**Lab Guide**

IBM Business Automation Manager Open Edition

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Hands-on Lab

Integrating Watsonx Orchestrate with Open-Source Solutions

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# Introduction

In this Lab you connect watsonX Orchestrate using open-source solutions

A short video introduction of the use case for this lab is here:

<https://youtu.be/JxjfAQh8ii0>

The three open-source solutions used in the demo are:

* **BAMOE** – to run the decision service.

See <https://www.ibm.com/products/business-automation-manager-open-editions>

* **Cloudant** – to store ticket data.

See https://www.ibm.com/products/cloudant

* **React** –to create the ticket report.

See <https://react.dev/>

The Lab is structured into the following sections.

* Build a speeding ticket decision service.
* Build a skill to save the ticket to a database.
* Build a skill flow to combine the above and create a report.

## Pre-requisites

To perform this Lab, you need:

* Microsoft Remote Desktop (RDP)
* A GitHub Account. See https://github.com
* An IBM watsonx Orchestrate Standard account with Builder role.
* Techzone BAMOE VM

Alternatively, you can build a local laptop environment, in which case you need:

* VSC and the IBM BAMOE plugin
* Git Bash
* Latest Java JDK

# Build a decision service to calculate speeding fines

In this task, you ...

* Import a speeding ticket decision service.
* Run the service locally.
* Expose the decision service to the outside world

## Before you start

In this exercise, you will build and test the decision service using Visual Studio Code (VSC).

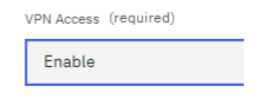
1. Find the following BAMOE Techzone image (or later version if available):

<https://techzone.ibm.com/collection/ibm-business-automation-manager-open-editions-environment/environments>

A screenshot of a computer

Description automatically generated

**IMPORTANT!** When reserving, ensure VPN access is enabled. This is required to invoke API calls into the VM:



2. Once the VM is reserved, login with Remote Desktop (RDP). On Windows this is:

**User:** .\techzone

**Password:** IBMDem0s!

For further details see the guide here: <https://ibm.box.com/v/IBM-BAMOE-ENV>

1. Open Git Bash by clicking the Git Bash  icon on the Windows **Taskbar** at the bottom of the screen.
2. Within the Git Bash shell, clone the rule project using the command:

git clone <https://github.com/ncrowther/bamoe2wxo>

1. Hit return. You should see the git repository cloned into the local drive:

A computer screen shot of a computer program

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Now open the decision project with VSC:

cd bamoe2wxo/

code SpeedingDecisionService/

1. VSC will open:

A screenshot of a computer

Description automatically generated

1. **IMPORTANT**: If you are using the Techzone VM you must update VSC. To do this, select *Help->Restart to update.* This will restart VSC with the latest version.
2. On the left-hand side of Visual Studio Code in file explorer locate *src\main\resources\TrafficViolation.dmn*A screenshot of a computer

   Description automatically generated
3. Click the DMN file to view it:

A screenshot of a diagram

Description automatically generated

1. On the far right, select the properties icon . In the *DMN Model Name,* prepend the name with your initials. For example, if your initials are XXX, the *DMN Model name* would be *XXXTrafficViolation*:

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1. Select the *Fine* decision and edit it by selecting 

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1. You should see the decision table below:

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This decision table will be used later in the lab to calculate speeding fines depending on severity.

1. Press Save (Ctl S).

## Run the Decision Service

In this step we are going to run our decision service in development mode using Quarkus. For details on Quarkus, visit <https://quarkus.io/>

1. Within the VSC editor, click on the **Terminal** menu at the top of the screen:



1. In the drop down click on **New Terminal**.

A screenshot of a computer

Description automatically generated with medium confidence

1. In this terminal window, verify you are in the *SpeedingDecisionService* folder and then run Mavern build:

mvn quarkus:dev

1. Once built, our decision model is deployed to Quarkus and ready to run. Take note of the URL encircled below. This is the development URL:

A computer screen with text

Description automatically generated

## Expose the decision service

1. Within the VSC editor, click the PORTS tab:

A screen shot of a computer

Description automatically generated

1. Select *Forward a Port* .
2. Enter kogito service port *8123* as the Port and hit return. You will see the following:

A close up of a message

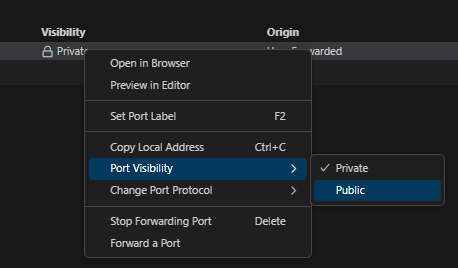
Description automatically generated

1. Select *Allow* and enter your GitHub credentials.
2. If successful, you should be returned to VSC and see this:

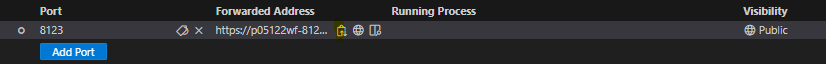
A black background with white text

Description automatically generated

1. Right-click *Private* in the *Visibility* column and change *Port Visibility* from *Private* to *Public*:



1. Press *Continue* to accept the warning message. Select the *copy local address* button  to store the exposed URL into your clipboard.



## Test the Decision Service

Let’s look at the API generated by Quarkus.

1. Open a browser. This can be any browser anywhere in the world as your Decision Service is public.
2. Paste the following URL into the browser address and press **Enter**.

[[REMOTE\_URL]/q/swagger-ui](localhost:8123/q/swagger-ui)

Where [REMOTE\_URL] is the url you copied in the last step of the previous section. Accept the warning by pressing *Continue*. You should see this:  
A screenshot of a computer

Description automatically generated

You are looking at the decision service endpoints exposed to the internet. If you followed the instructions, your endpoints have your initials prepended. You should see six endpoints, but the only endpoint we are interested in is **POST /TrafficViolation**.

1. Click on the **POST /TrafficViolation** endpoint to expand it, then click the **Try it out** button on the right-side.  
   A white rectangular object with a black border

   Description automatically generated
2. Enter data into the request body:

{

"Violation": {

"Date": "2023-12-21",

"SpeedLimit": 20,

"ActualSpeed": 40

},

"DriverId": "D45454"

}

1. Press *Execute*. You should see the following in the server response:

**Response Body**

**{**

**"Violation": {**

**"SpeedLimit": 20,**

**"ActualSpeed": 40,**

**"Date": "2023-12-21"**

**},**

**"DriverId": "D45454",**

**"Fine": {**

**"Points": 3,**

**"Amount": 500**

**}**

1. Verify the points are 3 and the fine is 500.
2. Congratulations, you have built and deployed the Speeding Ticket decision service on your local machine and exposed it to the outside world. The next step is to generate an OpenAPI specification to execute the service from watsonx Orchestrate.

# Generate an OpenAPI specification

In this section you generate an OpenAPI specification for watsonx Orchestrate.

**Important!** The decision service in the previous section must still be running in a separate VSC session.

1. Reopen Git Bash shell
2. Within the Git Bash shell, open the *OpenApiGenerator* folder in VSC:

cd ~/bamoe2wxo

code OpenApiGenerator/

1. The VSC editor appears.

A screenshot of a computer program

Description automatically generated

1. Expand the /*data* folder and edit *config.json*. You should see this:

A computer screen shot of a code

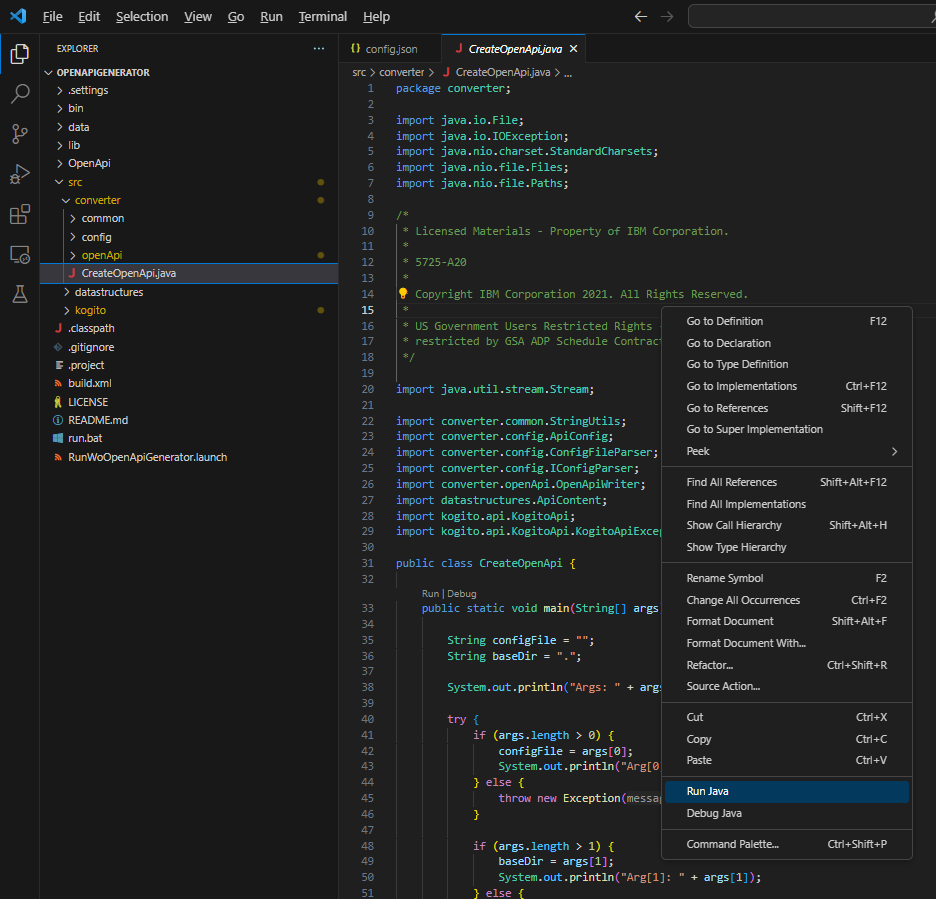
Description automatically generated

1. Change the name of *decisionId* by replacing [YOUR\_INITIALS] with your initials. This should be the same name as in section 7. For example, if your initials are XXX, the DMN Model name would be XXXTrafficViolation.
2. Change *localUrl* to the local URL of your running Kogito service. If you are using the Techzone VM this should be already be correct.
3. Change the external URL to the one defined on page 10.
4. Save *config.json* using Ctrl-S
5. Open *CreateOpenApi.java* in the /*src/converter* folder:

A screenshot of a computer

Description automatically generated

1. Right-click anywhere in the code and select *Run Java*. Accept the Windows Defender message if it appears. You should see this:



1. An open API file is generated. The generation is logged in the terminal of VSC:

A screen shot of a computer

Description automatically generated

If you see an error instead, check that your decision service is still running from section 1.2

1. Within VSC, open

\generated\[YOUR\_INITIALS]TrafficViolation.json

1. Copy and paste (Ctrl-A, Ctrl-C, Ctrl-V) the entire file contents into <https://editor.swagger.io>
2. Press OK when you see the convert to YAML message:

A black text on a white background

Description automatically generated

1. You should see the same decision service we inspected in section 1.4

A screenshot of a computer

Description automatically generated

1. But there are differences compared with the original:

* Your initials have been appended.
* *x-ibm* annotations have been added.
* The data model has been pulled into the specification.
* Only one endpoint is generated.

1. Test the OpenAPI following the steps specified in section 1.4

The OpenAPI is now ready to be imported into watsonx Orchestrate!

# Import the OpenAPI into watsonx Orchestrate

1. Login to **IBM watsonx Orchestrate:** <https://dl.watson-orchestrate.ibm.com>
2. Under build skills, select *add skills*
3. Select *From files*
4. Drag the OpenAPi file below into the drop area:

*~/bamoe2wxo/OpenApiGenerator/generated\[YOUR\_INITIALS]TrafficViolation.json*

TIP: If you are using a VM you may need to perform this in two steps

* 1. Drag the remote file to your local desktop
  2. Drag the local file to the drop area

A screenshot of a computer

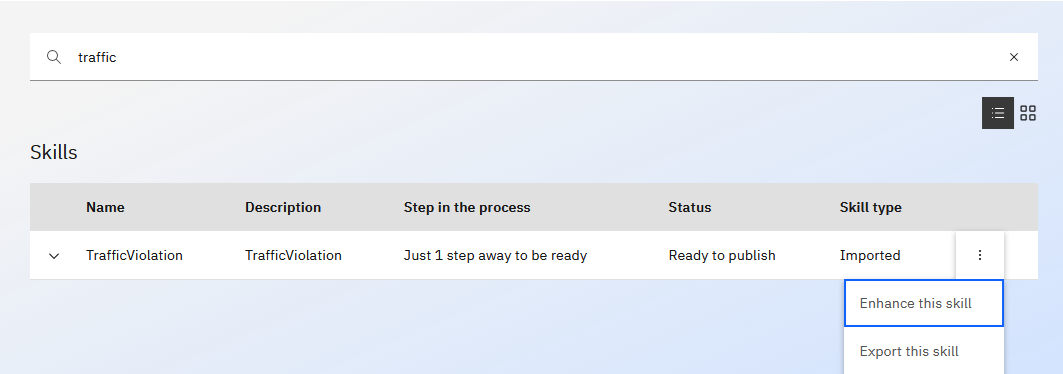
Description automatically generated

1. Click Next. Select the *[YOUR\_INITIALS]TrafficViolation* skill and press *Add*.

A screenshot of a computer

Description automatically generated

1. Find the [YOUR\_INITIALS]*TrafficViolation* skill.
2. Click the button with three vertical dots, and select *Enhance this skill*:



1. Publish the skill:

A close up of a logo

Description automatically generated

1. Click on *Skills Catalog*
2. In the *Find a skill* text field, search for [YOUR\_INITIALS]*TrafficViolation* skill (type in the full name to find it). Select it and press *Add skill*

A white background with black text

Description automatically generated

1. Click on Connect app  and enter any username and password (credentials are placebos).
2. Go to *Chat* and run the skill by typing *[YOUR\_INITIALS]trafficviolation*
3. The Traffic Violation data form appears. Enter the following data:

A screenshot of a computer

Description automatically generated

1. Hit *Apply*. This invokes the decision service via your local PC using the exposed port.
2. The response should be:

**A screenshot of a computer

Description automatically generated**

Congratulations! You have run your first BAMOE Decision Service from watsonx Orchestrate.

# Persist Decisions

In this section we call a database to store speeding tickets. We use a public instance. If you are interested in creating your own private instance, follow section 5.

1. Reopen Git Bash shell
2. Within the Git Bash shell, open the *cloudantFacade* in VSC. You should leave the other two VSC instances open.

cd ~/bamoe2wxo

code cloudantFacade/dataservice

1. The VSC editor should appear with the *cloudantFacade/Dataservice* folder.

A screenshot of a computer

Description automatically generated

1. Expand the *openapi* folder and edit *dataApi.yaml*
2. Perform a global search and replace of the text [YOUR\_INITIALS], replacing with your initials. To do this, select Ctrl-R:

A screenshot of a computer

Description automatically generated

1. Save *dataApi.yaml*
2. Paste the contents of *dataApi.yaml* into <https://editor.swagger.io>
3. You should see the following, with your initials instead of XXX:

A screenshot of a computer

Description automatically generated

1. Now we will import this API into watsonx Orchestrate
2. Login to IBM watsonx Orchestrate
3. Under *Build* *skills*, select *add skills* from *Files* then drag and drop the *dataApi.yaml* API spec:

A screenshot of a computer

Description automatically generated

1. Click Next. Select the first twoskills and press *Add*.

A screenshot of a computer

Description automatically generated

1. Publish both skills and add them to your catalog, as described in section 3
2. You should now have both skills published under the *cloudantWxoFacade* and added to your catalog.
3. Run the skill *write a doc to cloudant.* Enter a *driverId* starting with D and then six numbers:

A screenshot of a computer

Description automatically generated

1. Hit Apply.
2. Now run the *get docs from cloudant* skill. You should see all speeding fines retrieved from the database.
3. Find your entry by using the search  button:

A screenshot of a computer

Description automatically generated

Congratulations! You have run your first Cloudant skill by entering data and retrieving it from watsonx Orchestrate.

# Create a Composite Flow using Decisions, Cloudant and React

We will now combine the Decision skill and the Cloudant skill with a React UI.

1. Under *Build* *Skills*, select the down arrow on the *Add Skills* button and choose *Create a skill flow*.

A blue and yellow box with text

Description automatically generated

1. You should see the following:

A screenshot of a computer

Description automatically generated

1. Select the pen  and name the flow *[YOUR\_INITIALS]* *IssueSpeedingTicket*, where [YOUR\_INITIALS] are your initials.
2. Select the  symbol and add [YOUR\_INITIALS]TrafficViolation. Your flow should look like this (where NTC should be your initials):

A screenshot of a message

Description automatically generated

1. Select the rightmost  symbol and add *[YOUR\_INITIALS]write a doc to Cloudant*. Your flow should look like this:

A screenshot of a computer

Description automatically generated

1. Select *write a doc to Cloudant*.
2. Select *generate mapping suggestions*.
3. Slide the toggle *Hide this form from the user*. You should see this:

A screenshot of a computer

Description automatically generated

1. At the very bottom of the form, enter *Speeding* as the violation:

A screenshot of a computer

Description automatically generated

1. Select the rightmost  symbol and add *[YOUR\_INITIALS]get docs from Cloudant*. Your flow should now look like this:

A screenshot of a computer

Description automatically generated

1. Select the rightmost  symbol and add *Custom Forms->Input Form*
2. Slide the toggle *Hide this form from the user*. You should see this:

A screenshot of a computer

Description automatically generated

1. Press *the Add input field* button and assign it a type of *Single line text*:

A screenshot of a computer

Description automatically generated

1. Press *Next* and give it a name of *TicketURL.* Press Apply. You should see this:

A screenshot of a computer

Description automatically generated

1. Select *TicketURL* and map it to *driverId* from *get docs from Cloudant.*

**Important!** This must be *driverId* from *get docs from Cloudant* and **not** *write a doc to cloudant*

A screenshot of a computer

Description automatically generated

1. In the *Define Transformations* section, enter the following data exactly as specified:

Operator:

Replace a string

Search for:

D

Replace with:

<https://fineui.1apbmbk49s5e.eu-gb.codeengine.appdomain.cloud/?driverId=D>

You should now see this:

A screenshot of a computer

Description automatically generated

1. Select the rightmost  symbol and add *Custom Forms->Output Form.*
2. Enter # in the output form and select  *Input form*->*TicketURL* as the field:

A screenshot of a computer program

Description automatically generated

1. You should see this:

A screenshot of a chat

Description automatically generated

1. The completed skill flow should look as follows:

A screenshot of a computer

Description automatically generated

1. Press *Actions* and then *Save, Enhance* and *Publish*
2. Add the skill to your catalog. Type the full name of the composite flow into the search bar of the Skill catalog. When found, a top level folder called Skill flow is shown:

A screenshot of a computer

Description automatically generated

1. Click on *Skill flows* and then select your flow.
2. In Chat, run the *[YOUR\_INITIALS]IssueSpeedingTicket* skill.
3. Enter a speeding violation. Ensure your driver Id starts with a capital D, for example D123456:

A screenshot of a computer

Description automatically generated

1. Press Apply.
2. After a while you should all speeding violations. Search for your driver id specified above. If you find more than one entry for the same driver id, select the topmost one:

A screenshot of a computer

Description automatically generated

1. Press Apply
2. You should see a Ticket URL displayed. Click the URL. This URL invokes a reporting tool that creates the speeding ticket. You should see a speeding ticket like the one below:

A screenshot of a vehicle

Description automatically generated

Congratulations! You have completed the lab!

# Challenge Lab

This challenge lab calculates whether the driver is disqualified based on historical speeding tickets stored in Cloudant. It is an optional lab.

Revisit the Speeding Decision Service in section 1.

Edit the following file:

*src\main\resources\isDisqualified.dmn*

You should see this:

A diagram of a flowchart

Description automatically generated

Apply the same lab instructions from section 1 and 2 and 3 to this DMN file. Once deployed on Orchestrate, invoke the *[YOUR\_INITIALS]IsDisqualified* skill. You should see this:

A screenshot of a computer

Description automatically generated

Press *Apply*. The rules determine that the driver is disqualified. The driver points accumulated in the last 24 months are equal to or greater than 12:

**Advanced**

Introduce this new skill to the skill flow to calculate whether the driver is disqualified based on historical speeding tickets. Pass the disqualification flag into the React URL as a query parameter. Change the react code *reactCloudant/src/TotalFines.js*. Edit line 38 and replace this with the Disqualification query parameter.

When building the skill flow you should see there is a problem in passing the list of speeding offences to the DMN skill. How do we resolve this?

# Conclusion

In this lab were created a decision service and called as a skill from wastonx Orchestrate. We then created a composite flow to store the results of the decision into a database.

Thank you for taking this lab and I hope you create new applications using this technology.

# Advanced Labs

In these advanced labs we implement the Cloudant and React skills used in the labs above. These labs are aimed at experienced NodeJs developers.

# Advanced Lab 1 – Create a Cloudant Speeding Ticket Service

## Local host Prerequisites

1. Create a Cloudant instance in your IBM Cloud account.
2. See: <https://cloud.ibm.com/docs/Cloudant?topic=Cloudant-getting-started-with-cloudant>
3. Create a Cloudant instance with name *wxodb.*
4. Create credentials.

## Run on local host

1. Clone repo: <https://github.com/ncrowther/bamoe2wxo>
2. Go to folder: bamoe2wxo/cloudantFacade/dataservice
3. Edit *setenv.bat* to your Cloudant credentials
4. Open Command prompt (NOT powershell).  Enter:

   setenv.bat

 Install a local nodejs server:

npm install

 Start a local nodejs server:

npm start

If the port is in use, change the port on line 32:

bamoe2wxo/cloudantFacade/dataservice/app.js

A local instance of the Cloudant service should now be running.

Open the OpenAPI spec:

bamoe2wxo/cloudantFacade/dataservice/openapi/dataApi.yaml

Write a ticket with:

*POST https://localhost:3000/doc*

A screenshot of a computer program

Description automatically generated

Read the tickets with:

GET[*https://localhost:3000/docs*](https://localhost:3000/docs):

*A screenshot of a computer

Description automatically generated*

## Code Engine Hosting Prerequisites

This section describes how you can host your Cloudant service on IBM Code Engine.

1. Create a *Code Engine* instance in IBM Cloud account. If using TechZone, reserve the following:

A screenshot of a computer

Description automatically generated

1. Login to the provisioned environment.
2. Create a code engine project called cloudant-facade, with the image referencing your docker image.

A screenshot of a computer

Description automatically generated

1. Within your CodeEngine project, select Secrets and configmaps. Press Create.
2. Create a configmap with name *dataserviceconfig* and press *Create.*
3. Create a code engine *configmap configuration* with your Cloudant credentials:

A screenshot of a computer

Description automatically generated

## Deployment to Code Engine

1. Open Git Bash shell from VSC
2. Login to IBM Cloud.

ibmcloud login --sso

1. In the IBM Cloud console, go to **Manage > Account > Account resources > Resource groups.** Select the resource group for Code Engine. E.g. *default*

ibmcloud target -g default

1. Select the code engine project:

ibmcloud ce project select -n [PROJECT\_NAME]

1. Start Docker Desktop
2. In Bash Shell, go to the dataservice folder e.g: /bamoe2wxo/cloudantFacade/dataservice
3. Within this folder, edit *build.sh* and *run.sh* and change the REGISTRY to your Docker registry.
4. Run *build.sh* to build the sample application in your docker repo:

./build

1. Run run.sh to deploy the application to Code Engine on IBM Cloud:

./run

1. Open the Code Engine console and copy the Cloudant service URL.
2. Edit the openAPI spec

bamoe2wxo/cloudantFacade/dataservice/openapi/dataApi.yaml

1. Change the server URL so that it points to your Cloudant service URL
2. Import the *dataApi.yaml* as a skill in IBM Watson x orchestrate and run the skill.

# Advanced Lab 2 – Create a Report in React

## Run on local host

Clone repo: <https://github.com/ncrowther/bamoe2wxo>

Go to folder: bamoe2wxo/reactCloudant

Open Command prompt. Enter:

npm install

 Start a local nodejs server:

npm start

The React reporting tool should appear. Enter the following URL, supplying a driver id that exists in the Cloudant database:

http://localhost:[PORT]/?driverId=D123456

If successful, this should display a Speeding report like the one below:

A screenshot of a computer

Description automatically generated

## Deployment to Code Engine

To deploy on Code Engine, follow the README instructions in

bamoe2wxo/reactCloudant/README.md