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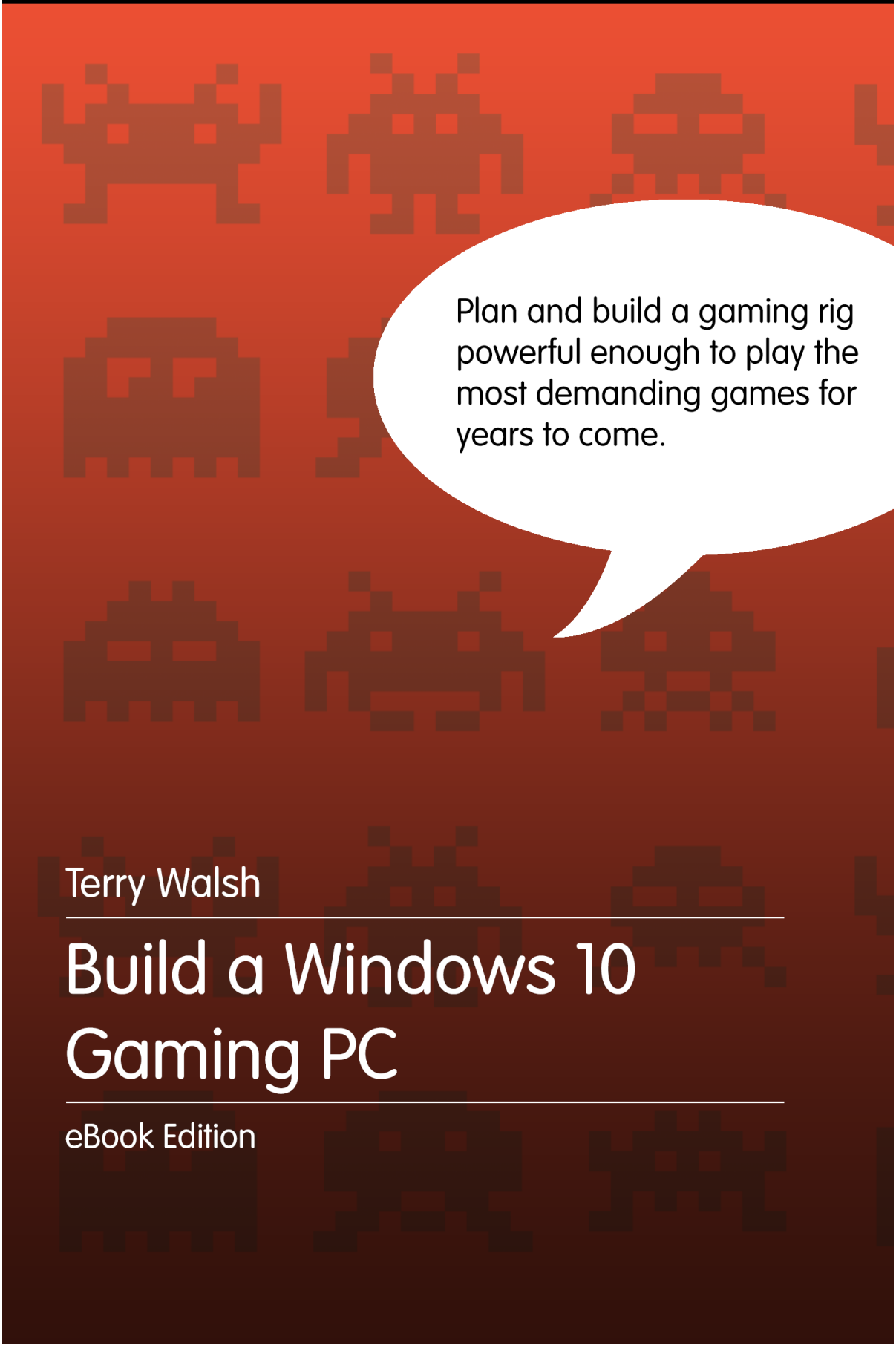

Terry Walsh

Build a Windows 10 Gaming PC

eBook Edition

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Terry Walsh is the Owner and Editor of We Got Served (http://www.wegotserved.com), which he established in 2007 to share his experiences with emerging home server platforms.

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Terry graduated from the University of Durham, UK in 1995 with a Bachelor of Arts in English Language and Literature. Prior to starting WGS, Terry cut his teeth online in 1993 building and operating successful alternative music websites and communities for international artists.

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Over the last four years, Terry has authored a wide range of Mac and Windows home server guides, including *Using OS X El Capitan Server at Home*, *Building a Windows 10 Home Server*, *Windows Home Server 2011 Step by Step*, *25 Essential Windows Home Server Projects* and *Building a Windows Home Theatre PC*. He has also edited a number of titles, including *Building a FreeNAS Home Server*, *Using Windows Home Server*, *25 Essential Windows Home Server Projects Volume 2* and *15 Essential Windows 8 Projects.*

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About We Got Served

We Got Served is a popular technology news and community site that was founded in February 2007. It is written, edited and moderated by a dedicated and knowledgeable team of technology enthusiasts around the world who are focused on bringing you the latest news, reviews, tutorials and support for the products you're using today and will be using tomorrow.

We created We Got Served as a place to learn about new technology, help readers make the most of the products and services they use, and most importantly to create a community where readers can learn, discuss and share their experience and knowledge with others in need of support. However you use the site, we hope you enjoy it.

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- Initial release

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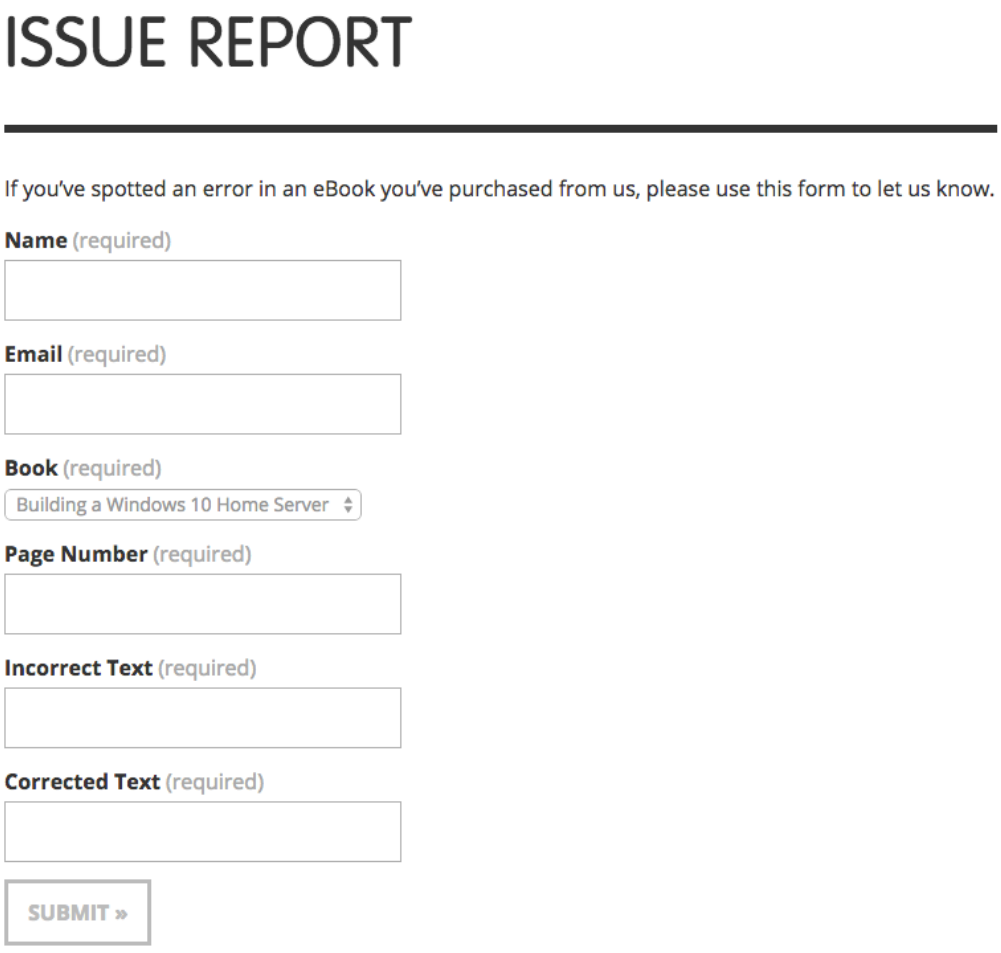
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Chapter 1:
So You Want to Build a Gaming PC?

PC sales may be slowing, as an ever-increasing number of mobile devices are sold around the world, but the PC Gaming industry continues to drive hardware innovation. The fastest, the latest and the greatest components all hit the gaming enthusiast market first, before trickling down into mainstream PCs. Whether you're an established gamer or simply passionate about the latest tech - it's a great time to build a Gaming PC!

We've featured a few PC builds at We Got Served (http://www.wegotserved.com)– mostly mid-range machines, targeted at home media server/HTPC use. But I've been itching to put together a Gaming PC for some time – a budget-blasting, high-octane racer that'll chew up and spit out any AAA game in 2016 and for a good few years beyond!

Today, we'll begin that journey – but rather than dive straight in and rattle through the build, straight away, let's talk through the planning process, before we get hands on with the kit. A new PC build presents a great excuse to talk through the latest technologies and components that have reached the marketplace. Whether you're a gamer, or simply interested in getting up to speed with the latest developments on the PC front, I hope you'll find this book of interest – and of use, of course! Many of the technologies I'll be talking through are as relevant to desktop PCs, home theater PCs and home servers as they are to gaming rigs – although there's going to be much more horsepower employed (alongside some unavoidable LED lighting, I fear) on this project!

Given this is a "how to" guide, I'll be talking through the concepts in my usual, step by step way. I'm not going to assume any advanced knowledge, to ensure no-one is left behind! If you're bamboozled by the prospect of liquid cooling, overclocking and you're in fear if getting your FPUs and your GPUs mixed up, I'll ensure that this is the guide for you!

Planning Your Extreme Gaming PC Build

Of course, anyone that has put together a PC build – any PC build, really – knows that you can't just head to the nearest big box electronics store and buy the first bits you see on the shelves. The first stage of a PC build – the planning – is often the longest to complete and for good reason. Without a clear plan and budget in mind, it's so easy to spend a healthy chunk of money on kit that isn't going to be suited to your needs – or even worse, resulting in a severely overpowered or underpowered PC with components that may need to be quickly replaced.

Defining the Goal

Before you even get into researching the components that will comprise your gaming PC, it's a really good idea to start out with a goal. You'll find that many people will advise you to start with a budget. Obviously, cash is a vital consideration but until you're clear on what you want to do with the PC, it's almost impossible to make the compromises you'll inevitably be faced with. Sure, you want to end up with a PC that can be used for gaming, but let's break that down: what kind of games are you seeking to play and at what kind of quality?

Unlike a games console, like the PlayStation 4 or Xbox One, where your gaming experience is pre-set, there's far more flexibility available in PC gaming. As you'd expect, many of the latest games run at their best on the latest hardware, but you can achieve good results on many games with older, less powerful kit.

Build a shortlist of games you'd like to play and then check out the minimum and recommended system requirements – they'll usually cover **Operating System**, **Processor**, **GPU (Graphics Processing Unit)**, **RAM**, **Storage**, **DirectX version** (Microsoft's Windows gaming APIs) and **Input requirements** (mouse and/or keyboard).

As an example, let's take a look at a recent game, *Rise of the Tomb Raider*. Its minimum specs are as follows:

Rise of the Tomb Raider Minimum Requirements

- OS: Windows 7 64 bit
- Processor: Intel Core i3-2100 or AMD equivalent
- GPU: NVIDIA GTX 650 2GB or AMD HD7770 2GB

- RAM: 6GB
- HD Space: 25GB
- DirectX: DirectX 11
- Input: Mouse & Keyboard

These are reasonably moderate specs for a modern, top-class game, but note that they're classed as *minimum* for the game to run. Of course, what this spec list doesn't tell you is the *quality* at which the game will run.

I'm paraphrasing here, but you'll generally find that "quality" in the gaming world is expressed in two currencies: **Frames per Second (FPS)** and **Resolution**. Simplistically, the "best" experience is a combination of the highest FPS achievable at the highest resolution. Run a game at 60 FPS at a display resolution of 2560 x 1440 and you're doing really well. It's also going to require more powerful hardware than the specs you see above – a GPU such as an **NVIDIA GeForce GTX 980 Ti** or, for 1080p resolution, a slightly cheaper **GTX 970**. To put the difference into financial terms, a typical **NVIDIA GTX 650** graphics card (the minimum specification listed here) will cost you just over $100 today. An NVIDIA GeForce GTX 980 Ti? Around $700. It's a *leap*.

If your plan is to focus on older games, then you don't need to spend your money on bleeding edge GPUs. An hour or so's browsing over at Steam will help you roughly shape out a target specification and a ballpark budget.

Valve's popular Steam online games repository is a great research resource.

If you're building a supremely powerful PC, then its potential is far greater than just gaming. Serious processing power, graphics capabilities and a hefty case that can hold oodles of storage? Say hello to your new video editing suite, photo tweaking lab, audio recording studio and Blu-ray movie archive! Once you've made the decision to go large, the opportunities are limited only by your imagination. An extreme gaming PC should be able to handle most workloads, but think through your needs to ensure you choose the right kit for the job(s).

Of course, it's not just about internals. When considering your hardware, you should also think about your **environment**. Where are you going to place the PC and how much space is available? High-powered PC components tend to generate heat (lots of it) and if you're tight for space – say, if you wanted to cram the PC near the TV in your AV cabinet – you're going to need a case and components that maximize cooling.

Put simply, smaller cases are better suited to more humble specs, while the most powerful rigs need space to breathe. The marvel of modern games consoles like the Xbox One and PS4 are that they manage to cram some serious horsepower into such compact cases.

More cooling can often (but not always) result in greater noise output from the PC – you may have hooked up your rig to an incredible surround sound system, but if all you can hear are cooling fans, you're going to be frustrated pretty quickly. So-called "silent" components – cases, fans and other cooling kit – can help, but heat and noise should be primary considerations when you're thinking through your build.

Of course, key for many gamers (but not necessarily this one) is **aesthetics**. Like the hot-rod tweakers of days gone by, there are a lot of PC builders out there seeking beauty, alongside brains and brawn! The current trend is for colored LEDs to appear almost everywhere – inside and outside the chassis, with windowed cases enabling assemblers to showcase their builds. It's not just about illumination either – matching components, in terms of color as well as brand, helps create an overall aesthetic that can quicken the pulse. If you're so inclined.

Also important to consider are supporting elements such as **networking**, **audio** and **input devices** – mice, keyboards and other controllers – which will complete your gaming experience. The cost of these items can quickly add up.

If your head is starting to spin, don't worry, each chapter of this book will walk carefully through each of the hardware categories. I'll share my planning as I work through the specs for my own gaming PC, which I'll be building later in the book.

For an introductory chapter, I'm in danger of diving into the detail, so I'll summarize as follows: **don't spend any money until you have a plan**. Your plan starts with a goal and some objectives, which is then translated into a shopping list. Agree what's important, where you're flexible and where you most definitely aren't. Define a budget and do your very best to stick to it!

I'm looking forward to getting started on my own plan and working through the options. I hope you'll enjoy the journey too!

Chapter 2:
Selecting a Powerful GPU

We start our guide to building a Gaming PC with a deep dive into perhaps the most important system component. No, it's not the main processor – we'll come to that very soon. In fact, the most vital element in a modern gaming PC is the GPU (or Graphics Processing Unit, to be formal).

Rewind the clock a few years and the CPU would certainly be the most expensive component you'd purchase for a self-build. Today, the **graphics card** has taken that crown. Sure, both Intel and AMD have dramatically ramped up the integrated graphics capabilities of their processors – to the point where they'll happily run older games and retro classics without the need for additional support.

But for modern games, where the PC needs to throw around millions of polygons simultaneously, it's going to need some help. That help comes from the **GPU** – specialized hardware which is focused on image processing.

Dedicated graphics cards connect to the PC's motherboard via the **PCIe** (PCI Express) slot, so they can be installed and upgraded with relative ease. To keep your PC's graphics capabilities at the bleeding edge (or at least, reasonably sharp) you can expect to upgrade your graphics card every couple of years, for best performance. Of course, you can sell on older cards via eBay and other sites to recoup some of the investment – there's a thriving after sales market for graphics cards.

For seriously extreme performance, you can choose to run multiple GPUs simultaneously, with significant horsepower devoted to drawing and animating images on a single screen. This feature is known as **CrossFire** on AMD Radeon graphics cards and **SLI** on NVIDIA GeForce cards. You'll obviously need a decent sized case, a motherboard with the appropriate dual connectors and sufficient cooling to keep this type of setup stable. Alongside a fat wallet!

As a convenient alternative to a massive desktop chassis, an external GPU solution may be of interest. A few manufacturers have dabbled with add-on peripherals housing graphics cards, with limited success. They're ideal for slimmer notebooks where you want to combine portability with power. After a long day at work, pull out the notebook, slot in the connector and game on!

The Razer Core external GPU dock.

The **Razer Core** is a modern take on the external graphics dock. Connecting to a newer laptop over Thunderbolt 3 (like the accompanying **Razer Stealth**, although other PCs may well be compatible, as long as their support Intel graphics switching in the BIOS), there's sufficient space for twin graphics card processing with the results fired back to the PC at 40 Gbps). The Razer Core is shipping in the first half of 2016.

Finding the right graphics card for your needs involves working through a few layers of decision-making. Certainly, the more money you spend, the more power (in terms of higher specs) you'll receive – it's an old adage, but it works. That said, with a vast range of GPUs available on the market today, you'll need some shortcuts to help you narrow down the choice. Here's my take:

NVIDIA or AMD?

Most GPUs are built (and tweaked) by third-party manufacturers, from reference designs created by NVIDIA (labeled GTX xxx) and AMD (Radeon R9 and R7 xxx). Simplistically, a graphics card includes the graphics processor itself (comprising a large number of processing cores) plus a reasonably healthy slab of memory (also known as RAM or VRAM). A dedicated cooling solution, often fans combined with a heatsink and/or heatpipe is employed to dissipate heat from the processing unit.

Importantly, selecting the best graphics card is not just about the hardware specs – driver support has to be top-notch too, to ensure stable performance with a large library of games.

You can spend from $100 up to $1000 (the NVIDIA GeForce Titan X) on a graphics card and you'll most likely find the AMD and NVIDIA designs duking it out for dominance. Hardware costs will vary dependent on the processing power the card is equipped with and the amount of dedicated RAM available to support.

At the time of writing, the ranges broadly compete as follows:

AMD	NVIDIA
High-end ($200-$1000)	
	GeForce Titan X
Radeon R9 Fury X	GeForce GTX 980 Ti
Radeon R9 Fury	GeForce GTX 980
Radeon R9 390X	
Radeon R9 390	GeForce GTX 970
Radeon R9 380	GeForce GTX 960
Mid-range ($100-$200)	
Radeon R7 370	GeForce GTX 950
Radeon R7 360	GeForce GTX 750 Ti

The split between High-end and Mid-range cards is subjective – don't sweat the split too much! I'm working here on the basis that a "budget" GPU equates to integrated graphics on the processor.

You may well have a (rational or irrational) brand preference already when it comes to AMD and NVIDIA, but it's always worth comparing specs, benchmarks and – importantly – online reviews of current driver performance before pulling the trigger.

Checking the Specs

Breaking down the specifications, the graphics processor (called **Maxwell** in NVIDIA's current architecture, competing with AMD's **Radeon**) will be quoted with a number of **cores** (look for Stream processors on AMD specs and CUDA cores on NVIDIA cards). The processor runs at a **base clock speed** with a **temporary boost clock speed** available if temperature conditions allow it.

The onboard RAM may also be quoted with a **clock speed**, **memory speed** and/or **memory bandwidth**. While higher-end cards ship with more RAM, be sure to note the type of memory used in the

card and its bandwidth. The latest cards use **GDDR5 memory**, which delivers far higher bandwidth than GDDR3 RAM, for example, that may run at the same clock speed. Obviously, more is generally better in terms of performance, but just like CPUs, faster generally means hotter, so cooling is critical.

Another important spec to check is the **power requirement** – this will be quoted as a **TDP wattage (Thermal Design Power)** figure. In GPUs, TDP is the maximum amount of power the cooling system needs to dissipate in order to keep the chip at or below its maximum temperature.

Other specifications you may see quoted include **Texture Fill Rate** – usually quoted in **GigaTexels per second** (texels are textured picture elements) – which is the number of texels the GPU can render. For example, the NVIDIA 980Ti has a Texture Fill Rate of 176 – that's 176 billion texels per second (for more on texels, check out this detailed guide).

Of course, outside of these granular processing specs, you should be checking the display resolution available (with at least 1920 x 1080p on offer, with 2560 x 1440p and higher preferred on a high-spec card), display connectors supported (with a choice of **Dual Link DVI-I**, **HDMI 2.0** and **DisplayPort 1.2** featured on the most powerful cards) and multi-monitor support if you're seeking to tile displays.

As you're going to be slotting these cards into some kind of case, their **physical dimensions** are a critical consideration. Not only will you need to fit them into the case, using the PCIe slot on your motherboard, you'll need to ensure there's sufficient ventilation space around them to allow heat to dissipate. You should expect height and length dimensions to be quoted, but be sure to check width too. High specification graphics cards will be quoted as single or dual slot/width. Single slot refers to a low profile card that occupies the space of a single expansion slot on the rear of your PC. The large coolers and/or fans that are fitted to powerful GPUs often lead them to be classed as dual slot or dual width, meaning that they'll occupy the space of two expansion slots.

A dual-width GPU will take up two expansion slots on the rear of your PC.

As I mentioned in the introduction to the series, most games manufacturers will quote minimum and recommended specifications, which will include GPU models. Sometimes, the specs will only reference an AMD or NVIDIA GPU – bear in mind this is more about marketing tie-ups than compatibility. The equivalent AMD/NVIDIA GPU should offer similar results, but be sure to check out game reviews for specific benchmarks – there can sometimes be surprising variations on FPS (Frames per Second) speeds at different display resolutions.

Before I talk through my pick, a couple of great links to check out comparing AMD and NVIDIA specifications and performance. PC Gamer has a mid-2015 comparison of graphics card specifications, generally favoring the NVIDIA Maxwell GPU over AMD's offer. Meanwhile, Kotaku (via Techspot) has an exhaustive suite of benchmarks, comparing performance across the range. You can see, at the

top-end, how performance varies by game and by resolution – what's clear though is the difference between the more expensive cards (of whatever brand) vs cheaper options. You get what you pay for when it comes to GPUs – just be clear on what you need.

Choosing a Manufacturer

I mentioned earlier that AMD and NVIDIA develop reference designs that are then built by third-party manufacturers – often, but not always, with additional tweaks and features. You'll have heard of many of these guys. **ASUS**, **EVGA**, **MSI**, **Gigabyte** and others all offer a wide range of AMD and/or NVIDA cards with proprietary features. They include overclocked processors, enhanced cooling options, premium components supporting better build quality (no-one likes a bent GPU) and styling enhancements, such as lighting and various material finishes. Also popular are software tweaking applications that allow easy overclocking and customization.

ASUS' GPU Tweak II app allows easy tweaking and game recording.

Again, you may have a specific brand preference, but once you have a rough idea of the GPU model in mind, a browse through the manufacturer sites listed above will help you better understand the options available.

My Choice: ASUS STRIX GTX 980 Ti

Having spent some time researching the marketplace, I opted for the **ASUS STRIX GTX 980 Ti** for a powerful Gaming PC. It's not the most expensive, or highest performing card available on the market today (that'd be the insanely priced **NVIDIA Titan X**, which will set you back over $1000) but at $670, it's a serious piece of kit that'll last you a good few years.

The powerful ASUS STRIX GTX 980 Ti GPU.

I have to admit to some brand bias here – I've always built with ASUS components, where possible, and to date they've never let me down. Sure, sometimes driver support is a little spotty, but the build quality is usually excellent and I've found their motherboard tweaking apps and BIOS firmware to be really powerful, yet easy to use. I can tell you now that bias may well bleed into my motherboard choice too.

Let's talk through the ASUS STRIX GTX 980 Ti and I'll highlight the features from both NVIDIA and ASUS that make it a great choice for any powerful Gaming PC.

Overclocked Performance

NVIDIA's reference graphics card design for the GTX 980 Ti defines 2816 CUDA cores, a base clock speed of 1000 MHz and a boost clock speed of 1050 MHz. The standard ASUS STRIX GTX 980 Ti (STRIX-GTX980TI-DC3-6GD5-GAMING) delivers that with a slightly enhanced boost clock speed of 1075 MHz. However, ASUS offers a factory-overclocked version of the card (model: STRIX-GTX980TI-DC3OC-6GD5-GAMING) that ups this to 1190 MHz/1291 MHz in its default mode, with an additional boost to 1216/1317 MHz in OC Mode. That's the model we'll be using in our build. Impressively, overclocking ensures the ASUS STRIX GTX 980 Ti can reach speeds that are over 10% faster than the reference NVIDIA Titan X – at a much cheaper price.

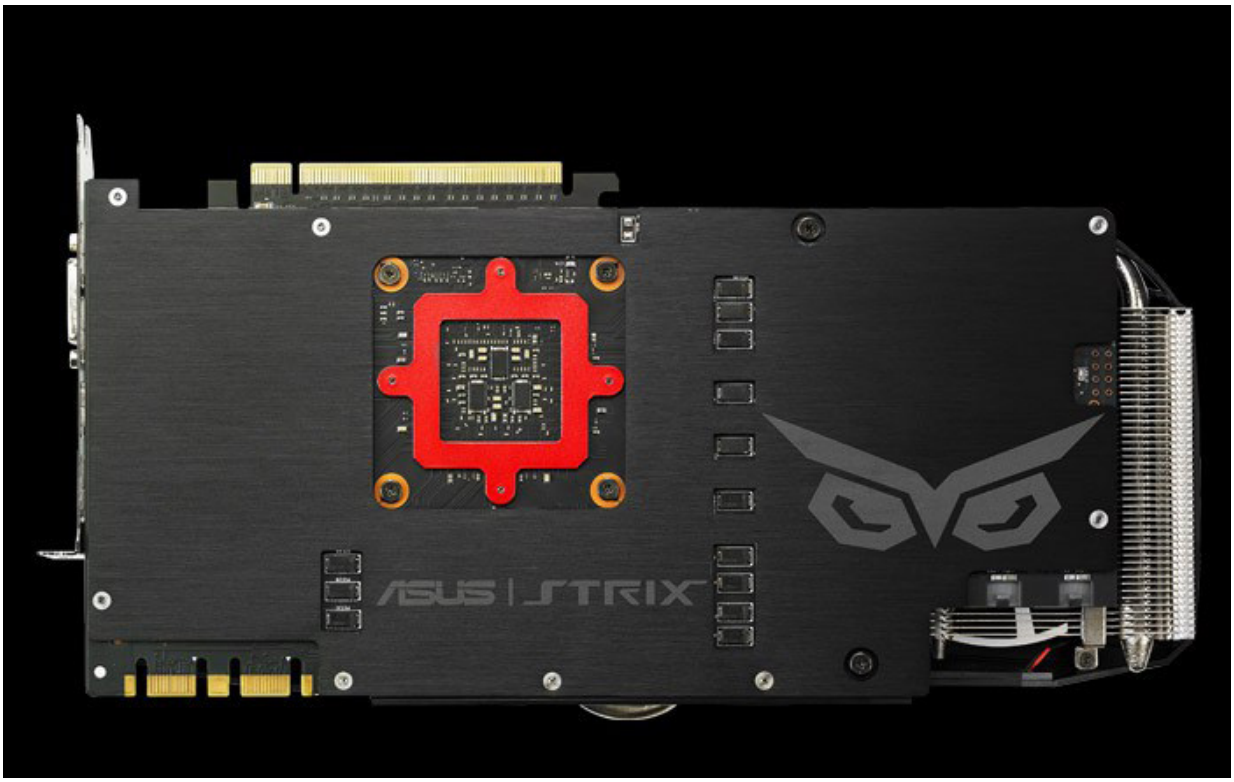
6 GB GDDR5 RAM is equipped with a clock speed of 7200 MHz – that's a 200 MHz boost over the reference. Maximum resolution is 4096 x 2160 – that's 4K, but we'll most likely need to tweak graphics qualities in games to get acceptable frame rates at the highest resolutions.

Connectivity is strong, with DVI-I, HDMI 2.0 and three Display Port sockets available to hook up. If you felt the need, you could combine up to four GTX 980 Ti cards in a multi-GPU SLI configuration.

Enhanced Cooling

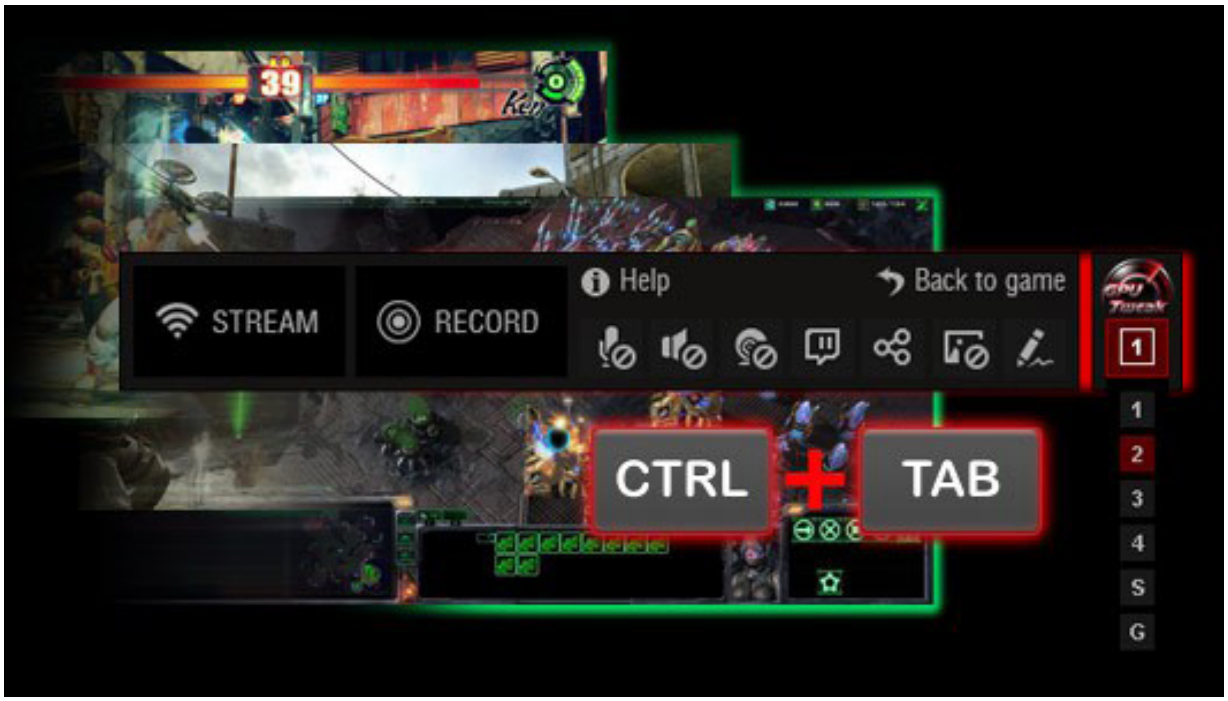
That is, if you have the chassis space! The ASUS STRIX GTX 980 Ti is a dual-slot graphics card with a custom cooling solution that ASUS uses on a number of models. They call it (breathe-in) **DirectCU III with Patented Triple Wing-Blade 0dB Fan Design**. The DirectCU III cooling technology features two 10 mm heat-pipes that are in direct contact with the GPU. ASUS says this transports 40% more heat away from the GPU and achieves up to 30% cooler gaming performance than reference designs. The three Triple Wing-Blade 0dB Fans allow air flow to be maximized. 0dB? Well, they're not exactly silent when running at full-tilt, but the fans are only powered on when required, so you can work, stream media or play older games with no GPU fan noise whatsoever.

ASUS are shouting loudly about their manufacturing processes and materials quality on the STRIX line. The STRIX GTX 980 Ti is strengthened with a backplate to prevent bowing, while the GPU itself is supported by a STRIX GPU-Fortifier, reducing physical stress. In terms of manufacturing, ASUS boasts that premium components enhance efficiency, reduce power loss, provide 2X reduced component buzzing while under full load, and achieve thermal levels that are approximately 50% cooler than previous designs.



Tweak Like a Pro

Like ASUS' motherboards, the GPU ships with a software application that can be used to easily configure settings. It's called (breathe-in again) **GPU Tweak II with XSplit Gamecaster** and combines easy setting of clock speeds, voltages and fan performance (in-game via an overlay or a dedicated app window) with a gameplay streaming or recording feature.



ASUS' GPU Tweak II application.

Preset modes – OC, Gaming and Silent allow simple profile switching, while more advanced options allow you to turn off Windows visual disable OS services or processes and defrag the PCs RAM. Manual controls allow you to twiddle away to your heart's content.

Essential app or marketing blather? Possibly both, but we'll find out! Add some pulsating LED lights (whatever floats your boat) and you've got one decent looking graphics card.

NVIDIA GeForce Experience

Of course, other manufacturers will offer their own proprietary features, but all will benefit from goodies delivered in the NVIDIA reference design.

The card supports Microsoft's **DirectX 12 API** suite, enhancing gameplay with new visual effects and rendering techniques including V**olume Tiled Resources, Conservative Rasters, Raster Order Views, Tiled Resources, Typed UAV Access, Bindless Textures, and Async Compute**. Importantly, alongside the additional effects boost, processing efficiency is improved, allowing optimized DirectX 12 games to run faster on the hardware.

There's support for **Dynamic Super Resolution (DSR)**, which renders a game at a higher (4K) resolution before shrinking the result back down to your monitor's native resolution, enhancing image

quality on 1920 x 1080 and 2560 x 1440 monitors. AMD call their version of the technology **Virtual Super Resolution (VSR)**. **Multi-Frame Anti-Aliasing (MFAA)** improves anti-aliasing on Maxwell GPUs with programmable sample positions for rasterization. For improved display performance, NVIDIA's **G-Sync** technology (on compatible monitors) synchronizes display refresh rates to the GPU, eliminating screen tearing and minimizing display stutter and input lag. AMD has a similar feature, which is called **FreeSync**.

Drivers are often the bane of a gamer's life. NVIDIA offers an app called **GeForce Experience** that automatically notifies you of new driver releases and supports a one-click update, ensuring you'll be running the latest and greatest drivers for the GPU.

There's also a library of tweaks available for a long list of games, allowing easy settings configuration to optimize graphics performance. **NVIDIA ShadowPlay**, like ASUS' XSplit Gamecaster, supports easy gameplay recording as well as broadcasting to **Twitch**. If you're jealous of the Xbox One's ability to stream games to your Windows 10 PC, you can (almost) turn the tables by streaming games from the PC to an NVIDIA Shield console, in 1080p and 4K.

Alternative Options

If you're lusting for an AMD graphics card in a similar class, then the **ASUS STRIX R9 Fury** ($569) and **ASUS R9 Fury X** ($669) are your go to cards, offering similar ASUS-developed features.

If you're happy to drop down a class to save some budget, then check out the **ASUS Strix GeForce GTX 980** ($520) or ASUS Strix GeForce GTX 970 ($340).

That completes my rundown of GPU options. I'm really excited about checking out what the ASUS Strix GeForce 980 Ti can do! In the next chapter, we'll take a look at the other big slab of expenditure for our Windows 10 Gaming PC – the CPU.

Chapter 3:
Choosing the Right CPU

In the last chapter, I walked through the features to look for in the most expensive element of the build – the GPU. While a decent Graphics Processing Unit can take a significant amount of stress off the PC's main processor, a super-fast and flexible CPU ensures you can run the latest games at the highest resolutions.

Importantly, investing in a powerful processor will pay off by lengthening the time required until it needs replacing – especially if it can be **overclocked**.

Overclocked? Let me explain. You'll probably be aware that processors run at a certain **clock speed**. The clock speed, usually expressed in Gigahertz (GHz), is set during the manufacturing process to perform a certain number of operations per second. However, on some processors, you have the ability to increase that clock speed via the clock multiplier (the ratio between the CPU and the computer's front side bus) to force a faster operation.

The result? A faster PC, but – and this is important – a hotter PC, as well as the risk of instability (and potential damage to the CPU) if you push the CPU too far. If you're considering overclocking a processor, you'll need to ensure you've got adequate cooling onboard – potentially a water-cooled radiator, rather than a stock air cooler – and you should start small, nudging speeds slowly higher. More on this later in the series.

Not every processor can be overclocked, although up until a few years ago, you could push many CPUs a little further. However, Intel began locking their chips a few years ago, introducing a top-tier "K series" of processors, with unlocked clock multipliers, specifically for the gaming enthusiast market.

In truth, on modern systems, it's more likely that the GPU becomes the bottleneck on a gaming system – rather than the main processor – but overclocking remains a useful tool in the gamer's arsenal on big-budget systems.

AMD or Intel?

While AMD and NVIDIA have historically battled for GPU dominance, in the CPU arena it's AMD and Intel that are the big players. **AMD's FX series** can be considered a value performer, with four and eight core processors available at prices under $300.

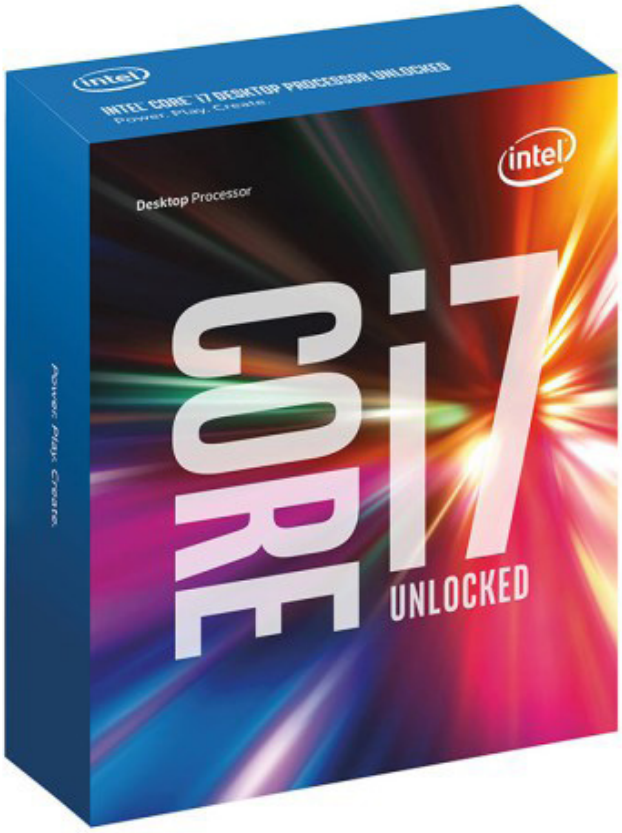
The top of the range **AMD FX-9370** is an octa-core processor with a clock speed of 4.4 GHz. It's fully unlocked with speeds up to 5 GHz a real possibility, courtesy of AMD OverDrive technology and AMD Catalyst Control Center software suites. To take advantage of this CPU, you'll need a 990FX motherboard (like the ASUS Crosshair V Formula-Z, GIGABYTE GA-990FXA-UD7 and ASRock 990FX Extreme9) with an AM3+ CPU socket.

The AMD FX processor.

Moving down the range, the $160 **AMD FX-8350** is another AM3+ processor with a slightly lower standard clock speed (at 4.0 GHz), but with the right cooling, can be overclocked to approach speeds of its more expensive cousins. Note that both of these processors run quite hot, with TDPs of 200w and 125w respectively, so if you decide to go down the AMD route, you'll certainly be able to pick up a great value processor but be sure to focus on cooling and air flow when you get into the build.

However, Intel has generally dominated the upper echelons of the gaming enthusiast market with the **Intel Core i7 "K Series"**. The latest Intel Core family, the 6th Generation "Skylake" series, may well offer less processing cores and, on paper, slower clock speeds than AMD competitors but for modern gaming rigs, they're almost a de facto option.

They support up to 64GB DDR4 RAM, which runs at higher speeds with lower voltage than the older DDR3 equivalent. For those seeking a wider range of applications alongside gaming, media playback is enhanced with integrated support for HEVC, VP8 and VP9 on the **Intel Core i7-6700K** and **Intel Core i5-6600K**. Intel Quick Sync video encoding support dramatically accelerates background encoding jobs so there's a strong array of features for gamers, media professionals and enthusiasts alike.



Intel's Core i7 K Series processors offer overclocked performance.

The company positions the Intel Core i7-6700K and Intel Core i5-6600K as the processors designed for serious gamers. They differ, of course on price, with the Intel Core i7 weighing in at $420 and the Intel Core i5 at $260. The extra cash provides a higher standard clock speed (4 GHz vs 3,5 GHz), Turbo Boost clock speed (4.2 GHz playing 3.9 GHz), increased cache memory (8 MB vs 6 MB) and processing threads (8 plays 4), plus there's Hyper-Threading support on the Core i7, which isn't available on the Core i5.

That said, if you're on a budget, the additional features found on the Intel Core i7 may not provide much of a boost in gameplay, although there's a win in more general purpose computing terms for media encoding, graphics rendering and other CPU-intensive jobs. The Intel Core i5-6600K is a great all-rounder and, as it's a K-series processor, can still be overclocked for an additional boost. Importantly, both processors run at TDP of just 91 w, which is still hot for a processor, but these are processing beasts with a significantly lower profile compared to AMD's CPUs.

The other option for a cost saving is to go with a standard, locked processor. The Desktop Series **Intel Core i7-6700** and **Intel Core i5-6600** are available for $360 and $230 respectively, with all of the same features as their gaming-focused siblings, with the absence of overclocking. Unlike K Series CPUs, they also ship with a CPU heatsink and fan – gamers setting their sights on Intel's top-tier will have to budget for a standalone cooling solution for the CPU.

When you investigate the benchmarks, of course, more expensive processors deliver "better" results, but in an age where GPU bottlenecks are more likely to restrict gaming than CPU performance, there are very solid options to suit most build budgets.

I'd certainly recommend taking a hard look at the Intel Core i5-6600 and 6600K as a starting point, and nudging up if you feel you need the extra performance boost.

What About the Games?

Of course, before you pull the trigger on your selected processor, it's worth taking a look at a range of games to understand their minimum and recommended processing specifications. Here are a few of the latest titles, selected at random, with the developer's minimum and recommended CPU specifications.

Game	Minimum CPU	Recommended CPU
The Division	Intel Core i5-2400 | AMD FX-6100	Intel Core i7-3770 | AMD FX-8350
Fallout 4	Intel Core i5-2300 | AMD Phenom II X4 945	Intel Core i7 4790 | AMD FX-9590
Rise of the Tomb Raider	Intel Core i3-2100 or AMD equivalent	Intel Core i7-3770 or AMD FX-8350
Just Cause 3	Intel Core i5-2500K | AMD Phenom II X6 1075T	Intel Core i7-3770 | AMD FX-8350
Batman Arkham Knight	Intel Core i5-750 | AMD Phenom II X4 965	Intel Core i7-3770 | AMD FX-8350

Certainly, you should be OK with a decent AMD processor for the latest games, while opting for an Intel Core i7 will give you maximum headroom. The Intel Core i5 option is a great middle ground and perhaps the sweet spot for many.

My Choice: Intel Core i7-6700K

"Go big or go home" the saying goes, and while I'd personally recommend the Intel Core i5 as offering better value, I'm personally in the market for a powerful Gaming PC. The Intel Core i7-6700K certainly takes away any concern about running the year's biggest and best games (as well next year's) and the unlocked CPU will give us plenty of scope to discuss cooling and overclocking later in the book. More broadly, the processor offers outstanding processing performance across a wide range of applications, which will be more than useful on other reviews and features.

In the next chapter, I'll be choosing a motherboard to pair up with my chosen GPU and CPU.