

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

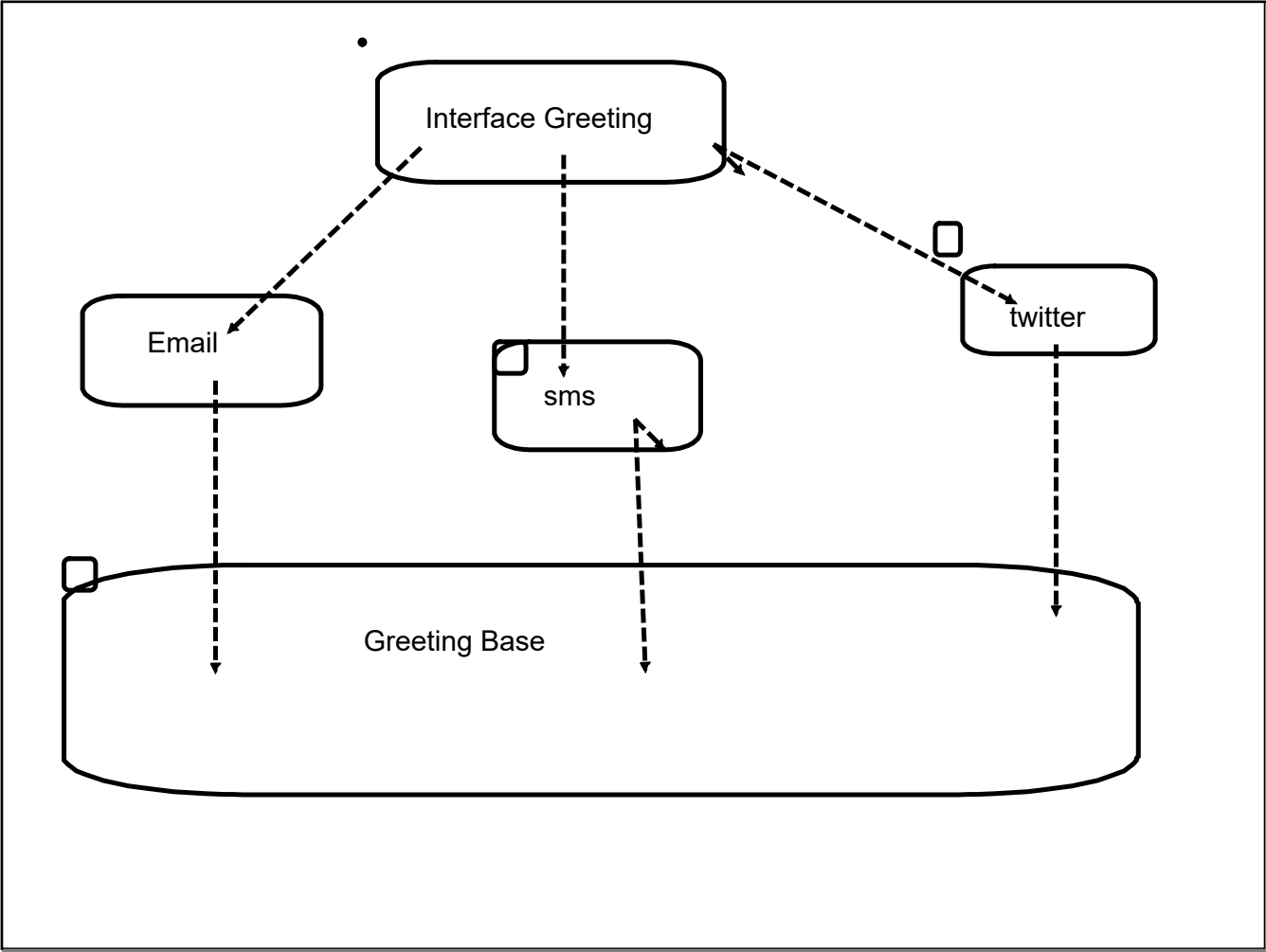
embrace object mutability (not in sync with concurrency)

Functional : Declarative

(What) : result

immutability

Analogous SQL

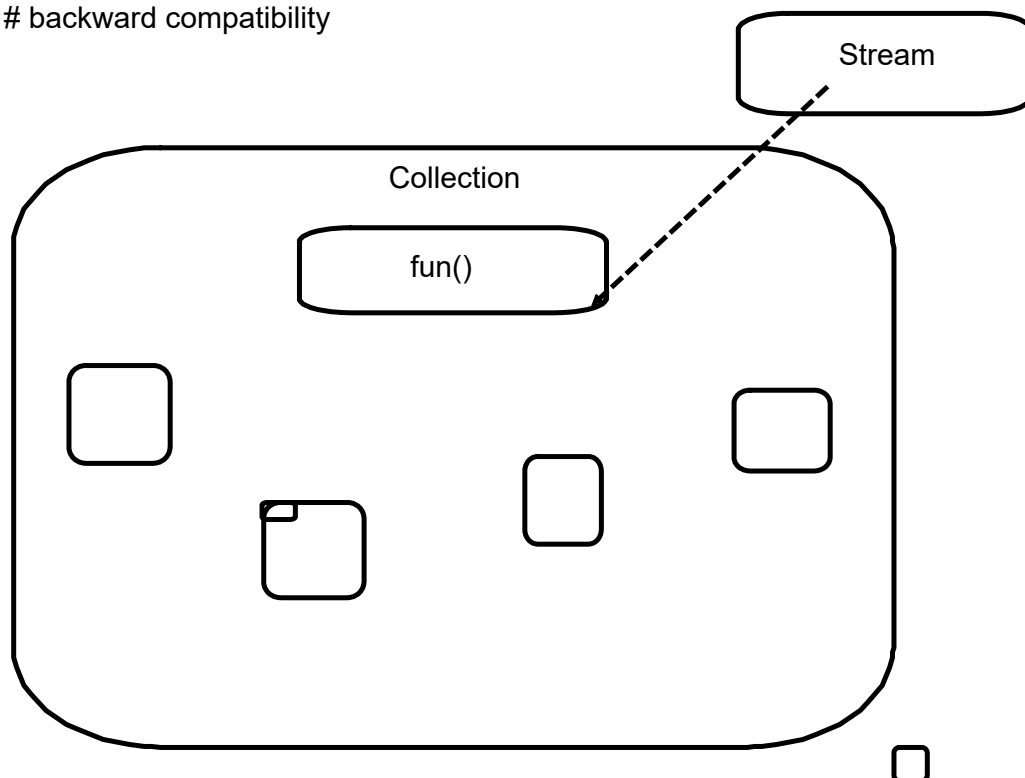


Interface :

```
# 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

p / for
conveyer belt

Terminal

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))

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

return value : would become a group

Transforms

y map(x)

flatMap() : Collection into stream

map:

["", ""]

["", " ", ""]

["", ""]

flat map

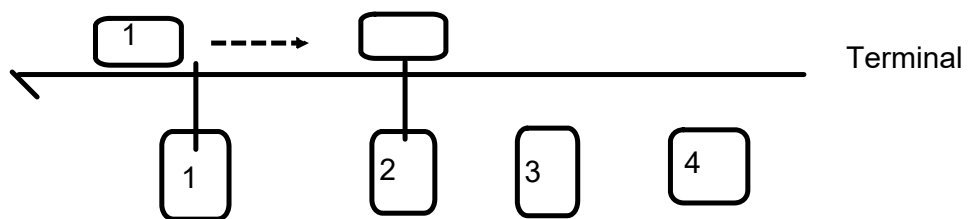
["", " ", " ", " ", " ", " ", " ", " ", " "]

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

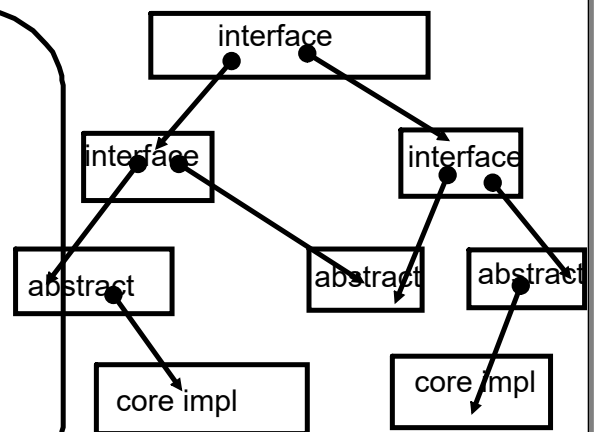
Thread per task

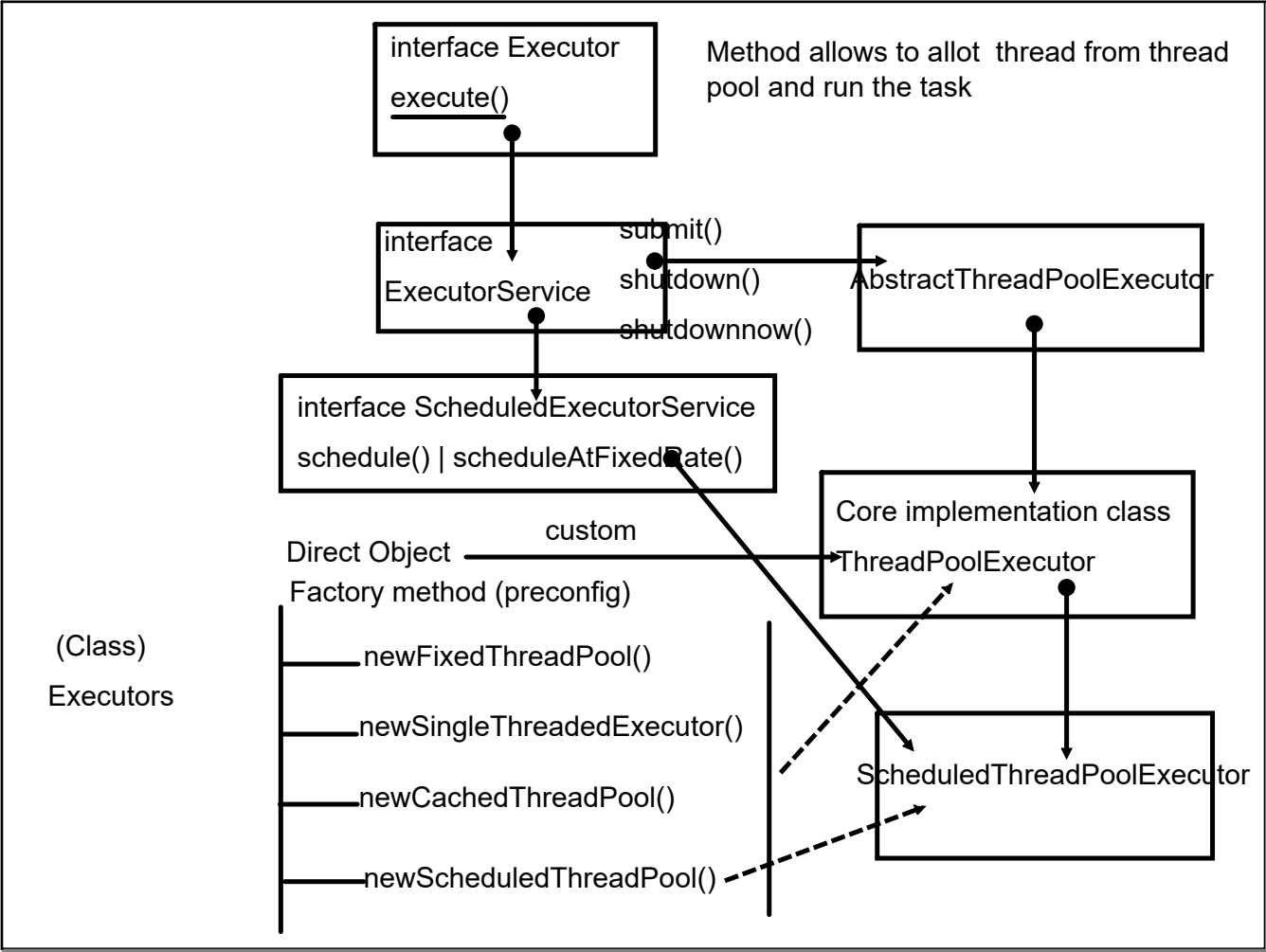
Not possible to keep a track of number of thread

Executor framework :

do all management + improve in performance

ThreadPool : create a predefined pool of thread





Need to create instance of ThreadPoolExecutor

FixedThreadPool (number of thread are predefined(extra task allotted 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()

FixedThreadPool(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

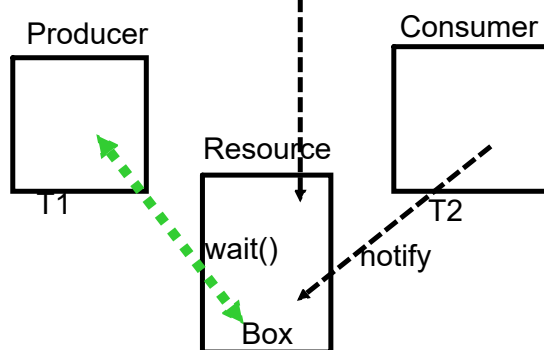
ScheduleThreadPool()

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

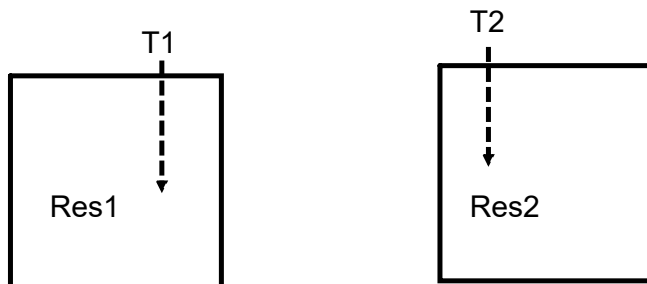
the method to associate a callback function

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

CompletableFuture by default uses the inbuilt thread pool

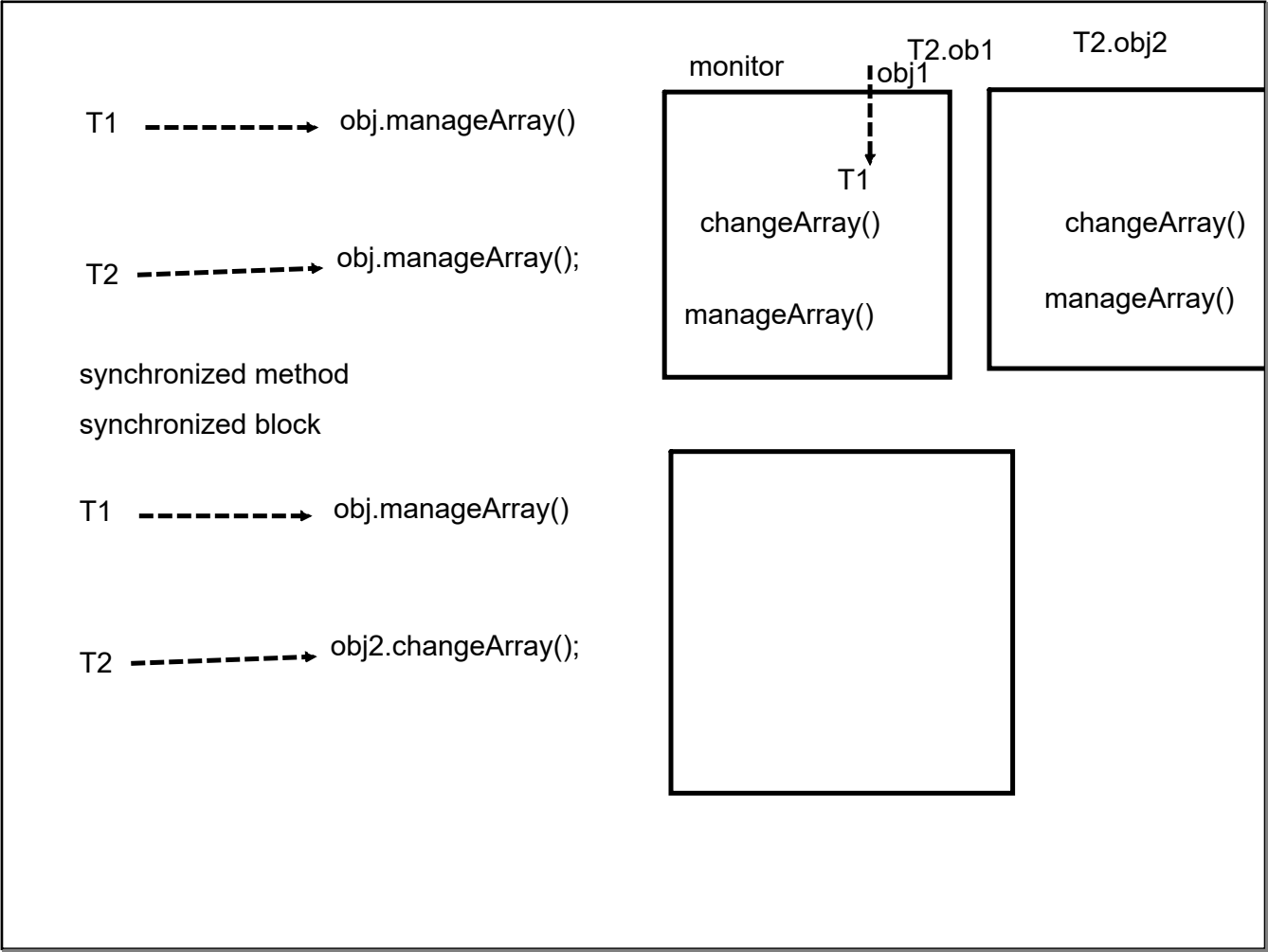
`ForkJoinPool.commonPool();`

Executor ThreadPool



Common Resource Shared among multiple threads (Thread safe)

Resolve Data inconsistency



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

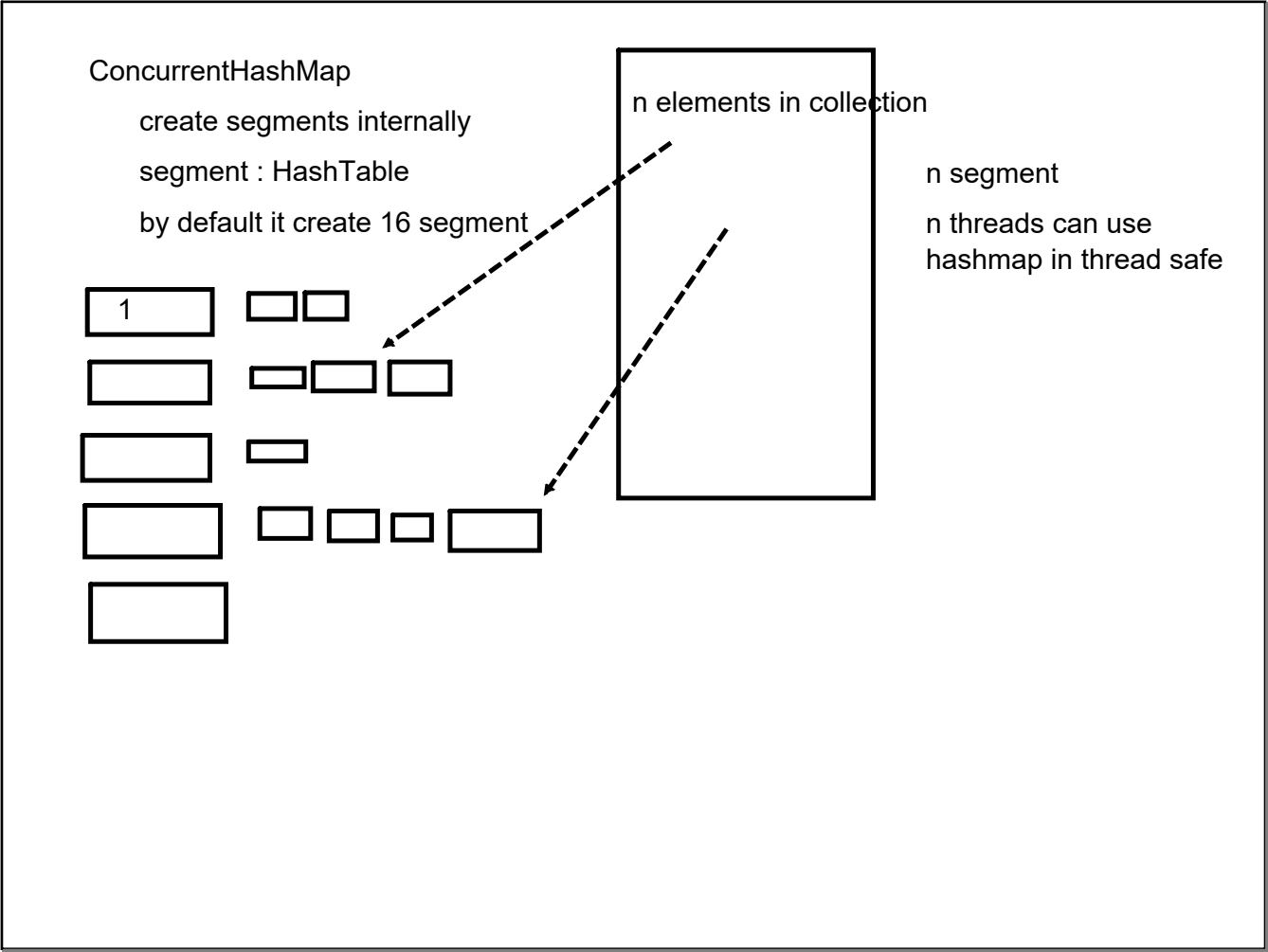
n=10; // Thread safe operations

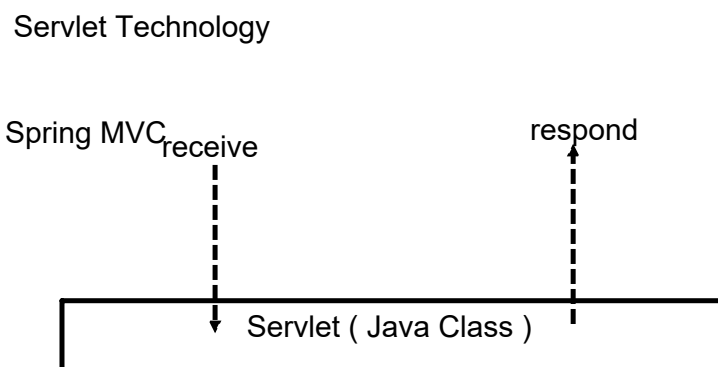
assignment long/double are non-atomic

Concurrent 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





How to define java class as Servlet

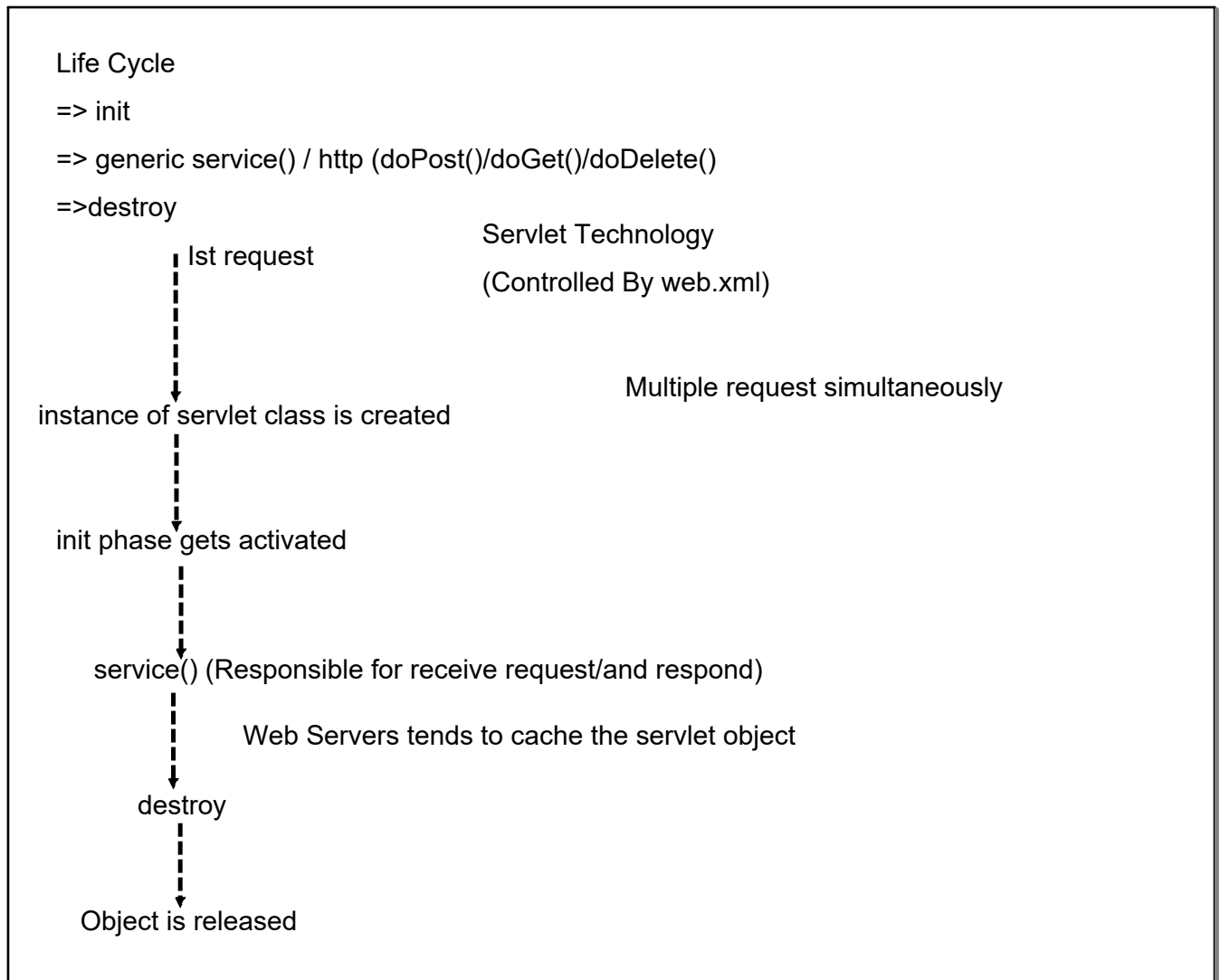
Extends

HttpServlet/GenericServlet

GenericServlet : does not classifies between various HTTP Verbs

HttpServlet : can identify

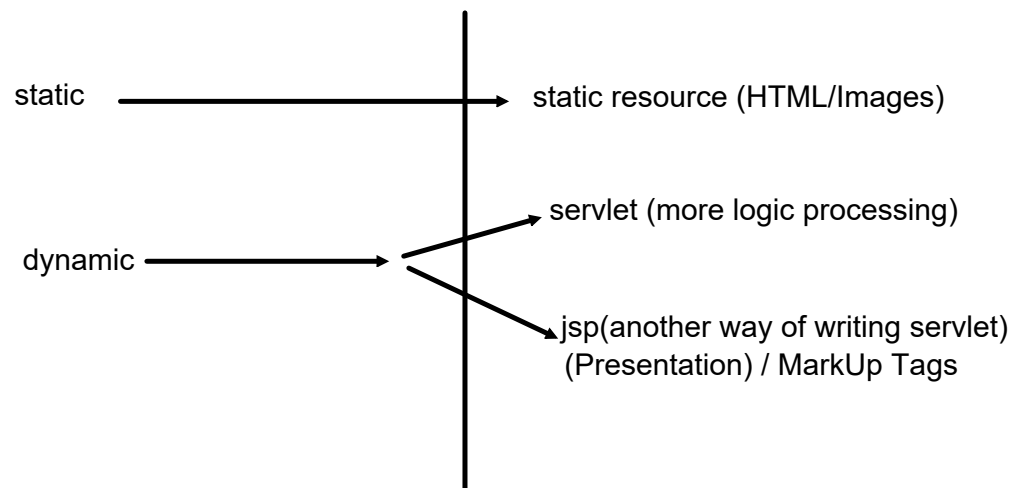
GET/POST/PUT/DELETE/PATCH



service method and variant

have an access over `HttpRequest/HttpResponse` object

JSP : another way of writing servlet

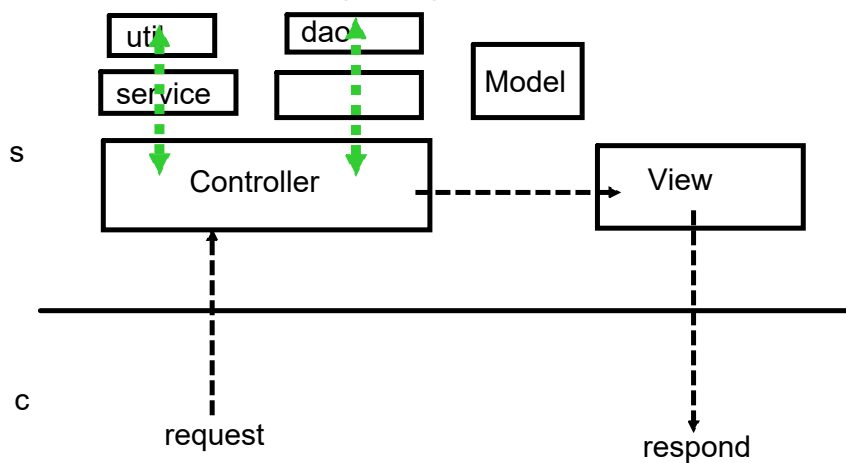


Spring uses Servlet Technology:

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

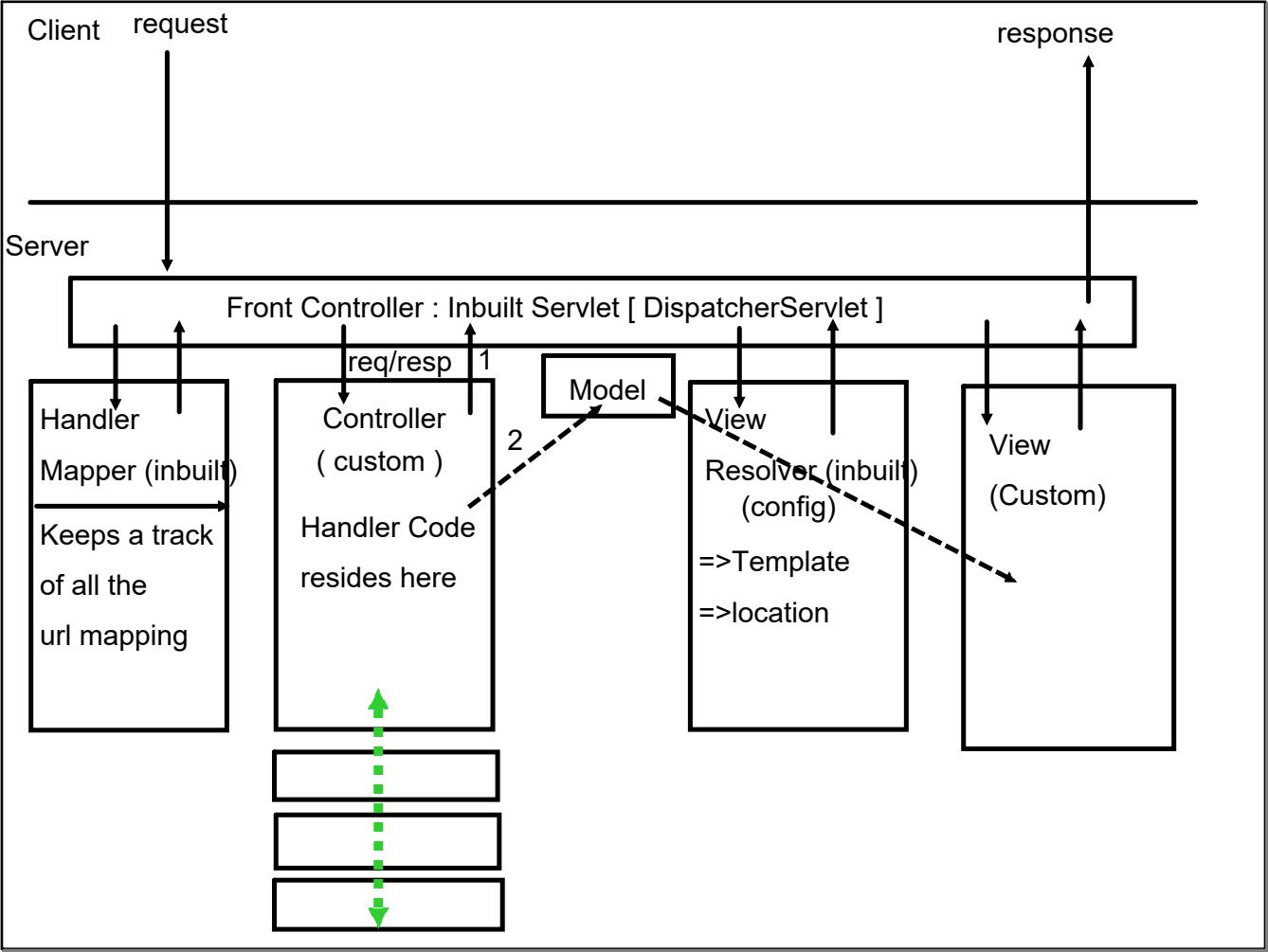
MVC architecture

Controller : to receive request / process it



Servlet

service method as task :
assign it to thread



we need to register your app resources (servlet spec)

Servlet :

need to register

registration can also be done using annotation

Controller : "index"

create a complete path

Register DispatcherServlet

Config of Spring in place

xml file

java

Need Spring config to connect with DS

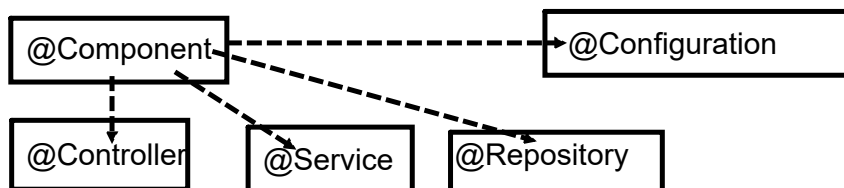
xml : <servlet-name>-servlet.xml

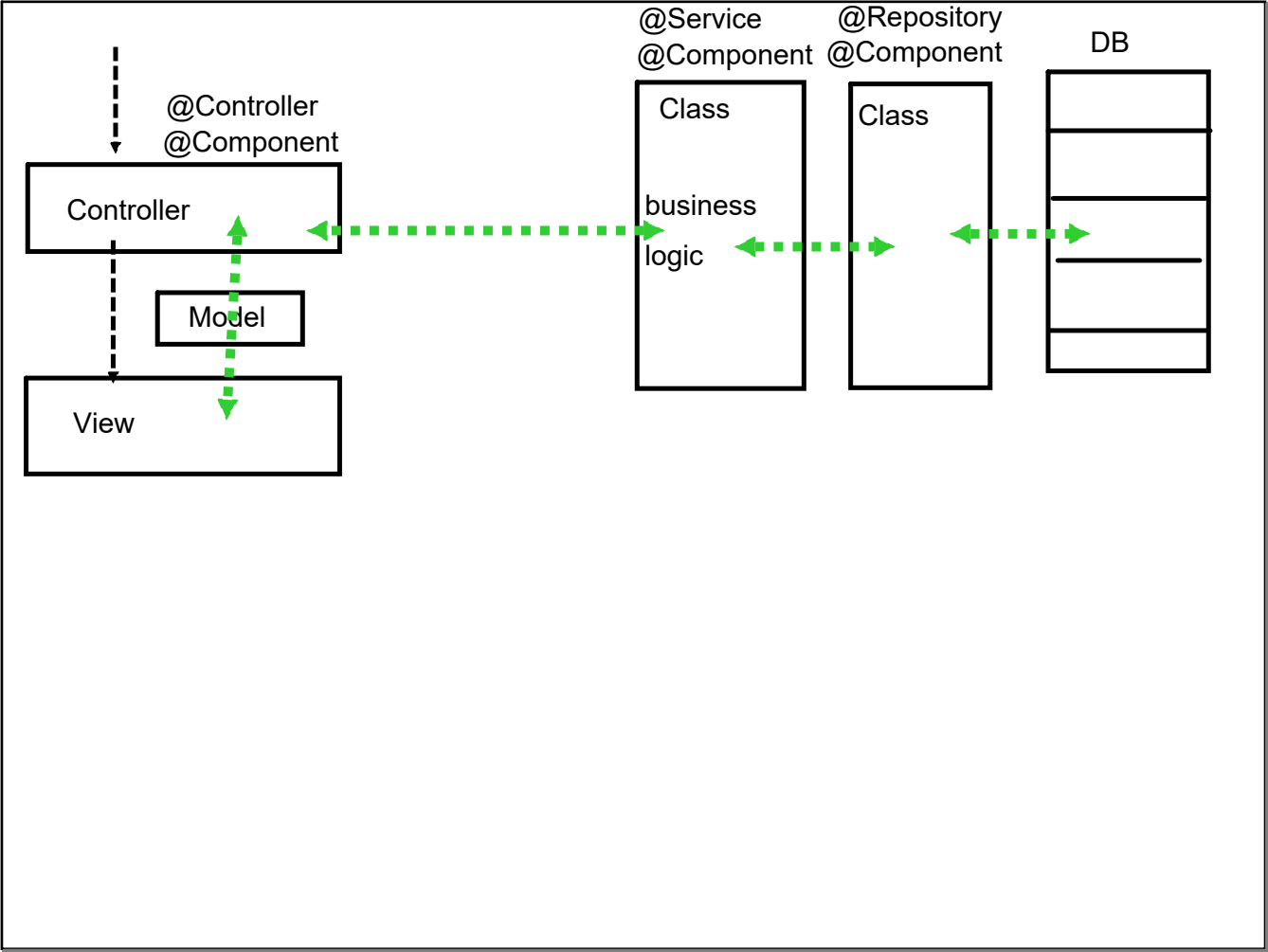
View Resolver : location + template (jsp+jstl) [extension]

```
<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



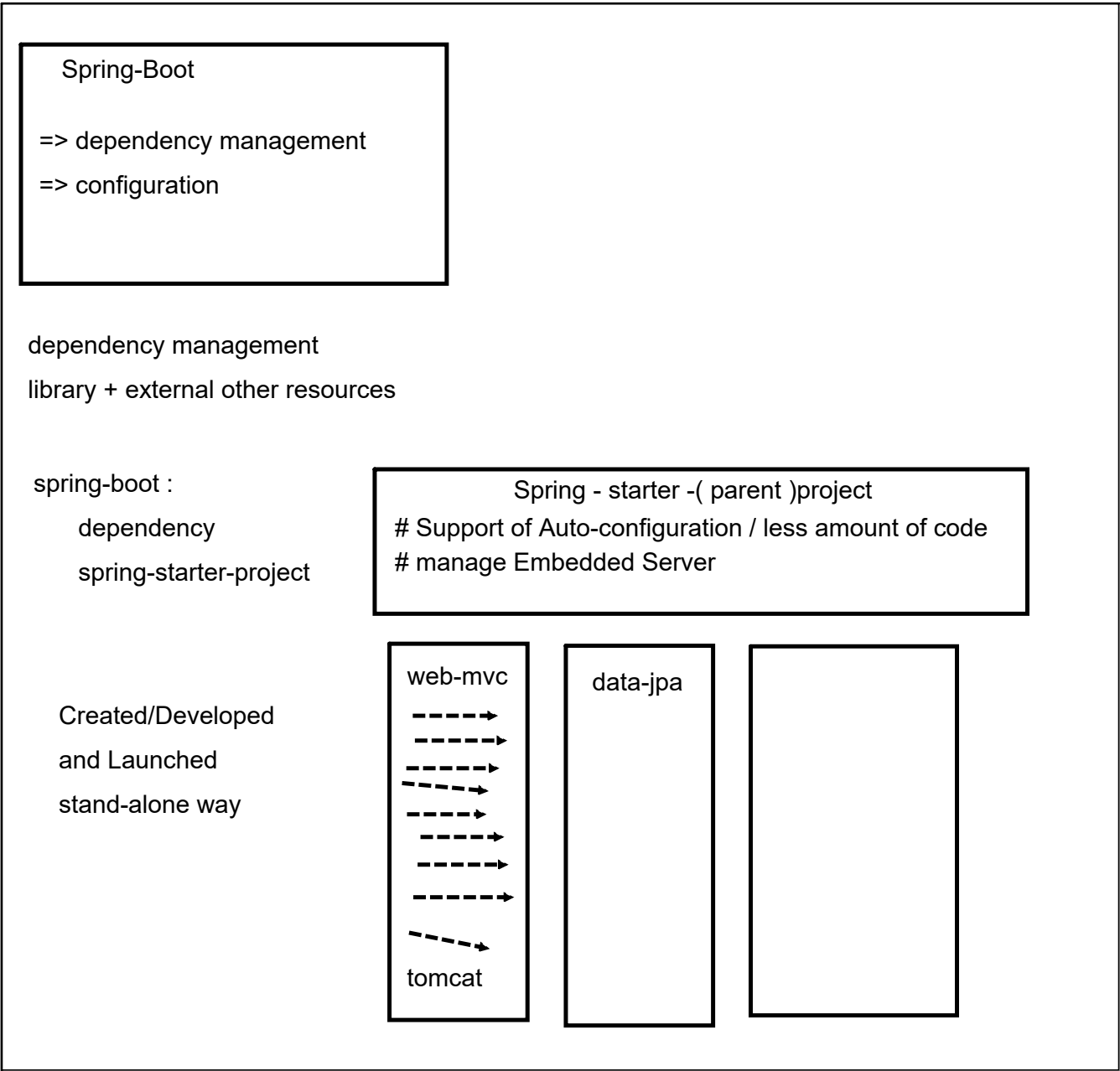


web.xml : ~ java config class

dispatcher-servlet.xml : ~ java config class

1. alternate for packaging : maven war plugin

Spring provides an inbuilt class to register DS



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/password

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

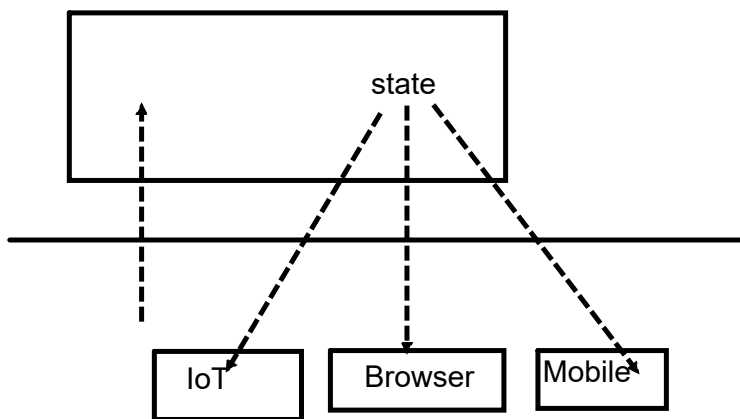
FreeMarker

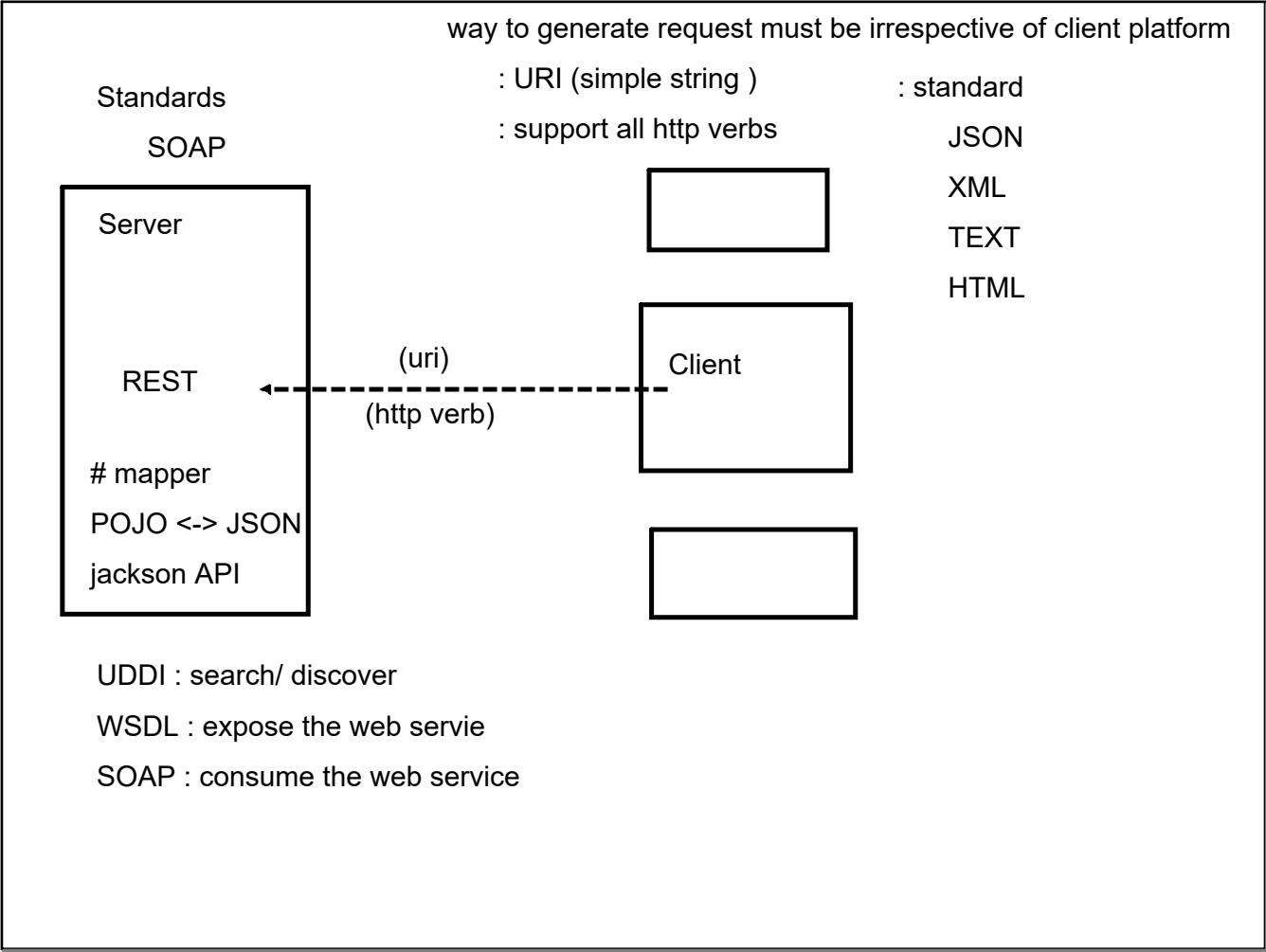
Tile

Velocity

Rest Based service

exposing server based info as Rest Service





@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

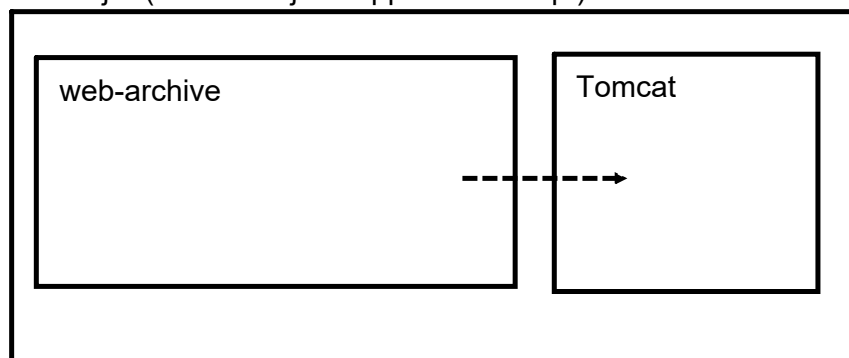
consume

@ResponseBody : content to be shared directly to client

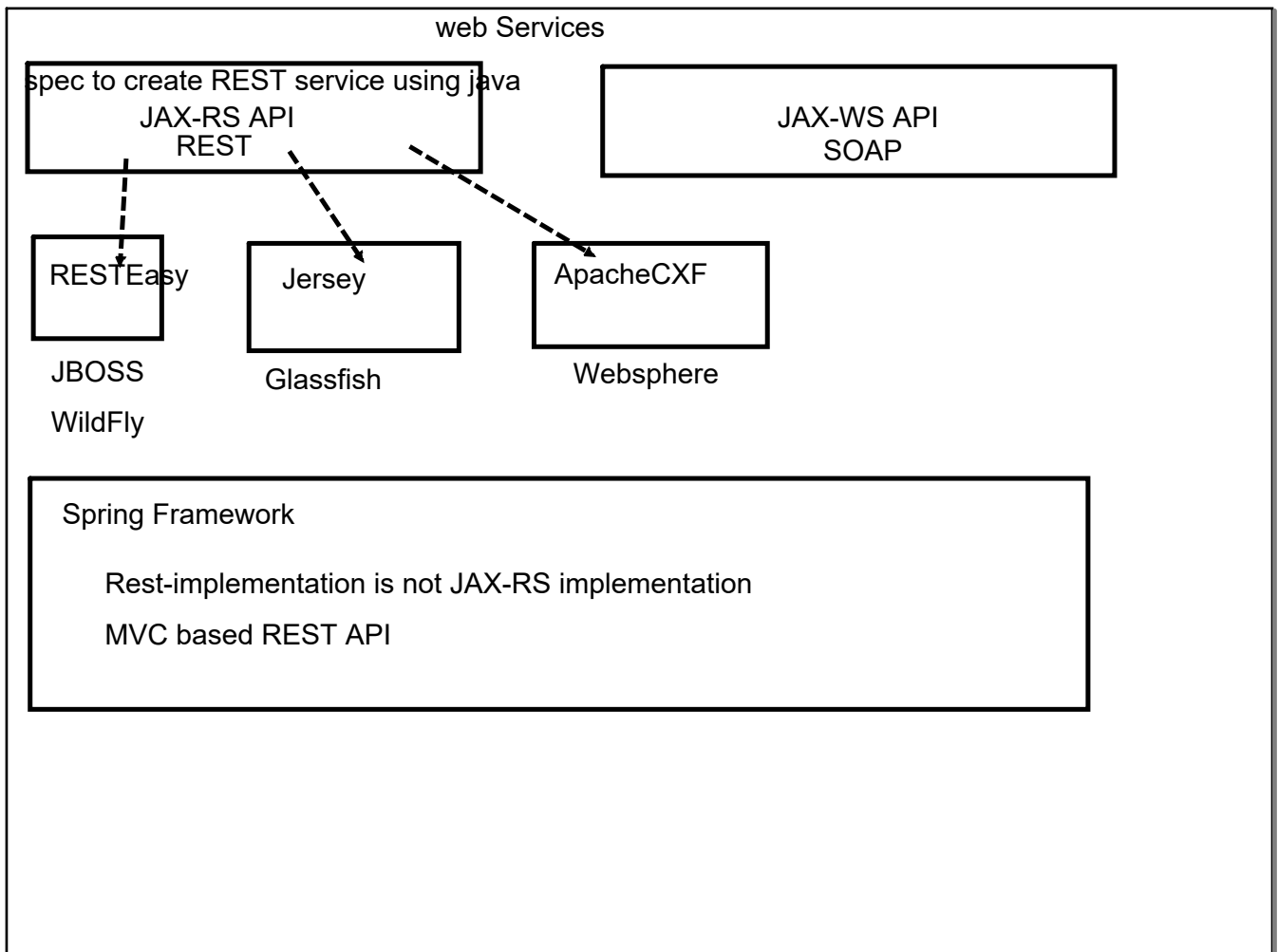
1.launch tomcat

2. deploy web-archive over tomcat

jar (additional java app build on top)



dev-tools: live reloading of server



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)

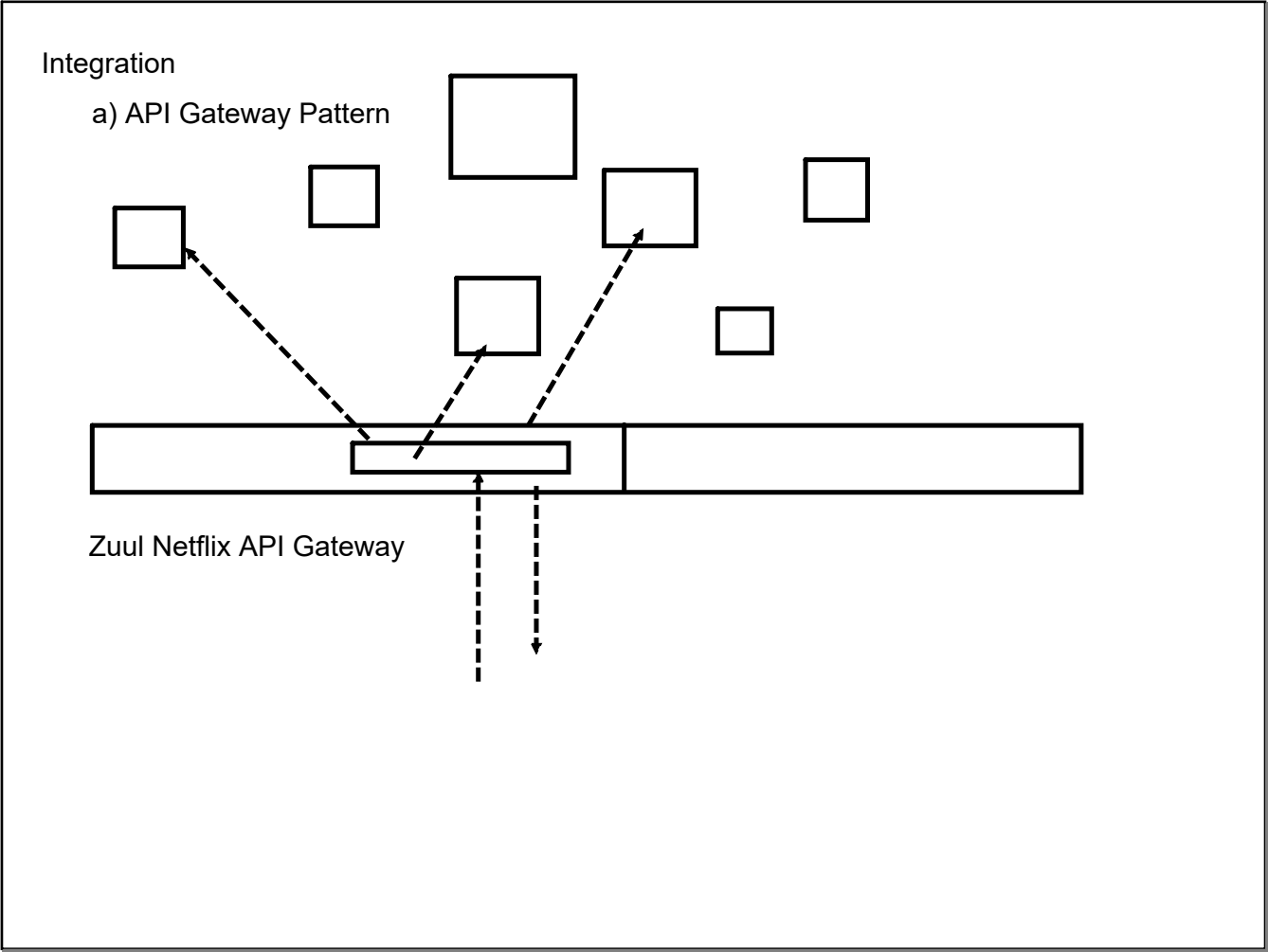
DDD : bounded context

sub-domains : BC with parent model

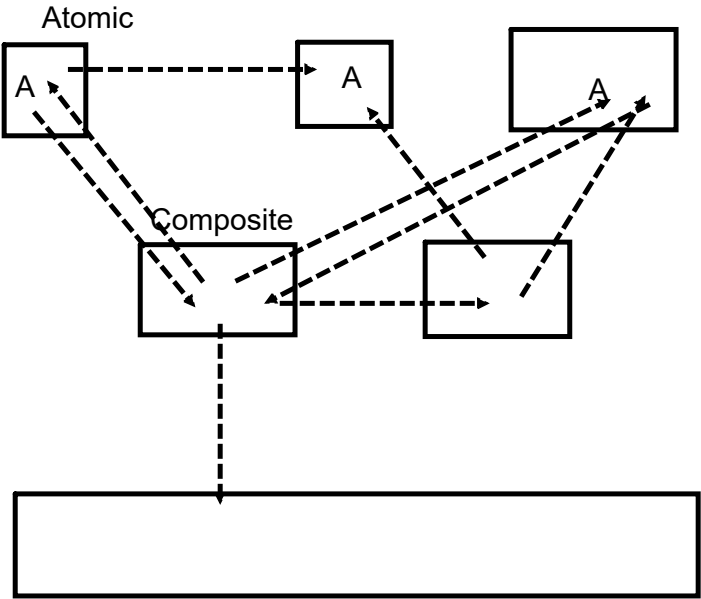
c) Strangler patterns

brownfield : converting monolith into MS

refactoring smaller req...



b) Aggregator Pattern



c) Client-side UI Composition

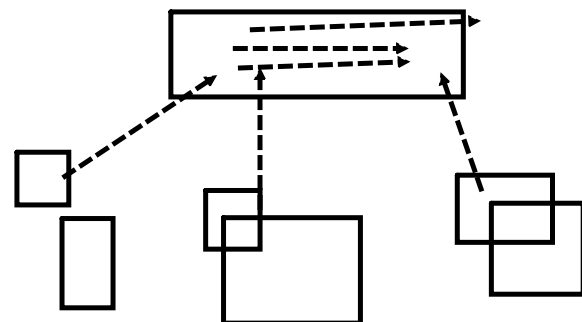
SPA : UI compositions

DataBase :

a) Ideal Pattern : Database Per Service

b) Shared Database :

2-3 MS (DDD)

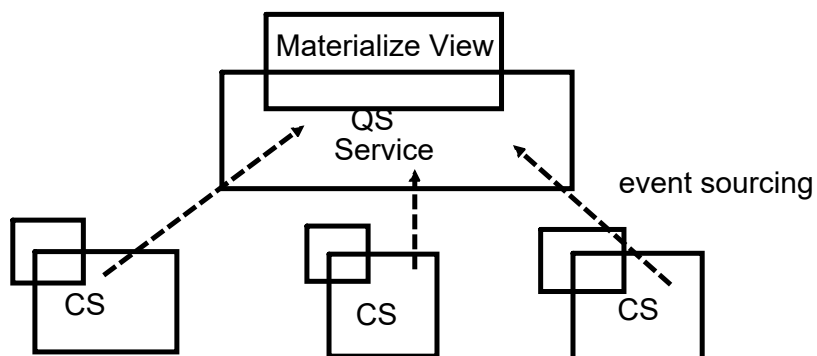


c) CQRS

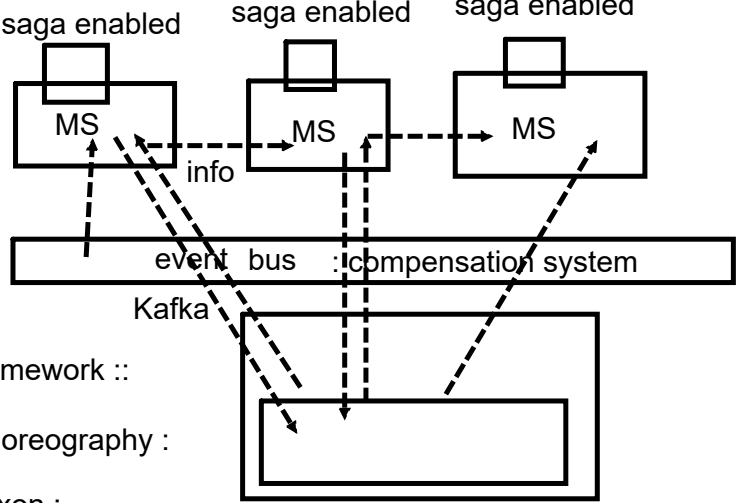
Command Query Responsibility Segregation

Command Side (create/update/delete)

Query Side (retrieve)



SAGA PATterns:



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

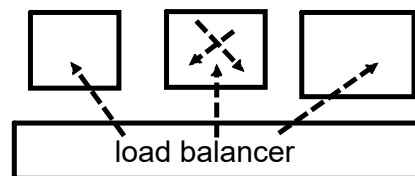
Zipkin Server

Spring Cloud Slueth

d) Health Check

actuators /health :

Ribbon



Cross-Cutting Concerns

a) External Configuration

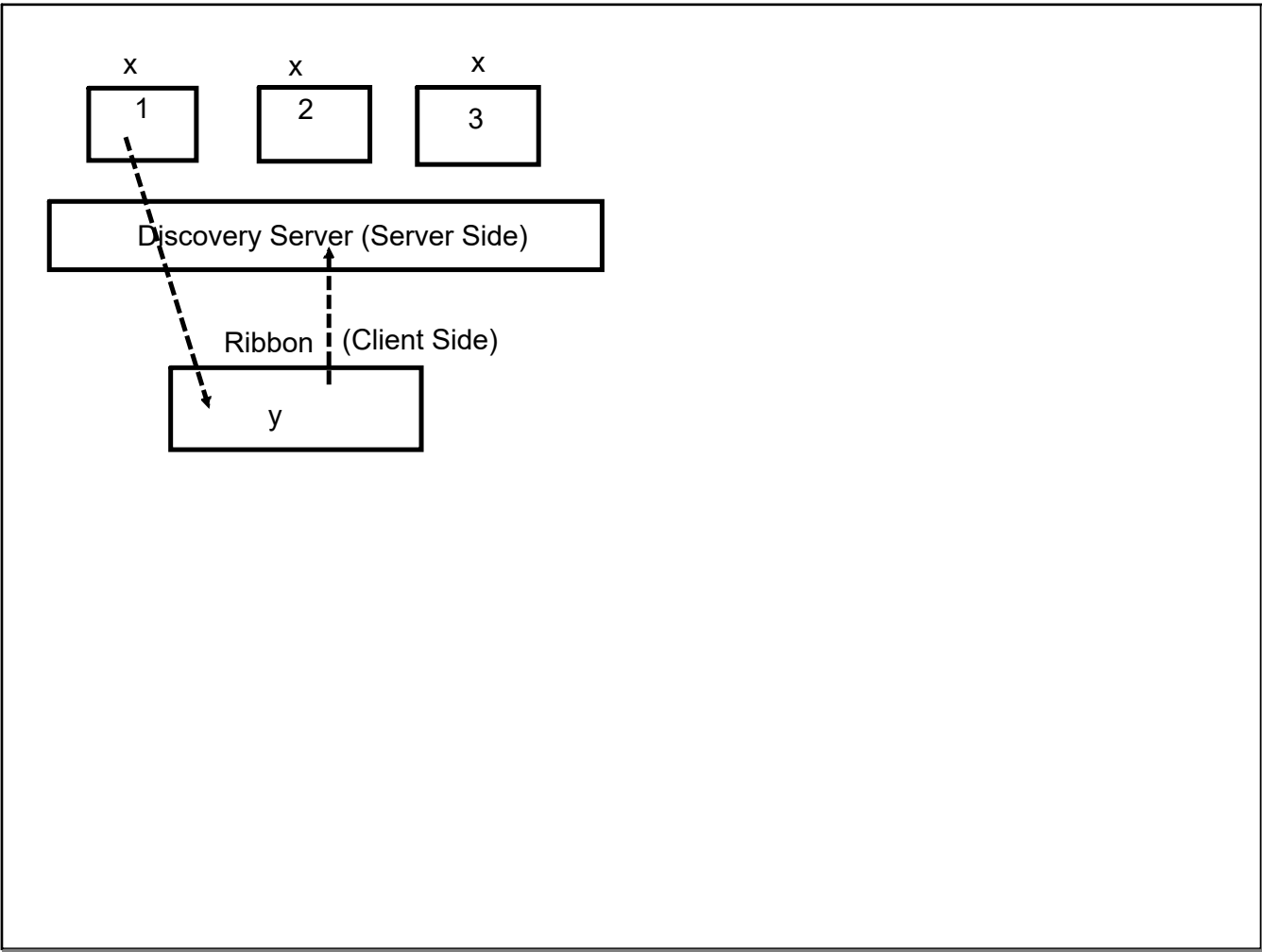
Spring Cloud Config Server

b) Service Discovery Pattern

all service shall register with registry system

Netflix Eureka Server

AWS ALB



c) Circuit Breaker Pattern

threshold

default response

keep on trying

Netflix Hystrix

10 sec

5

fallback

