



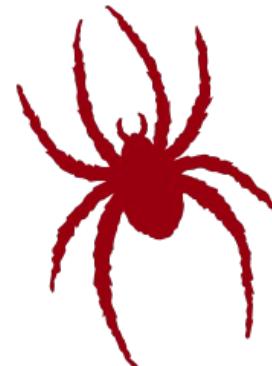
UNIVERSITY OF
RICHMOND

REST APIs

CMSC 240 Software Systems Development

Today – REST APIs

- Project Introduction
- REST APIs
- In-Class Exercises



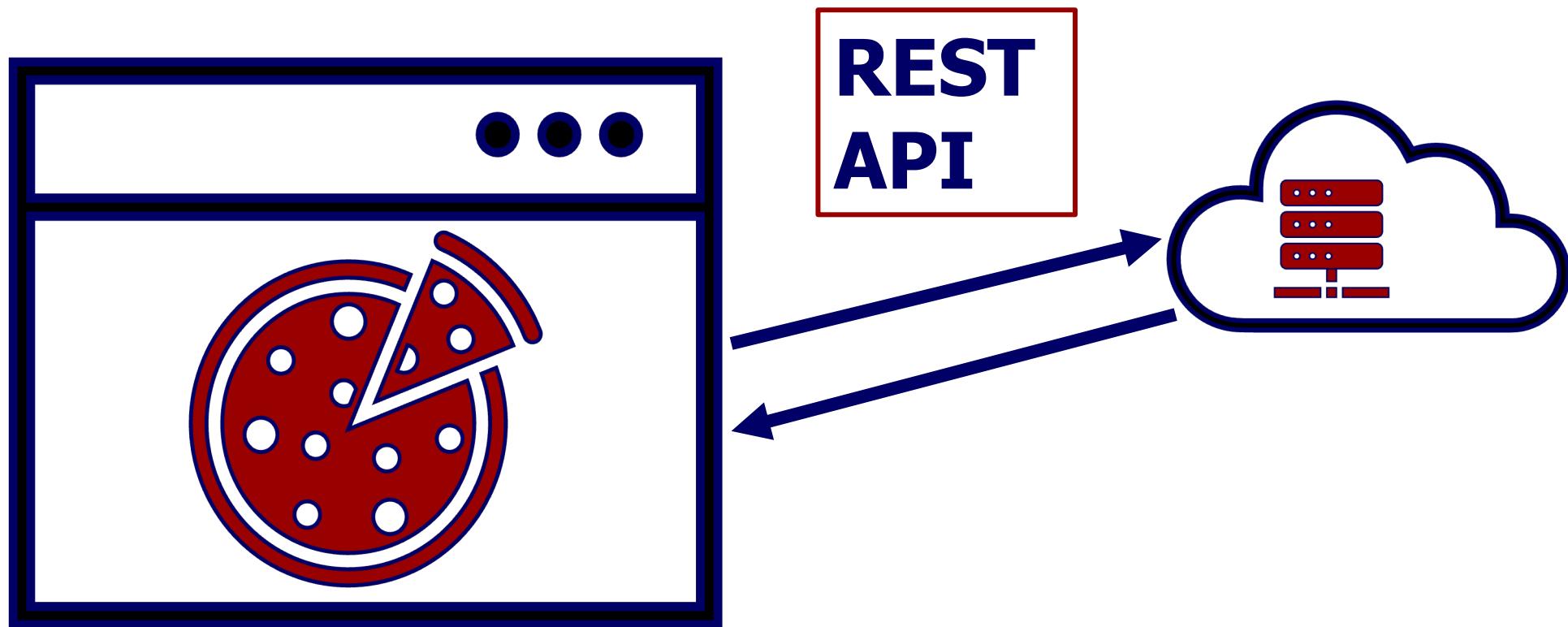
Project

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

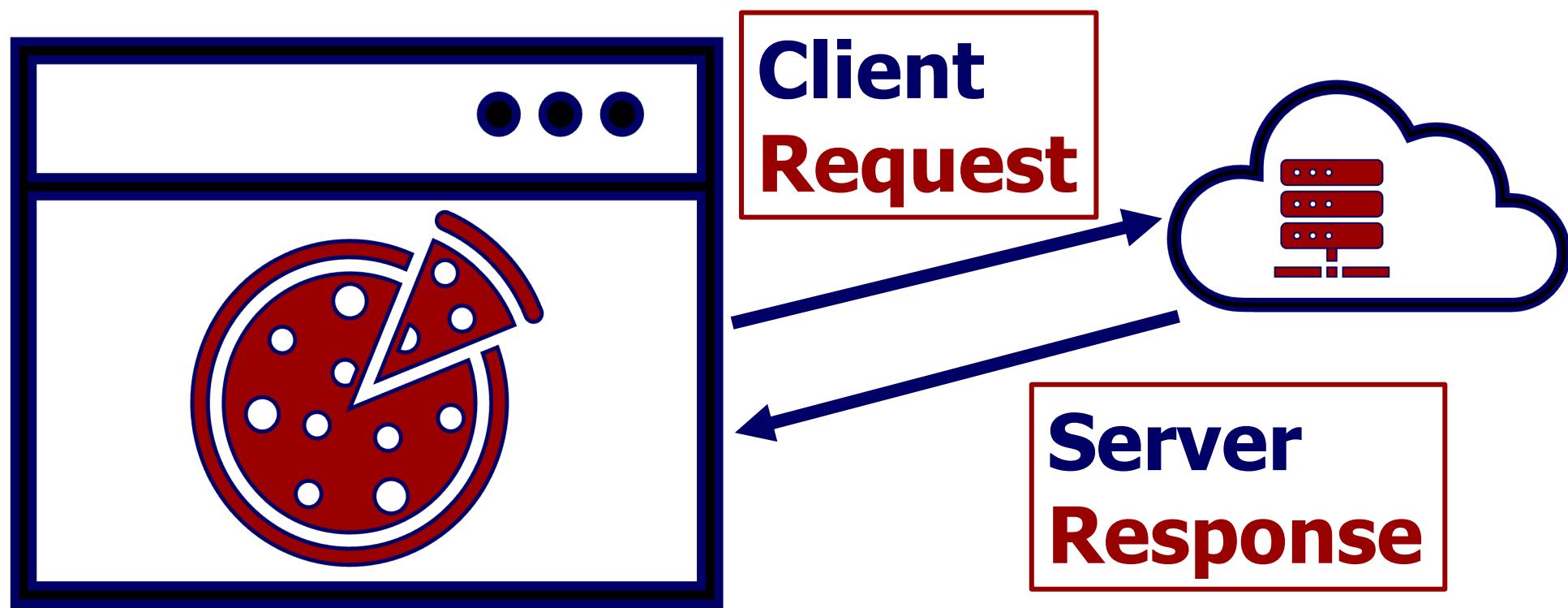
- **Representational State Transfer**
 - Communication between client and server “It’s how they talk”
 - “RESTful” web service



REST API

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

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



Request

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

HTTP Methods/Operations

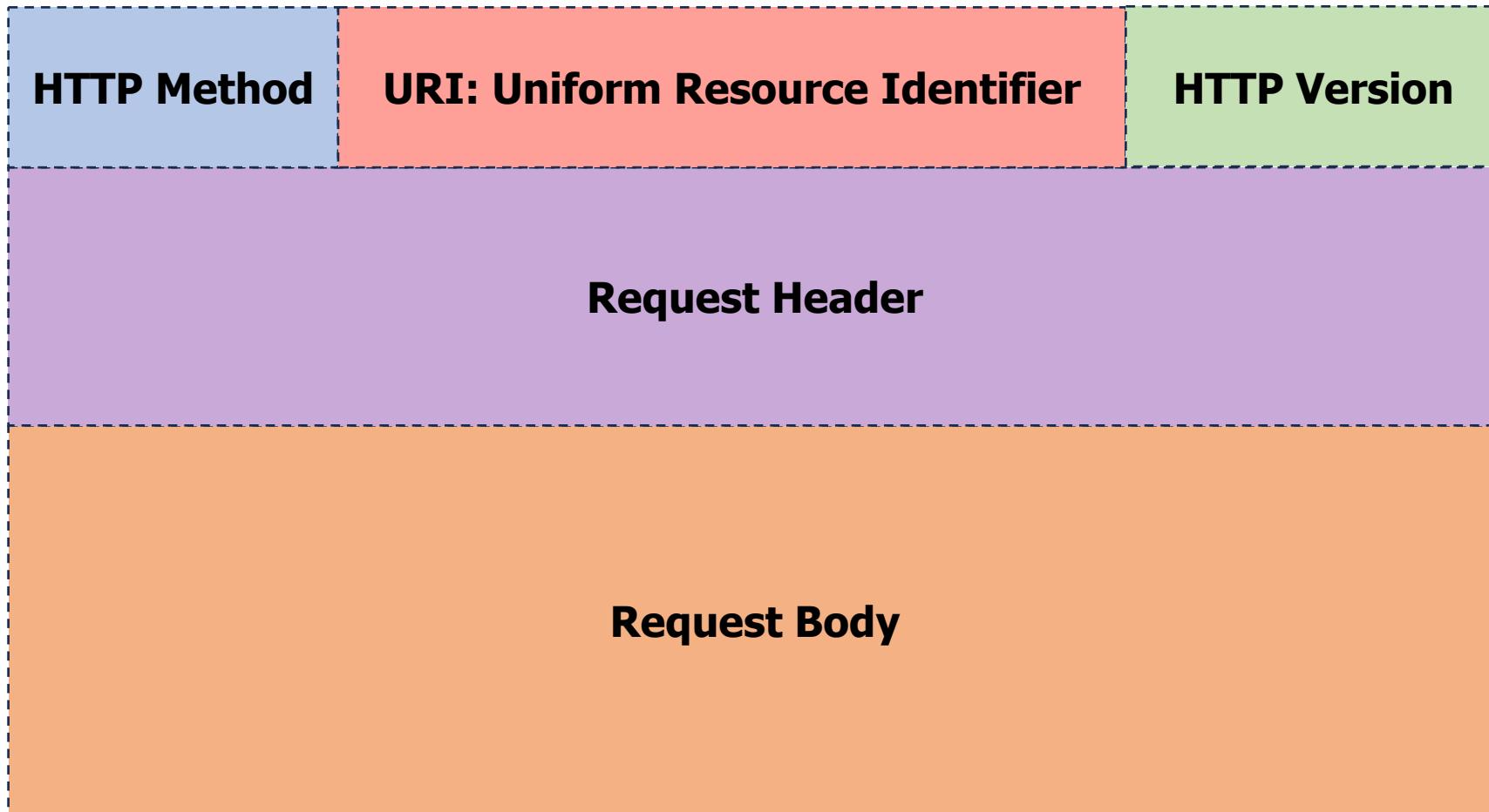
Create → POST

Read → GET

Update → PUT

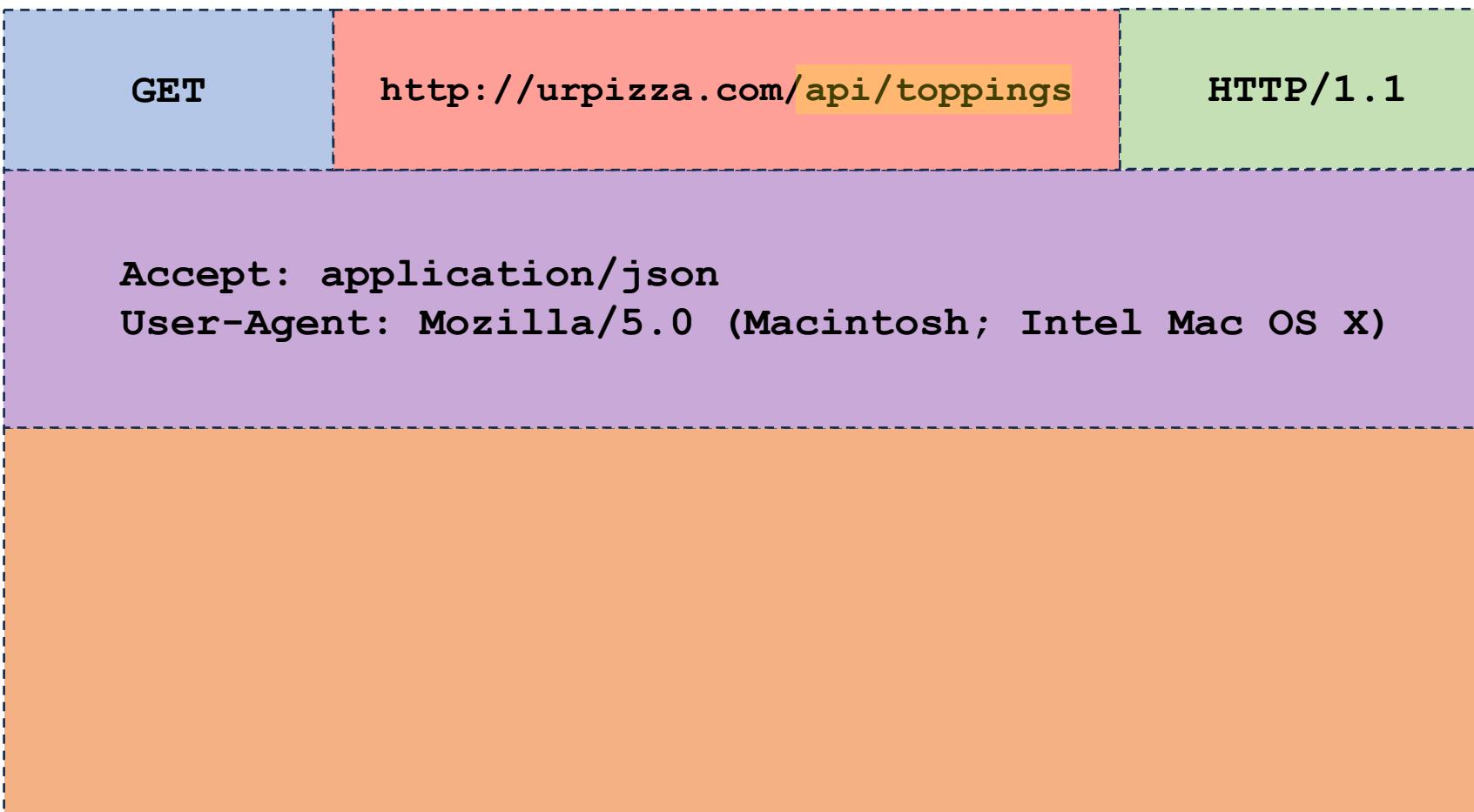
Delete → DELETE

HTTP Request

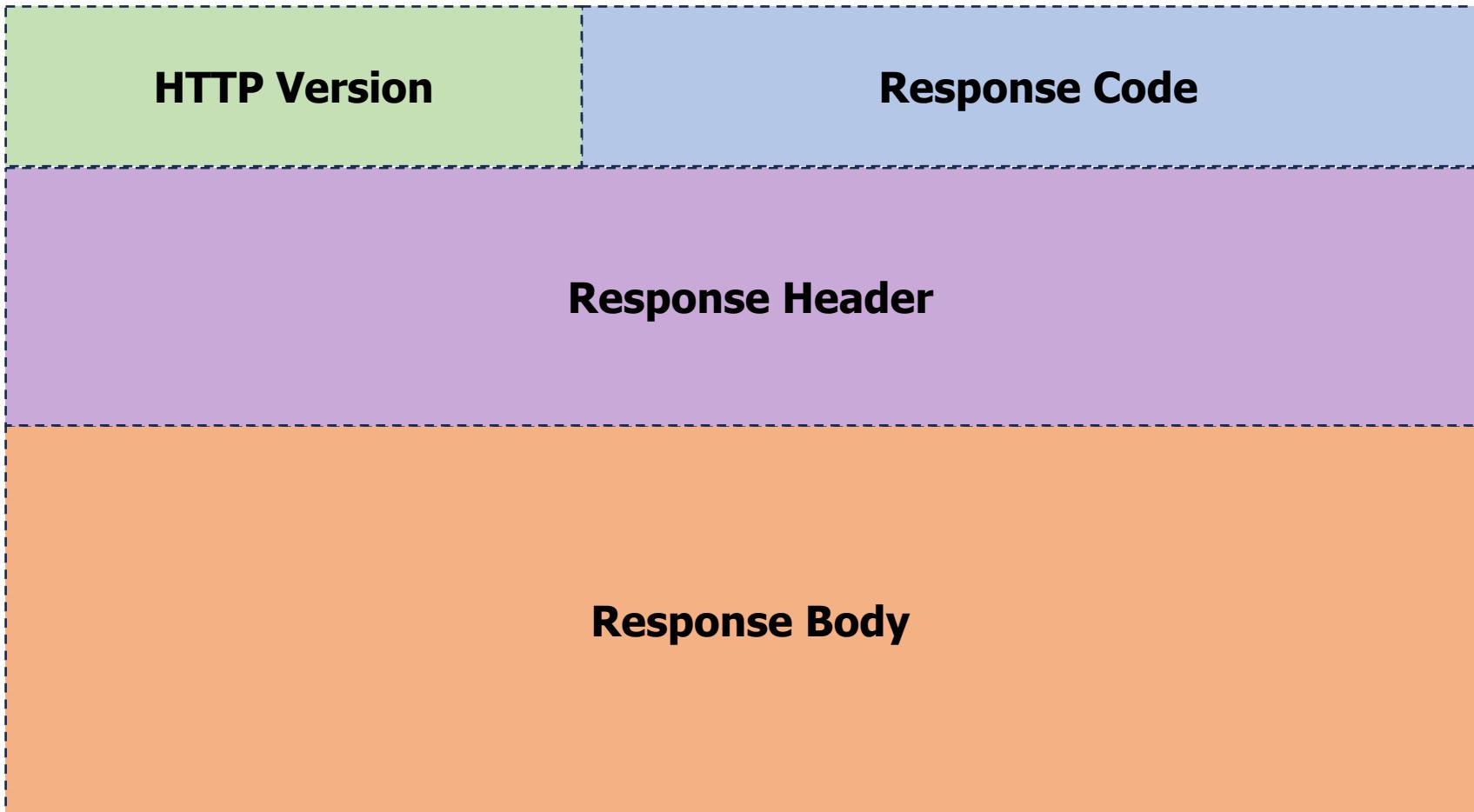


GET Request

`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

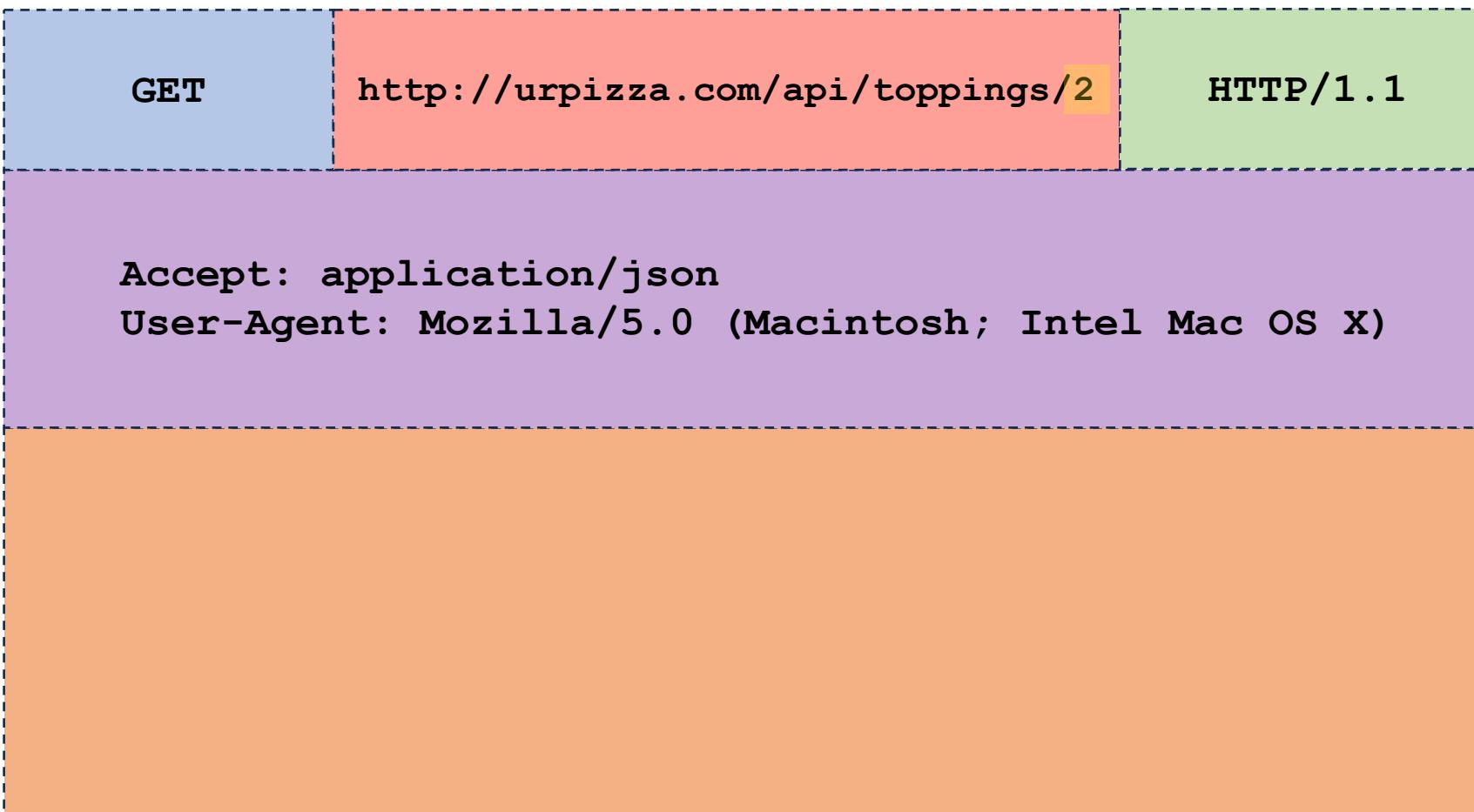
HTTP Response Codes For Client Errors

- 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>



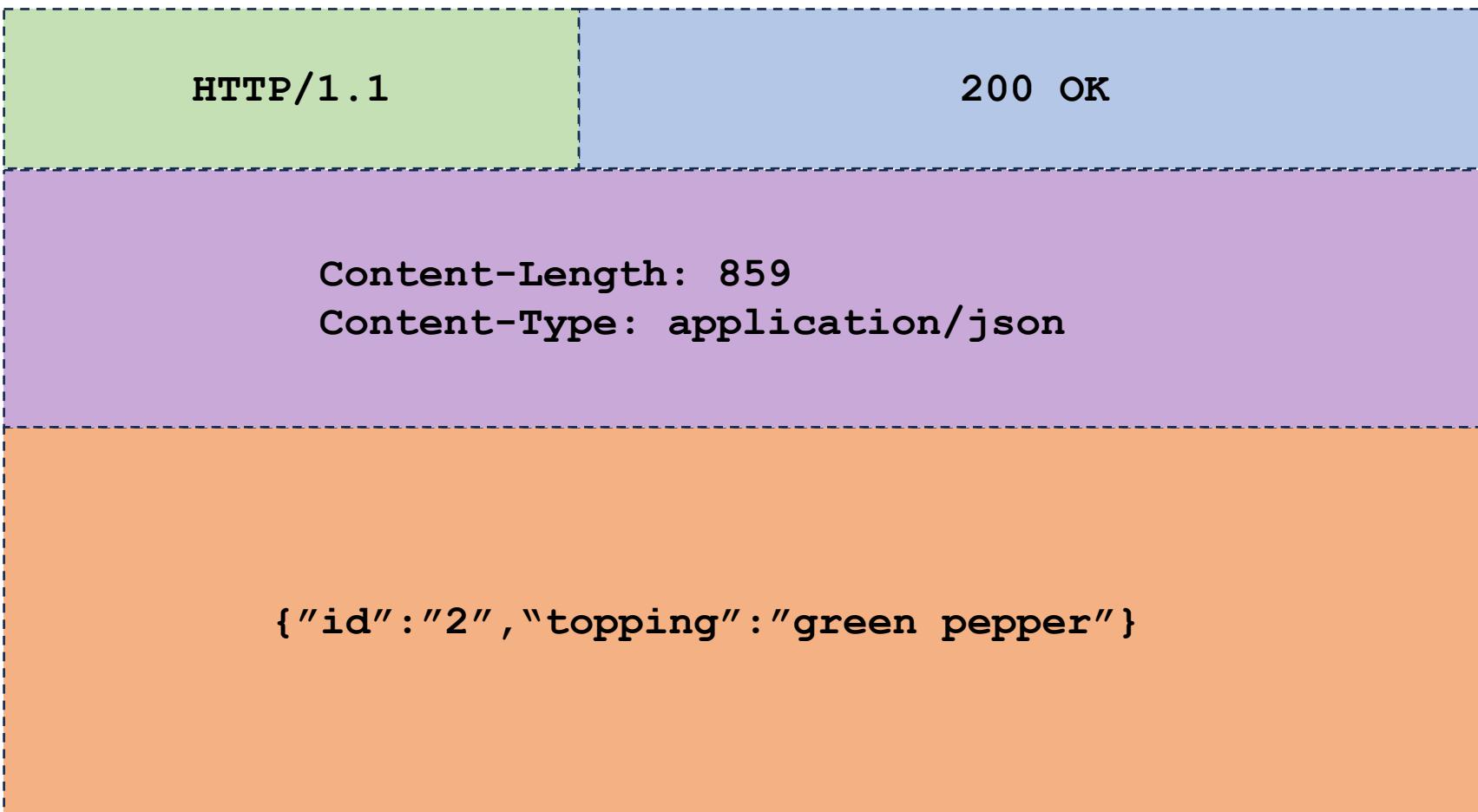
GET Request

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



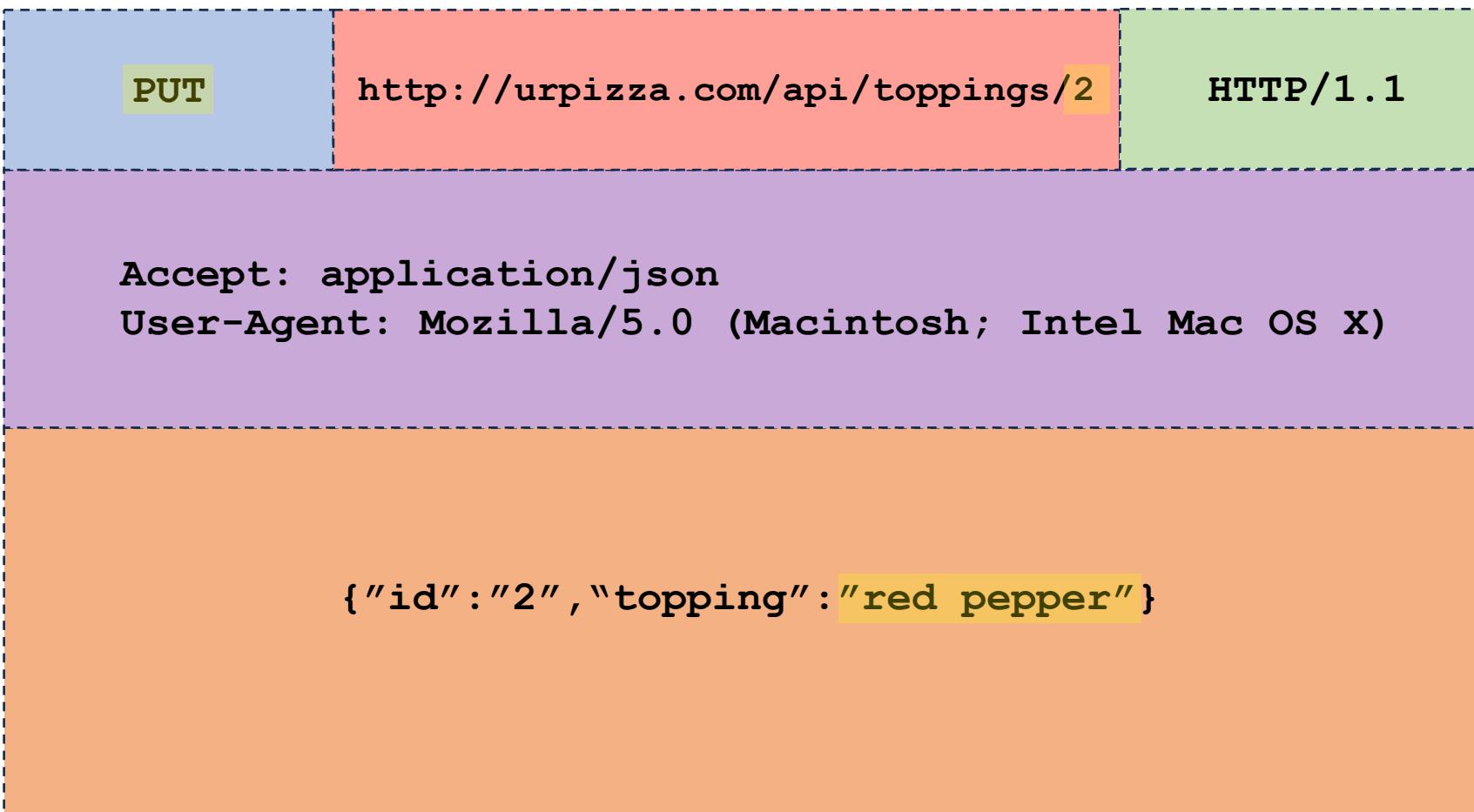
GET Response

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



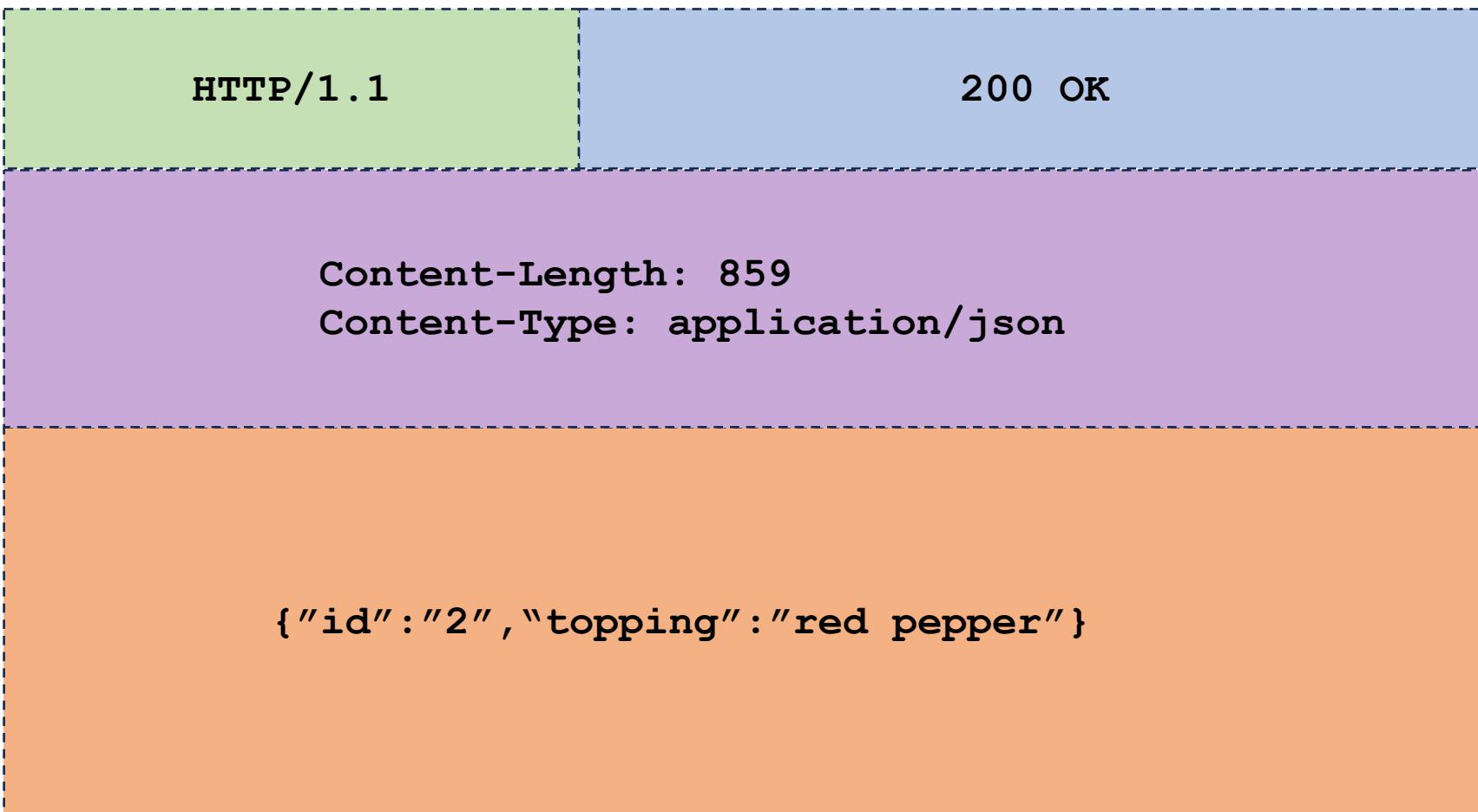
PUT Request

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



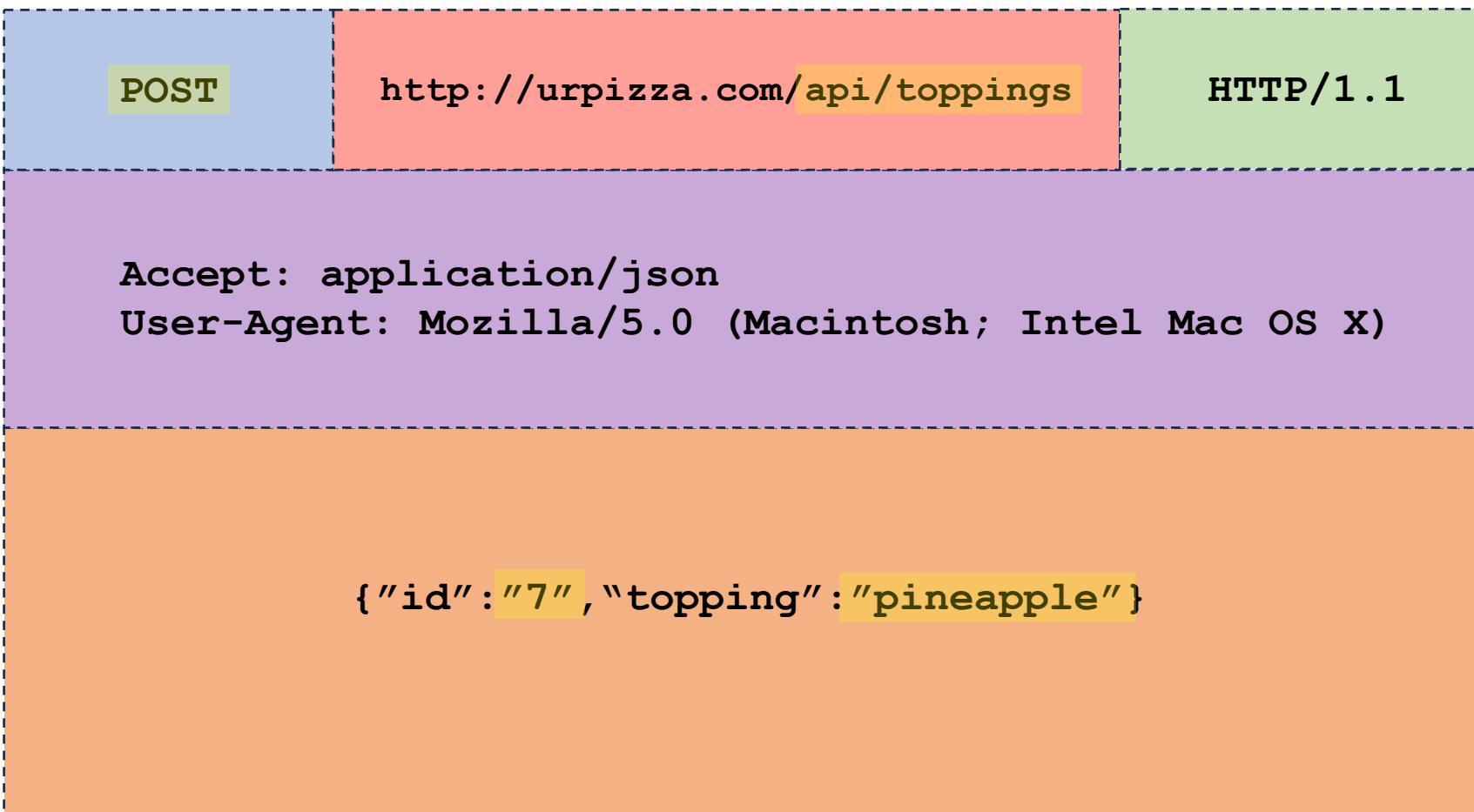
PUT Response

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



POST Request

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



POST Response

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

HTTP/1.1

201 Created

Content-Length: 859

Content-Type: application/json

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

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();
}
```