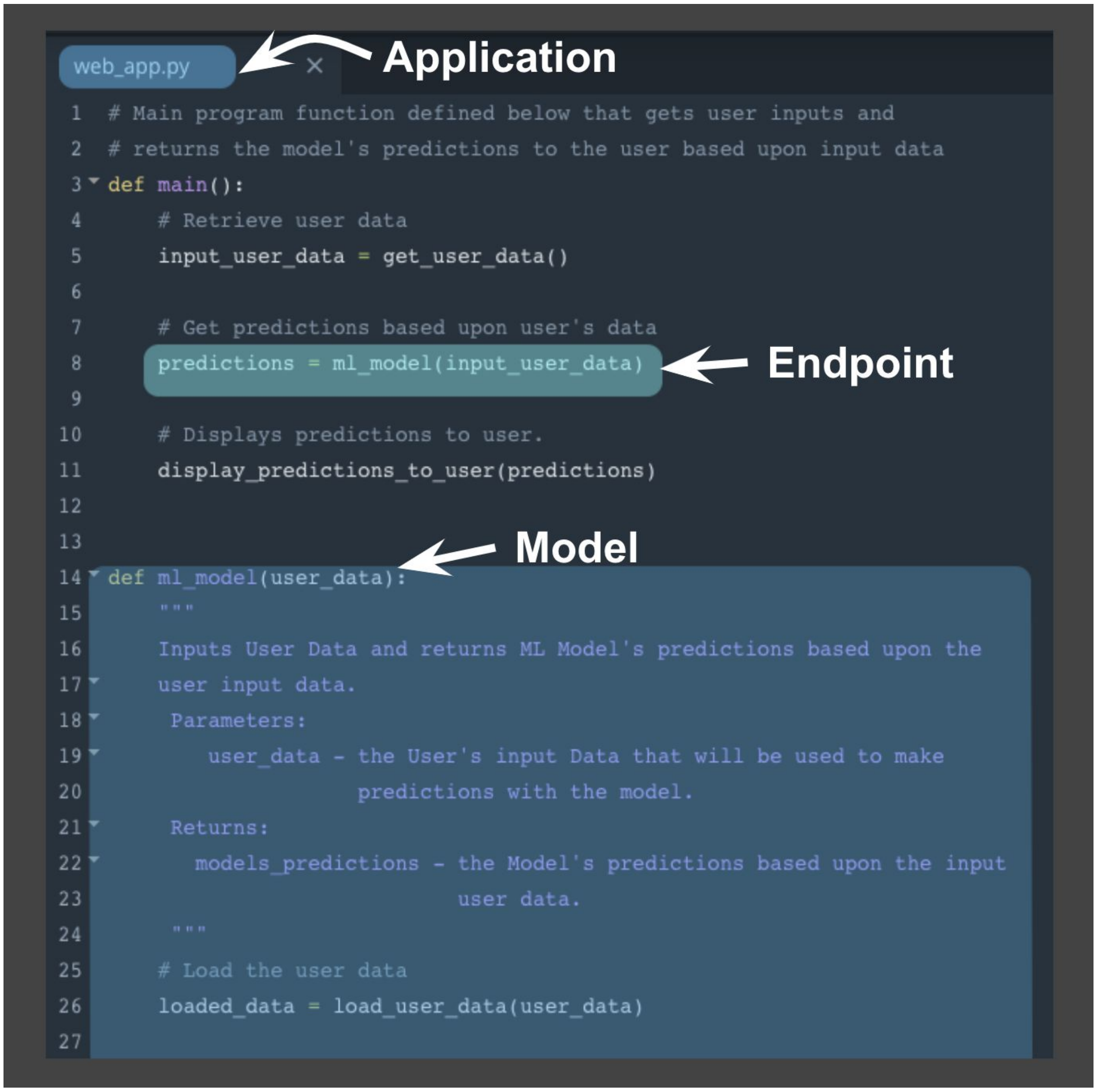
Production Environment and the Endpoint

When we discussed the *production environment*, the ***endpoint*** was defined as the **interface** to the model. This **interface** (***endpoint***) facilitates an ease of communication between the *model* and the *application*. Specifically, this **interface** (***endpoint***)

- Allows the *application* to send ***user data*** to the *model* and
- Receives ***predictions*** back from the *model* based upon that ***user data***.

Model, Application, and Endpoint



```python
# Main program function defined below that gets user inputs and
# returns the model's predictions to the user based upon input data
def main():
    # Retrieve user data
    input_user_data = get_user_data()

    # Get predictions based upon user's data
    predictions = ml_model(input_user_data)

    # Displays predictions to user.
    display_predictions_to_user(predictions)


def ml_model(user_data):
    """
    Inputs User Data and returns ML Model's predictions based upon the
    user input data.
     Parameters:
        user_data - the User's input Data that will be used to make
                    predictions with the model.
     Returns:
       models_predictions - the Model's predictions based upon the input
                            user data.
     """
    # Load the user data
    loaded_data = load_user_data(user_data)

```

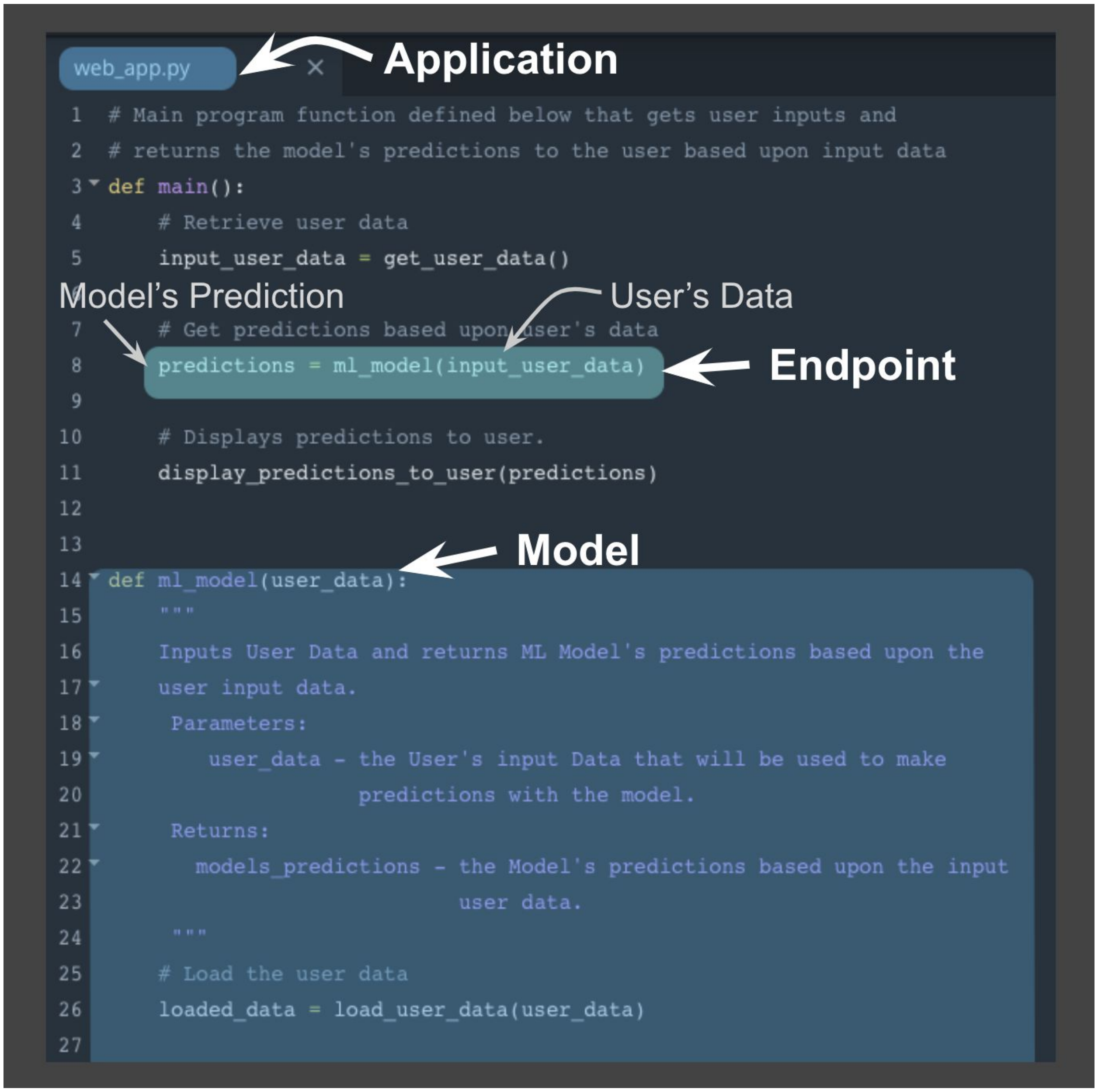
One way to think of the ***endpoint*** that acts as this *interface*, is to think of a *Python program* where:

- the **endpoint** itself is like a ***function call***
- the ***function*** itself would be the **model** and

- the ***Python program*** is the **application**.

The image **above** depicts the association between a ***Python program*** and the **endpoint**, **model**, and **application**.

- the **endpoint**: *line **8 function call*** to **ml_model**
- the **model**: beginning on *line **14 function definition*** for **ml_model**
- the **application**: ***Python program*** **web_app.py**



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Using this example **above** notice the following:

- *Similar* to a ***function call*** the **endpoint** accepts *user data* as the ***input*** and ***returns*** the *model's prediction* based upon this ***input*** through the **endpoint**.
- In the example, the *user data* is the ***input argument*** and the *prediction* is the ***returned value*** from the ***function call***.

- The **application**, here the ***python program***, displays the *model's prediction* to the *application user*.

This example highlights how the **endpoint** itself is just the ***interface*** between the **model** and the **application**; where this ***interface*** enables users to get *predictions* from the ***deployed*** *model* based on their *user data*.

Next we'll focus on *how* the **endpoint** (***interface***) facilitates communication between **application** and **model**.

Endpoint and REST API

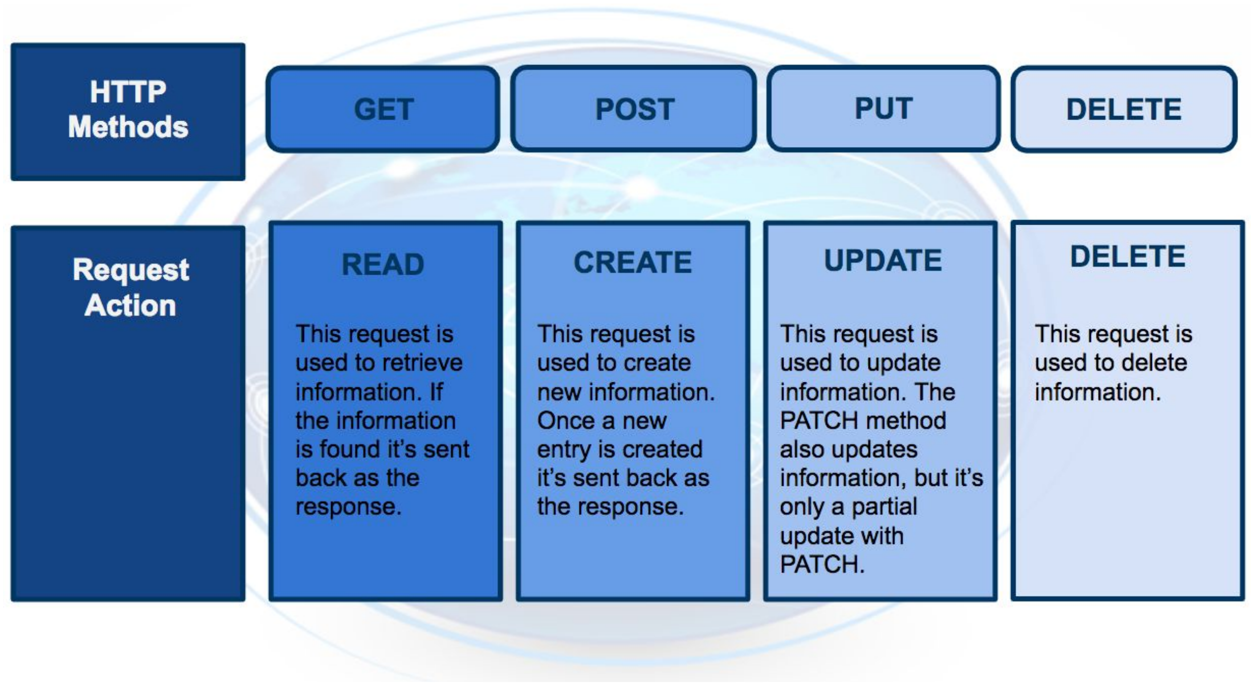
Communication between the **application** and the **model** is done through the **endpoint** (***interface***), where the **endpoint** is an **Application Programming Interface** (**API**).

- An *easy* way to think of an **API**, is as a *set of rules* that *enable* programs, here the **application** and the **model**, to *communicate* with each other.
- In this case, our **API** uses a **RE**presentational **S**tate **T**ransfer, **REST**, architecture that provides a framework for the *set of rules* and *constraints* that must be adhered to for *communication* between programs.
- This **REST API** is one that uses *HTTP requests* and *responses* to enable communication between the **application** and the **model** through the **endpoint** (***interface***).

- Noting that ***both*** the **HTTP request** and **HTTP response** are *communications* sent between the **application** and **model**.

The **HTTP request** that's sent from your **application** to your **model** is composed of *four* parts:

- **Endpoint**
  - This **endpoint** will be in the form of a URL, Uniform Resource Locator, which is commonly known as a web address.
- HTTP Method
  - Below you will find four of the **HTTP methods**, but for purposes of ***deployment*** our **application** will use the ***POST method*** *only*.
- HTTP Headers
  - The **headers** will contain additional information, like the format of the data within the message, that's passed to the *receiving* program.
- Message (Data or Body)
  - The final part is the **message** (data or body); for ***deployment*** will contain the *user's data* which is input into the **model**.



HTTP Methods	GET	POST	PUT	DELETE
Request Action	READ This request is used to retrieve information. If the information is found it's sent back as the response.	CREATE This request is used to create new information. Once a new entry is created it's sent back as the response.	UPDATE This request is used to update information. The PATCH method also updates information, but it's only a partial update with PATCH.	DELETE This request is used to delete information.

The **HTTP response** sent from your model to your application is composed of *three* parts:

- HTTP Status Code
  - If the model successfully received and processed the *user's data* that was sent in the **message**, the status code should start with a **2**, like *200*.
- HTTP Headers
  - The **headers** will contain additional information, like the format of the data within the **message**, that's passed to the receiving program.
- Message (Data or Body)
  - What's returned as the *data* within the **message** is the *prediction* that's provided by the **model**.

This *prediction* is then presented to the *application user* through the **application**. The **endpoint** is the ***interface*** that *enables communication* between the **application** and the **model** using a **REST API**.

As we learn more about **REST*ful* API**, realize that it's the **application's** responsibility:

- To format the *user's data* in a way that can be easily put into the **HTTP request *message*** and ***used*** by the **model**.
- To translate the *predictions* from the **HTTP response *message*** in a way that's easy for the *application user's* to understand.

Notice the following regarding the *information* included in the ***HTTP messages*** sent between **application** and **model**:

- Often *user's data* will need to be in a *CSV* or *JSON* format with a specific *ordering* of the data that's dependent upon the **model** used.
- Often *predictions* will be returned in *CSV* or *JSON* format with a specific *ordering* of the returned *predictions* dependent upon the **model** used.