

# **Open Cloud Testbed (OCT) for FPGA**

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The OCT design workflow for FPGAs works on 2 different toolchains-

1. The Massachusetts Open Cloud (MOC)
2. CloudLab

The MOC is used for the development and bring up of the project. It hosts the EDA toolchains like Vitis and Vivado (Xilinx EDA toolchains have proper support from the MOC, hence they are preferable.)

Once the design and functional testing is verified, the generated bitstreams can be launched on target Hardware (in this case, FPGAs) using CloudLab. It accommodates 8 Alveo U280 Data center accelerator cards which are further connected via host machines.

Find workflow details at <https://github.com/OCT-FPGA/OCT-Tutorials/blob/master/README.md>

## **Getting Started on MOC**

### **1. Signing up on MOC**

One needs to sign up for a project access request form at [www.massopen.cloud](http://www.massopen.cloud). Start from the link here: <https://massopen.cloud/request-an-account/>

1.1. Click on the "Request a MOC project" link and use your university account or an ORCID account (in case your university does not grant access for MOC; mostly it should.) ORCID is an organization/ community for researchers, and you can sign up free of cost.

Sign up at <https://orcid.org/signin>

orcid.org/signin

cookies to improve your experience and to help us understand how you use our websites. [Learn more about how we use cookies.](#)

**ORCID**  
Connecting research and researchers

ABOUT FOR RESEARCHERS MEMBERSHIP DOCUMENTATION RESOURCES NEWS & EVENTS

**Sign in**

Email or 16-digit ORCID ID  
skaur4@hawk.iit.edu

example@email.com or 0000-0001-2345-6789

Password  
\*\*\*\*\*

**SIGN IN**

Figure 1: ORCID Sign in

## 2. Access request approval email

After you have submitted your access request form, you will get an approval email in 2-3 business days asking to login via Kaizen.

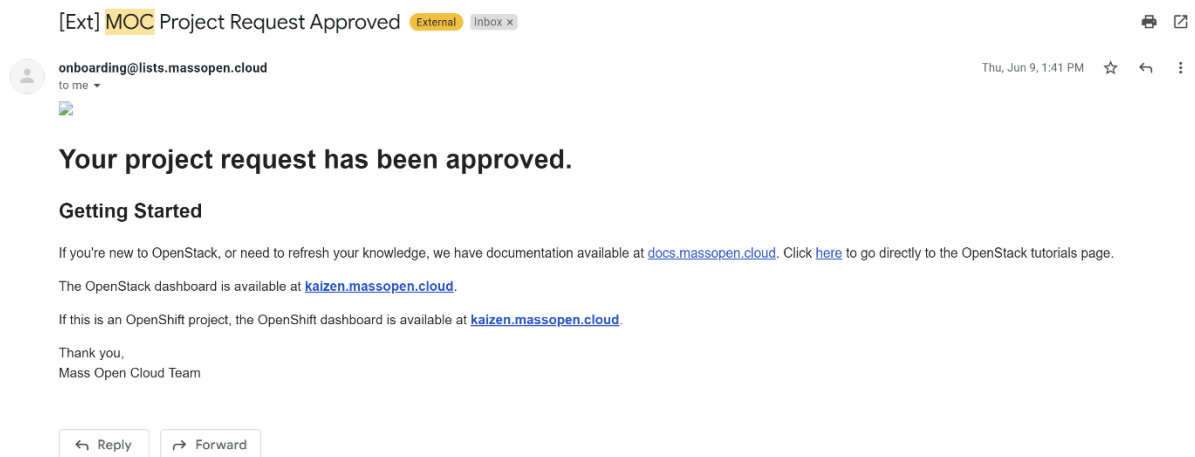


Figure 2: MOC access confirmation

### 3. Kaizen RedHat Login

Join here: Follow the email link at <https://kaizen.massopen.cloud/dashboard/auth/login/?next=/dashboard/> to login to your MOC account. (If you already have an MOC account, start by login in from this step). Use your Institute login credentials.

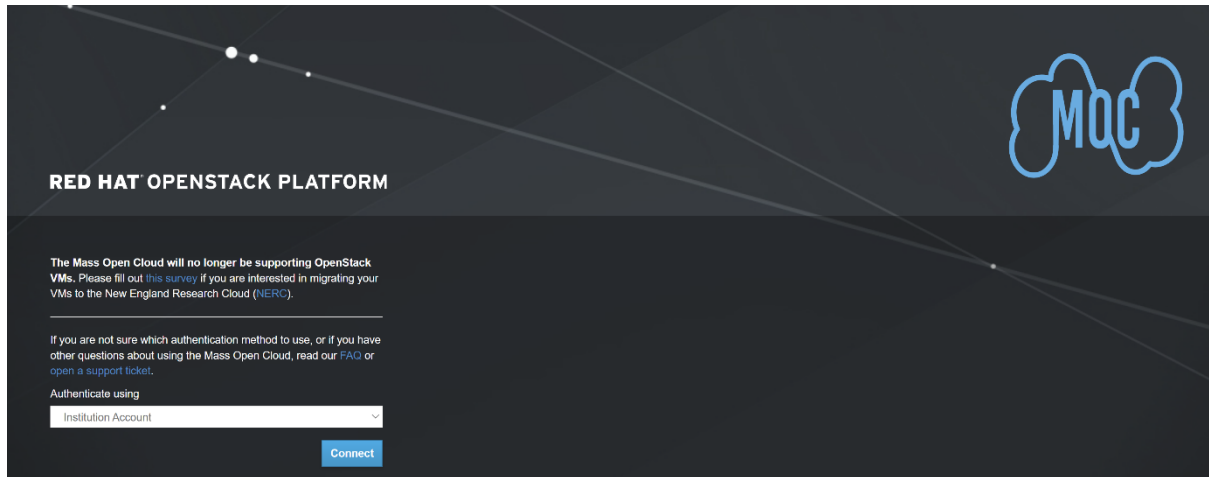


Figure 3: Kaizen Login

### 4. MOC Kaizen Dashboard

Your welcome screen for MOC dashboard would look like this (just unoccupied space!)

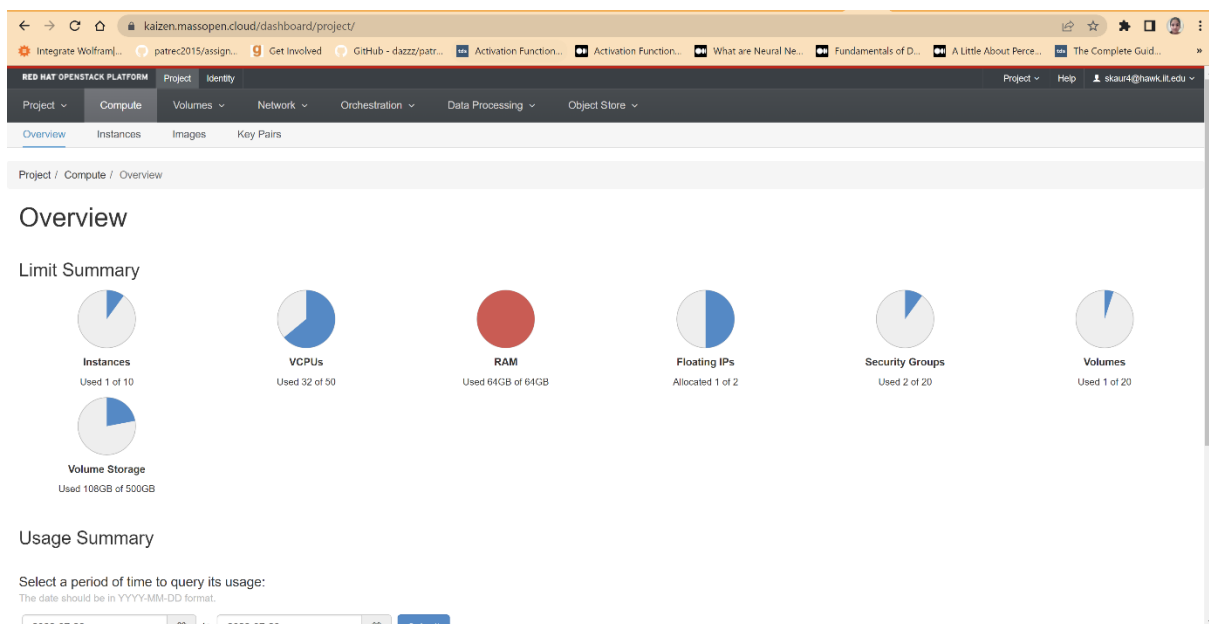


Figure 4: MOC Dashboard

# Setting up your VM

## 1. SSH Keys

Creating and setting up your key pairs for ssh is the first step. You can create a key from your MOC dashboard under 'Compute > Key Pairs > +Create key pair'. Provide a name for your key file and it will automatically download the key onto your local system.

**IMPORTANT:** The key created using MOC is a .pem file, and when you create a key from your local system (using PuTTY) it creates a .ppk format key since .pem is natively not supported in PuTTY. So you need to convert your MOC downloaded .pem key into .ppk format. Here is how to do it according to your OS <https://aws.amazon.com/premiumsupport/knowledge-center/ec2-ppk-pem-conversion/>

Once you have this key saved in .ppk format, you can use it to ssh into your MOC VM via your local system (using PuTTY)

## 2. Security Groups

Go to your MOC dashboard, under 'Network > Security Groups > + Create security group'; mention your name and description > create security group and then go to 'Manage Rules'. Add Rule 'Custom TCP Rule' and enter the Port 22 and click on 'Add'. Add another Rule (for VNC connection- for GUI experience on your VM)- Rule 'Custom TCP Rule' and Port 5901.

This is how it should look once you have created your rules.

RED HAT OPENSTACK PLATFORM Project Identity Project Help skaur4@hawk.iit.edu

Project Compute Volumes Network Orchestration Data Processing Object Store

Network Topology Networks Routers Security Groups Load Balancers Floating IPs Trunks

Project / Network / Security Groups / Manage Security Group Rule...

Manage Security Group Rules: sshvnc (0c327b52-b844-4bde-8f1b-b2119a09c046)

+ Add Rule Delete Rules

Displaying 4 items

<input type="checkbox"/>	Direction	Ether Type	IP Protocol	Port Range	Remote IP Prefix	Remote Security Group	Actions
<input type="checkbox"/>	Egress	IPv4	Any	Any	0.0.0.0/0	-	Delete Rule
<input type="checkbox"/>	Egress	IPv6	Any	Any	:::0	-	Delete Rule
<input type="checkbox"/>	Ingress	IPv4	TCP	22 (SSH)	0.0.0.0/0	-	Delete Rule
<input type="checkbox"/>	Ingress	IPv4	TCP	5901	0.0.0.0/0	-	Delete Rule

Displaying 4 items

Figure 5: MOC Security Groups

### 3. Creating VM instance

Go to 'Compute > instance > Launch Instance' and fill in your details for instance name and description as per your project. Follow the drop-down menu on the left and go to 'source' to select the OS and Vitis version as per your requirement. For the instance 'Flavor' select at 64 GB RAM (because you need a lot of RAM to run your Vitis/Vivado/EDA tools) you can even request for more disk space, if you need it (Fill out this form for more resources: <https://docs.google.com/forms/d/e/1FAIpQLSf-lk3XmFqVA2hVBGOGUXeFF8av9oXwJdLF3jA2409msFEriQ/viewform>).

Add your generated key pair, security group and click on 'Launch Instance'. Find more details for launching instance here: <https://docs.massopen.cloud/en/latest/openstack/launch-a-vm.html>

RED HAT OPENSTACK PLATFORM

Project

Identity

Project

Compute

Volumes

Network

Orchestration

Data Processing

Object Store

Project

Help

skaurf@hawk.iit.edu

Overview

Instances

Images

Key Pairs

Project / Compute / Instances

Instances

Instance ID ▾

Filter

Launch Instance (Quota exceeded)

Delete Instances

More Actions ▾

Displaying 1 item

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	NPU-test-vitis	-	10.0.0.44 Floating IPs: 128.31.26.64	c2.s2.2xlarge	NPU-test	Active	us-east-1 nova	None	Running	1 month, 1 week	Create Snapshot ▾

Displaying 1 item

Figure 6: MOC instances

### 4. Floating IP

Once your instance is created, you need an IP address associated with it to launch it via ssh. for that, click on the 'downward arrow' on extreme right of your instance and got to 'Associate floating IP'. If you have an IP address available to be allocated, you can add that else got to 'Network > Floating IP >' and then allocate this created IP to your instance.

### 5. SSH and VNC setup

Creating SSH session and VNC session on your local system you can use PuTTYGen and PuTTY for creating your key and pair it with your existing MOC key (saved in the .ppk format) and ssh into MOC VM. Use the same credentials to get GUI access using VNC. get a detail for VNC and SSH set up on local system here: <https://github.com/OCT-FPGA/OCT-Tutorials/blob/master/vncsshsetup/README.md>

Once your ssh is set up, it should look like this:

```
ubuntu@npu-test-vitis: ~  
Authenticating with public key "imported-openssh-key"  
Welcome to Ubuntu 18.04.2 LTS (GNU/Linux 4.15.0-48-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:        https://ubuntu.com/advantage  
  
System information as of Sat Jul 23 16:18:18 UTC 2022  
  
System load:  0.18               Processes:            393  
Usage of /:   50.6% of 104.50GB   Users logged in:     0  
Memory usage: 4%                IP address for ens3: 10.0.0.44  
Swap usage:   0%  
  
=> There is 1 zombie process.  
  
* Super-optimized for small spaces - read how we shrank the memory  
  footprint of MicroK8s to make it the smallest full K8s around.  
  
  https://ubuntu.com/blog/microk8s-memory-optimisation  
  
* Canonical Livepatch is available for installation.  
  - Reduce system reboots and improve kernel security. Activate at:  
    https://ubuntu.com/livepatch  
  
121 packages can be updated.  
1 update is a security update.  
  
*** System restart required ***  
Last login: Mon Jun 27 18:50:42 2022 from 104.194.96.108  
ubuntu@npu-test-vitis:~$
```

Figure 7: SSH setup

Once your VNC is set up, you can access Vitis and start your project!

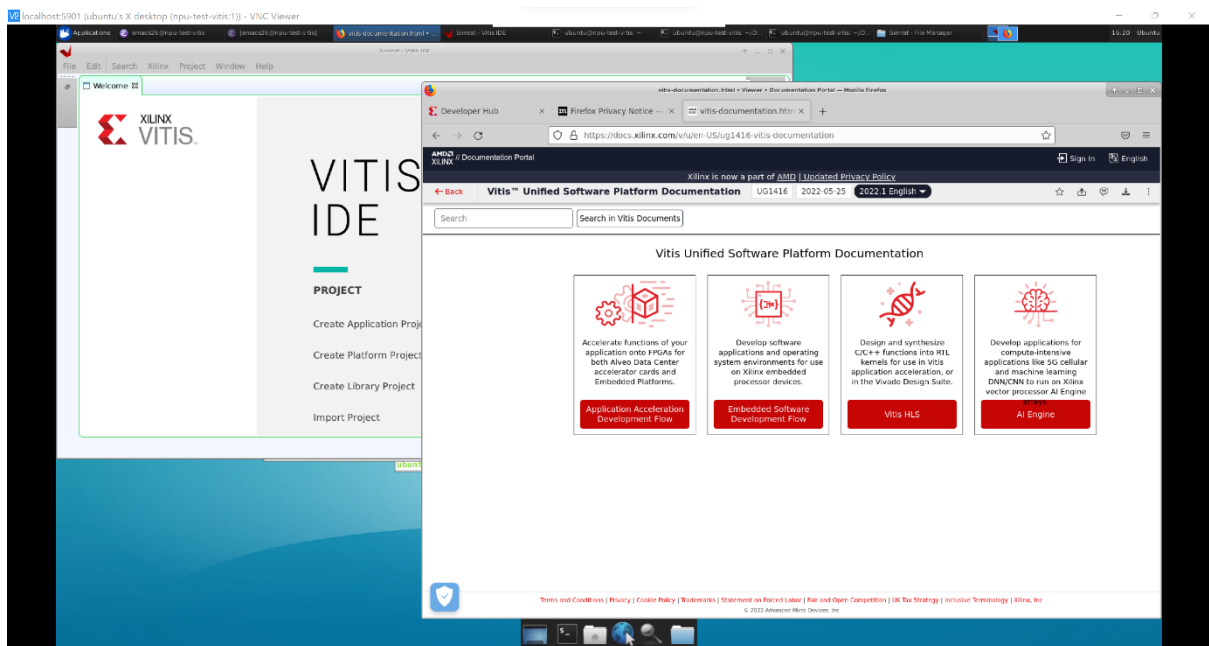


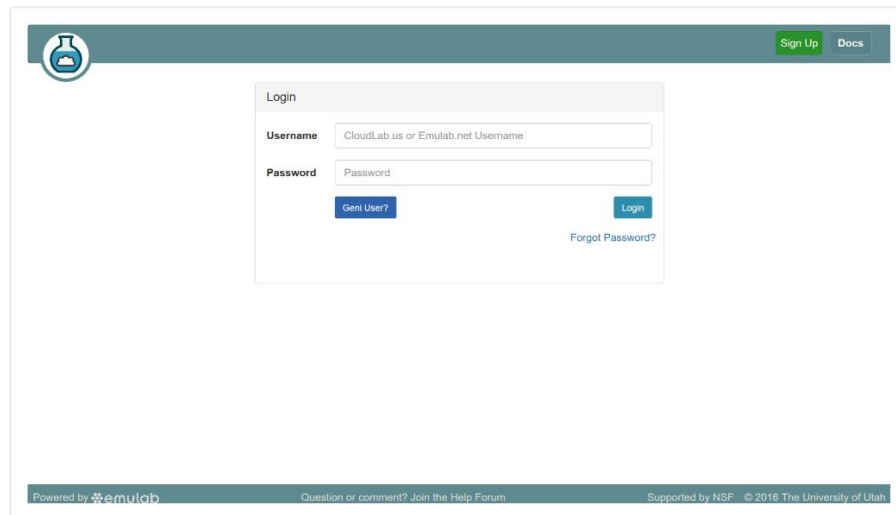
Figure 8: VNC Setup

# Getting Started on CloudLab

## 1. Signing up on Cloudlab

First step is signing up at cloudblab and requesting access for a project.

Sign up at <https://www.cloudlab.us>



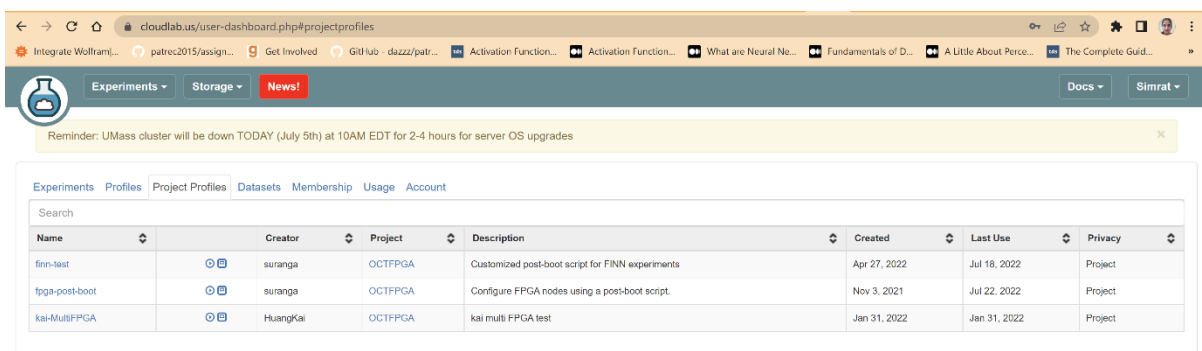
The image shows the CloudLab login page. At the top, there is a navigation bar with a CloudLab logo on the left and 'Sign Up' and 'Docs' buttons on the right. The main content area is titled 'Login' and contains two input fields: 'Username' (with a hint 'CloudLab.us or Emulab.net Username') and 'Password'. Below the password field are two buttons: 'Gen User?' and 'Login'. A link 'Forgot Password?' is located below the 'Login' button. At the bottom of the page, there is a footer with the text 'Powered by emulab', a link to 'Question or comment? Join the Help Forum', and 'Supported by NSF © 2016 The University of Utah'.

Figure 9: CloudLab login

Fill up your personal info and you can either request access for 'Start New Project' or 'Join existing project'. If you Join existing project, type in OCTFPGA for an FPGA project.

## 1. Cloudlab Dashboard

Once your request is approved, you can log in to cloudblab and this is how your dashboard looks like (without the projects!)



The image shows the CloudLab dashboard. At the top, there is a navigation bar with 'Experiments', 'Storage', and 'News' buttons. Below this is a yellow banner with a reminder: 'Reminder: UMass cluster will be down TODAY (July 5th) at 10AM EDT for 2-4 hours for server OS upgrades'. The main content area has tabs for 'Experiments', 'Profiles', 'Project Profiles', 'Datasets', 'Membership', 'Usage', and 'Account'. The 'Project Profiles' tab is selected, showing a table of projects. The table has columns for Name, Creator, Project, Description, Created, Last Use, and Privacy. There are three projects listed: 'finn-test', 'fpga-post-boot', and 'kai-MultiFPGA'.

Name	Creator	Project	Description	Created	Last Use	Privacy
finn-test	suranga	OCTFPGA	Customized post-boot script for FINN experiments	Apr 27, 2022	Jul 18, 2022	Project
fpga-post-boot	suranga	OCTFPGA	Configure FPGA nodes using a post-boot script.	Nov 3, 2021	Jul 22, 2022	Project
kai-MultiFPGA	HuangKai	OCTFPGA	kai multi FPGA test	Jan 31, 2022	Jan 31, 2022	Project

Figure 10: CloudLab Dashboard

## 2. SSH Keys

Go to your username dropdown on your top right of the dashboard, and click on 'Manage SSH Keys'

Here you can paste in your SSH key local system. Refer to the steps above to create SSH keys on you local system on PuTTY and add it to your cloudlab account.

Once you are done, it should look something like this.

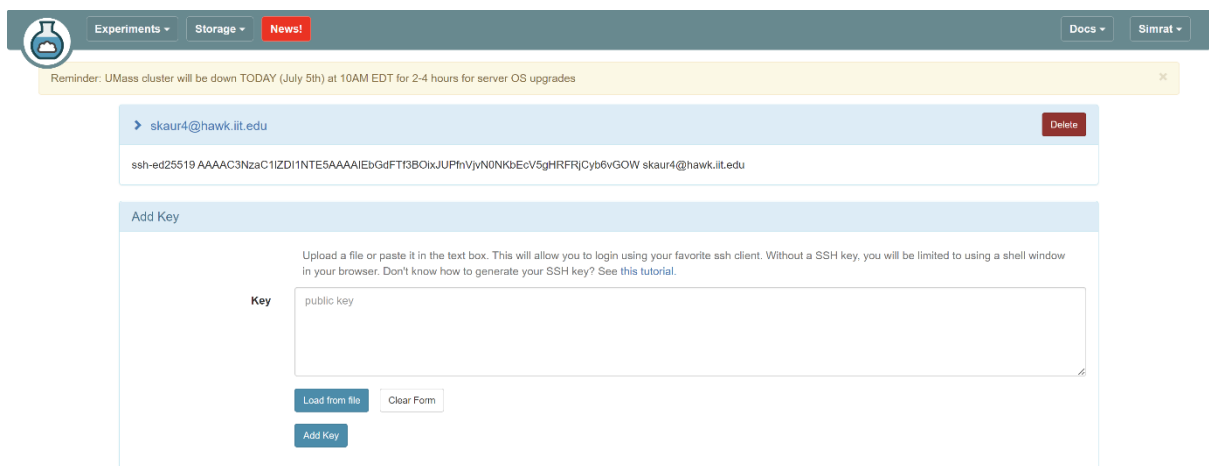


Figure 11: CloudLab SSH key

## 3. Manage Account

Go to 'Manage Account' to create a profile and click on 'change profile' > next > select 'fpga-post-boot' for OCTFPGA project and click next > select your OS Image and tool version > Give a Name to your project profile and click on NExt > Now you need to mention a start time and duration for how long are you going to work on this node. The maximum is 16 hours at a stretch and after that you will have to restart your experiment again.

Wait until you start time.

## 4. SSH into your OCT node

You are all set, once you start your experiment time; On you can see your experiment on your dashboard > click on settings under the 'Actions' and select Shell.

SSH in and Start your Experiment!



## References

OCT has some good documentation; you can refer it here:

1. <https://github.com/OCT-FPGA/OCT-Tutorials>
2. <https://docs.massopen.cloud/en/latest/openstack/index.html>
3. <http://docs.cloudlab.us/>