



Considerations for Building or Buying a New Computer

IF YOU'RE PLANNING TO REPLACE AN OLDER COMPUTER, IT'S IMPORTANT TO CONSIDER WHAT'S IN THE BOX. IN SOME WAYS, IT'S LIKE BUYING A NEW CAR.

Although this article is primarily about Windows computers, the same considerations apply to Linux computers and some of them apply to MacOS computers.

It's not uncommon to concentrate on the central processing unit and to ignore the other components. The CPU is important, of course, but so are the other parts.

Balance is even more important. Which is the most important department in a business? Managers like to think their department is the most important, but the business needs all the departments to operate properly.

What Will the Computer Do?

THE TASKS A COMPUTER WILL PERFORM DEFINE THE ESSENTIAL CHARACTERISTICS. BUYING A VEHICLE IS A GOOD ANALOGY.

The person who is buying a work truck will have specifications unlike the person who is buying a family car, and families will have vastly different needs.

A computer that will be used solely for email, web browsing, and general office work won't require a high-performance CPU or a massive amount of disk space. A basic graphics subsystem and four to eight gigabytes of memory will be sufficient.

A computer that's destined to process video or professional photographs will need both a fast CPU and an enhanced graphics subsystem. Large amounts of fast disk storage will be essential and 64 gigabytes of memory might not be enough.

Knowing how the computer will be used is the most important consideration to ensure that a new computer will succeed.



WHEN SELECTING A NEW COMPUTER, OPTIONS AVAILABLE WITH NOTEBOOK MODELS ARE SUBSTANTIALLY LESS THAN THOSE FOUND ON DESKTOP SYSTEMS. THE GREATEST FLEXIBILITY IS ACHIEVED BY WORKING WITH A CUSTOM COMPUTER BUILDER.

Balance the Computer

BALANCED COMPUTERS WORK BEST. THAT MEANS THE CPU, GRAPHICS PROCESSING UNIT, DISK DRIVES, AND OTHER COMPONENTS WORK WELL TOGETHER.

Here's another automotive analogy: It would be unwise to install a Ferrari 812GTS engine in a Fiat 124 Spider. Yes, they're both sports cars, but the Fiat isn't built to accept the power from a Ferrari engine.

Likewise, installing the Fiat engine in a Ferrari is likely to be quite disappointing.

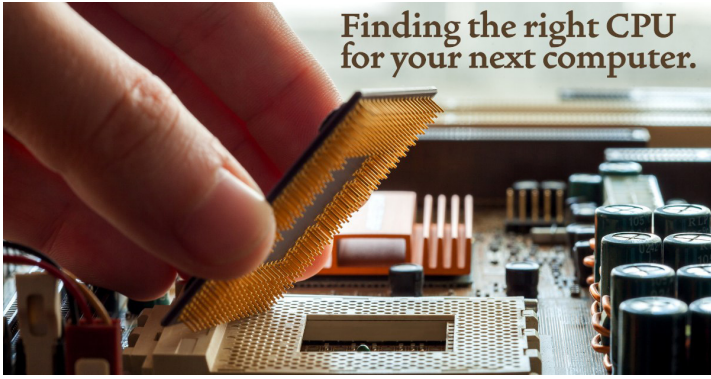
A computer with a super-fast CPU, but slow disk drives will not perform well because the CPU will have to wait for the disk drives to fetch or write data.

Starting with the CPU

LET'S CONSIDER CPUs FIRST EVEN THOUGH THEY AREN'T THE ONLY IMPORTANT COMPONENT. MAYBE THE CPU CAN BE THOUGHT OF AS A MARCHING BAND'S DRUM MAJOR.

A CPU that runs at 4GHz will be faster than one that runs at 3GHz. That's common sense, but if the 3GHz CPU has eight cores and the 4GHz CPU has four cores, the seemingly *slower* CPU will almost certainly be faster.

Each core acts like a separate CPU. For complex operations, the CPU divides tasks among the various cores, and many CPUs make each core look like two. A four-core CPU might look like it has eight processors.



Finding the right CPU for your next computer.

Of course, for applications to take advantage of all those cores, the software developers must plan for multi-tasking and multi-threading.

When transistors were invented in the 1960s, they were tiny compared to tubes, and some of today's CPUs have the equivalent of three to seven billion transistors on a device that's about as large as an oversize commemorative postage stamp and not a lot thicker.

CPUs with varying speeds all come from the same manufacturing batch. After CPUs have been manufactured, they are tested to see how fast they are. Manufacturers don't create a batch of CPUs that all run at 4GHz. Each must be tested.

Some will run at higher speeds than others in the batch, so each CPU comes with a speed rating. Those that work at higher speeds sell for more. Sometimes a lot more. The price difference between a CPU that's certified for 4.2GHz and one that's certified for 4.0GHz might be several hundred dollars.

That doesn't mean the 4.0GHz chip won't run at 4.2GHz. It probably will because both came from the same manufacturing batch. It just won't run reliably for as long at the higher speed.

Running a CPU at a speed higher than it's certified for is called *over-clocking*, which provides better performance from a less expensive processor, but also is likely to cause the CPU to fail sooner. Run the CPU as fast as you want if you're willing to take the risk, but also invest in more powerful cooling.

Even if you choose a super-fast 4.2GHz CPU, it won't run at 4.2GHz all the time. Computers spend a lot of time just waiting for humans to tell them to do something. Rather than running in place as fast as they can all the time, they relax by running at lower speeds until they need to do something.

CPUs can throttle down to near zero when there's nothing to do. But some can also run faster when extra processing power is needed. Intel calls the process of running the CPU above its rated speed for short periods *turbo-boost*. This

ability provides a kind of head room, and the more headroom a CPU has, the more it will cost.

Data that the CPU needs can come from several locations. Data that's already in cache memory on the CPU is the fastest to retrieve. Next is data that's in the computer's RAM. Data is retrieved more slowly from a solid-state disk drive, much more slowly from mechanical disk drives, and slower still from local area networks and the internet.

More Cash for More Cache

CACHE IS USED TO SPEED A COMPUTER'S OPERATION, BUT MORE CACHE ON THE CPU MEANS LESS CASH IN YOUR WALLET.

Cache memory retains data and instructions nearby so that the CPU doesn't have to wait for information from the computer's slower resources.

The CPU will have values for L1, L2, and L3 cache. The L1 cache is extremely fast but relatively small. The L2 cache area will be larger but slower, and L3 will be even larger but slower than L1 or L2. Low-end CPUs may have just 4MB of cache, while high-end CPUs can have sixty times that amount. More cache, faster operation.

Intel has Core i3, Core i5, Core i7, and Core i9 CPUs. AMD has Ryzen 3, Ryzen 5, Ryzen 7, and Ryzen 9 CPUs. Intel also has a line of Xeon processors, which are used primarily in *workstation* class computers. The Xeon line offers more cache, error checking, and a wider range of cores. Video processing is one example of an application that takes advantage of Xeon processors, but most users will be better served by more standard processors.

Low-end CPUs such as the Intel Core i3 can be found for less than \$100 while high-end devices such as AMD's Ryzen Thread-

ripper PRO 3995WX are priced at more than \$5000, and that's just the CPU — not an entire computer. Most manufacturers use CPUs such as the Intel Core i9-10920X or the AMD Ryzen 9 3950X, both of which run at 3.5GHz, in their premium-priced computers. If you're building your own, you'll find that these CPUs retail for less than \$700.



Beware Chip Shortages

YOU MAY HAVE HEARD ABOUT CHIP SHORTAGES THAT ARE CAUSING PROBLEMS FOR AUTO MANUFACTURERS AND PHONE MANUFACTURERS. THEY MAY AFFECT YOUR COMPUTER PURCHASE.

The problem is less with CPUs than with GPUs, graphics processors. The graphics processing unit is designed to enhance the processing of images. This relieves the CPU from performing intense calculations and accelerates screen performance. Many CPUs have an embedded GPU, but manufacturers can add specialized GPUs that are faster.

It's these specialized GPU components that are in short supply and this is what makes the resulting prices for GPUs high.

Which is better: Intel or AMD?

FROM A USABILITY STANDPOINT, IT DOESN'T MATTER. BOTH MANUFACTURERS MAKE CHIPS THAT WILL RUN WINDOWS AND ALL WINDOWS APPLICATIONS.

Note, though, that Windows 11 won't run on certain CPUs, mainly older devices. These are listed on Microsoft's website. There's a page for [Intel CPUs](#) and another for [AMD CPUs](#). If you want to be able to run Windows 11 on the computer you're building or buying, make sure the CPU is not on one of these lists.

It's easy to be overwhelmed by all of the possible considerations for a new computer, so aim for balance! 🍷