

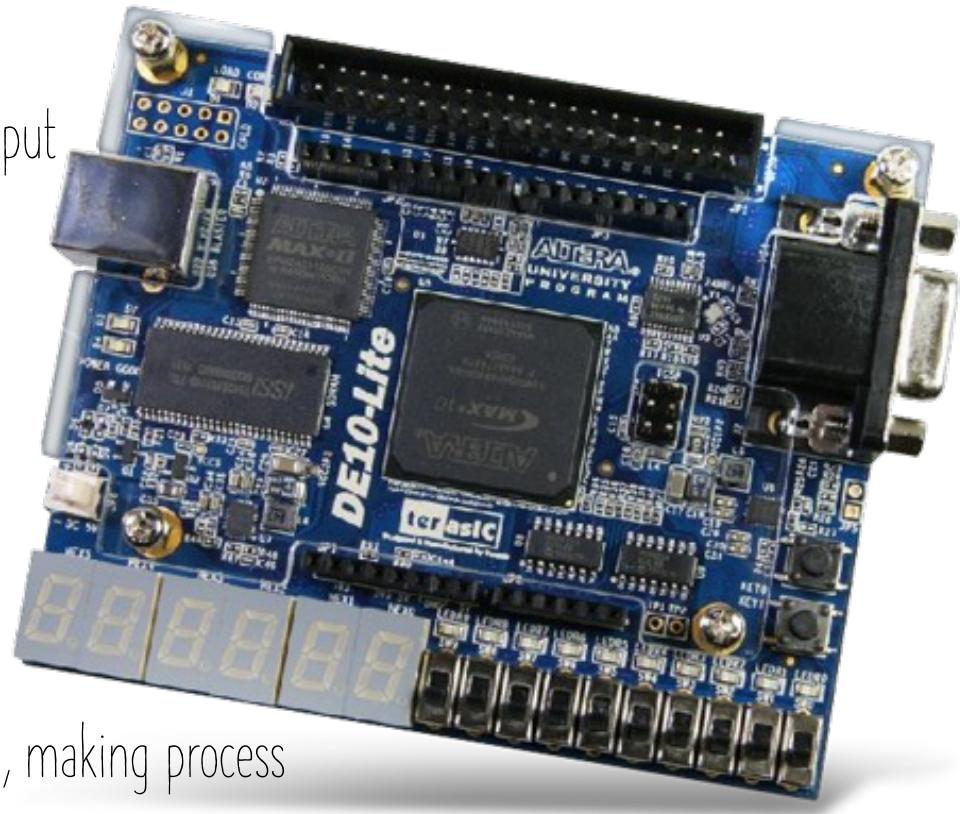


Digital Circuit Design

Li Bai

What we will cover...

- Digital (we will need to learn everything about the binary ...)
- We will need to design a process based on input/state to move into different output
- Difference between Arduino and DE10-Lite
- Quartus and EDA Playground
 - Quartus will be on AWS Academy
 - <https://edaplayground.com/>
- Learn combinatory logic, sequential logic, flip-flop, block diagram, timing diagram, making process



AWS Academy Student login

aws academy student login 1

All Perspectives Images Videos News More Tools

About 15,400,000 results (0.19 seconds)

 AWS Academy Portal
<https://www.awsacademy.com> ::

AWS Academy Portal
We have launched a new **login** experience for all **AWS Academy** users. Please re ... Forgot your Password? Are you a **student**? information. close image. If you are ...

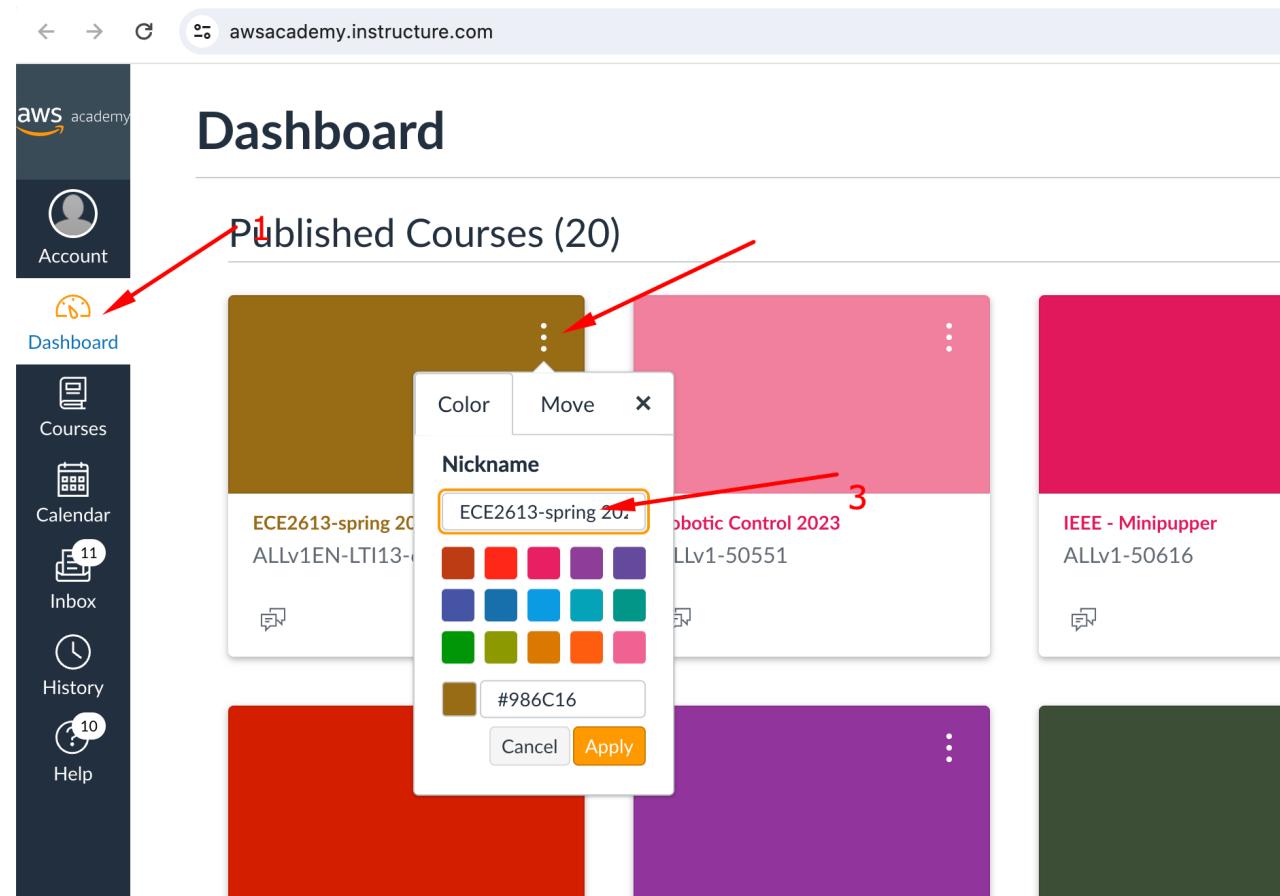
 Instructure
<https://awsacademy.instructure.com> · Translate this page ::

Untitled 2
学生の方はこちらからログインしてください。已注册课程的学生请在这里登录. Educator Login. (For educators who have access to the AWS Academy Portal).

 Instructure
<https://awsacademy.instructure.com/login/canvas> ::

Canvas - Amazon AWS Academy Login - Instructure
Canvas by Instructure. **Log In**. Forgot Password? Enter your Email and we'll send you a link to

AWS Academy Canvas



Access Learner's Lab

The screenshot shows a course navigation menu from awsacademy.instructure.com. The menu items are Home, Modules (which is highlighted with a red arrow labeled '1'), Discussions, and Grades. Below the menu, there are three main sections: Course Welcome and Overview, AWS Academy Learner Lab Compliance and Security, and AWS Academy Learner Lab. The AWS Academy Learner Lab section is expanded, showing a 'Launch AWS Academy Learner Lab' button (pointed to by a red arrow labeled '2') and a 'AWS Academy Learner Lab Resources' section.

awsacademy.instructure.com/courses/67880/modules

ALLv1EN-LTI13-67880 > Modules

Home

Modules

Discussions

Grades

Course Welcome and Overview

AWS Academy Learner Lab Compliance and Security

AWS Academy Learner Lab

Launch AWS Academy Learner Lab

AWS Academy Learner Lab Resources

Accept terms and conditions

-LTI... > Modules > AWS Academ... > Launch AWS Academy Learner Lab



Please read the terms and conditions shown below and click on the "I agree" button at the bottom of this page to continue.

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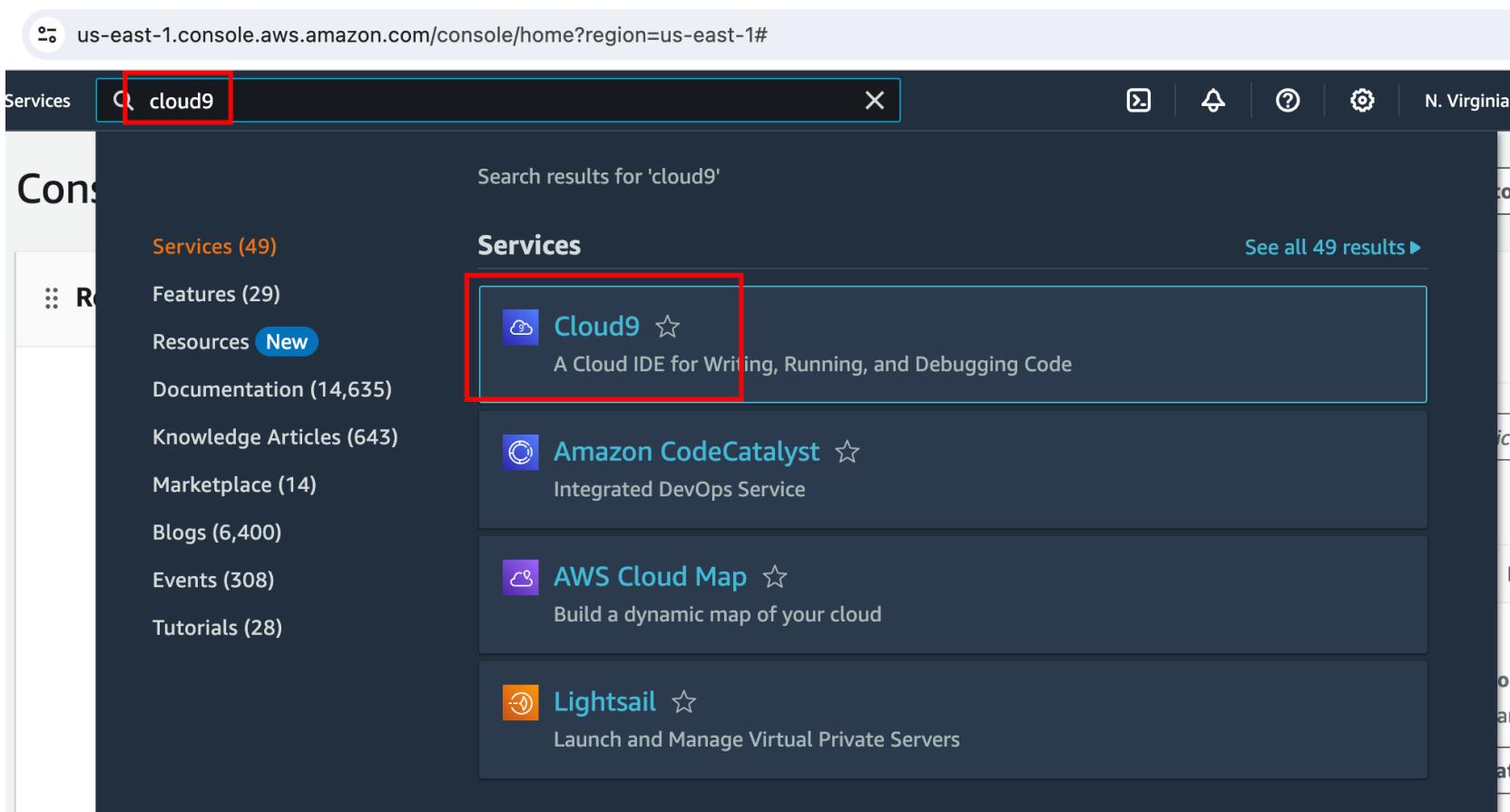
Start lab

The screenshot shows a web browser window for the AWS Academy Learner Lab. The URL in the address bar is `awsacademy.instructure.com/courses/67880/modules/items/6035341`. The page title is "ALLv1EN-LTI... > Modules > AWS Acade... > Launch AWS Academy Learner Lab". The main content area has a terminal-like interface with the prompt `eee_W_2764216@runweb109510:~$`. On the right side, there is a sidebar titled "Learner Lab" containing links for "Environment Overview", "Environment Navigation", "Access the AWS Management Console", "Region restriction", and "Service usage and other restrictions". At the top right of the main content area, there are several buttons: "Start Lab" (highlighted with a red box and arrow), "End Lab", "AWS Details", "Readme", "Reset", and a close button. The "AWS" tab is selected in the top navigation bar.

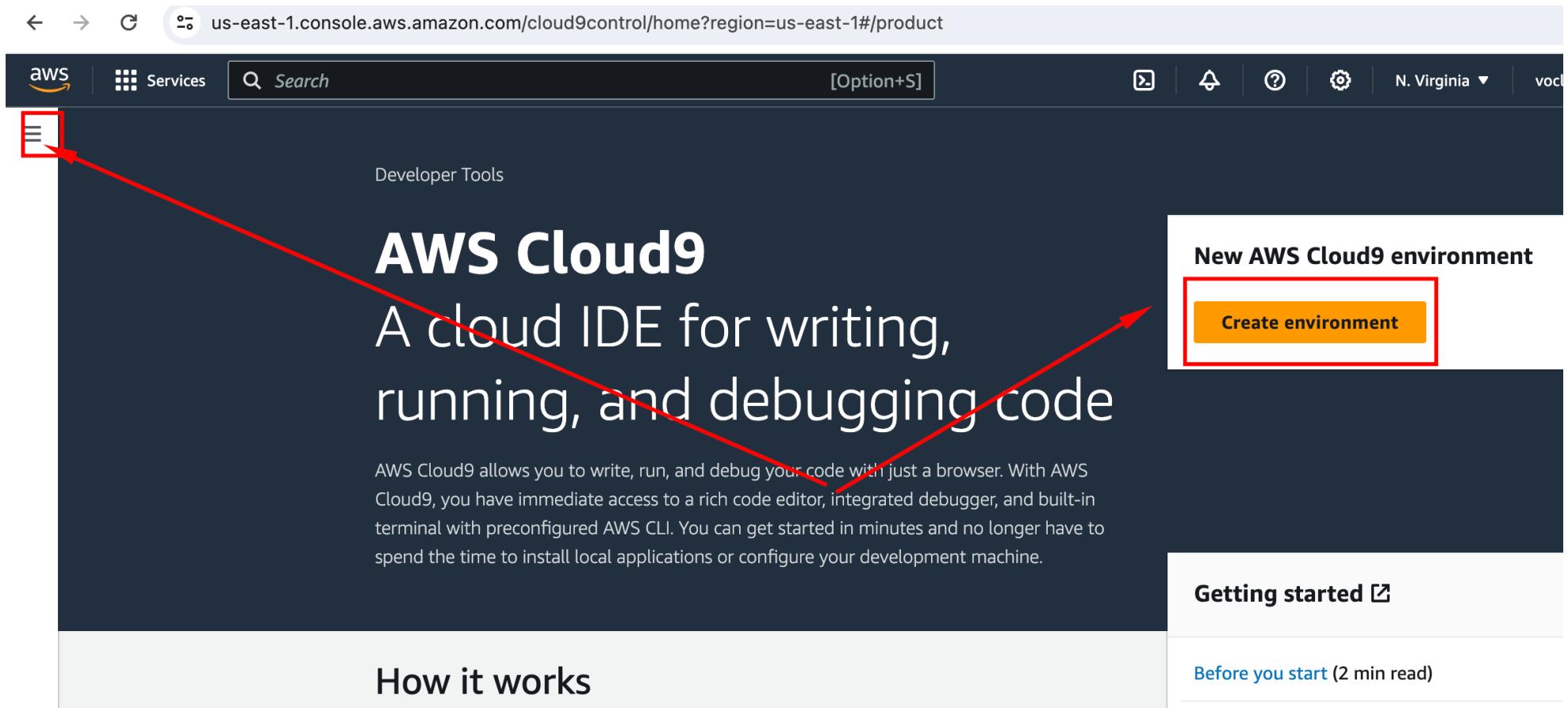
AWS green -> go to console

The screenshot shows the AWS Academy Learner Lab interface. At the top, there's a navigation bar with the path: ... > Modules > AWS Acade... > Launch AWS Academy Learner Lab. Below the navigation bar is a header with the AWS logo (highlighted with a red box), the status "Used \$0 of \$100", a timer "03:58", and buttons for "Start Lab", "End Lab", "AWS Details", and "Recent". A red arrow points from the AWS logo down to the terminal window. The terminal window displays the command "eee_W_2764216@runweb109509:~\$". To the right of the terminal is a sidebar titled "Learner La" with a dropdown menu set to "EN-US". The sidebar also contains a list of links: Environment Overview, Environment Navigation, Access the AWS Manager, Region restriction, Service usage and other r, Using the terminal in the, Running AWS CLI comma, Using the AWS SDK for Py, Preserving your budget, Accessing EC2 Instances, and SSH Access to EC2 Instanti.

Find cloud9



Create environment



Ubuntu server cloud9 setup

AWS Cloud9 > Environments > Create environment

Create environment Info

Details

Name Limit of 60 characters, alphanumeric, and unique per user.

Description - optional

Limit 200 characters.

Environment type Info New EC2 instance Existing compute

Determines what the Cloud9 IDE will run on.

New EC2 instance

Cloud9 creates an EC2 instance in your account. The configuration of your EC2 instance cannot be changed by Cloud9 after creation.

Existing compute

You have an existing instance or server that you'd like to use.

New EC2 instance

Services Search [Option+S] 

New EC2 instance

Instance type Info

The memory and CPU of the EC2 instance that will be created for Cloud9 to run on.

t2.micro (1 GiB RAM + 1 vCPU)
Free-tier eligible. Ideal for educational users and exploration.

t3.small (2 GiB RAM + 2 vCPU)
Recommended for small web projects.

m5.large (8 GiB RAM + 2 vCPU)
Recommended for production and most general-purpose development.

Additional instance types
Explore additional instances to fit your need.

Additional instance types

Platform Info

This will be installed on your EC2 instance. We recommend Amazon Linux 2023.

Timeout

How long Cloud9 can be inactive (no user input) before auto-hibernating. This helps prevent unnecessary charges.

Network settings Info

Finalize your cloud9 environment

Network settings Info

Connection
How your environment is accessed.

AWS Systems Manager (SSM)
Accesses environment via SSM without opening inbound ports (no ingress).

Secure Shell (SSH)
Accesses environment directly via SSH, opens inbound ports.

► **VPC settings Info**

► **Tags - optional Info**
A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

The following IAM resources will be created in your account

- **AWSServiceRoleForAWSCloud9** - AWS Cloud9 creates a service-linked role for you. This allows AWS Cloud9 to call other AWS services on your behalf.
You can delete the role from the AWS IAM console once you no longer have any AWS Cloud9 environments. [Learn more](#) 

[Cancel](#) **Create**

- c4.xlarge
- Ubuntu22.04
- ssh

Instruction on github

github.com/lbaitemple/ece2613/tree/spring24

lbaitemple / ece2613

Issues Pull requests Actions Projects Wiki Security Insights Settings

ece2613 Public

spring24 6 Branches 2 Tags

Switch branches/tags Find or create a branch...

Branches Tags

master default

de10lite

fall2021

rpi

✓ spring24

spring2022

View all branches

lab3

lab4

lab5

behind master

47524fd · 3 days ago 184 Commits

Add files via upload 3 months ago

Delete test.bat 4 years ago

Add files via upload 4 years ago

Add files via upload 3 years ago

Update tb_gates.sv 3 years ago

Add files via upload 3 years ago

Add files via upload 3 years ago

git clone -b spring24 https://github.com/lbaitemple/ece2613
cd ece2613
bash ./setup.bash
sudo reboot

2613_2024s

Instruction is provided at <https://sites.google.com/a/temple.edu/ece2612/home/cloud9-setup>

after you select the instance for cloud9, in the terminal

```
git clone -b spring24 https://github.com/lbaitemple/ece2613  
cd ece2613  
bash ./setup.bash  
sudo reboot
```

Test the code

- right click on m_sim (extension file) and run
- right click on qsf (extension file) and run

Resize cloud9 terminal windows

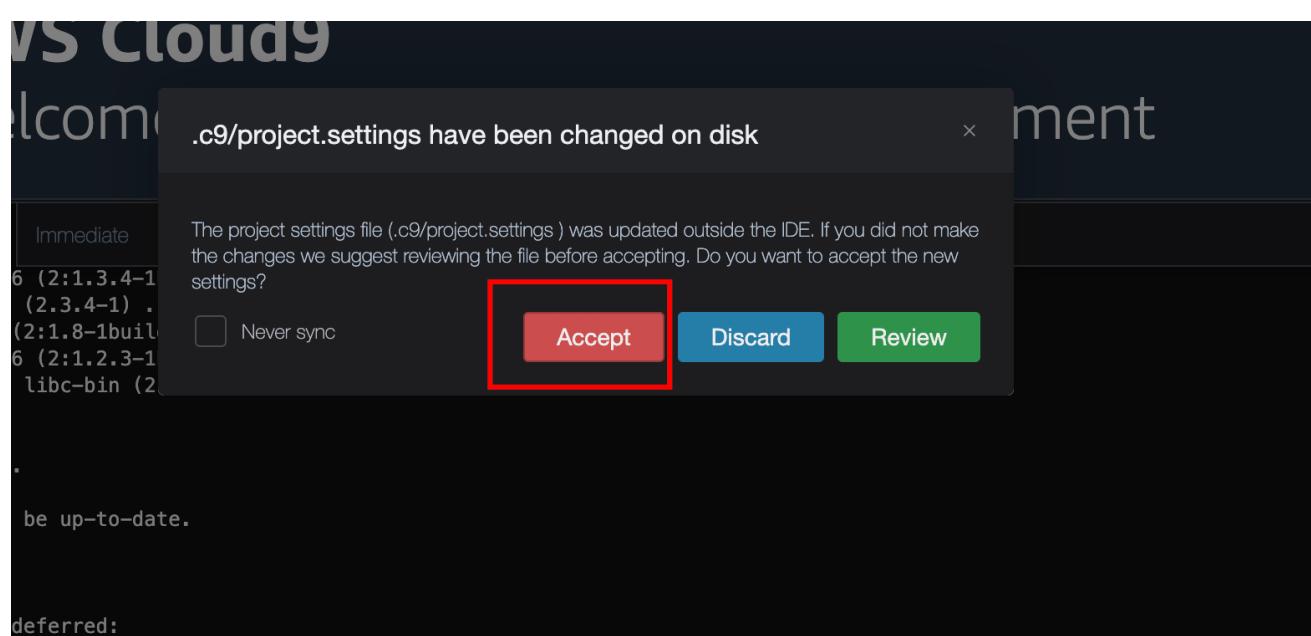
AWS Cloud9
Welcome to your development environment

```
bash - "ip-172-31-19-32" x Immediate x +  
Get:17 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy/multiverse amd64 c-n-f Metadata [8372 B]  
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1277 kB]  
Get:19 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/main Translation-en [261 kB]  
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [16.1 kB]  
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 Packages [1272 kB]  
Get:22 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted Translation-en [207 kB]  
Get:23 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 c-n-f Metadata [520 B]  
Get:24 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [1023 kB]  
Get:25 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe Translation-en [228 kB]  
Get:26 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 c-n-f Metadata [22.1 kB]  
Get:27 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 Packages [42.1 kB]  
Get:28 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/multiverse Translation-en [10.1 kB]  
Get:29 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 c-n-f Metadata [472 B]  
Get:30 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/main amd64 Packages [41.7 kB]  
Get:31 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/main Translation-en [10.5 kB]  
Get:32 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/main amd64 c-n-f Metadata [388 B]  
Get:33 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/restricted amd64 c-n-f Metadata [116 B]  
Get:34 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/universe amd64 Packages [24.3 kB]  
Get:35 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/universe Translation-en [16.5 kB]  
Get:36 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/universe amd64 c-n-f Metadata [644 B]  
Get:37 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports/multiverse amd64 c-n-f Metadata [116 B]  
Get:38 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [1062 kB]  
Get:39 http://security.ubuntu.com/ubuntu jammy-security/main Translation-en [201 kB]  
Get:40 http://security.ubuntu.com/ubuntu jammy-security/restricted amd64 Packages [1244 kB]  
Get:41 http://security.ubuntu.com/ubuntu jammy-security/restricted Translation-en [203 kB]  
Get:42 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages [826 kB]  
Get:43 http://security.ubuntu.com/ubuntu jammy-security/universe Translation-en [156 kB]  
93% [14 Commands-amd64 store 0 B]
```

After about 15-20 minutes...

sudo reboot

Reboot the system

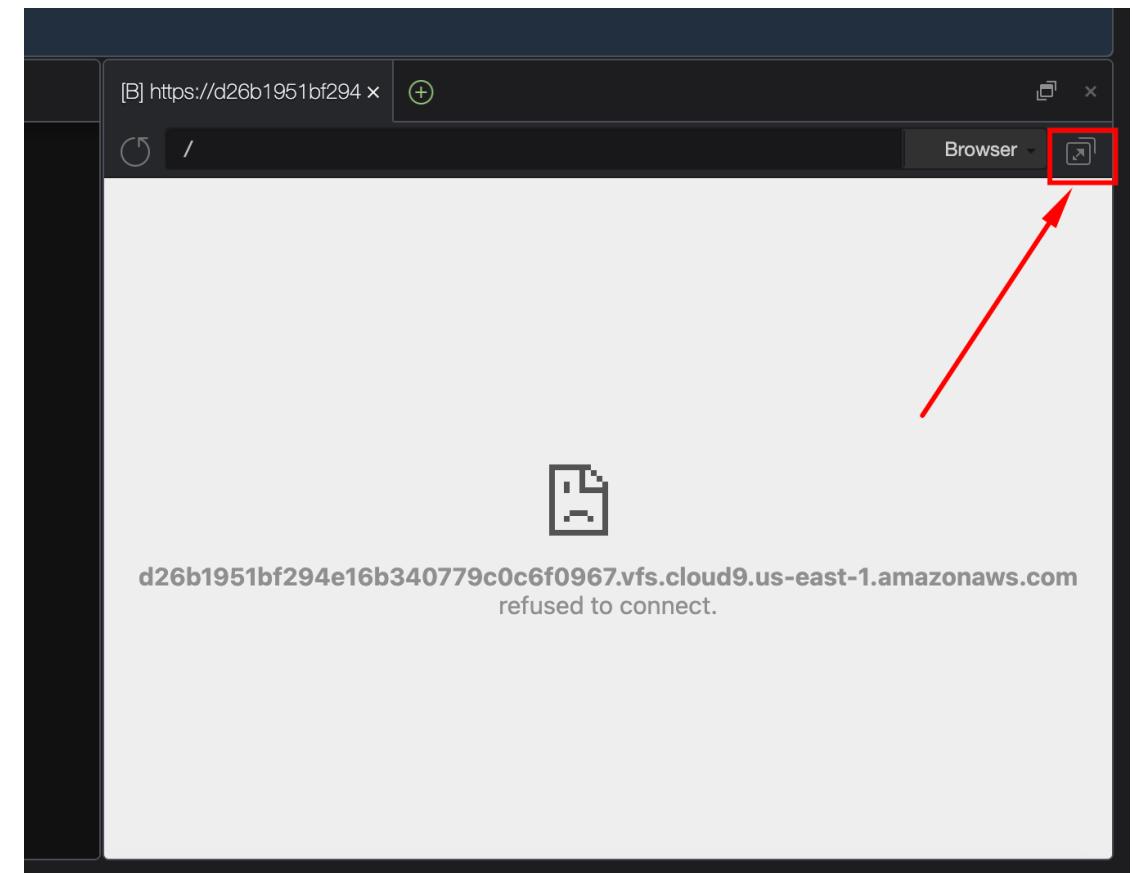
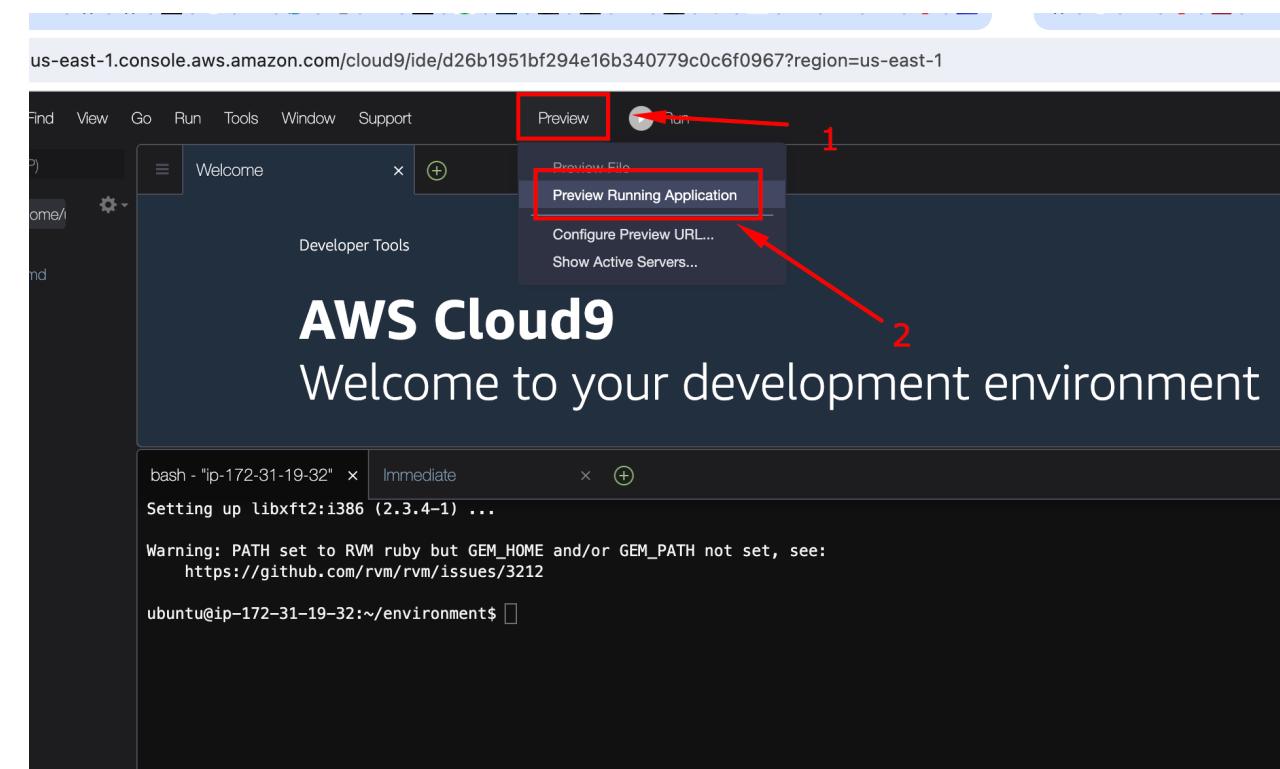


AWS Cloud9

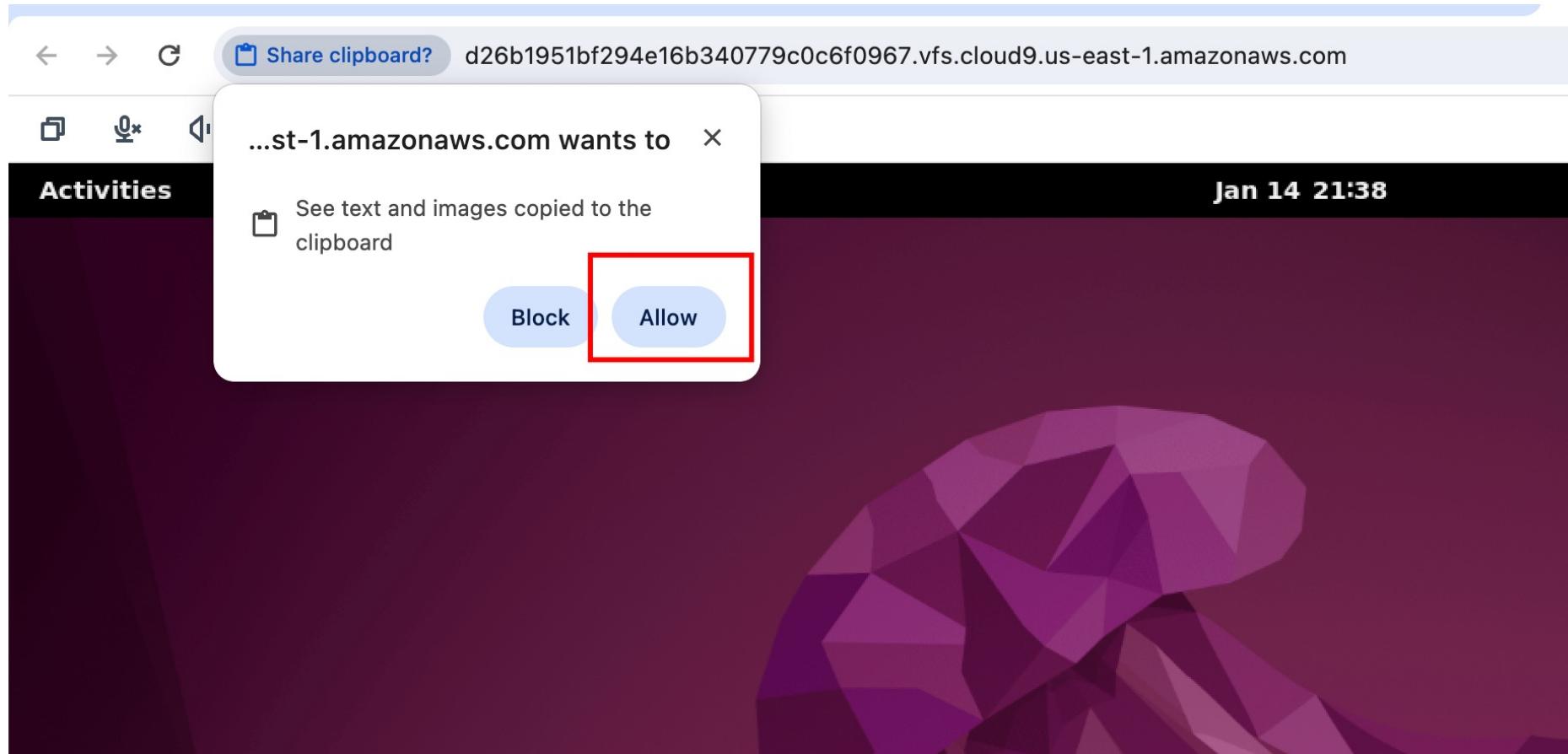
Welcome to your development environment

```
bash - "ip-172-31-19-32" ✘ Immediate ✘ +  
Setting up libxext6:i386 (2:1.3.4-1build1) ...  
Setting up libxft2:i386 (2.3.4-1) ...  
Setting up libxi6:i386 (2:1.8-1build1) ...  
Setting up libxtst6:i386 (2:1.2.3-1build4) ...  
Processing triggers for libc-bin (2.35-0ubuntu3.6) ...  
Scanning processes...  
Scanning candidates...  
Scanning linux images...  
  
Running kernel seems to be up-to-date.  
  
Restarting services...  
  
Service restarts being deferred:  
/etc/needrestart/restart.d/dbus.service  
systemctl restart docker.service  
systemctl restart getty@tty1.service  
systemctl restart networkd-dispatcher.service  
systemctl restart systemd-logind.service  
systemctl restart unattended-upgrades.service  
systemctl restart user@1000.service  
  
No containers need to be restarted.  
  
No user sessions are running outdated binaries.  
  
No VM guests are running outdated hypervisor (qemu) binaries on this host.  
voclabs:~/environment/ece2613 $ sudo reboot
```

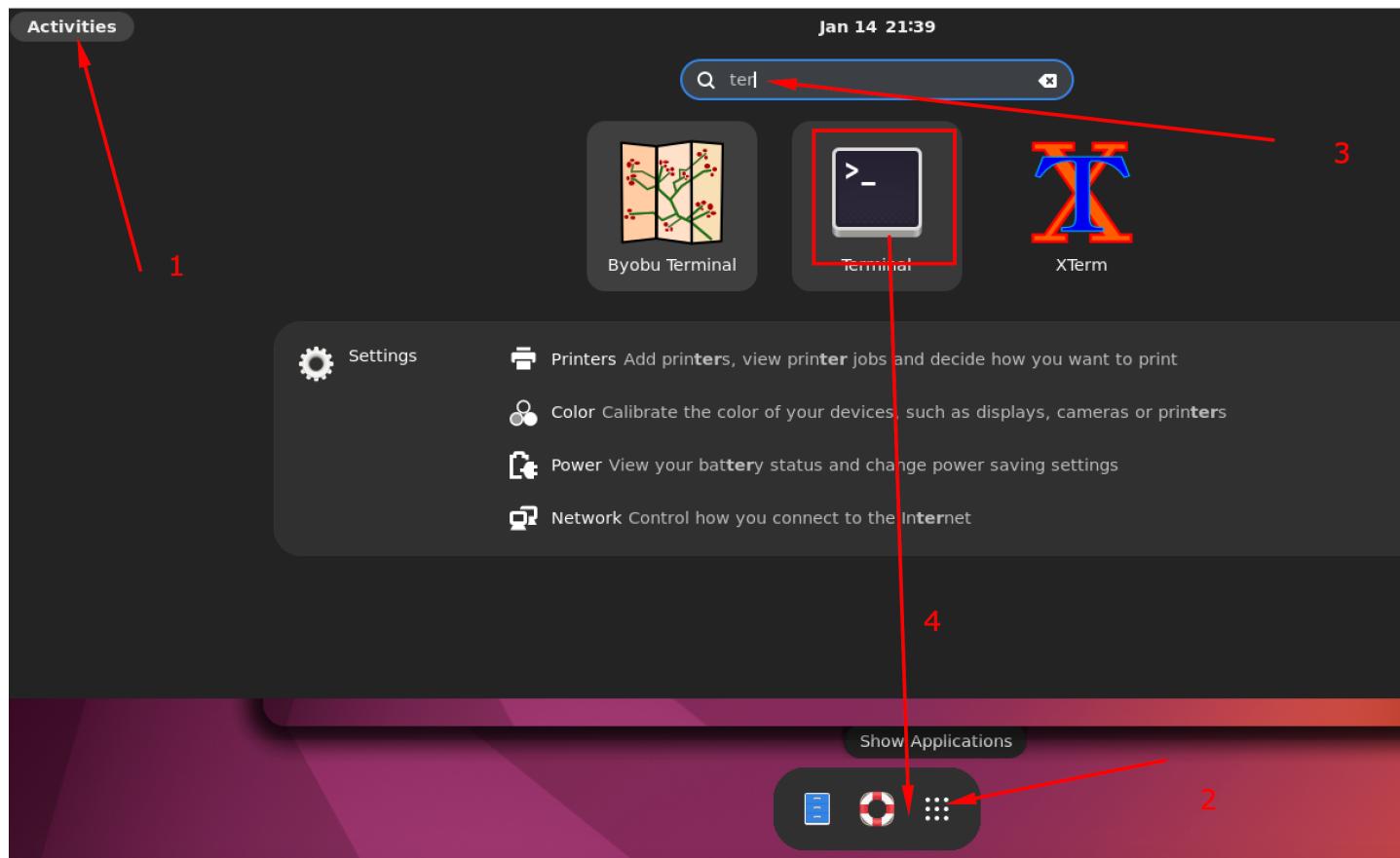
Xwindow access



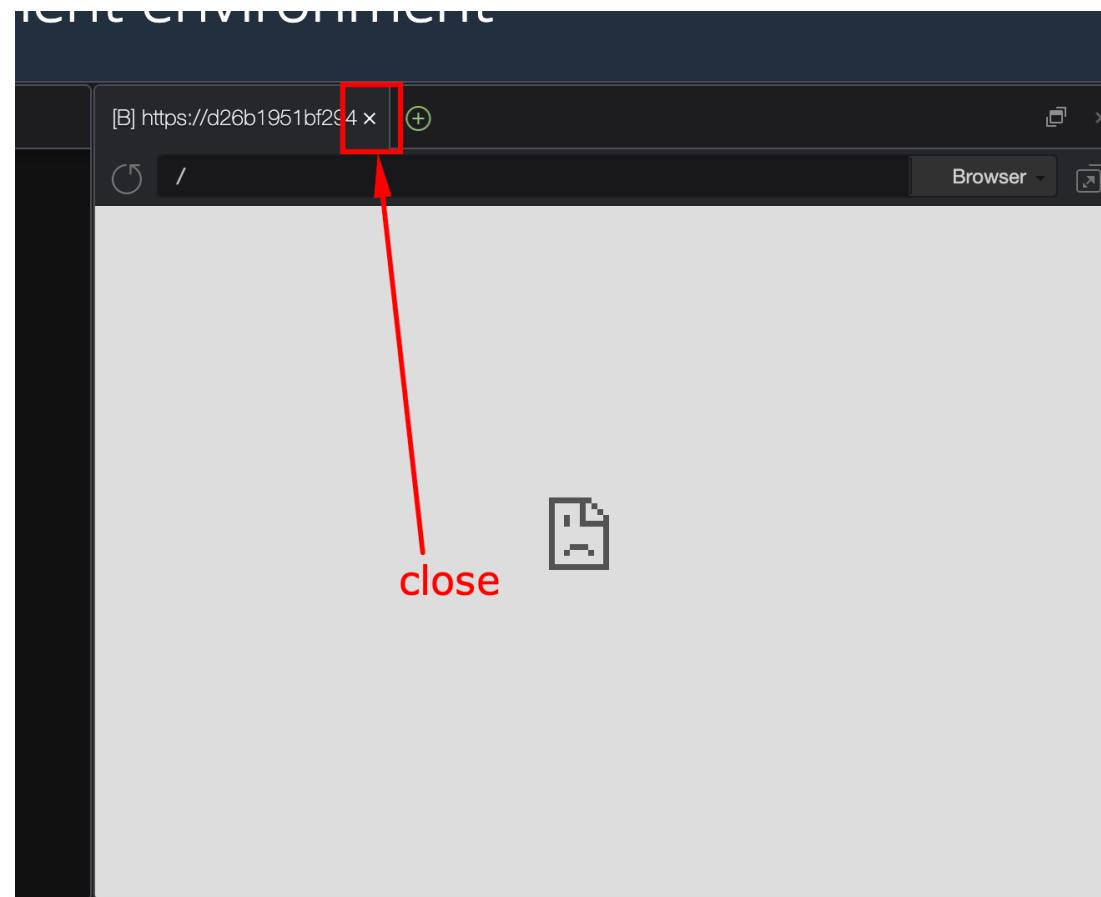
Allow xwindow



Place terminal in task bar

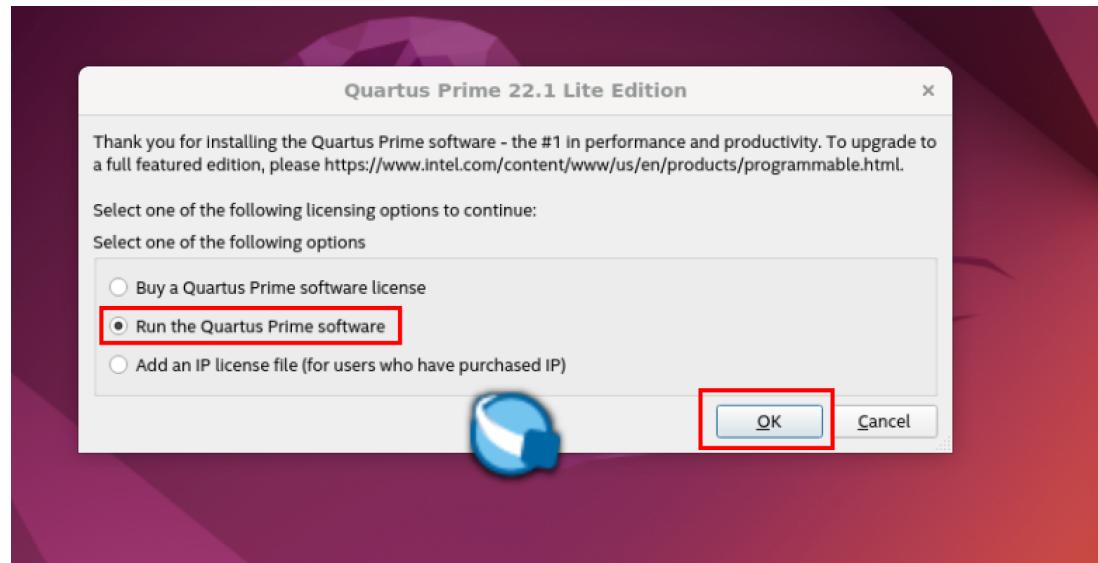


Close access to xwindow

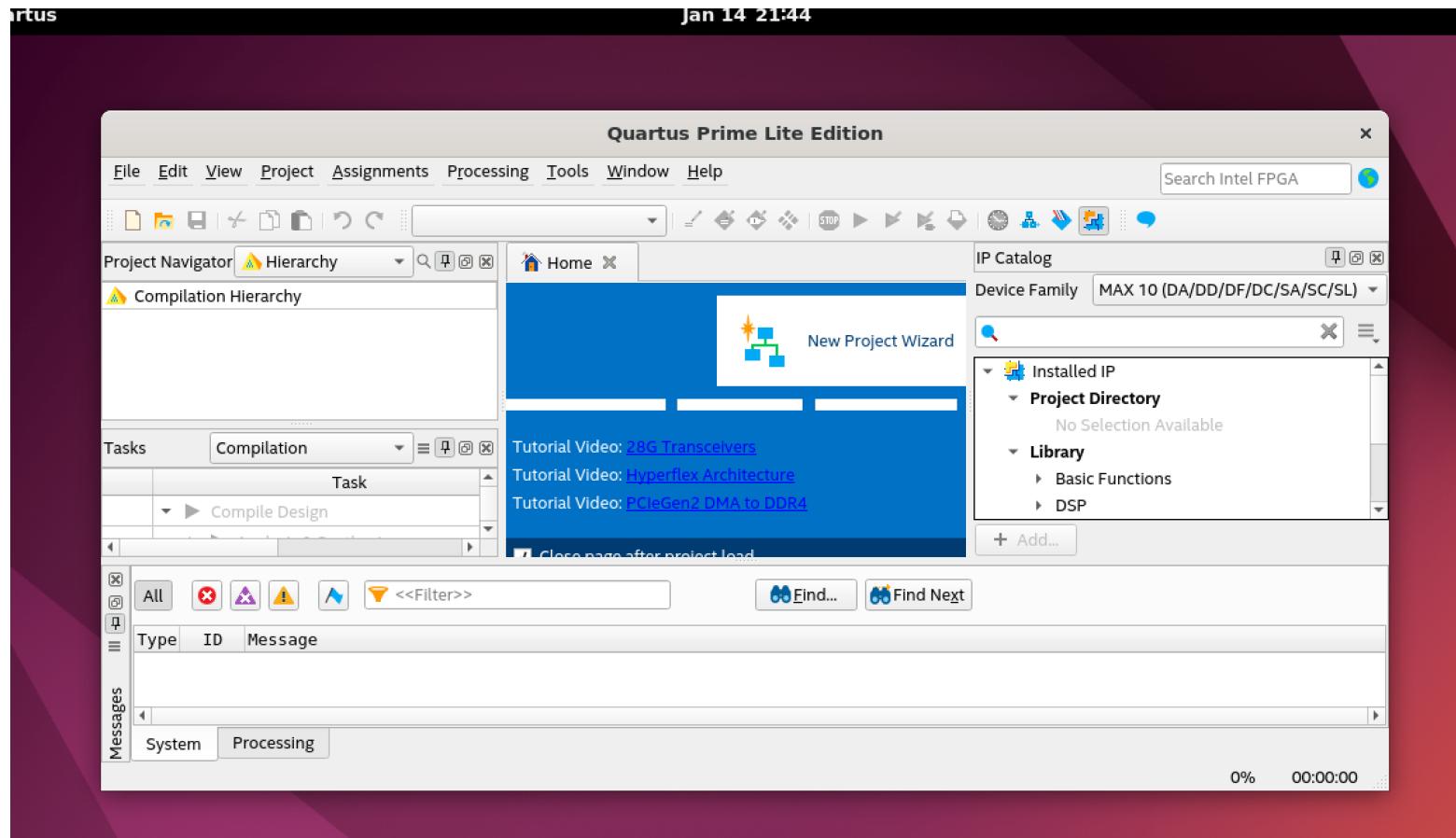


Open quartus in cloud 9 terminal

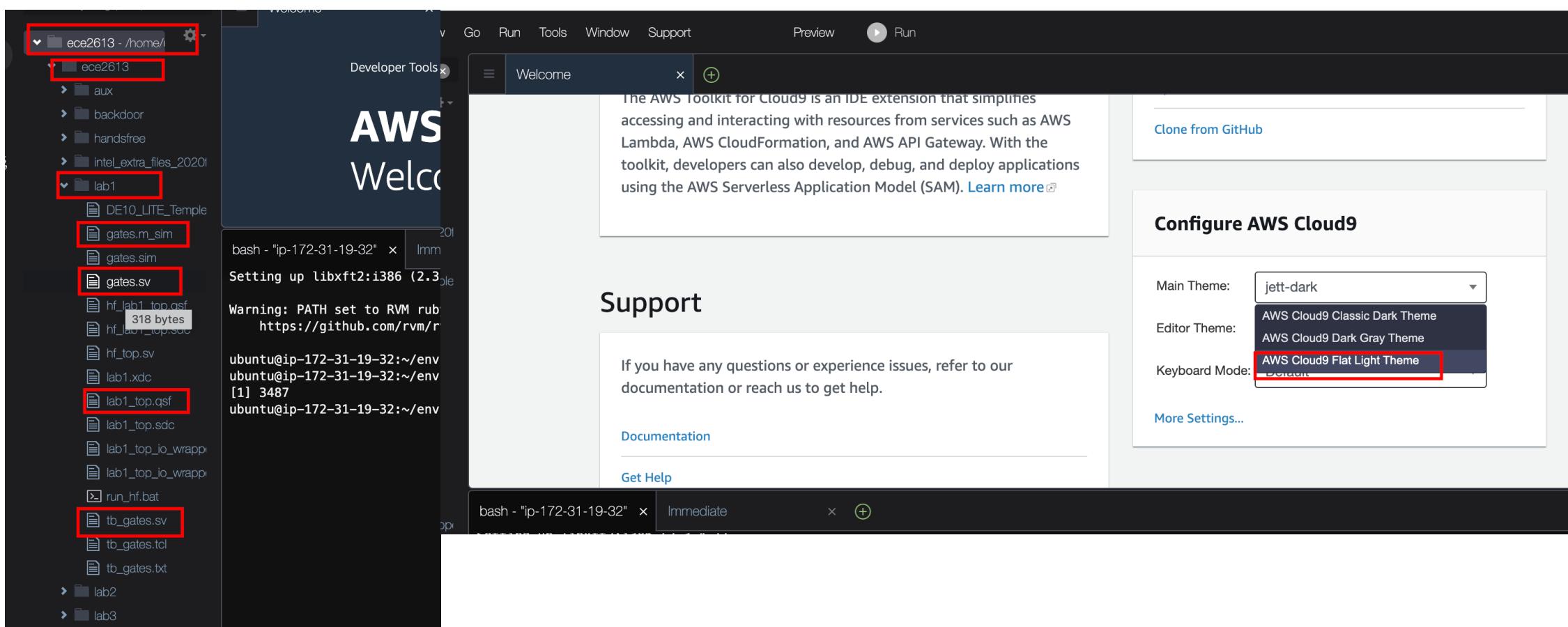
```
bash ip-172-31-19-32 ~ immediate
Setting up libxft2:i386 (2.3.4-1) ...
Warning: PATH set to RVM ruby but GEM_HOME and/or GEM_PATH not set, see:
https://github.com/rvm/rvm/issues/3212
ubuntu@ip-172-31-19-32:~/environment$ export DISPLAY=:0
ubuntu@ip-172-31-19-32:~/environment$ quartus &
```



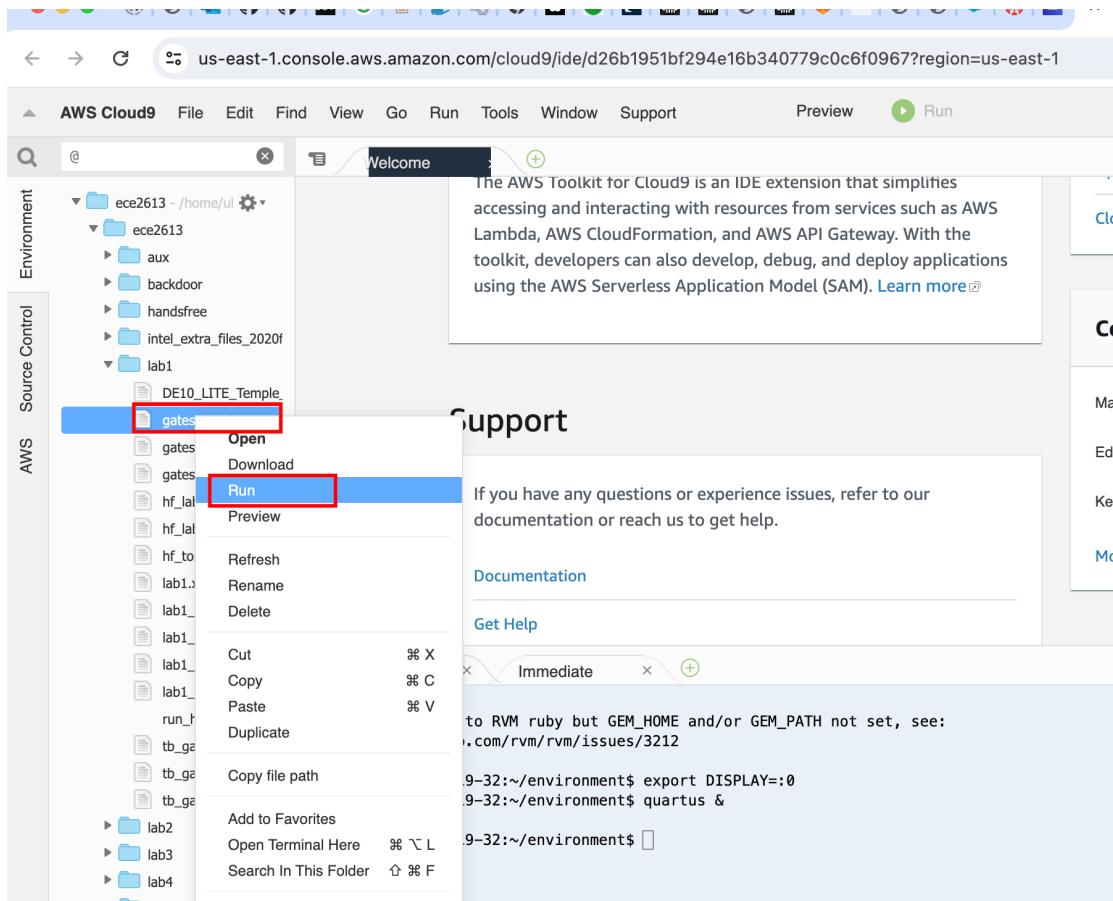
Quartus in xwindow



Cloud 9 file listing



Check m_sim file



```
# Loading work.gates
# do gates.m_sim
# Mismatch--loop index i: 0; input: 00, expected: 1000, received: xxxx
# Mismatch--loop index i: 1; input: 01, expected: 1110, received: xxxx
# Mismatch--loop index i: 2; input: 10, expected: 1110, received: xxxx
# Mismatch--loop index i: 3; input: 11, expected: 0011, received: xxxx
# Simulation complete - 4 mismatches!!!
# ** Note: $finish : tb_gates.sv(64)
#   Time: 80 ns Iteration: 0 Instance: /tb_gates
# End time: 21:48:13 on Jan 14, 2024, Elapsed time: 0:00:00
# Errors: 0, Warnings: 0
```

Process exited with code: 0

Check qsf file ...

The screenshot shows a terminal window with the following command and its output:

```
bash - "ip-172-31" * Immediate * ece2613/lab1/ga * ece2613/lab1/lab *
```

Command: ece2613/lab1/lab1_top.qsf

```
INFO: The Intel FPGA IP License Agreement, or other applicable license
Info: agreement, including, without limitation, that your use is for
Info: the sole purpose of programming logic devices manufactured by
Info: Intel and sold by Intel or its authorized distributors. Please
Info: refer to the applicable agreement for further details, at
Info: https://fpgasoftware.intel.com/eula.
Info: Processing started: Sun Jan 14 21:49:26 2024
Info: Command: quartus_cpf -c -q 1MHz -g 3.3 -n p output_files/lab1_top.sof output_files/lab1_top.svf
Info: Quartus Prime Convert_programming_file was successful. 0 errors, 0 warnings
Info: Peak virtual memory: 323 megabytes
Info: Processing ended: Sun Jan 14 21:49:26 2024
Info: Elapsed time: 00:00:00
Info: Total CPU time (on all processors): 00:00:01
```

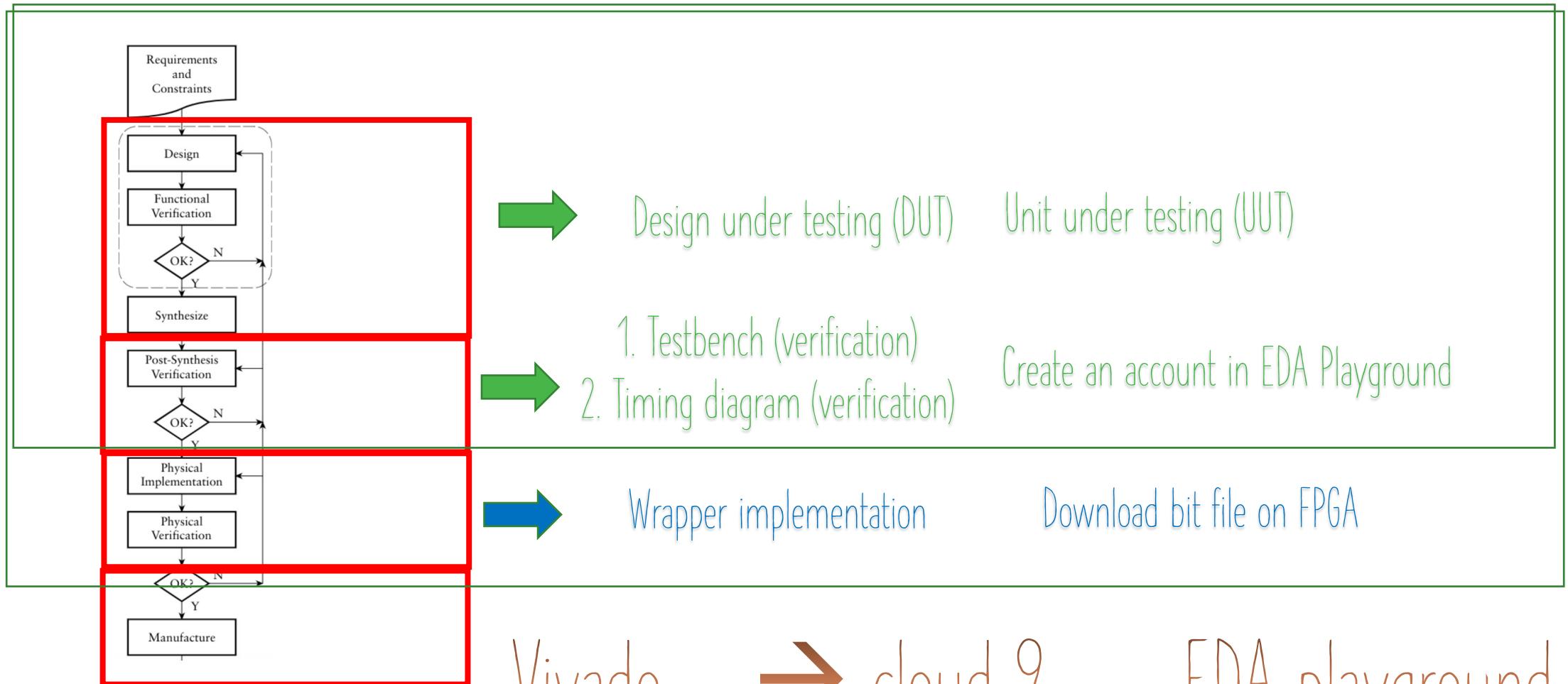
The terminal window is part of a larger interface with the following components:

- Left Panel:** A file browser showing a directory structure under "ece2613". A context menu is open over the file "lab1_top.qsf", with options: Open, Download, Run, Refresh, Rename, Delete, Cut, Copy, Paste, Duplicate, Copy file path, Add to Favorites, Open Terminal Here, Search In This Folder, New File, and Show Folders.
- Middle Panel:** A "Support" section with a "Documentation" link and a "Get Help" link.
- Right Panel:** A "Support" section with a "Main Theme: AWS Cloud9", "Editor Theme: Cloud9", "Keyboard Mode: Default", and a "More Settings..." button.
- File Browser:** A sidebar showing a tree view of files and folders, including "incremental_db" and "output_files" (which is expanded to show sub-files like "lab1_top.asm.rpt" and "lab1_top.sof").

For the next class...

- Think about how you would design a vendor machine with instruction...

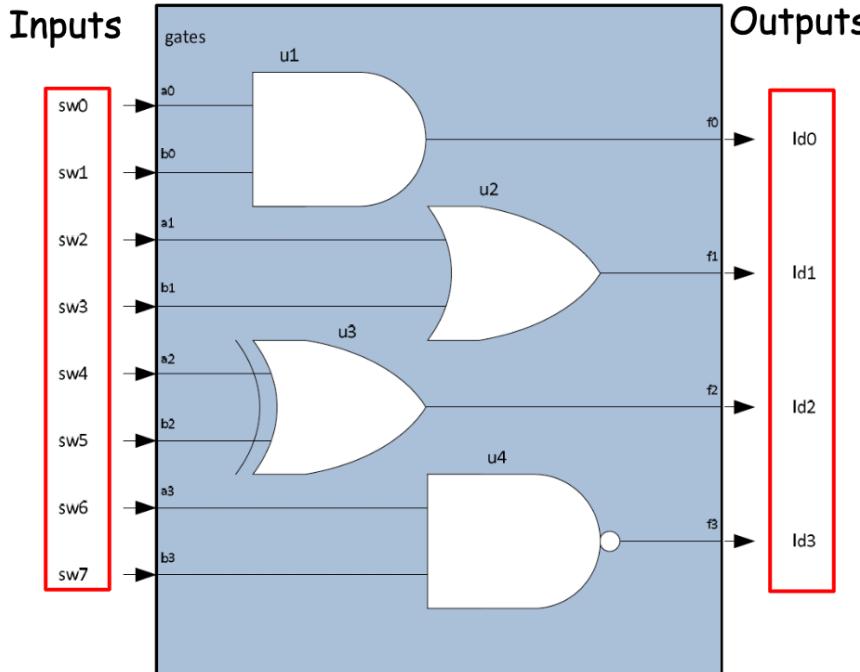
Understand Designs (pg. 27)



ABET seven student outcomes

STUDENT OUTCOMES	FUNDAMENTALS	ENGINEERING TO SPECS	EXPERIMENTING	HONORABLE PRACTICE	COMMUNICATING	TEAMWORK	ONGOING LEARNING
	"An ability to identify, formulate and solve complex problems by applying principles of engineering, science and mathematics."	"An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors."	"An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions."	"An ability to recognize ethical and professional responsibilities in engineering situations, and make informed judgements which consider the impact of engineering solutions in global, environmental, and social contexts."	"An ability to communicate effectively with a range of audiences."	"An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives."	"An ability to acquire and apply new knowledge as needed, using appropriate learning strategies."
1.1 Apply principles of engineering, science, and mathematics to formulate, model, analyze, and solve complex electrical engineering problems.	2.1 Plan and execute engineering projects by identifying objectives, requirements, constraints, and applicable standards, as well as by using creative problem-solving skills.	6.1 Develop, perform, and interpret research experiments, product or process evaluations, and validation testing, all in accordance with applicable standards and best-practice methods.	4.1 Design and implement engineering solutions responsibly — by showing local-to-global concern for factors such as business and economic impacts, environmental and sustainability challenges, and health, safety, legal, civic, and social justice issues.	3.1 Write effectively on engineering topics for diverse technical and nontechnical readers.	5.1 Collaborate effectively and inclusively with individuals of diverse disciplinary, professional, and cultural backgrounds.	7.1 Efficiently find, cite, and critically use engineering literature, related publications, and other library-database resources.	
1.2 Apply computational tools, design tools, and programming to solve complex electrical engineering problems.	2.2 Use modern instrumentation and equipment in electrical and computer systems.	6.2 Collect experimental test data using modern hardware-software tools.	4.2 Comply with the principles and rules of conduct in professional codes (e.g., IEEE's), and apply ethical reasoning to resolve issues of general ethics that arise in engineering practice.	3.2 Deliver effective oral presentations on engineering topics for diverse technical and nontechnical audiences.	5.2 Flexibly take on leadership and other responsibilities as needed by the team to establish goals, plan tasks, and meet objectives.	7.2 Know how to pursue continuing education, professional certifications, and other steps to maintain technical proficiency, acquire new competences, and advance one's career.	
	* The "considerations"	* Use 3.3 if you want a PI	4.3 Attend reflectively to engineering-related current	3.3 Use accurate content and appropriate organization			* Use 4.3 if you want a PI

Block Diagram



```
//  
// lab1 : version 06/12/2020  
//  
'timescale 1ns / 1ps  
module gates(  
    output logic f0, output logic f1, output logic f2, output logic f3,  
    input logic a0, input logic b0, input logic a1, input logic b1,  
    input logic a2, input logic b2, input logic a3, input logic b3  
);  
  
// Write code starting here ...  
  
endmodule
```

Block diagram of gates design