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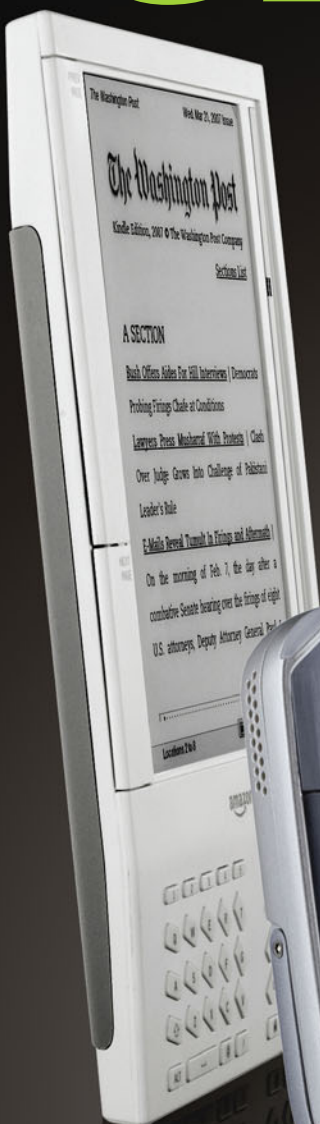
Since 1994: The Original Magazine of the Linux Community
DECEMBER 2008 | ISSUE 176

REVIEWED:

- » OpenMoko's Neo FreeRunner
- » Acer Aspire One
- » Dash Express
- » YDL PowerStation

GADGETS

- » Hacking a Nokia Internet Tablet
- » How-To: Using a BlackBerry with Linux
- » Linux Device Roundup
- » Checking out the Kindle



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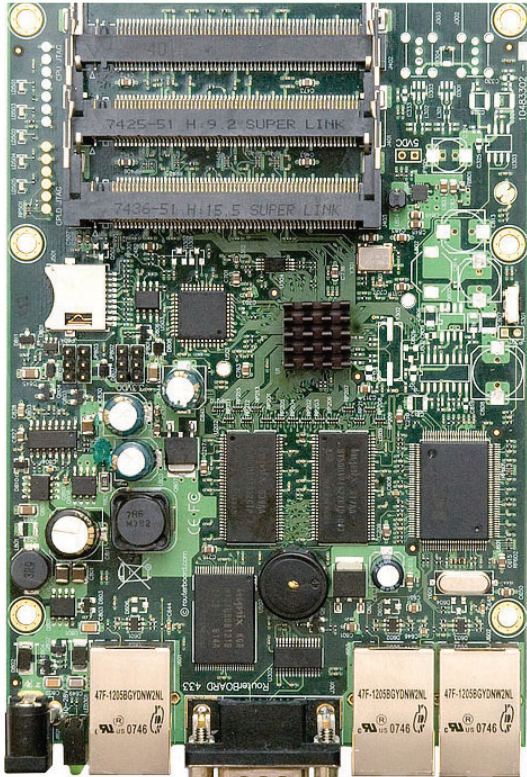
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RouterBOARD 433

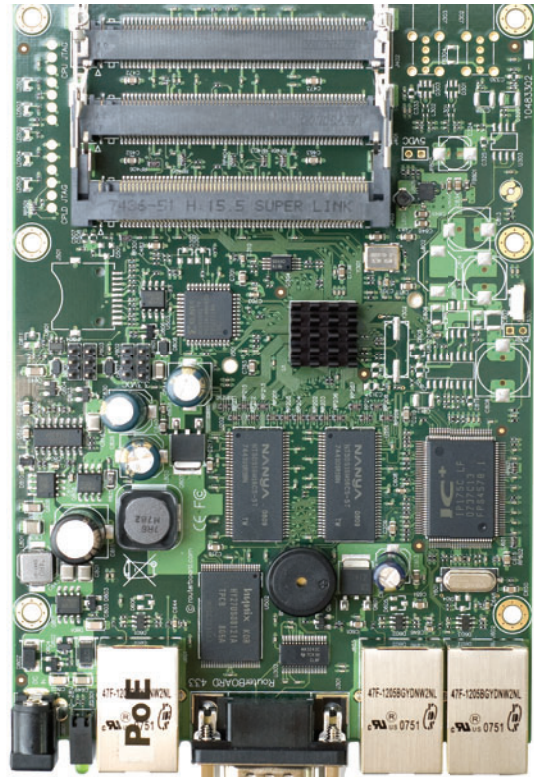
680MHz MIPS (overclock to 800MHz)

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These devices are preinstalled with the MikroTik RouterOS Firewall/QoS/Routing operating system. RB433 comes with a L4 license, and RB433AH with L5

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46 OPENMOKO'S NEO FREERUNNER

Next Month

SECURITY

Many of the indigenous peoples of the world don't believe in the concept of property, and they also don't worry about computer security. The rest of us aren't that lucky. Next month, we'll show you the first thing to do: Validate Your Security with the help of Jeremiah Bowling. Next, we'll check out MinorFs with an article by Rob Meijer for a more flexible form of discretionary access control. Federico Kereki will provide some tips on using the venerable PAM subsystem, and Greg Landeck will describe a simple solution for detecting botnets. Plus, Dirk Merkel will show you how to secure your passwords and take them along wherever you go with the Yubikey. The last thing to do, in our security roundup next month: be afraid, be very afraid, as Kyle Rankin will explain how Cold Boot Attacks could render all your security measures useless.



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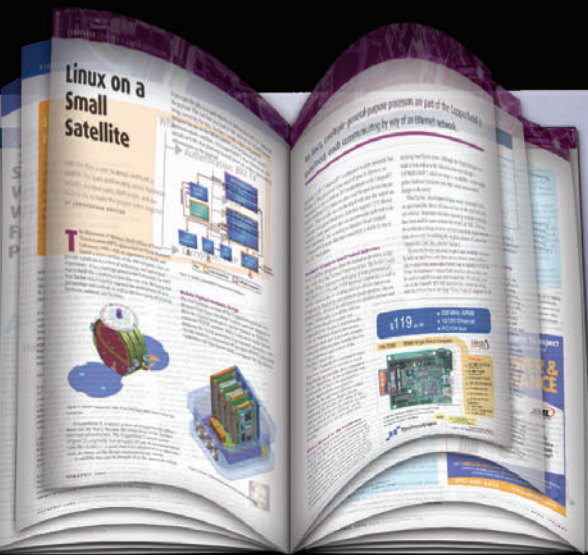
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Linux Journal is published by, and is a registered trade name of, Belltown Media, Inc.
PO Box 980985, Houston, TX 77098 USA

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SHAWN POWERS

Go Go Gadget Operating System!

Ah, gadgets. I remember back in 1996, the Palm Pilot came out and promised to streamline our schedules in such a way that we easily could get our daily work accomplished in half the time it normally took. (Yes, I realize the Apple Newton and several others offered similar features earlier, but it was the Palm Pilot that really took the world by storm—at least, my world.) The funny thing was that while the organization and portability of the Palm did in fact allow us to accomplish more in less time, the end result wasn't lots of free time and afternoons on the beach. Instead, we crammed more duties into an already-cramped day. It's been more than a decade since the Palm Pilot was introduced, and we're still using gadget after gadget to cram more and more activities into our lives. The good news is at least some of the gadgets cram *fun* into our lives as well as work.

If you're a Linux fan, as we here at *Linux Journal* obviously are, gadgets can be a double-edged sword. Although many, if not most, gadgets run some sort of Linux as their operating system, those very gadgets often are not designed to interface with a Linux desktop environment! Thankfully, many of them work with Linux—either by design or by hack—and this month, we talk a bit about both.

One device, the BlackBerry, doesn't run Linux as its operating system. It also doesn't support syncing with a Linux desktop. Like so many other hardware devices, the Linux community has wedged the BlackBerry into the list of supported devices, in spite of the RIM corporation. Carl Fink shows us all the gory details. Cory Wright takes us to the other end of the spectrum and shows us the OpenMoko Neo FreeRunner phone. This little beauty is open from the word go, and of course, it runs Linux. Cory tells us the ups, the downs and the potential future for a phone that makes other "Linux-friendly" phones seem cliché.

Some gadgets don't even need computer interaction. The Dash Express GPS, for example, is an in-car GPS system that connects to the Internet all by itself. It runs Linux, and with its

on-line access, could prove to be an amazingly powerful navigation tool. Luckily, our own Kyle Rankin has one, and he tells us all about it. Another Linux-running gadget that doesn't need any help getting on-line is Amazon's Kindle. Daniel Bartholomew tells us all about his and gives us the nitty-gritty regarding viewable content, DRM and the "free" EVDO Internet access.

Technology keeps shrinking and shrinking. Although my Palm Pilot back in 1996 was fairly limited in what it could do, nowadays, a device like the Nokia Internet Tablet isn't much bigger—but boy is it more powerful. Bill Childers shows us how to hack around with a Nokia, and Jes Hall shows us the Acer Aspire One. Granted it's a bit larger than your standard gadget, but the Aspire One can barely be called a laptop. Along with the Eee PC, the MSI Wind, the HP Mini-Note and a slew of others, it fits into that little space of devices called Netbooks. Jes tells us all about the one she's been using and how its features stack up.

For some power users, gadgets are just silly. Those folks will likely want to read this month's review of Terra Soft's PowerStation. It's a PPC-based workstation unlike anything you've seen. Luckily, those power users can still get "gadgets" of their own, of the software variety. Marcel Gagné shows us a handful of software goodies that, although tough to stuff into your pocket, will fit on your desktop easily.

And yes, even if gadgets aren't your thing at all, we have our regular cast of columnists writing on the topics you know and love. Reuven M. Lerner shows us how to speed up database transactions with memcached; Mick Bauer continues his series on Samba security; Dave Taylor finishes off his series on the FilmBuzz Trivia program; plus lots, lots more. So, whip out your Palm Pilot and schedule time to read this issue. You won't be disappointed. ■

Shawn Powers is the Associate Editor for *Linux Journal*. He's also the Gadget Guy for LinuxJournal.com, and he has an interesting collection of vintage Garfield coffee mugs. Don't let his silly hairdo fool you, he's a pretty ordinary guy and can be reached via e-mail at shawn@linuxjournal.com. Or, swing by the #linuxjournal IRC channel on Freenode.net.

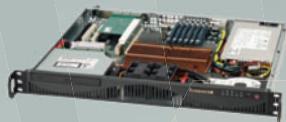
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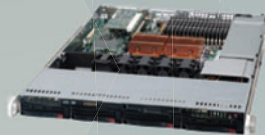
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letters



Upcoming Topics

Why can't you guys be a little more consistent with the focus on topics? The ULB issue has been coming out in different months in the last few years, and it's kind of hit or miss, because I can't seem to find anywhere on your Web site a little section that would say what's going to be in the next issue. And, what is up with the ULBs being nothing more than just high-end gaming PCs? Whatever happened to real workstations? Is nobody using those anymore?

--
Peter

You can find our editorial calendar with upcoming topics here www.linuxjournal.com/xstatic/author/topicsdue. As far as your ULB question, we've been working with readers to find out exactly what should constitute a ULB these days. Stay tuned.—Ed.

A Rant

I am having lots of problems with installers on recent "Linuxes". They all assume that just because I am installing their OS, it will be my primary OS. FAIL! My partitions are Kubuntu-swap-spare, and I use the spare (usually ext3) partition to test new OSes. Every time I do so, I have

to use a live CD to get the bootloader straightened out. What a mess! And, until I fix it, I can't get any work done with my primary OS.

Slackware gave me a choice: put the bootloader in the MBR or in the partition superblock. This made chainloading easy. Why can't I get that choice in any of the Debian/Ubuntu family? They overwrite menu.lst without warning. I plan on trying a BSD on the spare partition, won't that be fun?

I also wish GRUB used a single config file. Then, I could save that file to a thumbdrive and fix things with one command, rather than digging out a live CD and fumbling with Yet Another Shell Syntax. Say what you will about lilo, at least it was simple and consistent.

--
Roland Latour

Health Care

As a longtime software developer working in health care (health insurance-related applications), I read Doc Searls' "Why We Need Hackers to Fix Health Care" with great interest [*LJ*, October 2008]. My company, while our software is Windows-based and proprietary, struggles daily with interoperability issues with systems from other vendors with which our applications communicate. No patient lives are at risk if our applications encounter issues as described by Doc.

I'm curious about one thing that Doc said. He said that he was "using a Web browser on one of the nursing workstations there. I was surfing for about ten seconds when every screen in sight went blue." Just what was Doc doing that caused the issue? Or was it mere coincidence of timing?

--
Mike Chess

He was just surfing. Hard to say whether it was coincidence or timing.—Ed.

HP Media Vault Review

Greetings. I just received my October 2008 issue of *LJ*, and one of the wonderful articles I saw was the review of the HP Media Vault mv series product (mv2xxx and mv5xxx products). Having played with one for a few months now, I was surprised at the amount of research that did not go into the review.

For example, take the failure to mention the rather extensive hacking guide posted at www.k0lee.com/hpmediavault and written by one of the HP engineers responsible for this product. How can a review of these devices fail to mention this site? It has links to the source code for the product, how to replace a drive, re-flash instructions and so on.

Otherwise, it's nice to see an open-source-friendly NAS being reviewed—especially one that is open and hackable.

--
Ted Johnson

It was merely an oversight. Thank you for pointing out the hacking guide.—Ed.

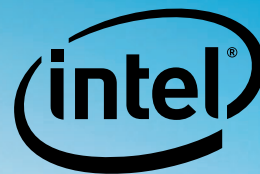
FoxyTag Update

Since you recently mentioned some interest for the FoxyTag speed-camera warning system [see New Projects, July 2008], I invite you to consult the latest press release at www.foxytag.com/blog/?p=48. This article has been copied in many blogs and some popular Web sites, including mashable.com.

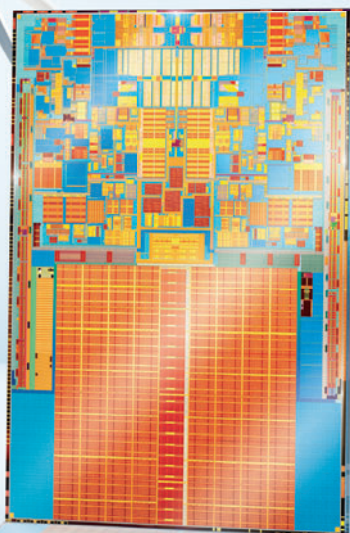
--
Dr Michel Deriaz

Linux-Friendly Concerns

I have been using Linux since the mid-1990s when I had to load a huge stack of floppies to get a command-line version running. Currently, on my primary PC, I dual-boot Windows XP and PCLinuxOS. This machine is a five-year-old home-built machine with an AMD, Socket-A ASUS A7VBX-X motherboard. I keep using it, because it works great with both XP and Linux. My laptop is an old Dell C400 that runs Ubuntu 8.04 wonderfully well.



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[LETTERS]

Linux always has worked well for me with the hardware of yesteryear, but that no longer appears to be the norm. I recently decided to build a dual-core machine to replace my old Socket-A machine. I built up a BioStar TF8200 A2+ with 4GB of RAM, a SATA primary drive and two more SATA drives for a RAID-1 /home. I soon discovered that today's new hardware is not very Linux-friendly. I have tried many distributions and *no* distribution can correctly process audio from the motherboard's onboard Realtek ALC888 audio chip combined with the NVIDIA support chipset. Likewise, there are problems with the onboard NVIDIA GF8200 graphics. Only Sabayon Linux

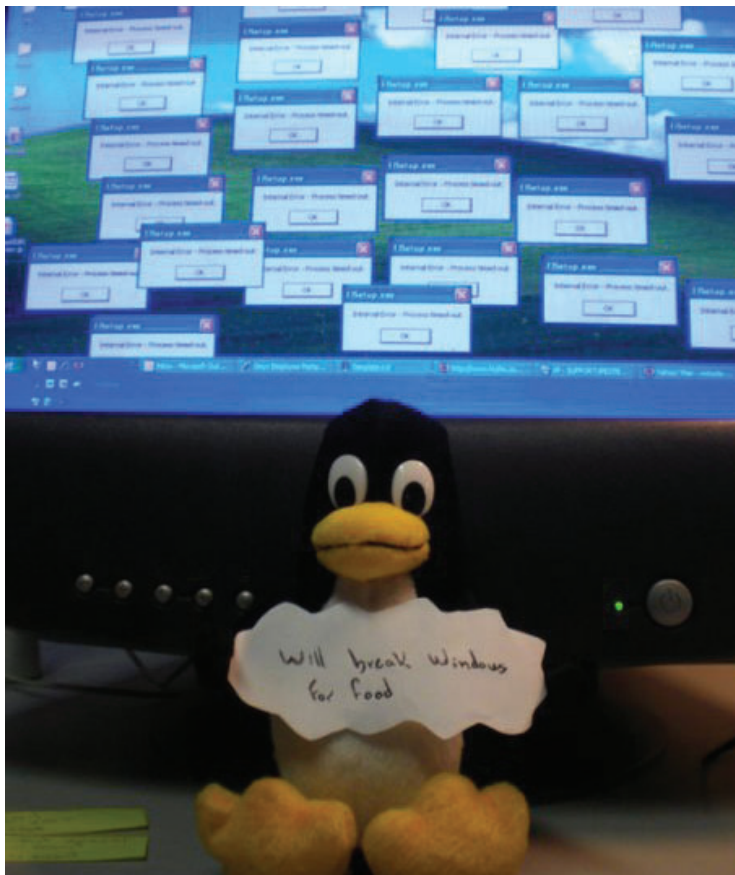
can use it "out of the box". It is a nightmare. Of course, Windows XP runs all of the hardware just fine.

My issue is that, today, it is very, very difficult to build a modern system that is Linux-compatible. I encourage you to work with motherboard and peripheral boards to advertise the products that are Linux-compatible. Given the dearth of computer makers seriously selling Linux computers and the difficulty of building a modern Linux-compatible system, I am concerned there never will be a serious mainstream proliferation of the Linux OS.

--
Edward Comer

PHOTO OF THE MONTH

Have a photo you'd like to share with *LJ* readers? Send your submission to publisher@linuxjournal.com. If we run yours in the magazine, we'll send you a free T-shirt.



Will Break Windows for Food, submitted by Victor Mendonça (wazem.org)

LJ pays \$100 for tech tips we publish. Send your tip and contact information to techtips@linuxjournal.com.

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diff -u

WHAT'S NEW IN KERNEL DEVELOPMENT

The **NILFS2 filesystem** is a new versioning filesystem, hot off the presses from **Ryusuke Konishi**. This filesystem does continuous data snapshotting, so that immediate recovery is possible after any inadvertent file deletion or corruption. The project has the support of **Andrew Morton**, who has put it in his own tree for wider distribution and testing. At this stage, the on-disk data format is nearly stable according to Ryusuke, but that will be a key issue in getting the code accepted into the main tree. Once the code is accepted, any changes in disk format almost certainly will have to include support for all previous formats. In general, this is extremely undesirable in a filesystem, so it's likely that Ryusuke will try to finalize the data format before submitting the code to **Linus Torvalds**.

Jonathan Corbet has written lots of extremely useful kernel documentation, including *O'Reilly's Linux Device Drivers*. Recently, he wrote a fairly long **intro to kernel development**, intended for developers employed by companies who support their kernel work. The goal is to make sure those companies understand what to expect from the developer community and from the relationship between their engineers and that community. This is an excellent document, filled with detailed advice and explanations to help newcomers understand how best to get their features into the kernel. Jonathan has submitted the work for inclusion in the Documentation

directory of the kernel sources, though it also may appear on **kernel.org** at some point.

The old **FireWire wiki**, having been overrun by spammers, is being replaced. **Stefan Richter** created **ieee1394.wiki.kernel.org**, which is already more up to date than the old spammy one, and it's better maintained as well. Those pesky spammers! When we all have nanotech brain implants, will the spammers get into those as well?

Reporting **BIOS bugs** to user space may be useful or it may just be overkill. **Thomas Renninger** has been working on this though. Various subsystems, such as ACPI and PCI, can introduce BIOS bugs, and the kernel has to sanity-check all of them. Thomas' argument is that user-space code would get several benefits from having access to the results of this sanity checking. Applications would be easier to test; they'd be better able to respond to the bugs when they were encountered; and users debugging their systems would be better able to identify the problems. Thomas wants to log all of these BIOS bugs to the system log files, where any user-space program could access them. On the flip side, as **Bjorn Helgaas** points out, the specific log entries for each of these BIOS bugs would have to be maintained individually, and new ones would have to be created by hand. The whole infrastructure would be subject to rapid aging, just like on that *Star Trek* episode, except without the miraculous cure. But, **Andi Kleen** thought the benefits would outweigh

the risks, offering various implementation suggestions, and even Bjorn had implementation suggestions of his own. So, it does seem likely we'll be seeing BIOS bug logging coming out of the kernel soon.

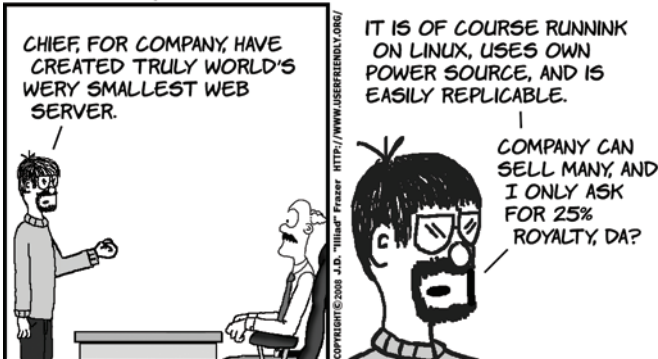
The **MTD subsystem** is being worked over pretty well to try to support Flash drives greater than 2GB. **Bruce Leonard** has been leading this charge, although unfortunately, he hit some technical obstacles when he modified the **kernel ABI** (Application Binary Interface). This is a real no-no, but as **Tim Anderson** points out, it may be necessary only to extend the ABI rather than actually change its existing interfaces. Once Bruce and others figure out the right interface for it, it's a dead certainty we'll be getting large Flash drive support in the kernel, probably very soon.

David Woodhouse has been following up on his effort to remove all **binary firmware** from the kernel. This controversial effort is inspired by the fact that it's weird having lots of binary-only data in an open-source project. But, weird as it is, it's been very convenient for kernel developers to have the firmware in the tree. David's effort involves extracting all those binary blobs into a single firmware git repository, which he has now created. He's also opening up the tree not only to firmware that has been distributed with kernel sources, but also to all firmware everywhere that vendors want to make available to Linux users. So, we'll see what comes of that, and whether they run into similar conflicts

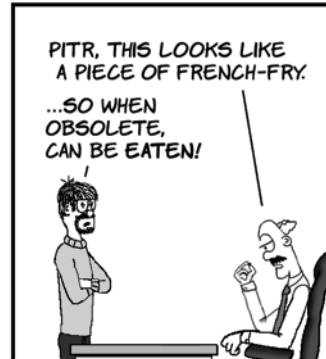
as those between kernel developers and GCC developers, where members of each project blame certain problems on the other project, leading to long-term disputes. This is less likely in David's firmware project, as the kernel folks could easily just revert to including their selected firmware blobs in the kernel again if there are any real disputes. Time will tell.

—ZACK BROWN

USER FRIENDLY by J.D. "Illiad" Frazer



LINUX JOURNAL EDITION



The Dell IdeaStorm Index

The Dell IdeaStorm site (www.dellideastorm.com) was an inspired move by the company, providing a way for the market to tell a major supplier what to do, rather than the reverse, which has been the default for the whole Industrial Age.

When the site first went up, it sustained what we might call an Insistence on Service Attack by Linux and open-source geeks. Since then, however, the pressure hasn't let up. At the time of this writing (on September 10, 2008), the same kind of demand is there.

What we see with IdeaStorm now is a rolling picture—almost a scroll—of market demand. Here's the current list in the order the items appear on the page:

- Put Ubuntu on the list of operating systems when building a PC.
- No more plastic wrap, please.
- BIOS upgrades that don't require Windows.
- Provide Linux drivers for all your hardware.
- Standardize power cables for laptops.
- Can we get Studio Hybrid with Ubuntu?
- There should be an option of having no trialware on all computers.
- Please make the Ubuntu XPS Notebook cheaper than the XPS Vista Notebook.
- Use magsafe power connectors.
- Pre-installed OpenOffice.org | alternative to MS Works & MS Office.
- When you choose not to implement an idea, explain why.
- Mini 9 Netbook Ubuntu price must be cheaper than the XP price with same config.
- Have Firefox pre-installed as default browser.
- Switch to LED monitors.
- Quit forcing McAfee subscriptions.
- Tell us what Wi-Fi chipset a laptop has.
- Backlit keyboards.
- Stop overcharging on notebook RAM.

To sum up, customers want practical improvements, transparency, promotional crap removal and Linux/Ubuntu support (the latter shows up four times). Maybe some other makers will start listening too.

—DOC SEARLS

Expert included.



As the head of Sales Engineering for Silicon Mechanics, Ken spends his time developing systems and configurations that are directly responsive to our customers' requests. That gives him unique insight into technologies that are catching on and gaining momentum. Lately Ken has been engineering a lot of clusters, and they tend to have some things in common.

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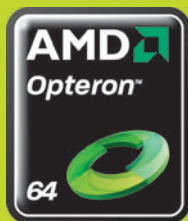


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What They're Using

Respecting Retro with Robert L. Morgan

Robert L. "Bob" Morgan reminds me why I miss the times when *Linux Journal* was headquartered in Seattle, not far west of U-Dub: the University of Washington. RL is one of many old UNIX/Linux hands in the Alpha Geek circle there.

I ran into Bob again at Digital ID World in September 2008, in one of the few open-source sessions held there. He sat in the back row, worn laptop on his knees, and asked Knowing Questions. So, I immediately asked him to be the object of our subject for this month. Here's how he ran down his goods:

My laptop is a three-year-old IBM/Lenovo ThinkPad X41 (non-tablet), now running Fedora 9. I have used a series of "ultra-light" ThinkPads for perhaps a dozen years (560Z, X21, X31 and now X41), and run Red Hat or Fedora Linux on every one. I do all my work on my laptop and carry it everywhere, so lightness, durability and stability are key. This combination has worked for me.

In my job (identity management architect for the University of Washington and Internet2), I do lots of e-mail (4,000 messages sent per year, average 200 incoming per workday). I use Pine, for much the same reasons as above for my choice of laptop and OS: it's fast, very stable and keeps on working year after year. It's nice to know that the folks who write it work upstairs from me, but I haven't needed any special support.

Maybe the most retro choice on this machine is the Window Maker window manager. It hasn't changed much at all in the last several years, but once again, it's fast and keeps on working. I live happily switching among my 20 virtual desktops with well-practiced keystrokes, and don't miss all those fancy features.

Like anyone else, I use modern full-featured apps like Firefox and OpenOffice.org, but if I'm not reading or composing e-mail in Pine, I'm probably taking notes in Emacs. I guess I'm just a retro kinda guy.

And it's great to have those guys around.

—DOC SEARLS



Robert L. Morgan

LJ Index, December 2008

1. Apache's percentage market share among Web servers in August 2008: **49.82**
2. Microsoft's percentage market share among Web servers in August 2008: **34.88**
3. Percentage of Netcraft's top ten most reliable hosting companies that run on Linux: **40**
4. Position of Linux-based Hurricane Electric among Netcraft's top ten most reliable hosting companies: **1**
5. Number of words in the Walt Disney Internet Group's Terms of Service: **5,038**
6. Number of words in the AT&T on-line Terms of Service: **10,944**
7. Number of words in the Verizon on-line Terms of Service: **8,569**
8. Linux percentage share of the smartphone market in Q2 2008: **7.3**
9. Soon-to-be-open-sourced Symbian share of the smartphone market in Q2 2008: **57.1**
10. Windows Mobile share of the smartphone market in Q2 2008: **13**
11. RIM share of the smartphone market in Q2 2008: **17.4**
12. Apple iPhone share of the smartphone market in Q2 2008: **2.8**
13. Linux adoption percentage at the 14 largest investment firms in 2006: **60**
14. Estimated Linux adoption percentage at the 14 largest investment firms in 2008: **72**
15. Dollars granted by the National Science Foundation to Polk Community College and University of South Florida Polytechnic to create a four-year Linux computer system administration program: **812,726**
16. Size in billions of dollars of the global advertising market in 2007: **600**
17. Projected size in billions of dollars of the global advertising market in 2012: **707**
18. Size in billions of dollars of the interactive (mostly on-line) advertising market in 2007: **45**
19. Projected size in billions of dollars of the interactive advertising market in 2102: **147**
20. Annual percentage growth rate of interactive advertising: **23.4**

Sources: 1-4: Netcraft.com
 5: disney.go.com/corporate/legal/terms.html
 6: my.att.net/legal/tos
 7: www.verizon.net/policies/vzcom
 8-12: Gartner, via www.tectonic.co.uk
 13, 14: CIO | 15: *Orlando Business Journal* |
 16-20: The Kelsey Group

They Said It

I'd rather not waste my time on nostalgia. I'd rather spend it on hindsight.

—Edward Felten, from his talk at US v. Microsoft, 10 Years Later, at Harvard University

While VMware is in use (www.vmware.com/company/news/releases/cern.html), the primary configuration for machines in the LHC computing grid (lcg.web.cern.ch/LCG) is based on the Scientific Linux distribution running directly on the hardware. This grid is used to receive and distribute the 15PB of data across the 100,000s of CPUs across the world.

—Tim, a commenter writing from a CERN IP address to an InternetNews.com story on the Large Hadron Collider, blog.internetnews.com/skerner/2008/09/large-hadron-collider---powere.html

Our commitment to Linux has not changed...What's changed is that customers will no longer be able to order Lenovo ThinkPads and ThinkCentres with pre-installed Linux via the lenovo.com Web site.

—Ray Gorman, Lenovo spokesman, in an e-mail to *Computerworld*, computerworld.com/action/article.do?command=viewArticleBasic&taxonomyName=hardware&articleId=9114485&taxonomyId=12&intsrc=kc_top

Apple views tennis-shoe DRM as a way to head off what it sees as a potential plague of sneaker hacking.

—Nicholas G. Carr, www.routhtype.com/archives/2008/09/apple_declares.php

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—KATHERINE DRUCKMAN

On the Web, Articles Talk!

Every couple weeks over at LinuxJournal.com, our Gadget Guy Shawn Powers posts a video. They are fun, silly, quirky and sometimes even useful. So, whether he's reviewing a new product or showing how to use some Linux software, be sure to swing over to the Web site and check out the latest video: www.linuxjournal.com/video.



We'll see you there, or more precisely, vice versa!

Going MoBile

WAP Review calls *Linux Journal's* mobile site, **m.linuxjournal.com**, “a beauty” and adds, “No tiny dumbed-down mobile site, it features just about everything found on the full site, including archives, commenting, forums and videos in mobile format.”

For that, we also can thank MoFuse (**mofuse.com**), which hit the streets last summer with a slick Linux-based way of cutting the cruft out of Weblogs and presenting them readably on mobile phones and other handhelds (we gave the company a mention in “Laundering Blog Layouts for Mobile Devices” in the Upfront section of our October 2008 issue).

Now that MoFuse has put some rubber on the road, we thought it was a good time to hit David Berube, Founder & Chief Architect of MoFuse, with a few questions about his fledgling business and Linux's role in it.

DS: How's it going so far?

DB: We are now approaching 14,000 mobile sites, and we just raised a seed round of funding from the Slater Fund in Providence, Rhode Island—our home town. We're moving quickly!

DS: What got you going with Linux?

DB: I chose Linux for a few reasons: 1) it's powerful and can do the job we need at MoFuse really well; 2) it's open, and that is key to how I'm working as an entrepreneur and how our small team can be so efficient; and 3) it's inexpensive—another key factor for a company just starting out.

Linux being free means a lot to an entrepreneur. Using Microsoft would have cost me more to get going when compared to a Fedora install. Also, there are many avenues out there I can reach out to for free and get help—more so on an open platform because it is community-driven. When I have a problem, I can almost always find the answer using a quick Google search. In the past, when I was using Windows servers, the answer or solution wasn't easily accessible.

Basically, Linux has enabled MoFuse to create what it is today and indirectly help foster the mobile Web. I'm sure these are things you've heard numerous times before, but it is very true for MoFuse.

DS: Well, we've heard some of the same rationales before, but fostering the mobile Web from an open-source angle is somewhat new. How are you doing that?

DB: Lots of ways, but one that comes to mind is the OpenX (**www.openx.org**) ad server. The OpenX team has done a fabulous job with it, and it's a great product. It's not in production, but we are working with it heavily behind the scenes to convert it to a mobile ad server. On our side, we're making modifications so that we can use it as our primary mobile ad server.



David Berube

DS: How about the larger mobile Web? Any handheld platforms you prefer?

DB: I'm very excited about Android and the prospects for a mainstream open-source mobile operating system using Linux. This will lower barriers for smaller companies and help further the growth of mobile far beyond where it is today—and hopefully, help drive the handset costs down so more consumers can have access to smartphones.

DS: One thing I like about MoFuse is that it cuts the bloat out of blogs and everything else that runs through it. Do you think this will have a positive influence on blog design and send some hints to the authoring software development folks?

DB: I don't know. When I design anything, I do it with two things in mind, the user (viewer) and simplicity. I think MoFuse reflects that, and my personal blog (**blog.daveberube.com**) certainly does. I like simple; I'm a fan of 37signals because of its take on design, and I try to bring that same take into projects I work on. But, as you know, some of the bigger blogs need to make space for advertising, and that can really clutter a design. There needs to be a balance

between design and revenue.

DS: I have a hope that mobile platforms, as they become more popular, will drive development in the direction of simplicity. If that happens, what will you be looking for from other developers, bloggers, Web site designers and your own team?

DB: With anything, you begin to see features creep in. It's a battle every developer wages, and it's not easy. You really need to figure out what is needed and what isn't. The good thing about mobile is that applications and Web sites need to be simple in order for them to function. For example, there is no mouse, so you must make the user interface simple to use in order for users to be able to do the things they need.

DS: Speaking of thin and lightweight, have you checked out Dave Winer's "news river" concept? The best example is nytimesriver.com, which Dave put together for the New York Times, but which it seems to have ignored.

DB: Yes, I have. It's straight to the point, is what it is. Nothing more, nothing less—perfect.

DS: Let's talk about the iPhone. My own view is that Apple has created a very slick data device that also happens to be a phone. It points toward a phone business that needs to be a data business. Meanwhile, the other phone makers have many different devices, with many different SDKs. This encourages developers to come to this one very capable platform, even though Apple is its one huge gatekeeper.

DB: Apple really has created not just a great device, but a whole new concept that flies in the face of the carriers, including its partner AT&T. Jobs has really leveraged the Apple brand to bend carriers to its needs, although Apple did cave in a little with the iPhone 3G and the forced contract with AT&T that subscribers now need to sign.

What I dislike about Apple's iPhone and the App Store are its limitations. Why are there limitations?

Why can't a developer create video recording software? Why can't developers create navigational software? Why does Apple get to be the gatekeeper to what gets exposed to the users? Why can't the users be their own gatekeepers?

It also stifles innovation! A company isn't going to invest \$100,000 in developing new software for the iPhone, if there is no guarantee that Apple even will approve of the software. Apple wants you to invest your time and money into developing for its platform, but there is always a risk that iPhone users never will get a chance to see it themselves. If that happens, you virtually have no other avenue to get to all those millions of iPhone users, except maybe marketing it to jail-broken phones. I just hope that over time, Apple will open up the platform a little more. We could really see some cool things if it did that.

DS: Meanwhile, on the Linux side, I've discovered some of the phones can't do sound yet. Can they compete? How?

DB: That will change. Sound is moving forward. If you don't have it now, you will have it soon.

DS: And, you think Android will make it happen?

DB: Hope so. The problem Android is going to have is that the carriers are still going to try to lock down the operating system. It's going to be an OS that is fractured, because it's not going on one single device but on many. That means developers are going to have to create applications that work for devices with and without a touchscreen, with and without a QWERTY keyboard, with 3G and Wi-Fi and without. The list goes on. That's a challenge, but hopefully what Android can do is at least create a standard moving forward.

It's up to the carriers. If they don't lock down the operating system and really let it be a true sandbox for developers, I'm positive we will see great innovation. The mobile phone is capable of doing so much. It's a device that we always have with us, and it's always on. It's the most personal computing device we have.

—DOC SEARLS



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REUVEN M. LERNER

Memcached

Want to make sure your application will scale? Consider memcached, which allows you to speed up response time, as well as reduce the load on your database server.

One of the watchwords for modern Web developers is scalability. Whether we're following the latest news about Twitter's servers or writing our own applications, developers always are thinking about whether their system will be scalable.

This issue has been particularly prominent during the spring and summer of 2008, as Ruby on Rails (my preferred platform for Web development) has been criticized for its use of RAM and its relatively slow execution speed. The massive server problems that Twitter experienced during the first half of 2008 were widely described as stemming from Twitter's use of Rails (despite denials from Twitter's technical team) and led to speculation that Rails cannot be used for a scalable application. One of the hosts of the weekly RailsEnvy podcast makes a point of sarcastically saying that "Rails doesn't scale" in each episode, because it was said so frequently.

There's no doubt that Rails is more resource-intensive than many other application development frameworks. This is partly due to the need for improvements in the Ruby language itself—improvements that look like they'll be available within the coming year. And, it also is true that the Rails framework uses more CPU and memory than some of its counterparts, such as Django, because of the nature of the features that it offers.

But, there's a difference, I believe, between calling Rails resource-intensive and calling it inherently unscalable. Scalability has more to do with the architecture and design of an application, allowing it to grow naturally from a single box containing both the Web and database servers to a network of servers. A Web application written in C might execute very quickly and, thus, handle a larger load on a single server, but that doesn't mean the application is inherently more scalable. At a certain point, even an efficient C program will reach its capacity, and if it isn't designed with this in mind, the more efficient application will be the less scalable one.

So, I tend to think about scalability as an architectural problem, one that ignores the specific programming language in which an application is implemented, and which is different from the issue of execution speed and efficiency. You can have highly scalable programs written in an inefficient framework, but it does take a bit more

discipline and requires that programmers think carefully about the way they are writing the code. Even if you're starting on a single computer, designing the software in a scalable way allows you to distribute the load (and tasks) across a number of specialized servers.

One of the most important issues having to do with scalability actually has little or nothing to do with the Web application framework on which the program is written. Most modern Web applications use a relational database for persistent data storage, which means that the database server can be a bottleneck. Even if the database server isn't pushing its limits, the fact is that it takes time for a relational database to process a query, retrieve one or more appropriate rows and send them back to the querying application.

If your application is highly dynamic, it might use as many as a dozen SQL calls for each page, which will not only stress your database, but also significantly reduce the speed with which you can service each HTTP request. Longer request times mean that your users will be drumming their fingers longer and that your server will need more processes to handle the same number of requests.

One solution is to use multiple database servers. There are solutions for hooking together multiple servers from an open-source database (for example, PostgreSQL or MySQL), not to mention proprietary (and expensive) solutions for commercial databases, such as Oracle and MS-SQL. But, this is a tricky business, and many of the solutions involve what's known as master-slave replication, in which one database server (the master) is used for data modification, and the other (the slave) can be used for reading and retrieving information. This can help, but it isn't always the kind of solution you need.

But, there is another solution—one that is simple to understand and relatively easy to implement: memcached (pronounced "mem-cash-dee"). Memcached is an open-source, distributed storage system that acts as a hash table across a network. You can store virtually anything you like in memcached, as well as retrieve it quickly and easily. There are client libraries for numerous programming languages, so no matter what framework you enjoy using, there probably is a memcached solution for you.

This month, we take a quick look at memcached. When integrated into a Web application, it should

help make that application more scalable—meaning it can handle a large number of users, spread across a large number of servers, without forcing you to rewrite large amounts of code. Version 2.1 of Ruby on Rails went so far as to integrate memcached support into the framework, making it even easier to use memcached in your applications.

Memcached

As I mentioned previously, you can think of memcached as a network-accessible hash table. Like a hash table, it has keys and values, with a single value stored per key. Also like a hash table, there aren't a lot of ways to store and retrieve your data. You can set a key-value pair; you can retrieve a value based on a key, and you can delete a key.

This might seem like a limited set of functions. And, it is, if you think of memcached as your primary data store. But, that's exactly the point. Memcached never was designed to be a general-purpose database or to serve as the primary persistent storage mechanism for your application. Rather, it was meant to cache information that you already had retrieved from a relational database and

that you probably were going to need to retrieve again in the near future.

In other words, memcached allows you to make your application more scalable, letting you take advantage of the fact that data is fetched repeatedly from the database, often by multiple users. By first querying memcached and accessing the database only when necessary, you reduce the load on your database and increase the effective speed of your Web application.

The main cost to you is the time involved in integrating memcached into your application, the RAM that you allocate to memcached and the server(s) that you dedicate to memcached. How many servers you will want to allocate to memcached depends, of course, on the size and scale of your Web site. You might need only one memcached server when you start out, but you might well need to expand to ten, 100 or even several hundred memcached servers (as I've heard Facebook uses) to maximize application speed and efficiency.

Using Memcached

On my Ubuntu system, I was able to install

Expert included.

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memcached with:

```
apt-get install memcached
```

Then, I started memcached with:

```
/usr/bin/memcached -vv -u reuven
```

The `-vv` option turns on very verbose logging, allowing me to see precisely what is happening from the server's perspective. The `-u` flag lets me set the user under which memcached will run; it cannot be run as root, for security reasons.

Now, let's write a short client program to store and retrieve values. I'm going to write the client program in Ruby, although you can use almost any language (including Perl, Python or PHP) that you like. I used the `memcache-client` Ruby gem to connect to the memcached server, which I installed by typing:

```
sudo gem install memcache-client
```

Here is a short program that connects to the memcached server, stores a value and then retrieves a value:

```
#!/usr/bin/ruby

# Load necessary libraries
require 'rubygems'
require 'memcache'

# Create the memcached client
CACHE = MemCache.new 'localhost:11211'

# Set a value
CACHE.set('foo', 'bar')

# Retrieve a value
value = CACHE.get('foo')
puts "Value = '#{value}'"
```

As you can see, the first thing we do is create a client to the memcached server. You can specify one or more servers; in this case, we indicate that there is only one, running on localhost, on port 11211. It might surprise you to learn that although memcached is described as a distributed caching mechanism, the various memcached servers never speak to one another. Rather, it is the client that decides on which server it will store a particular piece of data, and it uses that same algorithm to determine which server should be queried to retrieve that data.

So in this program, we connect to our server, set a value (much as we would set it in a hash table) and then retrieve it. It's nothing very exciting, although the fact that the memcached server might be on

another computer already makes things interesting.

Here is a slight variation on the previous program. Notice the third argument to `CACHE.set`, as well as the invocation of `sleep` afterward:

```
#!/usr/bin/ruby

require 'rubygems'
require 'memcache'

CACHE = MemCache.new 'localhost:11211'

CACHE.set('foo', 'bar', 3)

sleep 5

value = CACHE.get('foo')
puts "Value = '#{value}'"
```

This time, the output looks like this:

```
Value = ''
```

Huh? What happened to our value? Didn't we set it? Yes, we did, but we told memcached to expire the value after three seconds. This is one important way that memcached makes it easy to be integrated into a Web application. You can specify how long memcached should continue to see this data as valid. By passing no expiration time, memcached holds onto the value forever. Allowing the data to expire ensures that cached data is valid.

Just how long you should keep data in the cache is a question only you can answer, and it probably depends on the type of object you're storing. Orders from your on-line store probably should expire after a short period, because they likely will change as users visit your site. But, information about users is unlikely to change once they have registered, so it might make sense to hold onto that for a longer period of time.

It might seem strange for me to be describing memcached as a repository for complex objects, such as orders or people. And yet, memcached is fully able to handle such objects, assuming they are marshaled and unmarshaled by the client software. Thus, we can have the following short program:

```
#!/usr/bin/ruby

require 'rubygems'
require 'memcache'

CACHE = MemCache.new 'localhost:11211'

CACHE.set('foo', [:a, :b, 'c', [1,2,3],
                 {:blah => 5, :blahblah => 10}],
```

```
Time.now])
```

```
value = CACHE.get('foo')  
puts "Value = '#{value.map{ |i|  
i.class}.join(', ')}'"
```

Sure enough, we see that memcached is happy both to set and retrieve values of a variety of classes. This means that even if we create a complex class, we can store it in memcached and retrieve it later.

Conclusion

Memcached is an important part of nearly any Web application's strategy for scaling. It can reduce the time it takes to access certain types of information dramatically, resulting in faster response times for users and freeing up the relational database server for other jobs. Deciding exactly which objects can and should be stored in memcached and determining how long they should be kept in the cache before expiring are issues that must be addressed for each individual application.

Next month, I'll explain how memcached support has been integrated into Ruby on Rails, making it quite easy to take advantage of this technology in your own applications—and, dare I say it, help your

applications become truly scalable. ■

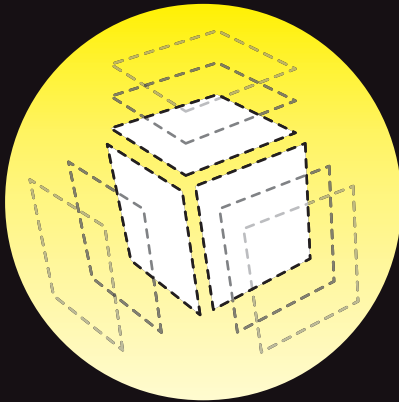
Reuven M. Lerner, a longtime Web/database developer and consultant, is a PhD candidate in learning sciences at Northwestern University, studying on-line learning communities. He recently returned (with his wife and three children) to their home in Modi'in, Israel, after four years in the Chicago area.

Resources

The home page for memcached is at www.danga.com/memcached. This site contains links to software (server and client), documentation and articles about memcached.

The Ruby client I used is called memcache-client, and it is available via RubyForge, at rubyforge.org/projects/seattlerb. This page is for all projects run by Seattle.rb, including memcache-client.

I haven't had a chance to read or review it, but there is a book about memcached, unsurprisingly called *Using memcached*, written by Josef Finsel and published by the Pragmatic Programmers as a PDF-only book in its "Friday" series.



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MARCEL GAGNÉ

Really Useful Gadgets...Sort of

Gadgets are tools, but referring to a tool as a gadget implies a bit of fun.

What on Earth is that, François? Something to make your job easier? Come on, *mon ami*, let's be honest. I don't work you that hard. So what does that thing do? *Quoi?* It's a combination corkscrew, pen, pocket knife, compass, notepad, wine thermometer, music player and crumber? That's the silliest thing I've ever heard of. You know I love gadgets as much as you do, but I think you outdo me with your choices. Our guests are arriving, François. Pay attention, and I will show you some really useful gadgets.

Good evening, everyone. It is wonderful to see you, *mes amis*. Welcome to *Chez Marcel*. François has prepared your usual tables and was just about to get tonight's wine. And, what a wine, *mes amis*. This 2006 wine from Tuscany is produced by Ornellaia and goes by the name of Le Volte (Figure 1). It's a rich, full-bodied, almost chewy red with lots of dark fruit on the palate. Your mouth will thank you. François, you'll find our shipment in the east wing of the cellar, near the secret passageway. *Vite!*



Figure 1. Tonight's Wine. Sampled and Approved

These days, software gadgets are designed to exploit the eye-candy capabilities of modern systems, and we'll look at some of those in a moment. But, what if your system isn't a modern computer? What if you have only limited memory and no high-end graphics system? Have no fear; I've found a couple gadgets guaranteed to be resource-friendly while still providing little productive value. The first is necessary for people using a Linux system who feel they may be missing out on that most impor-

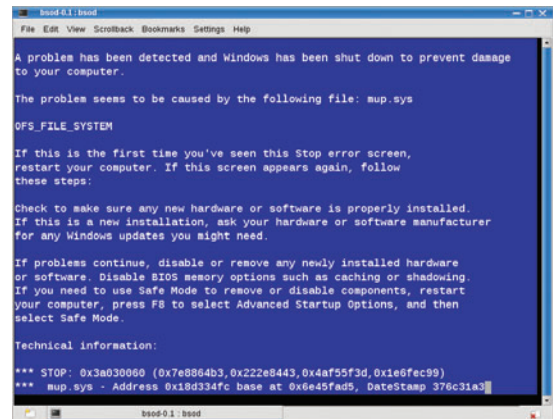


Figure 2. Every computer needs a Blue Screen of Death—sort of.



Figure 3. Fish are endlessly fascinating to watch, even when they're merely ASCII characters in a terminal window.

tant of Windows tools. Yes, I'm talking about the Blue Screen of Death, lovingly crafted for Linux by Folkert van Heusden.

Get the source from www.vanheusden.com/bsod, extract it and then simply type `make` (or `make install`) to build it. To run it, type `bsod`. Your console, or terminal window, displays the Blue Screen of Death. There are no options or flags, so it's very easy to use.

Of course, the Blue Screen of Death doesn't do much. And, it's nowhere near as interesting as, say,

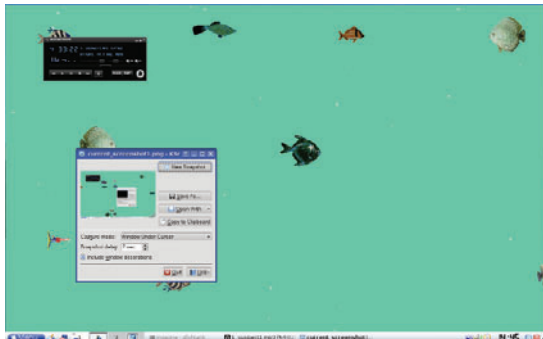


Figure 4. *xfishtank*. because people need fish swimming across their workspaces.

watching fish in an aquarium. We've got that taken care of as well with our next gadget. In keeping with our low-tech, low-end gadget needs, this aquarium doesn't require a graphics card. It's Kirk Baucom's ASCIIQuarium (Figure 3). The program displays a variety of fish, the occasional sea monster or man-eating shark, all in glorious ASCII.

Believe it or not, ASCIIQuarium is included in the repositories for various distributions, so you probably don't need to build it. However, source is available should you choose to go that route. There is no building to be done because ASCIIQuarium is a single Perl script. It requires only that you have the Curses and Term::Animation Perl modules installed. While the aquarium displays its two-dimensional life, you can press R to force a redraw, P to pause the display or Q to quit.

If ASCII seems just too, ahem, quaint for a desktop gadget, you'll be happy to know that you can get a different kind of aquarium with some nicer graphics. Most modern software gadgets tend to be small programs that run on your desktop background or wallpaper. Sometimes they become the background. One such program is *xfishtank* (Figure 4), written by Eric Bina. Once again, this is an easy program to find in your distribution's repositories.

Running *xfishtank* on most systems is as simple as typing the program name. You also can fire up your program launcher (Alt-F2), and type *xfishtank* to populate your aquarium. Whether you see something right away depends somewhat on the desktop environment you are running. Most environments, GNOME included, don't require any additional steps, but KDE does need to check with you before allowing programs to run on the desktop background. Right-click on your desktop, and select Configure Desktop from the pop-up menu. When the dialog box appears, click the Behavior icon in the left-hand sidebar. A three-tabbed window appears on the right-hand side. Look near the top on the General tab, and you'll see a check box with the words Allow programs in desktop window. Click

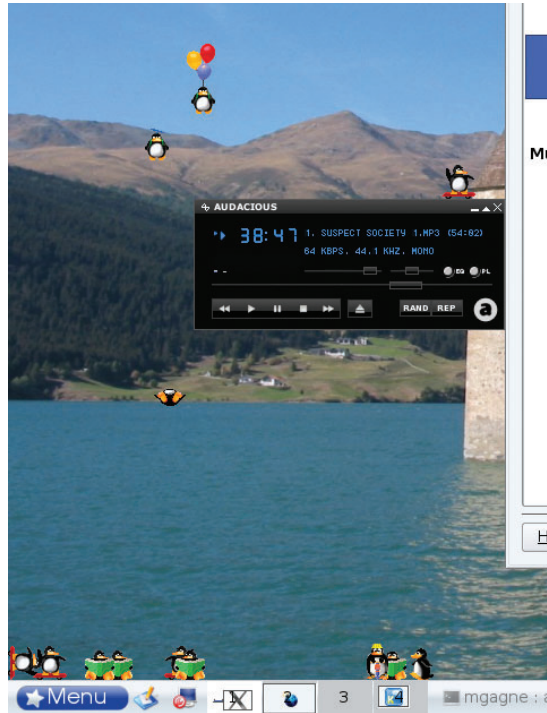


Figure 5. The penguins in *xpenguins* are an industrious lot—floating, skateboarding, drilling, walking, reading and more.

that check box, and then click OK.

I mention this now because you may need it again with some of our other gadgets. A lot of the newer background gadgets are small programs that take up a small portion of your screen, quietly displaying useful information, such as system load, memory usage or network traffic. But, wouldn't you rather see Tux running around on your screen, walking across your windows, skateboarding or parachuting down to your taskbar? Me too. You can thank Robin Hogan for writing *xpenguins* to help us out of that productivity conundrum. When you run *xpenguins*, Tux, in all the forms I mentioned, suddenly takes over your screen (Figure 5).

Should you decide your screen isn't busy enough, you can increase the default number of penguins by using the *-n* flag. That default is defined in the current theme. Theme? Did I say theme? If those wonderful little penguins vying for your attention aren't enough, you are running the right program, *mes amis*. One of the really fun things about *xpenguins* is that it comes with multiple themes. To discover those themes, type *xpenguins -l* at the command line:

```
$ xpenguins -l
Big Penguins
Bill
Classic Penguins
```

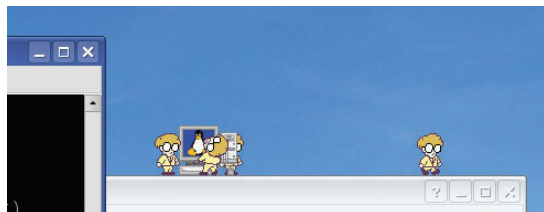


Figure 6. The evil hacker known only as Bill can replace those cute little penguins on your desktop.

Penguins

Turtles

To select a particular theme, do the following:

```
xpenguins -t Bill
```

Figure 6 shows the result. Bill, the famous hacker from Red Mond, wanders across your screen taking away Linux systems and replacing them with his own brand of OS. Yes, this is a takeoff of the (in)famous *xbill* game.

Even more themes are available. Visit the xpenguins Web site, and check out the user-contributed themes at xpenguins.seul.org/contrib. Before we move on, I want to mention one last flag available with xpenguins—the `-s` flag. That one makes it possible for you to squish the characters with your mouse cursor. If you find yourself a little squeamish at the result, the `-b` option means no blood.

I could pass the next one by, but I really need to mention it. It's a little less tasteful, but it's lots of fun if you want to turn off your coworkers. `xcockroach`, written by Nicolas Adenis-Lamarre, generates a variety of cockroaches that scurry across your screen and hide under your active windows. Move the window and the critters run off in all directions. It's pretty disgusting, but certainly entertaining. Unlike xpenguins, there is no squash function. You can, however, change themes and behaviors for your roaches. For a full list of options, type `xcockroach -h`.

Let's get off the nostalgia bus now and take a look at the modern state of desktop gadgets. KDE 4.1's impressive desktop features a new desktop shell called Plasma. Plasma is, in a way, the ultimate gadget—it's a gadget that runs gadgets. Inside Plasma, you run programs (or widgets or gadgets) that appear on the desktop. Each of these programs is commonly referred to as a plasmoid. Plasmoids are more than programs, however. Each is a containment that can contain other plasmoids, all of which are, technically, able to communicate with one another. Plasma, the desktop shell, is just one big containment that contains other plasmoids. The panel at the bottom of the screen with its system-tray icons, taskbar, clock and program launcher is

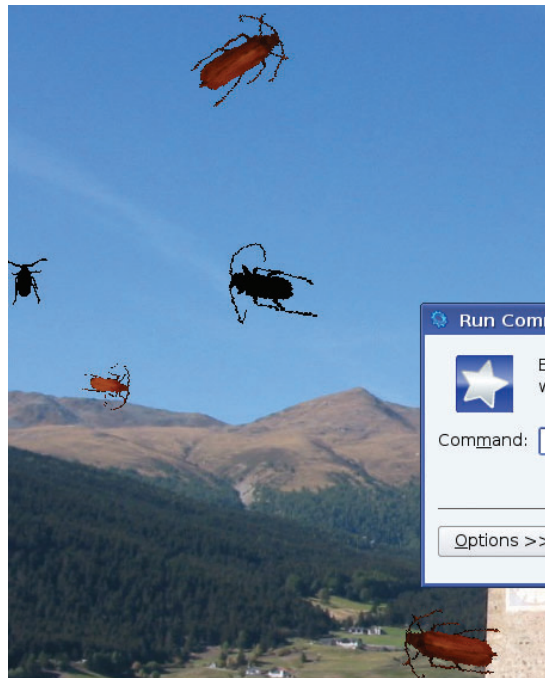


Figure 7. A close-up of a roach-infested desktop—luckily, getting rid of them is as easy as issuing a kill command.

yet another containment. Shakespearean fans can think of it as a play within a play.

Plasmoids use scalable vector graphics (SVG). These graphics can be zoomed and rotated smoothly, meaning that plasmoids can live pretty much anywhere on your desktop, in any size and any orientation. The result is super-sweet eye candy of the gadget variety.

Note:

Yes, we have a real issue with this whole gadget thing. It's called language. Some people call them gadgets, and others refer to them as widgets. KDE 4.1 calls them both widgets and plasmoids. Other environments refer to these things as toys. Gadgets and widgets and plasmoids and toys, oh my!

To add a plasmoid to the KDE 4 desktop, click on that cashew icon in the top right-hand corner of your screen. A small pop-out menu appears. If it says Unlock Widgets, make sure you click that first, then recall the menu. Now, you should see Add Widgets at the top of that menu (Figure 8).

When you click Add Widgets, a window labeled



Figure 8. Click the cashew to add desktop widgets, or plasmoids, or gadgets, or whatever you like to call them.

Add Widgets appears (Figure 9). It contains a list of all the plasmoids installed on your system, and each one has a description below its name. Some of my favorites include Dictionary, a live desktop word lookup; Luna, a moon-phase display; and the Twitter Microblogging applet. I also enjoy a variety of clocks, including a classic analog clock as well as



Figure 9. KDE 4.1 plasmoids seriously dress up a desktop. Shown here are the KDE Twitter, Luna, binary and analog clock, notes, dictionary, calculator and trash plasmoids.

a binary model. Those little yellow sticky notes also are handy. There's even a plasmoid that pulls in and displays your favorite comic strips right on your desktop. Figure 9 shows a number of different plasmoids running on my desktop.

While the plasmoids are unlocked, you can pause over any of them to fade in the controls (Figure 10). Each has a rotate handle, a resize handle and a button

1

2

3

4

5

6

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Figure 10. Control handles (or buttons) fade in when you hover over a plasmoid, letting you rotate, resize, configure or close the plasmoid.

to close the plasmoid. Many, though not all, also are configurable and offer a settings icon.

Running all these cool desktop gadgets is great, but what if you've got a dozen windows open, and you want to re-read today's comic? Minimizing all those windows can be a pain, but it's one you don't need to suffer. Press Ctrl-F12, and the Plasma dashboard jumps to the forefront of your running windows, letting you see and interact with any of your plasmoids.

The last item on tonight's menu comes from those gadget-crazy people over at Google who come to us with the aptly named Google Gadgets. Unlike plasmoids, you can't rotate them, and they live only on your current virtual desktop, but the sheer number of gadgets, not to mention coolness factor, makes Google Gadgets a must. I was able to install Google Gadgets for my system from the Mandriva repositories, so check yours first. You also can get the latest from code.google.com/p/google-gadgets-for-linux.

When you install Google Gadgets for Linux, you'll find that there are two versions of the code: one for the Qt toolkit (KDE) and another for GTK (GNOME). When you first run the program (with a shortcut command named `gg1`), an icon appears in your system tray. To add gadgets to your desktop, right-click the icon and select Add Gadgets. Figure 11 shows a sampling Google Gadgets running on my desktop. There's a nice flowerpot that requires you to water and care for the flowers in order for them to grow (ignore the flowers and they wither and die). If, like me, you never can have enough trivia, check out the Absolut Trivia gadget (yes, that Absolut), which displays a new piece of trivia every

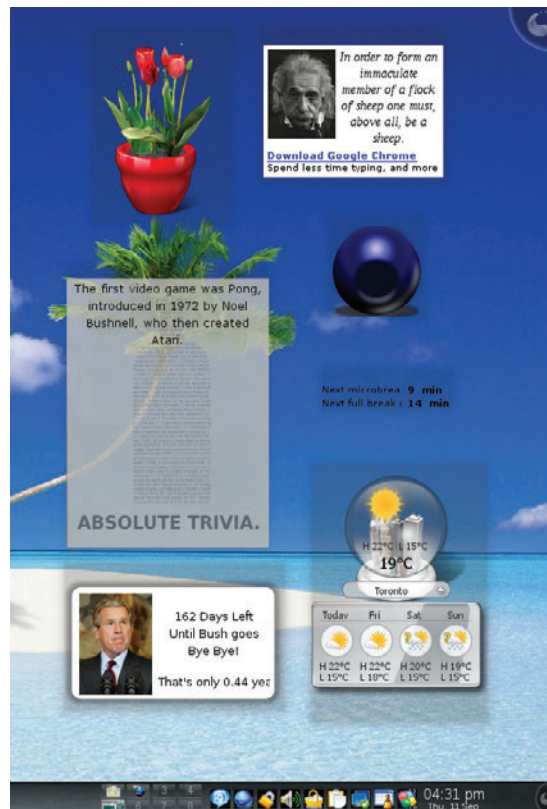


Figure 11. A sample of the hundreds of gadgets available from Google Gadgets for Linux.

few seconds. To help me make decisions, I've got a Magic 8 Ball. The weather, always important, shows up in a cool weather globe. And, of course, when I've been working too long, the RSI Break gadget tells me to take a break.

One gadget you likely won't need by the time you read this is the George Bush "days left in office" countdown gadget, which is either a countdown to freedom and renewed sanity, or a dark day for American politics, depending on where you sit on the GBW fence. Although I can't say for sure, I suspect that an Obama or McCain countdown timer probably is in the works.

There are tons of gadgets available, so how do you choose? When you select Add Gadgets from the system-tray icon, it fires up the Gadget Browser. Using the Gadget Browser (Figure 12), you can select from hundreds of gadgets, categorized according to interest and function, as well as new and updated gadgets. Those created by Google have their own category.

For instance, click on Lifestyle, and you will be able to choose from more than 150 gadgets that do all sorts of wonderful things, including display horoscopes, recipes, quotes from various sources or pictures from the world's greatest beaches. You

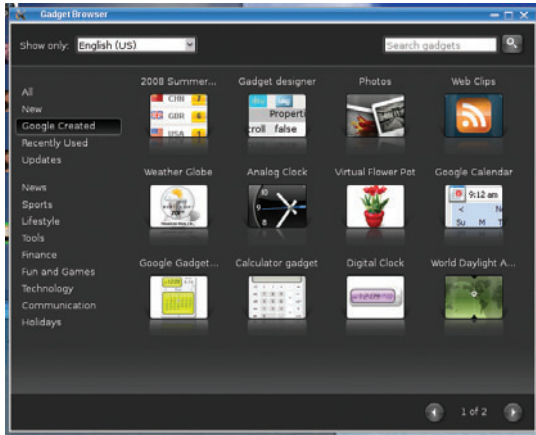


Figure 12. Google's Gadget Browser lets you select from several categories of gadgets, including those created by Google.

know, that last one doesn't sound half bad.

Well, *mes amis*, I fear it is that time again. The hour is late, and closing time is upon us. As you have seen, useful tools need not be all business, just as business in this fine restaurant is, in fact, much closer to pleasure. With one of the world's finest wine cellars and undoubtedly the finest waiter in the world, how could it be anything else? Speaking of whom, François, kindly refill our guests' glasses a final time. Please, *mes amis*, raise your glasses and

let us all drink to one another's health. *A votre santé! Bon appétit!* ■

Marcel Gagné is an award-winning writer living in Waterloo, Ontario. He is the author of the *Moving to Linux* series of books from Addison-Wesley. Marcel is also a pilot, a past Top-40 disc jockey, writes science fiction and fantasy, and folds a mean Origami T-Rex. He can be reached via e-mail at marcel@marcelgagne.com. You can discover lots of other things (including great Wine links) from his Web sites at www.marcelgagne.com and www.cookingwithlinux.com.

Resources

ASCIIQuarium: robobunny.com/projects/asciiquarium/html

BSOD: www.vanheusden.com/bsod

Google Gadgets for Linux:
code.google.com/p/google-gadgets-for-linux

KDE Plasma Wiki: techbase.kde.org/Projects/Plasma

xcockroach: xcockroach.free.fr

xpenguins: xpenguins.seul.org

Marcel's Web Site: www.marcelgagne.com

Cooking with Linux: www.cookingwithlinux.com

TECH TIP Speed Up Multiple SSH Connections to the Same Server

If you run a lot of terminal tabs or scripts that all need to make OpenSSH connections to the same server, you can speed them all up with multiplexing: making the first one act as the master and letting the others share its TCP connection to the server.

If you don't already have a config file in the `.ssh` directory in your home directory, create it with permissions 600: readable and writeable only by you.

Then, add these lines:

```
Host *
  ControlMaster auto
  ControlPath ~/.ssh/master-%r@%h:%p
```

`ControlMaster auto` tells `ssh` to try to start a master if none is running, or to use an existing master otherwise. `ControlPath` is the location of a socket for the `ssh` processes to communicate among themselves. The `%r`, `%h` and `%p` are replaced with your user name, the host to which you're connecting and the port number—only `ssh` sessions from the same user to the same host on the same port can or should share a TCP connection, so each group of multiplexed `ssh` processes needs a separate socket.

To make sure it worked, start one `ssh` session and keep it running. Then, in another window, open another connection with the `-v` option:

```
~$ ssh -v example.com echo "hi"
```

And, instead of the long verbose messages of a normal `ssh` session, you'll see a few lines, ending with:

```
debug1: auto-mux: Trying existing master
hi
```

Pretty fast.

If you have to connect to an old `ssh` implementation that doesn't support multiplexed connections, you can make a separate `Host` section:

```
Host antique.example.com
  ControlMaster no
```

For more info, see `man ssh` and `man ssh_config`.

—DON MARTI



DAVE TAYLOR

FilmBuzz Trivia Goes Live

Wrapping up the Twitter movie trivia game.

I was sure last month that we'd wrap up this film-trivia Twitter game, but, as you'll recall, I ended that column with "Oh. We've run out of space. Again."

This month, I'll skip the prelude and jump in. You should follow the triviabot at twitter.com/FilmBuzz, and you can find back columns on the *Linux Journal* Web site if you need to get up to speed.

Command-Line Tweets

Last month, I ended by showing you a rudimentary solution to sending out twitters on the command line that looked like this:

```
#!/bin/sh
# tweet - command line twitter interface
user="filmbuzz"; pass="acctpasswd"
msg=$(echo $@ | sed 's/+/ %2B/g; s/ /+/g')
$curl --silent --user "$user:$pass" --data-ascii \
  "status=$msg" "http://twitter.com/statuses/update.json" \
  > /dev/null
```

With that available, sending Twitter updates is as easy as typing:

```
$ tweet "My favorite film? Probably Lawrence of Arabia"
```

And, it's off into the ether (Figure 1).

So, clearly you can send tweet messages from the command line. In previous columns, we also pulled all the pieces together to be able to output trivia questions to standard out (stdout).

Let's Put It Together

We have two command-line shell scripts that we need to put together: one sends its input as a message to Twitter, and the other actually generates a trivia question. Here's the latter, in action:

```
$ generate-trivia-question.sh
Film Trivia! Was the movie "Schindler's List"
released in 1993, 1994 or 1996?
```

There are a bunch of ways to put them together, but I'm partial to subshells using the `$()` notation. So, here's how I can output the very first real live programmatically generated trivia question to the FilmBuzz Twitter account:

```
$ ./tweet $(bash generate-trivia-question.sh)
```

And, Figure 2 shows the output. Hu-bloody-rah! Finally.

Making It a Cron Job

Now that we have a command-line-based method of generating and disseminating movie trivia questions via Twitter, we need to automate the process, because I am not going to log in

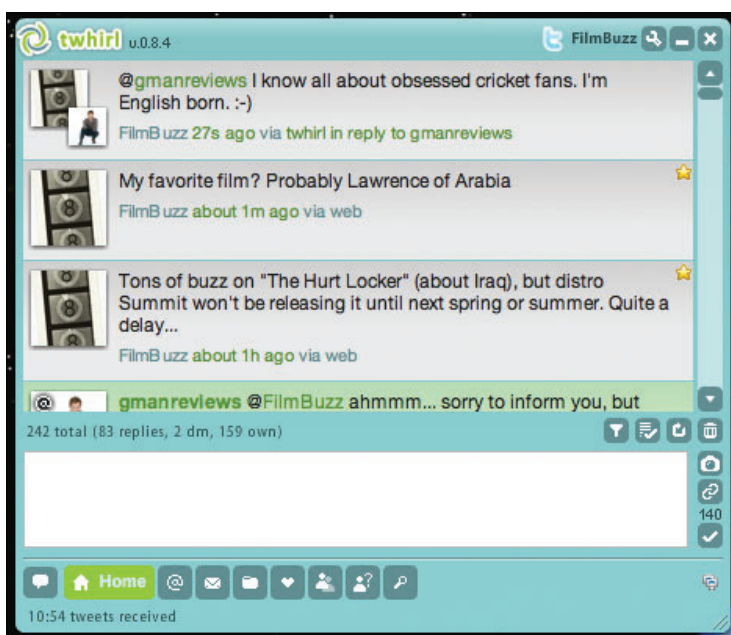


Figure 1. Notice the middle tweet. That's us!

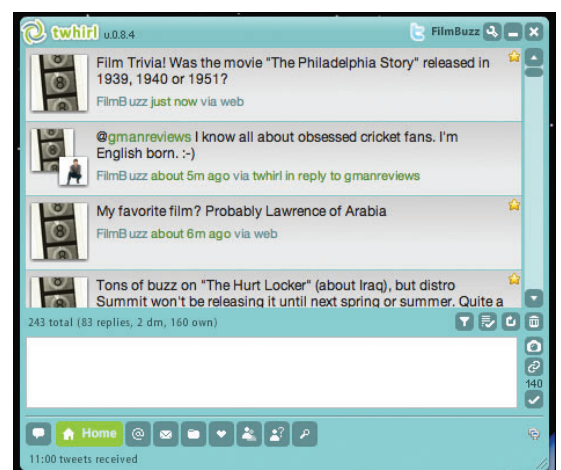


Figure 2. The topmost entry is our trivia question.

We have two command-line shell scripts that we need to put together: one sends its input as a message to Twitter, and the other actually generates a trivia question.

every few hours and type that command on the command line!

The tool of choice for any sort of automation, of course, is crontab. If you're reading *Linux Journal*, I imagine you're already familiar with it, but if not, read the man page for this powerful utility (`man crontab`).

For all its strengths, crontab requires that you have a simple invocation, and I generally like to write a script specifically targeting that crontab entry—like this:

```
#!/bin/sh
# film trivia crontab job
tweet="/home/filmbuzz/trivia/tweet"
generateq="/home/filmbuzz/trivia/generate-trivia-question.sh"
question="$(/usr/local/bin/bash $generateq)"
$tweet "$question"
exit 0
```

Easy enough. This can, of course, be run from the command line to test it, but what we really want to do is run it from crontab to see if all the paths and file permissions are correct, so it can run unattended.

To create or edit a crontab file, type `crontab -e`. I'm going to send out only two trivia questions each day: one at 11am and one at 3pm. The format of crontab entries is a bit tricky though, as the time and date recurrence requirements are specified as minute, hour, day-of-month, month and day-of-week, followed by the command itself. Fields you don't want to specify can be left as an asterisk (a wild card). So, if I want to run this command seven days a week at 11am and 3pm, I can most easily specify it as:

```
@ 11,15 * * * trivia-cronjob
```

That's not quite right, though, because generally you can count on cron jobs having a far more truncated `PATH` than you're used to interactively, so every path should be specified (including in any



script that's executed). Here's what I actually have in my crontab:

```
@ 11,15 * * * $FBDIR/trivia/trivia-cronjob
```

Oh, there's one more wrinkle. My server runs in UTC (Universal Time, Coordinated, aka Greenwich mean time), so when it's 11:22am here in Colorado, my server thinks it's 17:22:41 GMT 2008.

Because crontab uses the system time, I need to adjust my specified times to meet my expectations, moving from 11,15 to 17,21. Otherwise, we're good to test!

Hmm...nothing happened. A quick check of my e-mail reveals the cause:

```
/home/filmbuzz/trivia/trivia-cronjob: permission denied
```

That's easily fixed with a `chmod` call (Figure 3).

As you can see in Figure 3, that fixed the problem, and now we've got a live trivia-question-injection system that scrapes the Internet Movie Database, figures out the correct and two likely, but incorrect, release years and puts it out on Twitter.

Next month, we'll finally move to a new scripting topic. And, in the meantime, if you want to enjoy the fruit of our extended labor and try your hand at film trivia, follow @FilmBuzz on Twitter at twitter.com/filmbuzz. ■

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Figure 3. See the topmost entry. It lives!



MICK BAUER

Samba Security, Part II

Build a secure file server with cross-platform compatibility.

Last month, I began a multipart series of articles on how to build a secure file server based on Samba for local (non-Internet-facing) use. I gave an overview of file server security goals, described why Samba might be the best tool for the particular job of serving “network drives” to clients on different platforms connected to a Local Area Network, defined a number of Samba acronyms and concepts, and explained how to install the Samba server daemons, client utilities and its configuration GUI, Swat.

This month, I expand upon our usage scenario and begin demonstrating how to construct an smb.conf file that executes this scenario in a secure fashion. As usual, I cover not only security, but also how to get things working in general—it isn’t helpful to be told how to secure a process that isn’t behaving the way you expect in the first place.

Usage Scenario

As I explained last month, we want to build a convenient and secure file server that supports both Windows and Linux (and other *nix) clients.

To use more Samba-specific terms, our server will operate with “user-mode” security, using a combination of local Linux/UNIX user account information and Samba-specific hashes of those users’ passwords to authenticate access to workgroup resources.

Specifically, we want to build a non-Internet-facing Samba file service that supports several different levels of security: Guest (anonymous) access, read-only access for some authorized users and read/write access for other authorized users.

To use more Samba-specific terms, our server will operate with “user-mode” security, using a combination of local Linux/UNIX user account information and Samba-specific hashes of those users’ passwords to authenticate access to workgroup resources. A workgroup, you may remember from last month, may include shares provided by multiple Samba servers, but each server in that workgroup must maintain its own user database independently

(which is why Domains and Active Directories are better choices than workgroups for more complex environments). Accordingly, our sample workgroup will use a single server.

To flesh out our example scenario still further, let’s suppose I’ve got a boardinghouse and my tenants are a trio of FBI special agents: Skippy, Knute and Pepe. Being fond of my cooking, they keep a close watch on my weekly meal schedule, which I post on my Samba server every Sunday night—you can bet nobody works late any evening on which tater tots will be served. This schedule is a public document, as far as I’m concerned (I’m vain about my cooking).

If my resident agents help mow the grass, feed the hedgehogs and tune the piano, they get a break on rent. So, I also maintain a schedule of chores they all can read, but which, of course, I don’t want them to be able to change themselves (imagine the outrage if Pepe always got to feed the hedgehogs).

Besides, being secret agents after all, these guys don’t want anyone else to know who’ll be outside raking the compost on any given Saturday—you never know when the enemies of freedom might strike. So, the chore schedule is private, and it can be read but not altered by my tenants.

Finally, unbeknownst to the boys, their boss has asked me to log their Web-surfing activity from my firewall. Although the joke’s on him (they all use TOR), these logs are nonetheless super-secret. Actually, those logs probably don’t belong on any file server at all, but sometimes I amuse myself by adding fake entries to Skippy’s log (“GET HTTP://thesharperimage.com/expensive_gifts_for_your_boss.html”), so my firewall stores them on a restricted share on the Samba server.

To summarize, I need to create a workgroup (I’ll call it FED-CENTRAL) with four user accounts (skippy, knute, pepe and mick) and three file shares (SUPPER, CHORES and BUZZ-OFF).

Samba Configuration: Global Settings

With that, we are ready to go. Assuming you successfully installed the Samba server and client packages per last month’s instructions, the first step in configuring Samba is to set some global variables.

There are two different ways to configure Samba. The first is by editing /etc/samba/smb.conf directly using your text editor of choice, and then restarting the smbd and nmbd Samba daemons. You very well may gravitate to this method as soon as you’re

comfortable with Samba, because it's the quickest and most direct way to change Samba's behavior.

Lately, I've become a big fan of the second way, however: Swat, the Samba Web Administration Tool. If you're scandalized by my endorsing a graphical tool that requires you to set a root password (which, by default, doesn't exist on Ubuntu systems), see last month's column. Suffice it to say that in this case, I'm not talking about an Internet-facing system, and the educational benefits of Swat outweigh its security risks here.

Besides, Swat really isn't a crutch; it simply presents you with a Web form for assigning values to all possible variables in `smb.conf`, with convenient Help buttons that send you directly to the appropriate section of the relevant man page. The more you use Swat, the more comfortable you'll be editing `smb.conf` directly. How many GUIs can you say *that* about?

I'm going to assume you had no problems with the instructions I provided last month on installing Samba and Swat, including configuring and restarting `inetd`, and that Ubuntu users were able to stomach issuing the `sudo passwd root` to set a root password. (And, even if you weren't, or simply prefer not to use Swat, all of what follows still should be useful, because the variables and values in my Swat screenshots and examples are the same as those contained in `smb.conf`.)

Running Swat is easy. Simply start your browser of choice, and point it to `http://localhost:901/`. The first thing you'll see is Swat's Home page, which consists of a row of navigation buttons (Home, Globals, Shares, Printers and so forth). These appear on every one of Swat's screens, but unique to the Home page is a list of links to local man pages, HOWTOs and even complete books. I leave it to you to explore those; this page leads to a wealth of useful information for Samba users at all levels of skill and experience.

For now, however, let's dive right into Samba's global settings. If you click the Globals button, and then scroll down to where the actual settings begin, you should see something like Figure 1.

Obviously, we want to change the value of `workgroup` from `WORKGROUP` to `FED-CENTRAL`. The default for `netbios name`, however, is the hostname Samba automatically read in from `/etc/hostname`, and you usually can leave that alone, although you don't have to. This is the name that turns up in people's "network neighborhood" browser when they look for your server.

The default value for `security`, which is `user`, also is exactly what we want. The same is true of `encrypt passwords` being marked `yes`.

The next two variables, however, `client schannel` and `server schannel`, need to be changed. `Schannel` refers to the secure channel method of allowing

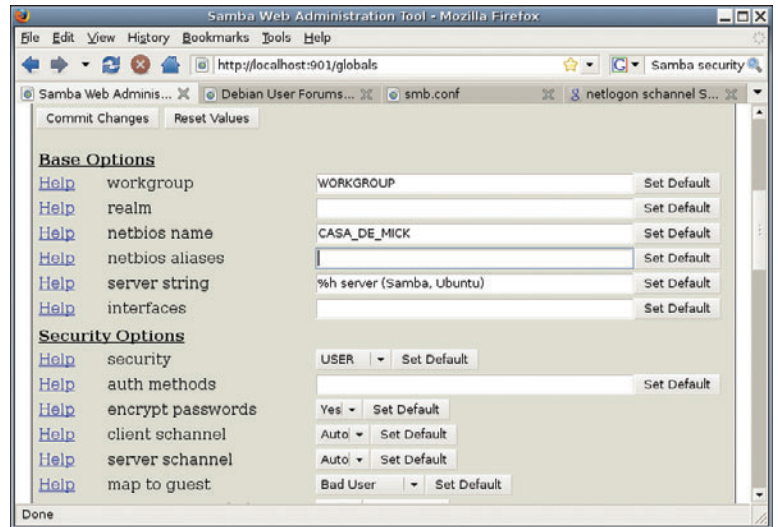


Figure 1. Some Global Settings

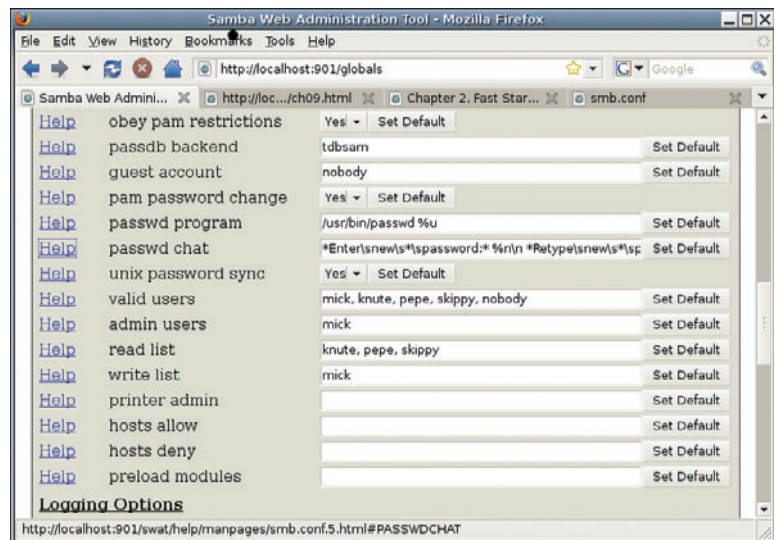


Figure 2. More Global Settings

Samba clients to log on to Samba servers, and we don't want this to be optional. We want it to be mandatory. Therefore, for both of those variables, we should change the value from `auto` to `yes`.

The last variable shown in Figure 1 is `map to guest`. That value tells Samba under what circumstances it should grant guest access to a client that has just had a failed login attempt. Samba's default for this is normally `never`, which effectively disables guest access. But, as you can see in Figure 1, on my Ubuntu system, the default value actually is `Bad User`, which means that if people try to log on with a nonexistent user name,

they'll be given guest access.

If you scroll farther down on Samba's Global page, you should see something like Figure 2.

Continuing through these global settings, obey pam restrictions implies that Samba will honor PAM (Pluggable Authentication Modules) settings. But in practice, if encrypt passwords remains set to yes, Samba will ignore PAM altogether.

passdb backend specifies what type of database Samba should use to store its password hashes. The default (tbdsm) is usually the best choice.

guest account is the local Linux account that will be used for clients who fail authentication, as I described earlier when talking about map to guest. passwd program, passwd chat and unix password sync involve how and whether Samba mediates end users' attempts to change their passwords via Samba (Windows file sharing) sessions. Leave these at the default settings unless you don't want users to be able to change their passwords that way.

By now, you may be wondering, what's the difference between Samba's password database and the list of hashes stored in /etc/shadow, given the fact that they correspond to the same set of local user accounts? The short answer is, Samba (SMB/CIFS) uses an authentication protocol with which UNIX password hashes are not compatible.

The bad news is that Samba's password database is, thus, totally redundant with Linux's, and it creates the potential for users having to remember two different passwords. The good news is that if passwd program and passwd chat are set correctly (which they should be by default, if you use your Linux distribution's official Samba packages), and unix password sync is set to yes, Samba automatically will update users' Linux passwords every time they change their Samba password. (I talk about this more in the next section.)

Moving on, valid users allows you to specify a list of Linux/UNIX user accounts to which you want to grant access to Samba shares. The default value "" (null) results in all local Linux accounts being valid. For our example scenario, I've set valid users to mick, knute, pepe, skippy and nobody.

admin users allows you to grant superuser privileges on all shares for one or more local user accounts, regardless of Samba or Linux file permissions on that share. Be careful with this setting! It has the effect of executing local commands as root on behalf of such users. In Figure 2, I've specified mick as an admin user, because I often use that account for system administration tasks anyhow.

read list allows you to specify which users should have default read-only permissions on shares. As you can see in Figure 2, I've set our read list to knute, pepe and skippy.

Similarly, write list specifies a list of users who should have read-write privileges by default. I've set that value to mick.

printer admin is out of the scope of this article for now (though I may cover printer shares later in this series). hosts allow and hosts deny, however, are noteworthy. They allow you to create TCP Wrappers-style access control lists. hosts allow is a whitelist of IP addresses, network addresses, host-names or domain names that should be allowed to connect by default (assuming successful authentication, of course).

hosts deny is a blacklist, also consisting of IP addresses, network addresses and so forth, whose members won't even be permitted to attempt authentication. Samba will break any connection attempted by any host matching this list. The hosts_access(5) man page provides complete information about the syntax of the values of these two variables.

And, that's it for global settings, for now. To write the changes we've made to our working /etc/samba/samba.conf file, click Swat's Commit Changes button.

Some of the variables you set to custom strings, such as valid users, may not appear when the screen refreshes. To see them, simply click the Advanced View button (next to Change View To: near the top of the page).

Setting Up User Accounts

The last task we've got space for this month is setting up our user accounts, and there are four steps:

1. Create the accounts under Linux.
2. Assign those accounts Linux passwords.
3. Create Samba password database entries for each.
4. Have the users change their Samba passwords.

Step one is to use whatever method you usually use to create user accounts on your system—either by using your system administration GUI of choice (such as GNOME's Users and Groups applet) or via the commands useradd, userdel and so forth.

For example, to create Pepe's account, I could use the following command. Note the sudo, necessary for Ubuntu. On other distributions, su to root before executing these commands, and omit the sudo that each begins with here:

```
bash-$ sudo useradd -c "Pepe" -m -g users pepe
```

This creates the user account pepe with the comment Pepe, automatically creates a home directory (/home/pepe) and assigns it to the group users.

Regenerating smb.conf in Debian/Ubuntu

What if, in the process of tinkering with your Samba configuration, you so completely lose track of what you've changed versus what you started with that you want to begin again with the default `/etc/samba/smb.conf` file? And, what if you failed to create a backup copy of `smb.conf` before you changed it?

You might think Swat could do this. Swat has default buttons next to each configuration option. Clicking a default button is

supposed to replace your custom value with the value from the default `smb.conf` file included with Samba. However, in my own experience, the behavior of these buttons is erratic. Sometimes null values are (incorrectly) returned, and clicking the default button for every option is time consuming anyhow.

My advice is that if you're using Debian or one of its derivatives, such as Ubuntu, and you need a fresh `smb.conf` file, you

should completely un-install the package `samba-common`, and then re-install it. (This also will result in things that depend on `samba-common` to be un-installed, so note which packages you'll need to re-install after you've restored `samba-common`.)

In between removing and re-installing `samba-common`, you may want to check `/etc/samba` to make sure `smb.conf` is truly gone, and delete it if it isn't.

To be extra paranoid, you could insert the string `-s /bin/false` after `-g users`, which will disable normal Linux logins for Pepe's account, making it useless for anything other than Samba access.

Step two is to set each user's Linux password, like this:

```
bash-$ sudo passwd pepe
```

Obviously, you need to communicate whatever password you set here to Pepe in a secure fashion, and Pepe will need to change this password to something you don't know. (But that part happens in step four.)

Step three is to use the `smbpasswd` command to create each user's Samba password database entry, like so:

```
bash-$ sudo smbpasswd -a pepe
```

You'll be prompted to set and confirm Pepe's Samba password, after which the new account will be added. It's probably a good idea to use the same initial password here that you used in step two.

Finally, you'll want Pepe to log in to the system (assuming you *didn't* set his shell to `/bin/false`) and issue the following command:

```
pepe@casademick$ smbpasswd
```

Pepe will be prompted for his old password, his new password and confirmation of his new password. Assuming all three of those are good, Samba will change both Pepe's Samba password and his Linux password accordingly. Note that this synchronization does *not* occur when you create a new Samba password entry as root, using the `-a` flag.

If Pepe has an invalid shell, such as `/bin/false`,

you'll have to let him sit at your console while you type the command `sudo smbpasswd pepe`, and then turn your back while he changes his password. You'll then need to do the same thing with the command `sudo passwd pepe`, because Samba does not synchronize Linux/UNIX passwords if you execute `smbpasswd` as root.

Conclusion

We've specified our usage scenario, set up some basic global settings using Swat and started adding users. Next month, we'll create the actual shares, but if you can't wait until then, you'll have no problem figuring out how using Swat's ample documentation. The "Official Samba 3.2.x HOWTO and Reference Guide" (see Resources) also may help. Have fun, and be safe! ■

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Resources

Christopher R. Hertel's On-line Book *Implementing CIFS*, a Comprehensive Source of Information on All Things CIFS/SMB-Related: www.ubiqx.org/cifs

"The Official Samba 3.2.x HOWTO and Reference Guide": us1.samba.org/samba/docs/man/Samba-HOWTO-Collection

Did you know Linux Journal maintains a mailing list where list members discuss all things Linux? Join LJ's linux-list today: <http://lists2.linuxjournal.com/mailman/listinfo/linux-list>.



KYLE RANKIN

Mutt and Virtual Folders

Why limit yourself to searching for messages within one folder in mutt? You are a few short shell scripts away from multifolder searching bliss.

If you didn't already know, I'm a mutt-addict^H^H^H^H^Huser. At this point, I can't even remember when I started using mutt. All I do know is that every time I try another mail client, I just get frustrated by how long it takes to go through my e-mail. Well, that, plus try to navigate a GUI e-mail program with vi key bindings—it (usually) doesn't work.

Why try other mail clients if I love mutt so much? Well for one, some of the other mail clients do have a few interesting features, such as virtual folders. With a virtual folder, you can create a keyword search, and then all messages that match the search end up in a special folder you can browse. Well, it turns out, the same functionality is available in mutt if you use maildirs and are willing to do a little scripting.

One major problem with the default search abilities in mutt is that you can search within only one folder at a time. I store just about everything that's important in e-mail, and I have many different folders with even more procmail

With a virtual folder, you can create a keyword search, and then all messages that match the search end up in a special folder you can browse.

rules to sort incoming mail between them. The downside to this is occasionally I can't remember exactly in which folder a particular e-mail message is located.

The solution to the mutt search problem takes advantage of the fact that if you use maildirs on your mail server, each folder is a directory on the server, and each e-mail message is a file within that directory. Basically, a script can go through each of your folders and grep for your keyword and then create a new maildir with symlinks to any matching files. I named my solution maildirsearch, and it looks something like this:

```
#!/bin/sh

MAILDIRS="$HOME/mail"
VFOLDER="search"
VFOLDERPATH="$MAILDIRS/$VFOLDER/cur/"
FOLDERS=`ls $MAILDIRS | egrep -v
"search|flagged"`

rm -f $VFOLDERPATH/*

for i in $FOLDERS
do
    for j in `egrep -LR "$@" $MAILDIRS/$i`
    do
        ln -s $j $VFOLDERPATH/;
    done;
done;
```

Next, I created another script called muttsearch that would execute my maildirsearch script, then open a new instance of mutt that reads the new virtual search folder. One nice feature of using this method is that I can see the search results grow within the mutt window and start reviewing results immediately:

```
#!/bin/sh

VFOLDER="search"
$HOME/bin/maildirsearch "$@" &
sleep 1;
mutt -f "$VFOLDER" && killall maildirsearch >/dev/null 2>&1
```

Finally, I set up a key binding in mutt so that I could press Esc-S, type in a keyword (or regex) and start the search:

```
macro index \eS "<shell-
escape>$HOME/bin/muttsearch \"\"
macro browser \eS "<shell-
escape>$HOME/bin/muttsearch \"\""
```

Now, there is a downside to this script—it's designed to be run on the server that stores the messages. In my case, I use a tool called offlineimap to sync my remote e-mail server with my laptop, so I

always have a copy of my messages locally. If you don't want to go that route, but want to be able to search from your local machine, you potentially could modify my muttsearch script so that it SSHes into your mail server and executes the script.

The script actually works well for me, but I realized after some time that I did a lot of the same searches over and over again. For instance, I am a heavy user of the "flag for follow-up" function in mutt. If you are in the message index and press the F key, it sets a flag on the message and displays an exclamation point in front of it. I use this to remind myself that I need to reply to a message. The downside to this is that I have to go to a particular folder regularly to see the flag, and sometimes I want to see all of my flagged messages at once. It turns out that the same virtual folder concept I used for my search works well for this too.

First, I created a script called flag-folder. When you flag an e-mail in a maildir system, the e-mail gets an F added after the last comma in the filename. Basically, my flag-folder script searches through all my maildirs for files that match the pattern and then symlinks those files into a new maildir named flagged:

```
#!/bin/sh

# This script finds all the flagged e-mail in a
# Maildir and symlinks them to a 'flagged' folder
# in the Maildir.
# To run it every 5 minutes, for instance, add the
# following to the user's crontab:
#
# * * * * * /home/greenfly/bin/flag-folder

MAILDIR="$HOME/mail/" # path to your maildir
FLAGGED="${MAILDIR}/flagged/cur" # path to your
# (precreated) flagged folder

cd $FLAGGED
rm ${FLAGGED}/*

# find all the files in the maildir, then search for
# flagged files (files with an F after the last comma
# in the filename) and symlink them
find ${MAILDIR} -type f | perl -ne ' $foo = ""; $foo =
  (split ",", $_)[-1] if(/,/); if($foo =~ /F/){chomp;
  system "ln -s $_ .\n";}'
```

As you can see in the comments in the script, you also simply can set this up as a cron job on your mail server so that your flagged folder is updated constantly. Then, I created a script similar to my muttsearch script called muttflag that basically does the same functions, except for the flag-folder script:

```
#!/bin/sh

VFOlder="flagged"
$HOME/bin/flag-folder &
sleep 1;
mutt -f "$VFOlder";
```

Finally, I created another key binding so that pressing Esc-F executes the muttflag script:

```
macro index \eF "<shell-escape>$HOME/bin/muttflag \n"
macro browser \eF "<shell-escape>$HOME/bin/muttflag \n"
```

There are a lot of other possibilities when you use virtual folders in mutt. So far, the only big downside I have found is that because the script uses symlinks, any flags applied to messages within virtual folders don't apply to the real message. For instance, if you reply to a message within a virtual folder, it updates the filename for the symlink, but not the file it links to. Essentially, this means you lose that reply flag unless you go to the original folder and reply.



Apart from the downsides though, I'm pretty happy with virtual folders in mutt. Once again, it's faster than searches I've seen in other clients, plus I get to keep my vi key bindings, which you can have when you pry them from my cold, dead IBM Model M keyboard. ■

Kyle Rankin is a Senior Systems Administrator in the San Francisco Bay Area and the author of a number of books, including *Knoppix Hacks* and *Ubuntu Hacks* for O'Reilly Media. He is currently the president of the North Bay Linux Users' Group.

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2.6 Kernel

Setting up a Panel PC can be a puzzling experience. However, the PPC-E7 Compact Panel PC comes ready to run with the Operating System installed on Flash Disk. Apply power and watch either the Linux X Windows or the Windows CE User Interface appear on the vivid color LCD. Interact with the PPC-E7 using the responsive integrated touch-screen. Everything works out of the box, allowing you to concentrate on your application, rather than building and configuring device drivers. Just Write-It and Run-It. Starting at \$495.

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Good OS's gOS Gadgets

gOS Gadgets, from the company Good OS, has been upgraded to Version 3. gOS Gadgets utilizes the diminutive and open-source Google Gadgets for the Linux platform to help PC OEMs make more affordable, consumer-friendly Netbooks and Nettops. New in the upgraded gOS Gadgets is an expanded, more stable release of Google Gadgets for Linux that offers users access to more than 100,000 Google and iGoogle Gadgets that decorate the desktop with live, personalized Internet content. It also features a unique user interface with big icons that launch Google applications in Mozilla Prism, a browser that makes Web applications feel more like desktop applications. gOS Gadgets is available for free download from Good OS's Web site.

www.thinkgos.com



Promise Technology's SuperTrak EX16650 16-Port RAID Controller

Promise Technology stresses comprehensive Linux support on its new 16-Port RAID Controller, the SuperTrak EX16650. The EX16650 and the rest of the SuperTrak EX RAID controller family now officially supports more than 15 different Linux kernel distributions in addition to the company's open-source Linux drivers. The devices also now have native "inbox" driver support in all major Linux distributions. The EX16650 provides 16 ports of SAS/SATA connectivity, eliminating the requirement for a separate expander in most applications. Promise says the controllers are ideal for enterprise data solutions, such as enterprise storage servers, network backup, disk-to-disk backup, security and surveillance, video editing and digital content creation.

www.promise.com

Terracotta

The open-source Java clustering solution Terracotta has added a tick to the tenths column, landing at Version 2.7. The makers of Terracotta claim their application lowers costs and simplifies Web application deployment by reducing development effort and easing the load on application servers and databases, making it a solution well suited for scaling critical applications. Because Terracotta offers "the performance of local memory with the high availability of a database", it eliminates the "unyielding performance and reliability trade-offs that constrain many Java applications today". Version 2.7 also extends support of the Spring framework and the Glassfish application server, plus features that enhance scalability, performance and operational visibility.

www.terracotta.org

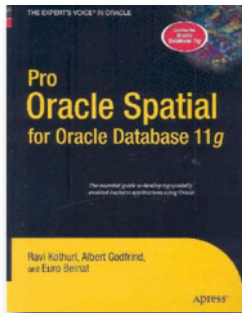


Fonality's HUD Unified Communications Platform

In telecom news, Fonality recently announced it will provide its HUD 3.0 unified communications software to the open-source trixbox Community Edition (CE) platform. Trixbox is the world's largest free and open-source telephony project. As a result, trixbox CE users will enjoy presence management and detection in a single interface for all types of office communications, including SMS, instant message, land-line calling, mobile calling, chat, voice mail, e-mail, conferencing, recording and barging. They also will have a "secure and affordable way to support remote and home-based workers", says Fonality. Fonality adds that its contributions will "bring the polish of the HUD 3.0 unified communications platform, which is in use by more than 100,000 paid users, to the trixbox community".

www.fonality.com

TERRACOTTA



Ravi Kothuri and Albert Godfrind's *Pro Oracle Spatial for Oracle Database 11g* (Apress)

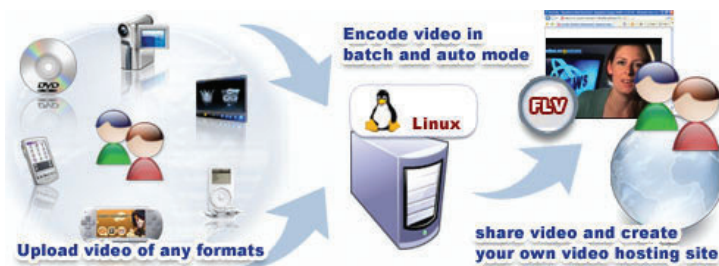
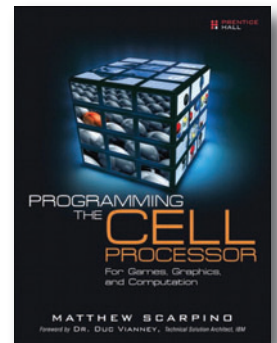
Apress is venturing into the under-published topic of geospatial data management with its new book *Pro Oracle Spatial for Oracle Database 11g*, by authors Ravi Kothuri and Albert Godfrind. The book is targeted at software developers who want to develop applications using Oracle's extensive built-in support for working with spatial, or geocoded, data. The book addresses issues such as the special nature of spatial data and its role in professional and consumer applications; the modeling, storing, accessing and analyzing of spatial data; the Oracle Spatial solution and the integration of spatial data into enterprise databases; and how spatial information is used to understand business and support decisions. Other topics include the SDO_GEOMETRY data type, geocoding of data, map creation, network modeling and optimizing analysis of spatial data.

www.apress.com

Matthew Scarpino's *Programming the Cell Processor* (Prentice-Hall)

The Cell processor is the linchpin that enables the world's fastest supercomputer, IBM's Roadrunner, so it likely will add wings to your application too. Matthew Scarpino's new book *Programming the Cell Processor*, published by Prentice-Hall, shows how to create applications that harness the power of IBM's powerful Cell processor. Oriented toward game developers, graphics programmers and engineers, the book covers everything from the Cell's advanced architecture to its tools and libraries, presenting code examples that help you gain a deep understanding of Cell development. Topics include mastering the Cell SDK, understanding Cell's PPU, programming the Synergistic Processor Unit and more.

www.informit.com



Sothink's Video Encoder Engine for Adobe Flash

If your next mission is to bump off YouTube with your own video-hosting site, Sothink hopes you'll choose its new solution, Video Encoder Engine for Adobe Flash, to do so. This Linux-based encoder can convert nearly any popular video format to FLV and can be utilized on Web servers, blogs, forums and other interactive sites. The

product also enables advanced video editing, batch conversion, quality control and other tasks with CGI or any other server-side scripting language. A demo video-hosting site, complete with source code and written in PHP, is included. Other functions include full control of video and audio quality and characteristics.

www.sothinkmedia.com

Astaro's Mail Gateway

Astaro offers that its new Mail Gateway appliance trumps its competitors by being "the only security vendor that provides e-mail encryption free with its mail gateway solution". Targeted at small- to medium-size businesses, the Mail Gateway also features virus protection and remote exchange access and runs transparently at the gateway to eliminate need for employee action. Removing individual employees from the encryption process, says Astaro, significantly lowers the chance that confidential data may be sent accidentally in plain text across the Internet. Astaro's encryption is based on standards, such as S/MIME, OpenPGP and TLS, and allows for scanning of encrypted e-mail for malware. In addition, Astaro's solution complements traditional antispam technologies with reputation-based filtering.

www.astaro.com



Please send information about releases of Linux-related products to newproducts@linuxjournal.com or New Products c/o *Linux Journal*, 1752 NW Market Street, #200, Seattle, WA 98107. Submissions are edited for length and content.

Fresh from the Labs

OpenNetAdmin— AJAX/Browser- Based Network Manager

(opennetadmin.com)

Born out of dissatisfaction with expensive commercial tools and the direction taken by most network admin projects, OpenNetAdmin (ONA) takes a different approach to network administration while making the task of administration a little bit nicer in the process. Project founder Matt Pascoe found commercial tools, such as Lucent QIP, Infoblox and Bluecat, to be okay, but they're expensive and clunky for certain tasks, and they don't follow the *nix principal of modular functionality. All of the open-source tools he found, such as IP-Plan/IP-Track, had big usability issues, and the Java interfaces always annoyed him, so a Web-based AJAX interface made more sense. After coming up with a bunch of cool ideas and methods with his former coworkers, Matt couldn't let all of them go to waste, so he re-created his own variant that would work in a general sense for the Open Source community.

ONA is meant to play a more authoritative role in your environment. Many tools want to go into a discovery mode and tell you what is in your network, while all the time adjusting your data. In contrast, ONA tells the network what it should have in it. This way, you can (hopefully) trust your own data to help you configure your environment the way you want it, but still utilize things like DHCP and its dynamic nature. ONA also is designed to help with auditing your network, and it's geared toward helping configure your routers/switches/firewalls/nagios/cacti or pretty much anything for which you want to create an output template. The GUI also is an important element of ONA, designed to flow easily with familiar elements, such as pop-ups, search as you go and so on.

Installation First, you need a basic LAMP installation of Apache, MySQL and PHP, or you'll be going nowhere fast.

Matt recommends installing the following packages:

- libapache2-mod-php5
- php5-mysql
- php5
- apache2
- mysql-server

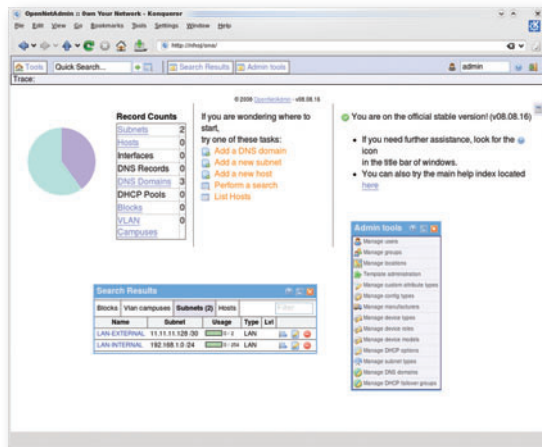
Once you've got the LAMP side of things sorted out, head to the ONA Web site, grab the latest tarball and save it somewhere locally. Once the download has finished, open a terminal in the directory where you saved the tarball, and enter the following commands as root or using sudo:

```
# tar -C /opt -zxvf ona-v000.00.00.tar.gz
# ln -s /opt/ona/www /var/www/ona
# touch /var/log/ona.log
# chmod 666 /var/log/ona.log
# chown www-data /opt/ona/www/local/config
```

(If you know what you're doing here and use a different Web server user, feel free to replace the user name.)

These steps should cover most circumstances, but alternative steps can be taken if you prefer more customization or if it simply doesn't work on your system. Check the installation documentation under docs/install in ONA's tarball for more information.

Usage ONA is a browser-based program, so open up your favorite browser and head to <http://<servername>/ona>. If you don't know your server name, localhost should work in most cases. This should take you to a License Agreement screen, but if you get a request to save a PHTML file instead, try another browser and check that PHP is installed properly (on my Ubuntu machine, for some reason it didn't work on Firefox, but it worked straightaway in Konqueror).



Network administration made clean and simple with OpenNetAdmin.

After the License Agreement, you'll go to a screen where you need to assign passwords to the default users and user names (which you can change if you prefer). There also will be a number of prerequisite checks—ensure that they are set to Yes. After that, you now should be on the main ONA screen. When you start out in the main screen, you will be acting as a Guest by default, so you need to log in as admin. Click in the field near the top right where it says Guest, and enter admin in that field. After you've done that, a password box appears; enter admin there as well.

Now that you're all set up, it's time to explore. In the middle of the screen is a group of the main tasks you will be performing, such as Add a DNS domain, Add a new host and so on. If you look at the top left of the screen, there's a button called Tools. This contains a menu of all the tasks just mentioned as well as a host of other options. However, the most important option is Admin Tools (which also happens to be in the top center of the screen). This has some powerful options, such as managing DHCP, device models and roles, subnet types, users, groups and more. Information on pretty much every ONA networking task is available in some form or another, and some kinds of information seem to be available in lovely pie-chart form—perfect for boardroom types.

Unfortunately, I just don't have the space in this column to give this program justice, so hopefully we can cover it in a more detailed form some time in the future. ONA is chock-full of options; the GUI is pretty nice to use, and the aesthetics are pleasant—all of which will hopefully draw some new users into the world of Net administration. Nevertheless, some potential users may run away in fear of the command line, so hopefully, the installation process will benefit from distro-specific packages in the future (and in turn, hopefully, ONA will make its way into major distributions soon as a great admin tool). And, for those who want to jump in and try it without going through all the nasty installation stuff, check out the on-line demo (demo.opennetadmin.com).

Vocatra—Text-Mode Vocabulary Trainer

(vocatra.esite.ch)

I'm always keen to bring you ever more niche-market stuff, and here's the latest little project I've found. Vocatra is a vocabulary trainer with a twist. It works in a terminal as text only—no GUI. I'm guessing there's a demographic for that—perhaps an Apache system administrator who wants to brush up on five minutes of Japanese while he's logged on by Telnet.

```

nhoj: bash
File Edit View Scrollback Bookmarks Settings Help
nhoj@nhoj:~$ vocatra vocabfile.txt
start...
jira
who
correct
samaja
ner
correct
pawa
tsoid
correct
Finish (Words: 8; Inquiries: 3; Mistakes: 0; Error rate: 0%; Time: 0:13)
nhoj@nhoj:~$
  
```

Vocabulary training by command line? Guess so, it's Vocatra!

Installation Deb and RPM packages are available at the Vocatra Web page, as well as a source package, and as usual, I cover the source version here for the sake of remaining bleeding edge. Grab the latest tarball from the

Web site, extract the contents, and open a terminal in the new directory. Compilation is a doddle, as it's the standard process of:

```
$ ./configure
$ make
```

And, as root or sudo:

```
# make install
```

Usage Once the source has com-

pleted and installed, start the program by entering `vocatra`. However, it will return an error message about missing a vocabulary file. This is normal, and for the moment, you will need to make your own vocabulary file. It sounds like a pain, but it's genuinely easy to do, and it allows you to define the words with which you want to train, as opposed to some projects that just grab random words from a dictionary file (where you're just as likely to come across words like

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Projects at a Glance

Kuklomenos—Weird Space Shooter?

(mbays.freeshell.org/kuklomenos)



Kuklomenos—if you work out this game, let me know!

Kuklomenos has to be one of the weirdest games I've ever come across. I'm not doing a full review here, because I simply can't figure it out! If you want to compile it, go right ahead; it's easy with the usual `./configure, make, make install` routine. But, once you get into the game, be prepared to be puzzled. I think it's a space shooter, because the background is black, but that's just a guess! Your goal is to fight off blobs with a strange control scheme that involves zooming, rotation and fire accuracy—all in a playing style that's like *Asteroids* rewritten by a French existentialist on crack. Intrigued? Check it out!

GnoMint—Graphical Certification Authority Management, X.509

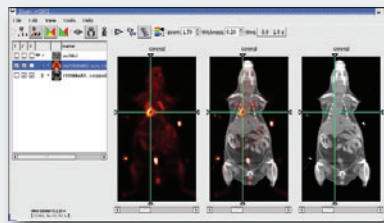
(gnomint.sf.net)

Unfortunately, I couldn't bring this project to you properly this month, as project maintainer David Marín Carreño ran into some security holes that needed plugging before it was ready for the mainstream. However, the end results of this project look promising. Imagine you're trying to establish an IPsec VPN. If you want

some actual security, you need X.509 certificates for all employees. At this point, you either can buy the certificates from an external CA (which costs money), or you can establish your own CA. Establishing your own CA always has been a bit of a pain. With OpenSSL, you need to use a console and log commands with a lot of obscure parameters. You could use other programs for managing CAs, but most of them are Web-based, and all you really want is a simple GUI application. GnoMint steps up to the plate here with a simple app that fits the bill nicely.

AMIDE—A Medical Imaging Data Examiner

(amide.sourceforge.net/index.html)



After running out of plot lines, CSI has turned its efforts to dead mice.

I was instantly taken by the screenshots for this program. AMIDE is a tool for viewing, analyzing and registering volumetric medical imaging data sets. It uses the GTK+ toolkit and runs on any platform that supports GTK+. Follow the link to the main page, and you'll be greeted with some amazing screenshots of what appears to be the human body and various anomalies. Follow the link to Sample Data Sets, and you'll see scanings of fluoride-injected mice that you can examine in full morbid detail! Whether you're scanning Ripley for gestating aliens or even using it for standard medical analysis (but that's just silly), AMIDE may be just for you!

helicopter and prophylactic in the same lesson instead of something more pertinent). To make a vocabulary file, simply make a new text file and enter any words you want to train with the following syntax:

```
Foreign word=meaning1,meaning2,meaning3,etc.
```

Here's an example from the Web site:

```
Chef=chief,boss
```

The foreign words and native definitions are separated by an equal sign (=), and multiple synonyms are separated with a comma (,). If you want to make any comments in the text file, add a number sign (#) in front of a line (in keeping with the style of most modern programming and scripting languages). Check here for an example file in German and English: vocatra.esite.ch/examples/animals-de-en.txt.

Once you have made your vocabulary file, you can start Vocatra by entering the following:

```
$ vocatra vocabulary-file.txt
```

Vocatra now presents the words you want to train with, and it's up to you to provide the answers. Once you've finished the lesson, a summary at the bottom of the screen tells you how many words you covered, how many mistakes you made, your error rate and the time it took you to complete the lesson.

Ultimately, this is a great little niche program that's going to make a geek somewhere very happy. And, given its tiny size and simplicity, I can't see why it wouldn't be included in good educational distros. Hopefully, a community of users will pool around this program, as it would be great if someone took the time to make a series of lessons that you could use right off the bat (rather than making your own).■

John Knight is a 24-year-old, drumming- and climbing-obsessed maniac from the world's most isolated city—Perth, Western Australia. He can usually be found either buried in an Audacity screen or thrashing a kick-drum beyond recognition.

Brewing something fresh, innovative or mind-bending? Send e-mail to knight.john.a@gmail.com.



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HARDWARE

OpenMoko's Neo FreeRunner: Open to the Core

The Neo FreeRunner has it all—Wi-Fi, Bluetooth, accelerometers—and best of all, it runs Linux. CORY WRIGHT

Okay, I'll admit it. I have a love-hate relationship with the Neo FreeRunner. But please, let me explain.

For more than a month now, I have carried the FreeRunner around with me. It is just such a cool little gadget, and I love what it represents: a completely open mobile device, the hardware and all. For those who are not familiar with it, the Neo FreeRunner is the highly anticipated mobile phone from the folks at OpenMoko. Although its previous phone, the Neo 1973, was targeted at hard-core developers, the FreeRunner "is a Linux-based touchscreen smartphone ultimately aimed at general consumer use as well as Linux desktop users and software developers".



OpenMoko's Neo FreeRunner

Even though the goal is eventually to have a general-purpose, consumer-friendly phone, the FreeRunner is not quite ready for the prime-time phone market just yet. The OpenMoko team is fully aware of this, and became slightly uneasy when they learned that *Linux Journal* wanted to write a review. As such, the aim of this article is not to talk much about the FreeRunner as a phone, but rather as a handheld Linux device for developers.

A Dream Device

A Linux geek couldn't ask for a better-equipped device than the FreeRunner. It comes with a 400MHz ARM processor, 256MB internal Flash storage, 128MB RAM and a microSD card slot for extra storage. The wireless capabilities of the FreeRunner also are impressive. It comes with tri-band GSM (with the option of either 850MHz or 900MHz on the low end), as well as GPRS, Bluetooth and Wi-Fi (using the Atheros AR6K chipset). To make things even more fun, the OpenMoko crew included two accelerometers and an assisted GPS chip. The device is a little bulky though, as it measures in at 120.7x62x18.5 millimeters and weighs around 180 grams. The FreeRunner is available on-line from openmoko.com for \$399. If you plan to use it for serious development, you also may consider purchasing the \$99 debug board that can be used to access the serial console.

One of the more exciting features is the FreeRunner's ability to boot from microSD cards. This means you can test other Linux distributions by installing them on microSD cards without formatting the main distribution that is installed in Flash. This flexibility is very exciting, and it offers an easy way to try before you buy.

The hardware definitely is appealing, but the most attractive thing about the FreeRunner is that it was built to run Linux. Although the official distribution of the FreeRunner is OM 2008.8, other options are available. Trolltech, the creators of Qt, produce the Qtopia distribution that runs very well on the FreeRunner. And, if you prefer a less-watered-down distribution, you'll be glad to learn that Debian also is available, in almost its entirety. Recently, an effort to port Gentoo to the FreeRunner has been started, and I'm sure other distributions will follow suit soon.

As a Phone

As I've said, I don't plan to spend much time talking about the FreeRunner as a phone. However, any review of a device that

is sold as a phone wouldn't be complete without at least covering the basics. Unfortunately, the basics are about all there is to go on. The call quality is rather poor, and recipients of calls reported lots of static and popping on their end. Also, the interface is quite awkward, especially for advanced features, such as call waiting. There is no clear way to adjust the volume, because there is no hardware volume control button. Text messaging is incredibly tedious, due to the impossibly small on-screen keyboard.

There is a lot of room for improvement with the phone software. Much work needs to go into improving call quality before I would consider using the FreeRunner as a primary phone.

As a Geek Toy

Because I decided not to use the FreeRunner as a phone, I thought it might be more interesting to install a full-featured Linux distribution. I chose Debian, as it is easily available, has a wide selection of packages and is the distribution with which I have the most experience.

The easiest way to install Debian is to run the install.sh shell script that is available from the DebianOnFreeRunner wiki page. You need to have an already-working installation of Linux installed on your FreeRunner, and it needs access to the Internet. You can use your desktop Linux PC or an installation of Linux in a virtual machine, such as VMware Fusion on Mac OS X.

It is quite easy to route traffic from a FreeRunner through a Linux PC. Each of the available distributions use the same default networking configuration and give the FreeRunner an IP of 192.168.0.202. Plug the USB cable in to the FreeRunner and your PC, and run the following commands:

```
# iptables -A POSTROUTING -t nat -j MASQUERADE -s 192.168.0.0/24
# sysctl -w net.ipv4.ip_forward=1
# ifconfig usb0 192.168.0.200
```

If your network is already using 192.168.0.0/24, you may need to use a different subnet mask. Once the USB network link is up, you should be able to SSH into the FreeRunner as root, with a blank password:

```
# ssh root@192.168.0.202
```

You may find that DNS is not resolving correctly from within the FreeRunner. To correct this, simply add an OpenDNS cache address to the FreeRunner's /etc/resolv.conf:

```
# echo nameserver 208.67.222.222 >> /etc/resolv.conf
# echo nameserver 208.67.220.220 >> /etc/resolv.conf
```

If your supported microSD card is placed in the FreeRunner, you can begin installing Debian onto it:

```
# wget http://pkg-fso.alioth.debian.org/freerunner/install.sh
# DASH_BINSH=false SD_PART1_FS=vfat sh install.sh
```

Here, we set the DASH_BINSH environment variable to false, so that the script installs the Bash shell instead of Dash. The SD_PART1_FS variable is set to vfat, so that the /boot



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- 930w Red PS.



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- Quantity 42 Installed.
- 1GB 667MGZ FBDIMMs.
- Supports 32GB FBDIMM.
- 40X250GB htswap SATA-II Drives Installed.
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partition on the SD card will be formatted with vfat instead of ext2. Some versions of the FreeRunner's bootloader, u-boot, do not support ext2, and although there are ways to remedy this, it simply is easier to use a vfat-formatted partition. You should have Debian installed within the hour, depending on the speed of your Internet connection. I must say, the Debian installers sure have improved a lot since the Potato days.

You might have noticed that I said "supported microSD card". According to the FreeRunner, all microSD cards are equal, but some microSD cards are more equal than others. The OpenMoko wiki has a page that lists all microSD cards that are known to work with the FreeRunner. I consulted this page and purchased two Kingston SD-C02G 2GB microSD cards. The FreeRunner recognized the cards, and I was able to partition them and write files to them. However, during installation, I received errors that were apparently related to the SD media. I replaced the 2GB Kingston card with the 512MB SanDisk card that came with the FreeRunner, and the installation worked flawlessly. I later transferred the partitions from the 512MB card to the 2GB using my Kubuntu desktop PC.

Once installation is complete, you will want to reboot into Debian. First, power off your FreeRunner. Once it has safely powered down, press and hold the AUX button (on the top-left side of the device), and press the power button until the u-boot menu appears. Press the AUX button until "Boot from SD" is selected, then press the power button again. After a minute or two, the phone interface should appear and you should be able to make and accept phone calls, provided you are using a supported SIM card.

As with microSD cards, the FreeRunner is rather picky about which SIM cards it accepts. When I first began testing the FreeRunner, I was using a first-generation iPhone as my primary phone. The SIM from my iPhone worked perfectly in the FreeRunner. A couple weeks later, I bought an iPhone 3G and received a new SIM with it, which also worked well with the FreeRunner. I eventually returned my 3G iPhone and received another new SIM card from AT&T. The FreeRunner would not register with the AT&T network via the new SIM. I tried a T-Mobile SIM to make sure there were no hardware problems, and it worked fine. After many, many hours of struggling with this issue, I finally discovered that there is a bug in the FreeRunner firmware that causes problems with certain SIM cards (OpenMoko bug #666). My previous SIM cards had a vendor and version number of 4022; however, the new SIM I received from AT&T had vendor and version number 2022. Unfortunately, the 2022 cards are newer and do not work with the FreeRunner. As it turns out, the OpenMoko wiki has a page that lists the compatibility status of various SIM cards. The good news is that once I figured out the problem, I was able to visit a local AT&T store and request a new 4022 SIM card, which they happily gave me.

It's the Little Things

Although most of us are quite familiar with open-source development, we normally get that experience only with software. It is one thing for JavaScript bugs to exist in our WordPress blogs, because it is easy to overlook and we know it probably will be fixed soon. However, I discovered that there is something different when dealing with open-source

hardware. Most mobile devices go through months of testing and QC and are, therefore, typically ready for daily use in the real world. Applying the open-source mentality to something like a mobile phone is actually pretty challenging. Although I may excuse WordPress for the JavaScript bug, I fully expect any and every microSD card and SIM card to work with a phone I've purchased. But, I guess that is the price of freedom, flexibility and openness.

Although the FreeRunner includes all the internal components you need to develop something interesting, a few things are frustrating and could use improvements. For example, there is no hardware volume control and no way to switch to vibrate mode. Now, the FreeRunner has two buttons that can control software, so it may be just a matter of implementing the feature, but this is something that should be present on every phone. There are only two hardware buttons on the phone, which in itself isn't bad. However, the buttons are placed in awkward places on the sides of the phone. It is quite difficult to press either button while holding the phone in one hand. Powering on the device can be rather tricky, as you must hold the power button for just the right amount of time in order to get the device to boot. My girlfriend was unable to power on the FreeRunner even after studying it for a few minutes.

The phone charges over its USB port, which is quite convenient, but unfortunately, the port also is located in an awkward spot. It is difficult to make a call while the phone is plugged in, as the port is on the right-hand side of the phone, where your hand is normally gripping the phone.

Also, the battery must not be completely drained. According to the OpenMoko wiki, "this is an issue because the internal charging circuitry cannot be turned on until the FreeRunner has booted, and booting through USB power alone does not work." It's the little things.

It's also the big things, like the stylus that comes with the FreeRunner. Every time I showed the FreeRunner to people, they laughed (out loud) when they saw the enormous stylus. In addition to being a stylus, it also functions as a full-sized pen, a flashlight and a laser pointer. Making matters worse, it contains four small batteries (to power the flashlight and laser pointer) at the opposite end from the tip that weigh it down and make it difficult to focus on small points on the screen, such as the keyboard. The "Matchbox" keyboard that is provided with the Debian distribution is marginally better than the one used by OM 2008.8 and Qtopia, but they both are painful to use.

I also found it rather annoying that I needed to remove the back of the case, the battery and the SIM card to swap out the microSD card. I was really looking forward to being able to boot multiple distributions during testing, but having to jump through these loops made that task a bit more tedious.

Speaking of loops, for the life of me, I cannot figure out why there is a lanyard loop on the bottom of the phone.

Oh, and it would really be nice if the FreeRunner provided a standard headphone jack rather than the 2.5mm jack that is included.

The Future of OpenMoko

Despite these issues, I still feel that the OpenMoko team is doing tremendous work, and I am continually impressed as

I dig deeper into the project. They are very clear that the FreeRunner is just a canvas for the community to build upon, as stated in this quote from OpenMoko developer Sean Moss-Pultz:

Think of our products as museums. We're building the environment. Each one different from the next. You'll get all the free art supplies you could imagine because we want you to add your own meaning. You choose: consume, create or both. Either way, you create your own meaning. It's about you.

I think that the OpenMoko team should reconsider the goal of eventually producing a consumer-usable phone. There are already plenty of those, and there isn't much else out there that is similar to the FreeRunner. Personally, I love the fact that I can run Debian on my phone. Having said that, I think there are a few areas where the OpenMoko team should focus their efforts.

First, the phone stack really needs work. The FreeRunner becomes a much more compelling alternative when I can use it as a phone. The call quality is currently bad enough that I would not recommend relying on it as your primary phone. I would rather carry a single device, rather than the FreeRunner in addition to a phone.

Second, the documentation is a mess. There is a lot of information on the OpenMoko wiki, but it is horribly organized, poorly written and often out of date. Many pages seem to hold the answer to your question, until you realize that the page was written for the Neo 1973, the FreeRunner's predecessor. Although a wiki follows in the spirit of a community-organized project, I'm not sure it's the best way to present official documentation. I spent a lot of time reading the wiki, only to become more confused.

Finally, OpenMoko should make a strong effort to support more microSD and SIM cards. Dealing with these two issues was probably the most frustrating thing about my experience with the FreeRunner.

Oh, and a note for the OpenMoko Marketing department. The people who buy the FreeRunner at this point are doing so because they really want to get involved and play with this cutting-edge device. This is the community; these are your fanboys and fangirls. They will support you and advertise for you, so how about including a couple OpenMoko stickers in the box?

I look forward to seeing what develops around OpenMoko and the Neo FreeRunner. There is still a long way to go before it is a usable phone, but as a geek gadget, the FreeRunner

is a lot of fun. Linux geeks don't mind getting their hands dirty, so it is nice to have a gadget that can challenge us. ■

Cory Wright has been using Linux since 1998, and mobile phones even longer. He is a developer and sysadmin at natuba.com, where he enjoys beating Will Reese at foosball and Wii Tennis. His Web site is at dnsfool.com.

Resources

OpenMoko Web Site: www.openmoko.com

OpenMoko Community Wiki: wiki.openmoko.org

Debian on the FreeRunner:
wiki.debian.org/DebianOnFreeRunner

Supported microSD Cards:
wiki.openmoko.org/wiki/Supported_microSD_cards

Supported SIM Cards:
wiki.openmoko.org/wiki/Carriers/ATT

OpenMoko's Sean Moss-Pultz on Design:
tinyurl.com/57r334

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HARDWARE

Dash Express

You are always on the Internet, so why shouldn't your GPS be? Read on for a review of the Dash Express GPRS-connected GPS system. KYLE RANKIN

I spend a lot of time in my car. Like a fair number of people who work in the San Francisco Bay Area, I commute a long distance—in my case, 60 miles one way. I've learned to time my commute to avoid the worst of the traffic, but I still spend about three hours each day in my car. I've tried different GPS (Global Positioning System) units here and there, but because most of my time in the car is spent going to the same place, I don't typically need a lot of driving directions. A GPS would sit unused only until I travel or go to a new restaurant, which is only every once in a while.

Introduction to the Dash Express

Now, I like gadgets at least as much as the next Linux geek, so when I first heard about the Dash Express GPS, I instantly was intrigued. Basically, Dash has created a new GPS unit aimed at the commuter market. This GPS adds a GPRS cellular connection, so that it has an always-on Internet connection while you drive. The Internet connection can be used to get new software updates and maps, but one of the main selling points for the Internet connection is improved traffic, routing and search data. The Dash network keeps track of each GPS unit anonymously and combines its data with traffic sensors and other data points to gauge up-to-the-minute traffic data it then shares with each Dash user.

The Internet connection also allows the Dash Express to source other Internet services when you do a search. Along with the built-in database of locations of interest, you also can search Yahoo for anything from the closest coffee shop to the best sushi place nearby, as Yahoo searches not only return locations but also ratings for each result.

One of the most interesting aspects of the Dash for me and other Linux users is the open-source nature of the device. For one, the hardware itself runs Linux. The hardware is actually similar to what is being used in the OpenMoko cellphones. In addition, Dash has opened its API, so interested parties can register as developers and write their own applications to run on the Dash Express. Later in this review, I talk about my own experience writing a Dash application.

Pricing

Of course, the GPS unit and cellular connection aren't free. The Dash Express currently retails for \$299 and includes three months of free cellular connection. After that, the cellular connection costs \$12.99 with a month-to-month contract, \$10.99 per month with a one-year contract and \$9.99 per month with a two-year contract. If you choose not to renew the cellular connection, the unit still functions like a standard GPS, but you no longer will be able to use Send2Car, Dash applications, Yahoo searches and other features that require the Internet.

Standard GPS Functions

Although the Internet features might seem cool, a GPS device still needs to be able to find your destinations and route you there correctly. Plus, if you don't renew the cellular connection, you'd like to know that the device still would be useful. First, though, let me point out the elephant in the room. One of the first things you will notice about the Dash Express is that it is *big* compared to other modern GPS devices (4.8" Wx4.1" Hx2.8" D and 13.3 ounces). Although the face of the device is about the same size as other devices, it's as thick as the Garmin GPSes from a few generations ago. Along with its thickness, the top of the device actually extends back a few inches in a sort of L shape and houses the speaker. Unfortunately, this means you won't be storing the Dash Express in your pocket or possibly even in a small glove compartment.

The installation is pretty straightforward, and out of the box, the device will connect to a cellular network (or open Wi-Fi access point) for any Internet features. The interface itself is simplified compared to some other GPS units and relies almost entirely on the touchscreen for input, apart from a physical menu and volume button on the top of the device. When you calculate a route, you will see and hear turn-by-turn directions from the main map screen. The interface is pretty clean (Figure 1) with most of the screen taken up by the map.

As a standalone GPS, the Dash is so-so. A few times I searched for a business only to find that when I got there it was out of business. The routing isn't entirely perfect either and seems to favor larger highways and more direct routes, even if they are slower. My town has four different exits on the highway, but even though the first exit is the fastest, the Dash always routed through a different exit. There is a particu-

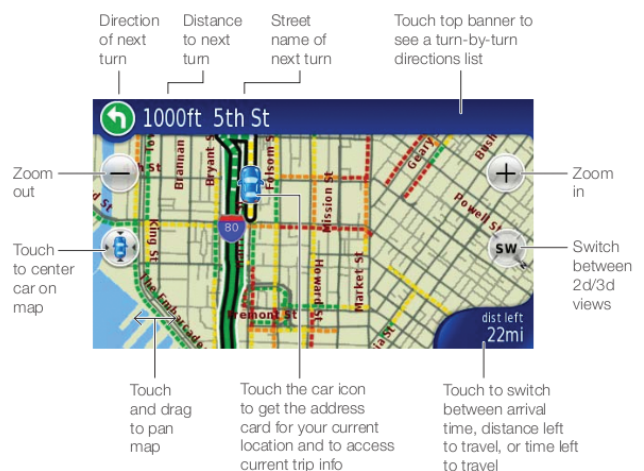


Figure 1. Dash Express Interface

larly bad bottleneck along my commute that occasionally backs up for miles. There's an alternate route to my house right before the bottleneck that normally takes longer except when there is very heavy traffic at the bottleneck, but the Dash seemed unaware of this as an alternate route.

The Dash does appear to be dealing with the routing issues actively. You can report a problem directly from the device, and it will tar up all of its logs and other information about your current location and send it off to Dash via the cell connection. Once you get home, you will see an e-mail response in your inbox, and you can go to Dash's Web site to fill out the details of your problem. I did, in fact, report an issue with routing around the bottleneck, and Dash was quick to respond. Apparently, the next iteration of its map and routing internally does not have the issue, so presumably my problem will be fixed at the next update.

Connected GPS Functions

There are a lot of different GPS units from which to choose, but the Dash Express is the first to include a cellular connection in its device. It really is the main feature that differentiates it from competitors, so it's even more important that this extra functionality is compelling. So, how do the Internet features fare?

When the Dash Express has a cellular signal, you will see the word connected on the search button at the main menu. Without a cellular signal, you can perform only local search, and the rest of the search options are grayed out. When connected, the default input box at the search window searches Yahoo for keywords you enter. In addition to the Yahoo searches, there are a number of saved search categories, including Airports, Food, Gas and Movie Theaters. The Gas and Movie Theater saved searches make special use of the Internet connection. The Movie Theater search will not only show you the theaters in your area, but it also will list the current show times. For the Gas search, each result also includes local gas prices along with how recently that information was gathered. You also can sort your results by price, which makes it quick and easy to find the cheapest gas in your area.

One of the most-touted features of the Internet connection is live traffic information. As I mentioned before, the Dash anonymously gathers the location information of all Dash units and combines it with trusted road sensors, information from commercial fleets and other data sources to create what it calls the Dash Network. On the main map screen, each street with traffic data shows up color-coded. Green represents good traffic; yellow indicates slight congestion; orange, moderate traffic; and red means heavy traffic. In addition, the Dash uses solid lines when the traffic information comes from its trusted Dash Network and dotted lines when the information is from less-trusted sources. So essentially, if someone else with a Dash Express is on the same road ahead of me, I can get very accurate traffic information. As you drive to your destination, if the GPS unit detects traffic ahead, you will get an alert on your screen with the option to calculate alternate routes.

One of the more straightforward Internet features is Send2Dash. Often one of the more annoying features of a GPS is typing in an address on the touchscreen. With

Send2Dash, you can log in to a custom portal on the Dash site, type in an address and then send it to your own Dash, where it will show up the next time it starts. This makes it nice and easy to build an address book. There's even a Firefox plugin, so you can highlight an address and then right-click and select Send to Car.

The Internet-enabled features on the Dash—specifically the enhanced searches—are great features, especially the Gas search. The Yahoo searches also work well as a supplement and second opinion to the internal map of destinations. The traffic, however, is a mixed bag. When it's accurate, it has been a lifesaver. It takes some time and familiarity with the map to interpret what light, moderate or heavy traffic really means, and how much weight to give to the dotted less-reliable traffic lines. Once you figure it out, however, you can search ahead while you commute and often see problems before they affect you.

On the downside, traffic information isn't always as "live" as I'd like it to be. I've seen a situation or two where I've been in pretty heavy congestion or even in stopped traffic a number of minutes before the Dash updates. Of course, maybe I'm the traffic canary in the coal mine helping the rest of the Dash community in the Bay Area. I know that Dash is working on traffic reporting, but for now, I recommend supplementing the Dash data with something like the Yahoo Traffic Incidents Dash application.

Dash Apps

Like Apple with the iPhone, the Dash has allowed third parties to write custom applications, "Dash apps", for use on the device. The applications are easy to add from Dash's Web portal, and so far, all of them are free. There are a number of interesting applications, but here are some of the more notable ones:

- Trapster—search for and report speed traps and red-light cameras along your route.
- Weatherbug—weather forecasts for your location or destination.
- Yahoo Traffic Incidents—accidents or slowdowns along your route.
- Trulia—local available real-estate with pricing.
- Baktrax—a list of local radio stations and the last few songs they played.

All in all, the Dash apps are one of the more compelling reasons to have a Dash Express right now. It's these sorts of programs that move the Dash from a standard GPS to use when you are lost to a GPS you use on your dashboard every day.

Developing Dash Apps

Earlier in the year, the Dash opened up its API to the community, so anyone could register on its site as a developer and write custom Dash apps. Since then, the API has been updated and expanded with some new features, and it still appears to

Listing 1. The Script

```
#!/usr/bin/perl

use CGI qw(:standard);

my $infile = 'maintenance.txt';
my $mileage_range = "10000"; # Only show entries within this range

if(param())
{
    $requestType = param("requestType");
    $serviceId = param("serviceId");
    $point = param("point");
    $count = param("count");
    $offset = param("offset");
    $sort = param("sort");
    $signature = param("signature");
    $mileage = param("q");
    my %hash;
    my $items = 0;

    parse_infile($infile, \%hash);

    foreach (sort keys %hash){
        if(abs($_ - $mileage) < $mileage_range){
            next if($hash{$_}{c'} == 1);

            $delta = $_ - $mileage;
            if($delta >= 0){
                $title = "$_ - $hash{$_}{desc}";
                $desc = "<![CDATA[<html>In <b>$delta</b>
                ↪miles:<br>$hash{$_}{desc}'</html>]]>";
            }
            else {
                $title = "PAST DUE: $hash{$_}{desc}";
                $desc = "<![CDATA[<html><font color=#FF0000>
                ↪<b>" . abs($delta) . "</b> miles <i>PAST DUE</i>
                ↪</font>:<br>$hash{$_}{desc}'</html>]]>";
            }

            $output .= output_result($title, $desc);
            $items++;
        }
    }
}

}

print header('text/xml');
print '<?xml version="1.0" encoding="UTF-8"?>'
    . "\n<resultSet>"
    . "<serviceId>$serviceId</serviceId>"
    . "<count>$items</count>";

print $output;
print '</resultSet>';
exit;
}

sub output_result {
    my $title = shift;
    my $desc = shift;
    my $output;

    $output = "\n<result>"
        . "<title>$title</title>"
        . "<description>$desc</description>"
        . '</result>';

    return $output;
}

sub parse_infile {
    my $infile = shift;
    my $href = shift;
    my ($mileage, $desc, $completed);

    open INFILE, $infile or die "Can't open $infile: $!\n";
    while(<INFILE>){
        chomp;
        $mileage = $desc = $completed = "";
        ($mileage, $desc, $completed) = split ', ', $_;
        $$href{$mileage}{desc}' = $desc;
        $$href{$mileage}{c'} = $completed;
    }
    close INFILE;
}

```

be in active development. Even so, there already seems to be a pretty active developer community springing up in the Dash forums, and quite a few community-developed Dash apps are already available on the site.

I wanted to see how easy it was to develop my own Dash app, so I downloaded the latest edition of the API documentation, registered as a developer on the site, and started with a sample PHP program I found on the forum. Essentially, when you conduct a search with a Dash app, the Dash Express then sends an HTTP GET to a Web service you specify that contains a few variables including the Dash's GPS location and potentially a custom value from a text entry window on the Dash itself. Your Web service

replies back with its results formatted in some basic XML (the structure is defined in the API documentation) that the Dash then displays. Here's a sample of the XML output that Dash accepts:

```
<?xml version="1.0" encoding="UTF-8"?>
<resultSet><serviceId>10114</serviceId><count>1</count>
<sort>di</sort>
<result><title>Title</title>
<point>38.2440154167-122.6531425</point>
<description>requestType->search serviceId->10114
point->38.24401541666667 -122.6531425 count->20
offset->0 sort->null signature->ed002f9a2f86013c9affd8d9e1b9f90e

```

```
</description><address>12000 San Jose  
Blvd</address><city>Jacksonville</city>  
<regionCode>FL</regionCode><countryCode>US</countryCode>  
<postalCode>32223</postalCode></result></resultSet>
```

After all these years, I still tend to favor Perl for this sort of thing, so the first thing I did was port the sample PHP script to Perl. Once I got that working, I decided to try to write something actually useful. I wasn't ready to dig heavily into sourcing sites like Google Maps for location data, so instead, I decided to write something more basic. I planned to write an application that would take the current mileage as input and then read from a basic CSV file and report back any maintenance due within plus or minus 10,000 miles. The first column in the CSV file has the mileage when the maintenance was due, the second column has a description of the maintenance, and the third column is optional but had a 1 or 0 depending on whether the task was completed. Here's some sample lines from the file:

```
151000,Change Oil,1  
156000,Change Oil and Filter,1  
161000,Change Oil  
160000,Replace Tires  
180000,Replace Coolant  
160000,Replace Air Filter
```

Listing 1 shows the script that reads from the file and outputs the XML for the Dash.

It's pretty basic, but it works. The whole process from testing the PHP script to writing the final application took only about two hours. Once you write the program, you can create a new Dash app instance via an interface on the my.dash.net site and add it to your saved searches. You also can choose to keep the program to yourself, or you can make it public so any Dash user can use it.

The ease of developing applications for the Dash is a definite plus for me. There are still some limitations in its API (for instance, there is only one text box available for user entry at the time of this writing), but the API still appears to be under heavy development and already has had feature updates. Even as it is, if you have some imagination and some programming ability, you can write some pretty useful applications.

Hacking the Dash

Okay, so I couldn't help myself. Here was a device that I knew ran Linux with not only a GPRS connection, but also a Wi-Fi connection. There had to be a way to get to a Linux prompt on the thing.

First, I let the Dash associate with my home Wi-Fi and then tried to SSH to it. It turns out, it actually does have SSH listening; however, I didn't know the password (if there even were one, I haven't had a chance to attempt SSH brute-force attacks yet), and it could use SSH keys.

The Dash Express does have a USB port on the side and even comes with a USB cable to connect it to your computer, but currently, there is no official use for this port other than charging the battery. When you connect it to Linux, dmesg

gives some hope:

```
Sep  1 21:53:11 minimus kernel: [ 1447.814648]  
usb 2-1: new full speed USB device using uhci_hcd  
and address 2  
Sep  1 21:53:11 minimus kernel: [ 1447.880419]  
usb 2-1: configuration #1 chosen from 2 choices  
Sep  1 21:53:11 minimus kernel: [ 1448.182503]  
usb0: register 'cdc_ether' at usb-0000:00:1d.1-1,  
CDC Ethernet Device, d6:a5:89:03:18:fe  
Sep  1 21:53:11 minimus kernel: [ 1448.182834] usbcore:  
registered new interface driver cdc_ether  
Sep  1 21:53:12 minimus dhcpcd: message_handler:  
message handler not found under /com/redhat/dhcp/usb0  
for sub-path usb0.dbus.get.reason
```

So, the device does show up as some sort of USB Ethernet device. Some research on the Internet led to a page that described how the OpenMoko phone had a similar connection, but unfortunately, if the Dash Express assigned itself a static IP, it didn't use the same one as the OpenMoko. I tried an nmap host discovery on all of the private IP space and even collected a few minutes of packets from the USB network to see whether there were any clues there, but as of yet, I haven't been able to get into the device.

Conclusion

Overall, the Dash Express is a very interesting GPS device. The Linux user in me wants to root for the underdog, especially if that underdog uses Linux as the OS on the device. The programmer in me is really drawn to the open API and the ability to write my own applications on the device and use the applications from a community of developers. The commuter in me likes a device aimed at delivering accurate traffic data. The gadget geek in me likes the concept of adding an Internet connection to a GPS device and is really interested in the potential that sort of improvement brings.

When it comes down to it, potential is the keyword for the Dash Express. Today, the Dash is a very useful GPS product with some advanced search features and Dash apps that no other competitor has—it just has some rough edges in some of the more fundamental GPS functions. It's the overall potential of the platform that is most compelling to me. I know that the rough parts are being worked on actively, and in the meantime, the community has added some great new free features to the device. As long as Dash can stay responsive to its users and especially to its developers (and maybe give us Linux geeks a peek under the hood), I think it's *the* GPS for geeks. ■

Kyle Rankin is a Senior Systems Administrator in the San Francisco Bay Area and the author of a number of books, including *Knoppix Hacks* and *Ubuntu Hacks* for O'Reilly Media. He is currently the president of the North Bay Linux Users' Group.

Resources

Official Dash Site: www.dash.net

Dash Customer Portal: my.dash.net

HARDWARE

Acer Aspire One

Acer Aspire One—just another Netbook or the pinnacle of tiny computing? JES HALL

The runaway success of the ASUS Eee PC has defined an entirely new market segment—the Netbook. Other manufacturers have quickly followed suit, and consumers now can choose from a veritable bevy of models.

The \$329 Aspire One from Acer is a relative newcomer, and it's clear that Acer looked very carefully before it leapt. With a glossy finish, rounded corners and subtle orange highlights, the Aspire One is all class. At 250x30x170mm, the Aspire One fits comfortably between the 9" Eee PC models and the 10" MSI Wind in size. This extra width is well used in providing a large keyboard with excellent travel and response. In order to accommodate the keyboard, the touchpad is very narrow, with the buttons to the left and right rather than above. The system weighs a very svelte two pounds.

Aesthetically, the Aspire One is extremely pleasing. The review unit we were sent is the deep-blue model; white is also available, with bronze and pink models to follow. Our only complaint is that the high-gloss finish very soon became a mess of smudges and fingerprints. This may not bother some, but we're the sort who tend toward obsessive polishing. The screen is frankly excellent—bright and clear with good contrast and crispness. It has a glossy finish, but the extra reflections were well worth the clarity and colour richness gained.

The Aspire One sports an impressive array of ports, with three USB ports, VGA-Out, 10/100 Ethernet, a headphone and microphone jack and two SD card readers. One is designed to read cards from removable storage devices, supporting MMC, xD and memory stick pro as well as SD. The other is labeled Memory Expansion, and it will add any memory card you insert dynamically to the available storage on the Aspire One.

Inside, the Aspire One is built around Intel's new Atom processor—the current de facto standard for Intel-based Netbooks and Nettops. The Atom is Intel's smallest chip, designed specifically for low-powered MIDs (Mobile Internet Devices). The 1.6GHz CPU present in the Aspire One is single core but supports hyperthreading. Although not as fast as true dual-core, hyperthreading gives a noticeable performance boost on this type of CPU, without much increase in energy consumption.

Although the focus of the Atom is power efficiency, its performance is quite reasonable, handling light content creation and media playback with aplomb. During our testing, the Aspire One never heated up past warm, and although the fan was at times audible, it was a low-pitched noise and not bothersome. The system features an 8GB SSD, 512MB DDR2 memory and 802.11b/g Wi-Fi. No Bluetooth or cellular modem is available on this model.

The operating system shipped is Linpus Linux Lite, a



Figure 1. Acer Aspire One

Taiwanese distribution based on Fedora 8 and Xfce 4. For reasons we are completely unable to fathom, Acer chose to ship the Aspire One with a default window border that mimics Windows XP. Thankfully, this is easy to change. Acer has really polished the user interface, adding a full-screen application launcher with program entries divided into Connect, Work, Fun and Files, with a fifth Settings category accessible by clicking on its icon at the lower right of the screen. A selected few applications from each category are displayed on the main launcher screen with additional applications accessible by clicking the More arrow.

A search box is embedded at top right that launches



Figure 2. The Aspire One Default Desktop

Firefox and provides Yahoo Search for any given search query. There doesn't seem to be a way of changing this search preference, which was disappointing. The Aspire One we reviewed had Yum repositories configured, allowing us to add extra software from the main Fedora distribution. In the limited time we had, we were unable to work out a way to add any kind of additional application launcher to the Aspire One's interface. Additional applications still can be launched through the standard Xfce run dialog, bound to Alt-F2.

The wireless support is very good, based on Network Manager, which has become a standard in most modern distributions. The Aspire One front end is simplified, and support for some authentication options has been removed—we were unable to find a way to connect to a Cisco LEAP corporate network, which is a limitation that probably affects almost no one. For home and hot-spot wireless use, the Aspire One has WPA and WEP configurations covered.

Most "Connect" applications are covered by Firefox 2 with Adobe's Flash plugin. Links to Wikipedia, Google Maps and Hotmail are listed, along with the applications Browser, Messenger, Mail and RSS Reader. Mail, RSS Reader, Contacts and Calendar actually are all combined into a single Acer-branded application. The RSS Reader is the simplest by far, allowing you to add a feed by URL and providing an e-mail-like interface. Calendar and Contacts both do exactly what you would expect—allow you to add appointments and contacts.

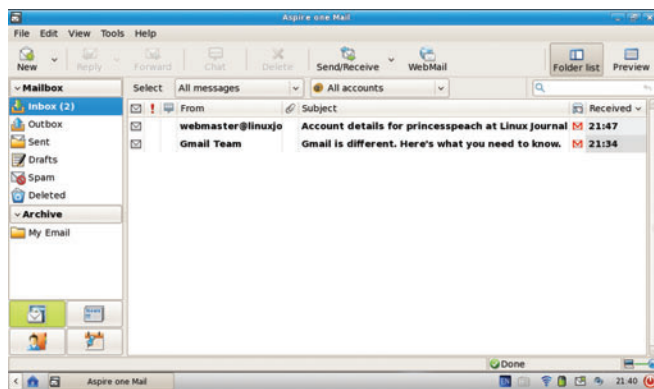


Figure 3. Aspire One Mail

Aspire One Mail is a mixed bag. The interface is clean and attractive, and the accounts wizard was a breeze. POP access works great, but we noticed some very odd behaviour on IMAP accounts. Every message in the inbox was marked as new, and we couldn't see how to access any other IMAP folders. It seemed to be applying the POP paradigm to IMAP, badly.

Acer's One Messaging is built on the libpurple framework that powers Pidgin. Unfortunately, Acer chose to expose only Yahoo, MSN, AIM and Google Talk support in its configuration dialog, even though the underlying support for other protocols has been included. The interface is extremely simple, with limited customization. An option to adjust font sizes in particular would have been appreciated.

We tested Webcam support between a Macintosh running

With a glossy finish, rounded corners and subtle orange highlights, the Aspire One is all class.

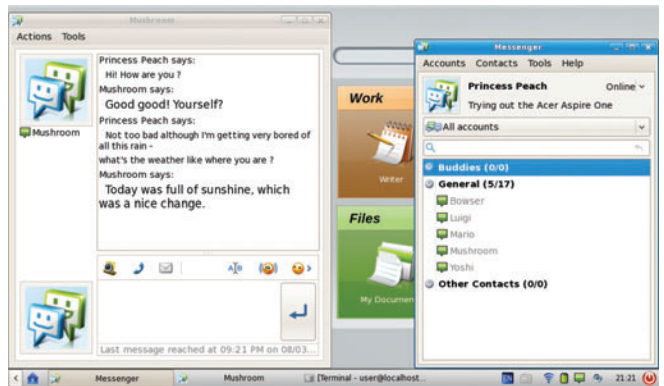


Figure 4. Aspire One's Messenger



Figure 5. Yahoo Video Chat

the official OS X Yahoo Messenger client and the Acer Aspire one. The Webcam quality was certainly acceptable, delivering clear images even in low-light conditions, and it worked out of the box with no configuration required.

The Work category is mostly filled out with the OpenOffice.org suite, at version 2.3.0. The previously mentioned Aspire One Contacts and Calendar application is included, as is a simple notepad (xpad) and calculator (calculator). We found OpenOffice.org's performance reasonable on the Atom, but certainly nothing to write home about.

The Fun category includes a wide range of games, a Webcam application that will capture images from the built-in camera and KolourPaint. Acer also has included two more

Although the focus of the Atom is power efficiency, its performance is quite reasonable, handling light content creation and media playback with aplomb.

custom applications, Media Master and Photo Master.

There's not much to say about Photo Master—it shows thumbnails of your images and allows you to display them as a slideshow. As far as we could ascertain, it had no editing capabilities. Media Master was a bit of a puzzle—we tried quite a few media formats and couldn't get it to play many. It was unable to play AVI video or FLAC audio files, although it did do an exceptional job of playing commercial DVDs from an external DVD drive. MP3 and Ogg are both supported.

The Aspire One's speakers were about what one would expect from a Netbook—really adequate only for system beeps—but the headphone jack delivered clean, excellent sound through our extremely unforgiving Sennheisers.

Files is covered entirely by the Xfce file manager, Thunar. Removable storage and external CD/DVDs are detected and accessible through Thunar's disk view. We attempted to get the Aspire One to recognise a current-generation iPod Nano and a Canon IXUS digital camera. Neither were recognised by the OS. Personal media players that appear as an external hard disk can be used with the Aspire One.

The only real weak point we found on the Aspire One was its battery life. With wireless on and the backlight on at around half, we managed to eke out a little less than three hours of Web surfing and light content creation. A 6-cell battery is available, but at the time of this writing, it was

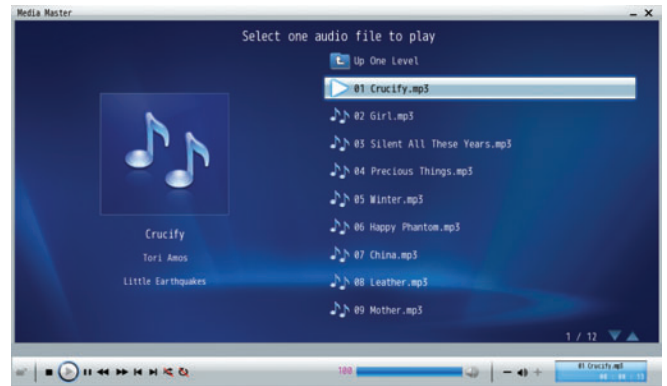


Figure 6. Media Master

retailing for \$119, which is quite steep given that the Aspire One is only \$329 itself. Acer has confirmed an Aspire One with the 6-cell built in at a much lower package price soon will be available, which will mitigate this issue.

Ultimately, we were pretty happy with what we saw. The large keyboard, exceptional screen and slick operating system made the Aspire One a joy to use. The Aspire One is strong competition for the original Eee PC series and provides a cheaper alternative to the new Atom-based Netbooks. Those who intend to use the built-in Linux rather than install their own flavour are well served, finding a more polished experience with the Aspire One. If you are looking for a device that can handle media playback of many formats, you may be better off looking elsewhere. If you want a lightweight and attractive device for cloud computing and light content creation, the Aspire One is for you. ■

Jes Hall is a Linux Systems Specialist from New Zealand. She's passionate about helping open-source software bring life-changing information and tools to those who would otherwise not have them.

TECH TIP Treating Compressed and Uncompressed Data Sources the Same

Occasionally, you need to process a number of files—some of which have been compressed and some which have not (think log files). Rather than running two variations, one compressed and one not, wrap it in a bash function:

```
function data_source ()
{
    local F=$1

    # strip the gz if it's there
    F=$(echo $F | perl -pe 's/\.gz$//')

    if [[ -f $F ]] ; then
        cat $F
    elif [[ -f $F.gz ]] ; then
```

```
    nice gunzip -c $F
    fi
}
```

which nicely allows:

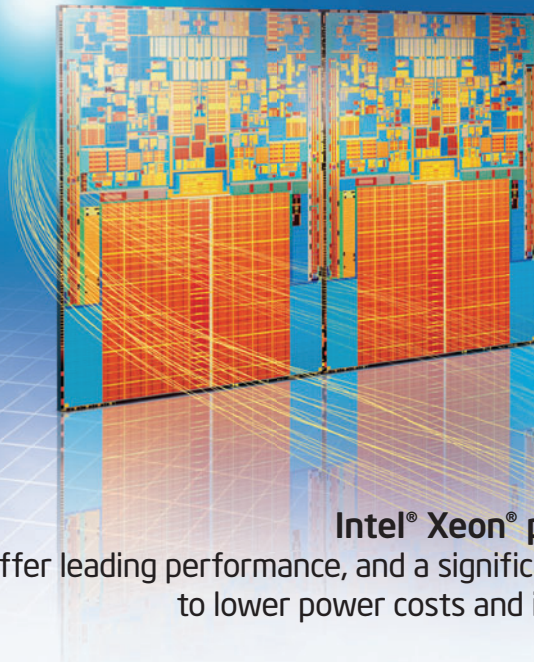
```
for file in * ; do
    data_source $file | ...
done
```

Whether you're dealing with gzip'd files or uncompressed, you no longer have to treat them differently mentally. With a little more effort, bzip files also could be detected and handled.

—DAVID A. SINCK



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HARDWARE

Power Up!

A Review of the YDL PowerStation.

DANIEL BARTHOLOMEW

On June 6, 2005, hell froze over, and Apple announced it was abandoning the PowerPC architecture it had helped develop in favor of processors from Intel, a company Apple had actively mocked for years. By August 2006, the transition was complete, and the largest maker of computers based on the PowerPC (or Power) architecture had become an Intel-only shop.

This transition affected one company more than almost anyone else. Terra Soft Solutions of Loveland, Colorado, has been working with Linux on PowerPC hardware longer than just about anyone. Its flagship product is Yellow Dog Linux (YDL), and for years, Terra Soft's major business was selling Apple PowerPC hardware with YDL pre-installed on it. Terra Soft actually had the distinction of being the only Apple reseller authorized to sell Macintosh hardware with something *other* than Mac OS installed on it. With Apple now out of the

picture, Terra Soft's primary business had to change.

For the past couple years, Terra Soft has focused a lot of its attention on server products from IBM and on the PlayStation 3 from Sony. Now, with the PowerStation, Terra Soft is taking a step into the hardware business Apple vacated. Its Web site says it all in a single sentence: "The Power workstation is back."



Figure 1. The internals of the PowerStation are easy to get to, and the box has numerous expansion opportunities.

Chips based on the Power architecture are found in many devices and products—from cars to mainframes to robots. Customers who relied on Apple for PPC-based workstation hardware were left in the lurch with Apple's Intel switch. For those that need it, being able to run PPC code without emulation on their local workstation is a big plus. The PowerStation was created to provide these developers with a high-quality open-source-friendly workstation. Not only is it more powerful than any PPC-based Power Mac from Apple, it also is more open and expandable.

The Hardware

The PowerStation comes with two dual-core 2.5GHz IBM 970MP processors, with 1MB of L2 cache per core. For memory, there are eight 667MHz DDR2 DIMM slots that allow the box to accommodate up to 32GB of RAM. Local storage is handled by a four-port SAS RAID controller and a single IDE controller. My test box was configured with a single 70GB SAS drive, 2GB of RAM and a DVD/CD-RW drive—nothing earth shattering, but decent enough.

Networking for the PowerStation is handled by dual Broadcom HT2000/BCM5780 Gigabit Ethernet ports. For serial I/O, there are two USB ports on the back and a couple more on the front of the case, two RS-232 serial ports and a single RJ45 VTY console port to round things out.

For expansion, the motherboard has a single PCIe x16 connector (that comes filled with a 512MB ATI X1650 Pro graphics card), two PCIe x8 connectors and a single PCI-X connector.

Finally, power for the box is supplied by an 815-Watt power supply.

Accessing the box's internals is easy. The entire side of the case pops off at the press of a latch. The four SAS hard drive



Figure 2. The Back of the PowerStation

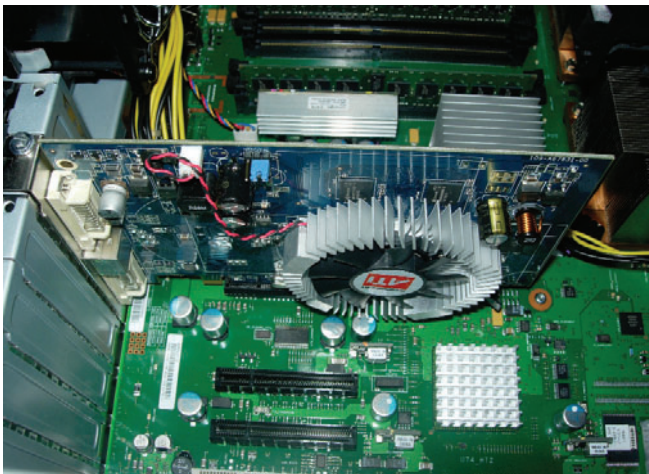


Figure 3. The graphics card in the PowerStation was switched at the last minute to this ATI X1650 Pro.

bays can be reached from behind a front panel that pops off just as easily as the side panel.

The firmware for the box is the Slimline Open Firmware (SLOF)—a BSD-licensed version of Open Firmware (IEEE-1275), which is what Apple used on its PowerPC-based Mac computers.

There is no sound card built in to the PowerStation. I asked the fine folks at Terra Soft about it, and they replied that they were exploring options with regard to sound output and that



Figure 4. The PowerStation opens with the touch of a button.

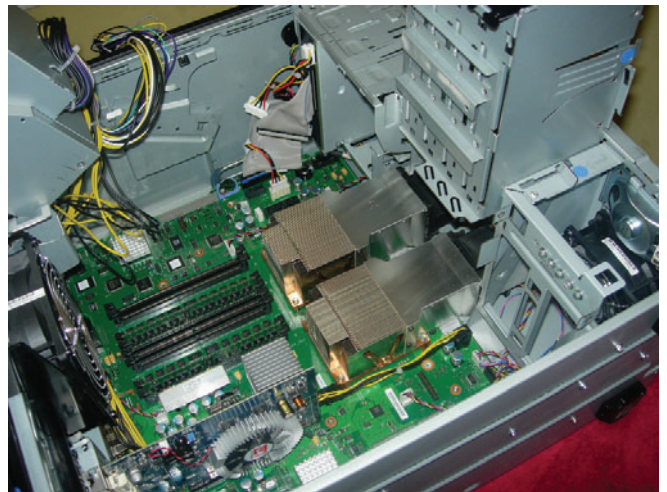


Figure 5. The PowerStation motherboard is dominated by the two IBM 970MP processors.

they would be releasing a solution soon (hopefully, it will be in place by the time you read this article). They said it likely would be in the form of a USB sound card dongle instead of an internal PCIe card (in order to save precious PCIe slots for more important duties).

One final note on the hardware is that the PowerStation fans make a lot of noise. It's not as loud as a rackmount server, but it's louder than my scratch-built home server (and I think that it's too noisy at times). On top of the normal noise, the fans on the PowerStation cycle up and down as needed to keep the system at the optimal temperature, which causes the noise level to fluctuate from loud to very loud almost at random. The noise level is not too bad for a normal office environment, but it would be far too loud in a quieter space (such as a recording studio).

The Software

The PowerStation comes with Yellow Dog Linux 6 pre-installed. YDL began life in 1999 as an alternative to the Mac OS on Apple's PowerPC hardware. It is based on Red Hat

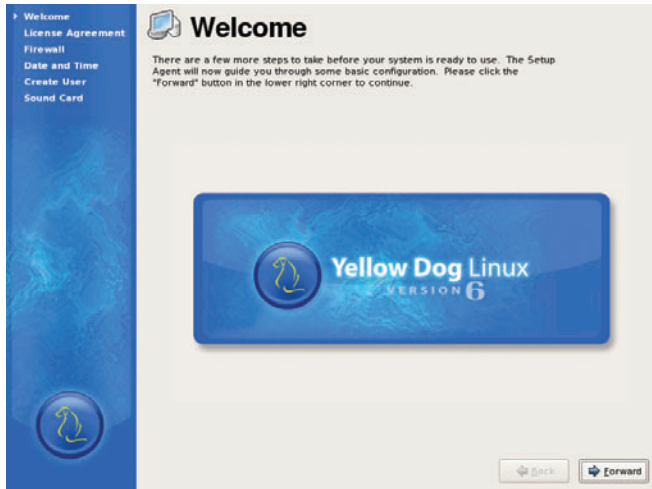


Figure 6. On initial boot, the PowerStation walks you through setting up an initial user.

Enterprise Linux and Fedora. Like every Red Hat/Fedora derivative I have ever used, it uses RPM for package management. Yum, which started as a Yellow Dog-specific add-on for simplifying package updates (and has been adopted by most RPM-based distributions) is naturally included, along with the graphical yum updater, Pup.

When first booting the PowerStation, you go through the normal Anaconda new-user setup. Unfortunately, this process crashed on me at the very end, forcing me to reboot the computer. It seemed like it was just a fluke, so I didn't worry about it too much, but I think it may have contributed to my Firefox problems (more on that later).

The package selection available in the default YDL repositories is decent, but it's not as large as I am used to on Ubuntu and Fedora. The repositories configured out of the box include the Yellow Dog Base, Extras and Updates repositories, along with a PowerStation-specific one. Most of the basic apps—from Firefox to OpenOffice.org to The GIMP to PostgreSQL to Pidgin—are present and accounted for.

Although most of the packages I expected to find were available, a couple interesting ones were absent. One in particular (which happens to be one of my favorite applications), Inkscape, was missing. Thanks to the PowerPC Fedora Extras repository, I was able to install it easily.

A couple packages I wanted to use on the box, such as the `renameutils` (from www.nongnu.org/renameutils), were not available as pre-built RPM packages (as far as I could see, anyway). In the case of `renameutils`, I was able to download, compile and install the package manually.

One big thing I had to get used to on the PowerStation was the lack of GRUB. Yaboot is the bootloader for the PowerStation.

Being unfamiliar with Yaboot, I elected not to tinker with it or even spend much time looking at it. The system booted fine, and I didn't want to render the box unbootable inadvertently. The Yaboot configuration does look marginally similar to GRUB's, and I'll leave it at that.

Enlightenment is the default desktop environment for the PowerStation. The default theme and layout are nice, and the

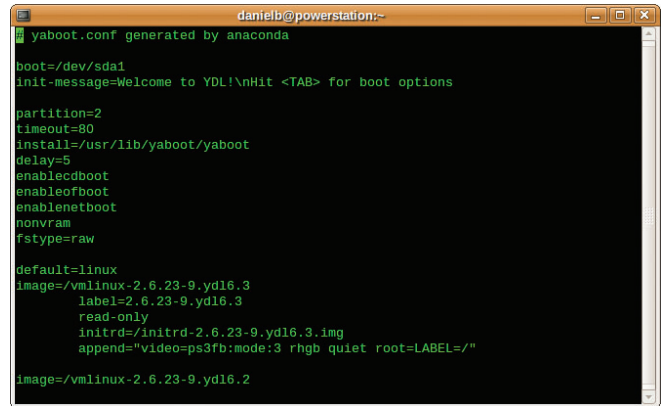


Figure 7. The Yaboot Configuration File

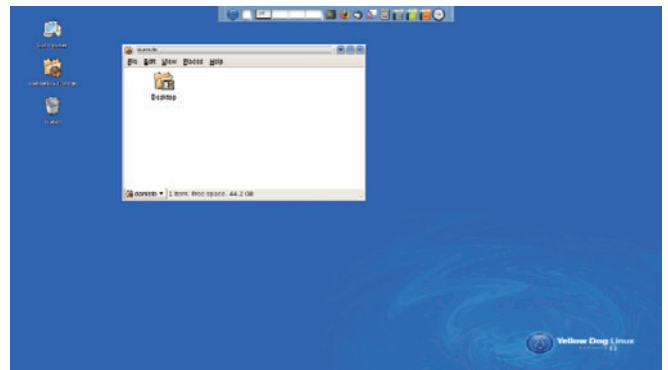


Figure 8. The PowerStation's Default Enlightenment + Nautilus Desktop

menus are well organized.

One interesting decision Terra Soft made was to configure the first Enlightenment desktop to run Nautilus full screen for file management purposes. This was a little confusing at first when I tried to change the Enlightenment wallpaper and nothing happened. To change the wallpaper of the first desktop, I had to change the GNOME wallpaper. Wallpaper issues aside, using Nautilus is a smart move, because it is one of the most advanced file managers available. I soon got used to using the first desktop for file management and the rest for running apps. This arrangement actually forced me to become better organized as different tasks were more clearly and cleanly separated. The other three desktops do not have Nautilus running on them, so they behave like regular Enlightenment desktops, animated backgrounds and all.

GNOME also is available out of the box as a session login option for those who prefer it, and KDE can be installed with the package manager.

There's no difference in running apps like The GIMP, OpenOffice.org or Firefox on an IBM Power processor as opposed to an Intel or AMD processor, so I won't go into running them other than to say they ran fine.

The Performance

Performance is one of those tricky areas that are hard to define and nail down—especially when trying to compare the PowerStation to x86 workstations. One thing I can say without

Table 1. Phoronix Test Results on the PowerStation

Test	Average Result
RAMspeed Average Integer Test	2,661.78MB/s
OpenSSL	36 signs per second
GnuPG 1GB file encryption	21.96 seconds
Compress a 128MB file with lzma	315.53 seconds
Compress a 512MB file with gzip	39.38 seconds
Compress a 512MB file with parallel-bzip2	67.60 seconds
SQLite 2,500 insertions on indexed db	74.05 seconds
SciMark composite test	264.64Mflops
Timed PHP compilation	82.93 seconds
IOMeter file server access pattern	89.87 seconds
Timed Apache build	54.48 seconds

any equivocation is that the PowerStation definitely is speedy. Applications launch instantly (or nearly so), and everything feels fast and snappy. But “feelings” sometimes can lie, so to get a more accurate view, I turned to some performance testing.

For testing, I installed the Phoronix test suite. Unfortunately, although I was able to install it without trouble by following the directions on the Phoronix Test Suite Web site and run most of the tests, a few of them, including compiling the Linux kernel and calculating Pi to 32 million digits, failed. In the case of the Linux kernel compilation test, Phoronix reported that the test completed in 4.12 seconds. This compares to a time on my laptop of 4,407.53 seconds. Now, I am the first to admit that the PowerStation is much faster than my old laptop, but it is not a thousand times faster.

In the case of the Pi calculation test, the issue was that the test assumes you are running on x86, and it tries to load an x86 binary, which obviously won't run on the IBM 970MP-powered PowerStation. Thankfully, other tests in the Phoronix test suite provided more trustworthy results. The mencoder test, for example, which converts an 89MB avi file, took a respectable average of 42.13 seconds. See Table 1 for the results of some of the other Phoronix test suite tests I ran on the PowerStation.

One caveat in my testing is that all of the tests shown in Table 1 finished with minor errors, such as “PHP Notice: Undefined offset: 0 in /usr/share/phoronix-test-suite/pts-core/

functions/pts-functions_system_cpu.php on line X”. I don't think the errors skewed the results in either direction, but there is a bug somewhere that does not exist when the tests are run on an x86-based machine.

My original plan was to run these tests head to head against a quad-core Xeon system I was testing at the time. However, due to delays in receiving the PowerStation and some unforeseen issues with the Xeon system, I was not able to do this. Feel free to run the same tests on your workstation and compare your performance to the PowerStation.

One curious thing about the test results is that some of them are slower than the score achieved by my laptop—for example, the SQLite test. My old laptop is able to complete that test in an average of 62.63 seconds—more than ten seconds faster than the PowerStation. This may be because of the way the SQLite test works, or maybe it favors Intel processors—I don't know. In most tests, the PowerStation was faster, and in some tests *significantly* faster, which is what I expected.

The Problems

My experience with the PowerStation was not without difficulties, however; although most issues were a result of the new nature of the product.

First and foremost on my list of issues is that Xorg on the PowerStation is unstable. It crashed several times. Even after updating the kernel to a more stable version, I still experienced crashes on occasion. However, this issue should be fixed by the time you read this, as it is known and Terra Soft is working on it.

Late in the development of the PowerStation there was a last-minute switch from using an XGI graphics card to using an ATI X1650 Pro. The reason for the switch, according to Terra Soft, was that the XGI graphics card was performing at a “sub-standard” level, and that “the resources required to enable reasonable X11 performance were not justified”. The full text of the graphics card announcement is here: lists.terasoftsolutions.com/pipermail/yellowdog-announce/2008-July/000183.html.

Changing the graphics card pushed the delivery of the review unit back by almost an entire month. It's possible that this late change is responsible for some of the issues.

The next most annoying issue I encountered was the one I

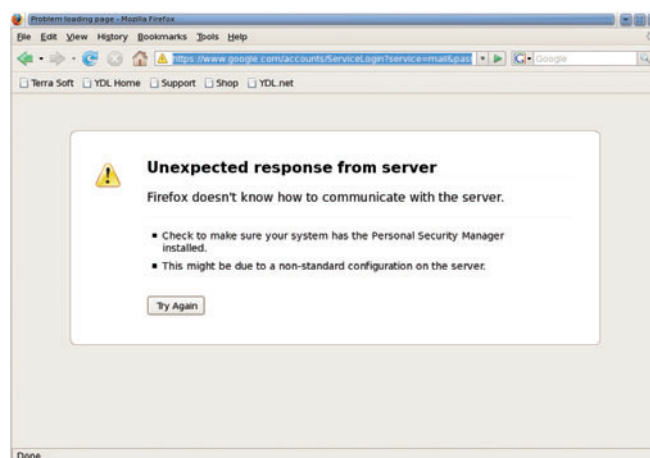


Figure 9. I ran into a strange Firefox error during testing.



Figure 10. The fix for the Firefox error was to create a new profile and delete the old one.

mentioned before. When I started Firefox after logging in the first time, I could go anywhere I wanted to on-line except any `https://` Web sites. For some reason, Firefox complained about not having the Personal Security Manager, which was weird, because Firefox was installed (with all of the required pieces).

The solution was to delete the default profile and create a new one using the profile manager, which leads me to believe that the default profile was corrupted in some way, probably due to the crash in the new-user setup wizard.

To bring up the profile manager, first quit Firefox, and then open a terminal and type `firefox -ProfileManager`. With the profile manager open, I created a new profile and deleted the original one. The new profile worked fine, and I was able to connect to all of the secure `https://` sites that I frequent, including my bank Web site and Webmail.

The next issue I ran into probably was my fault. Every PowerStation ships with a letter that has the root password specified on it. Unfortunately, I misplaced mine and had to talk with the support folks, who were very friendly and helpful, to get my root password. They had it on record, so I was able to get it without too much trouble.

The reason I needed the root password brings me to my last issue. Admittedly, this is in the realm of stylistic preference

and not a “real” issue. Whenever you run an application that requires root privileges, you actually have to enter the root password. I never have liked this way of doing things. A much better option, in my opinion, is to have admin-level users run admin programs using `sudo` or `gksudo`. The fewer the number of people who actually know the root password, the better. I’m happiest when I never have to use the root password or log in as root. As I said before, this is more of a style issue, not a problem or showstopper in any way.

Conclusion

If you are a developer for Power-architecture systems and servers, I heartily recommend the PowerStation. It’s a well-built, solid machine that can serve as your primary desktop as well as your main development box.

If you are just looking for a workstation, and you don’t develop on or for Power, your best bet is to look elsewhere. Sure, nearly anyone could use the PowerStation as a full-time workstation. It has all the desktop applications most people require, but as focused as this system is on Power developers, non-Power developers would best be served with an x86-based system. ■

Daniel Bartholomew lives with his wife and children in North Carolina. His normal on-line presence is at daniel-bartholomew.com, but he also can be found on Twitter as [daniel_bart](https://twitter.com/daniel_bart) and on identi.ca (and Jaiku and Pownce) as [bartholomew](https://identi.ca/bartholomew).

Resources

PowerStation Web Site: www.terasoftsolutions.com/products/powerstation

Download Open-Source Slimline Open Firmware (SLOF): www-128.ibm.com/developerworks/power/pa-slof

Instructions for Installing Third-Party Repositories for YDL 6: blogs.ydl.net/billb/2008/03/02/third-party-repos-for-ydl-6

Phoronix Test Suite: phoronix-test-suite.com

TECH TIP Slice and Dice Images with ImageMagick

You can use the `convert` command that comes with ImageMagick to extract parts of an image.

You can cut out a 100-pixel-wide chunk from somewhere in the middle of an image:

```
$ convert -crop 100x+0+0 orig/wrapperbg775.gif slice0.gif
$ convert -crop +200+0 orig/wrapperbg775.gif slice1.gif
$ convert +append slice0.gif slice1.gif wrapperbg675.gif
```

You can duplicate a 100-pixel-wide chunk from somewhere

in the middle of an image:

```
$ convert -crop 100x+100+0 orig/wrapperbg775.gif slice100.gif
$ convert +append slice0.gif slice100.gif slice 100.gif
  ↳ slice1.gif wrapperbg875.gif
```

Note that there was no need to specify the height of the image in any of the above commands. If you need to adjust the height instead of the width, the steps are similar, but use `-append` instead of `+append` to paste the slices vertically.

—JANOS GYERIK

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HACKING THE NOKIA INTERNET TABLET

Nokia Internet tablets are more than just small Webpads and e-mail appliances. Take a look and see just what they're capable of doing.

BILL CHILDERS



I've been a fan of tiny computing devices for a long, long time. I started my obsession for having a "PC in your pocket" with the Hewlett-Packard 95LX and stayed with that platform for a long time—graduating to a 100LX, then a 200LX. The 200LX was eminently hackable, as it was basically a PC/XT running DOS 5.0 with CGA graphics. At one point, I had the 200LX doing some crazy things, including acting as a mobile Internet terminal while I was on vacation touring Europe.

I then moved on to the Palm line of organizers, but although the features grew, the ability to hack the system slowly diminished. I'd pretty much given up on an easy-to-hack portable PC, until Nokia released its series of Internet tablets. Once I saw the N800 in action, I knew I had to get my grubby paws on one and see just how far the little platform could be hacked. I'm happy to say, I haven't been disappointed.

Nokia has released three models of Internet tablets at the time of this writing: the 770, N800 and N810. The 770 was basically the prototype Internet tablet, while the N800 and N810 are very similar in basic architecture. Because the 770 is somewhat unique, this article applies only to the N800 and N810. The Nokia Internet tablets have been covered in *Linux Journal* before—the N800 actually won the "Ultimate Linux Handheld" award in September 2007. Doc Searls and Jim Thompson wrote an article in that same issue and demonstrated the device's value when paired with a Bluetooth GPS and a cellular phone. That's one type of hack for the tablet, but there are many others.

The first "hack" anyone should do to the tablet is to flash it to the latest version of the operating system, if that's not been done already. The N800 ships by default with OS2007 (maemo 3.2, code-name Bora), and the N810 ships with OS2008 (maemo 4.0, code-name Chinook). However, a new version of OS2008 was released in June 2008 (maemo 4.1, code-name Diablo) that enabled over-the-air upgrading, much like apt-get does for Debian-based laptops and desktops. If you are *not* running this on your tablet, that's the first hack you should do.

The full instructions for updating your tablet are available on Nokia's wiki (see Resources), but I summarize

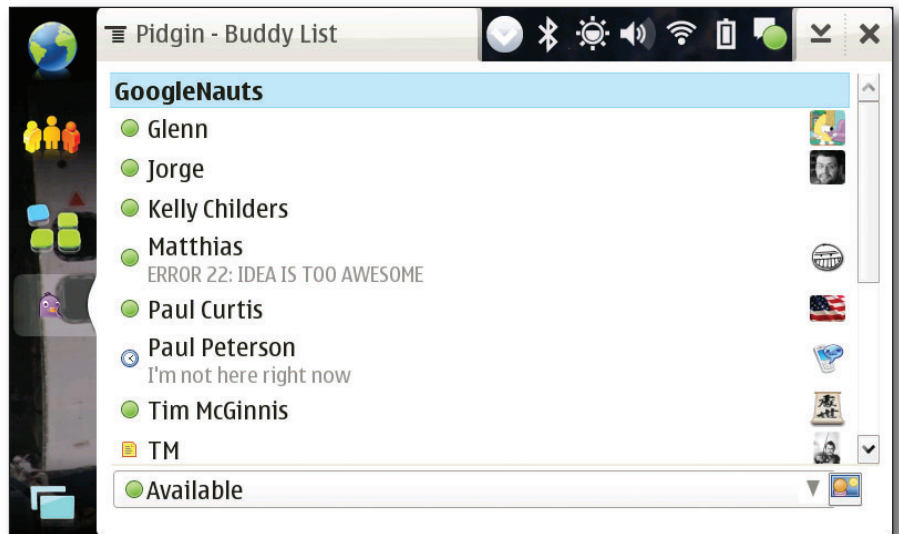


Figure 1. Pidgin on the Tablet



Figure 2. Running LXDE

them here. To update the OS on your tablet, the first thing you should do is run the internal backup utility (found in the Settings menu), back up the contents of the tablet, and then transfer the contents of that backup to your PC. Next, download the Linux "flasher" utility and the latest firmware image for your particular tablet to your PC. Ensure that the battery on your tablet is fully charged, power off the tablet, and connect the tablet to your PC. Finally, execute the flasher utility as root with a similar command line as shown on the wiki, and plug the tablet in to the

charger. The flasher utility displays messages as the firmware load progresses, and the tablet reboots automatically. That's it!

A tiny but very useful "hack" for the Internet tablet is to populate it with large Flash media (SD cards on the N800, miniSD cards on the N810) and use it as a USB storage device. Nokia had the foresight to give the tablet the ability to look like a USB mass storage device to a PC when a USB cable is connected. I have two 8GB SD cards in my N800, and I always leave a couple gigs of storage available on one of the cards, so that

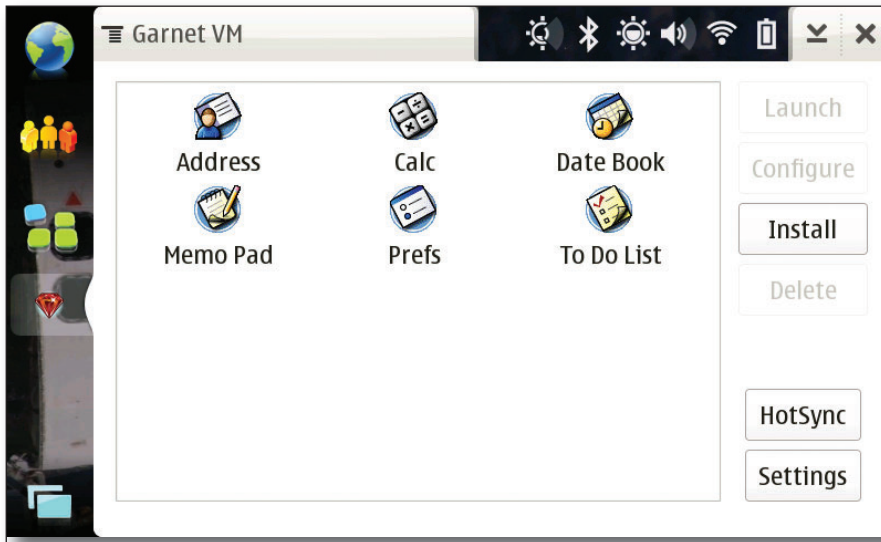


Figure 3. PalmOS Start Screen

in a pinch, I can jack the tablet up to a PC and use it as a portable hard disk. It has come in handy more than once.

Another useful "hack" that's really easy is installing Linux applications that have been ported to the tablet. One of my favorite applications on the tablet is the popular IM application Pidgin, as shown in Figure 1. Although the Nokia tablets come with an XMPP-compliant Jabber client, I find that having a consistent UI and behavior from desktop to laptop to tablet is really nice. Getting Pidgin installed on the tablet is really easy, as it's in the

Another useful "hack" that's really easy is installing Linux applications that have been ported to the tablet.

official Nokia software repositories. Simply fire up the Application Manager from the Settings menu, search for Pidgin, and click install. The launcher for Pidgin will be in the Extras section of the menu.

Of course, a Linux machine of any kind isn't really complete until it runs *Doom*. *LXDoom* has been ported to the tablet, and it runs just great, as shown in Figure 2. The controls take a little getting used to, due to the nature of the touchscreen and the directional pad on the tablet, but the game runs with a very playable framerate. Other games have been ported to the tablet, includ-

ing *Battle of Wesnoth*, *Nethack*, *Bombberman* and even *Quake*.

Another really interesting hack for the Nokia tablets is using them to emulate other computing environments. ACCESS (the owners of the Palm operating system) has released a free (as in beer) Virtual Machine (VM) for Nokia tablets that allows PalmOS applications to run on the tablet. To install the VM on your tablet, go to the link provided in the Resources section of this article, and register to download the VM. A link for downloading the VM will be sent to you

via e-mail. Open that e-mail message on your tablet and click the link, and you'll be sent to a site where you can agree to the EULA and download the binaries. Make sure to open the package in the Application Manager, and it will install automatically after you click OK in a couple dialogs.

Once you launch the application, you will see a start screen (Figure 3) where you can select the PalmOS app you want to run. Click the app, and then click Launch, and the VM launches that app (Figure 4). Once the app starts, you are in a PalmOS VM, and you can even call up a PalmOS "home" screen



Figure 4. Running the PalmOS Calculator App

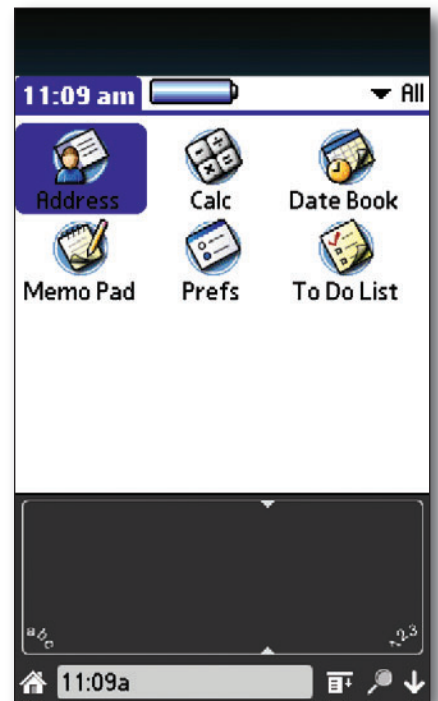


Figure 5. PalmOS Home Screen

by clicking on the house icon (Figure 5). This comes in very handy if you are a recovering Palmaholic who's got that one killer app you haven't been able to find on any other platform (TealAuto is that one for me!).

Other emulators have been ported to the tablet as well, such as Basilisk (if you are a fan of old Macintosh applications), DOSBox for old DOS programs or games and Bochs (if you want to try your hand at running Windows 3.1 or Windows 95 on your tablet). There are documented cases in the Nokia forums of people running Windows 95 and even Word 6.0 on their tablets.

The tablets also make great IP telephones. Not only is there a Skype client for the unit, but there also are fring and Gizmo clients, as well as the Web-enabled Google-based Grandcentral. The Internet Tablet Talk forum has a post that describes how to tie a free Gizmo and a free Grandcentral account together to get 100% free land-line phone calls from your Nokia tablet. Other than the Gizmo account and software, there are no real "hacky" things needed, other than a willingness to tie two services together in a way that neither provider envisioned.

For Further Hackery

Getting more information on the tablets and their extensibility is easy, thanks to excellent documentation on the Internet about these units. The first stop when looking for information should be the maemo.org site. This site is the home for all things tablet-related, from the Nokia wiki, to the software repositories, as well as the software updates and source code archives. It's all on maemo.org—except for the true hacks. Those can be found in the archives of the Internet Tablet Talks forums. The people there have come up with some truly amazing hacks and other really neat ways of using the tablets, and there's something new almost every day there.

So far, I've touched on some of the easier software hacks you can do that will extend your tablet. You can perform other more-advanced hacks on both the OS and hardware, but you need to have one thing before you can proceed with them, and that's a root shell.

In previous versions of the tablet's OS, this was truly a hack. In OS2008

(Diablo) this has been turned into an installable package, so it's really easy now. Simply open the Application Manager, search for the rootsh package and install it. Then, once you have a shell open in the X terminal, run `rootsh`, and you will have root access to your tablet.

Once you've got a root shell, you

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really can start digging into the OS of the tablet. One of my favorite hacks is to run the OS off an SD card rather than the internal Flash disk. Not only is it faster if you have a Class 6 SD card, you also can partition the disk so that you'll have more space for applications, and you still will have the internal Flash copy of the OS in the event that you break something.

This process is documented in full on the maemo.org wiki (see Resources), but the steps are actually pretty easy and can be summarized in this article. First, you need to have the root shell enabled on your tablet as described above. Then, you need to partition the SD card into two partitions: the first partition is a FAT32 partition for

A tablet, running in USB host mode, would be able to utilize a full-size keyboard and USB disk drives, effectively making it more of a PC.

your data, and the second is an ext2 partition for the copy of the tablet's OS. After you've prepared the card, you need to install some packages from the command line (wget, tar, an upgrade script called nupgrade.sh and a couple tablet-specific packages like initfs_flasher). initfs_flasher flashes the boot sector of the internal Flash disk to pop up a boot menu that lets you boot the tablet from internal Flash, an SD/MMC card or an external device like a USB memory stick.

Once initfs_flasher has finished doing its magic and you have set the default boot device, you're ready to clone the OS to the SD card. This is as easy as becoming root on the tablet and running the nupgrade.sh script with the proper arguments. Note that you'll run it five times according to the wiki—this lets you monitor each step of the way. The steps are as follows:

1. Creating the ext2 filesystem on partition two of the SD card.
2. Temporarily mounting partition two as /opt.
3. Temporarily mounting the rootfs as /floppy.
4. Cloning the OS from /floppy to /opt.

5. Committing the filesystem updates and unmounting /floppy and /opt.

The device reboots when it's done, and the boot menu pops up. At that point, just select what you want to boot from the menu. If you're really feeling adventurous, try "Advanced Booting" your tablet, so you can boot multiple copies of the OS from the card. The wiki has an example procedure that shows how you can set up a card to have a 2GB data partition and boot five different copies or versions of the tablet OS! Just the thing for the curious tablet user.

All of these hacks have dealt with the software or firmware of the tablet in one way or another. A very useful hardware hack is enabling a USB host

hardware-only hack, requiring soldering special USB cables to put the USB port into host mode.

With OS2008, Nokia put software hooks into the OS to allow users to flip the port into host mode. This is enabled by a small package called USBControl, which is in the Nokia repositories as well, and it can be installed via the Application Manager. Once you run USBControl, switching from device to host is as easy as touching a button. Then, simply hook up the device you want to use with the tablet using any adapters that are necessary, and that's it (assuming there are drivers for that device in the OS). Most input devices and storage devices are enabled out of the box.

The Nokia N800 and N810 are both great little devices and are much more than the sum of their parts, thanks to their open-source heritage and Nokia's willingness to allow them to be extended and hacked in this fashion. Kudos to all the maemo.org developers and hardware engineers for creating such a hackable and fun platform! ■

Bill Childers is an IT Manager in Silicon Valley, where he lives with his wife and two children. He enjoys Linux far too much, and he probably should get more sun from time to time. In his spare time, he does work with the Gilroy Garlic Festival, but he does not smell like garlic.

Resources

Maemo.org Home Page: maemo.org

Internet Tablet Talk Forums: www.internettablettalk.com

How to Flash the Latest Nokia OS Image:
wiki.maemo.org/Updating_the_tablet_firmware

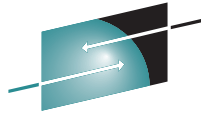
Gaining Root Access to the Tablet: wiki.maemo.org/Root_access

Booting the Tablet from a Flash Card:
wiki.maemo.org/Booting_from_a_flash_card

The Palm "Garnet" VM for the Nokia Tablets: www.access-company.com/products/gvm

How to Enable USB Host/OTG Mode on an N800:
www.harbaum.org/till/n800_usb/index.shtml

Using Gizmo and Grandcentral on the Nokia IT:
www.internettablettalk.com/forums/showthread.php?t=14536



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The BlackBerry in a World without Windows

Using the RIM BlackBerry Curve with Linux.

CARL FINK

What's black, red, gold or silver all over? It's a music and video player, e-mail client, personal organizer, Web browser and high-speed modem. Oh, and it's a telephone.

Yes, you guessed it, it's the RIM BlackBerry Curve. Like a lot of *LJ* readers, I'm addicted to gadgets. At one point, I carried a cellular phone, an MP3 player and a PDA everywhere. That's a lot of devices to stick in your pocket though, and a year or so ago, I decided it was time to consolidate. After a lot of research, I settled on the BlackBerry Curve. It has almost everything I need in a very small, attractive package. The few things

not included with the phone, like an SSH client, are available from third parties. As a longtime Linux user, I would have liked a Linux-based alternative (I once owned a Sharp Zaurus), but I couldn't locate any current Linux phones that had all the features I wanted and was easily available in the US.

Despite my willingness to use a non-Linux phone, I am not willing to give up my Linux-based computers. Research In Motion supports only Windows, so using the phone with my computers required some research and tinkering.

This article covers the following:

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- Charging your phone over USB.
- Backing up the phone's applications and data to a Linux computer and restoring if necessary.
- Transcoding video and audio files to use on the Curve.
- Syncing a BlackBerry with Evolution.

The test system for this article is my HP Pavilion DV6458 laptop running Debian GNU/Linux's Lenny distribution. By the time this article is published, Lenny either will be the stable release of Debian, or it will be just short of that status. My phone is the BlackBerry Curve 8320, running on the T-Mobile network.

For it to be useful as anything but a pure telephone, you must install a microSD Flash memory card in your Curve. I use a 6GB card, which can hold 20 albums of music plus 20 podcasts at a time and still leave a couple gigs for photos and video. Installing your microSD card will expose you to one of RIM's puzzling decisions: the SD card is under the battery. Yes, that's right. You have to power-cycle the phone to change cards. As booting after a power cycle is notoriously slow for BlackBerries, this is a major annoyance. Because of this, I strongly recommend getting the highest-capacity card or cards you can afford to minimize the need to swap.

Connecting the Phone to the PC

Another thing that puzzles and irritates Research In Motion's customers: RIM includes Bluetooth in its phones, but it's crippled. If you'd like to transfer data to and from your BlackBerry Curve, you must use a USB cable. The upside is, it's incredibly simple. Just plug a standard USB cable in to the phone and computer, and your system should detect the phone automatically. If you are using a disk manager, such as `gnome-volume-manager`, the microSD card in the BlackBerry should appear automatically as a removable disk drive. Transferring anything to or from the card is as simple as a `cp` command or dragging and dropping in any file manager.

Backup and Restore

First, you obviously can back up and restore the contents of the microSD card like any other mounted drive. However, the phone's own databases are not part of the filesystem, so special software is required. Luckily for me, there's a package already designed for this purpose, Barry, a project hosted and supported by NetDirect, a Canadian computer consultancy specializing in open-source solutions (www.netdirect.ca/software/packages/barry). Barry currently is alpha software, but it's quite usable. Unfortunately, it is not officially packaged for Debian. There are unofficial packages at that site for Debian Stable (Etch), but they are for the i386 architecture only, and they were problematic to install on my AMD64 system, so I was forced to compile my own. (In testing on my tower system, which runs the i386 distribution of Debian Lenny, the pre-created packages worked perfectly.) There is a special set of downloads and instructions on how to create Debian packages available at the Barry site, but unfortunately, they did not work on my system. (This may have been fixed by the time you read this.) However, the traditional

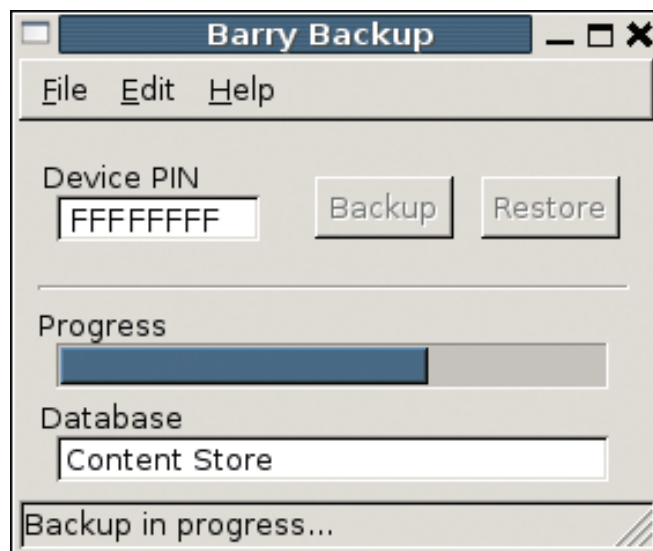


Figure 1. BarryBackup

`make ; sudo make install` combination worked perfectly. You can use `stow` to manage unpackaged applications.

Doing `make install` puts the `libbarry*` libraries into `/usr/local/bin`, but the actual executables expect them to be in `/lib/tls`. Rather than try to reconfigure the program, I simply copied the libraries to that location.

RPMs and instructions for creating RPMs are supplied for distributions that use that packaging system.

After installing Barry, you immediately can back up the BlackBerry databases, including contacts, appointments, settings, memos and so on. First, run the `bcharge` program. `bcharge` does two things:

1. You may have noticed that when you plug your BlackBerry in to a PC running Linux, you are warned that the "charging current is not sufficient". `bcharge` increases charging current to 500mA and eliminates this message, plus it allows your phone to charge much faster.
2. It takes control of the device away from the `usb_storage` kernel module, so that access to the database and other functions is available. Despite this, the microSD card still can be mounted and files copied back and forth.

Note: `bcharge` is not compatible with the kernel module `berry_charge`. If `lsmod` reveals that `berry_charge` is present, use `sudo modprobe -r berry_charge` to remove it before running `bcharge`. If you plan to use `bcharge` routinely, blacklist `berry_charge` (`sudo echo "blacklist berry_charge" >> /etc/modprobe.d/blacklist`).

Apparently, `bcharge` works differently on different computers, depending on the exact device configuration and system. Try running `sudo bcharge -o` first. If this fails, try `sudo bcharge (no flag)`. If even that fails, try `sudo bcharge ; sudo bcharge -o`. You can check whether the device has been detected using `sudo bttool -l`. On my computer, when the device is detected I see this output:

Blackberry devices found:

Device ID: 0xFFFFF. PIN: FFFFFFF,

Description: RIM 8300

Series Colour GPRS Handheld

(I have obscured my device and pin numbers in the above output.)

Barry's btool offers a lot of functionality, and I encourage you to do a man btool to learn more.

To back up my phone's databases, I used the barrybackup application. The installer did not set the program to setuid root, which is required. I had to sudo chmod +s /usr/local/bin/barrybackup before the program would work correctly.

Simply click the Backup button, and all databases are backed up. You can configure which databases are backed up and also choose to restore only certain databases, by clicking Edit→Config. Backups are stored as tar.gz files in ~/.barry/backup/FFFFFFF, where that last hex number is your device PIN.

Audio and Video on the Curve

I got this phone specifically to replace my MP3 player. It has excellent sound and video quality (given the tiny screen's limitations), and a high-capacity microSD card can hold a lot of music. Of course, given that the card must hold music, video, photos taken with the built-in camera, ebooks and everything else, you will want to use the most efficient file formats.

First, let's discuss music. The Curve supports MP3, AAC, MIDI and WMA files for audio. Because I'm trying to use free tools as much as possible, WMA and AAC formats are problematic, leaving me with MP3. (MIDI is a specialized format not usable for recorded music.) MP3 files also are supported in fapg (see below).

For CD audio, I use A Better CD Encoder (abcde) to rip the CD, with the command:

```
abcde -o mp3
```

This rips the CD into MP3 files in the current directory. As abcde uses lame for MP3 encoding, you can control the details of the files created to the finest detail, but the default settings actually are more than good enough for me.

The video screen on the Curve has a resolution of 320x240. It accepts video in MP4, 3GP and WMV formats. Obviously, we free-software types prefer to use MP4 (even if it's a patented format) over WMV. I'm not aware of any good free tools to create 3GP (Third-Generation Phone) files.

The Swiss army knife of free software video encoders is FFmpeg. For Debian distributions, you can obtain it by adding the repository at [deb.debian.org](http://deb.debian.org/debian-multimedia.org) to your /etc/apt/sources.list, then running sudo apt-get update

Listing 1. Setting Up msync tool to Work with Evolution and the BlackBerry

```
msync tool --addgroup evo-barry          # Create the sync group
msync tool --addmember evo-barry evo2-sync # dd Evolution's OpenSync
                                           # plugin
msync tool --addmember evo-barry barry-sync # Add Barry's OpenSync
                                           # plugin
msync tool --configure evo-barry 1        # Opens an editor for the
                                           # evo2-sync config file
msync tool --configure evo-barry 2        # Opens an editor for the
                                           # barry-sync config file
```

Listing 2. The barry-sync Configuration File

```
# This is the default configuration file
# for the barry-sync opensync plugin.
# Comments are preceded by a '#' mark at the
# beginning of a line.
# The config format is a set of lines of .
#
# Keywords available:
#
# DebugMode - If present, verbose USB debug
# output will be enabled
#
# Device - If present, it is followed by the following values:
# PIN number - PIN number of the device to sync with (in hex)
# sync calendar - 1 to sync calendar, 0 to skip
# sync contacts - 1 to sync contacts, 0 to skip
#
# Password secret - If present, specifies the device's
# password in plain text
#
#DebugMode

Device 3009efe3 1 1

#Password secret
```

&& sudo apt-get install ffmpeg. Starting with any supported video, converting is as simple as this command:

```
ffmpeg -i myvideo.avi -s 320x240 -b 64k --ab 64k myvideo.mp4
```

This sets the dimensions to 320x240, and the audio and video bitrates to 64kbps. You can adjust these settings to taste. Note that the Curve can play back video compressed using only the MPEG 4 Part Two Advanced Simple Protocol (ASP). H.264, or MPEG 4 Advanced Video Codec, is *not* supported.

Transferring audio and video files to the handset can be done with cp or a file manager like Krusader. Audio files should be stored in /Blackberry/music, and video in /Blackberry/videos. You can create subfolders within these

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for your own convenience, but the handset will ignore them and catalog the media based only on metadata (also known as ID3 tags) embedded in the files. Music can be viewed by Artist, Album, Genre or Playlists. The Media application works with M3U playlists, which can be created using fapg (the FAsT Playlist Generator, see Resources). M3U playlists are simple text files and can be modified using any editor.

When the Curve is disconnected from your computer, the Media application scans the music and video directories and generates lists of available audio and video files. This takes a few minutes, depending on how much is stored on the microSD card. Your songs may not be available until the scan is complete.

Synchronizing with Evolution

NetDirect has an excellent document explaining how to sync your BlackBerry Contacts and Appointments with Evolution using Barry here: www.netdirect.ca/software/packages/barry/sync.php. To do so requires that you install the Debian packages multisync-tools and libopensync0.

Before synchronizing, you must create a sync group

XmBlackBerry is a single GUI program, as opposed to Barry's suite of several mostly command-line tools.

that includes Evolution and the Barry opensync plugin (Listing 1).

Unless you have changed the default locations of the Evolution data files, you shouldn't need to change anything in the configuration file for evo2-sync. The barry-sync default configuration file looks like Listing 2.

Unless you have assigned a password for your Curve, the only change needed here is to replace 3009efe3 with the correct PIN, which you can find using `bttool -l`. If you have trouble with sync, you can uncomment DebugMode. Before syncing, Evolution and its back-end servers should be shut down:

```
evolution --force-shutdown
```

Then, syncing is as easy as:

```
msynctool --sync evo-barry
```

Note: on my Debian system, msynctool could not connect to the BlackBerry unless it was able to run with elevated privileges:

```
sudo chmod +s /usr/bin/msynctool
```

You also could change the permissions on the USB device to correct this problem.

Sync still is very much in alpha, and it can destroy your data! Be sure you have backups of both the Curve and

Evolution databases before you sync.

Wrapping Up: Alternatives and the Future

My BlackBerry does not connect to a BES (BlackBerry Enterprise Server), so I have not tested any interactions between Barry and enterprise systems.

There is another free software project with the goal of making BlackBerry functionality available to Linux users. XmBlackBerry is a single GUI program, as opposed to Barry's suite of several mostly command-line tools. I went with Barry for myself and for this article, because XmBlackBerry hasn't had a release in more than a year, and I am comfortable on the command line. If you have a BlackBerry, keep an eye on XmBlackBerry, which is being actively developed and looks very promising.

Both Barry and XmBlackBerry support using the phone as a tethered modem to connect your computer to a cellular data network. However, at this time, neither works correctly with the 8320. I have reported this to the Barry developers, and by the time you read this article, the problem may have been fixed. I hope so, because using the Curve as a modem is almost the only reason I ever boot my laptop into Windows.

When I started using Linux in the early 1990s, there was a real feeling of adventure. Every time you installed a program, you were likely to have to solve some sort of problem or invent a workaround. I don't regret the fact that Linux and free software are so polished and generally easy to use. Still, it's exciting to be working with software on the cutting edge again. BlackBerry support in Linux still is a work in progress, but it's just the sort of fun challenge that got a lot of us into this in the first place. I'm looking forward to seeing how things progress. ■

Carl Fink has, in his career, been a museum guide, schoolteacher, system administrator, programmer and corporate trainer. These days, he makes his living as a writer and spends much of his spare time helping to put on I-CON, an annual science-fiction convention on Long Island. He blogs at nitpicking.com.

Resources

Barry: www.netdirect.ca/software/packages/barry

XmBlackBerry: xmblackberry.sourceforge.net

Syncing Your Blackberry:
www.linux.com/feature/123251

A Better CD Encoder (abcde): code.google.com/p/abcde

Evolution: freshmeat.net/redirect/evolution/2452/url_homepage/evolution

Fast Audio Playlist Generator (fapg):
royale.zerezo.com/fapg

FFmpeg: ffmpeg.mplayerhq.hu

ACM/IFIP/USENIX 9TH INTERNATIONAL MIDDLEWARE CONFERENCE (MIDDLEWARE 2008)

DECEMBER 1–5, 2008, LEUVEN, BELGIUM
<http://middleware2008.cs.kuleuven.be>

FOURTH WORKSHOP ON HOT TOPICS IN SYSTEM DEPENDABILITY (HOTDEP '08)

Co-located with OSDI '08
DECEMBER 7, 2008, SAN DIEGO, CA, USA
<http://www.usenix.org/hotdep08>

FIRST USENIX WORKSHOP ON THE ANALYSIS OF SYSTEM LOGS (WASL '08)

Co-located with OSDI '08
DECEMBER 7, 2008, SAN DIEGO, CA, USA
<http://www.usenix.org/wasl08>

WORKSHOP ON POWER AWARE COMPUTING AND SYSTEMS (HOTPOWER '08)

Co-located with OSDI '08
DECEMBER 7, 2008, SAN DIEGO, CA, USA
<http://www.usenix.org/hotpower08>

8TH USENIX SYMPOSIUM ON OPERATING SYSTEMS DESIGN AND IMPLEMENTATION (OSDI '08)

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and ACM SIGOPS
APRIL 22–24, 2009, BOSTON, MA, USA
<http://www.usenix.org/nsdi09>

12TH WORKSHOP ON HOT TOPICS IN OPERATING SYSTEMS (HOTOS XII)

Sponsored by USENIX in cooperation with the IEEE Technical
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<http://www.usenix.org/hotos09>
Paper submissions due: January 13, 2009

2009 USENIX ANNUAL TECHNICAL CONFERENCE

JUNE 14–19, 2009, SAN DIEGO, CA, USA
<http://www.usenix.org/usenix09>
Paper submissions due: January 9, 2009

18TH USENIX SECURITY SYMPOSIUM

AUGUST 10–14, 2009, MONTREAL, CANADA
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Paper submissions due: February 4, 2009

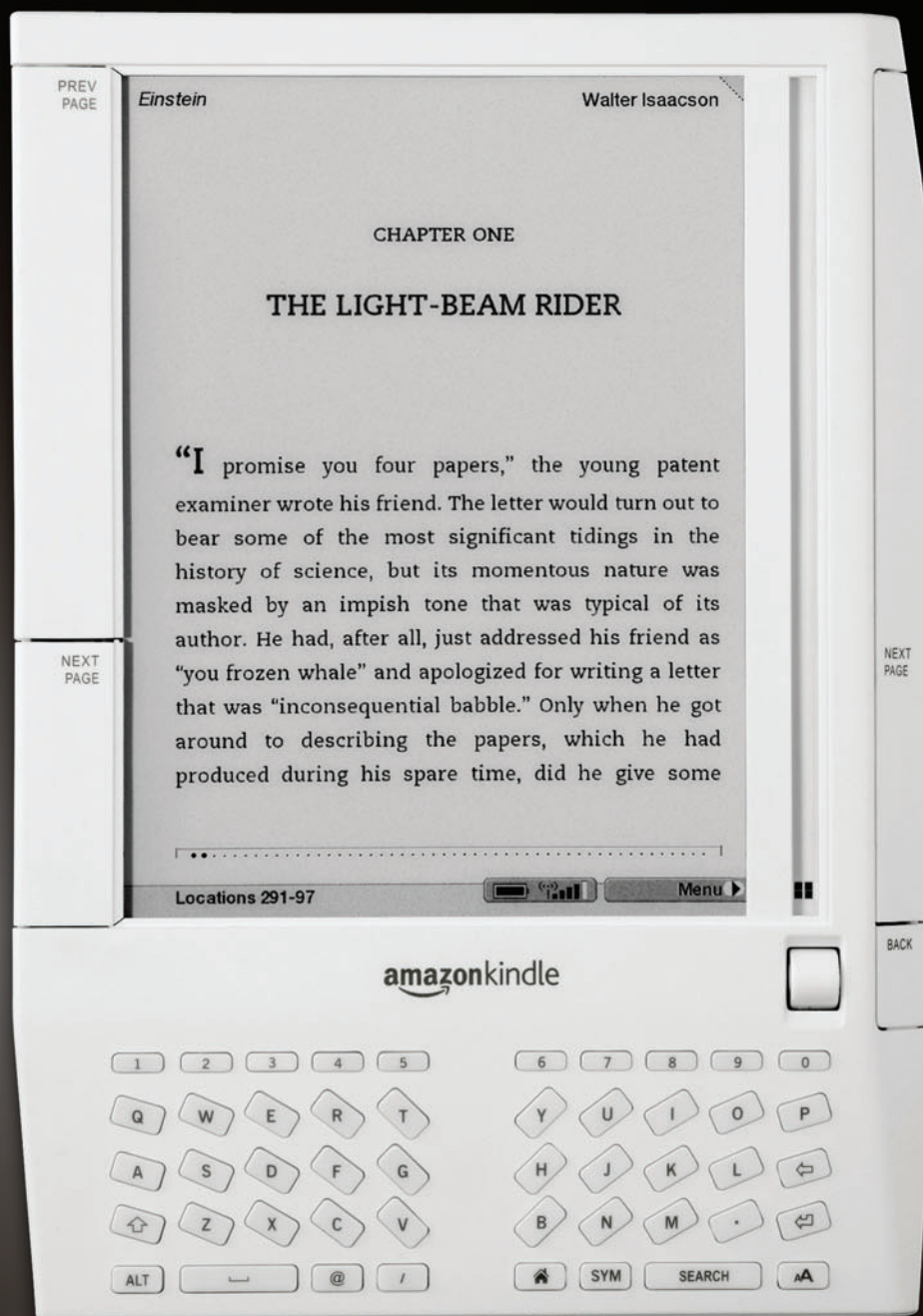
23RD LARGE INSTALLATION SYSTEM ADMINISTRATION CONFERENCE (LISA '09)

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NOVEMBER 1–6, 2009, BALTIMORE, MD, USA
<http://www.usenix.org/lisa09>

A Look at the Kindle

Yes, it
runs Linux.
Yes, you
can hack it.

DANIEL
BARTHOLOMEW



The Kindle has been out for a year now, and Amazon has had plenty of time to work out any kinks in the software and hardware. It should be a rock-solid device, right? I decided to find out. After spending some quality time with the Kindle, I now can say the answer is mixed. Some things work great on the Kindle, but other things just don't, and some of those things probably never will work right (until Kindle 2.0, that is).

The good news is that the Kindle is readily available. Early on, it was perpetually out of stock on Amazon's Web site. Some critics claimed the shortages were self-inflicted, and Amazon claimed demand was simply "overwhelming". Whatever the reasons were, they have been overcome. You want one delivered tomorrow? Done.

The Kindle comes in a very attractive package that resembles a book. Inside the box, you get a USB cable, a power brick, a manual, a handsome carrying case and the Kindle itself.

After performing my solemn duty as a man and a geek of throwing away the manual, it was time to get the Kindle up and running. The first order of business was to plug it in and



Figure 1. The Kindle comes with everything you see here.

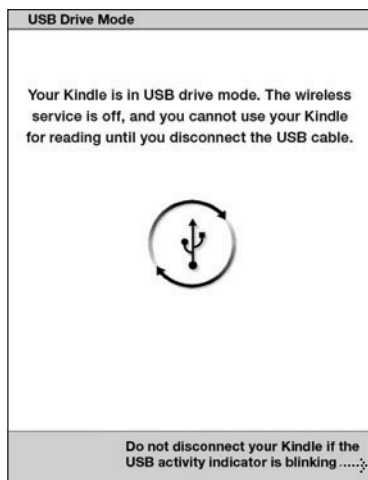


Figure 2. This screen appears on the Kindle while USB is plugged in.

charge it up, and then, get some content on it. Thankfully, charging takes only a couple hours, and you can use the Kindle while it's charging.

Connecting the Kindle to your computer is as easy as connecting any other modern electronic device via a standard USB cable. The Kindle shows up as a removable device, like most cameras and thumbdrives. If you have an SD card plugged in to the SD card slot, it also shows up.

First and foremost, the Kindle is defined by its screen. The E Ink display immediately sets it apart from LCD and CRT displays. The best word to describe it is steady. I can stare at it for hours without my eyes growing tired like



Figure 3. Ports on the Bottom of the Kindle

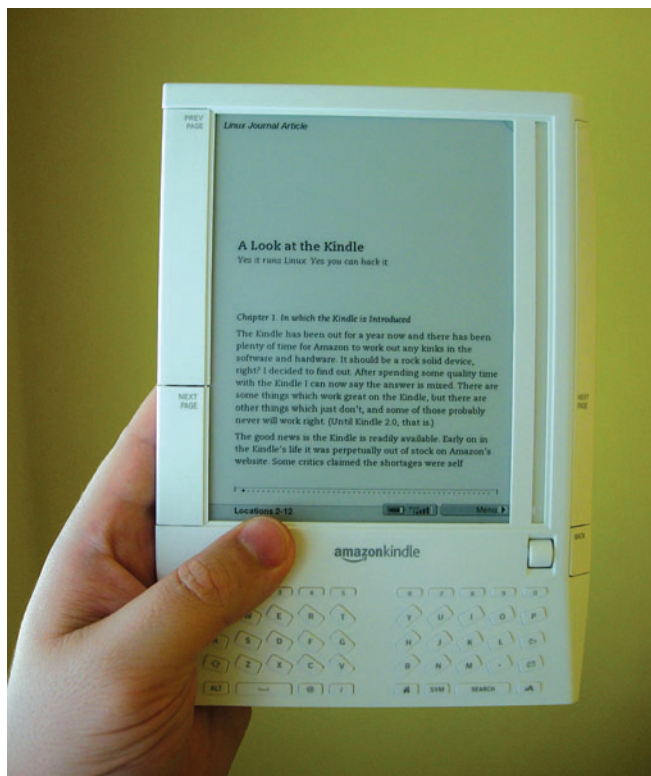


Figure 4. The Kindle is small and light.

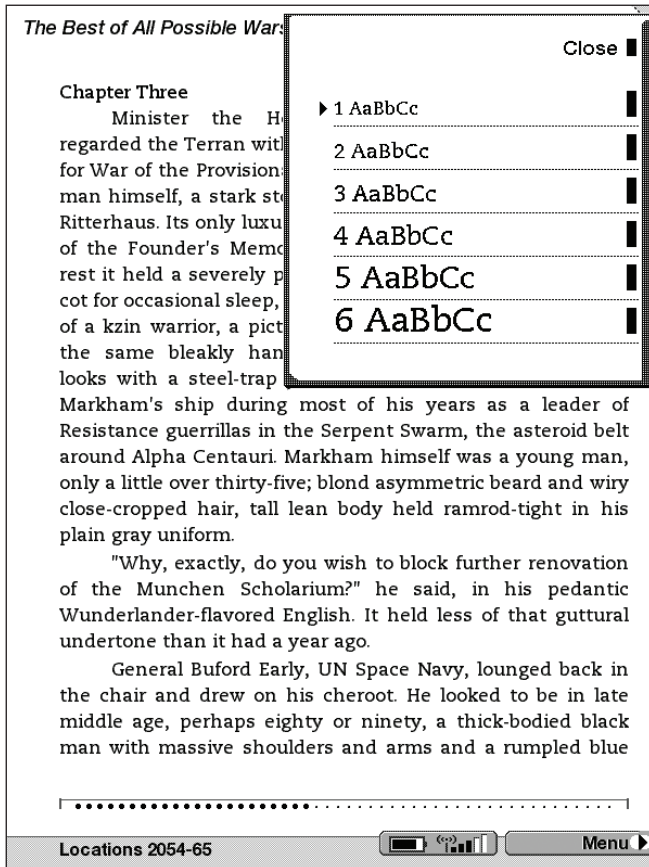


Figure 5. You can change the font size to whatever you like.

they do with LCD displays. Yes, it is only black and white with a few levels of gray, but for something designed for reading, it is ideal, or nearly so. The current generation of electronic pager displays isn't perfect—the blacks aren't truly black, and the whites are more of a light gray—but it's pretty close.

The Kindle is powered by a PXA255 XScale processor and has 256MB of internal Flash memory (with 180MB available for books and other content). Under the back cover of the Kindle is an SD card slot, the reset hole and the battery.

Navigation on the Kindle is handled by the Prev Page, Next Page and Back buttons along either side of the Kindle and by a clever scroll wheel, which functions as the Kindle's mouse replacement.

The keyboard on the Kindle is cramped. The keys are too small, and they require too much force when pressing them. It works though, and the typing needed is minimal, so I can live with it.

All documents on the Kindle behave more or less the same. There's no scrolling; instead, you page through the text. You can change the font size and use the scroll wheel to look up words in the built-in dictionary or follow links to other places in the document. You can bookmark a page by moving the scroll cursor to the top of its track and virtually folding down the top-right corner of the page. You also can add notes to the text and highlight passages by drawing boxes around them.

The Kindle's Features

One of the earliest complaints leveled against the Kindle was that it is tied to Amazon.com and its storefront. Along those lines, the two most common fears were "If my Kindle loses its memory, will I lose all my books and have to buy them again?" and "Is Amazon my only source for content?" The answer to both of those questions is no.

Amazon keeps a record of all of your purchases and lets you re-download them at any time. You also can back up your Kindle files on your computer. The Kindle is well integrated into Amazon's bookstore, but it is not tied to it. Several eBookstores have eBooks for free download or purchase, including ManyBooks.net, WebScription, Mobipocket.com and many others (see Resources).

Mobipocket is the originator of the Mobipocket eBook format. It was purchased by Amazon in 2005, so it's not surprising that the default format for Kindle eBooks is Mobipocket. Amazon adds DRM, unfortunately, to the otherwise Mobipocket-formatted eBooks it sells through Amazon.com and the built-in-to-the-Kindle bookstore. True to the real intent of DRM, this does little to stop piracy and everything to punish and annoy honest citizens. But, and this is a big one, the Kindle reads unencrypted Mobipocket files just fine. All of the sites listed above offer books in Mobipocket and other formats. My favorite of the bunch is ManyBooks.net, because it specializes in public domain books—meaning the books available for download on its site are not only free, they're also free (if you know what I mean).

One of the Kindle's neatest features is its wireless capabilities. The Kindle cannot connect to your Wi-Fi network, but it doesn't need to. Instead, it uses a built-in EVDO modem to connect to what Amazon calls its Whisper Net, but in reality, it's just Sprint's CDMA network. There is no charge for using this network, even for Web browsing. Instead, the costs are rolled in to the price of the Kindle itself, and the books, magazines and services you buy from Amazon.

Actually, I shouldn't include "services" in the above list, because right now, the only service Amazon charges for is its document-conversion service. You can e-mail Word, HTML or image documents to <yourname@kindle.com>, and they are converted and sent directly to your Kindle for \$0.10 each. There's also a free version where you can e-mail documents to <yourname@free.kindle.com>, and you'll get a link to the converted document sent back to you (getting it onto your Kindle is your responsibility). The yourname part of the e-mail can be set and changed at Amazon.com in the Manage Your Kindle section.

I tested the conversion functionality with several documents, and I tried both the no-cost and regular services. There wasn't any difference in the time it took to convert the documents. The only difference was that one was sent to my Kindle automatically and the other arrived in my e-mail and had to be transferred manually to my Kindle.

My first test involved sending some .pdf files for conversion. The text converted fine, but I lost the graphics, some of the formatting, internal links and the .pdf's table of contents. I can't be too upset about what failed though, as .pdf isn't an officially supported file format. With all the PDF documents I have, it's nice that it works, even with some limitations.

I also tried sending over .gif, .jpg, .odt, .ods, .doc, .xls, .rtf

and .html documents. The .html, .rtf, .gif, .jpg and .doc documents came through fine, but the translation service did not recognize the OpenDocument or Excel documents.

By default, this service converts and sends to your Kindle only documents sent from your primary e-mail address as configured at Amazon.com. You can add additional e-mail addresses.

The Kindle Is Open to Experimentation

The Kindle's main menu has an Experimental item on it. This submenu has three choices: Basic Web, Ask Kindle NowNow and Play Music.

Basic Web is what it claims to be—a basic Web browser. It has two viewing modes: Default and Advanced. Default strips out most formatting and just provides the content of the page you're viewing. Advanced mode tries to render some of the page's layout.

Ask Kindle NowNow is a human-powered search service from Amazon. You can ask a question and submit it, and then real people will research it on-line and send up to three responses to your Kindle. The service is free for now, but I can't imagine it will remain free indefinitely. To test it, I sent the question: "When will the successor to the Kindle be announced?" About 30 minutes later, I had three answers on my Kindle and in my e-mail inbox. They were all along the lines of "not this year". The first one was the best; it was well

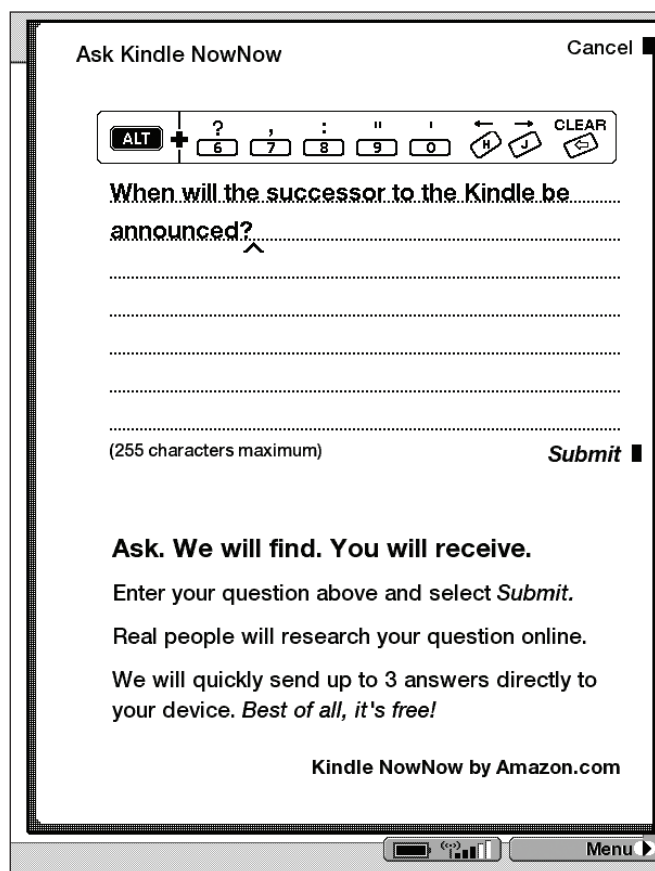


Figure 6. Ask Kindle NowNow any question, and people will try to answer it.

researched and included statements from Amazon on the subject. The other two were short and not as informative, but still good. The responses also included links. Clicking on the links opens up the Kindle Web browser to the page in question—rather handy.

Playing music on the kindle works for MP3 files. No other formats work. There's also no playlist support and no user interface apart from the Play button on the Experimental page. There are two undocumented keyboard shortcuts you can use: Alt-F to skip to the next song and Alt-P to Play/Pause the music. It's not the most useful of music players, but it does play music.

The Kindle's Openness

Because the Kindle runs on Linux, you can download the source code to the Kindle from Amazon's Web site. Several bits of the code, like the GUI layer, are not available.

The source code tar file weighs in at 72.4MB. When untarred, you are left with a gplresults directory. Inside this directory are the following tar.bz2 files: alsa-lib-1.0.6.tar.bz2, alsa-utils-1.0.6.tar.bz2, binutils-2.16.1.tar.bz2, bsdiff-4.3.tar.bz2, busybox-1.01.tar.bz2, bzip2-1.0.3.tar.bz2, dosfstools-2.11.tar.bz2, e2fsprogs-1.38.tar.bz2, freetype-2.1.10.tar.bz2, gcc-3.4.2.tar.bz2, jpeg-6b.tar.bz2, libpng-1.2.8.tar.bz2, linux-2.6.10-lab126.tar.bz2, module-init-tools-3.1.tar.bz2, ncurses-5.4.tar.bz2, ppp-2.4.4b1.tar.bz2, procps-3.2.7.tar.bz2, taglib-1.4.tar.bz2, u-boot-1.1.2.tar.bz2, uClibc-0.9.27.tar.bz2, util-linux-2.12.tar.bz2 and zlib-1.2.3.tar.bz2.

We can deduce several things from this list: the Kindle boots with Das U-Boot, it uses FreeType for fonts, ALSA for audio, and it is using a Linux 2.6.10 kernel. I'm not a programmer, so I didn't delve into the code to see what was changed, reworked or added.

Hacking the Kindle

One of the more interesting pieces of code on the Kindle is BusyBox. Its presence suggests there is support for a command-line interface of some sort. It turns out there is, but it's not easy to access.

If you take the back cover off the Kindle, there is a little covered access port next to the battery. This access port can be

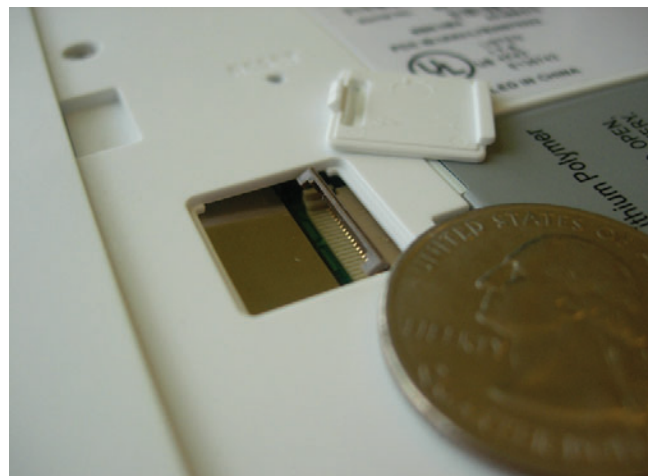


Figure 7. The console port on the back of the Kindle is small.

removed with a small flat-head screwdriver. Under the cover is a small ribbon connector port, which functions as a console port. See Resources for links to the full details of the hack.

Exposing the Kindle's Secrets

Thanks to the intrepid hacker who hacked into the Kindle through the console port, several hidden features of the Kindle have been brought to light.

First, there is a basic picture viewer built in to the Kindle. To enable it, you need to create a folder on the Kindle called pictures or dcim. In that folder, you can organize your photos into subfolders. Press Alt-Shift-Z while in the main menu of the Kindle, and each folder will appear as a separate "book" on the last page of the list of books.

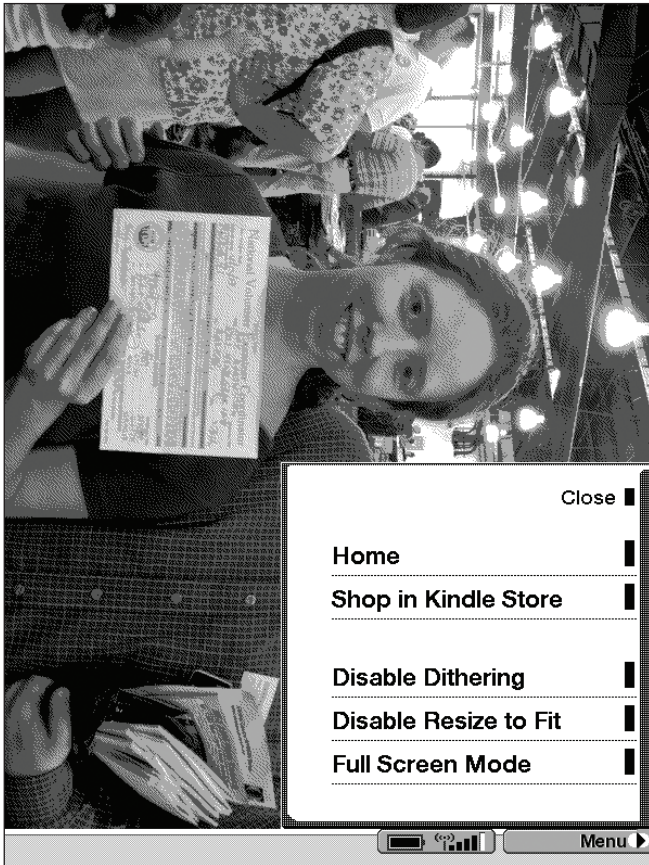


Figure 8. The options for the picture viewer app are few.

While viewing pictures, you can use the menu to enable and disable dithering and shrink to fit. You also can view photos in full-screen mode. While looking at your pictures, you can press Alt-Shift-0 to set the current picture as the picture for the Kindle screensaver. You also can press F to toggle full-screen mode.

A picture viewer isn't the only hidden application. There also is a *Minesweeper* game. You can launch it from the Kindle home screen by pressing Alt-Shift-M. From the menu, you can select different grid sizes from 4x5 to 8x10 to 14x14. Unfortunately, the novelty of having *Minesweeper* on the Kindle wears off as soon as you start playing. The Kindle's E Ink display just isn't suited to quick changes to

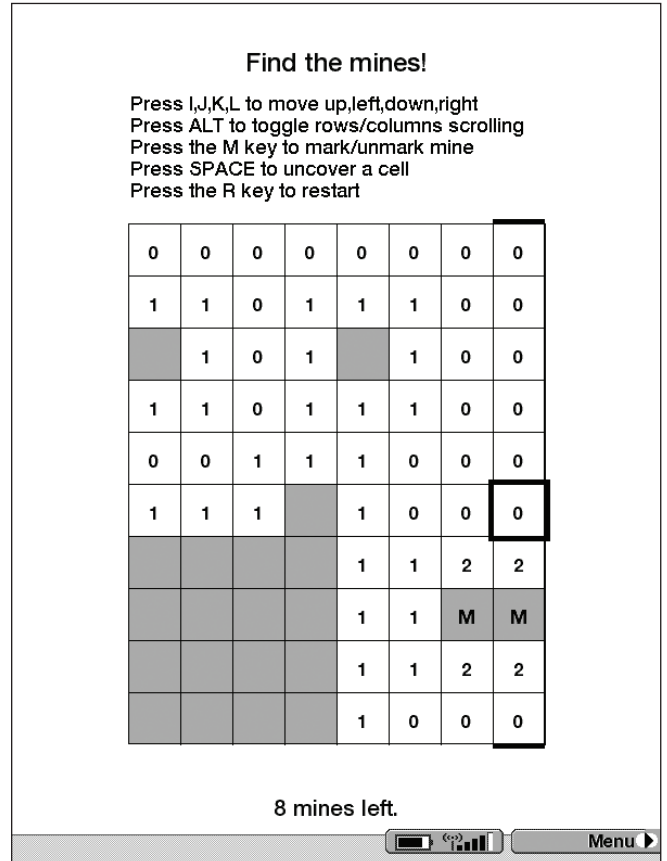


Figure 9. You can play *Minesweeper*, if you have the patience for it.

the screen. Moving the cursor in *Minesweeper* is an exercise in patience: you press L, wait a few seconds, and with any luck, the cursor moves one space to the left. The slowness of the gameplay is probably why Amazon never provided a proper link to *Minesweeper* in the interface. I'm glad Amazon didn't take it out though, as it shows the Kindle is at least marginally capable of running a wide variety of software.

The Browser has a few neat keyboard shortcuts, including links to Google Maps to show your current location (Alt-1), nearby gas stations (Alt-2), nearby restaurants (Alt-3) and nearby hotels (Alt-4). When you press Alt-5, a little box pops up asking "Are you looking for something nearby?", and you enter what you're looking for, and it searches for it. Well, it would, if any of these shortcuts worked. Instead of working, the Kindle just goes to Google Maps and puts "Not Avail,Not Avail" into the location box. Either it just doesn't work in my area, or there is some switch waiting to be thrown at Amazon or Sprint to enable it.

Finally, there are several global shortcuts that come in handy. The first is Alt-Shift-R, which reboots the Kindle. Next is Alt-Shift-., which restarts only the Kindle GUI. This last one is the most useful, for me anyway—Alt-Shift-G is a global screenshot shortcut.

Some Annoyances

The Kindle is underpowered, especially with larger books or when it's busy indexing or doing some other background task.

Next, the Kindle crashed a few times during my testing. Granted, I was running several apps that don't officially exist, but I don't feel I should have had to use the reset button as often as I did. Amazon still has some work to do there.

The Mobipocket format is another annoyance. It is an old binary format from the days when the Palm was known as the Pilot. It's not a very well documented format, and all of the tools for converting documents to it are proprietary and Windows-only.

Conclusion

The big question regarding the Kindle is whether it is actually worth \$350. My thought is it is, *if you read a lot*.

And, I do. I carry around lots of books and printouts and miscellaneous scraps of paper—some for enjoyment and many for my job. I used to try reading things on my computer, but found my eyes quickly tired, so I switched to printing out longer articles and documentation I wanted to read. Apart from being environmentally wasteful, all that loose, printed material has to be organized or it grows into a big mess.

The Kindle has eliminated a lot of the mess. Now, when I head back to the server room, the only thing I need to carry is the Kindle—no stacks of notes and no reams of product documentation. It's all in the Kindle, along with a new novel to read while waiting for the server to finish its install. And, my desk is cleaner than any time in recent memory.

Is it worth \$350? For me? Yes. ■

Daniel Bartholomew lives with his wife and children in North Carolina. His normal on-line presence is at daniel-bartholomew.com, but he also can be found on Twitter as [daniel_bart](https://twitter.com/daniel_bart) and on identi.ca (and Jaiku and Pownce) as bartholomew.

Resources

Kindle Source Code: www.amazon.com/gp/help/customer/display.html?ie=UTF8&nodeId=200203720&tag=partic-culturf-20

A Discussion of the .mobi File Format: www.mobileread.com/forums/showthread.php?t=16514

Hacking the Kindle, Parts 1–3:
igorsk.blogspot.com/2007/12/hacking-kindle-part-1-getting-console.html,
igorsk.blogspot.com/2007/12/hacking-kindle-part-2-bootloader-and.html and
igorsk.blogspot.com/2007/12/hacking-kindle-part-3-root-shell-and.html

MobileRead—a Forum Devoted to eBooks:
www.mobileread.com

Non-Amazon Places to Get Kindle-Ready Books:
manybooks.net, www.baen.com/library,
www.webscription.net and www.mobipocket.com

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LINUX DEVICE ROUNDUP

Four Linux device experts offer their opinions on the state of Linux devices and tell you about their must-have favorites.

JAMES GRAY

» In this article, *Linux Journal* speaks with four Linux device experts—Henry Kingman, Rick Lehrbaum, Shawn Powers and Bill Weinberg—in a virtual roundtable to take the pulse of Linux-based devices. They discuss the state of Linux-driven devices, their promise for the future and which ones are their favorites. Our roundtable participants are some of the best-known voices and “virtual pens” in the Linux device space:



Henry Kingman has edited the renowned site LinuxDevices.com since 2003. Kingman started his Web publishing career in 1998 at ZDNet, building a massive TipZone database largely composed of Microsoft software bugs.



Shawn Powers is the celebrated Gadget Guy product reviewer for LinuxJournal.com and Associate Editor for *Linux Journal*. He is also technology director for a K-12 school district in Michigan.



Rick Lehrbaum is the founder and editor of the popular site DeviceGuru.com, an independent blog devoted to new and emerging device technologies. In addition to founding LinuxDevices.com—now a part of DeviceForge.com—Lehrbaum cofounded Ampro Computers and consults for companies in the embedded market.



Bill Weinberg is an Independent Analyst and Consultant at LinuxPundit.com. He also serves as General Manager of the Linux Phone Standards (LiPS) Forum and Mobile Linux Weatherman for the Linux Foundation. Previously, Weinberg was with Open Source Development Labs (OSDL) as Senior Technology Analyst and manager of the group’s Mobile Linux and Carrier Grade Linux Initiatives, as well as a founding team member at MontaVista Software.

What are the most significant trends in the world of Linux-based devices?

Henry Kingman: Some trends in the world of Linux may be:

- Using desktop and server software instead of special “embedded” software (Nokia started this trend).
- Using Linux in place of an RTOS (real-time OS).
- Better “free” sources of Linux, such as the kernels, BSPs and filesystems supplied by chip or board suppliers and open-source projects.
- More commercial support options, with hybrid service/product companies like Embedded Alley making headway.
- Better tools, with the industry aligning behind Eclipse and its top-level Device Software Development Platform.

Trends *caused* by Linux may include:

- Ridiculous feature proliferation, such as multiple radios in mobile devices, car stereos that can park the car, vending machines that phone in orders and so on.
- Ubiquitous networking.
- Ubiquitous Web control interfaces.
- Near-ubiquitous media rendering and GPS.

- Richer interfaces across the board.
- Ever-shorter product life cycles.

Rick Lehrbaum: First, Linux is really well established. It’s become the default choice for devices with 32-bit processors—that is, developers tend to start with the assumption that they’ll use Linux and use something else only if they require special capabilities, or if the “politics” of their company are strongly stacked in favor of an RTOS or Windows CE/XPe.

Second, Linux has become the default OS for several device categories,

was Linux, but wasn’t really *about* Linux. It’s as if we’ve finally taken over the world, and it’s not as exciting as we thought it would be.

Bill Weinberg: Linux is becoming increasingly ubiquitous as an embedded software platform. From data gleaned from analyst reports and from my own direct contact with OEMs, about one-third of 32- and 64-bit designs are using Linux. Application areas include mobile telephony, consumer electronics, automotive systems/GPS, telecommunications and networking infrastructure, even medical and aerospace/defense.

“The second major trend is that the upward motion of the value line put OEMs in the pilot seat.”—Bill Weinberg

including the emerging MID, Netbook and Nettop product categories; traditional thin-client terminals; Wi-Fi routers; set-top boxes, such as TiVo and the Roku Netflix box; and very significantly, mid- and high-end mobile phones.

Shawn Powers: I think largely the idea that Linux is no longer a buzzword, but rather the norm, is very significant. It’s almost unsettling that so many devices are incorporating Linux, and yet that isn’t as unique and exciting as it used to be from a marketing standpoint. Back in August at LinuxWorld, I noticed a huge trend in that so much of the conference

Trends that I see include consolidation of systems/software platforms—mobile in particular. The visible manifestations of the trend toward consolidation include the merger of dot-orgs like LIPS and LiMo; companies like ACCESS, Azingo, Purple Labs and others joining LiMo and embracing that platform spec; Intel embracing Ubuntu/Canonical as part of Moblin and also buying OpenHand; Wind River buying Mizi Research; and Sun refocusing the role of Linux-based JavaFX Mobile to complement Google/Android.

Frankly, more important (in my humble opinion) than “.organic” mergers and activities is ORGANIC consolidation.

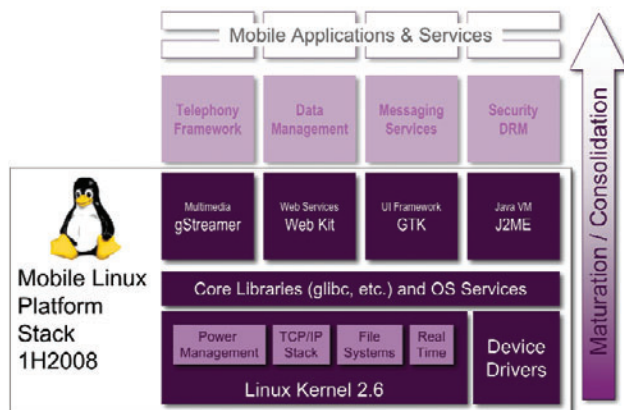


Figure 1. Consolidation (Copyright LinuxPundit 2008)

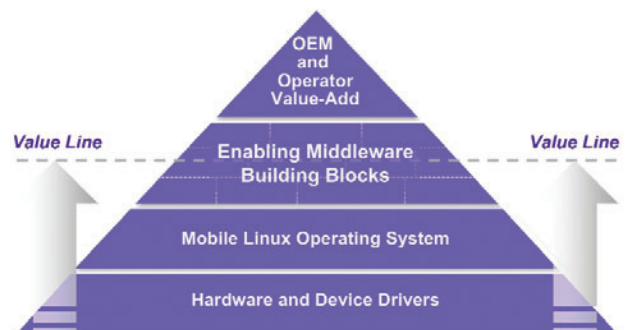


Figure 2. OEMs in the Pilot Seat (Copyright LinuxPundit 2008)

Roku's Netflix Player

(www.roku.com/products/netflixplayer)

"Instant movie gratification" coos Henry Kingman of Roku's Linux-driven Netflix Player, a networked video device that delivers Netflix streaming content directly to your television. It provides access to a library of more than 12,000 on-demand titles from Netflix. The Netflix Player is HD-ready and has all the connections you need to connect to a TV, HDTV, home theatre or A/V receiver, including HDMI. The device includes Ethernet and Wi-Fi (802.11b/g), allowing one to play, pause, fast-forward and rewind movies directly from the Internet over a home network.



Roku Netflix

Roku has used Linux on the Netflix Player has since its inception. Roku's David Westerhoff, Director of Software Engineering, says his company chose Linux because it has "come a long way" and allows it to "focus on developing [its] application and helps keep the costs down". Westerhoff adds that having the source code gives his team the flexibility to "go deep if necessary to debug, troubleshoot

and optimize our software for the best user experience". During product development, Roku developers found and fixed about a half-dozen distinct bugs in the build toolchain, plus some driver-specific bugs. However, the 2.6.19.1 Linux kernel has been very stable and required no modifications to the product.

The device uses the MIPS-based PNX8935 SoC from NXP Semiconductors for application and video processing. The application is written primarily in C++ and runs a Linux 2.6.19.1 kernel. Roku uses DirectFB to provide an abstraction layer for the graphics and video services on the platform and Qt 4.3 to provide a framework for UI development. The device has no hard disk, just 256MB of DDR RAM to provide the memory needed for its applications, plus the buffering necessary to support streaming video playback.

"Robust video streaming over home networks takes a significant amount of effort to get right", adds Westerhoff. Therefore, the Player uses dynamic bandwidth detection to select the best possible stream for the user's network and then monitors it continuously during playback to provide the best user experience possible. If the available bandwidth changes, the device responds by selecting a new stream at a bitrate appropriate for the situation.

directly from OSS projects with their value-added internal code and ISVware. And, they can mix and match. This development is illustrated in Figure 2.

Are you optimistic for the future of Linux-based devices?

Kingman: Yes. If they are running Linux, they won't crash, and the battery will last a long time.

Lehrbaum: Yes, very much so. Silicon vendors now favor Linux as the number-one platform to get their new device-oriented processors, chipsets and peripheral controllers up and running on, so Linux support gets a strong head start and is generally promoted by chip makers.

Powers: Oh, without a doubt. In fact, although I was joking a bit regarding "taking over the world"—I think Linux will continue to spread into the embedded market. It just makes sense. Also, with projects like Moblin and its ilk, embedded Linux on devices is looking really snazzy.

Weinberg: I remain very bullish on Linux as embedded systems software, notwithstanding announcements from Nokia, Symbian and others (see my blog, address in the Resources for this article) and advances by Microsoft. These and other moves/gestures toward openness and FOSS "scratch the itch" for access to source code as documentation and for source escrow, but they don't offer the unique combination of community-driven development, scalability, performance and real self-determination that you get with Linux and accompanying FOSS.

Do you consider any particular devices from the past year or so to be game-changers for the success of Linux? If so, why?

Kingman: The Wind River Linux Platform for Infotainment, for showing Linux could crack the automotive OEM equipment market; Motorola's Rokr Z6, for showing that a Linux phone could ship in volume in the US; the Netflix Player, for showing how inexpensive and powerful Linux multimedia devices can be; the myriad Orion-based NAS devices, for making NAS affordable to

In particular, if you look at the range of FOSS and commercial mobile platforms (including those mentioned above), you will see a consolidation of foundation components around: the Linux kernel 2.6, glibc, GTK+/Cairo/Pango, WebKit, GStreamer and Java (still a must for legacy interoperability). This development is illustrated in Figure 1.

The second major trend is that the upward motion of the value line put OEMs in the pilot seat. OEMs and

integrators have a better range of choices with regard to buying and/or building a Linux-based embedded platform and toolkit. They can certainly turn to OSVs, like MontaVista and Wind River, and/or smaller packaged product/services companies. They also can purchase application-purposed vertical stacks for mobile, automotive, MIDs and so on from companies like those mentioned above. They also can, with more confidence than ever before, self-integrate bits

Wind River Linux Platform for Infotainment

(www.windriver.com)

Although the Wind River Linux Platform for Infotainment (WRLPI) will remain in development until late 2009, our experts see it as a watershed development for the Linux device space. Wind River calls the platform an "automotive-optimized commercial Linux" for applications for the in-vehicle infotainment segment of the automotive industry. John Bruggeman, Wind River's Chief Marketing Officer, spoke of a "pure open-source strategy"—that is, not just a distribution but a "full and complete platform".

The company chose Linux because consumer electronics manufacturers and suppliers in the automotive sector have found that traditional proprietary approaches come with numerous barriers. These include not only integration and interoperability challenges, but also a lack of the flexibility to create true differentiation. Wind River says that its platform will improve both product development and time-to-market concerns.

WRLPI will be optimized for the Intel Atom processor and will offer

pre-integration with third-party networking and multimedia applications, such as speech-recognition and speech-to-text technologies by Nuance Communications, Inc.; Bluetooth and echo-cancellation and noise reduction solutions by Parrot; music management and automatic playlisting technologies by Gracenote, Inc.; multimedia networking solutions by SMSC; and DVD playback by Corel's LinDVD.

Wind River's senior VP and GM of the Linux product division, Vincent Rerolle said that WRLPI will "reduce the daunting complexity in the in-vehicle market" and be a "disruptive innovation expected to challenge the traditional approach to proprietary solutions and spawn a level of creativity not yet seen in this segment".

Other WRLPI features include support for popular audio and video standards; connectivity with numerous devices, such as the iPod; rich 3-D graphics support; power-state management; quick booting/initialization and automotive standards connectivity (for example, CAN and MOST).

home users; and low-cost, power-efficient Nettop and Netbook devices, such as the Eee PC, for bringing desktop Linux to the masses.

Lehrbaum: I really like the Netflix movie-streaming set-top-box (manufactured by Roku). Linux has long been a winner in TV set-top boxes (think TiVo), and it's an area of exploding interest, given the growing ubiquity of broadband and drive toward streaming content to everyone's home theaters.

Automotive infotainment systems—featuring GPS, traffic updates, Internet access, streaming media, VoIP and so on—is another area set to explode.

There also are two+ major emerging device categories that both typically either come standard Linux or offering Linux as a full-fledged alternative to Windows: MIDs (mobile Internet devices), Netbooks and Nettops. All these terms were coined by Intel. MIDs strongly favor Linux due to being more appliance-like with built-in applications and not a lot of capability for normal users to alter the application set. Netbooks, typified by the Eee PC, have fully functional OSes, albeit stripped to fit in limited resources (often Flash, though HDDs sometimes are available as an option). They are generally available with Linux-only offered for the

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Kangaroo TV

(www.kangaroo.tv)

It's official, folks—Linux has gone Joe Six-Pack. That's because our beloved OS has infiltrated the world of NASCAR autoracing and other sporting events. Embedded Linux is the horsepower under the hood of Kangaroo TV, a new device available for rental at NASCAR (and soon other) events that gives spectators a more entertaining autoracing experience. The wireless, handheld Kangaroo TV provides racing fans a slew of event information, including ten live MPEG-4 video feeds (replays, highlights and in-car views), 64 AC3 audio feeds (driver-to-pit conversations and commentary) and a plethora of real-time stats.

Jean Arseneau, Kangaroo's CTO, says that his firm chose Linux four years ago for many reasons, including its good fit with the ARM processor, strong customiza-



Kangaroo TV

tion possibilities, easier standardized device driver development, easier graphic application development with embedded Qt, availability of codec open-source libraries and a small footprint, among others.

Linux also has allowed Kangaroo to offer advanced features, says Arseneau, such as video fluidity and audio quality with low latency and a high level of user customization. The device is upgradeable through the USB port by becoming a mass storage to the PC.

a bit like an Internet-connected thin client, and Linux does very well in such scenarios. Consequently, Netbooks should be considered a very high-priority target for Linux, just as mid- to high-end mobile phones are an important battleground for embedded Linux.

And, just as Netbooks are a fertile field for Linux, the same is true with Nettops—devices in which much of the heavy-lifting apps are Internet-based, and the device itself mainly needs a browser, e-mail client (not even required), media players and other basic functions, but are not expected to be true PCs that run every app you might want to try to load from a DVD.

Powers: Yes, indeed. The Eee PC began a trend that not only caught on like wildfire, but also significantly displayed Linux as a viable operating system for standard computer usage. We're just beginning to see how the Linux Netbook idea will change computing. The Netbooks are smaller than standard computers (or even notebooks), so they have a lot in common with handheld devices, and yet they are fully functional, so they demonstrate some of the same characteristics as a standard desktop solution. I think Netbooks might bridge the gap and open the door for vendors to take another look at pre-installing Linux on OEM hardware—even on the big desktop machines. That's my hope anyway.

Weinberg: Embedded Linux is already incredibly ubiquitous in intelligent devices. The real question is "What would change the game?" I think there are two vectors that could boost embedded Linux positioning:

1. Truly open mass-market devices running Linux plus enabling middleware that would engender and excite both ISVs and a targeted developer community.
2. Highly differentiated devices where Linux at the core would make a real impression on end users and build brand equity.

I haven't seen either of those situations emerge yet, but then again, other embedded platforms don't enjoy either scenario. Most RTOSes are 100% invisible to end users (except

least expensive models and a choice of Linux or Windows XP Pro for the higher-end models (which have more RAM and storage Flash or HDD). A variant of the Netbook is the Nettop, having similar computing resources (including chipsets) but packaged in a mini PC-style box rather than the mini laptop-style formats of Netbooks.

low-end models, this could be good news for Linux. However, as costs come down and RAM/Flash becomes higher density, the barriers to using Windows (depending on Microsoft's price positioning) could make Windows affordable. But clearly, the lower the end-user pricing of a Netbook, the less likely it is going to be able to afford a full-function

“But clearly, the lower the end-user pricing of a Netbook, the less likely it is going to be able to afford a full-function MS OS like Windows XP or Vista.”—Rick Lehrbaum

The [articles on Netbooks by Lehrbaum, linked to in the Resources section] project the Netbook market will reach 50 million units by 2012, up from about 5 million this year. Obviously, given Linux as a baseline OS in the

MS OS like Windows XP or Vista.

So there is exciting potential here for Linux. Furthermore, bearing in mind that the whole idea of Netbook is the Net—that is, Web-based applications are central to its functioning. Thus, a Netbook is

TomTom GO 930

(www.tomtom.com)

TomTom's GO 930 is one of the slicker portable navigation devices (PNDs) running Linux that has caught our experts' attention. Just switch on the GO 930 and get moving, right out of the box, to find any address in the US, Canada or Europe, complete with turn-by-turn spoken instructions. Bill Weinberg raves about the TomTom devices because they offer "a great experience at an aggressive price and have features that I really love". He touts the community-based points of interest and IQ Routes (explained below), as well as TomTom's humorous approach to in-car navigation. For instance, you can choose John Cleese's voice to guide you, chuckling your way from point A to point B.

Although TomTom is coyest of all about sharing information on its Linux internals, it trumpets the IQ



TomTom's GO 930

Routes that Weinberg enjoys. These are optimal driving routes that have been gathered by its users, calculated by gathering voluntary, anonymous historical driving data from more than seven million users.

But, the GO 930 isn't the only Linux-driven PND in TomTom's lineup—all of the company's products are and have been since 2004.

when they fail). Even Windows Mobile does not enjoy ubiquitous end-user pull, nor much popularity among developers, even if in some markets it's the only game in town.

What limitations or barriers need to be overcome for world domination by Linux in the devices space?

Kingman: Well, Linux has been the dominant device OS since 2003 or 2004, according to the market research I see. For it to continue, I see three hurdles to clear:

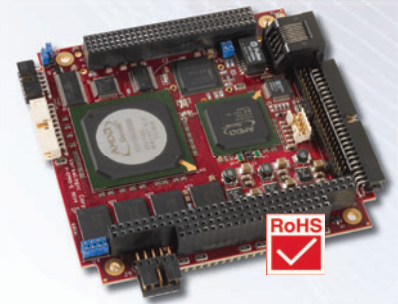
1. Each vertical market may ultimately need to fight fragmentation by forming an industry group and/or support existing standardization efforts, like CELF, LiMo, the LF and so on. That way, the "value line" separating what you get for free vs. where you start differentiating your product can continue to rise, which in turn will attract

new adopters. Linux is a collaboration, and I suspect that the better we work together, the bigger it will get.

2. Within the limitations of the fast product development cycles embedded Linux developers have to deal with, it would be great if more of them would get involved in Linux kernel development. By "active role", I mean tracking current kernel versions when feasible during development and submitting patches to the LKML. This saves Linux from being wholly shaped by enterprise server companies, but it also makes things easier when the time comes to port your stack forward to a new kernel version (if you ever plan to do that), especially if your patches are accepted.

3. It would be great if things continue to get easier, financially, for the commercial embedded Linux OS and tool providers like MontaVista, Wind River and others. These companies

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MooBella

Our beloved Linux can do almost anything, including producing real, fresh ice cream in 45 seconds flat! Well, it used to do that anyway. For almost three years, Linux was the OS inside the MooBella Ice Cream System, a device that produces hard-packed ice creams fresh to order. The device also used Firefox and open-source SQL databases.

LinuxDevices.com's Henry Kingman interviewed MooBella's VP of Engineering, Jim Baxter, who spoke highly of Linux, saying, "This product has gotten further than I ever imagined, in my wildest dreams."

Then in early 2008, MooBella switched manufacturers, the new one a Windows-only shop chosen for non-OS-related reasons, said



MooBella

Bob Brooks, MooBella's Director of Marketing. Although we are saddened to see such a neat device move over to the other side, it's a great feeling to know that our favorite OS can help make your favorite ice cream!

contribute quite a bit to open-source projects, like Linux and Eclipse, as well as to standards bodies and industry groups, helping to ensure that embedded interests are well represented in key projects.

Lehrbaum: One area of concern is the lack of a truly dominant, mainstream, free graphical application toolkit for device applications based on Linux. Qt is popular, but there are licensing and royalty requirements for commercial device applications. This could result in design wins for Windows CE, which is offered at a fairly low royalty rate to OEMs, and which has excellent and inexpensive development tools.

Powers: If you look at the number of Linux-based devices in the market now—not a whole lot needs to be done. I think perhaps we need to market "Linux Inside" stickers, so people actually know there's a penguin under the hood.

If you look slightly outside the gadget or device arena, however, there are a few hurdles that are still sizable. I have a friend who works for Honeywell, designing hardware-testing solutions. Much of

the firmware and software he develops for the hardware is still in MS-DOS. Many vendors are still embedding with DOS and providing only DOS drivers for their hardware. Since he's a friend, I've been hounding him for years to start switching over to Linux instead of building layers of DOS on top of Windows solutions, but in the end, he's held hostage by hardware vendors not opening up their specs enough to allow a programmer any access outside their proprietary DOS or Windows drivers. Because much of what he builds is mission-critical (and often could endanger lives), reverse-engineering isn't something he feels confident doing. It's very frustrating.

Weinberg: In real-world terms, "world domination" and 30%+ market share are almost synonymous. However, some ongoing barriers to adoption include:

- The refusal by the kernel developer community to stabilize kernel APIs and driver architecture to help OEMs and OSVs "future-proof" device drivers. The mismatch between the practices of this important community and actual industry practices is a gap

that neither side is ready to bridge.

- The hazy definition of "embedded Linux" and "mobile Linux" that is presented to ISVs and other developers not currently familiar with Linux. Although Windows/CE/Mobile, Symbian and Java are actually rather fragmented of their own accords, they at least provide the appearance of unified APIs and SDKs. The situation for Linux is improving. See the emerging quasi-standardized APIs from LiMo, OHA and others.
- The insistence of many embedded industry players, advocates and opponents of embedded Linux alike, in perpetuating concerns about GPL and other OSS licensing terms. Reciprocity need not be equated with "infection" and "contamination".

Are there any "dud" devices out there that don't live up to their promise in your view?

Kingman: Any Linux device released without source code or a promise to provide it is a dud in my book. There tends to be more GPL license violations in the device world, I guess because people think that no one will notice or want to modify software that's "embedded" inside a device. But, it's pretty obvious which devices out there run Linux. Usually, you can tell from a glance at the spec sheet—let alone any of the more-technical telltale fingerprints.

Lehrbaum: The Nokia 770. I've had one since it came out and have updated to the latest released OS for it, but I have to say that its capabilities are quite disappointing—particularly in comparison to how well Apple's iPhone performs on a small touchscreen.

Powers: Well, my Eee PC's tiny keyboard annoys me, but my fat fingers shouldn't count as a strike against ASUS. If there's a potential dud, it would be with the saturation of Netbook solutions from multiple vendors, and multiple revisions from the same vendors. I'm not sure whether that means it's a dud or just the natural progression of a viral product idea, but I do worry that it will start to veer people away from the tiny Notebook concept.

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FEATURE Linux Device Roundup

Weinberg: It's best to reference the reviews on LinuxDevices.com. The biggest dud concept, however, is that Linux-based phones confer almost none of the virtues to those devices that the OS does to other devices.

What are your favorite recent Linux-powered devices and why?

Kingman: Limiting myself to currently available offerings:

- Netflix Player—instant movie gratification!
- Nokia N810—sofa surfing!
- Motorola U9—ooh, curvy!
- MooBella ice cream machine—moo!
- The ones you build yourself—custom!

Lehrbaum: As mentioned above, the Roku Netflix box. Key features are its low cost, simplicity, low power consumption, ease of wireless configuration and a very nice, clean UI.

Powers: Although I've never touched one, the Nokia devices look like awesome little handheld devices. The ASUS Eee PC 701 was very significant,

and even if just by merit of originality, it's one of my favorites. I like the OpenMoko FreeRunner, and although it's not ready for prime time yet, I think it might be a huge boon to Linux-based cellular phones. Add in the adorable Tux Droid, and I think you have a handful of really nifty Linux devices. One is even penguin-shaped. [See page 46 for a review of the OpenMoko Neo FreeRunner and page 64 for an article on hacking Nokia Internet tablets.]

Weinberg: On a purely personal note, some of my favorite Linux-based devices from recent years include:

- TomTom navigation systems.
- Kangaroo TV (NASCAR streaming video).
- Dash in-car navigation with real-time interactive traffic data. [See Kyle Rankin's review of the Dash on page 50.]
- BMW Series 3 and 5 vehicles. ■

James Gray is *Linux Journal* Products Editor and a graduate student in environmental sciences and management at Michigan State University. A Linux enthusiast since the mid-1990s, he currently resides in Lansing, Michigan, with his wife and cats.

Resources

LinuxDevices.com: linuxdevices.com

DeviceGuru: www.deviceguru.com

Bill Weinberg's Blog: linuxpundit.wordpress.com

Shawn Powers' Video Reviews at LinuxJournal.com: www.linuxjournal.com/video

Shawn Powers' Web Site, The Brain of Shawn: The Thinks I Think: www.brainofshawn.com

Netbooks to Take the Market by Storm: www.deviceguru.com/2008/08/23/netbooks-to-take-the-market-by-storm

What's the Difference between a Netbook and a Nettop?: http://download.intel.com/pressroom/kits/events/idfspr_2008/Netbook-Nettopbriefing.pdf

Rick Lehrbaum's Review of the Roku Netflix Player: www.deviceguru.com/2008/05/20/100-netflix-dvd-downloader-runs-linux

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Automate System Administration Tasks with Puppet

Use Puppet for configuration management. SEAN WALBERG

If you have more than one UNIX box in your care, you know how duplication happens. Every machine needs a common set of settings. Package upgrades need to be deployed. Certain packages need to be on every server.

You also want to make sure that any changes to your systems happen in a controlled manner. It's one thing to start off with two servers that are similarly configured; it's another thing to know they're the same a year later, especially if other people are involved.

Puppet is a system for automating system administration tasks (in the author's own words). In the Puppet world, you define a policy (called a manifest) that describes the end state of your systems, and the Puppet software takes care of making sure the system meets that end state. If a file changes, it is replaced with a pristine copy. If a required package is removed, it is re-installed.

It is important to draw a distinction between shell scripts that copy files between systems and a tool like Puppet. The latter abstracts the policy from the steps required to make a system conform. Puppet is smart enough to use apt-get to install a package on a Debian system and yum on a Fedora system. Puppet is smart enough to do nothing if the system already is conformant to the policy.

The Puppet system is split into two parts: a central server and the clients. The server runs a daemon called puppetmaster. The clients run puppetd, which both connects to, and receives

connections from, the puppetmaster. The manifest is written on the puppetmaster. If Puppet is used to manage the central server, it also runs the puppetd client.

The best way to begin with a configuration management system like Puppet is to start with a single client and a simple policy, and then roll it out to more clients and a more complex policy. To that end, start off by installing the Puppet software. Puppet is written in the Ruby scripting language, so you need to install that before you begin (Ruby is available as a package for most distributions).

Installation

If you choose to install from source, you need the `facter` and `puppet` tarballs from the author's site:

- <http://reductivelabs.com/downloads/facter/facter-latest.tgz>
- <http://reductivelabs.com/downloads/puppet/puppet-latest.tgz>

The `facter` tarball contains the `Factor` utility, which generates facts about the host system. Facts can be anything from the Linux distribution to whether the host is a virtual machine. The `puppet` tarball contains both `puppetd` and `puppetmaster`.

Untar the files (`tar -xzf facter-latest.tgz` and `tar -xzf puppet-latest.tgz`). Change to the newly created

Packages Are Good

Some people scoff at the idea of using a prebuilt binary package and prefer to build everything from source. That'll work, but it just doesn't scale. When you get further along with Puppet, you'll see how your manifest can manage packages with a single line. It's certainly possible to specify all the files you built, but then you're putting in a lot of needless effort.

You can (and should) build your own packages where needed. Packaging your own applications means you will build the software consistently, version after version, so that files will be in the same place and you won't accidentally drop features. Building your own packages also handles dependencies

against other packages and keeps track of software versions.

In all likelihood, you will end up with your own package repository that holds your locally developed packages and any vendor packages that you've modified. You also will use Puppet to ensure that your clients are pointed at your repository.

Installing Puppet from a package also lets you manage the client's Puppet software through Puppet itself. Need to upgrade in order to get more features? Simply update your manifest.

facter directory, and run `ruby install.rb` as root. You will do the same for the puppet directory, which installs both the client and server packages.

Then, run:

```
puppetmasterd --mkusers; chown puppet /var/puppet
```

on the puppetmaster to create the puppet user (which also creates the initial directory structure and then fixes a permissions problem). You can skip this step if you are installing from packages.

On the client, run:

```
puppetd --mkusers; puppetd --server puppet.example.com --test
```

substituting the name of your puppetmaster for `puppet.example.com`, which creates the user and directory structure on the client, and then begin the SSL key exchange between the client and the server. You will get an error about certificate validation, because the certificates are not trusted yet.

Back on the puppetmaster, run `puppetca --list` to show the outstanding certificate requests. You then can use `puppetca --sign` to accept the certificate, as shown below:

```
[root@test1 etc]# puppetca --list
test2.ertw.com
[root@test1 etc]# puppetca --sign test2.ertw.com
Signed test2.ertw.com
```

At this point, the client and server have a mutually trusted connection. The next step is to define the manifest. For this article, I'm using the network time protocol (NTP) daemon as an example. The goal is to define a manifest that ensures the daemon is installed, configured and in the boot sequence.

Defining the Manifest

In Puppet terms, a resource is something being managed and the attributes that define it. A resource might be a file that has permission attributes or a package with a name and a version. Puppet comes bundled with many resource types; you also can create your own or download those that others have made.

The central manifest is defined in `/etc/puppet/manifests/site.pp`. Start with a simple resource defining the NTP package:

```
package {
  ntp:
    ensure => installed
}
```

The above defines a package resource called `ntp` with one attribute called `ensure`. The `ensure` attribute defines the state of the package, with values such as `installed`, `absent`, `latest` or even a version number.

Puppetmaster will notice the change in `site.pp` and reload

the manifest. The client will check in only every half-hour, so you can restart `puppetd` or send the process the `SIGUSR1` signal to force the client to check back with the server immediately. If all goes well, your client will read the manifest and install the `ntp` package. Try removing the package, and it will be replaced within 30 minutes. If not, check your logs (usually `/var/log/messages`) for any errors, and make sure your `site.pp` is correct.

NTP also requires a configuration file called `/etc/ntp.conf`. Puppet has a resource type called `file` that handles files. The puppetmaster will hold the master `ntp.conf` and copy it to the clients should they change their copies.

Create a directory in `/var/puppet` called `files`. Then, create `/etc/puppet/fileserver.conf` as shown below, and restart `puppetmasterd`:

```
[files]
  path /var/puppet/files
  allow *
```

`fileserver.conf` defines file shares for the internal Puppet file server. The above example implements a share

It is important to draw a distinction between shell scripts that copy files between systems and a tool like Puppet.

called `files`, which corresponds to a directory on the puppetmaster called `/var/puppet/files`. Use a URL like `puppet://puppet.example.com/files/etc/ntp.conf` to access a file located at `/var/puppet/files/etc/ntp.conf` on the puppetmaster. The `allow *` grants access to all puppet clients.

Put a working `ntp.conf` in `/var/puppet/files/etc/`, and then add the following to your existing `site.pp`:

```
file {
  "ntp.conf":
    mode => 644,
    owner => root,
    group => root,
    path => "/etc/ntp.conf",
    source => "puppet://puppet.example.com/files/etc/ntp.conf"
}
```

The format of this file resource is much like the package you previously set up. The resource has a tag of `ntp.conf` (which is quoted because of the period). The mode, owner and group attributes specify the file's permissions. The path attribute is the local path, which, if omitted, defaults to the value of the tag (the tag does not have a full path in this case, however). Finally, the file's source is a puppet URI that will be pulled from the puppetmaster.

Restart the puppet daemon on the client (or wait 30

minutes), and you will see `ntp.conf` has been updated. If you try to change it, you will see that it is replaced in the next cycle.

The final resource needed is the service resource, whose job is to make sure a `dæmon` is running and that the `dæmon` is in the startup scripts (or not, if that's your desire). Add the following fragment to your `site.pp`:

```
service {
  ntpd:
    ensure => true,
    enable => true,
    subscribe => [ File["ntp.conf"], Package[ntp] ]
}
```

The service resource handles the `ntpd` service. The `ensure` attribute makes sure the `dæmon` is running, and the `enable` attribute makes sure it is part of the startup script. The mechanics of this are handled by a provider, and each OS and distribution can have a different provider for each type of service. On Red Hat and Fedora systems, the service provider uses the `chkconfig` and `service` utilities.

The `subscribe` attribute brings the three resources together. The service resource is subscribed to the `ntp.conf` file resource and the `ntp` package resource. If any one of them change, the service resource is notified, which is an

Puppet comes bundled with many resource types; you also can create your own or download those that others have made.

indication that the service should be restarted. This means you can push out changes by editing the master file on the puppetmaster, and on the next cycle, the client will download the new configuration and restart the `dæmon` without your intervention.

The `subscribe` attribute can take either a single element, such as `Package[ntp]`, or multiple elements written in array format, such as `[element1, element2]`. Also be careful to capitalize the reference, as the lowercase version has been deprecated and will not work at some point in the future.

Introducing Classes

Although powerful, these resource definitions can become unwieldy. Puppet has ways around this too. Create a directory under manifests called `services`, and create a file in this directory called `ntpclient.pp` with the following contents:

```
class ntpclient {
  package {
    ntp:
      ensure => installed
  }
}
```

```
file {
  "ntp.conf":
    mode => 644,
    owner => root,
    group => root,
    path => "/etc/ntp.conf",
    source =>
      "puppet://puppet.example.com/files/etc/ntp.conf",
}

service {
  ntpd:
    ensure => true,
    enable => true,
    subscribe => [ File["ntp.conf"], Package [ntp] ],
}
}
```

This new file contains the three resources you created earlier, surrounded by a class definition. A class groups several resources, which simplifies your configuration and promotes manifest sharing.

Now, replace your `site.pp` with this simplified manifest:

```
import "services/*"

include ntpclient
```

The `import` line reads in all the files inside the `services` directory. The `include` line evaluates the class, which means that the class will be applied to the node. This configuration has the same effect as the one before, except the NTP client functionality now has been bundled into the class.

Getting Selective

So far, the manifest has assumed that all clients get the same configuration. The easiest way to give different configurations to different clients is with a node definition. A node definition applies a series of configuration directives to a given set of nodes. Replace your `site.pp` as follows:

```
import "services/*"

node test2, test3 {
  include ntpclient
}

node default {
}
```

With this policy in place, only `test2` and `test3` will have the `ntp` client class applied. Any other client will be caught by the default statement, which has no resources defined.

Facter is another way to differentiate hosts. Facter generates facts about a machine, such as the operating system, hostname and processor. Simply type `facter` to see a

list of the currently known facts. Here is a subset of the facts generated on one of my test machines:

```
architecture => i386
domain => ertw.com
facterversion => 1.3.8
fqdn => test2.ertw.com
hardwareisa => i686
hardwaremodel => i686
hostname => test2
id => root
ipaddress => 192.168.1.143
ipaddress_eth0 => 192.168.1.143
kernel => Linux
kernelrelease => 2.6.18-8.el5xen
lsbdistcodename => Final
lsbdistdescription => CentOS release 5 (Final)
lsbdistid => CentOS
lsbdistrelease => 5
macaddress => 00:16:3E:5D:22:17
macaddress_eth0 => 00:16:3E:5D:22:17
memoryfree => 159.17 MB
memorysize => 256.17 MB
operatingsystem => CentOS
operatingsystemrelease => 2.6.18-8.el5xen
processor0 => Intel(R) Pentium(R) 4 CPU 1.80GHz
processorcount => 1
ps => ps -ef
puppetversion => 0.24.2
```

Facts are exposed in the manifest as variables. The `operatingsystem` fact is seen as `$operatingsystem`. A common use of this is to make the same resource behave differently, depending on the operating system:

```
file { "foo"
  name => $operatingsystem ? {
    solaris => "/usr/local/etc/foo.conf",
    default => "/etc/foo.conf"
  }
}
```

The above example uses a Puppet selector to set the name attribute instead of a static string. A selector is much like a case statement in that it can return different values depending on the input. This file resource refers to `/usr/local/etc/foo.conf` on Solaris systems and `/etc/foo.conf` on other systems. The system type is determined from the input to the selector, which is the `$operatingsystem` Facter variable.

You can add your own facts by writing a Ruby script. See Resources for links to documentation for adding custom facts.

Puppet vs. the Alternatives

My first experience with configuration management was with a product called cfengine. With cfengine, I was able to manage a Web cluster of 14 servers easily and reduce the time to install a new node from several hours to a matter of minutes.

Puppet's author has a great deal of cfengine experience and built Puppet to address many shortcomings of cfengine.

Given that cfengine has a much wider install base than Puppet, why would one choose Puppet? After comparing the two, I've discovered several reasons. First, Puppet has a much cleaner configuration than cfengine. In the cfengine world, you are concerned with the ordering of certain operations, whereas Puppet handles ordering with the `subscribe` attribute (and some others).

Cfengine has many commands for adding and removing lines from files, which don't exist natively in Puppet. Puppet addresses this by providing native resource types for many of the systems that I found myself editing by hand, such as mountpoints. Using a dedicated resource type means the manifest is clear and simple.

Cfengine is open source, but it has a more closed community than Puppet. You can extend cfengine through modules, much akin to Puppet's recipes and facts, but it is nowhere near as integrated. Puppet seems designed from the start to be extensible, where cfengine feels like an afterthought. Puppet also promotes recipe sharing by making them modular, where sharing cfengine code is more difficult because the resources are in different parts of the cfengine policy.

Puppet is written in Ruby, and cfengine is written in C. Initially, I thought this was an advantage for cfengine, but after getting into Puppet, I realized it's not a big deal. Puppet's author takes great pains to abstract Puppet's configuration from the Ruby language, so no knowledge of Ruby is needed.

I found the learning curve for cfengine to be the steepest. Granted, I had no understanding of configuration management when starting with cfengine, and I had some cfengine experience by the time I started with Puppet, but many of my stumbling blocks have been fixed in Puppet.

Both projects offer support over their IRC channels. Cfengine has an extensive on-line manual and a fair bit of third-party documentation on other Web sites. Puppet has an excellent wiki and a comparable amount of third-party documentation.

Although Puppet is younger compared to cfengine, its openness and extensibility are what make it a better choice than cfengine.

Acknowledgement

Special thanks to James Turnbull, author of *Pulling Strings with Puppet*, for reviewing this before publication. ■

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Resources

Puppet's Home Page: reductivelabs.com/trac/puppet/wiki

Annotated Links on Using Puppet: del.icio.us/SeanW/puppetlj



The Browser Platform

Google makes good on an ancient Netscape promise. DOC SEARLS

What Netscape was to Web 1.0, Google is to Web 2.0. Like Netscape, Google is Net-native, pioneering, hacker-friendly, generous and likable. It charges for some stuff, but the most popular stuff it gives away for free. That's because it groks the Because Effect: you make money because of what you give away for free. Netscape made money with server software because it gave away the browser. Google makes money with advertising because it gives away search—and a growing portfolio of other services and applications that create vast new environments where advertising can be placed.

But, one gets major déjà vu watching Google succeed at doing exactly what Netscape wanted to do more than a decade ago, which was make the Web itself into a platform, with the browser serving as a kind of operating system. Netscape failed that mission for a variety of reasons, the most obvious of which was taunting Microsoft. In a long *Wired* story about the Microsoft antitrust case, John Hieleman wrote:

...here was Andreessen publicly proclaiming in the summer of 1995 that Netscape's plan was to reduce Windows to "a poorly debugged set of device drivers." "They didn't save it up", Myhrvold said. "They fucking pulled up alongside us and said, 'Hey, sorry, that guy's already history.'"

The tactic drove Redmond into a rage. The day after Andreessen's quote appeared in the press, John Doerr, the prominent venture capitalist and Netscape board member, received a chilling e-mail from Jon Lazarus, one of Gates' key advisers. In its entirety, it read, "Boy waves large red flag in front of herd of charging bulls and is then surprised to wake up gored."

That was back when Microsoft was still, as Bill Gates loved to say, "hard core". It was at the top of its game, which was Xtreme Business Hardball. There are legal limits on how hard you can play that game, as Microsoft found out when the feds went

after the company. But Netscape's wounds were also self-inflicted. As I put it in "The Shrinking Subject" in 2000, "For a year or two, Netscape looked like it could do no wrong. It was a Miata being chased down a mountain road by a tractor trailer. As long as it moved fast and looked ahead, there was no problem with the truck behind. But at some point, Netscape got fixated on the rear-view mirror. That's where it was looking when it drove off the cliff."

It also failed to execute. As I put it in that same article, "Worst of all, it bloated the browser from a compact, single-purpose tool to an immense contraption that eventually included authoring software, a newsgroup reader, a conferencing system and an e-mail client—all of which were done better by standalone applications."

Today, Netscape is a skin mounted on an AOL wall. Netscape.com now redirects to netscape.aol.com. And the last Netscape Navigator-branded browser rolled off the line early this year. Meanwhile, Google has authoring software (Blogger), a whole e-mail system (Gmail), all of Usenet, Google Groups, an on-line calendar, a document system and lots of other stuff. Some of it (Google Toolbar, Gmail) can bloat a browser, but only if the user wants it. Otherwise, Google has seemed content to let its spin-off, Mozilla, with Firefox, gradually eat away at Microsoft's dominant browser share—both by being a good product and by serving as host to an endless variety of extensions and plugins.

That is, until early September 2008. That's when Google announced Chrome—a new browser that really does serve the role of an operating system. Google explained Chrome through a 39-page series of illustrations in comic book style by the brilliant Scott McCloud. With Chrome, tabs aren't just for Web pages. They're for processes, "each having its own memory and its own copy of the global data structure". Sound familiar? The doc adds, "We're applying the same kind of process isolation you find in modern operating systems. Separate processes rendering separate tabs."

Chrome uses WebKit, the open-source rendering engine that began as KDE's KHTML

software library, then grew through work by Apple and a list of other companies that now include Nokia, Trolltech, Adobe and Google. Chrome also adds a pile of other new browser building materials, including Gears and the V8 JavaScript engine. All are open source (using the BSD license).

The Chrome comic concludes, "We hope v8's performance will set a new bar, and that the other development teams will continue to improve in this space. Because if you look at any other system that's become faster over time, what happens is you get bigger, better, more inventive apps."

Especially Google's huge back-end apps the run in the cloud. In his blog, Nick Carr writes, "To Google, the browser has become a weak link in the cloud system—the needle's eye through which the outputs of the company's massive data centers usually have to pass to reach the user—and as a result, the browser has to be rethought, revamped, retooled, modernized. Google can't wait for Microsoft or Apple or the Mozilla Foundation to make the changes...so Google is jump-starting the process with Chrome."

Netscape may have lost the "browser war" long ago, but Google is winning at a different game entirely—one in which the browser is just a way of organizing applications, documents and other things users need to make the most of where they all now live, which is on the Net. Not on a desktop operating system. And, let's not forget that most of the cloud's services run on Linux servers. Including nearly all of Google's.

At the time of this writing, Chrome is still available only for Windows. Google promises Mac and Linux versions as soon as possible. When Chrome comes out on Linux, it will be interesting to see if it will be to Linux's advantage to have a browser, rather than an operating system, serving as an application framework. If that's the case, maybe the best-debugged set of device drivers will finally win on the desktop too. ■

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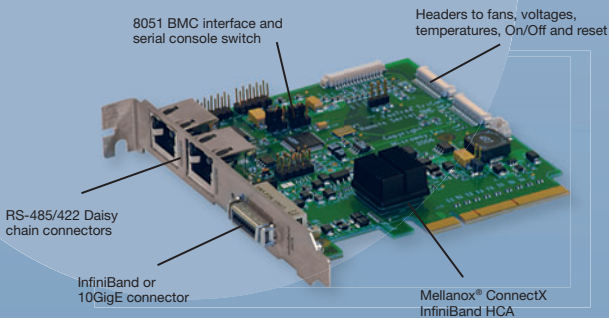
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