

Task 3

Question:

Document your solution to task 2. The documentation must *briefly* explain how to get it up & running. The target audience for this technical documentation are imaginary fellow developers, who would have to productize, evolve, support and maintain it.

Answer: Please see the instructions below and please see the instructions on how to execute **client.py**, all the unit and E2E tests mentioned below.

Step1:

✓ **IDE: VSCODE**

Step2:

✓ **Install Dependencies:**

```
pip install pytest      # pytest – test framework used to discover and run tests.
pip install httpx       # httpx – used in your actual code and mocking (httpx.get()).
pip install fastapi
pip install uvicorn     # Optional: for running the server (not for testing)
pip install requests    # Optional: only if used somewhere
pip install pytest
pip install pytest-mock  # Enables use of `monkeypatch` as a fixture
pip install pytest-asyncio
```

Step 3:

✓ **Execute “client.py” python file:**

□ **Step-by-step Instructions:**

1. **Ensure prerequisites are met:**
 - Your **FastAPI** server (likely at `http://localhost:8000/`) must be running. So, **run the command** on terminal : `docker compose up -d --build`
 - The server should require **Basic Auth** with username **"user"** and password **"password"**.
 - Python 3.10+ is installed. (In my case it is 3.13)
 - **httpx** is installed.
2. **Install httpx (if not already):**

```
pip install httpx
```

3. **Run the script**

On your terminal, run the command:

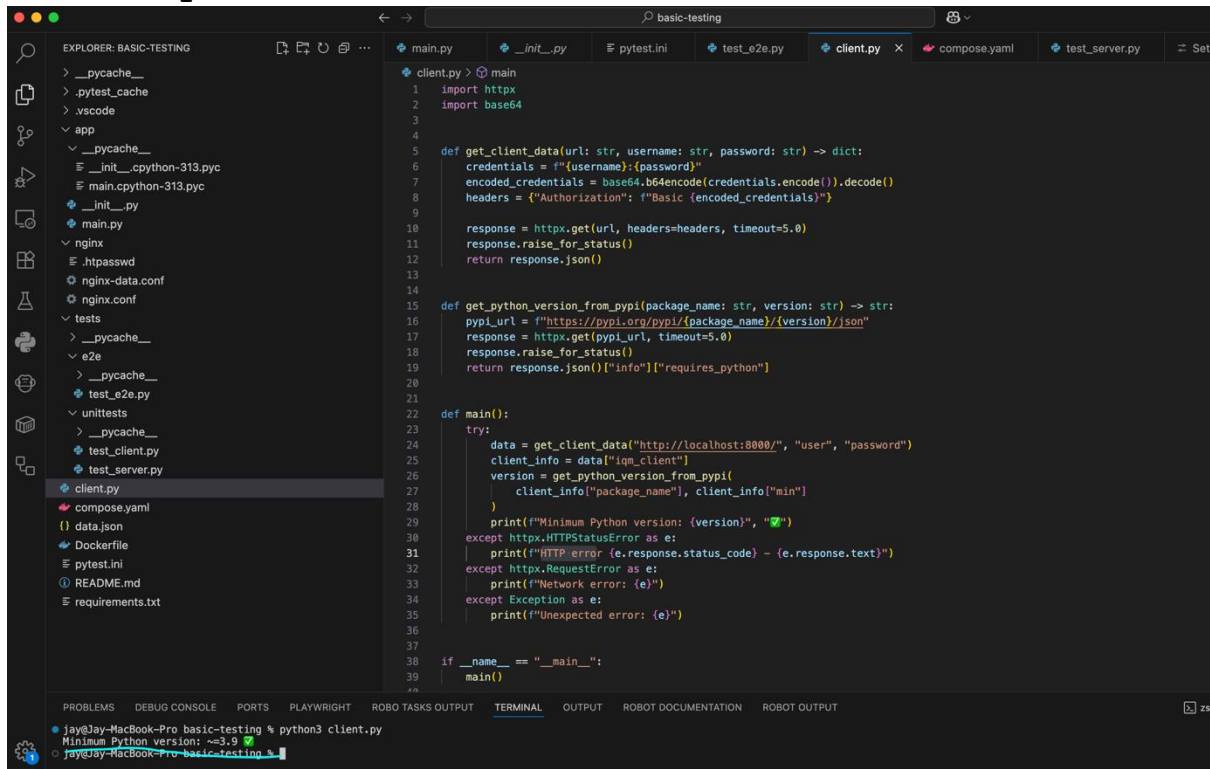
Python3 client.py

Or, if you're inside a project folder:

Python3 path/to/client.py

□ Output (if server returns expected data):

Minimum Python version: ~3.9 ✓



The screenshot shows a VS Code editor with a project named 'basic-testing'. The Explorer sidebar on the left shows the file structure, including a 'tests' directory with 'test_client.py' and 'test_server.py'. The main editor displays the code for 'client.py', which includes functions for getting client data and checking the minimum Python version. The code is as follows:

```
1 import httpx
2 import base64
3
4
5 def get_client_data(url: str, username: str, password: str) -> dict:
6     credentials = f"{username}:{password}"
7     encoded_credentials = base64.b64encode(credentials.encode()).decode()
8     headers = {"Authorization": f"Basic {encoded_credentials}"}
9
10    response = httpx.get(url, headers=headers, timeout=5.0)
11    response.raise_for_status()
12    return response.json()
13
14
15 def get_python_version_from_pypi(package_name: str, version: str) -> str:
16     pypi_url = f"https://pypi.org/pypi/{package_name}/{version}/json"
17     response = httpx.get(pypi_url, timeout=5.0)
18     response.raise_for_status()
19     return response.json()["info"]["requires_python"]
20
21
22 def main():
23     try:
24         data = get_client_data("http://localhost:8000/", "user", "password")
25         client_info = data["iqm_client"]
26         version = get_python_version_from_pypi(
27             client_info["package_name"], client_info["min"]
28         )
29         print(f"Minimum Python version: {version}", "✓")
30     except httpx.HTTPStatusError as e:
31         print(f"HTTP error {e.response.status_code} - {e.response.text}")
32     except httpx.RequestError as e:
33         print(f"Network error: {e}")
34     except Exception as e:
35         print(f"Unexpected error: {e}")
36
37
38 if __name__ == "__main__":
39     main()
```

The bottom of the screenshot shows the 'TERMINAL' panel with the following output:

```
jay@Jay-MacBook-Pro basic-testing % python3 client.py
Minimum Python version: ~3.9 ✓
jay@Jay-MacBook-Pro basic-testing %
```

✓ Run the unit tests:

✓**Pre-requisites:** If you're FastAPI server (<http://localhost:8000/>) is already up and running. Please shut down the services with the command: **docker compose down**

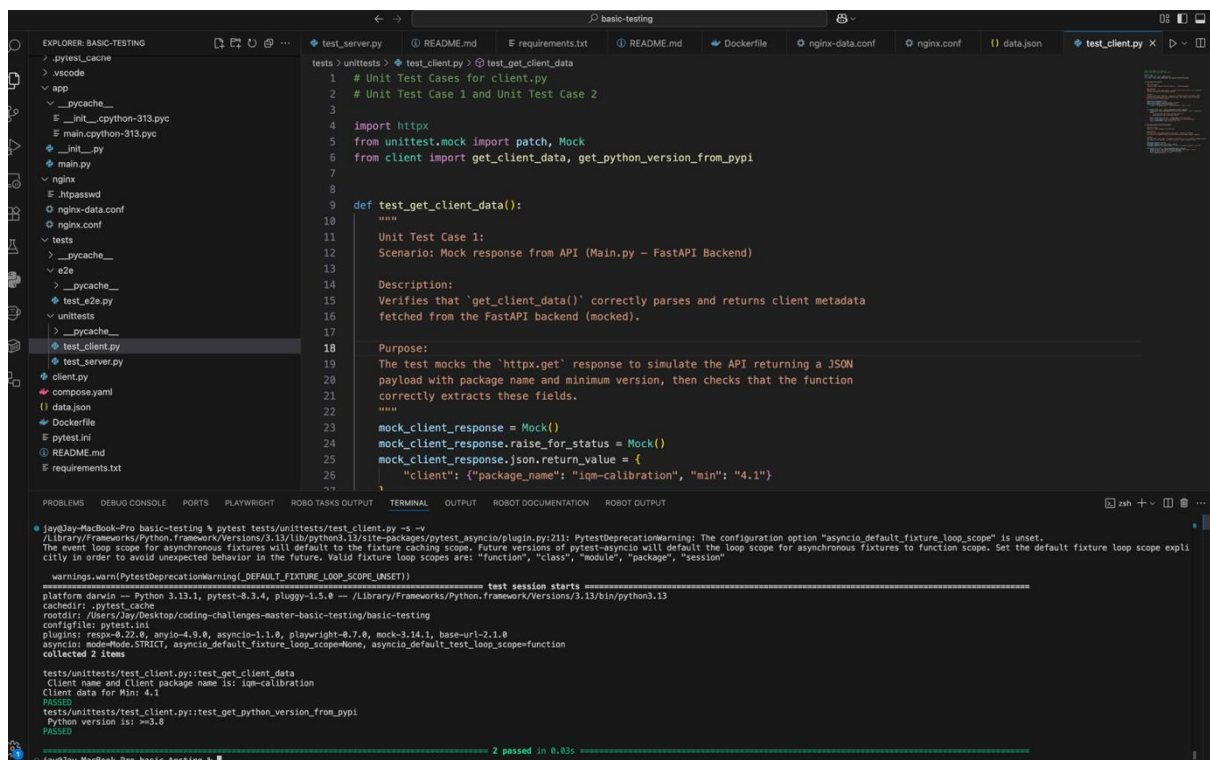
```
jay@Jay-MacBook-Pro basic-testing % docker compose down
[+] Running 4/4
  # Container data                Removed           0.3s
  # Container fastapi-application  Removed           0.4s
  # Container nginx                Removed           0.3s
  # Network "basic-testing_default" Removed           0.1s
jay@Jay-MacBook-Pro basic-testing %
```

Note: Ensure, you do not run you FastAPI server (<http://localhost:8000>) as our unit tests are mocked and we don't need a real server.

✓**Run the unit test for `client.py`:**

- ✓**Test name:** `test_client.py`
- Test Description** is described inside the tests as comments explaining manual steps.
- On your terminal, Run the unit test with command: **pytest tests/unittests/test_client.py -s -v**

Test Output:



The screenshot shows a VS Code editor with the file `test_client.py` open. The file contains unit tests for `client.py`. The tests are:

- `test_get_client_data()`: Verifies that `'get_client_data()'` correctly parses and returns client metadata fetched from the FastAPI backend (mocked).
- `test_get_python_version_from_pypi()`: Verifies that `'get_python_version_from_pypi()'` correctly extracts these fields.

The terminal output shows the execution of the tests:

```
platform darwin -- Python 3.13.1, pytest-8.3.4, pluggy-1.5.0 -- /Library/Frameworks/Python.framework/Versions/3.13/bin/python3.13
cachedir: .pytest_cache
rootdir: /Users/Jay/Desktop/coding-challenges-master-basic-testing/basic-testing
configfile: pytest.ini
plugins: respx-0.22.0, anyio-4.9.0, asyncio-1.1.0, playwright-0.7.0, mock-3.14.1, base-url-2.1.0
asyncio: mode=Mode.STRICT, asyncio_default_fixture_loop_scope=None, asyncio_default_test_loop_scope=function
collected 2 items

tests/unittests/test_client.py::test_get_client_data
  Client name and client package name is: lqm-calibration
  Client data for Min: 4.1
  PASSED
tests/unittests/test_client.py::test_get_python_version_from_pypi
  Python version is: >=3.8
  PASSED

===== 2 passed in 0.03s =====
```

✓ Run the unit test for **main.py (FastAPI Server)**:

- ✓ **Test name:** `test_server.py`
- Test Description** is described inside the tests as comments explaining manual steps.
- On your terminal, Run the unit test with command: **pytest tests/unittests/test_server.py -s -v**

Test Output:

```
tests > unittests > test_server.py > test_valid_client_key
11 def test_valid_client_key(monkeypatch):
34
35     response = client.get(f"/?client_key=iqm_client")
36     print("200 OK Response:", response.json())
37     assert response.status_code == 200
38     assert response.json() == {"iqm_client": mock_data["iqm_client"]}
39
40
41 def test_request_error(monkeypatch):
42     """
43     Unit Test Case 2:
44     Scenario: 502 - RequestError (Can't connect to data service)
45
46     Description:
47     FastAPI handles a connection failure to the data service gracefully.
48
49     Purpose:
50     Simulates an 'httpx.RequestError' (e.g., connection timeout or DNS failure),
51     and ensures FastAPI returns a 502 error with the appropriate error message.
52     """
53
54     def mock_get(*args, **kwargs):
55         raise httpx.RequestError("Connection failed")
56
57     monkeypatch.setattr(httpx, "get", mock_get)
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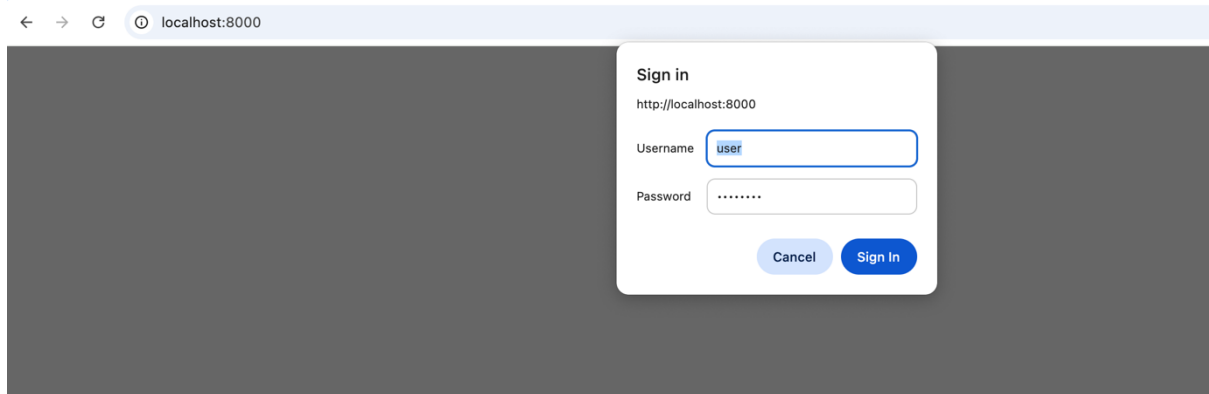
✓Run the **E2E or Integration tests**:

✓ Pre-requisite:

- Your **FastAPI** server (likely at <http://localhost:8000/>) must be up and running. So, please **run the command** on terminal: **docker compose up -d --build**

```
jay@Jay-MacBook-Pro basic-testing % docker compose down
[+] Running 4/4
  # Container fastapi-application Removed 0.4s
  # Container nginx Removed 0.3s
  # Container data Removed 0.3s
  # Network "basic-testing_default" Removed 0.1s
jay@Jay-MacBook-Pro basic-testing % docker compose up -d --build
[+] Building 4.4s (14/14) FINISHED
=> [internal] load build definition from Dockerfile 0.0s
=> => transferring dockerfile: 79B 0.0s
=> [internal] load .dockerignore 0.0s
=> => transferring context: 2B 0.0s
=> resolve image config for docker.io/docker/dockerfile:1.4 2.1s
=> CACHED docker-image://docker.io/docker/dockerfile:1.4@sha256:9ba7531bd80fb0a858632727cf7a112fbfd19b17e94c4e84ced81e24ef1a0dbc 0.0s
=> [internal] load .dockerignore 0.0s
=> [internal] load build definition from Dockerfile 0.0s
=> [internal] load metadata for docker.io/tiangolo/uvicorn-gunicorn-fastapi:python3.9-slim 1.9s
=> [builder 1/5] FROM docker.io/tiangolo/uvicorn-gunicorn-fastapi:python3.9-slim@sha256:ac5dc853b902c02a52a0d5da9666d29d73d16da04322bab99d79 0.0s
=> [internal] load build context 0.0s
=> => transferring context: 2.12kB 0.0s
=> CACHED [builder 2/5] WORKDIR /app 0.0s
=> CACHED [builder 3/5] COPY requirements.txt ./ 0.0s
=> CACHED [builder 4/5] RUN --mount=type=cache,target=/root/.cache/pip pip install -r requirements.txt 0.0s
=> [builder 5/5] COPY ./app ./app 0.0s
=> exporting image 0.0s
=> => exporting layers 0.0s
=> => writing image sha256:088dc1ba0bdb54f7be56c9c1e9d51792c02a8892ac76262fa547fcl1a82776265 0.0s
=> => naming to docker.io/library/basic-testing_api 0.0s
Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them
[+] Running 4/4
  # Network "basic-testing_default" Created
  # Container nginx Started
  # Container fastapi-application Started
  # Container data Started
jay@Jay-MacBook-Pro basic-testing % docker ps -a
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                               NAMES
b2d5f3e1d73e   nginx:alpine   "/docker-entrypoint..." 6 minutes ago  Up 6 minutes  0.0.0.0:8000->80/tcp               nginx
d7dbc7a0c842   nginx:alpine   "/docker-entrypoint..." 6 minutes ago  Up 6 minutes  0.0.0.0:8002->80/tcp               data
4307ab35c9d4   basic-testing_api "/start.sh"              6 minutes ago  Up 6 minutes  0.0.0.0:8001->8000/tcp             fastapi-application
jay@Jay-MacBook-Pro basic-testing %
```

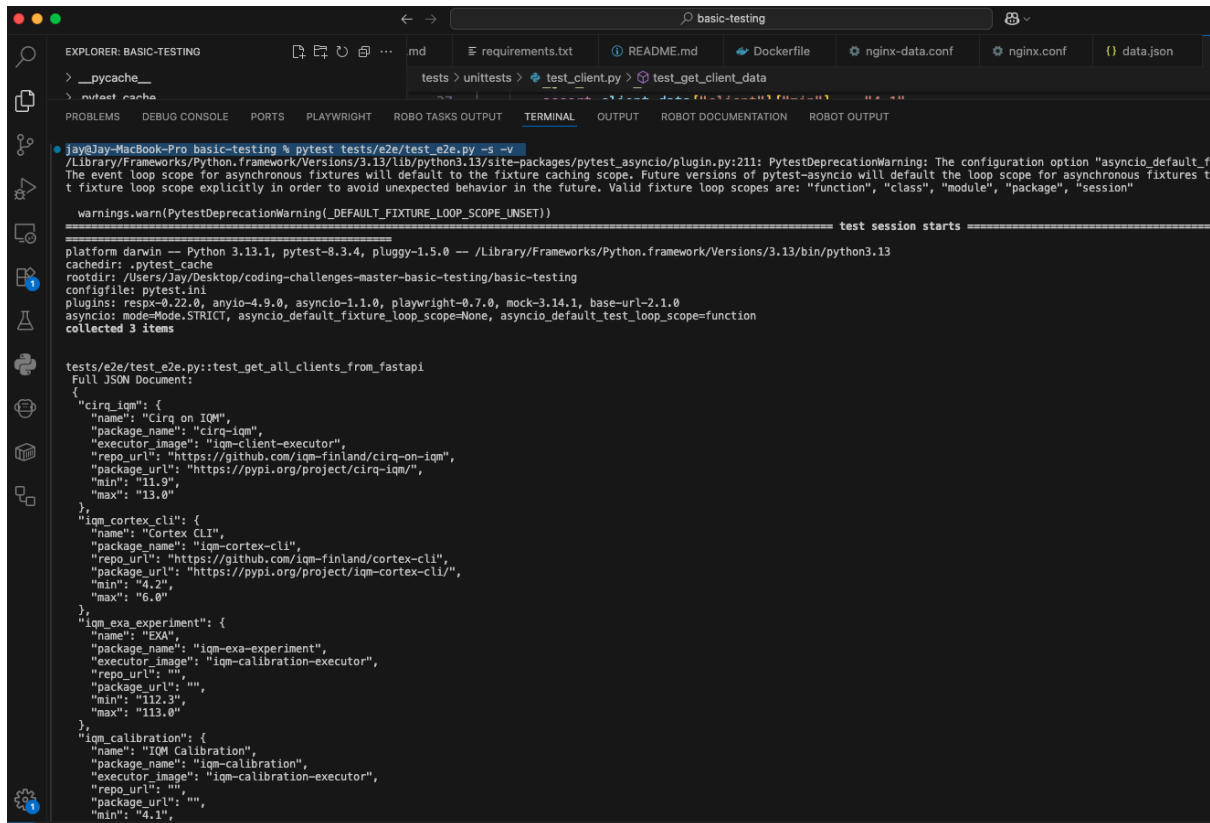
Once, your **FastAPI** server is up and running, open a new browser type <http://localhost:8000/> and type username as "user" and password as "password". Now, hit "Sign In" Button. You should see the web page displaying full **JSON document** like mentioned below.



```
← → ↻ localhost:8000
Pretty print ☒
{
  "cirq_iqm": {
    "name": "Cirq on IQM",
    "package_name": "cirq-iqm",
    "executor_image": "iqm-client-executor",
    "repo_url": "https://github.com/iqm-finland/cirq-on-iqm",
    "package_url": "https://pypi.org/project/cirq-iqm/",
    "min": "11.9",
    "max": "13.0"
  },
  "iqm_cortex_cli": {
    "name": "Cortex CLI",
    "package_name": "iqm-cortex-cli",
    "repo_url": "https://github.com/iqm-finland/cortex-cli",
    "package_url": "https://pypi.org/project/iqm-cortex-cli/",
    "min": "4.2",
    "max": "6.0"
  },
  "iqm_exa_experiment": {
    "name": "EXA",
    "package_name": "iqm-exa-experiment",
    "executor_image": "iqm-calibration-executor",
    "repo_url": "",
    "package_url": "",
    "min": "112.3",
    "max": "113.0"
  },
  "iqm_calibration": {
    "name": "IQM Calibration",
    "package_name": "iqm-calibration",
    "executor_image": "iqm-calibration-executor",
    "repo_url": "",
    "package_url": "",
    "min": "4.1",
    "max": "4.2"
  },
  "iqm_client": {
    "name": "IQM client",
    "package_name": "iqm-client",
    "executor_image": "iqm-client-executor",
    "repo_url": "https://github.com/iqm-finland/iqm-client",
    "package_url": "https://pypi.org/project/iqm-client/",
    "min": "13.2",
    "max": "15.0"
  },
  "qiskit_iqm": {
    "name": "Qiskit on IQM",
    "package_name": "qiskit-iqm",
    "executor_image": "iqm-client-executor",
    "repo_url": "https://github.com/iqm-finland/qiskit-on-iqm",
    "package_url": "https://pypi.org/project/qiskit-iqm/",
    "min": "10.9",
    "max": "12.0"
  }
}
```

- **Test name:** `test_e2e.py`
- **Test Description** is described inside the tests as comments explaining manual steps.
- On your terminal, Run the Integration (OR) E2E tests with command:
`pytest tests/e2e/test_e2e.py -s -v` (OR) `PYTHONPATH=. pytest -s -v tests/e2e/test_e2e.py -s -v`

Test Output:



The screenshot shows the VS Code interface with the Explorer pane on the left displaying the project structure. The main editor shows the output of a pytest command. The output includes a warning about the deprecated `asyncio_default_fixture_loop_scope` option, followed by a summary of the test session. The session summary lists the platform (darwin), Python version (3.13.1), pytest version (8.3.4), and the number of collected items (3). The test results show that all three tests passed successfully.

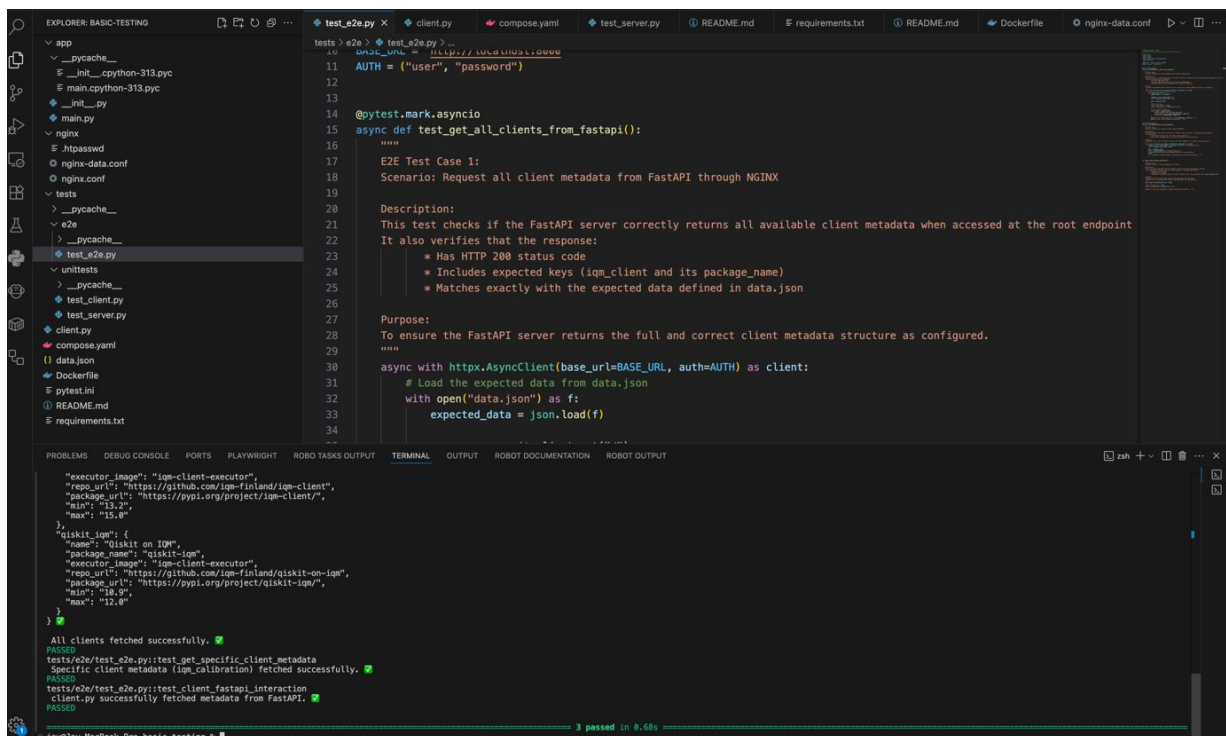
```
basic-testing
EXPLORER: BASIC-TESTING
> __pycache__
> tests > unittests > test_client.py > test_get_client_data
PROBLEMS DEBUG CONSOLE PORTS PLAYWRIGHT ROBO TASKS OUTPUT TERMINAL OUTPUT ROBOT DOCUMENTATION ROBOT OUTPUT

• jay@Jay-MacBook-Pro basic-testing % pytest tests/e2e/test_e2e.py -s -v
platform darwin -- Python 3.13.1, pytest-8.3.4, pluggy-1.5.0 -- /Library/Frameworks/Python.framework/Versions/3.13/bin/python3.13
cachedir: .pytest_cache
rootdir: /Users/Jay/Desktop/coding-challenges-master-basic-testing/basic-testing
configfile: pytest.ini
plugins: respx-0.22.0, anyio-4.9.0, asyncio-1.1.0, playwright-0.7.0, mock-3.14.1, base-url-2.1.0
asyncio: mode=Mode.STRICT, asyncio_default_fixture_loop_scope=None, asyncio_default_test_loop_scope=function
collected 3 items

tests/e2e/test_e2e.py::test_get_all_clients_from_fastapi
Full JSON Document:
{
  "cirq_iqm": {
    "name": "Cirq on IQM",
    "package_name": "cirq-iqm",
    "executor_image": "iqm-client-executor",
    "repo_url": "https://github.com/iqm-finland/cirq-on-iqm",
    "package_url": "https://pypi.org/project/cirq-iqm/",
    "min": "11.9",
    "max": "13.0"
  },
  "iqm_cortex_cli": {
    "name": "Cortex CLI",
    "package_name": "iqm-cortex-cli",
    "repo_url": "https://github.com/iqm-finland/cortex-cli",
    "package_url": "https://pypi.org/project/iqm-cortex-cli/",
    "min": "4.2",
    "max": "6.0"
  },
  "iqm_exa_experiment": {
    "name": "EXA",
    "package_name": "iqm-exa-experiment",
    "executor_image": "iqm-calibration-executor",
    "repo_url": "",
    "package_url": "",
    "min": "112.3",
    "max": "113.0"
  },
  "iqm_calibration": {
    "name": "IQM Calibration",
    "package_name": "iqm-calibration",
    "executor_image": "iqm-calibration-executor",
    "repo_url": "",
    "package_url": "",
    "min": "4.1",
    "max": "4.1"
  }
}

tests/e2e/test_e2e.py::test_get_specific_client_metadata
tests/e2e/test_e2e.py::test_client_fastapi_interaction
All clients fetched successfully.
PASSED
tests/e2e/test_e2e.py::test_get_specific_client_metadata
Specific client metadata (iqm_calibration) fetched successfully.
PASSED
tests/e2e/test_e2e.py::test_client_fastapi_interaction
client.py successfully fetched metadata from FastAPI.
PASSED

===== 3 passed in 0.68s =====
```



The screenshot shows the VS Code interface with the Explorer pane on the left displaying the project structure. The main editor shows the code for the test file `test_e2e.py`. The code defines a test function `test_get_all_clients_from_fastapi` that checks if the FastAPI server correctly returns all available client metadata. The test function is decorated with `@pytest.mark.asyncio` and `async def`. The test function includes a description, a purpose, and a list of expected keys. The test function is executed using `httpx.AsyncClient` and the expected data is loaded from `data.json`. The test results show that all three tests passed successfully.

```
test_e2e.py
EXPLORER: BASIC-TESTING
> __pycache__
> tests > unittests > test_client.py > test_get_client_data
PROBLEMS DEBUG CONSOLE PORTS PLAYWRIGHT ROBO TASKS OUTPUT TERMINAL OUTPUT ROBOT DOCUMENTATION ROBOT OUTPUT

• jay@Jay-MacBook-Pro basic-testing % pytest tests/e2e/test_e2e.py -s -v
platform darwin -- Python 3.13.1, pytest-8.3.4, pluggy-1.5.0 -- /Library/Frameworks/Python.framework/Versions/3.13/bin/python3.13
cachedir: .pytest_cache
rootdir: /Users/Jay/Desktop/coding-challenges-master-basic-testing/basic-testing
configfile: pytest.ini
plugins: respx-0.22.0, anyio-4.9.0, asyncio-1.1.0, playwright-0.7.0, mock-3.14.1, base-url-2.1.0
asyncio: mode=Mode.STRICT, asyncio_default_fixture_loop_scope=None, asyncio_default_test_loop_scope=function
collected 3 items

tests/e2e/test_e2e.py::test_get_all_clients_from_fastapi
Full JSON Document:
{
  "cirq_iqm": {
    "name": "Cirq on IQM",
    "package_name": "cirq-iqm",
    "executor_image": "iqm-client-executor",
    "repo_url": "https://github.com/iqm-finland/cirq-on-iqm",
    "package_url": "https://pypi.org/project/cirq-iqm/",
    "min": "11.9",
    "max": "13.0"
  },
  "iqm_cortex_cli": {
    "name": "Cortex CLI",
    "package_name": "iqm-cortex-cli",
    "repo_url": "https://github.com/iqm-finland/cortex-cli",
    "package_url": "https://pypi.org/project/iqm-cortex-cli/",
    "min": "4.2",
    "max": "6.0"
  },
  "iqm_exa_experiment": {
    "name": "EXA",
    "package_name": "iqm-exa-experiment",
    "executor_image": "iqm-calibration-executor",
    "repo_url": "",
    "package_url": "",
    "min": "112.3",
    "max": "113.0"
  },
  "iqm_calibration": {
    "name": "IQM Calibration",
    "package_name": "iqm-calibration",
    "executor_image": "iqm-calibration-executor",
    "repo_url": "",
    "package_url": "",
    "min": "4.1",
    "max": "4.1"
  }
}

tests/e2e/test_e2e.py::test_get_specific_client_metadata
tests/e2e/test_e2e.py::test_client_fastapi_interaction
All clients fetched successfully.
PASSED
tests/e2e/test_e2e.py::test_get_specific_client_metadata
Specific client metadata (iqm_calibration) fetched successfully.
PASSED
tests/e2e/test_e2e.py::test_client_fastapi_interaction
client.py successfully fetched metadata from FastAPI.
PASSED

===== 3 passed in 0.68s =====
```