# Using the CCS C Compiler Under MacOS

Through the use of a virtual machine, the CCS C Compilers can be used to program PIC microcontrollers on macOS. We recommend creating a Windows 10 virtual machine where you can then install the compiler and begin programming. Windows 10 does not require you to purchase a product key to make use of the operating system. By not activating Windows with a product key you can still use the OS however it will have limited features compared to an activated version. However, these limitations will not affect the use of CCS software.

Setting Up the Appropriate Drivers

Before we create the virtual machine, you must first install the appropriate driver to allow macOS to communicate with the ICD that is used when programming CCS prototyping boards. For this part, it is recommended that you download Xcode, a free app available on the app store. Xcode will make editing the driver files easier. Follow these steps to modify and install the appropriate drivers.

1. Download the driver from FTDI found here on the FTDI Chip website. On their website, scroll down to the table and find the correct driver for your version of macOS and download it. The download will contain a disk image that has the package for the driver inside. Run the installer package and follow the steps on screen to install the driver, a reboot may be required when the install is finished.

2. Open the Terminal app by searching for it using the spotlight search in the top-right corner or by searching for it in the Launchpad.
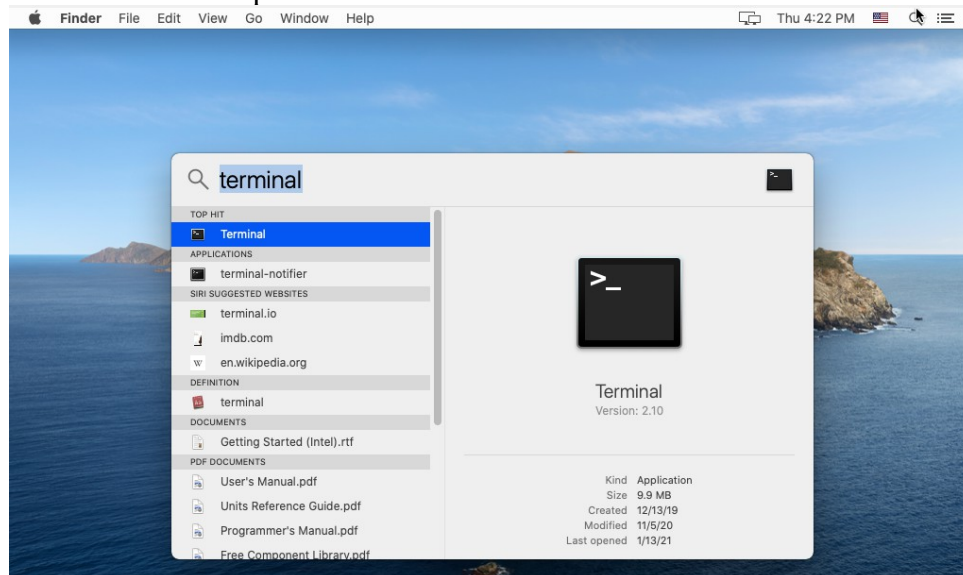

3. Enter the command "cp -R /Library/Extensions/FTDIUSBSerialDriver.kext /Users/<your login name>/tmp" into the terminal. This will copy the driver to the temporary folder in your user so it can be modified.
   Note: If using this command results in a error stating that the file was not found, change the directory to "/System/Library/Extensions/FTDIUSBSerialDriver.kext" instead of "/Library/Extensions/FTDIUSBSerialDriver.kext". Make this replacement in all future commands as well.

4. Enter the command "sudo rm -d -r /Library/Extensions/FTDIUSBSerialDriver.kext" this will

remove the old driver from the extensions folder. Using sudo will require you to enter the password for your user.

5. Open the Info.plist file located in the temporary folder of your user. This can be found by opening Finder and at the top of the screen selecting Go->Computer. Then select your hard drive and navigate to Users/<your login user>/tmp. Right click on the "FTDIUSBSerialDriver.kext" package and select "Show Package Contents". The Info.plist file will be located in the "Contents" folder. Right click the file and select "Open With" and select Xcode.
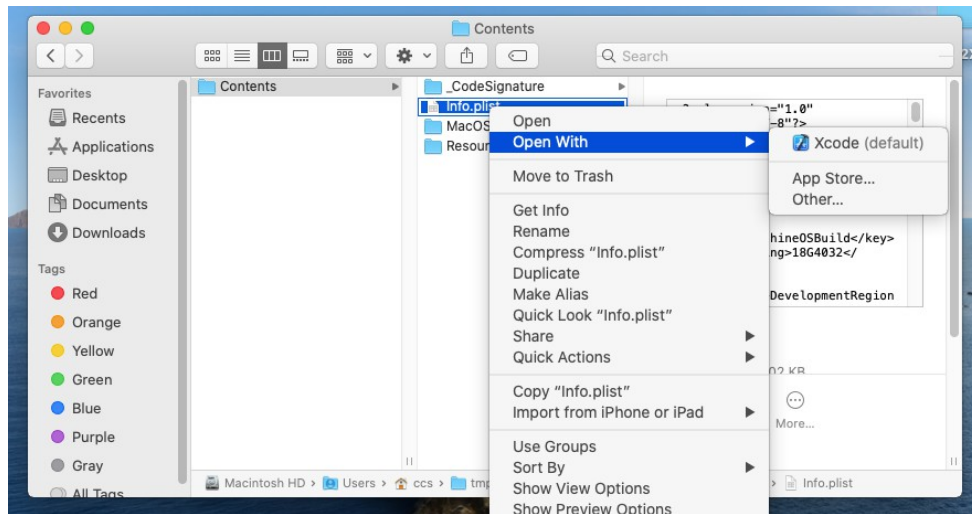
6. In the file, select the "IOKitPersonalities" section. This section will contain a list of compatible devices for the driver.
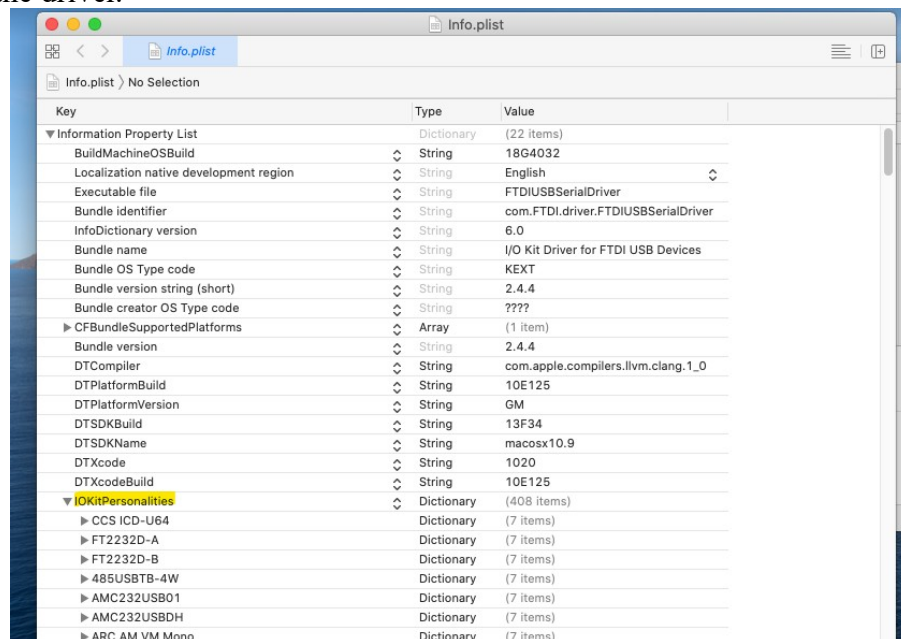
7. Copy one of the top entries listed and paste it to duplicate it. Rename the new entry to "CCS ICD-U64". Edit the new entry so it looks like the one pictured below, you should only need to change the idVendor and idProduct values.

▼ IOKitPersonalities		Dictionary	(408 items)
▼ CCS ICD-U64		Dictionary	(7 items)
CFBundleIdentifier		String	com.FTDI.driver.FTDIUSBSerialDriver
IOClass		String	FTDIUSBSerialDriver
IOProviderClass		String	IOUSBInterface
bConfigurationValue		Number	1
bInterfaceNumber		Number	0
idProduct		Number	63,956
idVendor		Number	1,027

8. Copy the driver package back to the extensions folder using the command "sudo cp -R /Users/<your login name>/tmp/FTDIUSBSerialDriver.kext /Library/Extensions". Reboot your computer to complete the installation.

9. Verify the driver is installed correctly by connecting the ICD to a prototyping board and then connecting the ICD to your computer. Then open the Terminal app and type the command "ls /dev". You should see two entries that contain "usbserial-*" in the name as pictured below. The name that you see may not contain the same characters at the end as what is shown.

```
[ccs@CCSs-MacBook-Pro ~ % ls /dev
afsc_type5                      ptyw9
auditpipe                       ptywa
auditsessions                   ptywb
autofs                          ptywc
autofs_control                  ptywd
autofs_homedirmounter           ptywe
autofs_notrigger                ptywf
autofs_nowait                   random
bpf0                            rdisk0
bpf1                            rdisk0s1
bpf2                            rdisk0s2
bpf3                            rdisk1
console                         rdisk1s1
cu.Bluetooth-Incoming-Port      rdisk1s2
cu.usbserial-I4YP649A           rdisk1s3
disk0                           rdisk1s4
disk0s1                         rdisk1s5
disk0s2                         sdt
disk1                           stderr
disk1s1                         stdin
disk1s2                         stdout
disk1s3                         systrace
disk1s4                         tty
disk1s5                         tty.Bluetooth-Incoming-Port
dtrace                          tty.usbserial-I4YP649A
dtracehelper                    ttyp0
```
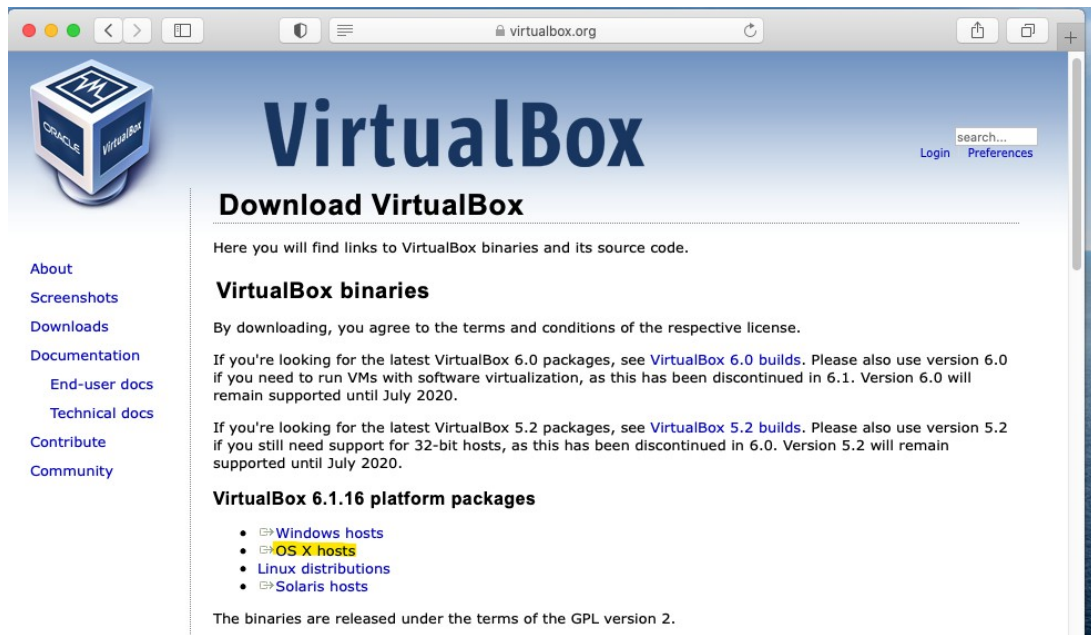
Setting Up a Virtual Machine
The next step is to create a virtual machine, we recommend using VirtualBox to run a VM.

1. Go to the VirtualBox download page here and download the OS X hosts package and install the application. We also recommend downloading the VirtualBox Extension Pack on the download page as well, this will provide extra tools that can be used with VirtualBox.
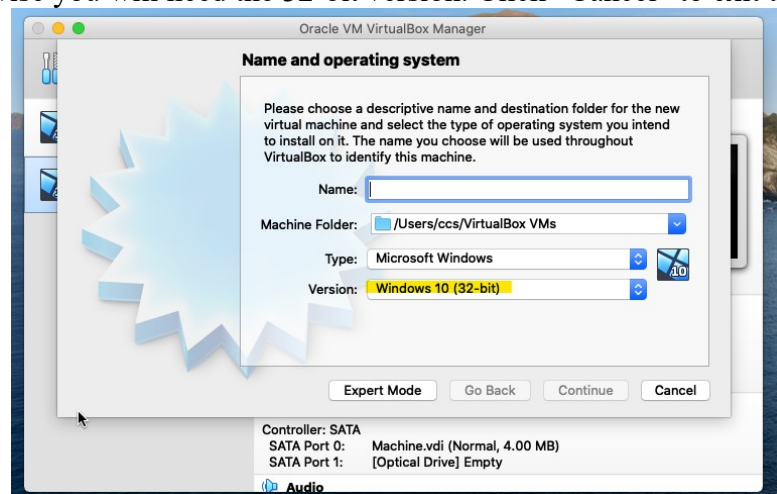
2. Determine what version of Windows 10 you need by running VirtualBox and selecting "New". Then select "Microsoft Windows" as the type and then select the drop down box next to the version. If you see an option for "Windows 10 (64-bit)" then you will need the 64-bit version of Windows, otherwise you will need the 32-bit version. Click "Cancel" to exit this window.


3. Go to the Microsoft website here and download a Windows 10 ISO image. If VirtualBox listed a Windows 10 (64-bit) version then download the 64-bit ISO image, otherwise download the 32-bit ISO.

4. Open VirtualBox and click the "New" option. In the window that appears, give the virtual machine a name and select a folder location for the files associated with the VM to be saved.

Then select "Microsoft Windows" for the type and choose either "Windows 10 (64-bit)" or "Windows 10 (32-bit)" depending on the ISO image you downloaded. Then click Continue.
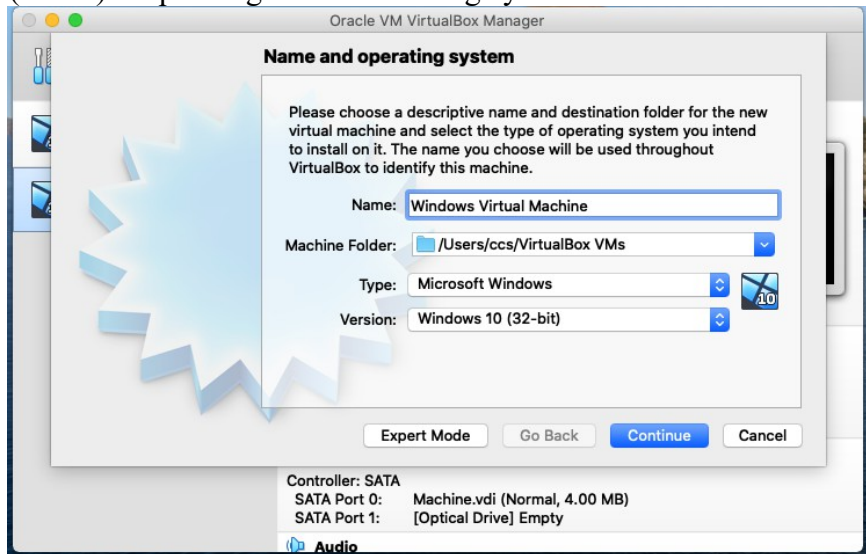

5. The next screen will ask how much memory you would like to dedicate to the VM, the minimum you should use is 4 GB or 4069 MB however, if your computer has more than 8 GB of memory you may provide more to the VM if you wish. Once you have selected the amount of memory you would like to dedicate click Continue.
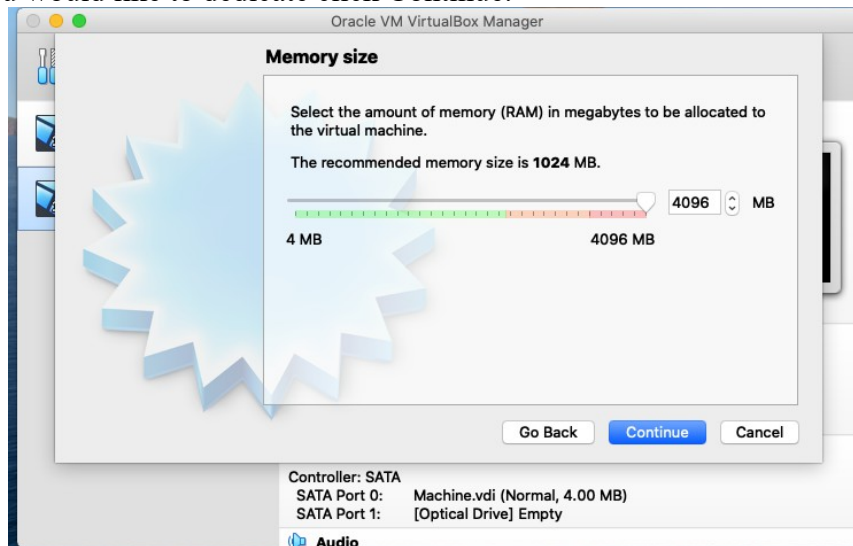

6. The next step will be setting up a virtual hard disk, select "Create a virtual hard disk now" and then click Create. On the next screen select "VDI (VirtualBox Disk Image)" for the disk type and click Continue.

7. The next screen will ask you if you would like the disk to be dynamically allocated or a fixed size. We recommend making it a fixed size in order to improve performance of the VM, then click Continue.

8. Select where you would like to store the virtual disk or leave it at the default location, you can then choose the size of the virtual disk. The amount of free space on your hard drive will limit how much you can dedicate to the VM however, a minimum of 50 GB is recommended. Once

you have the size of the virtual disk set click Create.
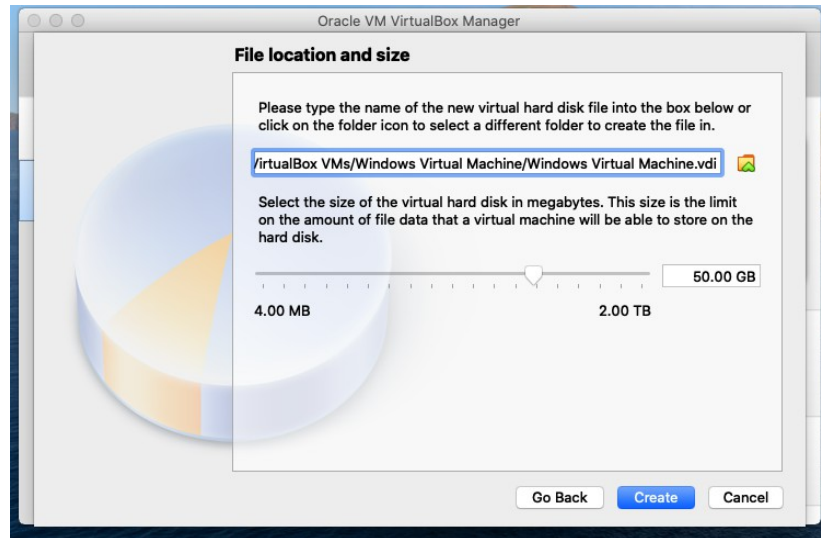
9. Once the virtual hard drive is created the ISO must be attached to the virtual machine. On the main VirtualBox screen, select the virtual machine you just created from the left hand side, with it selected click on "Settings".

10. Under the settings tab, click on "Storage". You will see a SATA controller listed under the "Storage Devices" section along with an "Attributes" section, as pictured below.
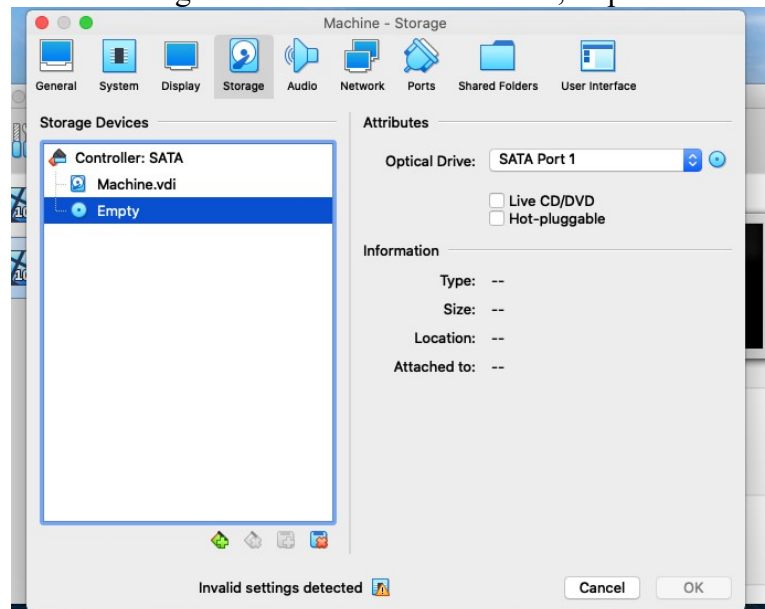

11. Select the CD icon under the "Storage Devices" section that has the word "Empty" next to it. Then in the "Attributes" section select the CD icon next to the drop down box and click "Choose a disk file…", then navigate to the ISO image you downloaded. Select the ISO image and click Open.

12. Once you have selected the ISO we are done in the Storage tab, now click on the System tab and then click the Processor section. There will be a slider that says "Processor(s)", set the slider to 2 CPUs to improve performance of the virtual machine. Then click OK to close the settings.
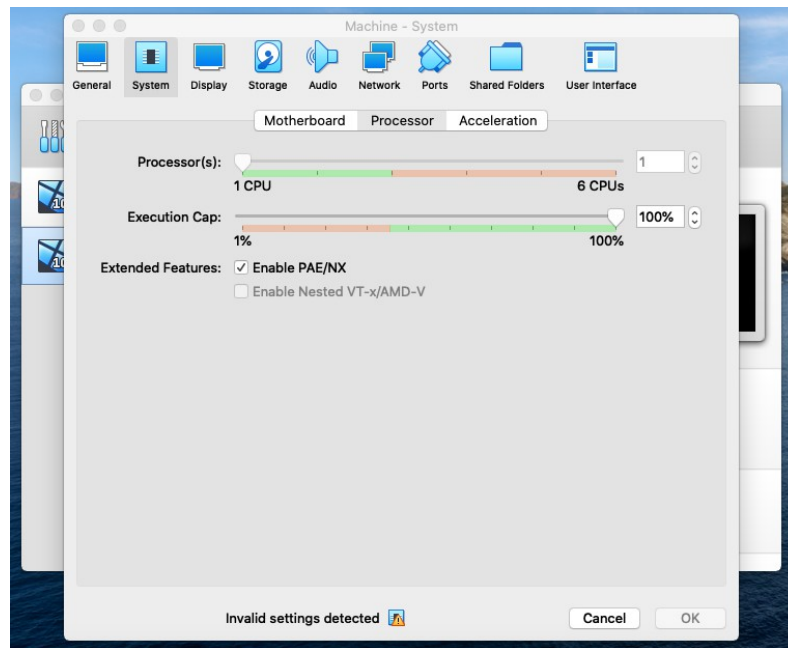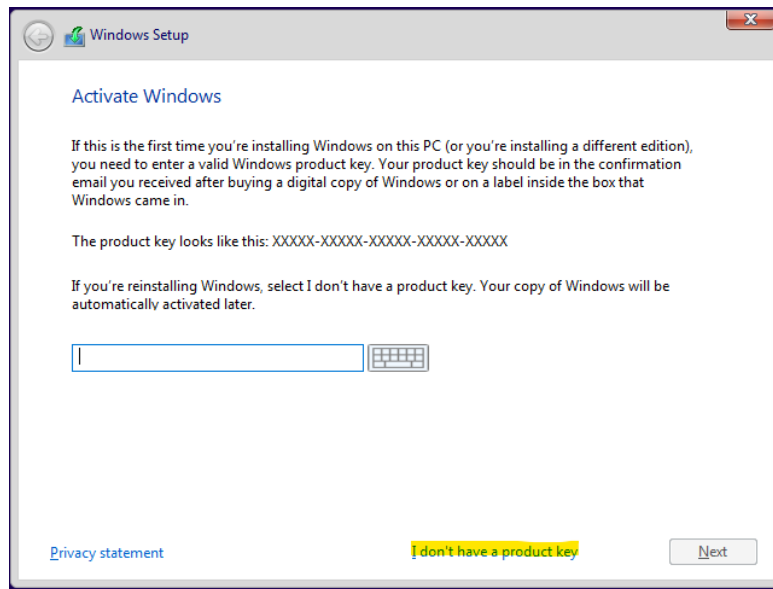
Installing Windows 10

The virtual machine is now ready to be started. The next step is to install Windows 10 onto the virtual machine.

1. Select the virtual machine on the left side of the window and click Start.

2. The first screen that will come up will ask you to select your language, time & currency format, and keyboard layout. Select your preferences then click Next then Install now.
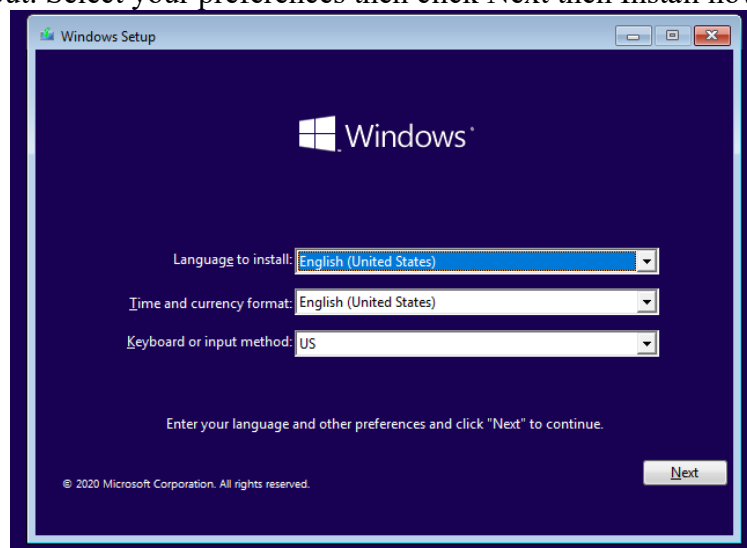
3. The next screen will ask for a Windows 10 product key, again, you do not need to purchase a product key in order to use Windows 10. You may select "I don't have a product key". This will allow you to use Windows 10 but you will lose some features however, you will still be able to use CCS software.
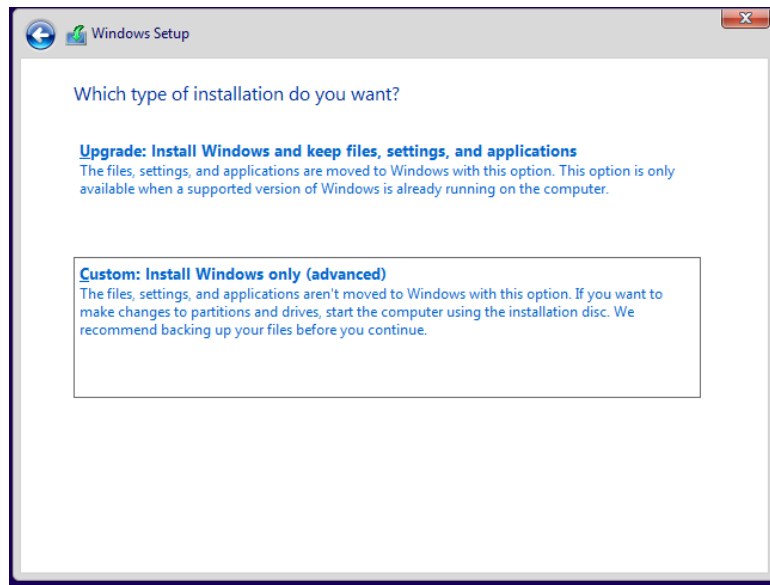
4. The next screen will list all the available versions of Windows 10. Select "Windows 10 Home" then click Next.
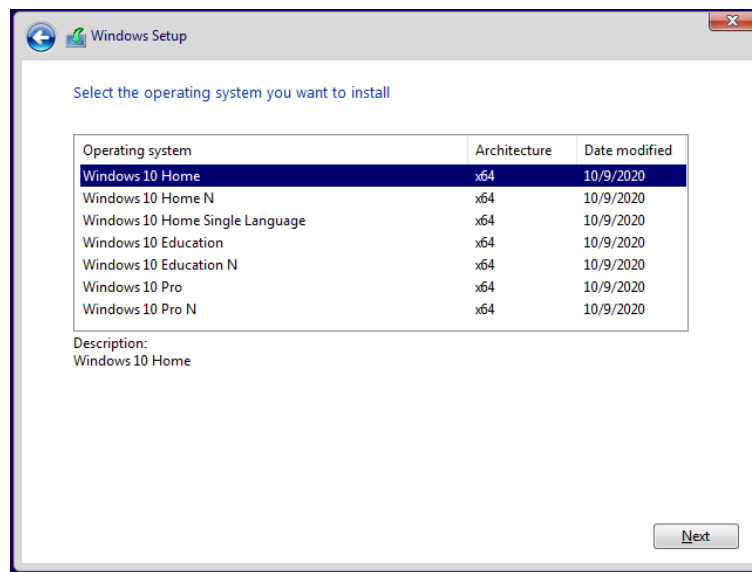

5. You will then be asked to accept the license terms, followed by being asked if you would like to upgrade or do a custom install of Windows, Select "Custom: Install Windows only (advanced)".

6. The next screen will list the available space in the system as well as some options. The only option for a location to install Windows will be "Drive 0 Unallocated Space" and it should have the same size as what you set the hard drive size to be when creating the VM. Select this option then click the New option. Without changing the value in the box that appears, click Apply.
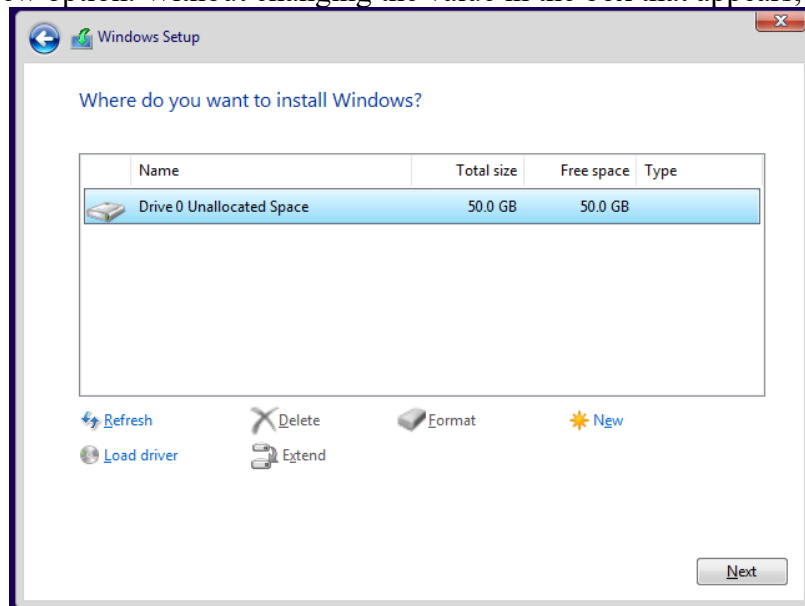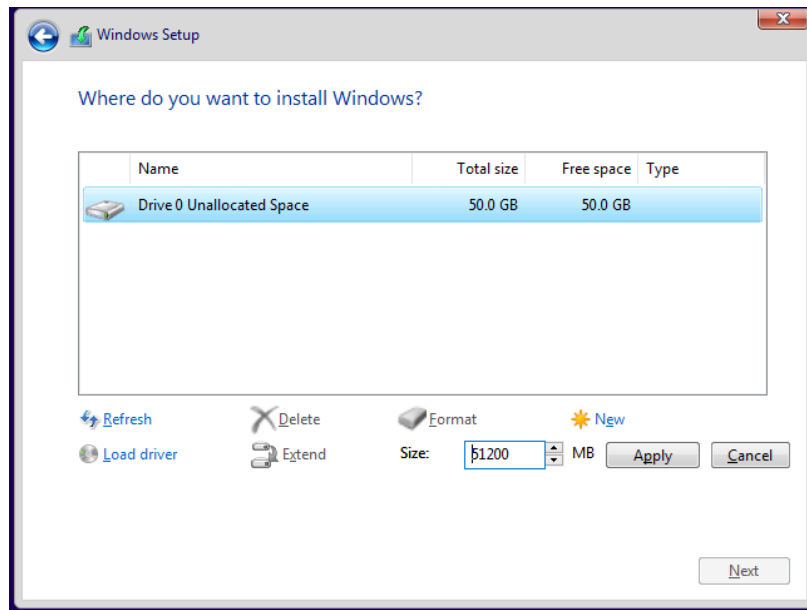
7. A window will pop up informing you that additional partitions will be created, click Ok then click Next. The system will then begin copying the Windows 10 files into the virtual disk of the VM. This will take some time and the machine will restart when it is finished.
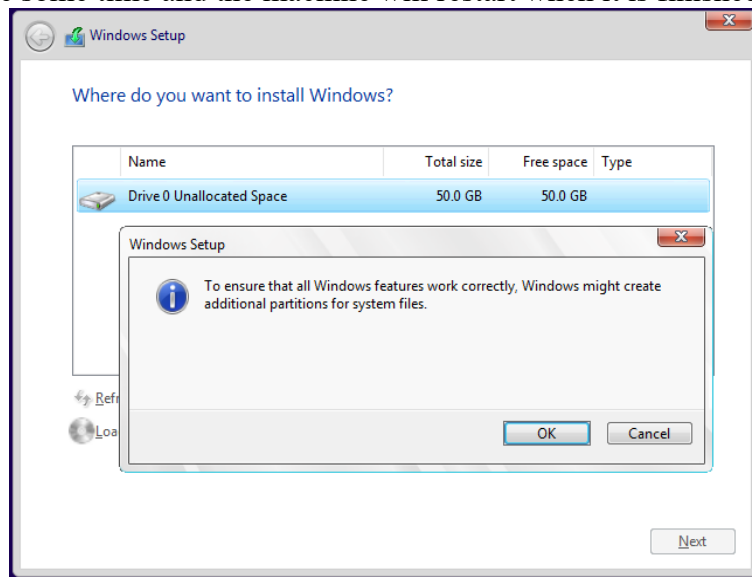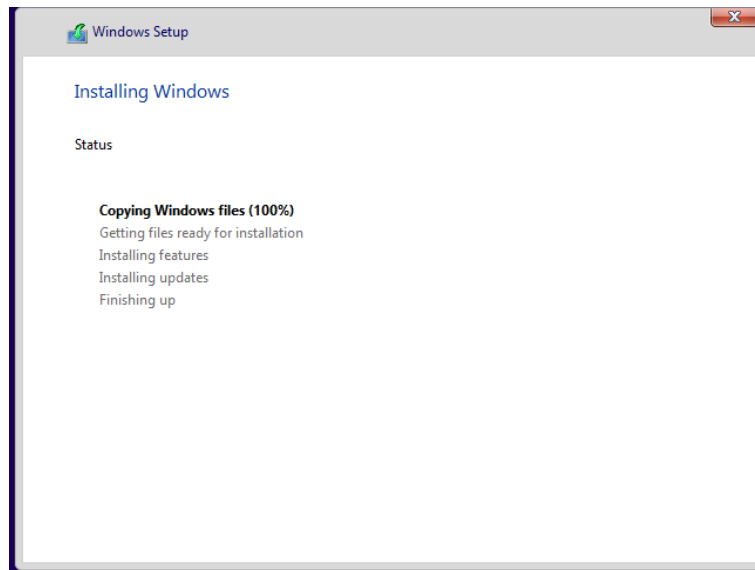
8. The virtual machine will then boot into Windows and you can follow the steps on screen to finish setting up the operating system according to your preferences. During the setup you will be asked to sign into a Microsoft account, if you do not have one you can create one at this point for free. This account will be used to login to Windows 10.

Transfer Compiler Installation Files to the Virtual Machine
Now that Windows 10 is installed you can now install the compiler onto the virtual machine. If you have the executable file to install the compiler you will need to set up a shared folder to transfer the file to the virtual machine.

1. With your virtual machine running, click on the Devices menu option at the top of the virtual machine window on your Mac, then select "Insert Guest Additions CD image…". It will not be greyed out on your screen. Doing this will make the Guest Additions CD available to the VM.
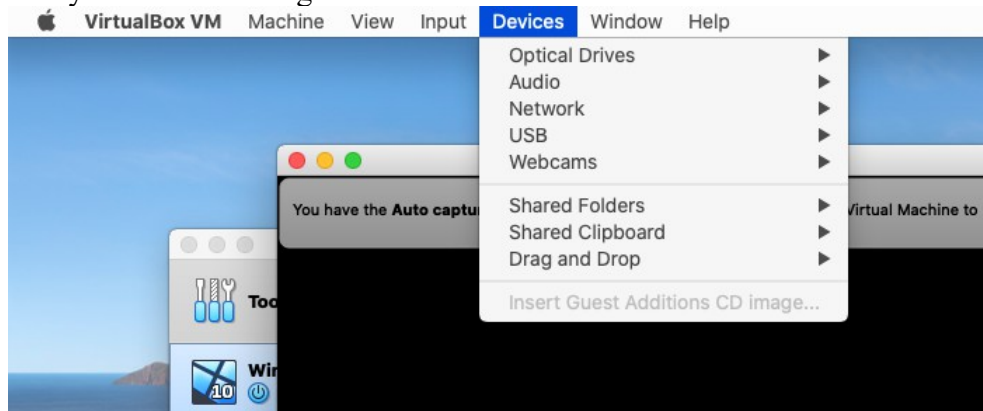

2. Open the file explorer in Windows 10 by clicking the folder icon at the bottom of the screen or by clicking the Windows icon in the bottom left corner and then begin typing "file explorer" and click on it when it appears.
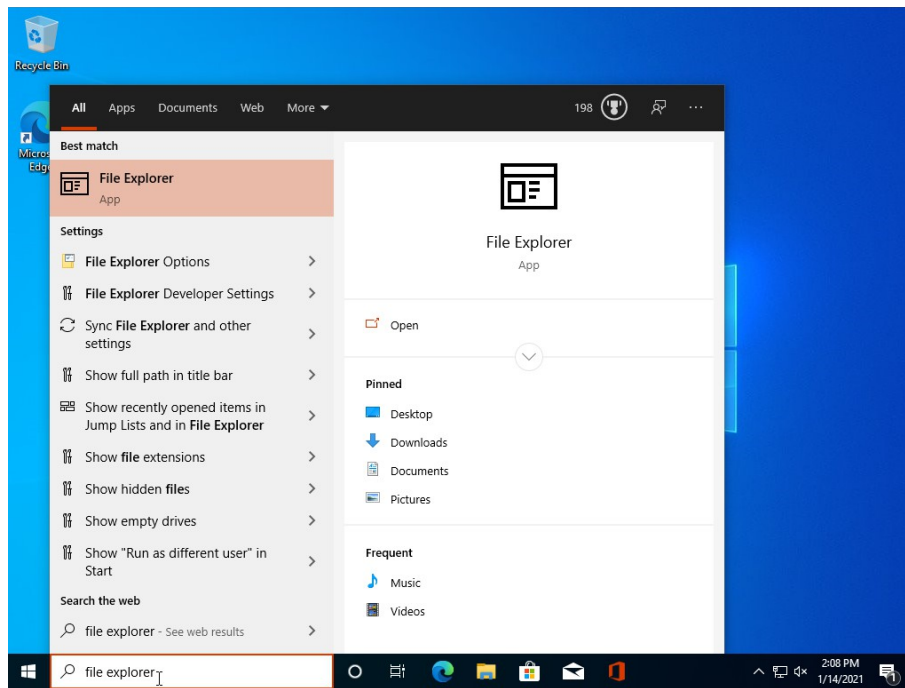
3. In the file explorer click on "This PC" on the left side of the window, you should then see a drive appear called "VirtualBox Guest Additions". Double click on this drive and then double click on the application called "VBoxWindowsAdditions" and follow the steps to install the Guest Additions. Leave all install options and the install location as the default and allow any prompts that come up during installation. Select "I want to manually reboot later" after the installation is complete.
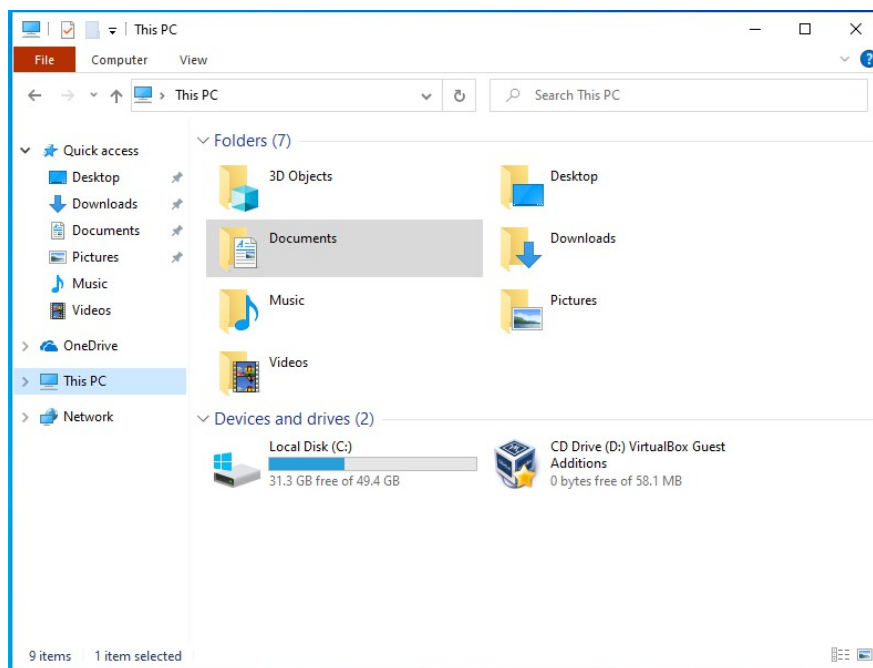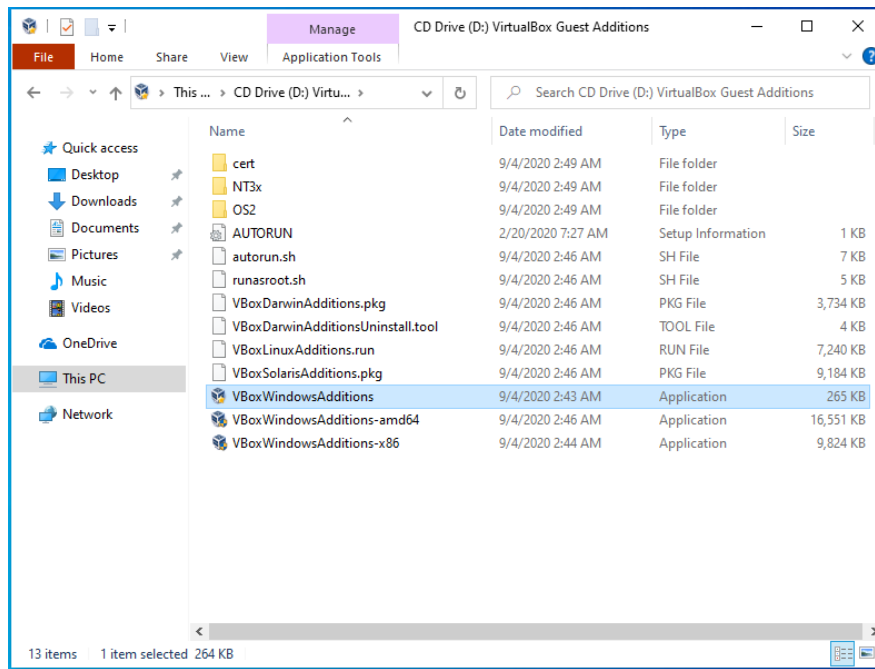
4. Click on the machine menu at the top of the virtual machine window on your Mac. Then go to Settings and click on the Shared Folders tab. On the right side of the window there will be a folder icon with a green plus, click on the icon.

5. A window will pop up asking for a folder path, click the down arrow and then select Other. This will prompt you to select a folder on your Mac that will be shared with the virtual machine. You can create a folder wherever you would like and then click it and then click Select Folder.Then select the Auto-Mount option as well as the Make Permanent option if there is one, then click OK.
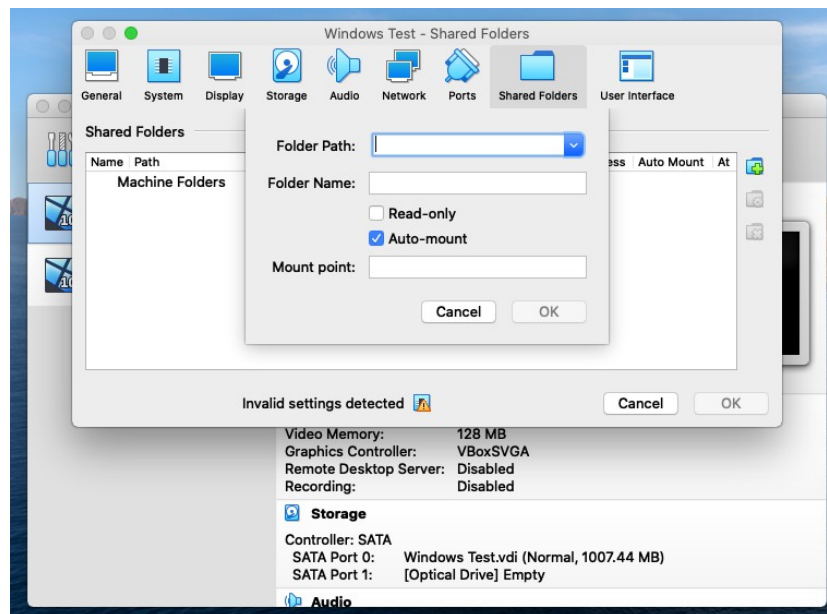
6. The shared folder should now be ready, move the installation files on your Mac into the shared folder. Once this is done, open up the file explorer again on the virtual machine and click "This PC". You should see a network location that has the same name as the shared folder on your

Mac. If you double click on it you will see the installation files.
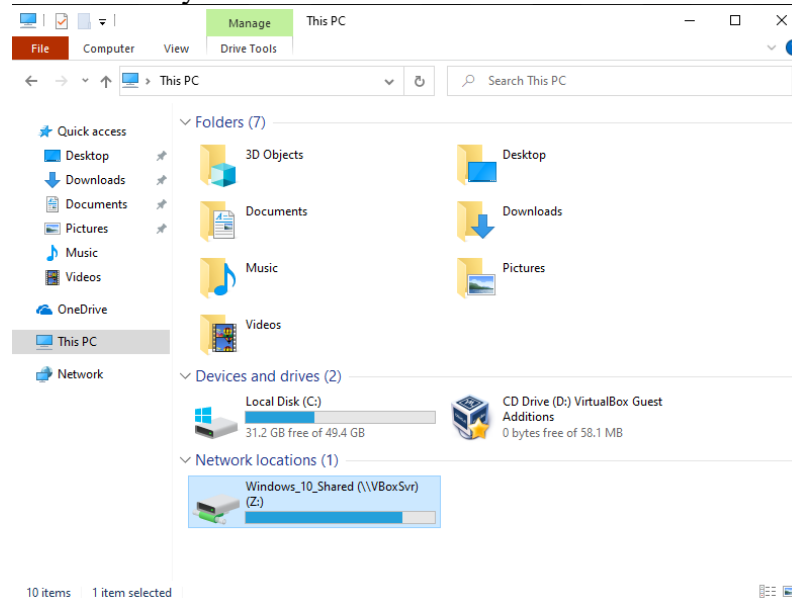
The shared folder is useful to transfer files between host and guest operating systems. Files can be transferred from Mac to the Windows 10 machine and vice versa. To move files from Windows 10 back to the Mac, simply copy any files you would like to share into the network location and they will become available in the shared folder on your Mac.
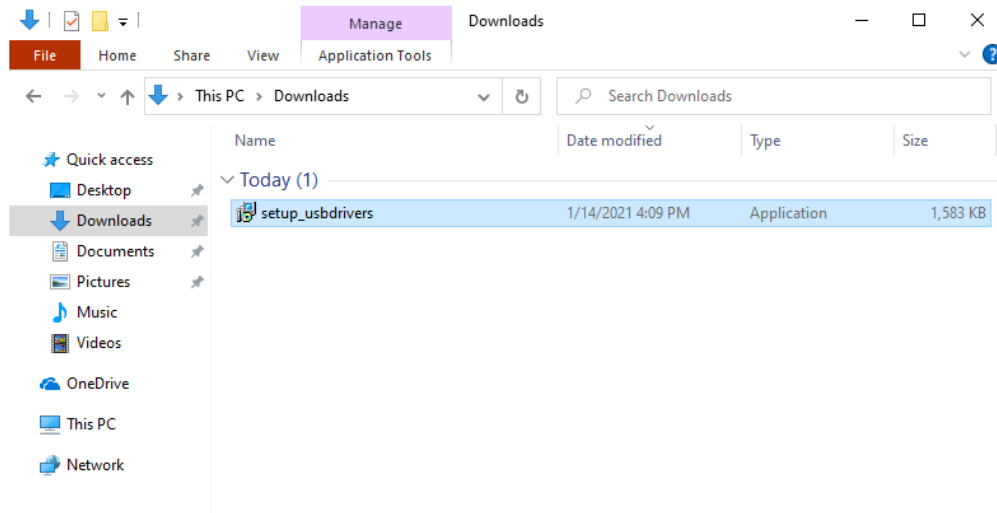
Install CCS Compiler
1. On the Windows virtual machine, open the file explorer and click "This PC". Open the network location that contains the shared folder.

2. Once in the shared folder, you will see the installation files for the compiler that were transferred from the previous step. Find the installation executable, this will be a file with a name ending in ".exe" and under type it should say "Application".

3. Double-click on the file, this will run the executable. You will be prompted with a window that asks if you would like to allow the application to make changes to the device, click "Yes".

4. The installation application will open in a window, follow through the steps of the installation. We recommend leaving all options at their default settings.

5. Once the installation is complete you will be prompted to close the window by clicking the "Finish" button. Before closing the window make sure to select the option to restart your computer now to finish installing the compiler.

Install USB Drivers for CCS Programmers/Debuggers

The final step required before using the compiler is installing the USB drivers for CCS programmers/debuggers on the virtual machine. The drivers can be found in the downloads section on the CCS website.

1. The driver can be found here on the downloads page under the "Programmer/Debugger Software" section. Download the USB Drivers and install them on the virtual machine. The executable will be located in the Downloads folder which can be found on the left side of the File Explorer.


2. After the USB Drivers are installed the compiler is ready to be used. To connect the ICD to the virtual machine plug the device into your computer. After a couple seconds, click on the Devices menu in the virtual machine window on your Mac.

3. Under the USB section, select the CCS ICD device. This will pass through the ICD to the virtual machine and allow it to be accessed by the compiler. Once the ICD is connected you are ready to start programming.
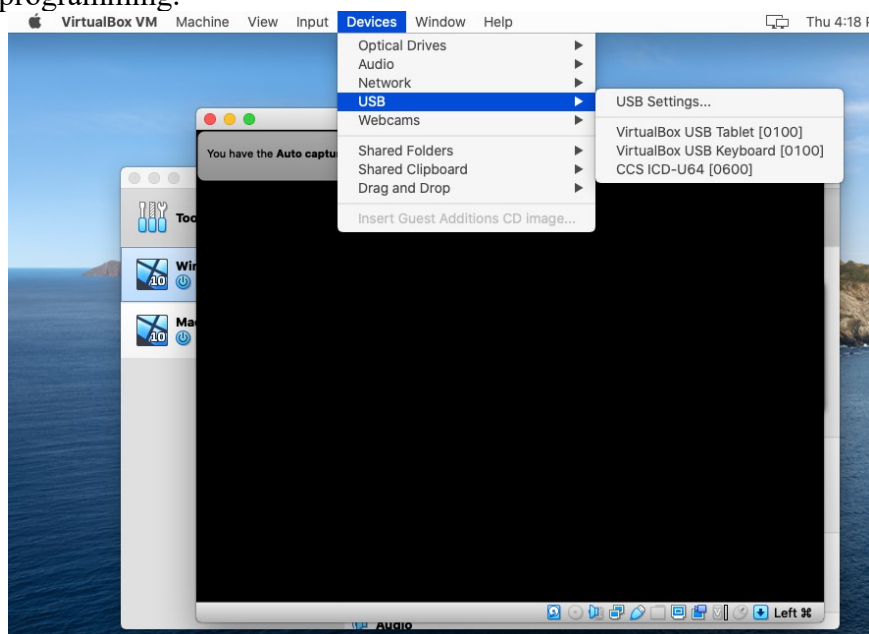
Running the Compiler

With the compiler and all appropriate drivers installed we can now run the compiler.

1. When the compiler was installed on the virtual machine a shortcut should have been created on the desktop called "PIC-C Compiler". Double-click the shortcut to open the compiler.
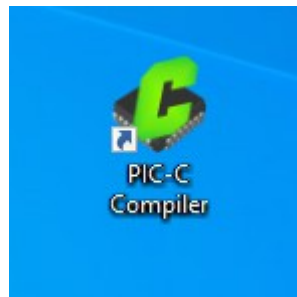
2. Another way to access the compiler is by clicking the Windows icon in the bottom left corner of the screen. Then begin typing "pic-c compiler", Windows will automatically begin searching for the application. The first option to appear should be the compiler, click on it to run the PIC-C Compiler.