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COMPUTER POWER USER



FALLOUT RIG
FROM DEEP WITHIN VAULT 111



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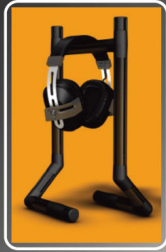
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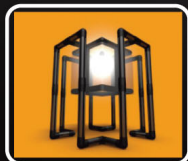


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Mad Reader Mod: Marc Molella's Fallout Rig



CPU At PAX East 2016

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HEAVY GEAR — P. 14

The latest PC hardware is here: reviews, product profiles, and category roundups.

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Input takes center stage this month in our keyboard and mouse buyer's guide.

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DIGITAL LIVING — P. 70

Trends and leisure, news from around the web, tech company interviews, and more.

DID YOU FIND THE HIDDEN CPU LOGO ON OUR COVER?



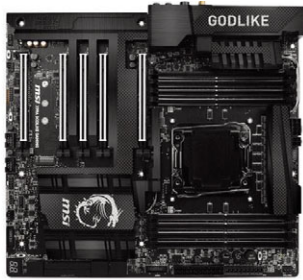
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Lincoln, NE 68501
or
120 W. Harvest Drive
Lincoln, NE 68521

Advertising: (800) 247-4880
Fax: (402) 479-2104

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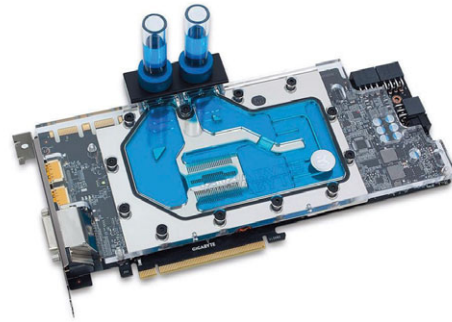


MSI X99A GODLIKE GAMING CARBON Offers Extreme OC Ability

MSI calls the new X99A GODLIKE GAMING CARBON Edition the world's most extreme GAMING motherboard, and it's now available in stores. MSI says the board raises the bar in performance, features, and aesthetics. Special touches include an all-black color scheme and improved Mystic Light RGB LEDs with support for 2,048 colors and eight LED effects you can control through your smartphone. Other standout features on the X99A GODLIKE GAMING CARBON Edition board include Audio Boost 3 Pro, Turbo M.2 connectivity, and USB 3.1 Type A and Type C. The X99A motherboards have already proven themselves in the world's top overclocking ranks and hold several world records. MSI's patented Turbo Socket provides 2,036 pins for better overclocking capabilities. Killer DoubleShot-X3 Pro technology lets the two Killer Ethernet connectors and Killer 1535 Wi-Fi adapter work together to increase bandwidth.

EKWB Has A Full-Cover Waterblock For GIGABYTE GTX 980 Ti Line

EK Water Blocks has released a new full-cover waterblock designed for one manufacturer's specific line of graphics cards. The EK-FC980 GTX Ti XG is meant to work with cards in the GIGABYTE GTX 980 Ti XTREME GAMING series. The blocks are available in nickel or acetate plus nickel and feature EKWB's split-flow cooling engine design that keeps liquid flowing even in systems that use low-power pumps. The base of the block is made of electrolytic copper that has been nickel-plated. Each block covers the card's GPU and RAM as well as the VRM area of the card. Together, the block and backplate cover the entire card, hiding the PCB from view and creating a clean look for any build's interior. The EK-FC980 GTX Ti XG is available for purchase now at EK's online store. MSRP for the waterblock is \$137.99; the black backplate runs \$34.49.



WATCHING THE CHIPS FALL

Here is the pricing information for various AMD and Intel CPUs.

CPU	Released	Original Price	Last Month's Price	Online Retail Price*
AMD FX-9590 Eight-Core (Vishera)	6/11/2013	N/A	\$219.99	\$229.99
AMD FX-9370 Eight-Core (Vishera)	6/11/2013	\$375	\$189.99	\$199.99
AMD FX-8350 Eight-Core (Vishera)	10/23/2012	\$195	\$159.99	\$149.99
AMD FX-8320 Eight-Core (Vishera)	10/23/2012	\$169	\$149.99	\$139.99
AMD FX-6350 Six-Core (Vishera)	4/30/2013	\$132	\$129.99	\$129.99
AMD A10-7850K Quad-Core (Kaveri)	1/14/2014	\$173	\$114.99	\$114.58
AMD A10-7800 Quad-Core (Kaveri)	7/2/2014	\$153	\$113.52	\$122.73
AMD A10-7700K Quad-Core (Kaveri)	1/14/2014	\$152	\$115.99	\$114.99
AMD A10-6800K Quad-Core (Richland)	6/4/2013	\$142**	\$114.00	\$127.10
AMD A10-5800K Quad-Core (Trinity)	10/2/2012	\$122**	\$114.00	\$176.16
Intel Core i7- 5960X Eight-Core (Haswell)	8/29/2014	\$999**	\$1,049.99	\$1,049.99
Intel Core i7- 4960X Six-Core (Ivy Bridge)	9/3/2013	\$990**	\$1,571.22	\$1,500.00
Intel Core i7- 5930K Six-Core (Haswell)	8/29/2014	\$583**	\$579.99	\$598.00
Intel Core i7- 4930K Six-Core (Ivy Bridge)	9/3/2013	\$583**	\$648.63	\$599.99
Intel Core i7- 5820K Six-Core (Haswell)	8/29/2014	\$389**	\$349.99	\$389.99
Intel Core i7-6700K Quad-Core (Skylake)	8/5/2015	\$359**	\$363.80	\$349.99
Intel Core i7-4790K Quad-Core (D.Canyon)	6/25/2014	\$339**	\$319.99	\$339.99
Intel Core i7-4820K Quad-Core (Ivy Bridge)	9/3/2013	\$323**	\$498.95	\$497.99
Intel Core i7-4790 Quad-Core (Haswell)	5/11/2014	\$303**	\$309.99	\$309.99
Intel Core i5-6600K Quad-Core (Skylake)	8/5/2015	\$249**	\$254.99	\$244.99

* As of April 2016

** Manufacturer's estimated price per 1,000



D-Link Announces Availability Of First Router In EXO Series

The first router in D-Link's new EXO series, the AC1900 EXO Wi-Fi Router, is designed for "Wi-Fi users who want great performance, premium design, and style" at an attractive price point, the company says. The router has built-in high-power amplifiers that help boost signal strength throughout a typical home. The dual-band router uses 11ac Wi-Fi to reach data speeds up to 1,300Mbps on the 5GHz band and 600Mbps on the 2.4GHz band. It comes with usability features such as Smart Connect technology that automatically assigns clients to the particular wireless band that offers the most bandwidth at the time. A mobile app called QRS (Quick Router Setup) helps new users get their network up and running as fast as possible. The AC1900 also features an attractive color scheme and stylish, modern design that's meant to complement the home. MSRP for the new router is \$149.99.

Razer Turret Makes It Easier To Play Games While Sitting On Your Couch

The \$159.99 Razer Turret, which consists of a mouse and integrated keyboard and mouse surface, brings the power of desktop-grade gaming peripherals into your lap. The Turret combo was first prototyped about a year ago and is now a reality. The gaming-grade chiclet keyboard has full anti-ghosting, and the gaming mouse has a precise 3,500dpi sensor. An integrated magnetic mouse mat ensures the mouse won't slip even during intense gaming sessions. Dual wireless connectivity means you can play lag-free when connected to a console via Bluetooth LE or a PC with the wireless 2.4GHz adapter. The Turret has a foldable hinge that makes the lapboard unobtrusive and dockable when not in use. Built-in high-capacity lithium-polymer batteries provide up to four months of usage on the keyboard and about 40 hours of nonstop play on the mouse.



Corsair Carbide SPEC-ALPHA Mid-Tower Now Available At Retailers

Corsair released the Carbide SPEC-ALPHA, a mid-tower case that's aimed at enthusiasts and gamers. The case uses color to highlight its angular, asymmetric design. The SPEC-ALPHA comes with three 120mm fans and a three-speed fan controller; the two front fans are LED. The chassis can handle ATX motherboards and has room in the front for a 240mm radiator for users who want liquid cooling. The case has native USB 3.0 support and can handle up to four SSDs. (The 5.25-inch drive cage can be removed to add room and improve airflow.) The chassis comes with a large side window for showing off your components. The SPEC-ALPHA is available now at retail in three different color schemes: black and red, black and gray, and red and white. Corsair says the MSRP on the SPEC-ALPHA is \$79.99.



Lian Li PC-J60 First In New Series

Lian Li announced a new chassis series for enthusiasts who like clean interiors that really highlight their components. The first release in the series is the PC-J60, an aluminum mid-tower with a separate compartment at the base that covers the power supply and drive racks. Cooling the case are two 120mm intake fans in front and a 140mm fan that directs air from the center of the case to the drive rack area, where the PSU then vents it to the rear. The PC-J60 is available in both windowed and windowless versions. The case has space for six drives. Rearranging the drives to the bottom of the case leaves plenty of room in the center compartment. The case has seven expansion slots, and it can hold graphics cards up to 16.14 inches long, if any of those even exist. The chassis has room for CPU coolers up to 6.29 inches high and ATX power supplies up to 8.26 inches. If you're a liquid-cooling fan, you shouldn't have any problems locating space for your rads in the PC-J60. Lian Li says the PC-J60 will be available soon on Newegg for \$189 (windowless) and \$210 (window version).

HARDWARE MOLE



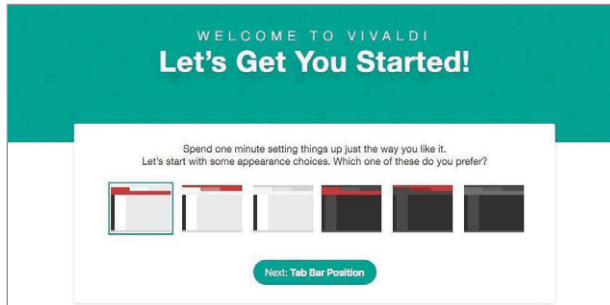
EVGA Announces First Notebook

EVGA's first mobile system, the SC17 Gaming Laptop, is targeted at gamers and enthusiasts, with a CPU, memory, and graphics that can be overclocked. The SC17 has a 17-inch 4K UHD (3,840 x 2,160) display. The laptop comes with an Intel i7 6820HK processor that users can overclock to 3,800MHz+ and 32GB of G.SKILL DDR4 at 2,666MHz, which also can be tweaked. Powering the graphics is an NVIDIA GeForce GTX 980M with 8GB of GDDR5, which EVGA says can be overclocked as well. The system has a full GUI BIOS to make overclocking as easy as possible, and it gives users the ability to tweak voltages, memory timings, frequency, CPU multipliers, and the GPU. EVGA calls the SC17 the "world's first TRUE overclocking laptop." MSRP for the SC17 is \$2,699.99.

Cooler Master MasterLiquid Pro AIO

Cooler Master's new MasterLiquid Pro liquid-cooling all-in-one kits come in four sizes, with 120 and 240 kits already available and 140 and 280 kits available later this month (see our full hands-on review of the 240 kit in the Heavy Gear section in this issue). The kits include a new power-pump design. Cooler Master says it put an extra chamber at the top of the pump that stays cooler because it is engineered to prevent heat from flowing back up the chamber. This cool chamber holds key components of the pump, which the company says ensures it will have a longer life span. The radiator has square fins that Cooler Master says create more surface area to absorb heat and also provide more space for airflow from the two MasterFan Pro Air Balance fans. You can find the 120 and 240 kits online for \$99.99 and \$119.99.



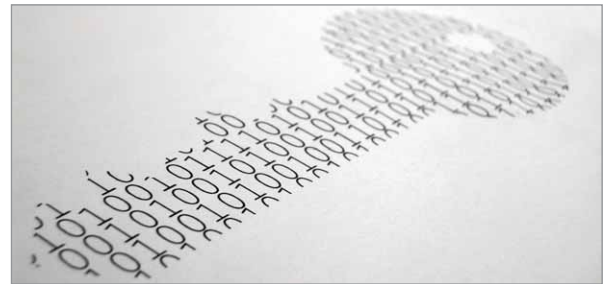


Vivaldi Launches As “A New Browser For The Web’s Most Demanding Users”

Other web browsers strip down their offerings, but Vivaldi adds features and powerful personalization options to help the web’s most demanding users increase their productivity and efficiency, the company says. The browser was created by a team of “browser pioneers,” including Opera Software co-founder Jon von Tetzchner. Power-user features include Tab Stacks, which lets you drop tabs on top of each other to help reduce clutter. A Notes feature lets you mark items on web pages and save them as notes, plus you can take screen shots. Web Panels lets you view websites in a Vivaldi sidebar, so you could chat or browse social media posts alongside your primary browsing window. With Vivaldi, you can designate certain mouse gestures or keyboard shortcuts to perform almost any action in the browser, and Quick Commands accesses open tabs, bookmarks, history, settings, and more through a command interface. In all, Vivaldi has more than 1 million ways to customize the browser. For more, see this month’s Software Tips & Projects article.

Cryptographic System Could Offer Control Over Which Apps Access Data

You likely use a range of applications that collect and store your personal information, and chances are you have no idea what data those apps collect, where it’s stored, and whether it’s secure. Sieve, a new app being created by MIT researchers, could solve that by providing you with greater control over your personal data. The Sieve application lets users store their personal data in encrypted form in the cloud. If an app wants to use data, it will send a request to the user, who then can allow Sieve to send the app a secret key to decrypt only the information the app needs. The user can then re-encrypt that data with a new key to revoke the app’s access. To make Sieve work, researchers had to create two cryptographic techniques: attribute-based encryption and key homomorphism. Attribute-based encryption assigns data in a file with different labels, or attributes, which can be unlocked individually after encryption. With key homomorphism, Sieve is able to revoke an app’s access to the user’s data, essentially re-encrypting the data without first having to decrypt it.



SOFTWARE SHORTS

Spec Will Keep USB Type-C Devices From Getting Fried

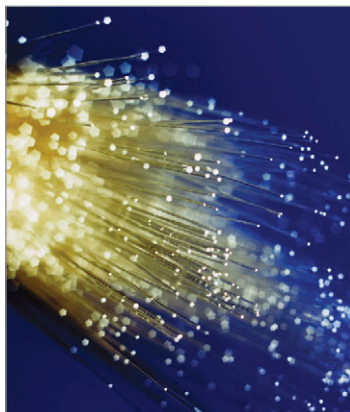
Faulty or subpar USB Type-C cables can damage or even destroy expensive equipment. To help reduce the chances of this happening, the USB 3.0 Promoter Group has developed the USB Type-C Authentication specification. The specification defines cryptographic-based authentication for USB Type-C chargers and devices. Using the protocol, host systems can check the authenticity of a USB device or charger, including its descriptions, capabilities, and certification status, all before transferring inappropriate power or data, according to the USB 3.0 Promoter Group. The Promoter Group offers a couple of examples where this



could come in handy. Travelers concerned about charging their phone at a public terminal could implement a policy to ensure their phone only allows a charge from certified USB chargers. Similarly a computer user or a company supporting dozens or hundreds of PCs could set a policy in the PCs that would grant access only to verified USB storage devices. The USB Type-C Authentication solution relies on 128-bit security for all cryptographic methods and can authenticate over either the USB data bus or USB Power Delivery communications channels. The specification follows internationally accepted cryptographic methods for certificate format, digital signing, hash, and random number generation, and products that use the protocol retain control over the security policies to be implemented and enforced.

Researchers Achieve Record-Breaking Speeds For Fiber-Optic Lines

Engineers at the University of Illinois say they have paved a fast lane on the information superhighway. The team, led by Milton Feng, an electrical and computer engineering professor, reached transmission speeds of 57Gbps over fiber optics. “Our big question has always been, how do you make information transmit faster?” Feng said in a press release. “There is a lot of data out there, but



if your data transmission is not fast enough, you cannot use data that’s been collected.” This same group of engineers has been working for years to push oxide-VCSEL technology, which serves as the underpins of fiber-optic communications systems, to ever-higher speeds. In 2014, it was the first U.S.

group to reach error-free data transmission at 40Gbps. Along with reaching 57Gbps at room temperature, the engineers also reached transmission rates of 50Gbps at temperatures up to 185 degrees Fahrenheit. That’s important, the researchers note, because the materials used prefer lower temperatures. The technology is expected to be used in data centers and airborne, lightweight communications such as that found in airplanes.

Symantec: Malware Numbers “No Longer Surprise Us”

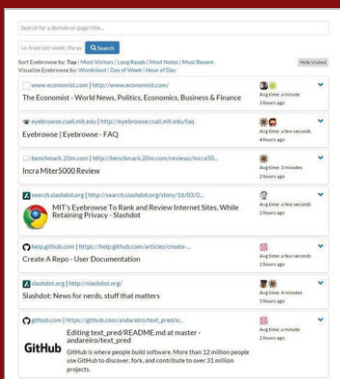
More than 430 million unique pieces of malware appeared last year (up 36% from 2014) and, as real life and online become indistinguishable and cybercrime becomes part of our daily lives, these numbers no longer surprise us, according to Symantec’s Internet Security Threat Report. Zero-day vulnerabilities also saw a pretty dramatic increase last year, with the number discovered up 125% from 2014. “In 2014, the number held relatively steady at 24, leading us to conclude that we had reached a plateau. That theory was short-lived,” the report notes. There was similar bad news for data breaches exposing personal records, spear-phishing campaigns, and ransomware. Symantec’s report shows that there were a record-setting nine mega-breaches last year with more than 10 million records breached in each event, and the number of reported stolen identities was up 23% from 2014, although Symantec notes this number is likely lower than the actual numbers as more companies chose not to reveal the full extent of their breaches last year. Spear-phishing campaigns aimed at employees were up 55% last year, and ransomware attacks were up 35% and expanded to any network-connected device, including smartphones, Macs, and Linux systems.



SITE SEEING

Program Lets You Share Browsing History With Friends & Researchers

A new system designed by MIT researchers could offer you more control over what data is being collected about your browsing history and how it’s being used. The system, dubbed Eyebrowse, consists of a website and an easy-to-install extension to Google’s Chrome browser. Once it’s installed, you’ll see an Eyebrowse icon you can use to whitelist a site so it always records your visit to the page, turn Eyebrowse off for private browsing, or record visits to websites not on your whitelist. That same menu also offers information on other Eyebrowse users who have visited that page and any annotations they have made. The researchers hope systems like Eyebrowse will



encourage changes in the regulatory environment to give users more control over what information is collected about them and how it’s used. Aside from that, the researchers say Eyebrowse can give users, academics, and scientists conducting research in the public interest access to the same type of browsing data that big Web companies currently collect and mine. In a press release, David Karger, an MIT electrical engineering professor, said there are several applications where the data could be useful to end users. “Awareness of where your friends are, the ability to run into them, the ability to go somewhere and discover that they were there before and you may want to talk to them about this thing that you both saw. There’s the ability to discover what’s popular, in a very broad way. There’s collaborative filtering.”



Job Of The Month

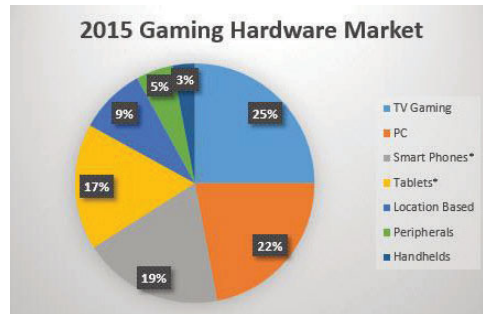
Although physical attacks by foreign entities on U.S. interests may be sporadic, cyber attacks launched from abroad are happening with increasing frequency. Uncle Sam is looking for a few patriots with the right technical chops to help defend the homeland. In particular, the National Security Agency is looking for a CND (computer network defense) analyst to help protect American networks. This person will help identify and analyze threats, increase situational awareness, and execute the general mission of the NTOC (NSA Threat Operations Center). This is an entry-level position, so requirements aren't that daunting: you just need a bachelor's degree in CS or a related field such as math or computer engineering. No experience necessary, but as always, the more you know, the better. People who have some knowledge of computer forensics, penetration testing, general network administration, and the like will have a head start over other applicants. Your service will be appreciated, and hey, the job is located in Hawaii, so when you're not tracking down bad guys, you can always sip Mai Tais on the beach.

Source: www.nsa.gov

We're #2! In Hardware, Anyway

Televisions are still the most popular hardware device people use when they game (consoles need screens, you know), but PCs come in a close second, at least according to market research firm Jon Peddie Research. The company recently published its results for the overall gaming hardware market for 2015. While the types of devices people use for their gaming entertainment have expanded dramatically over the past 20 years or so, the TV still rules the roost. Coming in at the other end of the spectrum are handheld gaming devices, which account for about 3% of the market. Jon Peddie may need to tweak its sampling instrument again this year, as the next shiny new gaming hardware arrives on the scene. We'll see where virtual reality headgear shows up in next year's chart.

Source: Jon Peddie Research



The Games We Like To Play

So you've just logged another squad kill and you're kicking back with a few friends, joking between games and watching the experience points load up. Ever wonder what the rest of the online world is playing? Newzoo publishes a list of the most popular PC games each month based on the number of unique game sessions played by a subset of users in North America and Europe. (The subset is the

Most Popular PC Games

Rank & Title (Publisher)

1. League Of Legends (Riot)
2. Minecraft (Mojang)
3. Counter-Strike: Global Offensive (Valve)
4. Hearthstone: Heroes of Warcraft (Blizzard)
5. World Of Tanks (Wargaming)
6. World of Warcraft (Blizzard)
7. Dota 2 (Valve)
8. Grand Theft Auto: San Andreas Multiplayer (Rockstar Games)
9. Guild Wars 2 (NCSoft)
10. ARMA 3 (Bohemia Interactive)

Source: Newzoo (March Monthly Rankings)

millions of gamers who use Overwolf in-game apps.) At left is Newzoo's most recent rankings. Don't see your favorite game on the list? You need to play more, friend.



RAW

Numbers:

21

The percentage of consumers in the United States who say they are interested in, or already use, one or more types of digital wallets.

Forrester

44

The percentage of gamers in a recent survey who said they had watched a formal eSports event or had seen informal video streaming of gameplay in the past six months.

NPD Group

98 million

The number of wearable healthcare devices forecast to ship annually by 2021. This is up from the 2.5 million devices expected to ship by the end of this year. The total value of the healthcare wearables market is forecast to reach \$17.8 billion in the next five years.

Tractica

30.7 billion

The estimated number of connected devices installed as part of the IoT (Internet of Things) by 2020. This installed base is forecast to grow to 75.4 billion devices by 2025.

IHS

\$247 billion

Forecast value of the worldwide service revenues that communications companies will generate in 2025 from 5G cellular networks.

ABI Research

ANNOUNCING

CPU LAN 2016

***CPU* magazine is hosting its first LAN event!**

Sept. 23-24, 2016 | Lincoln, Nebraska

- + Play games and have fun with 500 fellow gamers
- + See the latest products from leading manufacturers
- + Have a chance to win thousands of dollars in prizes

Save the date now, and watch for more details and registration information soon at www.ComputerPowerUser.com and in the pages of ***CPU* magazine!**



MSI Aegis

Harness The Power Of Gaming



For more information,
visit us.msi.com.

PC gamers looking to buy a new system have a lot of options these days. There are gaming notebooks and desktops of all shapes and sizes available for a wide range of prices, and many of them are pretty nice. But a gaming PC is the kind of investment you want to make carefully and thoughtfully, and in order to do that it's helpful to consider a brief list of factors. Is the system powerful enough to run the latest games quickly and smoothly? How big is the PC and how much does it weigh? Does it keep its components cool and run quietly? Does it support all of the latest gaming-related technologies? And does it look great while doing all of this?

MSI's Aegis marks a new generation of gaming PCs that check off all of these boxes and more.

World-Class Design

Aegis is different from run-of-the-mill gaming PCs because in designing this system, MSI started over from scratch in order to create something more than just a PC that runs games—it's a perfect fit for a PC gamer's life.

"We wanted to create a chassis that gamers would love to own and to show off," says MSI SPB Associate Marketing Manager Eugene Kuo. "The Aegis is meant to be the perfect foundation for enthusiast gamers now and in the future."

The Aegis chassis is very compact—it measures just 15 x 6.7 x 17 inches (HxWxD) and has an internal capacity of less than 20L. That means that it also weighs less than many desktop PCs and

is therefore more portable. (There's even a carry handle built into the back end of the top panel.) This is obviously a big deal if you like to attend BYOC LAN parties, and the small size is also nice for users who want to put a gaming PC in their living room or who have cramped gaming areas.

Aegis also looks amazing, with an aggressive stance and an angular front panel that is home to MSI's new Mystic Light feature. LED light shines through the gaps in Aegis' armor, and you can control not only the color (16 million possibilities!) but also the effect, including static lighting, a cool breathing effect, a gradient mode, and modes that pulse in sync with games or music.



The Aegis packs a lot of hardware into a very small space, but thanks to spot-on design, everything stays cool—and quiet. (Graphics card not included.)

Power & Options To Spare

Despite its diminutive size, the Aegis can accommodate everything you need in an enthusiast-grade PC.

“The chassis comes with a pre-installed MSI motherboard, a CPU cooler, and a 600W 80 Plus Silver power supply,” Kuo says. “The memory, storage, CPU, and graphics card are up to the end user to decide what they feel is the most appropriate to install for their gaming needs.”

Your options for rounding out the Aegis’ components list are extensive. For starters, the Aegis’ pre-installed B150 motherboard and its LGA 1151 socket let you install any of Intel’s Sixth Generation Core processors (code-named “Skylake”). Where graphics cards are concerned, you can install any card up to and including an NVIDIA GeForce GTX 980 Ti, which means that you’ll be able to run the latest, most demanding games at blistering frame rates. To meet your storage needs, MSI built in an M.2 port that runs in either SATA or PCIe mode and two drive bays that will accommodate any combination of two 3.5-inch or 2.5-inch drives. Last but not least, Aegis will support up to 32GB of lightning-fast DDR4 memory.

Cool & Quiet

You might wonder if heat is a concern when packing such an impressive list of components into a case so compact, and it’s a fair question. The answer, however, is a resounding “No!” thanks to MSI’s Silent Storm Cooling 2 system, which uses the Aegis’ dual-chamber construction to keep its CPU and GPU separate and nicely cool, and you can even opt for liquid cooling if you want to really bring system temps down. Having its small form factor PSU built into the pedestal the system perches on doesn’t hurt, either.

Thanks to its clever design, the Aegis can stay both cool and quiet; MSI says it runs at about 22dB when idle, hits 28dB when you are playing games, and maxes out at 32dB under a full load. That’s 3dB less than the noise you’ll hear in a library.

Forward-Thinking Tech

MSI built the Aegis to be your gaming PC today and tomorrow. That’s why the company gives the system support for the latest technologies, like USB 3.1 (Type C), DDR4 memory, Nahimic high-definition sound processing, and support for 4K video as well as NVIDIA’s VR Ready designation. And if

your idea of a robust gaming experience includes streaming your gameplay to friends and/or subscribers, you’ll be happy to hear that the Aegis comes equipped with XSplit Gamecaster v.2 as well as MSI’s own Dragon Eye tech, which lets you watch movies or stream while you play without the need to run your games in windowed mode. You can control the size and location of your “second screen,” so you can find the ideal configuration for your display.

And while we’re on the subject of the future, we should point out that the Aegis is designed for easy upgrades over time, so that you can swap in a new component now and then as needed.

“The Aegis is very easy to upgrade,” Kuo says. “The design of the Aegis was made to have easily accessible component compartments. The 3.5-inch and 2.5-inch bays, for example, are located at the top and can be accessed by sliding the cover off.”

Ready For Battle

Whether you are looking for a great system to take to your favorite LAN events or just want something that fits in nearly any room, the Aegis is your best choice. ■

AVADirect Avalanche II & Avalanche Mini

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If you want to see what a boutique builder is really capable of, skip past the custom configurator on the website and find the company's specialized systems. These high-end beauties are typically full of handcrafted details such as cleverly designed liquid-cooling loops and case mods for a unique look and/or better performance. The Avalanche Series is AVADirect's line of signature gaming PCs built with hardline PETG tubing, and overall, there's little about the Avalanche Series that's stock, which is just how we like it.

A Tale Of Two Avalanches

AVADirect sent us both an Avalanche II and Avalanche Mini to test. The latter, as you might imagine, is a smaller version and limited to only one GPU.

The Avalanche II uses the Corsair Carbide Air 540. AVADirect chose this case because it knew the case would support the big radiators necessary to cool a CPU and two GPUs without modification. The Avalanche Mini utilizes the smaller, but similar, Corsair Carbide Air 240. Both Corsair cases are cube-style chassis that allow AVADirect to separate the GPU and storage from the big, showy components of the build. Big side-panel windows provide a full view of the hardline tubing, GPU (or GPUs), and individually sleeved cabling.

Both of the Avalanche Series rigs were extremely well-lit. AVADirect runs an RGB LED strip light around the inside edge of the case, and the LEDs brightly illuminate the system internals. A white-and-black color

theme, fitting of the Avalanche name, runs throughout the outside and inside of the rig. Most notably, the white hardline tubing, individually-sleeved cables, and radiators visually stand out from the black case interior and motherboard PCB.

The hardline tubing is the most defining characteristic of the Avalanche Series, so let's take a little more time to discuss the loop. AVADirect uses mostly 90-degree bends with long, straight runs to the radiators. Impressively, AVADirect is able to route the tubing in and out of the case's separated compartments. It's necessary to do so, as well, because the reservoirs for both the Avalanche II and Avalanche Mini are in the same compartments as the power supplies. On the Avalanche II, the reservoir is visible from the

front panel, while it's hidden on the Avalanche Mini.

Envy-Inducing Parts List

AVADirect designs the Avalanche Series around the Intel Z170 chipset. For a gaming PC, it's a smart choice on AVADirect's part as Intel's enthusiast-level X99 chipset might be overkill and unnecessarily increase system cost. The company sent us the Ultimate configurations for both systems. Both rigs feature an Intel Core i7-6700K that's clocked at 4.8GHz, a 20% boost over the stock 4GHz speed. AVADirect also offers the Avalanche systems at stock speed, if you prefer to overclock the system yourself. As evidenced by the Ultimate configuration speeds, the built-in cooling provides ample headroom.

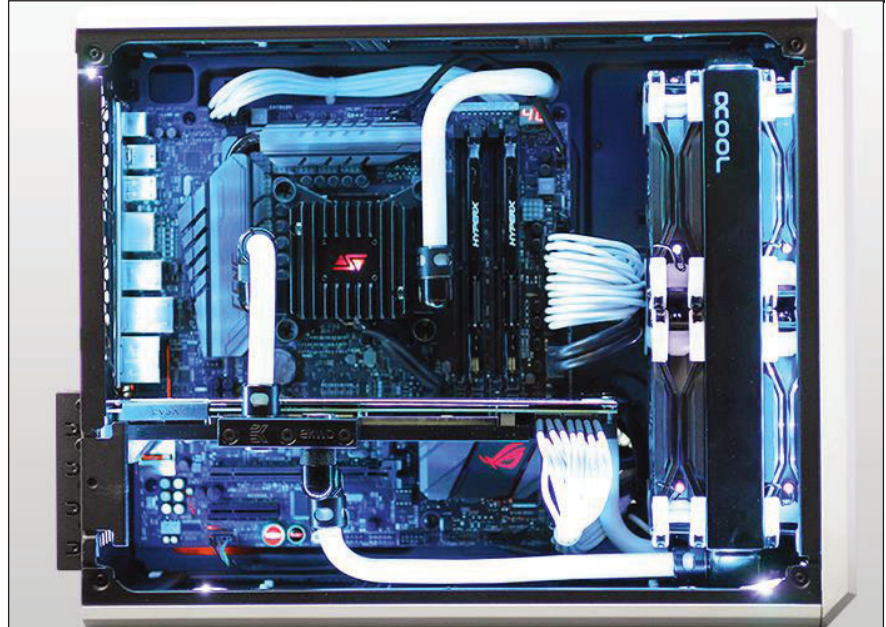
AVADirect also overclocks the EVGA GeForce GTX TITAN X graphics card (or cards) in the Avalanche Series. The graphics cards in our test systems were running at a 110% power target, which boosted the GPU clock by 250MHz and the memory clock by 125MHz. The graphics cards are gorgeous inside the rig, thanks largely to the EK-FC Titan X Backplate. The full-cover nickel backplate is CNC-machined to a mirrored finish that reflects the surrounding white components and white LEDs. In addition to the eye-catching look, the waterblock also provides passive cooling for the GPU's VRM.

The Avalanche Series systems we tested both feature an ASUS motherboard. The Avalanche II uses the ATX-sized Z170-DELUXE, while the Avalanche Mini boasts the microATX MAXIMUS VIII GENE. The high-quality onboard sound and network hardware, among other built-in extras, help AVADirect avoid using add-in cards that might cramp the GPU.

AVADirect also equips both rigs with 16GB of HyperX Fury memory. Oddly, the Avalanche II uses 2,133MHz memory, while the Avalanche Mini operates at 2,400MHz—both speeds that are comparatively slow for what the



Avalanche II Specs: Processor: Intel Core i7-6700K; Motherboard: ASUS Z170-DELUXE; GPUs: EVGA GeForce GTX TITAN X (x2, SLI); RAM: 16GB HyperX Fury DDR4-2133; Storage: 1TB Samsung 850 EVO, 3TB Seagate Barracuda; PSU: Corsair AX1200i; OS: Windows 10 Professional 64-bit; Warranty: 3 years



Avalanche Mini Specs: Processor: Intel Core i7-6700K; Motherboard: ASUS MAXIMUS VII GENE; GPU: EVGA GeForce GTX TITAN X; RAM: 16GB HyperX Fury DDR4-2400; Storage: 1TB Samsung 850 EVO, 3TB Seagate Barracuda; PSU: Corsair AX760; OS: Windows 10 Professional 64-bit; Warranty: 3 years

ASUS motherboards support. To power the rigs, AVADirect opts for Corsair's AX lineup. The dual GPU Avalanche II sports the AX1200i, while the single GPU uses Corsair's AX760.

Storage capacity on the Avalanche Series is beefy. Both of our test models came with a 1TB Samsung 850 EVO, which served as the OS drive, as well as a 3TB Seagate Barracuda for the data drive. AVADirect lets you configure the Avalanche Series with a RAID configuration on both the OS and data drives. On the Avalanche II, AVADirect mounts the SSD and HDD at the bottom of the chassis, whereas the Avalanche Mini hides the drives in the PSU partition. We prefer the look of the Avalanche Mini, as the bulky Seagate Barracuda distracts from the otherwise sleek interior.

Speed & Good Looks

Both Avalanche Series models produced outstanding benchmark results. The EVGA GeForce GTX Titan X cards deliver some mind-blowing frames-per-second rates, as you'll see in our benchmark chart. The Avalanche II, with its dual GeForce GTX Titan X graphics cards, does outpace the single GPU Avalanche Mini in our graphics-intensive and game benchmarks, but with 57fps being the lowest frame rate (in the Witcher 3), gamers won't be disappointed with either rig. In our processor, storage, and memory tests, scores were similar across the board for both systems. AVADirect's 4.8GHz overclock on the Intel Core i7-6700K paid off in our processor-intensive tests. Both rigs produced near 500 megapixels per second in SiSoftware Sandra's x32 Multi-Media Integer AVX2 test.

There's an unpretentious elegance to the Avalanche Series' interior. Whereas some builders use bright, showy color schemes and systems nearly bursting with hardware, AVADirect opts for precise, clean lines and gentle white illumination that perfectly matches the white hardline tubing. The effect makes the interior look roomy, even though neither chassis is a full tower. The high-quality hardware and generous overclocks assure performance that matches the precision look. ■

BY NATHAN LAKE

AVADirect Avalanche Series Benchmark Results	Avalanche II	Avalanche Mini
Price	\$6,729	\$4,329
3DMark Professional (Fire Strike Extreme)		
Score	15762	7683
Graphics Score	18232	8051
Physics Score	15262	14014
Combined Test	32.39	17.7
PCMark 8		
Creative Score	6482	6430
SiSoftware Sandra 2016		
Dhrystone Integer Native AVX2 (GIPS)	221.38	220.13
Whetstone Single-float Native AVX (GFLOPS)	128.61	127.7
x32 Multi-Media Integer AVX2 (Mpixels per second)	475	480
x16 Multi-Media Long-int AVX2	219.43	220.1
x1 Multi-Media Quad ALU	2.5	2.49
x16 Multi-Media Single-float FMA	474.21	475
Integer Memory Bandwidth B/F AVX/128 (GBps)	26	27.4
Floating Memory Bandwidth B/F AVX/128 (GBps)	26.74	27.85
Cinebench 15 CPU score (points)	1035	1033
POV-Ray 3.7 (pixels per second)	2260.64	2258.43
CrystalDiskMark 5.12 (MBps)		
Sequential Read (Q32T1)	556.4	550.2
Sequential Write (Q32T1)	530.8	529.4
4K Read (Q32T1)	402.1	400.1
4K Write (Q32T1)	362.1	340.4
Games (frames per second; tested at 2,560 x 1,440)		
Metro: Last Light (16xAF; SSAO off)	120.7	84.1
Dying Light (Med, AO On, AA On, Vsync Off)	125	87.3
The Witcher 3 (Vsync off, Unl.fps, Ultra)	82.1	57

GIGABYTE GA-X170-EXTREME ECC

When we think about workstation PCs, and the hardware within, we start feeling a little groggy. Our eyelids droop, and we fight to stay awake. Why? Because workstations are boring. The magazine is *Computer Power User*, people, not *Computer Power Snoozer*. (I'll be here all week. Try the veal.)

Workstations get a bad rap because most of us can't wait to escape to our gaming rigs when 5 o'clock rolls around. But what about enthusiasts who use their machines for serious work and serious play, the freelancers and work-from-home types? Shouldn't there be a motherboard for the coffee-in-the-morning, Red-Bull-in-the-evening power users?

Leave it to GIGABYTE to produce a workstation motherboard that looks right at home in a gaming setup. The GA-170X-EXTREME ECC is built around Intel's C236 chipset and is compatible with Xeon processors and ECC memory—all components you'd expect to find in a

workstation—but you wouldn't be able to tell by looking at it. Big, beefy heatsinks top the VRM, chipset, and integrated audio circuitry, and GIGABYTE swathes them in a digital camo pattern. Various board components (DIMM slots, PCIe slots, and the PCB itself) have a matching color scheme. If your workstation build will also be a gaming build and *also* have a military theme, well, we'd say the GA-170X-EXTREME ECC has you covered. Really, though, the overall aesthetic is quite well done.

Although this mobo uses Intel's LGA1151 processor socket, be aware of which CPUs it actually supports. The 6th Generation Core i7 and i5 processors won't officially work with the GA-170X-EXTREME ECC, and although Core i3, Pentium, and Celeron processors are compatible, these desktop chips really aren't a sensible match for the board. You wouldn't put a 4-cylinder engine in a Corvette's chassis, after all. We

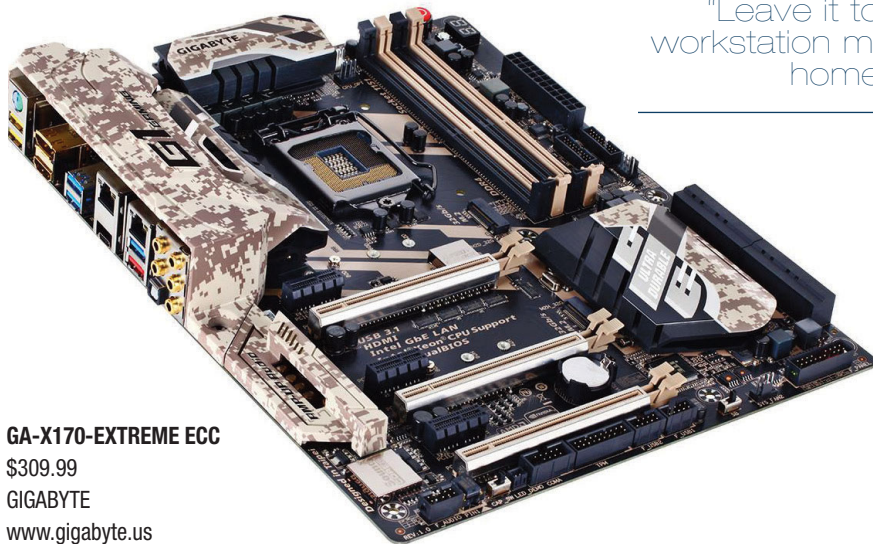
recommend rolling with a Xeon E3-1200 v5 CPU, but we wouldn't fault you for trying a 6th Generation Core i5 or i7.

GIGABYTE also touts the GA-170X-EXTREME ECC as the world's first C236-based motherboard with Thunderbolt 3 certification, a fact that's worth bragging about. Thunderbolt has largely taken hold as the peripheral interface of choice for creative professionals, and Thunderbolt 3 is on the cutting edge. The maximum theoretical bandwidth of the new interface rockets all the way to 40Gbps (twice that of Thunderbolt 2). Piped over the motherboard's USB 3.1 Type-C port, the Thunderbolt 3 interface also supports Power Delivery 2.0, so you can daisy-chain up to six devices together and then plug the chain into the GA-170X-EXTREME ECC.

Normally we keep trucking past USB support without further discussion, but we'll take a slight detour here. The Intel



"Leave it to GIGABYTE to produce a workstation motherboard that looks right at home in a gaming setup."



GA-X170-EXTREME ECC

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USB 3.1 controller on the GA-X170-EXTREME ECC has access to four PCIe 3.0 lanes, pumping up the board's two USB 3.1 ports' max theoretical bandwidth to 32Gbps. And with the Type-C connector shaping up to be the next industry standard, this motherboard has "futureproof" written all over it.

But enough work; let's talk about play. Both SLI and CrossFire are supported on the GA-X170-EXTREME ECC. You can install a pair of NVIDIA graphics cards, and each will operate at x8 speeds. Technically, 3-way CrossFire is possible, but it's not without a sprinkling of asterisks. The motherboard's third PCIe slot is limited to PCIe x4, and if you use the slot for a graphics card, one of the board's M.2 slots will be disabled. Either way, this mobo is a gamer.

Speaking of M.2, the GA-X170-EXTREME ECC rolls out the welcome mat for modern SSDs. There are two M.2 slots that support PCIe (or SATA) SSDs. For legacy storage, the motherboard has eight SATA ports—six of which are yoked

together for double duty as SATA Express connectors, if you're into that sort of thing.

The GA-X170-EXTREME ECC has many of the other staples of GIGABYTE's enthusiast boards. It features an integrated Creative Sound Core3D quad-core audio processor, plus Creative's collection of software (SBX Pro Studio, Scout Mode, and VoiceFX). The Killer E2400 networking controller is a step up from anything you're likely to find on a typical workstation motherboard, and the GA-X170-EXTREME ECC's UEFI BIOS has plenty of dials and knobs for power users to play with.

Because GIGABYTE positions the GA-X170-EXTREME ECC as workstation board with enthusiast DNA, we tested it with our usual battery of benchmarks. The results are roughly between a Core i5-6600K and Core i7-6700K, plus you have the added benefits of a Xeon processor (and, optionally, ECC memory). This is a serious motherboard that knows how to have fun. ■

BY VINCE COGLEY

Benchmark Results	GIGABYTE GA-X170-EXTREME ECC
3DMark Professional (Fire Strike Extreme)	7244
Graphics Score	7687
Physics Score	11573
PCMark 8	
Creative Score	4426
POV-Ray 3.7 (Pixels per second)	1690.97
Cinebench 15 (Points)	788
SiSoftware Sandra 2016	
Dhrystone Integer Native AVX2 (GIPS)	166.62
Whetstone Single-float Native AVX (GFLOPS)	96.4
x32 Multimedia Integer AVX2 (Mpixels/s)	365.57
x16 Multimedia Long-int AVX2 (Mpixels/s)	167.24
x1 Multimedia Quad ALU (Mpixels/s)	1.91
x16 Multimedia Single-float FMA (Mpixels/s)	352
Integer B/F AVX2/256 (GBps, mem bandwidth)	25.67
Floating B/F FMA/256 (GBps, mem bandwidth)	25.89
Games	2,560 X 1,440
Metro: LL (16XAF, SSAO Off)	79
Dying Light (Med, AO On, AA On, Vsync Off)	91
The Witcher 3: (Vsync Off, Unl. FPS, Ultra)	62.93

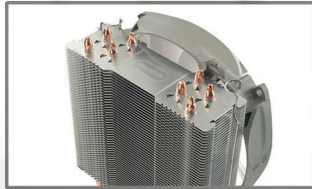
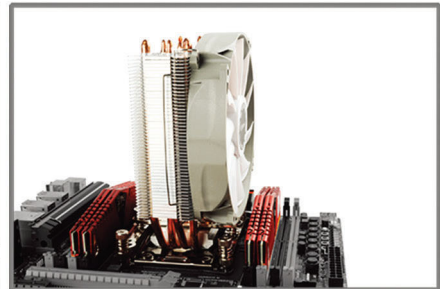
Specs: Max memory: 64GB DDR4-2133 (Unbuffered ECC 1Rx8/2Rx8 modules supported, varies by CPU); Slots: 3 PCIe 3.0 x16, 3 PCIe x1; Storage: 2 M.2 (type 2242/2260/2280), 3 SATA Express, 8 6Gbps SATA; Rear I/O: 1 DisplayPort, 1 HDMI, 2 USB 3.1 (1 Type-C, 1 Type-A), 5 USB 3.0, 1 PS/2, 2 Gigabit Ethernet, 1 S/PDIF, audio I/O; Form Factor: ATX; Warranty: 3 years

Test system specs: CPU: Intel Xeon E3 1230 v5; GPU: PNY GeForce GTX 980 Ti; RAM: 16GB Crucial DDR4-2133; Storage: 240GB Intel SSD 730 Series; OS: Windows 10 Enterprise



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We've been touting the benefits of all-in-one liquid coolers for a while now, but for those who've yet to see for themselves, let's recap. The cooling efficiency of liquid passing through a copper waterblock beats a traditional air cooler every day of the week. Unlike with a custom loop, there's no filling and draining to do, tubing to cut, or stressful leak-testing to perform. The pump and waterblock are integrated as a single unit, they run quietly, and they tend to look sharp as well. Cooler Master's New MasterLiquid Pro Series offers all of the above, and then some.

This cooler is built around CM's new FlowOp technology, which starts with a copper waterblock that features 657% more internal surface area and a structure that focuses coolant on the center of the block first. The pump is capable of moving liquid 40% better than previous models, and its custom "silent" driver runs significantly more smoothly, generating virtually none of the clicking and vibrating that's common with AIO pumps. Cooler Master's engineers outfitted this unique pump and waterblock with an extra chamber to help keep the

vital internal components from warming when the CPU heats up, which helps Cooler Master back this AIO with a solid 5-year warranty. To top it off, there's an attractive blue LED behind a Cooler Master logo etched into the pump/water block's transparent window.

A quick glance at the aluminum radiator and you'll notice another thing that differentiates the MasterLiquid Pro 240 from almost every other AIO cooler you can find; the square fins. Most radiators feature a series of liquid channels separated by a sine wave pattern of copper or aluminum fins. The problem with this design is that the liquid channels tend to make very little physical contact with the fins, but Cooler Master's square wave design maximizes this contact to ensure heat dissipates as quickly as possible.

To that end, there are a pair of 120mm MasterFan Pro Air Balance fans, equipped with square fins capable of maintaining high static pressure without the added noise. According to Cooler Master, they feature noise ratings between 6 and 30dBA, and there are three speed settings you can choose with the switch on the fan frame. We used the performance

mode during testing. Installing an AIO can often become frustrating, but on our X99-based system, the mounting hardware was easy to set up and the unit was ready to run in a matter of minutes.

Up to this point, we were already impressed, but the MasterLiquid Pro 240's performance simply blew us away. At idle, our Intel Core i7-5960X ran at 26.85 degrees Celsius. When we ran POV-Ray 3.7 to max out the CPU, temperatures climbed to 43 degrees. Prime 95's small FFTs torture test running flat-out on all eight cores pushed the mercury just a little higher, to a mere 48.23 degrees. Throughout, the fans were audible, but still unobtrusive.

As these numbers attest, the MasterLiquid Pro 240 isn't just another AIO, nor is it over-engineered for the sake of pulling in a higher retail price. Its test results combined with its innovative design elements (most notably its redesigned waterblock and radiator cooling fins) helped it win the CPU Cutting Edge Award, and if you're serious about cooling your processor, this AIO will do a mighty fine job of it. ■

BY ANDREW LEIBMAN

Specs: Materials: copper waterblock, corrugated fluorinated ethylene propylene tubing, aluminum radiator; Socket compatibility: Intel LGA 2011-3/2011/1366/1150/1151/1156/1155/775, AMD FM2+/FM2/FM1/AM3+/AM3/AM2+; Pump: 12V, blue LED; Fans: 2 120mm MasterFan Pro Air Balance fans (2,000rpm max) Radiator dimensions: 1.06 x 10.83 x 4.67 inches (HxWxD); Warranty: 5 years

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Sometimes, all you need is watts. Sure, PSUs with 80 PLUS Gold or Platinum efficiency ratings are ideal, but maximum efficiency commands a premium price. And guess what? A watt looks the same to a CPU or GPU, regardless of how efficient it is. If you're building a beefy rig on a value menu budget, opting for a solid power supply at a lower cost lets you put more money toward the components that make a real impact on performance. That's the idea behind ENERMAX's Triathlor ECO line of power supplies. On display this month is the 1,000W flagship.

We reviewed the Triathlor ECO 800W in the February 2016 issue (see page 17), and its big brother doesn't change much than a few numbers here and there in the specs sheet. To recap, though, the high-wattage Triathlor ECO PSUs have enough

juice for an extremely powerful system. Rather than carve up the +12V rail and spread it across a series of smaller rails, ENERMAX opts for a single-rail design, and the result is a +12V rail with a whopping 83 amps of current. So, go ahead and install one high-end graphics card. Better yet, install two or three; the Triathlor ECO 1000W has six 6+2-pin PCIe cables, which is enough for the majority of 3-way SLI and CrossFire setups.

The Triathlor ECO 1000W has a semi-modular design, and the cables ENERMAX chose to hardwire to the PSU makes good sense. The main ATX, one PCIe (two connectors), two CPU (one 4+4-pin, one 8-pin) connect directly to the PSU. Add modular cables as needed and leave the rest in the box for a neat and tidy system.

Don't underestimate the Triathlor ECO 1000W's 80 PLUS Bronze certification.

Like the 800W Triathlor ECO, the 1kW unit was within striking distance of Silver status when Ecova Plug Load Solutions tested it, and it would have earned Silver if its test results (85.53%/87.51%/84.52% efficiency at 20%/50%/100% load) rounded up. The power supply also supports Intel's C6/C7 sleep states, so when your system takes a nap, the Triathlor ECO 1000W effectively turns off the tap.

We tested ENERMAX's budget wonder with an Intel Core i7-5960X and a pair of factory-overclocked GeForce GTX 970 graphics cards. To put the power supply through its paces, we fired up Prime95's In-place mode and Unigine Heaven 4.0. Under load, the Triathlor ECO 1000W drew an average of 523 watts from the wall and produced an average power factor of 0.972.

Bargain hunters, sound the alarm. The Triathlor ECO 1000W puts a lot of power into your PC but doesn't take a lot of cash out of your wallet. If you need a bunch of watts without spending a fortune, this kilowatt PSU is the ticket. ■

BY VINCE COGLEY

Specs: Maximum wattage (continuous): 1,000W; +12V rails: 1 (83A); +3.3V max: 24A; +5V max: 24; Efficiency rating (advertised): 80 PLUS Bronze; Fan: 140mm; Connectors: 1 x 24-pin ATX, 1 x 8-pin EPS12V, 1 x 4+4-pin ATX/EPS12V, 6 x 6+2-pin PCIe, 12 x SATA, 8 x 4-pin Molex, 1 x floppy; Warranty: 3 years
Test system specs: CPU: Intel Core i7-5960X; GPU EVGA GeForce GTX 970 SSC GAMING ACX 2.0+ (SLI); Motherboard: GIGABYTE GA-X99-GAMING G1 WIFI; RAM: 16GB PNY Anarchy DDR4-; Storage: OCZ Vertex MAX IOPS 240GB; Windows 10

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For the most part, we like our graphics cards big and powerful, but even though neither term can be applied to NVIDIA's GeForce GTX 950, it's impressive just how much performance the green team managed to pack into such a small and energy-efficient GPU. Our latest look at this chip comes courtesy of MSI, inside the GTX 950 2GD5T OCV2.

But before we delve into MSI's tweaks, let's cover the brains of the operation, NVIDIA's Maxwell GM206. The die in this GPU was manufactured at 28nm and features 2.94 billion transistors. The firm uses this GPU in both the GTX 960 and GTX 950, which means that the GPU strapped to this card is slightly hamstrung. There are 768 CUDA cores instead of 1,024; 48 texture units versus 64; and the installed GDDR5 memory runs a bit slower, at 6.6GHz rather than 7GHz. Both cards have the same 32 ROP count and a relatively narrow 128-bit memory bus. Any GTX 950 you buy is going to come with 2GB of GDDR5 for its frame buffer.

NVIDIA has given its AiB partners free reign to come up with their own take on the heatsink and shroud, as well as push the core and boost clocks beyond the reference numbers. As such, MSI gave

this card core and boost clocks a kick in the pants to the tune of 1,076MHz and 1,253MHz, respectively.

The cooler on this card isn't the TwinFroze we've seen so often from MSI, but a more compact number with a white plastic shroud mounted to a pure aluminum heatsink. There's a large portion of the heatsink that covers the GPU and memory, but raised sections on the left and right help dissipate the heat over a wider area. A pair of 75mm fans do their part as well; overall it was a very quiet card, even under load. That's not surprising considering the fact that the GTX 950 is a mere 90W card.

MSI populated this GTX 950's PCB with a handful of Military Class 4 components certified to MIL-STD-810G standards, including long-life Hi-c CAP and solid-state capacitors. There's a 6-pin PCIe power connector on the top edge of the card and a dual-link DVI port, HDMI port, and DP port on the card's I/O bracket. This card also features an SLI connector for those looking to double-up their graphics horsepower. The card measures just under 9-inches long, which puts it at the larger end of the spectrum of GTX 950s currently available.

Specs & Scores	MSI GTX 950 2GD5T OCV2
Core clock	1,076MHz
Boost clock	1,253MHz
Memory clock	1,653MHz
Memory interface	128-bit
Memory	2GB GDDR5
3DMark Professional (Fire Strike)	5372
Graphics Score	5777
Physics Score	15562
Unigine Heaven 4.0	(1,920 x 1,200)
Score	617
FPS	24.5
Games	(1,920 x 1,080)
Shadow Of Mordor: (Vsync Off, Ultra, DoF, OIT, Tess)	25.64fps
Metro: Last Light (DX11, V High, 16XAF, V High Tess.)	42.33fps
Dying Light (High, AO On, AA On, Vsync off)	49.94fps
Witcher 3: Wild Hunt (Vsync off, Unl. fps, Ultra)	27.93fps

When we ran this card through our benchmarks, we were pleasantly surprised with how well it performed, especially because the games we use are significantly more demanding than the MOBAs, MMOs, and competitive shooters that serve as so many PC enthusiasts' gateway drugs. Only The Witcher 3 and Shadow Of Mordor failed to broach 30fps, but it's easy to dial back our rather aggressive settings to get those games looking great at 1,080p.

It's not going to set the record books ablaze, but the MSI GTX 950 2GD5T OCV2 will let you enjoy the best looking games currently available for very little scratch. ■

BY ANDREW LEIBMAN

Test System Specs: Processor: Intel Core i7-5960X; Motherboard: GIGABYTE X99-Gaming; RAM: 16GB PNY Anarchy DDR4-2400; Storage: 240GB OCZ SSD



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Rantopad MXX Mechanical Gaming Keyboard

Rantopad was founded more than a decade ago by a competitive gamer who created his own mousepad because the options available at the time were, frankly, inadequate. With the MXX, the company is applying its built-from-the-ground-up philosophy to a tenkeyless mechanical keyboard. And you can tell at first glance, this keyboard is a departure from the norm.

The 87-key MXX is a platform style keyboard, with the bottoms of the key switches fully exposed. The backplate consists of a brushed aluminum plate that's curved at the sides and mounted to a black plastic housing. The MXX we tested features a gunmetal gray aluminum plate, but this model is also available in blue. There's a metal plate with the Rantopad logo on it on both the left and right sides of the keyboard and the braided nylon-covered USB cable is detachable.

There are all the keys you'd expect on a standard US-layout keyboard. There's a Windows logo key, and each one of the

12 function keys has a secondary function that you can activate by pairing each key with the FN key on the bottom row, to the right of the right-side ALT key. For instance, press FN + F1 to launch the Windows calculator; control media volume and mute/unmute functions with the FN + F2, F3, and F4 keys; disable the app switching ALT + TAB function with the "game mode" FN + F9 combo; and control media playback with the FN + F6, F7, and F8 combos.

This is a mechanical keyboard, and as such, Rantopad relies on Gateron to supply the mechanical switches. The MXX comes with your choice of Gateron red or blue switches, and for sanity's sake, they perform nearly identically to the Cherry MX red and blue switches. Our MXX came with the red switches, and like the Cherry MX variants, they have a linear motion (no bump) and a fairly low actuation force of 45g. You'll be happy to know that these switches have an impressive 50 million click lifespan.

The top part of the switch housing is translucent, which helps the monochrome LEDs built into each one better light up the key cap and backplate. There are three LED indicators (for CAPS LOCK, SCROLL LOCK, and Game Mode) and a backlit MXX logo above the arrow keys. In a move that many enthusiasts will find refreshing, the MXX doesn't require a software utility. All of its special functions are performed using key combos. Aside from the function key-based combos we already mentioned, you have the ability to jump between default and secondary backlighting modes using the FN + F10 combo and the PAGE UP and PAGE DOWN keys, for a total of seven lighting modes.

If you're in the market for a no-nonsense mechanical keyboard with a slick look and fuss-free setup, the Rantopad MXX will more than satisfy. ■

BY ANDREW LEIBMAN

Specs: Mechanical switch type: Gateron red (also available in blue); monochrome LED per-key backlighting with 7 lighting modes; Tenkeyless; N Key Rollover anti-ghosting technology; 1ms response time; included acrylic key puller; No software necessary; Gold-plated USB 2.0 interface; black braided nylon cable

"The Shadow Rock Slim smartly straddles the line between space-saving and cooling prowess."



Shadow Rock Slim
\$44.90
be quiet!
www.bequiet.com

be quiet! Shadow Rock Slim

Large air coolers with boxy heatsinks and multiple fans have a tendency to appear clunky inside a case, especially when the CPU cooler covers the DIMM slots and VRM heatsinks on your motherboard. Diminutive air coolers, on the other hand, may produce underwhelming performance for power users. The Shadow Rock Slim smartly straddles the line between space-saving and cooling prowess by fitting four 6mm heatpipes into a heatsink that's only 2 inches thick. be quiet! rates the Shadow Rock Slim with a cooling capacity of 160W TDP.

When the included fan is installed, the Shadow Rock Slim is rectangular in statue with dimensions of 6.34 x 5.39 x 2.91 inches. The design all but eliminates the possibility of interference with system memory, while the heatsink's 6.34-inch height provides the surface area necessary to quickly dissipate heat.

The heatpipes are bare copper, but the baseplate is nickel-plated to prevent oxidization. On the top of the aluminum fin array, be quiet! adds a brushed-aluminum cover with heatpipe caps. The cover certainly improves the air cooler's appearance inside the case. It's noticeably more attractive, for example, than air coolers where you can see the heatsink's

fin structure and the crimped seals of the heatpipes.

If pure silence is your goal, not many slim air coolers can challenge the Shadow Rock Slim. be quiet!, of course, specializes in designing fans that get the job done in near silent manner. The Shadow Rock Slim comes with a Silent Wings 135mm, PWM fan that operates between 300 and 1,400rpm. The rifle-bearing fan is rated for a noise level of only 23.7dB(A) at full speed, and the CPU cooler is nearly inaudible at 300rpm. Incredibly, the 135mm fan is able to generate up to 67.8cfm at 1,400rpm. A second set of fan clips is provided, if you wish to create a push-pull setup and further lower temps.

When it comes to compatibility, you'll need to go back more than a decade to find a motherboard socket the Shadow Rock Slim won't work with, because it supports the legacy Intel LGA 775, as well as AMD's 754, 939, and 940 sockets. It can also handle the latest sockets, such as Intel LGA 2011 (3) and AMD FM2+.

Installing the Shadow Rock Slim won't take long, but we found that the process did go more smoothly when the motherboard was outside the case. The most difficult part is mounting the heatsink to the board, as you have to use

a hexagonal spanner (one is provided) to tighten the set of hexagonal nuts. If you have limited elbow room inside your case, it can be difficult to maneuver the spanner to lock down the nuts.

We tested the Shadow Rock Slim in a system with an Intel Core i7-6700K, a GIGABYTE GA-Z170X-SOC FORCE, and 16GB of Kingston HyperX Predator DDR4-3000. At idle, our Intel Core i7-6700K produced an average temperature of 23.6 degrees Celsius. To stress the CPU cooler, we ran POV-Ray 3.7 on all cores for 10 minutes, and average temperatures increased to 74.2 C with a maximum temperature of 81 C. Lastly, we ran Prime95's Small FFT to push the cooler's upper limits. It responded with an average temperature of 92.3 C and a maximum temperature of 98 C.

be quiet! aggressively prices the Shadow Rock Slim at \$44.90. It's an undoubtedly low-noise CPU cooler that should fit into most compact PC cases. We also like that be quiet! includes support for legacy Intel and AMD sockets, so the CPU cooler could even spruce up an outdated PC that you've repurposed for other duties, such as a NAS or media server. ■

BY NATHAN LAKE

Specs: Materials: Copper (base, heatpipes), aluminum (fins); Fan: 135mm PWM (300- 1,400rpm); Cooler Dimensions: 6.34 x 5.39 x 2.91 inches (HxWxD); Socket compatibility: Intel LGA775/115X/1366/2011(3), AMD 754/939/940/AM2+/AM3+/FM1/FM2/FM2+; Warranty: 3 years



"We're confident that this keyboard will stand up to the rigors of LAN party travel and play."

GIGABYTE FORCE K85

In an effort to court demanding power users, manufacturers often roll out hardware that practically overflows with features, hoping these "Ultimate" products will be more appealing than vanilla units. Feature-laden gear, when perfectly executed, is worth the money, but peppering hardware with extra doodads can easily backfire. Enthusiasts aren't stupid; they know when a bunch of bells and whistles are added to camouflage slipshod construction.

In a way, it takes a certain amount of courage in today's market to get back to basics, but that's what GIGABYTE has done with its FORCE K85 mechanical keyboard. There are a lot of things you won't find on the FORCE K85. You won't find a battery of macro keys. You won't find multicolored keycaps (such as the WASD keys). You won't find any onboard memory, either. What you *will* find is a solidly built mechanical keyboard that will go into battle and do work.

Gamers in search of a sturdy keyboard must take a look at the FORCE K85. Its plastic housing has very little give to it, and the keyboard weighs a solid 2.4 pounds. Combined with its non-slip rubber feet, the FORCE K85 isn't going anywhere once it's in position. We're

confident that this keyboard will stand up to the rigors of LAN party travel and play.

Beneath the FORCE K85's keycaps are Kailh Red mechanical switches. We recognize that each type of common switch style (Red, Blue, Brown, Black) has devoted partisans, and the "best" is largely a matter of personal preference. At the time of this writing, the FORCE K85 was only available with Kailh Reds, which is something to consider.

Kailh Red switches are linear, so there's no tactile bump or audible "click" when the switch actuates. (The actuation point is 2mm, and the switches bottom out at 4mm.) Speaking of actuation, Kailh Reds require a mere 45cN (that's centinewtons, in case you slept through physics) to register, making them ideal for the hair-trigger reactions necessary to compete in intense multiplayer skirmishes. The FORCE K85 also uses an anti-ghosting switch matrix for n-key rollover, making every sort of crazy key combo possible. According to GIGABYTE, the switches have a life span of 70 million keystrokes—no surprise coming from a company famous for its Ultra Durable components.

Capitalizing on a trend we've noticed among mechanical keyboards, the FORCE K85 features customizable LED

backlighting behind every single key. By tweaking the LEDs' RGB values using GIGABYTE's free downloadable utility, you have a palette of 16.8 million colors to choose from. The software itself doesn't do anything other than give you control over the FORCE K85's backlighting, but it's lightweight and very easy to use. In addition to creating custom colors, the software presents a couple of lighting effects (Pulsing and Cycling) and gives you the ability to adjust their speed as well as LED brightness. Like the FORCE K85 itself, the software is simple but highly effective. If you'd rather skip the software, though, the keyboard's quick access hotkeys can perform all the same functions with the lone exception of setting a custom RGB color.

In action, the FORCE K85 lived up to expectations. For 90 bucks, this keyboard is ideal for anyone who wants a solid gaming keyboard but doesn't want to shell out extra cash for superfluous extras. ■

BY VINCE COGLEY

FORCE K85

\$89.99

GIGABYTE

www.gigabyte.com

Specs: Mechanical switch type: Kailh Red; Switch life span: 70 million keystrokes; 16.8 million color RGB LED backlight; 104-key layout; N-key rollover; Polling rate: 1,000Hz; USB 2.0 interface; Cable length: 5.9ft.



"We like the look and feel of the Rantopad MT. . . ."

MT Mechanical Gaming Keyboard

\$129.99

Rantopad

rantopadusa.com

Rantopad MT Mechanical Gaming Keyboard

Looking for a full-sized keyboard with a single-minded focus on durability and comfort? Rantopad's MT Mechanical Gaming Keyboard is exactly that. This 104-key unit shares a lot of the features with the Rantopad MXX, but its aesthetics are all its own. The model we tested features a bright yellow acrylic frame around the keys, set into a black plastic housing with a rough matte finish. The key caps feature translucent yellow characters and white LEDs behind each one. The acrylic frame, which Rantopad refers to as a crystal panel, is inset so that it's flush with edges of the keyboard and it uses magnets to keep it snug. You can use the neon orange key puller that Rantopad bundles in to pull up the frame for cleaning or to swap it out entirely. The Rantopad MT is compatible with KT Series crystal panels and KT Series keycaps, letting you alter the keyboard's whole color palette. (There weren't any available for purchase at press time; Rantopad tells us they went like hotcakes at PAX East and will be back in stock soon.)

The mechanical keyswitches in the MT are from Gateron, and it's available in blue (tactile bump with an audible click feedback) or black switches (virtually silent, no bump and no feedback). Our Rantopad MT shipped with blue switches, and as someone who uses—and swears by—a Cherry MX Blue switch-equipped keyboard for my daily driver, I could discern no difference between the two brands of switches. Gateron's black switches are a linear variety fairly similar to Cherry MX switches of the same color, however with a slightly lower actuation force of 50g instead of 60g. These keys feature a 50 million click lifespan, so don't count on them giving up the ghost anytime soon. Speaking of ghosts, the MT also supports N Key Rollover technology and a 1ms response time to ensure every key press is registered virtually instantly.

According to Rantopad, this keyboard featured a fourth-generation simulated organic coating on the keycaps, which is designed to resist oil buildup. The keys have a slightly chalky feel to them, which

made for a comfortable and accurate typing experience.

In addition to the LEDs behind every key cap, the MT also features a quartet of blue LEDs above the number pad to indicate number lock, caps lock, scroll lock, and game mode settings. When enabled, game mode disables the ALT + TAB function and the Windows key, which can wreck your gaming session if you happen to fat finger your way into pressing them unintentionally.

There are fewer lighting modes available on the MT than in the MXX, just three: fully lit, and two slightly different takes on the breathing mode. If you want, you can also turn off the white backlight altogether.

We like the look and feel of the Rantopad MT, but we admit, its color scheme won't be for everybody. According to Rantopad, the KT Series crystal panels in alternate colors will be available May 15. ■

BY ANDREW LEIBMAN

Specs: Mechanical switch type: Gateron blue (also available in black); monochrome LED per-key backlighting with 3 lighting modes; full-size 104 keys; N Key Rollover anti-ghosting technology; 1ms response time; included acrylic key puller; No software necessary; Gold-plated USB 2.0 interface; black braided nylon cable



"Using infrared light as an actuator gives the B740A a decisive advantage over standard keyboards . . ."

B740A Light Strike Mechanical Keyboard

\$179.99

Bloody

www.bloody.com

Bloody B740A Light Strike Mechanical Keyboard

At the highest levels of competition, eSports athletes look for anything that will give them an edge, however slight. Would you expect anything less from professional gamers who live, eat, and play together? The pros are constantly on the lookout for innovations that can make them faster, more accurate, and deadlier.

Mechanical keyboards quickly gained popularity in competitive circles because their light actuation force, especially in Red and Brown keyswitches, facilitated the kind of quick-twitch responses that separates winners from losers. Of course, once enough people caught on, mechanical keyboards ceased to be a secret weapon. Peripheral manufacturer Bloody wants to keep you ahead of the curve, and the company has a trick up its sleeve that might do just that.

The B740A Light Strike Mechanical Keyboard is . . . a mechanical keyboard, but it's more than that. The secret sauce is the switches' use of an infrared light sensor, which registers keystrokes. Using infrared light as an actuator gives the B740A a decisive advantage over standard keyboards, because it doesn't suffer from the

latency-inducing key bounce effect. When a traditional metal keyswitch actuates, it introduces bouncing noise, which in turn adds latency. Now, we're not talking about the degree of latency we've all experienced when network latency can bring an online game to its knees, but lag is lag. According to Bloody, standard metal keyswitches add 18 to 30ms of latency; the B740A's key response time is a mere 0.2ms. The infrared mechanical switches have a considerably shorter throw, too, at 1.5mm.

On paper, the extra speed seems tremendous. After all, who's going to argue with the speed of light? The B740A's biggest weakness isn't the keyboard itself but rather the person behind the wheel, so to speak. For instance, can you tell the difference between a gamer who reacts a tenth of a second faster than his competitor? Unless you're a robot, probably not, and yet this gamer is 100ms "faster" than his opponent. Now, if you're a world-class League of Legends or Starcraft player, the infrared sensors could be a difference maker. For Joe and Jane Gamer, the B740A must succeed based primarily on its overall typing experience.

Good thing for the keyboard that its overall typing experience turned out to be pretty good. The keys don't quite feel like a traditional mechanical keyboard, which makes sense. In some regards, they profile closely to a Cherry MX Red mechanical keyswitch, with no tactile feedback and no audible report from the switches actuating. In practice, though, it's easy to bottom out the keys, so the B740A ends up being quiet, rather than silent, most of the time. The keyboard does "feel" fast, and I really enjoyed using it.

Elsewhere, you take the good with the bad. The QWER and ASDF keys are topped with non-slip silicone keycaps, and the LED backlighting is plenty bright even under the harsh glare of your typical Serious Business office fluorescents. However, the B740A's wrist rest is fused to the rest of its housing—not a deal breaker for me, but I understand that it might turn off others.

I hate reviewing products like the B740A, and it isn't because I think it's a bad keyboard. Quite the opposite: For me, it was great. For you, it could be a different story. If you like Cherry MX Red or Brown switches, I think the B740A Light Strike Mechanical Keyboard is worth a look. ■

BY VINCE COGLEY

Specs: Switch type: Infrared mechanical; Key response: 0.2ms; Adjustable LED backlight; 104-key anti-ghosting; 8 non-slip silicone keycaps; Spill-proof design; Braided nylon cable; Interface: USB 2.0



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"The TL80 is a mouse that's bursting with potential."

Bloody TL80 Terminator Laser Gaming Mouse

Point, click, kill—the concept is painfully simple, and yet here we are in 2016, still searching for the perfect gaming mouse. Now, given the diversity of games today, this mythical peripheral will never truly exist, but that doesn't stop manufacturers from trying. Enter Bloody, which puts its best foot forward with the TL80 Terminator Laser Gaming Mouse.

We can see why the TL80 Terminator would have mass appeal. With the exception of a pair of thumb buttons, the mouse has an ambidextrous body, and the silver and black color scheme pairs with nearly any build. It's plenty comfortable to use, too.

The real game changer, according to Bloody, is the TL80's use of the company's proprietary LK (Light Strike) technology. Instead of using typical metal switches beneath the mouse's main left and right

buttons, Bloody incorporates switches with infrared light sensors that register a click when a small beam of infrared light is interrupted. It's the same concept behind Bloody's LK mechanical keyboards, and it yields the same benefit. The infrared switches eliminate the metal bouncing effect, which introduces a small amount of peripheral-side latency (up to 30ms, Bloody indicates). As a result, the TL80's infrared light technology cuts the switches' response time to 0.2ms. Incidentally, Bloody uses the same technology in the mouse's scroll wheel.

Disclosure: I am not a professional CS:GO player. My total Call of Duty tournament winnings: \$0. I have the reflexes of a narcoleptic mall security guard. Maybe—just maybe—the speed advantages of the TL80's infrared switches are lost on me. While using the mouse, its buttons certainly weren't slower

than gaming mice I've used in the past, but I didn't think they were noticeably faster, either. Your mileage may vary.

Other features suggest that the TL80 is built for FPS gamers. It has six "sniper modes" to give you precise aim for any situation, and there are four shooting modes that tie burst shooting to a single click of the left mouse button. Bloody also offers downloadable software for the TL80 that lets you customize its button assignments, create macros, and more. It's quite deep and not difficult to use.

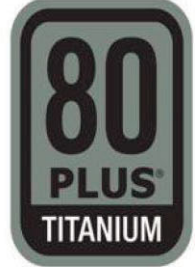
The TL80 is a mouse that's bursting with potential. If you can take advantage of the LK switches and the mouse's software, the TL80 is a terrific weapon to add to your arsenal. ■

BY VINCE COGLEY

Specs: Sensor: Avago 9800 (800 to 8,200dpi); Switch response time: 0.2ms; Tracking speed: 150ips; Body type: Ambidextrous; Infrared scroll wheel; Weight: 146g; 9 buttons; 160KB onboard memory; Interface: USB 2.0

State-Of-The-Art Standards

80 Plus



Power efficiency may not seem like a revolutionary concept in an era where efforts to be green and reduce overall power consumption are commonplace. But it's not all that long ago that computer power supplies wasted 30% or more of the power coming from the wall. In 2004, for example, the ATX 2.01 standard only required a PSU to be 70% efficient at 100% and 50% loads—and only 60% efficient at 20% load. The 80 PLUS program put efficiency at the forefront by developing a certification system that demands a power supply to be at least 80% efficient at 20%, 50%, and 100% loads. As PSUs have become more and more efficient, 80 PLUS created new certification levels, such as Bronze, Gold, and Titanium, to represent the greater efficiency levels. Read on if you've ever wanted to learn more about the 80 PLUS certification process and what each level of certification means.

How It All Started

When the 80 PLUS program launched in 2004, Ecova (known as Ecos Consulting at the time) and EPRI (the

Electronic Power Research Institute) worked together to develop a process for testing internal power supply efficiency. The resulting work was the Generalized Internal Power Supply

Efficiency Testing Protocol. At the time, there was no official testing protocol to verify power supply efficiency. Many manufacturers, of course, complied with the ATX standard, but there was



ENERMAX's Platimax lineup of power supplies all meet the 80 PLUS Platinum certification.

80 PLUS Verification and Testing Report

TYPICAL EFFICIENCY (50% Load):	92.94%
AVERAGE EFFICIENCY :	91.50%
80 PLUS COMPLIANT:	YES

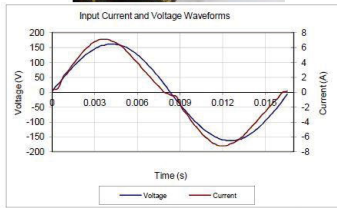


Ecos ID #	2839
Manufacturer	Enemax Technology Corporation
Model Number	EPM1000EWT
Serial Number	N/A
Year	2011
Type	ATX12V,EPS12V
Test Date	10/26/2011

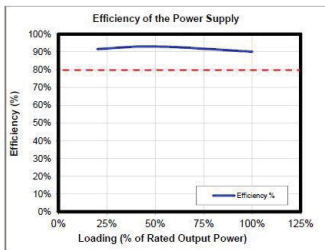
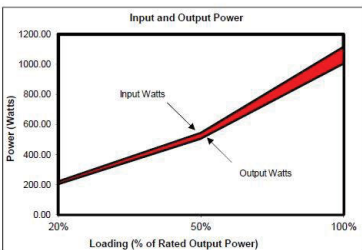
Rated Specifications	Value	Units
Input Voltage	115-240	Volts
Input Current	10.5-4.5	Amps
Input Frequency	50-60	Hz
Rated Output Power	1000	Watts

Note: All measurements were taken with input voltage at 115 V nominal and 60 Hz.

Line #	PF	I _{in} (%)	Load (%)	Fraction of Load	Input Watts	DC Terminal Voltage (V) / DC Load Current (A)					Output Watts	Efficiency %
						12V (cumulative of 12V1, 12V2, etc.)	-12V	3.3V	5V	5Vsb		
1.99	0.97	18.40%	20%	Light	222.70	12.2/0.1	3.3/2.2	5.1/2.2	5/0.5	203.80	91.51%	
4.80	0.99	10.98%	50%	Typical	545.40	12.2/0.2	3.3/5.4	5.1/5.4	5/1.3	506.91	92.94%	
9.71	0.99	6.53%	100%	Full	1118.00	12.2/0.5	3.3/10.7	5/10.7	4.9/2.7	1006.69	90.04%	



Input AC Current Waveform (THD = 10.98%, 50% Load)



The Platimax 1000W is 92.94% efficient at 50% load, as well as 91.51% efficient at 20% load.

PSU company wanted its power supply to feature the Energy Star logo. The ringing endorsement of Energy Star put 80 PLUS over the top, and nearly every PSU manufacturer began submitting PSUs to the program.

Gifts Of Bronze, Silver & Gold

With a plethora of power supplies now meeting the original 80 PLUS standard, Ecova created three new certification levels in 2008 to further distinguish PSU efficiency. On the 115V main power grid of the United States, the 80 PLUS Bronze standard requires a power supply to be at least 85% efficient at 50% load (sometimes known as peak load or peak efficiency), as well as 82% efficient at 20% and 100% loads. The 80 PLUS Silver certification hikes efficiency levels up another 3% across the load ranges, while 80 PLUS Gold is 5% higher than the Bronze requirements. For more information, see a complete chart of all the 80 PLUS certification levels elsewhere in this article.

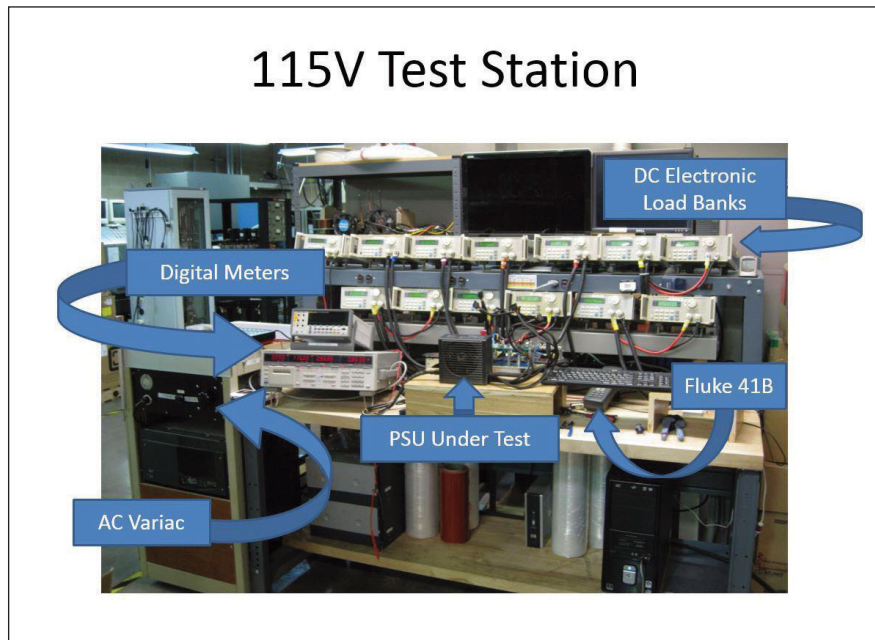
Besides meeting the necessary efficiency levels, the power supply must deliver a minimum power factor of .90

no way for consumers to check a PSU's actual efficiency level.

The 80 PLUS program concept was announced at the ACEEE (American Council for an Energy-Efficient Economy) Market Transformation Symposium in March 2004. Part of plan was for electrical utilities to pay incentives to manufacturers that produce PSUs and computers to cover the incremental cost of the better PSU. The NEEA (Northwest Energy Efficiency Alliance) became the first sponsor of 80 PLUS in late 2004, and after only 2.5 years, the 80 PLUS program had 14 program sponsors across North America. By 2010, the adoption rate of 80 PLUS allowed the NEEA to phase out the incentive program.

In early 2005, Seasonic's SS-400HT became the first 80 PLUS-certified power supply. By fall of 2006, 87 power supplies from 22 manufacturers were certified 80 PLUS. Energy Star also took note of the program, and in

2007, Energy Star made reaching the 80 PLUS certification mandatory if a



A variety of equipment is necessary to produce reliable testing results.

Fluke 8846A & Yokogawa WT2030



The Yokogawa WT-2030 captures input power readings, including input voltage, input current, input frequency, and input power. It also measures power factor, total harmonic distortion, and output current.

at peak efficiency. “PFC [power factor correction] illustrates how efficiently the PSU operates within the building’s existing wiring,” says Jason Boehlke, business channel manager at Ecova. “A .90 PFC PSU within a system allows up to twice the amount of computers to be installed on the existing branch wiring of a building.”

Due to efficiency level differences between the 115V and 230V power grid, the 80 PLUS program has a different set of efficiency requirements for internal PSUs connected to a 230V power grid. The 230V certification levels generally feature slightly higher efficiency levels, especially at 50% load. For example, a 230V power supply that meets the 80 PLUS Gold certification must be 92% efficient under 50% load, but a 115V PSU needs must be only 90% efficient. 80 PLUS also outlines a separate set of requirements for industrial power supplies, which are used in large-scale applications.

Platinum Hits

In October 2009, Ecova introduced the Platinum certification that requires at least 90% efficiency across 20%, 50%, and 100% loads. At peak efficiency, an 80

PLUS Platinum-certified PSU must reach an efficiency of at least 92%, as well as a power factor of 0.95. To reach the 115V industrial certification, a power supply must also be 85% efficient at 10% loads.

Even though the 80 PLUS Platinum standard has been out for a few years, there are relatively few Platinum power supplies, at least compared to the vast number of 80 PLUS Bronze and Gold PSUs on the market. “The reason may be the concern for actual demand,” says Nick Chou, product manager, PSU division at ENERMAX. “After all, the quantity always matters, and therefore, most manufacturers focus more on producing and selling the mainstream models than

spending time and money on Titanium or Platinum models.”

Titanium Titans

In 2012, 80 PLUS threw down the gauntlet by creating the 80 PLUS Titanium certification. To earn this badge, a PSU must reach the minimum efficiency levels of 90/92/94/90% at 10/20/50/100% loads. “Titanium is quite difficult to achieve with the popular analog control design of current PSUs, especially the 94% efficiency at 50% load,” says Chou. “Adopting a digital control circuit will undoubtedly enhance the unit’s efficiency performance, but most PSU manufacturers have stayed at analog stage because digital controls cost a lot and require great effort to develop.”

Astute observers will note that the Titanium specification adds a minimum efficiency requirement at 10% loads with 80 PLUS Titanium. “We test PSUs at 10, 20, 50 and 100% of rated load to offer insights into operating efficiency across the potential use of the PSU within the operating system,” says Boehlke. And because efficiency levels drop when a PSU operates above or below 50% load, it’s also difficult to achieve 90% efficiency at the low 10% load. The 80 PLUS Titanium standard also requires a power factor of 0.95 at 20% loads.

Options for 80 PLUS Titanium certified PSUs are currently scarce. At the time of this writing, for example, there were only 35 models Titanium certified models for 115V circuits on Ecova’s Plug Load Solutions website. Clearly, it’s no simple task to design and build a PSU that meets 80 PLUS Titanium.

How Is Power Efficiency Calculated?

In technical terms, power efficiency is the ratio of total real power output over real power input. Put more simply, it’s the wattage produced during the conversion process divided by what you draw from the wall. Then, the result is multiplied by 100 to create the percentage number. For example, let’s say that your PC is consuming 510 watts, while your power supply is pulling 600 watts from the wall. The PSU is operating at 85% efficiency.



Rosewill's Quark-1200 is completely modular and is up to 92% efficient, in compliance with the 80 PLUS Platinum certification.

What Are The Benefits Of Higher Efficiency?

Making the most of the power coming from the wall is the most obvious reason to invest in a high-efficiency power supply. But realistically, savings among similar 80 PLUS levels are minimal, at best.

“Assuming a \$0.10/kWh national electrical rate average, the annual savings ranges \$5 to \$6.50, based on badge increments,” says Boehlke. As you can see, with such low returns over the course of a year, a high-efficiency power supply will make virtually no difference on your electricity bill. And

the current premium you pay for a Platinum or Titanium power supply is unlikely to make up the difference over the lifetime of the PSU.

Fortunately, there's a much better reason for power users to purchase an efficient PSU—reducing heat. “Another reason for using Gold efficiency or better, and the most important, is to reduce ‘disposable heat,’” says Stanley Chu, director of R&D, PSU division at ENERMAX. “With equal wattage, for instance, a Bronze-efficiency PSU will generally run at higher temperatures than a Gold or better efficiency.” Less heat improves the PSU's lifespan and reliability, which is an important consideration, since you'll always want stable power delivery. Reducing the heat inside the PSU also lets manufacturers lower fan speed, which in turn helps to lower your system noise.

The Testing Process

To get a PSU tested by Ecova, and be eligible for the 80 PLUS program, a power supply manufacturer just needs to fill out the application questionnaire on the program website (plugloadsolutions.com/80PlusPowerSupplies_Application.aspX) with basic information, such as model name, form factor, and wattages. Ecova will reply with a confirmation email and a shipping address for sample submissions to EPRI, which is the independent test lab that performs testing for Ecova's 80 PLUS program.

Manufacturers send in two sample units per model to be tested, and if the first PSU fails to meet any of the criteria, the testing of that particular unit stops. The second unit picks up at the first PSU's point of failure, and if it passes, EPRI puts the second PSU through the entire battery of load tests. If the second unit fails, 80 PLUS issues the report to the PSU manufacturer about the failure points. With PSUs that come within 0.5% of the next-highest badge level on any loading parameter, EPRI will also try

80 Plus Minimum Efficiency Ratings

Percentage Of Rated Load	10%	20%	50%	100%
80 Plus	10%	80%	80%	80%
80 Plus Bronze		82%	85%	82%
80 Plus Silver		85%	88%	85%
80 Plus Gold		87%	90%	87%
80 Plus Platinum		90%	92%	90%
80 Plus Titanium	90%	92%	94%	90%

Find Your PSU's Efficiency Levels

You can check the efficient testing results for every PSU the 80 PLUS program has tested at plugloadsolutions.com/80PlusPowerSupplies.aspx. And because most every modern PSU now complies with some 80 PLUS certification level, it's likely that your computer's PSU efficiency is on record.

the second unit to see if it will pass to the next level.

The testing results are available approximately three weeks after the product samples arrive, and the manufacturer will receive a report with all the results. PSU manufacturers must approve the report's content (and complete payment) before the testing data is posted to the 80 PLUS page of the Plug Load Solutions website (plugloadsolutions.com/80PlusPowerSupplies.aspx).

Ecova and EPRI don't keep the testing process a secret. There's a Test Protocol link right on the Plug Load Solutions website where you can learn how they test, as well as the hardware used to generate loads and monitor efficiency. The 115V test station includes an 8KV UPS and a step up/step down isolation transformer. Test specifications require that the AC source be able to deliver the specified voltage and frequency within 1%. EPRI also uses LISN (Line Impedance Stabilization Network) to stabilize input impedance and generate repeatable power factor readings.

A Yokogawa WT-2030 digital power meter monitors and captures input power measurements, including input voltage, input current, input frequency, input power, power factor, and total harmonic distortion. The Yokogawa WT-2030 is also used to measure output current. To record output voltages, a Fluke 8845A multimeter takes a sample of 10 data points per output voltage, which generates the minimum and maximum measurements, as well as an average and standard deviation.

During the actual testing process, EPRI starts by applying a load of 10% to the PSU. Before any power

measurements are captured, the PSU runs for 15 minutes to reach a steady operating level. The same 15-minute run time also occurs before capturing the 20%, 50%, and 100% loads. You can view the individual results for each test on the Plug Load Solutions website, and 80 PLUS plots the efficiency levels on a graph to display how the PSU does under different load conditions. Besides efficiency data, you'll also be able to see the load applied to each rail (expressed in amps) and power factor information.

The 80 PLUS program records data not included in the report, as well. "We capture the weight of PSUs, and although we have not published those results, we anticipate offering a white paper if we see a correlation

between more weight and more efficient badge levels based on the BOM (bill of materials) in the PSU design," says Boehlke. "We also capture ancillary information of PSUs for future potential industry white papers, such as PSU efficiency under extremely light loads, ride-through testing, how long a PSU may operate when losing power, that would be potentially beneficial to IT managers when designing the system and understanding how much time the PSU will operate before a UPS would need to kick in to sustain power to the Data Center device."

A Badge Of Honor

When shopping for power supplies, you'll see the image of an 80 PLUS Badge, or at least a mention of the certification, on almost every PSU. And while you probably won't select a power supply based solely on its efficiency rating, the 80 PLUS certification level should hold some weight in your decision. At the very least, you should be extremely wary of any PSU that's not 80 PLUS certified. ■



The be quiet! Dark Power Pro 11 1000W meets the 80 PLUS Platinum certification and features a 135mm be quiet! SilentWings 3 fan that produces a noise level of only 10.1dB(A) at 20% load.

HARD HAT AREA
PC MODDER
MAD READER MOD



Fallout Rig

Last month's Mad Reader Mod was an homage to *The Witcher 3: Wild Hunt*, which was one of the biggest game releases of 2015. This month, our winning mod is based on another massive 2015 hit, *Fallout 4*. Unlike most of the *Fallout*-based mods we've seen, however, Marc Molella avoided going with the weathered, time-worn look that is popular for these projects.

"I was talking about doing a *Fallout* mod and someone asked me what I would incorporate into a *Fallout* mod. After some deliberation, the wheels started turning, and the ideas started flowing," Molella says. "I have seen many *Fallout*-themed mods that all had the concept of being weathered and worn, as if they had gone through nuclear fallout. While I loved them all very much and could really appreciate the techniques and creativity it took to create those ideas and bring them to fruition, I wanted to create a *Fallout* mod that could capture the theme of *Fallout* while maintaining a visually clean aesthetic appearance."

We have very much enjoyed some of the weathered *Fallout* mods, too, and going that route clearly makes sense given the source material. But Molella's *Fallout Rig* looks shiny and new, with the exception of the vault door in the custom graphic on the right-side panel and some of the mod's surfaces.

"I used some fluorescent acrylic panels in this mod, to give a radioactive affect. I wanted some of the panels to appear as if they had been scorched by radiation from a nuclear blast."

Another Fine RobCo Product

Remember that one time, when RobCo built the Pip-Boy for Vault-Tec? *Fallout Rig* is sort of like that, with its RobCo

logo and Vault-Tec blue and yellow color scheme. Molella used Electron Blue Pearl on most of the case, along with the aforementioned bright yellow accents.

"The entire case was painted with automotive-grade urethane-based clear coat," Molella says. "After the paint cured, I buffed the entire case to achieve the nice shine that you see in the photos."

Molella started the project with a Cooler Master MasterCase 5 Pro, which is a mid-tower, but Molella says he needed to make some changes to install the radiator he wanted.

"The case was only designed to hold up to two 240 or 280mm radiators," Molella says. "However, I wanted to use a 360mm radiator. So I had to cut away the front of the case and make custom mounts for the top and bottom to fit the radiator, while still allowing the front bezel to be removed for easy cleaning of the fans and radiator."

Molella also cut away a large portion of the motherboard tray and made a custom motherboard skirt so that he could mount his customizable reservoir, then cut a few extra holes for wiring. Then he took out the PSU compartment divider panel (because it limited space for his cooling gear) and made a custom PSU shroud and custom-sleeved all the PSU cables.

"I also had to modify the front bezel, as there were mounts for 5.25-inch bay devices and only two fans, and I needed holes for three fans, so the 5.25-inch bays had to be removed, and the entire front bezel cut out and replaced with two layers of acrylic to achieve the proper thickness. I then had to line everything up and drill three 4.5-inch holes for fans to cool the radiator. I also wanted to add fan grilles for safety reasons."



Sure, Marc, for “safety reasons.” It had nothing to do with the super-sweet custom 111 grilles calling out the Vault-Tec vault number from Fallout 4. (It’s OK, we’re not gonna judge.)

“The top case panel also had to be modified, so I cut it out and made a custom acrylic layered piece to cover the two top-mounted fans, which pull air directly into the case,” Molella says. “Even though the CPU and GPU are water-cooled, the VRMs on the motherboard and memory are passively cooled, thus the top fans help to keep those components cool.”

For the right-side panel, Molella wanted something unique.

“The theme of this whole mod is to look like an advertisement for Vault-Tec to help them sell their vaults,” he says. “This is why I chose bright colors that resemble the Vault Boy’s apparel and used him in the artwork on the rear panel. Imagine walking into Vault-Tec or RobCo to purchase your vault to protect you from the imminent fallout; this in the computer you would see on the desk that they would use to process your payment.”

What’s In The Vault

Fallout Rig consists of an Intel Core i7-5820K mounted on an GIGABYTE X99-UD5H-WIFI motherboard, a G.Skill TridentX DDR4-3000, an EVGA GeForce GTX 980 Ti Hydro Copper, a Cooler Master V1200 Platinum power supply, a 512GB boot SSD, and a 960GB SSD for storage. The custom cooling loop is made up of a Monsoon customizable reservoir, a Hardware Labs GTX 360 Black Ice Nemesis radiator, a Swiftech D5 pump, Thermaltake Riing RGB fans, and PrimoChill Rigid Revolver dual-tone fittings and PETG tubing.

After The War

As always, we asked Molella if he had any other projects in the works or in planning stage, and indeed he does, but he was very tight-lipped as to the nature of those mods.

“Yes, I am actually in the midst of a few more mod projects,” he says. “One is another personal project and a couple others I can’t speak about just yet.”

He did have this advice to share, however: “It doesn’t take fancy tools to create an awesome mod,” says Molella. “It takes creativity, time, and skill to create a mod, but skill can be learned and achieved with practice. If you have enough drive and determination, you can do anything!” ■

We Want Your Mod

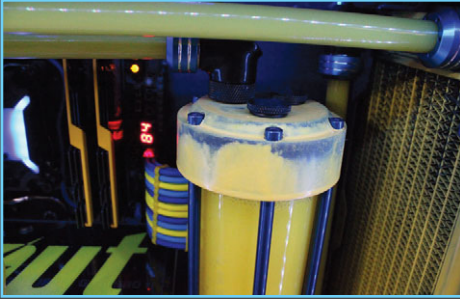
Have a computer mod that will bring tears to our eyes? Email photos and a description to madreadermod@cpumag.com. If we choose your system as our “Mad Reader Mod,” you’ll win \$1,500! (U.S. residents only, please.)



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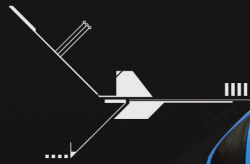


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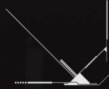
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Go East Young Man

The Highlights Of PAX East 2016

Always a thrill, PAX East 2016 is one that attendees won't soon forget. The show's exhibition hall was filled with up-and-coming trends in gaming, including a selection of VR demos for Oculus Rift, HTC Vive, and PlayStation VR. Many of the lines for the biggest VR demos, we heard, were often near three hours long. And those that did the VR demos typically said it was worth the wait to experience VR firsthand. A couple eSports events dominated stages in the middle of the exhibition hall, and eSports celebrities could be found signing autographs throughout the show. There was plenty of hardware hullabaloo, too, with new product releases from several big names.



The Boston Convention & Exhibition Center is a welcome sight to gamers and PC enthusiasts this time of year.



The PlayStation VR booth was one of the first you could see from the hall's main entrance.



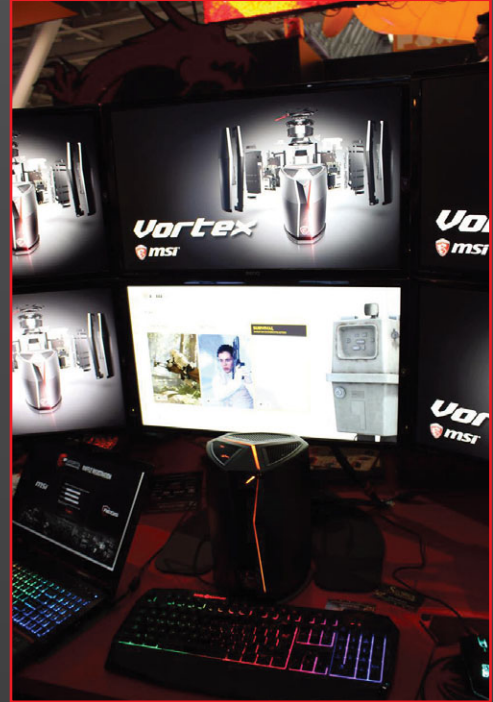
Collegiate League of Legends teams squared off in uLoL Campus Series events.

HARD HAT AREA
PC MODDER



GIGABYTE was showing off some motherboard engineering samples that'll soon refresh its X99 and Z170 lineups. The engineering samples all featured U.2 connectors, as well as expanded M.2 support for better support of PCIe SSDs.

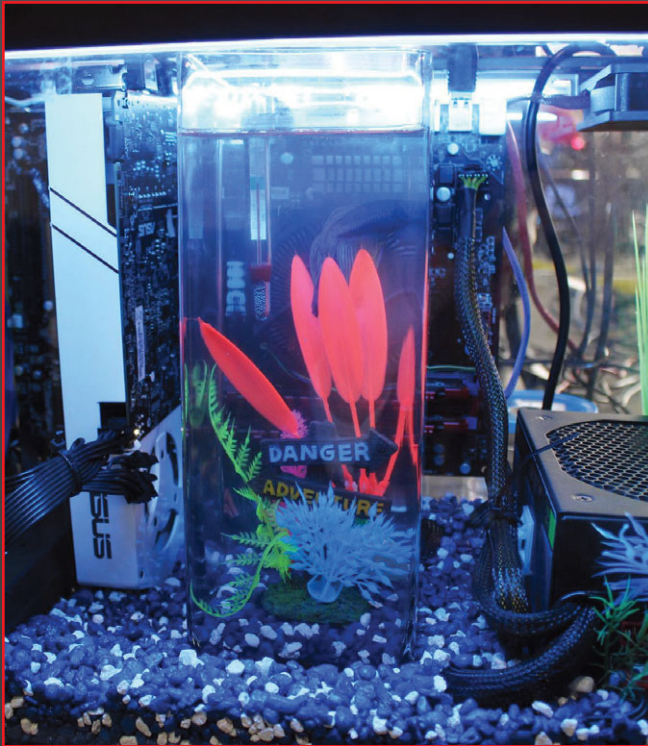
MSI showed off its new Aegis and Vortex systems (Vortex pictured left, Aegis below), two miniature powerhouses designed for gaming.



Attendees could rest weary legs and sore feet at DXRacer's booth.

HARD HAT AREA

PC MODDER



Alpha the Beta has called this PC home for the last couple months. Builder Alex Drella routes most of the system's power cables under the tank's decorative rocks for a clean appearance.



Rantopad displayed new color and mechanical switch options for its MXX Mechanical Gaming Keyboard.



ENERMAX is updating its Ostrog case series with the Ostrog ADV, which includes MaxBrite LED strips that can synchronize with ENERMAX Vegas fans for exceptionally illuminated lighting effects.

Cooler Master unveiled its MasterLiquid Pro 240, which boasts a revamped pump/waterblock unit (with a cool blue LED) and new high static pressure fans for improved cooling performance. New case accessories, such as the yellow accented panels in this picture, will be available soon for the MasterCase 5.



HARD HAT AREA

PC MODDER

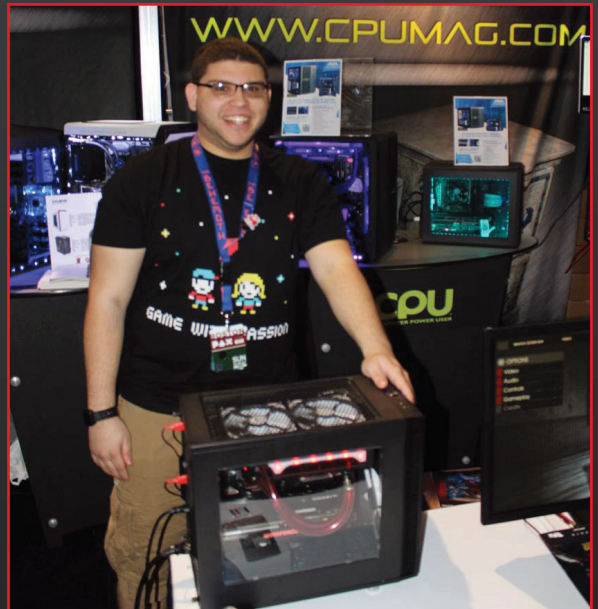
On day one, we gave away a few Rosewill cases and power supplies.



Saturday's prizes included a few Zalman cases and E-Blue's Auroza XI Gaming Chair.



Richard Clinton's Minecraft mod brought some boom to the BYOC. He put together the system with hundreds of wooden and plastic cubes. The mod's TNT box also functions as the power button, and the motherboard panel slides out for easy access to internal components.



Day-three prizes included CaseLabs' Mercury S8 and our April issue CPU System Workshop Build, the Nano Hammer.

LANFest 2016 Rolls On LAN Parties Touch Down In Michigan, Missouri, Nebraska & Arizona

Spring means it's LAN party season, and this year the LANFest series of LAN events included four events in the span of just four weeks in March and April.

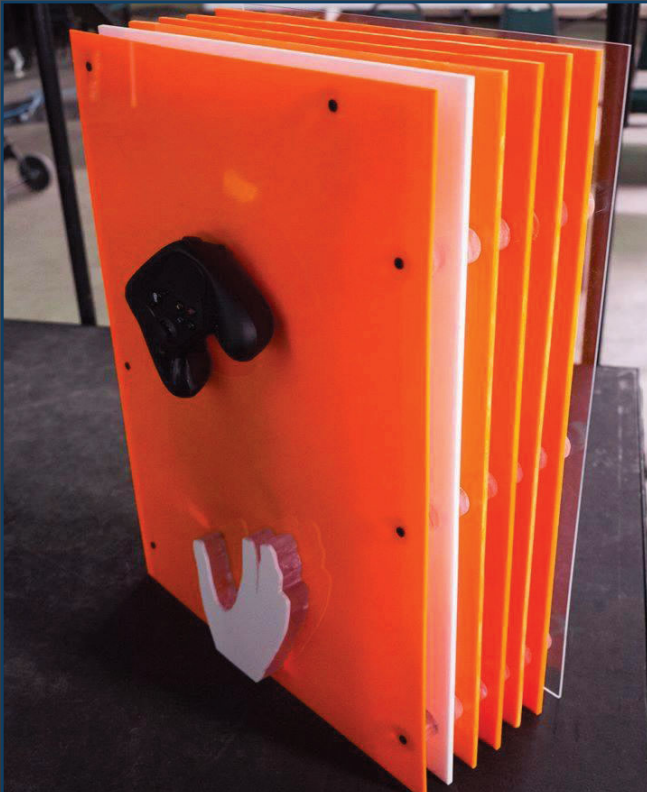
Laclede's LAN 16

This year, Laclede's LAN moved into a new room (the Wool Ballroom) at Saint Louis University, surpassing 200 seats and serving up even more awesome. Like Gamers For Giving, Laclede's LAN spanned Saturday and Sunday, March 12 and 13, and it included a full slate of tournaments and contests, including events for Counter-Strike: Global Offensive, DOTA 2, Hearthstone, League of Legends, Rocket League, Hawken, StarCraft II, SoulCalibur II, and Team Fortress 2. Pierre Laclede would have been proud.

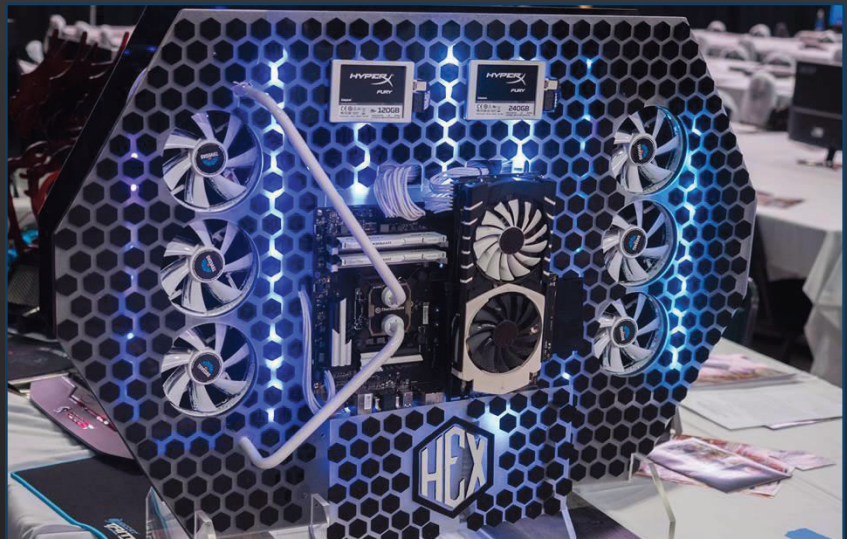
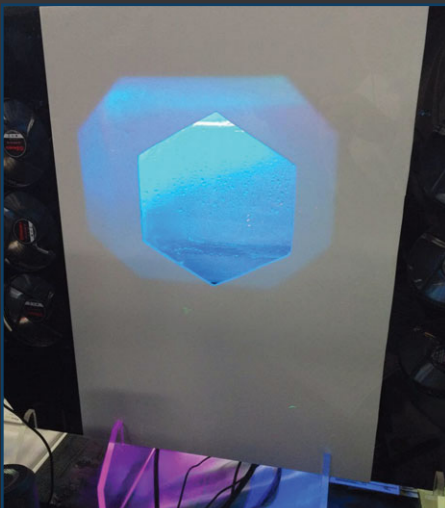


Gamers For Giving 2016

This cool event took place in Ypsilanti, Mich., at the Eastern Michigan University Convocation Center starting at 9 a.m. on Saturday, March 12 and running through 10 p.m. on Sunday, March 13. GfG is presented by Gamers Outreach Foundation, and raises an incredible amount of money for the organization's mission to put portable gaming carts (aka GO Karts) in hospitals that provide long-term care for children. This time around, the LAN raised more than \$170,000! In addition to League of Legends, StarCraft II, Counter-Strike Global Offensive, Hearthstone, Halo 5, Call of Duty Black Ops III, and Super Smash Bros., the event included keynote speakers, live streams, and of course a CPU Case Mod Contest!



Our mod contest winner was Haley Mullins with an assist from "Mad Reader Mod" alumnus James Fislar. The rig (aptly named "HEX," shown below and below left) is a custom build with components arranged along and in between custom panels standing vertically with support from two acrylic "feet."



NETWAR 30.0

LANFest NETWAR 30.0 was no April Fools' joke, although it did start on Friday, April 1 at 7 p.m. and run through 10 p.m. on Saturday, April 2. This was the second NETWAR BYOC event held at The Mark in Elkhorn (suburban Omaha), and included more than 500 paid seats and more than a dozen admins. In 27 hours, NETWAR packed in Counter-Strike: Global Offensive, Rocket League, and League of Legends tournaments as well as free-play events for CS:GO, Diablo 3, Grand Theft Auto 5, Team Fortress 2, and Unreal Tournament 2004. And because The Mark includes a laser tag facility; the LAN also hosted a laser tag tournament. CPU was on hand, and our mod contest went to James White, aka Robots_FTW.



White's Corsair Carbide Series Air 240 mod includes custom paint and custom LED lighting that White can control with a phone app. It's compact and portable yet has plenty of power.

DESERTBASH miniBASH 5

Intel wasn't using rooms 102 and 103 at its Chandler, Ariz. Fab 32 facility on Saturday, April 2, so LANFest did! This was a DESERTBASH miniBASH event, a 52-seat BYOC LAN that started at 10 a.m. and ran through 8 p.m. and raised nearly \$3,000 for Child's Play, a charity that provides toys and videogames to children in over 100 hospitals around the globe. We found a real gem in our CPU Case Mod Contest there; Taryn Ray's Balrog is an AMD FX-6300 rig in a Corsair Graphite Series 230T with an MSI 970 GAMING motherboard, and it is flat-out gorgeous. Ray sleeved the PSU cables in black and added a red cold cathode light inside to light things up and then spent a week painting the gorgeous scene depicting Gandalf's epic confrontation with the Balrog on its right-side panel.



Modder Q&A: Jeremy Birch

Assorted Thoughts On Modding, MST3K & Weyland-Yutani

Jeremy Birch, aka E.E.L. Ambience (which stands for “Experimental Electronic Linear Ambience”), is a prolific modder and a visionary artist whose work has appeared in CPU’s “Mad Reader Mod” feature on three occasions and elsewhere in the magazine on others. Birch is also a composer and musician (you can stream his work at eelambience.com), and he is a co-founder of themodzoo.com, a modding site whose staff includes the Godfather of Mod, Bill Owen.

Q: Do you remember when you modded your first case? How or why did you decide to mod it?

JB: I have some vague recollection of it; I believe it was a 386 rig. I simply cut a “blowhole” in the case (crudely, I might add) using a jigsaw and a drill, in order to get some air moving in the rig. A “function-only” mod, if you will. It was an AT server-class beige beast battleship chassis, with the slide-off sides/top (no separate side panels!). In fact, it gives me fresh nightmares thinking about those cases now.

Q: Now, of course, you have lots of projects under your belt. Our favorite E.E.L. Ambience mod is *Lumière Noire*, which was on the cover of the July 2010 issue, but we like all of ‘em. Which one is your favorite, and why?

JB: *Lumière Noire* projects are always my own personal rigs, so I’m hoping I can resurrect the name once again in the near future. Photographed projects significantly narrow down the choices, so I’d have to say CLUNK is my current favorite. Aside from LilyPC, it’s a more recent project so it’s fresh in the memory, and because the mod itself is done . . . but the project isn’t actually completed. (Cue dramatic music!)

Q: You’ve built a reputation for outstanding acrylic work. Was that an area of special interest for you, or is it just what people tend to notice in your projects?

JB: To use the vernacular, it’s kind of my shtick. Due to my “real” job as a



graphic designer, laser-tech, and commercial t-shirt printer, I simply worked what I knew into the art, and I’ve been told that my work was easier to pick out of a lineup based on that. I liked to change cases up internally, always trying to meld artistic vibe with utilitarian purpose.

A number of years back, Bill private-messaged me one day on a modding forum and commended me for my work and approached me about possibly designing new products for him. Being that I was a huge fan of his work as well—it’s Bill freakin’ Owen!—we totally hit it off. The rest is history!

Q: So you’ve been on a bit of a modding hiatus recently, working on other things. Do you have any mods that are still in progress that you need to get back to?

JB: Project Movie Sign! (a “Mystery Science Theater 3000” project) is still in dormant “working on” status, so once I’ve wrapped up an ongoing secret project I’m currently involved in I plan on revisiting that project and finishing it once and for all. Especially considering it was started as a dedication project 7 years back (!), and now the show’s officially coming back!

Q: What about projects that you had ideas for and wanted to pursue but haven’t started yet?

JB: Tons of ideas. I’ll see something just driving in to work, and think, “Hey that reminds me...” I still have a Weyland Corp/Prometheus project I’d like to get back to; something that replicates the control board on the bridge of the ship as well as some of

the outside of the ship. I'm also planning on doing something related to the 80's classic "The Last Starfighter," since that film doesn't get enough love. I'd also love to do something with RiffTrax, since it's MST3K-related and I've supported them since the beginning.

Q : Let's talk a little bit about The Mod Zoo. How did you get involved, and what's your role on the site?

JB : Bill approached me years back about designing a logo for a now-defunct modding forum called "The Mod Brothers," and a young modder by

the past six to eight years and just chill out and enjoy reading project logs and helping others with getting something done.

We also formed The Mod Zoo Official Podcast (basically what the forum was initially designed for), and it exploded! Kyle's the host, with Bill, Cheaps, and I as co-hosts, and I'm the producer/engineer/editor. The vibe could be described as zany, childish, morning whack-jack talk show idiocy, with some occasional modding talk thrown in.

Q . Now, for the most important question of all: How long 'til Project "Movie Sign!" is done?

NVIDIA. Drivers are more stable . . . I'm currently running an AMD card, too.

2) The Road Warrior or Mad Max: Fury Road?

Fury Road if I had to choose one, but this is an unfair question!

3) Acrylic or metal? (Show your work.)

Acrylic. It's where I'm comfortable at. Metal can be fun as well, but it depends on what it is. I like aluminum due to the softness and malleability of the material. I love using



A few of Jeremy's mods, from left to right: Project Lumière Noire, Project CLUNK, and Project Building Better Worlds.

the name of Kyle wanted to start a new podcast centered on modding, so the Mod Bros. Podcast was born. I jumped on as the producer. After a few years the site fell apart due to internal issues, and the podcast was ended shortly after. Immediately, Kyle and I began bugging Bill about starting something new. Bill was reluctant about starting a new forum at first, but our incessant bugging paid off. Enter The Mod Zoo.

Kyle, Bill, Cheapskate, and myself co-founded The Mod Zoo as a safe haven for budding modders and veterans alike to get away from the negative vibe that some of the big-name forums have taken on in

JB : Oh man, wishful thinking, it would be next week! I'm itching to get back to it. I started that project as a gift for my younger brother who was going into college, and to celebrate MST3K's 20th Anniversary. It's been a few years, and he's long-graduated now! I'm a bit behind on things I suppose. Can I use the phrase "fashionably late"? Nah, probably not.

Q : Alright, Jeremy, it's time for Five Quick Questions!

1) NVIDIA or AMD?

it to add new features to aluminum chassis, such as new blowholes, new mounts for rads, etc. Steel on the other hand is irritating, difficult, and takes forever to work with, kind of like the federal government.

4) Joel Hodgson or Mike Nelson?

MMMMMMike! I appreciate the sarcastic wit. Joel rocks too, even though he's severely sleepy-eyed!

5) Pancakes or waffles?

Pancakes—oh, I blew it! ■

CPU IS MOD CENTRAL

If you love great mods, *CPU* is the place for even more coverage of the latest mods, the greatest modders, and mod contest winners from all over. In these pages, you'll find modified stock cases, custom builds, and everything in between.



And if you have a mod you want to share with the world, drop us a line and let us know at madreadermod@cpumag.com.

Each month, one modder's work will show up on the cover and in the monthly "Mad Reader Mod" feature. If it's yours, you will win a cool \$1,500—and massive bragging rights.

All The Better To Frag You With

Mice & Keyboards That Up Your Game

The return to prominence of PC gaming has coincided with a renaissance of sorts for peripherals. Gamers have a wide selection of mice and keyboards to choose from that deliver impeccable accuracy and responsiveness. We're also seeing more specialization with mice and keyboards, so you can perfectly match the peripheral to your play style. Some mice, for example, are designed to suit a specific type of grip, while others let you adjust the physical shape to fit the claw, fingertip, or palm grip. Where keyboards are concerned, models with mechanical switches are a must-have for gamers due to the accuracy and longevity they bring to the table, as well as the unmistakable feedback they provide, which can take the form of a tactile bump, audible click, or resistance level, depending on the switch. This specialization means you'll need to strongly consider or how a peripheral's design might help or hinder your gameplay.

Mice Matters

Gaming mice have traditionally had an abundance of buttons, often as many as nine or ten. Buttons are no more numerous on the latest options, but mice makers have taken steps to give you more control over what the buttons can do. Many of the mice in this guide, for instance, include software that lets you assign macros (with timing intervals) or single keystrokes to almost every button on the mouse. Because gamers often switch settings for different game genres, modern gaming mice also let you save a few profiles to the onboard memory. The majority of gaming mice also include a DPI switch, so you can move among DPI settings on-the-fly. In the mouse's software, you generally have fine-grain control over the DPI sensitivity levels, as well.

All About The Switch

Cherry MX switches were the de facto standard in mechanical keyboards for years, but since the company's patent expired, the keyboard market has seen an influx of mechanical switch alternatives, such as Gateron and Kailh. Fortunately, several switch manufacturers utilize similar naming conventions to the Cherry MX switches; for example, Blue switches provide you with a tactile bump to indicate the actuation point, as well as a loud click. Blue's dual feedback is said to be preferred by those who do a lot of typing, because you'll know exactly when you've pressed a key. The feedback is also helpful in games where you must perfectly time key actuation. Brown switches deliver the same tactile bump but no acoustic feedback, which is ideal if you're in an environment where the "clicky" sound of a Blue switch might annoy those around you. Red and Black switches have neither a tactile bump nor a click sound. Rather, the linear switches offer a smooth, consistent feel with the keys actuating after a given amount of pressure is applied to the key. The linear action is ideal for games where you must repetitively press keys.

The mice and keyboards in our buyer's guide boast the latest high-end features and customization options. In each entry, we highlight the most important ways the given mouse or keyboard can enhance your gaming experience.

Zalman ZM-K700M

\$139.99

www.zalman.com

Why You'll Dig It: The ZM-K700M provides five macro keys and two profiles that can be setup directly from the keyboard with no software installation required. You can record macros in three different modes: Timing Macro, Loop Macro, and Auto Macro. The Timing Macro mode remembers the interval between each key input, ideal for games with lengthy, complex attack patterns. The Loop Macro repeats the registered keys with time interval, , while the Auto Macro rapidly and indefinitely presses the registered single key—perfect for escapes or spamming spells. Zalman installs Cherry MX Red key switches for a smooth feel (no tactile bump) that's consistent for each up/down stroke. LED effects are numerous; for instance, the keyboard can breathe (fade up and down), beat to music, illuminate a selection of your favorite keys, or light up just the pressed key, among others.

Who Should Apply: Gamers, such as those playing MMO and RTS titles, who require a variety of macro keys and the responsiveness of a mechanical keyboard.

Interface: USB/ PS/2

Switches: Mechanical (Cherry MX Red)

Backlighting: White per-key LED



GIGABYTE Force K85

\$89.99

www.gigabyte.us

Why You'll Dig It: GIGABYTE uses linear motion, Kailh Red mechanical switches in the Force K85 with an actuation distance of only 2mm for ultrafast keystrokes. The Force K85 also supports N-Key Rollover via GIGABYTE's Anti-Ghosting Matrix key switch design. The mechanical keys are rated for a 70 million key press lifespan, which is 20 million more than conventional mechanical keys, according to GIGABYTE. Vibrant, RGB LED backlighting illuminates each key, and you're able to choose from RGB's full 16.8 million color spectrum. The Force K85 features a row of quick access hotkeys to let you manage LED color, tempo, and brightness on the fly. You can also customize and save lighting effects in the GIGABYTE FORCE Configurator utility. GIGABYTE uses an island-style key layout to shield the keyboard from crumbs and spills that could permanently damage the keyboard.

Who Should Apply: Gamers looking for a mechanical keyboard with a short actuation distance and LED illumination.

Interface: USB

Switches: Mechanical (Kailh Red)

Backlighting: 16.8 million color RGB



Patriot Viper V760 RGB Mechanical Keyboard

\$99.99

www.patriotmemory.com

Why You'll Dig It: The Viper V760 features Kailh Brown mechanical switches to deliver a tactile response without being "clicky." Thus, a slight bump is the only feedback when a switch actuates, ideal for environments where noisy key presses could be problematic. We also like that Patriot includes a wrist rest that magnetically attaches to the aluminum keyboard, as it creates a secure connection and is exceptionally convenient. The keyboard's aluminum chassis is solid enough to take the beating of travel, or gamers who tend to pound keys. The Viper V760 boasts RGB (16.8 million colors) LED lighting and features 11 animation modes, and you can control the speed at which the effects happen, as well as the brightness. There are six dedicated multimedia keys and 103 macro programmable keys (all but the Windows key).

Who Should Apply: Gamers who prefer brown mechanical switches and want to customize the keyboard's backlighting.

Interface: USB

Switches: Mechanical (Kailh Brown)

Backlighting: 16.8 million colors Per-key

RGB (11 lighting modes)



Rantopad MXX Mechanical Gaming Keyboard

\$99.95

rantopadusa.com

Why You'll Dig It: The MXX Mechanical Gaming Keyboard is one of the more compact, lightweight gaming keyboards available on the market. Part of the portable size is due to the tenkeyless layout, and gamers looking for a travel keyboard will also appreciate the extremely slim frame and detachable USB cable. The MXX Mechanical Gaming Keyboard may look minimalist at first glance, but it's got a lot going on under the hood. Rantopad uses Gateron switches (available in Blue, Brown, and Red) that are known for their smooth action. The Gateron switches are also durable with a lifespan of 50 million clicks per key. Rantopad equips the MXX Mechanical Gaming Keyboard with a blue, gunmetal, or white aluminum cover for outstanding wear resistance. Top-notch performance is assured via the keyboard's N-key rollover and 1ms response time. Thanks to the monochrome LED backlight, keys are highly visible.

Who Should Apply: Gamers who want a high-performance and portable mechanical keyboard.

Interface: USB

Switches: Mechanical (Gateron Blue)

Backlighting: Monochrome LED



MSI GK-701 Mechanical GAMING Keyboard

\$106.59

us.msi.com

Why You'll Dig It: MSI's GK-701 Mechanical GAMING keyboard is built with Cherry MX Brown switches that provide a tactile bump, without any click sound, when the switch actuates. The soft Cherry MX Brown switches make this keyboard ideal for enthusiasts wanting a good middle-of-the-road option that's appropriate for both typing and gaming. MSI engineers the GK-701 Mechanical GAMING Keyboard with N-key rollover to ensure that it will register every key press. Gamers can also disable the Windows key to prevent accidental key presses from interrupting your in-progress game. Multimedia access keys are onboard, too, so you can conveniently control media playback. MSI knows that you don't replace your keyboard too often and designs the GK-701 to last. The laser-etched keys resist wear, and each key is rated for 50 million key presses. The red, individually backlit keys offer four brightness levels.

Who Should Apply: Enthusiasts who want a solid mechanical keyboard with Cherry MX Brown switches and LED backlighting.

Interface: USB

Switches: Mechanical (Cherry MX Brown)

Backlighting: Red LED, individually backlit



Bloody B740A

\$179.99

www.bloody.com

Why You'll Dig It: If you've ever felt that your keyboard doesn't react fast enough, Bloody's B740A is for you. This keyboard features infrared light sensors in each switch for a 0.2ms key response, which is around 30ms faster than mechanical switches. The keys on Bloody's B740A also actuate at 1.5mm for quicker keystrokes than a mechanical keyboard. Nearly zero input lag and short keystrokes help to ensure that you launch that ultimate ability or execute sniper shots exactly when you mean to. Bloody's design is more durable than conventional mechanical keyboards, as well, because the infrared laser sensor is extremely dust resistant. A 6mm barrier wall in each switch also prevents water damage. Eight gaming non-slip silicone keys are provided (Q, W, E, R, A, S, D, and F) that provide for additional grip and comfort on the keys you press the most.

Who Should Apply: Bloody's B740A reacts as fast as you do, so it's best for enthusiasts who want to eliminate key press lag.

Interface: USB

Switches: Infrared

Backlighting: Yes



Cooler Master MasterKeys Pro L

\$169.99

www.coolermaster.com

Why You'll Dig It: Cooler Master went back to the drawing board when designing the MasterKeys Pro L to allow for Cherry MX switches with the company's RGB housing for bright and concentrated light under the keycaps. The end result are keys awash with illumination—both on the lettering and underneath each key. Cooler Master, of course, packs RGB per key LED backlighting, so you can customize the keyboards' lighting to your build theme. There are several modes of LED operation, including color wave, breathing, and responsive effects. The MasterKeys Pro L is available in Cherry MX Brown, Blue, or Red switches. For quick macros, Cooler Master includes its MasterKeys Pro On-the-Fly System that lets you save and execute macros during a game, rather than forcing you to press ALT-TAB to open software and program the macro.

Who Should Apply: Gamers who want a mechanical keyboard with bright LEDs that's available in a variety of Cherry MX switches. We also like the easy to configure, on-the-fly macro capability.

Interface: USB

Switches: Mechanical (Cherry MX Red/Blue/Brown)

Backlighting: 16.7 million color RGB



Rantopad MT Mechanical Gaming Keyboard

\$129.95

rantopadusa.com

Why You'll Dig It: The Gateron switches found in Rantopad's MT Mechanical Gaming Keyboard feature a soft plastic stem and copper click leafs for an incredibly fluid typing experience. Rantopad offers the keyboard with either Black (no tactile or acoustic feedback) or Blue (tactile bump and click noise during actuation) Gateron switches. The former is particularly smooth, given the linear Black switch design and nearly frictionless feel of the Gateron switches. Rantopad also uses its fourth-generation simulated organic coated keycaps to add a soft feel to the keys. To ensure each and every keypress is registered, the MT Mechanical Gaming Keyboard delivers 1ms response speed and N-key rollover. Rantopad uses bright white LEDs to clearly illuminate each key.

Who Should Apply: Gamers who want a mechanical keyboard that delivers an exceptionally smooth typing experience.

Interface: USB

Switches: Mechanical (Gateron Black)

Backlighting: White LED



Bloody TL80

\$79.99

www.bloody.com

Why You'll Dig It: The TL80 uses infrared light sensors, rather than traditional metal micro switches, to create the world's fastest key response of 0.2ms. Metal micro switches generally take between 18ms to 30ms. Fractions of a second might not seem like much time, but the nearly instant response of the TL80 might just be the difference between winning and losing the frag battle. Bloody also utilizes the infrared technology on the scroll wheel. The TL80 offers five sensitivity levels with a max of 8,200dpi. Tracking speed is excellent, as well, at 150 inches per second. Last, but not least, the mouse's image processor can register 10.8 million pixels per second. It's safe to say the TL80 won't miss anything. Bloody offers six sniping modes to make it easy for you to adjust the mouse to your preferred grip and play style.

Who Should Apply: Gamers who won't settle for anything less than the best when it comes to mouse responsiveness, whether it be a button press or tracking accuracy.

Interface: USB

Sensor (DPI): Laser (up to 8,200)

Body Type: Ambidextrous



Zalman Knossos ZM-GM4

\$59.99

www.zalman.com

Why You'll Dig It: Zalman lets you customize the weight, size, and shape of the Knossos ZM-GM4. You can adjust the length and the width of the mouse to the shape of your hand using the included tuning tool, which conveniently stows away inside the mouse. To modify the ZM-GM4's heft, Zalman provides six 3.5g weights that insert into the center of the mouse's body. The Knossos ZM-GM4 also makes it easy to adjust the Avago A9800 laser sensor's DPI. There's a dedicated DPI quick switch to move among four DPI levels on-the-fly. The laser sensor features a max resolution of 8200dpi. Ten programmable buttons are spread along the top and sides of the mouse. You can program each and every button using Zalman's software. For instant response and durability, the Knossos ZM-GM4 features Omron buttons.

Who Should Apply: Enthusiasts who want to adjust the physical shape of the mouse, as well as DPI, sensitivity, button functions, and polling rate.

Interface: USB

Sensor (DPI): Laser (800 to 8,200)

Body Type: Ambidextrous



Cooler Master Xornet II

\$34.99

www.coolermaster.com

Why You'll Dig It: Cooler Master designs the Xornet II specifically for gamers that use the claw grip by shaping it in a way that prevents cramping. For example, there's an ergonomic ring finger rest and anti-slip rubber sides for your thumb to avoid finger fatigue. The Xornet II also features a lightweight design that helps to further enhance the claw grip's natural precision and movement advantages. In short, it's ready for all day FPS and RTS gaming sessions. For tracking accuracy, Cooler Master provides an Avago 3320 optical sensor, and an onboard DPI switch lets you move between the preset 500dpi, 1,250dpi, and 3,500dpi tracking resolutions. The Xornet II also includes a LOD (lift off distance) button, so you can quickly calibrate the sensor for different surface types. Overall, there are seven programmable buttons on the mouse, including two thumb buttons.

Who Should Apply: Gamers who love using the claw grip and want to adjust the mouse's tracking capabilities on-the-fly.

Interface: USB

Sensor (DPI): Optical (500 to 3,500dpi)

Body Type: Right-handed (claw grip)



MSI Interceptor DS200 GAMING Mouse

\$43.35

us.msi.com

Why You'll Dig It: MSI gives you complete control over the Interceptor DS200 GAMING Mouse. You can, for example, reprogram all of the mouse's nine buttons, and MSI lets you select from a wide selection of preset productivity (such as copy, cut, and paste), media (such as play/pause, next, and mute), and gaming functions. The Combo Key function, where you can configure the mouse to run a hotkey combination from your keyboard, is notable, as well as the Fire Key feature that allows you to manage the frequency and delay time of multi-click presses. MSI includes five profiles, so it's easy to switch among your specialized configurations. Spec-wise, the Interceptor DS200 GAMING Mouse includes everything you'd expect from a top-notch mouse, including an 8,200dpi laser sensor and a maximum frame rate of 12,800fps.

Who Should Apply: Gamers who want the ability to manage button functions, adjust sensor settings, and switch between onboard profiles for optimal mouse performance.

Interface: USB

Sensor (DPI): Laser (up to 8,200)

Body Type: Right-handed



GIGABYTE XM300

\$49.99

www.gigabyte.us

Why You'll Dig It: The XM300 is highly configurable. GIGABYTE equips it with a Pixart 3988 optical sensor that can range from 50 to 6,400dpi. You can also adjust the polling rate from 125Hz to 1,000Hz to suit your personal preference. GIGABYTE designs the mouse so that it's useable by all right-handed grip styles. Responsive left and right mouse buttons, for example, work well with claw and fingertip grips. And the mouse's 5.1-inch length makes it comfortable for palm grip users. GIGABYTE uses Omron switches with a rated lifespan of 20 million clicks. The XM300 supports a maximum acceleration of 50g and a maximum tracking speed of 200 inches per second. You can manage button settings and macros using GIGABYTE's XTREME Macro Engine utility. However you play, the XM300 can get the job done.

Who Should Apply: Gamers who want a mouse that's built to handle a wide variety of play styles. The XM300 accommodates you with a wide DPI range and is shaped to work with a variety of grips.

Interface: USB

Sensor (DPI): Optical (50 to 6,400dpi)

Body type: Right-handed



ASUS ROG Spatha

\$179.99

www.asus.com

Why You'll Dig It: ASUS' ROG Spatha is the Escalade of gaming mice. Constructed with a magnesium-alloy chassis, it sports a right-handed ergonomic grip, 12 programmable buttons, two sets of interchangeable Omron switches, an 8,200dpi laser sensor, wired or wireless operation, a wireless receiver/charging dock, a hard-sided carrying case, and triple-zone RGB lighting. It also has a dpi clutch for sniping and comes with ASUS' excellent ROG Armoury software for tweaking just about any setting you can think of, plus some you probably can't. Naturally, it also has onboard memory for storing your custom game profiles (up to five), which you can quickly select using hotkeys on the mouse body. Its two cables attach via a micro-USB port at the front of the mouse; one is a 1-meter rubber cable for everyday or travel use, and the other is a 2-meter braided number that gives you plenty of slack and looks great at home or at LAN parties.

Who Should Apply: Gamers who want the best and are unwilling to compromise on even the slightest detail where their input devices are concerned.

Interface: USB/RF 2.4GHz

Sensor (DPI): Optical (Up to 8,200)

Body Type: Right-handed (ergonomic)



Patriot Viper V560 RGB Laser Gaming Mouse

\$29.99

www.patriotmemory.com

Why You'll Dig It: Patriot's Viper utility lets you program the button functions, lift-off, and DPI; enable macros; and enable or disable angle snapping. The Viper V560 RGB Laser Gaming Mouse also features RGB lighting control for its profile settings, and you can pick from 64 profile indicator colors. You can customize the weight and feel of the mouse, as well. Patriot includes six five-gram weights that you can add to the right, left, front, or back of the mouse, depending on your preference. Two interchangeable side grips are available for the right side of the mouse. There are nine programmable buttons, and Patriot includes five onboard profiles, so you can easily switch button configurations and DPI settings for different play styles. If you require on-the-fly DPI control, there's also a DPI toggle switch on the Viper V560. The toggle switch moves among four DPI presets, and an LED indicator displays the current setting.

Who Should Apply: Gamers who want to customize the settings, weight, and profile of the mouse for ultimate precision and flexibility.

Interface: USB

Sensor (DPI): Laser (50 to 12,000dpi)

Body Type: Right-handed



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Mice	MSRP	Sensor (DPI)	Body Type	LEDs	Buttons	Macros	Onboard Memory
ASUS ROG Spatha	\$179.99	Laser (up to 8,200)	Right-handed (ergonomic)	Yes (16.8M colors)	12 programmable	Yes (5 profiles)	Yes
Bloody TL80	\$79.99	Laser Avago 9800 (up to 8,200)	Ambidextrous	No	9 programmable	Yes	Yes
Zalman Knossos ZM-GM4	\$59.99	Laser Avago 9800 (up to 8,200)	Ambidextrous	No	10 programmable	Yes (3 profiles)	Yes
GIGABYTE XM300	\$49.99	Optical Pixart 3988 (50 to 6,400)	Right-handed	Yes (16.8M colors)	8 programmable	Yes	Yes
MSI Interceptor DS200 GAMING Mouse	\$43.35	Laser (up to 8,200)	Right-handed	Yes (16.8M colors)	9 programmable	Yes (5 profiles)	Yes
Cooler Master Xornet II	\$34.99	Optical Avago 3320 (up to 3,500)	Right-handed (claw grip)	Yes (16.8M colors)	7 programmable	No	Yes
Patriot Viper V560 RGB Laser Gaming Mouse	\$29.99	Laser (up to 12,000)	Right-handed	Yes	9 programmable	Yes (5 profiles)	Yes
Keyboard	MSRP	Switch Type	Backlight	Rollover	Pass-through ports	Macros	Onboard Memory
Bloody B740A	\$179.99	Bloody Light Strike (infrared)	Yes	N-key	No	Yes (3 profiles)	Yes
Cooler Master MasterKeys Pro L	\$169.99	Cherry MX Brown, Blue, or Red	Yes (16.7 million color RGB)	N-key	No	Yes (4 profiles)	Yes
Zalman ZM-K700M	\$139.99	Cherry MX Red	Yes (white)	N-key	No	Yes (2 profiles)	Yes
Rantopad MT Mechanical Gaming Keyboard	\$129.95	Gateron Black or Blue	Yes (white)	N-key	No	No	No
MSI GK-701 Mechanical GAMING Keyboard	\$106.59	Cherry MX Brown	Yes (red)	N-key	No	No	No
Patriot Viper V760 RGB Mechanical Keyboard	\$99.99	Kailh Brown	Yes (16.8 million color RGB)	N-key	Yes (USB)	Yes (5 profiles)	Yes
Rantopad MXX Mechanical Gaming Keyboard	\$99.95	Gateron Blue or Red	Yes (monochrome)	N-key	No	No	No
GIGABYTE Force K85	\$89.99	Kailh Red	Yes (16.8 million color RGB)	N-key	No	No	Yes

Alternative Browser Brawl

What happens when you've tried Google Chrome, Internet Explorer, Microsoft Edge, Firefox, Safari, and even Opera's particular brand of porridge, but none hits the spot? Maybe they're not as secure as you'd like, play a little too fast and loose with your IP address and browsing history, load pages too slowly, don't offer enough options to tweak the look and feel, or bombard you with ads and pop-ups. Perhaps the fact that the big-name browsers are favorite targets of scammers and malware makers has you seeking out alternatives. Whatever the case may be, don't fret, there are plenty of options available that are sure to provide you with the browsing experience you're looking for. Read on for some of our favorite alternative browsers.

Vivaldi

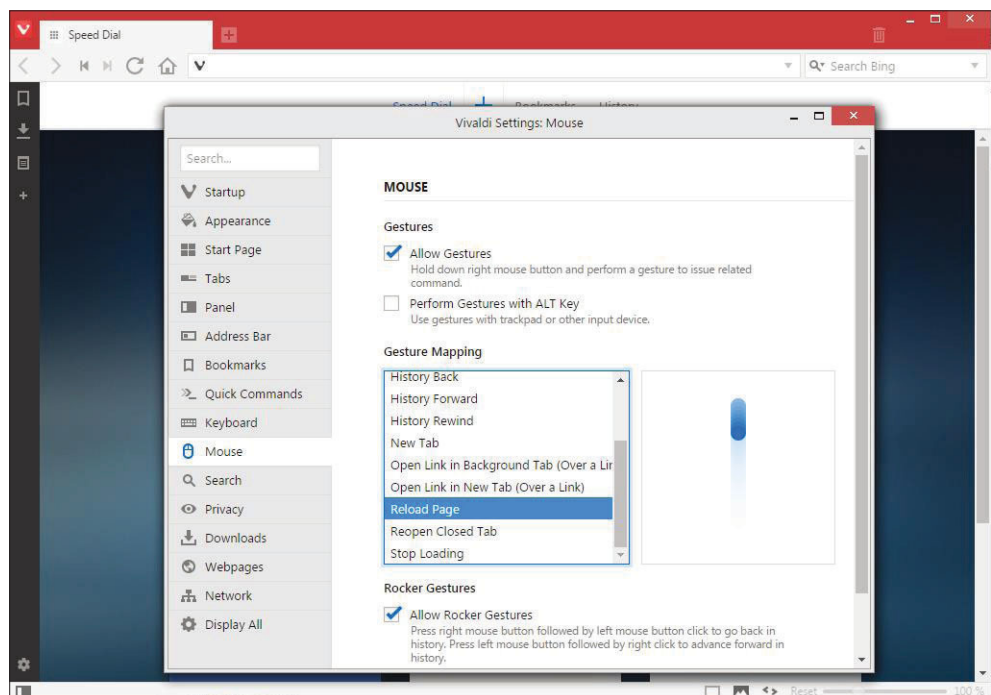
As the decidedly new kid on the block, Vivaldi (www.vivaldi.com) bills itself as a browser that's not for everybody, just you. Cheesy taglines aside, because of its focus on customization and personalization, Vivaldi seems to be making a name for itself among a crowd of technically-inclined users. But before you write it off as a here today, gone tomorrow startup, know that Vivaldi's founder, Jon Stephenson von Tetzchner, was a co-founder and the former CEO of Opera Software.

Vivaldi uses the Blink web browser engine, which is a tweaked version of Chromium, the same engine used in Chrome, Opera, and SRWare Iron. Built-in technologies include HTML5, Node.js, React.js, and numerous

modules from NPM (a JavaScript package manager).

According to von Tetzchner, the goal with Vivaldi is to replicate many of Opera 12's most popular features and

mouse gestures that let you hold down the right mouse button and move the cursor to perform actions such as opening a new tab, reloading a page, closing a tab, and more.

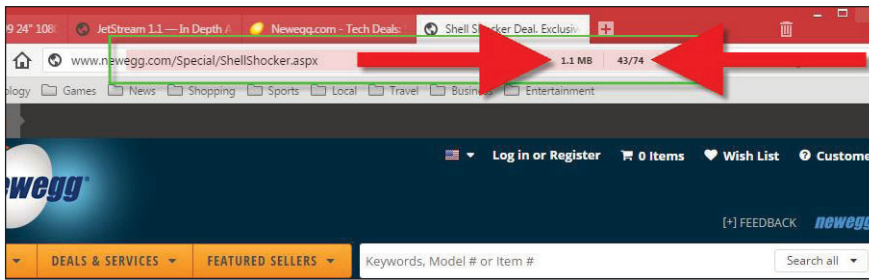


Vivaldi has a slick modern UI, and it's one of the most customizable browsers we've ever used.

add new features that cater to power users and frequent web surfers. There are several reasons you might want to give Vivaldi a try, including weekly snapshot updates, a minimalistic UI, and a color scheme that mimics the aesthetics of the current web page. Other features include support for tab stacking and tiling; webpage annotations; bookmark notes; a speed-dial feature for frequently accessed bookmarks; and quick commands that let you search bookmarks, browsing history, currently open tabs, and settings. Vivaldi also supports more than a dozen

Another point in Vivaldi's favor is the developers' push to foster an active community through forums, a blogging service, and a handful of other web services available to registered Vivaldi users.

To download Vivaldi, visit www.vivaldi.com and click Start Download. As we went to press, Vivaldi version 1.0.4345.42 was a mere 37MB download. After launching the installer, you can click Accept and Install to proceed, or click Advanced to choose your language, installation type (per user, all users, or standalone), modify the destination



Want to know how much more loading a webpage needs to do? Vivaldi tells you.

folder, and click a checkbox to set Vivaldi as the default browser.

The first thing you'll encounter after installing Vivaldi is the browser's welcome page and six appearance choices, with accents in bright red (RGB 236, 60, 60) and very dark gray (RGB 45, 45, 45). Click the Next button to get the option to determine the location of the tabs, either on the top, bottom, right, or left of the page. Click Next again to configure your start page background and then click Done when you're satisfied with your choices.

The UI is modern, and the icons are monochromatic and simple. The address bar features Forward and Back icons for navigating your browsing history. There are Fast Forward and Rewind buttons for jumping to the next page and the first page you visited at a site, respectively. The Reload button and Home button work just as you'd expect them to. Whenever you click a link, the address bar doubles as a progress bar that shrinks as the elements load, and there's a pair of counters on the right that show you how much of the page is loaded in megabytes or kilobytes, and how many items of the total number have loaded. Vivaldi is one of the fastest browsers we tested (read more in "The Benchmarks" sidebar below), so you have to be quick to notice this feature.

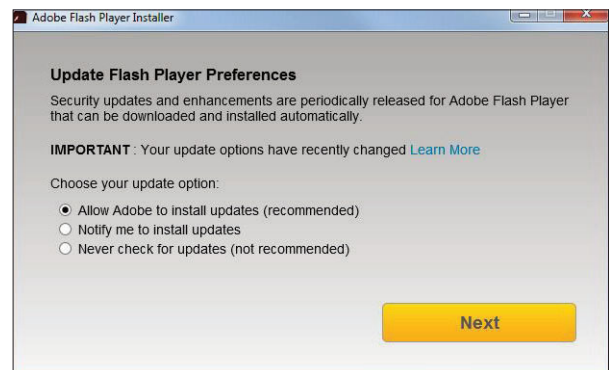
To access the settings, click the Gear icon from the bottom left of the screen. The left side of the Vivaldi browser window features a side panel where you'll go to find the bookmarks, downloads, and notes that let you jot down some text pertaining to the particular page. You

can also highlight any text on a webpage and right-click it and click Add Selection As New Note. By pressing F2, you can tap into Vivaldi's quick commands; just start typing the task you'd like to execute, and the list will narrow your results until you find what you're looking for. This menu also displays a list of every open tab and all the keyboard shortcuts Vivaldi supports. Click the trash can in the upper right to see your recently closed tabs or blocked pop-ups, with a convenient Clear All option at the bottom of the list. Another feature we like is the ability to grab a tab and drag it over another to pair them together under a single tab. You can also view tab stacks side-by-side by right-clicking the stacked tab and clicking Tile Tab Stack.

Although several features were not yet available in the build version we tested, Vivaldi Technologies has plans to launch an extension platform, native email client, and a service called Vivaldi Sync that lets users synchronize bookmarks, history, passwords, and settings across multiple computers. You can use the Chrome Web store to try extensions built for that browser (which shares Vivaldi's framework), so the lack of dedicated extensions shouldn't turn you away. Overall, Vivaldi's first public release comes off feeling very polished, and we love how customizable and user-friendly it is.

SRWare Iron

Germany-based SRWare released its first version of SRWare Iron (www.srware.net/en) in 2008, and it too uses a Chromium and Blink-based engine. SRWare distinguishes itself from Chrome and other Chromium-based browsers in its more privacy-aware approach to the user's searches and overall online identity. For instance, Chrome reports back unique identifying numbers for installation and promotions upon first install and run and reports back encoded information telling Google when and where Chrome was downloaded, plus the Google Updater service consumes resources in the background whenever you launch Chrome. There are a handful of other features that you can disable in Chrome to make it less nosy, but SRWare Iron ships with these features disabled by default, including reporting of URLs, text input into the address



SRWare Iron lets you decide whether or not to kick Adobe Flash Player to the curb.

bar, false addresses, and crashes or error message details.

Privacy advocacy isn't the only trick up SRWare's sleeve; the company also disabled DNS pre-caching in its browser, which could help thwart spammers. According to SRWare, the browser features a built-in ad blocker. In practice, we couldn't figure out a way to enable ad blocking from SRWare Iron without simply installing the Adblock Plus extension. That being said, Adblock Plus is very good at what it does.

The Benchmarks

We know that the look, feel, and features alone aren't compelling enough to convince you to give your old browser the heave-ho. For many of us, the web browser is our most-used utility, and raw performance plays a major role in the decision about which browser to use.

To break down how these alternative browsers perform compared to the old standbys, we used a pair of web-based benchmarks from www.browserbench.org designed to test the latency and throughput of various online workloads, applications, and tasks. The first one, Speedometer, attempts to rate web application responsiveness using a to-do list web utility called TodoMVC to simulate a typical modern browser workload. Its score is displayed in runs per minute, and a higher score is better. JetStream version 1.1 utilizes 39 JavaScript workloads that are commonly used by advanced users and programmers alike. The score is a geometric mean of the individual test results, and again, a higher number is better.

We ran the two tests on a mid-range laptop running Windows 7 wired to our corporate network (typically ~580Mbps down and ~600Mbps up), and again on a high-end PC running Windows 10 and connected to a wireless network (typically ~200Mbps down and ~200Mbps up). You can see the results in the charts on the right.

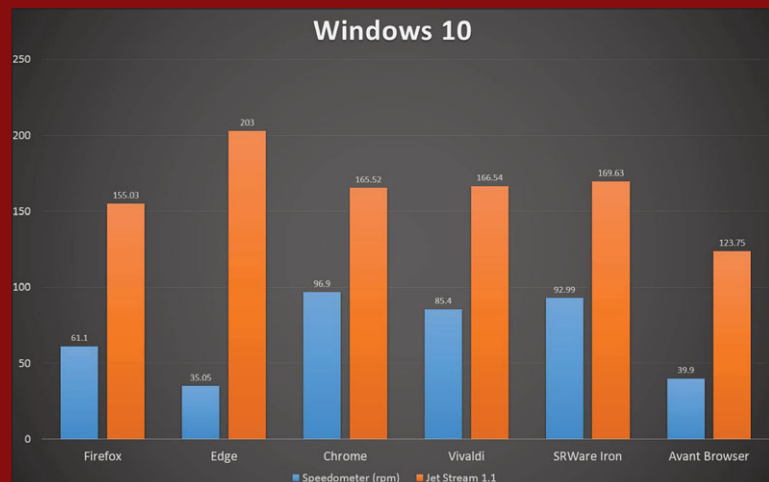
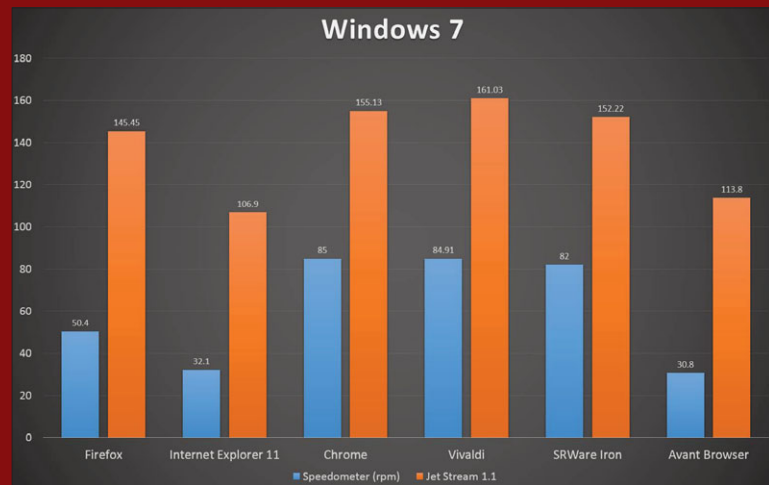
Our Windows 10 test system gave us some interesting results. Microsoft's Edge browser scored the best result in JetStream but the worst in Speedometer. SRWare Iron, Vivaldi, and Chrome's JetStream scores were all within the margin of error, with Speedometer scores in about the same range. Vivaldi and SRWare Iron, which are both Chromium-based browsers, had Speedometer results that were very close to Chrome's. The Avant Browser (using IE's Trident engine) was even slower than Firefox; however, things change dramatically with the engine being used. This browser scored 87.2 in Speedometer and 164.45 in JetStream when we swapped in the Chrome engine.

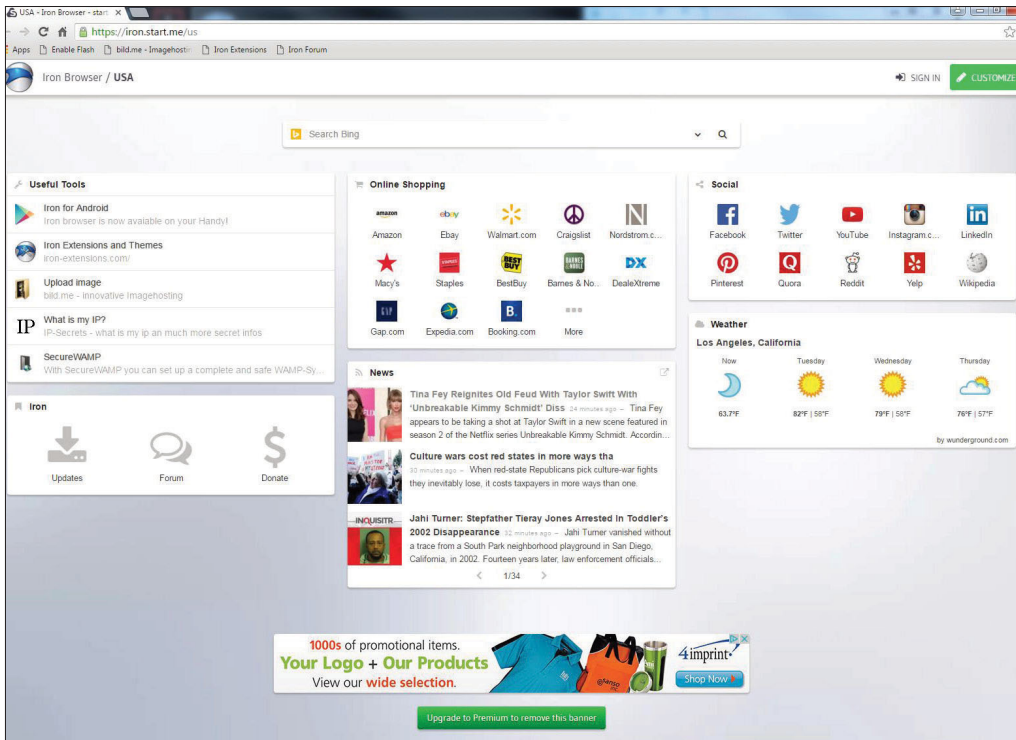
In Windows 7, Chrome, Vivaldi, and SRWare Iron all achieved similar scores. Here, Firefox outperformed the aging Internet Explorer 11, and Avant Browser's score lagged behind the rest of the alternative browsers we tested when running the IE engine, but it narrowed the gap significantly when using the Chrome engine.

In short, performance should not be an issue when opting to try one of these off-the-beaten-path browsers.



We used JetStream 1.1 and Speedometer to gauge browser performance.





SRWare Iron relies on a third-party solution for its start page, bookmarks, and RSS feed management.

Those with a penchant for tweaking their browsers will appreciate the fact that SRWare Iron's user agent can be modified from the UA.ini document. If you're a fan of preview thumbnails, SRWare Iron's support for up to 12 thumbnails beats Chrome's ability to just display eight thumbnails.

To download the browser, visit bit.ly/1euCIaW and click the Download hyperlink. The latest version available as we went to press was 49.0.2600.0, with a release date of March 20. The file is 46.7MB in size and, during the install, you can opt to have Adobe Flash Player installed or uncheck the box to prevent it from installing.

The Iron Browser home page features a series of boxes that contain items such as recent news, weather, social media, online shopping, and bookmarks for Iron-specific links as well as a Useful Tools box that is little more than a glorified advertisement for SRWare's other offerings.

The start page is hosted by Start.me, which lets you create an account and

sign in to configure and manage bookmarks, news feeds, and the browser's home page. It supports thousands of widgets you can use to tap into various web services and other data sources. There's also a banner ad that appears at the bottom of the iron.start.me page that you can disable if you upgrade to Premium. If you were wondering: Yes, the Adblock Plus extension does prevent Start.me ads from appearing.

SRWare Iron's interface is nearly identical to Chrome's, so if you've used Google's browser, you'll feel right at home. There was one strange phenomenon we encountered. Every time we navigated to our Gmail account, SRWare Iron automatically opened a new compose mail window. We even edited the URL in the bookmark, but the strange behavior persisted. Although annoying, this wasn't a deal breaker, especially considering how much we like the fact that this browser looks and acts like Chrome, just without all of the phoning home and search snooping

that Google's browser does out of the box.

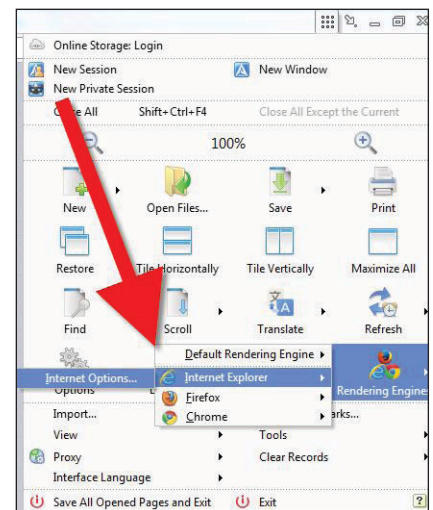
Avant Browser

If you want to get away from Chromium, there aren't a whole lot of feature-rich options. Avant Browser (www.avantbrowser.com), from Chinese programmer Anderson Che, was initially launched in 2004. It uses a unique "tri-core" rendering, or layout, engine, which supports Trident (Internet Explorer's engine), Gecko (Mozilla Firefox's engine), and WebKit (a fork of which is used in Chrome).

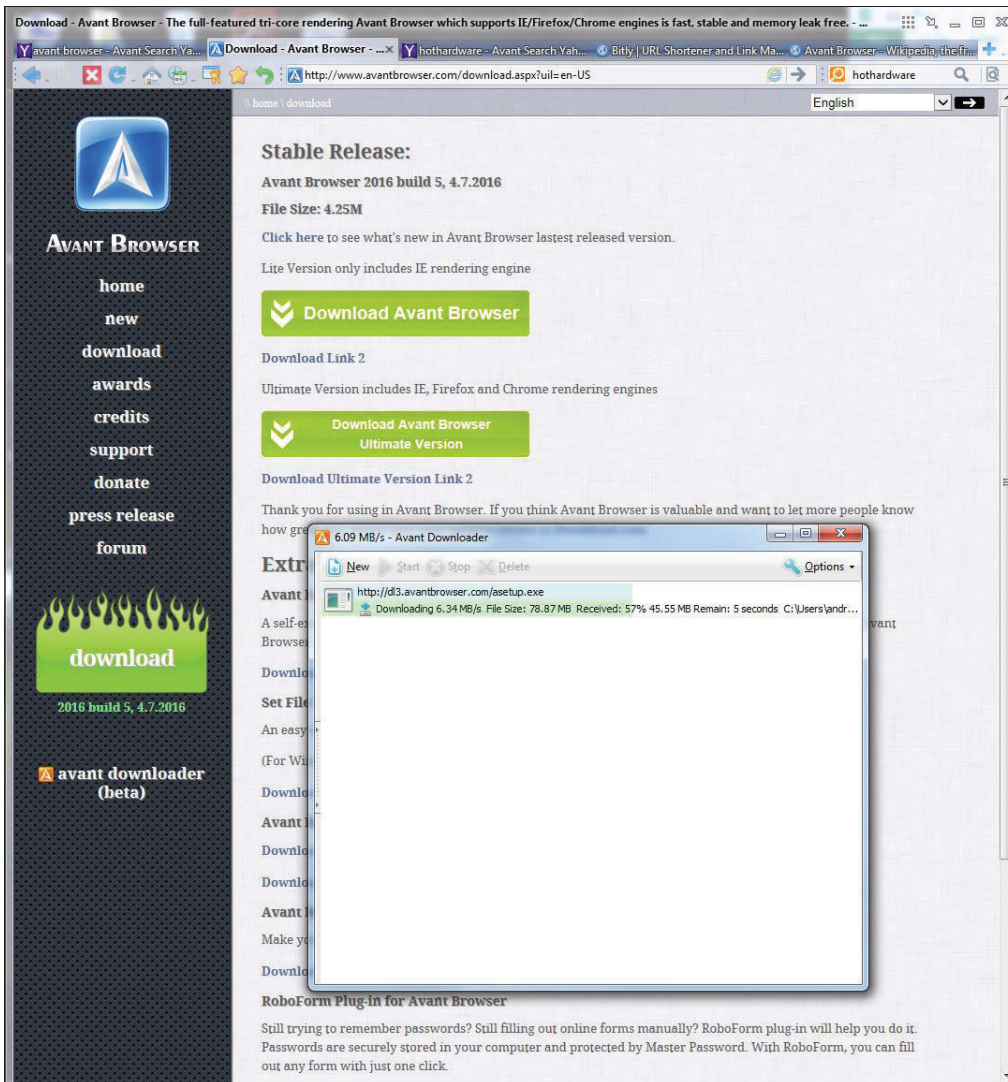
Whenever you're looking for an alternative browser, or any piece of software for that matter, regular updates and responsive support are paramount. Thankfully, Anderson Che's Avant Force

appears to be releasing regular updates to the browser. There were 10 updates released in 2015, and three so far this year, the latest of which arrived just a couple weeks before we went to press.

To download Avant Browser, visit bit.ly/1U5wV3n, where you'll find a pair



Switching the layout engine in Avant Browser is incredibly easy.



Avant Browser's three-engines-in-one feature can't be beat; the Ultimate version is a 78.8MB download.

of download links: one for the standard version and another for Avant Browser Ultimate. If the prospect of being able to swap the layout engine on-the-fly interests you, click the latter, then download and install it. Avant Browser Ultimate is a 78.8MB download, and the standard version (which relies only on the Trident engine) weighs in at a mere 4.25MB.

The browser's UI, icons, and visuals all look decidedly old-school compared to SRWare Iron and Vivaldi. By default, the Avant Browser uses the Internet Explorer-based Trident layout engine. To change the engine,

you can click the dial pad-looking icon from the top right, click Rendering Engine, Default Rendering Engine, and then choose IE Compatible, IE11 Standards, Firefox, or Chrome. If you want to swap engines more quickly, click the icon on the right of the address bar and reload the page you're currently viewing.

In addition to its tri-core rendering engine, Avant Browser supports a host of useful features. There are built-in ad and pop-up blockers, support for multiprocessing to ensure that if one tab crashes you won't lose the rest of your browsing session, a video sniffer

to detect videos and let you download them for offline browsing, an integrated multi-threaded downloader, support for viewing two sites in a single window via Avant Browser's split view, the ability to detach a tab and set it above all other windows, a private browsing mode to keep your history hidden, an auto-fill feature that streamlines website logins, an online service that syncs your bookmark settings across multiple computers, mouse gestures, a full-screen mode that auto-hides everything but the webpage (press F11), and a full desktop mode that hides everything but the webpage and the taskbar (press F12). Avant Browser also supports a flash animation filter and options for blocking image, video, sound, and ActiveX component downloads; an RSS reader; and an MDI (multi-document interface) that lets you browse several sites on your screen at once.

As if all of that weren't enough, power users will appreciate Avant Browser's comparatively low CPU

usage. The browser also efficiently handles memory by flushing objects stored there when the associated tab is closed, letting you kill memory-leaking tabs and get on with your browsing session.

Another nice feature was that whenever you go to close the browser, it displays a window with checkboxes that let you erase all browsing history or retain the opened tabs. The built-in ad blocker wasn't as comprehensive as others we've used, but it did catch most of the ads, particularly the most obtrusive ones that tend to disrupt your browsing experience. ■

Upgrades That'll Keep You Humming Along

How's your network looking? That's the question the bulk of our applications ask this month. We're featuring updates for a trio of network-monitoring programs, as well as a cool web browser based on Mozilla Firefox and a PDF editor. In this month's Driver Bay, AMD Radeon cards receive a virtual update.

SOFTWARE UPDATES

8pecxstudios Cyberfox 46.0

We have no shortage of web browsers based on Firefox, each one boasting a different look and/or specialization. Cyberfox's claim to fame is that separate, optimized versions of the browser are available for Intel- and AMD-based systems. The headlining feature of version 46.0 is a plugin whitelist, but the update makes many small changes and improvements, as well. For example, the update shuffles around the location of a few add-ons and removes a couple of UI redundancies. Developer 8pecxstudios also makes several changes to the browser's installer.

<https://cyberfox.8pecxstudios.com>

10-Strike Software Bandwidth Monitor 3.4

"Bandwidth Monitor" sells 10-Strike's capable software short, as the program does much more than tell you which computers are gobbling up how much bandwidth. With version 3.4, 10-Strike improves the IP address filtering algorithm for the software's "Do Not Count Local Traffic" function. It also corrects a bug related to sending SMS messages.

www.10-strike.com

BlackFog Privacy 1.1.0

Most of us have a decent handle on keeping malware nasties from coming in, but what about the data on your computer going out? Do you know where it's going, and who's looking at it? If you've been less than vigilant

about your outbound data, BlackFog can help. It clues you in on which programs are sending what data where, thwarts applications' attempts to profile your behavior, and more. Version 1.1.0 makes a few tweaks to the application's window behavior and adds Dashboard links to Facebook, Twitter, and Google. The previous version, 1.0.6, introduced a handful of performance improvements, such as better memory management during periods of high traffic volume.

www.blackfog.com

Burnaware PDF Shaper 5.2

When it comes to creating and editing PDFs, Adobe Acrobat Pro is great, but with a price tag of \$299, it definitely puts the "gold" in "gold standard." Burnaware's PDF Shaper is a wee bit cheaper but is nonetheless brimming with features. The current version adds a new feature, PDF-to-RTF conversion, and introduces a bunch of improvements. There are logging enhancements (logs now display security info and error codes), an updated and improved UI, and upgrades to the Crop and Watermark tools. Along the way, Burnaware squashes a few bugs, as well.

www.pdfshaper.com

SterJo Software Password Unmask 1.1

Password recovery isn't typically a problem for websites that require a login, but what about apps that don't have a recovery tool? In the latter situation, let Password Unmask take a swing at it. According to SterJo Software,

Password Unmask works with programs like CuteFTP, Microsoft Outlook, and a host of other email clients. The latest update includes multi-language support and introduces support for the following mail services: Mail.ru, ProtonMail, MuchoMail, Rediffmail, and Hushmail.

www.sterjosoft.com

Tenable Network Security Nessus Home 6.6.2

Admittedly more of an IT product, Nessus Home nonetheless gives your network enterprise-grade monitoring, keeping an eye out for vulnerabilities and potential malware threats. Although version 6.6.2 is the newest, and makes a handful of bugfixes (including one that could cause CPU utilization to skyrocket to 100% on an OS X system), version 6.6.0, released in early May, is the big one. Nessus Cloud's UI has been reworked, and now Nessus can sniff out malware on the filesystem. Version 6.6.0 also upgrades Nessus certificates to SHA-256 and fixes even more bugs.

www.tenable.com

DRIVER BAY

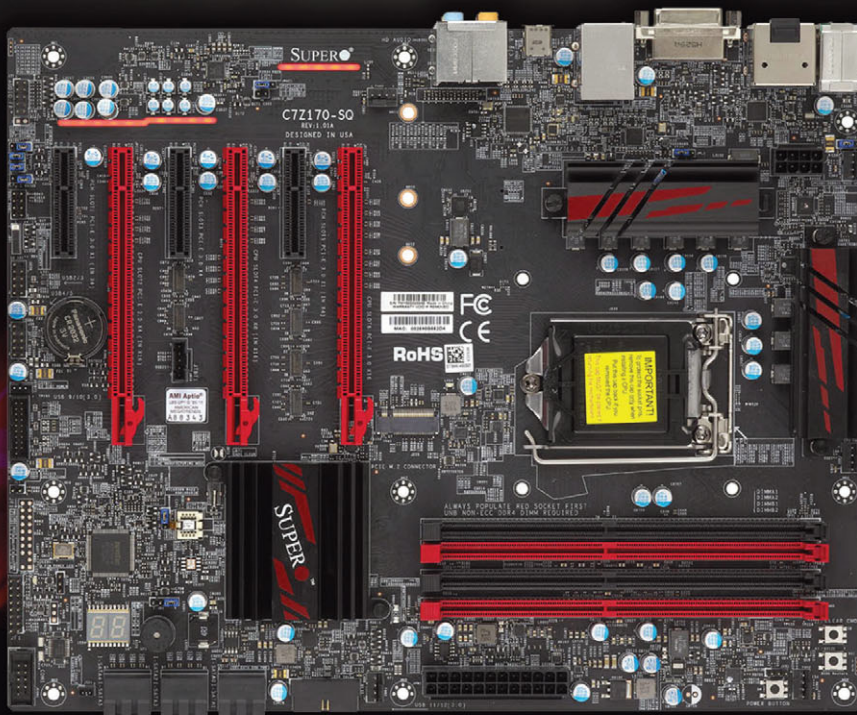
AMD Radeon Software Crimson Edition 16.15.211

Virtual reality is the focus of this driver update for AMD R9 Fury, R9 300, and R7 300 Series graphics cards. The new driver adds support for Oculus Rift SDK 1.3 and HTC Vive. Hitman fans will be glad to know that the update also includes new CrossFire profiles for the game.

support.amd.com

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Server Quality, Built for Gaming



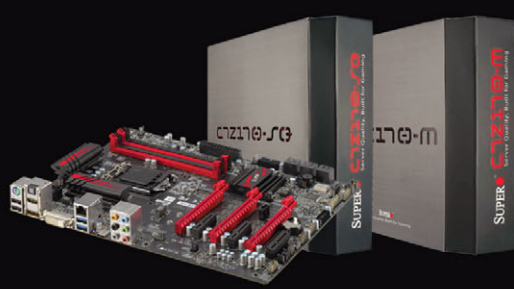
Leveraging server-grade designs and components to deliver industry leading durability, stability and performance

Designed for extreme gamers who crave the highest performance

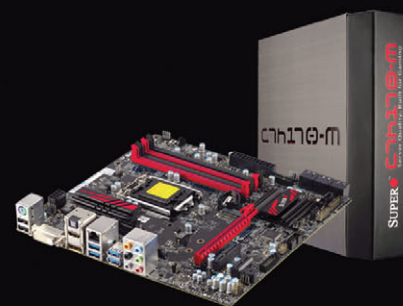
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On Your Digital Death

Why You Should Be Planning Your Digital Estate Now

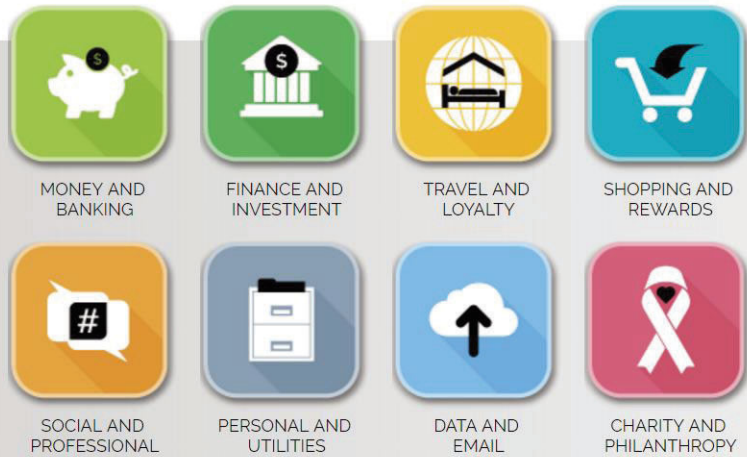
Lee Poskanzer started Directive Communication Systems after experiencing something many of us also have experienced: running across a deceased friend's presence on a social network. For Poskanzer, it was LinkedIn. "They wanted me to congratulate him on an anniversary," he says. "I was blown away because it was several months later and his profile was still out there." Poskanzer was also bothered at the idea of someone who got the same notice actually calling his friend's home, only for his daughter to answer and have to explain about her father.

Similarly, Joe Henderson founded Estate Map after losing his mother. He realized if he suddenly died, his wife and kids probably couldn't track down his online accounts, let alone access important information inside them. "That doesn't even scratch the surface of the number of keys, title certificates, funeral plans, etc. that they'd have trouble identifying," Henderson says. All of us can and should do better, he says, "if we want to keep our kids and spouses from suffering any more than they already will in the event of a sudden death or incapacity."

We're all amassing online accounts and digital assets—including email, social networks, bank accounts and financial records, music libraries, family photos, blogs, and even gaming currency—at a steady clip. This will only increase. Already, those in younger generations live entirely digital lifestyles free of paper receipts, bills, bank statements, photos, communication, and more. Just like physical assets, digital assets have real financial worth, immeasurable sentimental value, or both.

What happens to these digital assets, though, if we die, and how easily could our family, friends, estate planner, and others find, access, and appropriately deal

A single source for account organization



Numerous online services offer tools to help organize, create, and manage digital assets and online accounts in relation to estate planning. Directive Communication Systems, for example, helps users put final wishes for their accounts into action after they die.

The screenshot shows the Planned Departure website. At the top, there are links for "Sign Up for free" and "Login". The main content is divided into two sections: "THE OLD WAY" and "THE NEW WAY". "THE OLD WAY" is described as "Makes difficult time more stressful" and shows a complex, tangled web of icons representing various digital assets like social media, email, and banking. "THE NEW WAY" is described as "Hundreds fewer things to worry about" and shows a simple flowchart where a user or their loved ones can provide information to the service, which then ensures the right information is passed on at the right time. Below this, there is a "GET STARTED FOR FREE" button and a "START PLANNING" button. At the bottom, there are two sections: "WHAT WE OFFER" with icons for "Convenience - Access to critical information" and "Assurance - information will never be lost".

Failing to create a digital assets inventory can add stress for loved ones already grieving. Services such as Planned Departure aim to ease the process by securely storing inventories and passing them on to designated parties after death.

with them? If you're like many, you don't know the answers, which makes sense considering data shows that a majority of us never even create a will.

Unless you take preventive measures, passwords, encryption, terms-of-service agreements, state and federal laws, and other factors could make access to your accounts by your family anything from very difficult to impossible. Just consider how many online accounts you have that only you know about. If you're age 25 or younger, chances are you have many more than those who are older.

"When you're around, everything is just a few clicks away, but when you're gone, all the information could stay locked in the online world because there's no paper trail," says Komal Joshi, CEO of Planned Departure. This is one reason Joshi and others are increasingly touting the importance of incorporating an inventory of your digital assets, complete with usernames, passwords, and instructions for dealing with the assets after you die, into estate plans. If you don't do this, it's possible cybercriminals could steal your identity and open credit cards, bank accounts, and more.

Certainly, few people like to think about death or plan for it. Our increasingly digital lifestyles, however, mandate it. At the least, experts in estate planning and operators of online services specializing in this area highly recommend we all create a detailed inventory of our digital assets and the accounts they're in so that we can save our families some additional pain if we should die.

Identifying Digital Assets

Historically, someone who died left a paper trail of statements and records behind that others could use to track down important information to deal with the estate. As Poskanzer says, the Internet brought "more anonymity, more accounts, and more migration to living digital lifestyles." Today, many of us get e-statements sent to our email accounts that family members may not know about or access if they did. "If we don't keep an inventory of our online and digital

Save Your Loved Ones Unneeded Anguish

Death doesn't top most people's list of subjects to plan for. Neglecting to do so, though, can put more anguish and hardship on those already mourning your death by making it impossible for them to identify and/or access your digital accounts. Organizing digital assets/accounts isn't easy, but numerous resources can help. The Digital Passing blog, for example, has a free audit template to start with. Such services as Planned Departure, Estate Map, The Digital Beyond, and Directive Communication Systems also offer help. Generally, experts recommend you:

- Create an inventory of your online accounts and digital assets, along with usernames/passwords.
- Detail how you want each account/digital asset dealt with after you die.
- Securely store the inventory; some services do this and pass inventories to the appropriate parties upon your death.
- Communicate your wishes to your beneficiaries, attorney, estate executor, and others.
- Review online providers' terms of service.
- Incorporate your digital asset inventory into your will and clearly grant authorized access to your digital accounts.
- Back up cloud-stored data to a local drive.

My Digital Audit:
Passwords, Online Accounts, & Digital Property
© 2015 James D. Lamm

Voicemail & Home Security Systems

Name: _____

Home address: _____

Telephone #: _____

Voicemail # & password: _____

Security company & phone #: _____

Security system password: _____

Vacation home address: _____

Telephone #: _____

Voicemail # & password: _____

Security company & phone #: _____

Security system password: _____

Business address: _____

Telephone #: _____

Voicemail # & password: _____

Personal cell phone # & password: _____

Voicemail # & password: _____

Business cell phone # & password: _____

Voicemail # & password: _____

At a minimum, experts recommend creating an inventory of digital assets/online accounts, along with usernames and passwords for each and detailed instructions for how to handle the accounts after death. The Digital Passing blog offers a free audit tool to get started.

accounts, those get masked very easily and get forgotten about," he says.

Evan Carroll, an author, speaker, and founder of The Digital Beyond, says the digital accounts we're increasingly using for communicating, receiving

transactions, and storing personal memories could very well have value to others. Having your digital asset inventory gives your heirs a road map to find that digital property, he says. Further, incorporating these assets into a

will can provide an estate executor some legal authority to access, control, and discontinue accounts if desired.

Joshi puts digital assets into four main groups: those with financial value (banking, investment, online shopping, and other accounts; digital wallets; and virtual currency), social value (social network accounts, videogame accounts that may contain in-game purchases,

blogs, and online communication), personal value (domain names, intellectual property, copyrighted digital materials; registered trademarks; patents; media; and email, online storage, and photo-sharing accounts), and loyalty rewards (airline, hotel, rental car, and travel planning sites).

“Some folks may think ‘big whoop, so my kids can’t access my Facebook if I die unexpectedly,’” Henderson says. “But we’re not only talking about Facebook.” He points to estimates that 25% of life insurance policies go unclaimed and that state and federal governments are sitting on nearly \$60 billion in unclaimed property—money lost because “nobody knew where to look.” Carroll, meanwhile, cites a 2013 Harris poll that found 93% of Americans with digital assets don’t know or are misinformed about what will happen to them after they die, while Poskanzer points to research indicating the number of fraudulent tax returns filed on behalf of dead people has tripled in recent years.

“The more accounts we have online and don’t close when we need them closed, the more opportunity there is for that theft,” Poskanzer says. Succinctly, Henderson says “times have changed” and “the methods and places we store information and financial and personal assets has changed.”

The ways states are dealing with digital assets and account access from a legal sense are also increasingly changing. Almost universally, experts agree that to date, federal and state laws covering this area need updating. Henderson, an estate planning attorney, also believes most legal practitioners are “woefully lacking in the technical chops to figure out solutions”—something that has birthed a crop of services, including Estate Map, that provide users tools and services concerning digital asset inventories and estate planning and execution.

The Law Of The Land

Jim Lamm is a legal practitioner who possesses technical chops. He’s been an estate attorney for 18 years but has also

built and repaired computers for more than 33. Notably, he’s also a pioneer in this area where writing and speaking about how digital assets and estate planning from a legal sense is concerned. “These two worlds of mine collided when I had a client pass away,” he says.

Typically, estate executors ask a family to gather the deceased’s papers and watch the mail for others coming in. Lamm’s client left few paper records behind but did have several computers, including one password-protected. “We figured he was probably getting a lot of his bills and statements by email, which is exactly what happened,” Lamm says. Bypassing the password revealed the client was storing his financials in a software program. “I had never had that happen in an estate, and neither had any of my colleagues,” he says. “I thought this would be an interesting thing to write about because I knew both sides of the equation—the computer and the law.”

Lamm has worked over the years to update state and federal laws that make it difficult to legally access a deceased person’s digital accounts. The difficulty in doing so stems partially from online providers’ terms of service, he says. Creating a Yahoo! email account, for example, means agreeing to Yahoo!’s ToS, which Lamm equates to signing an enforceable contract. “What shocks people is what’s in there,” he says, which is essentially the ToS explicitly calling out death as ending the agreement and ending the account owner’s right to get his data back. “Imagine what people would say if their bank told them that ‘when you die, we get to keep your cash and your savings account.’ Something isn’t right with that,” Lamm says. “At least I have a negative reaction to that.”

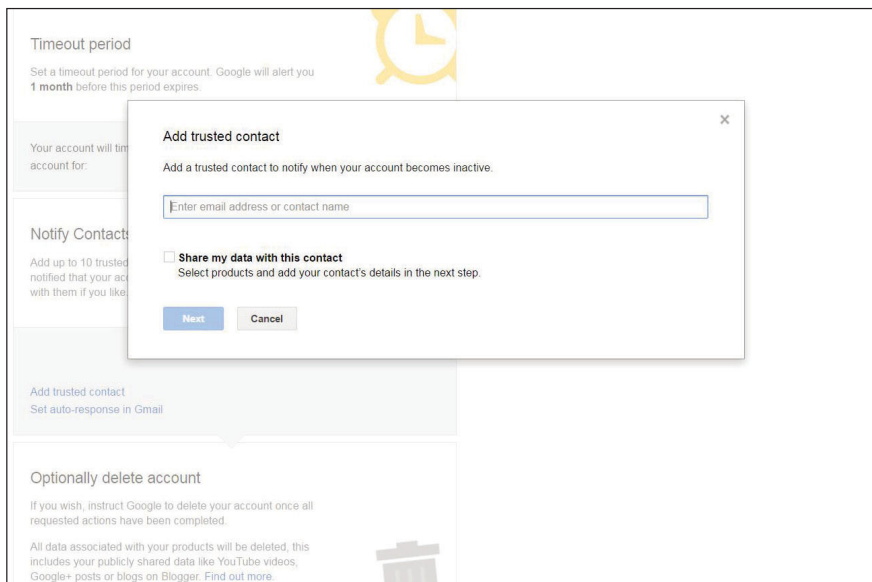
Tim Hewson, CEO of USLegalWills.com, says the crux of the problem concerns third parties gaining authorized access to online accounts. Unlike traditional assets where an estate goes through probate, an executor is appointed, and he can use a court-stamped document to get a bank to release assets, Hewson says, most online

The Special Case Of Digital Music

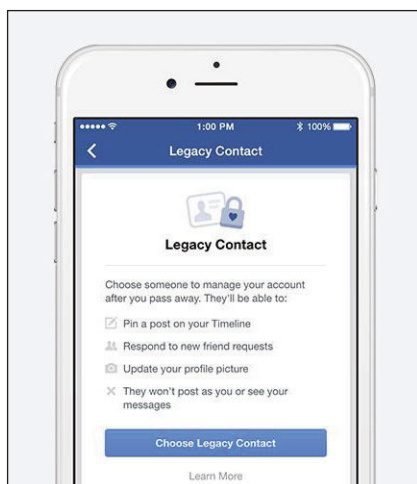
If you’re like other modern shoppers, you’ve amassed a library of digital music, movies, and books you’d like to leave to someone after you die. It might surprise you that doing so isn’t as simple as making your wishes known. As various sources point out, this is primarily because when you buy a copyrighted digital movie or song from, say, Apple or Amazon.com, you’re really buying a license to watch the movie or listen to the song.

“Can I leave my iTunes books, movies, and music to my kids when I die?” is actually one of the most common questions Jim Lamm, an estate attorney, hears. The topic is tricky, he says. “Federal copyright law is probably the biggest obstacle,” he says. That’s because digital music, and copyrighted digital music in particular, is treated differently than a purchased physical CD, LP, or cassette. “If I purchase an album on a CD, I’m buying the plastic disc with the music on it,” he says.

While you sell, pawn, give away, or otherwise transmit that physical media, selling or leaving a digital download is different because it can violate an online retailer’s EULA and federal copyright law, Lamm says. “And that actually comes out of the courts,” he adds. “So unless they make some changes to the law, copyright law is the big barrier in leaving iTunes and other digital music and books and movies at death.”



Some online providers offer options for how to deal with an account after death. Google's Inactive Account Manager, for example, lets users add trusted contacts who can access the account holder's account and data after she dies.



Facebook lets users designate a legacy contact for their accounts. If an account owner dies, Facebook can memorialize the account if desired and the legacy contact can maintain it in certain ways. The contact can't, however, log in to the account as the owner or view private messages shared with others.

services aren't experienced in dealing with probate administration. Further, he says, "it's not even clear whether a Pinterest account, for example, falls under the control of an estate administrator. What official documentation would give

somebody the authority to control a digital asset?"

Worth noting is that different online providers have different approaches to dealing with this topic. Google offers an Inactive Account Manager feature that Lamm describes as a "transfer death beneficiary designation," meaning an account owner can authorize someone to download his data after he dies or becomes incapacitated. Facebook has a Legacy Contact feature where the deceased's account is "memorialized," or converted to a "place for friends and family to gather and share memories," and the Legacy Contact can write a final message on his behalf, respond to new friend requests, update the profile photo/cover photo, and more.

What the Legacy Contact can't do is log into the account as the owner; remove friends, posts, and photos the deceased shared; or read messages the deceased shared with others. Lamm says a provision in Facebook's ToS basically states "you won't share your password or let anyone log in to your account." Thus, even if you leave your password to your spouse, using it to log in to your account could trigger federal privacy laws.

Ben Orzeske, chief counsel for the Uniform Law Commission, specifically cites the ECPA (Electronic Communications Privacy Act) of 1986 as restricting companies that handle electronic communications such as email and texts from releasing content in private messages to third parties unless the sender or the recipient consents. "Even for accounts that don't involve electronic communications, the provider may be worried about the additional costs involved with granting access and with verifying the credentials of persons claiming to be fiduciaries," he says.

The ECPA, Orzeske says, only deals with privacy issues, not the transfer of digital property after the owner's death or control of digital property if the owner becomes incapacitated. "Those issues have always been left to the states," he says. "Initially, states didn't enact laws dealing with digital property because most parties assumed digital property would be treated like any other property." Only after disputes arose between fiduciaries and online companies was it apparent new state laws specifically addressing digital assets were needed. "We're just starting to see widespread adoption of the new uniform state law governing fiduciary access to digital assets," he says.

That law is called RUFADAA (Revised Uniform Fiduciary Access to Digital Assets Act). By year's end, Orzeske expects 20-plus states will adopt a version of it, with likely all states doing so in coming years. Lamm was instrumental in writing the original UFADAA version. "I've worked on it since day 1. Helped write it. Helped revise it," he says.

Initially, the UFADAA had good traction with tech companies, Lamm says. Eventually, the companies lobbied against the law, he says, a core issue being if an authorized executor should be able to access digital property just like traditional assets. "The answer to me should be absolutely. It's just property," he says. The tech companies said "that's nice under state law but seems sideways" with federal laws dealing with service providers

Whom Should You Trust?

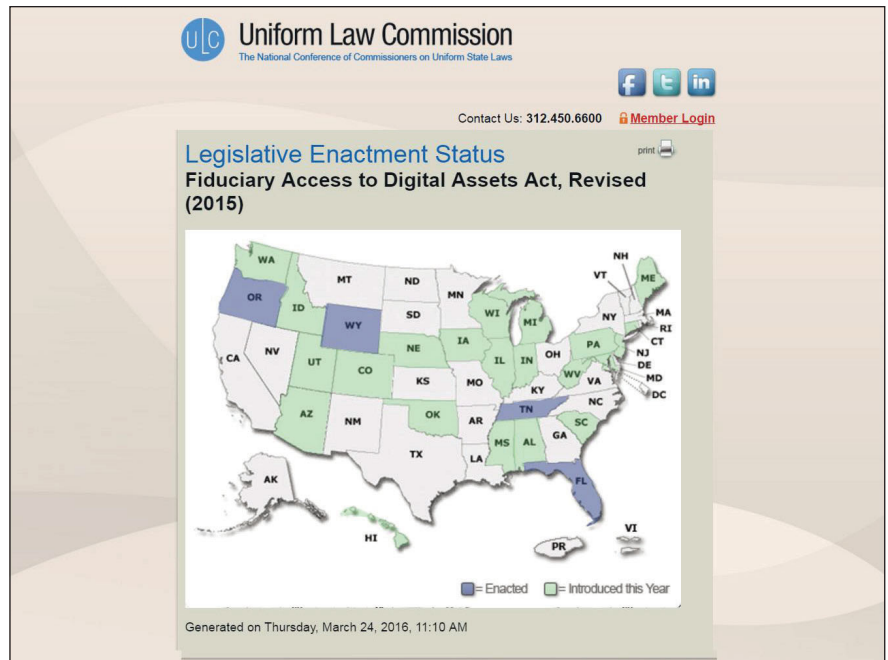
Creating an inventory of online accounts and digital assets is something we should all do. After doing so, the question to answer is whom to put in charge of carrying out your wishes for those accounts/assets after you die. Lee Poskanzer, president and founder of Directive Communication Systems, a service specializing in this area, says the answer depends on the account.

“If you’re talking about cash-value accounts or something that needs researched, you probably want someone with an ability to recognize materials that need to be communicated to the estate or have someone from the estate have access to those accounts so they can ID such information,” he says. For a social media account, you might consider someone more in tune with you socially, such as family or friends. “They’re going to have a different approach to handle the social impact and posting and identifying things nostalgic or legacy-driven,” Poskanzer says.

Poskanzer always recommends choosing people who can best manage respective accounts and do what’s necessary with the data in them. “There’s a real responsibility in that account’s contents, particularly with those that go back to the estate, because there are time periods that need to be dealt with,” he says. “[The accounts] can’t go on forever. Sometimes, people are emotional and will delay or avoid dealing with the harder things, so you want to pick someone who can effectively deal with or address the accounts and their contents.”

turning over the data without lawful consent of the account user. If the owner dies before doing so, Lamm says, “where’s that lawful consent?”

The RUFADAA presents a compromise. Basically, Orzeske says, the RUFADAA provides default rules to apply when an account owner hasn’t made other



By year’s end, Ben Orzeske, chief counsel at the Uniform Law Commission, expects more than 20 states will adopt a version of the Revised Uniform Fiduciary Access to Digital Assets Act, legislation the ULC created that would give fiduciaries power to manage a person’s digital property in the same way they manage tangible property.

arrangements. Specifically, a fiduciary ordered to manage the deceased’s tangible property also has default access to the user’s digital assets, except for the private electronic communications content that the ECPA protects.

Carl Szabo, senior policy counsel for NetChoice, a trade association of ecommerce businesses and online consumers, says although he expects uniform adoption of RUFADAA will eventually happen country-wide, “it’s important to remember that the iPad is only six years old, the iPhone only eight, and Google is barely old enough to vote. As the industry matures, we are creating tools to address these kinds of issues.”

Take A Digital Inventory

Experts in the area generally offer the same advice for planning for death, which you should do sooner rather than later. At a minimum, create an inventory of your digital assets. Include online accounts and usernames/passwords, and be sure to note exactly what should happen to each

after you die. Next, tell your beneficiaries, estate planner, attorney, or just someone you trust about your inventory and appoint a service or someone you trust to carry out your wishes.

Ideally, consider working with an estate attorney or planner familiar with digital assets to incorporate your inventory into your will. Be sure to clearly authorize access to your digital property and specifically address electronic communications. “That’s what’s needed for the federal law, and that’s what unlocks the doors to these service providers,” Lamm says. Lamm also recommends downloading your cloud-stored data to a local drive. “I can deal with the stuff on your local computer,” he says. “I have extra laws and ToS agreements and even passwords standing in the way of getting into those cloud accounts.”

The online services specializing in this can help with digital inventory and estate-planning tasks. While some services are essentially password managers that

Not Fit For A Will

It's possible some of your online accounts and digital assets have caused a few skeletons to gather in your closet. Everplans, a service that helps users create digital asset inventories and more, suggests on its site that you may want to begin making plans now to bury those skeletons and save yourself and your loved ones some potential embarrassment and grief after you die.

Although there are numerous digital assets/accounts you wouldn't mind loved ones knowing about or accessing after you're gone, other accounts, apps, online activities, email and IM communications, and possibly even illegal activities are probably better left forever unknown, whether it's photographs, videos, documents, bootlegged software, or memberships to certain

websites. Everplans collectively groups these into DIES categories, or Dangerous, Illegal, Embarrassing, and Secret.



Everplans, a service that securely stores digital asset archives for users, provides a checklist to help identify assets and accounts you may not want family and friends to know about after you die.

To deal with your DIES goods, Everplans suggests assigning a “cleaner,” or someone you trust implicitly to execute your wishes without judgment. The cleaner’s task is to scour your computer, smartphone, external drives, and “anywhere else questionable landmines might be lurking” to “delete and/or destroy them without question or complaint.” As Everplans notes, the job can be an upsetting and thankless one requiring discretion and “ability to keep everything they’re asked to do a secret for the rest of their lives.” So choose wisely. If you have so many skeletons you can’t remember them all, Everplans offers a free checklist to jog your memory.

will securely store your inventory, this alone won't help with issues of granting authorized access to your online accounts. Other services take this approach up a level by also helping track your online accounts, shut them down, pass your instructions to the appropriate people, and more.

Hewson says the LifeLocker service USLegalWills.com makes available, for example, helps users to make their digital assets available to loved ones at the right time and not before. Users can update information in the service, which Hewson says is a good complement to a will. (Hewson and others stress to never put actual passwords and usernames for accounts in a will, as it's a public document anyone can read after you die, thus opening up various risks.)

Estate Map's Henderson says while many services exist that can leave some version of an estate map behind to help locate assets, even “homemade ‘analog’ solutions” like binders of information are

better than nothing. “The simple truth is that people are too often dying, leaving already despairing loved ones struggling to find even basic identification of financial accounts or basic funeral plans,” he says.

Moving forward, Poskanzer expects that creating digital asset inventories and incorporating them into wills will become more common, though we'll have to make organizing our accounts a habit like anything else. “Organically, we're going to be signing in to more and more accounts. If we don't get into the habit of organizing them, we leave ourselves at risk,” he says. Especially as people witness the struggles their parents, grandparents, and friends go through, Poskanzer says we'll increasingly realize the importance of not creating unnecessary hardships for everyone involved.

In a legal sense, Lamm believes laws must catch up to the issue “because we haven't really started feeling the pain of this yet.” When that happens, people will

start calling their legislators, impressing upon them the urgency of making changes and improving efficiency, he says. “The challenge today is, depending on which study you look at, about half the people in the United States die without creating a will,” he says, something that's required to grant legal authorized access to digital accounts.

Hewson believes this issue will likely always pose challenges. “Estate planning laws in particular are painfully slow to change. Take a look at digital signature laws as an example,” he says. “For nearly 20 years, we've had the technology to uniquely identify individuals by a digital signature, but every last will and testament state law requires a will to be written on a piece of paper and the testator is identified by their scrawled signature. This law hasn't changed in centuries . . . we have the technology now to store wills online and stamp them digitally, but the law is nowhere close to keeping up.” ■

CPU

Game Of The Month

This month, At Your Leisure is brought to you by G2A.com, the Global Digital Marketplace. (Price information provided by G2A.com at press time and is subject to change.)

G2A.COM

QUANTUM BREAK

Finland-based Remedy Entertainment recently launched Quantum Break in concert with Microsoft Studios, and in doing so has cemented its status as a top-shelf game development studio. Quantum Break joins Remedy's Max Payne and Alan Wake among some of our favorite games of all time; it has the same combination of solid gameplay and an immersive, highly atmospheric story, and like those earlier releases, Quantum Break adds a twist that helps it transcend the third-person shooter genre.

Quantum Break is the story of Jack Joyce (played by "X-Men's" Shawn Ashmore), a good man with a somewhat checkered past, and his struggle to survive and, if possible, fix the cataclysmic effects of his best friend Paul Serene's time travel research at the local university. Serene (played by "Game of Thrones'" Aidan Gillen) contacts Joyce and asks him to come to their home city of Riverport and help him with Jack's older brother William ("The Lord of the Rings" trilogy's Dominic Monaghan), a brilliant physicist with some personal issues. Jack returns home only to find the project in turmoil. William has gone to university officials and had the program shuttered, and Serene needs Jack's help to complete a key experiment. Jack complies, and the resulting incident breaks time, threatening existence as we know it and giving both Jack and Serene the ability to manipulate time in lots of interesting ways.

The game takes off quickly: You immediately find out that Littlefinger may not have your best interests at heart, and you have to deal with waves of tactical goons from the local evil megacorp, Monarch, which quickly intervenes and steals the time-manipulation equipment from Serene's lab. Monarch's CEO, played by the incomparable Lance Reddick ("The Wire," "Fringe," etc.), launches a full-scale manhunt to catch or kill you, and a cast of well-developed if somewhat stock characters is on hand to help him.



Remedy Hits A Hat Trick

BY CHRIS TRUMBLE

G2A.com Price: \$38.44 (PC), \$49.98 (XOne)

ESRB: (M)ature • Microsoft Studios • www.quantumbreak.com

As you progress, you gain the use of new time-based abilities and level up the ones you have, and these abilities are a great addition to the gameplay. But the thing that perhaps contributes the most to Quantum Break's uniqueness is a series of interwoven TV episodes that play at various stages of the game to give you a keener grasp on what's going on outside of Jack's awareness. In addition, there are different versions of each episode, and your decisions at key points in the game determine which ones you see.

Ever since game consoles acquired the ability to play full-motion video, developers have been trying to integrate live action into gameplay, and Quantum Break is far and away the best example of this to date. The episodes are on par with what you'll see on lots of current TV action dramas, thanks to solid production values and a great cast, and for the first time in game history, watching in-game video for more than a few seconds doesn't feel like a chore.

There are some flaws, unfortunately. The PC version suffers from considerable technical issues, and if you've been playing a lot of third-person shooters recently (cough, The Division, cough), you'll find the game's combat control to be a little sloppy by comparison. The cover mechanic in particular is less than ideal in execution, and that's a bit of a problem when it's you against a half-dozen or more guys.

The real draw here, though, are Jack's time-based abilities, and those work great. Add the fun you'll have using them to the Remedy-caliber story, and it all adds up to what will quite possibly be in the running for Game of the Year and is certainly the best title of 2016 so far. If you can, we'd recommend playing it on Xbox One, though, at least until some of the PC version's issues get ironed out. ■





In Tom Clancy's *The Division*, you play the role of a highly trained paramilitary sleeper agent who is activated after a deadly bioweapon attack ravages the population of New York City. Your job is to restore order in the city by taking on the looters, thugs, and the murderous members of a few highly organized gangs that spring up in the wake of the virus to stake their claim on portions of the city. You start out with a very basic skill set and basic gear; you gain experience as you clean up the streets, and as you level up, you can customize your character's abilities using a standard skill tree and improve your arsenal by seizing the weapons of your fallen foes (loot drops).

The game is an online third-person shooter that takes place in a persistent world and has a hefty dose of RPG elements built in. It is quite a bit of fun at the outset, but like a lot of MMOs, the "real" game starts when you reach max level and can participate in raids and equip the game's best gear. Until then, the city streets are sometimes dangerous but rarely deadly for skilled players unless they have wandered into a zone populated by higher-level NPCs. As such, after logging a good number of hours in the game's initial content, things can start to feel a little repetitive.

The good news is that well before you hit the level cap (currently level 30), you can spice things up by venturing into the aptly named Dark Zone, a lawless quarantined section of the city where those diagnosed with the flu were sent early in the epidemic. The Dark Zone takes all the things that make the game fun and crank them up to 11. Tougher NPC enemies (and more of them), better loot, and active PvP, which is a really interesting dynamic in this



The MMO Shooter Takes A Step Forward

BY CHRIS TRUMBLE

G2A.com Price: \$31.21 (PC), \$61.06 (XOne), \$60.38 (PS4)
ESRB: (M)ature • Ubisoft • tomclancy-thedivision.ubi.com

game. Teaming up with other players improves your chances of survival, but on the other hand, that one guy has a really nice sniper rifle . . .

If you attack another player in the Dark Zone, you are flagged as a rogue agent, and every player in the zone can see you on the map and is free to attack you without sanction. It's fun for everyone involved and really adds to the overall Wild West feel of the Dark Zone.

The Dark Zone's loot extraction mechanic is also a fantastic gameplay element. Loot that you acquire in the Dark Zone can't simply be carried out because it is contaminated. To get items out of the DZ, you have to call for an extraction, which starts a timer and notifies all nearby players as a helicopter comes to your location to carry your stuff out for you. (It will be in your loot chest in bases and safe-houses when you exit the DZ.) Extraction is the perfect opportunity for people looking to prey on other players and take their stuff; once the chopper arrives, you have to attach your loot bag to a rope lowered by the chopper, and this takes several seconds, during which you are vulnerable to attack. Teamwork is key, and no matter how it shakes out, the whole process can be very entertaining.

Tom Clancy's *The Division* is a really good game that should get better over time; the company has a well-developed plan for additional content, and if things continue to go as well as they have started out, it might even be Season Pass-worthy. ■





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Day of the Tentacle Remastered

When Double Fine Productions boss Tim Schafer took the reins as co-lead designer for the original *Day of the Tentacle* way back 1993, he wasn't merely tasked with making a great game. He also shouldered the weight of *DotT*'s predecessor, *Maniac Mansion*, which arguably revolutionized the point-and-click adventure genre thanks to its SCUMM engine (not to mention its endearing, madcap story). Critics and gamers fell in love with *Maniac Mansion*, setting the bar for a sequel awfully high. Oh, and *DotT* was also the first project Schafer helmed. No pressure, right?

Schafer, then at LucasArts, delivered. *DotT* stayed true to its roots while improving the few flaws *Maniac Mansion* did have. For example, players who failed to solve one of the titular mansion's puzzles could easily wind up stuck, with no viable way to make further progress. Although Dr. Fred Edison's quirky abode returned for *DotT*, the residence was far more forgiving to players. Now, more than 20 years later, Schafer and his Double Fine crew have re-created the magic with *Day of the Tentacle Remastered*. Like previous LucasArts remasters such as *The Secret of Monkey Island* and *Grim Fandango*, *DotT Remastered* slathers a fresh coat of paint over the graphics, jazzes up the music, and includes tons of bonus content.

But we're getting ahead of ourselves. Maybe this is the first you've heard of Dr. Fred, his crib, and *DotT*'s trio of heroes, Bernard, Laverne, and Hoagie. Our intrepid humans square off against one of Dr. Fred's creations, Purple Tentacle, which drank deep from the river of toxic ooze seeping from his laboratory (side effect: megalomania). To thwart Purple Tentacle's plans of global domination, Bernard, Laverne, and Hoagie travel back in time to prevent the whole mess from happening. Their first attempt goes about as smoothly as you'd expect, as the gang crash-lands centuries apart from one another—Hoagie turns up in Colonial America, while Laverne emerges to a future where the Purple Tentacle has succeeded in subjugating humanity. Bernard stays put in the present, and all three work in concert to topple the Tentacle's totalitarian regime.

More often than not, success hinges on your team passing key objects backward and forward in time, where they interact with the environment (or other

Tentacular Puzzler Is Anything But SCUMM

BY VINCE COGLEY

G2A.com Price: \$14.91 (PC), OSX, PS4, and Vita versions also available
ESRB: (T)een • Double Fine Productions • dott.doublefine.com

objects) to solve puzzles and advance through the game. Figuring out the proper combination of items and time periods presents a light challenge, but the most enjoyable aspect of *DotT* is its commitment to being bonkers.

Aside from updated graphics, *DotT* presents a revamped UI. If you long for the originals, Double Fine can hook you up: *DotT* lets you toggle between the remastered game and the original, mixing and matching new graphics with the old UI (and vice versa) if desired. Having this option is a great way to get your nostalgia fix without beginning a brand-new game.



The true “replay value,” if you will, for anyone who’s played *DotT* comes from the extras Schafer & Friends included. There’s a collection of concept art to explore, and several members of *DotT*'s original team recorded an insightful commentary track that can play during the game. For a cult classic like *DotT*, we actually enjoyed hearing the creators discuss their baby.

If *Day of the Tentacle* somehow managed to fly under your radar (or you literally weren't alive when it originally launched), *DotT Remastered* is a must-buy. Veterans who have previously pointed and clicked their way through *DotT* should find enough value in *DotT Remastered*'s extra to take it for another spin. And yes, like the original game, *DotT Remastered* includes *Maniac Mansion* (not remastered, but who's complaining?) as a game-within-a-game Easter egg, which is worth 15 bucks by itself. ■



In IO-Interactive's latest installment of the long-running HITMAN series, you again play as Agent 47, a genetically engineered super assassin with an aversion to following the rules. The game starts out with a flashback of 47's first encounter with the International Contract Agency, which ultimately, with some reservations, hires him to be one of its covert killers-for-hire. The training missions are simulated recreations of past ICA missions. We like this design choice; it helps establish the firm's storied history and lets the player become familiar with the rules of the game. Likewise, Agent 47 gets his own trial-by-fire. These early missions take place in a couple of smaller sandbox arenas that give you a little taste of what the later game has in store.

Almost every objective in HITMAN has multiple paths to completion, and there's plenty of opportunity to choose how to dispatch targets. In addition to 47's arsenal, there's an impressive array of weapons you can pick up along the way, including tire irons, knives, rat poison, hammers, screwdrivers, and pipes. There is a handful of environmental traps you can set, such as creating puddles of water near electrical cords, dropping heavy objects from above, shooting explosive canisters, and poisoning food and drinks. You can drown your target in a toilet, toss him over a balcony, or snap her neck with the press of a key. There really is a staggering number of ways to kill in HITMAN.

As ever, stealth plays a big role in the game. Like previous games in the series, knocking out non-targets and stealing their clothes will become one of your primary tactics. This lets you blend in with a certain crowd and gain unnoticed access to areas that tend to be restricted to the general public. A character with a white dot over his head is someone



Missman

BY ANDREW LEIBMAN

G2A.com Price: \$44.13 (PC), \$56.52 (XOne), \$62.18 (PS4)
ESRB: (M)ature • IO-Interactive • www.square-enix.com

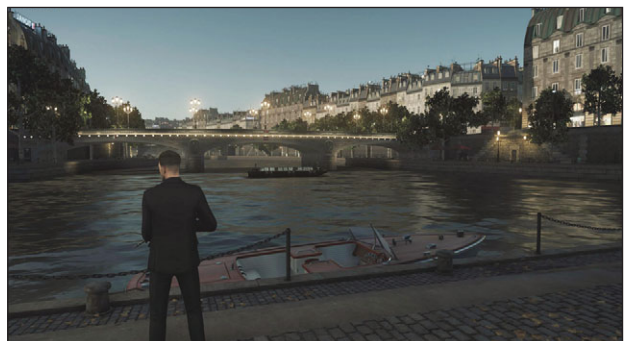
who'll see right through your disguise, but generally these enemies are easy to avoid as long as you stay out of their lines of sight. Don't forget to hide bodies—any corpse or unconscious character discovered will put the guards on high alert and render your pilfered disguise as suspicious.

Pressing the CTRL key initiates Instinct Mode, which muffles sounds and drains the color out of the scene but lets you see through walls to quickly get eyes on targets, NPCs to avoid, security cameras, body-stashing locations, nearby weapons, and other key environmental features.

The core mechanics are solid, the game looks gorgeous, and replay value is high. Unfortunately, because of HITMAN's unnecessary episodic nature, there was not much actual content as we went to press. The next episode will be available April 26, and subsequent content should arrive monthly. At the time we wrote this, the game included the training missions and a single large sandbox located in Paris.

Once the story mission is complete (it took us four hours), the rest of the game consists of grinding mini objectives, called opportunities, or killing one or two NPCs in the same map, give or take certain limitations such as randomly placed cameras to avoid or performing the kill wearing a given disguise or using a specific kill method.

There's the foundation of good game here, and six months from now, this could be one of the best HITMAN games yet. But right now, we have a hard time recommending paying the full price. Thankfully there's an a-la-carte option: you can pick up the Intro Pack for \$14.99 and subsequent episodes for \$9.99 each once they launch. ■



Q&A With Ed Skoudis

A Lifelong Hacker Spending Time Training Cyber Warriors In CyberCity

More than anything, Ed Skoudis considers himself a hacker. His love for hacking has led him to become a globally respected security expert and a faculty fellow at SANS Institute. There, he trains security professionals from the military, enterprises, and other organizations in the art of penetration testing. Skoudis also heads up NetWars and the CyberCity project for the institute, the former being a cyber range where “cyber warriors” learn and test skills in a “live-fire environment” to help them protect their own organizations’ networks.

CyberCity is an extension of NetWars and entails a miniaturized 6- x 8-foot physical city Skoudis and his team built complete with train tracks, a water tower, buildings, and even its own newspaper and social network. Underneath CyberCity are real-life industrial control system components and PLCs (programmable logic controllers) similar to those that real cities use to operate power grids, water and traffic control systems, and other infrastructure. Via CyberCity, cyber warriors from around the world engage in various missions in which they must protect or attack those systems. Notably, they visually see the results of their battles. Take down the power grid, for example, and CyberCity’s lights literally go dark. We talked with Skoudis about CyberCity and other security-related topics.

(You can read our entire conversation at www.computerpoweruser.com/article/20437)

Q : Can you describe what you do at the SANS Institute in an educational and training sense and why it’s important?

ES : I wear many hats with the SANS Institute. One of the ones I cherish most is my hat as a SANS instructor, and I teach classes associated with penetration testing. That’s the job where you try to find vulnerabilities to help those people who have the vulnerabilities fix their environments—a paid professional hacker, but a good-guy hacker. That’s the one thing I love the most, to teach people how to do that but how to do that really well. I’m also the curriculum lead for the penetration testing curriculum. That means it’s my job to make sure we have penetration testing classes that teach the skills that people need. People suggest classes to us all the time, and I help to make sure we have the appropriate authors and appropriate instructors to write and teach those classes. But also, I’m the director of a couple of projects there, and one is called NetWars.

NetWars is a cyber range where people build their skills in a live-fire environment. An extension of NetWars



is called CyberCity, and I’m the director of the CyberCity project, as well. That’s where we’ve taken NetWars and built an actual miniaturized physical city. The city is 6 x 8 feet, and on top of the table there are little buildings, there are train tracks, there are streets, and stuff like that. Under the table, though, we have the actual industrial control system equipment that’s associated with the real physical entities

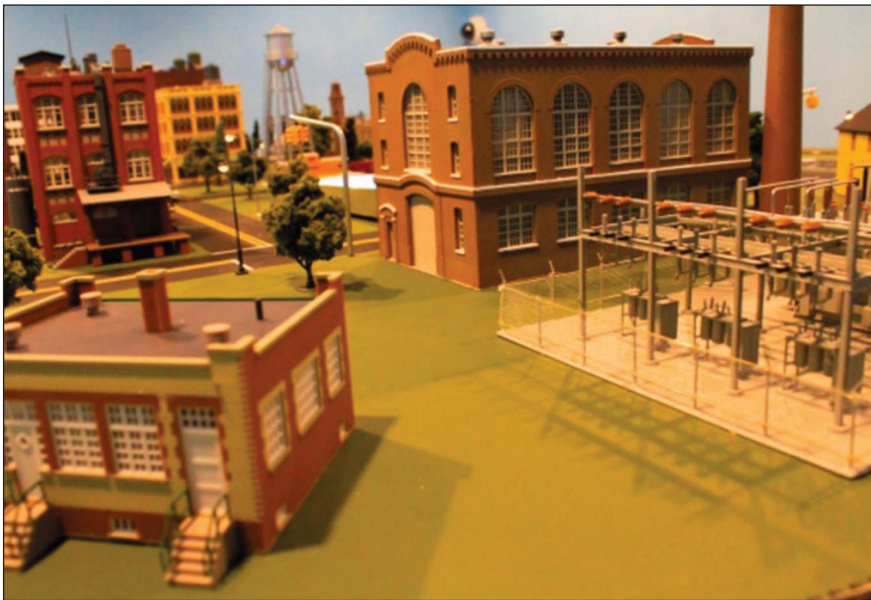
like in a real city. So CyberCity, while it’s a miniature city, actually has PLCs and other equipment to implement a power grid. We have water control systems. We have traffic control systems. We have all that kind of stuff that implements the control systems for a real city. Those are three of the main things I do with SANS: instructor, curriculum lead, and then focusing on the cyber ranges, meaning NetWars and CyberCity.

Q : Who takes your courses? You frequently use the term “cyber warrior.” What is a cyber warrior?

ES : I define a cyber warrior as anyone who needs to tangle with bad guys in their environment. That is, our networks are constantly under attack, whether it’s a government network, commercial company, or it might be a military organization. They’re constantly being attacked, and they need to defend those environments. And that includes hardening them up-front—that’s the preventive aspect—and also, though, finding vulnerabilities before they do bad and fixing them. That’s the penetration testing side of things. And also



CyberCity is a miniaturized 6- x 8-foot physical city with train tracks, a water tower, buildings, and even its own newspaper and social network. It uses real-life industrial control system components and PLCs (programmable logic controllers) similar to those that real cities use to operate power grids, water and traffic control systems, and other infrastructure.



hunting for the bad guys on their networks. All of those things are different aspects of NetWars: hardening things in advance, finding vulnerabilities and fixing them, and finding where the bad guys are and getting them out.

The people we teach this stuff to are from a wide variety of organizations. A lot of people come from commercial companies,

high-tech firms, petroleum companies, retail organizations, just across the board. Beyond the commercial stuff, we have a lot of military customers because they face the battle every day for control of their own networks to support their missions. Then we have civilian government customers. And this is from around the world. SANS teaches classes in dozens of countries on

a regular basis, and I'm really honored to support SANS in being able to do that.

Q: A key component of CyberCity is the visual aspect it provides. Participants actually see lights go out in a building when the power grid is taken down. Why is that important?

ES: It is so important. CyberCity has five streaming video cameras because people aren't there to look at the city in the same geography. They're accessing CyberCity from halfway across the country or even halfway across the world. So we have five streaming cameras so you can see all the action, and the action is in an actual physical city. There are tiny buildings. There's a train that moves around. There's a building that has a little diner in it that has a flashing sign above that says "Open." So we have this physicality that you can see remotely, and we have it for a couple of reasons.

One, it helps to spell out to the participants, the cyber warriors themselves, that there's a real thing here. It's not just a videogame. We could have built something, maybe with even better visuals, but there are a couple of issues with that. First, making a videogame with really compelling visuals costs a lot of money. We thought we could actually have pretty decent visuals with actually having a physicality to it. And that gives us the second big point, and that is to be able to say to decision makers, especially in the government and particularly the military, "Look, your people just got in and restored power to the power grid, and it's using the actual equipment that real power grids use. This is not a videogame." Or we could say, "Your people just derailed a train," or "they stopped the train from getting derailed."

Now admittedly, the train is 6 inches long, but it is a real train. It's not just some graphics that an artist came up with. It's an actual physical train that we modeled with some of the train control equipment. It's much more compelling. It is literally visceral. I mean, you can see what's happening. It's a compelling message for the cyber warriors themselves and especially their leadership. So that's why we focused so much time and effort on the visuals of CyberCity.

Q: We've read you're looking to extend the project to operate with a real abandoned town. Is that right?

ES: We are working on it. We have written three missions. In CyberCity, everything is organized around missions, and we have 18 missions right now in the miniature CyberCity. We have written three missions for a full-sized facility, and we are in discussions now about implementing those missions. It's just a matter of getting the funding together. But we are writing full-sized missions for military personnel, especially for the National Guard. So we have written the missions, and we're getting there on the funding. We're hoping we get that soon so we can build the missions out, and they're all based on lessons learned from the miniature.

That's a thing we never anticipated. When we started building the small version of CyberCity, we never thought we'd be building full-sized things someday, but we're close on that. I'm hoping within six months we'll have at least one mission implemented in a full-sized abandoned town. And we do have an abandoned town we are working with and on, but I'm not able to tell you what town that is yet.

Q: If that happens, will it enhance the visual and physical aspects of CyberCity even more?

ES: It will, and it's even beyond that. It will make it much more visual. I mean it's going to be full-sized, cyber controlling full-sized buildings and water refineries and subway systems and such. But the other thing you get by going full-sized is the ability to do integrated mission training where you have boots-on-the-ground soldiers coordinating with cyber soldiers. That's the Holy Grail right now because we're working and training in the miniature city, we're training the cyber guys, the cyber warriors who will sit behind their keyboards and do their thing. And that's great, but wouldn't it be cool to have training where those people are working with the people who have boots on the ground, machine

guns in the hand and doing their thing, and then having the two see what benefits they can get from the other guys?

One of the missions we're working on now is a prison mission where the bad guys have hacked into a prison and have control of the closed-circuit television. They have control over the voice-over-IT network, and they have control of the prison gates as well as the gates on the cells and they're trying to cause a riot. And what happens on this mission we've written, we call in soldiers to try and stop this riot from happening. So you have this physicality and making sure the prisoners don't riot, but there's also a cyber thing there. You have to find the bad guys on the network and kick them out.

I always remind myself
that I'm just a hacker.
That's all I ever wanted to be.

That's one example of a mission we've written. Another involves an attack against a water infrastructure where they're trying to poison the water. And the third one is associated with transportation subway stuff where the bad guys have hacked in there and they're controlling some of the signs on the subway, as well as ventilation equipment. Again, you have boots on the ground to maintain calm and make sure things go smoothly, but at the same time you have the cyber guys trying to find the bad guys and stop them from doing evil. It's a whole new dimension.

Q: In some respects, you're on the front lines of the cybersecurity battle in terms of teaching others how to guard against cybercriminals. What does that role mean to you?

ES: Well, first of all, I always remind myself that I'm just a hacker. That's all I ever wanted to be. That's all I am, and I'm proud of that. And by a hacker, I

don't mean somebody who is a hacker. A hacker is someone who views the world in a way that's like, "What happens if I try this unusual thing?" You think different, like Apple used to say in its ads. Hacking is fundamentally manipulating technology to make it do things it's not supposed to do. If I start getting too much into thoughts of "look at all this great and exciting stuff that I do," I want my ego to stay in check and not get outside of my focus. And my focus is I want to hack, and I love hacking.

I've been very fortunate to have a job where I can do applied hacking. I'm seriously thankful. Also, I really strive to treat all the people on my team—the students I have, and the people I work

with—with true respect and humanity and thankfulness for who they are as people. I'm a technologist. I love technology. I like bits and bytes. I like packets. I like computers and chips and software, but you know, it's the people thing that's so important, and the relationships are a sign of a life well lived.

Bill and Ted, in "Bill and Ted's Excellent Adventure," one of their big mantras was "be excellent to each other." [laughs] And I think we should follow that. Be excellent to each other. Some of the people who do hacking are a little bit socially awkward, and that's OK. That's totally fine. Embrace that. I do really try—I'm not saying I do this great—but I do really try to help people. That's what kind of keeps me going. Yeah, I love the bits and bytes, but how can I help people do the bits and bytes better and defend their environments better? That's where I try to keep my focus, not on what is my role and what is my philosophy and thoughts on the industry. You ask me that and it kind of boils down to "Bill and Ted's Excellent Adventure." Be excellent to each other and party on. ■



LAN PARTY LISTINGS

05.06-08.16

Dreamhack Austin
Austin, TX
dreamhackaustin.com

05.13-15.16

LANFest Sacramento Spring 2016*
Folsom, CA
lanfest.intel.com/events/sacramento-spring-2016

05.14.16

BearTrap Gaming LAN
Orem, UT
www.beartrapgaming.com

05.14.16

CEG LAN
Big Rapids, MI
ceg.ferris.edu

05.20-22.16

Baselan 29.5
Winnipeg, MB
www.aybonline.com/baselan29-5

05.20-22.16

LAN-A-THON Under The Sun
Bonita, CA
www.Sandiegolan.net/lanathon

05.21.16

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

05.21.16

Willamette Valley Gamers LAN
Eugene, OR
www.wvgamers.com

05.27-29.16

Wardogz LAN Group
Orange Park, FL
www.wardogz.org

05.29-30.16

Chicago LAN Party
Chicago, IL
www.chicagolanparty.com

06.10-12.16

FortCON 2016
Fort Wayne, IN
www.lanreg.org/fortlan/fortcon

06.17-19.16

Windy City LAN
Chicago, IL
www.windycitylan.com

06.18.16

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

06.18.16

Willamette Valley Gamers LAN
Eugene, OR
www.wvgamers.com

06.24-26.16

LAN In The Highlands
Latrobe, PA
www.clubconflict.com

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GUARANA

07.15-18.16

PDXLAN 28*
Portland, OR
pdxlan.net

07.16.16

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

07.23.16

Willamette Valley Gamers LAN
Eugene, OR
www.wvgamers.com

07.28-31.16

MillionManLan
Louisville, KY
www.lanwar.com/LWEventHome.asp?EventID=133

08.12-14.16

DreamHack Montreal
Montreal, QB
montreal.dreamhack.com

08.20.16

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

08.20.16

Willamette Valley Gamers LAN
Eugene, OR
www.wvgamers.com

09.16-18.16

Ready Set FightCon
Tigard, OR
readyssetfightcon.com

09.17.16

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

09.23-24.16

CPU LAN
Lincoln, NE
www.computerpoweruser.com

09.23-25.16

Wardogz LAN Group
Orange Park, FL
www.wardogz.org

09.24.16

Willamette Valley Gamers LAN
Eugene, OR
www.wvgamers.com

10.15.16

Oklahoma Gamers Group
Oklahoma City, OK
www.okgg.org

10.22.16

Willamette Valley Gamers LAN
Eugene, OR
www.wvgamers.com

10.28-30.16

Baselan 30
Eugene, OR
www.aybonline.com

11.04-06.16

Maryland LAN Gamers
Greenbelt, MD
www.marylandlangamers.net

* Event scheduled to include a *CPU* case mod contest

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www.bawls.com/sponsorship



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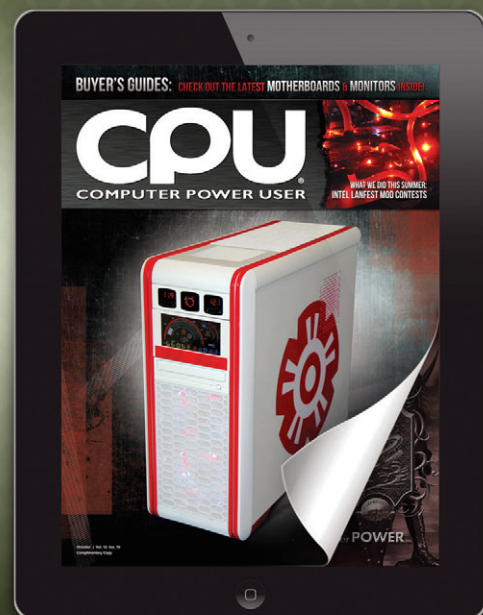
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