Java-8

=> Lambdas

Functional Programming

those feature that define functional programming

streams

Executor (Future)

Concurrency Collection

Style :

Traditional : Imperative

(HOW)

#exposing the steps how to perform an operation

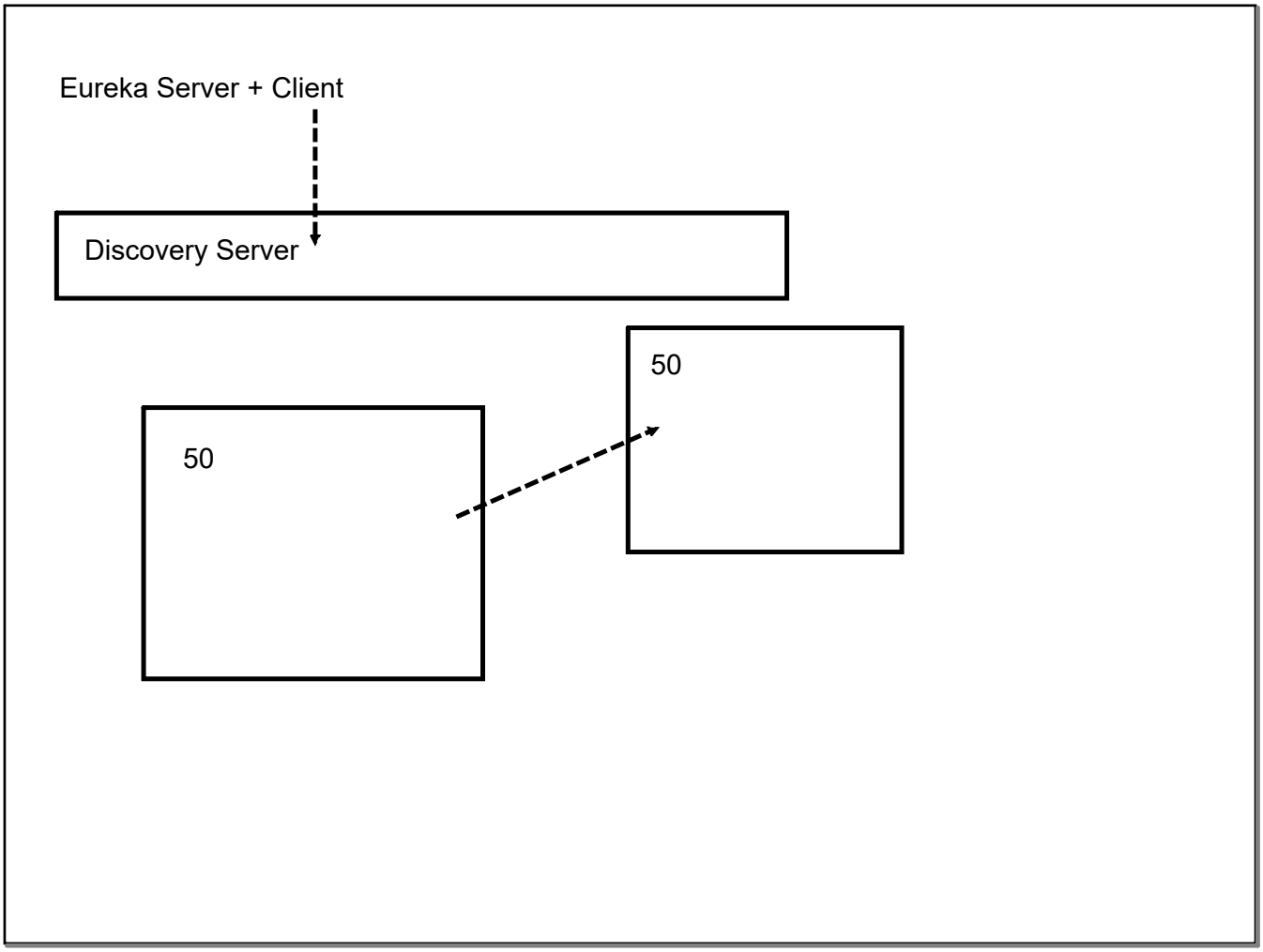
embrace object mutability (not in sync with concurrency)

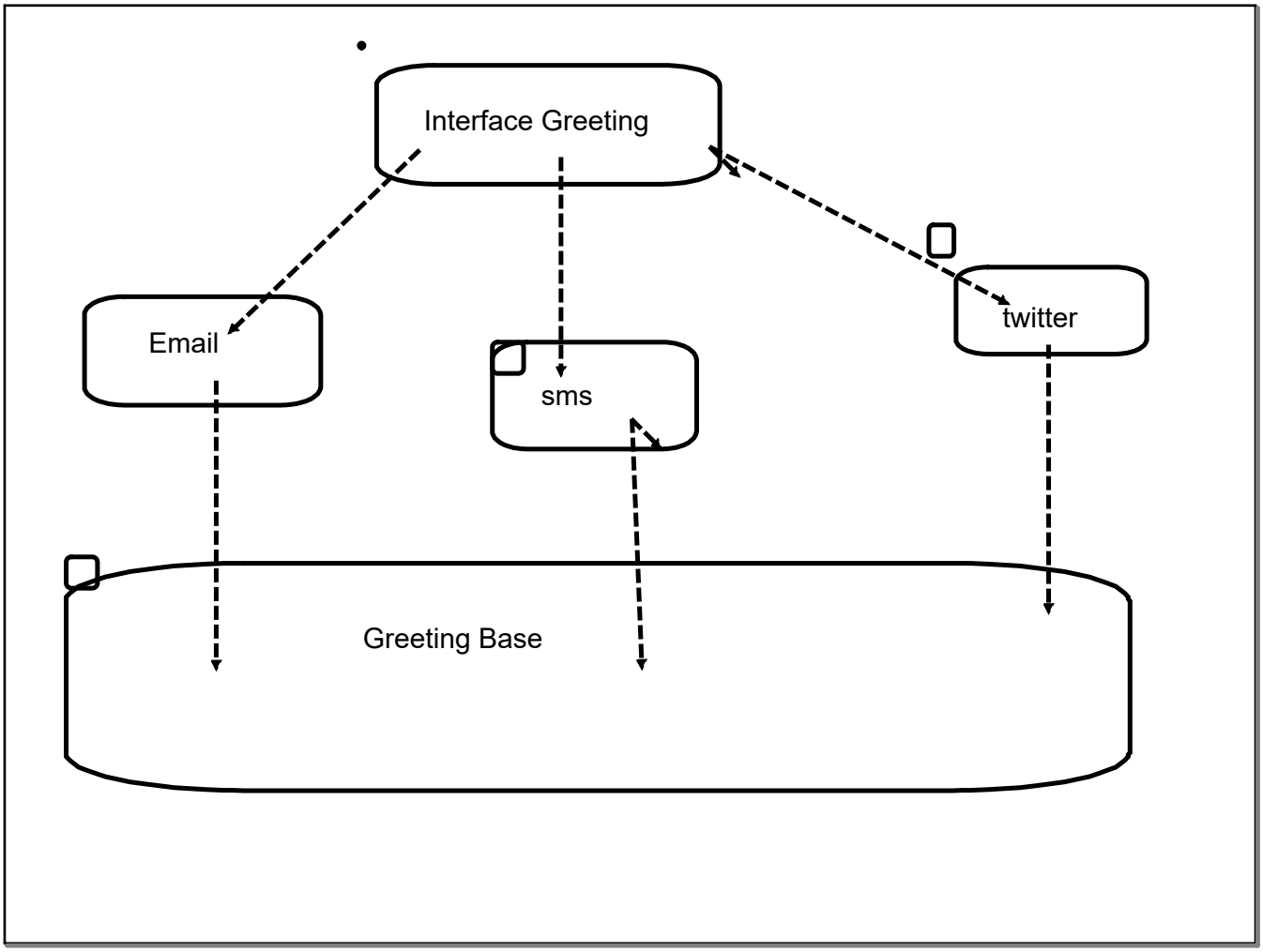
Functional : Declarative

(What) : result

immutability

Analogous SQL


Eureka Server + Client
Discovery Server
50
50

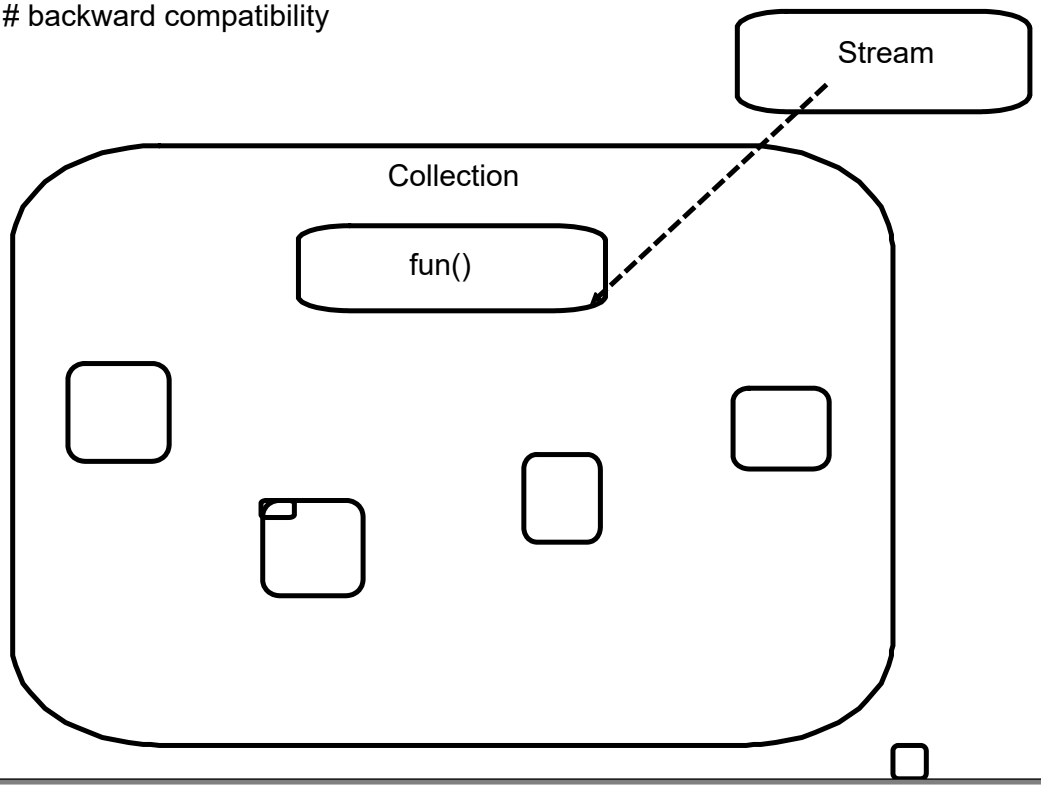

Interface Greeting
Email
sms
twitter
Greeting Base

Interface :

default method (definition)

multiple implementations can be inheritance

backward compatibility



Escape from OOPs

independent Functions (not wrapped inside an object)

Relationship between interface and function

1. interface must have only one abstract method (any number of default/static) :

Functional Interface : Annotation @FunctionalInterface

2. single method signature must match with function implementation

Lambda expression

(<arg1>,<arg2>) -> {

}

arg1 -> {

}

() -> {

}

(<arg1>) -> <return> <single instruction>

(a,b) -> <return>a+b;

(a,b) -> {

return a+b;

}

Pre defined functional interfaces

=> Runnable

=> Comparator

Explicit Functional Interface

Consumer

void accept(<>);

DoubleConsumer() // specialized implementations on primitive

BiConsumer

void accept(<>,<>);

Predicate (test)

boolean test(<>)

Supplier

<> get()

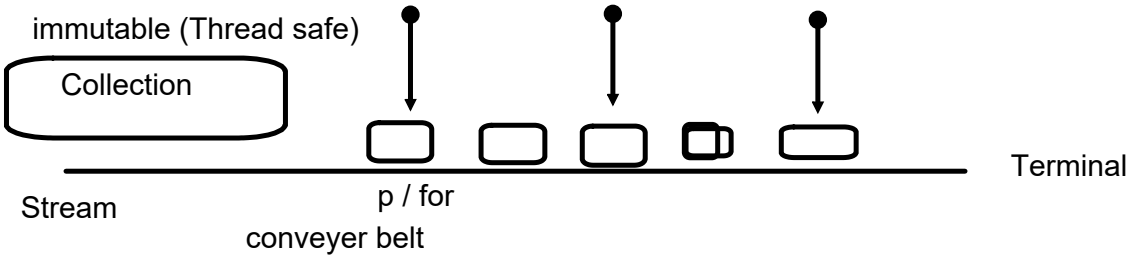
Function

<> apply(<>)

Stream :

not a data structure

immutable (Thread safe)



Stream : LAZY Processes

Stream can have 2 type of activities

intermidiate activities (filter/map/flat map)

Terminal activity : terminate/close the stream

forEach()

collect()

IF terminal activity is not present : stream will not initiate

groupingBy(<return> Function(student))

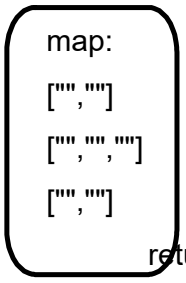
return value : would become a group

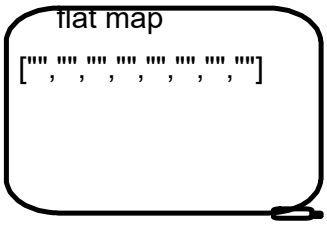
(Stream of) Multiple collection into (Stream of)single collection

Transforms

y map(x)

flatmap() : Collection into stream



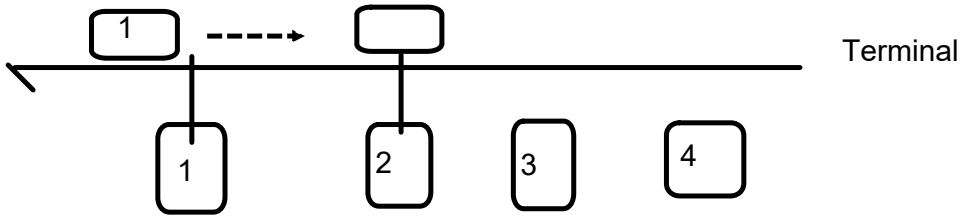


return type fixed : stream of data passed as argument

Stream :

Sequential Stream

Parallel Stream



Parallel Streaming not commended if working on external mutable data (not thread safe)

Activities that are inherently complex

Binary Operator : variant Function

y Function(x) : x and y can be of different type

z BinaryOperator(x,y) : x,y,z : must be of same type

Multithreading :

interleaved (Threaded Multitasking)

1. Multiple activities waiting for I/O : that time can be used by tasks
2. Multi-core architecture of micro-processor

Base Interface :

Runnable (run)

Implementation:

Core Functionality of Multithreading (Thread)

inheriting Runnable

inheriting Thread

Traditional approach:

create, execute, manage

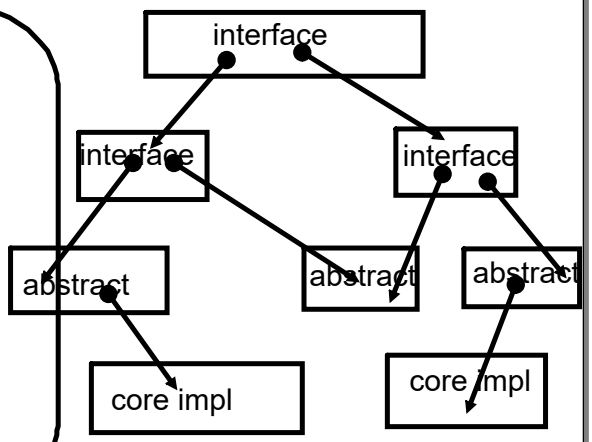
Thread per task

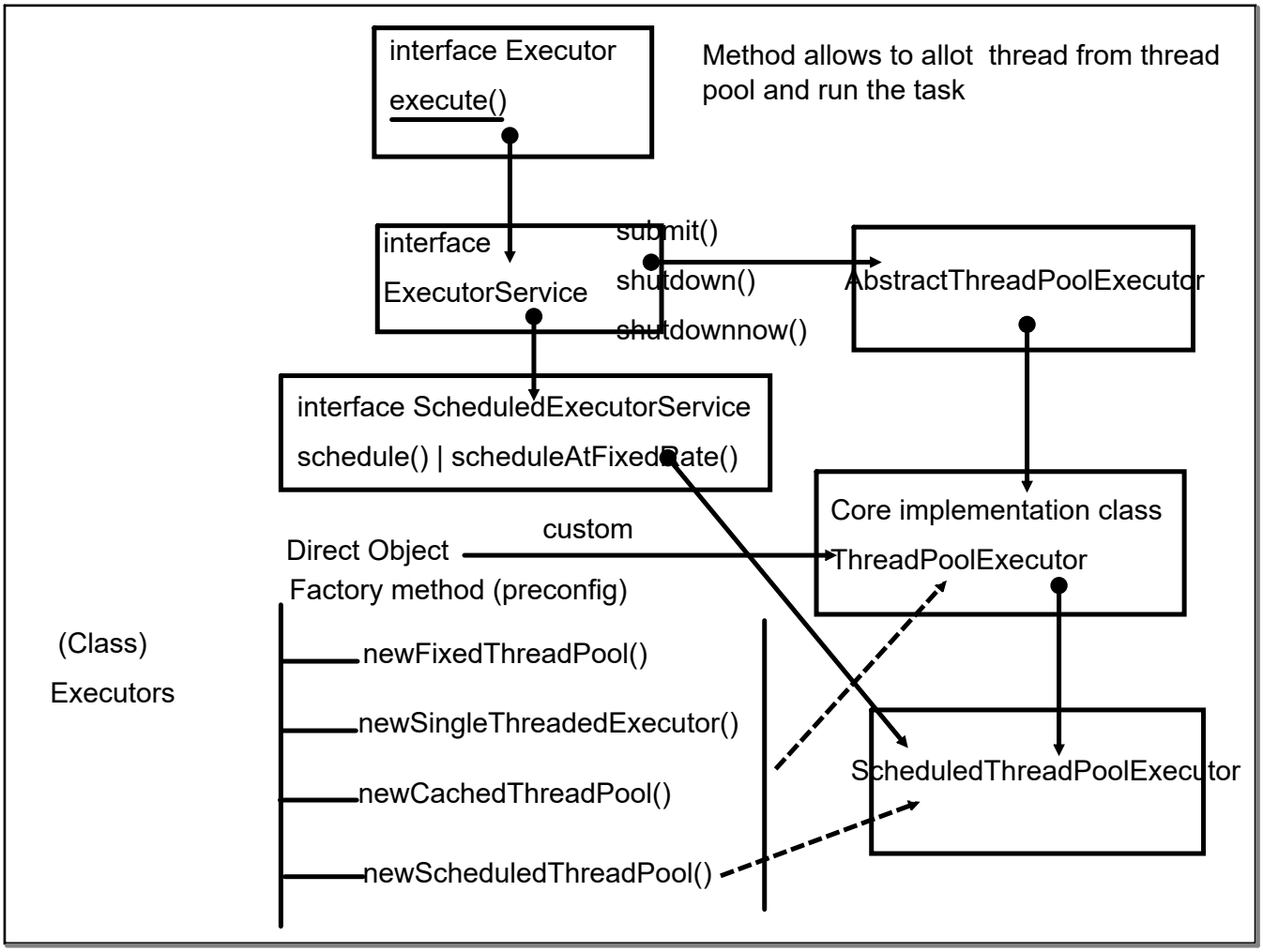
Not possible to keep a track of number of thread

Executor framework :

do all management + improve in performance

ThreadPool : create a predefined pool of thread




interface Executor
execute()
Method allows to allot thread from thread pool and run the task
interface
ExecutorService
submit()
shutdown()
shutdownnow()
AbstractThreadPoolExecutor
interface ScheduledExecutorService
schedule() | scheduleAtFixedRate()
Core implementation class
ThreadPoolExecutor
custom
Direct Object
Factory method (preconfig)
(Class)
Executors
newFixedThreadPool()
newSingleThreadedExecutor()
newCachedThreadPool()
newScheduledThreadPool()
ScheduledThreadPoolExecutor

Need to create instance of ThreadPoolExecutor

FixedThreadPool (number of thread are predefined(extra task alloted will added to queue)

CustomThreadPoolExecutor

<corePoolSize> : number of threads to always keep even if they are idle (2)

<maxPoolSize>: max no of thread (5)

<keepAliveTime> : time to wait before idle thread gets removed/released from thread pool

<TimeUnit> :

<queue capacity>: capacity of queue

<RejectedHAndler> : what to do if a task is rejected from queue

SingleThreadExecutor()

FixedThreadExecutor(1)

can change the thread capacity

CachedThreadPool() : Unbounded ThreadPool : Max Integer Val

if demand decreases : can tear down thread

default keep alive time : 1 min

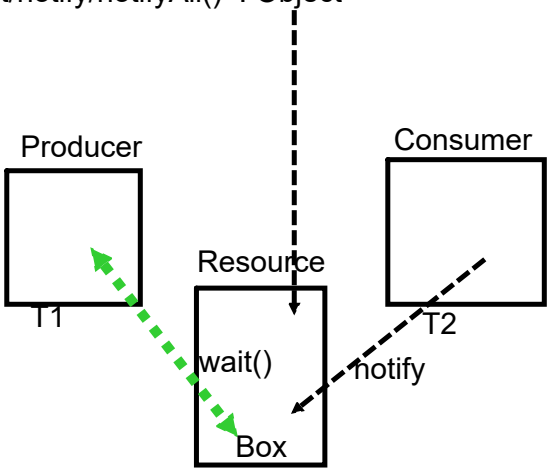
ScheduleThreadPool()

Thread returning some value

Special Interface Callable (call())

ThreadPool can work on Callable

wait/notify/notifyAll() : Object



ExecutorCompletionService

: will going to get results in order of completion of task

Future : blocking

CompletableFuture <callback : logic to follow when task is done>

Functional interfaces

Runnable

Callable

=> Supplier

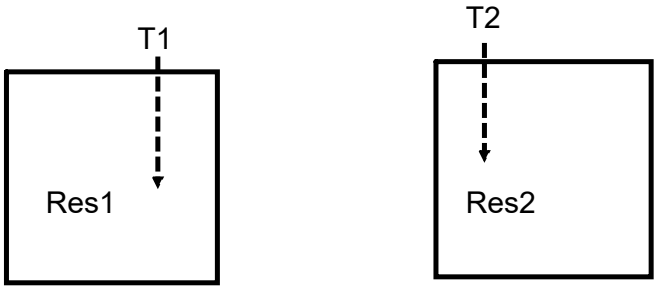
the method to associate a callback function

1. thenApply(Function); // transform
2. thenAccept(Consumer); // consuming and using

CompleatableFuture by default uses the inbuilt thread pool

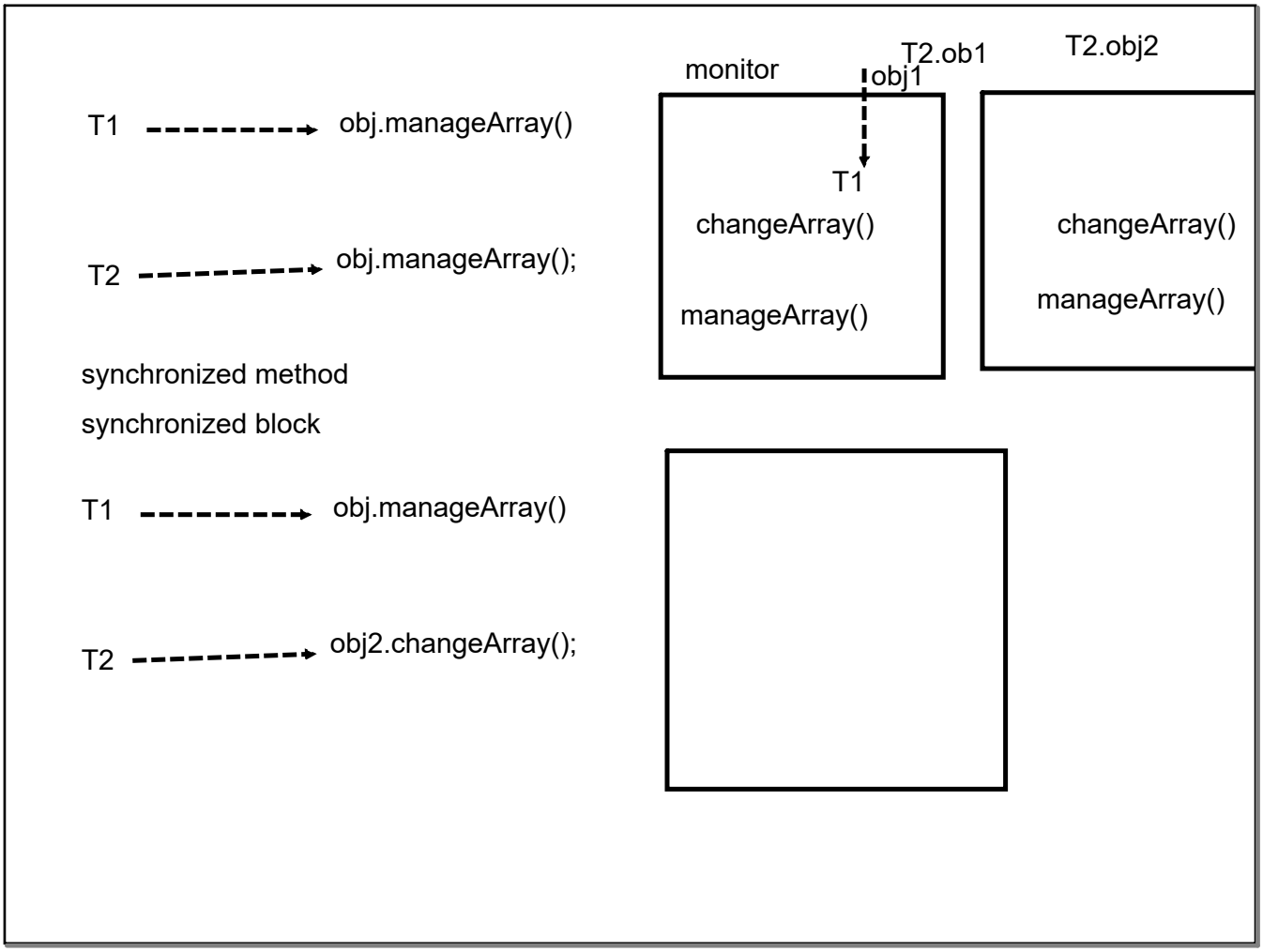
ForkJoinPool.commonPool();

Executor ThreadPool



Common Resource Shared among multiple threads (Thread safe)

Resolve Data inconsistency


T1
obj.manageArray()
T2
obj.manageArray();
synchronized method
synchronized block
T1
obj.manageArray()
T2
obj2.changeArray();
monitor
T2.ob1
obj1
T1
changeArray()
manageArray()
T2.obj2
changeArray()
manageArray()

locking :

=>wide spectrum locking : (synchronized...)

=>granular locking

java.util.concurrent.

API : Granular locking on resources

Collection API

1 .Traditional : 2

1. HashTable
2. Vector

2. To get a Thread safe variant of those class

Collections.concurrentList();

all methods are sync

Atomic operation : single CPU instruction

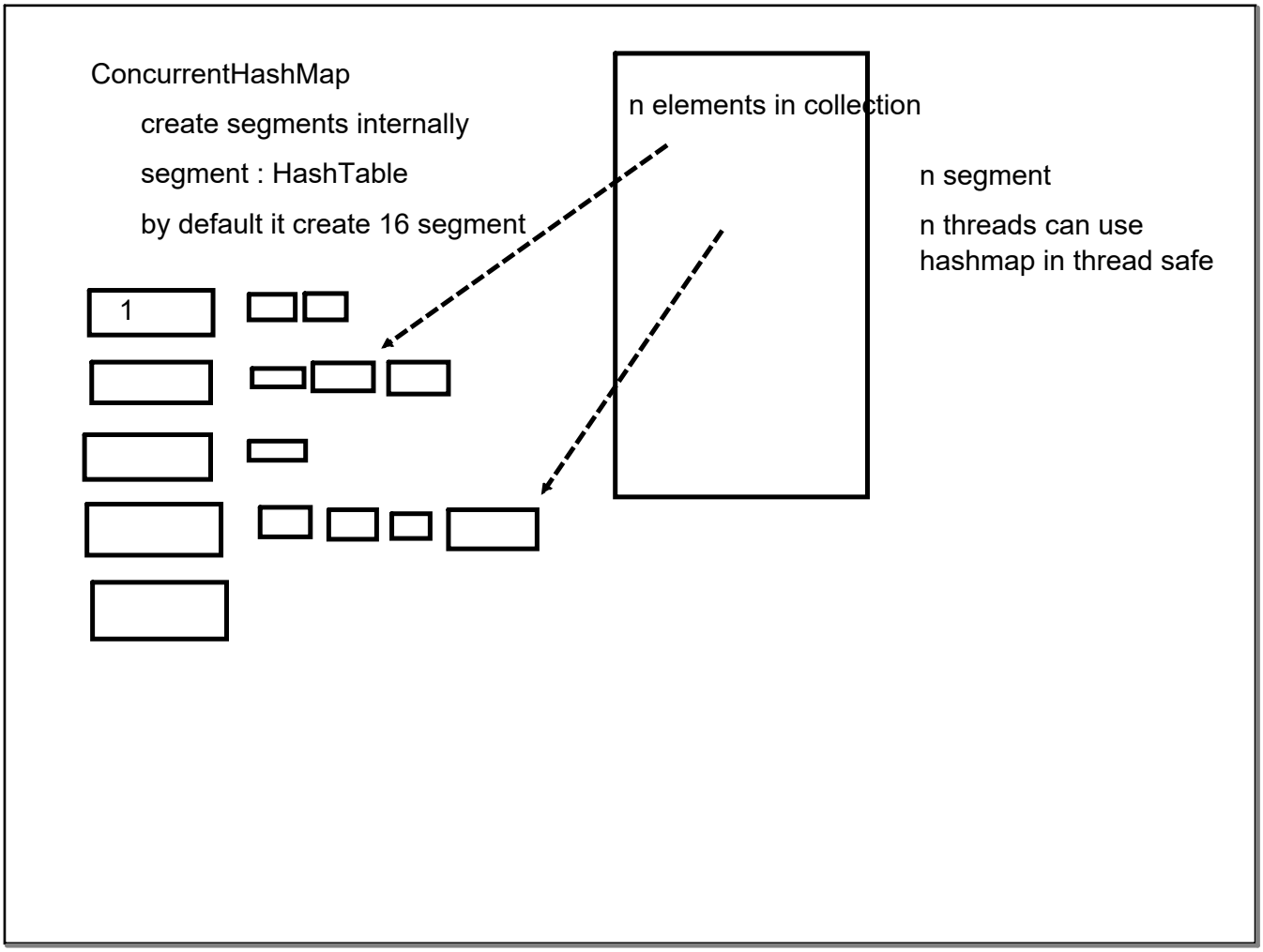
n=10; // Thread safe operations

assignment long/double are non-atomic

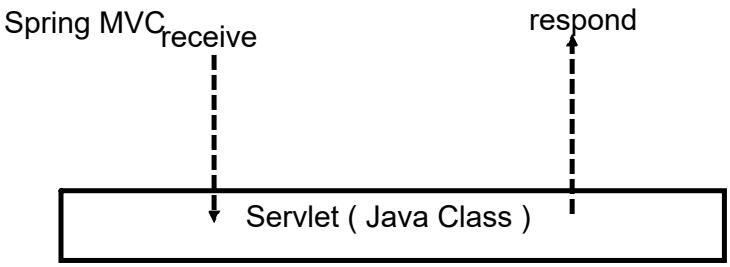
Concurent API : Focus on granular locking

Provides Atomic Variant of type : allow to convert non-atomic activities into atomic

multiple approach for ThreadSafety along with high level of concurrency


ConcurrentHashMap
create segments internally
segment : HashTable
by default it create 16 segment
1
n elements in collection
n segment
n threads can use
hashmap in thread safe

Servlet Technology



How to define java class as Servlet

Extends

HttpServlet/GenericServlet

GenericServlet : does not classifies between various HTTP Verbs

HttpServlet : can identify

GET/POST/PUT/DELETE/PATCH

Life Cycle

=> init

=> generic service() / http (doPost()/doGet()/doDelete()

=>destroy

Servlet Technology

(Controlled By web.xml)

lst request

Multiple request simultaneously

instance of servlet class is created

init phase gets activated

service() (Responsible for receive request/and respond)

Web Servers tends to cache the servlet object

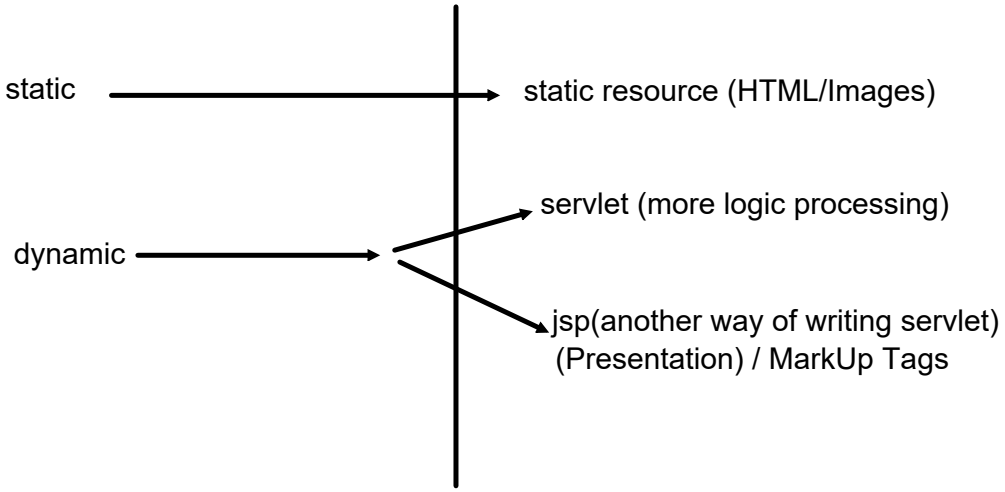
destroy

Object is released

service method and variant

have an access over HttpRequest/HttpResponse object

JSP : another way of writing servlet

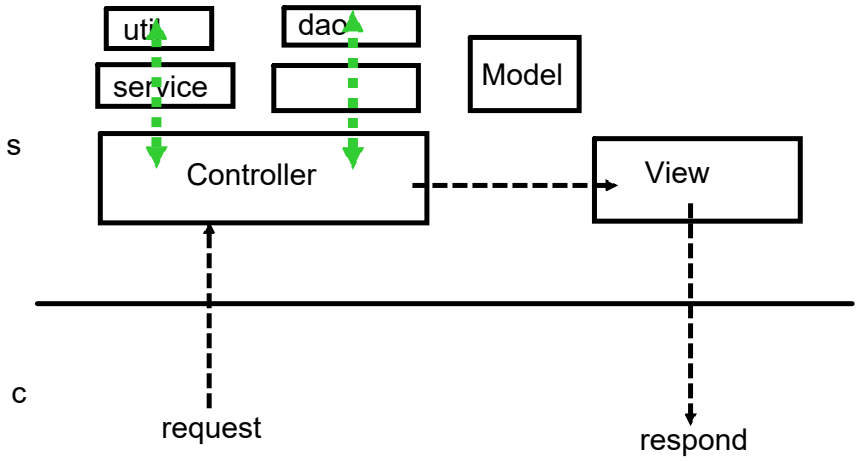


Spring uses Servlet Technology:

But provides a high level abstraction over complexities/ boilerplate req / config and enhances the seperation of concerns

MVC architecture

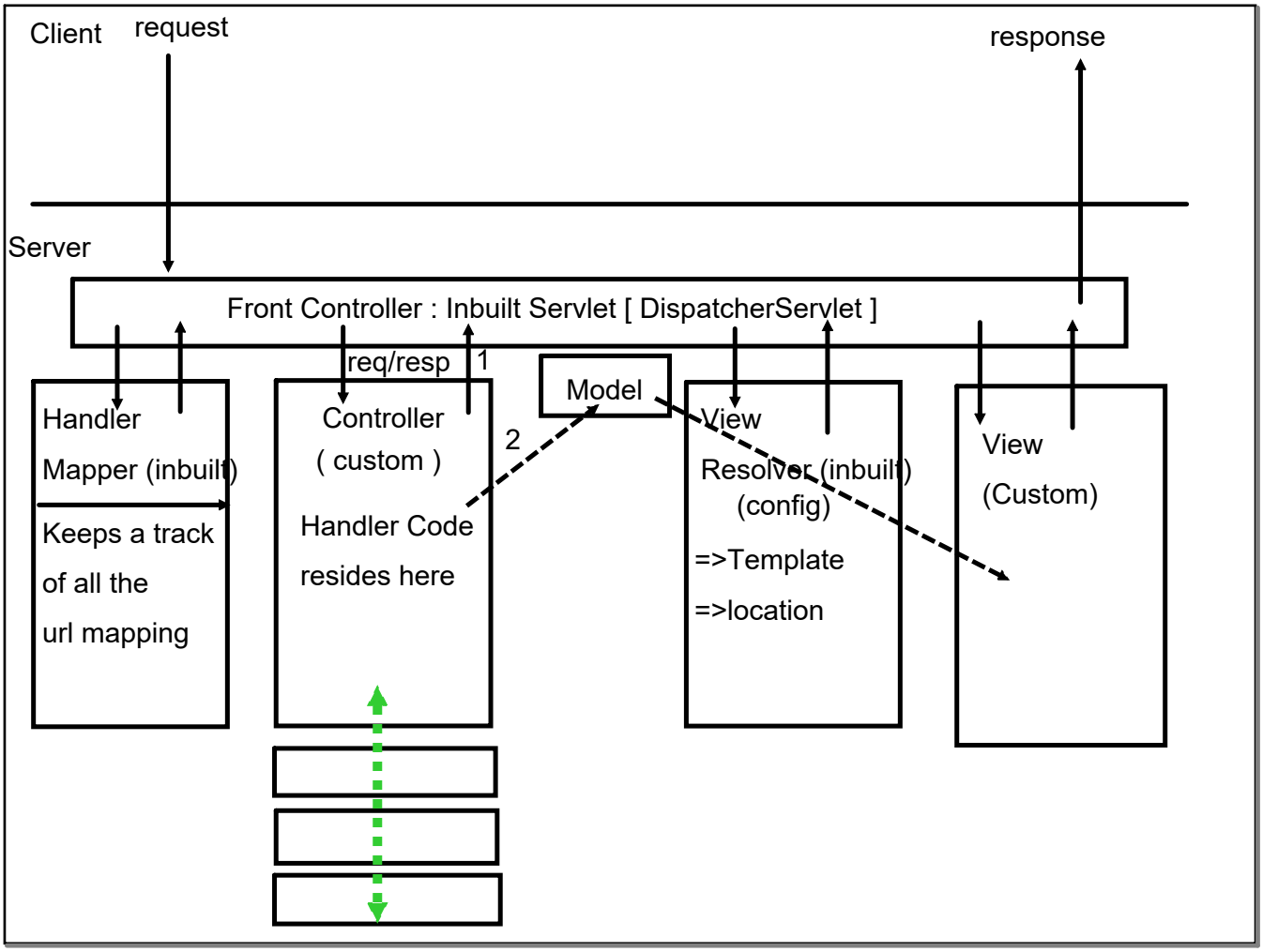
Controller : to receive request / process it



Servlet

service method as task :

assign it to thread


Client
request
response
Server
Front Controller : Inbuilt Servlet [DispatcherServlet]
req/resp
1
Handler
Mapper (inbuilt)
Keeps a track
of all the
url mapping
Controller
(custom)
Handler Code
resides here
2
Model
View
Resolver (inbuilt)
(config)
=>Template
=>location
View
(Custom)

we need to register your app resources (servlet spec)

Servlet :

need to register

registeration can also be done using annotation

Register DispatcherServlet

Config of Spring in place

xml file

java

Need Spring config to connect with DS

xml : <servlet-name>-servlet.xml

Controller : "index"

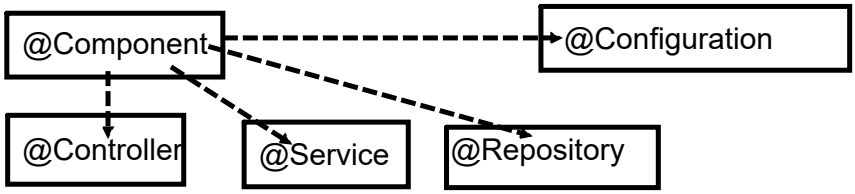
create a complete path

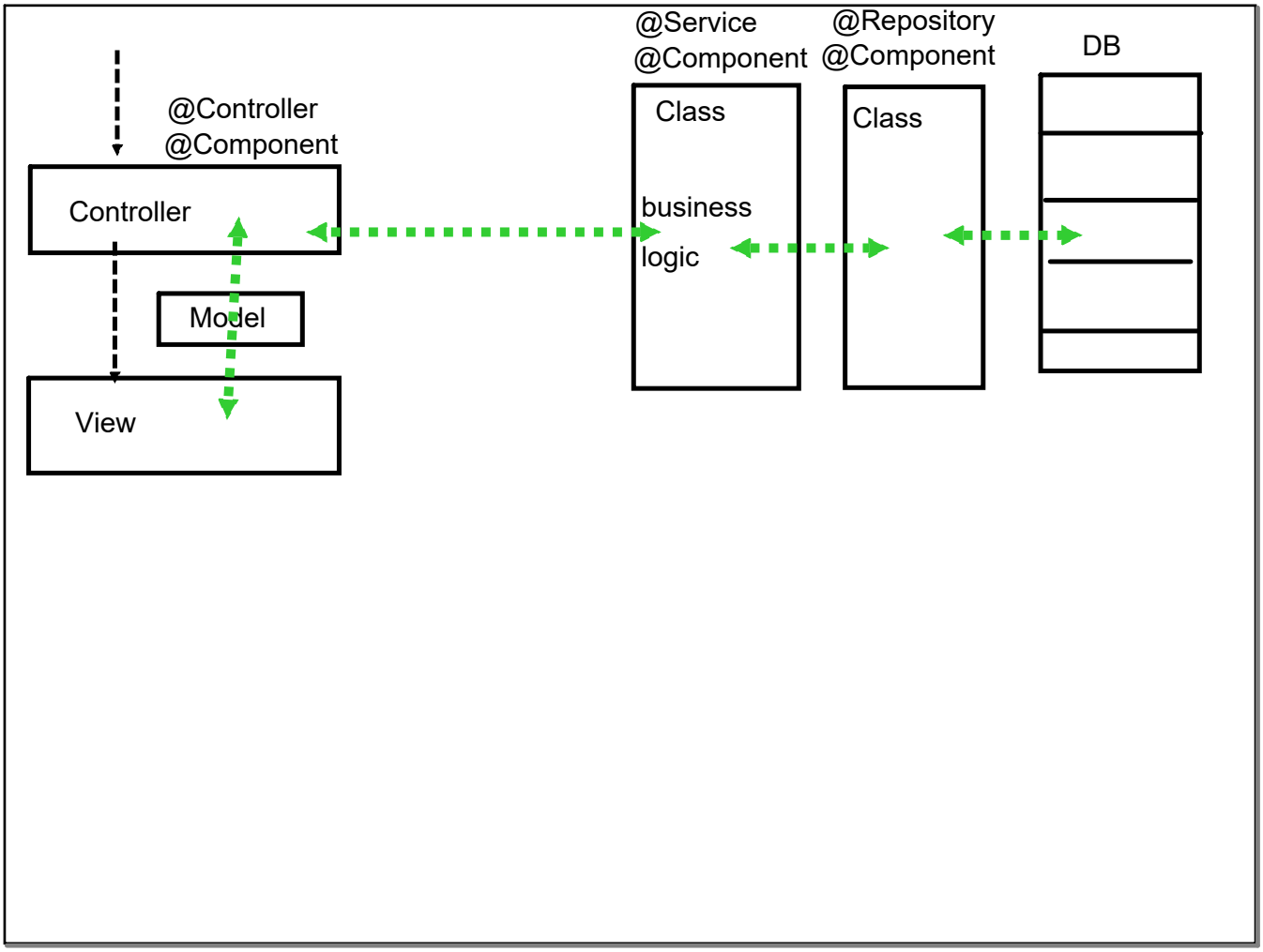
View Resolver : location + template (jsp+jstl) [extension]

```
<bean class="org.springframework.web.servlet.view.InternalResourceViewResolver">
        <property name="prefix" value="/WEB-INF/views/" />
        <property name="suffix" value=".jsp"/>
    </bean>
```

Controller return : "index"

/WEB-INF/views/index.jsp




@Service
@Component
@Repository
@Component
DB
@Controller
@Component
Class
Class
Controller
business
logic
Model
View

web.xml : ~ java config class

dispatcher-servlet.xml : ~ java config class

1. alternate for packaging : maven war plugin

Spring provides an inbuilt class to register DS

Spring-Boot

=> dependency management

=> configuration

dependency management

library + external other resources

spring-boot :

dependency

spring-starter-project

Spring - starter -(parent)project

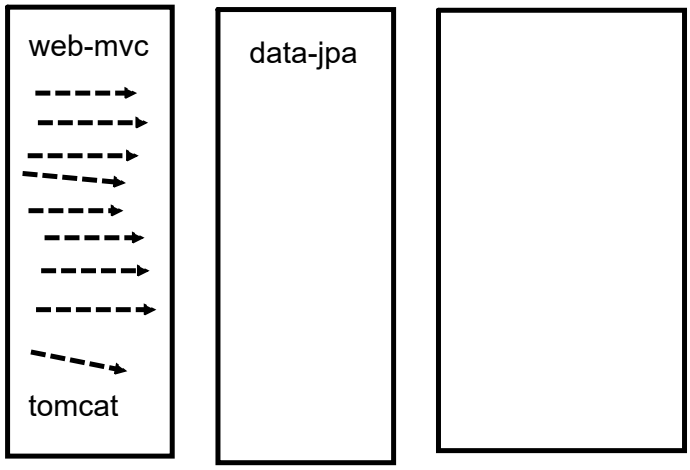
Support of Auto-configuration / less amount of code

manage Embedded Server

Created/Developed

and Launched

stand-alone way



start.spring.io

maven cli
maven command

Configuration
    # Spring boot Annotation
    # Dependency
    # Customization : special file application.properties
        key=value
key : predefined keys from different spring projects
    : possible values
    : custom keys/values
spring : yaml
      : heirarchy
      : application.yaml

Spring Boot Annotation

curated list of multiple annotation

EnableAutoConfiguration

tracking the dependencies

based on dependencies added:

add default config

expose the key

eg:

maven-web : Spring mvc:

DS servlet

spring-security

add default security

expose username/passed

tracking the properties files

looks for custom key-values pairs

defined in config-file

cli : key-values

mvc application

- controller
- view

pre-configured to use thymeleaf

View pages :

View Templates

Jsp-jstl

Thymeleaf

Mustache

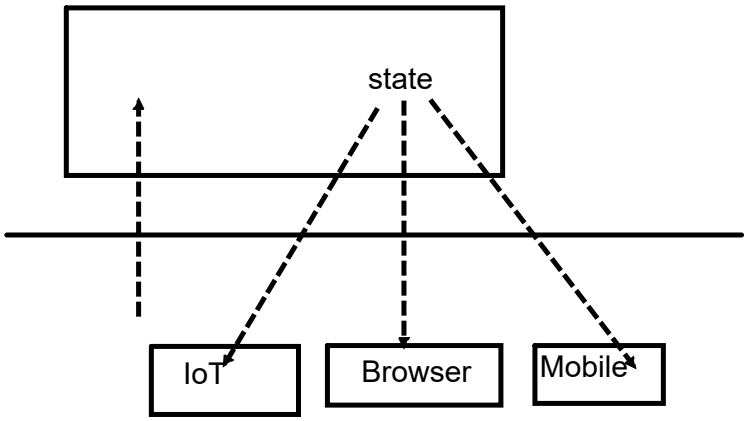
FreeMArker

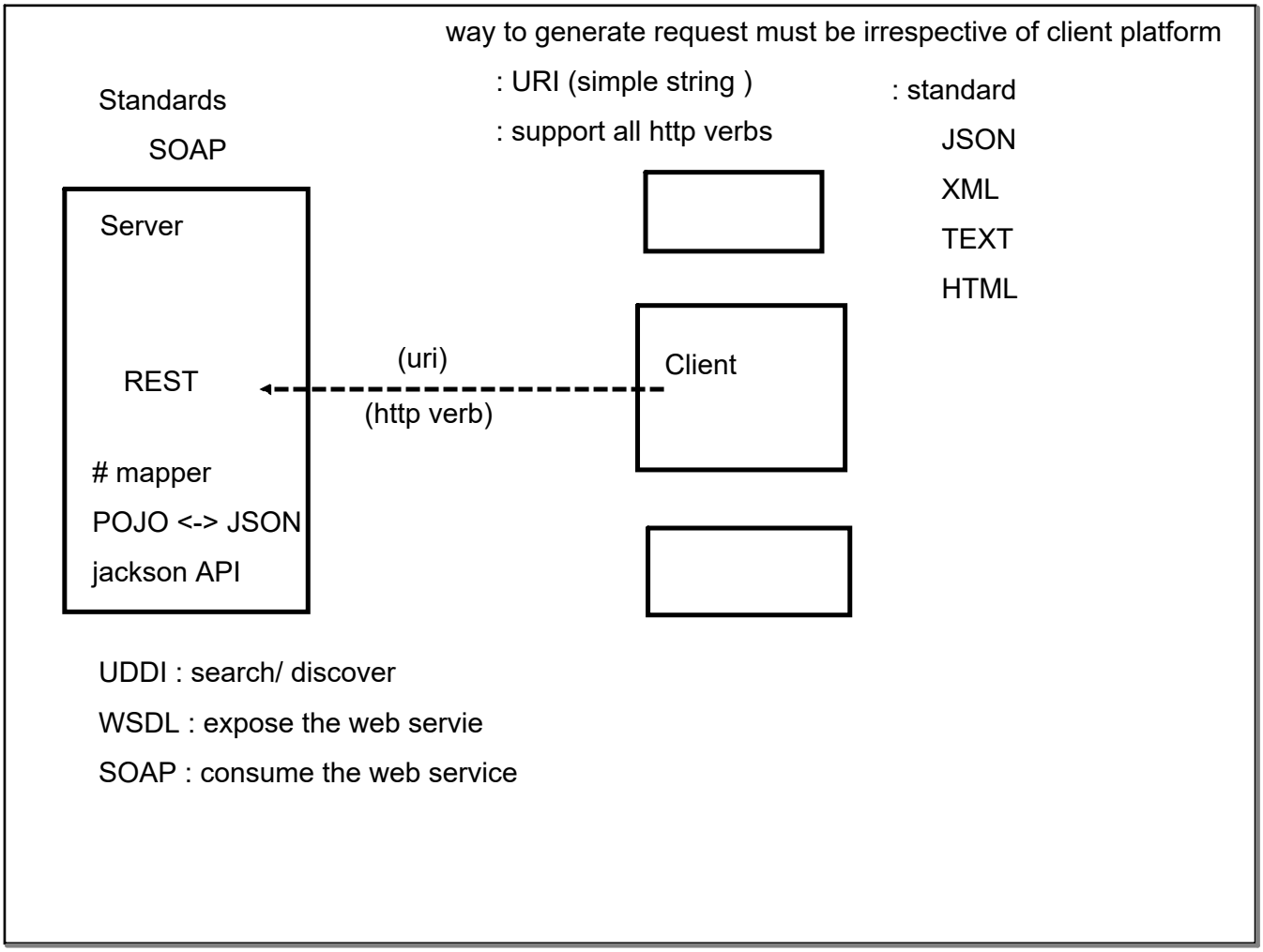
Tile

Velocity

Rest Based service

exposing server based info as Rest Service




way to generate request must be irrespective of client platform
: URI (simple string)
: support all http verbs
: standard
JSON
XML
TEXT
HTML
Standards
SOAP
Server
REST
# mapper
POJO <-> JSON
jackson API
(uri)
(http verb)
Client
UDDI : search/ discover
WSDL : expose the web servie
SOAP : consume the web service

@RestController : interconversion take care of

client intention

GET : data retrieval

POST : add new data

PUT : edition

DELETE : delete

Student /student

/getAll

Employee /employee

/getAll

@RestController : auto needs mapper in classpath (jackson)

@Controller

add mapper to classpath

produce

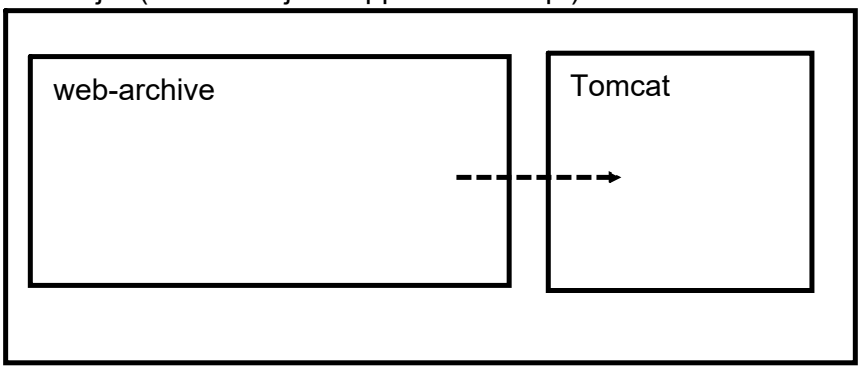
consume

@ResponseBody : content to be shared directly to client

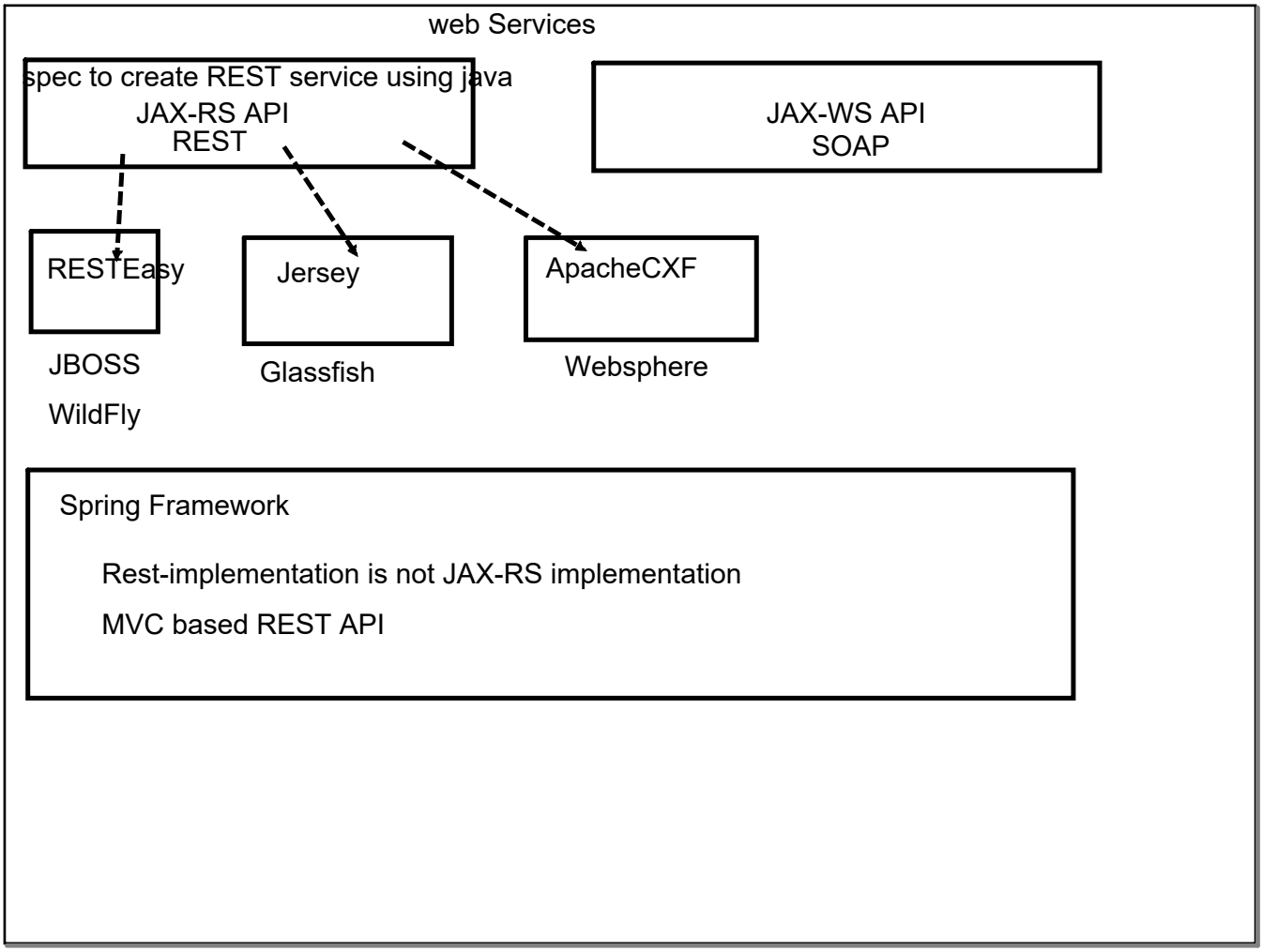
1.launch tomcat

2. deploy web-archive over tomcat

jar (additional java app build on top)



dev-tools: live reloading of server


web Services
spec to create REST service using java
JAX-RS API
REST
JAX-WS API
SOAP
RESTEasy
Jersey
ApacheCXF
JBOSS
WildFly
Glassfish
Websphere
Spring Framework
Rest-implementation is not JAX-RS implementation
MVC based REST API

actuator : exposes rest endpoint

Microservice architecture implements

Dividing a single large sized monolith application into
multiple smaller (independent) application

microservices : responsible to expose a particular service

DataDriven/Rest based

Stateless

Service Oriented Architecture : SOA :

Microservice : + technology/approach/design pattern

Monolith issues

involve light wight VS for deploying service components

Deployment :

Multi-Technology service component

DB : ideally must be using independent DB

Scaling : individual service comp

Robust in implementation

Design Guideline : MS (12 factor)

Design Pattern

Lightweight : concern/runtimes/data exchanging

Reactive : highly concurrent/longer processing

Stateless: scale better

Atomic : core design principle

Externalized config : config server

Consistent : style

Resilient : eliminate bottleneck

Good Citizens : expose usage statistics

well versioned :

Design Pattern:

Decompositions :

a) business capabilities

business-oriented rather than technical

b) sub-domain (technical)

domain class (parent/God classes)

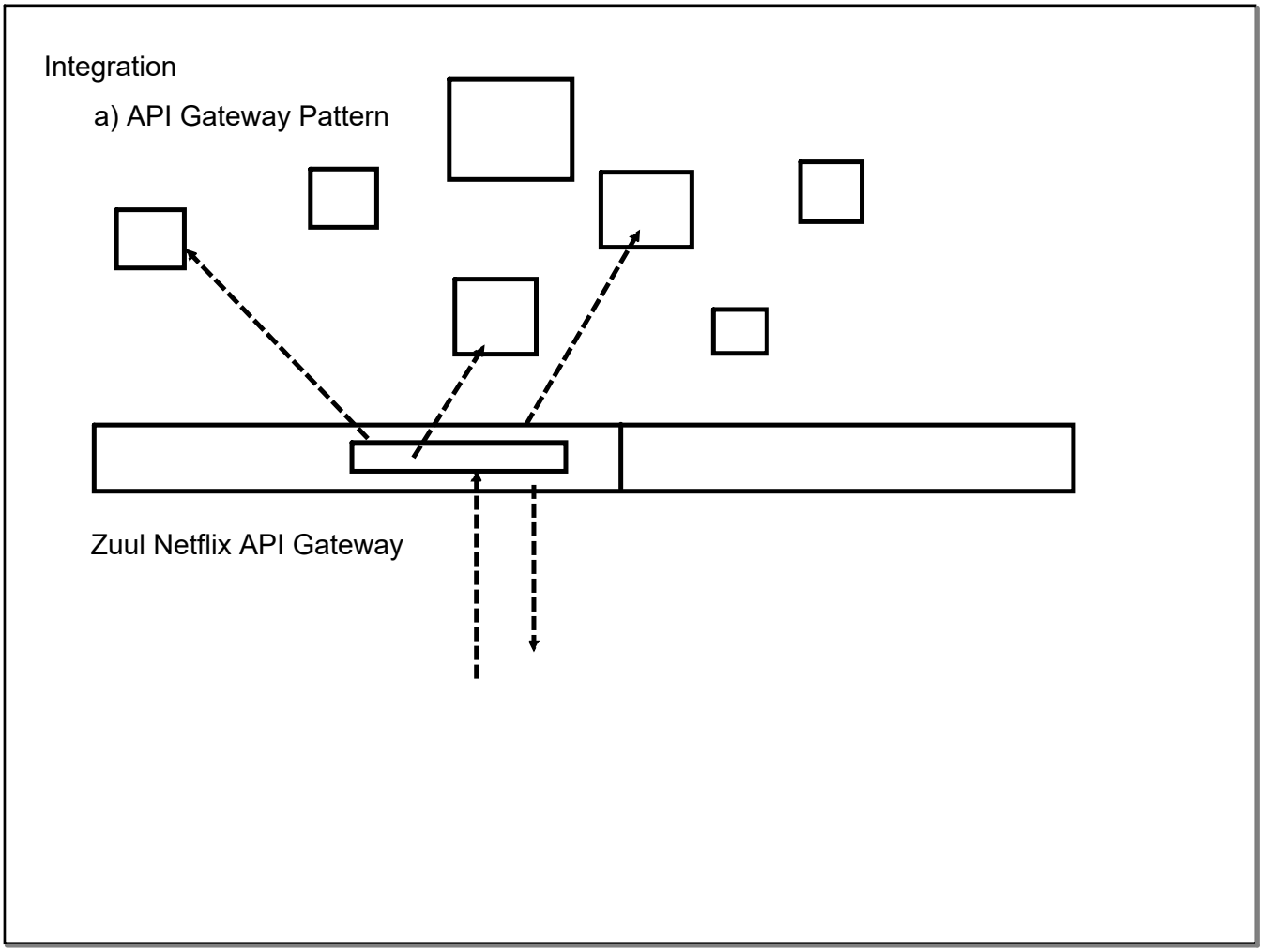
DDD : bounded context

sub-domains : BC with parent model

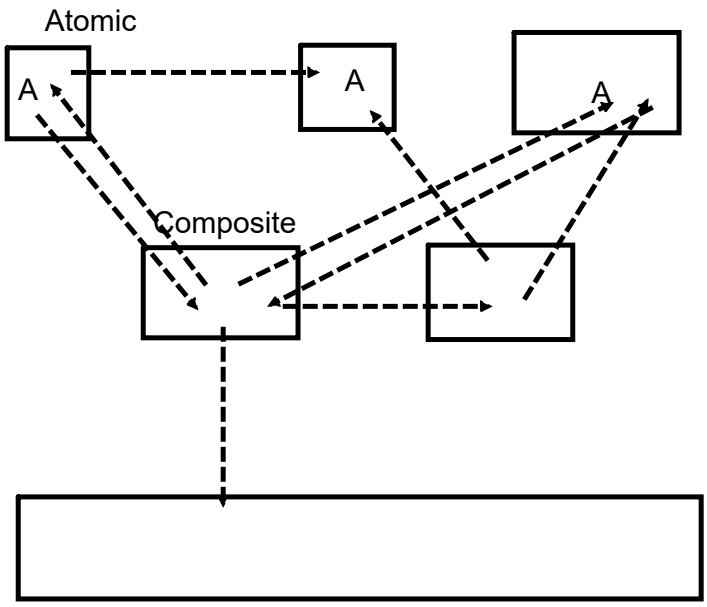
c) Strangler patterns

brownfield : converting monolith into MS

refactoring smaller req...

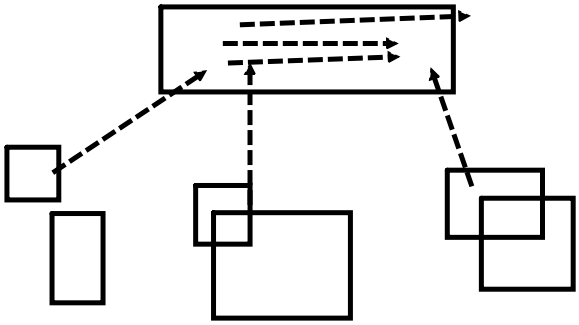

Integration
a) API Gateway Pattern
Zuul Netflix API Gateway

b) Aggregator Pattern



c) Client-side UI Composition

SPA : UI compositions



DataBase :

a) Ideal Pattern : Database Per Service

b) Shared Database :

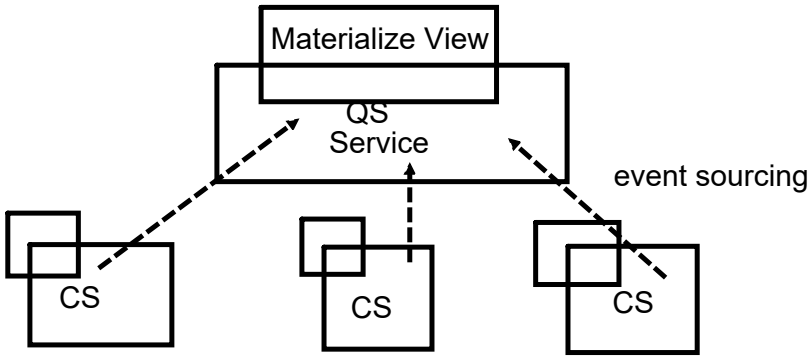
2-3 MS (DDD)

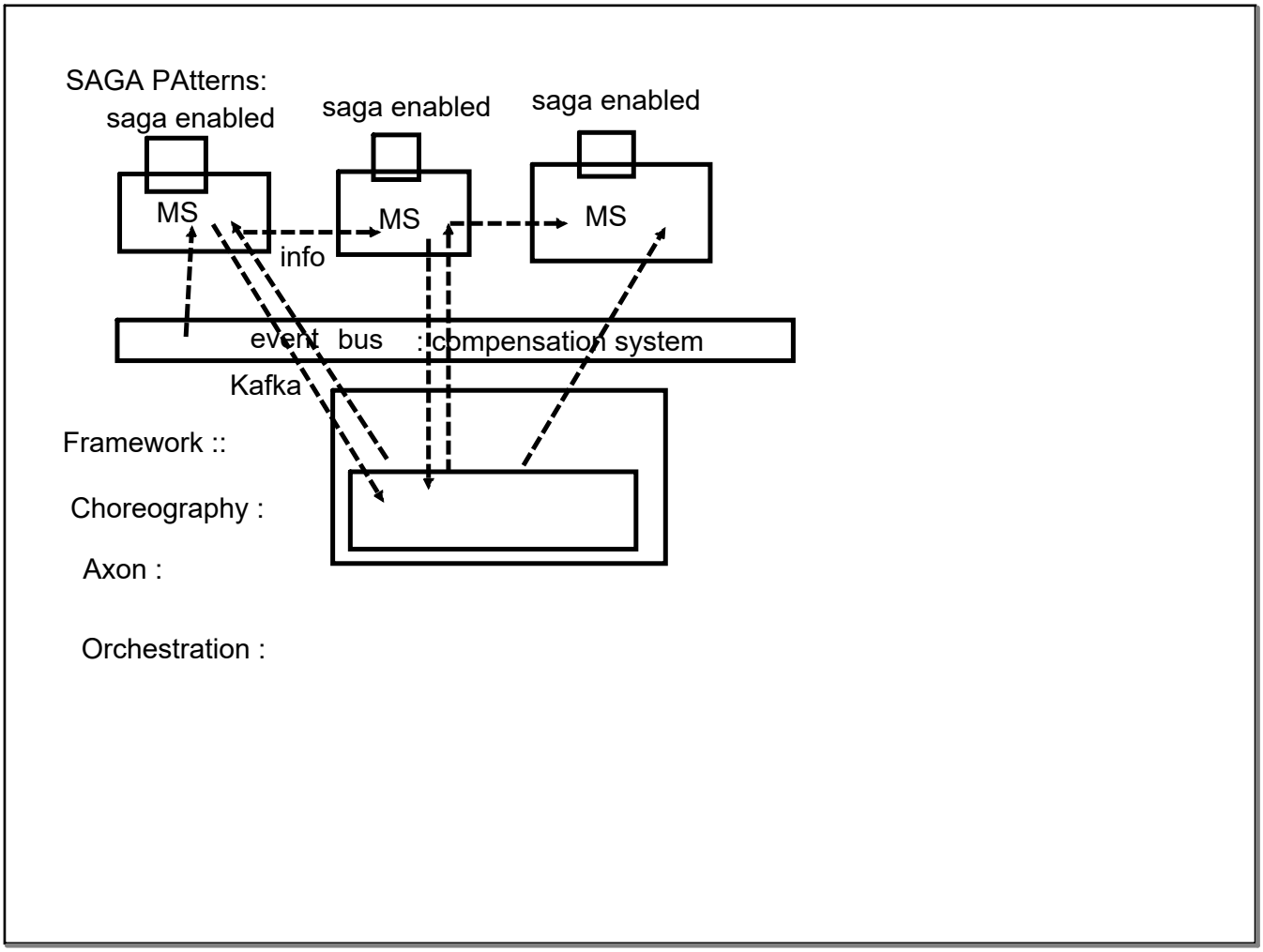
c) CQRS

Command Query Responsibility Segregation

Command Side (create/update/delete)

Query Side (retreive)




SAGA PAtterns:
saga enabled
saga enabled
saga enabled
MS
MS
MS
info
event bus
: compensation system
Kafka
Framework ::
Choreography :
Axon :
Orchestration :

Observability PAttern

a) Log Aggregation:

Centralized Logging pattern in place

track the log on request basis,

search

analysis

triggers alert

PCF : Pivotal Cloud Foundary

AWS Cloud Watch

b) Performance based

Centralized Metric service

push/pull model

=>NewRelics

=>Prometheus

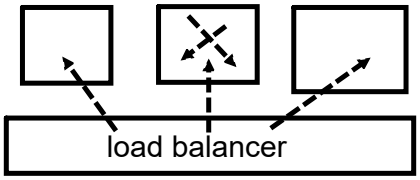
c) Distributed Tracing

system to track a request end-to-end

request id

Zipkin Server

Spring Cloud Slueth



d) Health Check

actuators /health :

Ribbon

Cross-Cutting Concerns

a) External Configuration

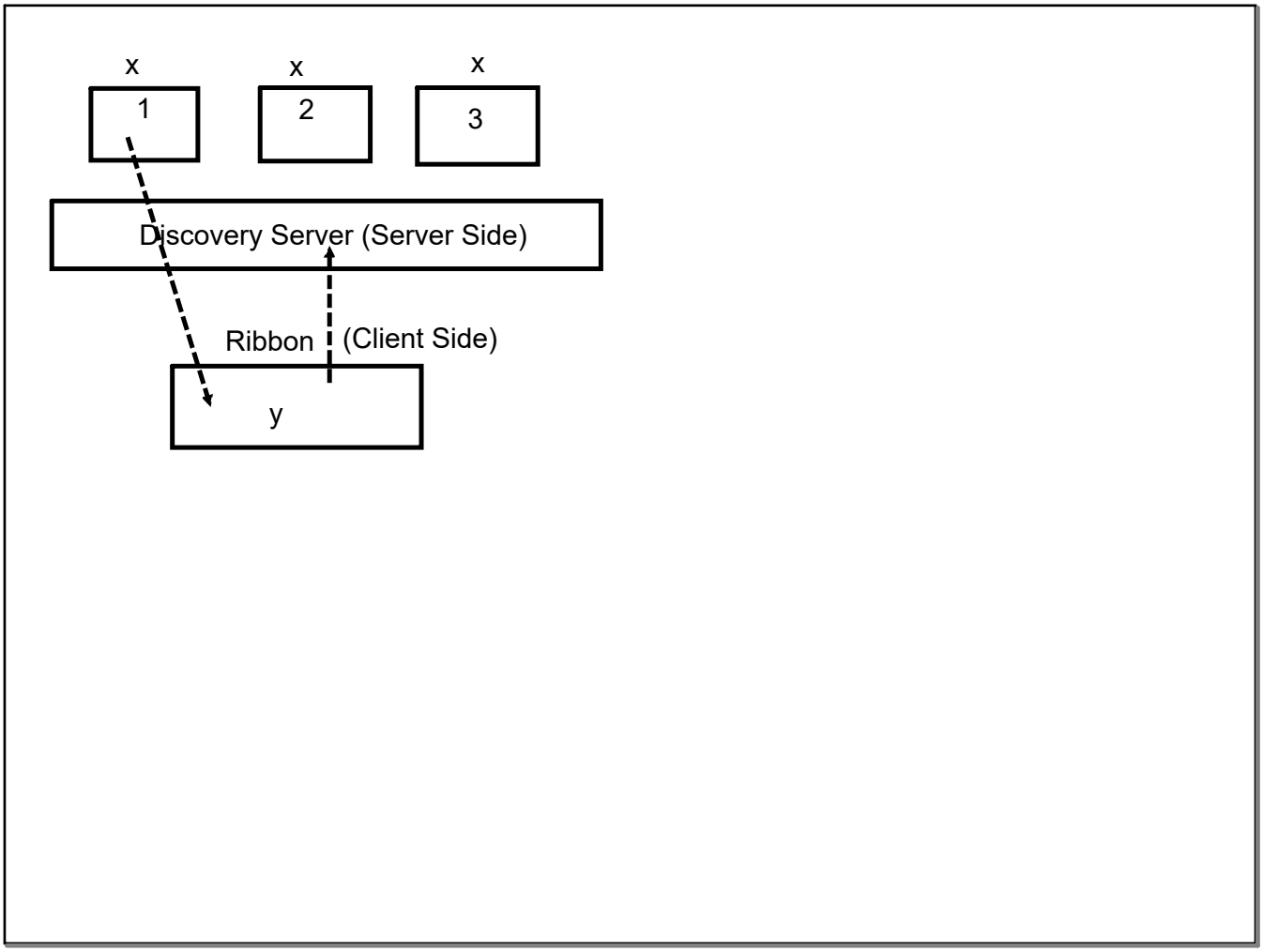
Spring Cloud Config Server

b) Service Discovery Pattern

all service shall register with registry system

Netflix Eureka Server

AWS ALB


x
x
x
1
2
3
Discovery Server (Server Side)
Ribbon
(Client Side)
y

c) Circuit Breaker Pattern

threshold

default response

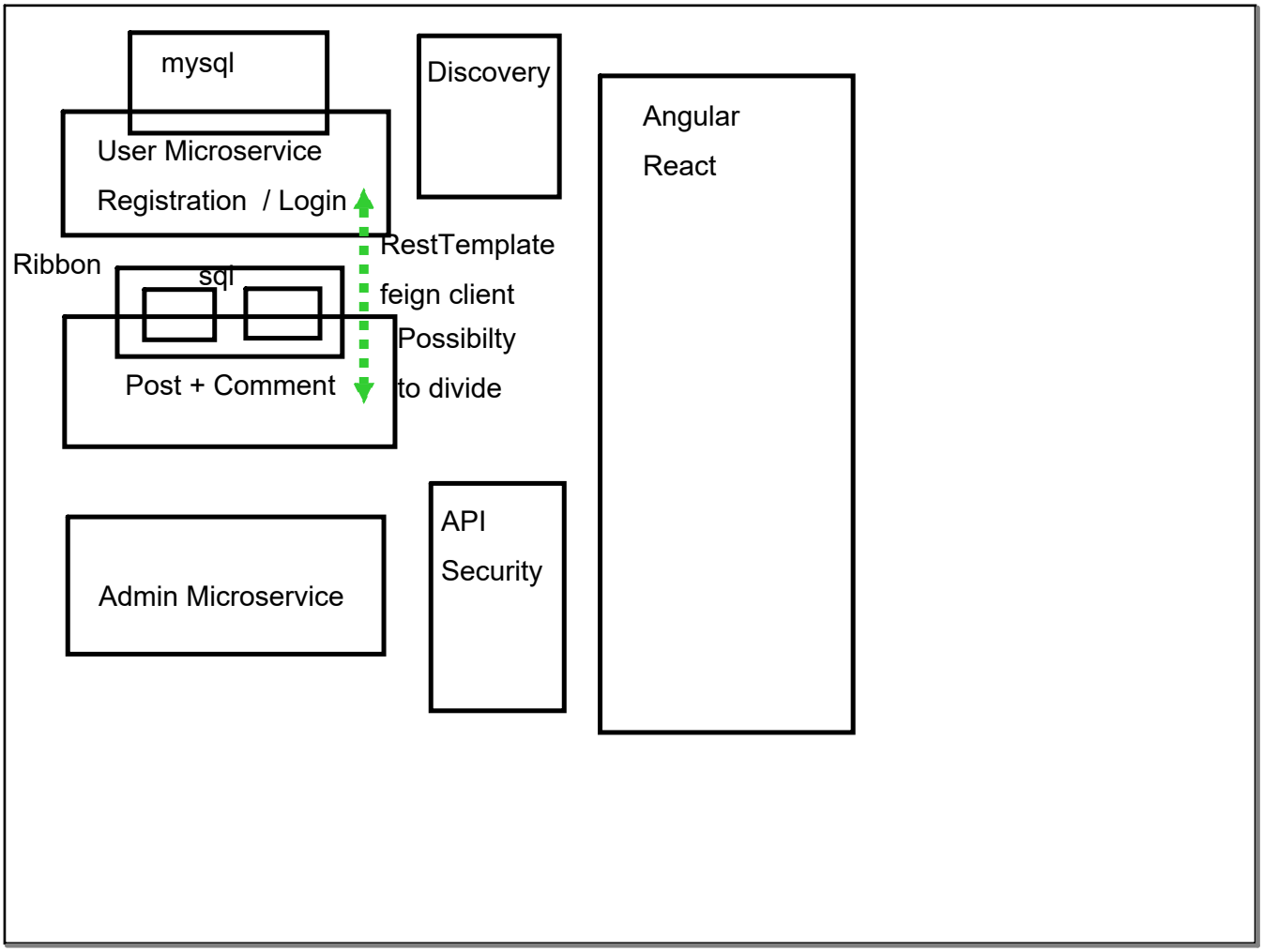
keep on trying

Netflix Hystrix

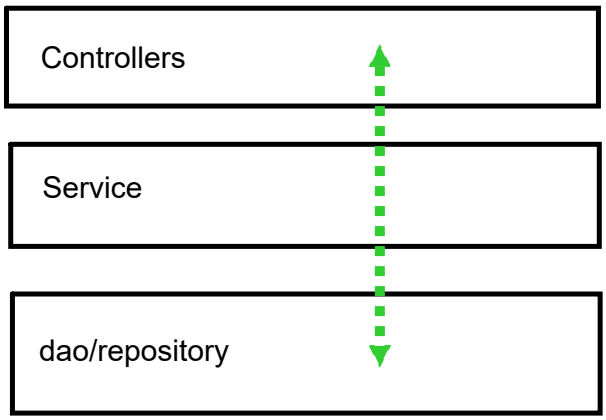
10 sec

5

fallback


mysql
Discovery
Angular
React
User Microservice
Registration / Login
RestTemplate
Ribbon
sql
feign client
Possibilty
Post + Comment
to divide
API
Security
Admin Microservice

Spring Cloud :



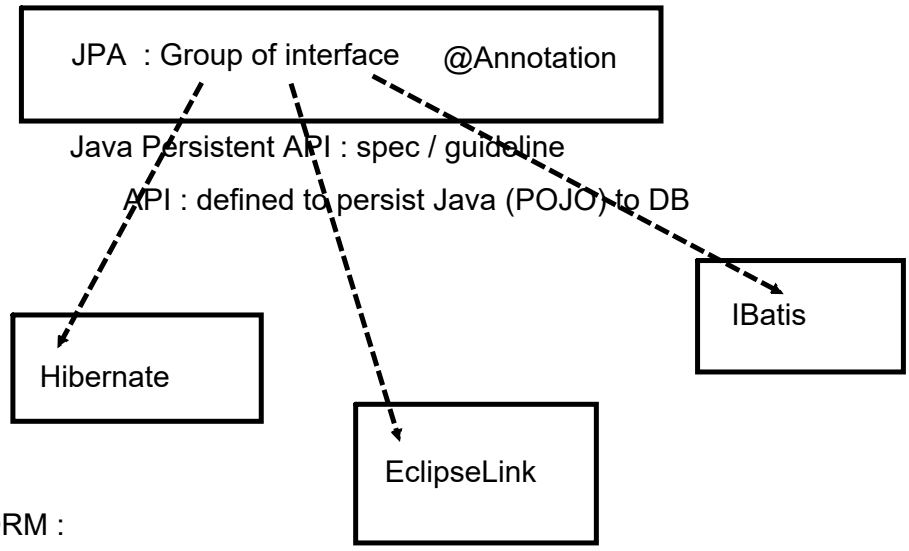
entity : POJO <----> DB schema

DTO : POJO
Validation

Exception

Spring Data JPA
inbuilt repository (generic) with implementation
that can be customized/extend
CRUD
select * from <table-name>
=>table
=>datatype of primary key

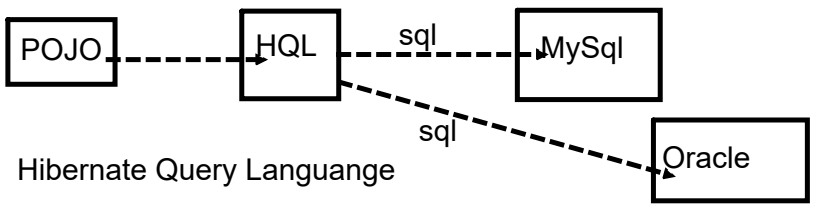
Need to configure properties file
for DB connection
: MySql-Driver : dependency



ORM :

behind the scene

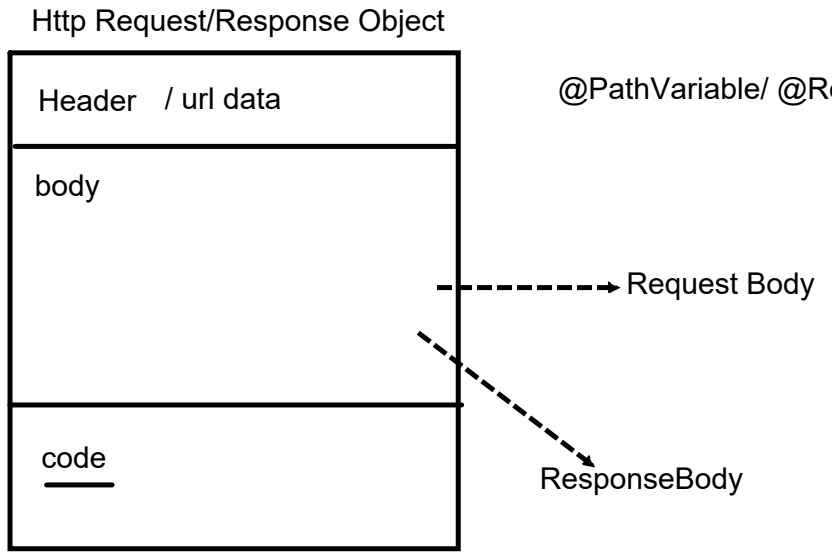
SQL queries would be created by Hibernate



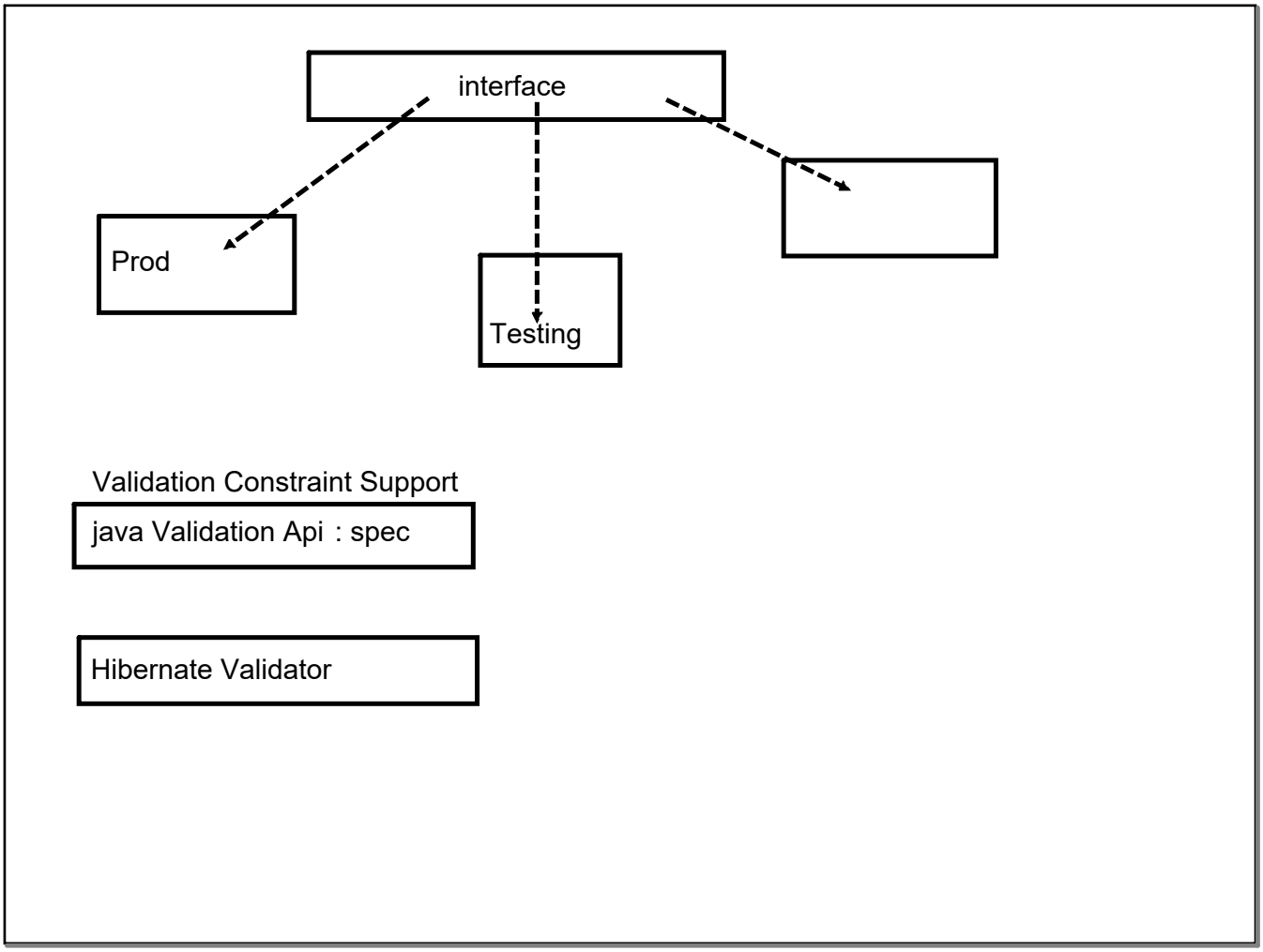
Hibernate Query Languange

Need to specify the dialect

c3p0 : dependency



All Rest Endpoints must have provision to customized the http Response object


interface
Prod
Testing
Validation Constraint Support
java Validation Api : spec
Hibernate Validator

Client Expecting : UserDetailDto (Success status)

Exception : UserExceptionDto (Failed status): throw an exception on client end of type mismatch

Server shall respond with appropriate status code

REst Client have provisions to check the status code

Adding a new data : instance/info about newly added data

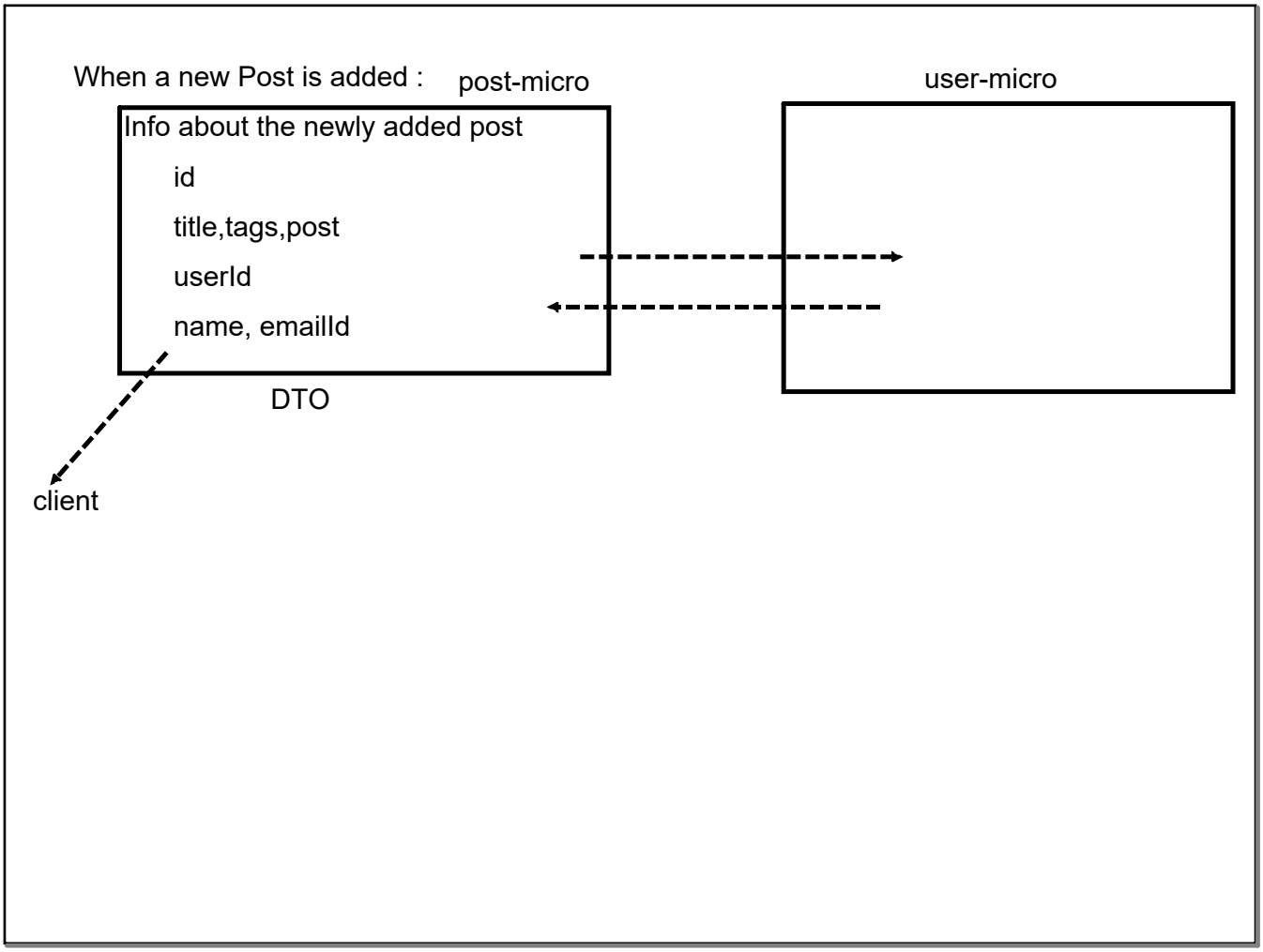
Updating the data : instance/info about update data

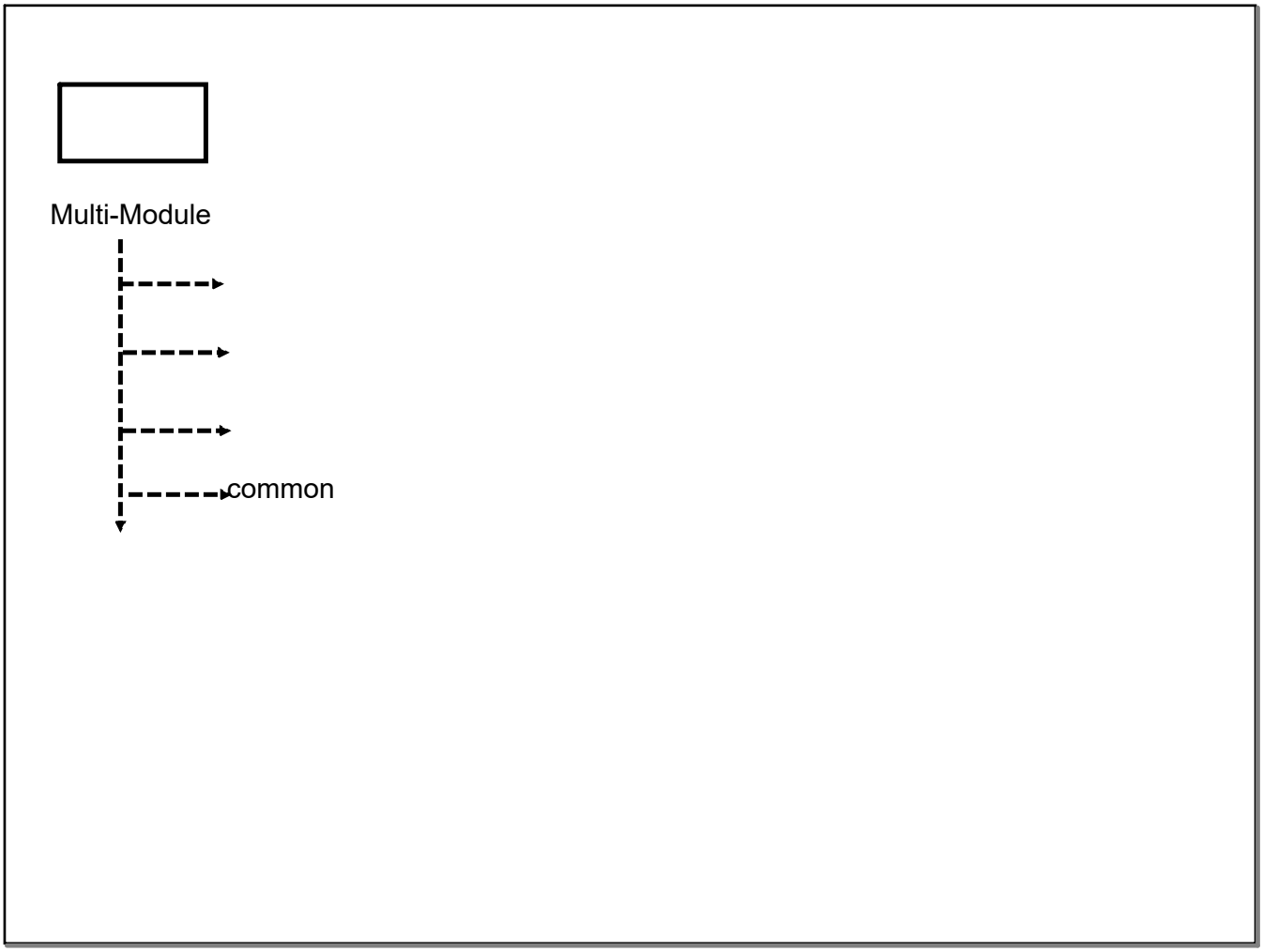
Deleting the record : instance/info about deleted data

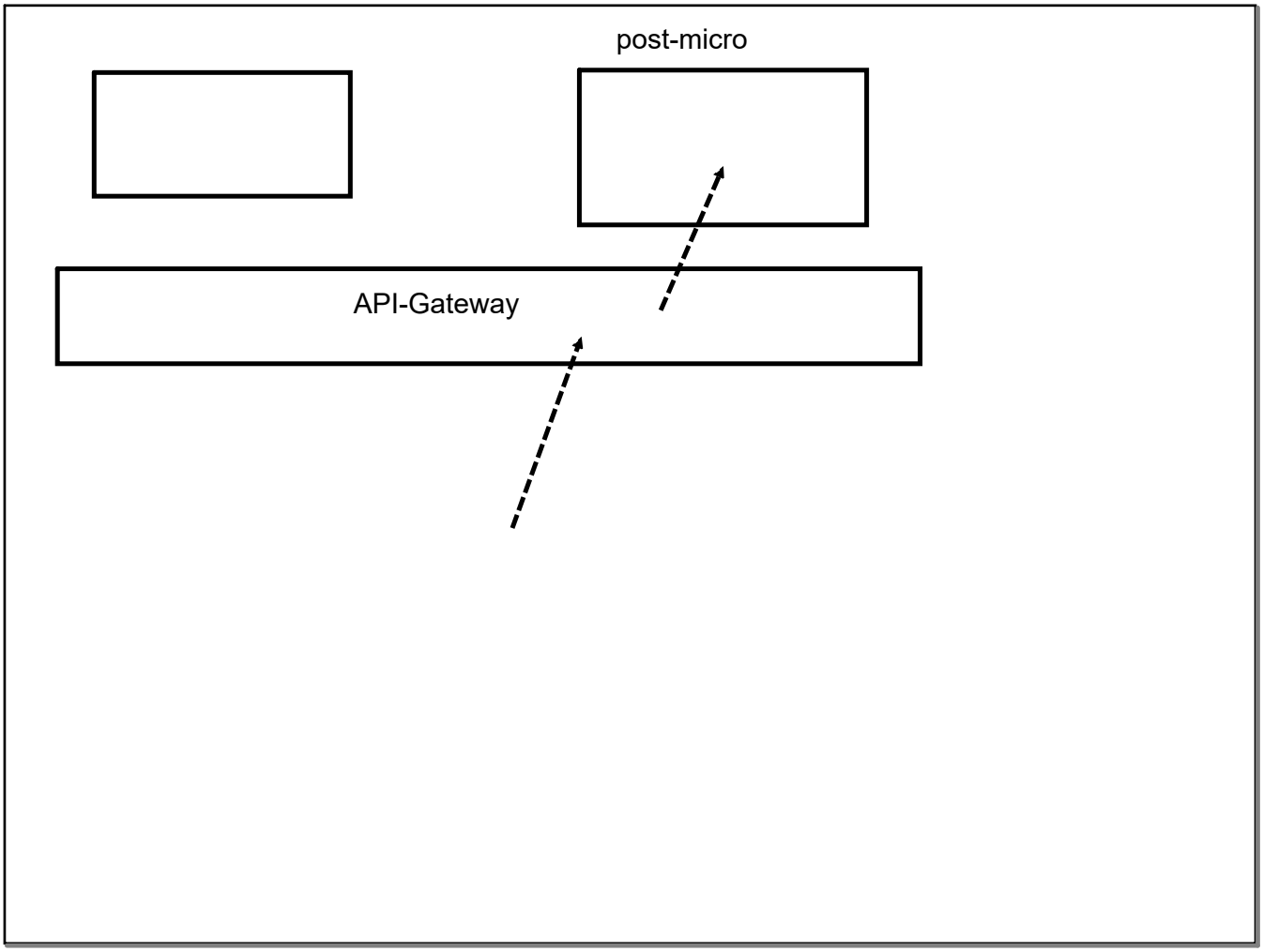
DTO - entity DTO ->

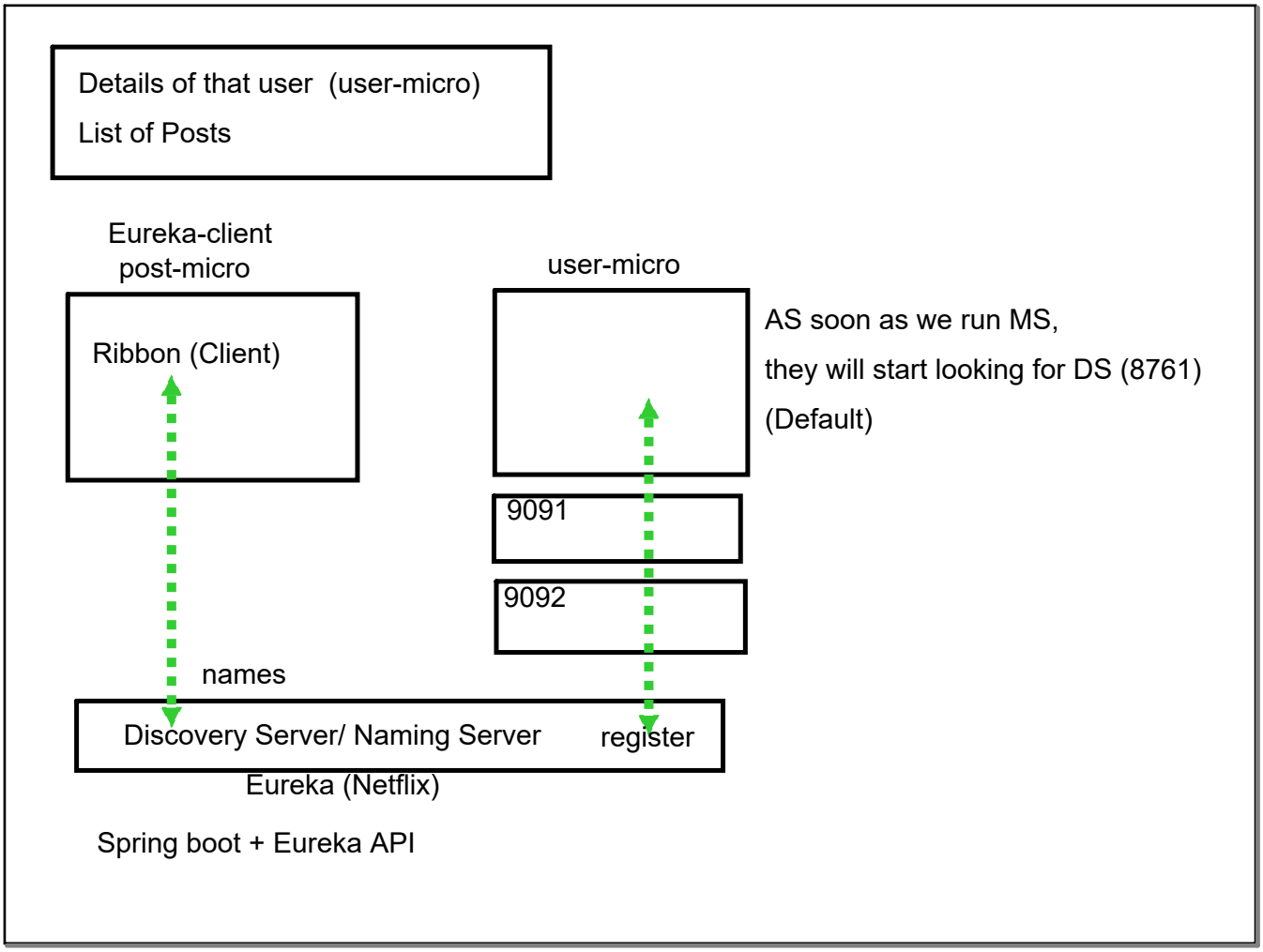
4 + 3 ---> DB

Client : 7 fld (primary


When a new Post is added :
post-micro
user-micro
Info about the newly added post
id
title,tags,post
userId
name, emailId
DTO
client


Multi-Module
common


post-micro
API-Gateway


Details of that user (user-micro)
List of Posts
Eureka-client
post-micro
Ribbon (Client)
user-micro
AS soon as we run MS,
they will start looking for DS (8761)
(Default)
9091
9092
names
Discovery Server/ Naming Server
register
Eureka (Netflix)
Spring boot + Eureka API

Two tables

1. User credential
2. Roles

User-Credentials
table ("users")
username : String
password : String
enabled : boolean

Roles
table ("authorities")
username : String
authority : String

password : encrypted form

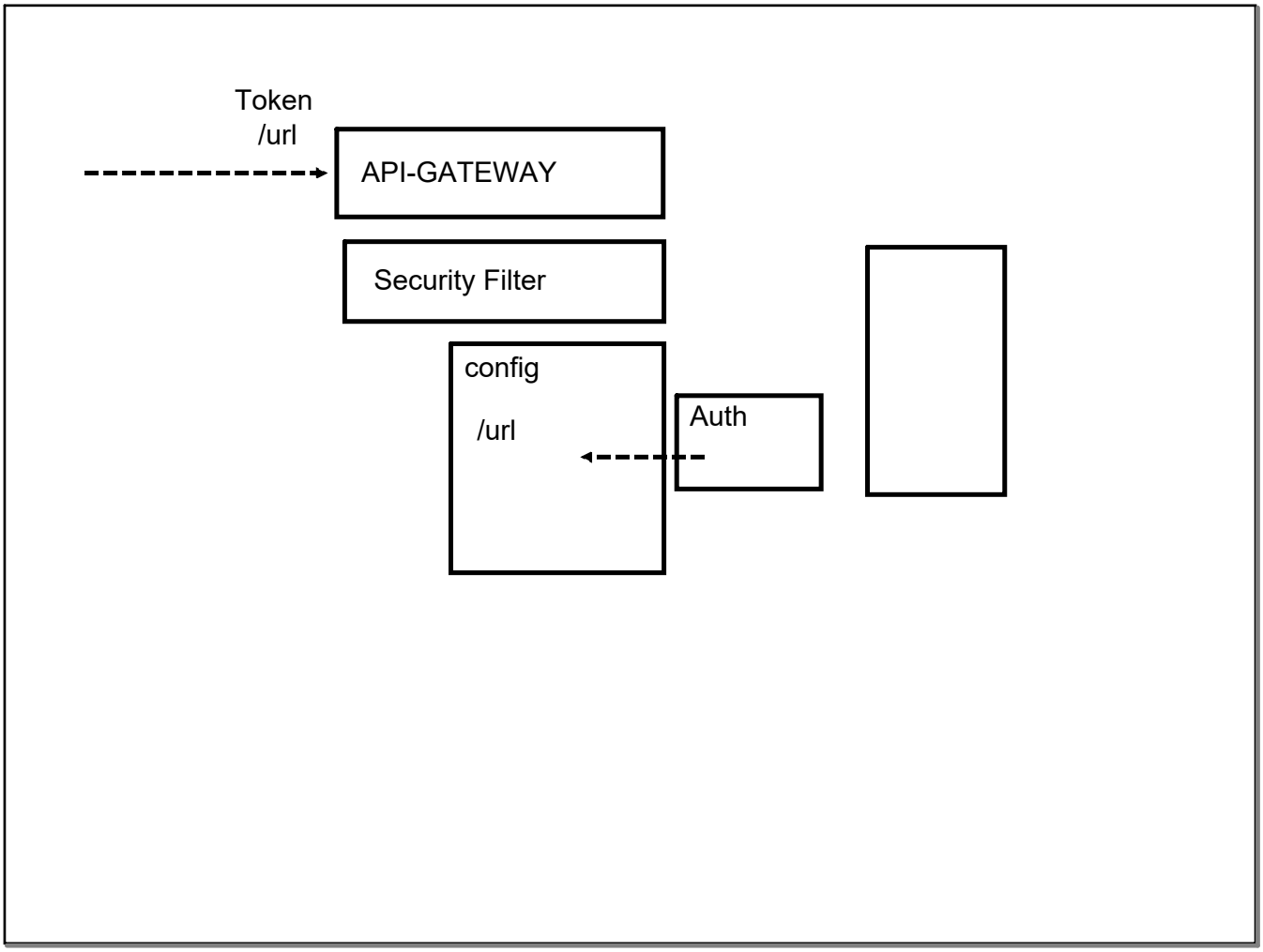
Spring security supports multiple encryption

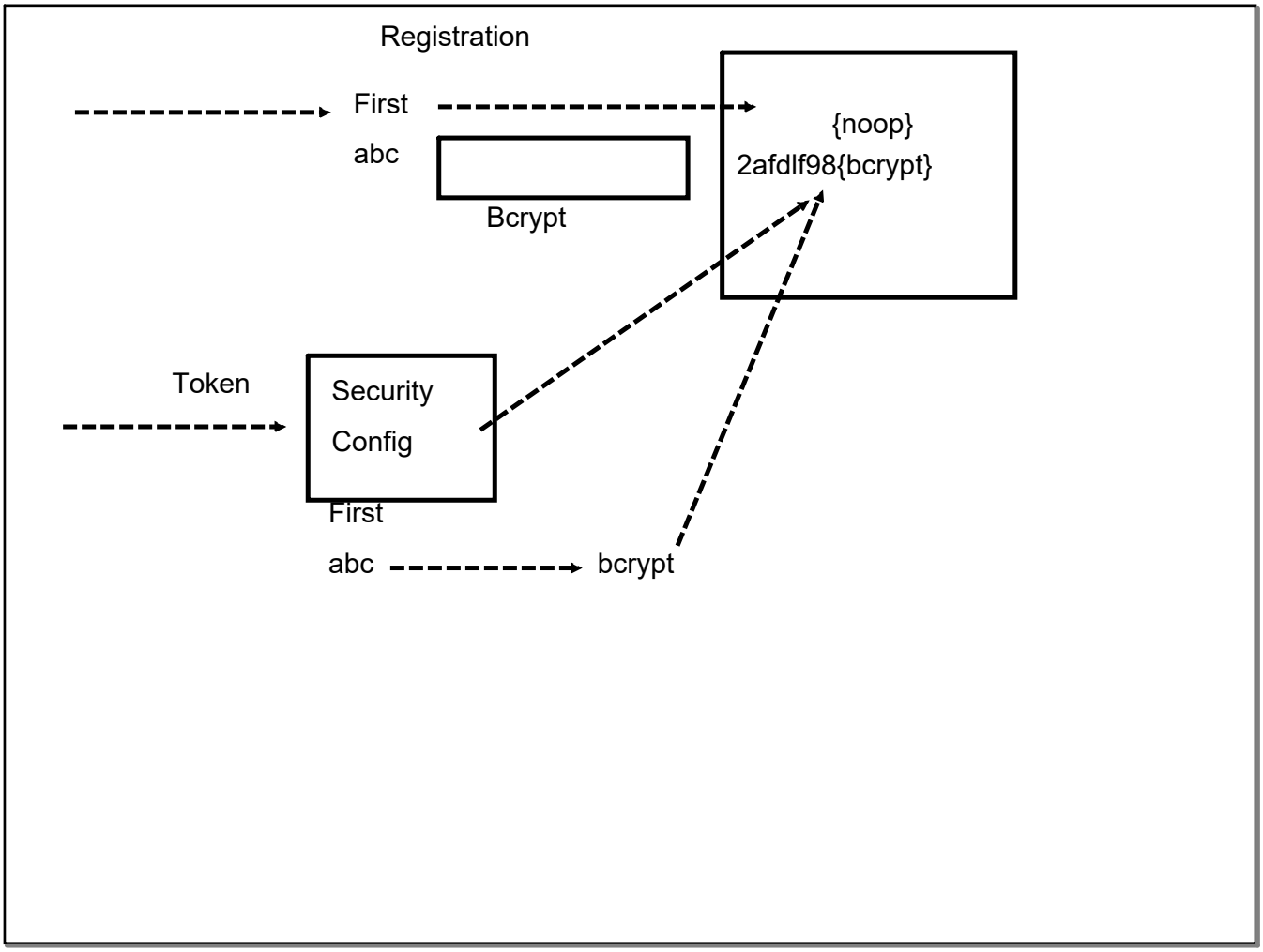
eg:

Plain-Text
abc{noop}

Bcrypt (one way)
{bcrypt}2afdhfldron98

Roles:
Manager ~ Role_Manager


Token
/url
API-GATEWAY
Security Filter
config
/url
Auth


Registration
First
abc
Bcrypt
{noop}
2afdlf98{bcrypt}
Token
Security
Config
First
abc
bcrypt

3 core elements

HTML : Structure

CSS : Presentation

JavaScript : Behavior

HTML-5

Validations

Drag n Drop

Semantic Tags

Web Workers

Offline functionlity

Geolocation

New Semantic Tag (Backward Compatible)

purpose full (specific to req)

=> container

=> attributes -- Form based extention

Smooth Renderring (outline algo)

more compatible to search algo

in sync with Assisstive Tech

Standardized Error handling algo : Developers (Debug)

images/audio/videos : third party plugins : HTML5 tags + API (control)

Built-in APIs

traditional:

<p>, ,

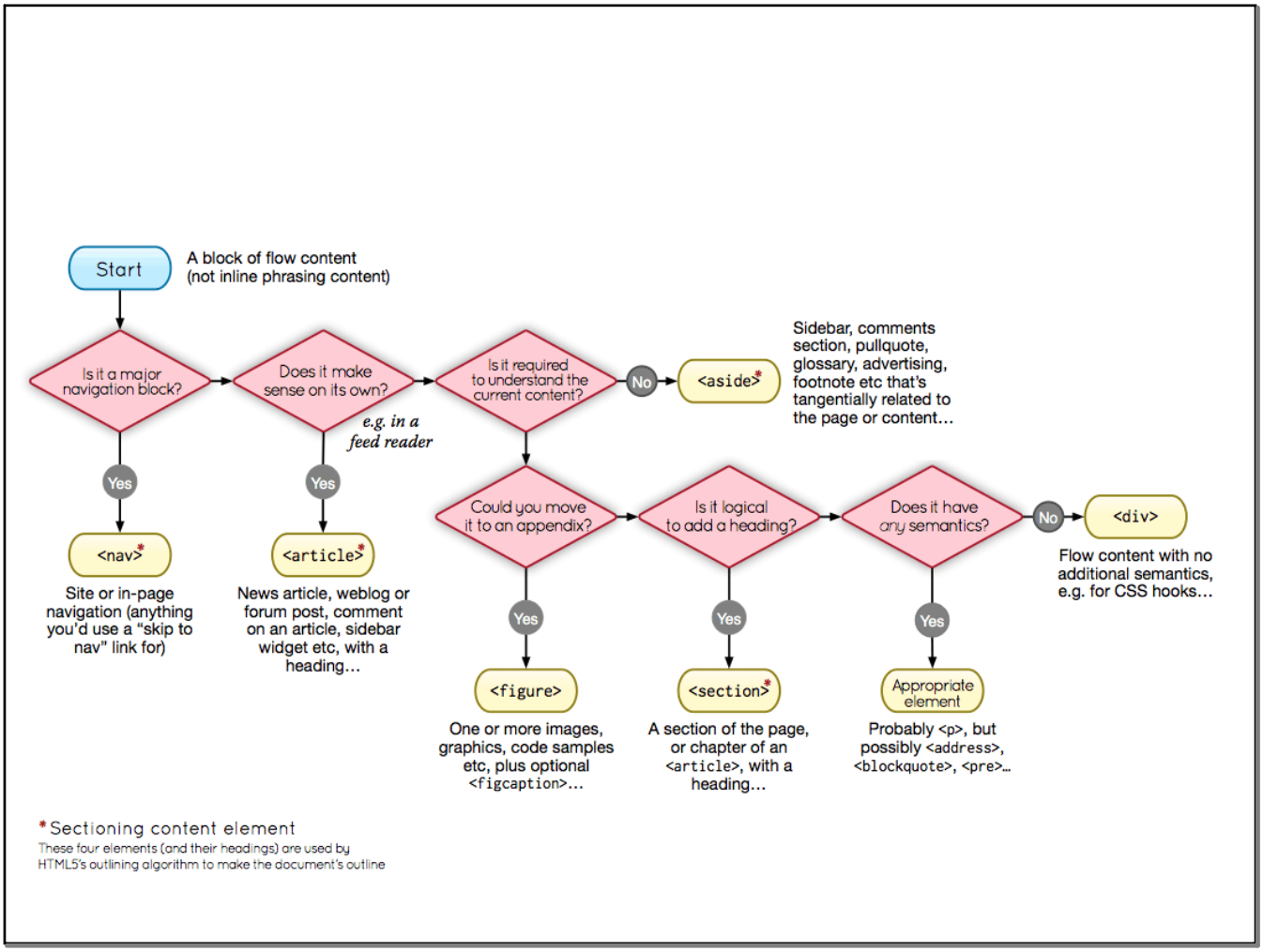
article

section

aside

header

footer


Start
A block of flow content (not inline phrasing content)
Is it a major navigation block?
Yes
<nav>*
Site or in-page navigation (anything you'd use a "skip to nav" link for)
Does it make sense on its own?
e.g. in a feed reader
Yes
<article>*
News article, weblog or forum post, comment on an article, sidebar widget etc, with a heading…
Is it required to understand the current content?
No
<aside>*
Sidebar, comments section, pullquote, glossary, advertising, footnote etc that's tangentially related to the page or content…
Could you move it to an appendix?
Yes
<figure>
One or more images, graphics, code samples etc, plus optional <figcaption>…
Is it logical to add a heading?
Yes
<section>*
A section of the page, or chapter of an <article>, with a heading…
Does it have any semantics?
Yes
Appropriate element
Probably <p>, but possibly <address>, <blockquote>, <pre>…
No

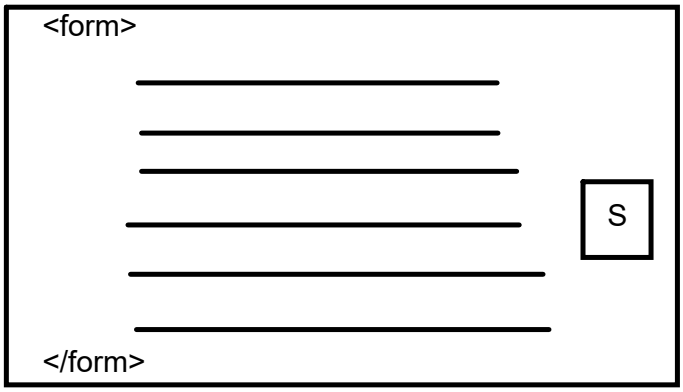
Flow content with no additional semantics, e.g. for CSS hooks…
*Sectioning content element
These four elements (and their headings) are used by HTML5's outlining algorithm to make the document's outline

Html form :

specialized form inputs

validation : required/pattern

special att : custom behavior of form



Canvas API

DOM Tree managed by the browser

Html component(Tag) : JS - object

User Interaction : presentation : CSS

Cascade style sheet

Stylesheet : : set of rules 'presented'

Cascade : set of rules : resolve the conflict of multiple ss applied on a element

Specificity

controlling over where to apply the style

CSS rule :

CSS Selector

CSS declaration

```
selector {
    property : value
}
```

selector : css rule would be applied to which HTML elem

Selector

Type (most varied : wide spectrum : which type HTML element)

ID

class

eg :

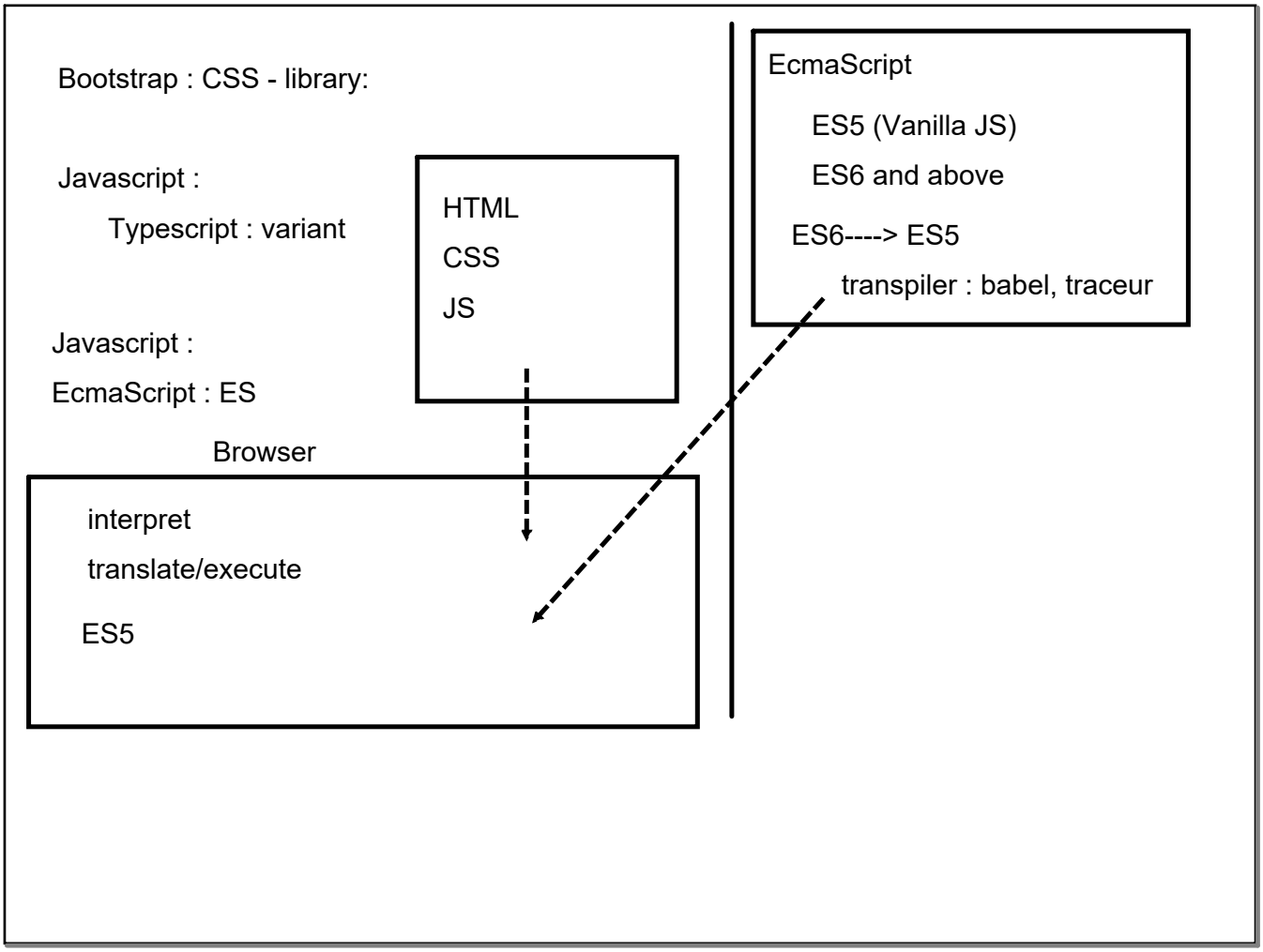
```
p{
    ----------
    ----------
}
```

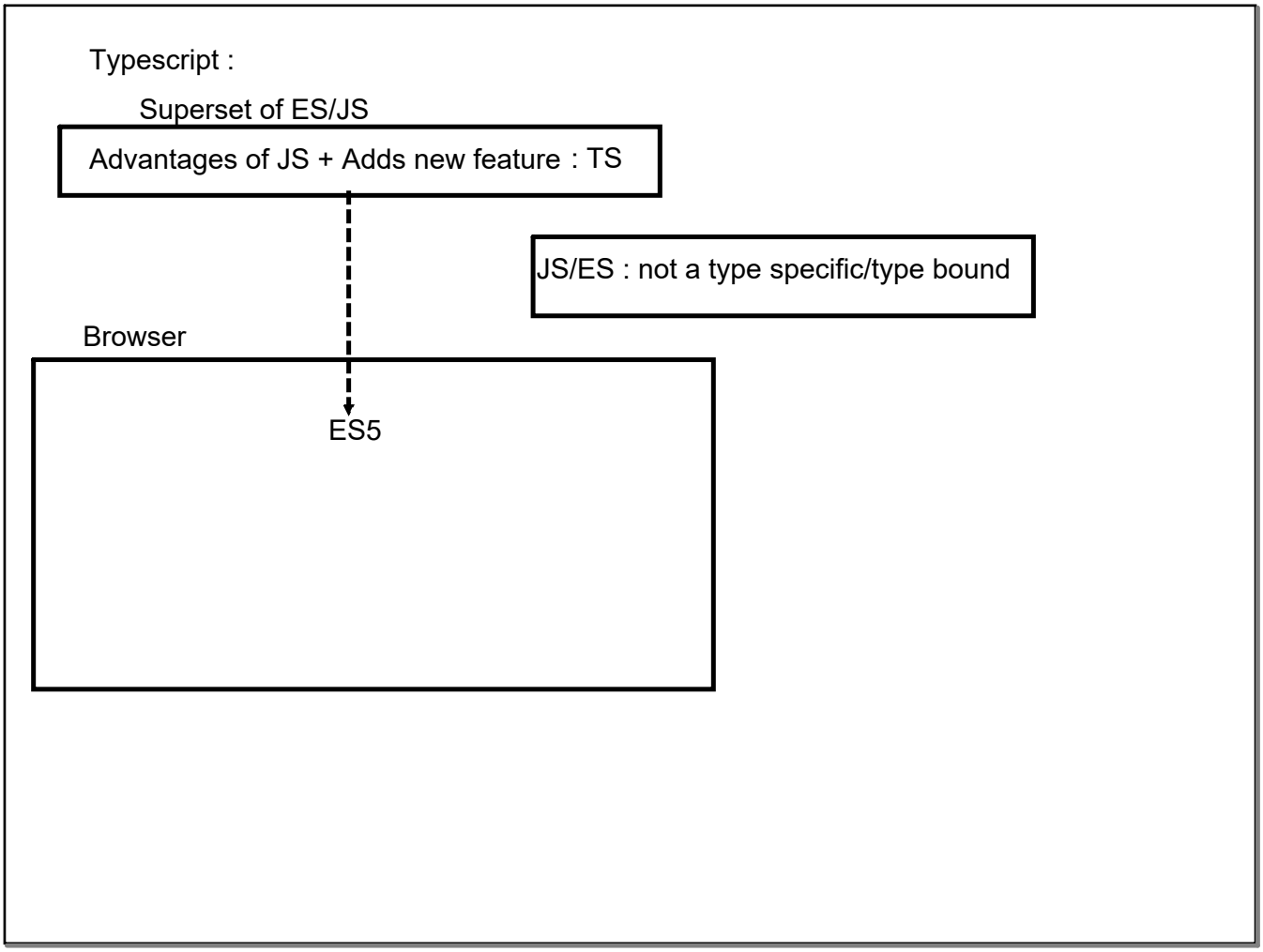
ID : very specific

```
#canvastest{
    ------------------------
    ------------------------
}
```

class

```
.mclass{
    -----------------
    -----------------
}
```


Bootstrap : CSS - library:
Javascript :
Typescript : variant
Javascript :
EcmaScript : ES
HTML
CSS
JS
Browser
interpret
translate/execute
ES5
EcmaScript
ES5 (Vanilla JS)
ES6 and above
ES6----> ES5
transpiler : babel, traceur


Typescript :
Superset of ES/JS
Advantages of JS + Adds new feature : TS
JS/ES : not a type specific/type bound
Browser
ES5

Javascript

```
function add(num1, num2){
  // validation check
   return num1 + num2;
}
```

call : add(20, 30); // arithmatic addition

: add('hello', 'world'); // string concatenation

Unwanted behavior at runtime

Typescript :

- Named Types...
- NextGen JS features
- NonJS features like Interface/Generics
- Decorators (Meta-Programming)
- More Config options

Transpiler : Typescript compiler

Javascript based resource, managed way

management tool :

- nodejs : npm : node package manager
- yarn

NodeJs : installed + system path

(npm) : cli

NodeJs : Framework that allows to use JS for server side programming: non-blocking, asynchronous server implementation

npm : is a project management tool for JS related project management

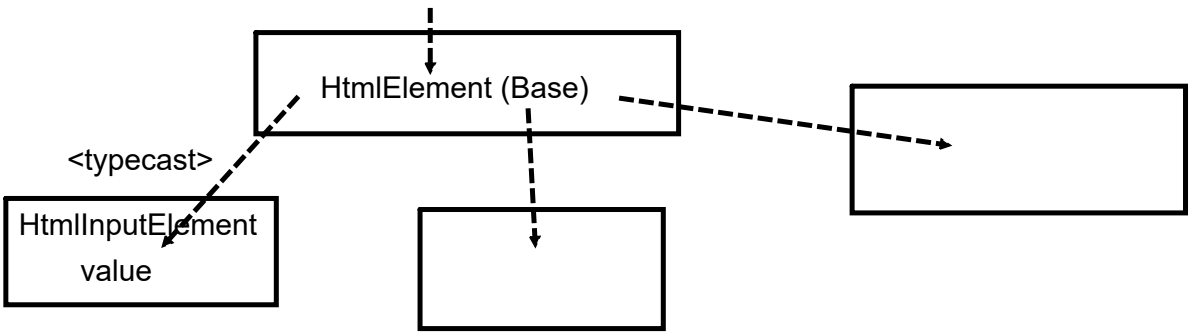
```
# Need to install typescript compiler
>npm install -g <tool> (global installation)
> npm install -g typescript
```

Typescript file must have ext : .ts

<variable name> : <typename>

Every HTML Components has a specific JS class

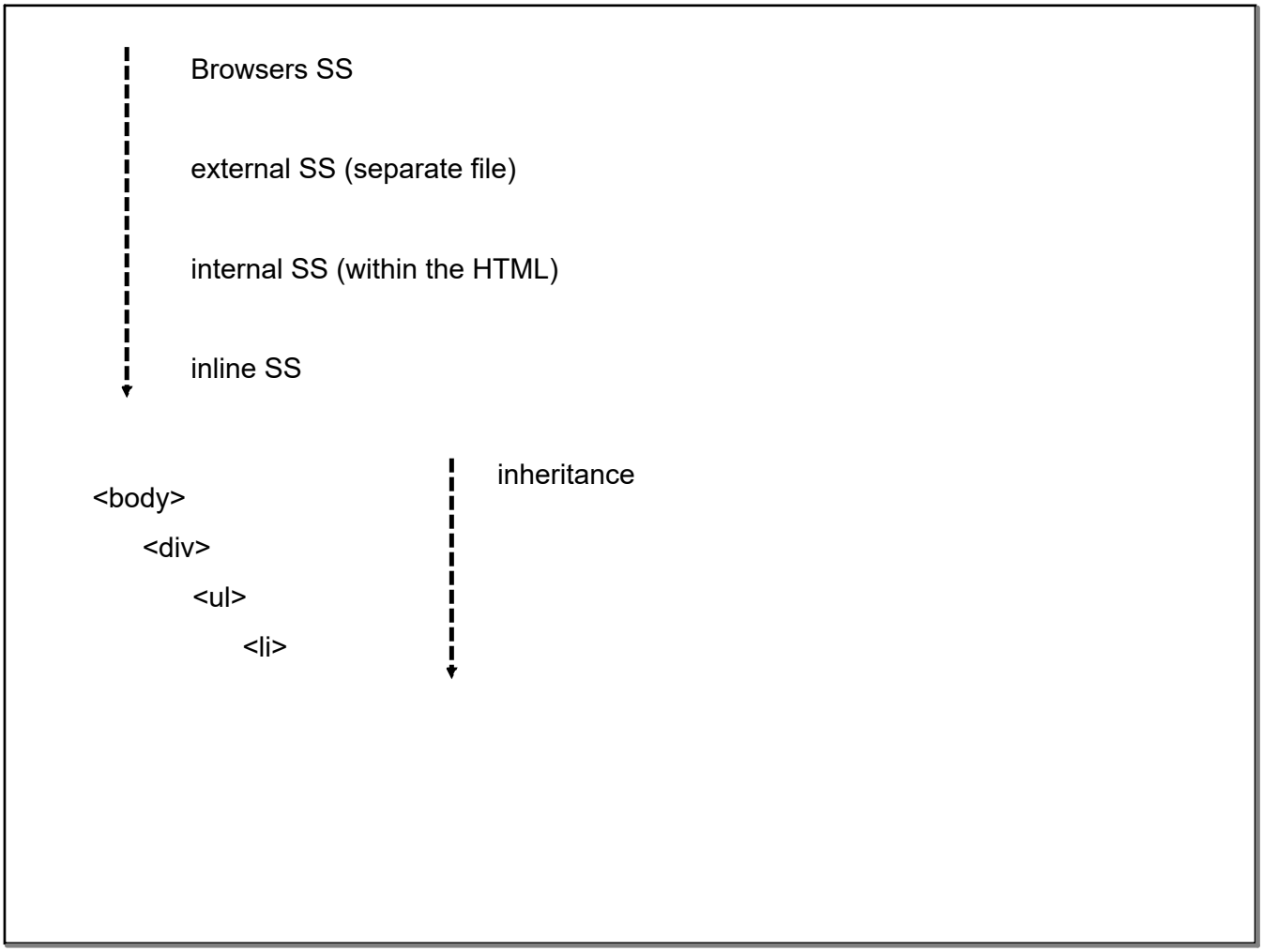
input1 = document.getElementById("num1")



var ~ ES6 : const / let

Core Types

- number : integer/fractions
- string : 'hello', "hello", `hello`
- boolean : true,false
- object : Javascript object (more type specific)Object Notation
- Array : JS has way to create array of heterogenous nature (TS : homogenous)
- Tuple : Fixed length : Type
- # Union : specify multiple types
- Enum : enumerated Datatype
- any : default JS type


Browsers SS
external SS (separate file)
internal SS (within the HTML)
inline SS
inheritance
<body>

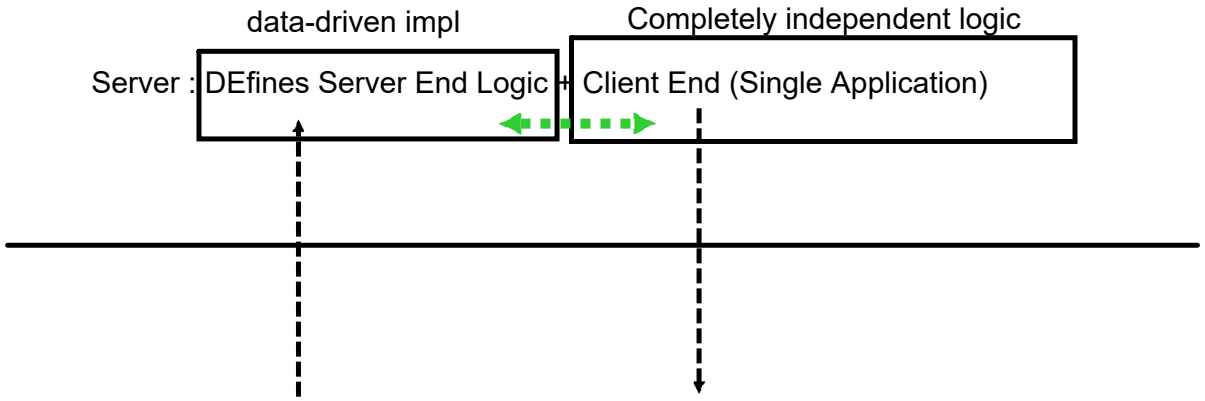
Classes : high level way :

Closures :

have global variable(memory retains across function calls) with local scope

static variables of C functions

Angular : FrontEnd Framework



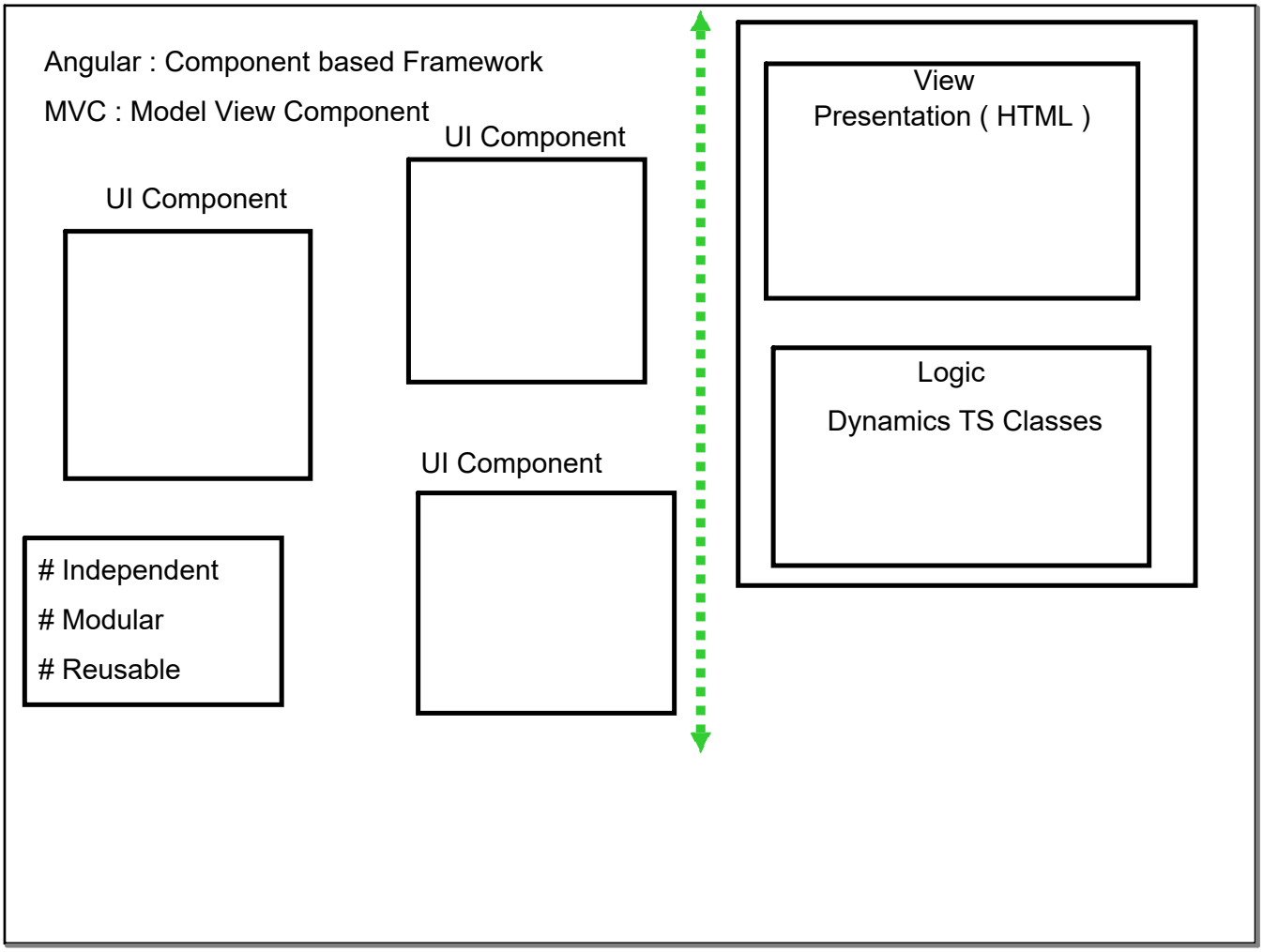
Loose coupling of Server Side (backend logic) and Client Side (Frontend logic)

1. Server Side is reusable
2. Client Side is also reusable (flexible)
3. More independent implementation
4. Load Distribution among client machine (renderring the dynamic web-pages : JS)
5. Client End Renderring can Highly customized

Angular Framework

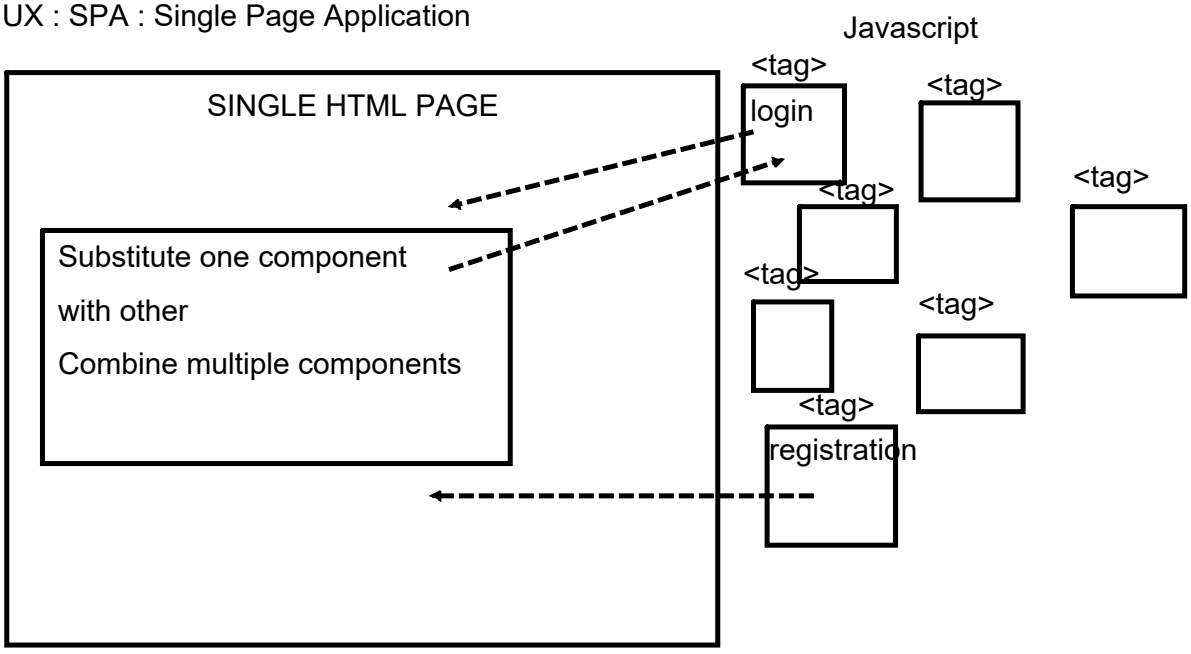
Complete Framework

Base Script : TS
Resources : Client Side JS Community Library
npm to manage angular application


Angular : Component based Framework
MVC : Model View Component
UI Component
UI Component
UI Component
Independent
Modular
Reusable
View
Presentation (HTML)
Logic
Dynamics TS Classes

Relationship : (logic + presentation) decide the output

UX : SPA : Single Page Application



Angular/CLI Project needs to be installed

Download angular CLI/installed

(by default latest version)

> npm install -g @angular/cli

Angular CLI will expose angular specific command

> ng <option>

> ng new <project-name>

1. Complete folder/file structure required as Angular Framework project

2. Download default Angular lib

> Add routing module (Y)

> Stylesheet : CSS(default)

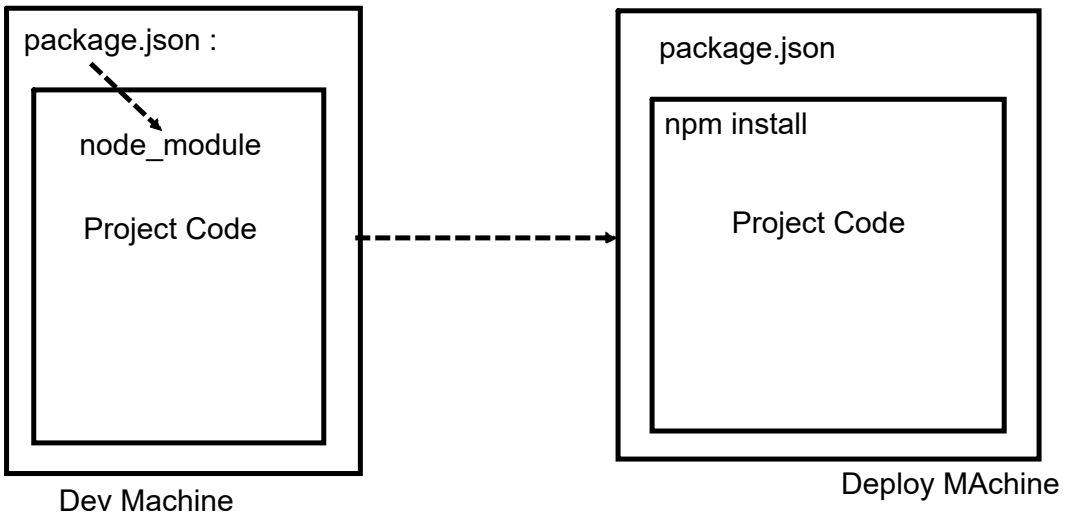
Feature Set for Unit/Integration Testing and End-To-End Testing

1. Jasmine Framework : JS Testing Framework (Write Test case unit/integration + e2e)
2. Test Runner : Unit Test (Karma)
3. Test Runnner/Framework : End-To-End Testing (Protractor)

e2e : supposed to contain test cases/config related to End-To-End Testing

node_module : All lib are stored in this folder

src : All Angular code goes here



package.json is default dependency file for all

JS based application

> npm install (--dev) command will by default read package.json

and download all dependencies auto and store in node_modules (Default folder for all JS app)

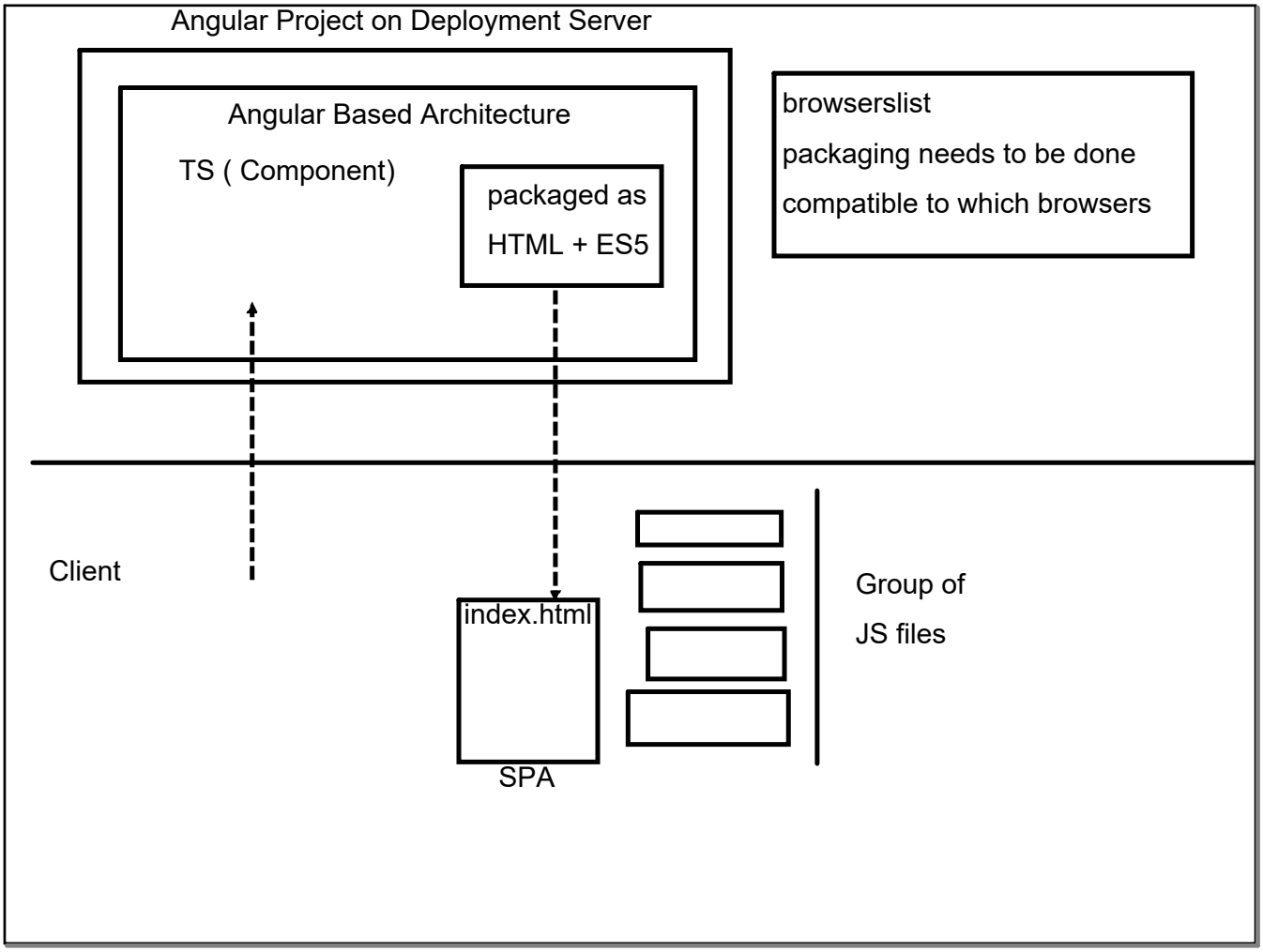
Adding a new Dependency:

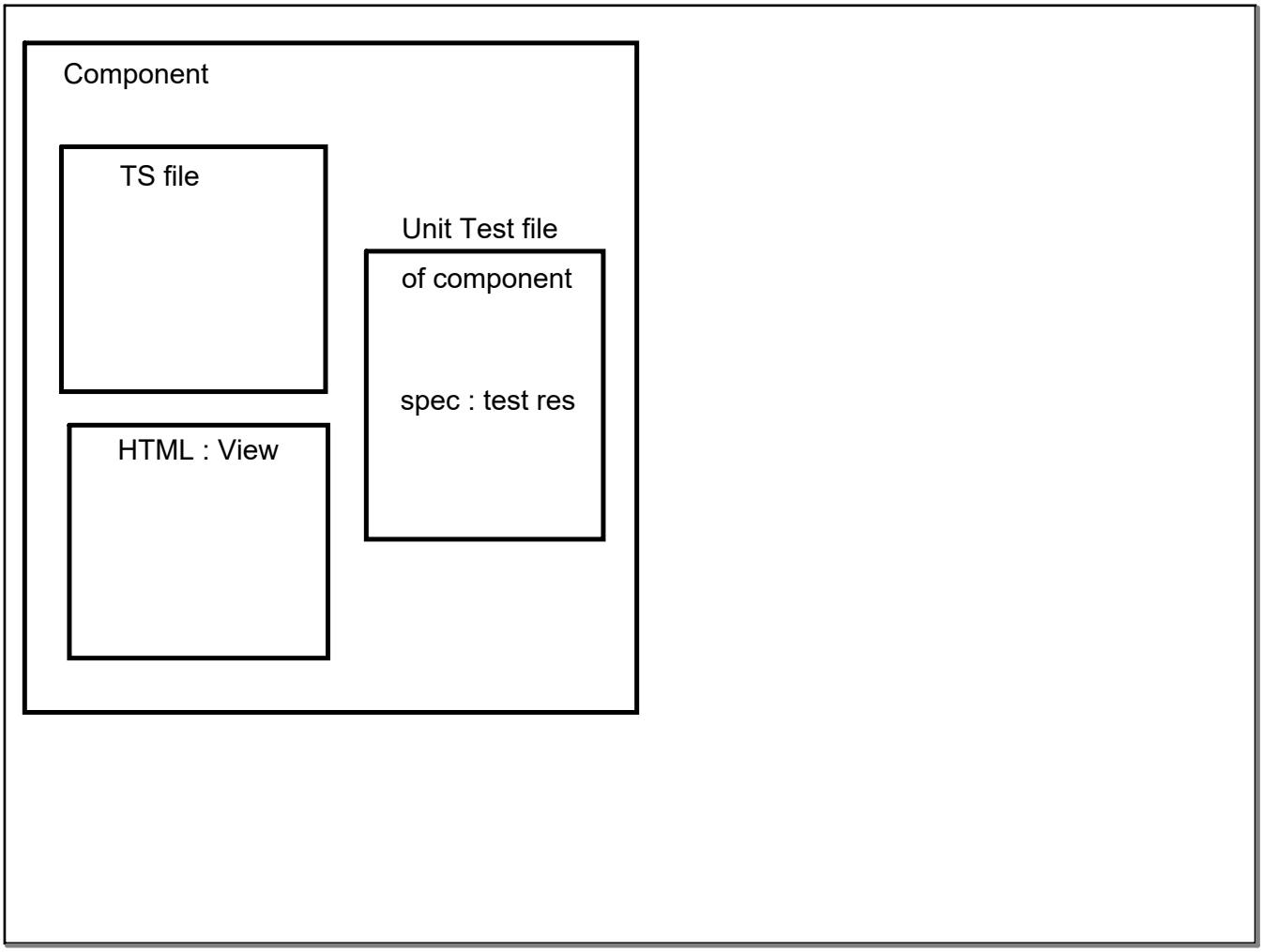
1. add an entry in package.json
2. npm install (download the dependency and add it to node_module)

1. npm install -g <lib-name> (install library globally in my system)

~ npm install --save --dev <lib-name>

1. add a entry in package.json(update)
2. down load dependency and save it in node_module


Angular Project on Deployment Server
Angular Based Architecture
TS (Component)
packaged as
HTML + ES5
browserslist
packaging needs to be done
compatible to which browsers
Client
index.html
SPA
Group of
JS files


Component
TS file
HTML : View
Unit Test file
of component
spec : test res