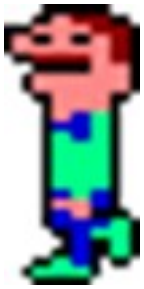
How To Build a Gaming Computer

February 2009 Edition



Welcome to the Build a Gaming Computer February 2009 Guide! The following pages will present you with a wealth of information. So, in an effort to help you not get overwhelmed we've kept the article format the same throughout this guide:

The majority of the articles consist of the basic information you need to understand what a component does, as well as what you should look for when you're building a gaming computer. The second part of every section contains our recommendations.

Since everyone is looking for a different configuration, we've provided three recommendations for every component based on their budgets: tight, average, and big. Tight and average budgets will provide you the best "bang for the buck" component, but you'll probably want to upgrade these components more often. Big budget components are for the rich, or the people who save their money for a few years to purchase a blazingly fast computer.

We've also broken this guide down into our **recommended buying order**:

1. Processor
2. Motherboard
3. RAM
4. Video Card
5. Hard Drive
6. Sound Card
7. Optical Drive
8. Network Card
9. Cooling System
10. Computer Case
11. Monitor

We recommend this buying order because of the overwhelming number of configuration options that are presented to new buyers. Once you've selected a few major components, like the processor and motherboard, then the field of other components you can buy is slimmed down enough to make a good buying decision.

The next twenty-something pages will tell you exactly what each component will do in your gaming computer, as well as what you need to look for when you're more concerned about performance in games, instead of just some word processor.

How to Build a Gaming Computer

Choosing the right components for the job is essential to building a gaming computer, but how do you go about actually building one?

It's actually pretty simple. Unlike cars, which have some very complicated components that look like they could fit anywhere or do anything, computer components generally fit into one connection on the motherboard; for example:

Processors are usually square pieces with a metallic covering and hundreds of tiny pins (connectors) on the bottom – this will only fit in one spot on the motherboard, and will only fit in certain motherboards!

Processors are build with “sockets” on the bottom – these sockets only fit in a specific configuration, so the wrong motherboard will not accept the wrong processor, which stops you from doing something silly causing some kind of virtual meltdown.

RAM is the same way: they have a certain number of pins and are a certain length, which presents a physical obstacle to inserting the wrong RAM in the wrong motherboard.

Every other component also fits in a specific slot. IDE, SATA, PCI, etc... all have unique connectors, so there's practically no way to screw up actually building your gaming computer: **just plug it in and go!**

How to Choose a Processor

Central Processing Unit, Processor, CPU - no matter what you call it, it's the single most important component of your gaming system. Sure, graphics are important, but if you don't have a decent processor you'll never be able to play modern games.

As games grow increasingly complex, processors must scale in complexity to meet that demand. Of course, this doesn't mean you need to buy the most expensive processor on the market! Instead, you'll need to select a processor that meets two requirements: minimum performance and priced within your budget.

Finding a processor priced within your budget is fairly simple (look at your budget, look at the price of the processor), so let's discuss the minimum performance you'll want to get out of your processor.

Minimum Performance

When selecting a processor, the first thing you'll want to consider is minimum performance. That is: how well does this process perform against the minimum requirements for the software you're going to run on it? Most processors sold at retail are going to meet the minimum requirements to use your operating system and some desktop applications, but some of the low-end processors may not be able to play your high-end games.

You'll need to ask yourself two questions: "can I play my current games on this processor," and "will I be able to play next year's games on this processor?"

Answering the first question is a pretty simple yes/no answer; however, the second question takes some thought. If the processor only meets the bare minimum requirements, chances are it's not going to play future games, but if it surpasses the minimum recommended specifications, you'll be able to use that processor for a longer period. How long depends on how fast processing needs grow over time.

Price/Performance

Its worth to note that a lot of experts urge you to buy a processor that's the best "price per performance" - which is a good idea, in theory. In practice, though, figuring out the price per performance is pretty difficult. Heck, entire websites are dedicated to showing you the raw processing numbers versus the cost of the processor.

Don't waste your time trying to comb through the endless charts, graphs, and articles. Instead, while looking at the processors you're thinking of buying (which meets your minimum performance criteria), consider these rules of thumb:

- The faster clock speed, the better for performance.
- The more on-chip cache (often called L2 cache), the better performance: more cache means faster access, and less time spent searching for stuff in RAM.
- The more cores, the better for future proofing: dual core processors are the standard of today, but tomorrow it will be quad-core and beyond.

Motherboard

With a processor picked out, now is the time to start considering what motherboard you'll want to get. You'll need to know three things about your processor in order to select the correct motherboard: Interface (also called Socket Type), Bus Speed, and Clock Speed.

The interface (socket type) is pretty important to know, since you can't fit a Socket 1366 processor into a Socket 775 motherboard. You'll also want to keep an eye on the bus speed and clock speed, because not all motherboards support the high-end bus and clock speeds that some processors require.

Another thing to keep in mind when motherboard searching is to find out how much power the motherboard can supply to the processor. As processing power grows so grows power requierments.

Nowadays, high end motherboards will support either LGA 1366 (Intel Core i7) or AM2+/AM3 (AMD Phenom II), and will support DDR2 or DDR3 memory. Most often you'll find that high end motherboards will support DDR3, while support for DDR2 will be present on lower end motherboards.

How to Choose a Motherboard

The motherboard is the body and soul of the computer: everything eventually goes through the motherboard. Since it's such an essential piece of equipment, you can imagine selecting a board is no small task!

If you're following our guide, then you would have already selected a processor, which makes the task of selecting a motherboard a little less painful.

There are a ton of motherboards out there, and a lot of them look very similar to each other. So, to choose one motherboard from the hundreds (literally) to choose from, you'll have to filter them out.

Your first filter is the processor you've chosen. You'll want a motherboard that supports the same Processor Interface (also called Socket Type), otherwise you won't be able to use your processor. You'll also want a motherboard that supports the clock and bus speed of your processor - if the motherboard doesn't support the processors full clock and bus speed you're not getting the most out of your money.

Now that you've limited your motherboard selection, it's time to talk features. Specifically, what features the motherboard has that you need.

RAM

While you could select your memory before a motherboard, there's no guarantee that you're going to find a motherboard that matches both your processor and your chosen memory. It's easier to choose a motherboard now and then pick the right RAM.

There are several different types of ram, but there are two rules you'll want to stick with:

- The faster the memory (memory is clocked in MHz, although high end RAM is now pushing GHz speeds), the better performance.
- The larger the memory (measured in GB), the better overall system performance.

I/O Connections

Motherboards can have several I/O connectors. These are generally used to attach devices, such as video cards, to your computer and can come in several different flavors. Generally, modern retail motherboards have:

- PCI-Express (PCIe) in several speeds: x1, x2, x4, x8, and x16..
  - PCIe x32 is usually just two x16 slots
  - PCIe x64 is just a marketing term for four x16 slots.
- PCI 2.0
  - Modern motherboards may only have one PCI 2.0 slots for hardware compatibility
- USB 2.0
- FireWire (IEE1394)
- IDE/SATA/SATA-II are the common connectors. IDE is the older/slower cousin of SATA (Serial ATA). SATA-II is a faster version of SATA, and can also be referred to as SATA 3.0Gb/s.
- Ethernet (also called network ports, RJ-45, or LAN ports) can often be provided. High-end motherboards often offer multiple Gigabit Ethernet ports, while most other boards offer single-port 10/100 Ethernet options.
- PS/2 ports might be found on most motherboard. They used to be the standard connectors for your keyboard and mouse; however, they have almost been replaced by their USB counterparts.
- Other connectors may be present on your motherboard, such as serial or parallel ports. While they're available, they're generally not used unless it's for a very specific application.

On-Board Audio

Depending on your motherboard it may come with on-board audio, so you won't have a need to buy a separate sound card. Modern on-board audio devices can provide acceptable performance if you're looking to cut back on your budget and avoid buying a dedicated sound card.

Video Cards

At this point you should take into account the video card you may want to use. If you're looking in the low to medium end gaming computer, you'll want to find a motherboard that supports, at least, one PCI-Express x16 port. For a high-end gaming machine you may want to look into motherboards that support CrossFireX (for ATI video cards) or SLI (for nVidia video cards).

Number of Drives

Most motherboards will support SATA or SATA-II drives, but may only support one or two drives, at most. If you're going to use multiple SATA drives you'll want to make sure that your motherboard can support the number of drives you plan on installing.

Question of Space

The final thing you'll want to keep in mind is the amount of space you'll have on the motherboard. If you plan on using an elaborate cooling system (such as water cooling) you'll need to make sure all of your components will fit.

How to Choose RAM

RAM - Random Access Memory - is one of the easiest things to overlook in a gaming computer. After all, you've got processors and video cards to worry about! But, RAM is, far and away, one of the most important components of any good gaming machines. , and selecting RAM isn't as easy as you might think.

While you might be able to buy a low-end processor and motherboard, you probably don't want to skimp on RAM - the more RAM you have the better performance you'll get out of your machine.

Types

RAM comes in a variety of types, sizes, and speeds. If you're following our How to Build a Gaming Computer guide, then you've already got a processor and a motherboard ready. If you don't, I suggest you read those parts (or at least the motherboard section), as knowing these bits of information make selecting RAM much easier.

If you already have your motherboard picked out, then you know the RAM you're going to buy! The motherboard has several specs that will tell you what the optimal memory component is.

DDR, DDR2, DDR3 are the more common types of RAM. DDR is an outdated technology. DDR2 is on the way out and being replaced with DDR3.

Check your motherboard specs - it should list four important pieces of information:

- **Memory Type** tells us which type of RAM is supported: DDR, DDR2, DDR3, DDR4 etc...
- **Memory Speed** is how fast the memory can be accessed, usually represented in MHz.
- **Memory Size** represents the amount of memory your particular motherboard supports. This is usually represented in GB (Gigabytes) as 1, 2, 3, 4, 16, 32, etc... Currently, 4GB and 8GB are the standard, but 16GB and 32GB support is starting to become common, with 64GB and 128GB not far behind.
- **Number of Modules** tells you how many sticks of RAM can be used. Typically a motherboard will hold anywhere from 1 to 4 sticks of RAM, while higher end motherboards may support 6 or 8 sticks. Some high end server motherboards support upwards of 32 sticks of RAM.

Go Big or Go Home

While building a gaming system on a tight budget is doable, you do not want to skimp on the amount of memory your system is going to hold. If you're going to build a gaming machine, but only put 512MB of RAM in it, you might as well be using a Commodore 64. At a minimum get 2GB of RAM, and if your motherboard supports it, get more.

How to Choose a Video Card

Selecting a video card might be one of the most important things you do when building your gaming machine. If you make a bad decision here you'll regret it in the future. Of course, that doesn't mean that picking the right graphics card has to be difficult, or expensive.

Yes, we've all heard the horror (or gloating) stories of gamers who spent thousands upon thousands of dollars on two video cards. Unless you're rich, or feel like taking out a loan, you don't need to spend an insane amount of money to find a great video card; however, you do need to do your homework.

Before you choose a video card make sure you at least have a motherboard in mind, otherwise you may end up choosing a video card that isn't supported by your hardware!

AGP or PCI-Express

Most modern video cards will only support PCI-Express, as the AGP standard is now obsolete; however you may run across an AGP card or two that offers decent performance at a relatively low cost. As great as it would be to save that money, remember that AGP is obsolete, which means you'll have to find an old motherboard that support AGP. Chances are this motherboard will not support the new processors and memory speeds.

If you're following our guide, then the decision is made for you: PCI-Express. The motherboards we recommend do not have an AGP slot.

PCI-Express Speed

There are a lot of PCIe video cards on the market, and they all come in different interface speeds. Since you're building a gaming computer, you'll want to stick with the maximum interface speed supported by your motherboard.

If you're following this guide, the motherboards we recommend all support PCIe x16 (and the Big Budget motherboard supports two PCIe x16 cards).

It's All About Performance

You may, at first, be dazzled by raw pixel numbers on products such as the Quadro FX series of video cards. Don't be fooled by these numbers: the Quadro FX series is built for professional graphics setups requiring a large amount of raw pixel pumping power. These cards often fail to perform decently as a consumer-grade product. In fact, most games will run slower on a top of the line Quadro FX card than on a mid-range consumer graphics card.

With that being said, buying a video card isn't strictly about price versus performance. Instead, it's more about what video games you generally play and how they perform on different video cards.

If you're on a budget, shop within your budget, but compare the performance of video cards running the games you want to play. Doing a simple Google search for "Video Card Review" will bring up a lot of results that you can draw your opinion from.

Monitors and Resolution

Now is a good time to bring up the subject of monitors. You're more than likely going to be getting an LCD monitor, because they're the industry standard - you're going to have one hell of a time finding a decently priced CRT monitor.

With that in mind, remember that LCD monitors generally have a lower maximum resolution than CRTs of old. It's pretty common to find low-end monitors that have a resolution of only 1024x768. This is important to note, because it doesn't matter how great your video card runs at 1900x1200 when your monitor only supports 1024x768.

This is an especially important task for the gamer on a tight budget. Keeping a close eye on how well your video card performs under your monitors optimal resolution can save you several hundred dollars, if you shop carefully.

ATI or nVidia?

Some gamers are very brand loyal. Some gamers swear by ATI while others swear by nVidia. Do not get caught up in brand loyalty! Yes, one brand may hold the top performance crown, but if you limit yourself to brand loyalty you'll miss out on great deals, like a mid-range card that performs like a high-end card.

Bigger is not Always Better

Yes, it would be nice to have a Quad-SLI nVidia GeForce 295 system. The problem is that you'll never get four times the performance of a single card. While you'll be able to gloat about your super gaming rig (for about a year, or until the latest batch of cards come out), your bank account will be crying at the thousands of dollars you needlessly spent on those video cards.

If you're looking to future-proof your computer, getting multiple video cards is not the best way to do it - there's no guarantee that your current PCIe slots will be enough to sustain the bandwidth needed by future cards; however, if you're looking to gloat, then by all means, go ahead.

Bottom Line

If you're willing to spend somewhere between $100 and $200, you'll get a decent mid-range video card that will last you a few years. Below $100 and there's no guarantee your card will play next year's games. Above $200 and your card will still last the same amount of time, but you'll get a higher resolution and (sometimes) better performance.

How to Choose a Hard Drive

Selecting a hard drive for your gaming computer usually isn't a simple case of getting the biggest drive. Let's face it: a gaming machine is all about performance. It doesn't matter is you have several terabytes of disk space when your hard drive is slower than a snail (of course, it doesn't hurt to have terabytes of space).

IDE, SATA, or SCSI?

Almost every modern consumer hard drive will come with a SATA connection. IDE hard drives are a thing of the past, and if you run across one, chances are that its performance will not be up to par with more modern drives.

SCSI has been, and continues to be, the enterprise standard. SCSI drives aren't built for performance, per say, but for reliability and expandability. Don't let the significant price difference between SATA and SCSI drives fool you! Your gaming rig will be much better off with a SATA drive.

Motherboard Support

If you're following our guide, then you don't really need to worry about what your motherboard supports: all of the motherboards recommended in this guide support SATA.

If you're upgrading an older motherboard, you'll want to make sure that it supports SATA by verifying that it has a SATA connector on the board. If it doesn't, you'll need to upgrade your motherboard, or stick with an IDE hard drive.

SATA

SATA stands for Serial-ATA, and it's the industry standard for storage device connectivity. There is, officially, only one type of Serial-ATA, and it's called SATA; however, you may notice that there are several hard drives that label their SATA support in different ways.

SATA, SATA-I, SATA-150, SATA 1.5Gb/s are all names for the standard connector that you'll find on most drives.

SATA-II, SATA 300, SATA 3.0Gb/s are all a faster version of SATA, but are not official names for the faster speeds. They all basically mean the same thing: 3.0 Gigabits/second of data transfer.

If you're following this guide, then don't worry: all of the recommended motherboards support this high-speed SATA interface.

RPM

The speed of a hard drive - how long it takes to access some portion of data - is generally represented in RPM - Rotations Per Minute. The higher the RPM, the faster you'll be able to get to your data. Of course, the faster the hard drive, the more noise it puts out and the hotter it gets (we'll discuss heat and noise in another article).

Does RPM really matter? Yes and no. If you're a serious gamer, you'll probably be able to notice the difference between 5400, 7200, and 10k RPM drives. Loading your operating system, games, and levels will certainly feel faster.

Ultimately it's up to you whether you get a 10k RPM drive or a 7200 RPM drive (5400 RPM drives are still sold, but gaming rigs deserve better). You'll have to decide for yourself if the increase in price for a higher RPM drive is worth it to you.

Storage vs. Performance

A gaming computer is build for speed: the faster everything works, the faster you can frag your buddies; but, with hard drives, faster may not always be better.

Faster hard drives - those with great performance numbers - generally come with significantly lower storage capacities. Larger hard drives tend to offer lower performance numbers but significantly higher storage capacity. So what's a gamer to do?

Pure Performance

Some gamers choose to ignore disk size and instead go with pure performance numbers. After all, what's the point in having a super-fast machine when you can't do anything until all of the data is loaded?

This setup has the distinct advantage of being really fast - everything from the operating system to games loads in the blink of an eye.

The problem with this line of reasoning is that you'll quickly run out of hard drive space and be forced to uninstall a few applications before you're able to install another game. That's kind of a bummer, especially when the game takes up several gigabytes of space.

Pure Storage

Other gamers choose to scoff at hard disk speed and instead try to pack in as much storage space as possible into a computer. Their line of reasoning goes that if they're going to have a gaming computer, you want to be able to play games on it and not waste time un/installing applications.

This is a great option if you want a massive amount of storage for everything. You'll be able to store all of your movies, music, and games on your computer and not have to worry about deleting anything.

The problem, of course, tends to be performance. Loading times skyrocket on these slower hard drives, and storing massive amounts of data tends to gunk up the system, which means you'll be spending a lot of time on housekeeping tasks, like a disk defragmenting.

Compromise

If you're like most gamers, you'll probably want to find a nice compromise between speed and storage. The trade off here is that you won't be able to store as much data or load it as fast.

Multiple Hard Drives

You're probably like most people and only have one hard drive in your computer. It can store, roughly, 500 Gigabytes of data (or 1.5 Terabytes), and holds everything from your operating system to your games. This setup is great for a gamer on a tight budget (or someone that really isn't concerned about performance), but the higher-end of the budget spectrum will probably want to invest in multiple hard drives.

Having multiple hard drives ensures a couple of things: separation of data and data integrity.

Separation of Data

By separating your operating system from your personal data you minimize the risk of losing everything when the time comes to upgrade or reinstall an operating system. This also means you can afford to invest in a smaller - yet faster - hard drive for your operating system (minimizing boot time) while investing in a larger hard drive for your data.

Data Integrity

It's a harsh reality to acknowledge: hard drives fail. By using multiple hard drives you can limit data loss. How you organize this is entirely up to you. Some gamers prefer a RAID array of drives which mirrors data, while others prefer to use individual drives to separate data types (music on one drive, movies on another, games on yet another).

By splitting up your data among multiple hard drives you gain the benefit of having a certain level of data integrity.

In Closing

Generally, hard drives are easy to pick - most of them offer the same features, speeds, and storage space. It's your hard drive configuration that will make the difference between the ultimate gaming rig and your average desktop.

How to Choose a Sound Card

The sound card provides exactly what its namesake implies: sound. From regular stereo sound to 8.1 channels of high-quality surround sound, these cards provide you with yet another level of immersion; but, do you really need a sound card?

Why Bother with a Sound Card?

Let's face it: the sound card is slowly being relegated to specialty niche markets. As more and more motherboards start to include on-board sound, the sound card's importance in a computer has been almost completely phased out.

The motherboards we recommended in our guide all come with on-board sound that are as good, if not better, than some of the sound cards you can purchase today.

The old argument for sound cards, especially in gaming systems, was that they provided hardware acceleration for sound, which reduced the average load on your CPU; but, modern operating systems - like Windows Vista - don't support hardware acceleration of sound. With quad core systems becoming commonplace, sexta-core systems on the horizon, and octo-core systems in the future there's really no argument for hardware acceleration.

That's not to say that you shouldn't consider getting one. If you're an audiophile or you want the latest support for the High Definition audio codecs, then you're going to want to invest in a good sound card. Heck, if you're looking for a totally immersive experience, without worrying about any hiccups, then you'll really want to consider getting a sound card.

Sound Card Channels

You may hear people refer to the number of channels a sound card (or audio device) supports, and really, it boils down to the number of speakers that the system supports. This can range from 1 channel on up. In practice, the number of channels tends to fall between 2 and 8.

8 Channels?

On the motherboards we've recommended you may notice that they advertise 8 channels of audio, yet the highest end sound cards only support 7.1 channels. This is more marketing hype than anything else: "7.1" refers to 7 speakers and 1 subwoofer (hence 7.1) while "8" also refers to the same 7 speakers/1 subwoofer configuration.

So, if you ever run across a sound card that promises 8 channels of audio, just remember that it's probably just 7.1 with a nice round marketing number attached to it.

How to Choose an Optical Drive

DVD drives are everywhere these days, and computers are no exception. From DVD to Blu-Ray, computers can host a variety of media readers and writers. Since computer games are generally shipped on a DVD disc (or multiple discs), a DVD drive is an essential piece of equipment for gamers of any budget, but, with a wide variety to choose from, which one should you buy?

Reader or Writer?

Even if you're on a super-tight budget, a DVD burner is ridiculously cheap: the lowest price is under $30. So, even if you don't plan on actually burning any media, you should buy a DVD burner anyway as you'll only save about ten bucks (plus you'll have the ability to burn CDs and DVDs in the future, should the need arise).

DVD or Blu-Ray?

If you can afford it, a Blu-Ray burner is the way to go. With support for CD's, DVD's and Blu-Ray discs, they are slowly going to be the standard in gaming computers. If you cannot afford the $300 price tag, DVD burners will give you great performance for a long time yet, and all for around $25.

How to Choose a Network Card

The Network Interface Card (or NIC) was once the exclusive domain of professional technology consultants, geeks, and hardcore gamers. Believe it or not, at one point in time home computers didn't come with an on-board Ethernet connector, since these computers didn't need to think about home networking; but, thanks to the advent of broadband, every home computer has at least one Ethernet port, some have two, and almost all of them support gigabit Ethernet speeds.

All of the motherboards we recommend in our guide come with an on-board gigabit Ethernet port. With that in mind: you only need to buy one if your motherboard doesn't come with a network port on board, otherwise you're probably just wasting money.

You could purchase the Killer K1 or Killer M1 gamer networking card, but those really are overkill, and that money could be better spent on a faster processor or more memory (of course, if you want an on-board Linux computer, the Killer M1 might be the card for you).

Don't worry about CPU overhead either: the amount of data being processed by the CPU for the network interface is so insignificantly small as to be hardly noticeable. Online games - from FPS's to MMORPG's - don't really send and receive a large amount of data; they just send small chunks of data really fast. It's a technical difference, but an important distinction to make. In other words, don't worry about the CPU overhead.

Now that buying a separate Ethernet card is basically out the window, there is something you should consider, and that's wireless networking. A, B, G, N, MIMO - there are so many acronyms out there that it can be downright confusing. Let's simplify things:

A, B, G, N - these letters refer to the variations of the 802.11 (wireless) networking standard. They all range in speed from 10Mb/s on up. While speed is important (and we recommend getting an 802.11N router and adapter), what you need to focus on is the compatibility: if your router and network card do not support the same standard, you may be throttled back to a slower speed (or not be able to connect at all).

MIMO - short for Multi-Input Multi-Output, any wireless device that supports a MIMO interface will have two or more antennas and generally support faster connection speeds. This comes at a significant cost, though: both your router and adapter must support MIMO, and you risk interfering with other wireless signals (such as your neighbor's wireless network).

How to Choose a Cooling System

Most people don't think about how to properly cool their computers, but gamers often learn that the proper cooling system can be the difference between a fried computer and one that will function for a decade. Of course, most gamers don't actually need to build their own cooling system - the stock cooling fans bundled with most products will be enough; however, there are two major reasons to build a cooling system into a computer: overclocking and low noise.

Overclocking is taking the stock speed of a product - usually the CPU and graphics cards - and making them perform at a faster speed. While actually overclocking a system is out of the scope of this article, having the proper cooling system is essential, because a higher clock speed means more heat will be generated - often more heat than the stock cooling fans can handle.

Lowering the noise of a computer may not appear to be a very important task, but taking a computer that sounds like a jet turbine and turning it into an inaudible device can greatly affect how you use your computer. Plus, with less noise there will be less competition for your attention.

Building a cooling system into your computer takes some time and planning: you need to know what you want to do with your system and how much you're willing to spend on cooling.

Air, Water, or Ice?

It may seem crazy to build a water-cooling system inside a computer full of sensitive electrical equipment, but when you consider how much heat a processor and all of its components put out, it makes sense to try to cool a computer to something more efficient at transferring heat than air.

Air cooling is the staple of all computer devices: almost every computer built today comes with some form of air cooling (even your DVD player has some kind of air cooling), and it does its job reasonably well. For people on a tight budget, or if you just don't plan on overclocking your computer, there's little reason to upgrade your cooling system.

If you're looking to reduce the noise of your stock fans, then you have two options: water cooling or quiet fans. Water cooling is expensive, but there are special quiet CPU fans that are designed to reduce the temperate and noise of your CPU cooling.

If you're an overclocker, or just looking for a really cool way to keep your system running smoothly, you may want to consider water cooling (technically it's liquid-cooling, as water alone is seldom the recommended coolant of choice). While it performs better than traditional cooling, and generates far less noise, it does have the distinct disadvantage of posing a serious electrical hazard if something goes wrong.

If you're considering water cooling you need to consider three major thing:

- **Budget** - water blocks, hoses, radiators, and reservoirs can all cost a lot of money by themselves, but put them together and you may end up blowing your budget on cooling.
- **Space** - liquid cooling of any sort takes up significantly more space than conventional air cooling does: you need room for your reservoir, radiator, pump, and hoses. If you're tight on space you may want to consider the high-performance heat sinks and fans.
- **Experience** - installing a water-cooling system is pretty straightforward, but if you don't have the proper installation experience, your computer could end up being nothing more than a very expensive brick. Of course, you could always get a cooling kit, which could reduce the complexity of a water-cooling installation.

There are other options out there, such as thermo-electric components (TEC), but these come with an inherent problem: ice (actually, condensation). Cooling components today simply transfer heat away from the processor and into the surrounding environment, but TECs and other devices can actually cool a processor below the ambient room temperature, leading to water condensation (and possibly frost) building up on the motherboard (thus leading to a short).

How to Choose a Computer Case

Now that you've built the internals of your gaming computer, it's time to take a look at the most obvious external component: the computer case. Buying the right computer case can be an amazingly complicated task, especially if you don't have all of the facts about your system in front of you.

Before you purchase your perfect computer case, you'll need to know some information about your setup:

Motherboard form factor - this generally comes in ATX, although other variants will be available. Basically you just want to make sure that the dimensions of the motherboard (length x width) will fit inside the case. Since there are standard form factors, you just need to match the form factor up with the size the case supports.

Number of internal drives - while it's possible to extend the number of drives you can fit into a case, you're going to eventually reach a physical limit.

Aesthetics - part of the reason of building a gaming computer is to make it aesthetically pleasing. If you're spending a few thousand dollars on the machine, it might as well look nice, yeah? So, before you put down a few hundred dollars on a really cool looking case, make sure all of the components, like the DVD drive, will look good sitting in the case - there's no reason to have a beige DVD drive sitting in an all-black case.

Size - there's one thing you really should take into consideration before buying a computer case: how big the sucker is. There's no sense in buying a case that will not fit into the space you planned on putting it in.

Power Supply - many computer cases include a power supply, while others don't. If you're looking to save some money you should probably invest in a case that comes with a power supply; however, be sure to double-check the power rating on the included PSU. If the combined power of the components draws more power than the PSU can handle, then the computer isn't going to work.

How to Choose a Monitor

Selecting the right monitor for your gaming computer is vital to your overall gaming experience, but knowing how to choose the right one can be the difference between a terrible experience and a fantastic one.

If you're looking for information on LCD vs CRT monitors, stop looking. With LCD monitors as cheap as they are nowadays, there is no reason to go with a similarly priced CRT monitor (and you'll have a difficult time finding a CRT monitor to purchase).

LCD Problems

When you're gaming, you're generally pushing your system to its limits, and that's true of your monitor as well. When you push hardware to its limits you tend to run into some problems. Although most of these problems can be handled internally, any problems on a monitor are going to be visible which reduces your overall gaming experience.

There are two common types of problems presented by LCD monitors: tearing and ghosting.

Tearing is usually caused when your monitor is unable to refresh itself as fast as the video card is able to draw the graphics.

Ghosting occurs when an LCD monitor is able to keep up with the video card, but the monitor itself is unable to switch pixel colors fast enough, so the previous image appears to be drawn on top of the new image.

Both of these problems can be fixed by simple looking at the specifications of the monitor you're going to buy. By choosing a monitor with the lowest possible refresh rate (we recommend getting a monitor with a response time of 8ms or below) to can limit or eliminate both ghosting and tearing. Also, make sure that your monitor has a connector that your graphics card supports (in most cases the video card and monitor will both support DVI connectors, but make sure, just in case.