

CS 334: Operating Systems
Lab 1: System Cadaver
Spring 2024. (100 pts possible)
Due Date: TU 1/24/2022 NLT midnight

Name 1: _____
Responsibilities and tasks performed: _____

Name 2: _____
Responsibilities and tasks performed: _____

Name 3: _____
Responsibilities and tasks performed: _____

Name 4: _____
Responsibilities and tasks performed: _____

Introduction:

This is a group exercise intended for a small group of 4-5 students. In your previous courses you learned a lot about either abstract constructs used in programming or physical devices that define the system architecture. As the operating system bridges the abstract constructs and hardware infrastructure, the goal of this exercise is to inspect how different hardware components look like and which 'abstractions' do they host. Each group was given a cadaver computer to take apart down to screws and see what the hardware components, interconnects, and the overall hardware architecture looks like. As some of you have more experience than others, I encourage the experienced ones to be the scribes and the students who never seen the insides of a computer to be the ones annotating the different parts of the computer system.

Educational objectives (student will be able to):

- * identify different hardware components
- * describe the high level function of each components
- * define the component's connectivity as well as the abstractions it provides
- * outline a sequence of resource operations the OS performs for user level tasks

Readings:

- * <https://computer.howstuffworks.com/> - I really like this resource
- * https://en.wikipedia.org/wiki/Computer_hardware
- * <https://en.wikipedia.org/wiki/Motherboard>
- * https://en.wikipedia.org/wiki/Hard_disk_drive
- * Tanenbaum Ch1.
- * feel free to use any online resources that will help you identify and define the hardware components

Materials (one of each per group):

- * A screwdriver, sticky notes,...
- * Photo editing tool like Gimp might be useful, but word will do. You can also annotate the components with sticky notes and take a picture.

Part 1 (10pts). System's peripherals

Each computer system provides connectivity to different peripheral devices. They are on the back of the computer and are commonly called ports, connectors, etc. The versatility

of the modern generic hardware (the computer system) is that each of these peripheral device connectors can be used for more than one type of a device.

a. Use the labels and label each peripheral device connector. Each label should have a sequential numbered and name of the connector (example "1. Universal Serial Bus (USB)). **Insert a picture of the back of the computer with all its ports labeled and insert it here:**

b. (a) List each connector type, (b) for each connector, list at least two different peripheral devices that could use this connector to interface with the system and (c) give the communication protocol the this connector uses to interface with the system.

Example:

1. a. USB - Universal serial bus.

b. keyboard, mouse, Ethernet, hard-drive

c. serial connector: one wire transmits data to and from device. Each USB device is identified by its unique ID and the devices data exchange rate can be synchronized with the computer (synchronous device), not synchronized (asynchronous) or adaptive for device to burst a frame of data as big as the system can take.

2. a. Ethernet - RJ45

b.

c. ...

List your interconnect details here:

Part 2 (50 pts). System Internals (let someone else take a lead to annotate the system components).

Now, let's see what is on the inside. After you remove the computer case and uncover some cooling "duct work" you see the circuit-board(s) and the microelectronic devices. Use the same approach as in the Part 1 above to label (at least) the following architectural features of the system.

a. A big picture: insert a picture of your opened case and label the following components.

1. power supply, 2. hard-drive, 3. motherboard, 4. expansion boards, 5. CD/Optical drive, 6. RAM memory, 7. CPU, 8. Video Card, 9. RAM Memory, 12. Jumpers, 13. PCI/SATA cable

Insert the picture with the labeled hardware components here.

b. Even closer look, a micro level view, of the motherboard architecture: (take a turn and someone else annotate the motherboard).

For this part a lot of parts, cables, were removed to reveal the main Integrated Circuit (IC) that houses and connects different computer components. You are looking for the following components: 1. bus, 2. jumpers, 3. chipset, 4. ROM, 5. RAM, 6. PGA or LGA socket, 7. CPU PINs, 8. heat sink, 9. SATA connector, 10. PCI or IDE or both connectors, 11. Integrated Audio chipset, 12. CMOS battery, 13. Front system bus (FSB), 14. L1 cache, 15. L2 cache, 16. L3 cache, 17. Power connector

Again, insert the labeled (annotated) picture of the motherboard hardware components here:

c. For each and every one of the 18 components above, (a) give its name, (b) briefly describe what the component does, and (c) what information does it store, exchange, receives, how? **Your answers should be 1-2 sentences max. Insert your answers here.**

Part 3 (20 pts). Really digging in.

Finally, let's look into one of the system components – the hard-drive. Even as technology advances, we will continue to see legacy hardware for many years to come; so even if you think that the spinning hard-drives are a thing of the past, think twice...

a. Expose the hard-drive insides to shows what is under the cover – its internals. Again, label the following: 1. data disk platters, 2. read-write head (actuator), 3. R/W buffer, 4. disk platter motor, 5. microprocessor chip, 6. programmable memory, 7. motor controller chip, 8. data connectors

Insert the labeled pictures of the HD components here.

Part 4 (20 pts). General questions about the architecture.

a. Which part of the operating system is responsible for or provides the communication with a peripheral device. In other words, if you design a custom peripheral device, what program do you need to write for the operating system to be able to communicate information to and from the device:

Answer:

b. Why we see fewer and fewer parallel devices and increasing number of serial devices? This is tricky, a parallel cable has 8 wires that carry data and serial cable has 1 wire that carries data. Why 8 wires is not better than 1 wire?

Answer:

c. If a CPU does all the computation, why do modern systems have an additional hardware chip called a **chipset**? In other words, what does the chipset do?

Answer:

d. What is Master Boot Record? On which hardware device is it installed?

Answer:

e. What happens when I press the power button a computer to power-up the computer? (list the steps in sequential order).

Answer:

f. What is BIOS and what does it do?

Answer:

Part 5 (0 pts): Additional information about his module:

Please give me any feedback about this module. What worked, what would you change, what additional questions would you include?

What to turn in on Moodle:

- * A pdf of the above report as a single document.
- * One pdf per team is sufficient (make sure all team member names are listed)

Notes:

- * if your pdf is too big for moodle upload, re-insert the images in lower resolution.
- * focus on the completeness and correctness of your answers, I don't really care about aesthetics (as long as everything is legible).
- * understand the function of each components in addition to the component labeling.