



Applications, Algorithms and Data:  
Open Educational Resources and the  
Next Generation of Virtual Learning

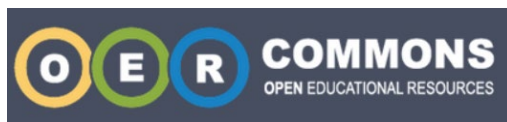
Stephen Downes  
RELIF  
Hammamet, Tunisia  
November 30, 2017

- Abstract: Open Educational Resources (OER) have traditionally been thought of as replacements for classroom materials such as textbooks, teaching aids, study guides, and background resources. In more recent years they have come to include multimedia resources such as animations, podcasts and videos, and they have led to the development of new educational modalities, such as massive open online courses (MOOCs). The next generation of OERs will take a step beyond traditional media and classroom support and begin to take advantage of the unique properties of virtual learning. Using examples such as virtual containers and actionable data books, education technology researcher Stephen Downes will sketch the future for the next generation of OERs as a distributed and interactive network of applications, algorithms and data.

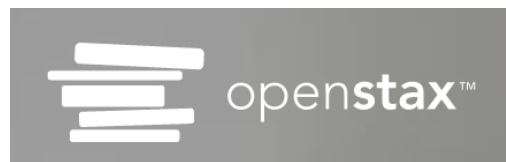
# State of the Art



# OER Repositories

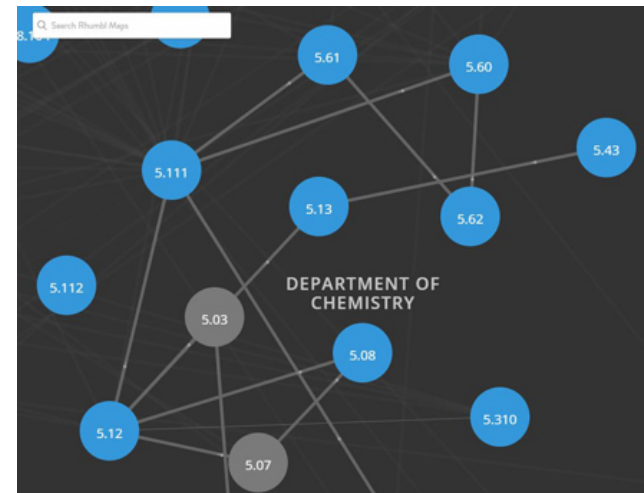


<https://www.oercommons.org/>



<https://openstax.org/>

OERs are now widely available through subject-specific libraries with provisions for authoring as well

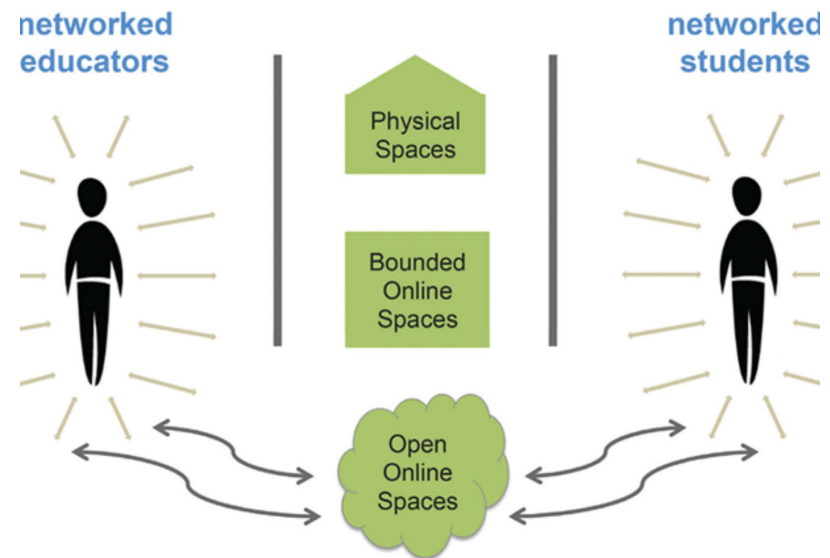


<https://ocw.mit.edu/>

# Open Resources, Open Teaching

- Open Pedagogy – Using OER to Change How We Teach – Heather Ross  
<https://words.usask.ca/gmcte/2016/09/26/open-pedagogy-using-oer-to-change-how-we-teach/>
- Open Education, Open Questions – Catherine Cronin  
<https://er.educause.edu/articles/2017/10/open-education-open-questions>

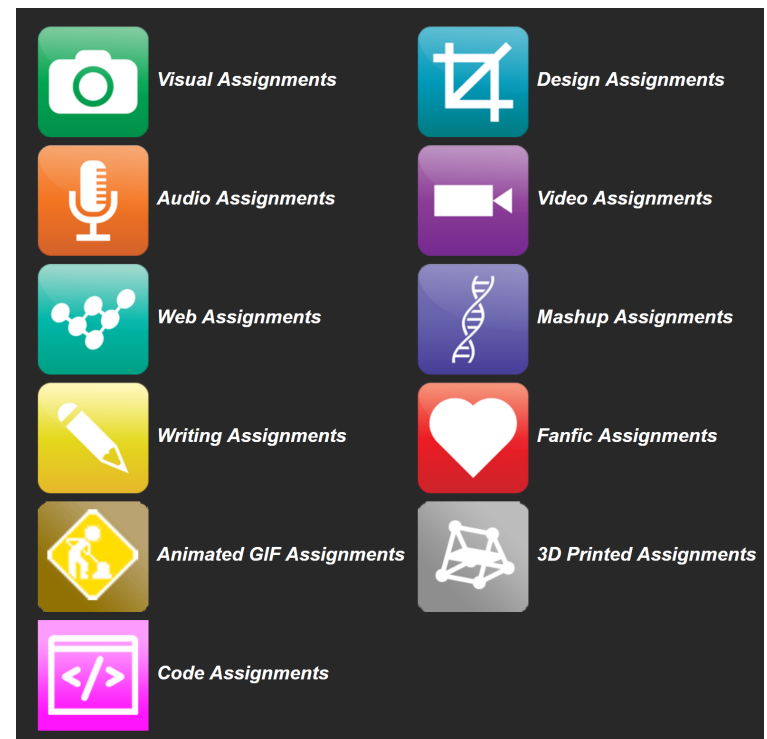
“The use of open practices by learners and educators is complex, personal, and contextual; it is also continually negotiated.”



1. A Model for Networked Education (Credit: Image by Catherine Cronin<sup>✉</sup>, building *Networked Teacher*<sup>✉</sup> by Alec Couros. CC BY-SA)

# OERs as Student Production

- DS106 – assignment bank  
<http://assignments.ds106.us/>
- Domain of One's Own -  
<https://reclaimhosting.com/domain-of-ones-own/>
- Creation of OERs through 'renewable assignments' – Christina Hendricks  
<http://flexible.learning.ubc.ca/news-events/renewable-assignments-student-work-adding-value-to-the-world/>



# Open Case Studies

- case studies that can be used by anyone, at UBC or elsewhere.
- Many focus on topics in sustainability
- cases on this site are open educational resources: they have an open license to allow for revision and reuse of the cases in other courses and contexts

Quoted from: <http://cases.open.ubc.ca/>



#### GWAII HAANAS NATIONAL PARK PRESERVE

Gwaii Haanas Park reserve and Haida Heritage site is an archipelago of 138 islands that lies 130km off the coast of mainland British Columbia; known simply as Gwaii Haanas, this area is protected as both a National Park reserve and an important Herit...

[Read More](#)



#### FORT MCMURRAY AND THE FIRES OF CLIMATE CHANGE

Fort McMurray, located in a beautiful service area with vast oil sands deposit in northeast of Alberta, is surrounded by peatlands and boreal forests of aspen and spruce. Though normally very wet, Fort McMurray is relative dry and hot in summer, and ...

[Read More](#)



#### ECOLOGICAL AND SOCIAL COSTS OF COTTON FARMING

In today's age, cotton is one of the most versatile crops that the earth has to offer. Many of us are familiar with the usage of clothing in cotton, but cotton is also used in beauty products and food products as well. Look at the clothes that you ar...

[Read More](#)



#### GOLF COURSE CONSERVATION MANAGEMENT

Urbanization is a trend that continues to remain consistent and dominant in our world today. Countries continue to expand infrastructure and grow industry in order to meet both global and national demands. As countries develop, rural landscapes are C...

[Read More](#)



#### SUBURBAN GOLF COURSE

There is much debate within our society today about whether or not golf courses provide conservation value. While some articles portray golf courses as improving conservation value by creating habitat for sensitive organisms, others sources are cynic...

[Read More](#)



#### CULTURAL KEYSTONE PLACES

The Colorado river delta was once a thriving and biological productive region, which spanned two million acres across Northwestern Mexico. However, by the middle of the twentieth century, the Colorado river began to be diverted and dammed for irrigat...

[Read More](#)



#### BIOFUELS

Biofuel is the product of the refinement of plant biomass which can then be burned for heat or light energy. It is made of organic matter, either directly from plants or indirectly from domestic, industrial or commercial wastes. There are different T...

[Read More](#)



#### TEACHER BLOGGER

Sarah has recently begun her first contract as a certified teacher at a high school in Vancouver. The position allows her to teach Physical Education and coach one of the school's basketball teams, which is exciting for her, as she is able to bring t...

[Read More](#)

# Content Syndication

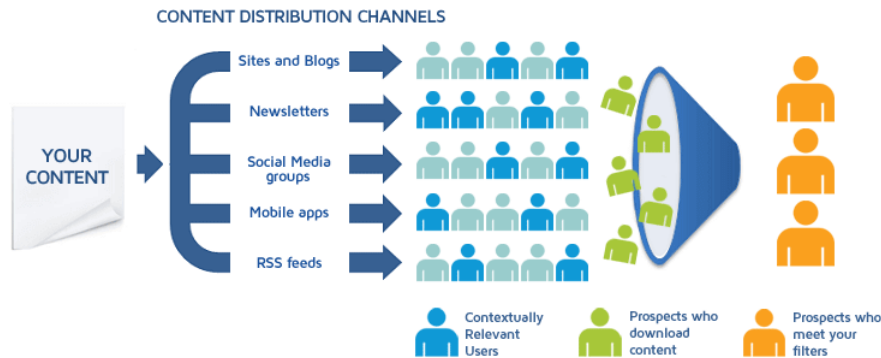


Image:

<https://blog.izooto.com/best-content-syndication-tools/>

- Blog posts and comments were the core of CCK08
  - gRSShopper – <http://grsshopper.downes.ca>
- FeedPress - <https://wordpress.org/plugins/feedpress/>
- FeedBurner - <https://feedburner.google.com>



# Scrapy

```
Terminal

$ pip install scrapy
$ cat > mspider.py <<EOF
import scrapy

class BlogSpider(scrapy.Spider):
    name = 'blogspider'
    start_urls = ['https://blog.scrapinghub.com']

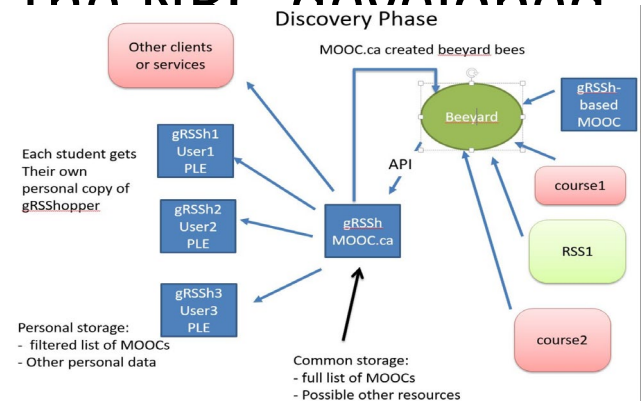
    def parse(self, response):
        for title in response.css('h2.entry-title'):
            yield {'title': title.css('a ::text').extract_first()}

        for next_page in response.css('div.prev-post > a'):
            yield response.follow(next_page, self.parse)

EOF
$ scrapy runspider mspider.py
```

<https://scrapy.org/>

- Python framework to aggregate and store content in RSS feeds and web sites
- Forms the core of the MVC developed



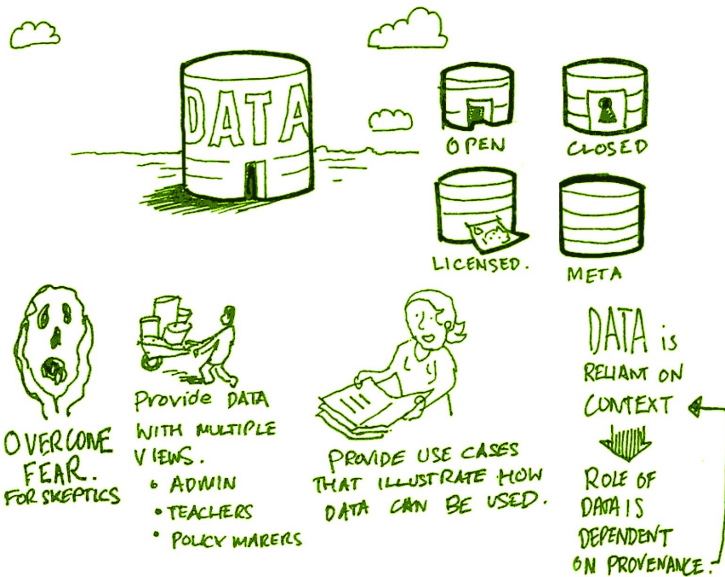
# MOOC.ca and gRSShopper



<http://grsshopper.downes.ca/>

[www.mooc.ca](http://www.mooc.ca) is an aggregator of MOOC course offerings (and is planned to aggregate OERs as well) using gRSShopper and Beeyard

# Open Data as OERs



- Civic engagement in Italy
- Into programming assignments
- Article-level metrics
- Geodata and Land Walks in Wales
- Open data for sustainable development

Atenas, J., & Havemann, L. (Eds.). (2015). Open Data as Open Educational Resources: Case studies of emerging practice. London: Open Knowledge, Open Education Working Group. <http://dx.doi.org/10.6084/m9.figshare.1590031>  
Also: Leo Havemann, slides [http://eprints.bbk.ac.uk/14750/1/Leo\\_ODasOER\\_UCL\\_4March16.pdf](http://eprints.bbk.ac.uk/14750/1/Leo_ODasOER_UCL_4March16.pdf)

# CodePen

10 stunning hover effects with scss  
A PEN BY Renan C. Araujo

Run Fork Settings Change View Log In Sign Up

**HTML**

```
1 <section class="head">
2   <a href="" data-bf="10 Stunning" data-af="with
  scss">HOVER EFFECTS</a>
3 </section>
4
5 <section class="p10">
6   <a href="">camera</a>
7 </section>
8 <section class="p11">
9   <a href="">
10     ROAD
11   </a>
12
13 </section>
14 <section class="p12">
```

**CSS (SCSS)**

```
1 @import "bourbon";
2
3 @import url(https://fonts.googleapis.com/css?
  family=Martel+Sans:200,300,400,800,900);
4
5 $image1: '//caraujo_pens.surge.sh/images/uZlR2bB.jpg';
6 $image2: '//caraujo_pens.surge.sh/images/OfpVv0s.jpg';
7 $image3: '//caraujo_pens.surge.sh/images/QYS0sMB.jpg';
8 $image4: '//caraujo_pens.surge.sh/images/qXJds9L.jpg';
9 $image5: '//caraujo_pens.surge.sh/images/0CroXDG.jpg';
10 $image6: '//caraujo_pens.surge.sh/images/TC4rvkU.jpg';
11 $image7: '//caraujo_pens.surge.sh/images/KBhOYIr.jpg';
12 $image8: '//caraujo_pens.surge.sh/images/cNm0LmL.jpg';
13 $image9: '//caraujo_pens.surge.sh/images/onQye0q.jpg';
14 $image10:
```

**JS**

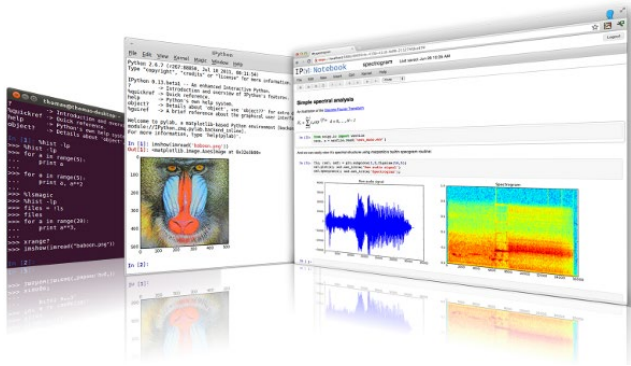
```
1 //all images by unsplash.com
2 //Chicago by Blaise Sewell:
  https://thenounproject.com/term/chicago-skyline/76262/
```

SABER

Console Assets Comments Shortcuts Share Export Embed

<https://codepen.io/caraujo/pen/LVPzxO>

# iPython and Jupyter



- iPython is an interactive programming shell for the Python programming language <https://ipython.org/>



- The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code... <http://jupyter.org/>

# A gallery of interesting Jupyter Notebooks

```
In [4]: my @svg = split ' ', q[
        https://upload.wikimedia.org/wikipedia/commons/f/fd/G
        https://upload.wikimedia.org/wikipedia/commons/f/f9/L
        ];
        IPerl->display( IPerl->svg( $_ , width => "200" ) ) for @svg;
        $png_display;
```



<https://github.com/jupyter/jupyter/wiki/A-gallery-of-interesting-Jupyter-Notebooks#machine-learning-statistics-and-probability>

noise, rotational and glacial seismology, and more.

## Linguistics and Text Mining

- [Workshop on text analysis](#) by Neal Caren.
- [Detecting Algorithmically Generated Domains](#), part of the [Data Hacking](#) collection on security-oriented data analysis with IPython & friends.
- [Mining the Social Web \(2nd Edition\)](#). A complete collection of notebooks accompanying Matthew Russel's book by O'Reilly.

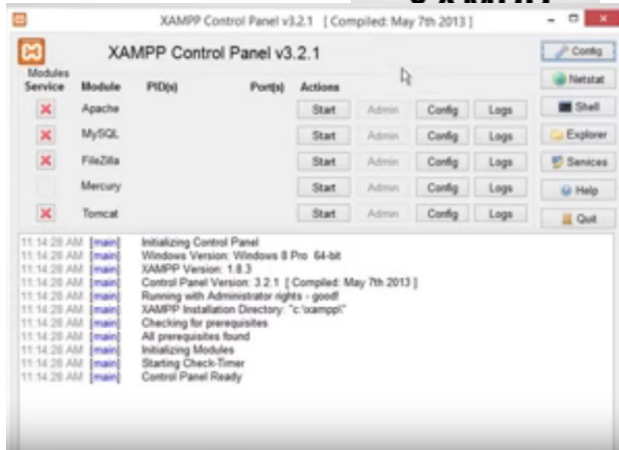
## Signal Processing

- [Sound Analysis with the Fourier Transform](#). A set of IPython Notebooks by Caleb Madrigal to explain what the Fourier Transform is and how to use it for basic audio processing applications.
- [An introduction to Compressed Sensing](#), part of [Python for Signal Processing](#): an entire book (and blog) on the subject by Jose Unpingco. [adasd](#)
- [Kalman and Bayesian Filters in Python](#). A textbook and accompanying filtering library on the topic of Kalman filtering and other related Bayesian filtering techniques.
- [Classify human movements using Dynamic Time Warping & K Nearest Neighbors](#): Signals from a smart phone gyroscope and accelerometer are used to classify if the person is running, walking, sitting standing etc. This IPython notebook contains a python implementation of DTW and KNN algorithms along with explanations and a practical application.
- [Digital Signal Processing](#) A collection of notebooks that accompanies a masters course on the topic.
- [An introduction to openCV](#) An introduction course into using openCV for computer vision in python

## Engineering Education

- [Introduction to Chemical Engineering Analysis](#) by Jeff Kantor. A collection of IPython notebooks illustrating topics in introductory chemical engineering analysis including

# XAMPP



“XAMPP is a completely free, easy to install Apache distribution containing MariaDB, PHP, and Perl. The XAMPP open source package has been set up to be incredibly easy to install and to use.”

## XAMPP on a USB Stick

<https://portableapps.com/apps/development/xampp>

<https://willtan.com/installing-xampp-on-usb-flash-drive/>

<https://www.apachefriends.org/index.html>

## Moodle on a Stick

“Spoodle is an up to date portable moodle / ‘moodle on a stick’ solution for learners to access Moodle courses without requiring constant internet access.”



<https://moodle.org/mod/forum/discuss.php?d=342367>

<https://www.youtube.com/watch?v=EsHEgSYKr4A>



# Embedding Applications in Other Applications

- gRSShopper as a Firefox Si

The image shows a Firefox Developer Edition window with the gRSShopper extension installed as a sidebar. The sidebar displays a loading screen with a grasshopper logo and the text "Loading...". The main browser window shows the Firefox Add-ons search results for "sidebar", displaying 2,054 results. The search results include "Gmail Mail Sidebar" (4,439 users), "Yandex.Bar" (548,439 users), and "Sidebar for Facebook™" (2,028 users). The gRSShopper extension is also visible in the "Temporary Extensions" section of the Firefox Developer Edition window.

Firefox Add-ons search results for "sidebar":

- 2,054 results for "sidebar"
- Filter results: Sort by Relevance, Add-on Type: All, Operating System: All, Featured add-ons only:
- Search results:
  - Gmail Mail Sidebar: Gmail right into your Firefox Sidebar. 4,439 users. 5 stars. Baris Derin
  - Yandex.Bar: Advanced toolbar for Firefox. 548,439 users. 5 stars. Yandex
  - Sidebar for Facebook™: Right into your Firefox. Get notifications, instantly. 2,028 users

Firefox Developer Edition window showing gRSShopper as a sidebar:

- Address bar: http://www.downes.ca/cgi-bin/
- gRSShopper sidebar: Loading... (Grasshopper logo)
- Temporary Extensions: gRSShopper as a Sidebar. This WebExtension has a temporary ID. Learn more.
- Activity Stream: Extension ID: activity-stream@mc

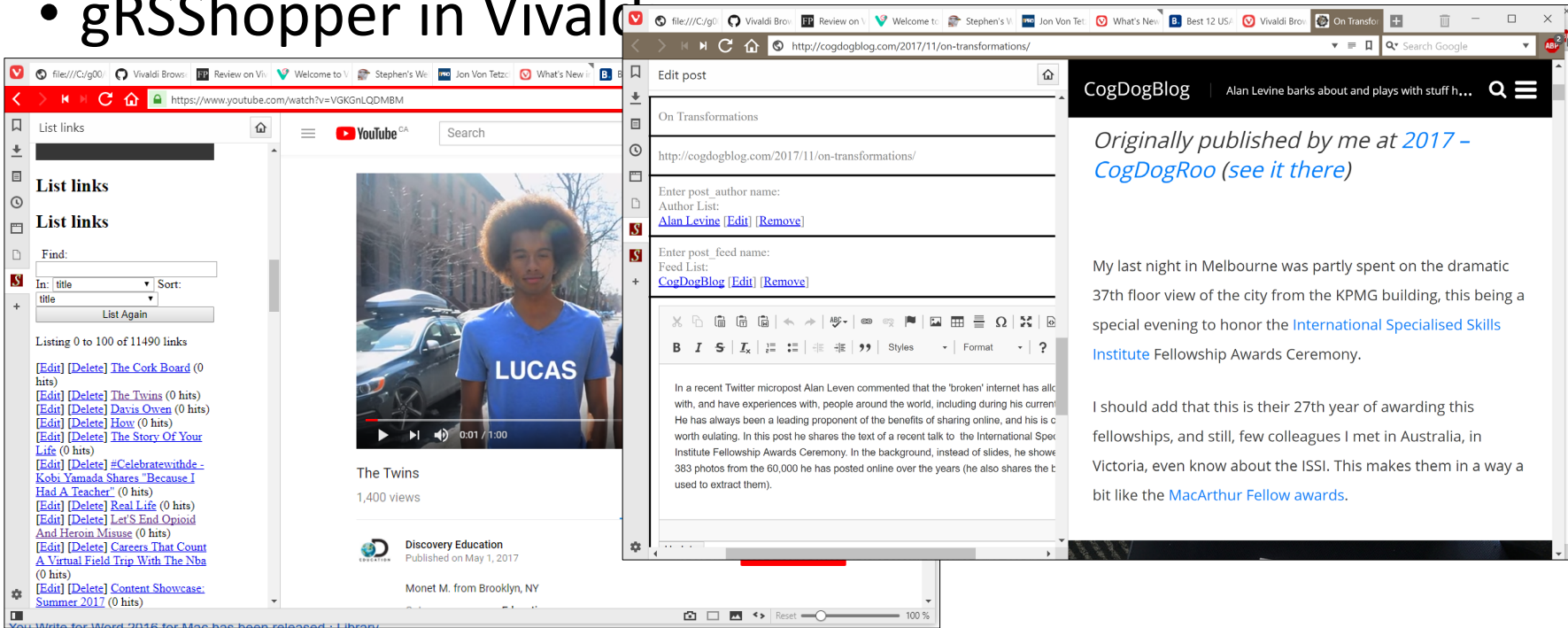
Firefox Developer Edition window showing "Yes this is my start page":

Downes	Audio	Photos	Social	MLB	Video	NRC
NewPost	Google Music	Upload	Google Plus	Games	Live - Watch	Wiki-ICT
ListPosts	CDC Radio	Albums	Medium	Scores	Live-Create	Wiki-LPSS
Presentation	Jamendo	Camera Roll	Twitter	Standings	My Channel	Zone
Pages	SoundCloud	OneDrive Photos	Twitter Activity	Blue Jays	YouTube	SAP
Admin	Ed Radio	Let's Make Art	Mastodon	Banter	Netflix	Service
Downes.ca			Jays Journal	Crave	GCcollab	
Services	Travel	News	Email	Slides	Blog	Intellectiv
Bank	Espedia	Weather	OWA Email	SlideShare	Half an Hour	FedScience Library

<https://addons.mozilla.org/en-US/firefox/search/?q=sidebar&platform=WINNT&appver=58.0>

# Embedding Applications in Other Applications

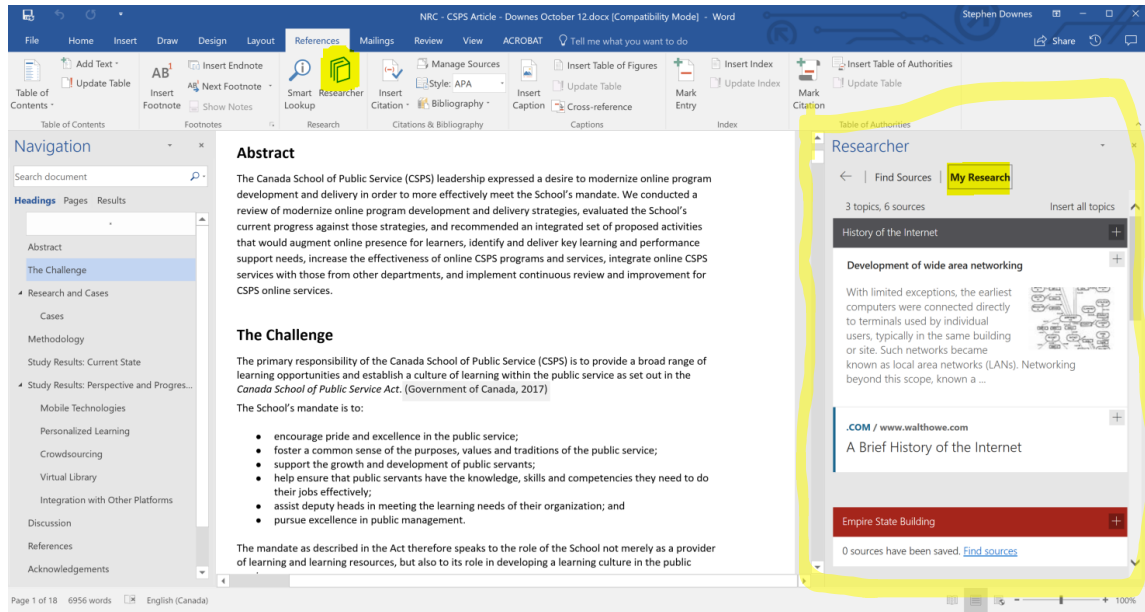
- gRSShopper in Vivaldi



<https://vivaldi.com/>

# Embedding Applications in Other Applications

## Research and Reference s in an MS-Word Plugin

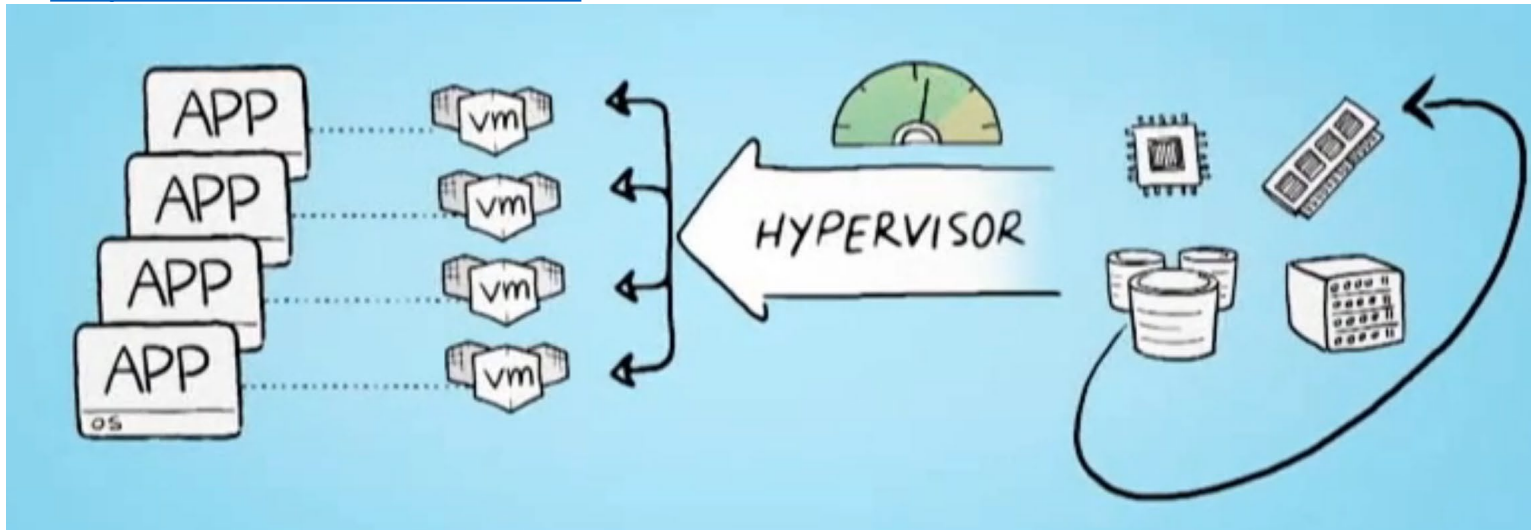


[https://www.officetooltips.com/office\\_2013/tips/advanced\\_research\\_with\\_research\\_pane.html](https://www.officetooltips.com/office_2013/tips/advanced_research_with_research_pane.html)

## Server Virtualization

- Parallels - <https://www.parallels.com/>
- VMWare - <https://www.vmware.com/>

- Virtual Box - <https://www.virtualbox.org/>
- Hyper-V - <https://docs.microsoft.com/en-us/virtualization/hyper-v-on-windows/quick-start/enable-hyper-v>



# Virtualization Platforms - Vagrant

```
$ vagrant init hashicorp/precise64

$ vagrant up
Bringing machine 'default' up with 'virtualbox' provider.
=> default: Importing base box 'hashicorp/precise64'...
=> default: Forwarding ports...
default: 22 (guest) => 2222 (host) (adapter 1)
=> default: Waiting for machine to boot...

$ vagrant ssh
vagrant@precise64:~$ _
```



<https://www.vagrantup.com/>

# Loading and Running Vagrant Boxes

- Scotch Box

- <https://box.scotch.io/> -- <http://192.168.33.10/>
- WPDistillery - <https://wpdistillery.org/> - for WordPress

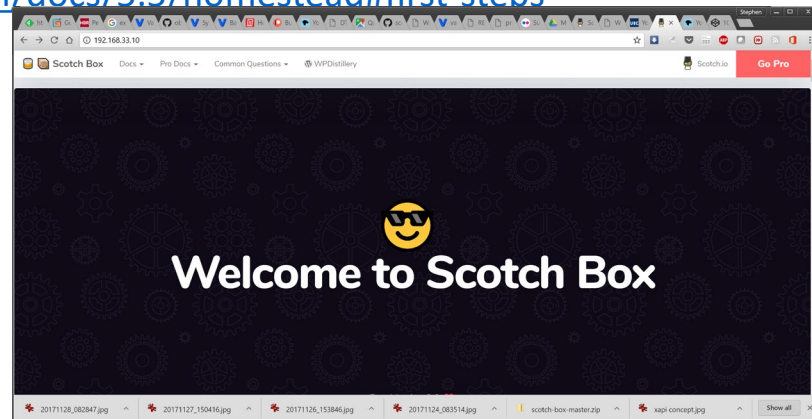
- Homestead

- Instructions - <https://laravel.com/docs/5.5/homestead#first-steps>

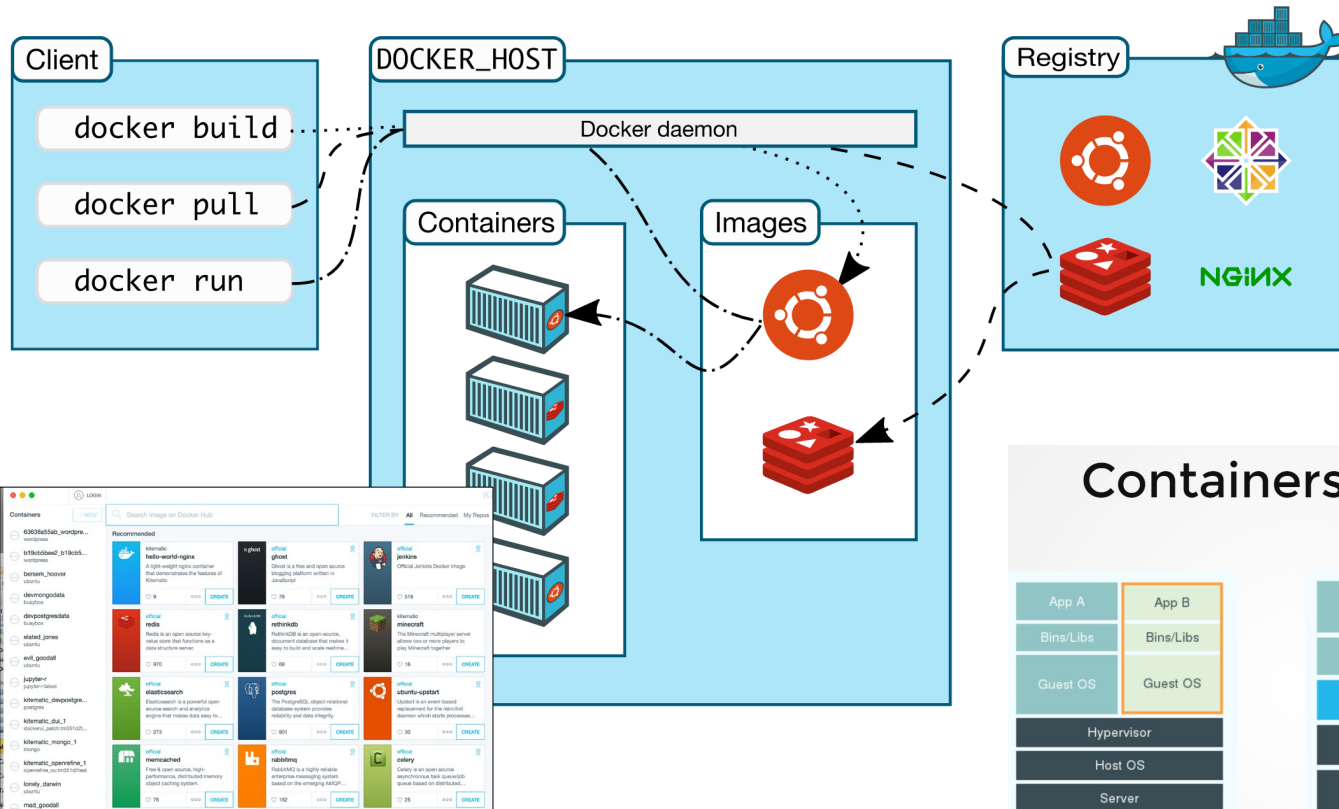
```
Command Prompt
Directory of C:\Users\steph\CodeProjects\Vagrant\lamp
11/27/2017 04:17 PM <DIR> .
11/27/2017 04:17 PM <DIR> ..
11/27/2017 04:17 PM <DIR> .vagrant
11/27/2017 04:17 PM 3,089 Vagrantfile
1 File(s) 3,089 bytes
3 Dir(s) 628,750,442,496 bytes free

C:\Users\steph\CodeProjects\Vagrant\lamp>cd ../scotchbox

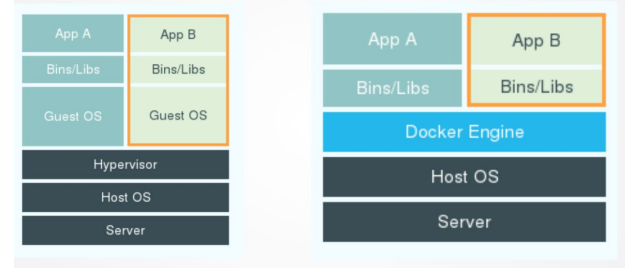
C:\Users\steph\CodeProjects\Vagrant\scotchbox>vagrant up
Bringing machine 'default' up with 'virtualbox' provider...
==> default: Box 'scotch/box' could not be found. Attempting to find and install...
default: Box Provider: virtualbox
default: Box Version: >= 0
==> default: Loading metadata for box 'scotch/box'
default: URL: https://vagrantcloud.com/scotch/box
==> default: Adding box 'scotch/box' (v3.0) for provider: virtualbox
default: Downloading: https://vagrantcloud.com/scotch/boxes/box/versions/3.0/providers/virtualbox.box
default:
==> default: Successfully added box 'scotch/box' (v3.0) for 'virtualbox'!
==> default: Importing base box 'scotch/box'...
==> default: Matching MAC address for NAT networking...
==> default: Checking if box 'scotch/box' is up to date...
==> default: Setting the name of the VM: scotchbox_default_1511952863136_42106
==> default: Clearing any previously set network interfaces...
==> default: Preparing network interfaces based on configuration...
default: Adapter 1: nat
```



# Docker



## Containers vs VMs







# Big Blue Button in Docker

Docker Pull Command

```
docker pull bigbluebutton/bigbluebutton
```

Owner



bigbluebutton

BigBlueButton - Demo Meeting

192.168.0.130/client/BigBlueButton.html?sessionToken=dylu1oqq2optkm6ym

Users

Fred Dixon (you)

Presentation: default.pdf

Chat

Public Options

Welcome to **Demo Meeting!**

For help on using BigBlueButton see these (short) [tutorial videos](#).

To join the audio bridge click the phone button. Use a headset to avoid causing background noise for others.

This server is running [BigBlueButton](#)

Fred Dixon 20:08

Running in Docker!

© 2017 BigBlueButton, Inc. (build 753)

[ WebRTC Audio ] English Default Layout

<http://docs.bigbluebutton.org/labs/docker.html>

<https://hub.docker.com/r/bigbluebutton/bigbluebutton/>

# Moodle on Docker

docker-moodle No Maintenance Intended ✖

A Dockerfile that installs and runs the latest Moodle stable.

## Installation

```
git clone https://github.com/jda/docker-moodle
cd docker-moodle
```

```
docker build -t moodle .
```

## Usage

To spawn a new instance of Moodle:

```
docker run -d --name DB -p 3306:3306 -e MYSQL_D
docker run -d -P --name moodle --link DB:DB -e M
```

You can visit the following URL in a browser to get started:

```
http://192.168.59.103:8080
```



The screenshot shows the Moodle administration interface. At the top, the Moodle logo is visible, along with the user name "Admin User (Logout)". The breadcrumb navigation shows "Moodle > Administration > Modules > Activities". The page title is "Activities".


On the left, there is a "Site Administration" sidebar with a search box. The sidebar menu includes: Notifications, Users, Courses, Location, Language, Modules (expanded), Activities, Blocks, Filters, Security, Appearance, Front Page, Server, Networking, Reports, and Miscellaneous. Below the sidebar is an "Admin bookmarks" section with a "bookmark this page" button.

The main content area displays a table of activities:

Activity module	Activities	Version	Hide/Show	Delete	Settings
Assignment	0	2007020200		Delete	Settings
Chat	0	2007020200		Delete	Settings
Choice	0	2007020200		Delete	Settings
Database	0	2007022601		Delete	Settings
Forum	0	2007020202			Settings
Glossary	0	2007020200		Delete	Settings
Hot Potatoes Quiz	0	2007020202		Delete	Settings
Journal	0	2007020200		Delete	
LAMS	0	2007020200		Delete	Settings
Label	0	2007020200		Delete	
Lesson	0	2007020201		Delete	
Quiz	0	2007020200		Delete	Settings
Resource	0	2007020200		Delete	Settings
SCORM/AICC	0	2007070300		Delete	Settings
Survey	0	2007020200		Delete	
Wiki	0	2007020200		Delete	
Workshop	0	2007020200		Delete	

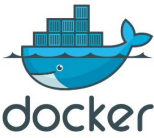
<https://hub.docker.com/r/jauer/moodle/>

# Options


applications cloud containers kubernetes enterprise support

---

## Launch Moodle now



[Launch Moodle using docker](#)  
Recommended if you're getting started with using containers on your workstation or laptop.



[Launch Moodle using Kubernetes](#)  
Recommended if you want to deploy your application on production infrastructure.

<https://bitnami.com/stack/moodle/containers>

# Cloud Infrastructure Providers



- AWS – Amazon - <https://aws.amazon.com/>



- Azure – Microsoft - <https://azure.microsoft.com>



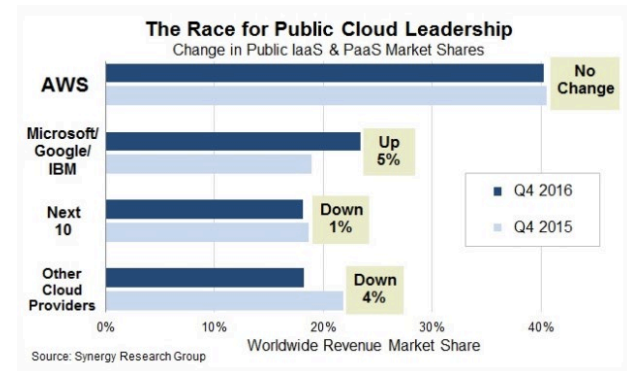
- Bluemix – IBM Cloud - <https://www.ibm.com/cloud/>



- Google Cloud Platform - <https://cloud.google.com/>




- Oracle Cloud - <https://cloud.oracle.com/>




<https://www.srgresearch.com/articles/microsoft-google-and-ibm-charge-public-cloud-expense-smaller-providers>

# Cloud Computing for Education




**How To Buy Cloud**  
Learn More »


**AWS PUBLIC SECTOR SUMMIT**  
Washington DC  
View Keynotes & Sessions »



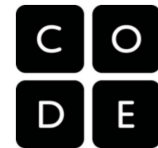
**Higher Education**  
From data center migration to student data and analytics, AWS has agile and flexible solutions.  
Learn more »



**K12 & Primary Schools**  
Streamline district IT operations, save money, and keep student information safe in the AWS Cloud.  
Learn more »



**Ed Tech Companies**  
Innovate and build the next generation of online learning, analytics, and campus management solutions.  
Learn more »



Amazon Web Services - <https://aws.amazon.com/education/>

# OER and Virtualization

- Open Distribution of Virtual Containers as a Key Framework for Open

<http://www.ejel.org/issue/download.html?idArticle=575>

“Unikernels represent a deeper simplification of the virtual container approach, given that all necessary computing elements (operative system kernel, basic libraries, frameworks, drivers, scientific application, etc.)”

S  
Alberto Corbi

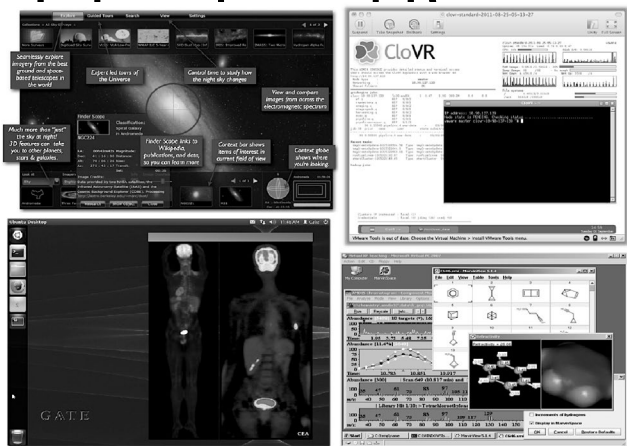


Figure 3: Some educational resources that are distributed as classic virtual machines (WWT, CloVR, vGATE, and a VirtualBox image for chemistry teaching).

# Mobile Authoring for ARLearn

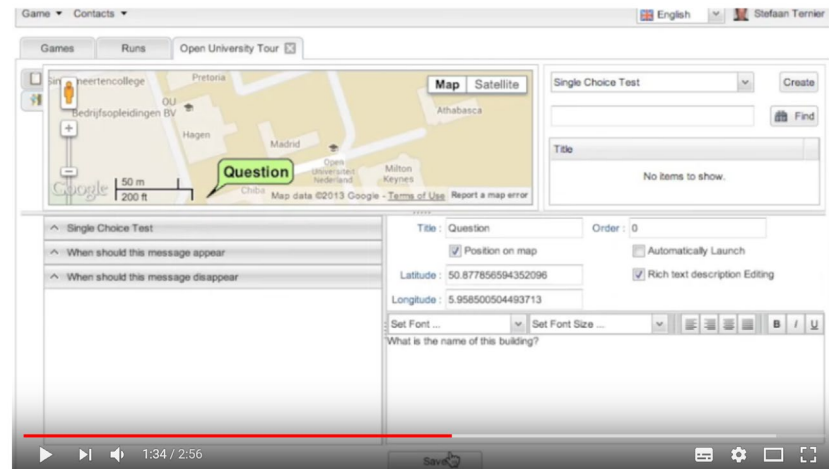
“The Mobile Authoring Tool complements the ARLearn desktop-based environment. Hence, a mobile game author can wander around creating items and synchronizing real world artefacts with game content”

[https://space.ou.nl/bitstream/1820/5674/1/UAIS\\_Tabuenca\\_2014.pdf](https://space.ou.nl/bitstream/1820/5674/1/UAIS_Tabuenca_2014.pdf)

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ARLearn <http://ar-learn.com/>

ARLearn is a technical framework for creating mobile serious games



<https://www.youtube.com/watch?v=Lqk3yrcNjNI>

# Happening Now...

- Docker images to build OER
  - <https://gitlab.com/oer/docs>
- Creativity in the Open World
  - <http://blogs.ubc.ca/chendri>
- Lti - xapi

