TOOLS of the TRADE

Kobo Aura HD

Though it has a lower profile than the Kindle or Nook, Kobo's line of e-readers is very good, with one outstanding, top-of-the-line device: the Kobo Aura HD. This 5" × 7" × 0.5" e-book reader has the sharpest resolution of any E Ink reader available. Measuring at 6.8", the Pearl E Ink screen produces 265 dpi with a resolution of 1,440 × 1,080 pixels. The screen works well in sunlight, while the built-in ComfortLight provides variable illumination evenly across the screen for use in low light. The only buttons on the device are a power button and a ComfortLight on/off switch. The rest of the controls are touchscreen prompts. The native format for books is ePub, but it will also read PDFs and MOBI-formatted text. You can purchase books, newspapers, and magazines from the Kobo eBookstore (more than four million titles are available), or you can borrow books from the public library. You also can import text in TXT, HTML, XHTML, and RTF formats and images in JPEG, GIF, PNG, or TIFF formats. There's a Web browser for accessing the Internet via a Wi-Fi connection. There's an on-board Merriam-Webster dictionary, and you can highlight text, take notes, and share content to Facebook. There's 4GB of internal storage available with a microSD slot for up to an additional 32GB, which will store a substantial library of 30,000 e-books. The battery can last up to two months on a charge, and you can select among 10 font styles in 24 sizes. Chess and Sudoku apps are built in.

www.kobo.com/koboaurahd

Leviton USB Charger Devices

There are a number of ways to charge your mobile devices, but most involve a cord and a brick or a large car plug. Leviton Manufacturing Company has downsized the process so that all you have to do is plug in a thin USB cord. The electrical supply company offers a selection of wall receptacles that provide a variety of wall plug and USB charger outlets. You can get an outlet with two USB ports and one power port or one with four USB ports. The chargers are compatible with tablets, mobile phones, Bluetooth headsets, digital cameras, GPS devices, Kindle and Nook e-readers, Nintendo 3DS, PlayStation Vita, and more. The chargers have a built-in smart chip that recognizes and optimizes charging power for this wide variety of devices. The adapter-free chargers are suitable for home and commercial installation. The four-port USB charger has 4.2 amps of charging capacity controlled by a microprocessor, and it can simultaneously charge up to four high-powered electronic devices.

The USB charger/tamper-resistant receptacle has two 2.1-amp ports and an additional 15-amp or 20-amp tamper-resistant receptacle for conventional power needs. Leviton also has a Mobile Device Station (pictured) that attaches to the wall plate with just a screwdriver and serves as a cradle for smaller mobile devices. You can find more information about them at www.leviton.com.

GoPro HERO3

The GoPro HERO3 is a sports camera that GoPro calls the "world's most versatile camera"—you can wear it, mount it, or just carry it around. What makes the plain and boxy GoPro look distinctive is the shock- and weather-resistant case and its mounting base that can clamp onto helmets, dashboards, the pole next to the birdhouse, the catwalk above the assembly line—almost anywhere. What makes it unique is the professional-quality videos and stills produced in shooting modes that include movie, still, time lapse, and burst. You can use remote Wi-Fi to turn the camera on and off and a free smartphone app to monitor

what you're shooting. There are several models of the camera that are based on experience level, and the white HERO3 is perfect for a beginner—especially since it's only $200. Image resolutions are impressive: Video records up to 1,080p30 and five-megapixel photos at up to 3 fps. It also has an ultra-wide-angle lens. Time lapse intervals range from 0.5 seconds to 60 seconds. The super-sharp audio includes advanced wind-noise reduction, and the camera is extremely lightweight (2.6 oz.—with housing, it's 4.8 oz.). Spot metering allows for filming in dark areas, and a looping video feature records continuous video that overwrites itself until you press the shutter button to stop it. MicroSD Class 4 cards or higher are recommended for up to 64GB of storage on each card. The camera is waterproof up to 131 feet.
www.gopro.com/cameras

Haswell NUC

Much smaller than the Mac Mini, the Intel-based Haswell NUC is a desktop computer that can function as a workstation, HTPC (home theater personal computer), or game console. The name is short for "Next Unit of Computing," and despite its tiny footprint (4.6" × 4.4" × 1.4"), a basic configuration can have a 1.3GHz Core i5 Intel CPU, 8GB to 18GB of RAM, Intel HD Graphics 5000, and a 128GB Crucial M500 mSATA hard drive, all driving Windows 8.1. But there are a few catches. There isn't much flexibility built in, and graphics-intensive work might be beyond its capabilities. It's also aimed toward hobbyists—there's some assembly required. The basic configuration listed above is about $702, comparable to a 2012 Mac Mini at $699. The NUC is available on Amazon, where you can choose models and components. But first search YouTube for videos on how to build a Haswell NUC to see if the whole idea interests you.
www.intel.com/NUC

TECH FORUM

Quantum Computers

By Michael Castelluccio, Editor

Most of the ordinary things that surround us aren't likely to ever make decisions for us, so there's little need to understand them beyond the uses they serve. It isn't necessary to know how images and glaze are applied to coffee mugs or what triggers the release spring in the toaster. But what about those digital devices that do occasionally make decisions for us? Shouldn't we have some understanding of how they work, given what we entrust to them?

One problem with computers is that they have become so complex and are accelerating to even deeper levels of difficulty that most people have given up trying to figure out how they do what they do. The situation is similar to what has happened to our cars. There once was a time when the average person could change his own points and plugs and know not to cross wires putting things back together to avoid backfiring. And originally, we were all a little closer to our first computers. We keyed abbreviated instructions into the command line on green or amber screens. No longer. Our cars have evolved into mechanical systems synchronized with digital chipsets, and we feed instructions to our computers with mouse clicks, yards away from that command line.

WELL BEYOND REACH

A dramatic example of where we tortoises currently place in this race to keep up with our own devices appeared on the February 17, 2014, cover of *TIME* magazine.

The cover is like a signpost on the side of the road, spelling out in a dozen short lines just how far away we are from one of the major controlling forces in our brave new world. The sign claims there's a $10 million computer called "The Infinity Machine." It's backed by NASA, the CIA, and technology entrepreneur Jeff Bezos, and "it promises to solve some of humanity's most complex problems." This miraculous machine works in a most inhuman atmosphere of -459°F. And how far ahead of us is this infinity machine?

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It seems "nobody knows how it actually works." That's what it says on *TIME*'s cover: "nobody."

The simple reason for the opacity of this machine is that it operates using quantum principles—it's a quantum computer. And anyone who tells you that they understand the forces operating in quantum physics should punctuate their claim with a wink.

The subject of Lev Grossman's *TIME* cover story is something called the D-Wave Two computer. Named after the company that produces them, the D-Wave Two computers—there are only five in the world—all operate using quantum rules instead of those defining classical physics. Quantum rules include some very odd principles, including the uncertainty principle and superposition.

According to the uncertainty principle, objects in a quantum system can be in more than one state or more than one place at the same time—superposition at the quantum level can allow a particle to travel two different paths at the same time. A conventional computer handles information as discrete bits, 1s and 0s, and it progresses in a linear mode that arranges the 1s and 0s in meaningful patterns. A quantum computer assumes the added dimension of superposition, and its calculations can employ discrete 1s and 0s, but it also can handle bits that can simultaneously be both a 1 and a 0. These quantum bits are called qubits, and because the qubits are in two states, each can simultaneously perform two calculations. This exponentially increases the computer's capacity since two qubits can perform four calculations, three can perform eight, and so on. The information in the dual quantum state needs to be translated back to be useful, so the D-Wave computer adds a layer of processing called annealing. The company says: "Quantum annealing 'tunes' qubits from their superposition state to a classical state to return a set of answers scored to show the best solution."

The supercooled niobium chip at the heart of the D-Wave Two quantum computer is a 512-qubit chipset that enables it to theoretically perform 2^{512} operations simultaneously. Grossman points out, "That's more calculations than there are atoms in the universe, by many orders of magnitude." Colin Williams, who is D-Wave's director of business development, says of the process, "We're tapping into the fabric of reality in a fundamentally new way, to make a kind of computer that the world has never seen."

Building quantum computers is very difficult, and so is operating them. In 2010, the University of Innsbruck in Austria produced the first system with 14 entangled qubits (entangled is the quantum state where two or more particles are linked to each other). The University of Maryland has a 20-qubit system, and D-Wave Systems, located near Vancouver, B.C., built a 128-qubit computer (the D-Wave One) that it sold to Lockheed Martin in 2011.

In 2013, the company created the D-Wave Two, a functioning 512-qubit computer. The company has been doubling the number of qubits each year, but there's a catch. The D-Wave computers use a method called adiabatic quantum computing, and it's different from the more conventional gate-model approach, which functions much closer to the way conventional computers work. As a result, D-Waves can only solve one class of problems: discrete combinatorial optimization problems. According to Grossman, these "involve finding the best—the shortest, or the fastest, or the cheapest, or the most efficient—way of doing a given task." Optimization problems can exist in a number of areas, such as system optimization, machine learning, pattern recognition, financial analysis, software/hardware verification and validation, and bioinformatics, including cancer research. But the D-Wave quantum computer can't crack cryptographic codes, for example, which can be done today, albeit slowly, on conventional computers.

And there's another problem with these computers. Not everyone is convinced that actual quantum states are being generated in D-Wave calculations. Scott Aaronson of the Massachusetts Institute of Technology, author of a blog about quantum computing offered this observation: "I'm convinced…that interesting quantum effects are probably present in D-Wave's devices, but I'm not convinced that these effects, right now, are playing any causal role in solving any problems faster than we could solve them with a classical computer." And Grossman quotes other, more skeptical critics who insist that the D-Wave doesn't create or use quantum bits in its calculations. He believes the final answer will come in the next five years or so with a few more generations of D-Waves and better benchmarking to test the results.

Meanwhile, organizations such as Google and NASA are heavily investing in research on running Artificial Intelligence (AI) programs on quantum systems. They and others see the intensive computer demands of AI as most suitable for quantum computing. And these are the very programs likely to make decisions for us—some less important (such as guessing at our reading preferences) and some very important (such as analyzing scans to discover medical anomalies). And so, as computers continue to do more for us, we progressively understand them even less than before—an uncomfortable inverse relationship. **SF**