NAME: Brodric Young

ECEN 324 – Lab #3 - Understanding the PC Architecture

1 Introduction

In this lab, you will have some hands-on experience with the architecture, and hardware, of a desktop personal computer (PC) and a laptop.

2 Logistics

You will be working with a motherboard, an older laptop and also a desktop SFF (small form factor) PC that will be made available to you in STC 155. Instructions dealing with the care and handling of these systems will be given in this handout, in class and on I-Learn. You will be working in teams of two.

3 Tasks to complete

NOTE: You will indicate completion of the items below using an I-Learn quiz. Each student will individually submit the I-Learn quiz.

- ☑ Watch a video that gives general instructions about this lab.
- ☑ Identify the major components of an *HP ProDesk 600 G2 SFF* desktop PC on page 3. This is the same type of PC that will be used later in the lab.
- ☑ Identify the different parts of an Asus B450-F motherboard (see pages 4 and 5). To assist you in doing this, you may inspect a motherboard "close-up" in STC 155. Some motherboards are in plastic bins that you may inspect. Identify parts by looking at the writing on the motherboard (the silkscreen). You may desire to use a magnifying glass to help you read some of the identifiers. Pictures of the motherboard are also available for your use (see I-Learn).
- ☑ Identify the IO ports on the Asus B450-F motherboard (see page 6).
- ☑ Match the cables and ports from the HP ProDesk 600 G2 SFF desktop with their description (see page 7).
- ☑ Write your names on the post-it note on the front of the laptop. Install an operating system on your assigned laptop. You may install either:
  - Windows 10 (instructions on page 8)
  - Fedora 34 (instructions on page 9)

  Be aware that installing an OS often involves some amount of "wait" time. Recommendation: Use the AC adapter for the laptop!
- ☑ After installing an operating system on the laptop, do the items listed for that operating system at the end of the installation instructions (Windows: bottom of page 8; Linux: page 10). Indicate in your conclusions what you did and learned.
- ☑ Add additional main memory (DRAM), provided in STC 155, to the laptop on which you installed an OS. NOTE: before doing this, you are to watch the video that has instructions on how to do this.

- ☑ After testing that the memory was installed successfully, remove the memory from the laptop and return it to the bin. Leave the OS installed on the laptop.

- ☑ View the video on installing an additional mass storage device, an SSD or a hard drive in the HP ProDesk 600 G2 SFF desktop.

- ☑ Add a second drive, a SATA drive, to one of the *HP ProDesk 600 G2 SFF* (small form factor) desktop PCs systems provided in STC 155. You should have already watched the video (in I-Learn) about how to do this, if not, watch it before doing this! Written instructions are on page 11. After installing the drive, format and prepare it for use. Then copy some files to a folder on the hard drive. For assistance on doing this in Linux, see page 12-13 (GUI version). For assistance on doing this in Windows, see page 15. Once the disk is installed and is usable, save some files on it.

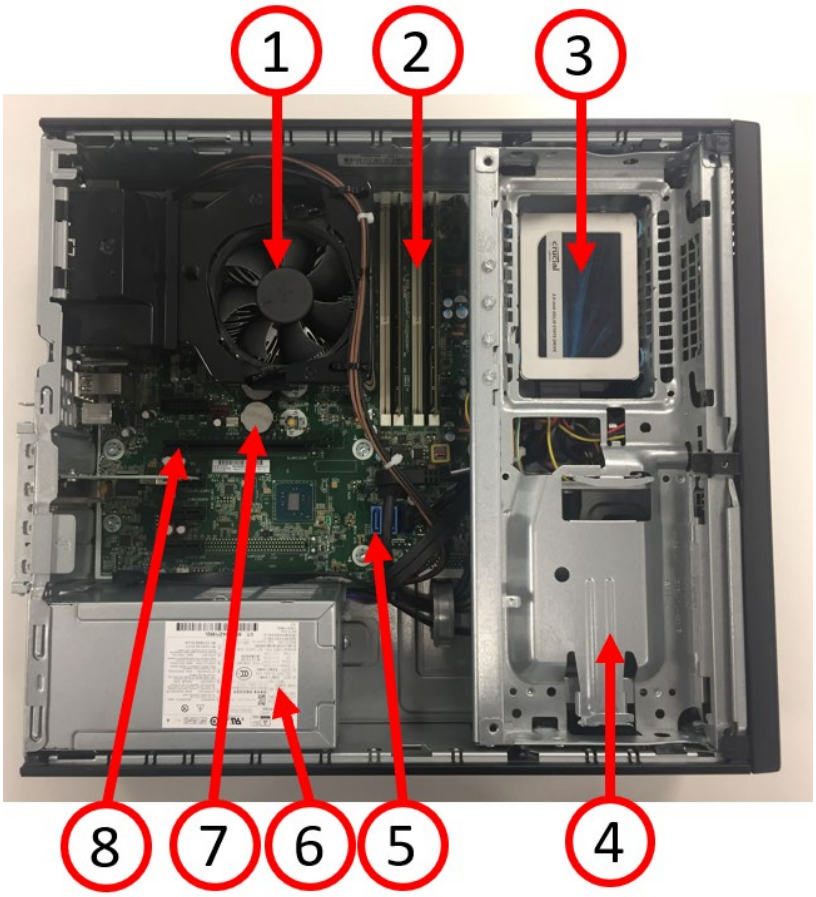
- ☑ Clean off the second hard drive (see the end of the install sections for the operating system you used). Shutdown the desktop and neatly replace the desktop, power cord, monitor, keyboard, mouse and SSD/hard drive behind the whiteboard in STC 155.

  CAUTION: clean off only the additional hard drive you added and not the main drive!

- ☑ Individually write a conclusion for this lab in I-Learn. NOTE: The conclusions section should discuss any activities that were partially completed, what you did to learn a little about the OS you installed, any issues or problems that occurred during the lab and what you learned and insights gained doing this lab.

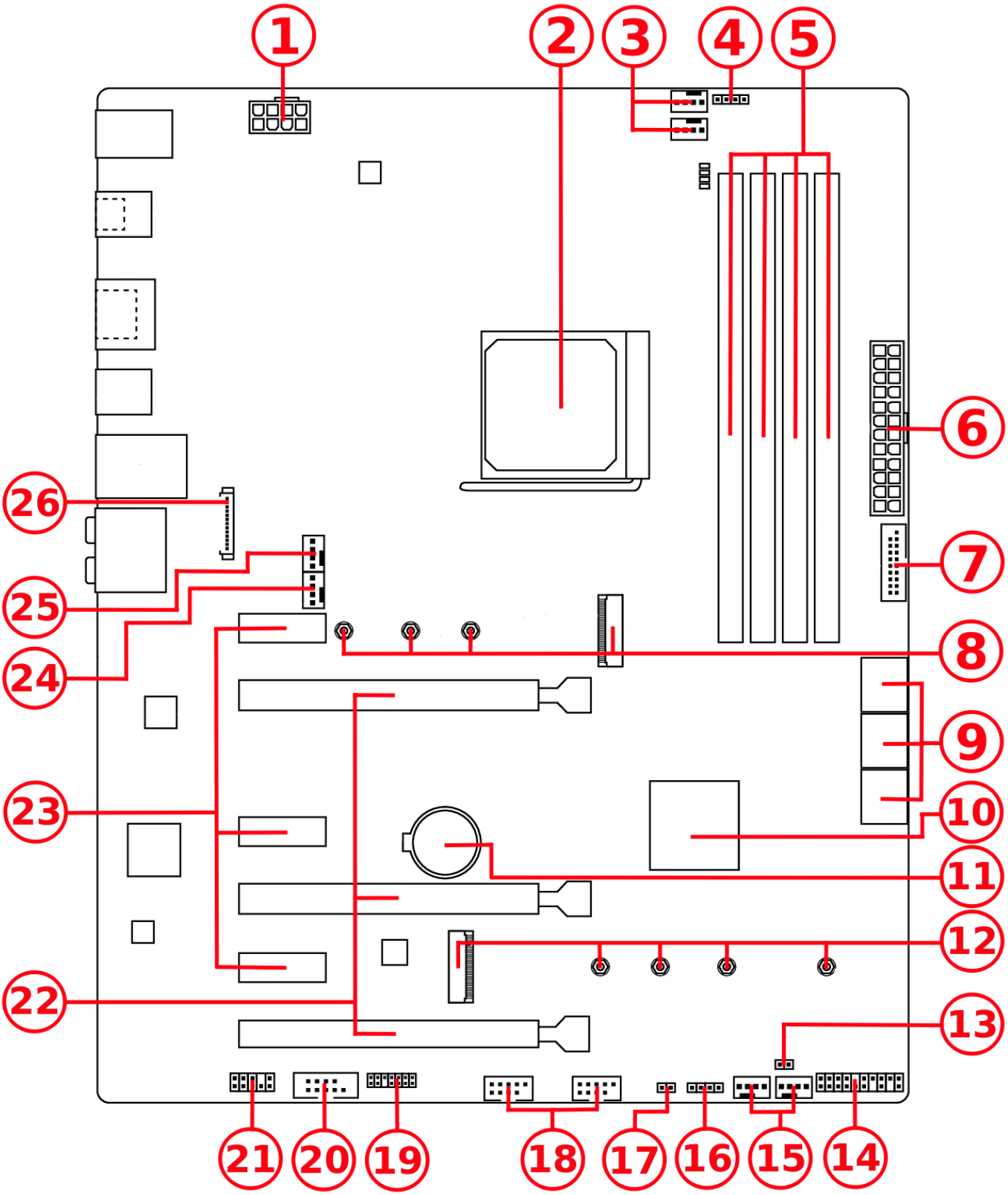
Conclusions

These will be done on I-Learn.



Match the system components with their descriptions listed below.	
7	Battery for the real time clock
4	Bay for an optical drive
2	Memory - DRAM
1	Processor with fan
3	SSD (Solid State Drive)
5	SATA Connector
6	Power Supply
8	PCIe x16 slot (PCI Express)

Inside the *HP ProDesk 600 G2 SFF*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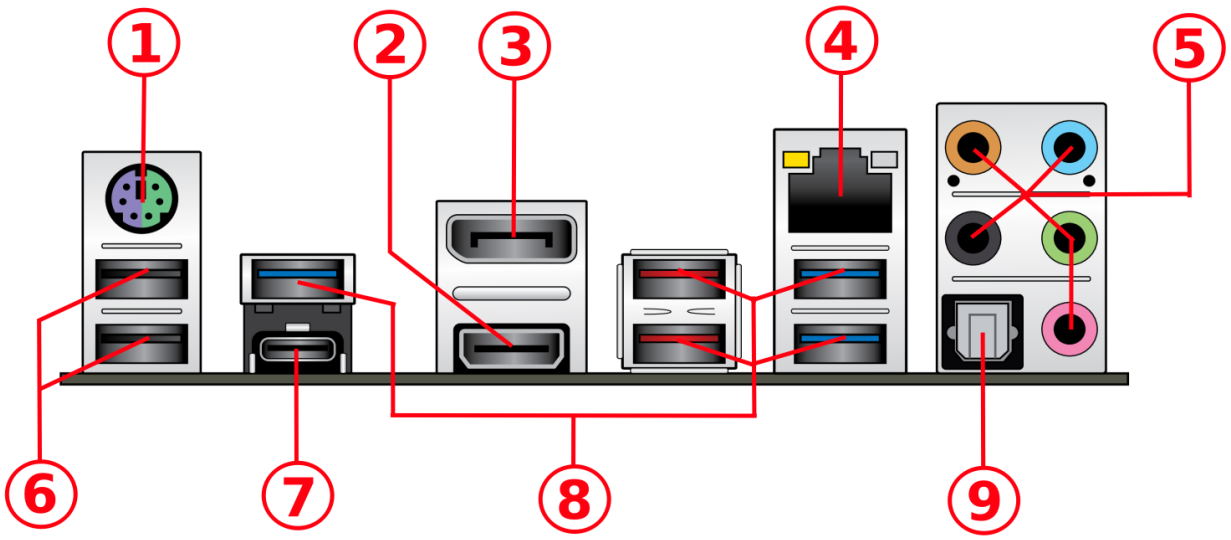
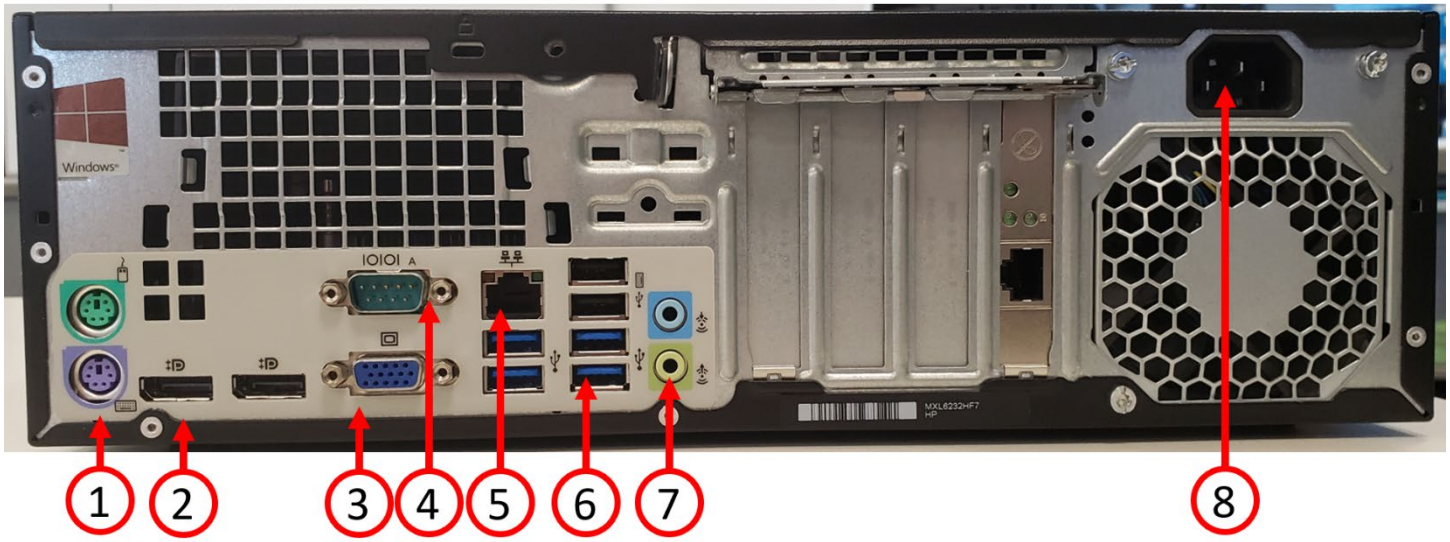
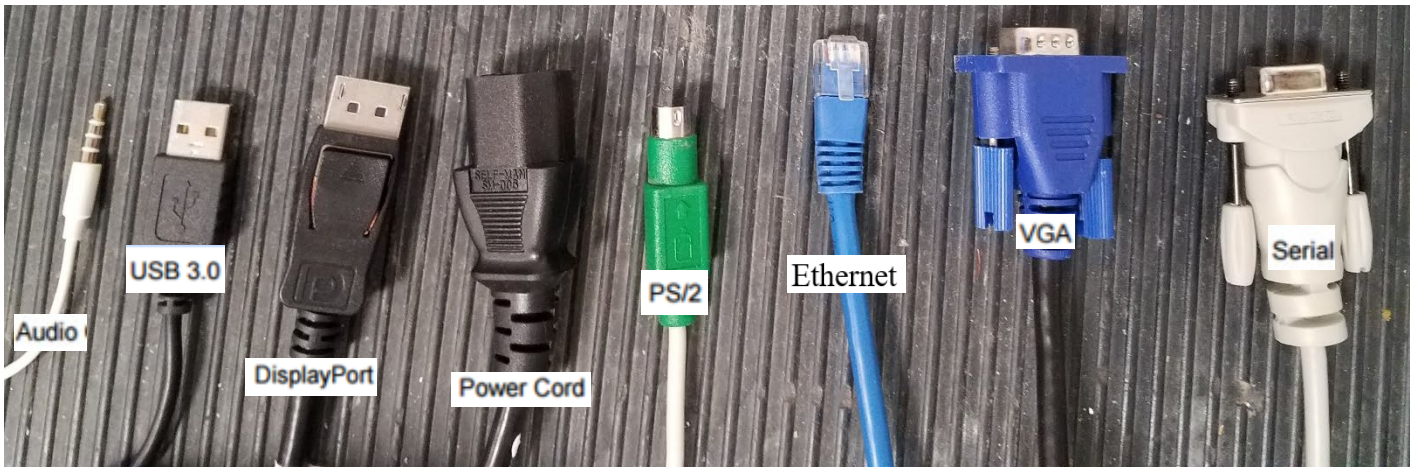
Match numbered motherboard components with descriptions below.			
AMD AM4 CPU Socket	2	LED Strip Connector (underneath the shield)	26
AMD B450 Chipset	10	RGB Connector [matches 2 numbers]	4, 16
16-lane PCI Express Slot (x3)	22	CPU Fan Connectors (x2)	3
Single-lane PCI Express Slot (x3)	23	USB 3.1 Gen 1 Connector	7
DDR4 DIMM Slot (x4)	5	System Panel Connector	14
ATX Power Connector (24-pin)	6	SATA Connectors (x6)	9
ATX Power Connector (8-pin)	1	Real-time Clock RAM Jumper (CLRTC)	17
M.2_1 Socket (PCIE 3.0 x4 and SATA)	8	Thermal Sensor Connector	13
M.2_2 Socket (PCIE 3.0 x4)	12	Trusted Platform Module Connector	19
Chassis Fan Header (x3) [matches 2 numbers]	15, 25	USB 2.0 Connector (x2)	18
All-in-one Liquid Cooling Pump Header	24	Serial Port Connector	20
Front Panel Audio Connector (AAFP)	21	CMOS Power Cell	11



Match the ports with their descriptions listed below.	
9	Optical S/PDIF Audio Port
2	HDMI 2.0a Port
7	USB 3.1 Gen 1 Type-C
8	USB 3.1 Gen 1 and Gen 2 Type-A
1	PS/2 Combined Keyboard/Mouse Port
5	7.1 Channel Audio Ports
4	Gigabit LAN Port
3	DisplayPort
6	USB 2.0 Type-A





Match the Cables and Ports	
2	Display Port
5	Ethernet
4	Serial
7	Audio
3	VGA monitor
1	PS/2
6	USB 3.0
8	Power Cord

Windows® 10 Enterprise Installation Guide

1. Power on the laptop. Power on the laptop. It will probably may say 'No Boot Device Found' or will go to a hardware diagnostics screen. Insert the Windows 10 Flash Drive into a USB Port and power cycle (power off, then on) the system to boot from the Flash Drive. If the hardware diagnostics come up, use the arrow keys on the keyboard to exit from it. [If the system has active partitions or doesn't boot from the flash drive, try another USB port and/or contact a lab assistant, Brother Jones or another student that knows how to delete partitions and boot the system from the flash drive.
2. After the setup files load, select an English (US) language configuration under "Time and currency format", and press "Next"
3. Press the "Install now ->" button.
4. Scan through (read if you desire) the license terms and accept the license terms, then press "Next."
5. Select the "Custom (advanced)" option
6. Press "Next" to install the operating system on the 298.1 GB 'Disk 0 Unallocated Space.'
7. Now, wait, as the install program copies and installs files. The computer may restart several times. If after installing files, the system boots from the flash drive (re-starting the install) instead of the hard disk, shut down the laptop, remove the flash drive and turn on the laptop.

   Note: If there are problems installing files, the USB port may be bad on the laptop, try another. If there are problems with a USB port on the laptop, make a note of it on the post-it note.
8. Select "Skip this step" when prompted for Wi-Fi, or select BYUI and enter in your info (doesn't make a difference).
9. Press "Use Express Settings".
10. If connected to Wi-Fi select the 'use local' and press "Next". If not connected to Wi-Fi you won't have this step.
11. Type in the username: ecen324
    and a computer name, possibly ECEN324XX where "XX" is the number of your computer as given on a label on the lid and one end of the laptop.
12. Enter the password as: 324STC155
    and the password hint as: class and room
    NOTE: this isn't the best password, but it is ok for this assignment.
13. The Windows 10 Installation is now complete.
14. If you didn't follow the instructions and used a password other than the one given above, change it to what the instructions say it should be set to.

Do the following after installing Windows 10:

[Include what you researched, and your findings, in the conclusions of the lab report.]

☐ Log in to the Windows system with the username and password used at the finalization of the Windows installation. Click on the folder icon on the bottom of the page. Then right click on 'This PC' and click 'Manage'. See what you can learn about the hardware from this Windows program.

☐ In Windows, the Device Manager shows all known hardware (with drivers) and unknown hardware (without drivers) that is in your computer. To learn about hardware components in the system, expand a category by clicking the arrow at the left of an item. Then right click on an item in the expanded category and click 'Properties'. Verify some of the components (processors, system Board Features [USB, PCI Bus, etc], CD-ROM, etc) you have seen inside the computer system that are listed within this Windows Device Manager program.

Fedora 34 Workstation Installation Guide

Note: Do not plug the system into a network.

1. Power on the laptop. It may say 'No Boot Device Found' or will go to a hardware diagnostics screen. Insert the Fedora 34 Flash Drive into a USB Port and power cycle (power off, then on) the system to boot from the Flash Drive. If the hardware diagnostics come up, use the arrow keys on the keyboard to exit from it. [If the system has active partitions, or doesn't boot from the flash drive, try another USB port, and/or contact a lab assistant, Brother Jones or another student that knows how to delete partitions and boot the system from the flash drive.]

2. The Fedora 34 install process will start after a small wait. The Gnome-based Fedora 34 desktop edition will be running "live." Running "live," means that the operating system may be booted from CD or a flash drive and tested out without installing anything on the computer's hard disk. Scroll up to "start Fedora 34 live" and press enter

3. Choose "Install to Hard Drive" from the "Welcome to Fedora" window. Clicking this may make the window become smaller. If this happens, click "Install to Hard Drive" again and the installation to the hard disk should start.

4. Select English as the language to use during the installation and English (United States). Then press "continue"

5. Select "Installation Destination", choose the one with 298.GiB (make sure not to select the USB Drive if it shows up), then press "Done" (in the top left corner).

6. Then select Time & Date. Choose the mountain time zone. Then press "Done". Note: it will say a city in the mountain time. It doesn't have to be Rexburg.

7. Then press "Begin Installation" and wait.

8. When the software is installed, click "Finish Installation."

9. Now power off Fedora 34 by selecting the down arrow (or battery symbol) in the top right corner and then the power symbol and then power off.

10. Remove the flash drive from the systems which was used to install Fedora and power on the system. Once you have logged back in a welcome menu will pop up (after a while) that says "Welcome to Fedora 34!" Click "Start Setup"

11. Select "Skip" for setting up Wi-Fi.

12. Set the privacy settings off and click "Next"

13. Fill in a name for "Full Name" (maybe ecen324) and use the username: ecen324 Click "Next"

14. Set the password as: 324STC155. Then press "Next"

15. The setup is complete. Click "Start Using Fedora"

Do the following if you installed Fedora 34 Workstation:

[Include what you researched, and your findings, in the conclusions of the lab report.]

- ☑ Explore the system some as the user you created.
- ☑ The Linux system has a '`/proc`' pseudo-file system that provides all kinds of information about the system. Doing a '`cat`' command on the 'files' in '`/proc`' will provide you information about the system. For example, in a terminal window (one of the applications on the system) you might issue the following command line command:

  ```
  cat /proc/cpuinfo
  ```

  You may use command line commands such as '`ls`' to view the contents of the file system to see other pseudo-files under `/proc`.

  You may also use the GUI 'Files' application on the system to explore the file system and the `/proc` pseudo-file system. Double clicking `cpuinfo` in the GUI file system viewer will bring up the contents of `/proc/cpuinfo` in an editor window.

- ☑ In a terminal window, execute the following command: `dmesg >dmesg.out`
  This will dump the contents of the kernel ring-buffer to the file "`dmesg.out`". This file will then contain information written to the kernel buffer as the computer was booting up. The file may be viewed with gedit or vi to see all kinds of very low level hardware information that was logged as the system was booting up the operating system.

Enjoy

Installing and Removing Hard Drives in an HP ProDesk 600 G2 SFF desktop PC

NOTE: Watch the video that shows how to do this!

Installing a SATA hard drive, or SSD, as a second drive:

1. If you haven't watched the video about doing this, watch the video!
2. Put on your ESD (Electrostatic Discharge) wrist strap.
3. Make sure the computer is turned off and not plugged in to a power outlet. After removing the power cord, press in the power button to turn on the computer and fully discharge the power supply.
4. Remove the top panel (lid) by lifting up on the latch and pulling up on the top panel.
5. Install the SATA hard drive, or SSD, into the opening for it. The opening is above the SSD that contains the operating system. Do this by aligning the screws on the side of the drive with the cutouts on the metal side rails that will hold the drive. Push the drive down and then slightly toward the nearest side of the computer to snap it in place.
6. Lift up the drive tray to be able to access the connectors on the back of the drive.
7. Connect the power and data cables, which should be near a cutout in the middle of the drive day, to the back of the drive. Make sure the "keyed" part of the connector is aligned the proper way and be careful in doing this. The connectors on the back of the drive may be damaged fairly easily.
8. Push the drive tray back into place.
9. Install the top panel on the PC by placing the front edge of the top panel next to the bezel and then nicely push down on the back of the top panel to snap it in place.
10. Plug in the computer.

Removing a hard disk drive or SSD:

1. Put on your ESD (Electrostatic Discharge) wrist strap.
2. Make sure the computer is turned off and not plugged in to a power outlet. After removing the power cord, press in the power button to turn on the computer and fully discharge the power supply.
3. Remove the top panel (lid) by lifting up on the latch and pulling up on the top panel
4. Lift up the drive tray to be able to access the connectors on the back of the drive.
5. Remove the data cable (if your SATA cable has a metal clip on it, press down the clip while pulling back) and then remove the power cable from the back of the drive pulling straight back on the connectors.
6. Push the drive tray back into place.
7. Remove the drive from the bay by pulling a latch, that is on the side of the metal enclosure that holds the drive, towards the CPU. This will allow you to slide the drive back (towards the center of the box) and up to remove it from the drive tray.
8. Place the drive in the labeled bin.
9. Install the top panel on the PC.

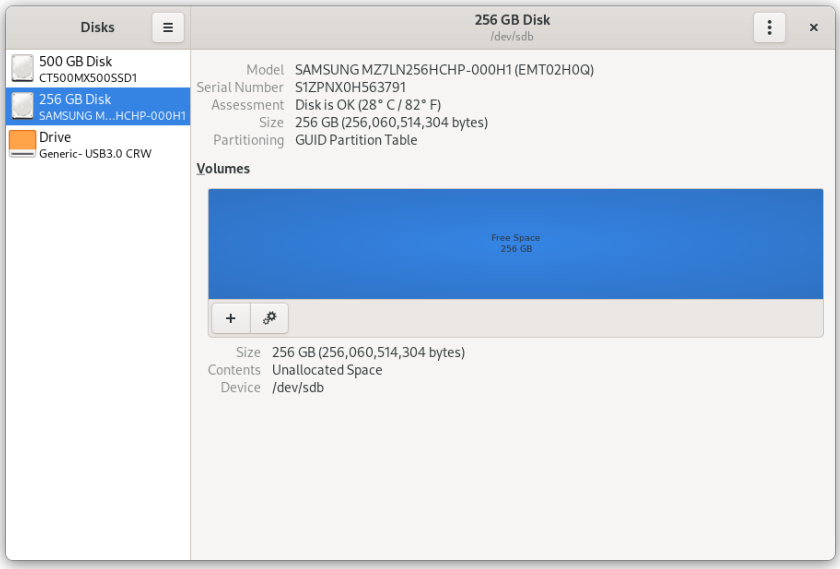
Setting up a second hard drive in Fedora 34 Linux (GUI)

Boot up the system (you may need to press F1 to save the changes that the system has seen). Login with the username 'ecen324' (no quotes) and password: 324STC155

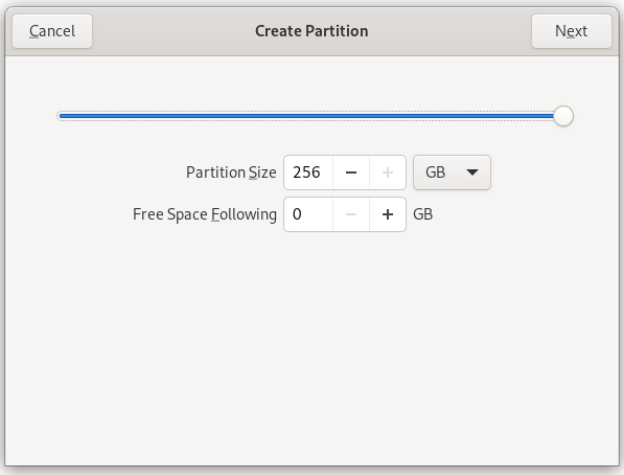
Formatting the Partition and Creating the File System

1. Open the 'Disks' utility: Activities (upper left) -> Show applications (matrix of 9 dots / waffle / tools menu) -> Utilities -> Disks. You may also type 'disks' into the search bar that shows up when you click on 'Activities.'

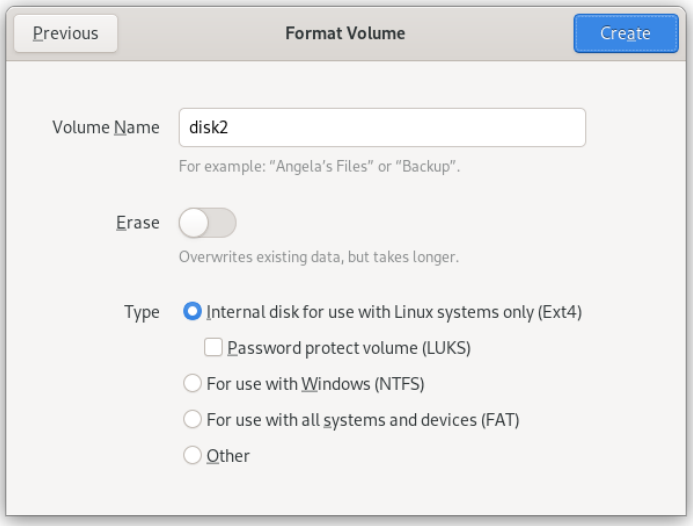
2. On the left hand side, pick the disk that is a 256 GB Disk, if you inserted an SSD, or the 40 GB disk if you inserted a hard disk drive. It should show up as 'Free Space' with a plus sign and some gears just below it. The tool tip on the plus sign is: Create partition in unallocated space



3. Select the plus sign to bring up the "Create Partition" window.



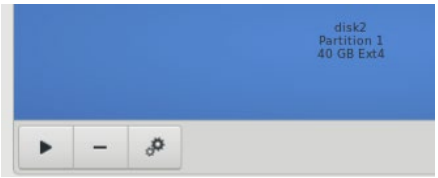
In this window, leave the defaults values which should use all of the drive and press 'Next.'



Press 'Create' and then you will need to authenticate and enter the password (324STC155). The partition will be created and an ext4 file system will also be created on the drive.

4. It may take a bit to format the drive and create the file system. If it does, you will see a spinning wheel in the left hand panel. When it is done, the 'Unknown' should change to say the volume name (disk2).

5. Now there will be an arrow with the tool tip 'Mount Selected Partition.' Click this and the partition should be mounted (after authenticating) at (if you named the drive 'disk2'): /run/media/cseetest/disk2



6. The arrow symbol you pressed will now turn into a rectangle (stop button) which will be used to unmount the new partition.

7. Use the GUI file manager or a terminal window to copy a file or two into the new volume. With a new volume, the only thing you might find in the directory is a sub-directory named 'lost+found'.
   GUI file manager: Activities -> Files (icon of a filing cabinet at the bottom of the screen)
   Terminal window: Activities -> Show Applications -> Terminal
   could do: cp /bin/md5sum /run/media/cseetest/disk2
   ls /run/media/ecen324/disk2

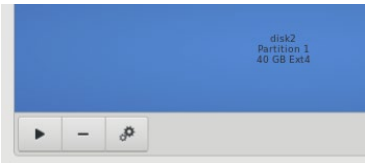
Cleaning off the second hard drive installed on the Linux OS (GUI)

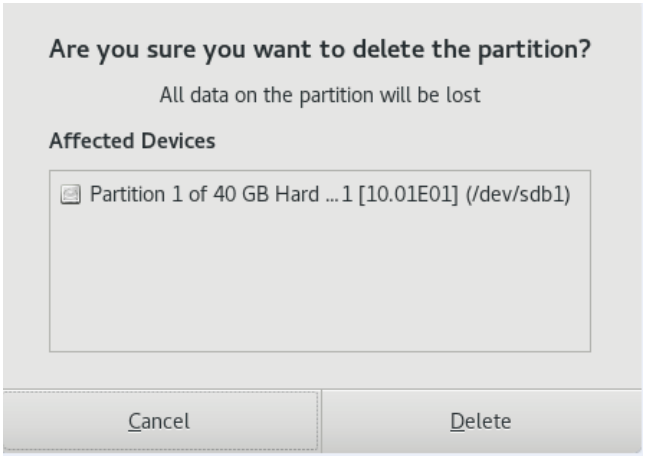
1. Open the 'Disks' utility: Activities (upper left) -> Show applications (matrix of 9 dots / waffle / tools menu) -> Utilities -> Disks. You may also type 'disks' into the search bar that shows up when you click on 'Activities.'

2. Select the 2nd hard disk in the system from the left hand panel (256 GB for the SSD or 40 GB for the hard drive).

3. Select the stop/rectangle, which has the tool tip "Unmount selected partition," to unmount the second disk drive. You will need to enter a password to execute this task.

4. Select the minus sign (dash) to delete the partition, and the data in the partition.





Setting up a second hard drive on Windows® 10

1. Boot up system
2. The password for the user "ecen324" is: 324STC155
3. Once Windows has loaded, open the disk management tool. A couple of ways to do this are:
    a. Right click on Start [Windows icon] and select Disk Management.

   Alternatively:
    a. Search for "Create and format hard disk partitions" from the taskbar.
    b. Selecting the control panel item that comes up, will open the Disk Management tool.
4. (*This step is not generally needed*) If the "Initialize and Convert Disk Wizard" comes up: select Next and then select Next again to initialize the disk; select Next again and don't convert the disk to a dynamic disk; click Finish.
5. (*This step should have been done*, but if not:) Delete all partitions on your **new** drive (Disk 1 or Disk 2) if it has any partitions. To do this, right click on the appropriate "Volume," or on the pictorial view of the disk.

   Note: You may need to scroll down or enlarge the window to see Disk 2 for the next step.
6. Disk 1 or Disk 2 should say "Online," be "Unallocated" and have a black bar over it. In this state, it needs a new partition.
    a. Right click on the unformatted disk (the portion that says "Unallocated").
    b. Select New Simple Volume.
    c. Select Next when the Wizard comes up.
    d. Select Next to allocate all the space on the drive to a single volume.
    e. Assign it the letter "**F**."
    f. Select Next
    g. Select "Format this volume with the following settings" with the settings being "NTFS" for the file system and the default allocation unit size. You may enter a volume label other than "New Volume" if you want to.
    h. Be sure that the box next to enable file & folder compression IS NOT checked.
    i. Be sure that the box next to quick format IS checked. Otherwise, it will attempt a complete format (which takes forever).
    j. Select Next
    k. Select the finish button, the colored bar over the drive should change from black to blue.
7. Use the 'File Explorer' to create a folder on the new disk (drive F:). Copy a file or two to the folder you just created from somewhere on the C: drive.

Cleaning off the second hard drive installed on the Windows OS

1. Go back into the Disk Management module.
2. Delete the partition on the second drive (F:) by right-clicking on the second drive and executing the 'Delete Volume …" command