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SEPTEMBER 2008 | ISSUE 173

UNDERDOGS

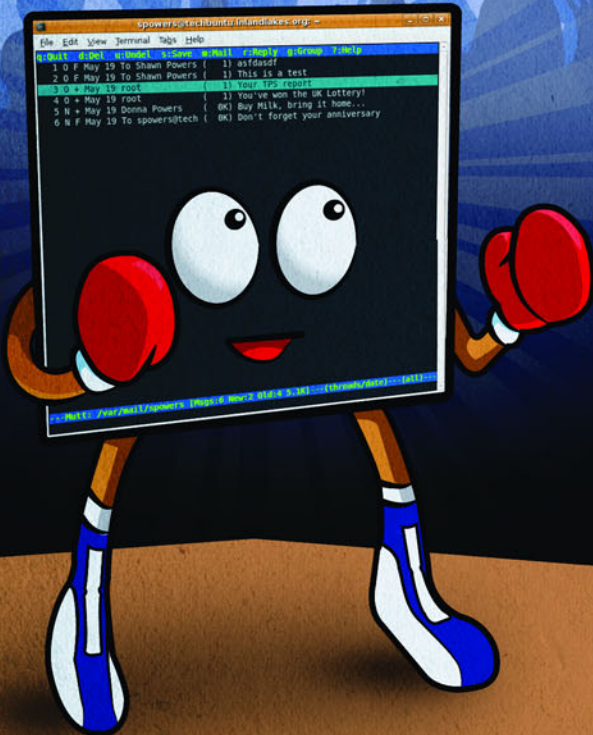
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```
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an: a trouble free network does not exist
```

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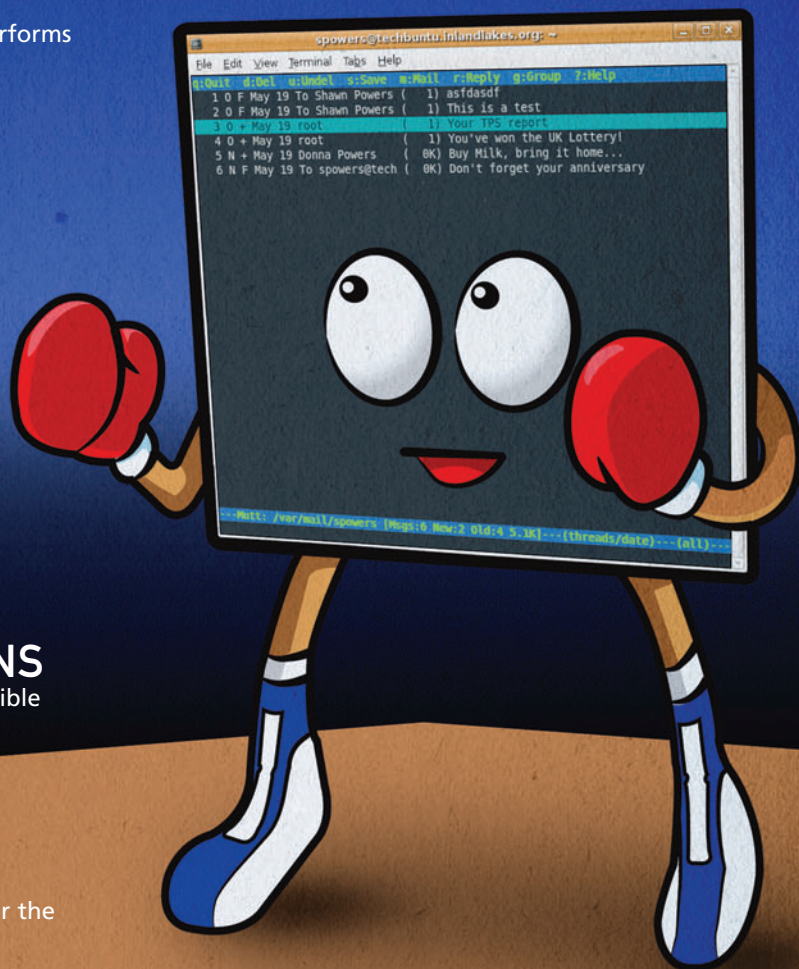
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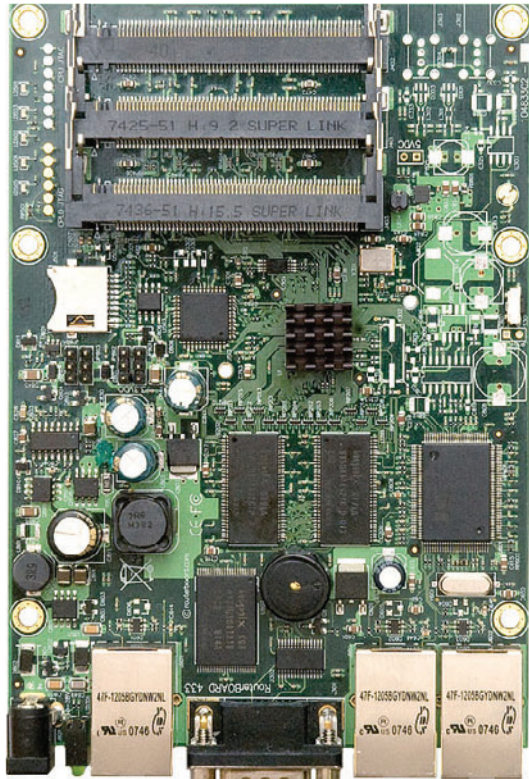
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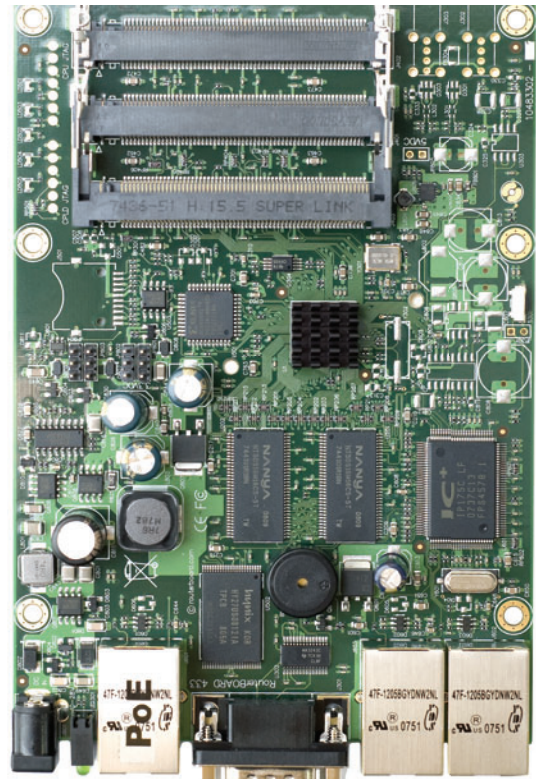
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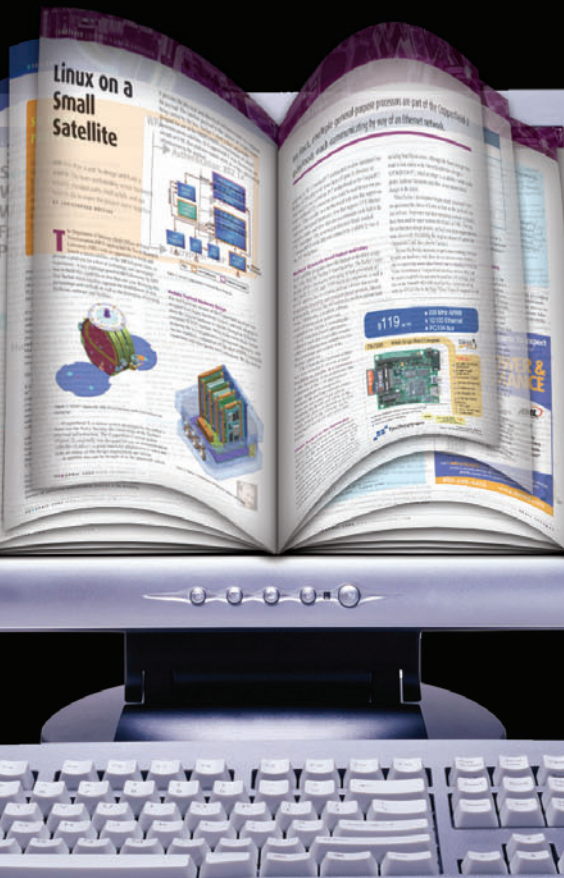
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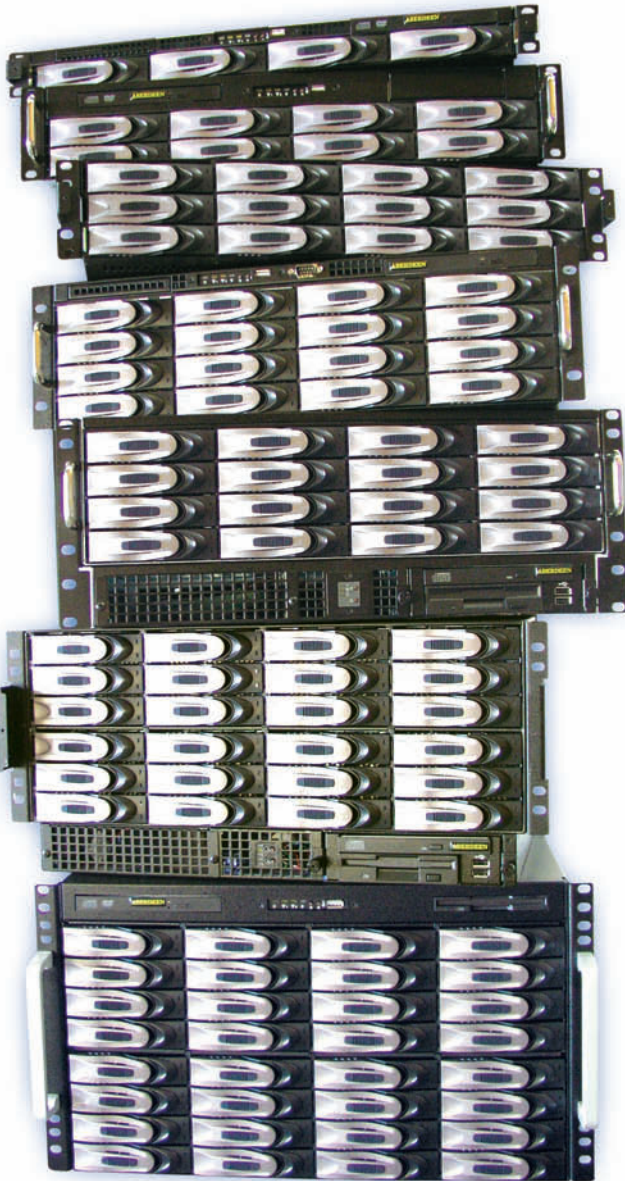
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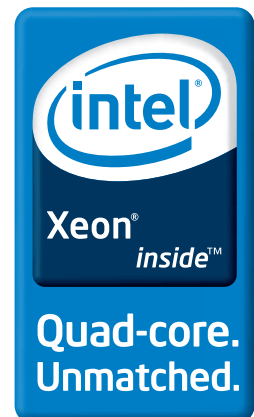
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When Underdogs Take Over the World

Programmers, network administrators, tech-support personnel and IT folks in general are rarely in the limelight. It's no secret, however, that the people behind the scenes are truly the ones running the world. As part of the geeky infrastructure that keeps the planet going, we all know the power of the underdog. Heck, we "save the day" on a regular basis, and most people never are the wiser. Can you imagine a world without any IT staff? Oh sure, that might seem a bit arrogant, but really, with little fanfare, we keep the end users happy. And, our operating system of choice? Linux, of course.

With its relatively small desktop market share, Linux often is considered an underdog. Here at *Linux Journal*, we prefer to think of it more along the lines of "Undiscovered Superhero", but however you look at it, Linux is the operating system that is easy to love. If you take off the wide-angle lens, however, and look strictly at software in the Open Source community, we have underdogs of our own. This month, we decided it would be nice to give the spotlight to those diamonds in the rough.

If you're reading this article on the *Linux Journal* Web site, chances are you're using the Firefox browser to do so. Firefox certainly isn't an underdog anymore, but James Gray gives us a play-by-play history of its evolution from the very beginning. Hopefully, the Firefox success story will be one we see repeated over and over. Will Xara Xtreme be the next application to offer some serious competition in its field? Well, switching to an open-source license for its core program certainly is a step in the right direction. Dan Sawyer shows us this graphics and illustration design program that is now available. If you're tired of running Adobe Illustrator via Wine, you'll love the new Linux native Xara Xtreme.

If indeed you are reading this on-line, you've probably correctly assumed that LinuxJournal.com is hosted with Apache. That should come as no surprise, but what might come as a bit of a shock is that Will Reese tells us Nginx might

be a better alternative. Thankfully, it's still very much an open-source project, so we're at least willing to listen. Cory Wright tells us about a wonderful alternative to BIND as well. If security and configuration concerns about BIND have given you cause to worry, djbdns just might be the ticket. Cory walks us through the why, how and where of configuring this little-known DNS server.

What discussion regarding underdogs would be complete without talking about the command line? Love it or hate it, Linux is built around the terminal. Kyle Rankin tells us how to get the most out of our terminal by splitting it up. If you're not sure what you would put in a split-window xterm, a good place to start is with e-mail. Victor Gregorio tells us all about Mutt, a command-line e-mail client that has more features than many of its GUI counterparts.

Here at *Linux Journal*, however, we're all about choice. If the command line makes you nervous, there are plenty of GUI alternatives. Heck, we even have choices when it comes to the version of Linux distribution you want to run. Many of us use the "big dogs" of the Linux world when it comes to distros, but what about Gentoo? It's certainly not for the faint of heart, but Mike Diehl thinks it might be worth the time it takes to install. Perhaps after reading his article, you'll agree.

If you're just looking to cheer for the underdog or hoping to discover the Next Big Thing, this issue should educate, enlighten and entertain. As always, we have our full lineup of regular columns, helpful tech tips, and geek-friendly product reviews. So whether you stay up reading all night or start a stockpile of reading material for the analog television blackout in February (Doc Searls talks about that this month as well), this issue is bound to be a keeper. ■

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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letters



Netbooks

Longtime subscriber here (from probably back in the late 90s or so). I've spent time in various engineering, IT and support positions during, before and after college to end up where I am now, and along the way, I've continually found my ideal notebook shrinking further and further, and my tolerance of bootup times shrinking proportionately.

This finally came to a head in 2004, when your hardware reviewer test-drove the Sharp Actius MM10, arguably the pinnacle of all ultramobile notebooks that came before. I was convinced and bought one from the same folks that supplied yours (in fact, I bought the *actual* review unit your reviewer used). I immediately fell in love with it for various reasons, and it followed me across the country several times, from Alaska to Florida, from the US to India and back. I became hooked to its light usefulness, and the 7.5–8 hours on the 9-cell battery. I patched my kernel with laptop mode, tweaked my journal commit times, and learned to love Xfce and later Fluxbox. I could power and boot fully in less than 30 seconds (though I later added some nice convenient things that lengthened it, but it still was less than one minute). I

got used to its weird little keyboard and learned how rarely I actually use an optical drive. I turned in lessons, then later administered remote servers, and yet later wrote code in vim via a VPN connection over wireless to the office from outdoors, airports and friends' houses (truly—how boring a guest am I?).

This was all fantastic and magical until its motherboard decided to stop playing nice with IDE devices sometime in late 2006. Nothing else on the market came close. There was no direct replacement. Well, some came close, but their 12" screens wouldn't fit the accessories I'd accumulated over time, or their low-power modes wouldn't yield the same battery life with their high-capacity batteries, or not all of their hardware had kernel support, or they cost way too much. I felt utterly abandoned by the industry, which seemed to assume that folks with my needs are obviously in the market for an overpriced tablet PC, essentially the only machines attempting to meet the MM10's form factor and feature set.

Then, sometime last year, something interesting, amazing and incredible happened. For completely tangential reasons, the industry saw fit to meet this exact market and form factor, and then one-up me by competing on price as well! Since then, I've tried to follow this mini-notebook trend, largely publicized via OLPC's XO, then later ASUS's Eee PC 700. And, the movement got a name—the netbook. I'm not sure I'm sold on this name, but it is certainly adequate, and at least I can tell the world that what I've been looking for has a name.

One great thing is these netbooks recognized that your typical desktop distribution (further, *no* operating system available) didn't really cater to a highly mobile audience and heavily customized them to address this issue. Hence, full GNU/Linux support is a foregone issue. Astounding! So, I have hope, and I'm in the market for an MM10 replacement

now. It shouldn't be too hard, because most of the new models out-sport comparable specs in most areas and exceed in others (I'll take your 15G hard drive, and double it as an SSD, no less).

What about the HP 2133 Mini-Note KX872AA? How about the MSI Wind? Any implementations of the new VIA OpenBook reference implementation? The new Eee PC 900? The brand-new mystery Dell netbook that everyone's salivating over now? There are others I know nothing about, I'm sure. How about a netbook showdown?

--
Sunit Das

showdate

Joshua's response to my showdate tech tip is indeed very helpful [see Letters in the March 2008 issue of *LJ*]. Frankly, I was not aware of the versatility of GNU's date program. I wrote showdate a long time ago and have used it for doing all sorts of date arithmetic, and I thought it would be nice to share it with others. showdate, however, is not broken or quirky, and if someone does find a bug in it, please contact me at ssahore@yahoo.com. It certainly has room for improvement—for example, the ability to change its datum or use string-valued symbols, such as now, before, after, ago and so forth.

--
Sandeep

Alternate Image Resizing Script

I would like to suggest an alternative solution for the image resizing script presented by Dave Taylor in his Work the Shell column in the June 2008 issue of *LJ*.

The basic script on page 29 contains nine calls to system utilities. That means every loop cycle will start nine separate processes. This is the price for the string splitting and the floating-point arithmetic used, which can be completely avoided by two simple tricks. What remains is a solution with one call to file. This will save about 70% runtime

when used in a loop running more than 100 arbitrary image files:

```
declare -i multiplier=75 # in percent (integer)

filename="edit.png"

string=( $(file "$filename") ) # make an array from output
width=${string[4]} # select width
height=${string[6]} # select height
height=${height%*,} # remove trailing comma

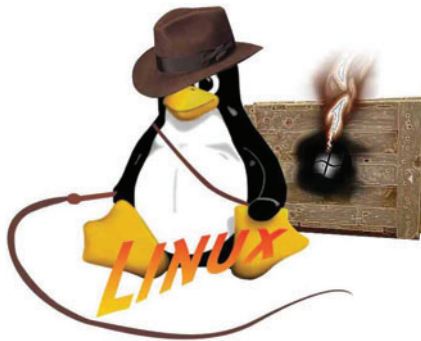
let width=$((width*multiplier)/100 # new width
let height=$((height*multiplier)/100 # new height

echo "$filename scaled: width=$width height=$height"
```

--
Fritz Mehner

Indy Tux

Thought this image might give you a laugh if you haven't already seen it.



Courtesy of SEO (www.seoclinic.co.uk).

--
Mike Wax

Sed Is Your Friend

Everything shown in Dave Taylor's July 2008 Work the Shell column using combinations of sed/grep/cut/etc can be drastically simplified, not to mention lighten the load on the system.

To grab the initial top list of films:

```
curl -s http://www.imdb.com/chart/top | \
sed -e 's/>>>\n/g' | \
sed -n -e 's/.*\(</title>/tt.*\)/.*http://www.imdb.com/1/pg' >
top250.txt
```

To fetch the titles:

```
curl -s "$1" | \
sed -n -e '/<title>/s/<title>\(.*\)\ ([0-9][0-9][0-9][0-9])*/\1 | \
\2/p'
```

And, finally, please—cat'ing a file into a pipeline that then uses head to peel off a subset of lines?

```
for name in $(head -10 top250.txt)
do
sh ./getfileinfo.sh ${name}
done
```

--
Randy Medd

Dave Taylor replies: Thanks for your note and reminder of the power of sed. It's tricky. I try to find a balance

between having incredibly obfuscated but powerful invocations of individual commands and having an evolving sequence of commands in pipes that mimic how most people develop shell scripts. Sometimes it produces utilities that are less than maximally efficient, but really, if it's run once a week, do 535.4 milliseconds really matter?

DTV Help

Thanks to Alolita Sharma for her article on DTV in the July 2008 issue of *Linux Journal*.

A couple years ago, my wife and I purchased a Hauppauge DVR-950 for use with our HP laptop. At the time, we wanted to find out what was available in HD via the local over-the-air stations

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[LETTERS]

before committing to the purchase of an HDTV receiver. We continue to use the 950 occasionally to record and play back programs.

I have been dual-booting the laptop since the release of Dapper Drake and have found increasingly little use for Windows with the exception of running the 950. Thanks to your article, I believe the day is close at hand when I will be able to eliminate Windows entirely.

I picked up my copy of *LJ* last Thursday and read your article over the weekend. On Monday, I started working on the project, and by

Monday afternoon I had MythTV up and running. At first, I had a problem with accessing the MySQL server, but after running the configuration utilities and resetting the password, I was able to get into the back end set up. After making a few educated guesses on the front end setup, I was able to get MythTV to scan for and find the active broadcast channels, and now have it working just fine for watching and recording DTV. I still need to refine the setup just a bit but I don't think that will be difficult at all.

--

William Parmley

PHOTO OF THE MONTH

Tux Cupcakes

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.



Cupcakes by Franci Rogers; Photo by Robert Rogers

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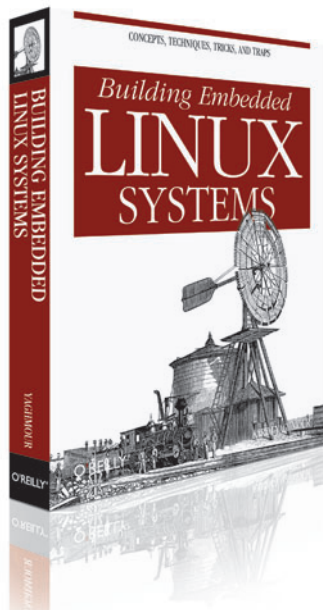
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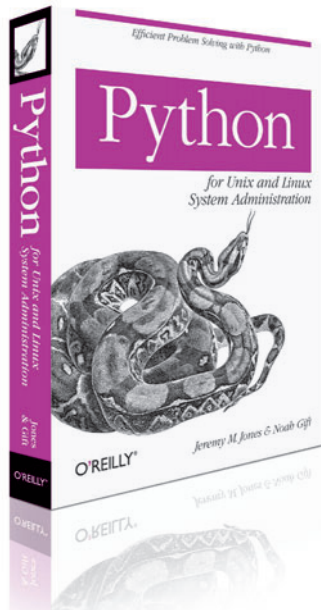
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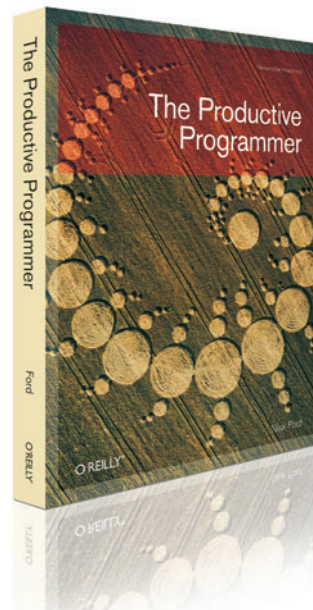
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diff -u

WHAT'S NEW
IN KERNEL
DEVELOPMENT

There's an interesting new project, the **Kernel Library Project**, that aims to port the Linux OS features, such as the Virtual Filesystem, into a generic library that would work on any other operating system.

Octavian Purdila, **Stefania Costache** and **Lucian Adrian Grijincu** have been working on this, and it could make it a lot easier to run Linux software anywhere else a user might want to run it. If you find this interesting, they're looking for volunteers to help out.

Mark Lord, **Tejun Heo** and a variety of others have been keeping **Serial ATA** good and solid. At the moment, they are focusing on fixing, or at least working around, all stability issues. In some cases, they've been making very small speed sacrifices in order to make sure that certain rare problems don't come up at all. At some point, they plan to revamp some of the code, in order to solve the problems and improve speed, but that will require more invasive changes. For the moment, they simply want to make sure that absolutely nothing can go wrong for users. Kudos to them for keeping up that discipline. As everyone knows, it's much more fun to throw caution to the wind and just build lots of new features.

Believe it or not, there still are plenty of people using **2.4** in the world. I'm sure they all wish they could upgrade to **2.6**, and the kernel developers wish that too, but undoubtedly, there are reasons why their entire corporate infrastructure and all their products would break if they upgraded to **2.6**. And for those users, **Willy Tarreau** has just come out with **2.4.36.4**, which includes a small number of key security fixes. Willy encourages all **2.4** users to upgrade to **2.4**.

David Woodhouse and **Paul Gortmaker** now are officially in charge of **embedded systems**. The idea of having a maintainer for a general kernel concept like embedded systems is fairly new, and it creates some ambiguity for people submitting patches. Do they

submit patches to the maintainer of the specific hardware driver or to the embedded system maintainers? In practice, it's likely that this won't be a real concern, and folks will get used to cc-ing whomever they should on their e-mail messages.

Another potential problem with having an overarching embedded system maintainer is that such a person might become hypnotized by the idea of reducing size at any cost, as **Andi Kleen** has pointed out. But, David has reassured him and everyone else, that size reduction is only one part of supporting embedded devices, and that the new maintainers plan to keep a broad outlook, making sure their changes are good for everyone (or at least not harmful to larger systems or to the kernel sources themselves).

One of David and Paul's main hopes, and **Andrew Morton's** as well as the whole thing was his idea to begin with, is that companies designing embedded devices will work with David and Paul to create a better dialogue between that class of companies and the kernel developers.

Adrian Bunk has submitted a patch to remove the final **PCI OSS driver** from the kernel. The **Trident 4DWave/SIS 7018 PCI Audio Core** has been on Adrian's hit list for a very long time, but **Muli Ben-Yehuda** always has resisted. Now that Muli has moved on to other projects, and an ALSA driver exists that works for the exact same hardware, Adrian's patience has paid off. OSS finally is fully out of the kernel.

UBIFS seems to be on a relatively fast track into the main kernel tree. The new Flash filesystem is likely to go into **Linux-Next** for a while, and from there, it should feed relatively automatically into **Linus Torvalds'** tree at the next merge window. **Artem Bityutskiy** set the wheels in motion with a formal request to **Stephen Rothwell**. **Christoph Hellwig** had a lot of feedback on the code for Artem, and it came out that NFS would be very difficult for UBIFS to support without significant code revisions. Artem was surprised to learn about that, and

admitted that yes, probably the initial version of UBIFS in Linus' tree would not support NFS. This doesn't seem to bother anyone, and in any case, Artem already is working on some ideas to fix the problems around NFS support. It does seem as though UBIFS will soon be part of the official kernel releases.

Recently, there was a fairly significant effort to eliminate the **BKL** (Big Kernel Lock) by replacing it with semaphores. This is an excellent goal, with all kinds of speed implications for regular users, but unfortunately, the particular implementation had some speed problems of its own that led Linus Torvalds eventually to undo the change entirely. This fairly severe step was prompted partly by the speed issues of the semaphore solution and partly by the sense that there must be a better solution out there.

Everyone, including Linus, wants to get rid of the BKL. But, doing this is very hard. The BKL has various qualities that are difficult to implement in any of the available alternative locking methods, and it also has some subtleties that make it hard to determine whether a given alternate implementation is doing the right thing or not.

Ingo Molnar, therefore, has decided to cut through the morass, with a partial solution that will make the full solution much more manageable. He plans first of all to extract all the BKL code out of the core kernel and into an isolated part of the source tree, where it can one day be replaced entirely, without requiring any subtle changes to core code. Eventually, he hopes to push each occurrence of the BKL into the relevant subsystem code, where it could be replaced with cleaner subsystem locks, which in turn could be eliminated in a more normal and familiar way.

With Ingo on the job, and Linus taking an active part, a lot of other big-time hackers have piled on, and there is no doubt that very significant locking changes are in store for the kernel. What does this mean for regular users? Probably a snappier, speedier kernel in the relatively near future.

—ZACK BROWN

LJ Index, September 2008

1. Number of directories in kernel 2.26: **1,417**
2. Number of files in kernel 2.26: **23,810**
3. Number of lines in kernel 2.26: **9,257,383**
4. Number of directories in gcc 4.4: **3,563**
5. Number of files in gcc 4.4: **58,264**
6. Number of lines in gcc 4.4: **10,187,740**
7. Number of directories in KDE 4.0: **7,515**
8. Number of files in KDE 4.0: **100,688**
9. Number of lines in KDE 4.0: **25,325,252**
10. Number of directories in GNOME 2.23: **573**
11. Number of files in GNOME 2.23: **8,278**
12. Number of lines in GNOME 2.23: **4,780,168**
13. Number of directories in X Window System 7.3: **1,023**
14. Number of files in X Window System 7.3: **14,976**
15. Number of lines in X Window System 7.3: **21,674,310**
16. Number of directories in Eclipse 3.4: **297,500**
17. Number of files in Eclipse 3.4: **912,309**
18. Number of lines in Eclipse 3.4: **94,187,895**
19. Number of dollars in the US National Debt: **9,388,297,685,583**
20. Dollars earned per line by open-source developers if the US Debt had been used to fund these projects: **56,756**

Sources:

- 1-18: wc -l
 19: www.brillig.com/debt_clock
 20: math

Adiós Windows 9x

The upcoming release of Cygwin version 1.7 will be dropping support for Windows 9x (Windows 95, Windows 98 and Windows Me). If you're lucky enough never to have to use Windows, Cygwin probably seems like a waste of effort. But, if you're not so lucky, Cygwin is what keeps you sane.

Cygwin is a Linux-like environment that runs on Windows. It provides you with a command-line environment with most of the tools you've come to know and love using Linux. It even provides a number of Linux daemons that can run as Windows' services, most notably an SSH daemon.

There also is a port of the X Window System called Cygwin/X, but it appears to have been without a maintainer for a few years. Given that most of the major open-source GUI toolkits now support Windows,

lack of the X Window System may not be a huge stumbling block.

Cygwin was started in 1995 by Steve Chamberlain, an engineer working for Cygnus (later absorbed by Red Hat). The earliest mailing list references on the Web are in early 1997, by which time it appears to have been in a functional state.

If you understand programming on Windows and on Linux, and you need some mental exercise, try to figure how you'd implement fork() on Windows. If you want to cheat, check out cygwin/fork.cc in the Cygwin CVS.

We can all imagine a better world, one where our favorite operating system is ubiquitous, but imagine a world without Cygwin. If you have to use Windows now and then, that would be a scary world indeed.

Get it at cygwin.com.

—MITCH FRAZIER

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—KATHERINE DRUCKMAN





eclipse

Eclipse Ganymede

The latest version of Eclipse, version 3.4, aka Ganymede, should be available by the time you read this. If you've never looked at Eclipse and you work with multiple programming languages or multiple platforms, take some time to try Eclipse.

Be prepared. Eclipse is a large, complex tool, and you won't grok it if you invest only 15 minutes. In addition to being large and complex, Eclipse's roots are at IBM, and it's big in the Java world, so there's a bit of "Blue-Speak" and "Enterprise-Speak" to deal with at times (and, of course, XML).

Most IDEs come with built-in "support" for lots of programming languages. Although for a lot of them, support means it colorizes your code. Eclipse is a bit different. It doesn't come with built-in support for many languages, or any, depending on the version you download. Support is provided via Eclipse Plugins. And normally, "support" means more than just colorizing your code. You usually get something that understands your language. It can show you an outline of the functions and data in your code; it can help you refactor

code; it can show where something is defined, and it integrates with the language's debugger.

Eclipse is not without its annoyances. Perhaps the most annoying is that it's *only* an IDE and *not* a text editor. Of course it edits text, but it's not a general-purpose text editor. If you want to open a file that's not part of a project, it's a bit cumbersome. There's no filesystem browser, and the open dialog doesn't remember the directory that you used last time. And, if you don't have a plugin for the file type you open, you don't get any code colorizing. So, you often end up using Eclipse for your "projects" but then using another text editor to look at files that aren't part of your project.

If you develop only C++ applications for KDE on Linux, or only XXX applications for YYY on ZZZ, there *might* be a better IDE than Eclipse. However, if you use multiple languages and/or multiple systems, and you want to use only a single IDE, there's no better IDE than Eclipse. And, even if you use only one language on one system, Eclipse sets the bar pretty high.

—MITCH FRAZIER

They Said It

Not everything worth doing is worth doing well.

—Tom West, from *The Soul of a New Machine* by Tracy Kidder, 1981

Technology has the shelf life of a banana.

—Scott McNealy

Never trust a computer you can't throw out a window.

—Steve Wozniak

Computers are useless. They can only give you answers.

—Pablo Picasso

In the long run, paying for Wi-Fi in your hotel will be like paying to use the toilet or the heater. You won't. Meanwhile, it would be nice if it were easy, cheap, good, or at least two out of those three.

—Doc Searls, blogs.law.harvard.edu/doc/2008/06/01/theres-gotta-be-a-better-way

First, it [Microsoft] "embraces" the wonderfulness of open source; then it "extends" open source through deals like the one it signed with Novell, effectively adding software patents to the free software mix; and then, one day, it "extinguishes" it by changing the terms of the licences it grants.

—Glyn Moody on Microsoft's old embrace, extend and extinguish cha-cha, www.linuxjournal.com/content/should-we-boycott-microsoft-can-we

Like the Presidential campaign, it's not who is most experienced or most viral or any of that. Rather, it's who's left after the least are gone. All the religious arguments—closed versus open in particular—are left in the dust by our desire to live as much in the future as we can.

—Steve Gillmor on the iPhone, gesturelab.com/?p=111

How much marketing fakery do you willingly accept, and how much do you want to know about? Does the vegetarian really want to know that they didn't wash the pot at the restaurant and a few molecules of chicken broth are in that soup?

—Seth Godin, sethgodin.typepad.com/seths_blog/2008/06/authenticity-an.html

As long as you have one person to talk to, you have a community. And I think way too many people are looking at how many Twitter followers they have, or how many RSS people they're having following them and that's a mistake. You need to embrace your community no matter how big or small—I mean, everyone started off real small.

—Gary Vaynerchuk, garyvaynerchuk.com/2008/06/05/when-do-you-know-you-have-a-community

USER FRIENDLY by J.D. "Illiad" Frazer
 WOW! HAVE YOU SEEN THIS? IT'S THE INTERACTIVE LINUX KERNEL MAP.



LINUX JOURNAL EDITION

HUNH. WAS THINKING IT WAS FUNCTION MAP FOR BORG COLLECTIVE.
 DO YOU SEE A 'DEUS EX MACHINA' FUNCTION? NO!



Linux on the Desktop? Who Cares?

Every so often, you read on Slashdot, Digg or some other techie news site that Linux is finally ready for the desktop. It's finally to the point that any end user could sit down at a computer and happily compute away. The applications are sufficiently sanitized and Windows-like that even the average Joe can use them. I think, however, that it's fair to say most of our previous conceptions of "ready for the desktop" are moot points.

The only folks who are still up in arms over whether Linux ever will be ready are the same folks who have been talking about it for years. New users really don't care. I don't say that arbitrarily; I say that because I work in a school, and I see the current generation of computer users. They don't care if they use a Mac, a PC or a Linux machine. Most don't even notice the

difference. In an unofficial, random sampling of college and high-school students, here's what they need from a computer:

- Firefox (really, by name—cool, eh?).
- A way to play music (iTunes often is mentioned, but not insisted upon).
- Microsoft Office.

And, that's it. The last point bummed me out a bit, so I asked more probing questions. It turns out that Microsoft Office has become the common name for an office suite—much like Kleenex became the name for facial tissue. For almost everyone I asked, OpenOffice.org or even Google Docs (in a pinch) is the same thing. In fact, some weren't really sure why I'd ask

such a thing, because "aren't they all the same?"

Some people want a specific type of computer for tasks like video production or gaming, but they aren't the overwhelming majority anymore. Everyone wants or needs a computer now, and the general population doesn't seem to care much about what operating system it's running.

My suspicion is that Web 2.0 and mobile (smartphone) technology is doing more to help Linux than anything else in history. It's not because Linux is better at such things; it's because the world is moving to the Web. The vehicle to get there is becoming less and less important.

The good news is that now Linux finally can take over the world, and most people won't even notice!

—SHAWN POWERS

Expert included.

Dan is a product manager for Silicon Mechanics, which means that he's always on the lookout for the next magical combination of features that will meet your needs. What is Dan's latest find? The new Rackform nServ A259, now available on the Silicon Mechanics website.

Dan knows that the A259 combines many of the features most in demand by IT professionals these days: eight fast, energy-efficient 2.5-inch drives; redundant power supplies; and the latest CPU technology from AMD – two Quad-Core AMD Opteron™ 2300 Series processors. Packing this much performance per watt into a 1U space only looks like magic. What you're actually seeing is the dedication to product and support excellence that you can expect from the Silicon Mechanics experts every day.

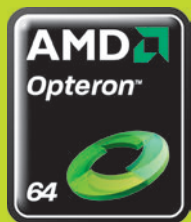
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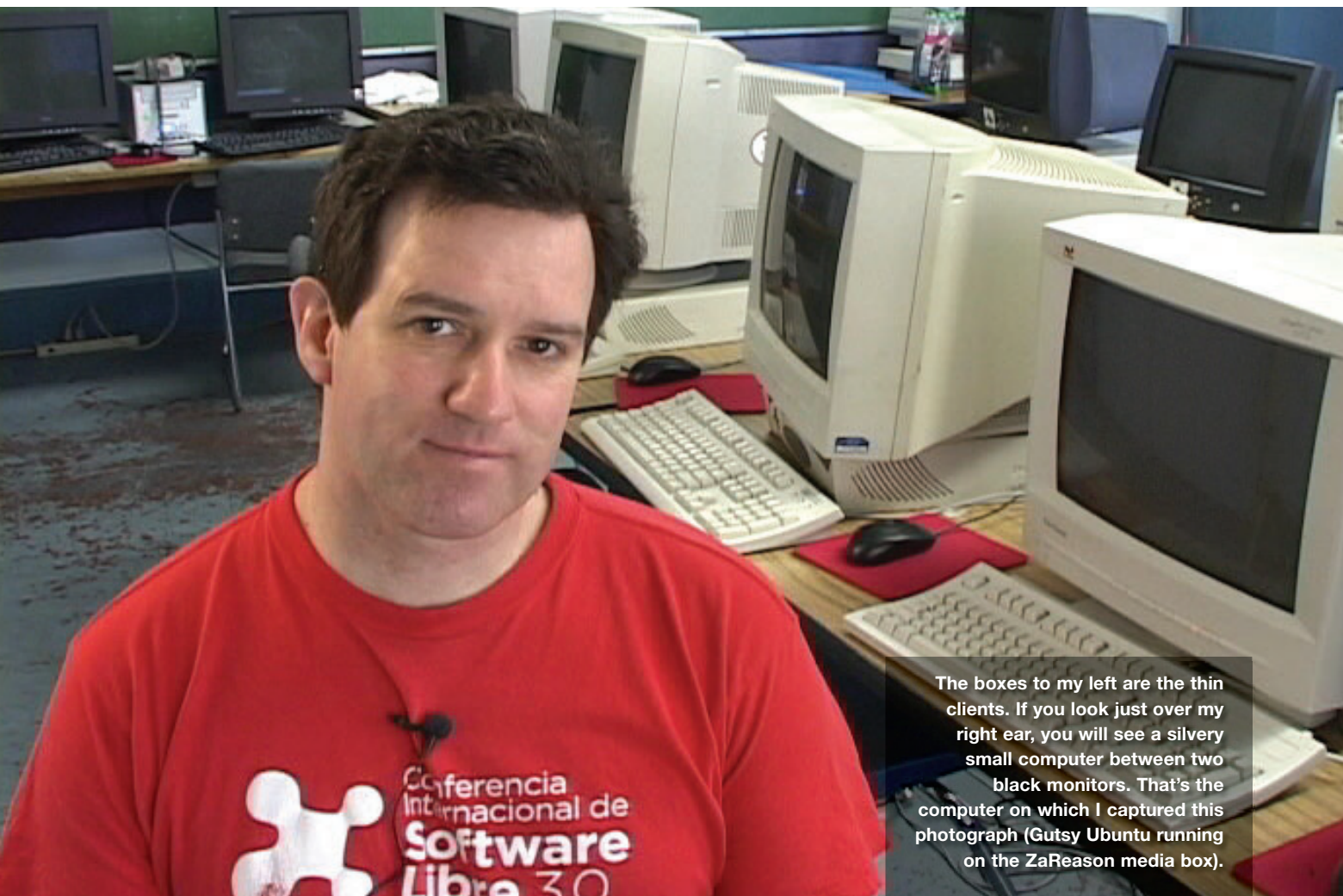
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The boxes to my left are the thin clients. If you look just over my right ear, you will see a silvery small computer between two black monitors. That's the computer on which I captured this photograph (Gutsy Ubuntu running on the ZaReason media box).

What They're Using

Christian Einfeldt, Producer, the *Digital Tipping Point*

I have six basic different uses for free, open-source software: 1) my law office practice; 2) managing and editing video for the *Digital Tipping Point* Project; 3) running a 25-seat Edubuntu lab at a public middle school as a volunteer in San Francisco; 4) placing ACCRC.org Linux computers in classrooms; 5) giving out ACCRC.org Ubuntu computers to friends, neighbors and the children who attend that school; and 6) supporting San Francisco's Tech Connect program by demonstrating Linux boxes at events for nonprofits and low-income individuals.

For my law practice, I use whatever cast-off computer I happen to have available at the moment from the other computers that I give out to students, friends or family. I generally can find a P4

computer with about 512MB of RAM, and I just copy my data from one machine to an external hard drive and then back onto the new machine. It really varies depending on the needs of the students, friends and neighbors I am helping. It's all part of a constant flow of equipment through my office. For a while, I was using OpenSUSE, but I switched to plain-old, brown GNOME Ubuntu, simply because most of the sysadmins who help me prefer plain-old brown.

For the *Digital Tipping Point* video project, I am using three machines. They all have the same "last name", so to speak, as they are all members of the "Beast" family. The least muscular is the Server Beast (sb), with two single-core AMD processors at about 1GHz

each, running on a Tyan 2460 motherboard and 750GB of storage on two internal hard drives (built by San Francisco Linux consultant Holden Aust). This machine has an added card with both USB 2.0 and IEEE 1394 ports. It's called the Server Beast because it was formerly a server owned by a law firm. I use it either for capturing video from my Sony tape deck, compressing the video, uploading the video to the Internet Archive's *Digital Tipping Point* Video Collection (www.archive.org/details/digitaltippingpoint) or for doing rough video editing with Kino, such as the 4:57 minute proof-of-concept video for the *Digital Tipping Point* Project (www.archive.org/details/proof_of_concept_four_mins.mpg).

Next up in the Beast family is the

Render Beast (rb, also built by Holden Aust). It has a Gibabyte-brand GA-MA69GM-S2H motherboard with an Athalon AMD 64 4200+ chip and 4GB of RAM. This machine so far has been used mostly for the same basic thing as the Server Beast, but it's much faster. It also has 1.5TB of internal HD storage.

Finally, the newest addition to the family is the TeraByte Beast (tbb, built by San Francisco Bay Area Linux consultant Daniel Gimpelevich and Holden Aust), with a Gibabyte-brand GA-MA790FX-DS5 motherboard with an Athlon AMD 64 4200+ chip and 4GB of RAM. This machine's claim to fame (at least at Beast family gatherings) is that it has 16 one-terabyte drives, for a total of 16TB. It's primarily used for storing video, although it occasionally is pressed into service to do the same things as its Beast brothers.

The public middle school's Edubuntu lab has three machines running various flavors of Ubuntu (built by ZaReason, Inc., a Berkeley-based computer retailer that sells only Linux-powered computers). There are two video-ready machines, each with an Intel Core 2 Duo E6300 and 2GB of RAM. Each machine also has a 500GB SATA drive. These are used by the students for watching video and listening to music, as well as practicing photo editing in The GIMP. The teachers have not yet put together a video-editing course, as they still are learning how to use video editing under Cinelerra and Kino. Let's keep our fingers crossed for next year.

ZaReason also built the Edubuntu thin-client server, which is a Pentium D 940 with 2GB of RAM and a 320GB hard drive. That machine supports 23 thin clients and is used by the students every day except Friday for on-line research and composing essays and sending them to their teachers via e-mail. The students also are taught to do presentations, which they deliver in front of their science and social studies classes. For their essays and presentations, they use Google Docs, which now has a presentation element (OpenOffice.org was choking the server). As a nice little bonus, Microsoft paid for all of the ZaReason boxes—a result of California's antitrust settlement (linux.slashdot.org/article.pl?sid=07/10/11/1446254).

With the help of Andrew Fife and Tom Belote of Untangle.com (a networking security company) and Linux expert Drew Hess, we will be turning the Edubuntu thin-client lab into an Edubuntu hybrid client network running the programs locally but serving up the files from the Zareason.com server. The thin clients were choking the server when audio or video was attempted, so we are shifting some of the work to the clients next year.

James Burgett, who runs the Alameda County Computer Resource Center (ACCRC.org) has been a really generous donor of equipment for the public middle school I am supporting with free, open-source software. James gave the school an initial donation of 30 HP P4 Ubuntu machines with 256MB of RAM. Some of those boxes were given to students, and some were used in the Edubuntu lab. Other boxes were placed in classrooms, where the students use the machines for the same purposes in the lab.

James Burgett (also of Untangle.com) and Andrew Fife organized a massive installfest (lwn.net/Articles/273770) at the school and four other locations in the San Francisco Bay Area (untangle.com/index.php?option=com_content&task=view&id=393&Itemid=139) on March 1, 2008. That installfest allowed me to give neighbors and friends some of the machines I had scrounged for the school, by replacing those machines with newer machines from the ACCRC.org - Untangle installfest. Also, many of the new machines were given out to students, many of whom have no computers at home. ACCRC.org and Untangle.com are planning another massive installfest (untangle.com/index.php?option=com_content&task=view&id=351&Itemid=139) for LinuxWorld Expo in August 2008 in San Francisco.

Finally, the St. Anthony Foundation of San Francisco has loaned me seven Dell GX 150 machines with 256MB of RAM, which I use to support Kari Gray in her work with the City and County of San Francisco's Tech Connect Project to introduce low-income people to technology. A video of an event at St. Anthony's Foundation in San Francisco's skid row is available at (news.cnet.com/Tenderloin-Tech-Day/1606-2_3-6223419.html?part=rss&tag=2547-1_3-0-20&subj=news).

—CHRISTIAN EINFELDT

New Top-Level Domains on the Way

In late June 2008, ICANN accepted a proposal to relax restrictions on the top-level domain namespace and, in the process, opened up the possibility for thousands of new domains.

Currently, there are only 21 top-level domains, such as .com, .org or .info, and around 240 active country-code domains, such as .us, .de and .uk. The proposed plan would allow any organization or person to apply for a customized top-level domain.

For example, New York City could operate the .nyc domain for addresses, such as brooklyn.nyc, penn-station.nyc or www.central-park.nyc. "It's a massive increase in the 'real estate' of the Internet", said Dr Paul Twomey, President and CEO of ICANN. The .com registry is by far the most crowded at this point, with 71 million registered domains. For comparison, the second (.de) and third (.net) most popular registries have only 11.2 million and 10.6 million domains, respectively.

Before you rush to register your new top-level domain, you may want to check your bank account first. ICANN is expected to charge a minimum of \$100,000 for the right to operate your own top-level domain, provided you qualify. Applicants must prove that they have a "business plan and technical capacity". There is hope that this measure will help keep domain squatters out of the top-level namespace.

ICANN also has a process in place to deal with controversial submissions, as stated on icann.org: "Offensive names will be subject to an objection-based process based on public morality and order. This process will be conducted by an international arbitration body utilizing criteria drawing on provisions in a number of international treaties. ICANN will not be the decision maker on these objections."

Applications for new names will be available in the second quarter of 2009.

Yes, it is true, ICANN HAZ MORE DOMAINS.

—CORY WRIGHT



REUVEN M. LERNER

Shoehorning Data into a Database

Databases make the world go round, but sometimes fitting a round data peg into a square database hole is less than ideal. What's a programmer to do?

Relational databases are really great for storing and retrieving data, but sometimes, they aren't quite up to the task. Joe Celko, whose *SQL for Smarties* books are among my favorites, dedicated an entire volume to the issue of trees and hierarchies. These data structures might be common and useful in most programming languages, but they can be difficult to model as tables, particularly if you care about efficient use of the database. Things become even trickier if you're dealing with a number of related, but distinct, types of entities, such as different types of employees or different types of vehicles.

One way to solve this problem is not to use relational databases. Objects can be quite good at handling trees and arrays, as well as inheritance hierarchies. Furthermore, object databases do exist, and the Python-based Zope application framework has demonstrated that it's even possible to have object databases in production. Gemstone's demonstration of Ruby running on top of its Smalltalk VM, with its accompanying object database, means that Ruby programmers soon might have access to similar technology.

But, object databases still are far from the mainstream. Most Web developers have access to a relational database, and not much else. Is there anything that we can do for these people?

This month, we take a look at two different ways we can handle data that doesn't quite fit into a relational database. These techniques are quite different from one another, and they don't even come close to the full range of possibilities you can get with a relational database. But, they both work and are used in production environments—and if your data doesn't seem to fit into standard database paradigms, you might want to consider one of them.

PostgreSQL's Table Inheritance

Some data-modeling issues are typically even harder to deal with. For example, a classic introduction to the world of object-oriented programming describes a human resources department. The HR department tracks employees, all of whom have some common characteristics. But, some employees are programmers, some are secretaries, and some are managers—and each of the employee types has specific data that needs to be associated with them.

In an object-oriented world, it's easy to model this.

You create an employee class, and then create multiple subclasses of programmer, secretary and manager. Subclassing creates an "is-a" relationship, such that a programmer is an employee. This means that programmers have all the attributes of an employee, but also have some additional characteristics that distinguish them from an ordinary employee. With these subclasses in place, we then can create an array (or any other data structure) of people in our company, knowing that although some are programmers and others are secretaries, they're all employees and can be treated as such.

Translating this idea to the world of relational databases can be a bit tricky. One solution is to use inheritance in your database tables. PostgreSQL has done this for years; thus, it's called an object-relational database by many users. You can do the following in PostgreSQL, for example:

```
CREATE TABLE Employees (
    id          SERIAL,
    first_name  TEXT    NOT NULL,
    last_name   TEXT    NOT NULL,
    email_address TEXT  NOT NULL,

    PRIMARY KEY(id),
    UNIQUE(email_address)
);

CREATE TABLE Programmers (
    main_language TEXT    NOT NULL
) INHERITS(Employees);

CREATE TABLE Secretaries (
    words_per_minute INTEGER NOT NULL
) INHERITS(Employees);

INSERT INTO Employees (first_name, last_name, email_address)
VALUES ('George', 'Washington', 'georgie@whitehouse.gov');

INSERT INTO Programmers (first_name, last_name,
                          email_address, main_language)
VALUES ('Linus', 'Torvalds', 'torvalds@osdl.org', 'C');

INSERT INTO Secretaries (first_name, last_name,
                          email_address, words_per_minute)
VALUES ('Condoleezza', 'Rice', 'rice@state.gov', 10);
```

If we ask for all employees in the system, we'll get all three of the people we have entered:

```
atf=# select * from employees;
 id | first_name | last_name | email_address
-----+-----+-----+-----
  1 | George     | Washington | georgie@whitehouse.gov
  2 | Linus      | Torvalds   | torvalds@osdl.org
  3 | Condoleezza | Rice      | rice@state.gov
(3 rows)
```

Of course, this query shows only the columns of the Employees table, which are common to that table and to those that inherit from it. If we want to find out how many words per minute someone types, we must address that query specifically to the Secretaries table:

```
atf=# select * from secretaries;
 id | first_name | last_name | email_address | words_per_minute
-----+-----+-----+-----+-----
  3 | Condoleezza | Rice      | rice@state.gov |          10
(1 row)
```

Notice that the id column for all three tables,

which was defined as SERIAL (that is, a nonrepeating incrementing integer), is unique across all three tables.

Polymorphic Associations

The way that PostgreSQL has integrated this type of object hierarchy into its relational system is impressive, flexible and useful. And yet, because it is unique to PostgreSQL, it means that no higher-level, database-agnostic application framework can support it. This especially is true in Ruby on Rails, which tries to treat all databases as similar or identical, going so far as to encourage programmers to use a Ruby-based domain-specific language (migrations) to create and modify database definitions. Using PostgreSQL's inheritance features might work, but it will take a fair amount of twisting to make it compatible with Rails.

Besides, Rails already has a feature, known as polymorphic associations, that lets us work with distinct types of items as if they were part of a single class. This isn't the same as an object hierarchy—we can't say that secretaries and programmers are both types of employees. But, we can say that secretaries and programmers are both employable and treat them as similar via that description.

1

2

3

4

5

6

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To begin, you might remember that Rails has something known as associations, which allow us to connect one model to another. For example, let's say that each company has one or more employees. Thus, we can create some simple models. We can generate migrations with:

```
./script/generate model company name:string
./script/generate model employee first_name:string
  last_name:string email_address:string company_id:integer
```

Then, we can turn the automatically generated migration files into actual database tables with the following:

```
rake db:migrate
```

Now, we can indicate that each company can have one or more employees by modifying the model files. For example, we add the following to `employee.rb`:

```
class Company < ActiveRecord::Base
  has_many :employees
end
```

Similarly, we can say:

```
class Employee < ActiveRecord::Base
  belongs_to :company
end
```

With `has_many` and `belongs_to` in place, we now have created an “association” between these two models. This might not seem too exciting, but it means we can treat the two tables as object classes and each row in the table as an instance:

```
xyz = Company.create(:name => 'XYZ Corporation')

george = Employee.create(:first_name => 'George',
  :last_name => 'Washington',
  :email_address => 'georgie@whitehouse.gov',
  :company_id => xyz.id)
```

Now, we can say:

```
p xyz.employees.first
```

and we get back our george user. Similarly, we can say:

```
p george.company
```

and get back our xyz company. This is all standard stuff for Rails programmers, and it is part of the ActiveRecord feature known as associations. You can create all sorts of associations, giving them arbitrary names. For example, we could say:

```
class Company < ActiveRecord::Base
  has_many :employees
  has_many :employees_with_a, :class_name => 'Employee',
    :conditions => "first_name ilike '%a%'"
end
```

With this in place, and after restarting the console (or typing `reLoad!`), we now can say:

```
xyz = Company.find_by_name('XYZ Corporation')

xyz.employees_with_a
```

This prints the empty list—not surprising, given that we have defined only a single employee so far, and his name didn't contain an a. But, now we can create a second employee:

```
jane = Employee.create(:first_name => 'Jane',
  :last_name => 'Austin',
  :email_address => 'jane@bookauthor.com',
  :company_id => xyz.id)
```

If we run our association again:

```
xyz.employees_with_a
```

now we get our jane employee.

This is all well and good, but what happens if we want to represent different types of employees, each of whom is employed by a company, but with different associated data? This is where polymorphic associations become useful. In order for this to work, we need to change the definitions of our models, as well as the relationships among them (if you're playing along at home, blow away the existing `Employee` and `Company` models before continuing):

```
./script/generate model company name:string
./script/generate model contract employable_id:integer
  employable_type:string company_id:integer
./script/generate model programmer main_language:string
  first_name:string last_name:string email_address:string
./script/generate model secretary words_per_minute:integer
  first_name:string last_name:string email_address:string
```

The above invocations of `script/generate` create four different models: one for a company, another for a programmer, another for a secretary and a fourth for a contract. Our PostgreSQL model allowed us to have a single `Employee` table and to have programmers and secretaries inherit from that table. Rails doesn't let us specify that one model inherits from another. Rather, we use Rails to describe the relationships among the models. Companies are connected to programmers and secretaries via employment contracts.

Because we are looking at the relationships

among standalone models, rather than an inheritance hierarchy, there's no obviously good place in which to stick attributes that are common to programmers and secretaries. In the end, I decided to put the attributes in the programmer and secretary models, respectively, despite the repetition.

Now, let's define the associations:

```
class Company < ActiveRecord::Base
  has_many :contracts
end

class Contract < ActiveRecord::Base
  belongs_to :company
  belongs_to :employable, :polymorphic => true
end

class Programmer < ActiveRecord::Base
  has_many :contracts, :as => :employable
  has_many :companies, :through => :contracts
end

class Secretary < ActiveRecord::Base
```

```
  has_many :contracts, :as => :employable
  has_many :companies, :through => :contracts
end
```

In other words, each company has many contracts. Each contract joins together a company and someone who is employable. Who is employable? Right now, only programmers and secretaries fit the bill, connecting to the employable interface with contracts, and then to a company via a contract.

Behind the scenes, Rails is pulling a nasty trick, one that should make any good database programmer feel sick. The contract model includes two fields (employable_id and employable_type), which point to a single row in a particular table. In some ways, this is sort of a poor man's foreign key. But the difference is that the foreign key can point to any of several tables. And, of course, there is no error checking; only the application can stop me from entering a random text string in the employable_type column.

So, now we can create some relationships:

```
xyz = Company.create(:name => 'XYZ Corporation')
```

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```

p1 = Programmer.create(:first_name => 'Linus',
                      :last_name => 'Torvalds',
                      :email_address => 'torvalds@osdl.org',
                      :main_language => 'C')

Contract.create(:employable => p1, :company => xyz)

s1 = Secretary.create(:first_name => 'Condoleezza',
                    :last_name => 'Rice',
                    :email_address => 'rice@state.gov',
                    :words_per_minute => 90)

Contract.create(:employable => s1, :company => xyz)

```

That's already pretty remarkable. Because both programmers and secretaries are employable (as they both expose the employable interface to the contracts model, using `has_many :as`), we can join each of them to an instance of the contract model.

But, it gets better, if we add a few more associations:

```

class Contract < ActiveRecord::Base
  belongs_to :company
  belongs_to :employable, :polymorphic => true

  belongs_to :programmer,
    :class_name => 'Programmer', :foreign_key => 'employable_id'
  belongs_to :secretary,
    :class_name => 'Secretary', :foreign_key => 'employable_id'
end

class Company < ActiveRecord::Base
  has_many :contracts

  has_many :programmers, :through => :contracts,
    :source => :programmer,
    :conditions => "contracts.employable_type = 'Programmer' "

  has_many :secretaries, :through => :contracts,
    :source => :secretary,
    :conditions => "contracts.employable_type = 'Secretary' "

end

```

With this in place, we now have a complete bidirectional association between programmers and secretaries on one side and companies on the other. Thus, we can say:

```

>> xyz.programmers
=> [#<Programmer id: 1, main_language: "C", first_name: "Linus",
last_name: "Torvalds", email_address: "torvalds@osdl.org", created_at:
"2008-06-12 00:47:58", updated_at: "2008-06-12 00:47:58">]

>> xyz.secretaries
=> [#<Secretary id: 1, words_per_minute: 90, first_name:

```

```

"Condoleezza", last_name: "Rice", email_address: "rice@state.gov",
created_at: "2008-06-12 00:54:34", updated_at: "2008-06-12
00:54:34">]

```

But, we also can say:

```

>> Programmer.find(1).companies
=> [#<Company id: 1, name: "XYZ Corporation", created_at: "2008-06-12
00:47:18", updated_at: "2008-06-12 00:47:18">]

```

Moreover, we can iterate over `xyz.contracts`, bringing together the secretaries and programmers models into one package:

```

>> xyz.contracts.each {|c| puts c.employable.first_name}
Linus
Condoleezza

```

Although Rails does not provide inheritance within the models, polymorphic associations make it possible to come close to such functionality. You also get a bunch of convenience functions that make it more natural to work with these additional attributes.

Conclusion

Not all data fits cleanly into two-dimensional tables. When this occurs, you can try to shoehorn your data into an inappropriate container. Or, you can try to use the help that is built in to one or more levels of your software stack. If you use PostgreSQL, inheritance can be really useful. If you use Rails, you can take advantage of polymorphic associations, allowing you to treat two or more models with a common API as similar. This isn't the sort of thing you'll do each day, but it's a useful skill to have on hand for cases when you need to take unusual data. ■

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

To learn how PostgreSQL allows for inheritance, read the on-line manual at www.postgresql.org/docs/8.3/static/ddl-inherit.html.

Rails Cookbook, by Rob Orsini, and published by O'Reilly, has some good information about polymorphic associations.

The Rails Wiki has some good examples and descriptions of polymorphic associations at wiki.rubyonrails.org/rails/pages/UnderstandingPolymorphicAssociations.



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MARCEL GAGNÉ

Browsers with the Speed of Lightning

When was the last time you heard someone mention the browser wars? Most pundits love to point out that Internet Explorer's only real competition is Mozilla Firefox. One or two will give Opera a nod. But, what about the underdogs of the browser world?

Speed of lightning, power of thunder? What is this I hear? *Mon Dieu*, François! How on earth did you find that old *Underdog* clip? Ah, of course—YouTube. I am surprised, *mon ami* that you even know about this old cartoon—one, I confess, I enjoyed a great deal in my youth. *Quoi?* You don't know it? You were just doing some research for the issue's theme, underdogs? To be honest, I'm not exactly sure what our editors meant, but I don't think rescuing Sweet Polly Purebred from the evil Simon Bar Sinister was what they had in mind. Underdogs, François, refer to people (or animals or things) who are disadvantaged in some way. They may be smaller and not quite as strong as their opponent, so that in a contest or fight, they are expected to lose. People love to see the underdog win. But enough of this, François. Our guests are arriving as we speak.

Welcome once again, *mes amis*, to *Chez Marcel*, where fine wine is a naturally perfect match for fine Linux and open-source software. Please, take your seats and make yourselves comfortable while my faithful waiter attends to the wine. François, please head down to the cellar and bring back that 2006 Torbreck Barossa Valley Woodcutter's Shiraz we were, uhm, submitting to quality control earlier today.

Before you arrived, François and I were discussing the meaning of the word underdog. Cartoon characters aside, in the desktop Web browser world, you will find some true underdogs. I'm not talking about Firefox, and I'm sure most people no longer see Firefox as an underdog when compared to the Redmond OS's flagship browser. Instead, I want to show you some Web browsers worthy of the underdog label that you may well want to consider using. Despite not being as feature-rich as the heavyweights, these lightweight browsers have small memory footprints, make few demands on system resources and are, in many cases, as fast as lightning. Let me start with a text-only browser that, strangely enough, does graphics.

Links, created by Mikulas Patocka, is a text-only

Web browser that is surprisingly rich in features (Figure 1). It can display tables and frames, and it supports colors, clickable links, SSL pages, background downloads and more. Sure, it works in text, but you have never seen pages load as quickly as you will when you decide to view the World Wide Web the way many of us first saw it—sans pictures. People doing research who want uncluttered information need to put away their graphical browsers and fire up Links. The effect of seeing only what you need, loaded in an instant, is a wonderful experience. Once you have used it, you always will make sure it is loaded on every Linux distribution you run.



Figure 1. Links is a perennial favorite for text-only Web browsing. When you can't get to a graphical desktop, nothing beats Links.

Links' popularity means you don't have to look far for it. Most distributions have it in their

repositories. Source is, of course, available from links.sourceforge.net.

Although it's true that Links is a text browser, it does respond to mouse clicks. In a nongraphical environment, you navigate by using cursor keys, jump from link to link with the Tab key, page using the spacebar and follow a link by pressing Enter. In a text console running under a graphical desktop, things are a little different. When you see a link, simply click, and you will go there.

Did I say text-only? I may have been mistaken. Graphically speaking, Links isn't merely a text browser. An update to Links, available from Twibright labs at links.twibright.com, provides a graphical interface that works even if you aren't running a graphical desktop. That's right. This Links will work on your framebuffer console as well (Figure 2). Once again, you should have no trouble finding the package in your repositories. The difference is in the command. To run the text-only version of Links, use the command `links`. For a graphical version of Links, try `links-graphic`.



Figure 2. If you thought Links was a text-only browser, think again.

Ah, François, you have returned. Please pour for our guests. Enjoy, *mes amis*. This Shiraz has a wonderfully rich aroma, complexity and texture, along with black cherry draped over the signature Shiraz peppery flavor. Make sure you fill my glass as well, François.

Another alternative to the monster browsers of today, and one that is entirely graphical in nature, is Dillo. Created by Jorge Arellano Cid, Dillo's demands on your system are meager, and its performance is seriously snappy. It won't render complex pages or tables particularly well, but it does support image browsing and bookmarks. Dillo's small size, speed and tiny memory footprint can sometimes make up for its limited features. Figure 3 shows Dillo in action.

The current 0.8 branch of Dillo is no longer



Figure 3. Dillo is a seriously snappy graphical browser.

maintained, but it's still a mainstay in most major distributions' repositories. It's easy to find and install. A new version based on FLTK2 is where development is going at this stage. Those of you feeling a little brave and willing to do a little source code compiling are invited to download the development code from the site at www.dillo.org. The classic source is also available.

Finding a balance between the needs of offering a feature-rich browser while maintaining speed at a maximum and resources at a minimum is the driving force behind the final two items on tonight's menu.

Our next selection for tonight is Christian Dywan's Midori, a great little Web browser whose rendering engine uses WebKit instead of Gecko. For those who may not know, WebKit is an open-source rendering engine based on KHTML, the HTML rendering engine created by the fine people of the KDE Project. Midori (Figure 4) also features tabbed browsing, custom context menus, configurable interface, JavaScript plugins and, of course, peppy rendering, courtesy of WebKit.



Figure 4. Cool name aside, Midori is the only browser I've found that can pass the Acid3 test.

Note:

Think you may have heard of WebKit somewhere else? That's because WebKit is the engine behind Mac OS X's Safari browser.

Changes to Midori's interface and behavior are largely controlled via the Preferences dialog (Figure 5). Click Edit on the menu bar, and select Preferences. From there, you can set a default home page, change the look and feel (including default fonts), and more. You'll also find evidence of Midori's young age when you run into pages that don't yet allow edits.

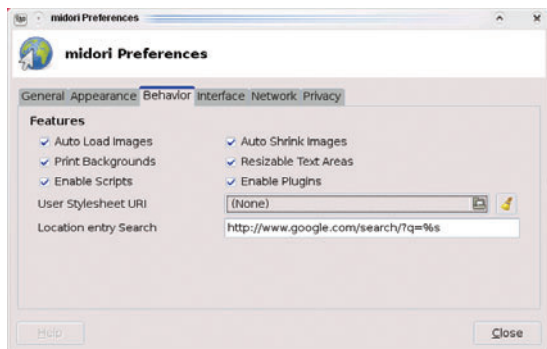


Figure 5. The Preferences menu gives you access to much of Midori's configuration.

Midori is, as I mentioned, a young browser. It's also a fascinating and promising project, and it's fast. Really fast. And, it's the only browser on my system to pass the Acid3 test (acid3.acidtests.org).

The final item on our menu is Hidetaka Iwai's Kazehakase, a graphical browser that uses the Mozilla Gecko rendering engine to display Web



Figure 6. Kazehakase is an excellent browser based on the Mozilla Gecko engine.

pages. As such, it doesn't lack for much when it comes to showing off Web sites as you expect to see them. Kazehakase, which means "Wind Doctor" is named after a short story by the Japanese author Sakaguchi Ango. This is a great little program that features tabbed browsing, customizable mouse gestures and keyboard shortcuts, RSS bookmarks and more (Figure 6).

Possibly the coolest thing about Kazehakase is its graded user interface. It's a great concept. By default, the user interface is kept as simple as possible, providing users with only the basics both in terms of menu options and configuration of system preferences. The user interface level (UI levels) can be set to beginner, medium or expert. At each level, you find additional hidden gems under the surface that let you fine-tune the browser. There are two ways to change the UI level. The first is by changing the preferences. To get to the system preferences, click Edit on the menu bar, then select Preference. The beginner UI preferences window appears with the main options to the right and a sidebar menu on the left (Figure 7).

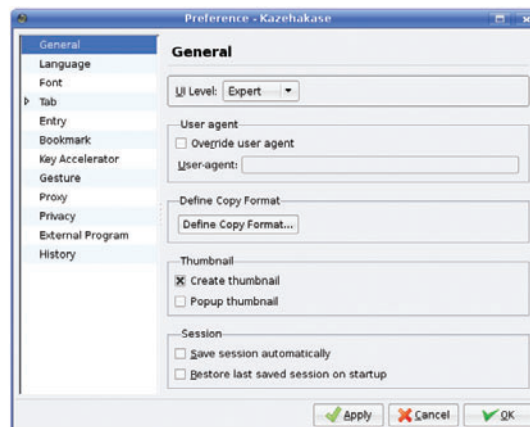
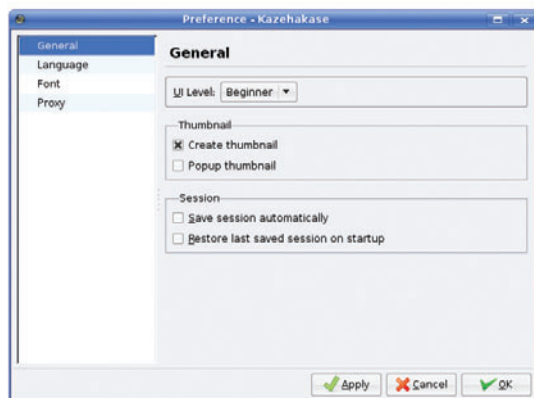


Figure 7. On the left, you can see Kazehakase's basic (or beginner) preferences. To the right is the same dialog but in expert mode.



Figure 8. Becoming an expert in Kazhakase is just one little menu option away.

Note:

Marcel's extract-and-build five-step is available from his Web site at www.marcelgagne.com/fivestep.html.

There are only four categories of simple changes here. If you change the UI level to expert, a much more complex and complete preferences menu appears, as shown on the right-hand side of Figure 7. If you choose, you also can toggle the UI level directly from the menu bar by clicking View and selecting your level of expertise from the UI level submenu (Figure 8).

Kazhakase isn't widely available in distribution repositories, so you may have to resort to the old extract-and-build five-step for that one. This is a great little browser and well worth checking out.

There you have it, *mes amis*, the underdogs of the browser world—some of them anyhow, as I am sure there are plenty more. Can any of them compete against the big guys? That depends on your needs and constraints. If fast as lightning trumps a bulked-up feature set, the underdogs win. The same is true on a small, under-powered machine. Researchers who are more interested in text may opt out of the graphical browsers entirely. Each underdog, you might say, can have its day.

Speaking of day, this one is nearly

done, and the only browsing I intend to do after closing is in the wine cellar. Speaking of which, keep your glasses handy as François will happily refill them a final time. Raise your glasses, *mes amis*, 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

Dillo: www.dillo.org

Kazhakase:
kzhakase.sourceforge.jp

Links: links.twibright.com

Midori: software.twotoasts.de/?page=midori

Marcel's Web Site:
www.marcelgagne.com

The WFTL-LUG, Marcel's Online Linux User Group: www.wftl-lug.org

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DAVE TAYLOR

Spreading Out Numbers

The hardest part of any game is coming up with likely, but incorrect, answers. In this month's column, Dave looks at ways to calculate probable wrong answers for the evolving movie trivia game.

The past few months, we've been writing a movie trivia game with the intent of having it be a Twitter client and sporadically spit out questions on its Twitter feed of the form "The film *Sunset Blvd.* was released in 1943, 1946, or 1950?"

What initially seemed like the most difficult task, finding the list of films and then extracting release dates, turned out to be a manageable one through the expedient of utilizing the terrific Internet Movie Database site (imdb.com) and pushing the data through some filters and transformations.

The end result is that with a simple invocation of a script, we can generate a data file called `top-250-films-with-release-dates.db` that looks like this: "Sunset Blvd. | 1950" (and now you know the answer to the question in paragraph one).

Generating Interesting Adjacent Numbers

Last column left off with the puzzle of generating good "adjacent" release years. That is, if we're talking about a movie like *Prince Caspian*, released in 2008, we want the adjacent values to be quite close—maybe 2005 and 2007. If we're talking about *Rear Window*, released back in 1954, we want the adjacent values to be spread out more, because offering up 1951, 1954 and 1955 is going to be more annoying and nit-picking than 1940, 1950 and 1954 or similar. See what I mean?

What we could do is simply subtract the release year from the current year, then apply some sort of multiple to tweak the delta. Then, *Prince Caspian* would have an "adjacency" of zero, and *Rear Window* would have one of 54. Let's consider dividing the value by five and using the ceiling value to see what the calculation for a half-dozen movies produces (Table 1).

That's not bad. *Sin City* could have incorrect year values within one year of the actual release, while *Metropolis* could be off by as much as 17 without most people realizing. I mean, if I asked you right now, "Did Fritz Lang's masterwork *Metropolis* come out in 1927, 1931 or 1947?", would you know the answer?

Table 1. Calculating Adjacency for the Movie Trivia Game

Title	Release Date	Adjacency	Factor
<i>Der Untergang</i>	2004	4	1
<i>Metropolis</i>	1927	81	17
<i>Sin City</i>	2005	3	1
<i>Chinatown</i>	1974	34	7
<i>Some Like It Hot</i>	1959	49	10

This leads to an important realization: we can't have the values perfectly spaced out, so the Factor above is the upper range of a 1..Factor choice. So, the amusing *Some Like It Hot* can have incorrect guesses that are anywhere from one year to nine years off.

Okay, enough discussion. How do we implement this in code?

Well, we have the release date of the movie in `releasedate`, and we have the current year in `thisyear`, so here's a simple test script:

```
thisyear="$(date +%Y)"
releasedate="$1"
adjacency="$(( $thisyear - $releasedate ))"
if [ $adjacency -lt 5 ] ; then
    factor="1"
else
    factor="$(( $adjacency / 5 + 1 ))"
fi
echo "For release $releasedate we have factor = $factor"
```

This demonstrates an important facet of shell scripting: sometimes thinking through the solution is more time consuming than actually coding your resultant algorithm. I could share an anecdote about my boss telling me to "stop thinking and start coding" in one of my earlier jobs, but I'll skip it. Just keep in mind that thinking through solution paths is a critical step in any job.

Now that we have a way to calculate our adjacency factor for a given movie release year, let's take the next step and actually calculate possible values:

```
delta="$(( $RANDOM % $factor + 1))"
```

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```
add="$(( $RANDOM % 2 ))"
if [ $add -eq 1 ] ; then
    closeyear="$(( $releasedate + $delta ))"
else
    closeyear="$(( $releasedate - $delta ))"
fi
```

That isn't too bad as a first step.

There are two problems I see with this algorithm as is, however. First, we can end up with release years in the future (that is, *Iron Man* could end up with a release year of 2009, which is wrong). Second, for movies released in the last five years, we also could end up with the actual release year always sandwiched in the middle once we de-dupe the results. (I hope you can see why that's the case.)

To fix the first problem, we need to add a test to ensure that the closeyear is never greater than thisyear, which is straightforward. For the second problem, I think that having a minimum delta of two, rather than one, gives us a bit more wiggle space, though any movie released in the current year is basically a gimme anyway for people who are paying even minimal attention.

Here's how I implemented these tweaks:

```
if [ $adjacency -lt 5 ] ; then
    factor="2"
else
    factor="$(( $adjacency / 5 + 1 ))"
fi
```

And, a bit later in the code:

```
if [ $closeyear -gt $thisyear ] ; then
    closeyear="$(( $releasedate - $delta ))"
fi
```

That seems to work pretty well. Now when we give the script a few different release years, here's what we see:

Release Year	First Five Generated Results
1962	1970, 1967, 1958, 1960, 1971
1994	1996, 1996, 1995, 1993, 1993
2002	2004, 2001, 2000, 2001, 2003
1927	1915, 1925, 1937, 1936, 1911
2008	2006, 2007, 2007, 2006, 2007

I think we can live with this—not bad at all, actually.

Now we have all the building blocks, and next month, we'll put them all together and create the movie trivia game. With luck, we'll have space to start pushing it out on Twitter too. In the meantime, if you want to sign up on Twitter for the game and watch as I develop it, follow FilmBuzz. ■

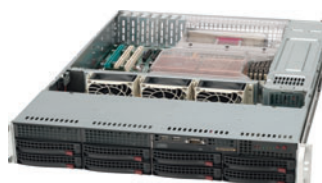
Dave Taylor is a 26-year veteran of UNIX, creator of The Elm Mail System, and most recently author of both the best-selling *Wicked Cool Shell Scripts* and *Teach Yourself Unix in 24 Hours*, among his 16 technical books. His main Web site is at www.intuitive.com, and he also offers up tech support at AskDaveTaylor.com. Follow him on Twitter if you'd like: twitter.com/DaveTaylor.

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MICK BAUER

Secured Remote Desktop/Application Sessions

Run graphical applications from afar, securely.

There are many different ways to control a Linux system over a network, and many reasons you might want to do so. When covering remote control in past columns, I've tended to focus on server-oriented usage scenarios and tools, which is to say, on administering servers via text-based applications, such as OpenSSH. But, what about GUI-based applications and remote desktops?

Remote desktop sessions can be very useful for technical support, surveillance and remote control of desktop applications. But, it isn't always necessary to access an entire desktop; you may need to run only one or two specific graphical applications.

In this month's column, I describe how to use VNC (Virtual Network Computing) for remote desktop sessions and OpenSSH with X forwarding for remote access to specific applications. Our focus here, of course, is on using these tools securely, and I include a healthy dose of opinion as to the relative merits of each.

Remote Desktops vs. Remote Applications

So, which approach should you use, remote desktops or remote applications? If you've come to Linux from the Microsoft world, you may be tempted to assume that because Terminal Services in Windows is so useful, you *have* to have some sort of remote desktop access in Linux too. But, that may not be the case.

Linux and most other UNIX-based operating systems use the X Window System as the basis for their various graphical environments. And, the X Window System was designed to be run over networks. In fact, it treats your local system as a self-contained network over which different parts of the X Window System communicate.

Accordingly, it's not only possible but easy to run individual X Window System applications over TCP/IP networks—that is, to display the output (window) of a remotely executed graphical application on your local system. Because the X Window System's use of networks isn't terribly secure (the X Window System has no native support whatsoever

for any kind of encryption), nowadays we usually tunnel X Window System application windows over the Secure Shell (SSH), especially OpenSSH.

The advantage of tunneling individual application windows is that it's faster and generally more secure than running the entire desktop remotely. The disadvantages are that OpenSSH has a history of security vulnerabilities, and for many Linux newcomers, forwarding graphical applications via commands entered in a shell session is counterintuitive. And besides, as I mentioned earlier, remote desktop control (or even just viewing) can be very useful for technical support and for security surveillance.

Using OpenSSH with X Window System Forwarding

Having said all that, tunneling X Window System applications over OpenSSH may be a lot easier than you imagine. All you need is a client system running an X server (for example, a Linux desktop system or a Windows system running the Cygwin X server) and a destination system running the OpenSSH daemon (sshd).

Note that I didn't say "a destination system running sshd *and* an X server". This is because X servers, oddly enough, don't actually run or control X Window System applications; they merely display their output. Therefore, if you're running an X Window System application on a remote system, you need to run an X server on your local system, not on the remote system. The application will execute on the remote system and send its output to your local X server's display.

Suppose you've got two systems, mylaptop and remotebox, and you want to monitor system resources on remotebox with the GNOME System Monitor. Suppose further you're running the X Window System on mylaptop and sshd on remotebox.

First, from a terminal window or xterm on mylaptop, you'd open an SSH session like this:

```
mick@mylaptop:~$ ssh -X admin-slave@remotebox
admin-slave@remotebox's password: *****
```

```
Last login: Wed Jun 11 21:50:19 2008 from dtcla00b674986d
admin-slave@remotebox:~$
```

Note the `-X` flag in my `ssh` command. This enables X Window System forwarding for the SSH session. In order for that to work, `sshd` on the remote system must be configured with `X11Forwarding` set to `yes` in its `/etc/ssh/sshd.conf` file. On many distributions, `yes` is the default setting, but check yours to be sure.

Next, to run the GNOME System Monitor on `remotebox`, such that its output (window) is displayed on `mylaptop`, simply execute it from within the same SSH session:

```
admin-slave@remotebox:~$ gnome-system-monitor &
```

The trailing ampersand (&) causes this command to run in the background, so you can initiate other commands from the same shell session. Without this, the cursor won't reappear in your shell window until you kill the command you just started.

At this point, the GNOME System Monitor window should appear on `mylaptop`'s screen, displaying system performance information for `remotebox`. And, that really is all there is to it.

This technique works for practically any X Window System application installed on the remote system. The only catch is that you need to know the *name* of anything you want to run in this way—that is, the actual name of the executable file.

If you're accustomed to starting your X Window System applications from a menu on your desktop, you may not know the names of their corresponding executables. One quick way to find out is to open your desktop manager's menu editor, and then view the properties screen for the application in question.

For example, on a GNOME desktop, you would right-click on the Applications menu button, select Edit Menus, scroll down to System/Administration, right-click on System Monitor and select Properties. This pops up a window whose Command field shows the name `gnome-system-monitor`.

Figure 1 shows the Launcher Properties, *not* for the GNOME System Monitor, but instead for the GNOME File Browser, which is a better example, because its launcher entry includes some command-line options. Obviously, all such options also can be used when starting X applications over SSH.

If this sounds like too much trouble, or if you're worried about accidentally messing up your desktop menus, you simply can run the application in question, issue the command `ps auxw` in a terminal window, and find the entry that corresponds to your application. The last field in each row of the output from `ps` is the

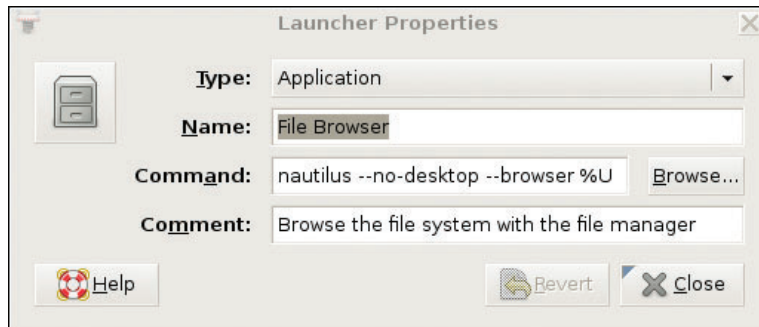


Figure 1. Launcher Properties for the GNOME File Browser (Nautilus)

executable's name plus the command-line options with which it was invoked.

Once you've finished running your remote X Window System application, you can close it the usual way (selecting Exit from its File menu, clicking the x button in the upper right-hand corner of its window and so forth). Don't forget to close your SSH session too, by issuing the command `exit` in the terminal window where you're running SSH.

Virtual Network Computing (VNC)

Now that I've shown you the *preferred* way to run remote X Window System applications, let's discuss how to control an entire remote desktop. In the Linux/UNIX world, the most popular tool for this is Virtual Network Computing, or VNC.

Originally a project of the Olivetti Research Laboratory (which was subsequently acquired by Oracle and then AT&T before being shut down), VNC uses a protocol called Remote Frame Buffer (RFB). The original creators of VNC now maintain the application suite RealVNC, which is available in free and commercial versions, but TightVNC, UltraVNC and GNOME's vino VNC server and vinagre VNC client also are popular.

VNC's strengths are its simplicity, ubiquity and portability—it runs on many different operating systems. Because it runs over a single TCP port (usually TCP 5900), it's also firewall-friendly and easy to tunnel.

Its security, however, is somewhat problematic. VNC authentication uses a DES-based transaction that, if eavesdropped-on, is vulnerable to optimized brute-force (password-guessing) attacks. This vulnerability is exacerbated by the fact that many versions of VNC support only eight-character passwords.

Furthermore, VNC session data usually is transmitted unencrypted. Only a couple flavors of VNC support TLS encryption of RFB streams, and it isn't clear how securely TLS has been implemented even in those. Thus, an attacker using a trivially hacked VNC client may be able to reconstruct and view eavesdropped VNC streams.

Luckily, as it operates over a single TCP port, VNC is easy to tunnel through SSH, through Virtual

But Don't Real Sysadmins Stick to Terminal Sessions?

If you've read my book or my past columns, you've endured my repeated exhortations to keep the X Window System off of Internet-facing servers, or any other system on which it isn't needed, due to X's complexity and history of security vulnerabilities. So, why am I devoting an entire column to graphical remote system administration?

Don't worry. I haven't gone soft-hearted (though possibly slightly soft-headed); I stand by that advice. But, there are

plenty of contexts in which you may need to administer or view things remotely besides hardened servers in Internet-facing DMZ networks.

And, not all people who need to run remote applications in those non-Internet-DMZ scenarios are advanced Linux users. Should they be forbidden from doing what they need to do until they've mastered using the vi editor and writing bash scripts? Especially given that it is possible to mitigate some of

the risks associated with the X Window System and VNC?

Of course they shouldn't! Although I do encourage all Linux newcomers to embrace the command line. The day may come when Linux is a truly graphically oriented operating system like Mac OS, but for now, pretty much the entire OS is driven by configuration files in /etc (and in users' home directories), and that's unlikely to change soon.

Private Network (VPN) sessions and through TLS/SSL wrappers, such as stunnel. Let's look at a simple VNC-over-SSH example.

Tunneling VNC over SSH

To tunnel VNC over SSH, your remote system must be running an SSH daemon (sshd) and a VNC server application. Your local system must have an SSH client (ssh) and a VNC client application.

Our example remote system, remotebox, already is running sshd. Suppose it also has vino, which is also known as the GNOME Remote Desktop Preferences applet (on Ubuntu systems, it's located in the System menu's Preferences section). First, presumably from remotebox's local console, you need to open that applet and enable remote desktop sharing. Figure 2 shows vino's General settings.

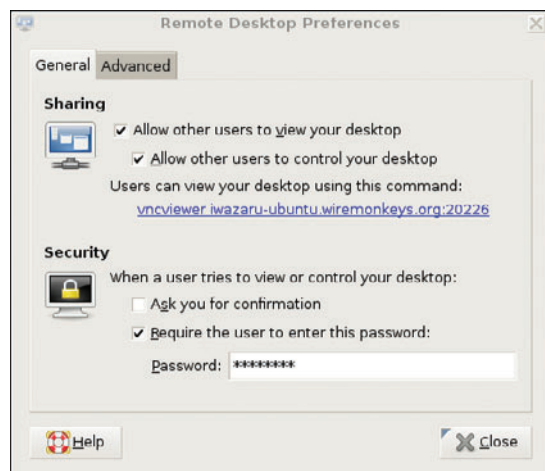


Figure 2. General Settings in GNOME Remote Desktop Preferences (vino)

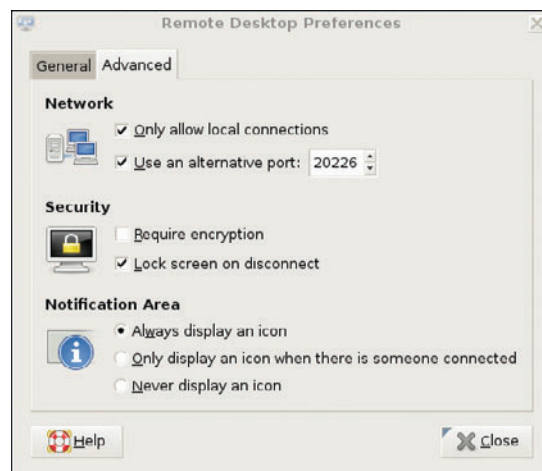


Figure 3. Advanced Settings in GNOME Remote Desktop Preferences (vino)

Continuing with our vino example, don't close that Remote Desktop Preferences applet yet. Be sure to check the Require the user to enter this password box and to select a difficult-to-guess password. Remember, vino runs in an *already-logged-in* desktop session, so unless you set a password here, you'll run the risk of allowing *completely unauthenticated* sessions (depending on whether a password-protected screensaver is running).

If your remote system will be run logged in but unattended, you probably will want to uncheck Ask you for confirmation. Again, don't forget that locked screensaver.

We're not done setting up vino on remotebox yet. Figure 3 shows the Advanced Settings tab.

Several advanced settings are particularly noteworthy. First, you should check Only allow local connections, after which remote connections still *will* be possible, but only via a port-forwarder like SSH or stunnel. Second, you may want to set a custom TCP port for vino to listen on via the Use an alternative port option. In this example, I've chosen 20226. This is an instance of useful security-through-obscurity; if our other (more meaningful) security

controls fail, at least we won't be running VNC on the obvious default port.

Also, you should check the box next to Lock screen on disconnect, but you probably should *not* check Require encryption, as SSH will provide our session encryption, and adding redundant (and not-necessarily-known-good) encryption will only increase vino's already-significant latency. If you think there's only a moderate level of risk of eavesdropping in the environment in which you want to use vino—for example, on a small, private, local-area network inaccessible from the Internet—vino's TLS implementation may be good enough for you. In that case, you may opt to check the Require encryption box and skip the SSH tunneling.

(If any of you know more about TLS in vino than I was able to divine from the Internet, please write in. During my research for this article, I found no documentation or on-line discussions of vino's TLS design details whatsoever—beyond people commenting that the soundness of TLS in vino is unknown.)

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“opt-out” opportunities in my examples than usual. Perhaps I’m becoming less dogmatic with age. Regardless, let’s assume you’ve followed my advice to forego vino’s encryption in favor of SSH.

At this point, you’re done with the server-side settings. You won’t have to change those again. If you restart your GNOME session on remotebox, vino will restart as well, with the options you just set. The following steps, however, are necessary each time you want to initiate a VNC/SSH session.

On mylaptop (the system from which you want to connect to remotebox), open a terminal window, and type this command:

```
mick@mylaptop:~$ ssh -L 20226:remotebox:20226 admin-slave@remotebox
```

OpenSSH’s `-L` option sets up a local port-forwarder. In this example, connections to mylaptop’s TCP port 20226 will be forwarded to the same port on remotebox. The syntax for this option is “`-L [localport]:[remote IP or hostname]:[remoteport]`”. You can use any available local TCP port you like (higher than 1024, unless you’re running SSH as root), but the remote port must correspond to the alternative port you set vino to listen on (20226 in our example), or if you didn’t set an alternative port, it should be VNC’s default of 5900.

That’s it for the SSH session. You’ll be prompted for a password and then given a bash prompt on remotebox. But, you won’t need it except to enter `exit` when your VNC session is finished. It’s time to fire up your VNC client.

vino’s companion client, vinagre (also known as the GNOME Remote Desktop Viewer) is good enough for our purposes here. On Ubuntu systems, it’s located in the Applications menu in the Internet section. In Figure 4, I’ve opened the Remote

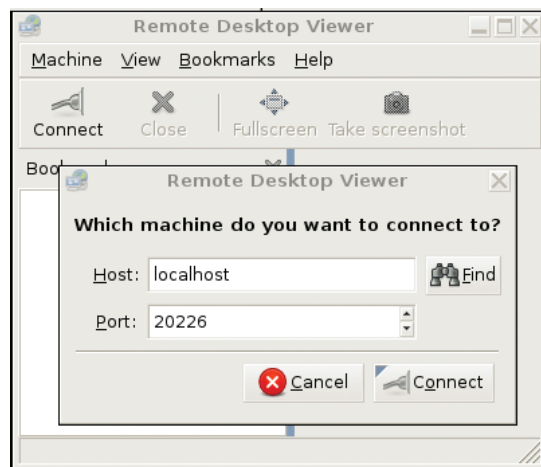


Figure 4. Using vinagre to Connect to an SSH-Forwarded Local Port

Desktop Viewer and clicked the Connect button. As you can see, rather than remotebox, I’ve entered localhost as the hostname. I’ve also entered port number 20226.

When I click the Connect button, vinagre connects to mylaptop’s local TCP port 20226, which actually is being listened on by my local SSH process. SSH forwards this connection attempt through its encrypted connection to TCP 20226 on remotebox, which is being listened on by remotebox’s vino process.

At this point, I’m prompted for remotebox’s vino password (shown in Figure 2). On successful authentication, I’ll have full access to my active desktop session on remotebox.

To end the session, I close the Remote Desktop Viewer’s session, and then enter `exit` in my SSH session to remotebox—that’s all there is to it.

This technique is easy to adapt to other versions of VNC servers and clients, and probably also to other versions of SSH—there are commercial alternatives to OpenSSH, including Windows versions. I mentioned that VNC client applications are available for a wide variety of platforms; on any such platform, you can use this technique, so long as you also have an SSH client that supports port forwarding.

Conclusion

Thus ends my crash course on how to control graphical applications over networks. I hope my examples of both techniques, SSH with X forwarding and VNC over SSH, help you get started with whatever particular distribution and software packages you prefer. Be safe! ■

Mick Bauer (darth.elmo@wiremonkeys.org) is Network Security Architect for one of the US’s largest banks. He is the author of the O’Reilly book *Linux Server Security*, 2nd edition (formerly called *Building Secure Servers With Linux*), an occasional presenter at information security conferences and composer of the “Network Engineering Polka”.

Resources

The Cygwin/X (information about Cygwin’s free X server for Microsoft Windows): x.cygwin.com.

Tichondrius’ HOWTO for setting up VNC with resumable sessions—Ubuntu-centric, but mostly applicable to other distributions: ubuntuforums.org/showthread.php?t=122402.

Wikipedia’s VNC article, which may be helpful in making sense of the different flavors of VNC: en.wikipedia.org/wiki/Vnc.

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Do the Splits

Get two terminals in the space of one with split screens on a number of different command-line tools.

Even with the high-resolution flat-screen monitors we have these days, screen real estate still can be at a premium. Of course, if you spend a lot of your time in a terminal, this is even more true. When you want to compare two files at the same time or monitor two different sessions at once, you either carefully position terminal windows or rely on tabs.

Tabs can be fine, but when I use terminals, I like to stick to the keyboard as much as possible. Plus, I don't know about anyone else, but for me, there are four main programs I run in terminals: mutt, vim, screen and irssi. Luckily for me, all of these programs support some form of split screens—the ability to divide the terminal either vertically or horizontally. Although these features aren't necessarily anything new, if you don't use them every day, it can be hard to remember how to split the screen, navigate between the sections, and then go back to a single screen. In this column, I discuss the split-screen features in my four favorite terminal applications and provide a simple guide to help us all commit them to memory.

Mutt Pager Indexes

I suppose if you want to be technical, this isn't exactly the same as the split screens in the other tools, but while you are in the mutt pager (the part that lets you view the body of an e-mail message), by default, mutt fills the entire terminal with the e-mail. If you want, however, you can tell mutt to take a specified number of lines at the top and use them to display your index. This way, you can browse through the contents of an e-mail message

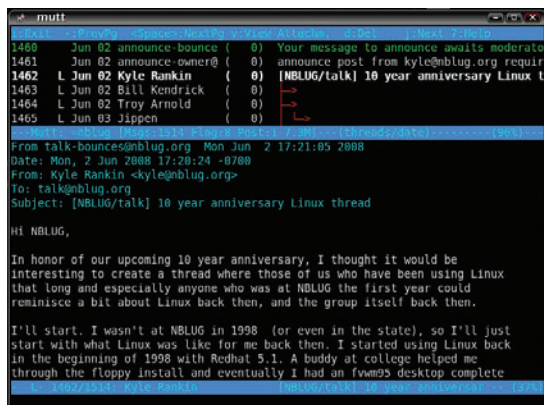


Figure 1. Mutt with pager_index_lines Enabled

but still be able to keep an eye on the other headers in your index. To use ten lines for this feature, simply add the following:

```
set pager_index_lines=10
```

to your ~/.muttrc.

Vim Splits

Vim is my favorite text editor (I've used it for basically all of my writing), and its split-screen feature is especially useful for sysadmin work. I can't count how many times I've made a change in one configuration file or script that I've wanted to add to a second file. To enable split-screen mode for a horizontal split, type:

```
:split
```

And, for a vertical split, type:

```
:vsplit
```

By default, vim shows the same file in both panes. Press Ctrl-W, and then use the regular HJKL keys (or arrow keys if you aren't a home-row junkie like me) to navigate between panes. So, if I had made a horizontal split and wanted to open a new file in the bottom pane, I would press Ctrl-W J to move the cursor to that pane, and then I would type :open filename to open the new file. When you are finished with a particular pane, make sure the cursor is in that pane, and then save and close the file in the normal fashion.

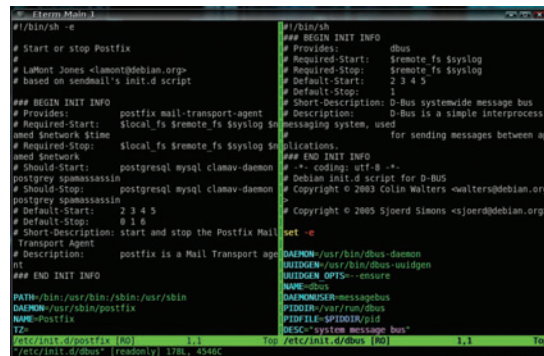


Figure 2. Vim with a Vertical Split

Vim isn't limited only to two panes either—simply type the `:split` or `:vsplit` command again to add a third horizontal or vertical pane, respectively. You even can split the window horizontally and then type `:vsplit` to split that pane further into two vertical panes.

Split Screen

Screen is another one of those indispensable command-line tools. If you haven't used screen before, it essentially allows you to open multiple numbered shells, and you can switch to them with `Ctrl-A <number>`. Then, you can detach from your screen session and connect to it later, and in the meantime, all the shells you have opened within it keep their state. One way I commonly use screen is for `irssi`, a command-line-based IRC client. I open `irssi` within screen on a server that is always up. Then, no matter where I am, I can connect to the remote server and resume my `irssi` session, which always stays connected.

Beyond the standard screen features, screen also supports a horizontal split screen. This can be useful if you want to monitor IRC in one window and perform other commands in the second. Also, if you use a text editor or other tools that don't support split panes on their own, you can use screen's split feature as a supplement.

To split the pane within screen, press `Ctrl-A Shift-S`. Then, you can press `Ctrl-A Tab` to move your cursor between the two panes. You will notice that the bottom pane is empty at the beginning. Once you have moved the cursor to it, you either can switch to a currently open window with `Ctrl-A <number>`, or you can press `Ctrl-A C` to create a new window in that pane. Screen also supports multiple panes. Simply press `Ctrl-A Shift-S` a second time to split the session into three equally sized panes. When you are ready to close a pane, press

`Ctrl-A Tab` until it has the cursor, and then press `Ctrl-A Shift-X` to close that pane.

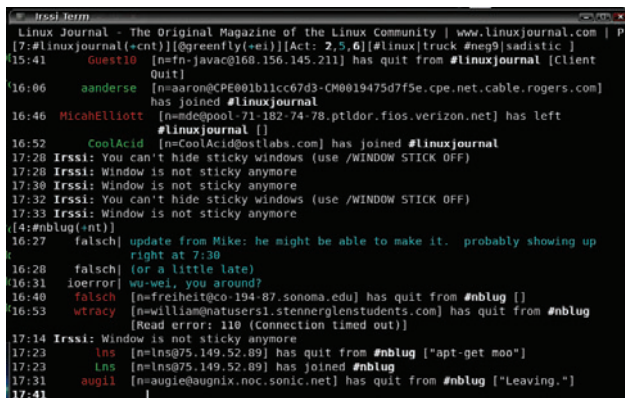
Irssi Split

`Irssi` is definitely my favorite IRC client, and I probably spend as much time in it as I do in any other command-line program. It also supports an interesting split-screen feature that takes some getting used to. Basically, each channel you join in `irssi` ends up in its own numbered window. On my setup, I always have particular channels set to open in a particular window, so when I press `Alt-7`, for instance, I always will go to `#linuxjournal`. Sometimes you have a lot of activity going on in more than one channel and want to monitor all of them. So, for instance, if I want to view both `#linuxjournal` (in window 7) and `#nblug` (in window 4), and I already am in `#nblug`, I could type:

```
/window show 7
```

Now the `irssi` screen splits in half with `#linuxjournal` on the top and `#nblug` on the bottom. If I want to chat in `#linuxjournal`, I press `Alt-7` to make sure it is selected (the topic header on `irssi` updates to show the currently selected window). Then, if I want to chat in `#nblug`, I press `Alt-4`.

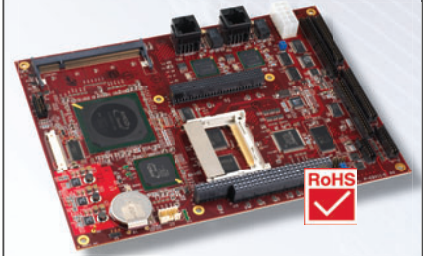
`Irssi` split windows become interesting once you start switching beyond two windows. Going back to the example, if I press `Alt-5` now (my `#knoppix` window), the bottom window changes to that channel. By default, `irssi` makes



```
Irssi term
Linux Journal - The Original Magazine of the Linux Community | www.linuxjournal.com | P
[7:#linuxjournal(-cnt)][@greenfly(+e)] [Act: 2,5,6] [#linux|truck #neg9|sadtastic ]
15:41 quest10 [n=fr-javac@160.156.145.211] has quit from #linuxjournal [Client
Quit]
16:06 aanderse [n=aaron@cpe01b1cc67d3-cm0019475d7f5e.cpe.net.cable.rogers.com]
has joined #linuxjournal
16:46 MicahElliott [n=mdgpool-71-182-74-78.ptldor.fios.verizon.net] has left
#linuxjournal []
16:52 CoolAcid [n=CoolAcid@ostlabs.com] has joined #linuxjournal
17:28 Irssi: You can't hide sticky windows (use /WINDOW STICK OFF)
17:28 Irssi: Window is not sticky anymore
17:38 Irssi: Window is not sticky anymore
17:32 Irssi: You can't hide sticky windows (use /WINDOW STICK OFF)
17:33 Irssi: Window is not sticky anymore
[4:#nblug(-nt)]
16:27 falsch| update from Mike: he might be able to make it. probably showing up
right at 7:30
16:28 falsch| (or a little late)
16:31 loerror| wu-wei, you around?
16:40 falsch [n=fraheito@194-87.sonoma.edu] has quit from #nblug []
16:53 wtracy [n=william@natusers1.stennerglenstudents.com] has quit from #nblug
[Read error: 110 (Connection timed out)]
17:14 Irssi: Window is not sticky anymore
17:23 lns [n=lns@75.149.52.89] has quit from #nblug ["apt-get moo"]
17:23 lns [n=lns@75.149.52.89] has joined #nblug
17:31 augil [n=augie@augnix.noc.sonic.net] has quit from #nblug ["Leaving."]
17:41 |
```

Figure 3. Irssi with Two Windows

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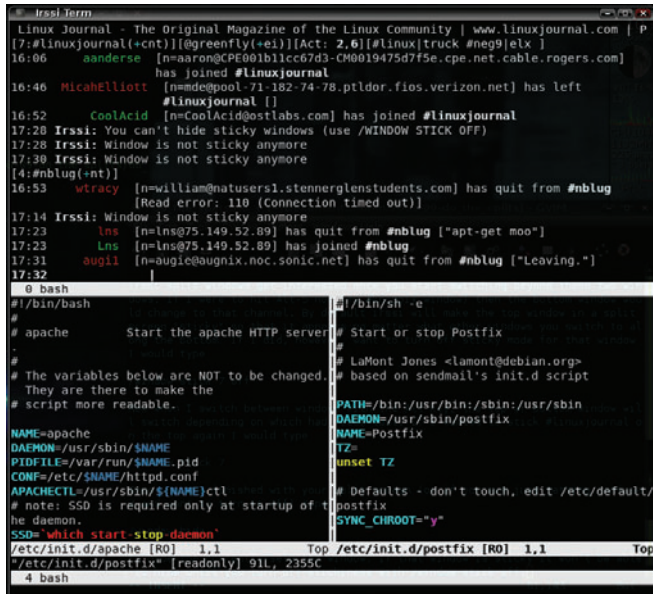


Figure 4. Screen Split with Two Panes, a Split Irssi on Top and a Vertically Split Vim on the Bottom

the top window in a split screen “sticky”, so that it appears no matter what other windows you switch to along the bottom. If I want to turn off sticky mode for that window I would type:

```
/window stick 7 off
```

Now, when I switch between windows with the Alt key, the top or bottom window switches, depending on which had focus last. If I want to stick #linuxjournal on the top again, I type:

```
/window stick 7
```

Once you are finished with your split screen (or if you are getting confused and want to turn it off), type:

```
/window hide
```

to hide the currently selected window. If that window is sticky, it won't be able to hide until you turn off stickiness with /window stick off.

Now, what would a column about splits be if I didn't show an insanely complicated nested set of split screens? Note that I don't advocate actually using a setup like the following on a daily basis, but Figure 4 shows what happens when you split screen into two windows, open a split irssi on the top window and a vertically split vim on the bottom. I hope these split-screen features help you stay organized and productive. ■

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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- 1X16 Port SATA-II Multilane RAID controller.
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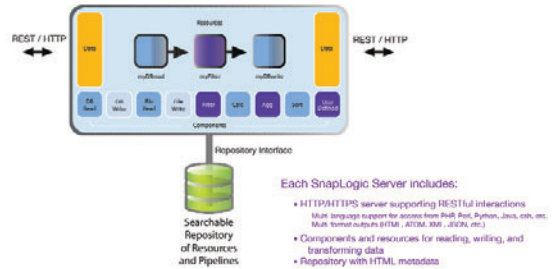
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SnapLogic for Amazon EC2

Under the paradigm "Really Simple Integration", the firm SnapLogic has released SnapLogic for Amazon Elastic Compute Cloud (EC2), a new variant of its open-source data integration framework. SnapLogic for EC2 "provides Amazon Web Services users with a convenient SnapLogic deployment option that scales easily and eliminates the costs of acquiring and maintaining expensive server hardware". SnapLogic for EC2 also makes it easier than ever to "easily integrate data in the cloud with data behind the firewall". Offered in two editions, a GPL'd Community Edition and a commercial Enterprise Edition, SnapLogic enables enterprises quickly and easily to make data from databases, SaaS applications, SOA Web services and other common data sources. The Really Simple Integration paradigm allows knowledge workers to use familiar tools, such as Web browsers, Google and Excel to discover, consume, transform and publish enterprise data, creating a virtuous cycle of self-service data access and distribution.

www.snaplogic.com



iStor Networks' 10GbE integraStor iS512-10G

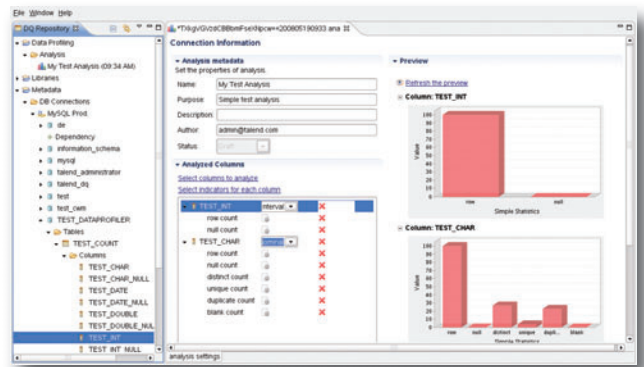
The latest iSCSI solution from iStor is the iS512-10G, a 10Gb model of the iS512 integraStor storage system, which iStor calls "the world's fastest scalable iSCSI storage array optimized for small and medium businesses". This second-generation 10GbE iSCSI storage array offers native 10Gbps architecture supporting full duplex wire speed data rates in excess of 1,100MB/sec and is "2.5 times faster and significantly less expensive than 4G Fibre Channel", says iStor. iStor also notes that mass adoption of 10GbE is close to or perhaps at its tipping point, given the cost per Gbps of 10GbE ports dropping below that for 1GbE ports, as well as the rate of server consolidation driven by virtualization.

www.istor.com

Talend's Open Profiler

Got "dirty" data? Skip the Pine-Sol and opt for Talend's Open Profiler. Open Profiler is an open-source data profiler, which enables companies to assess the quality of data and decide which actions must be taken to correct the dirty data that irritates customers and costs companies time and money. "Data profiling is the first step to achieving reliable, trustworthy data", says Talend. Such profiling reduces the time and resources needed to find problematic data and allows companies to identify potential problems before beginning data-intensive projects, such as data integration or new application development. It also allows business analysts to have more control over the maintenance and management of the data.

www.talend.com



Arkeia's EdgeFort 500 Series Backup Appliance

Arkeia is expanding its appliance business with the new EdgeFort 500 Series, an all-in-one, hardware and software backup system. This set of appliances comes standard with 5TB virtual tape library (expandable to 10TB), disk-to-disk-to-tape management software, Fibre Channel connectivity and is fully integrated with Arkeia's network backup software. Arkeia's federated data management architecture allows remote and centralized data protection, making it possible for remote offices and branch offices to back up, restore and archive critical data, with no local IT resource needed. The EdgeFort 500 series is for the largest data centers, while the earlier 100, 200 and 300 models were for small, medium and large ones.

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HP's Tru64 UNIX Advanced File System

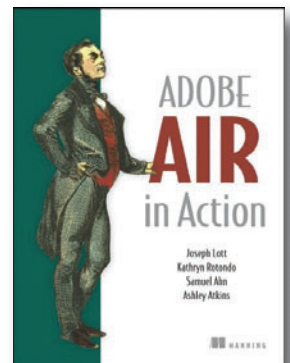
Although HP's Tru64 UNIX Advanced File System (AdvFS) has been available for more than 16 years, the big news is the recent contribution of its source code to the Open Source community. HP states that "the AdvFS source code includes capabilities that increase uptime, enhance security and help ensure maximum performance of Linux filesystems". HP will contribute the code as a reference implementation of an enterprise Linux filesystem under the terms of General Public License Version 2 for compatibility with the Linux kernel. In addition, HP will provide design documentation, test suites and engineering resources. HP further hopes that the source code will serve as a technology base to advance ongoing development of Linux by providing a comprehensive foundation for Linux kernel developers to leverage and improve Linux filesystem functionality.

advfs.sourceforge.net

Adobe AIR in Action (Manning)

The authorial team of Joey Lott, Kathryn Rotondo, Sam Ahn and Ashley Atkins are riding the Adobe AIR wave with their new book *Adobe AIR in Action*, published by Manning. Adobe AIR, which also is available for the Linux platform, is a cross-platform runtime environment that allows Web developers to use their existing skills to start building applications for the desktop. The example-driven book introduces AIR to developers familiar with Flash and Flex, showing them how to build solid AIR-driven desktop applications. Readers will learn the essential features of the AIR API. The book shows how to create and customize native windows, as well as how to read and write files and folders on the local filesystem. *Adobe AIR in Action* also shows how to set up and connect to a local database, detect network connectivity and connect to Web services, bridge ActionScript and JavaScript, and deploy and update their applications.

www.manning.com



Chris Haseman's Android Essentials (Apress)

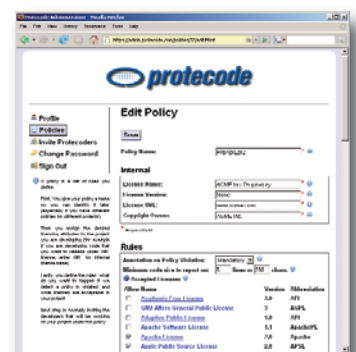
Will Google's Android mobile OS live up to its billing and shake up the world of mobile devices? Judge for yourself with the help of Chris Haseman's new book *Android Essentials* from Apress. Intended for professional software engineers seeking to move their applications into the mobile space, this book is a "no-frills, no-nonsense, code-centric run through the guts of application development" on Android. Rather than cover the entire Android catalog, *Android Essentials* focuses on only four main topics: the application life cycle and OS integration, user interface, location-based services and networking. Among other things, readers will learn how an Android application functions and communicates with the handset that hosts it, the complexities of timers, services and multimedia playback and much more.

www.apress.com

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Protecode is a software-development solution for governance and IP management that utilizes so-called protecoding, a unique methodology to ensure software pedigree tracking. The company says that the latest release "enables commercial software developers and open-source creators to accelerate managed adoption of open-source code in a simple, painless process". Protecode automatically generates records of software content, identifies and reports associated pedigree and licensing information by checking its properties and compliance against an organization's policies, establishing IP ownership and creating a software Bill of Materials (BOM). The tool brings forward the detection of license policy violations to the developer's desktop, where they can be addressed before becoming deeply embedded into the product. A complimentary one-year subscription to Protecode currently is available to anyone working actively on an Eclipse Project.

www.protecode.com



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Fresh from the Labs

PlayStation Portable Video Converter (PSPVC)

(pspvc.sourceforge.net)

First off is a handy tool for all you fellow PSP owners out there. PSPVC allows you to convert a video file into the PSP's native format and take care of its mandatory file-naming scheme. According to PSPVC's Web site: "PSPVC is an FFmpeg front end for converting video files for the PSP. It allows you to queue several conversions with different parameters for each. It supports MPEG-4/SP (all firmware) and H264/AVC (firmware 2.0+)."



PSPVC—PSP owners now can convert their videos with ease with this nice little application.

Installation PSPVC is available with certain distro repositories, but I'm running the bleeding-edge source version. In terms of requirements, PSPVC isn't too picky and uses fairly common libraries for most multimedia systems, including nasm, libfaac, liba52, libxvidcore and GTK+ 2.0. However, you also need the develop-

PSPVC allows you to convert a video file into the PSP's native format and take care of its mandatory file-naming scheme.

ment packages for these multimedia libraries—named in the style of liba52-dev, libfaac-dev and so on—although this may not be the case if you are using a source-based distribution instead of a binary one.

Grab the installation tarball from the project's Web site, and extract it to a new directory. Enter the new pspvc-install directory, open a terminal there, and enter the following command

(as root or with sudo):

```
# ./install.sh
```

If you're lucky, the install script should configure and compile itself in one long go. If it gets stuck partway through, it probably needs a library, and it will let you know in an error message. Once the script is finished, a menu entry usually appears under Multimedia→PSPVC - Video Converter, or you can start it by entering pspvc at the command line.

Usage Once loaded, the first thing you need to do is choose a video file to convert. The first field has a Browse button next to it, so choose the file you want to convert from there, and click Open. The file is loaded into the main screen, and you are given a number of options from which to choose before conversion. The first is called Profile, where you can select the video's aspect ratio (16/9 for widescreen or 4/3 for the older full-screen format), bitrate and codec. If you choose MPEG-4/SP, it will work on any PSP. However, selecting H264/AVC gives you better quality, but works only on PSPs that have had a firmware upgrade since version 2.0.

If the video's volume is too loud or quiet, the Volume field allows you to adjust it before encoding starts. The PSP Filename field is the trickiest; it contains the MAQ number, which makes you

choose a filename number that hasn't already been assigned in your PSP's video folder. This requires you to plug in your PSP, look under the video folder (my PSP uses mp_root/100mnn01, but yours may differ) and choose a number that doesn't appear on any filenames, if you already have some files in there. If there's nothing there to begin with, 10001 will do fine; otherwise, choose a new number.

Once all the options are out of the way, press Convert. A new window appears showing the conversion process, and a thumbnail generator lets you see a preview of the video you are converting. Once the conversion is finished, your new video will be sitting in the same folder as the video you chose to convert. Copy this new file to your PSP's video folder along with its corresponding *videoname.thm* file, and your new video is ready to play.

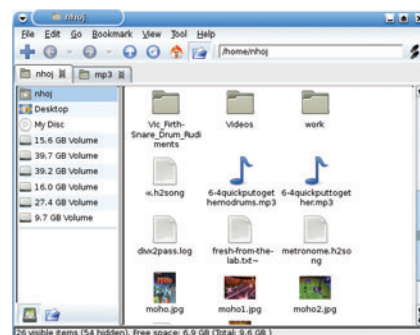
All in all, PSPVC is a simple and pain-free application that even has an easy compilation process. If you're a PSP owner, I'd put PlayStation Portable Video Converter in the must-have category. Hopefully, it will appear in most distro archives soon.

PCManFM—Lightweight File Manager

(pcmanfm.sourceforge.net)

PCManFM is a lightweight file manager that is both quick to load and easy to use. It includes tabbed browsing and device viewing, and it may well scratch an itch for those who like things streamlined. Here's the feature list, according to the project's Web site:

- Extremely fast and lightweight.
- Can be started in one second on normal machines.



PCManFM—Fast and Light File Management, with Tabbed Browsing

- Tabbed browsing (similar to Firefox).
- Built-in volume management (mount/umount/eject through HAL).
- Drag-and-drop support.
- Files can be dragged among tabs.
- Loads large directories in a reasonable amount of time.
- File association support (default application).
- Thumbnails for image files.
- Bookmark support.
- Handles non-UTF-8-encoded filenames correctly.
- Provides icon and detailed list views.
- Standards-compliant (follows FreeDesktop.org).
- Clean and user-friendly interface (GTK+ 2).

Installation Aside from the usual X11 libraries, here are the needed dependencies, as stated on the project's Web site:

- automake >= 1.9.
- libgtk2.0-dev >= 2.6.
- libglib2.0-dev >= 2.6 (2.10+ is highly recommended).
- libgamin-dev or libfam-dev (libgamin is preferred).
- libstartup-notification0-dev.
- libhal-dev (required when the `--enable-hal` configure option is used).
- libdbus-1-dev (required when the `--enable-hal` configure option is used).
- libhal-storage-dev (required when `--enable-hal` configure option is used).

Once you have the dependencies out of the way, head to the Web site, grab the latest tarball and extract it to a new folder. Open a terminal in the new folder, and do the usual:

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

And, as root or with sudo:

```
# make install
```

It should work without any issues, and if it doesn't, the configure script should pick up any snags.

Usage Once the installation finishes, PCManFM can be started either by entering `pcmanfm` at the command line or by going to Utilities→PCMan File Manager. Once inside the main screen, you'll notice two panes. The left contains links to your home folder, the desktop and your storage devices. The right contains all of your files and folders. For tabbed browsing, you can go to File→New Tab, or press Ctrl-T. You can open a new window by selecting File→New Window or pressing Ctrl-N.

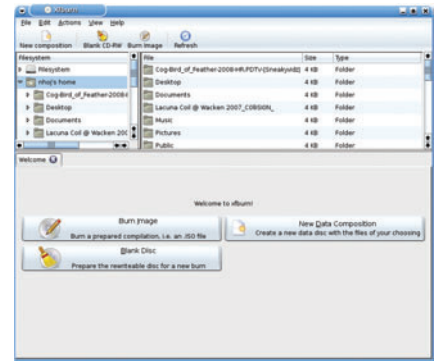
For further usage exploits, I recommend tweaking the settings under Edit→Preferences. Here you can change things such as colors and icon and font sizes, but most important, you can define which terminal you want to load via a shortcut, such as `xterm`, `eterm` and so on. Once this is set, when you are browsing around any folders, pressing F4 or choosing Tool→Open Terminal opens a new terminal that already is pathed to the folder in which you're sitting.

Ultimately, PCManFM is the best lightweight file manager I've used so far. It has a feel reminiscent of a streamlined Konqueror, and I recommend it to anyone who needs a file manager that is light on resources. For any lightweight distro builders, I also recommend trying this as your default file manager—the interface is very intuitive and familiar.

Xfburn—XFCE CD Burner

(www.xfce.org/projects/xfburn)

Finally, we have a CD-burning application for fans of the Xfce desktop, or even for those wanting a nice but light application for slower machines. According to its Web site, "Xfburn is a simple CD/DVD-burning tool based on libburnia libraries. It can blank CD-RWs,



Xfburn—Very K3b-ish but without the Bulk

burn and create ISO images, as well as burn personal compositions of data to either CD or DVD. It is currently under heavy development."

Installation Xfburn is available in some repositories, but as usual, it's typically an older version (I'm compiling 0.3.0 at the moment; at the time of this writing, the Ubuntu servers have version 0.2.0). Running with the source version, there are a few picky requirements, but not too many. Like almost all Linux apps designed for a certain desktop, they can be run in any desktop you like, but you need to have some of the original desktop's libraries installed. So yes, install Xfce while you're there.

As for other dependencies, the configure script whined about `libburn` and `libisofs`, which I installed from the Ubuntu archives, but that didn't work. The Web site mentions `libburnia`, which I couldn't find in the archives at all, so I actually grabbed the source for `libisofs` and compiled that, which did work (the `libburnia/libisofs` home page is at libburnia-project.org). The last thing the configure script niggled about was something called `exo`, which was fixed when I installed `libexo` and `libexo-dev`. After that was all sorted out, it was smooth sailing from there.

So, grab the latest tarball, extract it, open a terminal in the new folder and do the usual:

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

And, as root or with sudo:

```
# make install
```

Usage On what must be a record

string of luck, Xfburn was the third app in a row to install itself in the menu. Check under Utilities→Xfburn. If it's not there, enter `xfburn` at the command line. For me, first impressions were of a slimmed-down K3b, and if you're finding this strangely reminiscent of that last PCManFM section, you're right. This is another one of those instant-loading programs that doesn't contain a zillion warning messages upon startup, and it has functional aesthetics without being ugly and GNOMEish (yes, I said it—send all hate mail to the address at the end of this article).

However, usage still is fairly restricted for the moment. As you can see from those three big buttons at

the start, you currently are limited to "Burn Image, New Data Composition and Blank Disc". Any new projects are opened in new tabs, K3b style, leaving the welcome screen at the first tab, allowing you to continue with more burning tasks. The Preferences section is clean and simple, and it lets you scan for devices without any of the manual trickery you may expect from a lightweight application. The nicest touch I found was the drop-down box toward the bottom right of the screen when composing a new disc that lets you choose whatever size disc you are using on the fly—very refreshing.

For the moment, this application is quite limited in that it's data-only for

now (no audio CDs or video DVDs), but it still is in heavy development. The development team has made the wise choice of making the program very modular and scalable, allowing them to add bits later but keep the mechanics tight on what they have coded for now. Again, for any lightweight distro builders, this is a neat choice, and once development has added further functionality, Xfburn and PCManFM would make a formidable combination for everyday desktop usage. ■

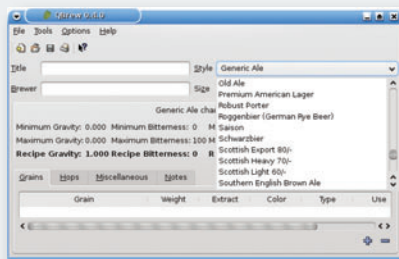
John Knight is a 24-year-old, drumming- and climbing-obsessed maniac from the world's most isolated city—Perth, Western Australia. He can usually be found either buried in an Audacity screen or thrashing a kick-drum beyond recognition.

Projects at a Glance

QBrew

Home Brewing Calculator
(www.usermode.org/code.html)

For the lucrative free-as-in-beer Linux drinking market comes the home brewing calculator QBrew. Full of great technical stuff like mash content, something called the Morey color calculation, presets for all kinds of beers/ales across the globe, and the thoughtful ability to change between metric and imperial, this project is a must for any home brewers out there.

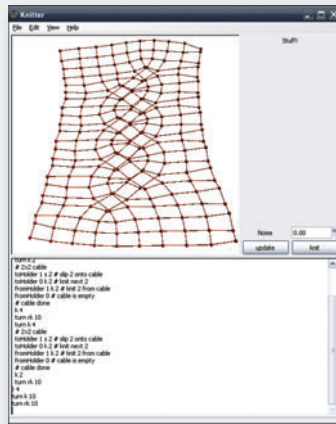


QBrew

Knitter

3-D Knitting Tool
(knitter.sourceforge.net)

Are you bored with the usual patterns in supermarket magazines and looking for something more hardcore? Well for you knitting maniacs, Knitter is a 3-D knitting tool that runs on Linux, Windows and Mac OS. With Knitter, you can preview patterns in full wire frame 3-D and even account for factors such as gravity with a new physics engine. So for all you hard-edged, dangerous knitting mavericks, rock on!



Knitter

TkResolver++

Telekinesis Testing Software
(pkl.net/~node/software/tkresolver)

Now for the most literal case of mind-bending software I've seen. This scientific experiment draws a line down the screen that's influenced directionally by a random number generator. Your job is to try to influence the line's behavior with your mind, and the program records the results, which can be compared to other operators' statistics around the globe—just don't bend your monitor's cathode ray.



TkResolver

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

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SOFTWARE

Simplifying Backups with Zmanda Recovery Manager

An easy-to-use yet comprehensive backup and recovery solution for MySQL databases is at the top of every DBA's wish list. **ALOLITA SHARMA**

Most modern enterprises process immense amounts of data as part of their day-to-day operations. On-demand access to this data is critical, and most enterprises invest heavily in relational database technologies to manage their data. Cutting-edge technologies at cost-effective prices have led many enterprises to adopt open-source databases such as MySQL. As a result, MySQL has become a core component of many data management solutions.

Traditionally, backup of data stored in relational databases like MySQL has been an art form, practiced by database administrators who have relied on a mix of command-line wizardry, custom scripts and, sometimes, just sheer luck. Successful data recovery often is seen as black magic, or almost. Not surprisingly, most backup and recovery strategies emphasize the backup phase, but they don't actually test whether data can be recovered successfully when it's needed.

Zmanda, Inc., a startup based in Sunnyvale, California, aims to bring sanity into the backup and recovery process of MySQL databases by incorporating industry best practices in its product—Zmanda Recovery Manager (ZRM) for MySQL. Zmanda's strong expertise in open-source backup and recovery software comes from many years of work by the company's core engineers on the award-winning Amanda open-source backup system, a project started at the University of Maryland back in 1991.

What Is the Zmanda Recovery Manager (ZRM)?

ZRM provides a comprehensive open-source solution for backup and recovery of MySQL databases. ZRM eases day-to-day backup and recovery tasks with its Web-based Zmanda Management

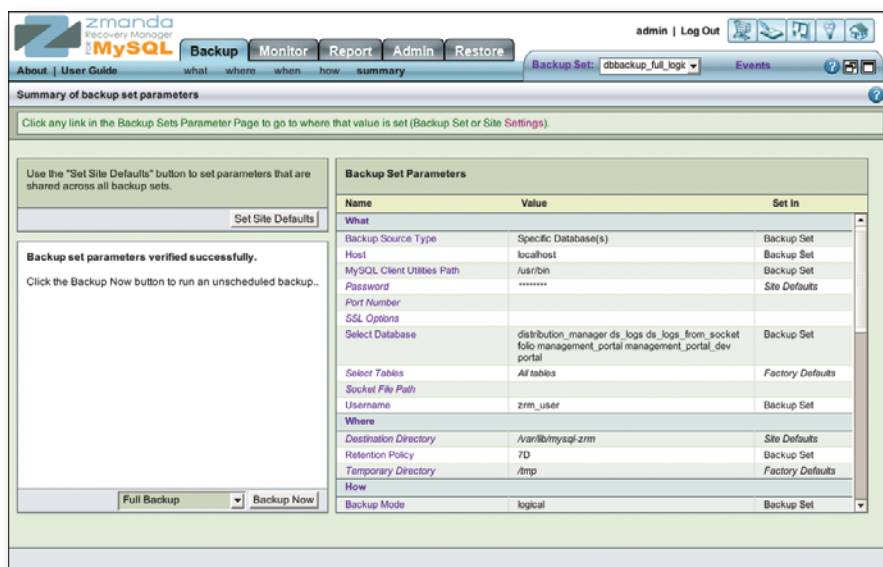


Figure 1. Summary of Backup Parameters in Zmanda Management Console

Console (ZMC). The management console integrates with the Zmanda Network to provide on-line documentation and other support services for ZRM. Because it is open source and supports common standards, as well as open data formats for backups, ZRM frees you from vendor lock-in. ZRM's command-line interface (CLI) integrates well into existing backup and recovery processes.

Enabling advanced backup and recovery practices, ZRM provides Continuous Data Protection (CDP) for MySQL by combining filesystem-level snapshots along with data from MySQL binary logs. Filesystem snapshots help reduce database server downtime, especially when working with large databases. ZRM uses a flexible framework of plugins for snapshotting LVM, NetApp SnapManager, Windows VSS, Veritas VxFS and Solaris ZFS. Plugins for

NetApp SnapManager and Veritas VxFS are sold separately.

Zmanda offers three versions of ZRM for MySQL: the ZRM Enterprise edition, ZRM Cluster edition and ZRM Community edition. The Enterprise edition includes a graphical installer, Zmanda Management Console, command-line interface and plugin framework. Three levels of support (Basic, Standard and Premium) are available for Enterprise edition customers. An annual subscription with basic support starts at \$300 (US). Customers using the NDB storage engine with MySQL Cluster can take advantage of the ZRM Cluster edition. The Community edition is a freely downloadable subset of the Enterprise edition, licensed under the GNU GPLv2, which supports LVM snapshots but does not include the ZMC and the graphical installer.

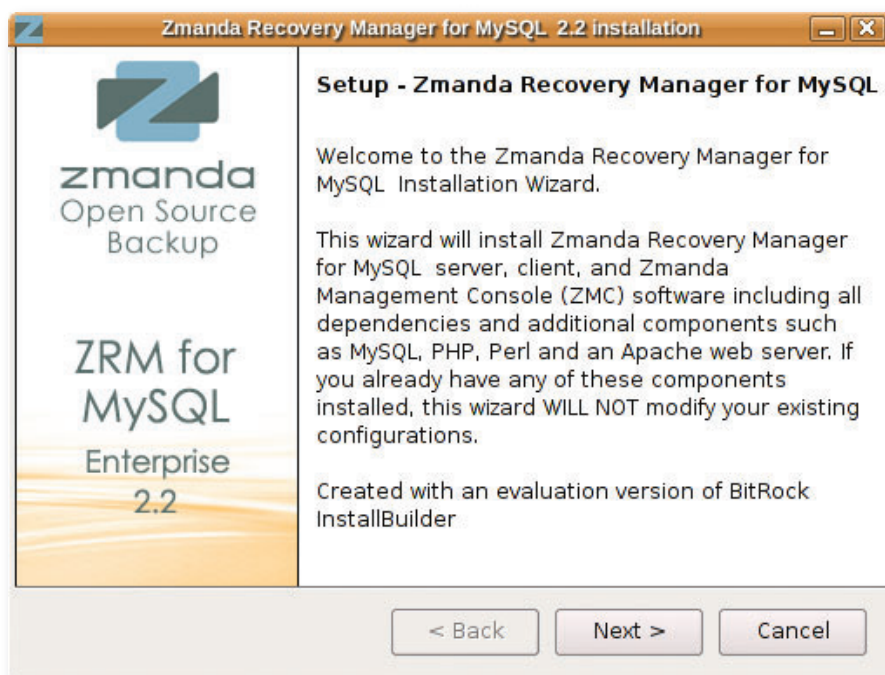


Figure 2. The graphical installer makes setting up ZRM a piece of cake.

Review Environment

I evaluated the Zmanda Recovery Manager for MySQL Enterprise edition version 2.2. The test platform (ZRM server) was Red Hat Enterprise Linux 5.1 installed on a PC with an Intel Dual Core 3GHz processor, 4GB of system memory and a 750GB SATA hard disk. I installed MySQL Community Server version 5.0.51a-0 locally on the ZRM server as well as on another PC with Ubuntu 7.10 server installed. With this configuration, I was able to test ZRM's ability to back up from and restore to local and remote MySQL servers. Note that MySQL versions 4.1.x are also supported by ZRM. Finally, I set up my test databases on a 50GB LVM (Logical Volume Manager) partition to test ZRM's hot backup capabilities.

Installing ZRM

Zmanda provides installation packages for ZRM on Red Hat Enterprise Linux, SUSE Linux Enterprise, Fedora, CentOS, Solaris and OpenSolaris. To install ZRM, download the ZRM graphical installer binary executable and ZRM license key file from the Zmanda Network site. The license key file has to be placed in `/etc/zmanda/zmanda_license`. A full installation of the ZRM Enterprise edition includes command-line tools, a MySQL server instance for use by ZRM, an

Apache Web server instance for ZMC and a PHP 5.2.x and Perl 5.8.x environment.

Getting ZRM up and running is easy, if you're familiar with a MySQL environment on Linux. A couple minor but necessary post-installation tasks included setting up sudo permissions for the mysql system user and creating a MySQL server user account with the right privileges to perform backups and restores.

Zmanda Management Console

The ZMC is a Web-based interface that acts as a control panel for managing the backup and recovery process end to end. Each major function (for example, Backup, Monitor, Report, Admin and Restore) is represented by a tab and corresponding panel in ZMC's interface. A key concept to understand while using the ZMC is that of a "backup set". A backup set defines a group of databases or tables in a database on a MySQL server. Once a backup set has been defined, a ZMC user can configure various actions for that backup set. To help you get a feel for ZRM, the following sections highlight ZRM functions accessible through the ZMC.

Backup

ZRM provides several ways to back up MySQL. Important factors to consider when choosing the best way to back up a MySQL database include database

availability during backup and the size of your database.

Logical backup should be considered if you're looking for flexibility. A logical backup captures the output of the `mysqldump` utility and supports all MySQL storage engines except NDB. You can restore a logical backup to a platform different from the original. For example, a backup of a MySQL database running on an RHEL x86 system can be restored to a MySQL database running on a Solaris Sparc system. However, the flexibility of a logical backup comes at a price. MySQL tables are read-locked during backup. Also, restoring a large database can be slow, as SQL statements are used to re-create the database. Furthermore, the size of the backup can be larger than the actual database or table being backed up.

Raw backups should be considered if you want minimal database downtime or if your database size is really large. Raw backups can take advantage of filesystem-level snapshots to shorten backup times. Also, the backup size of a raw backup is the same as the size of the data being backed up, but a raw backup is restrictive because it can be restored only to the exact MySQL server version on the same kind of platform. If you have a large database and/or high transaction volume, you should consider using the quick snapshot option to reduce backup time further, because the filesystem snapshot becomes the backup and is not copied to the ZRM server. Note that on Linux, LVM snapshotting is supported only for local MySQL backups.

ZRM makes it easy to run a mix of full or incremental backups. Full backups include all data in a database, whereas incremental backups capture the changes since the last successful backup. Incremental backups require that binary logging is enabled on the MySQL server.

If data security is a requirement, ZRM can utilize SSL for remote backups, and it can encrypt backup images using standard encryption tools, such as GnuPG.

I tested ZRM's backup functionality by running variations of full and incremental, logical and raw (with the quick snapshot option) backups of a million-record database table. The backups completed without any problems, and I was able to verify this using the summary report page under the Report tab in the ZMC.

Q&A with Zmanda

We talked with **Chander Kant, CEO and cofounder of Zmanda, as well as Paddy Sreenivasan, VP of Engineering and cofounder of Zmanda, about ZRM, open-source backup and growing an Open Source community.**

AS: Why should customers look at Zmanda Recovery Manager and open source?

CK: Although products based on open source and open standards almost always come with lower initial cost of acquisition, the greater benefit is achieved over the life cycle of the deployment. Inherent freedom provided by open products enables IT managers to lower the cost of ongoing maintenance significantly. Let's say your organization is using an operating system that is popular today, but becomes out of favor in a few years' time. It is possible, actually probable, that a proprietary backup vendor will withdraw support for this unprofitable operating system. This would force you to make a choice between either using some ad hoc mechanism to back up that system or to replace the system with a different OS—both costly choices. Open Source communities are known to provide support for older (and sometimes obscure) platforms. Furthermore, the source code is available to compile or recompile the software for a particular operating system.

Future profitability of proprietary software vendors depends on locking in customers to their proprietary formats and components. For example, if you use proprietary backup products to write to a tape, the only way to recover data from that tape is to use the same (and in most cases, the exact version of the) product. If you were restoring from the tape seven years from now, you'd better have the specific version of

the product lying around with a valid license or be ready to pay a premium price to recover your own data. In contrast, data backed up with Zmanda's products is always in an open format. Customers can recover their data even without using our products (of course, it is easier to recover if they do use our products). Also, the data can be repurposed for other applications (such as e-discovery).

AS: How did you come up with the idea of building an open-source database backup solution?

CK: We are the leading open-source backup company. For any backup company to be interesting for customers, you need a good database backup story. For us, it was a clear choice: MySQL is the leading open-source database—we had to be the core backup solution provider for MySQL.

AS: Why did you start Zmanda? How did you come up with the name?

CK: The company was founded around the Amanda open-source backup community. But we always wanted to do more than Amanda (such as our ZRM product line). So, we flipped A to Z and came up with Zmanda. Our slogan is that we are the "A to Z of Backup".

AS: What are your plans to provide a VMware virtual image of ZRM?

CK: We are going to start offering a VM for the ZRM Community edition and see how the adoption goes. We do think it makes a lot of sense for ZRM to be shipped as a virtual appliance.

AS: Can you tell us what's on ZRM's road map?

CK: ZRM is growing in multiple

directions. ZRM will be supported natively on Windows in an upcoming release. Today, you can back up MySQL running on Windows; however, you need a Linux server to run the ZRM core engine. Also, ZRM will be expanded to support MySQL-based applications, such as SugarCRM, MediaWiki and so on. So, not only will ZRM be able to back up the underlying MySQL database, but it also will be able to back up the surrounding environment—for example, a SugarCRM administrator simply can push one button for overall backup and recovery.

AS: What Linux distributions are supported by ZRM today?

PS: ZRM supports practically all RPM-based distributions. We also support other platforms like Mandriva and FreeBSD in our Community edition. Although we do not have a graphical user interface and installer for these platforms, we do provide default configurations that will allow you to do backups right away.

AS: How large and active is ZRM's community?

PS: The ZRM community is a mix of thousands of developers and end users. ZRM is written in Perl, and its architecture is plugin-based. This encourages more contributions from MySQL DBAs. Our engineers monitor forums actively, and usually you can expect a response within a day. We see thousands of downloads each month, and the community is active in suggesting features and answering questions. We have had numerous contributions from ZRM users/developers.

Users or developers from the community can become involved with Zmanda in many ways. They can contribute to the wiki, post or

answer questions on our on-line forums and, of course, contribute by trying the products, providing QA feedback and patches.

AS: How often can users expect a release of ZRM Enterprise edition or the ZRM Community edition?

PS: We do a release of the Enterprise edition once every 3–4 months. Usually a release has a combination of new features, new platforms supported and bug fixes. On the other hand, the Community edition has no fixed schedule. We have done 13 (major and minor) releases in about 24 months. Critical security bugs are fixed within 24 hours.

AS: What does Zmanda expect to gain by making an open-source Community edition of ZRM freely available?

PS: We are an open-source company. We believe in bringing the best of open source to the enterprise as well as contributing to open source to make it enterprise-ready. We gain a good understanding of MySQL DBA work flows and features needed. Of course, the Community edition is the proving ground for our features. And, it helps us recruit good engineers.

We have made significant contributions to open source. Our contributions are not just in development. We maintain source trees, a bug-tracking system and documentation, and we help evangelize ZRM using Webinars, presentations, whitepapers and contributing to books.

Monitoring

ZRM's monitoring function presents valuable information about the most recently run backup job as well as about currently running jobs. Information includes how much time the backup took, backup size and any warning or error messages. This feature was very helpful when tracking the progress of long-running backup jobs.

Reporting

ZRM provides excellent reports that analyze the details about backup and restore jobs, including summary reports, custom reports, predefined reports and data integrity reports. ZRM Enterprise edition provides nine predefined reports and allows customized reporting using 30 preset data fields. You can use ZRM's reporting data within other applications via RSS feeds. You also can configure ZRM to send e-mail alerts about the status of backup jobs.

I found the Backup Application Performance Report to be quite useful, because it provides stats about the amount of time that tables were read-locked and the total backup time. This information could help a DBA schedule backups to avoid peak periods of database usage.

Administration

ZMC's administration function lets you define and manage users, manage backup sets, set up ZRM site defaults and customize ZMC preferences. ZMC implements role-based access control where users can be defined as an operator or an administrator. Administrators can manage all backup sets on the ZRM server; however, operators can manage only the backup sets they own.

Recovery

ZRM simplifies the full or incremental recovery of lost data. Using ZMC, you select a backup set to be restored and specify a MySQL server to which to restore. If you want to verify your data manually after recovery, ZMC provides an option to shut down the MySQL server after recovery is complete.

Another option is point-in-time recovery, which lets you restore data selectively. Using the Visual Log Analyzer in ZMC, you can perform incremental recovery by specifying a given point in time or a binary log position up to which you want to recover.

To test ZRM's recovery functionality, I successfully restored the backups created from earlier tests. I also successfully restored the quick snapshot raw backup image of my million-record table to my remote MySQL server.

Help

Even though the ZMC interface is relatively easy to understand, you may need more information about a specific ZRM feature. Fortunately, ZMC provides context-sensitive on-line documentation through the Zmanda Network. Other helpful resources include the Zmanda Wiki, forums and blogs. Zmanda's active on-line community is helpful and responsive.

A Star in the Making

Zmanda Recovery Manager provides a robust, open and cost-effective backup and recovery solution for organizations relying on MySQL for their critical data. ZRM simplifies an otherwise intricate process of backup and recovery by managing complex open-source utilities through its Web-based console.

As with any evolving product, there always is room for improvement. Here are some of my suggestions: a smarter graphical installer that automates post-install tasks done manually today; a more sophisticated management console that enhances the user experience; snazzier graphical reports (think Google Analytics); and a ZRM virtual appliance (VM image) for easier deployment in virtualized environments.

Try out ZRM's open-source Community edition today. You'll see how effortless MySQL backup and recovery can be. ■

Alolita Sharma has been involved with open source since the early days of Linux. As a software engineer and industry consultant, she promotes innovation through open source. She is cofounder and CEO of Technetra and OSI Board Member. She can be contacted at alolita.sharma@gmail.com.

Resources

Zmanda Recovery Manager:
www.zmanda.com/backup-mysql.html

Zmanda Network: network.zmanda.com

ZRM Wiki: mysqlbackup.zmanda.com

ZRM Forums: forums.zmanda.com

POWER UP YOUR E-MAIL WITH MUTT

Tired of your e-mail client hogging all your system resources? Experience the low-cost power of Mutt.

VICTOR GREGORIO

E-mail—one of the Internet's first joys and evils. It brings us closer but forces us to weed through clutter, distractions and snake oil salesmen. Parsing and organizing the data is a tricky task. As with most jobs tricky and time-consuming, people marry a favorite tool. Presumably, you have an e-mail reader you hold dear to your heart. Nevertheless, I suggest you cheat on Thunderbird, Evolution or KMail for a day and experience the power of Mutt, the e-mail client underdog.

Mutt is a feature-rich, lightweight, text-based e-mail client. Yes, it's text-based. Don't let Mutt's simple presentation fool you. The text-based display is a feature, providing a customizable, concise viewport. The Mutt e-mail client will play nicely with remote IMAP, POP3 and SMTP servers. SSL connections also are supported. Whatever features Mutt does not provide, other tools, such as address books, Web browsers, document viewers and more, can be leveraged to enhance Mutt's innate abilities. So, why all the fuss when most e-mail clients can do the same? Mutt is faster, more customizable and less resource-intensive.

Need to sort quickly through hundreds of e-mail messages a day? Find that your current e-mail client takes up too much screen real estate? Maybe your e-mail client consumes too much memory? Do you want better e-mail threading for all those mailing lists to which you belong? Are you a system administrator who regularly needs a quick way to test e-mail servers? Tired of dealing with your laptop's mouse pad to read and send e-mail? Want to use Vim or Emacs to compose your e-mail? If any of these apply, Mutt will seduce you.

The first obvious advantage of Mutt is its small memory

footprint. Below, I show the memory usage of KMail, Thunderbird, Evolution and Mutt on my system:

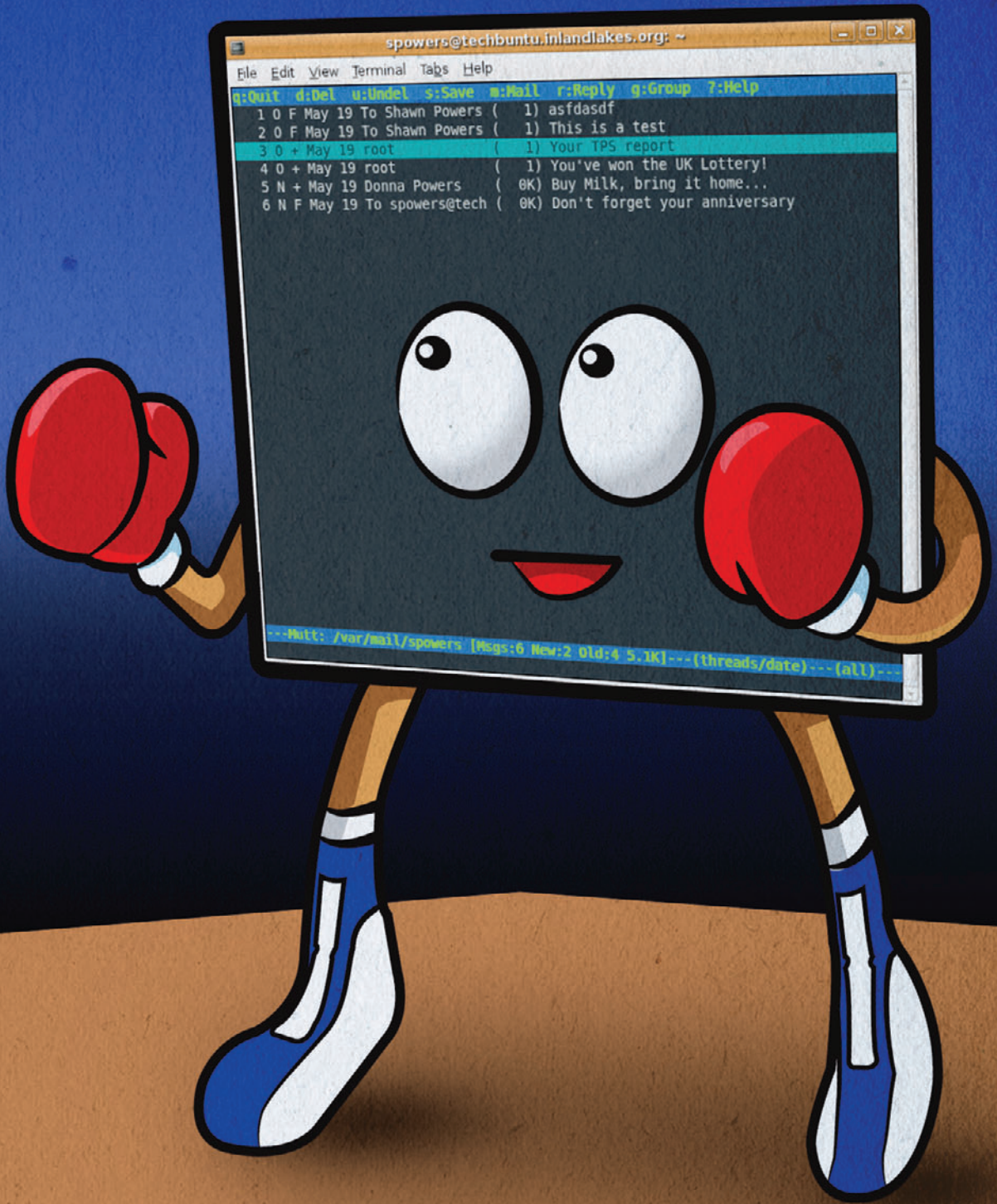
VIRT	RES	SHR	%MEM	COMMAND
156m	37m	19m	3.7	thunderbird-bin
161m	33m	19m	3.3	evolution
96352	23m	17m	2.3	kmail
14548	6092	3180	0.6	mutt

Mutt uses only a fraction of the memory used by most popular e-mail clients. So, if you are using older hardware, Mutt may speed up your computer by freeing some memory. Either way, Mutt will not hog your system's resources.

Another advantage of Mutt is the text-based display. For one, the interface is highly customizable. All fields and colors can be changed to meet your demands. Color new e-mail messages green and deleted messages red. Produce pretty, threaded message views. Anything is possible.

Mutt has it all and through a shell, no less. No longer will you need to open up IMAP access to your private server. Instead, ssh into the server and run Mutt.

Before I go into Mutt's other features, let's configure Mutt, so you can take a test drive. In this article, I focus on how to configure Mutt to work with an IMAP server. For my examples, I use Gmail's IMAP service. Because Gmail is a public, freely available service, everyone should be able to follow along. If you have another IMAP server you want to use, change the settings from my examples to match your IMAP server's configuration. If you are using Gmail, make sure you enable IMAP access to your account in Gmail's Settings→Forwarding and POP/IMAP.



FEATURE Mutt

Mutt Quickstart

First, install Mutt. I recommend using Mutt 1.5.17 or newer. Features I discuss here, such as IMAP header caching, are not available in older Mutt releases. Chances are, your distribution has the latest and greatest. So, use yum, apt-get or compile the source code from www.mutt.org. If your custom binaries ever produce warnings about unknown features, check that you have all necessary options enabled in the compile's configure step.

Before running Mutt the first time, let's configure your IMAP connection. Create and edit a `~/.muttrc` file, and add the following configuration options (make sure to fill in your account specifics):

```
set from="YOUR NAME <USER@gmail.com>"
set imap_user=USER@gmail.com
set imap_pass=PASS
```

This sets your From line and IMAP user login. If you are not comfortable with your password being in plain text on the filesystem, do not set `imap_pass` in your `~/.muttrc`. If `imap_pass` is not set, you will be prompted for a password when you execute Mutt.

Next, set your folder, the default location of your mailboxes. You also might want to set the spoolfile to your Gmail Inbox, so that Mutt opens it automatically:

```
set folder=imaps://imap.gmail.com
set spoolfile=imaps://imap.gmail.com/INBOX
```

Then, configure Mutt to save sent mail, or your record, into a Gmail folder named Sent. You also might want to configure a Draft, or postponed, folder:

```
set record=imaps://imap.gmail.com/Sent
set postponed=imaps://imap.gmail.com/Drafts
```

Make sure to enable header caching, or Mutt will have to download all of your Inbox's headers upon each execution:

```
set header_cache=~/.mutt_cache
```

Finally, you need to configure `smtp.gmail.com` as your SMTP server. By default, Mutt delivers e-mail using `/usr/sbin/sendmail -oem -oi`. In your case, use Gmail's SMTP server so that the e-mail envelope looks legitimate. Otherwise, your message might be flagged as spam for not originating from gmail.com:

```
set smtp_url="smtps://USER@gmail.com:PASS@smtp.gmail.com/"
```

Again, leave out `:PASS` to increase security and enable a password prompt for each message sent.

Although these are the basics, the `.muttrc` file has the potential for a slew of options. Listing 1 is my entire `.muttrc` with some additional tweaks. Many of the options are just that, optional. The `muttrc(5)` man page explains them all, so be sure to give it a look.

Finally, I also configure my `~/.mailcap` file so that Mutt knows with which applications to open HTML e-mail, PDFs and

LISTING 1. Sample `.muttrc` File

```
# Local folder
set mbox_type=Maildir
set folder=~/.Mail

# IMAP Settings
set realname="Victor Gregorio"
set from="Victor Gregorio <contactvictorg@gmail.com>"
set imap_user=contactvictorg@gmail.com
set folder=imaps://imap.gmail.com
set spoolfile=imaps://imap.gmail.com/INBOX
set record=imaps://imap.gmail.com/Sent
set postponed=imaps://imap.gmail.com/Drafts
mailboxes =INBOX # check for new email here
set header_cache=~/.mutt_cache

# Reading Mail
set timeout=10
set mail_check=5
set sort=threads
set sort_aux=date
set move=no
set mark_old=no
ignore * # ignore all headers except for ...
unignore Date: From: To: CC: Bcc: Subject:
hdr_order Subject: Date: From: To: CC: Bcc:
set index_format="%{%b %d} %-15.15L [%Z] %s" # custom index format

# Composing Mail
set editor="vim"
set markers=no
set signature=~/.sig
set include=yes
set forward_format="Fwd: %s"

# Sending Mail
set copy=yes
set smtp_url="smtps://contactvictorg@gmail.com@smtp.gmail.com/"

# Pretty Colors
color status white blue
color index green default -N # new
color index red default -D # deleted
color index brightmagenta default ~T # tagged
color index brightyellow default -F # flagged
color header green default "^Subject:"
color header yellow default "^Date:"
color header yellow default "^To:"
color header yellow default "^Cc:"
color header yellow default "^Bcc:"
color header yellow default "^From:"
color header red default "^X-*:"

# View Special Formats
set mailcap_path=~/.mailcap
auto_view text/html # auto-render html inline mutt
```


MUTT IS GREAT FOR LAPTOP USERS, BECAUSE THE HEAVY LIFTING IS DONE BY TYPING, NOT CLICKING.

images. I use w3m to auto-view HTML inline with Mutt. You also can use ELinks or Lynx:

```
text/html; echo && /usr/bin/w3m -dump %s; nametemplate=%s.html;
↳copiousoutput
application/pdf; /usr/bin/evince %s
image/jpeg; /usr/bin/display %s
image/gif; /usr/bin/display %s
image/png; /usr/bin/display %s
```

You are ready! Save all configuration files and run mutt. You will have to accept a security certificate from imap.gmail.com. If you choose to save the certificate, it will be saved in ~/.mutt_certificates.

Put Down the Mouse

The keyboard is your friend. Mutt is great for laptop users, because the heavy lifting is done by typing, not clicking. All the power of Mutt is yours without ever taking your hands off the keyboard.

Pressing Enter opens an e-mail message, the I key returns you to the mailbox's index. Use the arrows to move around, and press Q to quit just about any screen.

From the index, use Tab to skip to the next new messages, D to delete, F to flag and so forth. The top bar in your display will show some commonly used keystrokes. Enter ? to see the full list of available commands.

Color settings in Mutt are particularly useful in the index view. If you use the color settings from my example .muttrc, all new messages are displayed in green, flagged messages are displayed in yellow, deleted messages are red and tagged messages are purple (more on tagging later).

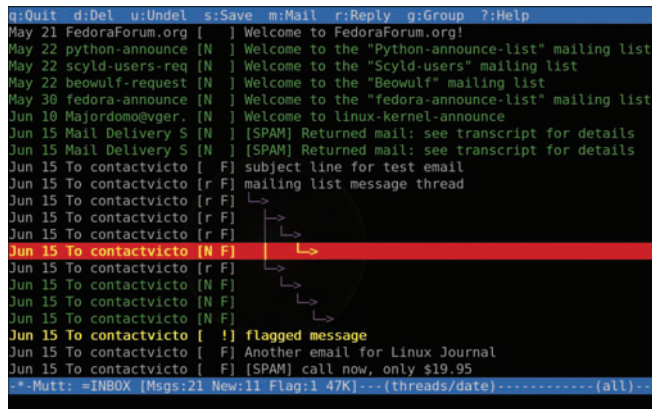


Figure 1. Mutt's Colors in Action

Sort and Search

Now that you have access to your IMAP account and can send

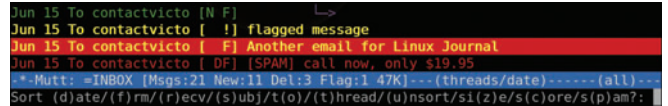


Figure 2. The Sort Options Available in the Index View

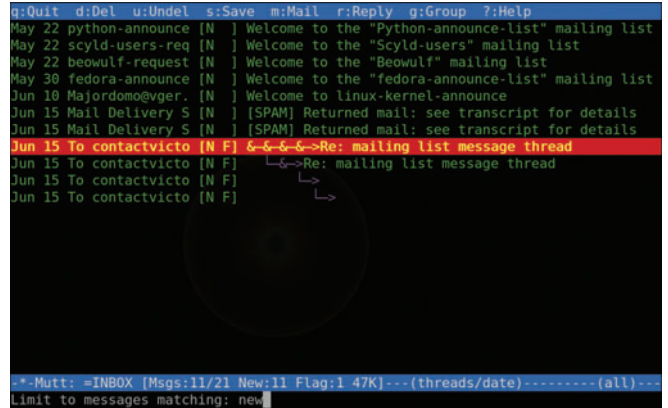


Figure 3. Mutt's View Limited to New Messages

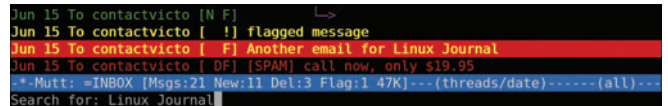


Figure 4. Searching for Messages in Mutt

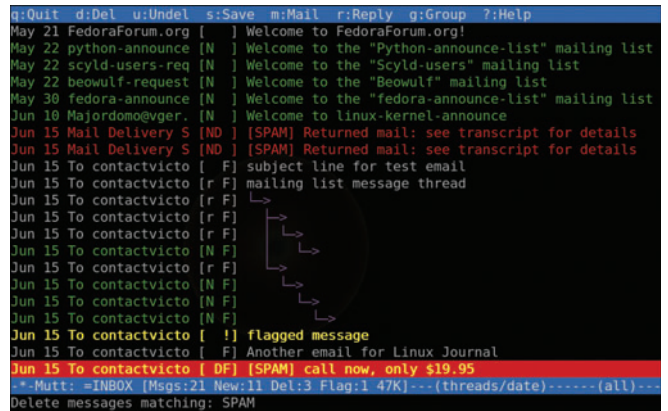


Figure 5. Deleting Messages Matching a Regex

e-mail, here are some shortcuts for managing your Inbox. These shortcuts are the seductive draw of Mutt. You can zip through your e-mail quickly without ever touching a mouse.

First, you can sort and order your email by date, thread and many other fields by pressing O. Set the default sort method in .muttrc using set sort. I prefer to sort by threads (set sort=threads), then date (set sort_aux=date).

Sorting your Inbox by threads opens a new group of commands that apply to entire threads. For instance, if you want to delete an entire thread, use Ctrl-D while highlighting any e-mail in the thread. Delete large threads of e-mail with one keyboard stroke.

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FEATURE Mutt

MUTT ALLOWS YOU TO TAG MESSAGES THAT YOU THEN CAN ACT ON IN ONE FELL SWOOP.

Once Vim's spell-checking is enabled, you have these options available to you when your cursor is over a misspelled word:

- zg to add a word to the word list.
- zw to reverse.
- zug to remove a word from the word list.
- z= to get list of possible spellings.

And, Much More

Mutt has too many interesting features to outline in the scope of one article. However, one last feature I want to share with you is the bounce command. Bounce lets you resend a message to a new recipient. The message arrives at the new recipient from the original sender, not the bouncer. Why is this useful? Well, what if a ton of e-mail was sent to your work address instead of your personal e-mail address? Don't just forward the messages in bulk—bounce them. First, tag all the messages you want to bounce by pressing T and providing a regex search string that matches your selection. Use the sender's name, for example. Then, act on the queue by pressing B. Fill in your personal e-mail address, and press Enter to execute the bounce.

Moving Forward

Do the keyboard commands seem obscure? They may at first, but they quickly will become resounding strokes of e-mail power chords. The effort will pay off. Mutt still is in active development, and you can expect this underdog to be around for a while.

There are some interesting features on the horizon for Mutt version 1.6. Brendan Cully, a Mutt developer and the SourceForge project administrator, provided this list of Mutt 1.6's features:

- Native SMTP support.
- IMAP/POP header and body caching,

and maildir/MH header caching.

- Significant IMAP performance enhancements (pipelined commands and IDLE support).
- IMAP server-side search.
- Flowed text support.
- More flexible charset support.
- User-defined variables (starting with \$my_).
- Large file support.
- Attachment counts in the index.
- Spam flagging.
- S/MIME support.

Whatever version you use, check www.mutt.org for release details. If you want more, the muttrc(5) man page can walk you through all of the .muttrc parameters, and the mutt.org site has more examples. If you are feeling lazy, use muttrcbuilder.org to build a .muttrc file.

I hope that you have found some value in Mutt and that it improves your e-mail experience. If nothing else, Mutt can be an additional power tool in your sysadmin toolchest. ■

Victor Gregorio lives in San Francisco, California, working as a Senior System Administrator and QA Engineer for Penguin Computing. He often can be found behind a camera or clicking away at a keyboard.

Resources

The Mutt E-Mail Client:
www.mutt.org

The ebook Address Book Program:
abook.sourceforge.net

On-line .muttrc Generator:
www.muttrcbuilder.org



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NGINX

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WILL REESE

Apache is the most popular Web server and one of the most successful open-source projects of all time. Since April 1996, Apache has served more Web sites than any other Web server. Many of the world's largest Web sites, including YouTube, Facebook, Wikipedia and Craigslist, use Apache to serve billions of page views per month. Over the years, Apache has proven itself to be a very stable, secure and configurable Web server. Although Apache is an excellent Web server, what if there were an alternative with the same functionality, a simpler configuration and better performance? That Web server exists, and it's called Nginx.

Nginx, pronounced "Engine X", is a high-performance Web server and reverse proxy. It was created by Igor Sysoev for www.rambler.ru, Russia's second-largest Web site. Rambler has used Nginx since summer 2004, and it's currently serving about 500 million requests per day. Like Apache, Nginx is used by some of the largest Web sites in the US, including WordPress (#26), YouPorn (#27), Hulu and MochiMedia. As of May 2008, Nginx is the fourth-most-popular Web server, and it is currently serving more than two million Web sites. As it is only trailing behind Apache, IIS and GFE, it is effectively the second-most-popular Web server available for Linux.

Why Use Nginx?

Like Apache, Nginx has all the features you would expect from a leading Web server:

- Static file serving.
- SSL/TLS support.
- Virtual hosts.
- Reverse proxying.
- Load balancing.
- Compression.
- Access controls.
- URL rewriting.
- Custom logging.
- Server-side includes.
- WebDAV.
- FLV streaming.
- FastCGI.

It is stable, secure and very easy to configure, as you will see later in the article. However, the main advantages of Nginx over Apache are performance and efficiency.

I ran a simple test against Nginx v0.5.22 and Apache v2.2.8 using `ab` (Apache's benchmarking tool). During the tests, I monitored the system with `vmstat` and `top`. The results indicate that Nginx outperforms Apache when serving static content. Both servers performed best with a concurrency of 100. Apache used four worker processes (threaded mode), 30% CPU and 17MB of memory to serve 6,500 requests per second. Nginx used one worker, 15% CPU and 1MB of memory to serve 11,500 requests per second.

Nginx is able to serve more requests per second with less resources because of its architecture. It consists of a master process, which delegates work to one or more worker processes. Each worker handles multiple requests in an event-driven or asynchronous manner using special functionality from the Linux kernel (`epoll/select/poll`). This allows Nginx to handle a large number of concurrent requests quickly with very little overhead. Apache can be configured to use either a process per request (pre-fork) or a thread for each request (worker). Although Apache's threaded mode performs much better than its pre-fork mode, it still uses more memory and CPU than Nginx's event-driven architecture.

Installation and Basic Usage

Nginx is available in most Linux distributions. For this article, I use Ubuntu 8.04 (Hardy), which includes Nginx version 0.5.33.

If your distro does not have Nginx, or if you want to run a newer version, you always can download the latest stable version (v0.6.31 at the time of this writing) and install from source.

Run the following command as root to install Nginx:

```
# apt-get install nginx
```

Now that Nginx is installed, you can use the startup script to start, stop or restart the Web server:

```
# /etc/init.d/nginx start
# /etc/init.d/nginx stop
# /etc/init.d/nginx restart
```

Most configuration changes do not require a restart, in which case you can use the reload command. It is generally a good idea to test the Nginx configuration file for errors before reloading:

```
# nginx -t
# /etc/init.d/nginx reload
```

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Let's go ahead and start the server:

```
# /etc/init.d/nginx start
```

Nginx now should be running on your machine. If you open `http://127.0.0.1/` in your browser, you should see a page with "Welcome to nginx!".

Main Configuration File

Now that Nginx is installed, let's take a look at its config file, located at `/etc/nginx/nginx.conf`. This file contains the server-wide settings for Nginx, and it should look similar to this:

```
user www-data;
worker_processes 1;
error_log /var/log/nginx/error.log;
pid /var/run/nginx.pid;
events {
    worker_connections 1024;
}
http {
    include /etc/nginx/mime.types;
    default_type application/octet-stream;
    access_log /var/log/nginx/access.log;
    sendfile on;
    keepalive_timeout 65;
    tcp_nodelay on;
    gzip on;
    include /etc/nginx/sites-enabled/*;
}
```

We are not going to change any of these settings, but let's talk about some of them to help us understand how Nginx works. The `worker_processes` setting tells Nginx how many child processes to start. If your server has more than one processor or is performing large amounts of disk IO, you might want to try increasing this number to see if you get better performance. The `worker_connections` setting limits the number of concurrent connections per worker process. To determine the maximum number of concurrent requests, you simply multiply `worker_processes` by `worker_connections`.

The `error_log` and `access_log` settings indicate the default logging locations. You also can configure these settings on a per-site basis, as you will see later in the article. Like Apache, Nginx is configured to run as the `www-data` user, but you easily can change this with the `user` setting. The startup script for Nginx needs to know the process ID for the master process, which is stored in `/var/run/nginx.pid`, as indicated by the `pid` setting.

The `sendfile` setting allows Nginx to use a special Linux system call to send a file over the network in a very efficient manner. The `gzip` option instructs Nginx to compress each response, which uses more CPU but saves bandwidth and decreases response time. Additionally, Nginx provides another compression module called `gzip precompression` (available as of version 0.6.24). This module looks for a compressed copy of the file with a `.gz` extension in the same location and serves it to `gzip-enabled` clients. This prevents having to compress the

file each time it's requested.

The last setting we are concerned with is the `include` directive for the sites-enabled directory. Inside `/etc/nginx`, you'll see two other directories, `/etc/nginx/sites-available` and `/etc/nginx/sites-enabled`. For each Web site you want to host with Nginx, you should create a config file in `/etc/nginx/sites-available`, then create a symlink in `/etc/nginx/sites-enabled` that points to the config file you created. The main Nginx config file includes all the files in `/etc/nginx/sites-enabled`. This helps organize your configuration files and makes it very easy to enable and disable specific Web sites.

Static Web Server

Now that we covered the main configuration file, let's create a config file for a basic Web site. Before we begin, we need to disable the default site that Ubuntu created for us:

```
# rm -f /etc/nginx/sites-enabled/default
```

Now, create a new configuration file called `/etc/nginx/sites-available/basic` with the following contents:

```
server {
    listen 127.0.0.1:80;
    server_name basic;
    access_log /var/log/nginx/basic.access.log;
    error_log /var/log/nginx/basic.error.log;
    location / {
        root /var/www/basic;
        index index.html index.htm;
    }
}
```

Create the root directory and `index.html` file:

```
# mkdir /var/www/basic
# cd /var/www/basic
# echo "Basic Web Site" > index.html
```

Enable the site and restart Nginx:

```
# cd /etc/nginx/sites-enabled
# ln -s ../sites-available/basic .
# /etc/init.d/nginx restart
```

If you open `http://127.0.0.1/` in your browser, you should see a page with "Basic Web Site". As you can see, it is very easy to create a new site using Nginx.

Let's go over the new configuration file we created. The `server` directive is used to define a new virtual server, and all of its settings are enclosed in braces. The `listen` directive indicates the IP and port on which this server will accept requests, and `server_name` sets the hostname for your virtual server. As I mentioned earlier, the `access_log` and `error_log` settings can be set on a per-site basis. It is usually a good idea to provide each site with its own set of log files.

Next is the `location` directive, which allows you to modify the settings for different parts of your site. In our case, we

have only one location for the entire site. However, you can have multiple location directives, and you can use regular expressions to define them. We have two other directives inside our location block: root and index. The root directive is used to define the document root for this location. This means a request for /img/test.gif would look for the file /var/www/localhost/img/test.gif. Finally, the index directive tells Nginx what files to use as the default file for this location.

Static Web Server with SSL

Some Web sites, such as on-line stores, require secure communication (HTTPS) to protect credit-card transactions and customer information. Like Apache, Nginx supports HTTPS via an SSL module, and it's very easy to set up.

First, you need to generate an SSL certificate. The openssl command will ask you a bunch of questions, but you simply can press Enter for each one:

```
# apt-get install openssl
# mkdir /etc/nginx/ssl
# cd /etc/nginx/ssl
# openssl req -new -x509 -nodes -out server.crt -keyout server.key
```

Create a new config file called /etc/nginx/sites-available/secure, which contains the following:

```
server {
    listen 127.0.0.1:443;
    server_name secure;
    access_log /var/log/nginx/secure.access.log;
    error_log /var/log/nginx/secure.error.log;
    ssl on;
    ssl_certificate /etc/nginx/ssl/server.crt;
    ssl_certificate_key /etc/nginx/ssl/server.key;
    location / {
        root /var/www/secure;
        index index.html index.htm;
    }
}
```

Create the root directory and index.html file:

```
# mkdir /var/www/secure
# cd /var/www/secure
# echo "Secure Web Site" > index.html
```

Enable the site and restart Nginx:

```
# cd /etc/nginx/sites-enabled
# ln -s ../sites-available/secure .
# /etc/init.d/nginx restart
```

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If you open `https://127.0.0.1/` in your browser (note the `https`), you probably will get a warning about not being able to verify the certificate. That's because we are using a self-signed certificate for this example. Go ahead and tell your browser to accept the certificate, and you should see a page with "Secure Web Site".

This config file is very similar to our previous config, but there are a few differences. First, notice that this new server is listening on port 443, which is the standard port for HTTPS. Second, we enabled the SSL module with the line `ssl on;`. If you compiled Nginx yourself instead of using

IN ADDITION TO BEING AN EXTREMELY FAST STATIC WEB SERVER, NGINX ALSO IS A LOAD BALANCER AND REVERSE PROXY.

the Ubuntu package, you need to make sure you specified `--with-http_ssl_module` when you ran `./configure`; otherwise, the SSL module will not be available. Third, we used the `ssl_certificate` and `ssl_certificate_key` directives to point to the certificate and key we created earlier.

Virtual Hosting

In many cases, you will want to run multiple Web sites from a single server. This is called virtual hosting, and Nginx supports both IP- and name-based vhosts.

Let's create two virtual hosts: `one.example.com` and `two.example.com`. First, we need to add a line to our `/etc/hosts` file, so that `one.example.com` and `two.example.com` point to our server (normally you would do this using DNS):

```
# echo "127.0.0.1 one.example.com two.example.com" >> /etc/hosts
```

Now, we need to create a configuration file for each site. First, create a file called `/etc/nginx/sites-available/one` with the following contents:

```
server {
    listen 127.0.0.1:80;
    server_name one.example.com;
    access_log /var/log/nginx/one.access.log;
    error_log /var/log/nginx/one.error.log;
    location / {
        root /var/www/one;
        index index.html index.htm;
    }
}
```

Then, make a copy of that file called `/etc/nginx/sites-available/two`, and replace each occurrence of "one" with "two":

```
# cd /etc/nginx/sites-available
# cp one two
# sed -i "s/one/two/" two
```

Create the root directories and `index.html` files:

```
# mkdir /var/www/{one,two}
# echo "Site 1" > /var/www/one/index.html
# echo "Site 2" > /var/www/two/index.html
```

Enable the sites and restart Nginx:

```
# cd /etc/nginx/sites-enabled
# ln -s ../sites-available/one .
# ln -s ../sites-available/two .
# /etc/init.d/nginx restart
```

If you open `http://one.example.com/` in your browser, you should see a page with "Site 1". For `http://two.example.com/`, you should see "Site 2".

We just created two name-based virtual hosts running on 127.0.0.1 by changing the `server_name` directive. For IP-based virtual hosts, simply change the `listen` directive to use a different IP for each site.

Now, go ahead and disable these two virtual hosts:

```
# rm -f /etc/nginx/sites-enabled/one
# rm -f /etc/nginx/sites-enabled/two
# /etc/init.d/nginx restart
```

Don't forget to remove the line we added to `/etc/hosts` when you are done.

Reverse Proxy and Load Balancer

In addition to being an extremely fast static Web server, Nginx also is a load balancer and reverse proxy. A load balancer is a device used to spread work out across multiple servers or processes, and a reverse proxy is a server that transparently hands off requests to another server. Among other things, this allows Nginx to handle requests for static content and to load-balance requests for dynamic content across many different back-end servers or processes.

For this example, let's create a very simple Python Web server to serve up some dynamic content. Don't worry if you are not familiar with Python; we're just using it to display a Web page that indicates on which port the server is running. Save the following to a file called `/tmp/server.py`:

```
import sys,BaseHTTPServer as B
class Handler(B.BaseHTTPRequestHandler):
    def do_GET(self):
        self.wfile.write("Served from port %s" % port)
    def log_message(self, *args):
        pass
if __name__ == '__main__':
    host,port = sys.argv[1:3]
    server = B.HTTPServer((host,int(port)), Handler)
    server.serve_forever()
```

Now we can start two of these local servers, each on a different port:

```
# python /tmp/server.py 127.0.0.1 8001 &
# python /tmp/server.py 127.0.0.1 8002 &
```

If you open `http://127.0.0.1:8001/` in your browser,

you should see “Served from port 8001”, and if you open `http://127.0.0.1:8002/`, you should see “Served from port 8002”.

Now, create a new configuration file called `/etc/nginx/sites-available/proxy` with the following contents:

```
upstream python_servers {
    server 127.0.0.1:8001;
    server 127.0.0.1:8002;
}
server {
    listen 127.0.0.1:8000;
    server_name proxy;
    access_log /var/log/nginx/proxy.access.log;
    error_log /var/log/nginx/proxy.error.log;
    location / {
        proxy_pass http://python_servers;
    }
}
```

Enable the site and restart Nginx:

```
# cd /etc/nginx/sites-enabled
# ln -s ../sites-available/proxy .
# /etc/init.d/nginx restart
```

If you open `http://127.0.0.1:8000/` in your browser, you should see a page with either “Served from port 8001” or “Served from port 8002”, and it should alternate each time you refresh the page.

Let’s go over some of these new settings. The upstream block defines a name for a group of back-end servers. In our case, we defined a group named `python_servers`, which contains the two local Python servers we started on port 8001 and 8002. We then configured Nginx to hand off all requests to our back-end servers with the line `proxy_pass http://python_servers;`. Nginx automatically load-balances the requests to each Python server in a round-robin manner. You also can set weights for each back end, so you can direct more or fewer requests to specific servers.

Nginx handles back-end failures automatically and will stop sending requests to a failed back-end server until it starts responding again. To demonstrate this, we can kill off the Python process that’s running on port 8001. Use the `jobs` command to find the job number for the Python process running on port 8001, and use `kill %<job number>`

to kill the process:

```
# jobs
# kill %1
```

Open `http://127.0.0.1:8000/` in your browser and keep refreshing the page, you should see only the “Served from port 8002” page. Nginx detected that the back-end server from port 8001 was not responding, so it stopped sending requests to that server. Now, restart the Python process for port 8001:

```
# python /tmp/server.py 127.0.0.1 8001 &
```

Keep refreshing the page and you should see your browser start alternating between “Served from port 8001” and “Served from port 8002” again. Nginx detected that the port 8001 back end was responding and began sending requests to it.

Conclusion

Whether you are looking to get the most out of your VPS or are attempting to scale one of the largest Web sites in the world, Nginx may be the best tool for the job. It’s fast, stable and easy to use. Thanks to Igor Sysoev for creating this excellent piece of software. ■

Will Reese has worked with Linux for the past ten years, primarily scaling Web applications running on Apache, Python and PostgreSQL. He enjoys beating Cory Wright at foosball and Wii Tennis.

Resources

Nginx Web Site: wiki.codemongers.com/Main

Module Comparison Index: wiki.codemongers.com/NginxModuleComparisonMatrix

Testimonials: wiki.codemongers.com/NginxWhyUseIt

Nginx at WordPress: barry.wordpress.com/2008/04/28/load-balancer-update

Facebook App Using Nginx: highscalability.com/friends-sale-architecture-300-million-page-view-month-facebook-ror-app

TECH TIP A Quick but Not Dirty Way to Create man Pages

`txt2man` converts flat ASCII text into the man page format. This allows you to author man pages without knowledge of `roff` macros. It’s a shell script that uses GNU `awk`, and it should run on any UNIX-like system. The script is available at mvertes.free.fr/txt2man/txt2man.

`txt2man` can generate its own man page for viewing on the screen via:

```
# txt2man -h 2>&1 | txt2man -T
```

The text source for the man page for `txt2man` is contained in the script itself; therefore, the source of the script shows you all you need to know to use `txt2man`.

—JAGADISH KAVUTURU

djbdns

More Than Just a Mouthful of Consonants

Recently released into the public domain, **djbdns** is a fast and secure replacement for BIND.

Cory Wright

Let's face it, DNS is not the most sexy component of the Internet's infrastructure. It is an old technology and doesn't get the same attention as newer, more flashy tools and software. Your Web site visitors may comment on how cool your new AJAX widget is, but I guarantee they will never tell the world how pleased they are with your DNS response time.

Nevertheless, DNS is crucial to the Internet. It is one of those services that always should "just work", and it's only when it doesn't work that people notice (and complain, loudly). Readers may remember the great "Google vanishing act" in May 2005, when the search engine giant briefly disappeared from the Internet. Many quickly assumed the site had been hacked, but the problem turned out to be a DNS configuration issue. The mishap was fixed quickly, but it highlighted how even the mightiest of the mighty can be crippled easily by a simple misconfiguration.

My primary goal for this article is to demonstrate that there is a free, secure and easy-to-configure alternative to BIND: djbdns. This article is intended for people who may have some experience with DNS, but who would like to consider new approaches. I assume only a basic understanding of DNS—specifically, familiarity with the basic record types, such as A, CNAME, MX, NS and SOA, as well as the concept of a TTL (time to live).

A Brief History of BIND and djbdns

For the first 15 years of the Internet as we know it, there was only one real choice when it came to DNS server software: BIND. BIND began life as a project by several graduate students at the University of California, Berkeley (thus the acronym, the Berkeley Internet Name Domain). In the early 1990s, the Internet Systems Consortium (ISC) was created to maintain, distribute and support this critical software formally. The ISC released BIND 8 in May 1997 as a major update to the aging BIND 4. Although there were major configuration differences, both BIND 4 and 8 were based on the original Berkeley code from the early and mid-1980s. While trying to raise funding for a major rewrite, one of BIND's authors described this code as "sleazeware produced in a drunken fury". A new team worked on the rewrite for several years, and BIND 9 was released formally in September 2000.

After years of dealing with security problems in BIND and frustration with its configuration syntax, Dan J. Bernstein began work on djbdns in 1999. Bernstein (or DJB as he is commonly known) already had made a name for himself as the author of qmail, the mail server software that was quickly gaining popularity among system administrators. At the time, Sendmail was the dominant mail server on the Internet, and, like BIND, it was notoriously difficult to configure and had a history of security problems. Bernstein's "thinking outside the box" design decisions about security and configuration simplicity not only catapulted qmail to success, but it also affected the way developers thought about writing software for the increasingly volatile Internet (Postfix, Courier and others were inspired by qmail's security partitioning design). Now that Bernstein had secured and simplified mail, it was time to do the same for DNS. The first alpha of djbdns was released in December 1999, and the current version, djbdns 1.05, eventually was released on February 11, 2001. That's right, the current version is more than seven years old. Remember, DNS is an old protocol, and it doesn't change very often. BIND software updates almost always are for bugfixes or security patches.

In the past, Bernstein's software was controversial because it lacked an explicit license. OS vendors were reluctant to distribute his packages because of the uncertainty around its licensing. However, in December 2007, Bernstein placed djbdns (as well as daemontools and qmail) into the public domain, allowing people to use or distribute it as they see fit.

Why djbdns?

BIND has been around since the earliest days of the Internet. It's still the most popular DNS server out there, so why should you consider switching to djbdns? For one, djbdns does not have BIND's history of problems. BIND's security record is on par with Sendmail's (not something to be proud of), and configuring it beyond the basics can be downright painful.

To complicate things further, BIND blurs the distinction between the different functions of DNS. There are two primary types of DNS services: DNS caches (also called recursive DNS servers) and DNS servers (also called authoritative servers or

name servers).

A DNS cache is what your desktop computer talks to when it needs to find the address for a Web site you are trying to reach. When a cache receives your request for the location of `www.google.com`, it first checks to see whether it already knows the answer to your question. If it does, it quickly tells you. If it does not know the answer already, it begins by first asking the root servers for the answer. The root servers respond with something similar to "I don't know the answer but the `.com` servers might; here are their addresses, go ask them." The caching server continues doing this until it has the IP for `www.google.com`, and then it returns the answer to your computer. The IP addresses you see in `/etc/resolv.conf` are for DNS caches. Caches talk to authoritative servers to get answers.

An authoritative server has a much more straightforward responsibility. Its job is simply to publish information from domains for which it is "authoritative". An authoritative server will give answers only to questions about domains for which it has been explicitly configured. For example, `ns1.google.com` (one of Google's authoritative DNS servers) never will answer a request for the address of `www.microsoft.com` (unless Microsoft and Google merge some day).

Although these are completely different services, BIND uses the same server for both. This may seem handy, but it complicates the configuration and quickly can become a security headache.

On the other hand, djbdns adheres to the UNIX philosophy of "do one thing, and do it well". The server components of djbdns are separated, with `dnscache` as the caching component and `tinydns` as the authoritative server (I detail the advantages of each shortly).

This separation allows each program to run individually chrooted as its own unprivileged user. If an attacker is able to crash your DNS cache, it will not impact your authoritative DNS service. A side effect of this is that `dnscache` and `tinydns` need separate IP addresses, so that each may bind to port 53. You can't run both on the same IP address.

Installing djbdns

The latest version of djbdns compiles on all the major Linux distributions. You also need to install `daemontools` (see sidebar), another package by Dan Bernstein.

Download djbdns from Bernstein's Web site, and run the following commands. The third line is a workaround for a glibc bug on Linux:

```
# tar xzf djbdns-1.05.tar.gz
# cd djbdns-1.05
# echo gcc -O2 -include /usr/include/errno.h > conf-cc
# make
# make setup check
```

See Bernstein's official documentation if you have further questions about installing djbdns.

tinydns, the authoritative DNS server in djbdns, takes an entirely different approach and makes it much more difficult to get yourself in trouble.

daemontools

daemontools is a collection of tools for managing UNIX services. Like most of Dan Bernstein's software, djbdns relies on daemontools.

daemontools services are created in directories, and they must contain an executable script named `run`. To start a service, you simply create a symbolic link from that directory into `/service`. Within five seconds, the `svscan` process will notice the new service, start it and begin monitoring it.

Logging is handled by the `multilog` program from the daemontools package. Anything written to standard output by the program is recorded in the processes log file, named `current`. Typically, the logs are stored within the service directory. For example, `dnscache`'s logs would be in `/service/dnscache/log/main/current`. `multilog` automatically rotates the current file once it reaches a certain size.

These days, I prefer the Ubuntu server distribution, which recently introduced the `upstart` replacement for `init`. I've written a patch for daemontools to make it compatible with `upstart`. See dnsfool.com/tips for the patch. daemontools is available from cr.yip.to/daemontools.html.

Using dnscache, a DNS Cache

One of the easiest ways to begin using djbdns is to configure a DNS cache on your local network. There are many reasons why you may want to do this—from faster DNS lookup times to avoiding those pesky mistyped domain search result pages. In either case, installing `dnscache` can help.

Let's assume you have a home network with several computers on `192.168.10.0/24`. Additionally, a Linux machine (named `linux1`) is running on `192.168.10.10`. You want to install `dnscache` on `linux1`, so it can provide DNS resolution service for the other machines on the network.

Fortunately, installing `dnscache` is trivial, thanks to the `dnscache-conf` utility provided with djbdns. Before running `dnscache-conf`, you need to create one new group and two accounts on `linux1`. These will be used exclusively by djbdns and should not be available for login:

```
# groupadd djbdns
# useradd -s /bin/false -d /etc/dnscache -g djbdns dnscache
# useradd -s /bin/false -d /dev/null -g djbdns dnslog
```

The next step is to run `dnscache-conf` and provide it with four parameters: the account for the `dnscache` process, the account for the logging process, the `dnscache` service directory and the IP on which `dnscache` should listen:

```
# dnscache-conf dnscache dnslog /etc/dnscache 192.168.10.10
```

The `/etc/dnscache` directory now should exist. Before you

can begin using your new cache, you need to allow access to it from your local network. `dnscache` checks to see if a machine is allowed to access it by comparing the IP of the incoming request address against files in `/etc/dnscache/root/ip/`. You can grant access to your whole network simply by touching a single file:

```
# touch /etc/dnscache/root/ip/192.168.10
```

At this point, you are ready to start the cache. If you are running BIND, you need to stop and disable it so that `dnscache` can take ownership of port 53. Assuming daemontools is installed and running, you now can start `dnscache`:

```
# ln -s /etc/dnscache /service/
```

That's it. You now have a DNS cache running on your local network. Your next step is to update the `/etc/resolv.conf` file on all your machines to point to `192.168.10.10`:

```
nameserver 192.168.10.10
```

If your network is very busy, you may find you need to increase the amount of memory that is allocated to your cache. Dan Bernstein provides instructions on his Web site for adjusting the cache size, but you also may want to take a look at Paul Jarc's `cache-effect.pl` Perl script or Mike Babcock's `dnscacheproc.py` Python script.

Using tinydns, an Authoritative DNS Server

If you have ever run BIND as an authoritative DNS server, it is likely that at some point you neglected to increment the serial on an SOA record, overlooked a missing semicolon somewhere or simply forgot to append a period (`.`) at the end of a record. These are just a few of the common mistakes people make when dealing with BIND's zone files. If you have been bitten by any of these issues, you probably remember the trouble it created for you. These errors can cause big headaches (just ask Google).

`tinydns`, the authoritative DNS server in djbdns, takes an entirely different approach and makes it much more difficult to get yourself in trouble. One major difference is that instead of separate zone files for each domain, `tinydns` uses a single text file named `data` to store every record of every domain. This data file is then compiled into a very fast database in `cdb` format. Of course, if you prefer managing domains in separate files, you still can, just concatenate them together before compiling the database.

Let's get started by configuring our `tinydns` instance. You should have daemontools already installed and running. Again, let's assume we are running a home network on `192.168.10.0/24`, and we now want to access each host by name using DNS. We have another Linux machine (named `linux2`) running on `192.168.10.20` that will publish DNS information with `tinydns`.

First, create the `tinydns` user:

```
# useradd -s /bin/false -d /etc/tinydns -g djbdns tinydns
```

Like `dnscache`, there is a utility for creating and configuring instances of `tinydns`. It also takes four parameters: the account

for the tinydns process, the account for the logging process, the tinydns service directory and the IP on which tinydns should listen:

```
# tinydns-conf tinydns dnsmlog /etc/tinydns 192.168.10.20
```

This creates the /etc/tinydns directory and populates it with everything needed to begin publishing your DNS data. The last step is to create a symbolic link for the tinydns service into /service. Again, be sure to stop and disable any BIND instances first:

```
# ln -s /etc/tinydns/ /service/
```

Now you can begin adding records for each host on your network.

Adding DNS Records

Before we begin, let's see how our DNS data would look in the traditional BIND zone file format (versions 8.2 and greater). Listing 1 shows everything needed to configure forward records for example.com and reverse records for 192.168.10.0/24. This includes the configuration for named.conf, as well as the zone data for example.com and 10.168.192.in-addr.arpa. This clocks in at 38 lines of configuration for our two domains.

As I mentioned, tinydns takes a different approach. Instead of defining records separately for forward and reverse zones, tinydns allows you to combine them into single records. Listing 2 contains the exact same configuration from Listing 1, except in tinydns format. Instead of 38 lines of configuration, we now have only ten lines. Let's go over what these lines do.

The first character of each line is used to specify the type of record or records that should be created. A period (.) line tells tinydns that it is authoritative for example.com:

```
.example.com::linux2.example.com
```

This creates an SOA (start of authority) record and sets linux2.example.com as an NS record. If an IP address was provided between the two colons, an A record also would have been created for linux2.example.com with that IP address. This one @ line replaces eight from the BIND zone file:

```
@example.com:192.168.10.15:mail.example.com:0
```

This line creates two records. An A record is created for mail.example.com with an address of 192.168.10.15, and an MX record is created for example.com pointing to mail.example.com with a distance of 0. Now, let's start defining our hosts:

```
=linux1.example.com:192.168.10.10  
=linux2.example.com:192.168.10.20  
=linux3.example.com:192.168.10.30
```

These lines each create two records. For example,

the first line creates an A record for linux1.example.com with an address of 192.168.10.10 and a PTR record (a reverse record) for 10.10.168.192.in-addr.arpa pointing to linux1.example.com. If you manage both the forward and reverse zones for your network, you probably already can see what a huge time-saver this can be.

Finally, we define simple aliases for our hosts. Each host has an alias that we prefer to use instead of the generic linux{1,2,3} names. To create alias A records, we use + lines, which are

Listing 1. BIND Configuration for example.com

```
-- BIND named.conf excerpt  
zone "example.com" in {  
    type master;  
    file "db.example.com";  
};  
  
zone "10.168.192.in-addr.arpa" in {  
    type master;  
    file "db.10.168.192.in-addr.arpa";  
};  
  
-- BIND zone file: db.example.com  
$TTL 86400  
example.com. IN SOA linux2.example.com. hostmaster.example.com. (  
    2008090101 ; serial number  
    3h        ; refresh  
    15m       ; update retry  
    3w        ; expire  
    3h        ; negative cache ttl  
    )  
    IN NS     linux2.example.com.  
    IN MX    0 mail.example.com.  
mail        IN A     192.168.10.10  
linux1      IN A     192.168.10.10  
linux2      IN A     192.168.10.20  
linux3      IN A     192.168.10.30  
flying      IN A     192.168.10.10  
spaghetti   IN A     192.168.10.20  
monster     IN A     192.168.10.30  
noodly-appendage IN CNAME linux1.example.com.  
  
-- BIND zone file: db.10.168.192.in-addr.arpa  
$TTL 86400  
10.168.192.in-addr.arpa. IN SOA linux2.example.com. hostmaster.example.com. (  
    2008090101 ; serial number  
    3h        ; refresh  
    15m       ; update retry  
    3w        ; expire  
    3h        ; negative cache ttl  
    )  
    IN NS     linux2.example.com.  
10          IN PTR   linux1.example.com.  
20          IN PTR   linux2.example.com.  
30          IN PTR   linux3.example.com.
```

Listing 2. tinydns Configuration for example.com

```
# /service/tinydns/root/data
.example.com::linux2.example.com
.10.168.192.in-addr.arpa::linux2.example.com
@example.com:192.168.10.10:mail.example.com:0
=linux1.example.com:192.168.10.10
=linux2.example.com:192.168.10.20
=linux3.example.com:192.168.10.30
+flying.example.com:192.168.10.10
+spaghetti.example.com:192.168.10.20
+monster.example.com:192.168.10.30
Cnoodly-appendage.example.com:linux1.example.com
```

exactly like = lines, except PTR records are not created:

```
+flying.example.com:192.168.10.10      # alias for linux1
+spaghetti.example.com:192.168.10.30   # alias for linux2
+monster.example.com:192.168.10.30    # alias for linux3
```

Although it's discouraged, you also could define an alias with a CNAME using a C line:

```
Cnoodly-appendage.example.com:linux1.example.com
```

All these records go in a single file, which in our case is `/service/tinydns/root/data`. Save the file, and from that directory run `make`. This compiles the text file into `data.cdb`, a constant database. If a `data.cdb` already exists, `tinydns` will continue serving from it until the new one is ready, at which point it is moved into place, and `tinydns` instantly begins using it. The `Makefile` simply calls the `tinydns-data` command:

```
data.cdb: data
    /usr/local/bin/tinydns-data
```

You can test that your new records are in the database by using the `tinydns-get` utility. `tinydns-get` accesses the `data.cdb` file directly, so you don't need to worry about your test queries being cached anywhere. For example, you can use `tinydns-get` to see that your MX record is configured properly. First, make sure you are in the `/service/tinydns/root` directory and that you have run `make` so that the database is up to date:

```
# tinydns-get mx example.com
15 example.com:
103 bytes, 1+1+1+2 records, response, authoritative, noerror
query: 15 example.com
answer: example.com 86400 MX 0 mail.example.com
authority: example.com 259200 NS linux2.example.com
additional: mail.example.com 86400 A 192.168.10.15
additional: linux2.example.com 86400 A 192.168.10.20
```

This shows that `linux2.example.com` is defined as the authoritative name server for `example.com`, that `mail.example.com` is the MX record for the domain, and that its IP address is `192.168.10.15`.

Convenience Features

There are many other convenience features that `tinydns` offers. For example, with `tinydns`, you do not need to remember to increment the serial on the SOA record each time you change something in a zone file. `tinydns` automatically generates serials from the last-modified timestamp on the data file, which ensures that they are incremented whenever the file changes.

If you ever have had to migrate DNS for an active domain, you will appreciate per-record timestamps. You can specify an exact time in the future for a record to change, without worrying about how it is cached around the Internet. `tinydns` dynamically calculates the TTL as it responds to queries. For example, if you want to migrate `samba.example.com` from `192.168.10.25` to `192.168.10.35` at 2 AM on October 15, 2008, you can add the following two records:

```
=samba.example.com:192.168.10.25:0:4000000048f594fa
=samba.example.com:192.168.10.35::4000000048f594fa
```

The last field on these records is a TAI64 timestamp representing 2008-10-15 02:00:00. (See Resources for tips on generating TAI64 timestamps.)

A cache that requests the A record for `samba.example.com` at 1:50:00 AM on October 15, 2008, will receive a response of `192.168.10.25` with a TTL of 600 seconds (ten minutes). A cache that requests the same record at 1:59:45 AM will receive the same response, except with a TTL of 15 seconds. After 2:00 AM, `tinydns` will begin responding automatically with the new IP, `192.168.10.35`. Because all prior responses were set to expire at exactly 2:00 AM, all caches will check back immediately for the new address.

It's the little things like this that make `djbdns` such a wonderful piece of software.

DNS Replication

BIND servers use zone transfers to replicate DNS data between servers. This process is rather complicated, has a history of problems and is not exactly easy to configure. Instead, Bernstein recommends using existing data transfer tools, such as `rsync` or `scp`, that are known to be fast, efficient and secure.

Let's add `linux3.example.com` as second DNS server for the `example.com` domain. Install `djbdns` on `linux3` and configure `tinydns` as above (using the appropriate IP address). Update your data file on `linux2` with the new record (anywhere in the file is fine):

```
.example.com::linux3.example.com
```

Next, update `/service/tinydns/root/Makefile` on `linux2` with the new `make` target. Replace everything in the `Makefile` with the following:

```
remote: data.cdb
    rsync -az -e ssh data.cdb \
        192.168.10.30:/service/tinydns/root/data.cdb
data.cdb: data
    /usr/local/bin/tinydns-data
```

Be sure to use tabs instead of spaces at the beginning of the command lines in your `Makefile`. Now, when you run



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FEATURE djbdns

make it will compile data.cdb and immediately rsync it to linux3. We are using the IP for linux3 in the rsync command, because DNS should not rely on itself (it would fail if your DNS was broken). Also, you may want to create a special account for this purpose and configure passwordless ssh access using keys. Dan Bernstein provides more thorough instructions on his Web site for configuring DNS replication.

DNS without the Pain

As I hope you have seen, DNS does not have to be a headache. Although BIND is ubiquitous on Linux, djbdns is more secure, more efficient and simply easier to use. And, now that it has been released into the public domain, there are no longer any philosophical reasons for rejecting it. We've only briefly covered what djbdns has to offer, so I hope you will read the on-line documentation, download it and experiment with it yourself. If you ever have found yourself babysitting a BIND instance, you may want to consider giving djbdns a chance.■

Cory Wright has an unhealthy obsession with DNS. Once the Lead DNS Systems Engineer for Rackspace, he is now a developer and sysadmin at www.natuba.com. He enjoys beating Will Reese at foosball and Wii Tennis. His Web site is at dnsfool.com.

Resources

Google Disappearing Act: tinyurl.com/ckx6x

daemontools: cr.yip.to/daemontools.html

DNS Fool Tips: www.dnsfool.com/tips

How to Install djbdns, by D. J. Bernstein:
cr.yip.to/djbdns/install.html

Paul Jarc's cache-effect.pl: code.dogmap.org/djbdns

Mike Babcock's dnscacheproc.py:
mikebabcock.ca/code/dnscacheproc

Replicating Your DNS Service:
cr.yip.to/djbdns/run-server.html#replicate

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XTREME ILLUSTRATIONS

Not only is **Xara Xtreme** a Linux-compatible alternative to Inkscape, but now it even has its roots into the Open Source community as well. **Dan Sawyer**

If you really, really need Adobe Illustrator, you can use Wine or CrossOver. If you don't, a number of options are available, the most popular among them being Inkscape, which I've used as needed for a couple years now. It's a good program, and among the available open-source vector graphics apps, it's right up near the top of the heap for feature completeness, quality of implementation and lack of bugs, but it's not without its problems.

First, it's slow. The memory footprint—especially when a large illustration is loaded—is heftier than The GIMP's, an app that is not noted for its modest memory usage and speedy response when editing complicated projects. The slowness quickly becomes apparent when using Inkscape to work at the coffee shop on my less-than-top-of-the-line laptop instead of at home on my holy-crap-it's-HAL graphics workstation. When you're in a groove trying to create and polish something, having to wait for the program to catch up really, really sucks.

My second beef with Inkscape (and really, I only have the two), is the interface. Now, I'm willing to go a long way to learn an interface, and in theory, I like Inkscape's two-fisted approach. After all, I'm the guy who prefers Blender over other the legal, licensed commercial 3-D and compositing systems I have in my shop because of its two-fisted approach—relying on hotkeys for the commands and the mouse for manipulation makes the work flow fast. The problem I've always had working with

Inkscape though, is that its command map is about four miles long, and most of the common functions still require two key combinations. Although I like the concept, the implementation takes a long time to learn, and the keystrokes aren't organized in a manner that lends itself to deducing different functions easily by experimentation.

The ideal situation would be to get a program that's just as well thought out as Inkscape, just as bugless, but that has a faster work flow and a smaller footprint. A fuller feature set would be nice too, but I don't begrudge a project at 0.46 for not yet having all its features in place. Still, a few extra tools to take it up into the class of high-end professional illustration software would be nice.

Enter Xara Xtreme, which almost does this very thing. Until last year, Xara X was a professional, closed-source, Windows-only commercial app that garnered excellent reviews in *PC World* and won a number of awards both for its performance and its habit of underselling the rest of the market. However, when Adobe bought up Macromedia and then Microsoft announced its intention to enter the graphics market in a signature Microsoftian way (that is, with the intention of squeezing out all the small players, marginalizing Adobe and capturing the market using standard products with ultra-slick marketing and ubiquitous sales placement), Xara saw the writing on the wall and figured it needed a way to stay in the game. Somehow it needed to cut costs, turn out a superior product and capture market

space being neglected or deliberately marginalized by the two big kids fighting over the playground.

Companies like MySQL and SugarCRM have used the open-source development model to great effect—maintaining a freely accessible GPL tree and then offering value-added packages with proprietary code, support and other goodies as the mainstay of their businesses. It's a strategy that, when conducted properly, results in everyone winning—the people the company employs get to keep their jobs, the community developers get a fun challenge and a hell of a résumé entry, the broader community gets to use the free version of the product, the clients that need the value-added services can purchase it for far less than the competition, and the company gets to continue existing and (hopefully) turning a profit.

Xara decided to pursue the same strategy, with only a modest change in terms of its goals. It wants to take over the world—it says so right on its Web site. It correctly notes that there are a dearth of pro-level graphics apps for Linux and Mac, and that the few goodies there are for Mac actually may go away, depending on which way the bricks blow off the Adobe building, and Xara thinks it can do something about it. So, Xara pulled the GPL judo and is hoping it sends it to the top of the stack, at least where artists are concerned.

Because of this, Xara has an excellent incentive to play nice, and that's exactly what it seems to be doing. Xara has positioned itself well strategically

with regards to the GPL—both to protect its business model and to protect it from the kind of trolling that SCO recently engaged in against, well, everyone. As such, Xara will accept code only from developers who explicitly (and in writing) permit this arrangement, thus covering everyone's backside.

THE GOOD

Opening it up, Xara Xtreme has two very obvious good points: it's well laid out, and it's fast. As I noted before, I do most of the draft-phase of my illustration work on my laptop in a coffee shop (when you run your own business, you don't actually meet a lot of people unless you make it a point to go somewhere). Laptops make it possible to do a day's work without setting foot in the office, depending on the day. Unfortunately, a proper graphics laptop still will cost you your grandmother's dentures recapped with diamonds, so my mobile rig is a bit more modest. As such, I care about speed. Programs that are bloated, overcomplicated or poorly engineered don't last long on my hard drive unless there is no other tool available. Xara is well engineered and handles big documents without lagging, particularly compared to Adobe Illustrator or Inkscape. Of course, it is possible to overload it—eventually, one meets the end of one's RAM—but you have to work at it.

The other glorious thing about this little program is the design. Far too often with graphics programs, the interface gets in the way. Mountains of opaque floating menus that bury your work—something that runs directly counter to the purpose of working in a visual medium—is generally de rigueur for this application space. Less egregious, but still irritating, is the tendency to bury commonly used tools in menus, submenus and under the rock in the corner. Xara, being a mature application that has, for years, had to fight for its market position, has kept its interface lean and accessible. It quite simply doesn't even get in your way. Alpha gradients, color gradients, distortion tools, primitives, freehand drawing tools, 3-D extrusion and skewing tools, rotation, and just about every other sort of basic manipulation is comfortably situated on the left-hand toolbar.

THE IDEAL SITUATION WOULD BE TO GET A PROGRAM THAT'S JUST AS WELL THOUGHT OUT AS INKSCAPE, JUST AS BUGLESS, BUT THAT HAS A FASTER WORK FLOW AND A SMALLER FOOTPRINT.

Context toolbars appear conveniently along the top of the drawing space, and they contain a few nifty tricks that, if not unique to Xara, certainly are

unique in their thoroughness.

For example, in Inkscape and Illustrator, when you add a primitive object, you have a certain amount of

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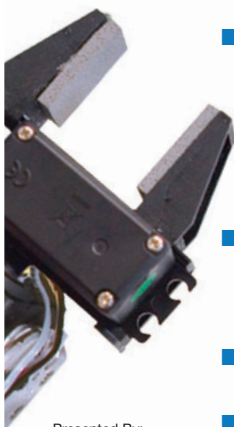
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control over how it winds up looking. In any decent vector graphics app, once a shape is on the page, you can edit its size, height and width, and in some cases, you can increase or decrease the number of sides and perhaps change the number of points, if it's a star. If all those fail, you can grab the bezier handles and tweak the shape manually. In Xara, you get one better. You can do all those things, but you also can change the type of object it is on the fly—polygon to circle to star—just by selecting it and pressing the button corresponding to what shape you want.

Xara's 3-D tools, although not yet fully implemented, are a cut above other open-source competitors. The bevel tool is at the left on the main toolbar and works splendidly, and—unlike other open-source apps—in Xara, you can adjust the color and direction of the light bevel without going into

XARA IS WELL ENGINEERED AND HANDLES BIG DOCUMENTS WITHOUT LAGGING, PARTICULARLY COMPARED TO ADOBE ILLUSTRATOR OR INKSCAPE.

submenus or subscreens. According to the documentation, you actually can use the bevel and contour tools to do honest-to-goodness extrusion, but having tried for a while to pull this off, I'm forced to conclude that parts of the tools are as-yet unimplemented in Linux, because it doesn't currently work as advertised (in the Windows version, however, this isn't a problem).

The final point in Xara's favor over Inkscape is its orientation. Xara is designed for artists, period. It's geared at people who aren't, and never will be, programmers. Quite a bit of Inkscape's best functionality requires far too much familiarity with XML, scripting and arcane geometric mathematics to be accessible to a run-of-the-mill graphic artist. I've been doing 3-D work for long enough that I can stumble my way through, but in a lot of cases, it's just more trouble than it's worth, and I'll do my roughs in Inkscape and then import the .svg into Blender to do the finishing touches. In Xara Xtreme, finished projects are far more obtainable without resorting to helper applications.

THE BAD

Despite these good points, Xara currently is limited in some fairly irritating ways. First, there is no 64-bit binary. The available 32-bit binary works fine in compatibility mode, but taking advantage of my processor's full bandwidth required compiling the source, and it wasn't the easiest compile in the world.

It's also still very much a work in progress. Porting a commercial app with a number of chunks of third-party code to a foreign platform using only open code is a nontrivial task, and at the time of this writing, there is still a healthy list of features that work in Windows but not in Linux. A number of features and effects present in Inkscape aren't yet available in Xara, and for now, it is wise to run both programs just in case you end up needing a tool in one that's not available in the other.

I've also discovered a bug, which

I've filed with Xara's bug tracker, with .eps import. As part of my testing process, I did a number of import/export operations with the different file formats Xara supports. The Adobe Illustrator .eps file format seems to import everything rotated 90° off prime, which is irritating by itself, but can be a fatal flaw for some projects when combined with another bug. It seems, you see, that Xara can't zoom out past 10% of the view, and in the case of one file I tested, that limitation ruined the project. The object in question was a 60" wide timeline on which I plotted a recent novel—it had several hundred detailed text entries cross-correlated in a number of ways, with a navigation key at the bottom. Upon importing it with the Illustrator .eps format, the rotation bug put half the length of the timeline out of my reach—no matter what I did, I could neither enlarge the canvas enough to encompass the whole project for rotation, nor could I zoom back far enough to grab all the constituent parts and drag them back

into the workspace. For that project, it's a deal-killer.

CONCLUSION

Despite the niggling bad points, I'm thoroughly impressed with Xara Xtreme, and highly recommend it to anyone looking for a proper pro-level graphics app on Linux. Although squirrely with imports and extremely large canvas sizes, for most projects, this program will serve nicely. It's suitable for design, for translating photos into vector-based paintings, for creating animation characters and for designing all kinds of Web graphics, print graphics, logos and mock-ups. The gallery on the Web site makes it clear that, with two months of use, I've still scratched only the surface of this deceptively simple program. Well worth the download, Xara Xtreme requires almost no time to learn and produces professional results, even in the hands of the most novice professional.

In the graphics space, this is how programs should be designed. Hooray for Xara for its decision to open source its project. Let's hope, in the long run, that decision pays off as handsomely for the company as it already is for this community member. ■

Dan Sawyer is the founder of ArtisticWhispers Productions (www.artisticwhispers.com), a small audio/video studio in the San Francisco Bay Area. He has been an enthusiastic advocate for free and open-source software since the late 1990s, when he founded the Blenderwars filmmaking community (www.blenderwars.com). He currently is the host of "The Polyschizmatic Reprobates Hour", a cultural commentary podcast, and "Sculpting God", a science-fiction anthology podcast. Author contact information is available at www.jdsawyer.net.

Resources

Xara Xtreme can be downloaded from www.xaraxtreme.org.

A quick series of comprehensive video tutorials to bring new users up to speed can be found at www.xaraxtreme.org/about/movies.html.

Inkscape, the current open-source top dog and still an excellent program, can be obtained at www.inkscape.org.

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Take a Ride on the Gentoo Train

I can't think of a better way to start a religious war in the Linux community than to compare Linux distributions. I don't intend to try to say that my favorite distribution is best; I just want to point out some of the features of Gentoo Linux that make it stand out in the context of some of the other more popular distributions.

Over the years, I've used many different Linux distributions, including Slackware, Red Hat, Mandrake, Yellow Dog, SUSE, Knoppix, Caldera and finally, Gentoo. When I first started using Linux, I used Slackware—back when it fit on 14 3.5" floppy disks, including the X Window System. I moved to Red Hat when I realized how convenient package management could be. Switching to Mandrake was a simple move, because it also was RPM-based and featured Pentium-optimized packages, which was nice at the time, as Red Hat still was compiling for i386. Finally, a coworker introduced me to Gentoo, and I've never looked back.

Gentoo is a completely source-based distribution, which means you don't install software by installing precompiled binaries using a package manager. With Gentoo, you compile

almost everything from scratch, under the control of the Gentoo package manager, known as emerge (more on emerge later).

For this article, I'm revisiting using a binary-package-based distribution. In this arena, I felt that Ubuntu and Fedora were the leading contenders.

For my tour of the Ubuntu system, I downloaded Ubuntu 8.04 Desktop edition from the Ubuntu Web site. After booting the CD image under VirtualBox, I was able to play around with the live CD. The live CD also offered me the opportunity to install the system onto my hard drive, which I did. I have to say, I was very impressed with how easy it all was. The system booted directly into the desktop environment without displaying a single kernel message. From there, I was able to access the local Windows network neighborhood and a full OpenOffice.org suite. Everything seemed to work "right out of the box". Within a minute of using the new system, I received a pop-up message indicating that new updates were available for installation. I opted to let the system perform the update, and the update was completely uneventful—the way I like updates to be.

Compile your entire Linux system for your particular CPU's instruction set with Gentoo.

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At first, I was a bit perplexed, because the system never asked me for a root password, even though I was performing actions that usually required root privileges. It turns out that Ubuntu has a mechanism allowing a system user to perform many privileged functions, such as mounting media, installing software and restarting the machine, without ever needing to know the root password. Of course, I've used su and sudo before, but Ubuntu's system seems to be broader and much more granular—and wrapped in a nice GUI. Overall, I was very impressed with how quickly I actually was able to get down to working with the Ubuntu system, without even knowing the root password. Eventually, I discovered how to "unlock" the root account, but I suspect many Ubuntu users never have to resort to such administrivia.

My whole experience with Ubuntu was very Windowsesque, and not in a monopolistic, dumbed-down, UNIX wanna-be kind of way. I was very impressed and easily could see how almost anyone could download an Ubuntu CD and be up and running productively within minutes.

When I went to Fedora's Web site to download the Fedora 9 installation CD, I was given a choice of downloading six CDs or one DVD image that weighed in at 3.6GB. There also was a network installation CD, but it required access to the other CDs over the network, and I didn't want to take the time to set up that. I opted to start the DVD image download and go to bed for the night. In the morning, I started the installation. During the installation, I was given the choice of doing a Desktop/Productivity, Web Server or Programming installation. I chose the Desktop installation. When it was done and the system had rebooted, I was presented with a GNOME desktop environment with OpenOffice.org already installed, as with Ubuntu. I found the menu structure for Fedora to be a bit more intuitive. The fact that the system required the root password in order to perform privileged functions left me feeling like I was in familiar territory.

By clicking on the Customize Now box, I was given the chance to determine, much more granularly, what software would be installed on my new system. For example, I saw that I could substitute the KDE environment, which I prefer, for the GNOME environment that Fedora installs by default. Of course, because Fedora is an RPM-based distribution, I can install new software anytime I want.

Fedora is a Red Hat-sponsored and community-supported project. Red Hat sponsorship carries a lot of weight with me, because I've dealt directly with some of the Red Hat developers whose drivers I've used, and I've always had a positive experience. To me, Red Hat epitomizes the open-source business model. It is a for-profit corporation that funds and supports open-source development. Because it is a for-profit corporation, Red Hat product licensing is an easy sell in the business arena. Managers tend to want to know that their core operating system will be documented and supported for the foreseeable future.

The rest of this article focuses on the Gentoo Linux distribution. My coverage of Ubuntu and Fedora are purposely superficial, because I think most Linux users have installed Linux before and understand how package management works and what configuration usually needs to be done on a new machine. Drawing on this experience gives us a context in which to discuss Gentoo.

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FEATURE Gentoo

Although Gentoo does have a live CD image with a graphical installation program, I usually download the minimal installation CD. It's only 50MB, so it typically takes longer to find a blank CD than it does to download. Once the installation CD has booted, you are presented with a bash shell prompt with root privilege, still running from the mounted CD image. As Indiana Jones once said, "We walk from here". From this point, we perform all of the installation steps manually.

The Gentoo documentation is excruciatingly thorough, and although I don't recommend you send it to the laser printer, it is very much worth reading. Fortunately, it's also color-coded, so experienced Gentoo users quickly can go through the steps without skipping a beat. The documentation walks you through partitioning and formatting the drive and installing a base system, upon which the rest of the system builds.

During the installation process, you can configure almost every aspect of the system. For example, Gentoo provides you with a `/etc/fstab` template, but you have to fill in the details. Finally, you configure and install GRUB, then reboot.

When you first log in to a new Gentoo system, you're faced with a completely stripped-down version of Linux—no port mapper, no Apache, no `(x)inetd`, nothing. The SSH daemon isn't even running by default! This is kind of the fork in the road. Are you building a Web server, a file server, a mail server or a desktop? Now you simply install the software

that needs to be installed, and *only* the software that needs to be installed.

During the installation process, you will encounter a few concepts that are unique to Gentoo: portage and use flags.

Portage is Gentoo's package management system. Although made up of a bunch of shell scripts, portage essentially is a database that tells emerge, the Gentoo software installer, how to download, build and install any given software package. Portage also takes care of calculating package dependencies. Installing a new software package is as easy as

During the installation process, you can configure almost every aspect of the system.

typing `emerge apache`, and emerge determines what other software packages are required, downloads all the needed packages, compiles them in order and installs the resulting binaries. Although not tied to a graphical environment, it is a pretty nice way to install software.

If you tend to prefer a more graphical experience, kuroo allows you to do anything that emerge can do, but with a point-and-click interface. Not much could be easier.

Source-based software installation is pretty slick, but Gentoo's use flags are what makes it as customizable as it possibly can be. Use flags are mechanisms that let you decide what optional features should be compiled into the system. For example, by setting or resetting the MySQL use flag, you can determine whether Qt is compiled with MySQL support. If you leave out the MySQL support, you also get rid of the MySQL dependency. So, by carefully tweaking the use flags, you can pare a system down to its bare necessities, and bare necessities are easier to secure and maintain.

Another benefit of installing from source is that you can configure GCC to take advantage of the particular chipset you are using. This feature, as well as the use flags, is configured in `/etc/make.conf`. By telling Gentoo that you are using an AMD processor, for example, you enable GCC to compile your software to take advantage of any AMD-specific instructions. Gentoo systems that run on a Pentium 4 computer will take advantage of the features of the P4 that are lacking from the PIII, AMD or PowerPC architectures.

I don't have any solid numbers to back my claim, but I felt the difference when I compiled KDE for the AMD Athlon as opposed to the generic Pentium at the time. With the divergence between Intel and Athlon, this feature will become more and more important in the future.

The magic of Gentoo is that you not only can determine *exactly* what software packages get installed on your system, but you also have quite a bit of flexibility in determining *how* those packages are compiled. I used to chuckle about how much cruft was being installed with the average Windows installation and feared that Linux was following the trend. There is no reason to install software you don't intend to use, and there are considerable advantages to not installing it at all. Gentoo gives you the control needed to ensure that your system has only those packages installed you intend to

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use. There is no reason for a Web server or a mail server to have the X Window System installed, for example.

I've been a Gentoo user for several years now, and I've found that the Gentoo mailing list is completely invaluable. Unlike some of the mailing lists for other mainstream Linux distributions, the Gentoo mailing-list members seem to understand that there are issues unique to Gentoo, and they are pretty patient with new and old users alike. I've never been patronized or insulted for asking dumb-sounding questions.

I have to say, the Gentoo community is one of the stronger arguments for using Gentoo in the first place. The community understands that Gentoo has a learning curve, and they are more than up to the task of helping people climb it.

Alas, Gentoo isn't without its weaknesses. Most new Gentoo users quickly realize that it can take time, sometimes a lot of time, to build a Gentoo system. Whereas the Ubuntu system was up and running in less than ten minutes, even under a virtual machine, a typical Gentoo system can take hours to build from scratch. I like to tell myself that you get what you pay for, and an initial investment in time spent during the installation process will pay dividends in heightened security and ease of maintenance in the end. Overall, I'd say that this time investment has paid off. Because my servers don't have as much software installed on them, they don't need to be patched as often, and they've been remarkably stable. But then, Linux is inherently stable.

Many new Gentoo users lament the lack of a graphical installation program. And, although a graphical installation wizard is nice, I'd argue that you get to know your system much more intimately by getting your hands dirty and configuring each and every aspect of it. Getting to know your servers intimately begins to make sense when you start building mission-critical servers and workstations. Such servers don't need the X Window System or any other extraneous software installed.

Eventually, I think, most Gentoo users end up scripting their installations, and as no GUI is involved, this process is fairly easy. I have an installation script that I'm quite happy with.

The other major weakness in the

Gentoo system is that sometimes the Gentoo maintainers decide to make major architectural changes. Because Gentoo users compile their systems from scratch, they don't enjoy any shelter from these various types of changes. I remember when the maintainers decided to rework completely how Gentoo did its network configuration. The old configuration was fairly simple and intuitive. The next configuration entailed a 30K configuration file. Of course, much of this configuration file was comments, but it still was daunting. To be fair, the result was a system that not only could configure the standard Ethernet, but also Wi-Fi, VPN and all sorts of esoteric network configurations. The resulting mechanism was pretty elegant, but the transition was a bit painful.

So, what are my recommendations as a longtime Linux user? Well, if you want to get up and running with a Linux system and have no, or little background in Linux, try Ubuntu, particularly if you are an enlightened Windows user. I think you'll be at home with Ubuntu almost immediately. I almost was sucked in too. If you are accustomed to the standard Linux installation process, or if, for political reasons, you need corporate support, I wholeheartedly recommend Red Hat or Fedora. However, if you want something a bit more customizable, or if you want to learn Linux at a completely different level, I recommend trying Gentoo. Walking through all of the steps needed to install a Linux machine from scratch is educational and can instill you with a profound appreciation for all the work that the Linux distribution maintainers do for the rest of us.

As a final comment, I'd like to mention that about every six months, someone on the Gentoo user's mailing list asks if Gentoo is suitable for production environments. My answer is pretty simple. All of my production servers, as well as my work-related workstations and laptops, are Gentoo systems. This list includes production mail and Web servers, production Asterisk servers and workstations that I simply can't afford to be without. So, yes, Gentoo is ready for the production environment. ■

Mike Diehl is a professional computer nerd in Albuquerque, New Mexico. Mike lives with his wife and three small boys, including a newborn, and can be reached via e-mail at mdiehl@diehlnet.com.

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The Story of Firefox: from Underdog to Superhero

How Firefox became our very favorite browser. JAMES GRAY

It took many years for Firefox to be an overnight success. Who would have thought back in March 1998, when the struggling Netscape released the source code for its Communicator Suite, that Firefox would be the favorite browser on the Linux platform and a formidable insurgent challenger to Microsoft's Internet Explorer (IE) on Windows.

Gradually over the past ten years, Netscape morphed into the Mozilla browser, which in turn gave rise to Firefox. Today, Firefox owns a market share of around 20% worldwide (and much higher in certain places). How was Firefox able to accomplish this rise from the ashes of Netscape and go from underdog to hero?

The story of Firefox also is a story of the coming of age of open source, of opportunities presented by Microsoft failing its users of IE, of Internet users hungering for something new and of cutting-edge innovation that blew our socks off.

Netscape: Firefox's Proprietary Great Uncle

Certainly you remember the browser wars of the mid- to late-1990s—the ones that Netscape lost handily. Although we were fortunate that Netscape cared enough to maintain a Linux version, we used the Communicator out of necessity, not passion.

Little did we know at the time, but the seeds of change (and the beginnings of the Firefox browser) would be planted

on January 23, 1998, when Netscape announced the release of source code for Netscape Navigator 5.0. Recall that back in 1998, the open-source model still was viewed with widespread skepticism. At that time, Eric S. Raymond had written the on-line version of *The Cathedral and the Bazaar*, which made open source tangible to more people. Raymond, who guided Netscape through its open-source strategy, noted that his contacts at the company had such a huge sense of relief, or even gratitude, because market conditions had become so bad, they could justify doing what they wanted to do anyway.

Netscape's Vice President of Products, Marc Andreessen, said his company open-sourced Netscape because, "we're at an inflection point, a trigger point, when there's an alignment with the energy of growth. Linux is hot. The technologists have adopted it, and it's growing fast all through the Open Source community. This gives us the confidence that we couldn't screw it up if we tried."

Raymond also called Netscape's decision, "the long-awaited breakout of free software into the commercial world". Little did he know the prescience of his words at the time.

A few months later, in March 1998, mozilla.org was founded, the source code for Netscape Communicator 4.0 was released and the community went to work.



Firefox Timeline

1998		1999	2002	2003	
<p>JANUARY 23, 1998 Netscape announces the release of the source code for Netscape Navigator 5.0.</p> <p>FEBRUARY 23, 1998 Netscape announces the mozilla.org Project.</p>	<p>MARCH 31, 1998 The first Mozilla code (for Netscape Communicator 5.0) became publicly available under the terms of an official open-source license and a governing body for the project, the Mozilla Organization, began its public work.</p>	<p>MARCH 18, 1999 America Online acquires Netscape.</p>	<p>JUNE 5, 2002 The Mozilla 1.0 suite, the open-source progeny of the proprietary Netscape Communicator, is released.</p> <p>SEPTEMBER 23, 2002 Phoenix 0.1 (Pescadero) is released, the first official version of a standalone browser that will later be renamed Firefox.</p>	<p>APRIL 2, 2003 Mozilla announces intent to develop what would become Firefox (code-named Firebird at the time) as a standalone application rather than as part of an integrated suite.</p> <p>JUNE 30, 2003 Mozilla 1.4 is released with pop-up blocking.</p>	<p>JULY 2003 The not-for-profit Mozilla foundation is spun off from AOL.</p> <p>AUGUST and NOVEMBER 2003 Mozilla wins the <i>Linux Journal</i> Editors' Choice Award for Best Web Browser and Readers' Choice Award for Favorite Browser for the first time.</p>

The Making of Mozilla: 1998–2002

It took some time for Mozilla to come of age post-Netscape. Although Netscape Communicator's source code was released in early 1998, the Mozilla 1.0 suite, or applications framework as it is technically called, was not finished until June 5, 2002. Despite Mozilla's Netscape-like look and feel during this period, much was changing under the hood. In November 2000, *Linux Journal* writer Mike Angelo commented that "if you have any notions that Mozilla, the browser suite, is an upgrade from Netscape Communicator 4.x, please lose them. Picture Mozilla as a browser suite that is new from the ground up, but just looks and feels lots like the Netscape 4.x browser suite, thanks to its skin".

In spite of the overhaul, Mozilla retained Netscape's "all-in-one" suite orientation, which was later to be shed by the self-standing Firefox. Mozilla consisted of the applications Mozilla Navigator, Mozilla Composer, Mozilla E-Mail, Mozilla News and ChatZilla.

During this period, in March 1999, Netscape went off to become part of America Online. Nevertheless, the two organizations retained close ties—for instance, many of Mozilla's developers were inside Netscape/AOL, and Netscape/AOL continued to assist Mozilla financially. Furthermore, while Netscape/AOL utilized the Mozilla code as a base for its own Netscape 6, the company added its own proprietary features, such as AIM.

Development-wise, these six interim years were productive. Most important, the Mozilla development team built the Gecko browser layout engine from scratch and ensured full W3C (World Wide Web Consortium) standards compliance. In addition, changing skins on the fly, security features and the plugin model were expanded and improved significantly.

Mozilla 1.0: Worth the Wait

After four long years of development, Mozilla 1.0, mostly free of its Netscape Communicator past, was at last released on June 4, 2002. CNET.com's Rex Baldazo raved that "The four-and-a-half-

year wait is over—Mozilla 1.0 has gone gold, and from what we've seen, it's been worth the delay." Immediately, users were impressed with Mozilla's speed, stability and features, such as tabbed browsing, pop-up blocking and custom skins.

Mozilla's features caught the surfing public's attention and re-ignited the browser wars of yore. Several different Web analytics firms reported that Microsoft's Internet Explorer dropped from a 97% market share in 2002 to 93% in late 2004. During the same period, Mozilla went from a 2% market share with Netscape to more than 5% with all of its open-source browser offerings.

Firefox Grows in the Shadow of the Mozilla Suite

While the Mozilla browser was out in the world making Web surfers everywhere gleeful, the development team at mozilla.org, led by Chief Technology Officer Brendan Eich, already was laying the foundation for a much better browser. On September 23, 2002, the Mozilla team released Phoenix 0.1 (Pescadero), the first official version of a standalone browser that would later be named Firebird and, eventually, Firefox. Phoenix was a redesign of Mozilla's browser component but written using the XUL user interface language and designed to be cross-platform. Phoenix's developers stated that "Phoenix is not your father's Mozilla browser. It's a lean and fast browser that doesn't skimp on features", loading pages in half the time as Mozilla 1.1. Furthermore, they added, "Not only does Phoenix aim to match the feature set of Mozilla—subtracting features deemed geeky and better offered as add-ons—but it extends it. We also believe Mozilla, in general, is going in the wrong direction in terms of bloat and UI, and see no reason for our releases to carry those connotations."

On April 3, 2003, Mozilla announced its intent to develop what would become Firefox (code-named Firebird at the time) as a standalone application rather than as part of an integrated suite.

Mozilla's Eich summarized the new browser's philosophy in

2004		2005	2006/2007	2008
<p>FEBRUARY 8, 2004 The new release Firefox 0.8 (Royal Oak), leaves behind the old name Mozilla Firebird.</p>	<p>DECEMBER 2004 The Mozilla Foundation places a full-page ad for Firefox in the <i>New York Times</i> with financial contributions from more than 10,000 users.</p>	<p>OCTOBER 19, 2005 Firefox reaches milestone of 100 million downloads.</p>	<p>OCTOBER 24, 2006 Firefox 2.0 is released.</p>	<p>MARCH 31, 2008 The Mozilla Project celebrates its 10th anniversary.</p>
<p>JUNE 17, 2004 Mozilla 1.7 is released with speed improvements and better standards support.</p>		<p>NOVEMBER 29, 2005 Firefox 1.5 is released.</p>	<p>NOVEMBER 19, 2007 Firefox 3.0 beta1 is released.</p>	<p>JUNE 17, 2008 Firefox 3.0 is released (projected at the time of this writing), with Download Day to set the Guinness World Record for Most Software Downloaded in 24 Hours.</p>
<p>NOVEMBER 9, 2004 Firefox 1.0 is released.</p>		<p>AUGUST and NOVEMBER 2005 Mozilla wins the <i>Linux Journal</i> Editors' Choice Award for Best Web Browser and Readers' Choice Award for Favorite Browser for the second time.</p>		

its development road map as follows:

[Firefox] is simply smaller, faster, and better—especially better not because it has every conflicting feature wanted by each segment of the Mozilla community, but because it has a strong “add-on” extension mechanism....Attempting to “hard-wire” all these features to the integrated application suite is not legitimate; it’s neither technically nor socially scalable.

Firefox 1.0 Arrives

Six years, seven months and nine days after the birth of mozilla.org, Firefox 1.0 was born on November 9, 2004. Looking back to the earliest days of Firefox 1.0 with three and a half years of perspective and comfortable browsing, it’s easy to forget how exciting the post-release vibe was. Firefox saw more than 100,000 downloads in the first few hours and nearly 10 million per month shortly after the release. Toward the end of its run, Firefox 1.0 reached 100 million downloads in October 2005. This success translated into a market share of around 5%. By early December 2004, according to OnStat.com, Internet Explorer’s market share dropped yet again to below 90%.

There was a palpable hunger for an alternative. As part of the Spread Firefox campaign, 10,000 Firefox supporters coughed up some of their hard-earned money to show support for their browser by contributing to fund a full-spread advertisement in the *New York Times*. Spread Firefox is the nexus of global community volunteerism to promote Firefox via guerrilla marketing activities.

The left page of the masterful *New York Times* ad features the names of all 10,000 contributors over a shadowed Firefox logo. The ad asks the reader, “Are you fed up with your Web browser? You’re not alone. We want you to know there is an alternative.” On the right page, it featured, “Introducing Mozilla Firefox 1.0” in bold type, followed by quotes from satisfied users and the advantages of Firefox, such as speed and browsing free of pop-ups and spyware. “Find out what 10 million users from around the world already know: there is an alternative.” Unfortunately, the *Times* ad is not printable in this space due to size constraints, although you can see it at the Spread Firefox Web site.

There also was hunger for better security. On the Windows side, it seemed that IE was once invincible. However, IE’s security problems pushed millions of users and countless organizations out to the far edge of the plank; Firefox was the nudge that made them jump ship in droves.

For most people, however, the reason to move to Firefox was its features. They ate up the tabbed browsing, better standards support, integrated search, a user-friendly plugin management system, easy installation and removal procedures and, of course, better security. The latter was possible, because Firefox lacks the deep hooks into the operating system as is the situation with IE, which therefore suffers greater impact from flaws.

Firefox 1.5

During 2005, Firefox gained 10% of global market share from its rivals, a feat that the proprietary Netscape could not muster

after falling behind Internet Explorer. The success train continued to roll down the tracks, and Mozilla released Firefox 1.5 on November 29, 2005.

In Firefox 1.5, the Mozilla development team added new features, such as even speedier page loading, drag-and-drop search, integrated RSS reader, tab re-ordering, better pop-up blocking, binary patching for upgrades, clearing of personal data with a single button and partial SVG 1.1 support—not to mention all the new extensions that continue to accumulate, which leave practically no limit to what you can do with Firefox.

Despite the increased complexity of version 1.5, the Firefox development team continued to prove itself more worthy than its rivals, not only attending to serious flaws but also avoiding them in the first place.

Firefox 2.0

We need another metaphor for inertia, because Firefox 2.0 has it too. As we sit on the verge of version 3.0, we can see that Firefox 2.0 has carved out another 8% of market share to reach 18%, according to Net Applications. This translates into approximately 170 million users worldwide.

For features, the 2.0 release added Google’s anti-phishing software, Live Titles for bookmarks, spell-checking, improved UI and improved support for SVG and JavaScript 1.7.

Firefox 3.0

As I finish this article, I longingly look ahead to the release date for Firefox 3.0, which looms just a few tantalizing days out at the time of this writing. The day is also Download Day, an initiative by Spread Firefox to set the Guinness World Record for Most Software Downloaded in 24 Hours. As of mid-June, the number stands at 1.1 million and growing. Clearly, now that open source has taken hold, it is possible to assert that one should never underestimate the effectiveness of disciplined bands of inspired volunteers to change the world of computing.

Mozilla has raised expectations for Firefox 3.0, saying that it will run double the speed of its predecessor and use much less memory. Furthermore, the browser will be much smarter,



Figure 1. Firefox says that Version 3.0 has more than 15,000 updates. Will it keep Firefox’s momentum going?

as you can simply begin typing into the location bar, or “aweome bar”, to find what you are looking for, and Firefox offers a list of options it thinks are most relevant to you.

Version 3.0 also implements the updated Gecko 1.9 layout engine, which allows it to pass the Acid2 test, a standards-compliance test for Web-page rendering.

From Underdog to Hero

Firefox’s trajectory—from proprietary Netscape to Mozilla to Phoenix/Firebird and finally Firefox—is an incredible story of triumph. What began as the outdated, proprietary Netscape browser, with shrinking market share from a struggling company, was set free with open source to transform itself into a technological and organizational powerhouse. Firefox now ranks with Linux and Apache as one of the world’s premier open-source applications. Although it has taken a decade, Firefox has valiantly clawed back to nearly 20% market share worldwide, with 29% in Europe and more than 40% in countries like Finland and Poland. This is quite an accomplishment, given that Firefox’s main competitors, IE and Safari, have huge pre-installation advantages.

Firefox came of age with open source and, as Technetra’s Alolita Sharma observed, “has helped make open source mainstream” and that “its success as a constantly evolving open-source product has validated the open-source development model”. Hats off to the pioneers like Eric S. Raymond who helped Netscape see the light in 1998 and get started on the right foot, as well as the hundreds of developers and activists who contributed to Firefox technically and promotionally. Without the army of Spread Firefox volunteers, who never would be so enthusiastic about a proprietary product, Firefox’s success would be much less viral.

Many thanks also go to Microsoft for so many things—its horrible attention to security, lack of innovation and IE’s overly tight integration with Windows—all of which made users so fed up and thirsty for an alternative. It helped tip so many millions to Firefox.

The past decade has been quite a run for our friend Firefox. It has matured admirably over time, and version 3.0 continues the positive, upward trend. As mentioned, however, competitors are in the wings who would love to experience similar success and grab hold of some of Google’s millions that Firefox currently receives. Already there are signs that Safari is eating into some of Firefox’s market share in North America. Regardless, if our fledgling hero can ride its current wave of technical innovation and popular support, we should see Firefox residing on ever more desktops of satisfied computer users. ■

James Gray is *Linux Journal* Products Editor and a graduate student in environmental science 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

Apple Computer’s Safari Browser: www.apple.com/safari

Mozilla Foundation: www.mozilla.org

Spread Firefox: www.spreadfirefox.com

Spread Firefox campaign’s advertisement in the *New York Times*: www.mozilla.org/press/nytimes-firefox-final.pdf

TECH TIP Monitoring Processes with Kill

If you have a process ID but aren’t sure whether it’s valid, you can use the most unlikely of candidates to test it: the kill command. If you don’t see any reference to this on the kill(1) man page, check the info pages. The man/info page states that signal 0 is special, and that the exit code from kill tells whether a signal could be sent to the specified process (or processes).

So `kill -0` will not terminate the process, and the return status can be used to determine whether a process is running. For example:

```
$ echo $$      # show our process id
12833
$ /bin/bash   # create new process
$ echo $$     # show new process id
12902
$ kill -0 12902
$ echo $?     # exists, exit code is 0
```

```
0
$ exit        # return to previous shell
$ kill -0 12902
bash: kill: (12902) - No such process
$ echo $?    # doesn't exist, exit code is 1
1
```

Many UNIX daemons store their process IDs in a file in `/var/run` when they are started. Using `kill -0` to test the pid is a lot easier than parsing `ps` output. For example, to test whether cron is running, do the following:

```
# kill -0 $(cat /var/run/cron.pid)
# echo $?
0
```

—RICH LUNDEEN

State of the Art: Linux Audio 2008

An overview of current capabilities and achievements in Linux audio development.

DAVE PHILLIPS

The world of Linux audio covers many domains, from basic desktop sound services to embedded systems, from simple Internet telephony to the demands of professional recording studios. This article presents an overview of the Linux audio world and its current status.

Due to the breadth of the topic, I have divided this article into two parts. For the same reason, it is impossible to discuss any particular program in-depth in this kind of survey. However, I cover many of the programs mentioned here in my articles for the *Linux Journal* Web site (www.linuxjournal.com), and I refer readers to those articles for more detail on individual programs.

General Commentary

Sound support in Linux has progressed grandly since my first experience with the system in the mid-1990s. The mainstream distributions all have excellent device detection, including sound card detection, and the typical desktop audio functions are configured transparently during installation. Most distributions let users add and configure extra sound devices manually, but some detect and configure multiple devices automatically. Any configuration needed after installation is handled similarly through control panels and other user-friendly utilities. In addition to technical advances, Linux sound and music applications have grown in number and sophistication. We now have excellent software for media production and playback, and there is good reason to expect continued development in audio-oriented domains.

Software Categories

In this overview, I distinguish between the two broad categories of system software and applications software. System software here includes the kernel sound system and other tools and utilities that make the user-level programs work. This software is usually not associated with normal usage, and typical users may, in fact, never even know about it. Nevertheless, this layer is where the heavy lifting is done, and although it's not flashy or sexy, it is the heart of the Linux audio system. In contrast, applications software includes the programs that present themselves to users via the distribution's menus, toolbars and file managers. This software is what typical users understand and employ on a regular basis.

The first part of this article covers system software and a variety of other audio-related software domains. The second part focuses on the state of Linux sound and music production software.

System Software

ALSA (Advanced Linux Sound Architecture) provides the core audio and MIDI services to the Linux kernel. These services include the device drivers installed with the kernel, a library and API for programmers, various user-level tools and utilities, and firmware for some USB and other devices. If a project's development is reflected in its changelogs, ALSA is clearly a very active project, with a steady stream of enhancements and fixes, and an expanding list of supported sound cards and audio chipsets.

The developers at 4Front Technologies have improved their OSS (Open Sound System) Linux package in similar fashion. In 2007, the company announced the decision to place the system under open-source licensing. As a result, OSS is now a free, open-source project, complete with source repository, Bugzilla, wiki and protection by the GPL, BSD and CDDL licenses. But, all this goodness isn't only for Linux. The OSS package also provides high-quality audio/MIDI services to our comrades on UNIX systems, such as FreeBSD and Solaris.

ALSA and OSS provide the device drivers needed to make your sound hardware usable by the operating system. Sometimes they create these drivers by consulting material provided by manufacturers, and sometimes they reverse-engineer a driver. To my knowledge, only Audio Science offers Linux drivers developed in-house. Audio Science manufactures high-quality audio hardware marketed mainly to radio broadcasters, and codes and provides native Linux drivers for its products. Ah, if only [manufacturer's name deleted] would be so wise.

Desktop Sound Servers

Normal desktop actions and activities that require audio services include system sounds, media players, Internet telephones and simple recording. However, normal users now expect amenities, such as transparent software mixing and relatively glitch-free performance, in a multitasking system. ALSA's `dmix` plugin provides software mixing, but not all distributions want to employ it. Thus, competition remains for the position of the default Linux desktop audio server. GNOME still uses `esd` (the Enlightened Sound Dæmon), and KDE still backs the `aRts` dæmon, but the PulseAudio Project definitely is the newcomer to watch. PulseAudio already has been adopted as the sound server of choice for the OLPC XO laptop and for recent releases of Ubuntu, and there's reason to believe it may overtake `esd` and/or `artsd` as the One True Server for typical users' sound-related activities.

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For the Professional: JACK

The demands of professional audio production require a different order of performance from a sound server. None of the servers mentioned above are capable of drop-out free performance under heavy resource demand—for example, multichannel recording with high sample rates and bit depths—and they cannot be considered suitable under pro-audio conditions. Fortunately, Linux has JACK, a truly professional-grade audio server and master transport system. If you plan on producing professional-quality audio with Linux sound and music software, you need to know JACK.

JACK development is steady and continues to expand the system's capabilities. JackMIDI is showing up in more applications, and the jackdmp Project points the way toward JACK's future on multiprocessor architectures. Current versions already run on OS X, and there's even been a successful port to Windows. Currently supported back ends now include ALSA, OSS, PulseAudio, FreeBob/FFADO (for FireWire devices) and CoreAudio (on OS X).

Other Notable System Software

Erik de Castro Lopo has contributed some essential components to the Linux audio infrastructure. His libsndfile provides programmers with a comprehensive library for handling file I/O for a great variety of soundfile formats, and his libsamplerate has found broad acceptance as the preferred tool for high-quality sample rate conversion. These libraries relieve applications programmers from the burden of writing code for very common tasks, and both packages are common dependencies throughout the world of Linux audio software. I'm also happy to report that both libraries are currently maintained.

Common Applications

The sound-related software most familiar to typical users includes media players, games and audio communication devices. In each instance, the application itself does not handle audio directly, instead relying on the kernel's sound API (that is, ALSA). This reliance frees application developers to focus on features, rather than on how to interface with users' sound hardware.

Media Players

Linux music players are a mixed blessing. For average users, programs such as Amarok, Banshee, Rhythmbox and the XMMS clan work well for playing most audio formats (MP3, Ogg, WAV, AIFF and so on). AlsaPlayer continues to provide a lighter-weight player, not so feature-rich but stable and JACK-savvy. JACK-awareness is one of my personal complaints with most of the current music players, but I have reason to hope that the major players will get it and at least provide a plugin for JACK connectivity. And, while I'm dreaming, I'd also like to see Linux media players adopt the JACK master control system. More typical wish lists include true gapless playback and support for huge collections. The development teams of the popular players are quite aware of these requests and are working to address them in future releases. As Figure 1 indicates, some developers are indeed moving forward.



Figure 1. Amarok does JACK with libxine.

Multimedia players, such as MPlayer and Xine, continue their development march forward. These projects are well established, and many users rely on them heavily for more than just DVD and video file playback. MPlayer (and its sister software MEncoder) is a veritable toolkit for a wide variety of video and audio tasks, and the Xine library is used by many other applications that need video capabilities. Both programs play a wide variety of video and audio formats, and both include hooks for user-friendly GUIs.

Alas, there is a snake in the grass in this field. Video players depend on codecs that provide support for the seemingly endless variety of video formats, and many popular formats are patent-encumbered. One immediate result of this situation is the difficulty or impossibility of including these codecs in a mainstream Linux distribution. Some distros simply point users to a repository where they can download the necessary packages, but it would, of course, be better if the codecs could be installed along with the players. However, until patent law reform takes place (in the US, at least), there can be no other way to supply the software.

Playback of encrypted DVDs also is problematic. It appears that the MPAA is no longer pursuing legal action against distribution of the DCSS software, but distribution vendors remain hesitant to include the software directly. Again, users typically are directed to a distribution point on the Internet where they can acquire the software they need to watch their legally purchased discs. Although these extra steps may seem trivial to seasoned users, they often are confusing and seem unnecessary to novices, especially when there is little or no understanding of the legal ramifications. Nevertheless, until patent encumbrance and copyright entanglements are things of the past, the extra steps will be necessary if users expect fully functional media playback.

Game Sound

Beyond *PySol* and *XScrabble*, I'm not much of a gamer.



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Most of the currently maintained game development toolkits (ClanLib, Crystal Space and SDL) support ALSA and OSS, but the Allegro library also supports JACK, which I think is very cool.

However, I do follow the updates on the Linux Game Tome and the Linux Games sites, and the scene for Linux gaming and game development clearly is alive and active. Game-centric programming toolkits flourish; new games appear frequently (with the attendant and predictable variability in quality), and even the occasional port from Windows shows up. The common critique I hear from avid gamers is that Linux is a great platform for running games, but too few great games exist in native Linux versions. Indeed, Windows users can claim a massive number of high-quality games available only for that platform, but from this dabbler's perspective, the Linux gaming world is healthy and developing nicely.

Most of the currently maintained game development toolkits (ClanLib, Crystal Space and SDL) support ALSA and OSS, but the Allegro library also supports JACK, which I think is very cool. The OpenAL Project still is under development, but slowly. Creative Labs and Apple have invested in the system's development, mainly for Vista and OS X, but it appears that 3-D and surround sound (5.1, 7.1) are fully supported in the Linux releases as well.

Embedded Devices

Linux-powered portable hardware is common these days, so we can expect to encounter the Linux sound system at work in those devices too. Alas, I own no such devices and cannot directly comment on implementation and performance of the sound system in that hardware. However, LinuxDevices.com



Figure 2. The Trinity DAW

publishes a handy on-line list of Linux-powered audio/video devices, most of which are media players, set-top boxes, integrated media phones and so forth. Two notable exceptions to the category include Ron Stewart's amazing Trinity, a portable Linux-powered DAW (Figure 2), and the Plugzilla, a rackmounted standalone audio plugins player. I don't own either of those units, but both should be tested and evaluated as soon as possible.

Emulators and Proprietary Software

The Wine Project has reached its 1.0 release stage. Among its many virtues, we find support for a variety of audio/MIDI back ends, including ALSA, JACK and OSS. Some sound and music programs for Windows run flawlessly with Wine, including Cockos Software's excellent Reaper audio/MIDI sequencer, thanks to work on the wineasio driver. This driver communicates with Wine's JACK support to yield surprising low-latency performance when running ASIO-compliant Windows applications under Wine, including VST/VSTi plugins. However, even with wineasio, it still is unlikely that the major music and sound packages for Windows (Cubase, Logic, Finale and so on) will run flawlessly under Wine. Those programs tend to be large packages with a complicated relationship to the operating system, typically more complicated than can be emulated with Wine.

Ardi's Executor, a Mac OS emulator, is gone, but at least two good Atari emulators remain. If you want to run all that late 1980s MIDI music software written for the Motorola 68K CPUs, XSteeem and Hatari will do the job. Alas, the Steem Project appears to be on hold, but Hatari is in current development.

The DOSemu Project continues on its steady development track. Recent releases include significant improvements to the emulator's sound and music capabilities, better integrating its functions with the kernel's ALSA system. The DOSBox Project supports sound through the SDL audio library, with special emphasis on game sound compatibility. MIDI output is supported, but current versions lack MIDI input capability.

Emulators may become relics if virtualization delivers equal or better performance. I have not yet tested music and sound applications in environments such as VMware or VirtualBox, but the specifications for those systems typically include ALSA and OSS support via virtualized hardware. Unfortunately, the virtual sound devices are compatible typically with the SoundBlaster16 or Intel's ubiquitous AC97 audio codec. These devices are sufficient for low-demand programs, but they are not suitable for use with high-end music and sound software for Windows.

A few intrepid commercial sound and music software houses have offered Linux ports of their packages. The Renoise tracker (Figure 3) is available in an excellent version for native Linux. Jorgen Aase's energyXT2 DAW (digital audio workstation) has a sizable base of Linux users, and Garritan recently announced that Aria, its next-generation sampler engine, will be available in a native Linux version. Other vendors, such as NCH Software (WavePad) and Cockos (Reaper), advertise that their programs work with Wine and extend official



Figure 3. Renoise in its Native Linux Version

support to that environment.

The number of these packages hardly constitutes a flood of releases from major Windows developers, but such small streams can grow. More users are becoming interested in Linux, and some percentage of those users will be focused on its audio capabilities and its applications for sound and music production. An opportunity exists for commercial developers to expand into the Linux world, and their way has been made clear by the solidity of the Linux audio infrastructure. I applaud the houses that already have crossed into the Linux world, but it remains to be seen whether these motivations and attractions are strong enough to compel other commercial houses to develop native Linux packages of their software.

Development Tools and Environments

The Linux audio infrastructure provides well-designed and well-tested programming interfaces for sound and music applications developers, particularly if they employ JACK to handle audio (and now MIDI) I/O. Alternatives include the OSS API and directly programming ALSA, but JACK is truly the superior solution.

Regarding GUI toolkits: Qt and GTK remain the dominant players, but FLTK and wxWidgets also are popular. This multiplicity of GUI toolkits has been a problem for plugin developers, although the emerging LV2 specification may resolve that issue.

Python and its GUI bindings have become popular for some types of music applications, Tcl/Tk remains a popular scripting language for smaller applications and rapid prototyping, and Java programmers have added a sizable number of excellent applications to the Linux audio software armory. Java audio programmers also can employ JJack, a JACK audio driver for the JavaSound API. At this time, only the Frinika sequencer

makes use of JJack, but I hope to see it receive the attention it deserves.

The JUCE multiplatform development environment provides excellent tools for developing audio applications. The JUCE framework is fully JACK-compliant, but unfortunately, its adoption has been slow so far. Current implementations include Rick Taube's GraceCL (next-generation algorithmic music environment), Kjetil Mattheussen's Mammot (massive FFT audio transformer) and Lucio Asnaghi's JOST plugin system. These programs all have attractive GUIs with excellent audio capabilities—all courtesy the JUCE framework.


Media-Optimized Linux Distributions


Audio/video-optimized Linux distributions are flourishing. Stand-out systems include Planet CCRMA, 64 Studio, JAD, MusiX, Dynebolic and Ubuntu Studio. Some of these distros include ISO images for making live CDs that can be used to test the system without installing it to your hard disk. All of them have been engineered for low-latency performance, and all are currently maintained. These distributions are the Linux audio novice's best friends; they are highly recommended for anyone who wants to work seriously with audio/MIDI on Linux.

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2.6 Kernel

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Community

Ivica Ico Bukvic is the current director of Linuxaudio.org, which is "...a not-for-profit consortium of libre software projects and artists, companies, institutions, organizations and hardware vendors using Linux kernel-based systems and allied libre software for audio-related work, with an emphasis on professional tools for the music, production, recording and broadcast industries." Among its many purposes, the organization functions as a portal to a variety of "priority" links, including URLs for an applications index, a software mirror, a VST plugins compatibility database and other useful resources.

Linux audio developers meet annually at the Linux Audio Conference, held in Koln in 2008. Rumor says that LAC2009 may be held in Parma, Italy, but no definite plans have been made at the time of this writing. This conference is the event of the season for Linux sound folk—a four-day fiesta of presentations, performances and much sharing of ideas, code and music. Keep an eye on the LAC link page at Linuxaudio.org for news of next year's conference, and be there if you can.

Program-centric communities have evolved around the maintained projects. Communications channels include the typical forums, wikis, mailing lists and IRC channels, but they now include channels, such as YouTube and MySpace. YouTube has become an especially useful channel for demonstration and instructional videos. Some examples of Linux audio software in action can be found there now, and I expect more to appear.

A wide variety of music made with Linux software can be heard at Hans Fugal's LAM site. Other good sources for Linux-made music include the Linux Audio Users mailing-list archives, the Internet Archive and, of course, the forums and other comm channels mentioned above.

Closing Remarks

In my opinion, the Linux audio infrastructure is now a solid structure, with exceptional capabilities and provision for future development. JACK is by itself a most remarkable achievement, and it has become the cornerstone for all serious audio applications, particularly in the pro-audio domain.

Configuration has been all but completely automated during installation, and post-installation configuration has become a no-brainer in most distributions. Distribution developers

deserve high praise for the work done in this regard. Again, it's not sexy stuff, but it makes a great difference to the newbies and even to the not-so-newbies.

Audio performance on the normal multitasking desktop has been a problematic point, but the PulseAudio Project promises a satisfactory resolution to that problem. Only time will tell if its adoption becomes widespread.

Normal applications that require audio support are well served by the current software map. Requested features are being implemented, and usability has improved greatly since Ye Olden Times. With software mixing and relatively xrun-free playback, the desktop audio system is looking and sounding better all the time.

Outro

In Part II of this article, I'll assess the current state of development of Linux sound and music applications. Until then, stay tuned. ■

Dave Phillips is a professional musician and writer living in Findlay, Ohio. He's been using Linux since the mid-1990s and was one of the original founders of the Linux Audio Developers group. He is the author of *The Book of Linux Music & Sound* (No Starch Press, 2000) and has written many articles on Linux music and sound issues for various journals and on-line news sites. When he isn't playing with light and sound, he enjoys reading Latin literature, practicing t'ai chi, chasing shar-pei puppies and spending time with his beloved Ivy.

Resources

Linux Journal On-line Articles by Dave Phillips:
www.linuxjournal.com/users/dave-phillips/track

List of Linux-Powered Hardware at LinuxDevices.com:
www.linuxdevices.com/articles/AT5690634012.html

The Linux Sound and Music Software Index at Linuxaudio.org: apps.linuxaudio.org

The Linux Sound and Music Applications List at linux-sound.org: linux-sound.org

The Linux Audio Music Site: lam.fugal.net

TECH TIP Easily Remove an Application after Installing from Source

If the program you want to install doesn't have a package for your distribution, you can use checkinstall to make one. Checkinstall makes Debian-, RPM- and Slackware-compatible packages. You can find checkinstall at asic-linux.com.mx/~izto/checkinstall.

Once you install it, download the source to the program you want to install and configure it and build it just as you normally would do. When it's time to run `make install`, use this instead:

```
# checkinstall
```

Checkinstall will make a package and install it on your system. The original motivation for checkinstall was to create an easy way to remove programs that had been installed from source. Now that you have a package, you can remove it like any other package on your system.

—MATTHEW MARTIN

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What Happens after Next February?

How Linux models a DIY path out of the coming DTV catastrophe. DOC SEARLS



Like many older geeks, I cut my technical teeth by hacking radio and television gear. I built my first AM receivers with crystals and wires wrapped around oatmeal boxes. In grade school, I built receivers and transmitters from kits by Lafayette and Heath. I became a ham radio operator at age 12, and I was obsessed with the innards of my Hammarlund HQ-129x receiver and my Johnson Viking I transmitter.

In high school, I put a home-brew radio station on the air, at 550kc (this was before we called cycles Hertz) on the AM dial. We had only dials then. I possessed defective math skills, but I was good with the concepts, especially as they applied in the terrestrial sphere. I understood the inverse square law and the geometries of wavelength applied to signals working in the real world.

In college, I followed a digressive path into the humanities, but maintained an obsession with RF transmission and propagation. In my twenties, I worked for a while in radio (where I got the Doc nickname), where among my duties was tweaking transmitters and climbing towers to change bulbs. Among my many minor distinctions was laying out the scenario by which many small-town FM stations in central North Carolina would grow to become 100,000-watt giants on towers up to 2,000-feet high, serving large portions of the state and beyond.

Today, on this page, I am committing a bold prophesy—one informed by more than 50 years of obsessing about RF propagation: television as we know it will end next February. It will end because nearly every station, by long-standing FCC orders, will vacate the familiar channel on which it has radiated for generations and go somewhere else on what used to be TV's "dial". More important, you're not going to get a signal at all

unless you're lucky enough to live within sight of the transmitting antenna.

Well, you might say, most of us don't get TV from antennas anymore. We get them from cable or satellite, which is true. And, most stations will continue to call themselves Channel 2 or Channel 13, even if their new digital signal is on Channel 50 or on Channel 18. But there will still be problems. UHF doesn't propagate as well as VHF. Digital signals don't degrade as gracefully. And, getting a converter box to turn digital signals into analog ones for your old television will be pointless if there's no signal there at all.

I won't even bother going into the other ways that DTV transmission will be a bust. The only thing that matters is that the conceptual basis of TV as we've known it since WWII—signals transmitted through the air, serving a physically limited region—will be nullified by reality. And, that reality will include far more than technical failings on the transmit side. The far bigger revolution will be on the production side. Because production won't be limited to entertainment giants pumping "programs" through a limited set of familiar "channels". Instead, the power to produce will belong to everybody. The ends will have the means. Horses will leave TV barns by the millions.

Which brings me to Linux, free software and open source. We've been modeling the DIY production of goods in the wild for the better part of two decades (or longer if we date our start with the origins of the Free Software movement). We've also been building our own "solutions" since long before that term came into vogue as a synonym for "products".

It's no coincidence that the transmitters on which billions watch YouTube are Linux servers. Or that Linux is in

most of the world's set-top-boxes already. As we pointed out in an UpFront piece last month, it's even in the new Sony Bravia flat screens too.

But, those solutions are all locked up. We need the open ones now—ones that let people produce and distribute whatever they want, any way they want, without the need to live within the channel-bound framework of the old closed world of television's "content distribution". We need Google, Amazon and other big "back-end" services to store our produced goods and distribute them agnostically—that is, without subordinating us to back-room dealings with Hollywood.

That's where the rub will come in. After TV as we know it fails in February, look for Hollywood to do new deals with the cable and phone carriers. The deal will be to create a two-tiered Internet—one in which the fast part will be a new TV transmission system to replace the old one. On the receiving end of Hollywood bucks will be AT&T, Comcast, Cox, Time-Warner and Verizon. The end result will be big downstream bandwidth for Big Content, and few if any upstream improvements for "consumers".

We have to fight that. There will be much call for taking the fight to Congress, but the more important battle will be in our own brains, where we'll need to come up with inventions that mother necessity for a symmetrical, unbiased Internet that works as a pure utility for everybody. If we succeed, the Linux Way wins. If we fail, we'll get TV 2.0. Sadly, it will be built on Linux too. ■

Doc Searls is Senior Editor of *Linux Journal* and a fellow with both Berkman Center for Internet and Society at Harvard University and the Center for Information Technology and Society at the University of California, Santa Barbara.

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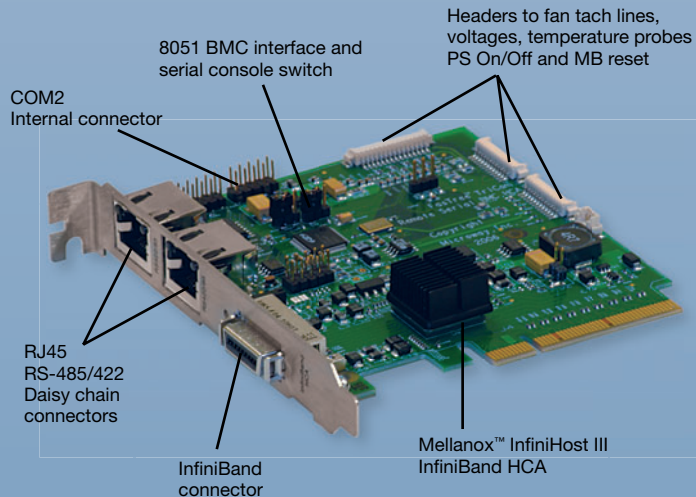


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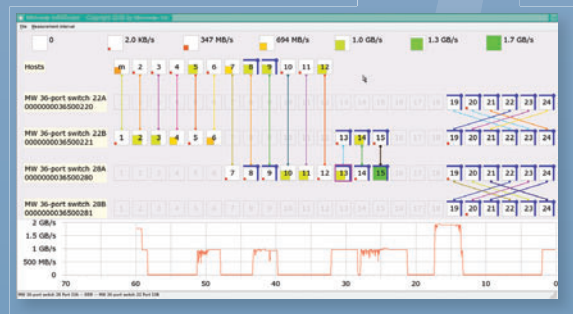
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