

Leonardo Roars for your Attention—**Fedora 11 Reviewed**

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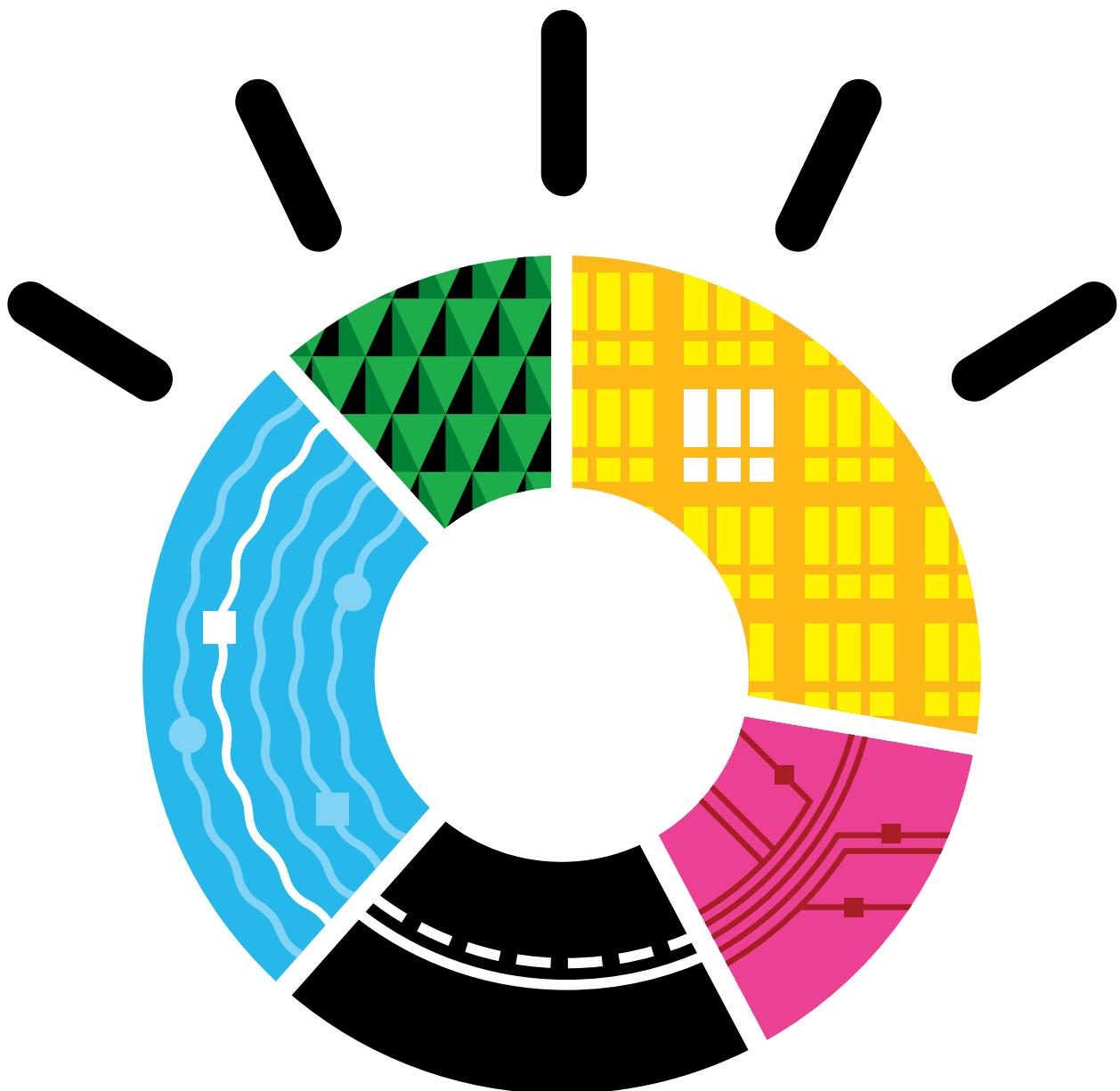
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LFY DVD: Fedora 11 'Leonidas'

This is the 11th release of this phenomenally successful RPM-based distro. Besides offering the latest kernel and software as usual, Fedora 11 "Leonidas" finally includes the DeltaRPM (Presto) support. A rock-solid workstation OS, this is a must-have distro for any full-time GNU/Linux user.



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Editorial

Dear readers

So what makes for the perfect editorial? Should we talk about what we do, or should we focus more on what's happening around us?

That's the question we tossed around in a discussion on what qualified to feature in this column.

Those of you who've read my earlier pieces will probably wonder—why this question now? Doesn't he usually write about what's happening at *LINUX For You* or the EFY Group? Yes...guilty as charged. Yet, there's no time like *now* to question one's habits and try to improve.

Back to our discussion. We all agreed that the worst thing I could do was talk about the various stories in the magazine. That being the easiest route, we unanimously reserved it for the last resort. But, what if some of the topics featured happen to be related to our own initiatives? Well, that's a tricky one, which I guess boils down to assigning priorities to each subject—in itself a subjective exercise! The verdict? We decided that we could all pool in different topics that we felt were important, as individuals. And then collectively arrive at what truly constitutes 'top priority'.

And the winner for this month, as indicated by our cover, is the launch of linuxforu.com. It's important to us for many reasons. For starters, it is totally based on open source technology. Second, since we did the entire development ourselves, we have shared with you the whole process in the true spirit of open source. Third, we genuinely believe that this website can grow into a great platform—for the Indian Linux and Open Source industry and community to spread its wings. Besides, this website will ease the common problems our readers face in trying to access our earlier issues. We will be taking most of our content online after a month or two (more about this later).

Well, the very concept of throwing open our content is an experiment! Having taken the plunge, we'll then figure out how on earth we are going to survive—will our newsstand sales go down? Will anyone still pay for the print edition? Will India's only Linux and Open Source magazine die a slow death as it grows

into a portal instead, or will the magazine become even stronger? Frankly, we don't know the answers to these questions yet. In that sense, you are with us in this, and together we shall see how this experiment pans out.

Last, and this is important for us since our future depends on it...if *we* don't highlight such an important milestone in our history and invite your feedback and guidance, who will?

since we did the entire development ourselves, we have shared with you the whole process in the true spirit of open source.

So that's about what's happening at our end. In the world around us, Microsoft's Bing was launched. We'll be following that to see if this new entrant can carve some space for itself on Google's turf. HTC's launch of an Android phone is also eagerly awaited. Nimish Dubey, our mobile phone expert, has a treat lined up for you in the coming issue.

As always, we look forward to your views. Join our discussion on what makes for a great editorial! For starters, tell us if you feel linuxforu.com is important enough to be discussed here...

Best Wishes!



Rahul Chopra
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You said it...



 I have been trying to install a Linux distro on my external hard drive, but have failed miserably over the past few months. I have tried out every distro given by you but there has been no positive result. Most devastating was when I unsuccessfully tried Dreamlinux, which had an option of being installed to an external hard drive (as mentioned by Shashwat Pant in the May 09 issue). If possible, please publish an article on installing distros on USB HDDs in the next edition of LFY.

—**Anuvrat Parashar,**
bhanuvrat@gmail.com

Shashwat replies: Kindly follow the instructions below to get the hard drive booting:

1. Make sure your motherboard supports booting from external devices like USB drives, card readers, etc.
2. Then Enter BIOS-->Advance BIOS Features-->Set First boot device; though the location depends from motherboard to motherboard and the type of BIOS it comes with. You can either try setting the first boot device to the USB-HDD or, in case this option is not available, look for the option "Set Hard Disk Boot Priority" under the same section in the BIOS. Make the attached drive as the primary booting source by slotting it as #1 in the list.
3. Again, under the Advance BIOS section, set the hard disk as the first boot device. Save and exit.
4. Now, if your motherboard supports booting from external drives, you will be able to boot from it if you have installed the distro correctly. I hope this helps you

boot Linux distros from your external hard drive. Happy and persistent booting!

Anuvrat replies: I have been fiddling around a bit with the BIOS, so all that had to be done to set up a boot priority was done perfectly. The installation of Dreamlinux on an external disk took place very well. I had opted for a 10 GB root partition, a 1 GB swap partition, and the rest as a home partition. The MBR was selected to load GRUB, and the installation was run in the absence of the internal hard drive.

When I tried to boot, 'ERROR 22' was what greeted me. And with some other configuration --perhaps with GRUB in the root partition -- the error that showed up was 'BOOTMGR missing'.

I have tried to install many other distros on my external drive in the past few months—for example, Debian Lenny, OpenSolaris 2008.11, Mandriva Spring 2008 and 2009, PCLinuxOS, openSuse 11.1, Ubuntu 8.10 and 9.04. Every time something or the other went wrong and I had to give up, disappointed. I tried my luck with Dreamlinux when I read about the possibility of installing it on an external drive. In case there is some editing to be done with GRUB, then please guide me as I do not know any thing about it except selecting it and pressing *Enter*. It would be very helpful if you could guide me further in my quest to install Dreamlinux successfully on my external drive.

Shashwat: Do let us know how you have installed the other distros? Try installing GRUB either in /dev/sda (or /dev/hda depending on type of hard disk), or create a separate /boot

partition to avoid that error. The Error 22 either means that the partition is missing, corrupted, or the boot list is messed up. Quoting <http://www.gnu.org/software/grub/manual/grub.html>: Error 22 is returned if a partition is requested in the device part of a device or full file name, which isn't on the selected disk.

Try a clean installation and please let me know what happened.

 I have been reading *LFY* since January this year. I had picked up a copy after about five years. Admittedly, I just wanted a Fedora 10 DVD, but when I saw the contents of the issue, I couldn't rest till I had finished it, and I read every single article! Since then I have been a regular reader, and the magazine never lets me down. Kudos to the *LFY* team! Keep up the good work!!!

I particularly liked some of your regular columns like *A Voyage to the Kernel*, *The Joy of Programming*, and *Programming in Python for Friends and Relations*. I was wondering if you could send me the PDFs of previous issues that featured articles from the above series. I am dying to read them from the beginning.

I have some suggestions for the magazine:

1. Please make sure that the CDs and DVDs you supply are bootable (I am talking about the PC-BSD DVD, bundled with the May 2009 issue). If you are packing multiple distros, you could create multi-boot DVDs. This saves readers the hassle of burning DVDs just for the sake of trying out the distro, and is

You said it...



eco-friendly too.

2. If possible, please bundle the PDFs of past issues on the accompanying CDs. This makes it easier to keep all the issues and search for the desired article. You could do this every six months, if not every month.
3. Can you start a series on Qt Programming? It is a huge topic, but you could carry the basics, at least.

ED: Thanks for your lovely feedback. We'll try to implement your suggestions as soon as possible. Also, we hope you've taken a look at LinuxForU.com. We're presently trying to populate it with older content for easy reference by our readers—anytime, anywhere. However, after reading it, we too have realised that we need to upload all the articles from the various ongoing series.

 I went through the beta of the LinuxForU.com website. This is my feedback:

The positive points:

1. Great design and the 'look 'n' feel' was good.
2. Does not take much time to load, even though there are many pictures and video links throughout the site.
3. I have the 'NoScript Plugin' installed for my Iceweasel in Debian. But I did not notice the site making much noise around loading JS elements.
4. The ads on the site are much more related to Linux and FOSS, though I did observe some ads for games.
5. Most of the articles from the previous issues are being scanned and posted onto the

site. I liked this feature, since many people would like to read one or two articles before buying the magazine.

6. The link to 'Distro Reviews' was a cool idea.
7. The code part or the developer's perspective is respected by adding links to the developer content from the magazine. Keep this going.

The negative points:

1. There isn't a single place where I can view the magazine as a whole. I would like a link to lfymag.com from the site.
2. Readers would like to know more about our editors and main authors. You may want to add this too.
3. Let people know that this site is from India
4. A link to a section like 'About Us' will spread LFY faster. There could be static places with a brief history about Linux and its evolution, and a brief introduction/history about LFY too.
5. There is a 'tips and tricks' column in the site. But I did not come to know how to add my tip to the existing ones. Or did I overlook something?

Dont's:

1. Please don't add a forum feature to this site. You will recall how difficult it was to search for Linux content when we had the forum the last time around.
2. Even if you plan to have one, please make sure only members of LFY can add a post or even a comment. This will stop spam.
Hope some of these points are of use. Please let me know if

I could help in website creation or maintenance, since I am also into Web development through J2EE.

Ananth Gouri, ananth.gouri@gmail.com

ED: Thanks a super ton for your comprehensive feedback. Will surely work with the team to try and reduce the negative points. As for the forum, we do plan to have one, but will use a better package this time -- one that has security features built in, and with special privileges for our authors and subscribers.



Great looking website! However, it fails accessibility test under WCAG. These errors are minor and can be easily rectified. There are a lot of people with disabilities using the Net and Linux [I'm a person with cerebral palsy, and use Linux since PCQ first got it out in the 90s]. Please follow the WCAG guidelines and put a logo of accessibility so that this would encourage others to do so.

Nilesh Singit, Disability Rights Activist, www.nileshsingit.org

ED: Thanks a lot for the feedback. We will surely try and fix this issue. Once we believe we have rectified it—we will get back to you to seek your suggestions for further improvement.

Please send your comments or suggestions to:

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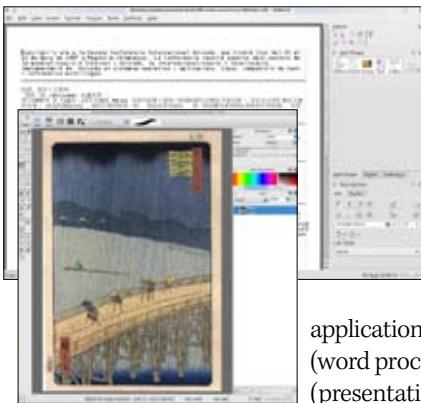
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Technology News

KOffice 2.0 debuts with a well thought out UI

Marking the end of more than three years of work to port KOffice to Qt 4 and the KDE4 libraries and, in some cases, totally rewrite the engine of the KOffice applications, the KOffice team has finally announced version 2.0.0 of KOffice. The intention, according to the developers, has been to increase integration between the components of KOffice, decrease duplication of functionality, and ease maintenance and development of new features. Furthermore, new approaches to UI design and interacting with the user have been implemented to support the new capabilities.



The team has claimed that the release is mainly aimed at developers, testers and early adopters.

KOffice 2.0 does not have all the features that KOffice 1.6 had. These features will return in the upcoming versions 2.1 and 2.2, in most cases better implemented and more efficient. Also, not all applications that were part of KOffice 1.6 made it into KOffice 2.0. The missing applications will return in 2.1 or possibly 2.2.

The release team has decided that the following applications are mature enough to be part of 2.0: KWord (word processor), KSpread (spreadsheet), KPresenter (presentation tool), KPlato (project management), Karbon (vector graphics editor) and Krita (raster graphics editor).

Besides this, the chart application KChart is available as a shape plug-in, which means that charts are available in all the KOffice applications in an integrated manner. The desktop database creator Kexi and the formula shape are aimed to be made available in version 2.1.

Time to compile Linux 2.6.30

With the majority of the code enhancements in data storage, Linus Torvalds has released Linux 2.6.30, kernelnewbies.org, and he summarises the release as follows: "This version adds the log-structured NILFS2 filesystem, a filesystem for object-based storage devices, a caching layer for local caching of NFS data, the RDS protocol which delivers high-performance reliable connections between the servers of a cluster, a distributed networking filesystem (POHMELEFS), automatic flushing of files on renames/truncates in ext3, ext4 and btrfs, preliminary support for the 802.11w drafts, support for the Microblaze architecture, the Tomoyo security module, DRM support for the Radeon R6xx/R7xx graphic cards, asynchronous scanning of devices and partitions for faster bootup, MD support for switching between raid5/6 modes, the preadv/pwritev syscalls, several new drivers and many other small improvements."

Citrix delivers XenServer 5.5

Citrix Systems has released Citrix XenServer 5.5. This version adds a wide range of new features that enable easier virtualisation management and broader integration with enterprise systems. It includes features such as consolidated back-up, enhanced conversion and search tools, Active Directory integration and expanded guest support for virtually every version of Windows and Linux. With the new 5.5 release, XenServer provides all the functionality that typically costs up to \$5,000 per server with other leading virtualisation products, for free. Also released is Citrix Essentials 5.5 for XenServer and Hyper-V, providing advanced virtualisation management capabilities for customers using XenServer or Microsoft Hyper-V.

Before Mac/Windows, USB 3.0 comes to Linux

Even before the availability of a USB 3.0 hardware device, it seems that support has been built into the Linux kernel, and will debut with the release of v2.6.31. On June 7, Intel's Sarah Sharp, the chief author of the driver, announced in her blog: "The xHCI (USB 3.0) host controller driver and initial support for USB 3.0 devices is now publicly available on my kernel.org git tree. Greg K-H has queued the patches for 2.6.31, so Linux users should have official USB 3.0 support around September 2009. This is impeccable timing, since NEC recently announced they'll be producing 1 million xHCI PCI express add-in cards in September... I'm working with Keve Gabbert (the OSV person in my group at Intel) to make sure that Linux distributions like Ubuntu and Red Hat pick up the xHCI driver. Advanced users can always compile their own kernel on a standard distro install."

CrossOver 8.0 for Windows apps on Linux

CodeWeavers has announced the release of CrossOver Linux 8.0. CrossOver 8.0 includes support for Internet Explorer 7, Quicken 2009 and performance upgrades for Microsoft Office 2007, particularly Outlook. Another major benefit of CrossOver 8.0 is that recent Wine Project developments have resulted in support for a myriad new applications. CrossOver Linux Standard is priced at \$39.95, and is a download-only product. It is priced at \$69.95,

and can be delivered with an optional CD.





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Technology News

OpenSolaris 2009.06 released

Sun Microsystems has released the OpenSolaris 2009.06 operating system, with significant improvements in networking, storage and virtualisation, in addition to performance enhancements and developer productivity updates. Central to the new release is the inclusion of Project Crossbow.



As a follow on to the ZFS technology, Project Crossbow's complete re-architecture of the network stack becomes the new standard for how networking at the operating system level is done. It delivers the networking capability designed for virtualisation in combination with highly scaled, multiple-core, multi-threaded processors connected with extremely fast network interfaces.

New, fully integrated Flash storage support in ZFS helps in optimising large-scale pools of storage by designating Flash devices as write accelerators and read accelerators. These pools are automatically managed by ZFS to achieve extreme levels of performance across many workloads, making the need for small caches on RAID controllers obsolete.

Native support for Microsoft CIFS has been added as a full peer to NFS, as a high performance kernel with integrated features and support for Microsoft Windows semantics for security, naming and access rights, allowing transparent use and sharing of files across Windows, Linux and Solaris environments. In addition to this, the OpenSolaris platform delivers key server virtualisation technologies in the form of Solaris Containers, Logical Domains (LDoms) for Sun CMT systems and the Xen-based hypervisor to give users a complete virtualisation platform built directly into the OpenSolaris OS. To find more information on these technologies, visit opensolaris.com/learn.

Acer Aspire 5536 comes with Linux

Acer has rolled out the Aspire 5536 notebook based on the AMD Athlon X2 Dual-Core processor. The Aspire 5536 entertainment notebook harnesses the power AMD Athlon X2 Dual-Core processor and a high-quality HD graphics solution to deliver an improved multimedia performance. The notebook also features AMD's latest M780G chipset with ATI Radeon HD 4570 graphics, enabling what it claims is the ultimate visual experience on-the-go. The Aspire 5536 notebook features a 15.6" HD CineCrystal screen. In addition, the new range is equipped with floating keyboards and controls, a multi-gesture touchpad that comes with circular-motion scrolling for quick and seamless navigation, pinch-action for zoom-in and zoom-out, and page flip for browsing and flipping through Web pages and photos. Other specs include

a 2 GB DDR3 1067 MHz, upgradeable up to 4 GB; a 320 GB HDD; a 8X DVD-Super Multi double-layer drive; a Dolby8-optimised surround sound system with two built-in stereo speakers; an integrated Acer Crystal Eye high-def webcam, featuring 640 x 480 @ 30 FPS; and a one year ITW. Available at all Acer Authorised Dealership and retail outlets, the Aspire 5536 Linux edition is priced at Rs 28,499.



LG to embed virtual desktop technology into monitors

LG Electronics is going to produce a new category of SmartVine N-series LCD monitors that include embedded 'virtualisation' technology from US-based NComputing Inc., enabling up to 11 people to share a single PC. These monitors will be marketed worldwide by LG beginning June. The sub-\$200 computing solution will bring its global distribution network to the alliance, while NComputing will contribute its hardware and vSpace virtualisation software. NComputing technology enables a single PC or server to be virtualised so that many users can tap the unused capacity.

LG's new flatscreen monitors will work with both Windows and Linux computers. Users connect their keyboards and mice directly to the monitor, which then connects to the host PC via a standard cable. An NComputing X550 PCI Card Kit with vSpace software enables the host PC to connect to five additional monitors. With two kits, a total of 11 users can share one PC.

In the United States, the LG SmartVine N-series line will include 17-inch (43.2 cm) and 19-inch (48.3 cm) class monitors (models N1742L-BF and N1941W-PF) covering both standard and widescreen resolutions. A 16-inch (40.6 cm) class model will also be available in other countries. All LG SmartVine N-series monitors can also be used as traditional monitors that connect through VGA for ultimate flexibility.

Technology News

WordPress 2.8 claims to be snappier

Just a few days before we officially relaunched LinuxForU.com, which is powered by WordPress 2.7.1, Matt Mullenweg announced the release of version 2.8—talk

about bad timing. “2.8 represents a nice fit and finished release for WordPress with improvements to themes, widgets, taxonomies, and overall speed. We also fixed over 790 bugs,” Mullenweg announced.

According to the announcement, the new version is much faster than the older releases, in addition to changes in the way WordPress does styling and scripting. “If you make edits

or tweaks to themes or plugins from your dashboard, you’ll appreciate the new CodePress editor which gives syntax highlighting to the previously-plain editor. Also, there is now contextual documentation for the functions in the file you’re editing linked right below the editor... We’ve completely redesigned the widgets interface (which we didn’t have time to do in 2.7) to allow you to do things like edit widgets on-the-fly, have multiple copies of the same widget, drag and drop widgets between sidebars, and save inactive widgets so you don’t lose all their settings. Developers now have access to a much cleaner and robust API for creating widgets as well,” Mullenweg wrote in his official WordPress.org blog. “Finally you should explore the new Screen Options on every page... Now, for example, if you have a wide monitor, you could set up your dashboard to have four columns of widgets instead of the two it has by default. On other pages you can change how many items show per page.”

Firefox 3.5 RC2 released

The Mozilla developers have announced the second release candidate of Firefox 3.5. New features and changes in this milestone include: support for over 70 languages; improved tools to control a user’s private data, including a Private Browsing Mode; support for the HTML5 `<video>` and `<audio>` elements, including native support for Ogg Theora encoded video and Vorbis encoded audio, and better performance and stability with the new TraceMonkey JavaScript engine. Version 3.5 also has the ability to provide Location Aware Browsing using Web standards for geolocation; support for native JSON, and Web worker threads; improvements to the Gecko layout engine, including speculative parsing for faster content rendering; support for new Web technologies such as downloadable fonts, CSS media queries, new transformations and properties, JavaScript query selectors, HTML5 local storage and offline application storage, `<canvas>` text, ICC profiles, and SVG transforms. Those who can’t wait for the final version can grab it from www.mozilla.com/en-US/firefox/all-rc.html.

Wind River Hypervisor for multi-core device development

Wind River has released a hypervisor, which it claims to be “...a key pillar of Wind River’s comprehensive Multicore Software Solution for device development.” The Wind River Hypervisor is a Type-1 hypervisor that supports virtualisation on single and multi-core processors. It provides integration with Wind River’s operating systems (VxWorks and Wind River Linux), as well as others. The new hypervisor enables virtualisation for devices



across a broad range of market segments, including aerospace and defence, automotive, consumer devices, industrial, and networking. Its key features include: support for single and multi-core processors; focus on real-time aspects such as performance, latency, determinism and minimal footprint; protection between operating systems and cores, including starting, stopping and reloading operating systems to increase reliability.

Safentrix: A hosted, free e-mail security service

Safentrix is a hosted e-mail security service that has been launched in India. It claims to offer 100 per cent virus protection and 99 per cent spam protection. The service offers seven different layers of spam protection that include: IP checks, HELO checks, selective greylisting, sender address/domain verification, recipient address/domain verification, in-house blacklist checks, and content checks. The good part is that being a hosted service, no hardware/software are required from the user side. It claims compatibility with ‘all modern e-mail servers’ including Qmail, Sendmail, Postfix, Lotus Notes and Exchange Server, as well as with hosting services like Yahoo! and Gmail. The three-step set-up process includes: registering and creating an account using an automated process; adding domains, corresponding delivery records and user names; and changing the MX record for the domain.

Safentrix is offered in two flavours, the standard and premium service. The former is absolutely free of cost with no compromises

on e-mail security. The premium service offers additional peace of mind through compliance with industry standards (HIPAA, GLB) and a 100 per cent service-level agreement warranty. For more details visit www.safentrix.com.

KNOW HOW



QI have been using Linux for the past one year and have fallen in love with the command line interface. There is a problem I face with my *caps lock* key: it always gets pressed unknowingly while pressing the tab key. Is there any way by which I can turn off the Caps Lock key while I am working on CLI?

—Adrian Pacheco, Mangalore

A. You can turn off the Caps Lock key through the command line interface by using the *xmodmap* command. Run:

```
xmodmap -e "remove lock = Caps Lock"
```

To reactivate the key, run:

```
xmodmap -e "add lock = Caps Lock"
```

Go through the man pages of *xmodmap* to know more about this command.

QI have two systems at home and have installed openSUSE 11.1 on both. I want to know if there's any way by which I can use 'One Click Install' to install software on my second system, which I access

using SSH. Both my systems have an Internet connection.

—Sanjay Mukherjee,
Faridabad

A. There is a command line tool in openSUSE that allows you to install software using 'One Click Install' over SSH. You need to *ssh* to the remote computer and run *OCICLI*.

```
# OCICLI <Path to software_name.ymp>
```

This will work similar to the GUI tool.

QI have a script that runs on my server, which does a few of the tasks that I need to perform every time I reboot my server. Is there a way I can execute this script automatically every time my server reboots? Currently, I manually run the script after every reboot. I am using CentOS 5.2.

—Ajay Rathore, Jaipur

A. To run your script at boot time you need to first copy your script to the */etc/init.d/* directory:

```
# cp <Your_Script> /etc/init.d
```

Now make it executable as follows:

```
# chmod +x <Your_Script>
```

Create a link to the script for all the run levels that you want your script to run:

```
#ln -s /etc/init.d/<scriptfile> /etc/
rc.d/rc5.d/S85<Your_Script>
#ln -s /etc/init.d/<scriptfile> /etc/
rc.d/rc5.d/K85<Your_Script>
```

You can do this for other run levels too, if required:

```
#ln -s /etc/init.d/<scriptfile> /etc/
rc.d/rc3.d/S85<Your_Script>
#ln -s /etc/init.d/<scriptfile> /etc/
rc.d/rc3.d/K85<Your_Script>
```

The name of each symbolic link begins with either a K or an S. K links are processes that are killed on that run level, while those beginning with an S are started. The S85 tells the system to start the script after starting all scripts with a lower number, and so is the case while killing at shutdown.

QI have a P4-based computer with 2 GB of RAM and two 160 GB hard disks. A few days back I bought a copy of *LINUX For You* that came with the Mandriva 2009.1 DVD. I want to try Mandriva, but I am scared that it will delete or damage all my existing data and OS. Currently, I am using Windows XP. Besides, will Mandriva run on my computer?

—S. Ram, Kochi

A. Mandriva will run on your computer without any problems. The minimum requirement for Mandriva is any Intel or AMD processor with 256 MB of RAM and 3 GB of free hard disk space. Its 3D desktop features require NVIDIA GeForce or later, ATI Radeon 7000 or later, or Intel i845 vga or later.

Installing Mandriva will not do any harm to your existing OS or data. All you need is to be careful while dealing with the partition tool. Try installing it on a free partition/space, if you have one, or else you can even resize your partition. Backing up your data is always recommended.



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GIMP for Beginners

Part 1: User Interface



The GIMP is a great tool, but many of us don't even know how to get started with it. So let's get a grip on this powerful image manipulation tool, beginning with its user interface.

The GIMP or the GNU Image Manipulation program is a free and open source raster image editing software. It is very powerful and a great alternative to Photoshop. It has always been denounced for an interface that's too perplexing for newbies.

I always wondered how people could be so good at creating wallpapers and editing images. I even asked them and tried Photoshop many a time. But its complexity always forced me to un-install it. One fine day, I installed Linux and started playing with the GIMP, as it was the default image editor. It wasn't long before I got used to it. I am still discovering uncovered facts and reaching newer shores with this tool. After I became comfortable with the GIMP, it was just a matter of time before I created a wallpaper, edited an image or any other work of art.

Now, allow me to guide you through the first leg of this tutorial where you will get introduced to a few basic facts about the interface, several basic editing tools, how to spice up photos, and other tips and tricks. Once we get these done, we will explore how to make wallpapers and designs with this image editor.

First, let me introduce you to the GIMP 2.6 interface and what those tools are meant for.

But before we get started, it is necessary to install the application (preferably, the latest version). The current stable version is 2.6.6 and it ensures that you are not affected by unwanted bugs. Every new Linux distribution comes with the GIMP 2.6 as the default image editing program. If you have an older

revision, you can update it using your package manager. If your operating system doesn't ship with it, head to www.gimp.org to find a binary installation package for your OS. Since the GIMP is a cross-platform software, it is available for nearly all the operating systems, ranging from Linux and Windows, to Mac OS and BSD. Thus, it shouldn't be a problem for you to get your binary package.

The interface

Once you have finished the installation, it's time to start the application. GIMP starts with a 'Splash Screen'; the initial loading can be a bit long depending on the system you use and the number of fonts and plug-ins installed. But this load time becomes much snappier from next time onwards.



Tips: You can change the splash screen by creating a 'splashes' directory in the `.gimp` folder.

- Linux: `~/.gimp/splashes`
 - Windows: `X:\Documents and Settings\username\.gimp-2.6\splashes`
- And copy the desired splash image with `gimp-splash.png` name

The default interface of the GIMP consists of three features:

1. **Toolbox:** This consists of tools and the tools option to perform several operations.
2. **Image Window:** This is the section where you

can do editing and drawing. It loads images and provides you with a platform to showcase your creativity.

3. **Layer Option:** The toolbar lists all the major functions like setting layers, paths and several other functions. The GIMP's interface is very flexible. You can easily customise it to suit your work needs.



Tips: You can always alter the interface for better ergonomics and for a lucid work experience. To change the interface, simply drag the icon/toolbox name and drop it in the area assigned (Figure 2). For example, to make the left toolbox utilise less space, we need to adjust the tool options located at the lower end. To do so, just click on the name written in bold black. By default, it is the Paintbrush, so drag it to the empty space in the right toolbar near the other tabs like Layer, Channel, etc.

Now just resize the left toolbar to give it a more streamlined look. It is advisable to change the default interface for a better and faster work experience.

Once you get the interface altered, you can start learning about the tools and options that the GIMP ships with. Another important aspect of note is the new interface. Since we will be using version 2.6 for our tutorial, please bear in mind that this version has a new kind of windows list —i.e., the toolbox, layerbox and current window has been merged into one windows list, making it easier for users to work with. But this new interface doesn't work well with KDE's Kwin and Compiz window managers; so if you are using any of these, you might face some problems while using the new interface.

The toolbox and layerbox don't stay on top of the image windows. In order to work with the GIMP in these two listed window managers you have to restore the default behaviour of version 2.4. To do this, simply navigate to *Edit→Preferences→Window Management* and select 'Normal Window' in both the drop down menus, save and restart the GIMP. You will now be able to use it without problem.

The toolbox

The toolbox that appears to the left side of the GIMP consists of useful tools. It's a one-stop-shop for all the tools you need. The main aim of the toolbox is to improve the user experience and enable faster use. You can always add or remove tools from it according to your needs. To add additional tools navigate to *Windows→Dockable Dialogs→Tools* and add the desired tools.

The toolbox, as you can see in Figure 5, has a lot of tools. The main toolbox has been divided into four categories. The upper portion with an faint image of Wilber [the GIMP's logo] is a drop area, into which you can directly drop your image and start editing or manipulating it.

The second portion consists of tools and the colour selector. You will notice there are two swatches for colour

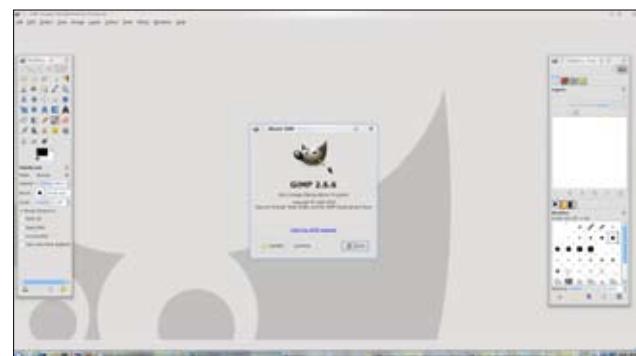


Figure 1: Default interface

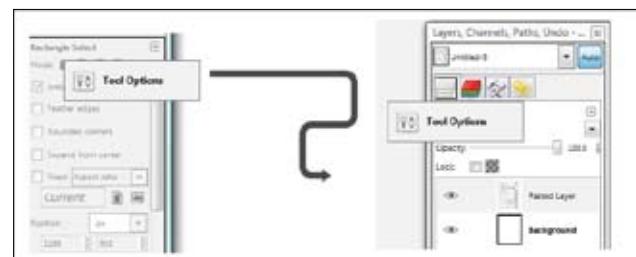


Figure 2: Dropping items at the dock station



Figure 3: Modified interface

selection—the one above is for the foreground and the lower one is for background colour selection. Just click it and select the colour. There's no need to worry about what these two are meant for—we will learn about them later.

The third and extremely useful section has the tool options. As the name suggests, these offer features and settings for the tools you select from the second section, i.e., by clicking on the tools icon. The options are variable and depend on the tools you select.

The last section comprises *save*, *restore*, *delete*, and *reset*. These options are used to set a default value for any of the tools. For example, if you generally use big brushes for painting, then from this option, all you need to do is set the desired value and save it. From the next time onwards, whenever you choose the brush, you can use it with the saved settings.

Do note the bulging lines just below the *colour selector* and the *save/restore* options. These are docking stations for different tools that you may like to use and are handy in customising the interface of the GIMP. You can drop dialogue boxes as already mentioned earlier, in Figure 2.

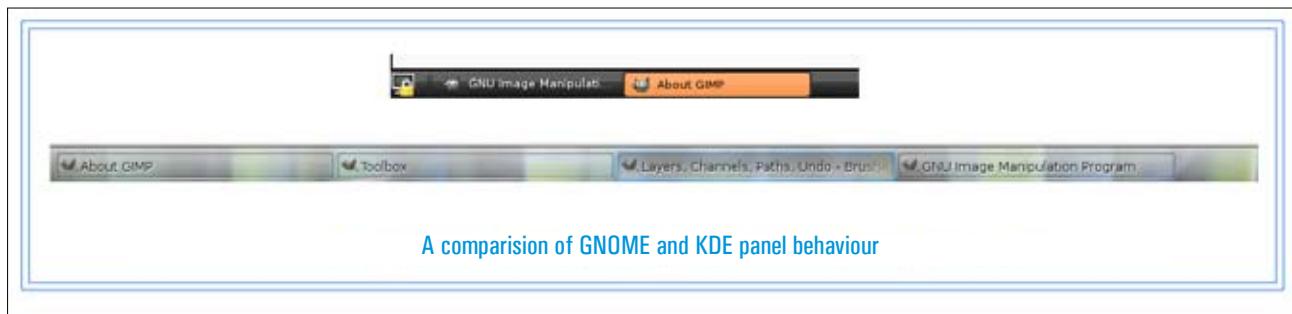


Figure 4: A comparison of the windows lists of GNOME and KDE

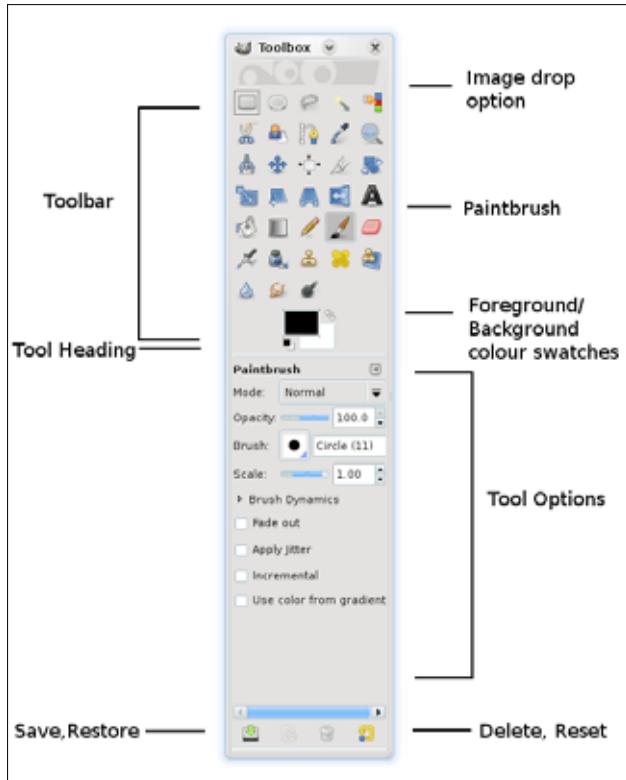


Figure 5: The default toolbox



Figure 6: The image window

The image window

The image window or the middle screen with the big Wilber logo is where you create wallpaper/edit pictures and do other such creative work. It's like a drawing book with tools on the side.

The image windows in version 2.6 have all the options unlike in the 2.4 series or older, where few options were scattered over the toolbox too. The menu has a plethora of options that are all listed, along with many others, in the *tools/layer box* menus, making it easier for you to access if you close any toolbox.

The *image window* menu options are as follows:

1. *File*: This menu has tools to create new images, and save, load, export and print them at your will.
2. *Edit*: Here you will find tools to undo/redo the mistakes you keep on doing while creating images. GIMP is the only image editor that allows quite a handful of undo steps (by default), and lets you easily go back and rectify or improve the image if you want. This section also lists a 'Preferences' icon, which lets you configure GIMP. The section also has a tool to provide easy outlines to selection.
3. *Select*: This menu basically lists tools for different kinds of selections, making it easier for the user to perform complex tasks such as providing a border with ease. Actions like shrinking, expanding and distorting a selection would never have been so easy without these tools.
4. *View*: This section gives you an access to complex mesh type views for more professional and precise drawing with a handful of other plug-ins.
5. *Image*: Here you can resize and crop the image. You can also fill in picture metadata, assign colour profiles and perform various image-related functions.
6. *Layers*: This section is almost the same as the image section, but is only applicable for layers. We will learn about layers in upcoming tutorials.
7. *Colours*: All the mixing, blending, paths and posterizing tools are listed here. You can add some breathtaking effects with just a few tweaks. The much-hyped GEGL feature can be enabled from this section.
8. *Tools*: This is a very handy section in case you close any other toolbar by mistake. It has all the tools (more than what are listed in *tools* and *layerbox*).
9. *Filters*: This is the wicked witch store for all the fancy effects and magic that you need for an extraordinary and sparkling effect if you wish to mesmerise your friends with the power of FOSS. The section has lots of sub-sections, leading to various magical wands

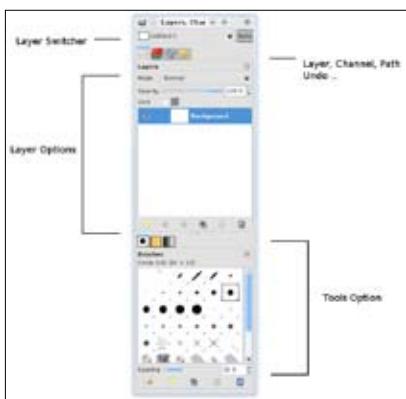


Figure 7: The layerbox

that you will need later to create unusual effects.

10. Windows: This is a new option that made its debut with version 2.6. It is a recovery stop for those who've managed to mess up their GIMP interface. For example, you can re-enable the layer menu if closed by mistake. [If this option fails you could try deleting menu config in `~/gimp-2.6/`.]

11. Help: This menu shows you information about the application version and provides links to the GIMP manual and other *Help* documents.

Once you add an image or a new template, you will notice some new options in the lower part of image window—for example, the zoom option—which is an extremely useful tool to make editing easier with accurate results.

On the lower right corner, you will see a four-directional arrow. This allows you to access/set any part of the image(s) while working. It is handy when you are working with high-resolution images or creating wallpapers.

The layer box

The layer box (Figure 7) is the last toolbox that appears on the right side of the screen. As the name suggests, this toolbox has been designed to work with layers. Like its sibling—the toolbox—the layerbox has also been partitioned into four sections.

The first option is the layer switcher. This drop down menu helps you easily switch between layers of two or more different images. This is only useful when working with multiple multi-layer images.

The second section has four tabs—*layer*, *channel*, *path* and *undo history*. *Layer* is to manage layers and it displays all the layers in the image. *Channel* lists the red-green-blue (RGB) colours in the image—you can disable any of them by clicking on the eye. *Path* is a very useful section when working with the path tool. It tracks the history of the path created [only with the path tool] and helps you easily use it in case you've lost the path that you had created.

Undo history lists all the steps/changes you have applied to an image. You can easily step down and undo any change with a simple click.

In the next section (down the layer box) you will notice the brush, patten and gradient tabs. You can choose any preset template and use it while drawing.

The bottom-most option is for the editing brush, gradient and patters. You can even create your own patters and brushes with easy options.

Well, this pretty much sums up the basics of the GIMP's interface. In the next article, we'll learn more about working with the interface.

It is very important to get comfortable with the user interface before working with it. So even if this tutorial was not sufficient, don't worry too much; you will only learn the ropes when you start using it regularly. Knowing a little bit of image editing comes very handy, whatever job you do! 

By: Shashwat Pant

The author is a FOSS/hardware enthusiast who likes to review software and tweak his hardware for optimum performance. He is interested in Python/Qt programming and fond of benchmarking the latest distros and applications.

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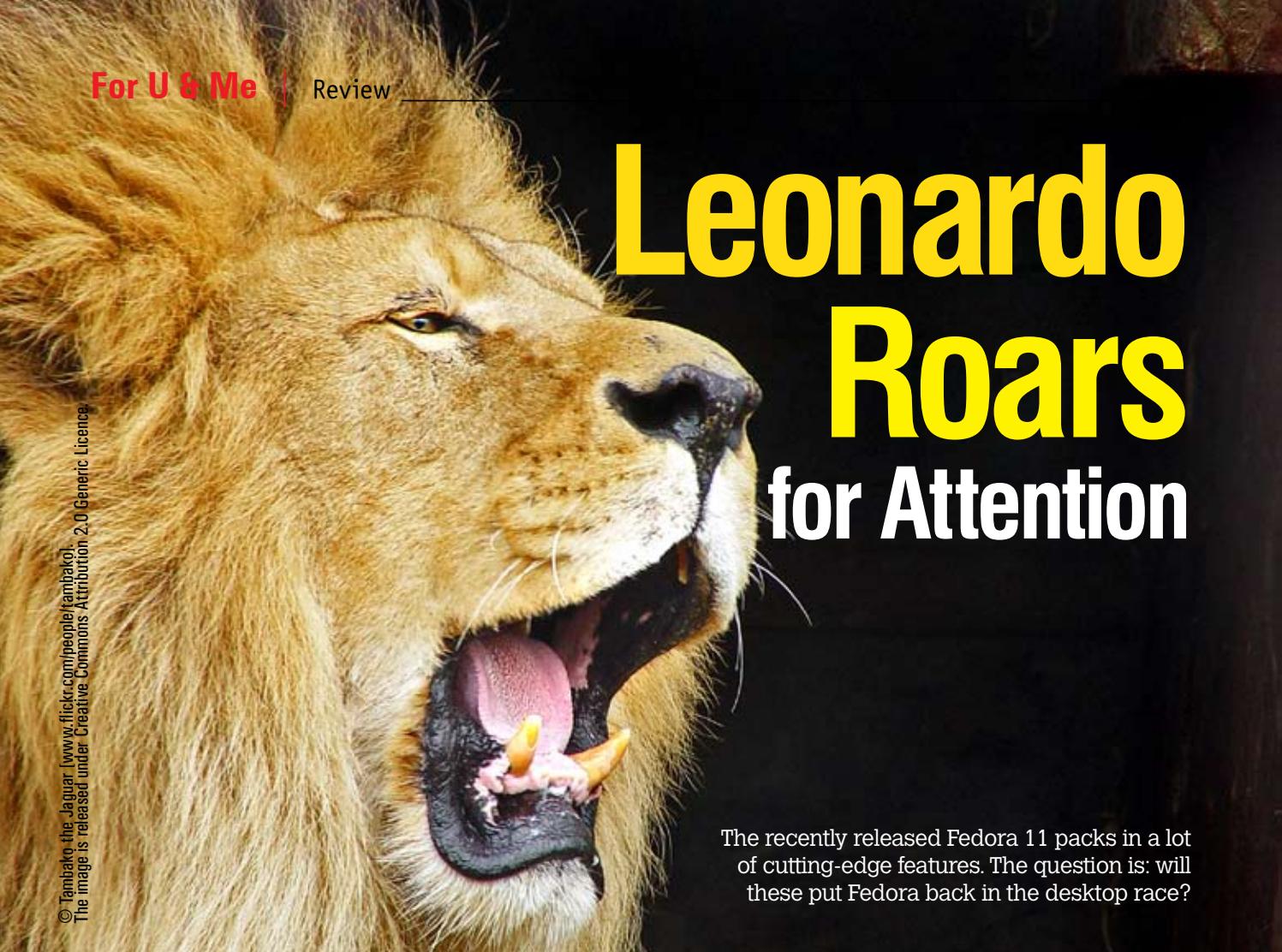


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Leonardo Roars for Attention

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The recently released Fedora 11 packs in a lot of cutting-edge features. The question is: will these put Fedora back in the desktop race?

A 20-second boot, Ext4 as default filesystem, Firefox 3.5 and Thunderbird 3.0, OpenOffice.org 3.1, Delta RPM support, better support for fingerprint readers, automatic fonts and mime installer... Well, these were some of the 50 odd features listed on the project website [fedoraproject.org/wiki/Releases/11/FeatureList] when the Fedora 11 development was taking shape. The good news is, when the final release was out, the status for all these listed features was 100 per cent. Impressive, eh?

Naturally, the next step was to head over to fedoraproject.org and download the ISO. As is the norm with any other distro, Fedora 11 (codenamed Leonardo) comes as an installable DVD, or live CDs of various spins, including GNOME and KDE. I chose GNOME (for a change), because features such as automatic codec and mime installation are reportedly GNOME-only for this release. Talk about treating KDE as your step child ;-)

The test systems

An HP 550 laptop with the following specs:

- Intel Core 2 Duo T5470 (1.6 GHz, 800 MHz FSB, 2 MB L2 cache)
- 1 GB 667 MHz DDR2 SDRAM
- 160 GB 5400 rpm SATA
- Mobile Intel GMA X3100 graphics

An assembled AMD-based desktop with the following specs:

- AMD Athlon X2 5600+ Dual Core (2.8 GHz, 2000 MHz HyperTransport, 1 MB L2 Cache)
- 2 GB 800 MHz DDR2 SDRAM
- 250 GB 7200 rpm SATA + 160GB 7200 rpm PATA
- NVIDIA 7050 PV (integrated graphics inside an ASUS M2N-VM DVI MoBo)

Test drive on a live CD

Since the kernel modesetting (KMS) works on Intel (as well as ATI) graphics cards, but not on NVIDIA by default, I booted the HP laptop first. KMS is the backbone of Plymouth, the replacement for RHGB for boot splash, which helps in a flicker-free X server initialisation.

While booting the live CD, I noticed the new splash screen—the Fedora infinity logo. You see the magic of KMS when GDM loads after the initial boot—the transition effect is, in fact, smooth. You understand the point that Fedora developers are trying to make when they say: “The start-up experience needs to be flicker-free, seamless and shiny.”

On the GDM screen, I also noticed what I believe is the new option for logging in using a finger impression, provided you have a fingerprint reader. I don’t, so I couldn’t test this one.

After logging into the desktop, you’re greeted by the excellent Fedora wallpaper—I loved it for the first time since the project’s inception. It has that professional touch that was always missing. Apart from this, things look pretty much the same visually. It’s the same GNOME 2.6 that we already know of from the Ubuntu and Mandriva Spring releases. The icon set, dubbed Fedora, is the plain old customised theme that made its debut with Fedora 7. Whatever happened to the Echo theme?

A change that I noticed is the new volume control tool. This one gets rid of the separate GNOME ALSA mixer and the one offered by PulseAudio, and integrates everything at one place. It makes sense to control all volumes from one location, but the application lacks the amount of mixers present in the ALSA mixer.

What’s quite discouraging to see is the lack of applications on the live CD. OpenOffice.org is missing, and so is a general digital camera/photo manager application like F-Spot. Well, of course, these can be installed from the online repository, but what is it that fills up the 687MB CD that leaves no room for OOo (which is present by default on all other live CD distros)? The Fedora team says it chooses to support a more complete set of languages that takes up the space as compared to others supporting only English (US). Good enough reasoning, but I guess if you choose to use another localisation setting, it’s a smaller download compared to OOo’s size, which most people will anyway need. The provided AbiWord as a replacement word processor is no solution at all.

Installation notes

Well, time to install the distro. The live installer, I gotta admit, is snappy. The only downside: you don’t have a say in the filesystem you’d like to use for your root. Fedora defaults to ext4. We’ve all heard a lot about data loss in this new FS when a computer is not properly shut down or if the OS crashes—a problem also common with XFS. Ext3, that way, has always been a safe bet. The kernel developers have obviously taken note of the complaints and patches to cure this have been included in version 2.6.30. Fedora, however, ships with 2.6.29, but the developers have reportedly backported these patches to its kernel.

I’d say, good job there. However, I have serious issues with giving the user no choice apart from ext4 for his root FS. The reason being, as I’ve been told, live CDs don’t have the ability to change filesystems. Essentially, they transfer a single pre-formatted image to the disk and write a boot loader on the system at the end of the process. You can, however, choose



Figure 1: Live CD installer reports ext4 is the only option for root partition

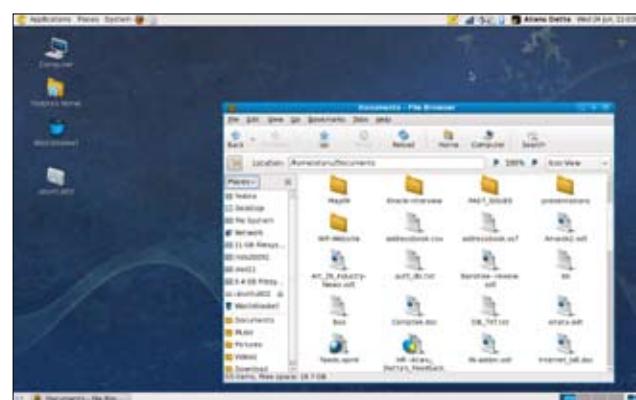


Figure 2: Fedora desktop with the Echo icon theme

your own FS if you’re using the installable DVD. Well, other live systems—viz., Ubuntu, Mandriva, openSUSE—surely let you select your own FS even when you install from live CDs.

Anyway, ext4 it is. The problem again is, it’ll force you to create a separate /boot partition of ext3 type, because GRUB still doesn’t have support for ext4. Anyway, enough with the complaints, the installer manages to copy the whole system within 5 to 6 minutes, which I gotta admit is amongst the fastest.

LFY, on the other hand, chose to bundle the DVD for being a more complete package. I got access to the DVD a bit later, which prompted me for fresh install on my assembled desktop PC. Anaconda behaves pretty much the same way, with all the options remaining the same. I still have issues with the partition screen where, by default, it’s set to erase all your partitions. You must select to manually set the partitions from the drop down, unless you’re using a blank hard disk.

While the installation using the live CD was faster compared to the other distros, the installable DVD took a lot of time installing packages. It took more than half-an-hour with the default choice of packages—the only thing that I had added to it were the packages under the virtualisation section. What I’ve noticed with Anaconda over the last few releases is that it starts off installing the packages at good speed, and then gradually slows down irrespective of the package size that it’s installing.

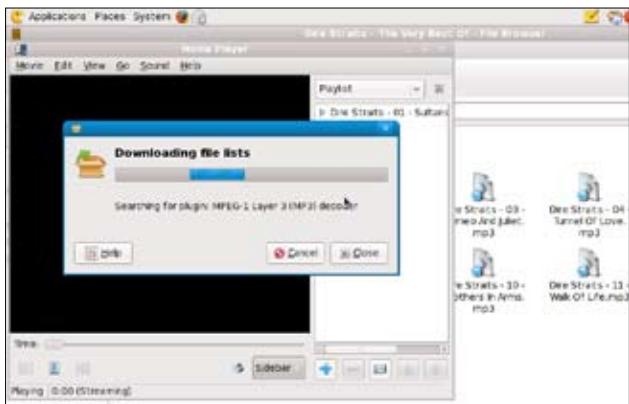


Figure 3: Fedora automatically looks for missing codecs

Back to the desktop

Booting up the brand new system, I notice the flicker-free X server initialisation missing because of being on a system with an NVIDIA chipset. The good thing is Fedora now uses the free Nouveau drivers for NVIDIA instead of NV—we all knew how unreliable NV was, right? I remember Fedora 10 live CD won't even start the X server; F11, on the other hand, even lets me use the maximum resolution of 1280x1028 using Nouveau.

Oh yes, the DVD installation gave me a more complete GNOME desktop, including OOo and F-Spot. Talking about OOo, its icons are still the ones that appeared with the release of Red Hat 8 back in 2002, and they are ugly.

Anyway, time to see what else is there on the DVD. Alas, the PackageKit/Yum interface doesn't include the DVD as a source by default and expects you to download the packages even if they are available on the DVD. Talk about waste of bandwidth and time. What's worse, the GUI doesn't give you an option to add it. Heck, even a simple option to add a proxy is missing.

The only option it lets you have control over is checking boxes to enable/disable the repositories. I understand this is adequate if you're only interested in adding third-party repos like RPM Fusion. You can simply head over to the website and install the RPMs for free and non-free repos, and it will automagically configure and enable the repos in your sources. But what if you're behind a proxy or want to add the DVD as a source? Well, then you've got to manually edit some files.

Here's how you add the DVD as a source—as root, create a file called `/etc/yum.repos.d/fedora-dvd.repo` and enter the following text in it:

```
[fedora-dvd]
name=Fedora 11 DVD
baseurl=file:///media/Fedora%2011%20i386%20DVD/
enabled=1
gpgcheck=0
```

That's it! Now the package manager is intelligent enough to not download the packages that are already on the DVD.

NVIDIA blues

On my home-brewed system I'm stuck with an NVIDIA integrated graphics card. Now, unlike other distros, Fedora doesn't officially support proprietary drivers, and naturally, there's no non-free repo to be had. Under the circumstances, RPM Fusion comes to the rescue.

I installed the `kmod-nvidia-185.14.18-1` package (a metapackage with tracks nvidia kernel modules for newest kernels) and restarted X. My resolution went back to 1024x768 from 1280x1024. Up on trying to launch the `system-config-display` tool from the command line, I got the following error:

Traceback (most recent call last):

```
File "/usr/share/system-config-display/xconf.py", line 376, in <module>
    dialog = xConfigDialog.XConfigDialog(hardware_state, xconfig, rhpxl,
videocard.VideoCardInfo())
File "/usr/share/system-config-display/xConfigDialog.py", line 641, in
__init__
    if len(self.xconfig.layout[0].adjacencies) > 1:
IndexError: index out-of-bounds
```

Up on searching the Web, I found a bug report at bugzilla.redhat.com/show_bug.cgi?id=493680. Solution from the Fedora forum [forums.fedoraproject.org/showthread.php?t=206931] that I got was to delete the `/etc/X11/xorg.conf` file and then launch `system-config-display`. Although it loads up now, it doesn't allow me to go beyond 1024x764 px.

Switching from init 5 to init 3, and launching `system-config-display` lets me change the resolution back to 1280x1024 px, but back on the desktop Compiz reports 3D isn't supported.

Up on various trial-and-errors and being still unable to resolve it, I thought I was better off with the free Nouveau drivers.

And here's how you set up Yum/PackageKit to use a proxy—append the following text in the `/etc/yum.conf` file:

```
#The proxy server - proxy server:port number
proxy=http://MyProxyURL:PortNumber
#The proxy user name and password
proxy_username=MyUserName
proxy_password=MyPassword
```

Of course, fill in your appropriate proxy URL/IP, port number, user name and password details above.

So, the first thing I did was install the Echo icon theme. Although, it's not a finished product, it's still gorgeous! Next thing was to test how the auto mime installation works. I headed over to my music folder and double clicked on an mp3 file. It automatically prompted me to press 'Search' to look for appropriate codecs, and returned `gstreamer-ugly-plugins` soon. Somehow, I wasn't so lucky with AVI files.

Still on the subject of PackageKit and Yum, I think it's rather slow in figuring out dependencies or even searching packages. I'm sure those from the `apt-get` wonderland

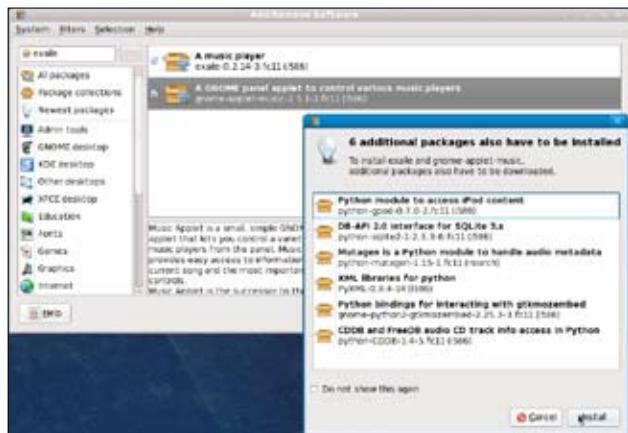


Figure 4: Installing Exaile using PackageKit

would be disappointed here. Heck, I even find Mandy's *urpmi* and openSUSE's *zypper* faster.

To end the discussion on package managers, the 11th edition of Fedora also officially supports delta RPMs, thanks to the Presto Yum plug-in, although this is not enabled by default. Install it by executing: *yum install yum-presto*.

You must be aware delta RPMs are a great way to save on your bandwidth traffic. This is because when updates are made available for any package, the package manager only needs to download what has changed in the new release since the last time (aka the diff patch). However, please note, it will only work if the said repository supports delta RPMs.

Coming back to applications, we all know the needs of users vary significantly. However, Fedora, just like other distros, has done a pretty decent job of selecting the defaults. And if you need more, you have the DVD and the online repos.

One thing I'd like to mention here is the decision to include Firefox 3.5. Well, it's still a beta release, but nonetheless, it's working like a charm on my installations. The new version debuts with the private browsing feature—you can access it from *Tools*—>*Start Private Browsing*. The immediate result is, Firefox saves and closes all the currently open tabs, and pulls up a new empty window with the following info: "In a Private Browsing session, Firefox won't keep any browser history, search history, download history, web form history, cookies, or temporary internet files. However, files you download and bookmarks you

make will be kept." In addition, there's more fine-grained control over clearing your browser history—you can choose to delete the history for an hour, two hours, four hours, today's, or everything. Additionally included is Thunderbird 3.0 beta, which finally comes with an outbox :-)

Overall

Although the overall experience with Fedora looks to be quite disappointing, it's also a pleasure running it—where else would you be able to check on the latest features that are awaiting you? Fedora 11 still proves to be among the most innovative GNU/Linux distros. The only thing missing is proper usability checks on essential features/options people come to expect from their desktop OS. Then again, we've too many distros that cater to the usability aspect to make GNU/Linux acceptable as a desktop OS by the next generation of users.

Critics often say Fedora is the test bed for Red Hat Enterprise Linux. I'd like to differ and point out that Fedora is, in fact, the test bed for most, if not all, GNU/Linux distros.



Ratings

Installer	3/5
Ease of use	3/5
Features	4/5
Stability	4/5
Community	4.5/5
Overall	3.5/5

Resources

- Fedora 11 Feature List: fedoraproject.org/wiki/Releases/11/FeatureList
- Kernel Modesetting: fedoraproject.org/wiki/Features/KernelModesetting
- Nouveau Modesetting: fedoraproject.org/wiki/Features/NouveauModesetting
- Graphical Boot Sequence: fedoraproject.org/wiki/Features/BetterStartup
- RPM Fusion: rpmfusion.org/Configuration

By: Atanu Datta

He likes to head bang and play air guitar in his spare time. Oh, and he's also a part of the LFY Bureau.

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Inspired by CRUX and started in March 2002 by Judd Vinet, the Arch Linux project might have been a late entrant into the world of distros. But within a short span of time, it has gained lots of fans, users and contributors. Arch Linux, according to its website, is a minimalist distribution aimed at intermediate Linux users who are not afraid of the command line.

Arch sticks firmly to the CRUX philosophy, 'Keep it Simple'. 'Simplicity', according to Arch, is defined as "...without unnecessary additions, modifications or complications." Arch is so simple that the core image is less than 320 MB. It's optimised for i686 processors, which means you need CPUs of Pentium II or a higher class to run. Arch also has an official x86_64 version.

An install of the latest Arch Linux core image will give you a command-line interface—no X, no desktop environment, no extra software. It might sound stupid—why would you want only a command line interface? But that is what I love about Arch. Linux is all about choice and in the process of trying to keep everything ready for you when the installation is over, distros like Ubuntu, openSUSE, Mandriva and the like, do not give users much of a choice as to what software they need to have. Of course, such distros are fantastic when it comes to first-time Linux users. They serve as a launch pad for them to better understand Linux. But intermediate Linux users would rarely use them (unless they are developing or contributing). [ED: And if you're also one of those who likes to get started with things without much fuss ;)]

The question that now arises is -- in what

way is it better than other proven distros like Debian, Slackware, etc?

Let us not try and compare distros. Every distro has its own philosophy. Here's what I like about Arch:

1. **Minimalist:** You can install it easily on computers that are relatively old. I've personally installed it on a Pentium III desktop with 128 MB of RAM and it works really well. Also, I'm typing this out on my laptop, which has a Core 2 Duo processor and 3 GB of RAM.
2. **Rolling release:** A rolling-release system is basically a framework in which you get the latest version of the operating system if you have the latest updates installed. It eliminates the headaches that I used to get using '*dist-upgrade*' on Debian. Yes. Gentoo, Sidux and Debian Sid also have a rolling release system. But I feel they are either too hard to install (Gentoo) or rather unpredictable with respect to stability (Sid).
3. **Configurability:** Since Arch core installs only a command line system with the necessary packages to detect a network, keyboard, display and other vital hardware, you can configure the system, pick and choose the software you need and set it up in just the way

you want. To edit settings, you have to open the respective *.conf* file directly and edit it yourself. This struck me as geeky. It's not really difficult to do this as there is a good wiki online and a strong community that will help you do it. For instance, to configure the X window system, you have to directly edit the */etc/X11/xorg.conf* file (if you have installed X). Yes, a simple *xorg -configure* would do the job as well, but there is nothing like configuring it yourself. Coming back to configurability, the repository has many desktop environments and window managers—including the popular ones like GNOME, KDE, XFCE, LXDE and window managers like Xmonad. Since you install only the packages you'll need, you will set up a system that will serve your needs, exactly.

4. Pacman: It has a wonderful package/update manager and a nice repository. Pacman, the package/update manager written by Judd Vinet himself, is one of the best I've seen and installs all dependencies for a software package. Though it is not a 'killer app', which is the term used to describe the mighty *apt-get*, it is still better than many other package managers. Another advantage is that it can be used to update the system as well.

- *pacman -S package_name* downloads and installs the package (gzipped tarballs),
- *pacman -Sy* syncs the local database of packages, and
- *pacman -Su* updates the system.

5. Ext4: The latest filesystem was made available here, before the so-called prominent distros.

6. Stability: The distro manages to strike a balance between the latest software and stability, with ease. Some bugs do come up here and there, but they aren't fatal to the computer and are patched soon after they are reported. I've encountered few bugs in the OS.

The disadvantages of Arch, according to me, are:

1. **Minimalist:** Yes, this also is a disadvantage. The system takes time to set up. It takes a few hours to install the base system, put X on top of it, and then a desktop environment on top of X. But hey, once the system is set, it works smooth as silk. You don't have to touch your installation CD again.
2. You can tell me...

Installation process

I'm going to tell you how to install an Arch base system from a core CD image, with the X window system and GNOME as the desktop environment. If you need instructions on setting up KDE and XFCE, the online wiki pages will come to your rescue.

You can download the latest version, i.e., 2009.02, from www.archlinux.org/download. There is an FTP install version also where you can download just the installer, which, in turn, will download the core packages from a server when you run it. Also, there are full CD, USB and ISOLINUX images available for both i686 and x86_64 targets.

I used Deluge [a Bit Torrent client] to download it and found a good number of people seeding the ISO. Thanks to

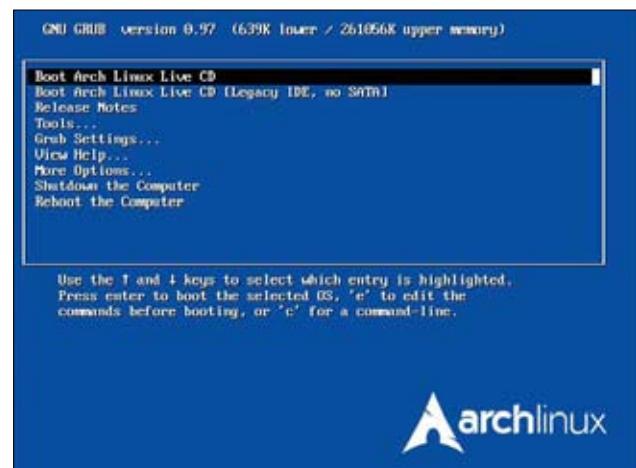


Figure 1: Arch's live CD boot menu



Figure 2: Arch installer

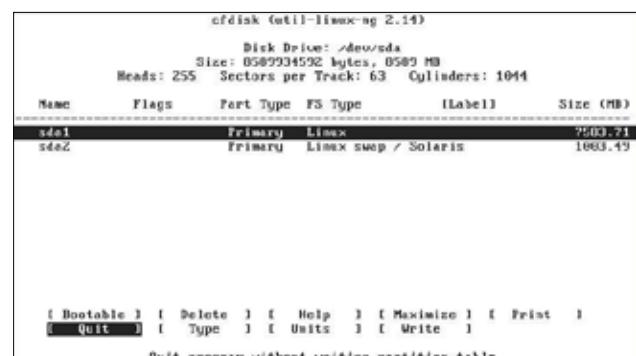


Figure 3: cfdisk partition program

that, I was done with the download in less than an hour.

After burning the ISO to a disc, place it in your CD-ROM drive, and reboot the PC. You'll be presented with a self-explanatory GRUB-like menu. I chose the first option that says "Boot Arch Live". This will load the live system, and you'll be presented with a console log-in. Just type in 'root' for the user name—this is the default log-in and you don't require a password at the moment.

Now that you've logged in, type */arch/setup* to start the installer.

Step 1: Selecting the source for packages. Since I downloaded a full core image, I chose the first option here, which is, "CD-ROM or other source". There is a second option available called "FTP/HTTP" (for the FTP install CD image)

which when chosen, will take you through a page where you can set up your network and select a mirror (choose the one nearest to you for maximum speed).

Step 2: Set the clock. You can choose from a list of continents, then countries (and then cities if the selected country has more than one city listed). I chose Asia and then India. So Asia/Kolkata was the result. The installer will then ask you to set the date and time.

Step 3: Prepare the hard drive. This step enables you to prepare your hard drive. The installer detects your hard drive first. You can then either choose 'Auto-prepare', which will use your entire hard drive (and erase any partitions present previously) or you can choose 'Partition Hard Drive' which will take you to *cfdisk*. This is familiar territory for any intermediate Linux user. I was going to install only Arch on my laptop. But still, I wanted to be able to choose how much of my hard drive I was going to allocate to */*, *swap* and */home*. I have a 320 GB hard drive on my laptop. So I allocated 2GB for swap, 20 GB for */*, made the partition bootable and allocated the rest to */home* and wrote changes to my hard drive. The next step here was to set the filesystem mount points. This is where I was going to instruct the operating system about which partition to use for what, and this is where you can choose between ext2, ext3 and ext4, among other filesystems.

Step 4: Select packages. There are two options available here—base and base-devel. The former has everything you need for a basic system and 'base-devel' contains other packages that are optional and not as important as 'base'. This is pretty much like the first and second Debian CDs. The first one containing all the necessary packages and the second with all the packages that are next in line, in terms of importance. It is recommended that you choose all the packages in base. Choose packages in base-devel is up to you.

Step 5: Install packages. This step is mandatory and will install all the packages you chose in the previous step.

Step 6: Configure system. Once all the selected packages have been installed, the installer will present you with a list of configuration files starting from *rc.conf* (the system configuration file) where you can configure your hostname, network settings (if you have a DHCP server for your wired connection, change the line in the networking section starting with *eth0*, or the interface that is present, to *eth0=dhcp*), the root password (Arch does not ask you to set up another user; you'll have to do it once the system is installed using the *useradd* command), among others. You can edit the configuration files using either Nano or Vim.

Step 7: Install the boot loader. While the previous versions of Arch had an option to install either GRUB or LILO, 2009.02 has the option to install GRUB or nothing at all (use this option if you already have another Linux OS in a separate partition, in which case, don't forget to add the Arch listing to the original GRUB *menu.lst* file).

You're done installing the base system. Reboot the system (and make sure you remove the CD from the optical drive to prevent the installer from starting again) and that's it.

The X factor

Before you install anything, make sure you create a new user with *useradd* and that your current system is up to date. A *pacman -S pacman* followed by a *pacman -Sy* and *pacman -Su* will update the system. Make sure you do this as the new user.

Use *pacman -S xorg* to install the X window system. Once installed, use *xorg -configure* or a *pacman -Shwd*, followed by a *hwd -xa* to configure X. In case you use a laptop and you find that your touchpad is not recognised, do a *pacman -S xf86-input-synaptics* to install the 'synaptics' driver (most laptops have a synaptic touchpad).

Now that X is in place, it's time to install a desktop environment—I'll set up GNOME here:

```
pacman -S gnome gnome-extra gnome-system-tools \
networkmamager network-manager-applet \
alsa-lib alsalib alsal-alsa oss
```

This will install GNOME, ALSA and NetworkManager. Once done, make sure you add *hal*, *network-manager*, *alsa* and *fam* daemons to the daemons section in */etc/rc.conf*. My daemons section looked like this.

```
DAEMONS=(syslog-ng !network netfs crond gdm hal fam networkmanager
network-manager-applet alsal)
```

That is all you need. You now have a usable system. You can install The GIMP, OpenOffice.org, Python and the likes with just *pacman -S package_name*. Oh, and don't forget to do a 'system update' now and then. Happy Arching!



Ratings

Installer	4/5
Ease of use	3.5/5
Features	5/5
Stability	4.5/5
Community	5/5
Overall	4.5/5

References

- Arch home: www.archlinux.org
- Arch wiki: wiki.archlinux.org
- Forum: bbs.archlinux.org
- Arch User Repo link: aur.archlinux.org
- Screenshots taken from: ebalaskas.gr/ArchLinux. If you want screenshots of the entire installation process, this is where you'll find it.

By: Bhargav Prasanna

The author is an 18-year-old, studying for a BE in Electrical and Electronics Engineering from Meenakshi Sundararajan Engineering College, Chennai. He loves tweaking anything that is tweakable (software and electronics) and when he's not doing that, you will find him spreading the word about Linux.

Bing is King!

My fling with the Bing!

In an alternate universe where you can go through a wormhole, you will find an Earth with a difference. There exists a very powerful corporation called My-crow-shaft. It's a company that believes in one philosophy for all. It doesn't discriminate between itself and its users.

The great operating system—actually it should be the great-great-grandfather of operating systems—that the company built and made popular tells the story of its philosophy, which says that perfectionism never achieved anything and everyone has equal—and some have even more—rights to succeed.

It's not that you only survive when you're good or excellent at something. The pro-people company (where 'pro' stands for 'produce and then force people to use') believes that even the mediocre and the below average have the right to succeed. All you need is good muscles, which you can flex, and a lot of monopoly.

This corporation created Windows to prove the point—its success is the proof of the philosophy it believes in, which is: everyone has the right to succeed.

Now, you know that most people use doors to enter and exit. Everyone knows what kind of people use windows to enter and exit. There is a big industry manufacturing alarms that prevent people from breaking in through windows.

This company, My-crow-shaft, has products that need regular reboots. It believes in: "Always take a nap during work; it increases productivity." So does its operating system—make sure you reboot and reformat it as and when you can, before it forces you to.

This year, just like every other year, the company reformatted and then rebooted its online search business—Live is dead, and Bing is its latest fling.

There is something interesting about Bing! It is trying to become our moral police, for us Indians at least. My-crow-shaft loves highway patrols and control.

This time it is enlisting parents. The firm wants to make sure that the next generation has free access to the required information. At the same time, parents should be happy their kids are not getting access to the wrong information.

If you enter the word 'sex' (on the Bing India portal), it will warn you with a message that reads, "The search for 'sex' may return sexually explicit content. To get results, change your search terms." But if you are looking for specific information and



key in something like: 'sex stories of', it will give you all the results you are looking for.

If you enter the most popular F-word (and no, I don't mean 'free'; I meant the other four-letter word), it will again warn you about 'sexually explicit content'. But if you enter something like, "You are a F****", it will give you all the desired results.

Now, according to Wikipedia, the word 'sex' is explained as follows, "In biology, sex is a process of combining and mixing genetic traits, often resulting in the specialisation of organisms into male and female types (or sexes)."

My-crow-shaft has issues with that? Oh! They want to keep a check on population explosion. So, if you are a researcher and want to write a chapter on sex education for kids and search for 'sex' on Bing, My-crow-shaft will warn you that this could be an offensive search. [Yes, in India—people are still debating whether sex education should be even allowed in schools.] But 'they' have no issues if you are a pervert and are searching for sex stories. They will not let an innocent professor get dirty by searching that word, but will give the 'right' information to the one who wants it. Remember the saying: "Seek and ye shall find."

Now, this is something beyond the understanding of my pea-brain.

My-crow-shaft is proving time and again—first DRM and now this censorship—that it will decide what is appropriate and what is not.

Oh! I forgot. Another beauty of Bing is that you can easily search for the first name of the former US vice president from the George Bush regime. My-Crow-Shaft is funny, ain't it? And people say it's a dull, boring company.

Hey, you just don't know how much fun Bing is going to have. Wait until next year—the following version might be called Fling.

If you know My-crow-shaft well, you can see it coming. 

By Swapnil Bhartiya

A Free Software fund-a-mental-ist and Charles Bukowski fan, Swapnil also writes fiction and tries to find cracks in a proprietary company's 'paper armours'. He is a big movie buff, and prefers listening to music at such loud volumes that he's gone partially deaf when it comes to identifying anything positive about proprietary companies. Oh, and he is also the assistant editor of *EFYTimes.com*.

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NCOSS-09

Thinking Beyond Just GNU/Linux

The National Conference on Open Source Software, NCOSS-09, was held on May 25 and 26, this year, at the Navi Mumbai campus of C-DAC. It was a step in the right direction in bringing the open source community closer...offering enthusiasts a platform for interaction, workshops and some intellectual stimulation.

*F*rom being a niche concept adopted only by the geeks in its earlier years, Open Source Software (OSS) is slowly being welcomed by one and all. Right from desktops to servers, and from data centres to embedded devices, OSS today powers innumerable applications.

NCOSS-09, held on May 25-26, 2009, at the Navi Mumbai campus of C-DAC, brought together the various groups working on developing open source applications catering to specific domains in the ICT world. These included education, health, accessibility, localisation, e-commerce, disaster management, expert systems, machine learning, et al. The gathering was a mix of academia, industry, the open source community and government.

The conference was driven by the OSS division of C-DAC Mumbai. This group is home to the OSSRC (Open Source Software Resource Centre), the first national resource centre in the area of open source, set up jointly by IIT Bombay, IBM and C-DAC Mumbai. Besides the C-DAC initiative, the conference was supported by the IEEE CS chapters of Mumbai and Chennai, along with the Computer Society of India.

And when you have gurus such as Dr

Deepak Phatak of IIT Bombay; Prof C R Muthukrishnan, former deputy director of IIT Chennai, currently advisor to TCS; and Dr S Ramakrishnan, director general of C-DAC; gracing the occasion, the event is a guaranteed winner.

Ensuring the success for such a large and prestigious event requires careful planning and execution. Working in the background was Dr M Sasikumar, associate director, C-DAC (Research). He, along with his team, saw to it that every aspect—right from logistics, lectures and presentations, workshop attendance, food and catering, to crowd management, was up to the mark. When quizzed about the elaborate preparations, Dr Sasikumar was upbeat, "This preparation started months in advance when the call for papers was initialised. The NCOSS is intended to act as a forum to promote the adoption of open source software and solutions in different areas, by sharing experiences in solution selection, customisation/adaptation, etc."

He went on to add that a record number of over 110 papers from all over India were submitted to the NCOSS committee. Finally, after a rigorous international refereeing process, about 30 papers were selected and presented during the conference. Further clarifying the role of NCOSS, Dr Sasikumar

The participants at NCOSS





says, "NCOSS is conceived of as an academic style conference, on a topic that has practical significance, with a specific focus on the application layer of open source."

Let's get started

When you have prominent personalities sharing their experiences, all you do is just sit back and listen. From workshop orientation, deploying FOSS applications, and sharing user experiences or case study details, it seemed like one action-packed thriller. (The only dilemma being what to attend—a lecture or a workshop?)

The keynote address by Prof C R Muthukrishnan on 'The Meaning, Purpose and Spirit of Open Source' was an eye-opener. The professor shared his experiences as a mentor to the OSS community. His mention of the software life cycle and the tension that sets in between the developers and the testing and marketing teams, struck a chord with the audience. According to the professor, quality control is a vital element in the success of any operating system and it all starts with the source code, notwithstanding the 'time to market' pressures. He further elaborated on interoperability issues, and was optimistic on how new phones in the market would make use of open standards. The keynote was followed by a talk by Dr Phatak, who enthralled the audience with his witty comments. Highlighting the success of 'Project Eklavya', he once again stressed upon the need for India's current role as a 'net-taker' to change to that of a 'net-giver' with respect to the worldwide open source community. Mind you, the fun had just begun.

Dr S Ramakrishnan, director general, C-DAC, offered his own insights on open source. He highlighted the role of OSS and how it was making inroads in many fields. "Open source software is maturing rapidly and different stakeholders in India are looking at it as a serious option for adoption. Government enterprises, the developer community, academia and users in different verticals have, in recent years, made specific moves towards adoption." And for that very reason, to keep the momentum going, NCOSS was initiated.

Inauguration session: (From left to right) Geroge Arakal, Zia Saquib, Prof C R Muthukrishnan, Dr Deepak Phatak and Dr S Ramakrishnan

Zia Saquib, executive director, C-DAC, in his brief speech, complimented the various groups at C-DAC on their efforts in the localisation project, and how these were helping bridge the digital divide. Summing up the inaugural session was George Arakal, director administration, C-DAC, who mentioned the uniqueness of NCOSS and how privileged C-DAC was with the 'Trimurti' gracing the occasion. He was obviously referring to the presence of Dr Phatak, Prof Muthukrishnan, and Dr Ramakrishnan. That probably set the tone for the rest of the conference.

Knowledge redefined

After an exciting start, it was the round for interactive sessions. Parallel tracks on knowledge management, enterprise application, e-learning/e-commerce, along with thought-provoking demos, were highlights of the conference. Topics such as knowledge management systems using Joomla, node-oriented knowledge management, Blender 3D, and Moodle were just some of the sessions keeping the audience spellbound.

The talk on 'Rapid Scientific Application Development with Python' presented by Prof Prabhu Ramachandran, IIT Bombay, was simply amazing. Python is an ideal language for rapid application development in the scientific computing domain, and with several scientists in the audience, it was a session where everyone was able to connect instantly. The demo was interlaced with 2D and 3D graphics, based on GUIs related to aerospace engineering and particle systems, in the course of which Prof Ramachandran delighted the audience.

The other speaker who had been invited was Shuvam Misra, CEO, Merce Technologies, who spoke on 'Open source as one point on a continuum'. He took everyone down memory lane. C-News, BSD UNIX, the Linux kernel project, RHEL, Ubuntu, Debian, and MySQL, were all re-visited.

Quick take



Dr S Srinivasan, research scientist from C-DAC, holds a doctorate in physics with about 30 years experience in research, teaching (at the UG & PG levels in engineering), information management, software processes and quality management. With some good funding and time on hand, he would like to develop e-learning kiosks, and some packages for tiny and small-scale industries. Overall, he is optimistic about the various developments in open source. Here's what we spoke of over a short tête-à-tête.

Q What kind of projects are you and your team (AU-KBC) working on currently? Is there something that you would like to highlight about your work as a project scientist at C-DAC?

At AU-KBC, the primary focus is on FOSS in higher education—the introduction of FOSS courses in the curriculum, the migration to FOSS in engineering labs, student projects and training of staff/students, the use of FOSS tools for various development activities at AU-KBC (Bioinfotracker, Linux Biopuppy, Morphological Analyser, Security Bed, Wi-Fi related packages, etc), a short course on ‘Wi-Fi with FOSS’, implementation of FOSS packages like Scilab, Koha, QCad, Talend, etc.

And at C-DAC, the primary focus is the desktop and server versions of Bharat Operating System Solutions (BOSS), which is a GNU/Linux distro based on Debian—and on adding applications to run on BOSS.

Q What, according to you, are the biggest challenges for engineers/developers who are trying to use

Later in the day, there was a demo-cum-presentation on Esvaasthya—an open source MIS for Indian hospitals. Another interesting topic was ‘Self-Help MIS—Enabling Financial Inclusion: Door Step Financial Services in Rural Areas’. The speaker was of the opinion that, “...market forces are tilting towards open standards and there is an increasing demand from customers towards interoperability.”

Finally, at the close of the conference, there was a panel discussion on ‘Circumventing barriers to FOSS adoption’, which offered an insight into how the OSS community is gearing up for a better and brighter future. Shuvam Misra, along with Ghanshyam Bansal from NIC, Venkatesh Hariharan (Venky) from Red Hat, Shrikant Mullik from L&T

OSS for their work?

Awareness and acceptance is the main factor. Most developers seem to have a negative mindset due to either inertia, a fear of the unknown or a misconception that zero or low cost means ‘cheap’ and, hence, a lack of quality. One needs to have a positive outlook.

Q So if you had to advise someone starting a new open source project, what would you say?

Try to enhance the features of an existing project or adapt/customise a FOSS package to suit local needs (with limited features to start with).

Q How has C-DAC progressed in dealing with open source projects and giving back to the community? Could you list the various initiatives and success stories?

We are interacting with various state government agencies to implement BOSS and help run e-governance and other applications. Besides, we are providing training to personnel from government departments, agencies like the Navy, ELCOT, etc. Other than that, we also provide maintenance and implementation support through a helpdesk and other interactive means. The progress is steady, though we are just scratching the surface.

Q Finally, what has your experience been like at NCOSS-09?

I feel positive, as there is an increasing awareness within the community and a desire to know more. Overall, it has been instructive learning with respect to how industry is adopting FOSS tools. Many companies are now in a position to contribute as mentors.

Infotech, and Dr Sasikumar, participated in this discussion.

Content management, collaboration technologies, e-governance, localisation—these were the keywords on everyone’s lips. The idea was to educate people on what OSS is all about and to urge them to think beyond GNU/Linux. All said and done, NCOSS-09 certainly achieved what it had aimed to, and did so with top honours. See you at the next conference. 

By: Nilesh Kakade

The author is an editorial consultant to the EFY group. He can be contacted at nkakade@rediffmail.com

It's Open Source All the Way for ITM



ITM, one of the leading technology and management institutes in the country, could be dubbed a role model for other such institutes. This fascinating case study will give you an idea about the FOSS-based IT infrastructure of the institute, and will also help you deploy similar solutions at your organisation.

The Institute for Technology and Management (ITM) was founded in association with the Southern New Hampshire University (SNHU), USA. The institute has expanded its collaborations to include distinguished universities across Europe and Asia, evolving academic programs of international repute.

The ITM Group of Business Schools grew from one business school in Mumbai, to seven campuses by the year 2004. Starting with a two-year full-time masters program in 1991, this group currently conducts 15 programs covering financial markets, retail, pharmaceuticals, healthcare, risk management, human resources, etc.

Recently, ITM has been chartered as a private state university in Chhattisgarh. The university status allows for greater autonomy in the design and deployment of path-breaking new programs, further strengthening ITM's reputation as a leader in specialised management education.

The infrastructure

The ITM Navi Mumbai campus is located in the Institutional Area of Kharghar, and occupies a total constructed area of over 100,000 square feet (9000 sq m). The campus is framed by the scenic hills of the Raigad district. It is laid out in a rough square flanked by four wings and featuring a beautiful landscaped lawn as its centrepiece. The classroom wing serves as the primary academic building and features 11 theatre-style, 60-seater classrooms. All students are issued laptops and Wi-Fi connectivity through the use of access points spread out in the corridors of each floor.

The administrative wing houses the offices of the 40 full-time faculty members, the director and assistant director, the registrar, research associates, and the accounts department, among others. All staff and faculty are provided with desktops, which include both thick clients and thin clients.

IT infrastructure

Being an educational institute, the IT needs of ITM were a bit different and more demanding compared to that of an ordinary organisation. There were typically three kinds of users—the staff, faculty and students/visitors.

The hardware needed by the institution required to focus on providing wired desktops for staff and faculty, while the students' needs were met using Wi-Fi connectivity for their laptops.

The core computing requirement of staff members was office applications, e-mail and Web-based ERP, while the faculty needed additional access to a variety of online resources (EBSCO, PROQUEST and HBR online) and in-house databases (Prowess and Capital Line). An intranet is used for disseminating local information.

The institution uses a mix of branded and assembled servers and client machines. And it uses the laptops of most of the well-known brands, such as Toshiba, IBM, HP, Fujitsu, Acer, etc.

The network infrastructure is completely powered by open source software, and all staff and faculty desktops too use open source applications running on different versions of Fedora. Unfortunately, volume licences of Windows XP Professional and MS Office 2007 Professional are being used for laptops. However, all other pre-loaded

Server stats

The following list gives details of the servers currently in use on the campus:

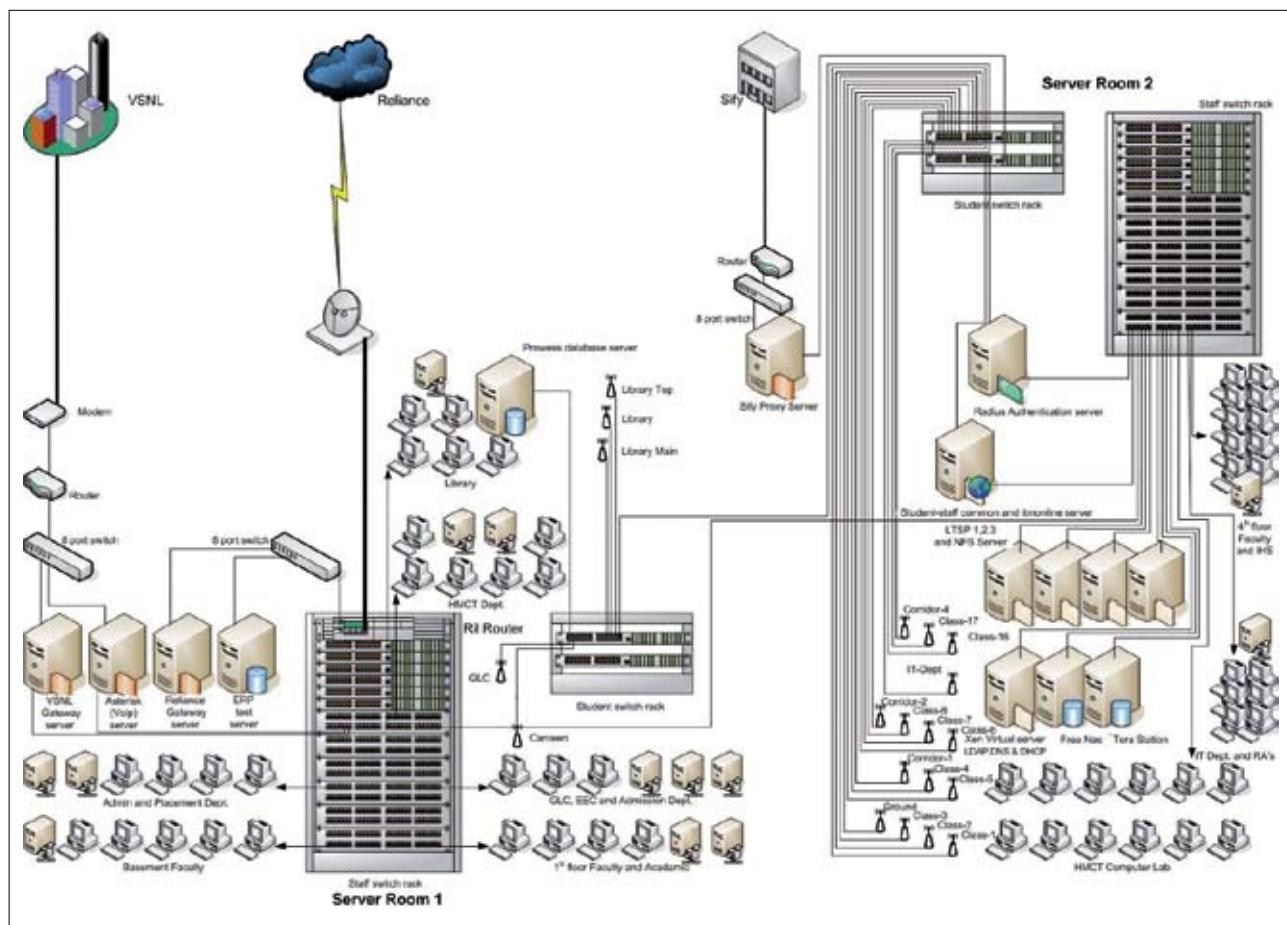
1. DHCP+DNS+LDAP virtual servers (Xen server) in a single physical machine
2. An NFS server (for mounting 'home' folders of all thick clients)
3. Three LTSP servers
4. The RADIUS server (to authenticate the Wi-Fi connections of laptops)
5. An ERP server (on campus for testing purposes and connected to the Internet)
6. A VoIP server
7. A data exchange cum intranet server
8. A student proxy cum DHCP server
9. Two Gateway servers for the staff and faculty
10. A NAS box
11. A prowess offline database server

In Reliance IDC

1. An ERP server (production)
2. A Web cum mail server

applications on laptops are open source.

The institution uses a mix of thin clients and standalone machines. There are 89 thin clients for



ITM Kharhgar network diagram

Open source solutions used by ITM

- Servers: CentOS, Fedora Core 5, Fedora 8, LTSP, Open LDAP, Free RADIUS, Free NAS and CUPS.
- Desktops: Fedora and Ubuntu
- Firewall and proxy: Shorewall and Squid
- Network monitoring: NTop and MRTG
- Systems administration: Webmin
- Databases: MySQL and PostgreSQL
- Special applications: Joomla, Asterisk and Moodle
- Desktop applications: OpenOffice.org, Thunderbird, Firefox, GIMP, VLC, etc.

the staff and faculty—a few of which are thin clients-cum-print servers. The number of laptops available for students is over 400.

Connecting people: networking security

The campus is divided into two independent networks. The wired network is used mainly by staff and faculty, while the wireless network is dedicated for students. Only the data exchange server, the Prowess database and intranet server have data common to the faculty and students. In each of these servers, the institute has two network cards that provide connectivity to each group while keeping the networks independent. All the servers—including the DNS, DHCP, LDAP, the Web server (intranet), LTSPs, NFS, the data exchange server and the NAS box (back-up server)—are in the staff network, which is completely isolated from the students.

To provide the much needed and efficient connectivity among the servers and clients, structured cabling is in place, connecting two server rooms located at diagonally opposite corners of the campus. The server rooms house the switch racks, with cables running directly to each machine on the campus or one of the many Wi-Fi access points. There are 18 access points by NetGear with RADIUS authentication deployed to meet all requirements.

Security

This kind of widespread network needs a lot of security measures—some physical and some at the virtual level. Besides physical security, the institute also ensures the normal log-in access control to servers.

The most important measure to secure servers is at the physical level, with access allowed only to authorised people. All servers are housed in the two server rooms, which normally remain locked and the keys are only with the senior systems administrator during each of the two shifts.

For login-based access control, only senior systems administrators have passwords for root access and junior administrators have limited access (using *sudo*) to servers. All systems administrators have to login with their own user names and associated passwords.

Normal users have no administrative access to any of the servers.

All users, including administrators, are authenticated through LDAP servers for network access. Administrators are assigned different privileges on the server by the senior systems administrator. All cannot work on all servers. Faculty and staff have access only to data in their home directories, Prowess database and to common shared data in the data exchange server. The faculty and staff can view data on the intranet server.

All the users in both the networks (staff, faculty and students) are authorised users with different levels of authorisation. The LTSP users (staff and faculty) are authenticated centrally through the LDAP server. All students are centrally authenticated through the RADIUS server. Also, for wireless access, MAC address bindings are used to assign the IP address to the authorised students only.

Security from intruders

The gateway and proxy servers that connect to the Internet run the Shoreline firewall (commonly known as Shorewall). All ports on these two machines are closed on the public interface. Even local internal servers normally have only need-based ports open. Besides all the above restrictions, the ERP, Web and mail servers allow SSH access only from one IP address.

Training day

Setting up this kind of an infrastructure that uses a lot of free software solutions needed a lot of expertise. The institute initially hired a consulting company. The primary role of the company was to set up the LTSP server and deploy around 20 thin clients.

This deployment also meant a learning process. The staff members needed to be trained in using this new technology. The secondary responsibility of the company was to train the systems administrators who later became trainers themselves. It was now mandatory for all systems administrators to either be certified before joining, or obtain Red Hat Certification within one year.

All training for staff and faculty was done in-house by systems administrators. The institute is now planning to use its experience to train outsiders so that others can also reap the benefits of Linux and Free Software technologies.



By Swapnil Bhartiya

A Free Software fund-a-mental-ist and Charles Bukowski fan, Swapnil also writes fiction and tries to find cracks in a proprietary company's 'paper armours'. He is a big movie buff, and prefers listening to music at such loud volumes that he's gone partially deaf when it comes to identifying anything positive about proprietary companies. Oh, and he is also the assistant editor of *EFYTimes.com*.

“We are certain that our model is applicable to any institute”

J A Bhavsar was lucky that the senior management at Institute for Technology and Management (ITM) was pro-open source. Even then, he had to face a number of other challenges while setting up a FOSS-based IT infrastructure at the institute. Successfully overcoming these obstacles and, hence, paving the way for other educational institutes to confidently adopt ITM's open source model, makes him our Tux Hero.



While working on this story about ITM's IT infrastructure, I realised that the face behind the open source implementation was J A Bhavsar, group head (IT), ITM Business School, Mumbai. So when did he first get acquainted with GNU/Linux? “I came across Linux in 1999 when I noticed a Linux installation on my friend's computer,” he says. That seemed to sow the seeds of freedom in his mind. Some time later, when ITM was considering the deployment of GNU/Linux and other free software solutions at the institute, Bhavsar was ready to take the plunge.

“While the initiative was taken by the chairman, I guided the implementation with the help of a Mumbai consultancy, The Argon Company, which is very familiar with Linux. One of the consultants was Rishi Ganguly, a close friend of Nitin Putcha (the chairman's son). Ganguly, who currently works for Apple, is an avid Linux enthusiast. He knew Richard Stallman, whom he invited for a talk at TIFR in Chembur, Mumbai, on January 21, 2004. I attended this talk.”

Now, the institute has become a role model for others. Bhavsar is also vocal about the institute's willingness to invite outsiders to get trained on the technologies at the ITM campus. This is the best way you can ‘pay it forward’ in the FOSS world.

But it was not like he only had to take over an existing GNU/Linux deployment. The FRESSO stack had to be built from the ground up. He confides, “My group and a two-member team from The Argon Company started from scratch.”

Unlike other organisations where business heads are basically a bit wary of GNU/Linux, at ITM, Bhavsar confided that, “...both our chairman, Dr P.V. Ramana, and his son, Nitin Putcha, were pro Linux.” This was one of those rare cases where the IT head did not need to convince the management with respect to the deployment of open source.

J A Bhavsar, group head (IT),
Institute for Technology and Management

"Honestly, I did not have to influence them... My role was to take on the responsibility to implement the project, and I just grabbed the opportunity." If the senior management at all organisations were as well informed as those at ITM, there would be no stopping the deployment of FOSS. The confidence in free software runs deeper today than ever before. In fact, when it comes to trust, GNU/Linux is considered the best suitor when compared to proprietary technologies, as today, organisations are interested not only in something that is merely available and that functions, but also in how the solution works in the back-end and how much control they have over it. This is unlikely in a proprietary solution where you are at the mercy of the vendor.

Bhavsar says, "Cost is just one good reason for using open source software. Freedom from vendor lock-in gives us more flexibility to change to the best-in-class software as and when required. For example, we started with MySQL as the database for our ERP, but changed to PostgreSQL as the volume grew, and speed and reliability became critical."

When asked specifically about the cost savings due to migration, he shares, "We have never quantified it, but we would have conservatively saved Rs 600,000 to Rs 800,000 per annum on an average. There are over 100 desktops running Fedora, and more than 500 students accessing at least four servers (proxy, data, RADIUS and Intranet running on separate machines). There are other servers for LDAP, DHCP and the NAS."

But it was not all a bed of roses. "While the management was pro-GNU/Linux, the staff was sceptical. We struggled for the first two years. Later, we met faculty members who had joined other institutes. They reported on the difference Linux and open source makes in trouble-free operation. We then knew we were on a strong footing," recalls Bhavsar.

Bhavsar admits that it was difficult to wean away users who had never worked on Linux. He and his team decided to be the role models, so all IT personnel stopped using Windows before asking others to do so. They then ensured that one of the IT team members would practically hand-hold users through difficult situations. The first thin client was put in Bhavsar's office. Today, he uses a dual boot laptop (Ubuntu and Win XP Pro). "We mostly use XP Pro outside our campus only if external hardware requires it. I have installed FC10 at home for my daughters to use," says Bhavsar.

"We had to set up five machines at a time, make the desktop look like Windows, train users personally, solve all their problems, and move on. We had monthly training sessions for the first six months, besides personally taking care of individual problems on a one-to-one basis. Our slogan was: 'Tell us what you do in Windows that you can't do with open source.' We then identified an appropriate open source tool. We conduct

user training sessions every six months, even now."

All said, I still wondered what the most important attraction of GNU/Linux was. Bhavsar has a simple answer, "Technically, the fact that it's robust, secure and least vulnerable to virus attacks attracted us to the Linux platform. Open source just won our hearts because it is made by altruist individuals and groups with a humanitarian approach. We believe open source can positively change lives in a way few other things can."

Going back to the implementation at ITM, one of the biggest challenges in the world of GNU/Linux is the availability of so many options. What do you have in the proprietary world? Windows or Mac—the devil or the deep blue sea; and that's the end of your options. But with GNU/Linux, the options are unlimited. So, how did Bhavsar and his team find the right solutions for their needs?

"The consultant helped us take the first few steps. Once we implemented one LTSP supporting 20 users (OpenOffice.org, Firefox, Gaim and Thunderbird) we started looking for tools commonly required on educational campuses. The Internet was the best source of information, followed by Linux magazines. Meetings with like-minded people in workshops and seminars also added to our knowledge."

What started at Bhavsar's campus is now spreading to other ITM centres as well. "We now have a few well-trained systems administrators who can independently set up the base systems required by every centre. Our proxy and data servers in Chennai, Bangalore and Warangal use open source only. Other centres are lined up for the transition. We will be adding Intranet servers and NAS (FreeNAS) boxes in each of our centres."

Bhavsar makes it a point to attend any workshop or seminar where open source is showcased. He is particularly interested in spreading this culture in educational institutes, which he feels need it the most. He is also planning to hold workshops at a nominal cost for teachers/professors and IT administrators of educational institutes.

He sums it with, "We are absolutely sure that our model is applicable to any educational institute. Currently, we are concentrating on making all our centres work on FOSS. We would be glad to help train any other educational institute's systems administrator who's willing to come to our Mumbai campus. We would not mind training interested individuals willing to bear the incidental expenses." 

By Swapnil Bhartiya

A Free Software fund-a-mental-ist and Charles Bukowski fan, Swapnil also writes fiction and tries to find cracks in a proprietary company's 'paper armours'. He is a big movie buff, and prefers listening to music at such loud volumes that he's gone partially deaf when it comes to identifying anything positive about proprietary companies. Oh, and he is also the assistant editor of *EFYTimes.com*.



Building a Magazine Website by Hacking into Word

Here comes an opportunity to walk through the ideation and development of LinuxForU.com, while seeping in the experience of using WordPress to build a magazine website. We hope, our experience, coupled with LinuxForU.com's source code, helps you tread your own path, and take the Open Source initiative forward.

It was February 2003 when LINUX For You saw its readers' faces for the first time. It's been six years since then, and the only Indian magazine on open source had been struggling and cowering, yet waiting patiently to make its presence felt on the Web. While the domain LinuxForU.com had been a part of our editorial offerings for almost as long, it laid dormant until very recently, when the project was revived all over again with more enthusiasm and determination!

The road to success wasn't a very sweet one, but it was absolutely pleasurable and very thought-provoking. After the debates, cups of tea, innumerable PJs and the intense philosophical discussions, we started looking at *LINUX For You* with a very different outlook. There were a lot of deliberations and immense amount of time spent before we decided on every single aspect of the site, be it the categorisation, the CMS, the colour scheme or a simple CSS styling for the `<pre>` tag; the experience was immensely educating.

While building a website for a magazine that already has such a huge following with a technical bend, the jitters are never

too far away. That, coupled with the fact that this was practically the very first website for the magazine, and the expectations from co-workers, fans and peers had shot sky-high.

While it was important to make it look good and sexy, our main focus had always been on the features offered by the website. We tried to highlight the Web 2.0 elements of the site, making it more interactive and content oriented.

Coming from a magazine that promotes Free and Open Source Software, it was a welcome surprise when I was asked to write a feature outlining the development of the website. I was also thrilled to know that *LFY* plans to share the source code of the website (minus the database, of course) with its readers. No, we aren't afraid of criticism or rotten tomatoes. Rather, what got us excited was the chance to learn, the scope to improve the site, and the beauty of going open source the true way!

Why do we use CMSs?

Everybody loves Wikipedia, don't they? Well, allow me to quote Wikipedia in my efforts to define what a content management system might be:



as a Web master, and encourages you to spend more time with the content, because, 'Content is the King'.

In favour of a CMS—Why?

- **Content modelling and storage:** This is the process by which you take the content you want to manage, and turn it into data that the system can process and store. A mature CMS makes it absolutely easy for the Web master to create the flow of the content, and even facilitates easy storage and retrieval of the data. Compare a CMS with cup noodles. It's all ready—all you need to do is pour some water and leave it aside for a minute or so.
- **Content editing:** In my brief Web developing career, there have been times when the choice of CMS was decided by the kind of text editor it offers. Well, while you'd always feel compelled to rubbish that line of thought, as a Web master, it *does* make a lot of sense at the end of the day. Ideally, the job of a Web master is the management of a website and not content population. Now, unless the person assigned to populate the site is well-versed with HTML tags and style sheets, the ease of use and the power of the editor become important factors to be considered. Of course, most modern-day editors allow you to edit the raw HTML of your content, in the same window, thus giving you more power and flexibility.

Here, I'd like to mention a thought that just crossed my mind. I remember, while designing a website for one of our sister concerns, *itmagz.com* (it's on Joomla), the content editor was very basic and needed me to set up my HTML editor from the site's preference menu. It used to freak me out every time, until I decided to go ahead and install JCE as the new editor.

- **Publishing and templating:** One of the most important focus points every time you get on to developing a new website is a 'spanking new' look and feel. It is a well-known

A content management system (CMS) such as a document management system (DMS) is a computer application used to manage workflow needed to collaboratively create, edit, review, index, search, publish and archive various kinds of digital media and electronic text."

Okay, that actually made the concept seem a little more confusing, didn't it? In layman terms, a CMS is a software that helps you to publish and manage content online, in a much easier and more efficient way. Traditionally, it used to take considerable knowledge and experience in HTML, PHP (server-side programming languages) and JavaScript to be able to churn out a 'professional-looking' website. A CMS is designed to make your life easier



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fact that every CMS has default ‘theming’ that stays the same, no matter how many times you install a new theme off the Web. Be it Drupal, WordPress or Joomla (even Tumblr, as a matter of fact), it needs an insane amount of customisation to make a site work “just the way you want it to”.

- **Low maintenance cost:** For a longer run, the maintenance cost for an open source CMS is absolutely low, because most of the development work is done by the community. Of course, there is always the need to upgrade a CMS every once in a while, to be able to use the latest features. But make it a golden rule to always install a version lower than the current one (unless it’s a major version upgrade) so as to guarantee yourself better tech and forum support, along with more tried and tested plug-ins and modules.

Requirements of LinuxForU.com

This was the trickiest part during the development process of the website. While we were clear about the fact that we would publish all the content from our previous issues under the Creative Commons Attribution Share-Alike license, we had no other concrete plans. Hailing from the social media background myself, I was adamant on keeping the website user friendly and building in a few Web 2.0 elements that would help us stay in touch with our readers, and also help them with their queries with the least possible delay. Thus started our journey of scouting for a suitable CMS to start the development on.

While considering the various CMSs available, we finally narrowed down on Drupal, WordPress and Joomla. Now the decisions weren’t as much technical as strategic. Here’s why:

1. Since I had already developed itmagz.com on Joomla, I preferred another CMS that would give it more flexibility with theming and Web 2.0 implementation. This made us favour Drupal and WordPress over Joomla.

2. I am not a PHP developer but I can create magic with CSS :-) This meant that developing a theme right from scratch was out of the question and we had to look out for customisation on existing ones. While scouring the Web for magazine themes, we realised that the free ones available for Drupal were too vanilla, and we were hell-bent on developing the website with freely available resources. This gave WordPress a big thumbs up.
3. When it comes to search engine optimising a website, Joomla could never beat WordPress or Drupal. This is one aspect where Joomla lags behind.
4. Just while we were tied between Drupal and WordPress, we had to take a call because WordPress will never be as scalable a CMS as Drupal is. On the other hand, I had never touched Drupal before.

There were decisions to be taken and a lot of cigarettes were stubbed out in our quest for that ideal CMS, when finally WordPress’ easy-to-use editor, the ease of adding captions to images, and the level of flexibility available took the trophy away and we ended up downloading the then-latest WordPress 2.7.1 while also looking out for that ever-elusive, free and ‘perfect’ theme for LinuxForU.com.

A History

When you write about the evolution of any technology, it is tempting to quote Wikipedia and fish out what the community has to say about WordPress:

“WordPress is a free and open source blog publishing application and Content Management System. WordPress is the official successor of b2\cafelog, which was developed by Michel Valdrighi. The latest release of WordPress is version 2.8, released on 11 June, 2009.”

WordPress is an innovative and revolutionary self-hosted personal blog publishing system that allows bloggers to develop and maintain their own blogs or websites. Its usability and sophistication stem from the fact that as an open source project, countless people worldwide have participated in the development and ongoing refinement of the platform for the community. The ease and non-technical aspect of WordPress opened the blogging world to everyone, including those with minimum computer experience.

WordPress was born out of a desire for an elegant, well-architected personal publishing system built on PHP and MySQL, and licensed under the GPL. WordPress is fresh software, but its roots and development go back to 2001.

It was in 2005 that WordPress released version 1.5, making theming possible, and this paved the way for its rise in popularity and fame. Bloggers and website owners could then personalise their sites with specific themes, layouts, colour schemes, etc, to suit their personal needs, and best of all, for free. Although having a blog/website organised with a free WordPress theme is great, it did have its disadvantages. The theme designs tend to be generic and not offer a wide selection of quality styles to choose from. Blogs all over the Internet looked the same without much originality; in addition, the free themes lacked a lot of advanced functionalities.

Hence, the WordPress premium theme industry took off. With the growing popularity of WordPress as a blogging platform, there were more free and premium themes in the market, which again contributed to the rise in WP’s popularity, thus creating a vicious circle. Moreover, this had also allowed bloggers and website designers to choose from a wide variety of great designs and be able to customise their sites using tools and plug-ins not available with most free themes. Some of the advantages of purchasing a WordPress premium theme include:

- a wide variety of excellent designs for originality

- being able to totally customise your site
- themes will be continually updated
- technical support availability
- more advanced and technical functionalities
- could be used for large websites of corporations and online news magazines.

(To learn more about WordPress, check out <http://en.wikipedia.org/wiki/Wordpress>).

The search for that perfect theme

Two months! Yes, we took two months to finally get the look that LinuxForU.com finally has, today. Hours of using Google's servers' processing time yielded a lot of results but we found none of them satisfactory. We considered quite a few WP theme developers like WooThemes (woothemes.com), wphacks (wphacks.com), PremiumWP (premiumwp.com), NattyWP (nattywp.com), WordPressThemesMarket (wordpressthemesmarket.com) and Premium Themes (premiumthemes.net) and finally managed to zero down to just four themes that suited our purpose. They were:

1. Open Book, from WPHacks (lyxia.org/blog)
2. The Stars, from Premium WP (premiumwp.com/demo/thestars)
3. Guzel Magazine, from Deluxe Themes (newwpthemes.net/guzel-magazine-2)
4. Comfy magazine, from Deluxe Themes (deluxethemes.com/comfy)

Our first choice was the OpenBook theme because we liked the overall look that was simple yet elegant. Moreover, we were keen on a dark background for the site, and black is the sexiest you

can find. OpenBook had fit into our requirements pretty well since we were looking for top menu-driven navigability that also has drop-downs, and easily-recognised categorisation of the content. As for the sidebar, despite being scant, it never lacked

functionality. So, although I had always preferred a four-column template, with fluid width and two sidebars, I could not find myself saying, "No" to OpenBook. Thus LinuxForU.com's development began based on OpenBook.

A few days of digging into the code and customising it, and we managed to stumble upon 'The Stars' theme from Premium WP. We immediately fell in love with the design, owing to its vibrant look and colourful pictures (we admit, we got seduced by the beautiful ladies featured in the theme ;-)). Suddenly, all our theme customisation got scrapped and we embraced 'The Stars'. We were aware that we HAD TO get rid of the shocking pink from the theme's colour scheme, and come up with a colour combination of our own. It was tough, but it was a challenge I was ready for.

I was always in love with the dark menu bar that 'The Stars' had. I made conscious efforts not to change that and yet work on revamping the theme's colour scheme. Hundreds of colour choices later, we finally decided on the pleasant blue and orange combo that LinuxForU.com currently features. A few more days and the complete colour scheme of the site got changed to blue, with a dash of orange. There was also a lot of customisation that had been done in the individual pages (more about that later) and the prospects were looking good.

Fortunately or unfortunately, fate always had a way of getting us distracted to better and more beautiful beings, and Atanu Datta (another member of LFY bureau) managed to chance upon two more theme designs



LinuxForU.com—the final look

that we simply couldn't ignore. They were 'Guzel' and 'Comfy' from Deluxe Themes. The reason we fell in love with both of those themes was the way they featured stories (neater, easier to understand and more user friendly), the prominence with which the subscription widget was placed, and a search bar that was easy to find and understand. While the search bar on 'The Stars' was funkier, it was much more prominent on the other themes.

These distractions posed a huge problem, especially for me, because the current theme had already been extremely customised and it would have been a pain in the you-know-where to again deploy another theme and start working on it. We had already spent a whole month in our quest for that ideal look for the website. On the other hand, it was also tough for us to ignore the advantages provided by 'Guzel' and 'Comfy'.

Even between 'Guzel' and 'Comfy', we failed to decide on one of them because while we loved the curvy looks of 'Comfy', 'Guzel' looked more complete and professional. Functionality-wise, 'Guzel' lagged a bit because it features only one story on the home page, for every category, as opposed to the five in the case of 'Comfy'. This made me ask myself a question. "What is it about 'Guzel' and 'Comfy' that's attracting us? Can we implement the same in the existing theme of LinuxForU.com?" It was this thought process that did the trick for us. I finally started segregating the content boxes, giving them a distinct look, to make them look a little elevated



The Stars theme—from where the LinuxForU.com's look has been derived

compared to the background. This gave rise to the idea of a three dimensional feel and the rounded-cornered boxes.

While the 3D effect was easily achieved by creating little graphic strips on the GIMP, I was torn between using images or CSS styling to achieve the rounded corner effect. While this could easily be achieved using the CSS styling rule `-moz-border-radius`—this styling is effective only on Mozilla Firefox and other Gecko-based browsers. This meant that the corners stayed rectangular for our visitors on Opera, Chrome, Safari and IE. Initially we had felt that we'd let it stay that way, publicly disclosing that we have made the website look more beautiful only for those with an open source browser (sadly, Chromium was excluded). However, we later changed our stance and decided to transform the edges into images. Although the menu bar would still be rounded only for the Gecko based browsers!:-)

Now that we managed to put the 'theme wars' to rest, we moved on to more serious jobs, i.e., hacking into the core PHP of the theme.

Redesigning the LFY logo

This was the toughest decision for us—redesigning the LFY logo. It takes years, even decades, to build up a brand and win recognition for it. At that point, a decision to revamp the very image that defines a brand can give any CEO a heart attack. So, we were very afraid to experiment with the current design of *LFY*'s logo (Figure 1-a). Thousands of readers around the country have come to associate this logo with our beloved magazine. How do we change all of that, overnight? Yet, there was this burning flame in our hearts to usher in a change, a revolution, and we went about our task.

We started slowly, without trying to be radical. We needed to understand which part of our logo needed more weightage. So, we broke up the logo into three pieces, 'LINUX', 'FOR YOU' and the tag line. Speaking of branding, we were very cautious about the 'FOR YOU' bit, and started getting a bit narcissistic as we went along, paving the way to the

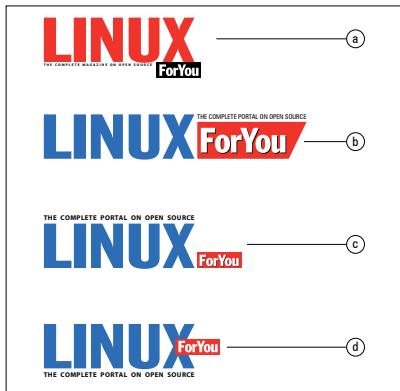


Figure 1: LFY progressive logos

design in Figure 1-b. While we still gave the same importance to 'LINUX', we were quick to realise that the 'FOR YOU' brand still had a long way to go before it earned the right to capture as much screen space as 'LINUX'. So, we reduced the size and formulated the design in Figure 1-c.

I do not know if you'd believe us but this logo actually got us very sad. Why, you might ask. Well, we love Linux and everything to do with it. However, in the logo, the 'FOR YOU' (that symbolises us) seemed to be very disassociated with 'LINUX' and we rejected it immediately.

We went back to the drawing board and started rethinking the role of LFY in our readers' life. We felt, we still exist because we managed to cater news, reviews and resources on Linux and open source to our readers, and this is what makes us survive and also find so much love around. This gave rise to the very wacky idea of us being a courier service that brings 'LINUX' to our readers' homes and hence we got the idea of the courier service's sticker pasted on top of the 'consignment',

which is 'LINUX'!

So, what do you say? Are we still the age-old magazine house with vanilla mentalities? We *are* turning wacky too!:-)

Feature requirements

1. While we were brainstorming on the feature requirements for LinuxForU.com, there were a lot of debates on how the content ought to be customised. Although I, personally, was in favour of genre-based categorisation, not many felt good about changing the categorisation structure from that of the magazine. While you wish to give your product an image overhaul, it becomes very hard to ignore your legacy and the norms that you have been following all these years. This finally resulted in a compromise—we decided to allow our readers to choose the way they wanted the content to be categorised. This very idea later made me wonder (without being intentionally narcissistic) why didn't other content-based portals all over the Web follow the same pattern?
2. One of our major concerns was the 'Archives' page. Since we plan to put up all the content from our previous issues, online, the content needed to be easily searchable and browse-able by visitors. Moreover, while we *were* building a website, at the end of the day it actually was an extension of the magazine itself. So while we aimed at a revamp, it was also important for us to maintain the feel of a magazine's website.
3. While the existing 'commenting' feature of WordPress is pretty nifty, I always used to search around for Ajax-based commenting. Moreover, I also wanted the comments to be editable by our readers, but only up to 15 minutes of the comment getting published.
4. "Before you expect something from others, always think of how to give out." It was this principle that made us wonder if there could be anything we could give to our readers for commenting on our website. Of course, it always



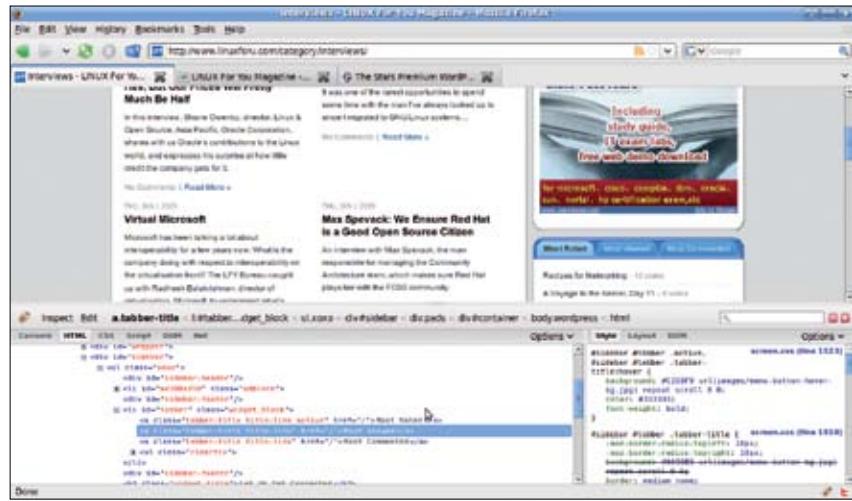
Figure 2: Another option, we considered



Figure 3: The final logo

needed to be the content that inspired the readers to comment, but we also wanted to give something extra to our readers. There are a few websites that feature their top commenters on the sidebar, but our sidebar didn't have enough space, and I was in search of something more space-efficient yet richer in returns.

5. If you want to increase the depth of navigation in your website, it is always a good idea to feature 'Related Articles' on every page. That way, you give your readers a way to read more on their preferred topics, without having to wade through a lot of irrelevant search results.
6. We also wanted an 'About the Author' section that is present in the magazine. The default WordPress installation doesn't provide that feature, and we went in search of a plug-in that could give us that functionality.
7. Conversations become more personal and engaging once you have a face to identify them with. This belief gave me the idea of including images for every commenter and also for the authors.
8. These days, while incorporating social bookmarking buttons in your content pages has become a fad, it has also become a necessity. Social bookmarking is a great way to get your content featured on other sites, in turn increasing your page views. While there are a lot of services like Share-a-holic, Quick Share and Tell-A-friend that provide such buttons and functionalities, most of them actually make your site look ugly rather than enhancing it. We were in search of something classier.
9. By default 'The Stars' theme had the same CSS style rules for both the `<pre>` and `<code>` tags, while our requirement was for them to be different. So, even that needed to be changed.
10. LFY has published a lot of articles in the past that have been co-authored by multiple writers. We needed to figure out a way to incorporate



Firebug in action

that feature into our website since WordPress doesn't have that functionality, by default.

Development tools used

- **gPHPEdit:** PHP, formerly the 'Personal Home Page' tools and now the 'PHP Hypertext Preprocessor' (celebrating the hacker tradition of recursive acronyms), is a scripting language for the Web with a gigantic following. It's also ideal for other general-purpose coding chores. Programs for hacking C, HTML and other languages have existed for some time; now PHP is starting to see its own dedicated software, and gPHPEdit is looking notably strong here. What's more, gPHPEdit also provides assisted development for CSS and HTML. It offers syntax highlighting, code completion and also tons of plug-ins to customise it the way you want it.
 - **Firebug:** For any Web developer, there can not be any life without Firebug. Firebug is a free Mozilla Firefox add-on that gives developers a powerful tool to inspect and edit HTML, perfect CSS, or even admire the beautiful code from other websites. For many, the add-on has become an indispensable part of website design, development and maintenance.
- Firebug provides a Box Model viewer, along with an improved inspector. Click on the HTML tab

in the left panel and the *Layout* tab in the right panel. The Box Model is displayed on the right while the HTML tree is displayed on the left. Start moving through the tree and as you hover over an HTML item, you'll notice the HTML in the browser window will be highlighted. Click on some text in the HTML tree. You can edit the HTML right there in Firebug.

You can even edit the CSS. Firebug provides you the ability to tweak your CSS while looking at the browser, so immediate adjustments can occur while editing the CSS – an excellent feature.

Well, truthfully, Firebug is a Web developer's Swiss army knife and deserves a complete article in itself. And if you are developing or theming for a CMS—such as Drupal, Joomla, WordPress or Blogspot—Firebug is an absolute essential tool. These applications comprise many files, and navigating through this maze can be daunting without a tool like Firebug. The beauty of content management systems is that you need not be a programmer to 'theme' a website, and you can typically do so without ever touching the programming code. But yes, you must be able to identify the controlling CSS to bring your own vision to the screen.

- **The GIMP:** Does it need an introduction?

- FileZilla:** FileZilla is an FTP client that basically lets you connect to a server that has FTP access enabled. Once connected, it lets you upload and download files and directory structures. It can also perform basic actions like changing the file attributes.

FileZilla can handle multiple transfer threads at the same time. This is especially helpful if you are transferring a lot of little files. It also has a nice keep-alive function that will keep your FTP connection open and available. Since most Web hosts will close the connection after a couple of minutes of no activity, this will prevent no end of frustration if you are making a bunch of little tweaks and changes on your site.

One gripe with FileZilla is that you cannot have simultaneous connections to multiple servers. I sometimes find this necessary while developing websites, and the only option is to get the files required to the local machine and then move them to the other server. But it is quite cumbersome, and this feature is absolutely desirable.

- Browsers (Firefox, Opera, IE, Google Chrome):** Yes, I have been booting into Windows pretty regularly. Why? Because IE4Linux proved to be inaccurate in rendering the site's CSS and it was important for me to know how the site fared on IE 6, 7 and 8. Moreover, despite the presence of the open source Webkit-based browser called Arora, it is very basic compared to Chrome and Safari. So I did need the afore-mentioned browsers to test the usability, look and navigability of LinuxForU.com.

Webmaster tools

- FeedBurner:** As far as RSS goes, FeedBurner is the hottest feed management technology. If you thought RSS was powerful before, it's ten times as useful when powered by their proprietary tracking and enhancement technologies. When you sign up for FeedBurner, you give it your RSS

feed's address, and FeedBurner gives you a new feed address to replace it with. When people subscribe to your new FeedBurner address, the service starts tracking subscriptions. This process is called 'burning your feed'. To learn more about FeedBurner and RSS feeds, check out technosailor.com/2006/11/29/review-of-feedburner.

- Google Webmaster tools:** This is a must if you want your site to be optimised for Google's search algorithm. It will tell you when the last Google crawler visit occurred, what kind of errors are encountered in your website, and the most important is your 'prefer domain'. Google Web master tools are free to use, which was a wonderful surprise—that Google actually came up with this tool to make the Web master's life easier.

If you often wonder why you didn't do too well in Google's ranking, this tool might help you to detect the problem. Anyway, it works fine but still lacks some important features. We encountered some trouble figuring out what had caused the errors in our website, and there was not much assistance to fix the errors other than just showing the error messages. For future releases, we hope this tool will become more intelligent and help us, step by step, in solving issues that may crop up.

- Google Analytics:** Google Analytics is one of the best tools out there for analysing traffic on your website. With a little bit of setting up, it will give you an enormous amount of information about who is coming to your site, what they're looking for, and how they're getting there. In fact, it has so much information that it can be overwhelming! Google Analytics shows you how people found your site, how they explored it, and how you can enhance their visitor experience. With this information, you can improve the return on investment of your website and increase conversions. (Check out

en.wikipedia.org/wiki/Google_Analytics for more information.)

Plug-ins incorporated!

Plug-ins are a great way to extend the functionality of anything, be it your desktop application, a device hardware or even a CMS. One of the major reasons the open source CMSs became popular was their capability of being extended effortlessly and without any programming knowledge, just by using plug-ins. Yes, even LinuxForU.com uses quite a few plug-ins, a lot more than what I'd have liked. Allow me to list the most important ones here and also mention why we installed them.

- Advanced Excerpt:** This plug-in extends the functionality of the default `wp_excerpt()` function by allowing you to specify the character length for the excerpts and also the addition of HTML markups.
- CommentLuv:** This plug-in has been used to show a link to the last post from the commenters' blog by parsing the feed at their given URL when they leave a comment. This was what we came up with when we wondered what more could be offered to a commenter!
- Editor Extender:** Despite the default TinyMCE editor of WordPress being pretty feature-rich, it lacked the capability to create tables. This was achieved by 'extending' the functionality of WordPress' default editor using this plug-in.
- Live Comment Preview:** A lot of us use HTML tags while commenting on a blog and more often than not end up using the preview feature just to make sure the comment looks the way we want it to. Well, we just made life easier for you and provided you with a live preview of whatever you want to write to us about. Happy commenting!
- Most Commented:** We have three tabs at the sidebar, one of which sorts the articles on the basis of the number of comments received. This helps in featuring popular content

- on every single page of the site, inspiring our authors to come up with better content, every time!
- Search Everything:** Previously, our search algorithm would search only the tags and words in the articles, but neither the excerpts nor the categories that an article had been classified into, which was achieved by installing this plug-in.
 - WordPress Related Posts:** As already mentioned, it was an important requirement from our side to be able to feature articles related to those you read on the site. Hence the plug-in.
 - WP Ajax Edit Comments:** This allows both the admins and users to edit the comments inline. It also allows the admins to edit every single comment on the website.
 - Flexo Archives:** We wanted to sort the articles in our 'Archives' page according to the year they were published. Moreover, we also plan to feature content on the site that has never been published in the magazine, and did not want such articles to be featured in the archives section. Plus, despite none of us being experts in JavaScript, we wanted the pull down functionality in our archives page, and hence ended up using the Flexo Archives plug-in.

Other customisations

- Changing the site's layout according to the categorisation:** The idea behind the change was to set up a cookie every time a button is pressed. It is the cookie that will decide the layout. For the source code, you can refer to LFY's CD and browse to *linuxforu/wp-content/themes/thestars/header.php* and *linuxforu/wp-content/themes/thestars/home.php* (relevant documentation has been provided with the code).
- Different CSS styling for `<pre>` and `<code>` tags:** Since we needed different styling for the two tags, we had to rewrite the CSS rules as follows (found in *linuxforu/wp-content/themes/thestars/master.css*):

```
pre {
    -x-system-font: none;
    background: #F6F6F6 none repeat scroll 0 0;
}

code {
    border: 2px solid #EEEEEE;
    display: block;
    font: 0.9em 'andale mono', 'lucida console', monospace;
    font-size-adjust: none;
    font-stretch: normal;
    font-style: normal;
    font-variant: normal;
    font-weight: normal;
    line-height: 1.5;
    margin: 0.5em;
    overflow-x: auto;
    overflow-y: hidden;
    padding: 10px;
}

code{
    font: 0.9em 'andale mono', 'lucida console', monospace;
    font-size-adjust: none;
    font-stretch: normal;
    font-style: normal;
    font-variant: normal;
    font-weight: normal;
    color: #F68B1F;
}
```

- Author Bio:** WordPress already stores details about an author in the database. All we needed to do was use the following piece of code wherever we needed to feature the author's bio:

```
<?php
$AuthorEmail = get_the_author_email();
$GravURL = get_bloginfo('template_directory');
$Grav = get_avatar($email =
$AuthorEmail, $size = 85, $default = $GravURL .
'/images/default-author-image.jpg');

?>
<?php
$authordesc = $authordata->user_description;
$AuthorDescription = apply_filters(
'archive_meta', '<div class="random-class">' .
$authordesc . '</div>';
if ( !empty($authordesc) ) echo '<div
class="author-meta">'; <div class="author-avatar">' . $Grav . '</div>' . $AuthorDescription .
'</div>';
?>
```

- Oh yes, we used Gravatar as our image service to show authors' photos. Gravatar stands for Globally Recognised Avatar. To create a gravatar, you need to visit www.gravatar.com and create an account. While doing so, make sure you give the same e-mail address and nickname that you intend to use when you leave a comment at LinuxForU.com.

Bug reports

- The 'Archives' page is still not ready. Although we have shared the page in this issue's CD, along with the rest of the site, we still haven't made the link go live. While we are able to list out articles the way we want to, unfortunately other links also get created where there is not a single article to show. Of course, if you manage to figure out the problem, you are more than welcome to share the solution with us. :-)
- While the article is not supposed to reload while commenting (isn't that what AJAX is for?) it still does.
- We find the menu and featured content rotator not performing up to the mark – they're a bit slow.
- The featured content rotator has been set to automatic and yet it has to be changed manually.

So are you wondering why we've also highlighted the bugs in LinuxForU.com? Well, call us smart, call us shrewd—we do expect you to take a look at our site's source, improvise on it and even pass it on! ;-)

P.S. The source code for LinuxForU.com website is included in the LFY CD. And of course, you get the "four essential freedoms" along with this too.



By: Sayantan Pal

An avid Twitter user and a social media enthusiast, the author is a passionate blogger and a professional gamer too. He also feels compelled to be opinionated about anything that comes his way, be it Linux distributions, our marketing strategies, table etiquettes or even the fabled Ramsay movies!



Collaborate in an Innovative Way

Among all the innovation happening around free software is Cyn.in, an innovative business model that makes open source software a profitable commercial product.

Innovation drives business; innovation creates new businesses—innovation is business. You will find a lot of proprietary companies playing hide and seek and then patting their own backs for their so-called innovations. They also seem to suggest that if you are creating something innovative, you must lock the code in your trunk. But the free software world follows a different philosophy of innovation. We have all heard the saying: “Necessity is the mother of all inventions” – something that the free software world lives by. However, the proprietary corporate world likes to go by the rule, “Innovate and create a need so that you can rule.”

Cyn.in is primarily a collaboration tool and platform that enables businesses to connect their people with each other and share their collective knowledge. The tool makes it easy for employees to work with each other and with key stakeholders outside the company. Users on board the platform can share knowledge, get answers, improve decision-making, and hence work much faster and productively.

“Think of it as a ‘Facebook+Wikimedia for businesses’, that a company of any size can set up within its corporate network. It combines the capabilities of various collaborative social applications like wikis, blogs, file repositories, microblogging, discussions, event calendars and more, into a single seamless platform. Teams use these tools to create, share and discuss knowledge using an intuitive Web interface or a rich desktop client,” says Romasha Roy Choudhury, business director—Cyn.in, Cynapse.

Core features

The core capabilities of Cyn.in are to securely and rapidly store, retrieve, co-author and discuss any form of digital content within virtual work areas called ‘Spaces’. Over these core capabilities, a layer of ‘content applications’ such as wikis, blogs, bookmarks, image/video/audio galleries, file repositories etc, provide for easy knowledge collaboration between users with diverse needs. “A key differentiator of Cyn.in is that, unlike most collaboration suites available for the enterprise, it is not a set of diverse applications loosely coupled into a suite. On the contrary, more than 85 per cent of Cyn.in’s features are common across the platform,” explains Romasha.

Google recently launched Wave, which the search engine giant claims to reform the way people communicate over the Internet. It seems Cyn.in already does most of it. So, how different would Wave be from Cyn.in? “Yes, we have been quite excited internally about the Google Wave announcement. There is a strong similarity in end goals (i.e., eventually making e-mail obsolete!), and also in some levels in the user experience of the two offerings. However, we are solving the problems at different levels. While Cyn.in aims at being a convergence point for all kinds of knowledge collaboration, Wave looks at content communication from a protocol perspective, and focuses on providing a foundation and open standards for the same,” opines Romasha.

“For Wave to be greatly successful, it would need to be adopted and integrated with collaboration platforms such as Cyn.in. The

greater match comes from the fact that we already have made substantial investments towards XMPP for real-time communication and are working towards tightly integrating the protocol into the heart of the platform. Since Google Wave is also based on XMPP, and is open source, you could expect to see Cyn.in implementing Wave some time in the near future, though it would be too early to discuss specifics."

The beginnings of the innovation

Cynapse, the company behind Cyn.in, has been in the business of providing collaboration and community solutions to medium and large enterprises for the last eight years. The company has also been a player in the evolving consumer Web applications front with products like SyncNotes. In its early years, it realised there was a huge gap between the evolution of consumer and enterprise technologies. "While the consumer applications (now called Web 2.0) evolved at a rapid pace towards empowering users with newer capabilities, enterprise applications focused purely at top-level business requirements, and failed to address the productivity and communication requirements of the users. As businesses become more and more knowledge-driven and deal with an ever-changing market ecosystem, real knowledge can be seldom successfully stored and communicated using structured databases and ERP applications," says Romasha.

She adds, "The real knowledge of the business is stored in the minds of its people and in the communications between them. Cyn.in was conceived to solve this. It aims to be the brain and the neural system for the modern enterprise, by connecting the people across the entire network of the business, i.e., partners, vendors, customers and not just its employees. Apurva Roy Choudhury (CEO, Cynapse) is the chief architect and inventor of Cyn.in along with Dhiraj Gupta (CTO) who heads the project."

Cyn.in is built on top of the Plone-Zope-Python platform. It is a layer over the famous Plone CMS, which is

highly-recommended for enterprises, and is known to be the most secure CMS out there. The company feels that the Plone and Zope communities have some of the smartest developers and technologists they have ever teamed up together, and a large number of them are really excited about where Cyn.in is taking Plone. Besides the Plone-Zope-Python platform, Cyn.in depends on and integrates various other open source projects such as the Apache Web server, the Ubuntu Linux server, the Ejabberd XMPP server, Adobe Flex and, soon Firefox and XUL as well, to name a few. Cyn.in does not, however, integrate any existing point applications such as wikis or blogs; they are all created from ground up within the Cyn.in platform.

The product is dual licensed—under the GPLv3 and a commercial license for enterprises that may choose to stay away from open source licences.

The innovation angle

While most similar initiatives in the enterprise collaboration space have traditionally revolved around enhancing e-mail systems and others have focused on porting point solutions of the consumer space like blogging and wiki software, and gluing them together, Cyn.in has been designed from ground up as an enterprise collaboration platform. The uniqueness of Cyn.in comes from its design of free-form communication and collaboration, while providing for a strong focus on enterprise information security needs.

But why the open source model?

Cynapse is not a core free software company; yet, it released Cyn.in as free software. Why would any company do that? Romasha hits the nail on the head when she says, "Open source is not just our development model, but also our business model. Since the enterprise collaboration market is relatively new, the open source model helps our customers in their process of value discovery, and hence helps Cyn.in to achieve rapid adoption. Cyn.in deployments have already far



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outnumbered the numbers touted by most of our competitors by a long shot, as IT departments have had free access to all of our technologies, and have keenly implemented internal POCs and begun initial adoption without worrying about procurements first."

She further says that the open source model also helps in reducing the cost of the sale, as most sales communications happen with potential customers who are already using the company's open source edition and are transitioning to a model that comes with commercial support. On the development front, open source has helped the company in a multitude of ways.

"We believe some of the greatest innovations in the technology front are happening in the open source ecosystem, and while proprietary software are compelled to look at most innovations as competition, the open source model provides for a mutually beneficial ecosystem that enables us to integrate the best-of-breed innovations into our offering. It has also helped us in recruiting some of the most passionate and smart technologists in the industry from across the world," reveals Romasha.

Cyn.in vs proprietary competitors

"Our highest investment in Cyn.in over the last year has been towards making it simple, usable and adaptable. Since we distribute, sell and support Cyn.in to businesses across the globe, over the Internet, we have had to make sure that though Cyn.in is a large enterprise software, it can as easily be set up, deployed and adopted as a desktop application. To top all of this, our pricing model is competitive enough, making the TCO of Cyn.in 80 per cent lower compared to most of our competition," quips Romasha.

She adds, "Along with a free (of cost) open source edition, Cyn.in is also available as a supported enterprise edition, as well as a hosted and managed SaaS (software as a service) offering. Most organisations using Cyn.in actively for critical operations within their businesses prefer to buy commercial support for Cyn.in. Most small- to mid-sized businesses prefer to go with the SaaS option to avoid infrastructure and maintenance expenses. Beyond our off-the-shelf commercial offerings, we provide customisation and custom integration to ERPs/CRMs for our large customers, along with various other services like customised training, information architecture consulting, customised documentation and manuals around a customer's business processes, etc."

The market for Cyn.in

Fundamentally, any knowledge-centric business or organisation that depends heavily on e-mail and digital documents for their business operations would require a product like Cyn.in. However, the company says its current market focus is towards mid- to large-sized businesses.

"We have broad customer diversity, ranging from Fortune 500 companies with over 40,000 users to small training institutes with 10 users. We have customers across

Cyn.in: The innovative edge

Contextual discussions: Cyn.in provides for rapid, threaded discussions across all its applications, enabling its users to discuss files, wiki documents, video and audio content, Web bookmarks, or any kind of content added to the system. Contextual discussions in Cyn.in form the heart of collaboration.

Activity stream: Though now a common concept thanks to the new Facebook, the company claims Cyn.in was the first application to create a cross-application, cross-context stream of live information. In its current avatar, the activity stream sports multi-faceted filtering of content, making it an indispensable tool for users who want to be updated at all times, locate any information and focus only on what is relevant to them.

IM-style desktop-based contextual discussions: The activity stream and contextual discussions are fused into a cross-platform desktop client that provides an instant-messaging-like experience to users, while maintaining context to the conversations and messages.

Tightly unified, extensible applications: Though the content applications in Cyn.in may share the branding and basic concepts of blogs, wikis and document management systems, their capabilities are strongly enhanced by each other and they are tightly coupled at various points.

Fine-grained security and access control: Unlike most Web 2.0/Enterprise 2.0 applications out there, Cyn.in addresses enterprise information security concerns and provides for a strong role-based security model at granular levels, making it well suited for compliance conscious enterprises.

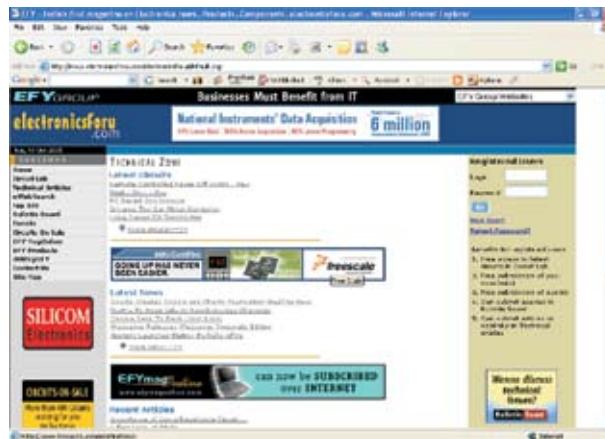
Software appliance-based rapid deployment: Cyn.in is distributed pre-bundled with its own application server, database server and a hardened operating system, making it a completely self-sufficient software appliance. It does not have any external dependencies apart from server hardware. This allows Cyn.in to be set up in minutes, and commercially supported customers are provided with additional benefits of remote support and troubleshooting, as well as live updates that ensure continuity and uptime.

the globe, from the US, Europe, the Middle East, Asia and even Africa. We have a strong close-knit community around Cyn.in, thanks to the Plone community and are scheduled to invest in growing the community publicly, beyond the Python/Plone circles." 

By Swapnil Bhartiya

A Free Software fund-a-mental-ist and Charles Bukowski fan, Swapnil also writes fiction and tries to find cracks in a proprietary company's 'paper armours'. He is a big movie buff, and prefers listening to music at such loud volumes that he's gone partially deaf when it comes to identifying anything positive about proprietary companies. Oh, and he is also the assistant editor of *EFYTimes.com*.

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Smartbooks

The Return of Linux?

Does the arrival of smartbooks powered by Qualcomm's Snapdragon platform herald a new era of popularity for Linux?

When Asus launched the original eeePC more than a year ago, many industry observers felt that the move finally heralded the arrival of Linux in mainstream consumer products. Although Linux had been around for a while, and was being offered by a number of manufacturers (such as Dell) on their systems, the eeePC was perhaps the first occasion that a Linux-based device had caught the popular imagination. It was felt that different flavours of Linux would dominate the netbook segment (to which devices like the eeePC belonged) as their system requirements were few and were much faster than Windows Vista, Microsoft's then-new operating system.

Microsoft, however, trumped all expectations when it decided to make its popular Windows XP available for netbook manufacturers. Naturally, most consumers gravitated towards the familiar interface and Intel, releasing its Atom processor for netbooks, increased their processing power significantly. The Wintel (Windows+Intel) partnership virtually took over the netbook segment as well. That is not to say that Linux was totally wiped out from these devices—the less expensive netbooks still came with versions of Linux on them, but the possibilities of a “netbook=Linux” equation that the original eeePC had established, no longer existed. In fact, as Atom processors got more powerful, Microsoft even took a leaf out of Ubuntu’s book and announced plans to have a special version of its forthcoming operating system, Windows 7, for netbooks. Linux seemed to have had its brief day in the tech sun, just as it had with the Moto Ming in the smartphone segment a few years ago, and looked set to be consigned to the sidelines.

Qualcomm throws the dice!

However, the rumours of Linux’s demise in the netbook segment might be premature. Qualcomm recently added a whole new spin to the netbook segment by introducing what it termed ‘smartbooks’, devices that are a blend of notebooks and smartphones. Most of the attention has been on the Snapdragon ARM processors powering these devices and the fact that they come with integrated Bluetooth, GPS, HSPA+ and Wi-Fi, apart from ensuring longer battery life. However, what has not been highlighted is that these devices are not shrunk notebooks but more like expanded smartphones. The devices are actually closer to cell phones than to notebooks, coming with in-built connectivity features that one tends to find in smartphones. In essence, a smartbook is going to be a device that has a cell phone-like interface and features, but with a larger screen and keypad—shades of Palm’s ill-fated Foleo, a notebook that could be paired with a smartphone to access features that were on the phone.

What makes this cell phone linkage important is that smartbooks are not likely to be running conventional desktop operating systems like Ubuntu or Windows, but tweaked versions of cell phone operating systems. And this is exactly where many observers feel that Linux might suddenly return to the mainstream. Many of the manufacturers believed to be working on smartbooks are actually considering using Android, Google’s much-publicised open source mobile OS, for their devices. Qualcomm actually showed a version of the eeePC running Android, while Acer announced that it would be coming out with an Android-driven netbook (not smartbook, do note) later this year. Besides, with HP believed to be working on Android-

driven smartbooks and Nokia suddenly reviving work on Maemo (its Linux platform for UMPCs), you can see why observers suddenly feel that Linux is on its way back to the computing mainstream.

Android on smartbooks: the challenges

Of course, it would be very premature for those in the open source camp to start popping the champagne. We have not yet seen a commercial smartbook or an Android-driven computer in the market yet. And are not likely to for a few months. But analysts are quick to point out that Android is best suited to take advantage of smartbooks as it is designed for a mobile interface. And being open source, it can be tweaked very easily to meet the needs of different devices. Of course, there is nothing stopping a user from installing Windows on a smartbook, but the desktop version of Windows is not designed to take advantage of mobility features like HSPA connectivity or GPS, and this would stop the device from functioning at its best. Yes, Windows does have a mobile avatar, but its popularity is very limited in the phone segment, which is dominated by Symbian. What's more, Android is perhaps the first Linux/open source OS to have caught the public imagination, mainly because of Google's involvement in it. With Android powering Linux devices, they might finally acquire that quality rarely found in the Linux world—aspirational value!

But these are early days. The ball is now squarely in the court of the developer community to come up with an interface and

applications that will make Linux the killer OS for smartbooks. Right now, there is a lot of optimism, but a great deal of confusion—people are not even sure whether all smartbooks will have touchscreens or whether they will be keypad/keyboard driven. Similarly, critics have been quick to point out that the Android platform does not have the kind of applications that most smartphone users need—we are still waiting for a viable mobile version of OpenOffice.org and of Firefox.

Compatibility with different hardware will also be an issue. And then there is the threat of Microsoft, which many feel could just tweak its Windows Mobile platform to meet the needs of smartbooks. There are rumours circulating that Windows Mobile 7 will actually be like Windows 7 in its interface, while incorporating the mobility-friendly features of Windows Mobile. Now, that would make it a formidable challenger in the smartbook segment.

All this is, of course, just speculation. As of now, what we do know is that there is a new gadget in town called a smartbook. And that in all probability, it will come loaded with an OS based on Linux. We do not know how long this state of affairs will persist. But the very fact that it exists, provides an enormous opportunity for Linux to return to the mainstream! 

By: Nimish Dubey

The author is a freelance writer with a passion for IT. He can be reached at nimishdubey@gmail.com

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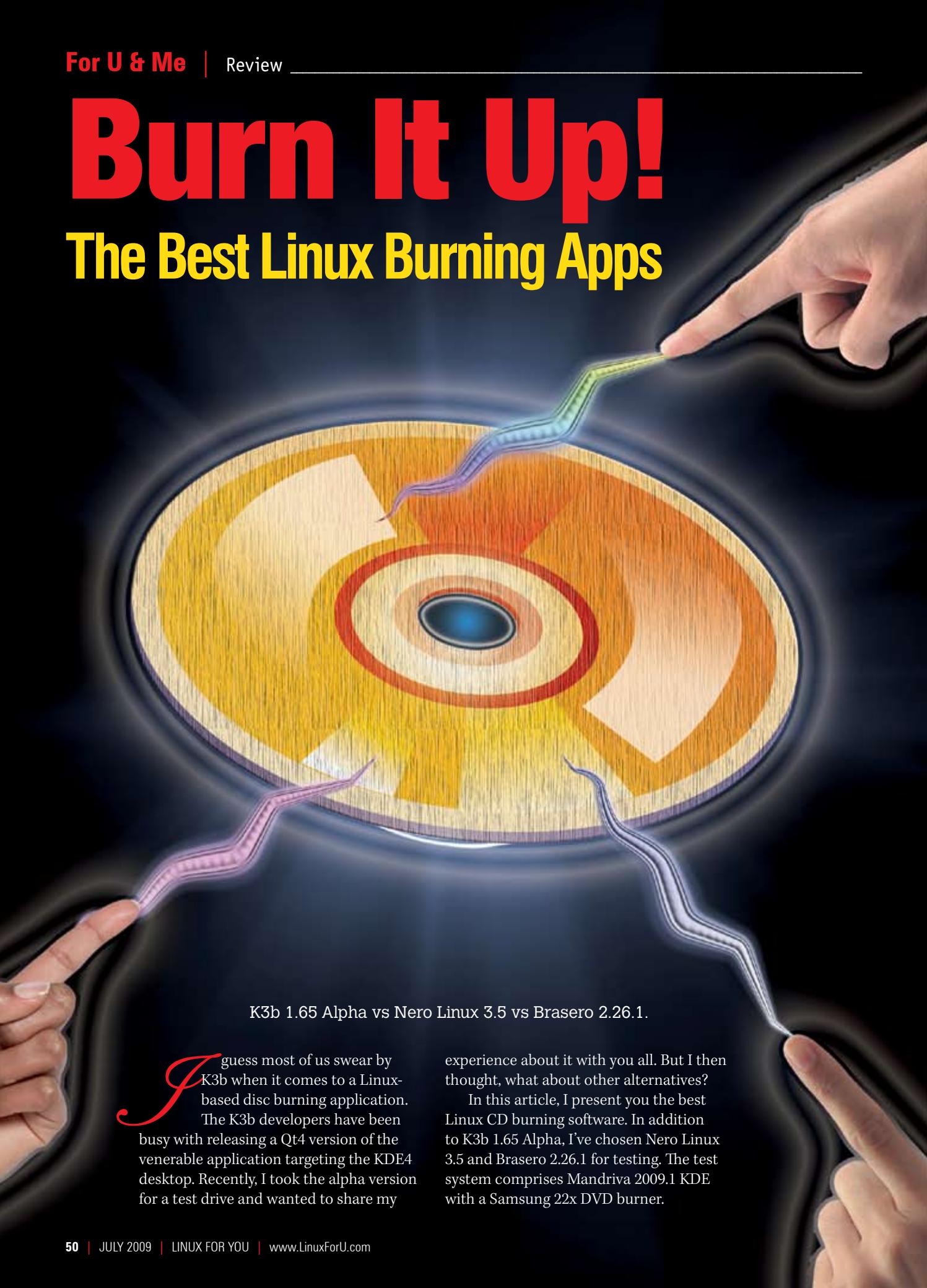
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Burn It Up!

The Best Linux Burning Apps



K3b 1.65 Alpha vs Nero Linux 3.5 vs Brasero 2.26.1.

*J*guess most of us swear by K3b when it comes to a Linux-based disc burning application. The K3b developers have been busy with releasing a Qt4 version of the venerable application targeting the KDE4 desktop. Recently, I took the alpha version for a test drive and wanted to share my

experience about it with you all. But I then thought, what about other alternatives?

In this article, I present you the best Linux CD burning software. In addition to K3b 1.65 Alpha, I've chosen Nero Linux 3.5 and Brasero 2.26.1 for testing. The test system comprises Mandriva 2009.1 KDE with a Samsung 22x DVD burner.



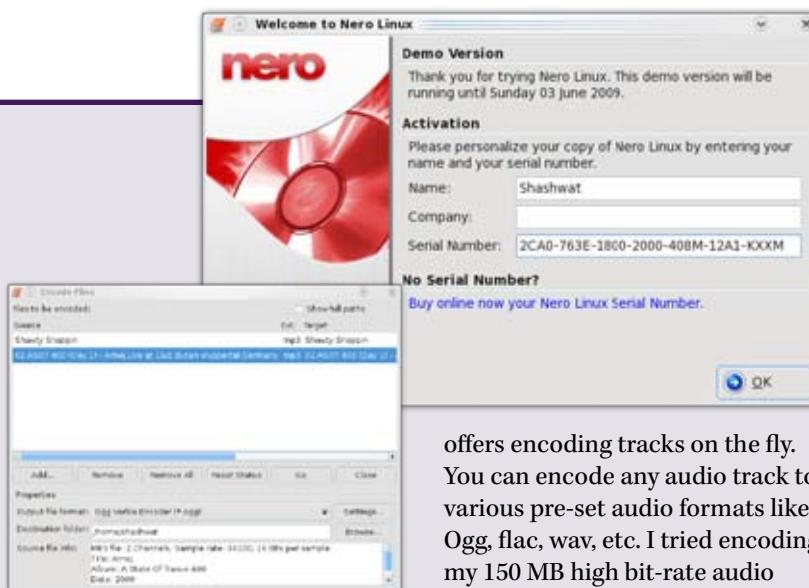
Nero Linux 3.5

Touted as the most prominent and user-friendly software for Windows, Nero doesn't stand back where Linux is concerned, either. Nero bestowed on us Blu-Ray support with a host of other new features. Nero Linux is probably the most under-rated and unpopular burning suite primarily because of its proprietary and closed source nature. But despite it all, Nero clears all the hurdles and tries to provide an easy-to-use burning software for end users with an interface reminiscent of older Windows releases.

Here are some of the burning capabilities of Nero:

- Audio CD (CD-DA)
- CD, DVD, Blu-ray, and HD DVD copy (with advanced settings)
- CD-Text
- CD-Extra support (with advanced settings)
- Bootable CD/DVD
- Multi-session CDs, DVDs, Blu-ray Discs, and HD DVDs (advanced features)
- Layer Jump Recording support
- DVD-Video and miniDVD (from DVD-Video files)
- CD, DVD, Blu-ray, and HD DVD image recording
- DVD double layer support
- .nrg/.cue/.iso image import
- Overburning support for CD and DVD
- Ultra-Buffer software buffering technology
- Speed tests and simulated burning
- Data verification after burning

Nero Linux 3 offers a paid as well as a demo version, which is available for one month of testing. Thankfully, all the features were available even in the demo version. Nero Linux offers a clean and hassle-free interface, supporting



almost every optical disc format available in the market, be it the mammoth Blu-Ray or the defunct HD-DVD. Windows users will love it, as the interface is pretty similar to older versions of Nero available for Windows.

Installation is fairly easy. The website provides easy packages for rpm/deb-based distros and an easy extracting script for non-rpm/deb distros. Since the difference in the paid and demo versions is the time limit and the serial key, all you need to do is download the demo and insert the key before you are ready to enjoy a great ride on the Nero Express.

Nero offers high quality burning capabilities and has successfully ported the major features from its Windows counterpart. Nero supports the UDF format and a host of other disc formats, making it easier to use in Linux without any need for assistance.

Burning with Nero is child's play. I was able to burn DVDs and CDs without any trouble. Nero offers faster burning than other available software. Even burning single large files above 4GB at low speed isn't an issue, unlike Brasero, which does give a few problems at that speed.

In addition to high quality burning capabilities, Nero Linux

offers encoding tracks on the fly. You can encode any audio track to various pre-set audio formats like Ogg, flac, wav, etc. I tried encoding my 150 MB high bit-rate audio track, and noticed that it was a bit sluggish compared to *ffmpeg* and other encoding tools. Nonetheless, it's a welcome addition and with an easy GUI, it will certainly reduce the hassles of grasping complex commands.

Despite high quality burning capabilities, Nero fails to offer video disc ripping – something that is much needed nowadays. Apart from this, Nero is a power-packed edition capable of churning out the most from your DVD/CD writer and providing high quality output at a decent price. Yes! Like its Windows sibling, Nero is paid for, but it hasn't been as atrociously priced as its Windows counterpart, thanks to a less bloated suite and the hassle-free interface of Linux.

Nero Linux 3.5



Pros:

Easy interface, Blue-ray & HD-DVD support, faster burning, handful of extra addons, supports almost all optical media.

Cons:

Proprietary software, costly

Platform: All distro supported

Price: \$24.99

Website: www.nero.com



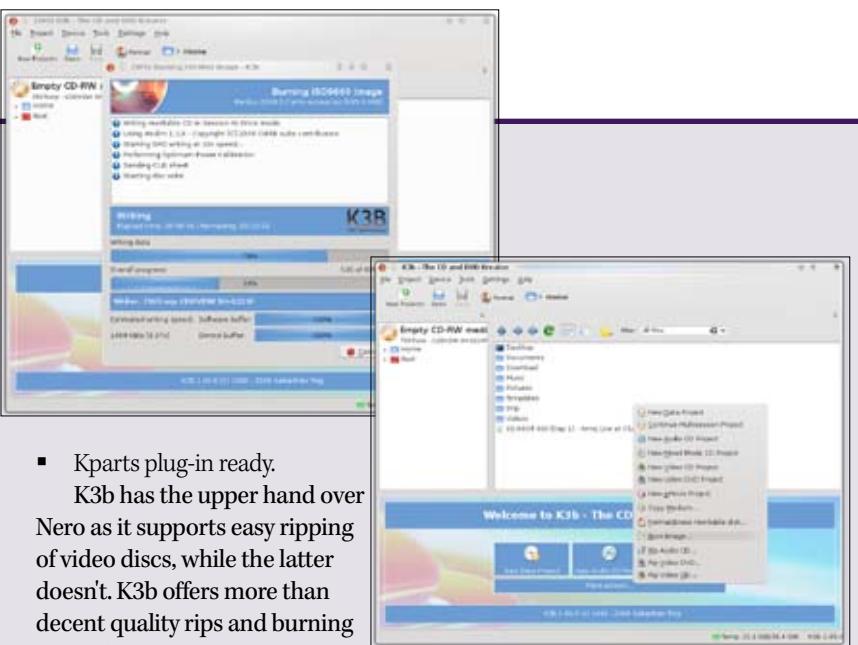
K3b 2.0 Alpha 1

I chose K3b Alpha to see what additional features it offers over the KDE3 version. It is advisable not to use the testing release for the production environment. The development for K3b 2.0 should be out soon and available before the KDE 4.3 release.

K3b 2.0 will finally bring native KDE 4 support and will eventually fill the gap that has been a deterrent to KDE4 acceptance. Besides, K3b offers Blu-Ray support to the open source industry.

K3b offers a complete solution out-of-the-box, irrespective of which format or media you throw at it. Here are the features it offers:

- Data CDs/DVDs/Blu-Ray discs
- Support for multiple El-Torito boot images
- Multi-session support
- Audio CDs
- Video CDs
- Mix mode CDs
- eMovix CDs
- CD copy
- DVD burning
- CD ripping
- DVD ripping and DivX/XviD encoding
- Save/load projects
- Blanking of CDR-W
- Retrieving table of contents and CDR information
- Writing existing ISO images to a CD or DVD with optional verification of the written data
- Writing cue/bin files created for CDRWIN
- DVD copy (no video transcoding yet)
- Enhanced CD device handling
- Automatic detection of maximum writing and reading speeds
- Detection of Burnfree and Justlink support
- Good media detection and optional automatic CD-RW and DVD-RW blanking



- Kparts plug-in ready.

K3b has the upper hand over Nero as it supports easy ripping of video discs, while the latter doesn't. K3b offers more than decent quality rips and burning capabilities with an easy to use interface. But creating a data disc might be a pain for a new user. The space provided for dropping in files is less and might become congested in windowed mode.

K3b offers high speed scanning of audio files and you can drop files in bulk, which is not the case with Brasero. The latter offers slow scanning of media files and thus becomes vexatious at times.

K3b is yet in the Alpha stage but still provides a quality experience. I have yet to experience any sort of crash or bug. Though the DVD burning sometimes gets stuck at 99 per cent, resulting in wasted space. So if you want to test K3b, get yourself a rewritable disc, which will substantially minimise the disc squander.

The UDF support in K3b (Linux in general) isn't as reliable as Nero Linux. Burning files in UDF mode resulted in non-working discs in Windows/MacOS, which is not the case with Nero Linux. I even used K3b 1.0.5 [kde3/qt3 version] to check them out, but all in vain.

Burning media in K3b is swift and effortless, though burning files larger than 4GB with UDF standards left a negative impression. It's not actually a problem with K3b—the Linux UDF standards didn't get recognised in

Windows and the Mac OSX.

Note: A UDF DVD burnt using K3b shows up as an empty media in Windows Explorer, while it lists all the files if you view the disc in a burning software even in Windows. So, it's more of an integration problem from the burning software's end. Discs burned using Nero Linux have no problem whatsoever.

Except for issues with UDF and large files, K3b is a rock solid disc burning software. It has been undoubtedly the most popular burning software in Linux, but major problems like non-working discs are certainly a let down. Hopefully, these will be fixed or a notification will be added informing users about the issues they could face.

K3b



Pros: Easy to use, Blue-ray support, audio/video ripping integrated, supports almost all optical media.

Cons: Somewhat congested interface, unreliable UDF support

Platform: Supports all distros

Price: Free (as in beer)

Website: k3b.plainblack.com



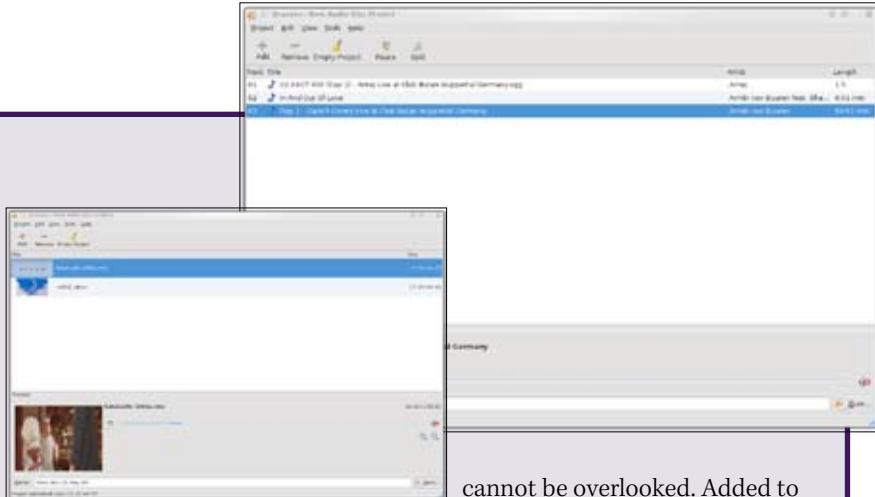
Brasero 2.26.1

Brasero started as a voluntary GNOME project, and has recently become an integral part of it. It is now the official disc burning software in GNOME, though the Nautilus burner is still shipped alongside Brasero.

In short, Brasero is all about simplicity. You just couldn't go wrong here. Brasero offers the easiest to use interface you can ever come across with any sort of burning software. It might not be as feature rich as Nero and K3b, but it's apt for lay persons looking to get their work done.

Brasero doesn't sport Blu-Ray or HD-DVD support. It didn't even burn single files above 4GB. However, unlike K3b, Brasero notifies the user that it cannot burn files over 4GB in advance. Some basic features that Brasero boasts of are:

- Data CD/DVD
- Audio CD
- CD/DVD Copy
- Erase CD/DVD
- Save/load projects
- Burn CD/DVD images and cue files
- Song, image and video previewer
- Device detection thanks to HAL



- File change notification (requires kernel > 2.6.13)
 - A customisable GUI (when used with GDL)
 - Supports Drag and Drop/Cut and Paste from Nautilus (and others apps)
 - Can use files on a network as long as the protocol is handled by GNOME-vfs
 - Can search for files thanks to Beagle (search is based on keywords or on file type)
 - Can display a playlist and its contents (note that playlists are automatically searched through Beagle)
 - All disc IO is done asynchronously to prevent the application from blocking
- Brasero is quite simple to use and suits everyone, but the lack of features—especially the inability to burn a single file of size over 4GB—

cannot be overlooked. Added to that, there is no support for Blu-Ray at present. Adding media files in bulk is not possible, so you need to search and browse repeatedly to add files. A bulk dropper is a must! Also, it takes a lot of time scanning for media files.

Brasero 2.26.1



Pros: Easy to use, decent burning speed, good for low-end usage.

Cons: No support for Blue-ray and HD-DVD, less features, doesn't support advanced ripping & burning options like the other two.

Platform: All distro supported

Price: Free (as in beer)

Website: www.gnome.org/projects/brasero

After burn marks

Contrary to what people think, the disc burning scenario is pretty despairing in Linux—the only software I can vouch for right now seems to be Nero. Apart from the lack of ripping features, it has everything a reliable software must provide. The inability of K3b and Brasero to burn larger file sizes cannot be ignored, and something must be done to fill the gaps so that they can compete with paid alternatives. K3b still has some great and usable tools, and is certainly more feature-rich than Brasero.

It is sad that major players like Roxio and Cyberlink haven't introduced their offering to the Linux market yet, and until then, I guess it's Nero Linux for me. If you

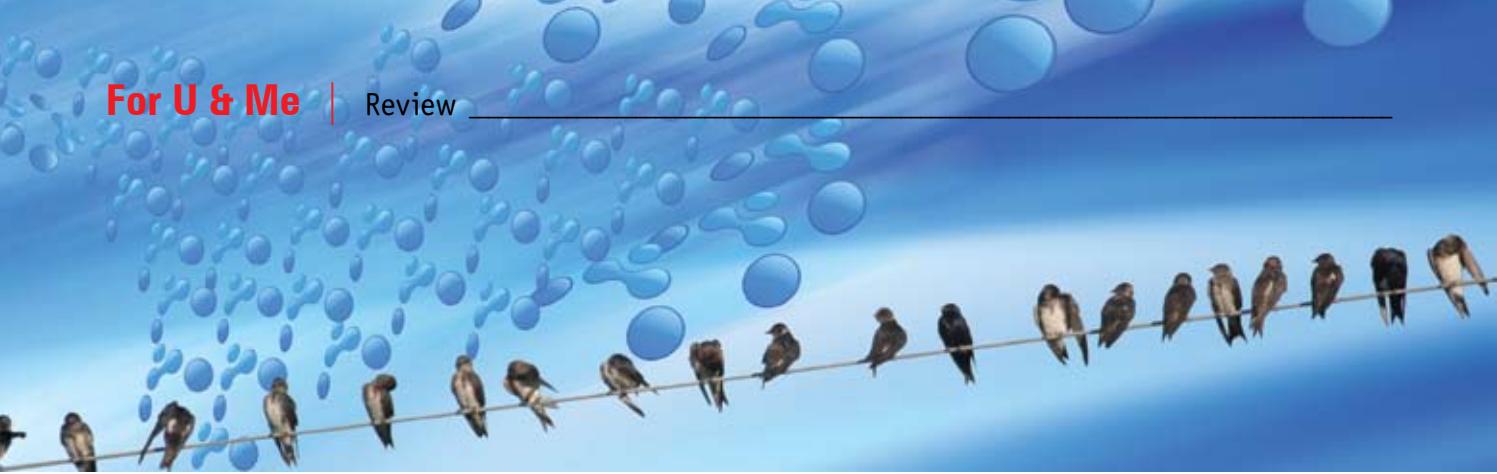
have the licensed OEM disc, then go for it. For anything else, K3b has the upper hand.

Resources

- Nero Linux: <http://www.nero.com/ena/linux3-features.html>
- K3b: <http://k3b.plainblack.com/k3b-news>
- Brasero: <http://projects.gnome.org/brasero/>
- Linux burners UDF incompatibility: <http://support.microsoft.com/kb/899527/>

By: Shashwat Pant

The author is a FOSS enthusiast interested in QT programming and technology. He is fond of reviewing the latest OSS tools and distros.



Will Social Media Junkies Flock Together with v2.5?

While a Web browser developed specifically to satisfy your social networking needs does sound exciting, will Flock 2.5, the latest browser developed with Firefox's engine at the core, be able to make the cut? Let's dive in and check how deep the water might be!

Flock 2.5 is an open source browser, scheduled around the Gecko rendering engine that takes off at a good starting point: Mozilla Firefox. While it is built on Mozilla's Firefox codebase, it tends to specialise in providing social networking and Web 2.0 facilities built into its user interface. With the Firefox base, Flock has incorporated new modules and has improved some aspects like graphics (three-dimensional icons) and new features like sharing bookmarks online, an integrated tool for creating and maintaining blogs, etc, while maintaining what made Firefox successful in the first place—extensions, lockout of automatic pop-ups, etc.

What's the hype all about?

Flock is designed to streamline how you interface with social networking sites, RSS and media feeds, and blogs. Because it's built on Firefox 3, its behaviour will seem familiar and it supports most—but not all—Firefox extensions. And yes, the 'awesome bar' is part of the latest version.

The social media add-ons are apparent

from the start, though. The 'My World' tab—set as your home page by default—is devoted to collating your favourite stuff in one single view. It's made up of a series of widgets that you can customise to display content from video and photo sites, RSS feeds, saved searches from Twitter and useful bookmarks.

How is a 'social Web browser' different?

While support from Twitter and Facebook had been present in Flock right from its inception, the browser now allows you to search the Twitter timeline and also keep them in *History* so that you can access them as and when you wish. Now, this is a very nifty feature because it lets you stay on top of trending topics on the micro-blogging network. Another great and useful feature is the automatic shortening of URLs that are shared on Twitter.

For the first time, Flock has integrated Facebook chat within the browser. While the side bar sits pretty, at the left of the browser, you can keep sharing content with your contacts while reading the latest

The pros and cons of the 'social Web browser'

Let's have the pros first:

1. Tight integration with various social media networks like Orkut, Facebook, Twitter, Flickr, YouTube and many more.
2. 'My World' features an iGoogle-esque homepage that shows the latest updates on your social connections every time you start the browser.
3. Can be integrated so that you get notified of and can reply to new e-mails on GMail and Yahoo Mail, right on the browser.
4. Has the heart of Mozilla Firefox, the most used (and abused) open source browser that's fast, reliable, feature-rich and secure.
5. My personal experience says Flock leaks less memory than Mozilla Firefox.

And the cons:

1. Eats up a lot of screen real estate (the sole reason why I'd never use Flock, despite being a social media enthusiast myself).
2. The colour schemes are too bright to let you concentrate on the contents of the websites you might be visiting.
3. Not as many plug-ins are available for Flock as for Firefox.

news on Google reader or playing Scrabble on Yahoo Apps. All you need to do is stay logged into the Facebook network. What else? If you find something interesting while browsing the Web, all you need to do is drag the content and drop it on the side panel panel to share it with the world.

Speaking of drag-n-drop, Flock enables you to drag and drop content from any website on to the sidebar and share it with your contacts. To make life easier still, another new feature called FlockCast lets you automatically send an update to Facebook when you perform an action on another site. So, if you use the built-in



Figure 1: With the wider top bar, the side bar and the media browser, hardly any space remains for meaningful browsing

functions to add a post to your blog, upload a photo to Flickr, a video to YouTube or a status message to Twitter, you can get it instantly echoed on Facebook. Right now, only Facebook is supported as a destination, but it's a nice idea that could get much more useful if more services are supported in future Flock updates.

So, why isn't everyone around me using Flock?

Flock can, any day, be used as a normal Web browser—the way you might use Mozilla Firefox and Epiphany for your daily surfing needs. However, it becomes a little inconvenient, with less screen space allowed by Flock for browsing, unless you are one of those rich kids who can't think of anything below the 21-inch plasma monitors with super-high resolutions. The ugly and very bright sidebar, which is supposedly the strength and USP of the browser, actually makes browsing very cumbersome.

Moreover, while even Twitter can make you go bonkers with information overload, a complete browser with such heavy social functionalities built in, is definitely not meant for those with serious work to do, where one needs to remain focused. Even if you happen to be a social-media junkie, unless you have a lot of free time, you'll always

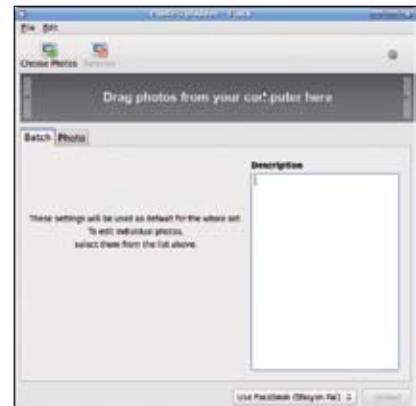


Figure 2: A Photo uploader built inherently within Flock

find yourself wanting to go back to whatever browser you are using.

Tip: There are a few Firefox plug-ins (like FireShot) that do work with Flock, but are not available for download. So, you can copy the Firefox's settings folder into that of Flock to get as many plug-ins as possible. However, in case some are not compatible, you will have to disable them yourself.



By: Sayantan Pal

An avid Twitter user and a social media enthusiast, the author is a passionate blogger and a professional gamer too. He also feels compelled to be opinionated about anything that comes his way, be it Linux distributions, our marketing strategies, table etiquettes or even the fabled Ramsay movies!



Extensions, Part 2

This is a continuation of the article 'Enrich OpenOffice.org with Extensions' published last month.

In the previous article, we have looked at how to develop two types of extensions—add-ons and add-ins. This time we'll discuss the remaining two extensions—client applications and UNO components—in addition to more discussions on UNO, a component model used for programmability.

Client applications

A client application is a stand-alone J2SE application that can bootstrap a UNO environment and start the default OpenOffice.org, or connect to a running instance. A client application project is nothing but a standard Java project with an added OpenOffice.org library. As APIs are integrated into NetBeans, features like code completion, error highlighting, the automatic import of packages, etc, are available.

Creating a client application is a straightforward *File→New Project→OpenOffice.org→OpenOffice.org Client Application*. In the next screen, fill in a project name, say *SimpleClient*, and a suitable package name like *org.lfy.example*. That's it! Your client application project has been successfully set up.

Now go to 'Project explorer' and open the code for the main method in *SimpleClient.java*: *SimpleClient→Source Packages→org.lfy.example→SimpleClient.java*.

A default code to bootstrap office instance is presented in the main method. Replace that with the following code, which is used to load a new Calc document when this client application is run.

```
try {  
    XComponentContext xContext = Bootstrap.  
        bootstrap();
```

```

if (xContext == null) {
    System.err.println("ERROR: Could not bootstrap default Office.");
    System.exit(0);
}

XMultiComponentFactory xMCF = xContext.getServiceManager();
Object desktop= xMCF.createInstanceWithContext("com.sun.star.frame.Desktop", xContext);
XComponentLoader xComponentLoader = (XComponentLoader)
UnoRuntime.queryInterface(XComponentLoader.class, desktop);
PropertyValue [] loadProps = new PropertyValue [0];
XComponent xComponent = xComponentLoader.loadComponentFromURL("private:factory/scalc", "_blank", 0, loadProps);

}catch (java.lang.Exception e){
    e.printStackTrace();
}finally {
    System.exit(0);
}

```

The packages required to import are not listed here; but NetBeans will help you for this purpose. You can add some more code to control spreadsheet(s) in the loaded Calc document, depending on your wishes.

Now use the *build* and *run* options of the project to test the extension. A new office instance will be created in which a blank Calc document is loaded. Note that the *deploy* option is not available for a client application because it is a simple J2SE application, as mentioned earlier.

This code looks very similar to the add-on code discussed in the previous article, except the first line where the context is already available as add-on code is invoked from the running instance.

Till now we have managed to create three types of projects without knowing much about UNO, so it is better to have a brief overview of UNO and some other terminology like API and IDL before going to the next example.

So do you know UNO?

Universal Network Objects (UNO) provide an environment to use OpenOffice.org services in a language-independent manner across platforms. It is a component model that, unlike others, is not bound to any programming language and offers interoperability between different languages.

UNO components can be created and accessed from any programming language, provided language binding is available for it. Languages like C++ and Java are well supported for UNO and a few more like Python or Ruby, which are under development.

The standalone environment of UNO objects that's isolated from OpenOffice.org is called the UNO Runtime Environment (URE).

Oo API

APIs are helpful to program Oo through UNO objects from many supported programming languages. The

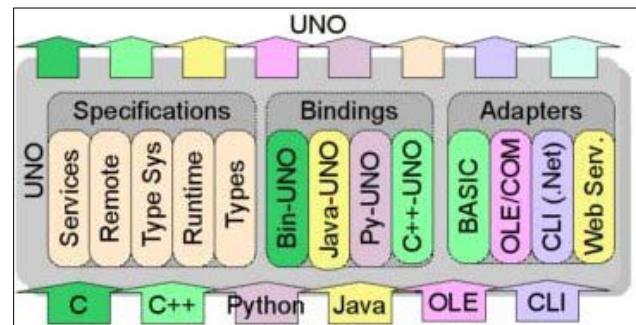


Figure 1: The UNO architecture [source udk.openoffice.org]

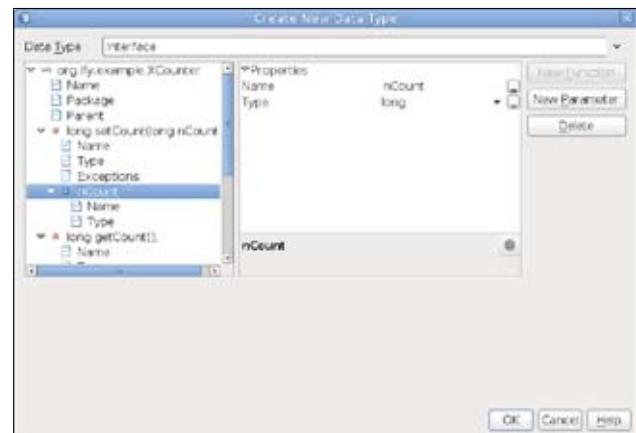


Figure 2: Creating an interface

main goal of the API project is to offer Oo as a service provider and integrate it with different applications.

IDL files

Interface Definition Language (IDL) files provide an abstract view of UNO objects. They contain attributes and methods. The IDL language used here is called UNO IDL.

A typical UNO IDL file looks like what follows:

```

#ifndef __org_lfy_XCountable__
#define __org_lfy_XCountable__
#include <com/sun/star/uno/XInterface.idl>
module org { module Ify { module example {
    interface XCountable {
        long getCount();
        void setCount([in] long nCount);
    };};};}
#endif

```

Every interface inherits from XIInterface. Modules are similar to packages in Java or namespaces in C++. Attributes are supported by get, set methods. Compiled IDL files are then merged with the implementation part to create complete objects.

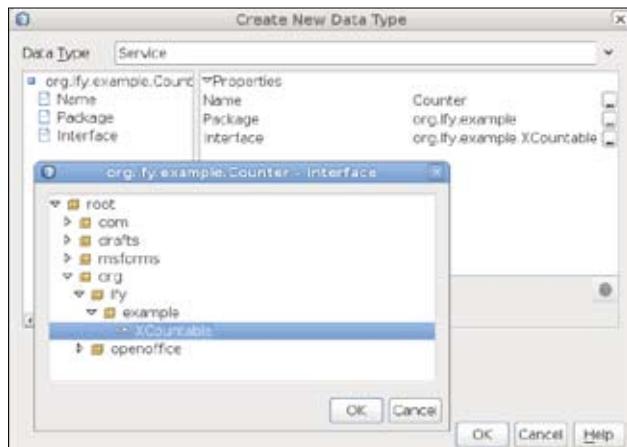


Figure 3: Creating a service

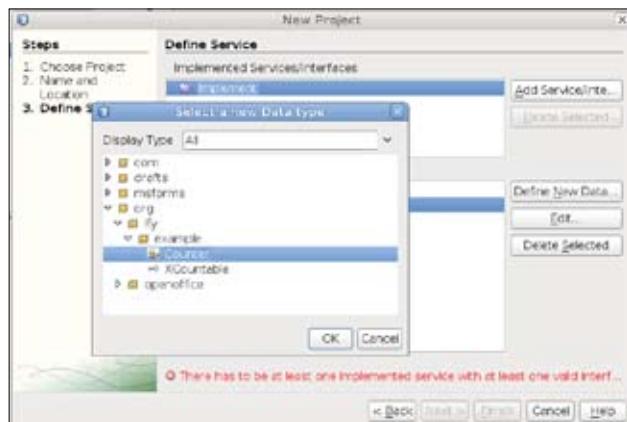


Figure 4: Adding a service

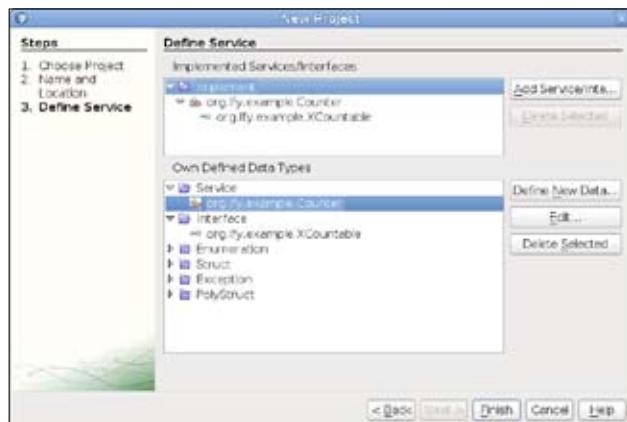


Figure 5: The added service

UNO components

Ref: This is a modified example from the tutorial on Uno/C++ Component by Daniel Bözle from the OpenOffice.org wiki. This example is implemented in Java with the NetBeans approach.

A UNO component is an implementation of one or more services provided by UNO or by creating new ones. A service typically wraps interfaces and properties to avail attributes and methods defined in those interfaces.

Here are the steps to create a simple UNO component: *File*→*New Project*→*OpenOffice.org*→*OpenOffice.org Component*. In the next screen, give a project name, say *SimpleUNO*, with a suitable package name like *org.ly.example*. The next screen is used to include an existing interface/service or create new ones to be added to the UNO component. In this example we will create a new interface called *XCountable* with the service, *Counter*.

The steps to create the *XCountable* interface are: Select *Interface*→*Define New Data*. Enter 'Name' as *XCountable*. Now, for the first method, enter *setCount* as 'Name' and *void* as 'Type'. For the parameter in the *setCount* method, enter *nCount* as 'Name' and *long* as 'Type'. Use the 'Next Function' to create the *getCount* method, where we'll enter *getCount* as the 'Name' and *long* as the 'Type'. As we'll not require the 'Parameter' in this case, delete it.

Similarly, create two more methods, *increment* and *decrement*, with no parameters and *long* return type.

The following are the steps to create the counter service: select *Service*→*Define New Data*. Enter *Counter* as the 'Name' and *org.ly.XCountable* as the 'Interface'.

Here are the steps to add the counter service: use the *Add Service/Interface* option and navigate to *org*→*ly*→*example*→*Counter* to add it.

After all the steps are done, the wizard will look like what's shown in Figure 5.

Now click on the *Finish* button to complete the creation of the project. Observe the created IDL files *XCountable.idl* and *Counter.idl* in the project explorer to get a better idea about IDL files.

We now need to implement methods defined in the *XCountable* interface. Open *SimpleUNO.java* from the project navigator as follows: *SimpleUNO*→*Source Packages*→*org.ly.example*→*SimpleUNO.java*—change these four methods as shown below and add a global variable, say, *xCount* to be used by all four methods:

```

long xCount;
public int getCount()
{
    return xCount;
}
public void setCount(int nCount)
{
    xCount=nCount;
}
public int increment()
{
    xCount++;
    return xCount;
}
public int decrement()
{

```

```

xCount--;
return count;
}

```

Use the *Deploy and Run Extension in OpenOffice.org* option to build and deploy this newly created UNO component. This can be tested from a macro with the following OOBasic code snippet. I assume the result is obvious:

```

Sub CountTest
    myService = createUNOService("org.lfy.example.Counter")
    myService.count=10          'setCount(10)
    MsgBox "count=&myService.count      'getCount()
    MsgBox "after increment=& myService.increment
    MsgBox "after decrement=& myService.decrement
End Sub

```

At any time, if the deployment of an extension fails, make sure that the correct version of JRE is set under *Tools→Options→OpenOffice.org→Java*.

In this example, we have created a new service. We

can also use an existing service to modify or enhance it. On understanding this sample component, you can develop real components to avail the services of OOo.



Resources

- Daniel Böhlze's article on Uno/Cpp Component Tutorial: wiki.services.openoffice.org/wiki/Uno/Cpp/Tutorials/component_tutorial
- OOo API: api.openoffice.org
- OpenOffice.org Developer Guide: wiki.services.openoffice.org/wiki/Documentation/DevGuide/OpenOffice.org_Developers_Guide

By: Rajesh Sola

The author has been involved in the OOo project since 2005 and has contributed to VBA Macro interoperability, and OOo programmability through macros and extensions. He is a faculty member of the computer science department at NBKRIST, Vidyanagar. He is keen on FOSS awareness and promotion in rural areas, and is fond of teaching. He believes in training, thus encouraging and supporting students to take the open source road. You can reach him at rajesh at lisor dot org.

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Tips & Tricks



A shell script to check if the network host is up

Here's a shell script that uses *ping* to check if a network host is up on the Internet:

```
HOSTS="yahoo.com"
for HOST in $HOSTS
do
  ping -c5 $HOST > /dev/null
  #suppress output, if host is up
  if [ $? -ne 0 ]
    then
      echo -n "$HOST unreachable on $(date +%d/%m/%Y-%H-%M-%S)" >> file.log
      #if there's a problem, print error message, and the date
    else
      logger "ping: $HOST OK"
      #log created at syslog
    fi
done
exit 0
```

—Anil Bakhtani, anil_bakhtani@yahoo.com



Generate sequences

You can use the *seq* command to generate sequences. For example:

```
seq 1 5
```

The output for the above command will be:

```
1
2
3
4
5
```

The above can be used in many places including scripts. For example:

```
$ for i in `seq 1 5`; do echo "i is $i"; done
i is 1
i is 2
i is 3
i is 4
i is 5
```

—Shiv Premani, shivpremani@gmail.com



Make your Linux box speak

Ubuntu and many other distros have an inbuilt speech synthesiser called *espeak*. Use the following command in the terminal:

```
espeak "I can speak"
```

Did you hear your Linux box report, “I can speak”?

—Saaz Rai, saaz.rai@gmail.com



Change X's resolution on the fly

In order to change the resolution of X we can make use of the command *xrandr*. Simply type this command on a terminal and it will display all resolutions supported by the X window. Then in order to set the resolution of the X window to one of the supported resolutions, say 1024x768, simply execute the following:

```
xrandr -s 1024x768
```

It will immediately change the resolution of the X window, on the fly.

—Pankaj Kumar, pankaj@glug4muz.org

Edit two files simultaneously in VIM

In VIM, we can open more than one file at a time. To do so, follow the steps given below:

1. Open a file with VIM
2. Get into command mode by typing : [i.e, colon]
3. Enter the command split 2ndfile
4. This will split the VIM window horizontally with the second file as the new buffer
5. Press Ctrl+w twice to move between the files
6. You can use all VIM commands in both files. You can even go on to open some more files.

If you want to learn more about VIM commands, enter Ctrl+d in the command mode (":") and you will get all possible VIM commands.

—**Sathiyamoorthy N, n.sathiyamoorthy@gmail.com**

Sending mails using the command line

First check, whether Sendmail is running:

```
# /etc/init.d/sendmail status
```

If the status shows that it's not, then start it:

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

Then, send mails using either the mail or mutt command:

```
# echo "body of the mail" | mail -s "subject of the mail" toAddress
```

Give the recipient's mail ID in place of toAddress.

As for the body of the mail, you can also redirect it from a file, as follows:

```
# mail -s "subject of the mail" toaddress < body_mail.txt
```

If you want to send a file as an attachment, you can use mutt instead:

```
# echo "body of the mail" | mutt -s "subject of the mail" \
-a fileToAttach.txt toAddress
```

Give the recipient's e-mail ID in place of toAddress.

—**Shiv Premani, shivpremani@gmail.com**

Change your Bash prompt

You can change your Bash prompt by just setting the environment variable \$PS1:

```
[root@localhost usr]# echo $PS1
```

```
\[\u@\h \W\]$
```

...where, \u is the user name, \h the hostname and \W is the current working directory.

Here's how you can set a new one with the export command.

```
[root@localhost usr]# export PS1=[hello] # "
[hello] #
```

```
[hello]# export PS1="\u \t #"
root 10:14:00 #
```

...where, \t gives the current time in the 24-hour format.

You can execute commands to populate PS1 like PS1=" \$(uname -r) #" or even shell scripts can be called. All these special characters can be found in the Bash man page under the Prompting section.

—**Saumitra Bhanage, bhanage.saumitra@gmail.com**

Access Windows shares from the terminal

The following command will help you to access the Windows shares from Linux systems:

```
# mkdir /mnt/win
# mount -t cifs //server-ip-or-name/share /mnt/win -o username=user,password=pass,username=DOMAIN
```

And to unmount the share, use the command given below:

```
# umount /mnt/win
```

—**Sivakumar E, sivakumar.e@gmail.com**



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The Art of Guard

Understanding the Targeted Policy

Here's an article that's all about Allow Rules!

SELinux, as mentioned in the first article of the series, is an implementation of MAC (Mandatory Access Controls). These controls are affected through a set of rules that check the security context of the subject (e.g., the processes) and the object (e.g., the file), and allow or disallow the particular action.

There are various rules defined in an SELinux policy. To view them, use the *seinfo* command discussed earlier.

```
[root@vbg ~]# seinfo
```

Statistics for policy file: /etc/selinux/targeted/policy/policy.21

Policy Version & Type: v.21 (binary, MLS)

Classes:	61	Permissions:	220
Types:	1514	Attributes:	148
Users:	3	Roles:	6
Booleans:	211	Cond. Expr.:	187
Sensitivities:	1	Categories:	1024
Allow:	82576	Neverallow:	0
Auditallow:	28	Dontaudit:	5086
Role allow:	5	Role trans:	0
Type_trans:	1399	Type_change:	17

Type_member:	0	Range_trans:	23
Constraints:	47	Validatetrans:	0
Fs_use:	15	Genfscon:	64
Portcon:	264	Netifcon:	0
Nodecon:	8	Initial SIDs:	27

The bold text in the above output represents the information section on rules. As we can see, the default policy loaded in my system has:

- 82,756 Allow Rules
- 1,399 Type Transition Rules
- 5,086 Don't Audit Rules, and so on.

To view these rules and get an understanding of how they work, let us explore the *sesearch* command.

```
[root@vbg ~]# sesearch -a
```

Found 87690 av rules:

```
allow bluetooth_helper_tmp_t bluetooth_helper_tmp_t : filesystem associate ;
allow httpd_bugzilla_script_t httpd_bugzilla_script_t : lnk_file
{ ioctl read getattr lock };
allow avahi_t avahi_t : fifo_file { read write };
allow avahi_t avahi_t : tcp_socket { ioctl read write create
getattr setattr append bind connect listen accept getopt se
```

```
top shutdown );
allow aide_t newrole_t :fd use ;
```

The *seseach* command allows us to query a policy for *Type Enforcement* rules. Let us explore the first of these rules—the Allow Rule.

- *Allow Rules:* These specifically allow ‘access’ to an ‘object’ by a ‘subject’.

Here, access is defined by:

- access permissions—such as read, write, execute, etc

object is defined by:

- the security context called the *target context (tcontext)*
- the class of the object called the *target class (tclass)*. Examples of the target class can be file, dir, socket, etc

subject is defined by:

- the security context called the *source context (scontext)*

A typical allow rule can be described as follows:

Allow the Web Process (Apache server) to read the file (*/var/www/html/index.html*)

If the above rule is not present in the policy, the Apache process will not be able to read a file in its default ‘documentroot’ folder and will be denied access.

To implement the above allow rule, we need to evaluate *Access Permissions Required*, *Target Context (tcontext)*, *Target Class (tclass)*, and *Source Context (scontext)*

For our example, the results will be as follows:

- Access Permissions Required: *read*
- Target Context (tcontext): (security context of */var/www/html/index.html*)

```
(ls -Z /var/www/html/index.html
=> system_u:object_r:httpd_sys_
content_t:s0
```

- Target Class (tclass): *file*
- Source Context (scontext): (security context of the *httpd* process)

```
(ps axZ | grep httpd) => user_u:
system_r:httpd_t:s0
```

Taking the above into consideration, our allow rule changes from:

Allow the *Web Process (apache server)* to *read* the file (*/var/www/html/index.html*)

TO

Allow the *Source Context – user_u:system_r:httpd_t:s0* permission to *read* on the *class file* bearing a *Target Context of system_u:object_r:httpd_sys_content_t:s0*

To search for all allow rules, specify as follows:

```
[root@vbg ~]# seseach --allow
```

To search for an allow rule that specifically contains scontext, tcontext and tclass, specify:

```
[root@vbg ~]# seseach -s scontext -t tcontext -c
tclass --allow
```

Since this rule exists in the default targeted policy, let us search for it using the *seseach* command:

```
[root@vbg ~]# seseach -s httpd_t -t httpd_sys_
content_t -c file --allow
Found 2 av rules:
allow httpd_t httpd_sys_content_t :file { ioctl
read setattr lock };
allow httpd_t httpd_sys_content_t :file { ioctl
read setattr lock };
```

Let us examine the syntax of the allow rule itself. The first word in a rule phrase specifies the type of the rule. Therefore, allow rules in a policy appear as: *allow scontext tcontext: tclass permissions*

By default, the rules in the targeted security policy do not allow the Web server to read a file of type *tmp_t*.

You can test this by changing the type of the *index.html* file.

```
[root@vbg ~]# chcon -t tmp_t /var/www/html/index.html
```

Now try to open this Web page. You will receive a *forbidden/access denied* error. This is because of SELinux MAC rules. There is no ‘allow rule’ in the policy to allow this access.

If you want to allow the Apache server to be able to read this file, you will need to insert an allow rule to the

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policy. This rule will look like: `allow httpd_t tmp_t:file { read }`

To insert this rule into your policy, you will need to compile it and load it.

Modifying the base SELinux policy is not recommended, especially for beginners. Such rules can be compiled in separate policy modules and loaded into the memory. We will come to SELinux modules in a later part of this series.

Access Vector Cache

Just imagine a scenario where you have installed a new application and are unable to execute it. The SELinux default policy in your system prevents access to files and other resources. How do you find out which allow rules are required and which are not? Also, what kind of overhead will the checking of these rules create on system performance?

If you see the `seinfo` command output above, there are more than 80,000 allow rules in the default targeted policy. Checking for multiple subjects while simultaneously accessing multiple objects can create a serious performance bottleneck.

SELinux tackles the performance overhead issue in the traditional manner—by caching rules. An Access Vector Cache is created from rules being looked up into the policy, so that subsequent look-ups can occur from

the AVC (Access Vector Cache). This provides significant performance benefits.

Access Vector Cache (AVC) denial logging gives an idea of why a particular access has been disallowed. Closer examination of these denial logs will enable you to figure out what allow rules need to be inserted into the policy to allow these actions.

Logging is a key feature of SELinux and it is important for security administrators to be able to decipher log messages. In the next series of this article we will explore how SELinux logging occurs and how to use the logs to effectively create allow rules.

Still to come

- SELinux logging
- Policy modules
- Other types of enforcement rules



By: Varad Gupta

Varad is an open source enthusiast who strongly believes in the open source collaborative model not only for technology but also for business. India's first RHCSS (Red Hat Certified Security Specialist), he has been involved in spreading open source through Keen & Able Computers Pvt Ltd, an open source systems integration company, and FOSTERing Linux, a FOSS training, education and research training centre. The author can be contacted at varad.gupta@fosteringlinux.com

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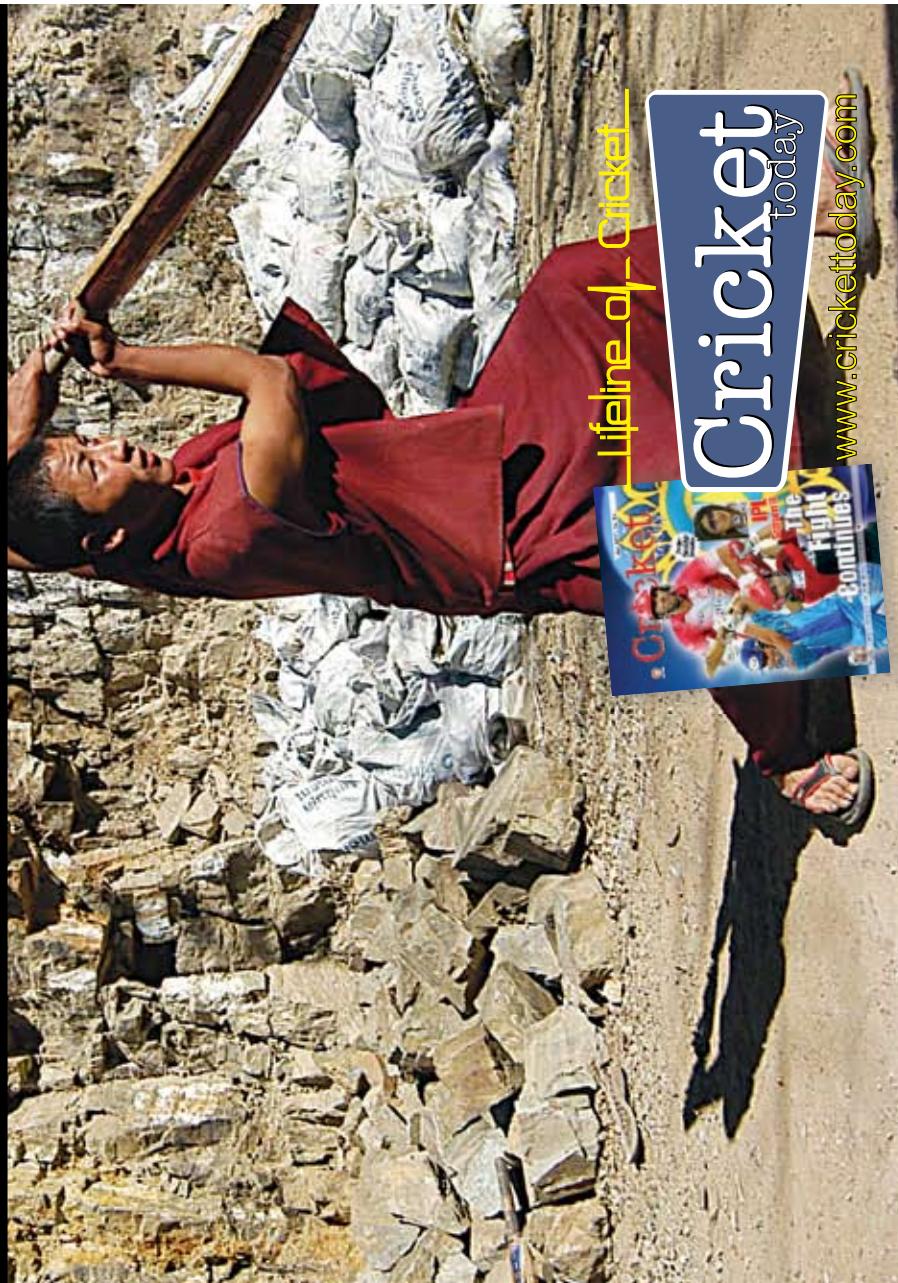
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Data Warehousing and FTP Serving

In this article, we will set up a FTP server, and then discuss FreeNAS, an operating system based on FreeBSD, which helps set up a data storage server.

More often than not, data comes as files. Efficiently storing these files is a major headache, and then making those files available to the general public or to specific authenticated users is even more so. In this article, we will set up a FTP server, and then discuss FreeNAS, an operating system based on FreeBSD, which helps set up a data storage server.

Section A: The FTP server

Setting up the FTP server requires some out-of-the ordinary steps if you don't have RPMForge. Those steps are—installing RPMForge! After you are done, open up a terminal prompt and type in the following:

```
yum install proftpd-mysql
```

That's all for the installation part. Before we move on to configuration, we need to set up ProFTPD to run automatically at system startup. To do that, execute the following:

```
chkconfig --level 345 proftpd on
```

And for the configuration, open up the file `/etc/proftpd.conf` in a text editor, and read on.

The first task is enabling Anonymous FTP. If you want to set up a FTP server to serve downloads to the general public (like ftp.gnu.org), you need this part. The 'Anonymous' section is in the config file at the very end, but it's commented out. Uncomment the whole section. There's another small task; the config file has an invalid directive called 'DisplayFirstChdir'. Run the following Perl command to correct it:

```
perl -pi -e 's/DisplayFirstChdir/DisplayChdir/' /etc/proftpd.conf
```

Another bit of work involves adding a directive. The directive will enable FTP access for accounts that do not have



Part 6

a shell. In the 'Anonymous' section, add the following line:

```
RequireValidShell Off
```

You're done! Just type in...

```
service proftpd start
```

...at a terminal and you're good to go!

Section B: Data warehousing

To run your own download server and host a big repository of source code or even company documents that would take up terabytes of storage space, repeatedly adding more hard disks to a single server would be impractical. In fact, it would be suicidal. So many pieces of hardware inside a single computer put a lot of load on the MoBo and the SMPS. Moreover, how many hard drives can you possibly attach to a single MoBo?

There is a solution, and it's called Network Attached Storage (NAS). A grid of computers interconnected with the Ethernet and running NAS servers is called a SAN, or Storage Area Network. But here's the good news: NAS comes cheap.

To have a NAS machine, you don't need very good hardware. A 600 MHz Transmeta Crusoe or Efficeon will suffice. Hey, you can even have ARM boxes. And in case you think you need something more, out here in Kolkata, eSys sells a Mini-ITX 'System In A Box', consisting of a 1.6 GHz Intel Atom processor mounted on an Intel 82945G Express Chipset-based motherboard, for a little over Rs 2,000. That's a good deal. As for RAM, you need about 512 MB for a decent performance.

And the only storage unit you'll ever need is a USB pen drive.

You can add as many hard drives to this baby as you want. I'd recommend buying some multi-terabyte SATA2 hard drives and attaching them internally. To expand storage, you can use as many external USB HDDs as you want (only if you use USB hubs to increase the number of available USB ports).

You'll need a 256 MB USB pen drive to install the firmware onto this storage unit. Yes, it cannot be called an operating system. What we're talking about is FreeNAS. Head to www.freenas.org and download the latest 60 MB ISO file. Boot up your storage unit with it, and then attach the USB pen drive after FreeNAS has started booting.

Once done, follow these steps to install it:

- At the first prompt, type "9" (without the quotes) and press *Enter*.
- At the first screen, select the third choice.
- Hit *OK* at the next screen.
- Now select the CD drive (most probably "acd0") where the FreeNAS disk is located.
- Select the destination drive: your 256 MB or above USB pen drive
- Do not read any of the text that comes up next (unless it's an error) and hit *Enter*.
- You're done! Exit the installer now, and reboot the unit. Enter the BIOS and enable booting from the USB (this depends on your BIOS make and version). Remove the FreeNAS disk, keep the USB pen drive attached and reboot the unit. Pretty soon, you'll be booted up into FreeNAS. Congratulations!

By default, you have a static LAN IP address, 192.168.1.250. Leave it at that. Now, open up a Web browser and browse to <http://192.168.1.250>. Now do you know why I called FreeNAS a 'Firmware'?

The default login credentials are "admin" as the username and "freenas" as the password. Once you are in, savour the beauty of the interface for a bit before moving on to configure this as a NFS server.

- Go to *Disks*→*Management* and click on the "+" icon at the bottom of the empty table.
- On the resulting page, choose a hard disk (example: ad6). Add a description if you wish. Then, activate SMART monitoring (check the tick box), leave the *Preformatted FS* option as unformatted and hit *Add*.
- On this page, hit *Apply Changes*. The status column should show *ONLINE*.
- Now go to *Disks*→*Format*.
- On this page, select a hard disk (it should have been added in the Management Section). It is important that you use the UFS+SU (GPT) filesystem, as this gives the best speed and reliability. FreeNAS doesn't use an MBR-based partition; it uses the more recent GPT style partition table from the EFI standard. Add a volume label and leave everything else intact. Hit *Format Disk* and then *OK*.
- The next bit is mounting the partition. Go to *Disks*→*Mount Point*, and hit that "+" icon again. Select a formatted disk, set the *Partition Type* to GPT, the partition number to



Figure 1: FreeNAS system info page

1 and the filesystem to UFS. Add a mount point name, and then remember it. On the next page, hit *Apply Changes*.

Disk configuration is now complete. We need to initialise the NFS service.

- Go to *Services*→*NFS* and check the "*Enable*" tick box. Set the *Number Of Servers* to something suitable, for example, 16. Then hit *Save And Restart*.
- Now go to the *Shares* tab and click on the "+" icon.
- On the resulting page, set a *Path To Share*. This refers to one of your mounted disks. Use the format */mnt/<mount point name>*. Then select whether to map all users as root (it's safe because Anonymous FTP will allow just Read-Only access). The authorised network should be 192.168.0.0/16. Hit *Add* and then apply changes.

Now, we are fully done with that.

Section C: Joining the two together

Shift to the FTP server, open up a terminal and type in the following:

```
rm -rf /var/ftp/*
mount 192.168.1.250:/mnt/media /var/ftp -v
```

Create a test file in */var/ftp*, connect to your FTP site with Firefox and see your handiwork in action.

That's all, folks.

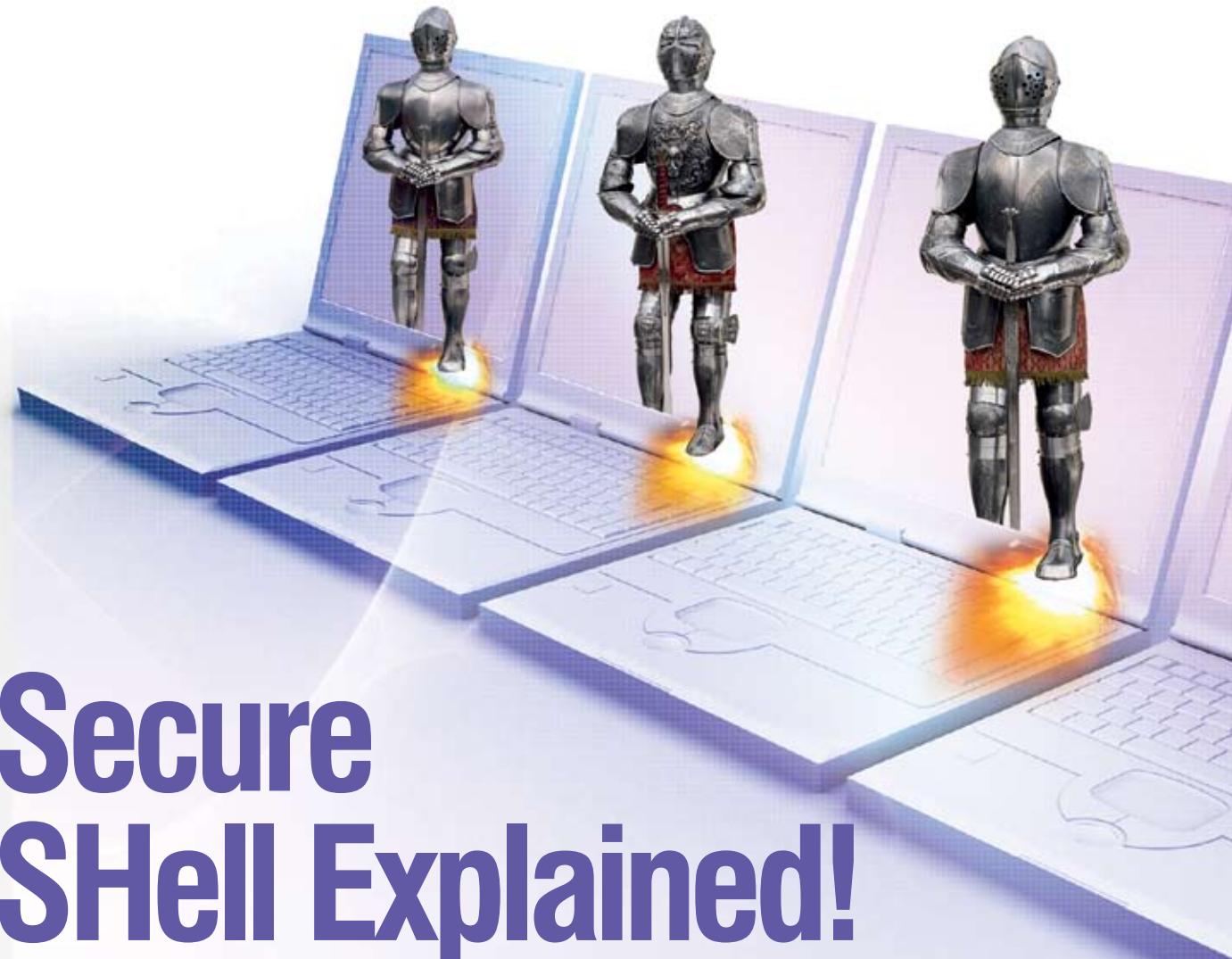
Tip: To make that NFS share mount at system startup, add the following line to */etc/fstab*:

```
192.168.1.250:/mnt/media /var/ftp defaults 00
```

Replace */mnt/media* with your own share's name.

By: Boudhayan Gupta

The author is a 14-year-old student studying in Class 9. He is a logician (as opposed to a magician), a great supporter of Free Software and loves hacking Linux. Other than that, he is an experienced programmer in BASIC and can also program in C++, Python and Assembly (NASM Syntax).



Secure SHell Explained!

Here're some insights into SSH (Secure Shell), an essential tool for accessing remote machines.

SH is used to access or log in to a remote machine on the network, using its hostname or IP address. It's a secure network data exchange protocol that came up as a replacement for insecure protocols like *rsh*, *telnet*, *ftp*, etc. It encrypts the bi-directional data transfers using cryptographic algorithms, making the data transfers secure. Hence, it is free from password theft or from the sniffing of packets being transferred over a network.

Some of the highlights of the SSH protocol are:

- Compression
 - Public key authentication
 - Port forwarding
 - Tunnelling
 - X11 forwarding
 - File transfer
- SSH runs as a service daemon to facilitate remote log-ins.

To install the SSH server on Debian-based distros, key in the following command:

```
# apt-get install openssh-server
```

Although the default port for SSH is 22, you can also configure it to run with other custom ports.

To perform remote log-ins, we require an SSH client. There are lots of SSH clients available, and they can be installed on Debian-based system as follows:

```
# apt-get install openssh-client
```

It is possible to access remote UNIX/Linux machines from any other OSs using some SSH clients. For example, it is possible to remotely log in to a UNIX box from Windows using the SSH client called Putty [www.putty.org].



Basic operations

We can remotely log in to a machine by issuing the following command:

```
slynx@gnubox:~$ ssh user@hostname
```

Here, ‘user’ is an existing user on the remote machine ‘hostname’, so you need to replace the two with relevant information. [You can also use an IP address instead of a hostname to log in.] Hitting the *Enter* key now will result in a prompt for the user’s password; and after entering it, you will get the remote user’s shell prompt.

Alternately, we can also provide the following command:

```
slynx@gnubox:~$ ssh hostname
```

...which is equivalent to:

```
slynx@gnubox:~$ ssh slynx@hostname
```

...i.e., if the user name of the one trying to remotely log in is the same as the current user, there is no need to specify the user name explicitly.

Sometimes systems administrators will configure the SSH daemon to listen to a non-standard port such as 422, instead of 22. This is done for security reasons—to make it difficult for an unauthorised person to easily find which port number the SSH daemon is listing to.

In cases where we need to perform the SSH log-in via a non-standard port, we can specify the port number explicitly using the *-p* option:

```
slynx@gnubox:~$ ssh -p 422 slynx@hostname
```

The initial key discovery

When you connect to an SSH server for the first time, you will be asked to verify the server’s key. When the users continue confirming ‘yes’, it will attach the server key with the hostname and store it in the *~/.ssh/known_hosts* file. After the initial probe for the server verification, it will check this *known_hosts* file to verify the authority of the server to which the SSH client is requesting a connection to.

```
slynx@gnubox:~$ ssh slynx@192.168.1.2
The authenticity of host '192.168.1.2 (192.168.1.2)' can't be established.
RSA key fingerprint is 6d:92:2c:f1:74:e7:a9:21:64:57:90:6f:72:3e:a3:18.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.2' (RSA) to the list of known hosts.
slynx@192.168.1.2's password:
Last login: Sun May 17 21:04:29 2009 from slynx-laptop
slynx@gnubox:~$
```

This initial key discovery process is to ensure security. It is possible for an attacker to steal information from the remote user log-in by impersonating the server, i.e., if the attacker can provide a server with the same host name and user authentication, the user connecting from the remote machine will be logged into a fraud machine and data may be stolen.

Each server will have a randomly generated RSA server key.

To ensure security, in cases where the server key changes, the SSH client will issue a serious warning reporting that the host identification has failed and that it will stop the log-in process.

```
slynx@gnubox:~$ ssh slynx@192.168.1.2
@@@@@@@aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
@@@@@@@aaaaaaaaaaaa
@ WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!  @
@@@@@@@aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
@@@@@@@aaaaaaaaaaaa
IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY!
Someone could be eavesdropping on you right now (man-in-the-middle attack)!
It is also possible that the RSA host key has just been changed.
The fingerprint for the RSA key sent by the remote host is
```

```
cd:41:70:30:48:07:16:81:e5:30:34:66:f1:56:ef:db.
Please contact your system administrator.
Add correct host key in /home/slynx/.ssh/known_hosts to get rid of this
message.
Offending key in /home/slynx/.ssh/known_hosts:24
RSA host key for localhost has changed and you have requested strict checking.
Host key verification failed.
```

If we're certain about the key identification chance of the remote machine, we can remove the corresponding server key entry from our `~/.ssh/known_hosts` file. Following which, the next time you try to log in, you will be asked for a key verification again and the server key will be again registered in the `known_hosts` file.

Executing remote commands

The main purpose of SSH is to execute commands remotely. As we have already seen, immediately after a successful SSH log-in, we're provided with the remote user's shell prompt from where we can execute all sorts of commands that the remote user is allowed to use. This 'pseudo' terminal session will exist as long as you're logged in.

It is also possible to execute commands on a one-at-a-time basis without assigning a pseudo-terminal, as follows:

```
slynx@gnubox:~$ ssh slynx-laptop 'uname -a'
slynx@slynx-laptop's password:
Linux slynx-laptop 2.6.28-9-generic #31-Ubuntu SMP Wed Mar 11 15:43:58 UTC
2009 i686 GNU/Linux
slynx@gnubox:~$
```

Note that we're back at our local shell prompt. The syntax is: `ssh user@hostname 'commands in quote'`.

Input/output redirection

Piping is a nifty feature provided by the shell. If you aren't already familiar with it, have a look at the basics of piping in the following section.

Piping is used for input and output redirection. In *nix shells, we can redirect input/output in different ways, as follows:

```
echo "Test" > file
```

Here the output text stream ("Test") is directed to a file. Thus the stream is stored to a file named `file`. '`>`' is the output redirection operator.

Now, take a look at the following command:

```
cat < file
```

Here, input is directed to the `cat` command. `cat` performs the concatenation of the input stream. Here the input is a file named `file`. '`<`' is an input redirection operator that directs the input stream to the specified command. Here it directs the input text stream from the file to the `cat`.

Finally, take a look at the following command:

```
echo hello | command1 | command2
```

Here, '`|`' is the piping operator. It uses the output of one command as the input of another. We can use any number of pipes serially, i.e., the output of one command appears as the input of another, and the output of *this second* command appears as the input of the third command and so on. Thus, the net result will be a serial application of these commands on data, one after the other.

For example:

```
slynx@slynx-laptop:~$ echo "hello" | tr -d T
"heo"
```

All of the above input/output redirection operations can also be performed using SSH commands. Let us look at the possibilities:

```
slynx@gnubox:~$ ssh slynx-laptop 'cat /etc/passwd | grep root'
slynx@gnubox:~$ ssh slynx-laptop 'cat /etc/passwd' > file.txt
slynx@gnubox:~$ ssh slynx-laptop 'cat > directed.txt' < file.txt
```

You can also club compression utilities along with SSH:

```
slynx@gnubox:~$ ssh slynx-laptop 'tar -czf - file.txt' > file.tar.gz
```

In the above command, we have used `tar -czf` to create a tarball file. '`tar -czf - file.txt`' has - [hyphen] as the file name. When a hyphen is provided as a filename, it implies that the output is not written to a file; instead, it is redirected to standard output.

Now, to list the files in the compressed archive, run the following command:

```
slynx@gnubox:~$ tar -ztf file.tar.gz
file.txt
```

The SSH protocol also supports data transfer with compression—which comes in handy when bandwidth is an issue. Use the `-C` option with the `ssh` command to enable compression:

```
slynx@gnubox:~$ ssh -C user@hostname
```

File transfer

SSH also offers the file transfer facility between machines on the network and is highly secure, with SSH being an encrypted protocol. Also, the transfer speed can be improved by enabling compression. Two significant data transfer utilities that use the SSH protocol are SCP and SFTP.

SCP stands for Secure Copy. We can use it to copy files from a local machine to a remote machine, a remote machine to a local machine, and a remote machine to another remote machine.

For the local machine to remote machine file transfer, we use the following:

```
scp local_file_path user@remote_host:destination_file_path
```

For a remote machine to local machine transfer:

```
scp user@remote_host:remote_file_path local_file_path
```

For a remote machine to remote machine transfer:

```
scp user1@remote_host1 user2@remote_host2
```

You can even use wildcards to select files:

```
scp ./home/slynx/*.* /home/gnubox/scp_example/
```

SFTP stands for Secure File Transfer Protocol. It is a secure implementation of the traditional FTP protocol with SSH as the backend. Let us take a look at how to use the *sftp* command:

```
sftp user@hostname
```

For example:

```
slynx@slynx-laptop:~$ sftp slynx-laptop
Connecting to slynx-laptop...
slynx@slynx-laptop's password:
sftp> cd django
sftp> ls -l
drwxr-xr-x  2 slynx  slynx   4096 Apr 30 17:33 website
sftp> cd website
sftp> ls
__init__.py  __init__.pyc  manage.py  settings.py  settings.pyc
urls.py      urls.pyc    view.py    view.pyc
sftp> get manage.py
Fetching /home/slynx/django/website/manage.py to manage.py
/home/slynx/django/website/manage.py  100% 542  0.5KB/s  00:01
sftp>
```

If the port for the target SSH daemon is different from the default port, we can provide the port number explicitly as an option, i.e., *-oPort=port_number*.

- Some of the commands available under *sftp* are:
 - *cd*—to change the current directory on the remote machine
 - *lcd*—to change the current directory on localhost
 - *ls*—to list the remote directory contents
 - *lls*—to list the local directory contents
 - *put*—to send/upload files to the remote machine from the current working directory of the localhost
 - *get*—to receive/download files from the remote machine to the current working directory of the localhost
- sftp* also supports wildcards for choosing files based on patterns.

SSH over GUI file managers

In GNOME, we can use the SSH protocol to navigate remote filesystems in the Nautilus file manager. It works as a GUI implementation of *sftp*. Type *ssh://user@hostname[:port]* at the address bar. It will prompt you for the password of the 'user' and then mount the remote filesystem. After that, we can navigate the filesystem just as with locally mounted disk data.

As for KDE users, you can use the *fish* protocol in Dolphin or Konqueror to browse remote filesystems. Type *fish://user@hostname[:port]* in the location bar and press *Enter*. It will again prompt for the remote user's password.

Running XWindow applications remotely

Well, the good news is that SSH is also a good enough protocol that can aid you to run applications other than terminal utilities remotely, with the help of X11 forwarding. To enable X11 forwarding, add the following line in */etc/ssh/ssh_config*, the configuration file.

```
ForwardX11 yes
```

Now to launch the GUI apps remotely, execute *ssh* commands with the *-X* option. For example:

```
ssh -X slynx-laptop 'vlc'
```

Port forwarding

One of the significant uses of SSH is port forwarding. SSH allows you to forward ports from client to server and server to client. There are two types of port forwarding: local and remote. In local port forwarding, ports from the client are forwarded to server ports. Thus the locally forwarded port will act as the proxy port for the port on the remote machine.

To establish local port forwarding, use the following code:

```
ssh -L local_port:remote_host:remote_port
```

For example:

```
ssh -L 2020:slynx.org:22
```

Here, it forwards local port 2020 to slynx.org's ssh port 22. Thus, we can use:

```
ssh localhost -p 2020
```

...instead of:

```
ssh slynx.org
```

In remote port forwarding, ports from the server are forwarded to a client port. Thus ports on the remote host will act as the proxy for ports on the local machine.

The significant application of remote forwarding is that, suppose you have a local machine that lies inside an internal network connected to the Internet through a router

or gateway—if we want to access the local machine from outside the network, it is impossible to access it directly. But by forwarding the local ports to a remote host, we can access the local machine through ports of the remote host.

Let's see how remote port forwarding is executed:

```
ssh -R remoteport remotehost:localport
```

For example:

```
ssh -R 2020:slynux.org:22
```

To SSH to the local machine from outside the internal network, we can make use of *slynux.org* as *ssh slynux.org:2020*.

SOCKS4 proxy

SSH has an interesting feature called Dynamic Port forwarding with which the SSH TCP connection will work as a SOCKS4 proxy. By connecting to the given port, it handles SOCKS data transfer requests.

An important application of Dynamic Port forwarding is the following case.

Let's suppose you have a machine on a network that is connected to the Internet and you have another machine on the same network that does not have any Internet connection. By using SSH Dynamic port forwarding, you can easily access the Internet by setting up the machine with an Internet connection to act as the SOCKS4 proxy using an SSH tunnel.

For dynamic port forwarding, use the following command:

```
ssh -D 3000 remotehost
```

Now, in your browser, specify proxy settings as:

- SOCKS4
- host: localhost
- port: 3000

To enable the DNS service in Firefox, navigate the *about:config* page and set...

```
network.proxy.socks_remote_dns = true
```

Automatic key authentication

Each time you access the other machine for the remote execution of some command, it probes for the password. This is not desirable when we need to automate tasks. If we need to shut down or reboot all the machines on the LAN, it is impractical to type the user password for command execution on each of the machines. There should be some mechanism that handles automatic authentication without probing for a password.

The solution for this hurdle is public key authentication, for which we will generate a public key from the machine we need to execute remote commands. That public key will be copied to each of the remote machines. Thus each time when we execute remote commands, it will perform a user authentication by verifying the public key and it no more

probes for the passwords.

Generate the public key as follows:

```
slynux@slynux-laptop:~$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/slynux/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/slynux/.ssh/id_rsa.
Your public key has been saved in /home/slynux/.ssh/id_rsa.pub.
The key fingerprint is:
0e:04:3d:e3:2a:54:8c:47:ae:10:9a:96:41:be:c1:8f slynux@slynux-laptop
```

Now we have the public key in the file *~/.ssh/id_rsa.pub*.

```
slynux@slynux-laptop:~$ cat .ssh/id_rsa.pub
ssh-rsa AAAAB3NzaC1yc2EAAQABlwAAAQEAtj6N7/juQ8CUTdmFP816Xn4iEI
j73pO7+xHPgIBFZGgxg8yeYZmU7zBjCUAcSXx/NhRiF7YytozhWk+n92DBFL6
U62lrukqtB/WdZRHh2w1JH4adC3hCDStJglaxt5WoZK4aFzjGRCbTBxC2rELQu
u929qowzQ8bU3Wd08UK0+U0/u8xSWXvWE4W2THAIWFTRjp+KDX33Ms9u
IYyx/h3Tx5voPSxV6cYBZfh5kJMzEoYDBCUpua6uHV4zDfJFNhN6Sdp3213FY/
cGRvT1vBCRDSmQd0Xkq2hU8npCfzOrQjXqGPuuzfVW8le6yRQQPtqXc3/
J5UMglgumgDgw== slynux@slynux-laptop
```

To implement auto authentication, append the public key in the *~/.ssh/authorized_keys* file in each of the remote machines where we need to perform auto authentication.

Appending the key can be performed manually or it can be automated using an *ssh* command as follows:

```
ssh remote_host "cat >> .ssh/authorized_keys" < ~/.ssh/id_rsa.pub
```

Finally, let us write a single loop shell script to reboot all the switched-on machines in the network.

```
#!/bin/bash
base_ip="192.168.0";

for machine in $base_ip{1..255};
do
    ping -c2 $machine &> /dev/null ;
    if [ $? -eq 0 ];
    then
        ssh $machine reboot ;
    fi
done
```

That's it about the secure shell. Hope you enjoyed this tutorial. Till we meet again, happy hacking! 

By: Sarath Lakshman

The author is a Hacktivist of Free and Open Source Software from Kerala. He loves working on the GNU/Linux environment and contributes to the PiTiVi video editor project. He is also the developer of SLYNUX, a distro for newbies. He blogs at www.sarathlakshman.info



S.G. Ganesh

C Puzzlers: Traps, Pitfalls and Corner Cases

Recently, I read an interesting book* on Java programming puzzles. Since a few of them would interest programmers knowledgeable in C-based languages, I am covering three puzzles from this book.

Assume the following: integer 4 bytes size and long 8 bytes size; the underlying machine uses two's complement representation for integers; the necessary header files are included; and the C compiler supports the C99 standard.

If you're a C, C++, Java, C# or even D programmer, you will enjoy these puzzles. Be warned: though they look harmless and appear to work fine, they however have bugs, so the results you see after executing these programs will surprise you!

- 1) This program is about implementing a simple digital clock. The *loop* variable 'millis' is for counting from 0 to the number of milliseconds in an hour. The variable 'mins' is to count minutes. The *printf* prints the number of minutes in an hour after executing the loop. So what is the output of this program? (Hint: There are 60 minutes in an hour).

```
int main()
{
    int mins = 0;
    for(int millis = 0; millis < 60*60*1000; millis++)
        if(millis % 60*1000 == 0)
            mins++;
    printf("%d", mins);
}
```

- 2) What is the output of this program? (Hint: It is a simple program to check if you've learned addition at school!)

```
int main()
{
    printf("%lx", 0x100000000L + 0xCAFEBAE);
}
```

- 3) You've written this program to search for articles on open source on the *LFY* website. Will it open Firefox or IE on your Linux machine? (Hint: IE is not available on Linux).

```
int main()
{
    http://www.linuxforu.com/
    printf("Linux + open source ");
}
```

(*) 'Java puzzlers: Traps, Pitfalls, and Corner Cases', Joshua Bloch, Neal Gafter, Addison-Wesley, 2005.

Answers:

- 1) You would expect the program to print 60, since one hour has 60 minutes. However, it prints 60000. This is the problem: the expression is evaluated as $(millis \% 60)*1000$ and not as $millis \% (60*1000)$. Remember that % has the same precedence as the * operator, so the % operator is evaluated before *.

Now, since $(millis \% 60)$ is 0 for $60*1000$ times in the loop, the expression *if(millis % 60*1000 == 0)* is true for 60000 times and hence the output.

- 2) You would expect this program to print 1CAFEBAE, because we are adding 0x100000000 to 0xCAFEBAE. However, you'd certainly be surprised with the answer: it prints only CAFEBAE! Why?

0xCAFEBAE is a negative integer constant! When we write negative constants in decimal form, like "-10", it is very clear that the constant is negative because we can see the preceding "-" sign. However, for hex and octal numbers, the number is negative if the highest order bit is negative. In this case, 0xCAFEBAE is a negative number. Here is a quick way to confirm it. If you run the following statement: "*printf*("%d", 0xCAFEBAE);", you'll get the value "-889275714" as the output. Now, what happens to the addition?

Note that 0x100000000L is a long number. When 0xCAFEBAE is promoted to long, it is prefixed with L's (i.e., the sign is extended). So it becomes 0xFFFFFFFFCAFEBAE. When we add 0x100000000L with 0xFFFFFFFFCAFEBAE, we get 0xCAFEBAE (remember, adding 1 to F is 0, with a carry 1). Hence the output!

- 3) This program prints "Linux + open source" in the command line. What happens to the URL <http://www.linuxforu.com/>? Well, if you check your compiler warnings, you might get something like: unreferenced label 'http' in function main. 'http' became a label (labels are used as the target for *goto* statements) and // became the starting of a single line comment! (C99 supports C++ style single line comments). 

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Programming in Python for Friends and Relations—Part 15

Personalising Photographs



Most of us enjoy sharing our photographs. We'd also like to add captions that can't be missed or send postcard-size images. That's what the Python imaging library is all about!

To manipulate individual images, products like The GIMP are most appropriate. However, if similar actions need to be applied to a group of images, consider programming them using the Python imaging module.

In order to keep the code simple, the assumption is that you have just downloaded the pictures from your camera. So, all the pictures you wish to process are in the same directory. Create a sub-directory *save/in* which you will keep your processed photos.

After that, we will go over how to write a Python generator and use the imaging library to create image transition effects when viewing photographs.

Transformation of images

Write a class called *photos* to track all the files in the current directory. You will get one photo at a time and can resize it to a pre-defined size. You can then modify this

photo and add a caption to it. Finally, you can save the modified photograph in the *save*/directory.

```
import os
import Image, ImageTk, ImageDraw
class photos:
    def __init__(self,new_size):
        self.file_generator = (fn for fn in os.listdir('.'))
        self.new_size = new_size
        self.image = None
```

The initialisation method is simple enough. The *file_generator* will be convenient for fetching the next file when needed. You can add the flexibility of passing the directory as a parameter.

```
def get_next_photo(self):
    while True:
        try:
            self.file_name = self.file_generator.next()
            image = Image.open(self.file_name)
```

```

        break
    except StopIteration, e:
        return None
    except Exception, e:
        pass # do nothing if not an image
    self.image = image.resize(self.new_size)
return self.image

```

You will get the next file, but since not all files in the directory may be images, you need to ignore the other files by using exception handling and iterating till you find an image.

Image.open will create an image object from the file but will raise an exception if the file does not contain a valid image. The method, *Resize*, on the *Image* object will create a new image of the desired size. You can find out more about what you can do with the python imaging module at www.pythontware.com/library/pil/handbook/index.htm.

Finally, return the resized image; but if there are no more files, return a null value.

Now, examine the code used to add a caption to the image:

```

def photo_with_caption(self, caption):
    self.im_caption = self.image.copy()
    draw = ImageDraw.Draw(self.im_caption)
    draw.text((50, self.new_size[1] - 50), caption)
    return self.im_caption

```

Since you may wish to change the caption, you can work with the copy of the image. The *ImageDraw* module of the imaging library allows you to draw on the image object. In this case, you are drawing some text on the image. The position chosen is 50 pixels from the left and bottom edges. The revised image is returned, as you will see, to the GUI object, which will display it.

```

def save(self):
    try:
        self.im_caption.save('save/' + self.file_name)
    except Exception, e:
        self.image.save('save/' + self.file_name)

```

The *save* method will save the image with the caption with the same name as the existing file, but in the *save/* directory. However, if one has not been created, it will save the resized image.

Interactive transformations

Now, you will need a GUI class to use the above class. The GUI should show you one image and allow you to add a caption to it. Once you are satisfied, save the photograph and move on to the next one. Or, you may decide to skip a photograph.

```
import Tkinter
```

```

class gui:
    def __init__(self, photos):
        # Save the photo application object context
        self.photos = photos
        self.root = Tkinter.Tk()
        # The photo frame
        self.foto = Tkinter.Canvas(self.root)
        self.foto.pack()
        # The application interaction frame
        self.frame = Tkinter.Frame(self.root)
        self.frame.pack()
        # Text caption
        self.caption = Tkinter.Entry(self.frame, width=72)
        self.caption.pack(side=Tkinter.LEFT)
        self.caption.insert(Tkinter.END, 'Press Enter to Apply Caption')
        self.caption.bind('<Return>', self.apply_caption)
        # The Buttons
        self.save = Tkinter.Button(self.frame, text='Save and Next',
        command=self.save_and_next)
        self.skip = Tkinter.Button(self.frame, text='Next', command=self.
next_image)
        self.save.pack(side=Tkinter.LEFT)
        self.skip.pack(side=Tkinter.LEFT)
        # Show the first image and start the event loop
        self.next_image()
        self.root.mainloop()

```

Your GUI consists of two parts -- a canvas on which the photograph will be displayed and a frame for interacting with the application.

The frame has a text entry widget and two buttons. The *Save* and *Next* button will save the current image and display the next one. The *Skip* button will just display the next image.

The text entry widget is triggered by the *Return* or the *Enter* key to copy the text you have entered onto the image.

Incidentally, it is not appropriate to import all from Tkinter (that is, *from Tkinter import **) because Tkinter also has a class *Image*, which will conflict with the import of the *Image* module.

The rest of the code in the GUI class will be as follows:

```

def display_image(self, image):
    self.foto['width'] = image.size[0]
    self.foto['height'] = image.size[1]
    self.tk_image = ImageTk.PhotoImage(image)
    self.foto.create_image(0,0,anchor='nw',image=self.tk_image)

```

The method to display the image changes the size of the photo frame to the size of the image. The *ImageTk* module in Python imaging is used to convert the image object into an image object for Tkinter. The *Create image* method of the canvas displays the image.

```
def next_image(self):
```

```
self.image = self.photos.get_next_photo()
if self.image == None:
    self.root.quit()
else:
    self.display_image(self.image)
```

The above method gets the next image from the *photos* object and calls the *display image* method. If there are no more images, the application quits.

```
def save_and_next(self):
    self.photos.save()
    self.next_image()
```

The above method calls the *save* method of the *photos* object and then continues to display the next image.

```
def apply_caption(self, event):
    text = self.caption.get()
    self.image = self.photos.photo_with_caption(text)
    self.display_image(self.image)
```

The *apply_caption* method is called when the *Return* or *Enter* key is pressed after entering the caption text. The modified image is displayed.

The code to create and start the application is as follows:

```
my_photos = photos((800,600)) # convert images to 800x600
app = gui(my_photos)
```

Font selection

If the text is too small, you can load and select your own font. The following lines of code will allow you to use your own font and size:

```
import ImageFont
self.font = ImageFont.truetype('/usr/share/fonts/lohit-hindi/lohit_
hi.ttf',30)
draw.text((50,self.new_size[1] - 50), caption,font=self.font,fill='#00f')
```

Not surprisingly, you can now enter the caption in Hindi, and in blue colour.

Jazz up the transitions

You can use your little application as a simple viewer as well. Just keep skipping each photograph! That's justification enough to explore some more capabilities of the imaging module.

You might like to have a fading effect whenever the next photograph is displayed. You need to write a method that will generate a sequence of images, starting with the current image and ending up with the new one. In the *photos* class, add the following method:

```
def generate_photo_transition(self):
```

```
try:
    old_image = self.image
    new_image = self.get_next_photo()
    for transition in range(10):
        self.transition_image = Image.blend(old_image, new_image,
0.1*(transition + 1))
        yield self.transition_image
except Exception,e:
    yield new_image
```

The generator for the sequence of images is simple. Just use a *yield* statement to return an image. The *blend* function from the *image* module is used to create a new image, which is a linear combination of the two images— $(1 - r)*old + r*new$. The factor *r* is the third parameter.

If there isn't an old or new image, an exception will be raised. If no old image exists, the new image will be displayed with no transition effect. If no new image exists, a null value will be returned and the GUI will terminate.

The GUI program will need to iterate over the generator. The revised *next_image* method will be more complex:

```
def next_image(self):
    for self.image in self.photos.generate_photo_transition():
        if self.image == None:
            self.root.quit()
        else:
            self.display_image(self.image)
            self.photo.update_idletasks()
            time.sleep(.1)
```

The key difference is that you are now iterating over the generator of the transition images. Each intermediary image is displayed and the application sleeps for a while. However, by default, it will not be updated until the control reverts to the main loop. The method *update_idletasks* forces the image to be displayed.

Obviously, the Python imaging module can do a lot more than can be covered in one article. You can use it to convert between formats, apply filters, enhance images, apply geometric transformations, manipulate pixels, crop and paste regions, manipulate frames in animated images, etc. In short, you can use it to convert your collection of photographs into a memorable set of pictures that you would love to see over and over. Also, you will not bore your friends with an endless stream of random pictures, where the good ones are lost in the clutter. 

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CodeSport



Sandya Mannarswamy

Welcome to another instalment of CodeSport, in which we'll continue our discussion on how to write efficient and correct code for multithreaded applications. We will also cover the complex issue of deadlock in multithreaded applications.

Thanks to all the readers who sent in their feedback on the problems we discussed in last month's column.

We had given a small code snippet of multithreaded code and asked you to find out the potential bug hiding in it. Congratulations to our readers Siva Kumar, Vivek Goel and Arjun Pakrashi for getting the answer correct. As pointed out by these readers, the code snippet had a potential deadlock situation. Here is the buggy code snippet from the takeaway problem:

```
void BookTicket(int row, int column)
{
    pthread_mutex_lock(&row_lock);
    pthread_mutex_lock(&column_lock);
    ticket[row][column].status = 'booked';
    pthread_mutex_unlock(&column_lock);
    pthread_mutex_unlock(&row_lock);
}

void CancelTicket(int row, int column)
{
    pthread_mutex_lock(&column_lock);
    pthread_mutex_lock(&row_lock);
    ticket[row][column].status = 'cancelled';
    pthread_mutex_unlock(&row_lock);
    pthread_mutex_unlock(&column_lock);
}
```

Note that two threads can concurrently issue booking and cancellation requests to the same ticket (same row and same column), and the system has to work correctly. The problem is that Thread 1 can enter the critical section 'BookTicket' and acquire the 'row_lock' and concurrently Thread 2 can enter the 'CancelTicket' critical section and acquire the 'column_lock'. Now Thread 1 will wait endlessly for 'column_lock' to be released while Thread 2 will wait for the 'row_lock' to be released. Neither of the threads can make any progress at all. How can you fix the code so that this problem does not occur?

In our example, it is quite easy to see that if we change the lock acquire order in 'CancelTicket' to first acquire 'row_lock' and then acquire 'column_lock', we can avoid the deadlock. Here is the corrected version of 'CancelTicket', which does not cause a deadlock with 'BookTicket':

```
void CancelTicket(int row, int column)
{
    pthread_mutex_lock(&row_lock);
    pthread_mutex_lock(&column_lock);
    ticket[row][column].status = 'cancelled';
    pthread_mutex_unlock(&column_lock);
    pthread_mutex_unlock(&row_lock);
}
```

What causes a deadlock?

A deadlock situation occurs when each thread waits for a resource that's being held by another thread and hence neither thread can make any progress. In last month's takeaway problem, we saw that each thread waited for the lock held by another thread, and hence couldn't make any progress.

Deadlock is one of the most common and highly dreaded bugs in multithreaded code. In this month's column, we will discuss what conditions can cause deadlock to occur, the techniques for deadlock prevention, etc.

There are two types of deadlocks—resource deadlocks and communication deadlocks. In a resource deadlock, threads (or processes, as in the case of a multi-process application as opposed to a multi-threaded application) are in a circular queue, waiting for resources currently owned by another thread, which in turn waits for a resource owned by this thread. A set of threads (processes) is resource deadlocked if each thread in the set requests a resource held by another thread (process) in the set.

In communication deadlocks, messages are the resources for which threads wait. A set of threads (processes) is communication deadlocked if each thread (process) in the set is waiting for a message from another thread (process) in the set, and no thread (process) in the set ever sends a message. Communication deadlocks are important in the world of message passing programming, where distributed processes communicate using messages. Over the rest of this column, we will focus our attention on resource-based deadlocks.

Conditions leading to deadlock

So what are the conditions that can lead to a deadlock situation? As we have seen in the earlier example, a circular wait among the threads is one of the conditions that can lead to deadlock. There are four conditions that must simultaneously occur, for a deadlock to happen. They are:

1. The mutual exclusion condition: The resources that are being contended for by the threads are not shareable. For example, consider our example with the critical sections, 'BookTicket' and 'CancelTicket'. In these sections, the rows and columns of the reservation tables are not shareable. Hence, the programmer has protected access to these resources using mutex locks. So our example deadlock satisfies the first condition.

2. The 'resource hold and wait' condition: There is a set of threads in which each thread holds a resource already allocated to it

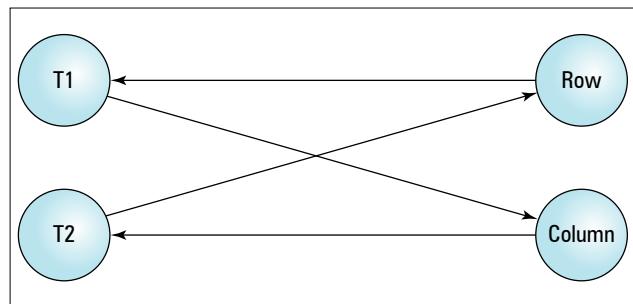


Figure 1: Example of a resource allocation graph

while waiting for additional resources that are currently being held by other threads. In our example, we have Thread 1 in the 'BookTicket' critical section, which holds the 'row_lock' and is requesting for the 'column_lock' critical section. We have Thread 2 in the 'CancelTicket' critical section, holding the 'column_lock' and requesting for 'row_lock'. Hence our example satisfies the condition of 'resource hold and wait'.

3. **The 'no pre-emption' condition:** Resources already allocated to a thread cannot be pre-empted and given to another thread. For instance, in our example code, the operating system cannot pre-empt Thread 2 to relinquish the 'column_lock' to Thread 1. So the 'no pre-emption' condition holds for our example deadlock.
4. **Circular wait condition:** The threads in the set form a circular list or chain where each thread in the list is waiting for a resource held by the next thread in the list. In our example, we have Thread 1 and Thread 2 as the elements of the circular list, with Thread 1 waiting for 'column_lock' and Thread 2 waiting for 'row_lock'. So our example satisfies the fourth condition needed for a deadlock to occur.

These four conditions must be satisfied simultaneously for a program to reach a deadlock state, after which, it remains forever in that state since no thread can make progress. Therefore the program needs to be killed and restarted by the programmer.

In order to understand the complex interactions between resources available and the threads that use these resources, a resource allocation graph is used to represent the interaction. The resource allocation graph is a bipartite directed graph, wherein resources and threads are the nodes of the graph. One partition consists of resource nodes and another partition consists of thread nodes. All the edges of the graph go between the two partitions. There are no edges between the nodes of the same partition. An edge exists from a resource to the thread to which it is allocated. Such an edge is

denoted as an ‘Assignment Edge’. An edge exists from a thread to a resource if the thread has requested for that resource, and such an edge is referred to as a ‘Request Edge’.

Consider the resource allocation graph (Figure 1) for our example code, in which we have two threads, T1 and T2; and two resources, Row and Column. One partition, say Partition 1, contains T1 and T2. The other partition, say Partition 2, contains Row and Column resources.

Since ‘row_lock’ is acquired by Thread 1, an edge exists from the resource ‘row’ to the node T1. Since ‘column_lock’ is acquired by Thread 2, an edge exists from the resource ‘column’ to node T2. Since Thread 1 has requested for the resource ‘column’, an edge exists from the node T1 to the node ‘column’. Similarly, an edge exists from node T2 to node ‘row’ since Thread 2 has requested for the resource ‘column’.

An application is deadlocked if the resource allocation graph of its current state contains a directed cycle in which each ‘request edge’ is followed by an ‘assignment edge’. We can use this fact for deadlock detection. We can write an algorithm to construct the resource allocation graph of an application’s current state and look for cycles in it. If a cycle of the kind mentioned above is found, we can declare that the application is deadlocked. I leave it to the reader to write the code for this problem.

There are three strategies programmers use for handling deadlocks. They are called:

1. Deadlock prevention
2. Deadlock avoidance
3. Deadlock detection

Each of these techniques is complex and we will discuss them in detail in our next month’s column. Can you come up with a technique for each of these strategies on your own?

This month’s takeaway problem

Consider the following code snippet where the main thread creates a child thread. The child thread increments the global counter and the main thread prints the value of the counter. The global counter is protected by a mutex lock. Can you point out whether this code snippet can deadlock?

```
void *counter_func(void *);  
  
int count_var;  
mutex_t count_var_lock;  
  
main()  
{
```

```
char str[80];  
pthread_t child_thread_id;  
  
pthread_create(&child_thread_id, NULL, counter_func);  
  
while(1)  
{  
  
    //read the next string  
    Scanf ("%s", str);  
    pthread_suspend(child_thread_id);  
  
    mutex_lock(&count_var_lock);  
    printf(" count value is = %d\n", count_var);  
    mutex_unlock(&count_var_lock);  
  
    pthread_continue(child_thread_id);  
}  
  
return(0);  
}  
  
void *counter_func(void *arg)  
{  
    int i;  
  
    while (1)  
    {  
        Printf("incrementing the counter value\n");  
        mutex_lock(&count_var_lock);  
        count_var++;  
  
        //do nothing  
        for (int i=0; i<MAXCNT; i++);  
  
        mutex_unlock(&count_var_lock);  
  
        //do nothing  
        for (int j=0; j<MAXCNT; j++);  
    }  
  
    return((void *)0);  
}
```

If you have any favourite programming puzzles that you would like to discuss on this forum, please send them to me, at sandyasm_AT_yahoo_DOT_com. Till we meet again next month, happy programming! 

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Compiling GNU Software for Windows

Let's find out how exactly a cross-platform software is compiled for Windows, and then let's do it ourselves!

Now there's this great software called The GIMP, which is more than a match for Photoshop, and it's smaller, and it's free! The GIMP, although made primarily for GNU systems tacked on top of a UNIX kernel (such as Linux), is also available for Windows. Ditto for the Apache Web server. Ever wondered how they write the source code once, and then build it for any operating system they choose? Ever wondered how *you* could do it for yourself?

Welcome to GCC

First of all, of course, you must write code that is platform independent, i.e., that uses instructions that can be reproduced in any operating system. As long as you write software using functions defined in the standard C library, minus POSIX functions (such as *fork()*), you are fine. It'll build. You can go to a GNU machine and pass your file through GCC to get a Linux binary, then go to a Windows box and pass it through VC++ to get a Windows binary.

Now, as you move to large programs (such as The GIMP), you will need multiple source code files to produce a single binary. This will result in problems, because you cannot just build the files at one go. You will need to compile your C sources into the assembler, then assemble them into object files, put all the object files together in a single object archive and then link that archive to the system libraries. The answer to this problem is *Makefiles*, which can do all that automatically according to a set of rules applied to a set of files. But even *Makefiles* have their limitations, and *Makefiles* written for GNU Make are not compatible with Microsoft NMAKE and a *Makefile* written to use GCC cannot use VC++, and vice versa.

The answer to this problem is to use something called a *retargetable compiler*, or a compiler that can produce binaries for different operating systems. Fortunately for us, GCC is retargetable. And unfortunately for us, GCC must be re-built before it can produce Win32 or Win64 code.

How does GCC work?

GCC cannot work on its own – it is part program, and partly a wrapper around other programs. To build a working toolchain, we need two packages -- GCC itself and GNU Binutils.

All that GCC does by itself is convert high-level source code into an assembler. GCC includes compilers for C, C++, ADA, Fortran, Objective C, Objective C++ and Java. Barring Java, which is interpreted, all other languages need their programs to be converted into binaries. To explain how this is done, let us do it manually from the command line.

First, create a file called *src.c*, with the following contents:

```
#include <stdio.h>

int main()
{
    printf("Hello World!\n");
    return 0;
}
```

Here's a directory listing at the current stage:

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ ls -l
total 4
-rw-r--r-- 1 bg14ina bg14ina 73 2009-06-07 15:29 src.c
```

First of all, let's compile this source file into the assembler. To do this, we need to execute the following:

```
gcc -S src.c -o src.S
```

...and some command line output:

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ gcc -S src.c -o src.S
bg14ina@bg14ina-desktop:~/Desktop/srcs$ cat src.S
_file "src.c"
.section .rodata
.LCO:
.string "Hello World!"
.text
.globl main
.type main,@function
main:
    leal 4(%esp),%ecx
    andl $-16,%esp
    pushl -4(%ecx)
    pushl %ebp
    movl %esp,%ebp
    pushl %ecx
    subl $4,%esp
    movl $.LCO,(%esp)
    call puts
    movl $0,%eax
    addl $4,%esp
    popl %ecx
    popl %ebp
```

```
leal    -4(%ecx), %esp
ret
.size   main, .-main
.ident  "GCC: (Ubuntu 4.3.3-5ubuntu4) 4.3.3"
.section .note.GNU-stack,"@progbits"
bg14ina@bg14ina-desktop:~/Desktop/srcs$ ls -l
total 8
-rw-r--r-- 1 bg14ina bg14ina 73 2009-06-07 15:29 src.c
-rw-r--r-- 1 bg14ina bg14ina 433 2009-06-07 15:40 src.S
```

See that beautifully indented and formatted assembler file? If you're a geek, you could optimise this file in a gazillion ways. I know a little about assemblers, but not enough to actually bring about a 500X increase in execution time. For all purposes, we will now assemble *src.S* into a object file. To do that, execute the following:

```
as < src.S
```

And the directory listing goes as follows:

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ ls -l
total 12
-rw-r--r-- 1 bg14ina bg14ina 864 2009-06-07 15:46 a.out
-rw-r--r-- 1 bg14ina bg14ina 73 2009-06-07 15:29 src.c
-rw-r--r-- 1 bg14ina bg14ina 433 2009-06-07 15:40 src.S
```

Notice the *a.out* file? That's our object file. We'll now link that file with the C libraries, to get an executable. The command to do this, however, is huge.

```
ld -eh-frame-hdr -m elf_i386 --hash-style=both -dynamic-linker /lib/ld-linux.so.2 \
-z relro /usr/lib/crt1.o /usr/lib/crti.o /usr/lib/gcc/i486-linux-gnu/4.3.3/crtbegin.o \
-L/usr/lib/gcc/i486-linux-gnu/4.3.3 -L/usr/lib/gcc/i486-linux-gnu/4.3.3 -L/usr/lib \
-L/lib ./a.out -lgcc --as-needed -lgcc_s --no-as-needed -lc -lgcc --as-needed -lgcc_s \
--no-as-needed /usr/lib/gcc/i486-linux-gnu/4.3.3/crtend.o /usr/lib/crtn.o -o a.exec
```

There's some bad news as well– the linker command is somewhat distro-specific (I'm using Ubuntu Jaunty) and it depends on the GCC version, Binutils version and location of the *crt* object files as well.

Okay, let's test this file:

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ ls -l
total 24
-rwxr-xr-x 1 bg14ina bg14ina 9143 2009-06-07 16:09 a.exec
-rw-r--r-- 1 bg14ina bg14ina 864 2009-06-07 16:05 a.out
-rw-r--r-- 1 bg14ina bg14ina 73 2009-06-07 16:02 src.c
-rw-r--r-- 1 bg14ina bg14ina 433 2009-06-07 16:04 src.S
bg14ina@bg14ina-desktop:~/Desktop/srcs$ ./a.exec
Hello World!
```

Bingo!

So what now?

Now that we know all about what GCC and the tools from Binutils do, we produce C. GCC converts it to assembly. GAS

converts that to a binary and LD links them to the libraries. Now C is high level, and the same C sources can be built on all C compilers. But the assembler is not, and the binaries are absolutely not.

What we need to do is build a version of the GNU toolchain that is capable of producing code meant for execution in Windows.

Enter MinGW32

Binaries also have certain formats. Linux uses the Executable Linkable Format (ELF) binaries. Windows, on the other hand, uses Common Object File Format (COFF) binaries, or technically, a variant of COFF, which is known as Windows PE (Portable Executable). PE files can store executable code, as well as all the resources needed to use that code (that is, pixmaps, icons, audio, animations and what not) all by itself. GCC could always produce COFF binaries, so it was a simple task of patching a few lines of code to make it produce PE files.

GCC versions post v2.95 could produce PE format binaries. With this hurdle cleared, all that remained was a C Runtime Library that would be able to support applications in Windows. A C Runtime Library (CRT) is the library that provides the standard header files and the LibC library. The MinGW Project was thus created, and it published two packages: a CRT that was linked against MSVCRT.DLL, or Microsoft's own C runtime library, and an (incomplete but substantial, enough for compiling GNU software) implementation of the Win32API (the Windows Platform SDK headers and libraries) for GCC.

What we are going to do now is build a version of GCC that will produce Win32 binaries.

Downloads

We need to get some source packages: GCC itself, GNU Binutils, w32api and mingwrt. Here are the download links:

- Win32API: <http://nchc.dl.sourceforge.net/sourceforge/mingw/w32api-3.13-mingw32-src.tar.gz>
- MinGW Runtime: <http://nchc.dl.sourceforge.net/sourceforge/mingw/mingwrt-3.15.2-mingw32-src.tar.gz>
- GNU Binutils (Latest snapshot, because release version is broken): <http://sources-redhat.mirrors.airband.net/binutils/snapshots/binutils.weekly.tar.bz2>
- GCC 4.4.0 (Yeah, it's been released!): <http://ftp.gnu.org/pub/gnu/gcc/gcc-4.4.0/gcc-4.4.0.tar.bz2>
- GMP: <http://ftp.gnu.org/gnu/gmp/gmp-4.3.1.tarbz2>
- MPFR: <http://www.mpfr.org/mpfr-current/mpfr-2.4.1.tar.bz2>

Building

It's safest to install something like a compiler to its own prefix, to keep it from mixing up with and fouling up the distro compilers. We will install our copy of the MinGW Cross Compilers to */opt/mingw*.

First, we need to build the MinGW targeted Binutils.

Open up a terminal, and type the following commands:

```
$: tar -xvf binutils.weeklytar.bz2
$: mkdir build
```

```
$: cd build
$: ./binutils-2.19.51/configure --target=i686-pc-mingw32 --prefix=/opt/mingw
$: make
$: sudo make install
$: export PATH=/opt/mingw/bin:$PATH
```

The last command added the MinGW compilers' bin directory to the PATH variable. Do not exit the terminal. If you do, you'll have to type in the export command again. We'll take care of this later.

Now we need to clean the build directory, and copy the MinGW headers required to build GCC.

```
$: rm -rf * # Remember not to add a forward slash anywhere :-)
$: cd ..
$: tar -xvzf mingwrt-3.15.2-mingw32-src.tar.gz
$: tar -xvzf w32api-3.13-mingw32-src.tar.gz
$: ln -s w32api-3.13-mingw32 w32api
$: sudo cp -r w32api/include /opt/mingw/i686-pc-mingw32
$: sudo cp -r mingwrt-3.15.2-mingw32/include /opt/mingw/i686-pc-mingw32
```

That soft link is required for building the runtime. Now it's time to build GCC. GCC needs to be built in two parts, first a basic C compiler, and then a full set of compilers for all languages.

```
$: tar -xvf gcc-4.4.0.tar.bz2
$: tar -xvf gmp-4.3.1.tar.bz2
$: tar -xvf mpfr-2.4.1.tar.bz2
```

GMP is often miscompiled. But there's nothing that can be done about it, as GMP will be built within GCC itself. To check, you can build GMP and then run a *make check* on it. If you find problems that can be corrected, you'll have to edit the source code yourself.

```
$: cd gcc-4.4.0
$: mv ../*gmp-4.3.1 gmp
$: mv ../*mpfr-2.4.1 mpfr
$: cd ../*build
$: sudo ../*gcc-4.4.0/configure --prefix=/opt/mingw --target=i686-pc-mingw32 \
--with-headers=/opt/mingw/i686-pc-mingw32/include \
--disable-shared --enable-languages=c
$: sudo make
$: sudo make install
```

That was the basic compiler build. Notice the use of *sudo* in all the three commands required to build GCC—this is because GCC insists on changing the directory structure in */opt/mingw* in the configure step itself, and since the makefiles have superuser permissions, we need to have root privileges to do the *make* and *make install*. Also note that we've disabled shared library building; this needs a file called *dllcrt.o* which is part of the MinGW runtime and hasn't been built yet.

We now need to build our C Runtime Library, the Win32API library and the actual build of GCC. First, the runtimes:

```
$: rm -rf *
$: cd ../w32api
$: ./configure --prefix=/opt/mingw/i686-pc-mingw32 --host=i686-pc-mingw32
$: make && sudo make install
$: cd ../mingwrt-3.15.2-mingw
$: ./configure --prefix=/opt/mingw/i686-pc-mingw32 --host=i686-pc-mingw32
$: make && sudo make install
$: cd ..build
$: sudo ..//gcc-4.4.0/configure --prefix=/opt/mingw --target=i686-pc-mingw32 \
--with-headers=/opt/mingw/i686-pc-mingw32/include \
--disable-shared --enable-languages=c,c++,fortran
$: sudo make
$: sudo make install
```

That's it! You have a fully working C, C++ and Formula Translator compiler toolchain that'll compile code meant to run on Windows!

More

MinGW does not provide a POSIX implementation, so you are out of luck on compiling programs that rely on POSIX functions. Not many do, and most that do, have an alternative set of sources meant to use the Win32API to replace POSIX calls by native Win32 ones. But once in a while, if you need POSIX API support, Google for Cygwin and download what's required. Beware though, Cygwin doesn't come as a cross-compiler and it's terribly difficult to build one. Cygwin requires Windows NT 5 and above to run.

(NT 5 is Windows 2000. XP is NT 5.1, and Windows Server 2003 is NT 5.2, as is Windows XP Professional x64 Edition. Vista and Server 2008 are NT 6, and Windows 7 and Server 2008 R2 are NT 6.1. This information will help when you want to develop a program meant to run only on certain versions of Windows, as internally, all Windows OSs 'know' themselves by their NT version numbers and not their names.)

But hey...

...we just built a cross-compiler, so how do we use it? It can be made difficult, and then it can be made simple. Actually, all you need are some environment variables. Here goes:

The first step is adding the path */opt/mingw/bin* to your PATH variable. Type in the export command that we executed after building Binutils.

The second step is configuring the source with a “*--host=i686-pc-mingw32*” flag.

That's all.

There's one final thing to do before signing off: testing the GCC compilers. I don't know any Fortran, so I could never test Fortran; however quite a lot of GNU Projects insist on having some version of Fortran in the toolchain, so its a safe bet to keep it built. We need to test the compilers in a “Hello World” program. For C, you can use the one in the example *src.c* file in the previous page; for C++ the program goes somewhat like:

```
// File: src.cc
#include <iostream>
using namespace std;

int main()
{
    cout << "Hello World!" << endl;
    return 0;
}
```

Compile both the files with:

```
$: i686-pc-mingw32-gcc src.c -o c.exe
$: i686-pc-mingw32-g++ src.cc -o cxx.exe
```

Here are the results of a comprehensive testing of both Binutils and GCC Components. Oh wait, I exaggerated ;-):

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ ls -l
total 3896
-rwxr-xr-x 1 bg14ina bg14ina 27363 2009-06-11 16:02 c.exe
-rwxr-xr-x 1 bg14ina bg14ina 3952542 2009-06-11 16:02 cxx.exe
-rw-r--r-- 1 bg14ina bg14ina 73 2009-06-07 16:02 src.c
-rw-r--r-- 1 bg14ina bg14ina 105 2009-06-11 16:01 src.cc

bg14ina@bg14ina-desktop:~/Desktop/srcs$ file c.exe
c.exe: PE32 executable for MS Windows (console) Intel 80386 32-bit
bg14ina@bg14ina-desktop:~/Desktop/srcs$ file cxx.exe
cxx.exe: PE32 executable for MS Windows (console) Intel 80386 32-bit
```

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ i686-pc-mingw32-strip \
> -s {c,cxx}.exe
```

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ ls -l
total 528
-rwxr-xr-x 1 bg14ina bg14ina 4096 2009-06-11 16:16 c.exe
-rwxr-xr-x 1 bg14ina bg14ina 525312 2009-06-11 16:16 cxx.exe
-rw-r--r-- 1 bg14ina bg14ina 73 2009-06-07 16:02 src.c
-rw-r--r-- 1 bg14ina bg14ina 105 2009-06-11 16:01 src.cc
```

```
bg14ina@bg14ina-desktop:~/Desktop/srcs$ wine c.exe
Hello World!
bg14ina@bg14ina-desktop:~/Desktop/srcs$ wine cxx.exe
Hello World!
```

There you go! One boxed product, ready to run!
Now I gotta go build myself a version of libVLC. Bye... 

By: Boudhayan Gupta

Boudhayan is a 14-year old student who suffers from an acute psychological disorder called Distromania. He owes his life to Larry Page and Sergei Brin. Apart from that, he enjoys both reading and writing, and when he is not playing with his Python ;-), during most of his spare time he can be found listening to Fort Minor, or cooking.

Scripting for Testing

(With a Spoonful of Perl and a Dollop of Ruby)

Inspired by the test scaffolding idea in Kernighan and Pike's "Practice Of Programming", this article is about generating a regression for a number crunching library.

 Every software needs to be tested—and needs to be tested exhaustively. I know, we all practice unit testing and love all that CppUnit/JUnit/TestNG/EasyMock stuff out there.

However, there are other kinds of testing, and it goes by the fancy term, Data Driven Testing. The idea is simple—we arrange the code to work on a piece of data, get the actual result and compare it with the already known, expected result. This is a very powerful idea, as you will see in a minute.

Where do you get this data, though? At times, we need to make it up...

Let's say we need a lot of words to test some string algorithms. Here is one way to generate the list of words...

```
>> perl -le '$k = "a"; print $k++ for (1 .. 1000)
a
b
...
air
ais
ait
aiu
aiv
aiw
aix
->
```

At times, this simple strategy can answer very complicated questions and validate any assumption you might have about code.

Here is a validation story...

We wanted to use the *tommath* library for number crunching, and though open source products are usually of great quality, we wanted to be very sure we made the right choice.

Now, how do you make sure some complex piece of C++ code is correct without grokking all the code—there being no

time and very little mathematical expertise on hand?

A few years ago, we wanted the number crunching features badly. To be specific, the number crunching had to be correct for numbers with up to 23 digits. In other words, we did not care if you multiplied two numbers, each with 24 (or more) digits in them. However, if the numbers had digits below 24, you needed to be correct.

So we had the code and it did all the math for us, but could we trust it? We wanted to know, badly.

I left home for the day, mulling over the problem, and while travelling, I had an idea... *What about random numbers?* And as usual, Linux is very good at them. So...

```
>> echo "$RANDOM$RANDOM$RANDOM$RANDOM * $RANDOM$RANDOM$RANDOM$RANDOM"
301447958390210712 * 2693820160176179720
->
```

So far, so good. However, we needed some addition, subtraction and division too. We needed more multiplication and division, as they are more complex to implement and hence, more bug-prone.

A spoonful of Perl

I decided to use the following trick that I first saw in Jon Bentley's *Programming Pearls* -- a book full of the choicest gems.

```
>> perl -lane '$k = rand();
quote>    if ($k < .4) { print "*"; next }
quote>    elsif ($k < .8) { print "/"; next }
quote>    elsif ($k < .9) { print "+"; next }
quote>    else { print "-" }'
```

We got a handful of * and /, and a few + and -. This goes by the fancy name of 'probability'.

Now the job was simple: we generated a pair of random numbers and pumped them into this Perl script.

```

-> echo "$RANDOM$RANDOM$RANDOM$RANDOM $RANDOM$RANDOM$RANDOM"
OM$RANDOM" | perl -lane '$k = rand();
if ($k < .4) { print "$F[0] * $F[1]"; next }
elsif ($k < .8) { print "$F[0] / $F[1]"; next }
elsif ($k < .9) { print "$F[0] + $F[1]"; next }
else { print "$F[0] - $F[1]"; print
214254513397827924 * 164672407792331690
~>

```

The next run gave us:

8323213972189022085 - 29706112412437431635

So far so good—I was getting on...

Getting a data hose

Zsh/Bash have in-built *for* loops. So we converted the left hand trickle into a hose...

```

-> for ((i = 0; i < 5; ++i))
do
echo "$RANDOM$RANDOM$RANDOM$RANDOM $RANDOM$RANDOM$RANDOM"
OM$RANDOM"
done | perl -lane '$k = rand();
pipe quote> if ($k < .4) { print "$F[0] * $F[1]"; next }
pipe quote> elsif ($k < .8) { print "$F[0] / $F[1]"; next }
pipe quote> elsif ($k < .9) { print "$F[0] + $F[1]"; next }
pipe quote> else { print "$F[0] - $F[1]"}' | tee > expressions.txt | bc > results.txt
20343140723230431628 / 12805234313157116052
1853726671299816051 + 29694216342188821346
2939317042993615625 / 38033016128821552
113881012327974203 + 1880313573241446378
276452368052387683 * 14343404223735113
~>

```

Now, we just increased the *for* loop runs, dumped the stuff into a file, and we had our test cases. 50000 such computations would be fine for us.

Computing the expected answers was simple—bc is always around, ready to do our bidding.

With a tee, I captured the test cases to the file, *expressions.txt*. The expected results went into *results.txt*.

A dollop of Ruby

However, I skirted the real issue: how were we to get random numbers that were around 24 digits—that is where our boundary conditions had to be validated...

```
>> ruby -e '100.times { print "#{rand(1000000000000000000000000)}\n"}'
```

And no, don't try and tap out those zeroes. After you enter 1, press Alt 23, release Alt, and hit 0 -- then the command line taps out 23 zeroes for you—pretty cool, right?

Just to make sure we get many numbers with 23 digits in them, you can quickly run a test...

```

-> ruby -e '100.times { print "#{rand(1000000000000000000000000)}\n"}' | awk
'length < 23' | wc -l
6
~>

```

I played with this by changing the loop counter 100 to a few other numbers and found that we got the desired numbers 90 per cent of the time—and that's good.

Could we just step further and generate the pair of them?

Oh yes, with some more Rubyism.

```

-> ruby -e 'def x
quote>   rand(1000000000000000000000000)
quote>   end
quote>   100.times { m,n = x,
quote>   print "#{m} #{n}\n"}'
18314555016727760411398 84040236638578144662058
39544321605321724850550 2777137155951945530143

```

We could take out the shell loop above and instead use the above Ruby code in its place.

TIMTOWTDI (Perl speak)

Well yes, using Linux's */dev/urandom* bucket you can pick as many as you want:

```
od -An -tu /dev/urandom | awk -vOFS="" '{$1=$1; print}' | sed -n
's/(.{24}).*/\1/p' | sed -n 'N; s/\n/ /p'*
```

There are a couple of awk and sed idioms here, however it is a nice exercise to open the info pages and figure out how these work. This, by the way, makes sure that we get each number with 24 digits in it.

We can make absolutely sure of this, but I will leave it as an exercise.

Voila!

And the test data is ready.

The rest was all easy and routine—we pulled these files into a CppUnit test method and called tommath APIs with the expression and compared the result.

And we found the answer in an hour—tommath faithfully produced the correct output for numbers with 27 digits in them, which was enough for us to choose it...

Problem solved. Open Source is totally awesome! 

By: Atul Shriniwas Khot

The author works at IBM Software Labs in Hyderabad as a senior software engineer, and has been dabbling with UNIX/Linux for the last 14 years. He is into Java/J2EE, Groovy and Ruby these days, but at times he hankers after dear-old C++ and Perl. He loves design patterns, algorithms, multi-threading and refactoring code to make it stylish. And of course, he loves vim (never miss a chance to use it) and zsh. He collects classic British mysteries (especially those green and white Penguin crime classics—penguins make life so delectable;-))



Understanding Memory Areas in a C Program

What happens when a C program is loaded into memory? Where are the different types of variables allocated? Let's look at some of these interesting 'under the hood' details.

Ravikiran from Hyderabad (a regular reader of my *Joy of Programming* column) asked me this: "Why do we need two data sections—initialised and un-initialised? If I initialise a static or a global variable with zero, where will it be stored? Since the scopes of global and static variables are different, why are they stored in the same data section?" These queries prompted me to write this article, which should interest any assembly language/C/C++ programmer.

Four important segments

Let us first understand the memory layout of a C program (which is compiled to an executable and loaded into the memory for execution). There are four main segments in a C program: data, code, stack and heap segments.

Global and function static variables are allocated in the data segment. The C compiler converts executable statements in a C program—such as `printf("hello world")`—into machine code; they are loaded in the code segment. When the program executes, function calls are made. Executing each function requires allocation of memory, as if in a frame, to store different information like the return pointer, local variables, etc. Since this allocation is done in the stack, these are known as 'stack

frames'. When we do dynamic memory allocation, such as the use of the malloc function, memory is allocated in the heap area.

The data and text areas are of fixed size. When a program is compiled, at that point itself, the sizes required for these segments are fixed and known—hence, they are also known as static segments. The sizes of the stack and heap areas are not known when the program gets compiled. Also, it is possible to change/configure the size of these areas (i.e., increase or decrease the size of these segments); so these areas are known as dynamic segments.

Let us look at each of these segments in detail now. For starters, we'll explore an example program and a tool to find out where the variables get allocated later.

Data segment

The data segment is to hold the value of those variables that need to be available throughout the lifetime of the program. So, it is obvious that global variables should be allocated in the data segment. How about local variables declared as static? Yes, they are also allocated in the data area because their values should be available across function calls. If they are allocated in the stack frame itself, they will get destroyed once the function returns. The only option is to allocate them in a global

area; hence, they are allocated in this segment. So, the lifetime of a local static variable is that of the lifetime of the program!

There are two parts in this data segment itself: the initialised data segment and the uninitialised data segment.

When the variables are initialised to some value (other than the default value, which is zero), they are allocated in the initialised data segment.

When the variables are uninitialised, they get allocated in the uninitialised data segment. This segment is usually referred to with a cryptic acronym called BSS. It stands for Block Starting with Symbol, and gets its name from the old IBM systems which had that segment initialised to zero.

The data area is separated into two, based on explicit initialisation, because the variables that are to be initialised need to be initialised one by one. However, the variables that are not initialised need not be explicitly initialised with zeros, one by one. Instead, the job of initialising the variables to zero is left to the operating system to take care of. This bulk initialisation can greatly reduce the time required to load.

When we want to run an executable program, the OS starts a program known as a loader. When this loads the file into memory, it takes the BSS segment and initialises the whole thing to zeros. That is why (and how) the uninitialised global data and static data always get the default value of zero.

The layout of the data segment is in the control of the underlying operating system; however, some loaders give partial control to the users. This information may be useful in applications such as embedded systems.

The data area can be addressed and accessed using pointers from the code. Automatic variables have an overhead in initialising the variables each time they are required, and code is required to do that initialisation. However, variables in the data area do not have such runtime overhead because the initialisation is done only once and, that too, at loading time.

Code segment

The program code is where the executable code is available for execution. This area is also known as the ‘text segment’ and is of fixed size. This can be accessed only by function pointers and not by other data pointers. Another important piece of information to take note of here is that the system may consider this area as a ‘read only’ memory area, and any attempt to write in this area can lead to undefined behaviour.

Stack and heap segments

To execute the program, two major parts are used: the stack and heap. Stack frames are created in the stack for functions and in the heap for dynamic memory allocation. The stack and heap are uninitialised areas. Therefore, whatever happens to be in the memory becomes the initial (garbage) value for the objects created in that space.

The local variables and function arguments are allocated in the stack. For the local variables that have an initialisation value, code is generated by the compiler to initialise them explicitly to those values when the stack frames are created. For function parameters, the compiler generates code to copy

the actual arguments to the space allocated for the parameters in the stack frames. (**Note:** Compilers do this efficiently, so this description is not entirely correct; we have given this description because it is useful to understand how function parameters are treated as local variables).

An example

We’ll take a sample source program and see where different program elements are stored when that program executes. The comments in the program explain where the variables get stored.

```
#include <stdio.h>
#include <string.h>
#include <stdlib.h>

int bss1;
static double bss2;
char *bss3;
// these variables are stored in initialized to zero segment
// also known as uninitialized data segment (BSS)

int init1 = 10;
float init2 = 10.0f;
char *init3 = "hello world";
// these variables are stored in initialized data segment
// the code for main function gets stored in code segment
int main()
{
    int local1 = 10;
    // this variable is allocated in stack; initialization code is generated by the
    // compiler
    int local2;
    // this variable is not initialized; hence it has garbage value
    // remember: it does not get initialized to zero

    static int local3;
    // this is allocated in BSS segment and gets initialized to zero

    static int local4 = 100;
    // this gets allocated in initialized data segment

    int (*local_foo)(const char *...) = printf;
    // printf is in a shared library (libc, or C runtime library)
    // local_foo is a local variable (a function pointer) that
    // points to that printf function

    local_foo("hello world\n");
    // this function call results in creation of a 'stack frame'
    // in the stack area

    int *local5 = malloc(sizeof(int));
    // local5 is allocated in stack; however it points to a dynamically
    // allocated block in heap

    return 0;
    // the stack frame for main function gets destroyed after executing main
}
```

Is there a tool with which we can check where these variables are stored? Yes, there are many. For example, the *objdump* tool can dump the whole executable file and show you the contents; but beginners would get overwhelmed by the details; so, a simpler tool will do. One such simple tool is *nm*.

Using the *nm* tool

The *nm* manpage says that it's a tool to "...list symbols from object files". So how does one use *nm*?

First, assume that we stored the program in */tmp/allocation.c* file. Now, compile it and create an executable, as shown below:

```
ganesh@linux-2rqz:~> cc -std=c99 /tmp/allocation.c
```

(Since I use some C99 features like single line comments, I compiled the program in C99 mode.)

Now, type *nm ./a.out* (even just typing *nm* will do—if there are no arguments given to *nm*, it assumes that it should take the input as *a.out*) and you'll get some cryptic output as follows:

```
ganesh@linux-2rqz:~> nm ./a.out
08049650 B bss1
08049648 b bss2
08049654 B bss3
08049638 A __bss_start
08048374 t call_gmon_start
08049638 b completed.5764
...
...
```

I haven't shown the whole output since it will fill a whole page. Where are the symbols that we did not type in the program, coming from? They have been inserted behind the scenes by the compiler for various reasons. We can ignore them for now.

Now, what are those strange numbers, followed by the letters (such as 'b', 'B', 't')? The numbers are the symbol's value, followed by the symbol type (displayed as a letter) and the symbol name.

The symbol type requires more explanation. A lowercase symbol means that it is local (to the file) and an uppercase letter means that it is global (externally available from the file). Here are the symbol types and their meanings that are of interest to us:

- "B" The symbol is in the uninitialised data section (known as BSS).
- "D" The symbol is in the initialised data section.
- "T" The symbol is in the text (code) section.
- "U" The symbol is undefined.

Oh good, that's a short list. Now, let's look out for the symbols that are relevant to us (by redirecting the output to *grep* command), and discuss them in detail:

```
ganesh@linux-2rqz:~> nm ./a.out | grep bss
08049650 B bss1
08049648 b bss2
```

08049654 B bss3

Variables *bss1* and *bss3* got allocated in the BSS section (global). Since we put the *storage* class as static for the variable *bss2*, it is listed as 'b' (lower case 'b' means that it is accessible only within that file) and is also allocated in the BSS section:

```
ganesh@linux-2rqz:~> nm ./a.out | grep init
08049628 D init1
0804962c D init2
08049630 D init3
```

No surprises here for variables *init1*, *init2* and *init3*: since they are explicitly initialised, they got allocated into the initialised data section.

```
ganesh@linux-2rqz:~> nm ./a.out | grep local
08049640 b local3.1847
08049634 d local4.1848
```

Only the *local3* and *local4* are allocated global memory. Since *local3* is uninitialized, it is allocated in BSS; and since *local4* is explicitly initialised, it is allocated in the initialised data segment. As both are local (to the function), they are indicated by smaller case letters ('b' and 'd', respectively). Why are the names suffixed with some numbers here? Presumably, since they are local to the function and to avoid accidental mixing them up with other local variables with the same name, they have been suffixed by some numbers. (**Note:** Compilers differ in their approaches in treating local static variables; this approach is for GCC.)

In the output, the following few symbols are also of interest to us:

```
080483f4 T main
U malloc@@GLIBC_2.0
U printf@@GLIBC_2.0
```

The *main* function is allocated in the text segment; obviously, we can access this function from outside the file (to start the execution). So, the type of this symbol is 'T'.

The *malloc* and *printf* functions used in the program are not defined in the program itself (the header files only *declare* them, they don't *define* them); they are defined in the shared library GLIBC, version 2.0—that's what the suffix "@@GLIBC_2.0" implies.

Hopefully, this article has demystified some of the behaviour of natively executable programs. You can take this as a starting point and explore more by yourself. Read about ELF and COFF file formats, about how segments other than the ones I've described here, are useful, etc. Check the GCC manual for more details. 

About the author:

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Thank You IIT Madras

It was in your hostel room
that the idea was conceived



The first issue in Jan '69



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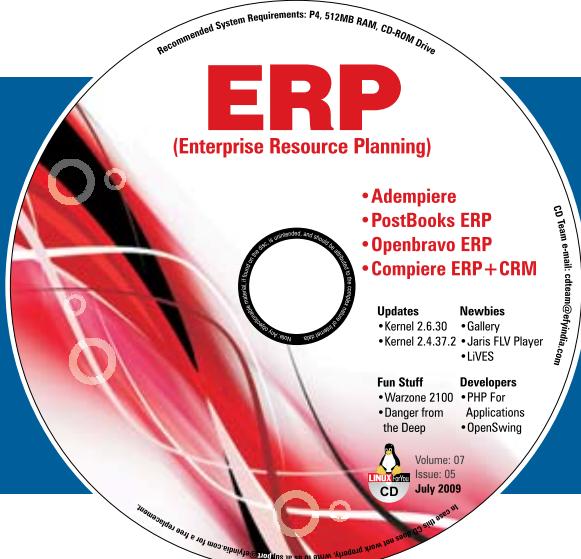
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ERP (Enterprise Resource Planning)

This month's LFY CD packs in some of the best ERP software from the FOSS world.

Quoting Wikipedia, "Enterprise resource planning (ERP) is a company-wide computer software system used to manage and coordinate all the resources, information, and functions of a business from shared data stores." We bring you some of the options from the FOSS ecosystem. Let us know if you enjoy the same amount of flexibility with these variants as you do with proprietary solutions.

ADempiere Business Suite

This is an ERP/CRM/MFG/SCM/POS done the 'bazaar' way in an open and "all that can be packed in" fashion. The focus is on the community that includes subject matter specialists, implementers and end-users. The goal of the ADempiere project is to create a community-developed and supported open source business solution. The project was created in September 2006 after a long running disagreement between ComPiere Inc, the developers of Compiere, and the community that formed around that project. The community believed Compiere Inc placed too much emphasis on the open source

nature of the project, rather than the community nature of the project, and after an impassioned discussion decided to split from Compiere, giving birth to the ADempiere project.

[./software/erp/adempiere/](#)

PostBooks ERP

This is a package that covers ERP, accounting and CRM applications. It is the ideal software platform for many small- to medium-sized businesses (SMBs). On the accounting side are basic features like the general ledger, accounts receivable and payable, etc. PostBooks also includes a fully-integrated CRM software, apart from functions that cover sales and purchasing, product definition, inventory, light manufacturing and OpenRPT, our open-source report writing software.

[./software/erp/xTuple/](#)

Openbravo ERP

This is a Web-based ERP for SMEs, built on the proven MVC and MDD framework that facilitates customisation. Openbravo features a Web-based interface, where the user can view the entire status of a company, including production

information, inventory, customer information, order tracking, and workflow information. It is possible to synchronise this information with other applications through the Java-based Openbravo API. Openbravo can also create and export reports and data to several formats, such as PDF and Microsoft Excel.

[./software/erp/openbravo/](#)

Compiere ERP+CRM

This is the leading open source ERP solution for the distribution, retail, manufacturing and service industries. Compiere automates accounting, supply chain management, inventory and sales orders. It includes ERP functionalities. The Compiere modules are: quote to cash, requisition-to-pay, customer relationship management, partner relations management, supply chain management, performance analysis, warehouse, double-entry book-keeping, workflow management and Web store. Compiere is a model-driven architecture development, deployment and maintenance framework, designed with the intention of following changes as business evolves.

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For You and Me

Gallery is a slick, intuitive Web-based photo gallery. It's easy to install, configure and use. Gallery photo management includes automatic thumbnails, resizing, rotation, and more. Authenticated users and privileged albums make this great for communities.

[.../software/newbies/gallery/](#)

Jaris FLV Player is a Flash FLV player made on Swishmax 2 that can be embedded into any website for free or commercial use. It supports thumbnails, full-screen views, volume control, as well as displaying the total duration of a video before playing it.

[.../software/newbies/jaris-1_0.zip](#)

LiVES is a video editing system. It is designed to be simple, yet powerful. It is small in size, yet has many advanced features. LiVES is part editor, part VJ tool. It mixes real-time video performance and non-linear editing in one professional quality application. It will let you start editing and making videos right away, without having to worry about formats, frame sizes, or frame rates. It is a very flexible tool with which you can mix and switch clips from the keyboard, use dozens of real-time effects, trim and edit your clips in the clip editor, and bring them together using the multi-track timeline.

[.../software/newbies/lives-1.0.0-pre1.tar.gz](#)

For developers

PHP For Applications is a PHP5 RAD and object-oriented PHP framework for building event-driven stateful Web applications. It is based on the Zend framework, and features tableless HTML, multiple databases, access key support, auto data type recognition, transparent AJAX, and has UTF-8 and i18n/l10n support.

[.../software/developers/p4a/](#)

OpenSwing is a components library that provides a rich set of advanced graphics components to develop

desktop applications and HTTP/RMI-based Java applications/RIAs based on the Swing front-end. It also provides adapters for Hibernate, JPA, iBatis, etc.

OpenSwing provides a complete solution (a framework and advanced Swing components with data binding capabilities) to quickly and easily develop rich-client applications.

[.../software/developers/openswing/](#)

Fun Stuff

Warzone 2100 is a hybrid real-time strategy and tactics computer game. It is fully three dimensional, based on the iViS games and 3D graphics engine developed by Sam Kerbeck of Eidos. The terrain is mapped by a grid; vehicles tilt to meet hilly terrain, and projectiles can be realistically blocked by steep mountains. The camera is free-moving and can zoom in and out, rotate, and pan up or down while navigating the battlefield. In Warzone 2100, you command the forces of 'The Project' in a battle to rebuild the world after mankind has almost been destroyed by nuclear missiles. The game offers campaign, multi-player and single-player skirmish modes.

[.../software/funstuff/warzone/](#)

Danger from the Deep (also known as dangerdeep or DftD) is a World War II German submarine simulator. The program and source code are available under the GPL licence and most of the artwork/data is released under a Creative Commons licence. This game is planned as a tactical simulation and is as realistic as our knowledge of physics allows. Its current state is alpha, but it is playable. The latest version of Danger from the Deep is 0.3.0. The Linux installer included in the CD contains both the program and the data.

[.../software/funstuff/dangerdeep/](#)



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A Voyage to the Kernel



Part 14

Segment 3.3: Day 13

Last time we discussed the various types of operations and system calls. In this article, we will focus more on the literature. Like I mentioned, there are two different modes: the kernel and the user mode. Let's look at the two types of switching. The first is when you make a system call. After calling it, the task will go for codes that are operational in the kernel mode. The other case is when you deal with interrupt requests (IRQs). Soon after an IRQ, a handler is called and the control goes back to the task that was interrupted.

A system call may be used when you want to access a particular I/O device or file, or when you need to get privileged information. It may also be used when you require to execute a command or to change the execution context.

Now let me elucidate the whole process that governs an IRQ event. We'll assume that a particular process is running. An IRQ may occur while the process is running. Then, the task will be interrupted to call the corresponding interrupt handler and it is executed right there. In the next step, as mentioned before, the control goes back to the task (which is running in user mode) and the process is back to its original state.

Advanced users can comprehend the mode of initiation by looking at the code below:

```
typedef irqreturn_t (*irq_handler_t)(int, void *);
```

```
struct irqaction {  
    irq_handler_t handler;  
    unsigned long flags;  
    cpumask_t mask;  
    const char *name;  
    void *dev_id;  
    struct irqaction *next;  
    int irq;  
    struct proc_dir_entry *dir;  
};  
  
extern irqreturn_t no_action(int cpl, void *dev_id);  
extern int __must_check request_irq(unsigned int, irq_handler_t handler,  
                                    unsigned long, const char *, void *);  
extern void free_irq(unsigned int, void *);  
  
struct device;  
  
extern int __must_check devm_request_irq(struct device *dev,  
                                         unsigned int irq,  
                                         irq_handler_t handler, unsigned long irqflags,  
                                         const char *devname, void *dev_id);  
extern void devm_free_irq(struct device *dev, unsigned int  
                         irq, void *dev_id);
```

Non-free elements in the kernel

In an earlier column, I had discussed the non-free code portions in the kernel. And I received a number of queries regarding the subject. So, I think it is appropriate to discuss it here.

It is true that the kernel (from the original

repository) contains non-free elements, especially hardware drivers that depend on non-free firmware. It will ask you to install additional non-free software that it doesn't contain.

In fact, there is a project (unfortunately, not very active!) involved in the process of removing software that is included without source code; say, with obfuscated or obscured source code. It is the Linux-libre project of FSF-LA.

Now let's have a look at the automated process (for an *exploded* tree) that does it!

```
kver=2.6.21 extra=0++
```

```
case $1 in
    -force) die () { echo ERROR: "$@": ignored >&2; }; shift;;
    *) die () { echo "$@" >&2; exit 1; };;
esac

if unifdef -Utest /dev/null; then :; else
    die unifdef is required
fi

check=`echo $0 | sed 's./[^/]*$,.~/deblob-check
if [ ! -f $check ]; then
    echo optional deblob-check missing, will remove entire files >&2
    have_check=false
else
    have_check=:
fi
```

Those who are good with shell programming can follow the steps easily (please refer to Segment 1 of the 'Voyage' series for shell programming related queries).

Now you can see how it performs the locating process:

```
clean_file () {
    #$$1 = filename
    if test ! -f $1; then
        die $1 does not exist, something is wrong
    fi
    rm -v $1
}

check_changed () {
    if test ! -f $1; then
        die $1 does not exist, something is wrong
    elif cmp $1.deblob $1 > /dev/null; then
        die $1 did not change, something is wrong
    fi
    mv $1.deblob $1
}

clean_blob () {

clean_kconfig () {
```

Inode interface

- *create()*: creates file in the directory
- *lookup()*: finds files by name, in a directory
- *link()/symlink()/unlink()/readlink()/follow_link()*: manages filesystem links
- *mkdir()/rmdir()*: creates/removes sub-directories
- *mknod()*: creates a directory or file
- *readpage()/writepage()*: reads or writes a page of physical memory to backing store
- *truncate()*: sets the length of a file to zero
- *permission()*: checks to see if a user process has permission to execute a given operation
- *smap()*: maps a logical file block to a physical device sector
- *bmap()*: maps a logical file block to a physical device block
- *rename()*: renames a file/directory

File interface

- *open()/release()*: to open/close the file
- *read()/write()*: read the file/write to the file
- *select()*: waits until the file is in a given state
- *lseek()*: moves to a particular offset in the file (if supported)
- *mmap()*: maps a region of the file into the virtual memory of the user process
- *fsync()/fasync()*: synchronises memory buffers with physical device
- *readdir*: reads the files that are pointed by the directory file
- *ioctl*: sets file attributes
- *check_media_change*: checks if a removable media has been removed
- *revalidate*: verifies that all the cached information is valid

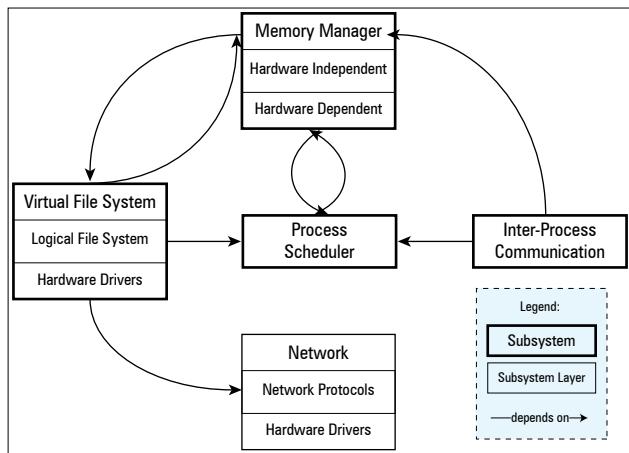


Figure 1: System decomposition

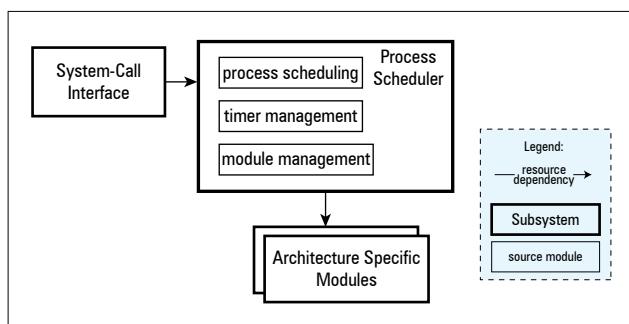


Figure 2: Process scheduler structure

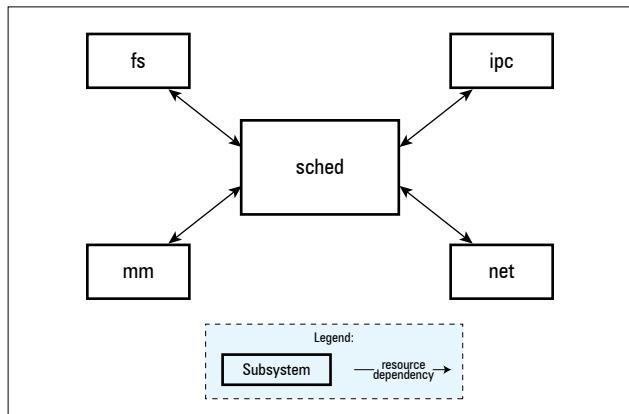


Figure 3: Process scheduler dependencies

```

#$1 = filename $2 = things to remove
echo Marking config $2 as depending on NONFREE in $1
sed "/^config \\\($2\\\)\$/p;i"
depends on NONFREE
d;}" $1 > $1.deblob
check_changed $1
}

clean_mk () {
#$1 = config $2 = Makefile name
# We don't clean up Makefiles any more --lxoliva
# sed -i "\\\($1\\\)/d" $2
}

```

```

# check_changed $2
if sed -n "/\\($1\\\\)/p" $2 | grep . > /dev/null; then
:
else
die $2 does not contain matches for $1
fi
}

clean_ifdef () {
#$1 = filename $2 = macro to -U
echo unifdefing $1 with -U$2
unifdef -U$2 $1 > $1.deblob
check_changed $1
}

```

Please note that *deblob-check* looks for blobs in the tarballs, source files and patches. Then it tries to clean up individual source files from non-free blobs. At the end, you should only have free and apparent blobs. The non-free bits are often derived from code under non-disclosure agreements that don't bestow permission for the code to be distributed under the GNU General Public License. Now, to handle the drivers:

```

# First, check that files that contain firmwares and their
# corresponding sources are present.

```

```

for f in \
drivers/char/ser_a2232fw.h \
drivers/char/ser_a2232fw.ax \
drivers/net/ixp2000/ixp2400_rx.ucode \
drivers/net/ixp2000/ixp2400_rx.uc \
drivers/net/ixp2000/ixp2400_tx.ucode \
drivers/net/ixp2000/ixp2400_rx.uc \
drivers/net/wan/wanlifw.inc_shipped \
drivers/net/wan/wanlifw.S \
drivers/net/wireless/atmel.c \
drivers/net/wireless/atmel.uc \
drivers/scsi/53c700_d.h_shipped \
drivers/scsi/53c700.scr \
drivers/scsi/aic7xxx/aic79xx_seq.h_shipped \
drivers/scsi/aic7xxx/aic79xx.seq \
drivers/scsi/aic7xxx/aic7xxx_seq.h_shipped \
drivers/scsi/aic7xxx/aic7xxx.seq \
drivers/scsi/aic7xxx_old/aic7xxx_seq.c \
drivers/scsi/aic7xxx_old/aic7xxx.seq \
drivers/scsi/53c7xx_d.h_shipped \
drivers/scsi/53c7xx.scr \
drivers/scsi/sym53c8xx_2/sym_fw1.h \
drivers/scsi/sym53c8xx_2/sym_fw1.h \
drivers/scsi/sym53c8xx_2/sym_fw2.h \
drivers/scsi/sym53c8xx_2/sym_fw2.h \
drivers/usb/serial/keysan_pda_fw.h \
drivers/usb/serial/keysan_pda.S \
drivers/usb/serial/xircos_pgs_fw.h \
drivers/usb/serial/xircos_pgs.S \

```

```
sound/pci/cs46xx/imgs/cwcbinhack.h \
sound/pci/cs46xx/imgs/cwcdma.asp \
; do
if test ! $f; then
die $f is not present, something is amiss
fi
done
```

For your reference, here are the functions performed by the scripts:

- **deblob-main**: The main script used to clean up the Linux tarball.
 - **deblob-check**: The script that finds blobs. It may also clean up work.
 - **deblob-2.6.##**: The script that cleans up blobs from within a given exploded Linux source tree.
- Now, coming to the removal:

```
# Identify the tarball.
sed -i "s/^EXTRAVERSION.*,&-libre$extra," Makefile
```

```
#####
# Removed ATM Drivers #
#####

# ATM_AMBASSADOR - Madge Ambassador (Collage PCI 155
Server)
clean_blob drivers/atm/atmsar11.data

# ATM_FORE200E_PCA
# ATM_FORE200E_SBA - SBA-200E
clean_kconfig drivers/atm/Kconfig 'ATM_FORE.*'
clean_mk CONFIG_ATM_FORE200E drivers/atm/Makefile

clean_file drivers/atm/pca200e.data
clean_file drivers/atm/pca200e_ecd.data
clean_file drivers/atm/sba200e_ecd.data
clean_kconfig drivers/atm/Kconfig 'ATM_AMBASSADOR'
clean_mk CONFIG_ATM_AMBASSADOR drivers/atm/Makefile
```

The interesting point is that maintaining Linux-libre is not a time-consuming process. And there are scripts that will inform the project manager whether there is anything that needs manual intervention.

David Woodhouse suggested having a separate branch of the kernel source tree (which would be excluded from a normal kernel build process) for non-free firmware. Thus, the non-free firmware could be distributed in a separate package. But the idea of 'complete freedom', as proposed by Linux-libre, is not respected here.

Outline of Linux kernel

Now let's consider the idea of tasks. We have already seen that Linux supports multi-tasking. Any application that runs the memory of the system and

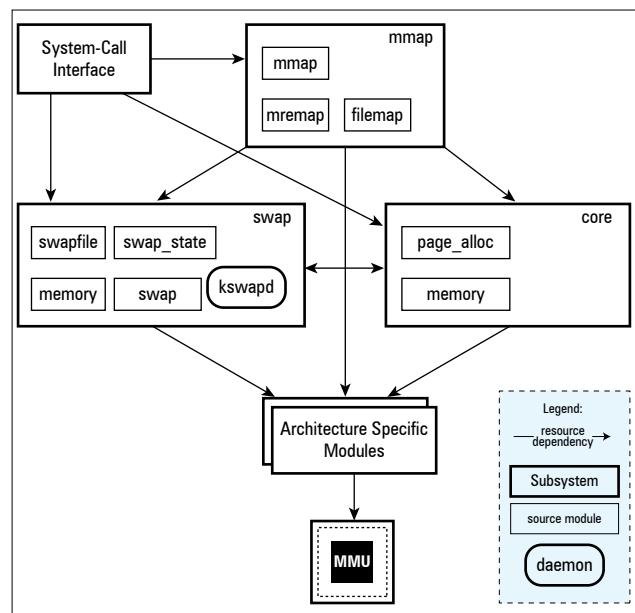


Figure 4: Memory manager structure

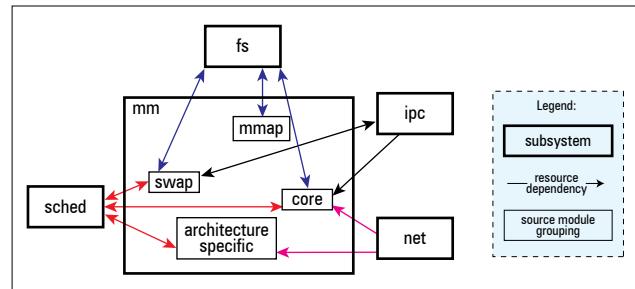


Figure 5: Memory manager dependencies

shares the system's resources may be termed as a task. And by multi-tasking, we are actually referring to the effective sharing of these resources among the tasks. Here, the system can switch from one task to another after a given *timeslice* time (say 10 ms). This gives an impression that many tasks are handled simultaneously.

Here are the detailed steps of the process: Let's say *task1* is running and using the resources. Then, a resource request will be made that forces the system to put the *task1* in the *block list* and choose *task2* from the *ready list* for task switching. This is what happens when it comes to two tasks. You can extend this idea to N number of tasks by choosing a timer IRQ for the switching stage.

Having discussed these ideas, we can now go back to the sub-system structure of the operating system.

The process scheduler is employed to:

- Allow processes to create fresh copies
- Send signals to the user processes
- Manage the timer
- Select the process that can access the CPU
- Receive interrupts and route them to the

- appropriate kernel subsystem
- Clean up process resources (final stage of the process)

There are two types of interfaces for this — a complete interface for the kernel system and a limited one for user processes. A process can initiate other processes by copying the existing process. For example, when the system is booting, only *init* will be running. Then the *fork()* system call is used to spawn off copies. This means that it creates a new child that is a true copy of its parent.

You can see that the process scheduler is also vital for loading, execution, and the proper termination of the user processes.

The structure *task_struct* is used to refer a task. You can find a field that is used to indicate the state. That may have any of the following states: ready, waiting, running, returning from a system call, processing the INT routine and processing SC. You can also find fields that carry information about the clock interval and priority. From this, process ID information can be retrieved. If you take a look at the *files_struct* (which is a substructure), you can see the list of files opened by the process. Fields concerning the amount of time the process has spent, can also be located.

Now we can discuss the aspects concerning memory management. Here are a few of the main points concerning the unique features:

- A large pool of address space (so that user programs can refer more memory than the physically available one).
- Memory for a process is private and it cannot be modified by another process. The memory manager restricts processes from overwriting code and any read-only data.
- The memory-mapping feature can map a file into a portion of virtual memory and access the file as memory.
- The *Fair Access to Physical Memory* feature offers good system performance.
- The memory manager allows processes to share portions of their memory.

The memory manager offers two interfaces—a system-call interface that's used by user processes and another interface used by the kernel subsystems to perform their actions. Please see the sidebox titled 'System-call interface' for a detailed review.

Filesystem

We have already seen that Linux has been ported to various platforms ranging from computers to wristwatches. We know that even for one particular device, say a hard drive, there are many differences in the interfaces used by different vendors. Linux supports a large number of logical filesystems. Thus,

SYSTEM-CALL INTERFACE

System-call interface

- mprotect*: To change the protection on the virtual memory portion
- mmap()*/*munmap()*/*msync()*/*mremap()*: To map files into the virtual memory portions
- mlock()*/*mlockall()*/*munlock()*/*munlockall()*: Super-user routines to refrain memory from being swapped
- swapon()*/*swapoff()*: Super-user routines to add and remove swap files
- malloc()*/*free()*: To allocate or free a portion of the memory for the use of a given process

Intra-kernel interface

- verify_area()*: To verify that a portion of the user memory is mapped with the necessary permissions
- kmalloc()*/*kfree()*: To allocate and free memory for use by the data structures of the kernel
- get_free_page()*/*free_page()*: To allocate and free memory pages

inter-operations are made possible. The filesystem has the following advantages:

- Supports multiple hardware devices
- Supports multiple logical filesystems
- Supports multiple executable formats
- Offers a common interface to the logical filesystems
- Provides high-speed access to files
- Can restrict a user's access to files and the user's total file size, with quotas

There are two levels of interfaces here—a system-call interface for the user processes and an internal interface for other kernel subsystems. File subsystems expose the data structures and the implementation function for the direct manipulation by other kernel subsystems. You may note that two interfaces are exposed, viz., inodes and files. Please glance at the box for more information.

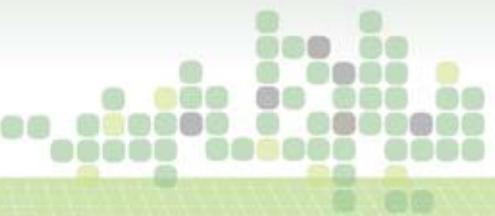
We have reached the end of today's voyage. I look forward to your feedback so that I can incorporate your ideas into our next voyage.

Happy kernel hacking! 

By: Aasis Vinayak PG

The author is a hacker and a free software activist who does programming in the open source domain. He is the developer of V-language—a programming language that employs AI and ANN. His research work/publications are available at www.aasisvinayak.com

Industry News



Intel to acquire Wind River for \$884 million

Intel has entered into a definitive agreement to acquire Wind River Systems, under which Intel will acquire all outstanding Wind River common stock for \$11.50 per share in cash, or approximately \$884 million in the aggregate. Wind River is a leading software vendor in embedded devices, and will become part of Intel's strategy to grow its processor and software presence outside the traditional PC and server market segments into embedded systems and mobile

handheld devices. Wind River will become a wholly owned subsidiary of Intel and continue with its current business model of supplying leading-edge products and services to its customers worldwide.

The acquisition will deliver to Intel robust software capabilities in embedded systems and mobile devices, both important growth areas for the company. Embedded systems and mobile devices include smart phones, mobile Internet devices, other consumer electronics (CE) devices, in-car 'info-tainment' systems and other

automotive areas, networking equipment, aerospace and defence, energy and hundreds of other devices. This multi-billion dollar market opportunity is increasingly becoming connected and more intelligent, requiring supporting applications and services as well as full Internet functionality.

The board of directors of Wind River has unanimously approved the transaction. It is expected to close this summer, subject to certain regulatory approvals and other conditions specified in the definitive agreement. Upon completion of the acquisition, Wind River will report into Intel's Software and Services Group, headed by Renee James.

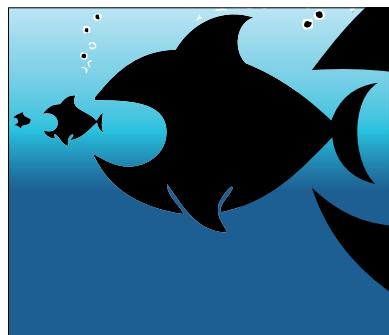
Open Patent Alliance expands 4G WiMAX

Building on worldwide 4G WiMAX technology momentum, Beceem Communications, GCT Semiconductor, Sequans Communications and UQ Communications have joined the Open Patent Alliance (OPA). Formed in June 2008, the OPA is dedicated to offering intellectual property rights (IPR) solutions that support the development and widespread adoption of WiMAX around the globe, further boosting the open industry standard approach to 4G wireless broadband.

Beceem, GCT Semiconductor, Sequans and UQ come in as associate (non-board-level) members, joining current OPA members Acer, Alcatel-Lucent, Alvarion, Cisco, Clearwire, Huawei Technologies, Intel Corporation and Samsung Electronics.

"It's been an exciting month for the Open Patent Alliance and WiMAX 4G, in general," said OPA President Yung Hahn. "The OPA ecosystem remains focused on broader choice along with competitive equipment and service costs for WiMAX technology, devices and applications, globally. With a critical mass of silicon providers now as members, the OPA can continue facilitating the formation of a singular, cohesive WiMAX patent pool to assist participating companies in obtaining access to patent licences from patent owners at a more predictable cost."

For more information, visit the OPA website at www.openpatentalliance.com.



Ubuntu becomes Intel's classmate

Canonical, the commercial sponsor of Ubuntu, has reached an agreement with Intel Corporation to deliver Ubuntu as an operating system for the Intel-powered Classmate PCs. The new Intel-powered Classmate PC (a netbook specifically designed for the education market) features a larger screen, more memory and larger SSD or HDD than the original classmate PC. It will also feature a modified version of Ubuntu Netbook Remix for the first time, improving the experience on smaller screens. The Intel-powered convertible Classmate PC features a touch screen on which users can rest their palm to write or draw, converts from a clamshell to a tablet PC, and auto-adjusts between landscape and portrait, depending on how the machine is held. Ubuntu will support all these use cases.

"Not only is this a significant step for an open operating system, it is a significant step for any device to

be able to offer these capabilities, at this cost, on standardised hardware,"

said Jon Melamut,

general manager, OEM services, Canonical. "Our goal has always been to take the best technology and make it available to everyone. Coupling our software with a fantastic, affordable education device like this is a concrete realisation of that ambition."



Red Hat collaborates with HP on SOA solutions

Red Hat has announced an optimised solution developed with HP around Service Oriented Architecture (SOA) Governance.

The JBoss Enterprise SOA Platform has been optimised to be governed by HP SOA Systinet software. With the addition of HP SOA Systinet, customers have an opportunity to drive revenue, remove costly errors and respond to market changes when they automate business processes through a deployment on JBoss Enterprise SOA Platform.

"Our collaboration with HP and its Systinet team offers a direct benefit to our SOA customers because now they will be able to deploy the two solutions together, and know that they have a secure and trusted governance framework that enhances their ability to reap the full benefits of their SOA deployment," said Craig Muzilla, vice president, Middleware, Red Hat.

MontaVista Joins GENIVI Alliance

MontaVista Software, Inc., has announced today that it has become a core member of the GENIVI Alliance, an industry collaboration dedicated to driving the development and adoption of an open source In-Vehicle Infotainment (IVI) reference platform for the automotive industry. With a long history of open source contributions in such projects as real-time, fast boot time, and small footprint, MontaVista is uniquely positioned to help GENIVI and its members bring a commercialized open source IVI solution to the market.



EFF busts 'bogus' Internet sub-domain patent

The US Patent and Trademark Office has announced that it will revoke an illegitimate patent on Internet sub-domains as a result of the Electronic Frontier Foundation's (EFF) Patent Busting Project campaign. U.S. Patent No. 6,687,746, now held by Hoshiko, LLC, claimed to cover the method of automatically assigning Internet sub-domains, like "action.eff.org" for the parent domain "eff.org." Previous patent owner IdeaFlood used this bogus patent to demand payment from website hosting companies offering personalised domains, such as LiveJournal, a social networking site where each of its three million users may have their own sub-domain.

In the original re-examination request, EFF and Rick McLeod of Klarquist Sparkman, LLP, showed that the method IdeaFlood claimed to have invented was well known before the patent was issued. In fact, website developers were having public discussions about how to create these virtual sub-domains on an Apache developer mailing list and on Usenet more than a year before IdeaFlood filed its patent application. The open source community's public record of the technology's development provided the linchpin to EFF's patent challenge.

"This patent was particularly troubling because the company tried to remove the work of open source developers from the public domain and use it to threaten others," said EFF Legal Director Cindy Cohn. "Ironically, the transparent open source development process gave us the tools to bust the patent!"

For more on EFF's Patent Busting Project visit www.eff.org/patent.



FSF welcomes the AdBard network for free software advertising

The Free Software Foundation (FSF) has welcomed the launch of AdBard, a new advertising network for technology-based websites based upon the promotion of free/libre and open source software (FLOSS) friendly products and services.

The AdBard Network has been created by Tag1 Consulting to serve websites dedicated to free software ideals, helping them connect with companies selling products and services targeting a FLOSS audience. AdBard solves the problem of proprietary software products being displayed on sites that otherwise promote computer user freedom.

"The Free Software Community now has an ethical alternative to ad networks that promote proprietary software," said Peter Brown, executive director of the Free Software Foundation. "This is a huge win for many of the sites that serve our community. And we wish AdBard and the websites that display AdBard adverts every success. We also hope this will inspire other ad networks to adopt similar policies."

"AdBard is a great way for advertisers and publishers in the free software community to come together and help grow the free software services market," said Jeremy Andrew, CEO of Tag1. Websites already using AdBard include Kerneltrap.org, Libre.FM and BoycottNovell.com. For a complete list, visit adbard.net/adbard/websites.



Getting Started with DTracing MySQL

...to understand the runtime behaviour of the RDBMS better.



DTrace is a dynamic tracing facility built into the Solaris and Open Solaris operating systems and can be used by systems administrators and developers to observe the runtime behaviour of user-level programs and of the OS itself. On one hand, DTrace can be used to identify potential bottlenecks in the running processes on a production system, while on the other hand it can help you understand the runtime behaviour of an external program such as MySQL better.

Originally available on Solaris, DTrace has now been ported to Mac OSX, FreeBSD and an experimental Linux port is also available. In this article, I shall use the OpenSolaris 2008.11 release to demonstrate how it works.

Some concepts first

The DTrace architecture [check the *References*] gives you a good look at the various

components of the DTrace framework. The graphic in Figure 1 (reproduced from the DTrace how-to at www.sun.com/software/solaris/howtогuides/dtracehowto.jsp) illustrates the DTrace framework and its various components. Note that 'probes', about which we will learn more shortly (and not shown in the figure) can be best visualised as sensors available to be probed by the DTrace consumers in user space.

We shall now learn the basic DTrace concepts that will help us during some serious playing around with DTrace and MySQL.

Probes, providers and consumers

DTrace dynamically modifies the operating system kernel and user processes to record data at locations of interest (or instrumentation points) called probes. The probe is user specified, and its specificity and description determine the benefit derived

from DTrace. A probe is a location or activity to which the DTrace framework can bind a request to perform actions, such as logging the system calls, the function calls in user level processes, recording a stack trace and so on. A probe is said to fire when the activity, as specified by the probe description, takes place. When a probe is fired, the requested action will take place. A probe has the following attributes that identify it uniquely:

- It has a name and a unique integer identifier
- It is made available by a provider
- It identifies the module and the function that it instruments

The current probes available on your system can be displayed by `pfexec dtrace -l`. By using various switches, it is also possible to display only the probes belonging to, say, a particular module. For example, `pfexec dtrace -l m:mysql*` will list all the probes available via the `mysql*` provider. (Note the `*` in `mysql*` denotes all modules with names starting with mysql.)

DTrace probes are implemented by kernel modules called providers, each of which perform a particular kind of instrumentation to create probes. Providers can thus be described as publishers of probes that can be used by DTrace consumers. Providers can be used for instrumenting kernel and user-level code. For user-level code, there are two ways in which probes can be defined: User-Level Statically Defined Tracing (USDT) or the PID provider.

In USDT, custom probe points are inserted into application code according to well-defined guidelines and practices. Refer to www.solarisinternals.com/wiki/index.php/DTrace_Topics_USDT for more details. Once the custom probe points are integrated, the application code is compiled and the binary is run, the probes become available for consumption by DTrace user-level consumers. However, unless they are used, the probes have a zero impact on the performance of the application or the system as a whole.

Does this mean that DTrace cannot be used with applications with no USDT probes defined? No, it doesn't.

The PID provider can be used to probe any user-level process, whether USDT probes were defined for it or not. Using the PID provider is a very generic and easy way to play around with DTrace. Code a simple application in your favourite programming language and have fun with DTrace by observing the function call flow, stack trace and a lot more. In the later part of this article, we shall use both of the above for DTracing a running MySQL server.

Probe descriptions*: A DTrace probe, as mentioned earlier, is uniquely specified by a 4-tuple, and usually takes the following form:

```
provider:module:function:name
```

If one or more of the fields are missing, the specified fields are interpreted in a right-to-left fashion, i.e., if a

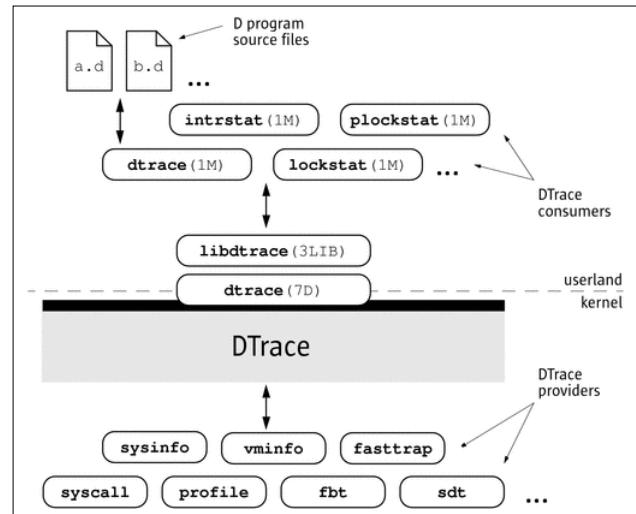


Figure 1: The DTrace architecture

probe description is given as `foo:bar`, the probe description matches all probes with the function `foo` and the name `bar`, regardless of the provider or the module. To obtain the desired results, specify all the required fields. You may also want to match all the probes published by any given provider, for which you would use the probe description like `fbt:::`, which matches all the probes of the `fbt` provider. [You can read the manual page of `fbt` at docs.sun.com/app/docs/doc/816-5177/6mbbc4g4t?a=view.]

A DTrace consumer is any process that interacts with the DTrace framework. The consumer specifies the instrumentation points by specifying probe descriptions. `dtrace` is the primary consumer of the DTrace framework. (Now, do you see the difference between DTrace and `dtrace`?)

DTrace scripts or D-scripts

Programs or scripts to interact with the DTrace framework are written in the D programming language. A D program source file consists of one or more probe clauses that describe the points of instrumentation to be enabled by DTrace. Each probe clause has the following form:

```
probe descriptions
/predicate /
{
  action statements
}
```

A D program can consist of one or more such probe clauses. The predicate and the list of action statements are optional and may not be required in some scenarios. D programs are described in detail at docs.sun.com/app/docs/doc/817-6223/chp-prog?a=view. A D program can be executed by specifying it via the `-s` switch to `dtrace` or making it an executable (like a shell script) and setting '`dtrace`' as the interpreter, by putting `#!/usr/sbin/dtrace` in the script.

Using DTrace with MySQL

As mentioned earlier, there are two ways in which DTrace can be used with any user-level process—USDT and the PID provider. We shall see demonstrations of both these mechanisms as we start using DTrace with the MySQL server, or specifically ‘mysqld’. One thing to note here is that DTrace one-liners can be used to demonstrate a lot of what we will be doing. But, to make the learning easier, we will use D-scripts, however small they may be. Familiarity with the MySQL source code is required to derive the maximum advantage from the rest of the article.

Before I start off with writing D scripts, here are some common points worth noting:

- Like a shell script, you can make a D script executable by using `chmod +x` and specifying the location of the script interpreter using `a #!`, like: `#!/usr/sbin/dtrace`.
- You can specify various switches to `dtrace`. For example, to specify a D script to `dtrace`, you will use the `-s` switch.
- The parameters of the function being traced are available to a D script using built-in variables: `arg0`, `arg1`, `arg2...` Other built-in variables like `timestamp`, `walltimestamp` are described at docs.sun.com/app/docs/doc/817-6223/chp-variables-5?a=view.timestamp gives the current value of a nanosecond counter, which increments from an arbitrary time in the past and is useful for relative time calculation. `walltimestamp`, the current number of nanoseconds since UTC, is more suited when date/time value is required.
- `copyinstr` is used to copy the value of a `char*` type parameter to a variable in your D script. By default, strings up to a maximum size of 256 can be stored. You can change it using `#pragma D option strsize=1024`.
- When monitoring probes for a multi-threaded application, such as `mysqld`, it is essential that each thread (and its variables) is treated as such. Thread-local variables, denoted using a `"self->"`: makes it possible to prevent corruption of the variables of one thread by another.
- DTrace allows use of `clause-local` variables. To declare a variable as `clause-local`, specify it as `this->`, such as `this->bar`. As suggested by its name, the scope of a `clause-local` variable is limited to the probe clause or predicate, in which it is used. For more information on thread-local and clause-local variables, please refer to wikis.sun.com/display/DTrace/Variables.
- A number of macro variables are available in DTrace. A very commonly used one is `"$target"`: which is used in scripts using the PID provider.

Using the PID provider

To use the PID provider, you need to have a `mysqld` instance running on an (Open)Solaris system. (You won't need any special build of MySQL for this.) Please note that the function names are garbled in a binary. Hence any command, for example, `mysql_parse` will not be exactly

the same, but will have other text at the starting and the ending. We can use “nm” to see the garbled names:

```
nm mysqld | grep mysql_parse
"2":1134 | 136472368| 640|FUNC |GLOB |0 |13 |__1cLmysql_
parse6FpnDTHD_pkclp3_v_
```

Hence, we shall simply use the regex `“*”` at the beginning and end of the function name in our D scripts.

• Watching queries

```
#!/usr/sbin/dtrace -q
pid$target::*mysql_parse*:entry /* This probe is fired when the execution
enters mysql_parse */
{
    printf("Query: %s\n", copyinstr(arg1));
}
```

Save this script to a file, say `watch.d`. A D script is specified to `dtrace` with the `-s` switch. The Process ID (PID) specified via the switch `-p` is automatically made available to the `$target` macro in the D script.

Now, run the D script, `watch.d`:

```
$ pfexec dtrace -s watch.d -p `pgrep -x mysqld`
```

Fire up a MySQL client and run some queries. The D script should display the queries that you executed from the client:

```
Query: show databases
Query: show variables
Query: show engines
Query: SELECT DATABASE()
Query: show databases
Query: show tables
Query: show tables
Query: select * from foo
```

• Follow the query execution: An SQL query before execution passes through various other stages, the first of which is the query parsing. The query parsing is taken care of by the `mysql_parse` function in `sql/sql_parse.cc`. Since all the other stages, such as query optimisation and, finally, execution follows from there, by using the following script, we can track all the functions that call and return from after `mysql_parse`:

```
#!/usr/sbin/dtrace
#pragma D option flowindent

pid$target::*mysql_parse*:entry
{
    self->start = vtimestamp;
```

```

}

pid$target:::entry
/self->start/
{
    trace(timestamp);

}

pid$target:::return
/self->start/
{
    trace(timestamp);
}
pid$target::*mysql_parse*:return
/self->start/
{
    self->start = 0;
}

```

You will observe an output similar to the following:

CPU FUNCTION

```

0 -> __1cLmysql_parse6FpnDTHD_pkclp3_v_      1791629230
0 -> __1cLex_start6FpnDTHD_v_      1791654796
0 -> __1cSst_select_lex_unitKinit_query6M_v_      1791682536
0 -> __1cSst_select_lex_nodeKinit_query6M_v_      1791710909
0 -< __1cSst_select_lex_nodeKinit_query6M_v_      1791731630
0 -< __1cSst_select_lex_unitKinit_query6M_v_      1791751932
0 -> __1cSst_select_lex_nodeLinit_select6M_v_      1791776112
0 -< __1cSst_select_lex_nodeLinit_select6M_v_      1791796307
0 -> __1cNst_select_lexKinit_query6M_v_      1791821839
0 -> __1cSst_select_lex_nodeKinit_query6M_v_      1791850872
0 -< __1cSst_select_lex_nodeKinit_query6M_v_      1791871148
0 -> __1cSql_alloc6Fl_pv_      1791900080
0 -> pthread_getspecific      1791921125
.
.
.
0 -< __1cElitemHcleanup6M_v_      27789538249088
0 -< __1cKItem_identHcleanup6M_v_      27789538281270
0 -< __1cKItem_fieldHcleanup6M_v_      27789538313437
0 -> __SLIPDELETER_Q      27789538347654
0 -< __SLIPDELETER_Q      27789538382588
0 -< __1cLQdDuery_arenaKfree_items6M_v_      27789538415179
0 <- __1cDTHDcleanup_after_query6M_v_      27789538450969
0 -> __1cKYacc_state2T5B6M_v_      27789538486642
0 <- __1cKYacc_state2T5B6M_v_      27789538521089
0 -> __1cQLex_input_stream2T5B6M_v_      27789538556597
0 <- __1cQLex_input_stream2T5B6M_v_      27789538600602
0 <- __1cLmysql_parse6FpnDTHD_pkclp3_v_      27789538637701

```

To dig into MySQL internals, as above, please refer to forge.mysql.com/wiki/MySQL_Internals. You are also advised to refer to the book *Understanding MySQL*

Internals by Sasha Pachev.

- **Logging queries:** So, we have watched queries go by; now how about capturing them into a file so as to use them for our own file logging purposes? We shall use a DTrace destructive function *freopen* that redirects all that is written to a standard output into the specified file. We are going to snoop on the “*dispatch_command*”: (in *sql_parse.cc*) function:

```

#!/usr/sbin/dtrace -qw
#pragma D option strsize=1024
dtrace:::BEGIN
{
    freopen("/tmp/sqls");
}

pid$target::*dispatch_command*:entry
{
    printf("%Y-> %s \n", walltimestamp,copyinstr(arg2));
}
which gives logs like:
2009 Feb 5 08:13:43-> create table fo_bawr (i INTEGER)
2009 Feb 5 08:13:56-> create table foo_bar (is INTEGER)

```

Using the embedded static probes

The PID provider helps us get up to speed really fast when we are learning to DTrace any user-level application. It also doesn't need a specially-built application binary. However, we need to know the source code of the application really well. A basic knowledge will enable us to write D scripts, which are only as good. DTrace static probes in an application partially reduce the need to know the code, end-to-end, in order to write useful probes. The reason is that the embedded probes can be the highest level of abstraction to the important functions that are useful and likely to be monitored for performance considerations. As noted earlier, as long as the static probes are not used, no performance hit is experienced.

Static probes are being gradually integrated into MySQL. As of MySQL 6.0.9, there are around 55 static probes. The probes are defined and documented in the *sql/probes.d* file, which is a good place to look at the currently available probes and understand how to use them in your D scripts. The currently available probes are also well described in the MySQL reference manual at dev.mysql.com/doc/refman/6.0/en/dba-dtrace-mysqld-ref.html.

To enable the static probes, you will have to supply an extra option to the configure script,—*enable-dtrace*. After the build is over, start *mysqld*. Now open a terminal, and type *\$pexec dtrace -l | grep mysql*. You should see something like the following:

```

135 mysql23509      mysqld __1cQdispatch_command6FnTenum_server_
command_pnDTHD_pcI_b_command-done
136 mysql23509      mysqld __1cQdispatch_command6FnTenum_server_

```

```
command_pnDTHD_pcI_b_command-start
137 mysql23509    mysqld __1cQclose_connection6FpnDTHD_ib_v_
connection-done
138 mysql23509    mysqld     handle_one_connection connection-
start
139 mysql23509    mysqld __1cMmysql_delete6FpnDTHD_pnKTABLE_
LIST_pnEltem_pnLst_sql_list_LXb_b_delete-done
140 mysql23509    mysqld __1cHhandlerNha_delete_row6MpkC_i_
delete-row-done
```

As expected, the function names are mangled. You can view the demangled names with *c++filt*:

```
pfexec dtrace -l -m:mysql* | c++filt
```

...which will show the demangled functions:

ID	PROVIDER	MODULE	FUNCTION NAME
56209	mysql706	mysqld	bool dispatch_command(enum_server_com- mand,THD*,char*,unsigned) command-done
56210	mysql706	mysqld	bool dispatch_command(enum_server_com- mand,THD*,char*,unsigned) command-start
56211	mysql706	mysqld	void close_connection(THD*,unsigned,bool) connection-done
56212	mysql706	mysqld	handle_one_connection connection- start
56213	mysql706	mysqld	bool mysql_delete(THD*,TABLE_ LIST*,Item*,st_sql_list*,unsigned long,unsigned long long,bool) delete-done
56214	mysql706	mysqld	int handler::ha_delete_row(const unsigned char*) delete-row-done
56215	mysql706	mysqld	int handler::ha_delete_row(const unsigned char*) delete-row-start
56216	mysql706	mysqld	int mysql_execute_command(THD*) delete- start
56217	mysql706	mysqld	unsigned long filesort(THD*,TABLE*,st_ sort_field*,unsigned,SQL_SELECT*,unsigned long,bool,unsigned long*) filesort-done
56218	mysql706	mysqld	unsigned long filesort(THD*,TABLE*,st_ sort_field*,unsigned,SQL_SELECT*,unsigned long,bool,unsigned long*) filesort-start
56219	mysql706	mysqld	int handler::ha_external_lock(THD*,int) handler-rdlock-done
56220	mysql706	mysqld	int handler::ha_external_lock(THD*,int) handler-rdlock-start
56221	mysql706	mysqld	int handler::ha_external_lock(THD*,int) handler-unlock-done
56222	mysql706	mysqld	int handler::ha_external_lock(THD*,int) handler-unlock-start
56223	mysql706	mysqld	int handler::ha_external_lock(THD*,int) handler-wrlock-done
56224	mysql706	mysqld	int handler::ha_external_lock(THD*,int) handler-wrlock-start
56225	mysql706	mysqld	bool mysql_insert(THD*,TABLE_ LIST*,List< >,&List< >,List< >,enum_duplicates,bool) insert-done
56226	mysql706	mysqld	int handler::ha_write_row(unsigned char*)

```
insert-row-done
56227  mysqld int handler::ha_write_row(unsigned char*)
insert-row-start
56228  mysqld void select_insert::abort() insert-select-
done
56229  mysqld bool select_insert::send_eof() insert-select-
done
56230  mysqld int mysql_execute_command(THD*) insert-
select-start
56231  mysqld int mysql_execute_command(THD*) insert-
start
56232  mysqld bool multi_delete::send_data(List&) multi-
delete-done
56233  mysqld int mysql_execute_command(THD*) multi-
delete-start
56234  mysqld bool multi_update::send_data(List&) multi-
update-done
```

A better query logger

Using one of the static probes, we shall now write a better query logger, containing information such as username and connection ID.

```
#!/usr/sbin/dtrace -qws
#pragma D option strsize=1024

dtrace:::BEGIN
{
    printf("Logging to file..Hit Ctrl-C to end.\n");
    freopen('/tmp/mysql.log');

}

mysql*::query-start /* using the mysql provider */
{

    self->query = copyinstr(arg0); /* Get the query */
    self->connid = arg1; /* Get the connection ID */
    self->db = copyinstr(arg2); /* Get the DB name */
    self->who = strjoin(copyinstr(arg3),strjoin("@.",copyinstr(arg4))); /* Get the
username */

    printf("%Y\t%20s\t Connection ID: %d \t Database: %s \t Query: %s\n",
walltimestamp, self->who ,self->connid, self->db, self->query);

}
```

This will store logs into a file, */tmp/mysql.log*:

```
2009 Feb 23 15:42:38      root@localhost  Connection ID: 3  Database:
Query: select user()
2009 Feb 23 15:42:41      root@localhost  Connection ID: 3  Database:
Query: show engines
2009 Feb 23 15:42:51      root@localhost  Connection ID: 3  Database:
Query: create table fo_bawr(is INTEGER)
2009 Feb 23 15:42:55      root@localhost  Connection ID: 3  Database:
Query: SELECT DATABASE()
```

```
2009 Feb 23 15:42:55      root@localhost Connection ID: 3 Database:
test  Query: show databases
2009 Feb 23 15:42:55      root@localhost Connection ID: 3 Database:
test  Query: show tables
2009 Feb 23 15:42:56      root@localhost Connection ID: 3 Database:
test  Query: create table fo_bawr(is INTEGER)
2009 Feb 23 15:43:04      root@localhost Connection ID: 3 Database:
test  Query: create table fo_bawr(i INTEGER)
2009 Feb 23 15:43:08      root@localhost Connection ID: 3 Database:
test  Query: create table fo_bawr2(i INTEGER)
```

Counting the bytes per-client connection

In the last example, we are going to use the following static probes to write a D script that will give the number of bytes transferred on a per-client connection basis:

- *connection_start(unsigned long conn_id, char *user, char *host);*: This probe is fired when a new client connects to the server
- *command_done(int status);*: This probe is fired when the client disconnects
- These probes can be used to measure the number of bytes transferred in read and write operations:

```
probe net_read_done(int status, unsigned long bytes);
probe net_write_start(unsigned long bytes);
```

The script is as follows:

```
#!/usr/sbin/dtrace
#pragma D option quiet

dtrace:::BEGIN
{
printf("Tracking the bytes.. Hit Ctrl-C to end.\n");
}

mysql*::connection-start
{
self->bytes_read = 0;
self->bytes_write = 0;
self->conn_id = arg0;
self->who = strjoin(copyinstr(arg1),strjoin("@",copyinstr(arg2))); /* Get the
username */
printf("Got a client connection at %Y from %20s with ID %u\n",
walltimestamp, self->who, self->conn_id);
self->client_connect_start = timestamp;
}

mysql*::net-read-done/* using the mysql provider */
{
self->bytes_read = self->bytes_read + arg1;
}

mysql*::net-write-start/* using the mysql provider */
{
self->start_w = timestamp;
self->bytes_write= self->bytes_write + arg1;
}

mysql*::connection-done
```

```
{
printf ("Connection with ID: %u closed.\nTotal Bytes transferred: %u \nTotal
connection time (ms): %-9d\n\n",self->conn_id, self->bytes_read + self-
>bytes_write,(timestamp-self->client_connect_start)/1000000 );
}
```

The above script reports the data transfer activity as follows:

Tracking the bytes.. Hit Ctrl-C to end.

Got a client connection at 2009 Feb 23 20:07:24 from root@localhost with ID 50

Got a client connection at 2009 Feb 23 20:07:27 from amit@localhost with ID 51

Connection with ID: 50 closed.

Total Bytes transferred: 1081204027

Total connection time (ms): 17650

Connection with ID: 51 closed.

Total Bytes transferred: 3039908614

Total connection time (ms): 23787

Where can DTrace help the MySQL community?

The niche MySQL community into which DTrace can breathe life is the database administrators (DBAs) who strive to keep the database in good health at all points. It's easy to identify the performance bottlenecks that might have crept into the server over a period of time. With intelligent probe descriptions, it's simple to get relevant statistics of a running MySQL server.

Besides the DBAs, DTrace is a great tool to understand how the control flow occurs in the MySQL server, from when it receives a client request, till it serves the request. This makes it very easy to understand all the different sub-components of the MySQL server architecture.



References and further information

- Tracing mysqld using DTrace: dev.mysql.com/doc/refman/6.0/en/dba-dtrace-server.html
- DTrace Community: opensolaris.org/os/community/dtrace
- DTrace Architecture: docs.sun.com/app/docs/doc/819-5488/gcdxn?a=view
- Solaris Dynamic Tracing Guide: docs.sun.com/app/docs/doc/817-6223
- Using DTrace with MySQL (MySQL University Session). In this session Martin MC Brown covers in a lot of details, how you could make use of the static probes in MySQL server, starting MySQL-6.0.8: forge.mysql.com/wiki/Using_DTrace_with_MySQL
- Optimising MySQL Database Application Performance with Solaris Dynamic Tracing: wikis.sun.com/display/BluePrints/Optimizing+MySQL+Database+Application+Performance+with+Solaris+Dynamic+Tracing

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Company: BA Continuum Solutions Pvt. Ltd.
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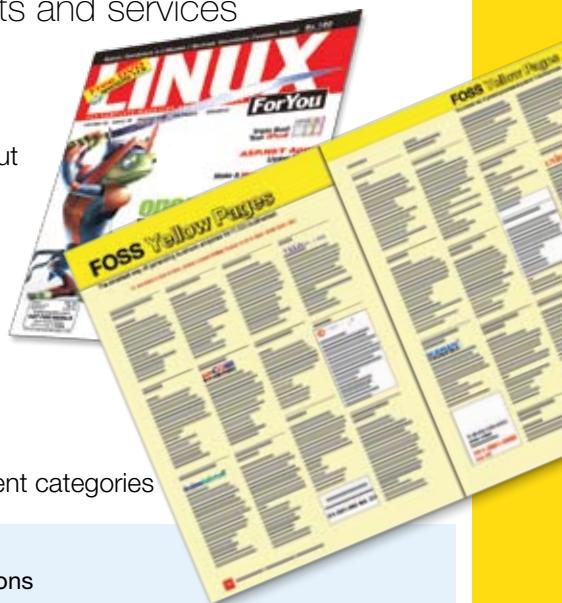
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- Discounts for booking multiple issues



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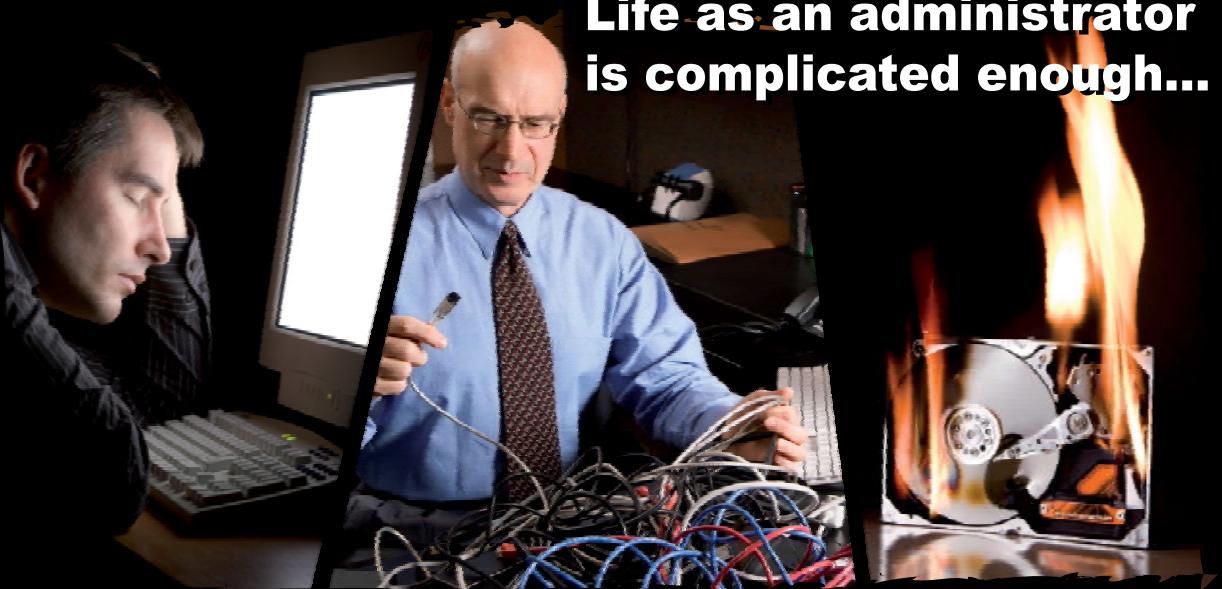
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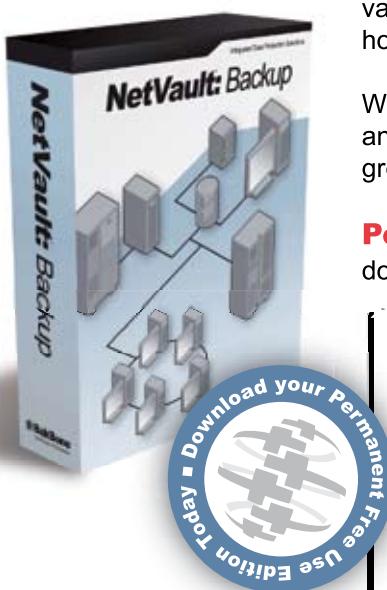
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