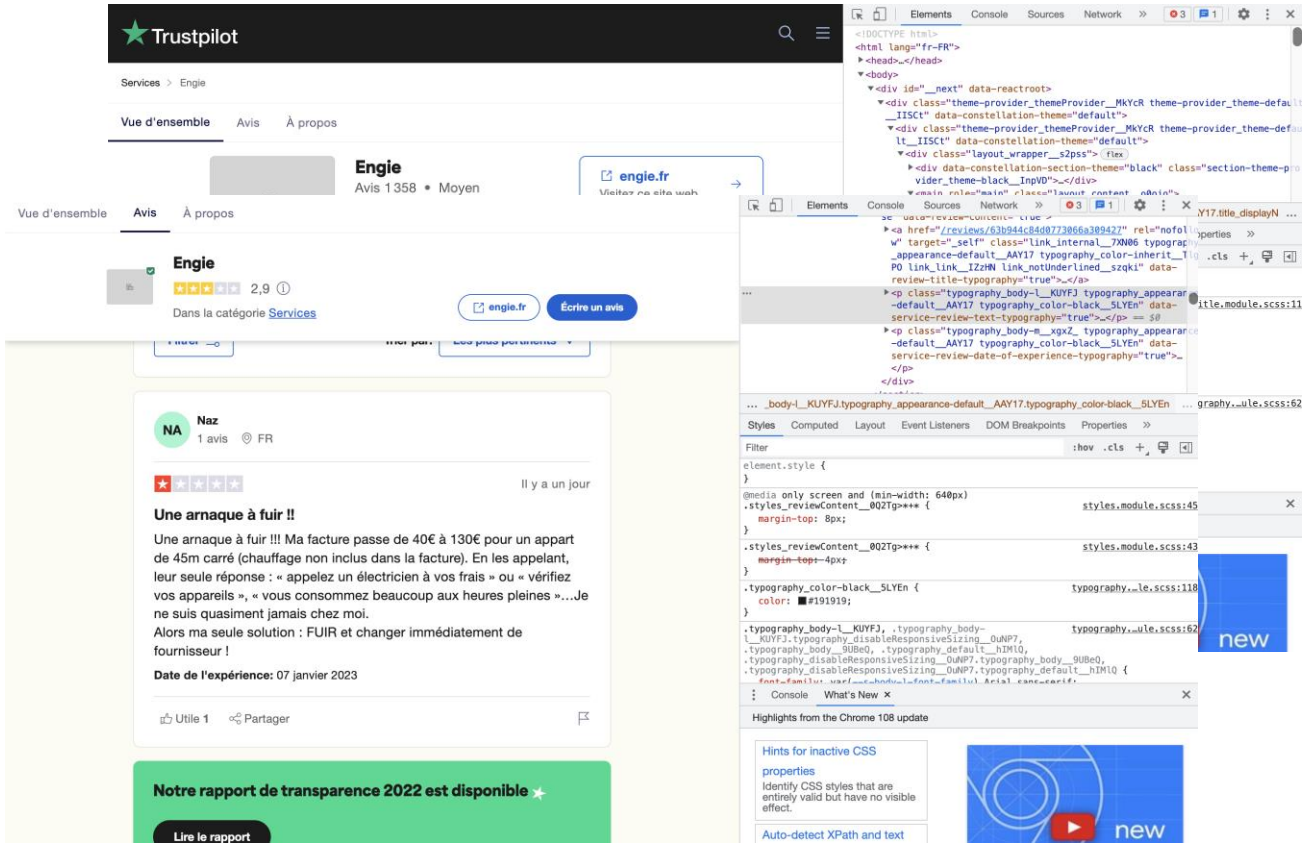
Scraping enables information retrieval from HTML

- Scraping packages enable the user to extract information from HTML pages and to structure it into databases
- Some browsers (Chrome, Firefox…) provide access to an interactive "Inspect mode", which enables the user to navigate within the output code of a web page :

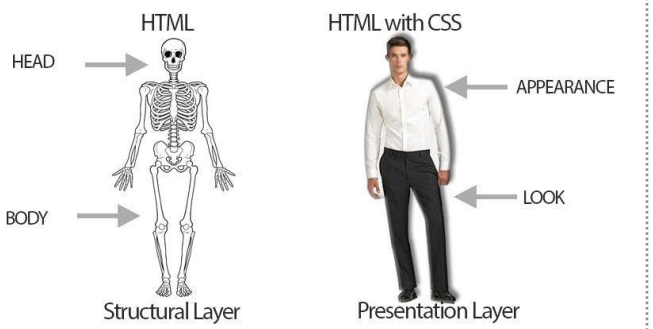
CTRL + SHIFT + I

OPTION + CMD + I

- The user chooses the information he wants to extract from a web page by exploring its code and by adding to his scraping code the tags he wants to extract



How is a web page structured ?



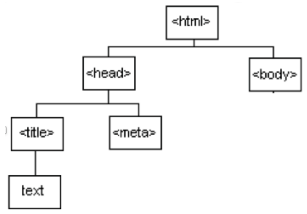
Structure

- A web page is structured by two main elements:
  - HTML : backbone of the web page, it contains text arranged into blocks, which have attributes
  - CSS : describes the style of the webpage

```
<!DOCTYPE html>
<html>
   <head>
         <meta charset="utf-8" />
         <title>Titre</title>
   </head>

   <body>

   </body>
</html>
```



Sequence

- It is a sequence of HTML tags which can be seen as a tree

<tag attribute="valeur"> ... </tag>

text tags	
	emphasize with italics
	emphasize with bold
	largest headline
	second largest headline
	smallest headline
<font size="?">	numbers 1-7 to determine size
<font color="?">	set font color w/ name or hex code
	subscripts,
	superscripts[1]
<del></del>	~~strikethrough~~
<code></code>	`insert codes`

E.g. Text tags

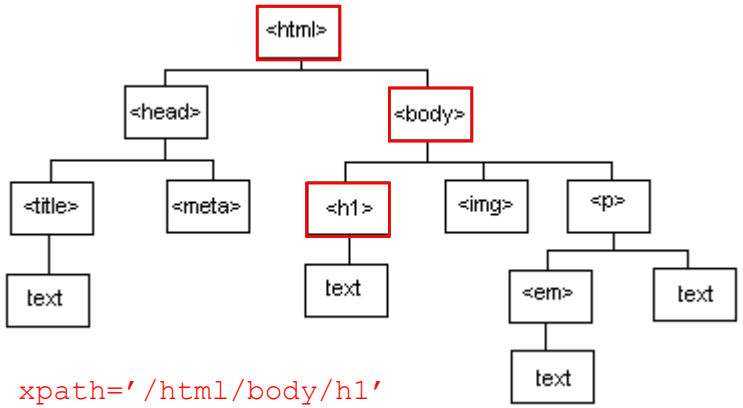
Tags

- Each tag has a specific format
- There are several attributes per tag: class, href, etc.

XPath notation to navigate HTML

What is XPath ?

- Xpath is a string which selects nodes in an HTML tree
- It can also be seen as the linear representation of the requested element



- XPath allows you to select:
  - The content of a markup
  - The content of its attributes (hypertext links for example)

Requested Element	Corresponding Xpath
Second division of the body	'/html/body/div[2]' (index start at 1)
All tables	'//table' #all tables
All tables descendants of the 2nd division	'/html/body/div[2]//table'
All paragraphs directly bellow the body	'//p'
Conditional division	'//div[@id="uid"]'
Wildcard	'/html/body/*'
All elements with a condition on the class	'//*[contains(@class, "class-1")]'
Selection of the attribute href cond. paragraph	'//p[@id="p2"]/a/@href'

Break

15’

Feel free to help yourself ! See you at 16h15 !

Setup
Downloads and installations

- Download Python by following the instructions for your operating system
- It is also possible to download anaconda and install Selenium in the conda environment

To download an IDE (Integrated Development Environment), you have several options, among which :

- PyCharm
- VS code

- Download a driver for your favorite web browser: Chrome, Firefox, Safari

Web scraping

- Introductory notions of HTML structured websites

- Getting started with selenium (installations, libraries)
- Basic manipulations on a reviews websites (Trustpilot and Avis Vérifiés)
- Extracting a first comment and its metadata
- Extracting data from the first then the second page of the website
- Building a database of all the comments, their ratings and dates (in 2 different ways)
- Exploiting the database by detecting the negative comments

Bonus exercise

- Parsing using BeautifulSoup
- Combining BeautifulSoup with Selenium

Hands-on 1

40’

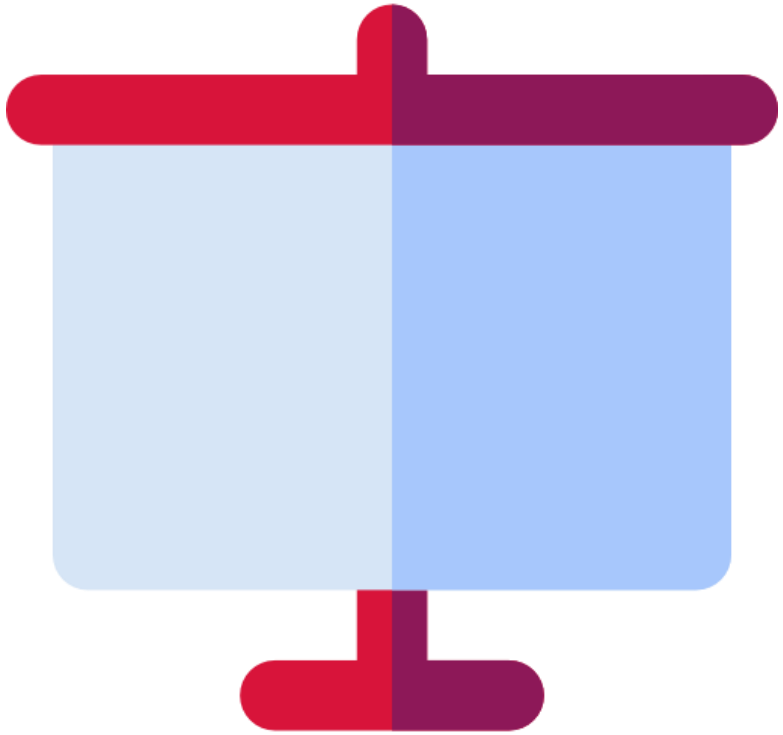
Use the notebook 1 to discover Selenium and get some information from the web

If you have any question about Python set-up, feel free to contact us about that !

Restitution

5’

Could you extract data ? What was challenging for you ?



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Hands-on 2

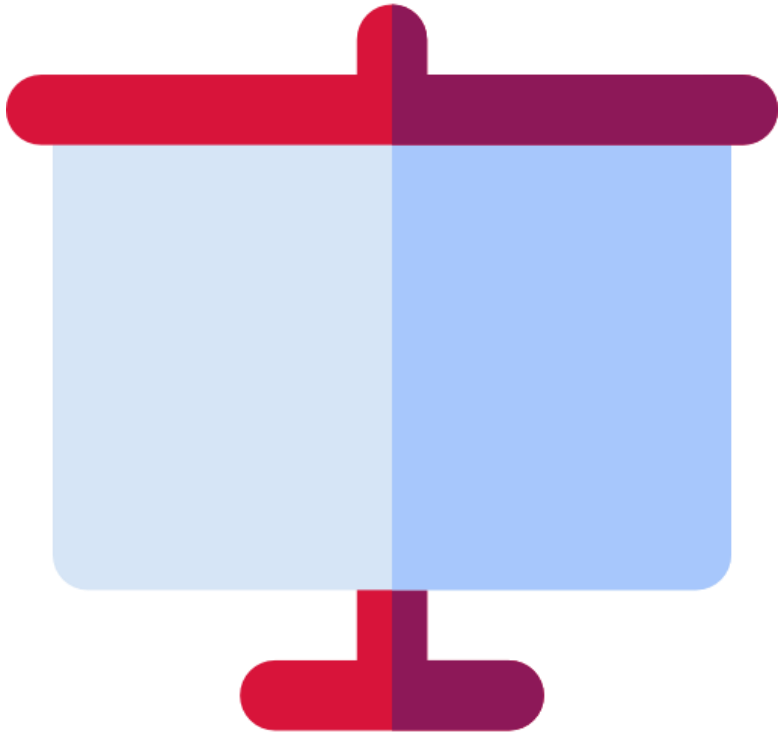
30’

Try to automate the scraping of Trustiplot

Restitution

5’

Could you extract data ? What was challenging for you ?



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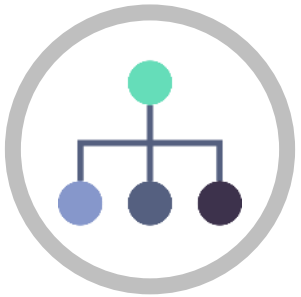
6. Html presentation & Selectors
7. Scraping with Selenium
8. **Summary of the session**

Summary of the session – To remember



Approach & organization of a data science consulting project

Typical approach of this type of project

- Data science workstream: Data scraping, cleansing & feature engineering, running of the different analyses, restitutions (visualizations etc.)
- Business workstream: Diagnosis of the current situation & transformation stakes (as-is/to-be analysis) with a quantification of the impacts

Organization & governance :

- Several dedicated meetings all along the project (e.g. weekly status updates, steering committees) to track progress and escalate potential issues

Scraping as a tool to retrieve information from the web

Scraping as a data collection tool:

- Data can be collected through several channels: databases, APIs, web scraping

Zoom on web scraping:

- Scraping tools (Python: Scrapy, BeautifulSoup, Selenium ; R: Rvest)
- Key steps and tools used to perform them :
  - Parsing : Xpath and CSS locators
  - Crawling : Spider classes
  - Storing : JSON file

Work for next week

Instructions

To practice what we learnt today, for next week, you'll have to :

- Prepare a competition benchmark of the French energy B2C offers to highlight main offer differentiators for customers
- Create a script able to scrape trustpilot website for the following energy suppliers, making sure that you have the comments of the first 10 pages :
  - https://fr.trustpilot.com/review/eni.fr
  - https://fr.trustpilot.com/review/totalenergies.fr
- Make sure that for each comment you have the date, the body, the rate and (bonus) the answer of the supplier.

We expect you to send your code and scraped file by Friday 27th evening to ines.el-kasmi@capgemini.com, fatima-zahra.mjerreb@capgemini.com, guillaume.remont@capgemini.com and thibault.venet@capgemini.com

If you have any questions, feel free to contact us by email.

Course evaluation

Did you like that first course ? It’s time to share your feedbacks !

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Thank you for your attention

See you next on campus !

GOODBYE !

January 23rd , 2023