Spring Boot

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du Canton de Vaud

What is Spring Boot?

- It is **kind of** a development platform: it provides high-level **integrations** to develop software components. It's an extension of Spring Framework.
- It is an execution platform: it provides an **embedded** environment to **run** these components "to live".
- It is an entreprise platform: it **allows to use different integration to** support distributed transactions, security, integration, etc.
- Separation of concerns: "The developer takes care of the business logic. **Spring Framework** takes care of the systemic qualities".

http://flickr.com/photos/decade_null/427124229/sizes/m/#cc_license

Spring Boot and standards

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- Spring Boot is a facilitator to use one or more libraries from Spring Framework.
  - Like Spring Framework, there is no standards nor specifications about Spring Boot
- Spring Boot and more generally Spring Framework is an “umbrella” of technologies
  - Spring Framework can comply on Java EE specifications and technologies but it does not force to use them.
  - At least, the Servlet Specs is brought to you by Spring Boot.
  - Spring Boot brings to you the tools to make the plumbing between your different application parts.

Architecture

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- Spring Boot is a facade for Spring Framework well organized to let you just pick up one Spring Boot starter and then let you build your apps quickly and easily.
  - The application container aka application server is therefore embedded into your application and you have several choice like Tomcat, Jetty or Undertow.
  - Running the application is easy:

```
java -jar jarFile.jar
```

  - Spring Source provide several bindings and integrations with most of the well known technologies:
    - JPA, JMS, Spring Security, ...
- Unlike with Java EE, Spring Boot is the container
  - the container is the **environment** in which we run components;
  - the container **provides services** (transactions, security, etc.) through APIs like Java EE. These libraries are available in the numerous libraries of Spring Framework;
  - Spring Boot offer only kind of a "**web**" container like we find in Java EE.

Spring Boot - Tiers

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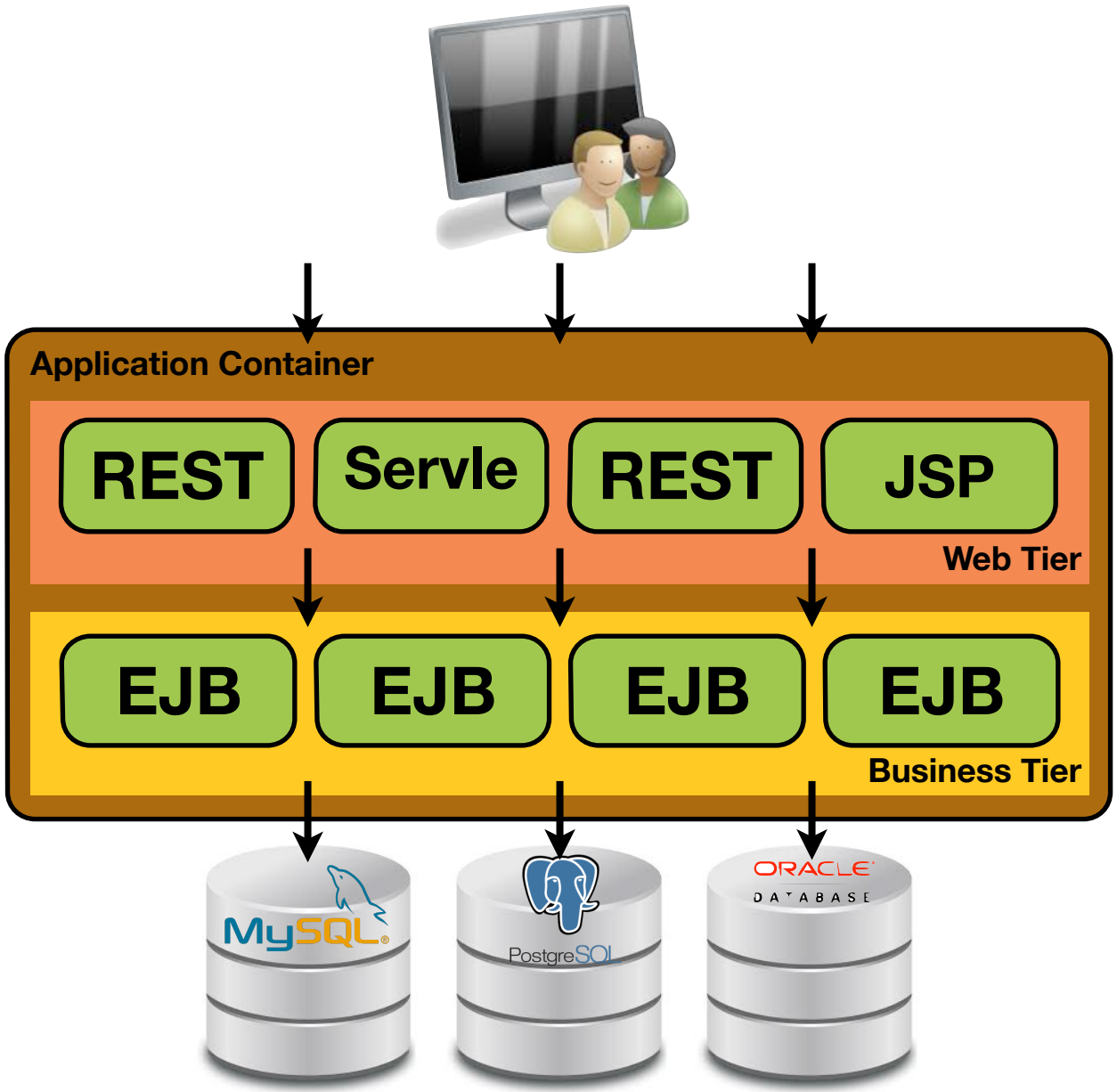

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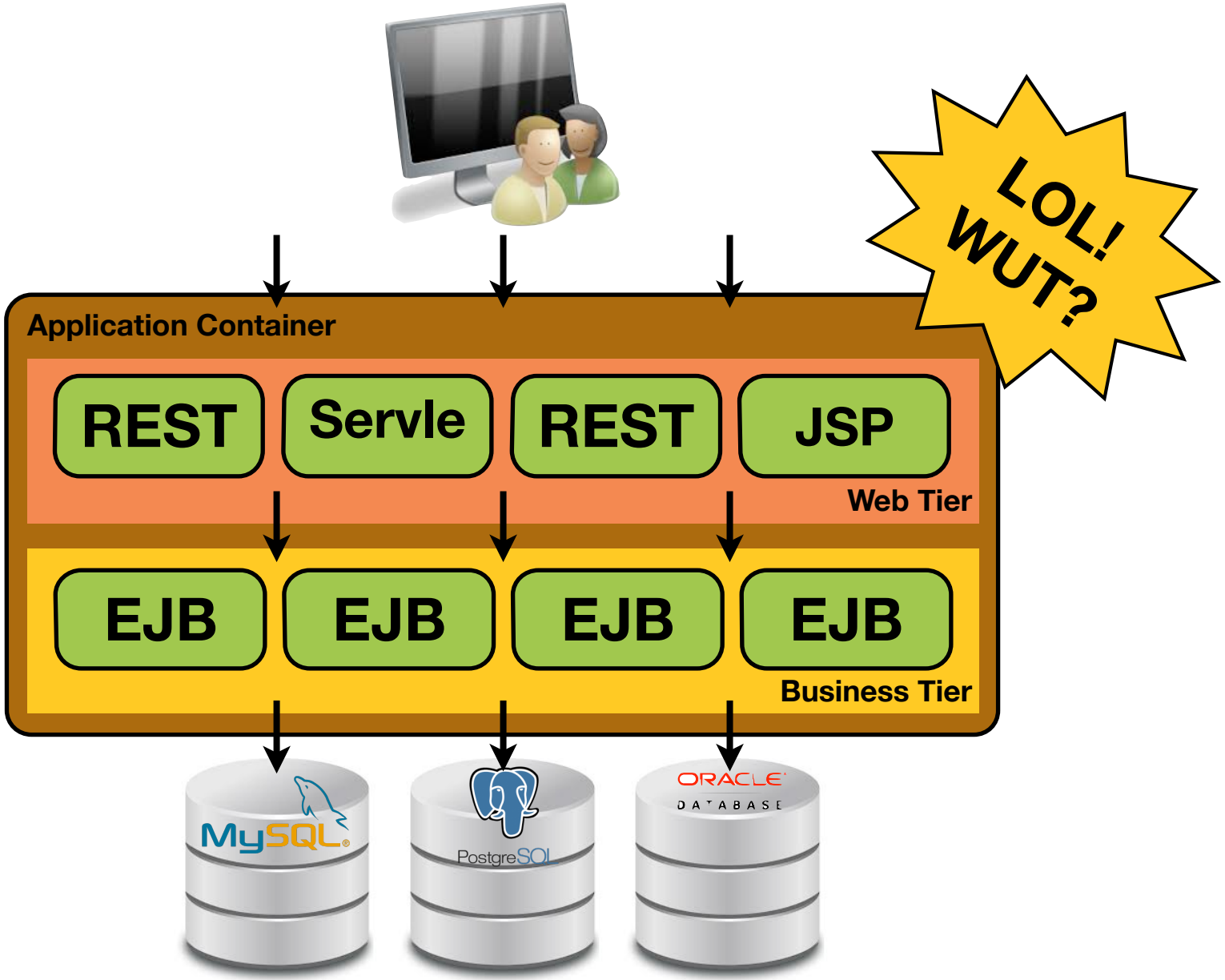

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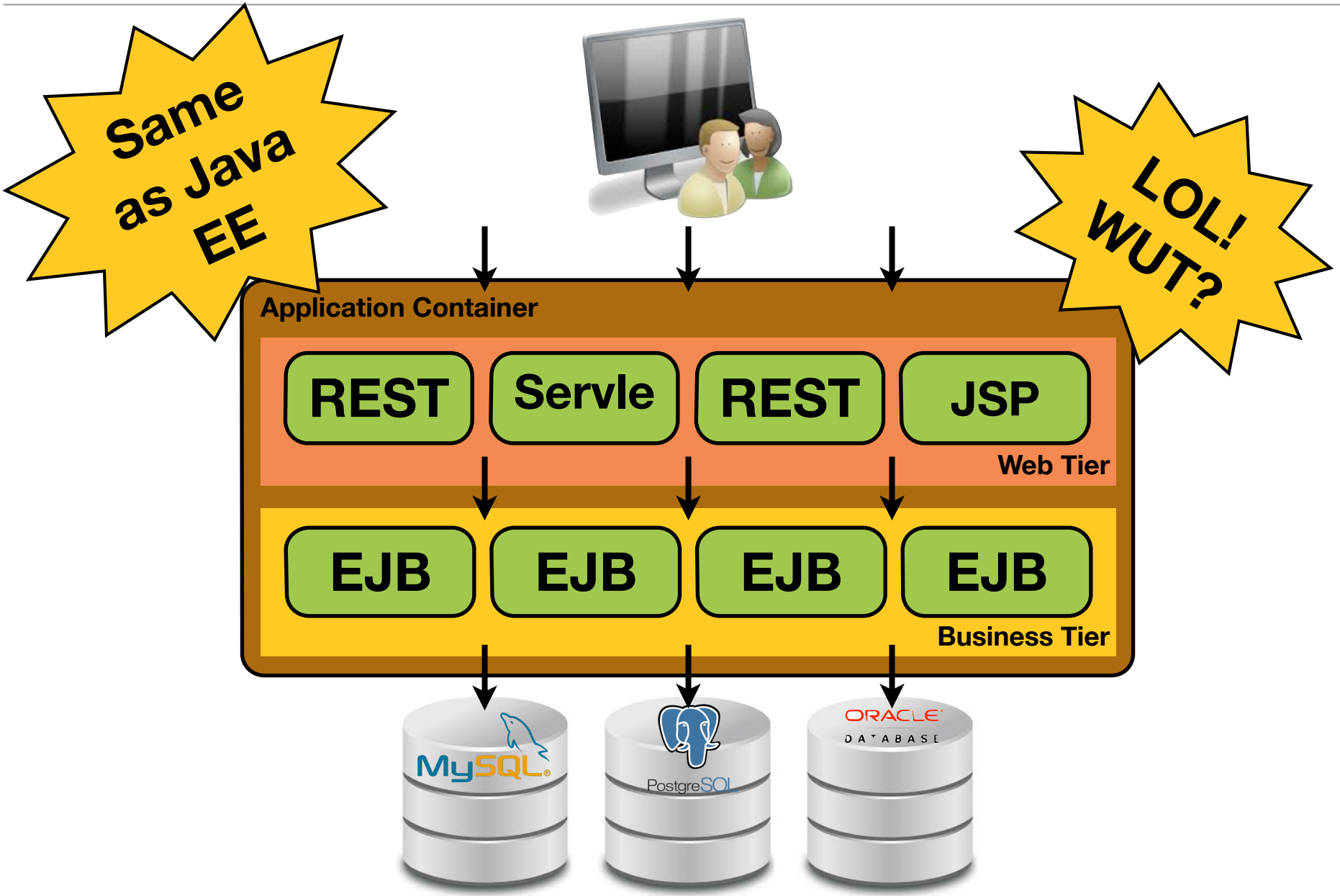

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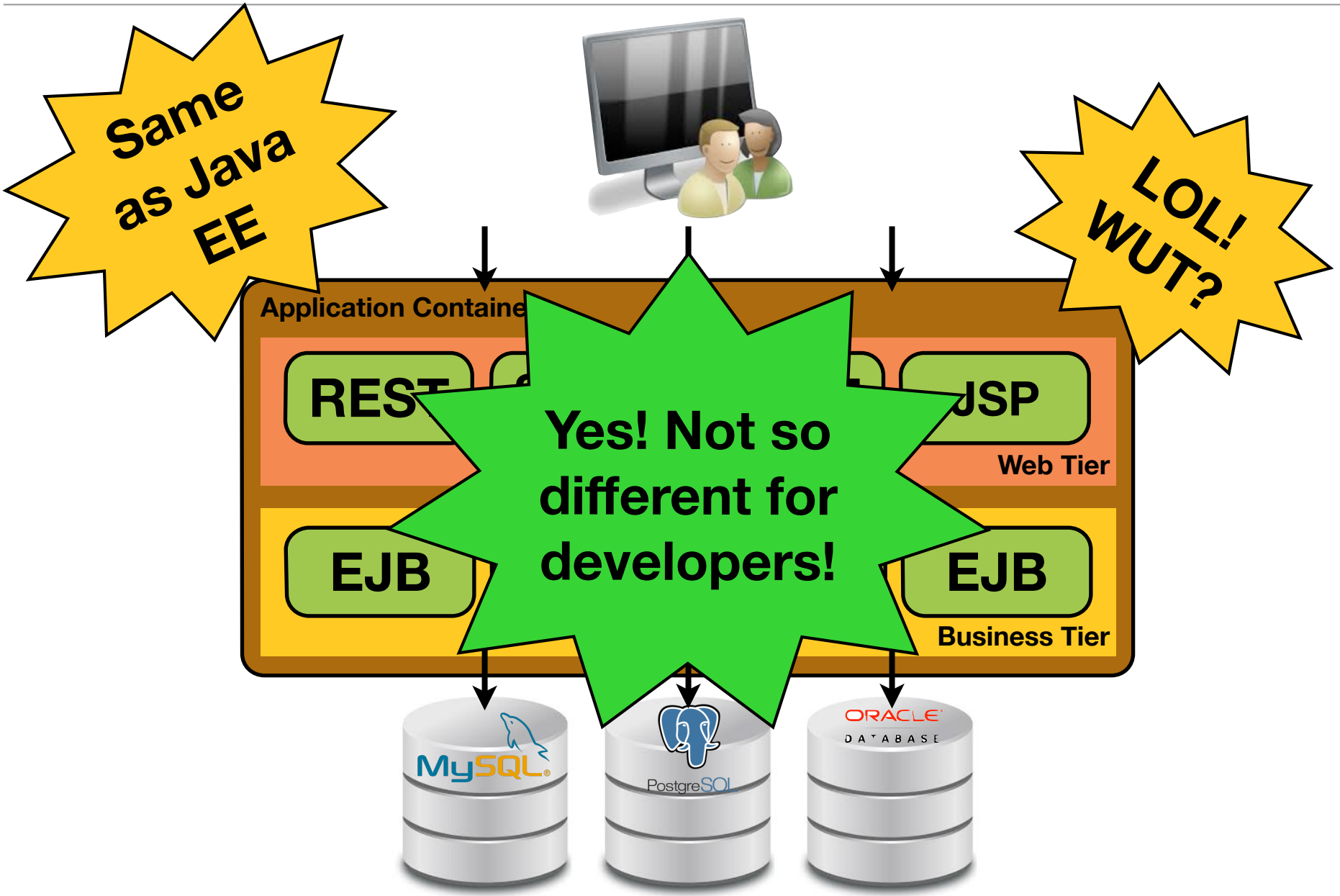

Mediated access

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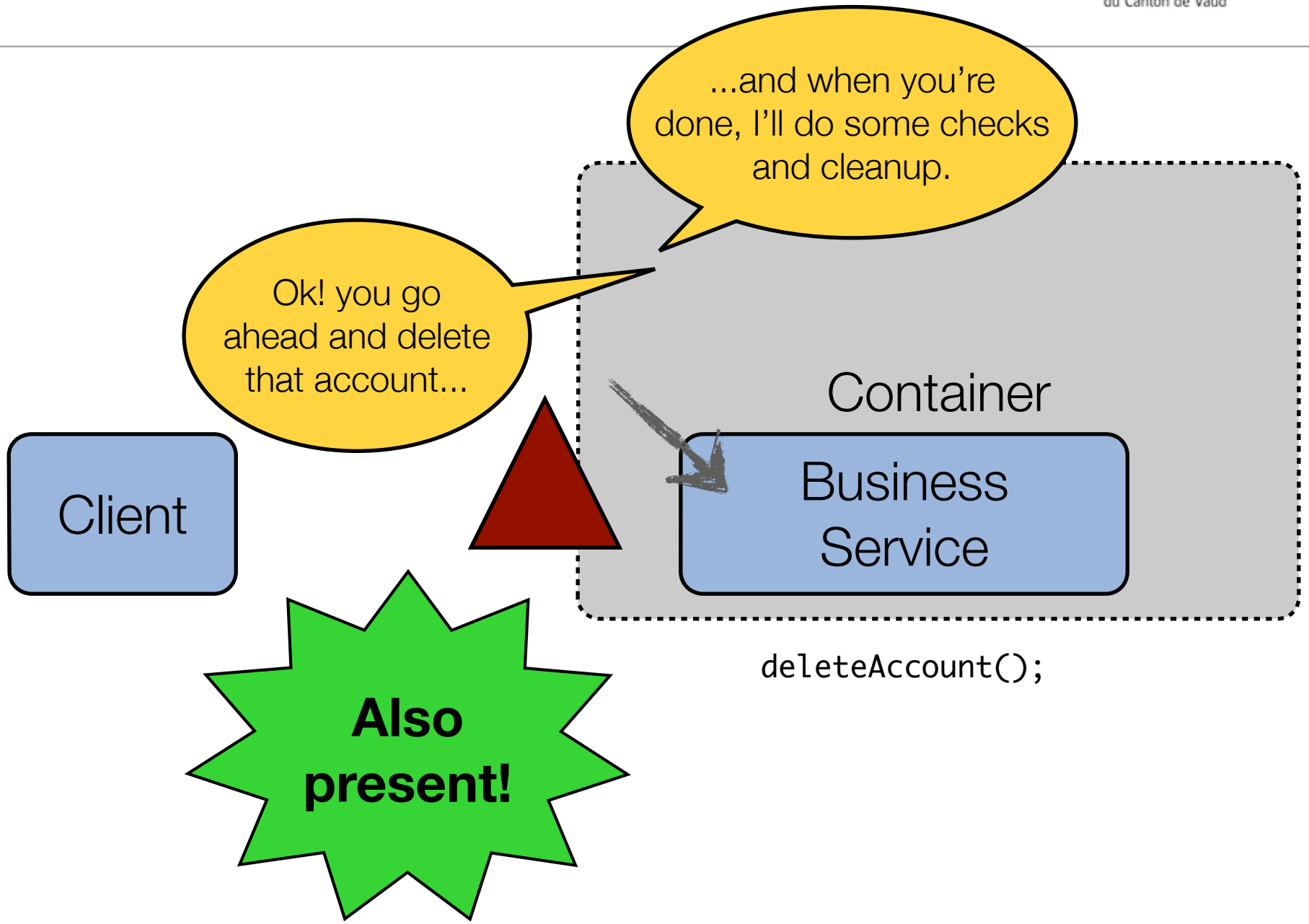

Why Spring Boot?

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- Java EE need new ideas to enrich his specs
- Developers love alternatives
- Spring Source is defacto a kind standard for various libraries (Spring Framework, Spring Security)
- Offers a lightweight way to develop Web applications
- Allows to integrate various technologies that are not necessary possible when we use Application Servers.
  - Glassfish: Jersey for REST APIs, cannot be changed
  - WildFly: RestEasy for REST APIs, cannot be changed
- Does not require to install and maintain an application server for the devs and ops.
- Really convenient to build POCs.

Spring Boot vs. Java EE

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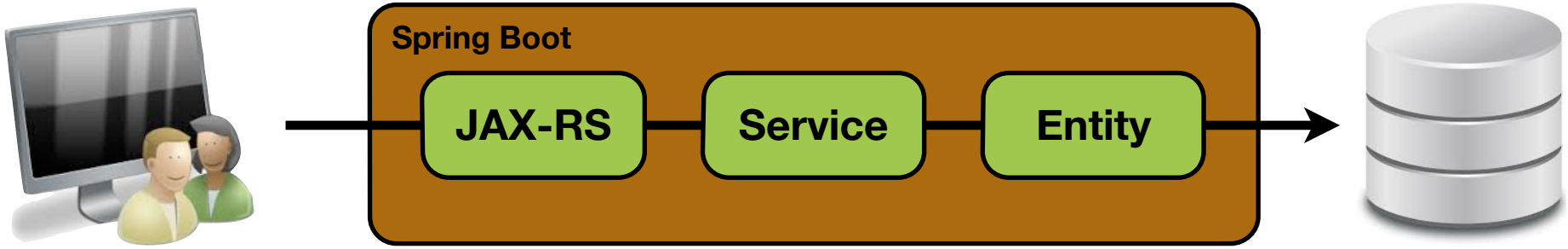
- Are they concurrent or complementary?
  - In fact, they play well together but that really depends what you are building.
  - Example: http://spring.io/blog/2014/11/23/bootiful-java-ee-support-in-spring-boot-1-2
  - Tons of code samples: https://github.com/spring-projects/spring-boot/tree/master/spring-boot-samples



Application example

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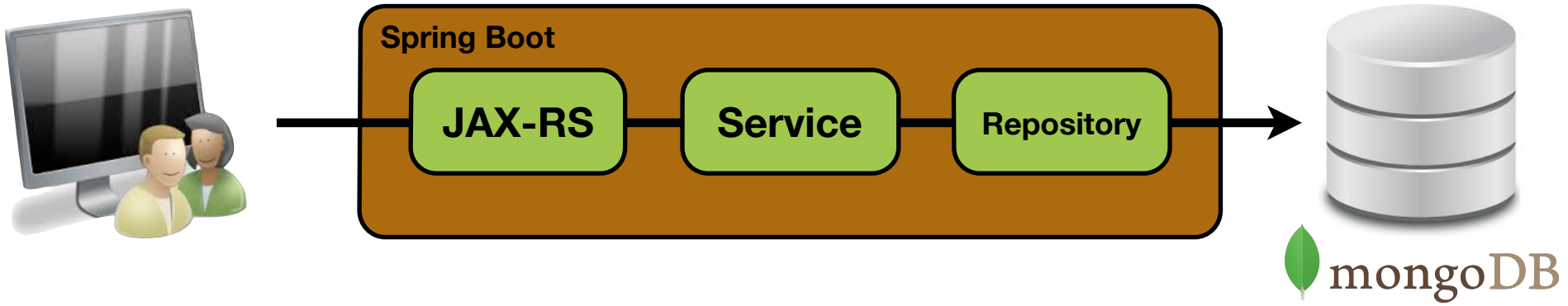

Entity in code

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```
package ch.heigvd.ptl.sc.model;

import org.springframework.data.annotation.Id;
import org.springframework.data.mongodb.core.mapping.DBRef;
import org.springframework.data.mongodb.core.mapping.Document;

@Document
public class User {
   public static enum Role {
    ADMIN,
    MEMBER
   }

   @Id
   private String id;

   private String username;

   private Role role;

   @DBRef
   private Address address;
}
```

Entity in code

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No more @Entity, welcome @Document specific for MongoDB but same purpose.

```
package ch.heigvd.ptl.sc.model;

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Entity in code

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No more @Entity, welcome @Document specific for MongoDB but same purpose.

Also an ID marker to be sure we have a sort of primary key...

```
package ch.heigvd.ptl.sc.model;

import org.springframework.data.annotation.Id;
import org.springframework.data.mongodb.core.mapping.DBRef;
import org.springframework.data.mongodb.core.mapping.Document;

@Document
public class User {
   public static enum Role {
    ADMIN,
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   @Id
   private Str

   private String username;

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No more way to constrain the length of the field.

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No more @Entity, welcome @Document specific for MongoDB but same purpose.

Also an ID marker to be sure we have a sort of primary key...

No more way to constrain the length of the field.

And no way to specify how is rendered an enum in the database.

Entity in code

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package ch.heigvd.ptl.sc.model;

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   private Address address;
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... but not the same package.

No more @Entity, welcome @Document specific for MongoDB but same purpose.

Also an ID marker to be sure we have a sort of primary key...

No more way to constrain the length of the field.

And no way to specify how is rendered an enum in the database.

A way to specify this object refers to another document in MongoDB.

Entity in code

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```
package ch.heigvd.ptl.sc.model;

import org.springframework.data.annotation.Id;

@Document
public class Address {
   @Id
   private String id;
   private String street;
   private String city;
   private int postalCode;
}
```

Entity in code

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No additional magic in this model. We retrieve the @Document and @Id markers.

```
package ch.heigvd.ptl.sc.model;

import org.springframework.data.annotation.Id;

@Document
public class Address {
   @Id
   private String id;
   private String street;
   private String city;
   private int postalCode;
}
```

Data Repository (Spring Data) in code

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```
package ch.heigvd.ptl.sc.persistence;

import ch.heigvd.ptl.sc.model.User;
import java.util.List;
import org.springframework.data.mongodb.repository.MongoRepository;

public interface UserRepository extends MongoRepository<User, String> {
   public List<User> findByUsername(String username);
}
```

Data Repository (Spring Data) in code

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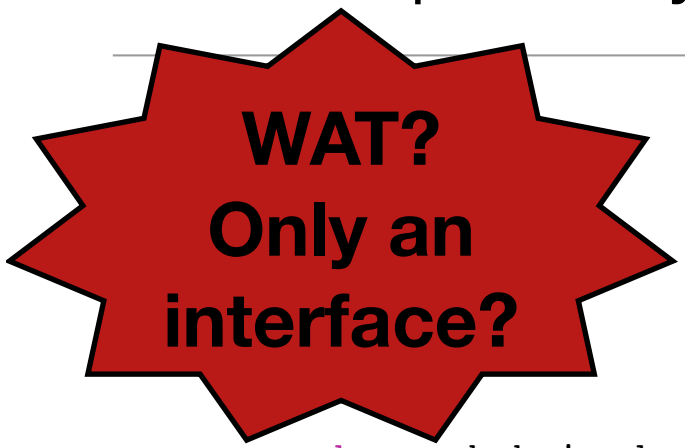


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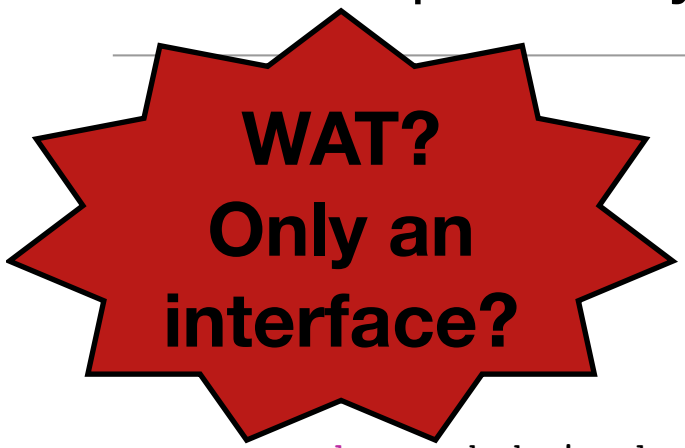


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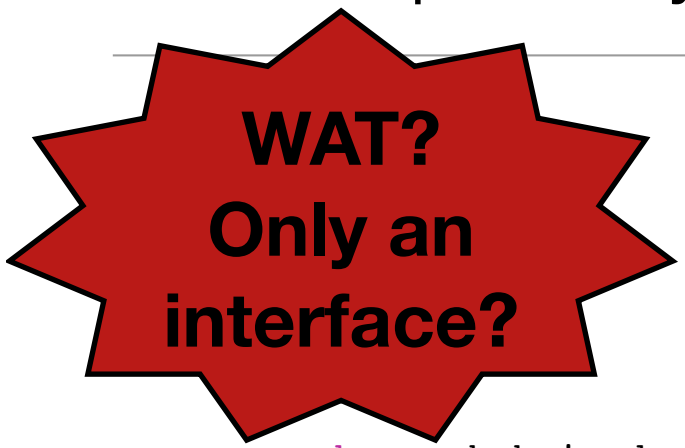


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public interface UserRepository extends MongoRepository<User, String> {
   public List<User> findByUsername(String username);
}
```

Service in code

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```
package ch.heigvd.ptl.sc.converter;

import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.to.UserTO;
import java.util.ArrayList;
import java.util.List;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;

@Service
public class UserConverter {
    @Autowired
    private AddressConverter addressConverter;

    public final List<UserTO> convertSourceToTarget(List<User> sources) { ... }
    public final UserTO convertSourceToTarget(User source) { ... }
    public final List<User> convertTargetToSource(List<UserTO> targets) { ... }
    public final User convertTargetToSource(UserTO target) { ... }

    public void fillTargetFromSource(UserTO target, User source) {
     target.setAddress(addressConverter.convertSourceToTarget(source.getAddress()));
     target.setUsername(source.getUsername());
     target.setRole(source.getRole().name());
    }

    public void fillSourceFromTarget(User source, UserTO target) {
     source.setAddress(addressConverter.convertTargetToSource(target.getAddress()));
     source.setUsername(target.getUsername());
    }
}
```

Service in code

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```
package ch.heigvd.ptl.sc.converter;

import ch.heigvd.ptl.sc.model.User;
import ch.heigv
import java.uti
import java.uti
import org.spri                                    utowired;
import org.spri

@Service
public class UserConverter {
    @Autowired
    private AddressConverter addressConverter;

    public final List<UserTO> convertSourceToTarget(List<User> sources) { ... }
    public final UserTO convertSourceToTarget(User source) { ... }
    public final List<User> convertTargetToSource(List<UserTO> targets) { ... }
    public final User convertTargetToSource(UserTO target) { ... }

    public void fillTargetFromSource(UserTO target, User source) {
     target.setAddress(addressConverter.convertSourceToTarget(source.getAddress()));
     target.setUsername(source.getUsername());
     target.setRole(source.getRole().name());
    }

    public void fillSourceFromTarget(User source, UserTO target) {
     source.setAddress(addressConverter.convertTargetToSource(target.getAddress()));
     source.setUsername(target.getUsername());
    }
}
```

Make sure that Spring plumbing see this class as a service that we can inject elsewhere in the application.

Service in code

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```
package ch.heigvd.ptl.sc.converter;

import ch.heigvd.ptl.sc.model.User;
import ch.heigv
import java.uti
import java.uti
import org.spri                                    utowired;
import org.spri

@Service
public class UserConverter {
    @Autowired
    private Addre  Converter addressConverter;

    public final List                                    ) { ... }
    public final User
    public final List                                    ) { ... }
    public final User

    public void fillTargetFromSource(UserTO target, User source) {
     target.setAddress(addressConverter.convertSourceToTarget(source.getAddress()));
     target.setUsername(source.getUsername());
     target.setRole(source.getRole().name());
    }

    public void fillSourceFromTarget(User source, UserTO target) {
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     source.setUsername(target.getUsername());
    }
}
```

Make sure that Spring plumbing see this class as a service that we can inject elsewhere in the application.

Spring will inject the corresponding service like we are used to with Java EE and @EJB annotation. This is something really similar.

Service in code

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```
package ch.heigvd.ptl.sc.converter;

import ch.heigvd.ptl.sc.model.User;
import ch.heigv
import java.uti
import java.uti
import org.spri                                    utowired;
import org.spri

@Service
public class UserConverter {
    @Autowired
    private Addre  Converter addressConverter;

    public final List                                  ) { ... }
    public final User
    public final List                                  ) { ... }
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    public void fillTargetFromSource(UserTO target, User source) {
     target.setAddress(addressConverter.convertSourceToTarget(source.getAddress()));
     target.setUsername(source.getUsername());
     target.setRole(source.getRole().name());
    }

    public void fillSourceFromTarget(User source, UserTO target) {
     source.setAddress(addressConverter.convertTargetToSource(target.getAddress()));
     source.setUsern me());
    }
}
```

Make sure that Spring plumbing see this class as a service that we can inject elsewhere in the application.

Spring will inject the corresponding service like we are used to with Java EE and @EJB annotation. This is something really similar.

We use the @Autowired service injected by Spring.

One more Service in code

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```
package ch.heigvd.ptl.sc.service;

import ch.heigvd.ptl.sc.converter.UserConverter;
import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.persistence.UserRepository;
import ch.heigvd.ptl.sc.to.UserTO;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;

@Service
public class UserService {
   @Autowired
   private UserConverter userConverter;

   @Autowired
   private UserRepository userRepository;

   public User register(UserTO userTO) {
    User user = userConverter.convertTargetToSource(userTO);

    user.setRole(User.Role.MEMBER);

    return userRepository.save(user);
   }
}
```

One more Service in code

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```
package ch.heigvd.ptl.sc.service;

import ch.heigvd.ptl.sc.converter.UserConverter;
import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.persistence.UserRepository;
import ch.heigvd.ptl.sc.to.UserTO;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;

@Service
public class UserService {
   @Autowired
   private UserConverter userConverter;

   @Autowired
   private UserRepository userRepository;

   public User register(UserTO userTO) {
    User user = userConverter.convertTargetToSource(userTO);

    user.setRole(User.Role.MEMBER);

    return userRepository.save(user);
   }
}
```

Again, Spring will inject the required services.

One more Service in code

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```
package ch.heigvd.ptl.sc.service;

import ch.heigvd.ptl.sc.converter.UserConverter;
import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.persistence.UserRepository;
import ch.heigvd.ptl.sc.to.UserTO;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;

@Service
public class UserService {
   @Autowired
   private UserConverter userConverter;

   @Autowired
   private UserRepository userRepository;

   public User register(UserTO userTO) {
    User user = userConverter.convertTargetToSource(userTO);

    user.setRole(User.Role.MEMBER);

    return userRepository.save(user);
   }
}
```

Again, Spring will inject the required services.

We can process additional business logic.

JAX-RS in code

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```
package ch.heigvd.ptl.sc.rest;

import ch.heigvd.ptl.sc.converter.UserConverter;
import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.service.UserService;
import ch.heigvd.ptl.sc.to.UserTO;
import javax.ws.rs.Consumes;
import javax.ws.rs.POST;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.MediaType;
import javax.ws.rs.core.Response;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Component;

@Component
@Path("/users")
public class UserResource {
  @Autowired
  private UserService userService;

  @Autowired
  private UserConverter userConverter;

  @POST
  @Produces(MediaType.APPLICATION_JSON)
  @Consumes(MediaType.APPLICATION_JSON)
  public Response register(UserTO userTO) {
    User user = userService.register(userTO);

    return Response.ok(
      userConverter.convertSourceToTarget(user)
    ).status(201).build();
  }
}
```

JAX-RS in code

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```
package ch.heigvd.ptl.sc.rest;

import ch.heigvd.ptl.sc.converter.UserConverter;
import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.service.UserService;
import ch.heigvd.ptl.sc.to.UserTO;
import javax.ws.rs.Consumes;
import javax.ws.rs.POST;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.MediaType;
import javax.ws.rs.core.Response;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Component;

@Component
@Path("/users")
public class UserResource {
  @Autowired
  private UserService userService;

  @Autowired
  private UserConverter userConverter;

  @POST
  @Produces(MediaType.APPLICATION_JSON)
  @Consumes(MediaType.APPLICATION_JSON)
  public Response register(UserTO userTO) {
    User user = userService.register(userTO);

    return Response.ok(
      userConverter.convertSourceToTarget(user)
    ).status(201).build();
  }
}
```

@Component annotation is required to let Spring managing the Resource for injections.

JAX-RS in code

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```
package ch.heigvd.ptl.sc.rest;

import ch.heigvd.ptl.sc.converter.UserConverter;
import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.service.UserService;
import ch.heigvd.ptl.sc.to.UserTO;
import javax.ws.rs.Consumes;
import
import
import
import javax.ws.rs.core.MediaType;
import javax.ws.rs.
import org.springfr
import org.springfr

@Component
@Path("/users")
public class UserResource {
  @Autowired
  private UserService userService;

  @Autowired
  private UserConverter userConverter;

  @POST
  @Produces(MediaType.APPLICATION_JSON)
  @Consumes(MediaType.APPLICATION_JSON)
  public Response register(UserTO userTO) {
    User user = userService.register(userTO);

    return Response.ok(
      userConverter.convertSourceToTarget(user)
    ).status(201).build();
  }
}
```

@Component annotation is required to let Spring managing the Resource for injections.

Nothing different than Java EE as we use JAX-RS which is a standard.

JAX-RS in code

heig-vd
Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

```
package ch.heigvd.ptl.sc.rest;

import ch.heigvd.ptl.sc.converter.UserConverter;
import ch.heigvd.ptl.sc.model.User;
import ch.heigvd.ptl.sc.service.UserService;
import ch.heigvd.ptl.sc.to.UserTO;
import javax.ws.rs.Consumes;
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public class UserRes
  @Autowired
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  private Us

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Method register will be called when we do a post on /users

JAX-RS in code

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Method register will be called when we do a post on /users

Consumes and **Produces** will define what is accepted as a representation format and what will be rendered as a response.

JAX-RS in code

heig-vd
Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

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import javax.ws.rs.POST;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.MediaType;
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import org.springframework.beans.factory.annotation.Autowired;
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    ).status(201).build();
  }
}
```

Request
POST /users HTTP/1.1
Content-Type: application/json

```
{
  “username”: “fuubar”,
  “address”: {
    “street”: “Somewhere”,
    “city”: “Elsewhere”,
    “postalCode”: 1337
  }
}
```

Response
Content-Type: application/json

```
{
  “username”: “fuubar”,
  “role”: “MEMBER”,
  “address”: {
    “street”: “Somewhere”,
    “city”: “Elsewhere”,
    “postalCode”: 1337
  }
}
```

JAX-RS in code

heig-vd
Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

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}
```

Magic happens there between **JAX-RS** (and the **Jersey** implementation with **Jackson**) and the container.

Once everything is correctly configured, serialization and deserialization is mainly done automatically.

JAX-RS in code

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Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

```java
package ch.heigvd.ptl.sc.rest;

import ch.heigvd.ptl.sc.converter.UserConverter;
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import ch.heigvd.ptl.sc.to.UserTO;
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}
```

Magic happens there between **JAX-RS** (and the **Jersey** implementation with **Jackson**) and the container.

Once everything is correctly configured, serialization and deserialization is mainly done automatically.

Same for the response.

JAX-RS Plumbing

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du Canton de Vaud

```
package ch.heigvd.ptl.sc;

import ch.heigvd.ptl.sc.rest.UserResource;
import javax.ws.rs.ApplicationPath;
import org.glassfish.jersey.server.ResourceConfig;
import org.springframework.stereotype.Component;

@Component
@ApplicationPath("/api")
public class JerseyConfig extends ResourceConfig {
  public JerseyConfig() {
    register(UserResource.class);
  }
}
```

JAX-RS Plumbing

heig-vd
Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

```
package ch.heigvd

import ch.heigvd.
import javax.ws.rs
import org.glassf
import org.springf

@Component
@ApplicationPath("/api")
public class JerseyConfig extends ResourceConfig {
  public JerseyConfig() {
    register(UserResource.class);
  }
}
```

Well, we define the base path for the all the resource that will be managed by this application class.

In this our example, the user resource will finally be available under /api/users.

JAX-RS Plumbing

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Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

```
package ch.heigvd

import ch.heigvd.
import javax.ws.r
import org.glassf
import org.spring

@Component
@ApplicationPath("/api")
public class JerseyConfig extends ResourceConfig {
  public JerseyConfig() {
    register(UserResource.class);
  }
}
```

Well, we define the base path for the all the resource that will be managed by this application class.

In this our example, the user resource will finally be available under /api/users.

We simply add the user resource class to the set of classes managed by this application.

Therefore, you can imagine having two different REST applications using the same resources.

REMARK: HTTP 404 -> Resource class probably missing there!

JAX-RS Plumbing

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We need to inform Spring to manage that configuration. Otherwise, no REST resources will be available once the app is started.

Well, we define the base path for the all the resource that will be managed by this application class.

In this our example, the user resource will finally be available under /api/users.

```
heigvd

eigvd.
x.ws.r
glassf
spring
```

```
@Component
@ApplicationPath("/api")
public class JerseyConfig extends ResourceConfig {
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We simply add the user resource class to the set of classes managed by this application.

Therefore, you can imagine having two different REST applications using the same resources.

REMARK: HTTP 404 -> Resource class probably missing there!

Spring Boot main application

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Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

```
package ch.heigvd.ptl.sc;

import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.boot.builder.SpringApplicationBuilder;
import org.springframework.boot.context.web.SpringBootServletInitializer;

@SpringBootApplication
public class SampleApplication extends SpringBootServletInitializer {
  @Override
  protected SpringApplicationBuilder configure(SpringApplicationBuilder application) {
    return application.sources(SampleApplication.class);
  }

  public static void main(String[] args) {
    new SampleApplication().configure(
      new SpringApplicationBuilder(SampleApplication.class)
    ).run(args);
  }
}
```

Spring Boot integrations

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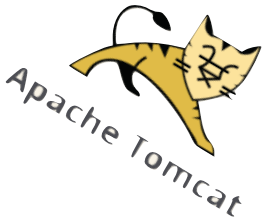
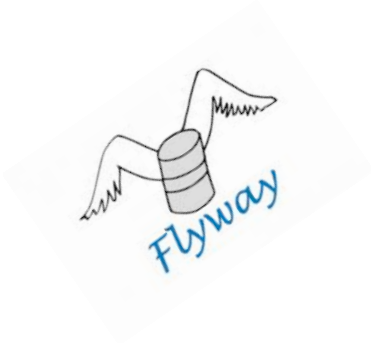
du Canton de Vaud





Spring Boot in summary

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Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud

- Brings the power of Spring Framework and related libraries
- Offers code infrastructure to easily develop and deploy
- Various integrations
- Nothing really new for the core technologies (services, persistence, ...)
- Production ready tools embedded (metrics, health, configuration, ...)
- Big community around Spring technologies
- Not specific to application servers