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32-bits, 64-bits – How many do I need?

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Over the past few years, Personal Computers have been moving from 32-bit Central Processor Units (CPU) to 64-bit CPUs. (Actually, 64-bit CPUs were first introduced way back in 2003, but it takes time to get new CPUs through the design/manufacture/produce cycle to finally provide “affordable products”.) So it’s not a matter of how many you need, it is a matter of what is on the market. From a user’s point of view, the main difference between 32-bit and 64-bit CPUs is performance. Performance is basically the speed at which the CPU can complete tasks and is measured in calculations per second: the faster the CPU, the higher the performance. Additionally, 64-bit CPUs can come in dual, quad and eight core versions which can provide further improvements in performance. Another difference is the maximum amount of RAM memory that can be accessed. 32-bit CPUs can access a maximum of 4 GB, whereas a 64-bit CPU can access far beyond 4 GB, which is necessary if you are using software to accomplish things like video editing or graphic design. In general, the more bits you have, the better the processing performance and capability, and therefore the better your computing experience.

The CPU defines the architecture. A 64-bit CPU is used in a 64-bit architecture and a 32-bit CPU is used in a 32-bit architecture. Today, almost all PCs are built around the 64-bit architecture, giving you the best possible computing experience if you only consider the number of bits. (Other contributing factors to your computing experience might be Internet connection speed, display size, hard drive size, and the number and speed of USB ports.) The Operating System (OS) software is intimately connected to the hardware architecture. That said, keep in mind that a computer with a 64-bit architecture can have a 64-bit OS or 32-bit OS installed; however, the 64-bit architecture with a 32-bit OS installed will not provide the 64-bit architecture’s full capability. Also note that the 32-bit architecture can only run a 32-bit OS. Windows 10 is built for the 64-bit architecture as was Windows 7, unlike Windows XP and 95 which were built for the 32-bit architecture.

A quick look in the rear-view mirror shows the original PC that was released in 1981 by IBM. This early PC was built around a 16-bit architecture which was quite a bit less capable then our current 64-bit or 32-bit CPUs. (The initial CPU was an 8088 which actually used 16 bits internally, but had an 8-bit Input/Output (IO) interface (possibly to keep costs down and possibly to interface to certain peripheral devices), making it a hybrid of sorts, 16 bits internally for calculations and 8 bits externally for I/O.) PCs that followed used the 8086 CPU which was a true 16-bit processor. 32-bit computers started to appear as early as 1985 with the Intel 386 CPU. Improvements in the 32-bit architecture continued from the mid 1980s till the 64-bit processor arrived in 2003. The 64-bit architecture has been improved over the past 15 years and the cost has been reduced to the point where almost every PC produced today has a 64-bit CPU in it. If you are looking for a new computer, definitely go for the 64-bit architecture. (You can find the architecture and OS information in Settings-System-About. In this window, “System type” will show the number of bits for the processor, and also the number of bits for the OS.)

The number of bits in a particular PC architecture indicates the number of bits used in calculations and the number of bits used to address an item in memory. So, a 64-bit architecture has a 64-bit Arithmetic/Logical Unit at the heart of the CPU and can address up to 2^64 or 16 exabytes in memory. (Note, not all PCs are built to take advantage of this large memory space, in fact most are limited by their hardware design to less than 512 Gigabytes.) An Exabyte is a very large number it is a million-million Terabytes. To put it in perspective, see the following table:



On top of the hardware limitation, which is not really very limiting, the Operating System in use places some limitations. The following table shows the limitations for some of the popular versions of Windows 10:



So, considering the number of items or bytes that we currently concern ourselves with, 4 to 32 gigabytes of RAM memory, and maybe 4 to 12 terabytes of hard drive space, the 64-bit architecture will probably take us pretty far into the future.

If one were purchasing a new computer, the best situation would be a 64-bit hardware architecture with a 64-bit OS and all 64-bit drivers. You would probably get this if you bought a middle to high end PC from a popular company like HP, Dell, or Lenovo. Low end or economy models might have a 32-bit or a 64-bit architecture. Note that if the amount of installed memory was over 4 GB then it would have to be a 64-bit architecture. If one did purchase a PC with a 32-bit architecture it would probably have a 32-bit OS installed. Knowing what OS is installed on your PC is important if you are installing new software. If your new software is built for a 64-bit OS, it will only run on a 64-bit OS; it will probably not run on a 32-bit OS. If your new software is built for a 32-bit OS then it will probably run on a 32-bit OS or a 64-bit OS. Sometimes a software vendor will make two versions available, one for the 32-bit OS and a different one for the 64-bit OS. So, if you can find it in your price range, a 64-bit architecture with a 64-bit OS and 12 GB of RAM and a 1TB hard drive would probably satisfy almost everyone’s needs, except maybe for a few very serious gamers.