Project Report

Enable white label B2B2C deployment on-cloud for low carbon app

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Executive Summary

This document described implementation of Phases 1 and 2 of a collaborative project between Sustainable Innovation at London South Bank University, and a London based SME operating in the smart grid sector. The aim was to make the SME's Low Carbon App white label deployable for any cloud.

The project phases were as follows.

1. Whitelabel deployment development

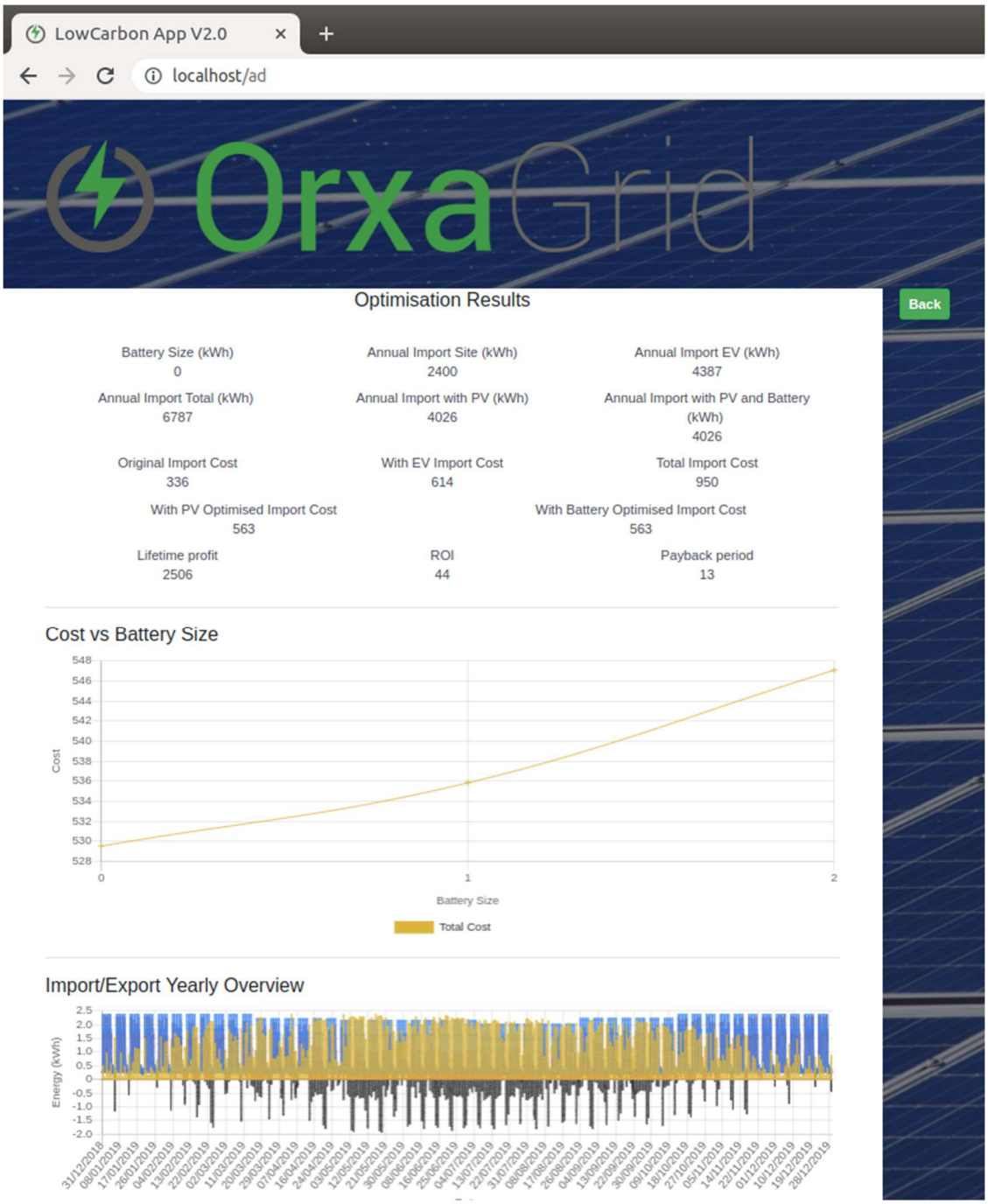
Phase 1 – Whitelabel deployment development

Objectives

- Split existing app into microservices. Strip app down to core functionality for purposes of project. Implement core functionalities using any-cloud services that can be containerised.
- Containerise each service, so that it can run in any cloud, or on a development machine.
- Orchestrate services for deployment. Wrap containers in an orchestration service that can bring all services up with minimal deployment effort.

Description

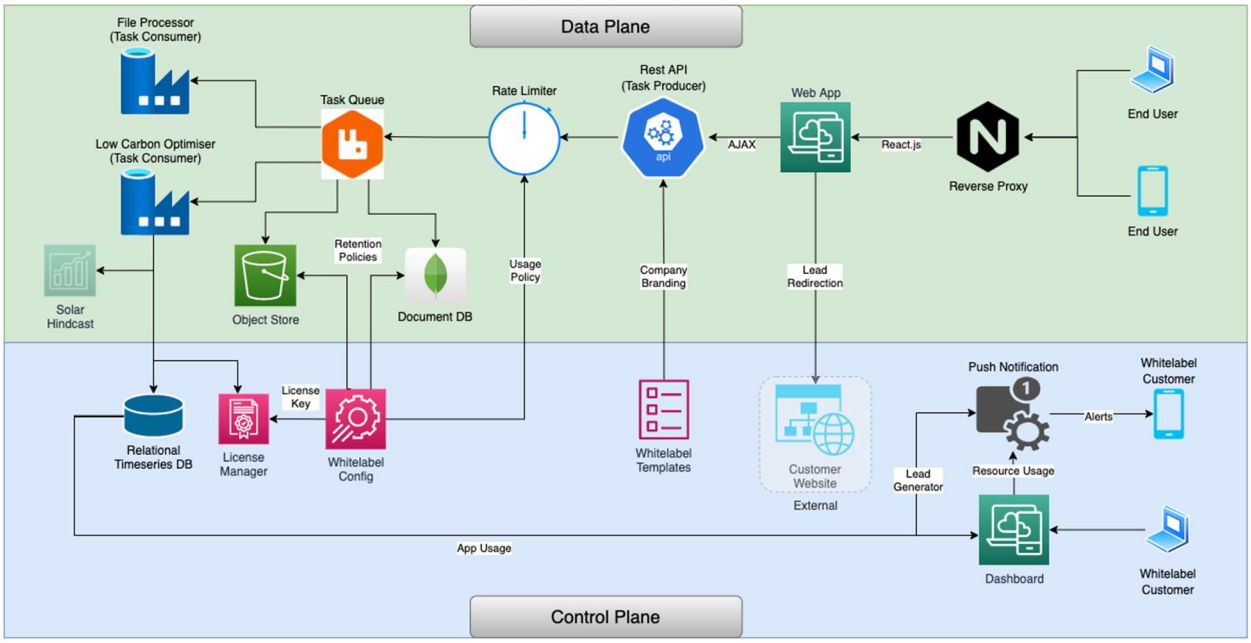
This application is a solar PV and battery system optimiser designed to be deployed by system installers for integration with their company website.



report

Architecture

- Reverse Proxy routes requests to the relevent service (todo)
- Web App serves HTML/CSS/JS content
- REST API interchanges data between the Web App and all other backend services
- Rate limiter prevents a single user over using the api (todo)
- Task queue routes work between API and data factories
- File processor is a data factory for cleaning uploaded files
- Low Carbon Optimiser is a data factory for sizing battery and solar PV systems
- Solar Hindcast provides solar generation data for a given location (todo)
- Object Store persists uploaded and cleaned files
- Document DB persists optimisation results
- Relational DB stores app usage statistics
- License Manager restricts operation of the optimiser to licensed installations (todo)
- Whitelabel Config enables custom branding of the Web App
- Whitelabel Templates enables custom branding of the optimisation reports (todo)
- Push Notifications generates sales leads and sends to system installers (todo)
- Dashboard displays business intelligence about how the app is being used (todo)



Architecture Diagram

Build Environment

This application should be built using Linux Docker on a Mac, Linux or Windows host with x64 architecture.

Deploy Environment

This application has been tested on a Linux Ubuntu host with x64 architecture, but should be deployable on any modern Linux host with Docker installed.

Development

- Install Docker (https://docs.docker.com/get-docker/)
- Insall Docker Compose (https://docs.docker.com/compose/install/)

Run the following commands to start the app in dev mode

Frontend and API services will hot-reload

```
docker-compose pull
docker-compose build .
docker-compose up -d
```

Check the services which came up

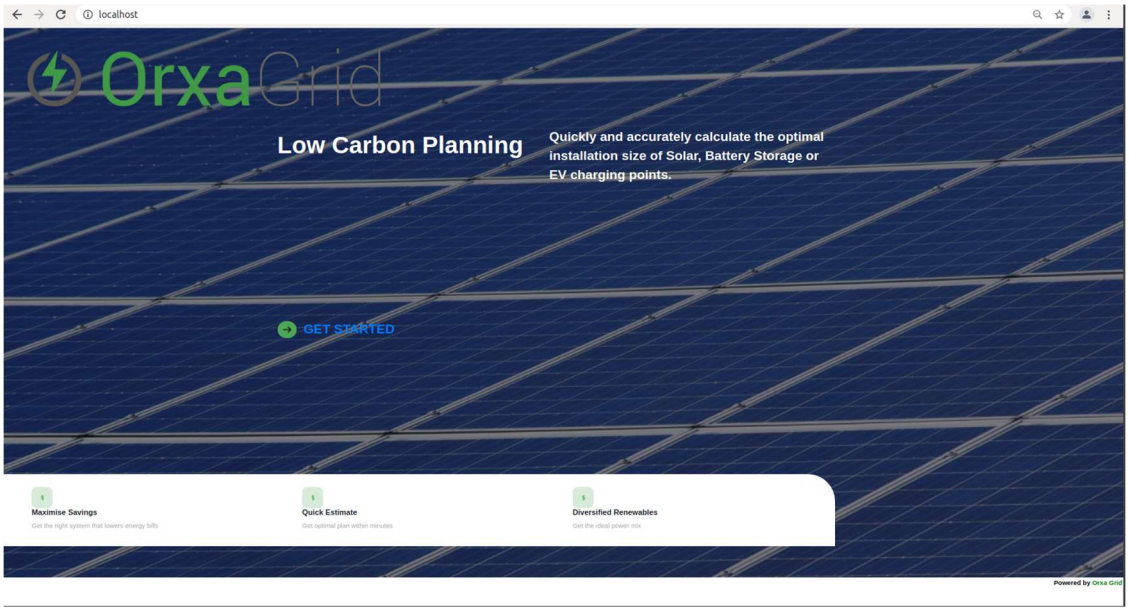
```
docker stats
```

Check the logs

```
docker-compose logs -f
```

Open app in browser

```
http://localhost
```



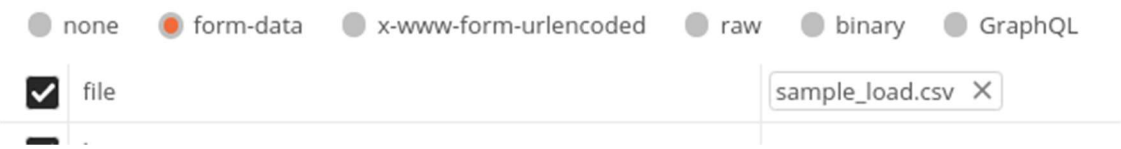
homepage

Testing

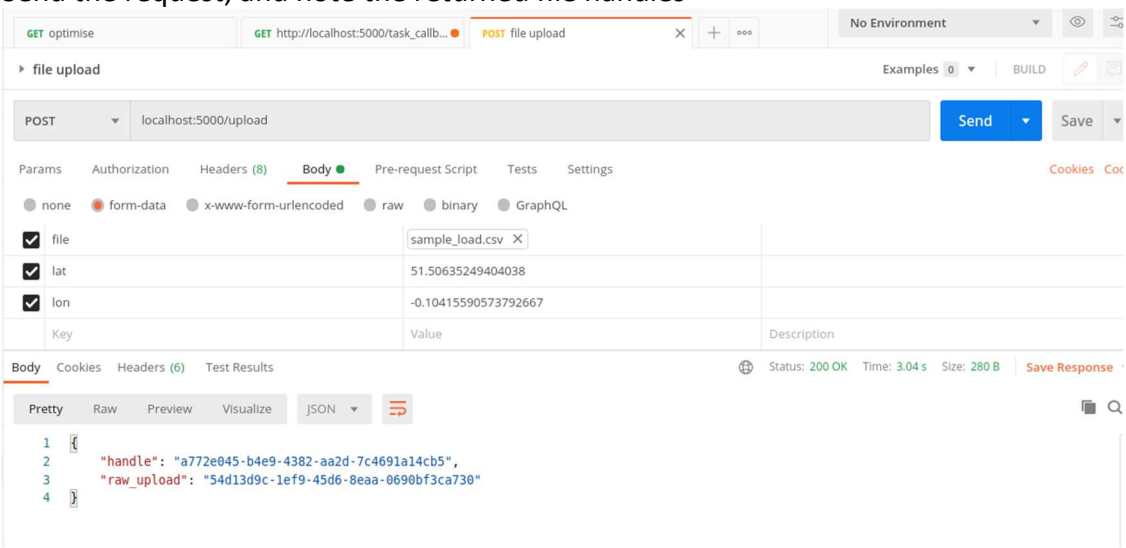
- Install Postman (https://www.postman.com/downloads/)
- Import API endpoint tests into Postman (orxagrid_si.postman_collection.json) (included in root of this repo)
- Run the following endpoints

File upload

Choose 'sample_load.csv' as 'file' (included in root of this repo)

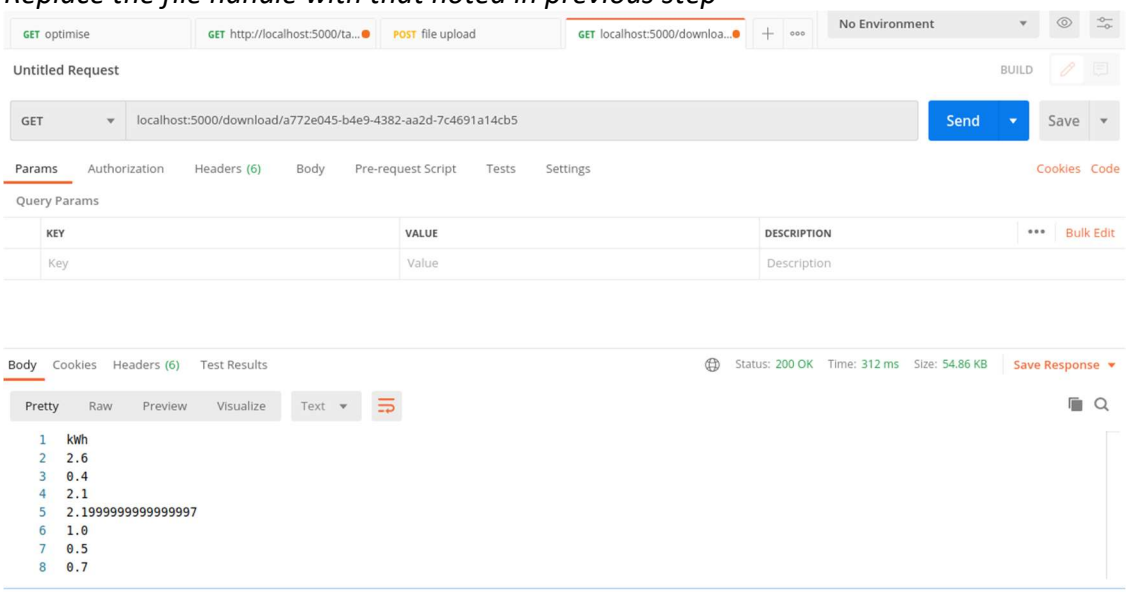


Send the request, and note the returned file handles



File Download

Replace the file handle with that noted in previous step



Optimise

GET optimise

No Environment

optimise

Examples 0 BUILD

GET localhost:5000/task_optimise Send Save

Params Authorization Headers (8) Body Pre-request Script Tests Settings Cookies Code

Query Params

KEY	VALUE	DESCRIPTION
Key	Value	Description

Bulk Edit

Body Cookies Headers (7) Test Results Status: 202 ACCEPTED Time: 64 ms Size: 333 B Save Response

Content-Type	application/json
Content-Length	66
Location	http://localhost:5000/task_callback/654e1989-da20-42b0-8c6c-2c21652740bc
Access-Control-Allow-Origin	*

Bootcamp

optimise

Follow the link given by Location in response header, using GET request

Content-Length	66
Location	http://localhost:5000/task_callback/654e1989-da20-42b0-8c6c-2c21652740bc
Access-Control-Allow-Origin	*

location

Response status code should be 202 until the results are ready

GET optimise GET http://localhost:5000/task_callb...

No Environment

Untitled Request BUILD

GET http://localhost:5000/task_callback/4c0f2591-fb3b-4592-b38e-952d711207c8 Send Save

Params Authorization Headers (6) Body Pre-request Script Tests Settings Cookies Code

Query Params

KEY	VALUE	DESCRIPTION
Key	Value	Description

Bulk Edit

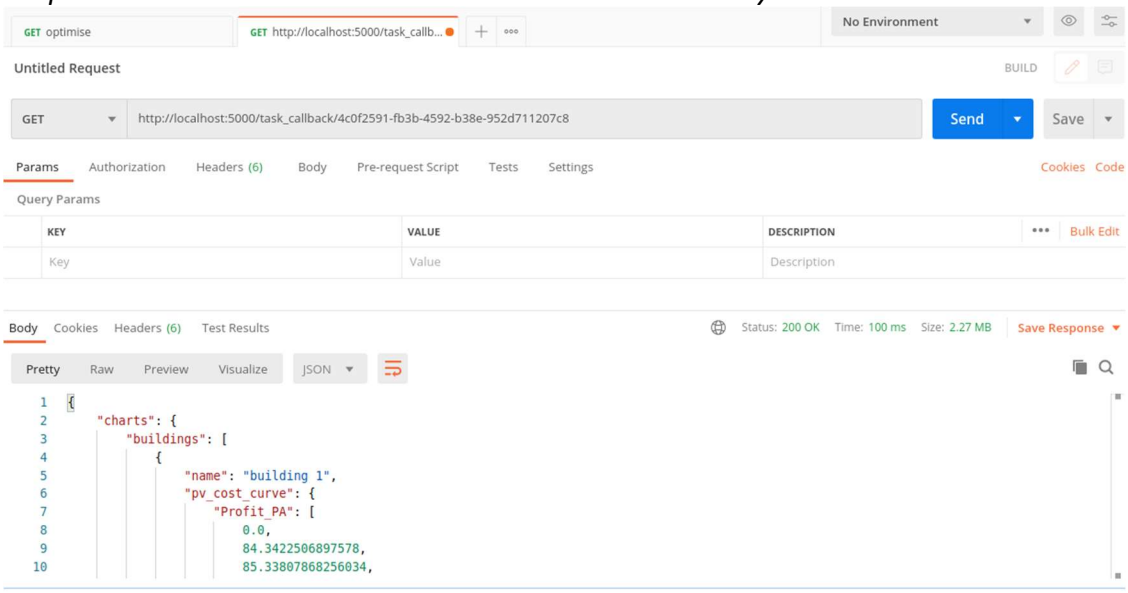
Body Cookies Headers (6) Test Results Status: 202 ACCEPTED Time: 84 ms Size: 185 B Save Response

Pretty Raw Preview Visualize JSON

```
1 {}
```

Keep calling the endpoint

Response status code should be 200 when results are ready



Local Deployment

Locally built images, with production web servers, no hot-reloading of code

```
docker-compose -f docker-compose-prod.yml build
docker-compose -f docker-compose-prod.yml up -d
```

```
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$ docker-compose -f docker-compose-prod.yml up -d
Creating network "orxagridlcapp2_default" with the default driver
Creating object-store-prod ...
Creating api-prod ...
Creating nosql-db-prod ...
Creating worker-prod ...
Creating task-queue-prod ...
Creating frontend-prod ...
Creating object-store-prod
Creating api-prod
Creating nosql-db-prod
Creating frontend-prod
Creating worker-prod
Creating object-store-prod ... done
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$
```

local deploy

```
docker stats
```

```
CONTAINER ID   NAME                CPU %     MEM USAGE / LIMIT     MEM %     NET I/O           BLOCK I/O         PIDS
5888f043474b   worker-prod         0.00%     297.7MiB / 7.748GiB   3.75%     36kB / 23.9kB     1.03MB / 0B       9
8af98d8d7413   task-queue-prod     0.28%     106.5MiB / 7.748GiB   1.34%     35.4kB / 22.6kB   3.14MB / 713kB    37
12895b0e6a4f   api-prod            0.03%     279.3MiB / 7.748GiB   3.52%     21.5kB / 9.95kB   365kB / 0B        42
a3649972dfb8   frontend-prod       0.00%     9.52MiB / 7.748GiB    0.12%     11.1kB / 0B       1.22MB / 0B       9
40d30525e249   nosql-db-prod       1.23%     158.9MiB / 7.748GiB   2.00%     13.4kB / 0B       4.22MB / 246kB    32
3d74bfb5f1d9   object-store-prod   0.00%     44.48MiB / 7.748GiB   0.56%     26.1kB / 11.9kB   3.93MB / 0B       11
```

stats

Open app in browser

```
http://localhost
```

Production Deployment (manual)

Build the API / Worker and Frontend images locally for remote deployment

```
docker build -t rabwent11/lcapp2:api-v1 -f ./api/Dockerfile.prod ./api
docker build -t rabwent11/lcapp2:frontend-v1 -f ./frontend/Dockerfile.prod
./frontend
```

Login to Dockerhub

```
docker login -u rabwent11 -p <password_or_token>
```

```
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$ docker login -u rabwent11 -p e4bc27c7-4bbb-4beb-983a-14087d76abad
WARNING! Using --password via the CLI is insecure. Use --password-stdin.
Login Succeeded
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$
```

docker login

Push the images to Dockerhub

```
docker push rabwent11/lcapp2:api-v1
docker push rabwent11/lcapp2:frontend-v1
```

```
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$ docker push rabwent11/lcapp2:api-v1
The push refers to repository [docker.io/rabwent11/lcapp2]
eaece621f1b0: Pushed
cd2b679981fe: Pushed
cc1cdedd76de: Pushed
638816a1721d: Pushed
50e90dc0dfaf: Pushed
490c2f015c3e: Layer already exists
88fb2db345cd: Layer already exists
747aa001f428: Layer already exists
f9ef7f1bcb19: Layer already exists
02c055ef67f5: Layer already exists
api-v1: digest: sha256:842e1965faf90298b36b8e8901d46594c463dddf818e27760c8a1ce0878648a1 size: 2417
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$
```

push

Copy docker-compose-deploy.yml to remote server

- e.g. using scp

```
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$ scp -i ../Cohort_1.pem docker-compose-deploy.yml ec2-user@lowcarbon.tk:~
docker-compose-deploy.yml                                                    100% 1860    15.4KB/s   00:00
(base) robert@ubuntu:~/si/orxagrid_lc_app_2$
```

scp

Open an ssh sesion to remote server

- see (https://www.ssh.com/academy/ssh/command) for instructions
- following steps are carried out on remote server over ssh

Edit the whitelabel configuration variables in docker-compose-deploy.yml

```
nano docker-compose-deploy.ym
```

- GENERIC_API_URL_FROM_ENV - this should be the URL or IP of remote server, port 5000
- COMPANY_LOGO_URL - url for the logo of the company purchasing / hosting the app
- COMPANY_WEBSITE_URL - url for the website of the company purchasing / hosting the app

```
  GNU nano 2.9.8                                                    docker-compose-deploy.yml

version: '3'


services:

  frontend:
    container_name:
      frontend-prod
    image: rabwent11/lcapp2:frontend-v1
    environment:
      - "GENERIC_API_URL_FROM_ENV=http://127.0.0.1:5000/"
      - "COMPANY_LOGO_URL=https://www.orxagrid.com/images/logo-03-02-2-250x72.png"
      - "COMPANY_WEBSITE_URL=https://www.orxagrid.com"
    restart: always
    ports:
      - '80:80'


  api:
    container_name:
      api-prod
    image: rabwent11/lcapp2:api-v1
```

nano

Save the file and close

```
<CTRL-O>
<CTRL-X>
```

Set up Docker

- Install Docker (https://docs.docker.com/get-docker/)
- Insall Docker Compose (https://docs.docker.com/compose/install/)
- Login to Dockerhub

  docker login -u rabwent11 -p

Pull required images

```
docker-compose -f docker-compose-deploy.yml pull
```

Start app

```
docker-compose -f docker-compose-deploy.yml up -d
```

Configure firewall

- Ensure ports 80 and 5000 are open

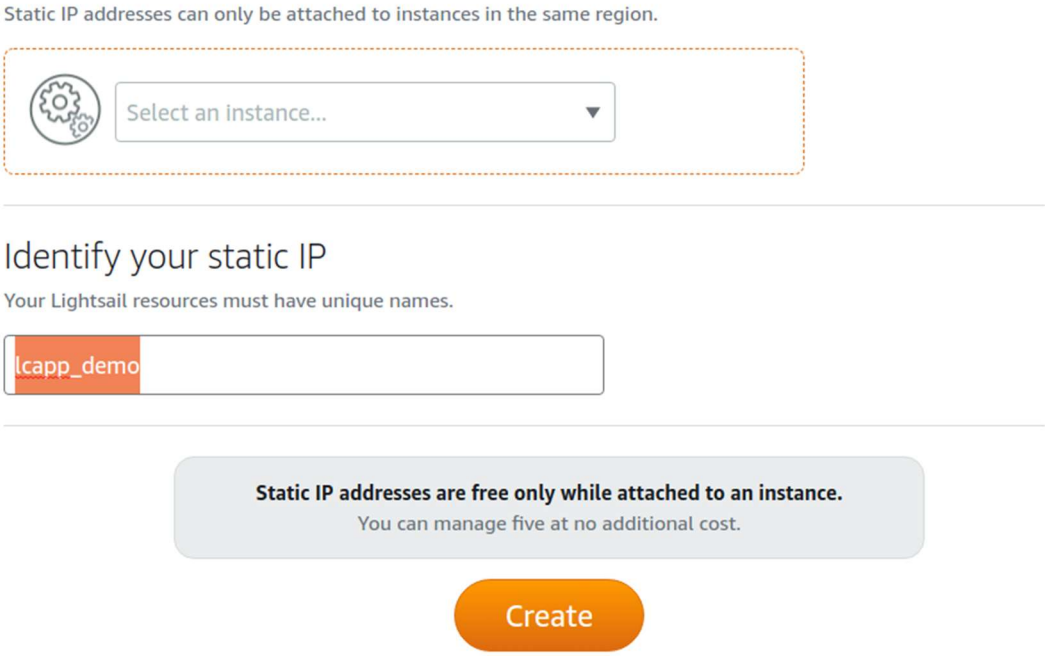
Test app

- Open remote server url in a browser on local machine

Production Deployment (automatic)

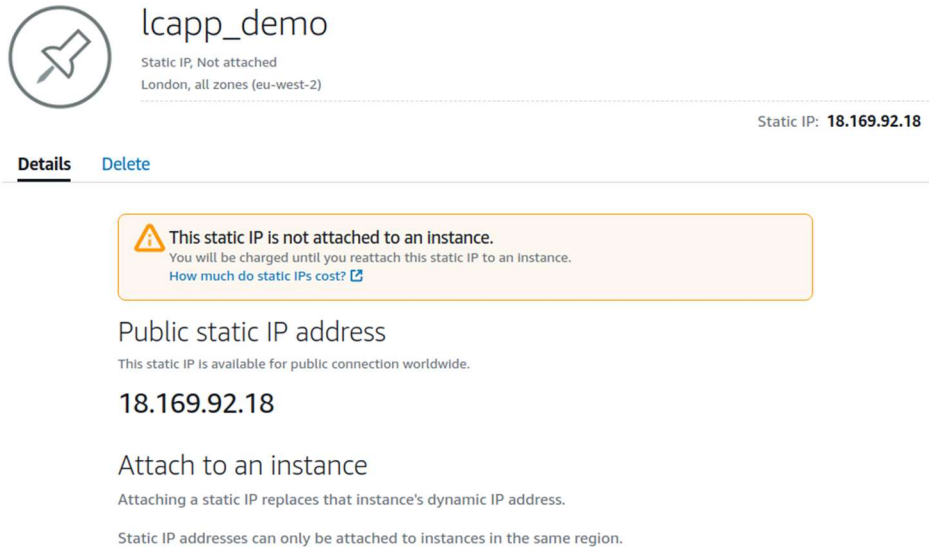
AWS Console

- Sign up / sign in to (http://console.aws.amazon.com)
- Select All Services >> Lighsail
- Select Networking >> Create Static IP >> Create



ip

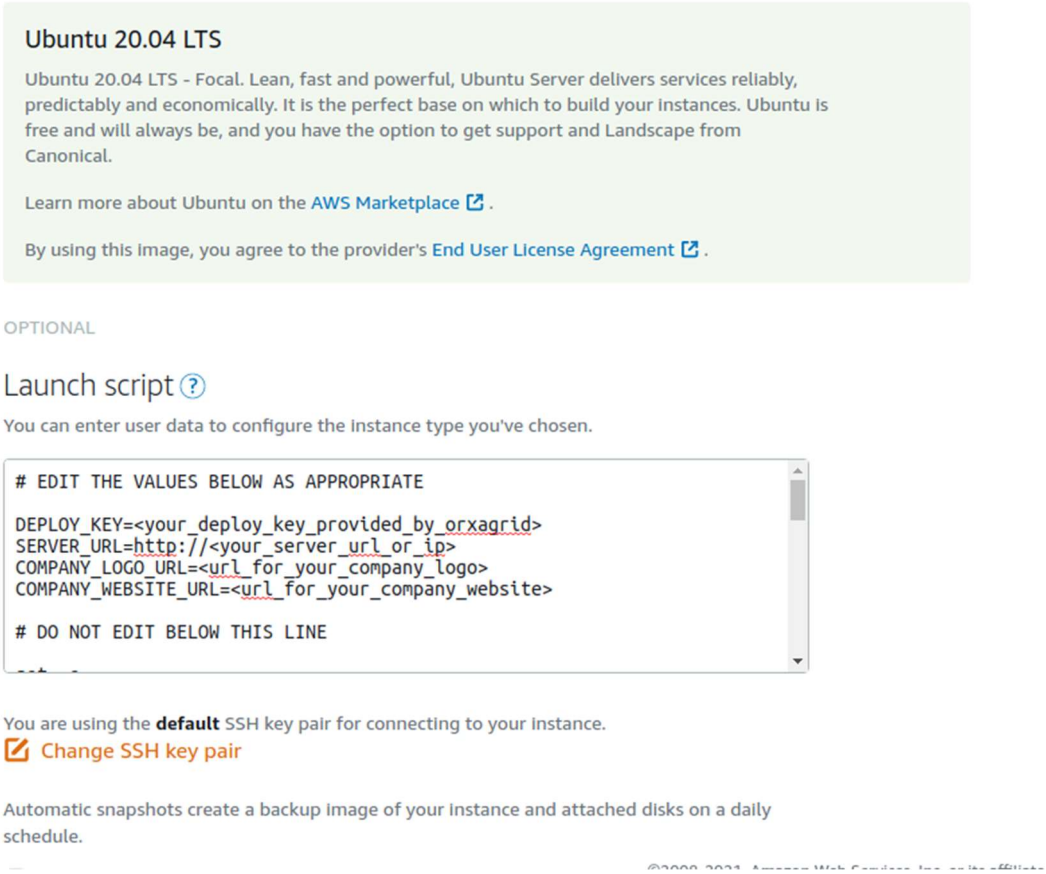
- Note the Static IP address



ip addr

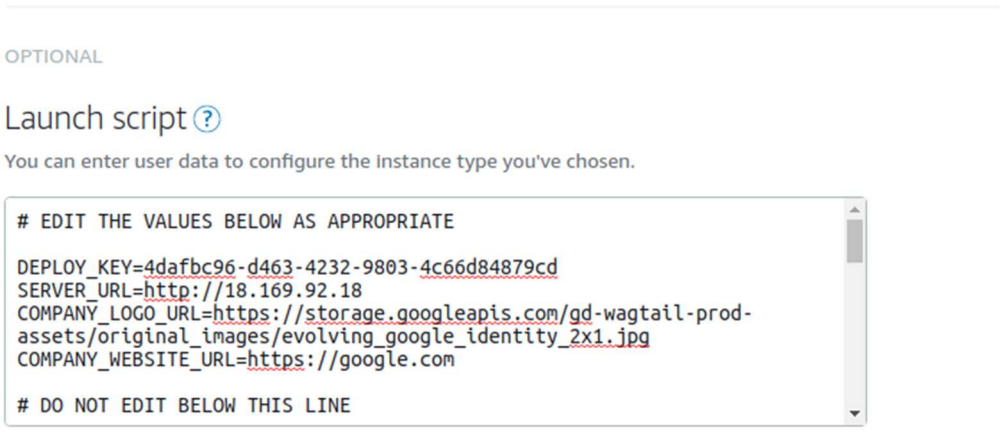
- Navigate back to Lightsail Dashboard
- Create Instance >> Linux (OS Only) >> Ubuntu 20
- Select a machine with at least 2 CPUs and 4GB RAM

- Click ‘Add Launch Script’
- Paste in contents of (install.sh) from root of this repo



launch script

- Edit the whitelabel constants at top of launch script
- DEPLOY_KEY - Dockerhub deploy key provided by OrxaGrid
- SERVER_URL - Static IP noted above
- COMPANY_LOGO_URL - url for the logo of the company purchasing / hosting the app
- COMPANY_WEBSITE_URL - url for the website of the company purchasing / hosting the app

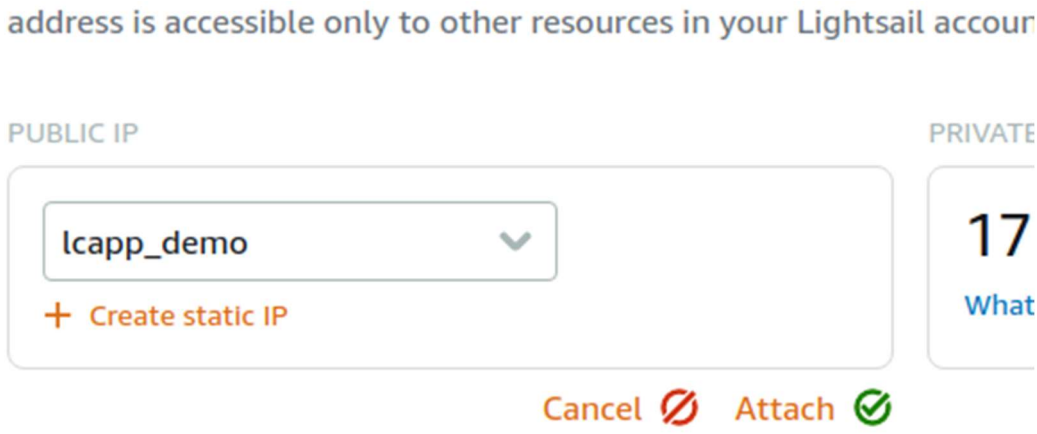


whitelabel

- Click ‘Create Instance’

Attach static IP

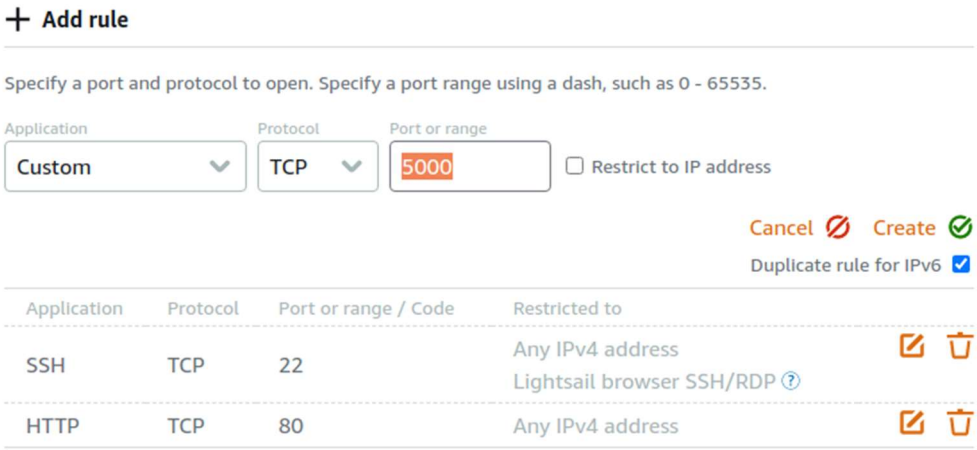
- Click on the instance, then select ‘Networking’
- Attach the static IP created in previous steps



attach

Open firewall ports

- Ensure port 80 is open
- Add a new rule to open port 5000



firewall

Test the app

- Wait 5 minutes for the app to come up after starting the instance with launch script
- Navigate browser to Static IP address of instance
- Web app logo and it’s hyperlink should be as specified at top of launch script


Not secure | 18.169.92.18
Google
Low Carbon Planning
Quickly and accurately calculate the optimal installation size of Solar, Battery Storage or EV charging points.
GET STARTED
Maximise Savings
Get the right system that lowers energy bills
Quick Estimate
Get optimal plan within minutes
Diversified Renewables
Get the ideal power mix
Powered by Orxa Grid

deployed

Summary

This app has been converted from B2B / B2C to B2B2C with whitelabel deployment. All generated intellectual property will be shared with the SME upon project sign-off by means of access to the project GitHub repository.

Conclusions and Recommendations

Conclusions

- The SME's Low Carbon app to optimally size grid connected battery and solar PV systems across multiple buildings with EV chargers was converted from a B2C / B2B product to a B2B2C solution.
- The app can now be sold directly to renewables technology installers
- The installers can customise the branding on the app and integrate it into their company website

Recommendations

- Acceptance testing for the B2B2C app by product owner
- Verification of the readme documentation by in-house development team
- Get early customer feedback
- Seek funding to implement Solar Hindcast service and add most requested customer features
- Advertise and sell the product as a Self-Hosted or SaaS application
- Investigate application of containerisation and orchestration technologies to the SME's other products, enabling rapid customer deployments.