



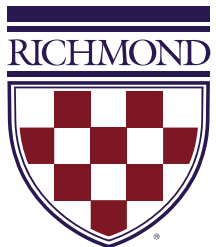
UNIVERSITY OF
RICHMOND

REST APIs

CMSC 240 Software Systems Development

Today – REST APIs

- Project Introduction
- REST APIs
- In-Class Exercises



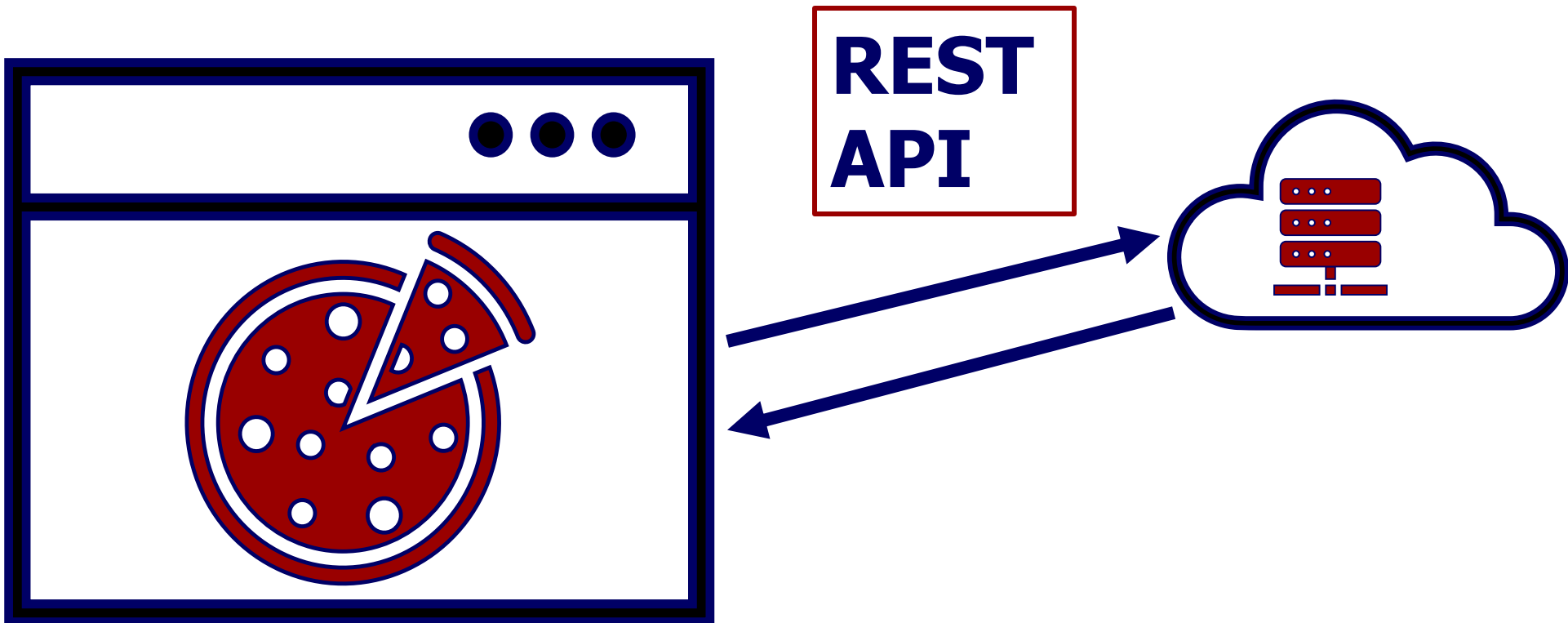
Project

Build a custom web service of your own design

1. Create self selected teams of size 2
2. Propose an idea for a web service
3. Create a design document including UML
4. Implement your web service in C++
5. Add a unit testing suite

REST API

- **R**epresentational **S**tate **T**ransfer
 - Communication between client and server "It's how they talk"
 - "RESTful" web service

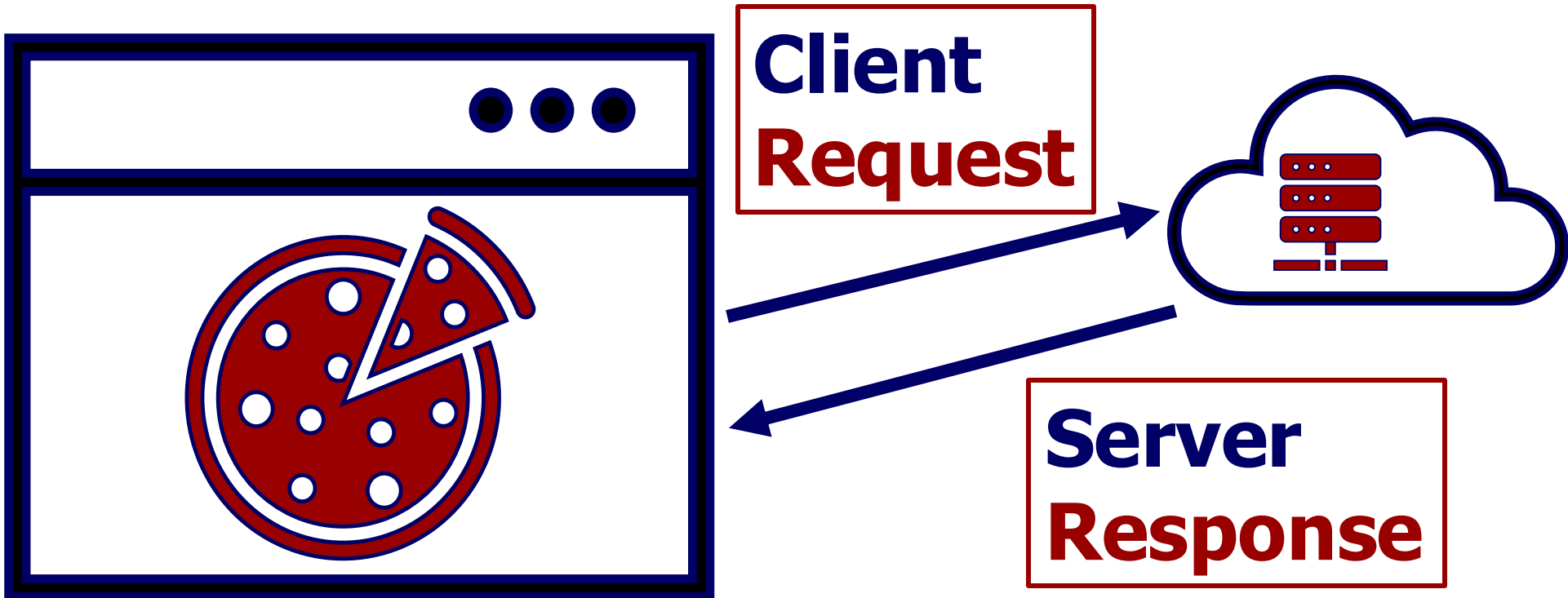


REST API

- Benefits of REST
 - Simple
 - Standardized
 - Scalable
 - Stateless
 - High Performance

<http://urpizza.com/api/toppings>

Resource



Request

What actions (verbs) would you want to perform on your resource?

HTTP Methods/Operations

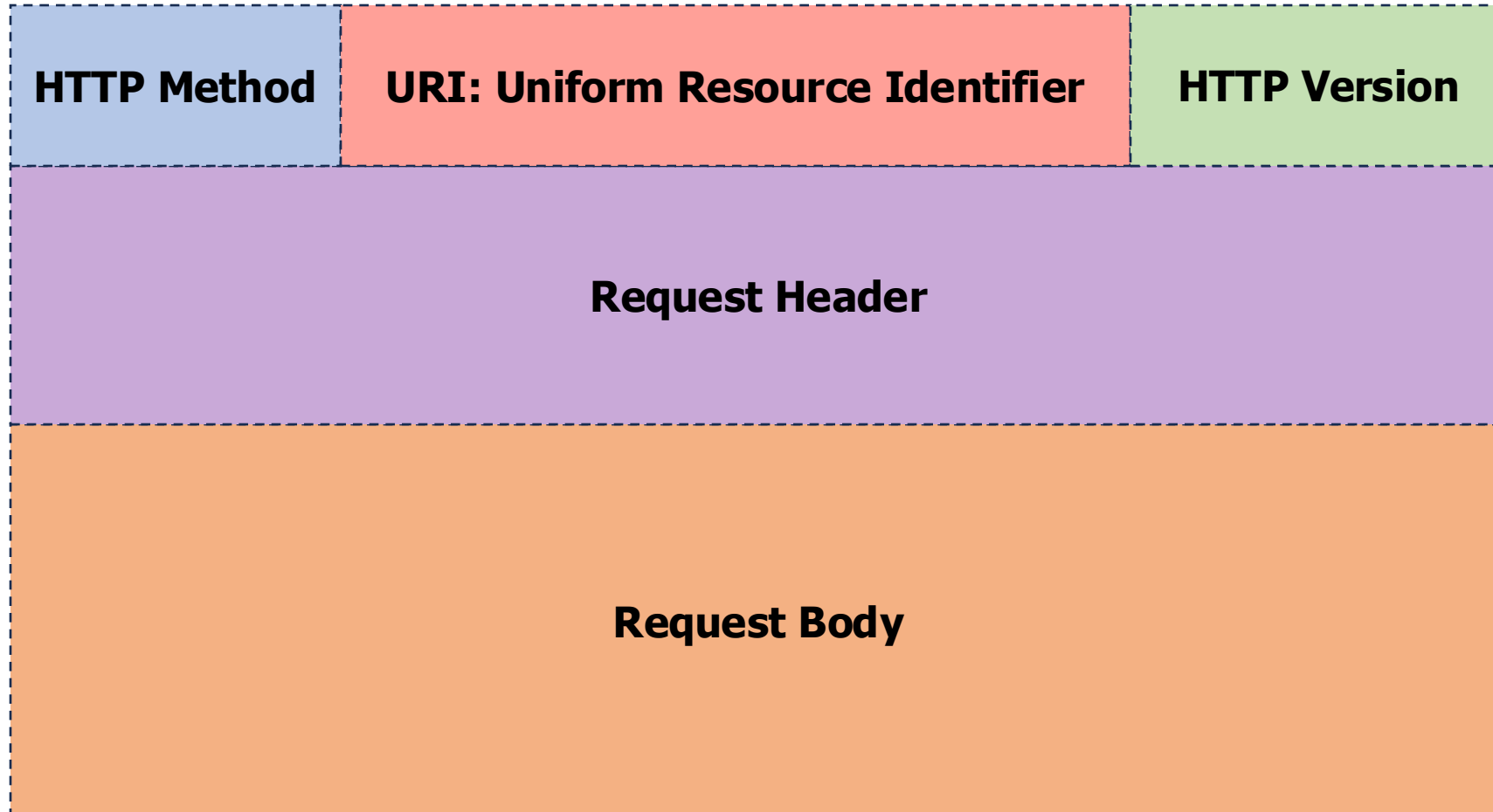
Create → **POST**

Read → **GET**

Uppdate → **PUT**

Delete → **DELETE**

HTTP Request

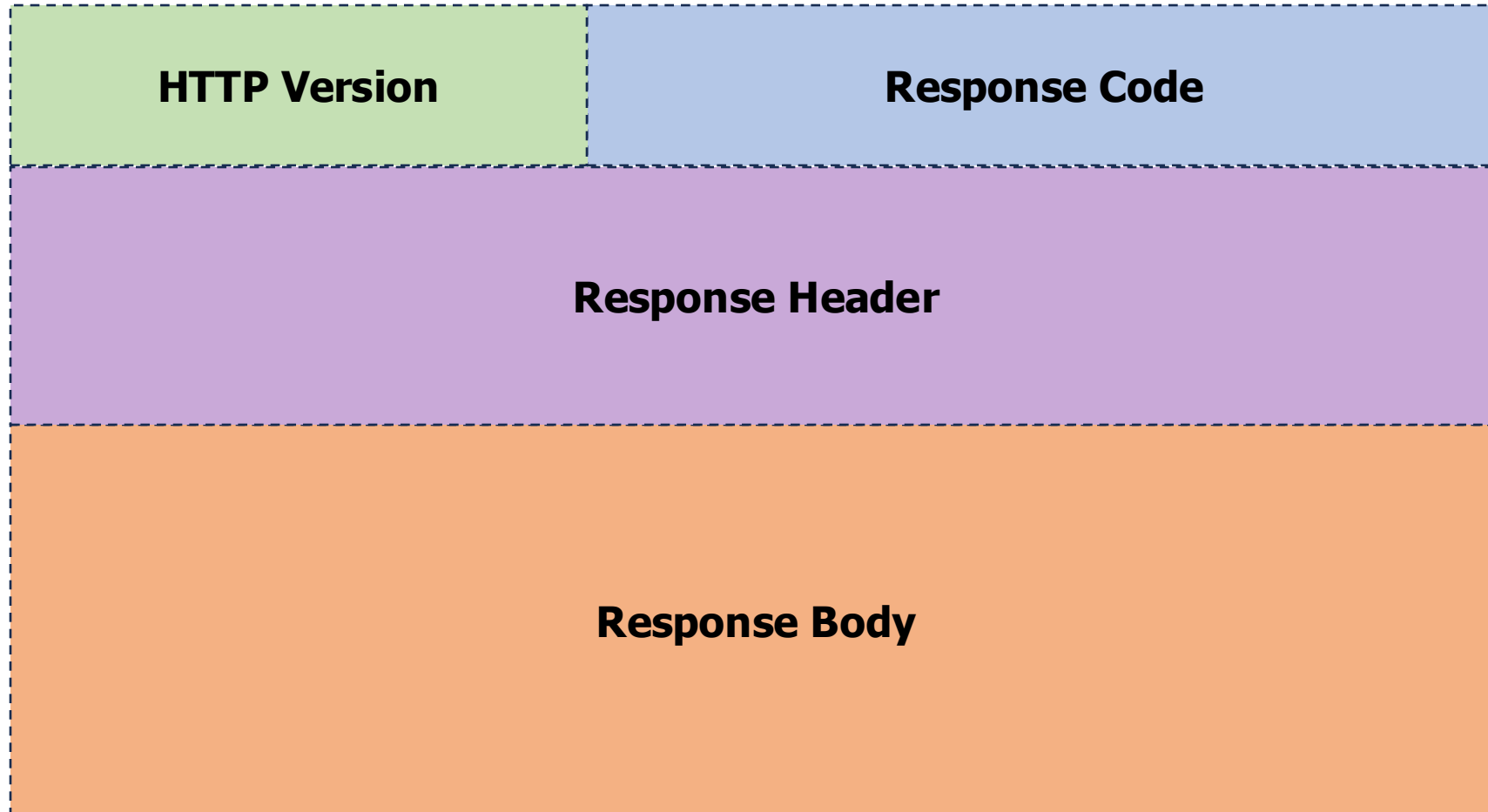


GET Request

<http://urpizza.com/api/toppings>



HTTP Response



GET Response

<http://urpizza.com/api/toppings>

HTTP/1.1

200 OK

Content-Length: 32859
Content-Type: application/json

```
[{"id": "1", "topping": "mozzarella"},  
{"id": "2", "topping": "green pepper"},  
{"id": "3", "topping": "black olive"},  
{"id": "4", "topping": "red onion"},  
{"id": "5", "topping": "mushroom"},  
{"id": "6", "topping": "pepperoni"}]
```

JSON (Java Script Object Notation)

- JSON Syntax Rules

- Data is in name/value pairs
- Data is separated by commas
- Curly braces hold objects
- Square brackets hold arrays

```
{
  "array": [
    1,
    2,
    3
  ],
  "boolean": true,
  "string": "Hello World",
  "null": null,
  "number": 123,
  "object": {
    "a": "b",
    "c": "d"
  }
}
```

HTTP Response Codes For Success

- 2xx success
 - 200 OK
 - Standard response for successful HTTP requests
 - Use for successful GET and PUT requests
 - 201 Created
 - The request has been fulfilled, resulting in the creation of a new resource
 - Use for successful POST requests
 - 204 No Content
 - The server successfully processed the request, and is not returning any content
 - Use for successful DELETE requests

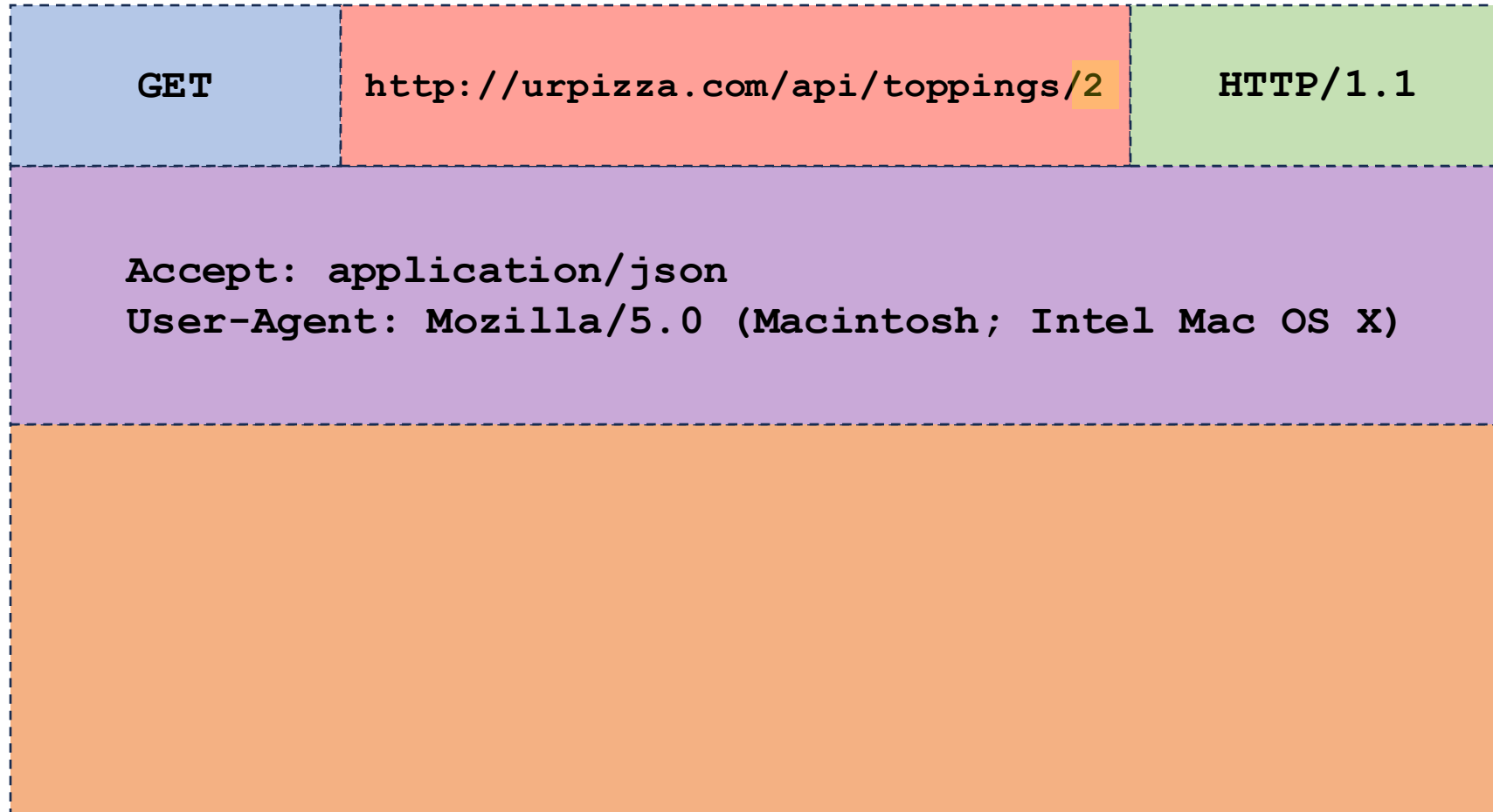
HTTP Response Codes For Client Errors

- 4xx client errors
 - 400 Bad Request
 - The server cannot or will not process the request due to an apparent client error e.g., malformed request syntax, size too large, invalid request message
 - Use for unsuccessful POST and PUT requests when JSON parsing fails
 - 401 Unauthorized
 - When authentication is required and has failed or has not yet been provided
 - 404 Not Found
 - The requested resource could not be found
 - Use for unsuccessful GET, PUT, and DELETE requests when resource is not found
 - 418 I'm a teapot
 - The server refuses to brew coffee because it is, permanently, a teapot
- <https://developer.mozilla.org/en-US/docs/Web/HTTP/Status>



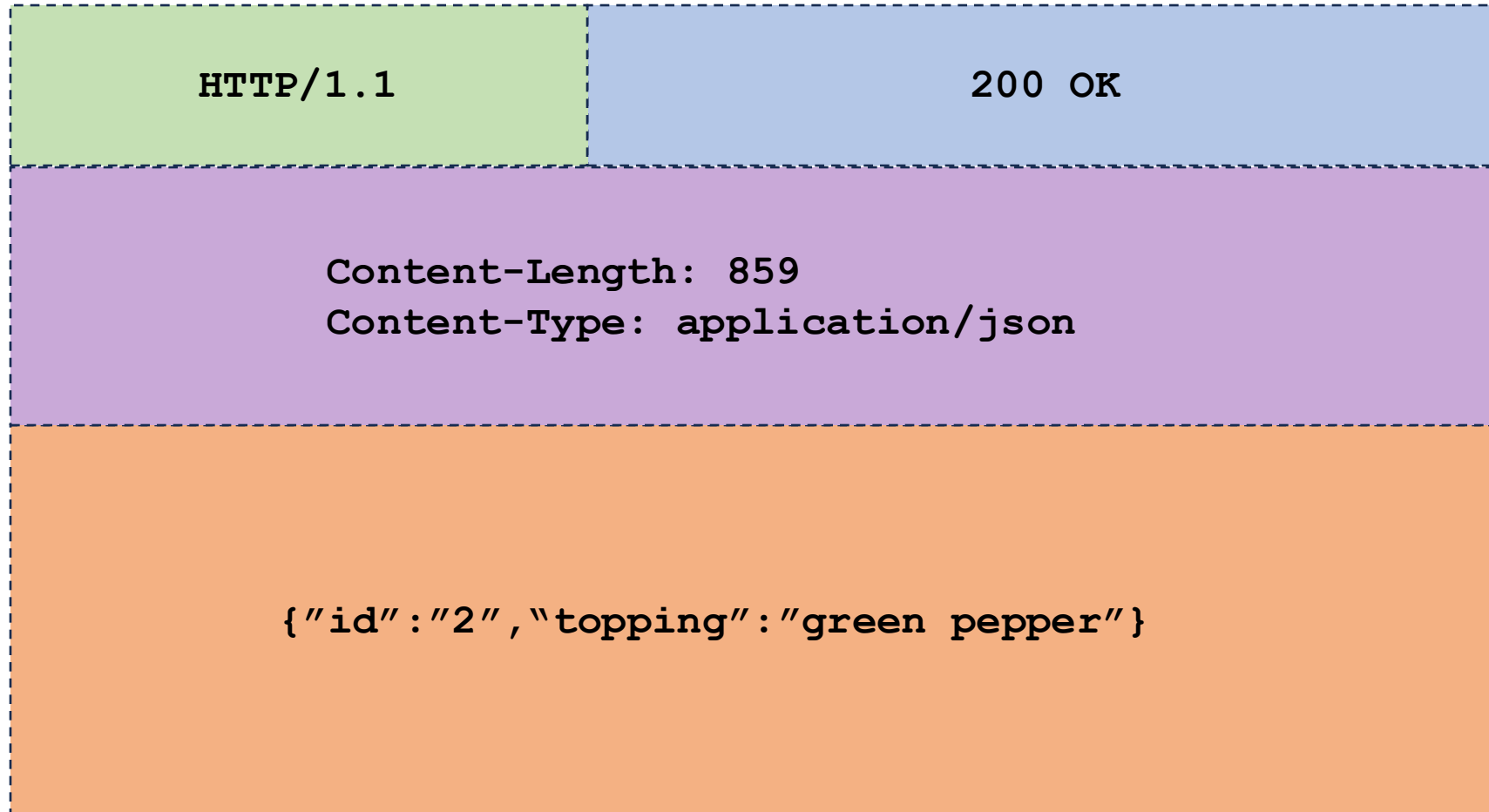
GET Request

<http://urpizza.com/api/toppings>



GET Response

<http://urpizza.com/api/toppings>



PUT Request

<http://urpizza.com/api/toppings>

PUT

`http://urpizza.com/api/toppings/2`

HTTP/1.1

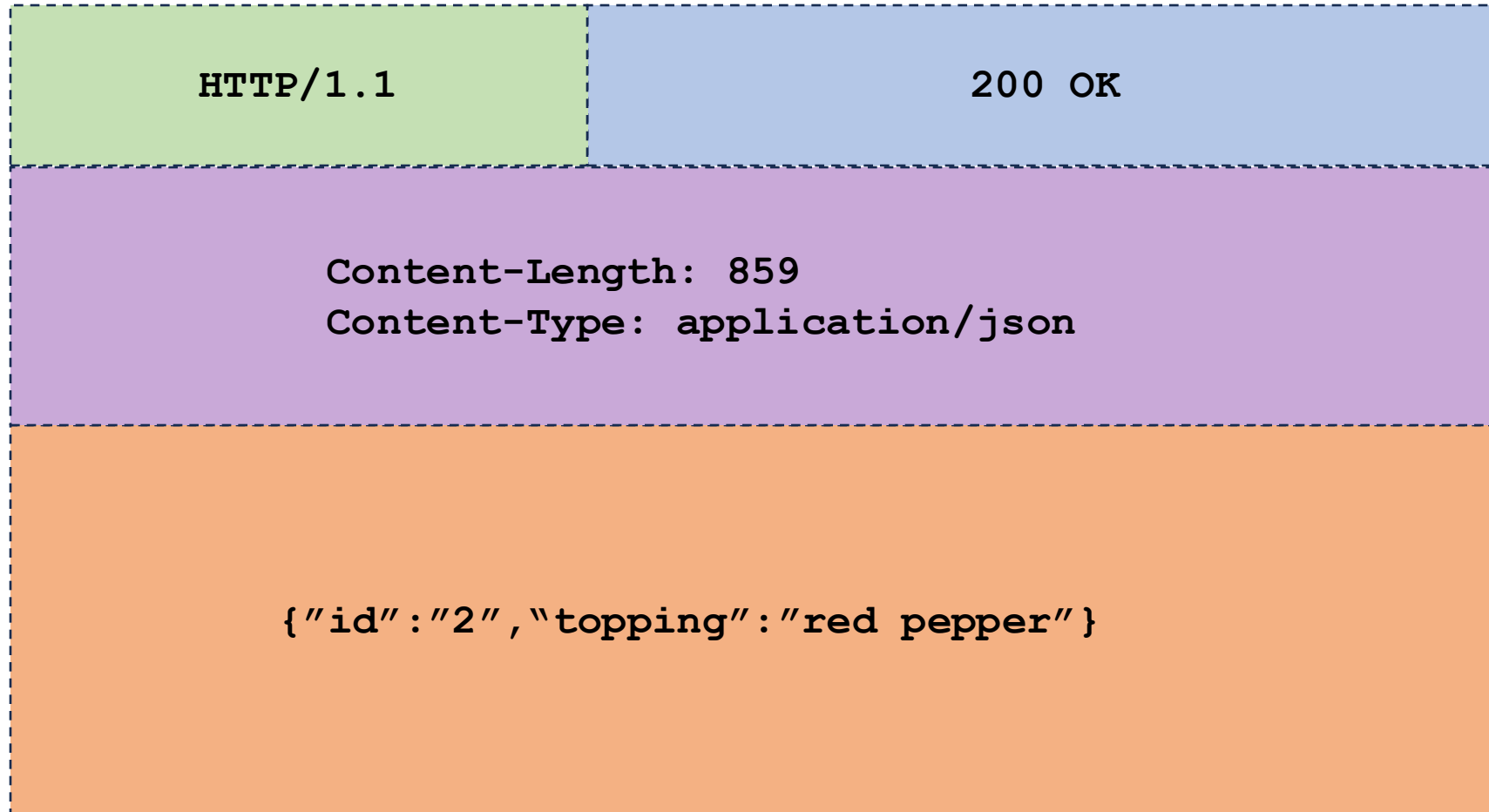
Accept: application/json

User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X)

```
{"id": "2", "topping": "red pepper"}
```

PUT Response

<http://urpizza.com/api/toppings>



POST Request

<http://urpizza.com/api/toppings>

POST

<http://urpizza.com/api/toppings>

HTTP/1.1

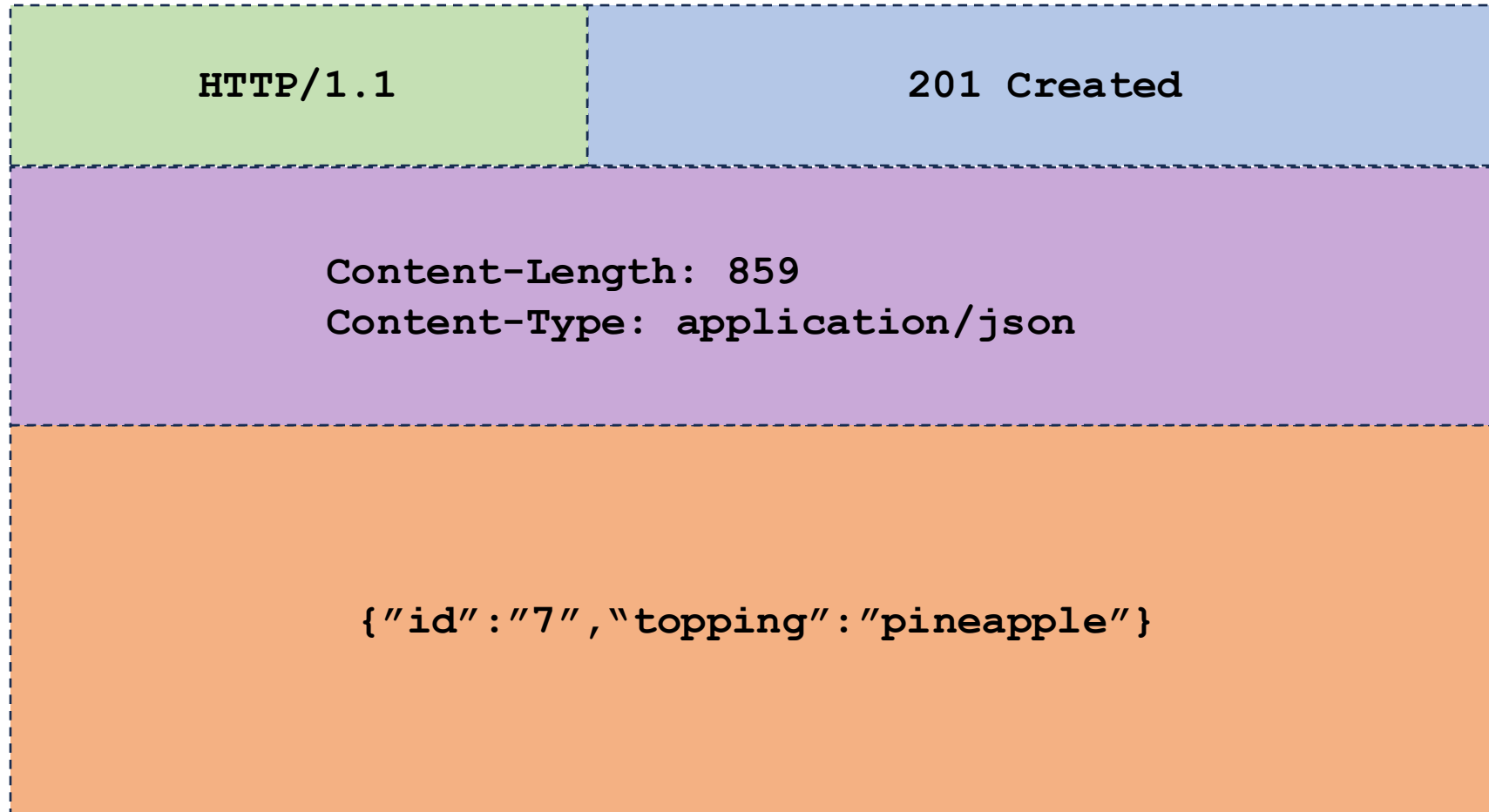
Accept: application/json

User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X)

```
{"id": "7", "topping": "pineapple"}
```

POST Response

<http://urpizza.com/api/toppings>



C++ Library for RESTful web service



A Fast and Easy to use microframework for the web.

Crow is a C++ framework for creating HTTP or Websocket web services. It uses routing similar to Python's Flask which makes it easy to use. It is also extremely fast, beating multiple existing C++ frameworks as well as non C++ frameworks.



Blazingly Fast



Header Only




Typesafe handlers





Websocket Support


<https://crowcpp.org>


Hello REST


```
 #include <crow.h>
#include <string>
using namespace std;
using namespace crow;

 response handleHelloGetRequest()
{
    string body = "Hello, world!";

    // Return the integer HTTP response code, and the response body as a string.
 return response(200, body);
}

int main()
{
 // Create a simple crow application.
SimpleApp app;

 // Define your endpoint and provide a function to handle the request.
CROW_ROUTE(app, "/api/hello").methods(HTTPMethod::Get)(handleHelloGetRequest);

 // Set the port and run the app.
app.port(18080).run();
}
```