



Helen Burns

Predicting and Visualizing Volcanic
Emissions in Nicaragua

Predicting and visualizing volcanic emissions in Nicaragua

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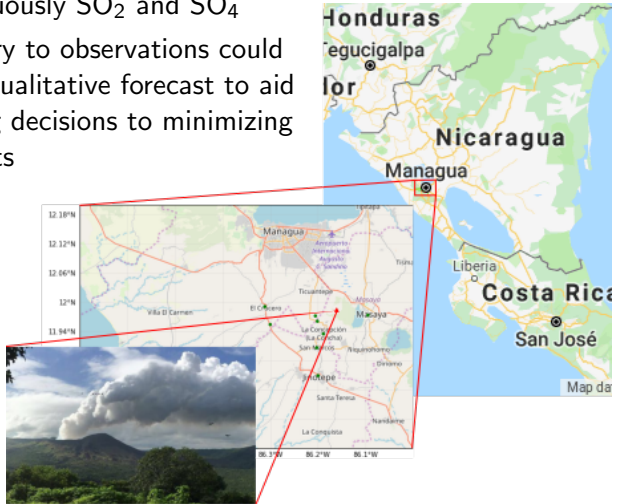
²Icelandic Meteorological Office

³University of Cambridge

July 9, 2019

Overview

- Volcano Masaya, Nicaragua
- Emits continuously SO_2 and SO_4
- Supplementary to observations could we create a qualitative forecast to aid locals making decisions to minimizing health impacts



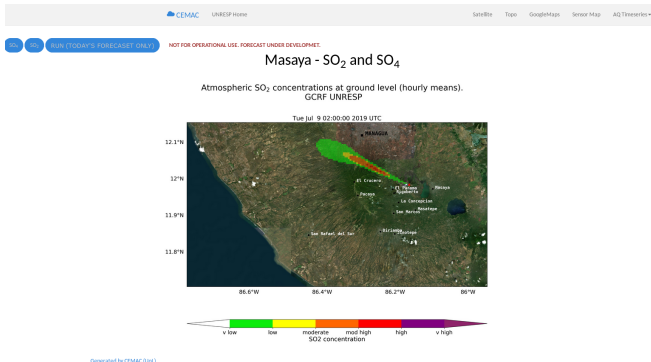
- CEMAC - Center for Environmental Modelling And Computation
- Research Software Engineers with Earth Systems modelling background
- Work with Science team to set up scientifically robust dispersion model to forecast concentrations of Sulphides and Sulphates
- Make the tool portable and easy to use and adapt
- Include visualization tools to display results

- CALPUFF dispersion model
- Modifications and scientific alterations added to git hub with scripts to install model.
- Created an automated work flow that takes meteorological datasets that are publicly available, processes them and runs the dispersion model.
- The whole modelling system from compiling to analysis can be ran in one command with out any prior knowledge of CALPUFF

The screenshot shows the GitHub repository page for the UNRESP Forecasting System. At the top, the CEMAC logo is displayed, along with the text 'Centre for Environmental Modelling and Computation' and the 'UNIVERSITY OF LEEDS' logo. The repository name 'UNRESP Forecasting System' is prominently featured. Below this, a navigation bar includes links for 'release v3.0', 'fortran 94.4%', 'issues 7 open', 'last commit today', 'downloads 0', 'license MIT', and 'DOI 10.5281/zenodo.2657642'. The main content area states: 'Repository for the UNRESP Forecasting System: An automated forecasting system has been created that uses the CALPUFF dispersion model to predict SO₂ and SO₄ concentrations around the Masaya volcano. This is based on the current forecasting system implemented by IMO, but with modifications and improvements. This work is displayed at: homepages.see.leeds.ac.uk/~earunres. The repository hosts the scripts required to run the CALPUFF dispersion model to predict SO₂ concentrations around the Masaya volcano forecasting for 48 hours using NAM data. The hourly output is plotted in individual png and googlegmaps files (visualisation can be turned on or off). A 'DOCUMENTATION' section follows, with a note that full documentation can be found on the repository's wiki. A 'Summary documentation' section lists five items: Requirements, Installation, Usage-Quick-Start, Visualization, and Contributions.

Visualization

- Visualization tools can automatically generate images and animations to display the forecast
- We provide a stand alone web tool that can be hosted locally using a simple python server
- www.homepages.leeds.ac.uk/~earunres



- Tested at number of institutions/ countries and platforms
- Beta version citeable via Zenodo
- To be implemented at INITER, but possible for others to use or tweak.
- In the process of fully documenting both science and code on github ready for future release.



Martin Callaghan

Masters' Level Apprenticeships –
Professional Learning and Development
for New RSEs



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Professional Learning Programmes and Masters Apprenticeships

Martin Callaghan & Nicola Williams

The Case for Apprenticeships (in RSE)



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We'd be mad not to.....

- It's a chance to think differently about the way we develop people
- We can recruit talent at the start of their career and allow them to gain “job ready” practical experience, whilst studying
- Tailored on-the-job training enabling us to build the skills we need in our workforce
- Apprenticeships will bring **diversity** of thought and different types of **experience** in to the service
- ***Higher level apprenticeships can be used to retrain/upskill existing staff members***
- A cost effective approach to funding development of RSEs by utilising levy funding
- A model to define a skills and competencies framework for RSE activity



The Apprenticeship Levy

- As of 6th April 2017 all employers with an annual wage bill of over £3m have to pay into the apprenticeship levy
- The levy is charged at 0.5% of the pay bill and is to be used to fund apprenticeship training in the organisation
- The money can only be used to fund apprentice training and end-point assessment. It cannot go towards salary or overhead costs
- Any money that isn't spent within 24 months of being paid into the apprenticeship fund goes to the government
- The cost per technical apprenticeship varies between £15,000 and £27,000, so it's going to be hard to spend this money

Apprenticeships have evolved



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- There are now different levels of apprenticeships

Apprenticeship Level	Equivalent educational level
Intermediate (2)	GCSE
Advanced (3)	A level
Higher (4,5,6,7)	Foundation degree and above
Degree (6 & 7)	BSc or MSc degree

- An opportunity to bring in talent at different stages of their career
- An opportunity to develop new talent
- There are no age restrictions on apprenticeship schemes
- They can be used to upskill and retrain existing staff members

What are our plans?



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Growing our own:

- Masters Level Programme for Research IT Staff
- Development Programmes for Research IT Staff
- Graduate training scheme for non IT graduates
- Supporting career change across the university not just IT

Supporting teamwork and collaboration:

- Bespoke IT programme
- University of Leeds providing the training

Masters Level Programme



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COMMON MODULES

Business and Technology	20
Technical and Digital Leadership	20
Major Postgraduate Project	60

SIX PATHWAY OPTIONS



SOFTWARE ENGINEERING * PATHWAY

Software Engineering Principles	20
Software Engineering Professional Practice I	20
Software Engineering Professional Practice II	20
Building OO Applications Professional Practice	20
	20
	20



DATA AND ANALYTICS PATHWAY

Data and Analytics Principles	20
Data and Analytics Professional Practice I	20
Data and Analytics Professional Practice II	20
Databases	20
Professional Practice	20



CYBER SECURITY PATHWAY

Data and Analytics Principles	20
Cyber Security Professional Practice I	20
Cyber Security Professional Practice II	20
Technical and Network Security	20
Professional Practice	20



ENTERPRISE ARCHITECT PATHWAY

Enterprise Architecture Principles	20
Enterprise Architecture Professional Practice I	20
Enterprise Architecture Professional Practice II	20
Technical Architecture	20
Professional Practice	20



IT OPS MANAGEMENT (CLOUD COMPUTING) PATHWAY

Cloud Operations Principles	20
Cloud Operations Professional Practice I	20
Cloud Operations Professional Practice II	20
Linux, Networking & Scripting	20
Professional Practice	20



IT/DIGITAL FUTURES (DEVOPS) PATHWAY

DevOps Principles	20
DevOps Professional Practice I	20
DevOps Professional Practice II	20
Linux, Networking & Scripting	20
Professional Practice	20

Masters Level Programme



COMMON MODULES

Module Name	Business and Technology
Credits	20
Optional / Core	Core
Year	Year 1
Description	<p>In this module, the learner will develop critical knowledge and skills in Innovation in Business and Technology.</p> <p>Typical topics covered in the module include; understanding the typology of innovation, how firms leverage internal and external resources to compete in the digital environment, and how to plan for innovation in the learner's organisation.</p> <p>This module prepares learners to think about innovation activities in the context of their IT specialism as well as the wider organisation and business ecosystem.</p>

Technical and Digital Leadership
20
Core
Year 1
<p>In this module, the learner will develop critical knowledge and skills in Technical & Digital Leadership.</p> <p>Typical topics covered in the module include; understanding the art and science of leading engineering and technology organisations and how to leverage a combination of individual capabilities and technology management practices and tools to deliver business impact and performance.</p> <p>This module addresses a critical gap in the learning and career development of future leaders operating in complex technological environments.</p>

Major Postgraduate Project
60
Core
Year 1
<p>In this module the learner will engage in a major applied research project, which demonstrates their ability to:</p> <ul style="list-style-type: none">• Undertake an extensive academic literature review• Develop evaluative skills and research outcomes in Digital & Technology Solutions• Apply them in the learner's workplace context• Critically analyse the implementation and recommend potential future improvements

Masters Level Programme



SOFTWARE ENGINEERING PATHWAY

Module Name	Software Engineering Principles
Credits	20
Optional / Core	Core
Year	Year 1
Description	<p>In this module, the learner will develop critical knowledge and skills in Software Engineering.</p> <p>Typical topics covered include; software life cycle models, agile development, continuous integration and source control, organising development projects, object-oriented modelling and test driven development - all areas considered to be essential for a Software Engineering professional.</p>

Software Engineering Professional Practice I
20
Core
Year 1
<p>A key element of the learner's journey towards becoming a Digital and Technology Specialist is their ongoing skills development. This is the first of two core modules in which they shall engage in a recognised CPD programme relating to their specialist pathway and to reflect upon how such learning can be embedded back into the workplace. To enable this we will consider the following areas:</p> <ul style="list-style-type: none">• Identification of a relevant skills need and subsequent CPD programme, embedded into the learner's module delivery• Design and presentation of a Professional Practice Log using appropriate reflective framework• Strategies to embed learning from their CPD into practice


Software Engineering Professional Practice II
20
Core
Year 1
<p>A key element of the learner's journey towards becoming a Digital and Technology Specialist is their ongoing skills development. This is the second of two core modules in which they shall engage in a recognised CPD programme relating to their specialist pathway and to reflect upon how such learning can be embedded back into the workplace. To enable this we will consider the following areas:</p> <ul style="list-style-type: none">• Identification of a relevant skills need and subsequent CPD programme, embedded into their module delivery• Design and presentation of a Professional Practice Log using appropriate reflective framework• Strategies to embed learning from their CPD into practice



Masters Level Programme



SOFTWARE ENGINEERING PATHWAY



Module Name	Building OO Applications
Credits	20
Optional / Core	Optional
Year	Year 1
Description	<p>In this module, the learner will develop knowledge and skills in Object Oriented (OO) Applications.</p> <p>Typical topics covered include; Analysing real-world software systems challenges and development of structured solutions, object oriented analysis and design methodologies, graphical object oriented software modelling and associated tools, key object oriented design concepts and features such as data abstraction, classes and class hierarchies (inheritance), polymorphism, encapsulation and implementing OO solutions in modern object oriented programming languages.</p>

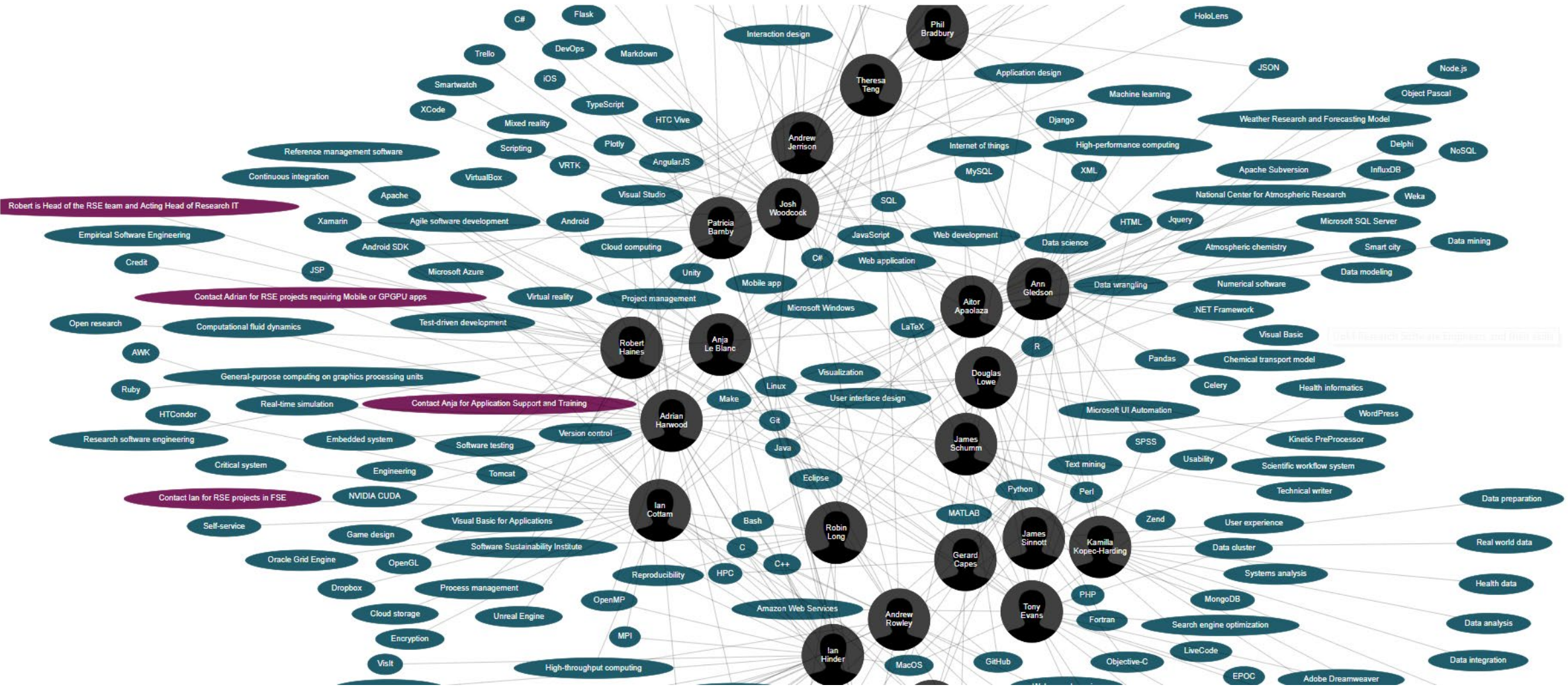
Professional Practice
20
Optional
Year 1
<p>A key element of the learner's journey towards becoming a Digital and Technology Specialist is their ongoing skills development. This module requires them to engage in recognised CPD programmes relating to their specialist pathway and reflect upon how such learning can be embedded back into the workplace. To enable this we will consider the following areas:</p> <ul style="list-style-type: none">• Identification of a relevant skills need and subsequent CPD programme, embedded into their module delivery• Design and presentation of a Professional Practice Log using appropriate reflective framework• Strategies to embed learning from their CPD into practice



Ian Cottam

RSE Skills Graph

UoM Research Software Engineers and their skills





Kate Court

3 Months as a Software Engineer

3 months as a software engineer

Crossing disciplines, embracing difference

Achieving an open mindset

Moving from fear of the unknown to knowing what I don't know

Finding my place

Meaningful contributions take different forms

Exposure

The next 3 months



Adrian Harwood

Mobile App Development



Introducing the Mobile Application Development Service

Adrian Harwood

Mobile and GPGPU Application Lead

Research Software Engineering, Research IT

What is it?

- Would your research benefit from using mobile devices?

- **Data Collection** (Surveys)
- Interventions
- Interactive **Games** for Outreach
- Visual Computing
- **Simulation**
- **Teaching** Companions



What is it?

- Research IT has seen an increase in requests for support developing mobile applications.
- We are now providing a **dedicated service** to researchers to provide a consistent, quality service:



**Research IT Mobile Application
Development Service**

What does it include?

1. Assistance with **project scoping** and preparation of the technical parts of **grant proposals** (free support).
2. Preparation of wireframes and **prototypes** for assessing designs and project feasibility.
3. **Research Software Engineers (RSEs)** to develop the application and dependent services.
4. A **project manager** within Research IT to coordinate the project including the deployment process.

Why do I need it?

Wouldn't it be easier to ask a student to develop an app for me?

- Not always the best option, especially if:
 - Application is **critical to project success**.
 - Mistakes could be **costly**.
 - Application needs **releasing publicly under the university name**.
 - Application needs to satisfy data security **regulations**.
 - Application needs **other IT services to function**.

Why do I need it?

- Mobile applications are **not easy coding projects** and present **unique challenges**:
 - Knowledge of different platforms and **specialised APIs** required.
 - Parallel, **multi-threaded programming** paradigm.
 - Experience needed to make decisions on **native vs hybrid vs web**.
 - Performance-critical applications need **careful implementation**.



APACHE
CORDOVA™



04/04/2019 **ionic**



PhoneGap



Research IT Club Meeting 4th April 2019

LIVECODE

Why do I need it?

- There are also benefits to using a **professional IT service** to deliver an app for you:
 - Research IT couples both software engineering and research infrastructure services: apps **link in with replicated storage systems** for your data.
 - We will help you with the data security procedures to ensure **information governance compliance**.
 - Most of our RSEs have been researchers and even PIs themselves so **we “get” the research environment**.

Why do I need it?

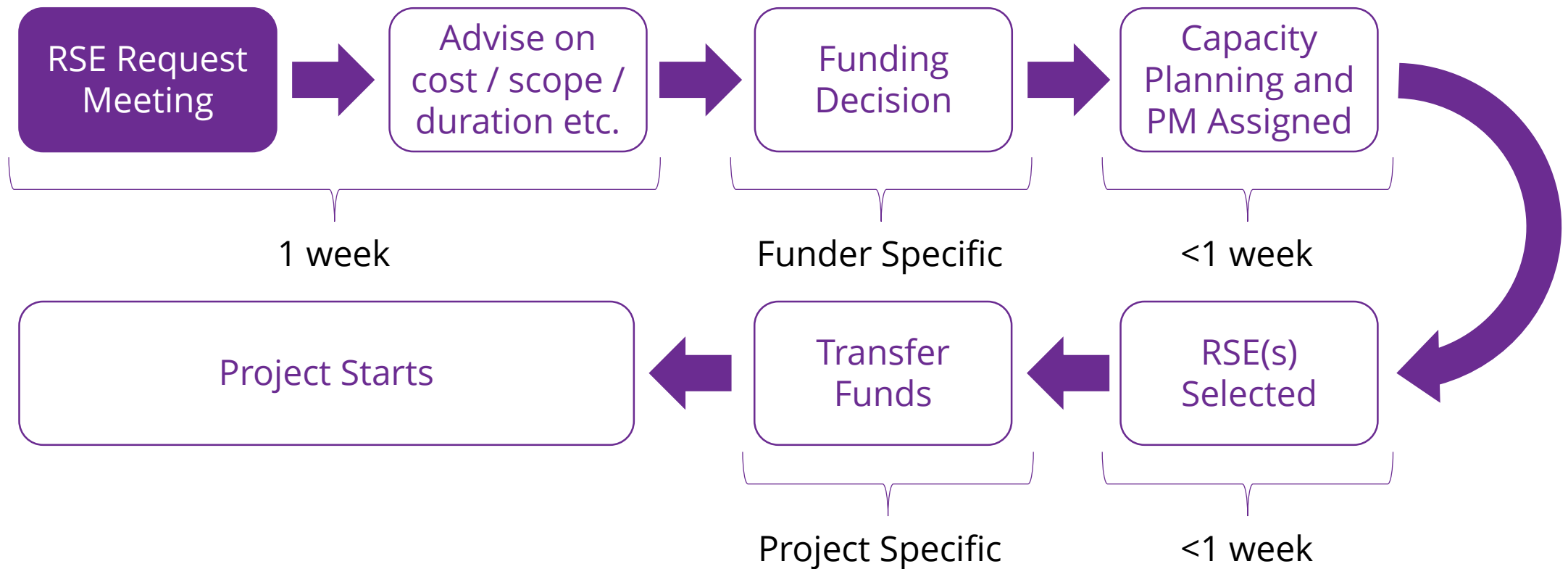
- Compared with an **external company** who might offer a similar service, **but...**
 - Research IT is a support service: helping you do your research is our primary goal, **not making a profit.**
 - We offer great value for money: our **day rate simply covers our costs.**
 - We have in-house **app templates** which are specifically designed for **common research app requests** allowing us to build your solutions quickly.

How do I get access?

- There are 3 methods to request this service:
 1. Raise a Service Desk **ticket** through The Support Portal
 2. Contact your **faculty lead**
 - **Ian Cottam** (FSE Lead)
 - **Andrew Jerrison** (FBMH Lead)
 - **Theresa Teng** (Humanities Lead)
 3. Contact **me** (Adrian Harwood) directly



How do I get access?



How much does it cost?

- In general, RSEs are permanent staff and are treated as a **support service**.
- We are currently in the process of **setting up official guidelines** for costing RSE support with the University's Director of Research Finance.
 - In the meantime, there are two approaches at present:

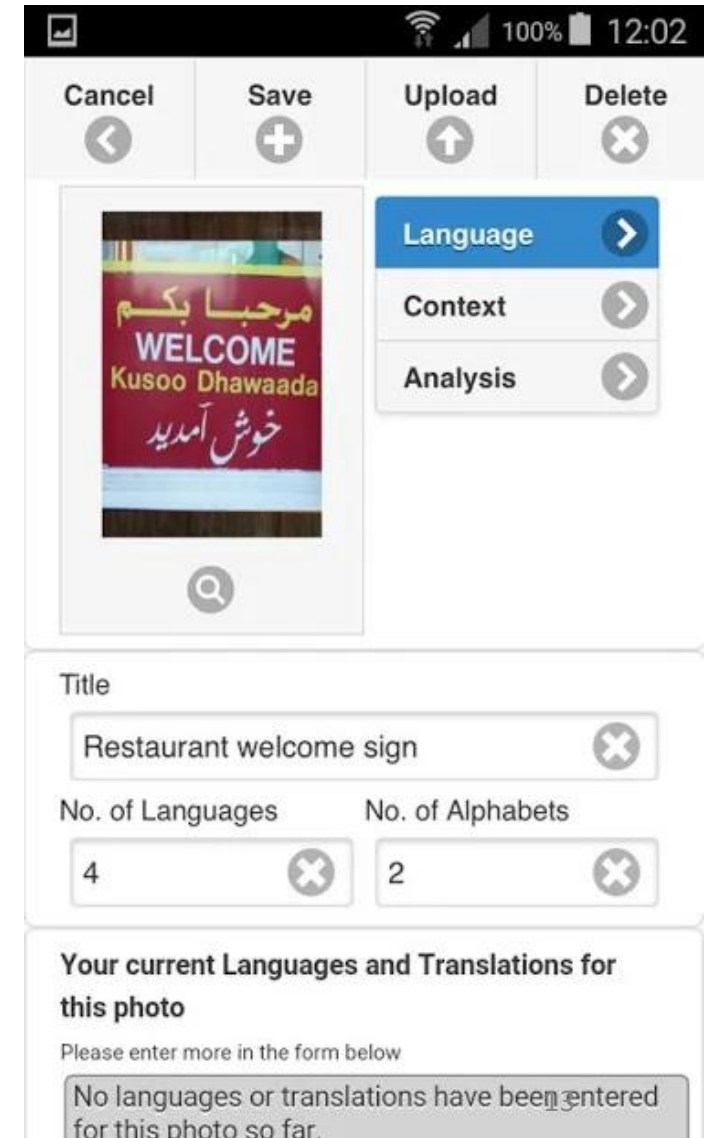
How much does it cost?

1. To cost RSEs on **proposals** (FEC funding not yet secured):
 - RSE services are costed as a **Grade 7.1 support service**.
 - Your Research Support Office can advise.
2. To pay for RSEs from an **existing university account**:
 - RSE services are charged at a **day rate of £250 / day**.
 - This can be authorised as an **internal transfer** through our finance team.

Example Projects

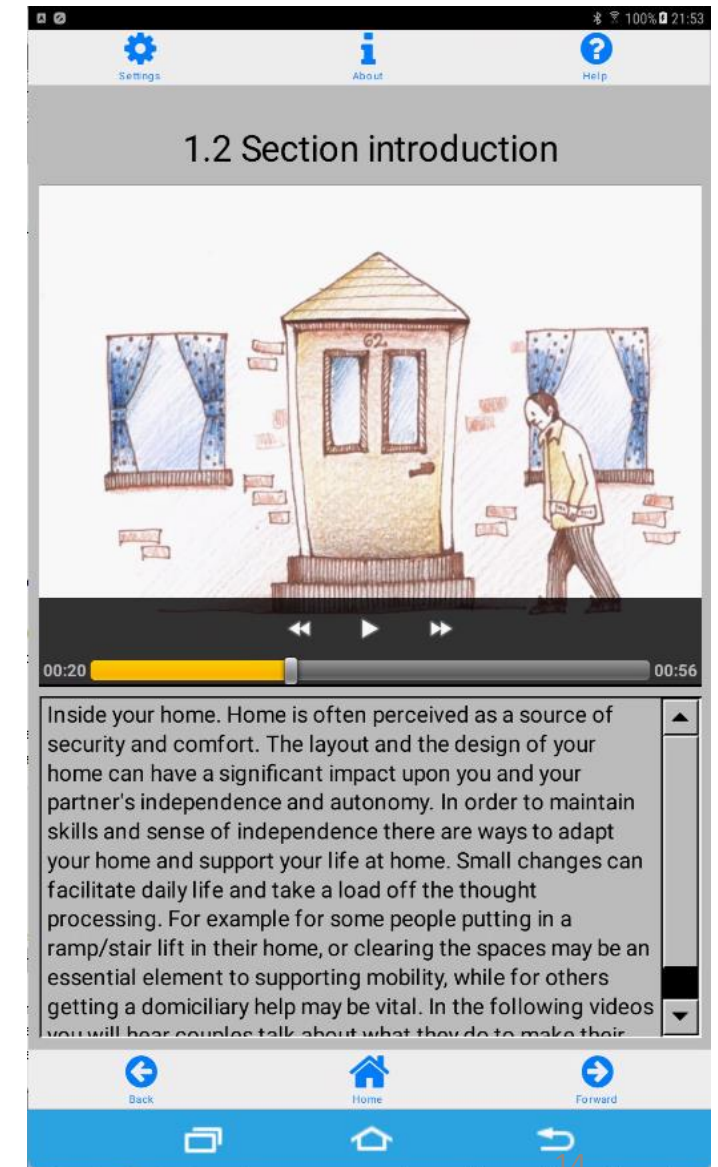


- A project to develop a multi-lingual landscape of Manchester.
- App is a **crucial data collection tool**.
- Cross-platform, web-based application, live on Google Play and Apple App Store.
- Melbourne and Jerusalem variants.



Example Projects

- **DemPower**
- A dementia **support, self-help app** for couples where one of the pair is living with dementia.
- Developed as part of a 5 year ESRC/NIHR project.
- Scripted **videos, activities, music, writing,** exercises and links to further information.

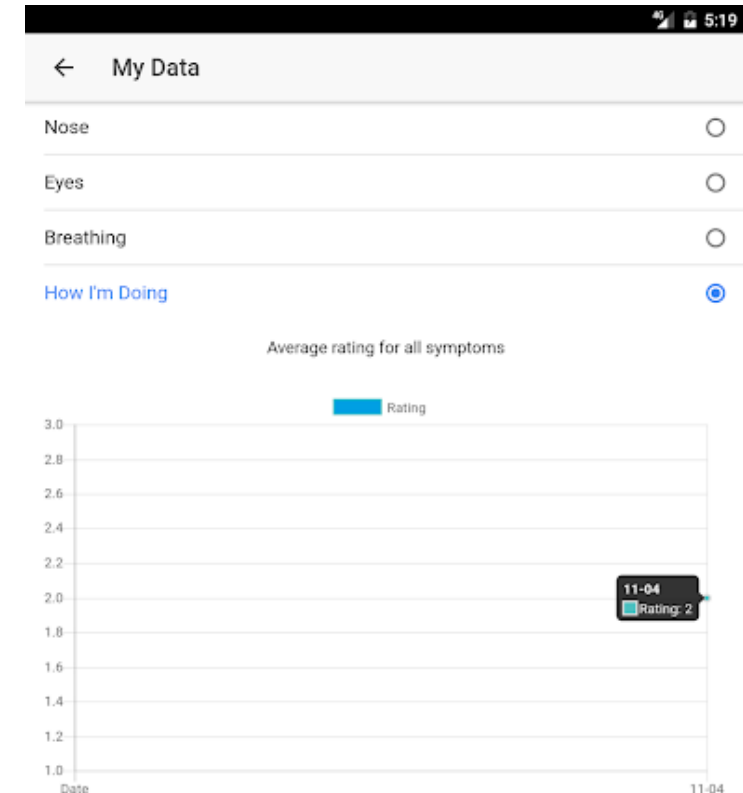


Example Projects

- **Britain Breathing**

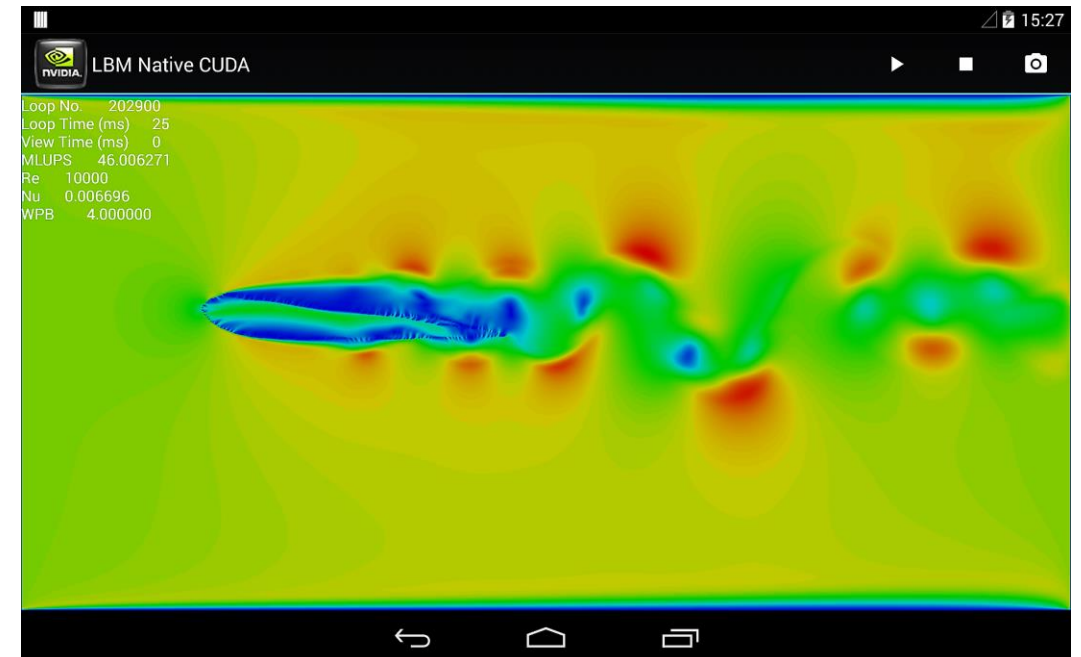


- Helps build a **database of symptoms** of seasonal allergy sufferers.
- A data collection tool with the ability to **track and plot** individuals' progress.
- Currently developing a second version and is a platform for Brazil Breathing.



Example Projects

- We also have expertise in the team in **native** mobile programming for **performance applications**.
- Our expertise includes:
 - **Mobile GPGPU programming** (CUDA and OpenGL)
 - C/C++ on mobile using **JNI**
 - Peer-to-peer connectivity



Take Away

- The Mobile Application Development Service is **live now!**
- Your research does not have to **be** the app: we can develop apps to **support a bigger research goal.**
- We are **flexible**: doesn't have to be 1.0 FTE.
- If you think we can help your research, **please speak to us.**
- We have a **wide variety of expertise** and **in-house templates** to increase productivity.

Adrian Harwood (adrian.harwood@manchester.ac.uk)



Jannetta Steyn

Coding for Research

CODING FOR RESEARCH

Dr Jannetta Steyn

Newcastle University

Senior Research Associate / Research Software Engineer



BE CAREFUL WHAT YOU WISH FOR ...

- I wanted variety
- I wanted to learn new things
- I wanted to learn and use different technologies

TWO PROJECTS

- ProvExplorer:
 1. Visualisation (openprovenance.org, graphstream.org)
 2. Policy syntax
 3. Policy application
 4. GUI for openprovenance.org conversion tool
- CESI – Centre for Energy Systems Integration:
 1. Visualisation
 2. Integration of models
 3. Scaling

PROVEXPLORER

The image displays the Provenance Explorer application interface, which is used for managing and visualizing provenance data. It consists of several main components:

- Code Editor:** Shows a Provenance Language (PROVN) script for an abstraction example. The script includes sections for activity, merging, analytics uses, analytics generates, final merging, and generating the final result. Key lines include:

```
38 // analytics activity
39
40 activity(ir:analytics1)
41 activity(ir:analytics2)
42 activity(ir:analytics3)
43
44 // merging
45
46 // analytics uses
47
48 used(ir:analytics1,ir:AJC-summary,-)
49 used(ir:analytics2,ir:AJC-summary,-)
50 used(ir:analytics2,ir:BNC-summary,-)
51 used(ir:analytics3,ir:BNC-summary,-)
52
53 // analytics generates
54
55 wasGeneratedBy(ir:report-1,ir:analytics1,2013-06-18T11:10:00)
56 wasGeneratedBy(ir:report-2,ir:analytics2,2013-06-18T11:10:00)
57 wasGeneratedBy(ir:report-3,ir:analytics3,2013-06-18T11:10:00)
58
59 // final merging
60
61 used(ir:report-editing,ir:report-1,-)
62 used(ir:report-editing,ir:report-2,-)
63 used(ir:report-editing,ir:report-3,-)
64
65 // generating the final result
66
67 wasGeneratedBy(ir:advice-reports, ir:report-editing, 2013-06-18T11:10:00)
68
69
70 endDocument
71
```
- Provenance Conversion Tool GUI:** A dialog box for configuring the conversion process. It includes fields for:
 - Verbose and Debug options (On/Off).
 - Select log file, Select input file, and File in format.
 - Select output file, File out format, and Select file for declaration of prefix namespaces.
 - Enter heading text, Select dot output form (set to 'dot'), and Select file for bindings to template.
 - Select bindings format.
 - Bindings version (set to 3), graph generator (N:n:first:seed:1), Generate order (On/Off), All expanded (On/Off), and Index (On/Off).
 - Template resource location, Select index file for merging, and Flatten (On/Off).
 - Package of bindings been class, Location of template resource, and File to compare with.
 - Output file for log comparison and an Execute button.
- Provenance Graph:** A directed graph visualizing the relationships between nodes. Nodes are represented by colored ovals:
 - Yellow ovals: `AJC-summary`, `BNC-summary`, `report-1`, `report-3`, and `advice-reports`.
 - Blue ovals: `analytics1`, `analytics3`, and `blurred`.Relationships are shown as directed edges:
 - `advice-reports` (yellow) generates (`gen`) `blurred` (blue).
 - `report-1` (yellow) generates (`gen`) `analytics1` (blue).
 - `report-3` (yellow) generates (`gen`) `analytics3` (blue).
 - `blurred` (blue) uses (`use`) `report-1` (yellow), `report-3` (yellow), and `advice-reports` (yellow).
 - `analytics1` (blue) uses (`use`) `AJC-summary` (yellow).
 - `analytics3` (blue) uses (`use`) `BNC-summary` (yellow).

CESI

- QGIS
- GeoServer – AWS Server
- OpenLayers
- JavaScript
- D3 Sankey

USING QGIS TO VISUALIZE GEOSPATIAL INFORMATION

The image shows a QGIS application window in the background and a GeoServer web browser window in the foreground. The GeoServer window displays the 'Layer Preview' page, which lists configured layers and provides preview options for each.

GeoServer Layer Preview Page:

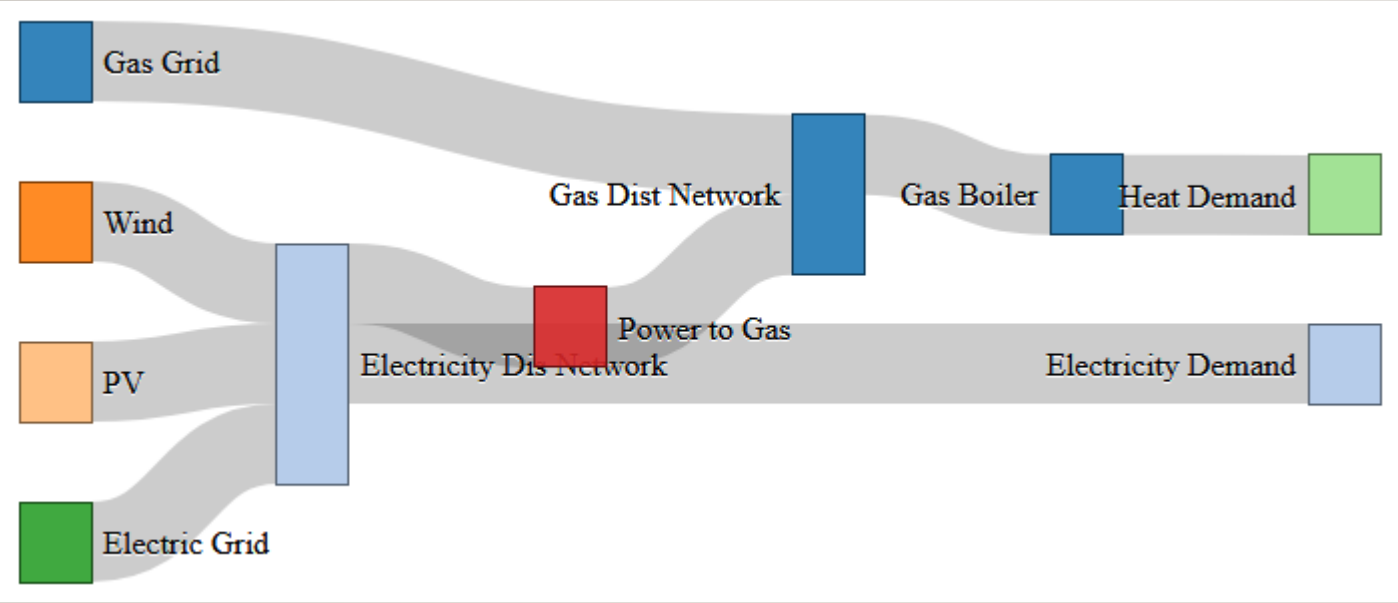
List of all layers configured in GeoServer and provides previews in various formats for each.

Results 1 to 5 (out of 5 items)

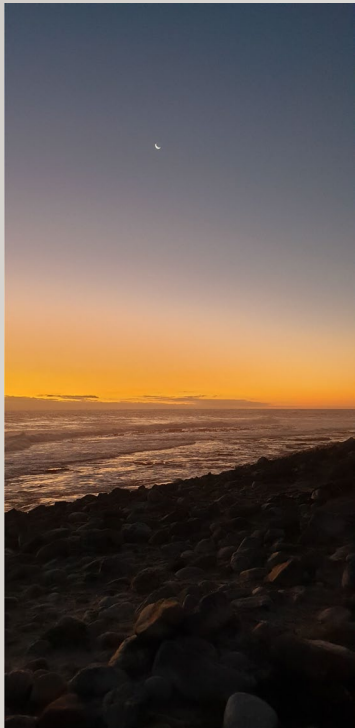
Type	Title	Name	Common Formats	All Formats
Point	Findhorn Houses	Scotland:Findhorn Houses	OpenLayers KML GML	Select one
Point	Scotland buildings	Scotland:gis_osm_buildings_a_free_1	OpenLayers KML GML	Select one
Line	Scotland roads	Scotland:gis_osm_roads_free_1	OpenLayers KML GML	Select one
Point	nodes	Scotland:nodes	OpenLayers KML GML	Select one
Point	turbines	Scotland:turbines	OpenLayers KML GML	Select one

Results 1 to 5 (out of 5 items)

D3 SANKEY



BACK TO THE FUTURE



```
Server.java /home/steve/Desktop
1
2 public class Server {
3
4     private String ip;
5     private int port;
6
7     public Server(String ip, int port){
8         this.ip = ip;
9         this.port = port;
10    }
11
12    public String getIp(){
13        return this.ip;
14    }
15
16    public void setIp(String ip){
17        this.ip = ip;
18    }
19
20    public int getPort(){
21        return this.port;
22    }
23 }
```