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ED'S NOTE

The crux of social cybersecurity

Cybersecurity has been a hot topic at HWM, and we've written at length from various angles and themes, but something new always pops up. Of course, I'm talking about the recent Facebook and Cambridge Analytica saga. Interestingly, we've actually written a piece about Cambridge Analytica all the way back in our June 2017 issue, titled 'The Tangled Tale of Cambridge Analytica'.

Now, the notion of cybersecurity used to just be how well we're secured from the threats of the internet. I'm talking about anti-viruses, firewalls, and good password practices. All these threats are external, trying to find a loophole in your security in order to infect and attack you.

The problem with Facebook, and to an extent, all forms of social media is different. There is no attack vector. There is no threat coming in. The price we pay to use all of these services is to open up our privacy for the world to see.

This is why cybersecurity in our social age is such a tangled mess. Yes, we have a right to privacy and there must be limits on what our data can be used for, or even used in the first place.

However, our data is so easily farmed because with every check-in, live stream, and silly quiz, we willingly give away our data. This is very similar to the world's waste problem. The only way to combat this particular cybersecurity issue, is to reduce the waste data we generate and practice stricter control on what we share.

Zachary Chan
Editor

ON THE COVER
PICTURE **SUPERCHARGE YOUR STORAGE**
ART DIRECTION **ORLAND PUNZALAN**

5 things you need to know about the Samsung Galaxy S9 and S9+

1. SHOOT LIKE A PRO IN CHALLENGING LIGHTING CONDITIONS

The Samsung Galaxy S9 and S9+ come with a dual aperture lens that switches automatically between f/1.5 and f/2.4. At f/1.5, the S9 and S9+ have the fastest smartphone lens around. f/1.5 is especially useful in low light.But you can also use it in good light to shoot with a higher shutter speed and capture sharp action.

2. SHOOT MESMERIZING SUPER SLOW-MOTION VIDEOS

The Samsung Galaxy S9 and S9+ can record super slow-motion HD video at up to 960 frames per second for 0.2 seconds. Those 0.2 seconds equal six seconds of slow-motion footage, so you want to make sure you grab the right action.

3. GET THE FASTEST 4G SPEEDS WITH THE DEEPEST AND WIDEST COVERAGE IN SINGAPORE

The Galaxy S9 and S9+ feature Samsung's new LTE Cat 18 modem, which offers up to 20 percent faster downloads. But you'll also need a swift network to make full use of the advanced modem.

And when it comes to networks, Singtel provides the fastest speeds nationwide. The telco is also enhancing its 4G network progressively to roll out speeds of up to 1Gbps, starting with high traffic areas such as Orchard, Raffles Place, Tanjong Pagar and Clarke Quay. At 1Gbps, you can download a 1GB video in seconds on Singtel's network.

You'll also want the widest 4G coverage to make the full use of your Galaxy S9 or S9+. Singtel's network covers 99.9% of Singapore, making it the widest 4G network in Singapore

for 13 consecutive quarters, based on IMDA's 4G Outdoor Mobile Service Coverage Measurement Results.

Singtel is the only telco that provides 4G LTE on the 900MHz spectrum. This low-band LTE frequency has high wall penetration capabilities, giving you better in-building coverage. So you'll enjoy rapid 4G speeds even when indoors or underground.

4. GET A DIGITAL MAKEOVER WITH PERSONALIZED AR EMOJIS

Here's a feature that's pure fun: turn your selfie into an emoji and bring your messaging to life. With the S9 and S9+'s AR Emoji feature, you can create an animated digital version of yourself that reflects your unique personality. Get your message across with an emoji that closely tracks your movements and facial expressions.

5. TRIPLE YOUR DATA AND MORE

With all these powerful features, you'll be sharing more of your photos and videos with friends online. This means you'll need a mobile data plan that can keep up with you.

Buy a Samsung Galaxy S9 or S9+ with a Combo 3 Mobile Plan and above with Singtel, and you'll enjoy triple the data on DATA X 3, free for the first three months (U.P. S$9.90 per month). If that's still not enough, you can top up S$39.90 a month for unlimited data.

Discover the exciting Samsung Galaxy S9 or S9+ on Singapore's fastest and widest 4G network at **https://www.singtel.com/galaxys9**

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Free data, mobile discounts, and more: what you should know about Singtel Circle

Singtel Circle is for families who are all-in on Singtel. You'll enjoy fantastic deals with Singtel Circle if you and your family sign up for Mobile plans, Fibre Broadband, and Pay TV with Singtel. Being part of Singtel Circle is free – here's what you and your family members can look forward to.

USE ALL THE DATA YOU WANT ON SUNDAYS

With Singtel Circle, the whole family can get free local data every Sunday. Free local data. So it doesn't matter if you use 1MB or 1GB that day, you won't have to pay for any of it when your monthly bill comes in! Make Sundays 'Drama Days' and stream entire seasons of your favorite dramas and movies.

GET DISCOUNTS ON YOUR MONTHLY BILLS

Get up to 30% off on mobile plans if your family members are also on Singtel. The more family members you nominate to Singtel Circle, the higher the discount. A single family member gets 10% off his or her bill, two get 15% off, three get 20% off, four get 25% off, and five get 30% off.

Family members must be staying under one roof to be eligible, and you can add up to five total (including yourself).

GET THE LATEST SMARTPHONE EVERY YEAR

Forget about waiting until the end of your contract to upgrade to the latest mobile phone. Singtel Circle comes with an annual handset upgrade fee waiver (worth S$350) so you can level up your smartphone every year.

LISTEN TO AD-FREE TUNES

Be part of Singtel Circle and you'll get free access to Stingray Music, ad-free. Stingray Music streams music with thousands of channels over various genres. The playlists are expertly curated, and you'll get personalized recommendations based on your listening history. You can enjoy Stingray Music on your Singtel TV, mobile devices, and web browser.

GET 50% OFF WITH THESE PROMOTIONS

With Singtel Circle, you can also get 50% off MobileShare and 50% off a DVR Set-Top Box.

Have you ever had two of your favourite programmes showing at the same time? With a Singtel TV HD DVR Set-Top Box, you won't have to miss anything! In fact, with the HD DVR Set-Top Box, you can record up to three shows and watch a fourth one at the same time! You can save up to 225 hours of Standard Definition or 110 hours of High Definition programs.

That's not all! MobileShare lets you share your mobile bundle with your loved ones or between multiple devices. If you have a family member who uses little data, for example, have them on a MobileShare supplementary plan and save.

Find out more about Singtel Circle at **singtel.com/SingtelCircle**

UPBEAT

Together with the brand new MONEY FM 89.3, Singapore's first English business and personal finance station and 96.3好FM, a Chinese infotainment station for the "new young", SPH Radio's ONE FM 91.3, Kiss92 and UFM100.3 inspire and enliven listeners day and night through captivating entertainment. Find out more about how SPH engages minds and enriches lives on **sph.com.sg**

sph
Engaging Minds, Enriching Lives

LITERALLY SPARKLING SOUND

Want deep bass and sizzling highs while standing out from the crowd? Then the 1More X Luxtrada headphones are for you. Encrusted with Swarovski crystals, these headphones take "bling" to the next level. But they're not all flash with no substance, the headphones feature 1More's triple-driver technology for incredible dynamic range and clarity.

PICTURE **1MORE**

WHEN TIME REALLY FLIES

Blancpain's Villeret Tourbillon Volant Heure Sautante Minute Rétrograde takes the flying tourbillon one step further. It replaces the lower bridge with a clear sapphire disk, this way the cage, balance wheel, and escapement appear to be floating in space. It's a magnificent sight that also adds jump hour and retrograde minute complications.

TRIPLE THE FUN

What's better than a dual camera setup? How about three-cameras?
Huawei's new P20 Pro sports a 40-megapixel (RGB), 20-megapixel
(monochrome), and 8-megapixel (3x zoom) triple camera setup. The phone
also has a 6.1-inch OLED display with a 2,240 x 1,080 resolution and a 19:9
aspect ratio. Huawei's Kirin 970 chip powers the phone with a dedicated
NPU (Neural Processing Unit) for advanced AI.

KEYBOARD WITH FLAIR

The ASUS ROG Strix Flare doesn't want to blend into the shadows. It features Cherry MX RGB mechanical switches, which support per-key lighting customizations. On top of that, there are nine extra LEDs along the edges that light up the entire frame. An illuminated ROG badge sits in the niche at the top right. You can even etch your own design on the provided blank insert.

ASUS' IPHONE X CHALLENGER

The ASUS ZenFone 5 sports a 6.2-inch 2,246 x 1,080-pixel IPS LCD display with a notch in it. The phone boasts a dual rear camera setup with a primary 12-megapixel, f/1.8 lens. That's paired with a secondary 8-megapixel, f/2.2 120-degree wide-angle lens. The phone also boasts AI features like AI performance boost and AI charging, which is supposed to extend your battery life. A Qualcomm Snapdragon 845 processor powers the phone.

WIDE BUT LIGHT

Using a mirrorless camera but stuck for wide angle lens options? The latest lens from Venus Optics might be the thing for you. The Laowa 9mm f/2.8 Zero-D lens weighs 215g and measures 60 by 53mm, making it smaller and lighter than other wide-angle options. Use the 113-degree angle and wide f/2.8 aperture to get impressive astrophotography shots with ease.

DRINK OUT OF YOUR SMARTPHONE

These glasses may look a little familiar - that's because they're made of recycled smartphone screens! German-English company Pentatonic makes everything out of trash, including this smokey glassware series named 'Handy.' Besides small and large glasses, you can also get a bowl made out of recycled smartphone glass.

RUN WITH YOUR
SMARTWATCH

Fitbit's Versa is a better-looking and simpler version of its first smartwatch, the Ionic. There's no built-in GPS or NFC, but you get fitness features like a daily step counter, heart rate data, and exercise logs. It works with specific activities like running, swimming, and weights. Plus, its four-day battery life won't leave you hanging.

PICTURE **FITBIT**

BUTTERLY SMOOTH GAMEPLAY

Gigabyte's new Aero 15X laptop just got better. The gorgeous edge-to-edge display now boasts a 144Hz refresh rate for fluid gameplay. It's even thinner than before, measuring 18mm thick. It's also equipped with the latest 8th-generation Intel Core processor and an NVIDIA GeForce GTX 1070 Max-Q. That's enough power to tackle any game out there.

NEVER ENOUGH
RGB LIGHTS

RGB fanatics, rejoice. Razer's Goliathus Chroma mouse mat comes with customizable Chroma lighting, with 16.8 million color options and an array of lighting effects. It retains the soft, textured cloth surface of the original, but its edge now comes ringed with LEDs to match the rest of your Razer gear.

NO MORE DEAD SIGNALS

How would you like an Android smartphone that can connect both via GSM (2G, 3G, or 4G) and satellite at the same time? Thuraya's new X5-Touch does just that. The satellite phone has a 5.2" Full-HD touchscreen that's made from Gorilla glass. It has two SIM-card slots, an IP67 dust, and water resistance rating, and compiles with MIL standard.
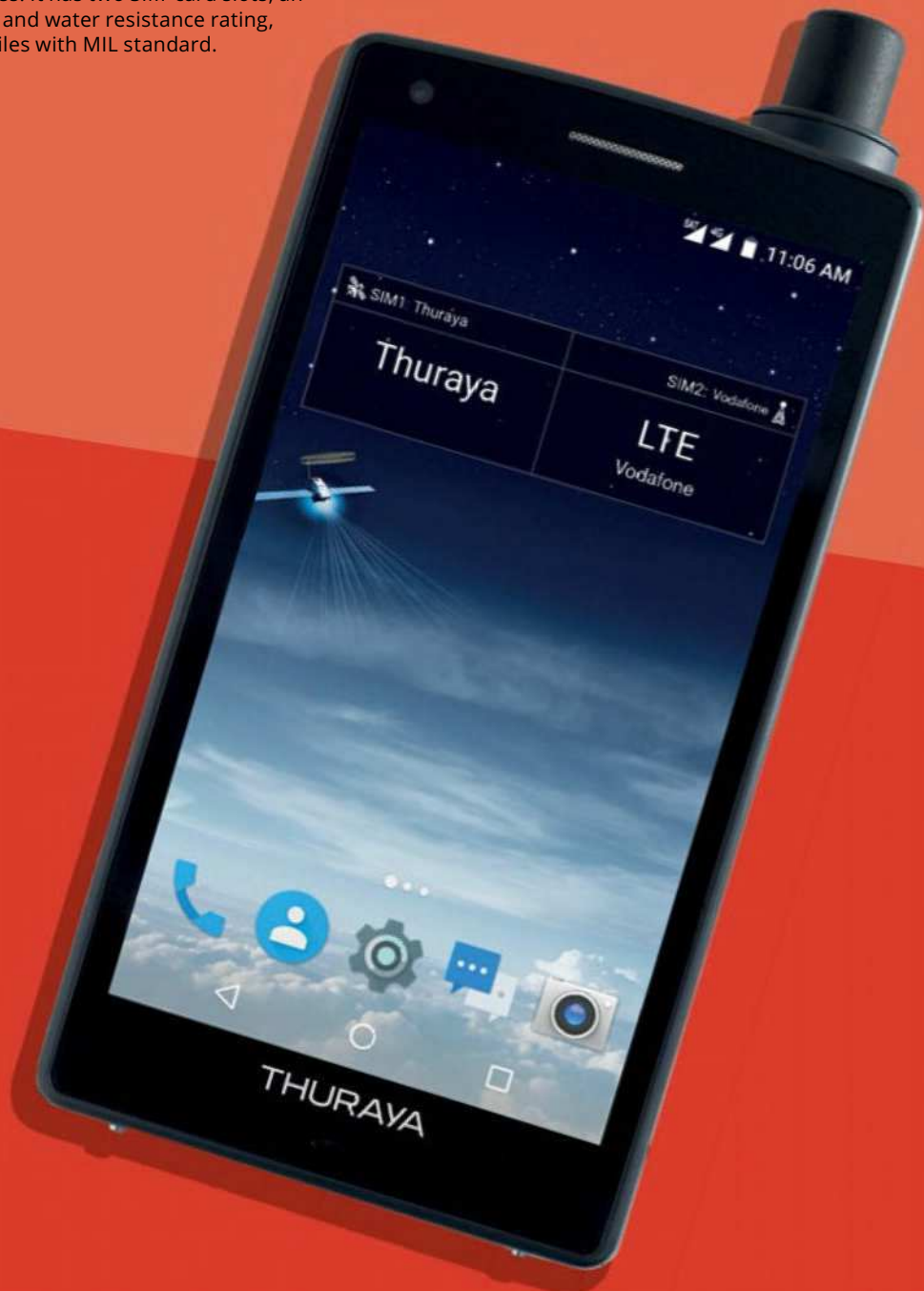
The new 'go-to' camera to go everywhere with

The light and slim Fujifilm X-A5 is a perfect companion.

THE FUJIFILM X-A5 is a camera that combines simplicity with performance. It's light and lean, making it easy to carry wherever you go. The camera connects to a smartphone via Bluetooth, so you can easily share your photos.

The X-A5 features a 24.2MP APS-C sensor that shoots intricate images. Fujifilm's rich color heritage creates compelling photographs full of lifelike hues and skin tones. Film Simulations replicate the look of classic Fujifilm film, and Advanced Filters add artistic touches to your final picture.

It's the first X-A camera to feature phase detection pixels. The smart Hybrid AF system now focuses twice as promptly as previous models, ensuring accurate focus lock, even on swift subjects.

A new image-processing engine is 1.5 times faster than that of previous models. ISO sensitivity now goes up to ISO 51,200, which helps the camera photograph more detail in low light.

There are lots of features for videos as well. The X-A5 can record Full-HD video at a quarter speed for fun slow-motion videos. 4K Burst Shooting takes images at 15 frames per second for ace action shots. Shoot 4K videos for detailed footage.

The X-A5 introduces the new FUJINON XC15-45mm f/3.5-5.6 OIS PZ lens. It's the first electric-powered zoom lens for Fujifilm X cameras. This lens is excellent for food and macro photography, as it only needs a distance of two inches to achieve focus.

Rotate the LCD monitor 180° and Eye Detection AF automatically focuses on your eyes. Take a selfie anyway you like and you'll always be in sharp focus. Battery life has been improved so you can shoot all day without worry.

The Fujifilm X-A5 is the new 'go-to' camera for easy travel and impeccable images. It's lightweight and easy to use. It shoots photos and videos full of vibrant colors and detail. The X-A5 is the perfect companion to capture your everyday moments.

The Fujifilm X-A5 is available in pink, brown, and silver. A dark silver limited edition is also available. The X-A5 with the FUJINON XC15-45mm kit lens will retail at S$999.

PICTURES **FUJIFILM**

To find out more about the FUJIFILM X-A5, visit **www.fujifilm.com.sg**

1. AFFORDABLE GAMING

The Dell G7 15 is among the first of Dell's new gaming G series products. It supports the latest 8th-generation Intel Core i9 processors, 16GB of RAM, and an NVIDIA GeForce GTX 1060 6GB Max-Q. It's decked out with the latest connectivity options as well, including a Thunderbolt 3 port and speedy USB 3.1 (Gen 2) connectors. Huge cooling vents and dual fans keep the laptop running cool.
DELL G7 15

2. HOME CINEMA ON A BUDGET

At $2,488, ViewSonic's PX727-4K projector presents an attractive option for those want a big screen, but balk at the prices of large TVs. This DLP-based projector touts a brightness of 2,200 ANSI lumens. It's compatible with HDR content and comes with two HDMI inputs (one of which supports HDCP 2.2). The lamp is rated at 4,000 hours under regular use, or 15,000 hours if you engage SuperEco mode.
VIEWSONIC PX727-4K

2

1

3

3. GET IN THE GAME

1More Spearhead VR Gaming headphones use 50mm Maglev graphene drivers for added realism so you feel like you're in the game. Active noise-canceling technology makes it easier for you to block out the crowd. The dual array microphone ensures your team members will hear your commands as if you were next to each other.
1MORE SPEARHEAD VR GAMING HEADPHONES

4. MINI BUT MIGHTY

IoT enthusiasts will love the new US$35 Raspberry Pi 3 Model B+. It's now powered by a faster 1.4GHz quad-core ARM Cortex-A53 CPU, with support for dual-band 802.11ac Wi-Fi and Bluetooth 4.2. Thanks to a new gigabit Ethernet controller, wired throughputs are improved, though still capped by the USB 2.0 bus.
FITBIT RASPBERRY PI 3 MODEL B+

5. I'M SORRY, DAVE. I'M AFRAID I CAN'T DO THAT

You can now own your own full-scale HAL 9000 computer from *2001: A Space Odyssey*, thanks to Master Replicas. The replica is licensed from Warner Bros. and is fully operational, thanks to a built-in Amazon Fire HD tablet and Amazon's Alexa AI assistant. You'll be able to address HAL 9000 as either HAL or Alexa, but don't ask it to open the pod bay doors.
HAL 9000 REPLICA

6. OUT OF SIGHT, OUT OF MIND

Corsair's Carbide Series 275R case wants to help you build a super clean and minimalist PC. The tempered glass panel will show off your build in its full glory, so it's good that there's a full-length power supply shroud to hide your cables. All your SSDs can also hide behind the motherboard tray, so only the coolest parts of your rig are on display.
CORSAIR CARBIDE 275R

7. XIAOMI GOES AFTER GAMERS

Xiaomi has gamers square in its crosshairs. The Mi Gaming Laptop packs a 15.6-inch screen, a 7th-generation Intel Core i7 processor, and an NVIDIA GeForce GTX 1060. That sets it up for a showdown with other mid-range gaming laptops. Plus, it features multiple USB 3.0 and USB-C ports and an HDMI output, so you shouldn't want for more connectors. Oh, and there's, of course, RGB backlighting on the keyboard.
XIAOMI MI GAMING LAPTOP

8. ELEGANCE WITH QI

The Aspire S24 is Acer's slimmest all-in-one desktop computer, and it might be its prettiest too. The S24 ships in classy champagne gold matched with black. The AIO ships with a 23.8-inch touchscreen display, with almost no bezels. There's a 2.1 channel speaker with a subwoofer built right into its base, and that base is also a Qi wireless charging station.

ACER ASPIRE S24 ALO

9. ROMER-G GOES LINEAR

The Logitech G513 mechanical gaming keyboard is the first to feature the new linear Romer-G switches. Its elegant 5052 aluminum-magnesium alloy frame will fit on just about any desk. Logitech's new Lightsync technology ensures that the keyboard is anything but boring. It supports per-key customizations and dynamic lighting effects, so your keyboard changes as your game progresses.

LOGITECH G513 MECHANICAL GAMING KEYBOARD

10. NEW YEAR, NEW CHIPS

The new Alienware 15 features Intel's latest Coffee Lake Core i9 mobile processors and an upgraded cooling system. That's especially important, as the chip can overclock up to 5.0GHz on a single core. Alienware ships the laptop in black for a stealthier look, which goes wonderfully with the light bars running along the edges. This is one mighty powerful 15-incher, and it'll take up to an NVIDIA GeForce GTX 1080.

ALIENWARE 15

11. NEW KID ON THE BLOCK

ASRock makes graphics cards now. The Phantom Gaming X Radeon RX 580 8G OC boasts a dual-fan cooling solution and overclocked base and memory frequencies, so you should enjoy slightly better than reference performance. Three different speed profiles are available, and you can switch between them in ASRock's Phantom Gaming Tweak software.

ASROCK PHANTOM GAMING X RADEON RX 580 8G OC

12. I DREAM OF NOTCHES

The Oppo R15 Dream Mirror Edition has a 6.28-inch OLED notched display with 2,280 x 1,080 resolution and a 19:9 aspect ratio. The phone sports an ultra-reflective glass back with a polished metal frame. It has a dual camera setup pairing a 16-megapixel f/1.7 lens, with a secondary wide-angle 5-megapixel f/2.2 lens. On the front, there's a 20-megapixel f/2.0 selfie camera. The phone is powered by a Qualcomm Snapdragon 660 chipset. A non-Dream Mirror Edition powered by an Helio P60 is also available.

OPPO R15 DREAM MIRROR EDITION

13. EVERYTHING YOU NEED IN ONE DESK

The Omnidesk is an electric, height-adjustable desk, with all the modular add-ons you could want for a dream workstation. The built-in arms can support up to six monitors, and you can also opt for custom mounts for a subwoofer and PC. Should you want an added bit of panache, Aftershock plans to offer custom artwork options as well.

AFTERSHOCK OMNIDESK PRO

14. BLACK BEAUTY

The Massdrop CTRL is a sleek, black specimen of a keyboard with a solid aluminum frame and a built-in switch plate. It uses modular Kaihua switch sockets, so you can pop out and replace the switches any time you like. It also features dual USB-C connectors and ships with doubleshot PBT keycaps by default, so you don't have to worry about your keycaps wearing down over time.

MASSDROP CTRL MECHANICAL KEYBOARD

Can't touch this

Rimac C_Two By **Kenny Yeo**

to 100km/h in under 2 seconds. 0 to 300km/h Just 11.8 seconds. And if you got the cojones and a long enough stretch of road, the C_Two can hit a maximum speed of 415km/h.

Despite the incredible performance, the C_Two has enough juice for a range of about 650km and can charge from 0 to 80% in just 30 minutes with a special fast-charger.

Wacky performance aside, the C_Two is also super high-tech. It has an array of 72 ECUs and processors, 12 ultrasonic sensors, 8 cameras, 6 radars, and LIDAR. This enables it to achieve Level 4 autonomy. And like the iPhone X, the C_Two can be unlocked with facial recognition technology. Say goodbye to keys!

Rimac plans to make only 150 units of these and the price is expected to be well into the seven figures territory. Hey, nobody ever said the latest in cutting-edge technology was cheap.

The name Rimac might leave you scratching your head, but this little automaker out of Croatia is dedicated to building some of the world's fastest and most outrageous all-electric supercars. Their newest weapon is called the C_Two and it is a monster for the road.

Let's talk performance first. Under the C_Two's full carbon fiber chassis are four electric motors producing 1,914hp and 2,300nm of torque. This is enough to catapult the C_Two from a standstill

A SPACE DRAMA
FOR EVERYONE
Updated for today's audience, Netflix's Lost in Space reboot is a show that will resonate with the whole family, whether you're a hardcore sci-fi fan or not.

THE ROLE OF HARDWARE SAFETY NETS IN CYBERSECURITY

Lionel Chng, Managing Director, HP Singapore

By **Zachary Chan**
Photography **Darren Chang**

> *As a major manufacturer of PCs and printers, HP plays a vital role to promote cybersecurity as an overall, good practices and all.*

Let's talk cybersecurity. Why is it that nobody bats an eyelid about smartphone cameras as we freely stream our lives away, but freak out over potential webcam spying?

With regards of what people are posting on the internet or how they use live streaming, that's really a topic about cyber wellness. You're not being well in cyberspace if you're not behaving responsibility. When it comes to cybersecurity, on your phone or PC, it's more about whether your passwords are enabled; your malware protection has been updated. In the past, I'd say there was more carelessness on how people stayed up to date, being aware, and took action on these things, but we're slowly getting there. As malware attacks continue to evolve, companies and individuals have to evolve as well. Simple behavior like whether you should connect to a public Wi-Fi you're not familiar with; that level of education has to take place.

Do you see a greater understanding of cybersecurity among consumers though?

We're heartened by the fact that basic cyber wellness and security is being taught now in schools. We're also heartened that when we speak in various forums about endpoint security, we're receiving a warmer response rather than an indifferent attitude from companies. The final step is how we ensure good practices, not just at the CIO level, but down to every single employee, because your weakest link is that one guy that opens up the company

to a malicious attack. That's how it starts. That continues to be a challenge.

What's HP's role in all of this?

You see, the thing is this. We as a leading MNC in the tech space, we have a responsibility too. And that's why we came up with basic education in corporate. We shared the entire "Wolf" video series for example to show how easy it is for a cyber attacker, making (the threats) more real to more people. A CIO may understand the threats of a cyberattack, but the board of directors and CEOs may not be as tech savvy. So, we've made it so simple to understand through these videos of security, whether printer or PC. Thus far, we're the only company that's doing that; promoting the importance from a hardware and endpoint device standpoint.

Some people believe that the only real protection from internet threats is a lockdown. Thoughts?

There are two schools of thought here, you know this. The debate is still ongoing, at least from a PC standpoint, on whether you should isolate (your network). The internet separation of the Singapore government was done in April of last year, and to a large extent, it protected them from different types of attacks that could have happened because there are hundreds of thousands of employees for the government. So, there are pros and cons for each approach.

But malicious attacks are so sophisticated now that it's getting much harder to notice. Are we doomed?

We are not a vendor of cybersecurity, but we can control what happens within our products. When it comes to basic things like the ability to prevent visual hacking, that's why we put in the integrated privacy filter in our notebooks. Press one button and the screen goes dark, everyone gets that. But we also have technology that goes well inside a product with the ability to protect all devices in the firmware level. The typical user may not care so much about this, but IT people will appreciate this. We're helping them manage their devices better too.

How then will a typical user benefit from HP's hardware security features?

To a large extent, attacks still happen because of carelessness. How we work to address that is having a wider safety net, such as Sure Start BIOS level protection.

We're also the only PC manufacturer that's also a major printer manufacturer. We know what goes into these powerful printers; there's a lot of computing power inside a multifunctional printer and copier. It was logical to migrate some of our technology into printers and copiers, so our printers are the most secure in the world too.

Uber's self-driving car fatality should not end autonomous driving

Self-driving technology could still save many lives.

By **Koh Wanzi**

On March 18, a self-driving Uber SUV struck Elaine Herzberg. Herzberg, 49 and a mother of two, was pushing her bicycle across a dark street at night. As she emerged from the shadows and in front of the Volvo XC90, it did not attempt to break and ran into her at 61 km/h. Herzberg died of her injuries at the hospital, making her the first pedestrian killed by an autonomous vehicle.

Everyone working in the autonomous vehicle industry saw this coming in some capacity. It was not a matter of if, but when. After all, cars kill people, and 1.3 million people die in road crashes every year.

Herzberg's death threatens to derail efforts by automakers to push the technology to market. An egregious failure like this casts everyone in a bad

Imagine if we went from a hundred deaths a day caused by humans to 10 caused by AI.

light and makes it tempting to paint the entire industry with the same brush.

But that doesn't mean it should. The incident needs to be investigated and processes need to change. Yet this shouldn't be cause to call for the complete abandonment of autonomous driving.

There's a disconnect between how we view accidents caused by people and those caused by machines. Staggering numbers of people die in road accidents daily, and yet you don't hear people talking about kicking driving to the curb.

We accept the risk every time we

get behind the wheel. But when AI is involved, we freak out. And that's understandable. Human error is unpredictable, and it stands to reason that we can do more to ensure that AI performs than we can to stop people from making mistakes.

This also means accepting that AI is also fallible. Ideally, autonomous driving would have a zero failure rate, but that's a huge ask of any technology. Imagine if we went from a hundred deaths a day caused by

humans to 10 caused by AI. Those 90 lives saved by self-driving cars could still be considered a success.

Progress is continually being made on self-driving cars. At GTC 2018, NVIDIA announced its Drive Constellation system. Drive Constellation tests driving software in simulated real-world driving environments. This means you can test autonomous vehicles in multiple scenarios without endangering anyone.

Looking forward, autonomous vehicles could save many lives. To get cold feet now would seem almost foolish.

Are the Swiss risking another Quartz Crisis?

By **Kenny Yeo**

The Swiss dominate the watch market, but it wasn't always that way. The Swiss watch industry was almost wiped out in the 1970s, by the advent of inexpensive and accurate watches powered by quartz movements. This later became known as the Quartz Crisis. You would then think that the Swiss would be more wary about smartwatches, but that doesn't seem to be the case.

The Swiss seem half-hearted at best about smartwatches. Every year in March, the major Swiss watch brands gather at the Baselworld fair to show off their latest releases. There were a couple of new smartwatches this year, but nothing groundbreaking.

The only major Swiss watch brand to have embraced smartwatches is TAG Heuer. The company is a formidable force in the Swiss watch industry, but even TAG Heuer doesn't have the resources to develop its own smartwatch platform. TAG Heuer's CEO Jean-Claude Biver, who also heads the watch division at luxury conglomerate LVMH, said that smartwatches are niche. A key problem for them and other Swiss watch brands is finding suppliers to provide the small number of components they need. Biver also doesn't believe that smartwatches are a fit for every Swiss company, as they don't communicate the message brands want to send.

One major problem the Swiss face is that they lack the resources to develop their own smartwatch platforms. Instead, they rely on ready-made solutions like Google's Wear OS or Manufacture Module Technologies' (MMT) Horological Smartwatch Platform. The latter is a joint venture by Silicon Valley's Fullpower Technologies, who helped develop the Jawbone UP24, and Union Horlogere Holdings, the parent company of Swiss watch brands Alpina and Frederique Constant. As a result, the Swiss are reliant on others to introduce new features. They can't innovate and differentiate themselves in the same way that Apple, the runaway leader in smartwatches, can.

> *One major problem the Swiss face is that they lack the resources to develop their own smartwatch platforms.*

Depending on which report you read, Apple's market share of the smartwatch market stands at around 50%. Even though Apple has kept the design of its Apple Watch identical since launch, they have consistently updated it every year. Last year's Apple Watch Series 3 included a cellular version, which allows it to function more independently of the iPhone. Apple also released watchOS 4, which included numerous improvements. These included a better workout app, more detailed heart rate tracking and new watch faces.

With no rival that can or wants to compete at the same level, Apple is running away with the smartwatch market. And if smartwatches become our primary communicating device in the future, the Swiss watch industry could be in turmoil again. But this time, they can't say they didn't see it coming.
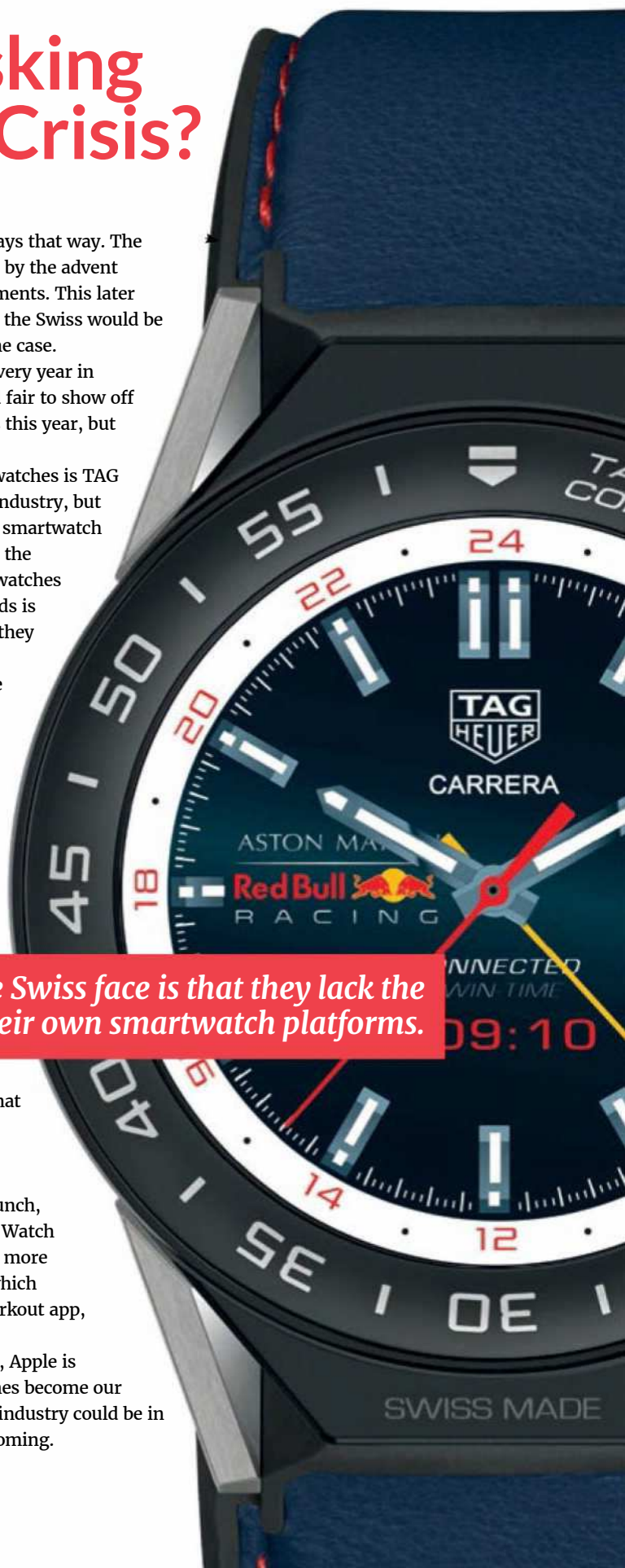
Shelter from the storm

An affordable 3D-printed house for those who need homes. By **Alvin Soon**

There are millions of people in the world today who live without adequate housing. New Story, a housing charity, has partnered with ICON, a construction technology company, to find a solution for these people.

This 350-square-foot house is the result of their collaboration. A gantry-style printer, called the Vulcan I, printed the house in 48 hours. It cost around US$10,000. New Story and ICON are working on the Vulcan II, with a goal to print houses that are around 600 to 800 square feet each, and to print one in less than 24 hours at US$4,000.

The Vulcan printer fully prints on-site and doesn't need different pieces to be assembled together (the roof, windows, doors, and electrical/plumbing are finished separately). The Vulcan prints using concrete, which is resilient and has a high thermal mass.

New Story and ICON plan to bring this technology to developing nations to solve housing shortages cheaply and quickly. The first stop on their list is the Republic El Salvador.

THE CANNIBALIZATION CONUNDRUM

When you have to devour yourself to save yourself...

By **Alvin Soon**
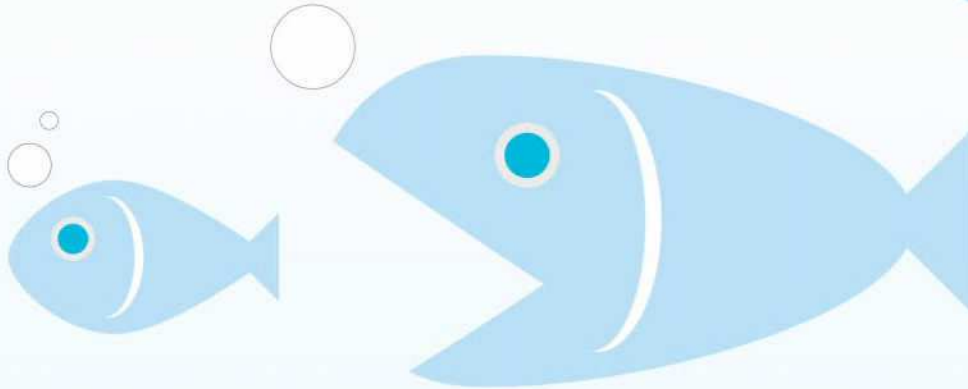
Nikon launched its mirrorless system, the Nikon 1, in 2011. The Nikon 1 cameras used a smaller 1" sensor, instead of an APS-C sensor like the ones in DSLRs or the competing Sony NEX cameras. The 1" sensor was even smaller than the ones found in the Micro Four Thirds mirrorless system.

It's likely that Nikon chose a smaller sensor to avoid cannibalizing sales of its APS-C DSLR cameras. Masahiko Inoue, group manager, put it this way. "Because our product mix covers full-frame and APS-C DSLR and the Nikon 1 ... we're not seeing cannibalization between the DSLR and the Nikon 1: the customer is completely different."

It's business strategy 101: differentiate your products and avoid eating into your own profits. But it didn't work out for Nikon. According to BCN, which ranks Japanese camera sales, the companies competing for the top three mirrorless spots in the past seven years have been Canon, Olympus, and Sony.

Canon took a different approach. The EOS M launched with an APS-C sensor in 2012, the same sensor as in its DSLR cameras. Canon has been number two in Japan's mirrorless markets for the past two years

(Olympus is number one).

Masahiro Sakata, president of Canon Marketing Japan, identified mirrorless as a 'growth market' for Canon. Talking with the Nikkei Asia Review, Sakata said, "[Canon must] actively roll out products for a growth market even if there is some cannibalization."

Sakata is right, the mirrorless market *is* a growing one, albeit a growing share of a declining market. According to CIPA (PDF), a total of 121 million digital cameras shipped in 2010. In 2017, only 24 million digital cameras shipped. DSLR shipments have declined from a high of 16 million in 2012 to 7.6 million in 2017.

Mirrorless shipments have risen — slightly. 3,957,000 mirrorless cameras shipped in 2012, while 4,080,000 mirrorless cameras shipped in 2017.

The numbers put cameras manufacturers in an unenviable position. It's especially precarious for

Nikon because its Imaging Products business accounts for most of the company's revenue. But Nikon has not released a new mirrorless camera since April 2015. In comparison, its competitors have unleashed 40 new mirrorless cameras since Nikon stopped.

Nikon has to make up for lost time. Despite the lack of new products, Nikon has officially stated that it's still developing mirrorless cameras. Rumors are that Nikon will release at least one new mirrorless camera this year. Plus the new mirrorless cameras will use APS-C or full-frame sensors, not 1" sensors. Nikon might finally be willing to eat itself.

Somewhere in here, there's a tough lesson, one summed up by the gold case study for disrupting your own products. The iPod was one of Apple's greatest hits, and arguably the product that made Apple an everyday name. Then Apple introduced the iPhone in 2007. "If you don't cannibalize yourself," Steve Jobs famously said, "someone else will."

Isolation is the future of cybersecurity

Kowsik Guruswamy, Chief Technology Officer, Menlo Security

By **Zachary Chan**   Photography **Orland Punzalan**

What is this isolation method you're talking about?

Well, what makes the web experience risky today are these codes, these scripts that are coming in. If you take away all of the scripts, all the interactive elements, the web is almost benign. It's this interactivity that we've added over time, the thing that makes the web so lively, is the very thing that ultimately delivers breaches and infections.

Most of the security products today don't do justice to keep users safe. So, the concept of isolation is very simple. Instead of playing a game of trying to figure out what is good and what is bad, we assume that everything is bad; we take all these scripts and run them in the cloud.

So, what actually happens?

Say I want to visit Hardwarezone. We put the Menlo cloud in the middle, and when the Menlo cloud receives my request to go to Hardwarezone.com, it basically gives me a brand new browser in the cloud. And it is this browser that ends up going to hardwarezone.com and executes all the scripts with the assumption that everything is bad. When I'm done, and I close this browser in the cloud, everything gets deleted. That browser in the cloud? Also gets deleted. The whole session is completely erased. If there

was actually an infection, it doesn't have a place to linger any more and there is nothing to infect.

Our first breakthrough was being able to do this with millions of users all doing browsing across the internet. Think of the massive scale, having a million browsers in the cloud and managing it all. The second part, which is also super interesting, is that for the user, you wouldn't be able to tell the difference. All of the interactivity that you're used to, the menus, scrolling, videos, everything still works, and feels exactly as before.

Is this similar to server-side compression, that you send an optimized stream to the end user?

It's more similar with a virtual desktop. But, a VDI environment is choppy and slow, you can't really copy and paste, and there's just a lot of issues with video streaming technologies. What we've figured out is a way to take just the visual components of the isolated browser, and bring that into my (local) browser. End users don't have to install anything or do anything different really. The combination of being able to do this at scale while preserving the user experience is the magic Menlo brings to the table.

This sounds like a catch-all solution to cybersecurity. Why isn't isolation a thing?

We're just getting started. It will be a thing at some point. The company was formed at 2013, and our first product was only launched in January 2015. Our first customer was JP Morgan Chase.

Well what I meant was this approach to cybersecurity. Why hasn't anyone thought this before?

Well there are a few companies that started doing this, and they have some variance of what we do – in terms of executing a browser in the cloud. But, the part that's super unique to us is our rendering technology. Some of the others do this like what I told you before, they run a browser in the cloud and send it to you via a video stream. Some others do this by making you install a new browser, which then connects to their browser. If you look at the history of cybersecurity, any technology that forces the user to change their behaviour or do something unnatural, has never succeeded. The user will simply go around because it's too cumbersome. Security by shackles doesn't work.

For this to succeed, we've taken a lot of effort to make sure the end user doesn't know Menlo is in the middle. We've done a number of pilots where a small set of trial users have been put behind the Menlo platform over the weekend. They go home on a Friday, then IT comes in

Isolation is a very powerful and simple mechanism that can take entire classes of cybersecurity risks, and nullify them.

and sets it up. Monday morning they come in to work, they don't know they're isolated.

You mentioned that traditional methods like anti-virus and firewalls don't do justice...

If you look at the history of cybersecurity, the anti-virus was introduced around 1987, I think, and the initial firewalls came around the same time. I built the first commercial in-line intrusion prevention system around 2002. Over the course of 20 years, many products were built around the threats at the time, so what happened was that their shelf lives would be limited. Two to three years would go by after a new technology is introduced and a whole new class of problems would emerge and they would become obsolete.

The thing about isolation, because we're not playing the detection game, this is effectively future proof. So, if there was a new type of threat that comes in six months from now, we don't need to change anything to combat that threat. Just by the virtue of moving the execution of all the active code to the cloud, solves that problem.

Isn't this just like sandboxing?

Well, a sandbox is still a way to do good vs. bad. Let's say you have a Word document with macros. What a sandbox does is try to load the Word document in a simulated environment, and let the document run its course to see if the macros executed tried to encrypt your file system (like in a ransomware attack). If it picks up these signals, it flags the file as bad. If it doesn't, then ok, the Word document is fine and given back to the user. So, the sandbox is still a type of anti-virus. Instead of applying signatures, it performs a kind of behavioural analysis.

Again, we're not trying to make a decision if a website is good or bad. We're just saying, execute (everything) remotely. We basically

The thing about isolation, because we're not playing the detection game, this is effectively future proof.
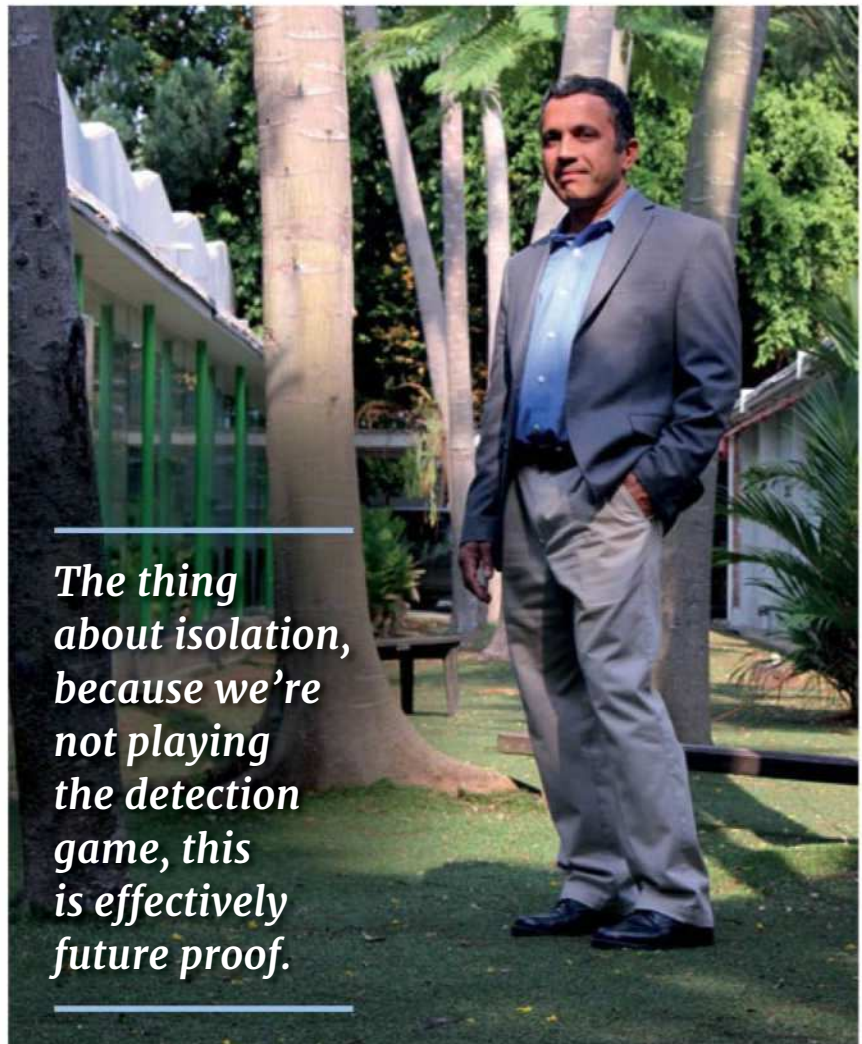
have this disposable browser in the cloud.

If everything goes through your cloud, how do you stop that from getting infected?

Well, one of the things that we're not doing, is that we're not trying to build a better browser. What we're using in the cloud is Chrome. The entire Menlo isolation platform architecture is built under the assumption that the isolated browser is not somehow better than you (the user). We assume that this browser can be compromised.

So if it does, the question becomes whether the infection can move laterally within our cloud, and if it can somehow still deliver the infection to the user. Without going into too much technical

detail, what we've done is to make sure that this cannot happen. So, even if the browser on the cloud gets infected, that infection has no place to go.

Would isolation still work hand-in hand with traditional anti-virus?

If you talk to cybersecurity vendors, they will try to convince you there is this notion of a risky web. I think that's completely silly, because nobody knows which slice of the web is risky. Anything good can go bad and so forth. Our whole vision and philosophy in the way we're building the product and the type of things we're doing is under the assumption that we need to get to the point where we isolate the entire internet for all the people. Because that's the only way to keep it risk free.

Watch

A sci-fi drama for the whole family

Space can be scary, but it's okay if you've got family with you.

By **Koh Wanzi**

■ Netflix's science-fiction shows can be heavy stuff. With gritty titles like Altered Carbon, Mute, and Annihilation stocking its virtual shelves, the service lacked a light-hearted sci-fi series that the whole family could watch.

That show is Lost in Space, a reboot of the 1960s series of the same name. An incident aboard the Robinsons' colony ship causes their Jupiter spaceship to crash-land onto an unknown planet and the family must figure out how to survive and escape.

Behind them is an Earth roiled by climate change, war, and governmental instability. In front of them lies uncertainty and possible death. Alpha Centauri promises a habitable, paradise-like planet where the best and brightest of humanity can start afresh, but only if they manage to get there.

Netflix has done a great job of updating the series for a modern audience. There are familiar tensions that most people will recognize. John and Maureen are separated, and only together for

the mission. Judy is a mixed-race teenager from Maureen's first marriage and has a contentious relationship with her step-sister Penny. The show's iconic robot has also been given a modern, menacing look and a shady backstory.

Despite all the angst, Lost in Space is a story about resilience, ingenuity, and familial bonds that never quite break, no matter how strained. When you're faced with a hostile environment, mysterious saboteurs, and the unknown, family may be all that you can rely on.

THE BEGINNING OF THE POST-INTEL-PC ERA

Chipzilla should worry when both Apple and Microsoft don't want its chips.

By **Ng Chong Seng**

"PCs are going to be like trucks. They're still going to be around. But they're going to be used by one out of x people."

That was Apple's Steve Jobs at the D8 conference in 2010. Jobs was explaining how advances in technology would enable non-traditional computing devices, like the iPad, to do more and bring about the "post-PC" era.

While the iPad has yet to become the computer on every desktop and in every home, it's hard to deny that the traditional computer is in trouble. And if your main revenue stream comes from selling chips for those devices, you, too, are going to be in trouble. Yes, Intel, I'm talking about you.

According to Bloomberg, Apple might ditch Intel chips in Macs in favor of its own ARM-based processors as soon as 2020. Put Apple's habit of wanting to have full control over its hardware and software stack aside. This reported switch makes sense because Apple's A-series chips have started to outpace Intel's laptop processors. When Apple made the switch from PowerPC to Intel x86 CPUs in 2006, it was because IBM's chips weren't performing. The 2020 Intel-to-ARM transition, if it happens, would be for the same reason.

One can argue that the Mac only makes up 8% of the worldwide PC market, so Intel is safe as long as they've chips to go into Windows machines. But remember, the PC market is expected to continue its decline in 2018. If you widen the PC market to include smartphones, tablets, and laptops, then look at device shipments by operating system, the two leaders are Android and iOS. The majority of these devices don't use Intel CPUs.

As Microsoft places more bets on the cloud and A.I., even Windows' future seems uncertain. The latest re-org saw a new "Experiences & Devices" division replacing the Windows and Devices Group. It's Microsoft's admission that Windows, and by extension the "Wintel" alliance, figure little in its long-term plans.

Consider this, too. On the consumer front, Windows on ARM is now a thing. And Microsoft has struck ARM cloud server deals with Qualcomm, Cavium, and AMD for its Zen-based processors. Such distancing from Intel would have been unimaginable not too long ago.

To quote Steve Jobs again, "We like to talk about the post-PC era, but when it really starts to happen, it's uncomfortable." Get ready for some discomfort.

PICTURE **123RF**

Your New Digital Canvas

CREATIVITY KNOWS NO BOUNDS

Say hello to the world's most powerful detachable PC. Whether you're in the studio or on the go, you won't have to sacrifice time and performance by juggling devices and file transfers. With the HP ZBOOK x2, your files and tools are always with you.

WHENEVER INSPIRATION HITS

Sketch your next great idea wherever you are. Remove the keyboard to use the 14-inch DreamColour display as an artist-ready tablet, complete with an included Wacom EMR pen. You'll get great color accuracy thanks to the anti-glare 4K IPS panel. And you'll get to work fast by using HP Quick Keys to access common Adobe shortcuts.

AS POWERFUL AS THEY COME

Spend more time looking at the big picture than waiting on renders. Powered by an Intel® 8th Gen Quad-Core processor and an NVIDIA® Graphics Card, you can add up to 32GB of memory and 2TB of storage to batch process raw photos or preview video composites. Hook up a pair of 4K monitors to the Thunderbolt 3, HDMI 1.4, or USB 3.0 ports to better scrutinize your work.

THE FULL DESKTOP EXPERIENCE

Import and sequence your best footage while you're still on-site. The full-sized keyboard packs both sets of CTRL and ALT keys, plus the full range of function and editing keys to make video editing a breeze. Since it's your primary workstation, you won't have to memorize different layouts or spend time exporting files to a studio-bound PC.

NAIL THE BASICS

Never be caught unprepared. A 720p webcam boasts low light sensitivity and dynamic range so you can attend last-minute web conferences, while the hidden dual-microphone array keeps your voice loud and clear. The Bang & Olufsen-powered speakers provide great audio while you're out and about. An integrated flash media slot means you'll never worry about an external reader again.

REVOLUTIONIZE YOUR WORKFLOW

Like cameras, the best tool for the job is the one that's with you. The HP ZBOOK x2 ensures you'll always have your best equipment on hand, running off a battery that'll last for 10 hours or more. With its stunning combination of power, portability, and versatility, you no longer have to think twice about bringing it out with you.

Visit **http://www.hp.com/sg/zbookx2** to find out more.

What you should know about using facebook

We've taken for granted that Facebook is all about sharing and fun. But there's a price to be paid for using it, from becoming a product to advertisers, to losing your privacy, and getting caught in fake news campaigns. Here's what you should know about using Facebook before you log in again.

By **Alvin Soon** *and* **Marcus Wong** *Illustration by* **Mar Kabayan**
Art Direction by **Orland Punzalan**

The good, the bad, and the ugly of Facebook

Facebook is a great place to connect with friends, stay in touch with family, and get updates on the latest news.

But Facebook is also more than that. Facebook has become a breeding ground for disinformation. Facebook tracks you pervasively, even if you're not a Facebook user. It plays loose with your data, freely sharing it with third parties.

At the heart of it, Facebook is a surveillance machine designed to turn your personal data into a product. Here's what you should know about using it.

Facebook as a battleground for the mind

Facebook has become a battleground for disinformation campaigns. It's likely that foreign agents used Facebook as a propaganda machine in the 2016 US presidential elections. US congressional investigations into the matter are still ongoing.

Malicious actors use Facebook to spread fake news and hate speech. Facebook was forced to shut down temporarily in Sri Lanka, after hate speech on the platform incited mob violence. United Nations investigators have also blamed Facebook for spreading hate speech inciting violence in Myanmar.

Facebook is a pervasive surveillance machine

Facebook tracks your activities online, even when you've logged out of Facebook. Facebook even tracks people who aren't Facebook users. Facebook creates shadow profiles triangulated from users who upload their contacts. Even if you've never registered for a Facebook account, it's likely that Facebook has data on you.

Facebook has so much user data that it's likely the largest surveillance machine ever built. How many more private corporations know who you are, where you live, where you work, who your friends are, whom you're with, where you've been, and more?

Facebook was careless with your personal data

The Cambridge Analytica scandal shows how Facebook was careless with users' personal data. In 2014, a researcher named Aleksandr Kogan ▶

PHOTOS **123RF**

If using Facebook disturbs you, the fastest way to get out is to delete your account. We'll show you how. But not everyone can stop using Facebook. So we also suggest how to minimize Facebook tracking and quell your use of Facebook.

Delete Facebook

So you've decided you want out of Facebook for good?

It's not as straightforward as you might think. The option doesn't even appear in your account settings. All you get are options to assign the account to someone after you die, and to deactivate your account.

Deactivating your account disables your profile and removes most of what you've shared. But some information may still be visible, as you'll still appear in your friends' lists. To completely delete your account from Facebook, take the steps that follow.

1. BACKUP ACCOUNT INFORMATION

If you ever need to refer back to what you posted on Facebook, a backup will be invaluable.
- Go to Settings.
- Click "General," then click "Download a copy of your Facebook data."
- Finish by clicking "Start My Archive."

2. SAVE PHOTOS

There's no quick way to keep a copy of all the photos you previously posted. You'll have to go through your albums and right-click to save each one before deleting them.

3. CLEAR LINKED APPS

Next, you'll want to clear all the apps that use your Facebook account for log in, unless you wish to stop using them too.
- Under settings, click Apps.
  This will show you all the apps and websites that use your Facebook ID as login credentials.
- Individually change the login to use another email address.
- On each app, click the pencil icon to go to the settings.
- Uncheck everything under "Info you provide to this app" and click "Save."
- Check the box next to the apps you wish to delete and click "Remove."
- A pop-up will ask you to confirm the removal of the app. Check "Delete all posts, photos and videos on Facebook that X app may have published on your behalf." Now, hit the "Remove" button.
- Turn off "Apps, Websites, and Games" by clicking the "Edit" button and clicking "Turn Off."

4. DELETE ACCOUNT

Now you're ready to delete your account, but you have to go to a separate page to do so.
- Head to https://www.facebook.com/help/delete_account
- Click the "Delete My Account" button, enter your password, the captcha, and confirm that you want to delete your account.
- Avoid logging into your Facebook account for at least 14 days or your account will be restored.

developed a personality quiz app for Facebook. About 270,000 users from the United States installed Kogan's app and consented to have their personal data harvested.

But the app also amassed the personal data of these users' friends, none of who consented to do so. As Facebook executives insisted, this wasn't a security breach. Facebook allowed its third-party developers to scrap friends of friends' data (it's since disabled this function). It was Facebook working as intended. But wasn't allowed was transferring this data to a third party outside Facebook.

But even after Facebook knew that data from nearly 50 million users was harvested and given to a third party, it didn't inform those users. It asked that the data be deleted, but didn't confirm that it was.

Facebook turns you into a product
Facebook is not free and it's never been. You may not have paid a single

cent to use the website. But you have been helping Facebook make billions by giving them your personal data to sell to advertisers. At its heart, Facebook is a surveillance machine designed to turn your personal data into a product.

Facebook allowed its third-party developers to scrap friends of friends' data.

A right to be forgotten
You could delete your Facebook account. But thanks to shadow profiles, your information could still be on the site. Even if you limit the amount of data you share, that doesn't stop the company from tracking your online activity.

But for all its problems, Facebook still has the potential for good. Millions use the site because it is a great place to connect with friends, stay in touch with

family, and get updates on the latest news.

Is there a way to have your cake and eat it too? Unless Facebook changes its business model and stops selling personal data, the answer is "no." But change may be on the horizon.

The European Union's General Data Protection Regulation (GDPR) law will come into effect from May. It curtails what companies can do with personal data, like selling people's information without its consent. It's very likely this law will affect Facebook, although to what extent remains to be seen.

Governments have been calling for investigations into Facebook following the Cambridge Analytica scandal. This groundswell of anti-Facebook might even lead to regulations on Facebook.

But in the meantime, it's worth asking you this question. After all that you've learned about Facebook, are you're still okay with using it?

Not ready to give up on Facebook yet? We're not judging. Just remember that every "like" and "share" on a Facebook page is giving away information on you. Here're some things you can do to keep Facebook's tracking to a minimum.

1. REMOVE AD PREFERENCES

Click on Settings, and then click the Ads link near the bottom of the list. This brings you to a page titled "Your ad preferences."
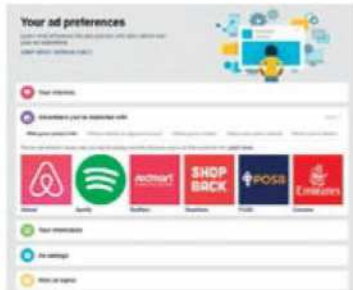
You'll find five expandable banners, with settings that affect the way Facebook sends you ads.

- There's a whole range of categories under this section ranging from People to Sports and Outdoors to Food and Drink. Be sure to go through each section, mouse over the interest and click to remove.
- Next, move to Advertisers you've interacted with and remove every company you don't wish to receive ads.
- From there, move on to Your Information and turn off all the various categories listed in About you and Your categories.
- Then, go to Ad settings. Change the settings to "Off", "No", and "No One", then move on to Hide ad topics.
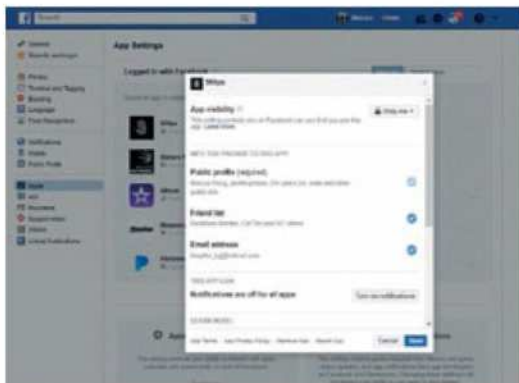
2. ADJUST YOUR APP SETTINGS

We've covered this in the section for deleting Facebook, but it's important to go through this list of apps even if you're staying. That's because every app collects different bits of information about you. Uncheck unnecessary things like "Friend list", "Relationships", "Work history" etc., then click save.

3. BLOCK THIRD-PARTY COOKIES

For Chrome, go to Settings, Advanced, Content settings, Cookies. This is where you block individual sites from adding cookies. Click add, type "facebook.com" and click add again to block cookies from Facebook.

For Firefox, click the gear icon to access settings and look for Privacy and Security. Choose Never remember history. Then, scroll down to the section Tracking Protection. Under Use Tracking Protection, select "Always". And do the same for Send websites a "Do Not Track" signal that you don't want to be tracked.

Mozilla also has a browser extension called the "Facebook container." It lets you isolate Facebook activity so it's not shared with external sites. Do note that this doesn't work if you use your Facebook account to log in to an external website.

4. USE A DIFFERENT BROWSER

For added security, you can also consider using a different browser completely. We'd recommend looking up Epic Privacy Browser and Tor as these focus on privacy. Tor bounces your communications through a network of servers around the world, so no one can trace what you're surfing.

Unfollow everyone to break your Facebook addiction

This method won't stop Facebook from tracking you. But it can help you break your addiction to Facebook. Unfollowing everyone turns your News Feed into a blank page. Without anything to see, the urge to check Facebook wanes.

1. UNFOLLOW WITH A LOT OF CLICKING

Facebook doesn't make it easy to unfollow everyone. Be warned, there is a lot of clicking to follow. In Facebook on the desktop, click on the drop-down menu on the upper right, and then chose 'News Feed Preferences.'

On the pop-up window that follows, click on Unfollow people to hide their posts. Then click on each one of the friends, pages, and groups you're following to unfollow them.
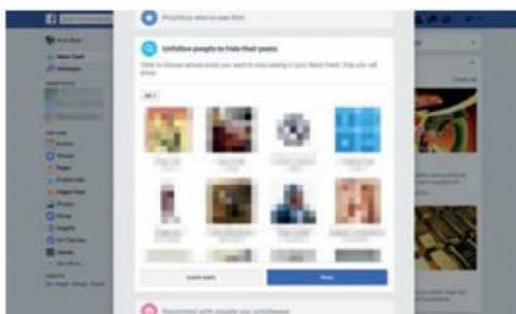
This takes a while. Facebook doesn't show you everything you're following on a single load. After finishing a batch, click out of the menu, and click back in again to continue unfollowing.

2. CHECK TO SEE YOU'RE FINALLY DONE

You're done when you use the drop-down menu in the unfollow box, select 'Friends only,' 'Pages only,' 'Groups only,' and find that nothing shows up in any of the options.

3. FACEBOOK MAY STILL BE SHOWING YOU POSTS

Your news feed may still be showing you posts after step 2. If so, go back to the modal window in step 1, select 'Prioritize who to see first,' and unfollow everyone there.

4. REACH 'NEWS FEED ZERO'

That was when you'll reach 'News Feed Zero.' Your news feed will no longer show posts from anyone. The only things it'll show from then on are you're your most recent posts, and your 'Facebook memories.' HWM

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TEST
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HOW WE RATE:
Products are rated on a scale of **1** to **10**; **1** being so abysmal, it should be a crime to sell it, and **10** being almost perfect. Come now, nothing is perfect. An Editor's Choice may also be awarded based on unique merits.

PICTURE **SAMSUNG**

M O R E I N S I D E >
SAMSUNG GALAXY S9 AND S9+
The Android poster boy is back.

HUAWEI P20 PRO
Finally, a worthy contender.

APPLE IPAD (2018)
More power, now with Pencil support.

ARMAGEDDON MKA-3C PSYCHFALON
·
LEOBOG K23
·
TECWARE PHANTOM RGB
·
YUEMI MK01

Mechanical on a shoestring

The 'click clack' of mechanical keyboards is everywhere these days, but the fact remains that many of them are still really expensive. Or are they?

By **Koh Wanzi** Photography by **Darren Chang Yimin** *Art Direction* by **Orland Punzalan**

ARMAGGEDDON MKA-3C PSYCHFALCON

Armaggeddon's MKA-3C Psychfalcon keyboard is targeted not at keyboard enthusiasts, but at gamers on a budget who want to see what the fuss over mechanical keyboards is about.

For starters, the keyboard feels fairly weighty at 976g. It's definitely not as solid or heavy as something like a Filco, but it doesn't feel like something you picked up from the bargain bin either. The metal body feels stiff and rigid, with no discernible flex to its chassis.

The Psychfalcon is outfitted with Outemu Blue switches, which are very similar to Cherry MX Blues. They are tactile and clicky, and feature an operating force of around 60g. The very distinct click that comes with every key press means that they are also very noisy to type on, so you'll want to bear that in mind if you intend to use this keyboard in the office.

These switches are also modular and hot swappable, so you can pluck them out and replace them with a new switch if you do get bored of how they feel. That's similar to what Tecware offers, and it's nice to see this level of flexibility at this price point.

The keycaps are constructed out of ABS plastic, which is known to wear easily and take on an unpleasant shine over time. Still, this is pretty much standard fare for most keyboards, even those that cost twice or even triple the price, so I can't really fault Armaggeddon here.

The secondary legends are pad-printed below the translucent legends, with clear labels for various media control functions and lighting modes. The legends are printed as quite a thick layer over the keycaps, and you'll notice them the minute you run your finger over the keycaps.

That said, pad-printing is way less durable than something like doubleshot molding, which the Tecware keyboard uses.

Finally, the Psychfalcon features RGB lighting for those who like their LEDs. The good news is that the lighting is quite even, as the keycaps with dual legends have them sitting side by side, so they're both sitting directly above the LED.

The keyboard supports true driver-free operation, and you're meant to do everything on the keyboard itself. However, this means you don't get more advanced features such as per-key RGB backlighting and are limited to just nine different lighting effects and nine game lighting profiles.

+

Decent build quality.

−

No per-key lighting or other more advanced controls.

The Outemu Blue switches here are modular and hot-swappable.

The keyboard uses fairly thick pad-printed legends.

The keyboard ships with keycap and switch pullers.

AT A GLANCE

SWITCHES
Outemu Blue

TYPE
Tactile and clicky

DIMENSIONS
355.8 x 135.9 x 38.6mm

WEIGHT
976g

PRICE
$59.90

The braided cable contributes to the overall impression of quality.

The doubleshot molding process ensures that the legends will never fade.

The switches can be replaced with a different switch type.

The Tecware Phantom RGB is a staggeringly feature-rich keyboard for its price. At $69, this is a pretty sweet deal for a mechanical keyboard, even if it is the most expensive keyboard in our field of bargain options.

It uses Outemu Brown switches, which are effectively Cherry MX Brown clones with a higher actuation force of 55g. But save for the slightly stiffer operation, they're nearly indistinguishable from their Cherry counterparts.

The Brown switches are also far more suitable for use in an office than their Blue siblings. They lack the distracting clicky feedback, so you're less likely to annoy your co-workers. The switches are modular, so you can swap out the switches if you're bored of them.

The keyboard supports per-key RGB lighting and macro recording, which is a huge bonus at this price point. You can set up to three profiles in Tecware's software utility, and if per-key customizations sound too tedious, you can pick from 18 different lighting presets.

As it turns out, you don't even have to use the driver if you don't want to, as the Phantom offers plenty of ways for you to adjust the lighting effects right on the keyboard itself. For instance, you can switch between nine different LED colors using a combination of the Fn and RGB key.

That aside, the Phantom also uses surface-mounted LEDs, which means they sit directly on top of the PCB, instead of being mounted on the switch housing. Each LED is also positioned directly beneath the key legends, so you get rather even illumination. It's a small detail, but it's also one that many keyboards overlook.

Most of the function keys double up as media controls and convenient shortcuts to your music player, calculator, web browser, and even file explorer. Better still, the keyboard supports true N-key rollover, which is an area where many of the other keyboards falter.

Tecware also needs to be commended for its use of double-shot ABS keycaps, which is still a rarity even on keyboards that cost twice as much. These comprise of two different pieces of plastic molded into each other so that the legends won't fade over time.

Finally, build quality is much better than I expected from a keyboard that costs under $70; it feels solid and well put together. Plus. the floating key design is nice as well, as it makes it easier to keep the keyboard clean.

➕
Impressively feature set.

➖
No detachable cable.

AT A GLANCE

SWITCHES
Outemu Brown

TYPE
Tactile and silent

DIMENSIONS
361.5 x 133.5 x 22.5mm

WEIGHT
950g

PRICE
$69

LEOBOG K23

The Leobog K23 is the cheapest keyboard in this shootout. At around US$15, it's a steal for a mechanical keyboard, and I can hardly see a keyboard getting much cheaper than this. Of course, this means it makes several compromises compared to the other keyboards here, which already include models chosen for their cutthroat pricing.

The K23 uses KRGD Red mechanical switches, which are linear, silent Cherry MX Red clones. These switches feel super light, not unlike their MX Red counterparts, but they also don't feel quite as smooth. The motion of the switch stem feels slightly scratchy on some of the keys, so they don't quite measure up to the real MX Red switches.

The keyboard also comprises mostly plastic, so it's distinctly less premium than some of the other options here. The good news is that the chassis is still reasonably rigid. While it definitely flexes more than the other keyboards, it still feels fairly robust.

I half-expected a US$15 dollar keyboard to feel like it was coming apart at the seams, but I'm happy that this wasn't the case.

The ABS keycaps feature pad-printed legends, which isn't surprising at this price point. Yes, ABS plastic and pad-printing are among the cheapest and least durable combination you can get, but you can't really ask for more at this price.

There's also no backlighting of any sort, although you do get secondary media controls on the function row, and even a gaming mode of sorts where you can disable the Windows key.

One quirk in the design is the ISO-style Enter key, which takes some time getting used to. It's shorter and taller, and the backslash key has been moved beside it. This means I often found myself hitting backslash when I was really going for Enter, which was slightly annoying.

The K23 also features one major limitation that may hinder it in certain games. While Leobog is claiming anti-ghosting features with up to 26-key rollover, that isn't always the case. When holding down W and Shift, the K23 becomes unable to recognize the Z, X, C, and V keys, which is a major problem in games like Fortnite.

All things considered, the K23 is pretty decent for its price. That said, if you're looking for your first mechanical keyboard, I'd still point you toward one of the other models, lest you come away with a lackluster first impression.

+

Extremely affordable for a mechanical keyboard.

−

Very limited anti-ghosting capabilities .

There are clearly labeled indicators for things like Caps, Scroll, and Win lock.

If you're used to the ANSI layout, you'll need to adapt to the ISO-style Enter key.

The K23 uses silent, linear KRGD Red switches.

AT A GLANCE

SWITCHES
KRGD Red

TYPE
Linear and silent

DIMENSIONS
372 x 164 x 39mm

WEIGHT
1,000g

PRICE
US$14.97

YUEMI MK01

The Yuemi MK01 is a mechanical keyboard sold by smartphone juggernaut Xiaomi. It stands out immediately for its elegant, all-white design, a welcome departure from the RGB LEDs and more gamer-oriented designs of the Armaggeddon and Tecware keyboards.

Fortunately, it doesn't just look pretty, and the keyboard is also quite solidly constructed. After all, the chassis is built mainly out of aluminum and the switches are mounted to a steel backplate for extra rigidity. The keyboard feet feel particularly sturdy as well, and they snap out with a reassuring click.

I also like the detachable cable, and it's the only keyboard of the lot to have this. The top plate comprises a glossy plastic finish that may turn some folks away, but fortunately fingerprints don't show up too egregiously.

The TTC Red switches are yet another clone of the original Cherry MX Reds, and they do feel smoother than the KRGD Reds on the Leobog K23. The silent and linear Red switches are especially suited for gaming, but typists will have a hard time not bottoming out given how light they are. What's interesting is that the spacebar uses a black switch instead of red, so it feels heavier than the rest of the keys.

The polycarbonate/ABS keycaps have a matte texture that feels better than most ABS keycaps, and the translucent lettering comprises a separate piece of plastic so they'll never fade.

That said, the MK01 is still a fairly basic keyboard. There's just a single-color white backlight, although you can toggle between six different brightness levels on the keyboard itself. There are also no secondary media keys as on the other keyboards, and there's no ability to reprogram any of the keys.

Hitting the Fn and Windows key does deactivate the Windows key however, so that can be pretty useful.

The keyboard's minimalist aesthetic is also uninterrupted by any LED indicators, and the Caps Lock and Scroll Lock keys glow orange when they're activated.

Unfortunately, one area where the MK01 is severely lacking is a key rollover feature. It doesn't have N-key rollover, or anything close to that. In fact, I was able to make it stop registering additional key presses after holding certain combinations of just two keys.

That's abysmal, especially for gaming, so I definitely wouldn't recommend this if you're looking for a gaming keyboard.

The spacebar is the only key to use a heavier TTC Black switch.

The cable can be detached for easier transport.

The rest of the keyboard uses TTC Red switches.

+

Clean, minimalist aesthetic.

−

2-key rollover limits its use for gaming.

AT A GLANCE

SWITCHES
TTC Red

TYPE
Linear and silent

DIMENSIONS
350 x 128 x 31.6mm

WEIGHT
940g

PRICE
299 yuan

SPECIFICATIONS

	Armaggeddon MKA-3C Psychfalcon	Leobog K23	Tecware Phantom RGB	Yuemi MK01
Switches	Outemu Blue	KRGD Red	Outemu Brown	TTC Red
Type	Tactile and clicky	Linear and silent	Tactile and silent	Linear and silent
Detachable cable	No	No	No	Yes
Driver software	No	No	Yes	No
Backlight	RGB	None	Per-key RGB	White (6-levels)
Dimensions	355.8 x 135.9 x 38.6mm	372 x 164 x 39mm	361.5 x 133.5 x 22.5mm	350 x 128 x 31.6mm
Weight	976g	1,000g	950g	940g
Price	$59.90	US$14.97	$69	299 yuan

AND THE BEST BUDGET MECHANICAL KEYBOARD IS…

TECWARE PHANTOM RGB

The Tecware Phantom RGB may be one of the most impressive sub-$100 mechanical keyboards around. It is the most expensive keyboard in this shootout, but that isn't saying a lot considering that it still costs just $69. For that price, you get plenty of features usually reserved for more expensive models, such as per-key lighting customizations, doubleshot keycaps, and modular switches. It also supports full N-key rollover, whereas the other keyboards falter in this area. The Phantom could use some refinement in the design department, but it's otherwise difficult to find fault with.

ASUS ROG SWIFT PG258Q

·

BENQ ZOWIE XL2540

·

VIEWSONIC XG2530

·

ALIENWARE AW2518H

·

ACER PREDATOR XB252Q

Gotta' Go Fast

120Hz was yesterday. Today's TN gaming monitors have left that revolutionary benchmark in the past, blazing towards higher refresh rates in the name of competitive gaming and esports. If you're willing to trade color and resolution for speed, here are some picks to consider.

By **Ade Putra** Photography by **Darren Chang**
Art Direction by **Orland Punzalan**

Read more at GAMEAXIS.com

ASUS ROG SWIFT PG258Q

Asus brought new meaning to their ROG Swift line with the PG258Q. Packing a 1ms response time, Nvidia G-Sync, and ULMB (Ultra Low Motion Blur), this 24.5-inch monitor helped pave the way for native 240Hz TN offerings.

At first blush, the PG258Q certainly invokes curiosity. Eyes are immediately drawn to the Light Signature projected onto the table and, by extension, the monitor's tripod stand. The former casts the ROG logo by default, but imaginative owners may get their own plates customized. While said light can be turned off, the stand poses more of a problem. The large footprint eats plenty of tabletop space, making this monitor a tight fit on smaller desks.

Still, the stand is stable for whatever height and orientation the monitor can be placed in. Asus brings the full range of adjustments, including tilt, swivel, and a 90-degree pivot. For greater flexibility, the PG258Q is also equipped with a 100mm VESA mount.

Looking under the detachable cable panel reveals a modest range of input options. The all-important DisplayPort 1.2 is there to surpass the 60Hz mark, while the HDMI 1.4 may come in handy for gaming consoles and the like. Wrapping up the list is a pair of USB 3.0 for a keyboard and mouse, or something permanently attached – the cable routing isn't designed for quick and easy access.

The strengths of the PG258Q shines once you sit down to use it. Games exhibited little to no blur or ghosting, making snap fire and quick turns in shooters enjoyable. Fast action scenes in movies and TV reap the benefits too, with little contrast or brightness issues, and impressive color (72% NTSC) for a TN panel. However, the narrow viewing angles makes this better suited for solo audiences, and initial calibration is highly recommended.

Thankfully, adjusting modes and settings are a breeze since Asus included both a joystick and physical buttons for the on-screen display. There's a blue light filter to help reduce eyestrain for long sessions, as well as user-defined presets bound to the physical buttons. Gaming-centric features such as an FPS counter, timer, and crosshair overlay are also present should you find those handy.

Asus have made an impressive first step in the 240Hz realm with the PG258Q, boasting plenty of performance chops and color competency to round it off as a good entertainment monitor.

+ Impressive performance with surprisingly good color

− Stand has an unnecessarily large footprint
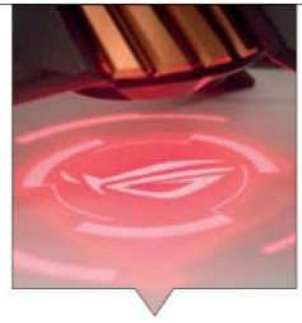
The Light Signature projection is highly customizable, coming with three blank templates that can be drawn on using markers.

AT A GLANCE

SIZE
24.5"

RESOLUTION
1920×1080

REFRESH RATE
240Hz Native

RESPONSE TIME
1ms

ADAPTIVE SYNC
Nvidia G-Sync

COLOR GAMUT
72% NTSC

DISPLAY INTERFACE
DisplayPort 1.2, HDMI 1.4

OTHER PORTS
USB 3.0 (×2), Headphone Out

VESA MOUNT
100mm

PRICE
$1,099

The detachable interface panel keeps cables in check without breaking up the Mayan-inspired patterns.

A sturdy carrying handle tops the stand for easy transportation – one hand still needs to support the monitor, but the handle makes things less cumbersome.

Rather than reaching for the monitor's physical buttons, the S-Switch provides quick access to monitor profiles and input toggles.

BENQ ZOWIE XL2540

BenQ Zowie has embedded deep into esports on the strength of its peripherals, and their XL2540 monitor has the same audience in mind. It touts the same native 240Hz refresh rate and 1ms response time of its peers but packages thoughtful accessories for the competitive gamer.

For a 24.5-inch monitor, the XL2540 appears larger than it is thanks to the detachable shields framing either side. They're designed to cut glare, reflections, and any flashes of light or movement that lie within peripheral vision — a bigger concern at events than at home. Nonetheless, it does help to pull focus towards the game or movie on-screen, bumping up the immersion factor.

Similarly, the XL2540 is mounted on a stand designed for events, with a solid top handle that doesn't leave the monitor rattling. The stand allows smooth adjustments to height, tilt, and swivel, with printed markers in place to serve as guides or future references. The stand's base also comes with a circular recess meant for the included S-Switch, an accessory to quickly switch monitor profiles or inputs.

For input, the XL2540 accepts the requisite DisplayPort 1.2 alongside HDMI 2.0 and DVI-DL. Other ports include four

USB 3.0, three of which are downstream for peripherals; you'll find two of them along the monitor's left edge, together with the microphone and headphone ports, as well as a pop-out headset hanger. There's even a slot for a Kensington lock.

When gaming, this monitor doesn't disappoint. It delivers on the promised 240Hz, alongside what they call an Advanced Motion Accelerator (AMA) for a smooth and blur-free experience. It held up just as well as the Asus in shooters, racers, and fighters, though it did require more leg-work when it come to movies. While out-of-the-box calibration did take longer on the XL2540, the final result didn't raise any eyebrows.

That being said, BenQ Zowie offers users plenty of room to tweak and customize to their liking. There are physical buttons on the back of the monitor to set-up contrast and brightness basics, as well as features such as color vibrancy, black equalizer, or blue light filter. Three of the eight available presets are customizable too, and you'll have quick access to all three via the S-Switch.

The XL2540 exudes confidence in an esports context but not much else, making this monitor an especially niche product in an already uncommon line-up.

+ Excellent build, design, and performance for esports

− Poor color reproduction limits its versatility

VIEWSONIC XG2530

ViewSonic's entry may seem reserved compared to the flash of the other featured monitors, but underneath that simple exterior lies a configuration that's well-suited for gaming and other entertainment tasks.

This 24.5-inch monitor adopts a simple, classic design that doesn't cry for attention. There's a brush of red here and there for visual interest, but the main appeal is in the brush-textured stand that's flat and spacious enough to accommodate keyboards or a gamepad. Up for personal debate is the curved, bottom bezel, which not only makes it look thicker but downright odd when in portrait mode.

The stand itself seems to share the same mixed bag of design decisions. On the one hand, the stand is one of the best in terms of looks and size, occupying as little space as possible without sacrificing stability. On the other hand, it comes with sketchy inclusions such as a cable-organizer that may as well not be there. In terms of overall function, however, the height, swivel, tilt, and pivot adjustments are all smooth enough to operate one-handed, adding another huge plus to the XG2530's books.

Connections-wise there is DisplayPort 1.2, HDMI 2.0, HDM 1.4, three USB 3.0 ports (one for upstream) and a 3.5mm jack for audio.

A Kensington lock slot and a headphone hanger can also be found elsewhere on the monitor. That leaves the XG2530 on-par with the BenQ Zowie, yet where it edges slightly ahead is with the inclusion of two 3W speakers — nothing spectacular but undoubtedly handy should you ever need it.

It's no slouch when it comes to performance, either. While supported games did hit 240Hz, there was just the slightest hint of delay compared to the others. It's by no means a deal-breaker since looking for it required some intense staring at high-contrast scenes (unnoticeable in actual gameplay), but it was there nonetheless. Enabling FreeSync with an AMD graphics card will help to improve things.

Notably, the XG2530 didn't take long to set-up and calibrate at all. Colors and contrast were fairly impressive out of the box, and while the eventual contrast did seem a tad lacking, the overall presentation was acceptable enough for streamed videos and movies. There is some noticeable color shift but nothing out of the ordinary for a TN panel; it's fine when viewed from dead center.

Although the ViewSonic XG2530 didn't excel in any particular area, the sum of its parts is proving to be greater than its flaws.

+ **All-rounded performance with good factory settings**

− **Slight delays and color shifts noticeable under scrutiny**

The brush textured stand is industrial in both looks and application, taking up little desktop space while still offering plenty of support.

AT A GLANCE

SIZE
24.5"

RESOLUTION
1920×1080

REFRESH RATE
240Hz Native

RESPONSE TIME
1ms

ADAPTIVE SYNC
AMD FreeSync

COLOR GAMUT
72% NTSC

DISPLAY INTERFACE
DisplayPort 1.2, HDMI 2.0, HDMI 1.4

OTHER PORTS
USB 3.0 (×3), Audio Out

VESA MOUNT
100mm

PRICE
$719

The optional cable management hook does the job, but it looks and feels flimsy compared to the rest of the monitor's build.

The RGB lighting offers a subtle touch of customization to the monitor, complementing the angled design of its rear panel.

A pair of USB 3.0 ports flank a headphone jack along the bottom bezel, ideal for a keyboard and mouse combo or for connecting flash drives.

ALIENWARE AW2518H

Home of the iconic alien head, Alienware are no sticklers for design conventions or playing things safe. Although the AW2518H isn't as out-of-this-world as some of their desktops, this 24.5-inch monitor will easily leave a lasting impression with anyone who's tried it.

It's no surprise that Alienware went with a gunmetal grey aesthetic, but the beautifully thin bezels pairs well with the lighting strips and imposing stand to carve a decidedly sci-fi look – more so when viewed in profile. RGB lighting and monitors may leave some recoiling, but it's only three strips arranged as a triangle crosshair on the rear. They're fairly subdued and can be turned off, whereas those who've embraced the bling will find plenty of ways to customize it to their liking.

The tripod stand is as heavy as it looks, so it's not going to be moving once it's been wrestled onto the desk. It's incredibly sturdy, with the full complement of height, tilt, swivel, and pivot adjustments you'd expect from today's gaming monitors. Interestingly, the buttons are just as sturdy, with no play when brushing your fingers against them. The power button is clearly separated from the rest, too, which is a welcome usability change from the tight grouping on the others.

The Alienware falls a little short with connections, offering only DisplayPort 1.2 and HDMI 1.4. It makes up for that by having a total of four USB 3.0 ports, two of which are placed under the bottom bezel. They both flank a headphone jack, and while all three are smack center and easily accessible, they can leave your desk looking messy with trailing cables.

Granted, it does look sci-fi cool in some ways. To further nitpick, the angled power cable jack and small cable routing slot all makes setting up a chore.

Is the panel worth those small grievances? Easily. The colors on the AW2518H are pleasant and vivid right out the box on factory settings, with impressive black levels to boot. The on-screen menu adjustments are basic, lacking a color temperature slider, choosing to offer more presets instead. Just as impressive as the colors was the slick performance, smoothed across a wide range thanks to G-Sync. There's a response time setting in the menu but, for best results, leave it at normal.

The Alienware AW2518H shaped up as a notable entry, hitting all the right notes for a competitive gaming monitor.

+ Great low-latency performance with impressive colors

– Small design inconveniences and steep price tag

ACER PREDATOR XB252Q

Acer have gained plenty of ground for gaming monitors, often going neck-and-neck against Asus in a race to the top. As a late addition to the year, where will their stake in the 240Hz battle wind up? Fairly high on the totem hole, as it turns out.

The XB252Q doesn't feel the need to make a loud presence, going with an understated design with Zero Frame bezels and a black border that's remarkably slim. The only flair going for it are the small logo on the front and the angular, four-legged stand that's almost as odds with the monitor's simple design. A row of buttons and a joystick make up the on-screen controls, located at the back but not hard to find.

The stand follows a straight-forward approach as well. Viewed from the side, it's angled away from the user yet doesn't get in the way of the height adjustments. Despite appearances the stand is as sturdy as they come, with no wobble by the mount or at the base. Given the monitor's chunky bulge along its midsection, it does help to make the overall product appear slimmer.

Inputs are what you'd expect by now: a DisplayPort 1.2 and HDMI 1.4. However, Acer is offering a total of five USB 3.0 ports, one of which is reserved for the upstream link to the PC. The usable four are split into groups of two, one pair with the rest of the inputs and the other pair joining a headphone out on the left side. Interestingly, this is also the only other monitor to feature integrated speakers, though they're only 2W each.

Out of the box, the XB252Q runs a tad high on its brightness and contrast settings. The latter stands to improve the most, oftentimes leaving a mildly washed out effect, though Acer has included a Dark Boost setting to alleviate that weakness. It does make the monitor struggle with high dynamic range in movies, TV shows, and horror games, but the colors are decent enough for video consumption.

Competitive games definitely hold up well with their clearly defined colors and silhouettes, so the poor contrast is less of an issue there. The high refresh rate and ULMB do not disappoint, with no perceptible input lag to negate the whole point of fast monitor.

In that regard, the Acer XB252Q is a fine choice if you're dead-set on trying out native 240Hz for competitive gaming. It may hamstring overall versatility, but it offers great performance at a middle-of-the-road price point.

➕ Good balance between price and performance

➖ Poor contrast hamstrings it outside of games

The monitor boasts thin bezels and slim black borders, maximizing its visual presentation.

AT A GLANCE

SIZE
24.5"

RESOLUTION
1920×1080

REFRESH RATE
240Hz Native

RESPONSE TIME
1ms

ADAPTIVE SYNC
Nvidia G-Sync

COLOR GAMUT
72% NTSC

DISPLAY INTERFACE
DisplayPort 1.2, HDMI 1.4

OTHER PORTS
USB 3.0 (×5), Headphone Out

VESA MOUNT
100mm

PRICE
$798

There are a grand total of five USB 3.0 ports, two of which sit off to the monitor's side for easy access.

SPECIFICATIONS

	ASUS ROG SWIFT PG258Q	**BENQ ZOWIE XL2540**	**VIEWSONIC XG2530**	**ALIENWARE AW2518H**	**ACER PREDATOR XB252Q**
SIZE	24.5-inch	24.5-inch	24.5-inch	24.5-inch	24.5-inch
RESOLUTION	Full HD (1920×1080)	Full HD (1920×1080)	Full HD (1920×1080)	Full HD (1920×1080)	Full HD (1920×1080)
REFRESH RATE	240Hz	240Hz	240Hz	240Hz	240Hz
ADAPTIVE SYNC	Nvidia G-Sync	Adaptive Sync (AMD)	AMD FreeSync	Nvidia G-Sync	Nvidia G-Sync
COLOR GAMUT	72% NTSC	72% NTSC	72% NTSC	72% NTSC	72% NTSC
DISPLAY INTERFACE	DisplayPort 1.2, HDMI 1.4	DisplayPort 1.2, HDMI 2.0, HDMI 1.4	DisplayPort 1.2, HDMI 2.0, HDMI 1.4	DisplayPort 1.2, HDMI 2.0, HDMI 1.4	DisplayPort 1.2, HDMI 1.4
OTHER PORTS	USB 3.0 (×2), Headphone Out	USB 3.0 (×4), Headphone Out, Microphone In	USB 3.0 (×3), Audio Out	USB 3.0 (×4), Headphone Out	USB 3.0 (×5), Headphone Out
INTEGRATED SPEAKERS	No	No	Yes	No	Yes
VESA MOUNT	100mm	100mm	100mm	100mm	100mm
UNIQUE FEATURES	Light Signature	Monitor Shields, S-Switch	-	RGB Lighting	-
PRICE	$1,099	$799	$719	$1,199	$798

AND THE BEST GAMING MONITOR IS...

ALIENWARE AW2518H

Despite being saddled by small inconveniences and a four-figure price tag, the AW2518H's singular pursuit of performance places it ahead of the 240Hz pack. The other featured monitors remain strong contenders for any esports enthusiast, but none have left an impression as deep as Alienware's. From setting it up to turning it on and testing it, everything about the monitor spoke to its quality.

The AW2518H nails the blistering fast performance and response times expected of a competitive gaming monitor, and then goes beyond by offering colors unexpected of a TN panel. Why compromise on your ability to enjoy watching videos when you've already sacrificed resolution? What's more, you won't have to spend minutes or hours tinkering away on calibration, letting you jump into the action as soon as possible.

All things considered, we believe the Alienware AW2518H is the best esports gaming monitor you can buy right now.

An evolutionary step up

Samsung Galaxy S9 and S9+

By **James Lu and Alvin Soon**

The Samsung Galaxy S9 and S9+ look almost identical to last year's models, right down to the antenna bars, buttons and ports, all being in the same places. That means the power button is on the right, and the volume rocker is on the left, with a dedicated Bixby button (which you still can't remap) below it. The phones are still IP68 rated, and yes, unlike a lot of phones out there, you still get a 3.5mm headphone port on the bottom.

Technically, there are some differences, although you almost certainly won't notice them. Both the S9 and S9+ are actually ever so slightly shorter than their predecessors, with

The new Lilac Purple color was created in the spirit of Pantone's Color of the Year 2018 (Pantone 18-3838 Ultra Violet).

marginally reduced top and bottom bezels. The S9 is 1.2mm shorter than the S8, and the S9+ is 1.3mm shorter than the S8+. However both phones are also about 0.5mm wider and thicker than their predecessors. Both phones are also slightly heavier, with the S9 coming in at 163g (8g heavier) - you won't notice this - and

the S9+ coming in at 189g (16g heavier) - you will notice this. The S9+'s extra weight is mainly due to the addition of a secondary camera on the rear.

The phones use the same Infinity Display design that was first introduced on the S8 and S8+, with the same screen sizes (5.8-inch on the S9 and 6.2-inch on the S9+), a 18.5:9 aspect ratio, and QHD+ resolution (2,560 x 1,440 pixels) with dual-curved edges. While the displays look mostly the same, Samsung has actually made some notable improvements to them. For starters, the new displays have an enhanced High Brightness mode that lets them achieve a staggering 1,130 nits, which is 20 percent higher

than the peak brightness capable on the S8 and S8+. The displays also boast significantly improved color accuracy.

For the first time on a Samsung phone, the S9 and S9+ are also equipped with stereo speakers. You get one speaker on the bottom of the phone, and the earpiece doubles up as the second speaker. The speakers are tuned by AKG and boast a surprisingly rich, full sound. Despite the larger size, the S9+ wasn't any louder or better than the S9 - stereo separation from both models was also about the same.

A big new feature on the S9 is AR Emoji, which lets you send animated emoji that imitate your own facial expressions. One big

difference from Apple's Animoji is that Samsung's version lets you create your own emoji option that lets you use a cartoon version of your own face. Once you've created your AR emoji, you can share it in GIF or PNG format, and it is also possible to use AR Emoji as stickers with compatible apps.

The main rear camera on both phones is a dual-aperture lens that switches between f/1.5 and f/2.4

The headline feature for the S9 and S9+ camera is its dual-aperture lens, which switches between f/1.5 and f/2.4. This main camera captures 12MP images using a 1/2.55-inch sensor, with a pixel size of 1.4 microns. The S9 comes with this main camera only, but the S9+ also comes with a second camera for zoom.

The S9+'s telephoto lens also captures 12MP photos, but it has a smaller sensor that measures 1/3.4", with a pixel size of 1 micron. Its lens has a fixed aperture of f/2.4. There's also an integrated DRAM module on the new 12MP sensor provides extra processing power for the S9 cameras. This allows Samsung to combine up to 12 images per shot for a final composite, up from three images before.

In Auto Mode, the main camera switches automatically between f/1.5 and f/2.4, depending on the amount of light. You can only toggle the aperture in Pro Mode. The lower a lens' aperture value, the wider it can open, and the more light it lets in. f/1.5 is especially useful in low light, but it can be too much in bright daylight. That's when the main camera will switch to f/2.4 to let less light in.

On cameras with bigger sensors, like a mirrorless or DSLR camera, a lens with a large aperture can create blurrier backgrounds. But on cameras with miniature sensors, like smartphones, the effect is negligible. You can use the S9+'s Live Focus Mode to simulate background blur, which works well most of the time.

It's in low light that the S9's f/1.5 lens shines. Because of its wide aperture, the S9 can capture more light in dark situations. It can also let you shoot at lower ISO, resulting in a cleaner photo with more detail. At f/1.5, the S9 has the fastest smartphone lens today.

As usual, there are two processor variants of the S9 and S9+. US and China get Qualcomm's Snapdragon 845 processor, while everyone else gets Samsung's own Exynos 9810. Like the 845, the Exynos 9810 is a 10nm 64-bit octa-core processor running on a 4x4 big.LITTLE configuration. It uses four high-power Mongoose M3 cores clocked at 2.7GHz, and four high-efficiency Cortex-A55One cores, clocked at 1.8GHz. The 9810 uses a Mali-G72 MP18 GPU. The S9 has 4GB RAM, while the S9+ has 6GB RAM.

Benchmark performance was good, but wasn't that much better than last year's models, with on average only a 10-15 percent increase in benchmark performance.

Like last year, the S9 uses a 3,000mAh battery, while the A9+ has a 3,500mAh battery. Battery life on both models remains excellent, although we didn't see much improvement from last year. In fact, the S9+ was a little worse than last year's S8+.

Last year's S8 and S8+ were huge jumps forward for Samsung. Those phones introduced us to an exciting new design, and new features like the Infinity Display and Bixby. This year, it's hard to feel the same level of enthusiasm for the S9 and S9+. That's not to say that they're not great phones though. These are still the best phones Samsung has ever made,

CONCLUSION
These are still the best phones Samsung has ever made, and by far the best Android phones available right now, but they're getting really pricey.

S9 AT A GLANCE

OPERATING SYSTEM
Android 8.0 Nougat with Samsung Experience 9.0

PROCESSOR
Samsung Exynos 9810 octa-core (4x2.8 GHz Mongoose M3 & 4x1.7 GHz Cortex-A55)

BUILT-IN MEMORY
4GB RAM

DISPLAY
5.8-inch 2,560 x 1,440 pixels (~570 ppi) Super AMOLED Infinity Display

CAMERA
12-megapixel, dual f/1.5 and 2.4, 26mm, Dual Pixel PDAF, OIS, LED flash

BATTERY
3,000mAh

DIMENSIONS
147.7 x 68.7 x 8.5 mm

WEIGHT
163g

S9+ AT A GLANCE

OPERATING SYSTEM
Android 8.0 Nougat with Samsung Experience 9.0

PROCESSOR
Samsung Exynos 9810 octa-core (4x2.8 GHz Mongoose M3 & 4x1.7 GHz Cortex-A55)

BUILT-IN MEMORY
6GB RAM

DISPLAY
6.2-inch 2,560 x 1,440 pixels (~529 ppi) Super AMOLED Infinity Display

CAMERA
Dual 12-megapixel, dual f/1.5 and 2.4, 26mm, Dual Pixel PDAF, OIS, LED flash and 12-megapixel f/2.4, 52mm telephoto, 2x optical zoom

BATTERY
3,500mAh

DIMENSIONS
158.1 x 73.8 x 8.5 mm

WEIGHT
189g

S9 TESTED & RATED

8.5/10

HWM SINGAPORE

S9+ TESTED & RATED

9.0/10

HWM SINGAPORE

TEST
EDITOR'S CHOICE
HWM
SINGAPORE

but they're evolutionary, not revolutionary, and they mainly build upon the foundation laid by the S8 and S8+.

Finally, it's worth noting that the price of Samsung's S range is slowly creeping up. Last year, the S8 retailed for $1,148, while the S8+ was $1,298. This year, the S9 is $1,198, and the S9+ starts at $1,348 for the 64GB model, and goes up to $1,498 for the 256GB model. That's $100 more than last year's Note8.

Bright and colorful

NEC NP-ME331W By **Ng Chong Seng**

The ME331W has both digital and analog inputs, including HDMI and composite.

AT A GLANCE

TECHNOLOGY
3LCD

RESOLUTION
1,280 x 800 (WXGA)

BRIGHTNESS
Up to 3,300 lumens

LAMP LIFE
Up to 9,000 hours (Eco)

PRICE
$1,290

NEC's ME331W is a multiple-purpose projector with a native 1,280 x 800 (WXGA) resolution. Based on 3LCD technology, it's designed for business use, which is why NEC is keen to tout the beamer's various eco features, including its long lamp life (up to 9,000 hours using Eco mode), and a mere 0.45W power consumption in standby mode.

In addition to its 3,300 lumens of brightness (in High Bright mode), the ME331W sports a 6,000:1 contrast ratio (with iris tech employed), 1.7x manual zoom, and a built-in 20W monaural speaker. Like most NEC projectors, you get a plethora of I/Os, including two HDMI inputs for digital sources and a wired LAN port. For certain settings where a secondary screen is needed (e.g., teachers who need to see the presentation on their own monitor), the projector also has a 15-pin mini D-Sub port for video output. While wireless networking is supported by the system's software, you need to buy a separate dongle.

Setting up the projector is straightforward, thanks to clearly labeled buttons and features like auto power on, auto vertical keystone correction, and wall color correction. Wireless presenting using smartphones and tablets can be easily done through NEC's MultiPresenter app, and there's even a virtual remote tool for direct PC control.

Performance-wise, at High Bright mode, the ME331W easily crosses the 3,300 lumens NEC has listed in its specs. That said, at this brightness level, the lamp will last at most 4,000 hours. For dimmer rooms, Eco mode is the way to go; but this mode will cut the brightness by about 50%.

For the most part, data projection is great, exhibiting sharp text and vibrant colors. There's a slight green cast in High Bright mode though, so for photo-heavy presentations, switch to other presets like Presentation or sRGB. The Movie preset is well-tuned for motion pictures, offering good contrast without sacrificing too much light output (~2,500 lumens). Some minute artifacts and black-level crushing are still present, but I won't consider them deal-breakers.

To conclude, the ME331W is an all-rounder. The 1.7x zoom lens offers flexibility, it plays nice with mobile devices, and the 20W speaker can go pretty loud.

CONCLUSION

Very bright with plenty of connectivity options. If you're shopping for an office projector, shortlist this.

TESTED & RATED

8.0/10

HWM
SINGAPORE

PICTURES **NEC**

Finding work-fun balance

Avita Liber By **Zachary Chan**

The unusually large trackpad seems cool, but actually gets in the way as your palms are almost always resting on it while using the notebook.

Ah, there aren't enough notebook choices... said no one ever. And yet, here we have a new player trying to make a name for themselves in a crowded market. What exactly can Avita—a US tech lifestyle brand—offer that's unique from the myriad of notebook brands already available? Well, colorways apparently, and lots of it.

The Avita Liber series comes in no less than 14 different colors, and in Singapore, the Liber was initially launched with 8 colors (depending on the configuration you go for), including very bold and bright options like Urban Ruby, Princess Pink and Angel Blue. The idea is that most productivity notebooks, regardless of design, only come in boring black or silver. The Avita Liber is

designed for the average user who has that one device for everything: study, work, a little play, and would like to stand out.

It also helps that the Liber is very affordable, with models starting from just $699. And yet, the Liber boasts of a full aluminum chassis that feels solidly constructed with very little flex. It is as slim as the best ultrabooks out there, with the thinnest point being just 5mm. It is also relatively lightweight at 1.37kg. Imagine a MacBook Air in rainbow colors if you will.

A rarity these days, the Liber also has a full complement of ports, including two USB 3.0, a USB Type-C, and mini HDMI.

Of course, at this price point, the specs are equally low. The cheapest $699 option features a 13.3-inch Full HD display and only comes with a Pentium N4200, 4GB RAM and 128GB SSD. Our review unit, which features a Core i5-7Y54, 8GB RAM and 256GB SSD goes for a more modest $1,199. You can configure it up to a Core i7 and 512GB SSD, but while the Liber uses Intel's 7th Gen Core processors, it's the low power 'Y' parts. They run much cooler and last longer; ours lasted a little over 4 hours and 30 minutes in battery tests. However, you'll be looking at sub 15fps if you plan on any kind of gaming with its integrated Intel HD 615 graphics, so it's really only suited for basic computing, homework, web surfing and some movies.

CONCLUSION

A serviceable entry-level notebook that will get your work done in style, if nothing else.

AT A GLANCE

PROCESSOR
Intel Core i5-7Y54
(1.2GHz, 4MB L3,
4.5W TDP)

RAM
8GB DDR3-1600

DISPLAY
13.3-inch, Full HD

STORAGE
256GB SSD

BATTERY
Li-ion, 36Wh

PRICE
$1,199

TESTED & RATED

7.0/10

HWM
SINGAPORE

The Zowie Celeritas II is a rarity in the mechanical keyboard world because it's one of the few gaming keyboards that doesn't use a Cherry MX-style switch. Instead, it uses a Flaretech optical key switch made by Taiwanese

modules themselves. Instead, surface-mounted infra-red optoelectronic components on the circuit board provide the sensing in conjunction with a prism in the switch slider. The optical sensor allows for a much faster confirmation of the

The Celeritas II uses Adomax Flaretech optical switches.

Smooth Operator

Zowie Celeritas II

By **James Lu**

is mostly unnoticeable, but it's nice to know that your keystroke technically confirms faster than the average Joe using a Cherry MX board.

The other interesting aspect of optical switches is that they allow for analog key travel. In other words, the optical sensor can read how far the key is depressed, and output a different result based on that. Having said that, Zowie does not use this feature in the Celeritas II, and it only reads linear on/off input.

Despite its exotic switch technology, the Celeritas II doesn't actually feel that different from a standard Cherry MX-style keyboard. The switches are linear with a very smooth feel and a relatively short travel distance.

manufacturer Adomax to Zowie's specifications.

Like Cherry MX-style switches, optical switches also consist of individual switch modules mounted in a metal plate over a printed circuit board. However, there are no electronics in the switch

keypress with a debouncing rate (the amount of time it takes for the key to settle) of just 0.03ms. To compare, Cherry MX switches have a debouncing rate of about 5ms. The only type of switch with a lower debouncing rate is a capacitive switch (i.e. Topre). In practice, this

They feel smoother than Cherry MX Reds, but with a heavier actuation force – somewhere between Reds and Blacks. Unfortunately Zowie won't disclose the exact specs of its switches, so I don't have any numbers to compare. The closest comparison for me would be slightly stiffer Gateron Reds.

The keyboard is full-sized, activated. I actually didn't realize this at first because I had the backlighting turned off completely.

While the keyboard uses standard Cherry MX stems, it has a non-conventional layout that makes keycap swapping tricky. It uses an irregular 'big-ass' backwards L Enter key, and a short right shift to make space for a relocated backslash key.

There are no adjustable feet, so you're stuck with the default height.

play. The keyboard is also quite rare in that it has PS/2 support via an included adaptor. Theoretically, PS/2 keyboards are superior to USB keyboards, because they aren't limited by USB polling rates, and instead send the signal the instant and input is activated. USB keyboards also have to share bandwidth with other connected USB devices, whereas PS/2 protocol acts independently of them. Once again, in practice, this is mostly unnoticeable, but it's nice for peace of mind.

From a purely technical standpoint, the Celeritas II is one of the best gaming keyboards you can buy. For min-maxers that want any possible advantage they can get, the Celeritas II's optical switches and PS/2 support offer the lowest possible latency you can get from a keyboard. Having said that, personally, I didn't notice any difference in game between the Celeritas II and my regular Vortex Pok3r with MX Reds. I also **wish there was a 60% or** tenkeyless version as full-size keyboards just take up too much space.

CONCLUSION
On paper, the best keyboard for competitive gaming.

with a matte finish, and red backlighting. There's a small built-in wrist rest that I wish was removable. It's not large enough for me to rest my wrist on, but it's too big for me to use my own wrist rest. There are multimedia function keys and backlight brightness controls using an Fn key modifier. There are no dedicated LED indicators for the Scroll, Num and Caps lock keys, instead the backlighting changes from red to blue when they're

The keycaps themselves are black ABS with translucent legends to allow the backlight to shine through.

There are no adjustable feet on the bottom of the keyboard, so you can't adjust its height, but it has a fairly comfortable gradient that should suit most people. The keyboard is hard wired in the center of the board.

Like all of Zowie's products, the Celeritas II is driverless and plug and

A great mechanical keyboard for Macs

Mistel MD870 Sleeker By **Kenny Yeo**

No RGB lighting here, just plain but classy white backlights.

Despite the popularity of mechanical keyboards, Mac-specific keyboards are still relatively rare. By Mac-specific, I mean keyboards that have Mac keycaps and support macOS shortcuts out of the box - no need for pesky software or remapping services.

Fortunately, there's now Mistel, a relatively new brand in the mechanical keyboard scene. The keyboard in question is the MD870 Sleeker. It comes in two sizes, regular 108-key full-size and 87-key tenkeyless. It is also available in the usual Cherry MX switches of red, black, blue, and brown. The unit that I have is the tenkeyless version with Cherry MX Brown switches.

At about 1.4kg, the MD870 Sleeker is one of the heaviest and sturdiest keyboards I have handled. Its chassis is in fact made out of two pieces of thick solid aluminum. The

CONCLUSION

This is a supremely elegant and functional mechanical keyboard for Mac users.

switches themselves are also mounted through a stainless steel plate for extra rigidity. The end result is a keyboard that would not flex or wobble even under the heaviest strokes.

A gripe I have about the keyboard is that it does not have kickstands. Instead, what you get are two additional feet that have to be screwed on to the bottom. Also, the feet only raise the keyboard by a fixed amount that, I find, is not sufficient.

The MD870 Sleeker comes with thick PBT keys,

AT A GLANCE

FORMAT
87-key tenkeyless

SWITCH
Cherry MX

KEYCAP MATERIAL
PBT

INTERFACE
USB Type-C

PRICE
$259

which are more resistant to wear and are pleasant to the touch. Thanks to the solid construction of the chassis, each key press is rewarded with a reassuring thud, not unlike the sound you get when you close the doors on a premium German saloon.

The Mac shortcuts also work as advertised. And speaking of keys, the keyboard does come with extra Windows keycaps for

Windows users. Although the keyboard works with Macs, it can be easily be remapped for Windows by pressing Fn and Space Bar together.

The MD870 Sleeker has backlighting too, but no fancy RGB here, just plain white lights which suit the design of the keyboard well.

Overall, the Mistel MD870 Sleeker is an excellent mechanical keyboard for Mac users. It's solidly constructed, pleasant to type on, and its overall aesthetics are a good complement for Mac devices.

TESTED & RATED

9.0/10

HWM SINGAPORE

PICTURES **MISTEL**

Apple has just given its most affordable iPad a refresh. However, you would be hard-pressed to tell, because it looks just like its predecessor. In fact, very little has actually changed: a new processor, support for Apple Pencil, and faster LTE connectivity. That's it. Everything else from the dimensions to the weight, camera, and battery capacity remain unchanged.

The newest iPad now features Apple's A10 Fusion processor, the same used in the iPhone 7 and iPhone 7 Plus. It is a much-welcomed change that brings about significant performance improvements.

On SunSpider, we found the new iPad to be 15% faster than the model it replaces. And on 3DMark, it achieved scores that were over 27% higher than its predecessor. In the real world, the new iPad feels noticeably faster, more fluid, and more responsive.

Despite the significant increase in performance, we found the new iPad to offer much better battery life. The newest iPad lasted 45 minutes longer than last year's version in our battery life test.

Support for Apple Pencil is another great addition because, previously, you could only use the Apple Pencil with Apple's much pricier iPad Pro tablets. The Apple Pencil might be a premium accessory, but if you love drawing and intend to take notes on your iPad, you won't find a better writing experience elsewhere.

The latest iPad supports 4G LTE speeds of up to 300Mbps now, which is a considerable increase from

The tablet for everyone

Apple iPad (2018)

*By* **Kenny Yeo**

CONCLUSION

The 'entry-level' iPad is so good, it makes you wonder if you really need the iPad Pro.

the 150Mbps of last year's version. For users who rely a lot on cellular connectivity, this is great news.

Unfortunately, Apple decided to save the Smart Connector for the iPad Pro tablets. Fortunately, this isn't a big deal since you can easily get a standard wireless

Bluetooth keyboard to pair with the iPad.

Though the improvements don't sound or look like much, they have a profound effect on the new iPad. It is a much faster device that runs more smoothly than its predecessor. On top of that, the addition of Apple
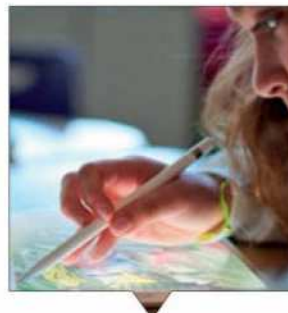
The Apple Pencil used to be exclusive to the iPad Pro, not anymore.

AT A GLANCE

DISPLAY
9.7-inch, 2,048 x 1,536 pixel resolution

PROCESSOR
Apple A10 Fusion

STORAGE
32GB, 128GB

BATTERY LIFE
Up to 10 hours
32GB, 128GB

PRICE
From $498

Pencil support makes the iPad much more versatile. In fact, it compares so favorably against the iPad Pro that, for most people, this is really all the tablet you will ever need.

TESTED & RATED

9.0 /10

HWM
SINGAPORE

Now you have my attention

Huawei P20 Pro By **James Lu and Alvin Soon**

Huawei has steadily been improving its smartphones for the past few years now, but they've always been just out of reach of being a serious threat to Samsung and Apple's dominance - but that might have changed with the new P20 Pro.

The P20 Pro measures 155 x 73.9 x 7.8 mm and weighs 180g, which makes it both thinner and lighter than your average flagship smartphone. For comparison, the Samsung Galaxy S9+ is 8.5mm thick and weighs 189g. Design-wise, Huawei has opted for

a safe but elegant look that obviously draws inspiration from the iPhone X, which includes a notch at the top of the display. The phone has a rounded aluminum frame with contoured 3D glass on the back. The back of the phone has a metallic, high gloss finish with a mirror-like shine. It's worth noting that while the phone has a glass back, it does not support wireless charging.

The design elements on

The P20 Pro has the world's first Leica co-engineered triple camera setup.

CONCLUSION

A beautiful design and a top-notch triple camera setup make the P20 Pro a legitimate challenger for best Android smartphone.

the rear of the phone are landscape-oriented to mimic the look of a camera. Back here you'll find the first ever Leica co-engineered Vario-Summilux-H f/1.6-/f.24 triple lens camera module. On the bottom of the phone there's a USB Type-C port, flanked by two speaker grills - which unfortunately means the phone doesn't have a 3.5mm headphone jack (although a dongle is included in the box).

The P20 Pro is unique among bezel-less smartphones as it keeps the home button below the display. The home button itself is very slim, and the chin on the P20 Pro isn't any larger than the button-less Samsung Galaxy S9. The home button is also smarter than usual, as it also doubles up as a navigation sensor. You can press the

home button to return to the previous screen, or long press it to return to the home screen. If you swipe along it, you'll be able to view the recent apps screen.

The P20 Pro has a 6.1-inch, Full HD+ 2,244 x 1,080 pixels resolution (~408 ppi) AMOLED display, giving it an unusual 18.7:9 ratio (the extra 0.2 is the notch). The display is very bright, and can be comfortably

The fingerprint scanner doubles up as a navigation bar.

used under bright sunlight, and as with most AMOLED displays, has excellent contrast.

The real star of the P20 Pro is its triple lens rear camera setup. The main camera is a 40MP RGB f/1.8 lens. You also get a telephoto 8MP f/2.4 lens, which provides 3x optical zoom, and a 20MP monochrome f/1.6 lens to provide extra detail, which is

digitally composited into the final image. Image quality from the P20 Pro is excellent with great detail retention, rich tones and vivid hues. There's an impressive lack of image noise, even at high ISOs. The P20 Pro also features a number of camera features that will help you get the most out of its Leica hardware. AI scene recognition will automatically choose the best settings for whatever you're shooting, whether it's a portrait, food shot or landscape (or 16 other scenes), but it's the new Night Mode that impressed me the most. Night Mode lets you take sharp and bright pictures in low-light environments without a tripod. It does this by using AI to stitch together multiple shots, emulating a 4 to 6 second long-exposure shot.

The P20 Pro is powered by Huawei's own Kirin 970 processor. Benchmark performance was about on-par with a Qualcomm Snapdragon 835 processor. While this is fine for now, new smartphones with the more powerful Snapdragon 845 processor will soon be available on the market. Battery life on the phone is excellent thanks to its power-efficient OLED display and a 4,000mAh battery. In our video looping benchmark, the P20 Pro lasted just under 12 hours.

The P20 Pro is the culmination of what's been a long road for Huawei. Gone is the reliance on gimmicky features, and in its place is refinement and innovation - that's something I never thought I would say about

AT A GLANCE

OPERATING SYSTEM
Android 8.1 Nougat with EMUI 8.1

PROCESSOR
Hisilicon Kirin 970 octa-core (4x2.4 GHz Cortex-A73 & 4x1.8 GHz Cortex-A53)

BUILT-IN MEMORY
6GB RAM

DISPLAY
6.1-inches 2,244 x 1,080 pixels (408 ppi) AMOLED 18.7:9 ratio

CAMERA
Triple 40-megapixel f/1.8 OIS + 20-megapixel f/1.6 + 8-megapixel f/2.4

BATTERY
4,000mAh

DIMENSIONS
155 x 73.9 x 7.8 mm

WEIGHT
180g

PRICE
$1,148

Huawei five years ago. If you're interested in owning the best phone out there, it's no longer enough to just consider Samsung and Apple, it's time to pay attention to Huawei.

S9+ TESTED & RATED
8.5/10

HWM
SINGAPORE

Welcome to the Era of Flash

Traditional hard disk drives may very well still have a place in modern computing, but the future belongs to SSDs.

By **Kenny Yeo**   *Art Direction* by **Orland Punzalan**

Six years ago, a 256GB SSD would set you back nearly $600. Today, the same capacity drive can be had for as little as $125 and that same $600 can get you a 1TB SSD with change to spare. Prices of SSDs have fallen dramatically and that has had a profound effect on the computing landscape.

SSDs are now becoming increasingly commonplace. A recent report by TrendForce said that the adoption rate of SSDs in notebooks will hit 50% this year. Put another way, one out of every two new notebooks will have an SSD. Due to falling costs, SSDs are also becoming increasingly popular in the enterprise space, especially in performance-critical applications. Many research firms believe that shipments of SSDs will surpass HDDs in the next two to three years. So what is it about SSDs that gives them a leg up over its mechanical rivals? Let's look at some key considerations now.
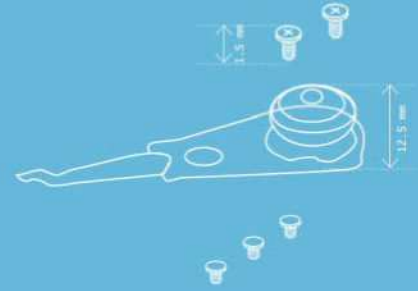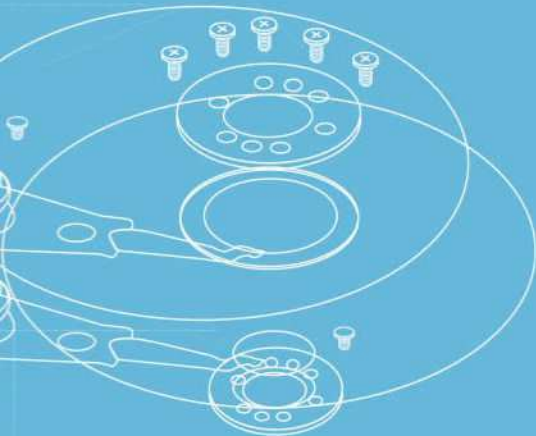
HDDs VS. SSDs

Performance

We all know performance is one of the biggest advantages that SSDs have over HDDs. Even the most basic SSD will run circles around the fastest, most advanced HDDs. SSDs are therefore well suited to performance-critical applications or tasks where high performance and throughput is required. For consumers, SSDs provide significantly shorter booting up and loading times. In the enterprise space, SSDs are suitable for data analytics, virtualization, and cloud services.

To give you an idea of just how fast SSDs are, consider the table opposite page:

Capacity

HDDs used to have the edge over SSDs because of their higher capacities. But this is no longer the case. Samsung announced a 15TB SSD in 2016 and followed up with a 30TB SSD just earlier this year that comes in a slightly thicker 2.5-inch form factor. For businesses who need more, Nimbus Data's ExaDrive DC100 is a 100TB SSD that comes in standard 3.5-inch form factor. In comparison, the largest capacity HDD currently holds only 14TB of data.

Power

SSDs are also considerably more power efficient than HDDs. For mobile devices, using SSDs in place of HDDs can extend battery life. In the enterprise space, this crucially means they generate less heat so less robust cooling is required, which translates to easier maintenance and lower running costs.

Shock and vibration

SSDs have no moving parts, which makes them significantly more resistant to shocks as compared to HDDs. HDDs can be easily damaged if they are jolted when in use. And since SSDs have no moving parts, they don't vibrate. This makes them easier to deploy in data centers. On the other hand, sufficient care must be taken to ensure that data racks and servers have the structural rigidity required to withstand the vibration caused by multiple HDDs spinning simultaneously.

Reliability

SSDs have a lifespan. There are only so many times you can write to a cell. However, SSD endurance and reliability have been steadily improving and are now as good as, if not better, than HDDs. One way of looking at reliability is MTBF or mean time between failures. Enterprise-grade SSDs have an MTBF of 2 to 2.5 million hours, similar to enterprise-grade HDDs.

For consumers, a better way of looking at reliability is endurance. Take, for example, a 512GB version of Samsung's new SSD 860 Pro. That has a rated endurance of 600TBW, which means you can write 600TB of data to it before it fails. In most client usage scenarios, most users will write, at most, about 30GB of data to their drives a day. Even if you are a heavy user and write 50GB of data per day, 600TBW is enough for roughly 32 years.

> *SSDs have no moving parts, which makes them significantly more resistant to shocks as compared to HDDs.*

SSD SPEED COMPARISON

| Drive Type	Interface	Maximum sequential read/write	Random 4K read/write
Enterprise-grade 15,000rpm HDD	SAS 12GBbps	250MB/s	550 / 430
Consumer-grade 2.5inch SSD	SATA 6Gbps	560MB/s	100,000 / 90,000
Consumer-grade SSD	PCIe 3.0 x 4	3,500MB/s	440,000 / 360,000
Enterprise-grade SSD	PCIe 3.0 x 8	6,300MB/s	1,000,000 / 180,000

Cost

Even though prices of SSDs have fallen significantly. They are still considerably more expensive than HDDs. Samsung's 15TB enterprise-grade PM1633a SSD, for example, retails for over US$10,000. On the other hand, a 12TB enterprise-grade HDD typically costs about US$500. Things are not much better on the client side. A 1TB SSD will set you back S$500, but a 1TB HDD can be had for as little as S$70.

THE ARRIVAL OF 3D NAND

Though the first SSD was shipped in 1991, SSDs in the client space only arrived about ten years ago. Back then, it was widely believed that SSDs could never compete against HDD when it came to capacity and reliability. The reason for that was because of the limitations of traditional NAND architecture.

In the past, flash memory manufacturers sought to increase memory density, and hence capacity, by either using smaller manufacturing processes to cram more cells onto the die or by increasing the number of bits

3D NAND STRUCTURE
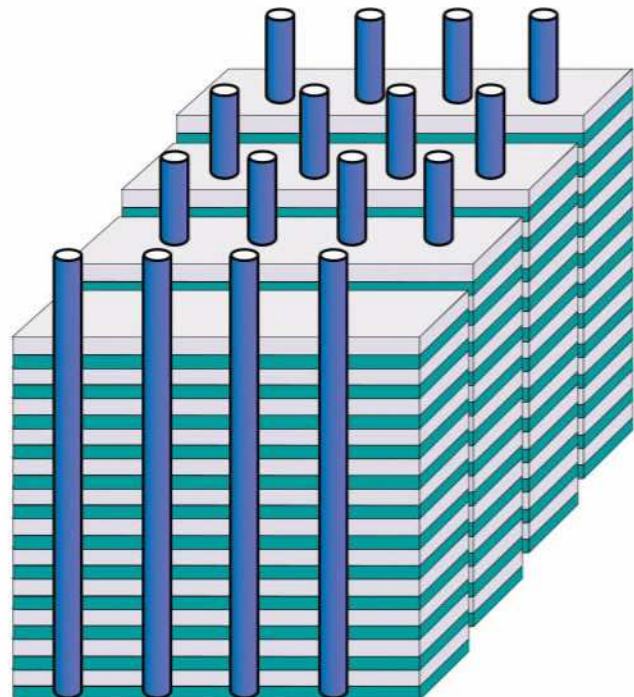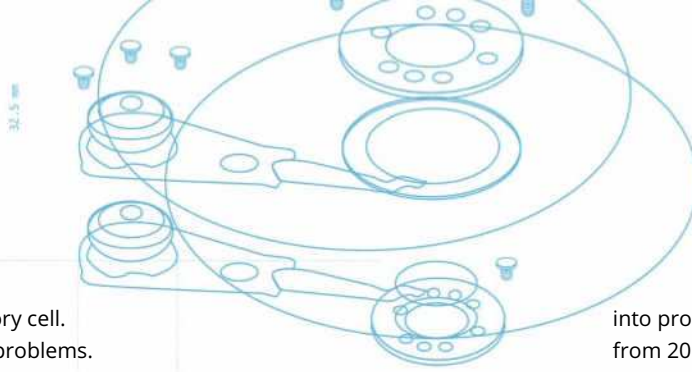
that can be stored per memory cell. Both approaches have their problems.

There is a limit to how much cells one can squeeze onto the die. Since each cell has to hold a charge, squeezing too many cells onto the die results in less space between each cell. Interference from neighboring cells can disrupt or even inadvertently change the state of the cell that it is next to and cause the data to become corrupt.

On the other hand, one can keep the size of cells constant but increase the amount of data stored on it. There are, however, two key downsides to this approach and they are performance and endurance. By increasing the number of bits per cell, you are increasing the number of voltage states for the drive controller to check. This reduces drive performance.

Additionally, by having more stages in each cell, the margin between individual stages is reduced. And since writing to the cell gradually reduces the layer of silicon oxide within that acts as an insulator between the various stages, this effectively means that each cell has a shorter lifespan.

These are the problems facing traditional NAND architecture. And in 2014, Samsung made a breakthrough with what they call 3D NAND or V-NAND (Vertical NAND), and this has gone on to become one of the most

3D NAND or V-NAND (Vertical NAND) has gone on to become one of the most important innovations in the flash memory business.

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Samsung's solution to the problems facing NAND is elegant and effective. As its name suggests, 3D NAND overcomes the limitation of traditional two-dimensional planar NAND by stacking cells upon each other. This not only allows more cells to be placed on a single die, it also creates more space between cells, allowing Samsung to roll back to a less aggressive manufacturing process node, thereby improving performance and endurance.

Samsung's first 3D NAND SSD to go

into production was the SSD 850 Pro from 2014 and its 3D NAND memory consisted of 24 stacked layers of cells. As of now, Samsung has already put into production 3D NAND with 64 layers of cells. This has allowed them to cram 4TB into a standard 2.5-inch form factor and 2TB on a standard M.2 2280 memory drive. And at the Flash Memory Summit last year, Samsung has shared that they are already working on 3D NAND with 96 layers of cells. Today, the vast majority of SSDs employ 3D NAND, which is a testament to the importance of this NAND technology.

Beyond 3D NAND, flash memory manufacturers are already exploring different types of memory. Intel and Micron have a new type of memory called 3D XPoint, which offers significantly greater performance and endurance than NAND memory. It is marketed to address the performance gap between NAND and DRAM.

Not to be outdone, Samsung is also working on a new type of memory that they call Z-NAND. Like 3D XPoint, Z-NAND is a high performance, high endurance memory that slots between NAND and DRAM. And like Intel and Micron, Samsung has not shared details about this new memory, but the first drive to use Z-NAND, the enterprise-focused SZ985, looks mighty promising.

HOW TO CHOOSE AN **SSD**

Considering how far prices of SSDs have fallen and the benefits of SSDs over HDDs, there has never been a better time to get an SSD. Here is a handy guide on how to pick and buy the correct SSD for your system.

FORM FACTOR

SSDs come in various shapes and sizes and it is important to pick the right form factor for your system. For instance, if you are upgrading your notebook, some notebooks will only accept M.2 SSDs, while others will only accommodate an mSATA drive or maybe only a 2.5-inch drive. SSDs come in four main form factors and they are:

▶ 2.5-inch

This is the most common form factor for SSDs. They look like small hard disk drives and typically support the SATA 6Gbps interface.

▶ mSATA

Mostly defunct, mSATA drives were commonly found in notebooks and were favored for their compact size. Like 2.5-inch SSDs, these also support the SATA 6Gbps interface.

▶ PCIe Add-in-Card

These are typically high-performance drives and they go directly into your PCIe slot and support the much faster PCIe interface. Be sure to check which PCIe version they support and make sure it is compatible with your motherboard.

▶ M.2

M.2 is the newest and most compact form factor for SSDs and is used by modern systems. They are typically about the size of a stick of chewing gum. They can support either PCIe or SATA 6Gbps interfaces so be sure to pick the correct one for your system.

TYPES OF INTERFACES

Form factors are just one part of the story. When deciding on which SSD to purchase, it is also important to consider the interface that they support. This is crucial because it affects performance and compatibility with your system.

▶ SATA 6Gbps

SATA 6Gbps is the most commonly supported drive interface, but it is also the slowest. 6Gbps translates to a theoretical maximum data transfer rate of 750MB/s. But because of bandwidth overheads, expect to see around 500 to 550MB/s in the real world. As a result, there are little performance gains to be had when getting a high-end SATA-based SSD over an entry-level one.

▶ PCIe

The alternative to SATA is PCIe. PCIe is favored because of its much higher bandwidth, allowing SSDs to perform to their full potential. However, be wary as not PCIe SSDs are the same. Pay attention to the PCIe version and also the number of lanes that the drive supports.

The fastest consumer SSDs support the PCIe 3.0 x4 interface. A single PCIe 3.0 lane offers a maximum data transfer rate of 8Gbps or 1GB/s. So a PCIe 3.0 x4 SSD supports a maximum theoretical data transfer rate of about 4GB/s.

In comparison, consider a PCIe SSD that supports the slower PCIe 2.0 standard. A single PCIe 2.0 lane has a maximum bandwidth of 500MB/s, this gives a PCIe 2.0 x4 SSD a maximum theoretical data transfer rate of 2GB/s - half that of a PCIe 3.0 x4 SSD..

PCIe version	x1	x2	x4
1.0	250MB/s	500MB/s	1GB/s
2.0	500MB/s	1GB/s	2GB/s
3.0	1GB/s	2GB/2	4GB/s
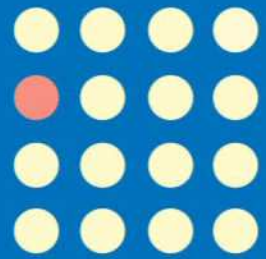
6 May 1998

On 6th May 1998, Apple CEO, Steve Jobs introduced the world to the iMac, and ushered in an era of Apple (as well as many other companies) adding the letter 'i' to just about every product it makes. What did the 'i' stand for? Jobs explained the name 'iMac' as representing "the marriage of the excitement of the Internet with the simplicity of Macintosh." A slide from Jobs' presentation also showed that the 'i' stood for "individual, instruct, inform and inspire."

The first iMac also marked the beginning of Apple's renaissance. In the three months between its announcement and its eventual release on 15th August 1998, the iMac received an unprecedented 150,000 pre-orders.

25 May 1977

Star Wars is released in thirty-two US theatres.

3rd May 1984

Michael Dell founds Dell Computer Corporation.

17 May 1991

Tim Berners-Lee sets up the first world wide web public server on his NeXTcube workstation at CERN.

22 May 1980

Namco releases Pac-Man (then known as Puck-Man) to Japanese arcades.

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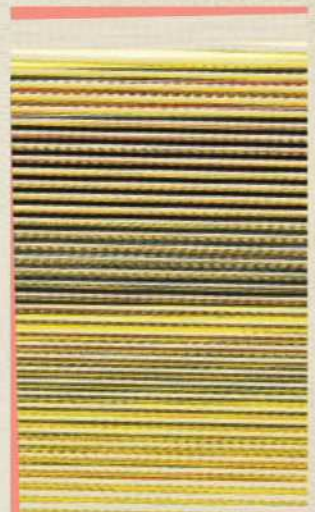
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