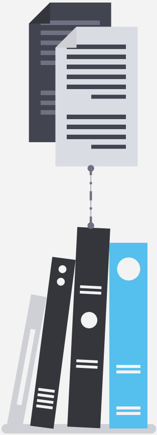
REST API Practical

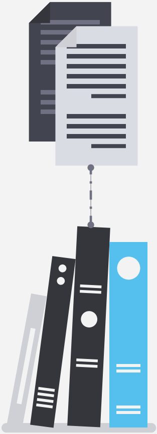
Catch up with one of the most popular standards in software industry

Table of contents

1. Fundamentals
2. Hands-on
3. CRUD Operations
4. Authentication & Authorization
5. Deployment
6. Advanced Topics
7. Best Practices
8. Summary, QnA



Prerequisites



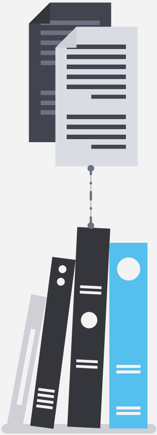
Software Requirements

- Visual Studio 2022 (17.8+) or VS Code
- .NET 8 SDK
- Git
- Postman or similar API testing tool (optional)

Prerequisites

Basic Knowledge

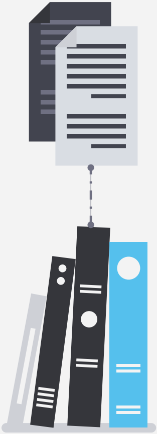
- C# fundamentals
- HTTP & Web API basics
- JSON
- Authentication/Authorization principles



Prerequisites

Nice to have

- Cloud platform knowledge (Azure/AWS)
- Git workflow
- CI/CD concepts



01

Fundamentals

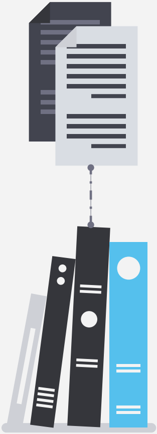
Do you know

- What is HTTP?
- Overview flow of a HTTP request/response
- Some real examples of HTTP

1. Fundamentals

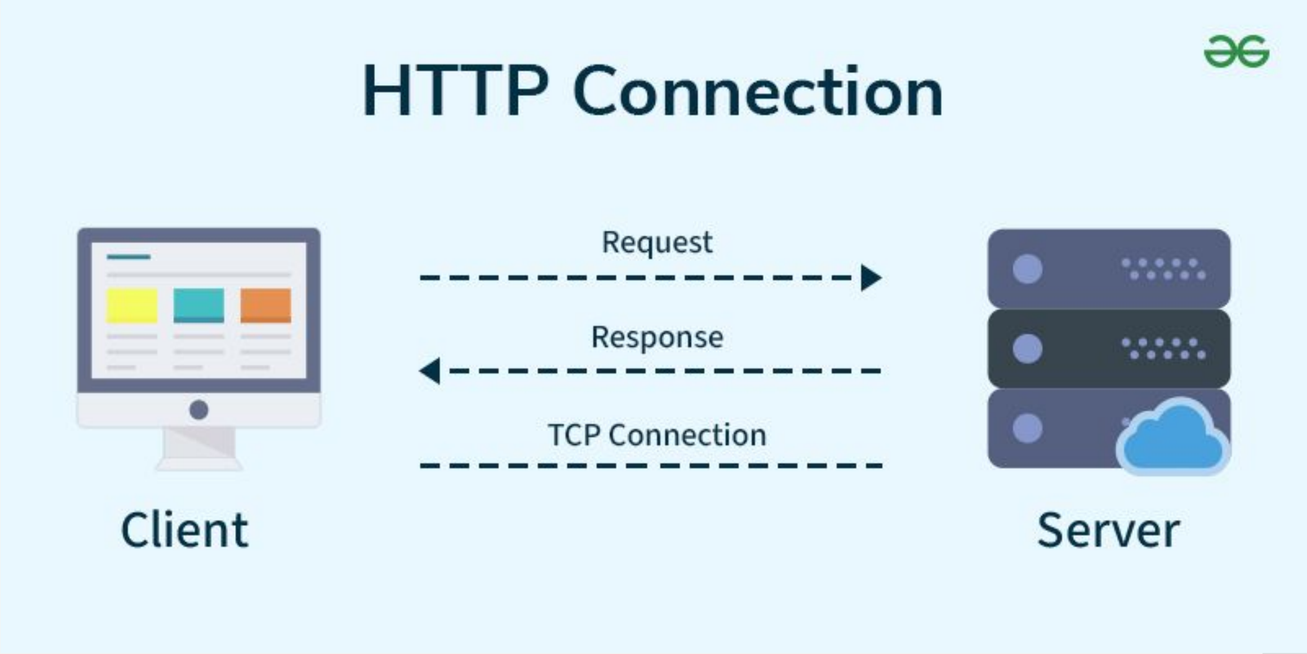
HTTP (Hypertext Transfer Protocol)

- Client-server communication protocol
- Stateless - each request is independent
- Request-response based
- Foundation of web communication



1. Fundamentals

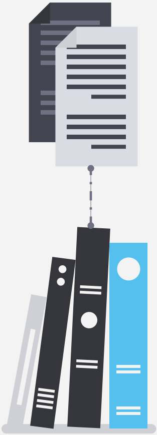
HTTP (Hypertext Transfer Protocol)



1. Fundamentals

What is REST/RESTful API?

- Stateless
- Client-Server
- Resource-Based
- Standard HTTP Methods
- Uniform Interface

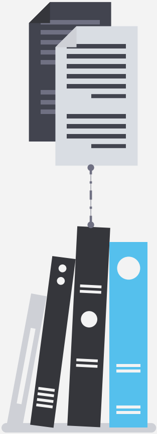


1. Fundamentals

HTTP methods

- GET: Retrieve data
- POST: Create new resource
- PUT: Update/Replace resource
- PATCH: Partial update
- DELETE: Remove resource

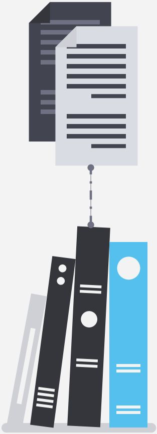
1. Fundamentals



Status codes

- 2xx Success:
  - **200** OK, **201** Created, **204** No Content
- 4xx Client Errors:
  - **400** Bad Request, **401** Unauthorized, **403** Forbidden, **404** Not Found
- 5xx Server Errors:
  - **500** Internal Server Error, **502** Bad Gateway, **503** Service Unavailable

1. Fundamentals



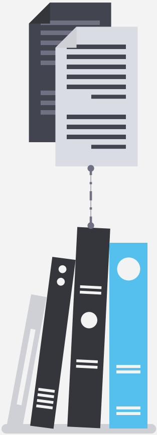
Resource naming conventions

- Use Nouns, Not Verbs
  - ✅ /api/posts
  - ❌ /api/getPost
- Plural for Collections
  - ✅ /api/users
  - ✅ /api/posts
  - ❌ /api/user
- Lowercase and Hyphens
  - ✅ /api/blog-posts
  - ❌ /api/blogPosts
  - ❌ /api/blog_posts

1. Fundamentals

Resource Relationships

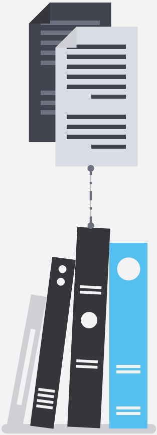
- Nested Resources
  - ✅ /api/posts/{id}/comments
  - ✅ /api/users/{id}/orders
- Query Parameters
  - ✅ /api/posts?category=tech
  - ✅ /api/users?role=admin



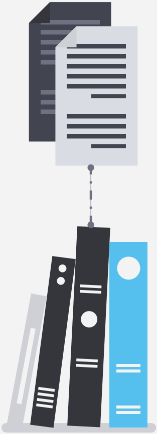
1. Fundamentals

Common Patterns

- **List:** /api/posts
- **Single:** /api/posts/{id}
- **Sub-resources:** /api/posts/{id}/comments
- **Filtering:** /api/posts?status=published
- **Sorting:** /api/posts?sort=date
- **Pagination:** /api/posts?page=1&size=10



1. Fundamentals



RESTful API request structure - Request URL

https://api.example.com/v1/users/{id}/posts?status=active

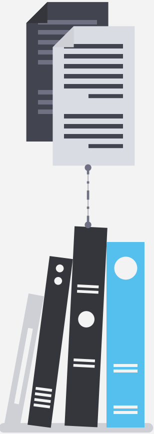
- Scheme: http/https
- Host: api.example.com
- Path : v1/users/{id}/posts
    - Path params: {id}
    - Resource: posts
- Query params:
    - status=active

1. Fundamentals

RESTful API request structure - Headers

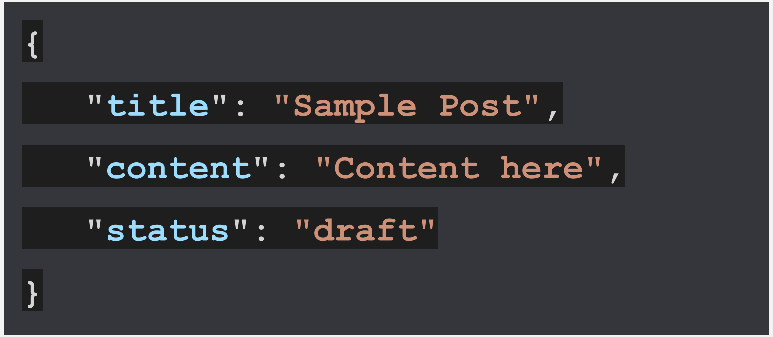
- HTTP headers that provide information about the request
- For examples:
  - Content-Type: application/json
  - Authorization: Bearer <token>
  - Accept: application/json
  - Accept-Language: en-US

1. Fundamentals



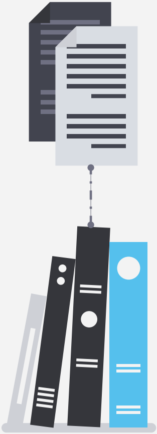
RESTful API request structure - Body

- Part of the request message carrying data from the client to the server.
- Crucial for methods like POST, PUT, and PATCH.



```
{
    "title": "Sample Post",
    "content": "Content here",
    "status": "draft"
}
```

1. Fundamentals



RESTful API response structure

- Body: response data from API
- Headers: HTTP headers that provide information about the response

Question

- How much percent (%) do you get from all of the previous information?

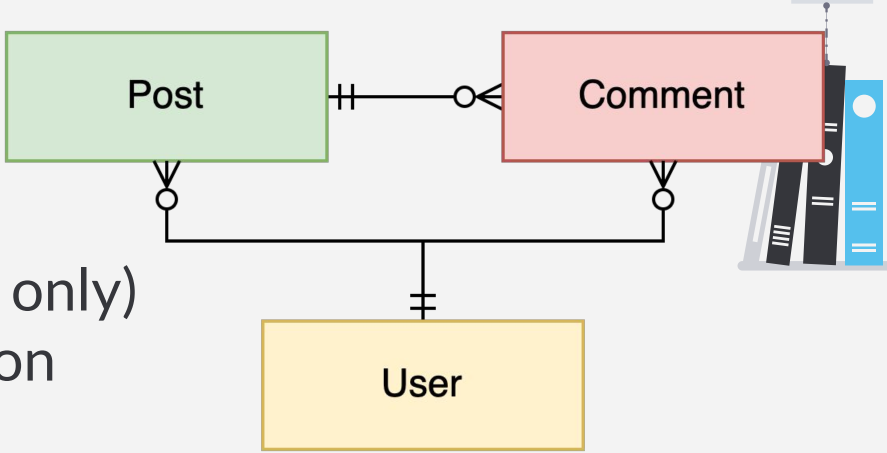
02

Hands-on

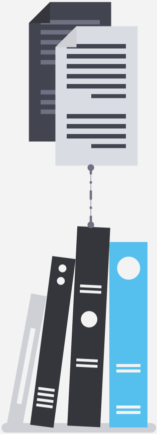
2. Hands-on

Project context - Key features

- Resource Management
  - Posts CRUD operations
  - Comments management
  - User management (admin only)
- Authentication & Authorization



2. Hands-on



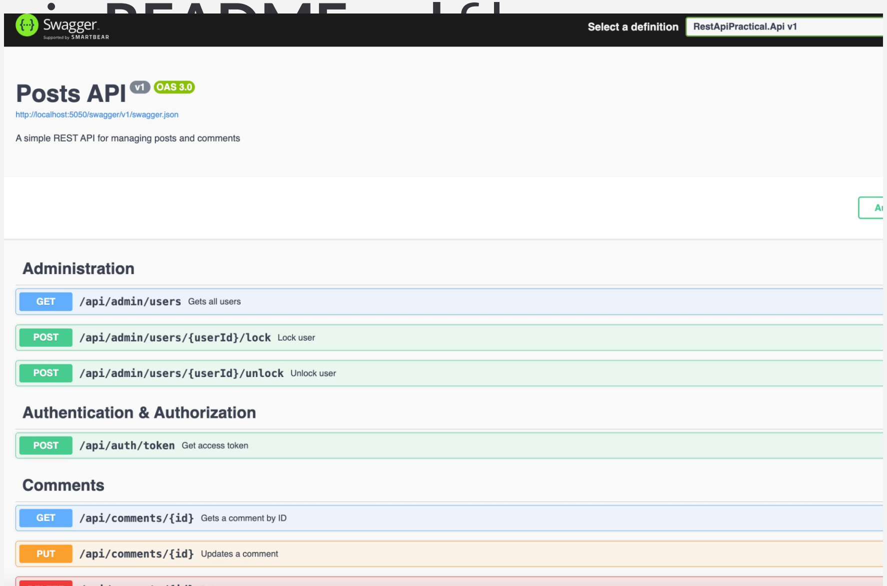
Project context - Architecture

- In-memory database for demonstration
- Minimal API approach
- DTOs for request/response

2. Hands-on

Project setup

- Github: https://github.com/A-Techaholic/rest-api-practical
- Instructions in README.md file



Posts API v1 OAS 3.0

http://localhost:5050/swagger/v1/swagger.json

A simple REST API for managing posts and comments

Administration

GET /api/admin/users Gets all users

POST /api/admin/users/{userId}/lock Lock user

POST /api/admin/users/{userId}/unlock Unlock user

Authentication & Authorization

POST /api/auth/token Get access token

Comments

GET /api/comments/{id} Gets a comment by ID

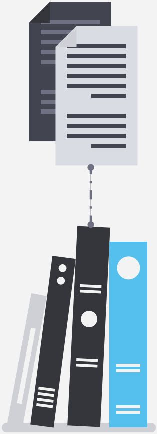
PUT /api/comments/{id} Updates a comment

2. Hands-on

Swagger

- API documentation tool that automatically generates interactive documentation
- Allows testing endpoints directly from the browser interface
- Describes API endpoints, parameters, responses, and authentication methods

2. Hands-on

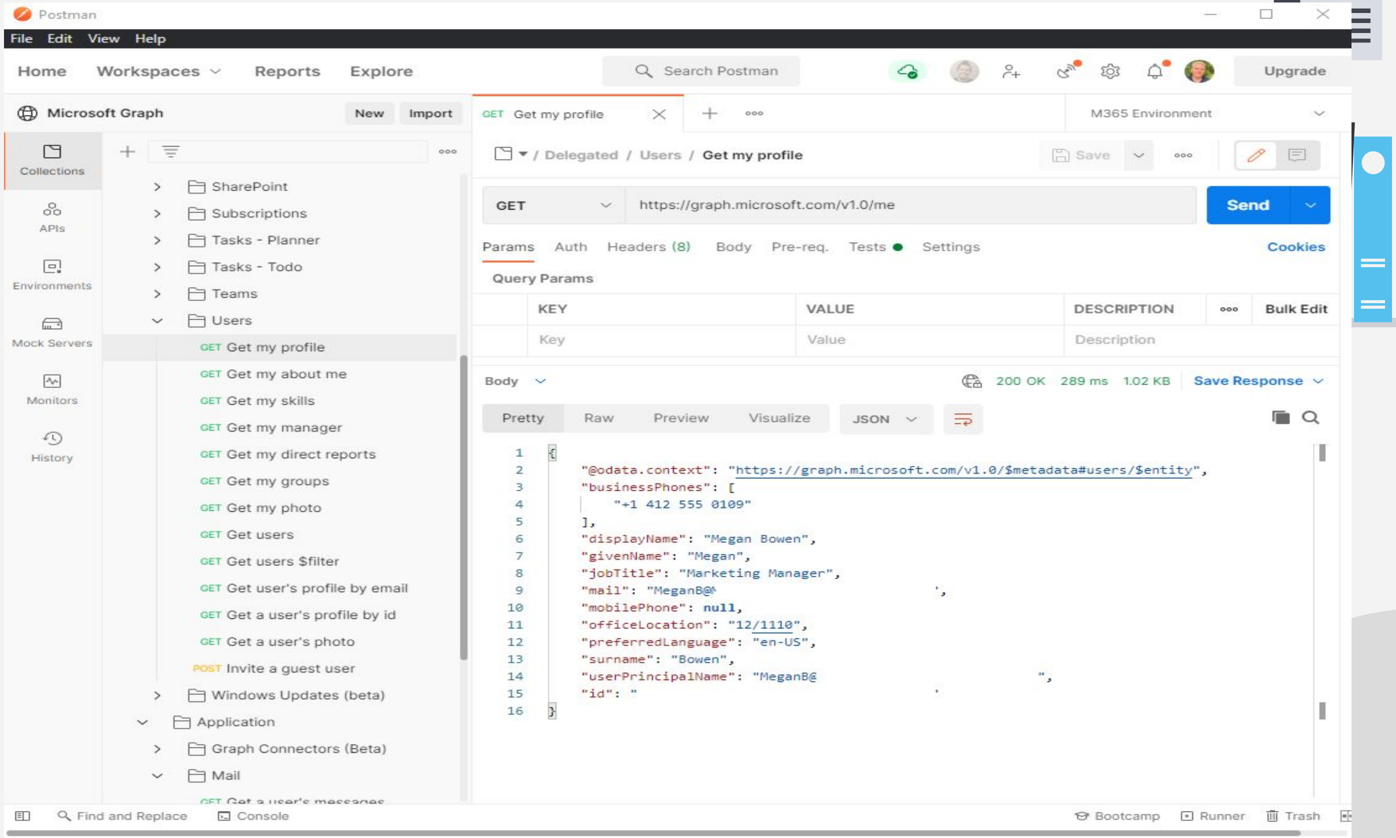


Postman

- API testing tool for sending requests and viewing responses
- Allows creating collections of API requests and test suites
- Supports environment variables and request automation
- Enables team collaboration and API documentation sharing
- Provides testing scripts and monitoring capabilities

2. Hands-on

Postman



GET https://graph.microsoft.com/v1.0/me

KEY	VALUE	DESCRIPTION
Key	Value	Description

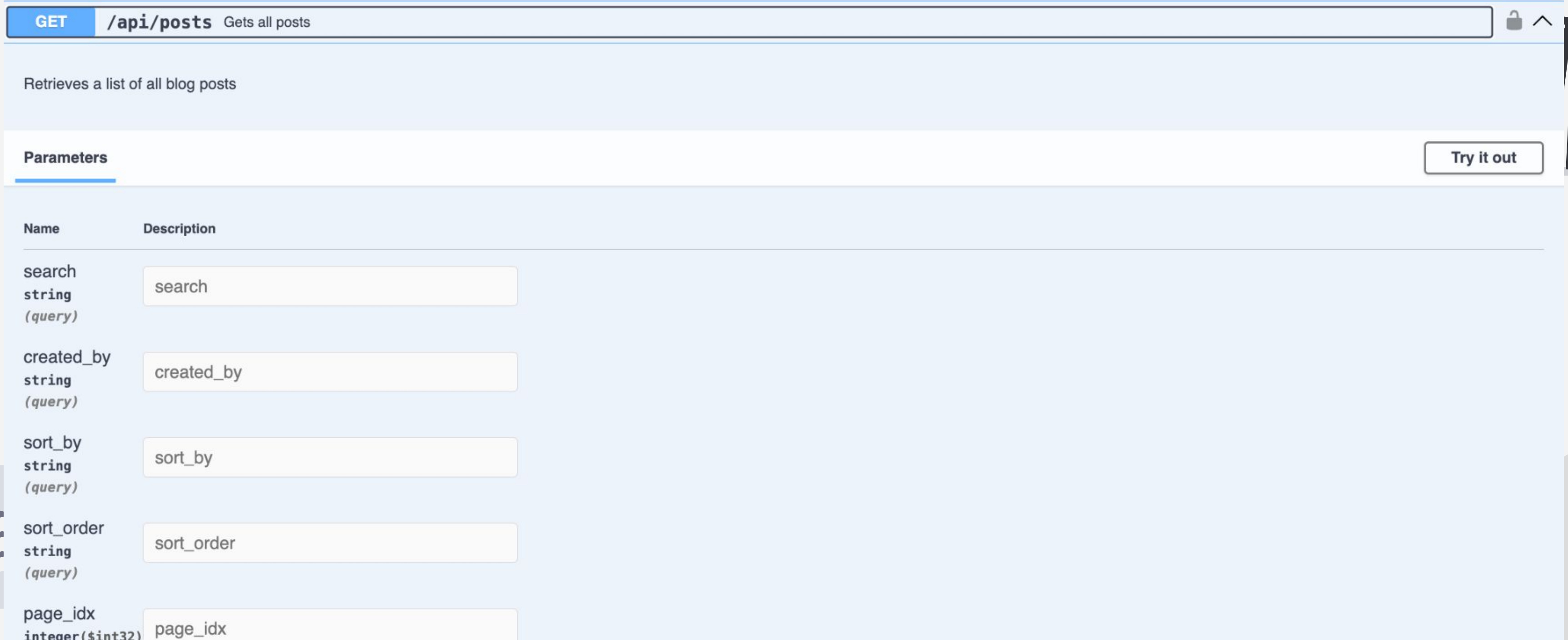
```
{
    "@odata.context": "https://graph.microsoft.com/v1.0/$metadata#users/$entity",
    "businessPhones": [
        "+1 412 555 0109"
    ],
    "displayName": "Megan Bowen",
    "givenName": "Megan",
    "jobTitle": "Marketing Manager",
    "mail": "MeganB@M                              ',
    "mobilePhone": null,
    "officeLocation": "12/1110",
    "preferredLanguage": "en-US",
    "surname": "Bowen",
    "userPrincipalName": "MeganB@                              ",
    "id": "                              '
}
```

03

CRUD Operations

3. CRUD Operations

Reading resources (GET)



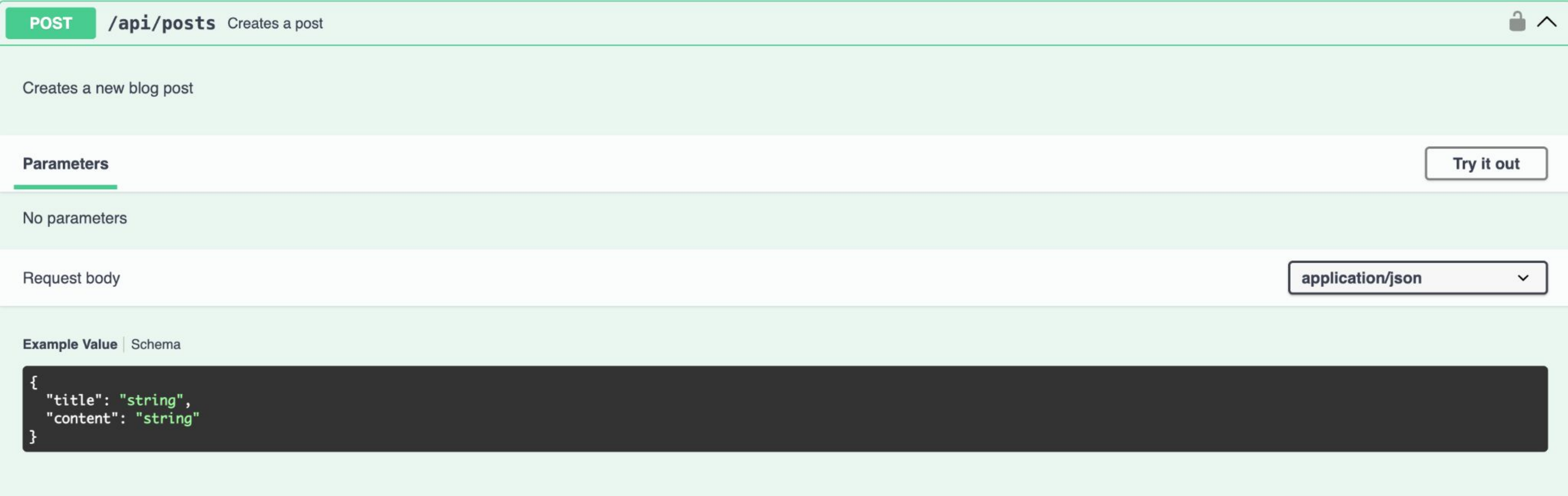
`/api/posts` Gets all posts

Retrieves a list of all blog posts

Name	Description
search string *(query)*	search
created_by string *(query)*	created_by
sort_by string *(query)*	sort_by
sort_order string *(query)*	sort_order
page_idx integer($int32)	page_idx

3. CRUD Operations

Creating resources (POST)



POST /api/posts Creates a post

Creates a new blog post

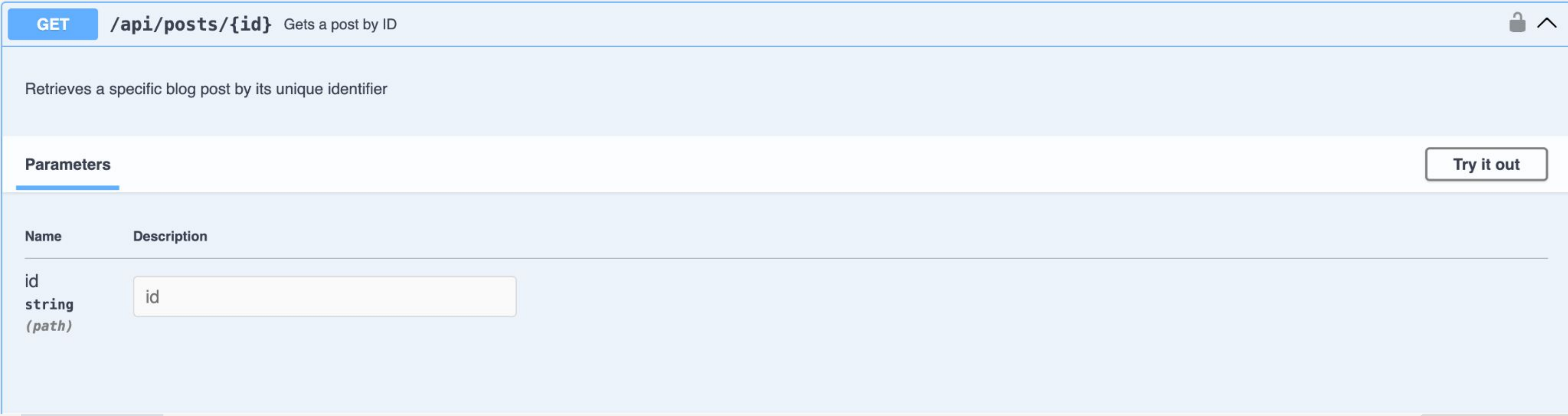
No parameters

Request body: application/json

```
{
  "title": "string",
  "content": "string"
}
```

3. CRUD Operations

Reading resource details (GET)



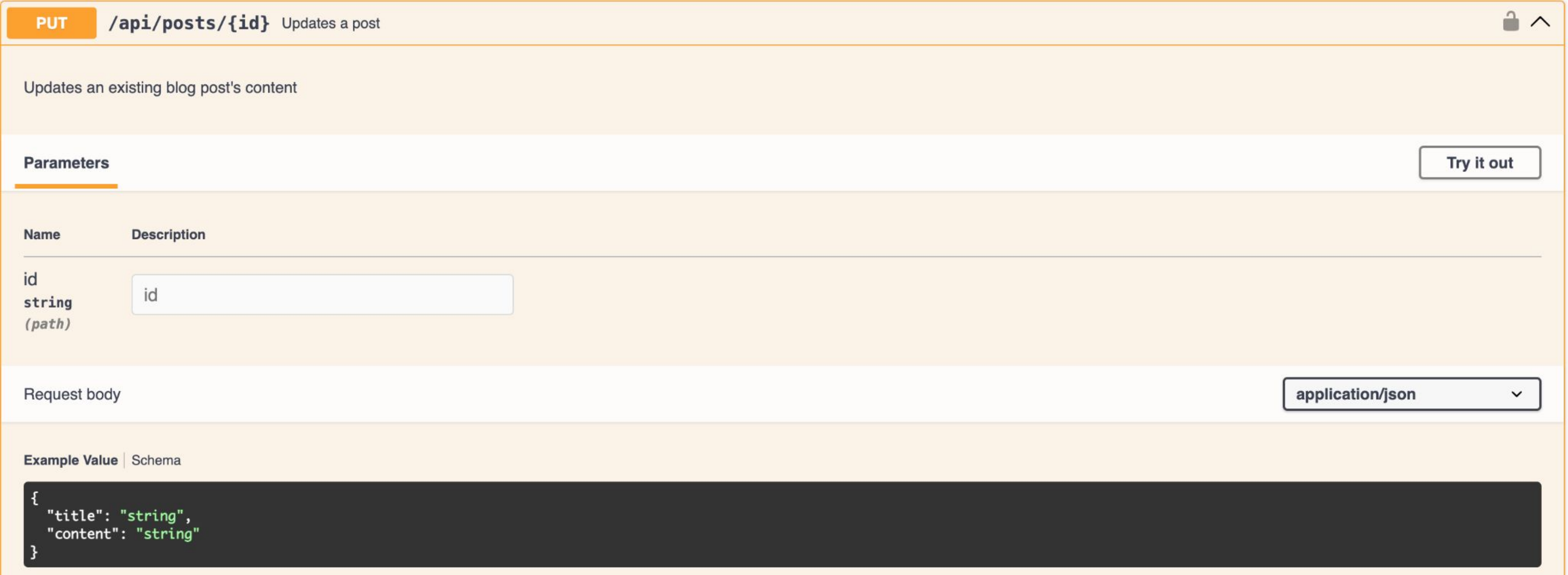
/api/posts/{id} Gets a post by ID

Retrieves a specific blog post by its unique identifier

Name	Description
id string *(path)*	id

3. CRUD Operations

Updating resources (PUT)



`/api/posts/{id}` Updates a post

Updates an existing blog post's content

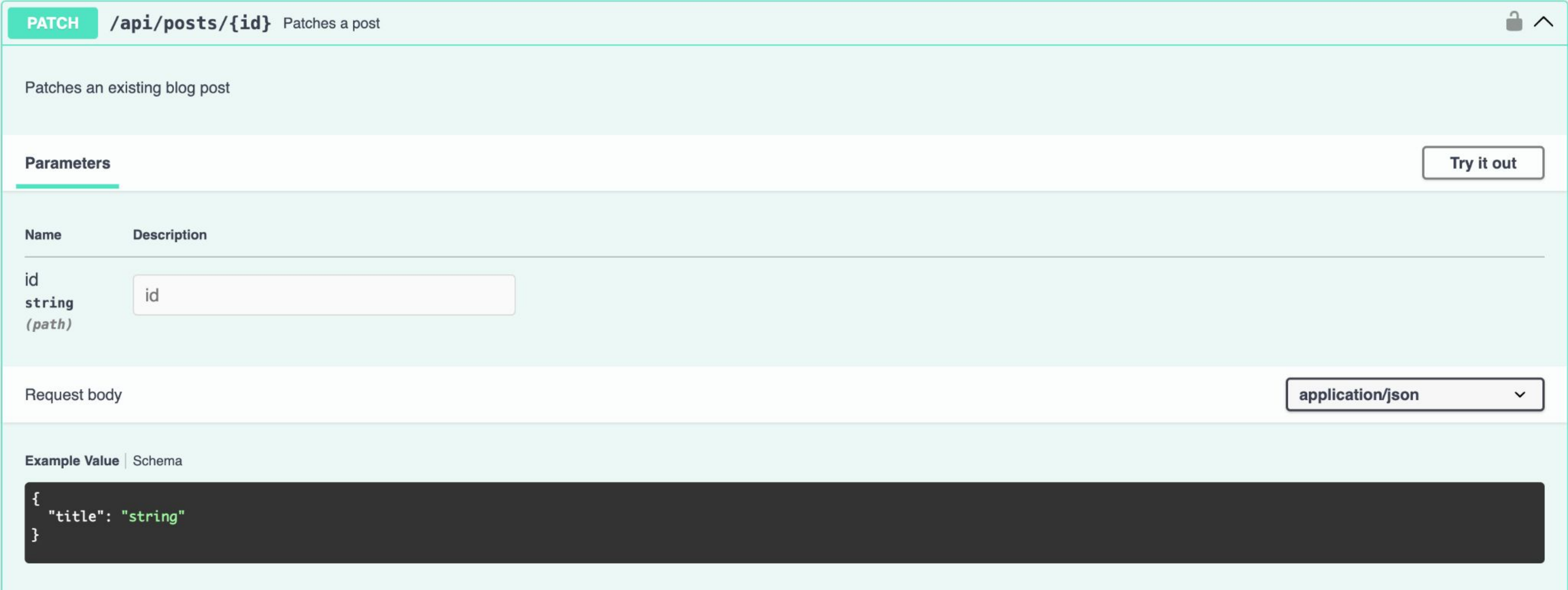
Name	Description
id **string** *(path)*	id

Request body: application/json

```
{
  "title": "string",
  "content": "string"
}
```

3. CRUD Operations

Updating resources (PATCH)



PATCH /api/posts/{id} Patches a post

Patches an existing blog post

Parameters

Name	Description
id string *(path)*	id

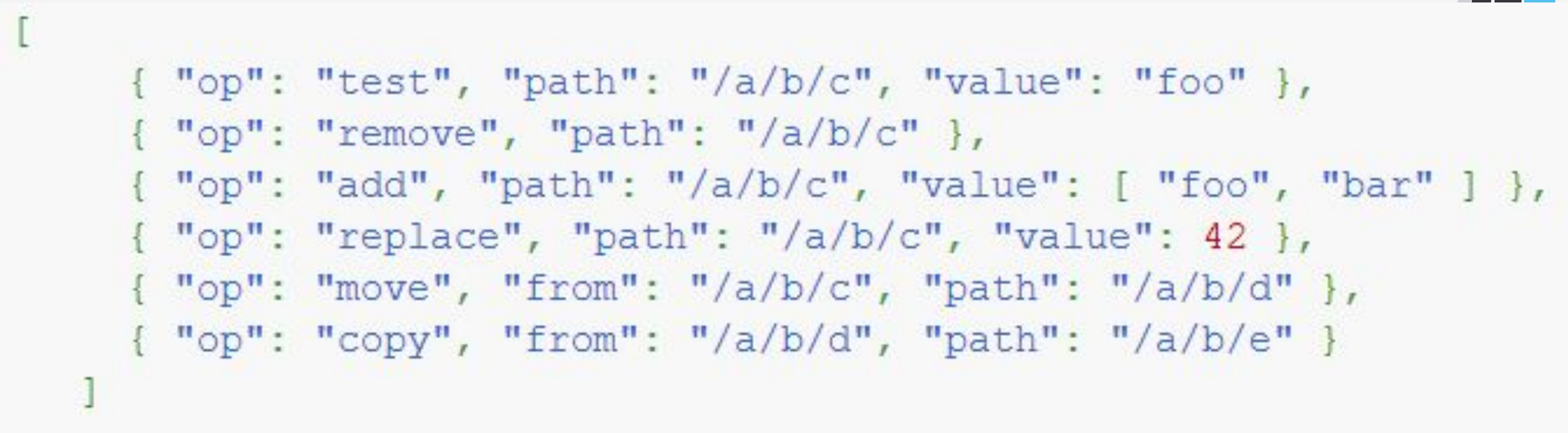
Request body: application/json

Example Value | Schema

```
{
  "title": "string"
}
```

3. CRUD Operations

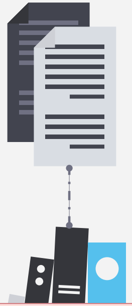
Updating resources (PATCH with JSON Patch)

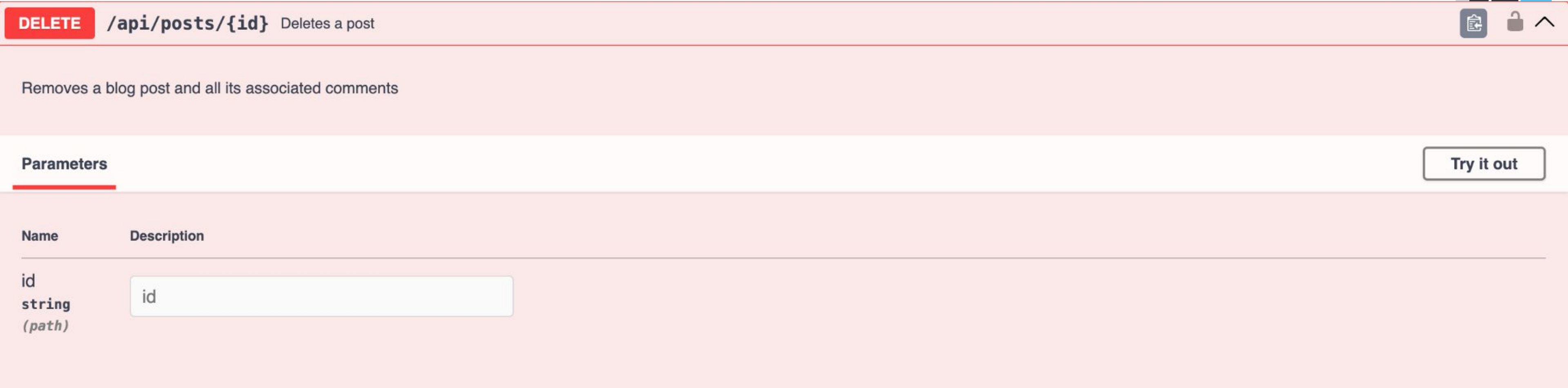


```
[
     { "op": "test", "path": "/a/b/c", "value": "foo" },
     { "op": "remove", "path": "/a/b/c" },
     { "op": "add", "path": "/a/b/c", "value": [ "foo", "bar" ] },
     { "op": "replace", "path": "/a/b/c", "value": 42 },
     { "op": "move", "from": "/a/b/c", "path": "/a/b/d" },
     { "op": "copy", "from": "/a/b/d", "path": "/a/b/e" }
   ]
```

3. CRUD Operations

Deleting resources (DELETE)





DELETE `/api/posts/{id}` Deletes a post

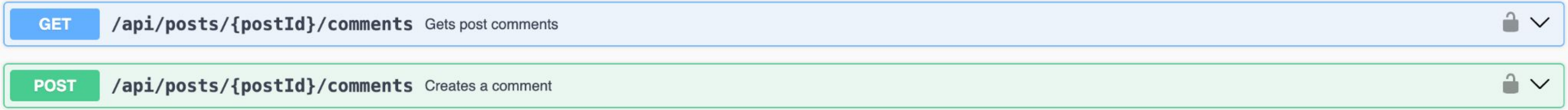
Removes a blog post and all its associated comments

Parameters

Name	Description
id `string` *(path)*	id

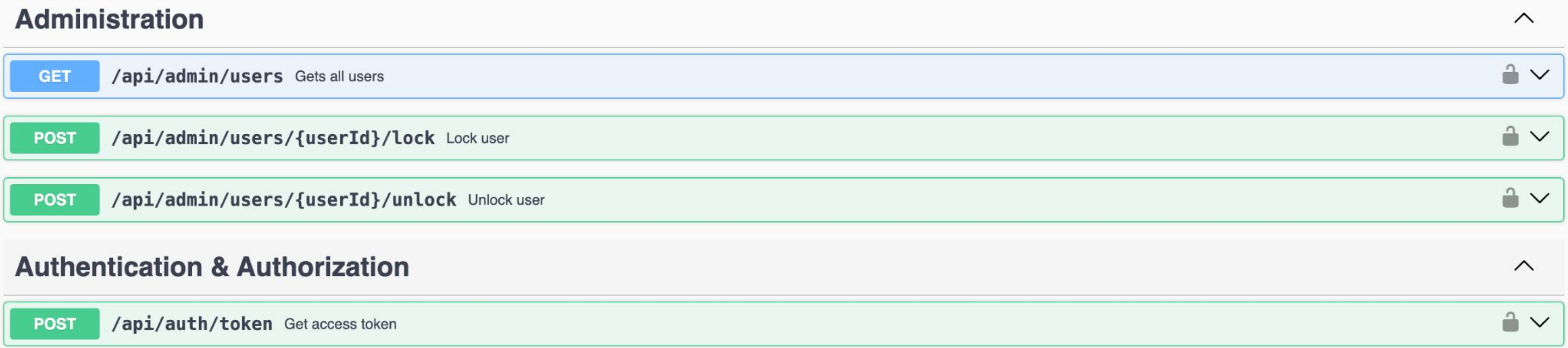
3. CRUD Operations

Others



GET `/api/posts/{postId}/comments` Gets post comments

POST `/api/posts/{postId}/comments` Creates a comment



Administration

GET `/api/admin/users` Gets all users

POST `/api/admin/users/{userId}/lock` Lock user

POST `/api/admin/users/{userId}/unlock` Unlock user

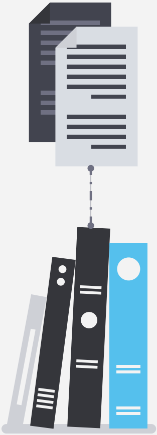
Authentication & Authorization

POST `/api/auth/token` Get access token

3. CRUD Operations

Real-world API examples

- Youtube: Videos | YouTube Data API | Google for Developers
- Wordpress: Reference – REST API Handbook | Developer.WordPress.org
- GitHub Pull requests: REST API endpoints for pull requests - GitHub Docs



Question

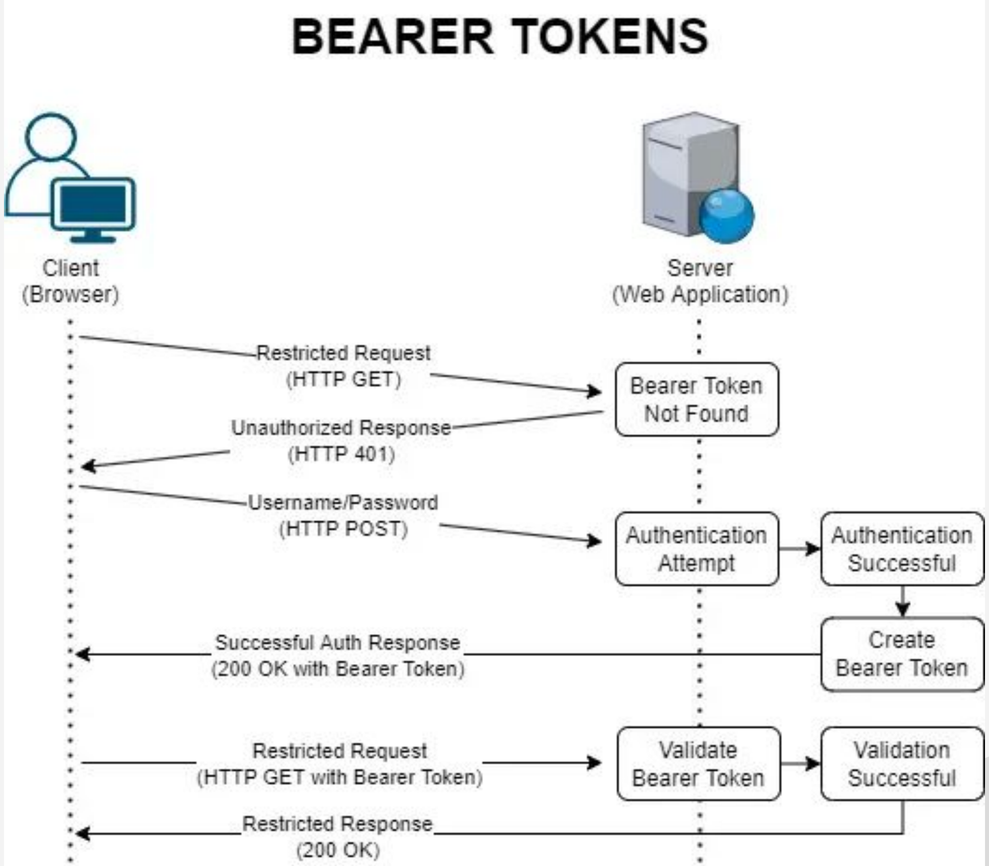
- How do you secure your API?

04

Authentication & Authorization

4. Authentication & Authorization

Bearer (Token) authentication



4. Authentication & Authorization

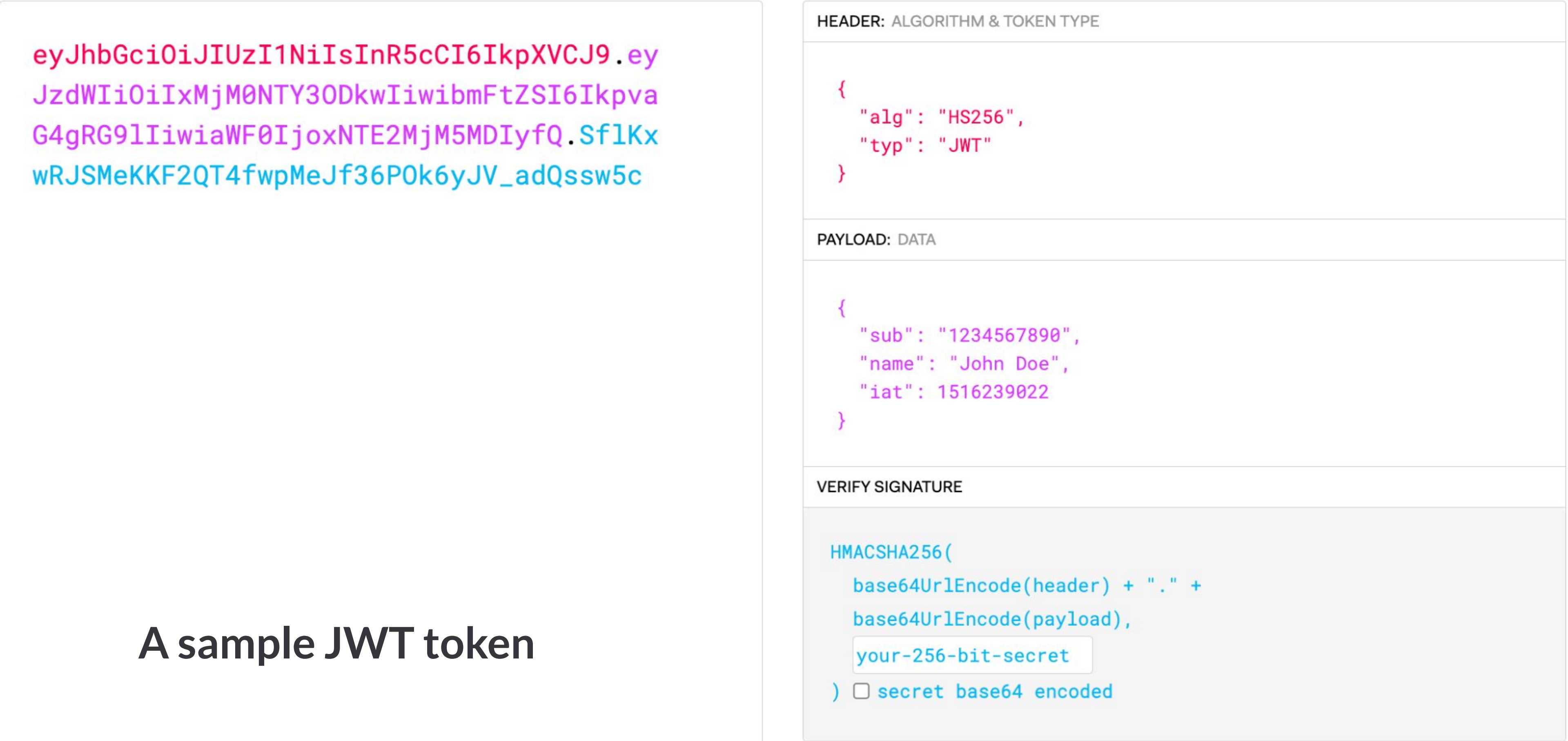
Token vs Cookies authentication

	Token authentication	**Cookies authentication**
Storage location	Client-side	Browser cookies
State management	Stateless	Stateful (session)
Cross-domain	Simple	Need to deal with CORS
Mobile support	Good for mobile app	Limited supports
Data and expiration	Self-contained info (JWT)	Server-controlled
API Integration	Good for API	Less suitable

4. Authentication & Authorization

JWT token

- Token: is simply a piece of data that represents authorization or authentication.
- JWT token: A self-contained token that carries its own information.



```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.ey
JzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6Ikpva
G4gRG9lIiwiaWF0IjoxNTE2MjM5MDIyfQ.SflKx
wRJSMeKKF2QT4fwpMeJf36POk6yJV_adQssw5c
```

HEADER: ALGORITHM & TOKEN TYPE

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

PAYLOAD: DATA

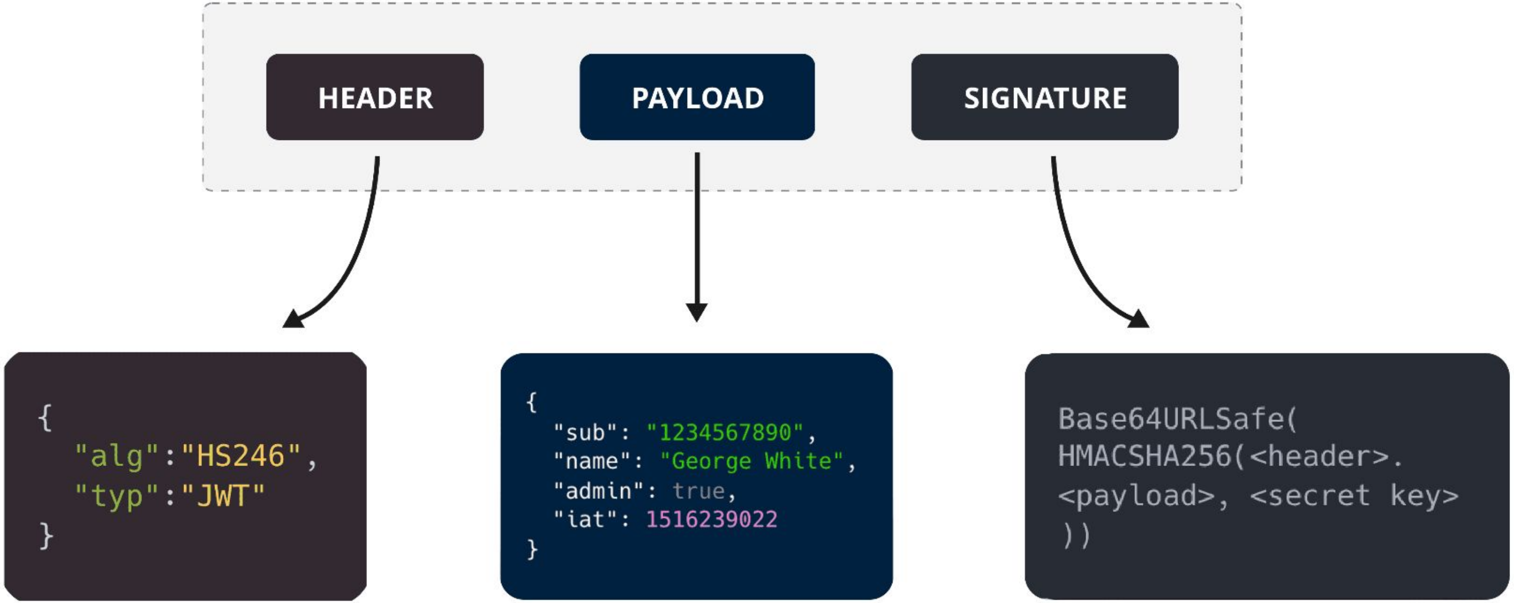
```
{
  "sub": "1234567890",
  "name": "John Doe",
  "iat": 1516239022
}
```

VERIFY SIGNATURE

```
HMACSHA256(
  base64UrlEncode(header) + "." +
  base64UrlEncode(payload),
  your-256-bit-secret
) □ secret base64 encoded
```

A sample JWT token

Structure of a JSON Web Token (JWT)



HEADER

PAYLOAD

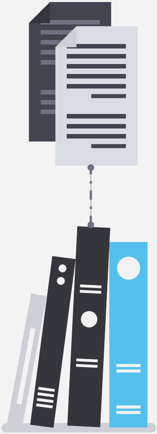
SIGNATURE

```
{
  "alg":"HS246",
  "typ":"JWT"
}
```

```
{
  "sub": "1234567890",
  "name": "George White",
  "admin": true,
  "iat": 1516239022
}
```

```
Base64URLSafe(
HMACSHA256(<header>.
<payload>, <secret key>
))
```

4. Authentication & Authorization

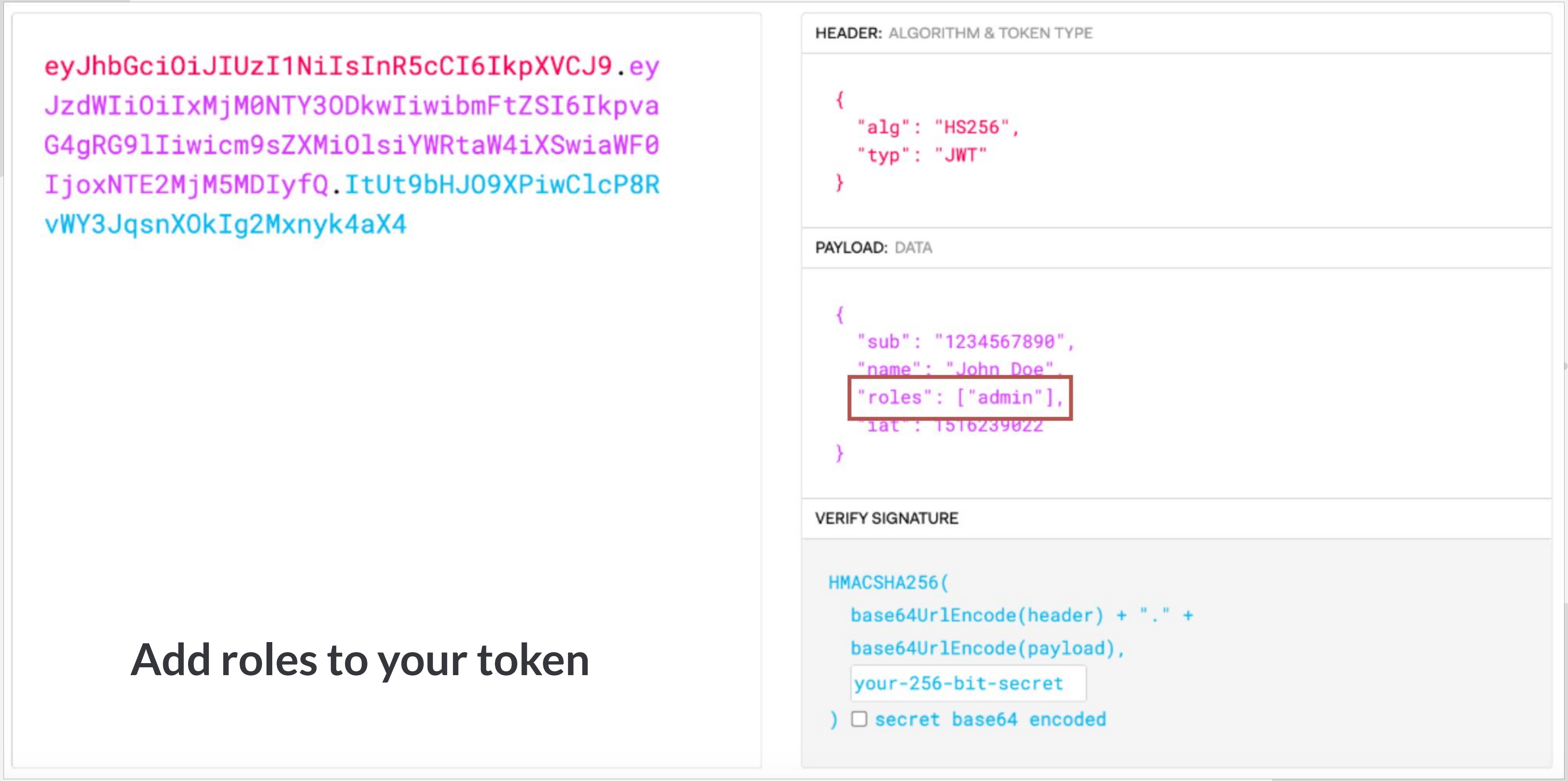


Role-based access control

- Users: Individual accounts
- Roles: Job functions/titles

→ Limit resource access by user roles

Add roles to your token



```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.ey
JzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6Ikpva
G4gRG9lIiwicm9sZXMiOlsiYWRtaW4iXSwiaWF0
IjoxNTE2MjM5MDIyfQ.ItUt9bHJO9XPiwClcP8R
vWY3JqsnXOkIg2Mxnyk4aX4
```

HEADER: ALGORITHM & TOKEN TYPE

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

PAYLOAD: DATA

```
{
  "sub": "1234567890",
  "name": "John Doe",
  "roles": ["admin"],
  "iat": 1516239022
}
```

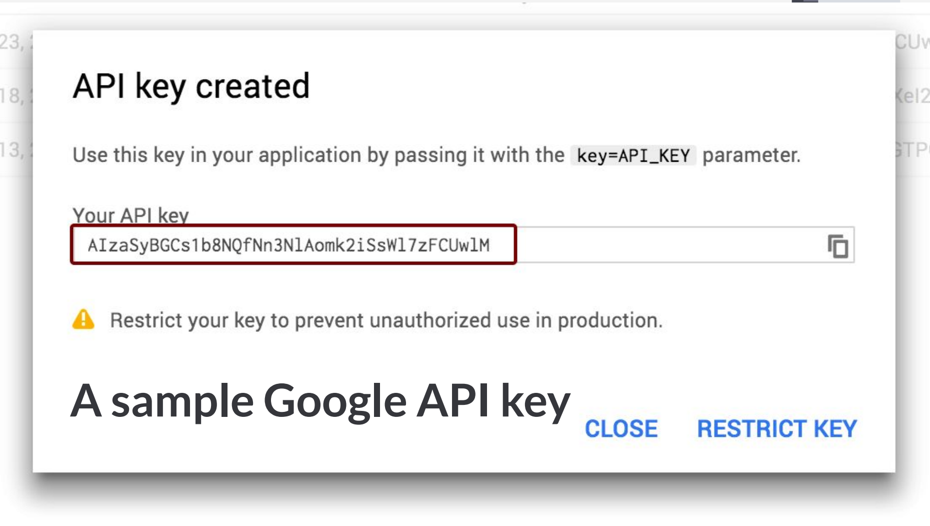
VERIFY SIGNATURE

```
HMACSHA256(
  base64UrlEncode(header) + "." +
  base64UrlEncode(payload),
  your-256-bit-secret
) □ secret base64 encoded
```

4. Authentication & Authorization

API keys

- Common Uses
  - Third-party API access
  - Service authentication
  - Usage tracking
  - Rate limiting
- Limitations
  - Not for user authentication
  - Less secure than OAuth/JWT
  - No built-in expiration
  - No standard format



API key created

Use this key in your application by passing it with the `key=API_KEY` parameter.

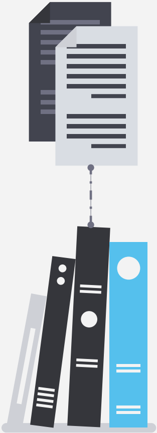
Your API key

`AIzaSyBGCs1b8NQfNn3NlAomk2iSsWl7zFCUwlM`

⚠ Restrict your key to prevent unauthorized use in production.

A sample Google API key

4. Authentication & Authorization



OAuth 2.0

- Authorization framework that enables apps to access user data without passwords
- Uses tokens instead of credentials for secure delegated access
- Involves four roles: Resource Owner, Client, Auth Server, Resource Server
- Supports different flows (grant types) for different use cases
- Issues access tokens and refresh tokens for secure API access

Question

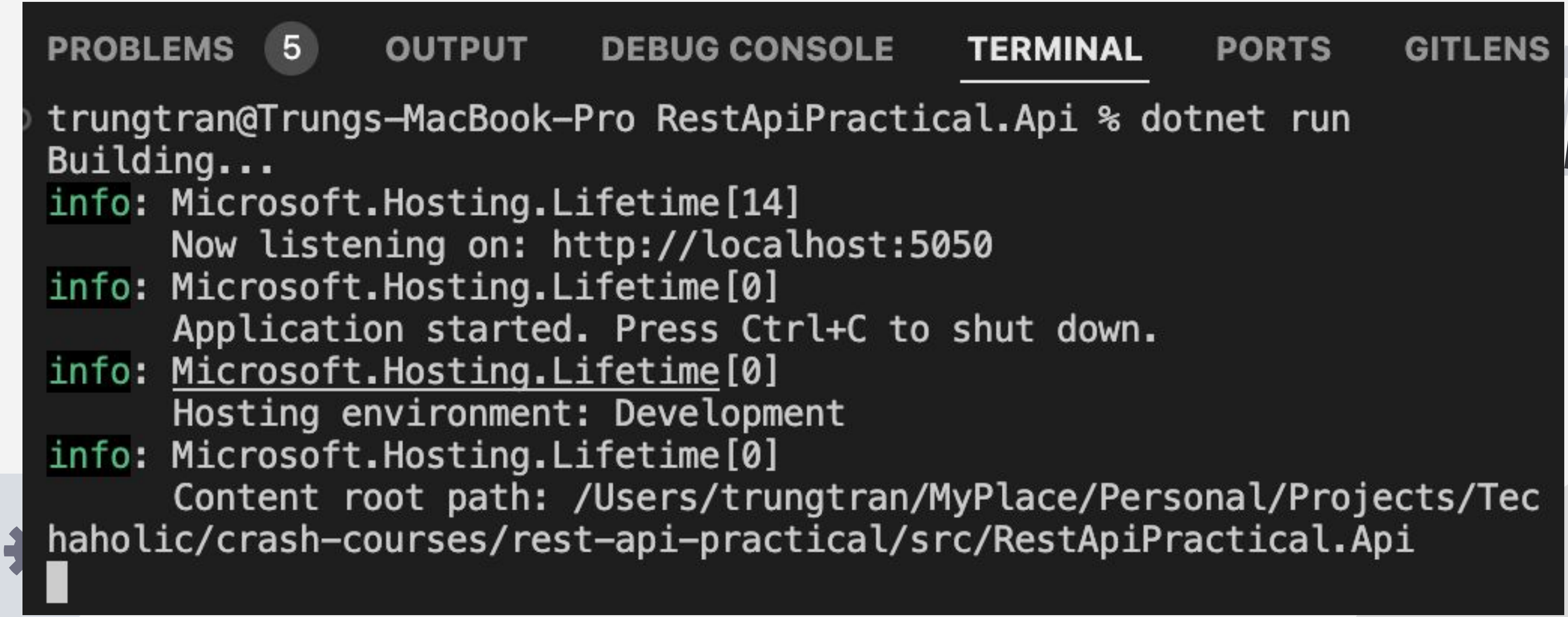
- How do you share your API to others?

05

Deployment

5. Deployment

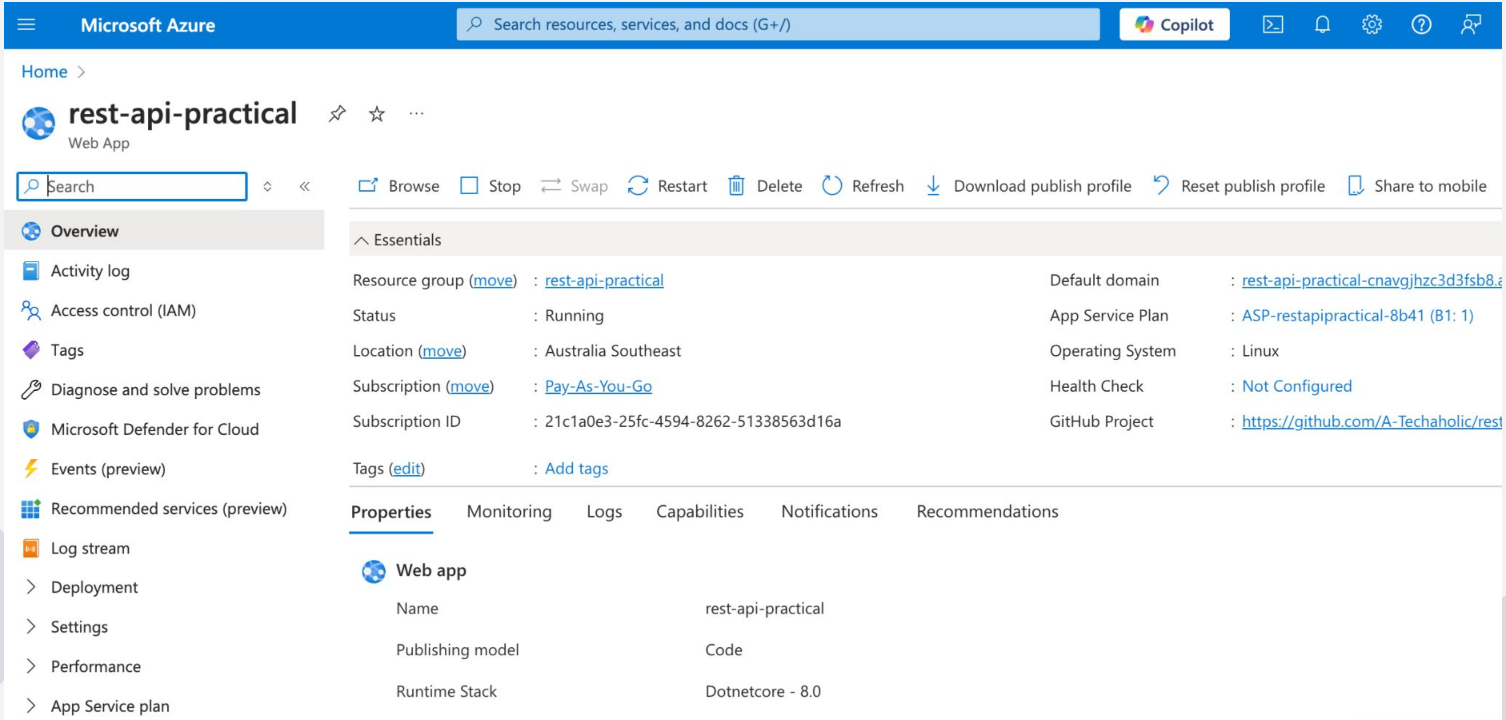
Local/Development



```
trungtran@Trungs-MacBook-Pro RestApiPractical.Api % dotnet run
Building...
info: Microsoft.Hosting.Lifetime[14]
      Now listening on: http://localhost:5050
info: Microsoft.Hosting.Lifetime[0]
      Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]
      Hosting environment: Development
info: Microsoft.Hosting.Lifetime[0]
      Content root path: /Users/trungtran/MyPlace/Personal/Projects/Tec
haholic/crash-courses/rest-api-practical/src/RestApiPractical.Api
```

5. Deployment

Cloud hosting



rest-api-practical
Web App

Resource group (move) : rest-api-practical
Status : Running
Location (move) : Australia Southeast
Subscription (move) : Pay-As-You-Go
Subscription ID : 21c1a0e3-25fc-4594-8262-51338563d16a
Tags (edit) : Add tags

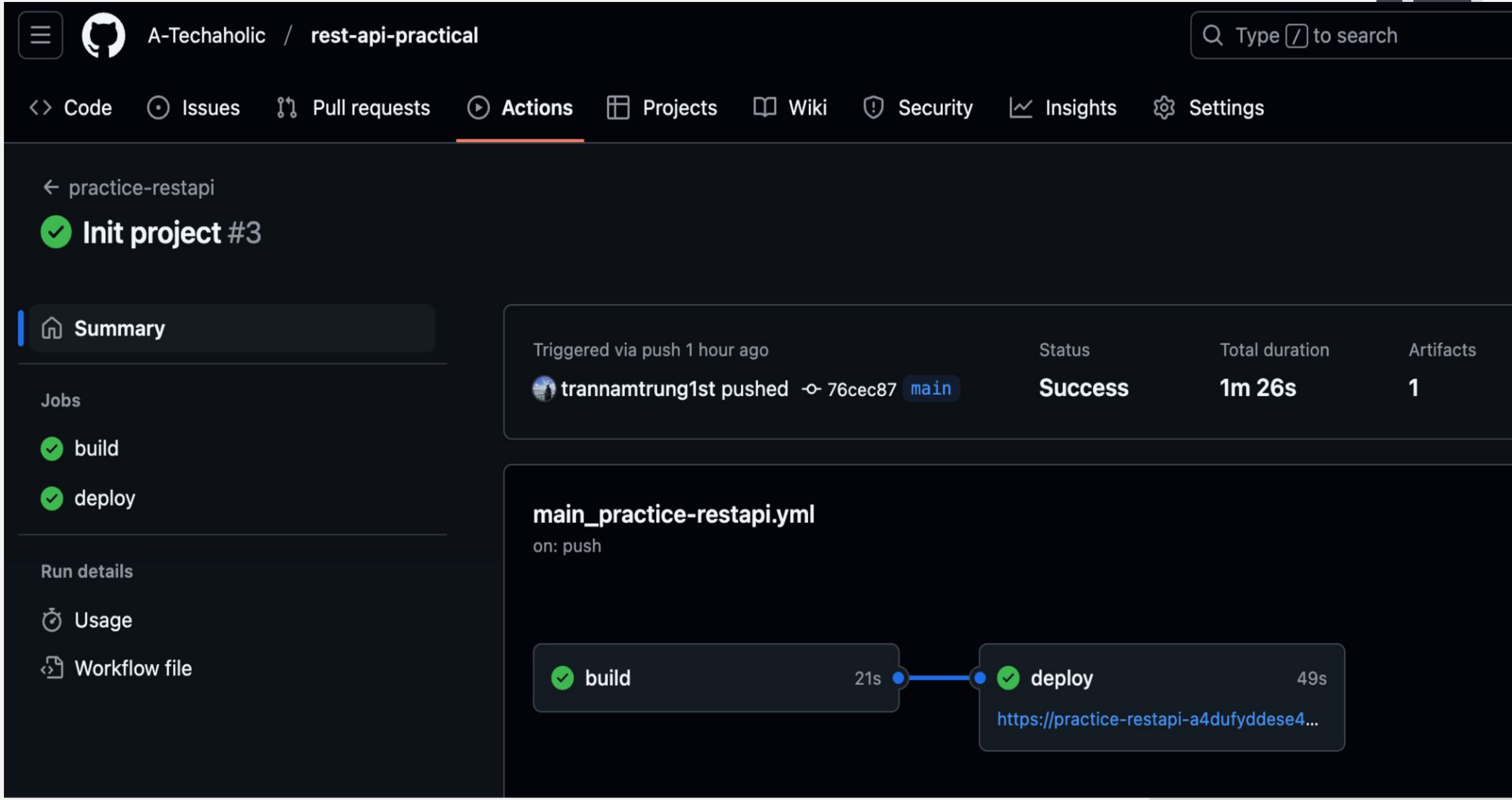
Default domain : rest-api-practical-cnavgjhzc3d3fsb8.a
App Service Plan : ASP-restapipractical-8b41 (B1: 1)
Operating System : Linux
Health Check : Not Configured
GitHub Project : https://github.com/A-Techaholic/rest

Web app

Name	rest-api-practical
Publishing model	Code
Runtime Stack	Dotnetcore - 8.0

5. Deployment

CI/CD



✓ Init project #3

Triggered via push 1 hour ago	Status	Total duration	Artifacts
trannamtrung1st pushed 76cec87 main	Success	1m 26s	1

main_practice-restapi.yml
on: push

✓ build 21s → ✓ deploy 49s

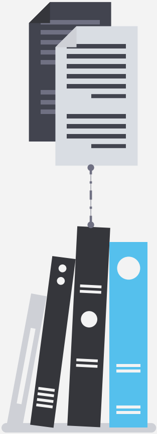
https://practice-restapi-a4dufyddese4...

06

Advanced Topics

6. Advanced Topics

- Versioning strategies
- Rate limiting
- Caching
- Documentation (Swagger/OpenAPI)
- Error handling

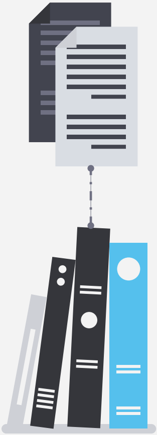


07

Best Practices

7. Best Practices

- Security considerations: OWASP API Security Project
- Performance optimization
- Testing strategies
- Monitoring and logging



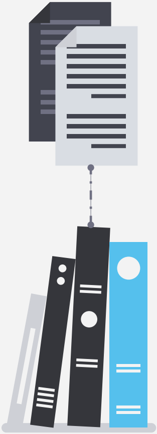
08

Summary, QnA

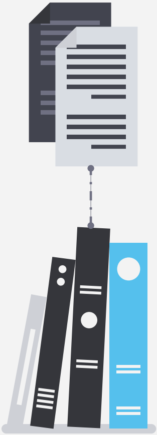
8. Summary, QnA

Summary

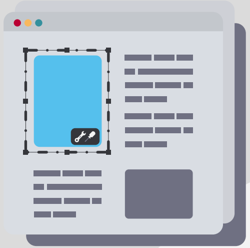
- RESTful API Fundamentals
- CRUD Operations
- Authentication & Authorization
- Deployment
- Advanced Topics
- Best Practices



References



- REST API Tutorial
- HTTP Status Codes Glossary - WebFX
- JWT
- OAuth 2.0
- Role-Based Access Control - Auth0
- Swagger Documentation | Swagger Docs
- Postman Learning Center
- Minimal APIs quick reference | Microsoft Learn
- ASP.NET Core security topics | Microsoft Learn
- OWASP API Security Project
- REST API Design - Resource Modeling | Thoughtworks



Thanks!

Do you have any questions?

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