

Look-aside Cache Pattern Example

This repo contains provides an example application demonstrating the use of Tanzu GemFire as a [look-aside cache](#).

The application uses [Spring Boot for Apache Geode](#) to cache data from the Bikewise.org public REST API. Look-aside caching is enabled with just a few annotations. When serving cached data, the application response time is dramatically improved.

How to get the app running on the local Env.

We are going to work now with an application that will use the look-aside features of gemfire caching. A standard spring-mvc app employs the use of stereotypes. These include:

- Domain Model
- Java DSL for Configuration
- Services
- View Controllers
- Spring MVC

The web MVC framework we are using is Thyme Leaf but will not be covered in this workshop. We will only look at the java code involved in the integration of Spring Boot Data Gemfire. Let's start with the domain.

Domain Object

Our domain is examining reports on incidents that effect bikes within a grouping nearby and associated with a zipcode. Our *BikeIncident* is structure to capture a description of an incident. Copy and paste this code into the *BikeIncident* class in the domain package.

```
private String type;
private String title;
private String description;
private String address;

public String getType() {
    return type;
}

public String getTitle() {
    return title;
}

public String getDescription() {
    return description;
}

public void setDescription(String description) {
    this.description = description;
}

public String getAddress() {
    return address;
}
```

Java DSL for configuration

We are going to add a few configurations to enable Spring Boot's AutoConfiguration that we learned about in Lab 2. First we annotate our *LookAsideCacheApplicationConfig* class with the `@Configuration` so that Spring Boot will process our configurations. We then tell it to `@EnableCachingDefinedRegions`, which we will identify in our Service coming up next. We then annotate it with `@EnableClusterAware` to take advantage of SBDG's autoconfiguration so that we can develop from our IDE with a near-cache, with a local cache and by the end of this lab you will see how to deploy and connect to your gemfire-cluster inside of kubernetes. Copy and paste this code into *LookAsideCacheApplicationConfig* class within the *config* package. [Note: we will use the `@EnableStatics` to show the difference in the speed of a cache access vs the time taken to invoke the restful API].

```

@Configuration
@EnableCachingDefinedRegions
@EnableStatistics
@EnableClusterAware

```

BikeIncidentService

Next we will add a service that takes the zipcode captured by our simple UI and calls out to a restful service to retrieve a report of bike incidents for a given zipcode and surrounding area.

```

private final RestTemplate restTemplate;

@Value("${bikewise.api.url}")
private String API_URL;

public BikeIncidentService(RestTemplate restTemplate) {
    this.restTemplate = restTemplate;
}

@Cacheable("BikeIncidentsByZip")
public List<BikeIncident> getBikeIncidents(String zipCode) throws IOException {

    String jsonIncidents = restTemplate.getForObject(API_URL + zipCode, String.class);

    return convertJsonToBikeIncidents(jsonIncidents);
}

private List<BikeIncident> convertJsonToBikeIncidents(String jsonIncidents) throws IOException {
    ObjectMapper objectMapper = new ObjectMapper();
    objectMapper.configure(DeserializationFeature.FAIL_ON_UNKNOWN_PROPERTIES, false);

    JsonNode bikeIncidentsAsJsonNode = objectMapper.readTree(jsonIncidents);

    List<BikeIncident> bikeIncidents = objectMapper.
        convertValue(bikeIncidentsAsJsonNode.get("incidents"),
            new TypeReference<List<BikeIncident>>(){});

    return bikeIncidents;
}

```

The important annotation to notice in this service is the `@Cacheable` that will enable the capturing of a list of bike incidents into a *BikeIncidentsByZip* region that we'll be able to query from within Gemfire.

View Controller

Next let's implement our View Controller.

Add the following code to the class *ViewController* in the controllers package:

```

@Autowired
BikeIncidentService bikeIncidentService;

private List<String> responseTimes = new ArrayList<>();

@GetMapping("/")
public String homePage(Model model) {
    model.addAttribute("zipCode");
    return "home";
}

@PostMapping("/")
public String requestIncidents(
    @RequestParam String zipCode,
    Model model) throws IOException {

    long timeStampBeforeQuery = System.currentTimeMillis();
    List<BikeIncident> bikeIncidents =
        bikeIncidentService.getBikeIncidents(zipCode);
    long timeElapsed = System.currentTimeMillis() - timeStampBeforeQuery;
}

```

```

        recordNewDataRequest(timeElapsed, zipCode);
        populateModelWithSearchResults(model, bikeIncidents, zipCode);

        return "home";
    }

    private void recordNewDataRequest(long timeElapsed, String zipCode) {
        responseTimes.add( "Zip Code: " + zipCode + ", Response Time: " + timeElapsed + " ms");
    }

    private void populateModelWithSearchResults(Model model, List<BikeIncident> bikeIncidents,
        String zipCode) {
        model.addAttribute("zipCode", zipCode);
        model.addAttribute("responseTimes", responseTimes);
        model.addAttribute("bikeIncidents", bikeIncidents);
    }

```

There is nothing specific to Gemfire that is in this controller. We have autowired in the *BikeIncidentService* and invoke the service with the zipcode parameter that is input into our search page.

Testing your application functionality locally

You should now be able to run your BikeIncident app locally with a local cache. Simply start the spring boot application *LookAsideCacheApplication* from your IDE or commandline.

```

gfsh>start locator
gfsh>configure pdx --read-serialized=true
gfsh>start server

```

Now run some queries on zip codes and do the following query:

```
gfsh>query --query="SELECT address, description FROM /BikeIncidentsByZip"
```

#Section Two - deploying our application to Kubernetes The first thing we need to do is change our default profile from "default" to kubernetes, allowing us to retrieve our gemfire-cluster locators and servers to connect to.

Open application.properties and uncomment the spring.profiles.active=kubernetes. This will pick up the additional properties we need for the gemfire cluster when we deploy our image.

1. Build the image

Starting with Spring Boot 2.3, you can now run a command and your build tool (maven or gradle) will build the Docker file for you. For this application if you run:

```
./gradlew bootBuildImage
```

This creates an image for you on your local docker daemon.

2. Load the image

We now need to load the image into the kind environment.

```
kind load docker-image docker.io/library/look-aside-cache:0.0.1-SNAPSHOT
```

3. Create a deployment

kubectl create deployment [my deployment name I make up] --image=[your look-aside-cache-image-name here]. - this should create you a deployment, replicaset, and pod using the image you build in step 1.

```
kubectl create deployment look-aside-cache --image=docker.io/library/look-aside-cache:0.0.1-SNAPSHOT
```

4. Expose the deployment

You now need to expose the deployment so that you can access your website: `kubectl expose deployment/deployment-name --type="NodePort" --port 8080`

```
kubectl expose deployment look-aside-cache --type="NodePort" --port 8080
```

You will now need the port exposed through the new service by doing the following:

```
kubectl get services
```

and the output should look like the following:

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
kubernetes	ClusterIP	10.96.0.1	<none>	443/TCP	4d22h
look-aside-cache	NodePort	10.108.118.222	<none>	8080:*30615*/TCP	17s

You will need your NodePort that is highlighted in bold.

5. Find the internal ip address

Once the deployment has been exposed you will need to find your internal ip address and then add NodePort you created in the previous step.

```
kubectl get nodes -o wide
```

and the output should look something similar to:

```
kubectl get nodes -o wide
```

NAME	STATUS	ROLES	AGE	VERSION	INTERNAL-IP	EXTERNAL-IP	OS-IMAGE	KERNEL-VER
kind-control-plane	Ready	master	4d22h	v1.18.2	172.18.0.2	<none>	Ubuntu 19.10	5.4.0-100