

TU259

**Architecture, Operating Systems
and Networking**

Assignment 1

Project Report

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Declaration

I hereby declare that the work described in this report is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

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1. Introduction

The Chief Technology Officer has requested that a report be prepared to research what hardware would be best suited for a new PC/laptop/Notebook for our new developer who has just joined the company. The main reason the CTO has asked for the report is to research why a developer seems to need a high-end powerful machine to perform their day to day tasks. I will do a research on specs of mainstream PCs and report on whether a low spec PC is enough for work.

2. Research

CPU is growing to become the most complicated and important part on a computer("A detailed history of the processor,"

n.d.), since every calculation from any program is performed by CPU. It takes instructions from the memory and gives the output through a series of logic gates inside.(“What Is a CPU, and What Is Its Function?,” 2017)

Performance indicators of CPU:

1. Clock Speed: Since cycles of instructions is running based on clock speed. The higher the clock speed, the more cycles a CPU can go through thus perform more instructions. But it is often inaccurate when comparing CPU performance between different CPU families.(“Megahertz myth,” 2022)
2. Cores: Cores are separate processing units in CPU. The single processor can run instructions on separate cores at the same time.(“Multi-core processor,” 2022)
3. Threads: Hyper-threading works by duplicating certain sections of the processor—those that store the architectural state such as registers, so if a logical processor is stalled with data issues, the core can process another task instead of being frozen.(“Hyper-threading,” 2021)
4. Architecture: Clock speed is useless if we do not see the differences in architectures. For example, a modern superscalar processor with pipeline technology would be

much faster than an outdated classic processor. Because it executes more than one instruction per cycle (on average).("Superscalar processor," 2022)

5. Width of data bus is also important, for it limits the amount of data to be processed by the processor in one cycle.

Motherboard is where all components of a computer sit on. It is necessary because it let every part of a computer communicate through circuits/buses on it. Without it, CPU may not be able to take data from memory thus no calculation can be performed.("what is the function of motherboard - Lisbdnet.com," n.d.)

Memory is where you store the program data, so it is obvious that memory is crucial. Memory stores data in chips just like registers in a CPU, and it has a control unit to write and read in correct address.("Memory card," 2022)

The RAM protocols are through many generations update:

1. DDR: Double data rate RAM. The name "double data rate" refers to the fact that a DDR SDRAM with a certain clock frequency achieves nearly twice the bandwidth of a SDR

SDRAM running at the same clock frequency, due to this double pumping.("DDR SDRAM," 2022)

2. DDR2/3/4/5: Different standards of DDR. The higher the better.

Persistent Storage can be any kind of disk. It stores data as well but unlike memory it is persistent, which means it can save the data even after power off. Both capacity and speed is crucial, since all programs are stored in disks and will have to be loaded to memory when executed.("Hard disk drive," 2022)

In terms of disk type, there are two types of hard disk, SSD and HDD:

- 1.HDD: HDD uses one or more rigid rapidly rotating discs coated with magnetic material. The discs are paired with magnetic heads, usually arranged on a moving actuator arm, which read and write data to the disc surfaces. The rotating speed often is an influential factor of reading and writing speed.("Hard disk drive," 2022)

- 2.SSD: SSDs are typically more resistant to physical shock, run silently, and have higher IOPS and lower latency, because SSD is lack of complex physical structures such as a spinning disc. It is

more like a RAM, and the speed will not be affected by physical limits. SSDs based on NAND Flash will slowly leak charge over time if left for long periods without power. Therefore, SSDs are not suitable for archival storage.("Solid-state drive," 2022)

In terms of interfaces and protocols, there are few types:

1. SCSI: Small Computer System Interface is a set of standards for physically connecting and transferring data between computers and peripheral devices.

2. ATA: The "AT" in the IBM PC/AT referred to "Advanced Technology" so ATA has also been referred to as "Advanced Technology Attachment". Both SCSI and ATA were originally parallel interfaces.("Parallel ATA," 2022)

3. SATA: SATA is serial ATA. The main problem with parallel is Eight or sixteen times as many lines certainly would mean eight or sixteen times the bandwidth - theoretically. With all these wires so close together, though, their electric fields start interfering with each other and generating false signals, and the faster the clock, the worse the crosstalk.("Serial ATA," 2022)

The main reason that bonded serial bus architecture was chosen over the traditional parallel bus is lower bandwidth due

to timing skew. Timing skew results from separate electrical signals within a parallel interface traveling through conductors of different lengths, on potentially different printed circuit board (PCB) layers, and at possibly different signal velocities.

4. PCIe: PCI Express drives, whether they use the M.2 or NVME connector standard, are faster than SATA, but still limited by the speed of the memory chips on the drive itself and the generation of PCI Express that they are designed for. PCIe 3.0 drives have a usual maximum sustained read/write speed of 3,500MBps, while PCIe 4.0 drives have a typical maximum sustained read/write speed of 5,000MBps.("PCIe and SATA have their advantages, but which one is right for your PC?," 2020)

Power Supply inside a PC provides energy for every part of the PC. It also converts AC to DC, which is more suitable for computers. When choosing a power supply, we need to make sure it has enough energy output.("Power supply," 2022)

Peripherals cover a wide variety of device. Mostly these devices are I/O device and deals with interactions between computers or between users and computers. They can be easily installed onto the motherboard. The most common are audio cards,

graphic cards, network cards, keyboards etc.("Peripheral,"
2022)

2.1 Laptop/PC

LG Gram 16Z90P-K.AAB9U1 worth 1000 euros has following specs("LG gram 16" Ultra-Lightweight and Slim Laptop with Intel® Evo 11th Gen Intel® Core™ i7 Processor and Iris® Xe Graphics (16Z90P-K.AAB9U1)," n.d.):

Processor i7-1195G7 (2.9 GHz, Turbo up to 5.0 GHz), L3 Cache 12MB, 4 cores, 8 threads

Memory 16GB LPDDR4X 4266MHz, - 16GB (On Board)

HARD DRIVE M.2 2280 SSD (Solid State Drive) NVMe™1TB (1TB x 1)

CONNECTIVITY Intel® Wi-Fi 6 AX201 (Wi-Fi 6 , 2x2, BT Combo)Bluetooth Bluetooth 5.1

DISPLAY

Screen 16"Display (2560 x 1600)

Graphics Intel® Iris® Xe Graphics

Review: It is a superfast ultra-book with i7 processor, 16GB RAM, and 1TB NVME SSD. It is suitable for most writing, coding, picture editing, and video editing works. It is known for its extended battery-life. Thin and light for those who need to carry along works in different locations. However, it may not be ideal for video games or tasks that require lots of graphic calculations for lack of independent graphic card.

2.2 Notebook

ASUS 15.6 inch Laptop Notebook worth 200 euros has following specs("15.6 inch Laptop Notebook Computer PC, Windows 10 Laptop, Intel J3355 Dual Core 2GHz(Up to 2.5GHz), 8GB RAM + 128GB SSD , 1920x1080 FHD IPS Display, WIFI, Chocolate Keyboard, Mini-HDMI : Amazon.co.uk: Computers & Accessories," n.d.):

Screen Resolution 1920 x 1080 pixels

Processor Celeron J3355 2 GHz 2 Cores

RAM Size 8 GB DDR3 DDR3 SDRAM

Hard Drive Size 128 GB SSD SATA

Audio Details Headphones

Graphics Coprocessor HD500 Intel

Number of USB 2.0 Ports 1

Number of USB 3.0 Ports 1

Number of HDMI Ports 1

Review: It is a bargain for those who only needs to do some word editing or simple tasks. 128GB SSD will guarantee its boot speed to be not too slow, but it is too small in disk space for large files. Overall, it is good if you are a light user for simple tasks and want to save a lot of money.

3. Evaluation of Criteria

This is a comparison of the specs as researched in section 2.1 and 2.2.

Firstly, let us inspect the requirements of IDEs.

1.6GHz processor and 1GB RAM is recommended for lightweight IDE like VS code, while a full function IDE like Pycharm recommends multicore processor and 8GB RAM. Disk capacity required is from 500MB to 5GB. Win10 requires 16 GB for 32-bit OS or 20 GB for 64-bit OS.("Install PyCharm |

PyCharm," n.d.; "Requirements for Visual Studio Code," n.d.;
"Windows 10 system requirements," n.d., p. 10)

Virtualbox recommends 16 GB RAM and 80GB disk
space.("How to Install Oracle VM VirtualBox on Windows 10,"
2020)

Then, for each component evaluate the spec for the Notebook
and laptop.

Celeron J3355 vs i7-1195G7:

The Celeron J3355 only has two cores while i7-1195G7 has 4
cores and 8 threads. Obviously i7 is more suitable since we
might want to open multiple IDEs or webpages at the same
time. It is even more important if we want to start virtual
machines to create environment for testing.

Motherboard:

For laptop and notebook motherboard, I do not see there is the
need for comparison. Because when considering motherboard,
compatibility and extensibility are what we are for, but the
extensibility of laptops and notebooks is poor no matter how hi

end it is. And there is no worry for compatibility as well, because all mother board are tailored for these machines.

Although in terms of integrated ports, the USB3.0 of notebook is surely not as fast as lightening port on the laptop, and HDMI is not worse than lightening as well.

Also, the bus speed is the same for both, because they all support 64bit bandwidth.

Memory:

Both machines have 8GB of memory though the clock speed has big difference. This will impact overall speed for it affects the speed of CPU getting data from memory. Actually, 8GB is not very enough when you are trying to run multiple programs even virtual machines like virtualbox(as discussed before it recommends 16GB RAM), we might consider the version with more memories.

SSD NVMe™512GB vs 128 GB SSD ESATA

From capacity point of view, 128GB just is not enough, since the OS will take as much as 25GB itself. If we are trying to add

multiple IDEs and SDKs on top of that, it will just be disaster. From speed point of view, although both disk types are SSD, but the 512GB SSD is faster and using new NVMe protocols to upper the speed limit.

Power Supply:

The laptop is charging using lightening port and it is USB Type-C Specification, which gives the convenience of sharing chargers with cell phones. The laptop has bigger battery as well. 17 hours of battery life allows more usage between charges.

Work has been lost due to power failures in the past. As a matter of fact, it is hard for this to happen to a laptop or notebook since they are both able to run on batteries if the power were cut off. This resembles the UPS, which is often used in case of power failures. A better solution could be using cloud repositories like github or setting up git servers such as gitlab.

Additional Hardware / Peripherals:

The laptop supports WiFi6 protocols which allows higher speed and lower latency in network.

The Graphic card on the laptop is better too, but both are not so powerful for heavy graphic tasks. The good news is that it saves a lot of energy for graphic cards tend to have a heavy need for energy and it is not needed for writing codes.

4. Conclusion

Above all, the laptop can relatively serve our purpose well, except we might tend to choose a version with more memory capacity. And the notebook is not eligible for our purpose for following reasons:

Firstly, the developer may face disk capacity problems when installing IDEs and dependencies.

Secondly, even if they managed to set up environments in limited disk space, they will find the computer become extremely slow when open up virtual machines. This due to low clock speed and lack of cores of CPU.

References

Appendices

Supporting information goes here

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