

API Server Side

Part 2

Objectives

- Understand the high-level architectural elements of the REST architecture
- Explain how HTTP methods are used to interact with RESTful resources
- Conform to RESTful conventions when using HTTP status codes
- Define CRUD and how it relates to HTTP methods and APIs
- Handle errors from backend code and alert the frontend that something has gone wrong
- Perform validation on client supplied request data
- Implement a RESTful web service that provides full CRUD functionality

SOLID Principles

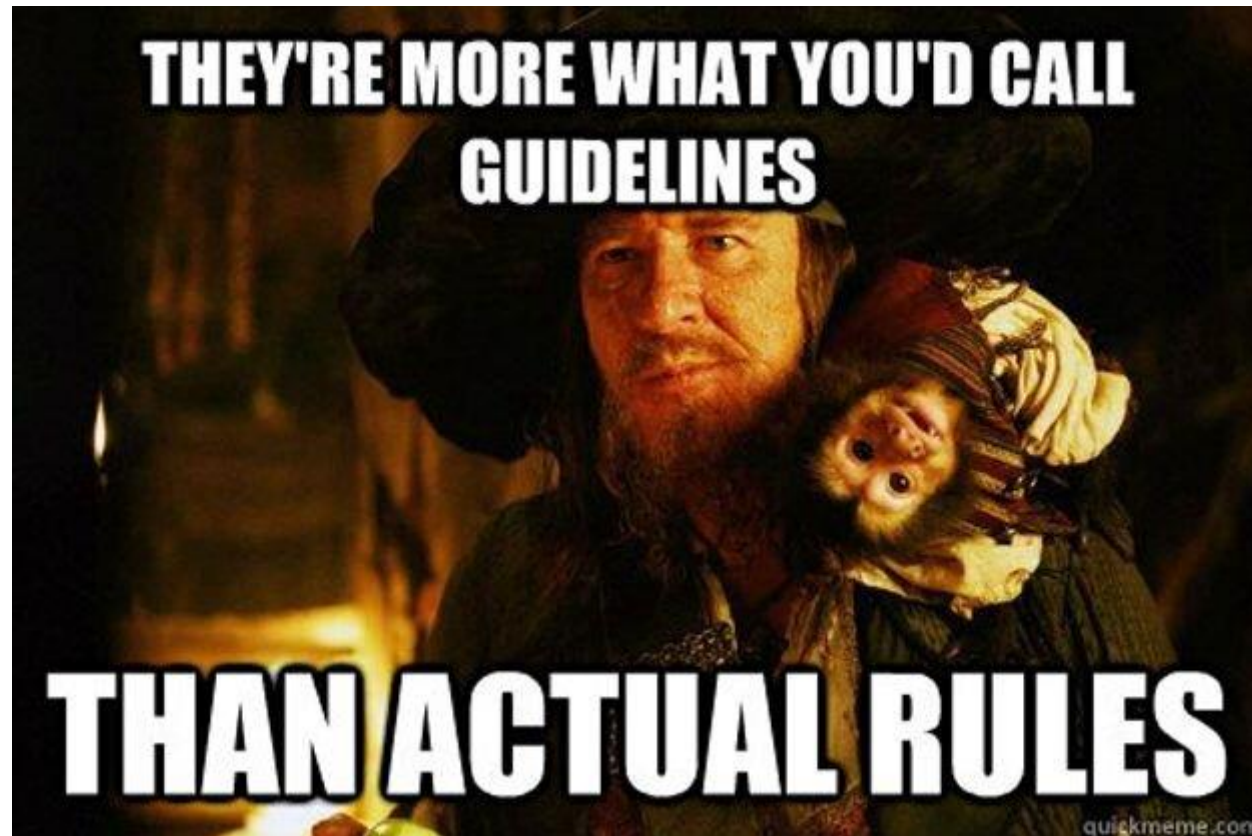
- SRP – Single Responsibility Principle
 - Every class (or similar structure) should only have one job to do
- OCP – Open Closed Principle
 - Classes should be open for extension but closed for modification
- LSP – Liskov Substitution Principle
 - In inheritance, design your classes so that dependencies can be substituted without needing modification in the client (use interfaces)
 - If it looks like a Duck, quacks like a Duck, but needs batteries, you probable have the wrong extraction (Tractor was not a child of FarmAnimal)
- ISP – Interface Segregation Principle
 - Keep interfaces small so you don't force classes to provide methods that have no meaning
- DIP – Dependency Inversion Principle
 - High-level modules should not depend on low-level modules, they should depend on abstractions

<https://www.jrebel.com/blog/solid-principles-in-java>

REST – What is it?

- Acronym for **RE**presentational **S**tate **T**ransfer
- Series of guidelines for defining web services
 - Uses technology you already know:
 - HTTP
 - URLs
 - JSON
 - Makes it easy to tie APIs to existing applications
- A **RESTful API** uses HTTP requests to GET, PUT, POST and DELETE data.

REST – What is it?



REST Resources

- Objects defined in application
 - Like an entity in a database
 - Or object in Object Oriented programming
- Building blocks defined in the application
 - Hotel Reservation is a resource

Addressing Resources

- Build a URL to address your resource
- `http://localhost:8080/hotels/reservationId`
- `http://localhost:8080/hotels/reservationId/reservations`

Actions on Resources

- CRUD!
 - Create => POST
 - Read => GET
 - Update => PUT
 - Delete => DELETE

HTTP Status codes

CATEGORY	DESCRIPTION
1xx: Informational	Communicates transfer protocol-level information.
2xx: Success	Indicates that the client's request was accepted successfully.
3xx: Redirection	Indicates that the client must take some additional action in order to complete their request.
4xx: Client Error	This category of error status codes points the finger at clients.
5xx: Server Error	The server takes responsibility for these error status codes.

Creating REST APIs

```
/**
 * Updates a reservation
 *
 * @param reservation
 * @param id
 * @return the updated Reservation
 * @throws ReservationNotFoundException
 */
@RequestMapping(path = "/reservations/{id}", method = RequestMethod.PUT)
public Reservation update(@RequestBody Reservation reservation,
                           @PathVariable int id) throws ReservationNotFoundException {

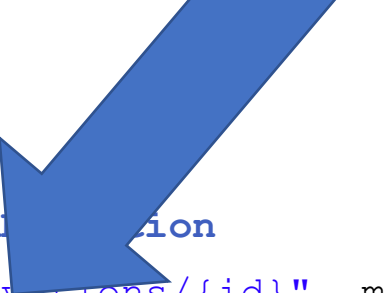
    return reservationDAO.update(reservation, id);
}

/**
 * Delete a reservation by id
 *
 * @param id
 * @throws ReservationNotFoundException
 */
@RequestMapping(path = "/reservations/{id}", method = RequestMethod.DELETE)
public void delete(@PathVariable int id) throws ReservationNotFoundException {

    reservationDAO.delete(id);
}
```

Let's Code PUT and DELETE!

Creating REST APIs



```
/**
 * Updates a reservation
 *
 * @param reservation
 * @param id
 * @return the updated Reservation
 * @throws ReservationNotFoundException
 */
@RequestMapping(path = "/reservations/{id}", method = RequestMethod.PUT)
public Reservation update(@Valid @RequestBody Reservation reservation,
                          @PathVariable int id) throws ReservationNotFoundException {

    return reservationDAO.update(reservation, id);
}

/**
 * Delete a reservation by id
 *
 * @param id
 * @throws ReservationNotFoundException
 */
@ResponseStatus(HttpStatus.NO_CONTENT)
@RequestMapping(path = "/reservations/{id}", method = RequestMethod.DELETE)
public void delete(@PathVariable int id) throws ReservationNotFoundException {

    reservationDAO.delete(id);
}
```

Server Side Validation

We can add special bits of annotation code to our classes to ensure that the data is consistent and free of errors. Some examples of these:

- In an Automobile class, an attribute measuring fuel tank capacity must be between 0 and 10 liters.
- For a Hotel reservation class, a begin date or end date must be provided.
- For a Customer class, a value must be provided for the customer name.

The goal is to implement these validation rules right on the classes that contain the fields that require validation.

Validation Annotations in Spring

Here is a list of common Spring validation annotations:

- **@NotBlank("message")**: Will check if a field is blank or not.
- **@Email("message")**: Verify if an input conforms to an email format.
- **@Min(value=<<x>>, message = "message")**: A form must have a minimum input value, where <<x>> is that number.
- **@Max(value=<<y>>, message = "message")**: A form must have a maximum input value, where <<y>> is that number.
- **@Pattern(regex= "<<z>>" , message="message")**: A form's value must conform to a regular expression, where <<z>> is that expression enclosed in double quotes.

Server Side Validation Example

Consider the following code:

```
public class Reservation {  
    private int id;  
    @Min( value = 1, message = "The field 'hotelID' is required.")  
    @Max( value = 8, message = "Hotel IDs are between 1 and 8.")  
    // a value must be provided for a hotel id:  
    private int hotelID;  
    @NotBlank( message = "The field 'fullName' is required.")  
    // a value must be provided for the guest name  
    private String fullName;  
    @NotBlank( message = "The field 'checkinDate' is required.")  
    private String checkinDate;  
    @NotBlank( message = "The field 'checkoutDate' is required.")  
    private String checkoutDate;  
    ... }  
}
```


PUT Requests

- A PUT request is used to update existing data.
- Like a POST, PUT requires a body containing the updated JSON Object:
- The validation techniques we learned with POST still apply!
- Consider the following example:

```
@RequestMapping(path = "/reservations/{id}", method = RequestMethod.PUT)
public Reservation update(@Valid @RequestBody Reservation reservation,
                          @PathVariable int id)throws ReservationNotFoundException {
    return reservationDAO.update(reservation, id);
}
```

DELETE Requests

- A DELETE request is used to remove data.

```
@RequestMapping(path = "/reservations/{id}", method = RequestMethod.DELETE)
public Reservation delete(@PathVariable int id,
    throws ReservationNotFoundException {
    return reservationDAO.delete(id);
}
```

Summary of Request Types

We have now covered the four basic persistent data storage operations. This is commonly referred to as CRUD (**C**reate, **R**ead, **U**ppdate, and **D**eleete).

Modulating the Response Code

Finally, Spring gives us the ability to tweak the response code a user receives. To review, recall the status code ranges:

- **2XX** : Everything is fine.
- **4XX** : There is a client side problem, something is wrong with your request.
- **5XX**: There is a server side problem

Common examples of each:

- **200**: Yep, everything's fine.
- **401**: Your request contains bad credentials.
- **500**: Internal Server Error

Modulating the Response Code

We can provide slightly more descriptive codes by using the `@ResponseStatus` annotations:

```
@ResponseStatus(HttpStatus.CREATED)
@RequestMapping(path = "/hotels/{id}/reservations",
                 method = RequestMethod.POST)
public Reservation addReservation (...) {
    ...
}
```

Provided the request completed without issue, the response back to the API user will now be 201 instead of 200.

Dependency Injection

Notice the constructor does not specify the class. We allow Spring to inject the correct class for us.



```
private HotelDao hotelDao;  
private ReservationDao reservationDao;  
  
public HotelController(HotelDao hotelDao, ReservationDao reservationDao) {  
    this.hotelDao = hotelDao;  
    this.reservationDao = reservationDao;  
}
```

Dependency Injection

Spring knows what class to inject
by the `@Component` annotation



```
@Component  
public class MemoryHotelDao implements HotelDao {
```


Dependency Injection

Spring will take this one step further for us, by Autowiring the component

```
@Component
public class MemoryHotelDao implements HotelDao {
```

```
private HotelDao hotelDao;
private ReservationDao reservationDao;

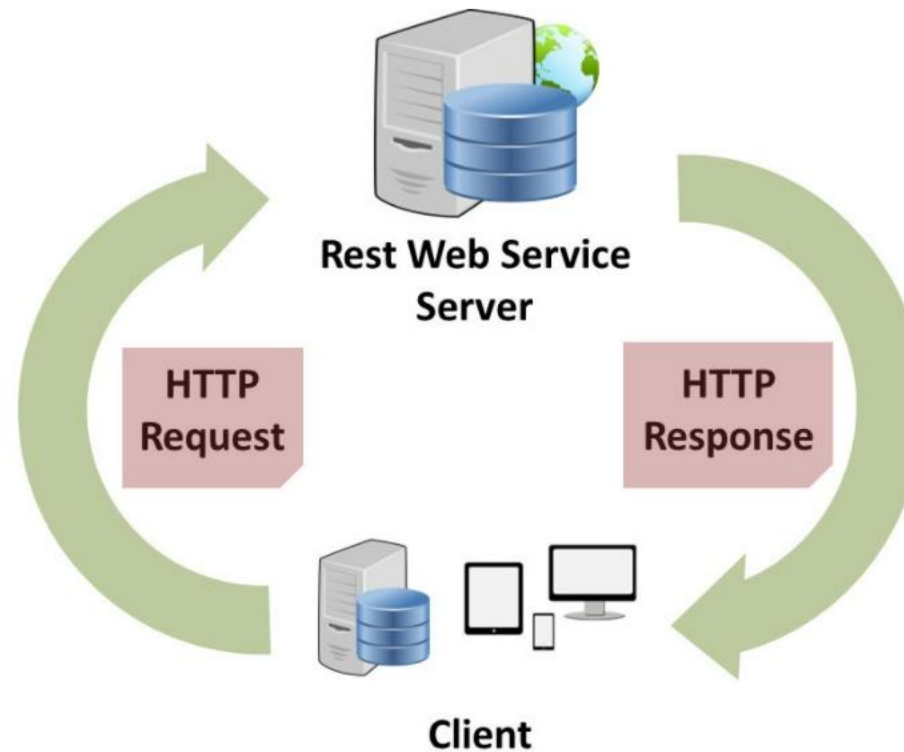
public HotelController(HotelDao hotelDao, ReservationDao reservationDao) {
    this.hotelDao = hotelDao;
    this.reservationDao = reservationDao;
}
```



```
@Autowired
private HotelDao hotelDao;
@Autowired
private ReservationDao reservationDao;
```


Objectives

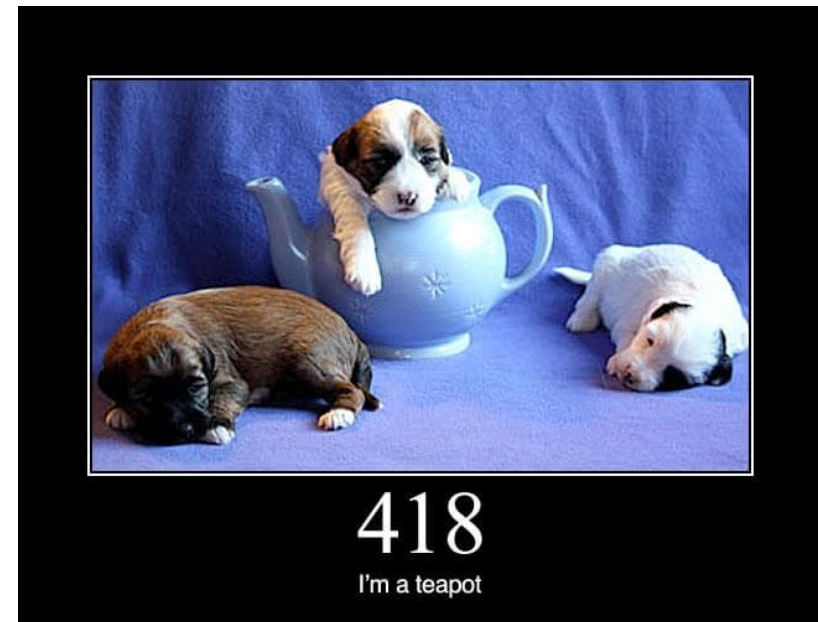
- Understand the high-level architectural elements of the REST architecture



REST is a simple way to organize interactions between independent systems.

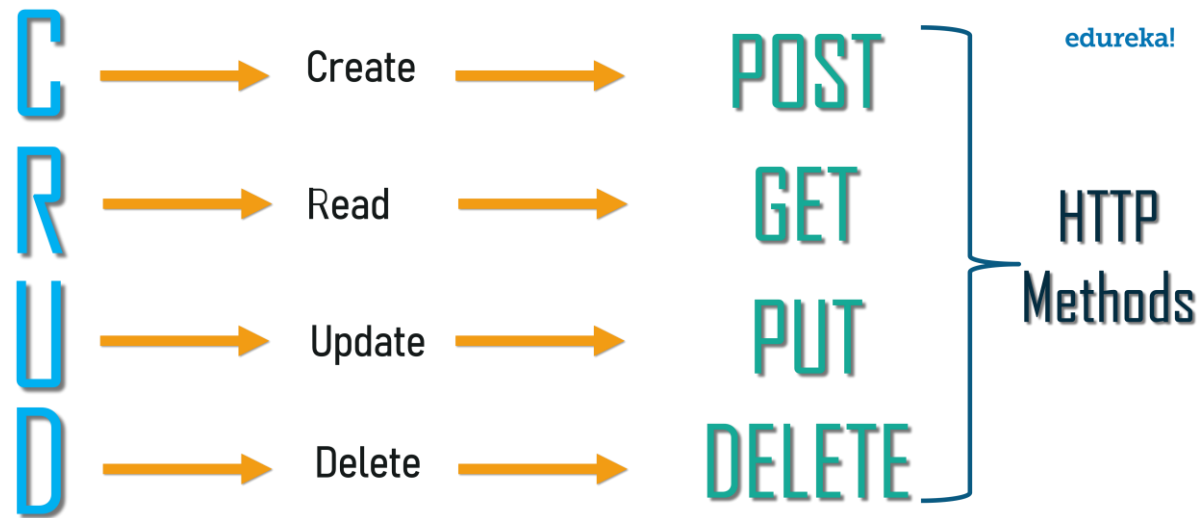
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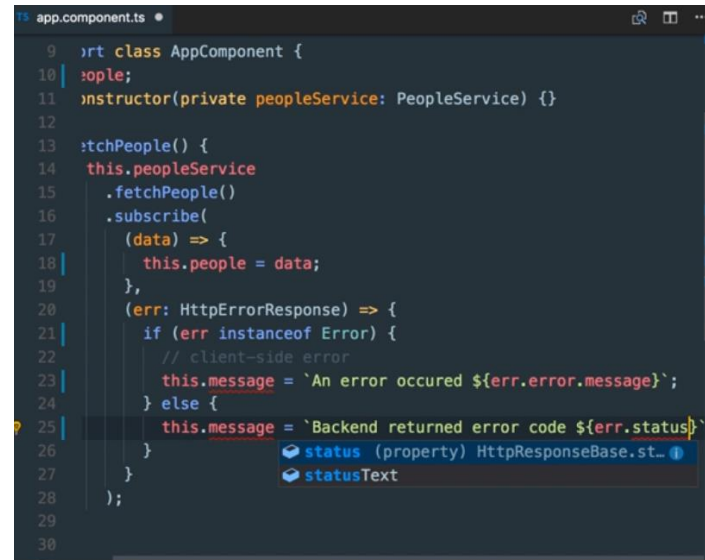
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```
9  >rt class AppComponent {
10  >ople;
11  >nstructor(private peopleService: PeopleService) {}
12
13  >tchPeople() {
14    this.peopleService
15      .fetchPeople()
16      .subscribe(
17        (data) => {
18          this.people = data;
19        },
20        (err: HttpResponse) => {
21          if (err instanceof Error) {
22            // client-side error
23            this.message = `An error occurred ${err.error.message}`;
24          } else {
25            this.message = `Backend returned error code ${err.status}`;
26          }
27          status (property) HttpResponseBase.st...
28          statusText
29        }
30      );
31  }
```

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```
public class Reservation {  
    private int id;  
    @Min( value = 1, message = "The field 'hotelID' is required.")  
    private int hotelID;  
    @NotBlank( message = "The field 'fullName' is required.")  
    private String fullName;  
    @NotBlank( message = "The field 'checkinDate' is required.")  
    private String checkinDate;  
    @NotBlank( message = "The field 'checkoutDate' is required.")  
    private String checkoutDate;  
    @Min( value = 1, message = "The minimum number of guests is 1")  
    @Max( value = 5, message = "The maximum number of guests is 5")  
    private int guests;  
}
```

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CRUD!

Let's Code!