

Workshop



Design good APIs

RESTful API
RPC



Start with REST



REST

Representational State Transfer

Scalability of component interactions

Generality of interfaces

Independent deployment of components

Intermediary components to reduce interaction latency



URI (Uniform Resource Identifier)

Method to access a resource on your server

URI = scheme "://" authority "/" **path** ["?" query] ["#" fragment]

URI = http://myserver.com/**mypath**?query=1#document

Underscores _ should not be used in URIs

Lowercase letters are preferred as case sensitivity is a differentiator in the path part of a URI



Design URI path for REST

Collection
Document
Controller



Collection

Directory of resources

Parameters to access document

Always use a plural noun for collection name

GET /cats	# All cats in collection
GET /cats/1	# A document of cat 1



Document

Resource pointing to a single object
It's have child resources

```
GET /cats/1    # A document of cat 1
GET /cats/1/kittens  # All kittens document of cat 1
GET /cats/1/kittens/1  # kittens 1 of cat 1
```



Controller

Controller resource is like a procedure/method

Use when can't map to CRUD

Always use a verb

POST /cats/1/feed # Feed cat 1

POST /cats/1/feed?food=fish # Food cat 1 with a fish



HTTP Verb

Name	Description
GET	Retrieve a resources
POST	Create a new resource in a collection or to execute a controller
PUT	Update a resource
DELETE	Remove a resource
PATCH	Perform partial update
HEAD	Retrieve the headers for a resources without body



URI query design

Filter
Pagination
Sorting
Search
Versioning

<https://hackernoon.com/restful-api-designing-guidelines-the-best-practices-60e1d954e7c9>



Filter

GET /cats?color=white&sex=male

GET /cats?age=gte:5

GET /cats?age=lt:5



Pagination

GET /cats?page=10

GET /cats?limit=10

GET /cats?limit=10&offset=10



Sorting

GET /cats?sort=age_asc

GET /cats?sort=age_desc

GET /cats?sort=+age

GET /cats?sort=-age

GET /cats?sort=age&order=asc

GET /cats?sort=age&order=desc



Search

GET /cats?search=keyword

GET /cats?q=keyword



Versioning

GET /v1/cats

GET /v2/cats

GET /cats?api-version=2

GET /cats

api-version=2



APIs should more readable and easy to understand



Response code

Code	Description
2xx	Success
3xx	Redirect
4xx	Client error
5xx	Server error



Response data (1)

POST /cats

RESPONSE HTTP 200 OK

```
{  
  "status": 400,  
  "statusMessage": "Bad Request"  
}
```



Response data (2)

POST /cats

RESPONSE HTTP 400 BAD REQUEST

```
{  
  "errorMessage": "Name should be"  
}
```



API Documentation

Swagger

API Blueprint

RAML (RESTful API Modeling Language)

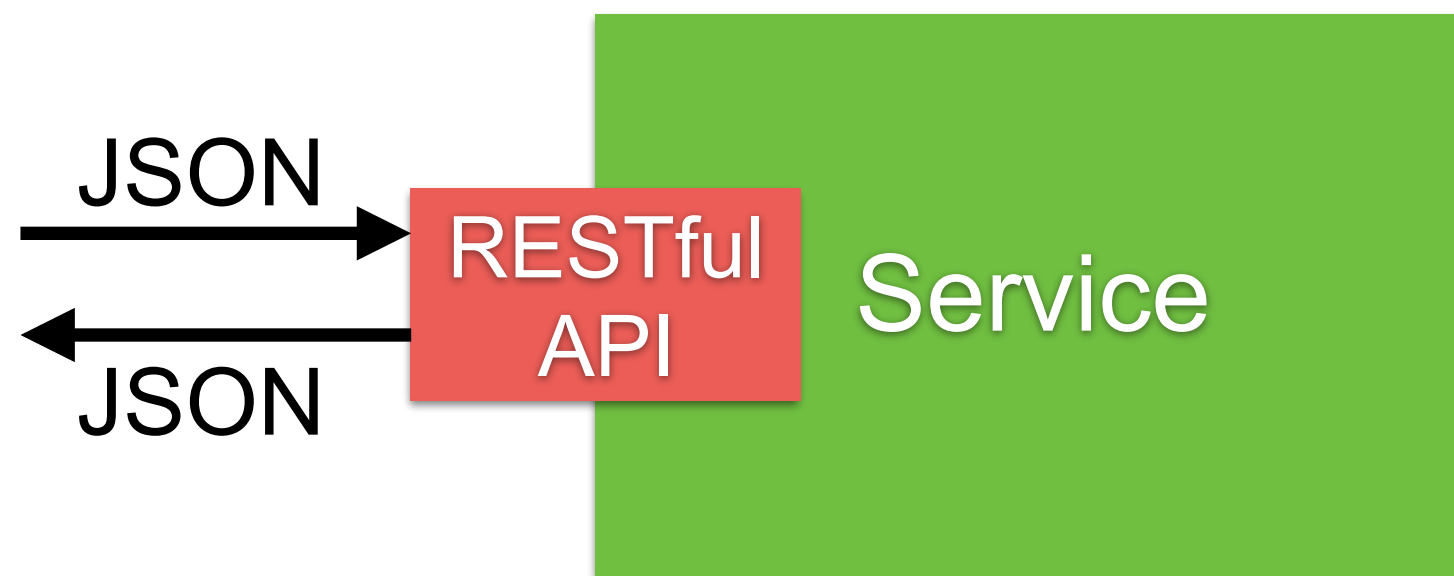


Develop RESTful API with Golang



Develop RESTful API with go

net/http package
encoding/json package



Step 1 Hello API

```
package main

import (
    "net/http"
    "fmt"
    "log"
)

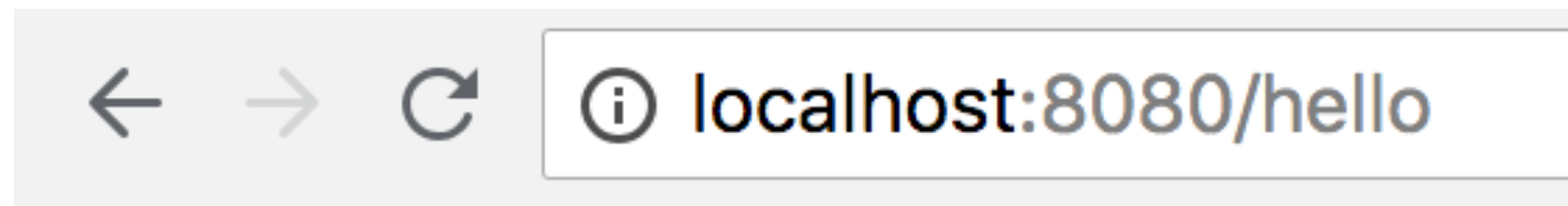
func main() {
    port := 8080
    http.HandleFunc("/hello", helloHandler)
    log.Printf("Server starting on port %v\n", port)
    log.Fatal(http.ListenAndServe(fmt.Sprintf(":%v", port), nil))
}

func helloHandler(w http.ResponseWriter, r *http.Request) {
    log.Printf("Called helloHandler\n")
    fmt.Fprint(w, "Hello World")
}
```



Run program

```
$go run step_01.go
```



Hello World



Build binary

```
$go build step_01.go
```



Return response in JSON



Step 2 Response with JSON

We need JSON data

```
{
  "header": {
    "code": 200,
    "description": "Success"
  },
  "body": {
    "message": "Hello World"
  }
}
```



Step 2 Response with JSON

encoding/json package

```
package main

import (
    "net/http"
    "fmt"
    "log"
    "encoding/json"
)
```



Step 2 Response with JSON

Create data format with Struct

```
type helloWorldResponse struct {  
    Header headerResponse `json:"header"`  
    Body bodyResponse `json:"body"`  
}
```

```
type headerResponse struct {  
    Code int `json:"code"`  
    Description string `json:"description"`  
}
```

```
type bodyResponse struct {  
    Message string `json:"message"`  
}
```



Step 2 Response with JSON

Create response of API

```
func helloHandler(w http.ResponseWriter, r *http.Request) {  
    response := helloWorldResponse {  
        Header: headerResponse{  
            Code: 200,  
            Description: "Success",  
        },  
        Body: bodyResponse { Message: "Hello World" },  
    }  
  
    data, err := json.Marshal(response)  
    if err != nil {  
        panic("Ooops")  
    }  
    fmt.Fprint(w, string(data))  
}
```



Run and see result

`$go run step_02.go`

```
← → ↻ ⓘ localhost:8080/hello

{
  - header: {
      code: 200,
      description: "Success"
    },
  - body: {
      message: "Hello World"
    }
}
```



Way to working with JSON

```
json.Marshal()  
json.NewEncoder()
```



Benchmark of two method

```
$go test -v -run="none" -bench=.  
-benchtime="5s" -benchmem
```

BenchmarkHelloHandlerVariable-4	10000000	559 ns/op
4 allocs/op		
BenchmarkHelloHandlerEncoder-4	20000000	341 ns/op
1 allocs/op		
BenchmarkHelloHandlerEncoderReference-4	20000000	301 ns/op
0 allocs/op		
PASS		

step_02/step_02_test.go



Step 3 Change to better solution

Create response of API

```
func helloHandler(w http.ResponseWriter, r *http.Request) {  
    response := helloWorldResponse {  
        Header: headerResponse{  
            Code: 200,  
            Description: "Success",  
        },  
        Body: bodyResponse { Message: "Hello World" },  
    }  
  
    encoder := json.NewEncoder(w)  
    encoder.Encode(&response)  
}
```



Run and see result

`$go run step_03.go`

```
← → ↻ ⓘ localhost:8080/hello

{
  - header: {
      code: 200,
      description: "Success"
    },
  - body: {
      message: "Hello World"
    }
}
```



Send JSON to API



Step 4 Send JSON to API

try to convert JSON to go struct

```
#Input
```

```
{  
    "name": "Somkiat"  
}
```

```
#Output
```

```
{  
    "message": "Hello Somkiat"  
}
```



Step 4 Send JSON to API

create struct of request and response

```
type helloWorldResponse struct {  
    Message string `json:"message"`  
}
```

```
type helloWorldRequest struct {  
    Name string `json:"name"`  
}
```



Step 4 Send JSON to API

API receive and convert JSON to go struct

```
func helloHandler(w http.ResponseWriter, r *http.Request) {  
    //Request  
    var request helloWorldRequest  
    decoder := json.NewDecoder(r.Body)  
  
    err := decoder.Decode(&request)  
    if err != nil {  
        http.Error(w, "Bad request", http.StatusBadRequest)  
        return  
    }  
  
    //Response  
}
```



Run and see result

```
$curl localhost:8080/hello -d '{"name":"Somkiat"}'
```

```
{"message":"Hello Somkiat"}
```



Try to benchmark again



DRY (Don't Repeat Yourself)

chi

Gin

Echo

Gokit

Go-micro

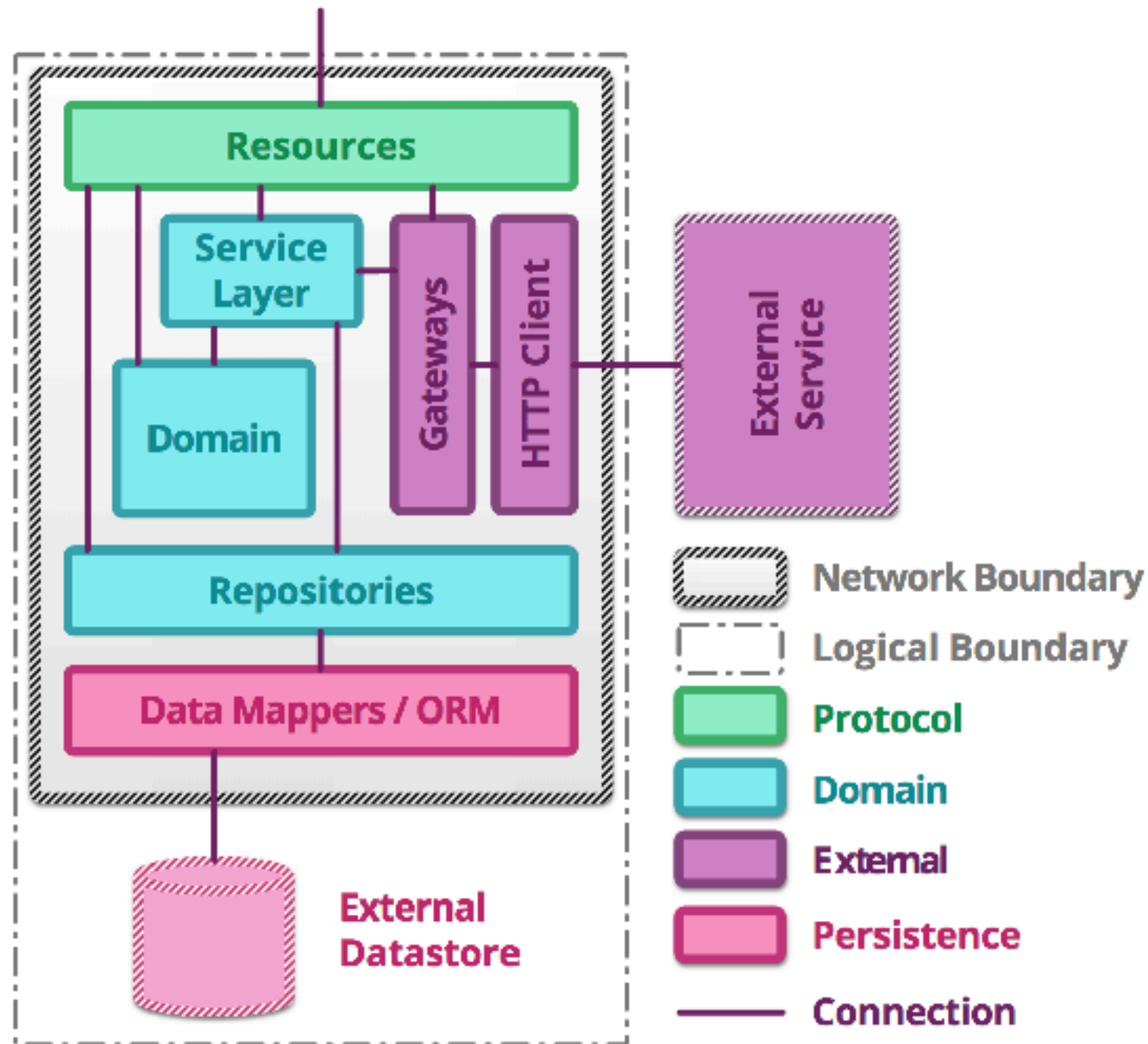
and more



Building search service



Project Structure



Search service



Search service structure

api	=> search_api.go
repository	=> mongo_repository.go
model	=> product.go
main	=> main.go

search_api/step_01



How to run with go ?

\$ssh run.sh

```
CURDIR=`pwd`
```

```
OLDGOPATH=$GOPATH
```

```
export GOPATH=$CURDIR
```

```
gofmt -w src/
```

```
go install main
```

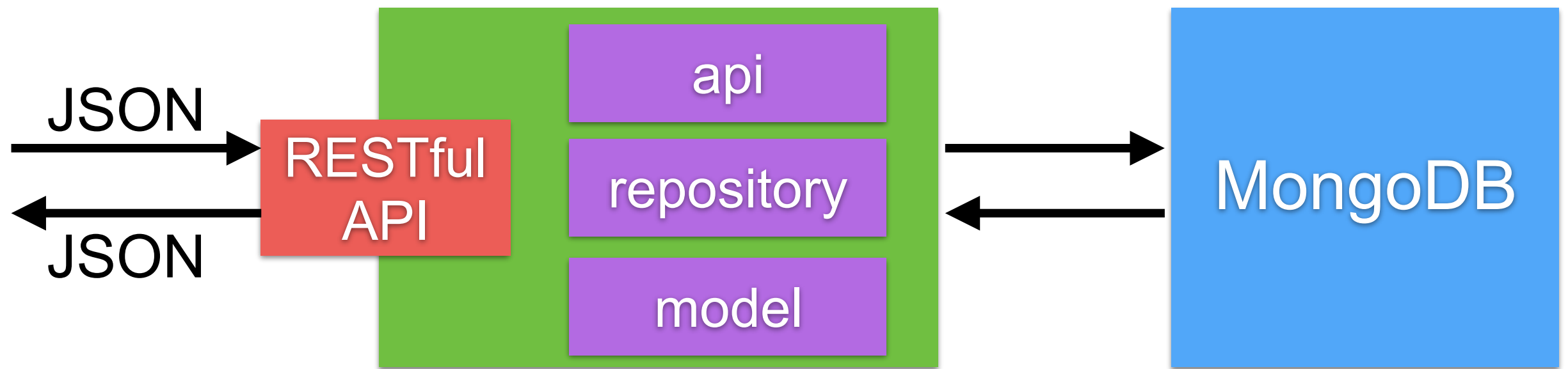
```
export GOPATH=$OLDGOPATH
```



Let's start to develop service

search_api/step_02





1. Create model

model/product.go

```
package model

type Product struct {
    Id      string
    Name    string
    Price   float32
}
```



2. Search data from MongoDB

How to connect to MongoDB with go ?

mgo

Rich MongoDB driver for Go

<https://labix.org/mgo>



2. Search data from MongoDB

How to add library/dependency to project ?

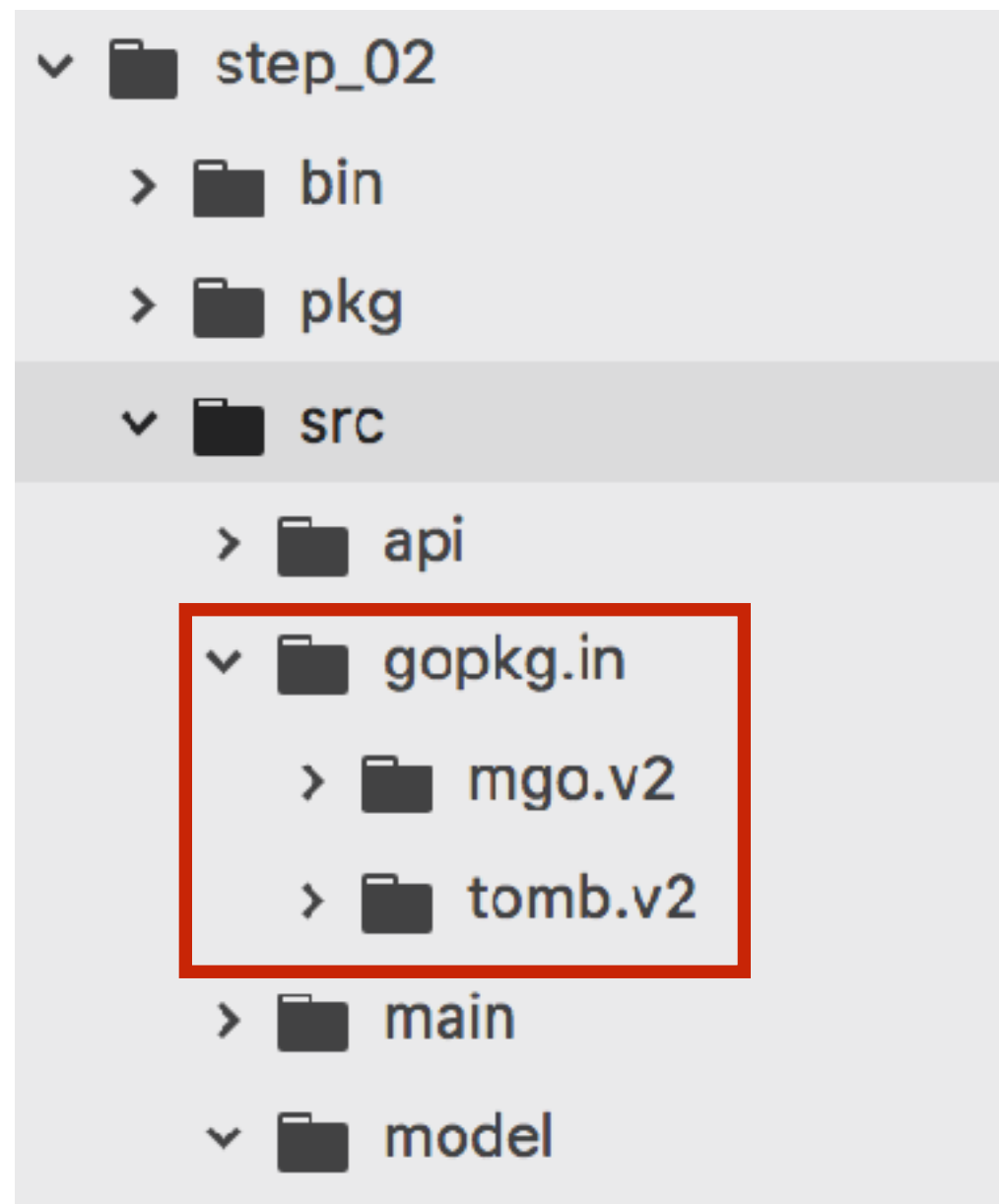
```
$go get gopkg.in/mgo.v2
```

```
$go get gopkg.in/tomb.v2
```



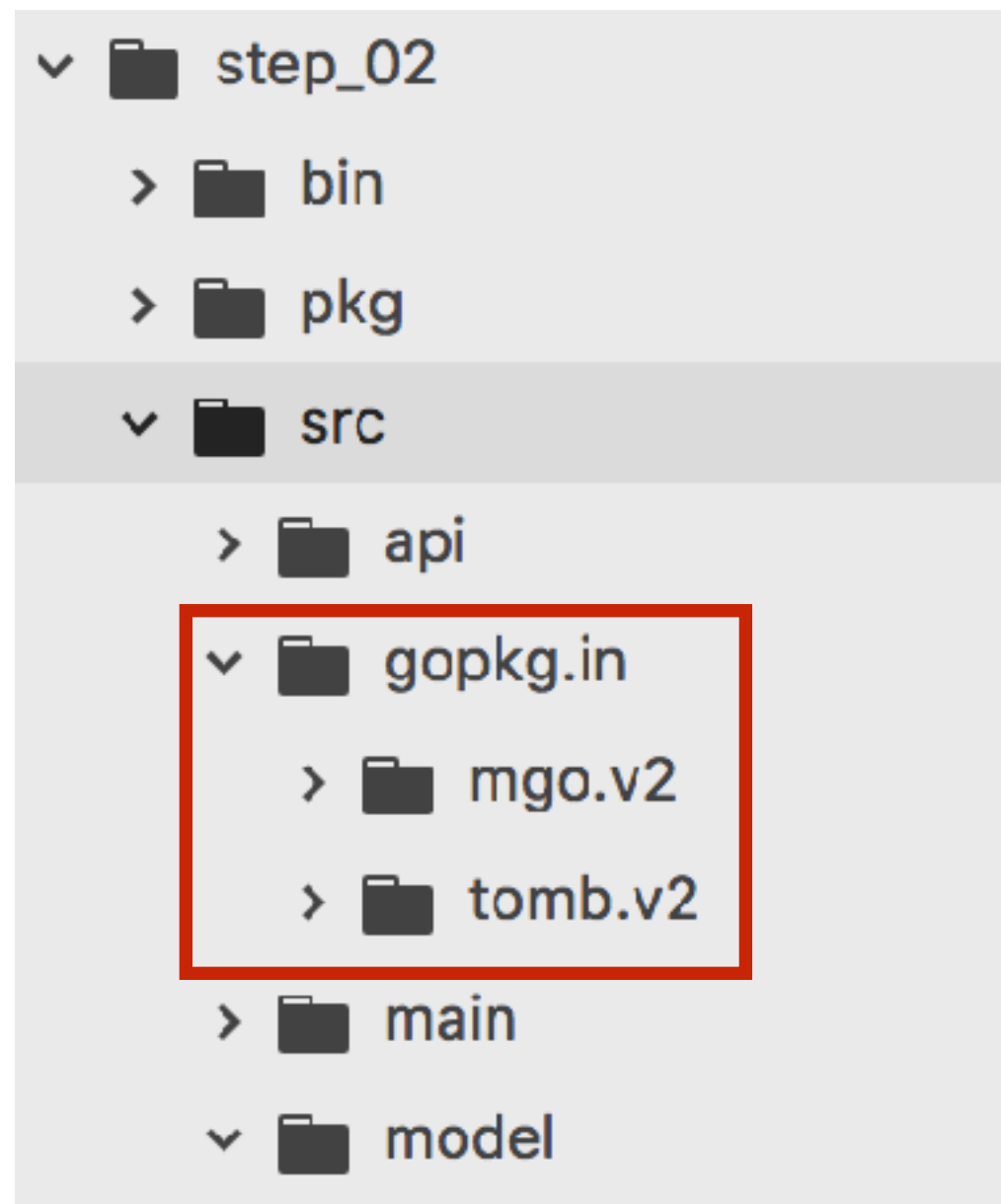
2. Search data from MongoDB

Go get try to download code into /src !!



2. Search data from MongoDB

Move **/gopkg.in** to **/src/vendor**



2. Search data from MongoDB

repository/mongo_repository.go

```
type Store interface {  
    Search(name string) []model.Product  
}
```

```
type MongoStore struct {  
    session *mgo.Session  
}
```



2. Search data from MongoDB

repository/mongo_repository.go

```
func (m *MongoStore) Search(name string) []model.Product {  
    s := m.session.Clone()  
    defer s.Close()  
  
    var results []model.Product  
    c := s.DB("productserver").C("products")  
    err := c.Find(model.Product{Name: name}).All(&results)  
    if err != nil {  
        return nil  
    }  
  
    return results  
}
```



Repository structure



Build and run search service

`$sh run.sh`

```
?      api      [no test files]
?      main     [no test files]
?      model    [no test files]
?      repository [no test files]
```



3. Create search API

api/search_api.go



3. Create search API

Create struct of request and response

```
type searchRequest struct {  
    Query string `json:"q"`  
}
```

```
type searchResponse struct {  
    Products []model.Product `json:"products"`  
}
```



3. Create search API

Create handler for search service

```
type Search struct {  
    DataStore repository.Store  
}
```



3. Create search API

Create handler for search service

```
func (s *Search) ServeHTTP(rw http.ResponseWriter, r *http.Request) {  
    decoder := json.NewDecoder(r.Body)  
    defer r.Body.Close()  
  
    request := new(searchRequest)  
    err := decoder.Decode(request)  
  
    products := s.DataStore.Search(request.Query)  
  
    encoder := json.NewEncoder(rw)  
    encoder.Encode(searchResponse{Products: products})  
}
```



4. Create main of service

main/main.go

```
func main() {  
    serverURI := "localhost"  
    if os.Getenv("MONGODB_SERVER") != "" {  
        serverURI = os.Getenv("MONGODB_SERVER")  
    }  
  
    store, err := repository.NewMongoStore(serverURI)  
    if err != nil {  
        log.Fatal(err)  
    }  
  
    handler := api.Search{DataStore: store}  
    err = http.ListenAndServe(":8080", &handler)  
    if err != nil {  
        log.Fatal(err)  
    }  
}
```



Build and run search service

`$sh run.sh`

```
?      api      [no test files]
?      main     [no test files]
?      model    [no test files]
?      repository [no test files]
```



Run search service

`$/bin/main`

no reachable servers



We need MongoDB server



Build Ship Run with Docker



Working with Docker-compose

open file docker-compose.yml

```
version: '3'
services:
  mongodb:
    image: mongo:4
    ports:
      - 27017:27017
```

https://hub.docker.com/_/mongo/



Start MongoDB server with

\$docker-compose up -d

```
Creating network "step_02_default" with the default driver
Pulling mongodb (mongo:4)...
4: Pulling from library/mongo
b234f539f7a1: Downloading [=====>] 32.5MB/43.12MB
Download complete
5ba5bbeb6b91: Download complete
43ae2841ad7a: Download complete
851B/851B190: Download complete
b270872207e3: Download complete
bd7d91d60f98: Download complete
1020ba9c757f: Download complete
398b5f5b19a9: Download complete
ec34a1504b9b: Download complete
6c52301152b7: Download complete
aca6ce6bd5b2: Downloading [=====>] 27.36MB/86.46MB
Download complete
8395dda89cc8: Download complete
```



Run search service

`$/bin/main`



Try to call service

```
$curl localhost:8080/hello -d '{"q":"Somkiat"}'
```



Build and run search service

\$sh run.sh

```
?      api      [no test files]
?      main     [no test files]
?      model    [no test files]
?      repository [no test files]
```

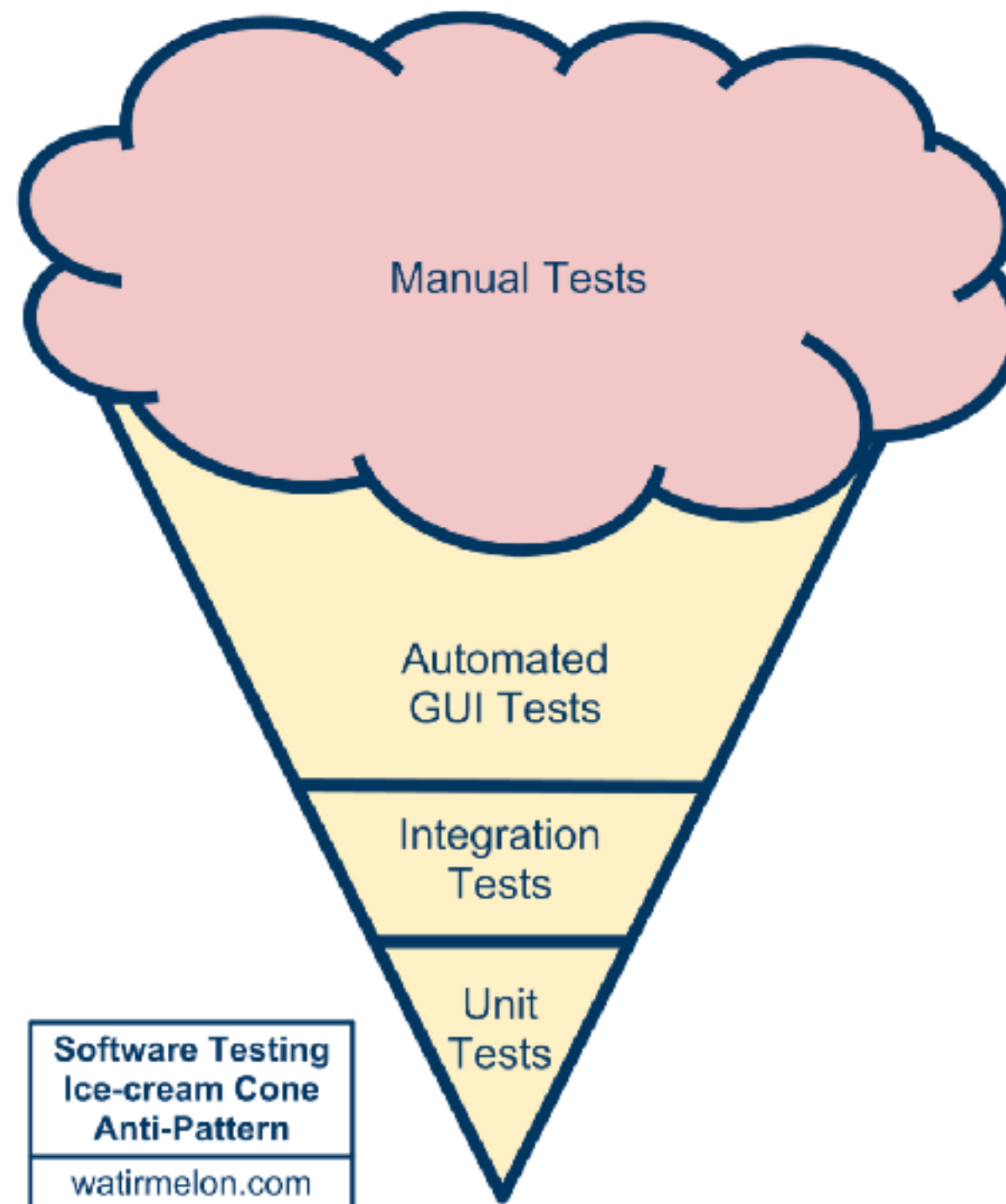


Testing ?

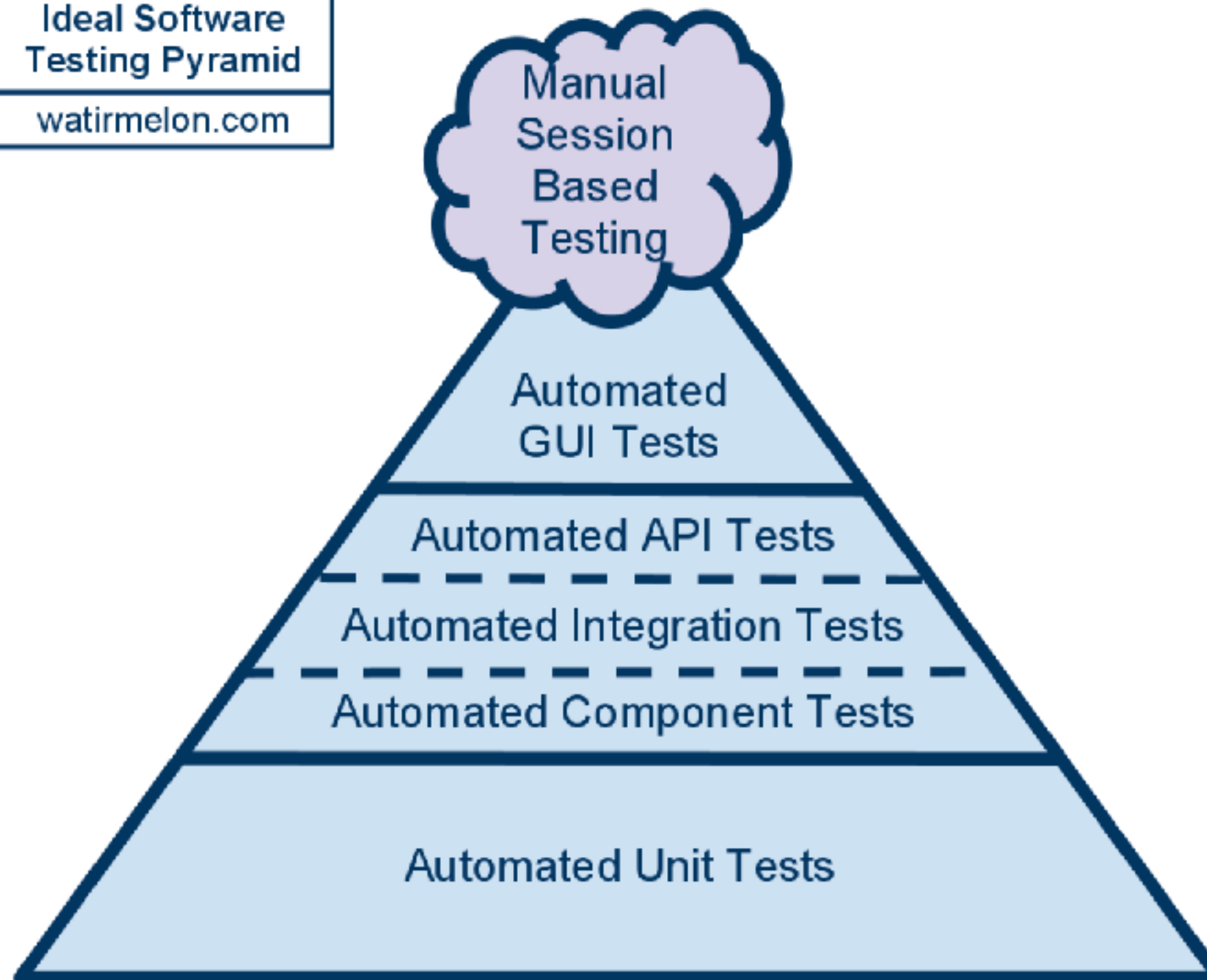


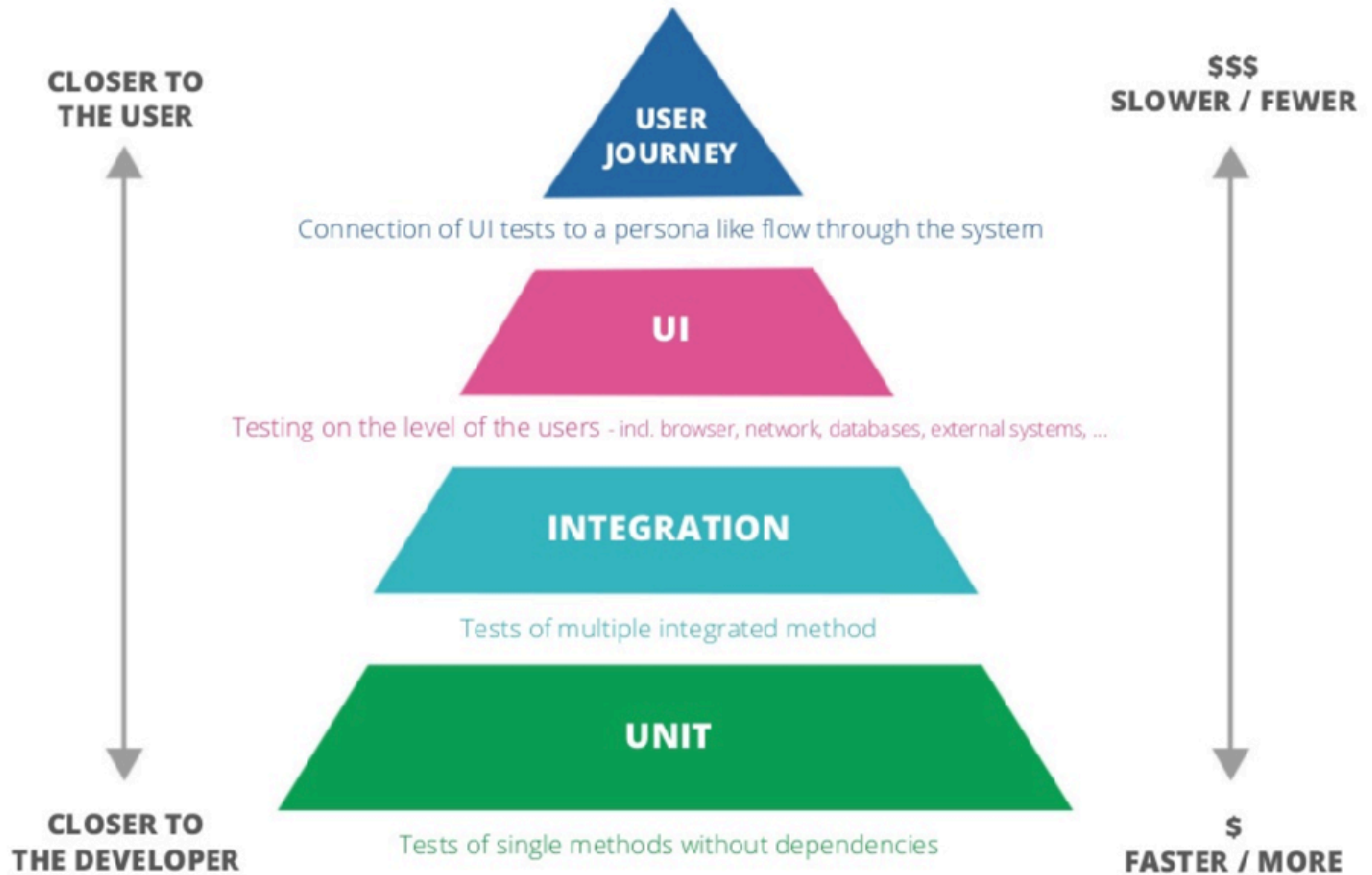
Microservice Testing ?

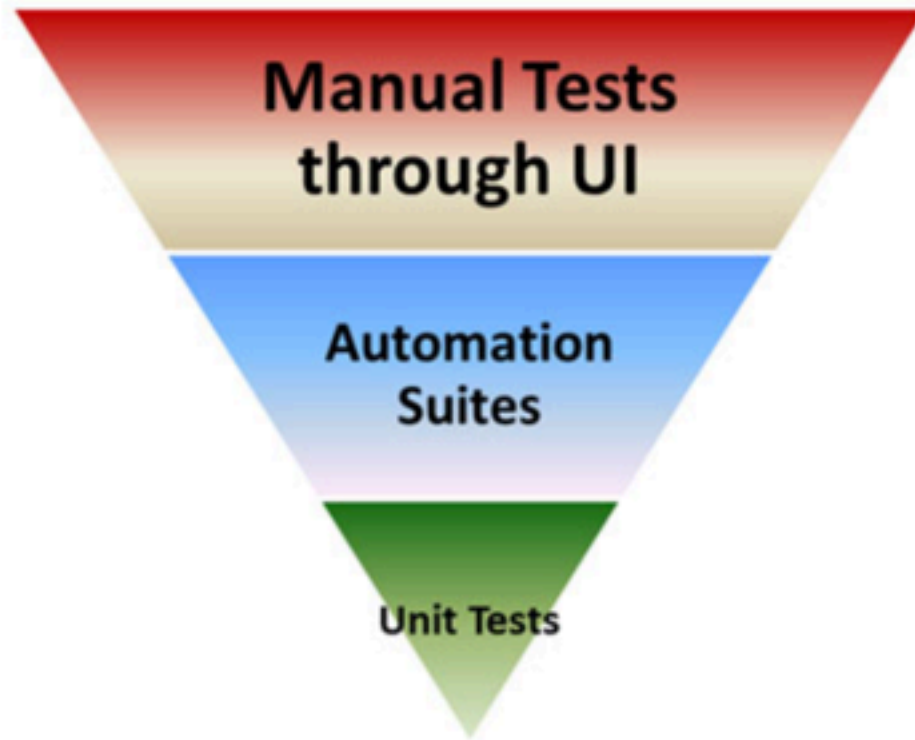




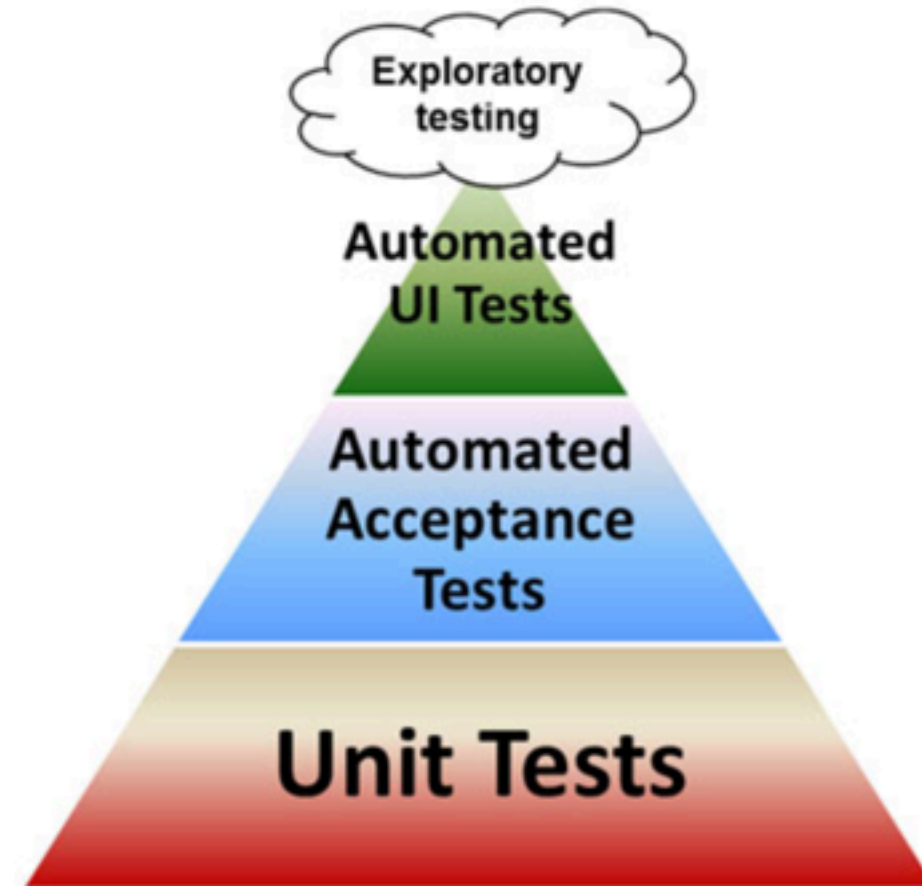
Ideal Software
Testing Pyramid
watirmelon.com







Traditional
(find bugs)

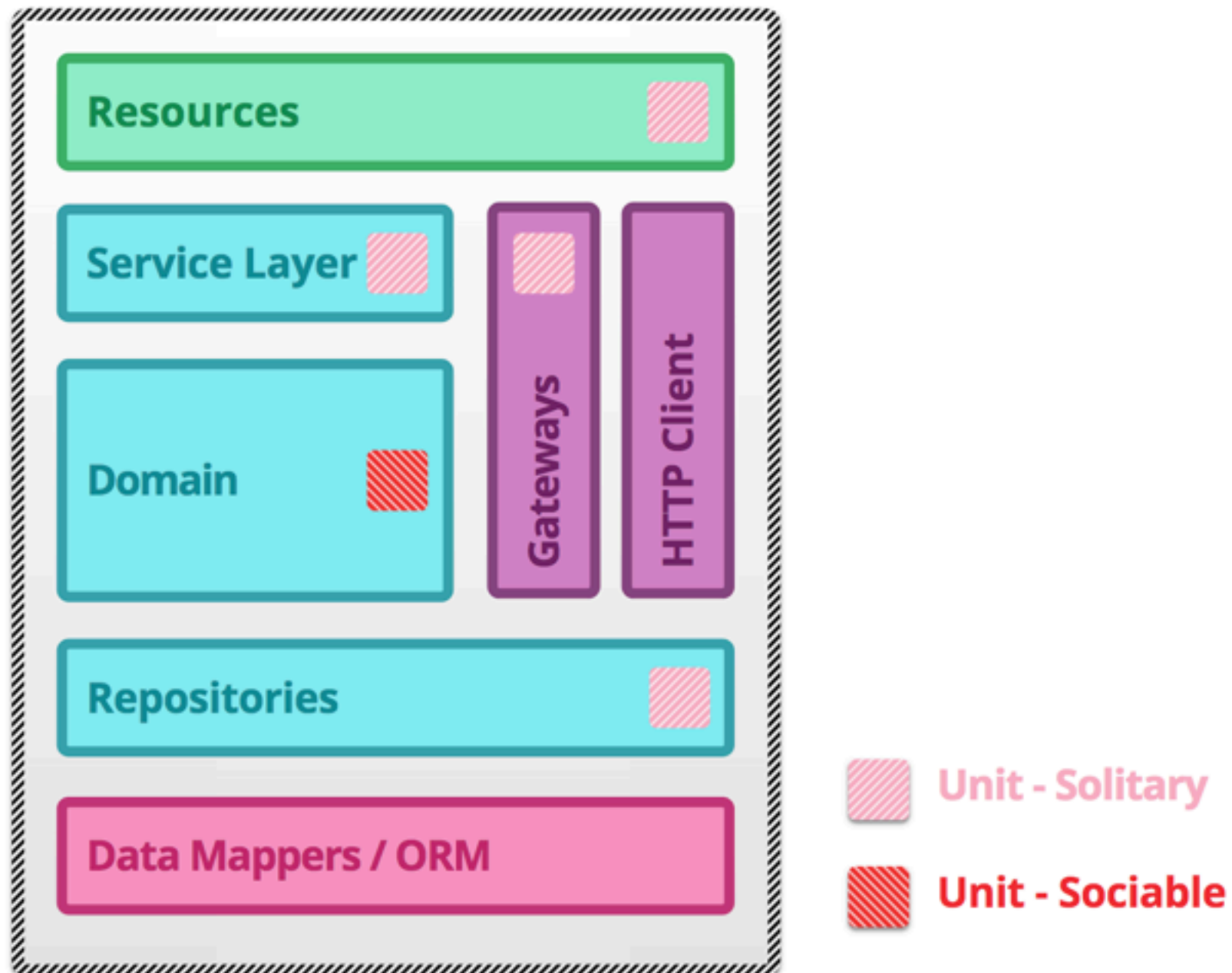


Agile
(prevent bugs)

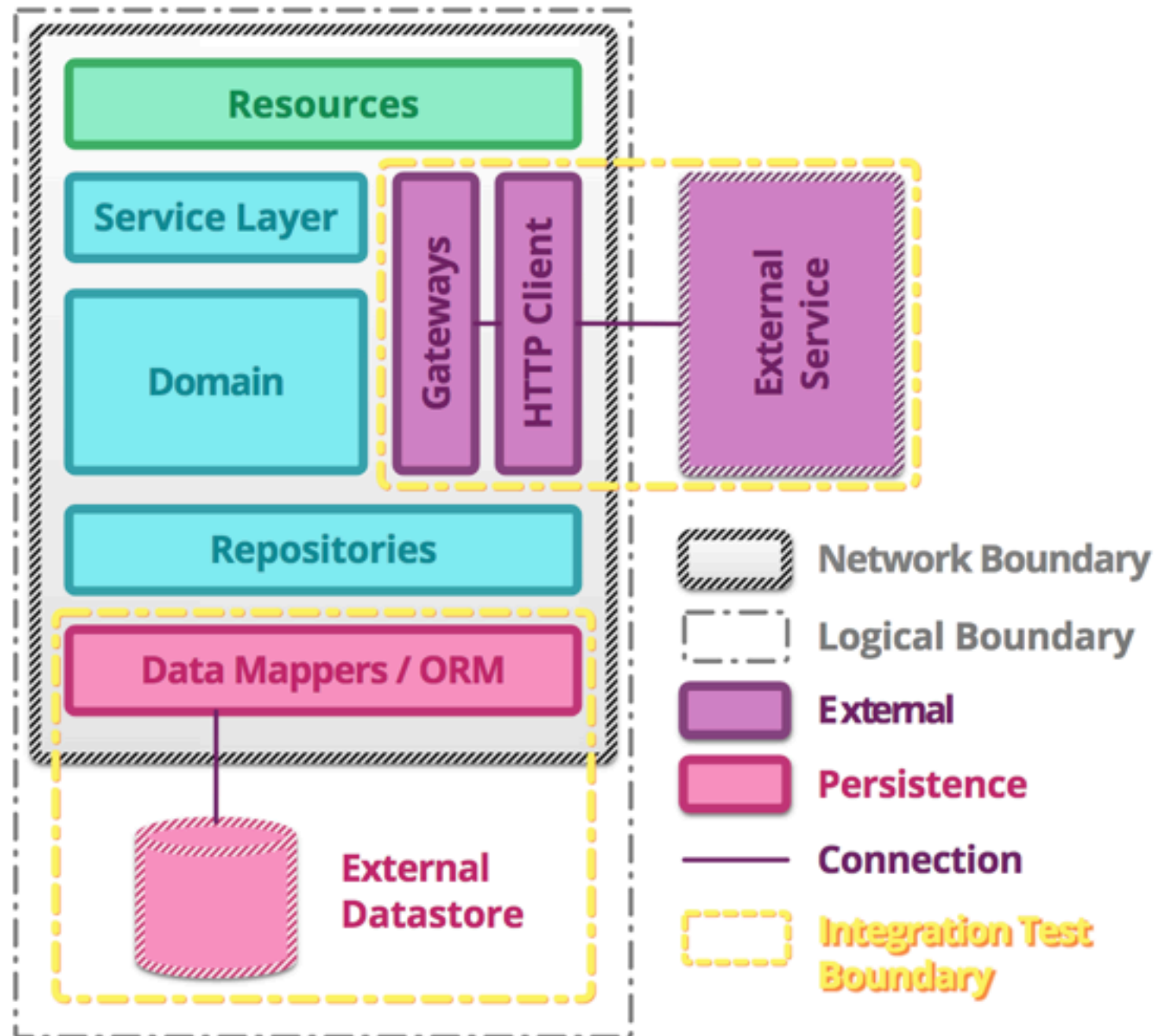




Unit testing

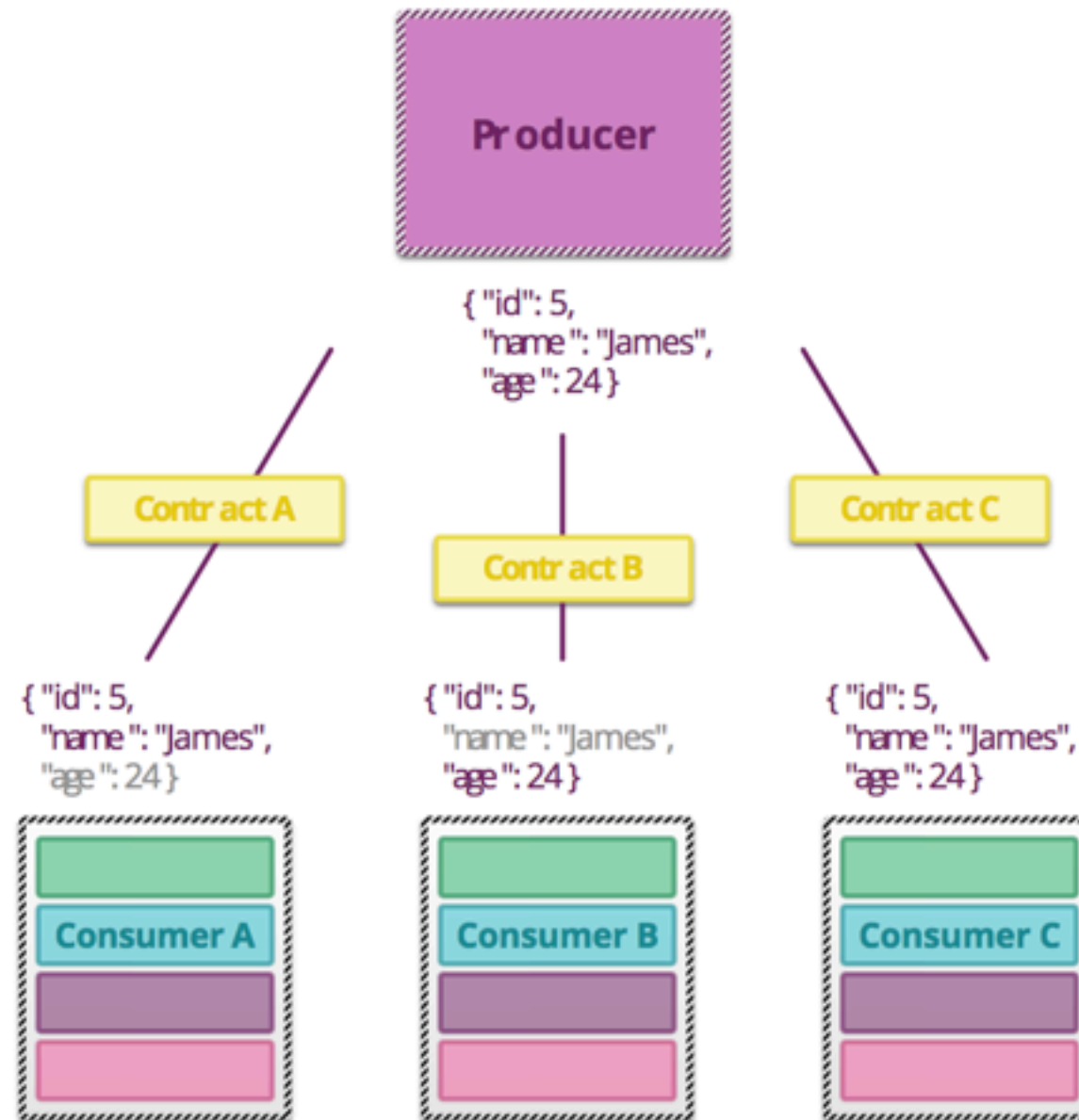


Integration testing

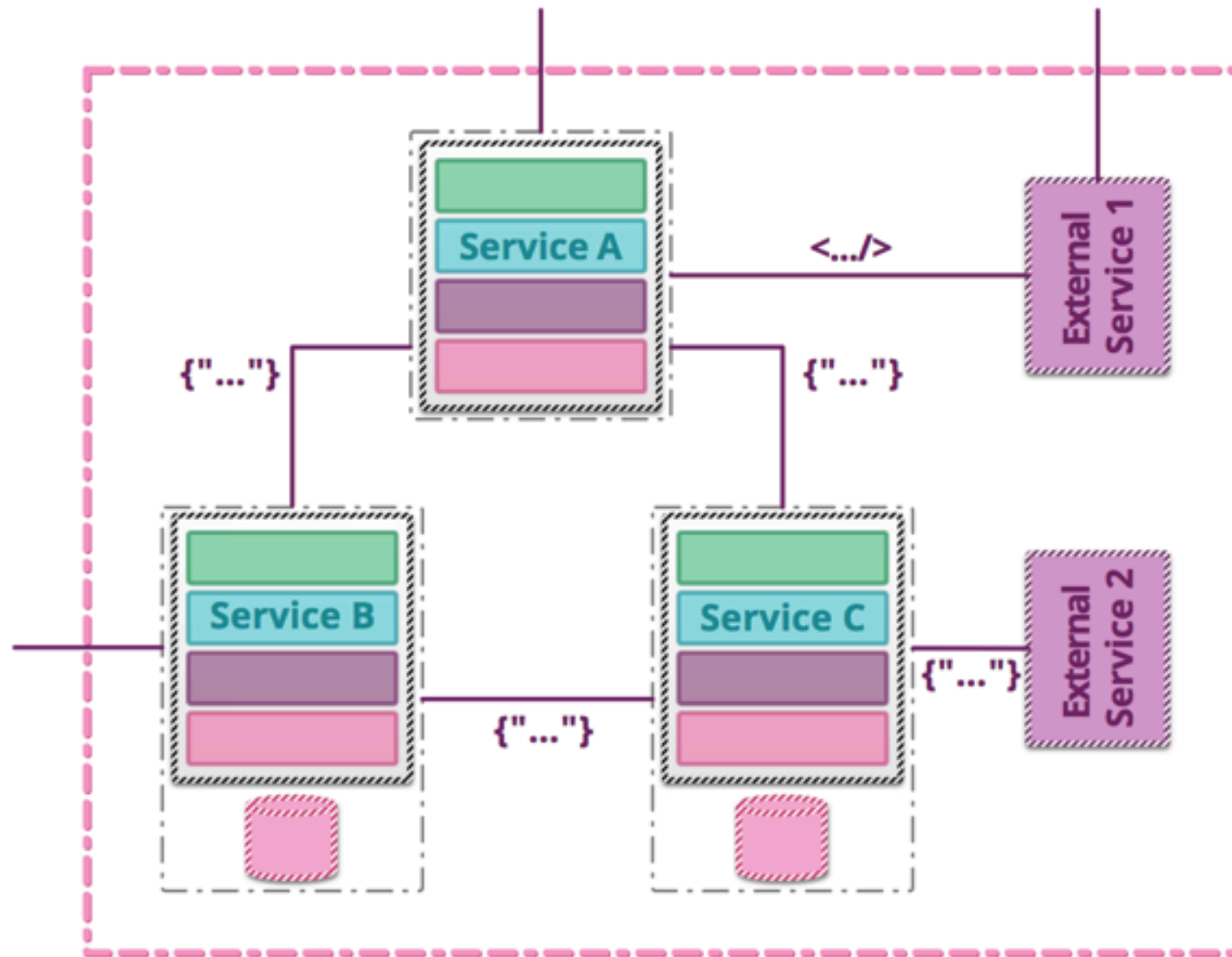





Contract testing




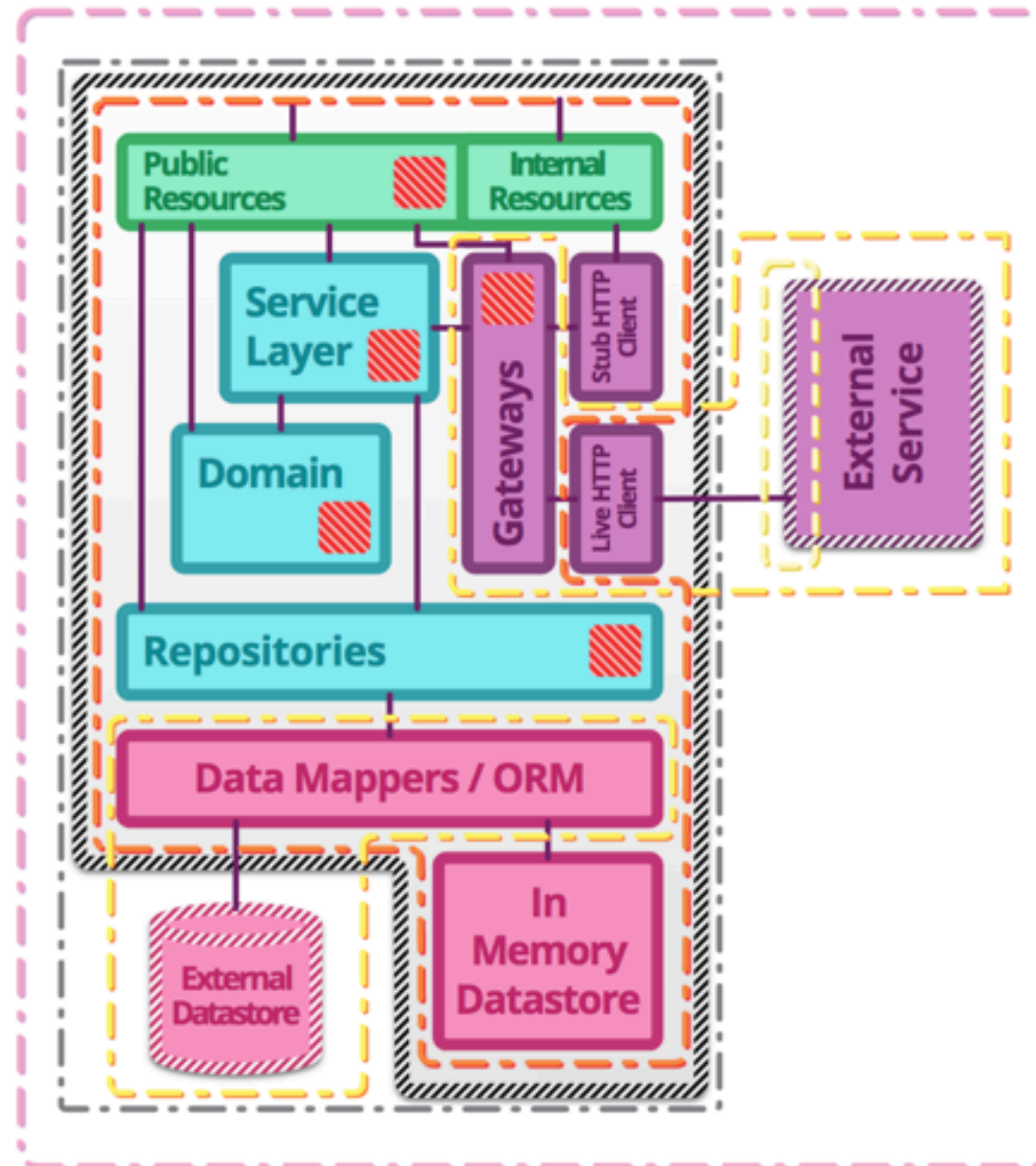
End-to-End testing





Summary


 **Unit tests** : exercise the smallest pieces of testable software in the application to determine whether they behave as expected.

 **Integration tests** : verify the communication paths and interactions between components to detect interface defects.



 **Component tests** : limit the scope of the exercised software to a portion of the system under test, manipulating the system through internal code interfaces and using test doubles to isolate the code under test from other components.

 **Contract tests** : verify interactions at the boundary of an external service asserting that it meets the contract expected by a consuming service.

 **End-to-end tests** : verify that a system meets external requirements and achieves its goals, testing the entire system, from end to end.

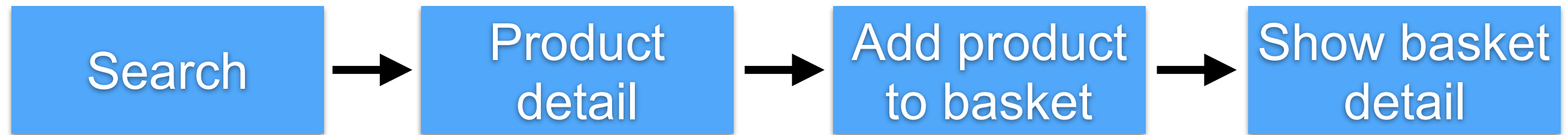


Start with acceptance testing

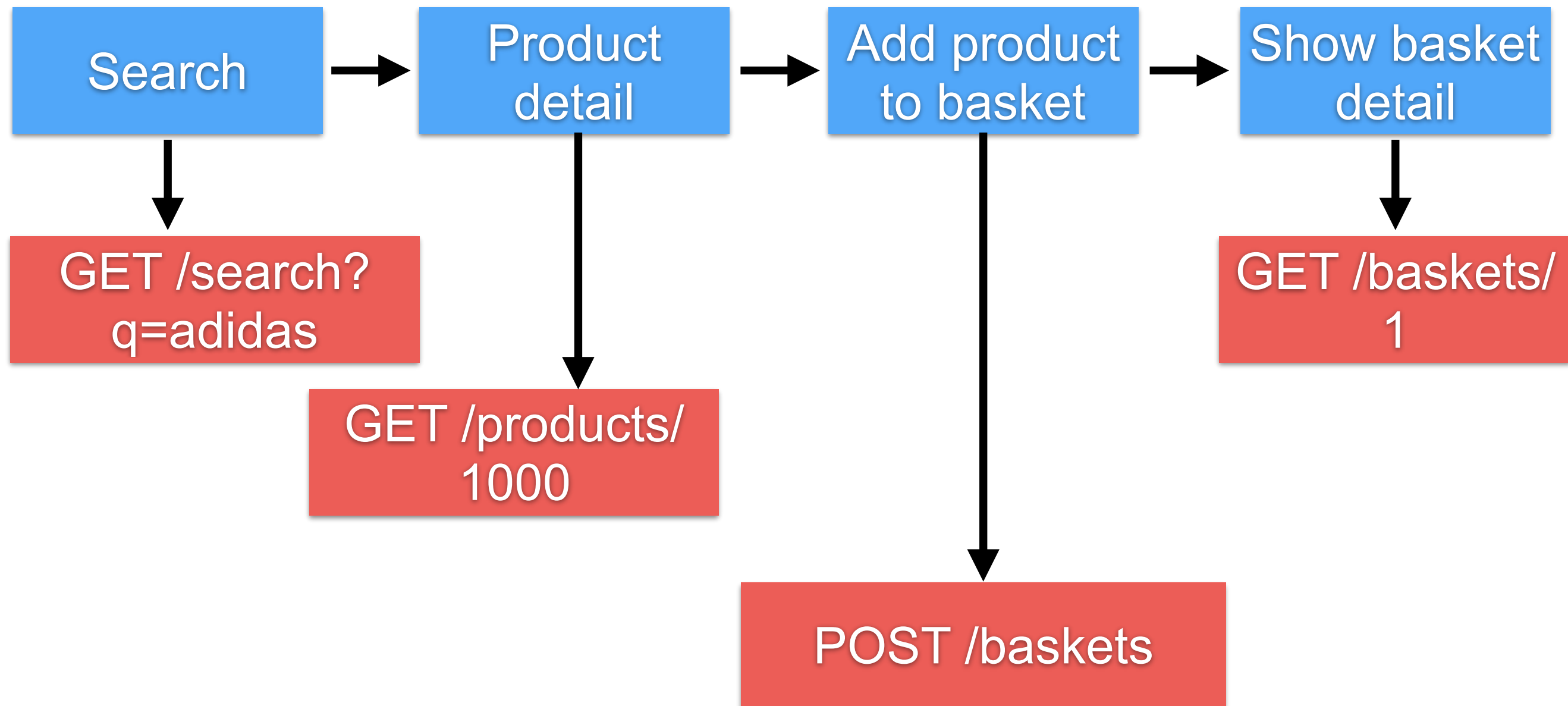
mock_api



Acceptance Testing



Acceptance Testing



Try to mock REST APIs

Stubby4j
WireMock
JSON Server
more ...



Stubby4j

\$java -jar stubby4j-6.0.1.jar --data api.yaml

Loaded: [GET] /search?q=adidas
Loaded: [GET] /product/1000
Loaded: [POST] /baskets
Loaded: [GET] /baskets/1

<https://github.com/azagniotov/stubby4j>



Create acceptance test



atdd/



Install robotframework

```
$pip install robotframework
```

<http://robotframework.org/>



Install library for API testing

\$pip install -U requests

\$pip install -U robotframework-requests

<https://github.com/bulkan/robotframework-requests>



Create first test case

Create file `first_case.robot`

```
1      *** Settings ***
2      Library      RequestsLibrary
3      Library      Collections
4
5      *** Variables ***
6
7      *** Testcases ***
8
9      *** Keywords ***
10
11
```



Run test

```
$pybot first_case.robot
```



Add new test case

Readable and easy to understand

```
7  *** Testcases ***
8  Try to add one product to empty basket
9      Search product by keyword adidas
10     Get product detail of id=1000
11     Add product id=1000 to empty basket
12     Get basket detail of id=1
```



Run test

```
$pybot first_case.robot
```



Create first keyword

Search product by keyword adidas

*** Keywords ***

Search product by keyword adidas

Create Session search <http://localhost:8882>

`${response}`= Get Request search /search?q=adidas

Should Be Equal `${response.status_code}` `${200}`

Should Be Equal `${response.json()['header']['code']}` `${200}`

`${size_of_product}`= Get length `${response.json()['body']}`

Should Be Equal `${size_of_product}` `${2}`

Should Be Equal `${response.json()['body'][0]['product_id']}` `${1000}`



Working with HTTP Post

Add product id=1000 to empty basket

Add product id=1000 to empty basket

```
Create Session      baskets      http://localhost:8882
&{headers}= Create Dictionary Content-Type=application/json
&{data}= Create Dictionary
... product_id=${1000}
... product_name=Adidas
... product_price=${1500}
... product_image=http://xxx.jpg
... quantity=${1}
${response}= Post Request baskets /baskets
... data=${data} headers=${headers}
Should Be Equal As Strings ${response.status_code} 200
```



Create more keyword



Run test

\$pybot first_case.robot

```
=====
First Case
=====
Try to add one product to empty basket | PASS |
-----
First Case | PASS |
1 critical test, 1 passed, 0 failed
1 test total, 1 passed, 0 failed
=====
```



Testing report

Open file report.html

First Case Test Report

Generated
20180710 22:25:46 GMT+07:00
50 seconds ago

Summary Information

Status:

All tests passed

Start Time:

20180710 22:25:46.236

End Time:

20180710 22:25:46.434

Elapsed Time:

00:00:00.198

Log File:

[log.html](#)

Test Statistics

Total Statistics	Total	Pass	Fail	Elapsed	Pass / Fail
Critical Tests	1	1	0	00:00:00	<div></div>
All Tests	1	1	0	00:00:00	<div></div>

Statistics by Tag	Total	Pass	Fail	Elapsed	Pass / Fail
No Tags					<div></div>

Statistics by Suite	Total	Pass	Fail	Elapsed	Pass / Fail
First Case	1	1	0	00:00:00	<div></div>

Test Details

Totals

Tags

Suites

Search

Type:

☐ Critical Tests

☐ All Tests



Testing report

Open file report.html

Test Execution Log

☐ **SUITE** First Case

Full Name: First Case
Source: /Users/somkiat/data/slide/microservice/slide/demo-go/atdd/first_case.robot
Start / End / Elapsed: 20180710 22:25:46.236 / 20180710 22:25:46.434 / 00:00:00.198
Status: 1 critical test, 1 passed, 0 failed
1 test total, 1 passed, 0 failed

☐ **TEST** Try to add one product to empty basket

Full Name: First Case.Try to add one product to empty basket
Start / End / Elapsed: 20180710 22:25:46.359 / 20180710 22:25:46.434 / 00:00:00.075
Status: **PASS** (critical)

- ☐ **KEYWORD** Search product by keyword adidas
- ☐ **KEYWORD** Get product detail of id=1000
- ☐ **KEYWORD** Add product id=1000 to empty basket
- ☐ **KEYWORD** Get basket detail of id=1



Start to develop real APIs



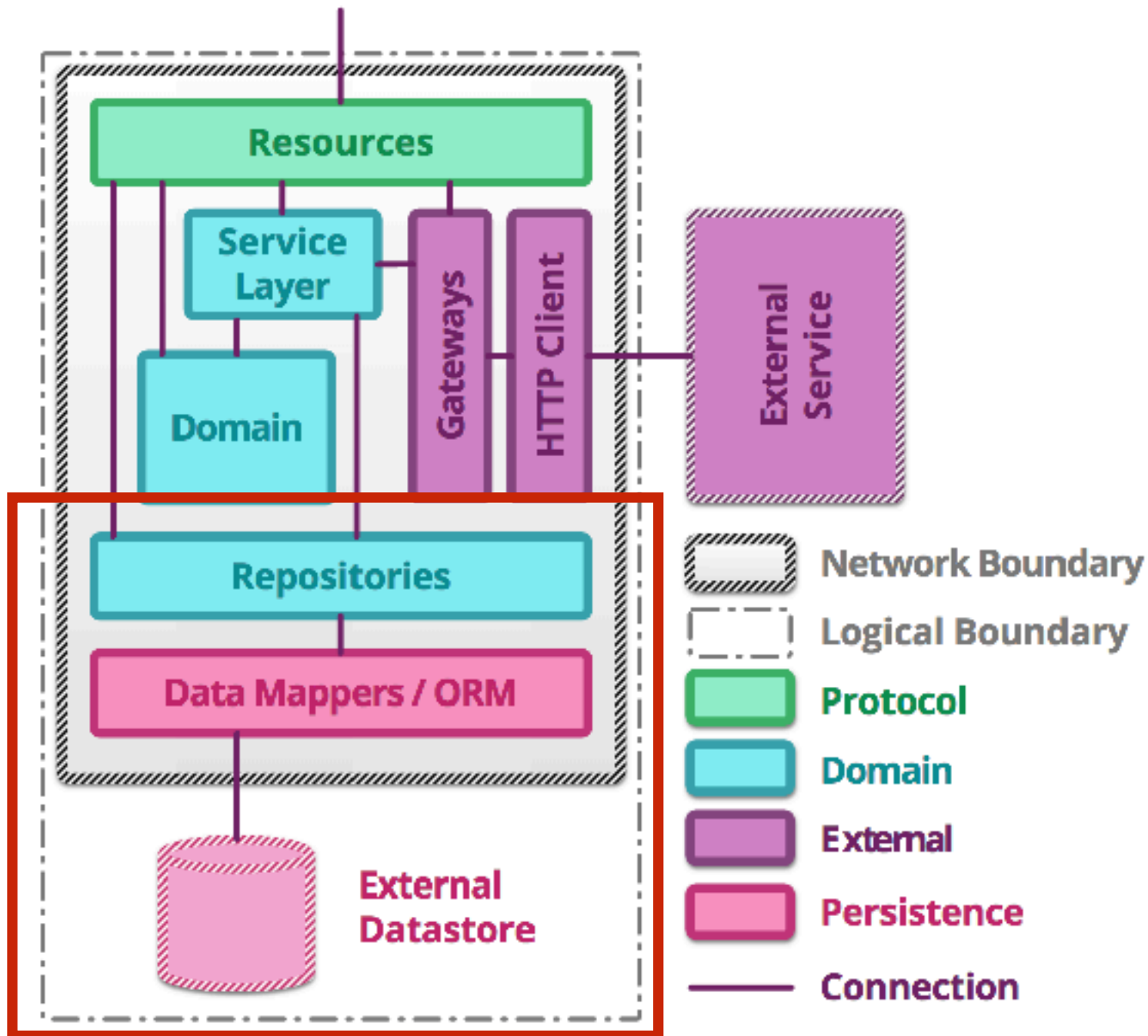
More testing ...



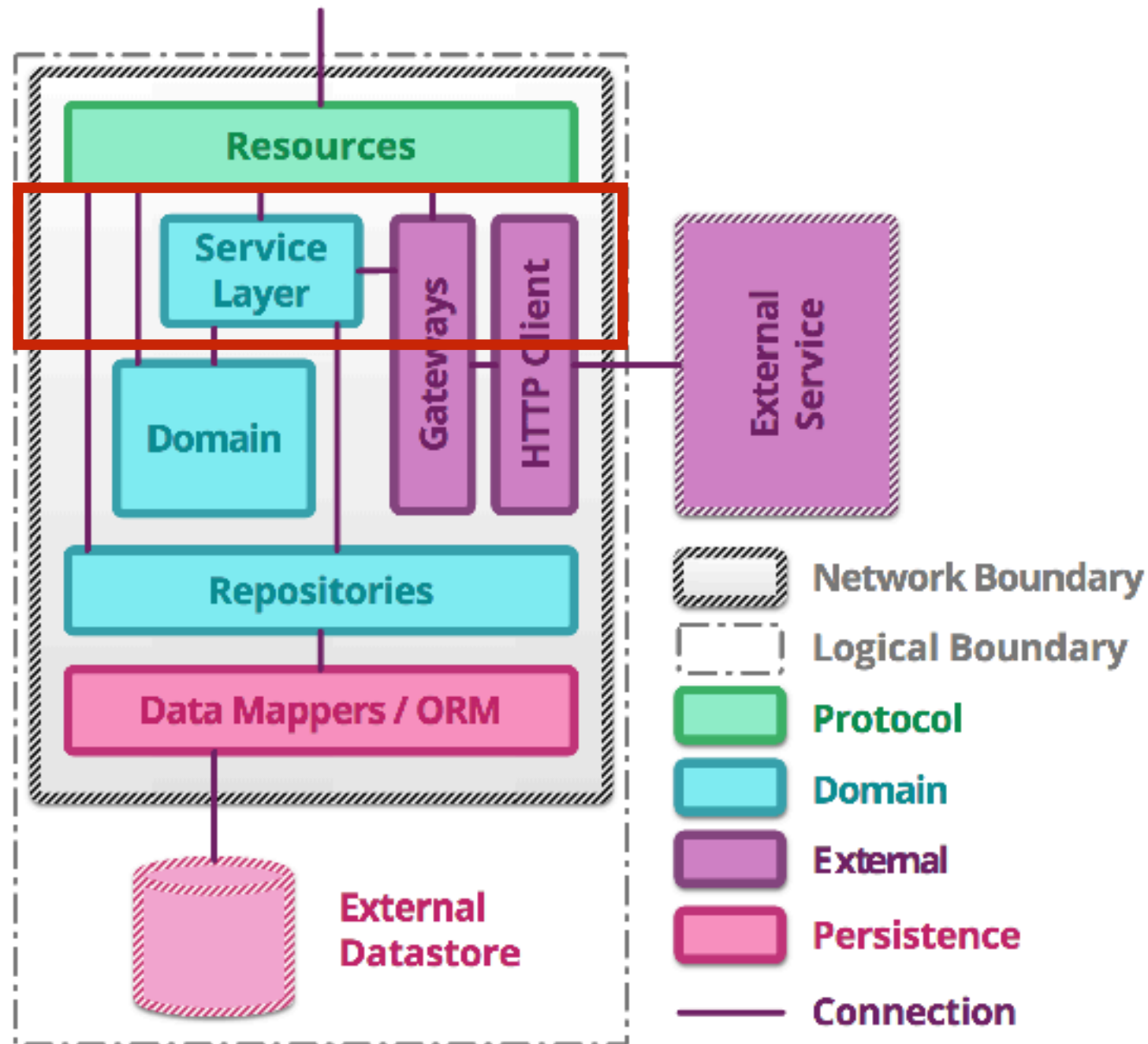
Slice testing in each layer/package



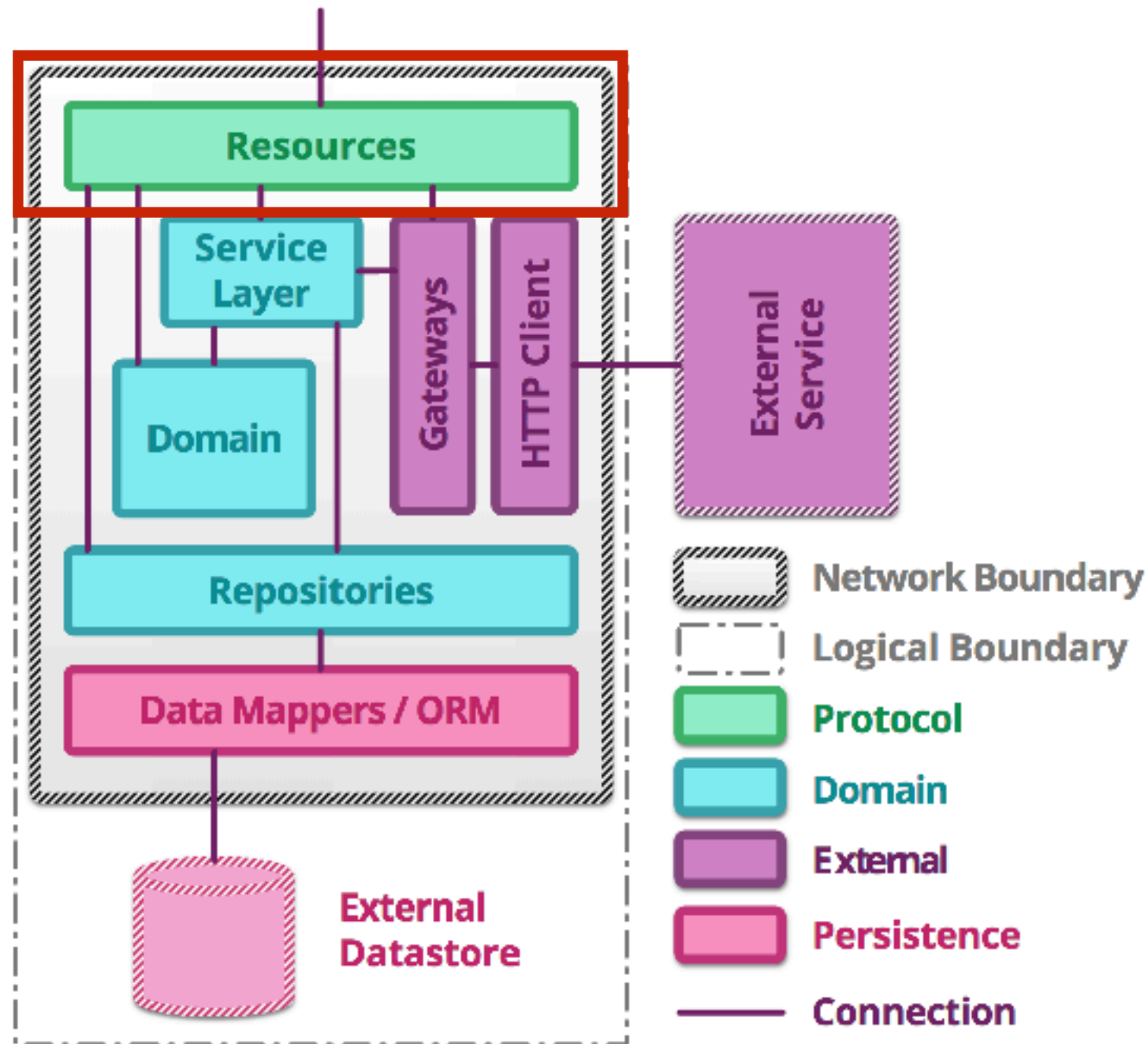
Repository testing



Service testing



API/Resources testing



Deploy with Docker



Go



Basic of Docker

Image
Container
Volume
Dockerfile
Docker-compose



Image

Template/blueprint of container

OFFICIAL REPOSITORY

golang ☆

Last pushed: a day ago

Repo Info Tags

Short Description

Go (golang) is a general purpose, higher-level, imperative programming language.

Full Description

Supported tags and respective `Dockerfile` links

https://hub.docker.com/_/golang/



Download Image

```
$docker image pull <image name>
```



List all images

\$docker image ls



Create container

`$docker container run <image name>`



List all container

\$docker container ps

\$docker container ps -a

\$docker container ps -a -q



Stop container

`$docker container stop <container id/name>`



Delete container

\$docker container prune



Working with Go project

1. Build binary file
2. Run binary in container



Build binary file

```
$docker container run --rm -p 8080:8080  
-v $(pwd):/go/ -w /go  
golang:1.10.3-alpine3.7 go build -o main main
```



Run binary in container

```
$docker container run --rm  
-p 8080:8080  
-v $(pwd):/go/ -w /go  
golang:1.10.3-alpine3.7 ./main
```



Make it easy with Dockerfile



Dockerfile

```
FROM golang:1.10.3-alpine3.7
WORKDIR /go
COPY . /go
RUN go build -o main main
CMD ["/go/main"]
```



Build image from Dockerfile

```
$docker image build -t sample:0.1 .
```



Run binary with container

```
$docker container run --rm -p 8080:8080  
sample:0.1
```



Using multi-stage build

<https://docs.docker.com/develop/develop-images/multistage-build/>



Dockerfile2

1

```
FROM golang:1.10.3-alpine3.7 as builder
WORKDIR /go
COPY . /go
RUN CGO_ENABLED=0 GOOS=linux go build -a -installsuffix cgo -o app
main
```

```
FROM scratch
WORKDIR /root/
COPY --from=builder /go/app .
CMD ["/app"]
```



Dockerfile2

```
FROM golang:1.10.3-alpine3.7 as builder
WORKDIR /go
COPY . /go
RUN CGO_ENABLED=0 GOOS=linux go build -a -installsuffix cgo -o app
main
```

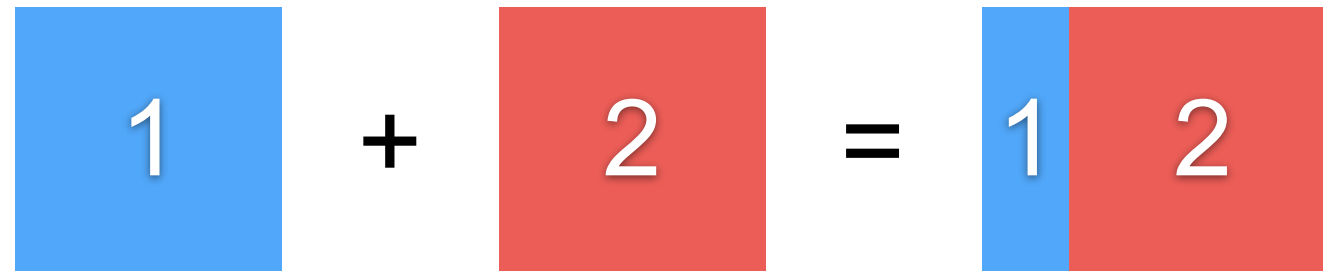
```
FROM scratch
WORKDIR /root/
COPY --from=builder /go/app .
CMD ["/app"]
```

2



Build image from Dockerfile

```
$docker image build -t sample:0.2  
-f Dockerfile2 .
```



Run binary with container

```
$docker container run --rm -p 8080:8080  
sample:0.2
```



Multiple services with docker-compose

<https://docs.docker.com/compose/>



Create file docker-compose.yml

```
$docker container run --rm -p 8080:8080  
sample:0.2
```



Run with docker-compose

```
$docker-compose up -d  
$docker-compose down
```

