In this tutorial, we'll focus on the "**Extract**", "**Transform**", and "**Load**" steps in the ETL process using Mage.ai and Python for streaming data from Kafka. Don't worry if you're not familiar with them—this guide is designed to be easy to follow! 😊

Before we dive into Mage.ai, let's discuss about the data that we will be dealing with. The data has a similar format as the Singapore dataset used in the batch data pipeline guide – a healthcare data for Malaysia that provides the total number of cases for various infectious diseases every week from years 2012 to 2022. A snippet of the data can be seen here:

	A	B	C
1	epi_week	disease	no._of_cases
2	2012-W01	Acute Viral hepatitis B	0
3	2012-W01	Acute Viral hepatitis C	0
4	2012-W01	Avian Influenza	0
5	2012-W01	Campylobacterenterosis	6
6	2012-W01	Chikungunya Fever	0
7	2012-W01	Cholera	0
8	2012-W01	Dengue Fever	74
9	2012-W01	Dengue Haemorrhagic Fever	0
10	2012-W01	Diphtheria	0
11	2012-W01	Encephalitis	0
12	2012-W01	Haemophilus influenzae type b	0
13	2012-W01	Hand, Foot Mouth Disease	326

In this course, we will aim to find out the top infectious diseases in Malaysia while keeping the year column. Thus, we need to:

(a) Get the year of each column [which means we will have many rows with the same year and disease]

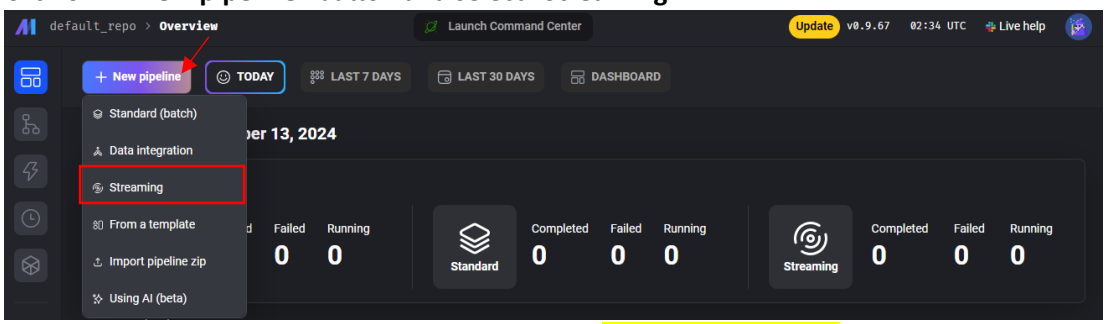
(b) Get the total number of cases based on the same year and disease [which will be stored in the existing column]

(c) Drop duplicate rows

(d) Add country column to indicate this is a column for Malaysia dataset.

With this information, let's get started on Mage.ai!

1. Click on "**+ New pipeline**" button and select "**Streaming**".

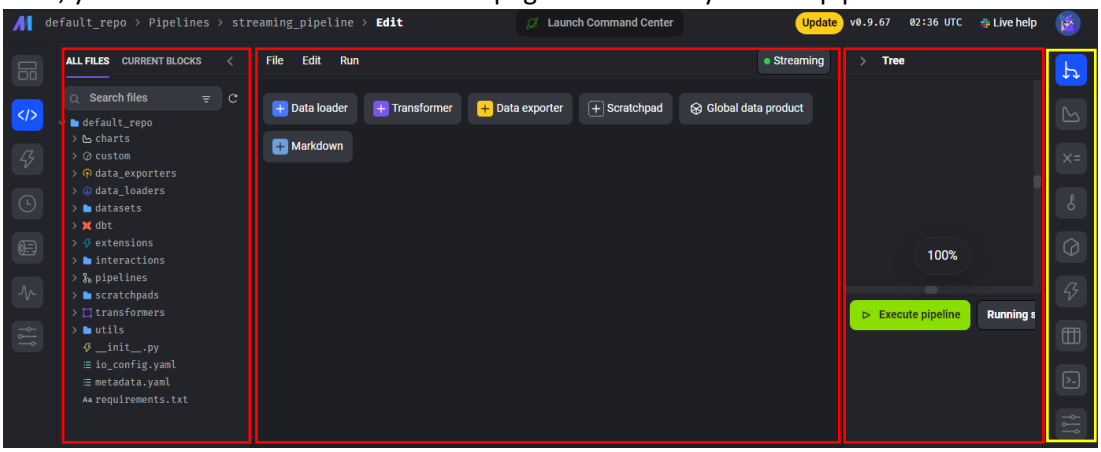


   a. Mage.ai offers different types of pipelines (TODO: Add usages):
      i. Standard (batch),
      ii. Data Integration,
      iii. Streaming,
      iv. From a template,
      v. Import pipeline zip, and
      vi. Using AI.
   b. You may change/add the pipeline's

For more information regarding Mage.ai's documentation, please refer to https://docs.mage.ai/.

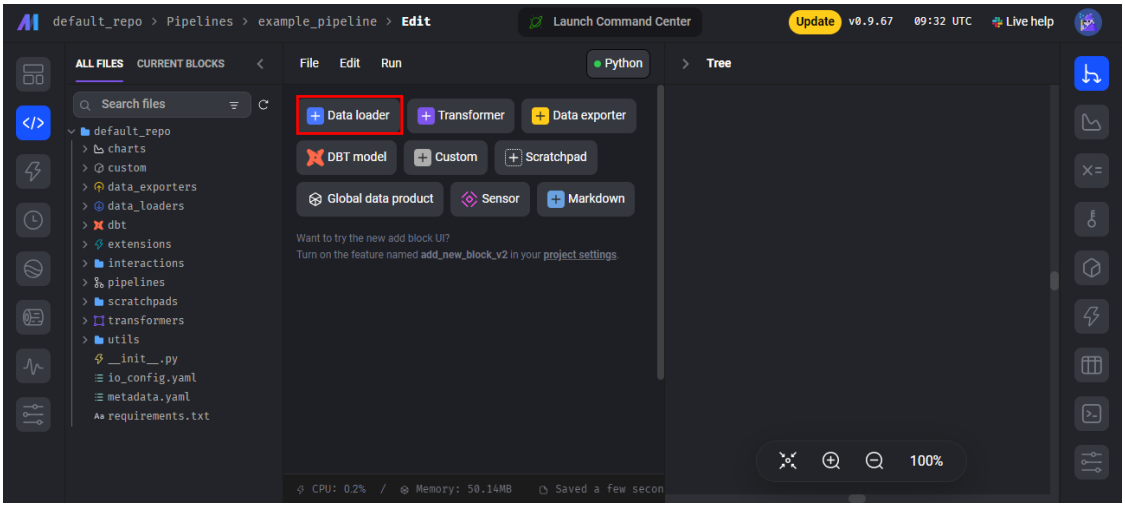
i. Name,
ii. Description, and/or
iii. Tags to this new pipeline.

2. Next, you will be redirected to the "**Edit**" page for the newly created pipeline.

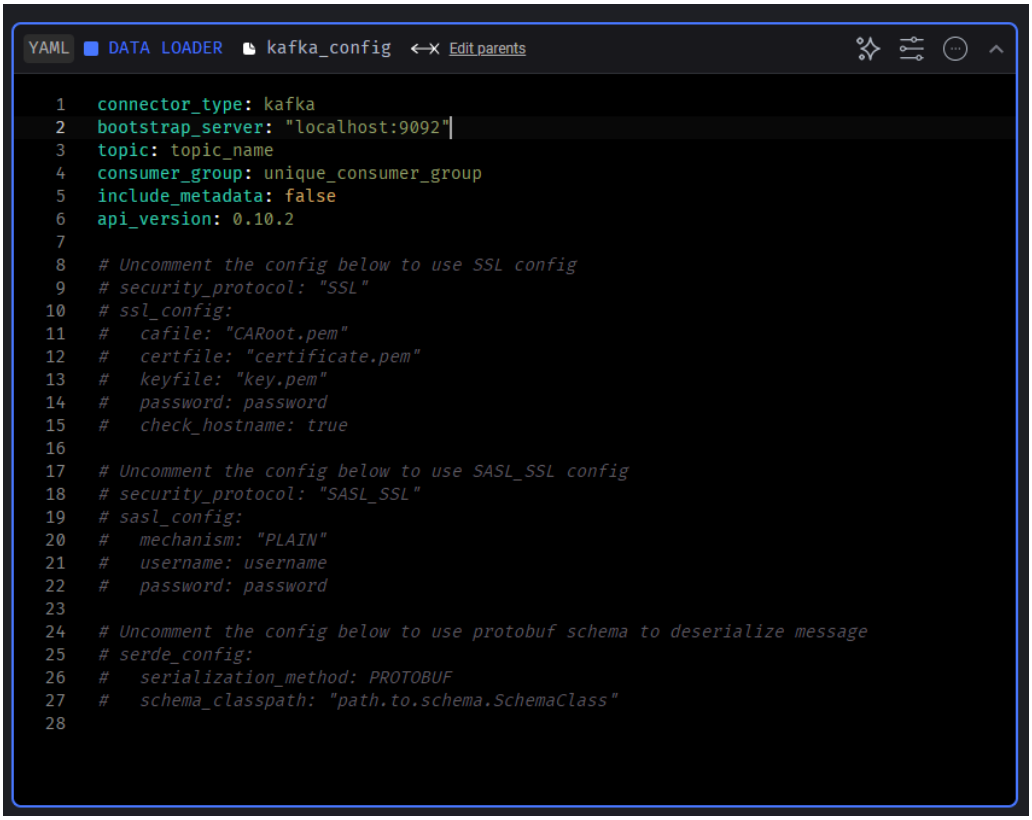


a. Left pane (Directory pane): Directory for "**/home/src/default_repo**".
b. Middle pane: Allows you to choose any to add a block to your pipeline and serves as a code editor.
c. Right pane: To view the items relevant to the icons on the extreme right that is boxed up in yellow.

3. Firstly, we will load the data from the file to Mage.ai:
Select "**+ Data loader**" > "**Kafka**". Change the name of this block to "**kafka_config**".



a. A code editor will be added to the middle pane.
b. In the code editor, note that you're viewing the code for *Data Loader* that is named "**kafka_config**".
c. The following block will be created in the middle pane.



d. Replace lines 2 and 3 with the following:

```
bootstrap_server: "kafka:9093"
topic: topic
```

i. This will configure this pipeline to stream messages from hostname "**kafka**" running on port "**9093**" that has messages published on topicname "**topic**".

4. Secondly, we will **transform** the data.
   a. Get the "**year**" from "**epi_week**".
      i. Scroll to the bottom of the middle pane and add a *Transformer*: Select "**Transformer**" block > "**Python**" > "**Generic (no template)**".
      ii. The function "**transform**" will be executed when this block runs. The first parameter that this function takes in ("**messages**") is the data being streamed in from Kafka.
      iii. To extract "**year**" from "**epi_week**", replace the code in "**transform**" function with the following. We will convert "**messages**" to Pandas' DataFrame type to transform the data in an orderly manner.

```
df = pd.DataFrame(messages)

# Extracts the first 4 characters of each value and store it under the "year" col
df['year'] = df['epi_week'].str.slice(0, 4)
# Removes "epi_week" column from the dataframe
df.drop(columns=['epi_week'], inplace=True)

# Returns this updated dataframe to pass it to the next block
return df.to_dict('records')
```

   b. Get the new number of cases based on year and disease:

i. Add another *Transformer* block by going to the end of the middle pane and select "**Transformer**" block > "**Python**" > "**Generic (no template)**".
ii. Similar to the "**transform**" function mentioned in Section 4.a.ii (TODO: Add link), the first parameter taken in by the function "**transform**" in this newly created *Transformer* is the list of dictionaries returned from the previous *Transformer*.
iii. To get the new number of cases, group the data based on its disease and year values for that row and sum the no._of_cases.

```
df = pd.DataFrame(messages)

# Groups data by disease and year to get the summed no._of_cases value
df = df.groupby(['disease', 'year']).agg({'no._of_cases': 'sum'}).reset_index()
return df.to_dict('records')
```

c. Drop duplicate rows
i. Based on Section 4.b.iii (TODO: Add link), there may have many duplicated rows in the dataframe (i.e. same year, disease, and number of cases).
ii. Add a new *Transformer* from the bottom of the middle pane: select "**Transformer**" block > "**Python**" > "**Generic (no template)**" and replace the code in "**transform**" function with the following:

```
df = pd.DataFrame(messages)

df.drop_duplicates(inplace=True)
return df.to_dict('records')
```

d. Add "**country**" column
i. Now that our data is ready, we want to add a new column called "**country**" and the values in this column will all be "**malaysia**". This allows us to add other countries' similar health data in the future.
ii. To do so, add a generic *Transformer* block like in Section 4.a.i (TODO: Add link) and replaced the function "**transform**" code with the following:

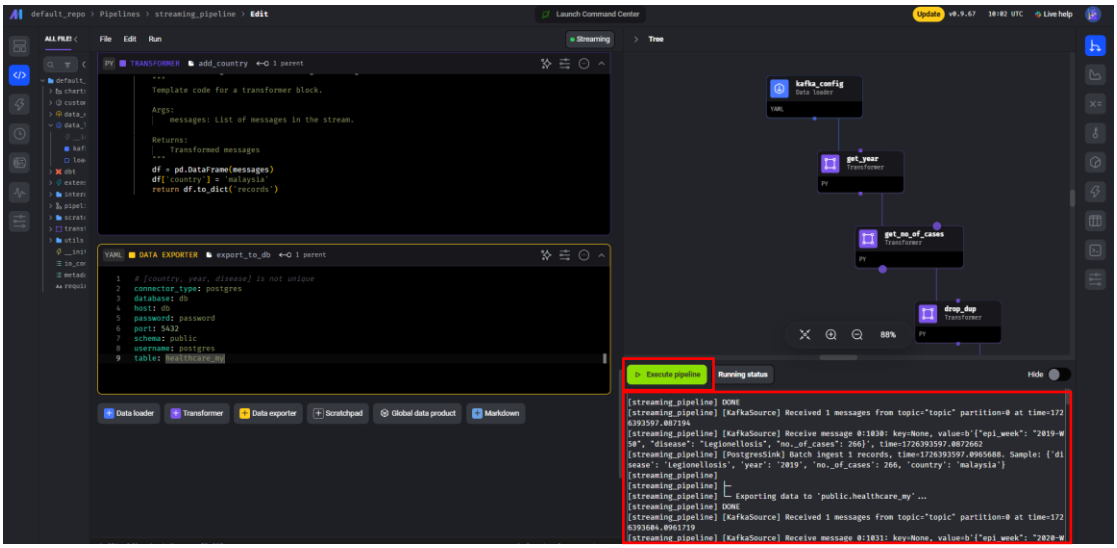
```
df = pd.DataFrame(messages)
df['country'] = 'malaysia'
return df.to_dict('records')
```

5. Lastly, let's **load** this data into your database.
a. Let's add a *Data Exporter* block at the end of the middle pane: Select "**Data Exporter**" > "**PostgreSQL**".

b. Update the code in this newly added block to the following:

```
# [country, year, disease] is not unique
connector_type: postgres
database: db
host: db
password: password
port: 5432
schema: public
username: postgres
table: healthcare_my
```

6. Now that our pipeline is ready, we can execute the pipeline on the right pane of this page:



a. The output from the pipeline execution will be displayed in the bigger red box. You may stop your pipeline execution at any time.