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AWS 08 - Introduction to EC2

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AWS sessions list

- AWS 01 AWS + Cloud Intro ✅ *1.5hrs*
- AWS 02 AWS CLI Setup ✅ *1.5hrs*
- AWS 03 S3 Storage (Console) ✅ *1.5hrs*
- AWS 04 CloudFormation Intro + S3 Storage (IaC) ✅ *1.5hrs*
- AWS 05 Lambda Intro ✅ *1.5hrs*
- AWS 06 Lambda (IaC) ✅ *1.5hrs*
- AWS 07 Redshift (IaC) ✅ *1.5hrs*
- AWS 08 EC2 (IaC) + Grafana setup ⬅ *1.5hrs*

Overview

- What is EC2
- Running a virtual server in the cloud
- Configuring the startup of an EC2
- Hosting applications inside our Servers

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Learning Objectives

- Add an EC2 server with CloudFormation
- Configure the User Data of the machine
- So that we can host (run) Grafana in the EC2

EC2

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EC2 (Elastic Compute Cloud)

- A service that allows you to rent virtual computers on which you can run your own applications
- 'Elastic' because you pay by the second for what you use!
- You get control over the geographical location of your virtual computers

Before cloud computing, you'd need to put in a request for physical hardware which could take weeks to provision, now it takes seconds, with a few clicks.

EC2 Pricing Types

On Demand:

Allows you to pay a fixed rate by the hour/minute/second with no commitment.

Reserved:

Provides you with a capacity reservation and a significant discount on the hourly charge of an instance. Locked into contract terms of 1 or 3 years.

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EC2 Pricing Types

Spot:

Enables you to bid whatever price you want for instance capacity, making better savings if your applications have flexible start/end times.

Dedicated Hosts:

Physical EC2 server dedicated for your own use.

EC2 - Concepts

Image: what is being used to build an instance (similar to Docker)

Instance: the machine you're creating

Security: security groups, key management, network interfaces

EC2 - Concepts (cont)

- *Image* - essentially the template that contains the software configuration required to launch your instance. Think of this as your installation DVd for your laptop :-)
- *Security Group* - a virtual firewall for your EC2 instances, to control incoming & outgoing traffic. Default security groups allow no traffic in, and all out - we must update these!
- *Network interface*: Configuring things like port numbers and network access - we can think of this as plugging in a network cable or connecting to the wifi.

EC2 & EBS

We need disks for our machine (instance) to run on - the Elastic Block Store is how we do this.

- Elastic Block Store - a high performance, highly available storage for EC2
- Block-level (organised/identified in blocks) storage that can be attached to EC2 instances
- 2 options available: SSD (Solid State Drive) or HDD (Hard Disk Drive)

EC2 UserData

- We usually want our servers to do something special when booting up
- To do this, we can provide a file of instructions called `userdata`
- This file has a special format
- ...but otherwise we can think of it as a special bash script that runs to set things up

There is an example at ./handouts/userdata.

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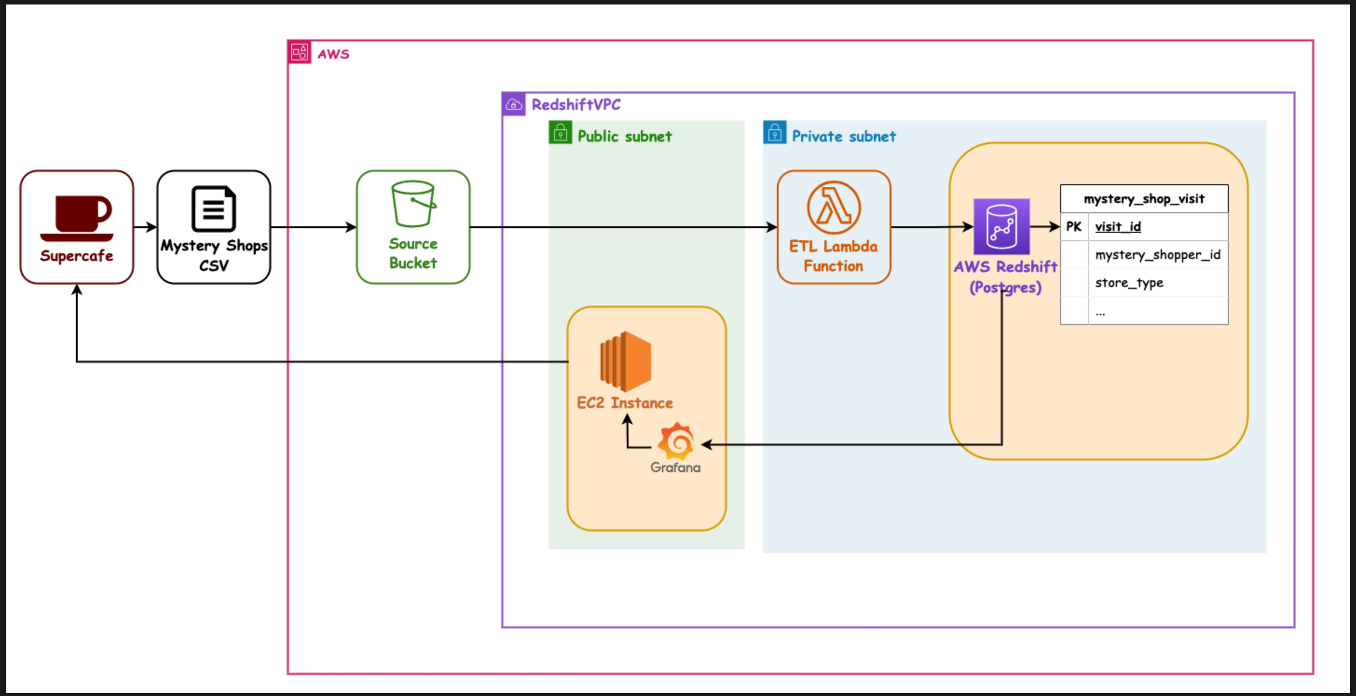
Proposed Pipeline Architecture

Let's revisit our Mystery Shopper target setup... at the end of this session we will have it all:



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Our last user story

`As a` SuperCafe senior manager

`I want` the Mystery Shopper data to be visualised

`So that` we can award the friendliest most helpful store a prize each month

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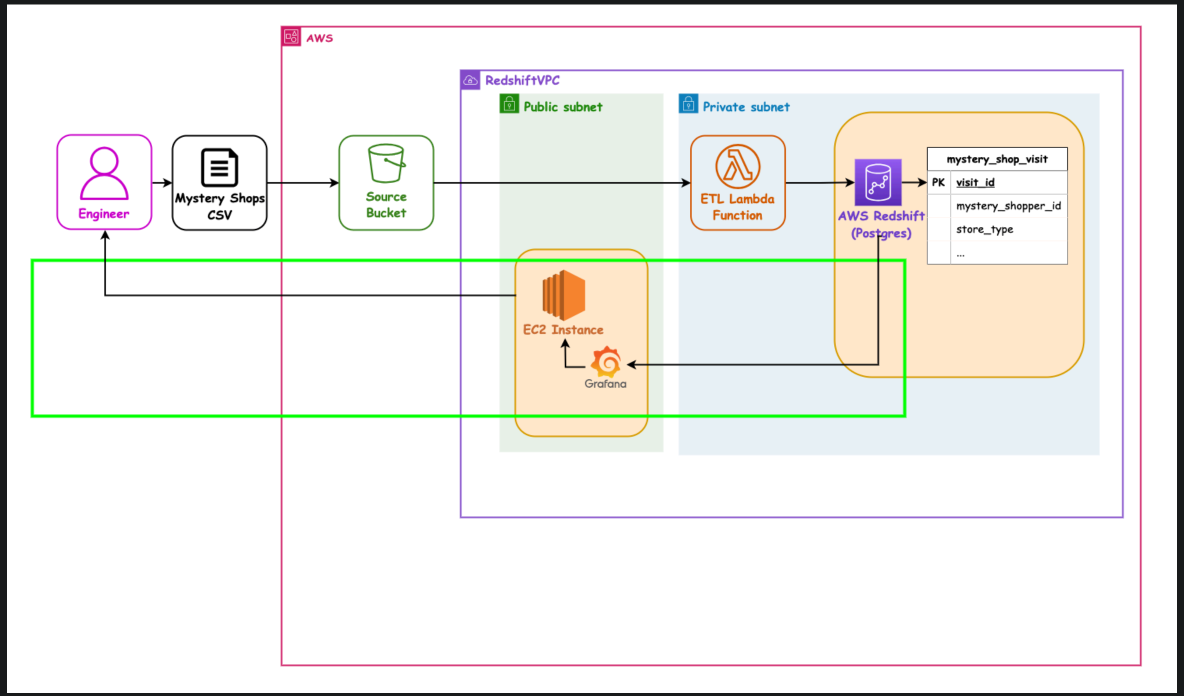
Our last user story - Architecture

We want to run Grafana in an EC2 so we can visualise our Mystery Shopper data:



Exercise time

Now we've learned about EC2, let's run through a group code-along where we create an EC2 instance using CloudFormation.

Once it's up and running, we can use it to host a Grafana dashboard so we have a place to put Mystery Shopper data visualisations later.

Demo - starting point

- We start with an initial ./handouts/etl-stack.yml file
- This matches the end stage of the previous sessions
- We need to fill in some extra pieces

Demo - extra fun stuff

- We have parameters for `TeamName` and `YourName` provided already
  - This session only, you need to specify both
  - So that you can have your own stack and also use your Teams shared database
- Some of the IAM and networking names have been predefined by the instructors

You can see these in the initial ./handouts/etl-stack.yml file.

Demo - new CF parameter 'LatestAmiId'

> We need to know what the base operating system on the virtual machine is.
>
> In the file, `LatestAmiId` uses a special CloudFormation trick to look up the latest one.

- For details see Looking up AMI IDs with CF and SSM

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Code along - Add CF Parameters

> We need a set of extra parameters to configure our instance.

- `EC2InstanceProfileRoleName`, so our EC2 can access other things
  - With `Type` of `String`
  - and `Default` value of `de-academy-ec2-role-instance-profile`
- `EC2InstanceIngressIp`, so we can allow our laptops access
  - With `Type` of `String` and *no* `Default` property
- `EC2UserData`, so we can tell the server what to run on boot
  - With `Type` of `String` and `Default` value of `""` (empty string)

Code along - Add EC2 Instance

> We need to define the EC2 resource it's self.

- We will call it `GrafanaEc2Instance`, and it needs...
  - `Type` set to `AWS::EC2::Instance`
  - `Properties`, the main settings
  - ...with `InstanceType`, for a small & cheap type of EC2
  - ...and `ImageId`, the binary template to run from
  - ...and `Tags`, so we can name it
  - ...and `NetworkInterfaces`, to link up to security and redshift
  - ...and `LaunchTemplate`, for a bunch more settings

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Demo - Launch Template

> We have defined a Launch Configuration to set more defaults for our instance.

- Look in your yaml file for `GrafanaEC2LaunchTemplate`
- The instructor can walk you through what it does
- `LaunchTemplateName` is, well, the name
- `VersionDescription` lets us have named versions - we will have just one

(See next slide for `LaunchTemplateData`.)

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Demo - Launch Template

- `LaunchTemplateData` does a few key things:
    - plugs in the `UserData`, the boot-up script
    - adds a `IamInstanceProfile` (IAM Role) for security restrictions,
    - and specifies the `MetadataOptions` options, a service our Grafana plugins will use
    - enables `Monitoring` for more stats in Cloud Watch
    - adds `BlockDeviceMappings` for the hard disk

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Launch Template settings - pros and cons

The EC2 settings we will use in the `GrafanaEc2Instance` has a `Version: !GetAtt` reference to the Launch Template `GrafanaEC2LaunchTemplate`, and it's `~.LatestVersionNumber`.

- This means that if in `GrafanaEC2LaunchTemplate` you change the `VersionDescription: '01'` value...
- ...then on next deployment the EC2 will be *completely destroyed and replaced afresh*

So:

- **Con:** any data you put in Grafana and don't back up (like dashboard definitions) will be lost
- **Pro:** if you forget your master Admin password for Grafana, the VM will come up clean and you can reset it

Demo - Security Group

> We have defined a security group to limit traffic in and out, to allow only your laptop IPs specific access to your VMs.

- Look in your yaml file for `GrafanaEC2InstanceSecurityGroup`
- The instructor can walk you through what it does

(More on next slide.)

Demo - Security Group

Under the `Properties` it has:

- A `GroupDescription` to explain what the group is for
- A `Tags` property with a child `Key` and `Value`, to name it
- A `VpcId` property for the same networking as RedShift
- A `SecurityGroupIngress` property for incoming traffic
- A `SecurityGroupIngress` property for outgoing network traffic

Code along - Check your IP

> Let's check our home IP addresses (IPv4) so you can limit access to your instance to only you.

- https://whatsmyip.org

We do this because the Grafana UI will use http (insecure) so we can lock it down this way instead.

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Code along - Log into AWS

> Make sure you are logged into AWS in your terminal

- Windows users may need to use Powershell

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Demo - the Deploy script - 5 mins

> The deploy script ./handouts/deploy.sh is done for you, so that it will reliably work.
>
> Instructor to show the file.

It does the following:

- Collect your `aws-profile`, `your-name` and `team-name` from the command line
- Deploy a stack called `your-name-shopper-deployment-bucket`
- Install the Lambda's dependencies in the `src` folder
- Package the `your-name-shopper-etl-pipeline` stack with Lambda Zip in S3
- Deploy a stack called `your-name-shopper-etl-pipeline`
- Configures your stack to find the `team_name_cafe_db` database

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Code along - Deploy

> Let's all deploy our stacks. This may take some time!

- Windows users may need to do this in GitBash
- `YourName` and `TeamName` name should be entered `lower-case-with-dashes`, as it will be used in the S3 Bucket names

Run the ./handouts/deploy.sh script like this:

```
cd handouts
./deploy.sh <aws_profile> <your-name> <team-name> <your-ip>
# i.e.
./deploy.sh sot-academy rory-gilmore la-vida-mocha 12.34.56.78
```

The results

> In the `./solutions` folder there is a completed `etl-stack.yml` with extra comments, as a refresher of what we have assembled.

This is provided so that after the session you can cross-reference what we put together with the slides.

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Visualisations

> Now we have everything deployed, we can use Grafana to visualise our data.

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Code along - Log into Grafana

- Find the IP of your EC2 instance from the AWS console
- Browse to it on http
    - e.g. http://12.34.56.78:80
- Log in with username `admin`, password `admin`
- Change the password!
    - Make a secure one and save it in your Password Manager

> Every time your VM reboots the IP will change - make a note of your current IP so you can find the password again next time you need it

Connecting Grafana to Redshift

> We will use the PostgreSQL data source as it is (a) similar to the library we are using in our lambda code and (b) the official RedShift data source has proven "extremely unreliable".
>
> The settings you need are in your RedShift *parameter* in AWS, e.g `la_vida_mocha_redshift_settings`

- In the AWS web console, open up Parameter Store in Systems manager and find your connection details

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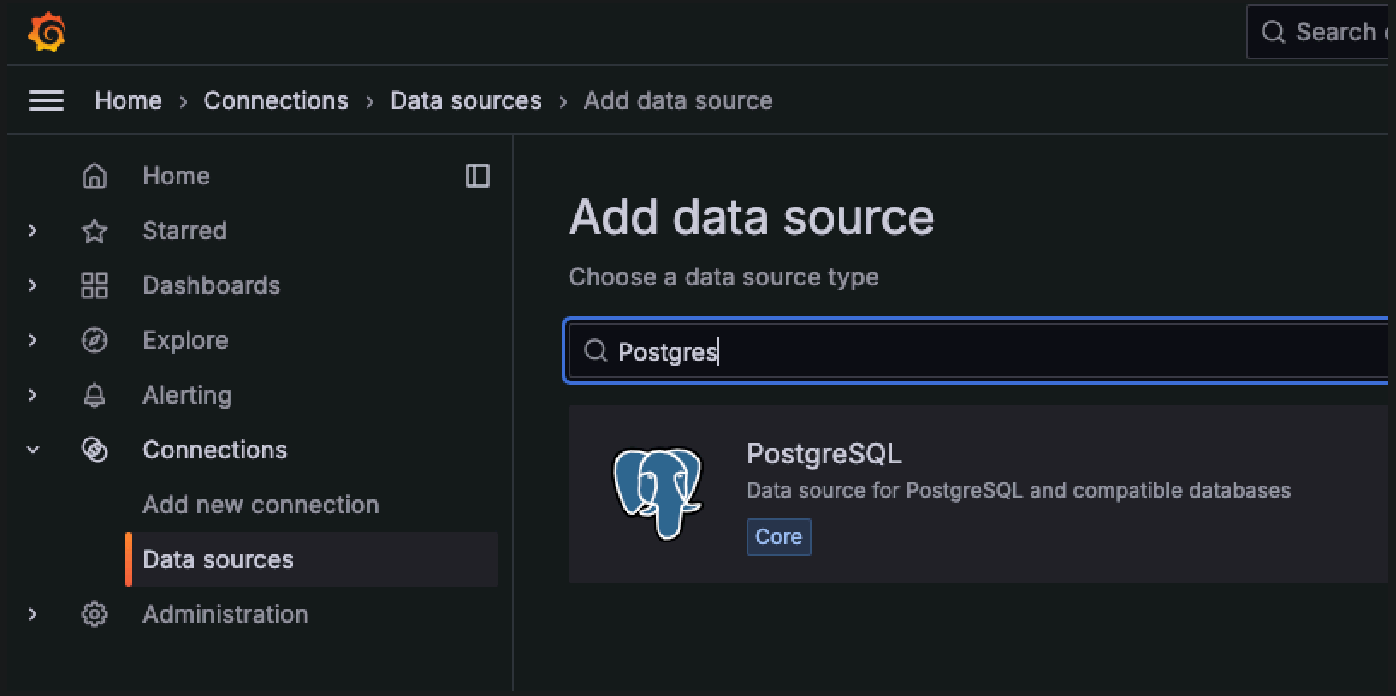
Connecting Grafana to Redshift

- Using the menu navigate to `Connections / Data sources`
- Search for `Postgres` (it should be pre-installed)
- Click it to add a new data source



Add data source

Choose a data source type

Postgres

PostgreSQL

Data source for PostgreSQL and compatible databases

Core

Code along - Settings for data source

- Enter the host in format `server:port` e.g. `redshiftcluster.~~~.com:5439`
- Enter the DB name e.g. `la_vida_mocha_cafe_db`
- Enter the DB user e.g. `la_vida_mocha_user`
- Enter the DB password e.g. `abcdefghijk`

(Image in next slide...)

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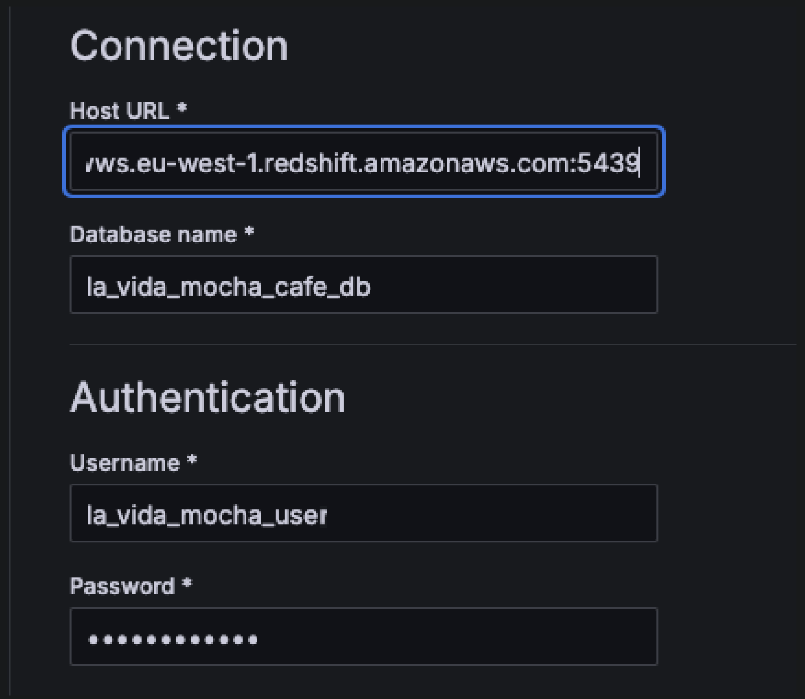
Code along - Settings for data source


Connection

Host URL *

ws.eu-west-1.redshift.amazonaws.com:5439

Database name *

la_vida_mocha_cafe_db

Authentication

Username *

la_vida_mocha_user

Password *

•••••••••••••

Double check you have `server:port`

e.g. `redshiftcluster.~~~.com:5439`

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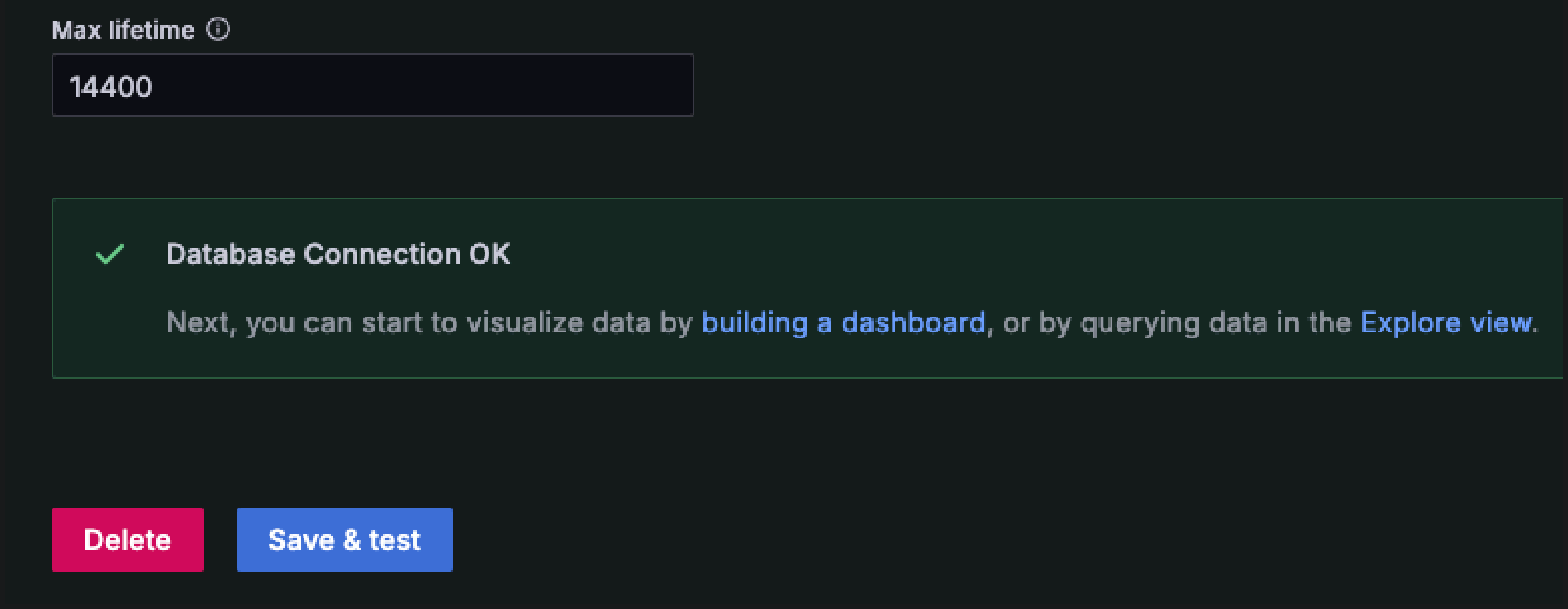
Code along - Test data source

- Scroll to the bottom of the datasource window
- Click "Save & Test"
- A green success flash should appear



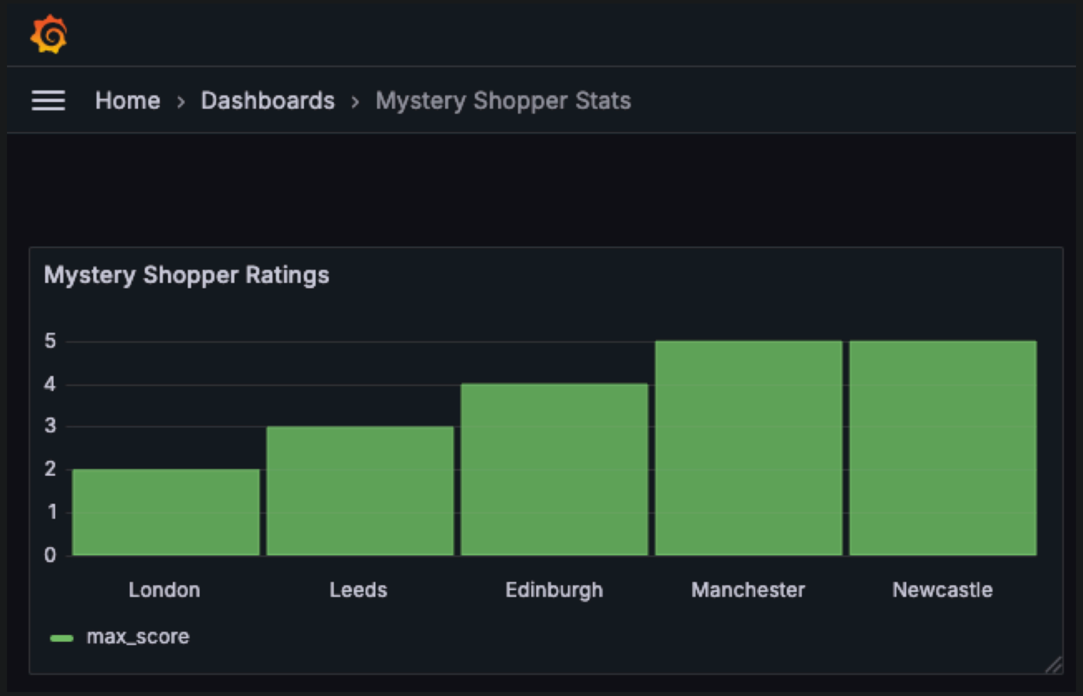
Max lifetime
14400

Database Connection OK

Next, you can start to visualize data by building a dashboard, or by querying data in the Explore view.

Our first visualisation

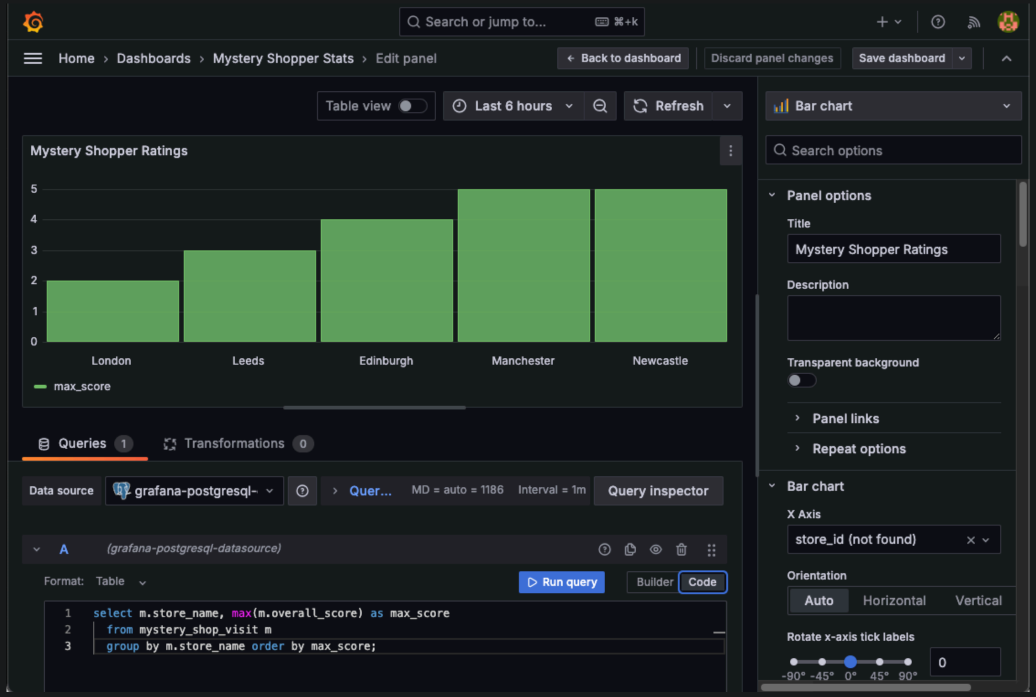
We are going to add our first Dashboard, with our first Panel like so:



(Details on next slides.)

Our First visualisation

Here's a preview of what this looks like under construction:



Data source: grafana-postgresql- · Quer... MD = auto = 1186 Interval = 1m

A (grafana-postgresql-datasource)

Format: Table

```sql
select m.store_name, max(m.overall_score) as max_score
  from mystery_shop_visit m
  group by m.store_name order by max_score;
```

Title: Mystery Shopper Ratings

Description:

Transparent background

Bar chart

X Axis: store_id (not found)

Orientation: Auto | Horizontal | Vertical

Rotate x-axis tick labels: 0

(Details on next slides.)

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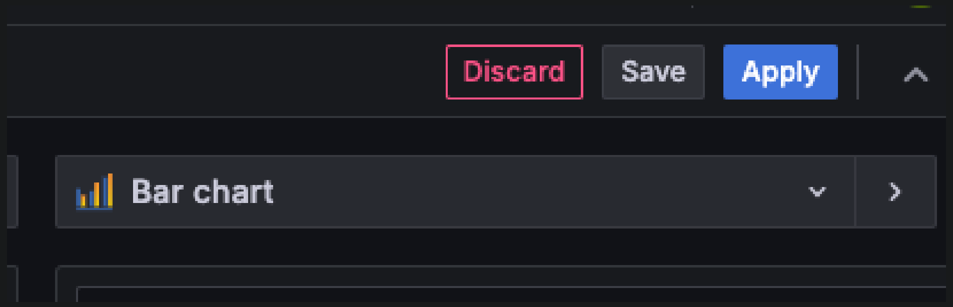
Code along - Add a visualisation

- From the main menu, add a new Dashboard
- When prompted, select your Postgres data source
- Change the Visualisation type to `Bar Chart`



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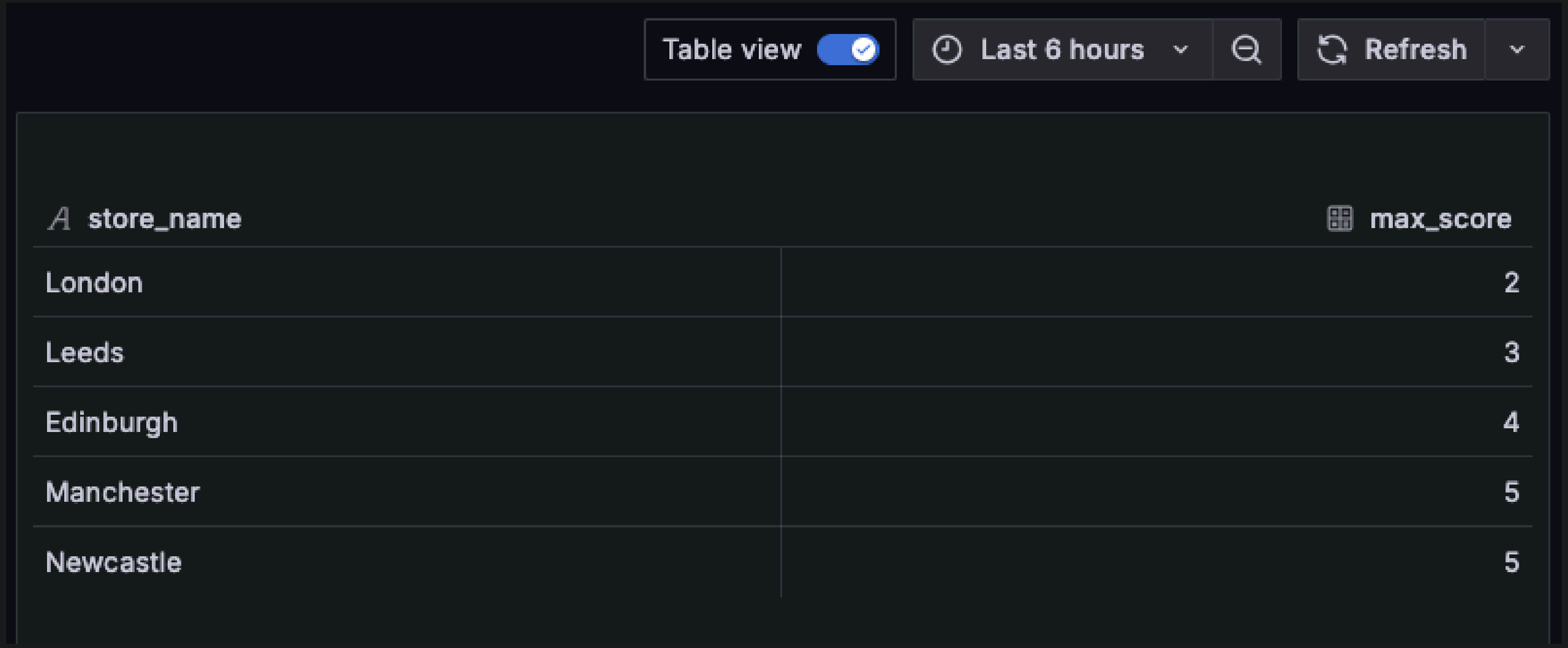
Code along - Table View on

- At the top, turn on the `Table View` toggle so we can see all the data (when it comes)



store_name	max_score
London	2
Leeds	3
Edinburgh	4
Manchester	5
Newcastle	5

> There won't be any data (yet)!

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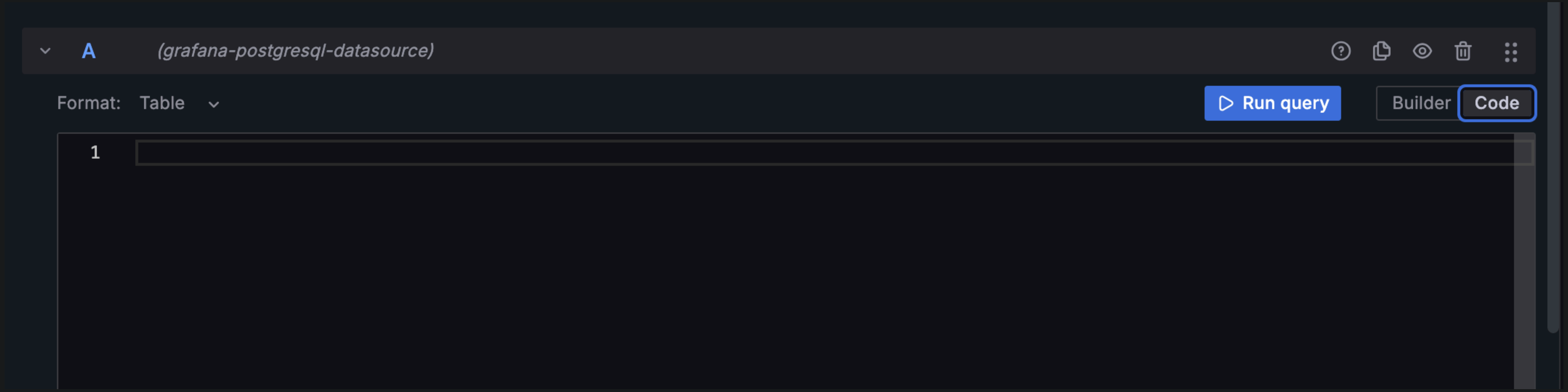
Code along - Add SQL

- Find the tiny `Code` button and click it to show the Code textbox
- Add the SQL from below

```
select m.store_name, max(m.overall_score) as max_score
  from mystery_shop_visit m
  group by m.store_name order by max_score;
```



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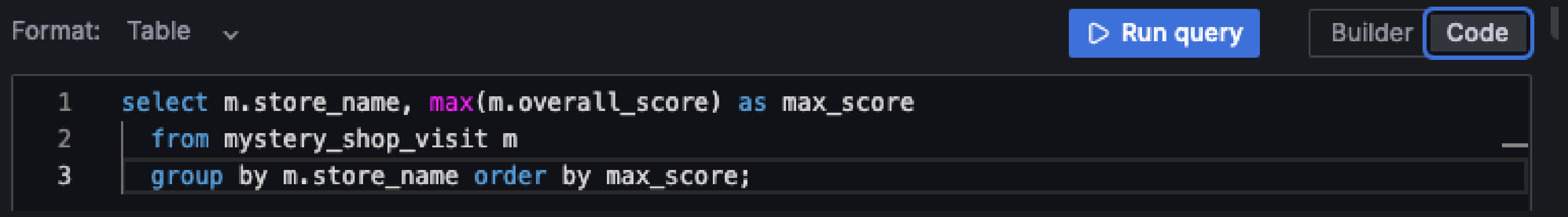
Code along - Run Query

- Click `Run Query`
- This should fetch data from RedShift
- The main data panel at the top (the table View) should display our data



```
select m.store_name, max(m.overall_score) as max_score
  from mystery_shop_visit m
  group by m.store_name order by max_score;
```

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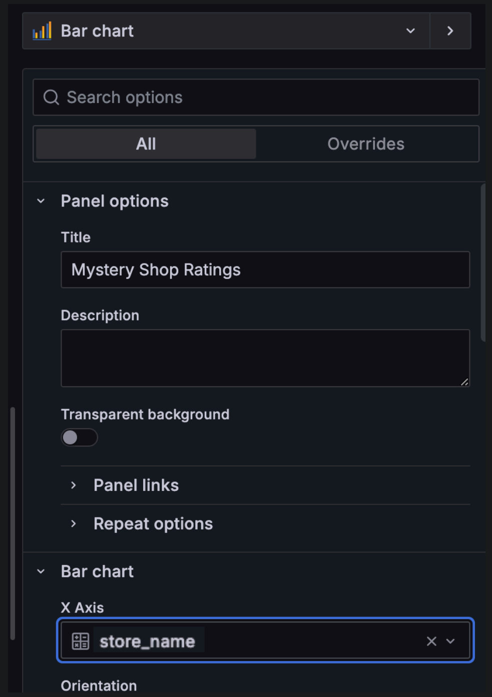
Code along - Bar Chart settings

- Make sure the Visualisation type is `Bar Chart`
- Under `Panel Options`, update the Panel Title to e.g. "Mystery Shopper Ratings"
- Under `Bar Chart`, change the `X Axis` to `store_name`


Bar chart

Search options

All | Overrides

Panel options

Title: Mystery Shop Ratings

Description:

Transparent background

Panel links

Repeat options

Bar chart

X Axis: store_name

Orientation

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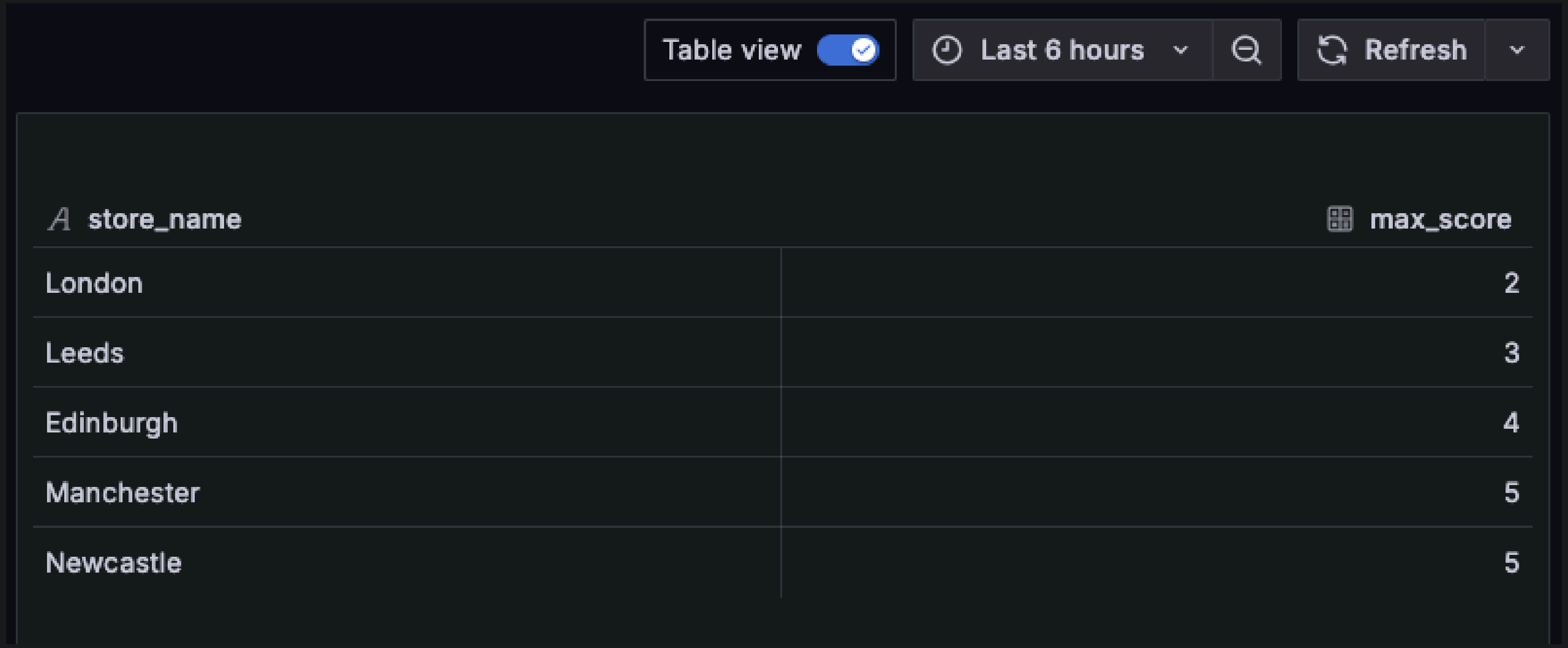
Code along - Got data?

> The table view at the top should now have some data!



store_name	max_score
London	2
Leeds	3
Edinburgh	4
Manchester	5
Newcastle	5

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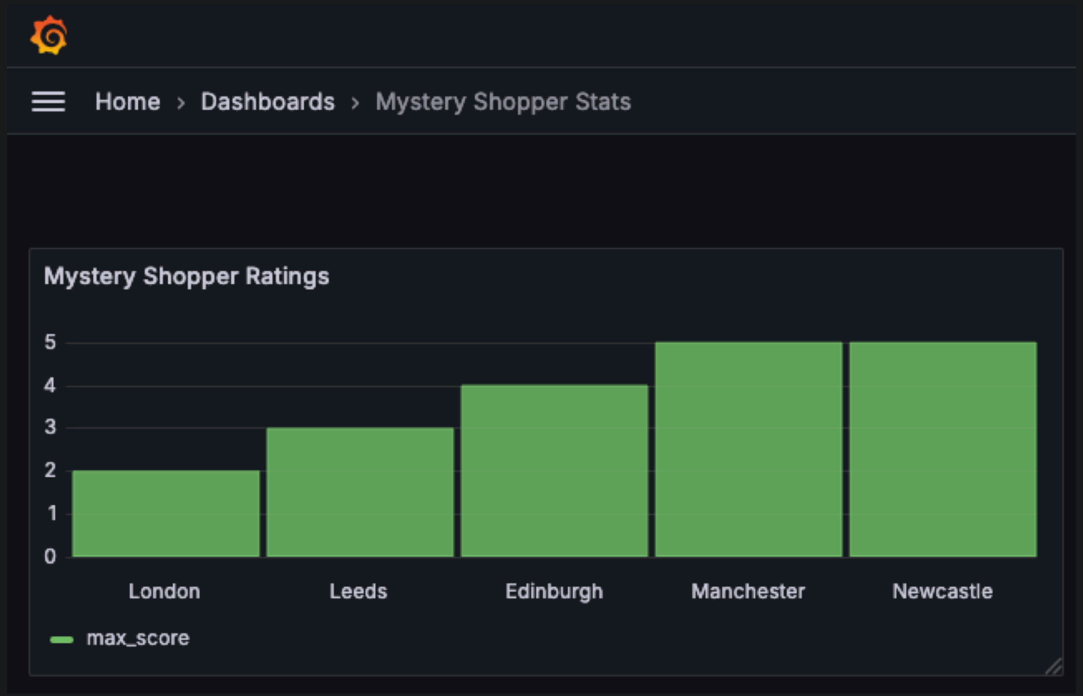
Code along - bar chart view

- Toggle the `Table View` setting to `off`
- We should now see some data in a graph!



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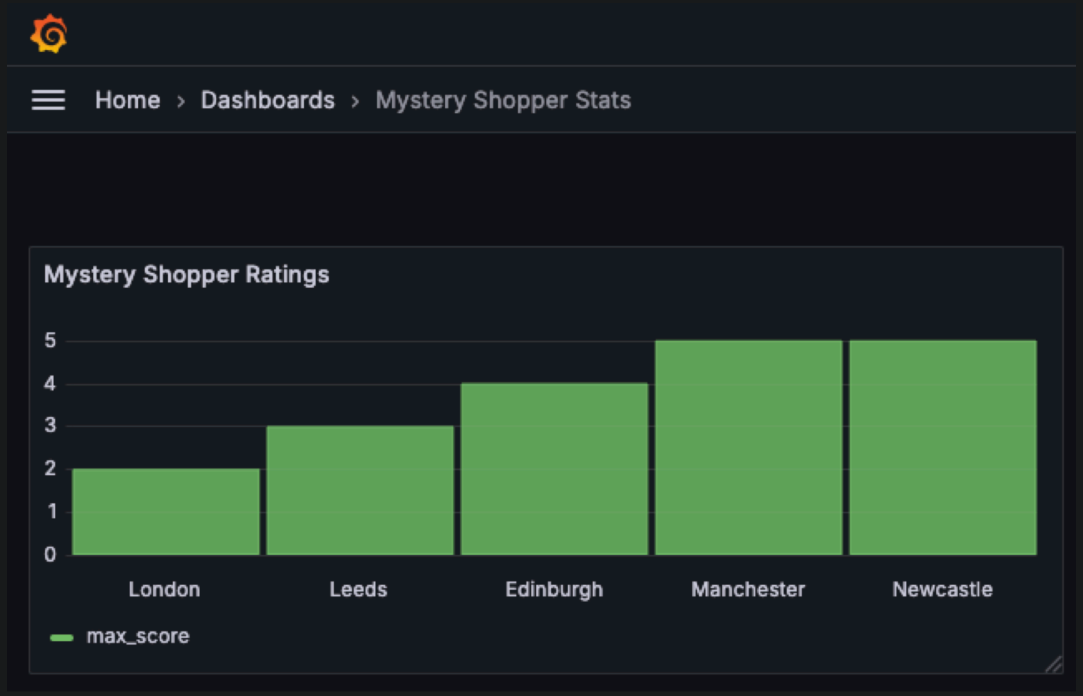
Code along - Save the dashboard (1/2)

The UI is a bit odd here, we've made a panel but now need to save the dashboard:

- Click on the `Save` button (*not the `Apply` button*)
- Name your dashboard e.g. `Mystery Shopper Stats`
- The dashboard should now be saved



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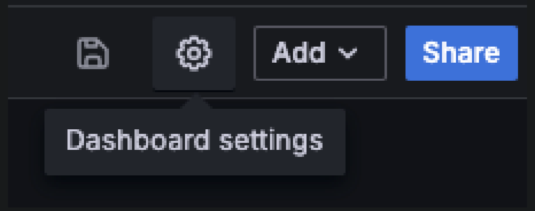
Code along - Save the dashboard (2/2)

- Whoopsy: If you click `Apply` instead of `Save` then you can still save the dashboard via the little cog icon:

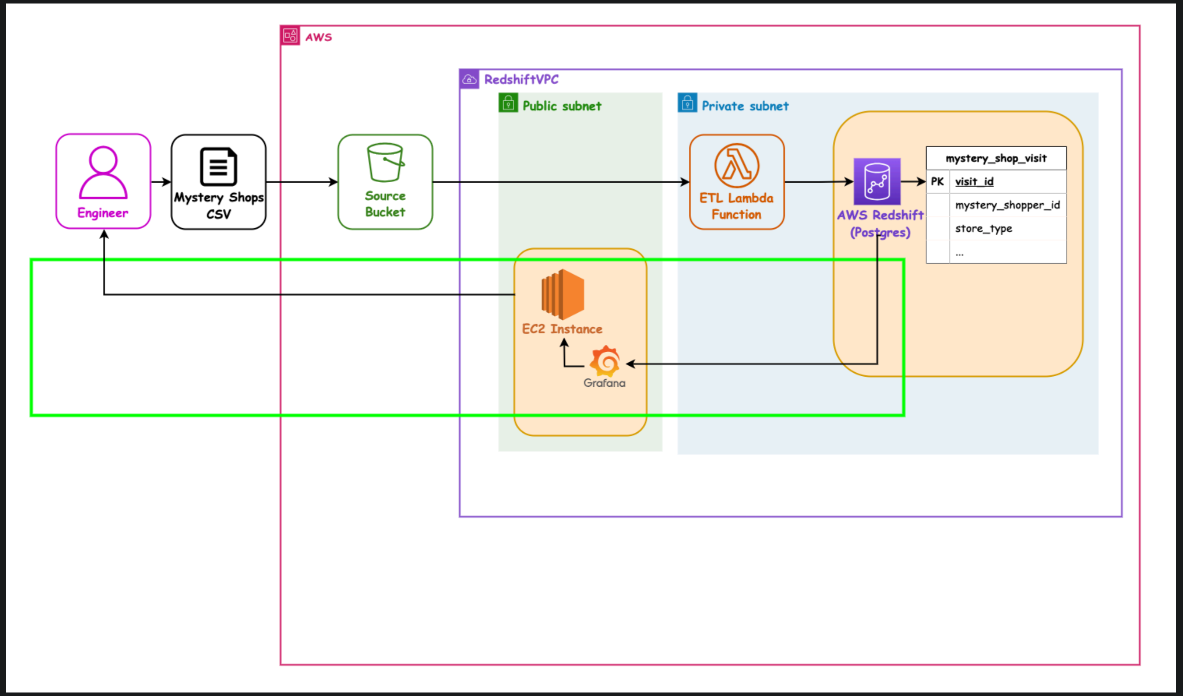


All done!

> Great news, we now have a full ETL pipeline with data visualisation!!

Our last user story - Architecture

This is what we just completed - our full pipeline configured in IaC!



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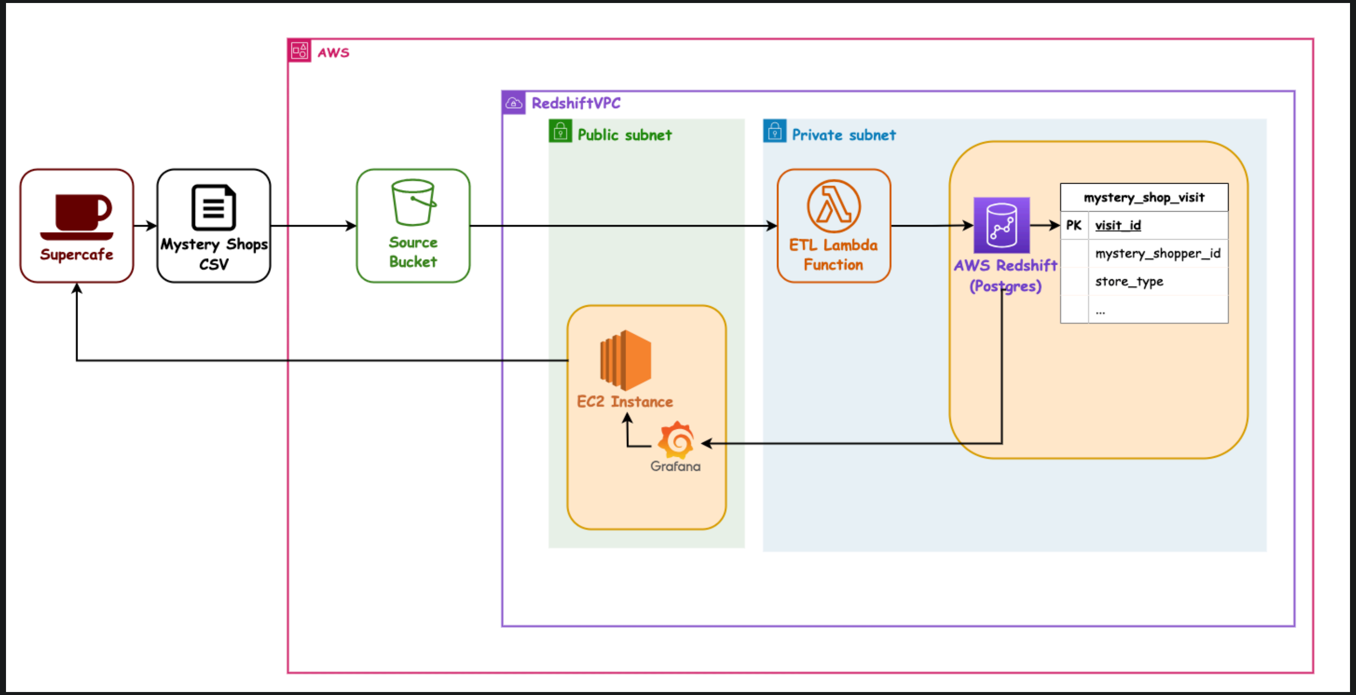
Final Pipeline Architecture

And finally - the diagram of "what we used this session" is now the same as the "Full Architecture Diagram"... we are *feature complete* on Mystery Shopper!



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Tips for your team projects (offline)

> For your project time, there is a file of a few pointers and gotchas to consider.

- See ./handouts/README-team-project-considerations.md

Terms and Definitions - recap

- EC2
- User data
- Launch Configuration
- Security Group
- IP Address
- Grafana for Visualisations
    - And in Grafana: Dashboard, Panel, Connector, Data Source

Overview - recap

- What is EC2
- Running a virtual server in the cloud
- Configuring the startup of an EC2
- Hosting applications inside our Servers

Learning Objectives - recap

- Add an EC2 server with CloudFormation
- Configure the User Data of the machine
- So that we can host (run) Grafana in the EC2

Emoji Check:

On a high level, do you think you understand the main concepts of this session? Say so if not!

1. 😢 Haven't a clue, please help!
2. 🙁 I'm starting to get it but need to go over some of it please
3. 😐 Ok. With a bit of help and practice, yes
4. 🙂 Yes, with team collaboration could try it
5. 😀 Yes, enough to start working on it collaboratively