

# 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

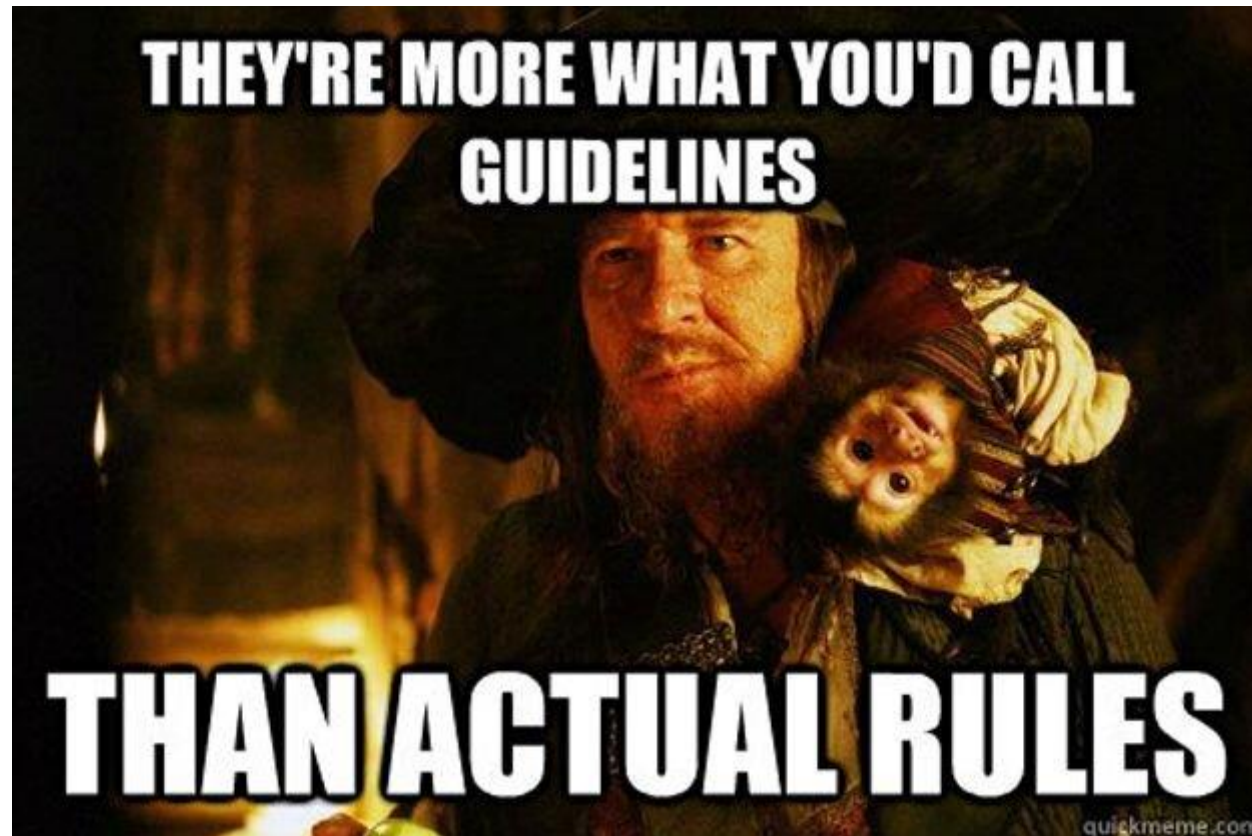
- SRP – Single Responsibility Principle
  - Every class (or similar structure) should only have one job to do
- OCP – Open Closed Principle
  - Classes should be open for extension but closed for modification
- LSP – Liskov Substitution Principle
  - In inheritance, design your classes so that dependencies 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

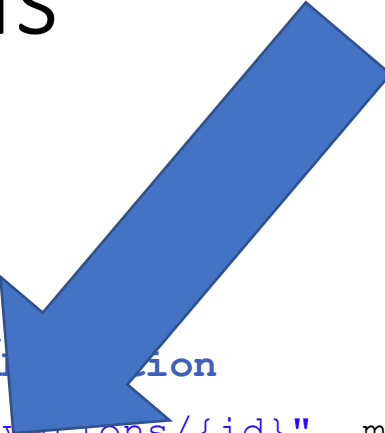
```
/**
 * Updates a reservation
 *
 * @param reservation
 * @param id
 * @return the updated Reservation
 * @throws ReservationNotFoundException
 */
@RequestMapping(path = "/reservations/{id}", method = RequestMethod.PUT)
public Reservation update(@RequestBody Reservation reservation,
             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

# 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 {
```

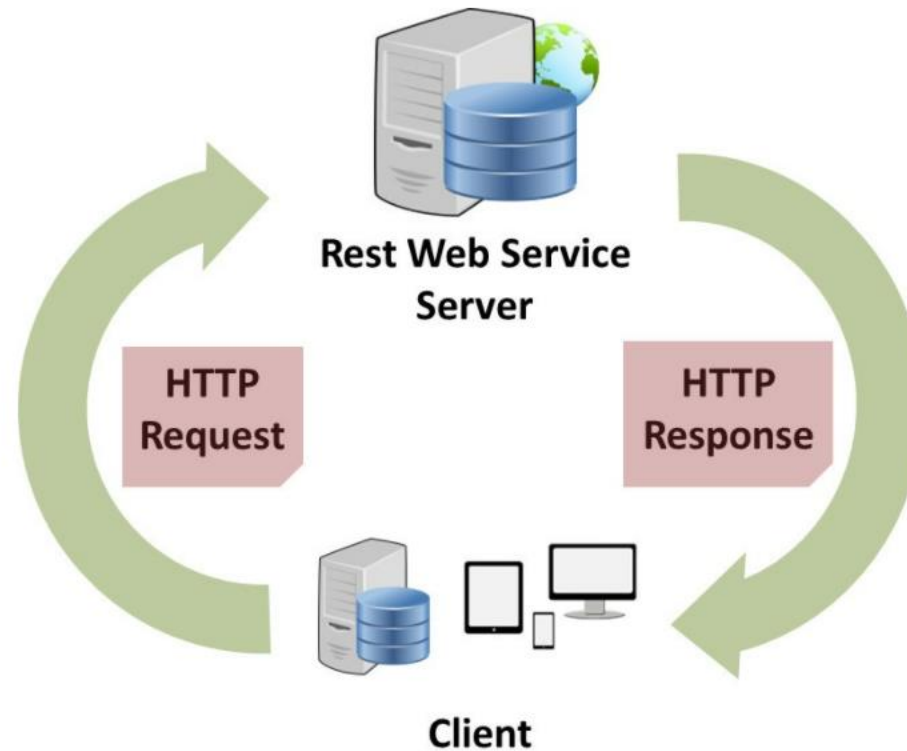
```
private HotelDao hotelDao;  
private ReservationDao reservationDao;  
  
public HotelController(HotelDao hotelDao, ReservationDao reservationDao) {  
    this.hotelDao = hotelDao;  
    this.reservationDao = reservationDao;  
}
```



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

# Objectives

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

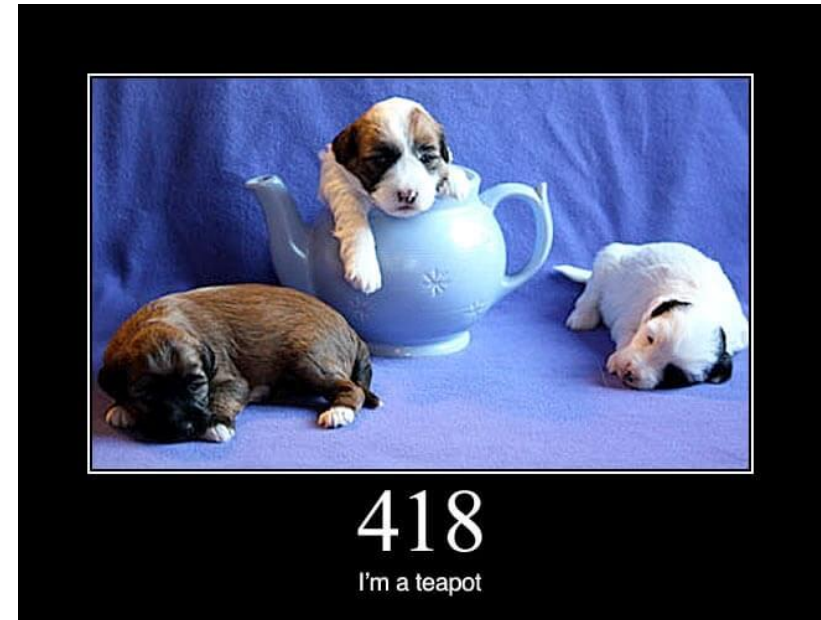


REST is a simple way to organize interactions between independent systems.



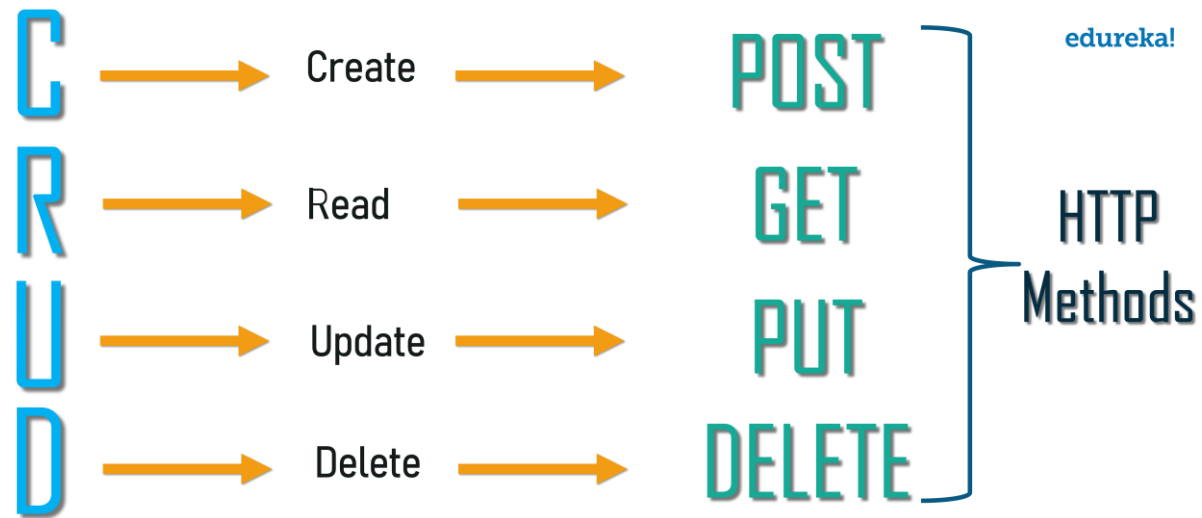
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- Conform to RESTful conventions when using HTTP status codes



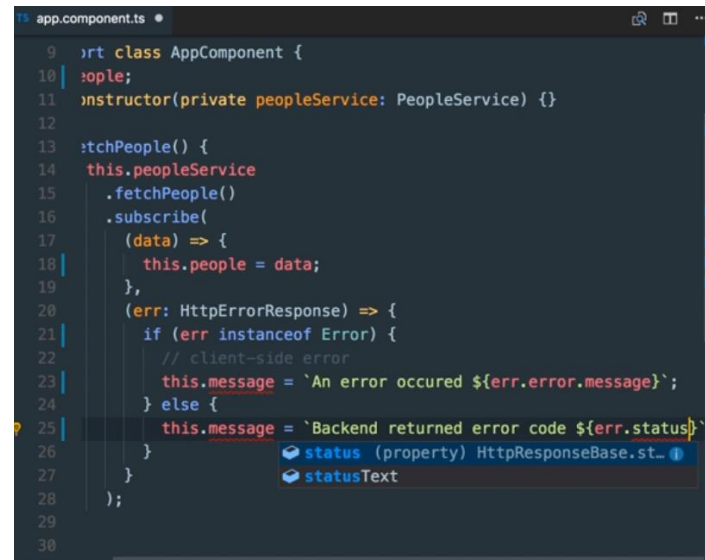
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```
9  >rt class AppComponent {
10  >ople;
11  >nstructor(private peopleService: PeopleService) {}
12
13  >tchPeople() {
14    this.peopleService
15      .fetchPeople()
16      .subscribe(
17        (data) => {
18          this.people = data;
19        },
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        }
28      );
29  }
30  }
```

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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!