ECE 3401 Digital Systems Design – Spring 2025

Setting up the VHDL Toolchain

We will use GHDL open-source simulator for the VHDL language. More details on GHDL can be found at <u>https://ghdl.github.io/ghdl/</u>. We will use the GTK+ based wave form viewer, GTKWave to view the VCD output of the designs. Three widely applicable methods to install these tools on your personal computers are discussed next. Once installed, run "ghdl –version" and "gtkwave –version" commands to confirm installation of the toolchain.

Method 1: Windows 10/11

You will leverage the Windows Subsystem for Linux (WSL). WSL is a lightweight Linux Virtual Machine (VM) that runs as a native Windows application.

The following instructions describe how to install WSL, Ubuntu Linux, and the required developer tools:

- Follow the Manual Installation Steps on the following webpage to install WSL:
 https://learn.microsoft.com/en-us/windows/wsl/install
- Open the Ubuntu Application by searching Ubuntu in start menu
- Install GHDL and GTKWave using the following commands in a terminal
 - o sudo apt update
 - o sudo apt install make ghdl gtkwave

Method 2: Linux

- Install GHDL and GTKWave using the following commands in a terminal
 - o sudo apt update
 - o sudo apt install make ghdl gtkwave

Method 3: MacOS

- Install Homebrew by running this command in a terminal:
 - /bin/bash -c "\$(curl -fsSL
 - https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"
- Install GHDL using this command
 - brew install --cask ghdl
- Now GTKWave can be installed using with brew install --cask gtkwave. For newer Macs, there is an issue with this gtkwave install. So, here is what needs to be done to install GTKWave on newer Mac machines.
 - o brew uninstall gtkwave
 - o brew untap randomplum/gtkwave
 - o brew install --HEAD randomplum/gtkwave/gtkwave

VirtualBox Installation

- 1. Download <u>Virtual box</u> and <u>Ubuntu 20.04.06 ISO</u>. Create a Linux virtual machine w/ 20GB of drive space and at least 4GB of RAM. You will run Method 2 once VM is installed.
- 2. Open Virtual Box and click on New

3. Give the name to your virtual machine and select the ISO image and click Next

🗳 Create Virtual Machine			?	×
athilli	Virtual r	machine Name and Operating System		
	Please choos will be used may be used	se a descriptive name and destination folder for the new virtual machine. The nam throughout VirtualBox to identify this machine. Additionally, you can select an ISO a to install the guest operating system.	e you ch image w	oose which
	<u>N</u> ame:	Test		
	<u>F</u> older:	C:\Users\ahgk2\VirtualBox VMs		•
	ISO Image:	C:\Users\ahgk2\Downloads\ubuntu-20.04.6-desktop-amd64.iso		•
				64
		Skip Unattended Installation		
		Detected OS type: Ubuntu (64-bit). This OS type can be installed unattended will start after this wizard is closed.	y. The in	nstall
Help		Expert Mode Back <u>N</u> ext	Can	cel

4. Update the username and password to your liking and click Next Create Virtual Machine

	You can configure the hostname. Additionally possible to provide a p	unattended guest OS i you can enable guest roduct key.	nstall by n additions	P nodifying username, install. For Microsoft	password, and Windows guests it	is
	Username and Passwor Username: Pass <u>w</u> ord: <u>R</u> epeat Password:	d testuser •••••	✓○	Additional Options Product Key: 4 Hostna <u>m</u> e: <u>D</u> omain Name:	Test myguest.virtualbo Install in Backgro	**************************************
	Gu <u>e</u> st Additions	C:\Program Files				
Help				Back	<u>N</u> ext	<u>C</u> ancel

5. Select 8GB or 4GB of base memory. For processors move the cursor to middle. And click Next

👽 Create Virtual Machine		?	\times
	Hardware		
	You can modify virtual machine's hardware by changing amount of RAM and virtual CPU count. Enabling EFI is also possible. Base Memory:	8192 M	в 🖨
	4 MB 16384 MB Processors: 1 1 CPU 16	5 CPUs	8 🗘
	Enable EFI (special OSes only)		
Help	Back	Can	cel

6. Create a Disk size of 25GB. And click Next

💱 Create Virtual Machine	2		? ×			
	Virtual Hard disk					
	If you wish you can add a virtual hard disk file or select an existing virtual hard disk.	hard disk to the new machine. You can either create a new one. Alternatively you can create a virtual machine without a				
	<u>Create a Virtual Hard Disk Now</u>					
	D <u>i</u> sk Size:		25.00 GB			
	4.00 MB	2.00 TB				
	Pre-allocate Full Siz	re la				
	Use an Existing Virtual Hard D	isk File				
	ubuntu-20.04.06.vdi (Normal. 100.00 GB)					
	Do Not Add a Virtual Hard Did	,				
Help		<u>B</u> ack <u>N</u> ext	Cancel			
Click Finish						
•						
😻 Create Virtual Machine			? X			
	Summary					
	The following table summarizes the configuration you have chosen for the new virtual machine.					
	When you are happy with the confi Alternatively you can go back and	iguration press Finish to create the virtual machine. modify the configuration.				
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Machine Name and OS Typ	e -				
	Machine Name	- Test				
	Machine Folder	C:/Users/ahgk2/VirtualBox VMs/Test	Lico			
	Guest OS Type	Ubuntu (64-bit)	1.150			
	Skip Unattended Install	false				
	🗛 Unattended Install					
r -	Username	testuser				
	Product Key	false				
	Install in Background	false				
The second se	Install Guest Additions	false				
	Hardware					
	Base Memory	8192				
	Processor(s)	8				

8. Open your terminal

Help

7.

- 9. Make sure you have sudo access. If not follow these steps
 - a. Run "su -"
 - b. Run "visudio"
 - c. Add the highlighted line in the file under the sudo as shown. Instead of testuser write your own username

	root@Test:~ Q = _
GNU nano 4.8	/etc/sudoers.tmp
# See the man #	page for details on how to write a sudoers file.
Defaults Defaults	env_reset mail_badpass
Deraults	secure_path="/usr/local/sbin:/usr/local/bin:/usr/sbin:/
# Host alias s	
# User alias s	
# Cmnd alias s	
# User privile root ALL=(A	ge specification LL:ALL) ALL
# Members of t %admin ALL=(AL	he admin group may gain root privileges L) ALL
# Allow member %sudo All=(A	s of group sudo to execute any command
%testuser ALL=	(ALL:ALL) ALL
See sudoers(5) for more information on "#include" directives:
#includedir /e	

d. Save it and Run "exit"