



TECHNICAL REPORT

On Building Your Own P.C. For the General Public / Consumer

Abstract

This report will cover building a PC and compare it to buying one from a retailer. The purpose is to inform consumers on the importance of understanding what is in their computers and why it should be repaired and understood by themselves.

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.5 EXECUTIVE SUMMARY

This report should inform the consumer of the parts in a computer and the reality of storebought computers and the issues they can be. Not only will I compare my own personal experience but also those from better known sources to further develop the research.

Making a computer yourself should be an option assuming that the time and effort that go into it are plausible. However, if the reader should decide that a prebuilt and the possible issues that come with it are worth it, this report should change that and show how much more efficient, and time proof a custom-made PC really is.

1.0 INTRODUCTION

This report will generalize all the computer parts to make sure a broader audience can understand how the parts work. It will cover the purpose of a computer, if the reader has some basic idea of what they would do with one and as society is so heavily screen focused, that is no issue. It will explain “shelf-life” and that prebuilt PCs aren’t able to last as long as a custom one would due to tool restrictions and other various issues that would require updating. It will also cover very basic and common concerns about making one at home and an even more basic cost comparison between making it yourself and having one from a retailer. In the end, it should be apparent that a storebought PC and having others fix it would be much more inefficient and time consuming compared to doing it all yourself.

GENERALIZED PARTS

2.1 CPU

The CPU, or the Computer Processing Chip, is the brains of the computer and should be treated delicately. The CPU provides all the instructions and the data for your computer to operate and is generally made by two companies, AMD or Intel. There aren't major differences besides price gaps and chips slotting. Chip slotting is the place where the CPU sits in the motherboard (Which will be covered later). While there is a price gap that may lead the consumer towards a decision. The different chip types each strive in their own ways. Intel has higher clock speeds, the speed "measures the number of cycles that your CPU executes measured in GHz. In this case, a 'cycle' is the basic unit that measures a CPU's speed" (Intel, n.d.). AMD on the other hand has a few different things besides just price. They are more flexible when it comes to overclocking, which is just speeding up the CPU to try and increase the performance, they generally have more cores (places where the processing happens) and that allows for easier multitasking since the workload is more spread out. AMD is also known for making more power efficient CPUs but that can easily be countered by a larger power supply.

2.2 Storage

Storage inside of a computer is just that. The storage on your computer is dependent on what the consumer needs the computer for. If the user is just going to use it for work, less storage would be necessary but why make an entire computer solely for work purposes? With other daily tasks in mind or even gaming it would be better to have more storage. However, with more clutter in your drives, the longer your computer will work through and operate through all the data. The amount of free space needed for optimal usage is also dependent on the type of storage device that is included in the pc build. SSDs, or Solid-State Drives, the

recommendation is “about 25 percent” (Chron, 2019) and for HDDs, or Hard Disk Drives “somewhere between 10 or 15 percent” (Chron, 2019). There are differences to that could be beneficial but as technology advances, everything is progressing towards SSDs. HDDs are cheaper, if cost is an issue, and they have longer lifespan. HDDs are alright for storing things that aren’t programs or things not necessary for the operating system. SSDs are faster, smaller, have no moving parts, and are shock resistant which is a particularly useful trait in an electric object. Ultimately, the decision isn’t an either/or choice. It is normal for the computer to be a “hybrid” where the important programs and OS are on an SSD and other things are on an HDD.



Figure 1 Tekie.com

2.3 GPU

The GPU, or Graphics Processing Unit, is necessary to output videos and images to the screen. Without it the machine cannot process anything graphically. The only way it is possible to get away without one is with an integrated GPU and if there is any plan of gaming, it’s better to get one. If the machine is for gaming the cheap GPU choice isn’t recommended but if it for work or family desktop use, an integrated one could suffice. The unfortunate downside to buying GPUs that will last for at least 10 years is that they tend to be rather expensive in current times because of the lack of resources to make the chips. There is also the issue that bitcoin miners use the better GPUs to mine for currency which is a whole other issue on its own.

2.4 Motherboard

The Motherboard “connects all your hardware to your processor, distributes electricity from your power supply, and defines the type of storage devices, memory modules, and graphics cards that can connect to your pc.” (Intel, n.d.). There are a multitude of things on the motherboard that make it work. There is the place to put the CPU, a slot for GPU(s), places for SSDs, slots for RAM and of course access to the power supply. This is like the nervous system but for the machine, if it fails, the whole computer will not work. Along with the CPU, the motherboards also have specific chip slots that the CPU needs to slide into, this depends on the generation of the board (what line it was produced from) and the type of chip it will allow (Intel or AMD).

2.5 RAM

RAM, or Random Access Memory is what the computer uses to compute information from the OS, “application programs and data in current use... so they can be quickly reached by the device’s processor.” (Peterson, 2021). RAM is considered volatile. What this means is that while the computer is on, data is retained in RAM, but if it is turned off, the data is lost. RAM is typically stored in microchips so the data it can store is significantly smaller and the typical computer has about 8Gb of RAM but the recommended is about 16. There are two types of RAM, DRAM, or Dynamic Random Access Memory, and SRAM, or Static Random Access Memory. DRAM needs a constantly refreshing electric charge to compensate for capacitor leaks and a transistor determines whether the capacitor value can be read or written. SRAM also needs constant power, but it doesn’t need to be refreshed the way that DRAM does. SRAM is faster and uses less power than DRAM but the price per Gb is higher.

2.6 Power Supply

The power supply does exactly what the name implies. Every computer will need some sort of battery or power supply otherwise nothing will get power. The power supply works by taking the “AC from the wall outlet, converts it to unregulated DC and reduces the voltage using

an input power transformer, typically stepping it down to the voltage required by the load.”

(Wavelength Electronics, n.d.) After all the power conversion it will feed into whatever you have plugged into the supply. There are slots on the back of the supply that allow for different numbers of pronged plugs to slide into and each slot that can be used will have some sort of matching head

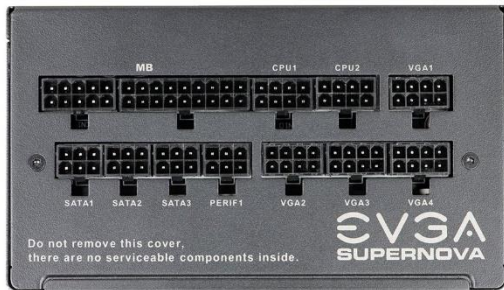



Figure 2 bestbuy.com

pattern like square, circle with line above, square, and so on.

That is rather important because cords with other pin patterns will not fit, however, there are plenty of cords that will come with the motherboard that should make it a lesser worry. Issues will arise if you are reusing cords and update the power though so be weary of that. There are ratings of power supply and those mean how efficient the power supply is under different loads

of electricity. They start with 80 plus then go up to a material name.



	Loading	80 Plus	Bronze	Silver	Gold	Platinum	Titanium
Efficiency	20%	80%	82%	85%	87%	90%	90%
	50%	80%	85%	88%	90%	92%	92%
	100%	80%	82%	85%	87%	89%	94%

Figure 3 velocitymicro.com

These are all things to consider while buying a power supply but the higher the rating, the higher the pricing as well. Gold is a very solid choice when it comes to both pricing and efficiency but what really matters is the wattage, if you have a higher wattage and are less concerned about the power supply short circuiting then the rating is for the consumer to decide.

There is also the case to keep in mind while purchasing your parts. This is a significantly easier step if you keep that in mind while purchasing everything else. The only challenge with purchasing a case is the space that you will need for all the parts to fit. Some cases are made smaller for smaller MBs which come in Micro-ATX and Mini-ITX. The average computer utilizes an ATX board. The only other thing to consider is how much cooling and ventilation your computer should utilize, better hardware usually burns hotter, so it is better to have superior cooling. Water cooling is also just a preference to the builder, it's not at all necessary.

3.0 BACKGROUND

The reason this report is being written is to inform consumers how much more cost-effective it is to make your own desktop. This is especially true if the consumers goals with the PC are in mind while buying parts. There are plenty of ways a computer could be used in a household and many more reasons why prebuilt or storebought computers aren't the greatest. When it comes to computers, they tend to be easy fixes physically, or even something that a simple google can help them fix. However, with storebought that isn't the case at all. There is generally something in these prebuilds that prevents user modification like storage bay blockers or too small of a case, or difficulty adding or removing anything because it is bolted down in some way. What this does is increase the difficulty of repairing the device and make it so only people with the special tools are able to edit and or repair the machine. With that, the general consumers options are spending money on another device to simply replace it, or spending the time waiting for repair, paying fees and labor, and not having the device in general. When building a PC from scratch there are plenty of things that come with it, the consumer themselves are building the machine so they know what is in it, where everything goes, how it should look while working, and so on. Also, when building from scratch, the parts should all fit together and work well but in the event it doesn't it's normally just some troubleshooting or a few returns away from being able to work again. There are also *no fees* for labor which is a huge plus on its own, but it also takes time and some delicacy to build one. The

only downtime that exists with a custom build is the time being taken to make it or fix something, other than that, there is almost no waiting at all (except for installing windows).

3.1 Purpose of Computer

The purpose of a computer may vary depending on the user. Most people have a computer today but when a computer is thought of many different ideas come to mind. Some think of work, some think of games, some think of the parts on the inside. The idea of a computer is the utility it brings home, the sheer versatility makes computers a vital part of society.

3.2 Shelf Life

Shelf life should be a huge factor when choosing a household computer. Nobody wants their work computer to die on them or their kids' favorite toy to self-destruct. The average lifespan of a computer could "potentially be five to eight years if maintained properly." (Review42, 2022) but the catch to that is "Old desktop computers can last for a long time if you constantly upgrade or replace defective components" (Review42, 2022) the average computer you buy from a store (unless it is built specifically to be taken apart) has very little room for improvement or replacement. Computers like this generally need some special tool that the manufacturer uses to assemble and take the machine apart. This creates all kinds of issues for the general consumer. When building a computer rather than buying one outright, the future of the machine is kept in mind and depending on the parts, the closest upgrade could be somewhere like 10 years from then. Older hardware should keep up well with the current market as nothing has been an astronomical advancement. On top of that it is always possible to upgrade purely from impulse.

COMMON ISSUES / CONCERNS

4.1 Scared of Breaking Something

Unfortunately, computer pieces aren't indestructible. There is always concern of breaking something in the machine but there is also the issue that it could be physically broken.

There are pieces that are more fragile and others that you could drop and most likely be fine unless the machine was on for some reason. Things like RAM and the slot where the CPU sits are very fragile if too much force is applied while placing or moving other parts. It is possible to snap RAM, but that is easy to avoid if the MB is properly mounted. The CPU is very susceptible to braking pins, I have personally destroyed a MB because the Intel CPU slid and pushed down the pins that touch the CPU and feed it power. I had the CPU cooler mounted improperly and that led to the demise of that board. With proper mounting that issue could have been prevented. Most of the parts in the PC should allow for some force if everything is mounted properly. Mounting is the main way to prevent 90% of accidents.

4.2 Electrocutation

This is by far the easiest issue to prevent. Any time someone is working on their machine and messing with the parts, the computer should be *off*. Make sure to ground whatever tool is being used by touching it to some metal to divert all electricity away from the tool to prevent frying of the parts, (The case generally works, some table leg, or whatever else). Also make sure to “Remove any HDMI, USB, or VGA cables altogether to ensure they do not connect to anything.” (Techfident, 2022). When the machine is being plugged in make sure the outlet has some kind of surge protection to prevent short circuiting in the event of some disasters.

4.3 Blue screen / error codes

The blue screen could pop up from a multitude of different things. It could be caused by “improperly installed, damaged, or aging hardware, or buggy or incompatible software.” (AVG, 2023). This could completely ruin anyone’s day but if they are upkeeping everything and paying

attention to whatever is going onto the PC these are easily avoidable. Not only should they be easily avoidable, but they also give you an error code that tells you vaguely how to fix it. That can lead someone down a rabbit hole but worse comes to worse there is always the reinstall windows and reformat the drives. It is a horrible thing to happen to a PC but unfortunately not all issues come from user error and sometimes it's purely some program integration failure.

COST ANALYSIS

5.1 Repairing Yourself vs Having it Fixed.

Finishing off the self-repairing talk, we'll touch on cost. Repairing it yourself costs nothing other than time if nothing is physically broken or throwing errors to the point of beyond repair. Even if something is broken, a quick trip to Best Buy or some other tech store and it's plug and play from there. Sometimes broken things need to be fixed immediately and that's the best option. Grab a couple of friends to keep company while working or have them help and get the job done in a reasonable amount of time with no added service fees or additional waiting without the desired device. A greater benefit of repairing a device at home is the knowledge and experience that was learned while working. Fixing it without a service assures that if an issue happens again, the repair should be significantly faster, and the other parts and pieces can be compared to how they were previously placed and or how something was organized. The alternative to this would be to have it repaired by someone else. This is time-consuming and requires fees. Many sources would disagree and think that a professional

should do the job, while that may be the case for store bought / prebuilt machines, it is incredibly different with PC builds made from home. As the consumer knows exactly what is in the PC build and how it should work/worked before the issues. In addition to that, the average “cost for computer repair is \$65 and hour.” (Homeguide, 2023) for having a professional do it and that as well as other possible fees depending on the issue and if they are needed to come to the caller, it is also possible that the fix could take more than one day.

6.0 LIST OF FIGURES

Figure 1 – 3

Figure 2 – 6

Figure 3 – 6

7.0 SOURCES

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