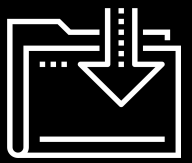
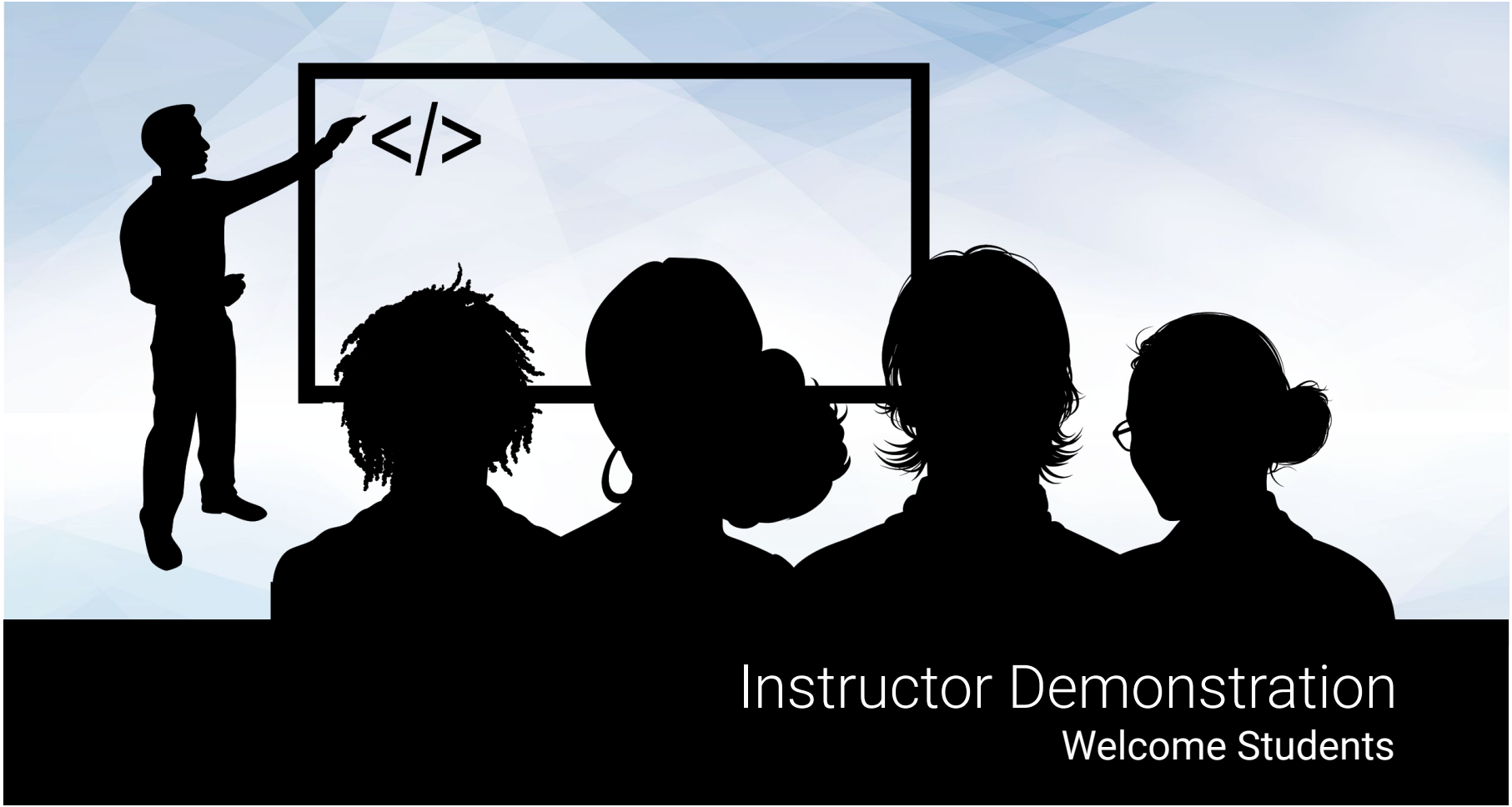
A Case Study of Extract, Transform, Load

Data Boot Camp

Lesson 13.1





Instructor Demonstration

Welcome Students


WELCOME

The Week Ahead

Day One (Today)

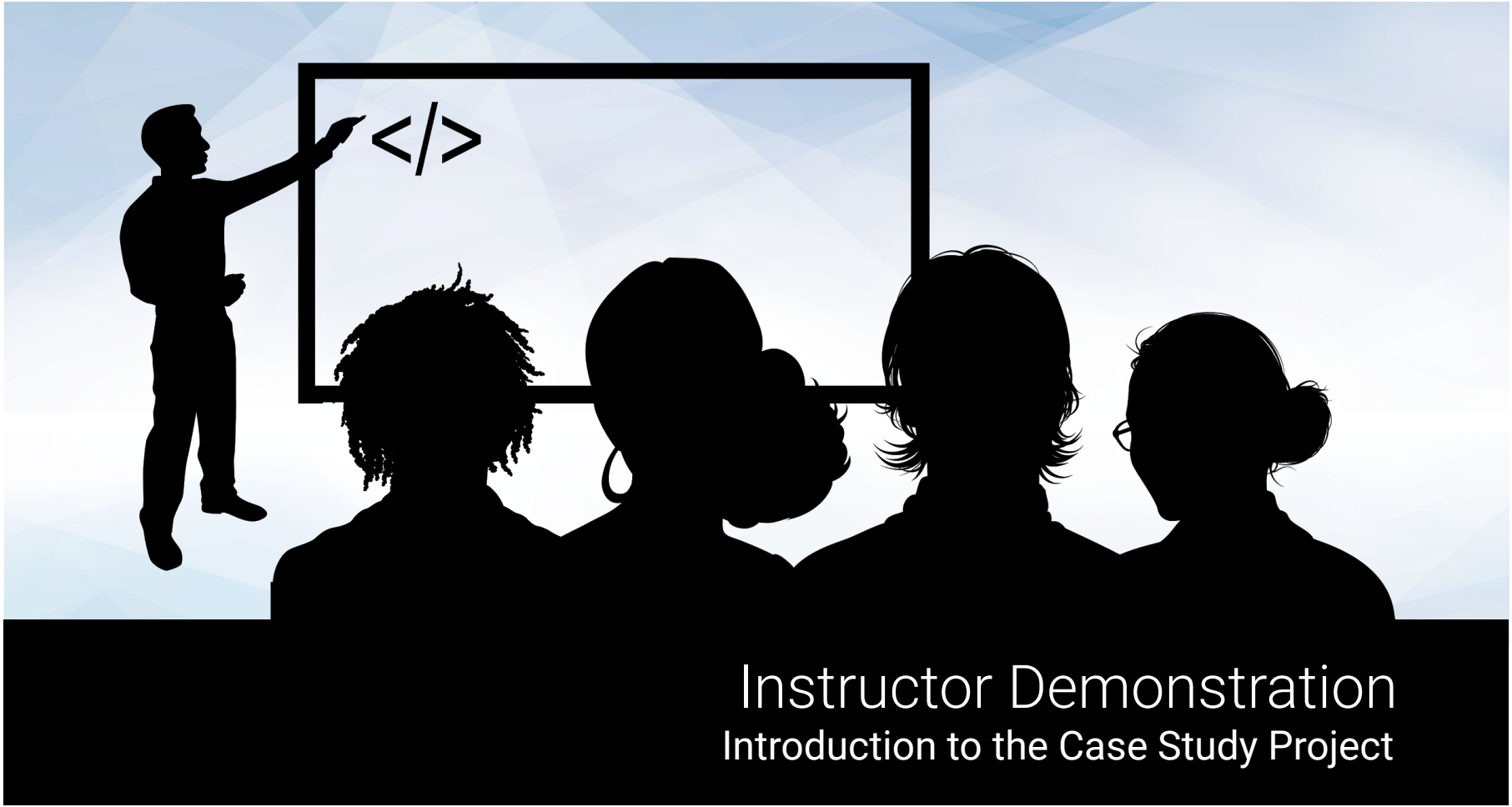
- Intro to the ETL Project
  - Goals
  - Requirements
- Working towards a feasible project idea with Instructor and TA
- Submit Project Proposal

Day Two

- Working on projects
- Full assistance from Instructor and TA

Day Three

- Project due date
- Discussion



Instructor Demonstration

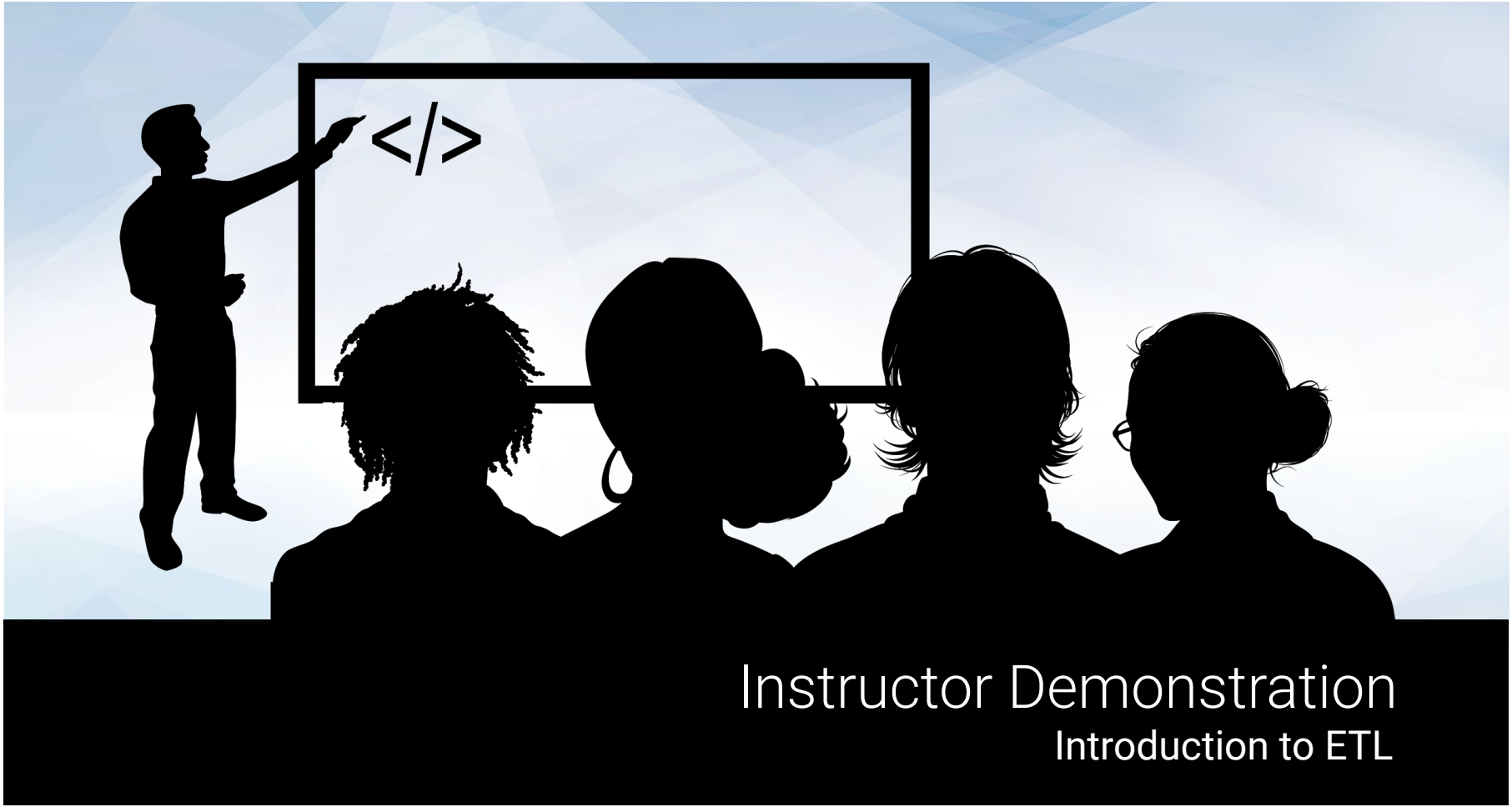
Introduction to the Case Study Project

Data Sources:

Introduction to the Case Study Project

- It must come from two (minimum) or more sources.
- Recommended sources:
  - Kaggle.
  - Data.word.
  - Google Dataset Search (https://datasetsearch.research.google.com/).
  - As an alternatively source you may use APIs.

- Once you datasets are identified - Perform ETL and documentation:
  - Documentation must have:
    - Datasets used and their sources.
    - Types of data wrangling performed - Data cleaning, joining, filtering and aggregating.
    - The schemata used in the final production database.



Instructor Demonstration

Introduction to ETL

Introduction to ETL

ETL

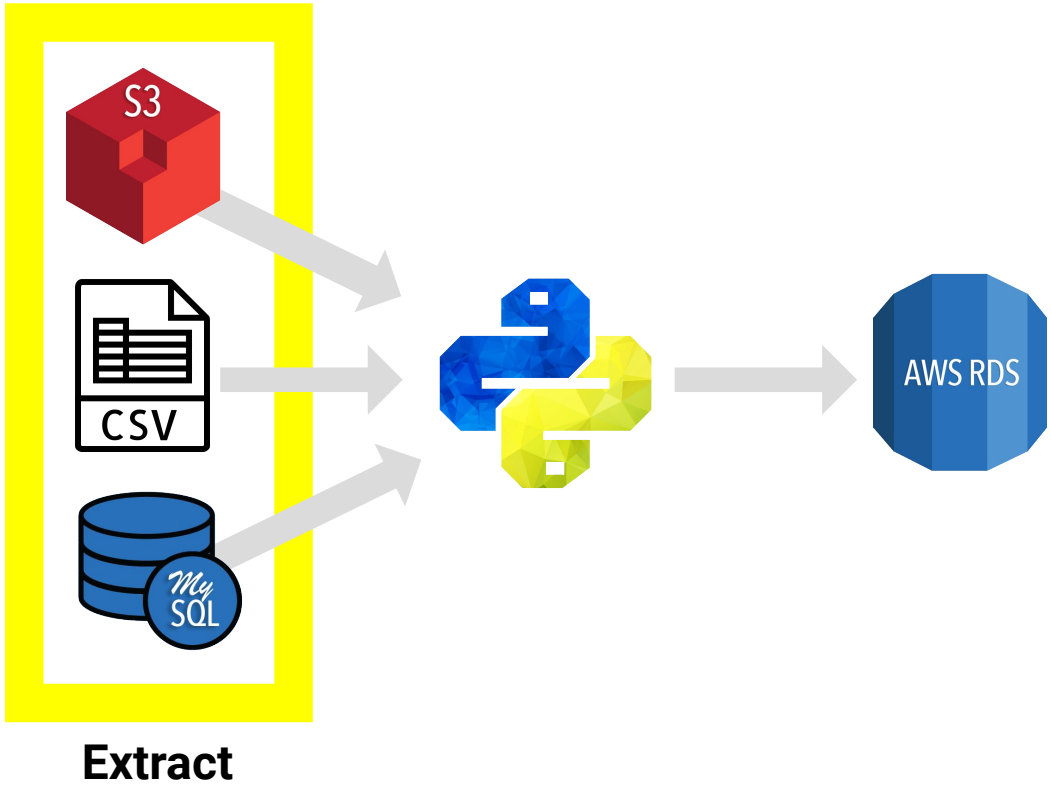
Data integration is an important part of working with data.

Introduction to ETL

Extract

Data may come from disparate sources, such as:

- CSV files
- JSON files
- HTML tables
- SQL databases
- Spreadsheets

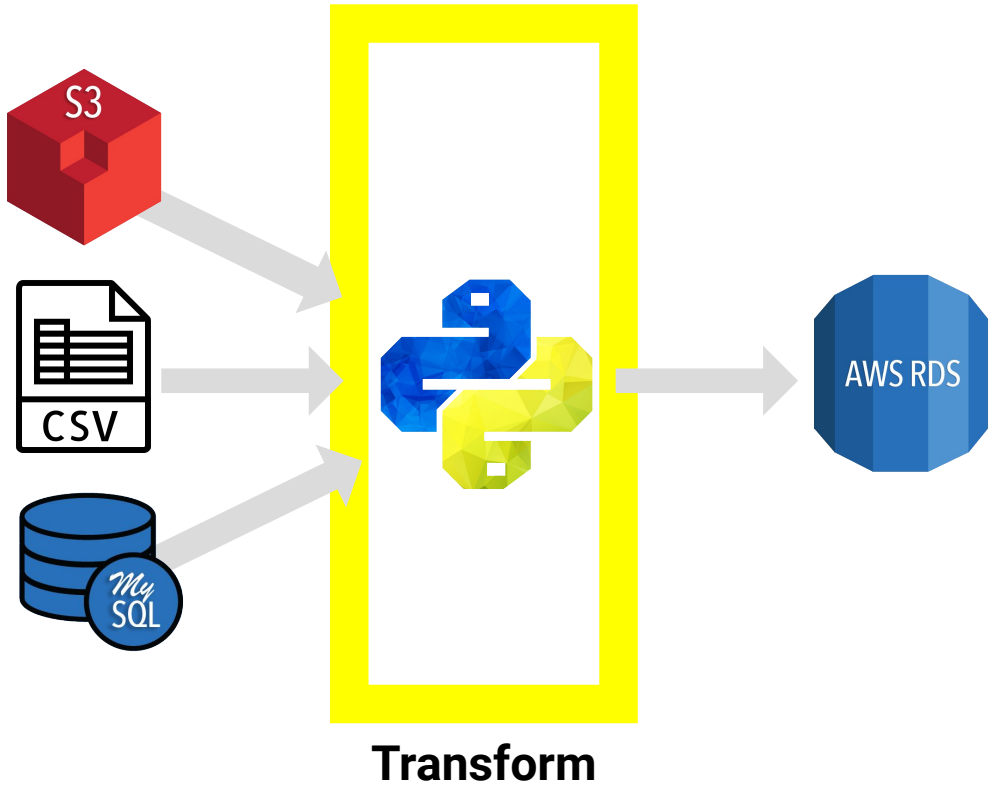


Introduction to ETL

Transform

Transform the data to suit business needs.
This may include:

- Data Cleaning
- Summarization
- Selection
- Joining
- Filtering
- Aggregating



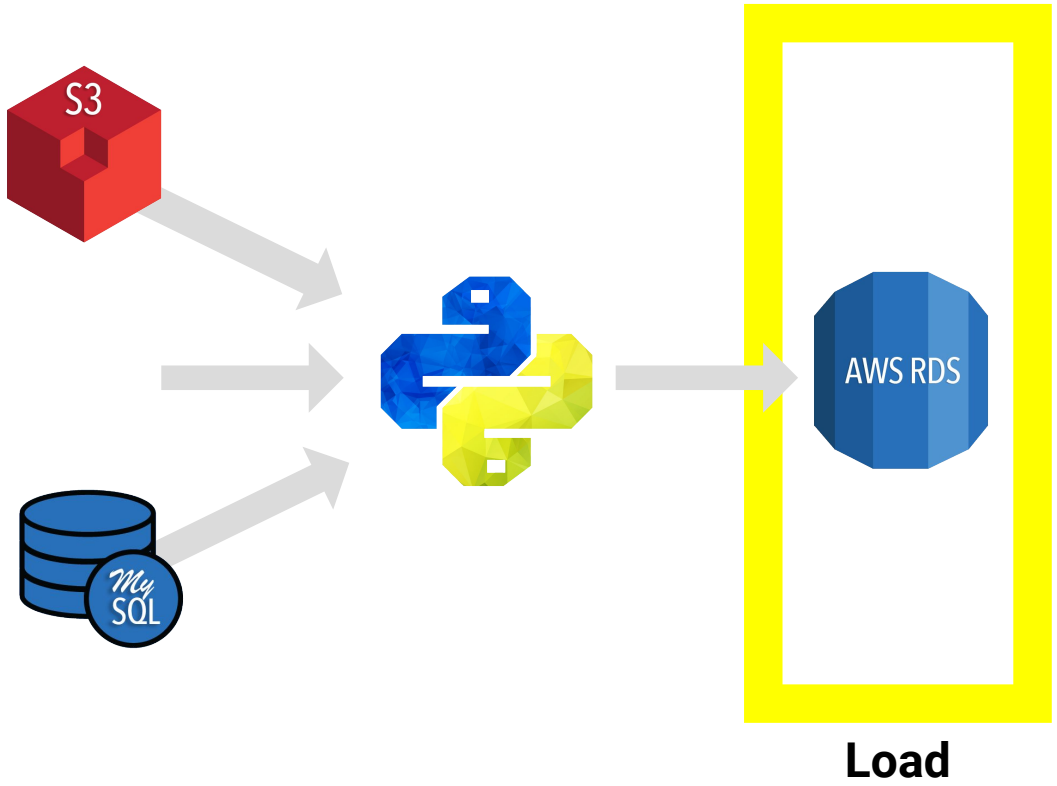
Note: We will use Python and pandas for transformation, which can also be done with SQL or a specialized ETL tool.

Introduction to ETL

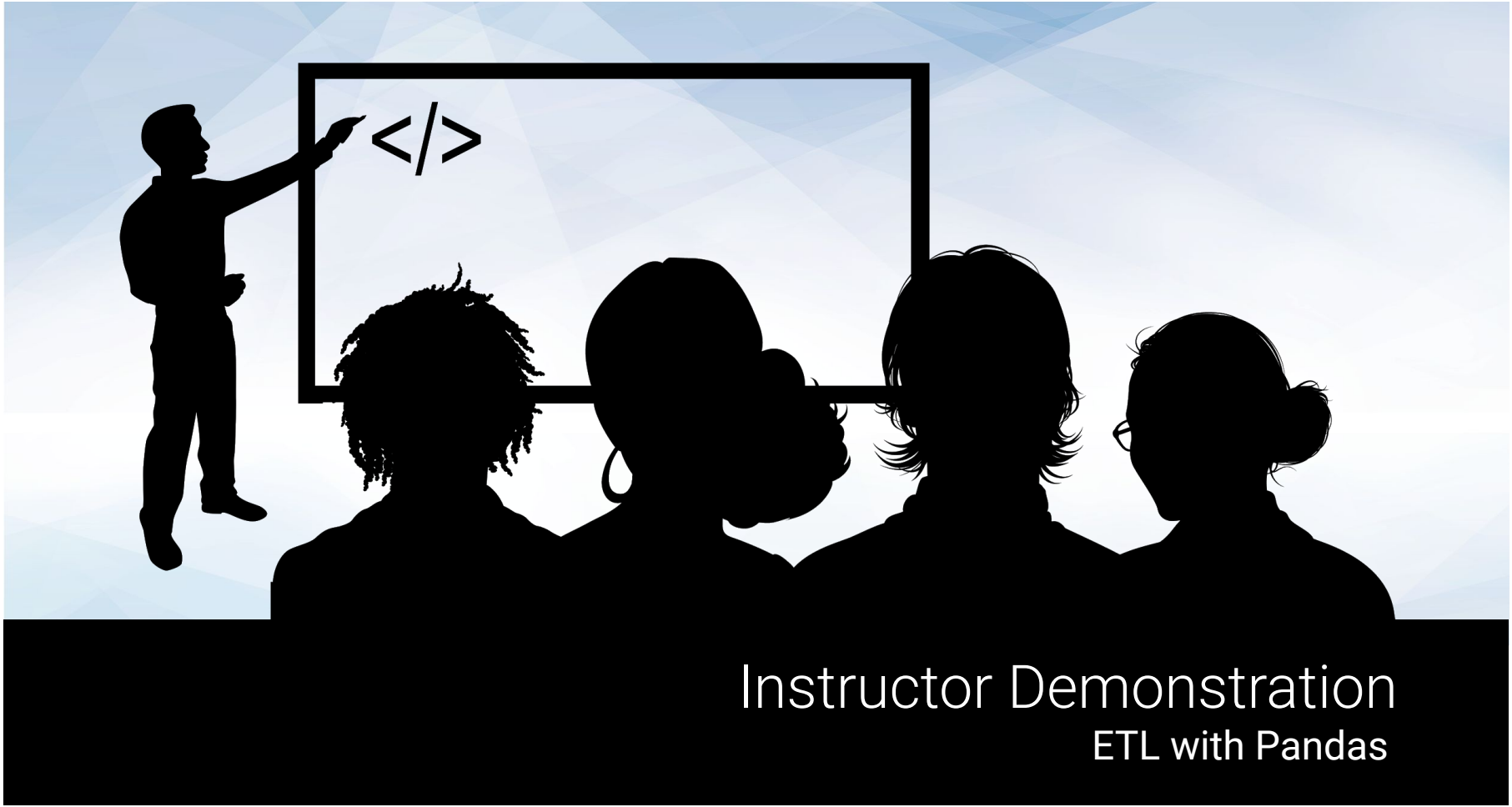
Load

Load the data into a final database that can be used
for future analysis or business use.

- Can be a relational or non-relational database
- Can be local or in the cloud
- Can be a data lake or data warehouse



Questions?

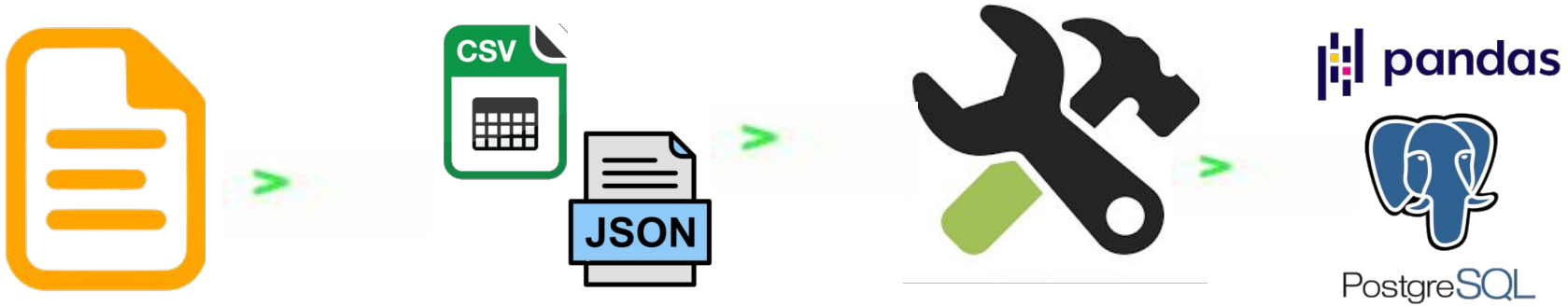


Instructor Demonstration

ETL with Pandas

ETL with Pandas

- Not limited to **Pandas,** the **ETL** process can be performed with a variety of tools and file formats.
- For this demonstration we will use the following:



ETL with Pandas

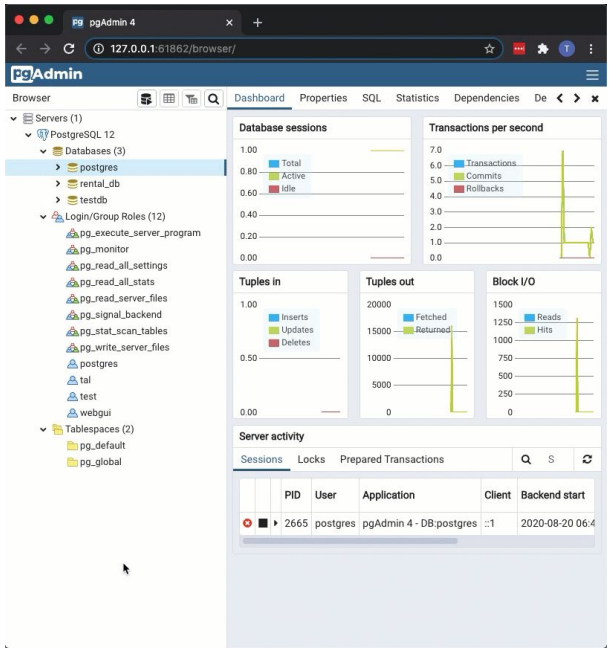
`pip install psycopg2`

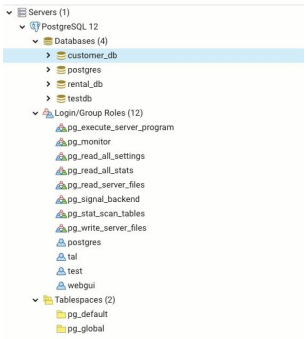
- ➔ `pip install psycopg2`
- ➔ Psycopg is a “driver” package -- An adapter for Python that works as a wrapper for **libpq**, which is the official postgreSQL client library.
- ➔ The psycopg2 package is used under the hood by SQLAlchemy

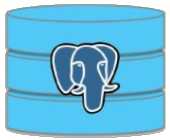
ETL with Pandas

pgAdmin postgreSQL

➔ Second, we need to open pgAdmin 4 and connect to a local server. Once connected we need to create a new **database** and **tables** accordingly.







database

tables

```
1  CREATE TABLE customer_name (
2  id INT PRIMARY KEY,
3  first_name TEXT,
4  last_name TEXT
5  );
6
7  CREATE TABLE customer_location (
8  id INT PRIMARY KEY,
9  address TEXT,
10 us_state TEXT
11 );
```

ETL with Pandas

.ipynb (Jupyter Notebook)

- Pandas is the pivotal piece of the ETL process. In Pandas, we are going to extract the data, Transform it and load back into dataframes. Let's follow the code line by line and see how it is done.

Store CSV into DataFrame

```
In [2]: csv_file = "../Resources/customer_data.csv"
        customer_data_df = pd.read_csv(csv_file)
        customer_data_df.head()
```

Out[2]:

	id	first_name	last_name	email	gender	car
0	1	Benetta	Cancott	bcancott0@studiopress.com	Female	Scion
1	2	Lilyan	Cherry	lcherry1@deliciousdays.com	Female	Chrysler
2	3	Ezekiel	Benasik	ebenasik2@wikia.com	Male	Mercedes-Benz
3	4	Kennedy	Atlay	katlay3@so-net.ne.jp	Male	Buick
4	5	Sanford	Salmen	ssalmen4@reuters.com	Male	Lincoln

Create new data with select columns

```
In [3]: new_customer_data_df = customer_data_df[['id', 'first_name', 'last_name']].co
        py()
        new_customer_data_df.head()
```

Out[3]:

	id	first_name	last_name
0	1	Benetta	Cancott
1	2	Lilyan	Cherry
2	3	Ezekiel	Benasik
3	4	Kennedy	Atlay
4	5	Sanford	Salmen

➔ Cell #2 has data pulled from a csv file and the data is assigned to a variable called `customer_data_df`.

➔ Cell #3 is returning a new dataframe with only the necessary columns. The new dataframe is assigned to a new variable as well.

ETL with Pandas

.ipynb (Jupyter Notebook)

Store JSON data into a DataFrame ¶

In [4]:
```
json_file = "../Resources/customer_location.json"
customer_location_df = pd.read_json(json_file)
customer_location_df.head()
```

Out[4]:

	address	id	latitude	longitude	us_state
0	043 Mockingbird Place	1	39.1682	-86.5186	Indiana
1	4 Prentice Point	2	41.0938	-85.0707	Indiana
2	46 Derek Junction	3	32.7673	-96.7776	Texas
3	11966 Old Shore Place	4	39.0350	-94.3567	Missouri
4	5 Evergreen Circle	5	40.7808	-73.9772	New York

Clean DataFrame

In [5]:
```
new_customer_location_df = customer_location_df[["id", "address", "us_stat
e"]].copy()
new_customer_location_df.head()
```

Out[5]:

	id	address	us_state
0	1	043 Mockingbird Place	Indiana
1	2	4 Prentice Point	Indiana
2	3	46 Derek Junction	Texas
3	4	11966 Old Shore Place	Missouri
4	5	5 Evergreen Circle	New York

➔ The same process of extracting and transforming the data is repeated with the JSON file as well.

ETL with Pandas

.ipynb (Jupyter Notebook)

Connect to local database

```
In [6]: rds_connection_string = "<insert user name>:<insert password>@localhost:5432/customer_db"
engine = create_engine(f'postgresql://{rds_connection_string}')
```

Check for tables

```
In [7]: engine.table_names()
Out[7]: ['customer_location', 'customer_name']
```

Use pandas to load csv converted DataFrame into database

```
In [8]: new_customer_data_df.to_sql(name='customer_name', con=engine, if_exists='append', index=False)
```

Use pandas to load json converted DataFrame into database

```
In [9]: new_customer_location_df.to_sql(name='customer_location', con=engine, if_exists='append', index=False)
```

- ➔ The following step is to connect to the local database. Once connected, we check the tables created earlier in the process.
- ➔ Next, we are dumping the newly created and trimmed dataframes into the database.

ETL with Pandas

.ipynb (Jupyter Notebook)

Confirm data has been added by querying the customer_name table

- NOTE: can also check using pgAdmin

```
In [10]: pd.read_sql_query('select * from customer_name', con=engine).head()
```

Out[10]:

	id	first_name	last_name
0	1	Benetta	Cancott
1	2	Lilyan	Cherry
2	3	Ezekiel	Benasik
3	4	Kennedy	Atlay
4	5	Sanford	Salmen

Confirm data has been added by querying the customer_location table

```
In [11]: pd.read_sql_query('select * from customer_location', con=engine).head()
```

Out[11]:

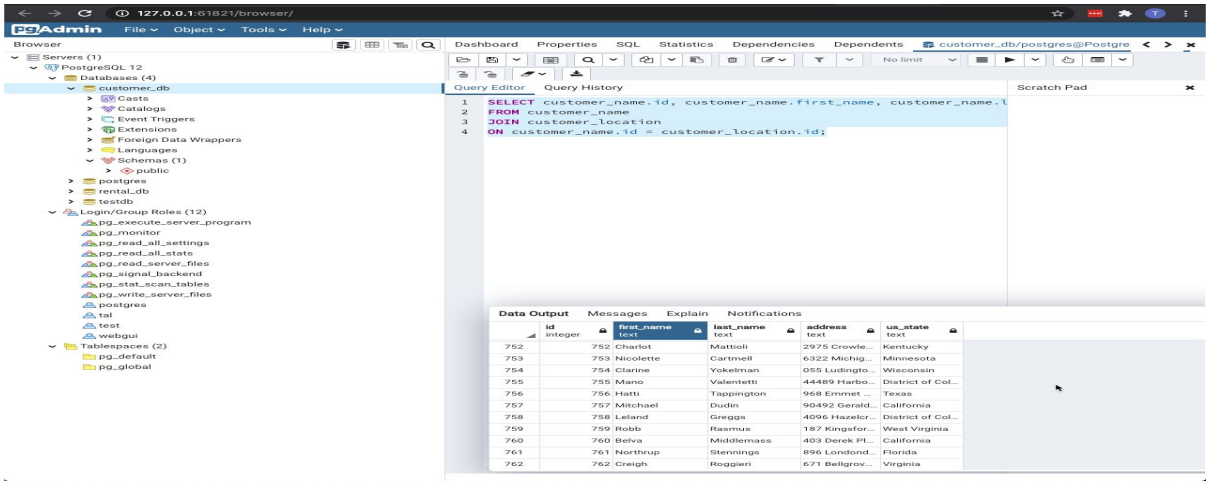
	id	address	us_state
0	1	043 Mockingbird Place	Indiana
1	2	4 Prentice Point	Indiana
2	3	46 Derek Junction	Texas
3	4	11966 Old Shore Place	Missouri
4	5	5 Evergreen Circle	New York

- ➔ At this point, all the data that we extracted and transformed is successfully loaded into our postgreSQL database.
- ➔ To double check, as a best practice, we performed queries for both tables at the database.

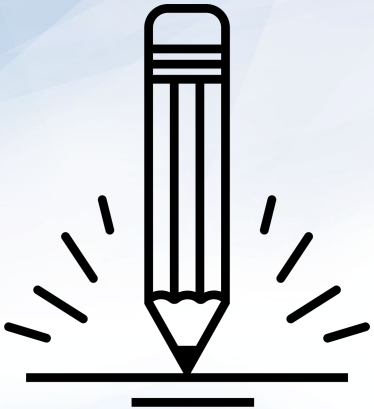
ETL with Pandas

pgAdmin postgreSQL

- The last piece of the process is coming back to pgAdmin to perform the join of the two tables we created.




```
SELECT customer_name.id, customer_name.first_name, customer_name.last_name, customer_location.address,
customer_location.us_state
FROM customer_name
JOIN customer_location
ON customer_name.id = customer_location.id;
```



Activity: Pandas ETL

In this activity, you will have the opportunity to perform your very first ETL process.

Suggested Time:
20 Minutes

Activity: Pandas ETL

Instructions:

- Create a `customer_db` database in pgAdmin 4 then create the following two tables within:
  - A premise table that contains the columns `id`, `premise_name` and `county_id`.
  - A county table that contains the columns `id`, `county_name`, `license_count` and `county_id`.
  - Be sure to assign a primary key, as Pandas will not be able to do so.
- In Jupyter Notebook perform all ETL.

➔ **Extraction**
- Put each CSV into a pandas DataFrame.

➔ **Transform**
- Copy only the columns needed into a new DataFrame.
- Rename columns to fit the tables created in the database.
- Handle any duplicates. **HINT**: some locations have the same name but each license number is unique.
- Set index to the previously created primary key.

Activity: Pandas ETL

Instructions:

- ➔ **Load**
  - Create a connection to database.
  - Check for a successful connection to the database and confirm that the tables have been created.
  - Append DataFrames to tables. Be sure to use the index set earlier.

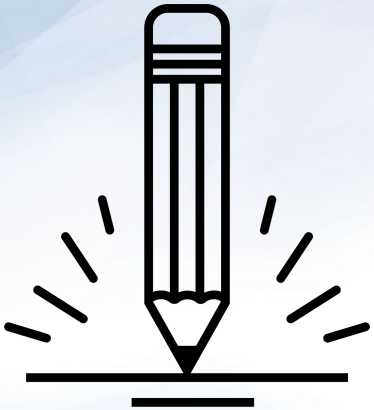
- Confirm successful **Load** by querying database.
- Join the two tables and select the `id` and `premise_name` from the `premise` table and `county_name` from the `county` table.

Time’s Up! Let’s Review.

Countdown timer

15:00

(with alarm)



Activity: Project Proposals

In this activity, you and your fellow group members will be going over the ETL project guidelines.

Suggested Time:
90 Minutes

Activity: Project Proposals

Team Effort

Due to the short timeline, teamwork will be crucial to the success of this project! Work closely with your team through all phases of the project to ensure that there are no surprises at the end of the week.

Working in a group enables you to tackle more difficult problems than you'd be able to working alone. In other words, working in a group allows you to work smart and dream big. Take advantage of it!

Project Proposal

Before you start writing any code, remember that you only have one week to complete this project. View this project as a typical assignment from work. Imagine a bunch of data came in and you and your team are tasked with migrating it to a production database.

Take advantage of your Instructor and TA support during office hours and class project work time. They are a valuable resource and can help you stay on track.

Activity: Project Proposals

Finding Data

Your project must use 2 or more sources of data. We recommend the following sites to use as sources of data:

- Data.world
- Kaggle

You can also use APIs or data scraped from the web. However, get approval from your instructor first. Again, there is only a week to complete this!

Activity: Project Proposals

Data Cleanup & Analysis

Once you have identified your datasets, perform ETL on the data. Make sure to plan and document the following:

- The sources of data that you will extract from.
- The type of transformation needed for this data (cleaning, joining, filtering, aggregating, etc).
- The type of final production database to load the data into (relational or non-relational).
- The final tables or collections that will be used in the production database.

You will be required to submit a final technical report with the above information and steps required to reproduce your ETL process.

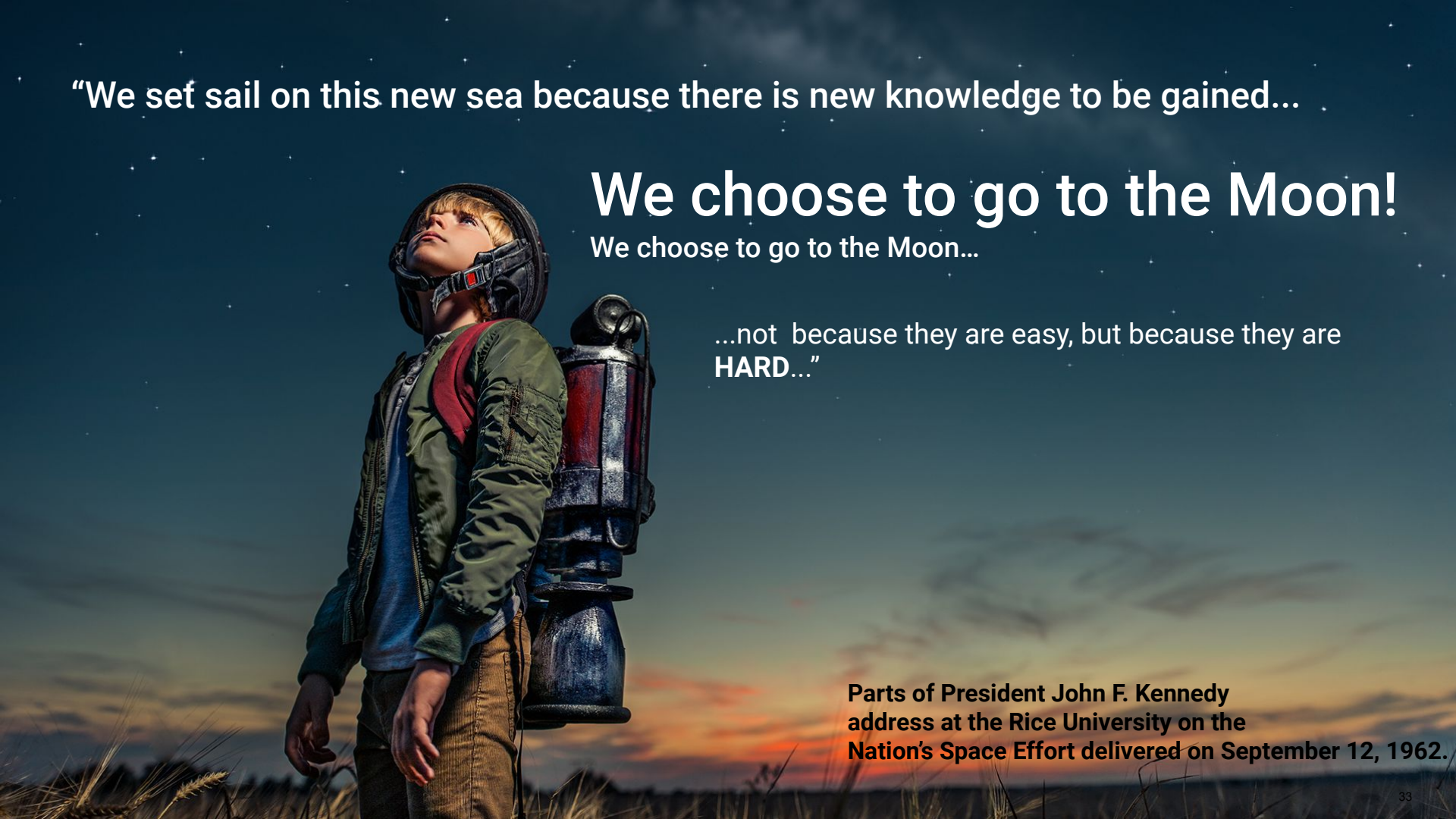
Activity: Project Proposals

Project Report

At the end of the week, your team will submit a Final Report that describes the following:

- **E**xtract: your original data sources and how the data was formatted (CSV, JSON, pgAdmin 4, etc).
- **T**ransform: what data cleaning or transformation was required.
- **L**oad: the final database, tables/collections, and why this was chosen.

Please upload the report to Github and submit a link to Bootcampspot.


“We set sail on this new sea because there is new knowledge to be gained...
We choose to go to the Moon!
We choose to go to the Moon…
...not because they are easy, but because they are HARD...”
Parts of President John F. Kennedy address at the Rice University on the Nation’s Space Effort delivered on September 12, 1962.