



XBOX ONE S: ULTIMATE 4K MEDIA DEVICE?

TECH AUSTRALIA life

• IT'S TECH SMARTS MADE SIMPLE •

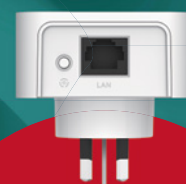
BEST WIRELESS ROUTERS REVEALED

DITCH YOUR ISP DEVICE: BETTER OPTIONS FOR ADSL, CABLE AND NBN CONNECTIONS REVIEWED

NETWORK KNOW-HOW MADE EASY

- * WHAT GEAR TO USE WHERE
- * ELIMINATE WI-FI DEAD SPOTS
- * PLUS: WHERE YOU SHOULD GO WIRED INSTEAD

BUILD IT!



ACCESSORIES TO EXPAND & EXTEND COVERAGE

POWERLINE ADAPTERS, WI-FI RANGE EXTENDERS, MEDIA BRIDGES + MORE: LABS TESTED & RATED

PERFECT WIRELESS NETWORK

IN-DEPTH JARGON-BUSTING GUIDE: CREATE THE ULTIMATE NETWORK SETUP FOR YOUR PLACE

AUSSIE TECH BUYER'S GUIDE

UPDATED EVERY MONTH!

- 28 CATEGORIES INCLUDING:
- * SMARTPHONES & TABLETS
 - * LAPTOPS & PC PARTS
 - * ACCESSORIES & PERIPHERALS
 - * AUDIO GEAR, CAMERAS
 - + MUCH MORE!

CLEVER TECH TIPS & TRICKS

THE EASY WAY TO EXPERTISE

- * DON'T GET SCAMMED: HOW TO SPOT A SKETCHY KICKSTARTER
- * BUILD YOUR OWN HOME-THEATRE PROJECTOR SCREEN
- * FREE UP DISK SPACE IN WINDOWS

ALL THE LATEST TECH REVIEWED

THE HOTTEST GEAR ON TEST

- * PORTABLE MEDIA SERVER: SHARE & STREAM ANYWHERE
- * SONY'S POCKET PROJECTOR: TV-SIZE FLICKS ON THE GO
- * IS SAMSUNG'S GALAXY NOTE7 WORTH THE \$\$\$ PRICE?



ISSUE 55 | OCTOBER 2016 | TECHLIFER | TECHLIFER 77 APPLE NEWSSTAND & GOOGLE PLAY

AUSTRALIA \$9.95
NEW ZEALAND \$10.90 INC GST
PRINTED IN AUSTRALIA
PERIODICALS
APPENDIX: 100000180
ISSN: 1322-3712

Future

Vigor3220 Series

Advanced Business Network Multi-WAN Solution for SMB

DrayTek
Aust & NZ
www.draytek.com.au

Quad-WAN Broadband Router with Dual USB Port for 3G/4G Connectivity, Security Firewall, 802.11n Wireless LAN, 1 x DMZ Port, 100 x VPN and 50 x SSL-VPN Tunnels



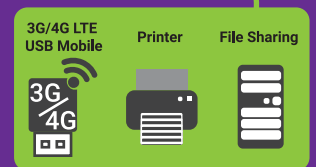
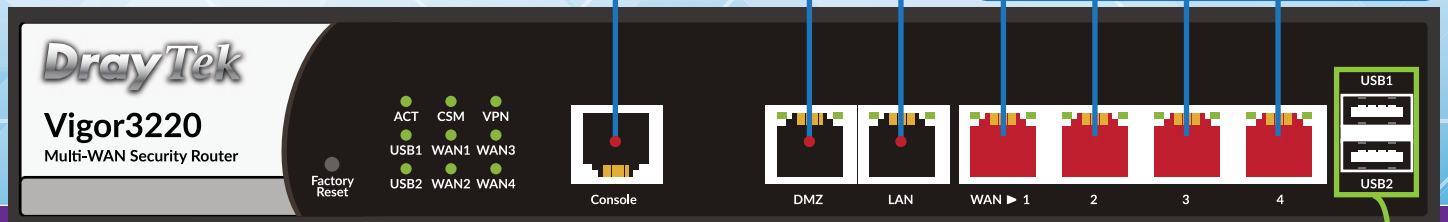
Console (RS232)

Servers

LAN

Internet

4 x Gigabit Ethernet WAN Ports
(ADSL2+/VDSL2, Cable, Optic Fiber and NBN NTU)



Router Key Features

- Quad-WAN: 4 x Gigabit Ethernet WAN ports
- 2 x USB ports (1 x USB 2.0, 1 x USB 3.0)
- Multi-WAN Load Balance and Failover
- 100 x VPN and 50 x SSL-VPN tunnels with Load Balance and Redundancy
- 1 x Gigabit LAN port with 100,000 NAT sessions
- 1 x Dedicated Gigabit Ethernet DMZ port for connecting servers
- 1 x Console port (RS232)
- Object-based SPI Firewall with Content Security Management (CSM)
- IEEE 802.11n Wireless LAN for Vigor3220n
- IPv6 compliant
- QoS functions
- 2 x USB ports support 3G/4G modem, file sharing or network printer
- Central VPN Management
- Central AP Management
- Central Switch Management
- Supports Smart Monitor Traffic Analyzer (up to 200 nodes)
- Supports VigorACS SI Central Management (TR-069)



i-LAN Technology Pty Ltd trading as DrayTek Aust & NZ

www.i-lan.com.au

(02) 9838 8899

sales@i-lan.com.au

© Copyright October 2016 i-LAN Technology Pty Ltd. All rights reserved.

EDITORIAL

UNFETTERED SPECULATION



[ELEMENTARY]

The double-edged sword

TECHLIFE'S EDITOR SHARES A COUPLE OF HIS FAVOURITE STORIES FROM THE LAST MONTH.

[DAN GARDINER]

THIS ISSUE, I thought I'd do something a bit different with this Ed's column and share a couple of the most interesting tech stories from the previous month — one that's generally positive and another that's a bit of a downer, but which, combined, give some interesting perspectives on current tech trends.

IBM'S WATSON AI DIAGNOSES MEDICAL CONDITION AFTER DOCTORS FAIL

A recent story out of Japan points to a rather positive future for medicine via the use of artificial intelligence. After human-prescribed treatments failed to work on a female patient, doctors turned to IBM's Watson software to try to get answers. We've discussed Watson in *TechLife* in past issues — it's an AI based on machine learning that's previously been used for hospitality purposes (doing things like coming up with off-the-wall meal recipes) and even competed on American game-show *Jeopardy!*, but this is the first time it's seemingly been used in medicine. What Watson managed to do where doctors failed was to analyse the woman's genome and discover that she had a rare form of leukemia, and using that diagnosis, doctors were able to successfully treat the disease. We're obviously some way off this kind of system being widespread, but it shows a lot of promise as an aid to doctors when dealing with complex pathologies.

SCAMMERS ARE PEOPLE, TOO

A young YouTuber from Birmingham in the UK

has managed to score a rather interesting interview with an employee at an Indian call centre that specialises in tech support scams — you know, the guys that call you up and try to convince you that your computer is messed up and that you need their help to fix it. If you comply, the scammer will then install a backdoor on your system and you can find yourself locked out and having to pay a ransom.

The scammer doesn't provide his real name, but divulges some interesting tidbits — he's interested in technology generally and gets paid on commission, depending on how many people are scammed. The call centre he works in has 50–60 other scammers and they often work 12-hour days, with an aim to carry off around 10 successful scams in a shift. Generally, he and his coworkers are aiming to target people who don't know much about computers.

What's perhaps most surprising is that the scammer doesn't actually like his job, describing it as "a horrible thing" and saying that he doesn't like to do it, but that he's signed a five-year contract and is effectively locked in.

It's an enlightening and slightly humanising look at an industry that's usually closed to scrutiny. Of course, that doesn't mean if you receive one of these calls that you shouldn't (politely) tell them where to go if you get the chance... Check out full the video at youtu.be/9Dswy6KEOV8. ■



WELCOME

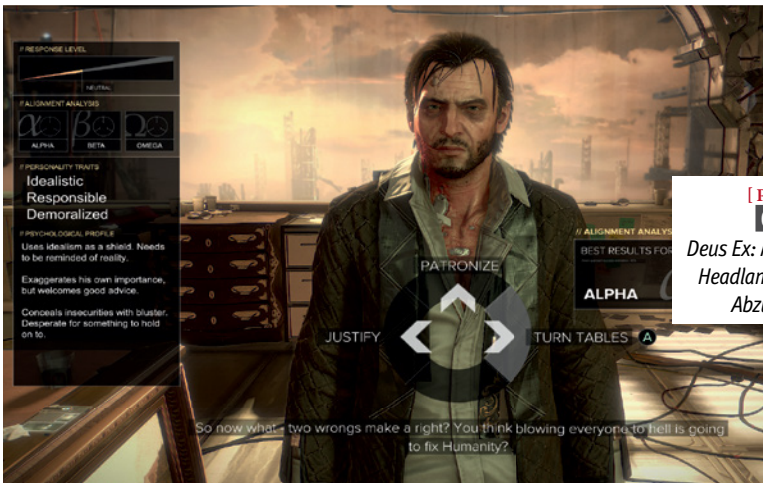
IN THIS ISSUE

055

BUILD IT!

PERFECT WIRELESS NETWORK

IN-DEPTH JARGON-BUSTING GUIDE: CREATE THE ULTIMATE NETWORK SETUP FOR YOUR PLACE



[PAGE 038]
GAMES

Deus Ex: Mankind Divided, Headlander, Starbound, Abzû and more.

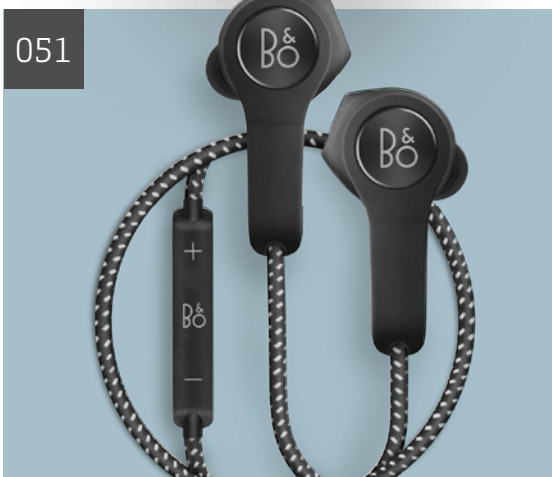




050



049



051



010



014

[THIS MONTH IN TECHLIFE]

Intro

[003] Editorial

Hotspot

- [010] Samsung Galaxy Note7 review
- [012] Essential tech news
- [014] Xbox One S review
- [017] The news in numbers
- [018] Western Digital My Passport Wireless Pro review
- [019] Kickstarted!
- [020] Pop science

Lifetools

- [021] Deep dive: Tech for sports
- [024] Don't back a dud: How to avoid losing money through crowdfunding

Discover

- [026] Apps for saving time
- [029] Top live-comedy podcasts
- [030] App showdown — The best ebook app
- [032] Multiplatform apps
- [036] Unearthed — Best new sites, services, plugins & more
- [038] PC & console game reviews
- [042] Bajo speaks: Puzzle me this
- [044] Mobile games reviews

Test Bench

- [046] Radar — Latest gear reviewed

Cover story

- [055] Contents
- [056] Create the perfect wireless home network
- [060] NBN setup guide
- [061] ADSL router reviews
- [066] Broadband router reviews
- [070] Expand and extend your network

Features

- [080] Blockchain: A TechLife primer

Help station

- [084] Q&A — Your questions answered
- [086] Clear up disk space in Windows
- [088] Give your Mac a health check
- [090] Android secrets, tips and shortcuts
- [092] Manage your iCloud drive on iOS and Mac
- [094] TechLife's essential Chromecast apps
- [096] Make yourself (nearly) hack proof
- [098] Tackling through-the-lens flashes
- [102] Build your own projector screen
- [106] Monitor your home energy use

Buyer's Guide

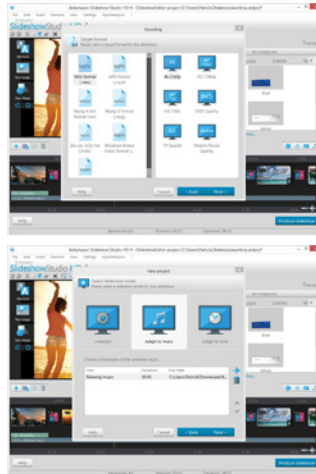
- [110] The best tech products

[DOWNLOADS]

Exclusive software

FULL-VERSION COMMERCIAL SOFTWARE EXCLUSIVELY FOR TECHLIFE READERS. THIS MONTH, WE'VE GOT TWO GREAT FULL-VERSION PROGRAMS TO HELP YOU GET THE MOST OUT OF YOUR PC.

ASHAMPOO SLIDESHOW STUDIO 2017 & ABELSSOFT STARTUPSTAR



MAKE EVERY PRESENTATION SING

KEEP YOUR AUDIENCES CAPTIVE WITH ASHAMPOO SLIDESHOW STUDIO 2017
FULL VERSION REQUIRES ONLINE REGISTRATION.

Ashampoo Slideshow turns your images into vibrant slideshows with cool effects. Numerous templates, transitions and effects allow you to work creatively and achieve fast results. Add more pizzazz and drama to your images with music, high-quality transitions and even voice narration! The integrated wizard will help you realise your ideas fast and easily. Bring your memories to life. Be inspired by the numerous templates and possibilities and create your own movie, no prior knowledge required!

Download link: www.ashampoo.com/techlife

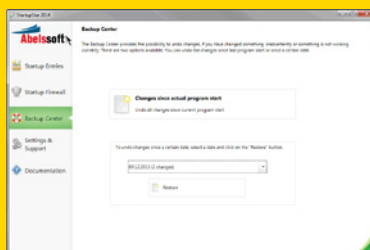
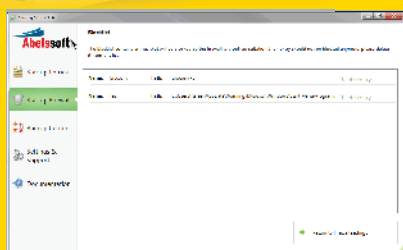


SWAT CUMBERSOME BACKGROUND OPERATIONS

REMOVE AND ADD START-UP APPLICATIONS WITH ABELSSOFT STARTUPSTAR.
FULL VERSION WORTH US\$37!

Did you know that an average PC has more than 20 different applications that are launched automatically when you start your PC? A lot of those startup entries are unnecessary and they usually slow down your PC's starting time. With StartupStar, you can see a quick and efficient overview of all startup entries and then enable, disable or delete them as desired.

Download link: www.techlife.net/exclusives
Download ZIP password: **October16c**



TECHlife

Future Publishing Australia,
PO Box 1077, Mount Street, North Sydney, NSW 2059
TEL: 02 9955 2677 FAX: 02 9955 2688
EMAIL: techlife@futurenet.com
WEB: www.techlife.net
SUBSCRIPTION ENQUIRIES: Please call Magshop 13 61 16

EDITOR-IN-CHIEF DAN GARDINER
SUB-EDITOR/JOURNALIST CARMEL SEALEY
JOURNALIST JOEL BURGESS
JOURNALIST STEPHEN LAMBRECHTS
SENIOR JOURNALIST SHAUN PRESCOTT
SENIOR JOURNALIST PAUL TAYLOR

CREATIVE DIRECTOR TROY COLEMAN
SENIOR DESIGNER NYKKE COLEMAN
DESIGNER SHARNEE BRISBOURNE

EDITORIAL CONTRIBUTORS

LOUISE BLAIN, JR BOOKWALTER, TIM BOTHWELL,
EMMA DAVIES, MATT ELLIOT, CAT ELLIS, CHRISTIAN HALL,
LINDSAY HANDMER, MATT HANSON, KENNY HEMPHILL,
ALI JENNINGS, GARY MARSHALL, HOWARD OAKLEY,
STEPHEN 'BAJO' O'DONNELL, NICK ODANTZIS, NICK PEERS,
JON PORTER, BENNETT RING, CHRIS SCHILLING, TOM STONE,
NATHAN TAYLOR, MATT THROWER, BEN TYRER, DARREN YATES

CHIEF OPERATING OFFICER NEVILLE DANIELS
COMMERCIAL DIRECTOR PAUL MARTTILA
paul.marttila@futurenet.com

ABOUT THE MAGAZINE

TechLife is published by Future Publishing Australia. Distributed in Australia and NZ by Network Services Printed by Webstar. All contents copyright Future Publishing (Overseas) Ltd, trading as Future Publishing Australia copyright 2013. All rights reserved. While all care is taken to ensure information is correct, please check prices and specifications before purchase.

PRIVACY STATEMENT

This issue of *TechLife* published by Future Publishing Australia may contain offers, competitions or surveys which require you to provide information about yourself if you choose to enter them or take part in them (Reader Offer). If you provide information about yourself to Future Publishing Australia, Future Publishing Australia will use this information to provide you with products or services you have requested, and may supply your information to contractors to enable Future Publishing Australia to do this. Future Publishing Australia will also use your information to inform you of other Future Publishing Australia publications, products, services and events. Future Publishing Australia may also give your information to organisations that are providing special prizes or offers and are clearly associated with the Reader Offer. Unless you tell us not to, Future Publishing Australia may give your information to other organisations that may use it to inform you of other products, services or events to give to other organisations that may use it for this purpose. If you would like to gain access to the information Future Publishing Australia holds about you please contact Future Publishing Australia's Privacy Officer.

Future

ABOUT FUTURE

Future Publishing Australia is part of Future plc. Future produces carefully targeted special-interest magazines, websites, and events for people who share a passion. We aim to satisfy that passion by creating titles offering value for money, reliable information, smart buying advice, and which are a pleasure to read or visit. Today we publish more than 180 magazines, websites and events, with over 100 international editions of our magazines published under license in 30 countries around the world. Future plc is a public company quoted on the London Stock Exchange (symbol: FUTR)

PETER ALLEN CHAIRMAN OF THE BOARD
ZILLAH BYNG-THORNE CEO

FIPP

XBOX ONE S: ULTIMATE 4K MEDIA DEVICE?

TECHlife

IT'S TECH SMARTS MADE SIMPLE

BEST WIRELESS ROUTERS REVEALED

NETWOK KNOW-HOW MADE EASY

PERFECT WIRELESS NETWORK

IN-DEPTH JARGON-BUSTING GUIDE: CREATE THE ULTIMATE NETWORK SETUP FOR YOUR PLACE

ACCESSORIES TO EXPAND & EXTEND COVERAGE

AUSSIE TECH BUYER'S GUIDE

CLEVER TECH TIPS & TRICKS

ALL THE LATEST TECH REVIEWED

TEST BENCH

Strix Gaming

THE TECHLIFE TEAM TESTS THE LATEST TECH GEAR AND PCS STARTING WITH ASUS'S SURPRISINGLY AFFORDABLE NEW GAMING LAPTOP

ASUS Strix GL502VT

ASUS'S STRIX GL502VT IS FAR FROM HEAVY. Not everyone will like its appearance, but you couldn't call it bad looking. And while it's not quite a bargain, it's reasonably priced for the specs on offer. In many ways, we were expecting the GL502VT to be a conservative upgrade of something like the GL50VW (reviewed in *TechLife* #16, page 52) that would lead to a decent middle of the road gaming laptop, but once you get past that facade the difference says to you that this is of a different order of the machine.

We've ranked a trend of late of laptop manufacturers only installing OEM in their gaming-oriented models, and that's the case here, too. That's a bit of a double-edged sword, as customisation is one of the key reasons people buy PCs in order to do so, and it can be a design decision that makes the gaming laptop about as useful as a paper toaster — at least if you want to have more than a few games installed at a time. While we can certainly understand the appeal of the Samsung PCeM2 SSD that ASUS has used here — with its 2,000,000 read and 400,000 write ops/s — that 6GB cache capacity is likely to leave you wanting more space sooner rather than later — especially if you'd like to store some HD movies and TV or other big media files on there alongside your games.

The other notable upgrade of the GL502VT from the GL50VW is the addition of a 4K IPS display. But again, a 4K display is a bit of a mixed blessing. Attached to a powerful desktop gaming rig, they can deliver a great experience, but most people going to be gaming in 4K on the GL502VT — the internal hardware is not far from that of a budget desktop PC — will find that to spend more having a sharper image and being able to stream 4K videos content on the usefulness of this display is somewhat limited.

There's another downside to that screen — the one it adds to battery life. The GL502VT lasted just 2 hours and 35 minutes in our PCMark 8 Home battery life test — and that was with the battery saver optimisations on. Switch to high performance mode and you'll only reach around 1 hour and 30 minutes.

The Intel i7-6700HQ CPU and the Nvidia GeForce GTX 950M GPU come together nicely here, easily popping out respectable frame rates on the latest titles at 1080p. The GL502VT matched the scores of the 2014 Alienware Alpha (a device which uses a desktop-class GTX 960M, with average frame rates of 76.35 and 72 frames per second on *Assassin's Creed: Unity* and *Battlefield 4* respectively on high and ultra settings. The chassis does get warm in certain hotspots above the keyboard when it's under load, but the CPU and GPU both remained under 80°C, a fairly nice level throughout our tests.

The GL502VT's keyboard is full-sized, yet it's detached any space around the number pad and runs a few keys to the right of the directional keys. The speakers aren't great, despite sitting particularly close to each of your ears on either edge of the base of the unit, roughly in line with the trackpad.

Still, we were surprised the street price landed at a reasonable \$1,900 for the 4K model, which means it's hard to be too harsh about the cutting-edge technology it does bring to the table. And at 2.3kg, the heftier hardware hasn't made the device unwieldy by any means either — this is a gaming laptop that's not too painful to carry around with you. ■ (PAGE 30, PAGE 31)

HOTSPOT
INSIDE TECHLIFE

[ALL THE DEETS]

Inside TechLife

GET THE LOWDOWN ON TECHLIFE'S EDITORIAL POLICIES, TEST PRACTICES, HOW TO READ THE BENCHMARK RESULTS AND MORE.

TECHLIFE IS AUSTRALIA'S youngest technology mainstream magazine, having been in print since 2012, when we launched as a redesigned and modernised version of *Australian PC User*. The latter was first printed in 1990, and *TechLife*'s current editor has been working for the mag (in both its incarnations) for over a decade. We take that 25-year heritage seriously and strive to be both ethical and transparent in our coverage of technology and any other topics we broach.

Like our sister magazine, *APC*, we have two main goals here at *TechLife*: to track down the best of modern tech and to help our readers get the most from it. We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices in their lives. And like you, *TechLife*'s journalists want to know what's good in tech — no matter what platform it resides on.

UNBIASED REVIEWS

Championing technology doesn't mean we're unrelentingly positive, however, and our other aim at *TechLife* is to be as objective as possible in our coverage. That means identifying the best products from multiple perspectives — the best performance, best value and best

features and, ideally, the products that offer the best mix of these three aspects.

As a matter of policy, reviews published in *TechLife* are not shared with product-providers prior to print. We will contact vendors under certain conditions; if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If a *TechLife* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

In order to make our reviews and other stories as unbiased as possible, *TechLife* strives to conduct rigorous, objective and scientific tests and benchmarks where possible. We use a variety of tools and programs to achieve this, including many freely available benchmark suites for assessing things like general system performance, gaming, media encoding and battery life.

In most cases, for the benchmark results published in *TechLife*, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such. ■

ASUS[®]
IN SEARCH OF INCREDIBLE



ProArt PA329Q Professional Monitor

ULTRA HD
4K

Accurate Colours. Perfect Pixels.

Wide Colour Gamut for Vibrant Images

Supports 100% Rec. 709, 100% sRGB,
99.5% Adobe RGB, 90% DCI-P3, and
Rec. 2020 with colour accuracy of $\Delta E < 2$

ASUS ProArt™ Calibration Technology

Provides colour accuracy tuning & uniformity
compensation, and even saves all colour
parameter profiles on the monitor's IC chip

* Compatible with X-Rite and Datacolour calibrators

4K UHD Content Playback at 60Hz

Experience stunning 4K UHD visual
at 60Hz via DisplayPort 1.2, Mini DisplayPort 1.2,
and four HDMI (v2.0) ports



ASUS Australia & New Zealand



www.asus.com.au

THE WALL

GUFF AND STUFF

[COME ON, HAVE YOUR SAY!]

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to techlife@futurenet.com. All correspondence becomes the property of *TechLife* and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.



Index of previous articles?

I have been subscribing to *PC User* and now *TechLife* for longer than I can remember. Quite often, there are articles I need to reread/reference sometime later, and I can spend ages wading through my older magazines quite often with no success. Often, I scan articles but that is only for ones I think I might need. I subscribe to the hard copy, but I understand that you have a digital version, is it possible to download different articles for easy future reference?

[DAVID MADIGAN]

Ed replies: We've had a few requests about the best way to find specific articles in previous issues, David, and we're currently discussing the feasibility of putting together a searchable online index, which would be updated each month with a full list of the contents of the new issue. Our resources are limited, though, so readers, if this is something you're interested in, send us an email and let us know.

[WWW.TECHLIFE.NET]



Tech help for seniors

In response to Charles DeJoux's request in *TechLife* 54 (see page 7) about tech help for those getting on in years, I'm not aware of any site that does exactly what he asks, but there are a number of sites and initiatives that offer training and tech help for the over-50s.

Broadband For Seniors (BFS) is an organisation I'm involved with — it's an Australian Government-funded, volunteer-run training system for the over 50s (not that we check birth certificates). Its aim is to enable seniors to be competent at using the internet and emails on PC, tablet or smartphone. It has been running for many years and is currently administered by Adult Learning Australia. See bfseniors.com.au for more details.

There's also Tech Savvy Seniors, an initiative of Telstra and the New South Wales, Victoria and Queensland governments. They provide both classroom-type training, as well as some

training resources to view online or download. Training session contacts can be found at www.telstra.com.au/tech-savvy-seniors/training-sessions.

The Australian Seniors Computer Clubs Association (www.ascca.org.au) is another resource for seniors seeking help, training and advice about tech items. Unfortunately, those seniors in remote or small communities often have trouble accessing an ASCCA club.

Lastly, YouTube is an often overlooked resource of valuable material — sure, there is a lot of useless stuff but it's certainly worth a browse!

[KEITH HARVEY] ■

HOTSPOT

YOUR GUIDE TO HOT NEW TECH

[EN GARDE, YOU OVERGROWN POCKETWATCH!]

The pen is mightier

SAMSUNG'S STYLUS-DRIVEN GALAXY NOTE IS BACK, BUT IS THERE ENOUGH ROOM IN THE PHABLET MARKET FOR BOTH IT AND THE S7 EDGE?

[DAN GARDINER]

FOR THE LAST couple of years, Samsung has had a bit of a problem on its hands: it's got two very similar phones that are in danger of cannibalising each other. After all, if the company already has a 5.7-inch flagship device in the form of the Galaxy S7 Edge, is the Note family now basically redundant? With the Note7, Samsung's answer is a resounding... "not quite". The Korean company's latest answer to this cannibalisation conundrum has been to separate the Note7 more clearly from its S7 counterpart. Samsung is clearly pitching this new Note as more of a business/creative device; the colour tones in TouchWiz and the interface as a whole are a little more subdued, the phone body's curves aren't quite as pronounced and the higher price tag implies that this is a premium device with special capabilities.

But this is also the first Note that's arguably kind of elegant. Samsung is only offering one Note model this year, and whether you like the curved display design or not, it looks like it's here to stay. However, those curved edges aren't as rounded here as on the S7 Edge, and with symmetrically-tapered edges (the front and back pieces of glass are identical and meet at a thin metal band that wraps all around the edge), it's a device that's actually much more comfortable in the hand than the S7 Edge. It's also got a slightly bigger footprint than the latter and squarer corners, and there's really no mistaking them — ultimately, it's not *just* the S Pen that separates these two.

EVERYTHING YOU'D EXPECT

Locally, it's got the same internals as the S7 and S7 Edge — a speedy Samsung-made octa-core Exynos CPU that's not quite the fastest chip around (that'd be the Snapdragon 820), but not a huge deal behind either. There's 64GB of storage as standard (that's actually the one and only option, too), plus 4GB of RAM and a fast-enough Mali T880 graphics chip.

As you'd expect from a Samsung flagship, the Note7 includes a litany of top-shelf features elsewhere, too, including IP68 water and dust resistance, a fingerprint scanner on the home button, wireless and fast charging, Gorilla Glass 5 front and back panels and class-leading camera performance from its 12MP rear and 5MP front shooters — apart from a slightly wider-angle lense, shots taken with the Note7 were basically indistinguishable from our S7's photos, so you get great performance in almost any lighting scenario. The 5.7-inch AMOLED display is a 1440p number, matching the S7 devices, and Samsung has finally adopted the Type-C USB port for charging, so it's a little more future-proof.

SLICKER AND MORE FLEXIBLE SOFTWARE

What's perhaps even more impressive than the Note7's sleek design and specs is the fact that Samsung has actually made some good improvements on the software side of things.

As we mentioned above, the Note7 has the most mature and understated implementation of TouchWiz UI we've seen, but the extra good news is that





AS YOU'D EXPECT FROM A SAMSUNG FLAGSHIP, THE NOTE7 INCLUDES A LITANY OF TOP-SHELF FEATURES ELSEWHERE, TOO, INCLUDING IP68 WATER AND DUST RESISTANCE, A FINGERPRINT SCANNER ON THE HOME BUTTON, WIRELESS AND FAST CHARGING, GORILLA GLASS 5 FRONT AND BACK PANELS AND CLASS-LEADING CAMERA PERFORMANCE FROM ITS 12MP REAR AND 5MP FRONT SHOOTERS.



SAMSUNG GALAXY NOTE7

\$1,349
www.samsung.com/au

CRITICAL SPECS:

Android 6.0.2; 5.7-inch AMOLED screen @ 1440p; octa-core Samsung Exynos 8890 CPU; Mali-T880 GPU; 4GB RAM; 64GB onboard storage; 3,500mAh non-removable quick-charge battery; 5MP and 12MP front and rear cameras; 169g

exclusive features like edge swiping (letting you bring up custom shortcuts to apps, contacts and other functions) and the S Pen widget now work fine with third-party launchers, so you can ditch TouchWiz completely if you want.

And the S Pen is also better than ever. The stylus itself isn't drastically different from last year's, but Samsung has amalgamated most of the associated apps into a single Notes app, meaning you've basically got the features of four separate programs bundled into one conveniently tabbed package. The stylus is more generally useful, too — flick it out while the

phone screen is locked and you're automatically given a simple chalkboard-style note-taking area.

You can even pin these notes to your lockscreen, so they can be opened and viewed in the future without having to unlock the phone — it's a great little feature for leaving yourself quick reminders, to-dos or shopping lists.

Also new is an encrypted and locked-off area called Secure Folder. This is basically a place that you can stash private apps, games and files, but its really neat trick is that it can actually run separate instances of applications. So, for example, you can create a second Gmail app inside that is just for your work email account. It's a neat extra layer of security that also allows you to let others play with your phone without worrying that they'll mess up anything important.

NEW CONVENIENCE FEATURES

Samsung has also been touting the ability to unlock the Note7 using a new iris-scanning technique thanks to a built-in infrared camera. For this to work properly, it does need to be facing your eyeballs, and although it registers both during setup, only one eye needs to be identified to unlock the device. And in practice, it largely works as advertised, barring a few

occasions where we were wearing glasses and it needed a second longer to recognise our eyes. You do need to have the device facing your noggin at a specific angle, but provided that's the case, it's near instantaneous to unlock. Samsung says that it won't work if you're sleeping (or, presumably, deceased) and somebody pries open your eyelids, but we didn't have the opportunity to test this ourselves.

So is iris unlocking better or more convenient than using a fingerprint? In some ways, yes — you can simply tap the side power button to wake the phone, meaning you don't have to place your finger or thumb on the Home button, but we wouldn't go so far as to say it's a must-have feature.

SAME OLD SAMSUNG

Not all of Samsung's idiosyncrasies have been ironed out yet, however. The company is still unnecessarily duplicating a lot of functionality by making its own apps when Google's options work fine — there's zero reason to use Samsung's no-frills web browser when you can opt for Chrome, for example, and the the Korean company has even needlessly ventured into new Google areas with the Note7 — there's now a Samsung Cloud app that offers to back up your phone's data and settings to Samsung's servers instead of Google's, for example.

A MIGHTY ALTERNATIVE

Samsung obviously needed to do something significant to help distinguish the Note7 from the S7 Edge and it's largely succeeded. It's made the S Pen's functionality more seamless and straightforward, so that the stylus is actually more usable than it's ever been before — if you've owned previous Notes but have largely ignored the S Pen, this might be the one that changes that. There's still a little bloat that Samsung could cut, to be sure, but the Note7 does manage to stand up as an agreeable device with its own identity. If you can actually make use of those unique features, it might even be worth that premium price. ■



FACEBOOK BLOCKS AD-BLOCKERS

AD-BLOCKERS RESPOND WITH AN IMPERFECT BYPASS.

In an effort to thwart ad-blockers, Facebook recently announced a workaround that would blend the HTML of its ads into its content, making it almost impossible to discern from regular posts. In almost no time, Adblock Plus released its own bypass to Facebook's solution, though according to the social network, it also blocks legitimate posts from friends and pages. [SL]

WIDESPREAD NEW EXPLOIT AFFECTS UP TO 900M ANDROID DEVICES

INCLUDES MANY FLAGSHIP DEVICES FROM MAJOR MANUFACTURERS.

If your Android phone sports a Qualcomm chipset, then it could be exposed to a set of four vulnerabilities dubbed QuadRooter. Discovered by the Check Point mobile threat research team, the exploit allows attackers to gain root access to your device. So far, phone manufacturers have fixes for three of the four vulnerabilities, with a fourth fix on the way. [SL]

TIME'S UP FOR VCRS

LAST JAPANESE MANUFACTURER HITS 'STOP' ON PRODUCTION.

Unable to continue its status as the last-known company still manufacturing videocassette recorders, Japan's Funai Corporation has decided to hit 'Eject' on its production of VCRs. Funai cited "difficulty acquiring parts" as the main reason for throwing in the towel, though we have to imagine that catering to a niche market of VHS enthusiasts doesn't exactly rake in the cash. [SL]



[THIS CYBER WAR IS GETTIN' HOT]

US Democratic Party hack an act of 'internet terrorism'

AUSTRALIAN SECURITY EXPERTS TELL ALL.

RECENTLY, THE DEMOCRATIC National Committee (DNC) experienced an aggressive cyber attack which led to privileged (and rather damaging) emails being thrust into the public eye by WikiLeaks, seriously damaging Hillary Clinton's Presidential campaign in the process. According to the The Australian Centre for Cyber Security at the University of New South Wales Canberra, the hack should be considered an act of "internet terror" due to its ability severely impact the political cycle, as it was directed at the liberal democracies by either non-state actors or by states themselves, as reported by Gizmodo. In response to the attack, the White House unveiled a new Presidential Policy Directive (PPD), which details how the United States should respond to cyber incidents which threaten national security. Professor Greg Austin says that "the new PPD, which calls for retaliatory action if appropriate, will be severely tested as the FBI conducts its investigation into the hack of the Democratic Party since Russia has been implicated by some in the attack".

[STEHPEN LAMBRECHTS]

[READ THE FINE PRINT]

ACCC to investigate ISPs' broadband speed claims

THE CONSUMER WATCHDOG IS OFF ITS LEASH.

FED UP WITH internet companies falling short of their speed promises, the Australian Competition and Consumer Commission (ACCC) has launched a public inquiry into why they fail to deliver on their advertised speeds. According to the ACCC's consultation on broadband speeds discussion paper, "consumers are entitled to expect clear and accurate information about the performance characteristics of a service they have purchased or are considering switching to", stating that advertised potential maximum speeds "misrepresent the speeds that the retail broadband service can consistently achieve, especially during peak periods when most consumers will want to use the service". The ACCC says "a lack of accurate information increases the likelihood that consumers will misunderstand or be misled about the quality and capabilities of the broadband options available". The consumer watchdog says it's "also interested in views on whether similar issues are arising in the marketing of mobile broadband services". It also proposes the implementation of a national monitoring system, though it'd need \$6 million from next year's budget to do so. [STEPHEN LAMBRECHTS]



[WE TOLD YOU SO]

Gaming good for students' results, Australian study finds

SPENDING TIME ON SOCIAL MEDIA... NOT SO MUCH.

ACCORDING TO NEW research published on the International Journal of Communication website, teenagers who regularly play online video games tend to perform better at school. Alberto Posso, Associate Professor at RMIT's School of Economics, Finance and Marketing, says that "students who play online games almost every day score 15 points above the average in maths and 17 points above the average in science". Posso explained that "when you play online games, you're solving puzzles to move to the next level and that involves using some of the general knowledge and skills in maths, reading and science that you've been taught during the day". Social media, however, has an adverse effect, with Facebook-obsessed teens scoring 20 points worse on average in maths. Associate Professor Posso says "students who are regularly on social media are, of course, losing time that could be spent on study — but it may also indicate that they are struggling with maths, reading and science and are going online to socialise instead".

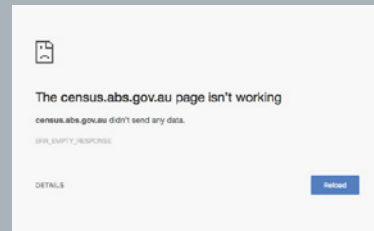
[STEPHEN LAMBRECHTS]

[PASSWORD1234]

With OpenYOLO, Google takes another stab at fixing passwords

YOU ONLY LOGIN ONCE.

KEEPING YOUR PRIVATE data secure is of the utmost importance these days, which is why Google is teaming up with the digital wallet and password manager startup Dashlane to create a universal password solution for the Android platform. Dubbed OpenYOLO due to its open-source API nature and "you only login once" mission statement, a Dashlane spokesperson stated that the project will provide "universal implementation by various apps and password managers across all platforms and operating systems". Though Google and Dashlane are heading up the project, Dashlane says that "leading password managers are either already participating or have expressed strong interest", listing the likes of 1Password, LastPass, Keeper and Keepass. As for Google's Smart Lock manager, Dashlane's Android Engineering Lead Stanojko Markovikjm says that it will be integrated into OpenYOLO. According to Markovikjm, Smart Lock "complements [OpenYOLO] by providing a mechanism to query other password providers installed on the device". Markovikjm hopes OpenYOLO will be "seamlessly available when you needed it, every time you need it". [STEPHEN LAMBRECHTS]



TURNBULL ASKS FOR INQUIRY INTO #CENSUSFAIL

PRIME MINISTER CALLS DDOS ATTACKS THAT BROUGHT DOWN SITE "COMPLETELY PREDICTABLE". As many expected, the Australian Bureau of Statistics' first attempt at holding an online Census crashed and burned in spectacular fashion, with four DoS attacks forcing the entire ABS site to go offline. Prime Minister Malcolm Turnbull called the attacks "completely predictable", laying the blame at the feet of contractor IBM. Turnbull has called for a full inquiry, warning there will be "serious consequences". [SL]

'SMART' BLUETOOTH LOCKS NOT ACTUALLY SO SAFE

INTERNET OF THINGS STILL NOT VERY SECURE. According to a presentation made at this year's DEF CON hacking conference, we're still a long way from having truly safe smart locks. Anthony Rose and Ben Ramsey of Mercurite Security took to the stage to demonstrate how easily the locks can be compromised using simple hacker tricks — some locks displayed passwords in plaintext, while others were cracked using a Bluetooth sniffer. [SL]

FRANCE ORDERS MICROSOFT TO STOP COLLECTING SO MUCH USER DATA

SACRÉ BLEU! Sick of Microsoft collecting excessive data on users of its Windows 10 operating system, the French data protection authority has ordered the tech giant to stop serving customers targeted ads without their consent. The Commission Nationale de l'Informatique has given Microsoft three months to cut its data collecting shenanigans, or else it could start a sanctions procedure. [SL]



[CONSOLE YOURSELF]

The One we've been waiting for?

FORGET JUST GAMING – MICROSOFT'S UPGRADED XBOX ONE S MIGHT JUST BE THE BEST ALL-ROUND MEDIA DEVICE FOR THOSE WHO'VE PICKED UP A 4K TV.

[PAUL TAYLOR & JOEL BURGESS]

MICROSOFT HAS A habit of being first. It was the first to produce a console with a built-in hard drive when it released the original Xbox. It was the first to sell a console capable of high-definition graphics, the Xbox 360. And now, with the Xbox One S, it's the first on the market with a console that not only plays movies and games in 4K, it does it all with high dynamic range (HDR) colour support too.

That's quite the feat, albeit with a few caveats.

Let's cover the basics first. The Xbox One S has shed 40% of its total volume compared to its immediate predecessor, and that's even with a new built-in power supply. Instead of an enormous hulking box, you now have a far more svelte unit, one wrapped in matte plastic that won't dominate your entertainment cabinet — it can even be placed vertically as well as horizontally. Both the Xbox One and the Xbox One S play Xbox One games — there won't be any exclusive Xbox One S titles, so if you bought an original One between November 2013 and today, it will still serve you well for a good few years yet.

Still, there is better hardware inside the S. All S models come with a tweaked GPU clock that's roughly 7% faster than the original One (914MHz in the S compared to the One's 853MHz). As a side effect, the increased clock speed benefits some older games and backwards-compatible titles, too. Screen-tearing in *Rise of the Tomb Raider* is less severe, and *Hitman* also shows off better frame rates. *Fallout 4*, meanwhile, is still as clunky as it has always been. *Alan Wake*, an Xbox 360 game, doesn't dip below 30fps as much as it used to — all of this is a tidy bonus.

KINECT IN THE BIN

A slightly redesigned controller with studded hand grips and Bluetooth functionality now comes as standard. (You can, if you wish, pair this controller to your PC, Mac or Android phone.) Our test console was the white launch model with a 2TB HDD, and retails for \$549. Once they're sold out, though, Microsoft isn't making any more, and you'll have to rely on the

1TB and 500GB versions, priced at \$499 and \$399, respectively. Both were officially released in Australia on August 23rd.

On the rear of the S, you'll find all the same ports as the original One, minus the marred Kinect port. Microsoft has unequivocally taken the hint that the majority of people don't want Kinect, and those that do can buy a separate \$54.95 adaptor which plugs into one of the two high-speed USB ports on the rear. A USB port that once sat on the side has, logically, been moved to the front, just under the disc slot.

About those initial caveats. Firstly, games don't run in 'true' 4K. Instead, your 4K-compliant screen is showing off an upscaled version of games that are still technically running at 1080p (or, as in many cases with the Xbox One, 900p). We're still a long way off consoles that can do native 4K at this price. Netflix and 4K UHD discs are another matter, which you can read about on page 16. In short, the results there are very encouraging.



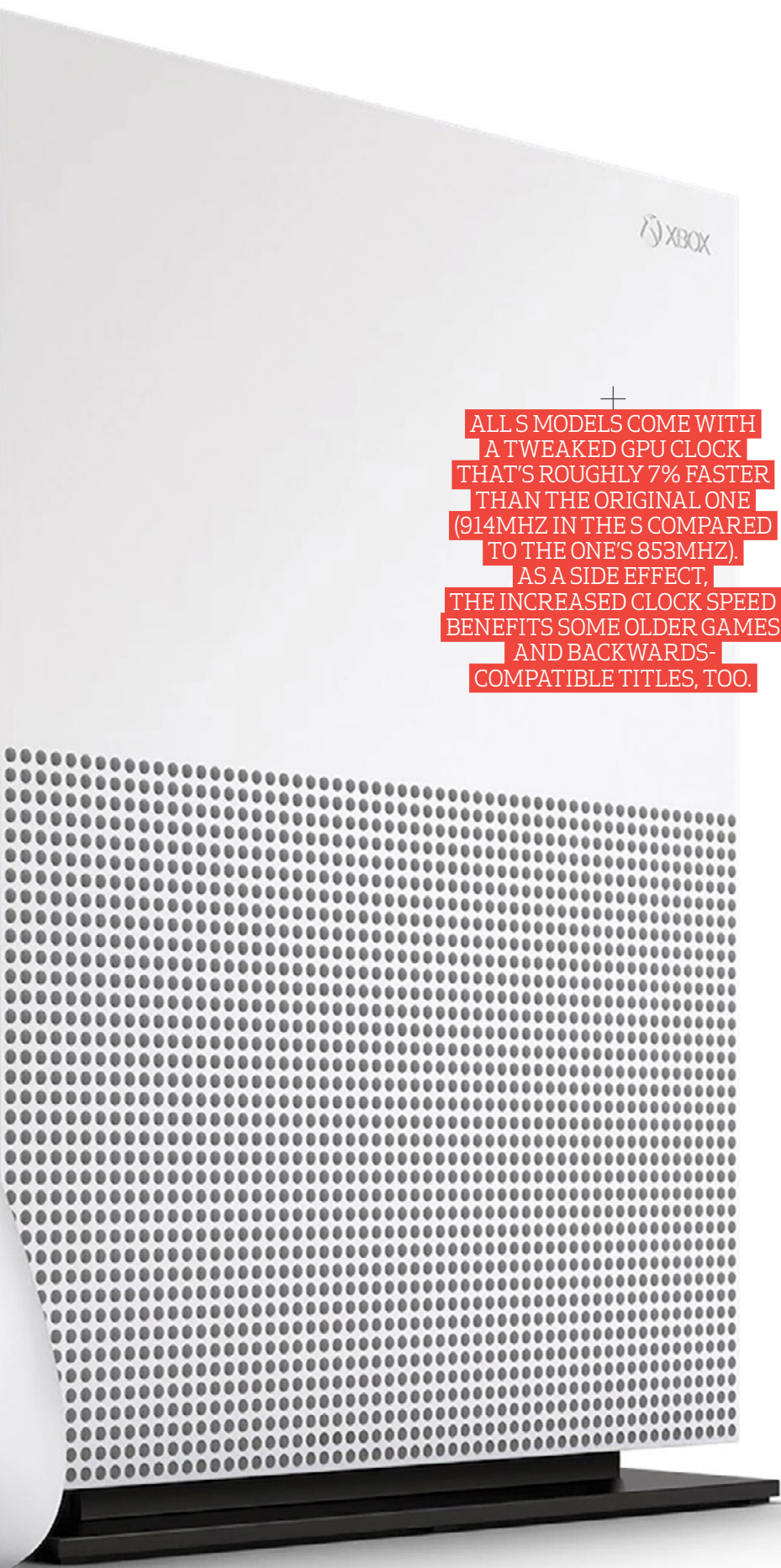
MICROSOFT XBOX ONE S

From \$399
www.xbox.com

CRITICAL SPECS

(ALPHA, AS TESTED):
Octa-core 1.75GHz AMD Jaguar; AMD GPU @ 914MHz with 12 Compute cores; 720p/1080p/4K video output with HDR; ultra-HD Blu-ray support; HDMI 2.0a; S/PDIF; 3 x USB 3.0 and dual-band 802.11 a/b/g/n Wi-Fi; Gigabit Ethernet; 500GB/1TB/2TB hard drive options; built-in IR blaster; 40% smaller than original Xbox One (exact dimensions and weight not specified)





+

ALL S MODELS COME WITH
A TWEAKED GPU CLOCK
THAT'S ROUGHLY 7% FASTER
THAN THE ORIGINAL ONE
(914MHZ IN THE S COMPARED
TO THE ONE'S 853MHZ).
AS A SIDE EFFECT,
THE INCREASED CLOCK SPEED
BENEFITS SOME OLDER GAMES
AND BACKWARDS-
COMPATIBLE TITLES, TOO.

But coming back to games, to get the very most out of the S, you'll not only need a 4K screen, but one that's also HDR compatible. We covered HDR in a bit more detail in our review of Samsung's 4K Blu-ray player (see *TechLife* August, page 14), but the basics are that it can boost colours and contrast so you can see more detail in both dark and light imagery and can make the picture really 'pop'. To that end, a few Microsoft-produced games will be available in the coming months that are HDR-compliant (notably *Forza Horizon 3* and *Gears of War 4*), which we've only seen in previews so far. Even at this stage, 4K HDR games look pretty amazing. Whilst not quite revolutionary, they do add a certain flair that should please anyone with an appreciative eye. With a larger contrast range, games and movies have more depth to them, and we're looking forward to how developers use this in dramatic scenarios.

THE ONLY WAY IS UP (RES)

For non-HDR games, the results are admittedly less impressive. While your eyes will definitely notice the difference between lowly SD and HD, the gulf isn't quite as large between full HD on a beautiful screen and 4K on a merely good display. While games run with more verve (as we said above regarding *Tomb Raider* and *Alan Wake*), on a sheer graphical level, the difference is barely perceptible. After countless laps in *Forza Motorsport 6*, the best this writer's eye could see was slightly better anti-aliasing.

You'll also need a 4K TV that can handle that resolution at 24Hz, 50Hz and 60Hz, and have HDMI 2.0 cables that can handle the HDCP 2.2 standard (the S does include one such cable in the box). Check your hi-fi receiver, too — if it's a few years old, it might be the weakest link and refuse to allow the higher-res signal through. Plus, we were a touch worried when the S spat back that one of our test screens, a 55-inch TCL C1 (one of the most affordable 4K screens on the market, albeit without HDR capabilities) did not support 4K 10-bit, and would be "unable to play" 4K games. The 10-bit reference refers to HDR, but despite that warning, in the end, the console and TV did gladly play games at 4K in 60Hz.

This confusion around the nomenclature stems from an array of 4K standards, thanks to 10-bit HDR and Dolby Vision's 12-bit. These wrinkles will no doubt be smoothed out over the next year or so, but until then, *TechLife* will be here to keep you well informed.

STING IN THE TAIL

All that said, the Xbox One S is relatively good value for money if you want a gaming box that can play 4K movies. Like someone who's gone on a lean diet and hit the gym, the Xbox One S has lost a lot of fat, is better looking, and can do more than ever before. Even at \$549, this is the cheapest 4K Blu-ray player on the market, and with the updated Netflix app, it'll also dazzle you with 4K shows and movies from the



world's most recognisable streaming service. At \$399 for the 500GB model, it's a steal.

The potential spanner in the works is that there's yet another Xbox looming on the horizon, 'Project Scorpio'. Revealed in June this year — alarmingly, at the same press conference where the Xbox One S was announced — Scorpio will be released in late 2017, and looks to be a gargantuan bit of kit, with true 4K gaming, VR support, and a GPU capable of 6 teraflops of performance — the same as a decently-specced

gaming PC. No other firm hardware specs have been released just yet, and Microsoft assures us that "Project Scorpio will join the Xbox One family and coexist alongside Xbox One and Xbox One S and all of your Xbox One games and accessories are compatible" and that it's aimed at people who have a 4K TV and want the absolute best. While there won't be any exclusive Project Scorpio games, developers will be free to utilise that extra power any way they see fit. This could be to shore up a game's

framerate, add a VR viewpoint, or go all-out with uncompressed, high-res textures.

So does Project Scorpio make the Xbox One S a moot point? Not really. If you don't own an Xbox One because you've been waiting for it to hit that sub-\$400 price point, this is the time to get one. There are also plenty of original Xbox One consoles available out there which are now even cheaper, so if you're resolved to hold on to your full HD display for a while yet, you'll likely be able to grab a bargain.

4K BLU-RAY ON THE CHEAP

THE ONE S HAS EMERGED JUST AS 4K BLU-RAY IS KICKING OFF AND THAT MAKES IT AN APPEALING OPTION... IF YOU'VE GOT THE TV TO MATCH.

Looking beyond the Xbox One S's capacity as a games console, the timing of its launch and its comparatively affordable price actually makes it a device well worth consideration as a standalone 4K media player. For those who've upgraded their lounge room TV to a new Ultra HD (AKA 4K) this year, then you might even be able to utilise the device's cutting-edge HDR capabilities, too.

You might be familiar with HDR (high dynamic range) from photography, but it works differently when it comes to video. Essentially, HDR video makes use of the broader colour and higher contrast capabilities that have become available in higher-end 4K TVs. This means they can produce images that display a wider range of colours that can, in turn, be further enhanced by more finely-graded contrast capabilities. The greater colour range comes from an increase in bit-depth. Until now, colour for home video has largely been encoded in 8-bit, which matches the capability of most TV screens and computer monitors. Recent higher-end TVs and professional monitors have started offering 10-bit capabilities, however. With the digitisation of images, what 'bits' really reflects is how many shades of grey between black and white can be displayed — with 8-bit, you get 256 shades, while with 10-bit, you get 1024. When combined with the red, green and blue colour channels, this means that 10-bit images have a palette of 1.07 billion colours to work with — that's each of the red, green and blue channels' 1,024 shades multiplied by each other (1,024 x 1,024 x 1,024 = 1.07 billion). By comparison, 8-bit only offers 16.7 million colours.

There are two competing HDR formats, but the more broadly used one is HDR10 — it's what the Xbox One S and Ultra-HD Blu-ray support. HDR10 is called as such because it utilises 10-bit encoding and can, therefore, make over 1 billion different colours. Having access to that number of colours means that

you can theoretically create pictures with notably more rich colour depth and discern subtle differences in shades that would have once been indistinguishable.

In our testing, Ultra HD Blu-ray discs played quite smoothly on the new Xbox — something that we'd be reluctant to say for Samsung's standalone UBD-K8500 UHD Blu-ray player — and there was a clear and significant difference between watching a 4K HDR Blu-ray and a regular SDR 1080p Blu-ray through the One S. That said, we didn't think the colour reproduction on the Xbox One S was as good as the UBD-K8500 — and we would go so far as to say that the HDR colour output of the Xbox landed right in between a standard Blu-ray and the UBD-K8500. Detailed analysis of the same 4K Blu-ray found the One S to have less rich colours, overly accentuated contrasts and, on the whole, a more faded appearance than the picture produced by the UBD-K8500.

Apart from 4K Blu-ray discs, of which there were around only 50 titles readily available at the time of writing, UHD availability is limited. The other major source for 4K content is Netflix — and the good news is that the Xbox One Netflix app has already been upgraded to be able to play back the 4K HDR content.

Furthermore digging into the settings, the One S also appears to be able to output 12-bit HDR colour, a standard that has been picked up by Dolby in Dolby

Vision, though there is no official word on how it intends to use this yet.

The fact that the Xbox One S is \$100 less expensive than Samsung's UBD-K8500 and notably less expensive than the alternatives on the horizon makes it a pretty hard contender to beat. At present, it doesn't perhaps offer the most vibrant colour in HDR images but that's presumably something Microsoft can fiddle with via patches — and for the price, it won't disappoint.

+

ESSENTIALLY, HDR VIDEO MAKES USE OF THE BROADER COLOUR AND HIGHER CONTRAST CAPABILITIES THAT HAVE BECOME AVAILABLE IN HIGHER-END 4K TVS. THIS MEANS THEY CAN PRODUCE IMAGES THAT DISPLAY A WIDER RANGE OF COLOURS THAT CAN, IN TURN, BE FURTHER ENHANCED BY MORE FINELY-GRADED CONTRAST CAPABILITIES.

The news in numbers

THE KEY FIGURES BEHIND THE LATEST ISSUES AND TRENDS IN TECHNOLOGY.

[CARMEL SEALEY]

1 billion iPhone

THE NUMBER OF IPHONES NOW SOLD.

On the 27th of July 2016, Apple announced that it had sold its one billionth iPhone since the launch of the original model way back in 2007. Yet despite this milestone, sales have been dropping in the wake of the iPhone 6 and 6S's success — supposedly due to the sluggish Chinese market. With the release of the 'iPhone 7' (or whatever it's ultimately called) expected this September, however, Apple will attempt to reinvigorate its potential audience, but many analysts are saying that 2015 may have been the year the iPhone peaked.



Dh2,000,000

HOW MUCH YOU COULD BE FINED FOR USING A VPN IN THE UNITED ARAB EMIRATES.

While we in Australia enjoy the luxury of being able to use a VPN without any legal ramifications — whether that's for business reasons or private — those who call the UAE home can't say the same. Despite the fact that the UN condemns governments that restrict citizen internet access (see p.11 of our last issue), the President introduced a new federal law in late July that banned the use of VPNs, affecting the 88% of the population who are expats that require VoIP services. If discovered, the VPN user could be fined up to Dh2,000,000 — the equivalent of around \$722,000. (Which is the equivalent of 4011 years' worth of Netflix, if my maths is correct...!)

[WWW.TECHLIFE.NET]



5TH PLACE

APPLE HAS DROPPED DOWN TO NUMBER FIVE IN CHINA'S SMARTPHONE MARKET.

Market research firm Counterpoint Research has reported that Apple has sunk to fifth place in the Chinese smartphone market. In May 2016, iPhones made up a mere 10.8% of purchases of smartphones, a slump from 12% over the same period the previous year. With brands such as Huawei, Oppo, Vivo and Xiaomi all ahead of the US tech giant, it will be interesting to see whether Apple can keep its spot in the top five in China in the future.



#6

TELSTRA IS THE SLOWEST ISP IN AUSTRALIA FOR STREAMING NETFLIX.

In mid July this year, Netflix released data from its ISP Speed Index, featuring the likes of iiNet, Optus, TPG and Telstra. While Optus came out on top with a speed of 3.41Mbps, Telstra found itself down in sixth place with an average speed of 2.48Mbps. Netflix notes, however, that the index is "a measure of prime time Netflix performance" but not of "overall performance for other services/data that may travel across the specific ISP network".



6 TERAFLUPS

HOW POWERFUL THE GPU IN THE UPCOMING XBOX SCORPIO CONSOLE IS RUMOURED TO BE.

Project Scorpio (which sounds like something from a James Bond movie) is Microsoft's recently announced Xbox console, which is purportedly going to be available in stores before the end of 2017. According to Microsoft, this blinged-up Xbox One will support 4K, be VR-ready and pack 6 teraflops of graphics processing power, making it the "most powerful console ever". ■



[MEDIA MOGUL]

More than just wireless storage

THE BEST PORTABLE BACKUP DRIVE JUST GOT BETTER — NOW IT'LL KEEP THE KIDS QUIET ON THE NEXT ROAD TRIP, TOO.

[DAN GARDINER]

Western Digital My Passport Wireless Pro

THE WIRELESS HARD DRIVE THAT CAN DO A WHOLE LOT MORE THAN JUST BACKUPS.

IF YOU JUST need an external hard drive to dump files onto or serve as a bit of extra storage, the My Passport Pro is not the device for you. In fact, calling this little square box a 'wireless hard drive' is underselling it substantially — this is more like a portable network-attached storage device on steroids.

Like its non-Pro predecessor, this new device is largely geared towards content creators like photographers and videographers, and many of its features are aimed squarely at making it easy to back up and share that kind of content. There's a built-in 6,400mAh battery so it can operate free of mains power for up to 10 hours, and the Wi-Fi is 802.11ac so transferring large files is relatively speedy (up to 433Mbps). Select devices can send images and video straight to the Pro via Wi-Fi; that includes Android and iOS phones and Wi-Fi-equipped cameras that support writing directly to FTP (that includes lots of Nikons, but sadly not many Canons).

And for devices that can't use the wireless, the built-in SD Card reader and a USB host port can be used alongside a one-touch backup button to

quickly copy the contents of plugged-in cards to the Wireless Pro's main storage, without the need for a PC to mediate between the two. That USB host port is particularly handy as it means that, with the correct cable or adapter, you can plug in just about any other type of storage device or even a camera directly. And what's more, you can even charge devices off that USB port, so if your smartphone's running a little low, you can top it up from the Wireless Pro while you're on the go.

Sharing is really where the Wireless Pro kicks things up a notch from its non-Pro counterpart, though, and a big part of that is the built-in Plex Media Server. We've covered Plex more than a few times in *TechLife* previously, but it's basically a way to share your own ripped movies and TV shows with a nice slick Netflix-like interface. Load up the Wireless Pro with your video files and Plex will fetch full descriptions, cast lists and flashy artwork to go with them. Then you can play those files back on your iOS or Android smartphones or tablets using the associated Plex mobile apps — it can even transcode files and stream to multiple devices at the same time.

The Wireless Pro can serve as a wireless hotspot and even piggy-back on another device's internet connection — like your smartphone's — meaning you can connect a few devices to the Wireless Pro to access its contents and still have internet access. And the Pro's internal drive is formatted as exFAT by default, so if you do need to plug it into a Windows or Mac machine, it'll be accessible on both.

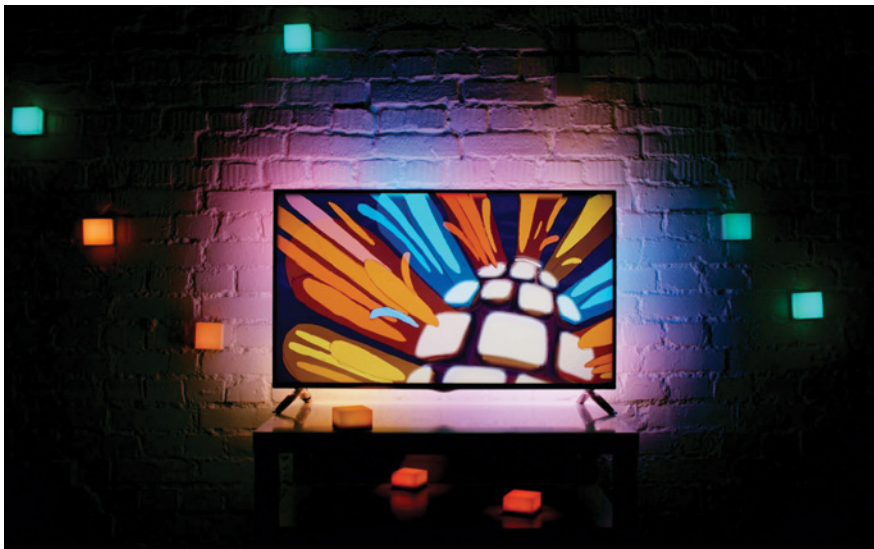
And all these features are generally well-implemented and easy to use — for the most part, once you've got the drive set up and connecting, it just hums away discretely and you don't even have to think about it.

The main caveat is that this new drive is considerably bigger than its forebear — including the USB cable, it's only a little shy of half a kilo. At \$389 for the 2TB model and \$449 for the 3TB, this isn't exactly a cheap storage device either, so you'll need to really make use of those extra features to get value out of it. (For comparison, a standard 3TB USB drive is around \$200.) This is an absolutely stonkin' bit of travel tech, so if the features appeal it's an easy recommendation. ■




WESTERN DIGITAL MY PASSPORT WIRELESS PRO
2TB, \$389; 3TB, \$449
www.wd.com

CRITICAL SPECS
802.11ac Wi-Fi; 2TB or 3TB capacity; 6,400mAh internal battery (up to 10 hours battery life); SMB and FTP file sharing; DLNA and Plex media sharing; 471g



[CROWDFUNDED]

Kickstarted!

FROM THE PRACTICAL TO THE QUIRKY TO THE DOWNRIGHT STRANGE, CROWDFUNDING WEBSITES HAVE ALLOWED THE CREATION OF AN AMAZING RANGE OF PRODUCTS. HERE'S A SELECTION OF LATEST PROJECTS THAT PIQUED OUR INTEREST.

[CARMEL SEALEY]

[OOH, SHINY!]

Lightpack 2

A LIGHT ORCHESTRA FOR YOUR TV.

www.lightpack.t | Goal: US\$198,000 | Raised: US\$508,525 from 2,051 backers | RRP: From US\$159

The Lightpack 2 isn't joking when it calls itself a "light orchestra for your living room". This set of lights includes an LED ribbon that sits around the back of your TV. Additional lights called Pixels can be fixed to the wall behind your TV in an artistically scattered way. These Pixels are wireless LED light 'modules' that flash colours relating to the colours displayed on screen, determined using a complex algorithm. In colourful movies or video games, the Pixels will sort of extend the TV to create the 'light orchestra' Lightpack 2 promises, which also makes viewing in darkness easier on the eyes. The *TechLife* team, however, was a bit split on whether this effect was stunning, or just distracting...

[SAD TROMBONE]

Failed Kickstarter of the Month

SOME CROWDFUNDING IDEAS WERE NEVER DESTINED TO SUCCEED.

[SWERVED OFF THE ROAD]

SKULLY AR-1

THE FIRST AR MOTORCYCLE HELMET.

www.skully.com | Goal: \$250,000 | Raised: US\$2,446,824 from 1,940 backers | RRP: From US\$1,499

Despite the fact that the company has recently been reported to have gone bust (and the Indiegogo campaign shut down), you wouldn't know it if you visited the Skully website. According to the company's spokesperson on Indiegogo, "our management team has worked feverishly to raise additional capital but unforeseen challenges and circumstances, beyond our control, made this effort impossible". However, a former employee for Skully claims that the founders of the company (Marcus and Mitchell Weller) had been using the funds to buy new sports cars and motorbikes, to frequent strip clubs, as well as buy apartments and first-class holiday flights. Regardless of whether these claims are true or not, it looks as though the Skully AR-1 helmet — that was touted to feature a heads-up display and wide-angle rear view camera, GPS navigation, fog-resistant visor, Bluetooth and hands-free — will never help you tackle the road.

[WWW.TECHLIFE.NET]



[GOIN' DOWN THE BAYOU]

FIREFLIES

AFFORDABLE WIRE-FREE EARBUDS.

firefliesaudio.com | Goal: US\$20,000 | Raised: US\$1,115,031 from 11,360 backers | RRP: US\$150

These little guys managed to raise 100% of the Kickstarter goal in under 12 hours, and then double that during the same day. Clearly, affordable wireless earbuds are something the masses truly want! The Bluetooth FireFlies offer high-quality, wire-free stereo audio without the eye-watering price of some of its competitors. The design is "sleek and convenient", and includes three different sizes of silicone tips and three different 'locking wings' to fit the inner curve of your ear and keep the earbuds securely in place. The FireFlies charge via a charging pod that connects to a power source through a microUSB connection, this keeps them relatively light, at 5.7g each.



[HEEL, BOY!]

COWAROBOT R1

THE FIRST AND ONLY ROBOTIC SUITCASE

www.cowarobot.com | Goal: US\$100,000 | Raised: US\$249,305 from 432 backers | RRP: US\$699

If you've read Terry Pratchett's *The Colour of Magic*, you'll likely be familiar with the concept of luggage following you around. However, unlike the Luggage (a mystical chest on dozens of legs), the Cowarobot R1 is something a bit more recognisable to the modern human. The R1 is a carry-on sized suitcase that possesses autonomous travel and obstacle avoidance technology, meaning you can fumble around with your passport and jacket in the terminal and not have to dedicate a whole hand to lugging around your luggage. Moving at a sprightly 7.2km/hr, it can tackle both smooth surfaces and uneven ground and can run for 20km on a single charge. The accompanying bracelet vibrates when your travelling companion gets too far away from you and the insides are equally as smart, including ample packing space and USB charging ports. ■



'But where is she?' Charlie wonders.
'Where's my Whisper?'

[I F & % \$ # @ * LOVE SCIENCE!]

Pop science

THE LATEST DISCOVERIES, INVENTIONS AND SCIENCE NEWS THAT'S HELPING SHAPE THE WORLD OF TOMORROW.

[CARMEL SEALEY]

Kids' screen time not all bad

BUT ONLY AS LONG AS PARENTS TAKE PART, TOO.

While passive screen time should probably be strictly limited for youngsters, what Lisa Kervin from the University of Wollongong has found is that, when parents also interact with their children's iPad screen time, it can be much more beneficial to the child. Apps that stimulate discussions and use real-world objects, rather than apps marketed as educational "based on rote learning", make that screen time engaging and an extension of play.

Dementia vaccine could be just years away

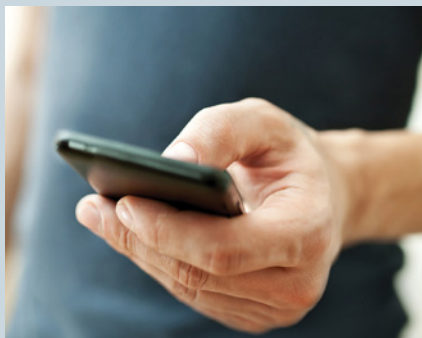
HUH?

Having been funded by the US Government, researchers from South Australia and California have been working together to develop a dementia and Alzheimer's vaccine that will likely be available to test on human subjects within the next couple of years. Targeting the proteins in the brain that "go wrong", the researchers hope that, if successful, the vaccine could be given to people before developing the disease or soon after showing symptoms, potentially reversing the effects.



THE ULTIMATE MOSQUITO REPELLANT? TURNS OUT IT'S CHICKEN. YUP, REALLY.

Mosquitos are notorious for carrying diseases (malaria, dengue fever and Zika virus among others), so Rickard Ignell of the Swedish University of Agricultural Science decided to discover which animals attracted or repelled mosquitos in an attempt to develop a better solution to keep them at bay. Turns out that the species he tested isn't too fond of chicken odour. If this is true for other species, this could be a very significant development in the battle against mosquito-borne viruses.



ABC'S CATALYST FAILED VIEWERS 'WI-FI DANGERS' STORY FOUND INACCURATE.

Catalyst is a program that covers scientific discoveries and knowledge with a goal to "inspire and activate" its viewers. However, in an episode called *Wi-Fried*, radiation from mobile phones and Wi-Fi devices was claimed to be dangerous and examples to back up this claim were heavily skewed and lacking credible evidence. Rather than putting forth an alternate view or instigating debate, the episode was promoting an uneducated opinion and has since been pulled offline and the journalist suspended.



GENETICALLY MODIFIED MICE MAY SOON BE ABLE TO SNIFF OUT DISEASES... AND WILL TASTE LIKE WAGYU BEEF! (KIDDING!)

Neurobiologist Professor Feinstein from the Hunter College in NYC has been studying odorant receptors in mice. Each receptor specialises in a certain scent and Feinstein is hoping to develop a way to heighten a single receptor, making the mouse's sense of smell for that one scent potentially 100 times more powerful. This means genetically-modified mice could be able to detect anything from Alzheimer's to land mines by simply sniffing around a bit. ■

LIFETOOLS

ENHANCE YOUR LIFE WITH TECH

[TECH DEEP DIVE]

Apps & gear
for sports

PLAY TO YOUR FULL POTENTIAL WITH THESE GAME-CHANGING APPS, GADGETS AND TECH RESOURCES FOR BEING BETTER AT SPORT.

[JOEL BURGESS]

AUSTRALIANS PLAY A lot of sport and there will be even more out there in the months following the inspiring highs and motivating stories that have emerged from the 2016 Olympics. But no matter if you're training for 2020 or you want to pick up a sport just to stay healthy, there are always things that you could do to be that little bit better. This Deep Dive has been developed specifically as a springboard for sporting success harnessing a worthy collection of gadgets, apps, websites and podcasts to help you get full marks in your next event.



[GADGETS]

Wilson X Basketball
THIS WILSON BALL WILL TALK TO YOU.US\$199.99 | www.wilson.com

If you're inspired to up your basketball game after the impressive performance by both Boomers and Opals, then this high-tech ball is the perfect companion. Built directly into the leather, this new app-connected basketball will keep track of exactly how many shots you land and can even give you a running commentary to get you in the zone. The Wilson X is more of a fun companion app that a genuinely useful training tool, but if you want to imagine what it'd be like to have a commentator narrating your moves, then this is the next best thing.

Golf Buddy Voice 2
YOUR SECOND BEST GOLFING BUDDY.\$149.99 | www.golfbuddyglobal.com

There is no shortage of gadgets and apps to help hone the skills of the modern golfer, but for the most part, they require you to use a touchscreen to interact with them. Resistive screens are a little unresponsive, yet you won't be able to use a golfing watch's capacitive touchscreen with gloves on. The Golf Buddy Voice range of wearables get around this by reading aloud your distance to the hole and suggested club so you don't even have to take your eye off the course.

Polar M600
THE BEST OF BOTH POLES.\$499 | www.polar.com

Polar has tended to target the training and fitness space rather than the smartwatch arena. The new M600 brings with it the excellent body tracking software for a range of different sport profiles that Polar is known for and pairs it with a sleek Android Wear smartwatch sporting a 1.3-inch colour touch display. With 4GB of internal storage to store your favourite songs and play it directly through your Bluetooth headphones, the new M600 seems to be the best of both worlds.

FitBit Scales
TIP THE SCALES IN YOUR FAVOUR.\$179.95 | www.fitbit.com/au/aria

Scales have become quite a bit smarter than the traditional, purely weight-measuring devices they once were. Using bioelectrical impedance by running a tiny electric current in the left foot and measuring the voltage loss on the right foot, the unit can get an accurate read on your body mass and how much extra weight you are carrying. This has obvious benefits for anyone trying to lose weight but for those that want to take their sport to the next level, it is a useful tool for knowing if you have the right body composition to play at your best.

Sports Camp Australia

SPORT AND CAMPING IN THE ONE HOLIDAY.

www.sportscampsaustralia.com.au

Holidays are a great opportunity for the kids to hone their skills at a particular sport, but if they're keen to dedicate some time to it, camp might be a worthy option. Sports Camp Australia is a website that has a comprehensive list of recommendations for camps that are specifically tailored to over 18 individual sporting codes. You can find a number of different camps for a particular sport or search for camps that are nearby. With everything from rugby to surfing, this website has a generous list of sporting options for the holidays.

The Roar

THE LOUDEST SPORTS BLOG OUT THERE.

www.theroar.com.au

Sometimes, keeping up with the activities, training regimes and success of the professional sports players is a good way to see what you should be doing in your own training sessions. There's nothing quite like practicing the winning shot from your favourite soccer team's penalty shootout on the weekend, or imagining you too could hit that deep three-point shot by the Sydney Kings key player. The Roar is your one-stop shop for sporting news in Australia.

The Journal of Science and Medicine in sport

SPRINKLE SOME SCIENCE ON YOUR SPORT.

www.jsams.org

Sports medicine and the general wisdoms of the time go through more change than any other medical field we can think of, and if you want to be on top of the latest findings and research, you're going to have to dig. The JSAMS periodical will give you insights into the latest scientific research on diet, training methods, tools and exercises which can be used to keep you ahead of the competition. If you're looking for something more than the average sports tips, there's no better way than to build your training from a scientific base.



CYCLEMETER

RECYCLE YOUR TRAINING ROUTINE.
Free, with IAP | iOS | abvio.com/cyclemeter

This iOS-exclusive app is one of the most highly-regarded tracking applications for cyclists. It plugs into a range of compatible sensors to track heart rate, cadence, power and speed and can connect to a headset to give you audio feedback. Using your smartphone's GPS, the app can save rides and allow you to race against a ghost of your earlier effort. It can also track skating, skiing and running.



FITIVITY

SPECIFIC FITNESS ACTIVITIES.
Free, US\$2.99 per month | Android, iOS | www.getfitivity.com

This app is an extensive encyclopedia of tutorials and training demos for being better at basketball. The Fitivity application itself is free but in order to access the 1,500+ videos, exercises and sport-specific workouts, you'll need to throw down US\$2.99 per month for a subscription. The tutorials cover dribbling drills, evasive and team-based manoeuvres, shooting techniques and technical plays. The app also includes fitness routines.



SPOTIFY

KEEP UP THE BPM.
\$11.99 per month | Android, iOS, Windows Phone
www.spotify.com/au

Music can have a profound impact on your mood—even on your performance in sport. It might be time to invest in a Spotify account to allow you to have the music that'll motivate you at your fingertips. There are a number of different streaming options out there, but Spotify can find you music with a beats-per-minute rate to match your speed.



HOLE 19

GOING THE EXTRA HOLE.
Free, with IAP | Android, iOS | www.hole19golf.com

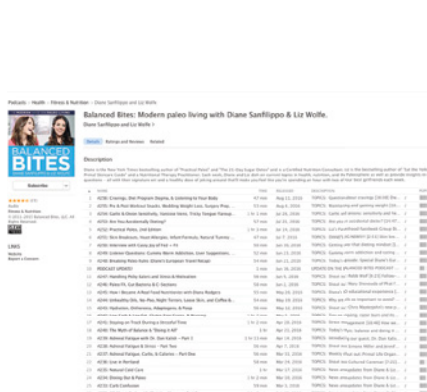
If you want to improve your golfing game, Hole 19 is an excellent place to start. The free app gives you access to over 39,000 course maps with GPS, rangefinding capabilities and an inbuilt scorecard. You have to manually enter your strokes, but it provides access to indepth statistics. If you have an Apple Watch or one of the many Android Wear devices, you can download the app to your wrist, too.



[OTHER RESOURCES] ABC Grandstand LISTEN FROM THE GRANDSTAND.

www.abc.net.au/news/sport

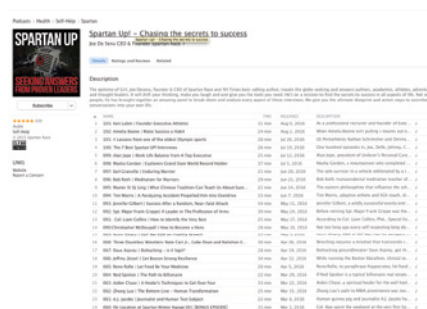
If you're out and about but there's a game you want to catch, ABC's *Grandstand* Radio program is the longstanding broadcast and podcast station that will give you running commentary on how it's progressing. Whether it's football (sorry, soccer), NRL, AFL or cricket, *Grandstand* will have you covered, being the flagship coverage from the ABC in many of the codes. The podcasts are updated regularly and the ABC website will let you listen to the live broadcast coverage. An excellent resource for never missing any of your favourite sports.



Balanced Bites YOU ARE WHAT YOU EAT.

www.balancedbites.com

There is a number of direct approaches you can take to being better at sports, but you can only dedicate so much time to training for any a particular activity. One of the most effective ways of making sure you are able to develop your sporting skills outside the training arena is your diet. *Balanced Bites* is a longstanding (250+ episodes) podcast that will give you some excellent tips on how to best refuel your body for an active lifestyle.



Spartan Up LOOKING BACK TO MOVE FORWARD.

www.spartanupthebook.com

This iTunes podcast comes off the back of one of the better motivational sports and fitness books of the 2014 New York Times Bestseller List: *Spartan Up*. This free resource has over 100 episodes interviewing influential American athletes, sports academics, food experts and professional trainers to get insights into the methods and techniques to be better at sport. It draws its athletic inspiration from the historical Spartan civilization and is bound to have something that will help you move forward.



The Wellness Couch DON'T GET OFF THIS COUCH.

thewellnesscouch.com

This home grown collection of health and lifestyle podcasts has a number of different shows to help you lead a more organic and active lifestyle. There are over 20 different shows that cover topics from paleo diets to interviews on inspirational sporting figures, and for anyone looking for motivation to be better at their sport, then there is no better place to start. Available on the Play Store, iTunes and in the browser, a number of these podcasts occupy the top 10 places in the iTunes Health podcast section.



Triton, a physics defying underwater rebreather device, had its campaign shut down by Kickstarter due to no working prototype.

[BARGAIN HUNTER]

Don't back a dud: How to avoid losing money on crowdfunded projects

BROWSE, RESEARCH AND FUND CROWDFUNDING PROJECTS SAFELY WITH THESE HANDY TIPS.

[LINDSAY HANDMER]

CROWDFUNDING CAN BE a great way to snag a new product earlier, and at a reduced cost. The idea itself has become incredibly popular, with a range of crowdfunding websites, and some projects backed to the tune of up to \$20 million. But it's not without risk; some of the largest projects have not delivered and others face endless delays. While some scams are easy to spot, others look legitimate, so we have put together a guide to ensuring you back a winner.

CROWDFUNDING 101

A quick recap — crowdfunding allows a person or company to present their idea or product to a huge number of potential investors. Users can browse and research the campaigns and financially back them in return for different rewards, such as an actual product. Importantly, crowdfunding

is not the same as pre-ordering — users are more like investors. This means there is a real risk involved and, if a project does not come to fruition, refunds are not readily available. The actual crowdfunding sites themselves don't take a side — rather they are just a platform to get creators and funding together.

Many crowdfunding campaigns have simply been outright scams, with creators who never intended to actually follow through. More common, though, are projects where the creator is genuine and passionate, but has simply underestimated how difficult the process would be, and either can't deliver, or under delivers. Being overly successful can actually compound the problem, as despite the extra funding, producing large numbers of a product is a huge challenge. Of course, scam or not, the end result is the same — the backer loses their money.

CROWDFUNDING WEBSITES

While Kickstarter (www.kickstarter.com) is one of the biggest, there are loads of other crowdfunding websites around. Indiegogo (www.indiegogo.com) is another solid choice and Pozible (www.pozible.com) is an Australian based funding site. GoFundMe (www.gofundme.com) is a very popular crowdfunding site, concentrating on non-incentive-based campaigns, such as support for medical expenses.

SPOTTING A SCAM OR IMMINENT FAILURE

The biggest defence against dodgy crowdfunding campaigns is good old common sense. If a project seems too good to be true, it probably is. For example, Triton — a James Bond-esque underwater rebreather device — flaunted the laws of physics, had an unconvincing demo and description, but still

DISCOVER

ESSENTIAL APPS, TOOLS AND ENTERTAINMENT

[TICK, TICK, TICK]

The best time-saving apps

DOWNLOAD THESE HANDY TOOLS AND YOU'LL HAVE THE TIME TO WRITE A HUMOROUS AND WITTY INTRODUCTION, LIKE ME.

[TIM BOTHWELL]

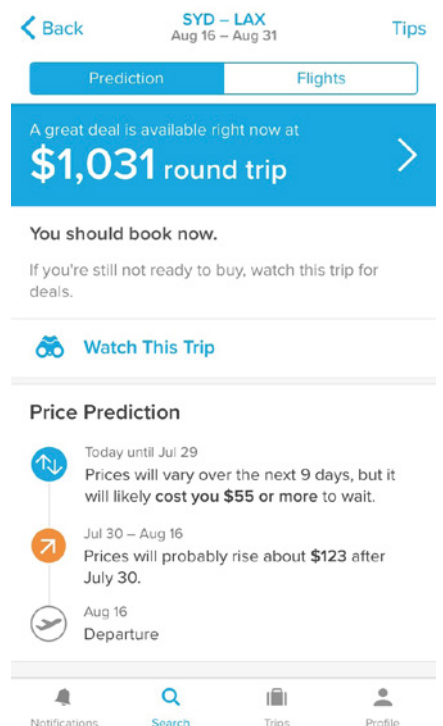
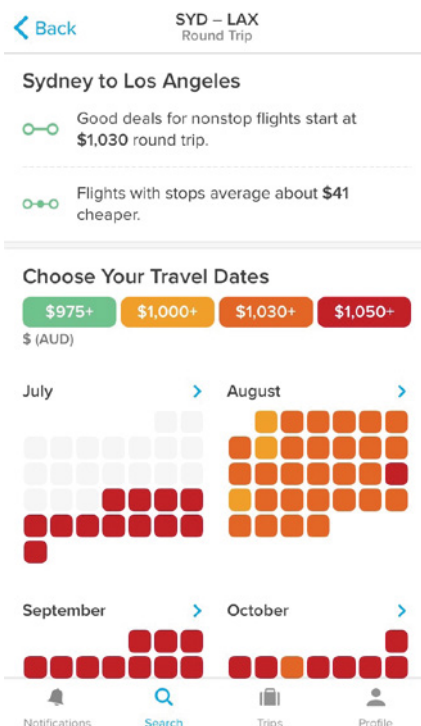
WE ALL KNOW that time flies when you're having fun, but it can also be the result of a busy work or study schedule. The 9-to-5 workday is no longer a given, with technology enabling many of us to work from anywhere we've got a decent internet connection. Thus, with our time becoming increasingly precious, it's important to make the most of what you've got.

A simple search of the web will reveal an almost endless number of 'hacks' to help you become more efficient — many of which are associated with using your mobile. While the smartphone is a great multitasker — you can browse the web, send an email or conduct a conference call... all while working out at the gym — there are apps that can further enhance your productivity. Here, we've listed a number of them, designed to help you get the most out of your day.



Holidays are a great way of getting some good old-fashioned R&R, but planning a trip can be time-consuming and stress-inducing. Finding the best (and cheapest) time to fly is extremely challenging, especially when attempting to compare prices across multiple airlines.

Hopper saves you the hassle by actively monitoring flights around the world to help find the cheapest ones. Simply choose a destination and you'll be presented with a calendar showing the least and the most expensive times to fly. After choosing your dates, the app will work to predict the cost of flights and whether they're likely to rise or drop in the future. You can even add dates to a watchlist, with the app notifying you of any changes.





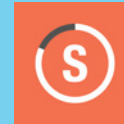
TASKER
\$3.49
tasker.dinglich.net

Sure, compared to my old Nokia, today's Android devices are certainly smarter. Yet, power users often complain about the limitations imposed by the Google OS. For them, we recommend Tasker, which allows you to program the automation of complex procedures. It initiates events based on particular circumstances — whether it's time of day, physical location, even the launching of a particular app. For example, a task could be created that lowers the screen's brightness during the evening, launches the music app when headphones are plugged in, silences your phone whilst at work, even texts your partner when you arrive home. While the app might seem scary at first, with a little trial and error, you'll be programming in no time.



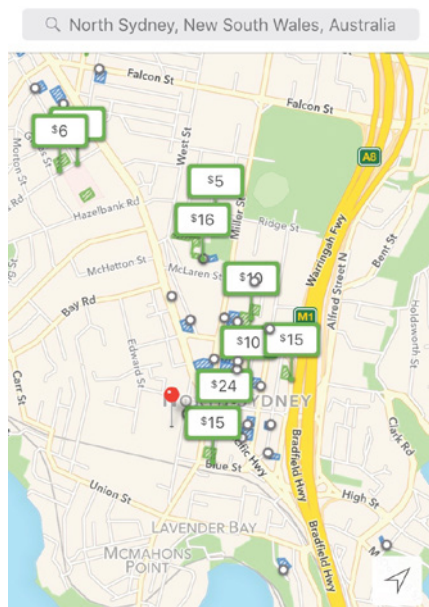
GBOARD
Free
tinyurl.com/tla55-itunes

Typing on a smartphone is nowhere near as convenient as using a physical keyboard. Say you're attempting to organise a night out with friends. As you converse over text, you suddenly recall the fancy hipster bar that sells overpriced cocktails in an establishment frequently overcrowded — perfect! Rather than close the current app and search for the location on Google, Gboard lets you do all that without leaving the current app. Using the keyboard, simply type in the name of the business to find contact details that can then be sent via text. You can also search for things like movies, GIFs or emojis. Probably the biggest time saver is the 'glide' feature which lets you type simply by sliding your finger between letters.



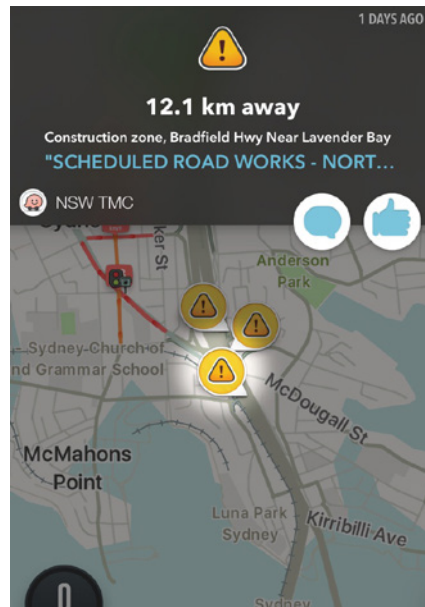
STREAKS
\$5.99
streaksapp.com

Sure, setting goals is a great way to improve productivity, but it can often be a struggle to actually achieve them. Having recently won a design award by Apple, Streaks is an app that has the simple role of helping you get stuff done! You can add up to six tasks — whether it's writing a novel, practising a musical instrument, even walking 10,000 steps. A simple press-and-hold marks a task as completed, with goals able to be further customised to require completion on certain days of the week. Even cooler is the ability for the app to integrate with Apple Health to automatically tick off exercise-related tasks.



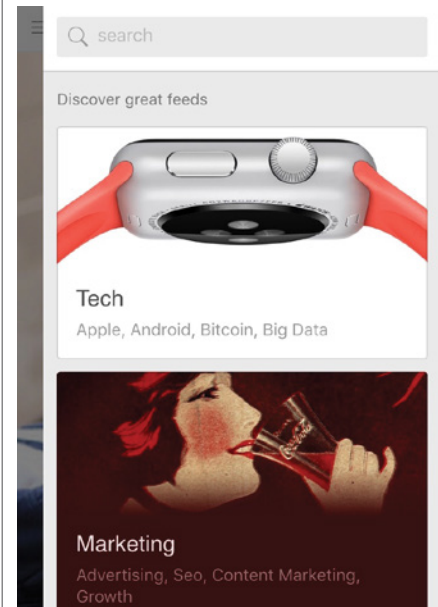
P
Parkopedia
Free with IAP
au.parkopedia.com

There's the common saying that time is money and this most certainly applies when it comes to parking. Spend more than a few hours in a shopping centre, hospital or CBD and you'll be charged an exorbitant amount for your stay. While a single trip mightn't seem like much, over time, parking can quickly add up to cost an absolute fortune. Parkopedia sells itself as the Wikipedia for parking — with ordinary users contributing to a global database of car spaces. Search using your smartphone's GPS to be presented with a list of nearby spots, along with opening hours and pricing. While the app is free, a subscription lets you apply filters such as stay duration, disability, even the height of a parking complex.



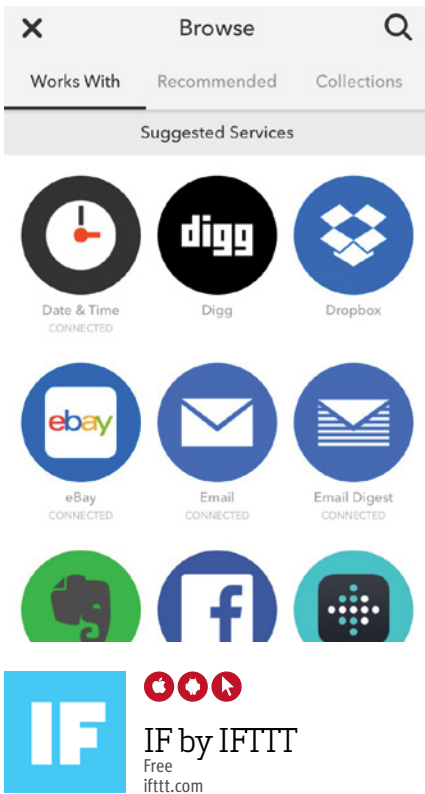
Waze
Free
www.waze.com

No longer required to purchase a bulky GPS unit, the app store is home to a plethora of navigation apps. However, it's well known that some of them work better than others (we're looking at you, Apple Maps). Acquired by Google in 2013, Waze uses a community-based approach to provide the best route, taking into account information provided by fellow users. Simply keep the app open and Waze will gather real-time traffic data that's then shared with others. For example, the app can automatically redirect you if there's a traffic jam up ahead. People can also report things like fuel prices, police traps and accidents — helping you get from A to B in the fastest time possible.

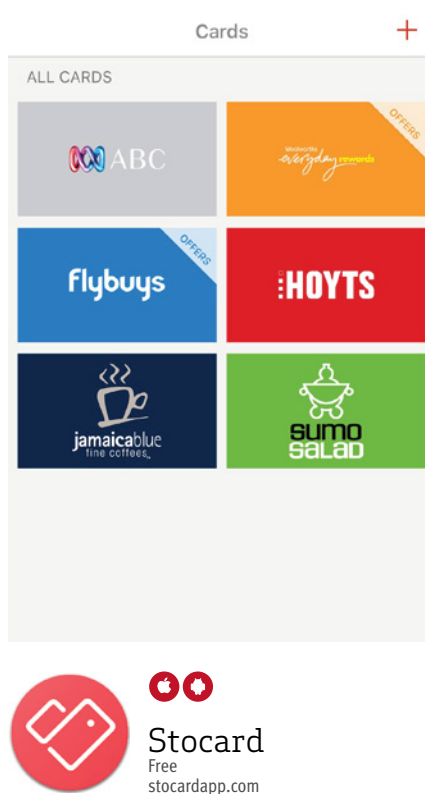


Feedly
Free
feedly.com

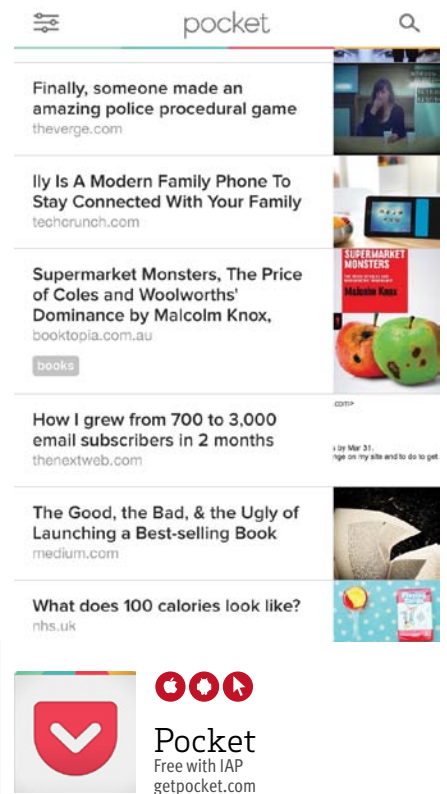
We all have sites that we visit on a daily basis, with the list often becoming overwhelming as you continue to find new and interesting content on the web. Hence why RSS feeds are such a great way of staying on top on all the stories published by your favourite sources. Feedly provides one-click access to the RSS feeds you care about — organised into categories that can be browsed at your own leisure. The app keeps track of unread stories so you'll always have something to read in a simple, clean interface that incorporates handy gestures to get through your feeds at lightning speed. If you're looking to be inspired, the app also features topics consisting of popular websites you can add to your list.



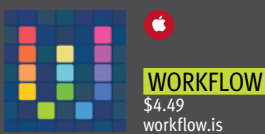
If you're like me, then you have accounts for a wide range of online services. While they may work great independently, it's their inability to 'talk' to each other that brings them down in terms of time-saving enhancements. Fear not, for IFTTT works to do just that. 'If This Then That' is an app that allows you to create 'recipes' that perform tasks utilising services such as Facebook, Dropbox, Instagram, smart lights, even your Fitbit. For example, you can create a recipe that saves all your Instagram photos to Dropbox, stores new phone contacts in a document on Google Drive, even get sent an email if it's going to rain tomorrow.



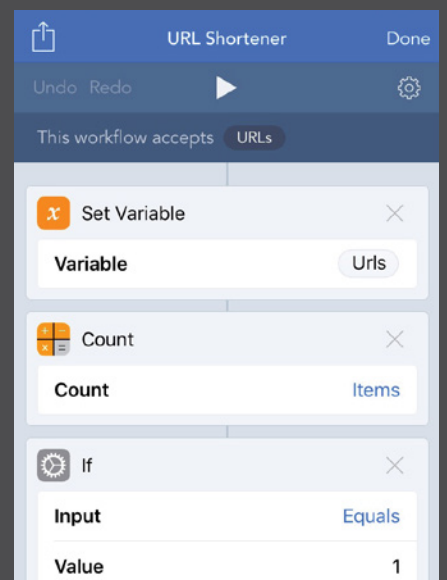
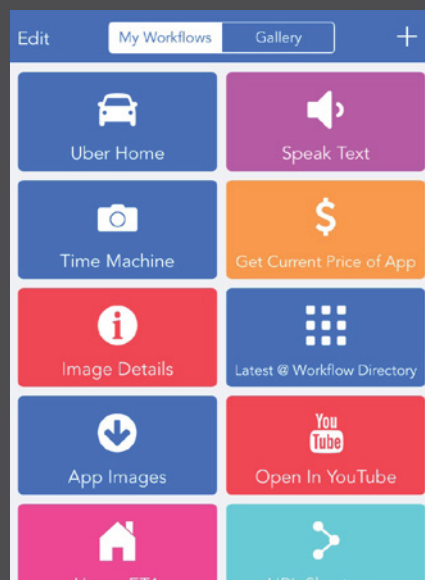
Walking through the shopping centre, I often struggle carrying the heavy and bulky thing that is my wallet — something that houses the many loyalty cards I've regrettably signed up for over the years. Too many times I've walked out of a store excited at the many points I'll accumulate, only to never return. And on the rare occasion that I do come back, it's the one time I leave the necessary card at home. Stocard assists by providing a digital locker for all those flimsy pieces of plastic. Using your smartphone's camera you can quickly scan and add barcodes, with the included today widget making them easily retrievable.



The web is home to an extraordinary amount of interesting content. Simply browsing your Facebook feed often reveals an array of stories you wish to read. Yet, sometimes, you just don't have the time to view them — say, for example, during a sneaky browse of your Twitter feed while at work. Pocket is a service that lets you store all the articles, videos and links you discover online so they can be read at a time more convenient to you. Stories are presented in a clean, distraction-free interface. Also handy is the ability to download articles so they can be viewed offline — useful for long flights or if you only have a limited data cap.



We all know that Apple iOS is a lot more restrictive compared to Android, but this becomes less true after installing Workflow. Similar to Tasker, the app allows you to perform complex tasks — whether that involves your calendar, photos, even music library. Using the simple drag-and-drop interface, you can create extremely powerful tasks, initiated at the touch of a button. Included is a gallery of readymade workflows such as one that sends an ETA based on your current location; orders an Uber to your next calendar event; even shortens a web URL. Workflows can be launched within the app, today widget, app extension or from a standalone icon on your homescreen.





[TAP, TAP. IS THIS THING ON?]

Top live-comedy podcasts

DO NOT LISTEN TO ANY OF THE FOLLOWING IN YOUR LOCAL LIBRARY.

[CARMEL SEALEY]

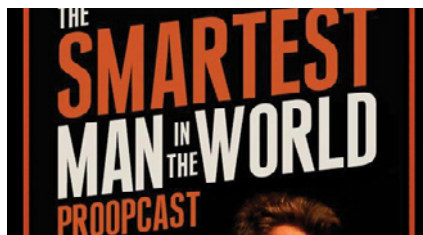
THIS MONTH, IN anticipation of this year's LA Podfest, we thought we'd focus on standup and unscripted live comedy. While some argue that the best way to experience this particular arm of comedy is to watch the performance in person (preferably not from the front row, unless you're very brave), podcasting is a great way for comedians to express themselves and deliver their art to a wider audience — even more so when their podcasts become popular enough to take on tour! The shows we've recommended are vastly different, with nothing overly resembling the stand-up you might see in a club — mostly due to the fact that the comedians who have a set performance (that they've likely worked on for months) want to attract bums on seats, rather than non-paying ears. However, the following will still split your sides, so without further ado...



Mortified

getmortified.com/podcast

The idea for this show attracted us immediately. Each guest reads out diary entries from their teenage years centring on a certain theme or event to an eager audience. In one episode, a boy plans out his first kiss in painful detail. In another, a girl pines over her forbidden high school crush. Each instalment filled us with nostalgia for our own adolescence, and the guests read their tales with such character that it's very hard not to burst out laughing.



The Smartest Man in the World

www.gregproops.com

Greg Proops is probably best known for his work on *Whose Line Is It Anyway?*, a show that rewards improvisation. *The Smartest Man in the World* is his solo effort in the realm of podcasts, where each episode is a recording of a live gig from somewhere around the world as he takes his talent on the road. Boy, can this guy talk...! Whether he's dishing out facts or recalling a story, his constant tongue-wagging will have you entertained.

[WWW.TECHLIFE.NET]



COMPETITIVE EROTIC FAN FICTION

NERDIST.COM/PODCASTS/COMPETITIVE-EROTIC-FAN-FICTION-CHANNEL

"Uh, what?" First and foremost, if you're under the age of 18, this is not the podcast for you. In fact, it made this particular reviewer dry heave almost as often as laugh, and in the words of host Bryan Cook, "It's really stupid." Still here? Excellent! The premise of this show is that Cook's guests are tasked with writing a piece of erotic fan fiction about a book, movie, character(s) or game that the audience suggests. Everything is fair game, even wookies. They get a short time to write, then they must read out their work to the audience. Gross and hilarious.



SPONTANEATION

WWW.EARWOLF.COM/SHOW/SPONTANEATION-WITH-PAUL-F-TOMPKINS
Paul F Tompkins and his guests have a lot of fun — that much is clear straight off the bat. While the host does have a few prompt questions that he brings to each episode, these act more as a springboard to in-character silliness rather than forming an interview-like podcast form. Each episode is sprinkled with musical accompaniment (also improvised), and while the episode is named after the location the improv is to take place in, you really don't know what to expect, which is the beauty of this type of comedy.



LOS ANGELES PODCAST FESTIVAL

LA Podfest (www.lapodfest.com) kicks off again on the 23rd of September. This is the largest live podcasting event in the world, showcasing some of the biggest names in the medium, such as *The Dollop*, *My Favorite Murder*, *Criminal*, *TOFOP*, *Welcome to the Night Vale* (all of which we've reviewed in previous issues) and many more. For those of us not native to LA, this year, each room is going to be livestreamed (for a small price), so we won't miss a thing. ■

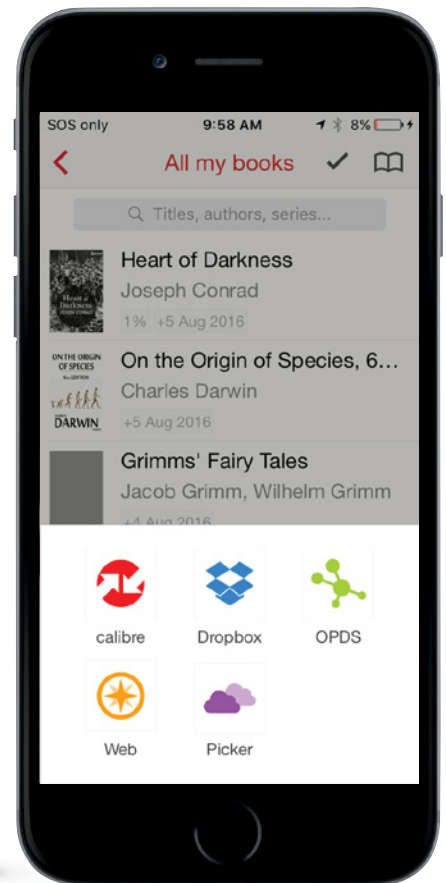
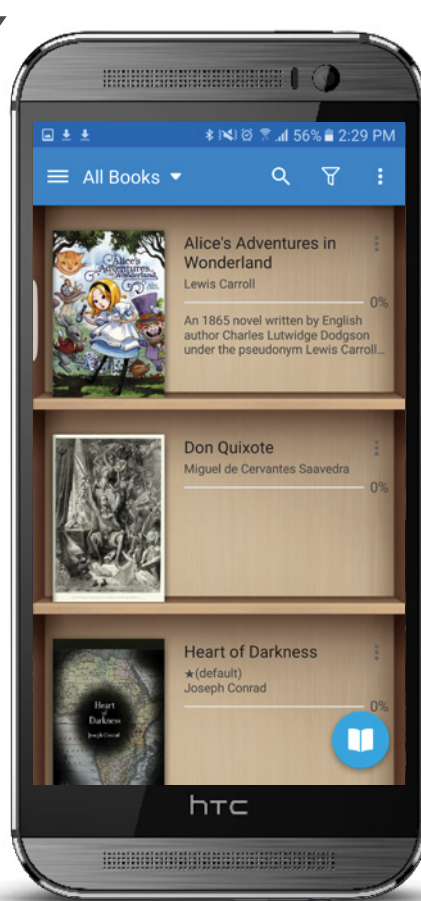
DISCOVER
BEST PODCASTS

[THE BEST EBOOK APP]

App showdown: The best apps for reading ebooks

BOOK YOURSELF IN FOR A MORE CONVENIENT AND POLISHED EBOOK READING EXPERIENCE.

[JOEL BURGESS]



KINDLE AND KOBO'S e-readers are excellent standalone devices for when you're spending hours on end reading a book or if you like to scan a few pages before bed, but the screens of new big smartphones and high-resolution tablets are getting to a point where they work just as well as eBook reading devices. On top of the added bonus of being able to flick between your favourite magazine, book or PDF file, reading on your tablet or smartphone will also allow you to simultaneously listen to music or even swap between the eBook and a synchronised audiobook. If you aren't always able to control the circumstance when you get time to read or you're keen to pick up some classic books that are past their copyright tenure, then investing in a good eBook application is definitely worthwhile.

+
READING ON YOUR TABLET OR SMARTPHONE WILL ALSO ALLOW YOU TO SIMULTANEOUSLY LISTEN TO MUSIC OR EVEN SWAP BETWEEN THE EBOOK AND A SYNCHRONISED AUDIOBOOK.

BEST E-READER FOR ANDROID



Moon+ Reader
BOTH THE SUN AND THE MOON.
Free; Pro, ~\$7
www.moondownload.com

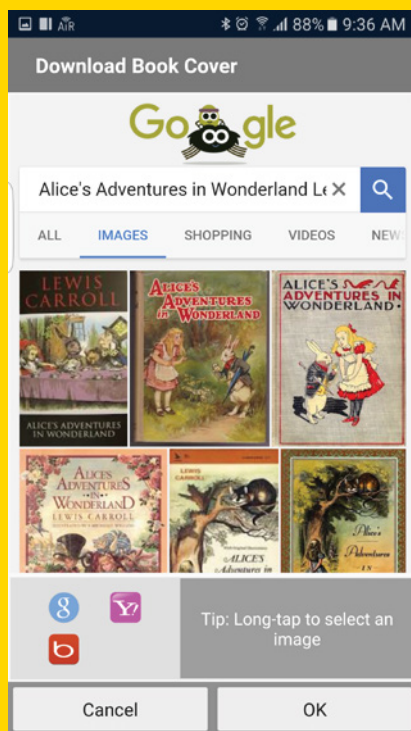
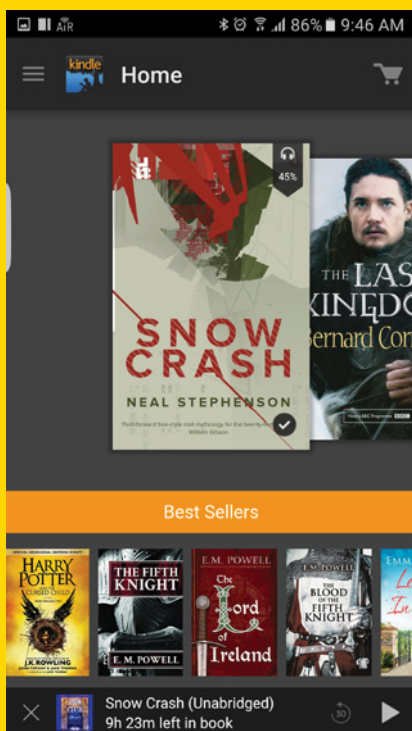
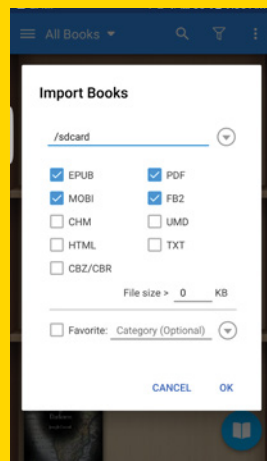
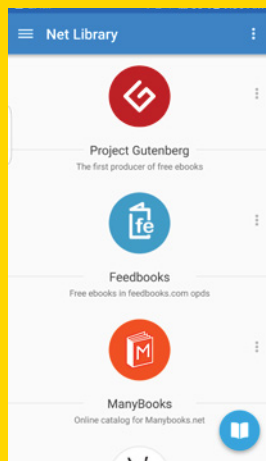
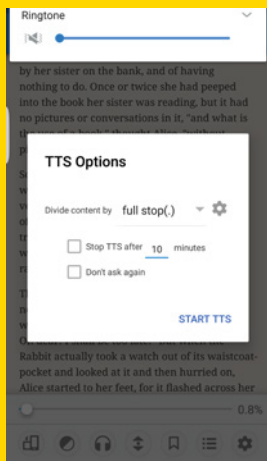
If you want a one-stop shop where you can buy and then read books, then you're probably better off sticking with the Google Play, Amazon and Kindle apps, but if you have a disparate collection of digital books in various formats and you're looking to amalgamate these titles into one nice-looking bookshelf, then Moon+ Reader is about as good as you are going to get. Offering a free version and an optional ~\$7 'Pro' tier, both have a streamlined and simple interface that can either be an evenly-spaced set of hovering book covers or an iBook-like set of wooden shelves to house your digital library. Apart from these two themes, there aren't any further options to customise the layout, a fact that we were thoroughly disappointed about, but you can download custom book covers from google without leaving the app which went a long way to make up for this. When it comes to options for reading, however, Moon+ Reader is more than adequate letting you control font size, spacing, background, a raft of control options and even some advanced features like syncing your page location via Dropbox or Google Drive. The best feature of Moon+ Reader, however, is its unparalleled compatibility across the full range of eBook formats.

BEST E-READER FOR IOS



Marvin
YOUR NEW BEST FRIEND.
Free; Pro, \$5.99
www.appstafarian.com

Generally, the iOS app store will take the lion's share of available apps in any given category, but Apple users must be content with the Kindle, Kobo and iBooks combo because there are really only a couple of alternate eBook apps on the platform. If you do happen to have a few publications that have been stripped of (or never had) any digital rights management (DRM) locks and are in the ePub format, then you'll be able to open them on your iOS device using the Marvin reader app. You're not limited to just importing books that you've downloaded already, it can also tap into the Open Publication Distribution System to give you access to thousands of classic DRM free titles from the Feedbooks Public Domain, Internet Archive and Project Gutenberg libraries (see page 37 for more on the latter). In much the same way as the other readers we've tested, you can swap between a 'cover page' view of your collection, or see them as a detailed list that provides the author's name and your position in the book. The free version of Marvin will only allow you to see one book at a time in your library which means you can get by if you don't want to flick between multiple books. That said, \$6 for easy access to thousands of free books isn't a bad deal at all.



TIPS FOR FLIPPING THE PAGE ON YOUR E-READER APP READ INTO IT

TEXT-TO-SPEECH

If you're happy to spend a bit buying both the eBook and its companion audiobook, then it'd be hard to go past the Kindle and Audible service Whispersync, which syncs your position between text and audio versions of a title. But unlocking Whispersync can be prohibitively expensive, especially for newer titles. However, most of the better e-reader apps will have (or can draw on your smartphone's inbuilt) text-to-speech software, allowing you to listen to the book. The harsh monotone of the computer won't be lulling you to sleep anytime soon, but for short bursts where you can't read, it's a great option.

CUSTOM BOOK COVERS

It might seem a little trivial when you get started, but for those willing to source the best book covers, you can make your eBook library look infinitely better. Not all of the options here make it easy to choose your own cover, but for anyone visual, this is a worthwhile perk.

DRM-FREE EBOOKS

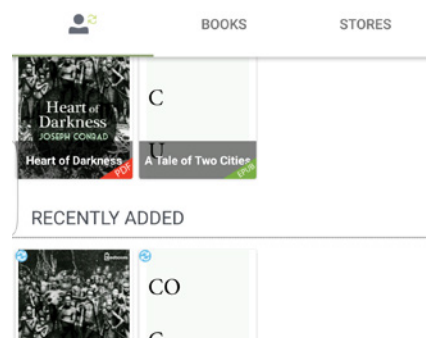
Despite the main appeal of an alternate eBook reader being access to the thousands of titles that do not have DRM attached, if you want to keep the titles you own with DRM in the same library, you'll generally have to remove the licensing yourself. The free Calibre software (calibre-ebook.com/download) will let you transform eBook file formats and remove DRM, but beware it's not strictly legal... even though you own the eBooks.

COMPATIBLE FILE FORMATS

Kindle's AZW/KF8 and ePub files are the most commonly used file formats for eBooks but there are a huge range of alternatives that are used to varying degrees. One of the main reasons the Moon+ reader was our favourite was its long list of compatible file formats, including: ePub, Mobi, PDF, CBR, CBZ, FB2, TXT, HTML and CHM.

ALSO CONSIDER...

A WORTHY RUNNER UP AND TWO SLIGHTLY OUT-OF-THE-BOX EBOOK APPS.



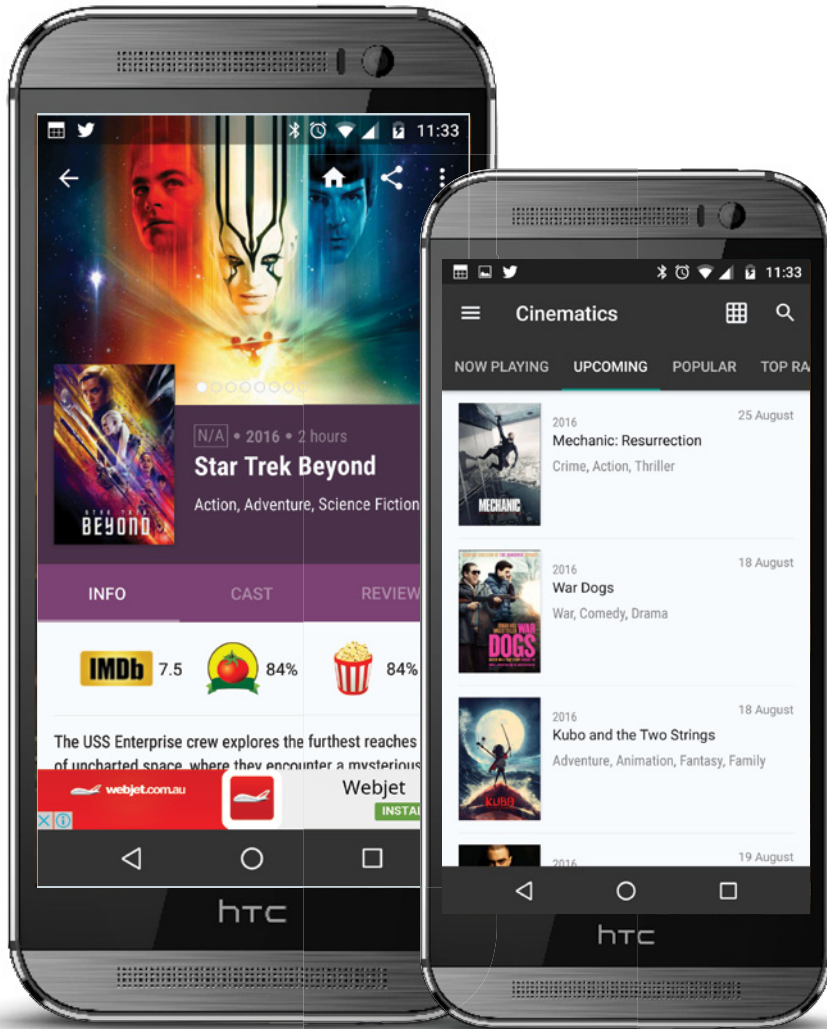
There are a few aspects that make this app a worthy runner up, or even the winner depending on your need set, but the first striking aspect of Bookari is how easy it is to sync your library across devices. It taps into your Google or Facebook account and allows you to store 50 books and 80MB of PDF files on the app's cloud in the free version. On top of this, Bookari will allow you to annotate the documents and ePub books and there's even a decent text-to-speech reader and a Chrome Extension.



Subscription-based video-on-demand services have shown us just how much value you can get from this kind of arrangement when you have enough people, and when it comes to book subscription services like Scribd, it's arguably even better. For \$13.99 per month, Scribd will give you all-you-can-eat access to Pulitzer prize-winning novels, New York Times Bestseller titles, collections from Nobel Prize laureates and the top trending page turners. Simply choose something you want to read from the constantly updated libraries and you can sync it between any of your Android or iOS devices or download the book and store it locally.



If you're not quite willing to do away with the traditional library just yet but you're keen to get stuck into eBooks, Borrow Box will let you use your library account to borrow eBooks for free from anywhere in the world. Much like traditional libraries, if someone has the eBook on loan you will have to wait until it is returned before you can borrow it yourself and what you are able to access is dependent on the calibre of the libraries you're signed up to, but it is a pretty sweet free alternative to something like Scribd. ■



[LATEST APPS]

Best new apps

THE **TECHLIFE** TEAM REVIEWS THE MOST INTERESTING NEW APPS FOR IOS, ANDROID AND WINDOWS MOBILE.

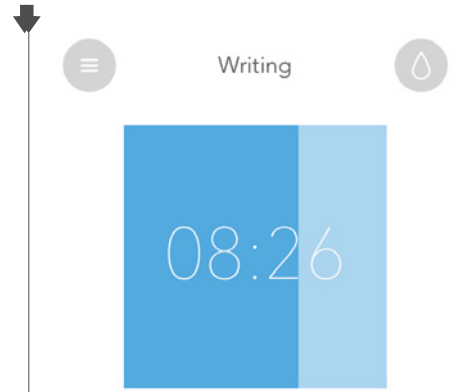


Cinematics


THIS CINEMA DATABASE OFFERS USEFUL CONTENT IN A STREAMLINED SETTING.
Free

Cinematics is basically an aggregator of film-related data and information, with most of the information sourced from IMDB and Rotten Tomatoes. When you boot up the app, several menu options are available, such as 'Now Playing' (in cinemas), 'Upcoming', 'Popular', 'Top rated' and more. The ad-supported app also tracks new DVD and Blu-ray releases, as well as top rentals or, in other words, any films that have just been made available in bricks and mortar video stores. As far as the film listings go, these

feature general info in addition to cast and reviews, and the 'Similar Movies' section is particularly useful if you're still unsure how enamoured you'll be with the latest Zac Efron pap. It's an undeniably useful app if you're a film appreciator, but there's not much info here you couldn't access by visiting IMDB directly, and since the whole database is stored online, it's not an offline alternative either. There's the option to set reminders, but this — in addition to switching off the ads — is locked behind an in-app purchase. [SHAUN PRESCOTT]



Avoid distractions and stay focused



BLOCK AND FLOW
AVOID DISTRACTIONS AND STAY FOCUSED.
Free | tinyurl.com/tla55-block

Productivity tools are fairly common these days, thanks to how easily they can be used via a mobile device, and also how distracted we've all become (no thanks to YouTube). While some of us might be disciplined enough to simply say: "Just get back to work, you numpity!" to ourselves, others need that little helping hand. Block and Flow is a 'Pomodoro' time management app, where you're encouraged to break your day up into blocks, designate each block to accomplishing or working at a certain task and concentrate on that one thing for a certain amount of time. Using the app is simple, thanks to its clean and self-explanatory UI. Create categories (such as study, exercise, work, research, testing, writing, chores and so on) and colour-code them. Your block is a 25-minute time period. Stay focused for that long and you achieve a block. Knowing you've kept your focus for that long is strangely satisfying, and keeping to your schedule is greatly rewarding.

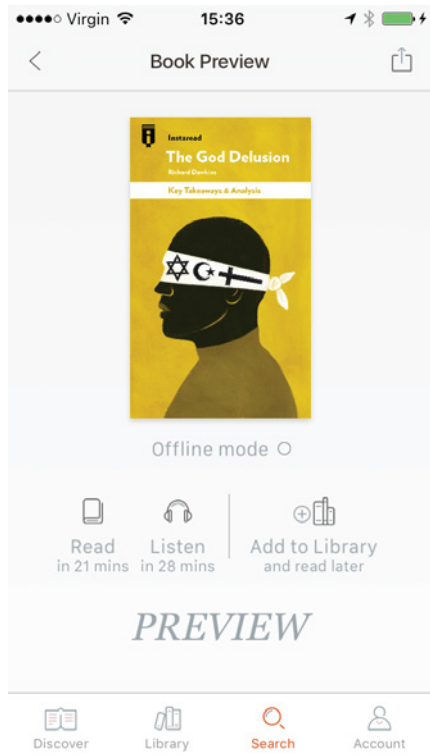
[CARMEL SEALEY]



FLUENTY

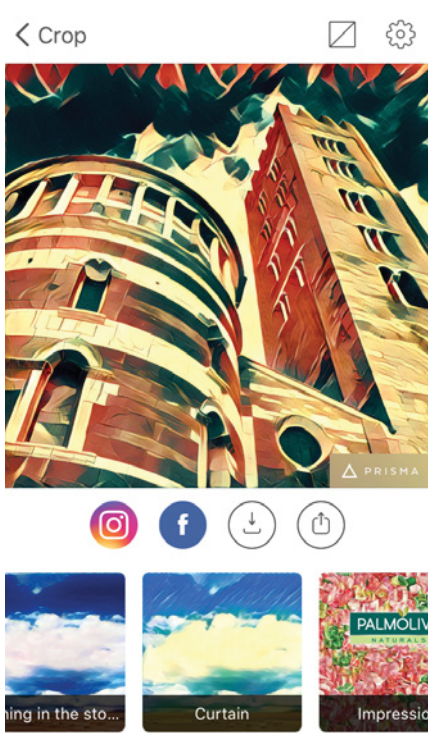
SOUND SMARTER AND COOLER, THANKS TO ARTIFICIAL INTELLIGENCE.
Free | fluenty.co

Sending text messages can be a huge pain in the bum, especially when you're expected to answer quickly and coherently. Fluenty theoretically makes that easier: for every received text message, it adds a dropdown box with a list of possible responses, ranging from the quick (yes, no, not sure) to the vaguely poetic (yes ma'am lol, *grabs popcorn*, facts only). But if none of the dropdown options appeal, you can always dictate a message with the press of a button, or send one in the good old fashioned manual way. It's a super easy tool to use, and it's amusing how Fluenty will often prioritise the more personable/charismatic responses over the functional ones, making you sound like some lame millennial AI. If you're in the habit of sending similar messages regularly, the app will remember and offer these in the menu for future conversations. Overall, this is a clever app, and well integrated into both the iOS and Android operating systems. [SHAUN PRESCOTT]



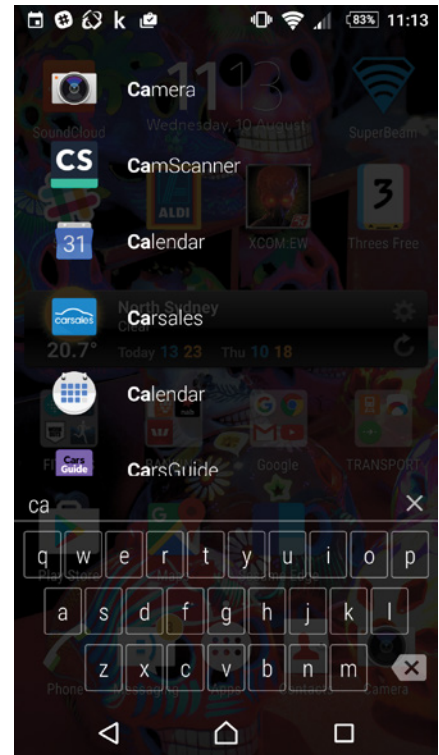
Instaread
BOOK SUMMARIES TO ABSORB.
Free with IAP; \$4.49 per month
instaread.co

So you're at uni studying classic literature or philosophy and you've just been given your reading list for the next month — two brick-sized novels to be read for next week's lesson! (Aah!) You need a reliable and indepth summary of those books so you can be involved in the class discussion (and get those valuable 'participation points'). Well, Instaread might be able to help. Each book in the library has been summarised (in text and audio form), which you can get through in about half an hour. While most of the content of this app is hidden behind the subscription paywall, \$4.49 per month isn't too much of a hit to the wallet if you find the service to your liking after the one-month trial period. Each book includes sections on important characters and locations in the story (or the study), key 'takeaways', notes on the author's style of writing and important facts about their life. Note: We do not recommend that you give up reading and rely on this app entirely to make yourself seem more widely-read and cultured. It's useful but shouldn't be your 'get out of jail free' card all the time. Nothing beats a good book, after all. [CARMEL SEALEY]



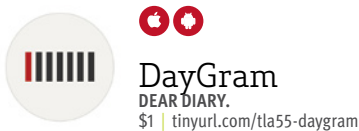
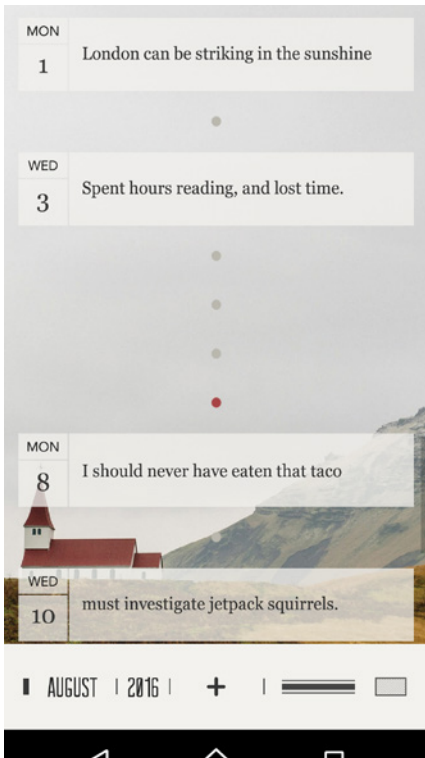
Prisma
TURN ANY PHOTO INTO ART.
Free | prisma-ai.com

This particular reviewer doesn't really 'get' the appeal of filters in the style of Instagram and Snapchat. But Prisma is different — miles different. There are no dog tongues or rainbows, '70s cop moustaches or pandas to be seen. Instead, the filters here are based on the works of famous and talented artists. Want to give your selfie a touch of Picasso? Done. Curious as to how Katsushika Hokusai may have captured that view? One tap later, instant masterpiece. Each filter lends a different style to your image of choice, but unfortunately, not every style works for every picture. 'Femme', for example, works best on faces, 'Red head' excels in urban environments and 'Coloured sky' is best used with simple photo subjects. New styles pop up every other day, too, so there's always a reason to come back. From Impressionist to sketchy, water colours to digital cartoon, Prisma can become very addictive very quickly. Take note, though, that constant use is going to make your phone rather warm. It's easy to share your creations to your social media of choice, as well, but this particular reviewer is happy to simply look at her fur baby the way Van Gogh may have done. [CARMEL SEALEY]



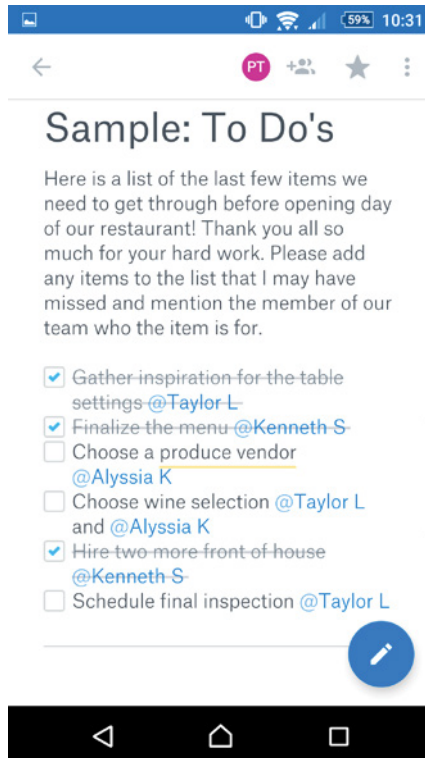
Sesame Edge
SHORTCUT TO THE CHASE
Free | tinyurl.com/tla55-sesame

Muscle memory is a funny thing. Perform an action long enough and your thumbs will twitch involuntarily through the motion without real conscious effort — but how much time could you save if you actually thought about it? Sesame Edge wants to break that muscle memory and offer a powerful way to reach shortcuts and not only for your most-used apps, but for your most searched-for shows, music and, well, searches across all of your apps. As you use your phone, Sesame Edge learns what you look for and use most frequently — and not in the creepy way. Open Sesame (which subtly hangs on the lower right-hand edge of your screen) and shortcuts to your ten most-used apps are immediately presented. Start typing and Sesame's search function rifles through your contacts and apps to return what it thinks you're looking for. It works, but it has a way to go yet: the description screen says the app will search for Netflix shows, too, as well as Spotify tracks and even Reddit posts. These functions, unfortunately, refused to work in our test. However, it's looking promising so far. [PAUL TAYLOR]



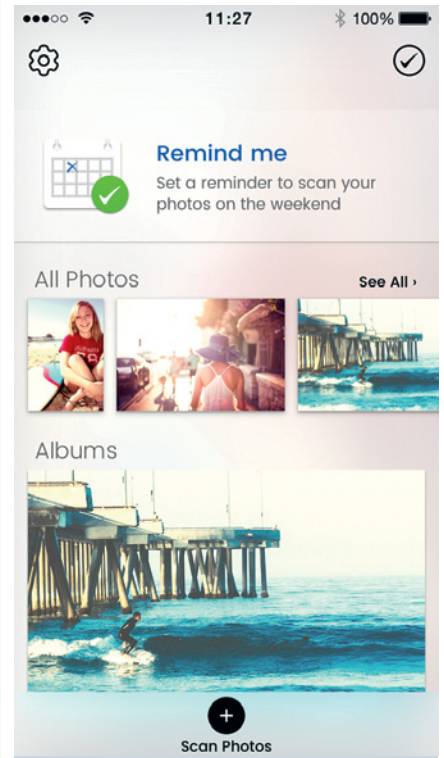
What, a diary app? Come on *TechLife*, what is this? Well, there's something remarkably zen about an app that's purely about keeping notes and in private, away from social media. We're laden with apps that offer notes, checklists, to-dos, diary plug-ins — DayGram shuns the lot and wants you to revel in the art of writing a diary for its own sake. Whilst rudimentary in function, it certainly nails the layout, offering a handwritten-styled font, and defaulting to full screen mode, removing the notifications bar to completely clear your mind and avoid temptations (uh, we mean distractions). You have to put the effort in here, just like a regular diary. DayGram won't pester you to keep up your journal, and the few luxuries it does offer are an automatic time stamp, a few themes and the ability to back up and restore from your Dropbox account. If you want to publish your work, you can only export to either email or as text. And before you ask, no, there isn't a free version — ads flicking around your innermost thoughts would break the flow.

[PAUL TAYLOR]

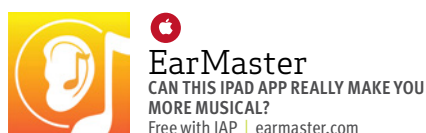
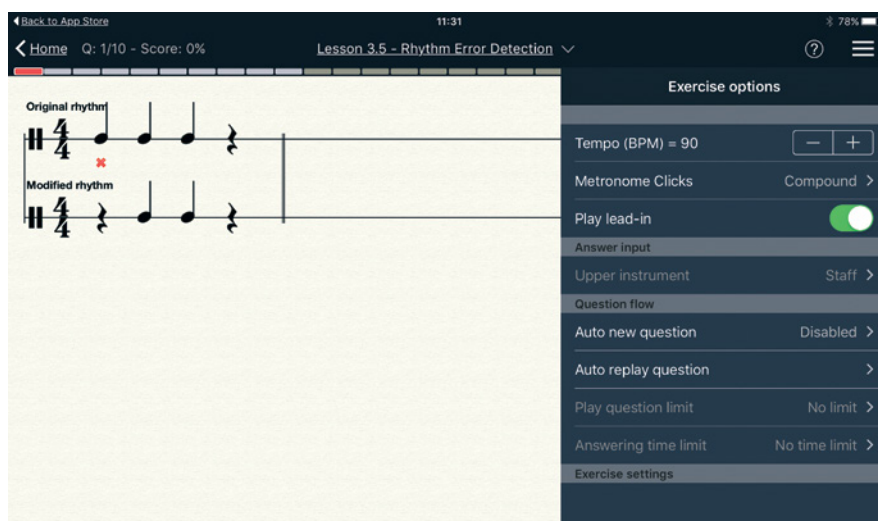
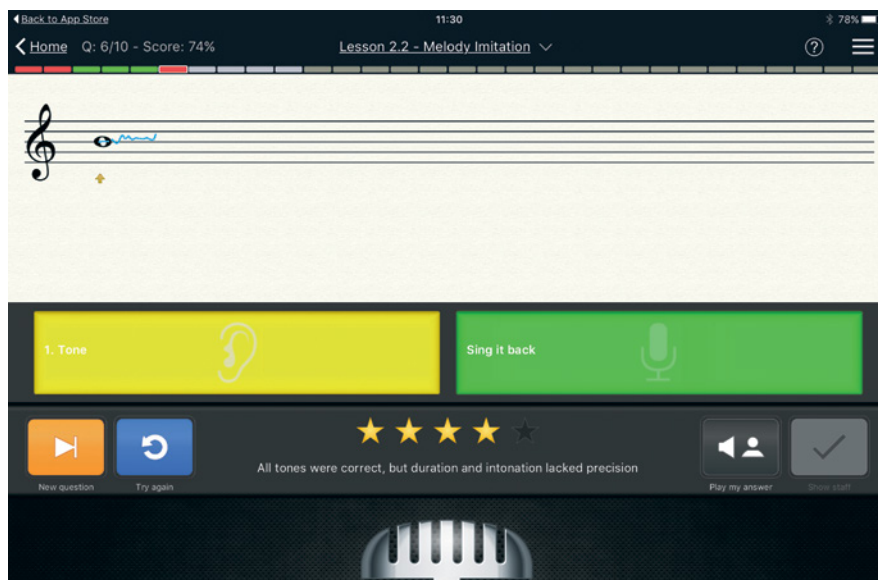


Until now, Google Drive and its suite of Microsoft Office-like tools has been the go-to collaborative creation. While Dropbox Paper does a lot of what Drive accomplishes, it's more than an alternative, it's a genuinely impressive package for building presentations, spreadsheets, documents and even compiling code. The power comes from how simple it is to format the document you're working on, and being able to tag your collaborators, whether you're asking for feedback on an idea or assigning tasks. The app's a paired-back version of the far more comprehensive desktop version — you'll need to turn to the latter to add in tables, code boxes and better commenting tools — but you're still free to add images, links to videos and websites, and more on the fly. Right now, Paper is still in a beta stage on Android, but what we've seen is very pleasing. If you love Google Docs, Sheets and so on, Paper might be enough to make switch over to the rival cloud storage service; you will need a regular Dropbox account to be able to use it, though.

[PAUL TAYLOR]



If you've ever inherited an old photo album from a loved one, chances are the photos are still sitting around collecting dust, while you desperately hope for enough free hours in the day to scan and clean up all the images. Now, thanks to a new app from the makers of Scanbot, you can make short work of just such a project. All you have to do is aim your iPhone at each individual photo laid out on a flat, well-lit surface. The app automatically grabs a scan, performs edge detection, then applies a filter to restore faded colours back to life. Scanned photos can be organised into albums, then saved to your Photo Library or shared. Unfade does an admirable job with automatic crop, edges magnetically snap against the sides and can be manually adjusted, with the option to fine-tune using a magnifier for precise corner selection. If you desire a more unique look, 25 Instagram-style filters are included, which can be applied with just a tap. Overall we found Unfade quite useful — results were fast and remarkably good quality. The app lacks manual contrast, brightness and color controls, however, and would benefit from an option to exclude borders, which currently have to be manually cropped. [J.R. BOOKWALTER]



Ear training enables you to recognise, understand, anticipate and perform music simply by listening to it. EarMaster has been available for the Mac for several years, and now it's joined by an iPad app. The app itself is free, but the lessons are in-app purchases.

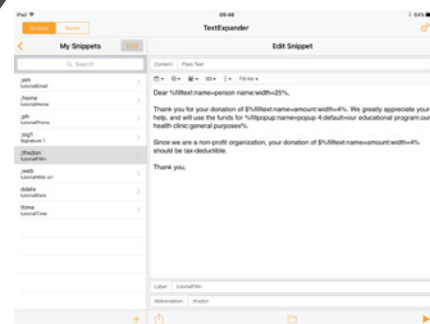
The courses are in four categories — Beginners Course, General Workshops, Jazz Workshops and Customized Exercises — and those categories are broken down into sub-categories such as intervals, chords, scales and rhythm. The free version gives you the first four modules of the Beginners Course and makes good use of the iPad's microphone or a MIDI controller for the pitch exercises, while rhythms are tapped on the iPad's touchscreen. If you don't get it quite right, the feedback is of the 'okay, but...' variety.

Simple and short exercises don't mean that the entire app is simplistic, though. As you progress through the modules, you're introduced to musical and rhythmic notation,

sight reading and melodic intervals, triads and harmonic progressions. There's also an extensive statistics page showing how far you've come and how long you've spent on each exercise, and if you're attending a school that uses EarMaster's popular EarMaster Cloud system, you can use the app to do your musical homework.

EarMaster isn't the only ear training app in the App Store, but it's by far the friendliest and best designed. It introduces new concepts clearly and with lots of examples, it offers constructive feedback and it enables you to specify your vocal range so that men don't have to reach crotch-tightening high notes or women sing notes so low that even Adele couldn't handle them.

EarMaster has been working with music schools for a long time, and it shows: the iPad app is constructive, friendly, not overly simplistic and structured so that the tasks don't drag or discourage. [GARY MARSHALL]



In the latest update of TextExpander 4, (TextExpander + Keyboard on the App Store), the focus has been on what's missing rather than what's new. SmileOnMyMac now has its own cloud-based syncing platform for TextExpander, which replaces the use of Dropbox and iCloud, and enables group sharing of snippets. The subscription model costs about US\$40 a year, with an upgrade price of \$20 for existing customers. (Version 3 remains for people who want to stick with other cloud services for syncing or don't want subscription software.)

TextExpander is a wonderful app. It installs as a third-party keyboard in iOS and offers improved autocorrection and all kinds of snippets, from frequently used text, dates, emoji and phrases, to formatted text and code blocks. Many big-name apps support it directly, and the TextExpander keyboard covers the apps it doesn't integrate with. But you can say the same about the old version, too... so is the new app better than the old one? For individual TextExpander users, rather than businesses who'll like group syncing, currently no.

All that's new in this version is group sharing and subscription pricing, which doesn't feel like enough. It's a powerful text tool, for sure, but the pricing is an issue. [GARY MARSHALL]



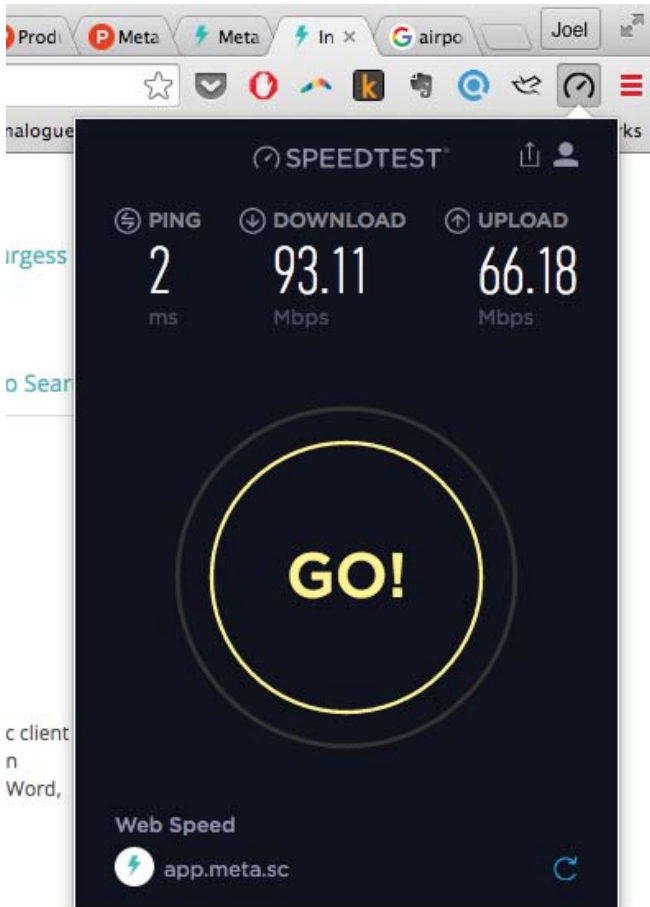
Self-improvement apps are as multitudinous as roadside waste at this point, and while most seem to focus on physical fitness and time management, there's also a huge category for making you smarter. While that appears to be the goal with Curiosity, its name implies that it'll reward those who just enjoy learning and knowing stuff. The app throws up a handful of interesting facts every day. Each is expandable and each links to related content — usually YouTube videos — if you want to know more. Today, we learned that Earth has returned to the same spot in the galaxy as it was during the age of the dinosaurs, which is actually really interesting, but your mileage will vary. Pop science tends to be the dominant area of interest, and while the presentation is pleasant enough, it's hard to imagine most people opting to choose to open this app instead of visiting some 'interesting' website instead. Maybe with widget functionality, Curiosity would shine.

[SHAUN PRESCOTT] ■

[COOL STUFF FROM AROUND THE WEB]

Unearthed

THE **TECHLIFE** TEAM'S FAVOURITE NEW SITES, SERVICES, BROWSER PLUGINS & OTHER HANDY TOOLS.



[CHROME EXTENSION]

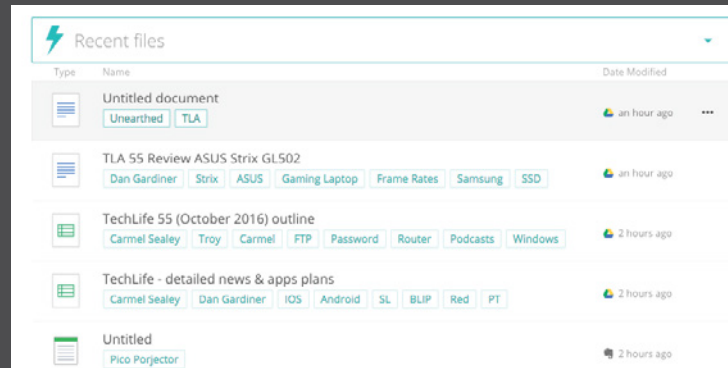
Speedtest by Ookla

YOUR SPEED CAMERA FOR THE INFORMATION SUPERHIGHWAY.

Free | www.speedtest.net

In any working week, we'll probably test our internet connection speed anywhere between three and 15 times depending on how consistently the office Wi-Fi is performing and so this new Chrome browser extension from Ookla naturally caught our eye. This simple extension doesn't do a whole lot more than the browser-based version, other than conveniently add it to the extensions tab, meaning you can test your connection that much quicker. When you consider the time it takes to navigate to the Speedtest page (particularly at times when you think of using the speed test), it probably cuts out 50% of the total process. Your most recent results will sit above the 'Begin Test' button in the dropdown box of the extension, but if you sign-in, you can have a complete, cloud-synced list of all your past speed tests in case you want to keep tabs on your service provider. There's also an additional feature that'll measure the load time of the page you're currently on.

[JOEL BURGESS]



[PC, BROWSER]

Meta Search (Beta)

A NEAT TOOL FOR FINDING STUFF YOU'VE SAVED TO THE CLOUD.

Free | www.meta.sc

Working from the cloud has some massive advantages, primarily in allowing you to sync progress across multiple devices, but with limited free space on cloud services and so many specific note-taking and document creation tools out there, you're likely to have your files spread across a number of different services. Meta search plugs into Google Drive, Dropbox, Gmail (for attachments), Slack, Trello and Evernote and creates an index so you can search for documents across all of them at the same time. It takes a bit of time to index all your files initially, but the service will shoot you an email when it's ready to go and then it's just a matter of downloading the PC client or logging on through a web portal. Much like any file index, there's a search bar at the top that allows you to refine results by filetype, account or how recently the file was used, and a preview box on the right side lets you see the document you are thinking of selecting. The system even allows you to tag items and put them in custom meta folders so you can organise your whole system in through the one portal.

[JOEL BURGESS]

[CHROME EXTENSION]

MuteTab

SWAT NOISY TABS WITH A BUTTON PRESS.

tinyurl.com/tla55-mutetab

It's happened to us all before: you're calmly reading the latest thinkpiece about *Pokémon GO* and then, wham! One of your other 50 or so Chrome tabs starts playing the opening riff to *The Final Countdown*. It's annoying, which is why MuteTab exists, a Chrome browser extension which can instantly mute any offending tabs, or simply track them, if that's all you want. While it's lately been possible to identify which tab is emitting sound thanks to the little speaker icon, if you've got dozens open, a simple toggle can make a world of difference under pressure. Better still, you can assign certain keys or key combinations to mute duty, meaning you'll never be harangued by EDM or intrusive betting pop-ups (for very long) ever again. In an age where auto-playing videos are still considered a very good idea by various media companies (Fairfax, we're looking at you), MuteTab is a good alternative to the comparatively erosive effects of ad blockers.

[SHAUN PRESCOTT]

[WEBSITE]
**THE INTERNET ARCHIVE'S
 AMIGA GAMES COLLECTION**
 AN INTOXICATING LOOK AT A FRUITFUL ERA
 FOR RETRO GAMING.
archive.org/details/softwarelibrary_amiga

If you spent hundreds of dollars in the '80s keeping abreast of the Amiga's extensive game catalogue, the Internet Archive's latest initiative might bring a tear to your eye. In early August, the website uploaded an astonishing 10,316 Amiga titles, ranging from games to software. It's all emulated in your browser, so reminiscing with a quick bash of *Bubble Bobble* is as simple as clicking an icon. While the games are arguably the strongest drawcard, rifling through the archive turns up some fascinating artefacts, such as acid house graphics showcases and a bunch of other independently-distributed software that never saw the light of commercial day. As a result, the Amiga collection is less a boon for retro gamers than it is a window into a long forgotten digital world.

[SHAUN PRESCOTT]

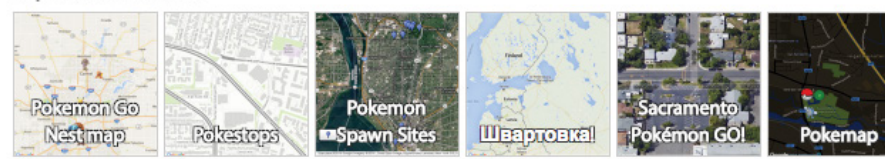
[WEBSITE]
PROJECT GUTENBERG
 EBOOKS, EBOOKS EVERYWHERE!
www.gutenberg.org

Feel like reading an eBook for free? Well, if you can't find something to your liking on Project Gutenberg, we'd be surprised. With over 50,000 free eBooks on offer (as well as those available through their partners), it has to be the easiest way to grab something to read. Simply hit 'Book Categories' if you just want to browse or 'Book Search Page' if you have a particular book in mind. You can look at the most popular eBooks, the newest releases or take a chance and click 'Random!' Once you've found something to your taste, you're given a few different format options — read online in-browser, or download to Dropbox, Google Drive or One Drive in EPUB, ZIP, plain text or MOBI for your Kindle. It's super easy and it's great to see so many classics here, such as Jane Austen, Arthur Conan Doyle, Leo Tolstoy, Bram Stoker and Charles Dickens in amongst non-fiction and the oodles of international books.

[CARMEL SEALEY]



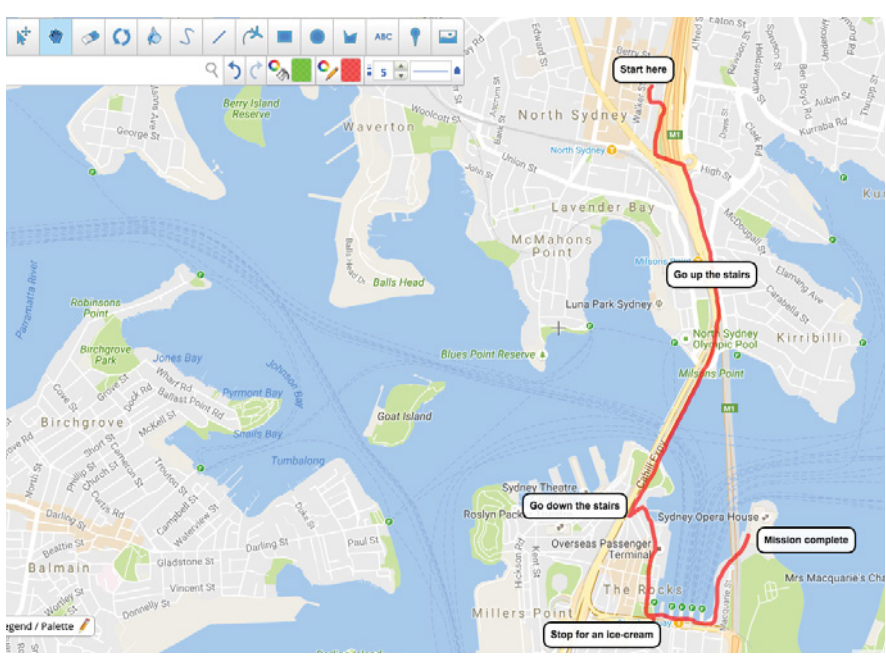
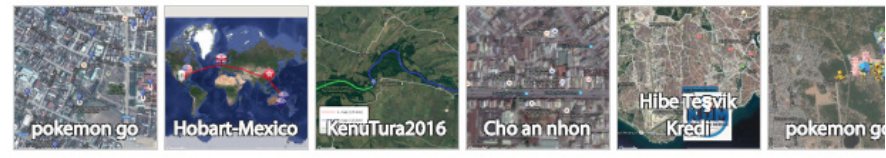
Popular This Month



Popular This Week



Popular Today



[WEBSITE]
Scribble Maps

PLOT A ROUTE OR LAY DOWN MARKERS.
www.scribblemaps.com

Google Maps is amazing but it doesn't know everything — such as that bush track you use to get to the train station, that this route is prettier, or that Killara Oval is still known by the locals as Bert Oldfield. While 'Get Directions' is normally quite good on Google Maps, it can get a bit fiddly if you don't want to walk, drive or cycle the fastest or most direct route to get from A to B. Also, what if you want to make note of a specific landmark that isn't listed? Scribble Maps is a super-easy-to-

use Google Maps manipulation tool that lets you draw your own route, mark points, add in bits of text, calculate the distance between points, and more, and then save your map. The community has a great deal of maps online to check out, ranging from "this is where we've been so far on our holiday" to a spread of pins showing "our award winners live in these cities", but the most popular maps for this month are all pins for *Pokémon GO*. Yep, *all* of them. [CARMEL SEALEY]



[PC AND CONSOLE GAMES]

The new black gold

WE REVIEW THE LATEST BIG-RELEASE AND INDIE GAMES ON PC AND CONSOLES, INCLUDING THE NEXT INSTALMENT IN THE *DEUS EX* SERIES.

Deus Ex: Mankind Divided

AUGMENTED TO (ALMOST) PERFECTION.

From \$79.95 | PC, PS4, Xbox One | www.deusex.com

WHERE *DEUS EX: Human Revolution's* transhumanism theme felt broadly timely in 2011, *Mankind Divided's* deeper exploration of a world beset by terrorism, tearing itself apart over differing beliefs, mistrust, violent law enforcement and dehumanising language, is a sobering reflection of our times. This uncomfortable proximity to current events has caused controversy, too, with language such as 'mechanical apartheid' and, more recently, 'Aug lives matter' having sparked criticism of its developer's judgement. But while there has been understandable controversy around the real-world parallels in its themes, that they have caused such a reaction is testament to the game's powerful depiction of the social divides at the centre of its fiction.

Set in 2029, two years after the Panchaea incident saw sabotage send thousands of augmented humans into a murderous, uncontrollable rage, this is a world where augs are marginalised and vilified. Metro stations have segregated sections for the augmented; frequent credential checks can see individuals arrested; and unscrupulous sorts will even try to shake you down for money.

Adam Jensen is now based in Prague and part of Task Force 29, a multinational anti-terrorism unit formed by Interpol in the

wake of Panchaea, but his posting has rankled some of the organisation's top brass. So while *Mankind Divided* gives you even more tactical and navigational options, you're still continually harassed, made to feel like a second-class citizen irrespective of your badge and (mostly) supportive colleagues.

This strain on Jensen's loyalties, as he attempts to reconcile the rights of augs with the safety of everyone, sets up the potent tension at the centre of *Mankind Divided*.

The game's sprawling, complex plot provides plenty to get your investigative teeth into. Unfortunately, the tale is frequently undermined by a script that can feel lumpen and hackneyed, as well as acting that varies wildly in quality. It's one of the few areas in which the game slips up. The performances and scriptwriting are at their best during the game's debates — 'social boss battles' in which you must feel your way through complex, ethically ambiguous conversations.

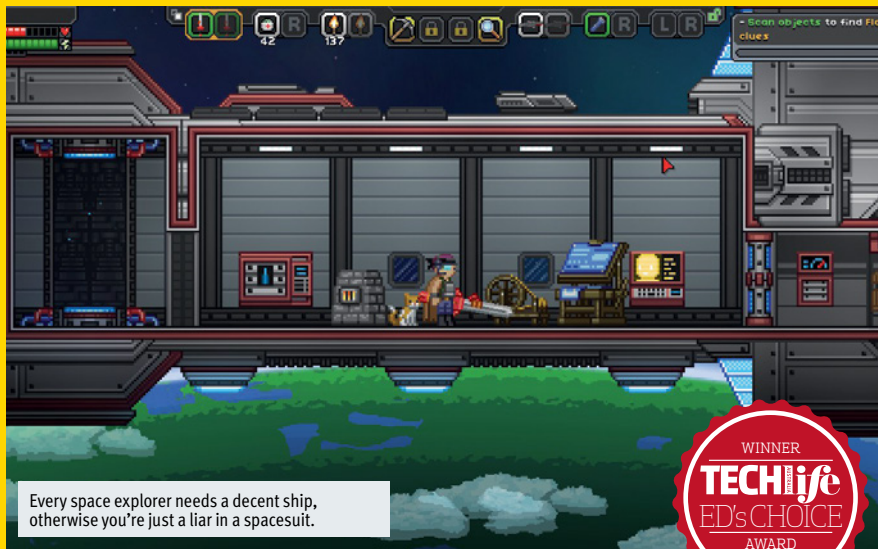
Mankind Divided's infiltration-focused action is built on the twin security vulnerabilities of selectively blind or forgetful guards and a network of ill-considered ventilation shafts, but clearly communicated and consistent rules of engagement make its systems a joy to toy with. Your options are manifold. You might hack the keypad of a bulky security door after subduing or killing the guards nearby. Or perhaps avoid contact altogether and find a circuitous route to your

objective through vents and storage cupboards. A handy tranquilliser gun can put individuals to sleep, luring anyone who spots the body into your sights if you choose not to hide it. And if you can access a security computer, you could turn turrets, patrolling drones and robots against their owners. The fastidious can find passwords and door codes in emails or diaries to open previously locked doors. Or you can just bust out the combat shotgun and mount a frontal assault.

Mankind Divided encourages you to switch tactics on the fly, responding to your mistakes by challenging you to adapt rather than punishing you with failure. Your efforts are supported by a mostly robust cover system and an expanded augmentation tree. Upgrades are purchased with Praxis Points found in kits around the world, gifted by NPCs or earned by levelling up, and there are more options than you'll acquire enough currency for in a single playthrough, encouraging you to specialise.

While *Mankind Divided's* main story thread can be rattled through in 20 or so hours, its world invites you to linger. This confident refinement of *Human Revolution's* potent, though flawed, proof of concept has resulted in one of the most elaborate videogame sandboxes in which we've ever had the pleasure of getting lost.





Starbound

IN SPACE, WE HOPE NO-ONE CAN HEAR THAT WE SPENT ANOTHER WHOLE WEEKEND MINING COPPER ORE...
 From US\$14.99 | PC, PS4, PS4, PS Vita, Xbox One | playstarbound.com

THIS AMBITIOUS INDIE craft 'em up is the kind of game we can imagine playing for years. It's been available on Early Access since the ancient days of 2013. Development was always going to be long when you're promising a hybrid of space exploration, crafting, building, mining, battling and even some subletting.

But for a game that promises you the stars, it starts small. You choose your hero from seven different species (including human, if you're boring) and soon receive the Matter Manipulator. This gadget lets you mine both up close and from a decent distance, a mix of pickaxe and laser pointer that proves *Minecraft* and *Terraria*'s ancient digging tools belong in a museum. It's an inspired upgradeable tool that immediately sets *Starbound* apart in the rather crowded crafting genre.

Once you've mastered the Manipulator, it's then time to blast into space with your own ship, ready to explore the universe! Except, no, actually. The ship's damaged, so you'll have to teleport to the planet below to search for a way of fixing it. You'll be down there for a long time. Typical. We're promised the stars, then booted down to Earth to basically play *Terraria*. It's like if Hello Games' Sean Murray invited you over to play *No Man's Sky*, then decided to give you a tour of his basement instead. But this isn't actually a complaint. *Starbound* makes you earn the trip, which is far more satisfying when you do finally lift off,

and keeps its universe feeling enormous. With every trip to a new planet, computer screen scrolling with calculating co-ordinates and the stars rushing past, you truly feel like you're travelling through 2D space.

Once you've been beamed down to a planet's surface, you'll fight an adorable bestiary of monsters. You'll chop wood for torches and housing, and craft campfires to cook crucial grub. This'll all be familiar to fans of crafting games, who'll be immediately comfortable with the smooth interface and tutorials. But the real adventure is beneath your feet. Each randomly generated world is hiding an underground ripe with networks of twisting tunnels, treasure chest-filled caves and seemingly endless secrets.

This is where *Starbound* starts taking over our lives. We'll intend to go mining for half an hour. Days later, we'd still be swordfighting bats and kicking open chests, trying in vain to remember what our initial plan was. We'd feel guiltier for the time lost if we weren't having so much gosh-darned fun.

There's a reason this genre has taken over the lives of creative types over the last few years. Now it's got better treasure hunting too — it's a miracle we ever see the surface.

[TOM STONE]



HEADLANDER

AIN'T NO BODY!
 From \$29.95 | PC, PS4
www.adultswim.com/games/pc-console/headlander

Headlander is one of the most handsome games you'll play all year. Actually, 'fabulous' is probably a better word to describe its sumptuous retro-futurist look, which draws equally from pulp sci-fi and '70s disco. All is not well in this future utopia, but to reveal too much would be to spoil the mystery. Suffice to say, you appear to be the last human to exist in physical form, with one minor caveat: you're just a head. You have a jet thruster where your larynx should be. To navigate, you'll have to fly your tiny head around until you find a robot body, whereupon you'll vacuum its head off and replace it with your own.

You end up inhabiting a variety of bodies to progress and you mostly use your powers to gain clearance to high security areas. That means taking control of the colour-coded Shepherd forces that have been alerted to your presence. It's easy enough to decapitate the reds, but the violent violets you'll encounter later are another matter.

The need to assume control of an intact body gives combat a different rhythm. Precision should be your first priority, and even when you've got a body to call your own, it's rarely wise to just blast away: take enough damage and your torso will explode, so it pays to keep at least one potential replacement in good nick. You can take cover behind objects, and fine-tune your aim while doing so, a thin line indicating the trajectory of your shots, including rebounds off walls and scenery. It's a bit like lining up a trick shot in snooker.

As the game goes on Shepherds become more aggressively keen to hold onto their heads, swiping sharply as you hover above them and firing more powerful weapons. Negotiating a path through the chaos can be tricky, so you'll need to seek out helmet augmentations to survive.

It's also a funny game. Beyond the sight gags, there are plenty of zingers and puns in the incidental dialogue. But the jokes don't always sit easily with a story that takes itself surprisingly seriously. If anything, it's not quite camp enough, which is a weird thing to say about a game where you play a disembodied head. Regardless, it's a game that feels comfortable in its own skin.

[CHRIS SCHILLING]



ABZÛ

IT'S LOVELY AT THE BOTTOM OF THE BEAUTIFUL BRINY SEA.
US\$19.99 | PS4, PC | www.abzugame.com

No other game in 2016 is going to make observing fish as sublime as this. Taking place entirely in the depths of a bright and colourful sea, *Abzû* puts you in the wetsuit of a nameless diver who's awoken by a mysterious signal pinging from a distance. Your aim to begin with is simply to discover your purpose. Initially, that's a little tricky while you grapple with the controls. But graceful animations plus a considered speed utterly convince you that you're underwater.

The best moments come when you find a meditation spot. Hidden in some of the more expansive sections of levels, your diver sits down upon a statue of a shark and the camera pulls away from you to focus on the marine life. Whether it's a school of fish gliding around rocks or a goblin shark munching his way through the lower rungs of the food chain, it's in these moments that *Abzû* reminds you of the many stories that are happening around you, and it repositions your role from the star to just a tiny part of the wider ecosystem.

The narrative wordlessly weaves in touching moments along with surprisingly cinematic cutscenes. And it's easily digested: the brief run-time (a few hours, depending on how exhaustively you scratch under the surface) and constant momentum means you'll likely polish it off in a single sitting.

That it's such a breathtaking place to explore should come as no surprise, seeing as *Abzû*'s creative team includes Matt Nava and Austin Wintory — the art director and composer of the spectacular *Journey*. Just as their 2012 masterpiece created a distinctive, wondrous world, so too does this latest collaboration. It's hard not to fall in love with *Abzû*'s art direction instantly and Wintory's musical score is just as powerful as *Journey*'s audio.

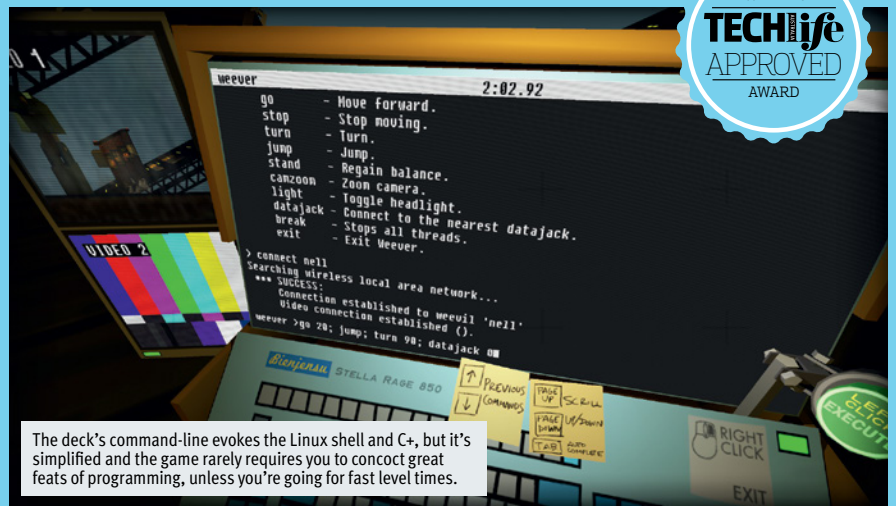
The biggest problem is the repetition and re-purposing of ideas. For a game that's only a few hours long, this adherence to a single structure dulls the thrill of exploring the ocean, and the reappearance of familiar design concepts betray the unique visuals.

But this niggle is partially washed away when you dive back in and submerge yourself in *Abzû*.

[BEN TYRER]



A pleasant reminder of just how tiny you are in this ocean.



The deck's command-line evokes the Linux shell and C+, but it's simplified and the game rarely requires you to concoct great feats of programming, unless you're going for fast level times.

WINNER
TECHlife
APPROVED
AWARD

Quadrilateral Cowboy

A CYBERPUNK HEIST ADVENTURE
US\$19.99 | PC | blendogames.com/qc

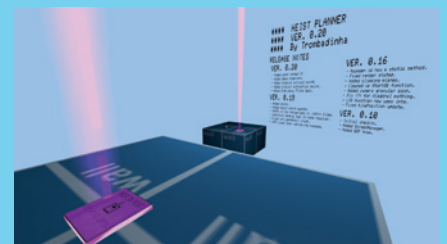
SETTING UP A good workspace is crucial in *Quadrilateral Cowboy*. In front of you, you'll place your laptop — constructed by you — a keyboard and screen to display a command-line interface, and it's your most prized piece of equipment, used for hacking into external networks and to control various amazing tools. To the side, you'll place your CCTV unit.

One feed might be from your four-legged remote bot that's small enough to get under pipes and through vents. You might tell it GO 150; TURN 90; GO 50, commands that tell it to move forward, turn to the right and move on again. Then you'll hammer out DATAJACK 0 to activate a node on the wall, which might switch off laser fields or open a window. Another video feed could be from your Auto Case, a briefcase that you set on the floor and which transforms into a gun.

But you won't be shooting a human target. This isn't that kind of game. The Auto Case is all about hitting buttons from afar with FIRE. The object of *Quadrilateral Cowboy* is to perform a series of simulated heists from your company's studio, formulating and practising elaborate raids on surreal banks, funiculars, luxury apartments, space stations and moving trucks, before getting out again, preferably without setting off alarms. The what and the why of a heist isn't important; it's the how, since this is essentially a puzzle game.

As you're steadily granted more tools, learning what they do is a thrill. You initially fumble around, resorting to typing HELP into the deck, reading sticky notes attached to it, and opening the in-game manual until, eventually, you master them.

Quadrilateral Cowboy takes place in entirely discrete locations, but it feels like it's part of a wider world. The characters are blocky and the environments simple, but details are obsessed over. This is a game of incidentals, where every



book in every bookcase has a different title; every functioning object has a name and has warning stickers and operating notes; every drawer opens and every tap and toilet flows. Yet it also feels artificial. You're aware you're exploring sets, painstakingly composed so they give you a cleanly presented puzzle to solve, comprising alarm systems, sightlines between windows for your Auto Case and vent systems to send your Weevil into.

There's also an affecting story going on of a hacker and her two friends establishing a company building up their tech and taking on jobs. Between levels, we experience vignettes of their lives, visiting their homes and playing badminton with them. The finer points are told through details, in contracts and certificates, with time shown through a plant steadily growing and seasonal decorations in the office.

With so much going on, all of it so carefully realised, something had to give. *Quadrilateral Cowboy* isn't long, and by the end of its 11 levels, you'll feel you've only scratched the surface of the challenges your many tools and abilities can provide.

Your friends' best times are there to goad you into executing a better plan faster. And Blendo Games' ambitions seem to be on another plane. *Quadrilateral Cowboy* comes with a guide to modding, so perhaps its potential will be fully realised by its players. For a game so preoccupied with the magic of its making, that's actually pretty fitting.





Regular visits to the village chiefs are worthwhile, as you'll gain access to missions that boost your standing within the village, unlocking various rewards.

Monster Hunter: Generations

THERE'S NO GREATER ADVERSARY THAN YOUR OWN COMPLACENCY.
US\$39.99 | 3DS | www.monsterhunter.com

WITH NO ADDITIONS to the 14 weapon types in *Monster Hunter 4 Ultimate*, Capcom has opted instead to give players more choice in how they wield them. The Striker style offers a simplified move-set, which can be customised with three Hunter Arts, special moves and buffs that can be triggered once their meter has been filled by landing attacks. Guild style will be immediately familiar to anyone who played the previous game, with the addition of two Arts. The aptly named Adept style, meanwhile, gets just the one, and demands a keen eye and responsive digits, with deftly timed evasive manoeuvres letting you launch devastating follow-up attacks.

Aerial style proved to be our new mainstay. Here, a tap of B can be used to vault off a monster's tail, its back, a Felyne companion, or another hunter's weapon, launching you high into the air. It's a useful way of setting up attacks from above — and escaping incoming projectiles and tail swipes — but also a much less fiddly way to mount a monster than luring it towards a climbable wall and leaping off onto its back. Dual Blades, we've found, are very useful for more mobile beasts, but it's the Longsword we've come to truly cherish.

As the name suggests, *Generations* is a game that isn't afraid to look backwards. Three of its four hubs are taken from previous games, while much of its menagerie is familiar. Smartly, it tends to borrow from much earlier in the series, ensuring those who've been

playing *MH4U* recently shouldn't experience too much déjà vu, and its selections are mostly sensible ones.

With gathering spots yielding more resources and slain creatures leaving more parts behind, this is the most generous, accommodating *Monster Hunter* to date. Capcom's desire to make it more approachable is undoubtedly behind the addition of Prowler mode, which lets you play as a Felyne hunter with nine lives, and no kit or stamina meter to worry about. It takes a significant time investment, however, to reach a stage at which a four-legged hunter can match its human counterparts. It's easy, too, to imagine some players being overwhelmed by an opening that's all too eager to highlight its abundance of options and information. And for all the hints and instructional text, it's still not great at communicating the nuances of combat: tutorials amount to little more than 'here's what the buttons do; now kill this monster'.

Generations might not be the perfect starting point it threatens to be, then, and nor do the four distinct styles quite amount to the sea change they first appear to be. It still offers some of the most exciting and handsomely-staged third-person combat you'll find in any game — and, if only by a small amount, *Generations* has raised the bar again.



If the dystopian future features cocktails and cat ears, we might be able to live with all the oppression and gloom.

VA-11 HALL-A

MIXING DRINKS FOR THE LOCALS IS DELIGHTFULLY INTOXICATING.
US\$14.99 | PC | waifubartending.com

This is a game about listening. Not in the tedious *Assassin's Creed* sense, where you creep around behind some sickly target, eavesdropping for mission information, but rather listening in a very human way. The patrons who visit your bar all have something to say worth hearing, whether they're good, bad or a talking goddamn dog.

Where does the 'game' element come in? As bartender Jill, your job is to serve the drinks people ask for and, sometimes, the drinks they don't. You listen to instructions and mix cocktails, selecting from a menu of exotic beverages. This is a bleak, dystopian future, though, so even a simple beer has to be synthesised using chemicals (the horror!). You can mix drinks slowly, taking multiple attempts to get it right. Serving the incorrect tippable will affect your pay, but you don't fail. Instead, the main focus is on the excellent story, which stumbles forward inexorably like a sloshed uncle. The wrong drink will divert the course of the narrative, but never end it.

Everyone you meet feels like they have a history. You find yourself looking forward to seeing the most unpleasant and eccentric characters just to learn more about them. *VA-11 HALL-A* also has a blackly comic sense of humour. It's bold enough to visit dark places. We won't spoil it, but Dorothy's story is especially cheerful and horrifying. At first she seems totally amoral, but as you progress the story, hidden layers are uncovered, like a PVC-coated onion.

There's a threatening sense of social unease, revealed through whispered conversations, news reports and blogs, which makes the world feel real. Your bar becomes a safe haven. Jill's simple struggle to exist is fascinating precisely because it's so ordinary, so relatable. Quiet distractions, like buying retro consoles or drinking beer on your balcony, have an understated sense of cosmic significance.

It would be easy to write *VA-11 HALL-A* off as simple, but there's really nothing straightforward about great writing. It doesn't ask much of you as a player, except for patience. And it's a different kind of patience. Nothing here frustrates. To enjoy it properly, you need to relax and give it the time it deserves. In that sense, it's not for everyone, but if you like cyberpunk, anime, cocktails, people, kotatsu and corgis, you'll find a refreshing frame of reference in *VA-11 HALL-A*.

[MATT ELLIOT]





BAJO GOES A BROAD



STEVEN 'BAJO' O'DONNELL

is a video game critic and co-host of ABC shows *Good Game* and *Good Game Spawn Point*. His love of games is only surpassed by his love of cats.

[HMM...]

Puzzle me this

WHY DO CHALLENGING PUZZLE GAMES CAPTIVATE US SO COMPLETELY?

[STEVEN 'BAJO' O'DONNELL]

WHENEVER I THINK about playing a puzzle game, the lazy Bajo inside me goes, "Whyyyy? Why put yourself through torture? Why hurt your tired brain? Why not play *Peggle* instead and lose yourself to the simple, joyful colours and satisfying bleeps and bloops?!" And yet, good puzzle games can own our time more than any other genre.

There are two types of puzzlers. Games like *Braid* and *The Witness* — which arguably aren't actually fun to play, but are still totally compelling for other reasons, and impressive for their complexity and cunning. And games like *Portal* and *Inside*, which offer a more accessible challenge, but retain a solid sense of satisfaction and progress.

Staring over the shoulder of mobile gamers is one of my favourite creeping pastimes. 9 times out of 10 (if they aren't rabidly catching squirtles in *Pokémon GO*), they're playing *Candy Crush*. Ew.

Seriously, ew. It's an ew game. It looks ew. It sounds ew. Worst of all, it makes you wait before you can play again, in an attempt to suck cash from your wallet. I mean no offence if you love the game, but seriously... it's gross.

Personally, for on-the-go puzzling, I prefer *Puzzle Quest*, made by Aussie developer Infinite Interactive. It's still my favourite portable/mobile game of all time, because it hits so many satisfying notes. Based on *Bejewelled*, the basic gameplay is to match gems. But it has this excellent layer of

role-playing to it as well. You level up classes, cast spells, and generally make gems cascade in glorious fashion until you've beaten your enemy. I mention this game, because it consumed all my free time, wherever I was, for a solid year. But why?

MARVEL PUZZLE QUEST

iOS, Android, Windows, PlayStation 3, PlayStation 4, Xbox 360, Xbox One
Whatever your poison, there's something satisfying about solving logic problems. If you're the kind of completionist who needs to reach 100% every game, they can be the perfect obsession. Even if you aren't one of those guys, being presented with a puzzle and knowing the solution is right there in front of you is a tantalising proposition.

Especially in 2016. The interface design issues of older games like *Myst One* and old point-and-click adventures are a thing of the past. Today, puzzle games are even more popular with non-gamers or irregular players. When you boil it all down, puzzles are gaming in its purest form. Pristine, clean-cut logic challenges that our brains desire to feast on. Maybe we love them because they distract us from the chaos of real life which is full of unsolvable problems like how to use the ATO's tax website, or trying to free up space on our parents' iCloud devices, or why TV remote controls are still so complicated? Seriously, someone get Elon Musk on that one.

Perhaps solving puzzles is just something our brains actually need to do. Pattern recognition is one of the major steps in human evolution. We evolved to fix things, to put things together, and eventually, one day, we will make a remote control that isn't completely black with tiny stupid buttons that make no sense.

2016 has been great for brain busters, with something to frustrate and delight gamers from all walks of life.

THE WITNESS

PS4, PC

From Jonathan Blow, the creator of *Braid*, comes *The Witness*. This ambitious open-world puzzler is set on a deserted island. Most of what you do in this game is guide a line from one point to another, but that's much harder than it sounds. The solutions surrounding the problems this game presents to you are exquisite.

HEADLANDER

PC, PS4

Headlander was created by the Double Fine Productions, makers of delightful games such as *Broken Age*, *Costume Quest* and *Psychonauts*. It's a Metroidvania-ish puzzle platformer with a funky sci-fi '70s theme. You're a head in a jar basically, and able to detach and reattach to robots to complete objectives. Neat!

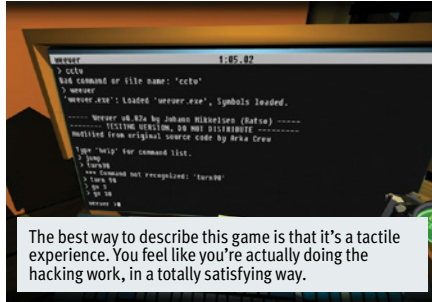


There's hundreds of puzzles, and while you don't need to complete them all to finish the game, you will almost definitely get stuck and scream. That's fun, though... right?

SNAKEBIRD

PC, IOS, Android

What happens when you combine a snake with a bird? You get a brainhurty jerk of a game that I highly recommend. There's something about a charming, fun-looking game that is actually very mean and completely evil.



The best way to describe this game is that it's a tactile experience. You feel like you're actually doing the hacking work, in a totally satisfying way.



Snakebird came out on PC in 2015, but recently had an iOS and Android release.

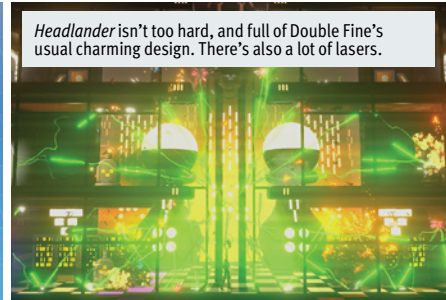
STEPHEN'S SAUSAGE ROLL

Windows, OSX, Linux

Stephen's Sausage Roll has the best video game title in years, but also makes me want to cry and bash my head into the screen. Your objective is to cook sausages by pushing and flipping them using Stephen's giant fork. Sounds simple, but this game is diabolical in its execution, and you have to respect how complex the solutions are.



You have to tip your hat to how insanely difficult this game makes cooking a sausage.

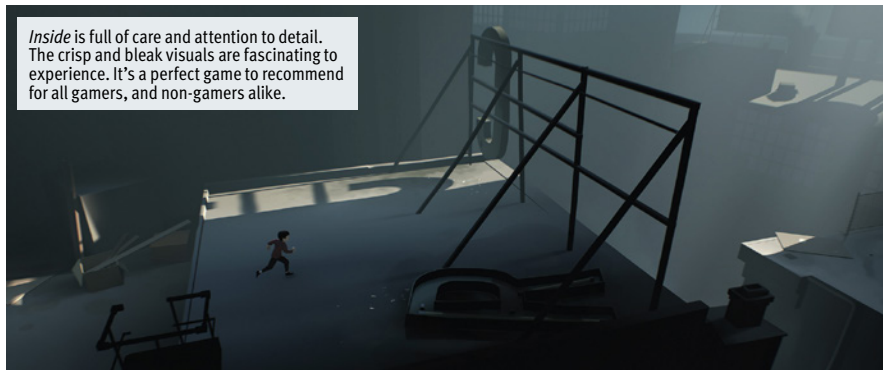


Headlander isn't too hard, and full of Double Fine's usual charming design. There's also a lot of lasers.

INSIDE

XBOX one, PC, PS4

Inside is a puzzle platformer from the makers of Limbo, and has similarly dark in theme. You play a small boy who gets caught up in a government conspiracy of sorts, but saying any more about the story would be spoiler city. Developer Play Dead have hit the difficulty range perfectly with Inside. There's real challenge, but no puzzle overstays its welcome or feels fiddly. You inherently know what to do, and it gives you just the right amount of push back to make the experience satisfying. You'll be discussing the ending with those around you the moment you finish.

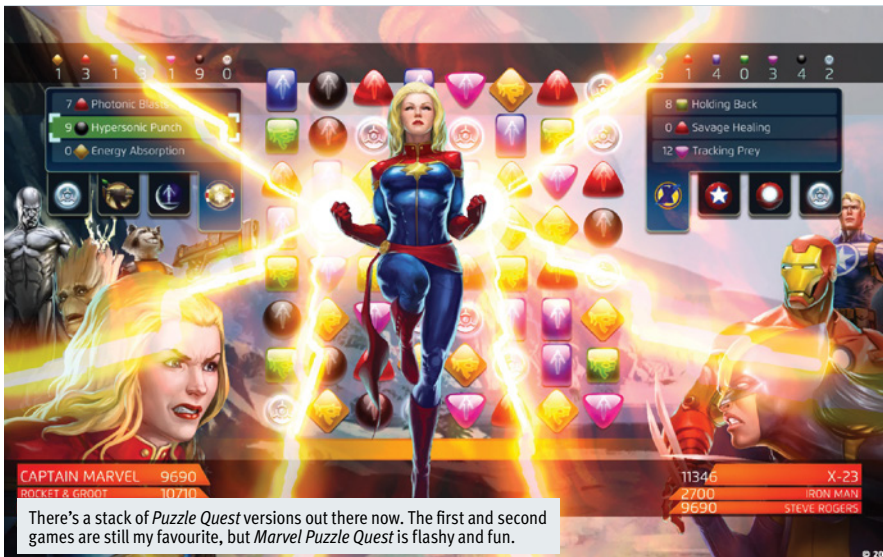


Inside is full of care and attention to detail. The crisp and bleak visuals are fascinating to experience. It's a perfect game to recommend for all gamers, and non-gamers alike.

QUADRILATERAL COWBOY

PC, OSX, Linux

Quadrilateral Cowboy is set in a bleak, surreal hacking world full of cyber espionage. It's from developer Blendo Games, makers of the excellent narrative experience 30 Flights of Loving. You're part of a group of hackers, who go on various heists to obtain files and safes. But the only way to get them is to plonk down your own old-school terminal and literally type out commands. You really do feel like you're hacking systems and going 'into the Matrix' at times, without needing to know a thing about hacking or coding. ■



There's a stack of Puzzle Quest versions out there now. The first and second games are still my favourite, but Marvel Puzzle Quest is flashy and fun.



[MOBILE GAMES]

I choose you

TECHLIFE'S TEAM REVIEWS THE LATEST GAMES FOR MOBILE DEVICES, STARTING WITH THE MONSTER-COLLECTING PHENOMENON.



Pokémon GO
HERE ARE YOUR PLANS FOR THE EEEVENING.
Free with IAP | www.pokemongo.com

On launch, the Pokémon Company's latest game quickly had more daily active users than Tinder, Twitter and Facebook. This means more people catching monsters than acting like them on social media. But here's the key question — is *Pokémon GO* actually any good? The answer is a resounding 'yes', and it can only get better.

If you've been unfortunate enough to have your head stuck in a Poké Ball since release, *Pokémon GO* uses your iPhone or Android device to hunt down Pikachu and pals across the real world. Using Google-powered technology pioneered by developer Niantic's previous game, *Ingress*, our analogue surroundings are translated into a tantalising mass of PokéStops, gyms and, of course, 151 Pokémon. On paper, it's exciting, but when you're outside looking at an open game world that mirrors your own, it's elevated to something exhilarating.

The free app isn't currently without its problems — as at the time of review, Niantic's servers were overwhelmed and causing frustrating crashes — but there's so much to love here and no need to spend cash. Catching 'em all is a simple joy. A well-aimed flick of a Poké Ball is all it takes

once you have your quarry in front of you and, if you're lucky enough to trap them first time, the flicker of three stars never gets any less satisfying. PokéStops too make walking to work a collector's paradise as churches, monuments and parks become caches of loot. Spin the Pokémon logo and Poké Balls and — hey presto! — revives will spill out in happy-making poppable bubbles.

You can't compete directly with other trainers yet (apparently one of many updates players can expect further down the line) but gym ownership is a fierce battle that lets you install your Pokémon in a location alongside fellow team members. Its interface may be simple for now and it's painfully lacking a tutorial, but the community aspect of *Pokémon GO* is its killer draw. Real-world trainers wander the streets with you in the hunt for more monsters.

There's a reason this has taken over the world and it might not be the best there ever was just yet, but like Ash Ketchum, it's on the way.

[LOUISE BLAIN]



Twilight Struggle

COLD WAR, HOT GAME.
\$14.99 | www.facebook.com/Playdek

Originally a tabletop board game simulating the Cold War, it's widely regarded by hobbyists as one of the finest around. Play involves using cards to spread the political influence of the US and USSR around the globe. Each card can either be played for influence, or for a historical event useful to one side or the other. These events, such as the US card 'Chernobyl' or the USSR's 'Glasnost', give the game a rich sensation of recreating an alternative yet plausible past.

Players frantically sort through their cards, conniving plans to advance their game while neutralising enemy events they'll be triggering. It can be frustrating, but it's also gripping and strategically satisfying. The learning curve is steep, but well-lit. That difficulty was off-putting in the physical game. Here, you can learn via a tutorial, then try your skills against an adequate AI. After that, you can move onto cross-platform play against human opponents.

Dragging and tapping feels like a natural substitute for handling real cards, and you quickly learn to cope with minor interface issues such as the board being too large to fit on screen all at once. Strategy sims of recent history have never been more approachable or enthralling. [MATT THROWER]





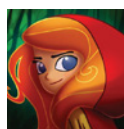
Perchang
THIS MACHINE KILLS BOREDOM.
\$2.99 | perchang.com

Each level tasks you with an exit (or exits) and a steady stream of ball bearings to guide you towards it by means of a miniature Rube Goldberg machine. These stages contain various elements — platforms, fans, flippers and so on — that can be manipulated using the buttons in the bottom corner of the screen, one red and one blue. You can change the colour of an element (and thus which of these two buttons controls it) with a tap, and working out which colour combo proves most efficient is often key to success.

It's not just a test of logic, though. Some levels require you to supply fan blasts or flipper pings at just the right time, to float or throw a ball to safety. With multiple balls on different elements at any one time, your concentration and coordination also need to be on point.

Get your technique for a level nailed, and the succession of ball bearings neatly bobbing their way along to the exit makes you feel a bit like Willy Wonka lording it over his factory. That, frankly, is something that we'll never see as a bad thing.

This is a truly joyful puzzle game that gives both your brain and your reflexes a gentle workout. [EMMA DAVIES]

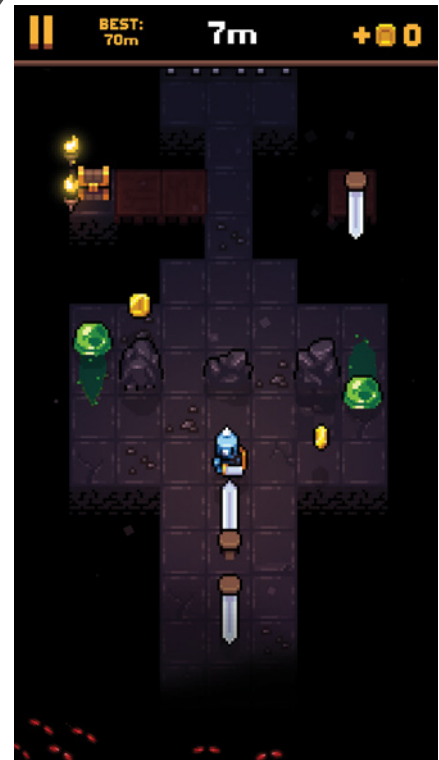


Red Story
THE WOODS ARE A DANGEROUS PLACE.
Free with IAP | fromparis.co

Red's map to Grandma's house was stolen by wolves (*gasp!*), so she now has to quickly get to Grandma's before they do. This means running through the forest, jumping, sliding, ducking, falling and back-tracking to avoid all the nasties that the wolves have put in her way — such as traps, wolves dressed up as chickens, pitfalls, chasms and a strange abundance of spiked wrecking balls and giant wheels. (Was that a troll?)

If you get hit, you lose the magical illumination of the lamps that you've been lighting along your way and you'll have to proceed the next leg in darkness. We liked this mechanic; however, we had a few problems with the controls, as the 'swipe finger from right to left' to turn back and 'slide finger from top to bottom' to duck was never reliable, but perhaps it was our fat thumbs that were at fault... The art is a delight, and it should be, since a *Rayman Origins* concept artist was involved here.

However, unlike *Rayman*, we didn't feel the urge to collect every flaming coin or every hidden letter (R, E, D). (Maybe we're really worried about Grandma... or maybe the magic is lost with the ads we're forced to watch each level?) [CARMEL SEALEY]



Redungeon
A CHALLENGING DUNGEON CRAWLER WITH INTRUSIVE MONETISATION.
Free | www.nitrome.com

As the name implies, *Redungeon* is about exploring dungeons and trying not to die in dungeons, but it's actually the ads that might kill you. Intrusive advertising is not a new phenomenon in mobile gaming by any means, but in the case of *Redungeon*, you're gonna see a lot of them — sometimes in the form of unskippable 18-second videos, an especially gruelling attack if you don't have a huge data cap. If you can weather these blows (or pay around \$4 to turn the ads off), you have a very fun rogue-lite inspired by the likes of *Crypt of the Necrodancer* and *Rogue Legacy*. The gridded layout means you'll only need to use one finger to swipe in one of four directions, and the randomly generated dungeons keep the game fresh, if a little overly difficult at times.

The in-game economy is a bit dire, though: gold coins can allow your hero to continue his journey once dead, but unless you play this game incessantly, you'll never have enough. That is, unless you buy some. The heavy-handed demand for your money might be too much, but if you can tolerate the nagging, *Redungeon* is a fun dungeon crawler perfect for phone.

[SHAUN PRESCOTT]



TEST BENCH

THE HOTTEST GEAR PRESSURE-TESTED



[UP TO ITS OLD STRIX AGAIN]

Strixly Gaming

THE **TECHLIFE** TEAM TESTS THE LATEST TECH GEAR AND PCS, STARTING WITH ASUS'S SURPRISINGLY-AFFORDABLE NEW GAMING LAPTOP.

ASUS Strix GL502VT

A FUTURE-PROOFED GAMING LAPTOP THAT COSTS LESS THAN YOU MIGHT THINK.

ASUS'S STRIX GL502VT is far from heavy. Not everyone will like its appearance, but you couldn't call it bad-looking. And while it's not quite a bargain, it's reasonably priced for the specs on offer. In many ways, we were expecting the GL502VT to be a commonplace upgrade of something like the GL552W (reviewed in *TechLife* 51, page 52) that would lead to a decent middle-of-the-road gaming laptop, but once you get past the facade, the differences seep in and they throw that idea of normalcy out the window.

We've noticed a trend of late of laptop manufacturers only installing SSDs in their gaming-oriented models, and that's the case here, too. That's a bit of a double-edged sword, as makers are often sacrificing much larger HDDs in order to do so and it can be a design decision that makes the gaming laptop about as useful as a holey bucket — at least if you want to have more than a few games installed at a time. While we can certainly understand the appeal of the Samsung PCIe M.2 SSD that ASUS has used here — with its 2,000MB/s read and 400MB/s plus write speeds — that 256GB capacity is likely to leave you wanting more space sooner rather than later — especially if you'd like to throw some HD movies and TV or other big media files on there alongside your games.

The other notable upgrade of the GL502VT from the GL552W is the addition of a 4K IPS display. But again, a 4K display is a bit of a mixed blessing. Attached to a powerful desktop gaming rig, they can deliver a great experience, but you're not going to be gaming in 4K on the GL502VT — the internal hardware is not *that* fast. So apart from having a sharper image and being able to stream 4K video content on it, the usefulness of this display is somewhat limited.

There's another downside to that screen — the strain it adds to battery life. The GL502VT netted just 2 hours and 33 minutes in our PC Mark 8 Home battery-life test — and that was with the battery-saver optimisations on. Switch to high-performance mode and you'll only reach around 1 hour and 14 minutes.

The Intel i7-6700HQ CPU and the Nvidia GeForce GTX 970M GPU come together nicely here, easily pumping out respectable frame rates on the latest titles at 1080p. The GL502VT matched the scores of the 2016 Alienware Alpha (a device which uses a desktop-class GTX 960), with average frame rates of 59, 35 and 72 from *Batman: Arkham Knight*, *FarCry Primal* and *Rainbow Six Siege* on high and ultra settings. The chassis does get warm in certain hotspots above the keyboard when it's under load, but the CPU and GPU both remained under 81°C, a fairly safe level, throughout our tests.

The GL502VT's keyboard is full-sized, yet it's ditched any space around the number pad and even a few of the keys to make it slot in a *Tetris*-style on the right of the directional keys. The speakers aren't great, despite sitting particularly close to each of your ears on either edge of the base of the unit, roughly in line with the trackpad.

Still, we were surprised the street price landed at a reasonable \$2,300 for the 4K model, which means it's hard to be too harsh about the cutting-edge technology slicing both ways. And at 2.2kg, the beefier hardware hasn't made the device unwieldy by any means either — this is a gaming laptop that's not too painful to cart around with you. ■ [JOEL BURGESS]



ASUS STRIX GL502VT

\$2,300
www.asus.com/au



CRITICAL SPECS

Windows 10 Home 64-bit; 15.6-inch IPS LCD @ 3,840 x 2,160-pixels; 2.6–3.5GHz Intel Core i7-6700HQ; Nvidia GeForce GTX 970M; 8GB RAM; 256GB NVMe Samsung SSD; 2.2kg

ONE OF THE PECULIARITIES OF THIS SYSTEM IS THAT IT IS THE ONLY ONE THAT MANAGES TO CRAM 32GB OF MEMORY INTO A 13.3-INCH FORM FACTOR.



Fujitsu LifeBook E736

COULD THIS BE THE PERFECT MOBILE WORKSTATION?

LET'S GET TO the point: the Fujitsu LifeBook E736 is an expensive laptop. But according to its manufacturer, it delivers uncompromising elegant design and functionality.

The truth is there are more svelte machines out there, but the E736 just about qualifies as an ultrabook. It is 20mm thick and weighs 1.6kg despite looking like a slab. Part of that surprising light-footedness is down to the use of magnesium in the lid and aluminium in the palm rest, which gives the latter a rather odd artificial smoothness.

One of the peculiarities of this system is that it is the only one that can cram up to 32GB of memory into a 13.3-inch form factor. Such a massive amount of RAM is ideal for memory-intensive applications.

Fujitsu opted for a classic look with a gunmetal lid and a red border that runs across one edge. Because of its metal palm rest, the first thing that strikes you when opening this machine up is how cold the chassis is. There's also the extreme smoothness of the palm rest.

The display is attached to the base via two hinges. We noticed a lot of flex in the display, the sort usually associated with entry-level laptops. The keyboard also showed some flex during long typing sessions. In either case, though, this didn't affect our working experience. The keyboard has a longer-than-average travel, and the keys are soft to the touch, which might make for a mushier typing experience than you're used to, while the touchpad is big and responsive enough with two physical buttons.

A fingerprint reader, located on the palm rest, joins a pair of tiny speakers (generating a

boxy sound without much depth); five status lights; and the power, Wi-Fi on/off and Eco mode buttons, all of which are located above the first row of keys.

The amount of raw power packed in the E736 is impressive and it doesn't come as a surprise that this laptop can deliver the sort of performance that would befit a full-tower workstation only a decade ago.

Not once did we encounter any sort of stuttering, as you would expect from such a beast. The fan did kick in a few times but not to any worrying extent. Fujitsu allows you to disable it completely via the BIOS (accessible via F2) but we'd suggest keeping things as such, otherwise the CPU will be throttled (in other words, the CPU speed will drop in such a way as to prevent too much heat from being generated).

Battery life was exceptional on our test unit, as expected. It managed to last 12 hours, — yes, 12 long hours, playing an MKV file with sound and brightness set at 50%.

But the LifeBook E736 won't appeal to everyone — this laptop's price and design drew blanks on the faces of some of our consumer-oriented colleagues but that's understandable. They're used to the MacBook Pros and the Dell XPS 13s of this world, while we were looking for something that would be more suited to a business user.

Instead, it scores high points when it comes to modularity/expandability, performance, manageability and battery life. The particular model we tested isn't available at retail in Australia: it packed in 32GB of memory, whereas the nearest equivalent has 8GB.

Regardless, there's still the option of up to 18-hour battery life (with less-intensive tasks) via the addition of a secondary battery which takes the weight to 1.75kg. There's also an optional Port Replicator as well, which we loved. It's compact and offers more connectivity options than most of the competition, it's just a shame that it doesn't support 4K resolution screens.

At the time of print, street prices varied quite significantly for the Core i7/8GB/256GB model of the E736 (the nearest to what we tested here), with the lowest being around \$1,900 and the highest at \$2,300. That lower price is a reasonably fair one, although the 256GB size of the internal SSD is perhaps a little small, but that's alleviated by the modular drive, which can take a second hard drive.

On paper, this is one of the best business laptops available, but its value does very much depend on how much you can find it for. Snag a Core i7 version for under \$2,000 and it's not a bad deal at all. ■

FUJITSU LIFEBOOK E736
From \$1,400 (Core i5 model)
www.fujitsu.com/au

CRITICAL SPECS (AS TESTED)
13.3-inch full HD IGZO display; Intel Core i7-6600U processor; 256GB OPAL FDE SATA 3 SSD; 32GB DDR4-2133; mic and headphones ports; 3 x USB 3.0 ports; VGA port; full-size DisplayPort; Ethernet port; SD card slot; 802.11ac Wi-Fi; Bluetooth 4.0; 1.6kg.

AS A POINT IN CASE, LAST YEAR'S ONE A9 HANDSET WAS A PRETTY GOOD MIMIC OF THE IPHONE 6S — AT LEAST IN TERMS OF LOOKS — AND WITH THIS NEW X9, HTC IS SQUARELY AIMING AT THE BIGGER IPHONE 6S PLUS.



HTC One X9

AN IPHONE 6S PLUS FOR AROUND HALF THE PRICE?

TAIWANESE PHONE-MAKER HTC was once the darling of the Android world, but with the smartphone market becoming increasingly competitive and saturated, it's had a troubled few years of late. The company's latest strategy to try to turn that around seems to be something along the lines of 'copy Apple, but cheaper'. As a point in case, last year's One A9 handset was a pretty good mimic of the iPhone 6S — at least in terms of looks — and with this new X9, HTC is squarely aiming at the bigger iPhone 6S Plus. The X9 ups the screen from 5 inches to 5.5 inches but otherwise keeps the fairly iPhone-esque shape, with smooth curves combined with a metal unibody back and glass front. To its credit, HTC has at least added a few more ornamental design flourishes to the X9 — notably around the rear camera and front-facing speakers — so it's not quite as plain as the iPhone, but the overall intent is still quite clear.

Thankfully, there's actually a lot to like about the X9 elsewhere. Despite the \$599 price, it's actually fairly well equipped, specs wise, with a 1080p screen, 32GB of onboard storage, 3GB of RAM and Android 6.0 (AKA Marshmallow). The 3,000mAh built-in battery supports fast-charging (though you'll need to fork out for an extra adaptor), the

cameras (13MP rear and 5MP front) produce generally pleasing results, and there's even a microSD slot to expand your storage, with support for cards up to 256GB. This phone also sees the return of HTC's front-facing Boomsound speakers and they're still some of the best built-ins you'll find in a phone, making it better (though still not great) for watching videos on sans headphones.

It's also one tough-feeling phone, although it is a little big and unwieldy in the hand — Samsung's bigger phones are a little trimmer and nicer to hold, and the X9 doesn't carry off its big size quite as smoothly.

You also get HTC's Sense UI, which is one of the slicker custom Android interfaces on offer. The good news here is that HTC has taken the same approach with the X9 as with its flagship HTC 10; it's avoided bundling in its own apps just for the sake of branding and, where Google's stock apps are good enough to stand on their own, HTC has used those rather than doubling up by including its own (often uninstallable) duplicates.

Under the hood, HTC has opted to go with a MediaTek Helio processor, rather than the Qualcomm Snapdragon seen in the One A9, but that's not an entirely bad thing. The Helio is quite a clippy little chip, with the X9 turning in benchmark results quite a bit

faster than its smaller sibling, and the battery life is good too, reaching a respectable 8:40hr in PCMark for Android at 50% screen brightness. The X9 is a bit behind when it comes to gaming speed, however — it's passable, but falls behind in more demanding titles, where current flagships can be up to five times faster.

While not perfect then, there's a good-enough mix of specs, performance and pleasing design in the X9 to make it a worthwhile offering at this \$599 price — provided you actually like the iPhone stylings, of course.

[DAN GARDINER]

 A promotional graphic for the HTC One X9. It features a red circle with the number '4' inside, positioned over a background of three overlapping circles. Below this, the phone is shown from both front and back views.

HTC ONE X9
\$599
www.htc.com

CRITICAL SPECS
Android 6.0; 5.5-inch Super LCD display; octa-core MediaTek Helios MT6795 CPU; PowerVR G6200 GPU; 3GB RAM; 32GB storage; microSD slot (up to 256GB); 3,000mAh non-removable battery with fast charging; 173g

+

THE TG-TRACKER COMES SUPPLIED WITH A RANGE OF ACCESSORIES, INCLUDING A STEADY GRIP THAT BOLTS ON TO THE BOTTOM OF THE BODY, GIVING IT AN ALMOST SUPER 8 CINE CAMERA LOOK AND FEEL.



Olympus TG-Tracker

A SOLID FIRST FORAY INTO THE ACTION CAM MARKET.

THE TG-TRACKER IS Olympus's first venture into the action camera market. It certainly stands out visually. At 3.5 x 5.7 x 9.3cm, it's relatively small, but its 180g weight makes it a little heavier than the GoPro Hero4 Black. This extra weight can cause a bit of wobble when it's mounted on a bike's handlebar. Helpfully, the built-in image stabiliser can be enabled in the menu system, and does a good job of reducing vibrations.

The TG-Tracker has a small LED lamp to illuminate night-time filming. It's also waterproof out of the box to 30m, and can operate in temperatures down to -10°C, survive being dropped from up to 2.1m, and is crushproof up to 100kg.

The small camera has built-in Wi-Fi, GPS, motion sensors, 4K video capability, compass, barometer, thermometer and accelerometer — these make it a serious rival to the Garmin Virb XE and TomTom Bandit. Inside the TG-Tracker is a 7.2-million-pixel, 1/2.3-inch CMOS sensor, fronted by an ultra-wide 204° lens (which produces a fish-eye perspective). In addition to 4K at 30fps, you can record at 1080p and 720p at 60fps and 30fps. There's also a high-speed recording option, which raises the frame rate of 720p and 480p video to 240fps, enabling slow-motion playback once edited. Stills can also be shot at 8MP, and all your footage is captured on a MicroSD card

that slots into the back of the camera. The camera is comfortable to use, with the 3.8-inch flip-out screen making handheld filming very easy; however, the screen merely flips out, rather than flipping and rotating.

The TG-Tracker comes supplied with a range of accessories, including a steady grip that bolts on to the bottom of the body, giving it an almost Super 8 cine camera look and feel.

The TG-Tracker's 4K video footage is well balanced for exposure, with plenty of fine detail. Contrast is a bit high, and as with the majority of action cameras, it struggles with dynamic range, losing some shadow and highlight detail in high-contrast situations.

When you're filming while moving between bright and shaded areas, however, the exposure adjusts quickly, and automatic white balance works well. Dropping the resolution down to 1080p at 30fps results in well-balanced footage with a good level of detail. Filming at 60fps captures smooth motion, but at the cost of a slight drop in the quality of the detail and tonal rendition when compared with footage shot at 30fps.

All the settings and controls are accessed via the buttons on top of the body, alongside the shutter release. This is the easiest action camera to use that we've tested and the companion OI.Track app is quick and easy to set up. Once connected, video and log files can

be downloaded to your iPhone and viewed alongside any sensor data recorded, but the software has a long way to go before it's as fully featured as the competition.

The steady mounting grip makes the TG-Tracker easy to hold, and the included mount coupling makes it simple to attach the camera to just about anything, including a standard GoPro mount.

The TG-Tracker is a break from the usual action cam design. Image quality is good, and capturing location and motion data is a huge selling point. The software doesn't match the quality of the camera itself, but at least the hardware is in place. Hopefully the software will be updated to make full use of its capabilities. ■ [ALI JENNINGS]

OLYMPUS TG-TRACKER
\$499
olympus.com.au

CRITICAL SPECS
4K video at 30fps; 8MP still images; rugged case; 204° ultra-wide lens; Wi-Fi; GPS; motion sensors; waterproof to 30m; 3.5 x 5.7 x 9.3cm; 180g



Garmin Forerunner 735XT

THIS SMARTWATCH IS A TRUE MULTI-SPORT CHAMPION.

IT LOOKS LIKE cannibalism. The best of Garmin's best, the Fenix 3, has given its DNA to the Forerunner 735XT. Look again, though, and this vampire hasn't digested the Fenix 3 entirely, but made itself a clone that's lighter, more refined and focused, and it's probably the best triathlon-centric watch you can buy.

The first thing you'll notice about the 735XT is just how light it is, all without making sacrifices. ANT+ and Bluetooth connectivity opens up the capability for more metrics, if you have a speed sensor on your bike, or the optional chest-strap heart-rate monitor. On the reverse side of the face is an optical heart-rate monitor that keeps measure during any land-based activity. The GPS is ready and willing, beeping into life at a moment's notice.

Flick through the activities menu and you'll find the three core triathlon sports — swimming (open water and pool), running and cycling — plus a dedicated 'triathlon' activity, with the option to add more (think paddle boarding, hiking etc). Choose 'triathlon', hit the start button, and from there, you can blast through an entire tri, tapping the 'return' button as you begin the next activity, transitions included, to keep track as simply as possible.

The 31.1mm display is large and clear, and you'll also get notifications from your iOS or Android device. This is more convenience than anything else, as long messages need to be scrolled through — a nice feature, but you're eyeing off the 735XT if you fancy yourself to be a serious athlete. Also at hand is a race predictor, as well as a recovery countdown. Plus, there's the Strava suffer score, a quick and dirty number that gives you an idea of how hard you're working compared to your mates. [PAUL TAYLOR]



Sony MP-CL1

A GENUINELY POCKETABLE PROJECTOR THAT'S GREAT FOR TRAVELLING NIGHT-OWLS.

SCI-FI MOVIES ARE responsible for that desire we all have to interact with holographic computers or project images onto walls and although it's been possible to do this with 'pico' projectors in the past, Sony has launched the first one that actually makes you want to.

The black metal chassis is no bigger than a large mobile phone and gives the projector an understated class that is reflective of the money you'll fork out for it. In addition to a micro-USB charging port, there's also a MHL HDMI output, 3.5mm headphone jack and a USB output, letting you use it as a powerbank. Like a number of pico projectors, the MP-CL1 uses LED-based projection so you don't have to worry about focusing the device at any distance, having to replace an expensive projection lamp, or waiting for that lamp to warm-up before use.

The MP-CL1 isn't the brightest projector, pushing a meagre 32 lumens (compared to around 1,500 for most home theatre projectors), but what it lacks in shine, it makes up for with an impressive 80,000:1 contrast ratio and a surprisingly high 1,920 x 720 resolution. While that lower brightness makes the MP-CL1 practically unusable in the daytime (a tablet half the price will show a 10-inch picture significantly better), fire the device up in the dark and you'll get an awesome image that looks excellent up to about an 80-inch projection size.

If you happen to have a recent smartphone, then you can use the Wi-Fi-based Miracast to connect to the MP-CL1 wirelessly, which will allow you to simultaneously connect to Bluetooth speakers without interference (or alternatively run speakers from the projector via the AUX out). It still surprises us that a projector this size can play through an entire film with a 40- to 80-inch picture on a single charge — with sound. And what's more, that 3,400mAh internal battery actually lasts up to two hours if you're not using the projector's own speakers, which are really a last resort option anyway. [JOEL BURGESS]



GARMIN FORERUNNER 735XT

\$699
www.garmin.com.au

CRITICAL SPECS

ANT+, GPS; Lithium-ion battery, 11 days (watch mode), 14 hours (activity mode); 5 ATM water rating; 215 x 80 pixels display; 44.5mm x 44.5mm x 11.9mm; 40.2g



SONY MP-CL1

\$699
www.sony.com.au

CRITICAL SPECS

Up to 120-inch 16:9 display; 1,920 x 720 resolution; 3,400mAh battery; 80,000:1 dynamic contrast ratio; 32 Lumens brightness (max 37 Lumens); 210g





Jabra Halo Smart

AN AFFORDABLE ENTRY-PASS INTO BLUETOOTH'S PEARLY GATES.

DESPITE THE IMAGES on the front of the box looking like these Bluetooth headphones have been designed for the urban professional, we'd generally consider the Jabra Halo Smart as being more suited to sporting applications. The simple black neckband is embellished by a neon blue, red or black pair of cables that extend up to matching earbuds, making it visually a little loud for your general work get-up... unless you intend it to be the standout feature of your outfit, of course. Furthermore, the 'splashproof' IP54 rating means that it's more than capable of being worn during exercise.

In addition to audio cues that'll tell you how much of the Halo Smart's rather-generous 15-17 hour battery life is left, you can optionally install the Jabra Assist smartphone app (for Android and iOS) to keep more detailed tabs on exactly when you've used the battery over its lifespan, along with handy options to read incoming messages, emails and notifications to you, there's even an option to ping the Halo's speakers to help you find the headset if you misplace it.

Paired with a Galaxy S7 Edge smartphone, the Bluetooth 4.1 connection worked excellently up to a range of around 8m before it became unusable. That range was significantly reduced, though, when we attempted to play music directly to the Halo from a Motorola Moto 360 smartwatch, dropping out regularly at distances of around 50cm, but we assume this was more due to the smartwatch's Bluetooth Low Energy connection than the wireless headphones themselves — note, however, that your milage may vary depending on the playback device.

The quality of the Halo's audio itself was generally good — very full and bassy — but does leave a little to be desired in places. The max volume is reasonably conservative, for example, and music had a tendency to distort above about 70% volume — though that wasn't quite bad enough to be noticeable while exercising. On the whole, at less than \$90 on the street, the Jabra Halo Smart makes for an excellent pair of Bluetooth headphones that come in at a highly competitive price.

[JOEL BURGESS]



B&O Play Beoplay H5

HIGH FIVE FOR BANG & OLUFSEN'S FIRST BLUETOOTH EARPHONES.

WITH CURRENT BATTERY tech basically equating to bigger = better, Bluetooth earphones have to make a tough choice. They can go with a neckband style design (like the Jabra Halo Smart opposite), ditch the cable altogether and have two discrete buds, or opt for the 'standard' design, like what B&O has done with these Beoplay H5s, which just happen to be the brand's first Bluetooth in-ear offering.

As you'd expect, these buds are decked out with the latest and greatest technical components, including support for the newish Bluetooth 4.2 specification and Qualcomm's aptX Low Latency technology that helps keep media in sync. Similarly, the audio quality is exceptionally crisp and full from two well-engineered 6.4mm dynamic speakers and can be cranked up surprisingly loud without distortion.

The overall physical design is pleasing, too, with a the magnetic clasp that hooks the headphones together when they're not in your ears. Though that clasp wasn't overly strong and actually sits a little awkwardly on your chest (with the earbuds protruding downwards), it's very convenient and didn't actually take long to get used to. We actually became extremely fond of the fact that clipping the buds together is the method for switching off the headset, a notably faster alternative to finding a power button.

We were rewarded with the same pleasant surprise in the Beoplay H5's battery life which, while inarguably lower than what you'll get from earbuds with a neckband, still rounded out at a perfectly-usable five-hour lifespan. The 50mAh batteries in each earbud do mean that the buds are a little bulky, but the range of silicone and foam tips and the ergonomic design mean that they still stay firmly in your ear.

B&O doesn't explicitly mention the IP rating of the Beoplay H5s but suggest splash and dust resistance to ward off sweat and exposure to the elements while training, adding up to a generous list of features that go a long way towards living up to the premium price tag. [JOEL BURGESS]



JABRA HALO SMART

\$90
www.jabra.com.au

CRITICAL SPECS

Bluetooth 4.0 (~8m range); 230mAh battery (15 hours music playback, 22 days standby); IP54 splash and dustproof rating; max 8 paired devices (2 simultaneously connected); 3g



B&O PLAY BEOPLAY H5

\$390
www.beoplay.com

CRITICAL SPECS

Available in pink and black; 2 x 50mAh batteries (5 hours playback on 2-hour recharge time); Bluetooth 4.2 with aptX-LT and AAC codecs; Android and iOS B&O Play app; 18g





AKG K92

GREAT SOUND QUALITY IN A BUDGET HOUSING

WHEN IT COMES to headphones, the general consensus is that you very much get what you pay for. AKG, though, has always been a company willing to thumb its nose at this idea. The K92s are a very reasonably priced set of headphones that, in some ways, match the features of cans double their price but, in other ways, fall prey to many of the problems of budget sets. The K92s are also a big pair of headphones. Their size means you're unlikely to want to wear these headphones out and about; they're much better suited to being used at home, at a desk or on a train or plane. The flatness of the 'phones does introduce the problem of the cloth inside the headphone cup touching your ears.

Outside of the cups themselves, the band has a well-made support strap that means the weight of the headphones sits on the top of your head rather than on your ears. This meant we were able to use the K92s for hours at a time without feeling any sort of discomfort.

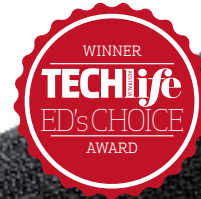
In terms of overall build quality, the K92s look and feel like their price would suggest. Their entirely plastic construction isn't anything special, and we personally weren't a fan of the gold accents. At least the AKG branding on each earcup is pretty tasteful.

Listening to various genres in a variety of formats, including lossless, reveals the K92s have a nicely balanced sound. Bass has punch without overwhelming the rest of the audio and separation between instruments is good. The soundstage on these headphones is also slightly squashed compared to more expensive models. Let's be clear, these aren't actually meant as really major criticisms. The K92s perform excellently for a pair of headphones at this price, but we've been spoiled by AKG in the past with models that have managed to sound as good as headphones double their price. These aren't quite there, but they're very good. Spending a little more may deliver incremental improvements in build and sound quality, but at this price, the K92s are a solid, if not revolutionary, purchase. [JON PORTER]



AKG K92
\$115
akg.com

CRITICAL SPECS
Closed back; 40mm drivers; 16Hz–22kHz range; 198g



JBL Charge 3

THIS BLUETOOTH SPEAKER STRIKES A NEAR PERFECT BALANCE BETWEEN SOUND, FEATURES AND PRICE.

THERE ARE A million Bluetooth speakers on the market but JBL has always stood near the top. Its line of Charge speakers are one of the only Bluetooth speakers out there that'll let you charge your device while playing music — hence the name. Like its competitors in the UE Boom series, the JBL Charge 3 is completely waterproof. There were many fans of the Charge 2's battery life, build quality and sound and the Charge 3 mostly improves on its predecessor's legacy.

The JBL Charge 3 is big. It will take up a fair bit of room in your backpack or hand luggage and at 800g, it'll weigh you down as well. However, you do get 20 hours of battery life and waterproofing. The latter is the big new feature for the Charge 3, and it's IPX7 rated, which means you can submerge the speaker in up to a metre of water for 30 minutes. On the top of the Charge 3, you'll find buttons for power, Bluetooth pairing, volume control, play/pause/skip and a unique JBL Connect button. This special button will allow you to connect multiple JBL Connect speakers to augment sound, in the sense that both speakers will play mono versions, not play in stereo. The Charge 3 also features a built-in mic.

The speaker features dual external passive radiators that provide a visual element to your music playing — you'll see them vibrate with bass-heavy tracks. Although exposed radiators are weak spots, these are sufficiently strong enough to withstand pokes and have a rubber guard around them that allow you to prop up the Charge 3 vertically (though we found this negatively impacted the sound quality). But these can really crank and will have no problem filling a large room. The Charge 3 offers some of the deepest and most powerful bass we've heard from a portable Bluetooth speaker and it played loudly without distortion.

The only disappointment in the sound is that high frequencies aren't as sparkly and detailed as some competitors. [TECHLIFE TEAM]

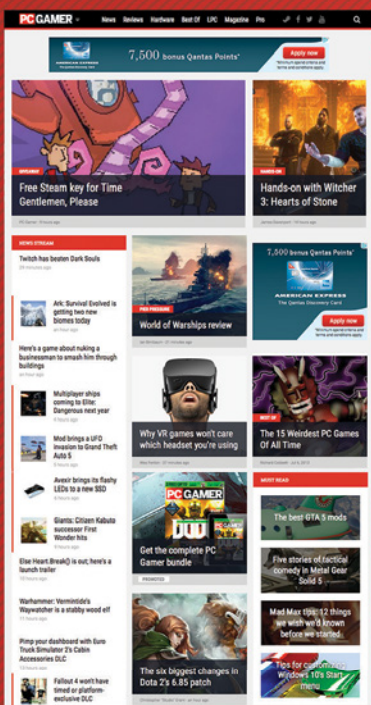


JBL CHARGE 3 BLUETOOTH SPEAKER
\$170
au.jbl.com

CRITICAL SPECS
Lithium-ion Polymer (22.2Wh) battery; frequency response: 65Hz–20kHz; Bluetooth; waterproof to 1m for 30 minutes; 213mm x 87mm x 88.5mm; 800g



SMARTER COOKIES ENABLED



JOIN US ONLINE AT
WWW.PCGAMER.COM

[SPECIAL OFFER]
Subscribe
to TechLife
and SAVE!

GET THE NEXT GENERATION
OF TECH MAGAZINE
DELIVERED DIRECTLY TO
YOUR DOOR EVERY MONTH!

Subscribe to *TechLife* and become part of Australia's newest and most exciting technology title. We'll keep you up to date with all the ways modern tech can improve your life, focusing on practical news, reviews, guides and tutorials rather than on specs and gigahertz. *TechLife* isn't just for the geeks: it's for everyone!

XBOX ONE S: ULTIMATE 4K MEDIA DEVICE?

TECHlife AUSTRALIA

• IT'S TECH SMARTS MADE SIMPLE •

BEST WIRELESS ROUTERS REVEALED

DITCH YOUR ISP DEVICE: BETTER OPTIONS FOR ADSL, CABLE AND NBN CONNECTIONS REVIEWED

NETWORK KNOW-HOW MADE EASY

- * WHAT GEAR TO USE WHERE
- * ELIMINATE WI-FI DEAD SPOTS
- * PLUS: WHERE YOU SHOULD GO WIRED INSTEAD

BUILD IT!

ACCESSORIES TO EXPAND & EXTEND COVERAGE

POWERLINE ADAPTERS, WI-FI RANGE EXTENDERS, MEDIA BRIDGES + MORE: LABS TESTED & RATED

PERFECT WIRELESS NETWORK

IN-DEPTH JARGON-BUSTING GUIDE: CREATE THE ULTIMATE NETWORK SETUP FOR YOUR PLACE

ISSUE 53 OCTOBER 2016 | FUTURE TECH PUBLISHERS | APPLE NEWSSTAND & GOOGLE PLAY

AUSSIE TECH BUYER'S GUIDE
UPDATED EVERY MONTH!
28 CATEGORIES INCLUDING:
* SMARTPHONES & TABLETS
* LAPTOPS & PC PARTS
* ACCESSORIES & PERIPHERALS
* AUDIO GEAR, CAMERAS
+ MUCH MORE!

CLEVER TECH TIPS & TRICKS
THE EASY WAY TO EXPERTISE
* DON'T GET SCAMMED: HOW TO SPOT A SKETCHY KICKSTARTER
* BUILD YOUR OWN HOME-THEATRE PROJECTOR SCREEN
* FREE UP DISK SPACE IN WINDOWS

ALL THE LATEST TECH REVIEWED
THE HOTTEST GEAR ON TEST
* PORTABLE MEDIA SERVER: SHARE & STREAM YOUR MEDIA COLLECTION ON THE GO
* SONY'S POCKET PROJECTOR: TV-SIZE FLICKS ANYWHERE
* IS SAMSUNG'S GALAXY NOTE7 WORTH THE PRICE?

Hurry! Offer ends October 10th.

DON'T WAIT! VISIT WWW.MAGSHOP.COM.AU/FUTURE OR CALL 13 61 16 AND QUOTE m1610pcu TO SUBSCRIBE TO TECHLIFE MAGAZINE.

A GREAT OFFER
FOR LOYAL READERS

Save
42%

12

ISSUES FOR \$69
JUST \$5.75 PER ISSUE!

Save
46%

24

ISSUES FOR \$128
JUST \$5.33 PER ISSUE!

Terms & conditions: This offer expires 10th October 2016 and is available to subscribers within Australia only. Please allow 6-8 weeks for delivery of your first issue. For full terms and conditions, see www.magshop.com.au/future. Please see our privacy policy on page 6.



PERFECT WIRELESS NETWORK

IN-DEPTH JARGON-BUSTING GUIDE: CREATE THE ULTIMATE NETWORK SETUP FOR YOUR PLACE

56

CREATE THE PERFECT HOME WIRELESS NETWORK

How to get the most out of your Wi-Fi.

60

CONNECTING TO THE NBN: WHAT TO EXPECT

Confused about what's involved with getting the NBN hooked up? We outline all the essential info you need to know.

61

UBER-FAST ADSL ROUTERS

ADSL is still the default broadband connection for most Australians. These combo modem-routers get you connected and sharing with the one box.

66

BLAZING-FAST BROADBAND ROUTERS

If you're on an NBN or cable connection that includes its own modem, one of these standard broadband routers is what you need for sharing your connection.

70

EXPAND AND EXTEND YOUR NETWORK

We compare a swathe of accessories designed to help you stretch your wired or wireless connections where they're needed.

[WARNING: SHARED ZONE]

Create the perfect home wireless network

HOW TO GET THE MOST OUT OF YOUR WI-FI.

[NATHAN TAYLOR]

EVERYBODY HAS WI-FI, but not everybody has a network that's up to snuff. Perhaps there are holes in the network, black spots where the signal is spotty. Perhaps it struggles to stream HD video, especially when there are multiple devices using it at once. Perhaps the signal drops out whenever the neighbour uses their microwave. Whatever the problem, we're here to solve it.

We'll look at building a home network in two ways: for speed and for coverage. Those things aren't mutually exclusive — indeed, better coverage also means better speed as you get a stronger signal — but if you're having the problem with one or the other you can start there.

BUILDING FOR SPEED

If you're getting three or four bars on your Wi-Fi signal strength meter, but it still can't deliver Netflix or 1080p YouTube reliably, then it's probably time to start looking at new hardware.

For best speeds you absolutely need an 802.11ac router, and nearly all such routers are given an 'ACxxxx' designation, indicating the total theoretical bandwidth they support. For example, an AC2400 router supports a total bandwidth of 2,333Mbps (they rounded up, of course).

Currently, the state of the art in consumer Wi-Fi routers is AC5300/AC5400 Wave 2, which are typically monstrously large beasts sporting eight antennas. The 'Wave 2' part of the equation indicates support for a technology called MU-MIMO, a technique that reduces contention between devices. Normally, when two devices are accessing a Wi-Fi access point at the same time, they are competing for bandwidth. With MU-MIMO, they each get an independent stream, meaning that, in environments where you have lots of devices working at once, you'll get better individual performance. MU-MIMO is great, and definitely worth having for the future, but it won't give you an immediate impact because almost no mobiles or PCs

The top-end looks something like this, with a forest of antennae and support for MU-MIMO. It's probably overkill for most people, however.



or other wireless devices support it just yet. The AC rating itself is problematic, since it doesn't really tell you how that number is achieved. In AC5300/AC5400 routers, for example, they hit the lofty number by creating three independent wireless networks: two 802.11ac networks (which are backwards compatible with 802.11n) and an 802.11n network. A given device can only connect to one of those networks, however, and the maximum speed achievable is 2,166Mbps (or 1,733Mbps; see our sidebar on QAM on page 58). These routers are only useful in environments where there are a huge number of devices using them at once.

So what's your optimum AC rating? It really depends on what you're using the network for and how many people are using it at once. Very few people need anything close to an AC5300 router, and for most home

users, an AC2400/3100/3150 is more than good enough. That should support four or five HD Netflix streams simultaneously. Even an AC1900 router is good for most homes. In fact, if you only have one or two people in your home, an AC1900 router is ideal. Wireless connections can only go as fast as the client device, and very few mobiles and PCs support anything higher than 867Mbps. Really fast routers exist for environments where lots of devices are competing for airtime.

If you later find that your Wi-Fi network is struggling, you can always add an additional wireless access point or optimise your coverage to get better reception and,

SPEEDS BY AC RATING

TYPE	802.11N SPEED (MBPS)	802.11AC SPEED (MBPS)
AC600	150	433
AC750	300	433
AC1200	300	867
AC1300	400*	867
AC1300	-	1,300
AC1450	450	975
AC1600	300	1,300
AC1750	450	1,300
AC1900	600*	1,300
AC2350/2400	600	1,733
AC2600	800*	1,733
AC3100/3150	1,000**	2,167**
AC3150	1,000**	2,167**
AC3200	600*	1,300 + 1,300***
AC5300 /5400	1,000**	2,167 + 2,167*** ***

*Uses 256-QAM for 802.11n (not officially part of the spec, and not supported by many client devices).

** Uses 1024-QAM (not officially part of either 802.11n or 802.11ac). Without client support for 1024-QAM, its speed is 800/1,733Mbps.

*** Creates multiple Wi-Fi networks in the 5GHz band, each operating as a discreet access point. A given wireless device can only connect to one of them.



therefore, better speeds for your client devices. We'll talk about that more later.

BUILDING FOR COVERAGE

Sometimes, you don't need to be able to stream Netflix in 4K. Sometimes, you just want to access the internet, but can't because of poor reception. If you're having coverage problems, then there are definitely some remedial steps you can take.

Of course, getting a stronger signal also means better performance. Wi-Fi is not an on/off thing. The weaker the signal, the slower it gets, as it has to transmit more data to overcome RF noise and it has to trade speed for signal robustness.

ROUTER POSITIONING

The place to start is router positioning. It's the thing most likely to get you results and it also happens to have no cost involved (other than arguments about ruining the decor). The main things you should know are:

Nearly all consumer Wi-Fi routers use omnidirectional antennas. They're not truly omnidirectional (which we'll get to in a second), but there's equal coverage in all directions on the horizontal plane. The upshot of that is that the router should be placed as close to the centre of your home as you can make it. Putting it in a corner is the worst solution, since you're wasting an awful lot of transmission power when you do that. Yes, that means you might have to run some extra phone and network cabling.

Radio signals will pass through most objects, but will pass through some better than others. Certain types of walls and barriers will substantially reduce signal strength: concrete and brick walls (such as load-bearing and external walls), tiles and walls with lead paint or metal inside are good examples. There are also some

WHY YOU SHOULD DITCH YOUR DEFAULT ROUTER THAT EL-CHEAPO ROUTER SENT FROM YOUR ISP MIGHT DO THE JOB, BUT THERE ARE LOADS OF REASONS TO UPGRADE.

Even if it handles 802.11ac, many of the latest Wi-Fi devices support newer multi-radio technologies that can handle much higher speeds than a default router. While they can be expensive, opting for a high spec now helps ensure you are future-proofed. As more devices are connected, cheaper models struggle to efficiently share the available bandwidth. For those with an ADSL connection, a higher-quality router can give a faster connection speed. Even those lucky enough to have the NBN will be better able to use the available bandwidth with a newer router. Newer routers also have other handy features, such as being able to operate like a NAS with USB-based storage, create a person cloud, or run a print server.

complete showstoppers that will likely create a 'shadow' in your Wi-Fi coverage: pools and fish tanks, certain mirrors, walls with chicken wire or similar materials inside and some metal household appliances.

The key is to figure out what is between the router and the device that wants to access it and to try to work around it by moving the router or, if needs be, adding a new access point. Certainly, you should not be burying your router in cupboards or behind

bookshelves; Wi-Fi works best when there is as little as possible between the router/access point and the device that wants to talk to it.

As anybody who has tried to set up Wi-Fi in a multistorey house probably knows, most router antennas are aligned for best reception on the horizontal plane. That means they work best when the router is on the same floor as the user. Consequently, it's not a good idea to put the router in a basement, in the roof/attic or under the house. If you have a

2.4GHZ VS 5GHZ

ONE OF THE BIG DIFFERENCES BETWEEN THE OLD 802.11N AND THE NEW 802.11AC WI-FI STANDARD IS THAT 802.11N WORKS IN BOTH THE 2.4GHZ RADIO FREQUENCY AND THE 5GHZ FREQUENCY, WHILE 802.11AC ONLY WORKS IN 5GHZ.

The result is that 802.11ac suffers less from interference from other devices. But it has a downside — 802.11n can get better coverage in certain environments. The lower frequency of 2.4GHz 802.11n means that it travels through walls and intervening objects better. As a practical matter, it often gets better range than 802.11ac, and for environments where coverage is an issue, it shouldn't be ignored or switched off. In a weak signal environment, you may find you get much more reliable performance from 2.4GHz. There are even certain routers that focus on this. The TP-Link TL-WR941HP, for instance, only supports 802.11n in 2.4GHz, and comes with three enormous 9dBi very high-powered antennae (most routers come with 2–5dBi) to really maximise coverage.



Router antennae have equal coverage on 360 degrees of the horizontal plane. Larger/more powerful antennae have better reception, and some routers can have their antennae removed and replaced.

QAM SHENANIGANS (QAMNANIGANS)

ROUTER AC RATINGS AREN'T JUST COMPLICATED BY THE FACT THAT, INSTEAD OF JUST TELLING YOU HOW FAST THE FASTEST NETWORK IS, THE VENDOR COMBINES THE TOTAL BANDWIDTH FOR ALL NETWORKS TO COME UP WITH ITS NUMBER. THEY ALSO USE UNOFFICIAL SPEED RATINGS TO FLUFF THEIR NUMBERS.

Wi-Fi uses a technique called quadrature amplitude modulation (QAM) to embed data on radio waves. More complex QAM = more data. Now the older 802.11n standard uses 64QAM. One of the reasons 802.11ac is faster is that it uses 256QAM. But vendors have backported 256QAM to 802.11n to give it a speed boost. The problem is that clients don't generally support it. It's mostly there to increase the AC rating of the device. It turns an AC1200 router into an AC1300 router, for example.

Most recently, we've seen the introduction of 1024QAM (AKA NitroQAM/TurboQAM), which is not officially supported at all in 802.11ac and virtually no client devices support it. But it turns an AC2400 router into an AC3150 router, so they'll sell it anyway. For most users, however, an AC2400 is functionally identical to an AC3150 router.

multistorey house, you can sometimes get a little better reception by 'splitting the difference' and, say, putting the router on a high shelf on the lower floor, but that can sometimes create as many problems as it solves.

If you want to check what effect moving the router has, then you can try one of our favourite mobile apps: WiFi Analyzer for Android, available on Google Play. WiFi Analyzer will give you a signal power reading for all the Wi-Fi networks that your mobile can pick up, and by carrying your mobile around the house, you can get a picture of what kind of coverage you get where.

WiFi Analyzer will report signal power in dBm relative to source power, so the number is a negative. The more negative the number,

the worse the signal is. To give you an indication of what the results mean:

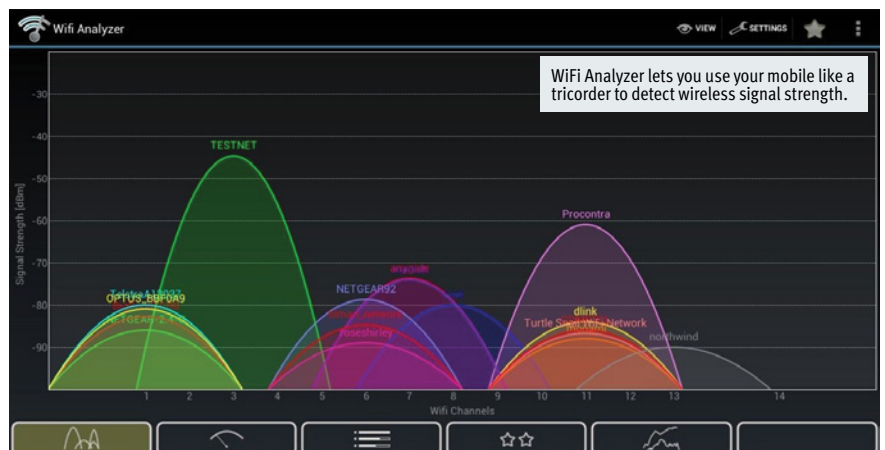
- * -60dBm or better is a good signal. A very good signal will be around -40dBm.
- * At around -70dBm, the signal is okay, generally between two and three bars.
- * At -80dBm, performance starts to dip a lot, and you might struggle with HD video.
- * At -90dBm and worse, you'll drop to one bar and will likely start experiencing dropouts.

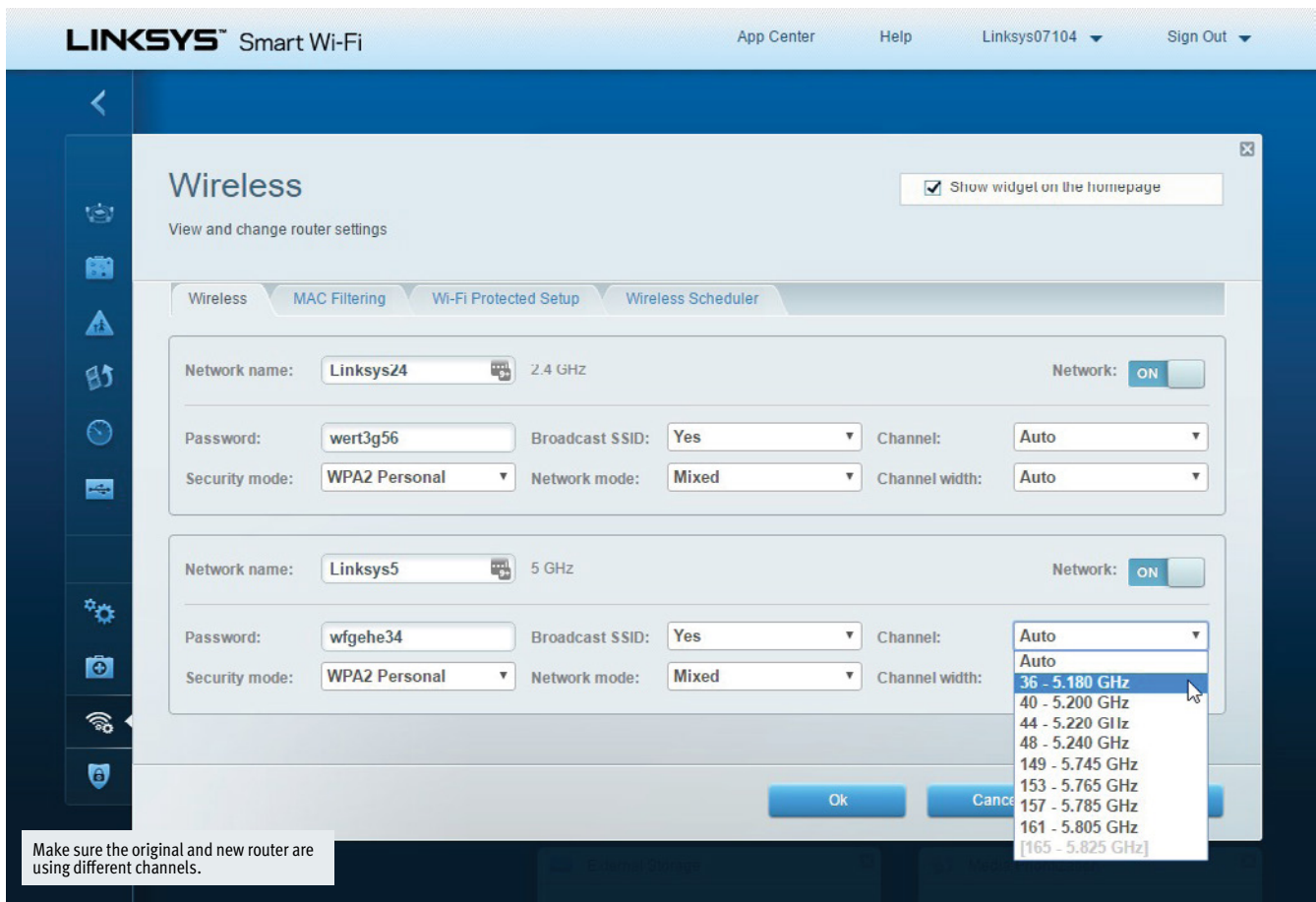
EXTENDING YOUR COVERAGE

So moving your router is not getting the job done, and you find yourself just creating new black spots when you try to fix the old ones. That's when you have to look at extending your network.

Now, we're going to come out and say it: range extenders and Wi-Fi repeaters are kind of rubbish, at least for people wanting to build a high performance network. They reduce bandwidth and add latency, both of which are not ideal. The power point models also tend to have very weak antennas. They have their place: if you don't care at all about speed and just want to be able to Facebook from your corner bedroom, they offer a simple solution. But they're not the ultimate answer. (We should note here, however, that a lot of range extenders have multiple modes and can also function as routers and stand-alone access points, and in that capacity, they can be excellent tools for extending your network).

The optimum solution is simply to set up another Wi-Fi router or access point, positioned to capture the users that the main router misses. Technically, all you need is a wireless access point, not a full Wi-Fi router, but in the realm of consumer products, nearly all access points are actually routers as well, and nearly all routers can be run as access points. As mentioned, a lot of range extenders also offer an 'access point mode'





that you can use. For the setup, you should adhere to the following rules:

Position the second router/access point wherever it will deliver best coverage to those devices that have reception issues.

Connect it back to the primary router (the one with the connection to the internet) with an Ethernet cable, LAN port to LAN port. If running an Ethernet cable through/under your house is not an option, HomePlug powerline networking products provide an excellent way to

connect the secondary router/access point to the primary.

Configure the new access point to use the same security (WPA2), SSID/network name and password as the original. That way, you don't need to configure your devices to access the new wireless network. They will just connect to the one with the strongest signal.

Lastly, and this is important, set the new router up to use a different wireless channel than the original. Now, this may be something that you never bothered with before, so it may take a moment to figure out. You'll have to log into your original router's admin page and find the wireless settings, and then set the channel manually.

WiFi Analyzer can actually recommend which channel to use — ideally you want to be using channels that your neighbours are not.

Then, on your new router/access point, find the channel settings and set it to something different from the original.

This setup is not perfect. For a start, if you move around the house, devices will tend to stick to the router they're currently connected to rather than switch to the other, even if the signal is weak.

Seamless roaming is, unfortunately, a feature only really found in enterprise and commercial access points, the kind you find in airports, shopping centres and hotels.

On Android, you can kind of fake it using an app called WiFi Roaming Fix, which will force your Android device to switch between routers once a signal strength threshold is passed.

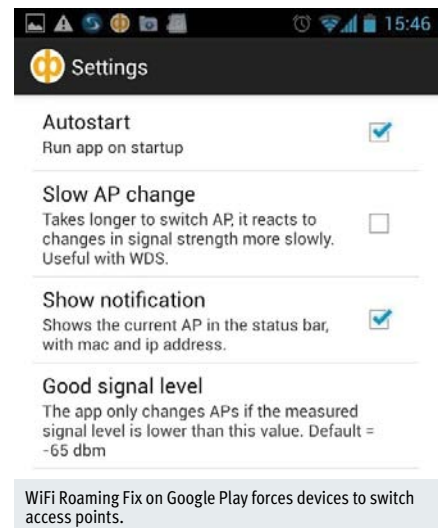
Yet as a consumer, this is about as good as it gets. The two routers provide better coverage, and, as an added bonus, provide greater total bandwidth as devices connected to one router don't compete with devices connected to the other for airtime.

+

NOW WE'RE GOING TO COME OUT AND SAY IT: RANGE EXTENDERS AND WI-FI REPEATERS ARE KIND OF RUBBISH, AT LEAST FOR PEOPLE WANTING TO BUILD A HIGH-PERFORMANCE NETWORK.



In lieu of running Ethernet cables all over the place, powerline solutions like the Netcomm Wireless NP507 can provide a neat way to link your second router back to your first.



[ROLL OUT]

Connecting to the NBN: what to expect

CONFUSED ABOUT WHAT'S INVOLVED WITH GETTING THE NBN HOOKED UP? WE OUTLINE ALL THE ESSENTIAL INFO YOU NEED TO KNOW.

[NATHAN TAYLOR]

SO YOU'VE CHECKED the rollout map at nbnco.com.au and now know when you'll be getting the NBN. And now you'd like to know how this whole thing works, what you'll need and what you'll have to do to set it up.

The answer to that really depends on what flavour of NBN you'll be getting. There are six possibilities, and unfortunately, the rollout map doesn't presently break it down by type other than fixed line vs wireless.

You can make a guess: most of the areas currently covered by the rollout map are fibre to the premises/home (FTTP) since that's mostly the tail end of the original Labor NBN plan. If you can currently get Foxtel or Optus cable TV in your area, you'll probably be getting hybrid fibre coax (HFC). If you can currently get ADSL 2+ (but not cable or fibre), you'll probably end up on fibre to the node (FTTN) or fibre to the building (FTTB) in the case of unit blocks. And if you're currently wireless, you'll likely end up on either fixed wireless or satellite. Of course, these are guesses — we wouldn't recommend going out and buying equipment pre-emptively based on these assumptions!

So how will the rollout work for each of these? We'll give you a quick breakdown.

FIBRE TO THE PREMISES

With FTTP, most of the equipment needed is built into the box that gets attached to your house during installation. All you will need is a generic broadband router with a gigabit Ethernet WAN port (many current DSL routers also have a gigabit Ethernet WAN port and can indeed be used with FTTP).

The installer will attach a utility box to the outside of your house as well as a connection box and power unit inside your home. The connection box has a gigabit Ethernet port on it (called UNI-D). It's into this that you plug an Ethernet cable and connect it to the WAN port on your broadband router. The broadband router just uses DHCP for configuration, which is the default setting on most such routers.

FIBRE TO THE NODE/FIBRE TO THE BUILDING

FTTN and FTTB look and work a lot like ADSL. No new equipment is installed in your home and nobody needs to visit your premises. Your current phone line will remain your link to the internet.

There will need to be one change on your end. Your old ADSL router won't cut it anymore. You'll need a modem router with

support for VDSL2, the updated DSL standard being used for FTTN. Many newer ADSL routers also support VDSL, but older routers do not.

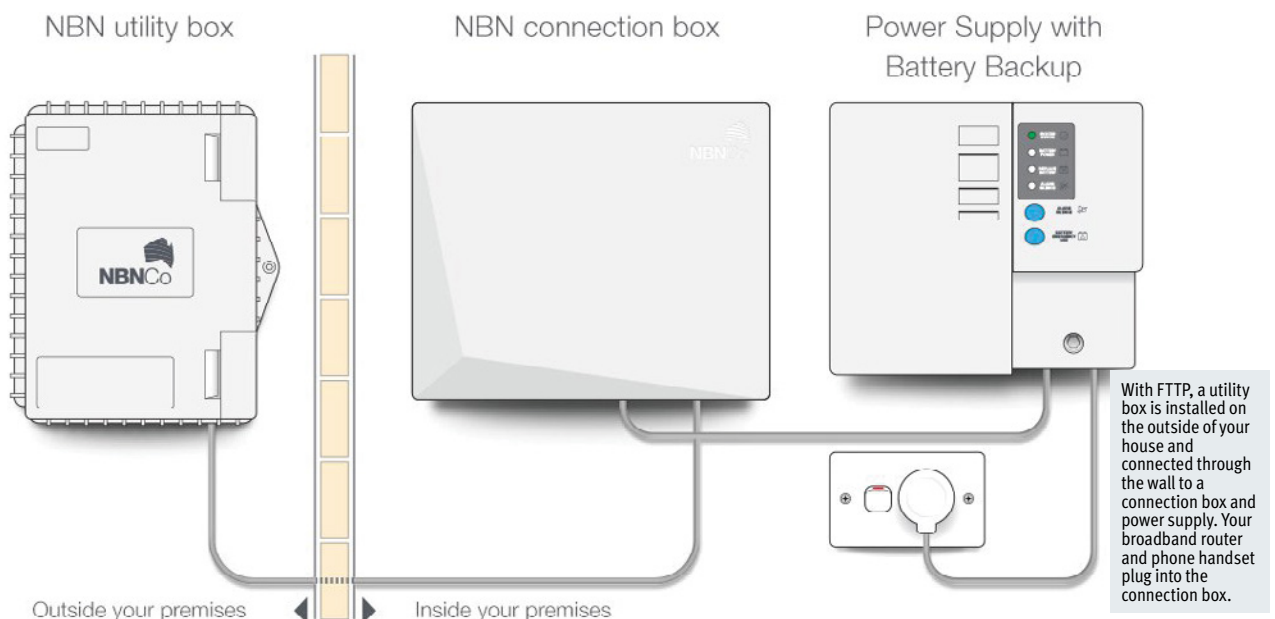
HYBRID FIBRE-COAX

If you currently have HFC connected to your home, there won't need to be any changes or anybody coming into your house. If you've never had cable TV or cable internet, however, an installer will need to come in and set it up. Typically, a wall plate will be set up into which a coaxial cable can be plugged.

If you don't currently have a cable modem router, you will need one, which you'll be able to purchase from your ISP. You can't use a generic broadband router. There are plans to upgrade the cable network in 2017/2018, which might again require a new router.

FIXED WIRELESS AND SATELLITE

Much like FTTP, an installer will need to come to your house and install equipment, which will include a connection box and a satellite dish or fixed outdoor antenna. You connect to that equipment with a general broadband router (as with FTTP). ■



[SYNCING ABOUT YOU]

Uber-fast ADSL routers

WIDESPREAD ACCESS MEANS THAT ADSL IS STILL THE DEFAULT BROADBAND CONNECTION FOR MOST AUSTRALIANS. THESE COMBO MODEM-ROUTERS GET YOU CONNECTED AND SHARING WITH THE ONE BOX.

[NATHAN TAYLOR]

FOR THE MAJORITY of Australia's broadband users, a DSL modem router is the way to go. It's a necessary component of any ADSL setup, and it's going to continue to be relevant now that a big chunk of the NBN is going to be using fibre to the node.

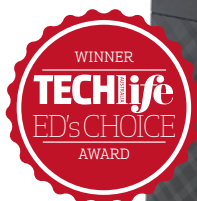
In fact, if you know you're going to be getting FTTN as part of the NBN rollout, now is a pretty good time to upgrade. FTTN uses an upgraded version of ADSL called VDSL, and most older modem routers will not support it. Many new DSL modem routers now boast support for VDSL, however, and should work just fine when you switch over to FTTN.

As an extra layer of future-proofing, a majority of new DSL modem routers also now feature a dedicated WAN port, or at least a LAN port that can be reassigned as a WAN port, meaning that they can serve as a broadband router if they need to. That means that they will also work perfectly well with fibre to the home, which requires only a broadband router (rather than a modem router). The only flavour of NBN that they won't work with is HFC, which requires a cable modem router.

HOW WE TESTED

Like the broadband routers, we performed simple speed tests at 5m and 15m, copying a 1GB file and recording the speed. The client device was a Linksys WUMC710 wireless AC bridge, which is capable of 1,300Mbps wireless AC.

As always with wireless, this is useful only as a comparative. Every home is different, and you may find that you'll get speeds higher or lower than those we found.



ASUS DSL-AC68U

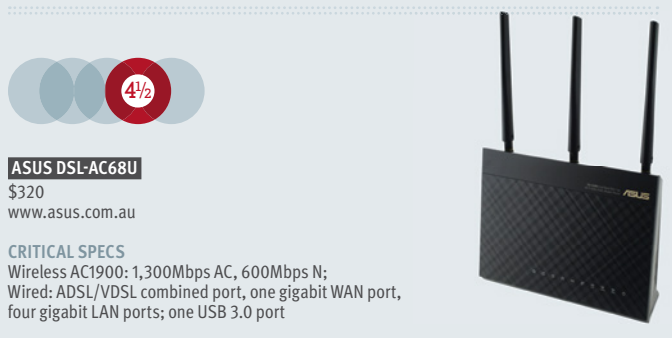
THE BEST FIRMWARE AROUND, AND SOLID HARDWARE AS WELL.

A FEW YEARS ago, ASUS decided to switch its router firmware over to a customised version of OpenWRT, the open source firmware. That decision continues to pay dividends: ASUSWRT remains the best consumer firmware around by a considerable margin. It supports features rarely seen at this price, yet still retains a user friendliness that some other vendors might do well to emulate.

Notably, it supports VPN connections natively, allowing you to route all your internet traffic through a VPN service or create your own VPN that you can dial into remotely. Its traffic management and QoS features are simply better than the rest, with per-user monitoring or usage and a simple drag-and-drop quality of service setup. It supports the use of 3G/4G USB modems as a failover or primary internet access tool, lets you access connected storage devices remotely through the AiCloud service and has genuine user-level parental controls and access restrictions. It's pretty much all you could ask for.

The mobile app available for the router is great as well. It provides not just an easy setup from your mobile, but real-time information on usage, connected devices and even lets you configure advanced features like parental controls and QoS without having to dive into the web console.

All this is coupled with some pretty great hardware. The ASUS DSL-AC86U is one of the older products here, and is no longer on the cutting edge, but there's enough horsepower here for most homes. Its performance was good in our tests, and it's a router you really can't go wrong with.



ASUS DSL-AC68U

\$320
www.asus.com.au

CRITICAL SPECS

Wireless AC1900: 1,300Mbps AC, 600Mbps N;
Wired: ADSL/VDSL combined port, one gigabit WAN port, four gigabit LAN ports; one USB 3.0 port



AVM Fritz!Box 7490

AWESOME VOIP AND A GREAT ROUTER.

AVM'S FRITZ!BOX 7490 feels like it has been around forever, but it's a testament to how well it was designed and just how advanced it was that it still stands up well today. Its wireless may no longer be on the top edge of performance, but everything else about the router is aces.

At the top of the 7490's pro list is its VoIP support. Not only is it one of the few VoIP routers still being sold (only DrayTek is really competing in this space), but its feature set is guaranteed to tick off every item on your VoIP wish list and add a few things you never thought you wanted. There are voice mailboxes, stored on an attached hard drive. There's PSTN failover, complete call logs, contact synchronisation with Google contacts, wake-up calls, a DECT basestation for cordless handsets... It's pretty much the final form for VoIP routers.

VoIP is far from the only appealing feature of its firmware. While it doesn't have the consumer-friendly graphical interface of the ASUS firmware, it actually nearly matches it in terms of features. It has VPN support, parental controls, advanced QoS, full file and media server (and both of the ports are USB 3.0 for top speed), can use 3G/4G USB modems as a failover and much more.

AVM also has a few mobile apps to go along with the router. Collectively, the apps provide a full suite of tools for the router, including setup from the mobile and full diagnostics and voice and traffic reporting. They also provide remote access to data stored on a device connected to the Fritz!Box, much like AiCloud does. There's even an app that will route calls from your mobile through the Fritz!Box landline. Although AVM might do well to combine some of these apps, their total capabilities are excellent.



DrayTek Vigor 2860ac

A SMALL BUSINESS ROUTER FOR PEOPLE WHO WANT ADVANCED MANAGEMENT AND SECURITY. NOT FOR THE BEGINNER, HOWEVER.

DRAYTEK ROUTERS ARE often preferred by people who want a bit more from their router than the typical consumer, and aren't afraid of facing some tough technical terms and choices. They're very much designed for small businesses and 'prosumers' — if you're looking for an easy setup or aren't interested in the advanced management and security features on offer, then you're probably better off with an easier solution. But if you're willing to pay top dollar for a router with enterprise features, the DrayTek is a good option.

The DrayTek Vigor has a unique ports-forward design reminiscent of rack-mount routers, designed for easy patch-plugging of devices. There are six LAN ports as well, in addition to the WAN port and ADSL port.

The firmware supports VPNs — both client and server — and DrayTek has finally cleaned up its VPN configuration, although there are still some annoyances like the VPN wizard not supporting SSL. It also supports multiple-device management from a single console (if you have multiple DrayTek routers in play); load balancing and failover between WAN options, which can include 3G/4G modem plugged into it USB ports; VLAN segmentation; business-grade content filtering; per-user scheduling and reporting, advanced QoS and more.

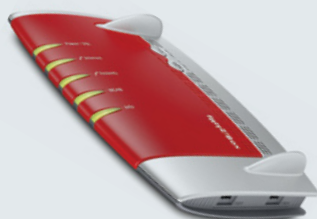
If everything in that last paragraph sounds like gibberish to you, then this probably isn't what you want. DrayTek is not big on the hand-holding and even its mobile apps are pretty raw. But if you feel comfortable with those things, then DrayTek offers quite a bit more than your typical router. It doesn't have cutting-edge hardware, but it does have a lot going on under the hood.



AVM FRITZ!BOX 7490
\$280
en.avm.de

CRITICAL SPECS

Wireless AC1750: 1,300Mbps AC, 450Mbps N;
Wired: ADSL/VDSL combined port, four gigabit LAN ports (one can be reassigned as WAN); two USB 3.0 port



DRAYTEK VIGOR 2860AC
\$495
www.draytek.com.au

CRITICAL SPECS

Wireless AC1600: 1,300Mbps AC, 300Mbps N;
Wired: ADSL/VDSL combined port, one gigabit WAN port, six gigabit LAN ports; two USB 2.0 ports





Netgear Nighthawk X4S D7800

AWESOME WIRELESS. PRETTY GOOD EVERYTHING ELSE.

LIKE D-LINK, NETGEAR has not been content to let its DSL router range linger in the backwaters of Wi-Fi. Boasting wireless capabilities greater than most broadband routers, the NightHawk X4S is the first and only DSL router we've seen that supports MU-MIMO. MU-MIMO, if you'll recall, is the technology that lets each client device have its own spatially separated downlink stream. That is to say, they don't compete with each other for bandwidth and thus get full speed access to the router. Now that's not that big a deal right now, since almost no devices support it, but it will be over the next few years as more MU-MIMO capable devices come online. In addition to MU-MIMO support, the X4S is also capable of full 1,733Mbps wireless AC using its four antennas. That's more than enough to support a household of six or more heavy internet users. It delivered in our tests as well, pulling the fastest speeds at 15m of all the DSL routers tested.

The X4S uses Netgear's genie interface for management. It's not as sleek as Linksys' or ASUS's interface, but it provides plenty of information and options to the user. This is not a router with a lot of advanced firmware features, however, and if you want things like VPNs and VLAN segmentation, this is not the place to look for it. We do like its integrated parental controls, which deploys OpenDNS content filtering in an understandable and simple way.

The mobile app, like the main interface, is a little raw and a little retro and doesn't quite give you access to the full suite of router options, but for basic setup it's easy enough.

Overall, we really like the Netgear. It provides premium future-proof Wi-Fi and solid features for families. It is very expensive, but for the kind of tech on offer, that's probably to be expected.

D-Link DSL-4320L Taipan

A MONSTER FOR ENVIRONMENTS WITH LOTS OF WIRELESS DEVICES.

DSL ROUTERS TEND to lag a little when it comes to wireless technology, often topping out a tier or two behind broadband devices. The DSL-4320L Taipan is different, however. D-Link has finally provided an option for users that are looking for a DSL router that can support a huge number of users at once.

The Taipan is an enormous router that boasts six antennae. Like other AC3200 devices, it actually creates two distinct 802.11ac networks, each operating in a different channel (so they don't compete for airspace) and each is capable of a maximum speed of 1,300Mbps. When a mobile device connects to the router, it is dynamically assigned to one network or the other, depending on current load.

This configuration is designed to support a large number of devices connecting at once. For smaller homes, it probably won't be of much use at all, but if you're in an environment where eight or more devices might be trying to stream at once, it can make the difference.

When it comes to the firmware, D-Link lacks the depth of features found in some of its competition. The firmware isn't bad, and D-Link has improved the setup process for beginners considerably in the last few iterations, but if you're looking for advanced feature like VPN support, this is not the router for you. We particularly like the network visualisation options in the firmware.

The mobile apps aren't that great, however — they're much more focused on D-Link's camera solutions than its routers, and the setup, control and management features are limited.



NETGEAR NIGHTHAWK X4S D7800

\$480
www.netgear.com.au

CRITICAL SPECS

Wireless AC2600: 1,733Mbps AC, 800Mbps N;
Wired: ADSL/VDSL combined port, one gigabit WAN port,
four gigabit LAN ports; two USB 3.0 ports, one eSATA port

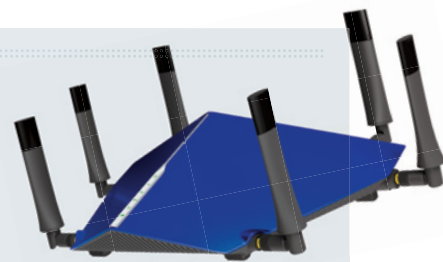


D-LINK DSL-4320L TAIPAN

\$500
www.dlink.com.au

CRITICAL SPECS

Wireless AC3200: 1,300+1,300Mbps AC, 600Mbps N;
Wired: ADSL/VDSL combined port, four gigabit LAN ports
(one can be reassigned as WAN); one USB 3.0 port, one USB 2.0 port





Linksys X6200

CHEAP AND SIMPLE.

UP UNTIL RECENTLY, Linksys had been a bit of a slacker when it came to VDSL. But with the X6200, it finally has a VDSL-capable router in its repertoire. Linksys went in a totally different direction to most of its VDSL-capable competition. Instead of a powerhouse supporting the latest wireless tech, the X6200 is instead a compact, modestly priced device that has minimal specifications.

The X6200 is a single-antenna solution for 802.11ac, and that antenna is buried inside the router's compact body. With only a single antenna, its maximum throughput is limited to just 433Mbps, which is a third or a quarter (or less) of what the competition is capable of. Our test results are a reflection of those limitations. But that's not to say "OMG, this is terrible" — if you're in a one- or two-person home, this is enough to deliver Netflix comfortably. We streamed 1080p Netflix from the router at 15m with no problem.

The router uses Linksys' familiar firmware, the same firmware it deploys on all of its consumer routers. For an advanced user, it has its limitations and annoyances (though occasionally surprising depth), but it's not designed for advanced users. It's made for people who use setup CDs and mobile apps to configure their router rather than web interfaces. Linksys, in fact, just released a major overhaul of its Smart Wi-Fi mobile app, and we were really impressed by the new look and feel. All the features are accessible, including things like parental controls, QoS and connection monitoring, and the design and management is straightforward. We still like ASUS's app better, but Linksys has done a great job here.



TP-Link Archer D9

NO VDSL, BUT IT'S A SOLID MID-RANGE MODEM ROUTER.

ONE OF THE oldest products on review here, the TP-Link Archer D9 is the sole DSL router in this review that does not support VDSL, and for a lot of people, that is an instant disqualification. But if you don't anticipate being moved over to FTTN any time soon it's still a decent choice. It's not going to set your world on fire, but there are no major red flags here. (As a side note, TP-Link does have new and upcoming VDSL-capable modem routers, but we couldn't get one that supports 802.11ac in time for this review).

It's a slightly weird-looking beast with detachable antennae that stick straight up from the top of the router. With its 3X3 antenna setup, it's capable of 1,300Mbps 802.11ac, and even with the relatively modest 3dBi antennas in use it performed well when we tested it, hitting numbers on par with the newer routers even at range.

The firmware holds no major surprises and doesn't have any really notable features that set it apart from the rest of the consumer crop. In recent generations, however, TP-Link has improved the setup and configuration of its routers considerably. The web console is still a little raw, but if you want to use a straightforward and simple setup wizard, then TP-Link provides them for both PC and mobiles. Its mobile app (TP-Link Tether), in particular, is improved — providing access to most of the features of the router, including parental controls and user restrictions. Not everything is there, but most of the features that will be commonly accessed by regular users are covered, and there's a handy visualisation of connected devices.



LINKSYS X6200

\$165
www.linksys.com.au

CRITICAL SPECS

Wireless AC750: 433Mbps AC, 300Mbps N;
Wired: ADSL/VDSL combined port, one gigabit WAN port,
four gigabit LAN ports; one USB 2.0 port



TP-LINK ARCHER D9

\$258
tp-link.com.au

CRITICAL SPECS

Wireless AC1900: 1,300Mbps AC, 600Mbps N; Wired: ADSL/
VDSL combined port, four gigabit LAN ports (one can be
reassigned as WAN); one USB 3.0 port, one USB 2.0 port



ADSL ROUTER SPECIFICATIONS

ROUTER MODEL	ASUS DSL-AC68U DUAL-BAND WIRELESS-AC1900 ADSL/VDSL MODEM ROUTER	AVM FRITZ!BOX 7490	D-LINK DSLI-4320L TAIPAN AC3200 ULTRA-WI-FI MODEM ROUTER	DRAYTEK VIGOR2860AC	LINKSYS X6200 AC750 WI-FI VDSL MODEM ROUTER	NETGEAR NIGHTHAWK X4S D7800 AC2600 WIFI VDSL/ADSL MODEM ROUTER	TP-LINK ARCHER D9
Street price	\$308	\$280	\$500	\$495	\$165	\$480	\$258
Website	www.asus.com.au	en.avm.de	www.dlink.com.au	www.draytek.com.au	www.linksys.com.au	www.netgear.com.au	tp-link.com.au
Modem	ADSL2+/VDSL2 (combined port)	ADSL2+/VDSL2 (combined port)	ADSL2+/VDSL2 (combined port)	ADSL2+/VDSL2 (combined port)	ADSL2+/VDSL2 (combined port)	ADSL2+/VDSL2 (combined port)	ADSL2+
WAN ports	One Gigabit Ethernet	None (one LAN port can be reassigned)	None (LAN ports can be reassigned)	One Gigabit Ethernet	One Gigabit Ethernet	One Gigabit Ethernet	None (one LAN port can be reassigned)
LAN ports	Four Gigabit Ethernet	Four Gigabit Ethernet	Four Gigabit Ethernet	Six Gigabit Ethernet	Four Gigabit Ethernet	Four Gigabit Ethernet	Four Gigabit Ethernet
Wireless	1,300Mbps AC, 600Mbps dual-band N (using 3x3 MIMO)	1,300Mbps AC, 450Mbps dual-band N	1,300 + 1,300Mbps AC (twin networks), 600Mbps dual-band N	1,300Mbps AC, 300Mbps dual-band N	433Mbps AC, 300Mbps dual-band N	1,733Mbps AC, 800Mbps dual-band N (using 4x4 MIMO)	1,300Mbps AC, 600Mbps dual-band N (using 3x3 MIMO)
USB ports	One USB 3.0	Two USB 3.0	One USB 2.0, one USB 3.0	Two USB 2.0	One USB 2.0	Two USB 3.0 (and an additional eSATA port)	One USB 2.0, one USB 3.0
File sharing support	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP	Yes; SMB and FTP	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP
3G/4G support	USB	Yes	No	Yes	No	No	No
VoIP support	No	Yes; DECT base station, PSTN failover, 2 analogue handset ports	No	No	No	No	No
MU-MIMO	No	No	No	No	No	Yes	No
TEST RESULTS: COPY SPEED (MB/S)							
5 METRES	63.2	61.3	64.1	57.7	16.5	60.6	57.6
15 METRES	23.6	19.9	25.3	18.4	6.8	26.4	25.3

BROADBAND ROUTER SPECIFICATIONS

ROUTER MODEL	ASUS RT-AC5300	ASUS RT-AC68U	D-LINK DIR-895L	DRAYTEK VIGOR2132AC	LINKSYS EA9500	NETGEAR NIGHTHAWK X6 R8000 AC3200 SMART WIFI ROUTER	TP-LINK ARCHER C2600
Street price	\$480	\$218	\$650	\$389	\$550	\$360	\$240
Web site	www.asus.com.au	www.asus.com.au	www.dlink.com.au	draytek.com.au	linksys.com.au	netgear.com.au	www.tp-link.com.au
WAN ports	One Gigabit Ethernet	One Gigabit Ethernet	One Gigabit Ethernet	One Gigabit Ethernet	One Gigabit Ethernet	One Gigabit Ethernet	One Gigabit Ethernet
LAN ports	Four Gigabit Ethernet	Four Gigabit Ethernet	Four Gigabit Ethernet	Four Gigabit Ethernet	Eight Gigabit Ethernet	Four Gigabit Ethernet	Four Gigabit Ethernet
Wireless	2,137 + 2,137Mbps AC (twin networks), 1,000Mbps dual-band N	1,300Mbps AC, 600Mbps dual-band N	2,137 + 2,137Mbps AC (twin networks), 1,000Mbps dual-band N	1,300Mbps AC, 300Mbps dual-band N	2,137 + 2,137Mbps AC (twin networks), 1,000Mbps dual-band N	1,300 + 1,300Mbps AC (twin networks), 600Mbps dual-band N	1,733Mbps AC, 800Mbps dual-band N
USB ports	One USB 2.0, one USB 3.0	One USB 2.0, one USB 3.0	One USB 2.0, one USB 3.0	Two USB 2.0	One USB 2.0, one USB 3.0	One USB 2.0, one USB 3.0	Two USB 3.0
File sharing support	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP	Yes; SMB, FTP	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP	Yes; SMB, DLNA and FTP
3G/4G support	USB	USB	No	Yes	No	No	No
VoIP support	No	No	No	No	No	No	No
MU-MIMO	Yes	No	Yes	No	Yes	No	Yes
TEST RESULTS: COPY SPEED (MB/S)							
5 METRES	65.8	56.3	64.2	49.9	66.7	57.8	60.3
15 METRES	24.1	17.4	26.8	18.3	23.1	20	22



[FAST CONNECTORS]

Blazing-fast broadband routers

IF YOU'RE ON AN NBN OR CABLE CONNECTION THAT INCLUDES ITS OWN MODEM, ONE OF THESE STANDARD BROADBAND ROUTERS IS WHAT YOU NEED FOR SHARING YOUR CONNECTION.

[NATHAN TAYLOR]

BROADBAND ROUTERS ARE perfect for people who already have a modem in place. If you have an FTTH NBN service, then the modem is built into the wall panel that's installed as part of the service and all you need is a broadband router. If you have an existing ADSL/VDSL or cable modem router, a broadband router can be used to cover its deficiencies or expand your wireless network.

For instance, if you're not happy with the wireless range and performance of your bundled cable modem router, you can switch it to 'bridged mode' and connect the WAN port of a broadband router to the LAN port of the cable modem router. Then the broadband router becomes the primary network hub, managing devices, security and network access.

Broadband routers can also be used as stand-alone wireless access points. Connect a LAN port of a broadband router to a LAN port on your existing modem router and configure the wireless to complement or replace your existing wireless network. If you're having coverage or performance issues, this can provide a great solution.

HOW WE TESTED

We performed simple speed tests at 5m and 15m, as with the DSL routers, copying a 1GB file and recording the speed. The client device was a Linksys WUMC710 wireless AC bridge, which is capable of 1,300Mbps wireless AC.

As always with wireless, this is useful only as a comparative. Every home is different, and you may find that you'll get speeds higher or lower than those we found.

ASUS RT-AC5300

IF YOU'RE LOOKING FOR THE BIGGEST AND BEST, THIS IS IT.

IF YOU SIMPLY must have the very latest tech, the ASUS RT-AC5300 is your best bet. It's cheaper than its AC5300/AC5400 competition and boasts more features than any of the other similarly-specced routers.

As we have noted in other ASUS router reviews, the company really has the best bundled firmware on the market today. Based on the open source OpenWRT, it possesses features commonly only found in business and security routers, but retains an appealing graphical user interface that makes it accessible to non-technical users.

The feature list is extensive: there's VPN support (both client and server), fantastic QoS and traffic management tools and reporting, 3G/4G data sharing as a failover in case the main network goes down, excellent USB storage and printer sharing, per-user parental controls and management, peer-to-peer and direct download management, and remote access to files on attached storage devices using the AiCloud service. The mobile tools are also great, providing easy setup and giving access to the full range of features available in the firmware.

So let's talk about the hardware, then. When it comes to consumer Wi-Fi, this is it — the very best you can get. It creates two 802.11ac networks with MU-MIMO and 1024QAM support, individually capable of 2,137Mbps. When a device connects, it is dynamically assigned to a network based on the current network load. All this bandwidth makes it best for environments where there are a large number of users likely to hit it at once. It's probably overkill for most households, but small businesses and multi-dwelling units could make good use of it.



ASUS RT-AC5300 802.11AC TRI-BAND GIGABIT ROUTER

\$480

www.asus.com.au

CRITICAL SPECS

Wireless AC5300: 2,137+2,137Mbps AC, 1,000Mbps N; Wired: one gigabit WAN port, four gigabit LAN ports; one USB 2.0 port, one USB 3.0 port





ASUS RT-AC68U

A FANTASTIC ROUTER THAT'S ACTUALLY AFFORDABLE.

SO PERHAPS YOU'RE not looking to serve an entire village with your router, and just want something more modest and appropriate for a household. In contrast to the huge AC5300/AC5400 routers, that's what the ASUS RT-AC68U offers — an affordable and capable broadband router suitable for medium to large households.

The three-antenna RT-AC68U is capable of 1,300Mbps, which is about as fast as any single mobile device or laptop will go (most actually top out at 433Mbps or 867Mbps), so there are no speed issues with the router unless lots of people are trying to access it at once. With our test device (which is capable of 1,300Mbps), the RT-AC68U achieved speeds a little lower than the average, but there really wasn't a huge spread of results, so there's no major red flag here.

And, of course, it comes with ASUSWRT, the firmware that we've raved about before and will continue to do so here. You'll be hard pressed to find another \$200-ish router that does all the things that the RT-AC68U does, at least not without using third-party firmware. ASUSWRT supports pretty much everything you could ask for: parental controls, VPNs, USB storage and 3G/4G modems for internet failover, sophisticated traffic management and quality of service, remote access to stored data and more. Yet for all of it, it's easy to understand and manage — more so for the excellent mobile apps that ASUS provides on both iOS and Android.

It's not the prettiest device, and it doesn't boast the latest tech, but if you're looking for an affordable mid- to high-range router for a medium-sized home, the RT-AC68U comes highly recommended.



Linksys EA9500

SUPER-SPEED WIRELESS AND PLENTY OF LAN PORTS MAKE THIS PERFECT FOR SERVING LOTS OF USERS AND DEVICES.

AT THE TOP end of Linksys' current broadband router range sits the new EA9500, a router with all the wireless features you can ask for. There's MU-MIMO for maximum per-user performance, twin 2,137Mbps AC networks with dynamic user load balancing to support a huge number of users at once, and an 802.11n support that deploys 1024QAM to support a theoretical 1,000Mbps. Much like the ASUS RT-AC5300 and D-Link DIR-895L this is pretty much the pinnacle of consumer Wi-Fi right now. (As a small aside, Linksys calls this AC5400. It's actually the same as the AC5300 of the D-Link and ASUS; we have no idea where Linksys gets the extra hundred from).

One thing that sets it apart from the AC5300 competition is the LAN ports. The double-thick router (it's a very big router overall) has two rows of four gigabit Ethernet LAN ports, for a total of eight. For households that have a substantial number of wired devices, this is a big deal, sparing the need to buy additional switches and power adapters to support those switches. We wished more vendors would recognise that four ports just isn't enough anymore.

It uses Linksys standard firmware, which is built to be easy to use and configure but can't match the likes of DrayTek and ASUS for features. Although there is a web console available, Linksys expects you to use its PC or mobile apps for configuration, and those apps have been recently overhauled with a much-improved user interface. They provide almost complete access to the router's features, including wireless setup, parental controls, diagnostics and network maps, and more. It's more expensive than the ASUS alternative, but it's a contender for top spot.



ASUS RT-AC68U DUAL-BAND WIRELESS-AC1900 GIGABIT ROUTER
\$218
www.asus.com.au

CRITICAL SPECS

Wireless AC1900: 1,300Mbps AC, 600Mbps N; Wired: one gigabit WAN port, four gigabit LAN ports; one USB 2.0 port, one USB 3.0 port



LINKSYS EA9500 MAX-STREAM AC5400 MU-MIMO GIGABIT ROUTER
\$550
linksys.com.au

CRITICAL SPECS

Wireless AC5300: 2,137+2,137Mbps AC, 1,000Mbps N; Wired: one gigabit WAN port, eight gigabit LAN ports; one USB 2.0 port, one USB 3.0 port



Netgear Nighthawk X6 R8000

GREAT CONSUMER FEATURES AND A MORE REASONABLE PRICE THAN AN AC5300 ROUTER.

IF YOU DON'T need something quite so extravagant as a full AC5300 router, an AC3200 is just a small step down in terms of performance and a big step down in price. Although it may seem like there's a big difference, in a practical sense, there's not that much. Almost no wireless devices support the 1024QAM and 4X4 MIMO that give AC5300 its speed. Most devices will talk to an AC3200 router just as fast as they would an AC5300. It's only when you get very large numbers of devices connecting at once (we're talking eight or more) that you might see a noticeable difference in performance. Which brings us to the Nighthawk X6. A space-agey looking six-antenna device, it lacks support for MU-MIMO but will develop two 1,300Mbps wireless AC networks with user load balancing across them. It also has the standard four wired gigabit LAN ports and two USB ports.

While Netgear feels like it has been a little left behind when it comes to UI design, it still has some really great firmware features that set it apart. In particular, ReadyShare and its integrated OpenDNS parental controls are excellent. ReadyShare is the benchmark for shared file access, with SMB, FTP and DLNA access to content on an attached USB drive, as well as remote access (via app or FTP) and even a PC app called ReadyShare Vault that will back up a PC to a shared hard drive. The parental controls are also fantastic, with proper user-level access control and content filtering.

You won't find some of the more advanced enterprise features here, and Netgear's mobile apps are merely all right, but for home users, it certainly has a lot to offer.



TP-Link Archer C2600

HITS A GREAT SWEET SPOT OF PERFORMANCE AND PRICE.

LIKE THE ASUS RT-AC68U, TP-Link's Archer C2600 is perfect for people who want premium wireless performance but don't want to splash out for an extravagant AC5300 router. Its wireless performance is still as good as it gets — including support for MU-MIMO — but instead of the twin networks of the AC5300 routers, it creates only a single 802.11ac network. That means it will support fewer devices, but those devices should go just as fast as any other router.

There are plenty of other things to like about the TP-Link. It's driven by a more powerful processor than most of its competition (1.4GHz dual-core as opposed to the common 1GHz), and both of its USB ports offer full 3.0 speed making it a great platform for file sharing. It supports Windows File Sharing and DLNA media streaming well.

Although the firmware UI is still a little lacking, TP-Link's easy setup wizards and mobile apps have improved over the generations, and non-technical users should have no problems setting up and configuring the router. For more technical users, there's considerable depth to its quality of service and firewall settings, but it lacks some of the advanced features you might hope for, such as per-user metering and VPN support.

Even without those advanced features, we're big fans of the TP-Link. It manages to hit a great sweet spot: premium wireless without going unnecessarily overboard, affordable price, good performance. Its hardware is pretty much perfect for people who want the fastest wireless but don't need to serve more than their own household.



NETGEAR NIGHTHAWK X6 R8000 AC3200 SMART WIFI ROUTER
\$360
netgear.com.au

CRITICAL SPECS

Wireless AC3200: 1,300+1,300Mbps AC, 600Mbps N; Wired: one gigabit WAN port, four gigabit LAN ports; one USB 2.0 port, one USB 3.0 port



TP-LINK ARCHER C2600 WIRELESS GIGABIT DUAL-BAND ROUTER
\$240
www.tp-link.com.au

CRITICAL SPECS

Wireless AC2600: 1,733Mbps AC, 800Mbps N; Wired: one gigabit WAN port, four gigabit LAN ports; two USB 3.0 ports



D-Link DIR-895L

POWERFUL, BUT OVERPRICED.

USING THE SAME underlying wireless hardware as the ASUS RT-AC5300 and Linksys EA9500, the D-Link DIR-895L is as powerful as they come. It has full AC5300 support, creating three independent wireless networks, two of which are capable of 2137mbps and one of 1000mbps. A given device can only connect to one, but the D-Link will intelligently decide which one based on load and client capabilities.

The unfortunate thing about the D-Link, however, is its price. It's presently retailing for \$100 or more than its Linksys and ASUS competition, and it doesn't really have anything to justify that extra cost. Indeed, ASUS actually has considerably more features available in its firmware, while Linksys has additional LAN ports. The only argument for getting the D-Link over those products is really its aesthetic, which is certainly unique. We're not huge fans of its alien crab look, but you might find it fits better in your house than the admittedly drab Linksys and ASUS routers.

Although we prefer the ASUS and Linksys firmware, the D-Link firmware is certainly not bad. Recent updates to the D-Link firmware have made it more visual, more user-friendly and more accessible to everyday users. The mydlink Lite mobile app is a little too camera-centric for our liking (D-Link really should have a separate app for routers) and doesn't give full access to the router feature, but it does make initial setup easy. One upside, the mydlink SharePort app is great, letting you remotely access files and stream media from USB storage attached to the router, as well as upload photos from your phone to the storage.



DrayTek Vigor2132ac

A CAPABLE BUT COMPLEX SECURITY ROUTER.

AS WITH MOST DrayTek routers, the focus of the Vigor2132ac is not on ease of use, mobile access or fancy consumer design. This is a router made for small businesses and advanced users. It doesn't hold your hand, doesn't have easy setup apps, has no remote access mobile app and doesn't have a colourful user interface. The ports are up front for easy access and the industrial design is simple and functional.

However, if you're interested in detailed and complex configuration of your local network, the DrayTek has more going on than most. It supports VPN client and server, though this particular router (being at the low-end of DrayTek's range) only supports two simultaneous tunnels. It has sophisticated but technical quality of service systems, remote management including multi-device management from a single app, as well as business-grade content filtering that can block services like Facebook as well as inappropriate websites.

Although it has two USB ports, both are USB 2.0 and are not really all that useful as a file-sharing platform. The DrayTek doesn't have media streaming, though it does have SMB and FTP service. It also supports USB printer sharing, as well as using a 3G/4G modem as a secondary WAN option. Many local Optus, Telstra and Vodafone 4G adapters are supported, and can be used as either a failover or load balanced with the regular WAN port.

The wireless hardware is enough to support most households and many small businesses. It's a far cry from the extremes of the Linksys and D-Link router, for example, but for a more modest number of users, it should be more than enough.



D-LINK DIR-895L AC5300
MU-MIMO ULTRA WI-FI ROUTER
\$650
www.dlink.com.au



CRITICAL SPECS

Wireless AC5300: 2,137+2,137Mbps AC, 1,000Mbps N; Wired: one gigabit WAN port, four gigabit LAN ports; one USB 2.0 port, one USB 3.0 port



DRAYTEK VIGOR2132AC
\$389
draytek.com.au



CRITICAL SPECS

Wireless AC1600: 1,300Mbps AC, 300Mbps N; Wired: one gigabit WAN port, four gigabit LAN ports; two USB 2.0 ports



[MY KINGDOM FOR INTERNET]

Expand and extend your network

NETWORK NOT REACHING WHERE IT SHOULD? WE COMPARE A SWATHE OF ACCESSORIES DESIGNED TO HELP YOU STRETCH YOUR WIRED OR WIRELESS CONNECTIONS WHERE THEY'RE NEEDED.

[LINDSAY HANDMER]

THESE DAYS, MANY homes are filled with all sorts of network-connected devices, all competing for bandwidth. While Wi-Fi is very convenient, it isn't suitable in all situations and can struggle in larger houses. The increasing popularity of HD media streaming also puts more pressure on home networks — especially those with users who all want to watch their own show at the same time. For those not lucky enough to have hard wired Ethernet in every room, there are loads of different ways to get the best speeds. The latest spec USB and PCIe Wi-Fi cards can actually be as fast as a wired connection, thanks to all sorts of clever MIMO tricks and multiple antennae. For

those who want or need wired stability without a permanent install or messy cables (such as renters), powerline adapters create a 'plug and play' wired connection over existing electrical wires. If wireless woes are getting you down, Wi-Fi range extenders can eliminate black spots, give a solid connection in far flung rooms and even improve throughput. For those who need a super high-speed wireless link, the latest media bridges can have more bandwidth available than Gigabit Ethernet. Some have multiple Ethernet ports, too, which allows easy connection of wired-only devices such as TVs and consoles. Other devices can do double or

triple duty, as powerline adapters with Wi-Fi, or range extenders that can run as access points or be configured as a media bridge. Some accessories are even aimed at improving your experience when travelling, or accessing networks on the go.

To provide a more in-depth look at all the available options, we benchmarked 21 wired and wireless network upgrades. We focused on real-world throughput (don't believe all the claims on the box) and range. Keep in mind that our results reflect the specific testing environment, and while they can be compared to each other, it does not necessarily reflect the performance in a difference setup.



Powerline networking adapters

POWERLINE ADAPTERS TRANSMIT NETWORK DATA VIA EXISTING ELECTRICITY WIRING, AS AN ALTERNATIVE TO WI-FI, OR HAVING TO PHYSICALLY RUN ETHERNET CABLES.

Installation is fast and easy, no physical changes are needed, wireless interference is avoided, and they are fairly affordable. That said, there are quite a few important factors to consider before buying a Powerline setup. Many units come in a kit of two, but some are sold individually. Other models can have extras, such as a built-in Wi-Fi access point or a mini Ethernet switch. While the maximum speeds listed are quite high (exceeding Gigabit Ethernet in some cases), real-world speeds are typically much much lower. While some can work across phases, adapters can generally only communicate with units plugged into the same circuit. Powerline units are still subject to interference from other appliances, and use with plug boards or surge protectors should be avoided. Most units comply with HomePlug standards, so cross-brand compatibility is possible, but not guaranteed.

If in doubt, make sure you buy from a retailer with a good return policy, in case the Powerline adapters don't give the desired results.

HOW WE TESTED

PowerLine adapters were connected to circuit sharing with other electronic appliances, such as a TV and modem. Speed was tested with approximately 7m between the adapters, each plugged directly into the socket. Throughput was tested with LAN Speed Test, between two Gigabit Ethernet connect PCs.



D-Link AV2 1000 DHP-601AV

GET CONNECTED.

CONSISTING OF A kit of two, the D-Link DHP-601AV is aimed at those wanting to create a high-speed network. The powerline adaptors are rated at speeds up to 1,000Mbps, for streaming media and large file copies. Each unit has a single Gigabit Ethernet port, and comes with cables. If you already own a D-Link PowerLine product such as the AV500, the faster model is fully backwards compatible. You can also add up to 16 of the adapters, for really big networks.

The 601AV adapters are plug and play, so setup is as easy as plugging them in and pressing the configure button. Handily for your power bill, and the environment, the adapters have a power saving mode which reduces consumption by up to 85%.

The D-Link units plug directly into the socket and they're fairly slim, so they don't block other ports. In testing, they performed quite well, and we managed speeds of 168/162Mbps, uploading and downloading data. The \$115 price tag is also pretty good, all things considered.



D-Link PowerLine AV500 DHP-309AV

A MINI STARTER KIT.

DESIGNED FOR LESS demanding needs, the D-Link DHP-309AV adapters are rated for up to 500Mbps throughput. The starter kit consists of two units, each with a 10/100 Ethernet port on the bottom, plus a cable in the box. Setup is very simple — plug the devices in, and hit the configuration button. The adapters automatically connect, and use 128-bit encryption to keep your data safe from snooping. While slower than the D-Link AV2 1000 adapters, the AV500 kit is cross compatible for future upgrades.

In total, you can install up to 16 adapters, for wired networking in every corner of a house. It also has built-in power savings, reducing consumption by up to 70%. The units also use a QoS engine to analyse and separate the transmitted data, to ensure important traffic is given priority.

In real-world use, the D-Link kit handles itself quite well, and managed 67Mbps up and 64Mbps down. Quite compact, the adapters have an underside spacer, to help them sit out and above other plugs.

<p>D-LINK AV2 1000 DHP-601AV \$115 www.dlink.com.au</p>		<p>D-LINK POWERLINE AV500 DHP-309AV \$79 www.dlink.com.au</p>	
<p>CRITICAL SPECS 1,000Mbps; max 16 adapters; backwards compatible</p>		<p>CRITICAL SPECS 500Mbps throughput; max 16 adapters; backwards compatible</p>	



Edimax HP-5101ES

AN UPGRADED POWERLINE ADAPTER.

THE EDIMAX HP-5101ES bucks the trend and is sold per device, not in a kit of two. This is because Edimax actually has quite a range of different adapters, which can be mixed and matched to create the perfect setup for your home.

Instead of a single Ethernet connection, the HP-101ES incorporates a three-port 10/100 switch. This makes for a more affordable and easier way to plug multiple devices into the one socket without needing extra hardware. For example, it's perfect for connecting a TV, media player and gaming console to the network.

The HP5101ES uses the AV500 spec, for speeds up to 500Mbps. It's compatible with other HomePlug 1.0 devices (including AV200 spec), and Edimax adapters. In testing, we hit speeds of 87/81Mbps up and down. This is pretty good, and while slower than Gigabit spec devices, plenty fast enough for normal network use.

The HP-5101ES has built in 128-bit security, noise filtering, IGMP managed multicast streams and has a power saving mode if not in use.

Edimax HP-5102Wn

WIRED AND WIRELESS, TOGETHER AT LAST.

IN AN EFFORT to get the best of both worlds, the Edimax HP-5102Wn squeezes a Wi-Fi access point into the powerline adapter. This makes it super easy (and affordable), to bring a wired connected to a distant room for a PC, but also allow devices such as phones to connect wirelessly. The powerLine side of the adapter is rated at AV500 spec, for speeds up to 500Mbps, and has a single 10/100 Ethernet port. The built-in Wi-Fi access point is 802.11n spec, with two internal antennas, and can handle speeds up to 300Mbps.

The HP-5102Wn is sold as a single device rather than a kit of two (like the one to the left) and is compatible with other Edimax and HomePlug 1.0 devices. This means the Edimax powerline adapters can be used to create a more versatile overall network, without needing any extras such as a Wi-Fi access point.

In real-world speed tests, the HP-5102Wn is on par with its compatriots, managing 82 and 79Mbps, up and down. At 2m (in the same room), we pulled peaked at 65Mbps from the Wi-Fi.

NetComm NP511

A POWERLINE UPGRADE KIT.

TURNING YOUR EXISTING electrical cables into a high-speed network, the NetComm NP511 is rated for speeds up to 500Mbps. The kit includes two devices, each with a single 10/100 Gigabit Ethernet port on the bottom. The adapters pass the AC power through, and the design includes a spacer on the underside so it can more easily coexist with other plugs.

The NP511 is HomePlug 1.1 compatible, but NetComm recommends not mixing brands. The units have built-in noise filtering, and an automatic power saving mode when not in active use. Up to 15 can be connected together into a single network.

The NP511 managed better throughput (89/82Mbps up and down) than any other AV500 spec adapter we tested, but not by a huge margin. The NP511 has a green, amber and red LED to indicate connection speed, from best to worst. It also has a button for one-touch security, to avoid any data being accessible externally.

The downside is (based on price) that the NP511 competes with faster 1,000Mbps products, without adding any extra functionality.



EDIMAX HP-5101ES

\$55 (one unit)
www.edimax.com

CRITICAL SPECS

AV500 spec; 3-port 10/100 switch; 16 devices total

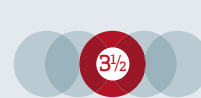


EDIMAX HP-5102WN

\$65 (one unit)
www.edimax.com

CRITICAL SPECS

AV500 spec; 802.11n Wi-Fi; 1x 10/100 Ethernet



NETCOMM NP511

\$115
www.netcommwireless.com

CRITICAL SPECS

AV500 spec; 1x 10/100 LAN port; HomePlug 1.1 compatible



Netgear Powerline 1000

HIGH-SPEED CONNECTIVITY WITHOUT EXTRA WIRES.

FOR THOSE WITH demanding network needs, the Netgear PL1000 is rated for up to 1000 Mbps throughput. Each unit in the kit of two has a single Gigabit Ethernet port, and comes with a 2m cable. The PL1000 kit is AV2 HomePlug compliant, so is cross compatible with devices that use the same spec. It's also backwards compatible with HomePlug AV1.0, and can coexist (but not cross communicate) with HomePlug 1.0 devices sharing the same circuit. Netgear recommends no more than 8 PL1000 adapters should be used at once on the same circuit, however.

Slightly wider than some, the PL1000 uses a spacer to sit out far enough to allow most normal plugs to use the next socket. When not actually connected, the unit powers down to save a little electricity. Setup is easy — plug it in and the hit the button to secure the network.

In our testing, the PL1000 managed excellent speeds of 178/174Mbps up and down. To help find the best connection speed, the unit has a multicoloured LED indicator.



NETGEAR POWERLINE 1000

\$115
www.netgear.com

CRITICAL SPECS

1,000Mbps throughput; Homeplug AV2 compliant; max 8 adapters



TP-Link TL-PA8010P

FEEL THE NEED FOR SPEED.

SUPPORTING THE LATEST HomePlug AV2 spec, the TP-Link TL-PA8010P uses 2 x 2 MIMO tech and all three power wires to offer speeds of up to 1,200Mbps. It also means the system can handle longer ranges better, and make a connection in places that lesser devices won't be able to reach.

Each adapter has a single Gigabit Ethernet port, and the kit comes with dual 2m cables. The TL-PA8010P devices are fully backwards compatible with slower AV spec adapters, down to AV200 — though run at the speed of the slowest unit.

Installing the TP-Link adapters is very simple — just plug them in, and hit the button to pair the units and enable 128-bit security.

While the rated 1,200Mbps speed is more than the Gigabit Ethernet port can handle, in real-world testing the adapters managed 221Mbps up and 219Mbps down. That's still faster than any other PowerLine device tested, which is a fantastic result overall.

While the TP-Link kit is a bit pricier than the competition, it's well worth the extra cost.



TP-LINK TL-PA8010P

\$125
www.tp-link.com.au

CRITICAL SPECS

AV2 spec; Gigabit Ethernet; 2x2 MIMO



TP-Link TL-WPA4220

LINKING YOUR WIRED AND WIRELESS WORLDS.

SQUEEZING A WI-FI access point into the powerline adapter, the TP-Link TL-WPA4220 makes it easy to bring both a wired and wireless connection to remote corners of a house. The units are rated for speeds up to 500Mbps, using the HomePlug AV standard and a 10/100 Ethernet port. The Wi-Fi half is 802.11n only, and good for up to 300Mbps. They are also fully compatible with other HomePlug AV spec devices.

Back in the real world, we managed 71Mbps up and 69Mbps down, and a maximum of 59Mbps on Wi-Fi, in the same room. Setup is the usual plug in and press the pair button, which also turns on 128-bit security. To make extending your existing Wi-Fi easier, the adapters have a Wi-Fi clone button, which copies the existing router configuration and is good to go. They also have a three-colour LED, which indicates the quality of the network connection at the current location.

While we tested a two-adapter kit (\$109), the TL-WPA4220 is also available as an individual unit for \$69.



TP-LINK TL-WPA4220

\$109
www.tp-link.com.au

CRITICAL SPECS

AV500 spec; 802.11n Wi-Fi; wireless cloning



Wi-Fi range extenders

WI-FI IS VERY CONVENIENT, BUT LOADS OF FACTORS CAN DEGRADE THE SIGNAL AND GIVE POOR BANDWIDTH, OR AN UNRELIABLE, HIGH-PING CONNECTION.

Many houses end up with an annoying black spot, and maintaining a link into a backyard or garage can be a frustrating experience. Wi-Fi range extenders step in to help by picking up an existing signal and re-broadcasting it, to increase the overall range. For a device connecting to the network, the switch between the two complementary networks is automatic and seamless. Some models also have a LAN port, and can extend a wired network, over Wi-Fi. Others can be configured as a media bridge, to bring wireless connectivity to wired-only devices such as a gaming console.

It is important to match the range extender to your existing Wi-Fi. The spec is usually given as the Wi-Fi standard supported (N or AC), and the total throughput in Mbps — for example, AC1900 means 802.11ac spec, with a total of 1,900Mbps throughput on both 2.4GHz and 5GHz.

HOW WE TESTED

Wi-Fi range extenders were connected to our test network, using a Linksys EA9500 or compatible router. Each was positioned for the best signal strength, around halfway to the 'edge' of the main network. Throughput was tested at a further 10m range, beyond a useful connection to the original Wi-Fi. Speeds were measured with the LAN Speed Test. The extenders were configured to just repeat the signal on both frequencies, and not link back to the router on the other band. This reduces overall bandwidth, but ensures both 2.4GHz and 5GHz devices can connect.

ASUS RP-AC68U

A SERIOUSLY HIGH-END RANGE EXTENDER.

UNLIKE SOME OF the slimline options, the ASUS RP-AC68U is a stylish, yet chunky and elongated cube, measuring in at 178mm x 106mm x 106mm. It uses the extra space to hide four internal MIMO antennae that are designed to cover large areas. It also has five gigabit LAN ports, to allow wired-only devices to tap in.

The AC68U IS AC1900 spec, so can handle 600Mbps on the 2.4GHz band, and 1,300Mbps on 5GHz. Getting set up is fast and easy with a WPS button, and it has LED indicators that help fine tune positioning for the best signal strength. The repeater also has a USB 3.0 port, which can turn your storage devices into a NAS, and is remotely accessible via the AiCloud app. The RP-AC68U had no problem extending our Wi-Fi out beyond the range of the original router, and gave a big speed boost under the test conditions.

The AC68U operates as a Wi-Fi range extender by default, but can also be switched to work as an access point, or media bridge.



ASUS RP-AC68U

\$229
www.asus.com

CRITICAL SPECS

Dual band; AC1900 spec; 1x USB 3.0; 5x LAN Ports

D-Link DMG-112A

A RANGE EXTENDER WITH A DIFFERENCE.

UNLIKE THE LARGE mains-powered options, the D-Link DMG-112A opts to be very compact and USB-powered. Important to note, the D-Link extender is 2.4GHz 802.11n only, and has a maximum throughput of 300Mbps. Its antennae are internal as well, so its range is comparatively limited.

In real-world testing, though, it easily helped counter dead zones and brought a strong signal to our backyard. Its real-world speed is also fairly low, but keep in mind that it's specifically designed to be low-cost, low power use and very portable. The DMG-112A has a WPS button for quick setup, but is otherwise configured through a free D-Link app. The unit does come with a mains USB power adapter, which — coupled with a USB extension cable — makes it really easy to position the unit in the ideal location. We also ran it directly from a USB power bank — a perfect option for temporarily boosting Wi-Fi outdoors.

Considering the bargain price, the D-Link DMG-112A is a very handy little device to have around.



D-LINK DMG-112A

\$45
www.dlink.com.au

CRITICAL SPECS

802.11n spec; USB powered; WPS button



Linksys RE7000

FOR HIGH-SPEED NETWORKS.

BASED AROUND THE AC1900 spec, the RE7000 can manage 600Mbps on the 2.4GHz band and 1,300Mbps on 5GHz. It uses MU-MIMO tech, so is ideal to maximum speeds with multiple users. The unit is also designed to be very simple, with internal antennae, a WPS button and an app-guided setup. The RE7000 also goes a step further, with a single Gigabit Ethernet port, which feeds the network connect out to a wired-only device. Alternatively, the device can be plugged into a wired network, and configured as a high-speed Wi-Fi access point.

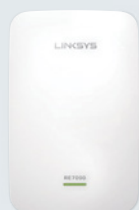
While the RE7000 is backwards compatible with older networks, to get the full speeds, a fairly modern Wi-Fi router is needed. The device plugs directly into a 240v socket, but we found that this wasn't ideal when trying to position it for the best range. Instead, we used a short extension cord, and tucked it away (standing vertically) on top of a book shelf. This allowed it to dramatically improve both the range and throughput of our network.



LINKSYS RE7000

\$210
www.linksys.com

CRITICAL SPECS
AC1900 spec; 1x Gigabit Ethernet; access point mode



Netgear EX6150

A HIGH-END BUT STILL AFFORDABLE OPTION.

INSTEAD OF GOING for all-out speed, the Netgear EX6150 dials it back a bit, using the AC1200 spec. That's still pretty fast, with up to 300Mbps on the 2.4GHz band and 900Mbps using 5GHz. It also uses Netgear FastLane Technology, which can configure one band to only talk to the router (like a media bridge), while the other band connects to your devices. On the side, the EX6150 has a Gigabit Ethernet port, which can be used to connect to wired-only devices, or allow the unit to work as an access point. It also has a WPS button for easy connections, and dual adjustable antennae.

In normal use, the EX6150 does an excellent job of improving range and throughput, but the direct 240v socket plug in can be both inconvenient and handy. If using FastLane and 2.4GHz to link back to the router, bandwidth is reduced, but the better penetrating power of the lower frequency band means the range extender can be plugged in further away.



NETGEAR EX6150

\$160
www.netgear.com

CRITICAL SPECS
AC1200 spec; 1x Gigabit Ethernet; access point mode



TP-Link RE210

AFFORDABLE YET EFFECTIVE.

OPERATING AT A slower AC750 spec, the TP-Link RE210 is good for 300Mbps on the 2.4GHz band and 433Mbps on the 5GHz band. To put it in context, the range extender is only \$70, so is aimed at everyday networks, rather than those who need the absolute highest throughput.

The RE210 uses dual, adjustable external antennae, and has an LED signal meter to help find the best position. It also has a WPS button and can have the indicator LEDs turned off for night use.

Underneath, it also has a Gigabit LAN port (and comes with a cable), so can connect your wired devices to the network. The RE210 also has a 'high speed mode', which uses one band to send data and the other to receive it, and works a bit like a media bridge.

While the RE210 doesn't achieve the same level of throughput as more expensive repeaters, it did an excellent job of extending our existing network. Like many repeaters, it plugs into a 240v socket directly.



TP-LINK RE210

\$70
www.tp-link.com

CRITICAL SPECS
AC750 spec; 1x Gigabit Ethernet; media bridge mode



WI-FI 802.11AC
ADAPTERS



802.11ac wireless adapters and media bridges

WI-FI CAN BE A GREAT WAY TO CONNECT A MULTITUDE OF DEVICES TO A NETWORK WITH LITTLE FUSS.

In a world with increasing demand for high bandwidth media streaming and the ability to handle large files, real-life speeds can be a letdown. Updates to the 802.11ac Wi-Fi standard mean that many new devices can use all sorts of techniques to maximise throughput. To help bring older computers up to date, we've tested a bundle of the latest 802.11ac spec USB and PCIe Wi-Fi adapters. For wired-only devices, a media bridge creates a high-speed wireless link between two points, with Ethernet ports at each end. By dedicating multiple antennae to the task, speeds approaching that of a wired connection can be created. This is ideal for bandwidth-heavy tasks, such as HD streaming from a NAS to a TV, in situations where running a cable is not possible. It's also useful for consoles and other wired network devices, where a fast, reliable, yet wireless connection is needed.

HOW WE TESTED

Wi-Fi adapters were connected to a Linksys EA9500 router on the 5GHz band, and tested indoors at 1m range with no obstructions, then at a 10m range, with three walls in between. Media bridges were linked to a compatible router, and also tested at the same 1m and 10m locations. Network speeds were measured with the LAN Speed Test, between two computers. Note that some high-speed wireless connections are bottlenecked by the Gigabit Ethernet at each end. As a comparison, a wired Ethernet connection tested at 919Mbps up and 903Mbps down.

ASUS USB-AC68

A WI-FI DONGLE LIKE NO OTHER.

NOT CONTENT WITH normal reception or speeds, the ASUS boffins built a dual band 802.11ac adapter that uses the AC1900 spec. The AC68 connects via USB 3.0, and uses a special 3 x 4 MIMO antenna design (three transmit, four receive), with two fold-out antennae that can lock in multiple positions. Combined with the ASUS AiRadar software, this makes it easy to optimise the connection for maximum throughput. The device is large but quite portable and can be plugged directly into a USB port, but is better used with the included extension cable and stand.

To achieve full speed, the AC68 needs a compatible router, and pulls up to 600Mbps from the 2.4GHz band, and 1,300Mbps from 5GHz. Under the hood, it has a Realtek RTL8814AU chipset.

Performance is absolutely top notch, and we hit speeds that no other USB adapter could manage. The large antennae also mean that the AC68 excelled at longer ranges. While much pricier than the slower competition, the extra speed is well worth it.

D-Link DWA-582

A DESKTOP WI-FI UPGRADE.

USING A PCIe 1x interface, the D-Link DWA-582 supports 802.11ac Wi-Fi on both 2.4GHz and 5GHz bands. The card uses dual large 4.5dBi external antennae, which can be repositioned for the best reception. By default, it has a standard height PCI adapter plate installed for normal use. For those with a mini-PC build, it also comes with a low profile plate that can be swapped into place by removing two screws.

The DWA-582 can manage transfer rates up to 300Mbps on 2.4GHz, and 867Mbps on 5GHz. Of course, in the real world, it's a whole lot less, but the Wi-Fi card can still hold its own for normal use. At longer ranges, the connection speeds remain strong, as long as the antennae are on the same side of the PC as the router. If instead the computer is orientated with the rear away from the router, the extra mass of metal and interference can drop the connection speed in half.

ASUS USB-AC68
\$117
www.asus.com

CRITICAL SPECS
Dual band; USB 3.0; extension cable

D-LINK DWA-582
\$79
www.dlink.com.au

CRITICAL SPECS
Dual band; PCIe interface; half height



EXPAND AND ENHANCE YOUR NETWORK
SUPERGUIDE



Linksys WUSB6100M

COMPACT AND PORTABLE.

THE LITTLE LINKSYS AC600 measures in at just 37mm x 6mm x 5mm, and weighs 6 grams — about the same as a USB drive. Hidden inside is a marvel of compact 802.11ac Wi-Fi connectivity, with both 2.4GHz and 5GHz frequencies supported. The little dongle only needs USB 2.0 as well, so is compatible with older systems. The 5GHz side can handle speeds up to 433Mbps, while the 2.4GHz band manages 150Mbps. Despite lacking external antennae, it still features MU-MIMO and beamforming, to improve the connection when used at the same time as other Wi-Fi devices.

Over in the real world, the Linksys dongle is respectably fast when close to the router. At longer ranges, the tiny internal antennae mean walls and other obstructions quickly eat into the throughput. This is particularly noticeable when using the 5GHz band, which, while faster close up, is more easily absorbed across a house.

Thankfully, the Linksys dongle is quite affordable, and makes a great upgrade for older devices — at least if long range is not the focus.



NETGEAR POWERLINE 1000

\$65
www.linksys.com

CRITICAL SPECS
Dual band; USB 2.0; MU-MIMO



Netgear A6200

A USB WI-FI UPGRADE.

THE CHUNKY NETGEAR AC6200 takes the USB Wi-Fi dongle concept to a new level, with a large adjustable antenna, as well as a USB extension cable and base for better positioning. At its heart, it's a dual-band 802.11ac adaptor, beefed up for longer range. Of course, that makes it a little chunkier, and the dongle measures in at 95mm x 31mm x 14mm, and weighs 20 grams. The 2.4GHz side maxes out at 300Mbps, while the 5GHz band is good up to 867Mbps.

In the real world, the speeds are slower (even up close), but still excellent. At longer ranges, the available throughput drops off, but the adjustable antenna does a great job of gathering every last packet of data.

USB 3.0 is needed for best effect, but it can still operate on USB 2.0 if need be.

Considering the excellent performance, the A6200 is surprisingly affordable at \$65, and is a great wireless upgrade for a laptop or desktop.



NETGEAR A6200

\$65
www.netgear.com

CRITICAL SPECS
Dual band; USB 3.0; adjustable antenna



TP-Link Archer T9E

AFFORDABLE PERFORMANCE.

IT'S COMMON TO use Gigabit Ethernet rather than Wi-Fi on desktops, for the increased speed. But the PCIe-based TP-Link Archer T9E can hit up to 1,300Mbps using the 5GHz band and 600Mbps on the 2.4 GHz band. The Wi-Fi card uses three adjustable antennae, to help make it easy to tweak for the best connection speeds. The card itself has a low-profile passive heatsink to keep cool, but while fairly compact, only comes with a full height PCIe mount.

During testing, the Archer T9E is extremely fast at close range — though still not quite as good as a wired connection. At a distance, careful positioning of the antennae is needed to get the best result, but as long as the rear of the computers is aimed at the router, throughput remains strong.

Cheaper than a 1,300Mbps-capable USB Wi-Fi dongle, the T9E is also not much more expensive than a slower PCIe adapter. It also supports older Windows systems with drivers available back to XP.



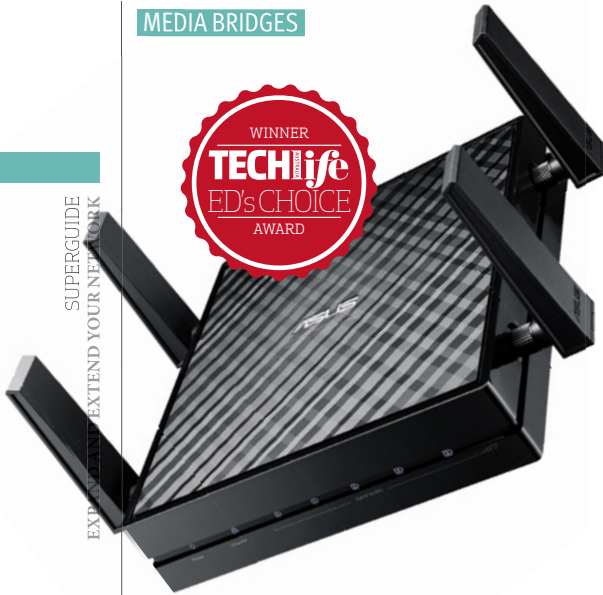
TP-LINK ARCHER T9E

\$89
www.tp-link.com

CRITICAL SPECS
Dual band; 3x antennae; full height PCIe 1x



MEDIA BRIDGES



ASUS EA-AC87

FOR THE ULTIMATE WIRELESS CONNECTION.

USING 5GHZ FREQUENCIES and a 4 x 4 MIMO design, the ASUS EA-AC87 can create a wireless link at speeds of up to 1,734Mbps. Of course, it does need a compatible 4 x 4 Wi-Fi router — though a lesser model will still work, just slower. The EA-AC87 has a five-port Gigabit switch built in, so can connect a whole bundle of wired devices. The AC87 can also be used as a Wi-Fi access point, with a coverage of up to 465m².

To help get the best throughput, the media bridge has an LED readout that shows the link quality. Small adjustments (especially at range) have a large effect, so it's important to tweak the position. Up close, the EA-AC87 is actually limited by the Gigabit Ethernet throughput. Further out, the signal strength and throughput drops, but it's still miles ahead of most wireless connections, and more than enough for fast file transfers or multiple HD streams.

The EA-AC87 is fairly expensive (more so if you need to upgrade a router too), but worth the cost.



D-link DAP-1650

GIVE YOUR NETWORK AN UPGRADE.

PAIRED UP WITH a compatible Wi-Fi router, the D-Link DAP-1650 can create a high-speed link with speeds of up to 867Mbps. It uses dual band 802.11ac technology, but also has a four-port Gigabit Ethernet switch built in. Unlike most other media bridges, the DAP-1650 has all its antennae mounted internally, for a sleek and minimalistic exterior that blends in easily.

In real-world use, the D-Link device is not as fast as the competition, but then again, it's almost half the price. Up close and personal, the DAP-1650 maxes out at about 650Mbps, which drops off dramatically at range. Still, that's a pretty good result, and unlike faster options, it can likely get the best from your existing router.

While we primarily tested the DAP-1650 as a media bridge, it's versatile enough to also operate as both a range extender, or wireless access point. Round the back, it has a single USB 2.0 port, which can be used to connect USB drives or a printer to the network.



Netgear Nighthawk EX7000

CREATE A HIGH-SPEED WIRELESS LINK.

THE NIGHTHAWK EX7000 uses dual-band 802.11ac spec Wi-Fi to create a media bridge capable of Gigabit+ speeds. In 5GHz mode, it can handle 1,300Mbps, or 600Mbps if relegated to 2.4GHz. To make full use of the EX7000's capabilities, a compatible 3 x 3 router is needed, though it can also run at reduced throughput with lesser hardware.

The Nighthawk has three large external antennae, which can be positioned independently for best effect. Round the back, it has five Gigabit Ethernet ports, to bridge multiple devices to the wireless connection. It also has a USB 3.0 port for access to external storage, or to add a printer to the network.

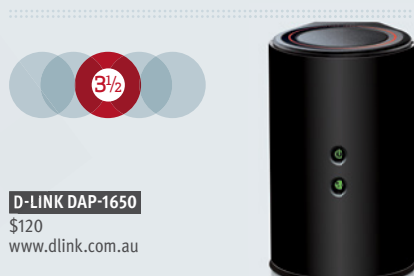
In our testing, the EX7000 can create a wireless link with near wired speed throughput — at least at close range. Add a few walls into the mix and it slows down, but still has plenty of bandwidth for most tasks.

The Nighthawk isn't a one trick pony either — it can be set up as a powerful Wi-Fi range extender, or used as a dedicated access point.



ASUS EA-AC87
\$220
www.asus.com

CRITICAL SPECS
4 x 4 5GHz; 5-port Gigabit Switch; access point mode



D-LINK DAP-1650
\$120
www.dlink.com.au

CRITICAL SPECS
Dual band, 4-port Gigabit LAN; USB 2.0 port



NETGEAR NIGHTHAWK EX7000
\$230
www.netgear.com.au

CRITICAL SPECS
Dual band; 5x Gigabit LAN; 1x USB 3.0

POWERLINE SPECS & TEST RESULTS

	PRICE	ADAPTERS IN BOX	PRICE FOR 2	SPEC	RATED THROUGHPUT	LAN PORTS (EACH UNIT)	WI-FI	TOTAL ADAPTERS SUPPORTED	DOWNLOAD MBPS	UPLOAD MBPS
D-LINK DHP-601AV	115	2	115	AV2	1,000 MBPS	1X GIGABIT	NO	16	168	162
D-LINK DHP-309AV	79	2	79	AV500	500 MBPS	1X10/100	NO	16	67	64
EDIMAX HP-5101ES	55	1	110	AV500	500 MBPS	3X10/100	NO	16	87	81
EDIMAX HP-5102WN	65	1	130	AV500	500 MBPS	1X10/100	N300	16	82	79
NETCOMM NP511	115	2	115	AV500	500 MBPS	1X10/100	NO	15	89	82
NETGEAR POWERLINE 1000	115	2	115	AV2	1,000 MBPS	1X GIGABIT	NO	8	178	174
TP-LINK TL-PA8010P	125	2	125	AV2	1,200 MBPS	1X GIGABIT	NO	254	221	219
TP-LINK TL-WPA4220	109	2	109	AV500	500 MBPS	1X10/100	N300	16	71	69

WI-FI EXTENDERS SPECS & TEST RESULTS


	SCORE	PRICE	WIFI SPEC	DUAL BAND	ETHERNET	USB	OTHER MODES	2.4 GHZ DOWNLOAD / UPLOAD (MBPS)	5GHZ DOWNLOAD / UPLOAD (MBPS)
ASUS RP-AC68U	4	229	AC1900	YES	5	1X3.0	ACCESS POINT, MEDIA BRIDGE	167 / 158	389 / 358
D-LINK DMG-112A	3.5	45	N300	NO	NO	POWER ONLY	NONE	59 / 61	N/A
LINKSYS RE7000	4	210	AC1900	YES	1	NO	ACCESS POINT	77 / 65	298 / 270
NETGEAR EX6150	4	160	AC1200	YES	1	NO	ACCESS POINT, FASTLANE	74 / 81	211 / 233
TP-LINK RE210	4	70	AC750	YES	1	NO	MEDIA BRIDGE	79 / 60	101 / 98

WI-FI USB & PCIE ADAPTERS SPECS & TEST RESULTS

	PRICE	INTERFACE	DUAL BAND	SPEC	1M RANGE DOWNLOAD / UPLOAD (MBPS)	10M RANGE DOWNLOAD / UPLOAD (MBPS)
ASUS USB-AC68	117	USB	YES	AC1900	821 / 714	421 / 364
D-LINK DWA-582	79	PCIE	YES	AC1200	555 / 548	214 / 186
LINKSYS AC600	65	USB	YES	AC600	321 / 317	104 / 99
NETGEAR A6200	65	USB	YES	AC1200	623 / 600	256 / 221
TP-LINK ARCHERT9E	89	PCIE	YES	AC1900	772 / 709	322 / 331

MEDIA BRIDGE BENCHMARKS NETWORKING ACCESSORIES COMPARISON

	PRICE	SPEC	MAX SPEED	ETHERNET	USB	MODES	1M RANGE DOWNLOAD / UPLOAD (MBPS)	10M RANGE DOWNLOAD / UPLOAD (MBPS)
ASUS EA-AC87	220	AC1800	1,734 MBPS	5	NO	ACCESS POINT	904 / 867	522 / 645
D-LINK DAP1650	120	AC1200	867 MBPS	4	1X2.0	ACCESS POINT, WI-FI EXTENDER	641 / 657	289 / 369
NETGEAR NIGHTHAWK EX7000	230	AC1900	1,300 MBPS	5	1X3.0	ACCESS POINT, WI-FI EXTENDER	879 / 866	412 / 489



BLOCKCHAIN

A
TECHLIFE
PRIMER

Bitcoin was the first digital
currency to use blockchain
technology.

IT'S THE BUZZWORD PROMISING TO DISRUPT EVERYTHING FROM FINANCIAL MARKETS TO THE WAY WE VOTE, BUT WHAT IS A 'BLOCKCHAIN' AND WHAT DOES IT DO?

[DARREN YATES]

OVER THE LAST 20 years, the internet has gone from an office curiosity for sending emails and downloading shareware software to all but running the global economy. In fact, it's become such an economic driver, a recent PricewaterhouseCoopers report estimates that connecting the world's remaining four billion people not yet on the internet could add as much as US\$6.7 trillion to the global economy (tinyurl.com/tla55-economy).

But while the internet has spawned a new globally-connected economy, it's also attracted its fair share of crooks. According to the Australian Cybercrime Online Reporting Network (ACORN), more than \$127 million was reported lost by Australian consumers to online scams in 2015 (tinyurl.com/tla55-scams). Australian businesses don't appear to be faring much better with PricewaterhouseCoopers' recent 2016 Global Economic Crime Survey suggesting Australia has become a hotspot for cybercrime. In the report, 65% of businesses surveyed reported cybercrime over the previous two years, double the global average (tinyurl.com/tla55-crime).

And not even central banks are immune — not after the hacking of the Bangladesh Bank in February netted thieves some US\$81 million through fake inter-bank money transfers. According to reports, the only thing that stopped the crooks from nabbing a massive US\$1 billion haul was the lack of a spell-checker (tinyurl.com/tla55-heist).

But there's a technology that underpins new digital or 'crypto' currencies like Bitcoin that not only has the potential to slash banking costs, it could disrupt much of the financial sector and even revolutionise the way we vote in general elections. It's called 'blockchain' and you'll be hearing more of it in the years to come.

CRYPTOCURRENCY ORIGINS

Cryptocurrencies have enjoyed a high profile in geek circles since the 2009 launch of Bitcoin and dozens of variations since. But while digital currencies can be either deflationary (only a fixed number of coins can be produced, like Bitcoin and Litecoin) or inflationary (no

limits on currency production, like Peercoin and Dogecoin), they all invariably use a unique method of storing the currency's transaction histories.

Transactions between banks typically take place through a central register or clearing house, ensuring that each dollar is accounted for. But the developer(s) of Bitcoin (just who created Bitcoin is up for debate) went the other way — they chose an open system of networked or 'distributed' ledgers or databases called the 'blockchain' to keep track of every Bitcoin transaction. Think something along the lines of 'peer-to-peer networking' and you're on the right track. But what's more, the system's checks and balances, combined with the peer-to-peer decentralisation used to protect the blockchain, ensure that no one person can take control of it — at least in theory. These days, reports are as much as 80% of bitcoin processing activity or 'mining' occurs in four main mining groups or 'pools' in China (tinyurl.com/tla55-bitcoin).

WHAT IS THE BLOCKCHAIN?

Bitcoin explains the blockchain as a 'shared public ledger' that keeps track of and proves

'who owns what' when it comes to bitcoins. Any time a bitcoin is spent, a transaction is created, logging essential details such as the spender, the receiver and the bitcoin amount spent. But to ensure its legitimacy, the transaction itself is digitally encoded with a secret signature called a 'private key', which is kept in the user's Bitcoin wallet, along with their bitcoins. It generally takes ten minutes for the system to confirm a transaction but, once confirmed, it is then added to a 'block'. These blocks are linked chronologically to maintain the system's consistency and integrity, creating a chain of blocks, which becomes the 'blockchain' (bitcoin.org/en/how-it-works).

What makes cryptocurrencies like Bitcoin unique is that anyone can set up and begin processing these transactions to continue the blockchain, a process called Bitcoin 'mining'. You may have heard of geeks setting up banks of computers to 'mine bitcoins' for profit — they're not mining actual currency, but rather, they're processing or confirming these transactions and receiving a fee in bitcoins for their work. In addition, bitcoins can also be obtained through traditional currency

The image shows a screenshot of the Microsoft Azure website. The top navigation bar includes 'Microsoft Azure', 'SALES 1-800-867-1389', 'MY ACCOUNT', 'PORTAL', and a search icon. Below the navigation, there are links for 'Why Azure', 'Solutions', 'Products', 'Documentation', 'Pricing', 'Partners', 'Blog', 'Resources', and 'Support'. A prominent 'FREE ACCOUNT' button is visible on the right. The main content area features a large image of a cityscape with the text 'Blockchain as a Service' and 'Develop, test, and deploy blockchain applications'. A green 'Start free' button is also present. Below this, there is a section titled 'What is blockchain?' with a diagram of a blockchain network (a series of colored blocks connected by lines) and a text box stating 'Blockchain-as-a-service is the latest product offering from Microsoft.' The text explains that blockchain is an emerging way for businesses, industries, and public organizations to almost instantaneously make and verify transactions—streamlining business processes, saving money, and reducing the potential for fraud. It describes a blockchain as a data structure that's used to create a digital transaction ledger that, instead of resting with a single provider, is shared among a distributed network of computers. The result is a more open, transparent, and publicly verifiable system that will fundamentally change the way we think about exchanging value and assets, enforcing contracts, and sharing data across industries. The applications using blockchain are almost limitless, ranging from loans, bonds, and payments to more efficient supply chains to even identity management and verification.

The image shows a diagram of a Bitcoin transaction network on the left, with a Bitcoin website screenshot on the right. The website header says "Bitcoin is an innovative payment network and a new kind of money." Below it, there's a group of people and a Bitcoin icon. Three features are listed: "Fast peer-to-peer transactions", "Worldwide payments", and "Low processing fees".

Blockchain enables everyone to view a Bitcoin transaction.

Anyone can mine bitcoins but it now requires specialised hardware.

followmyvote.com

The image shows a screenshot of the Follow My Vote website. The headline reads "Introducing a secure and transparent online voting solution for the modern age: FOLLOW MY VOTE". Below the headline, there's a "Join Our List Of Supporters!" section with a "Enter Your Email" field, a "Select Country" dropdown, and a "Support Us!" button.

US startup Follow My Vote is trialing blockchain tech for e-voting.



exchange. The other important thing is that the Bitcoin blockchain is accessible to anyone. That's because, once the blockchain is written, the system's cryptographic and peer-to-peer nature means it's all but impossible to change it, making it a permanent record.

WHY BANKS ARE INTERESTED

Governments and financial institutions are mostly lukewarm on the idea of cryptocurrencies, but enthusiasm amongst leading global financial players for blockchain

technology appears to be spreading at bushfire-speed.

While early reports suggest blockchain is separating the top-tier institutions from the smaller players, the technology is seen as a way of slashing the cost and time of clearing inter-bank transactions, as well as creating a more secure system. At the moment, the situation seems to mirror many previous new technology arrivals, with stakeholders scrambling to form new alliances to commercialise blockchain technology (think 'VHS vs Beta' of the mid-

1980s). The most significant of these alliances so far from an Australian perspective is the R3 consortium (r3cev.com), which includes three of Australia's 'big four' local banks — Westpac, Commonwealth and NAB — as well as more than 40 other banks and financial institutions around the world.

Testing of the technology is well underway, with the Commonwealth Bank and 10 other global banks setting up a blockchain trading simulation in January 2016 with Microsoft's Azure enterprise cloud-storage playing host (tinyurl.com/tla55-commbank). That was followed in March by a much larger trial involving R3 members testing a range of blockchain technology providers including IBM, Intel and Ethereum (tinyurl.com/tla55-trial). And to give you an idea of just how fast things are moving, the R3 group decided the following month that it was ready to jump aboard the Microsoft bandwagon and ink a deal that will likely cement the software giant as a leading player in blockchain services.

EVERYTHING AS A SERVICE

Blockchain competition amongst the tech giants is growing rapidly. The days of making squillions from selling computer hardware to corporations are fading fast — these days, the big money comes from selling products as services, thanks mostly to distributed or 'cloud' computing. You may have already heard of 'software as a service' (SaaS), such as your Office 365 online subscription. But there's also 'infrastructure as a service' (IaaS), where tech companies supply virtual hardware over the internet and care for enterprise-scale servers running many corporations.

But showing that you can seemingly make almost anything a service, Microsoft is now selling 'blockchain as a service' (BaaS), offering to play host to blockchain ledgers not just for banking but for "businesses, industries and public organisations". IBM and Amazon are also revving up their cloud computing reserves to deliver blockchain services. Meanwhile, chip giant Intel has announced its own distributed ledger technology codenamed 'Sawtooth Lake' in support of the Linux Foundation's HyperLedger Project (tinyurl.com/tla55-intel), of which, Australia's ANZ Bank is a member.

POTENTIAL JOB LOSSES

But even before blockchain technology has clocked on for its first shift, there is talk that the rise in new financial technology or 'fintech' could lead to significant job losses within the financial services sector. A report from Citigroup released at the end of March this year forecasts as many as 1.7 million jobs could be lost to disruptive technology changes within the industry in the US and Europe over the next 10 years — equating to 30% of the current industry workforce. Report author Ronit Ghose is quoted as saying that "the biggest take out [of jobs] will

happen in countries that have been through a crisis or are tech savvy". Those job losses are expected to come from the continued move from face-to-face to online banking, as well as implementing cost-cutting technology such as blockchain (tinyurl.com/zkwjwrv). At time of writing, no-one had put a number on the potential job losses in Australia, although it would be unrealistic to think the local industry will be immune.

OVER-HYPED?

According to market analyst Gartner, cryptocurrencies in general remain high on its 2015 Hype Cycle for Emerging Technologies. CEO of financial services firm JP Morgan, Jamie Dimon, reportedly believes cryptocurrencies like Bitcoin will struggle in the face of government controls (tinyurl.com/tla55-jpmorg). What's more, not everyone shares the view that blockchain will set the world alight. While many, Dimon included, acknowledge the potential of blockchain tech, others question the role it will play in the financial industry. The European Central Bank published a paper in April this year on 'distributed ledger technology' (tinyurl.com/zog95du, PDF), concluding that, while blockchain has potential, questions over whether it can make the leap to mainstream financial markets mean "it is more likely to cause a gradual change in processes, rather than a revolution in the market".

ELECTRONIC VOTING

But it's not just financial sector feeling the blockchain blowtorch — it's even being touted as a solution for e-voting. The recent closely-fought federal election in Australia saw many call for the introduction of electronic voting. The expectation is that e-voting will speed up vote-counting and the declaration of seat winners, but also reduce waiting times for voters at the polls. Not only has Prime Minister Malcolm Turnbull thrown his support behind it, so too have academics, including director of the University of Western Australia Centre for Software Practice, Dr. David Glance.

However, within government circles, e-voting has generally been considered fraught with complications, not least of these being privacy and security. Various Australian Government inquiries have looked at electronic voting since 2000, when a small delegation from the Australian Electoral Commission (AEC) headed to the US to witness e-voting during the then US presidential election. The following year, the AEC itself produced a report into e-voting, noting the major advantages, including instantaneous calculating of results and the ability for any voter to vote anywhere in the country. But it also outlined the disadvantages, from cost of computer hardware needed at each polling station to the lack of a paper trail of ballots, potentially raising "unacceptable risks" (www.aec.gov.au/voting/report.htm).

More recently, the second interim report of the parliamentary inquiry into the conduct of the 2013 federal election investigated options for e-voting. It noted the main concerns were the security, integrity and transparency of the system, along with cost and the system's ability to maintain vote secrecy and engender voter confidence (tinyurl.com/tla55-report). The final report of the 2013 election concluded in its introduction that "to introduce large-scale electronic voting in the near future would dangerously compromise federal electoral integrity" (tinyurl.com/tla55-2013).

Read online forums and you'll find responses to the idea of e-voting range from enthusiasm to acceptance, caution to suspicion. As some argue, the fact that we still scrawl markings on sheets of paper makes our voting system robust and much more difficult to hack, as multiple scrutineers check the counting of each vote. In the end, it might be slow and labourious, but it's considered accurate and trustworthy.

AUSSIE START-UPS

However, blockchain transactions are considered extremely difficult to hack, they remain forever and can be viewed by anyone, which means blockchain could solve the problem of waiting for weeks for an election outcome.

Perth-based veri.vote (veri.vote) is one Australian start-up in the race against teams from the US to deliver e-voting technology based on blockchain storage. According to its website, veri.vote is aiming for a system that is efficient in resources, secured through blockchain technology, completely anonymous and uses open-source software and protocols to allow anyone to view an election result.

Still, there are many questions that remain unanswered about how e-voting would work in practice, from vote-taking to vote-counting to vote verification processes that ensure computers don't muck things up. Then there's protecting voter anonymity, something enshrined in Australian electoral laws. We suspect it'll take a bit more than just someone from the AEC or government of the day coming out and saying that e-voting is perfectly anonymous to convince voters. Acceptance may even come down along generational lines, with younger 'digital-native' voters possibly more likely to accept e-voting than older voters.

SECURING THE FUTURE?

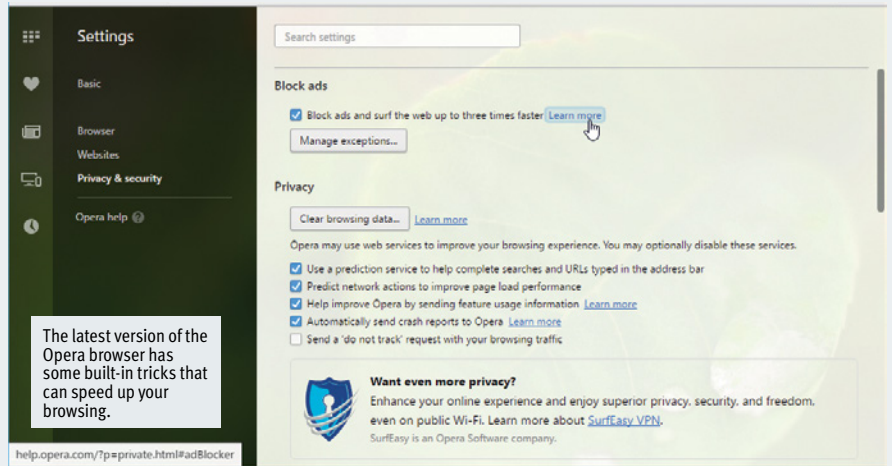
Blockchain is viewed as having real potential for solving some of the internet's greatest security and privacy concerns — from financial transactions to electronic voting. But it's very early days, and while testing is progressing, blockchain still has a long way to go before its running global banking and democratic elections. That's reason enough for us to keep a lid on expectations for a little while yet. ■

HELP STATION

GET THE MOST FROM YOUR TECH

[THIS MONTH IN HELP STATION]

- 84 **Q&A**
YOUR QUESTIONS ANSWERED
- 86 **Windows**
CLEAR UP DISK SPACE IN WINDOWS
- 88 **Mac**
GIVE YOUR MAC A HEALTH CHECK
- 90 **Android**
ANDROID SECRETS, TIPS AND SHORTCUTS
- 92 **iOS**
MANAGE YOUR ICLOUD DRIVE ON IOS AND MAC
- 94 **Downloads & streaming**
TECHLIFE'S ESSENTIAL CHROMECAST APPS
- 96 **Security & privacy**
USING GOOGLE AUTHENTICATOR
- 98 **Photography**
TACKLING THROUGH-THE-LENS FLASHES
- 102 **Home AV**
BUILD YOUR OWN PROJECTOR SCREEN
- 106 **Smarthome**
GETTING STARTED WITH ENERGY MONITORING



[INTERNET]
Speed up a sluggish connection

I recently moved to a rural area and constantly have to deal with very poor browsing speeds. Is there any way to boost my connection?
[IAN PARKER]

Nick Odantzis replies: There is, and it won't cost you a penny. The Opera browser (www.opera.com) has a couple of built-in tools you can use to ensure your browsing is as fast and efficient as possible. Once you've got it installed, follow these steps.

1. Click the Menu button and select 'Opera Turbo' — this setting ensures any web pages you request are first sent to Opera's own servers where they're compressed. These smaller pages are then sent to your PC where they load quicker.
2. Opera also features ad-blocking technology to speed up page loading by leaving out

potentially bandwidth-sapping adverts. You should be prompted to switch it on, or you can do so via 'Menu > Settings > Privacy and Security'.

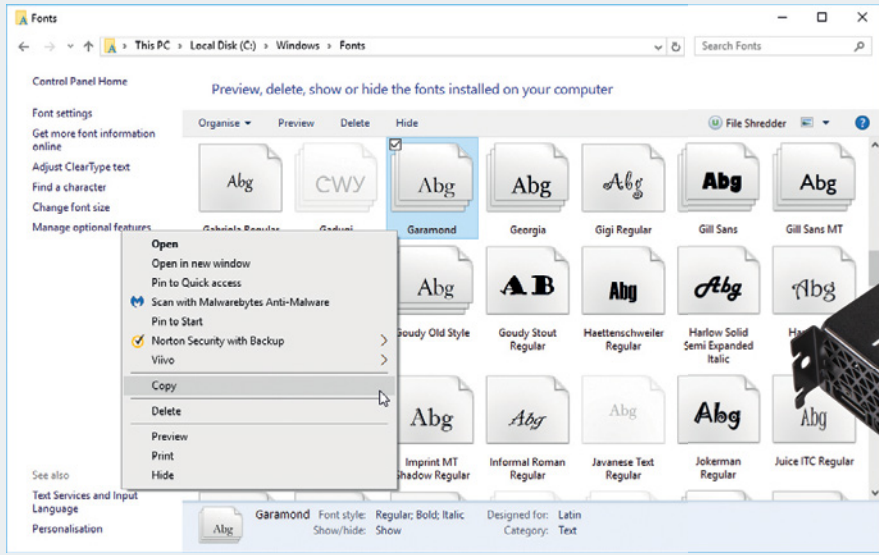
3. Many content-driven sites depend on the income from ads to survive. After visiting a site, click the blue shield icon in the Address Bar to review how many ads are blocked — click the 'Speed Test' link to see how much time is saved.

4. If the site loads quickly even with ads, we recommend you whitelist it — this means ads will only load on that site in future. It ensures the site receives much-needed revenue, while penalising those sites that are plagued with slow-loading adverts.

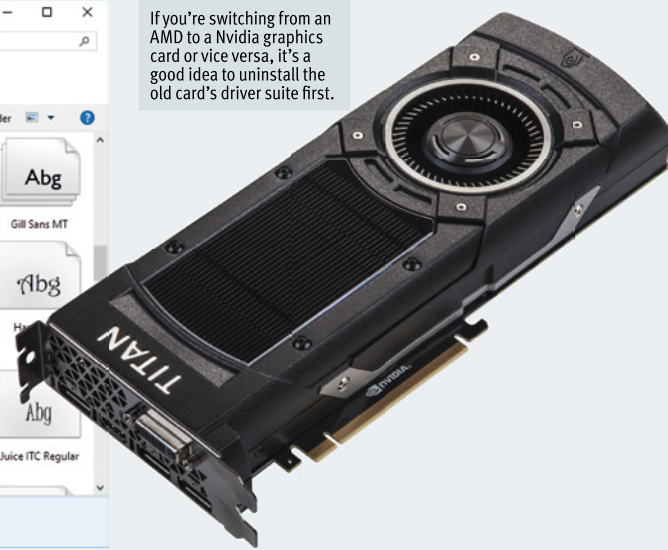
[WINDOWS]
Where'd that font go?

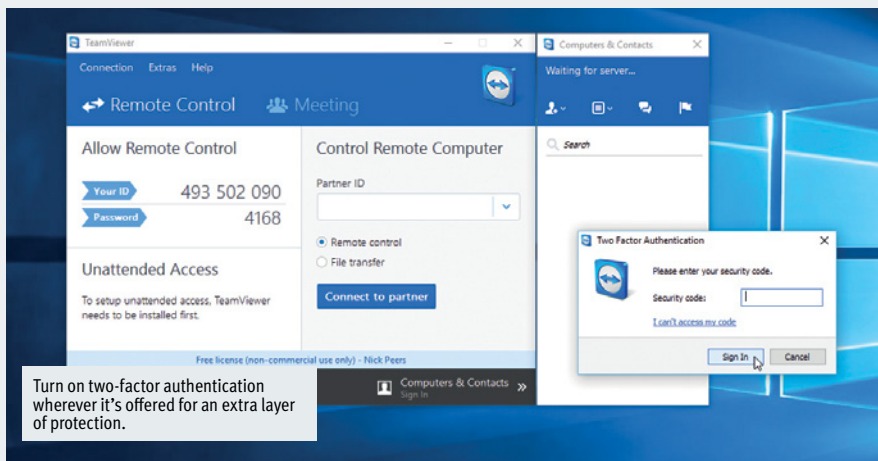
I recently upgraded my HP Pavilion dv6 laptop to Windows 10, but now the cordless Logitech V470 mouse I use has stopped working with it, despite attempts to remove and reinstall the software. I've also lost the Garamond

New fonts should be copied to a Windows PC's Fonts folder.



If you're switching from an AMD to a Nvidia graphics card or vice versa, it's a good idea to uninstall the old card's driver suite first.





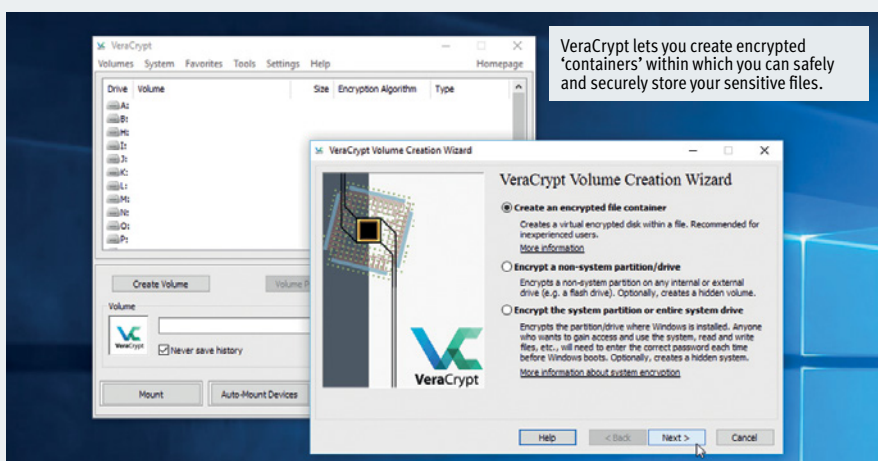
remote control apps altogether. TeamViewer has tightened security, but the most effective way to block these kinds of attacks is to switch on two-factor authentication. Doing so means your mobile must be physically present whenever you log on to TeamViewer, helping keep hackers at bay.

[WINDOWS]
Windows Update query

When Windows Update schedules a reboot, what happens when it reaches that point? I know it logs me out and reboots, but does it return to where I left off? And will it update my PC if the computer happens to be asleep when that scheduled point is reached?

[STU ROBERTSON]

Cat Ellis replies: No, when Windows logs out, reboots and updates, it'll return you to the login screen. When you next log in, any programs you had running will have been shut down, so it's just like loading Windows from scratch. Another thing to beware is if you had any open documents they'll have been closed and unsaved changes lost. If your PC is asleep when the scheduled moment arrives, then Windows will wake it to perform the update in the same way — again, don't put it to sleep without saving or closing documents first.



font I was using with WordPerfect when the laptop was still running Windows 7. Can these be fixed?

[JOHN ELLINGHOUSE]

Nick Peers replies: Sadly, a trip to Logitech's website reveals the V470 mouse hasn't been passed as Windows 10-compatible, even though it works with Windows 8. It might be worth contacting Logitech to see if it has any plans to support Windows 10, but we doubt it. The Garamond font isn't supplied with Windows or WordPerfect, so we presume it was removed when John upgraded. It's shipped with Office, which John had installed on his desktop PC — he browsed to C:\Windows\Fonts where the Garamond entry was present. Right-clicking this and choosing 'Copy', then pasting it to a USB thumb drive meant he could transfer the three copied files (GARA.TTF, GARABD.TTF and GARAIT.TTF) to the C:\Windows\Fonts folder on his laptop.

Cat Ellis replies: We suspected that Gail may have swapped between NVIDIA and AMD graphics cards or vice versa without first uninstalling the old card. Sure enough, she revealed that the error message mentioned 'Catalyst Control Centre', a reference to the AMD driver software. Gail located and removed this from her PC and the error messages ceased. Always uninstall your old graphics driver before shutting down and replacing the card — even if it's the same manufacturer. Windows will automatically detect the new card and install the correct drivers for it.

[SECURITY]
Is TeamViewer safe?

With the recent reports that TeamViewer has been compromised, does this mean we should no longer use it for remote control purposes? If not, what alternatives are there?

[SAUL COOK]

Nick Peers replies: There's probable truth in TeamViewer's claim that those who reuse weak passwords from other sites made it easier for hijackers to get a foothold on some systems. It's entirely possible that, if you allow others to remotely control your PC, their lack of security could have put you at risk. Switching to another remote control app like Ammyy Admin (www.ammyy.com) doesn't reduce this vulnerability, so the only practical alternative is to stop using

[HARDWARE]
Constant reboot after upgrade

I replaced the monitor for my PC and transferred a more powerful graphics card into it from another computer I'd upgraded. However, since doing so, the PC annoyingly keeps rebooting every couple of minutes. Why is it doing this?! Hoping you can help?

[GAIL ROSE]

[SECURITY]
Extra cloud encryption

I'd like to add another layer of encryption to my cloud storage account, but only for selected folders. What's the best way to do this?

[JOHN DERBY]

Matt Hanson replies: You could set up an encrypted container using VeraCrypt (get it from veracrypt.codeplex.com) inside which your most sensitive folders are stored. Keep a local, unencrypted copy of your files — just in case.

1. To start, open up VeraCrypt and then go to 'Create Volume > Create an encrypted file container > Standard VeraCrypt volume'. Click 'Select File...' to choose a location within your cloud storage folder, and give it a suitable filename.

2. Using the default encryption options should be fine, so click 'Next'. Set a suitable volume size large enough to contain all the files and folders you plan to store in here, then set your security (password, plus an option for a key file).

3. Now we need to format the container. Choose a file type (FAT is the default, consider NTFS), then wiggle your mouse until the bar turns green. Click 'Format', followed by 'Yes' and 'OK' when prompted. Click 'Exit', then choose 'Select File...' to load your container.

4. Now select a drive letter and click 'Mount' (or 'Auto-mount Devices' to mount on startup). Supply the password and — if applicable — key file and click 'Mount'. Once done, move sensitive files into the container for additional security.

[WINDOWS]

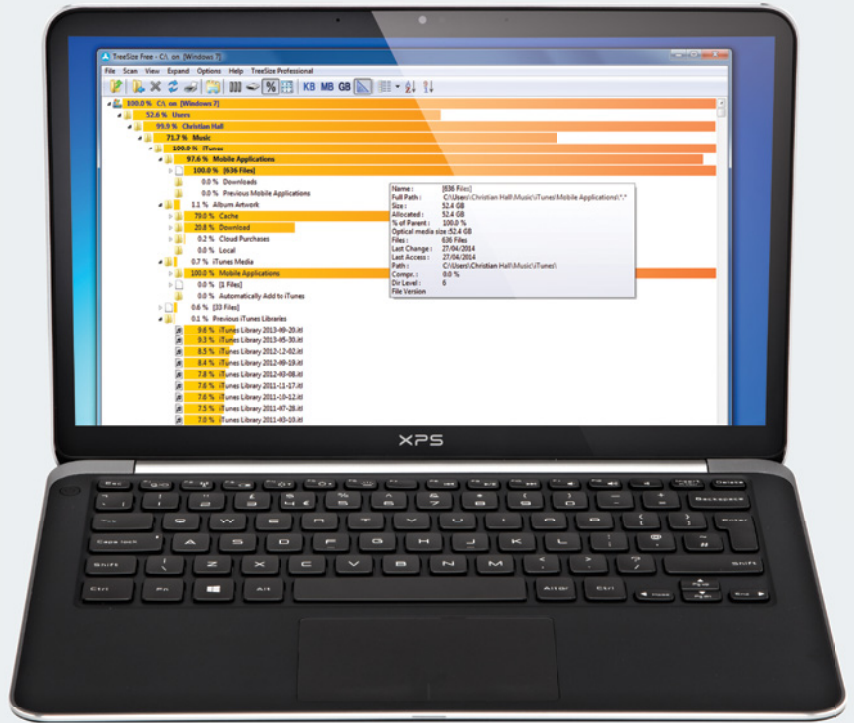
Clear up disk space in Windows

WINDOWS ISN'T GREAT AT SHOWING YOU HOW THINGS ARE ORGANISED ON YOUR HARD DRIVE, SO MAKE TREESIZE YOUR FIRST PORT OF CALL IF YOU'RE STRUGGLING FOR SPACE.

[CHRISTIAN HALL]

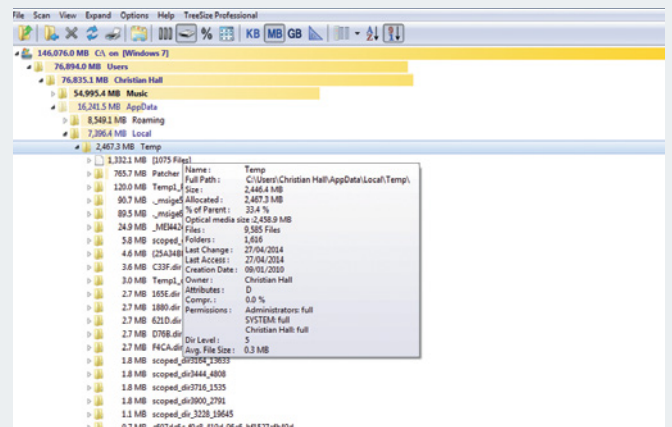
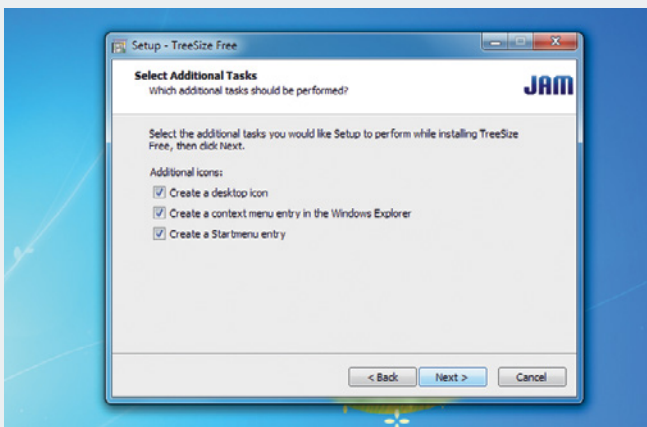
STORAGE HAS NEVER been cheaper, but instead of splashing out on an extra hard drive when you need more room, you could just find out what's hogging space on your computer. TreeSize Free is a fantastic tool for finding out what's really going on with files on your PC. You can download it for free from www.jam-software.com/treesize_free.

TreeSize Free can be started from the context menu of a folder or drive, and it shows you the size of that folder and its subfolders. Folders taking up lots of space can be identified at a glance, thanks to a subtle gradient bar. Scan results can be drilled down to file level, and filters can be applied for certain file types. It's easy to switch between levels and views for size, allocated space, file count, compression rate, sorting and more. You'll soon know exactly what's taking up space on your PC, including anything that's using more than its fair share.



[STEP BY STEP]

EASILY ANALYSE YOUR HARD DRIVE'S CONTENTS



01

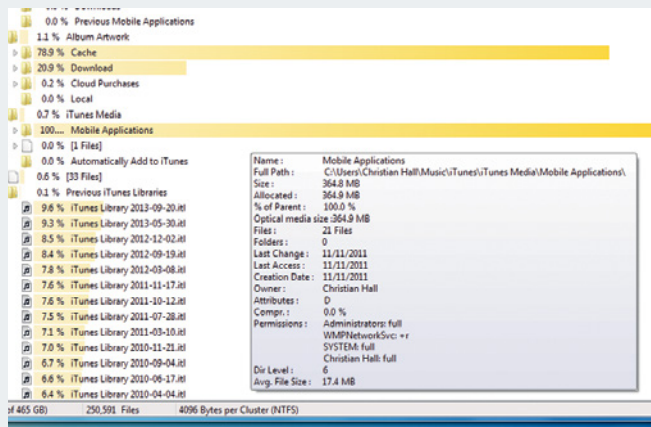
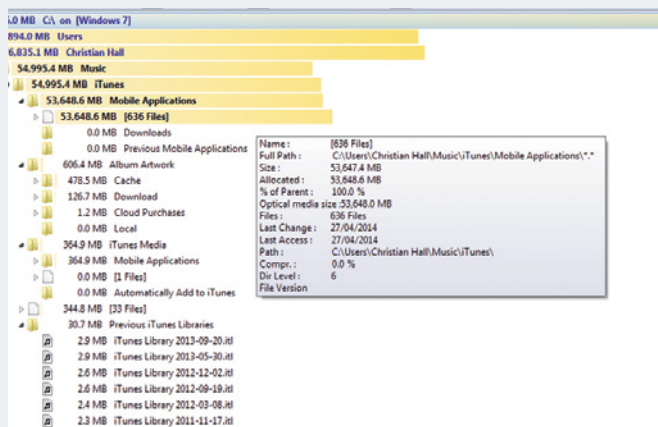
SELECT ADDITIONAL TASKS

As you run the installer, you'll be taken through the usual wizard asking you to install features, including a context menu link. You might be used to unchecking these because you find them annoying, but TreeSize is most useful when you have this feature, so keep it! When TreeSize opens, you'll see it start to analyse your hard disk, just like Disk Defragmenter does.

02

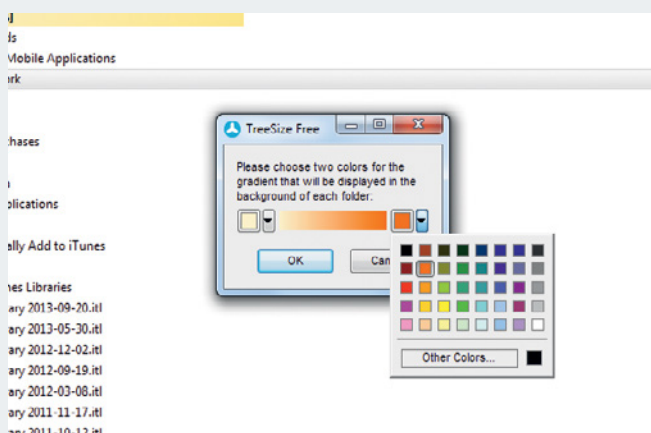
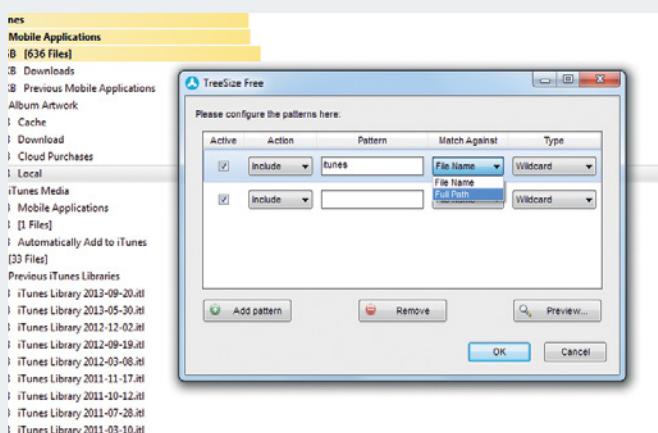
VOLUME OVERVIEW

The menu bar provides a lot of shortcuts that you can use to customise your scans. A graphical overview of the scanned drive or folder is shown behind the directory tree. The arrows in front of each subfolder can be used to expand this view and look into the subfolder's contents. Hover over a file's path to see a more detailed view in the grey box.



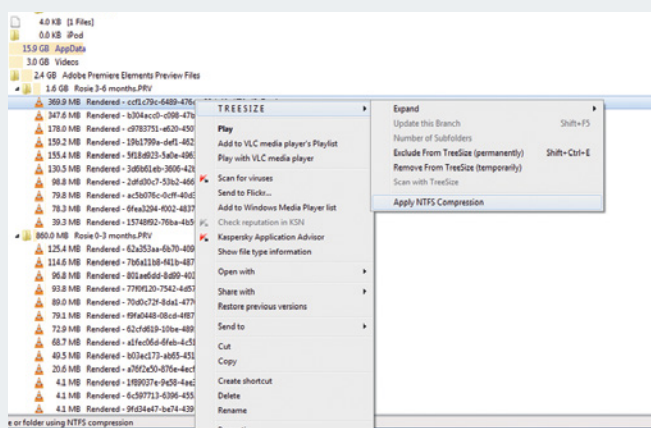
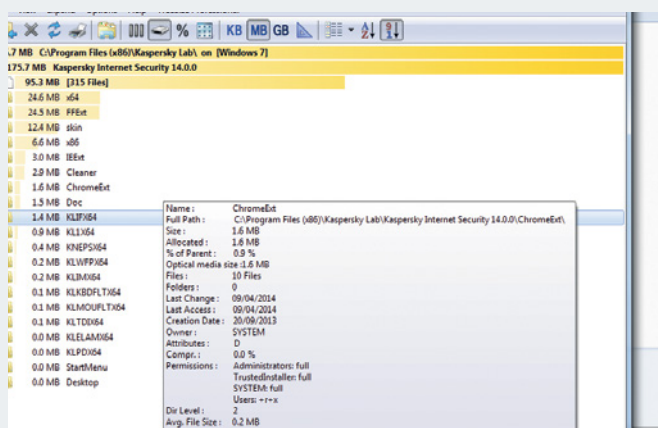
03 EXPAND LEVELS
Choose 'Expand' on the menu bar, then select a level to expand or collapse the directory tree accordingly. You can also use the 'Full expand' option to see any folder that is available in the current scan of your drive. You should re-scan every time there are changes to files and folders, or if you want to change which drive you are currently analysing.

04 CHANGE DRIVE VISUALISATION
On the menu bar, you can change how you visualise the data. Your options include 'Disk size', 'Allocated space', 'Percentage' and 'File count'. The advantage of switching to 'Percentage' is that you'll suddenly see a lot more coloured bars, which can make wading through the directory tree a little easier. You'll need to use 'Disk size' or 'Allocated space' to identify file or folder sizes.



05 FILTERING OPTIONS
You'll see thousands of directories because TreeSize is visualising your whole drive. If you want to exclude programs from scans — perhaps because you're already aware of how much space is being taken up by them — go to 'Options > Filter'. Now enter a term under 'Pattern' and choose some parameters to check against. Add more exclusions with the 'Add pattern' button.

06 COLOUR GRADIENT
If the graphical overview colour isn't to your liking, you can choose a new shade. You can also select the blend so instead of the default white-to-yellow, you can make it orange-to-red, for example. Go to 'Options > Choose gradient' and select the two colours you'd like to use as the visualisation blend. You'll be given a few options, but you can define your own under 'Other colors'.



07 ANALYSE FROM WINDOWS
If you kept the option when installing, you should have a right-click context menu entry for TreeSize scans. This means you can browse to any file or folder in Windows, right-click on it and find out exactly how much space that item is taking up on your hard drive. Essentially, you get the same interface as you would if you were launching TreeSize normally.

08 APPLY COMPRESSION
Numerous options are available under the right-click menu. For example, if you choose 'Apply NTFS Compression', then that file's directory will be compressed, which is ideal for saving space when you're dealing with bloated folders. Use this method on the worst offenders and you could easily save hundreds of megabytes of space on your hard drive.

[MAC]

Give your Mac a health check

QUICKLY TEST YOUR HARDWARE AND DIAGNOSE ERRORS WITH MACCHECK.

[HOWARD OAKLEY]

WHENEVER AN APP quits unexpectedly or your Mac restarts after freezing, you would probably like to run a quick check to reassure yourself that there's nothing more serious wrong with it. You could restart and run Apple Diagnostics or start up OS X Recovery to run Disk Utility's First Aid feature, but by then, it'll be lunchtime and you'll have got nothing else done.

These are ideal situations to run a quick and lightweight check, so that you can get back on with what you were doing with the minimum of fuss. To this end, it's time for MacCheck from micromat.com — when you first open this app, it'll ask you to register for a free serial number; there's no price attached.

MacCheck is much like a health screening for your computer. It performs a quick run through the most important indicators of

significant problems with a Mac's hardware. It checks the results of the last power-on self-test (POST), memory and several kinds of storage error, as well as the battery on portable Macs.

If you get a set of green lights at the end of the tests, you can be happy that, whatever it was that happened, your Mac remains in fine fettle. If any test returns a red light, you need a strategy and the tools to follow it up.

Most errors found during the power-on self-test are likely to be with memory, and should have attracted your attention at that time as you would have experienced problems during your most recent startup. Battery problems tend to be straightforward, and are typically fixed by replacing the failing battery.

DEAL WITH THE PROGNOSIS

MacCheck only tests internal drives, so it won't recognise an external RAID drive even if it was set up using OS X's software-based RAID tech. Drives with a hardware-based RAID controller normally have their own maintenance tools to check and report their status. Use Disk Utility to check software-based RAID drives.

If you suspect a hardware fault, Apple Diagnostics (tinyurl.com/tla55-apple) is the ultimate check. Power on your Mac and hold 'D' until it appears. (If you have trouble with this, use the Recovery system to remove any firmware password you've set, or try a wired keyboard and mouse.) You may get a choice of regular or extended checks; in the first instance, pick the former. Note any error code to quote to AppleCare or a Genius Bar.

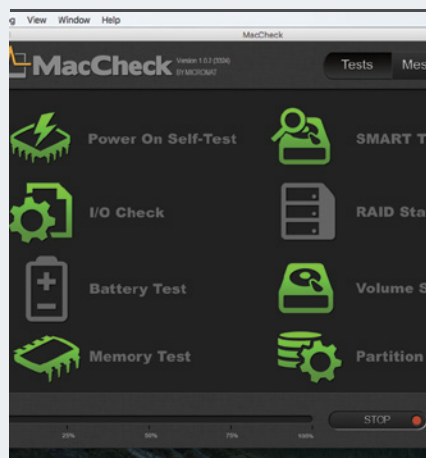
AFTER A CRASH OR FREEZE,
TWO MINUTES WITH
MACCHECK SCREENS FOR
PROBLEMS YOU NEED TO FIX.

[STEP BY STEP]

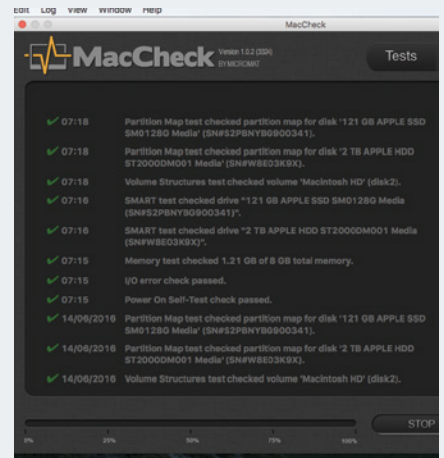
TEST YOUR COMPUTER WITH MACCHECK



01 START THE TESTS
MacCheck inspects your computer and works out what tests it can perform. There are no options to choose from, and the app always runs all the tests that it can on the hardware you're asking it to check. Simply click the Start button.

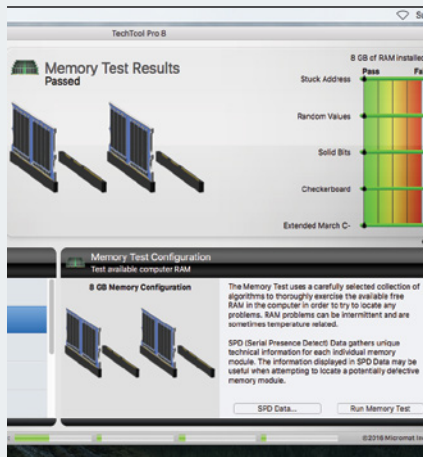
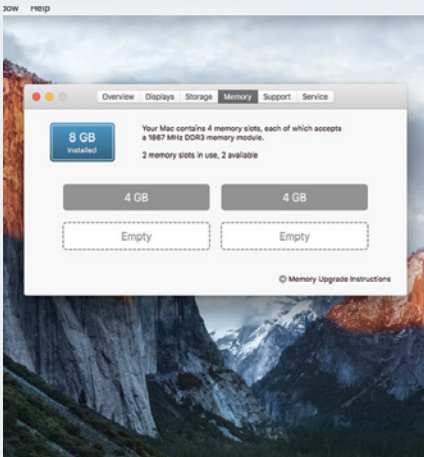


02 SEE THE RESULT
As the app works through its tests, each one's icon changes from amber to green or red, showing whether your Mac passed or failed that item. The Volume Structures test invariably takes longest, according to the drive's capacity.



03 BROWSE MACCHECK'S LOG
If you get any red lights, click on the Log button at the top right to inspect MacCheck's testing log. This should give you a good idea as to what to do next, so you can further diagnose and fix any problems the app detected.

[STEP BY STEP]
INVESTIGATE MEMORY FAULTS

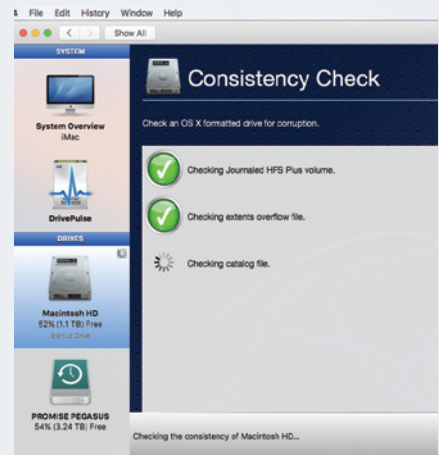
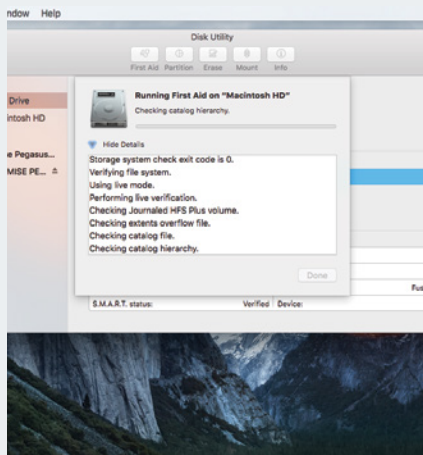
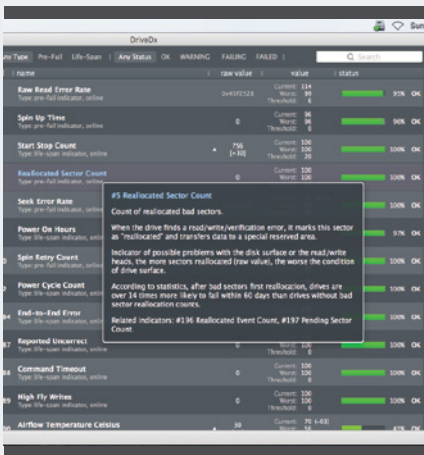


01 CHECK INSTALLED MEMORY
Memory errors can cause MacCheck's power-on self-test or memory test to fail. If either comes up red, choose 'Apple > About This Mac' and then click the Memory tab to check what memory is installed and successfully detected by your Mac.

02 SCAN YOUR MEMORY
MacCheck runs one test on a sample of memory, typically around 1–2GB out of 8GB. Paid-for apps like TechTool Pro (about \$130, micromat.com) can test more intensively, and help pinpoint the fault so you can replace any faulty modules.

03 RUN A SPECIALIST CHECKER
Specialised memory testing tools like ATOMIC (about \$80, micromat.com) can be used to test even more memory, and can run tests for half an hour or more as a stress test. This can help bring troublesome intermittent faults to light.

[STEP BY STEP]
INVESTIGATE DISK ERRORS



01 RUN SMART DIAGNOSTICS
Some SMART diagnostic indicators are better predictors of disk failure than others. Use a specialist tool such as DriveDx (about \$26, binaryfruit.com) to investigate a SMART error, and its tips will advise appropriate action.

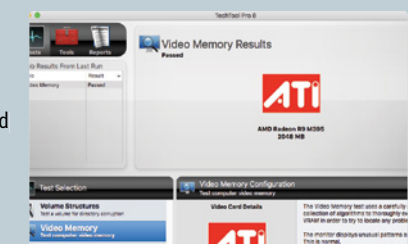
02 DISK UTILITY'S FIRST AID
Input/output and disk errors are best repaired using Disk Utility from the Recovery system (hold Command-R at the startup sound). Select the drive rather than volume on it, so it can check and repair low-level disk structures too.

03 TRY SPECIALIST REPAIR
If Disk Utility can't fix your drive, use a specialist tool such as Drive Genius (about \$130, prosofteng.com). If damage is substantial, try to make at least one backup, then initialise the disk using Disk Utility. If old, consider replacing the drive.

BEYOND MACCHECK

Some things take longer to test.

Two things MacCheck doesn't test, for speed and simplicity, are external drives and graphics cards. Checking and repairing external hard drives is best done using Disk Utility. Macs don't normally monitor the SMART status of USB drives, but should over Thunderbolt. Graphics processors are tougher; TechTool Pro tests their memory, but Apple Diagnostics can miss serious faults. After storage, they are among the components most likely to fail. If you still suspect you have a problem, a Genius Bar or Authorised Service Provider is your best bet for help. ■



[ANDROID]

Android secrets, tips and shortcuts

THE BEST TRICKS AND FEATURES YOU SHOULD KNOW.

[LINDSAY HANDMER]

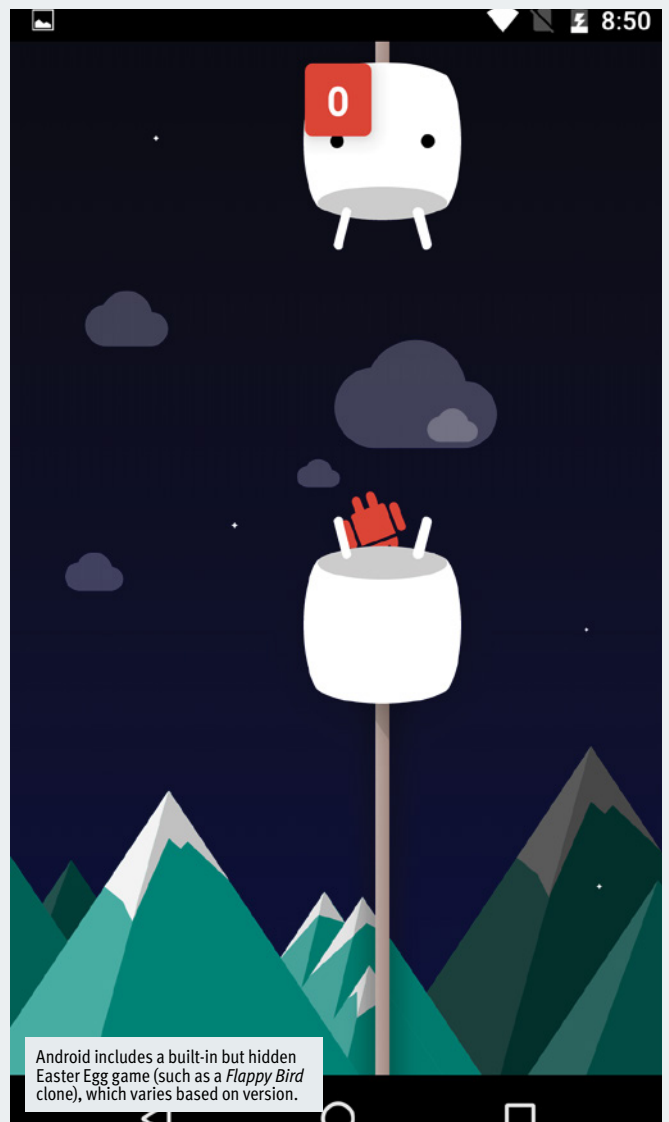
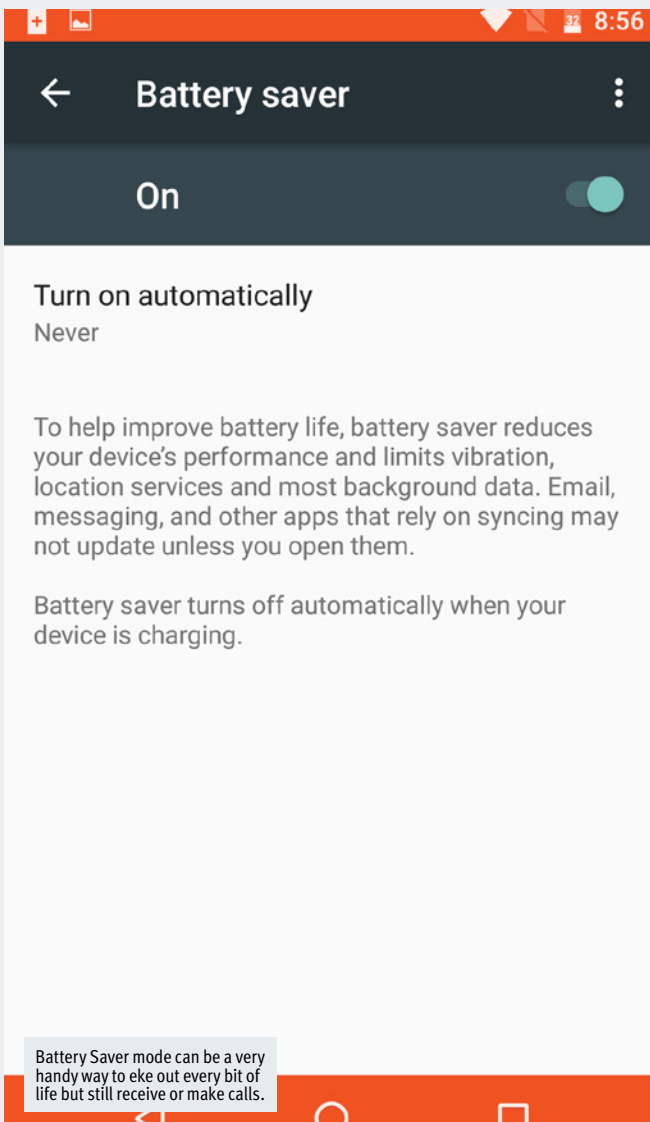
EVERY NEW VERSION of Android brings new features and tricks that can help you get the most out of the operating system. Some we can't not live without, others are just good to know, while a few will blow your mind. This guide is based around Marshmallow (6.0), but many tricks work in older versions too. Depending on the phone, some menu options may differ. If in doubt, use the Search option in settings to quickly find what you need. Android has loads of hidden functionality activated by touching and holding a button, so give it a try and see what you can find.

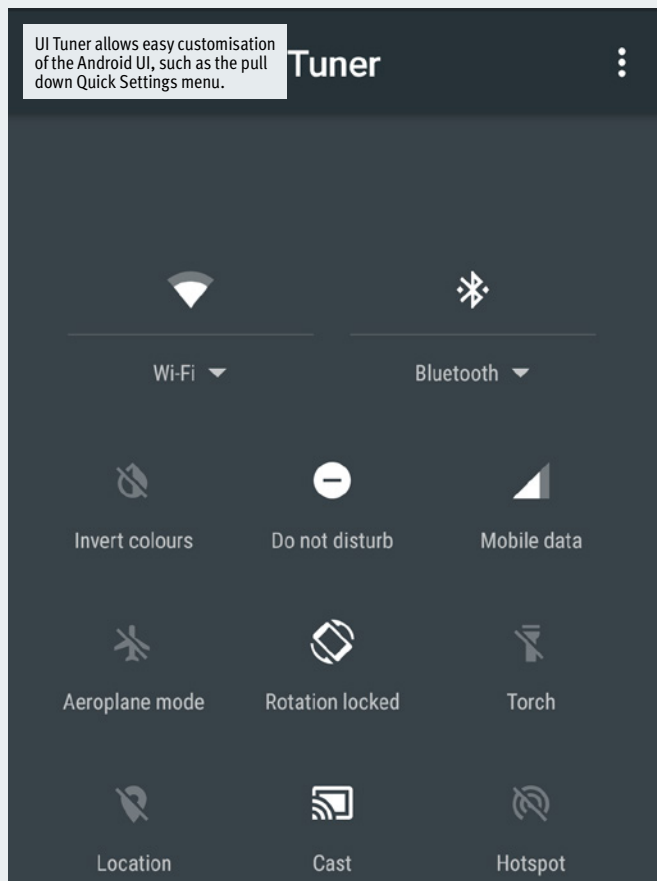
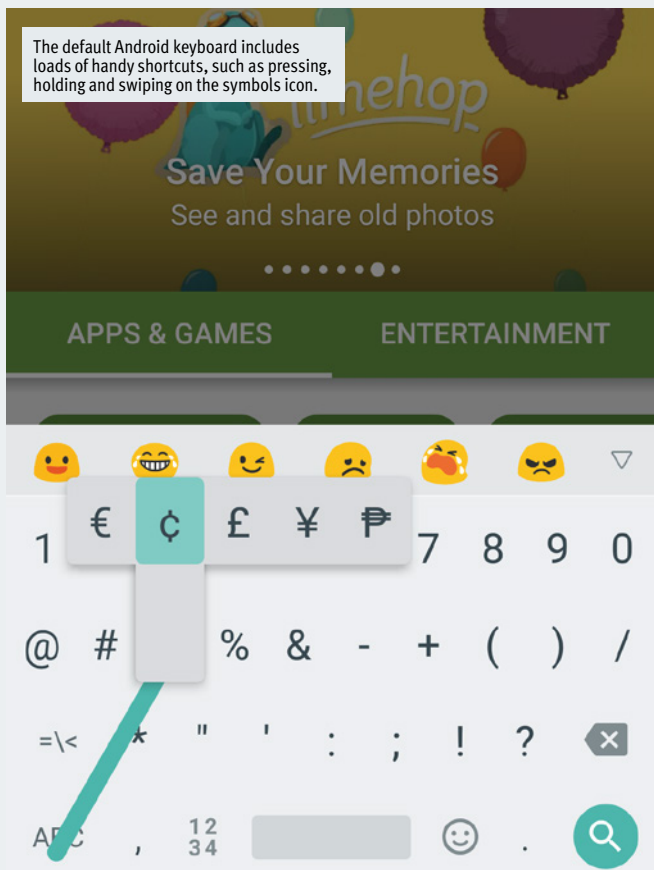
KEYBOARD SHORTCUTS

Considering that a huge amount of smartphone use involves a keyboard, knowing the ins and outs can save time and frustration. These tips are aimed at the latest default Android keyboard.

To make editing a sentence or word a whole lot easier, swiping left or right on the keyboard space bar moves the cursor. In the same vein, touching and holding the delete key, then swiping left (without removing your finger) allows quick selection of one or more entire words to delete. Touching and holding the top

row of letters brings up alternate options, including numbers. This also works on other keys, such as the period, which brings up other punctuation options. Touching and holding on the comma brings up quick link to the settings and languages, as well as an option to shrink the keyboard for one-handed typing on larger phones. Touching and holding the symbols icon (bottom left), then dragging to the chosen symbol before releasing makes the selection then automatically revert back to the main keyboard.





Pressing and holding the shift key turns caps lock on until it's touched again. Touching the shift key, then swiping across to a letter and releasing types it as a capital. Touch and hold a word to highlight it, and hit the shift key once to capitalise it, and twice to turn it to all caps.

PHYSICAL BUTTONS

Hardware buttons on an Android phone can do more than the basic volume control or switching your device on and off — though it varies for non-stock Android models. A quick double press on the power button launches the camera, even if the phone is locked or you are in another app. The volume buttons also snap a picture once the app is open.

In Marshmallow, holding down the volume down key turns the phone to 'vibrate only' mode. Doing it again activates 'do not disturb' mode, while the up button does the reverse. In Android 4.0 or higher, holding the power button and volume down button takes a screenshot. A long hold on the power button brings up options such as shutdown, restart, aeroplane mode and sound adjustments.

APPS AND GOOGLE NOW

Finding apps in the app tray is easy with a search, but there is also a simple way to increase the effectiveness of the scroll. Touch and hold the scroll bar itself (rather than swiping the entire screen), to get an alphabet scroll readout that makes it very fast

to find the app you are looking for. Another app tray shortcut is touching and holding an app icon (as if you are going to place it on a home screen), then sliding it up to the app info text and releasing. This takes you directly into the settings for the particular app, such as adjusting permissions. A little more common knowledge, touching and holding the home button at any time opens up Google Now, with lots of helpful info and shortcuts based on whatever app or website was open. For those who prefer voice search, the "OK Google" activation phrase can be set to work at all times, not just when the icon is pressed. Open up Google Now, and touch the menu tab (three horizontal lines, top left), then tap 'Settings > Voice', 'OK Google' detection, then select 'From any screen'.

UNDER THE HOOD

Android Marshmallow comes with a built-in file explorer — find it by heading to 'Settings > Storage & USB', then 'Explore'. The hidden System UI Tuner is a great way to tweak the layout and usability of the Android. Turn it on by opening the Quick Settings menu and holding the settings cog icon for five seconds, then release. Now navigate to Settings, and select 'UI Tuner' right down the bottom. There are various options, such as creating a custom Quick Settings menu, or adding and removing icons from the status bar. Under 'UI Tuner', it's also possible to replace that hard-to-read battery gauge with numbers showing remaining

percentage of charge. Another super handy feature for when you're running low on juice is the Battery saver option (Settings > Battery > Menu > Battery saver), which disables almost everything aside from calls and messages until you exit it, or charge the device.

REMOTE MANAGEMENT

Logging into your account at www.google.com/android/devicemanager lets you remotely locate, lock, ring and erase any phones connected to your account. For those with the same account signed into Chrome, simply typing "where is my phone" (or similar), locates it. Typing other commands into Google (with a signed-in Chrome account) also work. Typing "remind me" allows Google Now reminders to be set based on a time or a place, such as, "Remind me to buy coffee when I am at Coles Lane Cove" or "Remind me to call Mum tomorrow at 7pm".

EASTER EGG

Just for fun, Google has been including a hidden game of sorts in Android for years. Head to 'Settings > About phone', then repeatedly tap the Android version number until a logo appears. Tap it once and a sweet treat will appear, then touch and hold to fire up the game. Depending on what version of Android you run, the treat will vary (Marshmallow, Lollipop, KitKat, Jelly Bean) as will the game. Android 5.0 and 6.0 get a *Flappy Bird* clone, while 4.0 has a tile game. ■

[iOS]

Manage your iCloud Drive on iOS and Mac

WORK WITH FILES ON OS X AND iOS, AND EVEN RECOVER WHAT YOU'VE DELETED

[KENNY HEMPHILL]

APPLE'S RELATIONSHIP WITH online storage and syncing tools hasn't always been a good one. From iTools through to MobileMe, it made one misstep after another. Even when it first introduced iCloud, there was no easy way to use the service as cloud storage like you would Dropbox or OneDrive, for example.

That changed with the introduction of iCloud Drive. It's integrated into OS X's Finder, making it simple to add files to and retrieve them from your online storage. The iCloud Drive app added in iOS 9 (see below) allows for file management on your iPhone or iPad.

When it comes to working with your files, there's a handful of tips and tricks that are worth knowing. Moving them to iCloud Drive on your Mac is easy — drag and drop them onto its row in Finder's sidebar, or click that

row and then drag and drop items onto a folder within.

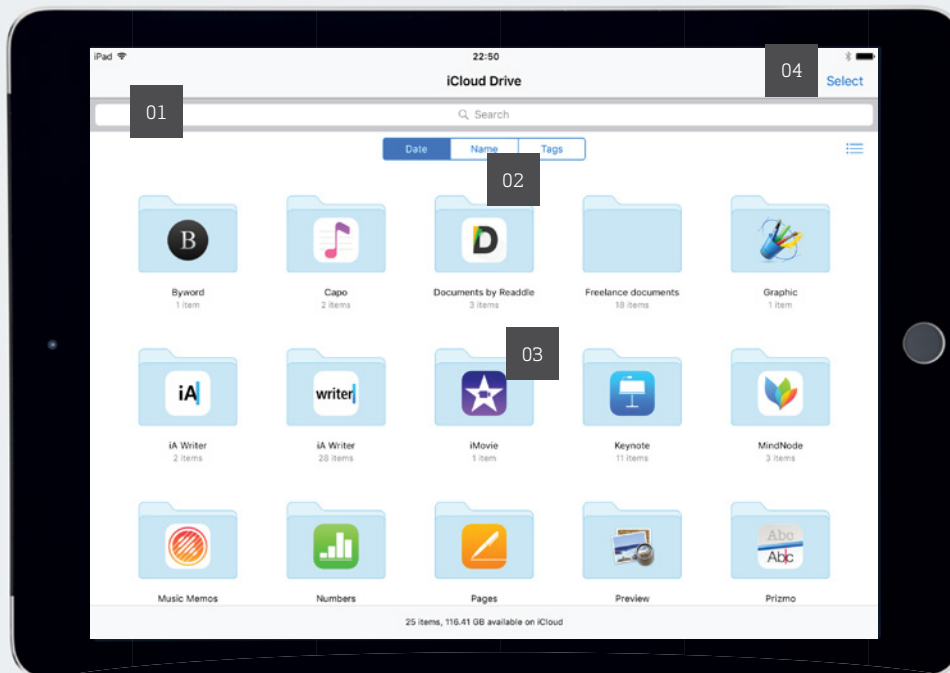
The iCloud Drive app for iOS is largely straightforward, yet it provides several ways to get certain things done. It gives you two ways to view your files and folders: as large icons or in a list. To switch between them, go to the top level of your iCloud Drive, then tap the bulleted list icon at the top right corner.

There are three ways to sort your files and folders: by date, name or tags. To use tags, you'll need to create and attach them in OS X, as there's no way to do so in iOS. In OS X, click iCloud Drive in Finder's sidebar, Ctrl-click the file you want to tag, then choose Tags in the contextual menu. The easiest way to create tags is in 'Finder > Preferences > Tags'.

MOVE MOUNTAINS OF FILES

Back in the iOS app, the list view enables you to move a file by tapping the 'i' to the right of its name, then the toolbar's folder icon, and choosing a folder. You can move multiple files at the same time by tapping 'Select' at the top of the screen, then the items to move and finally 'Move' at the bottom of the screen. A third option for moving files is to swipe left over a file's row in list view and tap 'More', then 'Move to Folder'. In icon view, hold a finger on a file, choose 'More' when the options bar appears, then tap 'Move to Folder'. The Select and swipe methods also let you delete files.

If you delete files from iCloud Drive, you can recover them for up to 30 days after deletion. See how to on the opposite page.



01 SEARCH DRIVE
Tap the search bar and then type to look for files and folders in iCloud Drive. Matching items appear below.

02 SORT THE VIEW
Swipe down past the first items listed to reveal sorting options. Tap one to sort the view on that attribute.

03 APP FOLDERS
Folders with icons are used by respective iOS apps to store docs. Mac apps are able to save outside of these.

04 MANAGE ITEMS
Tap 'Select' to add checkboxes that enable you to select multiple items and then move or delete them.



01

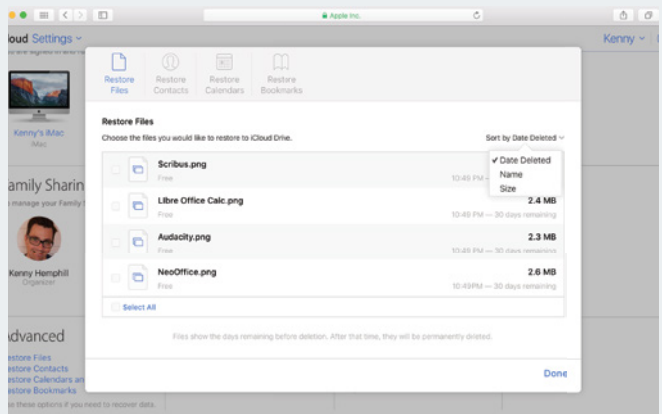
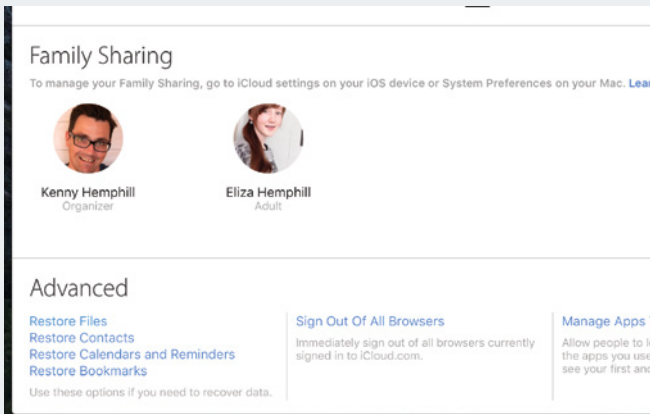
LOG IN TO ICLOUD ON THE WEB

To recover files you've deleted from iCloud Drive, sign in at **iCloud.com** on your Mac. Next, if two-factor authentication or two-step verification is enabled on your account, pick a device to receive a verification code.

02

COMPLETE AUTHENTICATION

After you've picked a device, wait for the verification code to arrive on it, then type it into the box on the iCloud.com sign-in form. Once you're successfully signed in, click the Settings icon on the site's Home screen.



03

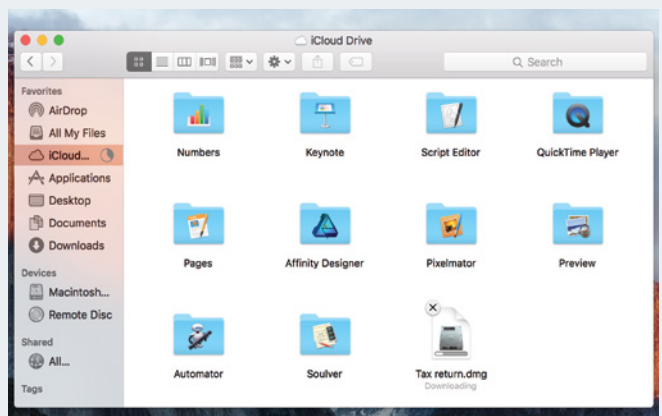
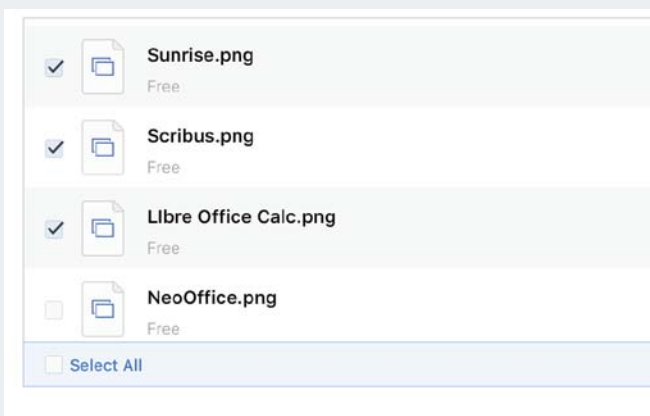
VIEW DELETED FILES

Scroll down to the bottom of the page. Under the Advanced heading, you'll see four options, allowing you to restore different types of data. Click 'Restore Files' to see a list of files deleted within the last 30 days.

04

SORT AND SEARCH FOR FILES

By default, files are sorted by date deleted, with the most recently deleted at the top of the list. To sort them by name or size, click the 'Sort by' option at the top-right corner of the file list and pick an order.



05

CHOOSE A FILE TO RESTORE

Once you've sorted your files, scroll down the list to find items you want to restore. Click the checkbox to the left of each's name. Alternatively, click the 'Select All' box at the bottom of the list. Click 'Done'.

06

SIGN OUT AND WAIT

Click your name at the top-right corner of the page, then 'Sign Out'. Next, go to iCloud Drive in Finder on your Mac or open its app on your iOS device. Your restored file(s) should soon reappear there. ■

[DOWNLOADS AND STREAMING]

TechLife's essential Chromecast apps

GET SMART STREAMING IN THE LIVING ROOM, SANS SMART TV.

{ NATHAN TAYLOR }

WE'VE TALKED ABOUT a lot of different streaming services in this column over the years, and pretty much all of them are available on both PC and mobile. But what if you want to watch them on your TV, sitting on your couch with feet up and popcorn in hand? That becomes trickier.

If you don't have a smart TV, or your smart TV doesn't support a particular service you want, then the cheapest and most widely supported solution is the Google Chromecast. It's not the only solution — the Apple TV is a solid choice as well, and the Roku/Telstra TV can work, but the Chromecast is simple, controlled from your phone and available for just \$59.

Using a Chromecast is straightforward: if a streaming app or game supports it, then it will have a 'Google Cast' button visible when you're playing a video or in the video selection screen. Tap on that button, choose a receiver, and the video or app will be beamed to the TV that the Chromecast is attached to. Playback and control is still managed from the mobile, so essentially your mobile becomes the remote for the app.

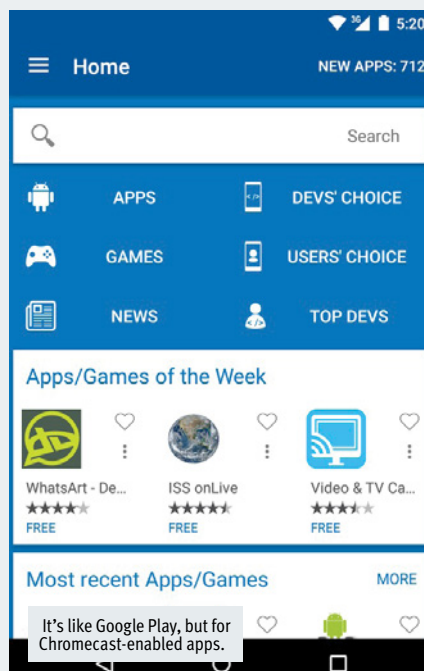
There are a huge number of apps now that support the Chromecast, and in this issue, we thought we'd take a look at some of the essential apps to download if you've invested in the Chromecast.

GOOGLE CAST

Available for: *Android, iOS*

Unfortunately, Google doesn't actually provide an easy way to find Chromecast-enabled apps as part of its Play store. That's why your first download should be the Google Cast app, which links to services and apps that support Google Cast.

It also has a more important feature: screen casting (which is Android only). Just tap on the navigation drawer on the top left corner and select 'Cast screen/audio'. This lets you mirror your phone's screen on the TV, which makes it useful for apps that don't have native Chromecast support. If you're using Cast Screen, you'll have to keep your phone on and the app open, since it's simply a mirror.



CAST STORE FOR CHROMECAST APPS

Available for: *Android*

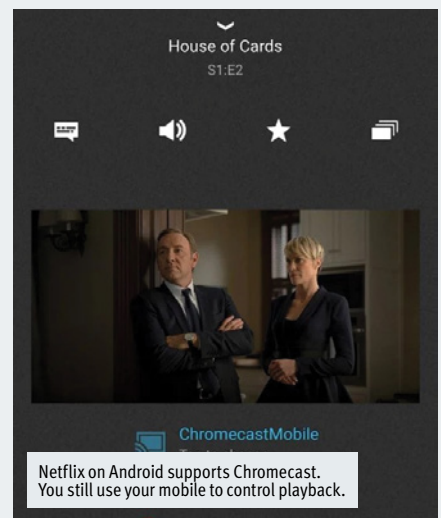
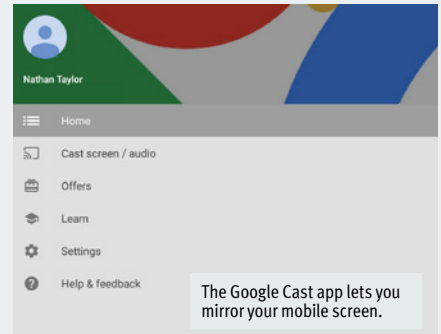
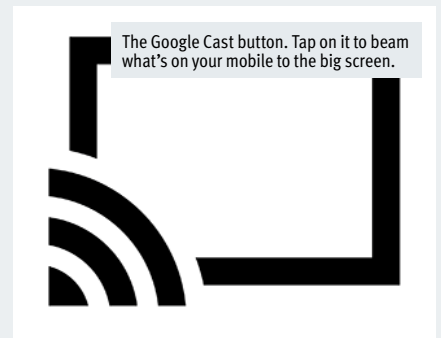
An even better solution for finding Chromecast apps is Cast Store for Chromecast Apps, which is itself available from Google Play. This is not actually an alternate store — it still downloads apps from Google Play — and, therefore, does not require that you enable third-party apps or change your security settings. It is instead a directory of Chromecast apps, sorted into categories and by popularity, with links back to Google Play. It's a great starting point for finding cool Chromecast apps.

NETFLIX, STAN AND PRESTO

Available for: *Android, iOS*

The three major subscription streaming services available in Australia all support Chromecast. With prices ranging from \$9 to \$15 per month, the services offer a huge variety of movie and TV content.

All three have Google Cast support on both Android and iOS, with full control, as well as background casting (so you can do other stuff



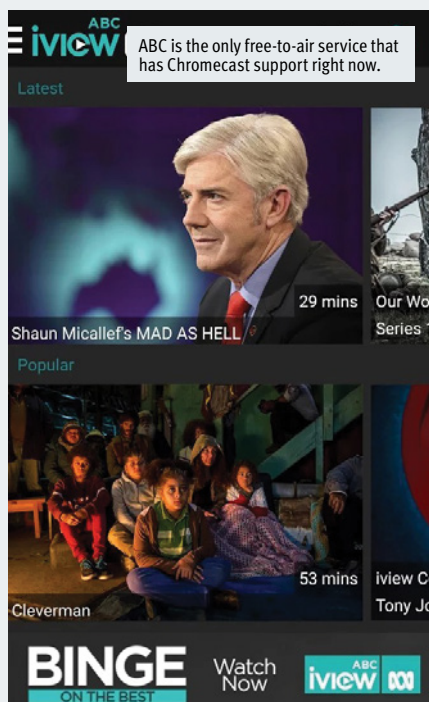
like Facebooking or Twittering while a movie is playing) and the ability to continue casting even when the mobile screen is turned off. In each app, you just tap on the Cast icon to beam the video.

ABC IVIEW

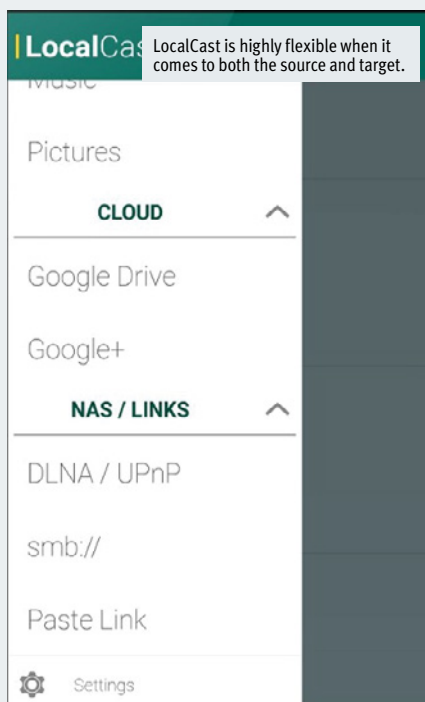
Available for: *Android, iOS*

The free-to-air networks have been very slack when it comes to Chromecast support. Right now, only the ABC supports it natively. iView on mobile has a Google Cast button that you can tap to beam it instantly and smoothly to your Chromecast.

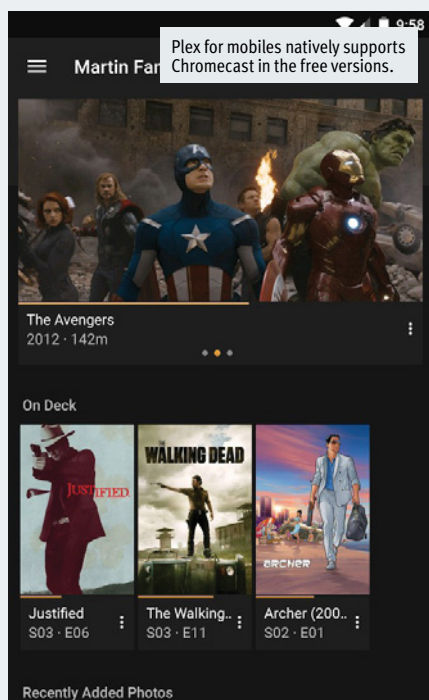
The others (SBS on Demand, TenPlay, 9Now and 7Plus) have yet to implement it. However, you can potentially watch them on the Chromecast using the Chrome web browser on your mobile. Open up the site in Chrome and start playing a video. Tap on the embedded video, and you'll see that Chrome has added a little 'cast' button. Tap on that and



ABC is the only free-to-air service that has Chromecast support right now.



LocalCast is highly flexible when it comes to both the source and target.



Plex for mobiles natively supports Chromecast in the free versions.



Big Web Quiz from Google is a great party trivia game using Chromecast.

it should start casting the embedded video. This works pretty well, but not for everything. 9Now, for example, doesn't let you play many videos in a mobile browser for DRM reasons.

PLEX

Available for: Android, iOS

For Chromecast streaming of your own content — stored on a local server, on your mobile or on a remote server — Plex is pretty much the way to go. A Chromecast button in the top right will start it streaming to a Chromecast.

LOCALCAST FOR CHROMECAST/DLNA

Available for: Android

LocalCast, like AllCast and other similar

solutions lets you beam local media (that is, media you have stored locally on your phone or on a PC server) to a Chromecast.

LocalCast's appeal is that it's highly flexible. It can play media stored on the mobile, on a Windows PC using Windows file sharing or stored on Google Drive. It can beam media

to a Chromecast, an AirPlay device like Apple TV or to a DLNA media renderer like the Xbox or a device running Kodi.

OTHER APPS

While we've covered your major streaming apps above, we'd also recommend:

DAYFRAME

Available for: Android

DayFrame is a cool app that can turn any screen into a photo frame. It beams a continuous and configurable slideshow of images to a Chromecast device, effectively turning a TV set into a super-sized digital picture frame.

TINYCAM MONITOR PRO

Available for: Android

tinyCam Monitor is an IP camera monitoring tool, useful for nanny cams and security, as well as just watching the world go by. Best of all, it works with Chromecast, beaming the camera stream to a TV set. You need the Pro (\$5) version for Chromecast.

BIG WEB QUIZ

Available for: Android, iOS

An awesome party game playable by up to five people. The Chromecast displays questions and puzzles on the TV screen, while up to five people use their own phones to enter the answers.

MONOPOLY HERE & NOW

Available for: Android, iOS

Here & Now lets you play Monopoly with friends (or solo against the AI) using the Chromecast. The board appears on the TV screen, while each player uses their mobile to control their moves.

TRICKY TITANS

Available for: Android, iOS

A simple but fun party game that, like Monopoly and *Big Web Quiz*, uses the Chromecast to beam the 'board' to the TV screen while each player controls their titan with the mobile.

CHROMECAST AND HDMI CEC

HDMI CEC (AKA Anynet+, Aquos Link, Bravia Link, Viera Link, EasyLink, Kuro Link and several other names besides) is a system that lets you control devices attached to a TV using the TV remote.

The Chromecast does indeed support HDMI CEC, so you can control some Google Cast apps with your TV remote. The app itself has to support it, however, and many key ones don't. More and more do, however, including Netflix (finally). ■

[PRIVACY AND SECURITY]

Make yourself (nearly) hack proof

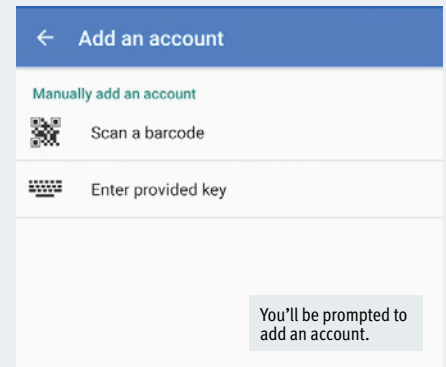
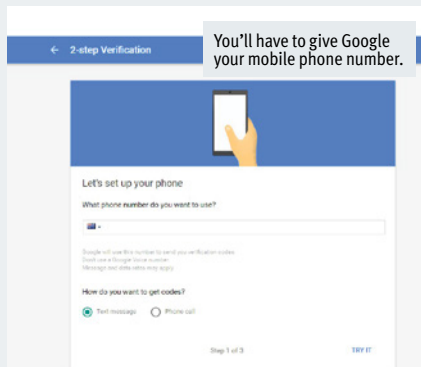
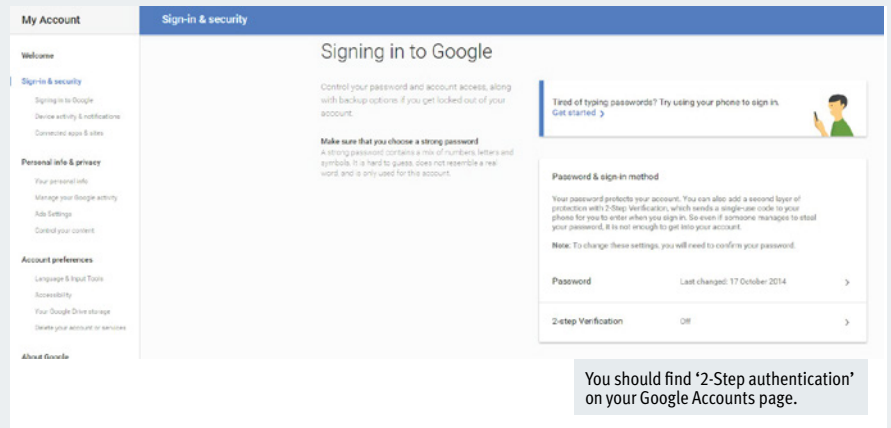
TWO-FACTOR AUTHENTICATION IS ESSENTIAL FOR SECURITY. TIME TO SET IT UP.

[NATHAN TAYLOR]

WITH A RASH of recent hacks, your public accounts have become more vulnerable than ever. A hacked Twitter account (and there have been a lot of those recently) can lead to hacked Google accounts, LastPass accounts, Microsoft accounts and more. If you use a common password across sites, the hackers will try to use your email/password combination on all the major sites. There are even easy tools to help them do this: an application called Shard, for example, will let hackers test dozens of sites with a given username and password combination at once.

One thing to combat this is good passwords, of course. A password manager is essential, both generating and storing good, unique passwords for each site. But a password manager isn't the end of security: two-factor authentication (2FA) is also essential. This is a device or app that only you have access to and will be queried whenever somebody tries to access your account. So to log in, you need both the password and the device.

Commonly, SMS text messages are used as the second factor, but Google Authenticator is a great alternative for services that don't support SMS or on devices that don't have SMS (like Wi-Fi tablets). It works for your Google account, of course, but also for a host of other services, including LastPass, Wordpress, Dropbox and even Microsoft. Google Authenticator provides a rotating code for services linked to it, based on a unique key stored on your phone. It's actually not very hard to set up or use, and it vastly increases the security of your services.



USING APPS THAT DON'T SUPPORT AUTHENTICATOR

One issue you might come across is that you can have apps that access your Google account but don't support 2FA. Mail apps like Thunderbird fall into this category, as well as console apps.

For these apps, you have to create an app password. This is a super-long password to be used in that specific app that forgoes 2FA. Go to security.google.com/settings/security/apppasswords to create them.

We noticed a recent login attempt from an unusual device or location.

IF THIS WASN'T YOU
Secure your account by resetting your password now

Reset password

IF THIS WAS YOU
Just to be safe, please confirm your identity by using this temporary code on Twitter or wherever you would normally enter your Twitter password:

If you get a message like this, it's time to change your password. And if any other sites use the same password, you'll need to change those too. Quickly.

Below we'll walk you through how to set it up for your Google and LastPass accounts. Other services will follow a similar process.

SETTING UP 2-STEP AUTHENTICATION FOR GOOGLE

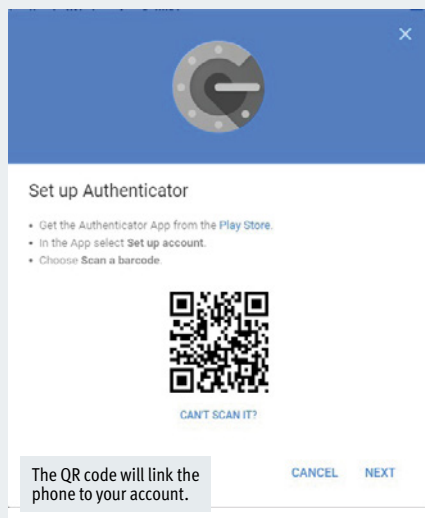
The first thing we need to do is enable two-step authentication on Google. Just follow these steps.

Go to myaccount.google.com and click on 'Signing in to Google'.

Click on '2-Step verification' on the right. (Note that if you have a business account —

for example, if you have Google controlling a domain you own — you may not see this. That's because it has to be enabled in the Business admin console. Go to admin.google.com, then click on 'Security > basic settings' to enable it.)

Follow the steps, providing Google with your mobile phone number for SMS, and it will text you a code and ask you to enter it. You'll also be asked if you want to authenticate the computer you're currently using (if it's your home computer, choose 'yes').



+

GOOGLE AUTHENTICATOR IS A GREAT ALTERNATIVE FOR SERVICES THAT DON'T SUPPORT SMS OR ON DEVICES THAT DON'T HAVE SMS.

When you've completed the steps, 2FA should be set up. Google will SMS you whenever somebody tries to access your Google service on a new device or app. Now it's time to set up authenticator.

SETTING UP THE GOOGLE AUTHENTICATOR APP FOR GOOGLE.

Now that two-step verification is enabled for Google, time to set up Google Authenticator:

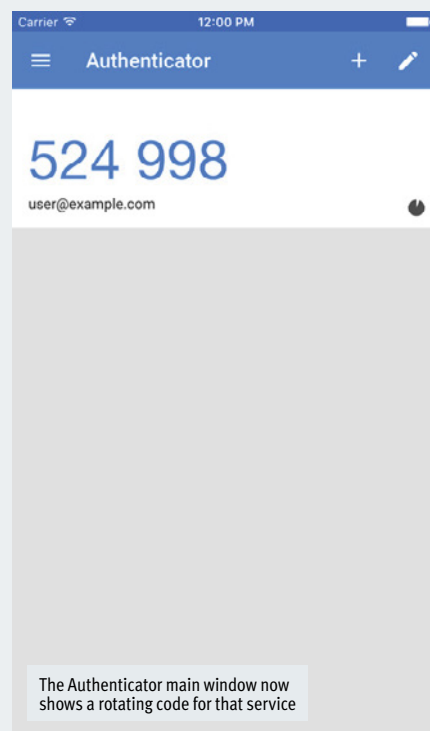
Go to Google Play or the iTunes App Store and download Google Authenticator on your mobile. Open it. Because this is your first use, you'll be taken immediately to the 'add an account' page. (You can access this page again or add additional accounts later by clicking on the '+' icon).

Leave your phone for a moment. Head to your PC and log into your Google Account page at **myaccount.google.com**. Go to sign-in and security again. Click on '2-step verification' — you'll then be asked to reenter your password).

There will be an option on screen to use the app for two-step verification. Click on it, then choose the platform (iOS or Android).

A QR code will appear on screen. Just leave it there and head back to your phone.

On the phone, choose 'Scan barcode'. The phone will go into camera mode. Point it at the QR code on your PC screen.



Once the phone gets a clear enough picture, it should immediately register the code and link it to your account. In the main window, you see a six-digit code that changes every 30 seconds, with the name of the service and your login username.

Back on your PC, click 'Next' and you'll be prompted to enter the code. The process will complete when you type it into the field.

That's it, you're all done. In the future, every time you're asked for a Google account authentication code, you just open this app and enter the number you currently see on screen for that service.

ADDING LASTPASS

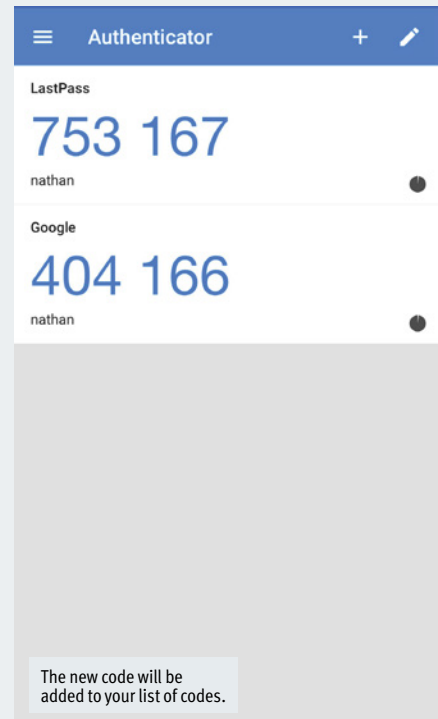
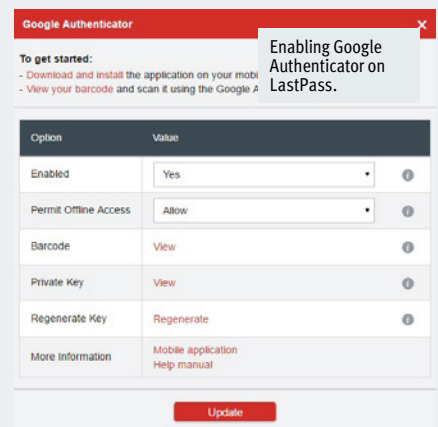
As we mentioned, you could and should also use Authenticator for all the services that support it. It's very easy to add new services. We'll walk through one example: LastPass.

On your PC, log into your LastPass Vault (you can do that from the browser icon), then click on 'Account Settings'.

Click on the Multifactor Options tab. This shows you the various 2FA options that LastPass supports.

Next to Google Authenticator, click on the edit (pencil) icon. A window will pop up. Change Enabled to 'Yes'.

Next to Barcode, click on 'View'. You may be asked to re-enter your LastPass master password, then a QR barcode will appear onscreen.



Go to your phone and open Google Authenticator. Click on '+' to add a new service, then choose 'Scan barcode'.

Point the phone camera at the LastPass barcode on your PC screen, just as you did with Google.

It should immediately add the service to your list, with a unique rotating code.

Back on your PC, click on 'Update'. You'll be asked to authorise LastPass using the new code. LastPass requires that it be re-authorized for a given device every 30 days.

You can continue to add other services like Dropbox, Microsoft, Twitter, Facebook and others. Most of the major social media services support it, and you should absolutely enable 2FA where it's available. Passwords can be cracked; 2FA is not so easy. ■

[PHOTOGRAPHY MASTERCLASS]

Tackling through-the-lens flash

TAKE YOUR FIRST STEPS INTO THROUGH-THE-LENS FLASH PHOTOGRAPHY.

[TECHLIFE TEAM]

FLASH CAN BE intimidating; just too complicated, too unpredictable and too many acronyms to get your head around. But getting to grips with it can give your photography an edge, whether you're using a subtle blip of pop-up flash to brighten up shadows in a portrait or setting up multiple off-camera flashguns to illuminate an entire scene.

The flash exposure is affected by four key factors: the power of the flash, the distance it is from the subject, the aperture and the ISO. In manual flash mode, you decide how to manage these settings; but in through-the-lens (TTL) flash mode, the camera measures the brightness of the flash being reflected by the scene into the lens, and automatically adapts the power to produce what it determines is a good exposure.

The advantage of a TTL flash exposure is that the camera fine-tunes the flash exposure to compensate for any filters on the front of the lens or accessories on the flash head itself. It also

means that, unlike manual flash, you don't have to spend time working out the exposure if you change the aperture or the distance the flash is from the subject; as long as you're close enough, the camera will make adjustments in order to maintain a consistent flash exposure.

TTL is not without its drawbacks, however. As it measures the light that's reflected by the surface that the flash strikes, it can overcompensate for very bright or dark or particularly reflective areas in the picture and output too much light or not enough. It also lacks the consistency of manual flash: a slight change in the position of the camera or subject can noticeably change the flash exposure. If you don't like the result, you can use the flash exposure compensation function on the camera or the flashgun, in order to increase or decrease the brightness for a subsequent shot.

The latest iterations of TTL flash systems are intelligent, but they're limited by the 'sync'

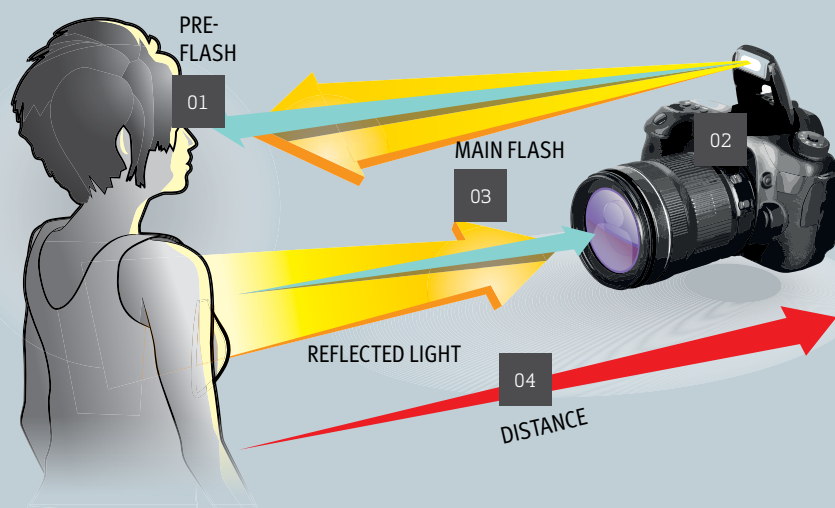
speed. This is the fastest shutter speed at which normal TTL flash can be used, typically 1/200 sec or 1/250 sec. The limiting factor here is the way that the pair of shutter curtains in front of a camera's imaging sensor work. At the sync speed or slower, the entire surface of the imaging sensor will be exposed to light when you take a picture. However, at faster shutter speeds, the sensor is never fully exposed to light in one go — the second curtain begins closing before the first one has finished opening, so the sensor is exposed through a fast-moving slit. This means that only part of the picture would be exposed by the flash when it fires. Many systems incorporate a high-speed sync mode to get around this. In this mode, the flash fires a rapid sequence of low-power bursts to coincide with the gap created by the moving shutter curtains. The downside is that the flash needs to be much closer to the subject for it to be effective.

TTL FLASH AND DIGITAL CAMERAS

In the days of film photography, a separate TTL flash sensor in the camera continuously measured the amount of light that was reflected from the surface of the camera film. Once the flash sensor had determined that the subject had been exposed correctly, the flash was extinguished.

The imaging sensors in digital cameras don't reflect light in the same way that a frame of film does, so TTL flash metering has had to evolve. Today's advanced TTL flash systems, such as Nikon's iTTL and Canon's E-TTL II, use a low-power pre-flash to determine the optimum flash exposure before the main flash exposure begins. In some instances, you may notice this pre-flash — watch for people blinking in flash-lit portraits — but invariably the light from the pre-flash and the main flash are indistinguishable.

The light that's reflected by the subject through the lens during this pre-flash hits the shutter curtains, and is measured by the camera's normal metering system rather than by a dedicated flash meter.



01 QUICK FIRE

When you press the shutter release, the camera's mirror flips up and a pre-flash is fired. The subject and other parts of the scene that are illuminated reflect some of this light into the lens.

02 MEASURING UP

The light strikes the shutter curtains that continue to remain closed in front of the camera's sensor. The camera's exposure meter then measures the light being reflected by the curtains.

03 CONTROLLING THE LIGHT

The camera then uses this information to determine the optimum power for the main flash. The shutter curtains now open to expose the sensor and the main flash is fired.

04 FINE-TUNING

Flash power falls away with distance, but a larger aperture or higher ISO will extend the flash's reach. Try using flash exposure compensation for stronger or more subtle results, too.

KEY FEATURES OF A TTL-COMPATIBLE FLASHGUN EXPLAINED...



01 DIFFUSER SCREEN

Spreads the light to provide even coverage. A pull-out panel spreads the light further still for wide-angle photography, and can also act as a bounce panel to change the direction of the light.

02 AUTOFOCUS ASSIST LAMP

Illuminates the subject in front of the flash so that a camera's autofocus system can lock on more easily.

03 ACCESSORY SHOE

Slots into the hotshoe on the top of a camera and allows the two to communicate. It also enables the flash to be attached to a flash cord for off-camera firing.

04 FLASH TUBE

A high-voltage charge passes through this glass tube filled with xenon gas. It's this that creates the flash burst.

05 FLASH HEAD

Depending on the model, this may offer a swivel-and-tilt function so that you can bounce the light from ceilings and walls, or target specific areas of the scene. It may also include a zoom function, which produces a narrower or a wider beam of light.

The Guide Number indicates the maximum power output. The amount of power needed will depend on the aperture (larger ones need less power), the ISO (higher ISOs need less power) and the distance.

FRONT OR REAR?

Choose when the flash fires for more effective shots of moving subjects.

A shutter mechanism is typically made up of two sets of curtains or blinds that sit between the mirror and the imaging sensor. These shutter curtains prevent light from reaching the sensor until you take a picture. By default, a flash fires at the start of the exposure, as the first set of curtains move out of the way. This is beneficial if timing is critical for a shot, but can be problematic if the subject

is moving; any movement recorded during the main exposure will appear in front of the flash-lit subject. However, many cameras and flashes enable you to choose rear or second curtain sync mode, which fires the flash just before the exposure ends. Any movement recorded at the start of the exposure will trail behind the subject, creating a more natural result.

FIRST CURTAIN SYNC

01 SHUTTER CURTAIN OPENS

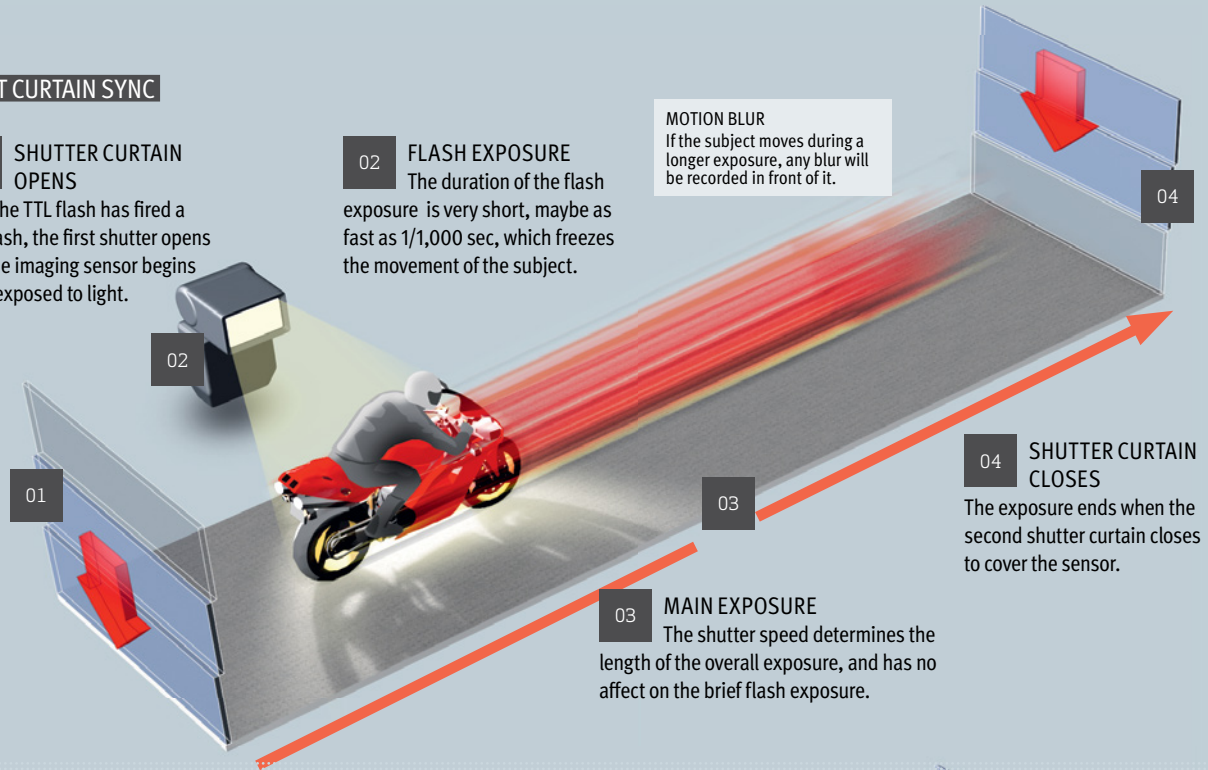
After the TTL flash has fired a pre-flash, the first shutter opens and the imaging sensor begins to be exposed to light.

02 FLASH EXPOSURE

The duration of the flash exposure is very short, maybe as fast as 1/1,000 sec, which freezes the movement of the subject.

MOTION BLUR

If the subject moves during a longer exposure, any blur will be recorded in front of it.



SECOND CURTAIN SYNC

01 EXPOSURE STARTS

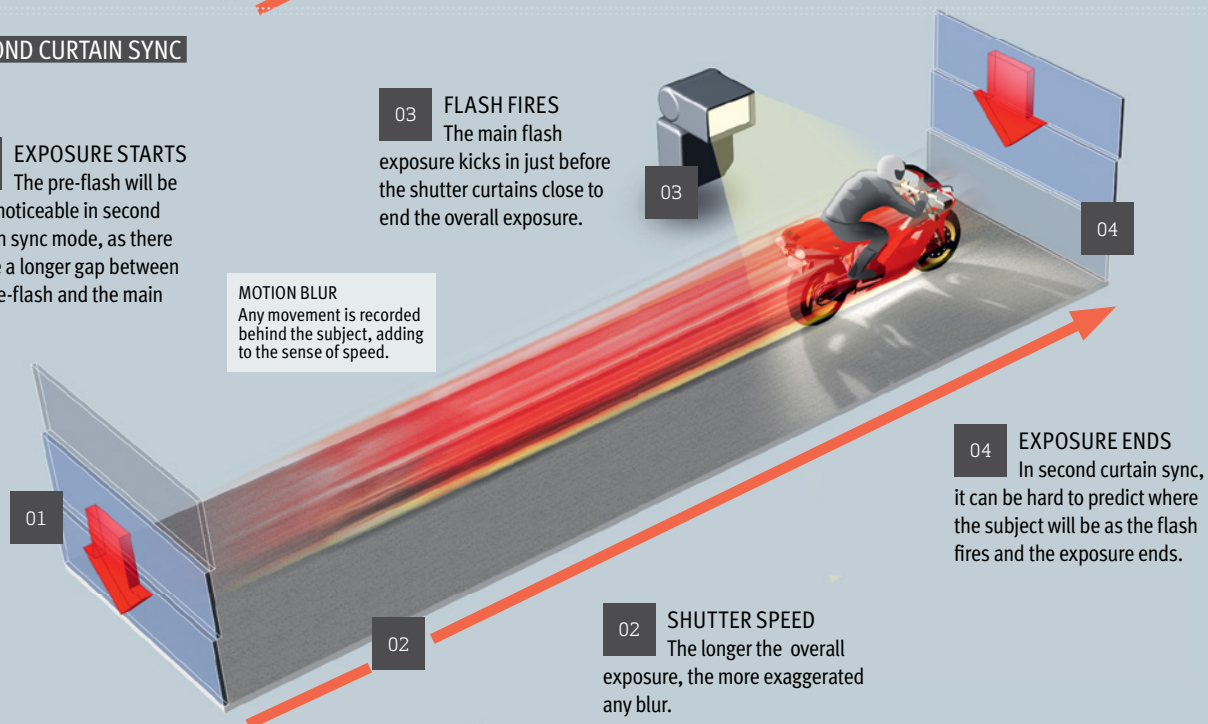
The pre-flash will be more noticeable in second curtain sync mode, as there will be a longer gap between the pre-flash and the main flash.

03 FLASH FIRES

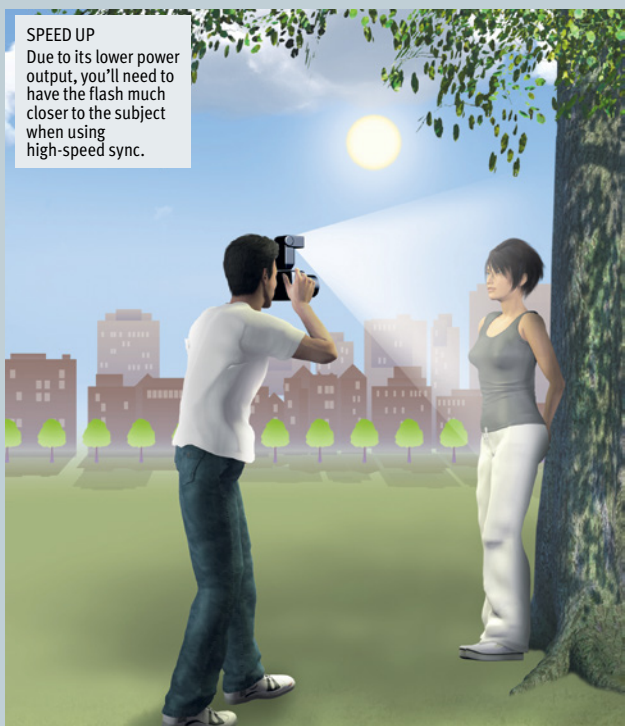
The main flash exposure kicks in just before the shutter curtains close to end the overall exposure.

MOTION BLUR

Any movement is recorded behind the subject, adding to the sense of speed.

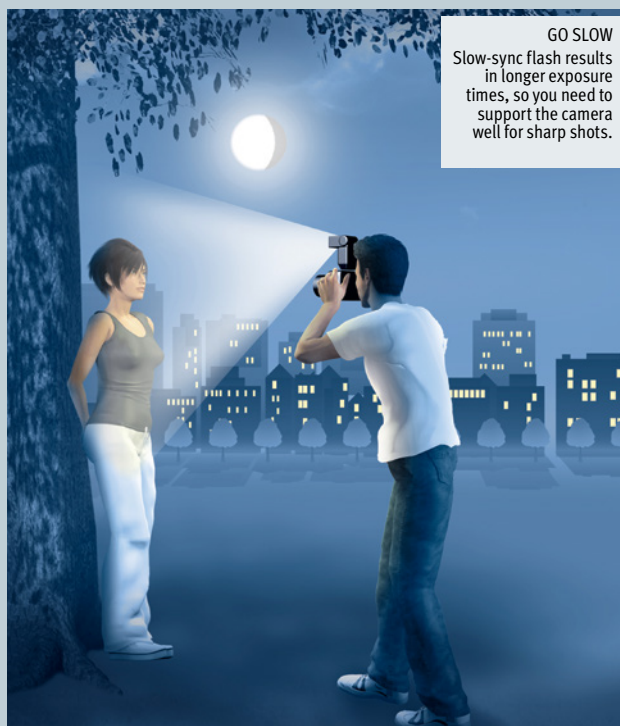


SPEED UP
Due to its lower power output, you'll need to have the flash much closer to the subject when using high-speed sync.



FLASH IN BRIGHT LIGHT

GO SLOW
Slow-sync flash results in longer exposure times, so you need to support the camera well for sharp shots.



FLASH IN LOW LIGHT



RESULT WITHOUT HIGH-SPEED FLASH

Setting a large aperture to blur the background can lead to an overexposed shot. This is because the camera has to set the flash sync speed, and this may result in an overall exposure that's much longer than the brightly lit scene needs.

GETTING IN SYNC

How high-speed sync and slow-speed sync give you more control

The two situations in which TTL flash often needs a little help are when you're using it in sunlight and in near-darkness. Using a large aperture in very bright conditions may require a shutter speed that's much faster than the sync speed of the flash. To avoid exposure errors, you'll need to reduce the overall exposure so it's within the flash's range, perhaps by setting a smaller



RESULT WITHOUT SLOW-SPEED FLASH

Without slow-speed flash, background detail won't be visible. Some flash systems are set to slow-sync by default, although this does mean you need to keep an eye on the shutter speed if you want to avoid blurred results. ■



As you can see, sometimes plain walls have a dramatic effect on image quality, and not in a good way.

[HOME AV MASTERCLASS]

Build your own projector screen

WHY SETTLE FOR AN EXPENSIVE PROJECTOR SCREEN WHEN YOU CAN BUILD YOUR OWN FOR A FRACTION OF THE PRICE – AND WITHOUT LOSING OUT ON QUALITY?

[BENNETT RING]

WITH PROJECTOR PRICES starting at around the \$800 mark, and easily exceeding several thousand dollars for a larger screen, they're a huge chunk of the coin needed to build your own projector-based home theatre. But we've got a secret for you — there are several ways to build your own for a fraction of the cost, and you'll be hard picked to notice any quality differences unless you're running a \$15,000 projector. From blank walls, to special pain, to building a true frame with reflective material, we're going to show you exactly how to save a massive amount when it comes to setting up your home theatre screen. Let's start with the simplest — no screen at all.

WHAT IS 'GAIN'?

Most projector screens refer to their gain, and this simply measures the reflectivity of any screen or projection surface. The number itself represents the ratio of light that is reflected from the screen when compared to the light reflected from a standard white (magnesium oxide) board. A gain of 1. Will reflect the exact same amount of light as that from a white board, while 1.5 means it's reflecting 1.5x the light of a white board.

Gain is measured directly from the front of the screen, perpendicular to the vantage point, where it's at its brightest. This is known as the 'Peak Gain at Zero Degree Viewing Axis'. However, if you move to an angle where the gain is only 50% of the peak value, you're now viewing it from the 'Half Gain Viewing Angle'.

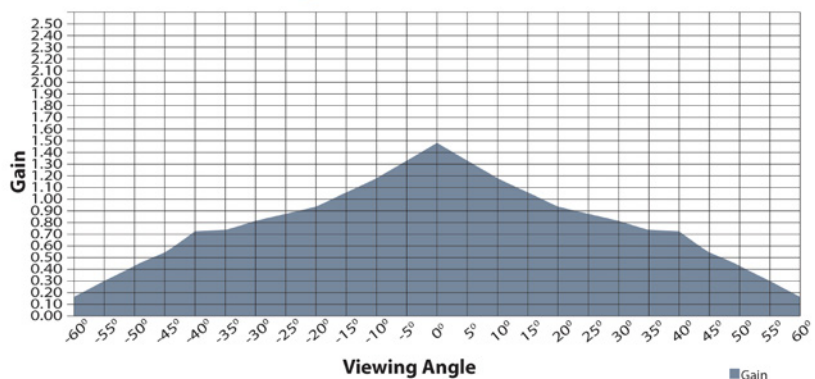
A screen with a lower overall gain will have wider Half Gain Viewing Angles, as they diffuse the light more evenly across the screen, making for a better experience when multiple people are viewing the screen.

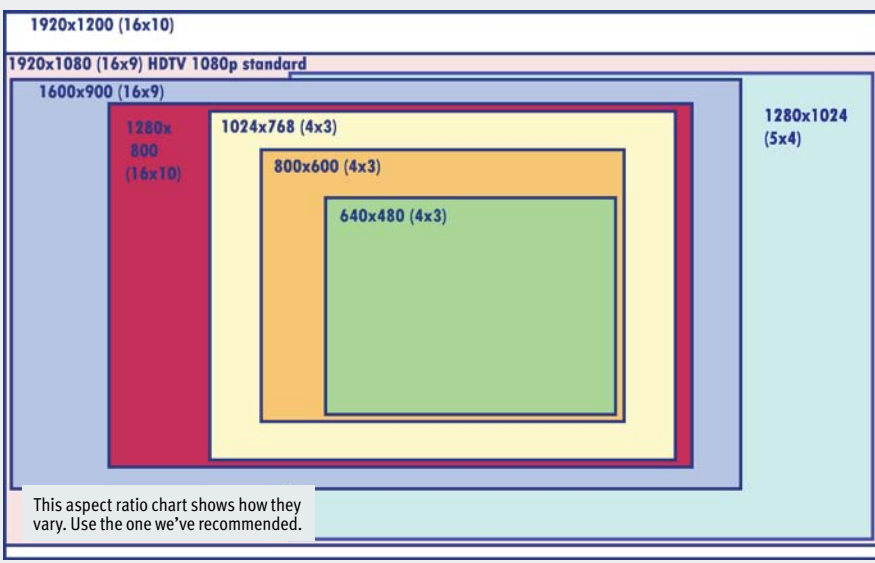
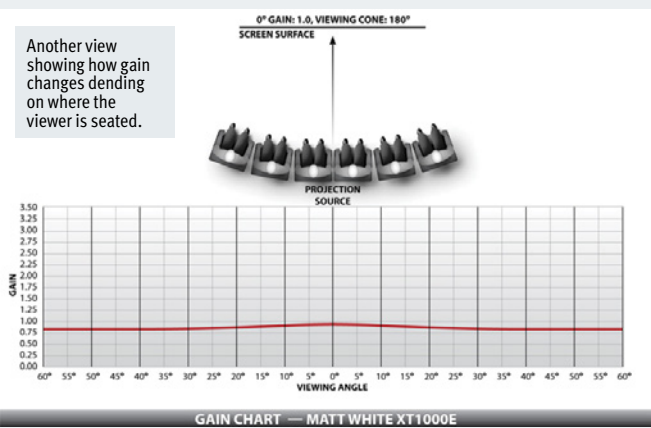
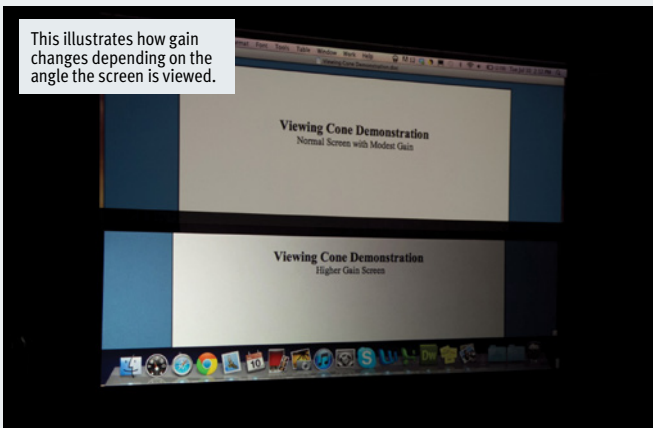
Many people jump to the assumption that a high gain screen is best, as it's pumping out a

This is a more scientific chart showing gain changes depending on viewing angle.



On-axis 0° Gain: 1.5
Viewing Cone: 80°





'Hot-Spotting', where it's brightest in the centre of the screen. Below 1.3, this shouldn't be noticeable, but it can become an issue on high gain screens.

However, high gain screens have benefits. They're especially useful in rooms where light leakage from outside occurs, as it will help to keep the image nice and bright.

PLAIN WALLS

I remember my very first projector setup had absolutely no screen — I simply shone it on a matte white wall. Now this was a \$1,000 720p projector, so I was working to an absolute budget. I made the screen look a little spiffier by painting a black border around the image. Simply set up the projector to the correct size and dimensions, and then use a pencil to mark a border approximately 7cm around the projected image. Pay particular attention to the size and shape of the image — this permanent solution can be super annoying if you get the dimensions wrong. Then simply paint the border using a matte black paint to give it that finishing edge. It's important to use matte paint, as reflective paint will show glare and shine when the image inevitably comes into contact with it. If you want to get really serious, you can also paint the white area to improve the gain of the screen. Look for shades of colour that have absolutely no additives, which are usually referred to as the 'base white' colours. You won't want a totally matte paint here, though, as it will lead to a flat image quality. Most paints come in about five



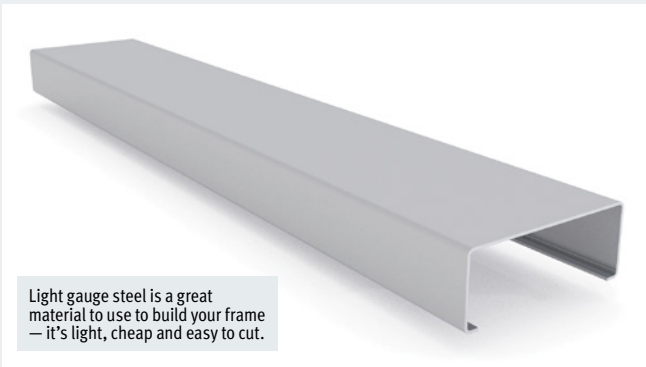
Screen goo is an affordable way to get an excellent screen simply by painting your wall with it.

brighter image. However, as mentioned, this means the optimal viewing angle is relatively narrow, so is best for theatres designed for one or two people. A 1.0 gain screen throws out light evenly in all directions, making it the better gain level for screens that will have several seats that are oblique to the screen.

A high gain can also have another negative effect — it won't show red, blue and green equally. This means that, as you move around the room, viewing the screen from various angles, noticeable colour shifts will be apparent.

Finally, a screen with a gain higher than 1.0 can display a phenomenon known as





Light gauge steel is a great material to use to build your frame — it's light, cheap and easy to cut.



You'll need a set of tin snips to cut the corners.

different levels of sheen — we suggest starting with the middle of the pack.

Another option is to use a light to medium grey paint for the main screen itself. These are popular as they increase the perceived contrast ratio of the projected image, especially in rooms with less than perfect light control. This paint is not optimum for totally dark rooms, though, where white is the preferred choice, especially as today's projectors have incredibly high contrast ratios.

SCREEN GOO

The next step up from using plain white paint is to use special paint designed for projector screens, with Screen Goo being the most well known. It's not exactly cheap, at about \$399 per 1,000mL tub, and comes in a variety of flavours; reference white, high contrast, max contrast and ultra max contrast. Like paint, one of the beauties of Screen Goo is that it can be used on slightly curved walls, making for more of an immersive screen. Painting it on is as simple as using a short-haired fibre roller, but the makers suggest spraying it as the ultimate method. A 500mL tub should cover around 2.33 square metres, but this drops slightly to 1.86 square metres when sprayed.

Screen Goo is an acrylic paint that is designed specifically for projection surfaces, and is available in various levels of gain. According to the manufacturer, the lack of any filler gives it a far superior image quality than usual paint, using "museum-grade acrylic base resins and the best pigments available". Other

benefits include exceptional colour fidelity, excellent gain with minimal hotspotting, industry-leading horizontal and vertical off-axis performance, wide viewing angles, zero colour shifting and a colour accurate screen structure.

BUILDING YOUR OWN SCREEN

While painting a screen is arguably the cheapest method, nothing beats using proper projection material for your projector. Building your own screen and frame only requires a handful of tools, and can be done for around \$600 including the cost of material. Let's see how it's done.

First things first, determine the size you want, simply by projecting it on the wall. You'll also need to pick the aspect ratio you'll use most often — 4:3, 16:9, 2:35:1. The most common aspect ratio for a Blu-ray screen is 16:9, though many movies now use 2.4:1.

Now to choose the material to use. You'll want something stiff enough that the screen doesn't warp, which is where light gauge steel studs are handy. They're only a little more expensive than wood, but far more rigid. They can also be easily cut with tin snips or a hacksaw, and are nice and light. Buy five studs that are around three inches thick, and the right length for your height and width. You'll want two vertical studs, but a third one to run through the centre of the screen to help keep it nice and rigid.

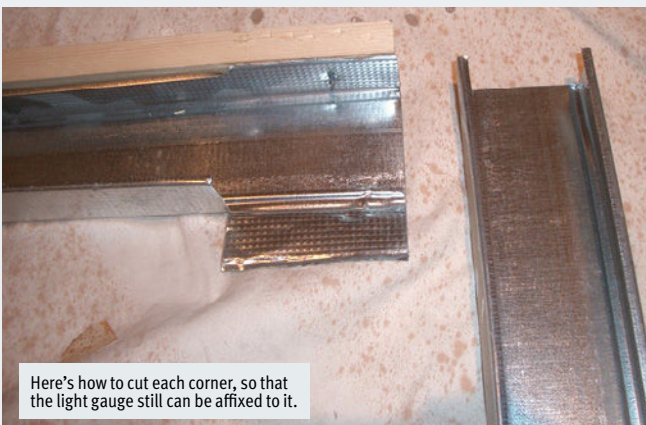
Now we need to assemble the main rectangular frame. Cut one edge of the stud

so that the other piece can slide into place, and then use a rivet gun or bolt and screw to firmly affix each corner together. Next up is installing the centre brace — use the same method as you did to affix each corner to set this directly in the centre of the screen. This isn't always necessary, though — if you feel like the frame is already sturdy, we'd avoid this, as it can lead to the central strut being visible through the projection material.

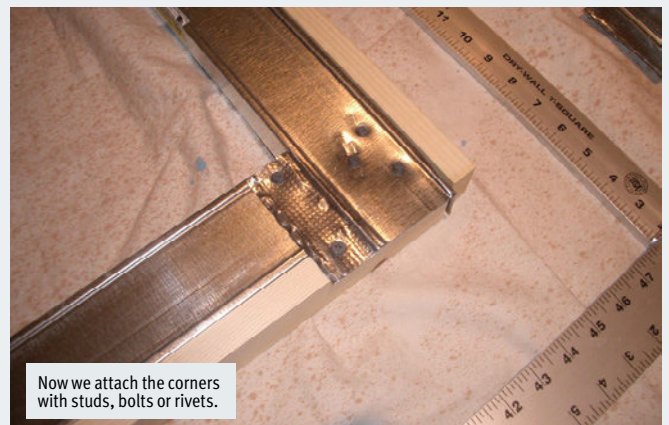
If you do go with the central strut, we'll need to add some soft padding across the entire front side to cover any spars or bolts. Very thin quilt stuffing will do the job nicely, so buy a piece slightly larger than the entire front space, and glue it over the front of the screen. Ensure you pull it extremely tightly as you do so, then trim off any spare overhang on the edges. You should end up with an extremely smooth surface devoid of any bolts or brace being visible, and this is what we're going to stick our projection material to.

There's a wide array of different projection screen material on the market, all offering differing qualities — price, gain and colour. Go for a slightly greyish material if light is going to be an issue, while still with a gain of around 1.2 if your room is going to be dark. Go higher gain if light is a problem.

Buy a size that allows the material to wrap around the edges of the screen — not all the way so that it's overhanging the rear, but so that it reaches the back edge of each screen edge. Now we're going to buy some double-sided Velcro tape to keep it in place. Use one



Here's how to cut each corner, so that the light gauge still can be affixed to it.

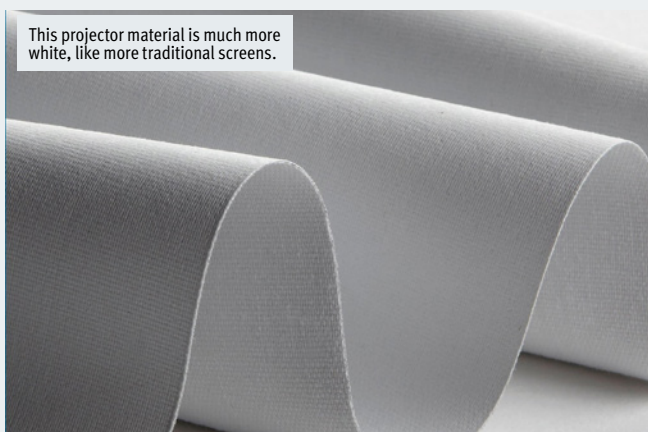


Now we attach the corners with studs, bolts or rivets.

Here's just one version of projector material — in this case, a grey colour for high contrast situations.



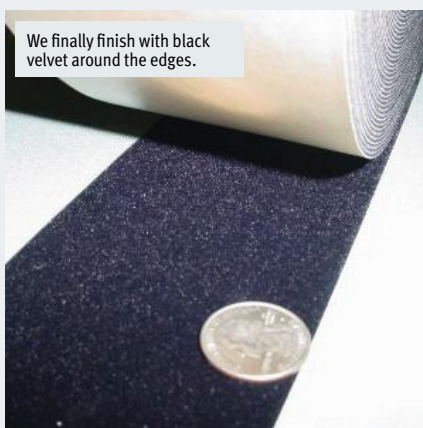
This projector material is much more white, like more traditional screens.



Velcro tape is perfect for adhering both the screen material and velvet to the frame.



We finally finish with black velvet around the edges.



piece per edge of the screen, giving the material something to affix to. Now place your material over the front of the screen, and slowly add the other side of the Velcro tape to each edge. As you do this, stick it to the screen, ensuring you pull it tight so that there are absolutely no wrinkles, and work your way around the edge of the screen. If you've done it right, you should end up with material in place that has no wrinkles.

However, the benefit of using double-sided Velcro tape is that you can pull it tighter in certain places if you notice wrinkles, which will also develop over time. Make especially certain that your corners are well placed with the Velcro in the right place, as this is

where you're most likely to get warping and rippling.

Our finishing touch is the black velvet used to outline the screen and provide a sharp edge to the image. We use black velvet as it absorbs any light — if your projection is slightly out of shape, the black velvet will make it impossible to see the error. Buy this in a long strip approximately 7cm thick, and then use more double sided Velcro to place it around the edge of the projector material.

Clean up any rough edges, and then you should have a screen that looks professionally made for a fraction of the cost.

Mounting it to the wall can be done in several ways. I've generally just used three

or four screws, which the metal struts can just sit on, but some prefer a more rugged method.

It's possible to screw a short (40cm) length of wood to the top strut, and then have a matching piece on the wall. The screen will then sit on this piece of wood — make sure you use a spirit level to ensure it's nice and straight, otherwise you're going to have an off-kilter screen.

The total cost of a screen like this is approximately \$500, though it really does depend on the screen material you use, which can cost upwards of several thousand for the really serious stuff.

One benefit this type of screen has over others is the use of the double-sided Velcro — screens do sag and wrinkle over time, but by using the Velcro, it's incredibly simple to tighten up any soft spots. It's also perfect for building the perfect sized screen for your room, whereas most pre-built screens only come in select sizes.

Just remember to take your time, measure everything twice, and don't get frustrated if things don't go right straight away. Once it's up and running, the joy of knowing you built this for a fraction of the cost of a pre-built projector screen will make the effort more than worthwhile. ■



Light quilt stuffing behind the main projection material will get rid of any bulges or knobs.



The Efergy Engage products use a central internet-connected hub and wireless transmitters to monitor whole home power use.

[SMARTHOME MASTERCLASS]

Monitor your home energy use to save money (and the planet)

HAVING A SMARTHOME IS NOT JUST ABOUT COOL TECH, IT'S ALSO ABOUT THE WAYS IN WHICH WE CAN MAKE TECH MORE ENERGY EFFICIENT.

[LINDSAY HANDMER]

A BIG FOCUS in smarthome technology is smarter, more efficient use of electricity, to reduce power bills, as well as environmental impact. Energy monitoring systems can help identify appliances and usage trends that consume a lot of power, and provide the data needed to make effective changes.

ENERGY MONITORING BENEFITS

While solar and battery storage systems such as the Tesla Powerwall are often touted as methods to reduce electricity costs, simple reducing consumption can be just as effective. Of course, knowing how much you actually use day to day, and even minute to minute, is key. To make it easier, there is a range of products available that can track energy usage and bring the information together in an easy-to-understand dashboard. Going a step further, it's possible to remotely shut down energy-hogging devices, and set goals and alarms for consumption.

While many users have flat rate energy prices, time of use metering is becoming more popular. By tracking when and what is using the most power in peak times, usage times can be changed to save money without even needing to reduce overall consumption.

Another large consumer of power is idle load from electronic devices. While more modern appliances generally drop idle power to very low levels, some older equipment draws a surprisingly large amount of electricity even when off. This adds up over time, and

identifying and reducing idle draw is a great way to save money. Energy monitoring is also a great way to better understand where power is flowing in a solar or battery storage setup.

EFERGY

www.efergy.com

Featuring a large range of products designed to track and display energy usage, Efergy is a great starting point for smarthome power monitoring. Getting hands on, we installed and tested some of the most popular devices as part of our guide to smarter home energy monitoring. Using the Efergy platform, everything from whole home power to individual appliances can be tracked. Also included is a free online platform, which provides a simple graphical dashboard, that gives an instant view of power use, as well as enabling detailed consideration of trends over time. It's even possible to remotely control individual appliances with Wi-Fi-connected power tracking switches.

OTHER OPTIONS

While one of the best, Efergy is not the only monitoring system available. The popular Belkin WeMo range (www.belkin.com) includes a power monitoring and remote control wall switch called Insight, which can log consumption from a particular socket. It doesn't have the main feed line electricity meter level of data

logging, though, but can be easier to tie in with other smarthome functionality. Power Tracker (www.powertracker.com.au) and SMA (www.sma-australia.com.au) are two more companies that both offer a range of networked and internet-connected power tracking products. Another basic option for those getting started are power meters such as the MS6116 from jaycar.com.au, which cost under \$25 and track usage on a single power point, with no online connectivity.



The Belkin WeMo Insight can monitor the power use from a single appliance, and log the data online.

PRODUCTS

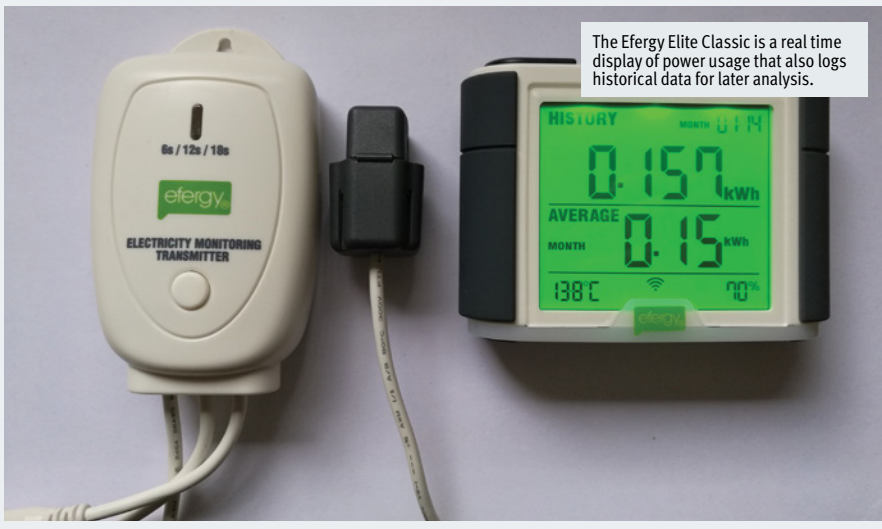
Efergy has a huge range of products designed to monitor power use in different scenarios. These are available in a range of ready-to-go kits, as well as being sold individually. While some use an internet-connected hub as a central connection point, others work directly with a monitoring display or smartphone.

SENSORS

The Efergy system uses non-contact CT sensors to monitor how much power is flowing through a live cable. These work as a transformer, where AC current in the wire induces a current in the sensor, which is then measured, and transmitted wirelessly back to a hub. The basic kit of a sensor, transmitter and hub costs \$149.95, and adding extra sensors cost \$69 each. Just the hub costs \$79.95. Starter kits for solar system monitoring (\$229.95) and three phase (\$169.95) are also available. A power monitoring Engage Socket product is coming soon to allow data collection from individual appliances.

DISPLAYS

While all the data can be viewed online or via smartphone app, Efergy also has two portable wireless displays. These can receive and display the power use directly in real time, to make monitoring super quick, without the need for internet access. The displays are available separately, or as part of different starter kits.



The Elite Classic costs \$99.95 (and comes with a CT sensor and transmitter) and displays real-time data on a large screen, with activatable backlight. It's mains or battery powered (12-month life), and can record and display 12 months of historical kWh usage data. The display can also be set up to calculate and show the power cost, based on your rates, as well as show CO2 produced. It can be set to sound an alarm if a pre-set consumption target is exceeded. The Elite Classic doesn't need a hub or internet connection to operate either, but its data can't be automatically logged elsewhere. This is a great option for those who want a simple readout and basic historical power use data (such as solar monitoring), without any extra complexities.

The e2 Classic (\$129.95) offers the same functionality, with a few extra features. For a start, it can monitor and store up to 24 months of data. Using Efergy's elink 2.3 software, the

recorded information can be downloaded to a computer and viewed as graphs, or outputted as a spreadsheet for further analysis.

EFERGY EGO

The Engage systems are great for whole-house or circuit monitoring, but not to see how much your home theatre gear is using when turned off. The Efergy Ego is Wi-Fi-enabled device that plugs between your appliance and the wall socket, and records the power usage. Even more importantly, it can be remotely turned on and off to cut any parasitic idle electricity use. The switch also has smarthome uses, such as remotely turning on an appliance. We tested it by tracking the power used by a fridge, AV equipment, and activated an electric kettle each morning so it was boiled and ready for a morning coffee. The Ego is controlled and monitored via a free Android or iOS smartphone app.



The Efergy Ego and smartphone app allow easy monitoring and control of a single power socket.



The Efergy Engage system uses battery-powered wireless transmitters to send data to the online dashboard.



The non-contact CT Sensors are clipped around a power feed wire to measure the current flow in real time.



INSTALLATION

While units such as the Ego can be simply plugged in, the CT sensors have to be clipped over wires. As a non-contact technology, these can be installed without an electrician, but it's highly recommended to use a professional. In our case, we got help from a relative with an electrician's licence. For those living in strata titled units or townhouses, special permission may be needed, and the distance from transmitter to receiver hub may be too far for reliable transmission.

CT SENSORS

Installation procedure will vary a lot depending on the type of electrical meter and panel. Our system is particularly ancient, but that did allow for easy access to the underlying rat's nest of wiring. The sensors come with installation instructions, but they don't match all power meter types. If in doubt, Efergy themselves can help identify the correct wire. For extra monitoring, we clipped CT sensors onto our main feed line, off peak line, and the one lighting circuit. From there, the separate wall socket consumption can be calculated.

The actual installation is as simple as clipping the CT sensor onto the live feed wire, running the cable clear and plugging it into

+

AS A NON-CONTACT TECHNOLOGY, THESE CAN BE INSTALLED WITHOUT AN ELECTRICIAN, BUT IT'S HIGHLY RECOMMENDED TO USE A PROFESSIONAL.

the transmitter. Our hub was on the opposite side of the house to the meter, so we found that leaving the transmitter in the electrical box itself shielded the wireless signal and caused an unreliable connection. Since the units are waterproof, we mounted them under the electrical box with double-sided tape. A drilled hole allows the wires to exit the meter without blocking the electrical panel door.

Another more complex option (speak to an electrician) is to mount the CT sensor on a wire behind a single power outlet. This then allows tracking of the usage from one particular device, such as a fridge.

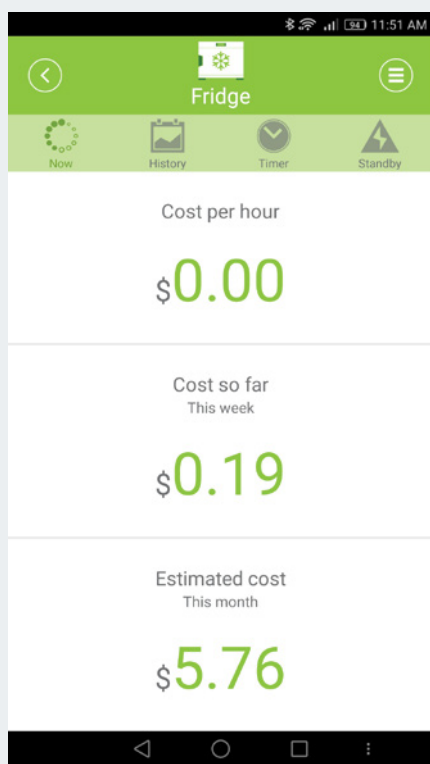
ENGAGE HUB

This little unit plugs into your router and receives the signals from the CT sensor

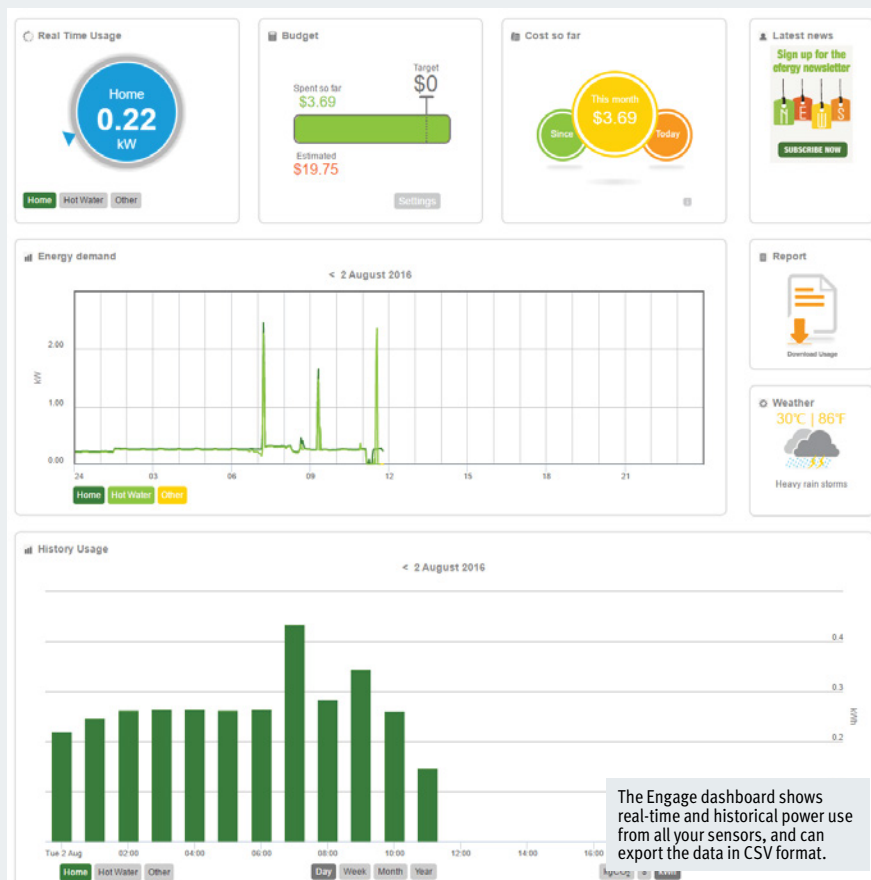
transmitters, and logs them. It needs mains wall power, as well as a single Ethernet connection and internet access. After creating an account, the monitoring system walks you through connecting the transmitters. In our case, the auto-search picked them up and started logging data right away. To make sure the data was accurate, we fired up a high draw load (an electric kettle) and watched the power draw spike immediately.

ELITE CLASSIC DISPLAY

We set up and tested the LCD as if it was installed independently to the monitoring system. This mimics use by a household that just wants an easy-to-read power meter, with some data tracking, not an internet-connected system. The transmitter and CT sensor included with the Elite Classic is the same as the others used in the Engage system, so installation was as simple as clipping it onto the main feed wire. Getting the two connected just involves pressing the link button on the display, and turning on the transmitter. The screen is rated for a 70m range, but we mounted the transmitter outside of the power meter.



Using a free smartphone app, the Efergy Ego can remotely control and record power usage on individual appliances.



The Engage dashboard shows real-time and historical power use from all your sensors, and can export the data in CSV format.

MONITORING AND RESULTS

To get a better idea of individual device power usage, extra CT sensors can be installed on different circuits, or the one sensor can be moved around. For example, sensors could be used to monitor the lighting circuit, hot water system, kitchen appliance circuit, air conditioner circuit and more.

COST AND CO2 TRACKING

The Efergy online dashboard allows you to enter an electricity price in cents per kWh. From there, it can calculate how much your energy use has cost each day, month or from a specific date. You can find the per kWh price on your bill, though some have multiple tariff levels depending on overall use. In such a case, dividing your total power use in kWh by the usage charges will give the average kWh price. Be aware that the supply charge is a separate value to usage.

The Efergy system can also calculate CO2 emitted, and uses a default value of 0.5kg per kWh. While this is a decent starting point, for a more accurate number, try contacting your energy supplier.

ANALYSING THE DATA

The Efergy dashboard includes a simple graph

with selectable options that makes it easy to compare power cost, kWh usage and CO2 emissions, over a period of a day, a week and a year. For those who like to play with the numbers in more detail, the system can also generate a report in CSV format. This can be set to a data resolution of as little as every minute, and cover a selected month. It also includes the raw data from all sensors tied into your account. A good starting point (after recording some baseline data) is to try turning off power points for TVs and other devices when not in use, and compare overall power use information.

EFERGY EGO

Unfortunately, the Ego system does not mesh into the Engage power monitoring, and instead uses its own app. Setup involves plugging in the Ego unit, and connecting to it via the app. This turned out to be a complex process, as the automatic connection did not work. Instead, it was necessary to manually add the Ego switch. Afterwards, it was necessary to reset the phone before it would run stably.

The Ego app allows data collection and real-time viewing in a similar fashion to the Engage dashboard. You can input your electricity price

+

A GOOD STARTING POINT (AFTER RECORDING SOME BASELINE DATA) IS TO TRY TURNING OFF POWER POINTS FOR TVS AND OTHER DEVICES WHEN NOT IN USE, AND COMPARE POWER USE.

per kWh, and calculate costs and CO2 emissions. Historical data can be viewed on a daily, weekly or monthly time scale. You can also compare different switches, set up on/off timers, and have the Ego learn to disable idle power draw.

















Using Ego, we tracked a whole range of different appliances to get a better idea of their power use. A notable discovery was that the washing machine draws ~30w when not in use, which adds up to a very significant \$60 a year added to the power bill. One large overall consumer of electricity was the fridge, which chewed through 518kWh a year. Interestingly, sliding it out about 5cm and removing items on top that impeded cooling airflow dropped the usage by 14.3%, saving 74 kWh, or \$17 a year. Every little bit counts! ■



















BUYER'S GUIDE

YOUR READY RECKONER TO THE BEST TECHNOLOGY PRODUCTS



The *TechLife* team finds the best budget, value and performance products, and the latest releases in the top technology categories. If you believe there are other products that deserve the title in any of the tech categories, let us know and give us your reasons why in 50 words or less. Equally, if there's a hot new product that's worthy of attention, we want to know. Send your email to techlife@futurenet.com.

	NEW ENTRY 			
	[BEST BUDGET] TP-Link Archer D20	[BEST VALUE] TP-Link Archer D7	[BEST PERFORMANCE] ASUS DSL-AC68U	[NEW ON SHELF] D-Link DSL-4320L
ADSL ROUTERS (WITH MODEM)	\$90 www.tp-link.com.au It's basic and no-frills, with AC750 Wi-Fi and 100Mbps Ethernet, but at this price, you won't do better.	\$170 www.tp-link.com.au The UI is a bit no-frills, but once set up, this is a very solid AC1900 router for a price well below the average.	\$320 www.asus.com/au It ain't cheap, but if you want it all, this 802.11ac unit is fast and packed with handy enthusiast features.	\$580 www.dlink.com.au This tri-band ADSL router offers lots of speed potential, but is expensive and low on smarts.
				NEW ENTRY 
	[BEST BUDGET] Netgear WNR2000	[BEST VALUE] TP-Link Archer C7	[BEST PERFORMANCE] ASUS RT-AC87U	[NEW ON SHELF] Linksys EA9500
BROADBAND ROUTERS (NO MODEM)	\$70 www.netgear.com.au It's only 802.11n, but for around \$70, this four-port router will cover the basics.	\$150 www.tp-link.com.au This modemless version of the D7 (above) has all the basics you'll need to set up a 1,300Mbps AC network.	\$300 www.asus.com/au This full-featured unit is overflowing with options and settings, plus it has super-fast wireless.	\$550 www.linksys.com/au This uber (expensive) router offers three radios for AC5400 Wi-Fi, plus plenty of other bells and whistles.
				
	[BEST WIRELESS EXTENDER] Netgear EX6200 Wi-Fi Range Extender	[BEST WIRELESS BRIDGE] Linksys WUMC710	[BEST POWERLINE ADAPTER (BUDGET)] D-Link DHP-601AV	[BEST POWERLINE ADAPTER WITH WI-FI EXTENSION] Netcomm NP508
NETWORKING ACCESSORIES	\$140 www.netgear.com.au This AC extender is capable of speeds up to 867Mbps, has great range and can host storage via its USB 3.0 port.	\$140 au.linksys.com This 802.11ac bridge is a great way of linking up to four wired network devices to a 1,300Mbps AC network.	\$129 www.dlink.com.au Not the most compact, but quite affordable, it offers Gigabit speeds and performed well in testing.	\$138 www.netcomm.com.au If you want to add wireless extension onto powerline capabilities, this topped our 2.4GHz Wi-Fi speed tests.
				
	[BEST BUDGET] Netgear ReadyNAS RN102	[BEST VALUE] Asustor AS-202TE	[BEST PREMIUM] Synology DS416j	[NEW ON SHELF] Asustor AS3102T
NETWORK ATTACHED STORAGE DEVICES	\$170 (diskless) www.netgear.com.au It's not particularly new, but this two-bay NAS has the basics at an affordable price.	\$295 (diskless) www.asustor.com This two-bay NAS offers excellent features, and can double as a media player via XBMC and HDMI-output.	\$400 (diskless) www.synology.com This four-bay NAS runs Synology's excellent operating system, which lets you add heaps of extra features via apps.	\$370 (diskless) www.asustor.com The newer version of the AS-202TE (left), with enough grunt for 4K media playback and transcoding.

 <p>[BEST BUDGET] Jawbone Mini Jambox</p>	 <p>[BEST PORTABLE] Bose SoundLink Mini II</p>	 <p>[BEST MULTIROOM SYSTEM] Sonos Play</p>	 <p>[NEW ON SHELF] Bose SoundTouch 10</p>
<p>\$99 www.jawbone.com At this new low price (available at JB Hi-Fi) the Mini Jambox is a robust, good-sounding portable unit.</p>	<p>\$299 www.bose.com.au It's on the expensive side, but this compact Bluetooth portable sounds amazing for its size.</p>	<p>From \$299 www.sonos.com Sonos still offers the best multiroom speaker range, with the broadest support for streaming services.</p>	<p>\$300 www.bose.com.au Bose's entry into the modular streaming speaker-system is surprisingly affordable. Review forthcoming.</p>
 <p>[BEST BUDGET] Shure SRH440</p>	<p>PRICE CHANGE</p>  <p>[BEST VALUE] Audio-Technica ATH-M50X</p>	 <p>[BEST PREMIUM] Sennheiser Momentum Wireless</p>	 <p>[BEST WIRELESS] Plantronics BackBeat Pro+</p>
<p>\$118 www.jands.com.au Bright, clear sound and great bang for buck.</p>	<p>\$185 www.audio-technica.com.au A well-priced set of over-ear headphones with fantastic audio and detachable cables.</p>	<p>\$670 en-au.sennheiser.com They're not cheap, but the wireless Momentums are about the best over-ear cans money can buy.</p>	<p>\$420 www.plantronics.com/au This recently refreshed set of BT cans blew us away with their great acoustics and noise-cancelling capabilities.</p>
 <p>[BEST BUDGET] Google Chromecast 2</p>	 <p>[BEST VALUE] Western Digital WD TV Live</p>	 <p>[BEST PREMIUM] Apple TV</p>	 <p>[NEW ON SHELF] Telstra TV</p>
<p>\$50 play.google.com Google's updated wireless HDMI dongle is now 802.11ac and makes it easy to stream online media content to your TV.</p>	<p>\$120 www.wdc.com It beats many TVs for video format support and its fast processor supports 1080p network streaming.</p>	<p>From \$269 www.apple.com/au The recently updated Apple TV now has its own dedicated app store and more processing power.</p>	<p>\$110 www.telstra.com.au Telstra's rebranded Roku 2 media streamer supports many Aussie streaming services and is reasonably priced.</p>
 <p>[BEST VALUE] Epson EB-W120</p>	 <p>[BEST PORTABLE] Epson EB-1761W</p>	<p>NEW ENTRY</p>  <p>[BEST HOME THEATRE] BenQ MH530</p>	 <p>[NEW ON SHELF] LG MiniBeam PG60</p>
<p>\$580 www.epson.com.au This compact 3LCD, WXGA unit has good features and image quality and decently priced lamps.</p>	<p>\$1,199 www.epson.com.au One of the most compact 'full-size' projectors, this WXGA unit is only 1.7kg and new lamps are just \$120.</p>	<p>\$900 www.benq.com.au A high-brightness 1080p DLP projector that's affordable and relatively compact.</p>	<p>\$999 www.lg.com/au This compact and portable home-theatre projector will go anywhere, though its not high specced.</p>
 <p>[BEST COMPACT TV] Samsung UA32J5500AW</p>	 <p>[BEST BUDGET TV] Hisense K3110PW</p>	 <p>[BEST MAINSTREAM TV] LG 55UH770T</p>	 <p>[BEST PREMIUM TV] LG 55EG960T</p>
<p>\$600 www.samsung.com/au This compact and inexpensive 32-inch telly has a 1080p resolution and outstanding visuals.</p>	<p>\$800 hisense.com.au A compelling mix of size (50 inches), value and visuals: a solid all-rounder at a very keen price.</p>	<p>\$2,300 www.lg.com/au With 4K and HDR, this LED-backlit IPS 55-incher provides fantastic image quality.</p>	<p>\$4,500 www.lg.com/au LG's 55-inch OLED 4K set basically blows the competition away... though you can find non-OLED competitors for much less.</p>
 <p>[BEST BUDGET] HP Stream 13-C204TU</p>	 <p>[BEST ULTRABOOK] Apple MacBook Air 13-inch</p>	 <p>[BEST GAMING] ASUS G751JT</p>	 <p>[NEW ON SHELF] Razer Blade Stealth</p>
<p>\$400 www.hp.com/au A basic but functional 15.6-inch laptop that's perfect for the kids or those with simple computing needs.</p>	<p>From \$1,549 www.apple.com/au This thin, lightweight unit has an aluminium unibody chassis, fast CPU and is well-priced for an ultrabook.</p>	<p>\$2,499 www.asus.com/au This unashamedly huge 17-inch desktop replacement packs heaps of power and a GTX 970M GPU.</p>	<p>From \$1,549 www.razerzone.com/au Aiming at the 12-inch MacBook, the build-quality and value on this tough portable are outstanding.</p>

WIRELESS SPEAKERS
BUYER'S GUIDE
READY RECKONER

MUSIC HEADPHONES


PERSONAL & HOME AV GEAR
NETWORK MEDIA PLAYERS

DATA PROJECTORS

TVS

LAPTOPS, TABLETS & SMARTPHONES
LAPTOPS

	 <p>[BEST WINDOWS] Microsoft Lumia 650</p> <p>\$299 www.microsoft.com With 4G, a 5-inch OLED screen and Windows 10 Mobile, this is a solid entry-level choice for MS fans.</p>	 <p>[BEST BIG SCREEN] Motorola Moto G (2014)</p> <p>\$149 www.motorola.com.au Now widely on clearance, this dual-SIM 3G phone with 5-inch 720p LCD and 8GB storage has all the basics.</p>	<p>PRICE DROP</p>  <p>[BEST PERFORMANCE] Oppo R7s</p> <p>\$399 (16GB) www.oppo.com This Android-powered unit has a 5.5-inch IPS 1080p display, solid performance and a stylish design.</p>	<p>NEW ENTRY</p>  <p>[NEW ON SHELF] Motorola Moto G4 Plus</p> <p>\$390 (16GB) www.motorola.com.au Moto's big 5.5-inch G4 Plus has a 1080p display and a respectable Snapdragon CPU.</p>
	 <p>[BEST BUDGET] Google Nexus 5X</p> <p>\$400 (16GB) www.google.com A speedy LG-made 5.2-inch phone with lots of flagship features. Be sure to shop around for a much-lower price.</p>	<p>NEW ENTRY</p>  <p>[BEST BIG SCREEN] Samsung Galaxy Note7</p> <p>\$1,349 www.samsung.com/au It costs a bomb, but the 5.7-inch Note7 doesn't disappoint. Fast, great camera and useful stylus tricks.</p>	 <p>[BEST PREMIUM — TIED] Samsung Galaxy S7</p> <p>From \$1,149 www.samsung.com/au The S7 brings back microSD and waterproofing, and combines them with a classy chassis and top specs.</p>	 <p>[BEST PREMIUM — TIED] Apple iPhone 6S</p> <p>From \$1199 www.apple.com/au This new model includes a pressure-sensitive '3D Touch' display, better camera and faster internals.</p>
	 <p>[BEST BUDGET] Samsung Galaxy Tab 4 8.0</p> <p>\$240 (16GB) www.samsung.com/au It's getting a little long in the tooth, but this 8-inch quad-core Android tablet is our current budget pick.</p>	 <p>[BEST COMPACT] Apple iPad mini 2</p> <p>\$369 (16GB) www.apple.com/au With a Retina display, the iPad mini 2 is fantastic value if you want a small tablet with all the frills.</p>	 <p>[BEST PERFORMANCE] Apple iPad Air 2</p> <p>\$599 (16GB) www.apple.com/au Now 2 years old, the iPad Air 2 is still very competitive and there are heaps of tablet-specific iOS apps available.</p>	 <p>[BEST VERSATILITY] Microsoft Surface 3</p> <p>\$699 (64GB) www.microsoft.com A lower-end, Intel Atom-powered alternative to the Surface Pro, but still runs the full version of Windows.</p>
	 <p>[BEST BUDGET] Apple iPad Air (Refurbished)</p> <p>From \$439 (16GB) www.apple.com/au If the budget doesn't extend to an Air 2, get this 2013 unit instead. Recheck the store frequently if it's ever sold out.</p>	 <p>[BEST VERSATILITY] Microsoft Surface Pro 4</p> <p>From \$1,349 www.microsoftstore.com This official Windows 10 tablet has a great stylus and runs traditional Windows software.</p>	 <p>[BEST PERFORMANCE] Apple iPad Pro (9.7-inch)</p> <p>From \$899 www.apple.com/au This smaller iPad Pro has the same top-spec internals as its bigger brother, but is far more portable.</p>	<p>NEW ENTRY</p>  <p>[NEW ON SHELF] Samsung Galaxy TabPro S</p> <p>From \$1,349 www.samsung.com/au One of the neatest 2-in-1s we've tested, this is a Windows tablet-convertible that's lightweight and flexible.</p>
	 <p>[BEST FOR IPAD 2/3/4] Logitech Keyboard Case for iPad</p> <p>\$90 www.logitech.com Offers good protection and comfy, responsive keys on a budget.</p>	 <p>[BEST FOR IPAD AIR/AIR 2] ClamCase for iPad Air</p> <p>\$150 www.clamcase.com If you want to turn your iPad into a mini MacBook, this clamshell keyboard case is a great option.</p>	 <p>[BEST FOR IPAD MINI] Logitech Ultrathin Keyboard Cover</p> <p>\$90 www.logitech.com The Ultrathin combines a fantastic-quality keyboard with a metal-backed case.</p>	 <p>[BEST FULL-SIZED KEYBOARD] Logitech Tablet Keyboard</p> <p>\$120 www.logitech.com If you want the full-sized typing experience, this is your best bet.</p>
	 <p>[BEST POINT-AND-SHOOT] Canon PowerShot G7X Mark II</p> <p>\$850 www.canon.com.au This flexible fixed-lens compact delivers great photos without the hassle of a DSLR or mirrorless.</p>	 <p>[BEST MIRRORLESS] Fujifilm X-T10</p> <p>\$1,070 (16–50mm lens) www.fujifilm.com.au Offers a compact DSLR-style body, superb image quality and a growing range of premium lenses.</p>	 <p>[BEST DIGITAL SLR] Canon EOS 750D</p> <p>\$980 (18–55mm lens) www.canon.com.au This beginner's DSLR is a great place to learn the intricacies of pro shooting (and for a fair price).</p>	 <p>[NEW ON SHELF] Sony RX10 III</p> <p>\$2,299 (24–600mm lens) www.sony.com.au The RX10 III offers unrivalled image quality, superb 4K and HD video and a huge zoom range, at a price.</p>

 <p>[BEST POWER BANK] TP-Link TL-PB1040</p>	<p>NEW ENTRY</p>  <p>[BEST WIRELESS HARD DRIVE] WD My Passport Wireless Pro 3TB</p>	 <p>[BEST STYLUS] Adonit Jot Pro</p>	 <p>[BEST MOBILE GAMEPAD] iPega PG-9025</p>
<p>\$50 www.tp-link.com.au This 10,400mAh power bank will let you recharge your smartphone or tablet anywhere and weighs just 241g.</p>	<p>\$449 www.wd.com A great way to share and back up your files anywhere, plus it has Plex media streaming.</p>	<p>\$45 www.adonit.net This one's great for scribbling notes on Android and iOS tablets and doesn't cost the Earth.</p>	<p>\$25 www.dx.com You'll need to buy it online, but this gamepad is nice and responsive, and works with both iOS and Android.</p>
 <p>[BEST BUDGET] Toshiba Canvio Basic 1TB</p>	 <p>[BEST VALUE] Western Digital My Passport Ultra 2TB</p>	 <p>[BEST PERFORMANCE] Seagate Backup Plus Fast 4TB</p>	<p>NEW ENTRY</p>  <p>[NEW ON SHELF] Western Digital My Passport Ultra 4TB</p>
<p>\$90 www.toshiba.com A compact portable hard drive with USB 2.0, 3.0 and backward compatibility.</p>	<p>\$149 www.wd.com Great value, with lots of storage, good software and USB 3.0 support.</p>	<p>\$390 www.seagate.com This speedy USB 3.0 drive transfers data at up to 220MB/s — twice as fast as most others.</p>	<p>\$269 www.wd.com A big-capacity drive that isn't too bulky to take with you. The price is decent too.</p>
<p>NEW ENTRY</p>  <p>[BEST SMARTWATCH FOR ANDROID] Samsung Gear S2</p>	 <p>[BEST SMARTWATCH FOR IOS] Pebble Time</p>	 <p>[BEST FITNESS BAND] Fitbit Charge HR</p>	 <p>[BEST EXERCISE HEADPHONES] Jabra Sport Pulse Wireless</p>
<p>\$469 www.samsung.com/au Samsung's round-faced wearable looks great, works with lots of phones and runs Android Wear 2.0.</p>	<p>US\$200 www.getpebble.com This new colour e-paper smartwatch has great battery life and one of the most mature app ecosystems.</p>	<p>\$200 www.fitbit.com This top-end tracker from Fitbit's latest range offers heart-rate tracking and a handy display for a fair price.</p>	<p>\$250 www.jabra.com These in-ear buds connect to your phone via Bluetooth and have integrated heart-rate monitoring.</p>
 <p>[BEST BUDGET] LG 23MP48HQ-P</p>	 <p>[BEST VALUE] Dell S2415H</p>	 <p>[BEST PROFESSIONAL] Dell UltraSharp U2717D</p>	 <p>[BEST GAMING] Acer Predator XB270HU</p>
<p>\$180 www.lg.com/au Just need the basics? This matte 23-inch 1080p IPS display has good colour reproduction and a tilt stand.</p>	<p>\$279 www.dell.com.au An affordable glossy 1080p 24-inch that, despite the low price, still offers IPS and good all-round performance.</p>	<p>\$849 www.dell.com.au This 27-inch IPS display offers a 1440p res plus a wide colour gamut, making it perfect for design work.</p>	<p>\$899 www.acer.com.au With Nvidia G-Sync support, 1440p res and vibrant colours, this one's a true gaming great.</p>
 <p>[BEST BUDGET] Tt eSports Poseidon ZX</p>	 <p>[BEST VALUE] Logitech G710+</p>	 <p>[BEST PREMIUM] Corsair Vengeance K95 RGB</p>	 <p>[NEW ON SHELF] Razer BlackWidow Chroma</p>
<p>\$99 www.au.tt esports.com This basic compact board still has it where it counts, with solid performance and comfortable keys.</p>	<p>\$130 www.logitech.com This brown switched mechanical gaming keyboard is comparatively quiet and has great key feel.</p>	<p>\$230 www.corsair.com Available in multiple switch colours, the K95's backlighting can be customised in almost any shade.</p>	<p>\$210 www.razerzone.com Razer's joined the multicoloured LED club, upgrading its BlackWidow with rainbow-coloured backlighting.</p>
 <p>[BEST BUDGET] Microsoft LifeChat LX-3000</p>	 <p>[BEST VALUE] SteelSeries Siberia V2</p>	 <p>[BEST PERFORMANCE] Audio-Technica ATH-AG1</p>	 <p>[NEW ON SHELF] Kingston HyperX Cloud II</p>
<p>\$35 www.microsoft.com.au/hardware A cheap basic USB headset with noise-cancelling tech.</p>	<p>\$99 www.steelseries.com Luxurious with great sound and a brilliant retractable microphone.</p>	<p>\$349 www.audio-technica.com.au A super-comfy headset with massive drivers and fantastic sound.</p>	<p>\$160 www.kingston.com These affordable cans sound great across games, music and movies.</p>

TABLET & SMARTPHONE ACCESSORIES

BUYER'S GUIDE
READY RECKONER

GADGETS & ACCESSORIES
PORTABLE HARD DRIVES

WEARABLES

PC MONITORS

PC PERIPHERALS
GAMING KEYBOARDS

GAMING HEADSETS

				
	[BEST BUDGET] Logitech G402 Hyperion Fury	[BEST VALUE] Razer DeathAdder Chroma	[BEST AMBIDEXTEROUS] SteelSeries Sensei RAW	[BEST WIRELESS] Logitech G900 Chaos Spectrum
	\$49 www.logitech.com A hybrid-sensor gaming mouse with optical, gyro and accelerometer tracking, this one doesn't skip a beat.	\$65 www.razerzone.com/au-en This super-comfy ergonomic mouse for right-handers has a great, organic-feeling sensor.	\$80 www.steelseries.com Ditching unneeded features, this is a lean, mean headshotting machine that's good for lefties and righties.	\$200 www.logitech.com It ain't cheap, but this is the best wireless gaming mouse we've used; surprisingly light and well balanced.
				
	[BEST BUDGET] Brother HL-L2340DW	[BEST VALUE] HP Officejet Pro 8620	[BEST PHOTO PRINTER] Epson Expression Premium XP-720	[BEST SMALL-BUSINESS LASER] HP Colour LaserJet Pro MFP M277dw
	\$110 www.brother.com.au It's black and white only, but with Wi-Fi and great text print quality alignment, very fast print speeds and cheap to run.	\$190 www.hp.com/au A great all-rounder that's up for printing both photos and text documents.	\$230 www.epson.com.au Creates fantastic-quality photo prints at a relatively affordable price.	\$450 www.hp.com/au Built-in wireless, duplex print and scan, cloud and mobile print, and great print quality at a fair price.
				
	[BEST BUDGET] Gigabyte GV-R737WF20C-2GD	[BEST VALUE] ASUS STRIX-R9380-DC20C-4GD5-GAMING	[BEST PREMIUM] Gigabyte GV-N970WF30C-4GD	[BEST EXTREME] MSI GeForce GTX 1070 Armor 8G
	\$200 www.gigabyte.com.au This mid-range card from AMD can run pretty much anything with all the bells and whistles at 1080p.	\$280 www.asus.com/au A fast Radeon R9 380 card with 4GB of memory. A good choice for 1440p gaming.	\$445 www.gigabyte.com.au If your budget stretches to around \$500, this new GeForce is extremely fast and great value.	\$740 au.msi.com One step down from the new king, this card is a little more affordable and beats the last-gen leaders.
				
	[BEST BUDGET] ASUS B150M Pro Gaming	[BEST VALUE] Gigabyte GA-Z170M-D3H	[BEST PERFORMANCE] ASUS Z170 Pro Gaming	[NEW ON SHELF] ASRock X99 Taichi
	\$145 www.asus.com/au A great companion for the Pentium G4400; this has everything you need for under \$150.	\$200 www.gigabyte.com.au This low-cost Z170 board has all the basics you need, including Intel LAN and 6th-Gen Core i support.	\$265 www.asus.com/au A great match for the i5-6500 CPU, with a good mix of useful features at a reasonable price.	\$390 www.asrock.com This (slightly) cheaper X99 board is still feature-packed and a good match for the i7-6800K CPU.
				
	[BEST BUDGET] Intel Pentium G4400	[BEST VALUE] Intel Core i5-6500	[BEST PREMIUM] Intel Core i7-6700K	[NEW ON SHELF] Intel Core i7-6800K
	\$85 www.intel.com An extremely overclockable dual-core Skylake CPU for those looking to build budget rig.	\$295 www.intel.com This new Skylake Core i5 chip offers great performance with low power use.	\$520 www.intel.com The top chip from Intel's new 6th-Gen Core i desktops is extremely fast and overclockable.	\$580 www.intel.com This new six-core 'Broadwell-E' chip offers top-shelf performance (at a top-shelf price).
				
	[BEST BUDGET] OCZ Arc 100 120GB	[BEST VALUE] SanDisk Ultra II 240GB	[BEST PREMIUM] Samsung 850 EVO 1TB	[BEST EXTREME] Samsung 950 Pro 512GB
	\$75 www.ocz.com This Toshiba-made SSD is fast, reliable and very low-priced. A great option for anyone looking for a budget SSD.	\$125 www.sandisk.com 240GB is no longer the sweet spot in terms of cost-per-gig, but this model is the best option under \$150.	\$425 www.samsung.com/au This successor to the 840 EVO offers the best mix of speed, capacity and price for those with big needs.	\$420 www.samsung.com/au It's pricey, but with 2TB/s read and write speeds this M.2 drive is stupid-fast.



techradar.

The home of technology

techradar.com

Parrot®

it's
*Flying
Season*®



Our prices fall, your drones soar.
**Save up to \$100 until
July 4th 2016!***

\$40
Cash Back



Airborne
Cargo Drone™
& Night Drone™



Jumping
Race Drone™
& Night Drone™



Hydrofoil Drone™



Jumping
Sumo™



Rolling
Spider™

\$50
Cash Back



Bebop Drone®

\$100
Cash Back

Bebop, the compact drone
that follows you everywhere



Bebop Drone®
& Skycontroller®

Visit parrot.com for more product information

* Buy a Parrot drone from 1st June to 4th July 2016 and get up to \$100 cash back. Cash back details: \$40 cash back for the purchase of a Parrot MiniDrone, \$50 cash back for the purchase of Parrot Bebop Drone, \$100 cash back for the purchase of Bebop Drone & Skycontroller. Bebop 2 and Bebop 2 & Skycontroller bundle not included in the offer. Terms & Conditions apply visit parrot.com for more information.

Parrot is a trademark or registered trademark of Parrot SA, used under licence therefrom. Flying season, Bebop Drone, Parrot Skycontroller and A.R.Drone are trademarks or registered trademarks of Parrot Drones SAS. Airborne Cargo Drone, Night Drone, Hydrofoil Drone and Jumping Race Drone are trademarks of Parrot Drones SAS.