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Guy Cocker

JUST BUILD IT

HANDS DOWN, no question, the RTX 4070 Super is the pick of Nvidia's updated GPU range. It's 15 to 20 percent quicker than the OG 4070 for exactly the same money. Yes, yes, the vanilla RTX 4070 has had a $50 haircut, and now has an MSRP of $549 to the RTX 4070 Super's $599, but that price gap is less than 10 percent. Do the math, or just read Zak's review on page 74.

While we're talking 4070 Supers, you won't be surprised that our former head honcho, Zak, has slotted one into the heart of this month's sleek and sinister build, starting on page 16. To match the moody all-black attire of the 4070 Super Founder's Edition card, Zak has gone for a minimalist and monolithic stealth vibe, courtesy of the Hyte Y40 mid tower case, plus Noctua Chromax Black fans and CPU cooler to suit.

Add the virtually pure-black Gigabyte X670 Aorus mainboard and Corsair's equally ominous vengeance DDR5 sticks, and you have a veritable dark destroyer that sucks in light like a singularity. It's interesting to see this rig topping last issue's build based on the regular 4070 by up to 18 percent in games. Okay, we'd like the RTX 4070 Super to be cheaper still, but Nvidia's GPU pricing is moving in the right direction at last.

Consequently, this isn't a monster money machine. It all comes in at a whisker over $2,000, also thanks to a relatively modest AMD Ryzen 5 7600X CPU, and the fact that the price of most components has now normalized after years of abnormal inflationary pressure. $120 for 32GB of fast DDR5 memory and $150 for a quality 2TB SSD are testament to that.

Speaking of PC builds, Zak's gone full-on forensic from page 44 with the first half of a two-part guide to everything you need to know to become a master PC builder. From air cooling to air pressure and SSDs to CPU installation, Zak's Ultimate PC Build Guide is an absolute goldmine of tips, tricks, clever tools, and exactly what *Maximum PC* does best: building PCs. Don't miss part two next month.

Rounding out our buildtastic coverage this issue is Nate Drake's guide to building a sustainable, energy-efficient PC. Before you think that sounds a little too worthy, building a green PC can save you money in the long run. More efficient PCs tend to be more reliable, and can actually be faster. Find out more from page 64.

In our tutorial section, we lift the lid on seed boxes, have a handy guide to using a Stream Deck, and navigating files using just the command prompt. I've also condensed my recent visit to CES into a 10-page roundup from page 32. Reviews-wise, aside from that RTX 4070 Super, we've got what might just be the best gaming laptop yet from Lenovo, plus we review two new PCIe Gen 5 SSDs from Crucial and Gigabyte, and build our own keyboard with the Ducky ProjectD.

As if that's not enough, we also have our very first look at LG's second-gen MLA OLED panel tech, courtesy of the Asus ROG Swift OLED PG34WCDM. At 1,300 nits peak, it's the brightest OLED panel ever in a PC monitor. Can it close the gap to Samsung's QD-OLED technology for all-round performance and image quality? Turn to page 82 to find out.

Enjoy the issue!

Guy Cocker

Guy is Maximum PC's *editor-in-chief. He built his first gaming PC in 1997 to play* Tomb Raider *on 3dfx, and has been obsessed with all things PC ever since.*

↘ submit your questions to: editor@maximumpc.com

THE NEWS

AMD confirms Zen 5

Intel will fight back with Arrow Lake

THIS TIME of the year, companies often put on a show for investors. For AMD, that means official confirmation that we'll be getting Zen 5 consumer PC processors in 2024 with the Ryzen 9000-series. Not exactly a surprise, but it is good to know that plans are on track. Rumor had it that we would get the first models as soon as April, with the V-Cache variants following in the fall. That now looks optimistic. At the event, AMD representatives confirmed a launch in the second half of the year.

Zen 5 is expected to be a fairly major redesign of the Zen 4 architecture rather than a respin, with better branch prediction, more L1 data cache, and six rather than four ALUs per core, plus other tweaks. It'll use the AM5 socket, and follow the same basic configuration, with either one or two Core Complex Dies (CCDs), each with eight Zen 5 cores using TSMC's N4 process. If past form and current expectations pan out, we are looking at an IPC gain of between 10 and 15 percent, but some sources claim as much as 30 percent. We will also see APU versions this year, with RDNA 3.5 integrated graphics with up to 40 Compute Units, which equates to the performance of a Radeon RX 6750XT. Those sound sweet.

AMD hasn't finished with its existing Zen 4 architecture, though. It has four new 65W desktop APUs based on the Phoenix chip already seen in laptops. The top model is the Ryzen 7 8700G with eight cores, and Radeon 780M graphics (768 shading units, 12 CUs, and ray tracing units), yours for $329. There are two six-core chips, the Ryzen 5 8600G, and 8500G, with either 760M or 740M graphics. These will be $229 and $170 respectively. AMD hails these APUs as having the fastest integrated graphics in the world. In practice, it's looking roughly 30 percent faster than the old 5000-series APU in early tests, and something of a bargain, offering decent 1080p gaming with no card. The top two models also feature integrated AI hardware, an NPU unit capable of 16 TOPS.

If you're sticking with an AM4 platform then AMD has a treat: a new V-Cache chip, the Ryzen 7 5700X3D. It's like the 5800X3D, but only $249. It has the same eight cores, with a fat 96MB of L3 cache on top. The base clock is 3.0Ghz, and the maximum boost is 4.1GHz—both a tad slower than its big brother. It may be on last season's platform, but that cache still works, as early tests have it hammering an Intel Core i5-13600K. Alongside this are three other new 5000-series AM4 chips aimed at the budget gamer.

Meanwhile, Intel also has a busy year. For a start, we have the all-new Arrow Lake processor, the next big generation of desktop chips. It's a tile-based design mixing performance and efficiency cores, as Meteor Lake does in laptops. The big news is that Arrow Lake brings Intel's new 20A process, too. It'll also include AI hardware, something Intel is keen to point out. Arrow Lake supposedly has about three times the AI grunt of Meteor Lake. Intel CEO, Pat Gelsinger, claims this will double again when Panther Lake surfaces in 2025.

Engineering samples with 24 threads have been spotted with eight Performance and 16 Efficiency cores, so Arrow Lake will be dropping HyperThreading from its Performance cores. All this sits in a new LGA 1851 socket with DDR5 memory support up to DDR5-6400, marking the end of the line for DDR4 on Intel systems. Yet another new mobile CPU, Lunar Lake, is also in the wings. A new ground-up mobile design, it's slated to introduce Intel's 18A process. If Intel manages both launches, it will have delivered on its multi-node roadmap.

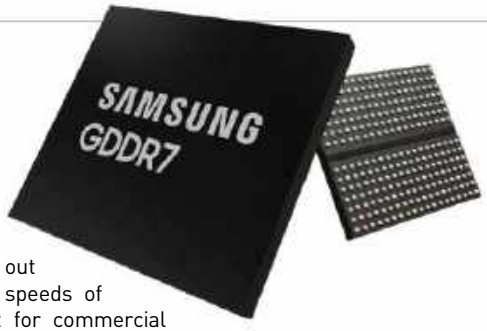
Rumor has it that Intel will keep support for its existing LGA 1700 platform, too, with more Raptor Lake refreshes for LGA1700 systems—a refresh of a refresh, if you will. Not much is known about these chips, codenamed Bartlett Lake, but if released, they will offer a budget-friendly alternative to Arrow Lake, with an emphasis on gaming. Intel has drawn fire for being too quick to drop CPU sockets, not helped by AMD's AM4 platform lasting for so long. That first appeared in 2016, while LGA 1700 only appeared in 2021.

It looks as if this fall, we'll see the new generations of desktop chips from both AMD and Intel land around the same time. Cue the usual pitched battle for plaudits. Epic. **–CL**

AMD's CEO Lisa Su gives out the good news: Zen 5 is currently on track

© AMD

GIVE IT UP FOR GDDR7



SAMSUNG ANNOUNCED GDDR7 last summer, but now it has revealed more. The spec item that stands out is, rather obviously, peak transfer speeds of 37 Gb/s. More realistic throughput for commercial applications is likely to be in the region of 32 Gb/s. Micron also has GDDR7 brewing, and it's claiming a 36 Gb/s target speed. SK Hynix, likewise, has chips nearing release, this time topping out at 35.4 Gb/s. For context, GDDR6 has been in mass production since 2018, the best versions of which can reach 24 Gb/s. All three manufacturers are likely to be cranking out GDDR7 chips in volume some time in the second half on this year, just in time for a new generation of GPUs. Nvidia usually uses Micron memory, while AMD uses Samsung or SK Hynix. But who will be first to launch a next-gen GPU with GDDR7? The race is on. Outside and very long odds bet in Intel, anyone? **–CL**

CHROME'S INCOGNITO MODE ISN'T WHAT IT SEEMS

GOOGLE HAS A NEW disclaimer when you fire up an Incognito session in its latest test version. It now states that 'this won't change how data is collected by websites you visit and the services they use, including Google'. The current release version still states simply, 'Now you can browse privately, and other people who use this device won't see your activity.' Both warnings still tell you that your activity 'might' be visible by websites, employer or school, and your ISP.

Why the subtle change? The original warning was the subject of a $5 billion class action lawsuit that held that the wording was misleading, and users could think they were running a genuinely private session, when actually activity was still being tracked. The case was launched in 2022, and Google has finally agreed to pay up, although we await final approval of the settlement. What's clear is that Chrome doesn't have a true incognito mode, despite that logo denoting anonymity. **–CL**

Tech Triumphs and Tragedies

A monthly snapshot of what's good and bad in tech

TRIUMPHS

STARLINK HAS LASERS
SpaceX's satellites now use over 9.000 lasers to transmit to ground stations or each other. They shift 42 Petabytes a day.

HDD'S NEW RECORDS
Seagate has released a 30TB HAMR drive, with a 32TB shingle magnetic drive to follow.

WIN3.11 GOING STRONG
Almost all of the railway display boards in Germany, as well as some cab displays, still use MS-DOS, and Win3.11.

TRAGEDIES

CLOSED FOR BUSINESSES
Apple Maps has a habit of marking small businesses as permanently closed. It isn't that easy to get it corrected, either.

GOODBYE WORDPAD
The latest preview of Windows has no WordPad, free with Windows since Win95.

ROOMBA DEAL DIES
Amazon was all set to buy the robot vacuum company, iRobot, for $1.7 billion, but regulators scuppered the deal.

WINDOW'S AI UPDATE

This year's second update is all about Copilot

IF YOU THINK AI is everywhere already, it's about to get even more pervasive. By summer, we'll have the first swathe of AI PCs—systems with hardware AI acceleration. Windows will have a new update aimed at integrating AI into the heart of the OS, rather than a scattered feature set. Called update 24H2 (we have 24H1 to come this spring, first), the buzz was that Microsoft would mark the significance of the change by calling it Windows 12. Other sources, which have delved into Microsoft's support documentation, can find no mention of '12'. Given that Windows 11 has yet to really establish itself as the leading version, and the fact that Windows 10 only has about a year of full support left, it seems that we will have to wait until 2025 for Win12.

When it does arrive, expect a substantial upgrade that will push an 'advanced' version of Copilot right to the front—not on a sidebar. We'll get AI-powered assistants for text, images, and more, plus you'll be able to use natural language search queries. Windows will be able to upscale images and videos, too. We saw the new UI features at a Microsoft presentation recently, including a floating taskbar, system icons at the top of the screen, and a new Start menu (there's always a new Start menu). It'll be more modular, and you'll be able to drag widgets to your desktop. Details are fuzzy, but some features are already on the Windows Insider Canary channel, where changes requiring long lead times are tested.

We're barely 15 months on from the public launches of ChatGPT and DALL-E, yet by the end of this year, we'll have AI PCs running a version of Windows with embedded AI functions. That's a lot of progress in a short time, but with Microsoft overtaking Apple as the world's most valuable company this month, expect AI to be part of pretty much everything the Redmond giant does going forward. **–CL**

Get used to the Copilot logo: Microsoft is set to embrace AI with a big update this fall.

NIGHTSHADE

ARTISTS STRIKE BACK

New tool to protect work from the AI engines

PUT AN IMAGE on the internet, and there's every chance a large AI model will come along and scrape it, copyright or not. Nightshade, a new anti-AI tool designed to stall the scraping process, amassed 250,000 downloads in the first five days of its release in January, perhaps proving how many artists are suffering from AI anxiety. It works by 'poisoning' the data, manipulating it to make images difficult for AI to process properly. Most of this data is invisible to the human eye, although images without much texture can show signs at the most aggressive settings.

These tweaks stop AI from correctly identifying the image subject. If an AI model incorporates too many poisoned images then it starts to corrupt, producing cakes when asked for hats. Nightshade hails from a team at the University of Chicago, which claims that Nightshade's goal is "not to break models, but to increase the cost of training on unlicensed data, such that licensing images from their creators becomes a viable alternative". The University of Chicago has another anti-AI tool called Glaze, which it recommends using in conjunction with Nightshade. Rather than obscuring the subject of the work, it masks the artistic style.

Moreover, the fact that AI models are essentially parasitic was confirmed by OpenAI in written evidence recently presented to a legal committee. It claims that because copyright covers virtually every sort of human expression online, "It would be impossible to train today's leading AI models without using copyrighted materials." OpenAI also points out that any model limited to public domain material might be interesting, but wouldn't enable the building of a usable modern AI system. In short, if you want AI features, you must feed the machine. If you produce original artwork, tools like Nightshade might slow the AI hordes down. But given OpenAI's resources, it would be a feat to keep the machine at bay forever. At least the company acknowledges that there is "still work to be done to support and empower creators". No question, there are ethical issues which remain unanswered. **–CL**

Intel's new Battlemage graphics coming this year

THE ASSAULT OF THE DISCRETE graphic card market by Intel has been fairly leisurely. Its first-gen Arc Alchemist cards are cost-effective, and feature set is decent. But initial driver problems were legion. The latter has been addressed, but all we've seen in nearly two years are graphics cards that just about compete at the lower end of the market. The challenge for Intel's second generation of GPUs is to raise the game. Enter Battlemage, with its Xe2-HPG architecture that is rumored to be at least as fast as the GeForce RTX 4070.

Leaked slides show two GPUs with 150W and 225W power profiles. They feature new machine learning rendering technology, new memory sub-system with compression, and improved ray tracing. Xe2-HPG also uses a new structure for the Xe Vector Engines (XVEs), which process 16 instructions per clock cycle. Current Alchemist cards have 16 XVEs per Xe core—if that is maintained then this will add considerable horsepower.

Some rumors even put Battlemage up at RTX 4080 levels. If it can deliver, it will inject some needed competition into the GPU market. Even if you have no intention of buying an Intel GPU, a high-performing card will help push down prices of Nvidia and AMD cards. Here's hoping Intel's second-gen graphics architecture succeeds where its first failed. **–CL**

Intel hasn't produced any slick marketing material for Battlemage yet, so here's some from Alchemist.

New Wi-Fi range record

Back in 2016, the WiFi Alliance approved a new standard, HaLow 802.11ah, using the 900MHz band, which aimed to extend the range to over a kilometer, keep power consumption down, and penetrate buildings. Not a lot happened for a while after that, but it seems the standard is finally hitting the market in equipment you can actually buy. Morse Micro has just used HaLow 802.11ah to set a new Wi-Fi world record by conducting a video call at a range of 1.8 miles (three kilometers). Admittedly, the data rate drops off from 17Mbps at 250 meters, down to 1Mbps at the full distance. One application is the battery-powered Adobe Edge Camera, which can be placed up to a mile away from your house. **–CL**

AMD APUs get frame generation

AMD is adding what it calls Fluid Frame Generation to its RDNA 3-based integrated graphics—a feature previously only available in full discrete cards. Currently, it's only available via a beta driver. AMD inevitably released one of its orange bar charts to show just how good the new feature is. AMD estimates that you'll get up to 75 per cent more frames, showing *Balder's Gate* jumping from 58 to 90 fps running on a Ryzen 7 8700G, at a resolution of 1080p. Other games fare even better—*Starfield* nearly doubles, *Star War Jedi: Survivor* even more again. It's worth remembering, of course, that frame generation helps with smoothness, but not latency, which is actually made worse. **–CL**

Jarred Walton

TECH TALK

This is a disappointing generation of GPUs

ALONGSIDE THE INTRODUCTION of the RTX 40-series Super models, this past month also saw the launch of AMD's RX 7600 XT. I think it's fair to say that this entire generation of GPUs has been disappointing on the whole, but AMD's offerings were particularly bad.

The previous generation of GPUs were plagued by scalpers and cryptocurrency miners jacking up prices—why wouldn't AMD and Nvidia bump MSRPs? If that wasn't bad enough, AI and deep learning have come of age. Add China tensions and restrictions on what can be manufactured and sold, then factor in rising costs of chip manufacturing technology, and we have the current situation.

But even with all that, let's look at GPU lineups. Nvidia didn't hold back on the top AD102 chip, going with a tuned TSMC 4N process and 608 mm2 die size, but that's the exception. The previous-generation RTX 30-series used Samsung 8N with a 628 mm2 die size on the RTX 3080 and 3090 class cards. The 4080 Super and below all have smaller die sizes: 377 mm2 for the 4080 class and 4070 Ti Super, and only 295 mm2 for 4070 Ti through 4070, with sub-200 mm2 die sizes on AD106 and AD107.

Consider that cache and memory interfaces don't scale as well with process shrinks, and the larger L2 cache sizes on Ada, and you can see why Nvidia reduced memory interface widths. It tried to offset that by creating DLSS 3 Frame Generation, but the benefits of frame generation can be overstated in performance charts with it enabled.

The RX 7600 XT should wrap up new GPUs for this generation, which has been a big disappointment overall.

Generationally, RTX 40-series parts provided less of a boost in bang for the buck compared to prior generations. 4090 was a step up over 3090—up to 80 percent faster at 4K. But while 4080 was up to 60 percent faster than the 3080, it also cost 70 percent more. The margins shrink as we go down the hierarchy, with the 4070 beating the 3070 by up to 40 percent—again, with a 20 percent increase in pricing—and the 4060 was only 20 percent faster than the 3060, though at least it got a price cut.

The door was open for AMD to close the gap, but instead it largely followed Nvidia. The only GPUs that are significantly faster than the prior generation are the 7900 XTX and XT, with the XTX beating the 6900 XT by up to 50 percent. 7800 XT, meanwhile, mostly matched the 6800 XT in price and performance. The 7700 XT leads the 6700 XT by up to 35 percent, and has a lower MSRP, but AMD's later 6000-series parts had inflated prices due to the cryptocurrency mining boom.

The biggest change for AMD came with the move to a GPU chiplet architecture. That worked for Ryzen, especially in later generations, but first gen GPU chiplets were about reducing costs. In fact, chiplets hurt GPU efficiency and performance, and when you look at comparative die sizes, it looks like AMD does less with more silicon. The result is that the performance gap with Nvidia has mostly stayed the same.

It's not a complete loss. Nvidia's GPUs are efficient compared to the previous generation. We also got universal AV1 encoding support. AMD didn't completely skimp on VRAM capacity, but the most worrying thing is that these types of gen-over-gen 'improvements' look like a sign of what's to come.

Moore's Law has slowed, and every improvement comes with higher costs. Research and development, both for the lithography and microprocessors built on the newer process nodes, has become extremely expensive. The cost per transistor has been flat for a while now, and is starting to trend upward. Will Nvidia's Blackwell and AMD's RDNA 4 buck the current trend and get back on track? I wouldn't bet on it. If it does happen, it will likely be thanks to AI tools—the same AI that's helping to increase GPU prices.

Jarred Walton has been a PC and gaming enthusiast for over 30 years.

THE LIST

THE BEST AUDIOPHILE HEADPHONES

YOU MIGHT THINK that it's overkill to use high-end headphones for gaming, but they can transform your experience. They can make your games sound so much better than a cheap headset ever can. However, when it comes to gaming and PC usage in general, it's worth noting that quite a few audiophile headphones lack microphones, but that's less of an issue now that you can get a good USB microphone for so little money. Plus, some headsets have microphone attachments you can order to convert your set of cans into a gaming headset.

3 SENNHEISER HD 650

Highly detailed drivers, spotless audio quality, and a wide soundstage. Not only that; they're well built and comfy, too. The HD 650s excel at the high-end and deliver superb clarity and definition through the frequency range. They're lighter on bass response compared to most gaming headsets and planar magnetics, though, and whether that flatter sound works is up to you. **$315, www.sennheiser-hearing.com**

5 NURAPHONE

These beautifully designed cans are noise cancelling masters, and even come with an app that can customize the EQ to your ears. The result is rich and detailed soundscapes unlike anything else out there. These have come down in price a lot since launch, though if you want a microphone, you'll have to fork out more for an attachment. But when it comes to audio quality, build, design, and noise reduction, these certainly deliver the sonic goods. **$199, www.nurasound.com**

2 DROP + EPOS PC38X

Cheap audiophile headphones may seem like an oxymoron, but the stunning audio quality and excellent depth combined with a high-performing and easy-to-use microphone means this Drop/EPOS collaboration is a great pick for the audiophile on a budget. The impressive imaging and spacious sound works wonders in your favorite games. In short, these cans are a great choice for those looking for superb audio without the mega cost. **$180, www.drop.com**

4 AUDEZE MAXWELL

Audiophile headphones and wireless tech are not traditionally good bedfellows. The Audeze Maxwell is here to buck that trend, however, what with its staggeringly good planar magnetic drivers that are normally the realm of some of the highest-end audio gear on the planet. Basslines punch through with a command and authority that most headphones can't reproduce, while leaving the mid-range and treble wide open for small details that would otherwise get lost. Simply stunning. **$329, www.audeze.com**

1 BEYERDYNAMIC DT 900 PRO X

With incredible audio performance and supreme comfort, the Beyerdynamic DT 900 Pro X represents just about the best audiophile gaming experience you can buy right now, all wrapped up in a handsome and solid frame. The DT 900 Pro X is almost surgically precise, allowing you to hear layers of bass that hit just right. Beyer really wasn't kidding when they said these cans are for critical listening; you hear everything. A classic in studios the world over, and perfect for your games, too. **$269, www.beyerdynamic.com**

Jeremy Laird

TRADE CHAT

Are cheap chips a thing of the past?

I'M NOT JUST TALKING ABOUT OVERPRICED graphics cards, but the underlying cost of manufacturing advanced integrated circuits. A chip manufacturing expert from Google, Milind Shah, thinks so, recently declaring that the per-transistor cost stalled as far back as the 28nm node over a decade ago. That's pretty worrying, but it can't possibly be true. Here's why.

This gloomy observation has been accompanied by data plotting the cost of 100 million transistor gates across multiple generations of chip production. It shows the cost plummeting from 90nm to 65nm, falling steeply again to 45nm, with another decent drop at the 28nm node. And then nothing.

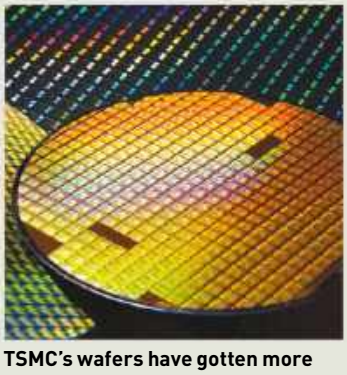
Actually, it's worse than that, because the graph shows a gentle incline. It's more expensive to manufacture 100 million gates using today's most advanced 5nm and 3nm nodes than 28nm silicon.

But this can't be true. Let's take Nvidia's 28nm GK104 GPU. It first appeared in 2012, and was used in various GeForce graphics cards from the GTX 680 downwards. GK104 contained 3.5 billion transistors. Today, the current Nvidia 104-class chip, AD104, as found in the RTX 4070 and 4070 Ti, clocks in at 35 billion transistors.

That's 10 times the number of transistors. Is Nvidia really paying 10 times as much for an AD104 die today as it did for a GK104 die in 2012? Graphics cards have gotten pricier, but not by that much.

Let's consider the possible explanations. For starters, these figures appear to be largely centred on the cost of buying chips from Taiwanese foundry TSMC, which is notorious for putting its prices up in recent years. Back in 2012, TSMC was considered to be well behind Intel for chip production technology. Now, it leads the world, charging a pretty penny as a consequence.

> Are we to believe that transistor costs have remained the same, despite today's CPU containing over 10 times as many?



TSMC's wafers have gotten more expensive, but not that much more

At the same time, perhaps the non-GPU costs of graphics cards, like VRAM, the PCB, assembly, and so on have come down dramatically since 2012, preventing the price of the card from jumping up 10 times.

But the whole 10x thing is punchy. Consider instead an Intel Raptor Lake CPU, such as the Core i9-14900K. That contains around 25 billion transistors. Wind back 10 years, and you come to Intel's Ivy Bridge CPUs, which topped out at a little over 2 billion transistors. That's well over 10 times the number of transistors in today's 14900K than an Ivy Bridge CPU.

A 14900K costs about $550. The top Ivy Bridge chip was either just under $600, or $999 if you include the Core i7 Extreme 4960X. Either way, those chips were more expensive than today's CPUs. But are we to believe that transistor costs have remained the same, despite today's CPU containing over 10 times as many? Over 10 times as many transistors in today's CPUs than 10 years ago? Per-transistor cost has stayed the same, but prices have fallen a bit.

Moreover, with a CPU, there's less cost to account for beyond the CPU die itself. It's not built into a large PCB with VRAM, a cooler, video output hardware, and so on. The cost per transistor of a CPU die should have a more direct effect on the final retail price than a GPU die has on a graphics card, but it appears to have had less impact.

There's some nuance lost in the claim that transistors aren't getting cheaper. If that was strictly true, high-end CPUs for consumer desktop PCs would be several thousand dollars. But they're not, so we probably don't need to panic. Yes, it's true that chip production costs have been inflating, but I still think you're going to get more bang from your buck in the coming years from PC components.

Six raw 4K panels for breakfast, laced with extract of x86... Jeremy Laird eats and breathes PC technology.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Samba share
> Keep Chromebook?
> Recovery partition

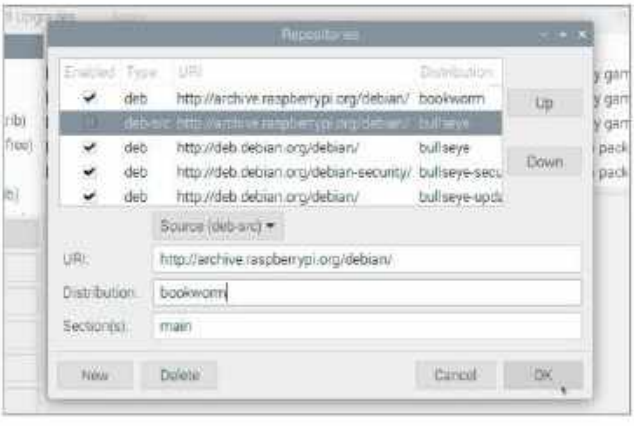
Inaccessible Pi share

I've had a Plex server running on a Raspberry Pi for several years. I set up a shared folder on the server that I've been able to connect from my two Windows 10 computers so I can drop TV shows without having to pull the USB drives. I've now replaced my Windows 10 Pro laptop with two newer systems running Windows 11 Home and Pro, neither of which can connect to the share (the Windows 10 desktop can still connect).

I can get as far as entering the Pi's IP address into File Explorer—namely \\10.0.0.200—which prompts me for a username and password, but am told that it's incorrect, even though it works fine in Windows 10. I checked 'Turn Windows features On or Off' to make sure everything is the same. I can connect to the Pi through both VNC and Putty on both Windows 11 computers, as well as Plex through a web browser using the IP address.

Both newer systems have the same login info and workgroup as the Windows 10 PC, so I'm stumped. Any suggestions?

—David Maurice



Make sure you're running the Buster or Bookworm version of the Raspberry Pi OS.

THE DOCTOR RESPONDS:

This could be a combination of the fact that Windows 11 drops support for SMBv1. You can try re-enabling this by checking 'SMB 1.0/CIFS File Sharing Support' under 'Turn Windows features On or Off', with the version of Debian powering your Raspberry Pi OS. If you're running a version of the Raspberry Pi OS based on Debian 11 ('Bullseye') or later, this shouldn't arise, because SMB 2.0 support is enabled and working.

If this is the case, you can try inserting the following into your smb.conf file in the [global] section ('sudo nano /etc/samba/smb.conf'):

```
min protocol = SMB2
```

Save and exit nano, then restart the Samba service (sudo service smbd restart), and see if you can connect. If not, consider upgrading your Pi OS to a later version ('Bullseye' or later) by following the guides at https://raspberrytips.com/update-raspberry-pi-latest-version/ for both command line and desktop.

If you already have Bullseye or Bookworm installed, it may be a case of reviewing your sharing setup on the Pi to check everything is in place for your Windows 11 machines. For example, have you set a Samba password for your user? This command will prompt you to do so—substitute 'pi' with the username on your Raspberry Pi:

```
$ sudo smbpasswd -a pi
```

We'd also recommend checking your smb.conf file to verify the shared setup is correct—the settings for your shared folder should look something like this:

```
[share]
Comment = Shared Folder Description
Path = /home/username/share
Browseable = yes
Writeable = Yes
guest ok = no
```

There may be other lines, particularly if as your question suggests, you mount USB-connected drives as shares, but the above should be sufficient to set up a share that you can connect through Windows 11 PCs using your Pi username and Samba-specific password. Once smb.conf is updated, don't forget to restart the sharing service:

```
$ sudo service smbd restart
```

Future-proof Chromebook

My HP Chromebook recently alerted me to the fact

↘ submit your questions to: doctor@maximumpc.com

support for Chrome OS would end later this year. However, it then installed an update, and I've not been prompted since. How can I confirm if I'm about to be left high and dry? **—Eugene S White**

THE DOCTOR RESPONDS: It's possible that the alert was related to the version of Chrome OS you were running—if it performed a major update, then it's likely that you should be fine for the foreseeable future. You can verify this by opening Settings and navigating to 'About Chrome OS > Additional details' to find out the end date—in Eugene's case, his HP model would be supported until June 2027.

When originally launched, Chromebooks were guaranteed a maximum of five years of updates, which meant models launched in 2019 would no longer be supported as of this summer. This was extended to eight years in 2021, and in September 2023 it was announced that support would be extended for a further two years.

This additional two years will only be added automatically to Chromebooks released in 2021 or later, so for models that were released in 2019 like Eugene's, what happens? According to Google, when you receive your 'final' update, presumably in June 2027, you'll be given the opportunity to extend automatic updates for a further two years.

Even then, your Chromebook won't necessarily have to be thrown on the scrapheap if it's still working. Google has been working on the Lacros (Linux And ChRome OS) project to decouple the underlying Linux OS from the Chrome browser to allow each one to be updated independently, while there are numerous Linux-based alternatives designed to run on low-powered hardware, many of which can easily be installed through ChromeOS's Linux Developer mode. In addition to the community-supported Chromium OS, check out GalliumOS (https://galliumos.org/), a Linux distro designed for Chromebooks.

Broken Immich update

After installing Immich as per your tutorial in the Holiday 2023 issue, I came to upgrade to v1.91, taking account of the 'breaking upgrade' warning. However, despite adapting my Docker compose file as per the instructions on the release notes page (https://github.com/immich-app/immich/releases/tag/v1.91.0), I'm unable to get it working. Part of the web interface comes up, but I get an error message if I attempt to log in. What have I missed?

—Michael J Santillan

THE DOCTOR RESPONDS: It's not made clear, but there are two breaking changes you need to take account of, the first being documented in v1.88 (https://github.com/immich-app/immich/releases/tag/v1.88.0). This basically removes the immich-web container, and instead adds a port redirection from 2283 to 3001. Once you add these changes to your compose file, along with those from v1.91, you should find that the container recreates itself with all your previous settings and uploads intact.

Migrating from Authy

Now that Authy is discontinuing its desktop apps, I'm on the lookout for a convenient but secure alternative I can use across multiple platforms, including my PC. What do you recommend? **—Jody Carter**

THE DOCTOR RESPONDS: One solution is to see if your password manager supports 2FA. An increasing number do, including LastPass, KeepassXC, and Bitwarden. The issue is whether you're happy storing both 2FA codes and passwords with the same provider—if your passwords are stored in the cloud, you might prefer a direct replacement.

One open-source alternative that offers iOS and Android apps, plus a browser extension to give you access from your desktop, is 2FAS (https://2fas.com/). All codes are stored on your phone unless you want to set up multiple devices, in which case they can be backed up (and synchronized) through iCloud or Google Drive—all encrypted. Even if you trust your password manager with your 2FA keys, we recommend using 2FAS to store the 2FA code for your password manager to give you an extra security layer.

Once you've made your choice, you'll need to migrate each 2FA code from Authy to your new service. This involves logging into each online account protected by a 2FA authentication code to see if it's possible to add the same code to your password manager. If not, you'll need to disable and re-enable the feature to generate a new code. Look out for services that allow you to add additional 2FA codes alongside your existing Authy code—remove the Authy code before adding the new one. Also, delete the code from your Authy account when you've added the code to 2FAS or your password manager.

If you've dozens of codes to migrate, go to https://gist.github.com/gboudreau/ and click the 'AuthyToOtherAuthenticator.md' link to explore a means of transferring your Authy 2FA codes to your new 2FA solution. Otherwise, consider moving them in batches—you have until summer until the desktop app is removed completely.

Lost recovery partition

I was recently informed that an attempt to install a Windows Recovery Environment update on my Windows 10 PC (KB5034441) had failed with the following error code: 0x80070643 - ERROR_INSTALL_FAILURE. I visited https://support.microsoft.com/kb/5034441 for clarification, and discovered that it's linked to a problem with the size of my recovery partition. There's a link to instructions on manually resizing the partition, which I ignored in favor of trying to move the partition using a third-party partition manager. I've somehow deleted the recovery partition, and can't get it back. What can I do?

—Darryl Branham

THE DOCTOR RESPONDS: If you've instigated a daily backup using a tool like Macrium Reflect or Hasleo Backup Suite, you can restore the 'missing' recovery partition In Hasleo, for example, select 'Restore > Select task to restore', choose your latest backup, and click Next. Switch to 'Partition mode', select your recovery partition from the list, and click Next. Locate the former recovery partition (marked as 'unallocated'), then click Next. Review the changes and click Proceed.

If you don't have a backup, visit https://support.microsoft.com/kb/5028997 to follow the instructions from the point where you shrink your C drive to accommodate the new recovery partition. It's the most effective way to recreate the partition—no freebie third-party partition manager we know can set it up correctly, so its partition type is specifically 'Windows Recovery Environment' on an 'NTFS (OEM service volume)' filesystem, as described by Paragon Partition Manager (www.paragon-software.com/free/pm-express/).

GHOST IN THE MACHINE

THE RTX 4070 SUPER BUILD

Anti-RGB in 2024

PEOPLE, REJOICE—the RTX Super cards have arrived, and with them comes some nicely tweaked internal specs, better performance across some models, and to top it all off, some consistency in their price tags.

What's better than that, though? A super-sleek, stealthy, sexy, black founder's edition graphics card from Nvidia, that's what. There's not a peep of RGB lighting on this little beauty. Nvidia really has come out of the gate swinging with its Super FE cards. You still get that same passthrough fan design throughout, the same 12VHPWR power cable location, and the same form factor as before (although bear in mind that this thing is far far far smaller than its RTX 4080 siblings), but most impressively, it's that sleek mix of black metals and silver accents that really makes this thing stand out from the crowd.

That got us thinking—firstly, the obvious question is how does this card perform away from the top-tier, bottleneck-free test beds of the big brands, with something a little more down to earth on the CPU front? Secondly, can you make a kick-ass stealth build in 2024 that performs like a champ, cools like a king, and still looks the part?

That's the aim of the game: build a budget, affordable, clean, kick-ass gaming PC, capable of hitting those 1440p and 4K resolutions with ease. Let's dive in, shall we? –ZAK STOREY

INGREDIENTS		PRICE
CPU	AMD Ryzen 5 7600X	$229
Motherboard	Gigabyte X670 Aorus Elite AX	$270
CPU Cooler	Noctua NH-U12A chromax.black	$130
RAM	32GB (2x16GB) Corsair Vengeance DDR5 @ 5600	$120
SSD	2TB Crucial T500 M.2 PCIe 4.0	$150
GPU	Nvidia GeForce RTX 4070 Super 12GB	$599
Case	Hyte Y40 ATX Mid Tower	$149
PSU	Be Quiet! Dark Power 13 850W 80+ Titanium	$190
120mm Fans	4x Noctua NF-A12x25 PWM chromax.black.swap	$140
140mm Fans:	3x Noctua NF-A14 PWM chromax.black.swap	$81
TOTAL		$2,058

PRICES CORRECT AT THE TIME OF PRINTING

https://content.jwplatform.com/videos/GEudxYH7-u2lN49He.mp4/
Please type this URL into your browser if the link is broken

STEP-BY-STEP GUIDE
PG. 22

STEALTHY SELECTIONS

CPU $229

AMD Ryzen 5 7600X

AMD's Ryzen 7000 series might have launched back in 2022, but that doesn't stop these processors from offering good value for money and top-tier performance. The Ryzen 5 7600X does just that. Packing in six cores, 12 threads, and a base clock speed of 4.7 GHz, ramping up to 5.3 GHz under load, it's potent enough to handle all of our gaming and rendering needs. Couple that with its 32MB of cache, and weird advantage (it's running a single core complex, rather than two communicating via the Infinity Fabric), and it keeps pace with a number of Intel's current-gen mid-range offerings.

It's not as advanced as the X3D offerings AMD has at its disposal in the form of the 7800X3D and above, but honestly, although the 3D V-cache is pretty impressive in use, it's dependent on games, and the closest priced sibling, the 7800X3D comes in at $150 higher than what we have here. **www.amd.com**

Motherboard $270

Gigabyte X670 Aorus Elite AX

We had the option of two boards for this issue's build: either this Aorus Elite AX from Gigabyte, or MSI's MPG X670E Carbon WiFi. As any good *Maximum PC* system builder does, we (said builder and photographer) looked at both boards and went, "Nah, that one", entirely based on appearance. Thus, here we are. Both boards are capable, mid-range ATX mobos to house your components, but there's something about the classy styling on the Aorus Elite AX that gives us that stealthy vibe we were going for here.

On top of the snazzy design language, it also comes with a fairly impressive 16+2+2 VRM, and some substantial cooling, support for PCIe 5.0 devices, and an impressive array of rear I/O, too. That includes WiFi 6E support, 2.5Gb Ethernet, eight USB 3.2 Type-A ports, one USB Type-C port, and four USB 2.0 ports—basically, all the modern connectivity you need without breaking the bank in the process. **www.gigabyte.com**

RAM **$120**

32GB (2x16GB) Corsair Vengeance DDR5 @ 5600

Sticking with our stealth theme, we decided to keep the memory kit fairly simple this time around. Yep, we've gone with a set of Corsair Vengeance DDR5, clocking in at 5,600 MT/s with a CAS latency of 36, adding up to a real-world latency of 12.86 ns or thereabouts. This isn't the best kit for this build, we'll admit—you'd be much better off getting something closer to the 6,000 MT/s mark.

AMD's 7000 series chips, like their predecessors, prefer high-speed memory for the infinity fabric interconnect. In an ideal world, you're looking for a kit closer to the 6,000 MT/s figure to get the maximum performance out of your system. This does predominantly affect multi-core performance in particular, and anything where more than one core complex is communicating with each other. However, as our Ryzen chip only has one active, we'll forgo it this time. **www.corsair.com**

STEP-BY-STEP GUIDE
PG. 22

CPU Cooler **$130**

Noctua NH-U12A chromax.black

We've gone back to Noctua this issue in a big way. We've picked up this sweet little number to get us started in the form of the (relatively) small form factor NH-U12A chromax.black. It's svelte, stealthy, and completely black, strapped together with an impressive seven-heatpipe design that, according to Noctua allows for 37 percent additional fin surface area, compared to its NH-U12S. On top of that, the company has also added not one, but two of its latest and greatest NF-A12x25 120mm fans in a push-pull configuration.

It also comes with support for sockets all the way from LGA1150 up to 1851, plus AM4 and AM5, and you can request a free bracket for LGA1366 and LGA775 if you're still running anything on those. **www.noctua.at**

Fans $221

Noctua NF-A14 & NF-A12x25 PWM Fans

The final piece of our cooling puzzle. Okay, let's be honest, that's a big chunk of cash to drop on seven fans, but these are the best when it comes to the air-cooling world. Combine that with the two A12x25 PWM fans on our cooler, and we're up to nine fans in our system—plenty to shove around all that air.

Let's talk top-line stats, shall we? We've got four 120mm A12x25 fans. These units punch out 2.34mm H2O at 2000rpm at 22.6 dB(A), along with 102.1 m3/h of airflow to back it up. They also come with an assortment of rubber gaskets in a variety of colors, and feature a six-year warranty and 150,000-hour mean failure rate.

The 140mm NF-A14 has more of a classic style, designed to push airflow over big gobbets of static pressure, but manages 2.08 mmH2O of static pressure, 140.2 m3/h of airflow at 1500rpm, and 24.6 dB(A). They don't have any RGB bling like some of their competitors, but those figures alone make these a solid pick.

www.noctua.com

SSD $150

2TB Crucial T500 Pro M.2 PCIe 4.0

We've bumped up the storage for this build compared to the rig last issue, and with one thing in mind: capacity. Let's face it, 1TB might do the job, but 2TB is just better. In an ideal world, 3TB is the number to have: 1TB for your OS, and 2TB for everything else over two drives, but we're trying to keep the price low, and the Crucial T500 2TB PCIe 4.0 drive does the job perfectly.

Complete with some blistering 6-7K sequentials and being relatively affordable at just $150, it's an easy pick for this build. You can get it in two variants: a non-heatsink version (not shown here), which is a little cheaper, and this chunky buddy here, with heatsink attached.

It's a snappy and ideal drive, perfect for use in either a PC like this or your PS5 if you're looking for a little more local storage there.

www.crucial.com

PSU $190

Be Quiet! Dark Power 13 850W 80+ Titanium

The Dark Power 13 without doubt fits our classy stealth system aesthetic this issue. Its subtle black design and super-quiet fan, combined with exemplary efficiency and support for all the latest and greatest cables (thanks Nvidia), made it an easy pick.

Also, it's just $190. Let's just let that sink in for a second. 850W, ATX 3.0, Nvidia 12VHPWR cable, fully modular, and a super-silent fan and sleek aesthetic. Oh, and it's got an 80+ Titanium rating, plus a ten-year warranty, for less than $200. That's incredible value from the German manufacturer, and we're happy to bring it on board.

www.bequiet.com

STEP-BY-STEP GUIDE
PG. 22

GPU $599

Nvidia GeForce RTX 4070 Super 12GB

First up on the block, the RTX 4070 Super, complete in its glorious all-black Founders Edition finish. Seriously, this thing is sleek and compact. We still have the same 12VHPWR connector and twin-fan design, as in other units, but it's really the hardware inside that's leveraged its weight the most.

There has been a significant increase in overall hardware internally. In fact, it's seen a 21 percent bump in CUDA cores alone, compared to the initial RTX 4070. Combine that with significantly more ray tracing and tensor cores for that DLSS goodness, plus more L2 cache as well, and you're talking about a serious upgrade in contrast to the RTX 4070. It doesn't even break the bank, either, as the pricing is identical to the RTX 4070's launch price.

The cost of everything might be going up, but at least Intel and Nvidia seem to be keeping pricing steady. We're not sure if that's a good or a bad sign, if we're honest.
www.nvidia.com

Case $150

Hyte Y40 ATX Mid Tower

We've got another Hyte chassis on the anti-static block this issue, and this one's the Y40. Unlike the Y70 Touch, which we featured a couple of issues back, the Y40 is much more of a traditional chassis. You've got that familiar tower-shaped design, cable management, and glass windows, but the Hyte touches are on display here, too.

There's a 140mm fan mount buried in the floor under the GPU, side intake vents, a PCIe riser (along with half-height slots, so you'll be vertically mounting your GPU), along with offset AIO mounts in the roof, and a phenomenal amount of cooling support. It also comes with that PCIe 4.0 riser, and is available in the usual vast array of colors the company touts (white/black, black/black, red/black, white/white).
www.hyte.com

SOPHISTICATED SILENCE

Difficulty	EASY
Time	1 HOUR

SO THERE YOU HAVE IT folks, our carefully curated list of parts for your consideration. Now, we did have to dip into the *Maximum PC* kit cupboard at a few crucial moments to address some minor hiccups, but aside from that, the overall build process for this little beauty is fairly seamless. There's no overly complicated cooling to deal with, no excess cables, no RGB to worry about (at least not really, although more on that later), and no major case shenanigans to contend with. At its heart, this thing is simple, and there's a beauty in that.

Hyte's Y40 chassis is a stunning piece of kit. It's not without fault—there are some minor foibles that we consider fairly annoying (you're still pushed into mounting your GPU vertically), but from a performance and aesthetic perspective, it's a stunning bit of kit. The big question is that GPU, the RTX 4070 Super. It's an interesting card, with plenty of additional hardware internally, and a revamped design, complete with a similar price tag, making it an intriguing pick.

On the surface, that should translate into some comfortable frame rates at 4K, at least if you've got the CPU to partner with it. That's a big part of the reason why we decided to go with something a little more left-field in the form of Ryzen's 7600X. It's more reasonably priced, and if we're honest, a CPU that should really be paired with a card like the RTX 4070 Super. We've got some more analysis on that and the Super cards later, but for the time being, let's talk about that build.

ALL GOOD BUILDS...

...start with a stripdown. It's our go-to build step for every system we resolve to create. In fact, you can read more about that and some of our best building advice on page 44. Stripping down your chassis does three things. First and foremost, it protects your side panels, glass windows, and internal hardware from any accidental knocks, bumps, grazes and, most importantly, smudgy fingerprints. Second, it makes your case a lot lighter to chuck around and maneuver in, which is super useful for cooler installations. Lastly, and perhaps most importantly, it gives you foresight, and lets you passively analyze what's coming up, where you might face problems, where you need to install component parts, and more. Honestly, a good chassis strip-down is half of what you need to do to review a chassis professionally for that very reason.

1

The Hyte Y40 stripdown went smoothly. The side panels popped off easily enough—they're on a lean and pop latch mechanism, as you can see in the cutout in the rear panel (top left of STEP 1) that allows your fingers to slide in. Be careful here, as it'll lean out and come crashing on the floor if you're not there to catch it. The rear panel is identical in its operation as well. On top of that, the roof pops off—simply pull up from the rear. As for the front glass panel, we've left it in place, as there are no fans or hardware really being installed around it. You can remove it, as it's secured in place via screws, though it's a little more fiddly to deal with.

PRE-INSTALLED UNITS

Hyte's Y40 also comes with two pre-installed fans by default. One 120mm in the rear acting as an exhaust, and the other 120mm buried under the PSU shroud, next to the cable tidied cables STEP 2. It's one of the features we love most about this case. Having a fan drawing cool air directly from the bottom of the chassis and firing it up through the PSU shroud and into the graphics card above, particularly a vertically mounted one, makes so much sense, and helps with cooling quite substantially.

That said, as we're buried up to the hilt in Noctua's latest and greatest, we'll be

4

removing both of these and replacing them with something a bit more performance-orientated. To remove the friendly 120mm bottom fan, turn the chassis over, remove the fan filter in the way (lift up the tab/latch and slide it out), then remove the four fan screws. Don't worry if you lose these—each Noctua fan comes with a set as well. As for the rear 120mm fan, there's four screws there, and then you're done.

AMDING IT TO THE NINES

Next up is getting the motherboard prepped and good to go. Unlike last issue, we're not going to go quite so far as to install the cooler to the board outside of the case, but there's still a lot to do here. First up, we've grabbed our board and popped it on top of the box it came in, as it acts as a nice anti-static 'workbench' (don't worry, it's temporary). Then, as AMD's using the LGA socket for its AM5 chips, we've got to be content with the usual LGA bracket shenanigans. Lift the retention arm up and out of position, then carefully lift the bracket out, revealing the socket and its pins below STEP 3.

With that, you can then go ahead and carefully place your CPU down into the socket, making sure you align the text so it reads left to right with the top left of your motherboard. The socket also has notches in it, and there's a golden triangle etched into both the socket and the chip to help you orient it, just in case. With that done, it's simply a process of going backward in reverse.

Bring the bracket down, then secure it into position with the retention arm once more. The plastic socket cover should pop off of its own accord at this point. Alternatively, you can remove it before you secure the bracket in position STEP 4.

A POLITE REMINDER

Next, we're on to our SSD installation. Our M.2 SSD is of the PCIe 4.0 variety, so not the absolute cutting edge of tech, but it's still fast enough for our needs here, and we're still going to be installing it into the topmost M.2 slot on our motherboard.

Gigabyte includes an integrated M.2 heatsink, so we're going to remove that. It's secured with a single screw at one end, and a notch on the other, which once the screw is unsecured, simply slides out at the top of the M.2. Although we're not going to be using the integrated heatsink in our build (our M.2 has one pre-installed), always remember to remove the plastic film from your thermal pad located under the motherboard's M.2 heatsinks for the best performance STEP 5.

In the race for 'ways to install an M.2 without using a tiny screw', Gigabyte has

6


crucial
T500
PCIe® Gen4 NVMe™ M.2 SSD

7

8


VENGEANCE
AORUS
X670

9

10


GIGABYTE
crucial
HYTE

come up with this novel rotating plastic divot thing (not the official terminology). To install your SSD, simply line up the drive with the notch in the M.2, slot it into position, push it down, then rotate the notch so that it locks the SSD into position. It's quick and simple, and no screwdriver is required STEP 6.

TIME TO SADDLE UP

With our SSD in position, it's time to get that CPU cooler ready to go. Noctua's coolers come with an instruction manual and a ton of extra goodies, including a tube of its NT-H1 thermal paste, a long screwdriver, and practically every bracket for every socket in the last ten years.

One of the best things about AMD's Ryzen platform is that its motherboards have always come with a fairly chunky CPU backplate built in and pre-attached. This has eliminated a huge amount of frustration for those swapping out coolers over time, and the same is true here. Noctua has taken advantage of that. Grab the AMD parts from the box, locate the correct spacers for AM5, remove the stock brackets, then carefully install the new ones with the included screws, making sure to install them the right way around. Noctua has actually etched the words 'East' and 'West' into each bracket, with an arrow pointing to the direction of the CPU. Additionally, there are two positions for you to secure each bracket down, giving you the option to offset the cooler if necessary for larger VRM solutions or more awkward motherboards STEP 7.

RAMTASTIC

We're actually going straight ahead and installing our RAM on this one, just in the apprehension of our CPU cooler being a bit finicky to install at a later date if we don't (it's more of a laziness thing, as the U12A comes with its fan pre-attached, and dealing with those finicky metal brackets is frustrating for any veteran PC builder).

Unlatch the two DIMM slots you want to use—in this case, the pair furthest away from the CPU—line up the notch on the RAM with the slot in the motherboard, and push it into position until it clicks into place. We like to give it a little extra nudge once it's in to really make sure it's secure and in contact with the socket. Another helpful tip is to run your finger over the top of them once both are installed to make sure they're level and flush with one another, as it's usually a good indicator that they're in properly STEP 8.

PRELIMINARY INSTALLS

With that done, our motherboard prep is complete and it's good to go in the chassis. Hyte has included a small box underneath the PSU cover with all the screws we might possibly need for this build, including a bag of motherboard screws, so we'll be using them this time around.

But first, we've got to contend with the chassis itself, and that PCIe 4.0 riser. Simply remove the screw from the rear of the case, as if you were removing a GPU, and move the riser out of the way. In our build, given the position of the topmost PCIe slot on our board, we actually had to move the riser down a slot from where it's initially secured as well. Simply put, treat this part like you would an add-in card or graphics card, remove the PCIe slot cover you need to install it, push the PCIe riser into the PCIe slot, re-secure down with the thumbscrew you just removed, and you're done with STEP 9.

The PCIe riser is one of the more frustrating elements of this build. It's nice that Hyte has included a 4.0 riser by default, particularly given these things can cost up to $60. That said, we wish we had the choice to install a GPU in the traditional manner if we so desired. Is that too much to ask for? On the plus side, unlike our red Hyte Y70 Touch build from a few issues back, the Y40's black PCIe 4.0 riser looks a lot slicker, and, ahem, stealthier, than we expected it to STEP 10, so we'll be keeping it in its shroud for the time being, although you can remove it with a few Philips screws if you need to.

OF LIGHT AND AIR

This is the moment in the build where we started to question what the next best step for continuing is: fans or power supply (we know the graphics card is probably going in last). In this case, given the minimal amount of access we're going to have at the top of the chassis, once the CPU air tower is installed, plus those three 120mm exhaust fans in the roof, and the 120mm in the rear, it's imperative that we get the PSU and perform any cable-management now.

We're pre-empting this and installing our power supply cables ahead of time outside of the chassis, before installing the unit in the case. There's not a huge amount of room to work with in there, particularly as we're going to be installing a 140mm fan in there, too STEP 11.

Routing around in the *Maximum PC* cupboards, we found an interesting piece of tech, namely a BitFenix 60cm magnetic Alchemy LED strip (about $20 on Amazon). It's pure white, powered entirely by SATA power, and is a simple, bright, plug-and-play strip. There's an old adage that we live by when it comes to lighting in PC builds, and it's a fairly simple mantra to

follow: light should be thrown, not seen. Keep your light source out of view, but your light throw prominent, and it'll look stellar. To integrate this into our build, we've hidden it around the very edge of the power supply shroud. Hyte has built a little ledge in the shroud itself, and it's easy to pop an RGB strip in there to brighten up the place a touch.

After that, we've gone ahead and installed our 140mm intake fan in the bottom of the chassis. To do that, we've turned the case on its side, lined the fan up with the mounts, and secured it into position. Noctua's fans have detachable cables, so make sure you line your fan up so that its cable is near the rear of the case, and you'll be good to go STEP 12.

CABLE CUNNING

With the fan in, we then grabbed the power supply and slid it into position, again securing it with the PSU screws provided by Hyte. We've bundled as many cables together as we can, and cable-tied them together where possible to ensure that nothing gets in the way of that 140mm intake fan in the case STEP 13.

We've also installed all of the front panel headers that we can. Similar to NZXT, Hyte's Y40 chassis comes with a single block for the front I/O buttons, so there's no fiddling around with tiny pins. It's a tight fit down here, particularly with the 140mm fan, so try to take advantage of the cable routing as best as you can.

Now for more fan fun times, this time with the twin intakes on the side of the chassis. As these are running as intakes, we're mounting them with the label facing towards us and the fan guard facing out with the Chromax logo. This pushes the detachable fan cables to the bottom left of each fan, which is a little tricky for running those fan cables, but fortunately, even squishing them together like this isn't much of a problem STEP 14.

With all our cables installed and the big 140mms in, next was the 120mm exhausts: three in the roof, and one in the rear. We've lined those up as best we can so we can run the cables out of the back of the case and into the cable management tray STEP 15. However, this was the moment that we realized we had nine fans needing to be plugged in, and mildly panicked. Fortunately, the CPU tower has a splitter cable, allowing us to condense two fans into one, but that left eight to be installed, with only five ports on the motherboard. A quick foray into the kit cupboard, and once again a Corsair Commander Core unit saved the day, allowing us to connect six of those eight, and run them off a single USB header. The CPU fans could then be ran off the CPU header and the bottom 140mm intake on a chassis fan header on the bottom.

EVEN MORE FANS

Installing the RAM first because you didn't want to take the cooler fans off, only to have to do exactly that, is a bit ironic. To install our cooler, we turned the chassis on its side and placed a small line of thermal paste on the CPU (as long as it's non-conductive, it's fine—just make sure you've got enough for contact between the CPU block and CPU). Then, we removed the two fans from the cooler, lined it up with the CPU bracket mounts (there are two screws on either side of the tower), and secured it into position, screwing each side bit by bit to avoid uneven pressure. Secure each screw to the end of its thread, then re-attach the fans with their metal securing clips back into position. If you're struggling, try using a small set of needle nose pliers, or a flat-head screwdriver to help push the bracket past the heatsink's fins and securely into position STEP 16.

It's important to get those fans plugged in. Again, we're going to be using a Corsair Commander Core, which will work with any fan, not just Corsair's arsenal, and doesn't need RGB. Simply plug your fans into the unit 1-6, plug in a SATA power, run the USB cable to a USB 2.0 header on the motherboard, and you're set. We've also bunched up as many of the cables as we can, tying them down to specific mounting locations on the back of the motherboard tray to tidy up the build and keep that stealth aesthetic at the front STEP 17.

THE FINAL PIECE OF THE PUZZLE

With the cooling resolved and cabling in position, it's time for our graphics card, the RTX 4070 Super Founder's Edition. Remove the two PCIe slot covers in the rear of the chassis, closest to the PCIe riser location, then lower your graphics card into position, making sure to line up the card with the slot (it's easy to miss this). Once it clicks into position, secure it back down in the rear of the case using the two screws you removed earlier to remove those slot covers.

Once that's done, it's simply a case of installing your 12VHPWR cable (or PCIe power cables, if you're using a non-Nvidia 4000 series GPU). Line up the cable so the sense pins connect properly, push the power cable into the card all the way, and make sure it's properly connected, with no tight kinks or radii on the cable (this has been reported to lead to cable burnout, so better to be safe than sorry). Now, you're all set STEP 18.

13

15

17

14

16

18

HAS ANYONE SEEN A PC AROUND HERE?

OKAY, THAT'S A BAD JOKE. We're just super happy with how this one turned out. The all-black build might not make our publisher happy (let's be fair, it's not the most emotive PC build for a cover), but there's a simple mechanical beauty to this thing that really makes it pop. There's no over-the-top glare, and no overtly nonsensical unicorn madness going on inside—just a slick black metallic finish, complete with silver and gray accents, clean lines, and a ton of glass, with a hint of white illumination in the interior. Honestly, we think it looks killer.

Overall, the build process went incredibly smoothly—pretty much every element of it went to plan. Again, it's an absolute testament to Hyte's design team, designing a chassis that's so easy to work in.

It wasn't entirely without hiccups, of course, but the majority of that came from component selections. In an ideal world, picking up a fan controller ahead of time, even a simple one, would have kept our stress levels low, and is a good word of warning for those building their first, second, or even 50th PC. It's easy to forget the small things every now and then, and a motherboard without nine fan headers is one of those things that's very easy to forget about.

It's a fair comment to suggest that Hyte should have included some form of simple fan controller in the Y40 as well (in fact, the Y70 Touch doesn't have one either, and that's got a full-blown screen in the thing), but at the same time, that would have bumped the price up even more, and given that this thing slides in at just $150 for such a premium experience, it's hard to complain about it. It represents a fantastic budget/mid-range option for any system builder who's looking to save some cash, but still wants a super-slick case.

Things we'd change? Aside from securing that fan controller down, adding a secondary LED strip in the roof of the case would've been a good shout. We did toy around with a diffused Phanteks RGB LED strip that runs off the D-RGB header on the motherboard, but it was so dim that you couldn't even tell it was on without looking directly at it. But having some form of white lighting firing down hidden around the edge of the case would've looked stellar, and still keep that stealth feel we were going for.

Additionally, it's something we always come back to, but custom-sleeved cables make a world of difference to a premium build like this. It would have added to the cost, and it's a nice upgrade later down the line, but boy would we have liked to have them. Be quiet! actually sells a set of custom cables for its PSUs now as well, so you don't have to go to a third party either. But otherwise, that's about it.

1 **Nvidia's RTX 4070 Super graphics card in all its glory. What a piece of engineering. It's slick and gorgeous, and although not having the option to horizontally mount it is annoying, it does look epic when sat upright like this at the bottom of the case.**

2 **Part of us wanted to install these two 140mm Noctua Chromax fans so the fan guards were exhausting out of the case instead for aesthetic reasons, but really, this is the better solution, and does provide us with a build that's closer to balanced pressure than negative.**

3 **You might notice the gray accents on the chromax fans on the top left of the case here. Each chromax fan comes with a whole range of different color options for these—four of each. So you could add yellow, red, orange, green, or blue accents to your fans if you wanted.**

4 **Hiding a white RGB LED strip in the top of the chassis that shines light down would have done wonders for our interior lighting setup.**

AIR COOLING & GENERATIONAL UPDATES

WE'RE COMPARING this build directly to last issue's Hydra mini system. There are some big differences between these two rigs, but as you can imagine, the big focal point from a hardware perspective on this one is the graphics card, and the bump from the RTX 4070 to the Super. There are some caveats to that, of course—in the case of the Hydra Mini build, we are running an Intel Core i7-14700K, a processor with notoriously potent single-core performance. Not only is that something AMD has historically struggled with, even with the very best of Ryzen, but it's something that generally leverages itself well to improving graphical performance in-game. The one mitigating factor to that is that our testing is done entirely at 4K, which mostly alleviates the processor as a bottleneck.

4K gaming typically leverages more weight onto the graphics card than the CPU, as frame rates are lower than they would be at 1440p and 1080p. As long as you're using a fairly modern CPU, you're not likely to see any major performance degradation when gaming at 4K with modern GPUs (it's why the vast majority of professional hardware reviewers skip 4K game testing with CPU reviews).

The long and short of it is that, for 20 percent additional internal hardware, in-game performance varies anywhere between seven and 18 percent in our testing, with the 4070 Super averaging around the 13-15-percent increased average fps, compared to the standard RTX 4070. That's not entirely surprising, given what we know, but doesn't tell the whole story. The games we're testing here are incredibly aggressive when it comes to graphical performance without the support of DLSS, particularly *Cyberpunk* and *Metro Exodus*. Enable DLSS 3.5 on *Cyberpunk* with ray tracing as an example, and frame rates climbed close to the 50 fps mark in our benchmark runs—well within playable range, and looking gorgeous in the process. It's a big difference, and gives us hope for where Nvidia's Tensor core brilliance goes next.

As for general PC performance, the PCIe 4.0 SSD wiped the floor with the WD drive from the last build by some margin, and held its own in Cinebench R23's single-core test, too, although it didn't quite beat out the 14700K. That said, the 14700K and its 28 threads monstered the Ryzen 5 7600X's 12, as it suffered a 51 percent deficit by comparison.

As for Core price, that four percent win for the AMD rig is notable, particularly given we've got a strong motherboard, along with double the storage capacity and a faster PCIe 4.0 drive.

All in all, the Stealth rig is a success. It's solid, sleek, and subtle, and can kick some serious butt at 4K. Is this the end of 1080p gaming? It certainly looks like it.

BENCHMARKS

	ZERO-POINT	
Cinebench R23 Single-Core (Index)	2,117	2,031 (-4%)
Cinebench R23 Multi-Core (Index)	29,446	14,545 (-51%)
CrystalDisk QD32 Sequential Read (MB/s)	4,176	6,987 (67%)
CrystalDisk QD32 Sequential Write (MB/s)	4,135	6,755 (63%)
3DMark Fire Strike Ultra (Index)	10,099	11,135 (10%)
Cyberpunk 2077 (fps)	26	29 (12%)
Cyberpunk 2077 RTX (fps)	17	20 (18%)
Metro Exodus (fps)	43	46 (7%)
Metro Exodus RTX (fps)	30	34 (13%)
Total War: Three Kingdoms (fps)	42	48 (14%)
Core Price	$1,431	$1,368 (-4%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point consists of the Core i7 ITX build from last issue. Featuring an Intel Core i7-14700K, Nvidia GeForce RTX 4070, MSI MPG Z790i Edge WiFi Motherboard, 32GB (2x16GB) of XPG Lancer Blade RGB DDR5-6000, and 1TB Western Digital Blue SN580 PCIe 4.0 M.2 SSD. All games tested at 4K "Ultra" graphics presets with DLSS and V-sync turned off and XMP for RAM speed turned on. No manual CPU overclocking. "Core Price" refers to the key components generating performance (CPU, GPU, Mobo, SSD, RAM), not accessories.

NVIDIA'S SUPER CARDS HAVE ARRIVED

Nvidia's RTX 4070 Super packs in 20 percent more hardware than its predecessor does, all at the same price.

CES WAS REMARKABLY QUIET this year for proper PC hardware launches. There was the odd smattering of products here and there, but generally speaking, only one of the leading players launched anything of merit, and it was Team Green who lit up the press with an interesting array of new product announcements, namely its newly refreshed and highly rumored Super series GPUs.

There's a grand total of three at launch, each one having dropped one week after the other in January. All three models represent some interesting adjustments to what were already solid, if expensive, cards.

The RTX 4070 Super, for example, is the most aggressively altered card of the lot, jumping up from 5,888 CUDA cores to 7,168, along with more L2 cache, and a significant 20 percent boost to its ray tracing and tensor AI core tech as well. The 4070 Ti Super, on the other hand, has a smaller upgrade of just 10 percent to the total hardware count. That goes for CUDA cores and ray tracing/DLSS componentry, but the big difference is in the VRAM count, as that jumps up from its ill-fated 12GB up to the 16GB that the vast majority of power users expected at launch.

Then there's the RTX 4080 Super. It has technically received a bump in hardware, going from 9,728 CUDA cores up to 10,240 (a five percent increase). The same goes for the ray-tracing elements. Nvidia has said that performance should be well within the same region as its 4080 counterpart, within 1-3 percent or so, even less or negative if you currently have an overclocked RTX 4080.

So why the Super moniker for that card? Well, being cheaper is the main argument. Unlike the other two cards, which retain the same launch MSRP, the RTX 4080 Super launches at the lower price of $999—$200 cheaper than the stock RTX 4080. That does make it a bit more confusing, however, as if overclocked AIB partner card RTX 4080s outperform the Super, and come in cheaper or at the same price, are you still going to be better off getting that card, instead of the Super? Honestly, this feels like another RTX 4080 12GB situation again, and we're just not fans of it.

ARE THE SUPER CARDS WORTH IT?

We've got a fair amount of analysis coming for these cards in this and the coming issues, so we won't go too in-depth here, but the long and the short of it is that it depends—on if you've already bought a 4000 series card. If you have, then moving up a GPU isn't going to be worth it. That said, the difference in ray tracing and DLSS performance on the 4000 series compared to even the 3000 series is staggering.

If you're looking to upgrade, and Nvidia is the name of the game, these are fantastic. The fact the Ti Super and the 4070 Super are the same price, but with more of everything, really does sell it.

Across our testing, we've seen the RTX 4070 Super demolish 4K gaming, pipping 60 fps across the majority of our test titles. It's one of the best-value GPUs Nvidia has in its line-up, even smoking the RTX 4070 Ti and the 4080 by comparison.

NVIDIA RTX SUPER CARDS COMPARED	NVIDIA GEFORCE RTX 4070 SUPER	NVIDIA GEFORCE RTX 4070	NVIDIA GEFORCE RTX 4070 TI SUPER	NVIDIA GEFORCE RTX 4070 TI
GPU	AD104-350	AD104-250	AD103-275	AD104-400
Transistors (Billions)	35.8	35.8	45.9	35.8
CUDA Cores	7,168	5,888	8,448	7,680
Tensor Cores	224	184	264	240
Ray Tracing Cores	56	46	66	60
Base Clock / Boost Clock (MHz)	1,980 / 2,475	1,920 / 2,475	2,340 / 2,610	2,310 / 2,610
Memory Size (GB)	12	12	16	12
Memory Type	GDDR6X	GDDR6X	GDDR6X	GDDR6X
TDP(W)	200	220	285	285
RRP	$599	$599	$799	$799

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BEST OF CES 2024

The biggest tech show in the world returned to Las Vegas with more monitors, laptops, and handhelds than you could shake a big stick at. Thankfully, *Guy Cocker* was there, stick in hand, to see all the PC tech you'll want to keep an eye on in 2024

WITH MOBILE PROCESSORS from Intel, new graphics cards from Nvidia, and a whole host of monitors and laptops from everyone else, this CES had plenty of shiny new tech for us to get excited about. Let's start with gaming laptops, which are getting thinner, lighter, and more portable than ever before; perfect if you're looking for a machine that's small and light enough to take into the office, but powerful enough to slay demons in *Diablo* at lunchtime. There were also a litany of new OLED monitors, which while still being on the pricey side, are at least going to be available in smaller sizes, so you no longer need a massive desk to accommodate one.

Predictably, the buzzword of CES 2024 was AI, and entertainment could be had counting the number of references to the shareholder-pleasing term during keynotes. In reality, we did see some cool uses of artifical intelligence, most notably in Lenovo's Legion laptops, which will sense what you're doing with your PC and apply overclocking settings if it's gaming or creative work, or throttle things down for word processing to save battery.

With that said, here are the best products we saw at the show, and the tech we're most anticipating this year. Best get saving now.

NVIDIA'S AI NON-PLAYABLE CHARACTER

Not so much a product as a tech demo showing how we may soon interact with game characters, this was built in Unreal Engine 5, and uses AI tech from startup Convai. In the demo, you enter a ramen restaurant in a cyberpunk world, and start a conversation with Jin, the bartender, and Nova, a customer. Instead of choosing from a few pre-written questions, though, you just talk into a microphone, and the characters audibly respond to whatever you ask. You can order some ramen, find out if they've ever traveled to the Grand Canyon, what brand of GPUs they prefer—anything you can think of, with accurate and even quite funny responses during our interactive demo.
• Out: TBC • www.nvidia.com • Price: N/A

MSI CLAW

PC gaming handhelds have so far all run AMD hardware, but MSI's is the first to use Intel's CPU and GPU tech. Available with either a Core Ultra 5 or Core Ultra 7 155H and Arc graphics, the Claw also reportedly has a higher max power draw compared to its competitor, the ROG Ally. A 53WHr battery is being touted as lasting 50 percent longer than the market average (translating to two hours in full power mode, compared to the Ally and Steam Deck's hour). It all looks promising.
• Out: H1 2024 • www.msi.com
• Price: $699-799

RAZER PROJECT ESTHER

Razer has already released haptic-feedback controllers and headsets to give you vibrations through your hands and head. Now, it's coming for your derriere. Project Esther is a cushion that goes over your existing desk chair, which is covered in a series of haptic motors that create localized vibrations through your body. Our demo consisted of a battle mech demo firing and being shot at, and the sensation did prove more immersive as well as useful, as you can tell if you're being shot at, even if you can't see it on the screen.
• Out: No release date (concept only)
• www.razer.com • Price: TBC

HP OMEN TRANSCEND 14

Each year, the gaming laptop market seems to pivot more and more away from traditional gamer aesthetics. Take the HP Omen Transcend 14, which does have RGB lighting on the keyboard, but could otherwise easily be mistaken for an ultraportable. In fact, HP is selling it as "the world's lightest 14-inch gaming laptop" at just 3.6 pounds, which is amazing, given it also packs an RTX 40-series GPU and a 2.8K 120Hz OLED.

- **Out: Now**
- **www.omen.com**
- **Price: $1,599**

XREAL AIR 2 ULTRA

While Meta Quest 3 and Apple Vision Pro seem content to do augmented reality in a very VR headset-looking way, Xreal is making AR much more accessible with these sunglasses-styled lenses. They have dual 3D cameras up front, which allow for surrounding mapping and hand tracking, while the integrated 1080p OLED displays provide you with high-quality information, video, and games. AR still feels niche, but these glasses could be what take it mainstream.

- Out: March
- www.xreal.com
- Price: $699

XGIMI ALADDIN

We love a projector for large-screen gaming here at *Maximum PC*, and XGIMI makes the best in the business. Its new Aladdin model completely disappears into the room thanks to the fact that it's disguised as a ceiling lamp. It still packs some serious tech credentials though, with a 100-inch screen capability, 1080p resolution, and Harman Kardon speakers. It can also show dynamic wallpapers when not in home entertainment use, while also playing interactive children's stories or ambient sounds

- **Out: June 2024 (Japan)**
- **www.xgimi.com**
- **Price: Approx. $1000**

TP-LINK ARCHER GE800

The Wi-Fi 7 router market is now up and running (see our Netgear review on page 80), but this is the first gaming-focused router we've seen in the category. That means that of course it has immersive RGB lighting on its sides, but it also reaches download speeds of up to 19 Gbps. The rear specs are ridiculous, with two 10 gigabit ports along with four 2.5 gigabit ports, with one of those 2.5 gigabit ports dedicated to gaming, and all traffic from that device prioritized.

• Out: 2024 • www.tp-link.com • Price: TBC

ACER SWIFT X 14

The Acer Swift X 14 is shaping up to be the ultimate all-rounder laptop in the year of AI. That's because it uses both an RTX 4070 and Intel Ultra 7 processor, and will intelligently switch between them. You can also kill the GPU completely to save battery. The 2.8K OLED display at 120Hz refresh rate at 16:10 aspect ratio is right at the sweet spot for gaming and creativity, plus you can specify up to 32GB of RAM, and up to 1TB of SSD storage.

- Out: April 2024
- www.acer.com
- Price: $1,499

RABBIT R1

Okay, so this isn't technically a PC product, but it is an interesting AI-driven mobile device. The $199 pocket device aims to be the bridge between you and your apps, allowing you to use your voice to book a holiday, get you a cab, or queue up a playlist of music. It's also co-designed with the Swedish geniuses at Teenage Engineering, the same folks who designed the aluminum PC chassis that was our September 2022 cover star.

- **Out: Now • www.rabbit.tech**
- **Price: $199**

LENOVO TAB M11

Lenovo's new Android tablet isn't quite in the 'pocket change' category at $179, but it is under half the price of many other so-called 'budget' tablets. Moreover, it has a lot going for it—that 11-inch screen runs at 90Hz for fluid scrolling and gaming, it supports Lenovo's excellent Tab Pen for productivity and creativity, and comes with Android 13 and software updates up to 2028. It won't replace your laptop, but if you fancy an Android tablet this year, this looks like a no-brainer.

- **Out: Now**
- **www.lenovo.com**
- **Price: $179**

ALIENWARE AW3225QF

Alienware has spent the last couple of years leading the way when it comes to OLED monitors, but even with lots of competitors now snapping at its heels, it's still maintaining that lead. That's thanks to its 32-inch 4K model, which boasts the world's fastest refresh rate of any 4K OLED at 240Hz. It also has a 0.03ms response time, 99 percent DCI-P3 color reproduction, and 140 pixels per inch. If you're a gamer with a high-end GPU, then beg, borrow, or steal to get this monitor.

- Out: Now • www.alienware.com
- Price: $1,199

ACER PREDATOR Z57

While most of the buzz around monitors at CES 2024 was OLED panels, if size is what you care about, then you should divert your attention to the Acer Predator Z57. The DUHD (7,620 x 2,160) VA panel is like viewing two 4K monitors side by side, while Mini LED backlighting, a 120Hz refresh rate, and AMD FreeSync Premium round out the package.

- **Out: Now**
- **www.acer.com**
- **Price: From $2,499**

CREALITY K1C

The best 3D printer of CES 2024 was this new model from Creality, which builds off the success of the already great K1 by sustaining higher temperatures and working with more exotic filaments. The new model features an all-metal hotend, which allows it to operate at 300 degrees and therefore work with carbon fiber (that's what the "C" in K1C means). The printer also has a revised bowden tube path and better build plate. • Out: Now • www.creality.com • Price: $559

RAZER BLADE 16

While many will bemoan the death of the classic Razer Blade 15, any complaints will evaporate once you see the OLED screen on the new 16. Samsung's panel is the first 240Hz model on a gaming laptop, and with a 0.2ms response time. VESA certified DisplayHDR True Black and Calman certified 100 percent DCI-P3 will impress gamers and creatives alike. Plus, it comes with up to an RTX 4090 at full 175W power, plus Intel's overclockable i9-14900HX CPU.

- **Out: Now**
- **www.razer.com**
- **Price: From $3,000**

ASUS ROG NUC PC

It feels like massive GPUs have made small form factor PCs less popular recently, but Asus is bringing them back with its NUC mini PC. Think of it as a laptop converted into a tiny desktop at 144 x 112 x 41mm, but there's an Nvidia GeForce RTX 4070 GPU and Intel Core Ultra i9 processor crammed into this tiny chassis. There are also cheaper models that use Intel's Arc GPUs, and they're all completely tool-less for easy upgradeability.

• Out: Q2 2024 • www.asus.com

• Price: $1,600

LENOVO MAGIC BAY STUDIO

Attached to the lid of both Lenovo's ThinkBook 13X and ThinkBook 16P are magnets and pogo pin connectors that allow you to quickly snap on and swap out a variety of peripherals. These include a 4K webcam, a secondary 8-inch display, an aromatherapy kit, a mirror that doubles as a ring light, and a robot companion that winks at you to encourage you to keep working.

• Out: April 2024 (4K webcam), others TBC • www.lenovo.com

• Price: $199 (4K webcam)

ASUS ROG PHONE 8

For those of you who've read our gaming phone reviews, you'll know the drill—incredible hardware specs, bad cameras. This looks like it could be the first to buck this trend, with a 50MP main lens, 13MP ultrawide, 32MP 3x telephoto, and a 32MP front-facing camera.

• Out: Now (China), April 2024 (US)

• www.asus.com • Price: $999

ASROCK PHANTOM GAMING B760I LIGHTNING WI-FI

Want to build a cutting edge mini PC without breaking the bank? ASRock's new Mini-ITX motherboard, which supports Intel's range-topping Core i9-14900K but costs just $200, has you covered. The board also has two DDR5 memory slots, good connectivity including Wi-Fi 6E, and decent overclocking potential, using a 14+1+1 voltage regulating module covered with massive heatsinks.

• Out: TBC • www.asrock.com • Price: From $200

HYPERX CLUTCH TANTO MINI WD

Xbox and PlayStation's game controllers are great, but they can be quite cumbersome for those with smaller hands, like kids. Enter the HyperX Clutch Tanto Mini WD, a wired controller with proportions that accommodate younger gamers and smaller hands alike. This wired mini-controller offers a full function gamepad experience, and is an officially licensed Xbox peripheral that supports Xbox, PC, Steam Deck, and mobile devices.

• Out: 2024 • www.hyperx.com

• Price: TBC

COOLER MASTER MK770

Customizable keyboards are great, but they're not exactly affordable—just look at the $300 Ducky ProjectD Outlaw 65 review on page 87 for proof. Cooler Master's MK770 has all the premium features we'd look for—it's gasket-mounted, hot-swappable, wireless with tri-mode connectivity, has double-shot PBT keycaps, and more than one colorway, but it's set to cost just $119 when it launches later this year. It should be a no-brainer for those who want an affordable 96 percent keyboard.

• Out: TBC 2024 • www.coolermaster.com • Price: $119

MSI MEG MAESTRO 700L PZ

Motherboards with rear-facing connectors will become common this year, and MSI's Project Zero boards are some of the first to market. The company's MEG Maestro 700L PZ case takes the en vogue 'fishbowl' case style to the next level, with the entire front and side panel made up of one massive curved piece of tempered glass. This is arguably the prettiest of these kinds of cases we've seen yet.

• Out: Now
• www.msi.com
• Price: $400 (approx)

PHISON PCIE 5.0 POWERED DRIVES AND CONTROLLERS

Phison's E31 controller will launch later this year, bringing with it a move to TSMC's 7nm (N7) process. This should help 'mainstream' PCIe 5.0 drives finally get to market, with lower price points, lower power use, and still high performance. This should max out what we can expect from PCIe 5.0 drives—we'll then need PCIe 6.0 to get significantly faster. E31 may actually end up in laptops as well.

• Out: 2024
• www.phison.com
• Price: N/A

MAD CATZ MMO 7+

This is a wireless version of Mad Catz's classic MMO-focused multi-button mouse, featuring a whopping 21 programmable buttons with a shift mode and five profiles for up to 210 inputs. Those 21 buttons are not just laid out in a 12-button side panel like most MMO mice have, but are kind of... all over the mouse, which makes them easier to differentiate. As well as being highly customizable, it's also got a 26,000DPI sensitivity, although the 40-hour battery life is short.

• Out: June 2024 • www.madcatz.com
• Price: TBC

ASUS ZENBOOK DUO

The dual-screen laptop was also a theme at last year's CES, but with the Zenbook Duo, it now feels ready for prime time. That's mainly because it features dual 14-inch OLED displays and detachable Bluetooth keyboard that simply magnetically attaches and detaches from the laptop. It's thin and light, but is packed with ports including HDMI and Thunderbolt 4, plus it packs up to an Intel Core Ultra 9 185H.

• Out: February 2024
• www.asus.com
• Price: $1,500

PLANETPC XR2 MINI DESKTOP

These Linux-based mini PCs look cool, run fast, and offer what looks to be good value for money. The killer feature has to be that front mounted touchscreen, from which you can see system information and toggle features such as Wi-Fi. Each system is based around an 8-core ARM processor, and start with 4GB RAM/32GB Flash, but they're easily upgradeable on the memory and storage front at purchase, or later.

• Out: Now
• www.planetcom.co.uk
• Price: From $650

ALIENWARE M16 R2

The M16 is finally portable! Yes, the previous model of this popular mid-ranger was good, but it had a wide shelf at the back, which hardly made it portable (I should know, I was lugging one around the Las Vegas Convention Centre all week). The new model loses the shelf and becomes 15 percent smaller. It comes with Intel's Ultra H Series and RTX 4050, 4060, or 4070 GPU.

• Out: Now • www.alienware.com
• Price: From $1,499

LG OLED M4

For those who prefer to do their PC gaming in the living room, LG's M4 OLED looks like it's the TV to die for. The key is its Zero Connect Box, into which you plug your sources, which then transmits the signal to the TV wirelessly. True, PC purists will already be wondering about the latency and response time at this point, which concerns us too, but the TV has also had a refresh rate bump from 120Hz to 144Hz.

• Out: 2024 • www.lg.com • Price: $3,999 (65-inch model)

FRAMEWORK 16

Our favorite modular and upgradeable laptop has got even better. We were shown the new 16-inch model at CES, which features a mainboard that uses the larger chassis for a plethora of things, such as a larger battery, better cooling, and a n AMD GPU. We also saw their latest keyboard expansion modules, which allow you to add LED animation panels, add or remove a numpad, or reposition the touchpad. **• Out: Q2 2024 • www.frame.work • Price: $1,699 (Pre-built), $1,399 (DIY kits)**

LG GRAM PRO 2-IN-1

This is the lightest 16-inch 2-in-1 laptop in the world at 3.08 pounds, and has the Guinness World Record to prove it. Like all LG Gram laptops, it's almost impossibly thin and light, but this time, the highest-end model boasts an OLED display at 2,880 x 1,800 resolution, which is good enough for creative work, plus the Intel Core Ultra 7 processor, 32GB of RAM, and 1TB of M.2 SSD storage will help, too.

- Out: TBC 2024
- www.lg.com
- Price: TBC

ACER PREDATOR HELIOS NEO 16

This combines the power and style of Acer's Helios 16 with the affordability of the Nitro 17. It's stylish, but the QHD+ (2560 x 1600) display features a 240Hz refresh rate and DCI-P3 100 percent color gamut, so it can double as a creative machine. It goes up to an Intel Core i9-14900HX CPU and Nvidia GeForce RTX 4070 GPU—great for gamers on a budget. • Out: March 2024

- www.acer.com
- Price: From $1,499

NVIDIA RTX 40 SUPER SERIES

Okay, so these cards are out now, and we have the RTX 4070 SUPER in our cover build and you can read our full verdict on page 74. The most notable card is the 4080 SUPER, given that it's more powerful than the card it supercedes, but costs $200 less. But the $599 4070 SUPER is the card most people will be interested in, and we can report that it delivers when it comes to performance.

• Out: Now • www.nvidia.com

• Price: $599 (4070 SUPER), $799 (4070Ti SUPER), $999 (4080 SUPER)

MSI ROAMII BE PRO MESH SYSTEM

In support of its gaming laptop line in 2024—all Wi-Fi 7-enabled—MSI has unveiled three levels of mesh routers using the new standard. The base model Roamii BE Lite Mesh System is just $299 for a two-pack, while the upgraded Pro model adds 6Ghz and up to 11GBps in a two-pack for just $399. The Roamii BE Max Mesh System bumps up to 23Gbps for only $499.

- **Out: Q1 2024**
- **www.msi.com**
- **Price: $399**

HYTE NEXUS LINK

Hyte's Nexus Link is a competitor to Corsair's iCue Link, using similar daisy-chained magnetic connectors and fans. But Hyte also offers magnetic RGB strips that use the same connector. It's powered using a quad-core Arm CPU housed in the screen built into the company's Thicc Q60 AIO cooler, and feels more refined, visually interesting, and arguably better built than what anyone else is doing in the DIY space right now.

- Out: February 2024 • www.hyte.com
- Price: $299 (Thicc Q60 AIO)

ACER SWIFT GO 14

This laptop looks like it will be the new king of thin and light notebooks. The 2024 model comes with a 14-inch WQXGA+ (2,880 x 1,880) OLED screen that makes anything displayed look bright and crisp, there's a 1440p QHD camera, up to Intel Core Ultra 9 185H CPU and Intel Arc graphics, and it starts at just $799. Sign us up.

- **Out: Now • www.acer.com**
- **Price: From $799**

RYZEN 7 8700G AND RYZEN 5 8600G

AMD's new chips offer superb value for their mid-level price point. They boast a powerful integrated RDNA 3 graphics engine that AMD claims can deliver 1080p-capable gaming performance, even in some AAA titles. They also support AM5's DDR5 and PCIe 4.0 connectivity, as well as FSR, HYPR-RX, and Fluid Motion Frames support. They even come with bundled coolers. Bargain!

- Out: Now • www.amd.com
- Price: $229 (8600G), $329 (8700G)

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THE ULTIMATE

PC BUILD GUIDE

Strap in as we divulge the first 20 tips on how to become the next master PC builder

By Zak Storey

HERE AT MAXIMUM PC, we're specialists when it comes to, you know, building PCs. It is our bread and butter, and we've been doing it for a heck of a long time now. This journalist alone has logged no less than 63 separate build logs in these hallowed pages, and built many more. Along the way, we've picked up a ton of tips and tricks to make the process as painless and seamless as possible.

It's this knowledge, these ingrained subtle refined notions and ideas that have turned even the most challenging of concept system builds into paltry, simple, and easy-to-produce machines of mayhem. They can be crafted on a whim, and knocked out in less than a few hours. Here, we'll be divulging all that information to you.

Yep, we've scoured the team's collective brains and come up with no less than 41 tips and tricks to really max out your next build, or at least make you think about tidying up your current one. Whether you're a novice or a pro, a gamer or a 3D renderer, there's something for everyone in *Maximum PC*'s 2024, occasionally annual, Builders Manual.

01 PREPARATION, PREPARATION, PREPARATION

Nothing is more important in life than a good solid plan—Sun Tzu once said, "Know the enemy and know yourself; in a hundred battles you will never be defeated." An extreme example, but this is absolutely correct, no matter where you apply it. Our enemy today is the humble system build laid out before us. It is our target, our goal, our challenge, and with it comes a plethora of considerations we need to take into account before committing one single cent to that basket of parts.

We can't stress enough that research is going to be your best friend. Identify your budget, and what performance you're looking for. Every build is different, and every budget equally so. The value of the dollar is always going to change for you, depending on how much of it you have available for your build. The less you have, the more important it is to spend each and every dollar wisely to ensure you get the most relevant performance out of the components in question.

02 BUDGET BEFORE BEAUTY

It's that last part that we need to emphasize first. If you've followed our most recent builds, you'll see that we've embedded a new measurement into our benchmark tables at the end, and that's 'Core Price'. Simply put, this is the cost of all the key components that are generating performance, including the motherboard. Your processor, RAM, SSD, graphics card, and mobo all sit on that list—basically, anything that makes your system tick. Why is that important? Because this really ought to be where you're spending the majority of your cash.

Take issue 224. That build, complete with Core i9-14900K and RTX 4090 overall, costs less than the following issue's build with a Core i5-14600K and RTX 4080, despite those two components outclassing the others. This was down to the extra expenditure on fancy Corsair QX fans, lighting, and cases with displays built into them.

They do look great, but think of them as extra frills; things you can come back to and add later. They can wait—what matters most is the performance you see on screen, not the light show going on in your chassis.

03 PRIDE COMETH BEFORE THE FALL

Third on the agenda is the acknowledgment that you don't need that $2,000 GPU. It's easy to get swept up in the hype of your pals buying ridiculous hardware for their next builds, but don't fall prey to peer pressure if you're not going to benefit from the hardware in question. Don't just buy it; setting out a core spec and the performance you want is a great place to start.

For each issue, we collectively decide what it is we want to achieve with that month's build. That might only apply to us, working on a tech magazine, but it can easily be transcribed into real life as well. What is it that you want to do with the machine? Do you want to game at 1080p, render 4K video, fold proteins, or build a home theater PC? Tie that in with your budget, and look at hardware that's suitable for that pursuit.

You can buy a Corvette Stingray to drive the kids to school, but it's not exactly a practical expenditure. This might sound like we're teaching you to butter biscuits, but it's always helpful during the planning process to remind yourself exactly what it is you're setting out to do. Look at your final spec, and ask yourself the question, 'is this fit for the purpose I've set out?'

04 SPECIFYING SPECIFICATIONS

Once you've settled on those elements, you need to consider components that are intrinsically tied to your key parts. In our eyes, these are basically the GPU and the CPU, and that's about it. After those two are dialed in, you've then got to look at supporting parts and how they interconnect. You'll need a motherboard, but how much I/O do you need? You'll require RAM, maybe 32GB for Photoshop, but do you need DDR4 or DDR5? What RAM frequency will be best for your processor or application? You're going to want some snappy storage, but is PCIe 4.0 or 5.0 the best? Does your motherboard support that?

Then there's the case and cooling, and everything else in between. This will take time, and that's okay. It's a whole intricate interconnecting web of decisions, with one part defining another. Settle on your GPU, CPU, and budget, and most, if not all, should start to fall into place.

05 CHASSIS SHENANIGANS

One of the primary considerations you're going to need to think about next is, ironically, your workspace. Where is this machine going to sit? Do you have a nine-foot-long desk? Or are you stuck in college, with only a small cubby hole to your name?

These considerations are important because case size matters (no seriously, it does), and thinking about where your PC is going to live can have an impact. There's no point in buying a full-tower ready for liquid cooling if you don't have the space for it. ITX does solve these kind of problems, but then you run the risk of hardware not fitting, needing an SFX PSU, or having to make accommodations for your graphics card due to space constraints.

Case size is a big deal, particularly if you've got a small office to play with.

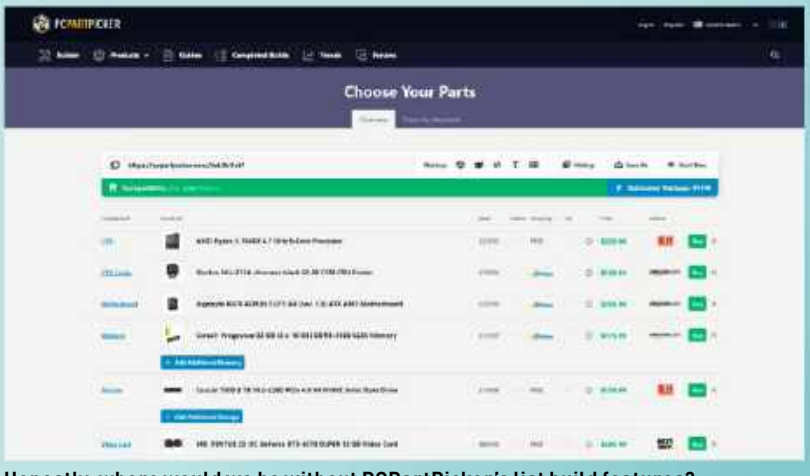
06 THE SAVING GRACE OF PCPARTPICKER

PCPartPicker has become ubiquitous in the PC-building community. It's one of the most comprehensive system-building tools out there. Not only do they have a list of community builds, using cases and parts of all sizes and makes, but there are some incredibly versatile compatibility features built into its PC list-building feature that make planning your next rig a dream.

It will tell you if your CPU comes with a cooler or not, what your estimated maximum load power draw will be, whether your motherboard might need a BIOS update to be compatible with your processor, and break down exactly which component will fit in which slot, and at which speeds.

Of course, it's not without fault—not every component is featured on there. There is a lag, particularly for new parts. Additionally, as it is an affiliate-supported site, the majority of its hardware has to be sold on a site that has an affiliate program of some description, like Amazon, Newegg, or Best Buy.

Some manufacturers don't always have those, or keep special components on their webstore only, so it's always worth double-checking. Additionally, its live pricing isn't always up to date, and stock levels can change so rapidly that it can be difficult for the site to keep up, so as always, check twice, pay once.



Honestly, where would we be without PCPartPicker's list build features?

07 MOTHERBOARD 101

Here's the thing with motherboards: realistically, performance across all of them for your component parts should be roughly equal. There are exceptions to this rule, of course: if you've got a PCIe 5.0 M.2 SSD, and one board supports 4.0 and the other 5.0, then yes, the 5.0 board should have the edge, but for CPU and GPU (before you say anything, the RTX 4090 still struggles to fully saturate a PCIe 3.0 x16 slot under load—103 percent saturation for those interested at peak!), really, it shouldn't matter if you plug them into a $150 or a $700; both should be well within around two to four percent in terms of real-world performance to one another.

So what's the big deal, then? It mostly comes down to feature set and I/O. The more you spend, the better they look, and the more I/O they should support. On top of that, more premium boards will have better power phase solutions. The bigger the power-phase, the more wattage the board can handle, and the smoother it can deliver that power to the processor, leading to higher sustained clock speeds. Ultimately, you need to find a board that fits your I/O needs and looks the part for your system. But if you have to reduce the hard cash investment, it's not the end of the world.

08 COOL RUNNINGS: AIR VS LIQUID

So you've picked all your parts up to now. Next is the big one: how do you cool your CPU? You have three options: custom liquid-cooled loop, all-in-one (AIO) liquid cooling, or an air-tower. The first thing you need to know is that these all effectively work off the same basic principle: the processor heats up, a fluid takes that heat, evaporates, or moves (via pump) to a radiator packed with fins, the heat then transfers across to those fins, and cool air passes over them, usually from a fan of some description, cools the liquid or gas, and moves back (or condenses and falls in the case of heatsinks) down towards the processor. It's that simple. All of our cooling operates in the same manner. In fact, there's no difference between the radiator in your car to the one in your PC's AIO. The main difference, of course, between all these methods is speed, volume of coolant, and surface area.

Air definitely has its advantages. It's generally cheaper, sometimes easier to install, and usually far more reliable. If a pump fails in your AIO, you have to remove the entire unit. If a custom loop

Motherboards shouldn't define the performance of your hardware; they should increase the amount of I/O you have access to.

starts to leak, you've got big problems, but if a fan fails on your heatsink? You replace the fan. That said, AIOs are far better at holding and moving bigger volumes of heat away from a processor, and of course, given the size of the radiators themselves, often have far larger surface areas to cool than that of a traditional heatsink. Usually, these radiators top out at 420mm in size.

Custom loops take that one step further by allowing you to add even more radiators—and thicker ones, too. However, you will reach a point of diminishing returns where no matter what you do, the cooling speed won't increase, as you'll be bottlenecked by the speed at which the heat can be transferred from the CPU or GPU into the liquid, and the speed at which the pump can move that coolant away and to the radiators.

09 IT AIN'T ALL ABOUT THE FANS

Once upon a time, fan design mattered. We had an assortment of both static pressure and airflow fans—fans designed to shift great big gobbets of air, and fans designed to pressurize a smaller amount as best it could in a singular direction. In today's era of PC building, generally speaking, this no longer applies (unless you're Noctua). Most premium fan solutions are generally multi-purpose, and most radiators and heatsinks likewise don't particularly benefit from one type of fan over another.

Once upon a time, it was common to see radiator specs declare 'Fin Density' as a number, with the higher the density meaning the higher the static pressure required to cool them. These days, it's commonly accepted that the performance difference between those types of fans is so negligible for the vast majority of fans that it's not worth worrying about. What's more important is that the surface area you have available has air moving over it. So don't sweat the small stuff; pick up the fans you like most.

10 SYSTEM PRESSURE – MORE FAN...TASTIC CONUNDRUMS

When it comes to building your system, fan balance has and will remain a contentious issue. You have three main system styles, all with their supporters and detractors: negative pressure, where the majority of fans are blowing air out of the case, drawing fresh air in from gaps and unventilated access areas; positive pressure, where the majority of fans are pulling cool air into the case, and pushing hot air out of unfiltered gaps in the case; and balanced pressure, where there's an equal mix of pressure both in and out from filtered areas of the case.

For the longest time, the prevailing notion was that for dust management and maintenance, positive pressure was the way to go, but lately that has come under some scrutiny, particularly given how much dust filters tend to impede fan performance. Generally speaking, it's better to go for a balanced system as best you can, scrap the filters where possible, and give your system a good dust once a month or so.

If you're struggling then there's a sneaky workaround. If you can fix your fan speeds for your case fans, you can actually create a balanced system by altering the fan speeds in BIOS or fan control software, although it will require a bit of math, depending on your system and fan specs.

It's rare to find static pressure or airflow-optimized fans these days, but that's okay.

11 PICKING THE RIGHT PSU

We've already touched on this with PCPartPicker, but there are some considerations to be made here, too. Please make sure that whatever you do, buy a respectable power supply from a well-known manufacturer with a good warranty. Next, make sure that it will fit your case, and finally, make sure it comes with all the cables you need for your build.

Always double check whether it will be enough wattage for your system, too. Bear in mind that most power supplies are actually most efficient at an 80 percent load. If you've got a system with an 800W max expected load, a 1000W PSU will be the right pick.

12 AIO FAN QUERIES

One of the questions we get asked most often is 'what's the best way to mount fans to our AIO?' Simply put, is it better to place our AIO's radiator behind our intake fans, or instead, place it on top of our exhaust fans?

This is one of the few areas where fan management can significantly alter performance, and it depends on your component parts. Full custom-loops and heatsinks don't suffer from this particular issue, fortunately.

Effectively, if you place your AIO's radiator behind the intake fans (with the intake fans drawing cool air over the radiator immediately), you're going to end up with a cooler CPU. However, it comes at the cost of hotter internal components, particularly your storage and your graphics card, where temperatures can rise by 10-15 C respectively. Alternatively, if you place your radiator with your exhaust fans, your CPU will run hotter, but your GPU and every other component will run cooler. This is where cases with side and front fan mounting locations actually benefit most.

If you can ensure a cool source of air for your GPU and cool air for your CPU, you will see significant performance benefits with higher clock-speeds through turbos. However, if that's not possible, we almost always recommend installing your AIO with the exhaust fans instead, as a thermally throttling GPU will hit performance a lot harder than if the CPU hits 100 C.

13 FAN MANAGER 2024

Fan management is a big deal these days. There are a whole heap of ways to get those pesky spinners to behave just like you want, but there are a few caveats. First up, the best way by far is to use the BIOS, and dodge the bloatware. If you can get away without installing third-party desktop software then that will work a treat. Get those fans hooked up to a PWM hub connected to a motherboard header—or better yet, individually onto each fan header—then run into your BIOS, and configure them how you like.

We highly recommend utilizing a fixed-speed fan setting wherever possible based off percentage rather than messing around with PWM settings or custom fan profiles, particularly if you're using any form of liquid cooler. Drop them to 40 percent, and let the good times roll. In this day and age, keeping fan settings tight is key, particularly as CPUs can ramp up to 100 C and sit there comfortably.

Desktop software is a tricky one. A lot of fan management software can come with default safety settings that stop you from running them at low RPMs, or will automatically ramp up the fans if there's a sudden CPU temp spike (which can happen often). Unfortunately, there are few ways around it.

14 THE ALTERNATIVE: SYSTEM INTEGRATORS

Does this sound like too much work? Not got enough time, but still want a kick-ass PC built to your exact spec, ready to go straight out of the box? There are plenty of system builders that will happily do the job for you.

SI's—or System Integrators, as they're aptly known—are specialized PC builders whose sole industry is based on building custom PCs that are just right for the customer. There are a number of advantages to using them. First and foremost, like us, they're experts at building PCs. There's no fuss, no hassle, and you'll be left with a system that's built to a pro level and stress tested, with Windows installed and ready to go.

On top of that, these manufacturers will also be buying their componentry usually directly from the supplier in bulk. This is a bit of a mixed bag, as depending on market volatility, they may buy a crate of RTX 4080s at $1,200 apiece, only for the 4080 to come down to $900 three months later while the SI still has that stock left, meaning prices may still remain high. That said, they'll likely still be getting a discount at the time of purchase.

You'll also find a number of unique case options and fully liquid-cooled builds out there. Manufacturers we recommend are iBuyPower, Corsair/Origin, MSI, Cyberpower, and Falcon Northwest, to name just a few.

System builders often provide unique designs, professional-level build quality, discounts, and a solid warranty for peace of mind.

The humble 3.5-inch and 2.5-inch hard drives are slowly being phased out for their far faster son, the M.2 drive.

15 AMBIENT ENVIRONMENT

Can you control where your PC is, and, better yet, what the temperature is in that room? This is going to vary depending on where you are in the world, but ideally, you want your PC in a temperature-controlled room with comfortable humidity.

Remember that your PC will generate a ton of heat. It's entirely possible, if the office space is small enough, for a fairly mid-range rig to heat it up 5-6 degrees hotter than the rest of your house, even under a light load, within 30 minutes. So turn down that thermostat, and get the air con out.

16 STORAGE SOLUTIONS

Storing your data has changed dramatically in the last decade. We went from spinning 3.5-inch hard drives, to a mix of those and 2.5-inch SATA SSDs, to just 2.5-inch drives, and now we're on our third generation of M.2 drives with PCIe 5.0 leading the way for absolutely blistering speeds. In real world terms, our sequential storage speeds have increased by a factor of 100 in the space of a decade.

On top of that, we've also got access to a whole arsenal of online cloud storage solutions, from Google Drive, to Microsoft's OneDrive, to Dropbox, and even Adobe Creative Cloud.

So what do you for storage? We'd always recommend one or two M.2s for your primary system (getting large-capacity, cheap PCIe 3.0 M.2s is easy these days). If you need more space than that, a dedicated NAS solution from Western Digital, Synology, or Qnap is a good shout for all those valuable files, backups, and media that doesn't quite require those 12 GB/s download speeds.

17 GETTING STARTED

The storage has been chosen, and the parts have been picked. You know what you're doing. What now? Well, there are a few helpful things you can do to prepare your build area. First, we have to add that you shouldn't build a PC on a carpet, while wearing woolen clothing, or anything that can generate static electricity. Second, you're going to want a container, or a magnetic bowl or two to hold onto any screws, cable ties, or accessories. Grab your tools of the trade together, most importantly a Phillips

Screwdriver. Then, it's time to start unboxing.

Open up your chassis, then strip it down as far as you can. Remove any panels, glass windows, fan mesh screens—anything that might get in the way. Store these in your case's cardboard box, using the foam packaging to protect each piece. Once that's done, you can get your motherboard out of its box, remove it from the antistatic bag, and place it on top of the cardboard box (not on top of the bag—the outside is conductive).

18 BUILD ORDERS AND YOU

From this point, you're going to need to plan your build. Take a moment to consider what you want your system to look like. Look at your case, identify any areas that might be a tight squeeze, test fit a few components, and look for what could cause clearance issues.

We recommend installing as much as you can on the motherboard first, particularly the CPU, as that can be a bit finicky (especially with LGA sockets). M.2s, RAM, and cooler backplates are all worthwhile additions.

From there, installing the components is going to be done on a case-by-case basis. There's no 'right' way of building a PC, or a particular order you need to follow. All that matters is that you make it as easy as possible for yourself.

AMD and Intel's CPU socket installation procedure is pretty much identical these days.

19 CPU INSTALLATION TODAY

With AMD's 7th generation processors, team red has ditched the PGA socket, opting for LGA. Now, both manufacturers use similar sockets for their processors, and the process is almost identical across both brands. This does two things for CPU manufacturers—first, you're less likely to damage a CPU, as they'll no longer have bendable pins on them. Secondly, if any pins do get damaged in the socket itself on the motherboard, it's then up to that third party to repair or replace the board instead.

To install your CPU, identify the retention arm holding the CPU bracket and its cover in place. Lift that up and out of the socket, then lift the bracket up to reveal the socket underneath. Carefully align your processor so the branded writing on it reads left to right with the top of the motherboard. There's also usually an additional little triangle in the bottom right-hand corner, and one engraved on the CPU bracket itself. Plus, Intel and AMD will have specific notches that only allow you to install the CPU a certain way in the socket.

Once in alignment, re-secure the top CPU bracket into position, either removing the plastic cover or leaving it on if it's Intel, re-secure the retention arm, and you'll be good to go.

20 DON'T JUST RAM IT IN

Memory installation—like most computing hardware, at this point—follows a similar pattern. You'll notice that your DDR5 or DDR4 has a specific notch that's not directly in the center. Look at the DIMM or memory slots on your motherboard, and you'll spot the little raised bump in the middle that lines up with it. Simple enough.

Before you do anything, make sure the little tabs at the top and or bottom of the slots are unlocked, then carefully install your memory. Most motherboard manufacturers recommend you use every other slot, with the two furthest away from the CPU being the primary slots to populate first. Refer to your motherboard's manual if you're unsure.

That's it for now—you can read part two of this feature in the next issue!

Chassis stripdowns give you all the room in the world to play with, and protect your panels from any unwanted damage.

CENTERFOLD

PERFORMANCE GEAR LAID BARE

Nvidia GeForce RTX 4070 Ti Super

NVIDIA MADE A MISTAKE. With the announcement of the RTX 4000 series, and our first look at the product line-up, there was one key product that didn't quite hit the mark. A 12GB RTX 4080, with far less componentry than the stock RTX 4080, and therefor far less performance. The media and community were quick to latch on to that, and Nvidia unlaunched it before it even began. A quick rebadge and reboxing later, and the RTX 4070 Ti was born, complete with the same specs and 12GB. Yet still, massively underwhelming.

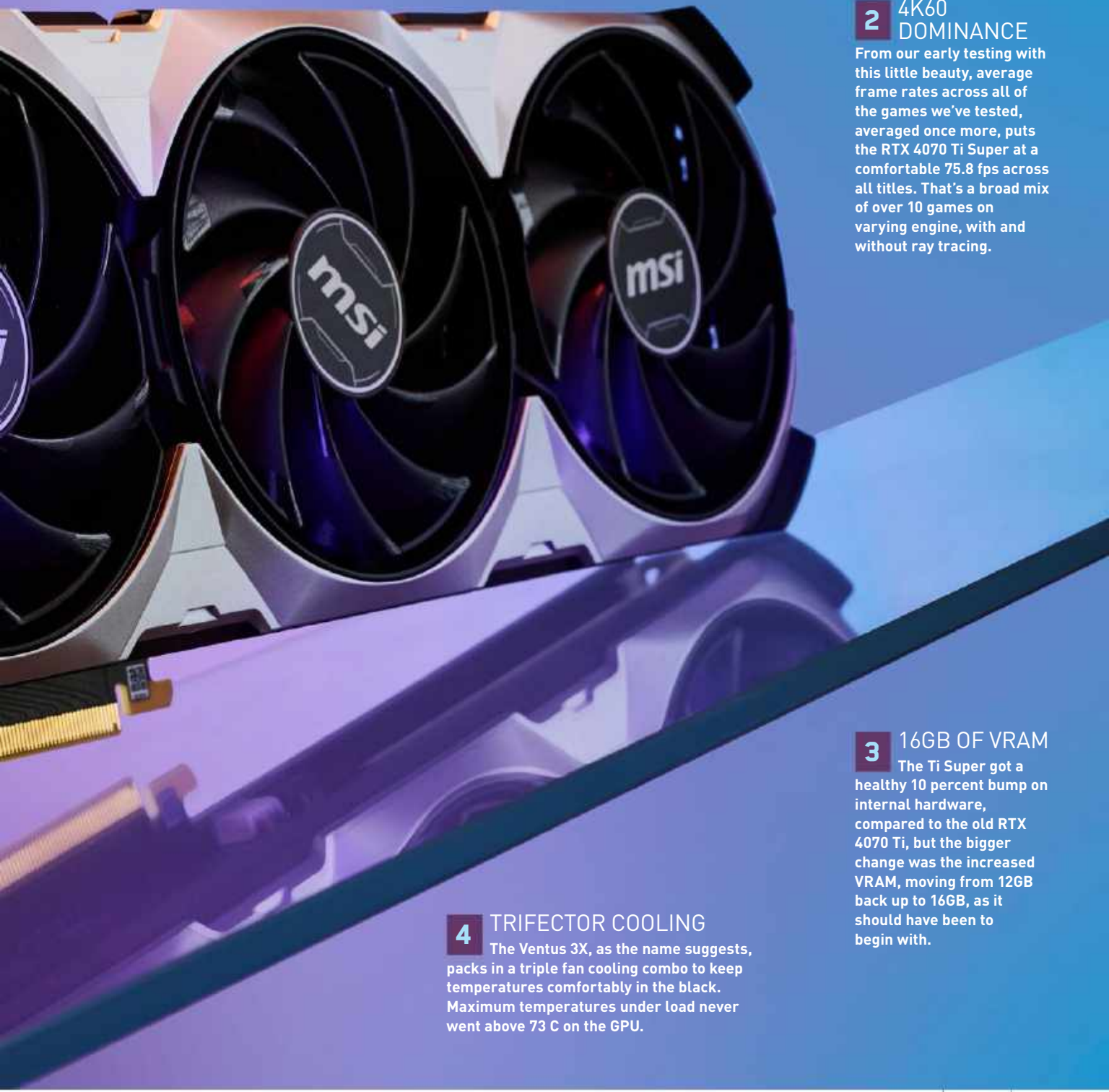
This, ladies and gentlemen, then, is what the RTX 4070 Ti should have been: an evolution, if you will. A chance for Nvidia to right the wrongs of its past launch, albeit a year later, and give us what we deserved from the outset, a loosely 'mid-range' card that topples the competition, and secures itself not only as a revolution of what it once was, but a dynamic state change in what resolution we should all be playing at.

Yep, that's right, with such a well-bodied and refined architecture like Ada Lovelace, 4K gaming at 60 fps is not only possible, it's, well, comfortable, and for that, we have the RTX 4070 Ti Super and its 4070 sibling to thank for it.

–ZAK STOREY

1 FORM FACTOR NORMALITY

Our Nvidia RTX 4070 Ti Super comes in this stunning MSI Ventus 3X variant, and with it is a return to normality in the form factor wars. This isn't substantially larger than your average house brick, but is what a graphics card should be at just 12.1 x 4.8 x 2.0 inches.



2 4K60 DOMINANCE

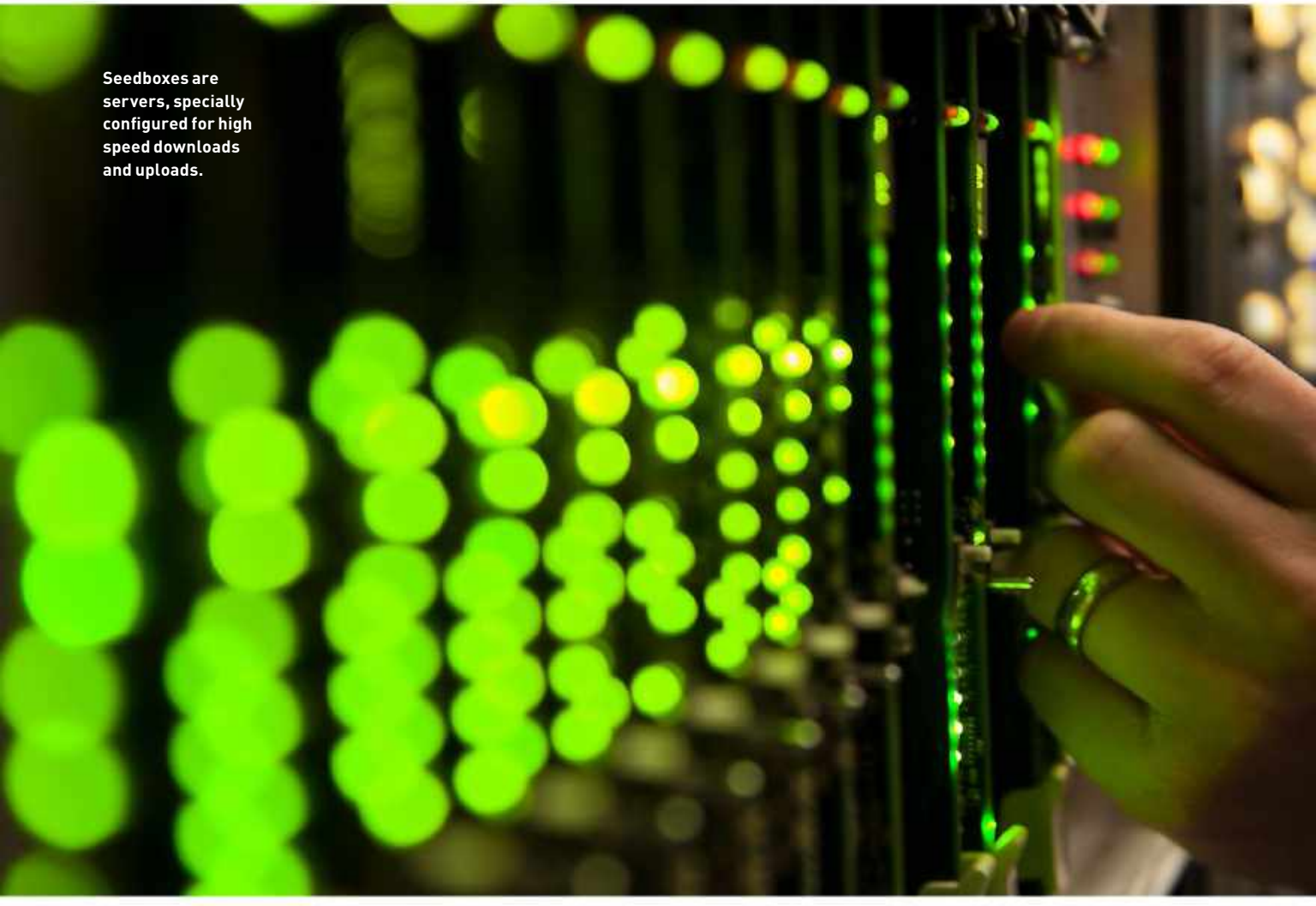
From our early testing with this little beauty, average frame rates across all of the games we've tested, averaged once more, puts the RTX 4070 Ti Super at a comfortable 75.8 fps across all titles. That's a broad mix of over 10 games on varying engine, with and without ray tracing.

3 16GB OF VRAM

The Ti Super got a healthy 10 percent bump on internal hardware, compared to the old RTX 4070 Ti, but the bigger change was the increased VRAM, moving from 12GB back up to 16GB, as it should have been to begin with.

4 TRIFECTOR COOLING

The Ventus 3X, as the name suggests, packs in a triple fan cooling combo to keep temperatures comfortably in the black. Maximum temperatures under load never went above 73 C on the GPU.



Seedboxes are servers, specially configured for high speed downloads and uploads.

Any experienced internet user knows that BitTorrent is a protocol for peer-to-peer file sharing. BitTorrent trackers can provide a list of files available for transfer, and allow the client to find peer users, known as 'seeds', who may transfer the files using a specialized BitTorrent client. Given how efficient it is for sharing large files, it's hardly surprising that BitTorrent accounts for around three percent of all internet traffic worldwide.

Technically, you can access files via BitTorrent using your home computer, but it can cause complications, as connected peers can see your device's IP address, you can be targeted by bad actors like hackers.

As BitTorrent is sometimes used to share copyrighted files, some networks and ISPs also block or 'throttle' the protocol, making downloading directly to your machine more difficult.

This is where seedboxes come in. A seedbox quite simply is a remote server, specifically designed for downloading/uploading files via BitTorrent at high speeds—usually 100Mbps (8MB/s) to 10Gbps (1250MB/s).

Once the files are in the seedbox, users can then download them to their own devices using other common protocols like HTTP, FTP, SFTP, or rsync.

Not only does this bypass the worry of sharing your IP address with strangers, it makes for much more efficient management of your files.

Why do you need a seedbox?

It's true that you can mask your IP to some extent by using a VPN, though not all allow

Make sure you read through and compare seedbox plans. If available, find a low-cost trial plan before paying for a seedbox with huge amounts of bandwidth and storage.

SUCCEED WITH SEEDBOXES

Nate Drake introduces you to one of the internet's best kept secrets to turbo charge your downloads and uploads

BitTorrent traffic. This also won't help if your ISP places caps on how much data you can download. Some popular seedbox providers let you install OpenVPN server, allowing you to connect securely without paying for a separate subscription.

If you normally use an iOS device, you'll also have noticed that the App Store isn't exactly loaded with BitTorrent applications, but setting up a seedbox allows you to manage downloads via the web interface in your mobile browser.

Of course, you can accomplish much the same thing by renting your own VPS (Virtual Private Server) and installing software manually, but seedbox providers take much of the hassle away from you.

Aside from being specifically designed for fast file sharing, all seedboxes come with a number of preinstalled applications. Naturally, chief among these are popular BitTorrent clients like ruTorrent, Deluge, qbittorent, and Transmission.

Setting up and configuring these apps via the seedbox web interface works virtually identically to desktop clients, with the crucial caveat that they can be connected 24/7. This makes it much easier to maintain a good sharing ratio, which is necessary for some private trackers.

Before delving further into seedbox features, it's worth addressing the elephant in the room: the BitTorrent protocol and seedboxes can be used to share and download pirated content. Still, they have lawful uses. The Internet Archive (archive.org), for instance, makes public domain files available via BitTorrent. IPT, which is one of the oldest private trackers, holds many copyright-free movies and music, as well as public domain learning materials. Many seedbox providers also block public trackers, like from the Pirate Bay, to reduce the chance of receiving DMCA takedown notices.

Seedboxes also offer an excellent way to share content you've created yourself via BitTorrent without having your home bandwidth consumed by eager downloaders. As your seedbox is online around the clock, you can be certain that at least one seed is always available.

Upon registration, your chosen seedbox will offer various ways to access files you download to it. Certain providers may offer a way to do this via HTTP, such as through a server app like 'filebrowser'. You'll also always be able to access the seedbox via FTP, as you would with any server, though for security reasons we recommend choosing a service that supports SFTP via a reliable client like FileZilla.

Naturally, copyright laws vary by jurisdiction, so laws may operate differently where you live to the state where your chosen seedbox is based. We suggest taking legal advice before sharing or downloading any files.

Having decided that a seedbox is right for you, we encourage you to research providers yourself to find one that fits your requirements. Popular seedbox services include Whatbox (https://whatbox.ca/). Seed Host (https://www.seedhost.eu/), and Giga Rapid (https://giga-rapid.com/), which we've used for the screenshots in this guide.

When signing up, remember that it's less important where the seedbox service itself is based than the server itself. For instance, while Whatbox is based in Canada, it has servers in the Netherlands, which can considerably reduce latency for European users.

Set up your seed box

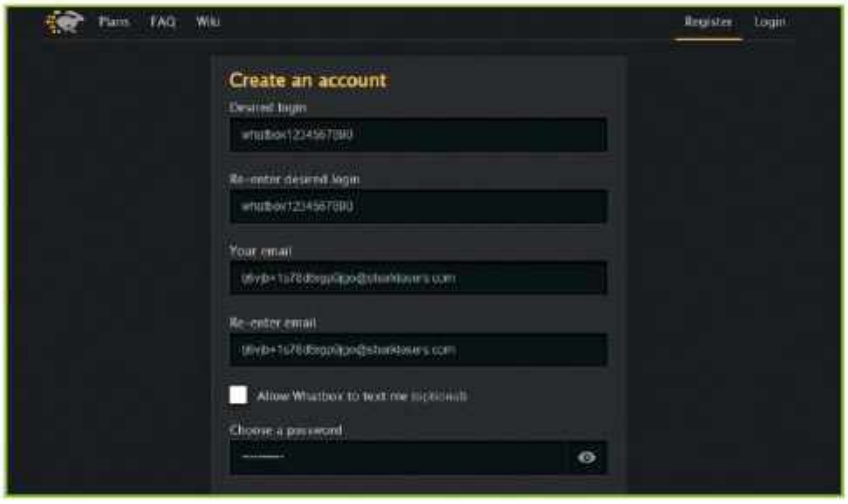
Assuming you've selected a particular seedbox provider, your first step should be selecting a plan that's suitable for you. This is another great perk of using a seedbox versus a home server setup, as you can choose a low-cost, low-spec plan, then upgrade when you need better features.

Given that both seedboxes and end users have different needs and capabilities, we recommend starting out with a low-priced plan, and ideally a provider that offers a free trial. Sometimes this is easier said than done, as the lowest pricing tiers are often sold out. Your chosen plan should rest on three main criteria:

Location

As discussed, however fast data downloads to your seedbox, you'll need to access it from one of your own devices at some stage either through direct download or streaming. Make sure you check exactly where the server is hosted to reduce latency. Some providers, like Whatbox, offer a multi-threaded speedtest on their site (https://whatbox.ca/speedtest).

Specifying the location is also important if you want to share files legally, as some countries like Spain, the Netherlands, Switzerland, and Mexico have more relaxed copyright laws. Again, make sure you check with a local lawyer before diving in.



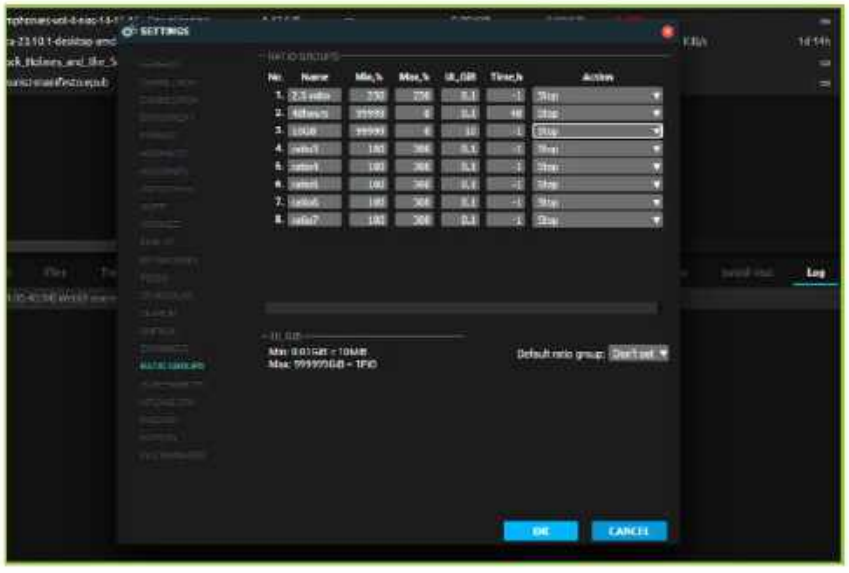
For privacy reasons, you may want to register using a temporary email address. Many seedbox providers also accept anonymous payment methods like BItcoin.

Bandwidth

Seedboxes offer various download and upload speeds, but the typical rate is around 100 Mbit/s. This means that all things being equal, a 1 GB file could download to your seedbox in under 30 seconds. That file can be uploaded to other users in the same time, creating a 1:1 share ratio. This gives you an advantage over sharing from home, as most domestic connections offer miniscule upload speeds relative to downloads. If you're using a shared network and/or drive, your transfer speed can be affected by other users' activity. Some providers offer plans with bare-metal servers/dedicated drives, though naturally these cost more.

Some seedbox services offer 'unlimited' plans, but most have a traffic quota. In other words, there's an upper limit on how much you can download and upload. Check your plan policy carefully—many providers will not count downloads from your seedbox via FTP towards this limit. Certain bundled apps, like those that allow HTTP downloads, may also be excluded.

Make sure you check your seedbox's policy for users who exceed their quota. In most cases, it means that your traffic will be capped. For instance, if you exceed your bandwidth allocation for any Giga Rapid plan, your download speed is reduced to 20Mbps, and upload speed to 10Mbps. Most providers allow you to purchase additional bandwidth if you exceed your limit.



You can use ruTorrent 'ratio groups' to stop sharing files from your seedbox once a certain limit has been reached.

Storage

Naturally, if you're planning to use your seedbox to store large files, you'll need a generous amount of storage. Given the blazingly fast download speeds of some services, even a 1 Gbps Seedbox can find its download speed limited by the write speed of the disk itself. If this is a concern, consider using a service like WhatBox, which offers NVMe SSDs. You'll get the best read/write speeds from a dedicated server with its own drive, but these plans are more expensive. It's better to start with a plan using a shared drive, then upgrade as necessary.

Once again, check your plan's wording carefully to see how your provider handles users who exceed their storage unit.

Usually, your download speed is reduced or access otherwise restricted until you delete some files. As with bandwidth, you can usually purchase additional storage by upgrading your plan.

Clients

If you're signing up for a seedbox, it's likely that you already have a favorite BitTorrent client. Still, not every seedbox plan offers every single application listed on the main website, so make sure you check the plan policy carefully. Many providers also only allow you to install and launch one BitTorrent client at a time, so choose wisely.

Media server

Although seedbox services offer a variety of installable apps, one of the most common setups is using a BitTorrent client to download media files, which you can then view or play using specialized server software like Plex or Jellyfin.

The obvious advantage of this is that you don't have to redownload files from seedbox to view them; you can just stream them via a handy client app on your computer, mobile device, or Smart TV.

If you plan to use the seedbox in this way, make sure these apps are available. Some providers like GigaRapid only allow you to install and use one media server program at a time.

Other apps

A seedbox is essentially a customized server, so can be used for a great deal more than just downloading and playing media. Take some time to browse the apps offered for inspiration. If OpenVPN Access Server is offered, you can configure your seedbox as a VPN. Alternatively, check if your seedbox service supports Calibre in order to create your own personal eBook server.

You can also use open-source software like Nextcloud to set up your own private cloud storage service on your seedbox. The only real limits in this case are your imagination and those applications offered for installation with your chosen seedbox plan.

Most Seedbox services offer a handy list of installable applications, saving the trouble of tinkering with the command line to download packages and dependencies.

Root access

If you like to customize your server with your own programs and perform manual updates/upgrades then you may want to choose a seedbox plan that offers root access. This is usually unnecessary, given the number of bundled apps. There's also a security risk in having root access, given that in the wrong hands it can be used to access your private files.

If your chosen Seedbox provider doesn't offer root and you do need to run a program that's not currently listed in the available applications, you may be able to compile and run it via a local account. Contact your seedbox provider's support page for help with this.

Delivery time

For reasons we don't fully fathom, the majority of seedbox plans are still confirmed manually. You can glean some idea of how long this will take by checking your chosen provider's website. Upon registration, you'll usually be enrolled

SIGNUP SECURITY

There's nothing illegal about renting or using a seedbox, but if it's based in a country with particularly robust IP laws, it could be targeted. In March 2023, a seedbox provider in Denmark was targeted by the local government, resulting in the prosecution of the owner, staff members, and even some users.

While you may only use your seedbox for downloading and sharing lawful content, the less personal information you give to your provider, the less likely you are to be targeted by spurious legal cases. This is a particular concern if you share a seedbox with other users, as if someone misuses their account in any way, their activity could be confused with yours.

Fortunately, most seedbox services actually only collect a minimum of information. If you don't feel comfortable giving out your personal email address for seedbox registration, consider generating a temporary disposable one using a service like GuerillaMail (www.guerrillamail.com).

The provider may also ask for your name and address, but during our tests with GigaRapid, the site happily accepted our PO Box instead of a street address.

When paying for your subscription, you should also check if your chosen provider accepts anonymous payment methods like Bitcoin. The Seedbox Guide website maintains a list of current providers (https://seedboxgui.de/seedbox/), which you can filter by payment method.

Make sure you check your seedbox provider's privacy policy carefully for what personal information they log when you sign in. If they do record the IP addresses of visitors, consider connecting via a third-party VPN service. If you do this, all connections will be routed via the VPN server so that only its IP will be logged, rather than that of your home devices.

Remember, if you choose to use your seedbox service to host any personal content like family photos, your privacy could be at risk if the server is hacked or seized. Naturally, you can reduce this risk by securing files using client-side encryption—check if your seedbox provider offers applications like Nextcloud that support this.

and receive your login credentials in 24-72 hours.

Dicing with the dashboard

Assuming that you've chosen and enrolled for a seedbox plan, it's time to set it up according to your tastes. The exact configuration of each seedbox service is different, so you should check your provider's support page for specific steps.

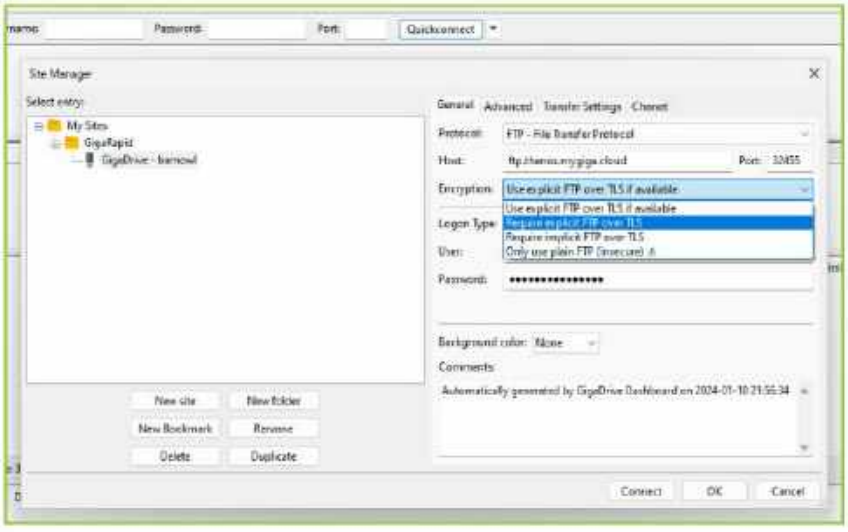
Still, it's likely that upon login, your seedbox provider will take you to your main dashboard. From here, you can usually see a list of any active seedboxes. Clicking on the name of an individual plan/seedbox will also usually display a helpful infographic indicating CPU, bandwidth, memory, and disk usage. Keep a careful eye on these to make sure you stay within the assigned quota and avoid speed caps.

If this is your first login, you may be asked to specify a username and password. The main dashboard should indicate the IPV4 address of the server, along with the relevant ports for FTP/SSH access. You may need to click to reveal these and/or re-enter your password.

The dashboard is also a good place to return if you mess up your configuration, such as forgetting passwords or installing the wrong apps. From here, you can usually wipe your seedbox disk/credentials, and start over.

Setting up your client

Having mastered the dashboard, it's time to start using your seedbox for its intended purpose. Again, the exact steps you need to take in order to set up your chosen BitTorrent client will vary, but it's likely that you'll be able to view a list of available 'Applications' or 'Installers' via the dashboard.



FileZilla is an excellent way to transfer files from your seedbox to your home network. Enable FTP over TLS if available to encrypt transfers.

You will most likely need to click 'Install' via the UI to actually download and set up your chosen package. Your seedbox will also ask you to generate an app-specific password for the torrent client or set one yourself. You can usually view this on the app's info screen. You'll be prompted for it upon launch. Even if you've used the BitTorrent client before, take some time to go through the Web UI to note any differences—in particular, open preferences to double-check the exact location of downloaded files.

It's now time to take your client for a test spin. Find a legal torrent file from the public domain, eg. via archive.org, then add its URL. Remember that each time you share this file with a peer, this can count towards your traffic limit, so make sure to set a sharing ratio, eg. 2. Consult your BitTorrent client documentation if you need help with this.

Access your files (http/s)

One of the quickest and easiest ways to access files downloaded via your seedbox is via a specialized app like Advanced Browser. Take some time to browse the available apps in your seedbox, and go through the install process as you did for the BitTorrent client.

On first launch, you may also be asked for an app-specific password. Most apps of this kind will allow you to simply click on a file stored in the seedbox to begin the download, though some like Advanced Browser can also play media content within your browser window.

Aside from easy setup, the main advantage of accessing your files this way

RATION YOUR RATIOS

Most seedbox providers offer ruTorrent, a web-based version of the text-based rTorrent client. This is because it's easy to manage downloads via the web interface (which itself is based on uTorrent's web UI) and it's also highly customizable.

Once ruTorrent is installed, you should set strict file sharing ratios. Start by clicking on the settings icon, then choose 'Ratio Groups' in the left-hand pane.

Each ratio group has four different conditions (Min,% / Max,% / UL,MB / Time,h) and an action to take when these conditions are met. By default, this is to stop sharing the file.

For instance, if you simply want to stop sharing after a ratio of has been met like 2.5, just set Min% and Max% to the same value e.g. 250%. Most private trackers will require maintaining a certain ratio, so this is all you need to configure.

You can also use the 'Default ratio group' drop-down menu at the bottom right to make sure any torrents added moving forward conform to the conditions of a particular ratio group.

If you don't want to use simple sharing ratios, 'UL,GiB' field can be used to specify an action when a certain amount of data has been uploaded. For example, if you wanted to stop a torrent seeding after 10 GiB have been uploaded regardless of ratio, you could input:

```
Min% : 99999 Max%: 0% UL,GiB : 10 Time,h: -1 Action: Stop
```

Some private trackers require that files are shared for a certain amount of time. You can specify this (in hours), via the 'Time,h'. Note by default this is set to '-1' (unlimited).

For instance, if you wanted to stop a torrent seeding after 48 hours, regardless of the ratio or how much data has been uploaded, you could input:

```
Min% : 99999 Max%: 0% UL,GiB : (default value) Time,h: 48 Action: Stop
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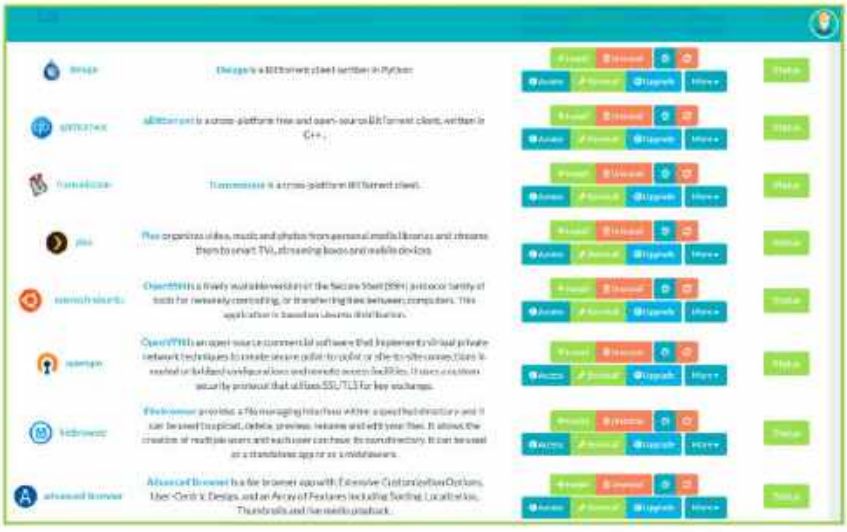


Take some time to browse through the list of available applications. For installed apps, there will be an 'Acccess' or 'Info' button to launch and view credentials.

is that you can access them securely via SSL : the connection is secured by the TLS certificate issued by your seedbox provider. However, most such programs also don't allow you to move or edit files, which makes it impossible to effectively manage your media collection.

Manage your files (ftp)

Upon first login, it's likely that you'll have created a username and password. The main dashboard should also list the specific FTP port for your seedbox. As a *Maximum PC* reader, it's likely that you've been using FTP since you were knee-high to a grasshopper, and we have no desire to patronize you.

Still, not all seedbox providers implement FTP in the same way. If you've chosen a seedbox for privacy reasons, remember that plain FTP is unencrypted. This includes your username and password, so if your provider only offers access this way, anyone monitoring your connection will know exactly what you're downloading, and can even harvest your login credentials. For this reason, we recommend finding a seedbox provider who supports SFTP or FTPS, which can use TLS encryption for file transfers.

It's also very unlikely that your Seedbox instance will use the traditional TCP port 21 for FTP transfers. If you're setting up an FTP connection manually, check your seedbox dashboard to determine the port used. Unless you already have a preferred program, we recommend the free and open-source FileZilla. This FTP client is such a popular choice that our chosen seedbox provider, GigaRapid, had an automatic Filezilla Site Manager configuration file available for download.

When configuring connections in FileZilla, it's a simple matter to choose a secure method under 'Encryption', such as 'Require Explicit FTP over TLS'. Check your seedbox provider's help pages to determine which are supported.

On first connection, be sure to carefully check the certificate fingerprint and the listed domains to make sure they exactly match those of your seedbox before choosing to trust it. Accessing your seedbox data in this way makes them much easier to manage, as unlike with the HTTP browser, you can edit names, move files, and create new directories. When renaming files in your FTP client, don't fall into the same trap that we did by accidentally deleting the file extension.

If you plan to use your seedbox as a media server, this may be a good time to create a dedicated folder for content in the root directory, such as 'plex-movies'. If you plan to seed a certain file, now is also the perfect time to use your FTP client to upload it. Naturally, you should make sure you upload to a folder to which your BitTorrent client has access.

Track bandwidth usage

While the main dashboard can give you a quick overview of bandwidth usage to make sure you haven't exceeded your quota, you can usually click into this section to view more detailed stats. This will allow you to look beyond the simple number of GB received and sent, and into more detailed data, such as how much of this data is exempt—eg. because it was due to FTP transfers, as well as examine data usage on a per-app basis.

Manage your media

If you want to avoid the trouble of downloading media files in your seedbox to play at home, most providers support media server software like Plex or Jellyfin. This offers a few advantages over a domestic setup. Firstly, if you enjoy traveling, you can take your media server wherever you go by accessing your media

Your key considerations when choosing a seedbox should be available storage, network speed, and traffic limits (if any).

Most seedbox providers offer a main dashboard with a quick overview of usage stats. From here, you can also access available applications.

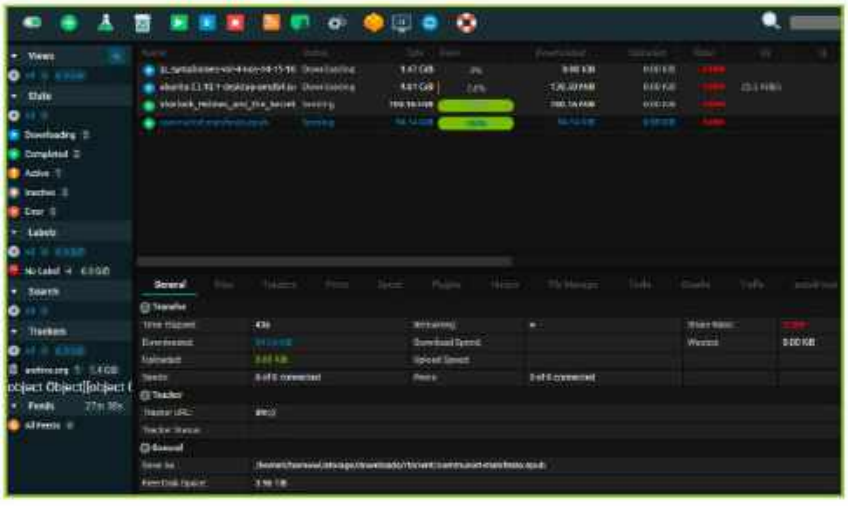
server using a portable medium, such as an Amazon Firestick.

Secondly, if you want to share your downloads with family and friends, you can do so without having to open up ports on your home router and share your own bandwidth.

You can find available media server software in the 'Applications' or 'Installers' section of your main dashboard. However, some providers, like our chosen seedbox, GigaRapid, may require you to only run one media server at a time. If you've not done so already, you should first connect to your seedbox via SSH or FTP to create dedicated folders for your media libraries. Ideally, these should be outside your torrent client's download folders.

For our test seedbox, we created two empty folders for Plex on the root drive named 'plex-movies' and 'plex-tv' to store movies and TV shows respectively. Most clients will allow you to specify where to move a file once download is complete when you first add a torrent. In ruTorrent, for instance, you can right-click and choose 'Save To'.

If you plan to download a large number of movies, you may prefer to streamline this process. The 'AutoTools' feature in ruTorrent (accessed via Settings > 'AUTOTOOLS') allows you to sort files according to predefined 'labels'.



Seedboxes offer versions of most popular BitTorrent clients, including ruTorrent, Deluge, qBittorrent, and Transmission.

Plex

When using Plex on a seedbox, you will also need to enable remote access for your clients to connect. Once the app is installed, you can usually access its configuration via the dashboard. From here, you can note down the designated web port—eg. 57688.

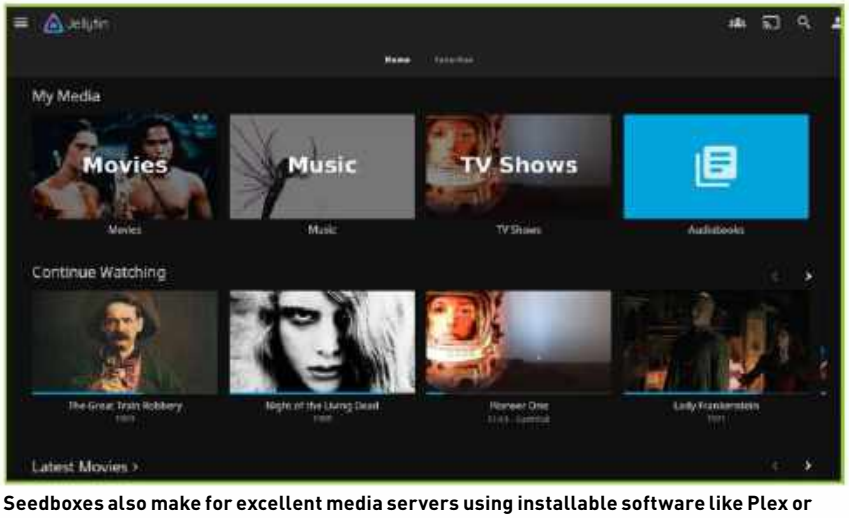
Next, launch the application and create your Plex account (if necessary). Once you're signed in, you will be asked to set a memorable name for your Plex server. Be sure to check the box marked 'Allow me to access my media outside my home'. You can then click 'Add Library' to create your first media library. From here, you can navigate to the folders you created earlier to store your content, eg. 'plex-movies'.

Once you're done, click the settings (wrench) icon at the top right. Select 'Remote Access' under 'Settings' in the left-hand pane, then 'Show Advanced'. From here, you can choose 'Enable Remote Access'. Check the box next to 'Manually specify public port', then enter the 'web port' number you noted down earlier under 'Applications' for Plex.

One of the reasons we favor Plex is because the platform has teamed up with Let's Encrypt to support 'Secure Server Connections'. This means that if a snooper were to perform DPI on your internet traffic, they may recognize that you're using Plex, but won't be able to decrypt packets to determine which specific content you're streaming.

If you choose 'Network' under 'Settings', then select 'Show Advanced' once again, you can change 'Secure connections' from 'Preferred' to 'Required'. This will block insecure connections, but may mean that you cannot stream media server content via certain devices or apps.

Plex's support pages provide a full list of compatible apps. (https://support.plex.tv/articles/206225077-how-to-use-secure-server-connections/) By default, the local Plex web app itself will load over insecure HTTP. If you installed Plex via a seedbox, however, it's likely that the connection will be secured by your seedbox domain's SSL certificate.



Seedboxes also make for excellent media servers using installable software like Plex or Jellyfin. This means you don't have to redownload files to your home computer.

Jellyfin

As powerful and easy to set up as Plex is, you may need to pay to access certain features like 'Plex Pass' to stream content on certain devices. This is why almost all seedbox providers offer plans incorporating Jellyfin.

This free and open-source media server software may be more limited in scope, but it's also more lightweight. As FOSS, it's also easier to verify that Jellyfin has greater respect for user privacy, being free of ads and trackers.

If you wish to use Jellyfin, you only need to select it from your seedbox's 'Applications' or 'Installers'. This will launch an extremely intuitive wizard, which will ask you to specify your language, username, and password.

During setup, you'll come to the 'Configure Remote Access' screen. Make

sure to check both 'Allow Connections to this Jellyfin Server' and 'Enable automatic port mapping'. Once initial setup is complete, navigate to the 'Info' or 'Settings' section for Jellyfin from your main dashboard. From here, you can view both the HTTP and HTTPS port numbers.

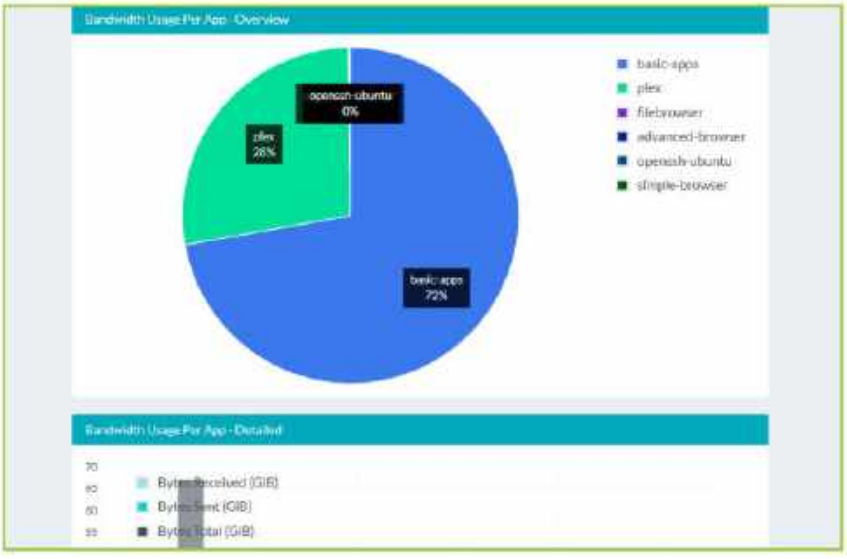
Return to the Jellyfin web UI and click on the icon at the top right. Select 'Dashboard' under the 'Admin' section. Next go to 'Advanced' > 'Networking'. Fill in the 'Public HTTP port number' and 'Public HTTPS port number' fields with the values you noted down earlier. To add your chosen media folders, return to the Dashboard, then select 'Server' > 'Libraries' > 'Add Media Library'.

Sharing seedboxes

The majority of seedboxes are shared—each user has their own account to access a shared server. Resources may be allocated equally or divided between users based on their plans.

The specifics of your seedbox setup will vary based on provider and plan, but a shared seedbox is usually sufficient for most users who just want to download/share content and stream media. Even if you don't get the full resources of the server or its entire download speed, applications like ruTorrent and Jellyfin are extremely lightweight.

Another popular (if slightly more expensive) solution is to provide users each with their own VPS running on a physical server. This gives you a better guarantee of privacy, plus in most cases you'll have root access so can customize it further. Seedbox plans which use VPS are also easy to upgrade if you need better storage or bandwidth.



Unless you have an unlimited plan, keep a close eye on bandwidth usage. Most providers allow you to break this down on a per-app basis.

Naturally, the very best privacy, performance and speeds are to be had from renting entire physical servers. Some providers, like SeedHost, do offer this, but naturally these are the most costly subscriptions.

Seedboxes in summary

The decision on whether or not to use a seedbox depends entirely on your needs, your ISP, and your resources. Power users may well be happy to take the time to set up their own web server with PHP, then install rTorrent, ruTorrent, various dependencies, configure RPC socket, and so on to get it running. Alternatively, you can pay a few dollars to rent a seedbox and have your chosen BitTorrent client running out of the box.

If you're considering setting up your own seedbox to do more than just download files, we encourage readers to read the plan carefully, as not every application is supported for every plan.

SEEDBOX + VPN

As your seedbox is effectively a server, many providers offer plans that support running your instance as a VPN server. Take the time to check through the 'Applications' section to discover popular software like OpenVPN Access Server and/or WireGuard.

While generating public/private key pairs to establish a secure VPN connection isn't difficult via the command line, most seedbox providers save you the hard work by setting up a dedicated subdomain to connect via your client, as well as a suitable .ovpn configuration file, in the case of OpenVPN.

The main advantage of connecting to your seedbox via a VPN is that as your traffic is encrypted, anyone with access to your ISP's record won't know that you've connected to your seedbox, nor what type of content you're accessing, like streaming video.

Using a seedbox like this comes with some drawbacks relative to using a dedicated VPN service, however. First, VPN usage may count towards your data limit. If you decide to browse the web while using your seedbox as a VPN server, remember that its IP address will be visible, so can be targeted by bad actors, such as for Denial of Service attacks. Check your provider's privacy policy for what information they log.

Once VPN configuration is complete on the seedbox side, we recommend using open source software like OpenVPN Connect (https://openvpn.net/client/) for VPN usage on your own devices.

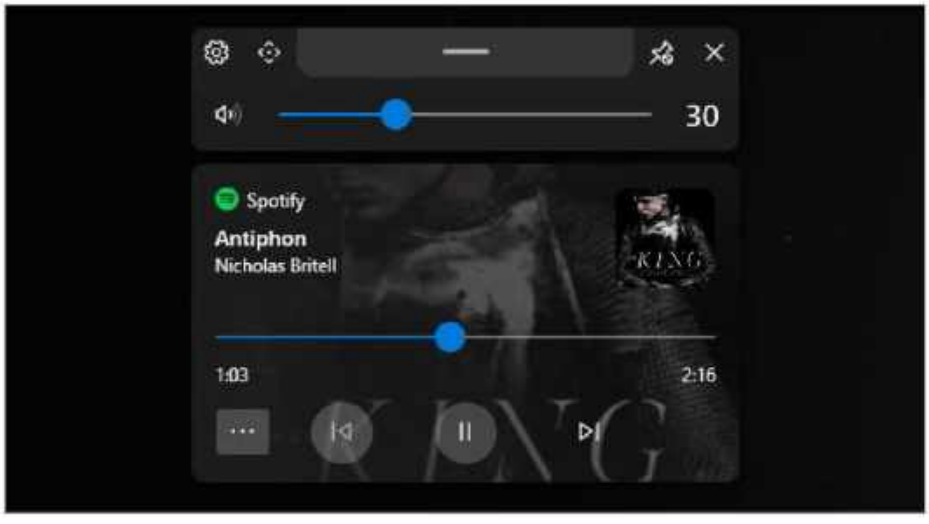
If your ISP and/or home state block VPN connections, check if your seedbox provider's OpenVPN implementation is v2.9 or later. If so, check if you can configure TLS control channel security in the Admin Web UI. From here, you can enable tls-crypt, which encrypts data packets and the TLS control panel to make it resemble ordinary HTTPS traffic. This makes it harder to detect and block.

If your seedbox supports OpenVPN Access Server, you can usually install the configuration files with just a few clicks.

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

TIP OF THE MONTH



BRING BACK THE MEDIA OVERLAY

Remember Windows 10's media flyout box, in which you simply turned up the volume via the keyboard, and you got a nice little overlay telling you what media was playing at the time? Hate that it's missing in Windows 11, despite it being promised and launching now for what feels like an eternity? Head to the Microsoft Store, and search for ModernFlyouts (Preview). Install that, and your media overlay will have returned! Huzzah!

MAKE – USE – CREATE

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Build yourself a green PC

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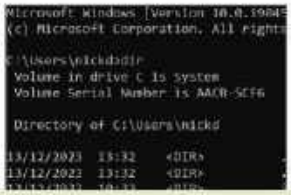
How to set up a Stream Deck



70
List and find files in Command Prompt

ZAK STOREY
CONTRIBUTOR

INTEL & AMD IN 2024

As a freelancer, I get to ply my trade across a number of titles. With that comes the opportunity to test a colossal amount of kit. One caveat is that every test I perform for every brand needs to have a unique test-bed and conditions. It's a lot of work, but it gives me a deep perspective on how these components perform.

Take my GPU benchmarks. Each card I test has 82 data points across different titles. I've been doing the same with CPUs, albeit with slightly fewer tests, and the thing that keeps popping up in my head is a pang of disappointment, from both AMD and Intel.

They're competing well, but it feels like the paths they're heading down are different. 7th-gen AMD with its 3D V-Cache is interesting, but hit and miss on certain games. Although Intel's single-core prowess is topping charts, its multi-core performance is sub-par, while power draw and temperature generation is through the roof.

I'm not going to pretend I know what the solution is—generational leaps and silicon based engineering is outside my remit, but I'm hoping Intel 15th gen and Ryzen 8000 bring something new to the table—something exciting that makes this more of a two-horse race, rather than comparing golf to tennis.

↘ submit your How To project idea to: editor@maximumpc.com

IFIXIT presents:

AUTOPSY

THIS MONTH WE DISSECT...

Fairphone 5

Instead of a core module that snakes around the casing, the internals are similar to Android phones: split between a motherboard and daughterboard.

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com

On the bottom of the phone, USB-C port replacements are more straightforward. A small metal lid on the left side lets you lift it out comfortably.

The connector cover of the top module is now connected to the main module instead of being separate, so the small plastic piece can't get lost during the repair.

The cameras are individually accessible, so it's not necessary to replace the whole camera module if just one of them breaks.

BACKGROUND

The Fairphone 5 is the fifth phone in Fairphone's repairable lineup. It keeps the same part modularity as its previous generations.

MAJOR TECH SPECS

- Qualcomm Snapdragon QCM 6490 SoC with 4 performance and 4 efficiency cores
- 6.46" Full HD+ OLED with Gorilla Glass 5 display, 1224×2700 pixel resolution
- Rear-facing dual camera; 50 MP, f/1.9, (wide), 1/1.49", 1.0µm, PDAF, OIS; f/2.2, (ultrawide), 1/2.51", 0.7µm, PDAF; TOF 3D, (depth)
- 8GB of RAM and 256GB of storage (external up to 2TB)
- 5G, Wi-Fi 6E, Bluetooth 5.2, GPS/A-GPS, Beidou, Galileo, GLONASS
- Android 13 OS
- IP55 rated

KEY FINDINGS

- The opening procedure is the same as it's always been: unclip the plastic back cover to get inside. The outer shape of the back cover has changed, though, which with an increased thickness of nano coating, leads to a slightly improved IP55 rating.
- While the Fairphone 5 has the same dust resistance as its predecessor, it can now survive water jets instead of just splashes. The battery takes up more space than before, and it shows in the capacity: 4,200 mAh instead of 3,905 mAh.
- There are some quality-of-life improvements for fixers that are much appreciated. The connector cover of the top module is now connected to the module itself, rather than being separate, meaning it can't get lost during the repair.
- Below the top module, the individually replaceable cameras are accessible, so it's not necessary to replace the complete camera module if one breaks, like with its predecessor.
- The major internal change, however, becomes visible as soon as all these surface-level components are removed. Instead of a Fairphone 4-style Core Module that snakes around the casing similar to the logic boards of recent iPhones or Google Pixel phones, we have a view that is much more common in Android phones: a split between a motherboard and daughterboard.
- The change explains the warning stickers that, at first glance, feel out of place. Previously, securing the core module with a Torx screw sufficed in order to steer owners towards the correct path of repair. The new layout creates additional areas for accidentally disconnecting something you really shouldn't.
- The stickers create a stop sign to think about disconnecting the antenna cables or the interconnect cable between the motherboard and daughterboard, because both have the potential to break functionality.
- Even if you disconnect the antenna cables, the connectors are marked to make sure you reconnect the cables correctly. That's what intuitive repair design is all about: it should be easy to do the right thing and complicated to do the wrong thing.
- It's not only on the hardware side where you see Fairphone's commitment to durability. While this comes with a promise of Android version upgrades and at least eight years of security updates, 10 years is their goal.
- Repairability Score: 10 out of 10 (10 is easiest to repair). Overall, the Fairphone 5 keeps the aspects that were great about previous models, while improving the repair experience. It features a modular design with easy access to critical parts and accessible, reasonably priced replacements. Furthermore, Fairphone provides the necessary repair information.

Build a Green PC

YOU'LL NEED THIS

TIME AND A REASONABLE BUDGET

WHEN THE INDOMITABLE Barry Collins traveled to Lenovo HQ in North Carolina last year on *Maximum PC*'s behalf, he discovered that despite promises of plant-based PCs, bamboo packaging, and vegan-friendly covers, mass-producing green computers is tough.

We applaud Lenovo and other manufacturers' efforts to reach for that rainbow, but it's also up to each of us to reduce our own carbon footprint. With residential energy bills increasing in the US by around 14 percent in the past two years, it doesn't take a flower child to see that having an energy-efficient PC makes sound financial sense, too.

There are some obvious ways to be greener, including shutting down your PC when not in use. Still, if you're operating a home server or mining rig, it needs to run round the clock. Equally, having your own solar rig or wind turbine is a win for the planet, but infeasible for most.

In this guide, we'll focus on the main PC power draw culprits. You'll learn not only how to better understand how efficiency is measured, but also how to select the best components to lessen the impact on both your budget and the planet. –**NATE DRAKE**

1 GRAB AN EFFICIENT PSU

PSU efficiency is calculated by dividing the total power it consumes versus its power output. For instance, a PSU drawing 100 W from an AC socket and providing 90 W to the PC would have an overall efficiency of 90 percent. PSUs achieve higher efficiency under typical loads, the sweet spot usually being around 50 percent of their maximum capacity.

» Traditionally, '80Plus' has been an excellent indicator for PSU efficiency. As the name suggests, manufacturers with an efficiency rating of at last 80 percent can apply for certification. The various levels of efficiency each have their own requirements and for the sake of simplicity are codenamed Bronze, Silver, Gold, Platinum, and Titanium.

» 80Plus is still an industry standard, and has certifications for both 115V and 230V to keep both US and European PC builders happy. [**Image A**]

» Still, other standards like Cybenetics' ETA are sometimes a better indicator of energy efficiency, given that they test a much greater number of loads across a PSU's entire wattage range. For the sake of simplicity, Cybenetics use a similar naming scheme to rate PSUS : Bronze, Silver, Gold, Platinum, and Titanium. There's also a new 'Diamond' standard, though currently no PSU has been awarded this honor in Cybenetics' database (https://www.cybenetics.com/index.php?option=power-supplies).

» If price is no object, feel free to bag yourself a high-rated PSU, like the Titanium-rated Corsair AX1600i for $600. Even if you're on a budget, check the PSU's specs and its certification carefully to avoid wasting heat, money, and electricity on an inefficient model.

» If you're building from scratch, use a power supply calculator like Newegg's (https://www.newegg.com/tools/power-supply-calculator/) to determine the minimum wattage that you'll need.

2 MOTHERBOARD METRICS

The choice of motherboard is often overlooked when building a green, energy-efficient PC. True, you'll make the most energy savings through common-sense steps like not overloading DIMM slots, using only a single Ethernet port, and avoiding models with sparkly LED lights.

» When it comes to motherboard efficiency, Mini-ITX motherboard specification takes some beating [**Image B**]. These are chiefly designed for small portable systems—they measure around 6.7 x 6.7 inches (170 x 170 mm), but crucially, almost all models use four of the standard ATX screw holes,so can fit inside a regular PC case. This is also better for energy efficiency, as smaller cases are more difficult to cool.

» Mini-ITX motherboards consume around 100 watts of power on average; about 5 to 25 watts less than larger architectures.

» Still, not every gamer or server administrator is flocking to install mini-ITX motherboards in order to reduce heat and electricity bills. The main reason for this is that the Mini-ITX range has fewer PCIe

TOUR YOUR GREEN PC

1. EFFICIENT PSU
Check for certification from 80Plus or Cybentes to determine your chosen PSU's overall efficiency. If you're starting out, use an online power supply calculator to determine the minimum PSU wattage you'll need.

2. MOTHERBOARD
Try to source an energy-efficient motherboard, such as the mini-ITX series. These are compatible with most mid to large PC cases, but draw less power than regular ATX motherboards.

3. COOL CPU
CPU efficiency is measured by TDP (Thermal Design Power). This is the amount of power consumed under the maximum theoretical load. The lower the TDP, the more efficient a CPU is.

4. GREEN GRAPHICS CARD
The latest temporal upscaling tech, like Nvidia's DLSS (Deep Learning Super Sampling), allows the graphics pipeline to run at a lower resolution, increasing performance, but lowering your graphics card's power draw.

5. SUPERIOR SSD
SSDs are much less power-hungry than old mechanical hard disks. Use a 3rd or 4th generation NVMe M.2 SSD for maximum power efficiency.

6. CARBON-NEUTRAL CASE
The greenest PC cases have multiple vents and plenty of space to allow free air flow and stop formation of hot air pockets. Extra space also allows more room for fans or your own AIO cooler.

slots and RAM slots compared to regular ATX motherboards. Some models also traditionally have had their own x86 CPU soldered to the board, along with a heatsink, but no fan. This makes repairs extremely difficult and upgrades almost impossible.

» In recent years, more socketed Mini-ITX motherboards have appeared on the market, like the ROG STRIX Z790-I GAMING WIFI (pictured), which is compatible with 12th, 13th, and 14th generation Intel CPUs. Naturally, motherboards like these are more expensive than their ATX equivalents, so make sure you ask the manufacturer about the power draw of their specific model before buying.

C

© WIKIMEDIA, AMD

3 CHOOSE A COOL CPU

Just as with PSUs, CPUs have an objective standard for measuring power efficiency. TDP (Thermal Design Power) is measured in watts. It reflects the amount of power a cooling system like a fan needs to dissipate enough heat to avoid a CPU meltdown.

» Generally speaking, the smaller the TDP, the lower the CPU's power consumption. The best way to gauge the average TDP of a chip is to refer to websites that aggregate data from thousands of benchmarks, such as CPUBenchmark, which relies on PassMark to collate such data.

» If you take a moment to visit www.cpubenchmark.net/power_performance.html, you'll see that the crown currently goes to the Intel Core i7-1260U, which not only has a typical TDP of 9W, but is also compatible with the ASUA ROG Mini-ITX motherboard listed above.

» From examining the top 200 CPUs for power performance, it's clear that the efficiency comes at a price, as such processors go for $400 - $500.

» If you opt for the one of the AMD Ryzen 7000 series [**Image C**], you can also use the company's 'Master' software to enable 'Eco Mode'. This can reduce the average TDP for this CPU line from over 100W to 65W.

» Even if your CPU doesn't support a specific 'Eco' mode, you can also set power limits via the BIOS. Contact your motherboard manufacturer for help with this.

4 GREEN GREEN GRAPHICS

One of the best ways to run an energy-efficient computer is to use integrated graphics, though if you're going to the trouble of building your own PC, it's unlikely to meet your needs.

» You can save a significant amount of energy (and money) by asking yourself some hard questions, though. For instance, while ray tracing can deliver smooth, stunning graphics, it's still not widespread in 2024. This means you can usually safely choose a GPU that doesn't support it, though it's hard to determine exactly how much power you'll save in doing so.

» However, before you dismiss newer graphics cards, temporal upscaling technology like Nvidia's DLSS (Deep Learning Super Sampling) or AMD's FSR (FidelityFX Super Resolution) can actually make your machine more energy efficient.

» When a game is normally run at a higher resolution, this naturally means greater hardware requirements and more strain on system resources. However, DLSS 3 can make use of AI to generate every other frame you see when playing. It can also use 'Ray Reconstruction' to improve ray tracing image quality.

» This not only improves the framerate of games, but can also cause the graphics card to draw considerably less power.

» One of the best examples of this can be found in benchmarks run by Tathagata Biswas after *Cyberpunk 2077* introduced a patch for DLSS 3.5 in 2023. Tests on an Nvidia RTX 4060 Ti revealed using DLSS 3.5 cut the graphic card's power consumption from 150W to around 120W (around 28 percent).

» Gaming journalist Arka Mukherjee found similar results when running *Cyberpunk 2077* with the Nvidia RTX 4090. With DLSS frame generation and Super Resolution applied, the power draw fell from around 400 W to less than 300.

» Naturally, the RTX 4090 is fairly power hungry to begin with, and not everyone necessarily wants a Nvidia graphics card.

» When it comes to measuring power efficiency, most manufacturers can provide a TDP rating in watts, in exactly the same way as for a GPU. Websites like 'Video Card Benchmark' (www.videocardbenchmark.net/power_performance.html) aggregate data from thousands of PassMark tests to give you some insight into this. The GeForce RTX 4060 Ti ranks in the top 20 with a maximum TDP of 160 W.

» You can also gain insight by analyzing the graphic's card's performance per watt, which can be simplified as the number of frames a GPU can render per joule of energy. In the tests on the RTX 4090 with *Cyberpunk 2077*, the performance per watt almost quadrupled when using DLSS 3.5, so this is an important metric to check with the manufacturer and in your own tests.

» If you're choosing an AMD card, check if it supports 'PowerTune'. This allows certain software to dynamically alter the GPU's clock speed, which can improve performance and reduce the overall power draw.

5 SUPERIOR SSDS

Modern hard drives draw very little power, but you'll get the very best energy efficiency from an NVMe M2 SSD. Besides not needing to draw as much electricity due to its reliance on NAND technology over spinning disks, these SSDs also have five power states.

» These states include Active, Idle, and various low-power states like L1.2. During active use, the SSD operates at full capacity, but when idle, it can enter lower power states to conserve energy. NVMe architecture is designed to reduce the power footprint to 0.50 - 3 W when idle. This increases to 3 - 10 W when read/write operations take place.

» The main advantage of NVMe SSDs is to conserve battery life in portable devices, but you can utilize an NVMe SSD in your PC, provided you've a compatible slot.

» The latest, fastest NVMe M.2 SSDs such as the 1TB Crucial T700 [**Image D**] use the PCIe 5.0 standard, and

POWER UPS

If you're running Windows 11, you can tweak your PC power settings. Go to Settings > System > Power and Battery to access these.

Take a moment to read the 'Energy Recommendations' at the top of the screen to lower your carbon footprint. These usually include disabling the screensaver altogether, as well as powering off the screen after a set time, eg. three minutes. Windows will also suggest you let it adjust the power mode for 'best efficiency. Click 'Apply' next to each suggestion to proceed.

If you prefer to do things manually, return to the previous screen and select 'Power Mode' > 'Best Power Efficiency.' This reduces CPU clock speed and screen brightness.

Dark desktop themes are more energy efficient. To make the switch, right click anywhere on the desktop and choose 'Personalization'. Click to select the 'Windows (dark) theme'.

You can also reduce your monitor power consumption by lowering its refresh rate, albeit at the expense of reduced image/video quality. To change this, go to Settings > System > Display > 'Advanced display'. Click to display adapter properties then go to the 'Monitor' tab in the new window. From here, you can set a new 'Screen refresh rate' via the drop-down menu.

E

promise blindingly fast read/write speeds. Still, at the time of writing they're relatively expensive. It's also possible that the increased data transfer rates afforded by PCIe 5.0 (32 GT/s) vs PCIe 4.0 (14 GT/s) could mean greater power consumption. If you don't need this kind of speed, consider an older NVME M.2 SSD with more modest requirements.

6 ON THE CASE

It stands to reason that the less energy your computer has to spend on cooling key components, the greener it will be. This means that when choosing a case for your PC, your primary consideration should be airflow.

» For this reason, while we have sung the praises of the Mini-ITX series of motherboards, we do not recommend using their cases, as your components will be more densely crowded, making pockets of hot air more likely to heat up. Mid and full-towers will usually have more space to expel this.

» Larger cases also tend to have room for multiple fans. Fractal Design's Meshify 2 [**Image E**] can take up to seven fans, placed at the front, rear, top, and bottom of the case. A larger tower is best if you want to install a liquid cooling system with radiators, though you'll need power to pump the coolant.

» When building your PC, you should also pay attention to placement of cables. Use ties where possible to minimize their contact with vents, fans, and other components to stop them blocking heat dissipation.


F

THE L WORD

No matter how much you tweak your hardware, if you have a resource-intensive operating system and apps, you won't be doing all you can to save the planet or your wallet.

Microsoft is currently working on a new 'Energy Saver' mode for Windows 11, though currently it's only available in developer builds.

On the other hand, the Linux operating system has long had a reputation for being extremely light on resources. This is partly due to the lack of bloatware inherent in FOSS (free and open-source software), though some versions of Linux like WattOS (pictured) are actually designed to be more energy efficient through using programs like the lightweight LXDE desktop environment.

Naturally, Windows programs don't run natively in Linux, but as desktop distros like Ubuntu have become more popular in recent years, a number of popular apps, like Steam and Telegram, have been ported to the OS. You can also find functionally equivalent programs—for instance, LibreOffice is a respectable alternative to Microsoft Office. GIMP also has similar functionality to Adobe Photoshop.

Most Linux distros can be booted from a USB stick into RAM. You can use this 'live' mode to check your PC's power consumption relative to using Windows before installing.

7 MONITOR METRICS

When it comes to finding a green monitor, size matters. A huge 49-inch monitor operating at maximum brightness will naturally consume more power than a 24-inch one at mid-level brightness.

» This means you'll need to strike a balance between energy efficiency and interacting with your PC in a meaningful way. The US Department of Energy has done its bit by introducing 'ENERGY STAR' certified monitors.

» This standard measures monitor power consumption both as a factor of viewable screen area and resolution. The main website (www.energystar.gov/products/monitors) even has a database of the top picks for 2024, including the HP E14 G4 portable monitor [**Image F**], which has a mode which uses just 3.8 watts.

» In the nature of things, LED monitors need to draw more power due to the backlight. OLED monitors don't require a backlight, so use less electricity.

» High-contrast monitors also tend to be more energy efficient than low-contrast ones, though this isn't a hard and fast rule. Virtually all modern monitors support a 'sleep mode'. Make sure to check with the manufacturer how much power the device consumes when idle.

How to set up a Stream Deck

YOU'LL NEED THIS

ELGATO STREAM DECK
https://www.elgato.com/us/en/s/welcome-to-stream-deck

ELGATO MARKETPLACE
https://marketplace.elgato.com

STREAM DECK SOFTWARE
https://www.elgato.com/us/en/s/downloads

ELGATO'S STREAM DECK is one of those devices that you don't think you need, but then you get one and wonder how you ever lived without it. It's more than just a macro keyboard, and combined with an extensive range of plugins and open-source devkits, its flexibility has been well documented. In fact, a significant number of companies have integrated it into their workflows too, most notably Virgin Atlantic, who utilize a fleet of them for all manner of automation and workflow simplification.

We're not focusing on that today, though; we're going to be running you through how to set up your own little piece of Stream Deck majesty, and what you need to get started. Whether you're a Twitch streamer with a vast assortment of clips, audio files, lighting, and cameras to control, a professional photographer working in a photo studio, or to a casual gamer who just wants to control some desktop software and the odd light or two, there's a solution for everyone using one of these fancy bits of kit. Let's dive in, shall we? **–ZAK STOREY**


A

1 WHICH STREAM DECK?

There are a plethora of Stream Decks out there to choose from, and getting the right one for you is going to depend on a number of conditions. First and foremost, budget; second, how many buttons you want, and finally, utilization. Bear in mind that you can always configure a Stream Deck with additional pages and folders, so don't feel like you 'must' have a 32-button deck to satisfy all your needs.

» The Stream Deck Mini is first up. For the cash, you get an angled display, six keys, and it clocks in at just $60. Next is the most iconic of the lot, the Stream Deck Mk.2. For $150, you get 15 keys. The Stream Deck XL is slightly larger, clocking in at 32 keys for $250, then you have the Stream Deck+ with eight keys, an integrated touch-screen display, and four rotary dials for $200, then finally the Stream Deck Pedal, which retails at $70 but gives you full Stream Deck control at the tips of your feet with three buttons. Additionally, there's Stream Deck Mobile for iOS, which features all the same compatibility as a Stream Deck just on your iOS device of choice. With that, you get six keys for free straight out of the gate with no upfront cost. That said, you can increase that up to 64 keys, along with access to custom layouts and designs for $3 a month, $25 for the year, or $50 for a lifetime. An Android version is available, but it's not quite as up to date as the iOS variant, and requires an initial investment upfront.

» In our tutorial, we're going to be utilizing the Stream Deck+ [**Image A**] .

2 UNDERSTANDING THE STREAM DECK

With your Stream Deck+ plugged into your PC, the first thing you're going to need to do is head to www.elgato.com/us/en/s/downloads and download the latest Stream Deck 6.5.0 software. Get that installed on your PC, and you'll be greeted with a screen that looks a little bit like this [**Image B**].

» Elgato has a number of plugins built into the software by default, which you can use to configure your setup. There are a few things we need to pay attention to here. If you look at the top right, you'll see an option to swap between Keys and Dials. Clicking those tabs will show you what you can apply to each style of button.

» At the top left, you'll see the words 'Stream Deck', followed by a drop-down arrow. Clicking this will let you access multiple Stream Decks, or add a mobile device. Below that is the 'Profile' button. Click the drop-down, and you've got access to multiple profile setups. Click 'Edit Profiles', and a new window will pop up, giving you access to your profiles, along with a number of tabs.

» At the top right of the main page, there are four icons. The leftmost is notifications, then the Elgato Marketplace, settings, and an account creation button.


B

3 ADDING A BUTTON

To add a button to your blank Stream Deck, the process is simple: look at the list on the right, and grab one from the category or plugin that suits your needs. Left-click, hold, and drag across to your button of choice on the virtual display.

» You can configure any settings in the menu below it. There are a number of default actions here—'Multi Action', for instance, allows you to combine multiple functions. There's support for macro recording, opening of programs, text pasting, and more. The true brilliance comes when you add third-party plugins.

4 ELGATO MARKETPLACE

The Elgato Marketplace is the place to be when it comes to getting the most out of your Stream Deck. Here, you'll find all manner of graphics, audio, plugins, program profiles, and more. Head to https://marketplace.elgato.com/stream-deck. First, we're going to grab some useful plugins.

» The official Elgato plugins are great picks if you're already invested in the ecosystem. Control Center controls any ring lights; Wave Link adjusts your mic settings, and Camera Hub helps control zoom, contrast, and exposure settings on your kit.

» If you're into streaming and use OBS or Twitch Studio, then the OBS Studio and Twitch Studio plugins are great picks. Audio Switcher is invaluable, too, allowing you to swap between headphones and speakers on the fly with a click of a button.

» For hardware nerds, there's Speed Test and HWInfo; and plugins for Teams, Zoom, Slack, Discord, World Clocks, Stocks—you name it. Home lighting can be controlled here, particularly if you're running Philips Hue, Lifx, or Nanoleaf devices.

» To download a plugin, click the sign-in button at the top right of the page, then either create an account, or sign in via Twitch, Discord, Facebook, or Google. Go back to Stream Deck, select plugins, then find a plugin. You can install these in one of two ways: hover over the icon, and a button with the word 'get' will appear. Your web browser will ask if you'd like to open it in Stream Deck. Hit yes, and the plugin will download. Alternatively, you can go into each plugin and read about them.

5 LAM UP YOUR PLUGINS.

Next, we're going to make these little buttons pop a bit.

» Back on the marketplace, head to Stream Deck, then Icons. You'll find a massive number of icon packs to peruse. Find a set you like, and as before, hit 'Get', and let it get absorbed into your Stream Deck app.

» Go back to your Stream Deck app, and click on the key whose icon you want to change. In the bottom menu, you'll see a square with the icon and two buttons: a '+' and a drop-down arrow. Hit the + symbol. A new window will open up called Icon Library [**Image C**], and the icon pack you just downloaded will be here. Click the drop-down on the set you want, then find the icon you want to allocate to that action. Select it, then close the menu.

» Some plugin keys have two icon states: one for On, and one for Off. When you select them, you'll notice two dots below the square icon in the bottom menu that we used to change the graphic on earlier. Clicking each dot will swap between the two icon states, allowing you to change each state individually. If you've got an audio switcher swapping between headsets and speakers, you can have a unique icon for each one.

6 BACKUP YOUR PROFILE

There's no local storage on your Stream Deck, so if you do decide to unplug it and run it on another system, you'll have to reconfigure the entire thing.

» Fortunately, we can get around that by backing up the profile that we've made. Click the drop-down arrow on the Default Profile on the top left of the Stream Deck app, then hit 'Edit Profiles'. Once the 'Preferences' window opens, under the 'Profiles' tab, locate the small down arrow on the bottom right of the left menu. Select the profile you want to back up from the menu list, hit that arrow, then Export. Stream Deck will ask you where you'd like to save your program. Our advice? Save it to your Google Drive, or whatever online storage you use to back up data.

» Loading a profile on first install will leave you with blank apps, as you no longer have the plugins installed. But each will be named—it's simply a case of then going to the Marketplace, redownloading those plugins, and as you do so, the Icon graphics will kick back in.

» Some plugins, such as Network Attached Devices, will require you to reconfigure and pair them.

PROFILE DOWNLOADS

You can also download custom profiles. In the Elgato Marketplace, click Stream Deck, then Profiles. You'll find a wide range of pre-configured profiles for everything from Photoshop to Dungeons & Dragons.

There's a mix of paid and free options. Click 'Get' on a profile, or go through the payment procedure for anything more advanced. Hit 'download' once the button is green.

Place the profile on your desktop and head back to the Stream Deck app. Click the Default Profile drop-down arrow, then 'Edit Profiles'. Click the small arrow in the bottom right of the leftmost menu, and hit 'import'. Choose the profile you just downloaded. Stream Deck will ask you if you're sure you want to install this profile. Hit install. Click the profile you've selected, then in the Application menu, select Other, navigate to your program's .exe file, and select it.

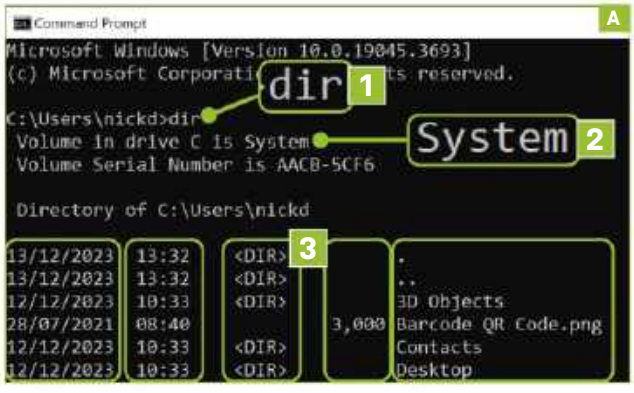
You'll still need to download the necessary plugins for it to work, as these won't download automatically.

List and find files in Command Prompt

YOU'LL NEED THIS

WINDOWS 10 OR 11
45 minutes

WHEN USING COMMAND PROMPT, have you ever needed to list the contents of a folder or drive? If so, then the DIR command has you covered. At first glance, that's all it can do—and in a less visually accessible way than File Explorer. But dig a little deeper, and you'll find ways in which DIR can play a more active role: use it to quickly perform file searches, generate file lists you can open and edit in any text editor, and even confirm that your precious files are safe when Windows refuses to load. Here, we'll explain how to use this powerful tool. Note that whenever we use 'yourname', you should replace it with your name as it's registered in your Users folder (it's 'nickd' in our screenshots). –NICK PEERS



1 LEARN THE BASICS OF DIR

Open Command Prompt (press Win+R, type `cmd` and press Enter) to find yourself in your personal user folder—for example, C:\Users\yourname. Type `dir` [1] [Image A] and press Enter. The command will first list the drive's label if it has one—it's 'System' in our example [2]. If there isn't one, you'll see 'Volume in drive C has no label'. Below that will be an alphabetical list of the contents of your user folder.

» Information about each entry is split into five columns [3]: the first two show the date and time the file or folder was last modified—the same information that's shown in File Explorer.

» Next to this is a column that's either marked <DIR> for a folder, or left blank for a file, followed by a column that lists file size in bytes. The final column displays the folder or file name. These figures are always displayed in bytes.

» You can translate these figures into kilobytes (KB), megabytes (MB), or gigabytes (GB) with the help of a calculator: divide the number of bytes by 1,024 once for KB, twice (or 1,048,576) for MB, or three times (or 1,073,741,824) for GB.

» At the bottom, you'll see the total number of files in the list and the space they take up; and the number of subfolders within this folder, along with the amount of free drive space left.

» If there's a lot of content in the folder you've chosen, you'll need to use the scrollbar on the right of Command Prompt (or your mouse wheel) to scroll back up the list. There are better ways to display this list, as we'll see shortly.

» On its own, the DIR command doesn't do much—nothing you couldn't just as easily find out by opening File Explorer, browsing to the folder in question, and choosing the Details view. However, you can feed in all kinds of inputs and switches to DIR to improve its usefulness and make it a viable alternative to File Explorer.

2 LIST THE CONTENTS OF A DRIVE OR FOLDER

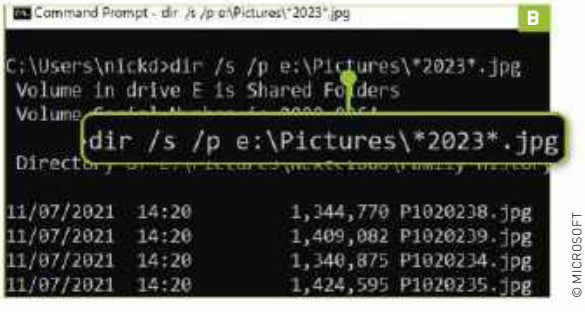
The first thing you should do is list the contents of any drive or folder on your computer—not just the one you're currently in. One trick is to check the contents of any subfolder inside the folder you're in without having to supply the full file path. So, from within your C:\Users\yourname folder, you can view the contents of your Documents folder by typing `dir documents`.

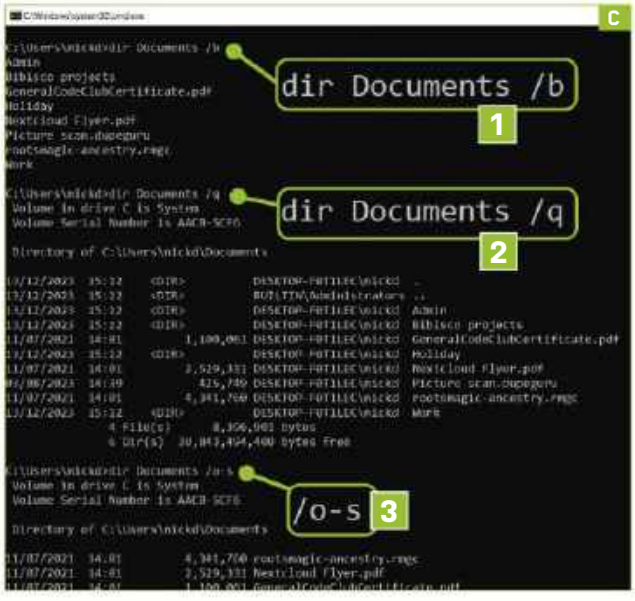
» If you want to examine the contents of a different folder (including one on a different drive), you'll need to supply the full path to the folder. This is as simple as typing `dir` followed by the drive and file path of the folder—for example, `dir d:\backups\familyhistory`. To find out the file path of a drive or folder, browse to it in File Explorer, then click inside the address bar.

» DIR also recognizes environment variables, which act as a kind of shortcut by pointing to a specific folder on your PC, so you can list the contents of your OneDrive storage folder or a Windows folder by typing `dir %OneDrive%` or `dir %WinDir%` respectively (including space after `dir`).

» One obvious weakness of this approach is that you can only explore the top level of a folder—it will list subfolders, but not their contents. This is where DIR's support for a wide range of switches comes into play. Switches are preceded by `/` (forward slash) and instruct DIR to perform additional functions or display its results in different ways.

» Let's start with the `/s` switch, which instructs DIR to add the contents of any subfolders to the file list. This can be placed anywhere within the command, so typing `dir Pictures /s` or `dir /s Pictures` has the same effect. DIR then displays the contents of each subfolder in their own separate sections.





3 FIND FILES USING WILDCARDS

That list is quickly becoming quite unwieldy, isn't it? Chances are you're looking for a specific file or group of files. To save you having to press Ctrl+F (Ctrl+Shift+F in Windows 11) to open Command Prompt's Find tool, you can use DIR's own filtering options to turn it into an advanced file-searching tool.

» This follows the usual syntax when working with files and folders in Command Prompt, so you can either type complete file names, or use wildcard (*) characters—for example, `dir *.doc` would list all Microsoft Word documents (both .doc and .docx), while `dir /s blu*.*` will search both the current folder and any subfolders for files beginning with 'blu'.

» Extend the search further to include files containing 'blu' anywhere in their file name by typing `dir /s *blu*.*`.

» These commands make DIR handy for searching your hard drive for files based on their names. It delivers results quicker than using File Explorer, and of course you don't need to move between folders to narrow your search to that folder as you do in File Explorer; simply specify the path, so typing `dir /s /p e:\Pictures\*2023*.jpg` [Image B] would search the Pictures folder on Drive E for any JPEG files containing '2023' in the file name.

» You can also filter the search to include—or exclude—results based on their type. This is done using the `/a` switch. Use this on its own (`dir /a *.*`) and it'll list all types of files and folders, including those with special attributes that may prevent them from appearing in either File Explorer or the Command Prompt.

4 SAVE YOUR RESULTS AS TEXT FILES

One drawback of how we've used DIR so far is that we can only see the results within the Command Prompt window. Another option is to instruct DIR to save its output elsewhere—specifically a text file you can view at your own leisure.

» In this example, we're creating a text file on our desktop listing the MP3 files in our Music folder: `dir /s music\*.mp3 > desktop\mp3filelist.txt`. Replace 'desktop' with the location you want to save your text file. Replace 'mp3filelist' with what you want to name your file. Make sure it ends with a .txt extension. To save the text file in the same folder you're currently in, just type `dir /s music\*.mp3 > mp3filelist.txt`, losing desktop.

» This could take some time, but as soon as your cursor reappears, the search is complete, and you can open the file in a text editor, such as Notepad.

5 SORT YOUR RESULTS

Right now, your list of music files is probably displaying a lot of unnecessary information, such as file sizes and date and time stamps. You can display just file names and folders in a straight list using the `/b` switch [1] [Image C]. You can also add an additional column displaying each file or folder's owner using the `/q` switch [2].

» Also consider using the `/o` switch, which changes the order of your results: `/od` (date/time, oldest first); `/og` (show folders first, then files); `/oe` (extension); `/os` (size, smallest first); and `/on` (alphabetical, a-z). Add the `-` prefix to reverse the sort order. So to display items in order of size, largest first, type `/o-s` [3].

6 RECOVER YOUR DRIVES IF YOU CAN'T LOAD WINDOWS

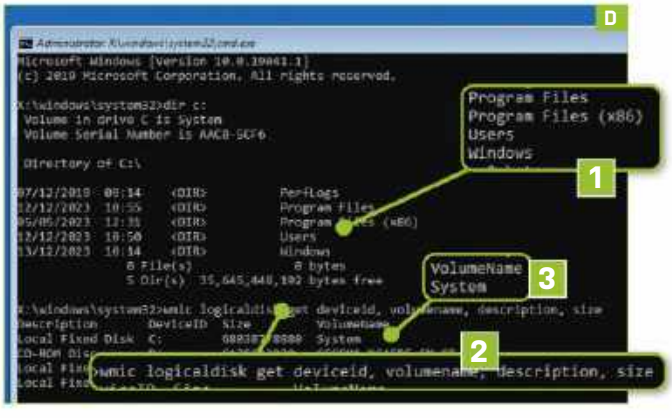
Try DIR if you can't get Windows to load and your only option is to select Troubleshoot, 'Advanced options', then Command Prompt. After inputting your password, you'll find yourself at the Command Prompt, but pointing to an unfamiliar location: X:\system\windows32.

» The X drive is the Windows Recovery Environment, so the first thing DIR can do is verify your Windows drive is visible and the files all present and correct. Type `dir c:` and press Enter. All being well, you should see a list of familiar folders (including Program Files, Users, and Windows— [1] [Image D]. You can now switch to drive C (type `c:` and press Enter) and start using DIR to confirm that your personal files are still intact.

» However, if drive C isn't recognized, or the files and folders from a different drive are shown instead, don't panic. It's possible—and quite common on drives with multiple hard drives attached—for the Windows Recovery Environment to jumble up drive letters.

» If this is the case, type `wmic logicaldisk get deviceid, volumename, description, size`—[2], and cut and paste this from pastebin.com/R7DhpLwm. Press Enter to see a full drive list, hopefully confirming your Windows drive is present and correct under a different drive letter. If it's been labeled, you can identify it in the VolumeName column (it's 'System' in our screenshot [3]).

» If it's not listed, look for a Fixed Local Disk under Description, then look for the biggest number under Size. This is likely to be your drive. Check by typing its letter (for example, `d:`) and pressing Enter. This will list its contents. Drive letters in the Windows Recovery Environment are temporary. When you boot back into Windows, they'll revert to their correct letter.



LAB NOTES

ZAK STOREY, CONTRIBUTOR

Maximum PC, Minimum BS

Intel & Z790 Is Too Damn Hot

LAST I CHECKED, those four words in bold up top there graced the front of each and every issue of *Maximum PC*. What they represent is this humble publication's very ethos, its spirit, its soul. Maximum performance, with minimal... attached nonsense. It's a mantra I've lived my tech journalism career by, and one that extends to the everyday too.

Why do I bring this up? Simply put, I'm tired of the ongoing nonsense with architectures and chipsets. At the moment, plying my trade as a freelancer, I'm fortunate enough to be doing a lot of work with graphics cards, testing them for all manner of publications. For my test bed, I'm using an Intel Core i9-14900K and a Z790 motherboard of similar ilk, mostly due to the heavy single-core performance and chunky smart-cache eliminating bottlenecks. Recently, however, after a huge amount of frustration dealing with continuous crashing while testing the RTX 4080 Super (*Returnal* being the game in question), I decided that the problem must be the motherboard, so I swapped it out for another $700 item from a competitor.

I stripped the system, swapped the SSDs, flattened the OS, reinstalled and redownloaded all the benchmarks—the lot, only to find that instead of one game crashing continually, three or four would now either crash on load or at some point in the benchmark itself, eliminating the run. Every time, some form of CPU or Clock IRQL error would be the culprit. It was only mildly remedied when I went into the BIOS (newly updated) and disabled some auto-power overvolting nonsense that the AIB had enabled and added because I was using an AIO (they'd increased the PL1 limit from 253W to 4096W). Otherwise, it was entirely stock, bar XMP being enabled.

You're not in my good books, 14900K and/or motherboard manufacturers.

Here's the thing: even with that mildly resolved, I'm left with a 14900K that'll quite happily jump up to 100C under load, without even blinking. Swap that out to a 14700K or a 14600K, and the same thing occurs. If it's leading to constant crashing on fresh systems with different $700 motherboards, I've got to question whether it's worth pushing the limit of an architecture so hard.

Consumers shouldn't be required to sit here with a $3,000 PC and spend the next week troubleshooting why a BIOS version is bluescreening on a CPU in a gaming benchmark from 2019. Yet here we are, at the cutting edge. Eugh. Did I ever tell you this mag is my therapy sometimes?

JEREMY LAIRD
Contributor

You might think Google releasing a version of Chrome for Windows that runs natively on Arm is small beer. But it could be a waypoint on the PC's transition from x86 CPUs to Arm chips.

It's not clear why Google snubbed Arm. Chrome has been available for Arm on nearly all platforms bar Windows, until now.

It matters because of how important Chrome is for many PC users. I do almost everything in Chrome. I know it's flawed, but as a platform to sync my digital activities across numerous devices, it's tough to beat.

Without native support for Chrome, I wouldn't have countenanced a Windows for Arm laptop. But now I can, and that's fantastic because, gaming aside, Arm chips make for much better mobile processors than x86 CPUs. I'm particularly excited to see where Qualcomm's upcoming Snapdragon X Elite chip ends up. If you're familiar with the MacBook Air with Apple silicon, you'll know how silly it makes PC laptops seem when it comes to efficiency.

Gaming will remain something of a stumbling block for Arm totally taking over, right? I'm not so sure. Apple has shown that amazing things can be done when it comes to emulating x86 code. Give it a few years to allow for some really powerful new Arm chips to appear, and even legacy x86 games might actually run well on Arm PCs.

The latest Asus Flow X13 is a gorgeous 2-in-1 ultraportable with decent gaming chops. It's just a shame about battery life.

Editor's Pick:
Asus ROG Flow X13 (2023)

Game your own way

ASUS has updated its 13-inch 2-in-1 convertible laptop, the Asus ROG Flow X13, with the latest hardware. This means AMD's Phoenix APU in full Ryzen 9 7940HS spec with eight cores and a pretty powerful integrated GPU.

You can also opt for one of three Nvidia dedicated graphics chips: the GeForce RTX 4050, 4060, or 4070 mobile GPUs. Whatever graphics you go for, it outputs to a 13.4-inch display with a 2,560 by 1,600 pixel resolution and 165Hz refresh rate. It's touch-enabled, with a 360-degree hinge that supports various modes.

You can also option a more powerful GPU via the Asus XG Mobile external graphics box that hooks up courtesy of a dedicated I/O port, but that's costly. The laptop is packaged into a slick and slim 1.3kg 13-inch chassis that's beautifully built, feels high quality, and is very rigid, including virtually no keyboard bounce. The chassis top and screen enclosure also sport appealing textured finishes. That extends to the 360-degree hinge. Meanwhile, the screen's slim bezels keep things pretty compact while allowing for a 1080p webcam in the top bezel. It all makes for a very versatile laptop.

If there is a catch, it's that the slim proportions put a cap on performance. The RTX 4060 in our review unit is capped to 60W and 1,470MHz, much lower than Nvidia allows for the chip. A skinny chassis also tends to limit connectivity, and the Flow X13 has just enough ports, but no more. You get USB4, which doubles as the charging socket, a full-sized HDMI port, one USB-A, microSD, headphone, and Asus's XG Mobile IO port, which supports not only a powerful external GPU, but via the XG Mobile box adds HDMI, DisplayPort, three USB-A ports, and a Type-C socket.

Anyway, that AMD Ryzen 9 7940HS CPU and Nvidia RTX 4060 mobile GPU is quite the combo for such a compact, versatile laptop. This isn't an out-and-out gaming laptop, more an ultra-portable 2-in-1 convertible with a great build and some gaming chops.

Expectations need to be kept in check, what with the RTX 4060 GPU's 60W power cap. The consequence is lower frame rates than gaming-focused laptops with the 4060. You'll still get frame rates of around 60fps at 1080p in the latest games at ultra settings, provided you don't run high levels of ray tracing. That said, the RTX 4060 does have the full suite of NVIDIA DLSS features, including upscaling.

That's handy, as it makes playing games at the Flow X13's 2,560 by 1,600 pixel native resolution achievable. Without DLSS, that wouldn't be very realistic with an RTX 4060, especially not the 60W version, which would be a pity, given that the display is an IPS running at 165Hz.

Elsewhere, the AMD CPU provides all the performance you could ask for from this class of laptop, while the 16GB of RAM and 1TB M.2 SSD should cover you. There's also an option to upgrade to 32GB.

The one major disappointment is battery life. An efficient AMD APU, plus a 75WHr battery in a compact chassis, is a promising combination. In practice, the Flow X13 doesn't quite clock seven hours in a fairly undemanding video playback test with the screen at half brightness.

Crank up the brightness or attempt anything intensive, and that figure falls. In other words, all-day battery life isn't on offer even for light tasks. That's a shame, given this is such a versatile machine. **–GC**

$1,699, www.asus.com

Reviewed...

Nvidia GeForce RTX 4070 Super

The ultimate budget 4K solution

IT FEELS WEIRD saying this about a $599 graphics card, but yes, this is in fact the best budget GPU you can buy right now.

The RTX 40 Super cards were announced at CES this year, and out of the lot, the RTX 4070 Super is arguably the most interesting of the bunch. We're talking significantly more on-board hardware (albeit the same memory), a static RRP price tag (a lovely addition, given the current state of inflation), and better yet, killer performance at 4K. Is this the card to finally put the nail in 1080p's coffin? It might just be.

At this point in time, you'll likely have read more than enough in these hallowed pages about Ada Lovelace, the Supers, and Nvidia's progress over the last year and a bit, so we won't bore you with the details yet again. To put it simply, initial reaction towards the 40 series GPUs was mixed. Top-tier performance? Yes. Top-tier pricing? Absolutely not.

The Super series seems to be Nvidia's way of trying to rectify that last faux pas somewhat, and the RTX 4070 Super is the best of the bunch when it comes to handling that budget label. Compared to its namesake, the RTX 4070, it gets an additional 1,280 CUDA cores (from 5,888 to 7,168), 40 extra TMUs, 16 ROPs, and more importantly, 10 additional ray tracing cores, plus 40 more tensor cores for all those RTX and DLSS shenanigans.

But it's that CUDA bump that really matters, as that's a staggering 21.7 percent increase to the hardware that really makes your frame rate jump, and boy can you see it.

It's not all increases and clock speeds, though. Memory has remained the same at 12GB, and although the turbo clocks are identical, we've also seen a slight bump in the base TDP (climbing from 200W to 220W respectively), although that's hardly surprising, given all that additional kit Nvidia's packed into this.

It's in-game, though, that the 4070 Super shines. As you can see from our test results below, it demolishes 4K gaming across the board, with almost all of our titles either at or floating around the 55 fps+ mark, and comfortably, too. All these games were tested at the highest presets, with everything dialed to 11. The one exception was *Cyberpunk* (clocking in at 55 fps), which we did allow DLSS to be enabled on. unlike our usual testing suite (as this is actually enabled by default with the Ultra ray tracing preset). Regardless, performance was exceptional, and given the price tag, it marks the first time we've seen average frame rates push past that 60 fps mark across the board at this price point without compromise.

That's important for two reasons. Firstly, 4K monitors are becoming fairly affordable—a good-quality IPS panel from MSI will set you back $200 at the time of writing. Secondly, with that bump in performance, certainly compared to the stock RTX 4070, this is the first mid-range card we've seen that's capable of doing that in the latest titles without breaking a sweat or tweaking the in-game settings to death.

If you were upgrading today, had an RTX 2060, or a GTX 1070, and picked one of these up, you'd be happy. It's not super exciting from a generational standpoint, and hopefully it doesn't mark a slowing down in Nvidia's GPU progress, but it's still an impressive update. **–ZAK STOREY**

BENCHMARKS

	Nvidia GeForce RTX 4070 Super	Nvidia GeForce RTX 4070
3D Mark: Speedway (Index)	**5,024**	4,532
3D Mark: Port Royal (Index)	**12,859**	11,298
Max Power Draw (Watts)	502.3	**499.3**
Max Temperature (Celsius)	78.9	**73.7**
Total War: Three Kingdoms @ 1080p (avg fps)	**173**	147
Final Fantasy XIV @ 1080p (avg fps)	**211**	169
Far Cry 6 @ 1080p (avg fps)	**136**	123
Assassins Creed: Valhalla @ 1080p (avg fps)	**152**	117
Cyberpunk 2077 @ 1080p (avg fps)	**132**	100
Total War: Three Kingdoms @ 4K (avg fps)	**53**	41
Final Fantasy XIV @ 4K (avg fps)	**110**	88
Far Cry 6 @ 4K (avg fps)	**83**	67
Assassins Creed: Valhalla @ 4K (avg fps)	**74**	56
Cyberpunk 2077 @ 4K (avg fps)	**55**	45
Avg fps @ 1080p	**160.8**	131.2
Avg fps @ 4K	**75**	59.4
Avg fps per $ spent @ 4K (Index)	**0.13**	0.10

Best scores in bold. Our test bed consists of an Intel Core i9-14900K, 32GB of Corsair Dominator Titanium @ 7200, Corsair H150i AIO, and an Asus Z790 Dark Hero. All tests performed at 1080p & 4K, avg. fps recorded, RTX & DLSS is enabled in Cyberpunk. Power Draw and Temperature recorded during Port Royal benchmarking.

VERDICT **9**

Nvidia GeForce RTX 4070 Super

SUPER CALIFRAGILISTIC EXPIALIDOCIOUS 4K60 fps finally possible on the mid-range; Significant hardware bump-up; Identical retail price to RTX 4070.

SUPERFLUOUS Not a new generation; TDP increased slightly.

$599, www.nvidia.com

SPECIFICATIONS

Architecture	Ada Lovelace
Manufacturing Process	TSMC 4N 5nm
CUDA Cores	7,168
ROPs	80
RT Cores	56
Tensor Cores	224
Memory	12GB GDDR6X
Memory Bus	192-bit
TDP	220W

The best 'budget' (well, $599) GPU you can buy right now.

Lenovo Legion 9i

This RTX 4090-powered beast might just be Lenovo's finest hour

LENOVO HAS made a hypocrite of *Maximum PC*. Since this latest generation of gaming laptops rocking Nvidia RTX 40-series graphics chips first landed, we've been saying that only a fool would buy a notebook with an RTX 4090 in it. Yet, here we are, bigging up the Lenovo Legion 9i with precisely that GPU inside it, and despite the near $4,000 sticker price.

That said, there's a moderately more affordable model with an RTX 4080 that will likely deliver practically the same level of gaming performance. Hold that thought while we consider the Legion's sturdy build quality. There's no noticeable give to the chassis, and it all feels superbly engineered and robust. The composite top layer is delightfully tactile, too, as are the set of white ceramic key caps that come secreted in the box.

The keyboard itself is classic Lenovo fare in that it's the best around. The full-size board is great to type on, from the ergonomic shape and size of the key caps to their depth of travel, and the full numpad is always going to appeal to a certain user. You alt-code people know what we're talking about.

The Legion is also impressively slender for something that can house RTX 4090 laptop silicon. That may be thanks to its cooling design, including what Lenovo calls 'integrated liquid cooling'. It boils down, pun intended, to a slightly larger vapor chamber. There's no radiator and only the tiniest pump that pushes liquid around the GPU and VRAM. It looks like a gimmick, but this is the fastest we've seen the RTX 4090 laptop GPU run.

Perhaps that's more to do with pass-through cooling with twin fans pulling in air from the underside and expelling it directly out of the top and sides of the chassis. That's why the keyboard has been shifted down, so there's space for the vented area directly below the screen.

Graphics grunt aside, another highlight is the 16-inch mini-LED display. It rocks a 3,200 by 2,000 native resolution, and is nothing short of stunning. It's super bright, hitting 1,200 nits, and like other top-end mini-LED laptop panels, it somehow doesn't have any of the backlight issues that plague full-size mini-LED gaming monitors.

Anyway, with that RTX 4090 running at its maximum 175W spec, this thing flies. It's definitely faster than the Razer Blade and its 175W RTX 4090. Importantly, it also beats Lenovo's Legion Pro 7i running an RTX 4080. That's important, because the problem with the RTXB 4090 is that lower clocked versions can actually end up slower than the 4080, which makes the added expense a bit of a farce.

Battery life is a weak point, especially during gaming, where you're looking at under an hour of operation away from the mains. Still, you get two power supplies as standard: one 330W, and another smaller 140W Type-C charger for when you want to take it out-and-about. That 140W mini-brick isn't going to deliver enough charge for you to game on, however, so it's more about keeping it topped up.

Anyway, as a complete package, the Legion 9i has a lot going for it. It's beautifully designed while avoiding the overly aggressive 'gamer' aesthetic of some competing laptops. You can get away with bringing it into a serious business meeting in a way you wouldn't with the likes of an Asus ROG monster.

Plus, it's got that screen, which is one of the very best in any gaming laptop. All told, the Legion 9i is in with a shout of being the money-no-object gaming laptop of choice. We suspect the RTX 4080 version is very nearly as fast, and so will make a superior-value proposition. But in either configuration, this well-designed and expertly engineered machine is very likely Lenovo's finest hour. **–DAVE JAMES**

BENCHMARKS

	Lenovo Legion 9i RTX 4090	Razer Blade 16 RTX 4090	Lenovo lLegion Pro 7i RTX 4080
Cyberpunk 2077 RT 1080p (fps)	**66**	64	62
Hitman 3 1080p (fps)	**321**	270	269
Metro Exodus 1080p (fps)	**118**	99	103
Horizon Zero Dawn 1080p (fps)	**163**	130	147
GPU speed under load (MHz)	2,166	1,708	**2,361**

VERDICT **9**

Lenovo Legion 9i

MILITARY GRADE Great build quality; fab screen; excellent performance.

FOREIGN LEGION Very expensive; awful battery life.

$3,693, www.lenovo.com

SPECIFICATIONS

CPU	Intel Core i9 13980HX
GPU	Nvidia RTX 4090
Memory	32GB DDR5-5600
Storage	2TB NVMe SSD
Screen size	16-inch Mini-LED
Resolution	3200 x 2000
Refresh rate	165Hz
Peak luminance	1200 nits
Battery	99.9Whr
Dimensions	18.99 - 22.7 x 357.7 x 277.7mm
Weight	2.5kg

© UNSPLASH

Clever pass-through cooling allows the Legion to make the most of the RTX 4090 GPU.

Iiyama Prolite XUB3293UHSN-B5

Big, bright, and versatile, this is ideal for showing what your rig can do

THERE'S NOTHING LIKE a big monitor to make your PC look awesome, and this Prolite model from Iiyama does just that. Although not the biggest—there are 43-inch screens and expansive ultrawides, if you really want to show off—a 32-inch screen looks more imposing than a 28-inch model, and gives an appreciable increase in screen area, too.

Around the back of the Prolite are three inputs—USB-C, DisplayPort, and HDMI—and a USB hub that offers KVM capability. This means that you can have a desktop PC connected to the DisplayPort, a laptop on the USB-C, and maybe a streaming stick in the HDMI, making for a versatile screen that's ideal if you're limited to just this. A pair of 3W speakers and a headphone socket round out the audio capabilities, and the ability to control volume using the OSD controls is a nice touch.

The USB-C connection sends 65W of power to your laptop, so you can lose an extra charging cable, and in these days of wireless keyboards and mice, the ability to share one wireless receiver between two computers is useful. You can connect an external hard drive (a fast SSD would be limited by the USB 3.2 Gen 1 speeds) to the remaining USB 3 port and share that, if you like. There's an Ethernet port to wire yourself into the local network, and data and video can be sent down the USB-C connection to a laptop, while a USB 3 Type B connector and the remaining video connectors facilitate a desktop PC.

We measured the Prolite outputting 400 nits at 100 percent brightness, which is 50 more than its official specs list, giving it decent SDR brightness. You get reasonable color reproduction, too, with 100 percent of sRGB, 83 percent of AdobeRGB, and 92 percent of P3 registering on our colorimeter. This, along with the KVM, positions this screen as something that might sit on the desk of a video or photo editor, and being able to full-screen something like Lightroom across a 32-inch panel means you won't want to sit too close, or you'll be craning your neck back and forth as you try to take in the full display area.

4K resolution means there are plenty of pixels. With a suitable signal, you'll get an image that's full of color thanks to the IPS panel. Brightness, contrast, and color temperature can be adjusted via the OSD, but the buttons are fiddly, and the menu doesn't stay on the screen for long.

There's a hefty stand included, plus a 100mm VESA mount attachment if you want to fix it on an arm or wall, and it offers a gymnastic amount of movement, with the ability to flip the screen into portrait orientation. The whole thing goes together with just two screws, which are both easy to do up with your fingers.

With a refresh rate of just 60Hz, this may not be the screen for gamers looking for high-framerate thrills, but as a display for creative apps, most games, and playing video, it's a versatile choice. The KVM functionality is nice to have, especially if you're blessed with multiple PCs and dislike swapping cables or having multiple wireless receivers, but it's the strength of the image quality that will attract the most users. **–IAN EVENDEN**

VERDICT
8

Iiyama Prolite XUB3293UHSN-B5

BIG SCREEN Large, bright and colorful; Useful integrated KVM.

BLUE SCREEN Heavy; A bit on the expensive side; Only 60Hz.

$693, iiyama.com

SPECIFICATIONS

Screen	31.5in LED-backlit IPS, 3840 x 2160, 60Hz
Response time	4ms
Brightness	350 cd/m2
Connectivity	1x HDMI, 1x DisplayPort, 1x USB-C, Ethernet, 2x USB 3.2 Gen 1 Type-A, 1x USB 3.2 Gen 1 Type B, headphones
Dimensions	28.1 x 17.8 x 9.4in
Weight	22lbs

This 32-inch 4K screen is aimed squarely at creatives, not gamers.

Netgear Nighthawk RS700

Excels where other Wi-Fi 7 routers fall short

WITH THE PERFORMANCE goodies like 6GHz transmissions and 320MHz data channels that Wi-Fi 7 has to offer, Netgear's Nighthawk RS700S has the power to speed up just about any network. Easy to set up and modify, the tri-band RS700's real worth is its throughput at mid-range distances, meaning that it's a great upgrade for a modest-sized home (around 3,500 square feet).

It can be expensive to join the cutting edge, however. At $700, it's $100 more than the TP-Link Archer BE800, and is the same price as the Archer BE900, but lacks either's physical info screens. Netgear's Armor security is excellent and a free year is included, but it adds over $100 a year to ownership costs after that.

The RS700S is unique when it comes to looks, with a black vertical tower design that has chrome accents at its vents. Its six-sided profile looks like a triangular prism with its corners blunted. At 11.1 x 5.6 x 4.9 inches, it's large, but actually quite a bit smaller than other Wi-Fi 7 routers, like the TP-Link Archer BE800.

The tri-band RS700S has eight internal antennas, arranged to create a spherical transmission pattern that Netgear engineers optimized to cover a main floor: one above and one below. It can work with up to 200 devices at a time, and uses Broadcom's BCM6726/3 Wi-Fi chipset to deliver 4X4 performance on the 2.4, 5, and 6GHz bands for 12 streams of data. The router has a 2.6GHz quad-core processor, 2GB of RAM, and 512MB of storage, and tops out at a throughput of 19Gbps. At the moment, it can't merge separate bands into a single data stream using Multi-Link Operations (MLO), something other Wi-Fi 7 routers from competitors can do, but Netgear plans a firmware upgrade to address this.

On the wired side, there's a 10Gbps Ethernet input and output port for connecting the latest broadband and LAN equipment. There are also four gigabit per second downstream connections, two of which can be aggregated, plus a USB 3.2 port for plugging in an external drive whose contents can be delivered anywhere on the network

With the ability to use the 2.4, 5, and 6GHz bands, the Nighthawk RS700S has the potential to deliver lots of data. With the Wi-Fi 7-capable OnePlus 11 test phone next to the router, it could move 2.278Gbps of data using the iXChariot networking benchmark set to mimic 10 data-hungry users. That's slightly off the 2.531Gbps recorded by the Archer BE800.

The RS700S came into its own at 50 feet, a distance that is more in line with the way home networks are used. Here, the OnePlus 11 phone received 691.8Mbps—more than twice the throughput recorded for the Archer BE800, and one quarter more data flow than an Orbi RBE973's 495.1Mbps. This is the router to get for general daily use in real-world conditions where the router and device are separated by half a house.

The RS700S uses just 15.1 watts while operating—about a third less electricity than the BE800's 22.2 watts. If it's on 24/7 and you pay the national average of 16 cents per kilowatt hour of power, it should cost around $21.15 a year to operate.

It may not be the fastest Wi-Fi 7 router up close, but the Nighthawk RS700S has the throughput where it counts at medium distances, where it's most needed in the home. The tri-band router has one of the quickest and easiest set up routines, although it lacks the Archer BE800's info screen. Its Armor extra-defensive layer of software includes Bitdefender malware scanning, which can help keep the network and its devices virus-free, but requires annual payment for updates.

At $700, the Nighthawk RS700 is among the most expensive traditional home routers, and $100 more than the TP-Link Archer BE800, but it's worth it for those who want data to fly through their home. All that's needed now are more Wi-Fi devices to use it. **–BRIAN NADEL**

VERDICT

8

Netgear Nighthawk RS700

SPEEDING UP Good speed; Quick and easy set up; Lots of configuration options.

SLOWING DOWN Expensive; No Multi-Link Operations; $100/year Armor security.

$700, www.netgear.com

BENCHMARKS

	Netgear Nighthawk RS700S	TP-Link Archer BE800	Netgear Orbi RBE973
15 feet (Gps)	1.773	1.967	**2.003**
50 feet (Mbps)	**691.8**	335.6	495.1
75 feet (Mbps)	**187.6**	91.5	174.8
90 feet (Mbps)	**40.6**	19.8	25.3

Best scores are in bold.

SPECIFICATIONS

Wi-Fi Spec	BE19000 (802.11be)
Number of Antennas/ Removable	8/No
Ports	One 10Gbps WAN input, one 10Gbps downstream, four 1Gbps, USB 3.2
Processor/ Memory/Storage	Quad-core 2.6GHz/2GB/512MB
Wi-Fi chip	Broadcom BCM6726/3
Peak 802.11ac performance	1.773Gbps (at 15 feet)
Range	95 feet
Size	11.1 x 5.6 x 4.9 inches

The RS700S looks good, but more importantly, performs well.

At $1,299, this new Asus is an awful lot of money for a glorified 1440p panel.

© UNSPLASH

Asus ROG Swift OLED PG34WCDM

Our first taste of LG's latest OLED

WELCOME TO THE second generation of OLED gaming monitors. Or should that be the third, as Asus is claiming? It depends on how you measure, but this new Asus monitor definitely moves the game on, courtesy of the latest LG OLED panel tech.

The key question is whether LG can close the gap to Samsung's QD-OLED tech for both outright full-screen brightness and brightness consistency. As for the PG34WCDM itself, it's a 34-inch curved ultrawide model with 3,440 by 1,440 pixels, so the basic form factor isn't novel. That said, at 240Hz, it's a step up in terms of refresh rate from earlier 34-inch ultrawide OLED monitors.

Meanwhile, Asus is quoting 0.03ms as a response time, which is standard OLED fare, if still pretty eye-popping compared to any LCD monitor. Color coverage is 99 percent of DCI-P3, which again is both excellent and about what you'd expect from a modern OLED panel.

Where things differ most obviously from existing gaming monitors with LG OLED technology is brightness. Peak brightness is up to 1,300 nits, albeit in a three percent window, while brightness in a 10 percent window is 650 nits. As for full-screen brightness, that's 250 nits—modest compared to most LCD monitors, but an improvement on the sub-200 nits of previous LG-powered OLED monitors.

Arguably, full-screen brightness has been the greatest weakness of OLED monitors based on LG's OLED technology. Asus says the PG34WCGM uses LG's "latest-generation" MLA panel tech, plus a fanless custom heatsink, all in the name of better brightness. What's more, Asus has implemented a Uniform Brightness mode designed to deal with the way LG-powered OLED monitors can bounce around in terms of panel brightness.

OLED panels are limited in how much of the screen can be lit at once, hence the 1,300 nits, but only in a three percent spec. The problem, in a PC context, is that the whole screen brightens and dims when, for instance, you resize a predominantly white browser window. Not with Asus Uniform Brightness switched on.

Money is at the front of our mind when firing the Asus ROG Swift OLED PG34WCDM up for the first time. Asus has priced this panel at $1,299, which begs comparison with the $799 Alienware 34 AW3423DWF. That's a lot more money.

Thankfully, the new PG34WCGM has a bit more zing than every other LG-based OLED gaming monitor we've seen. As for whether it has closed the gap to QD-OLED, that's more complicated.

Asus's Uniform Brightness mode is problematic. When enabled, the panel is dimmer than we'd prefer. With it disabled, there is some variability in brightness, but it's not as distracting as previous LG panel generations, and the overall brightness never drops as low as it does with Uniform Brightness enabled.

In other words, we'd leave that option off, even on the desktop. Compared to the latest Samsung QD-OLED panels, it's still a bit less consistent, and full-screen brightness is still a whisker behind. LG and in turn Asus have closed most of the gap, for sure. It's just frustrating that this isn't even better, given the price. For $1,300, it doesn't seem too much to ask that brightness isn't an issue, however minor. **–JEREMY LAIRD**

VERDICT **8**

Asus ROG Swift OLED PG34WCDM

BRIGHT LIGHTS Latest LG OLED tech improves brightness; Great feature set.

AFTER MIDNIGHT Full-screen brightness still an issue; Ridiculously expensive.

$1,299, www.asus.com

SPECIFICATIONS

Screen size	34-inch
Resolution	3,440 x 1,440
Brightness	250 nits full screen, 1,300 nits 3% window
Color coverage	99% DCI-P3
Response time	0.03ms
Refresh rate	240Hz
HDR	DisplayHDR 400 True Black
Features	LG WOLED MLA Gen 2 panel, adaptive sync, 1x DisplayPort 1.4, 2x HDMI 2.1, 1x USB-C with 90W PD, KVM switch

Crucial T700 Pro 2TB

For whom the benchmark tolls

THIS IS WHY benchmarking is important. From the outset, the Crucial T700 Pro 2TB looks like another incredible PCIe 5.0 drive at the cutting edge of what's possible right now. It's advertised with 12,000 MB/s sequentials, a big chunky heatsink to dissipate all that warmth, and a slick design, too. Combine that with 2TB of storage at a more than affordable $270, and it's well on its way to being a dead-set winner.

Except, it isn't. Sadly, the CT2000T700SSD5 (catchy name, we know) doesn't quite hit the same speeds as some other PCIE 5.0 drives right now. In fact, in our testing, it fell significantly under par in comparison. CrystalDiskMark's sequential testing at a queue depth of 32 recorded read and write performance of just 7,084 and 6,841 MB/s respectively. Still impressive numbers, no doubt, but a far cry from the up to 12,000 MB/s listed on the product page. This is a fresh-out-of-the-box experience; there's no OS installed on it, it's running formatted and tested within minutes of one another, and is located in the top PCIe 5.0 M.2 slot in the MSI MEG Z790 Ace Max motherboard, covered in a massive M.2 heatsink (temps top out at 66C according to HWMonitor).

We keep testing, of course, moving over to another sequential benchmark in the form of AS SSD, and similarly to before, figures still fall significantly lower than the competition (although not entirely surprisingly, given AS SSD's street cred), clocking just 5,825 MB/s on read and 5,890 MB/s on write. Now, it is worth stating at this point that in comparison, Gigabyte's Aorus Gen5 12000 equally falls low in AS SSD, but even so, that still clocks in at a top write speed of 9,948 MB/s there.

It's quite the conundrum. Dig deeper, however, and figures start to creep up to more respectable figures. Where the performance truly matters, random 4K, the T700 Pro begins to shine, with AS SSD reporting 82.84 and 261.66 MB/s. Likewise, CrystalDisk hits 95 and 312 MB/s respectively, pipping the Gigabyte Aorus Gen5 in the process. Access time was also lower at 0.015 and 0.033 ms, again beating Gigabyte's PCIe 5.0 showpiece.

So what's going on with those sequential numbers? A quick glance at the product page will point you to a small annotation, very specifically regarding that performance, and how it's been measured. It's achieved by using CrystalDiskMark at a queue depth of 512, with write cache enabled (it's on by default), and Windows 11 Core isolation's memory integrity disabled as well. Yeah, you know, the security feature that actively protects core processes and memory from malicious actors and code. The thing is, we tried testing under those conditions as well, and it only bumped the sequentials up by 100 MB/s—still well below what we expected.

Is that the be-all and end-all? Is this drive a dud? Should you abandon it and go for the Gigabyte Aorus Gen 5 or Corsair's offering instead? Honestly, sequential read speeds have, for the longest time, been a bit of a marketing buzzword. Big number is big and grows bigger, therefore audience must like that. At a glance, that is kind of true. The bigger the sequentials, generally the better performance for 4K as well. Take a look at the Samsung PM981 PCIe 3.0 drive for comparison: 3,465 MB/s sequential read speed; 201 MB/s write speed at 4K. The Gigabyte Aorus Gen 5 has a 12,353 MB/s read speed, 310 MB/s write. It's not as big a jump, but performance has improved.

Crucial's T700 delivers performance in the right areas. Its sequentials are okay—a bit lacking, and dependent on myriad conditions, but for day-to-day performance in-game, and accessing those random files, it'll easily keep up with the Aorus Gen5 12000, and even beat it. **–ZAK STOREY**

BENCHMARKS

	1TB Crucial T700 Pro PCIe 5.0 M.2 SSD	2TB Gigabyte Aorus Gen5 12000 PCIe 5.0 M.2 SSD	1TB Samsung PM981 OEM PCIe 3.0 M.2 SSD
AS SSD Sequential - Read / Write (MB/s)	5,825 / 5,890	**8,970 / 9,948**	3,020 / 2,444
AS SSD Random 4K - Read / Write (MB/s)	82.84 / 261.66	**86.65 / 289.12**	51.88 / 193.69
AS SSD Access Time (ms)	**0.015** / 0.033	0.017 / 0.037	0.076 / **0.019**
CrystalDiskMark Sequential QD32 Read / Write (MB/s)	7,084 / 6,841	**12,353 / 11,598**	3,465 / 2,390
CrystalDiskMark Random 4KQ1 Read / Write (MB/s)	**95 / 312**	89 / 310	65 / 201
Max Temp Under Load (C)	**66**	78	**66**
Gigabyte per $ (GB)	6.76	7.69	**7.75**
Sequential Read MB/s per $ (MB/s)	23.93	**47.51**	26.86

Best scores in bold. Our test bed consists of an Intel Core i9-14900K, 32GB of Corsair Dominator Titanium @ 7200, an Nvidia GeForce RTX 4080, Corsair H150i AIO, and an Asus Z790 Dark Hero. Max Temp recorded via HWMonitor during benchmarking process.

VERDICT **7**

Crucial T700 Pro 2TB

RAPIDLY Top-Tier Random 4K performance; Super cool throughout testing; Slim form factor.

DEGRADING Sequentials way off the mark; Pricier than the competition.

$296, www.crucial.com

SPECIFICATIONS

Variants	Bare, Heatsink
Form Factor	M.2 2280
Interface / Protocol	PCIe 5.0 / NVMe
Flash Memory	TLC NAND3
Sequential Read	12,400 MB/s
Sequential Write	11,800 MB/s
Random Read	1,500K IOPS
Random Write	1,500K IOPS
Endurance (TBW)	1,200
Warranty	5 Years Limited Warranty

Ultimately, this delivers
performance where it matters.

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Ducky ProjectD Outlaw 65

Build yourself a killer keyboard

IF YOU'VE EVER wanted to build your own keyboard, then the Ducky ProjectD Outlaw65 is a simple and easy way to go about it. Included in this compact kit are most of the pieces required to build a mechanical keyboard from scratch, and a guarantee that every piece will fit together—you need only provide switches and keycaps.

Why might you want to build your own keyboard when you can pay someone less for one that has already been made? Good question, and if you don't already get why that might be appealing, I don't have a particularly convincing answer for you. Beyond an opportunity to lube up all your stabilizers and switches before actually putting them inside your keyboard, or the option to customize often inaccessible layers, you mostly need to be in it for the love of the game.

No doubt the concept should appeal to many in the PC gaming community—personally, any excuse to tinker with my setup is gratefully received. The Ducky Outlaw lets you skip the planning process and get right into the keyboard assembly.

Assembly is easy if you abide by the instructions. Opening the neat black carry case, I'm greeted by the many bags of components to fit together. It's pretty much all of which is needed, though Ducky does include a bag of spares in case you end up dropping anything.

The first step is building the base for the keyboard, mostly comprised of weighty sandblasted aluminum, making it one of the heaviest keyboards I've got in my collection. Once the base is formed, it's time to move onto the PCB by lubing up the stabilizers included in the case. Lubing these stabilizers helps improve the final typing experience and makes for a very smooth actuation of the larger keys. Ducky includes some lube and a tiny brush for this purpose in the box, so there's no need to worry about sorting any of that ahead of time.

ASSEMBLY ASSESSMENT

You only need a small amount of the included lubricant for the stabilizers themselves, and if you wanted to, you could definitely spread it over an entire pack of switches as well. I've decided to use NovelKeys' Novelias switches for this build, though I've not bothered with lubing them. They're an extremely heavy tactile switch I bought back in 2018, used sparingly since, and they feel pretty great, anyway.

Once you've fitted the stabilizers to the PCB, you fit the backplate, with both a black FR4 with gold trim or a white POM option available. A couple of spacers are also required here before slotting the sound dampening foam between it and the PCB and firmly screwing it down. Once that's sorted, I attached the included USB connector to the PCB and got ready to assemble it.

The next bit is the most repetitive part of the build: switches and caps. Admittedly I quite like the job, but it's not for everyone. The switches I've got for this build fit a gasket mount keyboard such as this, and you'll need to check compatibility for any others you use with it. They also come with a see-through plastic housing on the south side of the switch for RGB LEDs to shine through.

Once you complete the keyboard build, you're able to appreciate what is the nicest compact board I've personally used in terms of the tactile typing feedback. The rock-solid construction and sheer weight of it see to that. Admittedly, the switches I had spare aren't the most ideal for gaming, considering their 90g weight and tactile feedback, but it's still a mechanical keyboard, and still plenty responsive for it.

As a way to build a keyboard from scratch without the planning stage to slow you down, Ducky has delivered a superb kit here, though it's not without a custom mech keyboard price tag at $299 without caps or switches. Nobody said building your own mechanical keyboard was cheap, easy, or necessary—but I'll be damned if it isn't incredibly satisfying.

–JACOB RIDLEY

VERDICT **9**

Ducky ProjectD Outlaw65

DO IT YOURSELF Fun project; Seriously hefty; High-quality parts.

DON'T BOTHER YOURSELF Expensive for a compact board; Be sure to source the correct keycaps.

$299, www.duckychannel.com.tw

SPECIFICATIONS

Size	65%
Included in kit	Aluminium casing, PCB, choice of top plates, bottom plate, USB Type-C connector, screws and fittings, adjustable feet
Not included in standard kit	Switches, keycaps (First Edition comes with both)
Hot swappable	Yes

Sony Inzone H5 Wireless Gaming Headset

If brand tax was a thing, this'd be at the top of the pile

HONESTLY, it's with a sense of great sadness that we review these beautiful-looking crisp-white cans. Sony has produced some absolutely magnificent headphones over the years. Whether that's stylish options for going out downtown, to legendary audiophile solutions from yesteryear, to noise-canceling behemoths that took the world by storm, it's often never missed a beat. That's at least until you take a look at its gaming headset range.

The Inzone H5 Wireless is reminiscent of a brand's first gaming headset. You know the ones we're talking about—those headphones from 2011, where no one quite knew what they were doing, just ramped up the bass and the volume for the 'gamers', and left the overall soundscape as muted and dull as a two-inch piece of chipboard painted beige. They looked like they could deliver, but when it came to providing what really mattered—top-quality audio—they typically fell apart at the seams. That's exactly what we've got here. Unfortunately, however, the world has moved on in the last 13 years, and Sony's competition has advanced leaps and bounds beyond what you have with these.

Before we go any further, let's summarize a few things. Firstly, are these okay headphones? Yes. Do they have a microphone that works? Yes. Do they look good? Yes. Is connectivity solid? Yes. By and large, these are a hard six to seven in the *Maximum PC* scoring system. They function as a product as intended. Fantastic. Good job. You achieved the bare minimum.

The problem arises when you look at the price and the competition, and sadly a score of 6-7 and "it's acceptable" as a quote just isn't enough in 2024. The headset arena right now is littered with absolute monster products, from a stunning number of manufacturers, capable of generating incredible audio at the drop of a dime, or make your voice sound like it's being captured on a full-blown desktop mic, all while looking the part at the same time. The Inzone H5 Wireless, sadly, just can't compete with all that at this price point. It's such a competitive market that setting a foot wrong in it is foolish at best, particularly for such a well-known brand.

So what are the gripes with the H5? Well, it stems from the sound clarity. To start with, the audio is flat. It's bass-heavy, sure, but lacks any comfortable mids. Treble again is there, but seemingly muted at the very top end, like it's been purposely cut off. It lacks the clarity and crispness that pairs well with those heavy explosions and bass notes to provide balanced sound. It just doesn't have the gravitas needed.

Sony does have some impressive software available (although only for PC users), and there are EQ presets on there too, but only three: Flat, Bass Boost, and Music/Video. Bass Boost bumps the low-end frequencies up, but mutilates the mids in response. Equally, the bass drivers are too weak, even at 100 percent volume, to really feel anything, and the Music/Video preset actually drops the top-end treble by 10 dB on the 8K and 16K frequencies as well, which is odd for a headset that already struggles with that.

The microphone is actually fairly solid, for what it's worth. It captures audio well, although weirdly better than its more expensive H9 sibling. Auto-gain control (a software feature) is a nice touch too, clearing up any harsh tones and notes from your voice, but it's not hugely noticeable, and we wouldn't go so far as to say that it's the best thing ever, either.

The Inzone H5 is exactly what it needs to be—an okay headset that does what it needs to do, looks good while doing it, but is just priced wrong, and lacks the panache of some of its competitors. In a field as heavily contested as this, that's just not enough to mark it out from the competition. –ZAK STOREY

VERDICT 6

Sony Inzone H5 Wireless Gaming Headset

+ IN THE ZONE Nice styling; Okay audio; Good software.

– INZONE Just okay audio; Materials feel cheap; Wrong price point entirely.

$150, www.sony.com

SPECIFICATIONS

Driver	40mm Dynamic
Magnet	Neodymium
Frequency Response	5 Hz - 20,000 Hz
Battery Life	28 Hours
Connection Type	Wireless 2.4 GHz
Platforms	PC, PS5
Mic	Integrated Boom Arm
Weight	9.17 ounces

Gigabyte Aorus Gen5 12000

I've got a need; a need for sequentials

THIS IS Gigabyte's Aorus Gen5 12000 PCIe 5.0 SSD, second edition. We're long past the days of paltry 7 GB/s; this is the real deal, full-fat 12GB/s sequential transfers at a queue depth of 32. Unlike the Crucial T700, there's no masonic handshake required to get this beauty to sing at its advertised speeds. Slap a good heatsink on top of it (or the huge stock one it comes with), get that thing ripping and roaring, and you're good to go.

Gigabyte's a bit of an interesting case when it comes to storage. For the longest time, it wasn't particularly a field that the company excelled in. It was there, it had options available—usually budget SSD solutions and the like—but it was only when the industry shifted to PCIe 3.0 M.2 SSDs that the brand really dived into the field. But again, simple budget solutions, not the grand touting flagships we see today.

With PCIe 5.0, the company is now at the very cutting edge of the tech. At the initial launch, everyone and their dog was using the same Phison controller, the same NAND, and predominantly the same M.2 cooling solution, complete with a ridiculously tiny fan, built in to offset the ridiculously insane temps the new NAND flash could generate at the drop of a file transfer. Gigabyte, on the other hand, went in a different direction, and built a completely fresh, and frankly ridiculous passive heatsink—the same one you see here, in fact. Even Corsair, the company that basically built itself off the back of SSD and DRAM, didn't have something quite as flashy as this thing.

It's a beautiful piece of kit, although wildly impractical. Its massive twin heatpipe design and dense fin array mimic that of a small CPU tower, rather than just a chunky block of aluminum, and help keep the Phison controller well within its temperature parameters. Gigabyte has called this the 'M.2 Thermal Guard XTREME', and there is one minor caveat to having such a chunky heatsink: that it's quite the challenge to fit anywhere. That can be particularly frustrating if you've got a $700 motherboard with one PCIe 5.0 slot that has placed a giant VRM heatsink in the way.

Fortunately, there is a workaround, and if you have said $700 motherboard, they typically come with a much larger integrated heatsink of their own. In that case, grab your trusty screwdriver set, and you can simply remove the four Philips screws on the heatsink, and release the drive from within. There are no special Torx screws, or bespoke 'don't you dare open this case, or you'll void the warranty' screws; just simple Philips screws.

But enough about the heatsink. We're here for performance, and boy does this deliver. CrystalDiskMark tops out at 12,353 /11,598, and AS SSD nearly breaks 10 GB/s on read. SSD access time is as low as 0.017 ns, and Random 4Ks clocks in at an impressive 89/310 MB/s. It's not the quickest PCIe 5.0 drive we've tested on the random front, but that huge sequential performance does make up for it. It's cheap, too, clocking in at $260, when it's in stock anyway.

Gigabyte's Aorus Gen5 12000 is a healthy upgrade on the OG 10000 that the company launched early last year, and it continues to impress. Whether that's with its all-round top-tier performance or impressive pricing, it's a drive that you should be looking to sink your teeth into for your next build. –ZAK STOREY

BENCHMARKS

	2TB Gigabyte Aorus Gen5 12000 PCIe 5.0 M.2 SSD	1TB Crucial T700 Pro PCIe 5.0 M.2 SSD	1TB WD Black SN770M PCIe 4.0 M.2 SSD
AS SSD Sequential - Read / Write (MB/s)	**8,970 / 9,948**	5,825 / 5,890	4,550 / 3,818
AS SSD Random 4K - Read / Write (MB/s)	**86.65 / 289.12**	82.84 / 261.66	67.31 / 264.00
AS SSD Access Time (ms)	0.017 / 0.037	**0.015** / 0.033	0.017 / **0.017**
CrystalDiskMark Sequential QD32 Read / Write (MB/s)	**12,353 / 11,598**	7,084 / 6,841	5,222 / 4,968
CrystalDiskMark Random 4KQ1 Read / Write (MB/s)	89 / 310	**95 / 312**	90 / 294
Max Temp Under Load (C)	78	**66**	89
Gigabyte per $ (GB)	7.69	6.76	**9.17**
Sequential Read MB/s per $ (MB/s)	47.51	23.93	**47.91**

Best scores in bold. Our test bed consists of an Intel Core i9-14900K, 32GB of Corsair Dominator Titanium @ 7200, an Nvidia GeForce RTX 4080, Corsair H150i AIO, and an Asus Z790 Dark Hero. Max Temp recorded via HWMonitor during benchmarking process.

VERDICT **9** KICK ASS!

Gigabyte Aorus Gen5 12000

J R R TOLKEIN Stellar performance all round; Impressive price point; Impeccable heatsink.

SOME CELEBRITY AUTHOR Heatsink compatibility.

$260 (2TB, tested), www.gigabyte.com

SPECIFICATIONS

Variants	Heatsink
Form Factor	M.2 2280
Interface / Protocol	PCIe 5.0 / NVMe
Flash Memory	3D TLC NAND Flash
Sequential Read	12,400 MB/s
Sequential Write	11,800 MB/s
Random Read	1500K IOPS
Random Write	1500K IOPS
Endurance (TBW)	1400
Warranty	5 Years Limited Warranty

Unique traversal and melee attacks lend the four characters a sliver of individualism, but the combat is repetitive.

ACTION-ADVENTURE SHOOTER

Suicide Squad: Kill the Justice League

Captivating, but where's the focus and refinement?

YOU HAVE TO ADMIRE Rocksteady Studios for committing so thoroughly to the bit; for the ruthless efficiency with which the developer has burned down a corner of the DC Comics universe that it had spent a decade building up. The Arkham-verse has been torn asunder, its greatest heroes are gone, and its most memorable surviving villains locked inside the Hall of Justice as weapons vendors. A Crisis on Infinite Earths leaves surprisingly little room for the carnage to be undone in a Lazarus Pit as part of the ongoing live service story, or whatever new adventures may eventually lay beyond it.

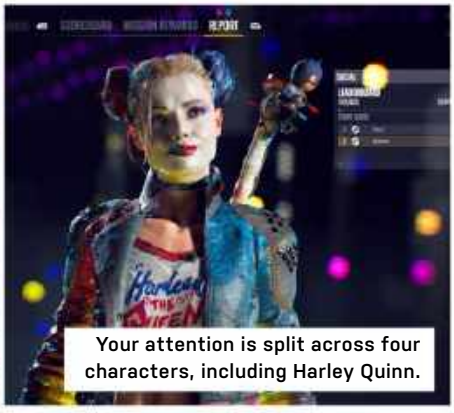
It's captivating to see a prominent studio take such a wild swing with a licensed intellectual property. *Suicide Squad: Kill the Justice League* tasks you with completing an impossible mission: to assassinate Earth's mightiest heroes with little reflection or remorse, or die trying. But despite all of its promise and potential, *Suicide Squad* lacks the ambition or imagination to execute such a creative concept with any real confidence.

At the core of the problem is the gameplay. The cooperative framework forces a homogenized approach to action, progression, and character definition. Repeating enemy encounters are the only real point of interest across an otherwise empty, sprawling open-world Metropolis, with checklist challenges fuelling trips to a single instanced hub—a claustrophobic space where you're free to catalog mountains of looted items, while static NPCs bark empty platitudes back in your direction.

It's a far cry from the boundless ingenuity that Rocksteady used to define its *Batman: Arkham* trilogy. They're meticulously crafted action adventures that worked to leverage the strengths and weaknesses of one hero operating on home turf, with every combat system, level outlay, and scripted mission ultimately working in tandem to strengthen a single power fantasy.

Suicide Squad: Kill the Justice League isn't able to grasp similar refinement

The characters are beautifully modeled and the cut scenes are fab. Shame about the gameplay.



Your attention is split across four characters, including Harley Quinn.

It's an empty, sprawling, open-world Metropolis out there, lumbered with checklist challenges.

Rocksteady has delivered a premium, luxurious-looking game, but the studio has stumbled with the basics.

or focus, surely a result of Rocksteady splitting its attention across four playable villains—Captain Boomerang, Deadshot, King Shark, and Harley Quinn. These are four wildly different characters who are ultimately born of the same basic mold here, their individual traits inherently weakened in the need to fit archetypal squad roles.

ON THE ATTACK

Unique traversal and melee attacks do help lend each of the four characters a sliver of individualism. Shotguns and sniper rifles are snappy, and the assortment of full-auto weapons have a nice weight to them. Combat undoubtedly improves over time, too, as you glacially level individual characters and move down needlessly restrictive progression trees.

In that sense, Rocksteady has delivered a dependable, if unspectacular third-person shooter. But the battles are always a hailstorm of gunfire and critical reloads—a cumbersome system in such a speedy, busy shooter, and far better suited to the more methodical pace of the *Gears of War* series.

More to the point, it's a great shame that *Suicide Squad: Kill the Justice League* lacks definition in the areas that matter the most, because Rocksteady has done an otherwise fantastic job bringing the core cast to life once control is wrestled out of your hands. Task Force X are a fantastically written group in cutscenes; quick to quip, and even quicker to whine sardonically as they are pushed into increasingly outlandish positions.

Character models are astoundingly detailed, matched with fluid animations and energetic performances. There's a playful exuberance present in the scripted scenes, and a momentum to their direction and execution that helps breathe real life into an otherwise catatonically paced adventure.

So, like Warner Bros Games' *Gotham Knights* before it, *Suicide Squad: Kill the Justice League* can be fun with friends or in short bursts of solo play. Rocksteady has delivered a premium, luxurious-looking game that could eventually settle into its live service framing as the conclusion of the story drags out across a dozen chapters. But it's difficult to ignore the fact that the studio has stumbled with the basics. As a result, *Suicide Squad* ultimately lacks the focus and refinement that have defined so many of the best superhero games in the years since the *Batman: Arkham* trilogy reigned supreme. –JOSH WEST

VERDICT **6**

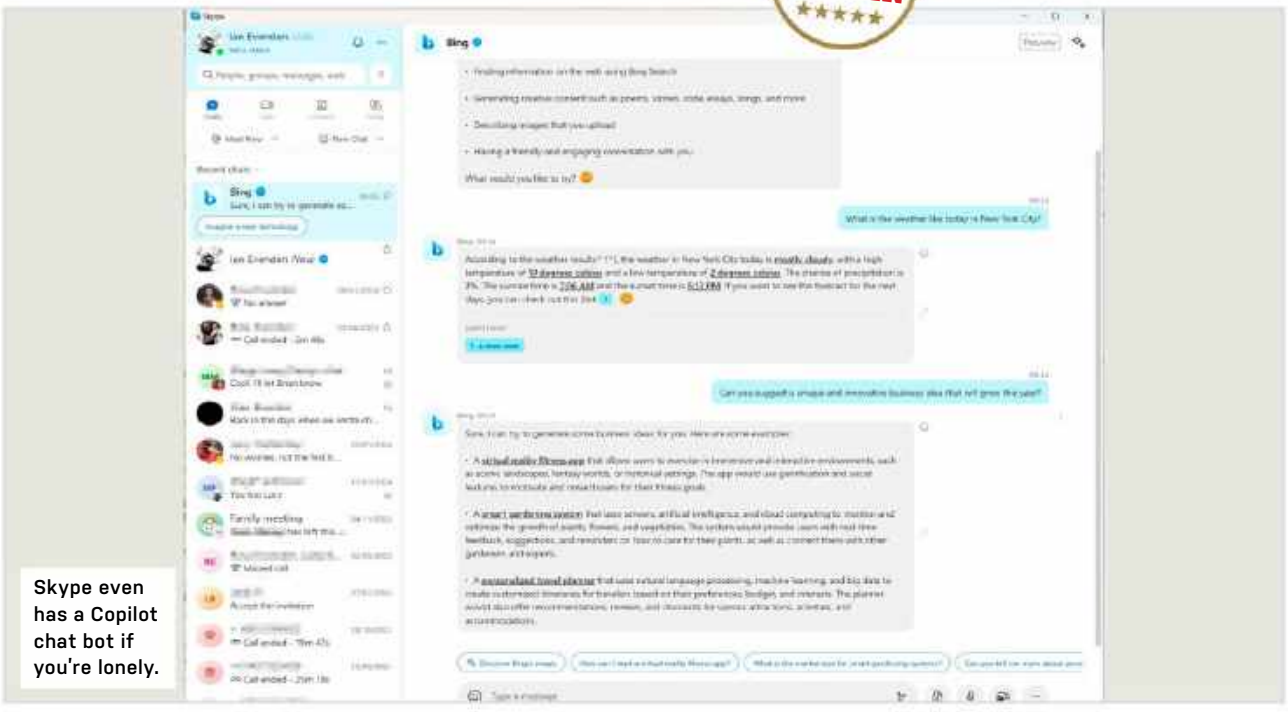
Suicide Squad: Kill the Justice League

ARKHAM ASYLUM Premium look and feel; Fabulous cutscenes.

MAD HOUSE Bland and repetitive gameplay; Fundamentally lacks focus.

RECOMMENDED SPECS CPU, Intel i7-10700K or AMD Ryzen 7 5800 X3D. GPU, NVIDIA GeForce RTX 2080 or AMD Radeon RX 6800 XT. RAM, 16GB.

$69.99, www.suicidesquadgame.com, M-rated



Skype even has a Copilot chat bot if you're lonely.

Skype vs Teams

Which of Microsoft's chat apps is the winner?

TWO APPS that do the same thing, owned by the same company, that run on the same platforms and are even interoperable. It may seem strange that one hasn't been closed down in favor of the other, but Microsoft has kept Skype and Teams running in parallel, keeping them separate through features and pricing plans.

Both Skype and Teams can be used for online group meetings and video or voice calls, they have text chat facilities, screen sharing and file sharing, and are both free—to begin with, anyway. They also have similar user interfaces that appear to be converging as new updates arrive. Only one offers live streaming, however, and only one has digital whiteboards and breakout rooms that can be useful when giving presentations or trying to coordinate a large meeting.

Being Microsoft products, both come as Windows apps, but there are web apps, mobile apps, and programs for other operating systems, too.

The main difference between the programs is that while Skype is a communication platform, Teams is a collaboration platform. The subtleties of this may be difficult to grasp, as the two apps' features overlap so much, but it boils down to Teams being a more sophisticated—and harder to use—tool than Skype, with integration into Microsoft Office and tighter security. Skype, by contrast, has a simpler interface, and is set up to get you talking or texting with another person or multiple people.

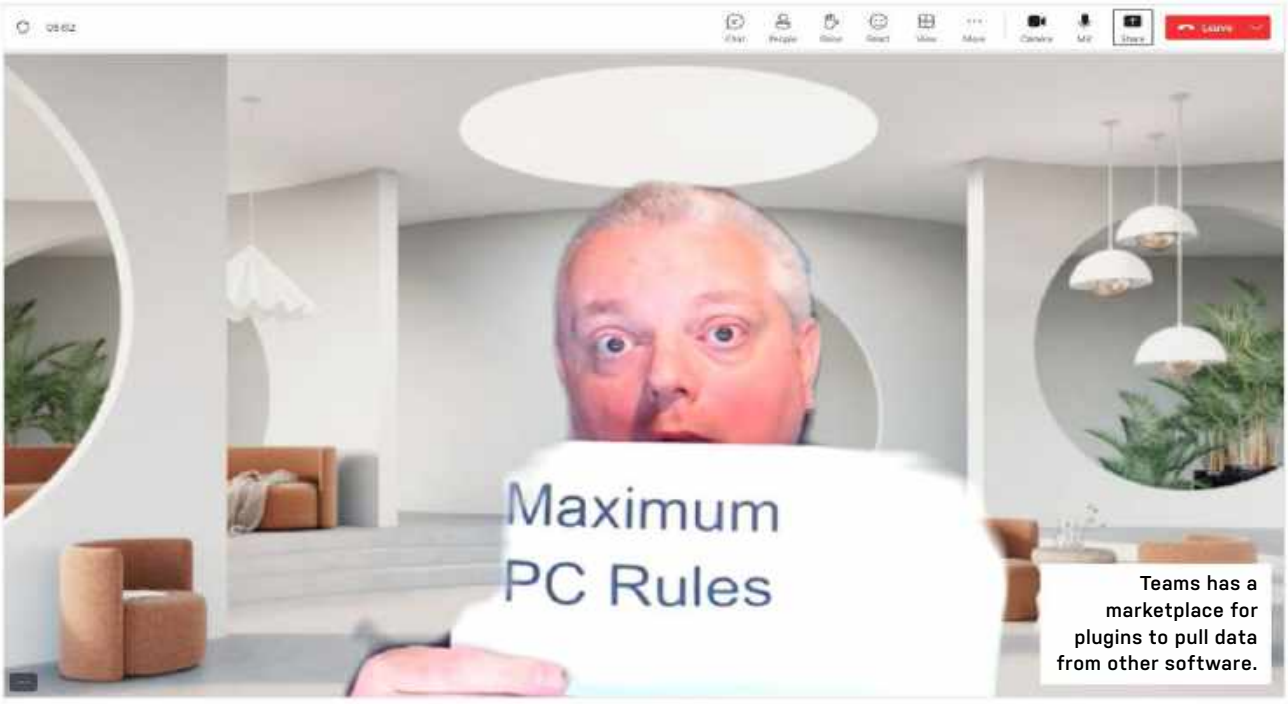
While Teams remains the professional solution, Skype is ideal for anyone who just wants to talk to grandma, have a family-wide group chat, or make calls to people in other countries without paying high international calling charges. The older app remains the standard for personal communication on a Windows PC, though it's possible to use many other platforms through the web, while Teams has become the go-to app for business communication, and is priced as such.

TEAMS

The integration of Teams into the Microsoft ecosystem dates back to 2016, when the company considered buying Slack for $8 billion. Bill Gates was against the idea, and Teams was launched in 2017 as a competitor. It has absorbed Skype for Business along the way to becoming one of the biggest names in office communication in a world where we increasingly work from home, and also replaced Microsoft Classroom in the education sector. The free version of Teams was launched in 2018, and offers most of the app's features with limits on participants, call length (meetings can only last 60 minutes), and file storage. The app is part of Office 365, so to get subscription features in your workplace, you'll need at least the Business Basic version of Office, which costs $5 a month per user, and comes with 1TB of storage for each subscriber.

Teams offers text chats with multiple participants, as well as voice and video calling with up to 1,000 in a single meeting. Meetings can last for up to 24 hours, be recorded and transcribed automatically, and breakout rooms can be created so smaller groups can have a related discussion away from the main meeting. Teams Live Events also makes it possible to stream a presentation or speech to 10,000 people. Teams meetings can be shared with an emailable link, and there's deep integration with Microsoft Outlook. Further third-party integrations can be found in the AppSource marketplace, so you can find a plugin for Teams that pulls data from your other business software—something that Skype doesn't offer.

Within a meeting or chat, you can



Teams has a marketplace for plugins to pull data from other software.

share your screen with other participants, send files, and use a digital whiteboard, which can be seen by everybody, to draw, add text notes, insert pictures, and more. Everyone on the call can modify the whiteboard, if enabled, and the whiteboard can be saved after the meeting has ended to continue working on, or use as a reference.

SKYPE

Skype hasn't always been a Microsoft product. The program, in the guise of a VOIP phone app, was first released in 2003 by Swedish, Danish, and Estonian developers. It was sold to eBay in 2005 for $2.6 billion, who sold 65 percent of it to a Canadian pension fund in 2009. Microsoft bought it for $8.5bn in 2011, and used it to replace Windows Live Messenger in Windows 8.1 (and would replace Microsoft Lync with Skype for Business).

As a result of this long life, many people see Skype as the de facto app for calls and messaging over the internet, and like Teams, it claims hundreds of millions of users. There's no paid tier for Skype anymore, beyond the purchase of credit for calls to phone lines, and all the features are available in the free version.

With the advent of Teams, Skype for Business is no more, but the older app is still viable for setting up meetings between groups of coworkers, family, and friends. The maximum number of people you can have in one meeting is 100, which should suit most working teams, but won't be enough for larger companies who like to have all-hands conferences, and meetings can last as long as 24 hours, should you need them to.

Skype offers instant messaging and both video and voice calls with no subscription, though the ability to call landline and mobile numbers uses purchasable credit, while Skype clients can also send SMS messages to cellphones. A phone number attached to your Skype account can be purchased, allowing callers to place calls and send SMS messages to your Skype app—60 minutes of Skype calls per month are included with an Office 365 subscription. In some countries (not the United States), Skype can contact emergency services.

There's 1080p video calling and screen-sharing, and you can share images and files by dragging and dropping them into the text entry field. Skype works like WhatsApp or other messaging apps, though its presence on multiple platforms can give it an edge over mobile-based solutions. The app also features a Copilot chat bot, so you have something to talk to even when no friends are online.

Both Skype and Teams have a view mode for group video calls that puts the head and shoulders views of participants in a virtual environment, which can be a custom image, as if they were poking out from behind walls or sitting on benches. It's clever, but relies on good visual processing to remove backgrounds, plus a strong internet connection.

The two apps can also work together. Teams users can start a chat or call with a Skype user and vice versa, and both apps can search for people using the other app. There are some limitations in place, such as text chats losing rich formatting, emojis and @-mentions, a complete lack of group chats, and no screen sharing.

With Skype for Business being discontinued, the future for Skype has a question mark over it. As Teams is in the MS stable as well, are two apps that cover much of the same ground needed? Teams certainly seems to get the lion's share of development time, but Skype, with its simplified interface and focus on informal chats, seems to have enough value to remain a separate app for now, and is actually preferred by many. –IAN EVENDEN

VERDICT 9

Skype

SKY HIGH All the communication app you need unless you're a business.

DOWN LOW Larger organizations can quickly outgrow its capabilities.

Free, www.skype.com

VERDICT 8

Teams

BEAMS Top-quality collaboration and communication.

STEAMS Perhaps better to stick with Skype unless you'll use its premium features.

Free/$4-12.50 per month, www.microsoft.com

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> More chips please
> Best budget GPU
> Starter servers

Taiwan trepidation

It's been over a year since you covered the rise and rise of TSMC, and its strategic importance to the world in terms of chip production. With a new Taiwanese president in place who has been labeled a "troublemaker" by China, do you think there's any danger of the global chip supply being majorly disrupted in the coming years?

Also, what do you think of tech companies like Intel who are slowly moving chip manufacturing to America? Do you think that's ever going to realistically work?

–R. Daltry

JEREMY LAIRD RESPONDS: Firstly, anything can happen, but the question is what is probable. China's supreme leader, Xi Jinping, is no fool. He knows that any attempt to take Taiwan by force will mean the end of the island nation's chip foundry industry.

TSMC's chip manufacturing plants are unimaginably complex and fragile, you see. A tiny speck of dust in the air can have them shutting down, let alone damage from munitions. They also need an army of ultra-skilled staff, so the bottom line is this: if China takes Taiwan by military force, it's unimaginable that this could be achieved without catastrophically disrupting TSMC (and other foundries in Taiwan).

Best case scenario, it would take five years to recover. More likely, in the event of a brain drain, it could take a decade or more to get those fabs back to where they are now: leading the world. And that's assuming China could get hold of new lithography machines from ASML, which has a monopoly on the most advanced equipment. The problem is that the US has already banned China from buying ASML's machines, so it hardly seems likely that conflict in Taiwan would have the US reverse that position.

So what it all comes down to is this: Xi can take Taiwan if he wants. China has the military might to do that, and realistically, nobody would stop him, not even the US. But he can't have those fabs—not in working order, not even in the long run. Again, Xi may be an autocrat and even a despot, but he's a sharp cookie, and will know all this and plenty more. The question is whether he wants Taiwan for the sake of it, but without Taiwan's most valuable prize; those fabs. Nobody knows, but my hunch is that he would prefer to find a way to reunify Taiwan with China without using force and in order that chip production isn't disrupted. For what it's worth, then, my odds say chip production in Taiwan won't be disrupted.

As for chip production in the US—well, it is of course already happening. Most of Intel's chips are made here. Whether satellite factories run by the likes of TSMC in, for instance, Arizona are genuine long-term commitments or merely designed to keep the US government happy is very hard to say.

The Nvidia RTX4070 Super, reviewed this issue on p74.

$499 GPU conundrum

I held off buying a GPU at the end of last year because of the rumors of new Nvidia 'Super' cards coming down the road. However, with the cheapest of those cards costing $599, it's still just a bit out of my price range. I don't think that I'll ever be able to mentally process spending more than $499 on a GPU—it just seems crazy to me!

Anyway, that presents a quandary, one I'm sure Nvidia has made intentional in its pricing, as it doesn't have a $499 card. You can get the RTX 4060Ti for $399, the 4070 for $549, and the aforementioned 4070 Super for $599. Or, of course, there's AMD with its Radeon RX 7800 XT at my $499 price point, although I've always used Nvidia GPUs in the past. What's my best option at this point in 2024? I'd like to

↘ submit your questions to: editor@maximumpc.com

game at 1440p if possible, although I'm happy to drop down to 1080p if needs must. **–D. Bavishi**

JEREMY LAIRD RESPONDS: The easiest option is to hang tight and wait for an RTX 4070 for $499. It will happen—just keep your scanners peeled at the usual online retail suspects. You're right not to compromise on the RTX 4060 Ti—it's overpriced junk. Okay, that's not fair. It's a good GPU, but it should be priced at $200—then it would be the right hardware at the right price.

As for the AMD option, the 7800 XT is a nice little chip for conventional raster graphics. But AMD's RDNA 3 architecture has been a fairly major disappointment in terms of ray-tracing performance. AMD just didn't raise its game much with RDNA3 over RDNA 2 when it comes to ray tracing.

AMD is also undeniably behind when it comes to the full feature set. Nvidia's DLSS upscaling is superior to AMD's FSR (sorry, it just is), and likewise, Nvidia's frame gen is clearly more polished than AMD's hastily cobbled together alternative.

But if you want my advice—and you're going to get it anyway—get yourself a 4070 Super. It's a nice step up from the plain 4070. If you can afford $499, you can probably afford $599 (or maybe a little less if you shop around). Spread over, say, three years of gaming, that $100 becomes about $30 a year extra.

It does irk me to recommend anyone pay the man at Nvidia given the company's obviously dismissive attitude to what was once its core gaming audience, not to mention its punitive pricing practices of late. But in the end, it's the gaming experience that matters, not getting one over Nvidia. With this in mind, I'd say not to cut off your nose to spite your face—just bag yourself an RTX 4070 Super.

LG's second-gen MLA OLED is better, but it's still not good enough. Asus's ROG Swift OLED PG34WCDM is reviewed this issue on p82.

Is OLED a bright idea yet?

I see that LG is flaunting its new second-gen MLA OLED panel tech. I'm sure it's great for TVs, but does it work for PC monitors any better than LG's first-gen MLA panels? **–S. Matthews**

JEREMY LAIRD RESPONDS: The short answer is that it's better, but I'd say still not good enough. You can check out my review of Asus's latest 34-inch ultrawide monitor using the new LG panel tech on page 82. It's a definite improvement, but for my money, you shouldn't have to compromise at all on brightness for $1,299.

Server selections

I read a lot in *Maximum PC* about running your own server, whether that's features on how to build your own, tutorials on how to run apps in containers, or the Doctor advising readers on how a server will solve whatever problem they're writing in about!

I've decided I want to take the plunge and run one myself, mainly because I'm sick of paying Apple, Google, and Microsoft for their own solutions across the multitude of devices used by me and my family. I want to be able to store my personal data without worrying about running out of space, whether my files are truly being kept privately and securely, and without having to fork out year after year for subscription services.

However, what I would like is a ready-made solution, as I just don't have the time or inclination to be putting my own hardware together and running technical support on it going forward. Do you have any suggestions on manufacturers I should look at, features I should be aware of, and anything else a first-time server owner should consider before taking the plunge?

– M. Agustus

EDITOR-IN-CHIEF, GUY COCKER, RESPONDS: First of all, welcome to the world of self-managed data storage! I applaud your effort to take ownership of your data, as well as hopefully save yourself some cash in the long run.

The main players in this space are Synology and QNAP, although Terramaster and Asustor are also worth looking at if you have a specific budget. The big question is how much storage you're likely to need, not just now, but in the next five or so years. If you're just backing up data from your devices, then you probably don't need more than a single or dual bay model, as modern HDDs go up to 22TB and growing. However, are you likely to want to store a media collection as well, either now or in the future? If yes, then you might want to go for a four-bay model instead. This is what I chose to do recently when I bought Synology's DS423+, which has space for four drives, even though currently I'm only using two (one drive for data storage, and another for redundancy). I also bought WD Elements external hard drives and 'shucked' (removed) the drives from their caddies, just because these drives tend to be much cheaper in terms of $/TB than WD Red or Seagate IronWolf drives, and work just fine in a Synology.

I think it's important to note that even when you've bought a NAS, you still ideally want to have at least one off-site backup solution as well, just in case your NAS gets stolen or damaged. I personally use iDrive because they offer 10TB for $5 for the first year (http://tinyurl.com/mrju83cp), and my personal backup of files, photos, and media is around 2.4TB. Synology has an iDrive app in its app store, so I just set the NAS to do a cloud backup between 2am-6am every night. Google, Microsoft, and Amazon cloud equivalents are also available. It also doesn't hurt to have a USB hard drive attached and an automated backup run once a week or month, just to offer further protection.

Good luck, and let us know how you get on!

THE BUILDS

THIS MONTH'S STREET PRICES...

CES HAS COME and gone—you can read about all of the latest news on page 32. One of the most exciting launches for us hardware folk, however, had to be Nvidia's Super line-up. Now all three are out there in the wild, they've shaken up what GPU should fit where in your next build.

The thing is, our budgets aren't quite so generous, and sadly only one of the cards made it into this month's blueprints. But more on that later—we've got a budget build to go over first. This month has been fairly hectic. A number of parts have changed across both systems, with memory, SSD, and motherboards all on the chopping block for both builds.

AMD in particular saw an increase in the CPU price, countered by a drop in the GPU. The bigger problem, however, was the TeamGroup SSD we snatched up last issue. It was too expensive this time around, so we've chucked it in favor of Adata's Legend 800 SSD. On top of that, we've bumped up our motherboard selections on both the Intel and the AMD rig for something a bit more premium and futureproofed. For AMD, we've dropped the A620 Plus and gone for the X670-P from Asus. For Intel, Asus's Prime B760 was swapped out for the MSI Pro Z790-S. Both are premium solutions, and both bump up the price, but they do bring better power delivery, a more premium BIOS, and more I/O than their counterparts for not a huge bump in overall price.

We've also dropped the 12th gen Intel Core i5 for a 14th gen Core i5-14500. This catapults our CPU core count from 6 to 14 for $80 extra. The only caveat is that the motherboard might need a BIOS update, so talk to the eseller before pulling the trigger.

Overall, both builds have had a fairly substantial price hike this month, increasing by $100 and $160 respectively, but these upgrades are worth it, and give you the flexibility to upgrade in the future, if you so desire.

AMD INGREDIENTS

PART		PRICE
Case	Corsair 4000D Airflow	$95
PSU	600W Thermaltake Toughpower GX2 80+ Gold	$65
Mobo	Asus Prime X670-P ATX AM5 NEW	$200
CPU	AMD Ryzen 5 7600	$217
GPU	XFX Speedster Swift 210 Core RX 7600 8GB	$260
RAM	16GB (2x8GB) Patriot Viper Venom DDR5 @ 5600 NEW	$66
SSD 1	1TB Crucial P3 Plus PCIe 4.0 M.2	$63
SSD 2	1TB Adata Legend 800 PCIe 4.0 M.2 NEW	$64
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32

Approximate Price: $1,062

INTEL INGREDIENTS

PART		PRICE
Case	Corsair 4000D Airflow	$95
PSU	600W Thermaltake Toughpower GX2 80+ Gold	$65
Mobo	MSI Pro Z790-S WiFi ATX LGA1700 NEW	$170
CPU	Intel Core i5-14500 NEW	$225
GPU	Gigabyte Windforce OC RTX 4060 8GB	$300
RAM	16GB (2x8GB) Patriot Viper Venom DDR5 @ 5600	$66
SSD 1	1TB Crucial P3 Plus PCIe 4.0 M.2	$63
SSD 2	1TB Adata Legend 800 PCIe 4.0 M.2 NEW	$64
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32

Approximate Price: $1,080

IF IT AINT BROKE, don't fix it ought to be a *Maximum PC* motto. Nevertheless, that's exactly what we did with this month's mid-range builds.

Both builds saw significant pricing shuffles across the board. On the red side, the Ryzen 7 7700X dropped in price by $15, the case dropped by $3, and the PSU by $10. Other areas increased, including the SSD and the motherboard too, offsetting those small victories. By far the biggest loss was in the cooling department, however, with the Pure Loop 2 240mm AIO getting a $40 price increase, likely off the back of a promotional period ending, so we had to ditch it. We've gone for one of Corsair's A115 Air Towers. It's a fairly new release for the company, paired with two of its AF140 Elite airflow fans, and coming with six heat pipes as standard, pre-applied thermal paste, which is apparently "very good", and is compatible with everything from LGA1150 and AM4 onwards.

Similarly, on our Intel build, we've opted to keep it super simple this time, with the only major change coming in the form of the memory swapping out, with TeamGroup's T-Force Vulcan DDR5 @ 6000 getting pipped for a nice, sleek G.Skill unit. Not only did the TeamGroup kit get a price bump, this kit is actually cheaper than last month's. Also, can we all just appreciate how cheap 32GB of DDR5 @ 6000 is right now? $85 is incredible.

We did toy with the idea of swapping out that RTX 4060 Ti for an RTX 4070 Super, but sadly that would have added an extra $204 onto the overall cost of the build, pushing us to $1,678, and that's just not a bridge we're willing to cross right now, despite it being one of the best-value GPUs out there today (you can read more about that on page 74). Regardless ,our Intel build is $54 cheaper than last month without sacrificing any performance, and that's a win in our book.

AMD INGREDIENTS

PART		PRICE
Case	NZXT H7 Flow	$115
PSU	750W Corsair RM750e - 80+ Gold	$90
Mobo	MSI PRO X670-P WiFi ATX - AM5	$228
CPU	AMD Ryzen 7 7700X	$334
Cooler	Corsair A115 Air Tower NEW	$100
GPU	ASRock Radeon RX 7700 XT Challenger OC	$430
RAM	32GB (2x16GB) Corsair Vengeance RGB DDR5 @ 6000	$112
SSD 1	1TB Corsair MP600 PRO LPX M.2 PCIe 4.0 SSD	$90
SSD 2	1TB Adata Legend 800 M.2 PCIe 4.0 SSD	$63
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$1,594**

INTEL INGREDIENTS

PART		PRICE
Case	NZXT H7 Flow	$115
PSU	750W Corsair RM750e - 80+ Gold	$90
Mobo	MSI Z790 Gaming Pro WiFi ATX	$190
CPU	Intel Core i5-14600KF	$285
Cooler	EK AIO Basic 360 - 360mm AIO	$129
GPU	MSI Ventus 3X OC RTX 4060 Ti 8GB	$395
RAM	32GB (2x16GB) G.Skill Ripjaws S5 DDR5 @ 60000 NEW	$85
SSD 1	1TB Corsair MP600 PRO LPX M.2 PCIe 4.0 SSD	$90
SSD 2	1TB Adata Legend 800 M.2 PCIe 4.0 SSD	$63
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$1,474**

WE'VE DONE SOME FAIRLY extensive changes to our Turbo builds, and managed to keep the price tight in the process. In fact, both builds have fallen in price by more than $100.

Let's start with the joint products first. TeamGroup's T-Force Cardea Z44Q finally ran out of stock, and we can't find it anywhere. The good news is that PNY's 4TB CS2241 PCIe 4.0 drive is equally available in good quantity out there, and for $5 cheaper than the TeamGroup from last month. On top of that, our be quiet! Straight Power 12 shot up in price by $40, pushing us to swap out to a Super Flower Leadex Platinum SE instead. It's still 80+ Platinum, still modular, still 1,200W, but all for an impeccable $160 instead ($20 cheaper than last month). Super Flower has been in the game for a fair ol time now, and although they might sound like a fairly middling brand, their PSUs are well renowned, particularly in the professional overclocking scene.

With that out of the way, let's talk AMD. The only major change came in the form of the motherboard. We dropped the Asus Prime X670E-Pro WiFi in favor of Gigabyte's Aorus Pro X variant instead, as the Asus board saw a $20 price bump, but that's about it. Otherwise, both the CPU and the GPU saw price drops as well, and with our SSD, case, and PSU savings, we ended up with a $113 cheaper build than last month.

On the Intel front, the price drops continued, although not as dramatically as AMD. Nonetheless, a comfortable CPU price drop definitely helped. On top of that, thanks to the launch of the RTX 4080 Super coming in at $200 less than the stock 4080, we've dropped our old Ventus 3X OC card in favor of the new super, and saved $50 in the process, while grabbing ourselves an OC variant here, too. It doesn't sound like a lot, but we've gained a touch more performance and saved $113.

There's not a huge amount we'd change on either build. If anything, that additional cash might be better served invested in the case and the cooling solutions, but otherwise, we're getting close to the pinnacle of what you can pick up off the shelf in today's age, barring an RTX 4090, of course.

AMD INGREDIENTS

PART		PRICE
Case	Phanteks Enthoo Pro 2 Tempered Glass	$150
PSU	Super Flower Leadex Platinum SE 1200W - 80+ Platinum NEW	$160
Mobo	Gigabyte X670E Aorus Pro X ATX - AM5 NEW	$300
CPU	AMD Ryzen 9 7950X	$517
Cooler	NZXT Kraken Elite 360 RGB - 360mm AIO	$276
GPU	Sapphire Nitro+ RX 7900 XTX 24GB	$1,060
RAM	64GB (2x32GB) TeamGroup T-Create Expert @ 6000 C34	$185
SSD 1	2TB Corsair MP700 PCIe 5.0 M.2	$260
SSD 2	4TB PNY CS2241 PCIe 4.0 M.2 NEW	$225
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$3,165**

INTEL INGREDIENTS

PART		PRICE
Case	Phanteks Enthoo Pro 2 Tempered Glass	$150
PSU	Super Flower Leadex Platinum SE 1200W - 80+ Platinum NEW	$160
Mobo	Gigabyte Z790 Aorus Elite AX-W ATX	$367
CPU	Intel Core i9-14900KF	$530
Cooler	NZXT Kraken Elite 360 RGB - 360mm AIO	$276
GPU	Gigbayte Aero OC RTX 4080 Super 16GB NEW	$1,100
RAM	48GB (2x 24GB) G.Skill Trident Z5 RGB DDR5 @ 6800 CL34	$170
SSD 1	2TB Corsair MP700 PCIe 5.0 M.2	$260
SSD 2	4TB PNY CS2241 PCIe 4.0 M.2 NEW	$225
OS	Windows 10 Home 64-bit OEM (Windows 11 Compatible)	$32
Approximate Price:		**$3,270**

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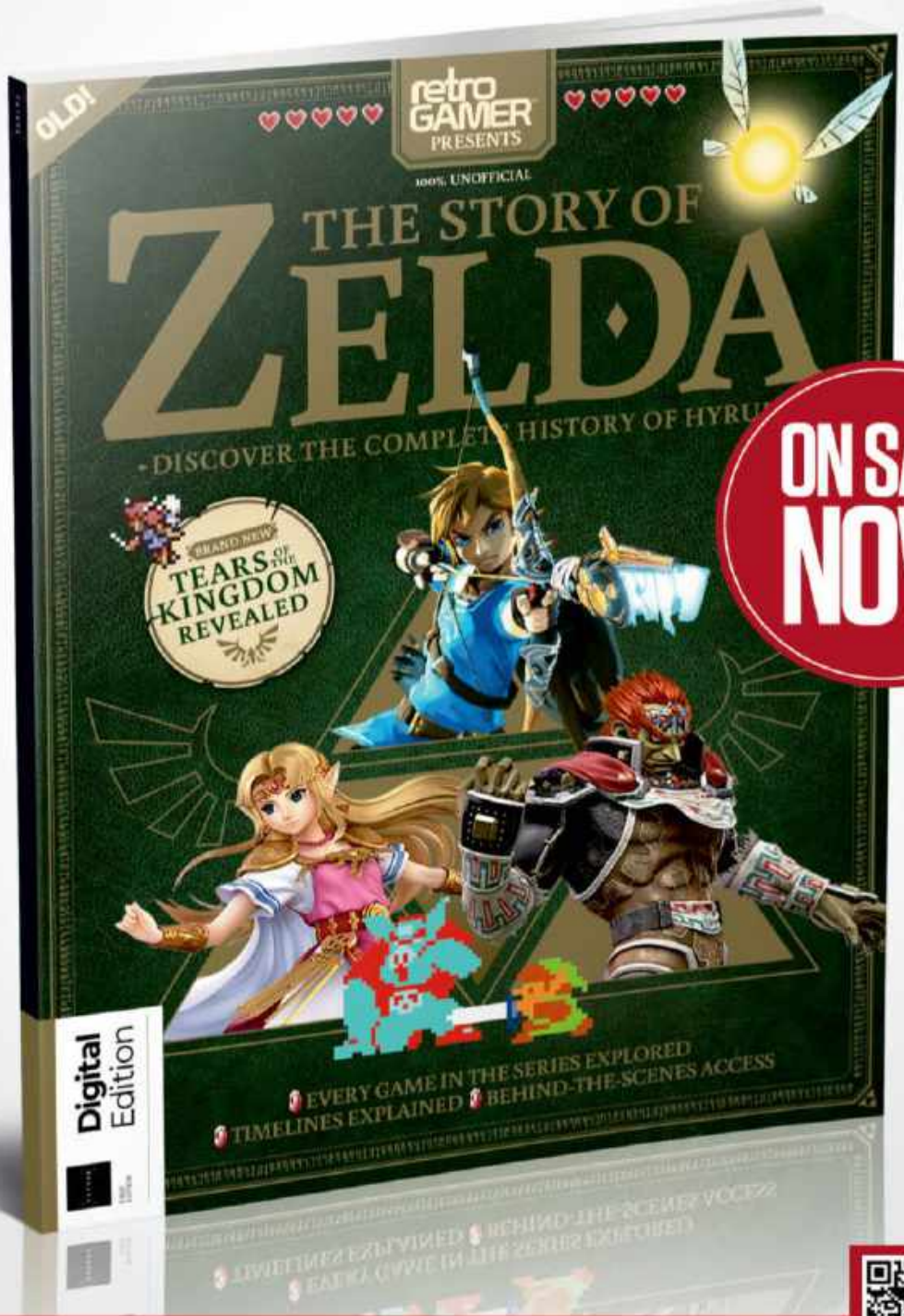

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