

Intel® Edison Tutorial: Introduction, Linux Operating System Shell Access and SFTP



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Introduction

This tutorial will guide users through the following tasks:

1. Examination of an overview of the Intel Edison Compute Module
2. Assembling an Intel Edison kit
3. Learning how to access the Linux Operating System Shell of an Intel Edison through a:
 1. Wireline USB serial connection
 2. Wireless Wi-Fi SSH connection
4. Transferring files between an Intel Edison and a personal computer using a graphical SFTP application

List of Required Equipment and Materials

1. 1x Intel Edison Compute Module
2. 1x Edison Board for Arduino
3. 2x USB 2.0 A-Male to Micro B Cable (micro USB cable)
4. 1x powered USB hub **OR** an external power supply
5. 1x Personal Computer with
 1. At least 1x USB 2.0 port
 2. Windows (Windows 8 or newer) **OR**
 3. Mac OS X (Mountain Lion or newer) **OR**
 4. Linux
6. Access to a network with an internet connection



Intel Edison Overview

The Intel Edison development platform is designed to lower the barriers to entry for a range of inventors, entrepreneurs, and consumer product designers to rapidly prototype and produce “Internet of Things” (IoT) and wearable computing products.



Figure 1. Intel Edison Compute Module attached to Edison Board for Arduino

Key Features

- Integrated CPU and MCU
 - CPU: Dual-core, dual-threaded Intel Atom 22nm CPU at 500MHz
 - MCU: 32-bit Intel Quark microcontroller at 100MHz
- Yocto Embedded Linux
- Integrated Wi-Fi (on board the Intel Edison Compute Module)
 - Dual-band (2.4 and 5 GHz)
- Integrated Bluetooth (BT 4.0) (on board the Intel Edison Compute Module)
- 40 external interfaces
 - SD Card
 - UART, I2C, SPI, I2S
 - GPIO, PWM
 - USB 2.0
 - Clock output (32KHz, 19.2MHz)
- Memory
 - 1GB RAM (2 channel 32-bits at 800MT/sec)
 - 4GB Flash Storage (4GB eMMC, v4.51 spec)
- Managed online community for project ideas and engagement with other product users
- Intel product expert support and open source community software tools
- Access to device-to-device and device-to-cloud connectivity framework to enable cross device communication and a cloud based, multi-tenant, time-series analytics service
- For additional information, please refer to the below link

<http://www.intel.com/content/www/us/en/do-it-yourself/edison.html>



Assembly

1. Watch the following video and then complete the steps below.
<https://software.intel.com/en-us/videos/intel-edison-kit-for-arduino-unboxing-and-assembly>

2. The kit should contain the following items:

1x Intel Edison Compute Module
1x Edison Board for Arduino
4x Screws
4x Corner Spacers
2x Nuts

3. Place the Intel Edison Compute Module on the bottom left corner of the Edison board for Arduino.
4. Press on the Intel Edison Compute Module just below the label: “What will you make?”. Press until the connectors engage with a snap. Please note that the module must be securely attached to the Edison Board for Arduino.

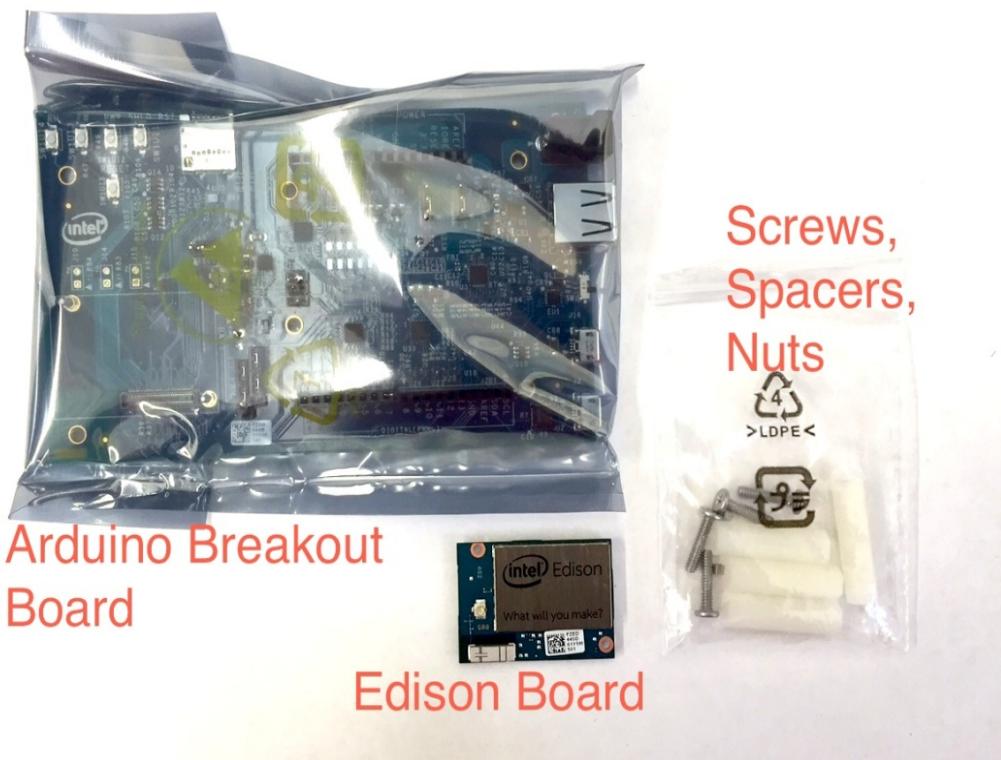


Figure 2. Contents of the Intel Edison kit



5. Use the nuts to secure the Intel Edison Compute Module to the Edison Board for Arduino.

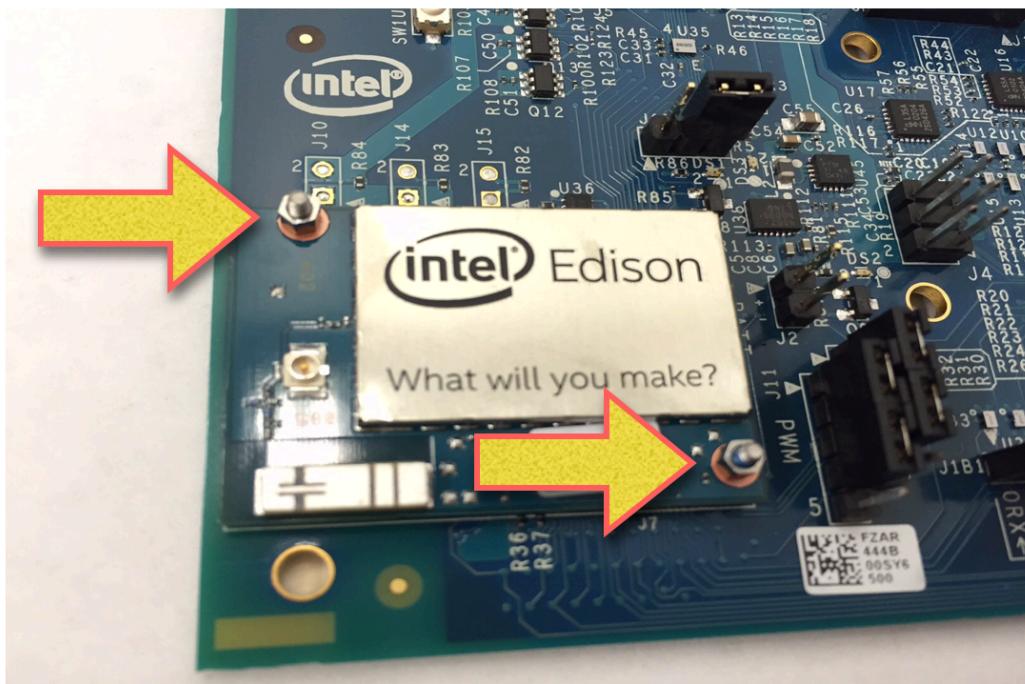


Figure 3. Close-up view of Intel Edison Compute Module

6. Attach the corner placers with the screws on the four corners of the Edison Board for Arduino.

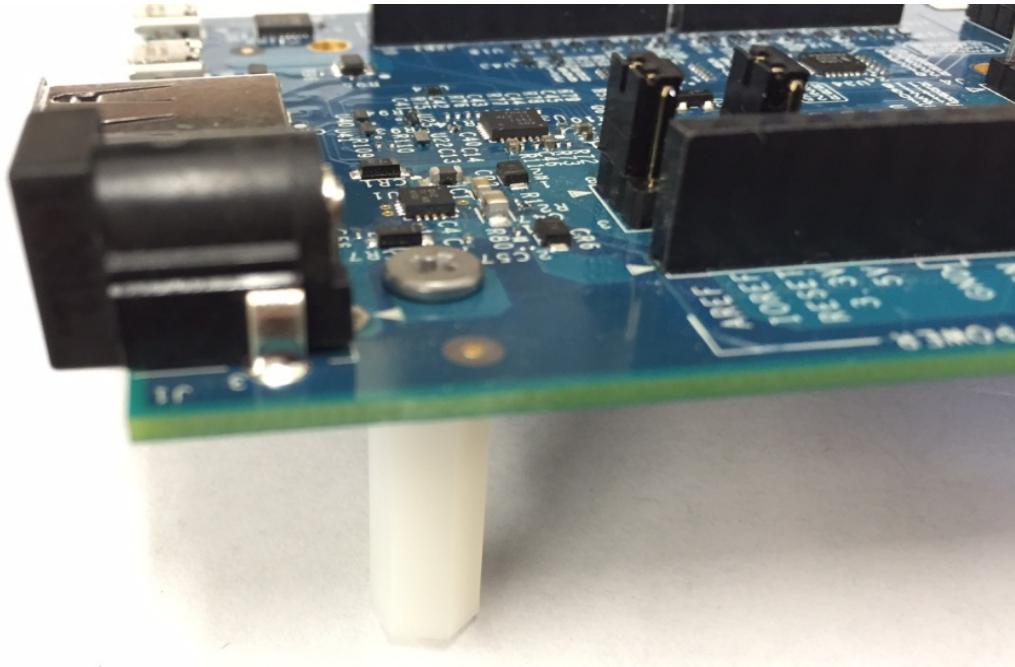


Figure 4: Close-up view of screws

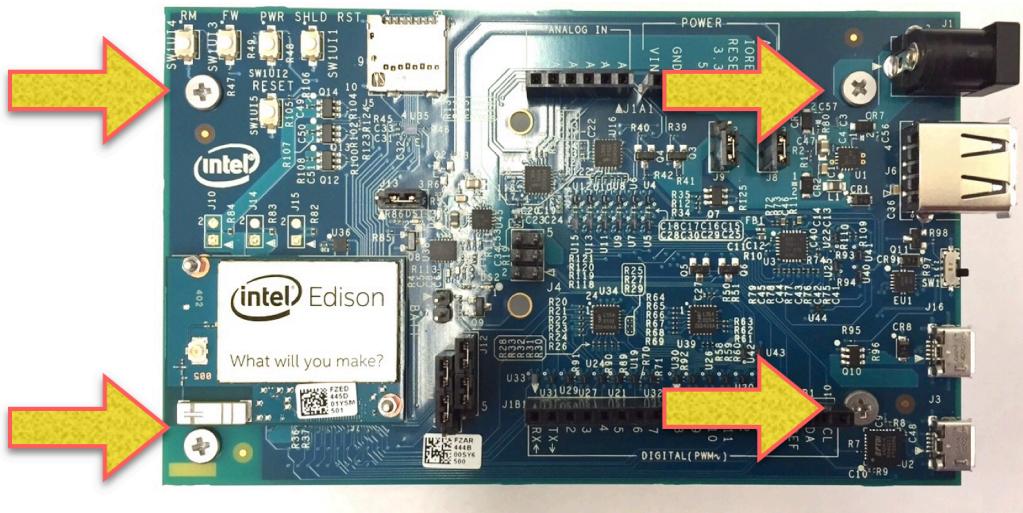
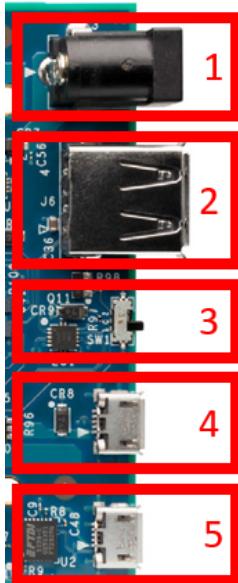


Figure 5. How the screws should be placed on the Edison Board for Arduino

7. The board is now assembled! Examine the critical ports and switch on the right side of the breakout board as indicated in the figure below.



1. Barrel interface for external power supply
 1. See for <https://software.intel.com/en-us/assembling-intel-edison-board-with-arduino-expansion-board> for exact specifications
2. USB 2.0 Host Interface for peripherals such as
 1. Mouse
 2. Keyboard
 3. Webcam
3. Switch
 1. Upper Position: USB Host Mode – USB 2.0 Host Interface is enabled
 2. Lower Position: Device Mode – Multi-gadget Micro USB interface and UART serial USB interface are enabled
4. Multi-gadget Micro USB interface
 1. Supply 5V via USB cable, may not suffice for more energy intensive projects such as actuation of servos
 2. Interact with the Arduino IDE
 3. Use Ethernet over USB
 4. Write to onboard flash-memory
5. UART serial USB interface

Figure 6. Details of interfaces on the Edison Board for Arduino



Linux Operating System Shell Access – Serial Terminal Connection

It is necessary to access the Linux Operating System through the shell program on the Intel Edison Compute Module to begin developing an IoT project. For more information about Linux, refer to the document labelled ***Intel Edison Tutorial – Introduction to Linux*** after completing this tutorial.

This tutorial will provide documentation on two methods of communication with your Intel Edison. These methods are listed below.

1. Serial terminal for communication over a USB wireline connection.
2. SSH communication over a wireless Wi-Fi network.

In order for the Intel Edison to service incoming SSH connections, it must first be configured to accept SSH connections. This can be done by accessing the shell program via a serial terminal session. Follow the below steps to access the shell program via a serial terminal session.

NOTE: When instructed to issue a command, type the bolded text into the shell prompt, and press [Enter].

Hardware Setup

1. Ensure the board in “device mode” by lowering the position of the switch highlighted below.

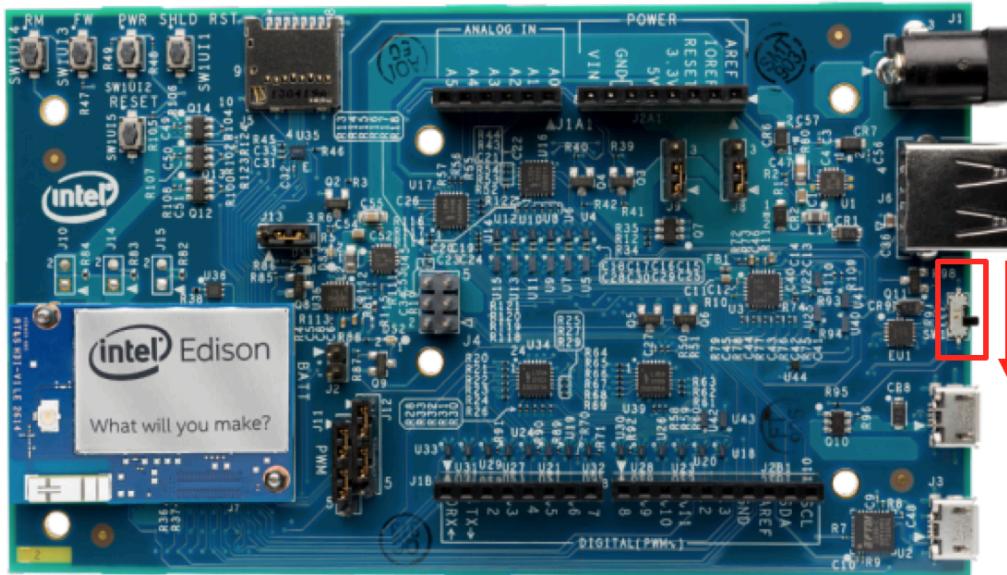


Figure 7. Switching the Edison board for Arduino to “device mode”



2. Plug the power supply into the wall. Connect the power supply to the indicated interface.
OR

Connect the USB A-male side (regular USB) to your personal computer. Connect the USB micro-B (micro USB) side to the indicated interface.

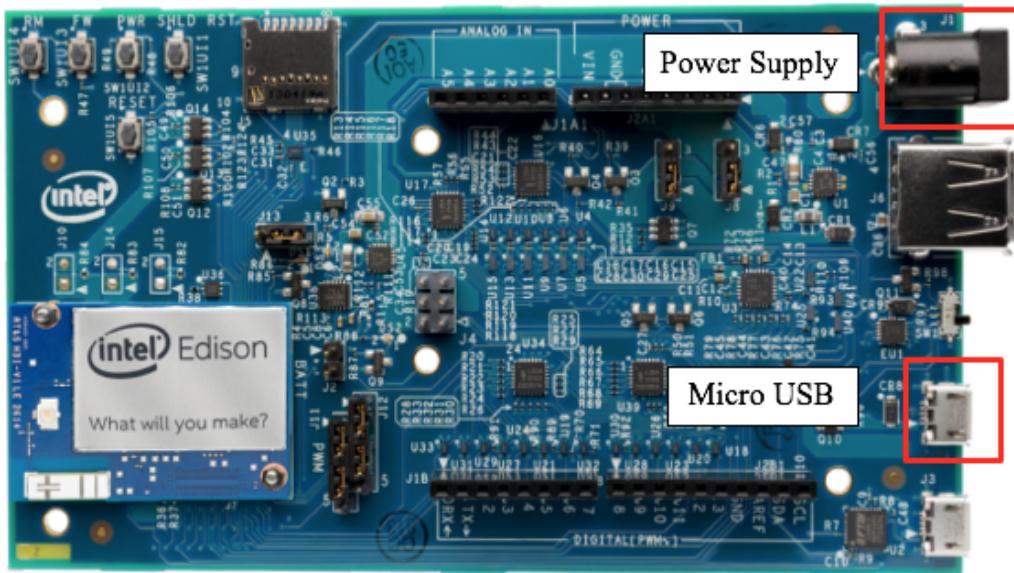


Figure 8. Highlighting the interfaces that provide power to the Intel Edison

3. Connect the USB micro-B side of the cable to the indicated serial interface.

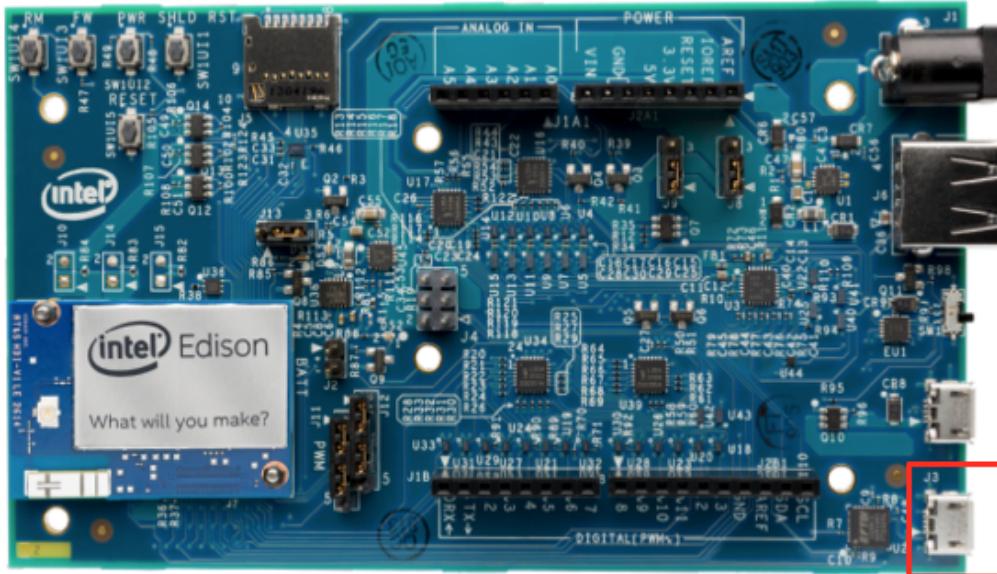


Figure 9. Highlighting the interface that provides wireline serial access

4. Follow the steps below for your computer's operating system.



Windows Operating System

1. This section applies only to Windows operating system computers. Please skip this section if your personal computer does not use the **Windows** operating system.

2. Carefully watch, **prior to performing any steps**, the below two videos:

<https://software.intel.com/en-us/videos/intel-edison-set-up-your-computer-windows>

<https://software.intel.com/en-us/videos/shell-access-windows>

3. Download and install the PuTTY program on your personal computer.

<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>

4. Execute the PuTTY program.

Select **Session** from the category on the left and select **Serial** as the connection type.

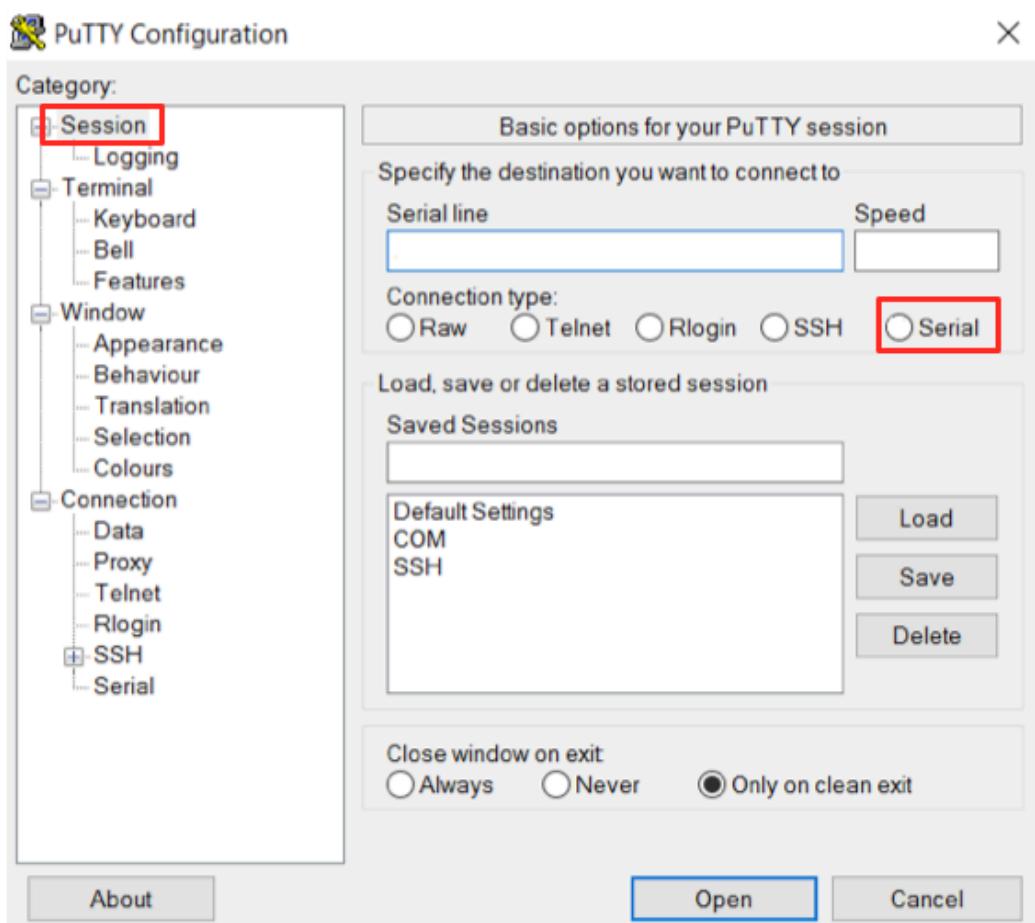


Figure 10. The window that should appear after starting PuTTY

5. Open the device manager. (see: <http://www.computerhope.com/issues/ch000833.htm>)



6. Expand the **Ports (COMS & LPT)** section and record the **COM** value in the brackets next to the device listed as **USB Serial Port**.

If there is no category that matches **Ports (COMS & LPT)** or if there are no devices listed under this category, reboot your personal computer, and repeat the steps above.

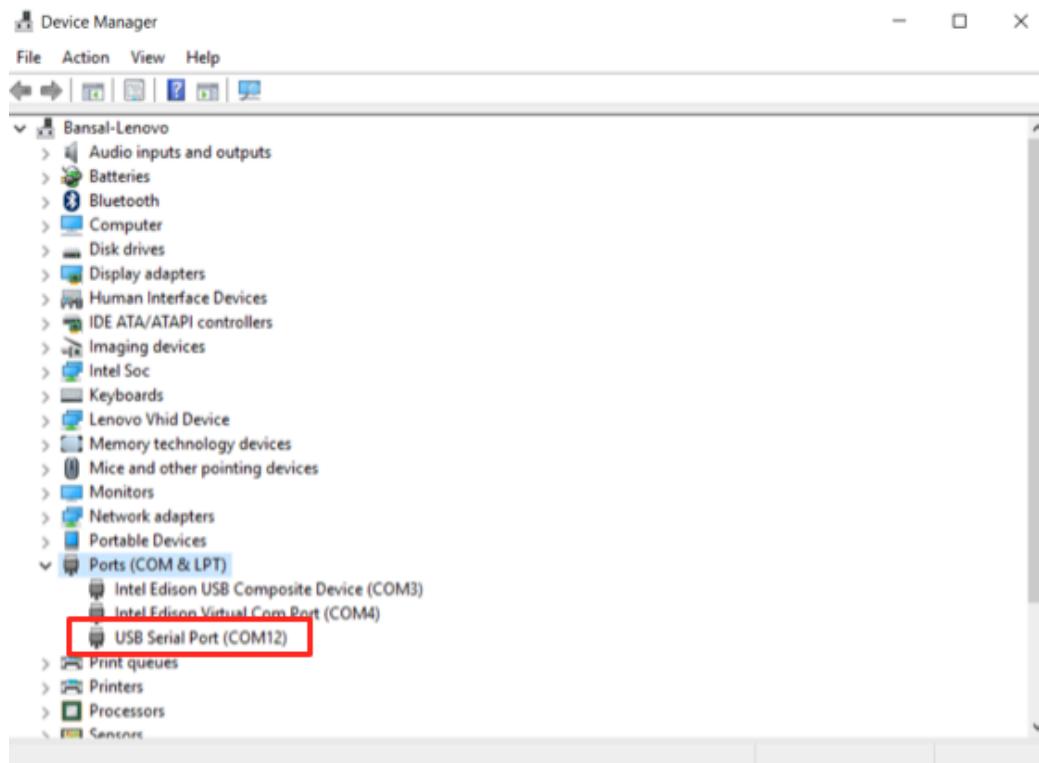


Figure 11. Discovering the port number from the Device Manager

In this case, the **COM** port is **COM12**.

7. Type the **COM** that recorded in step 6 into the line labelled “**Serial line**”. Refer to Figure 12 for clarification.
8. Enter **115200** in the line labelled “**Speed**”.



9. The PuTTY Configuration window should match the below screenshot.

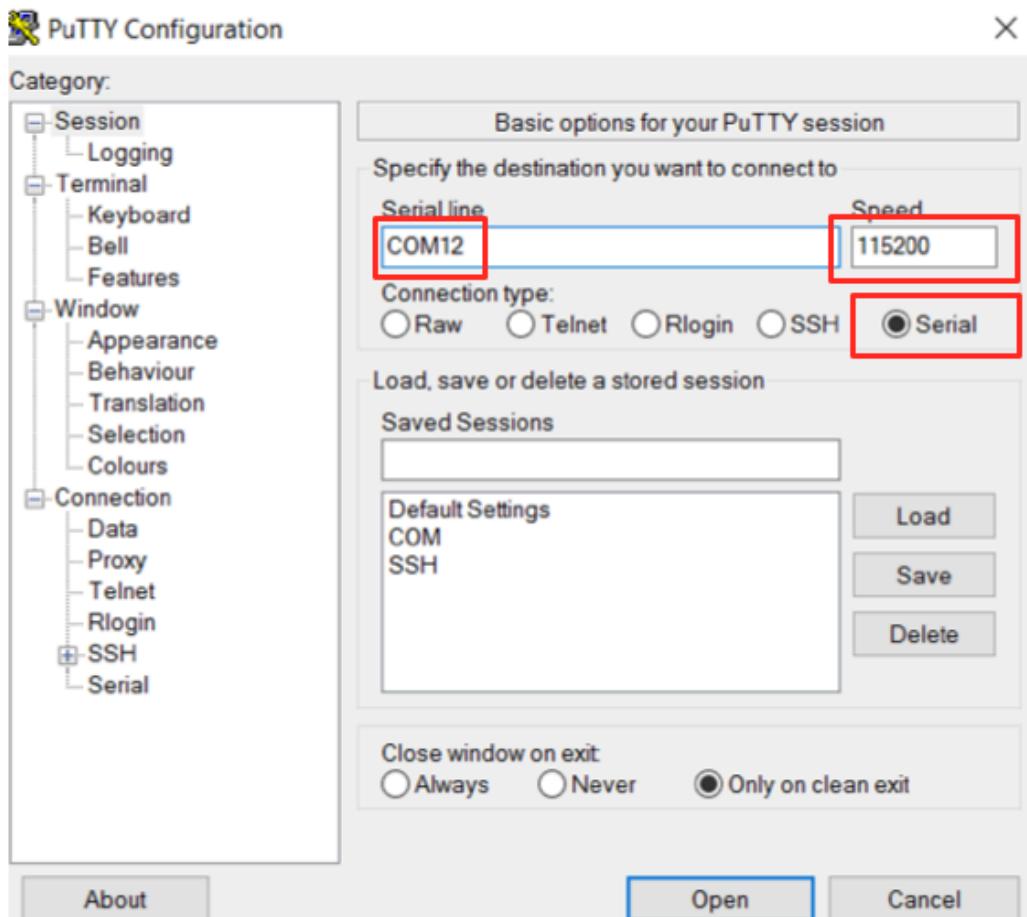


Figure 12. What the PuTTY window should resemble after correctly configuring PuTTY
The “Serial line” field will differ as per Step 6.

10. Click Open then a blank screen will appear.

11. Proceed to the section labelled Login and Setup.



Apple Mac OS-X Operating System

1. Carefully watch, **prior to performing any steps**, the below video:

<https://software.intel.com/en-us/videos/shell-access-mac>

2. Open the Terminal utility.

Terminal is a built-in application for Mac OS-X.

3. Find the Intel Edison device by issuing the below command:

ls /dev/cu.usbserial-*

Note that there is a space between “ls” and “/dev/”.

```
Chriss-MacBook-Pro:Volumes chris$ ls /dev/cu.usbserial-*
/dev/cu.usbserial-A502OP7S
```

Figure 13. Discovering your Intel Edison device using the command line interface

4. Unplug the USB micro-B cable from the UART serial USB interface (the interface closest to the corner of the board).
5. Re-issue the command from Step 3. The device that is no longer listed is the Intel Edison.
6. Plug the USB micro-B cable back into the UART serial USB interface.
7. Issue the below command:

screen /dev/cu.usbserial-XXXXXXXXX 115200

Note that there is a space between “screen” and “/dev/”.

Replace XXXXXXXX with what you found in the previous steps. (in this example, A502OP7S)

If this command does not function as expected, please disconnect then reconnect the USB cables to the board. If the issue is not resolved, reboot your personal computer and repeat the above steps.

8. A blank screen will appear.
9. Proceed to the section labelled “Login and Setup”.

Linux Operating System

Refer to <https://software.intel.com/en-us/setting-up-serial-terminal-on-system-with-linux>.

Proceed to the section labelled “Login and Setup”.



Login and Setup

The below section is intended for **all** users.

1. At the blank screen, press [Enter].
2. The login screen is displayed. If not, press [Enter] again.

If this screen does not appear after pressing [Enter], unplug the USB cable from the UART serial interface and repeat the above steps to access the shell program on the Intel Edison.

If the issue persists, **power cycle** the Intel Edison by removing all USB and power cables from the Edison Board for Arduino. Wait about 10 seconds, then reconfigure the cables to match the arrangement described in the section labelled Hardware Setup. Once the Intel Edison has successfully completed the boot process, repeat the steps in the section labelled Linux Operating System Shell Access – Serial Terminal Connection.

Please contact the course instructor if the Intel Edison remains undiscoverable.

```
Poky (Yocto Project Reference Distro) 1.6.1 edison ttyMFD2
edison login: [REDACTED]
```

Figure 14. Login screen, seeing this indicates all previous steps are successfully completed

3. When prompted for a username, type

root

Press [Enter].

If the Intel Edison requests user input for a password, please see the course instructor. An alternative strategy includes **flashing** the latest Linux Yocto Embedded image onto the Intel Edison Compute Module. This will remove all passwords from the device. For detailed instructions, refer to the document labelled **Troubleshooting Guide**.

4. You have logged into the Yocto Embedded Linux Operating System on the Intel Edison.

On successful login, a command line interface for interacting with the Linux Operating System through the shell program will appear. Similar to a personal computer, the Intel Edison has its own operating system called ***Yocto Embedded Linux***. It is a light-weight version of Linux that includes preinstalled tools for IoT development. This custom Linux image is created with the Yocto project, which is an open source project that provides templates, tools, metadata, recipes, and documentation to assist development of custom Linux for any embedded computing device.



To learn more about the Yocto Embedded Linux Operating System, refer to document labelled ***Intel Edison Tutorial – Introduction to Linux***.



Enabling SSH Access to the Intel Edison

Follow the below steps to enable SSH access after successfully accessing the shell program on the Intel Edison via a serial terminal connection.

1. Read the suggestions below and proceed to issue the following command:

configure_edison --setup

Note that there are two ‘–’s in front of the “setup”. There is also a space between `configure_edison` and the first ‘–’.

After issuing the above command and **reading the below suggestions**, follow the onscreen instructions and prompts as required.

2. Pick a unique name for the Intel Edison. This will be useful to identify different Intel Edison boards when building more complex projects. Follow the suggested naming convention.

`JoeBruin_Edison`
`JenBruin_Edison`

3. Pick a simple password (such as “password123”) that can be shared with group members or course instructors. **Record this password in a secure location.**

If the password for the root account is lost, the user will be required to reinstall the latest Yocto Embedded Linux Operating System. This process requires writing digital contents to the nonvolatile (flash) memory of a computing device. It is a time consuming process that will result in the loss of all files and data present in the flash memory of the Intel Edison. If this is necessary, refer to the document labelled **Troubleshooting Guide** to reinstall Yocto Embedded Linux on the Intel Edison.

4. Once the onscreen instructions request user input for Wi-Fi network access, proceed to **step 3** in the below section labelled Establishing Wireless Network Access – Wi-Fi.
5. To change the password at a later date, issue the command below, and follow the onscreen instructions.

configure_edison --password



Establishing Wireless Network Access – Wi-Fi

Most modern operating systems, such as Windows or Mac, provide some graphical method to configure Wi-Fi network access. However a graphical tool may not be easily accessible on some popular Linux distributions such as **Ubuntu**, or **Debian**. On some of these systems, the Wi-Fi configuration can be changed by editing a file labelled “**interfaces**”. This file can be found in the directory labelled **/etc/network/**.

However, the Yocto Embedded Linux Operating System for the Intel Edison provides a convenient command-line tool to configure network access over Wi-Fi. Follow the below steps to establish a data transport channel between your Intel Edison board and a Wi-Fi network.

1. Access the shell using a serial terminal connection as described in the section labelled Linux Operating System Shell Access – Serial Terminal Connection.
2. Issue the following command:

```
configure_edison --wifi
```

Note: there are two ‘-’s in front of “**wifi**”.

3. A Wi-Fi configuration screen is displayed and it starts scanning for available networks.

```
Configure Edison: WiFi Connection

Scanning: 1 seconds left

0 : Rescan for networks
1 : Exit WiFi Setup
2 : Manually input a hidden SSID
3 : MEDGUEST
4 : HP03A73F
5 : Desdemona's Wi-Fi Network
6 : NETGEAR38
7 : MEDWIFI
8 : eduroam
9 : Brant and JP Office
10 : TP-LINK_E79C74
11 : karlin-5G
12 : ShafferLab
13 : LS 5323
14 : karlin
15 : LS5309
16 : NIMS-LS
17 : Lohmueller_Lab_5G
18 : NIMS_GTO
19 : Peshkel
20 : Lohmueller_Lab_Guest
21 : Lohmueller_Lab
22 : NIMS
23 : Peshkel 5G

Enter 0 to rescan for networks.
Enter 1 to exit.
Enter 2 to input a hidden network SSID.
Enter a number between 3 to 23 to choose one of the listed network SSIDs: █
```

Figure 15: Sample output from `configure_edison --wifi`

4. Follow the onscreen instructions.



5. For operation on the UCLA campus, select the **eduroam** network. Read step 6 and enter your network credentials.

NO OTHER NETWORKS AT UCLA WILL FUNCTION

If the Intel Edison appears to establish a connection to **UCLA_SECURE_RES**, **UCLA_WEB**, **UCLA_WIFI**, **UCLA_SECURE_RES**, or **UCLA_WIFI_RES** and all tests return successful, **it may still not have unrestricted network access**.

6. If your email address is joebruin@g.ucla.edu, omit the ‘.g’ such that your username is as follows

username: joebruin@ucla.edu

password: Bruins1919 (the same password used for your my.ucla.edu account)

```
Configure Edison: WiFi Connection
Scanning: 1 seconds left

0 : Rescan for networks
1 : Manually input a hidden SSID
2 : James's Wi-Fi Network
3 : MEDQUEST
4 : \x00
5 : ShafferLab
6 : Brant and JP Office
7 : karlin-5G
8 : CTRL-TC2
9 : karlin
10 : MEDWIFI
11 : eduroam ←
12 : NIMS GTO
13 : Lohmueller_Lab
14 : Lohmueller_Lab_Guest
15 : ImSaek

Enter 0 to rescan for networks.
Enter 1 to input a hidden network SSID.
Enter a number between 2 to 15 to choose one of the listed network SSIDs: 11
Is eduroam correct? [Y or N]: Y
Please enter the network username: drfaustus@ucla.edu ← Your UCLA email address!
What is the network password?: ***** ← Your BOL login password!
Initiating connection to eduroam. Please wait...
Attempting to enable network access, please check 'wpa_cli status' after a minute to confirm.
Done. Please connect your laptop or PC to the same network as this device and go to http://10.140.135.216 or http://edison.local in your browser.
root@edison:~#
```

Figure 16 Screenshot outlining how to input your login credentials for the eduroam network

7. On Wi-Fi connection success, proceed to step 9 below. On Wi-Fi connection error, press **ctrl-C** to issue an interrupt which will terminate the Wi-Fi configuration tool process. Then proceed to step 8 below.
8. Issue the following commands in the given order. Then, repeat steps 2-6.

1. **ifconfig usb0 down**
2. **ifconfig wlan0 down**
3. **ifconfig usb0 up**
4. **ifconfig wlan0 up**

If the error persists, refer to the link below or consult the course instructor.

<http://www.intel.com/support/edison/sb/CS-035234.htm>

9. Proceed to the Verification section below.



Verification

1. Verify that your personal computer and the Intel Edison are connected to the same network. For instance, if the Intel Edison is connected to **eduroam**, your personal computer must also be connected to **eduroam**.
2. Issue the following command:

configure_edison --showWiFiIP

3. If an IP address is returned, record it and proceed to step 4. If no IP address is returned, attempt to re-establish network access. Follow the steps from the section labelled Establishing Wireless Network Access – Wi-Fi.
4. Issue the following command in order to verify that the Intel Edison has internet access:

ping google.com

```
root@edison:/etc# ping google.com
PING google.com (216.58.216.14): 56 data bytes
64 bytes from 216.58.216.14: seq=0 ttl=53 time=4.561 ms
64 bytes from 216.58.216.14: seq=1 ttl=53 time=20.964 ms
64 bytes from 216.58.216.14: seq=2 ttl=53 time=20.964 ms
```

Figure 17: Sample output for when google.com is online and your Intel Edison has internet access

5. If the ping command is successful, proceed to the next section labelled Shell Access – SSH Connection. If the **ping google.com** command returns an error such as

ping: bad address 'google.com'

Verify that Google is accessible by visiting www.google.com on a web browser on your personal computer. If www.google.com is not accessible, attempt to access another website on your web browser. If no websites are loading on your personal browser, please contact the course instructor or IT system administrator.

If a website is through a web browser on your personal computer, attempt to ping it from the Intel Edison by issuing the following command:

ping <other_website>

If this command returns the same error as above (**bad address**), please attempt to re-establish network access by following the steps in the section labelled Establishing Wireless Network Access – Wi-Fi.

6. Press **ctrl-C** to quit.



Shell Access – SSH Connection

SSH stands for “Secure SHell”. It is used to communicate in a secure manner over an unsecure network.

If the SSH connection is established over a wireless Wi-Fi network, it can provide many advantages over a serial terminal connection.

- The communication is encrypted, and is therefore more secure.
- A communication channel can be maintained between your personal computer and multiple Intel Edison’s without the use of wireline USB cables. However, to function correctly, the Intel Edison Compute Module requires a power supply, such as a battery or AC-DC wall adapter.
- The steps to establish an SSH connection between your personal computer and the Intel Edison also enables the transfer of files.

However, SSH connections also have disadvantages. These disadvantages stem mainly from relying on a Wi-Fi network to establish an SSH connection. Some of these disadvantages are listed below.

- Wi-Fi connections may have network latencies. These latencies may cause large delays between performing an action (such as issuing a keystroke) and the consequential reaction (such as executing a process or displaying the keystroke).
- Each time the Intel Edison board completes the boot process, the user must access the shell program via a wireline serial connection. This is to verify that the Intel Edison has network access, and to obtain the IP address assigned to the Intel Edison.

The **eduroam** network utilizes the **Dynamic Host Configuration Protocol** (DHCP) to assign IP addresses; as it must service users connecting and disconnecting at unknown time intervals. DHCP allows devices to request an IP address on connection initialization. Devices may be assigned a static IP address, or have one automatically assigned to them by DHCP. As such, devices that are not assigned a static IP address may not rely upon having the same IP address on initialization of a connection with the Wi-Fi network utilizing DHCP.

Follow the steps below to use SSH to access the shell program on your Intel Edison.

1. Establish a serial terminal connection with the Intel Edison.
2. Discover the IP address assigned to the Intel Edison by issuing the following command:

configure_edison --showWiFiIP

```
root@edison:~# configure_edison --showWiFiIP
131.179.12.118
root@edison:~#
```

Figure 18. Discovering the IP address of your Intel Edison

The IP address assigned to the Intel Edison board is 131.179.12.118 in this scenario.



3. Proceed to the instructions corresponding to the operating system of your personal computer below.



Windows Operating System

1. This section applies only to Windows operating system computers. Please skip this section if your personal computer does not use the Windows operating system.
2. Download and install the MobaXTerm program on your personal computer. It provides a graphical interface for SFTP and a method for establishing SSH connections.
http://mobaxterm.mobatek.net/MobaXterm_Setup_9.0.msi
3. Execute the MobaXTerm program.
4. Click the “session” button in the top left of the window.

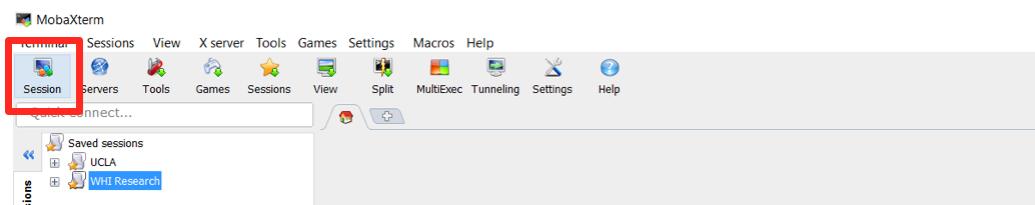


Figure 19. Screenshot of the MobaXterm GUI

5. Click the “SSH” button in the top left of the new window.

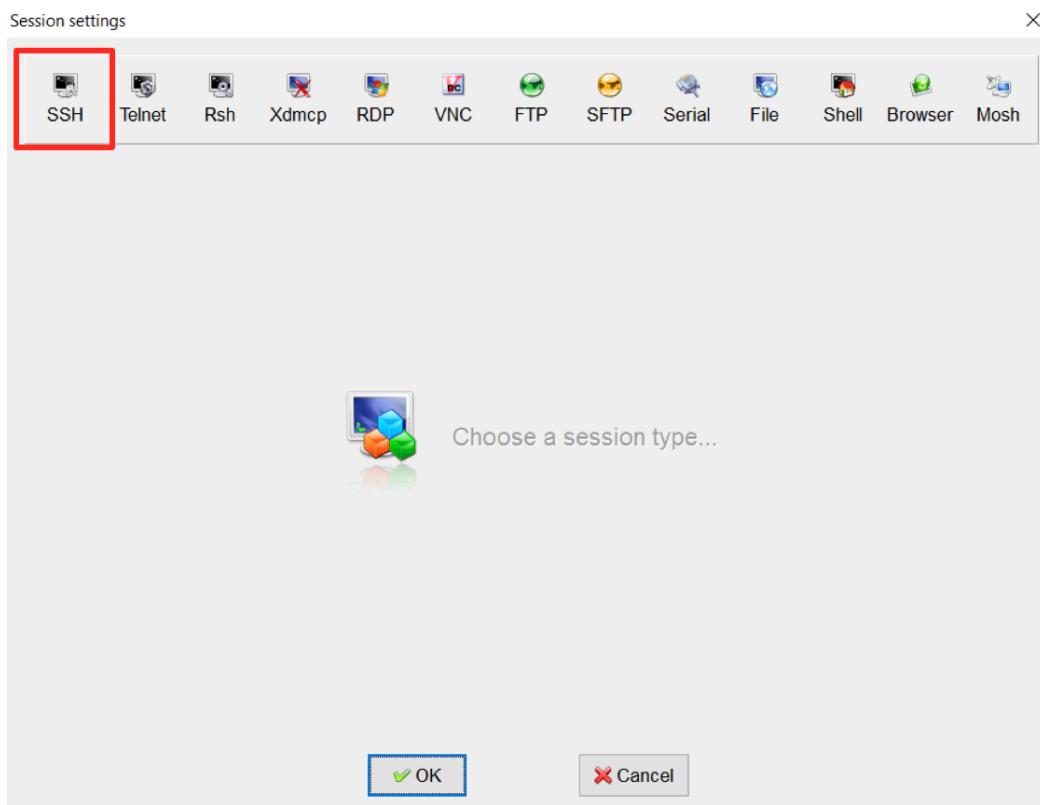


Figure 20. Selecting the correct session for MobaXterm



- Type in the IP address assigned to the Intel Edison into the dialog box labelled **Remote host ***.

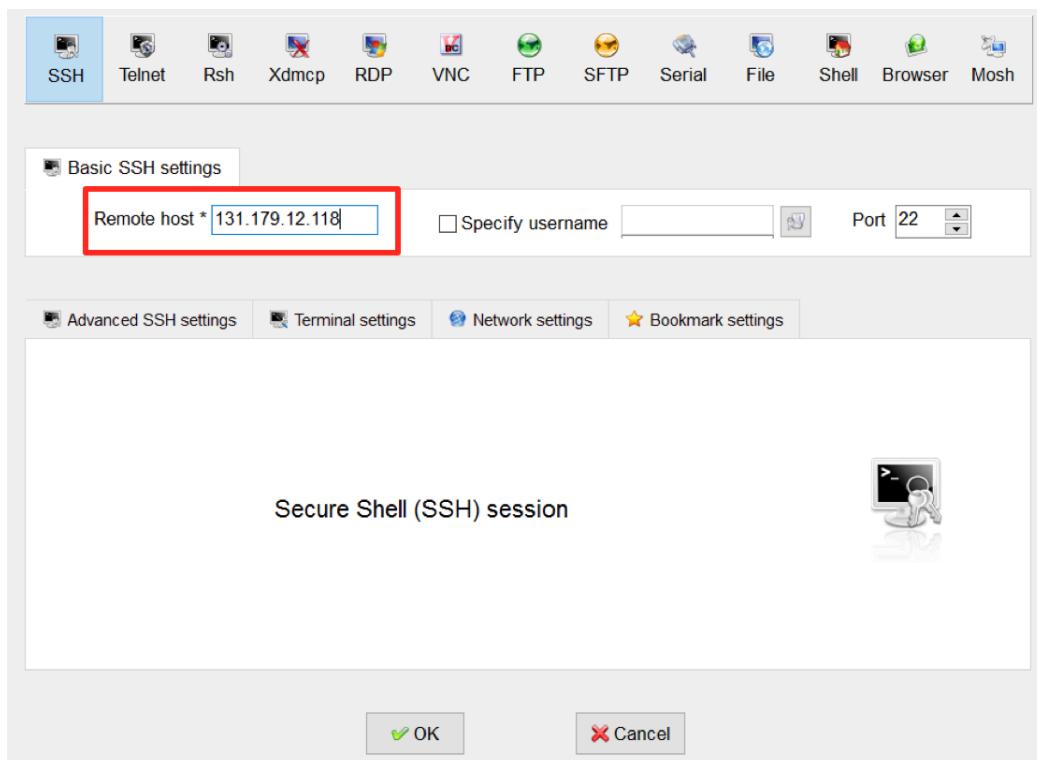


Figure 21. Entering the IP address of your Intel Edison into the MobaXterm prompt

- Click **ok**.

When the shell requests login credentials by displaying the string “login as:” on standard output, type **root** and press [Enter].

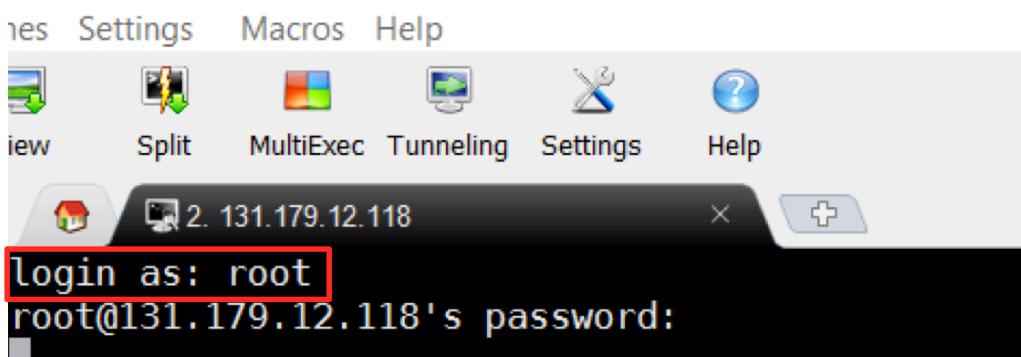


Figure 22. Providing the SSH client with the correct credentials to enable an SSH connection

- Enter the password for the **root** account on the Intel Edison as assigned in the section labelled Shell Access – SSH Connection.

The password field will not change as you enter the password.

A new dialog box will pop up, click “yes”.

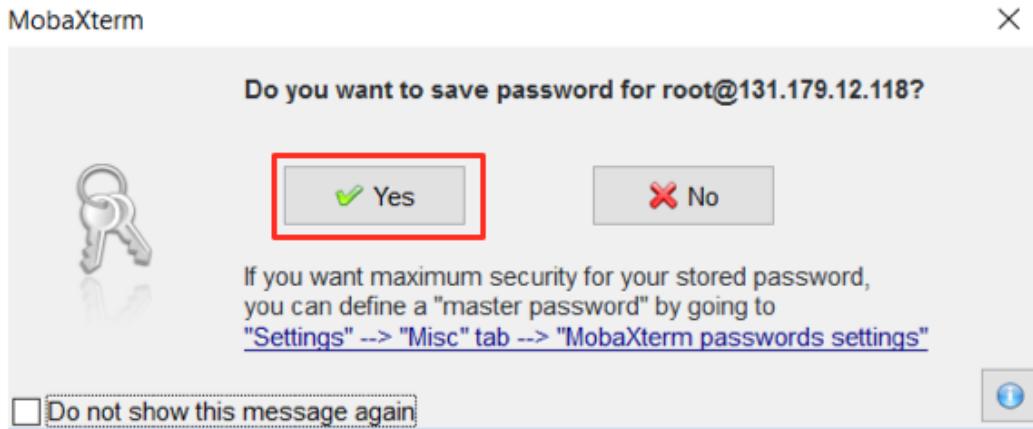
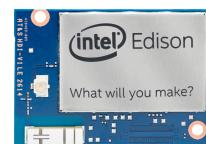


Figure 23. Prompt regarding login credential storage

9. You now have access to the shell program on the Intel Edison through an SSH connection.
10. Another key feature that MobaXTerm provides is a GUI based SFTP client. To access this feature, open the file explorer and attempt to drag and drop a file into the pane as shown in the figure below.

Issue the command **ls** to show the contents of your current working directory. Notice how the file is now listed in the current directory.

Transfer the file back onto your windows desktop by dragging it from the pane and onto your desktop. Notice how you can interact with the newly transferred file.

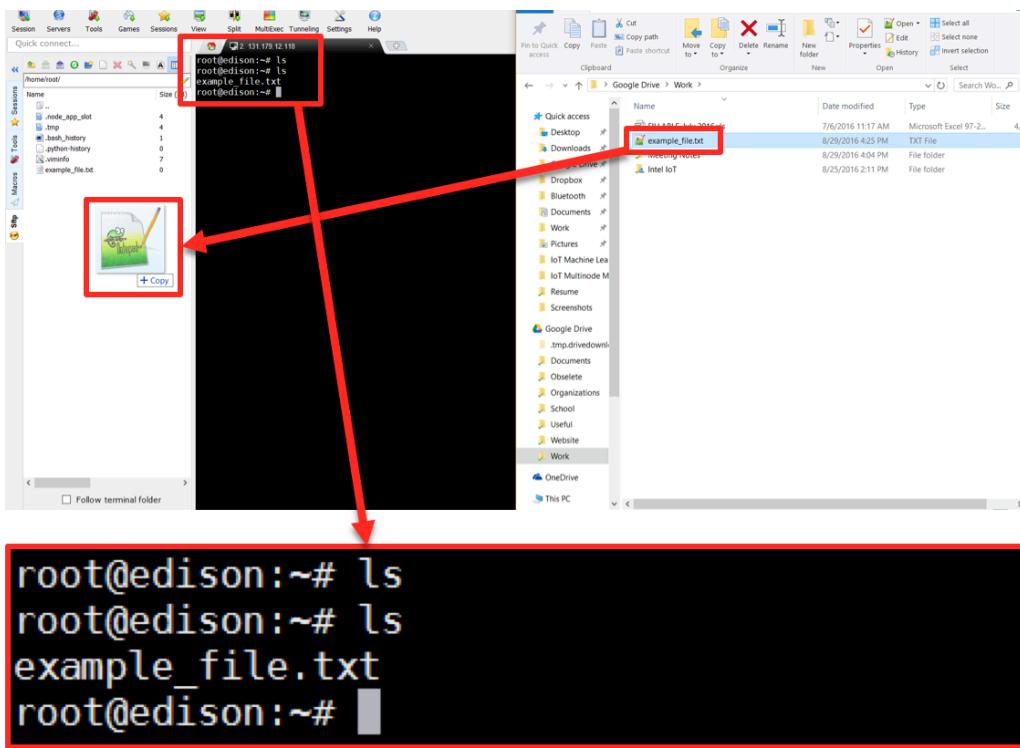


Figure 24. SSH Client



Mac OS-X and Linux Operating Systems

Most Mac OS-X and Linux Operating Systems come preconfigured with command line utilities to initiate SSH connections. Follow the below steps to learn the syntax of the **ssh** command.

1. This section applies only to Mac OS-X and Linux Operating System users. Please skip this section if your personal computer does not use one of these operating systems.
2. Open a terminal window.
3. Issue the below command:

```
ssh root@<ip_address>
```

Note: Ensure that the command contains **root@**, if this is not provided, the SSH connection be misconfigured and your login attempt will be denied.

```
Chriss-MBP:~ Chris$ ssh root@131.179.12.143
```

Figure 25. Issuing the command to access the shell on the Intel Edison through an SSH connection
The IP address is 131.179.12.143.

4. If prompted to continue connecting, type **yes** and press [Enter].

```
Chriss-MBP:~ Chris$ ssh root@131.179.12.143
The authenticity of host '131.179.12.143 (131.179.12.143)' can't be established.
ECDSA key fingerprint is SHA256:5joRpZkzrPZhfKYLkH3QK4Kz67Lb8+iDUKlDK/nAas.
Are you sure you want to continue connecting (yes/no)?
```

Figure 26. Example SSH authentication prompt

5. Enter the password assigned to the **root** account when prompted and press [Enter]. The password field will remain blank as you are inputting characters. This is a security feature.

```
Chriss-MBP:~ Chris$ ssh root@131.179.12.143
The authenticity of host '131.179.12.143 (131.179.12.143)' can't be established.
ECDSA key fingerprint is SHA256:5joRpZkzrPZhfKYLkH3QK4Kz67Lb8+iDUKlDK/nAas.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '131.179.12.143' (ECDSA) to the list of known hosts.
root@131.179.12.143's password: ?
```

Figure 27. Intel Edison prompt for user to input password

6. You have successfully established an SSH connection with the Intel Edison.

```
Chriss-MBP:~ Chris$ ssh root@131.179.12.143
The authenticity of host '131.179.12.143 (131.179.12.143)' can't be established.
ECDSA key fingerprint is SHA256:5joRpZkzrPZhfKYLkH3QK4Kz67Lb8+iDUKlDK/nAas.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '131.179.12.143' (ECDSA) to the list of known hosts.
root@131.179.12.143's password:
root@ucla_iot:~#
```

Figure 28. Screen after successfully logging into your Intel Edison



SFTP Access – Cyberduck

SFTP stands for “SSH File Transfer Protocol”. It is a network protocol that provides file access, file transfer, and file management over a potentially insecure network. This section describes how to use a GUI to transfer files between your Intel Edison and your personal computer utilizing SFTP.

1. This section pertains to personal computers with Mac OS-X. If your personal computer has the Windows Operating System and you would like to learn about using Cyberduck, proceed with the below section. Download and install the Cyberduck from the following link. (<https://cyberduck.io/?l=en>)
2. Execute the Cyberduck app.
3. Click “open connection” in the top left corner.

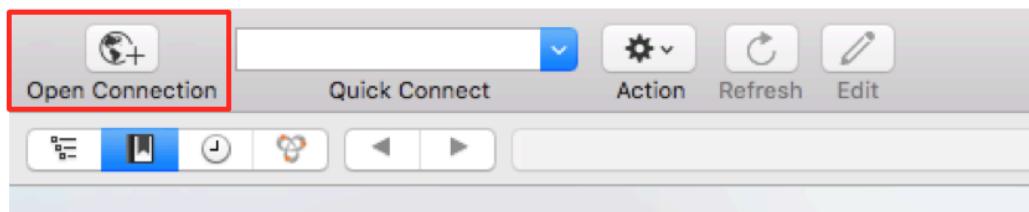


Figure 29. Opening a new connection using the Cyberduck application

4. A dialog box will appear.

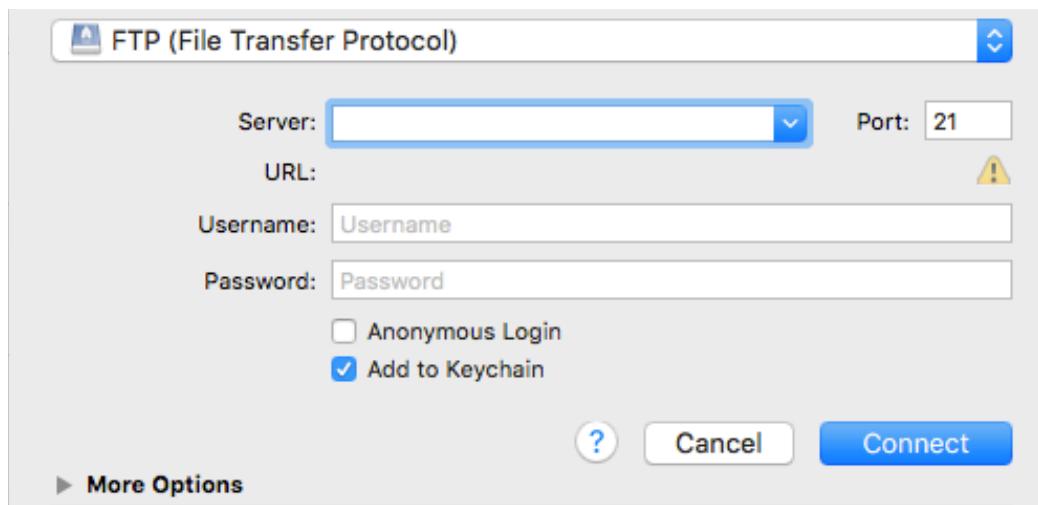


Figure 30. Dialog box that prompts user to input the relevant connection information



5. Change the protocol to SFTP.

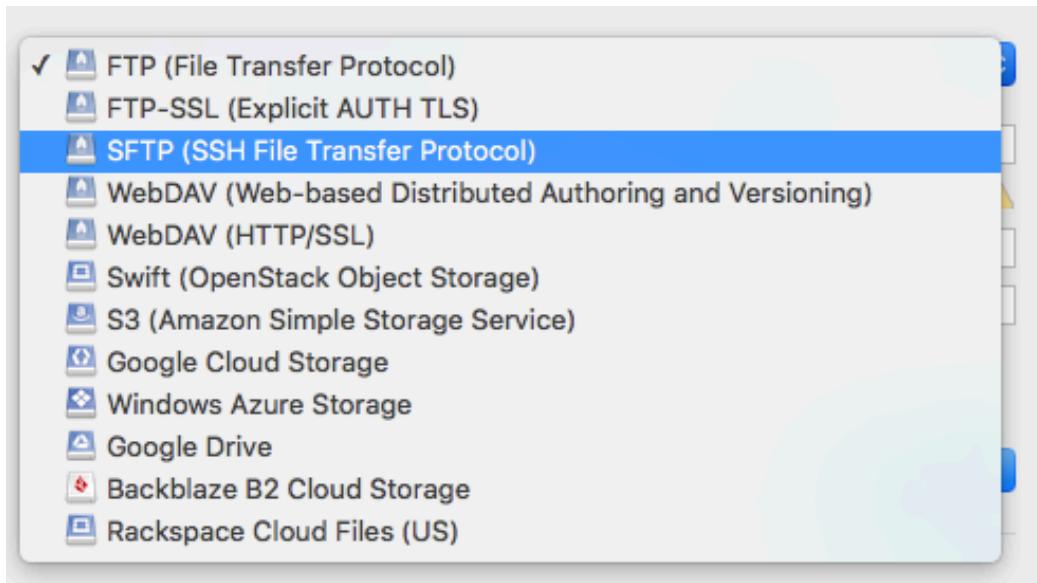


Figure 31. Selecting SFTP for the file transfer protocol

6. Enter **root** in the **Username** field, the password assigned to the **root** account in the **Password** field, and the IP address assigned to the Intel Edison in the **Server** field.

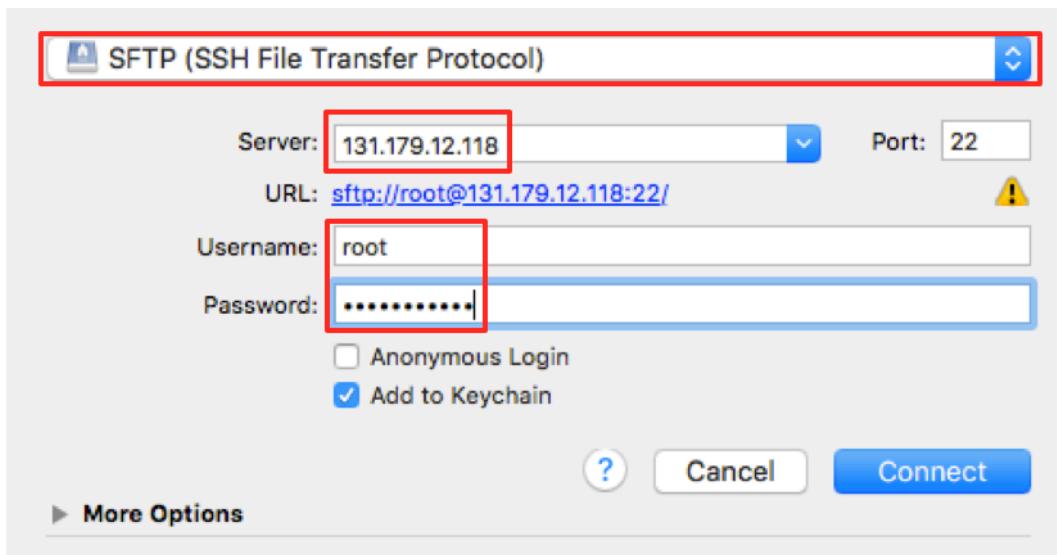


Figure 32. Example login prompt screen

7. An SFTP connection has been successfully established between the Intel Edison and your personal computer.
8. To transfer a file using SFTP, open the file explorer (**Finder** on Mac OS-X). Next, drag and drop a file into the Cyberduck application. The window should also display a current list of files onboard the Intel Edison.
9. Issue the command **ls** to the shell program. This will display the contents of the current working directory. Notice how the transferred file is now listed in the current directory.



10. Transfer the file back to your personal computer by dragging it from the Cyberduck application and onto your personal computer's desktop. Notice how you can interact with the file transferred from the Intel Edison.