

SEMESTER 2 2019

# MASHUP/DOCKER REPORT

CAB432: CLOUD COMPUTING

INDIVIDUAL TASK – ASSESSMENT 1

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## Introduction

WordReport is a web mashup that utilises News and Keyword Extraction APIs, providing users current news from around the world by showcasing trending news headlines via key words that many news sources are covering in recent times. Important 'keywords' and 'phrases' are scanned from a list of URLs, and outputs 10 words compiled by the APIs. Clicking one of the words will prompt up all news articles relating to the keyword. If the user wants to read the full news, then clicking one of the headlines/images will show the article's website.

Users must first search a country that is **available** in the search bar in which the auto suggestion will provide countries that can be looked up. After clicking search, the APIs will begin fetching URLs and words related to that country and then direct the user to another page with the returned results. A table of 10 words will appear on this webpage, and users can either lookup another 10 words from a different country or click one of the words to preview its news articles. At this stage, the user is directed to the final point of the website and can preview the headlines, sources, descriptions, images, and links of each article before dwelling into the source's website for more information. See Appendices A and B for a full walkthrough.

### News API

<https://newsapi.org/docs/client-libraries/node-js>

News is a simple HTTP REST API for searching and retrieving live articles from all over the web. Various methods of calling news includes keywords and phrases, the date it was published, sources, and news from different countries.

The API contains three endpoints which provides 'top headlines' about breaking news for any country, 'everything' such as finding queries about a word, sorting articles or adjust the number of articles, and 'sources' to handle news publishers and language/country preferences.

### Keyword Extraction API

<https://rapidapi.com/UnFound/api/keywords-extraction2>

Keyword Extraction can extract the most important 'Keywords' and 'Phrases' from the text or URL that being given. It can extract entities such as names of important People, Organizations, Places, and even Concepts, Sub-topics, etc.

The API can take multiple text or URLs as input and can specify the number of keywords that needs to be extracted for results. Inputting URLs can correspond to news, blogs, and other webpages across the internet.

## Mashup

### Use Case A

**As a user, I want to find out what's trending right now, so I can get onboard with popular news.**

The user is welcomed to the index page and begins to lookup what Australia has to offer by typing away in the search box and clicking the *search* button (the query will be abbreviated to its country code as a reference). This gives them time to wait for the keywords to be fetched.

## Welcome to WordReport

See important keywords reported across the world.



1

Categories  
business | entertainment | general | health | science | sports | technology

Country

2

III

Please wait while we fetch some words..

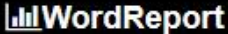
The user is then presented with ten words after waiting for the data to be loaded. Here, the user is interested in the word 'greedfall' being #1 and continues from there, only to see news articles about Greedfall. To their surprise, they learn that Greedfall is a new upcoming video game.

## Words That Makes News

Keywords in: AU

greedfall	#1
root	#2
bercow	#3
england	#4
ms gobbo	#5
years	#6
time	#7
police	#8
mokbel	#9
year	#10


Select a Country



## Setting

Kotaku.com

I have not enjoyed playing Greedfall, the latest role-playing game by Spiders. That's not because it is a poor experience in terms of how it plays. Greedfall offers a BioWare-esque adventure with branching quests, companion characters, and exploration. Greedf...




Published at: 2019-09-09T22:15:00Z

---

## Upcoming Exploration RPG Greedfall Has My Attention

Kotaku.com

When I was first asked to preview Greedfall, an upcoming RPG by Spiders, I didn't really know what to expect. Its vast world, packed with ruins and frontier towns, captured a sense of discovery but also evoked a strange apprehension in me. Greedfall brims wit...



APIs utilised: Keyword Extraction, News

## Use Case B

**As a reader, I want to know what's trending in another country, so I can get an idea of what's happening there.**

The user begins on the index page and starts searching right away in the search input. They suggest looking up trending keywords from 'United States' to see what people are talking about over there.

## Welcome to WordReport

See important keywords reported across the world.



1

2

UAE

Ukraine

United Kingdom

United States

As a result, they find out that many keywords do in fact relate to what's happening around that country. The user then decides to lookup another country, this time in Germany.

## Words That Makes News

Keywords in: US

🗨	trump	#1
🗨	abrams	#2
🗨	apple	#3
🗨	people	#4
🗨	deal	#5
🗨	cheadle	#6
🗨	bad robot	#7
🗨	panthers	#8
🗨	buccaneers	#9
🗨	president	#10

1

Select a Country

Germany

2

Search

⏸

Please wait while we fetch some words..

After loading, the keywords retrieved have appeared to be shown in deutsche, reflecting the emphasis of the use of the language in Germany. Clicking on the word 'werden' has shown a degree of reference from sources and headlines in the country.

### Words That Makes News

Keywords in: DE

uhr	#1
die	#2
von	#3
werden	#4
der	#5
das	#6
eine	#7
sie	#8
aber	#9
er	#10

Select a Country

Argentina

Search

### Söder: Empfehlungen für neues Polizeigesetz werden übernommen

Heise.de

Bayerns Ministerpräsident hat angekündigt, die Expertenkritik am geplanten Polizeigesetz nicht ignorieren zu wollen. Alle Vorschläge sollen umgesetzt werden.



Published at: 2019-09-02T14:00:00Z

APIs utilised: Keyword Extraction, News



## Use Case C

**As an enthusiast, I'd like to see what's trending in technology, so I can keep up with the subject.**

The user has the option to lookup 'technology' on the index page labelled under the category section. They then click and wait for their request to be completed.

## Welcome to WordReport

See important keywords reported across the world.



**1**

Categories  
business | entertainment | general | health | science | sports | **technology**

Country

**Search**

By looking at the important keywords, the user decides to click and read the latest news about Apple and their latest iPhone.

Keywords in: TECHNOLOGY

apple	#1
event	#2
livestream	#3
iphone	#4
ios	#5
<b>apple iphone</b>	#6
pt	#7
cnet	#8
youtube	#9
first time	#10

**2**

### News Articles about: APPLE IPHONE


Search Results: 20

**3**

#### How to Watch Apple's iPhone Event Tuesday

Lifehacker.com

Apple is holding a media event tomorrow where it's expected to announce, among other things, the next iPhone. Rumor has it there will actually be three new versions of the phone: the iPhone 11, iPhone 11 Pro, and iPhone 11 Max. Read more...

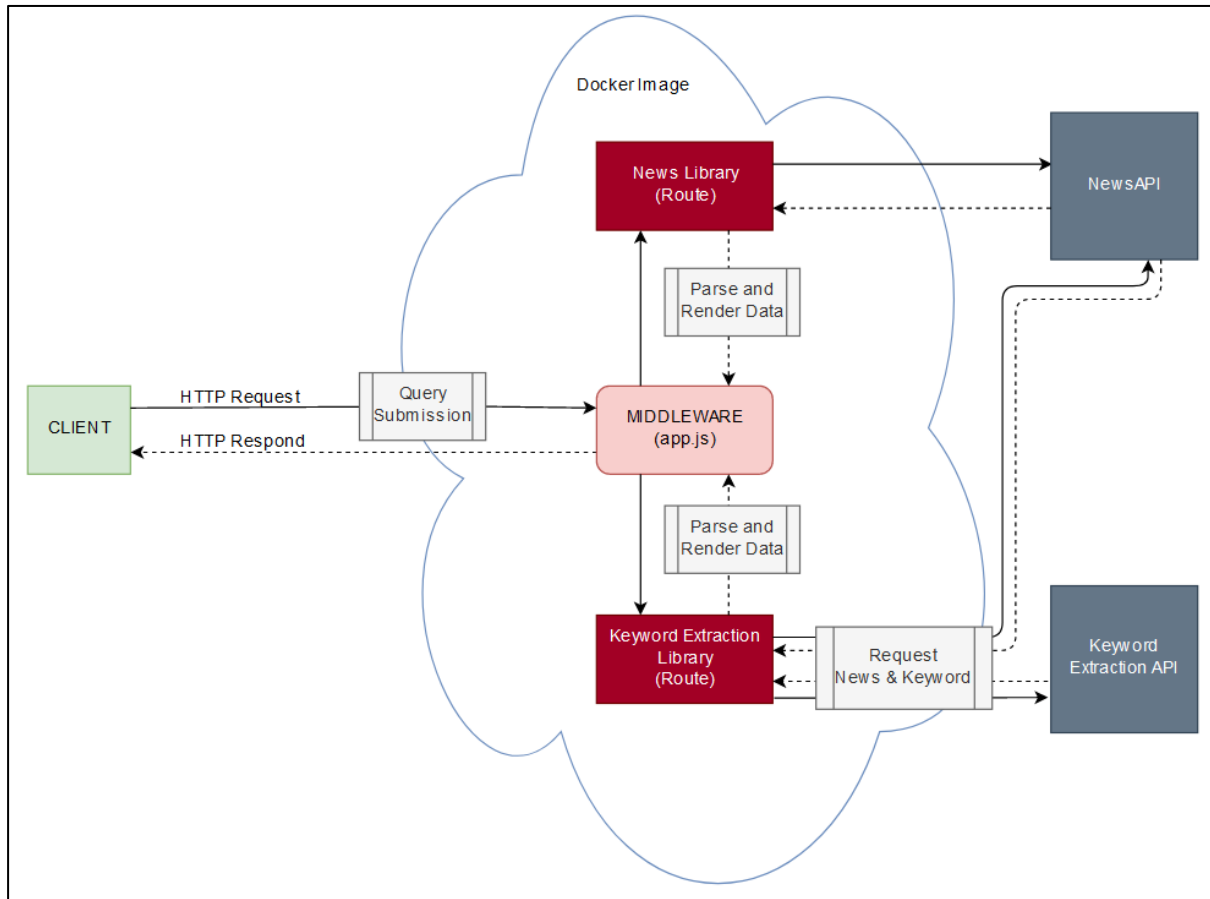


Published at: 2019-09-09T14:30:00Z

APIs utilised: Keyword Extraction, News

## Application Description

Overall the architecture of the application shows a great deal of processing data in the server-side than the client-side. Requests by the client are passed through to the middleware which is also linked to two other routes: the news and keyword extraction libraries. These libraries heavily refer to the API services used to make this application work. The APIs respond, with filtering provided through the libraries so that correct data is sent to the client's needs in the client side.



### Client Side

The client will often post data to request information whether it's typing a search query or clicking a link. All information is sent through the server side in HTML form POSTs or hypertext references. Validation is used to ensure that proper POSTS are made when searching a dynamic query. If approved, the information will then be processed and respond back to the user by directing them to a new page. Subsequently, the user will be able to see a new display of elements and feedback from their requested data that they inputted.

### Server Side

Beyond the client lies the server side which handles any request that the client requires, by setting up a middleware server to take HTTP requests from the client and responses from routes. Furthermore, the routes themselves are created as libraries to request data from API services, which benefit the client's needs by providing proper information to the server. While the *News* library solely requests information from the News API, the *Keyword Extraction* library needs to request both APIs to properly serve its response data and forward it to the middleware, which now has to respond to the client. The Keyword Extraction API requests 20 news URLs from the NewsAPI, given that the NewsAPI requests a

query for either country/category. It then extracts 10 important keywords from the URLs and then parses the words into a proper display for the webpage.



### Parsing and Rendering Data

When data is given to the libraries from the APIs, they must only extract relevant information that the client wishes to see. Each data is composed as a JSON object that can be parsed and extracted in HTML. The filtered data can now be easily sent through the server and render to the client side without having to compile unnecessary information. They are then written as a HTML file to load in and render in the webpage upon server requests and responses.

```

55 function parseNews(data) {
56
57     let s = '';
58     let news = data.articles;
59
60     for (let i in news) {
61         s += `
62             <h3><a href = "${news[i].url}"><b>${news[i].title}</b></a></h3>
63             <p>${news[i].source.name}</p>
64             <p>${news[i].description}</p>
65             <div class = "container">
66                 <a href = "${news[i].url}"> <img alt = "${news[i].title}" src = "${news[i].urlToImage}" /></a>
67             </div>
68             <p>Published at: ${news[i].publishedAt}</p>
69             <hr>
70         `;
71     }
72
73     // Write data for HTML.
74     fs.writeFile('./views/html/news.html', s, (err) => {
75
76         // In case of a error throw err.
77         if (err) throw err;
78     })
79
80     return s;

```

asn1 > wordreport > views > html			
Name	Date modified	Type	Size
 news.html	13/09/2019 11:39 AM	Firefox HTML Doc...	19 KB
 words.html	13/09/2019 11:38 AM	Firefox HTML Doc...	3 KB

### Pug html

An alternative solution for building webpages compared to standard HTML or PHP, Pug is a HTML templating engine that provides useful features to render and implement data from JSON or other static files, and can organise templates for much more simple and flexible ways to work with content efficiently. Pug is mainly used for server-side responses and is compiled into HTML code once it is sent to the client side. Since I used a function to parse and write HTML files for rendering, Pug lets me include this and any other static files, whether it's HTML, CSS or JavaScript. Overall, all webpages are written in pug.

## Issues encountered

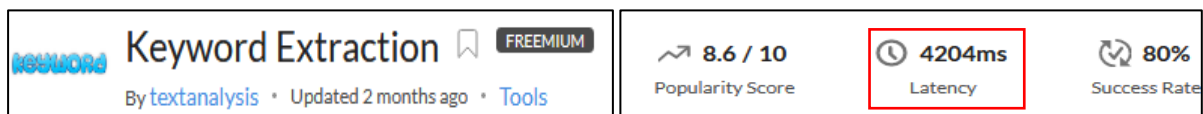
### Request Problems

Almost all countries available in the database can be searched, however some countries produce errors while trying to request and compile data. One particular example is looking up China (cn) to find its keywords, only to realise JSON is unable to parse non-Unicode characters. Unlike most countries reporting their news, China only uses Chinese characters for their writing format which makes it difficult to work with JSON. The *Keyword Extraction API* is also unable to resolve this issue, which leads to a compromise of removing China as an option to look up its keywords and news. A test plan for this issue is mentioned later in the report.

```
SyntaxError: Unexpected end of JSON input
    at JSON.parse (<anonymous>)
    at IncomingMessage.<anonymous> (C:\Users\Kevin\Desktop\asgn1\wordreport\routes\words.js:69:32)
    at IncomingMessage.emit (events.js:203:15)
    at endReadableNT (_stream_readable.js:1145:12)
    at process._tickCallback (internal/process/next_tick.js:63:19)
```

### API Latency

While inevitable, loading times for requesting queries can take some time before data responds back to the client. The Keyword Extraction API can take up from 2874ms to at least 4204ms maximum if internet ping worsens. This leads to having to wait around 30-40 seconds for all countries/categories to produce results for the user. If the user is experiencing a slow connection, then requesting a query may cause issues to the server side, as it is necessary for the NewsAPI to fetch the URLs in time to write the file and pass it on to the Keyword Extraction API for request.



## Use of Docker

A Dockerfile is a text document that includes line commands to assemble an image in Docker. The file is placed next to the web mashup folder which is tasked to copy the source directory and build an image based on the web application. This means it will contain all files and folders of the original source performed in line 2.

```
1 FROM node:buster-slim
2 COPY /wordreport .
3 EXPOSE 80
4 RUN npm install
5 CMD ["node", "app.js"]
```

For the first line in Dockerfile we establish the use of Node.js's buster-slim, a lite version of the recommended 10.16.3 LTS. This allows us to build a smaller image, whereas using the default 'node:10' will give us an image size of 920MB. Buster-slim provides a lightweight, yet faster build of an image with all the dependencies carried with it. Port 80 is exposed in line 3 for our server (app.js), and 'RUN npm install' is given in line 4 to install our dependencies. Finally, in line 5, we give the command to run the server. The image is then pushed to my Dockerhub account, ready to be pulled back later on to the AWS public VM (Appendix C).

## Testing and Limitations

A basic test plan table is created to ensure the web application is behaving as it should be. Each test looks at an ordinary task where a user would interact and should produce an outcome that is ideal to how the web application reacts. A result column is also added to determine whether the test passes or fails, and references to the tasks can be seen in the screenshot guide section (Appendix B).

~ RH = Response Handling

~ cn = China

Task	Expected Outcome	Result	Screenshot Guide (Appendix B)
Search for words (country)	Displays 10 keywords related to country	PASS	01
Search for words (category)	Displays 10 keywords related to category	PASS	02
Enter incorrect search	Prevents submission	PASS	03
Use dropdown list to search	Results display 10 new keywords	PASS	04
Loading interaction	Shows loading animation while waiting	PASS	05
Click keyword for news	Directs to a new page full of news	PASS	06
Click article to read full news	Redirects to the source article	PASS	07
RH: search for invalid country (URL)	Should reject in URL parameter (local): <code>http://127.0.0.1:3000/words/cn</code>	PASS	08
RH: search for incorrect category (URL)	Produce an empty result page	PASS	09
Fetch keywords at a slow connection	Display a slow connection message	PASS	10

Overall there are limitations that are added to mitigate errors from the user. These are usually handled on an error page indicating the user that they have submitted an error or that there is a problem with the request from the application. Another error handling function is the client-side validation, which upon query searches, users must fill out queries that are available in the auto suggestion list and also not to leave a blank on the search bar if they're trying to find keywords from a country.

## Extensions

### Third API

Due to the time constraint and the need to complete the basics of the application, a third API was not considered. A proposed idea was adding a google maps API that would allow users to explore the world and click on a country to search for trending keywords. This implementation would overhaul my current mashup and explore new features suitable for more use cases. Another suggestion was adding Twitter to read people's thoughts and opinions on the latest news and keywords.

### Filter Preferences

Prior to searching for keywords, it is preferable to suggest filters for producing more accurate keywords that are desirable. For example, adding a data range when the word is used a lot, or include a sort field via relevancy or popularity of the word.

### Email Notifications

A feature that would serve well for users would be the idea of subscribing to a keyword that they'd like to read more about for future references of the term. Email notifications would provide the user news articles relating to the keyword just like how news articles are extracted using the query parameter in the mashup application.

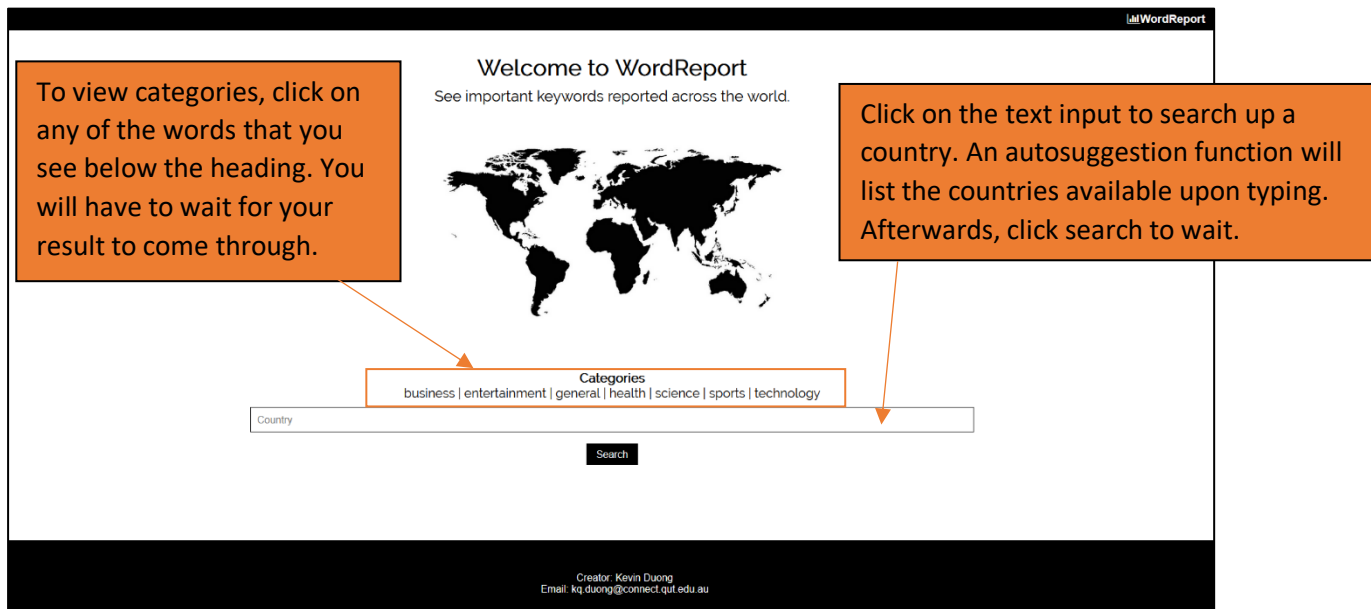
## References

1. NewsAPI. (n.d). Documentation. Retrieved from:  
<https://newsapi.org/docs/client-libraries/node-js>
2. UnFound. (2019). Keywords Extraction API Documentation. Retrieved from:  
<https://rapidapi.com/UnFound/api/keywords-extraction2>
3. Docker. (n.d). Dockerfile reference. Retrieved from:  
<https://docs.docker.com/engine/reference/builder/>

## Appendix A – User Guide

### Getting Started

Welcome to WordReport! This web application finds the top 10 news keywords of a country or category that have been frequently mentioned a lot. On the main page there is a choice of choosing categories or searching up a country:



### Results Page

Once the page has loaded in with keywords, you can decide whether you want to search again with a different country or go back to the main page and pick a different category. For the main functionality of this page, you can click any keyword that sounds interesting to you.



## News Articles

After you decided to click on a term, you will be directed to a news page full of articles related to the word. Feel free to scroll through the webpage to find an article you'd like to read. The maximum limit of articles is 20.

The screenshot shows a webpage titled "News Articles about: BLACK HOLE" with a "WordReport" logo in the top right corner. Below the title, it says "Search Results: 20". A red box highlights the headline "Securely Transfer Files for Free With Black Hole's Blockchain-Based Service" from "Lifehacker.com". Below the headline is a short summary: "We've covered many file-transfer services previously, but we recently stumbled upon Black Hole, a relatively new service uses the blockchain-based Blockstack network for user logins, file storage, and delivery. (Best of all: It's free.) Read more...". Below the text is a large image of the BlackHole logo and a smartphone. A red callout box with an arrow pointing to the headline and the image contains the text: "You can click the headline or the image of the article to read the full news."

The screenshot shows a webpage with a row of five iPhones in different colors (gold, green, silver, black, and a fifth one partially visible). Below the iPhones, it says "Published at: 2019-09-10T22:20:00Z". At the bottom left, there is a "Go Back" button. A red callout box with an arrow pointing to the "Go Back" button contains the text: "To go back to results, you can click the button on the bottom left at the end of the page."

Creator: Kevin Duong  
Email: kq.duong@connect.qut.edu.au



## Appendix B – Manual Documentation

### 01 – Search for words (country)

1

Categories

business | entertainment | general | health | science

Singapore

2

Search

Words That Makes News		
Keywords in: SG		
hong kong	#1	
china	#2	
iphone	#3	
years	#4	
liverpool	#5	
singapore	#6	
games	#7	
nea	#8	
sept	#9	
new macan	#10	

### 02 – Search for words (category)

1

Categories

business | entertainment | general | health | science | sports | technology

Words That Makes News		
Keywords in: HEALTH		
people	#1	
study	#2	
patients	#3	
measles	#4	
treatment	#5	
disease	#6	
symptoms	#7	
time	#8	
risk	#9	
year	#10	

## 03 – Enter incorrect search

Welcome to WordReport  
See important keywords reported across the world.




Categories  
business | entertainment | general | health | science | sports | technology

Country

Please fill out this field. Search

Welcome to WordReport  
See important keywords reported across the world.



Sorry, we don't have results for "gergerge".  
OK

Categories  
business | entertainment | general | health | science | sports | technology

gergerge

Search

## 04 – Use dropdown list to search

**1**

**Words That Makes News**

ERTAINMENT

years	#1
people	#2
september	#3
life	#4
show	#5
year	#6
film	#7
anthem	#8
love	#9
allen	#10

**2**

Search

Keywords in: NL

de	#1
het	#2
ecb	#3
hij	#4
iphone	#5
dat	#6
pro	#7
op	#8
bedrijf	#9
van	#10

Select a Country

Argentina

Search

## 05 – Loading interaction

## Welcome to WordReport

See important keywords reported across the world.



Categories  
business | entertainment | general | health | science | sports | technology

Search

■■■

Please wait while we fetch some words..

## Words That Makes News

Keywords in: AU

■	b cells	#1
■	roosters	#2
■	review	#3
■	cells	#4
■	residents	#5
■	year	#6
■	chinese australians	#7
■	people	#8
■	cats	#9
■	side	#10

Select a Country

Search

■■■

Please wait while we fetch some words..

## 06 – Click keyword for news

Keywords in: FR	
go	
les	
eur	
il	
pro	
habitants	
iphone	
dans	
et	
septembre	

## Astronomie : que voir dans le ciel en septembre ?

Le Monde

Profitez des dernières belles nuits de l'été pour admirer la Voie lactée et les planètes Jupiter et Saturne dans le ciel du soir. L'été s'achève mais il n'est pas encore trop tard pour admirer le cœur de la Voie lactée qui luit magnifiquement au-dessus de l'h...



## 07 – Click article to read full news

**La gazette du mercato : Wissam Ben Yedder sur le Rocher, Adil Rami viré, et Wesley Sneijder retraité**

Le Monde

Chaque semaine, « Le Monde » vous fait vivre, à sa manière, le marché estival des transferts, qui dure jusqu'au 2 septembre.



Published at: 2019-08-16T12:57:16Z



Se connecterS'abonner

ACTUALITÉSÉCONOMIEVIDÉOSOPINIONS CULTUREM LE MAGSERVICES

FOOTBALL

Partage

## La gazette du mercato : Wissam Ben Yedder sur le Rocher, Adil Rami viré et Neymar en pause au Portugal

Chaque semaine, « Le Monde » vous fait vivre, à sa manière, le marché estival des transferts, qui dure jusqu'au 2 septembre.

Par Anthony Hernandez et Lætitia Béraud · Publié le 16 août 2019 à 14h57 - Mis à jour le 19 août 2019 à 10h38

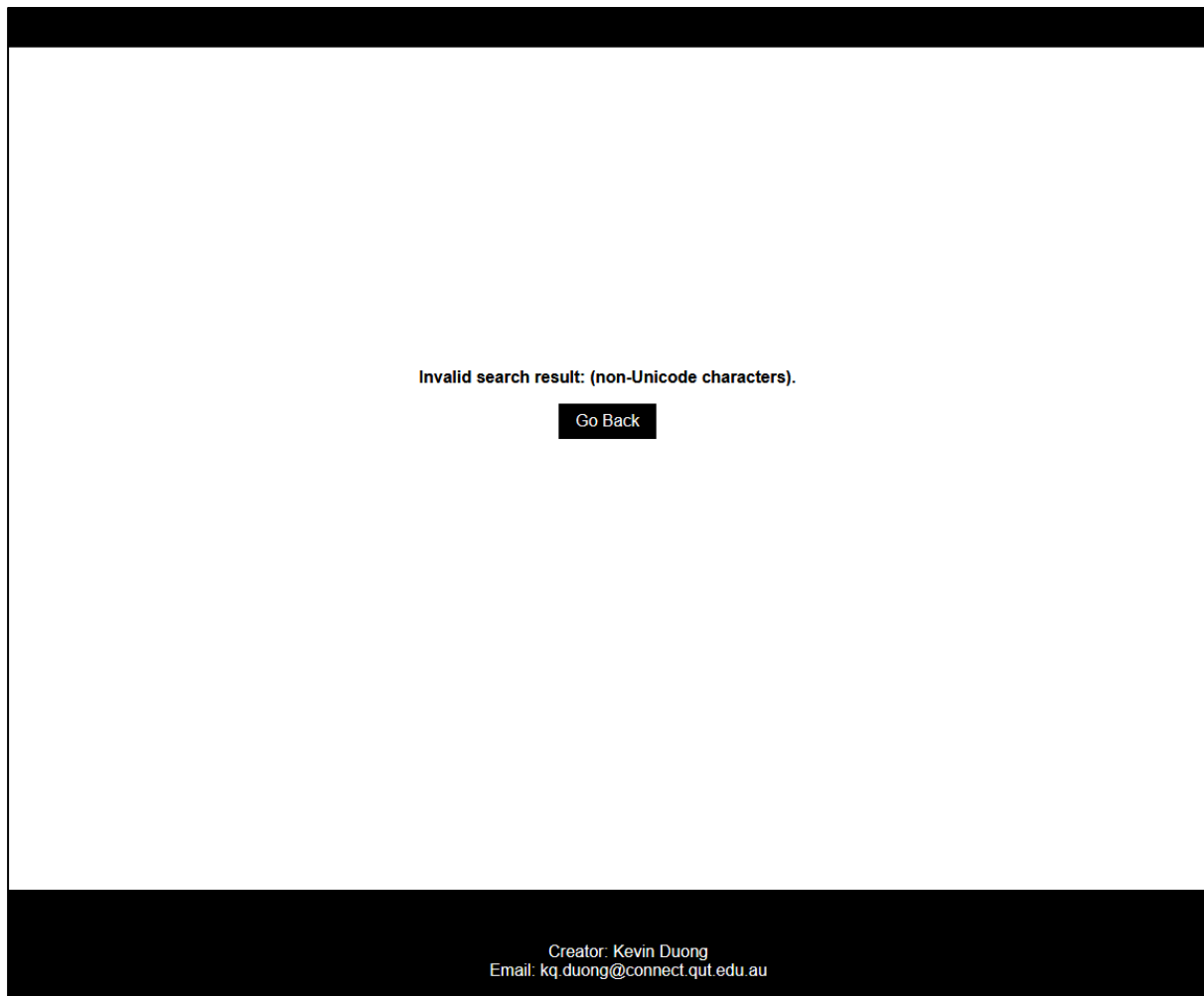
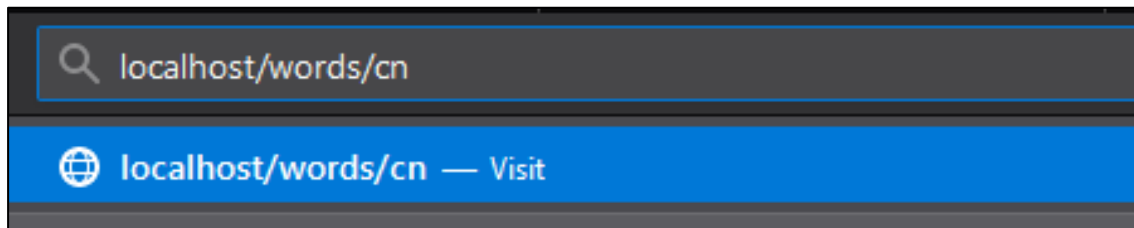
Lecture 5 min.



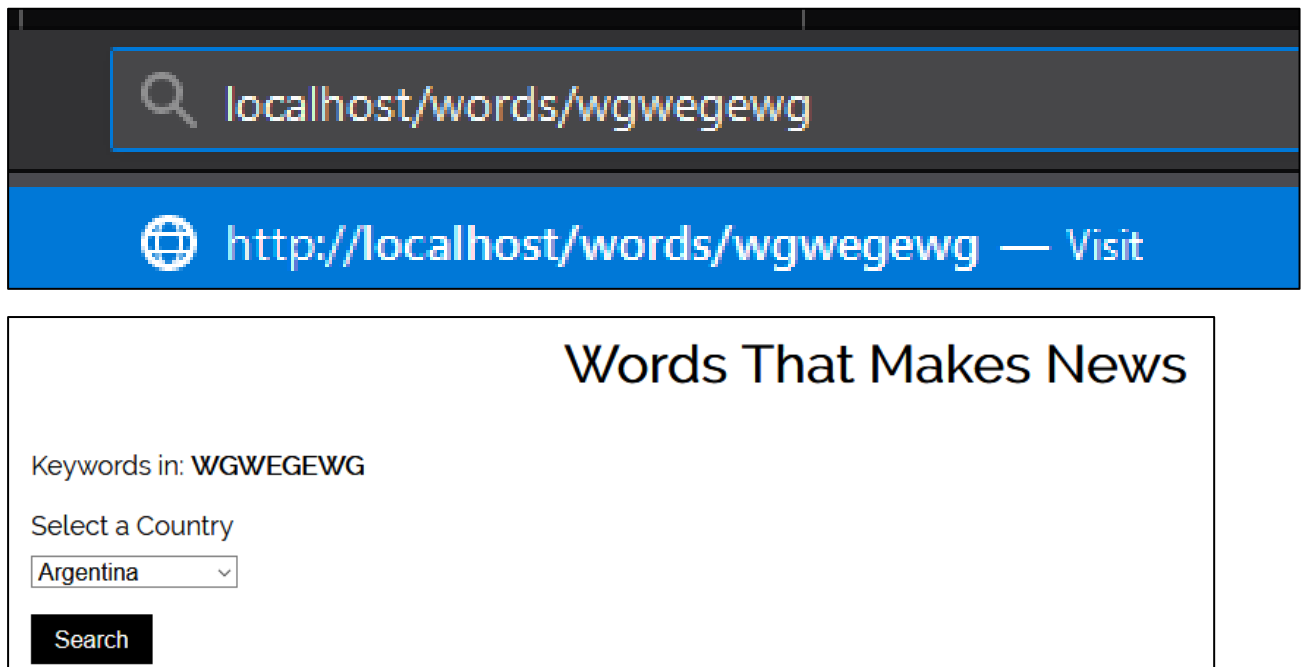
### Les plus lus

- 1 Imbroglio autour de la suspension d'un policier après une interpellation violente à Sevran
- 2 Grève à la RATP : les Parisiens prévoyants malgré un trafic

08 – RH: search for invalid country (URL)

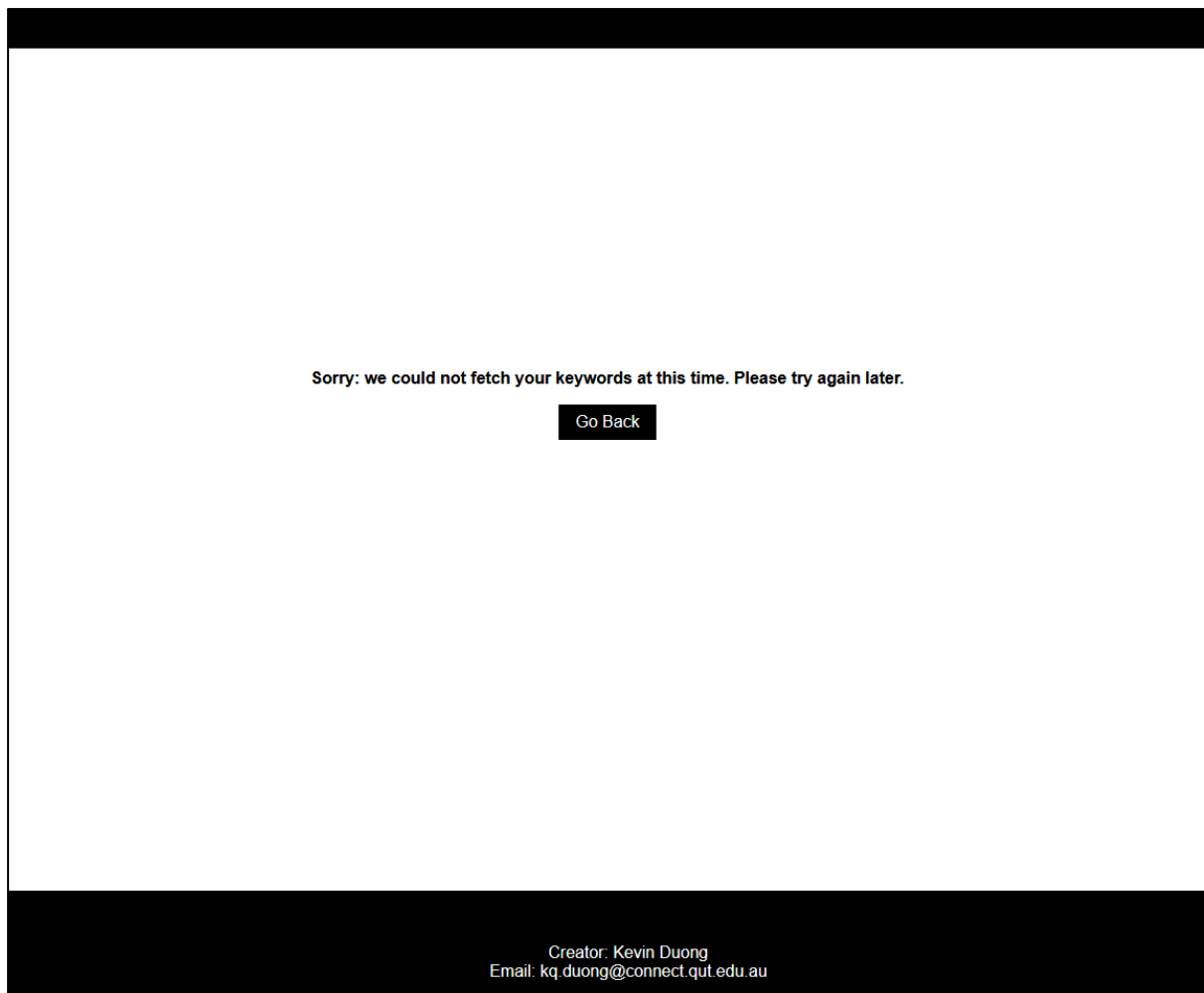


09 – RH: search for incorrect category (URL)



The screenshot shows a web browser interface. The address bar contains the URL `localhost/words/wgwegewg`. Below the address bar, there is a blue bar with a globe icon and the text `http://localhost/words/wgwegewg — Visit`. The main content area has a title **Words That Makes News**. Below the title, it says **Keywords in: WGWEGEWG**. There is a section labeled **Select a Country** with a dropdown menu showing **Argentina**. A **Search** button is located below the dropdown menu.

10 – Fetch keywords at a slow connection



The screenshot shows a web browser interface. The main content area is mostly empty, with a message in the center: **Sorry: we could not fetch your keywords at this time. Please try again later.** Below this message is a **Go Back** button. At the bottom of the page, there is a footer with the text: **Creator: Kevin Duong** and **Email: kq.duong@connect.qut.edu.au**.



## Appendix C – Deploying App to Cloud

### AWS Public VM Instance

We need to setup a public VM instance first to identify what the host name is for the server – instead using <http://127.0.0.1:3000>, we instead use the instance's public IP. An Ubuntu server 18.04 LTS instance from Amazon Web Service will be used to hold our proposed Dockerised app.

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)	IPv4 Public IP	IPv6 IPs	Key Name	Monitoring	Launch Time
	i-0561cec34e892ca4a	t2.micro	us-east-1d	running	2/2 checks ...	None	ec2-18-206-169-246.co...	18.206.169.246	-	asgn1	disabled	Septembe
	i-050785563b286d8f	t2.micro	us-east-1d	terminated		None	-	-	-	asgn1	disabled	Septembe
	i-0b8d4162b1cd3018f	t2.micro	us-east-1c	terminated		None	-	-	-	asgn1	disabled	Septembe

Instance: i-0561cec34e892ca4a		Public DNS: ec2-18-206-169-246.compute-1.amazonaws.com	
Description	Status Checks	Monitoring	Tags
Instance ID	i-0561cec34e892ca4a	Public DNS (IPv4)	ec2-18-206-169-246.compute-1.amazonaws.com
Instance state	running	IPv4 Public IP	18.206.169.246
Instance type	t2.micro	IPv6 IPs	-
Elastic IPs		Private DNS	ip-172-31-27-204.ec2.internal
Availability zone	us-east-1d	Private IPs	172.31.27.204
Security groups	asgn1-demo, view inbound rules, view outbound rules	Secondary private IPs	
Scheduled events	No scheduled events	VPC ID	vpc-ee640b94

The host name from here on will be the IPv4 Public IP + public port:

*<http://18.206.169.246:3000>*

Furthermore, changes have been made to connect to the new host throughout the files:

```

8    // Initialise app
9    const app = express();
10
11    const hostname = '54.146.195.172';
12    const port = 80;

```

### Building a Docker Image

To build our image, we need to setup a Dockerfile which sets a bunch of commands from us to work with our web application. The following script will be used to build the image:

```

1  FROM node:buster-slim
2  COPY /wordreport .
3  EXPOSE 80
4  RUN npm install
5  CMD ["node", "app.js"]

```

Using Ubuntu virtual machine with Docker installed on the terminal, we are ready to build the image of the app – the image name will be my Dockerhub username + 'asgn1' + a tag.

```
ubuntu@ubuntu-desktop:~/Desktop/asgn1$ docker build -t n9934731/asgn1:1 .
```

The docker will fetch our dependencies and modules to work with the app in the image.

```
ubuntu@ubuntu-desktop:~/Desktop/asgn1$ docker build -t n9934731/asgn1:1 .
Sending build context to Docker daemon 270.8kB
Step 1/5 : FROM node:buster-slim
buster-slim: Pulling from library/node
b8f262c62ec6: Pull complete
cd902351b877: Pull complete
bfd96150ed4c: Pull complete
091f390be83f: Pull complete
38a8448b9186: Pull complete
Digest: sha256:a04ae1bd20545bb1d239a5281026caa21a3af4fc85e50f33467a170ebaf6afcf
Status: Downloaded newer image for node:buster-slim
--> 740f5f5b53e3
Step 2/5 : COPY /wordreport .
--> 1b118ffc1877
Step 3/5 : EXPOSE 80
--> Running in 9802b1a1321e
Removing intermediate container 9802b1a1321e
--> 44c4391cb2e2
Step 4/5 : RUN npm install
--> Running in cce2d7971d87

> core-js@2.6.9 postinstall /node_modules/core-js
> node scripts/postinstall || echo "ignore"

Thank you for using core-js ( https://github.com/zloirock/core-js ) for polyfilling JavaScript standard library!

The project needs your help! Please consider supporting of core-js on Open Collective or Patreon:
> https://opencollective.com/core-js
> https://www.patreon.com/zloirock

Also, the author of core-js ( https://github.com/zloirock ) is looking for a good job -)

npm WARN cab432-asgn1@1.0.0 No repository field.

added 136 packages from 195 contributors and audited 256 packages in 17.672s
found 0 vulnerabilities

Removing intermediate container cce2d7971d87
--> efc76159a27c
Step 5/5 : CMD npm start
--> Running in 0684cdbafc36
Removing intermediate container 0684cdbafc36
--> c418637e3106
Successfully built c418637e3106
Successfully tagged n9934731/asgn1:1
```

To see if the image is built, we can check docker image directory:

```
ubuntu@ubuntu-desktop:~/Desktop/asgn1$ docker image ls
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
n9934731/asgn1	1	c418637e3106	About a minute ago	178MB
node	buster-slim	740f5f5b53e3	47 hours ago	161MB

### Pushing Image to Dockerhub

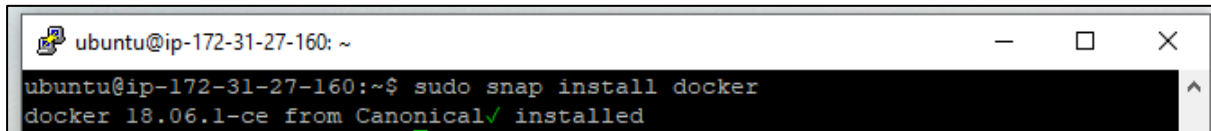
The image can be sent to a user's Dockerhub repository. To do this, we must send a 'push' command to our repository listed in the image directory:

```
ubuntu@ubuntu-desktop:~/Desktop/asgn1$ docker push n9934731/asgn1
The push refers to repository [docker.io/n9934731/asgn1]
466dcf2ed03f: Pushed
1718d62992dc: Pushed
bab9193ada77: Mounted from library/node
227c3f8399ab: Mounted from library/node
ba64ffa52226: Mounted from library/node
627d6bea28f5: Mounted from library/node
2db44bce66cd: Mounted from library/node
1: digest: sha256:3a70489fba596948e2bcafbba7caf2b9839142e2f49d5aec4dd8779dfe216606a size: 1787
```

### Pulling Image from AWS cloud VM

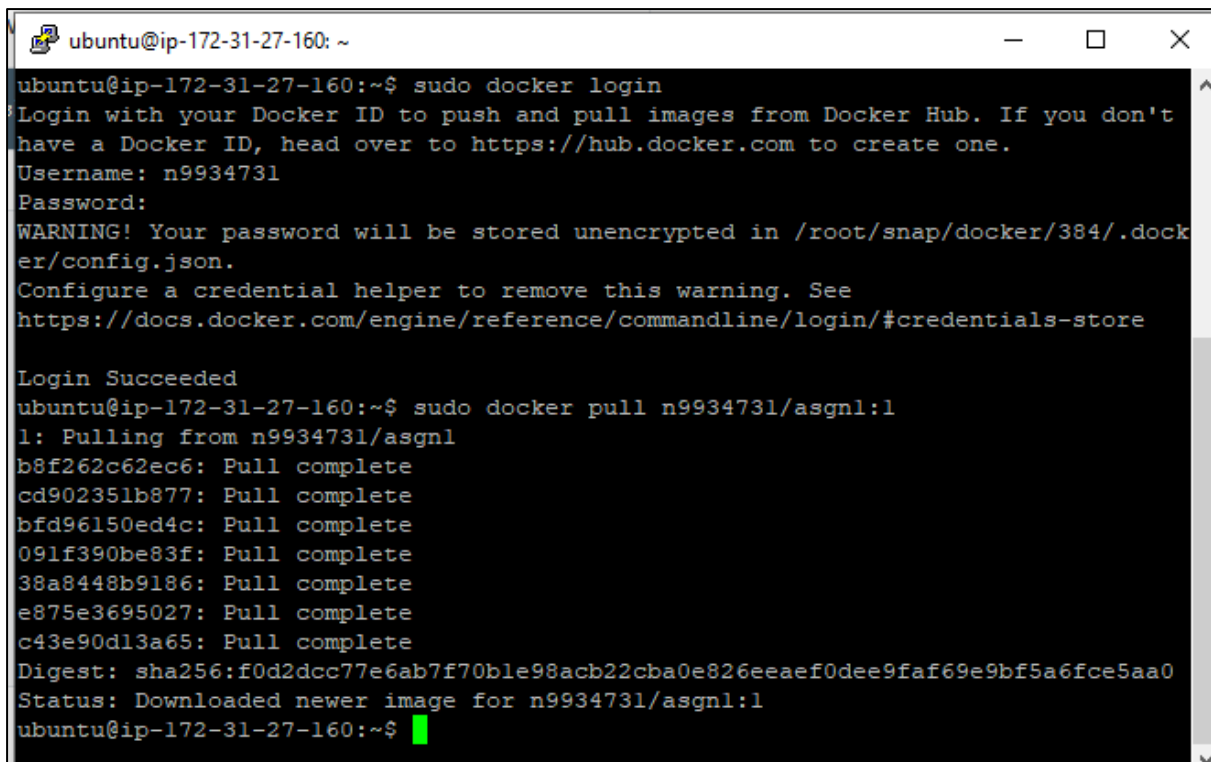
Given that the public DNS is: `ec2-18-206-169-246.compute-1.amazonaws.com`

We must now connect to our instance that we created in AWS to pull the image. References to how to connect via PUTTY is mentioned in the webpage, but our focus is pulling the image from Dockerhub. First thing is to install Docker in our public VM:

A terminal window titled 'ubuntu@ip-172-31-27-160: ~' showing the command 'sudo snap install docker' being executed. The output is 'docker 18.06.1-ce from Canonical✓ installed'.

```
ubuntu@ip-172-31-27-160: ~  
ubuntu@ip-172-31-27-160:~$ sudo snap install docker  
docker 18.06.1-ce from Canonical✓ installed
```

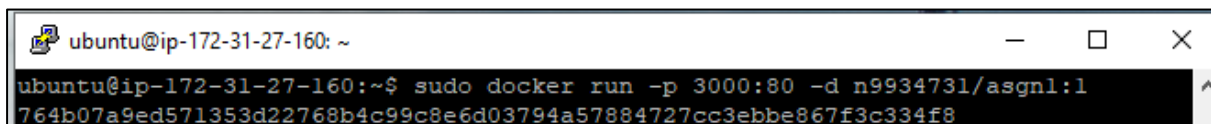
Then login your Dockerhub credentials and pull the image:

A terminal window titled 'ubuntu@ip-172-31-27-160: ~' showing the command 'sudo docker login' followed by 'sudo docker pull n9934731/asgnl:1'. The output shows the login process and the successful pull of the image with its digest and status.

```
ubuntu@ip-172-31-27-160: ~  
ubuntu@ip-172-31-27-160:~$ sudo docker login  
Login with your Docker ID to push and pull images from Docker Hub. If you don't  
have a Docker ID, head over to https://hub.docker.com to create one.  
Username: n9934731  
Password:  
WARNING! Your password will be stored unencrypted in /root/.docker/config.json.  
Configure a credential helper to remove this warning. See  
https://docs.docker.com/engine/reference/commandline/login/#credentials-store  
  
Login Succeeded  
ubuntu@ip-172-31-27-160:~$ sudo docker pull n9934731/asgnl:1  
1: Pulling from n9934731/asgnl  
b8f262c62ec6: Pull complete  
cd902351b877: Pull complete  
bfd96150ed4c: Pull complete  
091f390be83f: Pull complete  
38a8448b9186: Pull complete  
e875e3695027: Pull complete  
c43e90d13a65: Pull complete  
Digest: sha256:f0d2dcc77e6ab7f70b1e98acb22cba0e826eeaf0dee9faf69e9bf5a6fce5aa0  
Status: Downloaded newer image for n9934731/asgnl:1  
ubuntu@ip-172-31-27-160:~$
```

### Containerising Docker App

Our final step is to contain our image that we pulled from the repository. We will be running the image at this point and exposing its ports to the public where we can now access the website anywhere, which is now hosted by the public VM.

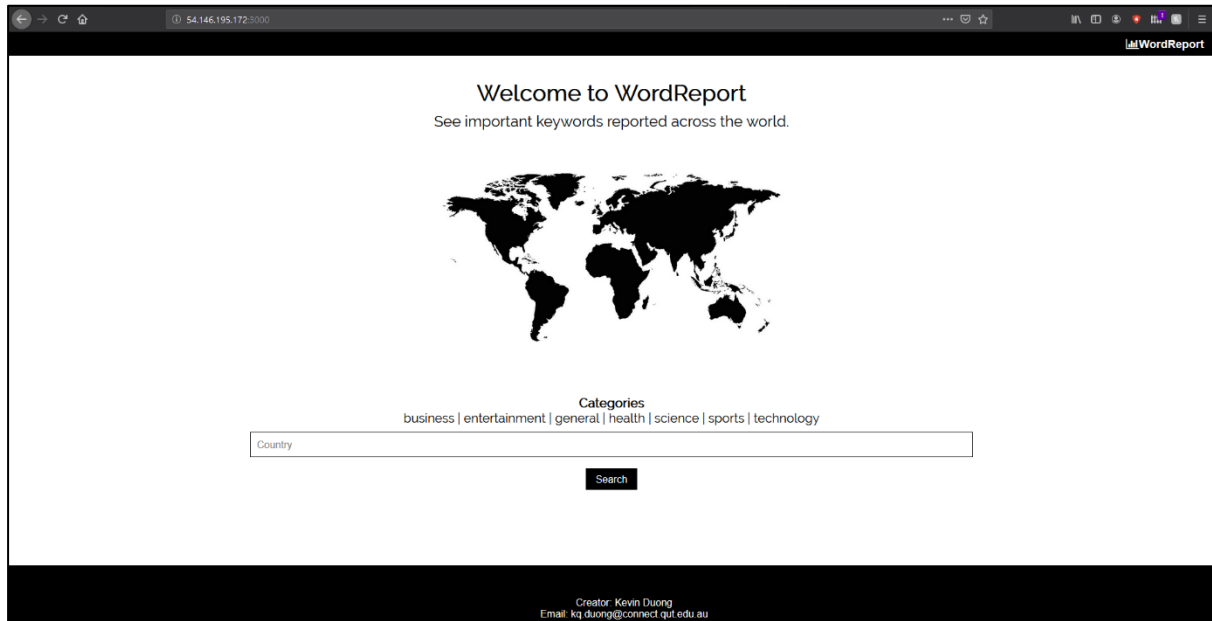
A terminal window titled 'ubuntu@ip-172-31-27-160: ~' showing the command 'sudo docker run -p 3000:80 -d n9934731/asgnl:1'. The output is a long alphanumeric string representing the container ID.

```
ubuntu@ip-172-31-27-160: ~  
ubuntu@ip-172-31-27-160:~$ sudo docker run -p 3000:80 -d n9934731/asgnl:1  
764b07a9ed571353d22768b4c99c8e6d03794a57884727cc3ebbe867f3c334f8
```

The virtual machine is now running the app as expected. Port 80 is a private port, but using port 3000, we can access the page here:

*`http://18.206.169.246:3000`*

Just like the local version, the website is now running on the virtual machine.



We can also check the container list to see it running:

```
ubuntu@ip-172-31-27-160:~$ sudo docker container list
CONTAINER ID   IMAGE          COMMAND                  CREATED
STATUS        PORTS          NAMES
764b07a9ed57   n9934731/asgnl:1  "docker-entrypoint.s..."  2 minutes ago
Up 2 minutes   0.0.0.0:3000->80/tcp  lucid_bardeen
```

To end the server, simply stop the container ID:

```
ubuntu@ip-172-31-27-160:~$ sudo docker stop 764b07a9ed57
764b07a9ed57
```