

# CSEE 4840

## Embedded System Design

### Tutorial: Installing Quartus and Related Tools

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This shows how to install Quartus 13.1 under CentOS 5.9 running on a virtual machine (Virtualbox). This will enable you to use your own machine to develop hardware and software for the SoCKit board. You can also connect a SoCKit board to your host machine and program its FPGA through your virtual machine.

#### 1 Download and Install VirtualBox

Download a binary for your platform from <https://www.virtualbox.org/wiki/Downloads>. Download both the platform-specific “platform package” and the platform-independent “VirtualBox Extension Pack” with the matching version number.

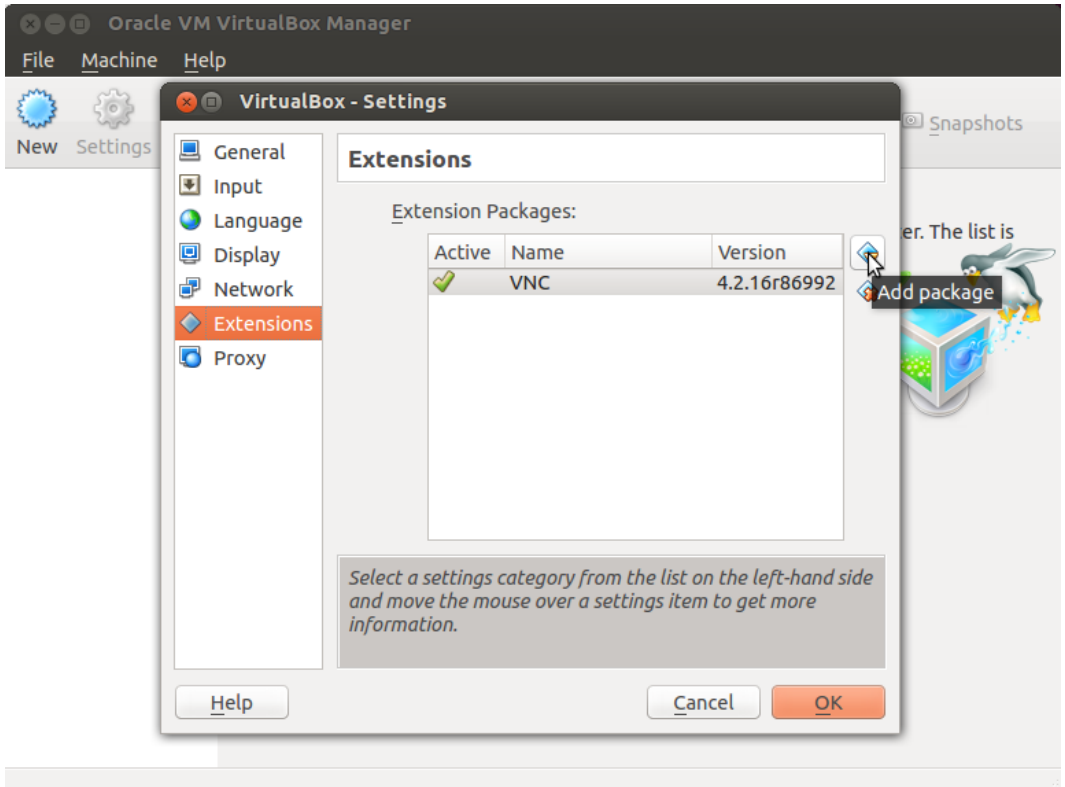
#### VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

- **VirtualBox platform packages.** The binaries are released under the terms of the GPL version 2.
  - **VirtualBox 4.3.6 for Windows hosts** ⇨ [x86/amd64](#)
  - **VirtualBox 4.3.6 for OS X hosts** ⇨ [x86/amd64](#)
  - **VirtualBox 4.3.6 for Linux hosts**
  - **VirtualBox 4.3.6 for Solaris hosts** ⇨ [x86/amd64](#)
- **VirtualBox 4.3.6 Oracle VM VirtualBox Extension Pack** ⇨ [All supported platforms](#)  
Support for USB 2.0 devices, VirtualBox RDP and PXE boot for Intel cards. See [this chapter from the User Manual](#) for an introduction to this Extension Pack. The Extension Pack binaries are released under the [VirtualBox Personal Use and Evaluation License \(PUEL\)](#).  
*Please install the extension pack with the same version as your installed version of VirtualBox!*  
*If you are using **VirtualBox 4.2.20**, please download the extension pack ⇨ [here](#).*  
*If you are using **VirtualBox 4.1.28**, please download the extension pack ⇨ [here](#).*  
*If you are using **VirtualBox 4.0.20**, please download the extension pack ⇨ [here](#).*

Install the platform package and run it.

Install the VirtualBox Extension Pack: either double-click the file's icon or start VirtualBox, go to File→Preferences→Extensions, and add the extension. This enables USB 2.0 devices, among other things.



**If your host machine is Linux**, VirtualBox needs permissions to access USB devices. As root on your host, run `usermod -a -G vboxusers user`, where `user` is the name of the user that runs the VirtualBox. You will need to log out and back in for this change to take effect. Without this step, VirtualBox will give “Failed to access USB subsystem” errors.

## 2 Download CentOS 5.9

Download the first CentOS 5.9 DVD image from, e.g., <http://mirrors.arsc.edu/centos/5.9/isos/>.

Download [CentOS-5.9-x86\\_64-bin-DVD-1of2.iso](#).

If you have an older (32-bit) machine, then download [CentOS-5.9-i386-bin-DVD-1of2.iso](#).

Do not unpack these files: the VM reads .iso files directly.

### 3 Install CentOS 5.9 on the VM

Start VirtualBox and click “New” to create a new virtual machine. Call it “CentOS 5.9,” set the type to “Linux,” and the version to “Red Hat (64 bit)” (or just “Red Hat” if you have an older machine).



**Name and operating system**

Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine.

Name:

Type:  

Version:

Select at least “2048 MB” (2 GB) for memory size. Bigger is better, but do not ask for more than, about half of your host machine’s memory. If necessary, change this later with Settings→System→Motherboard→Base Memory.



**Memory size**

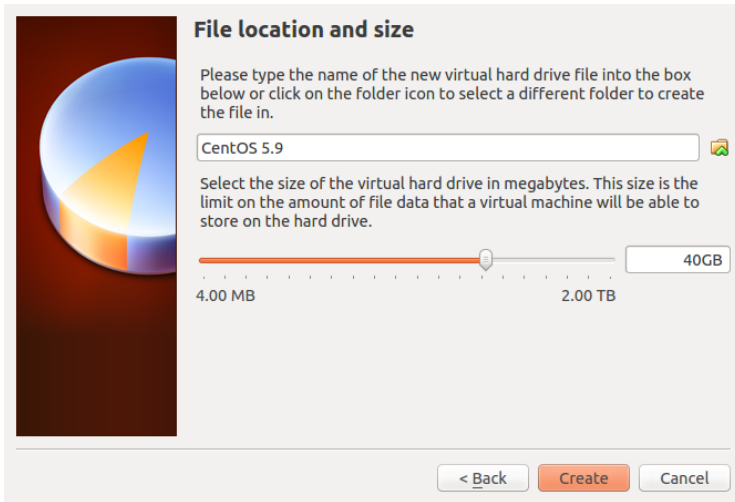
Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.

The recommended memory size is 512 MB.

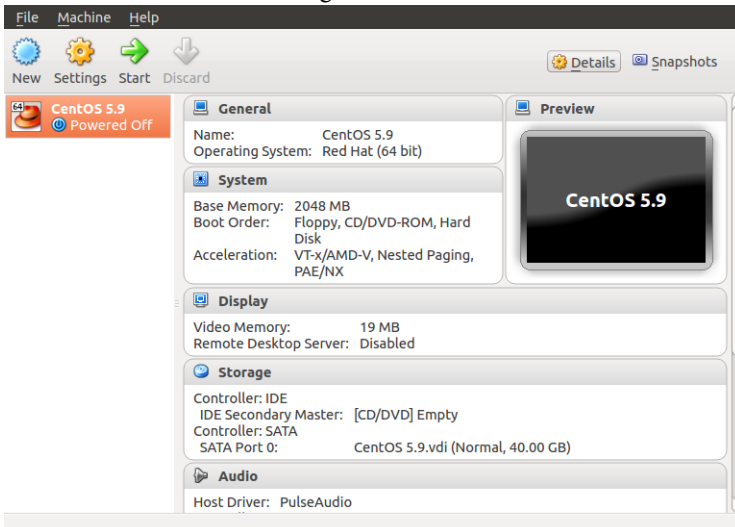
MB

4 MB 28672 MB

On the next screen, select “Create a virtual hard drive now.” Then select “VDI (VirtualBox Disk Image).” Then select “Dynamically allocated.” Finally, set the size to “40 GB” and click “Create.”



The virtual machine should now be configured:



Click “Start” to boot the virtual machine. Select the first CentOS 5.9 installation DVD image (e.g., “CentOS-5.9-x86\_64-bin-DVD-1of2.iso”) as the startup disk using Devices→CD/DVD Devices→Choose a virtual CD/DVD disk file...

At this point, clicking in the virtual machine window passes control of the mouse and keyboard to the virtual machine; the right control key returns control to your host operating system.

We will simplify this later.

Press Return in the VM to install CentOS 5.9 in graphical mode:



Select “Skip” when it asks about testing the installation media.

Select your preferred language and keyboard layout.

Allow it to “Remove linux partition on selected drives and create default layout.”

Allow it to make eth0 (the network connection) active on boot and have it set the hostname automatically via DHCP.

Choose and remember a good root password.

Allow it to install software for the default “Desktop - Gnome” task (you won’t need the others).

Start the installation process; it will take a while.

Click on “Reboot” when it says “Congratulations.” Your virtual machine should now reboot into CentOS 5.9 and present you with a welcome screen.



Click “Next.” Leave the firewall enabled with SSH trusted.

Click “Forward.” **Important:** Set the SELinux Setting to “Disabled.” Leaving SELinux enabled will prevent Quartus from starting and give cryptic “cannot restore segment prot” errors.

Create a user account for yourself.

Click “Finish” and allow the system to reboot.

Log in as root on the VM.

Open a terminal window by selecting Applications→Accessories→Terminal.

Type “yum update -y” to install system updates (-y tells it to skip prompts). When I did this, it downloaded and installed over 200 packages.

#### 4 Install VirtualBox Guest Additions on the VM

From <http://download.virtualbox.org/virtualbox/4.2.16/> (replace 4.2.16 with the VirtualBox version you installed; see Help→About Virtualbox... to check the version), download [VBoxGuestAdditions\\_4.2.16.iso](#)

Log in as root on the VM.

Open a terminal window by selecting Applications→Accessories→Terminal.

Type “yum install -y gcc kernel-devel”

Mount the Guest Additions ISO file by selecting  
Devices→CD/DVD Devices→Choose a virtual CD/DVD disk file... and then selecting the  
VBoxGuestAdditions ISO file.

Type “cd /media/VBOX\*”

Type “./VBoxLinuxAdditions.run” and let the additions compile and install themselves.

Reboot the VM. It should start up in a much larger window and no longer require you to click to focus the mouse in the VM window.

## 5 Download Quartus 13.1, Updates, and the SoC Design Suite

On your host machine, download Quartus II Web Edition v13.1 from <http://dl.altera.com/?edition=web>

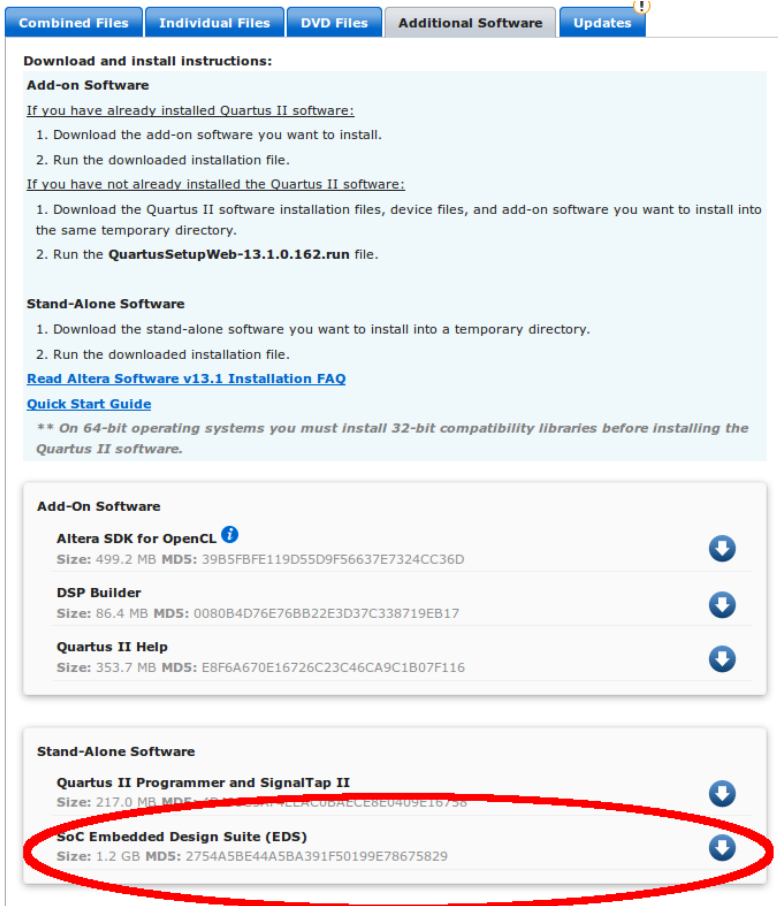
Select “Linux,” “Direct Download,” “Combined Files” and download “Quartus-web-13.1.0.162-linux.tar.”

The screenshot shows the Altera Download Center website. The page title is "Quartus II Web Edition". The navigation menu includes "Devices", "Design Tools & Services", "End Markets", "Technology", "Training", "Support", "About", and "Buy". The left sidebar lists various software categories like "Design Software", "Embedded Software", "Archives", "Licensing", "Programming Software", "Drivers", "Board System Design", "Board Layout and Test", and "Legacy Software". The main content area shows the "Quartus II Web Edition" download page. It includes a search bar, a navigation breadcrumb "Home > Support > Downloads > Quartus II Web Edition", and a release date of "November, 2013". The page allows users to select a previous version of Quartus II (currently set to 13.1) and choose an operating system (Windows or Linux). The "Download Method" is set to "Direct Download". A yellow box contains information about supported device families and provides links to a "Software Selector" and a "Device Support List". Below this, there are tabs for "Combined Files", "Individual Files", "DVD Files", "Additional Software", and "Updates". The "Combined Files" tab is selected, showing "Download and install instructions" and a "Quick Start Guide". At the bottom, a red circle highlights the download link for "Quartus II Web Edition Software (Device support included)" with the filename "Quartus-web-13.1.0.162-linux.tar" and a size of 4.5 GB.

You may have to sign up for a (free) account to do this.

Download any updates (e.g., QuartusSetup-13.1.1.166.run.crdownload)

Download “SoC Embedded Design Suite (EDS)” under “Additional Software.”



The screenshot shows the 'Additional Software' tab of the Quartus II download page. It contains instructions for installing add-on and stand-alone software, a list of available software packages, and a 'Quick Start Guide' link. The 'SoC Embedded Design Suite (EDS)' package is highlighted with a red oval.

**Download and install instructions:**

**Add-on Software**

If you have already installed Quartus II software:

1. Download the add-on software you want to install.
2. Run the downloaded installation file.

If you have not already installed the Quartus II software:

1. Download the Quartus II software installation files, device files, and add-on software you want to install into the same temporary directory.
2. Run the **QuartusSetupWeb-13.1.0.162.run** file.

**Stand-Alone Software**

1. Download the stand-alone software you want to install into a temporary directory.
2. Run the downloaded installation file.

[Read Altera Software v13.1 Installation FAQ](#)

[Quick Start Guide](#)

**\*\* On 64-bit operating systems you must install 32-bit compatibility libraries before installing the Quartus II software.**

**Add-On Software**

<b>Altera SDK for OpenCL</b> Size: 499.2 MB MD5: 39B5FBFE119D55D9F56637E7324CC36D	↓
<b>DSP Builder</b> Size: 86.4 MB MD5: 0080B4D76E76BB22E3D37C338719EB17	↓
<b>Quartus II Help</b> Size: 353.7 MB MD5: E8F6A670E16726C23C46CA9C1B07F116	↓

**Stand-Alone Software**

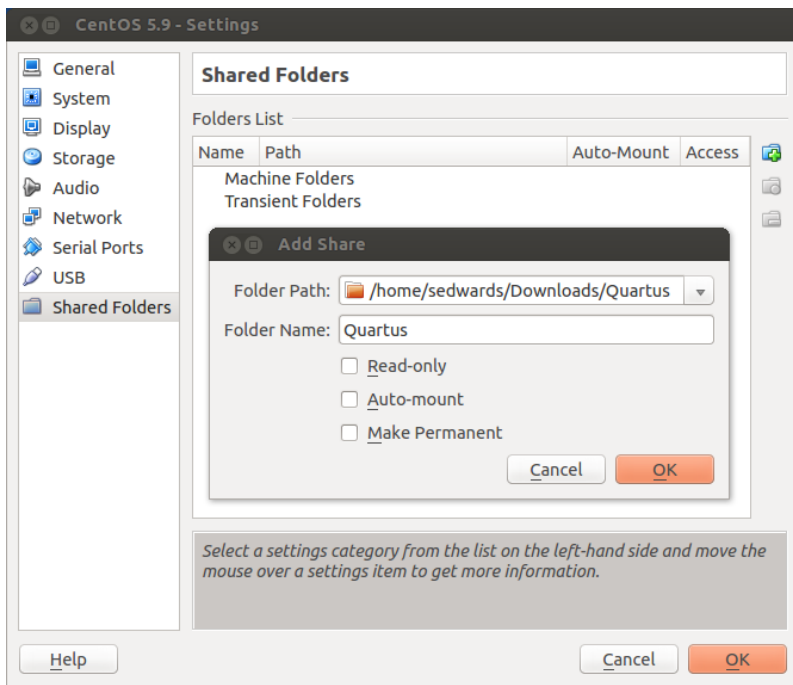
<b>Quartus II Programmer and SignalTap II</b> Size: 217.0 MB MD5: 4C77723844EBC06A9CE8E0409E16758	↓
<b>SoC Embedded Design Suite (EDS)</b> Size: 1.2 GB MD5: 2754A5BE44A5BA391F50199E78675829	↓

## 6 Install Quartus 13.1, Updates, and Extras

Move the downloaded Quartus files into a folder on your host machine named, e.g., “Quartus.”

On the VM, select Devices→Shared Folders..., and add a share. Select the path to the folder in which the Quartus .tar file resides. (I called my folder /home/sedwards/Downloads/Quartus; yours will be different). Call the share “Quartus.”





Log in as root on the VM.

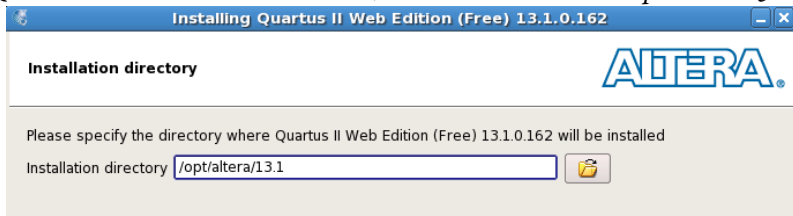
Open a terminal window by selecting Applications→Accessories→Terminal.

Type “`mount -t vboxsf Quartus /mnt`”

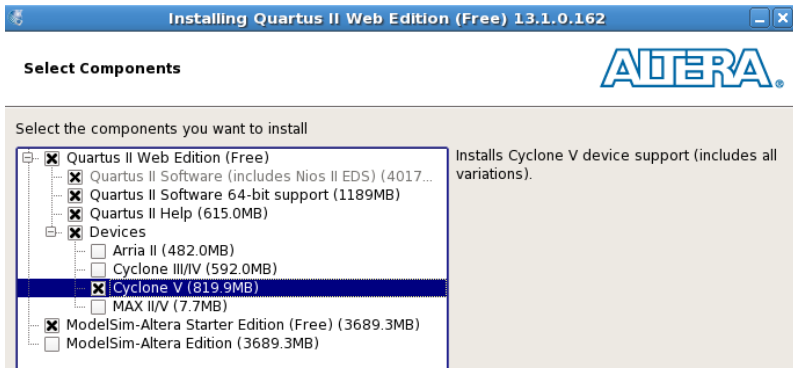
Type “`tar xf /mnt/Quartus*.tar`”

Type “`./setup.sh`”

Once the Quartus installation wizard starts, direct it to install in `/opt/altera/13.1`.



Under “Devices,” make sure “Cyclone V” is selected (the others are unnecessary).



Let the installation complete; this will take a while.

Terminate the installer (don't start Quartus yet).

Install any updates. Type “`chmod +x /mnt/QuartusSetup*.run`” and then “`/mnt/QuartusSetup*`”

Specify `/opt/altera/13.1` as the installation directory (i.e., as you specified earlier).

Install the Embedded Design Suite: Type “`chmod +x /mnt/SoC*`” and “`/mnt/Soc*.run`.”

Specify `/opt/altera/13.1` as the installation directory (i.e., as you specified earlier).

To make a desktop icon, type

```
cat > ~/Desktop/Quartus.desktop <<EOF
[Desktop Entry]
Type=Application
Version=0.9.4
Name=Quartus II 13.1 (64-bit) Web Edition
Comment=Quartus II 13.1 (64-bit)
Icon=/opt/altera/13.1/quartus/adm/quartusii.png
Exec=/opt/altera/13.1/quartus/bin/quartus --64bit
Terminal=false
Path=/opt/altera/13.1
EOF
```

## 7 Enable USB JTAG

If you want to program the FPGA on the SoCKit board using your computer, do the following.

As root on the VM, add the following udev rules file:

```
cat > /etc/udev/rules.d/51-socket.rules <<EOF
BUS=="usb", SYSFS{idVendor}=="09fb", SYSFS{idProduct}=="6010", MODE="0666"
BUS=="usb", SYSFS{idVendor}=="09fb", SYSFS{idProduct}=="6810", MODE="0666"
EOF
```

When the VM is running and you have the SoCKit board connected to your host machine, select Devices→USB Devices→Altera CV SoCKit to make the VM see the connected JTAG device.

Now, as a normal user, when you have a SoCKit board connected to your computer, “/opt/altera/13.1/quartus/bin/jtagconfig” should report something like

```
1) CV SoCKit [USB 1-1]
   02D020DD  5CSEBA6(.|ES)/5CSEMA6/..
   4BA00477  SOCVHPS
```