Spring Framework:

Framework for building Java Applications

Simpler and lightweight alt to J2EE

Early version of J2EE complex object management

Multiple deployment descriptors

Multiple interface

Poor Performance

Rod Johnson

Lightweight Object management tool : Object Factory/Bean Factory/Application Context

Spring :

=> highly Modular

=> Independent to be used : loose coupling among modules

=> Java POJOs : Lightweight dev process

Relationship among resources of Spring application

1. IoC : Inversion of control
2. DI : Dependency Injection
3. AOP : Aspect Oriented Programming (proxy)

Modules

- Core Container : Bean Factory
- Web Layer : MVC Framework
- Data Access Module : JDBC/ORM/Transaction
- Infra : AOP/Messaging
- Testing : JUnit/Mocking

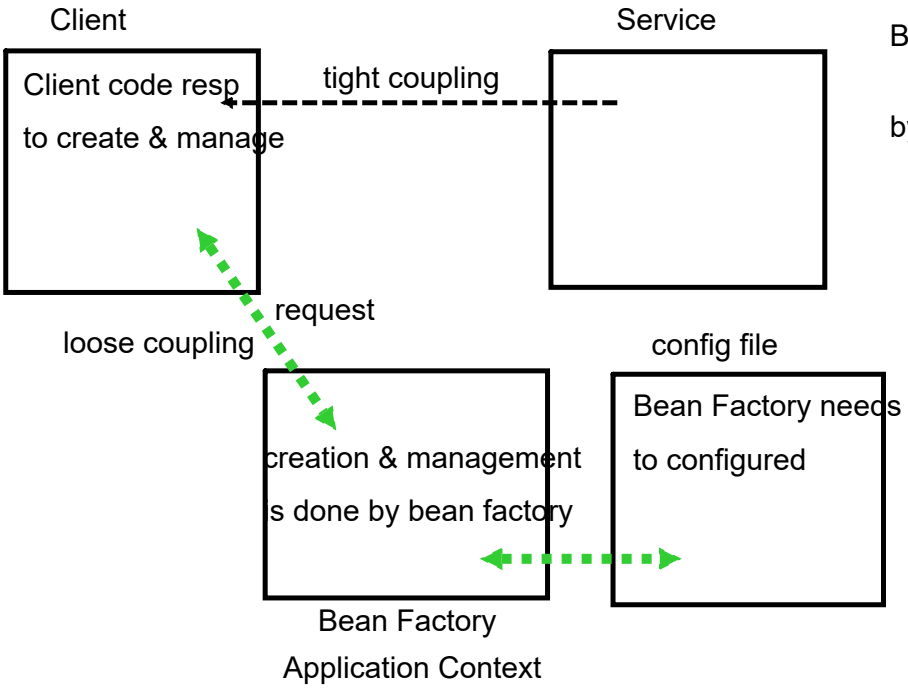
Spring Projects:

- Spring Data
- Spring Cloud
- Spring security
- WebFlux

1. IoC : Inversion of Control

Outsourcing the Creation and Management of Object :

Object Factory/Bean Factory



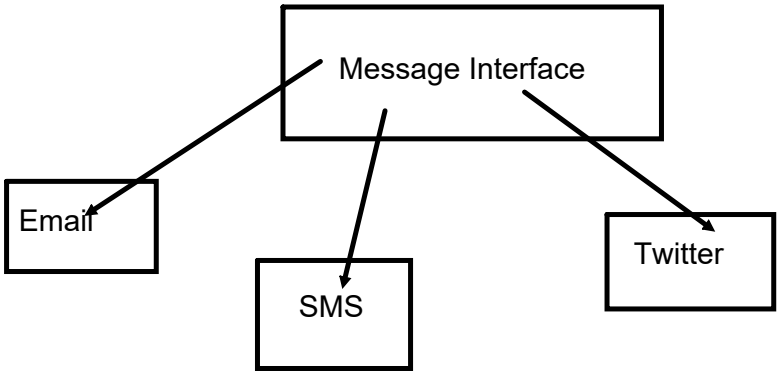
Beans :

Objects managed by spring containers

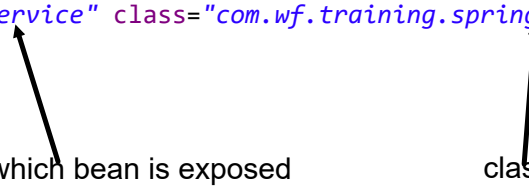
Spring Jar files : https://repo.spring.io/release/org/springframework/spring/

Configuration of Bean Factory

1. XML based config (legacy)
2. Annotations
3. Pure Java Code



```
<bean id="mservice" class="com.wf.training.spring.service.EmailService">
```



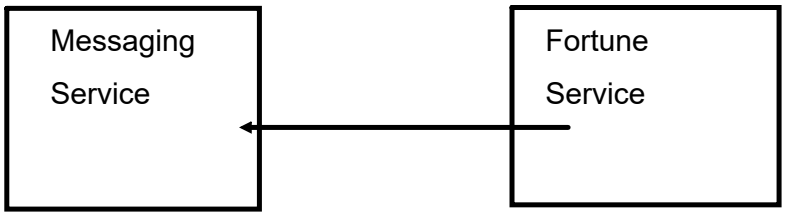
DI : Dependency Injection

Creation of complex object might have dependency on other object :

injecting those dependency with the help of Spring Container

XML based config:

1. Constructor based
2. Setter based



literal values should not be integrated in config file

==> property file to keep the literal values

KEY - VALUE PAIRS

Referred by SpEL

Scope of Beans

Default scope : Singleton

Only one instance which shared among all calls

Scope possibility :

singleton

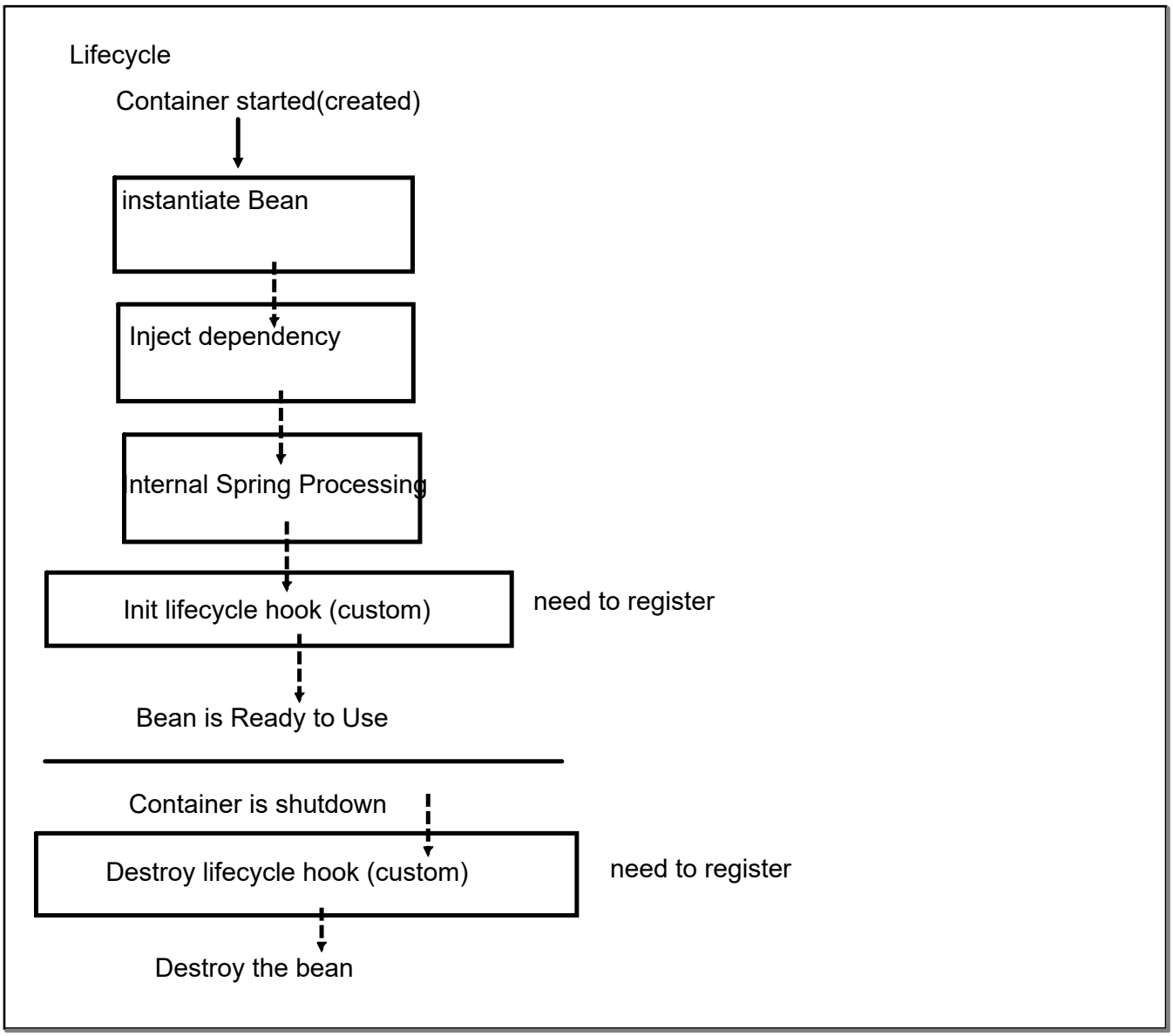
prototype : a new bean would be created

Web Context :

request

session

global-session

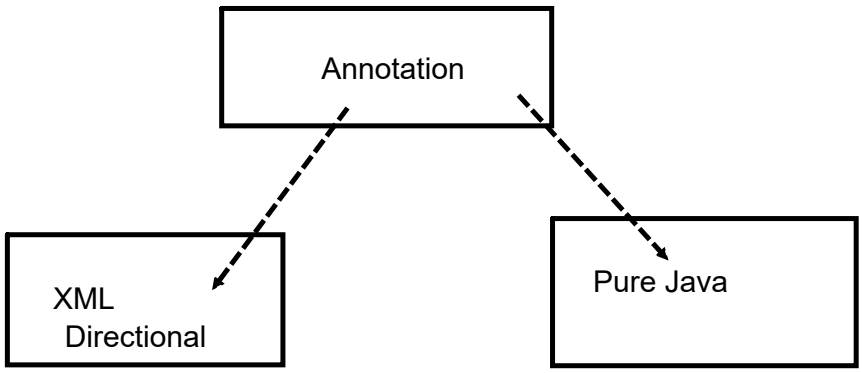

Lifecycle
Container started(created)
instantiate Bean
Inject dependency
nternal Spring Processing
Init lifecycle hook (custom)
need to register
Bean is Ready to Use
Container is shutdown
Destroy lifecycle hook (custom)
need to register
Destroy the bean

Life cycle hook method

1. any name
2. any access modifier
3. not static
4. they may return values but can't capture
5. No parameter

Prototype : Spring container does not maintain lifecycle

Annotation based config



@Component : informing spring to create and manage bean of that class

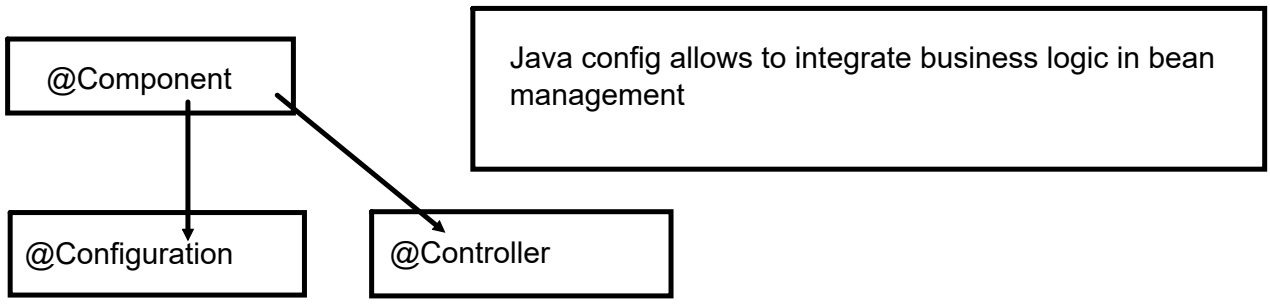
Every bean must be exposed by an id (Class name (with first char small) is default id)

Annotation based DI

1. Constructor
2. Setter
3. Field

Java Based Configuration

XML file is replaced by a Java Config



Developing Web Based Application using Spring Framework

spring web-mvc

spring-core

Spring also uses Servlet-API (Servlet Spec)

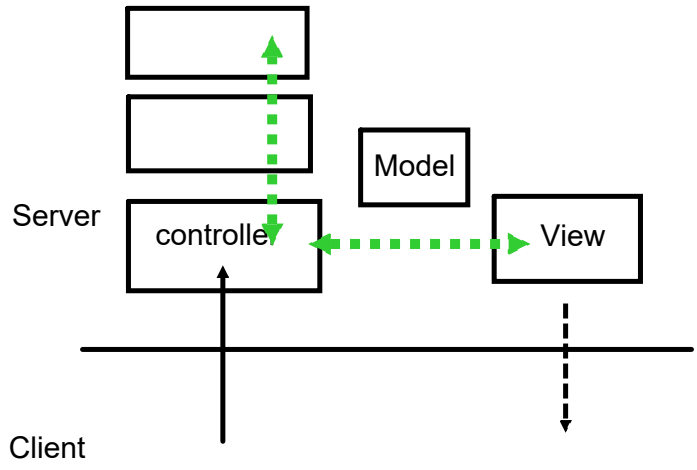
spring container

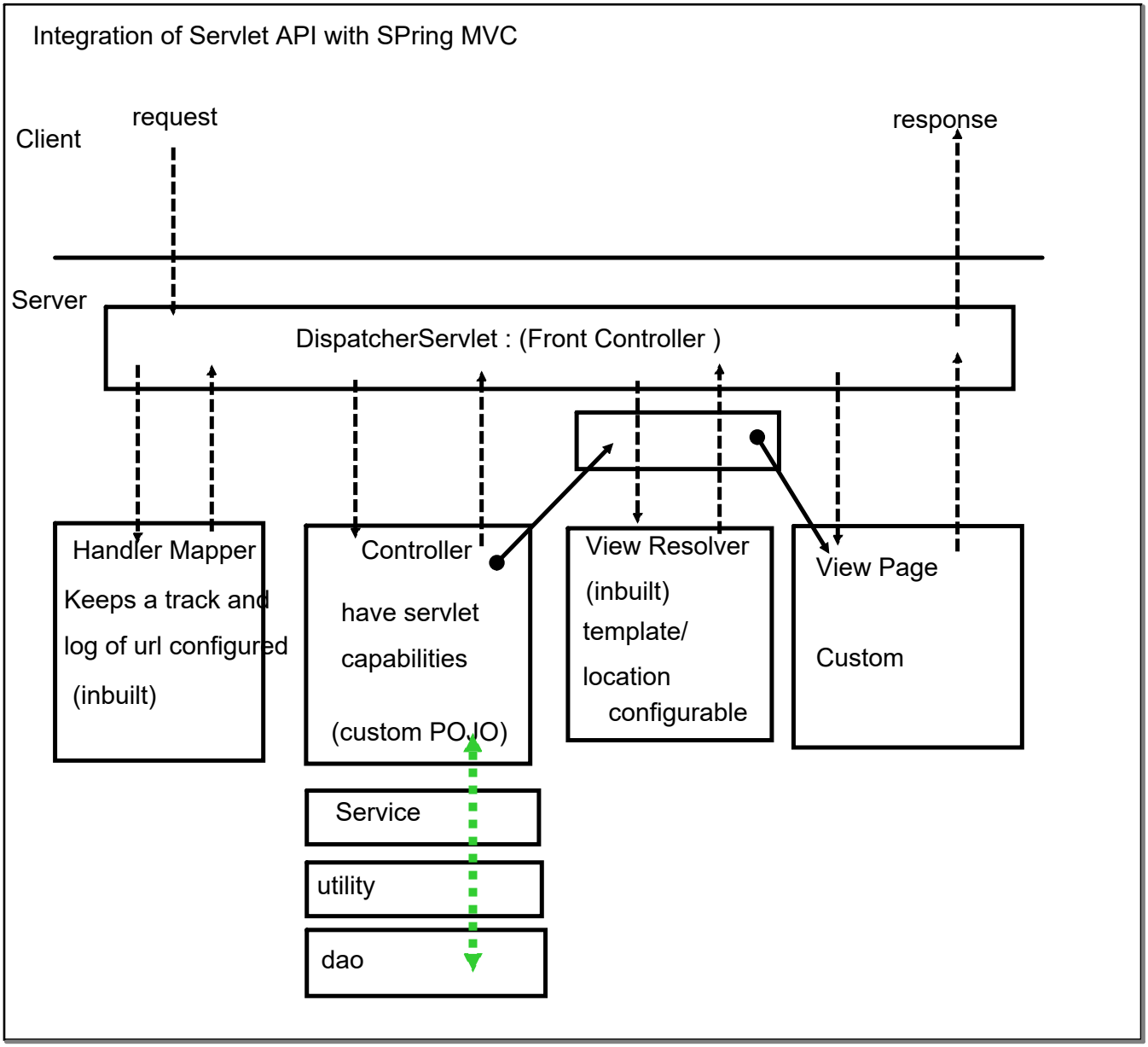
highly abstraction : POJOs

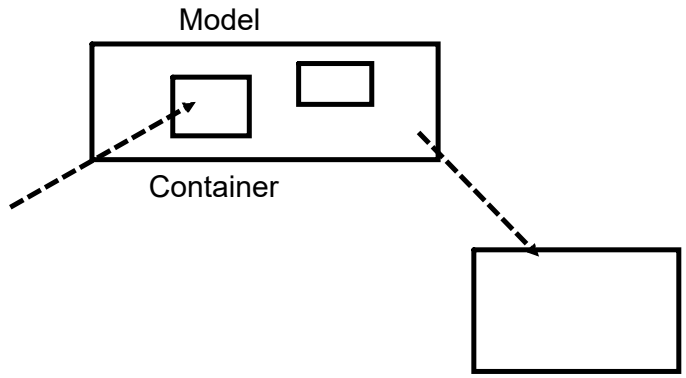
Spring Web : MVC Design Pattern

Servlet API :

Strictly exposes the MVC : standardized, uniform




Integration of Servlet API with SPring MVC
Client
request
response
Server
DispatcherServlet : (Front Controller)
Handler Mapper
Keeps a track and
log of url configured
(inbuilt)
Controller
have servlet
capabilities
(custom POJO)
View Resolver
(inbuilt)
template/
location
configurable
View Page
Custom
Service
utility
dao



Spring MVC:

Multiple View Templates :

Traditional Default : JSP + JSTL (lib added for jsp+jstl)

- Thymeleaf
- FreeMarker
- Tiles
- Velocity
- Mustache

Two configurations

1. Servlet API based : Need register and configure the Dispatcher Servlet
2. Spring config for that servlet, helpers for servlet
   xml file needs to tightly binded with servlet
   naming convention : <servlet-name>-servlet.xml

eg:

dispatcher-servlet.xml

View Resolver : Creating and exposing a bean of View Resolver

Controller revert back : Name of view page

eg: "my-view"

/WEB-INF/views/my-view.jsp

URL Mapping must be unique across the application

Class level URL Mapping can be done

Multiple Urls mapped to same method

Default mapping

Fallback

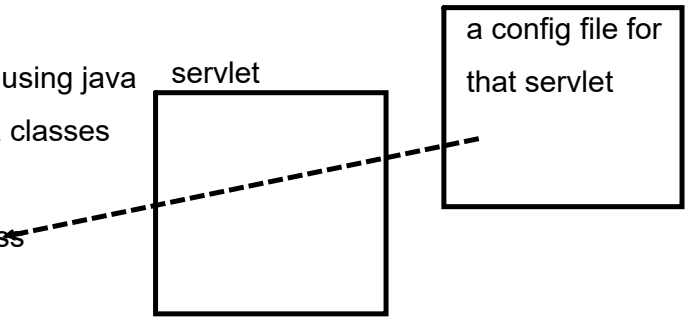
@RequestMapping() maps all http verbs by default (GET/POST/PUT/DELETE)

Spring Web MVC project configured using java

XML files would be replaced by Java classes

web.xml : Java class

dispatcher-servlet.xml : Java class



web.xml ~

Register the DS : inherit a spring framework class

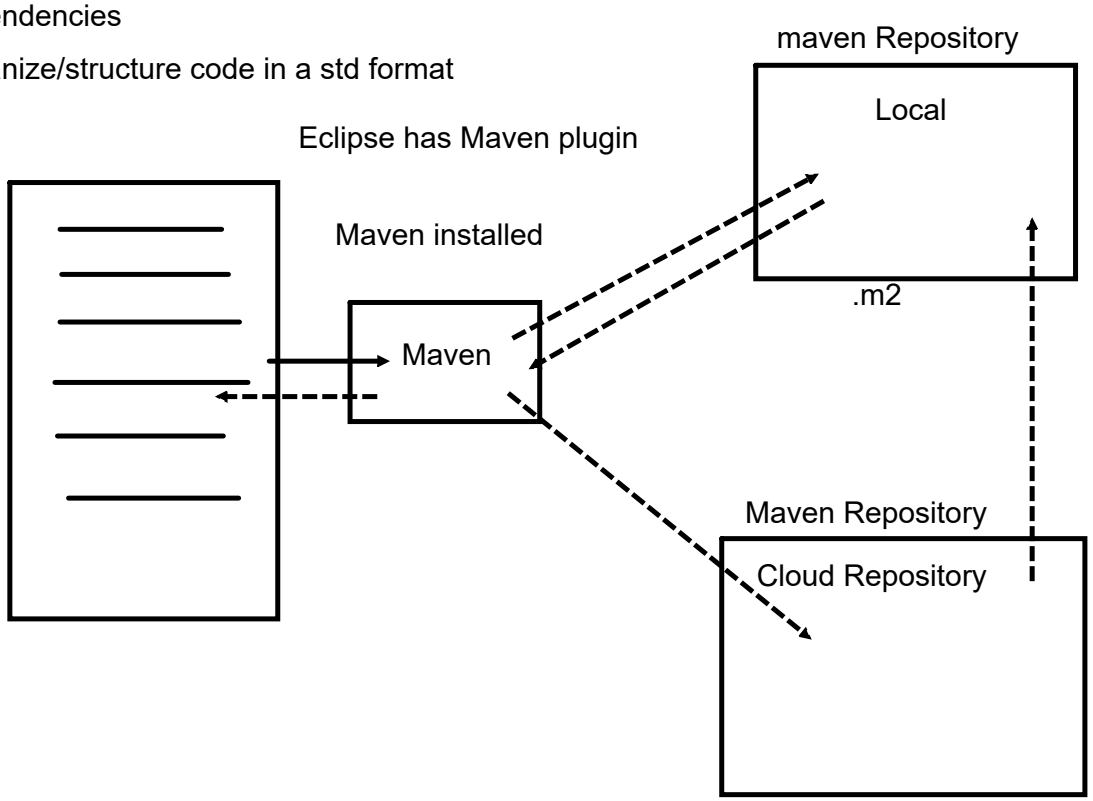
Other config to be done by overriding the abstract method

Traditional way : jar file management

Tools Project Management Tools

Ant, Gradle, Maven

1. dependencies
2. Organize/structure code in a std format



Each Maven Project is identified by GAV coordinates

GROUP : organisation (reverse domain)

Artifact ID : project name

Version : version of project

Dependency:

1. spring webmvc
2. servlets
3. jsp

plugin :

maven war plugin

maven webapp archetype project
changed java 1.5 to 1.8
added the Server Runtime Support
Added maven dependency
deleted the web.xml
add maven war plugin

Forms in Spring

Spring provides library that exposes tags for form handling

Spring Form tags :

It can be mapped with Model Object

Inherent Security : CSRF attack

Validation

Client Side : Javascript

Server Side :

Java Validation API: Validate the java object

Just a spec (interfaces) but no implementation is there

Most Popular implementation : Hibernate validators (not ORM)

Native JAva Validation API :

Implementation Annotation not recommended : prevent vendor locking

Added dependency hibernate validator
Decorated the model flds with validation annotation
Need to tell spring to validate and get the result
need to check the result and decide
show the message

Model classes shall not use
the primitive type
wrapper types

data ----------> String

1. eg _____First_____

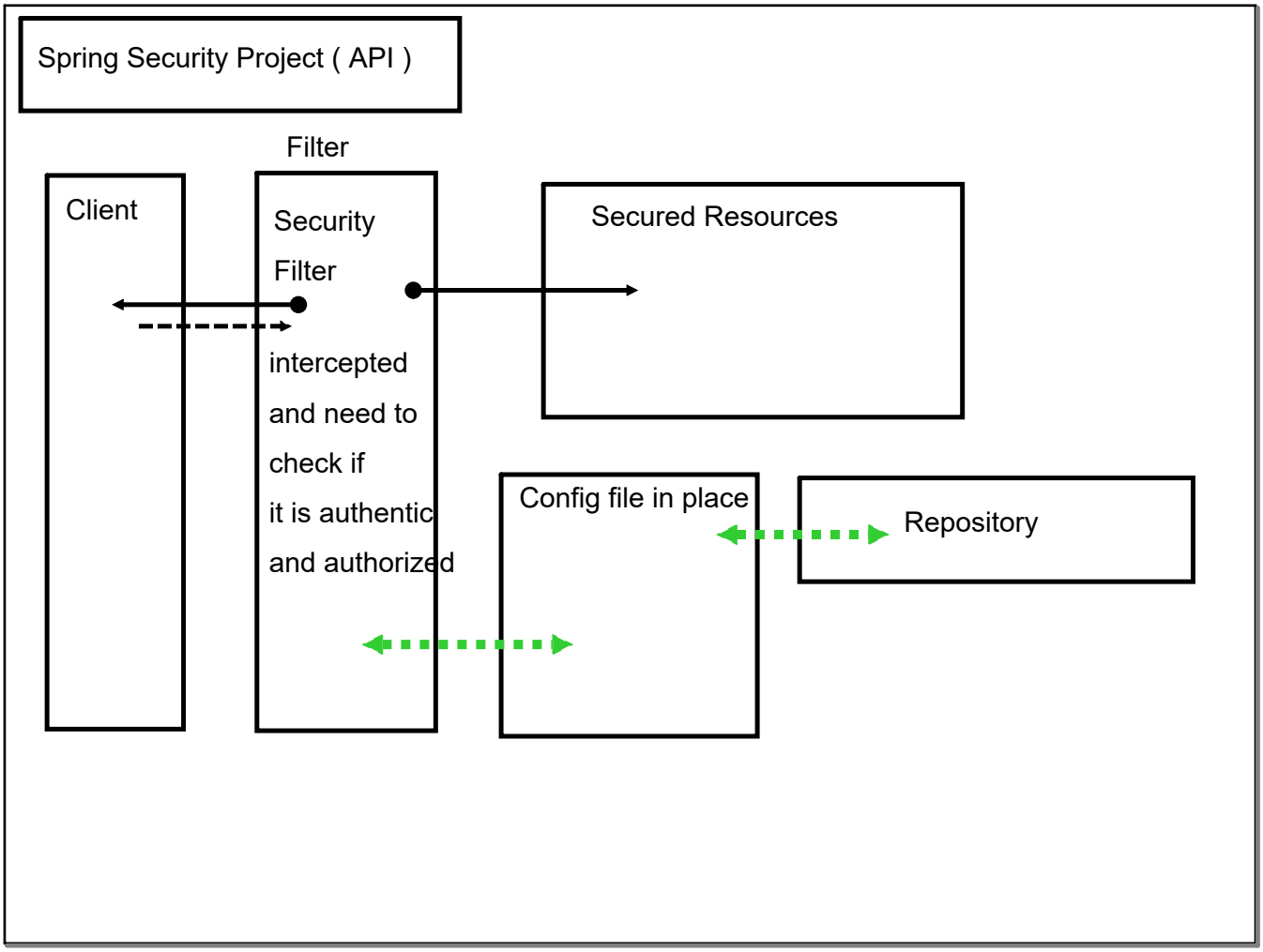
2. Empty string : NULL

proxy method

Custom Validation Annotation

Create an annotation

interface

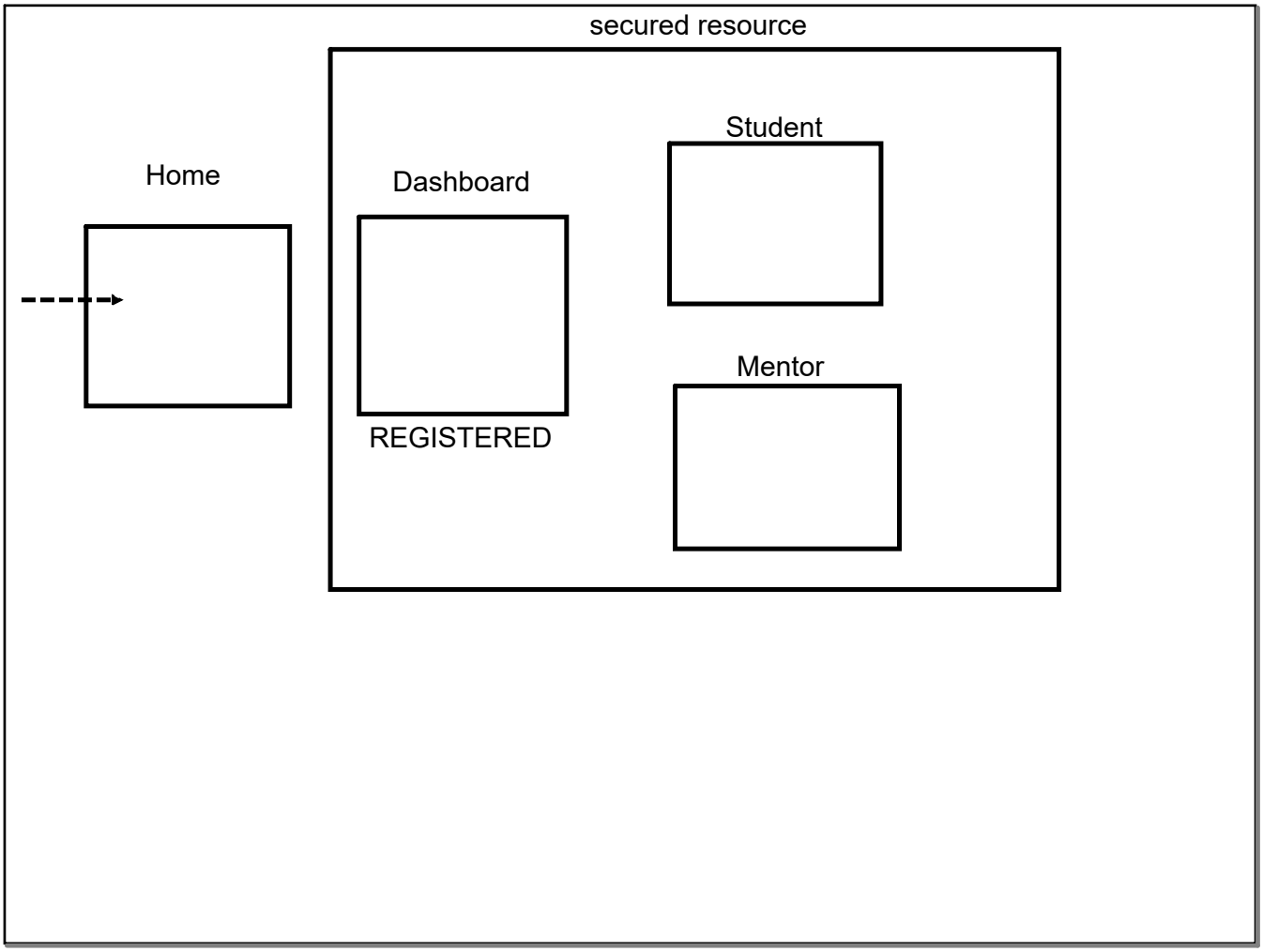

Spring Security Project (API)
Filter
Client
Security
Filter
Secured Resources
intercepted
and need to
check if
it is authentic
and authorized
Config file in place
Repository

Confirmation of all these are through config file

1. if request is not of secured resource, direct access

2. is for secured resource : filter exposes a login form (inbuilt login form provided by spring security API)

3. Credential submission is confirmed by config file, reverted back to filter


secured resource
Home
Dashboard
REGISTERED
Student
Mentor

Dependency :

spring-security-web (filter)

spring-security-config (add config)

spring-security-taglibs

1. Initialize the security Filter

Authentication an take place in three different ways

1. httpbasic : instruct the browser to generate a login dialog-box (not-recommended)
2. formlogin : (default) default login form / customization
3. basicauth: Token based (Data-driven) REST APIs (Stateless)

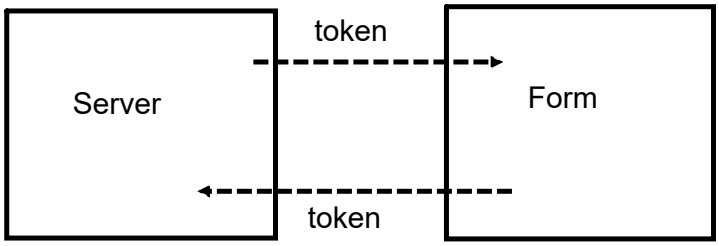
in case of bad credentials /custom-login?error

Spring form : CSRF attack

spring form : token system

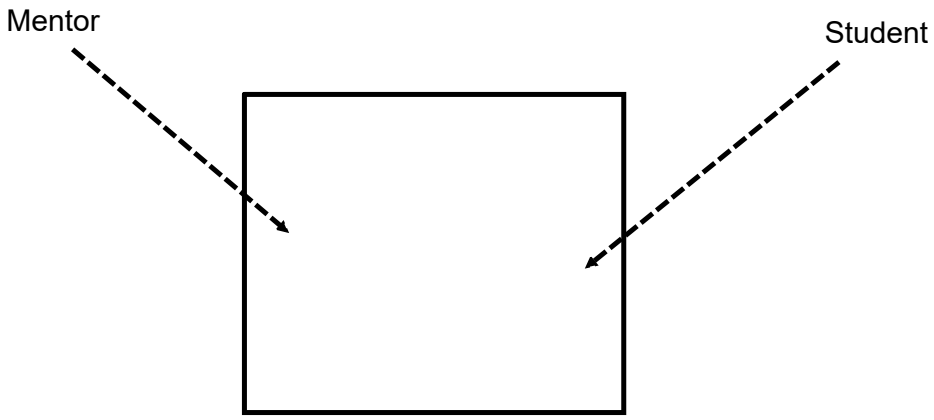
+

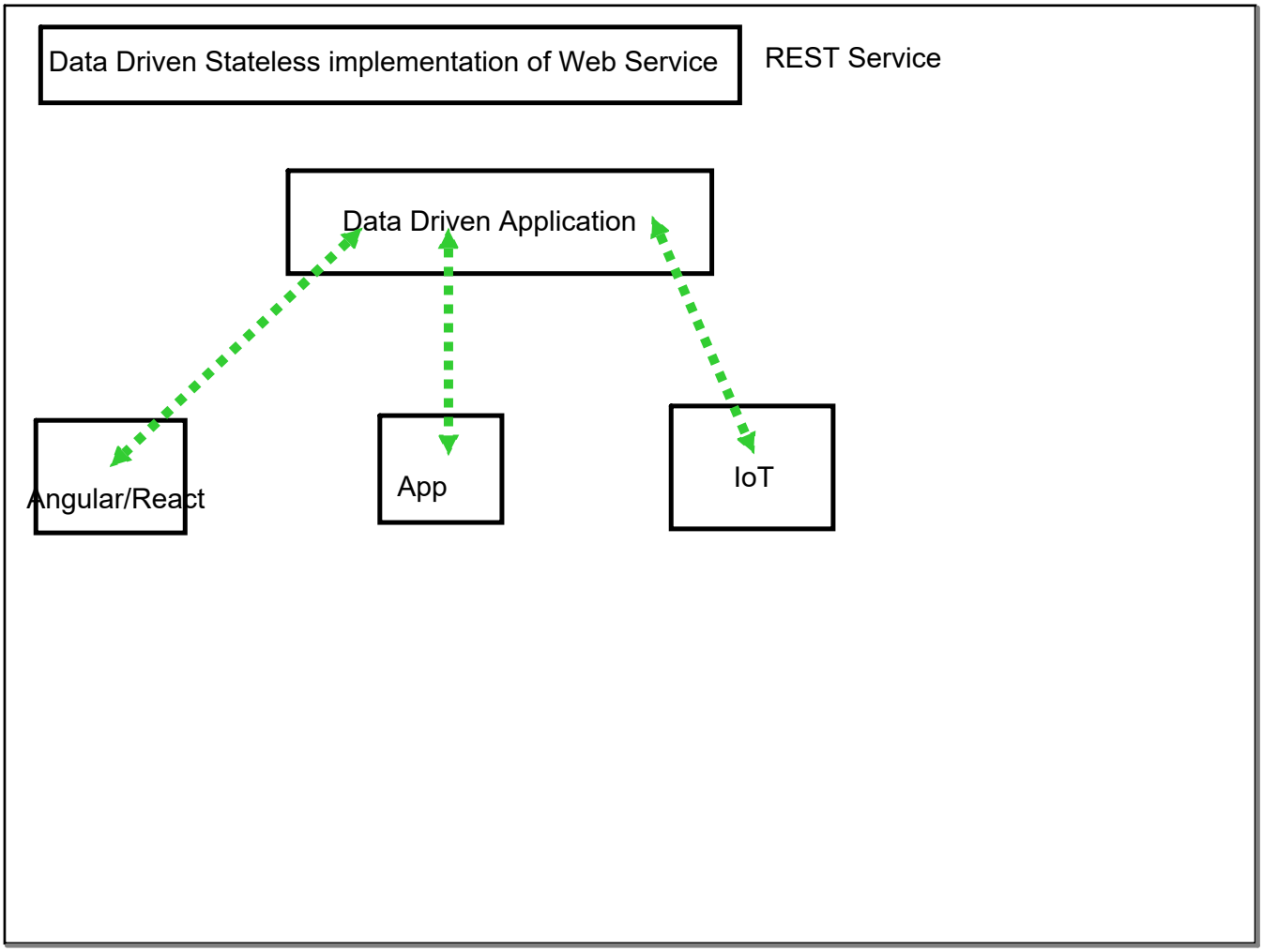
spring security

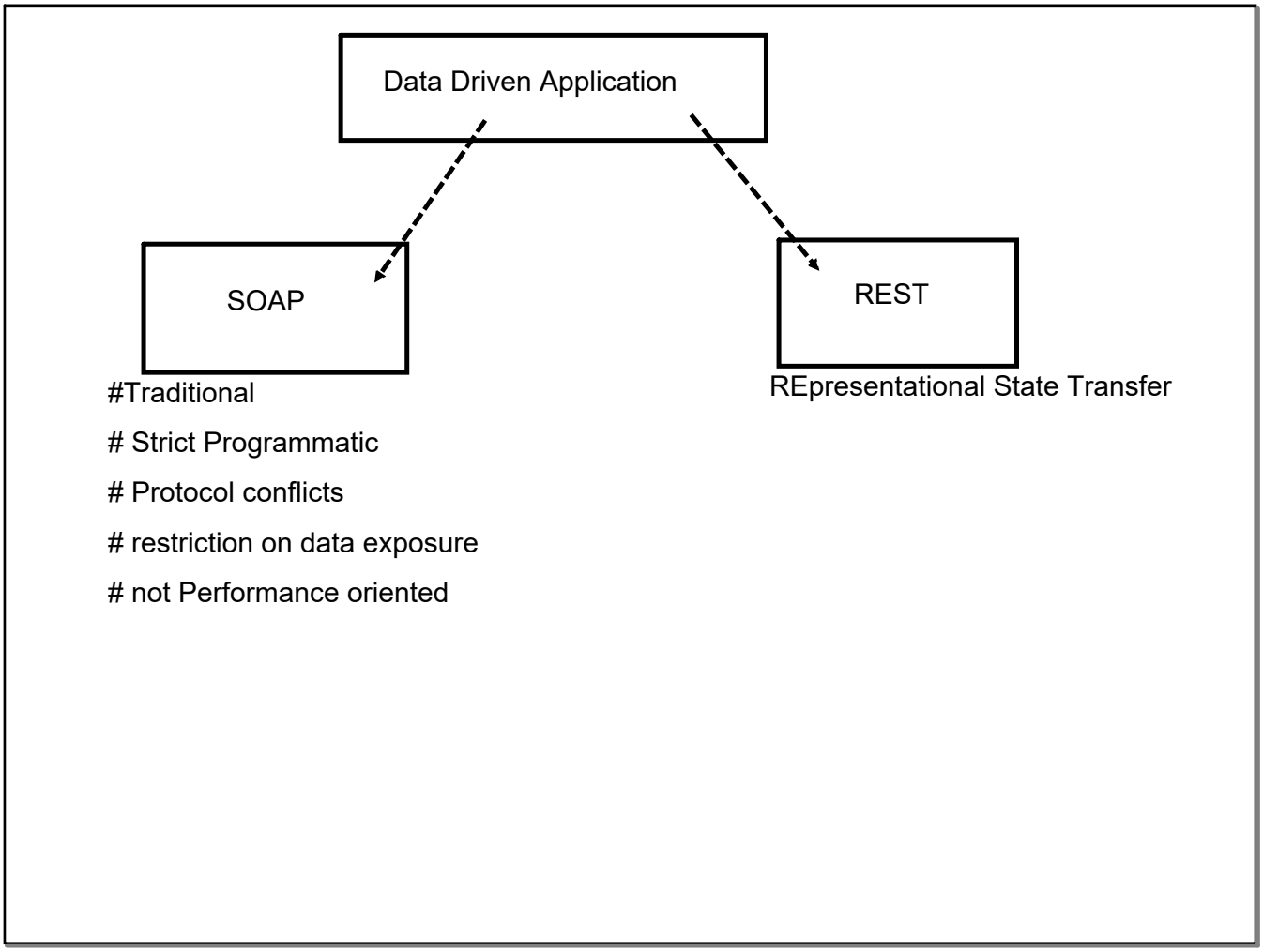


logout : form created , with a submit button (logout)

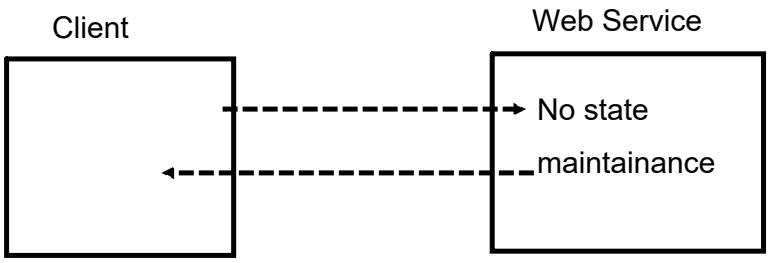
Principal : an object initialized with logged in user details




Data Driven Stateless implementation of Web Service
REST Service
Data Driven Application
Angular/React
App
IoT


Data Driven Application
SOAP
REST
#Traditional
Strict Programmatic
Protocol conflicts
restriction on data exposure
not Performance oriented
REpresentational State Transfer

URL : HTTP VERB (GET,POST...)



1. How to interact : url based connect
2. What technology Web is using : std HTTP protocol
3. How to consume : JSON (popular), XML, plain text, html

Spring : Allows to create REST Controllers

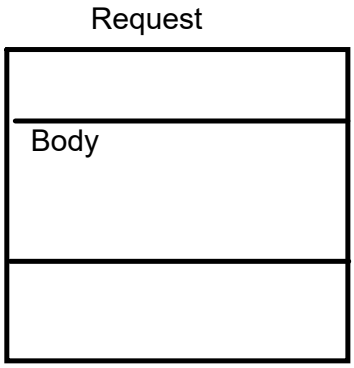
JSON <----->POJO

mapping

Library : Jackson-databind project

@RestController : Auto consume the mapping api:

Mapping uses getter/setter method



Spring Boot

Framework/Tool : to allow to create(boot),initialize and develop a spring application quickly eliminating a lot of boiler plate code

Similar in performance

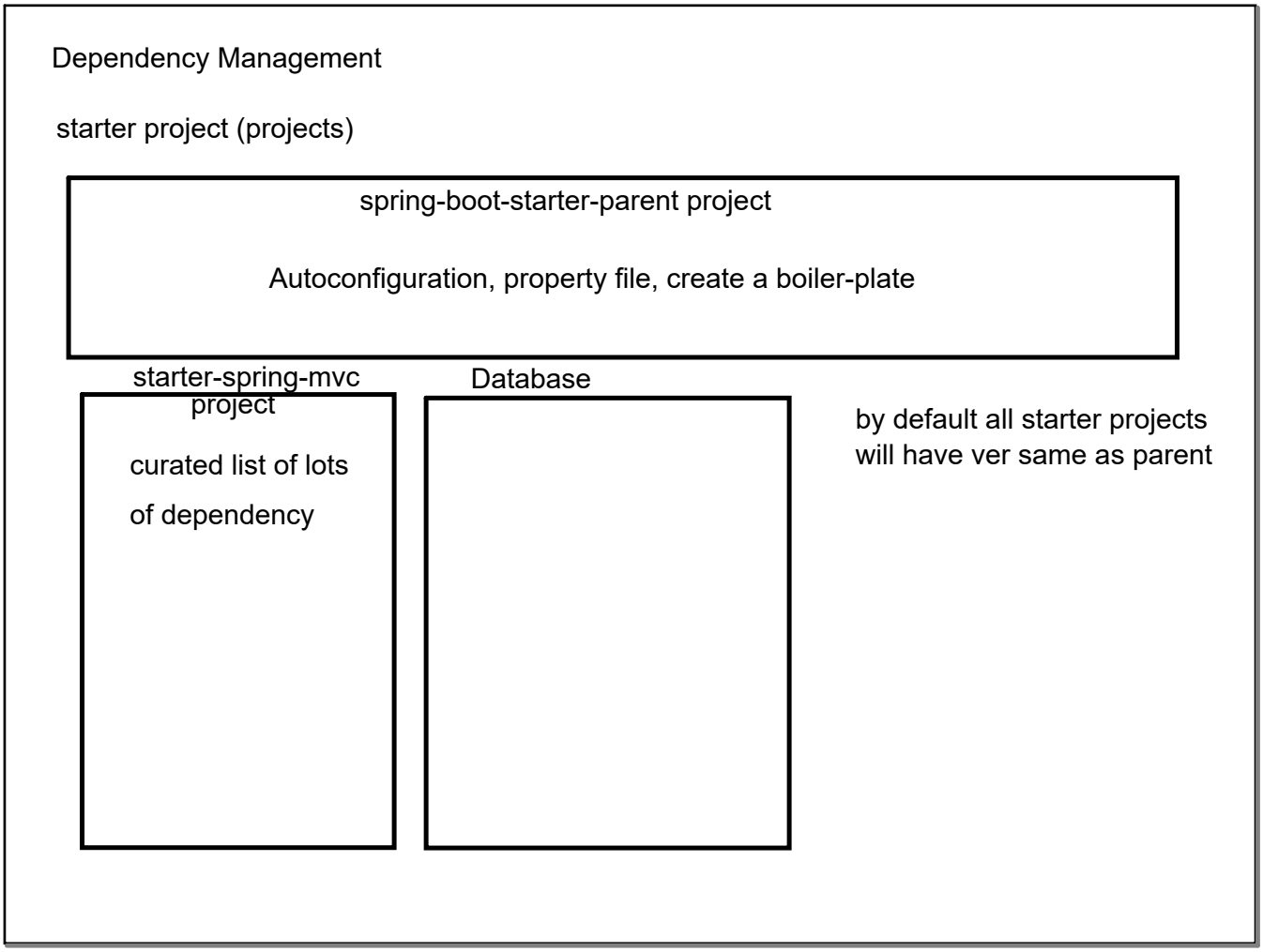
Advantages

1. Dependency management
2. Configuration
   a. More abstract annotation (highly specialized,curated)
   b. Auto Configuration : default set of config is provided based on dependency
   c. Custom config : outsource and place the config detail in text file (properties)
3. Tends to create a standalone/self sufficient spring application

   NO Specific IDE

   Integrates MAven

   Web Server


Dependency Management
starter project (projects)
spring-boot-starter-parent project
Autoconfiguration, property file, create a boiler-plate
starter-spring-mvc project
curated list of lots
of dependency
Database
by default all starter projects
will have ver same as parent

Online portal : spring initializr

spring initializr plugin :

mvnw : linux/mac

mvnw.cmd : win

batch file : mvn cli command

Live Reloading of server : devtools

Application Maintanance/Devops : Actuators

=> Application Architecture : Multi-layered architecture

Controller

Service

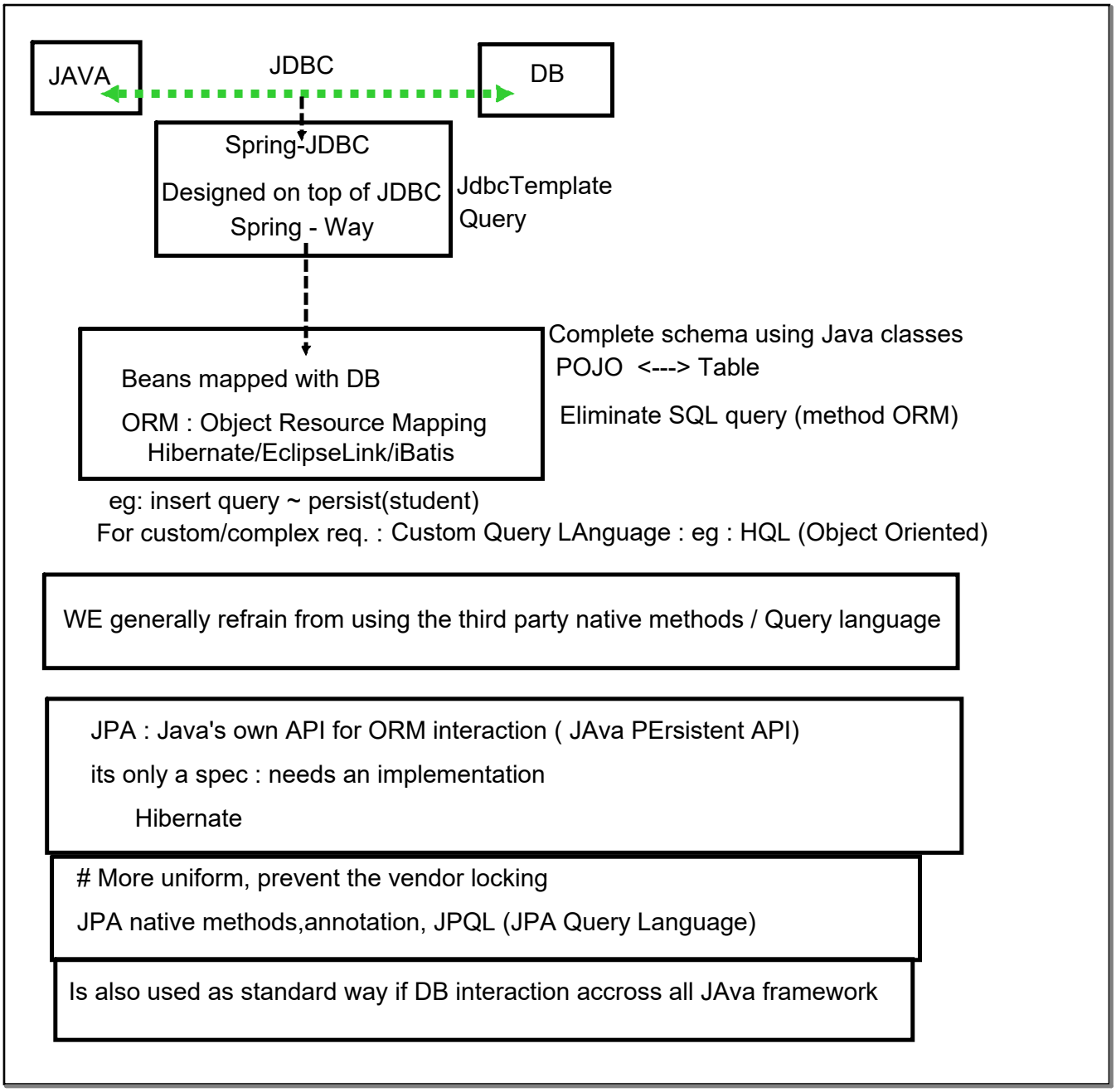
DAO

Exception

Entity

Dto/model

=> Persistence : backend DB (mysql) ~ H2 (Embedded)


JAVA
JDBC
DB
Spring-JDBC
Designed on top of JDBC
Spring - Way
JdbcTemplate
Query
Beans mapped with DB
ORM : Object Resource Mapping
Hibernate/EclipseLink/iBatis
Complete schema using Java classes
POJO <---> Table
Eliminate SQL query (method ORM)
eg: insert query ~ persist(student)
For custom/complex req. : Custom Query LAnguage : eg : HQL (Object Oriented)
WE generally refrain from using the third party native methods / Query language
JPA : Java's own API for ORM interaction (JAva PErsistent API)
its only a spec : needs an implementation
Hibernate
More uniform, prevent the vendor locking
JPA native methods,annotation, JPQL (JPA Query Language)
Is also used as standard way if DB interaction accross all JAva framework

Specialized project (module) to ORM based DB interaction using JPA spec

spring-data

More abstraction has been added

spring-data : SQL/NO-SQL

getter/setter
Default Constructor
All Arg Constructors()
ToString()

need to have lombok plugin configured in IDE


1. Controller
2. Service
3. Dao(Repository)
4. Entity (POJO--->DB Tables)
JPA (Spec)
Hibernate

For DB Interaction:

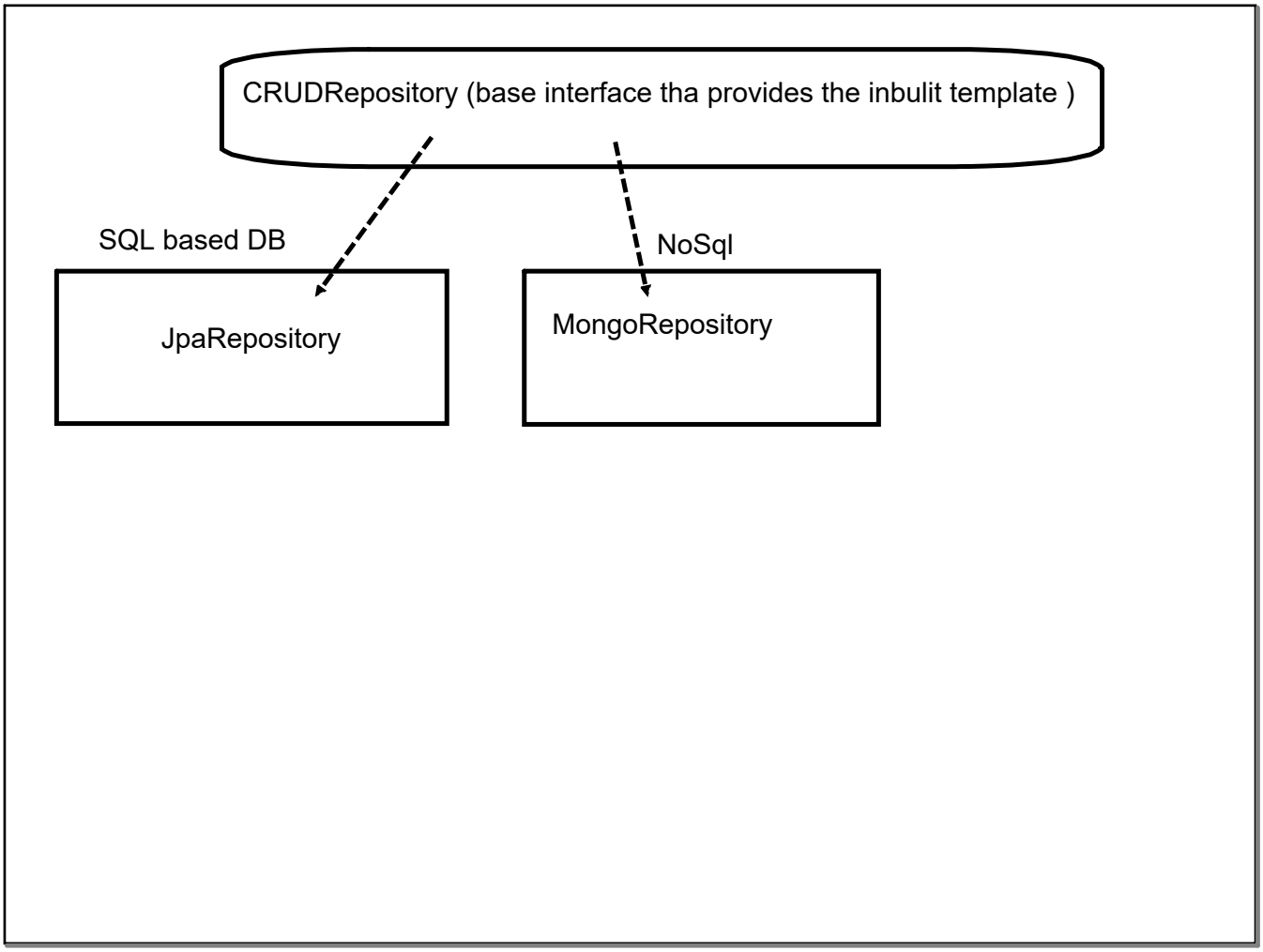
student : fetch all : select * from student;

product : fetch all : select * from product

<entity> : fetch all : select * from <entity>

All crud functionalities same template

Pass on the Entity info , it will come back with all std CRUD functionalities


CRUDRepository (base interface tha provides the inbulit template)
SQL based DB
NoSql
JpaRepository
MongoRepository

Expose REST Endpoints for Basic CRUD Functionalities

Best Practices:

fetch all records : /getallrecords

fetch a single record based on id : /getbyid

add a new record : /addstudent

edit an existing record : /editstudent

delete an existing record : /deletestudent

1. Rest Endpoint are generally exposed on the basis of entity
2. plural form of entity : eg student~students
3. stick to a common end-point but we'll change the http verb

Eg:

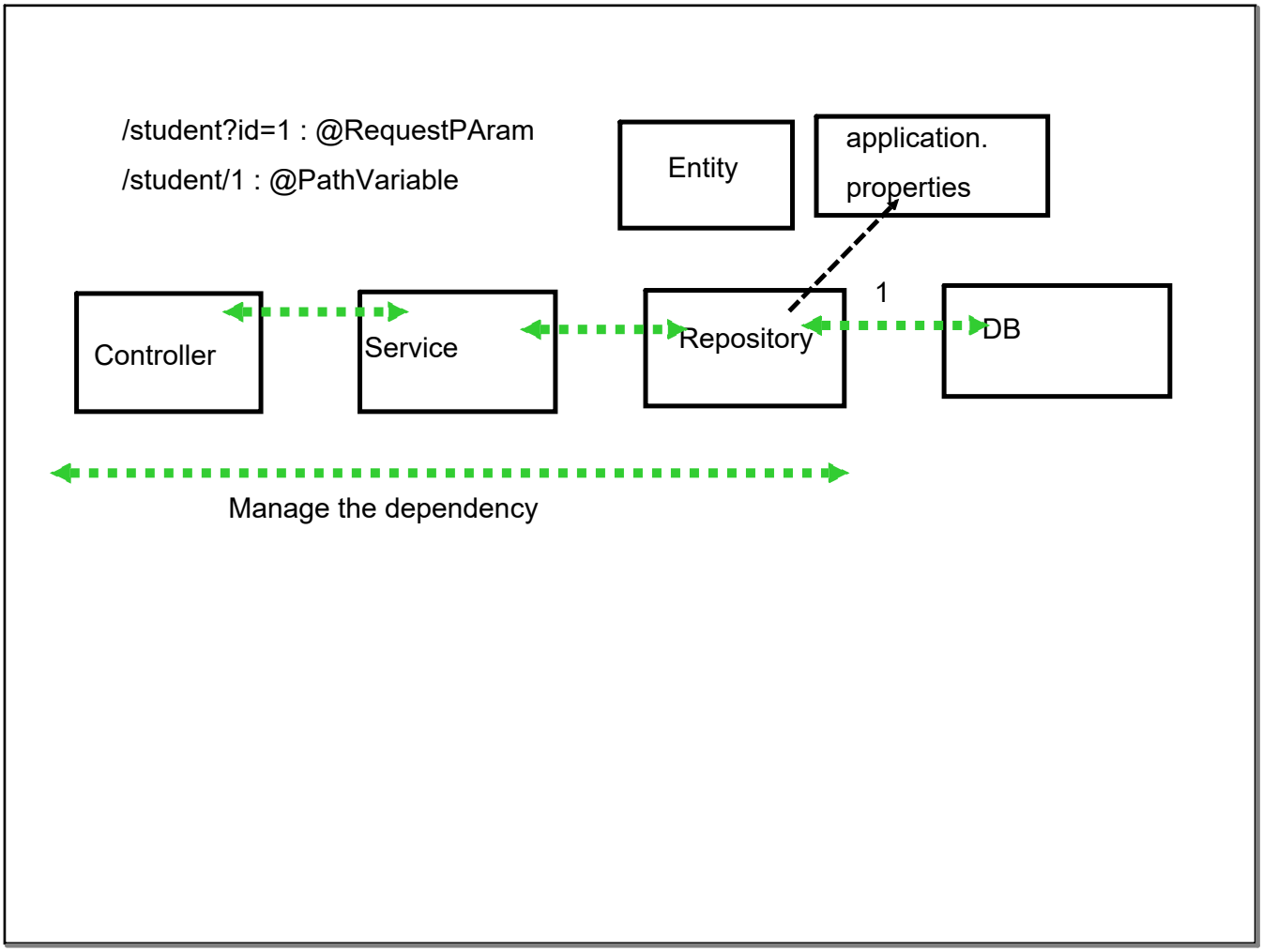
fetch all records : /students (GET)

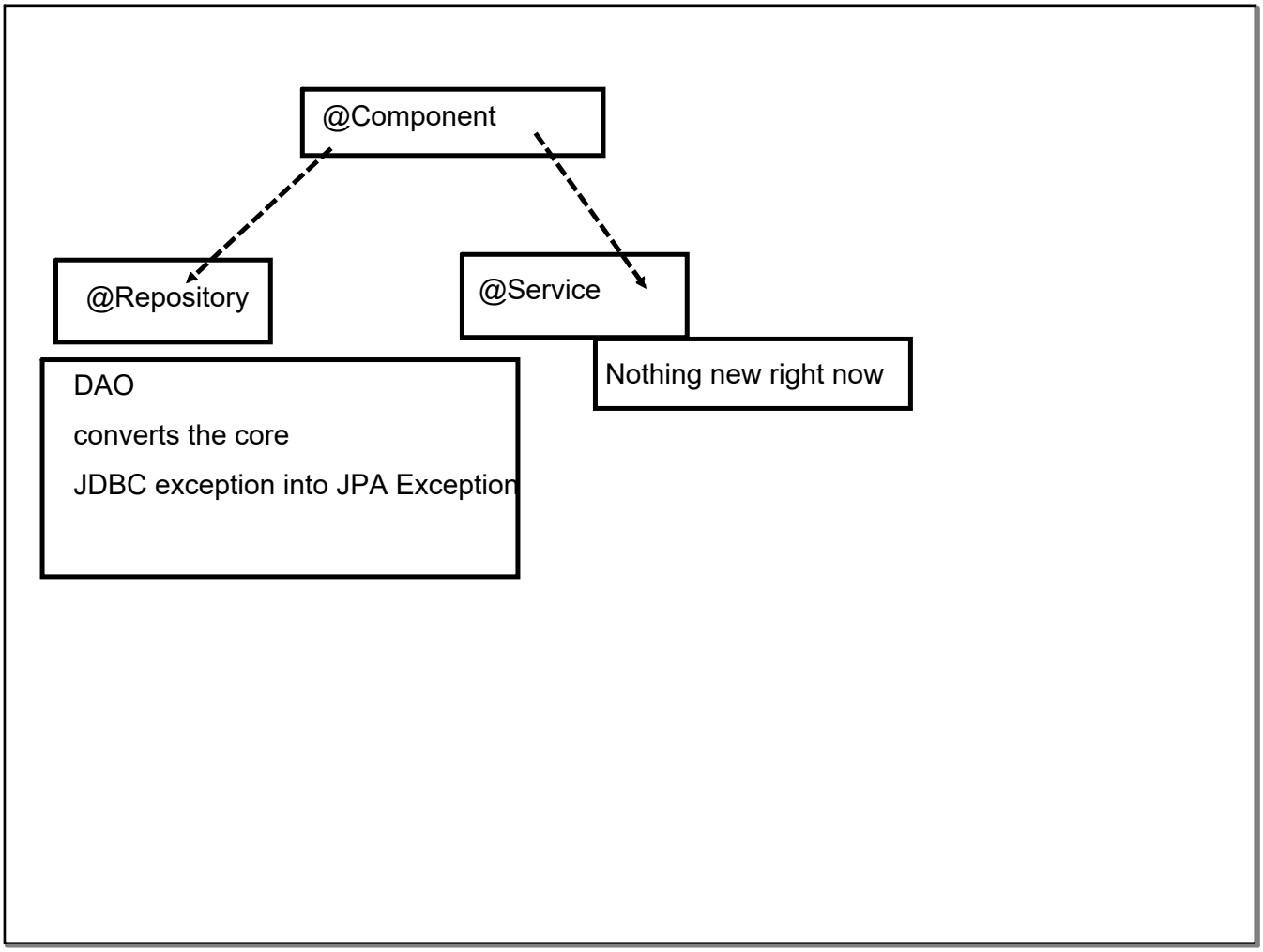
fetch a single record based on id : /students/{id} (GET)

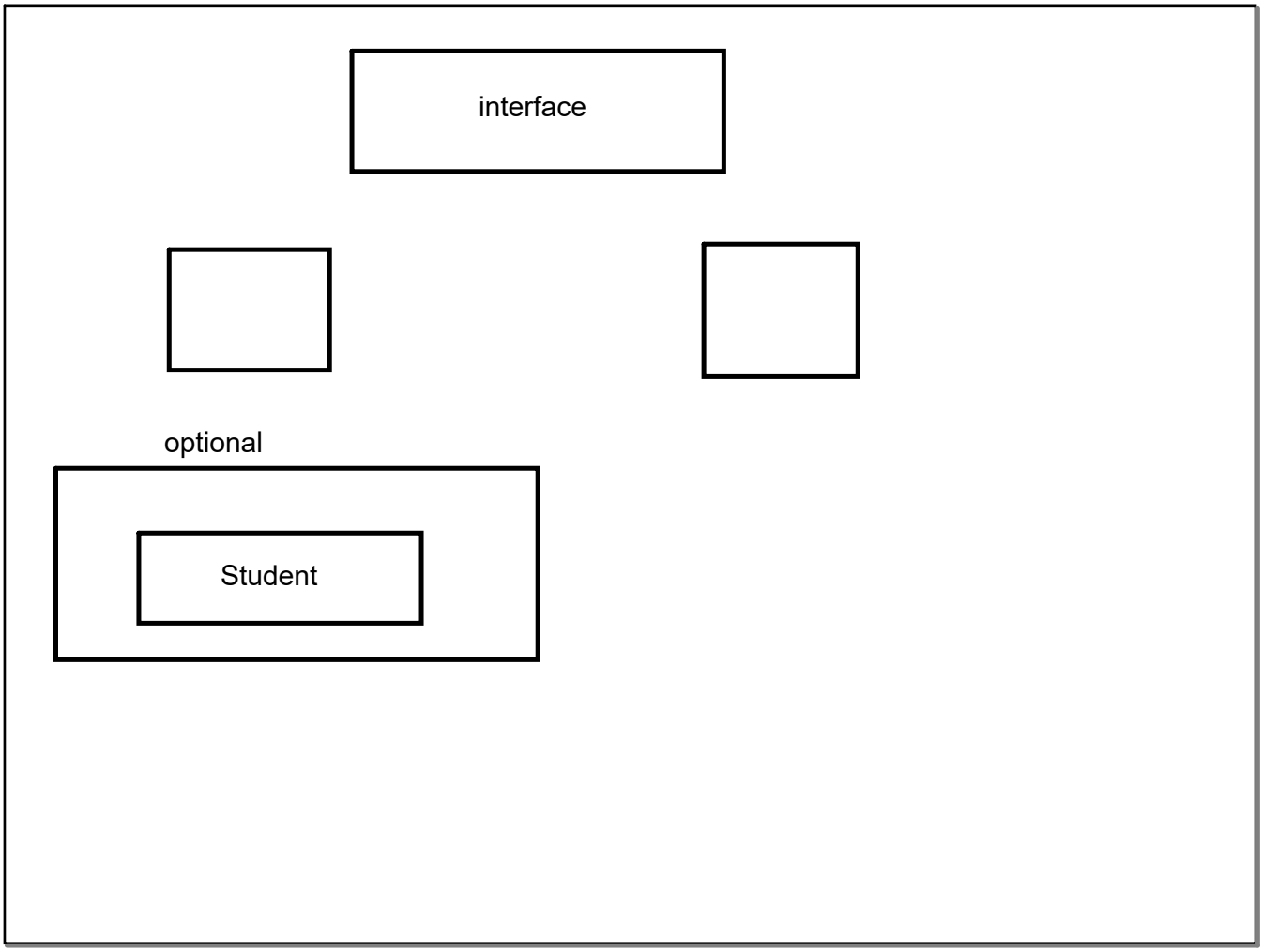
add a new record : /students (POST) | data as a part Request Body

edit an existing record : /students (PUT) | data as a part Request Body

delete an existing record : /students/{id} (DELETE)


/student?id=1 : @RequestPAram
/student/1 : @PathVariable
Entity
application.
properties
1
Controller
Service
Repository
DB
Manage the dependency

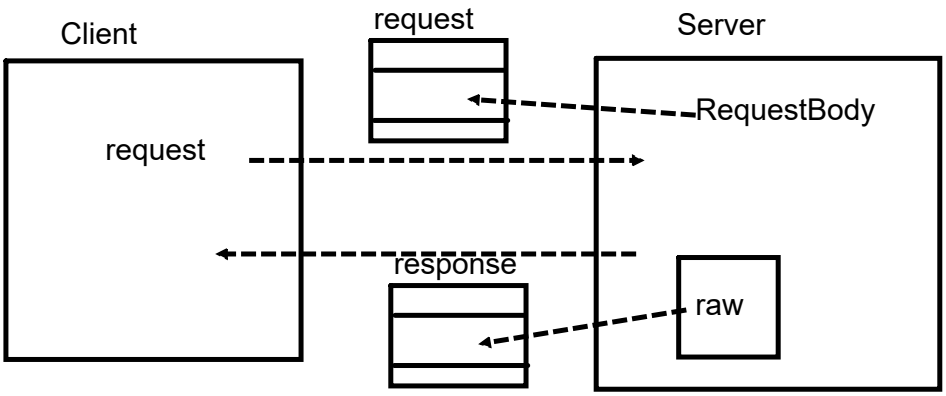

@Component
@Repository
@Service
DAO
converts the core
JDBC exception into JPA Exception
Nothing new right now


interface
optional
Student

Handling the exceptions spring way...

Rest Best Practices : Don't return the raw data:

=> wrapper



ResponseEntity : wrapper that allows us to define the response object

H2 SQL Based Embedded Database

==> Dependency added for H2

==> application.properties

Spring-Boot to develop View Based Applications

Spring-Boot by default configured to use Thymeleaf as a view default (jsp-jstl is not the default)

templates folder is the home to view pages for Thymeleaf engine

View Pages with simple .html ext.

Spring boot is default configured for Thymeleaf

Convert an existing HTML to Dynamic view page

Very efficient in implementation

Pure View based implementation

Easier way to add dynamics

Configuring Spring boot application to use JSP-jstl view template

- Dependency to be added
- application.properties
- structural need to be done

Dependency for JSP

```
<!-- https://mvnrepository.com/artifact/javax.servlet/jstl -->
        <dependency>
            <groupId>javax.servlet</groupId>
            <artifactId>jstl</artifactId>
            <version>1.2</version>
        </dependency>

        <!-- Needed for compiling JSP -->
        <!-- https://mvnrepository.com/artifact/org.apache.tomcat.embed/tomcat-
embed-jasper -->
        <dependency>
            <groupId>org.apache.tomcat.embed</groupId>
            <artifactId>tomcat-embed-jasper</artifactId>
            <version>9.0.38</version>
        </dependency>
```

Rest-Template

Feign-Client

Need to expose bean of RestTemplate