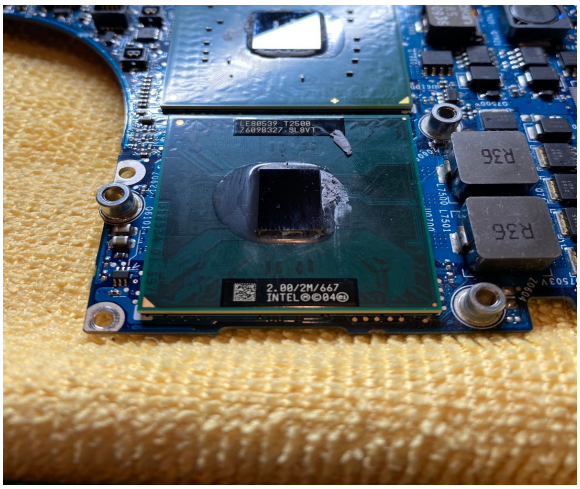
Team 663A

Texas Instruments

8 December 2020

Electronics Online Challenge

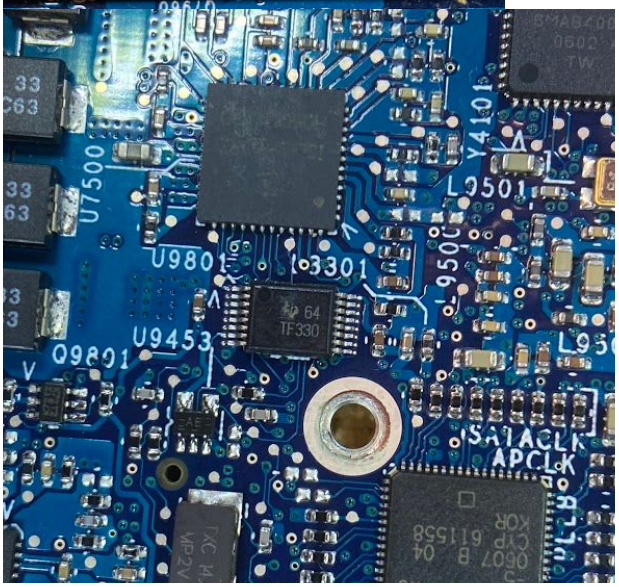
For the 2021 Texas Instruments sponsored Electronics Online Challenge, our team decided to disassemble a late 2004 MacBook Core 2 Duo. We chose this device because one of our team members is experienced in taking apart iPhones and laptops such as this one. He repairs broken devices. With our prior understanding of the density of components on a laptop logic board, it was highly likely that we would uncover Texas Instruments Chipsets on the board. Sadly, there are just too many components that help compose the logic board to discuss them all. This report will include the most important chips and components, and of course the Texas Instruments chipsets.



First off is the processing chip: the Intel Core 2 Duo T2500 processor. This is responsible for managing all of the tasks on the computer. The processor receives data from components throughout the computer, such as a mouse or USB drive. It takes that data, processes it into usable commands, and sends out those commands to the program you are running, such as Windows 10.

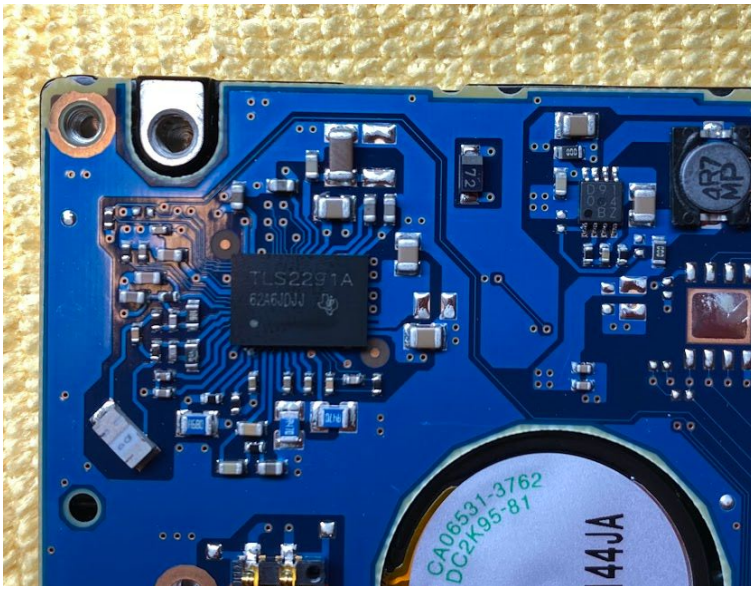
Next is the Graphics and Memory Controller. This chip is very similar to the processor because its job is also to do a lot of reading and writing of data. But instead of doing long and

complex tasks, it executes more simple tasks hundreds of times. These tasks figure out what colors should be on what pixels at what time. Hundreds to thousands of "cores" within the chip execute simple tasks to make sure that your screen is making the right colors.



And now on to the cool and amazing Texas Instrument components! The first chip we found was the Tf330, or the TS3V330. It is a tiny chip on the back of the logic board, but nonetheless important. The TF330 is a "4-bit multiplexer/demultiplexer, with a single switch-enable input"(TI Datasheet). Put simply, this chip is responsible for taking different sound inputs and compiling them into a singular sound output, but also while giving you the opportunity to switch your inputs when desired.

Lastly, the TLS220 series chipset was found on the logic board on the spinning hard drive. The TLS220 is the "Voice-coil motor driver and the spindle motor driver" (Datasheet.com). This chip tells the spindle motor how quickly and in which manner it should turn. It also tells the voice-coil how and where to move in order for the actuator to read the correct data.

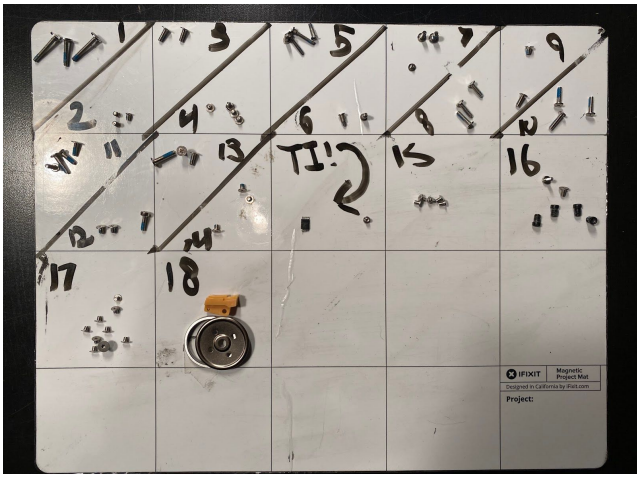


This is an actuator. It's responsible for reading data on a hard drive. The copper coil is controlled by the TLS220, it positions the actuator.

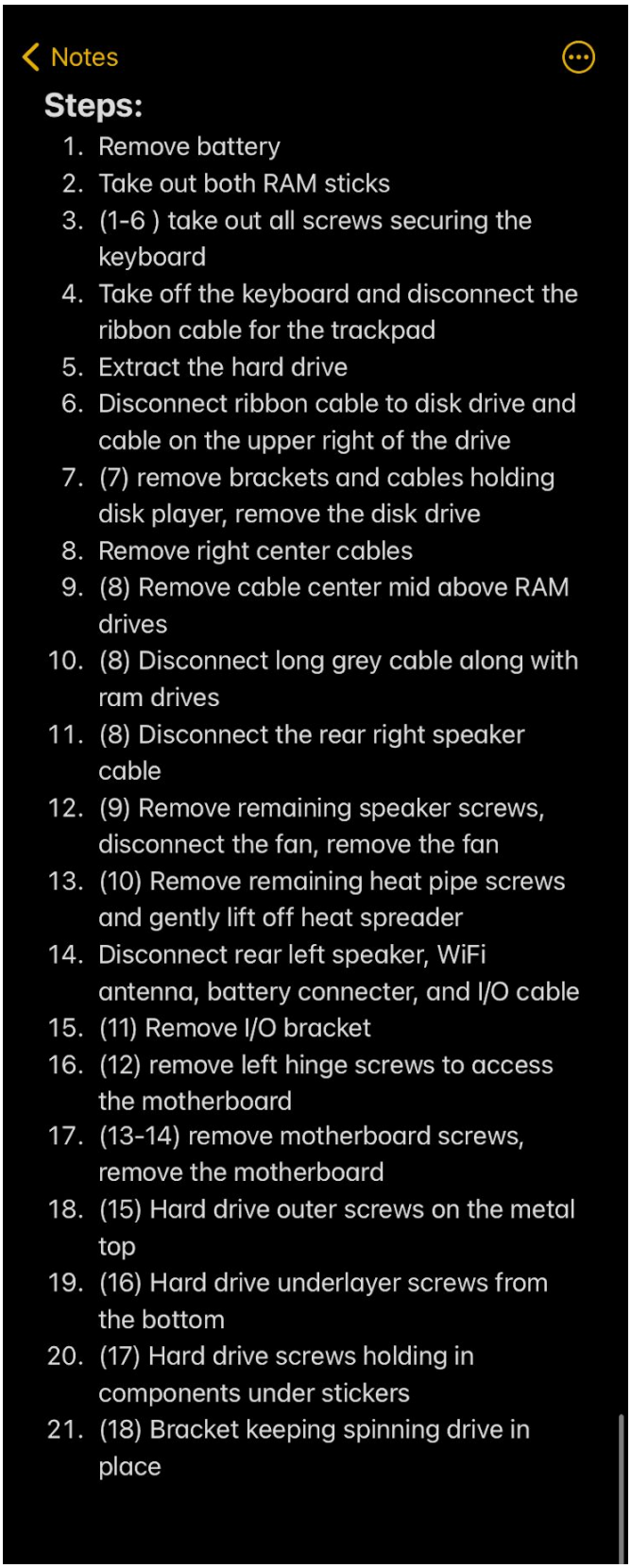
In conclusion, we learned that even though this is a brand-specific device, Apple outsources a majority of their components from other companies. We also ascertained how each of the many chipsets and components on a logic board has a specialized job, but how also the unique components collaborate to create a greater computing device. Without any single-chip functioning properly, the computer would be unable to operate at its full potential.

Process:

(From Notepad, refer to magnetic whiteboard screw holder for numbering)



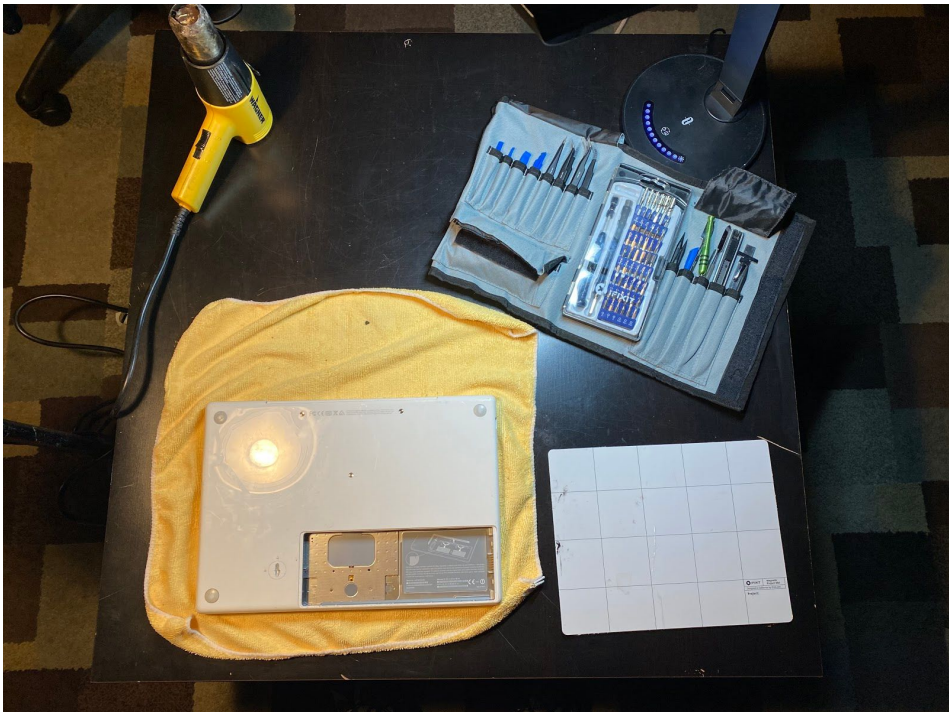
As we were taking apart the laptop, we documented each step to ensure we know what screws go with what component and in which order.



Notes

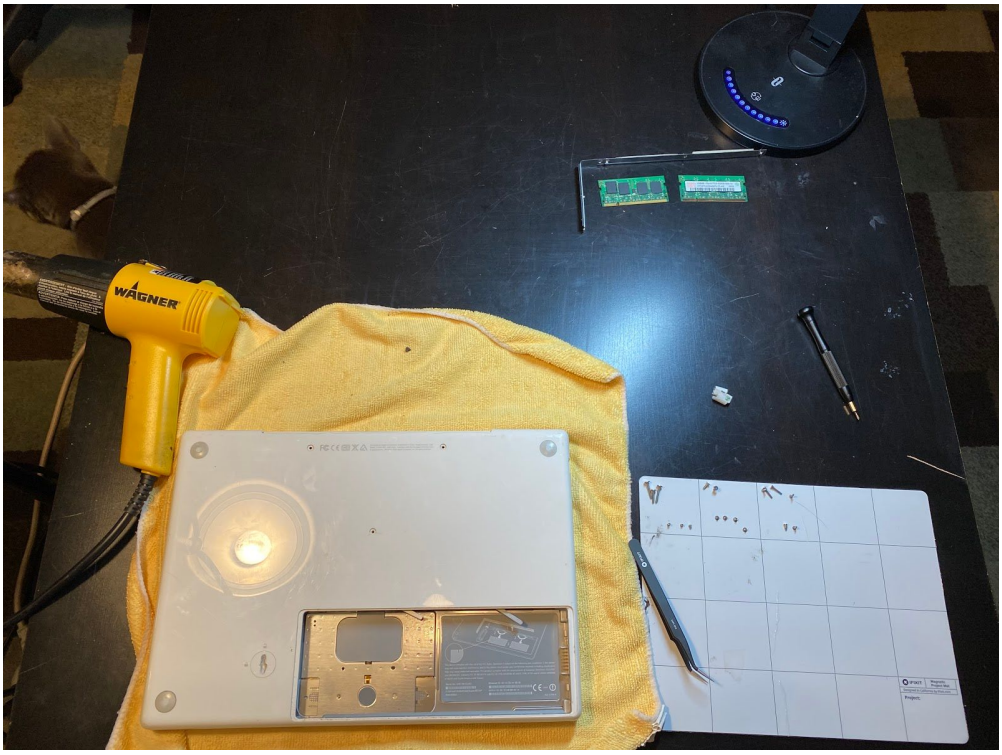
Steps:

1. Remove battery
2. Take out both RAM sticks
3. (1-6) take out all screws securing the keyboard
4. Take off the keyboard and disconnect the ribbon cable for the trackpad
5. Extract the hard drive
6. Disconnect ribbon cable to disk drive and cable on the upper right of the drive
7. (7) remove brackets and cables holding disk player, remove the disk drive
8. Remove right center cables
9. (8) Remove cable center mid above RAM drives
10. (8) Disconnect long grey cable along with ram drives
11. (8) Disconnect the rear right speaker cable
12. (9) Remove remaining speaker screws, disconnect the fan, remove the fan
13. (10) Remove remaining heat pipe screws and gently lift off heat spreader
14. Disconnect rear left speaker, WiFi antenna, battery connecter, and I/O cable
15. (11) Remove I/O bracket
16. (12) remove left hinge screws to access the motherboard
17. (13-14) remove motherboard screws, remove the motherboard
18. (15) Hard drive outer screws on the metal top
19. (16) Hard drive underlayer screws from the bottom
20. (17) Hard drive screws holding in components under stickers
21. (18) Bracket keeping spinning drive in place



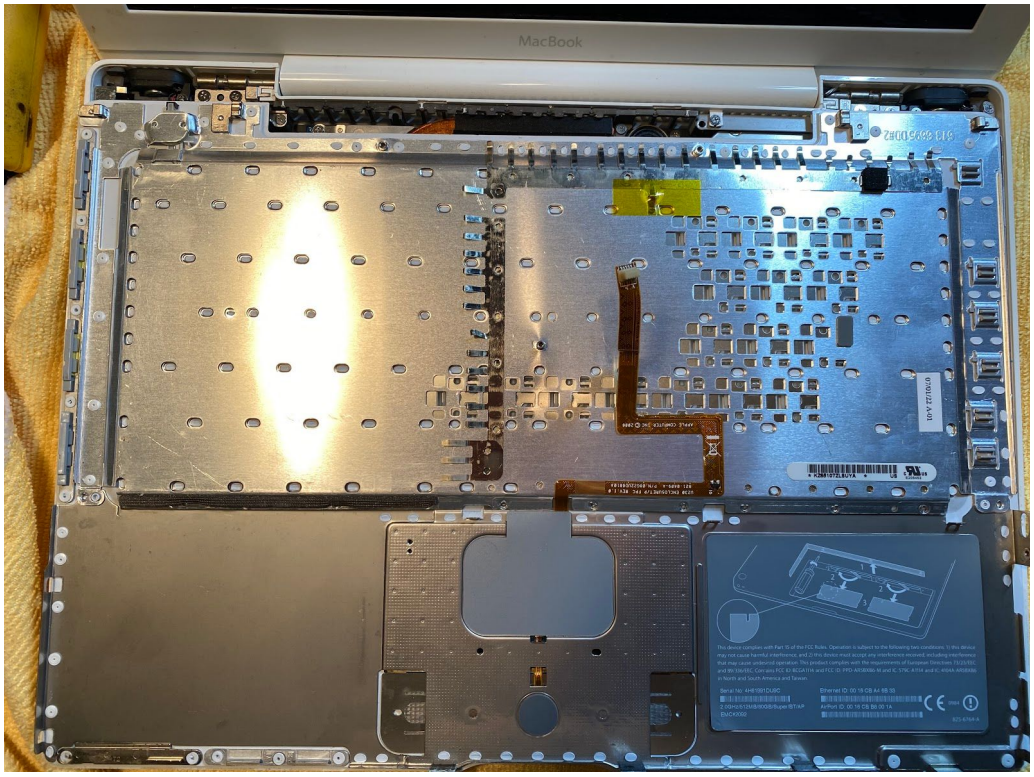
This was the very beginning of the process, we did not know what was to come so we came prepared for everything.

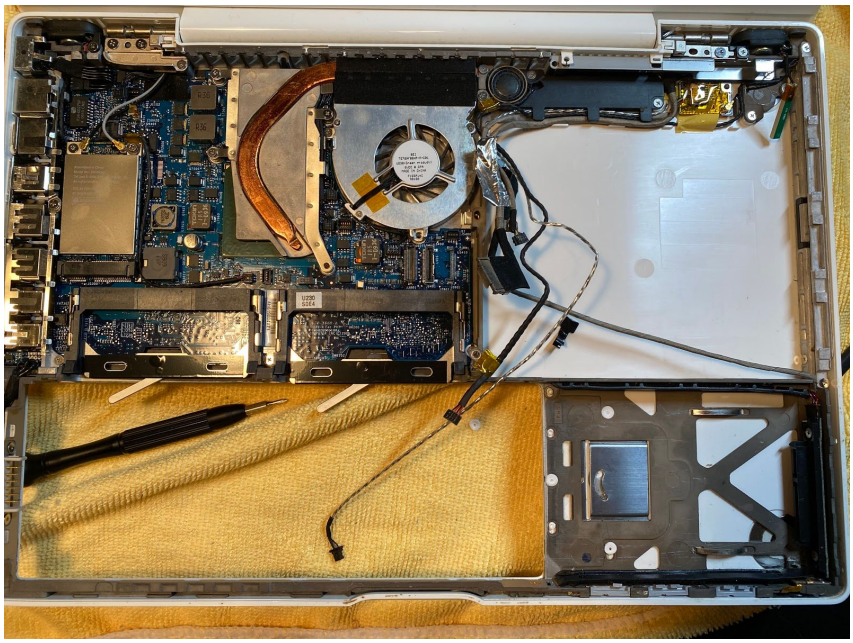
After removing all of the case screws, we realized that we would need to soon clear off space to make room for parts.



This is what the laptop first looked like when we removed the keyboard assembly. The goal from here is to take out all the components.

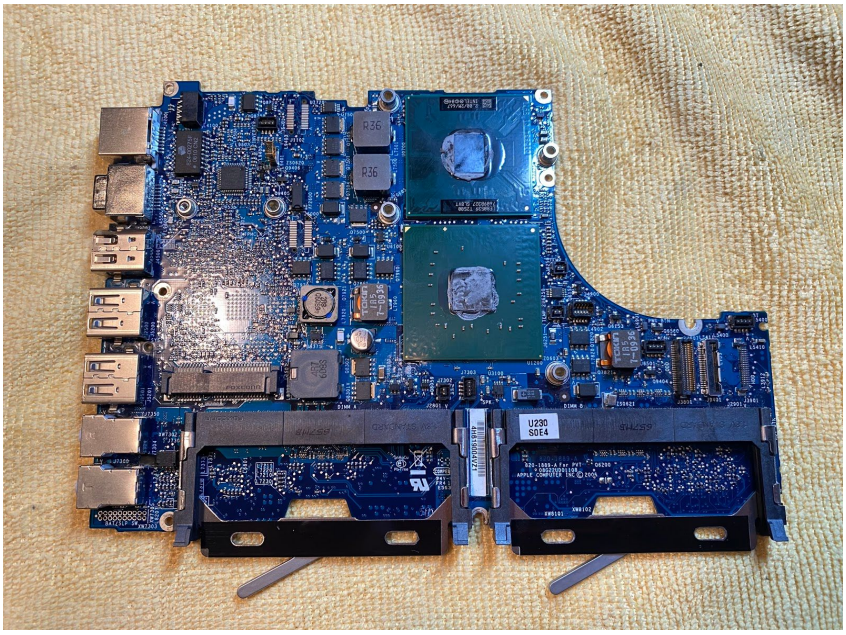
We found no easy way to disassemble the underside of the keyboard assembly so we left it as is.

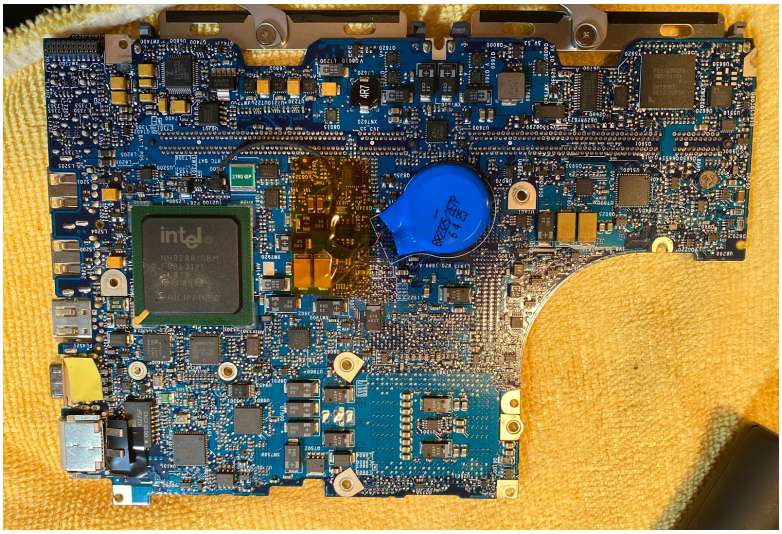


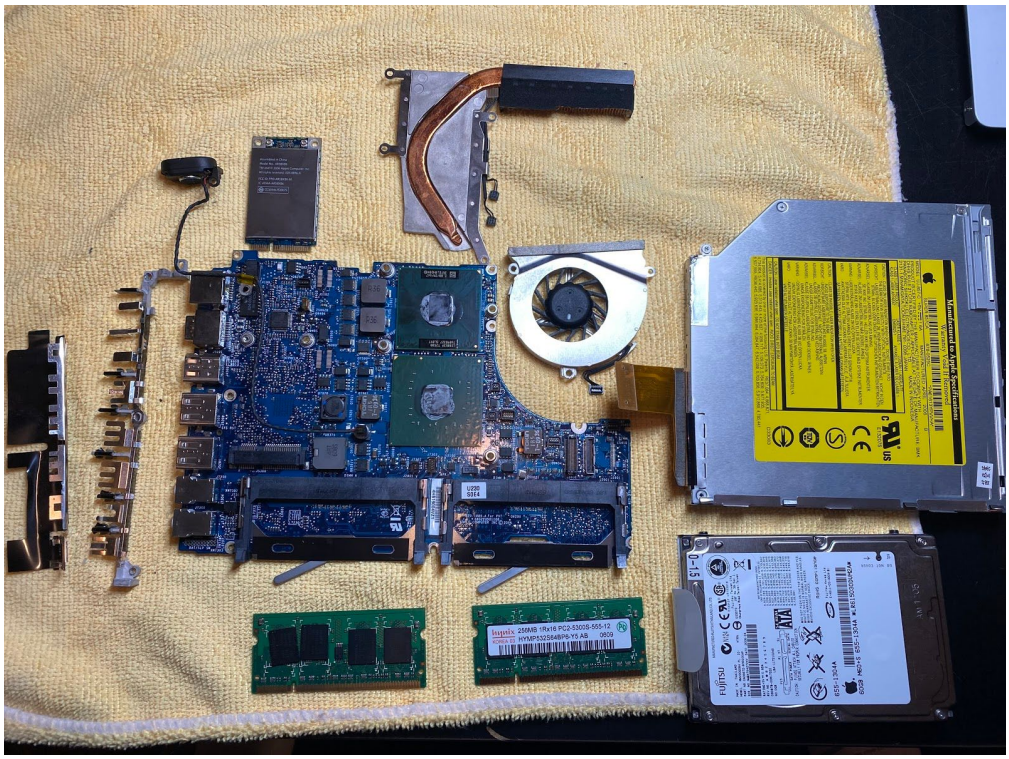


This is the laptop with disk-drive and harddrive removed, next steps are taking off the heat sync in order to get to the logic board.

The logic board. Here we can see all of the I/O and the inner working of this Macbook.

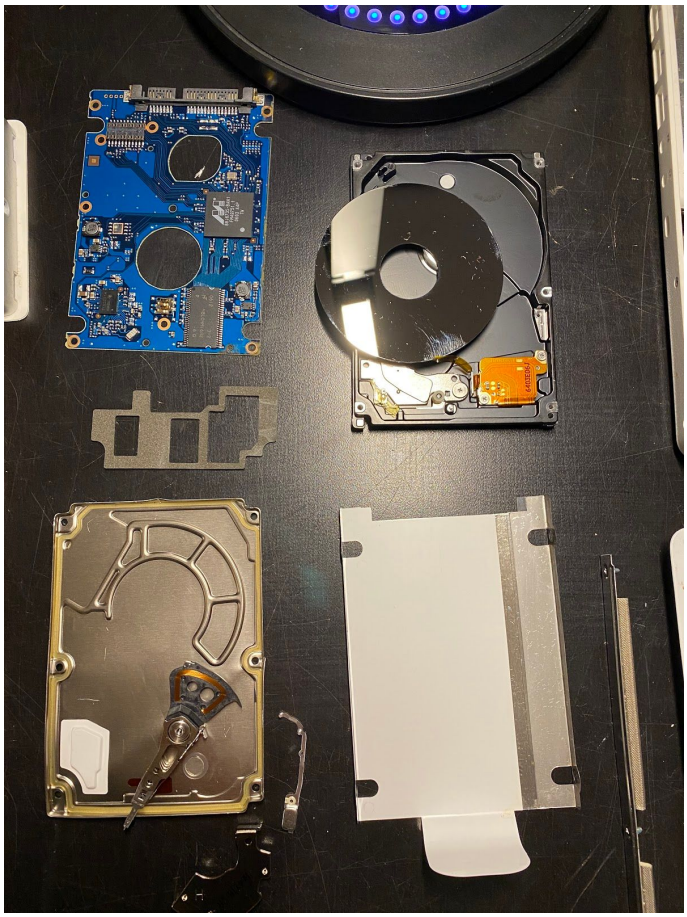






The MacBook internals positioned to show the blown-up placement of components.

This is a hard drive broken down into its main parts. If you look at the blue logic board you can see the TLS220 Chipset.



Completed! This is the result of hours of research and the delicate process of disassembling an intricate laptop. This has been a valuable experience.

Sources

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