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

Stephen Downes
RELIF
Hammamet, Tunisia
November 30, 2017

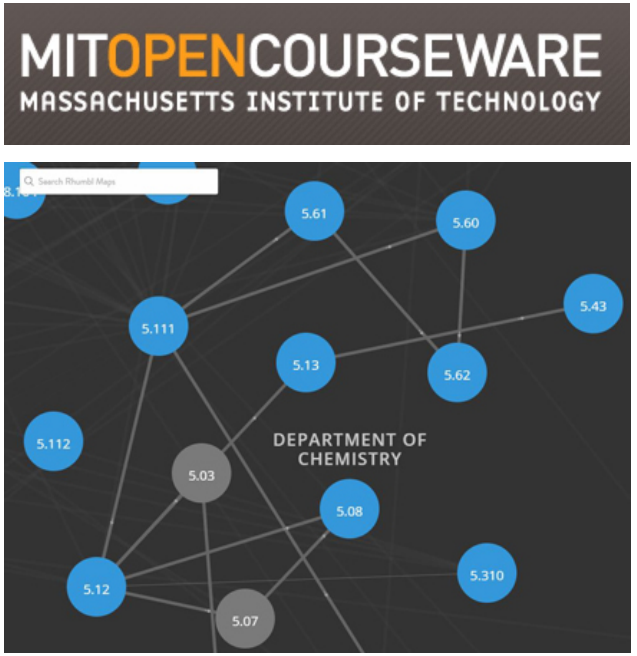
- Abstract: Open Educational Resources (OER) have traditionally been thought of as replacements for classroom materials such as textbooks, teaching aids, study guides, and background resources. In more recent years they have come to include multimedia resources such as animations, podcasts and videos, 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/



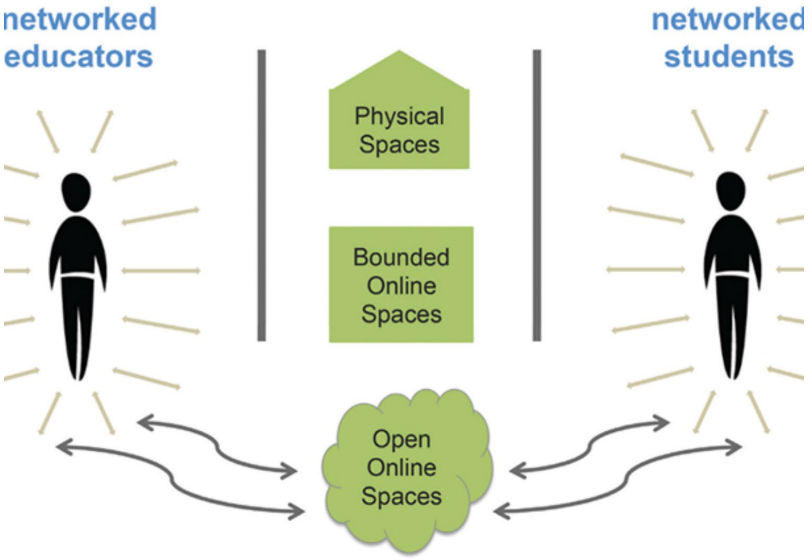
https://ocw.mit.edu/

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

Open Resources, Open Teaching

- Open Pedagogy – Using OER to Chane 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."



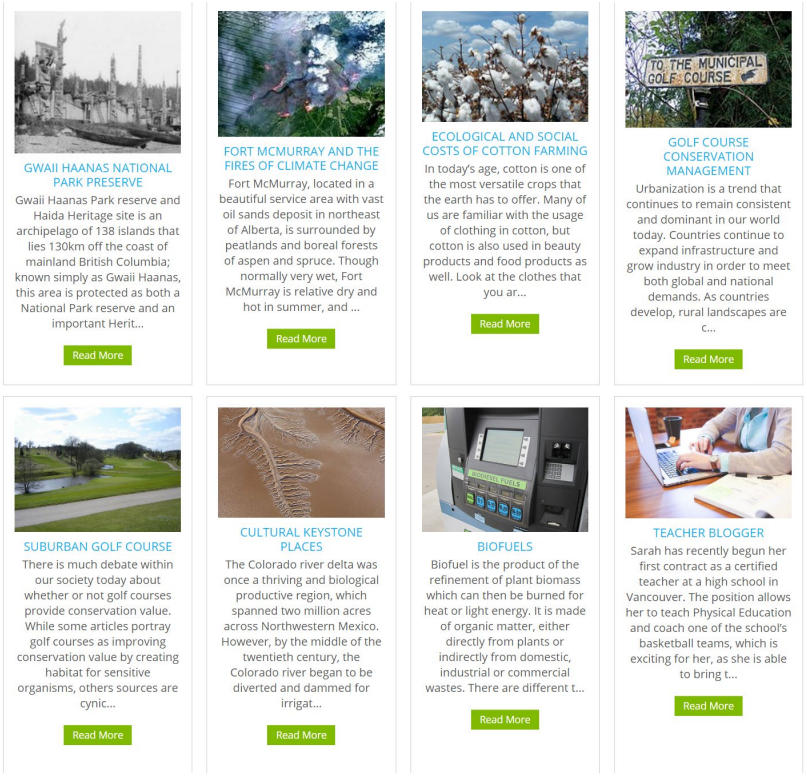
1. A Model for Networked Education (*Credit:* Image by Catherine Cronin, buildin
letworked Teacher" by Alec Couros. CC BY-SA)

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/

Content Syndication

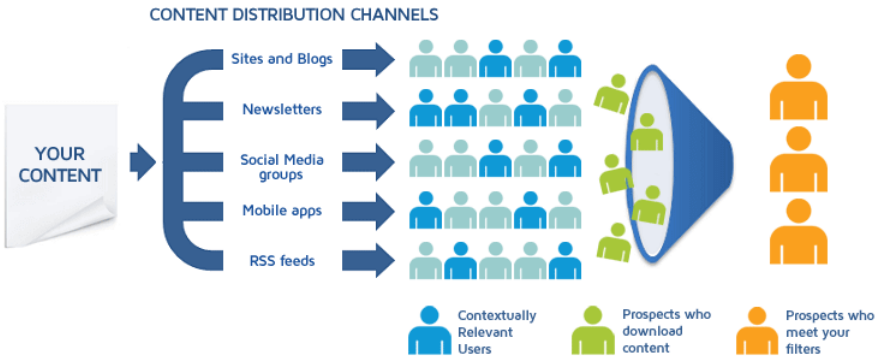


Image: https://blog.izooto.com/best-content-syndication-tools/

- 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

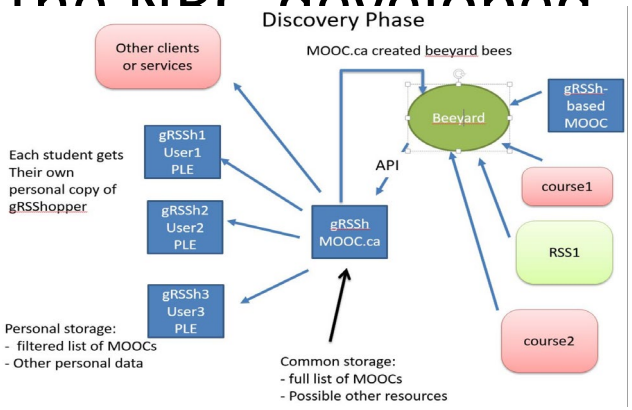
Scrapy

Terminal

```
$ pip install scrapy
$ cat > myspider.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 myspider.py
```

https://scrapy.org/

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



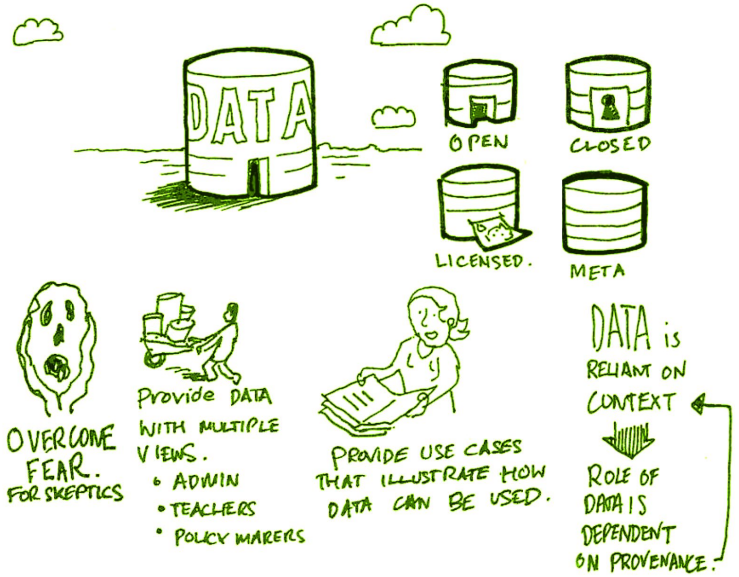
MOOC.ca and gRSShopper

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

gRSShopper

http://grsshopper.downes.ca/

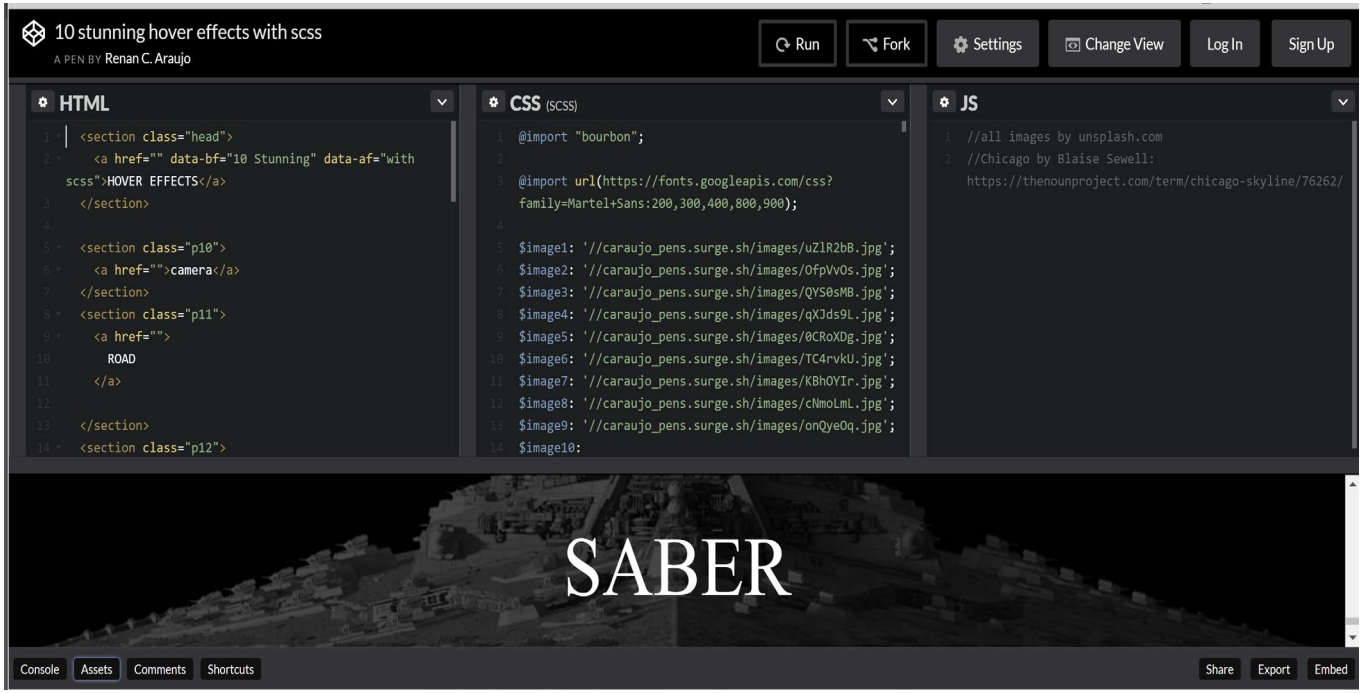
Open Data as OERs



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

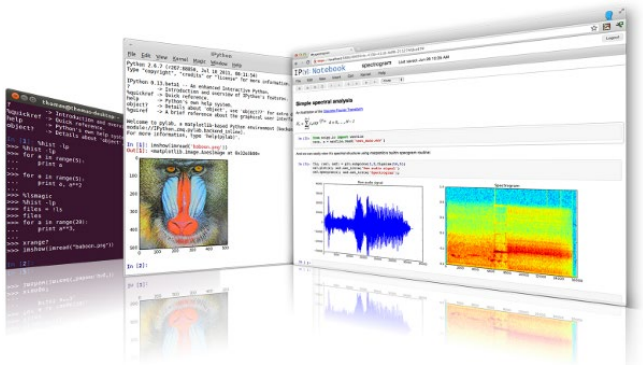
Atenas, J., & Havemann, L. (Eds.). (2015). Open Data as Open Educational Resources: Case studies of emerging practice. London: Open Knowledge, Open Education Working Group. http://dx.doi.org/10.6084/m9.figshare.1590031
Also: Leo Havemann, slides http://eprints.bbk.ac.uk/14750/1/Leo_ODasOER_UCL_4March16.pdf

CodePen



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. `ádasd`
- 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

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

"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."

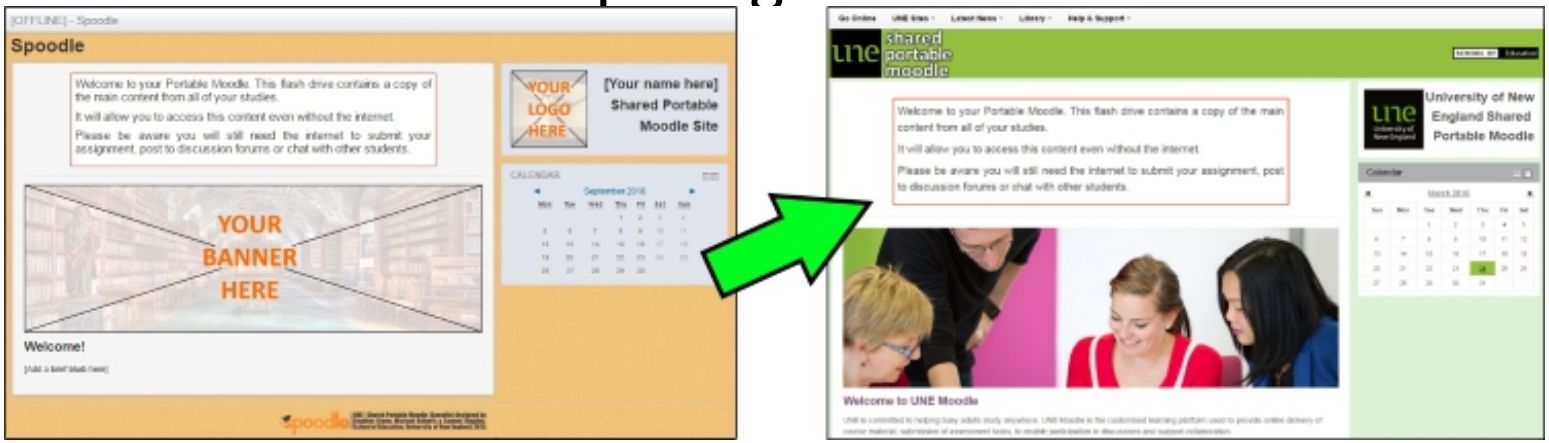
XAMPP on a USB Stick

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

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

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."

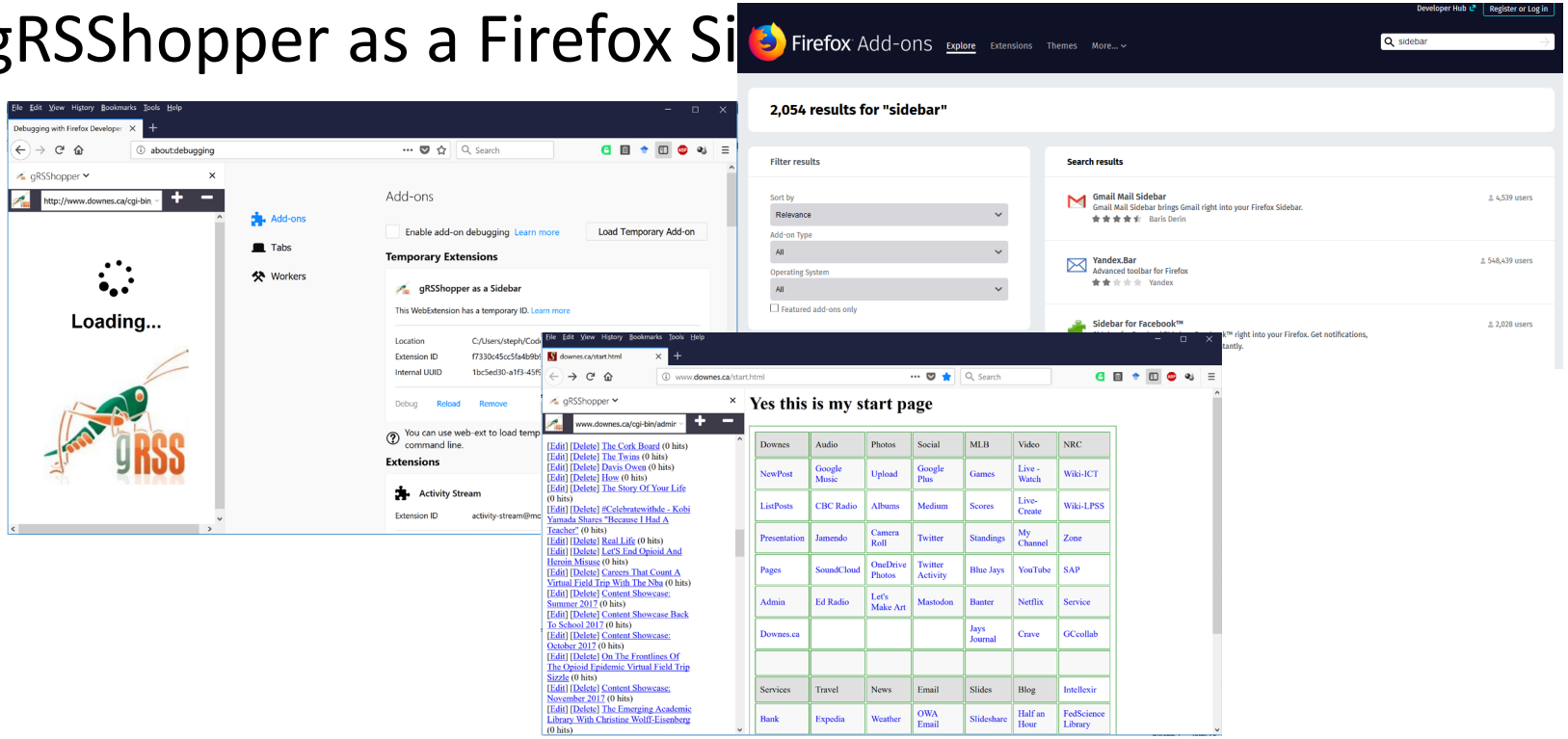


https://moodle.org/mod/forum/discuss.php?d=342367

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

Embedding Applications in Other Applications

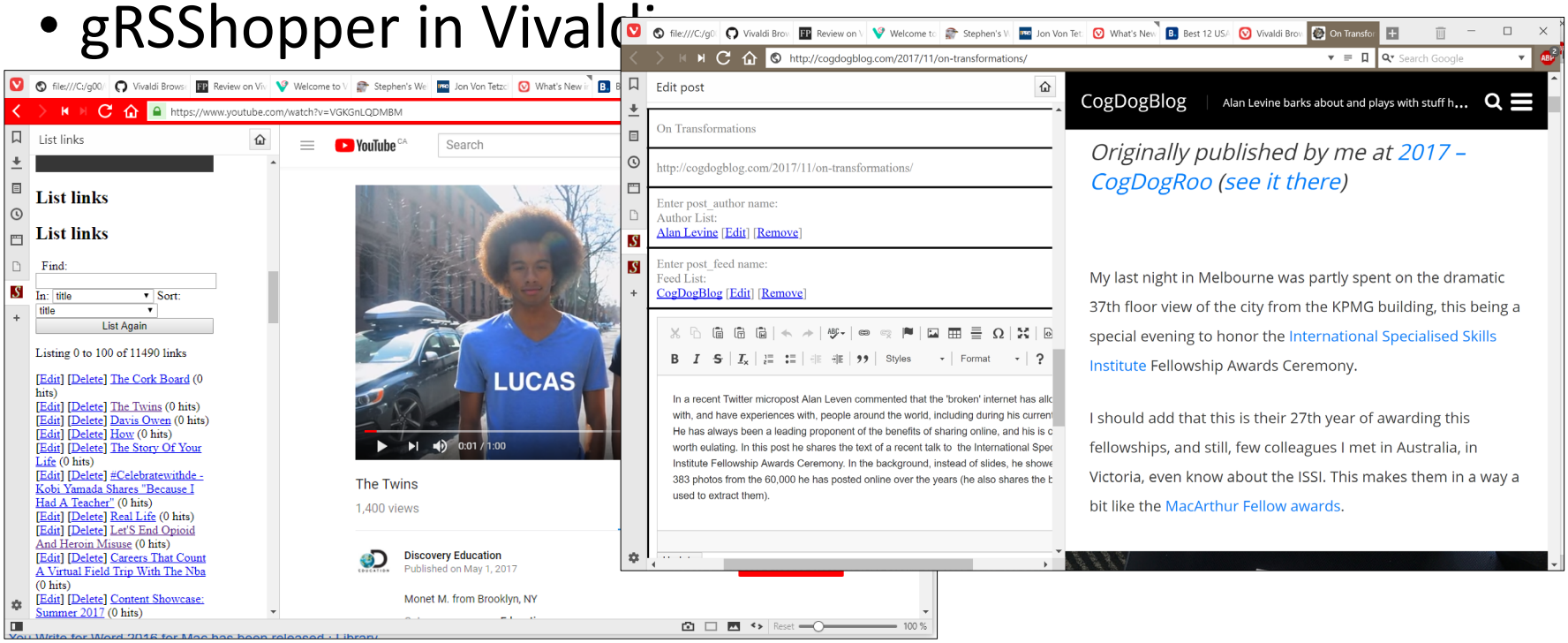
- gRSShopper as a Firefox Si



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

Embedding Applications in Other Applications

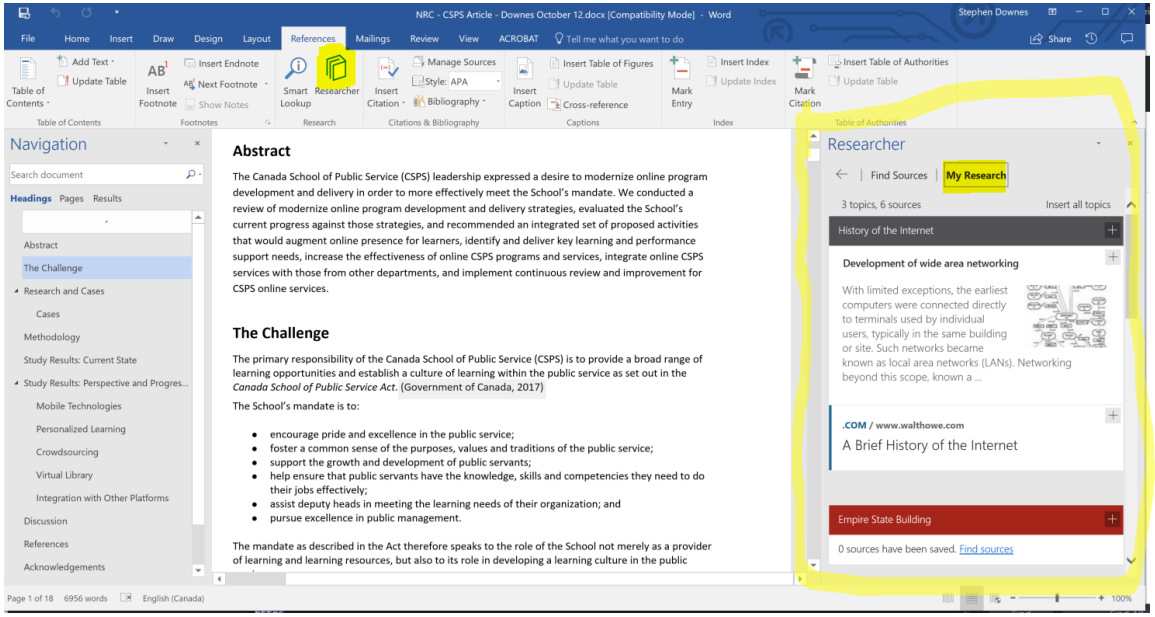
- gRSShopper in Vivaldi



https://vivaldi.com/

Embedding Applications in Other Applications

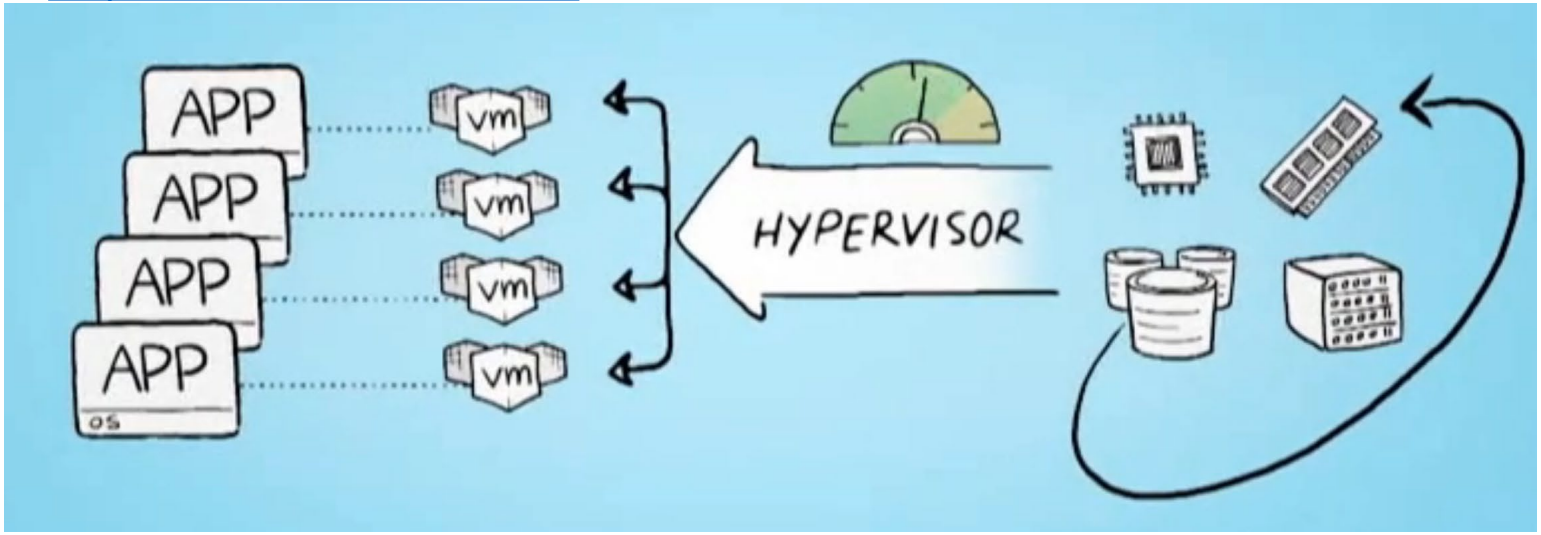
Research and References in an MS-Word Plugin



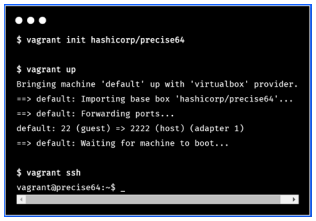
https://www.officetooltips.com/office_2013/tips/advanced_research_with_research_pane.html

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



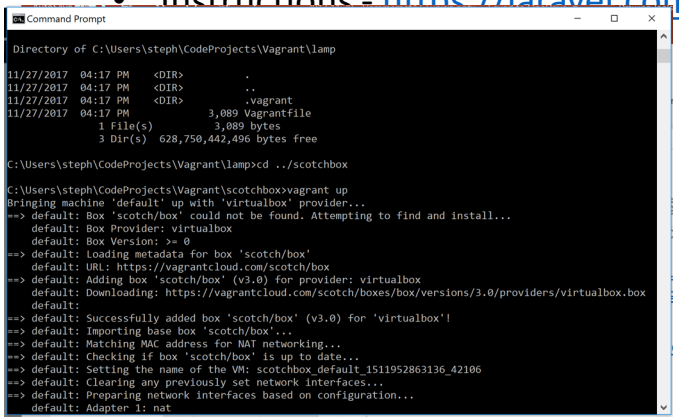
Virtualization Platforms - Vagrant

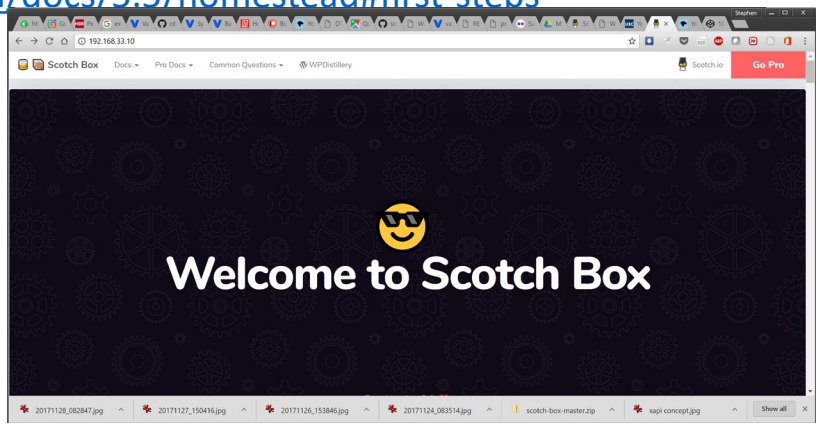


https://www.vagrantup.com/

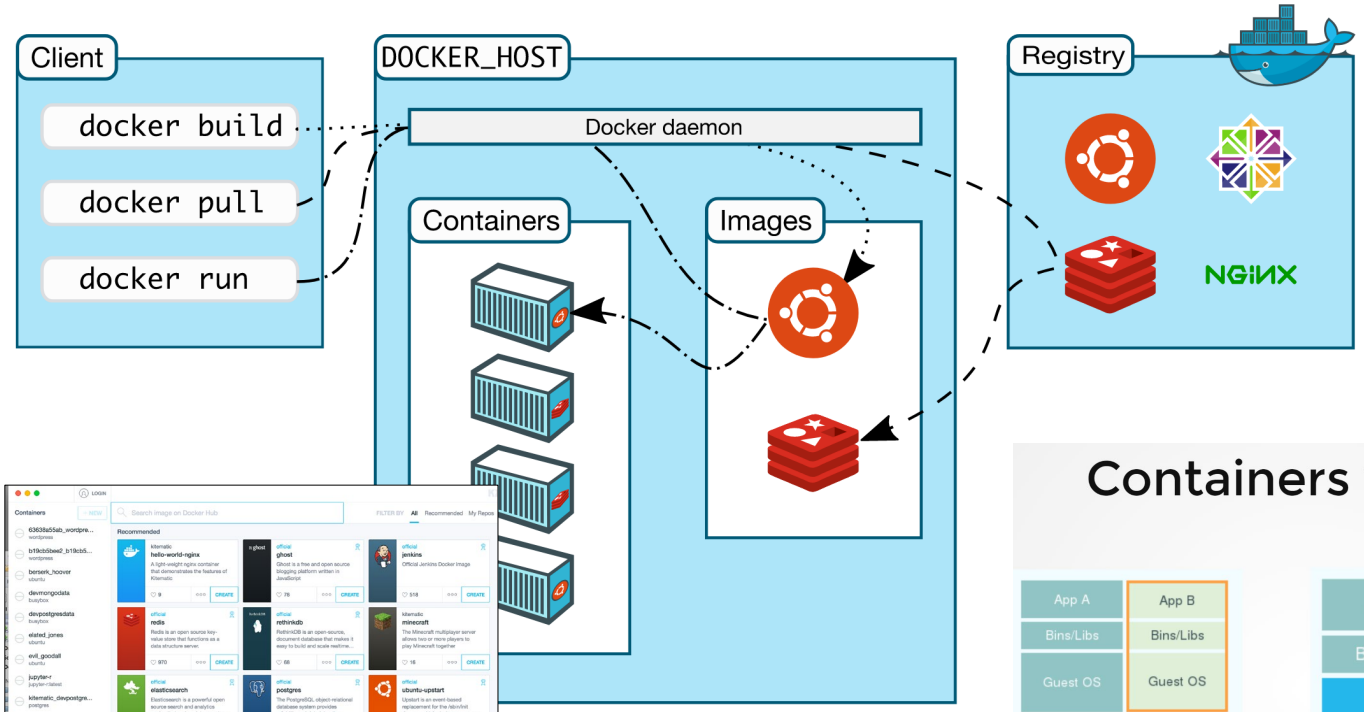
Loading and Running Vagrant Boxes

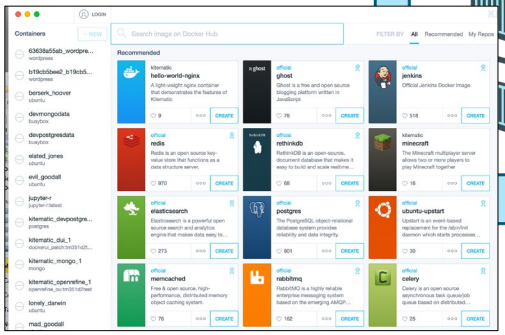
- Scotch Box
  - https://box.scotch.io/ -- http://192.168.33.10/
  - WPDistillery - https://wpdistillery.org/ - for WordPress
- Homestead
  - Instructions - https://laravel.com/docs/5.5/homestead#first-steps

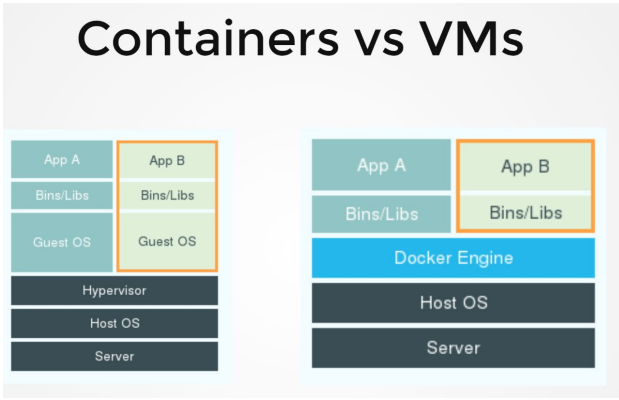




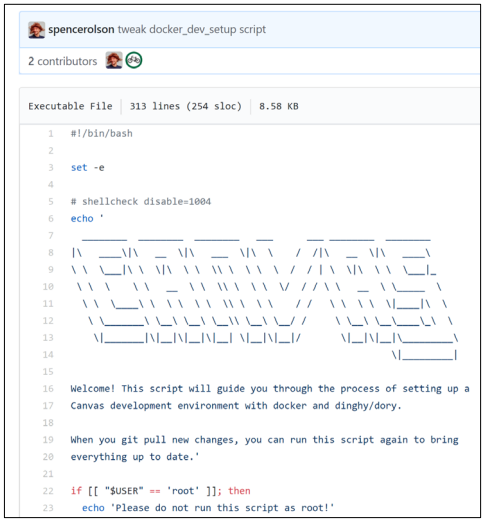
Docker


Client
docker build
docker pull
docker run
DOCKER_HOST
Docker daemon
Containers
Images
Registry
NGINX




Containers vs VMs
App A
App B
Bins/Libs
Bins/Libs
Guest OS
Guest OS
Hypervisor
Host OS
Server
App A
App B
Bins/Libs
Bins/Libs
Docker Engine
Host OS
Server

Canvas on Docker



https://github.com/instructure/canvas-lms/blob/master/script/docker_dev_setup.sh

http://slides.com/jamesluker/how-to-docker-2#/

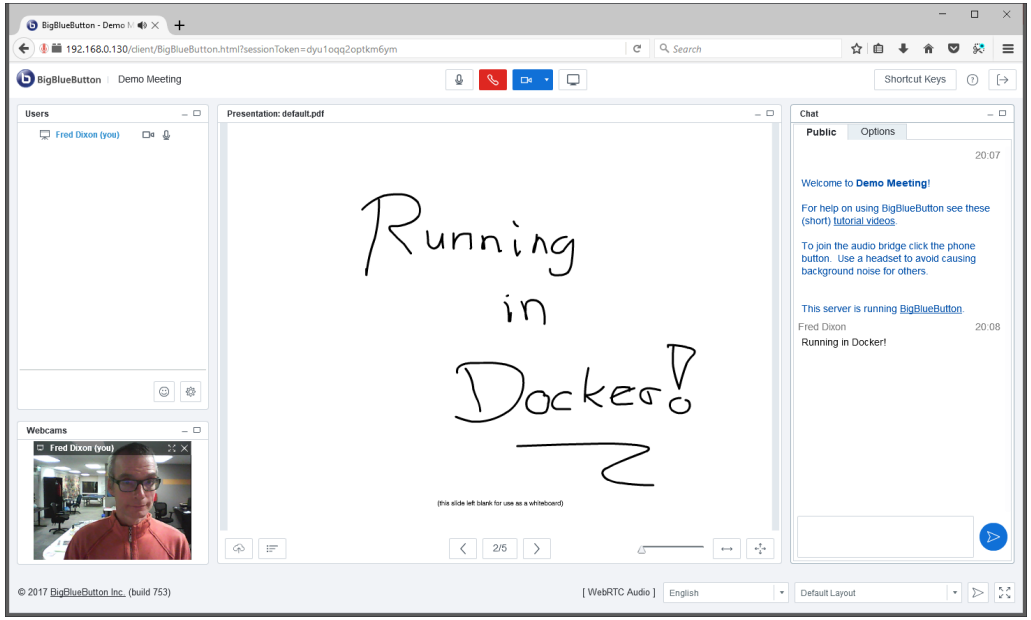
Big Blue Button in Docker

Docker Pull Command

```
docker pull bigbluebutton/bigbluebutton
```

Owner

bigbluebutton



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:

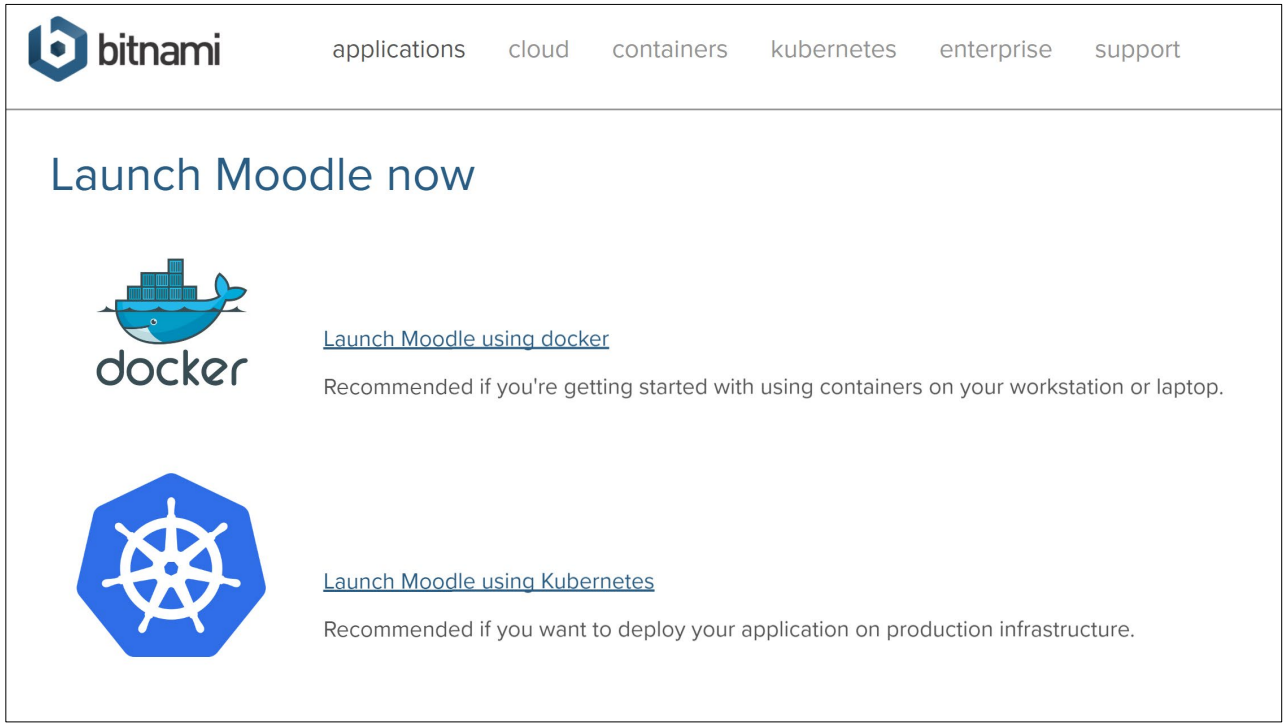
```
docker run -d --name DB -p 3306:3306 -e MYSQL_D
docker run -d -P --name moodle --link DB:DB -e M
```

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

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

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

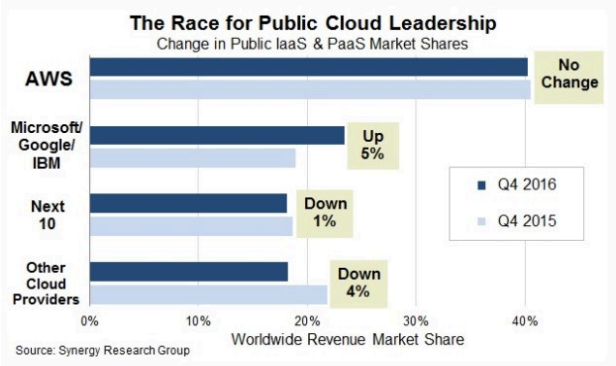
Options



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

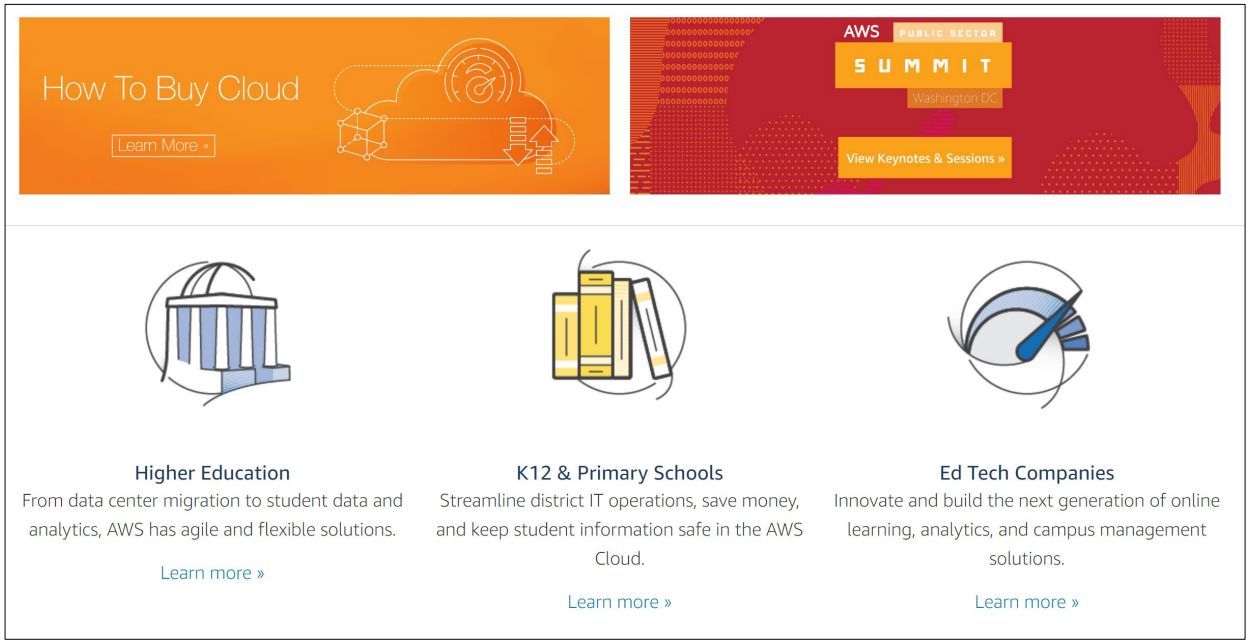
Cloud Infrastructure Providers

- 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



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

OER and Virtualization

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

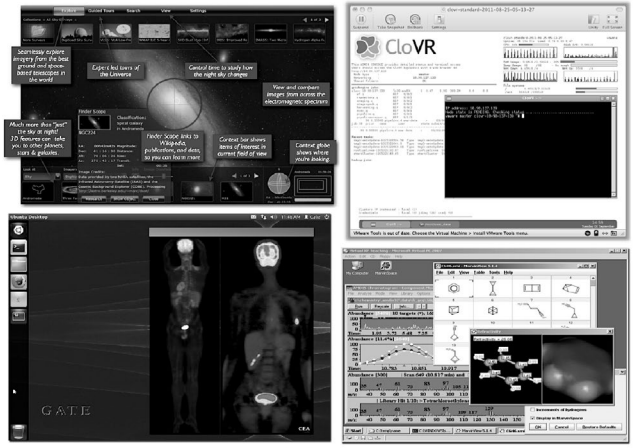


Figure 3: Some educational resources that are distributed as classic virtual machines (WWT, CloVR, vGATE, and a VirtualBox image for chemistry teaching).

lberto Corbi

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

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

Mobile Authoring for ARLearn

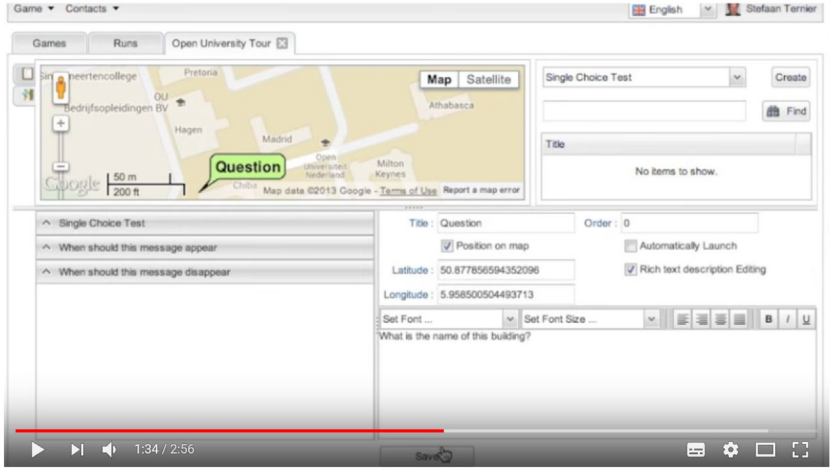
"The Mobile Authoring Tool complements the ARLearn desktop-based environment. Hence, a mobile game author can wander around creating items and synchronizing real world artefacts with game content."

https://dspace.ou.nl/bitstream/1820/5674/1/UAIS_Tabuenca_2014.pdf

Bernardo Tabuenca; Marco Kalz; Stefaan Ternier; Marcus Specht

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/doc
- Creativity in the Open Wo
  - http://blogs.ubc.ca/chendr
- Lti - xapi