

This project will count for 25% of your Final Exam grade. It is due at 11:59pm on the Thursday before Stop Day.

The goal of this lab is to: <ul style="list-style-type: none">• Gain experience replacing parts in both servers and desktop computers• Verify hardware is in proper working condition	To that end, you will: <ul style="list-style-type: none">• Put parts in a desktop computer• Replace thermal paste on a CPU• Test RAM and Hard Drives for errors
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NOTES:

- The inside of a computer and a server can contain sharp edges. **BE VERY CAREFUL.**
- Static electricity can kill some computer parts. Be sure to wear the provided anti-static wrist strap. Some people say that these don't do anything, some say they do. It's a \$5 piece of equipment that may help prevent destruction of hundreds of dollars' worth of equipment, so why not just to be safe?!
- Are your station (Figure 1), you will find:
 - 1x syringe of thermal paste
 - 1x 16GB USB flash drive
 - 1x anti-static wrist strap
 - These are brand new, never been used by other students. **They are all yours to keep.**
- **All stations are assigned, just look for the station with your name on it**

Complete the following steps and submit your evaluation of the hardware

Installing RAM and HDD into a desktop computer

1. Open up the desktop computer case.
2. Put on the anti-static wrist strap and attach the alligator clip to a metal part on the computer case. An informational video about these can be found below.
 - a. https://www.youtube.com/watch?v=_m_F4j-oQaU
3. Look in the computer case for any loose hardware, dust, cables that may get in the way of fans, etc.
4. Insert the provided RAM into the DIMM 1 slot in the Desktop Computer.
 - a. There is only one way for them to go in. Look at where the notch is on the RAM and where the notch in the memory slot is and try to line them up.
 - b. Use a bit of pressure, but do not force it if it doesn't feel right!
 - c. You will feel and hear a click when they are in all the way
5. The provided hard drive is a 250GB SATA HDD. These are more of the traditional style hard drives and not as fast as an SSD.

- a. Plug in the HDD using the SATA connector and power cable that are already plugged into the motherboard. Screws are provided if you would like to use them, but it is not required as the computer will not be moved once turned on
6. Leave the case open for testing and take off your anti-static band.
 - a. This will allow you to listen for any odd sounds. Sometimes there may be a whine or a clicking noise from hard drives, it will be easier to hear with the lid off.
7. Move the desktop closer to the monitor at your station. There are four cables that are on the back side of the table: DisplayPort, USB mouse, USB keyboard, and power.
 - a. Plug all of these into the back of the computer

Tests to be performed

Testing RAM (~15 minutes)

1. Test the RAM using the provided USB drive by plugging it in to the front of the desktop computer BEFORE turning it on.
 - a. The USB drive contains software called [MemTest86+](#)
2. Turn on the PC and enter the boot options menu
 - a. There will be a message that appears on the screen during boot that says what key to press. It will be one of the Function keys (F9 or F12 usually)
 - b. Select the USB drive from the boot options menu
3. The test should start automatically, do not change any settings. For 4GB of RAM, it will take about 15 minutes.
4. Once the test is complete, take a picture of the results with your phone
5. Shut down the computer so that you can go on to the next test

Testing a Hard Drive (~1 hour, 30 minutes)

1. Truly testing a hard drive is a time consuming task, but is fairly easy to do. We will be using a Live Boot version of Ubuntu Desktop to complete this task
 - a. Download the [Ubuntu](#) ISO from my EECS web page (it will be faster than their own download)
 - i. <https://people.eecs.ku.edu/~c731s050/ubuntu.iso>
 - b. Download [Rufus](#) to create a bootable drive
 - i. <https://people.eecs.ku.edu/~c731s050/rufus.exe>
 - c. If you are using a MAC, you'll most likely need to use Etcher
 - i. <https://etcher.io/>
2. Insert the provided USB drive into the PC/laptop you are using.
 - a. This can be your own laptop or one of the lab desktops (not the PC you are working on)
 - b. If using a lab computer, you'll need to plug the USB keyboard and mouse back into the lab computer
3. Open the software of your choice (etcher or rufus) and select the Ubuntu ISO to write to the drive
 - a. Make sure to select the correct drive! It will be a little smaller than 16GB.
4. Writing the ISO to the USB drive will take a couple minutes. Once it is complete, securely eject the USB from the computer and put it back into the PC we are testing (HP ProDesk)

5. Turn on the PC and enter the Boot Menu, just like when testing RAM. Be sure to select the USB drive.
6. The USB drive will go through the boot process and eventually show a screen with two options: Try Ubuntu and Install Ubuntu.
 - a. Select Try Ubuntu
7. Once you are at the Ubuntu Desktop, you'll need to open up a terminal
 - a. Up in the top left corner is an application menu, move your mouse all the way to the corner. (Click on applications if you see those words)
 - b. Once the screen changes and you see a search box, search for Terminal
8. We need to figure out where the HDD has been mounted.
 - a. Type ***sudo lsblk***
 - i. This will list all block devices that can be seen, including the hard drive we are testing
 - ii. You're looking for the name of the drive. It will be something like sda or sdb. One will show a size of ~240GB and another will show a size of ~15GB
 - iii. The full path will be /dev/[sda, sdb], which one it is depends on the PC you're working with.
 - b. Type ***sudo badblocks -wsv -b 4096 -t 0x00 /dev/[sda, sdb]***
 - i. ONLY DO THIS ON A DRIVE YOU DO NOT CARE ABOUT BEING ERASED
 - ii. Normally, you would not include the -t 0x00. This will only test the drive by writing zeros and attempting to read them. Normally, a full test would test 10101010, 01010101, 11111111, and 00000000.
 - iii. -wsv will do a destructive write test, showing the progress, and outputting more verbose information.
 - iv. -b 4096 will decrease the time that the test takes by instructing it to use a block size of 4096 bytes.
 - v. Example command:
 1. ***sudo badblocks -wsv -b 4096 -t 0x00 /dev/sda***
9. Let the test run to completion, it will take a while, so you can move on to the next test while it runs!
10. Once it has completed, record the results by taking a picture of the screen.

Replacing Thermal Paste

Most servers that are fairly old (like ours) have never had their thermal paste replaced! This is something that should be done every time the cooler is replaced or once every few years.

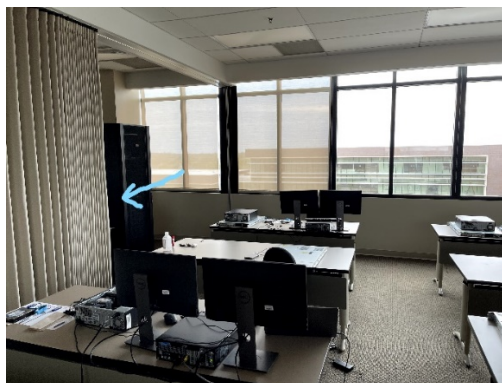
I have gone ahead and removed the old, caked on thermal paste for you. For this, you will just be putting on thermal paste, putting the cooler on, and taking the cooler back off.

1. Open up the server case by undoing the latch on the top of the case, sliding the case panel back, then lifting it off and placing to the side.
2. Inside, you will see a black air baffle that is used to direct the flow of air while the server is running. You can simply lift it up and out of the case to get to the RAM and CPUs below it. **See Figure 3 below for a reference.**

3. You will see one or two CPU coolers in the middle of the motherboard. These are held down by two metal clips.
 - a. Push down on the plastic part of the clip, swing it out and up.
 - b. You'll need to do that for both clips
4. There are many common ways to apply thermal paste, many valid and can depend on the processor you have.
 - a. <https://youtu.be/ofyNgJyhGuc?t=173>
 - i. You can stop around 5:13 to see the thermal results
 - b. Personally, I will usually go the route of spreading the thermal paste so that it will be applied more consistently
5. Choose a method to apply the thermal paste, then take a picture of it using your phone.
6. Place the CPU cooler back on the processor and lock it down using the CPU cooler clips
7. Take the cooler back off and note any observations from your application
 - a. Too much? Too little? Odd shape?
 - b. Take a picture of the CPU after removing the cooler.
8. Lift the CPU cooler up off of the processor and place it to the side
9. The CPU can be removed by undoing the latch on the protective metal case. The case can then be flipped up and the processor lifted up out of it's socket.
10. Using the provided paper towel, clean the thermal paste off the CPU and the cooler. Place them back in the server and close it up.

What now?

1. You will turn in a PDF document through Blackboard with:
 - a. The pictures of your RAM and HDD test results
 - b. Any observations from your thermal paste application
 - c. The pictures of your thermal paste application
2. You will remove both the HDD and RAM from the PC. Place them on the sheets of paper next to the server cabinet (blue arrow in picture below), based on the results of the test.
 - a. If the HDD passed, place it on the paper saying HDD Tested Good
 - b. If the HDD failed it's test, place it on the paper saying HDD Tested Bad
 - c. Do the same for the RAM.
3. **On the whiteboard at the front of the class, write: This lab has been used on [insert date here]**
 - a. This will let the cleaning crew know that the room has been used and to come in to disinfect the room.



Pictures from my tests and of the room



Figure 1 - Lab station setup



Figure 2 - Inside of an HP ProDesk computer

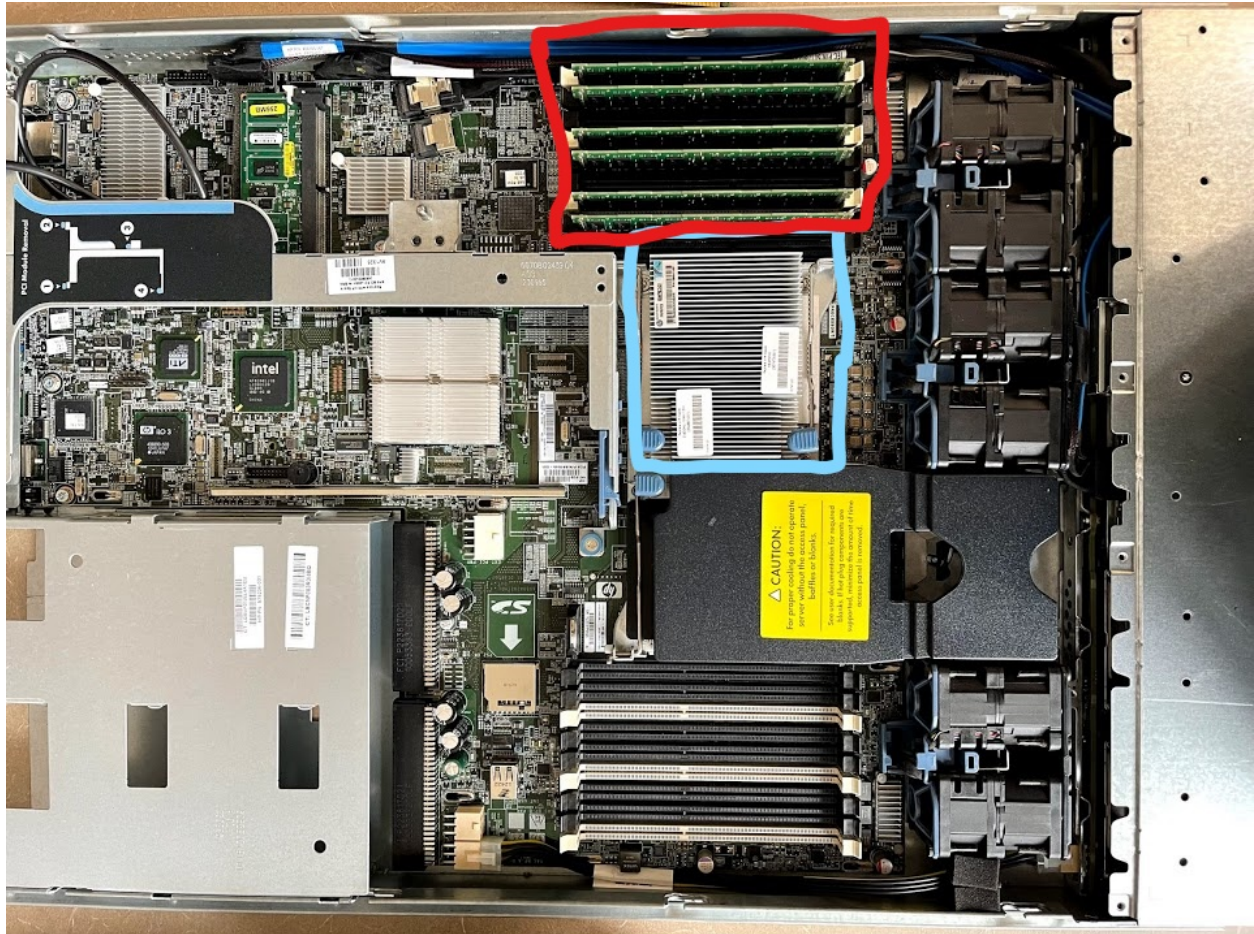


Figure 3 - Inside of a server (red is RAM, blue is CPU cooler)



Figure 4 - Rear view of HP ProDesk


```
Memtest86 5.31b : Intel(R) Core(TM) i5-4570 CPU @ 3.20GHz
CLK: 3193 MHz (X64 Mode) : Pass 2%
L1 Cache: 32K 212845 MB/s : Test 7% ##
L2 Cache: 256K 52339 MB/s : Test #5 [Moving inversions, 8 bit pattern]
L3 Cache: 6144K 39415 MB/s : Testing: 1024K - 2048M 2047M of 4008M
Memory : 4008M 9473 MB/s : Pattern: 80000000 : Time: 0:16:24
-----
Core#: 0 (SMP: Disabled) : CPU Temp : RAM: 665 MHz (DDR3-1333) - BCLK: 99
State: + Running... : 37°C : Timings: CAS 9-9-9-24 @ 64-bit Mode
Cores: 1 Active / 1 Total (Run: All) : Pass: 1 Errors: 0
-----
Memory SPD Informations
-----
- Slot 0 : 4096 MB DDR3-1333 - Micron 16JTF51264A2-1G4D1
```

Figure 5 - My Memtest Results

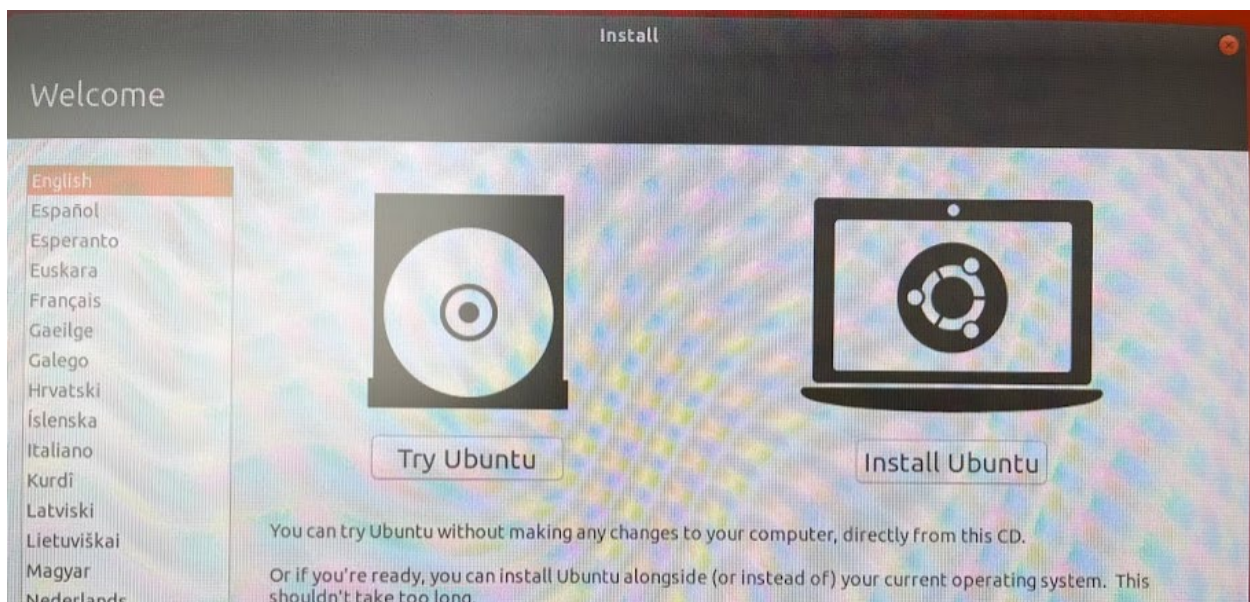


Figure 6 - Ubuntu setup screen

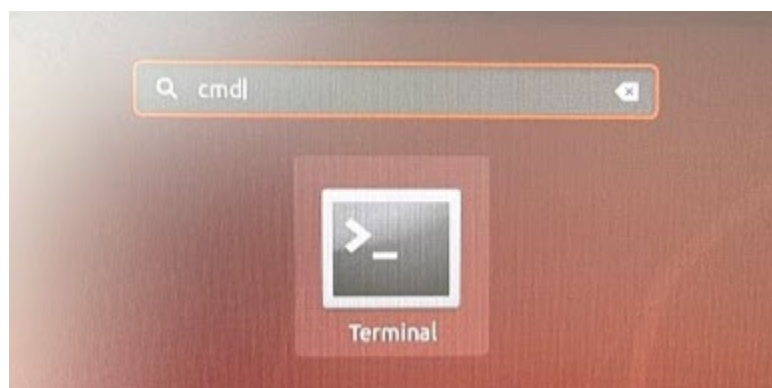


Figure 7 - Searching to Terminal in Ubuntu

```

ubuntu@ubuntu:~$ sudo lsblk
NAME        MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
loop0       7:0      0    1.9G  1 loop /rofs
loop1       7:1      0   89.1M  1 loop /snap/core/8268
loop2       7:2      0   54.7M  1 loop /snap/core18/1668
loop3       7:3      0   44.9M  1 loop /snap/gtk-common-themes/1440
loop4       7:4      0  160.2M  1 loop /snap/gnome-3-28-1804/116
loop5       7:5      0    4.2M  1 loop /snap/gnome-calculator/544
sda         8:0      0 232.9G  0 disk
└─sda1      8:1      0 232.9G  0 part
sdb         8:16     1   14.7G  0 disk
└─sdb1      8:17     1   14.7G  0 part /cdrom
sr0        11:0     1   1024M  0 rom

ubuntu@ubuntu:~$ sudo badblocks -wsv /dev/sda
Checking for bad blocks in read-write mode
From block 0 to 244198583
Testing with pattern 0xaa:   0.16% done, 0:03 elapsed. (0/0/0 errors)

```

Figure 8 - lsblk and badblocks

```

ubuntu@ubuntu:~$ sudo time badblocks -wsv -b 4096 -t 0x00 /dev/sda
Checking for bad blocks in read-write mode
From block 0 to 61049645
Testing with pattern 0x00: done
Reading and comparing: ^[[A^[[C^[[done

Pass completed, 0 bad blocks found. (0/0/0 errors)
125.52user 182.04system 1:18:39elapsed 6%CPU (0avgtext+0avgdata 3176maxresident)
k

```

Figure 9 - Badblocks test results